

# ProcessMaster FEP630, HygienicMaster FEH630

## Electromagnetic flowmeter



Devices-Firmware version: 01.10.00

**Measurement made easy**

—  
FEP630  
FEH630  
FET630

### Introduction

Intelligent design and extended functions for efficient system operation at reduced costs and with higher profitability.

#### ProcessMaster FEP630

The first choice for demanding applications in the processing industry.

#### HygienicMaster FEH630

The first choice for demanding applications in the food industry.

### Additional Information

Additional documentation on ProcessMaster FEP630, HygienicMaster FEH630 is available for download free of charge at [www.abb.com/flow](http://www.abb.com/flow). Alternatively simply scan this code:



### My Measurement Assistant

The app that puts ABB measurement device support at your fingertips:



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# 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

This device is intended for the following uses:

- For the transmission of fluid, pulpy or pasty measuring media with electrical conductivity.
- For volume flow measurement (in operating conditions).
- For mass flow measurement (based on a non-adjustable density value).

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

When using measuring media, the following points must be observed:

- Wetted parts such as measuring electrodes, liner, grounding electrodes, grounding plates or protection plates must not be damaged by the chemical and physical properties of the measuring medium during the operating time.
- Measuring media with unknown properties or abrasive measuring media may only be used if the operator is able to perform regular and suitable tests to ensure the safe condition of the device
- The indications on the name plate must be observed
- Before use of corrosive or abrasive measuring media, the operator must clarify the level of resistance of wetted parts.

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

## Improper use

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

- Operation as a flexible compensating adapter in piping, for example for compensating pipe offsets, pipe vibrations, pipe expansions, etc.
- 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.



## Use in Potentially Explosive Atmospheres

### Note

- An additional document with Ex safety instructions is available for measuring systems that are used in potentially explosive atmospheres.
- Ex safety instructions are an integral part of this manual. As a result, it is crucial that the installation guidelines and connection values it lists are also observed.  
The icon on the name plate indicates the following:



## Cyber security disclaimer

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 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.

## Software downloads

By visiting the web pages indicated below, you will find notifications about newly found software vulnerabilities and options to download the latest software. It is recommended that you visit this web pages regularly:

[www.abb.com/cybersecurity](http://www.abb.com/cybersecurity)

[ABB Library – FEP630 / FEH630](#)



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For more information visit:

[www.abb.com/measurement](http://www.abb.com/measurement)

## 2 Product identification

### Name plate

#### Note

The name plates displayed are examples. The device identification plates affixed to the device can differ from this representation.

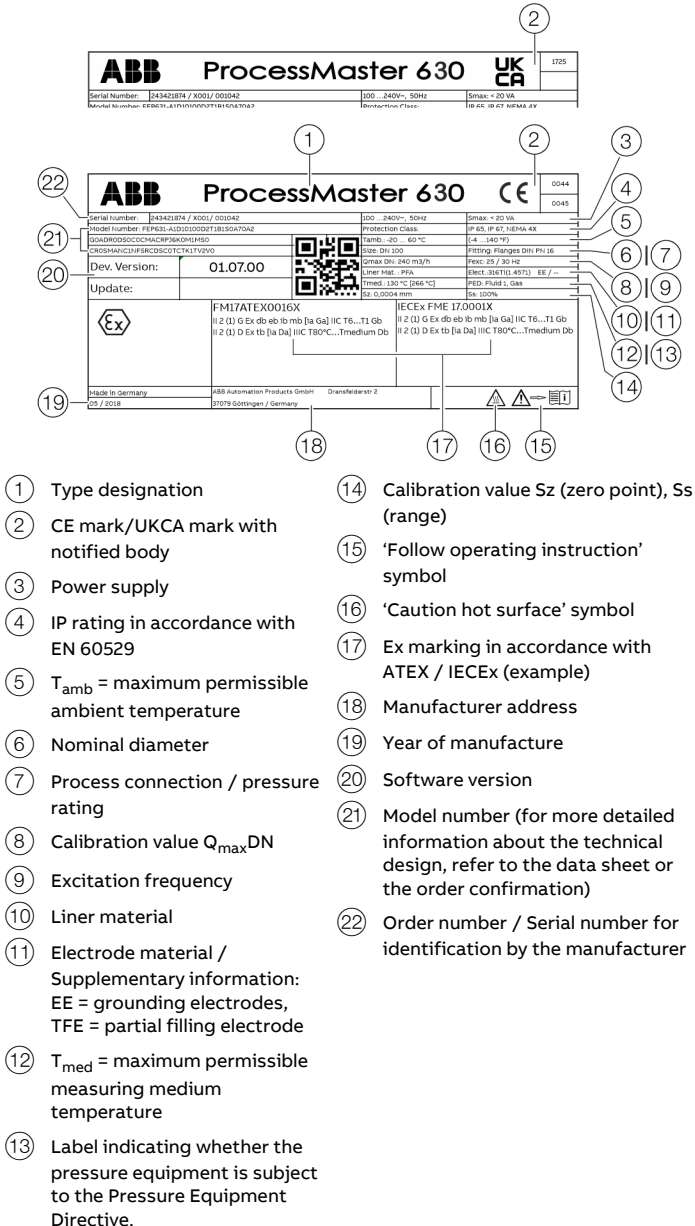


Figure 1: Name plate (example)

#### Note

Devices with 3A approval SIL are labeled with an additional plate.

### Marking in accordance with Pressure Equipment Directive 2014/68/EU

Information on the relevant fluid group (Figure 1, Position ⑬):

- PED: Fluid 1, Gas  
Fluid group 1 = hazardous fluids, liquid, gaseous. (PED = PressureEquipmentDirective).
- SEP  
If the pressure equipment is not in the scope of the Pressure Equipment Directive, it is classified in accordance with SEP = Sound Engineering Practice ('sound engineering practice') in accordance with Art. 4 para. 3 of the Pressure Equipment Directive.

If there is no such information at all, there is no compliance with the requirements of the Pressure Equipment Directive. Water supplies and connected equipment accessories are classed as an exception in accordance with guideline 1/16 of Art. 1 Para. 3.2 of the Pressure Equipment Directive.

### Additional warning plate

Devices which are approved for use in potentially explosive atmospheres have an additional warning plate.

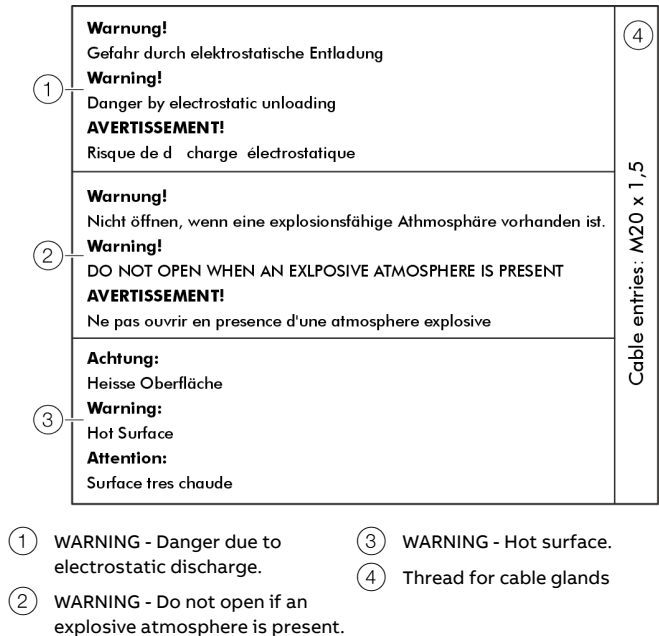


Figure 2: Additional warning plate

### 3 Transport and storage

#### 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.

#### Transport

##### **⚠ DANGER**

##### **Life-threatening danger due to suspended loads.**

In the case of suspended loads, a danger of the load falling exists.

- Standing under suspended loads is prohibited.

##### **⚠ WARNING**

##### **Risk of injury due to device slipping.**

The device's center of gravity may be higher than the harness suspension points.

- Make sure that the device does not slip or turn during transport.
- Support the device laterally during transport.

##### **NOTICE**

##### **Potential damage to the device!**

The protection plates or protection caps mounted at the process connections on devices with PTFE / PFA liners may only be removed immediately before installation.

- To prevent possible leakage, make sure that the liner on the flange is not cut or damaged.

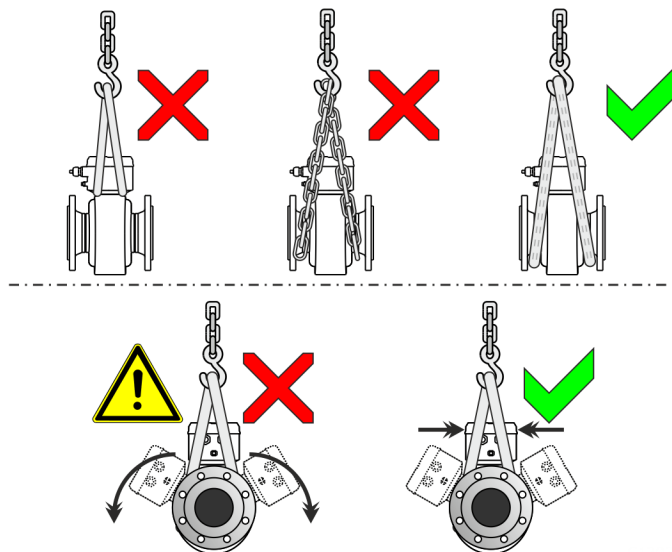


Figure 3: Transport instructions - ≤ DN 450

##### **Flange devices ≤ DN 450**

- Use carrying straps to transport flange designs smaller than DN 450.
- Wrap the carrying straps around both process connections when lifting the device.
- Chains should not be used, since these may damage the housing.

##### **Flange devices > DN 450**

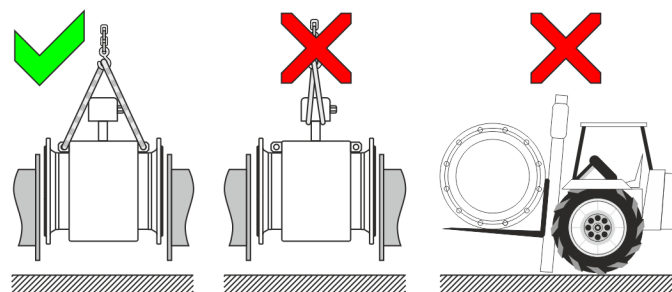


Figure 4: Transport instructions - > DN 450

- Using a forklift to transport flange device can dent the housing.
- Flange devices must not be lifted by the center of the housing when using a forklift for transport.
- Flange devices must not be lifted by the terminal box or by the center of the housing.
- Only the transport lugs fitted to the device can be used to lift the device and insert it into the piping.

## ... 3 Transport and storage

### 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.

### Temperature data

#### Storage temperature range

–40 to 70 °C (–40 to 158 °F)

The ambient conditions for the transport and storage of the device correspond to the ambient conditions for operation of the device.

Adhere to the device data sheet!

### Returning devices

Use the original packaging or a secure transport container of an appropriate type if you need to return the device for repair or recalibration purposes.

Fill out the return form (see **Return form** on page 92) and include this with the device.

In accordance with the EU Directive governing hazardous materials, the owner of hazardous waste is responsible for its disposal or must observe the following regulations for shipping purposes:

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

Please contact Customer Center Service acc. to page 5 for nearest service location.

## 4 Installation

### Safety instructions

#### 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 working on the device.

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

#### WARNING

##### **Risk of injury due to live parts!**

When the housing is open, contact protection is not provided and EMC protection is limited.

- Before opening the housing, switch off the power supply.

### Use in potentially explosive Atmospheres

#### DANGER

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

While using the device in potentially explosive atmospheres before opening the transmitter housing or the terminal box, note the following points:

- A valid fire permit must be present.
- Make sure that no flammable or hazardous atmospheres are present.

### Note

- An additional document with Ex safety instructions is available for measuring systems that are used in potentially explosive atmospheres.
  - Ex safety instructions are an integral part of this manual. As a result, it is crucial that the installation guidelines and connection values it lists are also observed.
- The icon on the name plate indicates the following:



### Installation conditions

#### General

The following points must be observed during installation:

- The flow direction must correspond to the marking, if present
- The maximum torque for all flange screws must be complied with
- Secure flange screws and nuts against pipe vibration.
- The devices must be installed without mechanical tension (torsion, bending)
- Install flange devices / wafer-type devices with plane parallel counterflanges and use appropriate gaskets only
- Use gaskets made from a material that is compatible with the measuring medium and measuring medium temperature.
- Gaskets must not extend into the flow area, since possible turbulence could influence the accuracy of the device
- The piping may not exert any inadmissible forces or torques on the device.
- Make sure that the temperature limits are not up-scaled during operation of the device.
- Vacuum shocks in the piping should be avoided to prevent damage to the liners (PTFE liner). Vacuum shocks can destroy the device.
- Do not remove the sealing plugs in the cable glands until you are ready to install the electrical cable
- Make sure the gaskets for the housing cover are seated correctly. Carefully seal the cover. Tighten the cover fittings
- The transmitter with a remote mount design must be installed at a largely vibration-free location
- Do not expose the transmitter and sensor to direct sunlight. Provide appropriate sun protection as necessary. If necessary, provide a suited means of sun protection.
- When installing the transmitter in a control cabinet, make sure adequate cooling is provided

#### Devices with extended diagnostic functions

For devices with extended diagnostic functions different installation conditions may be valid.

For additional information, see **Extended diagnostic functions** on page 75.

## ... 4 Installation

### ... Installation conditions

#### Brackets

#### NOTICE

##### Potential damage to the device!

Improper support for the device may result in a deformed housing and damage to internal magnetic coils.

- Place the supports at the edge of the sensor housing (see arrows in Figure 5).

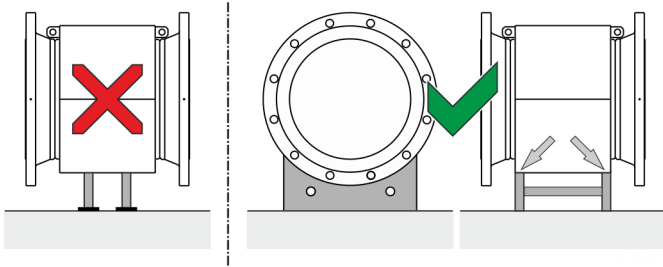


Figure 5: Support for nominal diameters greater than DN 400

Devices with nominal diameters larger than DN 400 must be mounted on a sufficiently strong foundation with support.

#### Gaskets

The following points must be observed when installing gaskets:

- To achieve the best results, make sure that the gaskets and meter tube fit concentrically.
- To make sure that the flow profile is not distorted, the gaskets may not intrude in the piping cross-section.
- The use of graphite with the flange or process connection gaskets is prohibited. This is because, in some instances, an electrically conductive coating may form on the inside of the meter tube.
- For Non RTJ flange type sensors used in high pressure installations (PN63, CL600 and up), ensure using an appropriate gasket.

#### Devices with hard rubber or soft rubber liner

- Devices with a hard / soft rubber liner always require additional gaskets
- ABB recommends using gaskets made from rubber or rubber-like sealing materials
- When selecting the gaskets, make sure that the tightening torques specified in chapter **Torque information** on page 93 are not up-scaled.

#### Devices with a PTFE, PFA or ETFE liner

- In principle, devices with a PTFE, PFA or ETFE liner do not require additional gaskets.

#### Devices with a wafer-type design

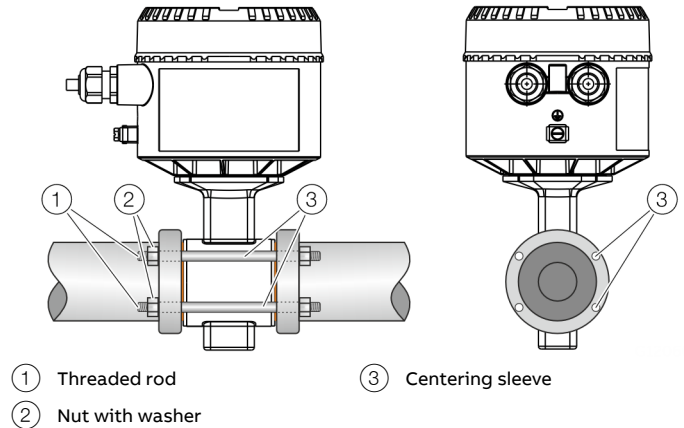


Figure 6: Assembly set for wafer type assembly (example)

For devices with a wafer-type design, ABB offers an installation set as an accessory that comprises threaded rods, nuts, washers and centering sleeves for installation.

#### Flow direction

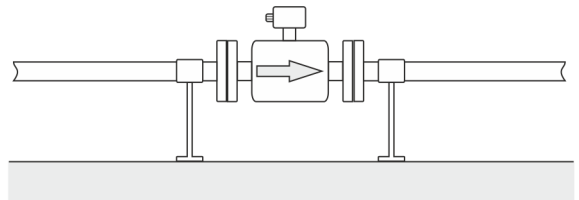


Figure 7: Flow direction

The device measures the flow rate in both flow directions. Forward flow is the factory setting, as shown in Figure 7.

### Electrode axis

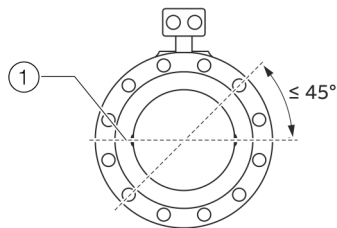


Figure 8: Orientation of the electrode axis

The electrode axis ① should be horizontal if at all possible or no more than 45° from horizontal.

### Mounting position

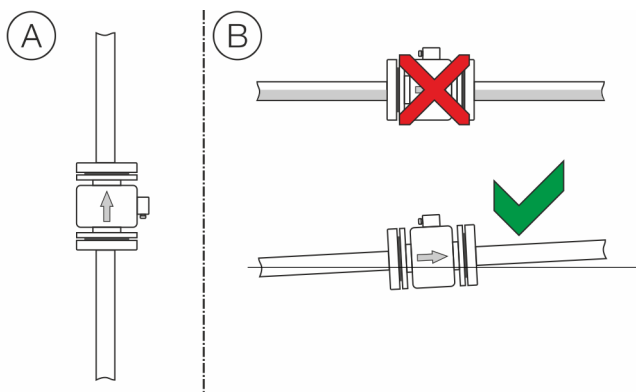


Figure 9: Mounting position

- Ⓐ Vertical installation for measuring abrasive materials, preferably with flow in upward direction.
- Ⓑ For a horizontal installation, the meter tube must always be completely filled with the measuring medium. Provide for a slight incline of the connection for degassing.

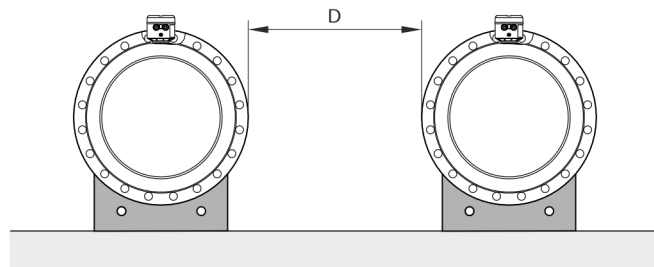
### Note

For hygienic applications, the vertical mounting position is preferred.

For a horizontal mounting position, make sure that the sensor is installed to be self-draining.

### Minimum spacing of the devices

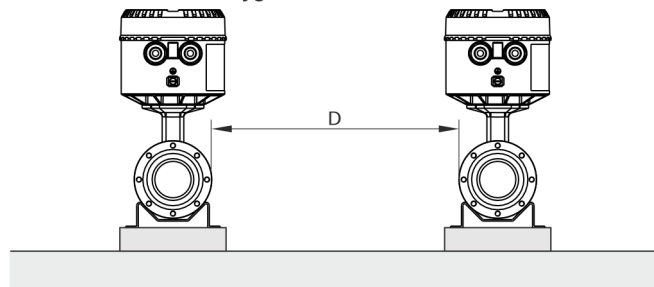
ProcessMaster FEPxxx



Spacing D:  $\geq 1.0$  m (3.3 ft) for Design Level 'A'

Figure 10: Minimum spacing of the devices

HygienicMaster FEHxxx



Spacing D:  $\geq 1.0$  m ( $\geq 3.3$  ft)

Figure 11: Minimum spacing of the devices

- In order to prevent the devices from interfering with each other, a minimum distance as presented in Minimum spacing of the devices must be maintained between the devices.
- The sensor must not be operated in the vicinity of powerful electromagnetic fields, e.g., motors, pumps, transformers, etc. A minimum spacing of approx. 1 m (3.28 ft) must be maintained.
- For installation on or to steel parts (e.g. steel brackets), a minimum spacing of 100 mm (3.94 in) must be maintained (based on IEC801-2 and IECTC77B).

## ... 4 Installation

### ... Installation conditions

#### Grounding

The flowmeter sensor must be connected to ground potential. For technical reasons, this potential must be identical to the potential of the measuring medium.

For plastic or insulated lined pipelines, the measuring medium is grounded by installing ground plates.

When there are stray potentials present in the pipeline, a ground plate is recommended on both ends of the flowmeter sensor.

#### Sensor insulation

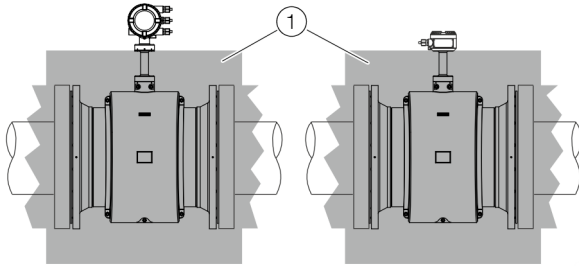
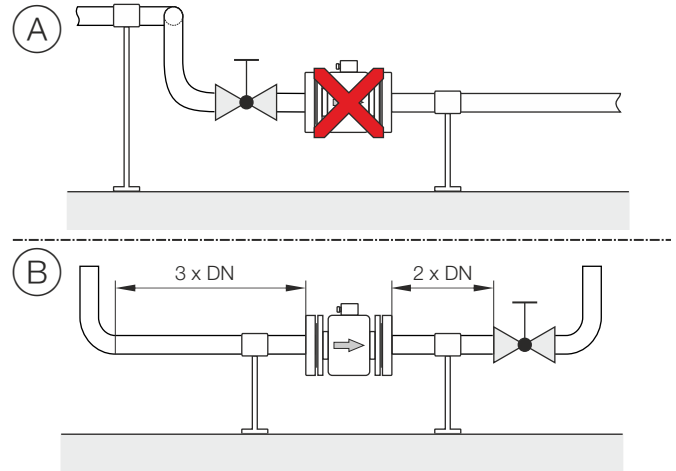


Figure 12: Insulation of the flowmeter sensor

The high temperature design allows for complete thermal insulation of the flowmeter sensor. The pipeline and sensor must be insulated ① after installing the unit according to the illustration.

#### Inlet and outlet sections



① Double elbow                      ② Turn-off device

Figure 13: Inlet and outlet section, turn-off devices

The measuring principle is independent of the flow profile as long as standing eddies do not extend into the measured value formation, such as may for example occur after double elbows, in the event of tangential inflow, or where half-open gate valves are located upstream of the sensor. In such cases, measures must be put in place to normalize the flow profile.

Ⓐ Do not install fittings, manifolds, valves, etc., right before the flowmeter sensor.

Ⓑ Inlet / outlet sections: length of the straight piping upstream and downstream on the sensor.

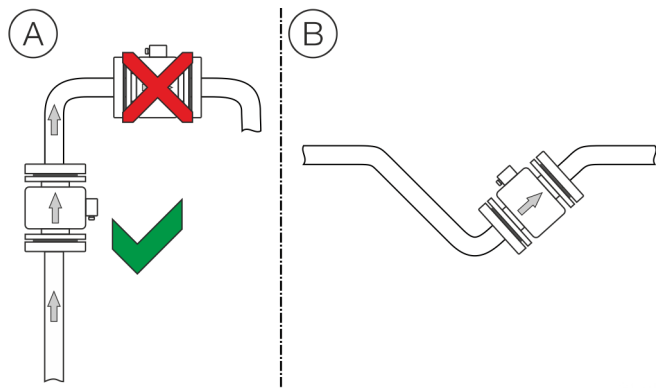
Experience has shown that, in most installations, straight inlet sections  $3 \times \text{DN}$  long and straight outlet sections  $2 \times \text{DN}$  long are sufficient (DN = nominal diameter of the flowmeter sensor).

For test stands, the reference conditions of  $10 \times \text{DN}$  straight inlet and  $5 \times \text{DN}$  straight outlet must be provided, in accordance with EN 29104 / ISO 9104.

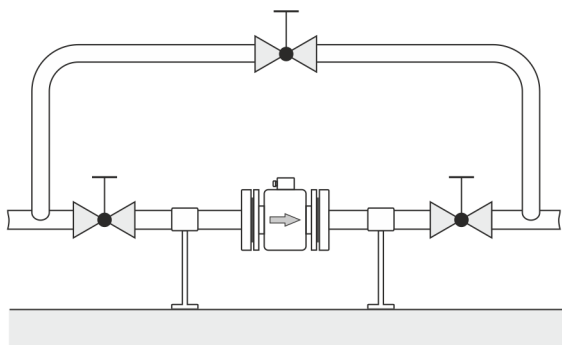
Valves or other turn-off devices should be installed in the outlet section.

Valve flaps must be installed so that the valve damper plate does not extend into the flowmeter sensor.

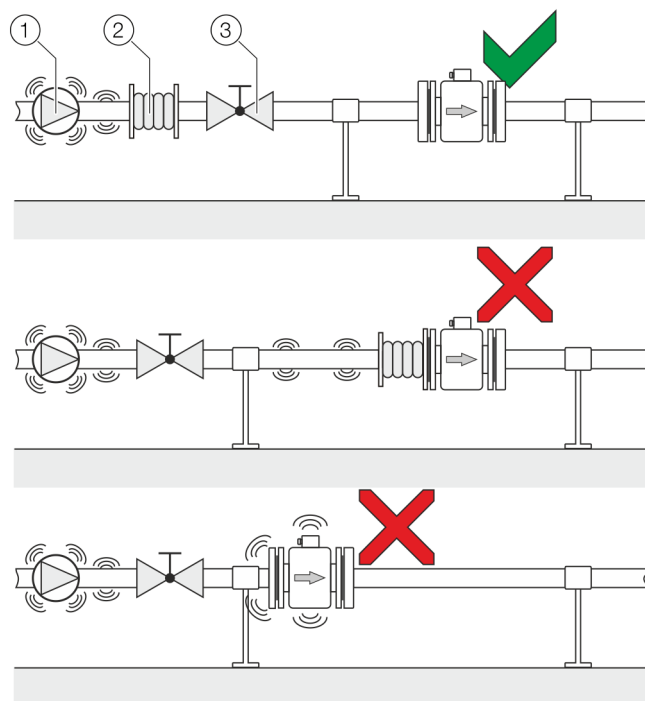


**Free inlet or outlet****Figure 14: Free inflow and outflow**

- Ⓐ For a free outflow, do not install flowmeter at the highest point of the piping or on its outflow side, since the measuring tube may run empty, creating air bubbles.
- Ⓑ For free inflow/outflow, provide an invert to make sure that the piping is always full

**Mounting with heavily contaminated measuring media****Figure 15: Bypass line**

For strongly contaminated measuring media, a bypass line in accordance with the figure is recommended so that operation of the system can continue to run without interruption during mechanical cleaning.

**Mounting with pipe vibration**

- ① Pump
- ② Damping device
- ③ Shut-off device

**Figure 16: Vibration damping**

Strong vibrations in the pipeline must be damped using flexible damping devices.

The damping devices must be installed beyond the supported flowmeter section and outside of the section between the shut-off devices.

Do not connect flexible damping devices directly to the flowmeter sensor.

## ... 4 Installation

### ... Installation conditions

#### Installation in piping with larger nominal diameter

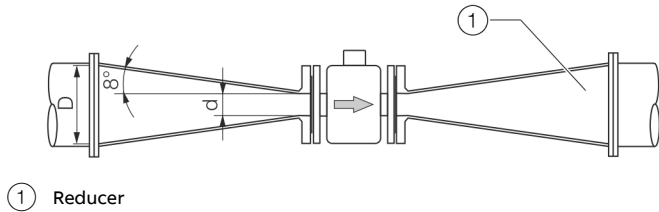


Figure 17: Using reducers

Determine the resulting pressure loss when using reducers:

1. Determine diameter ratios  $d/D$ .
2. Determine the flow velocity based on the flow rate nomogram (Figure 18).
3. Read the pressure loss on the Y-axis in Figure 18.

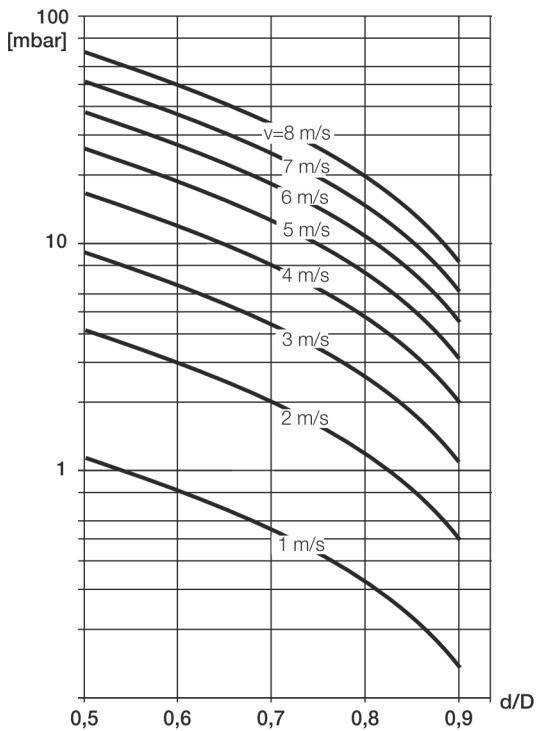


Figure 18: Flow rate nomogram for flange transition piece at  $\alpha/2 = 8^\circ$

#### Installation in 3A compliant installations

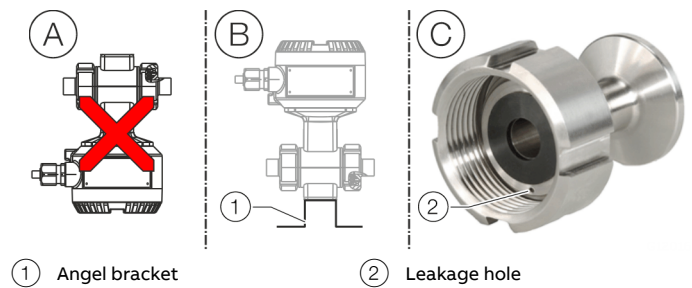


Figure 19: 3A compliant installation

Please observe the following points:

- (A) Do not install the device vertically with the terminal box or transmitter housing pointing downward.
- (B) The 'angel bracket' option is not 3A compliant.
- (C) Please make sure that the leakage hole of the process connection is located at the lowest point of the installed device.
- A vertical mounting position is preferred. For a horizontal mounting position, make sure that the sensor is installed to be self-draining.
- Make sure that the cover of terminal box and / or transmitter housing is properly sealed. There can be no gaps between the housing and the cover.

Only devices with the following process connections fulfill 3A compliance.

- Welded spuds
- Tri-clamp

## Installing the sensor

### NOTICE

#### Damage to the device

Damage to the device due to improper assembly.

- The use of graphite with the flange or process connection gaskets is prohibited. This is because, in some instances, an electrically conductive coating may form on the inside of the meter tube.
- Vacuum shocks in the piping should be avoided to prevent damage to the liners (PTFE liner). Vacuum shocks can destroy the device.

The flowmeter sensor can be installed at any location in the piping while taking the installation conditions into account.

1. Remove protective plates, if present, to the right and left of the meter tube. To prevent possible leakage, make sure that the liner on the flange is not cut or damaged.
2. Position the flowmeter sensor plane parallel and centered between the piping.
3. Install gaskets between the surfaces, see **Gaskets** on page 10.

#### Note

For achieve the best results, ensure the gaskets fit concentrically with the meter tube

To guarantee that the flow profile is not distorted, the gaskets must not protrude into the piping.

4. Use the appropriate screws for the holes in accordance with **Torque information** on page 93.
5. Slightly grease the threaded nuts.
6. Tighten the nuts in a crosswise manner as shown in the figure. Observe the tightening torques in accordance with **Torque information** on page 93!

First tighten the nuts to approx. 50 % of the maximum torque, then to 80 %, and finally a third time to the maximum torque. Do not exceed the max. torque.

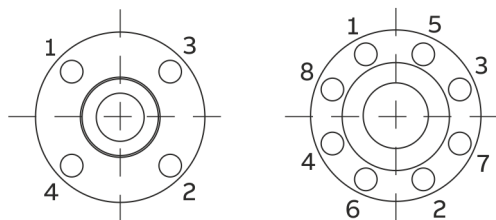


Figure 20: Tightening sequence for the flange screws

## Installing the transmitter in the remote mount design

When selecting a location for the transmitter, consider the following points:

- Observe the information concerning maximum ambient temperature and IP rating on the name plate
  - The location must be mostly free from vibration.
  - The location must not be exposed to direct sunlight. If necessary provide a sun screen on site.
  - Do not up-scale the maximum signal cable length between the transmitter and the sensor.
1. Drill mounting holes at mounting location.
  2. Attach transmitter securely to the mounting location using suited fasteners for the base material.

## ... 4 Installation

### ... Installing the transmitter in the remote mount design

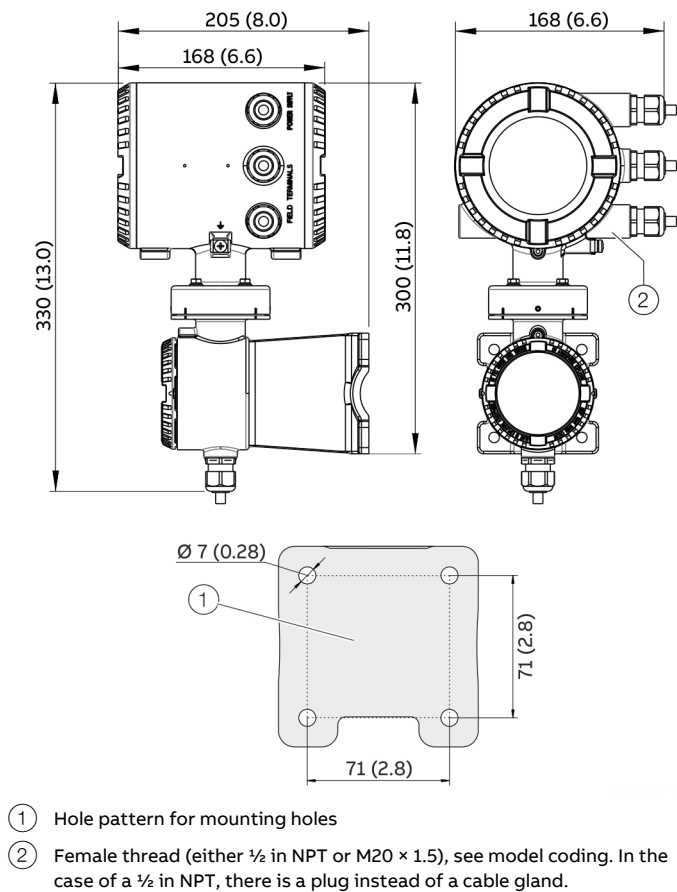


Figure 21: Mounting dimensions dual-compartment housing

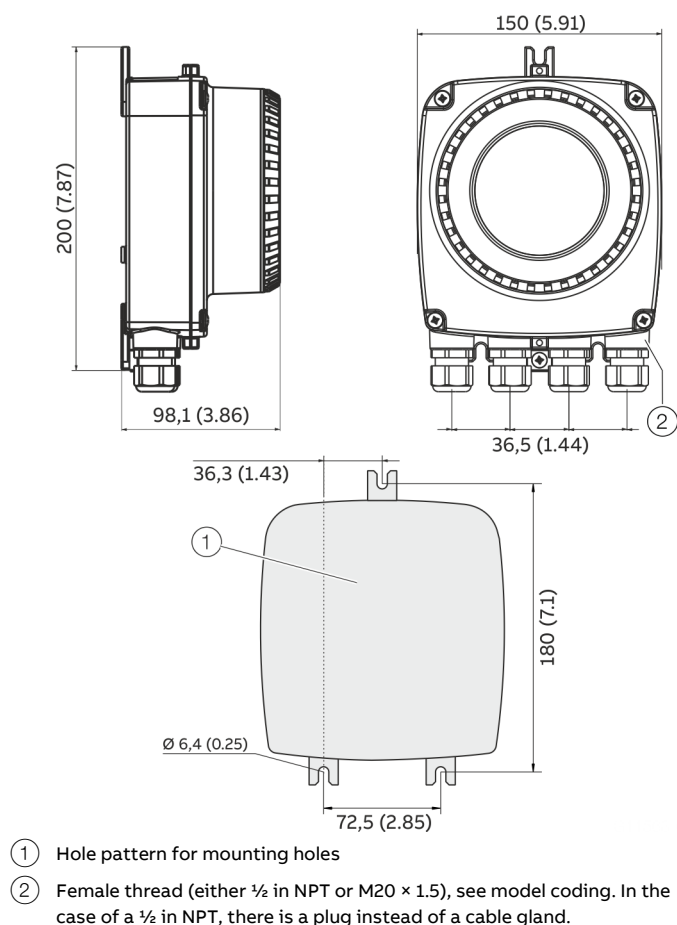


Figure 23: Mounting dimensions single-compartment housing

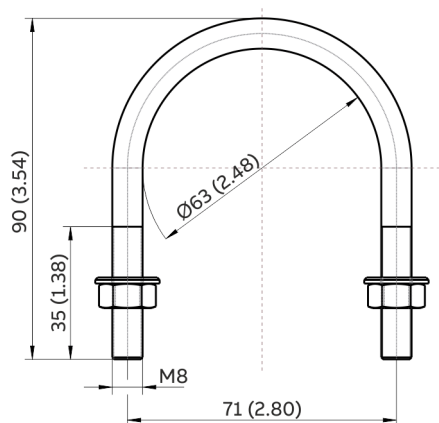


Figure 22: Assembly set for 2" pipe mounting

## Opening and closing the housing

### **⚠ DANGER**

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

While using the device in potentially explosive atmospheres before opening the transmitter housing or the terminal box, note the following points:

- A valid fire permit must be present.
- Make sure that no flammable or hazardous atmospheres are present.

### **⚠ WARNING**

**Risk of injury due to live parts!**

When the housing is open, contact protection is not provided and EMC protection is limited.

- Before opening the housing, switch off the power supply.

### **NOTICE**

**Potential adverse effect on 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.

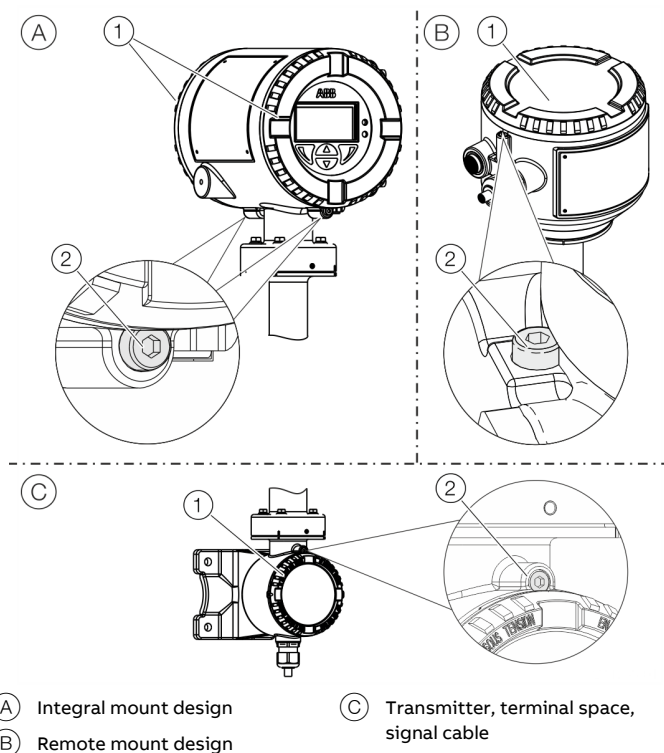


Figure 24: Cover lock (example)

#### **Open the housing:**

1. Release the cover lock by screwing in the Allen screw (2).
2. Unscrew cover (1).

#### **Close the housing:**

1. Screw on the cover (1).
2. After closing the housing, lock the cover by unscrewing the Allen screw (2).

## ... 4 Installation

### ... Opening and closing the housing

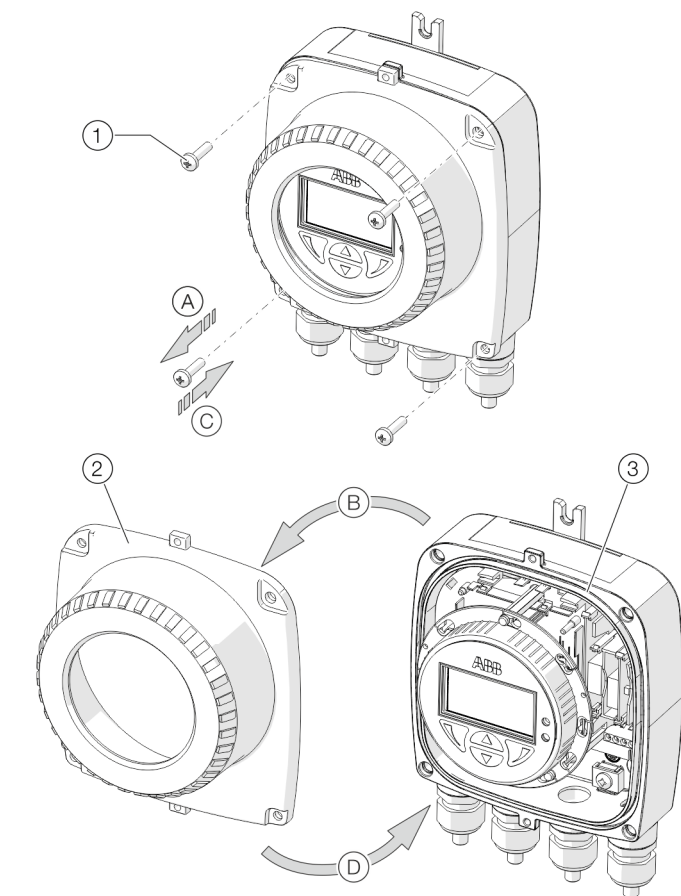


Figure 25: Open / close single-compartment housing

#### Open the housing:

- Perform steps (A) and (B).

#### Close the housing:

- Perform steps (C) and (D).

### Adjusting the transmitter position

Depending on the installation position, the transmitter housing or LCD display can be rotated to enable horizontal readings.

In addition, the display in the LCD indicator can be rotated by 180° using the parameter 'Display Rotation' (see Parameter description in the operating instruction).

#### Transmitter housing

#### **⚠ DANGER**

**Damaging the device carries a risk of explosion!**

When the screws for the transmitter housing are loosened, the explosion protection is suspended.

- Tighten all screws prior to commissioning.
- Never disconnect the transmitter housing from the sensor.
- Loosen only the screws indicated when rotating the transmitter housing!

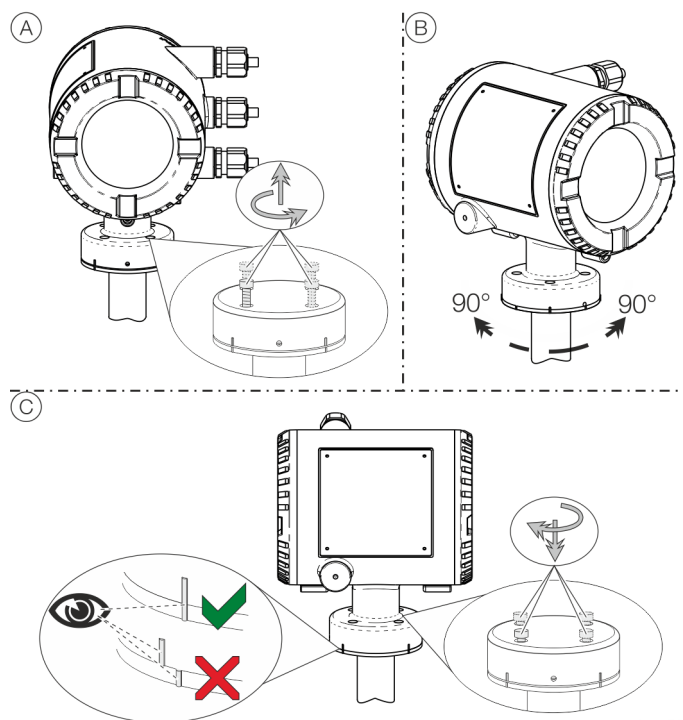


Figure 26: Rotate transmitter housing

#### Rotate the housing:

- Perform steps (A) to (C).

### Rotate LCD indicator – dual-compartment housing

The LCD indicator can be rotated in three increments of 90° each.

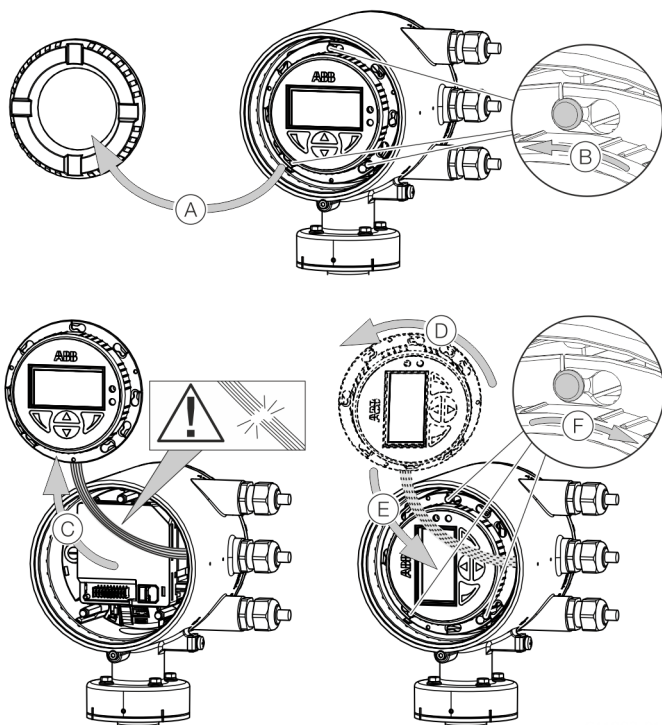


Figure 27: Rotating the LCD indicator

#### Turn the LCD indicator:

1. Open housing (A), see **Opening and closing the housing** on page 17.
2. Perform steps (B) to (F).

### Rotate LCD indicator – single-compartment housing

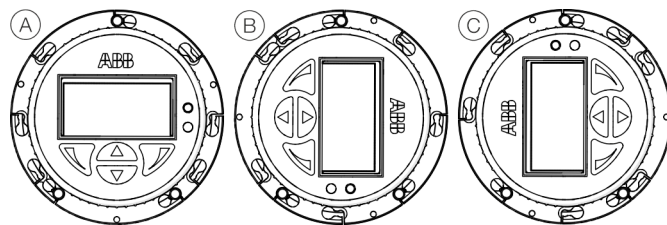


Figure 28: Possible positions of LCD indicator

The LCD indicator can be rotated to the (A), (B) and (C) positions. The 'upside down' position is not possible. To correct the display for the 'upside down' position, use the menu 'Display / Display Rotation'. This allows the display to be rotated 180° by software.

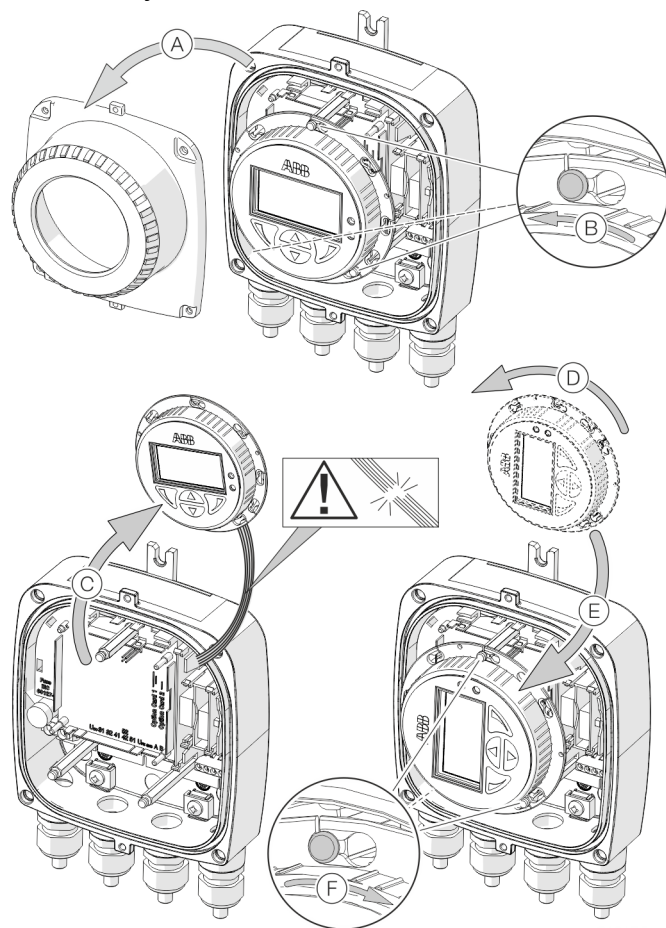


Figure 29: Rotating the LCD indicator


#### Turn the LCD indicator:

1. Open housing (A), see **Opening and closing the housing** on page 17.
2. Perform steps (B) to (F).



## ... 4 Installation

### Installing the plug-in cards


**WARNING**


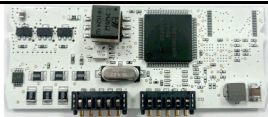

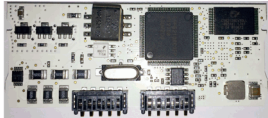
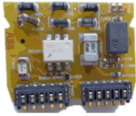
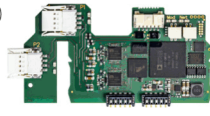
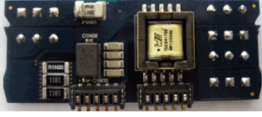

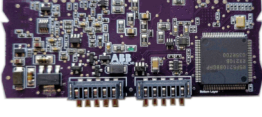
**Loss of Ex Approval!**

Loss of Ex Approval due to retrofitting of plug-in cards on devices for use in potentially explosive atmospheres.

- Devices for use in potentially explosive atmospheres may not be retrofitted with plug-in cards.
- If devices are to be used in potentially explosive atmospheres, the required plug-in cards must be specified when the order is placed.

#### Optional plug-in cards

The transmitter has two slots (OC1, OC2) into which plug-in cards can be inserted to extend inputs and outputs. The slots are located on the transmitter motherboard and can be accessed after removing the front housing cover.

Plug-in cards		Pos.	Description	Quantity*		
①		⑤		①	Current output, 4 to 20 mA passive (red) Order no.: 3KQZ400029U0100	2
②		⑥		②	Passive digital output (green) Order no.: 3KQZ400030U0100	1**
③		⑦		③	Passive digital input (yellow) Order no.: 3KQZ400032U0100	1
④		⑧		④	24 V DC voltage supply (blue) Order no.: 3KQZ400031U0100	1
⑨				⑤	Modbus RTU® RS485 (white) Order no.: 3KQZ400028U0100	1
				⑥	PROFIBUS DP® (white) Order no.: 3KQZ400027U0100	1
				⑦	Ethernet (various protocols) Order no.: 3KQZ400037U0100	1
				⑧	Power over Ethernet (POE) Order no.: 3KQZ400039U0100	1
				⑨	PROFIBUS PA® (blue) Order no.: 3KQZ400061U0100	1**

\* The 'Number' column indicates the maximum number of plug-in cards of the same type that can be used.

\* Only one plug-in card of passive digital output type can be inserted in Pos. ②.



### Dual-compartment housing

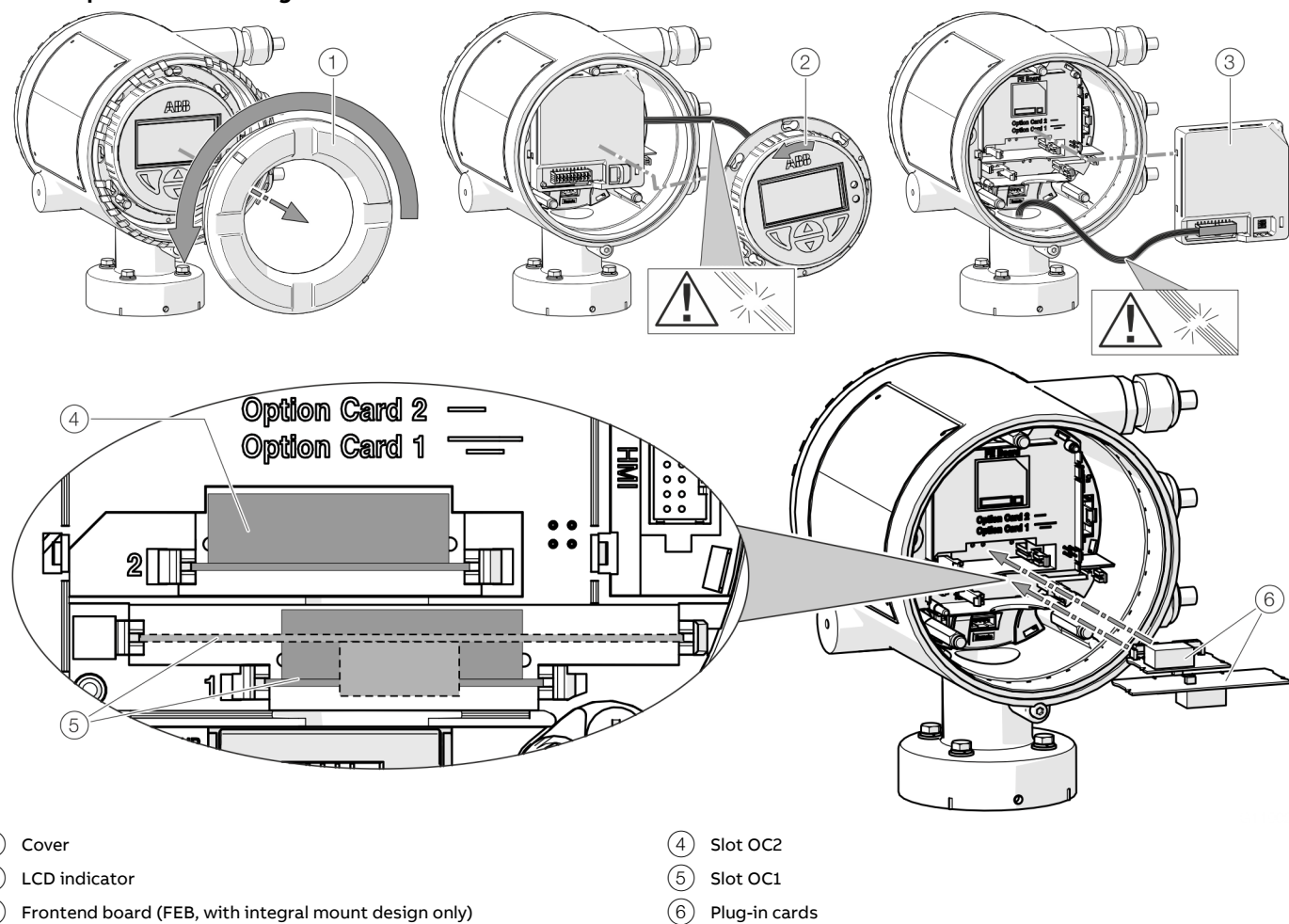


Figure 30: Installation of plug-in cards (example, dual-compartment housing)

## ... 4 Installation

### ... Installing the plug-in cards

#### Single-compartment housing

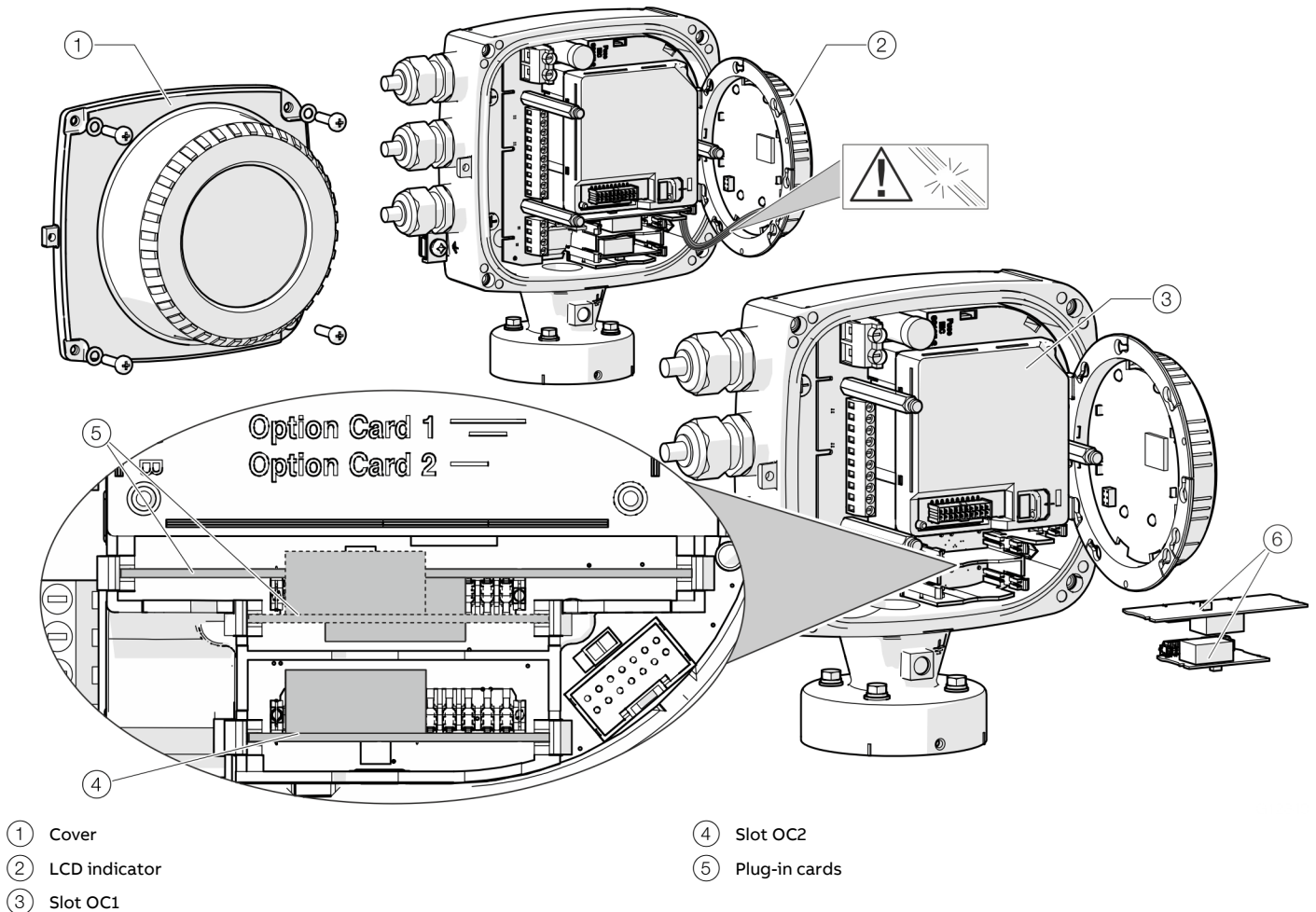


Figure 31: Installation of plug-in cards (example, single-compartment housing)

#### **WARNING**

##### **Risk of injury due to live parts!**

When the housing is open, contact protection is not provided and EMC protection is limited.

- Before opening the housing, switch off the power supply.

#### **NOTICE**

##### **Damage to components!**

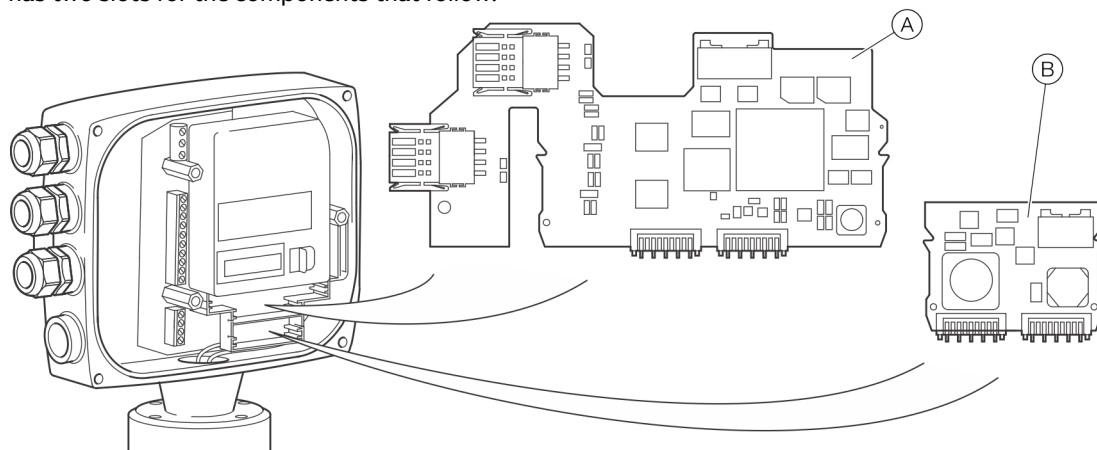
The electronic components of the printed circuit board can be damaged by static electricity (observe ESD guidelines).

- Make sure that the static electricity in your body is discharged before touching electronic components.

1. Switch off the power supply.
2. Unscrew / remove the cover.
3. Remove the LCD indicator. Ensure that the cable harness is not damaged.  
Insert the LCD indicator into the bracket (only for single-compartment housings)
4. Remove front end board (only in integral mount design and dual-compartment housing). Ensure that the cable harness is not damaged.
5. Insert the plug-in card in the corresponding slot and engage. Ensure that the contacts are aligned correctly.
6. Attach the front end board, insert the LCD indicator and screw on / replace the cover.
7. Connect outputs V1 / V2 and V3 / V4 in accordance with **Electrical connections** on page 24.
8. After powering up the power supply, configure the plug-in card functions.

## Ethernet card

The Flowmeter has two slots for the components that follow:



(A) Ethernet card (part number 3KQZ400037U0100)

(B) Power over Ethernet (PoE) card (part number 3KQZ400039U0100)

Figure 32: Install the plug-in cards

### **⚠ DANGER**

#### **Explosion hazard due to improper installation!**

Ethernet Option Cards are designed only for use in hazardous applications Zone 2 / Division 2.

### **⚠ WARNING**

#### **Risk of injury due to live parts!**

When the housing is open, contact protection is not provided and EMC protection is limited.

- Before opening the housing, switch off the power supply.

### **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.

1. Switch off the power supply.
2. Unscrew / remove the cover.
3. Remove the LCD indicator. Ensure that the cable harness is not damaged.
  - Insert the LCD indicator into the bracket.
4. Insert the plug-in card in the corresponding slot and engage. Ensure that the contacts are aligned correctly.
5. Attach the frontend board, insert the LCD indicator and screw on / replace the cover.
6. Connect the Ethernet plug in card in accordance with **EtherNet/IP™ and PROFINET® communication** on page 48.
7. After powering up the power supply, configure the plug-in card functions.

#### **Note**

For detailed instructions how to plug in and connect the Power over Ethernet (PoE) card, please contact ABB.

## 5 Electrical connections

### Safety instructions

#### **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.

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.

### Use in potentially explosive Atmospheres

#### **Note**

- An additional document with Ex safety instructions is available for measuring systems that are used in potentially explosive atmospheres.
- Ex safety instructions are an integral part of this manual. As a result, it is crucial that the installation guidelines and connection values it lists are also observed.

The icon on the name plate indicates the following:



### Sensor grounding

#### **General information on grounding**

Observe the following items when grounding the device:

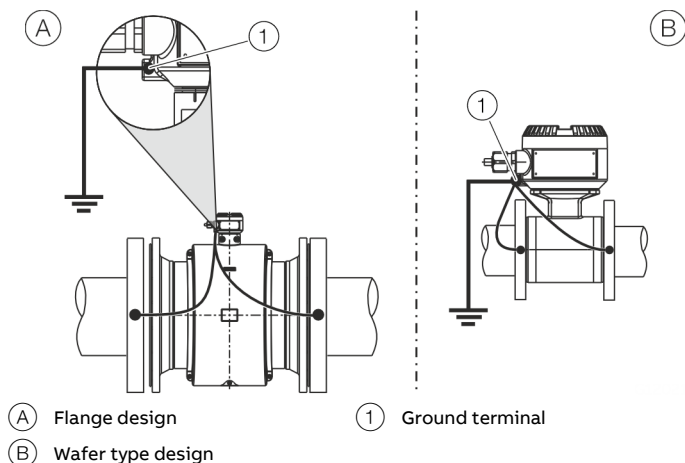
- For plastic piping or piping with insulating liner, the ground is provided by the grounding plate or grounding electrodes.
- When stray potentials are present, install a grounding plate upstream and downstream of the sensor.
- For measurement-related reasons, the potential in the station ground and in the piping should be identical.

#### **Note**

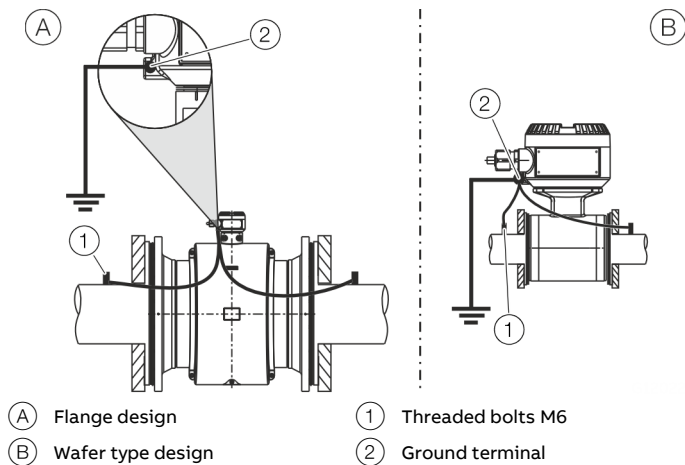
If the sensor is installed in plastic or earthenware pipelines, or in pipelines with an insulating liner, compensating currents may flow through the grounding electrode in special cases (e.g. with corrosive measuring media, acids and bases)

In the long term, this may destroy the sensor, since the ground electrode will in turn degrade electrochemically.

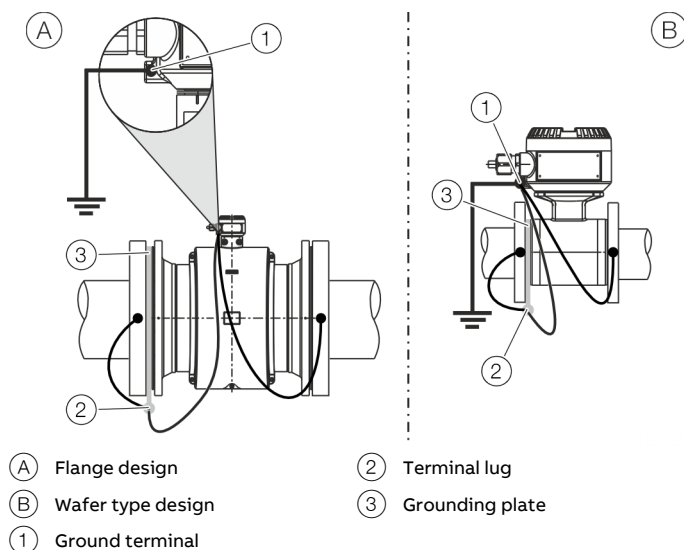
In these special cases, the connection to the ground must be performed using grounding plates. Install a grounding plate upstream and downstream of the device in this case.

**Metal pipe with fixed flanges****Figure 33: Metal pipe, without liner (example)**

Use a copper wire [at least  $2.5 \text{ mm}^2$  (14 AWG)] to establish the connection between the ground terminal of the sensor, the pipeline flanges and a suited grounding point in accordance with the figure.

**Metal pipe with loose flanges****Figure 34: Metal pipe, without liner (example)**

1. Solder the threaded bolts M6 to the piping and connect the ground in accordance with the figure.
2. Use a copper wire [at least  $2.5 \text{ mm}^2$  (14 AWG)] to establish the connection between the ground terminal of the sensor and a suited grounding point in accordance with the figure.

**Plastic pipes, non-metallic pipes or pipes with insulating liner****Figure 35: Plastic pipes, non-metallic pipes or pipes with insulating liner**

For plastic pipes or pipes with insulating lining, the grounding of the measuring medium is provided by the grounding plate as shown in the figure below or via grounding electrodes that must be installed in the device (option).

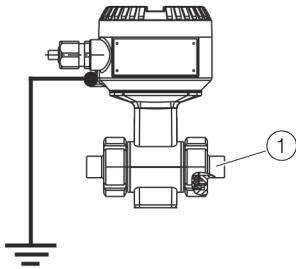
If grounding electrodes are used, the grounding plate is not necessary.

1. Install the sensor with grounding plate in the piping.
2. Connect the terminal lug of the grounding plate and ground connection on the sensor using the grounding strap.
3. Use a copper wire with at least  $2.5 \text{ mm}^2$  (14 AWG) to establish a connection between the ground connection and a suited grounding point.

## ... 5 Electrical connections

### ... Sensor grounding

#### Sensor type HygienicMaster



① Process connection adapter

Figure 36: Sensor, type HygienicMaster

Perform grounding as shown in the figure. The measuring medium is grounded via the process connection adapter, so additional grounding is not required.

#### Grounding for devices with protective plates

The protection plates are used to protect the edges of the meter tube liner, e.g. for abrasive media.

In addition, the protection plates function as a grounding plate.

- For plastic piping or piping with insulating liner, electrically connect the protection plate in the same manner as a grounding plate.

#### Grounding with conductive PTFE grounding plate

Grounding plates made of conductive PTFE are optionally available for nominal diameter ranges of DN 10 to 250. These are installed similar to conventional grounding plates.

#### Devices with extended diagnostic functions

For devices with extended diagnostic functions different installation conditions may be valid.

For additional information, see **Extended diagnostic functions** on page 75.

#### Installation and grounding in piping with cathodic corrosion protection

The installation of electromagnetic flowmeters in systems with cathodic corrosion protection must be made in compliance with the corresponding system conditions. The following factors are especially important:

1. Pipelines inside electrically conductive or insulating.
  2. Piping consistently and widely on cathodic corrosion protection potential. Or mixed systems with ranges on cathodic corrosion protection potential and ranges on functional ground potential.
- In the case of pipes free from stray current and insulated on the inside with liner, the sensor should be installed in the piping insulated with grounding plates (upstream and downstream from the sensor). The cathodic corrosion potential is bypassed around the sensor. The grounding plates upstream and downstream of the sensor are connected to functional ground (Figure 37 / Figure 38).
  - If the occurrence of external stray currents is to be expected in piping with internal insulation (e.g. in the case of long pipe sections in the vicinity of power supply units), an uninsulated pipe of approx.  $\frac{1}{4} \times \text{DN}$  of length should be provided upstream and downstream of the sensor in order to deviate these external stray currents away from the sensor (Figure 39).

### Internally insulated piping with cathodic corrosion potential

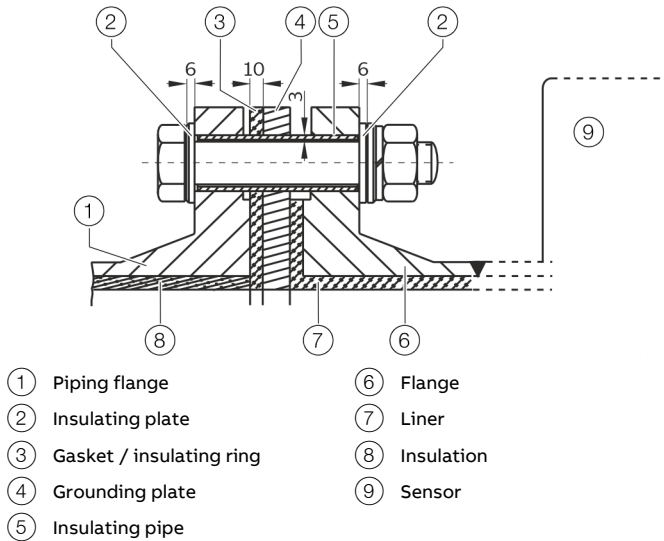
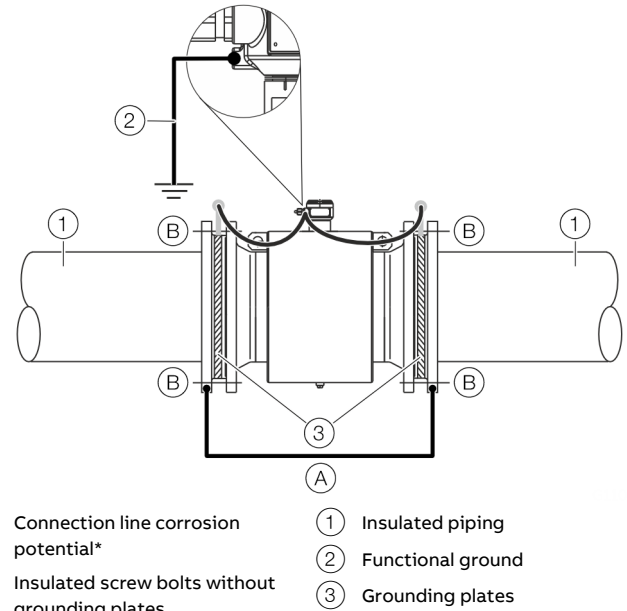


Figure 37: View Screw bolts

Install grounding plates on each side of the flowmeter sensor. Insulate the grounding plates from the pipe flanges and connect them to the flowmeter sensor and to functional ground. The screw bolts for flange connections should be mounted with insulation. The insulation plates and the insulation pipe are not included in the delivery. They must be provided onsite by the customer.



\*  $\geq 4 \text{ mm}^2 \text{ Cu}$ , not included in the delivery, to be provided on-site

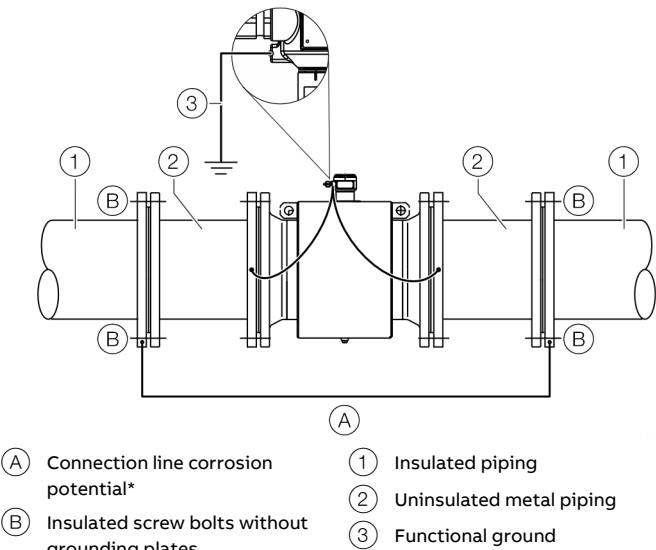
Figure 38: sensor with grounding plate and functional ground

The corrosion protection potential must be diverted through a connecting line (A) away from the insulated installed sensor.

# ... 5 Electrical connections

## ... Sensor grounding

Mixed system, piping with cathodic corrosion potential and functional ground potential



\*  $\geq 4 \text{ mm}^2 \text{ Cu}$ , not included in the delivery, to be provided on-site

Figure 39: Sensor with functional ground

This mixed system has an insulated piping with corrosion protection potential and an uninsulated metal pipe ( $L = \frac{1}{4} \times \text{DN}$  sensor) with functional ground potential upstream and downstream of the sensor.

Figure 39 shows the preferred installation for cathodic corrosion protection.

## Power supply

### Note

- Adhere to the limit values of the power supply 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 down-scale the minimum value required in accordance with the information on the name plate.

The power supply is connected to terminal L (phase), N (zero), or 1+, 2-, and PE.

A circuit breaker with a maximum rated current of 16 A must be installed in the power supply line.

The wire cross-sectional area of the power supply cable and the circuit breaker used must comply with VDE 0100 and must be dimensioned in accordance with the current consumption of the flowmeter measuring system. The cables must comply with IEC 227 and/or IEC 245.

The circuit breaker must be located near the device and marked as being associated with the device.

Connect the transmitter and sensor to functional earth.



## Cable entries

The electrical connection is made via cable entries with a  $\frac{1}{2}$  in-NPT or M20  $\times$  1.5 thread.

Devices with a M20  $\times$  1.5 or  $\frac{1}{2}$  in-NPT thread are equipped with protective plugs.

The black protective plugs in the cable glands are intended to provide protection during transport.

Any unused cable entries must be sealed with sealing plugs before commissioning in accordance with the applicable national standards.

- Observe maximum torque of 4.5 Nm (3.3 ft lb) when tightening the M20 cable gland.
- Make sure that the cable outer dimension used will fit the clamping range of the cable gland.

## Connection via cable conduit

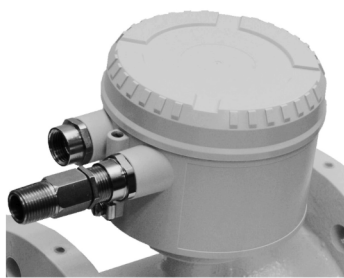


Figure 40: Installation set for cable conduit (Conduit)

### NOTICE

#### Condensate formation in terminal box!

If the flowmeter sensor is permanently connected to cable conduits, there is a possibility that moisture may get into the terminal box as a result of condensate formation in the cable conduit.

- Make sure that the cable conduits on the terminal box are sealed.

An installation set for sealing the cable conduit is available through order number 3KXF081300L0001 (Conduit).

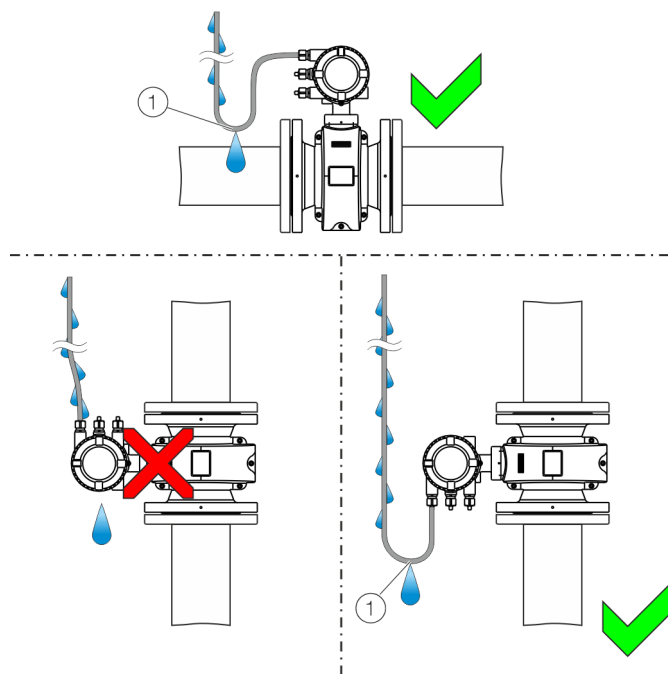
## Installing the connection cables

### General information on cable installation

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

When mounting the sensor vertically, position the cable entries at the bottom.

If necessary, rotate the transmitter housing accordingly.



① Drip loop

Figure 41: Installation of the connection cable (example, integral mount design)

... 5 Electrical connections

... Installing the connection cables

Notes on signal cable installation  
(only for remote mount design)

- Observe the following points when installing the signal cable:
- The maximum signal cable length is 200 m (565 ft).
  - Only used signal cable which is in accordance with the following cable specifications.
  - Avoid the vicinity of electrical equipment or switching elements that can create stray fields, switching pulses and induction. If this is not possible, run the signal / magnet coil cable through a metal pipe and connect this to the station ground.
  - To shield against magnetic interspersion, the cable contains outer shielding. This should be connected to the SE clamp.
  - Do not damage the sheathing of the cable during installation.

The signal cable used for the connection of the transmitter and sensor must fulfill at least the following technical specifications.

Cable specification	
Impedance	100 to 200 Ω
Withstand voltage	120 V
Outer diameter	6 to 12 mm (0.24 to 0.47 in)
Cable design	Two wire pairs as a star-quad cable
Conductor cross-section	Length-dependent
Shield	Copper braid with approximately 85 % coverage
Temperature range	Depends on application.

Maximum signal cable length	
0.25 mm² (AWG 24)	50 m (164 ft)
0.34 mm² (AWG 22)	100 m (328 ft)
0.5 mm² (AWG 20)	150 m (492 ft)
0.75 mm² (AWG 19)	200 m (656 ft)

Recommended cables

It is recommended to use an ABB signal cable with the order number 3KQZ407123U0100 for standard applications. The ABB signal cable fulfills the above-mentioned cable specification and can be utilized unrestrictedly up to an ambient temperature of T<sub>amb</sub> = 80 °C (176 °F).

For marine applications, an appropriate certified signal cable must be used. ABB recommends the cable HELKAMA RFE-FRHF 2×2×0,75 QUAD 250V (HELKAMA order number 20522).

Connection with IP rating IP 68

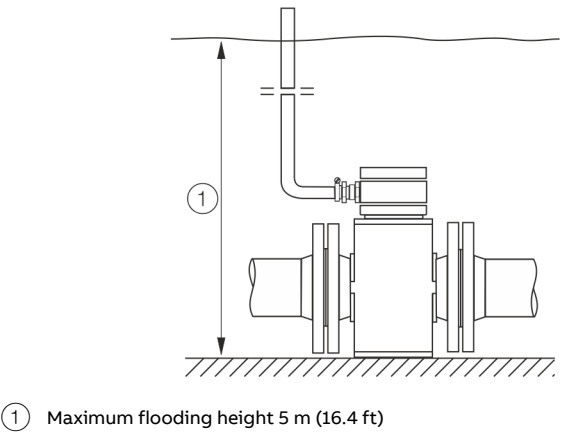


Figure 42: Maximum flooding height for IP 68 sensors

For sensors with IP rating IP 68, the maximum flooding height is 5 m (16.4 ft). The supplied signal cable fulfills all the submersion requirements.

The sensor is type-tested in accordance with EN 60529. Test conditions:  
14 days at a flooding height of 5 m 16.4 ft).

## Electrical connection

### NOTICE

#### Adverse effect on the IP rating IP 68

The IP rating IP 68 of the sensor may be adversely affected as a result of damage to the signal cable.

- The sheathing of the signal cable must not be damaged.

1. Use the supplied signal cable to connect the sensor and the transmitter.
2. Connect the signal cable in the terminal box of the sensor.
3. Route the cable from the terminal box to above the maximum flooding height of 5 m (16.4 ft).
4. Tighten the cable gland.
5. Carefully seal the terminal box. Make sure the gasket for the cover is seated properly.

#### Note

As an option, the sensor can be ordered with the signal cable already connected to the sensor and the terminal box already potted.

#### Potting the terminal box on-site

### CAUTION

#### Danger to health!

The two-component potting compound is toxic – observe all relevant safety measures!

Comply with the safety data sheet of the two-component potting compound before preparations are started.

#### Risk notes:

- R20: Damaging to health when inhaled.
- R36/37/38: Irritates the eyes, respiratory organs and the skin.
- R42/43: Sensitization through inhaling and skin contact is possible.

#### Safety advice:

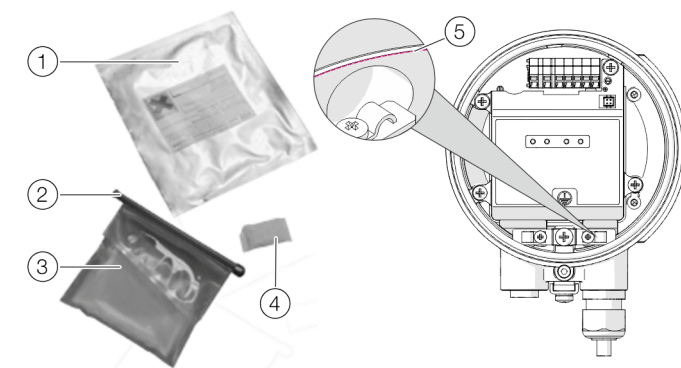
- S23: Do not inhale gas/smoke/humidity/aerosol.
- S24: Avoid contact with the skin.
- S37: Wear suited protective gloves.
- S63: In case of an accident due to inhaling: take the injured person out into the fresh air to rest.

If the terminal box is to be potted subsequently on-site, a special two-component potting compound can be ordered separately (order no. D141B038U01). Potting is only possible if the sensor is installed horizontally. Observe the following instructions during work activity:

## Preparation

- Complete the installation before potting in order to avoid moisture penetration. Before starting, check all the connections for correct fitting and stability
- Do not overfill the terminal box. Keep the potting compound away from the O-ring and the gasket / groove (see Figure 43).
- Prevent the two-component potting compound from penetrating the cable conduit (Conduit) for an ½ in NPT installation (if used).

## Procedure



- |                                  |                      |
|----------------------------------|----------------------|
| ① Packaging bag                  | ④ Drying bag         |
| ② Connection clamp               | ⑤ Maximum fill level |
| ③ Two-component potting compound |                      |

Figure 43: Terminal box sealing

1. Cut open the protective enclosure of the two-component potting compound (see packing).
2. Remove the connection clamp of the potting compound.
3. Knead both components thoroughly until a good mix is reached.
4. Cut open the bag at a corner. Perform work activity within 30 minutes.
5. Carefully fill the terminal box with the two-component potting compound until the connection cable is covered.
6. Wait a few hours before closing the cover in order to allow the compound to dry, and to release any possible gas.
7. Ensure that the packaging material and the drying bag are disposed of in an environmentally sound manner.

... 5 Electrical connections

Terminal assignment

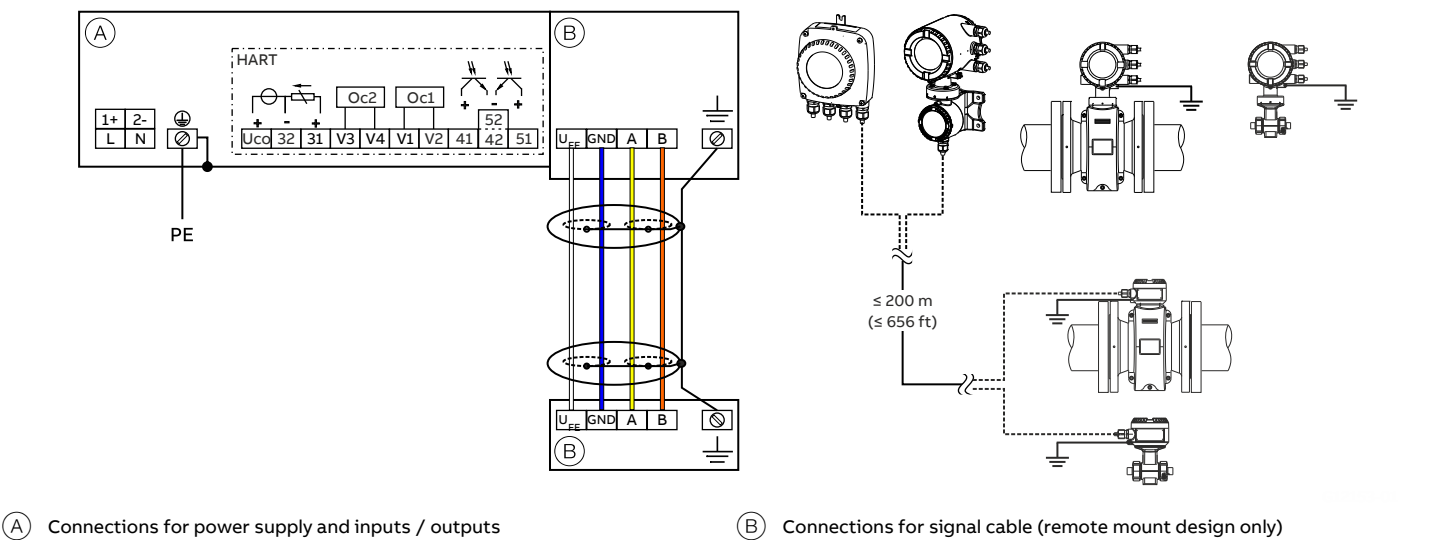


Figure 44: Electrical connections

Note

For additional information on the grounding of the transmitter, see **Grounding** on page 12.

Connections for the power supply

AC power supply	
Terminal	Function / comments
L	Phase
N	Neutral conductor
PE / ⊕	Protective earth (PE)

DC voltage supply	
Terminal	Function / comments
1+	+
2-	-
PE / ⊕	Protective earth (PE)

Connections for inputs and outputs

Terminal	Function / comments
Uco / 32	Current output 4 to 20 mA- / HART® output, active or
31 / 32	Current output 4 to 20 mA- / HART® output, passive
41 / 42	Passive digital output DO1
51 / 52	Passive digital output DO2
V1 / V2	Plug-in card, slot OC1
V3 / V4	Plug-in card, slot OC2
For details, see <b>Optional plug-in cards</b> on page 20.	

Connecting the signal cable

Only for remote mount design.  
The sensor housing and transmitter housing must be connected to potential equalization.

Terminal	Function / comments
U <sub>FE</sub>	Sensor power supply
GND	Ground
A	Data line
B	Data line
⏏	Functional earth / Shielding

## Electrical data for inputs and outputs

### Note

- An additional document with Ex safety instructions is available for measuring systems that are used in potentially explosive atmospheres.
- Ex safety instructions are an integral part of this manual. As a result, it is crucial that the installation guidelines and connection values it lists are also observed.

The icon on the name plate indicates the following:



### Power supply

#### AC power supply

Terminals	L / N
Operating voltage	100 to 240 V AC (-15 % / +10 %), 47 to 64 Hz
Power consumption	$S_{\max}$ : < 20 VA
Power-up current	18.4 A, $t < 3$ ms

#### DC voltage supply

Terminals	1+ / 2-
Operating voltage	16.8 to 30 V DC
Ripple	< 5 %
Power consumption	$P_{\max}$ : < 20 W
Power-up current	21 A, $t < 10$ ms

### HART communication

A HART DTM in accordance with FDT1.2 standards is available. HART protocol based Integrations in other Tools or systems (e.g., Emerson AMS/Siemens PCS7) are available on request. The DTM, the DD and EDD is available for download from [www.abb.com/flow](http://www.abb.com/flow).

#### HART output

Terminals	Active: Uco / 32 Passive: 31 / 32
Protocol	HART 7.1
Transmission	FSK modulation on current output 4 to 20 mA in accordance with Bell 202 standard
Baud rate	1200 baud
Signal amplitude	Maximum 1.2 mAss
Current output load	Minimum 250 $\Omega$
Cable	0,25 mm <sup>2</sup> (AWG 24), twisted
Maximum cable length	1200 m (3937 ft)

### Current output Uco / 32, 31 / 32

Can be configured for outputting mass flow and volume flow via the on-site software.

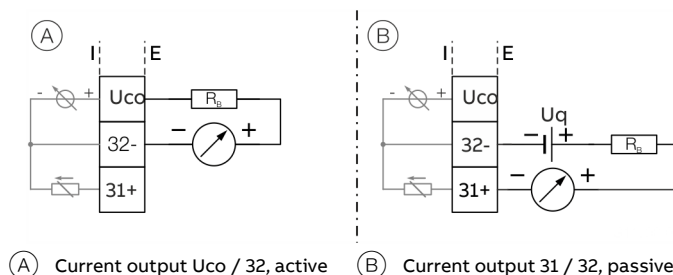
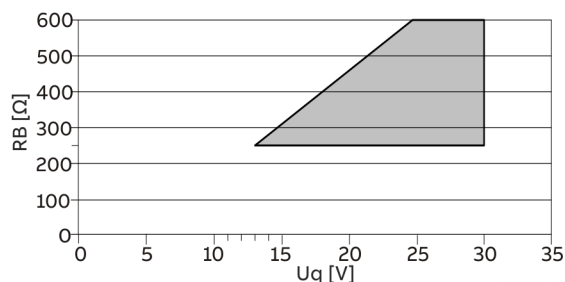


Figure 45: (I = internal, E = external,  $R_B$  = load)



Permissible source voltage  $U_q$  for passive outputs in relation to load resistance  $R_B$  where  $I_{\max} = 22$  mA. ■ = Permissible range

Figure 46: Source voltage for passive outputs

Current output	Active	Passive
Terminals	Uco / 32	31 / 32
Output signal	4 to 20 mA or 4 to 12 to 20 mA switchable	4 to 20 mA
Load $R_B$	$250 \Omega \leq R_B \leq 300 \Omega$	$250 \Omega \leq R_B \leq 600 \Omega$
Source voltage $U_q$ *	—	$13 \text{ V} \leq U_q \leq 30 \text{ V}$
Measuring error	< 0.1 % of measured value	
Resolution	0.4 $\mu\text{A}$ per digit	
Insulation	The current output and digital outputs are electrically isolated.	

\* Source voltage  $U_q$  depends on the load  $R_B$  and must be within the permissible range.

For information on communication via the HART protocol, refer to **HART® Communication** on page 44.

## ... 5 Electrical connections

### ... Terminal assignment

#### Digital output 41 / 42, 51 / 52 (basic device)

Can be configured as pulse, frequency or binary output via on-site software.

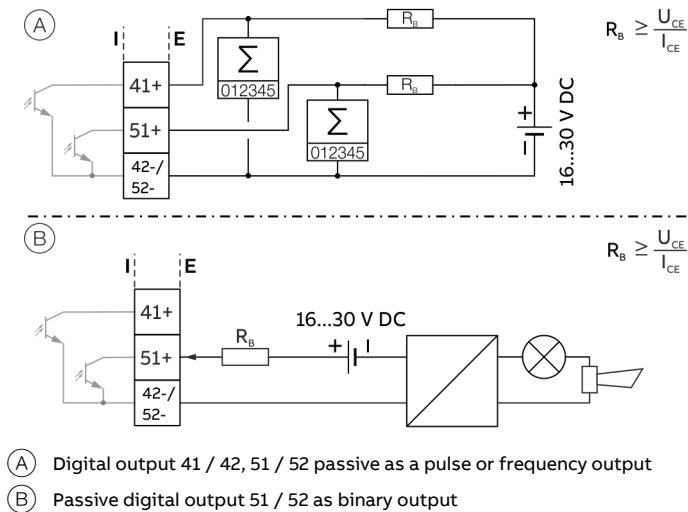


Figure 47: (I = internal, E = external,  $R_B$  = load)

Pulse / frequency output (passive)	
Terminals	41 / 42, 51 / 52
Output 'closed'	$0 \text{ V} \leq U_{\text{CEL}} \leq 3 \text{ V}$ For $f < 2.5 \text{ kHz}$ : $2 \text{ mA} < I_{\text{CEL}} < 30 \text{ mA}$ For $f > 2.5 \text{ kHz}$ : $10 \text{ mA} < I_{\text{CEL}} < 30 \text{ mA}$
Output 'open'	$16 \text{ V} \leq U_{\text{CEH}} \leq 30 \text{ V DC}$ $0 \text{ mA} \leq I_{\text{CEH}} \leq 0.2 \text{ mA}$
$f_{\text{max}}$	10.5 kHz
Pulse width	0.05 to 2000 ms

Binary output (passive)	
Terminals	41 / 42, 51 / 52
Output 'closed'	$0 \text{ V} \leq U_{\text{CEL}} \leq 3 \text{ V}$ $2 \text{ mA} \leq I_{\text{CEL}} \leq 30 \text{ mA}$
Output 'open'	$16 \text{ V} \leq U_{\text{CEH}} \leq 3 \text{ V DC}$ $0 \text{ mA} \leq I_{\text{CEH}} \leq 0.2 \text{ mA}$
Switching function	Can be configured using software.

#### Note

- Terminals 42 / 52 have common grounding. Digital outputs 41 / 42 and 51 / 52 are not electrically isolated from each other. An electrically isolated digital output can be made using a plug-in module.
- If using a mechanical counter, it is advisable to set a pulse width of  $\geq 30 \text{ ms}$  and a maximum frequency of  $f_{\text{max}} \leq 3 \text{ kHz}$ .

#### Current output V1 / V2, V3 / V4 (plug-in module)

Up to two additional plug-in modules can be implemented via the 'Passive current output (red)' option module.

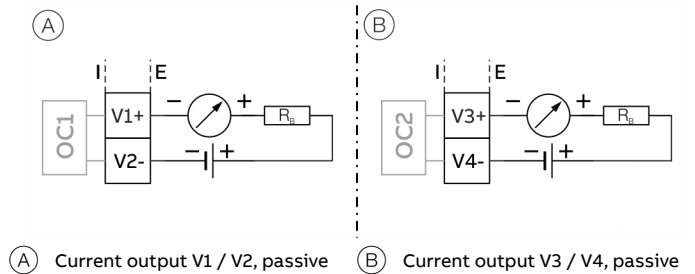
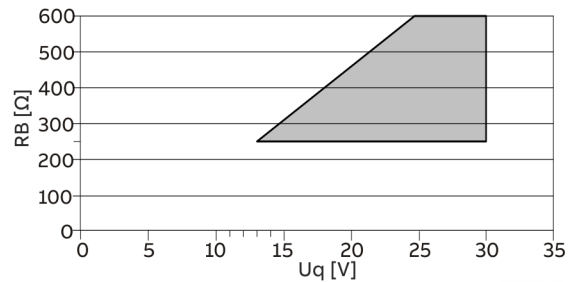


Figure 48: (I = internal, E = external,  $R_B$  = load)

The plug-in module can be used in slot OC1 and OC2.



Permissible source voltage  $U_q$  for passive outputs in relation to load resistance  $R_B$  where  $I_{\text{max}} = 22 \text{ mA}$ .  = Permissible range

Figure 49: Source voltage for passive outputs

Passive current output	
Terminals	V1 / V2, V3 / V4
Output signal	4 to 20 mA
Load $R_B$	$250 \Omega \leq R_B \leq 600 \Omega$
Source voltage $U_q$ *	$13 \text{ V} \leq U_q \leq 30 \text{ V}$
Measuring error	$< 0.1 \%$ of measured value
Resolution	$0.4 \mu\text{A}$ per digit

\* The source voltage  $U_q$  is dependent of the load  $R_B$  and must be placed in an additional area.

Digital output V1 / V2, V3 / V4 (plug-in card)

The ‘digital output passive (green)’ plug-in card can be used to create **one** additional binary output.

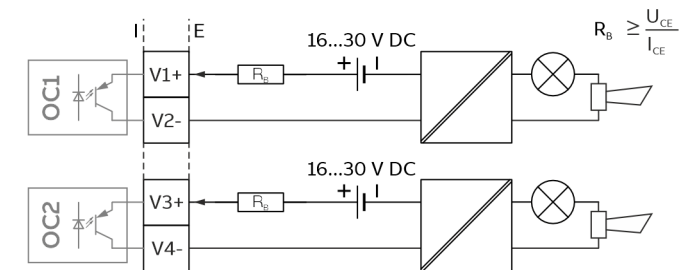


Figure 50: Plug-in card as binary output (I = internal, E = external,  $R_b$  = load)

The plug-in module can be used in slot OC1 **or** OC2.

Binary output (passive)	
Terminals	V1 / V2, V3 / V4
Output ‘closed’	$0\text{ V} \leq U_{CEH} \leq 3\text{ V}$ $2\text{ mA} < I_{CEL} < 30\text{ mA}$
Output ‘open’	$16\text{ V} \leq U_{CEH} \leq 30\text{ V DC}$ $0\text{ mA} \leq I_{CEH} \leq 0.2\text{ mA}$
Switching function	Parameterization possible.

Note

$I_{CEL} < 30\text{ mA}$ ;  $R_b = U_{CEH} / I_{CEL}$

- $R_b$  depends in the inner resistance of the DCS Input Card.  $R_b$  must be installed in case the inner resistance of the DCS Input Card does not limit  $I_{CE}$  to max. 30 mA.
- With the NAMUR switch set to ‘On’  $R_b$  is not required.

Digital input V1 / V2, V3 / V4 (plug-in card)

A digital input can be implemented via the ‘Passive digital input (yellow)’ plug-in card.

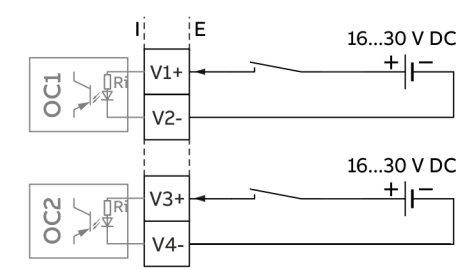


Figure 51: Plug-in card as digital input (I = internal, E = external)

The plug-in card can be used in slot OC1 **or** OC2.

Digital input	
Terminals	V1 / V2, V3 / V4
Input ‘On’	$16\text{ V} \leq U_{KL} \leq 30\text{ V}$
Input ‘Off’	$0\text{ V} \leq U_{KL} \leq 3\text{ V}$
Internal resistance $R_i$	6.5 k $\Omega$
Function	Parameterization possible.

... 5 Electrical connections

... Terminal assignment

**24 V DC loop power supply (plug-in card)**  
Use of the ‘loop power supply (blue)’ plug-in card allows a passive output on the transmitter to be used as an active output. See also **Connection examples** on page 37.

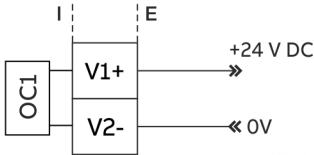


Figure 52: (I = Internal, E = External)

The plug-in card can only be used in slot OC1.

Loop power supply 24 V DC	
Terminals	V1 / V2
Function	For active connection of passive outputs
Output Voltage	24 V DC at 0 mA, 17 V DC at 25 mA
Load rating I <sub>max</sub>	25 mA, permanently short circuit-proof

**Note**

If the device is used in potentially explosive atmospheres, the plug-in card for the loop power supply may only be used to supply a passive output. It is not allowed, to connect it to multiple passive outputs!

**Modbus® / PROFIBUS DP/PA® interface V1 / V2 (plug-in card)**

A Modbus or PROFIBUS DP/PA interface can be implemented by using the ‘Modbus RTU, RS485 (white)’ or ‘PROFIBUS DP, RS485 (white)’ or ‘PROFIBUS PA, RS485 (blue)’ plug-in cards.

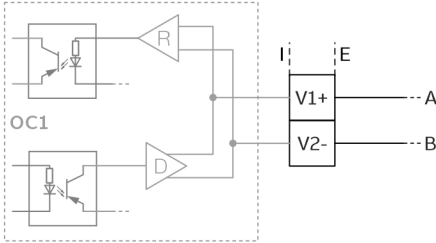


Figure 53: Plug-in card as a Modbus / PROFIBUS DP/PA interface (I = internal, E = external)

The corresponding plug-in card can only be used in slot OC1.

For information on communication through the Modbus or PROFIBUS DP/PA protocols, refer to chapters **Modbus® communication** on page 44 or **PROFIBUS DP® communication** on page 45 or **PROFIBUS PA® Communication** on page 47.



## Connection examples

Input and output functions are configured via the device software in accordance with the desired application.

### Digital output 41 / 42, 51 / 52, V3 / V4 active

When the 'loop power supply 24 V DC (blue)' plug-in card is used, the digital outputs on the basic device and on the option modules can also be wired as active digital outputs.

#### Note

Each 'loop power supply (blue)' plug-in card must only power one output.

It must not be connected to two outputs (for example digital output 41 / 42 and 51 / 52)!

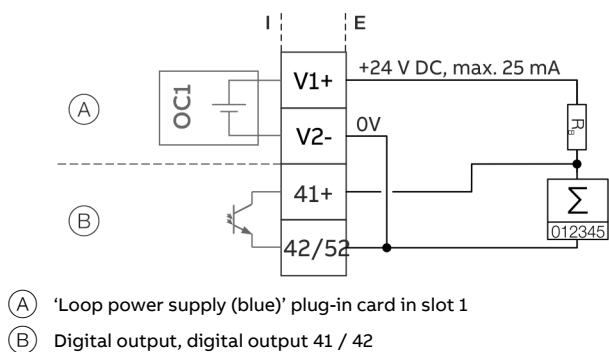


Figure 54: Active digital output 41 / 42 (example)

The connection example shows usage for digital output 41 / 42; the same applies to usage for digital output 51 / 52.

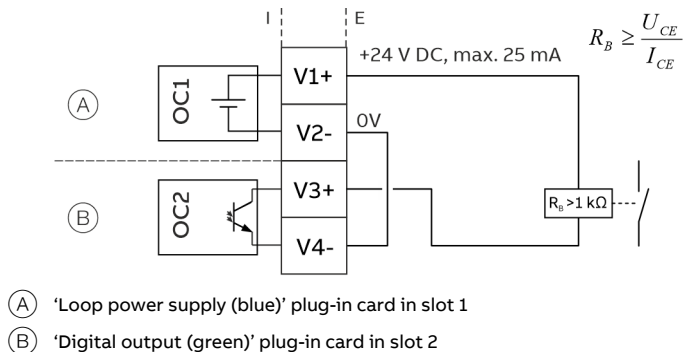


Figure 55: Active digital output V3 / V4 (example)

### Digital output 41 / 42, 51 / 52 passive on distributed control system

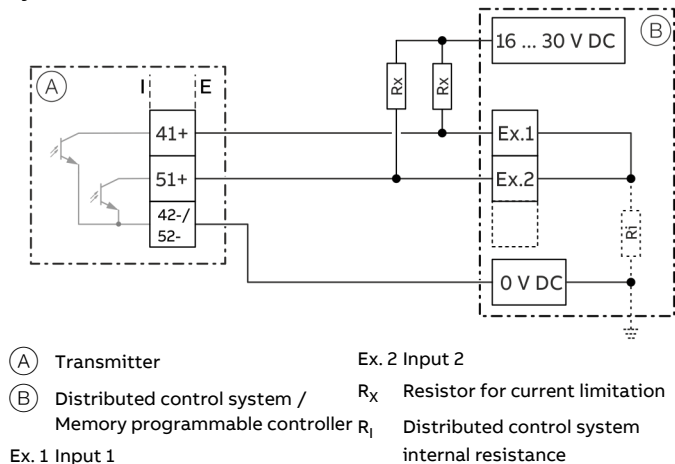


Figure 56: Digital output 41 / 42 on distributed control system (example)

The  $R_X$  resistors limit the maximum current through the optoelectronic coupler of the digital outputs in the transmitter. The maximum permissible current is 25 mA. An  $R_X$  value of  $1000 \Omega / 1 \text{ W}$  is recommended at a voltage level of 24 V DC. The input on the distributed control system is reduced from 24 V DC to 0 V DC (falling edge) with '1' at the digital output.

... 5 Electrical connections

... Terminal assignment

Current output V3 / V4 active

When the 'loop power supply 24 V DC, blue' plug-in card is used, the current output on the plug-in card can also be wired as the active current output.

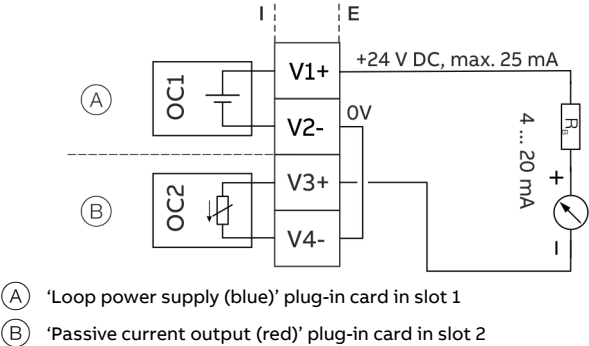


Figure 57: Active current output V3 / V4 (example)

Digital input V3 / V4 active

When the 'loop power supply 24 V DC, blue' plug-in card is used, the current output on the plug-in card can also be wired as the active current output.

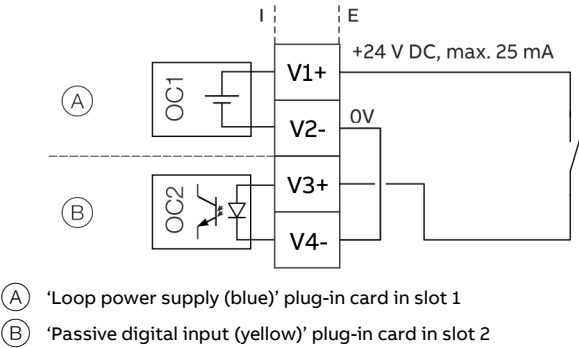


Figure 58: Active digital output V3 / V4 (example)

Connection versions digital output 41 / 42, 51 / 52

Depending on the wiring of digital outputs DO 41 / 42 and 51 / 52, they can be used parallel or only individually. The electrical isolation between the digital outputs also depends on the wiring.

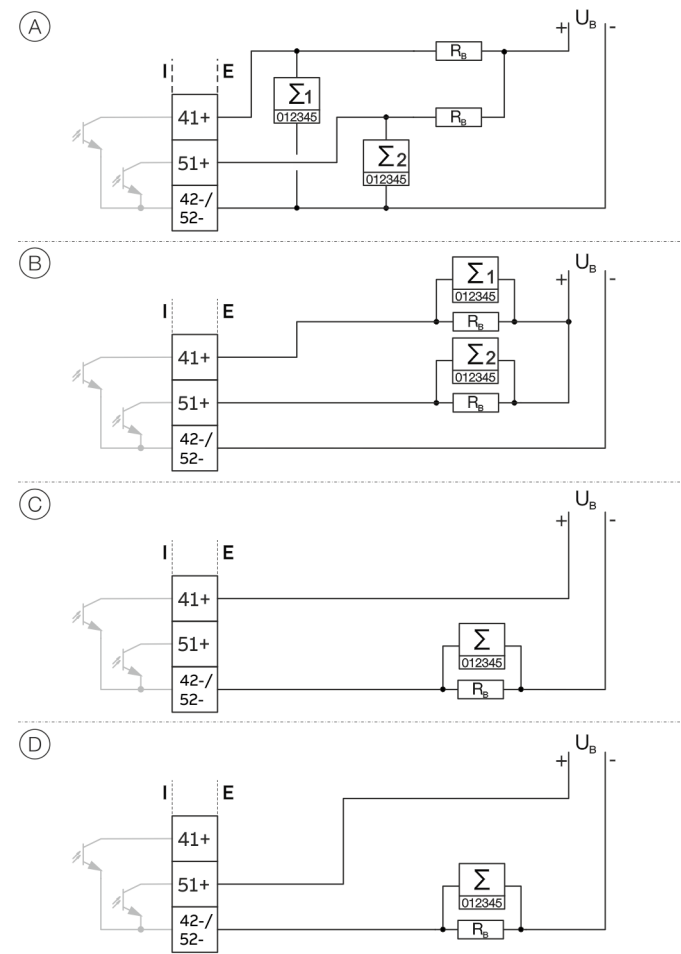


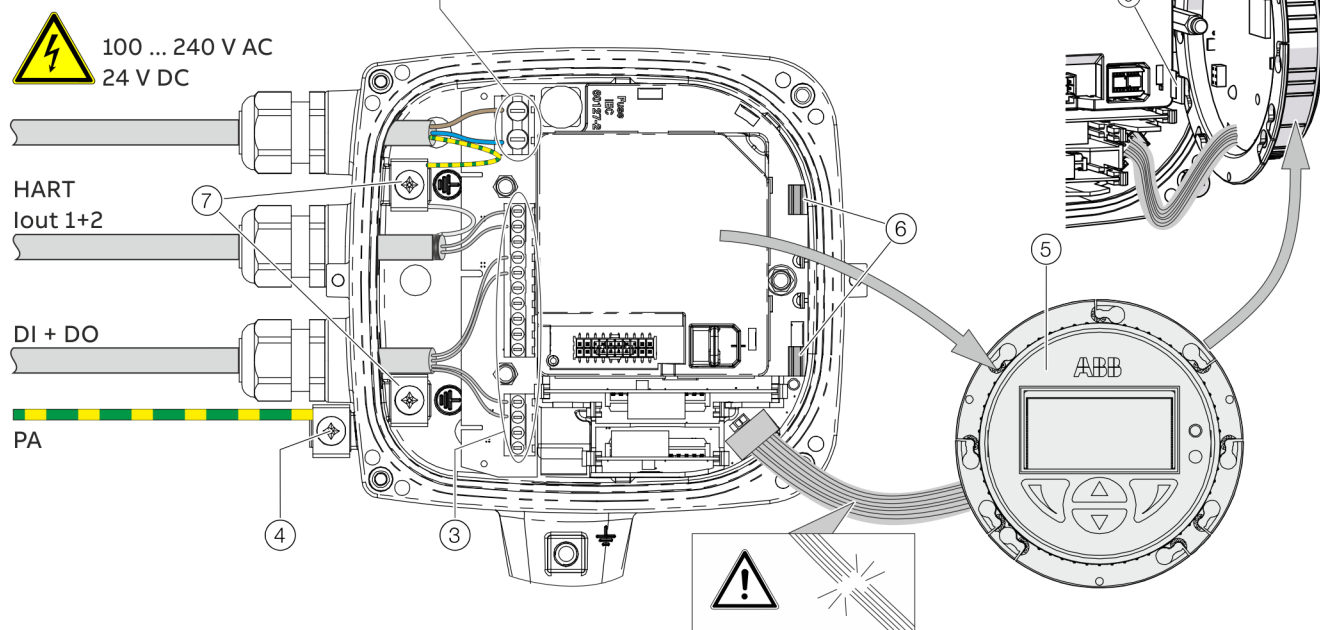
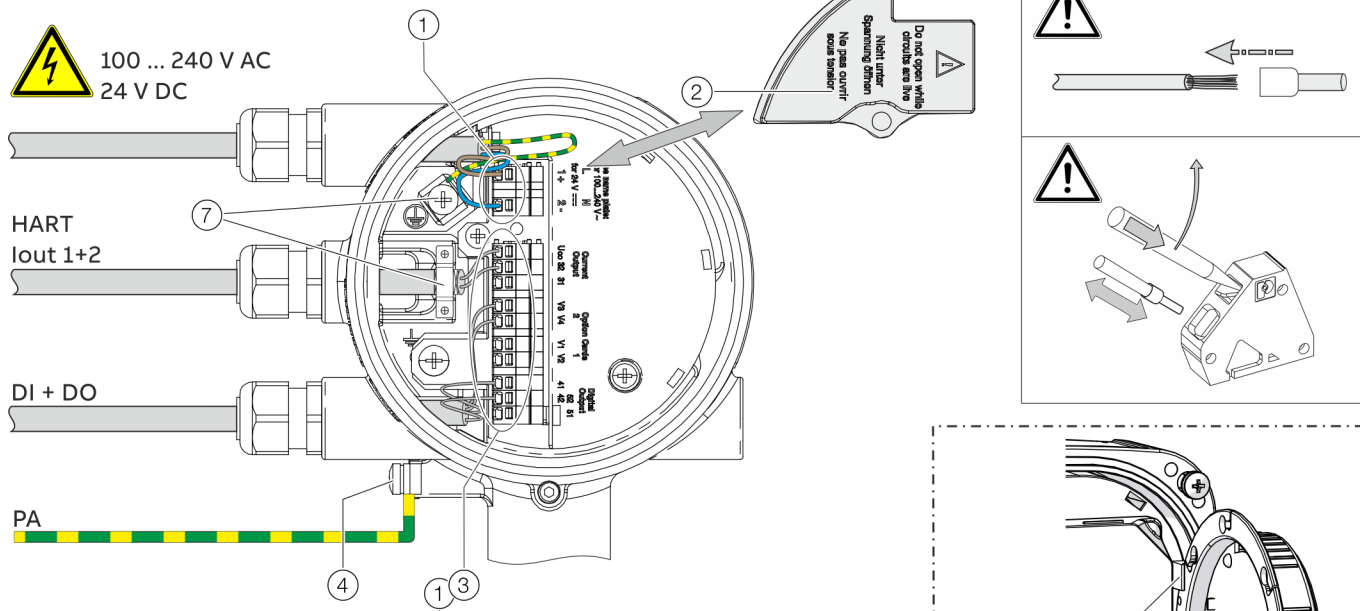
Figure 59: Connection versions digital output 41 / 42 and 51 / 52

	DO 41 / 42 and 51 / 52 can be used parallel	DO 41 / 42 and 51 / 52 electrically isolated
(A)	Yes	No
(B)	Yes	No
(C)	No, only DO 41 / 42 can be used	No
(D)	No, only DO 51 / 52 can be used	No

## Connection to the device

### Connection to integral mount design

#### Dual- compartment housing



#### Single-compartment housing

- |                                       |   |
|---------------------------------------|---|
| ① Terminals for power supply          | ⑤ LCD indicator                                 |
| ② Cover for power supply terminals    | ⑥ Bracket for LCD indicator (park position)     |
| ③ Terminals for inputs and outputs    | ⑦ Terminal for protective earth / cable shields |
| ④ Terminal for potential equalization |   |

Figure 60: Connection to device (example), PA = potential equalization

## ... 5 Electrical connections

### ... Connection to the device

#### **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 17 to open and close the housing safely.

Observe the following points when connecting to an electrical supply:

- Lead the power supply cable into the housing through the top cable entry.
- Lead the cables for signal inputs and signal outputs into the housing through the middle and, where necessary, bottom cable entries.
- Connect the cables in accordance with the electrical connection. If present, connect the cable shielding to the earthing clamp provided.
- Use wire end ferrules when connecting.
- After connecting the power supply to the dual-compartment housing, terminal cover ② must be installed.
- Close unused cable entries using suited plugs.

## Connection to remote mount design

### Transmitter

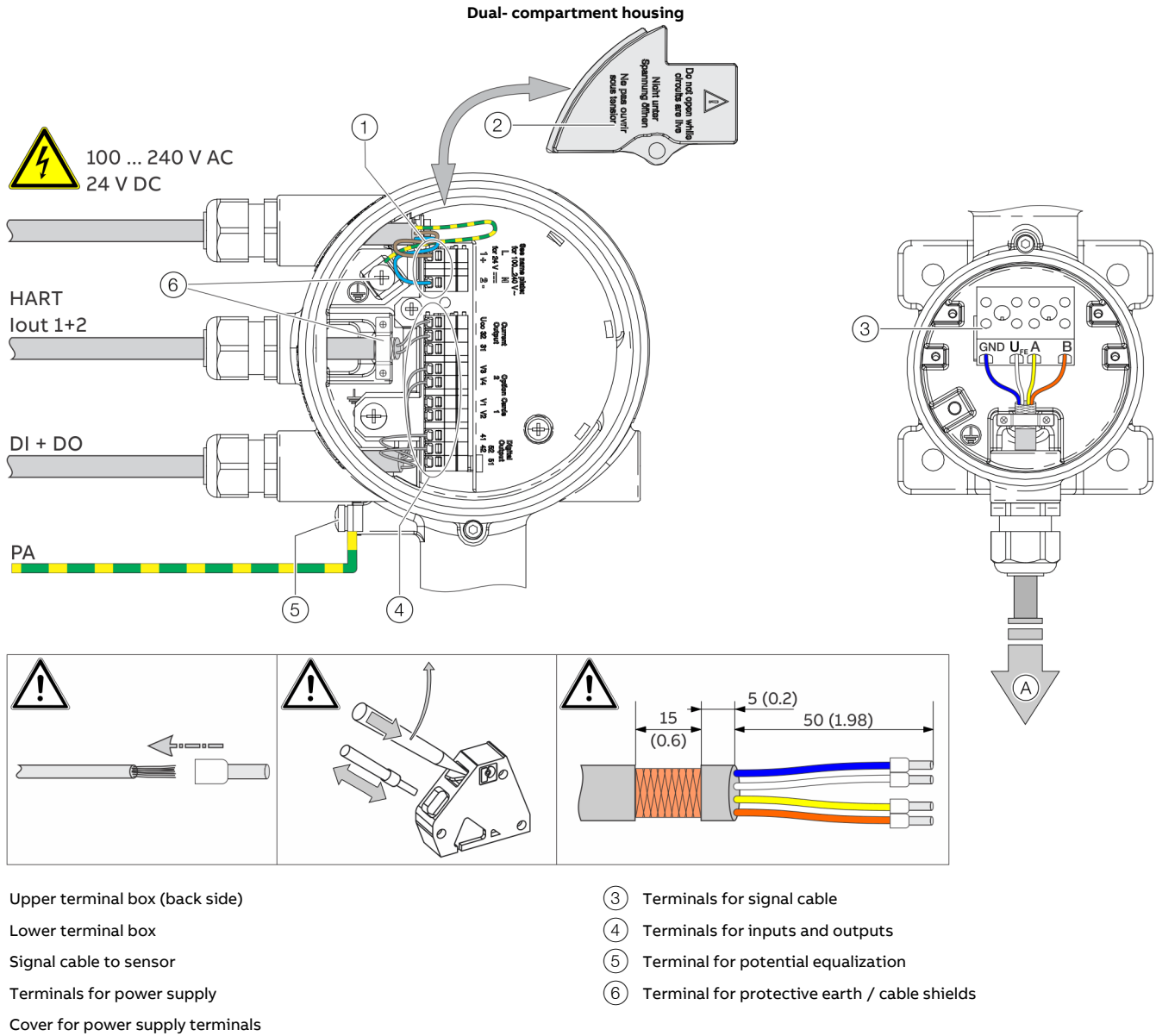


Figure 61: Electrical connection to transmitter in remote mount design [example, dimensions in mm (in)]

... 5 Electrical connections

... Connection to the device

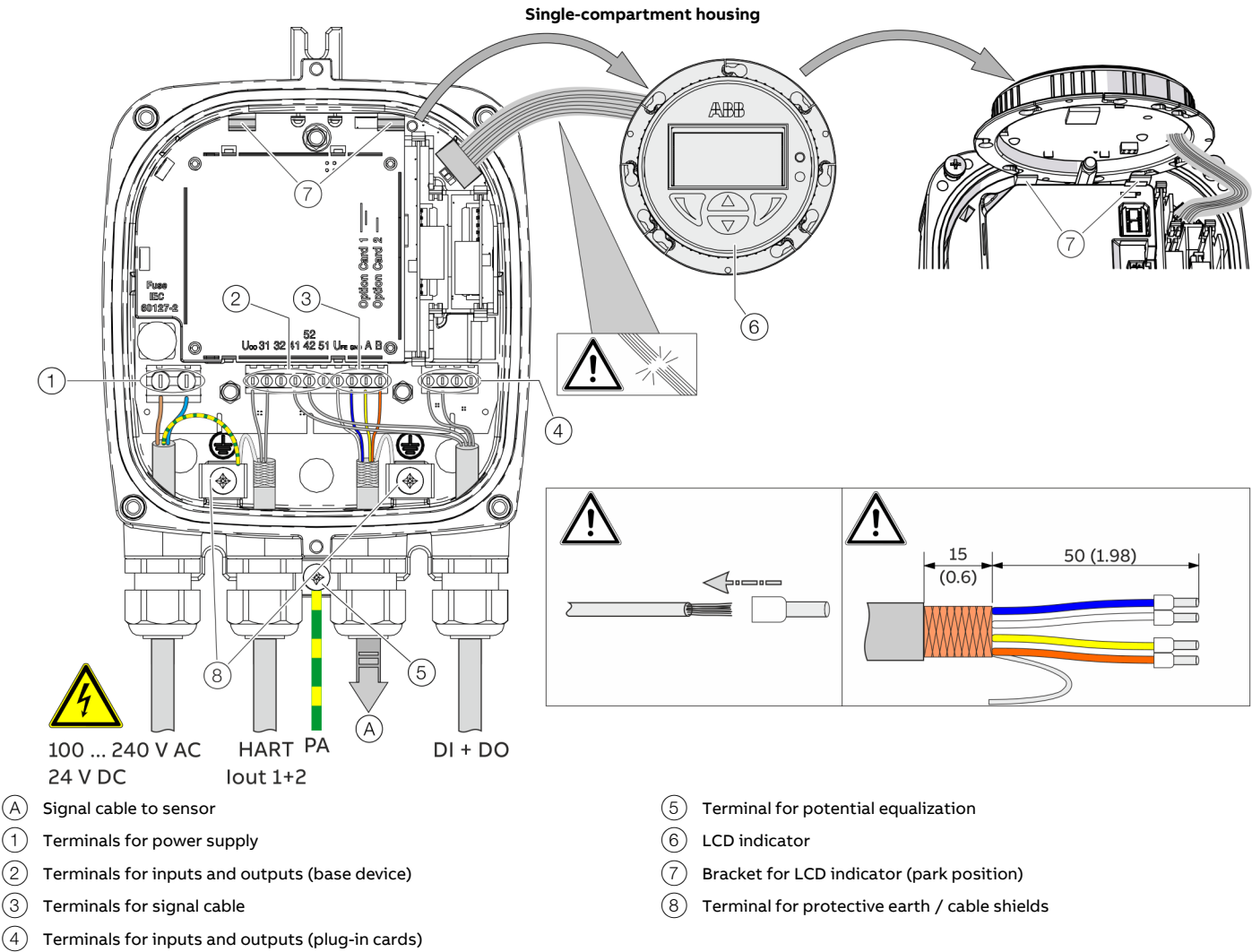


Figure 62: Electrical connection to transmitter in remote mount design [example, dimensions in mm (in)]

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 17 to open and close the housing safely.

Observe the following points when connecting to an electrical supply:

- Lead the cable for the power supply and the signal inputs and outputs into the housing as shown.
- The signal cable to the sensor is connected in the lower connection area of the transmitter.
- Connect the cables in accordance with the electrical connection diagram. If present, connect the cable shielding to the earthing clamp provided.
- Use wire end ferrules when connecting.
- After connecting the power supply, terminal cover (2) must be installed.
- Close unused cable entries using suitable plugs.

Terminal	ABB signal cable 3KQZ407123U0100	HELKAMA signal cable 20522
GND	Blue	Blue (4)
U <sub>FE</sub>	White	white (3)
A	Yellow	Blue (2)
B	Orange	white (1)

Flowmeter sensor

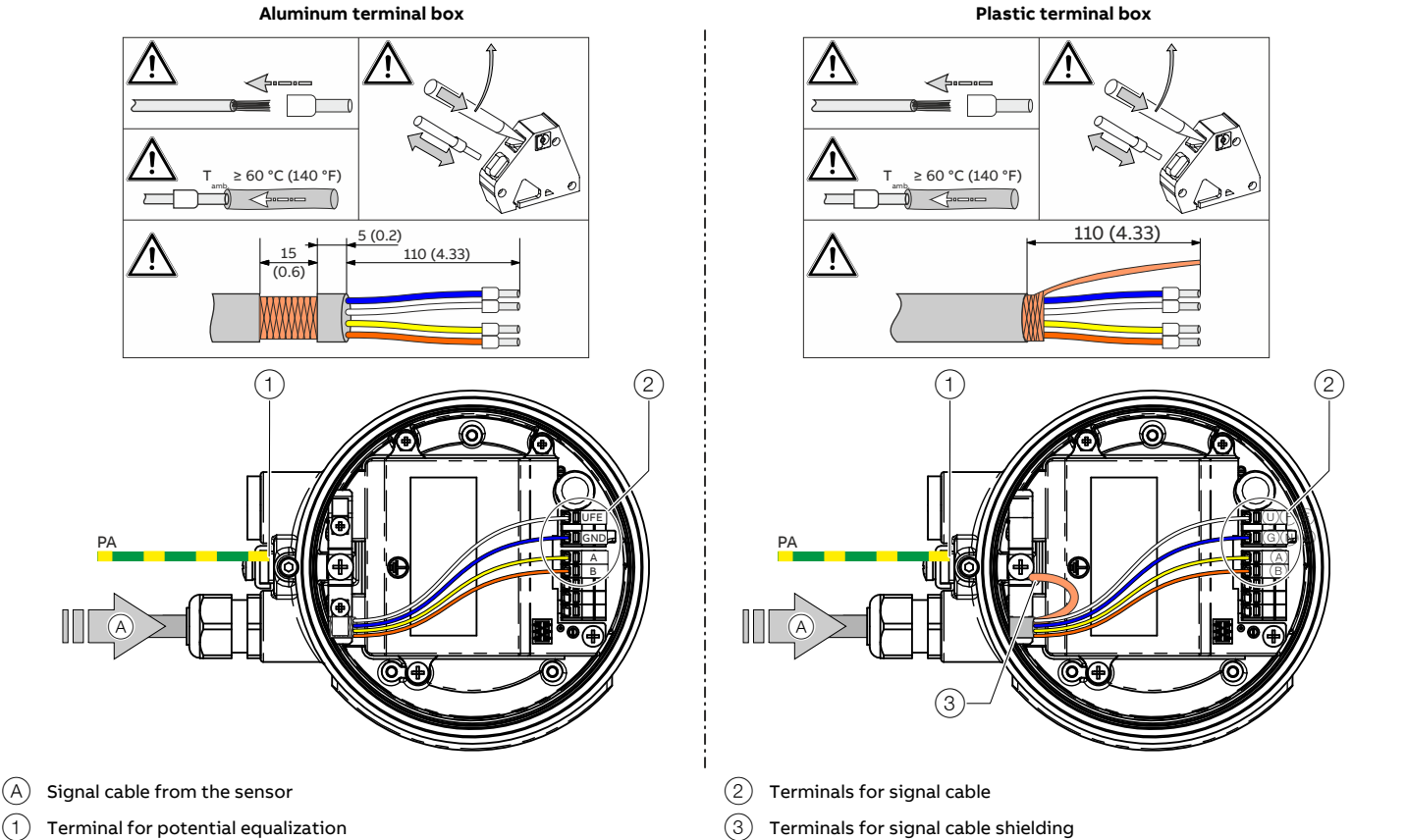


Figure 63: Connection to sensor in remote mount design (example)

**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 17 to open and close the housing safely.

- Observe the following points when connecting to an electrical supply:
- Lead the signal cable into the housing as shown.
  - Connect the cables in accordance with the electrical connection. If present, connect the cable shielding to the earthing clamp provided.
  - Use wire end ferrules when connecting.
  - From an ambient temperature of  $T_{amb.} \geq 60\text{ °C}$  ( $\geq 140\text{ °F}$ ) additionally insulate the wires with the enclosed silicone hoses.
  - Close unused cable entries using suited plugs.

Terminal	ABB signal cable 3KQZ407123U0100	HELKAMA signal cable 20522
GND	Blue	Blue (4)
$U_{FE}$	White	white (3)
A	Yellow	Blue (2)
B	Orange	white (1)

## 6 Digital communication

### HART® Communication

#### Note

The HART® protocol is an unsecured protocol, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

In connection with the DTM (Device Type Manager) available to the device, communication (configuration, parameterization) can be carried out FDT 0.98 or 1.2.

Other tool or system integrations (e.g. Emerson AMS / Siemens PCS7) on request.

The necessary DTMs and other files can be downloaded from [www.abb.com/flow](http://www.abb.com/flow).

#### HART output

Terminals	Active: Uco / 32 Passive: 31 / 32
Protocol	HART 7.1
Transmission	FSK modulation on current output 4 to 20 mA in accordance with the Bell 202 standard
Baud rate	1200 baud
Signal amplitude	Maximum 1.2 mAss

#### Factory setting of the HART process variables

HART process variable	Process value
Primary Value (PV)	Volume Flow in %
Secondary Value (SV)	Massflow in %
Tertiary Value (TV)	Volumeflow Totalizer Forward
Quaternary Value (QV)	Volumeflow Totalizer Reverse

The process values of the HART variables can be set in the device menu.

### Modbus® communication

#### Note

The Modbus® protocol is an unsecured protocol, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

Modbus is an open standard owned and administrated by an independent group of device manufacturers styled the Modbus Organization ([www.modbus.org/](http://www.modbus.org/)).

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.

#### Modbus protocol

Terminals	V1 / V2
Configuration	Via the Modbus interface or via the local operating interface in connection with a corresponding Device Type Manager (DTM)
Transmission	Modbus RTU - RS485 serial connection
Baud rate	2400, 4800, 9600, 19200, 38400, 56000, 57600, 115200 baud Factory setting: 9600 baud
Parity	None, even, odd Factory setting: odd
Stop bit	One, two Factory setting: One
IEEE format	Little endian, big endian Factory setting: Little endian
Typical response time	< 100 ms
Response delay time	0 to 200 milliseconds Factory setting: 10 milliseconds

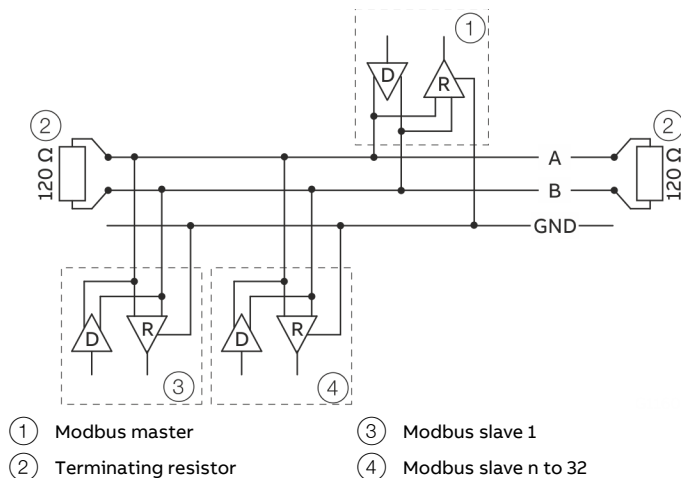


Figure 64: Communication with the Modbus protocol



Cable specification

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

- At a baud rate of 9600 and with a conductor cross-section of at least 0.14 mm<sup>2</sup> (AWG 26), the maximum length is 1000 m (3280 ft).
- When using a 4-core cable as a 2-wire wiring system, the maximum length must be halved.
- The spur lines must be short, a maximum of 20 m (66 ft).
- When using a distributor with 'n' connections, each branch must have a maximum length of 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.

PROFIBUS DP® communication

Note

The PROFIBUS DP® protocol is an unsecured protocol, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

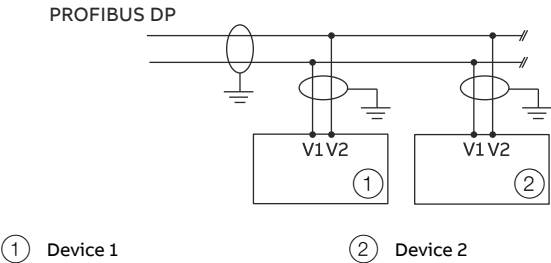


Figure 65: Communication with the PROFIBUS DP protocol

PROFIBUS DP interface	
Terminals	V1 / V2
Configuration	Via the PROFIBUS DP interface or via the local operating interface in connection with a corresponding Device Type Manager (DTM)
Transmission	Based on IEC 61158-2
Baud rate	9.6 kbps, 19.2 kbps, 45.45 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1.5 Mbps The baud rate is automatically detected and does not need to be configured manually
Device profile	PA Profile 3.02
Bus address	Address range 0 to 126 Factory setting: 126
Number of DP nodes	≤ 32, Node = Devices with / without PROFIBUS address
Bus termination	Bus termination required at the beginning and end of each DP segment!

## ... 6 Digital communication

### ... PROFIBUS DP® communication

For commissioning purposes, you will need a device driver in EDD (Electronic Device Description) or DTM (Device Type Manager) format plus a GSD file.

You can download EDD, DTM and GSD from [www.abb.com/flow](http://www.abb.com/flow).

The files required for operation can also be downloaded from [www.profibus.com](http://www.profibus.com).

ABB provides three different GSD files which can be integrated in the system.

ID number	GSD file name	
0x9740	PA139740.gsd	1xAI, 1xTOT
0x9700	PA139700.gsd	1AI
0x3432	ABB_3432.gsd	6xAI, 2xTOT, 1xAO, 1xDI, 1xDO

Users decide at system integration whether to install the full range of functions or only part. Switching is made using the 'Ident Nr. Selector' parameter.

See also **Parameter description** in the operating instruction.

#### General Information

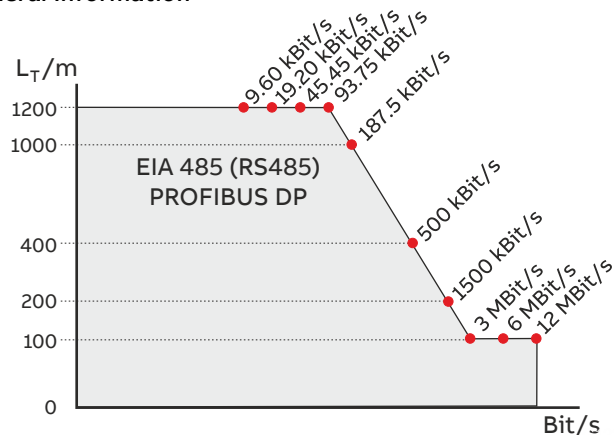


Figure 66: Bus cable length depends on the transmission rate

#### Pro PROFIBUS Line

(Line = Starts at DP Master and goes to last DP/PA Slave)

- Approximately 4 to 8 DP segments through the repeater (see repeater data sheets)
- Recommended DP transfer rate 500 to 1500 kBit/s
- The slowest DP node determines the transfer rate of the DP line
- Number of PROFIBUS DP and PA nodes  $\leq 126$  (addresses 0 to 125)

#### Per PROFIBUS DP segment

- Number of DP nodes  $\leq 32$   
(Node = Devices with / without PROFIBUS address)
- Bus termination required at the beginning and end of each DP segment!
- Trunk cable length ( $L_T$ ) see diagram (length dependent on transfer rate)
- Cable length of at least 1 m between two DP nodes at  $\geq 1500$  kBit/s!
- Spur cable length ( $L_S$ ), at  $\leq 1500$  kBit/s:  $L_S \leq 0.25$  m, at  $> 1500$  kBit/s:  $L_S = 0.00$  m!
- At 1500 kBit/s and ABB DP cable type A:
  - Sum of all spur cable lengths ( $L_S$ )  $\leq 6.60$  m, trunk cable length ( $L_T$ )  $> 6.60$  m, total length =  $L_T + (\sum L_S) \leq 200$  m, maximum 22 DP nodes (=  $6.60 \text{ m} / (0.25 \text{ m} + 0.05 \text{ m spare})$ )

## PROFIBUS PA® Communication

### Note

The PROFIBUS PA® protocol is an unsecured protocol, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

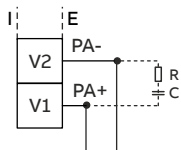


Figure 67: Communication with the PROFIBUS PA protocol

### PROFIBUS PA interface

Terminals	V1 (PA+) / V2 (PA-)
Configuration	Via Device HMI or PROFIBUS PA-DTM or FDI package
Transmission	Based on IEC 61158-2
Device profile	The interface conforms to profile 3.02 (PROFIBUS standard, EN 50170, DIN 19245 [PRO 91])
PROFIBUS PA ID no	0x3438
Alternative standard ID no	0x9700 or 0x9740
Bus cable	Shielded, twisted cable (acc. to IEC 61158-2, types A or B are preferred)

### Bus topology

- Tree and/or line structure
- Bus termination: passive at both ends of the main bus line (RC element  $R = 100 \Omega$ ,  $C = 1 \mu F$ )

### Voltage / current consumption

- Average current consumption: 10 mA
- In the event of an error, the integrated FDE function (=Fault Disconnection Electronic) integrated in the device ensures that the current consumption can rise to a maximum of 13 mA.
- The upper current limit is restricted electronically.
- The voltage on the bus line must be within 9 to 32 V DC

### Short circuit protection / reverse polarity protection

The Device Terminals V1 and V2, Profibus connects to, are short-circuit protected and have a reverse polarity protection.

### System integration

ABB provides three different GSD files which can be integrated in the system.

ID number	GSD file name
0x9700	PA139700.gsd
0x9740	PA139740.gsd
0x3438	ABB_3438.gsd

Users decide at system integration whether to install the full range of functions or only part. Switching is made using the 'Ident Nr. Selector' parameter.

See also **Parameter description** in the operating instruction.

You can download the GSD files from [www.abb.com/flow](http://www.abb.com/flow).

For additional information, see separate interface documentation.

### PROFIBUS PA connection via M12-Plug

Only in non-hazardous areas!

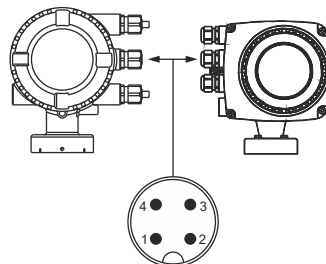


Figure 68: Pin assignment\* PROFIBUS PA M12-Plug (option)

### Pin assignment\*

Pin	Function
1	PA+
2	Not connected
3	PA-
4	Shield

\* Front view showing pin insert and pins

... 6 Digital communication

EtherNet/IP™ and PROFINET® communication

**Note**  
You will find detailed information regarding the “Ethernet” in the interface description ‘COM/FEP630/FEH630/E/MB’.

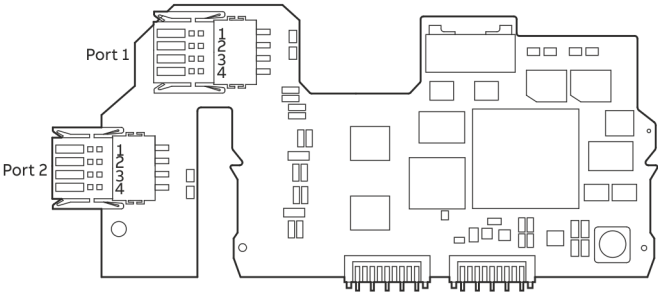


Figure 69: Ethernet communication plug-in card

One port connection without power over Ethernet

Terminal designation:			
Port	Pin	Function	Color coding
1	Pin 1	RD+	White / Orange
	Pin 2	RD–	Orange
	Pin 3	TD+	White / Green
	Pin 4	TD–	Green

Standard Ethernet 10/100 BASE-T/TX (IEEE802.3) single port connection.

One port connection with power over Ethernet

Terminal designation:			
Port	Pin	Function	Color coding
1	Pin 1	RD+	White / Orange
	Pin 2	RD–	Orange
	Pin 3	TD+	White / Green
	Pin 4	TD–	Green
2	Pin 1	PWR+	White / Blue
	Pin 2	PWR+	Blue
	Pin 3	PWR–	White / Brown
	Pin 4	PWR–	Brown

Standard Ethernet 10/100 BASE-T/TX (IEEE802.3) single port connection.

Two port connection without power over Ethernet

Terminal designation:			
Port	Pin	Function	Color coding
1	Pin 1	RD+	White / Orange
	Pin 2	RD–	Orange
	Pin 3	TD+	White / Green
	Pin 4	TD–	Green
2	Pin 1	RD+	White / Orange
	Pin 2	RD–	Orange
	Pin 3	TD+	White / Green
	Pin 4	TD–	Green

Ethernet communication

Equipped with an Ethernet Card, the flowmeter provides 2 Ports supporting a Ring, Star and Daisy Chain Network configuration.

In addition to the Ethernet Card, a plug-in Card providing ,Power over Ethernet‘ is available. This Card allows to power the 24 V DC Version of the flowmeter through Ethernet without the need for additional power supply.

### EtherNet/IP™ and PROFINET® protocol

#### Note

The protocol is not secure, as such. The application should be assessed before Implementation to ensure the protocol is suitable.

The EtherNet/IP and PROFINET protocol supports cyclic communication. Process Variables, Diagnostic Data and Device Status Information can be accessed cyclically. With PROFINET communication, the DHCP (Dynamic Host Configuration Protocol) function is not supported and PROFINET DCP (Discovery and Configuration Protocol) is used instead.

For Device Configuration a Webserver is available providing full access to all parameter and diagnostic data.

#### EtherNet/IP Interface

Configuration	Through the Webserver or the local operating Interface (Display).
EtherNet / IP ProductCode	5002
EDS file	FEW530_FEPFEH630_01_01.eds
Device profile	Profile 0x43, Generic Device, (keyable).
Supporte standards and protocols	Common Industrial Protocol (CIP™) Vol1, Ed 3.25 EtherNet/IP™ Adaptation of CIP™, Vol2, Ed 1.23
Cable	Cat 5

#### PROFINET Interface

Configuration	Through the Webserver or the local operating Interface (Display).
Device profile	PA Profile 4.01 Specification
GSDML File	GSDML-V2.42-ABB_001A-3437_FLOW_EL_MAGNETIC-20220713.xml
GSD File	ABB 0x3437 or PNO 0xB332
Supporte standards and protocols	Common Industrial Protocol (CIP™) Vol1, Ed 3.25 EtherNet/IP™ Adaptation of CIP™, Vol2, Ed 1.23 PROFINET PNIO_Version V2.42

### Further communication protocols

#### Note

The device supports following security modes:

Secured Protocols	Unsecured protocols
<b>Webserver https</b>	<b>EtherNet/IP, Modbus TCP and PROFINET</b>
<ul style="list-style-type: none"> <li>Used ports by Webserver: TCP 443</li> <li>Security is based on .x509 Certificates</li> </ul>	<ul style="list-style-type: none"> <li>Used ports by EtherNet/IP: TCP 44818, UDP 2222</li> <li>Used ports by Modbus/TCP: TCP 502</li> <li>Used ports by PROFINET: UDP 34964, 49152</li> </ul>

All protocols can be enabled / disabled in the HMI Menu.

#### Note

For EMC reasons, if an Ethernet output and a current or digital output are used simultaneously, a shielded cable must also be used for the current or digital output. The shield of the cable must be connected in the unit., see **Connection to integral mount design** on page 39 and **Connection to remote mount design** on page 41.

... 6 Digital communication

... EtherNet/IP™ and PROFINET® communication

Wiring with different network topologies

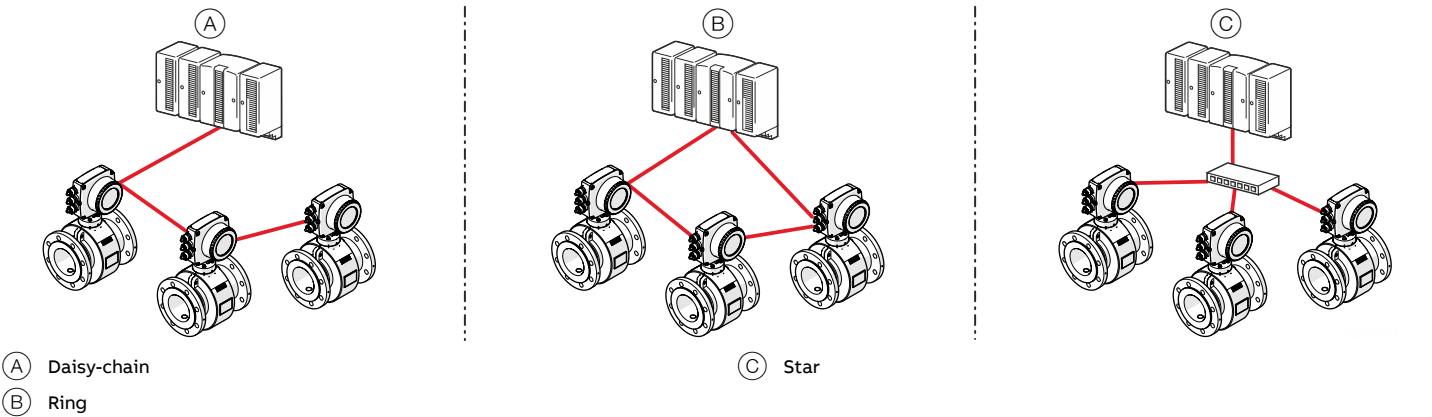


Figure 70: Connection topologies

Ethernet Option Cards are designed only for use in hazardous applications Zone 2 / Division 2 or general purpose areas. The output circuits are designed so that different topologies such as daisy chain or point to point can be connected. See Installation diagram for detailed information.

- It is not permitted to combine both topologies.
- Ethernet communication is only available for installations in Zone 2/Division 2 or general purpose
- The rated voltage of these non-intrinsically safe circuits are UM = 57 V.

Topology	No. Ethernet cables connected	No. wires in Ethernet cable	PoE	Port	Clamp	Function	Cable
<div>Star</div>	1	4	No	1	1	RD+	white / orange
					1	RD-	orange
					3	TD+	white / green
					4	TD-	green
	1	8	No	1	1	RD+	white / orange
					2	RD-	orange
					3	TD+	white / green
					4	TD-	green
				2	1	Spare 1+	white / blue
					2	Spare 1-	blue
					3	Spare 2+	white / brown
					4	Spare 2-	brown
	1	4	Yes	1	1	Recommendation:	
					2	Use cable with 8 wires	
					3		
					4		
	1	8	Yes	1	1	RD+	white / orange
					2	RD-	orange
					3	TD+	white / green
					4	TD-	green
				2	1	Spare 1+	white / blue
					2	Spare 1-	blue
					3	Spare 2+	white / brown
					4	Spare 2-	brown

Topology	No. Ethernet cables connected	No. wires in Ethernet cable	PoE	Port	Clamp	Function	Cable
Ring or daisy-chain	2	4*	No	1	1	RD+	white / orange
					2	RD-	orange
					3	TD+	white / green
					4	TD-	green
				2	1	RD+	white / orange
					2	RD-	orange
					3	TD+	white / green
					4	TD-	green

\* If you use 8-wire cables, 4 wires will not be connected.

Connect the retractable plug to the Ethernet card

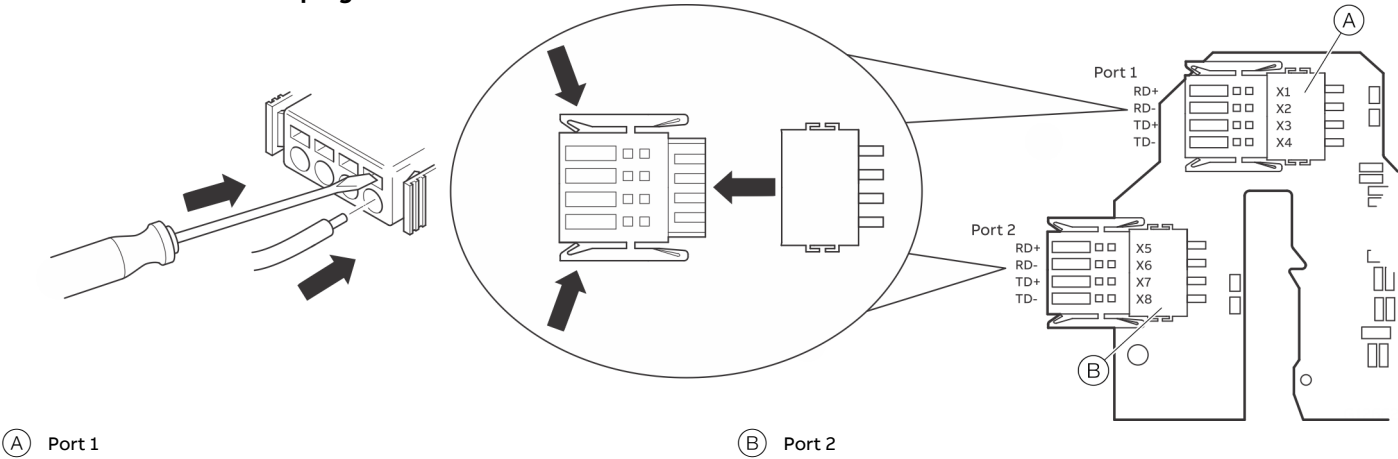


Figure 71: Ethernet card connection

... 6 Digital communication

... EtherNet/IP™ and PROFINET® communication

Preparing the EtherNet Cat5e cable

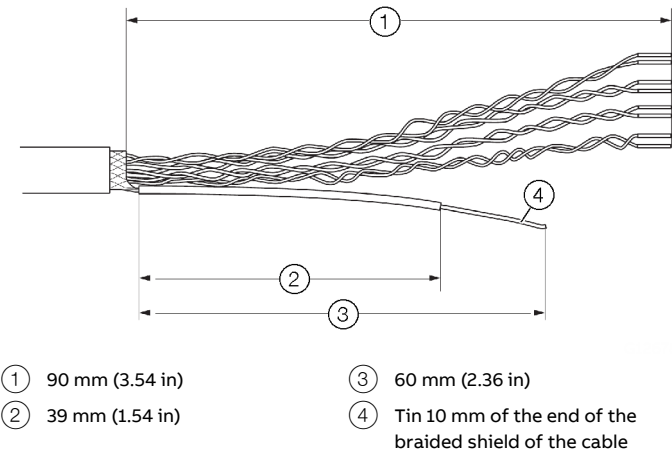


Figure 72: Preparing the EtherNet Cat5e cable

Ground the Ethernet connection cable

Connect the outer shield of the Ethernet cable to the screw terminal.

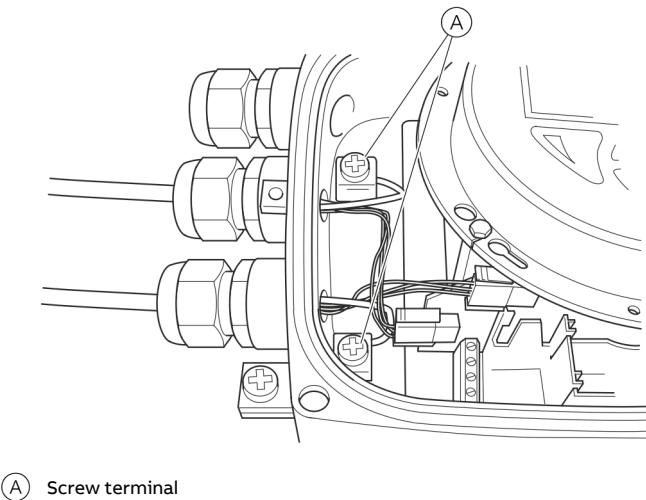






Figure 73: Ground the Ethernet connection cable

M12 connector (optional)

A variety of options are available for the M12 connector through the model code:

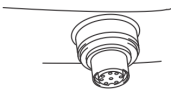
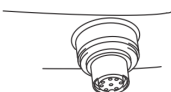
- Flowmeter equipped with 1 × M12 (four-wire, connection to Port 1)
- Flowmeter equipped with 2 × M12 (four-wire, connection to Port 1 and 2)
- Flowmeter equipped with 1 × M12 (eight-wire, connection to Port 1 and 2)

These options enable connection to various network topologies:

Topology	Four-wire	Four-wire	Four-wire	Eight-wire
				
	1 x M12 (four-wire)	2 x M12 (four-wire)	1 x M12 (eight-wire)	
Star	Y	Y	Y	
Ring or daisy chain	N	Y	N	
PoE	N	N	Y	


Electrical connections

You can reference the internal wiring in the transmitter and the corresponding pin assignment in the M12 connector in the following table:

Wiring inside the transmitter	M12 connector pin	Color	Ethernet plug-in card Connector/pin
 <p>M12 connector four-wire</p>	1	Yellow	Port 1 X1
	2	Orange	Port 1 X2
	3	White	Port 1 X3
	4	Blue	Port 1 X4
 <p>M12 connector eight-wire</p>	1	White	Port 1 X1
	2	Blue	Port 1 X2
	3	Brown	Port 1 X3
	4	Green	Port 1 X4
	5	Pink	Port 1 X5
	6	Yellow	Port 1 X6
	7	Grey	Port 1 X7
	8	Red	Port 1 X8



Use in potentially explosive atmospheres


 **WARNING**

There are limitations to the M12 connector in combination with an ATEX / IECEx / EAC-Ex approved flowmeter.

	No Ex area	ATEX/IECEX/ EAC-Ex Zone 2	Div 2
Ethernet cable connected directly to the terminals of the Ethernet plug-in card	Y	Y	Y
Ethernet cable connected to the M12 connector on the transmitter housing	Y	Y	N

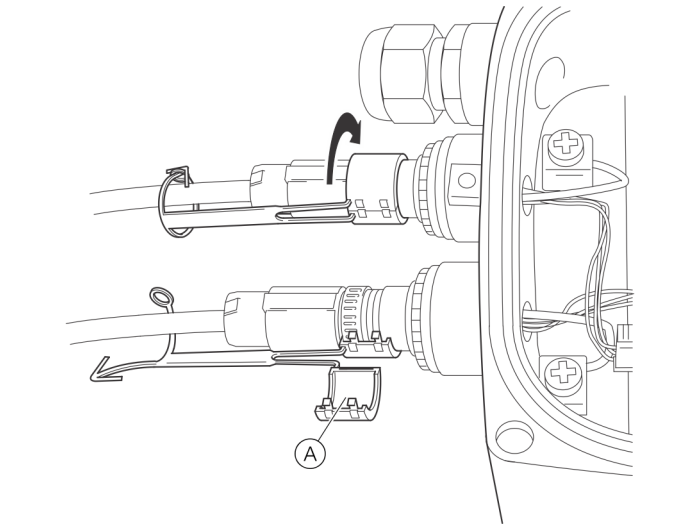
1. Remove the sealing cap of the M12 metal connector on the transmitter housing when delivered.
2. Connect the customer-provided M12 connector cable.
3. Place the enclosed locking clip around the M12 connector and close it until the locking clip engages, then secure the locking clip by closing the pin and pin boss.

Locking clip

 **WARNING**


A locking clip must be attached when using the M12 connector in combination with an ATEX / IECEx / EAC-Ex approved flowmeter.

- Use or operation of the device without the M12 locking clip is not permitted.



(A) Locking clip

Figure 74: Fastening the locking clip

 **DANGER**

**Explosion hazard**  
Explosion hazard caused by connecting or disconnecting the M12 connector when the device is in live state.

- Connect or disconnect the M12 connector only if the device is de-energized.

... 6 Digital communication

... EtherNet/IP™ and PROFINET® communication

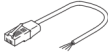
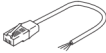
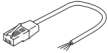

RJ45 connector (optional)

A variety of options are available for the RJ45 connector through the model code: The RJ45 connector is equipped with an Ethernet cable of a specific length, depending on the model code.

The flowmeter is supplied with an Ethernet cable, which is connected to the terminals in the transmitter at the factory.

- Flowmeter equipped with 1 × RJ45 (four-wire, connection to Port 1)
- Flowmeter equipped with 2 × RJ45 (four-wire, connection to Port 1 and 2)
- Flowmeter equipped with 1 × RJ45 (eight-wire, connection to Port 1 and 2)

These options enable connection to various network topologies:


Topology	Four-wire	Four-wire	Four-wire	Eight-wire
				
	1 x RJ45 (four-wire)	2 x M12 (four-wire)		1 x RJ45 (eight-wire)
Star	Y	Y		Y
Ring or daisy chain	N	Y		N
PoE	N	N		Y

Electrical connections

You can reference the in the transmitter and the corresponding pin assignment in the RJ45 connector in the following table:

Wiring inside the transmitter	Color	Ethernet plug-in card
RJ45 four-wire	Yellow	Port 1 X1
	Orange	Port 1 X2
	White	Port 1 X3
	Blue	Port 1 X4
RJ45 eight-wire	White/orange	Port 1 X1
	Orange	Port 1 X2
	White/Green	Port 1 X3
	Green	Port 1 X4
	White/blue	Port 2 X5
	Blue	Port 2 X6
	White/brown	Port 2 X7
	Brown	Port 2 X8

Use in potentially explosive atmospheres

 **WARNING**

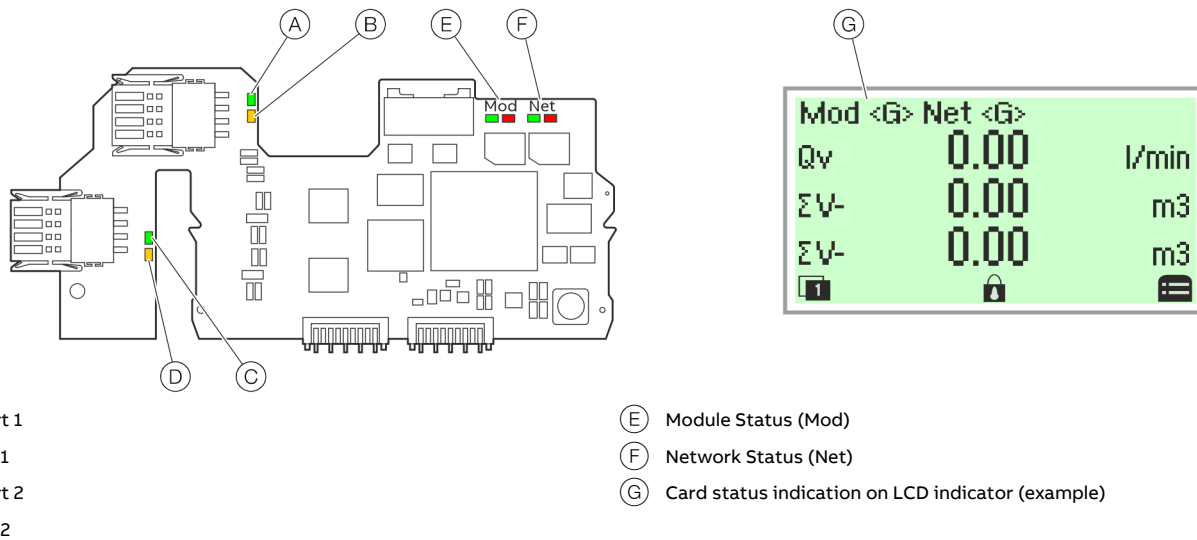
There are limitations to the RJ45 connector in combination with an ATEX / IECEx / EAC-Ex approved flowmeter.

	No Ex area ATEX/IECEx/E	Div 2
		AC-Ex Zone 2
Ethernet cable with RJ45 connector mounted to the transmitter housing	Y	Y N

### Ethernet card status LEDs

The 8 LEDs on the Ethernet card indicate the status of each port and the network.

To enable card status indication in the upper HMI Line, navigate to 'Display / Display Tag / Ethernet Status'.



- (A) Link port 1
- (B) Activity 1
- (C) Link port 2
- (D) Activity 2

- (E) Module Status (Mod)
- (F) Network Status (Net)
- (G) Card status indication on LCD indicator (example)

Figure 75: Ethernet card status LEDs

### EtherNet/IP™ communication

LED	Status	HMI display	Description
(A) Port 1	ON		Network connection (link up)
	OFF		No network
(B) Activity 1	Flashing or ON		Traffic
	OFF		No traffic
(C) Port 2	ON		Network connection (link up)
	OFF		No network
(D) Activity 2	Flashing or ON		Traffic
	OFF		No traffic
(E) Module Status (Mod)	green, ON	Mod showing <G> continuously	Device ready for Operation. Working properly
	green, Flashing (1 Hz)	Mod changing between <G> and < >	Standby. Device not configured yet
	green/ red, Flashing (1Hz)		Device performs "Power-On" Test
	red, Flashing (1 Hz)	Mod changing between <R> and < >	Simple Error, which can be fixed
	red, ON	Mod showing <R> continuously	Major Error. Non removable serious error
	OFF	Mod showing < > continuously	No Power
(F) Network Status (Net)	green, ON	Net showing <G> continuously	Connected. Device has at least one established connection
	green, Flashing (1 Hz)	Net changing between <G> and < >	No Connection. Device did not establish any connections, but was assigned an IP address
	green/ red, Flashing (1Hz)		Device performs "Power-On" Test
	red, ON	Net showing <R> continuously	Duplicated IP address. Device has detected that the device IP address is already in use
	OFF	Net showing < > continuously	No supply voltage or IP Address.
	red, flashing (1 Hz)	Mod changing between <R> and < >	Connection timeout

## ... 6 Digital communication

### ... EtherNet/IP™ and PROFINET® communication

#### PROFINET® communication

LED	Status	HMI display	Description
Ⓐ Port 1	ON		Network connection (link up)
	OFF		No network
Ⓑ Activity 1	Flashing or ON		Traffic
	OFF		No traffic
Ⓒ Port 2	ON		Network connection (link up)
	OFF		No network
Ⓓ Activity 2	Flashing or ON		Traffic
	OFF		No traffic
Ⓔ Module Status (Mod)	green, ON	Mod showing <G> continously	PROFINET configuration complete
	green, Flashing (1 Hz)	Mod changing between <G> and < >	Blink Test (Profinet)
	OFF	Mod showing < > continously	Startup or Device is turned off. No supply voltage.
Ⓕ Netzwerk-Status (Net)	green, ON	Net showing <R> continously	PLC connected
	red, flashing (1 Hz)	Mod changing between <R> and < >	No PLC connection
	OFF	Net showing < > continously	No supply voltage or IP Adress. Device does not have IP Adress or is turned off.

## 7 Commissioning

### Safety instructions

#### CAUTION

##### Risk of burns due to hot measuring media

The device surface temperature may exceed 70 °C (158 °F), depending on the measuring medium temperature!

- Before starting work on the device, make sure that it has cooled sufficiently.

Aggressive or corrosive media may lead to the damage of wetted parts of the sensor. As a result, measuring medium under pressure can leak out.

Wear to the flange gasket or process connection gaskets (e.g. pipe fitting, Tri-clamp, etc.) may caused a pressurized measuring medium to escape.

When using internal flat gaskets, they can become brittle through CIP- / SIP processes.

If pressure surges above the permissible nominal pressure of the device occur permanently during operation, this may affect the service life of the device.

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

### Use in potentially explosive Atmospheres

#### Note

- An additional document with Ex safety instructions is available for measuring systems that are used in potentially explosive atmospheres.
- Ex safety instructions are an integral part of this manual. As a result, it is crucial that the installation guidelines and connection values it lists are also observed.

The icon on the name plate indicates the following:

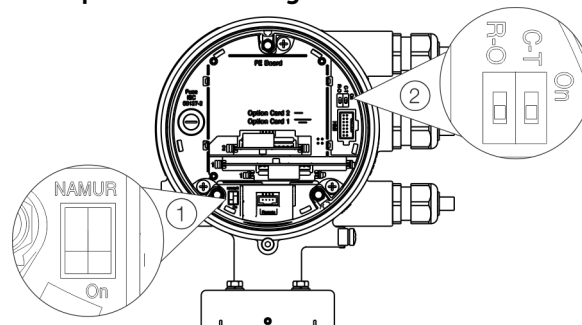


### Hardware settings

#### Note

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

#### Dual- compartment housing



① NAMUR DIP switch

② Write protection DIP switch

Figure 76: Position of the DIP switches

DIP switches are located behind the front housing cover. The DIP switches are used to configure specific hardware functions. The power supply to the transmitter must be briefly interrupted in order for the modified setting to take effect.

#### Write-protect switch

When write protection is activated, device parameterization cannot be changed via the LCD indicator. Activating and sealing the write protection switch protects the device against tampering

Number	Function
On	Write protection active
Off	Write protection deactivated.

#### Configuration of digital outputs 41 / 42 and 51 / 52

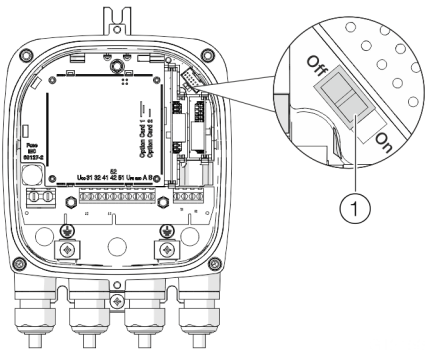
The configuration (NAMUR, optoelectronic coupler) for the digital outputs on the basic device is set via DIP switches in the transmitter.

Number	Function
On	Digital output 41 / 42 and 51 / 52 as NAMUR output.
Off	Digital output 41 / 42 and 51 / 52 as optoelectronic coupler output.

... 7 Commissioning

... Hardware settings

Single-compartment housing



① DIP switch, Write protection

Figure 77: Position of the DIP switch

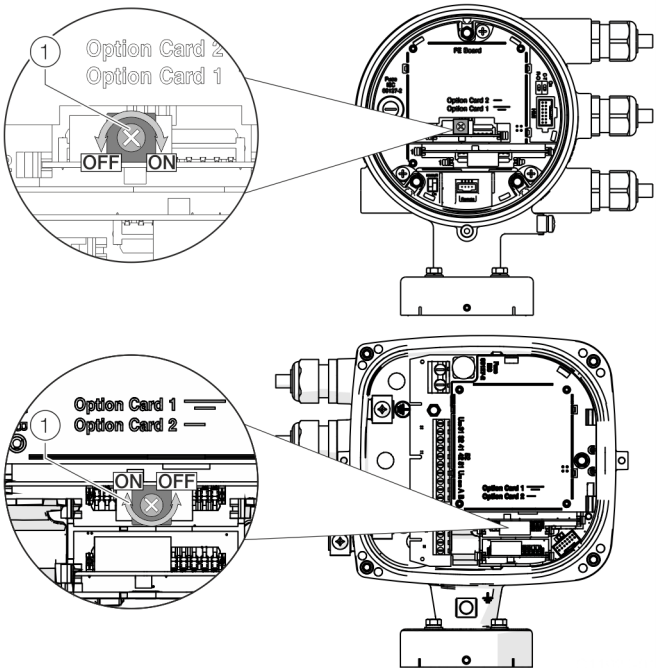
The DIP switches are used to configure specific hardware functions. The power supply to the transmitter must be briefly interrupted or the device reset in order for the modified setting to take effect.

Write-protect switch

When write protection is activated, device parameterization cannot be changed via the LCD indicator. Activating and sealing the write protection switch protects the device against tampering.

Number	Function
On	Write protection active
Off	Write protection deactivated.

Configuration of digital outputs V1 / V2 or V3 / V4



① NAMUR rotary switch

Figure 78: Position of rotary switch on the plug-in card

The configuration (NAMUR, optoelectronic coupler) for the digital output on the plug-in card is set via a rotary switch on the plug-in card.

Number	Function
On	Digital output V1 / V2 or V3 / V4 as NAMUR output.
Off	Digital output V1 / V2 or V3 / V4 as optoelectronic coupler output.

## Checks prior to commissioning

The following points must be checked before commissioning the device:

- Correct wiring in accordance with **Electrical connections** on page 24.
- Correct grounding of the device.
- The ambient conditions must meet the requirements set out in the specification.
- The power supply must meet the requirements set out on the name plate.

## Parameterization of the device

The ProcessMaster FEP630, HygienicMaster FEH630 can be commissioned and operated via the integrated LCD indicator (option, see **Parameterization via the menu function Easy Setup** on page 63).

Alternatively, the ProcessMaster FEP630, HygienicMaster FEH630 can also be commissioned and operated via ABB Asset Vision Basic (FEP6xx DTM).

### Installation of the ABB Field Information Manager (FIM)



Download the ABB Field Information Manager (FIM) using the adjacent download link.



Download the ABB FDI package using the adjacent download link.

Installation of the software and connection to the flowmeter:

1. Install ABB Field Information Manager (FIM).
2. Unpack the ABB FDI package into the c:\temp folder.
3. Connect the flowmeter with the PC / laptop, see chapter **Parameterization via the infrared service port adapter** on page 61 or **Parameterization via HART®** on page 62.
4. Power-up the power supply for the flowmeter and start the ABB Field Information Manager (FIM).
5. Drag and drop one of the following file to the ABB Field Information Manager (FIM):
  - 'ABB.FEW5xx\_FEX6xx\_FEXx1x.01.03.00.HART.fdx'
  - 'ABB.FEW530\_FEX630.01.00.01.PROFIBUS.fdx'
 No special view is needed for this.
6. Right-click ① as shown in **Figure 79**.

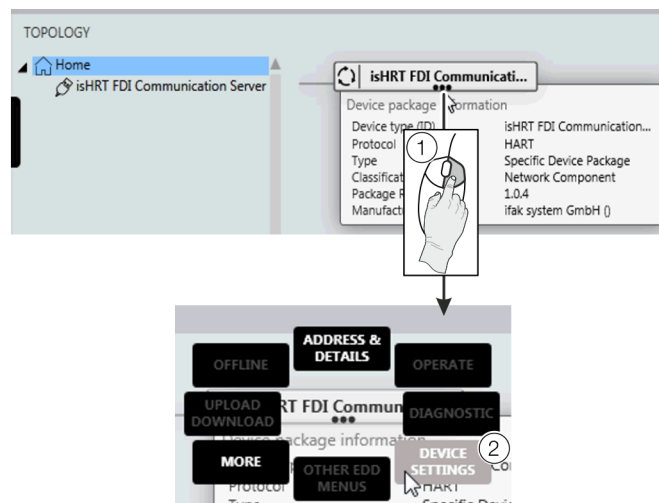


Figure 79: Select FIM – 'Device Settings'

7. Select 'DEVICE SETTINGS' ② as shown in **Figure 79**.

## ... 7 Commissioning

### ... Parameterization of the device

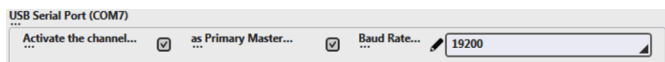



Figure 80: Select FIM – COM-Port

8. Select the corresponding COM port. Close the menu by clicking on 'send'.
9. By using the  menu button on the left side, the flowmeter is displayed under 'TOPOLOGY'.

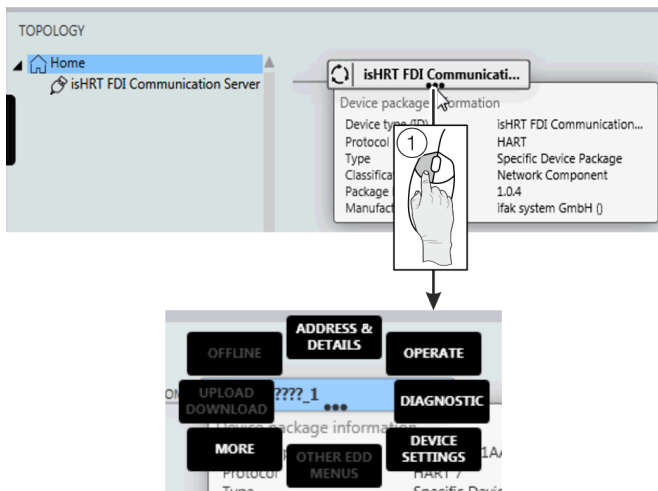
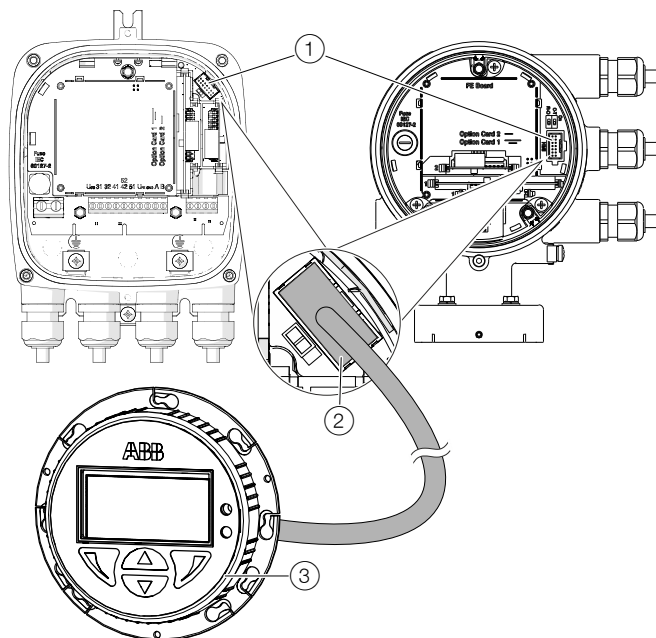


Figure 81:

All the submenus can be accessed by clicking the three points below the tag name of the flowmeter with the left mouse button ①.

### Parameterization with the optional LCD indicator



- ① Local operating interface
- ② Coupler connectors for LCD indicator
- ③ LCD indicator

Figure 82: Optional LCD indicator

For devices without LCD indicator, an optional LCD indicator for parameterization can be connected.



## Parameterization via the local operating interface

### **⚠ DANGER**

#### **Explosion hazard**

Risk of explosion during operation of the device with open terminal box!

- Only perform parameterization of the device via the local operating interface outside potentially explosive atmospheres!

A PC / Notebook and the USB interface cable are needed to configure the device via the device local operating interface. By combining the FDI package available at [www.abb.com/flow](http://www.abb.com/flow) and the ABB Field Information Manager (FIM), all parameters can be set even without a fieldbus connection.

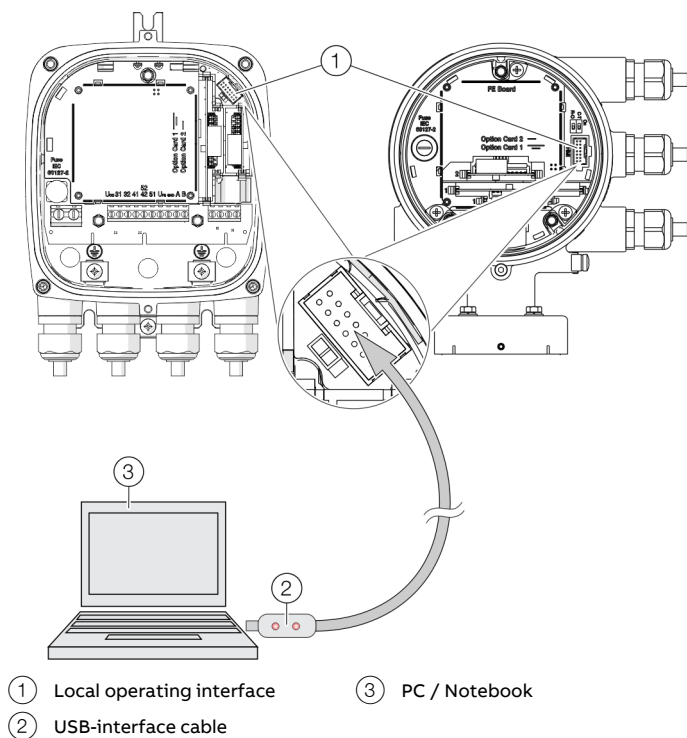


Figure 83: Connection to the local operating interface

1. Open device terminal box.
2. Connect programming plug to the local operating interface of the device.
3. Insert USB interface cable into a free USB female connector on the PC / notebook.
4. Switch on the device power supply.
5. Start ABB Field Information Manager (FIM) and perform parameterization of the device.

## Parameterization via the infrared service port adapter

Configuration via the infrared service port adapter on the device requires a PC / notebook and the FZA100 infrared service port adapter.

By combining the FDI package available at [www.abb.com/flow](http://www.abb.com/flow) and the ABB Field Information Manager (FIM), all parameters can be set even without a HART connection.

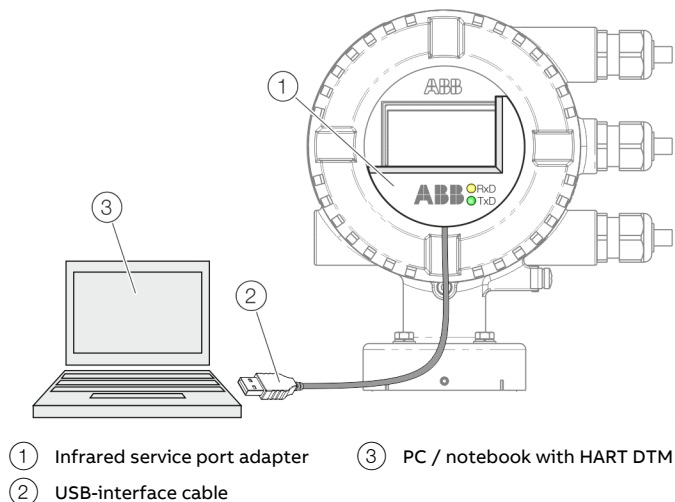


Figure 84: Infrared service port adapter on the transmitter (example)

1. Position the infrared service port adapter on the front plate of the transmitter as shown
2. Insert USB interface cable into a free USB female connector on the PC / notebook.
3. Switch on the device power supply.
4. Start the ABB Field Information Manager (FIM) and perform parameterization of the device.

## ... 7 Commissioning

### ... Parameterization of the device

#### Parameterization via HART®

Configuration via the HART interface of the device requires a PC / Notebook and a suited HART® Modem.

By combining the HART DTM available at [www.abb.com/flow](http://www.abb.com/flow) and the ABB Field Information Manager (FIM) , all parameters can also be set via the HART protocol.

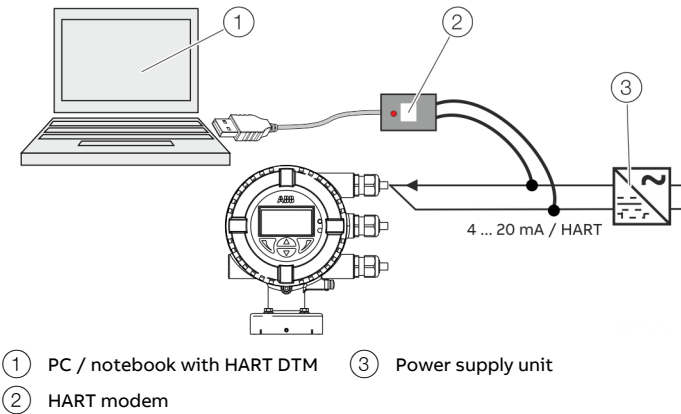


Figure 85: HART Modem on the transmitter (example)

For more detailed information on operating the software and the HART modem, please refer to the relevant operating instructions and the DTM online help.

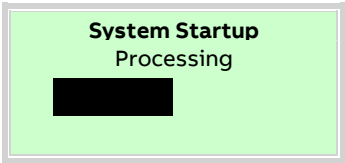
### Factory settings

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

Parameter	Factory setting
Qv Max 1	Q <sub>max</sub> DN (see Table <b>Measuring range</b> table on page 66)
Sensor Tag	None
TX Location TAG	None
Unit Volumeflow Qv	l/min
Unit Vol. Totalizer	l (Liter)
Pulses per Unit	1
Pulse Width	100 ms
Damping	1 s
Digital output 41 / 42	Impulses for Forward & Reverse
Digital output 51 / 52	Flow Direction
Current output	4-20mA FWD/REV
Curr.Out at Alarm	High Alarm, 21.8 mA
Current at flow > 20.5 mA	Off
Low Flow Cut Off	1 %
EPD Alarm	Off

### Switching on the power supply

- Switch on the power supply.
- The LCD display shows the following display during the startup process:

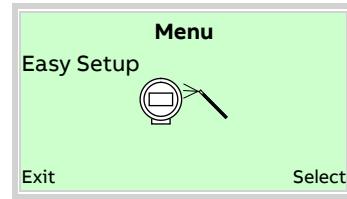


The process display is displayed after the startup process.

## Parameterization via the menu function Easy Setup

Settings for the most common parameters are summarized in the 'Easy Setup' menu. This menu provides the fastest way to configure the device.

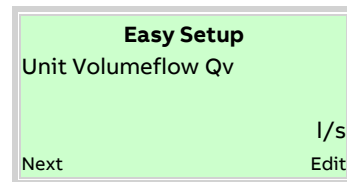
The following section describes parameterization via the 'Easy Setup' menu function.



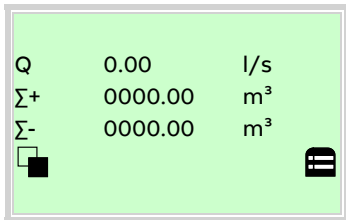
5. Use / to select 'Easy Setup'.
6. Confirm the selection with .



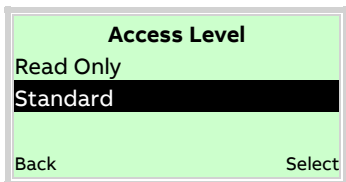
7. Use to call up the edit mode.
8. Use / to select the desired language.
9. Confirm the selection with .



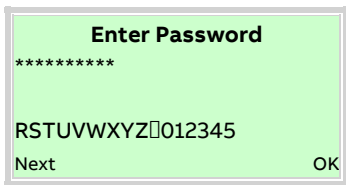
10. Use to call up the edit mode.
11. Use / to select the desired unit for the volume flow rate.
12. Confirm the selection with .



1. Switch to the configuration level with .



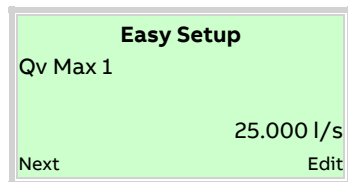
2. Use / to select 'Standard'.
3. Confirm the selection with .



4. Use to confirm the password. A password is not available as factory default; you can continue without entering a password.

## ... 7 Commissioning

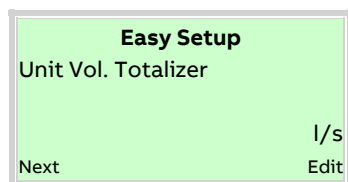
### ... Parameterization via the menu function Easy Setup



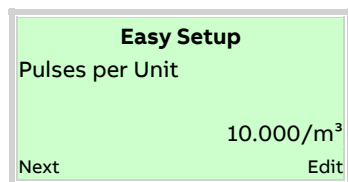
13. Use to call up the edit mode.
14. Use / to set the desired upper range value.
15. Confirm the selection with .

The device is factory calibrated to the flow range end value  $Q_{\max DN}$ , unless other customer information is available. The ideal upper range values are those which correspond to a flow velocity of 2 to 3 m/s ( $0.2$  to  $0.3 \times Q_{\max DN}$ )

The adjustable upper range values are listed in the table at **Measuring range table** on page 66.



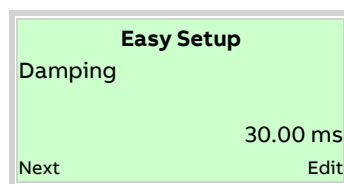
16. Use to call up the edit mode.
17. Use / to select the desired unit for the volume totalizer.
18. Confirm the selection with .



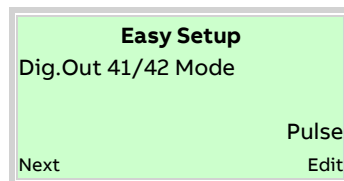
19. Use to call up the edit mode.
20. Use / to select the desired pulse per unit for the pulse output.
21. Confirm the selection with .



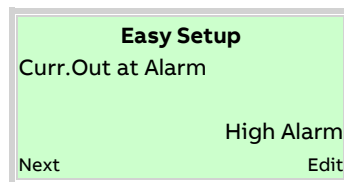
22. Use to call up the edit mode.
23. Use / to select the desired pulse width for the pulse output..
24. Confirm the selection with .



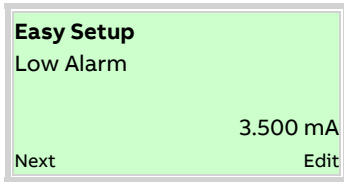
25. Use to call up the edit mode.
26. Use / to set the desired damping.
27. Confirm the selection with .



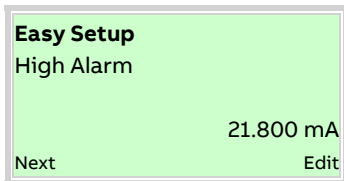
28. Use to call up the edit mode.
29. Use / to select the desired operating mode Off, Logic, Pulse, Frequency for the digital output.
30. Confirm the selection with .



31. Use to call up the edit mode.
32. Use / to select the desired alarm mode.
33. Confirm the selection with .



34. Use to call up the edit mode.  
 35. Use / to set the desired current for Low Alarm.  
 36. Confirm the selection with .



37. Use to call up the edit mode.  
 38. Use / to set the desired current for High Alarm.  
 39. Confirm the selection with .

### Zero point adjustment of the flowmeter

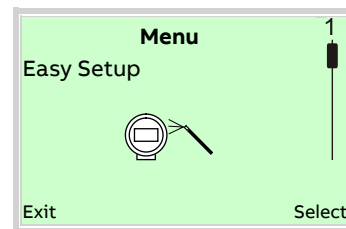
#### Note

Prior to starting the zero point adjustment, make sure that:

- There is no flow through the sensor (close all valves, shut-off devices etc.)
- The sensor is completely filled with the medium to be measured



- Use to start automatic adjustment of the zero point for the system.



Once all parameter have been set, the main menu appears again. The most important parameters are now set.

40. Use to switch to the process display.

## ... 7 Commissioning

### Measuring range table

The upper range value can be set between  $0.02 \times Q_{\max DN}$  and  $2 \times Q_{\max DN}$ .

Nominal diameter		Min. flow range end value	$Q_{\max DN}$	Max. flow range end value
DN	in	$0.02 \times Q_{\max DN} (\approx 0.2 \text{ m/s})$	0 to $\approx 10 \text{ m/s}$	$2 \times Q_{\max DN} (\approx 20 \text{ m/s})$
1	$\frac{1}{25}$	0.012 l/min (0.0032 US gal/min)	0.6 l/min (0.16 US gal/min)	1.2 l/min (0.32 US gal/min)
1.5	$\frac{1}{16}$	0.024 l/min (0.0063 US gal/min)	1.2 l/min (0.32 US gal/min)	2.4 l/min (0.63 US gal/min)
2	$\frac{1}{12}$	0.04 l/min (0.0106 US gal/min)	2 l/min (0.53 US gal/min)	4 l/min (1.06 US gal/min)
3	$\frac{1}{10}$	0.08 l/min (0.02 US gal/min)	4 l/min (1.06 US gal/min)	8 l/min (2.11 US gal/min)
4	$\frac{5}{32}$	0.16 l/min (0.04 US gal/min)	8 l/min (2.11 US gal/min)	16 l/min (4.23 US gal/min)
6	$\frac{1}{4}$	0.4 l/min (0.11 US gal/min)	20 l/min (5.28 US gal/min)	40 l/min (10.57 US gal/min)
8	$\frac{5}{16}$	0.6 l/min (0.16 US gal/min)	30 l/min (7.93 US gal/min)	60 l/min (15.85 US gal/min)
10	$\frac{3}{8}$	0.9 l/min (0.24 US gal/min)	45 l/min (11.9 US gal/min)	90 l/min (23.78 US gal/min)
15	$\frac{1}{2}$	2 l/min (0.53 US gal/min)	100 l/min (26.4 US gal/min)	200 l/min (52.8 US gal/min)
20	$\frac{3}{4}$	3 l/min (0.79 US gal/min)	150 l/min (39.6 US gal/min)	300 l/min (79.3 US gal/min)
25	1	4 l/min (1.06 US gal/min)	200 l/min (52.8 US gal/min)	400 l/min (106 US gal/min)
32	1 $\frac{1}{4}$	8 l/min (2.11 US gal/min)	400 l/min (106 US gal/min)	800 l/min (211 US gal/min)
40	1 $\frac{1}{2}$	12 l/min (3.17 US gal/min)	600 l/min (159 US gal/min)	1200 l/min (317 US gal/min)
50	2	1.2 m <sup>3</sup> /h (5.28 US gal/min)	60 m <sup>3</sup> /h (264 US gal/min)	120 m <sup>3</sup> /h (528 US gal/min)
65	2 $\frac{1}{2}$	2.4 m <sup>3</sup> /h (10.57 US gal/min)	120 m <sup>3</sup> /h (528 US gal/min)	240 m <sup>3</sup> /h (1057 US gal/min)
80	3	3.6 m <sup>3</sup> /h (15.9 US gal/min)	180 m <sup>3</sup> /h (793 US gal/min)	360 m <sup>3</sup> /h (1585 US gal/min)
100	4	4.8 m <sup>3</sup> /h (21.1 US gal/min)	240 m <sup>3</sup> /h (1057 US gal/min)	480 m <sup>3</sup> /h (2113 US gal/min)
125	5	8.4 m <sup>3</sup> /h (37 US gal/min)	420 m <sup>3</sup> /h (1849 US gal/min)	840 m <sup>3</sup> /h (3698 US gal/min)
150	6	12 m <sup>3</sup> /h (52.8 US gal/min)	600 m <sup>3</sup> /h (2642 US gal/min)	1200 m <sup>3</sup> /h (5283 US gal/min)
200	8	21.6 m <sup>3</sup> /h (95.1 US gal/min)	1080 m <sup>3</sup> /h (4755 US gal/min)	2160 m <sup>3</sup> /h (9510 US gal/min)
250	10	36 m <sup>3</sup> /h (159 US gal/min)	1800 m <sup>3</sup> /h (7925 US gal/min)	3600 m <sup>3</sup> /h (15850 US gal/min)
300	12	48 m <sup>3</sup> /h (211 US gal/min)	2400 m <sup>3</sup> /h (10567 US gal/min)	4800 m <sup>3</sup> /h (21134 US gal/min)
350	14	66 m <sup>3</sup> /h (291 US gal/min)	3300 m <sup>3</sup> /h (14529 US gal/min)	6600 m <sup>3</sup> /h (29059 US gal/min)
400	16	90 m <sup>3</sup> /h (396 US gal/min)	4500 m <sup>3</sup> /h (19813 US gal/min)	9000 m <sup>3</sup> /h (39626 US gal/min)
450	18	120 m <sup>3</sup> /h (528 US gal/min)	6000 m <sup>3</sup> /h (26417 US gal/min)	12000 m <sup>3</sup> /h (52834 US gal/min)
500	20	132 m <sup>3</sup> /h (581 US gal/min)	6600 m <sup>3</sup> /h (29059 US gal/min)	13200 m <sup>3</sup> /h (58117 US gal/min)
600	24	192 m <sup>3</sup> /h (845 US gal/min)	9600 m <sup>3</sup> /h (42268 US gal/min)	19200 m <sup>3</sup> /h (84535 US gal/min)
700	28	264 m <sup>3</sup> /h (1162 US gal/min)	13200 m <sup>3</sup> /h (58118 US gal/min)	26400 m <sup>3</sup> /h (116236 US gal/min)
760	30	312 m <sup>3</sup> /h (1374 US gal/min)	15600 m <sup>3</sup> /h (68685 US gal/min)	31200 m <sup>3</sup> /h (137369 US gal/min)
800	32	360 m <sup>3</sup> /h (1585 US gal/min)	18000 m <sup>3</sup> /h (79252 US gal/min)	36000 m <sup>3</sup> /h (158503 US gal/min)
900	36	480 m <sup>3</sup> /h (2113 US gal/min)	24000 m <sup>3</sup> /h (105669 US gal/min)	48000 m <sup>3</sup> /h (211337 US gal/min)
1000	40	540 m <sup>3</sup> /h (2378 US gal/min)	27000 m <sup>3</sup> /h (118877 US gal/min)	54000 m <sup>3</sup> /h (237754 US gal/min)
1050	42	616 m <sup>3</sup> /h (2712 US gal/min)	30800 m <sup>3</sup> /h (135608 US gal/min)	61600 m <sup>3</sup> /h (271217 US gal/min)
1100	44	660 m <sup>3</sup> /h (3038 US gal/min)	33000 m <sup>3</sup> /h (151899 US gal/min)	66000 m <sup>3</sup> /h (290589 US gal/min)
1200	48	840 m <sup>3</sup> /h (3698 US gal/min)	42000 m <sup>3</sup> /h (184920 US gal/min)	84000 m <sup>3</sup> /h (369841 US gal/min)
1400	54	1080 m <sup>3</sup> /h (4755 US gal/min)	54000 m <sup>3</sup> /h (237755 US gal/min)	108000 m <sup>3</sup> /h (475510 US gal/min)
1500	60	1260 m <sup>3</sup> /h (5548 US gal/min)	63000 m <sup>3</sup> /h (277381 US gal/min)	126000 m <sup>3</sup> /h (554761 US gal/min)
1,600	66	1440 m <sup>3</sup> /h (6340 US gal/min)	72000 m <sup>3</sup> /h (317006 US gal/min)	144000 m <sup>3</sup> /h (634013 US gal/min)
1800	72	1800 m <sup>3</sup> /h (7925 US gal/min)	90000 m <sup>3</sup> /h (396258 US gal/min)	180000 m <sup>3</sup> /h (792516 US gal/min)
2000	80	2280 m <sup>3</sup> /h (10039 US gal/min)	114000 m <sup>3</sup> /h (501927 US gal/min)	228000 m <sup>3</sup> /h (1003853 US gal/min)

## Parameterization overview (factory settings)

Parameter	Value range	Factory setting
Sensor Tag	Alphanumeric, maximum 20 characters.	None
Sensor Location Tag	Alphanumeric, maximum 20 characters.	None
Qv Max 1	Depending on the nominal diameter of the sensor.	Set to $Q_{\max}$ DN in accordance with <b>Measuring range table</b> on page 66.
Unit Volumeflow Qv	l/s; l/min; l/h; ml/s; ml/min; m3/s; m3/min; m3/h; m3/d; hl/h; g/s; g/min; g/h; kg/s; kg/min; kg/h; kg/d; t/min; t/h; t/d	l/min
Unit Vol. Totalizer	m3; l; ml; hl; g; kg; t	Liter (l)
Pulses per Unit	1 to 10000	1
Pulse Width	0.1 to 2000 ms	100 ms
Damping	0.02 to 60 s	1
Operating mode Digital output 41 / 42	Off, Binary output, Pulse output, Frequency output	Digital output 41/42 as pulse output for forward flow and reverse flow
Operating mode Digital output 51 / 52	Off, Binary output, pulse output (follows digital output 41 / 42, 90 ° or 180 ° out of phase)	Digital output 51 / 52 as binary output for output of the flow direction.
Curr.Out 31/32	4-20mA FWD/REV, 4-20mA FWD, 4-12-20 mA	4-20mA FWD/REV
Curr.Out at Alarm	High Alarm 21 to 23 mA or Low Alarm 3.5 to 3.6 mA	High Alarm, 21.8 mA
Current at flow rate > 103 % (I=20.5 mA)	Off (current output remains at 20.5 mA), High Alarm, Low Alarm ,	Off
Low flow cutoff	0 to 10 %	1 %
Empty pipe detection	On / Off	Off

## Software history

In accordance with NAMUR recommendation NE53, ABB offers a transparent and traceable software history.

### Device software package FEx630 (device firmware package)

Design	Issue date	Type of change	Description	Ordering number
00.04.00	2/3/2017	First publication	–	3KXF002044U0100_00.04.00
00.04.01	6/27/2017	Bug fixing	Piston pumps filter	3KXF002044U0100_00.04.01
00.05.00	1/12/2018	Bug fixing	Integrated Polish language	3KXF002044U0100_00.05.00
01.07.00	1/7/2018	Bug fixing	PROFIBUS DP® and Modbus® integrated. New bootloader	3KXF002044U0100_01.07.00
01.08.00	12/2020	New Feature added	HART Variables configurable, Fingerprint Improved	3KXF002044U0100_01.08.00
01.09.00	5/2021	New Feature added	Ethernet IP and Modbus TCP communication protocol added	3KXF002044U0100_01.09.00
01.10.00	9/2021	New Feature added	DC Offset Filter added, Peak Filter added	3KXF002044U0100_01.10.00
01.11.00	12/2022	New Feature added	Profibus PA communication protocol added	3KXF002044U0100_01.11.00
01.12.00	4/2023	New Feature added	PROFINET communication protocol added	3KXF002044U0100_01.12.00

## 8 Operation

### Safety instructions

#### ⚠ CAUTION

##### Risk of burns due to hot measuring media

The device surface temperature may exceed 70 °C (158 °F), depending on the measuring medium temperature!

- Before starting work on the device, make sure that it has cooled sufficiently.

Aggressive or corrosive media may lead to the damage of wetted parts of the sensor. As a result, measuring medium under pressure can leak out.

Wear to the flange gasket or process connection gaskets (e.g. pipe fitting, Tri-clamp, etc.) may caused a pressurized measuring medium to escape.

When using internal flat gaskets, they can become brittle through CIP- / SIP processes.

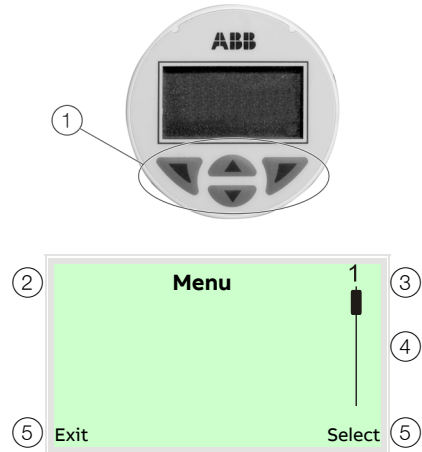
If pressure surges above the permissible nominal pressure of the device occur permanently during operation, this may affect the service life of the device.

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

#### Note

For a detailed description of the individual parameters and menus on the configuration level, please refer to the **Parameter description** in the operating instruction.





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



Figure 86: 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.

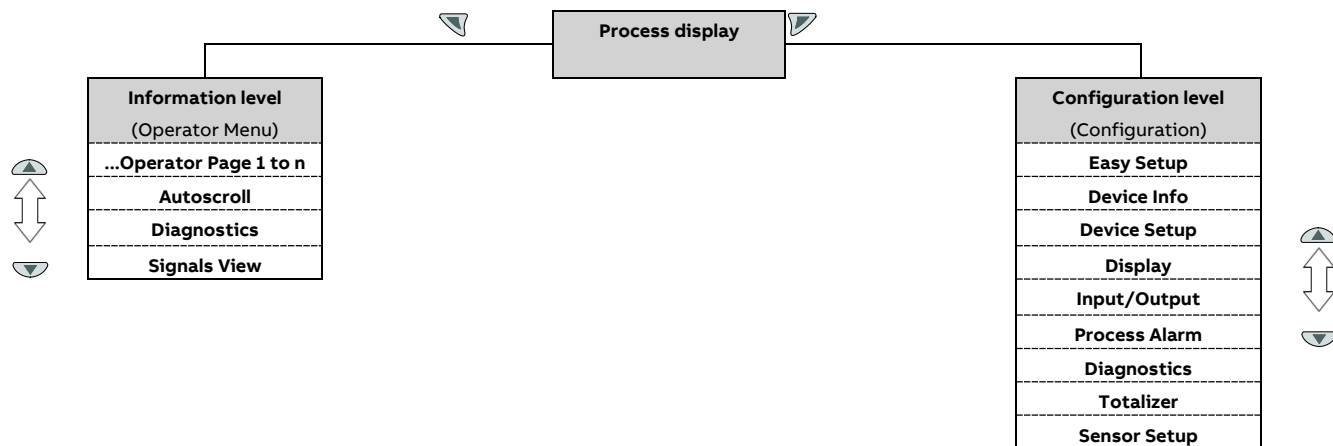
#### Control button functions

	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 additional information on the parameters see Parameter description in the operating instruction ,

Process display

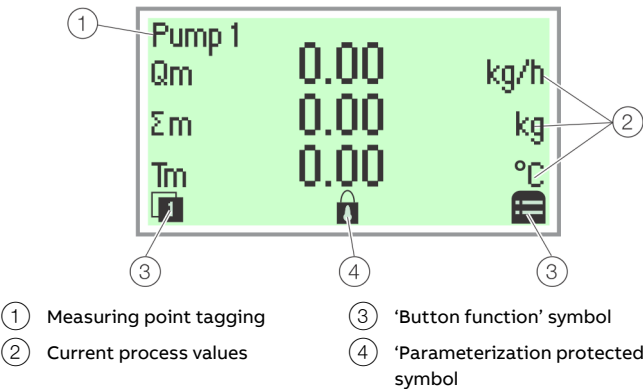









Figure 87: Process display (example)

The process display appears on the LCD display when the device is powered on. It shows information about the device and current process values.

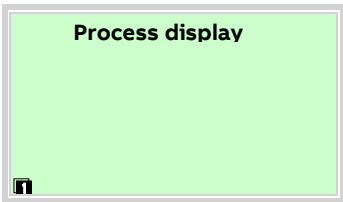
The way in which the current process values are shown can be adjusted on the configuration level.


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.

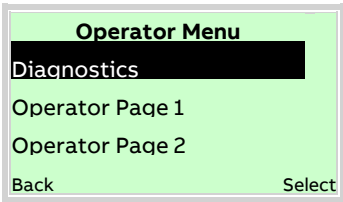
Symbol	Description
 / 	Call up information level. When Autoscroll mode is activated, the  icon appears here and the operator pages are automatically displayed one after the other.
	Call up configuration level.
	The device is protected against changes in the parametrization.




Switching to the information level

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



1. Open the  using Operator Menu.



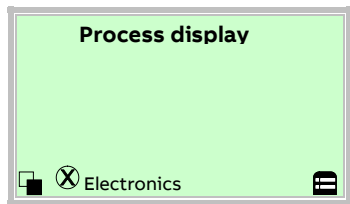
2. Select the desired submenu using  / .
3. Confirm the selection with .

Menu	Description
... / Operator Menu	
Diagnostics	Selection of sub-menu 'Diagnostics'; see also <b>Error messages on the LCD display</b> on page 72.
Operator Page 1 to n	Selection of operator page to be displayed.
Autoscroll	When 'Autoscroll' is activated, automatic switching of the operator pages is initiated on the process screen.
Signals View	Selection of submenu 'Signals View' (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 (e.g. 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:

Range	Description
Operation	Error / alarm due to the current operating conditions.
Sensor	Error / alarm of the flowmeter sensor.
Electronics	Error / alarm of the electronics.
Configuration	Error / alarm due to device configuration.

#### Note

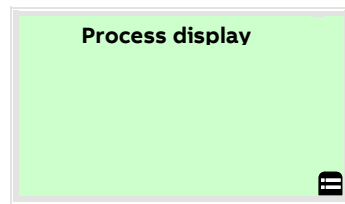
For a detailed description of errors and information regarding troubleshooting, refer to the chapter titled "Diagnosis / Error messages" in the operating instruction.

### Switching to the configuration level (parameterization)

#### Note

For a detailed description of the individual parameters and menus on the configuration level, please refer to the **Parameter description** in the operating instruction.

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



1. Switch to the configuration level with



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

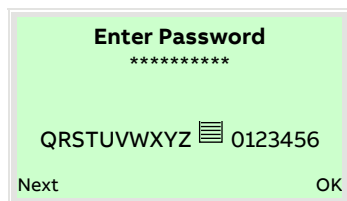
#### Note

There are three levels of access. A password can be defined for level 'Standard'.

- There is no factory default password. For security reasons it is recommended to set a password.
- The password prevents access to the parameterization via the buttons on the device. For further access protection via DTM or EDD (HART®, PROFIBUS®, Modbus®) the hardware write protection switch must be set (see **Hardware settings** on page 57).

Access Level	Description
Read Only	All parameters are locked. Parameters are read only and cannot be modified.
Standard	All the parameters can be changed.
Service	Only ABB 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 appropriate 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 .

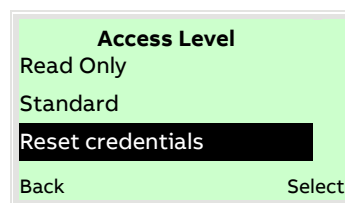
### Resetting the customer password

If the set password has been forgotten, the password can be reset and reassigned.

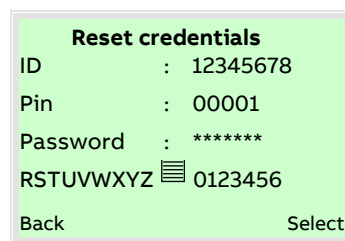
A one-time password is needed for this purpose and can be generated by ABB Service upon request.

To reset the password, the password has to be entered incorrectly once for the 'Standard' user level. When the configuration level is called up again, a new entry 'Reset credentials' then appears in the list of access levels.

1. Switch to the configuration level with .



2. Use / to select the 'Reset credentials' entry.
3. Confirm the selection with .



4. Contact ABB Service and request a one-time password, stating the 'ID' and 'Pin' shown.
5. Enter the one-time password.

### Note

The one-time password is only valid once and needs to separately requested with each password reset.

6. Confirm the input with .

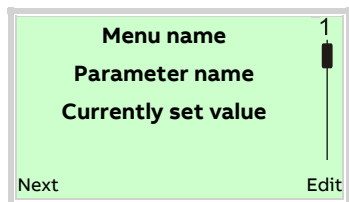
After the one-time password has been entered, the password for the 'Standard' access level is reset and can be reassigned.

## ... 8 Operation

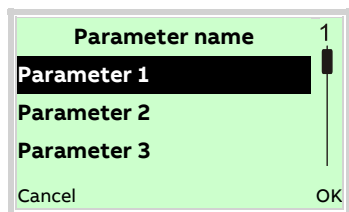
### Selecting and changing parameters

#### 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.

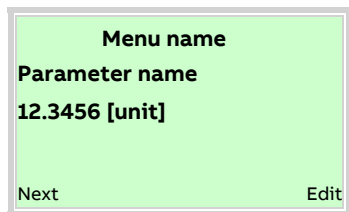


3. Select the desired value using / .
4. Confirm the selection with .

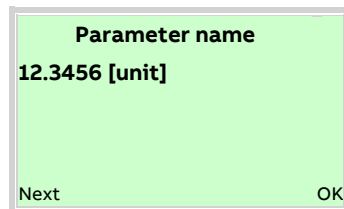
This concludes the procedure for selecting a parameter value.

#### Numerical entry

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



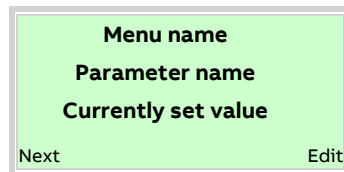
1. Select the parameters you want to set in the menu.
2. Use to call up the parameter for editing. The decimal place that is currently selected is highlighted.



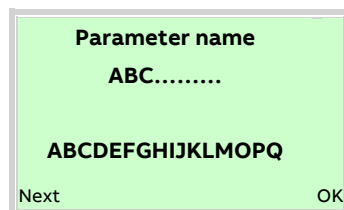
3. Use to select the decimal place to change.
  4. Use / to set the desired value.
  5. Use to select the next decimal place.
  6. If necessary select and set additional decimal places in accordance with steps 3 to 4.
  7. Use to confirm your setting.
- This concludes the procedure for changing a parameter 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.

## Brief overview of configurations

Configuration of digital output 41 / 42 as pulse output for forward flow and digital output 51 / 52 as pulse output for reverse flow.

Menu / parameter	Parameter setting
<b>Input/Output / Dig.Out 41/42 / ...</b>	
Mode	⇒ Pulse
Outp. Flow Direction	⇒ Forward
<b>Input/Output / ...Setup Pulse Output</b>	
Output Value Pulse	⇒ Pulse Volume Flow
Pulses per Unit	⇒ Setting in accordance with requirement
Pulse Width	⇒ Setting in accordance with requirement
<b>Input/Output / Dig.Out 51/52</b>	
Mode	⇒ Follow DO 41/42

## Extended diagnostic functions

### Overview

#### Note

- The extended diagnostic functions are only available on the ProcessMaster FEP630 and HygienicMaster FEH630 if the 'Extended diagnostic functions' software package has been ordered (see table) .
- The 'Partial Filling Detector' function is **not** available for HygienicMaster FEH630.
- To facilitate initial commissioning, the individual diagnosis options of the extended diagnostic functions are deactivated (factory default).
- Each diagnostic function (e.g. Gas Bubble Detector or Electrode Deposit Detector) can be individually activated. Once activated, the diagnostic function must be calibrated according to the conditions on site and the limit values must be set.

#### Diagnostic Functions

<b>Standard</b>	Empty pipe detection (EPD)
	Partial filling detection (TFE)
	Noise / grounding check
	Fingerprint verification
	Service interval
	Transmitter temperature
<b>Software package 'Extended diagnostic functions' (optional)</b>	Coil/sensor temperature
	Coil inductance
	Gas bubble detection
	Conductivity monitoring
	Electrode impedance / Leakage
	Monitoring
<b>Filling function (optional)</b>	Filling function

## ... 8 Operation

### ... Extended diagnostic functions

#### Detection of partial filling

A partially filled sensor affects the flowmeter reading and the measuring accuracy.

If the flowmeter sensor is ordered with a full pipe detection electrode, which is located at the Top of the sensor, the transmitter's '...Diagnosis Tfe' function enables for an alarm in case the sensor tube starts to become partially filled.

Pre-requisites using the functionality:

- Nominal diameter: > DN 50 (> 2")
- Flowmeter sensor design level A
- Conductivity of the measuring medium:  
20 to 20000 µS/cm

Installation conditions:

- The flowmeter sensor must be installed horizontally with the terminal box pointing upward.

#### Setup

The partial filling detection must be matched to the measuring medium on site.

Menu / parameter	Description
Diagnostics / ...Diagnosis Control / ... <b>Diagnosis Tfe</b>	
Tfe On/Off	Activate the function.
Start Tfe Adjust	Automatic adjustment of the TFE function. Prior to starting, make sure that: <ul style="list-style-type: none"> <li>• There is no flow</li> <li>• Sensor is completely filled</li> </ul>
Manual Tfe Adjust	Manual adjustment of the TFE function.
Tfe Threshold	Manual fine adjustment of the switching threshold.
Actual Tfe Value	Display of the current TFE value. Above the TFE threshold, an alarm occurs, if configured.

#### Detection of gas bubbles

Gas bubbles in the measuring medium effect the flowmeter reading and the accuracy.

Enhanced diagnostics feature the option for gas bubble detection to make the flow measurement most reliable. There is the option for a gas bubble alarm triggered once the actual gas bubble value exceeds the threshold configured. This alarm is shown in the HMI. The digital output flags an alarm if configured accordingly.

Pre-requisites using the functionality:

- Nominal diameter: DN 10 to DN 300 (3/8 to 12 in).
- Conductivity of the measuring medium:  
20 to 20000 µS/cm.

Installation conditions:

- The flowmeter sensor can be installed either horizontally or vertically. Vertical installation is preferable.

#### Setup

The gas bubble detection must be matched to the measuring medium on site.

Menu / parameter	Description
Diagnostics / ...Diagnosis Control / ... <b>Diagnosis Gas Bub.</b>	
Gas Bubble On/Off	Activate the function.
Start Adj Gas Bubble	Automatic adjustment of the Gas Bubble Detection function. Prior to starting, make sure that: <ul style="list-style-type: none"> <li>• There is no flow</li> <li>• Sensor is completely filled and free of gas bubbles</li> </ul>
Gas Bubble Threshold	Manual fine adjustment of the switching threshold.



### Monitoring the conductivity

The conductivity of the fluid can be monitored by setting minimum / maximum alarm thresholds.

Once alarm limits are exceeded, the digital output flags an alarm if configured accordingly.

The conductivity is available as 4 to 20 mA output (option card).

Pre-requisites using the functionality:

- Conductivity of the measuring medium:  
20 to 20000  $\mu\text{S}/\text{cm}$ .

### Setup

The conductivity monitoring must be matched to the measuring medium on site.

Menu / parameter	Description
<b>Diagnostics / ...Diagnosis Control / ...Diagnosis Conductiv</b>	
Conductivity On/Off	Activate the function.
Conductivity [ $\mu\text{S}/\text{cm}$ ]	Indicator of the conductivity in $\mu\text{S}/\text{cm}$ .
Adj. Cond. Value	Measure the conductivity of the measuring medium using a conductivity meter on-site and enter the measured value here.
Cond. Iout Min Value	Set the 4 mA and 20 mA value which correspond
Cond. Iout Max Value	to the upper and lower range of the conductivity value.
Cond.Min Alarm Value	Set the alarm for minimum and maximum
Cond.Max Alarm Value	conductivity. In the case of down-scale, an alarm is triggered.
Elec. Imp. E1-GND	Impedance between electrode E1 and GND (ground potential).
<b>Input/Output / ...Curr.Out V1/V1</b>	
Output Value	Select 'Conductivity' to output the conductivity over the current output V1 / V2 Only with appropriate plug-in card.

### Monitoring the electrode impedance

The measurement monitors the impedance between the measuring electrode and grounding and activates an alarm if the impedance drops below a limit. The function is activated together with the conductivity measurement.

Requirements for use:

- Conductivity of the measuring medium:  
20 to 20000  $\mu\text{S}/\text{cm}$ .

Additional installation conditions:

- When using plastic piping, install a grounding plate at the front and back of the device.
- There must not be any deposits on the measuring electrodes.
- The measuring tube must always be completely full, and the measuring medium must have only minor deviations in conductivity.

## ... 8 Operation

### ... Extended diagnostic functions

#### Measurements on the flowmeter

##### Flowmeter sensor coil inductance

A measurement of the flowmeter sensor coil inductance can be triggered. This enables to check for the flowmeter sensor coil integrity.

##### Flowmeter sensor temperature

A flowmeter sensor temperature measurement can be triggered. This enables to check for the flowmeter sensor temperature. With flowmeter sensor temperature out of spec, the digital output flags an alarm if configured accordingly.

#### Setup

Menu / parameter	Description
Diagnostics / ...Diagnosis Control / ... <b>Diagnosis Coil</b>	
Coil Diag On/Off	Activate the function.
Coil Resistor	Display the coil resistance.
Coil Current	Display the coil current.
Coil Inductance	Display the coil inductance.
Coil Temperature	Display the coil temperature within the sensor.
Coil Temperature Adj	Measurement of coil temperature must be set in accordance with the conditions on-site. Temperature measured with a separate thermometer can be entered here.
Coil Temp. Min Alarm	Min. and max. alarm for the sensor temperature
Coil Temp. Max Alarm	(coil temperature). Can be used to monitor the temperature limit of the meter tube liner

#### Transmitter monitoring

Monitoring the temperature of the electronic unit in the transmitter triggers an alarm via the digital output, if configured.

In the '...Diagnosis Values', the current temperature as well as the smallest and largest previously measured temperature is displayed.

#### Monitoring the grounding

The function checks for noise in the measuring signal and the electrical grounding of the device. While the check is in progress, no flow measurement can take place.

The noise / grounding check is started manually and delivers a 'successful / failed' result.

The measurements (Power Spectrum, Amplitude 1 to 4 and Frequency 1 to 4) will help if the noise / grounding check fails.

Requirements for use:

- The sensor must be filled completely with measuring medium.
- There is no flow through the sensor (close all valves, shut-off devices etc.)
- The sensor must be grounded (see ).
- There may not be any deposits on the measuring electrodes.

Menu / parameter	Description
Diagnostics / ...Diagnosis Control / ... <b>Noise Check</b>	
Start Noise Check	Start of test
Result Noise Check	Test result
Power Spectrum	Current power spectrum.
Amplitude 1 Value ... 4	Display of the four strongest amplitudes of the
Frequency 1 ... 4	frequency spectrum in $\mu\text{V}$ with the associated frequency.

## Verification

### Fingerprint database

The sensor and transmitter fingerprint stored in the SensorMemory allows you to compare the state of the device at the time of manufacture at the factory with the current state of the device at the customer site.

The check is started manually and returns a 'successful / failed' result.

If the verification is unsuccessful, troubleshooting information is shown on the display (parameter 'Rslt FP Verification').

A software tool (ABB Ability SRV500) is available for documentation and trend analysis.

### Setup

Menu / parameter	Description
<b>Diagnostics / ...Diagnosis Control / ...Fingerprints</b>	
Tx Factory CMR, 1m/s, 10m/s	Display of transmitter fingerprint (factory fingerprint)
Se Factory Coil Ind.	Display coil impedance fingerprint
Se Factory Imp. E1	Display electrode impedance fingerprint E1-GND,
Se Factory Imp.E2	E2-GND
Strt FP Verification	Start of test
Rslt FP Verification	Test result
Tx Customer CMR, 1m/s, 10m/s	Display of transmitter fingerprint (customer fingerprint)
Se Customer Coil Ind	Display coil impedance fingerprint
Se Customer Imp. E1	Display electrode impedance fingerprint E1-GND,
Se Customer Imp. E2	E2-GND

## 9 Maintenance

### Safety instructions

#### **WARNING**

##### **Risk of injury due to live parts!**

When the housing is open, contact protection is not provided and EMC protection is limited.

- Before opening the housing, switch off the power supply.

#### **CAUTION**

##### **Risk of burns due to hot measuring media**

The device surface temperature may exceed 70 °C (158 °F), depending on the measuring medium temperature!

- Before starting work on the device, make sure that it has cooled sufficiently.

#### **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.

Corrective maintenance work may only be performed by trained personnel.

- Before removing the device, depressurize it along with any adjacent lines or vessels.
- Check whether hazardous materials have been used as measuring medium before opening the device. Residual amounts of hazardous material may still be present in the device and could escape when it is opened.

Within the scope of operator responsibility, check the following as part of a regular inspection:

- pressure-carrying walls / pressure equipment liner
- the measurement-related function
- the leak tightness
- the wear (corrosion)

#### **Note**

For detailed information on the maintenance of the device, consult the associated operating instructions (OI)!

## 10 Recycling 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 8.

### 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.

## 11 Specification

### Note

The device data sheet is available in the ABB download area at [www.abb.com/flow](http://www.abb.com/flow).

### Permitted pipe vibration

In accordance with EN 60068-2-6

Applicable to sensors in remote mount design and sensors in integral mount design.

- Maximum deflection: 0.15 mm (0.006 in) in the frequency range of 10 to 58 Hz
- Maximum acceleration: 2 g in the frequency range of 58 to 150 Hz
- Maximum acceleration: 4g (Tested to DNV DNVGL-CG-0339-2019) for Devices specified with code 'CL5' in Modelcode. CL5 = DNV approved device.

### ProcessMaster - Temperature data

The temperature range offered by the device is dependent on a number of different factors.

These factors include the measuring medium temperature

$T_{\text{medium}}$ , the ambient temperature  $T_{\text{amb}}$ , operating pressure

$P_{\text{medium}}$ , liner material and the approval for explosion protection.

### Storage temperature range

–40 to 70 °C (–40 to 158 °F)

### Maximum permissible cleaning temperature

CIP media	Liner	Cleaning temperature
Steam	PTFE, PFA	150 °C (302 °F)
Cleaning fluid	PTFE, PFA	140 °C (284 °F)

- The maximum cleaning temperature specified applies to a maximum ambient temperature of 25 °C (77 °F).  
If the ambient temperature up-scales > 25 °C (> 77 °F), then the temperature difference to the current temperature must be subtracted from the max. cleaning temperature.
- The specified cleaning temperature may have an effect for a maximum of 60 minutes.

## ... 11 Specification

### ... ProcessMaster - Temperature data

#### Maximum ambient temperature depending on measuring medium temperature

##### Integral mount design

Flowmeter sensor in standard version					
Lining material	Flange material	Ambient temperature range (T <sub>amb</sub> )		Measuring medium temperature (T <sub>medium</sub> )	
		Minimum	Maximum	Minimum	Maximum
Hard rubber	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	85 °C (185 °F)
				-5 °C (23 °F)*	80 °C (176 °F)*
Hard rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)	-15 °C (5 °F)	85 °C (185 °F)
				-5 °C (23 °F) *	80 °C (176 °F) *
Soft rubber	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	60 °C (140 °F)
Soft rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)	-15 °C (5 °F)	60 °C (140 °F)
PTFE	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	90 °C (194 °F)
			45 °C (113 °F)		130 °C (266 °F)
PTFE	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-25 °C (-13 °F)	90 °C (194 °F)
		-40 °C (-40 °F)**	45 °C (113 °F)		130 °C (266 °F)
Thick PTFE***	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	90 °C (194 °F)
			45 °C (113 °F)		130 °C (266 °F)
Thick PTFE***	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-25 °C (-13 °F)	90 °C (194 °F)
		-40 °C (-40 °F)**	45 °C (113 °F)		130 °C (266 °F)
PFA***	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	90 °C (194 °F)
			45 °C (113 °F)		130 °C (266 °F)
PFA***	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-25 °C (-13 °F)	90 °C (194 °F)
		-40 °C (-40 °F)**	45 °C (113 °F)		130 °C (266 °F)
ETFE***	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	90 °C (194 °F)
			45 °C (113 °F)		130 °C (266 °F)
ETFE***	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-25 °C (-13 °F)	90 °C (194 °F)
		-40 °C (-40 °F)**	45 °C (113 °F)		130 °C (266 °F)
Linatex*	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	70 °C (158 °F)
Linatex*	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-20 °C (-4 °F)	70 °C (158 °F)
Ceramic carbide	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	80 °C (176 °F)
Ceramic carbide	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-20 °C (-4 °F)	80 °C (176 °F)

\* Only for China production site

\*\* For (optional) low-temperature version only

\*\*\* Only for design level 'A'

Flowmeter sensor in high temperature version***					
Lining material	Flange material	Ambient temperature range (T <sub>amb</sub> )		Measuring medium temperature (T <sub>medium</sub> )	
		Minimum	Maximum	Minimum	Maximum
Thick PTFE***	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	180 °C (356 °F)
Thick PTFE***	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-20 °C (-4 °F)	180 °C (356 °F)
		-40 °C (-40 °F)**			
PFA***	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	180 °C (356 °F)
PFA***	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-20 °C (-4 °F)	180 °C (356 °F)
		-40 °C (-40 °F)**			
ETFE***	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	130 °C (266 °F)
ETFE***	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-20 °C (-4 °F)	130 °C (266 °F)
		-40 °C (-40 °F)**			

\* Only for China production site

\*\* For (optional) low-temperature version only

\*\*\* Only for design level 'A'

# ... 11 Specification

## ... ProcessMaster - Temperature data

Remote mount design

Flowmeter sensor in standard version					
Lining material	Flange material	Ambient temperature range (T <sub>amb</sub> )		Measuring medium temperature (T <sub>medium</sub> )	
		Minimum	Maximum	Minimum	Maximum
Hard rubber	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	85 °C (185 °F)
				-5 °C (23 °F)*	80 °C (176 °F)*
Hard rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)	-15 °C (5 °F)	85 °C (185 °F)
				-5 °C (23 °F)*	80 °C (176 °F) *
Soft rubber	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	60 °C (140 °F)
Soft rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)	-15 °C (5 °F)	60 °C (140 °F)
PTFE	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	90 °C (194 °F)
		-10 °C (14 °F)	45 °C (113 °F)	-10 °C (14 °F)	130 °C (266 °F)
PTFE	Stainless steel	-25 °C (-13 °F)	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)
		-40 °C (-40 °F)**			
Thick PTFE***	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	130 °C (266 °F)
Thick PTFE***	Stainless steel	-25 °C (-13 °F)	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)
		-40 °C (-40 °F)**			
PFA***	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	130 °C (266 °F)
PFA***	Stainless steel	-25 °C (-13 °F)	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)
		-40 °C (-40 °F)**			
ETFE***	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	130 °C (266 °F)
ETFE***	Stainless steel	-25 °C (-13 °F)	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)
Linatex*	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	70 °C (158 °F)
Linatex*	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-20 °C (-4 °F)	70 °C (158 °F)
Ceramic carbide	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	80 °C (176 °F)
Ceramic carbide	Stainless steel	-25 °C (-13 °F)	60 °C (140 °F)	-20 °C (-4 °F)	80 °C (176 °F)

Flowmeter sensor in high temperature version***					
Lining material	Flange material	Ambient temperature range (T <sub>amb</sub> )		Measuring medium temperature (T <sub>medium</sub> )	
		Minimum	Maximum	Minimum	Maximum
Thick PTFE***	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	180 °C (356 °F)
Thick PTFE***	Stainless steel	-25 °C (-13 °F)	60 °C (140 °F)	-25 °C (-13 °F)	180 °C (356 °F)
		-40 °C (-40 °F)**			
PFA***	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	180 °C (356 °F)
PFA***	Stainless steel	-25 °C (-13 °F)	60 °C (140 °F)	-25 °C (-13 °F)	180 °C (356 °F)
		-40 °C (-40 °F)**			
ETFE	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	130 °C (266 °F)
ETFE	Stainless steel	-25 °C (-13 °F)	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)
		-40 °C (-40 °F)**			

\* Only for China production site

\*\* For (optional) low-temperature version only

\*\*\* Only for design level 'A'



## ProcessMaster – Material load for process connections

The limits of the permissible measuring medium temperature ( $T_{\text{medium}}$ ) and permissible pressure ( $P_{\text{medium}}$ ) are calculated on the basis of the liner and flange material used in the device (see device name plate).

### Minimum permissible operating pressure

The following tables show the permissible minimum operating pressure ( $P_{\text{medium}}$ ) as a function of the measuring medium temperature ( $T_{\text{medium}}$ ) and the liner material.

#### Design Level 'A'



Lining material	Nominal diameter	$P_{\text{medium}}$ [mbar abs]	$T_{\text{medium}}^*$
Hard rubber	DN 25 to DN 2000 (1 to 80")	0	< 85 °C (185 °F) < 80 °C (176 °F)**
Soft rubber	DN 50 to DN 2000 (2 to 80")	0	< 60 °C (140 °F)
PTFE	DN 10 to DN 600 (3/8 to 24")	270	< 20 °C (68 °F)
		400	< 100 °C (212 °F)
		500	< 130 °C (266 °F)
Thick PTFE	DN 25 to DN 80 (1 to 3")	0	< 180 °C (356 °F)
	DN 100 to DN 250 (4 to 10")	67	< 180 °C (356 °F)
	DN 300 (12")	27	< 180 °C (356 °F)
PFA	DN 3 to DN 200 (1/8 to 8")	0	< 180 °C (356 °F)
ETFE	DN 25 to DN 600 (1 to 24")	100	< 130 °C (266 °F)
Ceramic carbide	DN 25 to DN 1000 (1 to 40")	0	< 80 °C (176 °F)
Linatex**	DN 50 to DN 600 (6 to 24")	0	< 70 °C (158 °F)

\* For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to **Maximum permissible cleaning temperature** on page 81.

\*\* Only for China production site

### Material load

#### Flowmeter sensor Design Level 'A'

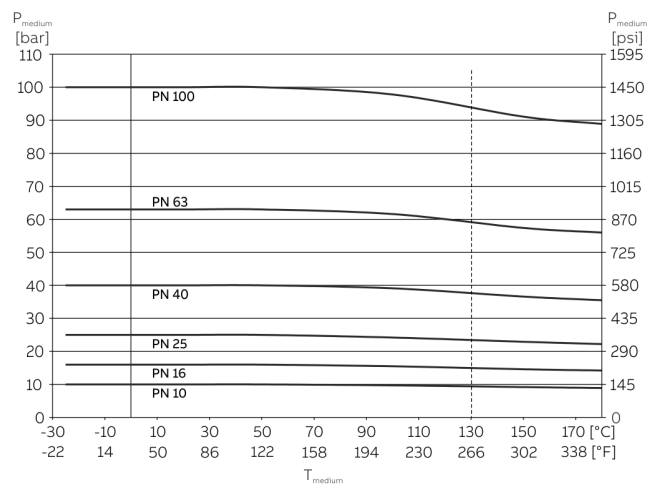


Figure 88: DIN-flange, stainless steel, to DN 600 (24"); Design Level 'A'

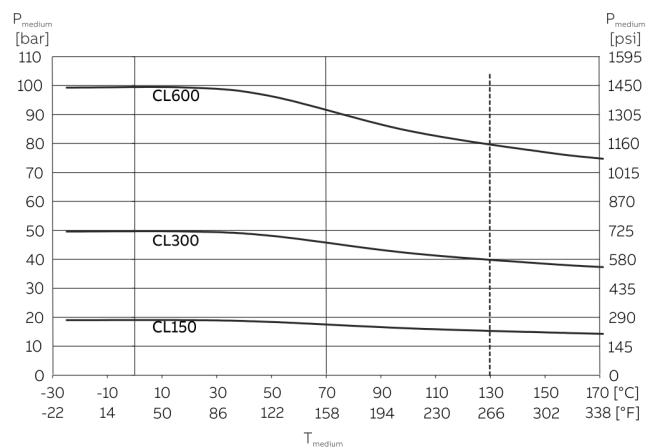


Figure 89: ASME-flange, stainless steel, to DN 400 (16") (CL150/300) to DN 1000 (40") (CL150); Design Level 'A'

... 11 Specification

... ProcessMaster – Material load for process connections

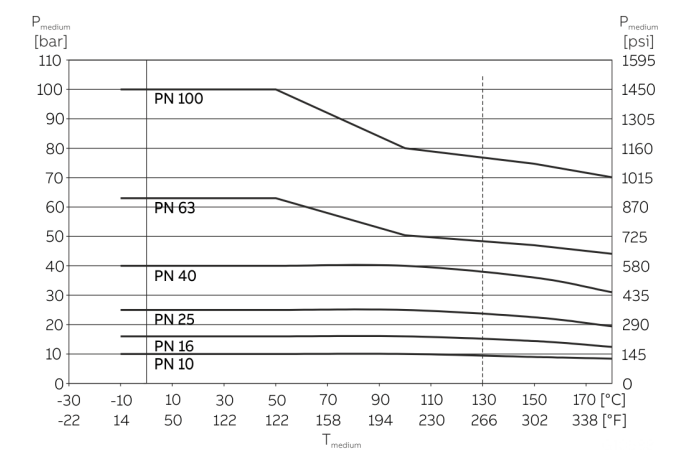


Figure 90: DIN flange, steel up to DN 600 (24"); Design Level 'A'

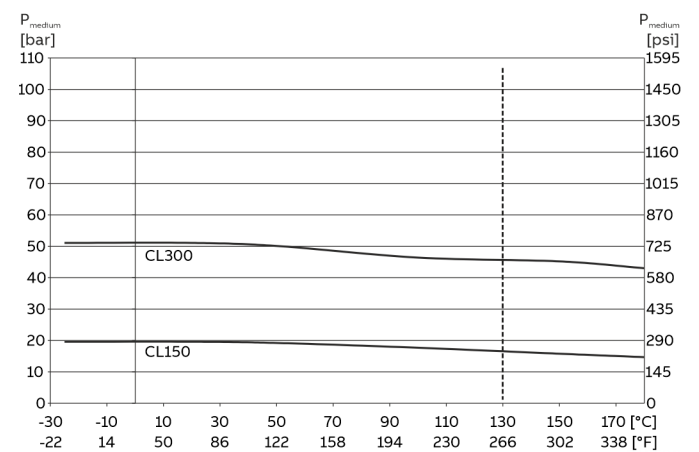
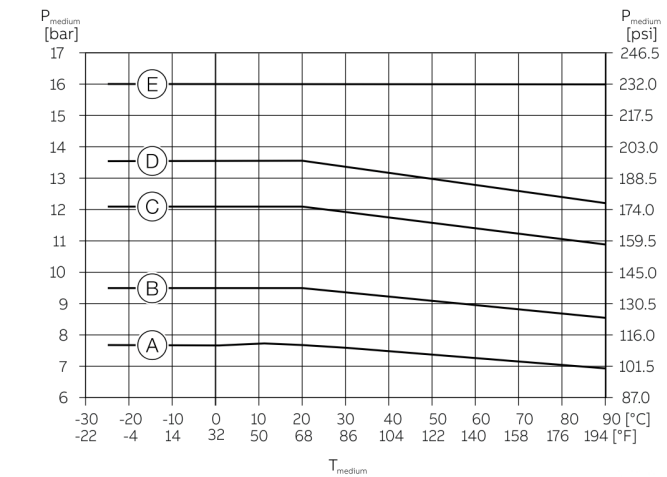


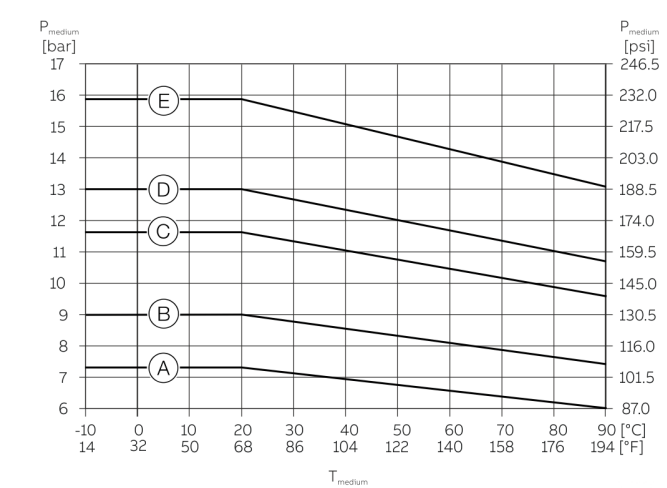
Figure 91: ASME-flange, steel up to DN 400 (16") (CL150/300) to DN 1000 (40") (CL150); Design Level 'A'

JIS 10K-B2210 flange				
DN	Material	PN	$T_{medium}$	$P_{medium}$
DN 32 to 400 (1 ¼ to 16")	Stainless steel	10	-25 to 180 °C (-13 to 356 °F)	10 bar (290 psi) (145 psi)
DN 32 to 400 (1 ¼ to 16")	Steel	10	-10 to 180 °C (14 to 356 °F)	10 bar (290 psi) (145 psi)



- (A) DN 1000, PN 10
- (B) DN 700, DN800, DN900, PN 10
- (C) DN 1000, PN 16
- (D) DN 900, DN 800, PN 16
- (E) DN 700, PN 16

Figure 92: DIN-flange, stainless steel, up to DN 700 (28") to DN 1000 (40"); Design Level 'A'



- (A) DN 1000, PN 10
- (B) DN 700, DN800, DN900, PN 10
- (C) DN 1000, PN 16
- (D) DN 900, DN 800, PN 16
- (E) DN 700, PN 16

Figure 93: DIN-flange, steel, up to DN 700 (28") to DN 1000 (40"); Design Level 'A'

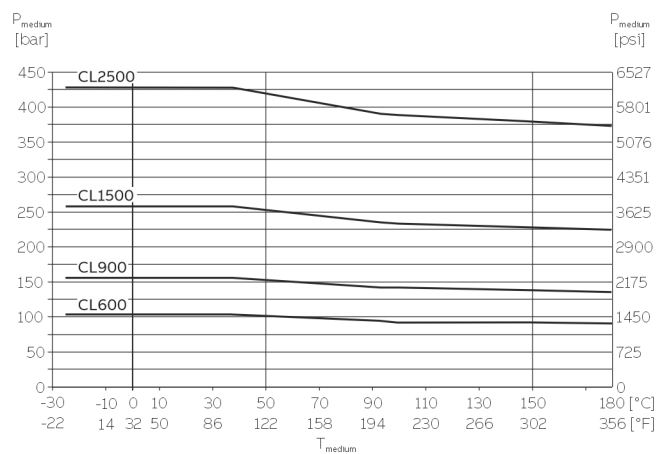


Figure 94: ASME flange, steel, DN 25 to 400 (1 to 24"); Design Level 'A'

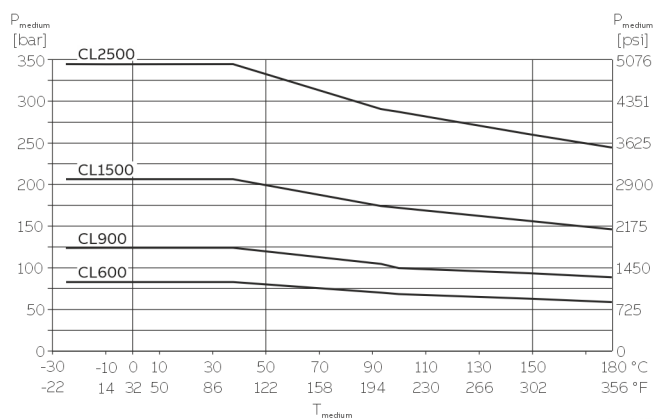


Figure 95: ASME flange, stainless steel, DN 25 to 400 (1 to 24"); Design Level 'A'

## ... 11 Specification

### HygienicMaster - Temperature data

The temperature range offered by the device is dependent on a number of different factors.

These factors include the measuring medium temperature

$T_{\text{medium}}$ , the ambient temperature  $T_{\text{amb}}$ , operating pressure

$P_{\text{medium}}$ , liner material and the approval for explosion protection.

#### Maximum Allowable Temperature Shock

Maximum allowable temperature shock difference in °C: Any

Temperature gradient °C/min: Any

#### Storage temperature range

-40 to 70 °C (-40 to 158 °F)

#### Maximum permissible cleaning temperature

CIP media	Liner	Cleaning temperature
Steam	PTFE, PFA	150 °C (302 °F)
Cleaning fluid	PTFE, PFA	140 °C (284 °F)

- The maximum cleaning temperature specified applies to a maximum ambient temperature of 25 °C (77 °F).  
If the ambient temperature up-scales > 25 °C (> 77 °F), then the temperature difference to the current temperature must be subtracted from the max. cleaning temperature.
- The specified cleaning temperature may have an effect for a maximum of 60 minutes.

#### Maximum ambient temperature depending on measuring medium temperature

Integral mount design or remote mount design

##### Flowmeter sensor in standard version

Process connection	Ambient temperature range ( $T_{\text{amb}}$ )		Measuring medium temperature ( $T_{\text{medium}}$ )	
	Minimum*	Maximum	Minimum	Maximum*
Flange	-20 °C (-4 °F)	60 °C (140 °F)	-25 °C (-13 °F)	100 °C (112 °F)
	-20 °C (-4 °F)	40 °C (104 °F)	-25 °C (-13 °F)	130 °C (266 °F)***
Variable process connections	-20 °C (-4 °F)	60 °C (140 °F)	-25 °C (-13 °F)	100 °C (112 °F)
	-20 °C (-4 °F)	40 °C (104 °F)	-25 °C (-13 °F)	130 °C (266 °F)***

##### High temperature version – from size DN 10 (3/8 in)

Process connection	Ambient temperature range ( $T_{\text{amb}}$ )		Measuring medium temperature ( $T_{\text{medium}}$ )	
	Minimum*	Maximum	Minimum	Maximum
Flange	-20 °C (-4 °F)	60 °C (140 °F)	-25 °C (-13 °F)	180 °C (356 °F)

\* Also available in low temperature version for ambient temperatures down to -40 °C (-40 °F)

\*\* For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to **Maximum permissible cleaning temperature** on page 88.

\*\*\* For units of nominal size DN 1 to 2, the measuring medium temperature is limited to 120 °C (248 °F)

## HygienicMaster – Material load for process connections

The limits of the permissible measuring medium temperature ( $T_{\text{medium}}$ ) and permissible pressure ( $P_{\text{medium}}$ ) are calculated on the basis of the liner and flange material used in the device (see device name plate).

### Minimum permissible operating pressure

The following tables show the permissible minimum operating pressure ( $P_{\text{medium}}$ ) as a function of the measuring medium temperature ( $T_{\text{medium}}$ ) and the liner material.

Lining material	Nominal diameter	$P_{\text{medium}}$ [mbar abs]	$T_{\text{medium}}^*$
PFA	DN 3 to DN 100 ( $\frac{1}{10}$ to 4 in)	0 < 130 °C (266 °F)	
PEEK	DN 1 to DN 2 ( $\frac{1}{25}$ to $\frac{1}{12}$ in)	0 < 120 °C (248 °F)	

\* For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to **Maximum permissible cleaning temperature** on page 88.

Liner approvals on request; please contact ABB.

### Overview – Material load

Process connection	DN	$P_{\text{medium max.}}$	$T_{\text{medium}}$
<b>Wafer type</b>	DN 3 to 50 ( $\frac{1}{10}$ to 2 in)	40 bar (580 psi)	–25 to 130 °C (–13 to 266 °F)
	DN 65 to 100 (2 $\frac{1}{2}$ to 4 in)	16 bar (232 psi)	
<b>Welded spuds</b> DIN 2463, ISO 1127, DIN 11850	DN 3 to 40 ( $\frac{1}{10}$ to 1 $\frac{1}{2}$ in)	40 bar (580 psi)	–25 to 130 °C (–13 to 266 °F)
	DN 50, DN 80 (2 in, 3 in)	16 bar (232 psi)	
	DN 65, DN 100 (2 $\frac{1}{2}$ in, 4 in)	10 bar (145 psi)	
<b>Welded spuds</b> SMS 1145	DN 25, DN 40 to 100 (1 in, 1.5 to 4 in)	6 bar (87 psi)	–25 to 130 °C (–13 to 266 °F)
<b>Threaded pipe connection</b> DIN 11851	DN 3 to 40 ( $\frac{1}{10}$ to 1 $\frac{1}{2}$ in)	40 bar (580 psi)	–25 to 130 °C (–13 to 266 °F)
	DN 50, DN 80 (2 in, 3 in)	16 bar (232 psi)	
	DN 65, DN 100 (2 $\frac{1}{2}$ in, 4 in)	10 bar (145 psi)	
<b>Tri-Clamp</b> DIN 32676	DN 3 to 50 ( $\frac{1}{10}$ to 2 in)	16 bar (232 psi)	–25 to 130 °C (–13 to 266 °F)
	DN 65 to 100 (2 $\frac{1}{2}$ to 4 in)	10 bar (145 psi)	
<b>Tri-Clamp</b> ASME BPE	DN 3 to 80 ( $\frac{1}{10}$ to 3 in)	10 bar (145 psi)	–25 to 121 °C (–13 to 250 °F)
	DN 100 (4 in)	8.6 bar (124.7 psi)	
<b>External threads</b> ISO 228, DIN 2999	DN 3 to 25 ( $\frac{1}{10}$ to 1 in)	16 bar (232 psi)	–25 to 130 °C (–13 to 266 °F)
<b>Welded spuds</b> OD tubing	DN 3 to 50 ( $\frac{1}{10}$ to 2 in)	10 bar (145 psi)	–25 to 130 °C (–13 to 266 °F)
<b><math>\frac{3}{8}</math> in hygiene connection</b>	DN 1 to DN 2 ( $\frac{1}{25}$ to $\frac{1}{12}$ in)	10 bar (145 psi)	–10 to 120 °C (–14 to 248 °F)

... 11 Specification

... HygienicMaster – Material load for process connections

Flange devices

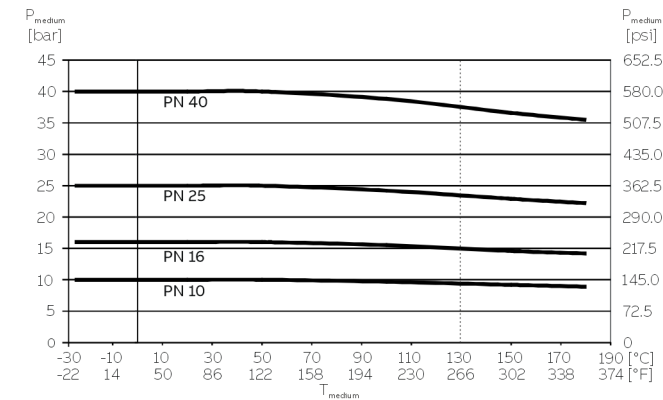


Figure 96: DIN flange, stainless steel, up to DN 100 (4 in)

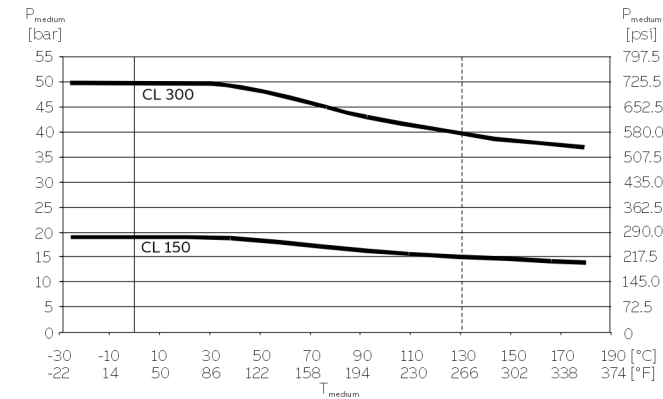


Figure 97: DIN flange, stainless steel, up to DN 100 (4 in) (CL 150 / 300)

JIS 10K-B2210 flange				
DN	Material	PN	$T_{medium}$	$P_{medium}$
DN 25 to 100 (1 to 4 in)	Stainless steel	10	-25 to 130 °C (-13 to 266 °F)	10 bar (290 psi) (145 psi)

Wafer type devices

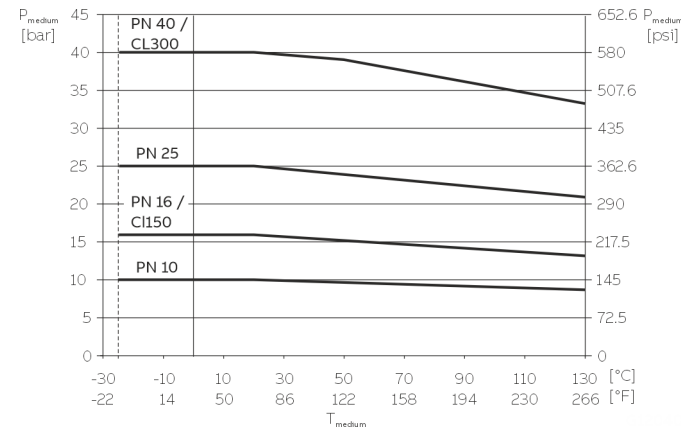


Figure 98: Wafer type design

JIS 10K-B2210 wafer type design				
DN	Material	PN	$T_{medium}$	$P_{medium}$
DN 32 to 100 (1 ¼ to 4 in)	1.4404 1.4435 1.4301	10	-25 to 130 °C (-13 to 266 °F)	10 bar (290 psi) (145 psi)

## 12 Additional documents

### Note

- An additional document with Ex safety instructions is available for measuring systems that are used in potentially explosive atmospheres.
- Ex safety instructions are an integral part of this manual. As a result, it is crucial that the installation guidelines and connection values it lists are also observed.

The icon on the name plate indicates the following:



### Note

All documentation, declarations of conformity, approvals, certificates and additional documentation are available in the ABB download area.

[www.abb.com/flow](http://www.abb.com/flow)

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## 13 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



## Torque information

Tightening torques for transducers with design level 'A'

### Note

The specified torques are valid only for greased threads and piping that is not subject to tensile stress.

ProcessMaster in flange design and HygienicMaster in flange or wafer-type design

Nominal diameter [mm (in)]	Pressure rating	Maximum tightening torque [Nm]					
		Hard / soft rubber		PTFE, PFA, ETFE		Ceramic carbide	
		**	***	**	***	**	***
DN 3 to 10* ( $\frac{1}{16}$ to $\frac{3}{8}$ in)*	PN40	–	–	12.43	12.43	–	–
	PN63/100	–	–	12.43	12.43	–	–
	CL150	–	–	12.98	12.98	–	–
	CL300	–	–	17.38	17.38	–	–
	JIS 10K	–	–	12.43	12.43	–	–
DN 15 ( $\frac{1}{2}$ in)	PN40	6.74	4.29	14.68	14.68	–	–
	PN63/100	13.19	11.2	22.75	22.75	–	–
	CL150	3.65	3.65	12.98	12.98	–	–
	CL300	4.94	3.86	17.38	17.38	–	–
	CL600	9.73	9.73	–	–	–	–
	JIS 10K	2.84	1.37	14.68	14.68	–	–
DN 20 ( $\frac{3}{4}$ in)	PN40	9.78	7.27	20.75	20.75	–	–
	PN63/100	24.57	20.42	42.15	42.15	–	–
	CL150	5.29	5.29	18.49	18.49	–	–
	CL300	9.77	9.77	33.28	33.28	–	–
	CL600	15.99	15.99	–	–	–	–
	JIS 10K	4.1	1.88	20.75	20.75	–	–
DN 25 (1 in)	PN40	13.32	8.6	13.32	8.6	13.32	8.6
	PN63/100	32.09	31.42	53.85	53.85	53.85	53.85
	CL150	5.04	2.84	23.98	23.98	23.98	23.98
	CL300	17.31	16.42	65.98	38.91	65.98	38.91
	CL600	22.11	22.11	–	–	–	–
	JIS 10K	8.46	5.56	26.94	26.94	26.94	26.94
DN 32 (1 $\frac{1}{4}$ in)	PN40	27.5	15.01	45.08	45.08	45.08	45.08
	PN63/100	42.85	41.45	74.19	70.07	74.19	70.07
	CL150	4.59	1.98	29.44	29.44	29.44	29.44
	CL300	25.61	14.22	45.52	45.52	45.52	45.52
	CL600	34.09	34.09	–	–	–	–
	JIS 10K	9.62	4.9	45.08	45.08	45.08	45.08

\* Connection flange DIN/EN 1092-1 = DN 10 ( $\frac{3}{8}$  in), connection flange ASME = DN 15 ( $\frac{1}{2}$  in)

\*\* Flange material: steel.

\*\*\* Flange material: stainless steel.

# ... 13 Appendix

## ... Torque information

Nominal diameter [mm (in)]	Pressure rating	Maximum tightening torque [Nm]					
		Hard / soft rubber		PTFE, PFA, ETFE		Ceramic carbide	
		**	***	**	***	**	***
DN 40 (1 ½ in)	PN40	30.44	23.71	56.06	56.06	56.06	56.06
	PN63/100	62.04	51.45	97.08	97.08	97.08	97.08
	CL150	5.82	2.88	36.12	36.12	36.12	36.12
	CL300	33.3	18.41	73.99	73.99	73.99	73.99
	CL600	23.08	23.08	–	–	–	–
	JIS 10K	12.49	6.85	56.06	56.06	56.06	56.06
DN 50 (1 ½ in)	PN40	41.26	27.24	71.45	71.45	71.45	71.45
	PN63	71.62	60.09	109.9	112.6	109.9	112.6
	CL150	22.33	22.33	66.22	66.22	66.22	66.22
	CL300	17.4	22.33	38.46	38.46	38.46	38.46
	CL600	35.03	35.03	–	–	–	–
	JIS 10K	17.27	10.47	71.45	71.45	71.45	71.45
DN 65 (2 ½ in)	PN16	14.94	8	37.02	39.1	37.02	39.1
	PN40	30.88	21.11	43.03	44.62	43.03	44.62
	PN63	57.89	51.5	81.66	75.72	81.66	75.72
	CL150	30.96	30.96	89.93	89.93	89.93	89.93
	CL300	38.38	27.04	61.21	61.21	61.21	61.21
	CL600	53.91	53.91	–	–	–	–
	JIS 10K	14.94	8	37.02	39.1	37.02	39.1
DN 80 (3 in)	PN40	38.3	26.04	51.9	53.59	51.9	53.59
	PN63	63.15	55.22	64.47	80.57	64.47	80.57
	CL150	19.46	19.46	104.6	104.6	104.6	104.6
	CL300	75.54	26.91	75.54	75.54	75.54	75.54
	CL600	84.63	84.63	–	–	–	–
	JIS 10K	16.26	9.65	45.07	47.16	45.07	47.16
DN 100 (4 in)	PN16	20.7	12.22	49.68	78.19	49.68	78.19
	PN40	67.77	47.12	78.24	78.19	78.24	78.19
	PN63	107.4	95.79	148.5	119.2	148.5	119.2
	CL150	17.41	7.82	76.2	76.2	76.2	76.2
	CL300	74.9	102.6	102.6	102.6	102.6	102.6
	CL600	147.1	147.1	–	–	–	–
	JIS 10K	20.7	12.22	49.68	78.19	49.68	78.19
DN 125 (5 in)	PN16	29.12	18.39	61.4	64.14	61.4	64.14
	PN40	108.5	75.81	123.7	109.6	123.7	109.6
	PN63	180.3	164.7	242.6	178.2	242.6	178.2
	CL150	24.96	11.05	98.05	98.05	98.05	98.05
	CL300	81.64	139.4	139.4	139.4	139.4	139.4
	CL600	244.1	244.1	–	–	–	–

\*\* Flange material: steel.  
 \*\*\* Flange material: stainless steel.

Nominal diameter [mm (in)]	Pressure rating	Maximum tightening torque [Nm]					
		Hard / soft rubber		PTFE, PFA, ETFE		Ceramic carbide	
		**	***	**	***	**	***
DN 150 (6 in)	PN16	46.99	23.7	81.23	85.08	81.23	85.08
	PN40	143.5	100.5	162.5	133.5	162.5	133.5
	PN63	288.7	269.3	371.3	243.4	371.3	243.4
	CL150	30.67	13.65	111.4	111.4	111.4	111.4
	CL300	101.4	58.4	123.6	123.6	123.6	123.6
	CL600	218.4	218.4	–	–	–	–
DN 200 (8 in)	PN10	45.57	27.4	113	116.9	113	116.9
	PN16	49.38	33.82	70.42	73	70.42	73
	PN25	100.6	69.17	109.9	112.5	109.9	112.5
	PN40	196.6	144.4	208.6	136.8	208.6	136.8
	PN63	350.4	331.8	425.5	282.5	425.5	282.5
	CL150	49.84	23.98	158.1	158.1	158.1	158.1
	CL300	133.9	78.35	224.3	224.3	224.3	224.3
	CL600	391.8	391.8	–	–	–	–
DN 250 (10 in)	PN10	23.54	27.31	86.06	89.17	86.06	89.17
	PN16	88.48	61.71	99.42	103.1	99.42	103.1
	PN25	137.4	117.6	166.5	133.9	166.5	133.9
	PN40	359.6	275.9	279.9	241	279.9	241
	CL150	55.18	27.31	146.1	148.3	146.1	148.3
	CL300	202.7	113.2	246.4	246.4	246.4	246.4
DN 300 (12 in)	PN10	58.79	38.45	91.29	94.65	91.29	94.65
	PN16	122.4	85.64	113.9	114.8	113.9	114.8
	PN25	180.6	130.2	151.1	106.9	151.1	106.9
	PN40	233.4	237.4	254.6	252.7	254.6	252.7
	CL150	90.13	50.37	203.5	198	203.5	198
	CL300	333.3	216.4	421.7	259.1	421.7	259.1
DN 350 (14 in)	PN10	69.62	47.56	72.49	75.22	72.49	75.22
	PN16	133.6	93.61	124.9	104.4	124.9	104.4
	PN25	282.3	204.3	226.9	167.9	226.9	167.9
	CL150	144.8	83.9	270.5	263	270.5	263
	CL300	424.1	252.7	463.9	259.4	463.9	259.4
DN 400 (16 in)	PN10	108.2	75.61	120.1	113.9	120.1	113.9
	PN16	189	137.2	191.4	153.8	191.4	153.8
	PN25	399.4	366	404	246.7	404	246.7
	CL150	177.6	100	229.3	222.8	229.3	222.8
	CL300	539.5	318.8	635.8	328.1	635.8	328.1
DN 450 (18 in)	CL150	218.6	120.5	267.3	192.3	267.3	192.3
	CL300	553.8	327.2	660.9	300	660.9	300

\*\* Flange material: steel.

\*\*\* Flange material: stainless steel.

# ... 13 Appendix

## ... Torque information

Nominal diameter [mm (in)]	Pressure rating	Maximum tightening torque [Nm]					
		Hard / soft rubber		PTFE, PFA, ETFE		Ceramic carbide	
		**	***	**	***	**	***
DN 500 (20 in)	PN10	141.6	101.4	153.9	103.5	153.9	103.5
	PN16	319.7	245.4	312.1	224.8	312.1	224.8
	PN25	481.9	350.5	477.1	286	477.1	286
	CL150	212.5	116	237.3	230.4	237.3	230.4
	CL300	686.3	411.8	786.8	363.1	786.8	363.1
DN 600 (24 in)	PN10	224.7	164.8	238.7	149.1	238.7	149.1
	PN16	515.1	399.9	496.7	365.3	496.7	365.3
	PN25	826.2	600.3	750.7	539.2	750.7	539.2
	CL150	356.6	202.8	451.6	305.8	451.6	305.8
	CL300	1188	719	1376	587.4	1376	587.4
DN 700 (28 in)	PN10	267.7	204.9	On request	On request	267.7	204.9
	PN16	455.7	353.2	On request	On request	455.7	353.2
	PN25	905.9	709.2	On request	On request	905.9	709.2
	CL150	364.1	326.2	449.2	432.8	364.1	326.2
	CL300	1241	On request	On request	On request	1241	On request
DN 750 (30 in)	CL150	423.8	380.9	493.3	442	423.8	380.9
	CL300	1886	On request	On request	On request	1886	On request
DN 800 (32 in)	PN10	391.7	304.2	On request	On request	391.7	304.2
	PN16	646.4	511.8	On request	On request	646.4	511.8
	PN25	1358	1087	On request	On request	1358	1087
	CL150	410.8	380.9	493.3	380.9	410.8	380.9
	CL300	2187	On request	On request	On request	2187	On request
DN 900 (36 in)	PN10	387.7	296.3	On request	On request	387.7	296.3
	PN16	680.8	537.3	On request	On request	680.8	537.3
	PN25	1399	1119	On request	On request	1399	1119
	CL150	336.2	394.6	511	458.5	336.2	394.6
	CL300	1972	On request	On request	On request	1972	On request
DN 1000 (40 in)	PN10	541.3	419.2	On request	On request	541.3	419.2
	PN16	955.5	756.1	On request	On request	955.5	756.1
	PN25	2006	1612	On request	On request	2006	1612
	CL150	654.2	598.8	650.6	385.1	654.2	598.8
	CL300	2181	On request	On request	On request	2181	On request
DN 1100 (44 in)	CL150	749.1	682.6	741.3	345.9	–	–
	CL300	2607	On request	On request	On request	–	–
DN 1200 (48 in)	PN 6	363.5	On request	–	–	–	–
	PN10	705.9	On request	–	–	–	–
	PN16	1464	On request	–	–	–	–
	CL150	815.3	731.6	–	–	–	–
	CL300	3300	On request	–	–	–	–

\*\* Flange material: steel.

\*\*\* Flange material: stainless steel.

Nominal diameter [mm (in)]	Pressure rating	Maximum tightening torque [Nm]					
		Hard / soft rubber		PTFE, PFA, ETFE		Ceramic carbide	
		**	***	**	***	**	***
DN 1350 (54 in)	CL150	1036	983.7	–	–	–	–
	CL300	5624	On request	–	–	–	–
DN 1400 (56 in)	PN 6	515	On request	–	–	–	–
	PN10	956.3	On request	–	–	–	–
	PN16	1558	On request	–	–	–	–
DN 1500 (60 in)	CL150	1284	1166	–	–	–	–
	CL300	6139	On request	–	–	–	–
DN 1600 (64 in)	PN 6	570.7	On request	–	–	–	–
	PN10	1215	On request	–	–	–	–
	PN16	2171	On request	–	–	–	–
DN 1800 (72 in)	PN 6	708.2	On request	–	–	–	–
	PN10	1492	On request	–	–	–	–
	PN16	2398	On request	–	–	–	–
DN 2000 (80 in)	PN 6	857.9	On request	–	–	–	–
	PN10	1840	On request	–	–	–	–
	PN16	2860	On request	–	–	–	–

\*\* Flange material: steel.

\*\*\* Flange material: stainless steel.

#### Tightening torques for HygienicMaster with variable process connections

Nominal diameter		Maximum tightening torque
[mm]	[in]	[Nm]
DN 3 to DN 10	3/8 in	8
DN 15	1/2 in	10
DN 20	3/4 in	21
DN 25	1	31
DN 32	1 1/4 in	60
DN 40	1 1/2 in	80
DN 50	2	5
DN 65	2 1/2 in	5
DN 80	3	15
DN 100	4	14

## ... 13 Appendix

### Parameterization overview (factory settings)

Parameter	Value range	Factory setting
Sensor Tag	Alphanumeric, maximum 20 characters.	None
Sensor Location Tag	Alphanumeric, maximum 20 characters.	None
Qv Max 1	Depending on the nominal diameter of the sensor.	Set to $Q_{\max}$ DN in accordance with <b>Measuring range table</b> on page 66.
Unit Volumeflow Qv	l/s; l/min; l/h; ml/s; ml/min; m3/s; m3/min; m3/h; m3/d; hl/h; g/s; g/min; g/h; kg/s; kg/min; kg/h; kg/d; t/min; t/h; t/d	l/min
Unit Vol. Totalizer	m3; l; ml; hl; g; kg; t	Liter (l)
Pulses per Unit	1 to 10000	1
Pulse Width	0.1 to 2000 ms	100 ms
Damping	0.02 to 60 s	1
Operating mode Digital output 41 / 42	Off, Binary output, Pulse output, Frequency output	Digital output 41/42 as pulse output for forward flow and reverse flow
Operating mode Digital output 51 / 52	Off, Binary output, pulse output (follows digital output 41 / 42, 90 ° or 180 ° out of phase)	Digital output 51 / 52 as binary output for output of the flow direction.
Curr.Out 31/32	4-20mA FWD/REV, 4-20mA FWD, 4-12-20 mA	4-20mA FWD/REV
Curr.Out at Alarm	High Alarm 21 to 23 mA or Low Alarm 3.5 to 3.6 mA	High Alarm, 21.8 mA
Current at flow rate > 103 % (I=20.5 mA)	Off (current output remains at 20.5 mA), High Alarm, Low Alarm ,	Off
Low flow cutoff	0 to 10 %	1 %
Empty pipe detection	On / Off	Off

## Notes

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