ABB MEASUREMENT & ANALYTICS | COMMISSIONING INSTRUCTION

ProcessMaster FEP630, HygienicMaster FEH630

Electromagnetic flowmeter

Devices-Firmware version: 01.07.00

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 FEP630, FEH630 is available for download free of charge at www.abb.com/flow.
Alternatively simply scan this code:

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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 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:

Notes on data safety

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

… 1 Safety

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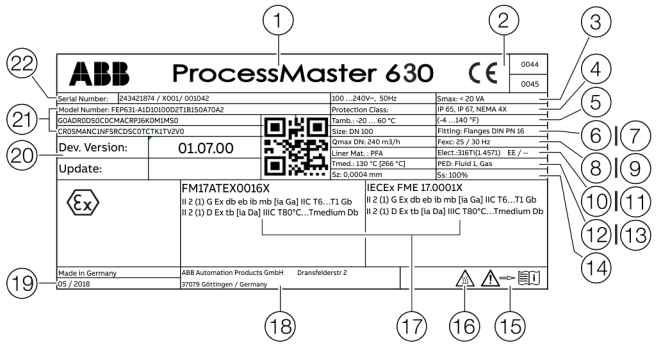
2 Product identification

Name plate

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

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.



1. Type designation
2. CE mark
3. Power supply
4. IP rating in accordance with EN 60529
5. T_{amb} = maximum permissible ambient temperature
6. Nominal diameter
7. Process connection / pressure rating
8. Calibration value $Q_{max}DN$
9. Excitation frequency
10. Liner material
11. Electrode material / Supplementary information: EE = grounding electrodes, TFE = partial filling electrode
12. T_{med} = maximum permissible measuring medium temperature
13. Label indicating whether the pressure equipment is subject to the Pressure Equipment Directive.
14. Calibration value Sz (zero point), Ss (range)
15. ‘Follow operating instruction’ symbol
16. ‘Caution hot surface’ symbol
17. Ex marking in accordance with ATEX / IECEx (example)
18. Manufacturer address
19. Year of manufacture
20. Software version
21. Model number (for more detailed information about the technical design, refer to the data sheet or the order confirmation)
22. Order number / Serial number for identification by the manufacturer

Figure 1: Name plate (example)

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

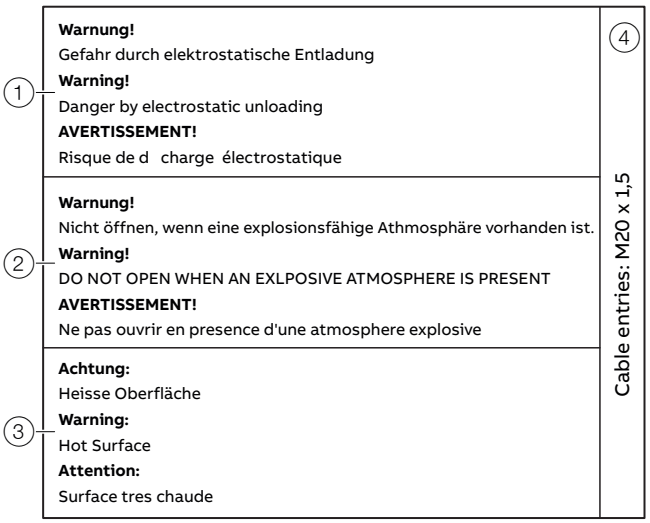
Marking in accordance with Pressure Equipment Directive 2014/68/EU
Information on the relevant fluid group (Figure 1, Position ⑬):

- 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.



① WARNING - Danger due to electrostatic discharge.
② WARNING - Do not open if an explosive atmosphere is present.
③ WARNING - Hot surface.
④ Thread for cable glands

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.

… 3 Transport and storage

… Transport

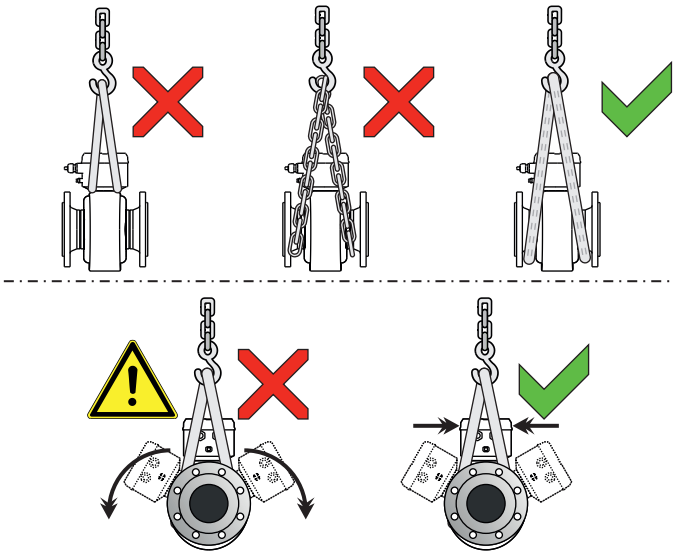


Figure 3: Transport instructions - ≤ DN 450

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

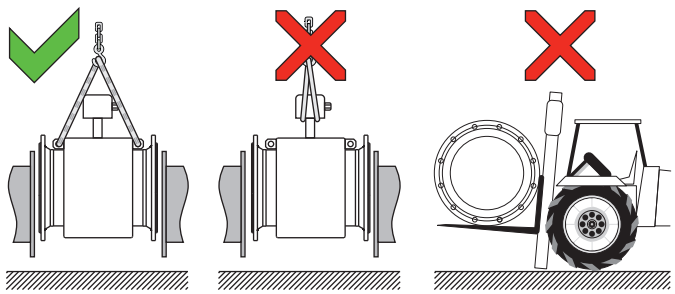


Figure 4: Transport instructions - > DN 450

- 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.

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 81) 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.).

Address for returns:
Please contact Customer Center Service according to page 6 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 63.

… 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**).

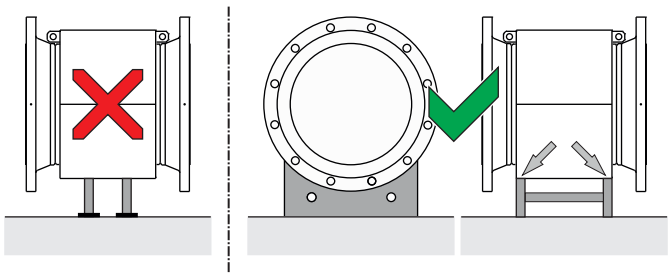


Figure 5: Support for nominal diameters larger than DN 400

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.

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 82 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

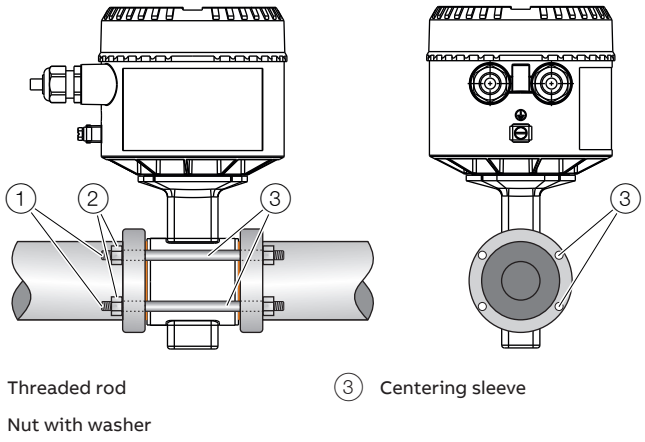


Figure 6: Assembly set for wafer type assembly (example)

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

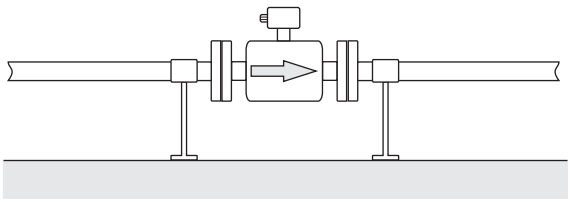
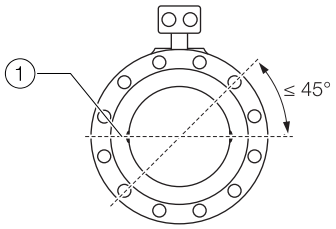


Figure 7: Flow direction

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

Electrode axis



① Electrode axis

Figure 8: Orientation of the electrode axis

The flowmeter sensor should be mounted in the piping in such a manner that the electrode axis is oriented as horizontally as possible.
A maximum deviation of 45° from the horizontal position is permissible.

Mounting position

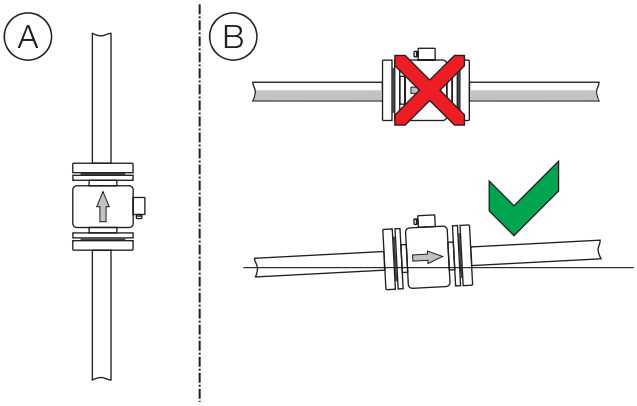


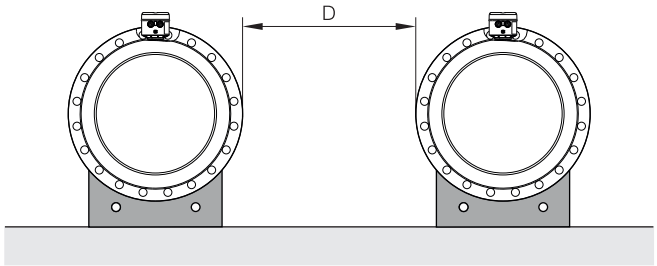
Figure 9: Mounting position

Ⓐ 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.

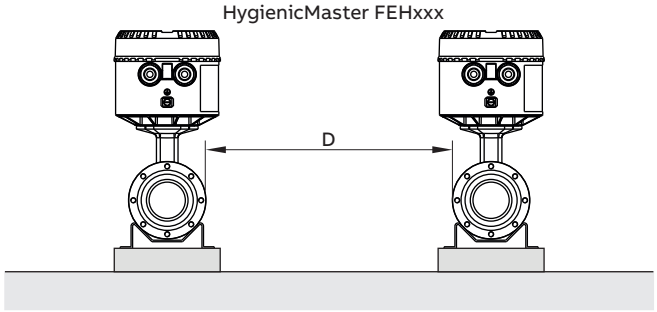
Minimum spacing of the devices

ProcessMaster FEPxxx



Spacing D: ≥ 1.0 m (3.3 ft) for Design Level 'A',
≥ 0.7 m (2.3 ft) for Design Level 'B'

HygienicMaster FEHxxx



Spacing D: ≥ 1.0 m (≥ 3.3 ft)

Figure 10: Minimum spacing

- 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. These values have been calculated on the basis of IEC 801-2 or IEC TC77B

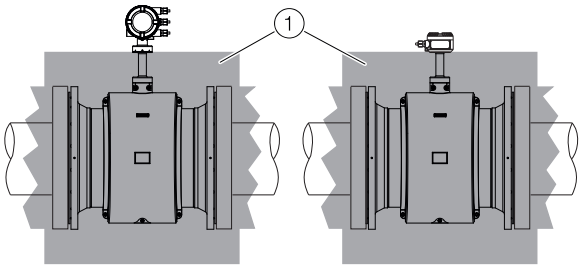
… 4 Installation

… 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.
In piping made of plastic or with insulating liner, grounding of the measuring medium is done by installing grounding plates. If stray potential is present in the piping, adding a grounding plate on both ends of the flowmeter sensor is recommended.

Sensor insulation

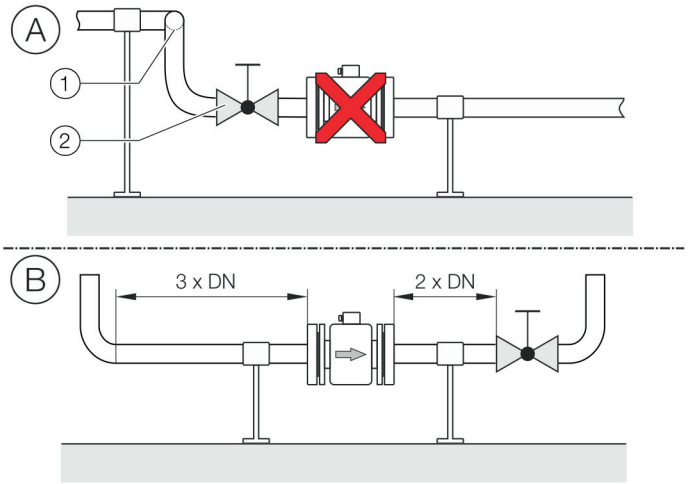


① Insulation

Figure 11: Insulation of the flowmeter sensor

In the high temperature design, the flowmeter sensor can be completely thermally insulated. After the unit is installed, the piping and sensor must be insulated in accordance with the figure.

Inlet and outlet sections



① Double manifold ② Turn-off device

Figure 12: 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 manifolds, 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 × DN long and straight outlet sections 2 × DN long are sufficient (DN = nominal diameter of the flowmeter sensor).
For test stands, the reference conditions of 10 × DN straight inlet and 5 × 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

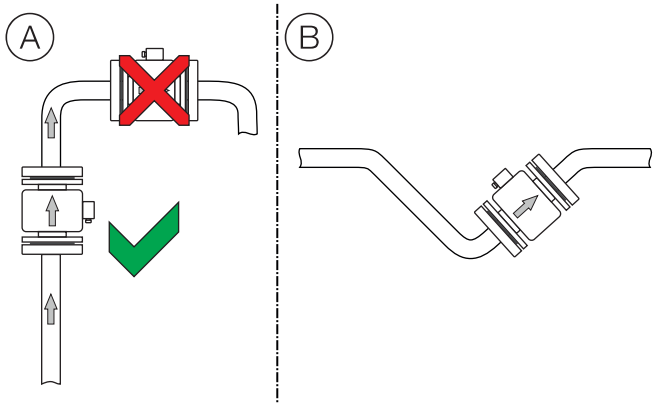


Figure 13: Free inflow and outflow

(A) 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.
(B) For free inflow/outflow, provide an invert to make sure that the piping is always full

Mounting with heavily contaminated measuring media

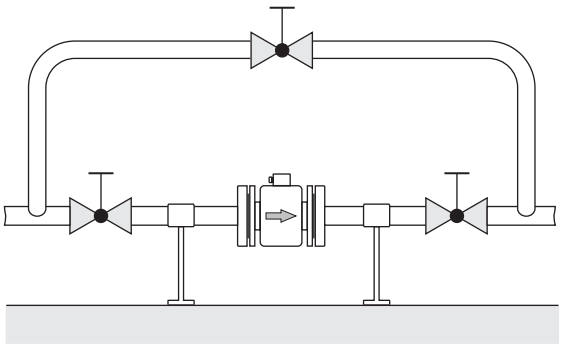
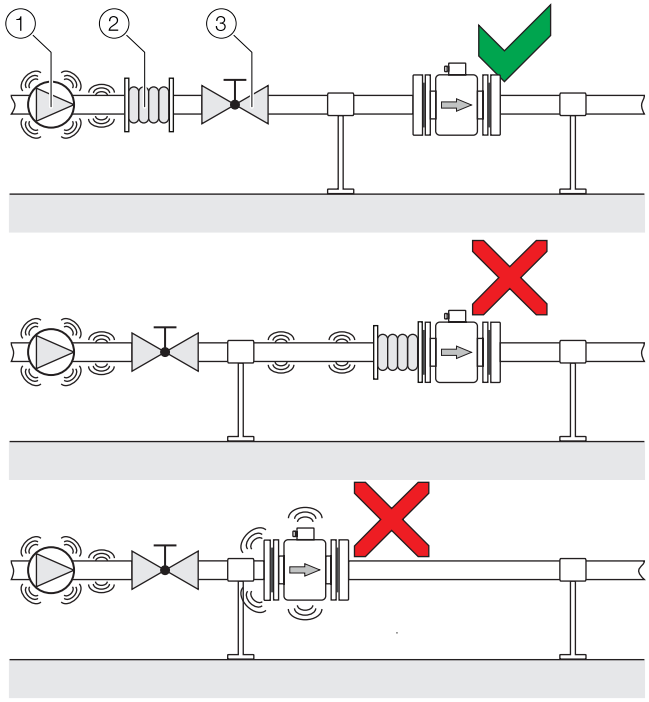


Figure 14: Bypass line

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) Turn-off device

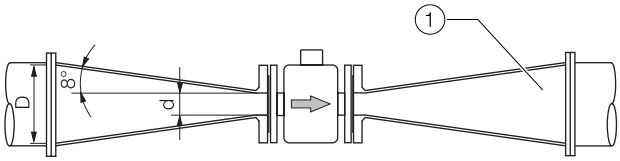
Figure 15: Vibration damping

If pipe vibration occurs, it needs to be damped using damping devices.
The damping devices must be installed outside the support section and outside of the piping section between the turn-off devices.
Avoid connecting damping devices directly to the flowmeter sensor.

… 4 Installation

… Installation conditions

Installation in piping with larger nominal diameter



① Reducer

Figure 16: 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 17).
3. Read the pressure loss on the Y-axis in Figure 17.

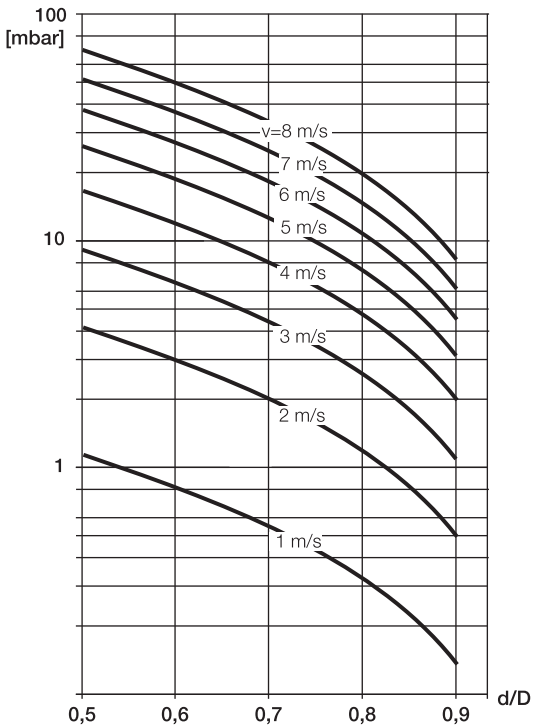
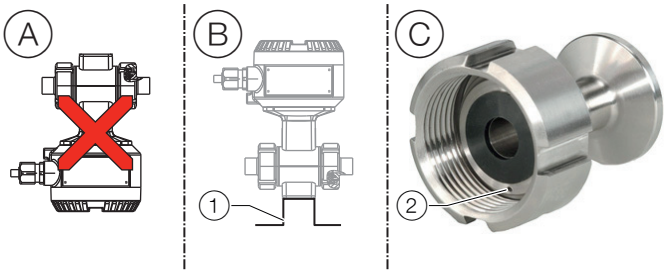


Figure 17: Flow rate nomogram for flange transition piece at α/2 = 8°

Installation in 3A compliant installations



① Angel bracket ② Leakage hole

Figure 18: 3A compliant installation

Please observe the following points:

Ⓐ Do not install the device vertically with the terminal box or transmitter housing pointing downward.
Ⓑ The ‘angel bracket’ option is not 3A compliant.
Ⓒ 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 ensure 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 82.
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 82!
   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.

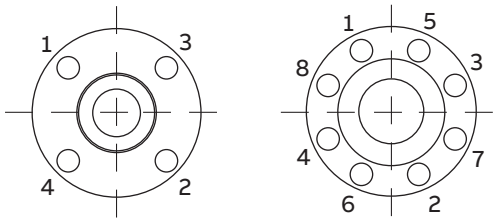


Figure 19: Tightening sequence for the flange screws

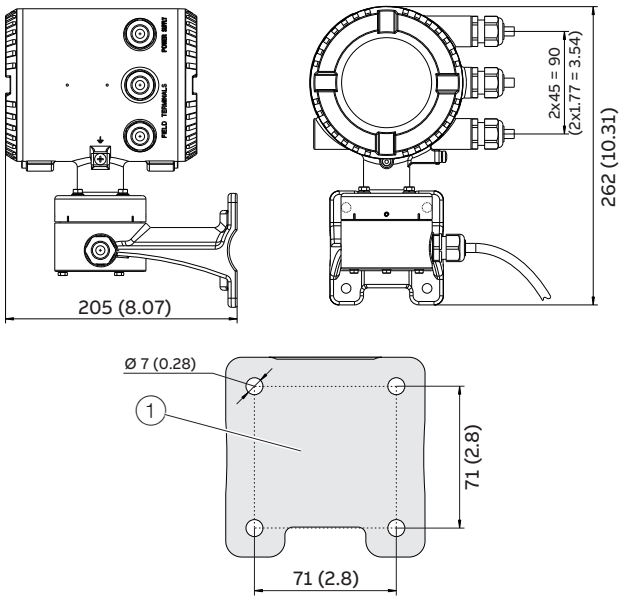
… 4 Installation

Installing the transmitter in the remote mount design

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

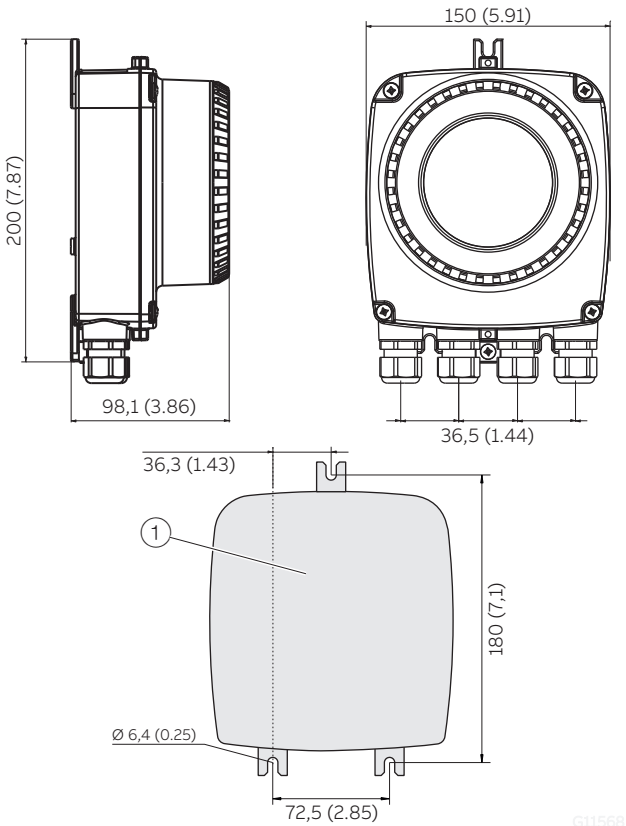
- Observe the information concerning maximum ambient temperature and IP rating on the name plate
- The location must be mostly free from vibration.
- The location must not be exposed to direct sunlight. If necessary provide a sun screen on site.
- Do not up-scale the maximum signal cable length between 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.



(1) Hole pattern for mounting holes

Figure 20: Mounting dimensions dual-compartment housing



(1) Hole pattern for mounting holes

Figure 21: Mounting dimensions single-compartment housing

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!

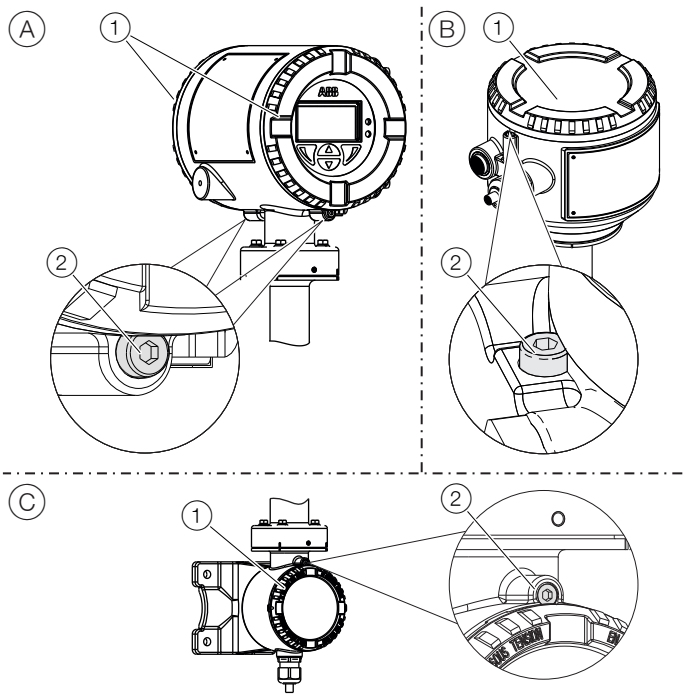
When the housing is open, contact protection is not provided and EMC protection is limited.

- 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.



(A) Integral mount design
(B) Remote mount design
(C) Transmitter, terminal space, signal cable

Figure 22: 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).

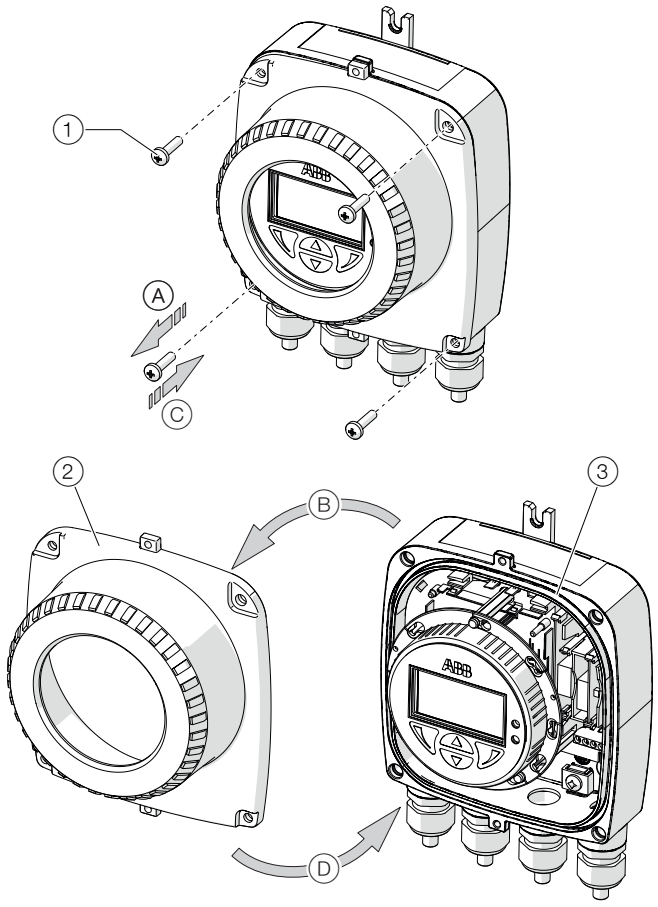
… 4 Installation

… Opening and closing the housing

NOTICE

Potential adverse effect on the IP rating

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



① Cover screws
② Transmitter housing cover
③ Gasket

Figure 23: Open / close single-compartment housing

Opentransmitter housing: Perform steps Ⓐ and Ⓑ.
Closetransmitter housing: Perform steps Ⓒ and Ⓓ.

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.
Only loosen the screws shown when rotating the transmitter housing!

Rotate transmitter housing: Perform steps Ⓐ to Ⓒ.

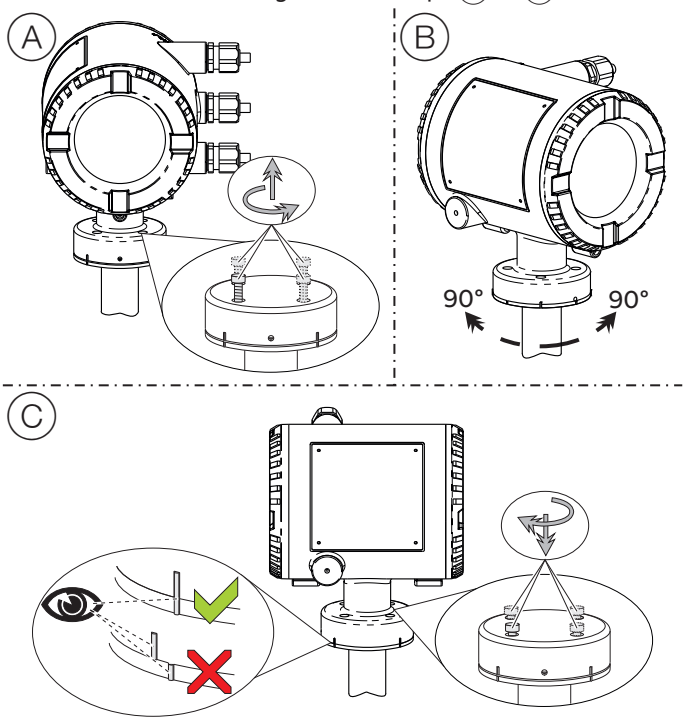


Figure 24: Rotate transmitter housing

Rotate LCD indicator – dual-compartment housing
The LCD indicator can be rotated in three increments of 90° each. To open and close the housing, refer to **Opening and closing the housing** on page 17.

Turn the LCD indicator:
Perform steps Ⓐ to Ⓕ.

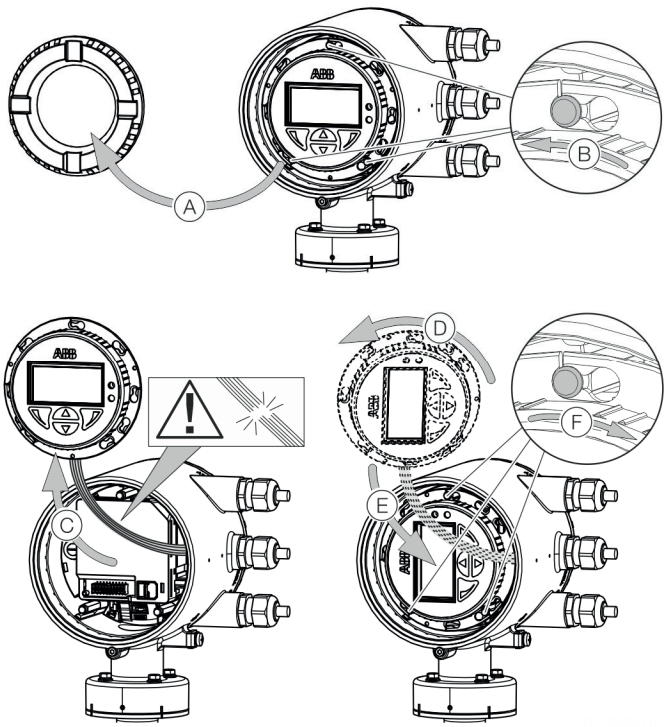


Figure 25: Rotating the LCD indicator

Rotate LCD indicator – single-compartment housing
The LCD indicator can be rotated in three increments of 90° each. To open and close the housing, refer to **Opening and closing the housing** on page 17.

Turn the LCD indicator:
Perform steps Ⓐ to Ⓕ.

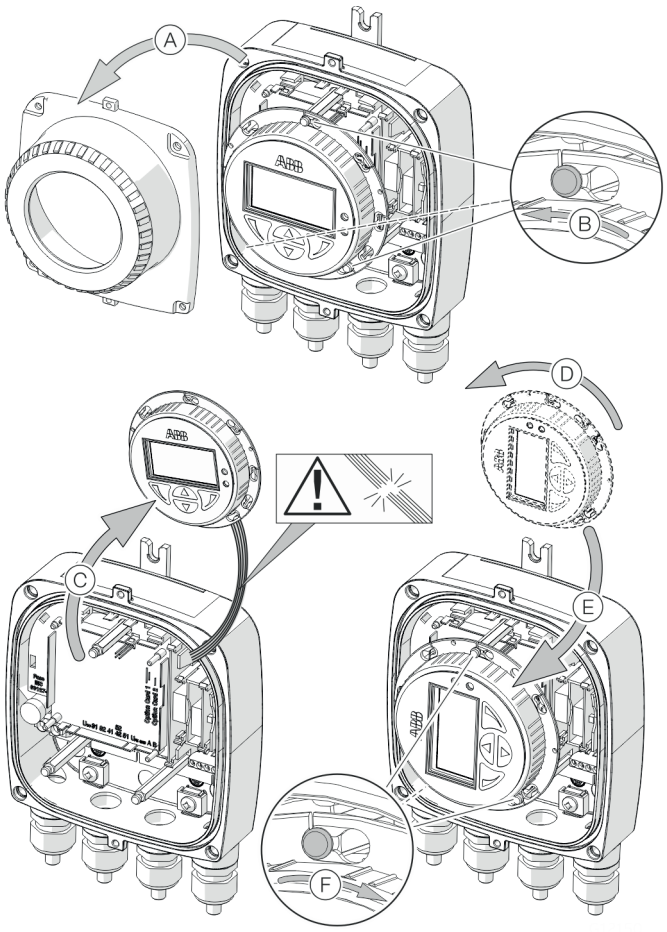


Figure 26: Rotating the LCD indicator

… 4 Installation

Installing the plug-in cards

⚠ WARNING

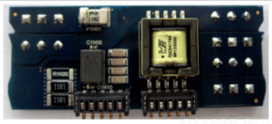
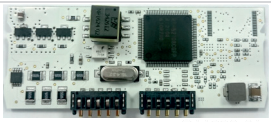
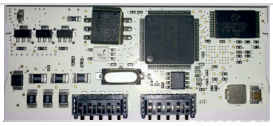
Loss of Ex Approval!

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

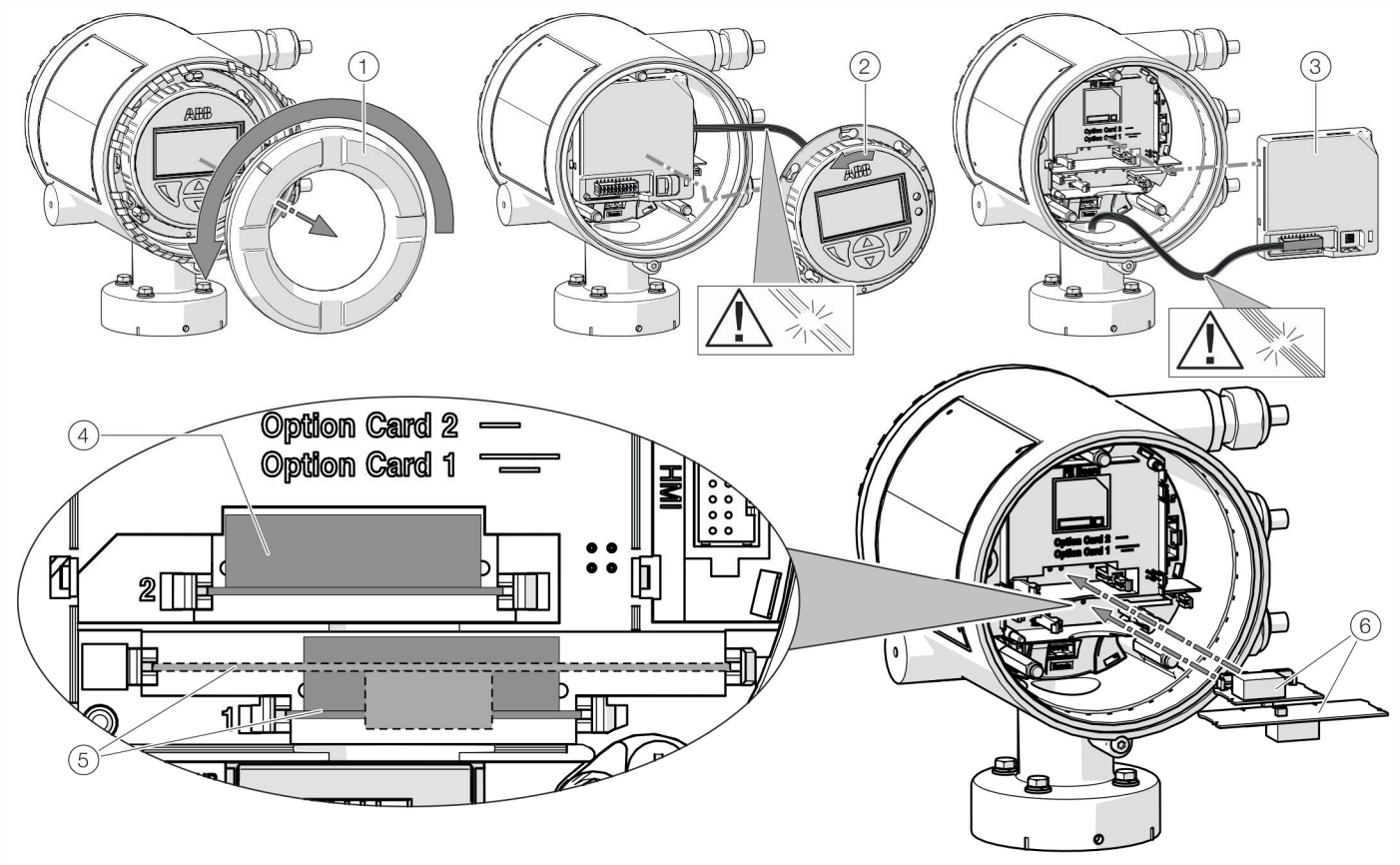
- Devices for use in potentially explosive atmospheres may not be retrofitted with plug-in cards.
- If devices are to be used in potentially explosive atmospheres, the required plug-in cards must be specified when the order is placed.

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 card	Description	Quantity*
	Current output, 4 to 20 mA passive (red) Order no.: 3KQZ400029U0100	Maximum of two plug-in cards
	Passive digital output (green) Order no.: 3KQZ400030U0100	Maximum of one plug-in card
	Passive digital input (yellow) Order no.: 3KQZ400032U0100	Maximum of one plug-in card
	Loop power supply 24 V DC (blue) Order no.: 3KQZ400031U0100	Maximum of one plug-in card
	Modbus RTU RS485 (white) Order no.: 3KQZ400028U0100	Maximum of one plug-in card
	Profibus DP (white) Order no.: 3KQZ400027U0100	Maximum of one plug-in card

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

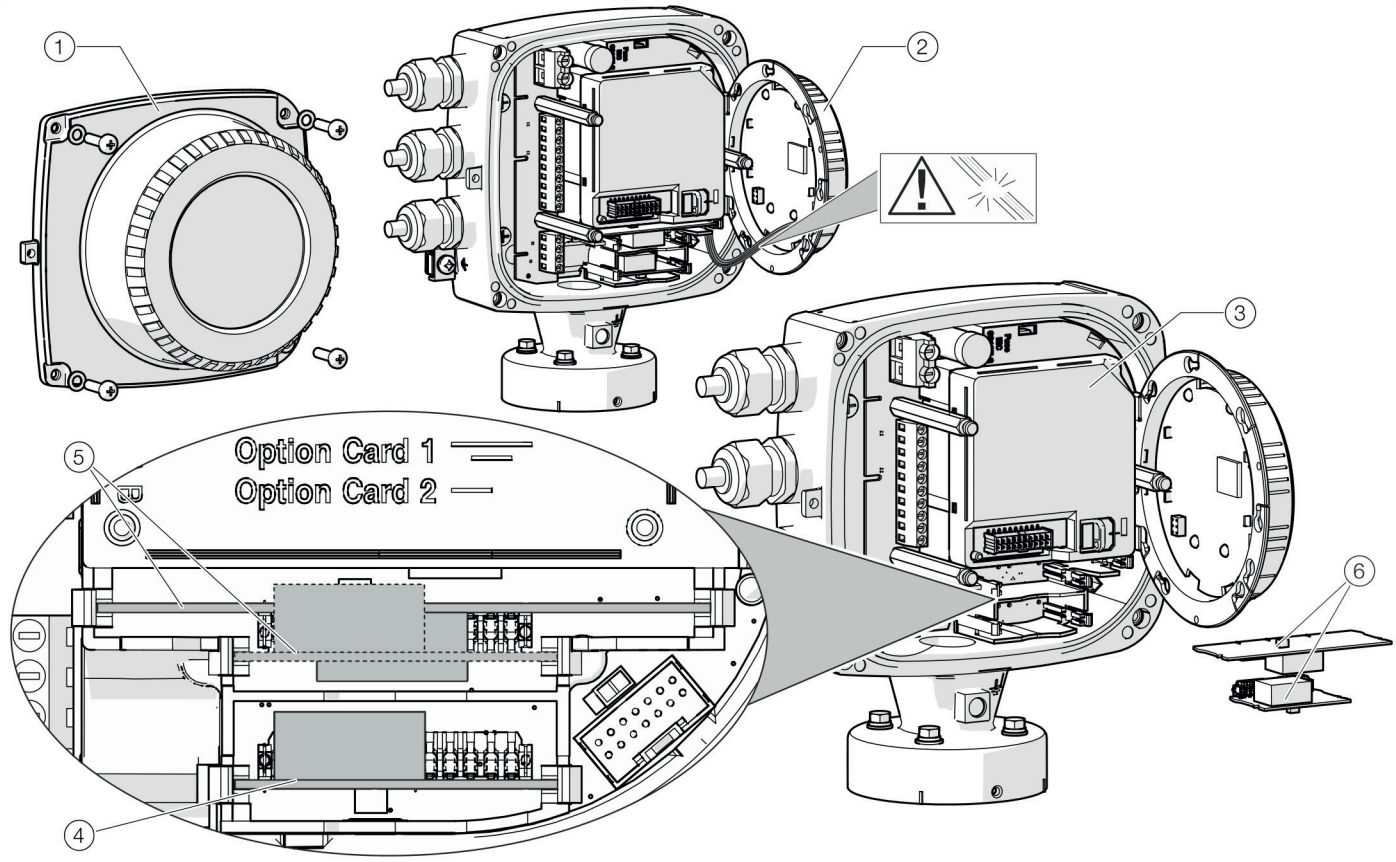


1. Cover
2. LCD indicator
3. Frontend board (FEB, with integral mount design only)
4. Slot OC2
5. Slot OC1
6. Plug-in cards

Figure 27: Installation of plug-in cards (example, dual-compartment housing)

… 4 Installation

… Installing the plug-in cards



1 Cover
2 LCD indicator
3 Slot OC1
4 Slot OC2
5 Plug-in cards

Figure 28: 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 frontend 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 frontend 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 23.
8. After powering up the power supply, configure the plug-in card functions.

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.

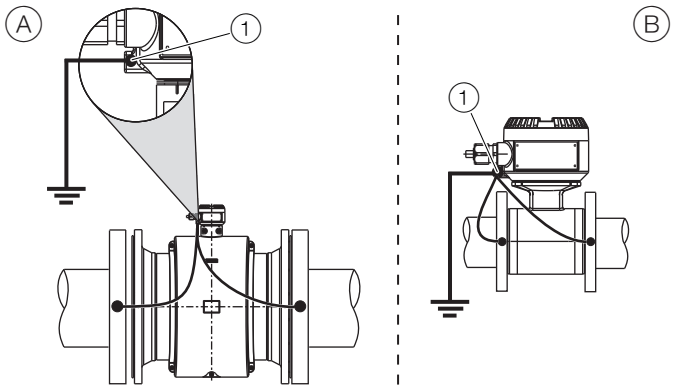
Note

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.

… 5 Electrical connections

… Sensor grounding

Metal pipe with fixed flanges

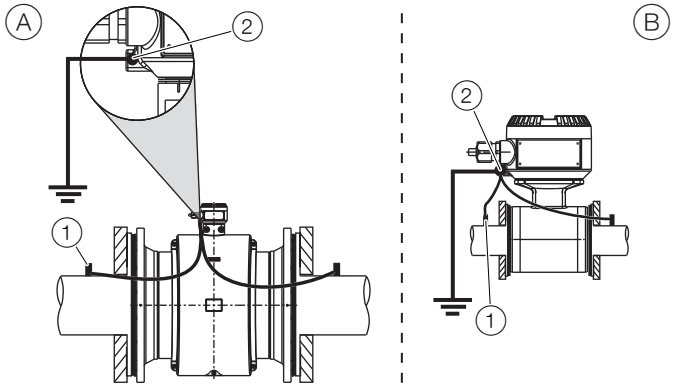


Ⓐ Flange design
Ⓑ Wafer type design
① Ground terminal

Figure 29: Metal pipe, without liner (example)

Use a copper wire [at least 2.5 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

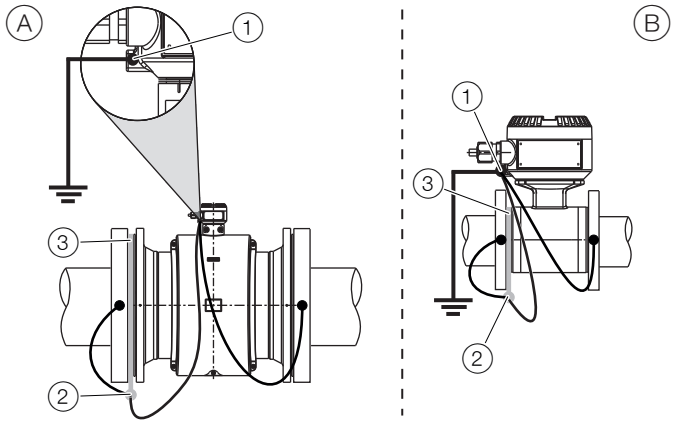


Ⓐ Flange design
Ⓑ Wafer type design
① Threaded bolts M6
② Ground terminal

Figure 30: 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 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



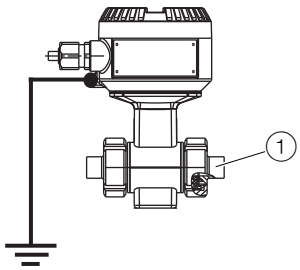
Ⓐ Flange design
Ⓑ Wafer type design
① Ground terminal
② Terminal lug
③ Grounding plate

Figure 31: 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 mm^2 (14 AWG)) to establish a connection between the ground connection and a suited grounding point.

Sensor type HygienicMaster



① Process connection adapter

Figure 32: 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 63.

Installation and grounding in piping with cathodic corrosion protection

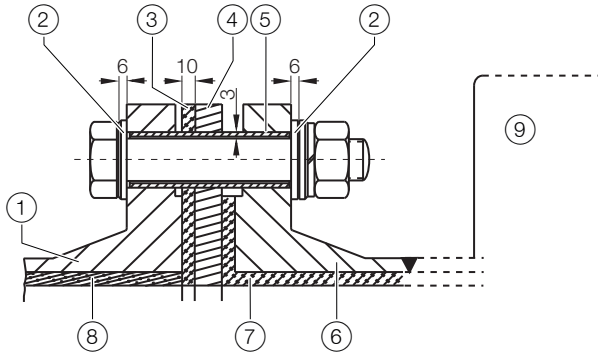
The installation of electromagnetic flowmeters in systems with cathodic corrosion protection must be made in compliance with the corresponding system conditions. The following factors are especially important:

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 33 / Figure 34).
   - 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. ¼ × 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 35).

… 5 Electrical connections

… Sensor grounding

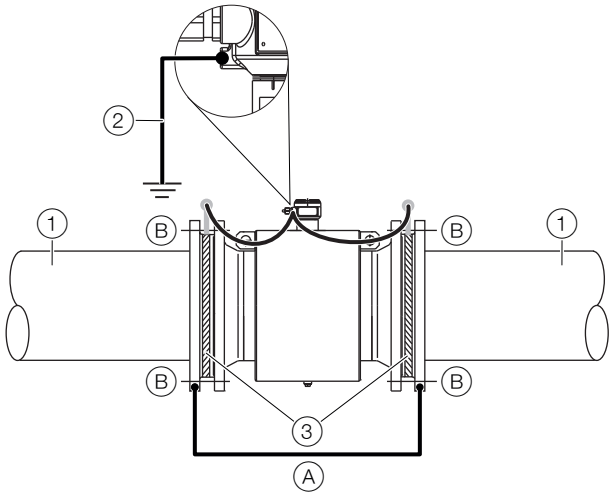
Internally insulated piping with cathodic corrosion potential



① Piping flange
② Insulating plate
③ Gasket / insulating ring
④ Grounding plate
⑤ Insulating pipe
⑥ Flange
⑦ Liner
⑧ Insulation
⑨ Sensor

Figure 33: 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.



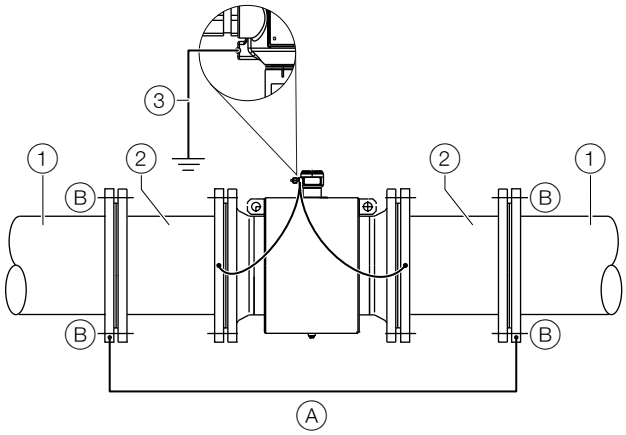
Ⓐ Connection line corrosion potential*
Ⓑ Insulated screw bolts without grounding plates
① Insulated piping
② Functional ground
③ Grounding plates

* ≥ 4 mm² Cu, not included in the delivery, to be provided on-site

Figure 34: sensor with grounding plate and functional ground

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

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



Ⓐ Connection line corrosion potential*

Ⓑ Insulated screw bolts without grounding plates

① Insulated piping

② Uninsulated metal piping

③ Functional ground

* ≥ 4 mm² Cu, not included in the delivery, to be provided on-site

Figure 35: Sensor with functional ground

This mixed system has an insulated piping with corrosion protection potential and an uninsulated metal pipe (L = ¼ × DN sensor) with functional ground potential upstream and downstream of the sensor.
Figure 35 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.

… 5 Electrical connections

Cable entries

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

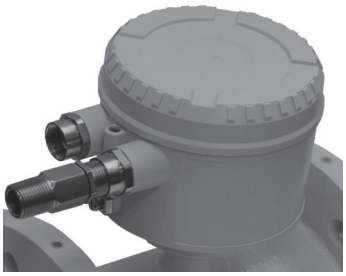


Figure 36: Installation set for cable conduit (Conduit)

NOTICE

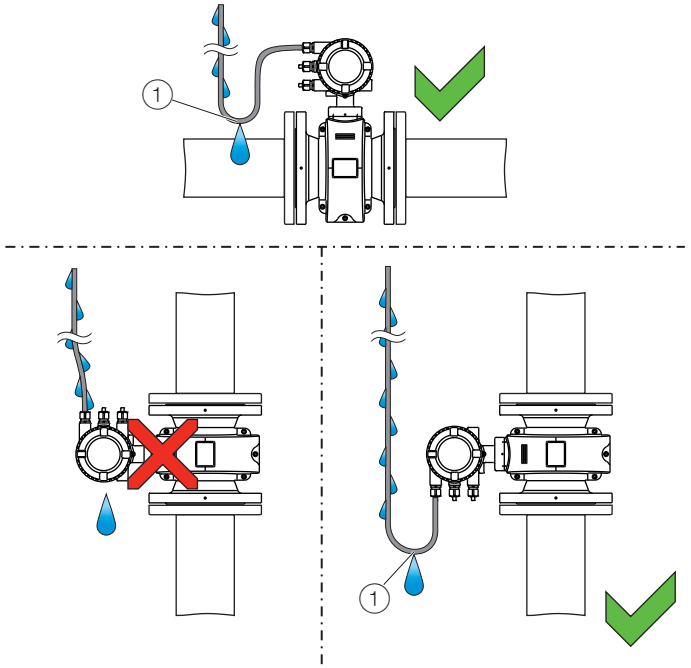
Condensate formation in terminal box!
If the flowmeter sensor is permanently connected to cable conduits, there is a possibility that moisture may get into the terminal box as a result of condensate formation in the cable conduit.

- 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 37: Installation of the connection cable (example, integral mount design)

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.

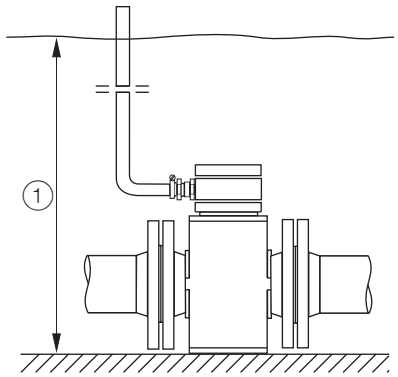
Cable specification	
Impedance	100 to 200 Ω
Withstand voltage	120 V
Outer diameter	6 to 12 mm (0.24 to 0.47 in)
Cable design	Two wire pairs as a star-quad cable
Conductor cross-section	Length-dependent
Shield	Copper braid with approximately 85 % coverage
Temperature range	Depends on application.

Maximum signal cable length	
0.25 mm^2 (AWG 24)	50 m (164 ft)
0.34 mm^2 (AWG 22)	100 m (328 ft)
0.5 mm^2 (AWG 20)	150 m (492 ft)
0.75 mm^2 (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_{amb} = 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



(1) Maximum flooding height 5 m (16.4 ft)

Figure 38: 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).

… 5 Electrical connections

… Connection with IP rating IP 68

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:

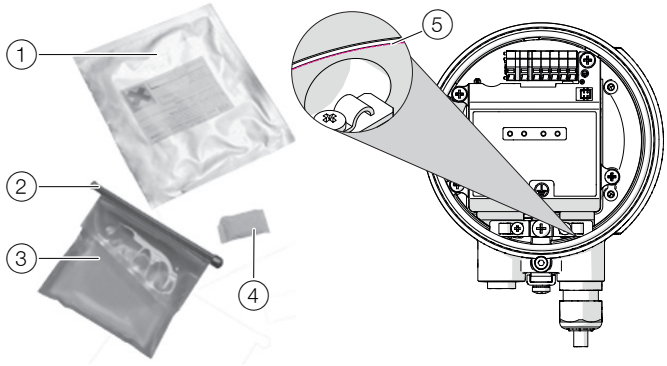
- S23: Do not inhale gas/smoke/humidity/aerosol.
- S24: Avoid contact with the skin.
- S37: Wear suited protective gloves.
- S63: In case of an accident due to inhaling: take the injured person out into the fresh air to rest.

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 39).
- Prevent the two-component potting compound from penetrating the cable conduit (Conduit) for an ½ in NPT installation (if used).

Procedure

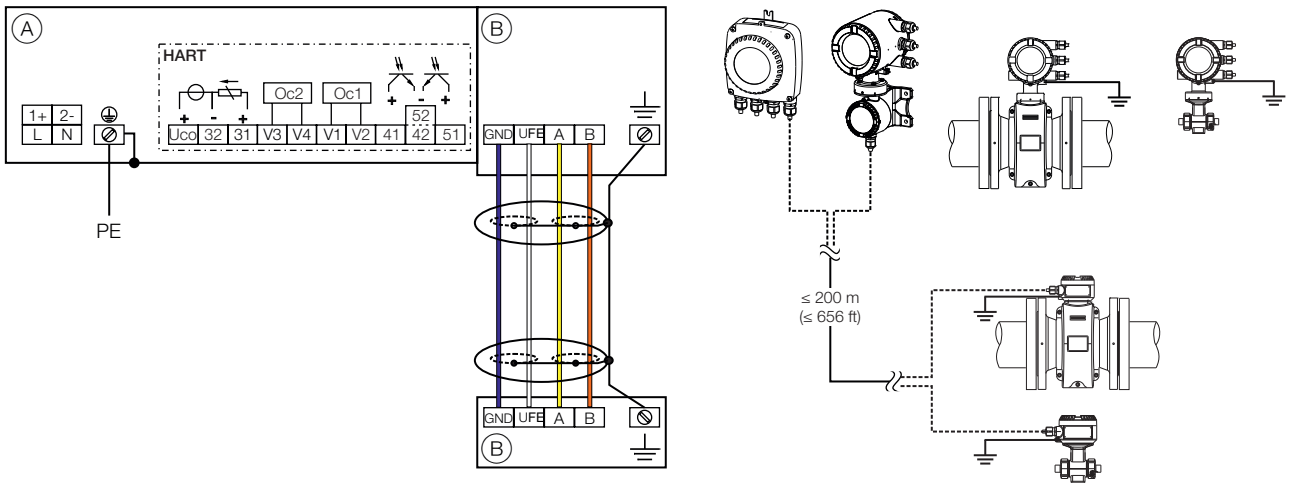


1. Packaging bag
2. Connection clamp
3. Two-component potting compound
4. Drying bag
5. Maximum fill level

Figure 39: 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.

Pin assignment



Ⓐ Connections for power supply and inputs / outputs

Ⓑ Connections for signal cable (remote mount design only)

Figure 40: 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 **Optional plug-in cards** 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_{FE}	Sensor power supply
GND	Ground
A	Data line
B	Data line
⏚	Functional earth / Shielding

… 5 Electrical connections

… Pin assignment

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:

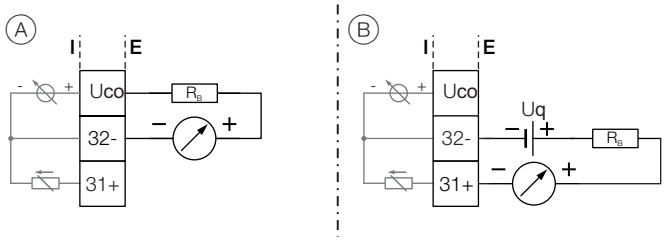
Power supply

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

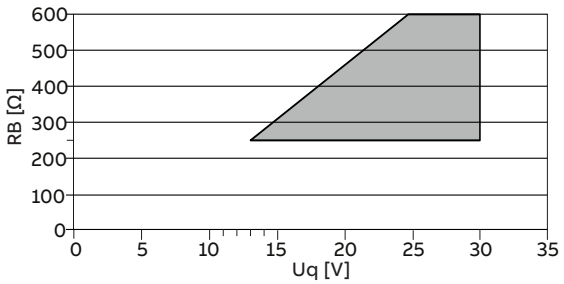
Current output Uco / 32, 31 / 32

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



(A) Current output Uco / 32, active (B) Current output 31 / 32, passive

Figure 41: (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 42: Source voltage for passive outputs

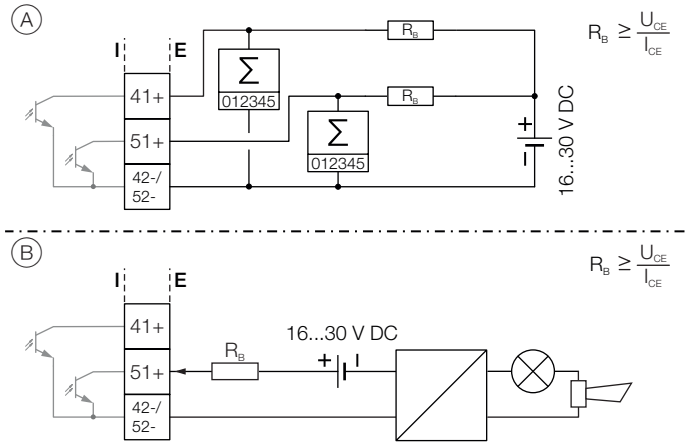
Current output	**Active**	**Passive**
Terminals	Uco / 32	31 / 32
Output signal	4 to 20 mA or 4 to 12 to 20 mA switchable	4 to 20 mA
Load R_B	250 Ω ≤ R_B ≤ 300 Ω	250 Ω ≤ R_B ≤ 600 Ω
Source voltage U_q*	—	13 V ≤ U_q ≤ 30 V
Measuring error	< 0.1 % of measured value	
Resolution	0.4 µA per digit	
Insulation	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 43.

Digital output 41 / 42, 51 / 52

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



(A) Digital output 41 / 42, 51 / 52 passive as a pulse or frequency output

(B) Passive digital output 51 / 52 as binary output

Figure 43: (I = internal, E = external, R_B = load)

Pulse / frequency output (passive)	
Terminals	41 / 42, 51 / 52
Output 'closed'	0 V ≤ U_{CEL} ≤ 3 V
	For f < 2.5 kHz: 2 mA < I_{CEL} < 30 mA
	For f > 2.5 kHz: 10 mA < I_{CEL} < 30 mA
Output 'open'	16 V ≤ U_{CEH} ≤ 30 V DC
	0 mA ≤ I_{CEH} ≤ 0.2 mA
f_{max}	10.5 kHz
Pulse width	0.1 to 2000 ms

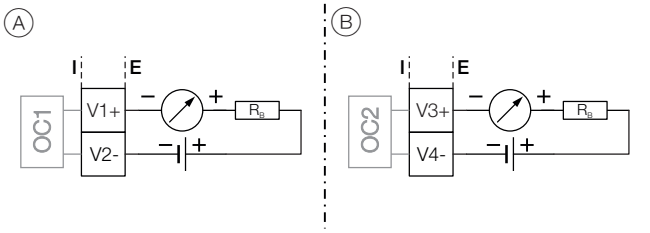
Binary output (passive)	
Terminals	41 / 42, 51 / 52
Output 'closed'	0 V ≤ U_{CEL} ≤ 3 V
	2 mA ≤ I_{CEL} ≤ 30 mA
Output 'open'	16 V ≤ U_{CEH} ≤ 30 V DC
	0 mA ≤ I_{CEH} ≤ 0.2 mA
Switching function	Parameterization possible.

Note

- Terminals 42 / 52 have the same potential. Digital outputs DO 41 / 42 and DO 51 / 52 are not electrically isolated from each other. If an additional electrically isolated digital output is required, a corresponding plug-in module must be used.
- If you are using a mechanical counter, we recommend setting a pulse width of ≥ 30 ms and a maximum frequency of f_{max} ≤ 30 Hz.

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

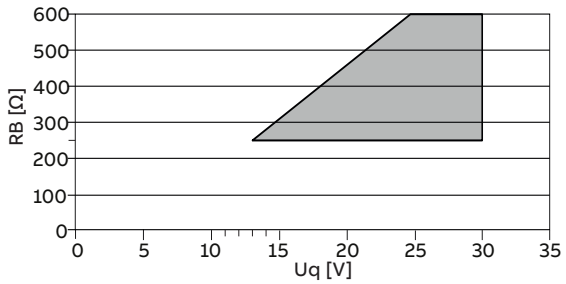
Up to two additional plug-in modules can be implemented via the 'Passive current output (red)' option module.



(A) Current output V1 / V2, passive (B) Current output V3 / V4, passive

Figure 44: (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 Imax = 22 mA. = Permissible range

Figure 45: Source voltage for passive outputs

Passive current output	
Terminals	V1 / V2, V3 / V4
Output signal	4 to 20 mA
Load R_B	250 Ω ≤ R_B ≤ 600 Ω
Source voltage U_q*	13 V ≤ U_q ≤ 30 V
Measuring error	< 0.1 % of measured value
Resolution	0.4 µA per digit

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

… 5 Electrical connections

… Pin assignment

Digital output V1 / V2, V3 / V4 (plug-in module)
The ‘digital output passive (green)’ plug-in card can be used to create **one** additional binary output.

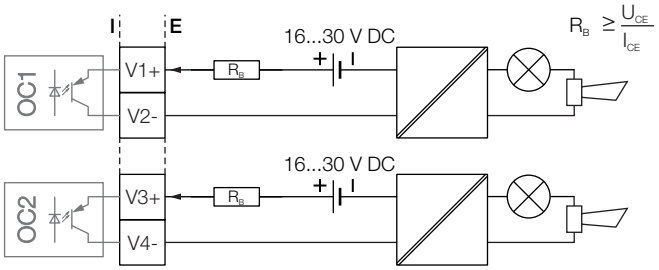


Figure 46: Plug-in card as binary output (I = internal, E = external, R_B = load)

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

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

Digital input V1 / V2, V3 / V4 (plug-in module)
A digital input can be implemented via the ‘Passive digital input (yellow)’ plug-in module.

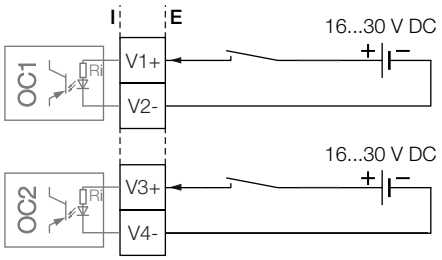


Figure 47: Plug-in card as digital input (I = internal, E = external)

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

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

24 V DC loop power supply (plug-in module)

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 36.

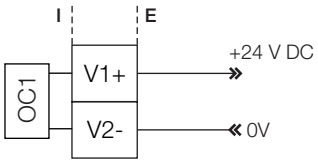


Figure 48: (I = Internal, E = External)

The plug-in module 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_{max}	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 interface V1 / V2 (plug-in card)

A Modbus or PROFIBUS DP interface can be implemented by using the 'Modbus RTU, RS485 (white)' or 'PROFIBUS DP, RS485 (white)' plug-in cards.

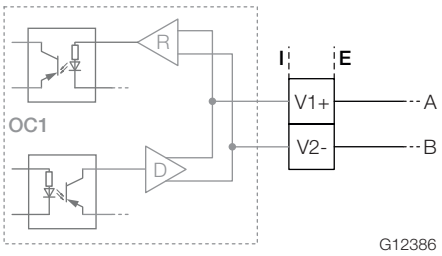


Figure 49: Plug-in card as a Modbus / PROFIBUS DP interface (I = internal, E = external)

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

For information on communication through the Modbus or PROFIBUS DP protocols, refer to chapters **Modbus® communication** on page 43 and **PROFIBUS DP® communication** on page 44.

… 5 Electrical connections

… Pin assignment

Connection examples

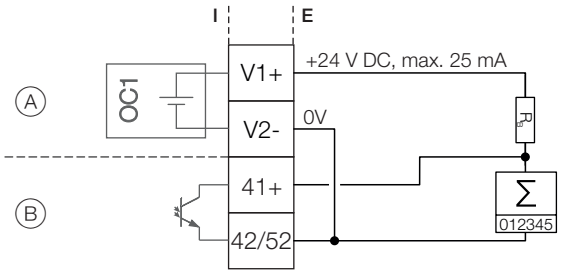
Input and output functions are configured via the device software in accordance with the desired application.

Active digital output 41 / 42, 51 / 52, V3 / V4

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

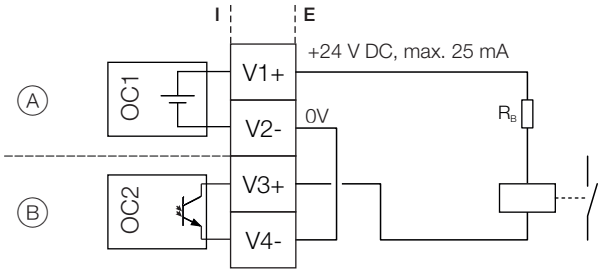
Each 'loop power supply (blue)' plug-in card must only power one output.
It must not be connected to two outputs (for example digital output 41 / 42 and 51 / 52)!



(A) 'Loop power supply (blue)' plug-in card in slot 1
(B) Digital output, digital output 41 / 42

Figure 50: Active digital output 41 / 42 (example)

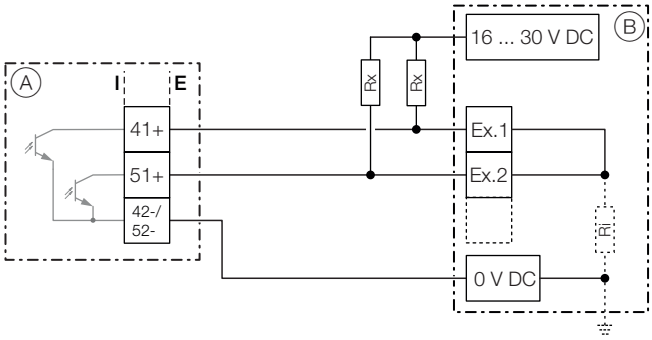
The connection example shows usage for digital output 41 / 42; the same applies to usage for digital output 51 / 52.



(A) 'Loop power supply (blue)' plug-in card in slot 1
(B) 'Digital output (green)' plug-in card in slot 2

Figure 51: Active digital output V3 / V4 (example)

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



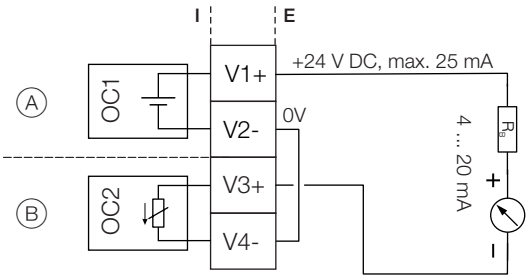
(A) Transmitter
(B) Distributed control system / Memory programmable controller
Ex. 1 Input 1
Ex. 2 Input 2
R_X Resistor for current limitation
R_I Distributed control system internal resistance

Figure 52: 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 Ω / 1 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.

Active current output V3 / V4

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.



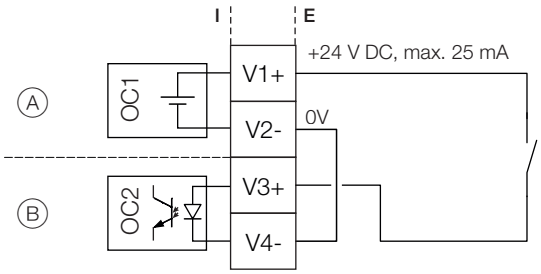
(A) 'Loop power supply (blue)' plug-in card in slot 1

(B) 'Passive current output (red)' plug-in card in slot 2

Figure 53: 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.



(A) 'Loop power supply (blue)' plug-in card in slot 1

(B) 'Passive digital input (yellow)' plug-in card in slot 2

Figure 54: 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.

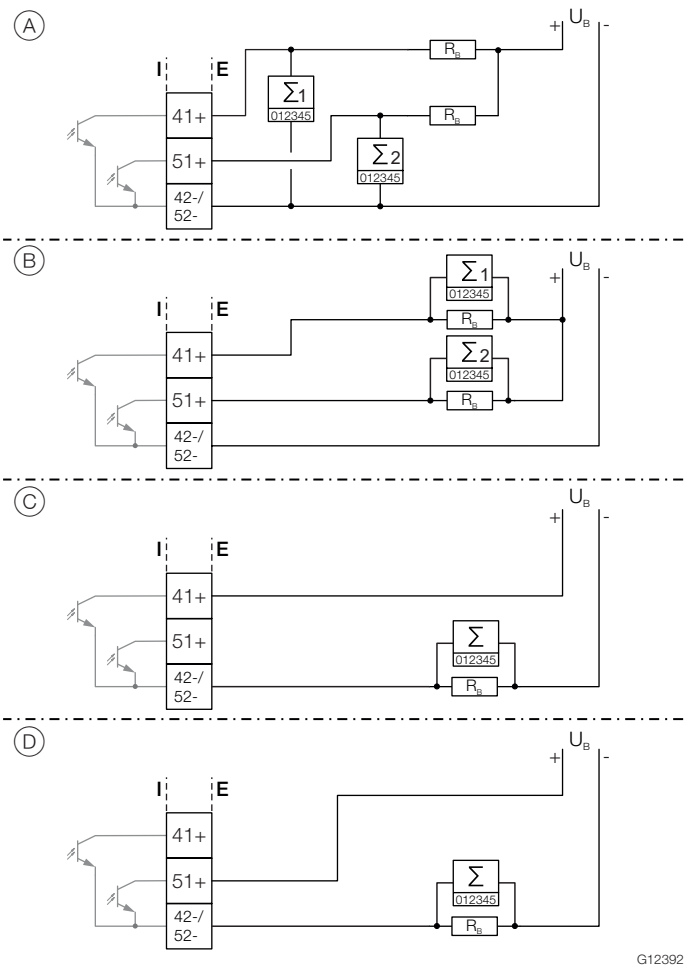


Figure 55: Connection versions digital output 41 / 42 and 51 / 52

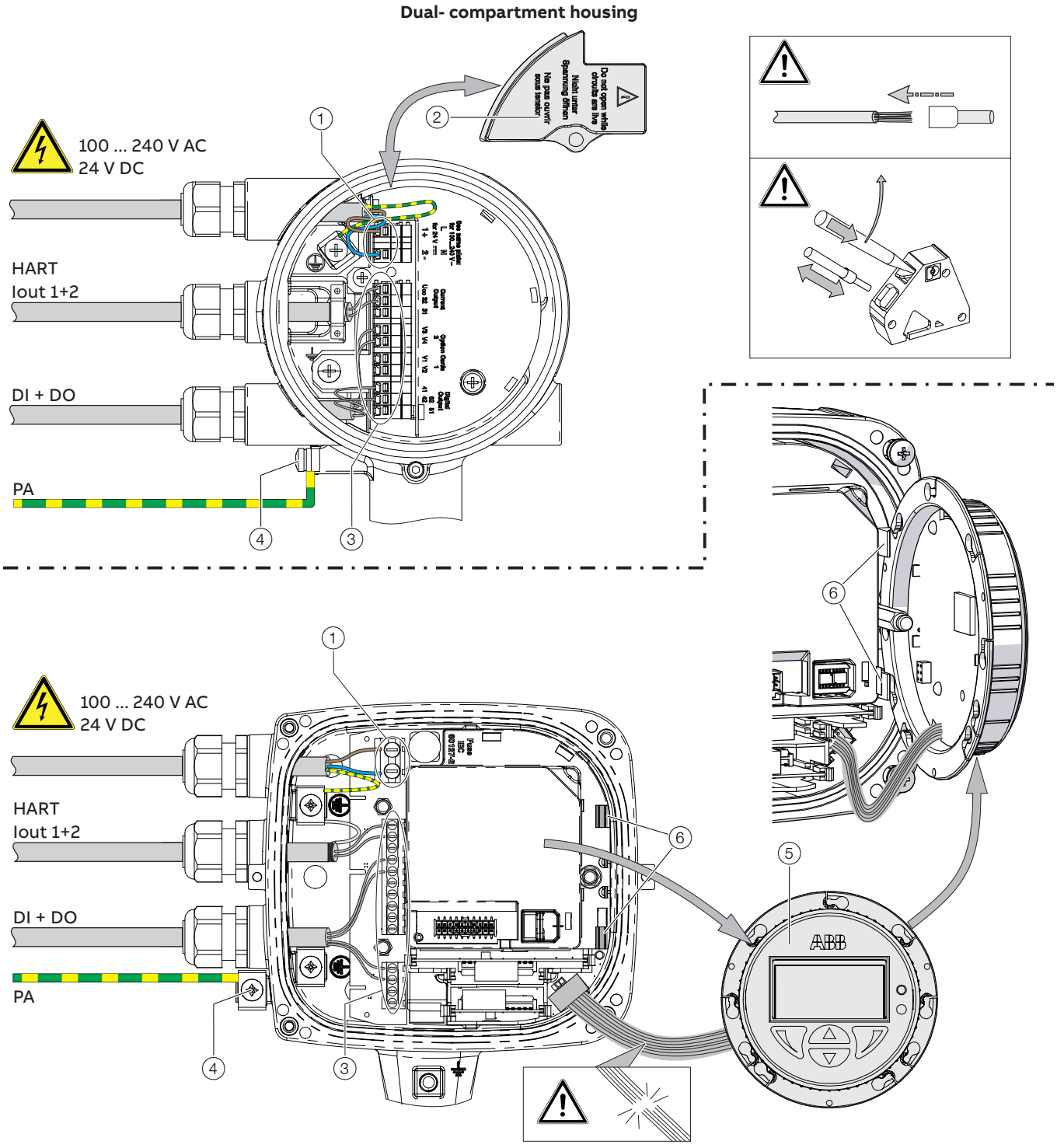
	DO 41 / 42 and 51 / 52 can be used parallel	DO 41 / 42 and 51 / 52 electrically isolated
(A)	Yes	No
(B)	Yes	Yes
(C)	No, only DO 41 / 42 can be used	No
(D)	No, only DO 51 / 52 can be used	No

Table 1: Connection versions digital output

… 5 Electrical connections

… Pin assignment

Connection to integral mount design



1 Terminals for power supply
2 Cover for power supply terminals
3 Terminals for inputs and outputs
4 Terminal for potential equalization
5 LCD indicator
6 Bracket for LCD indicator (park position)

Figure 56: Connection to device (example), PA = potential equalization

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:

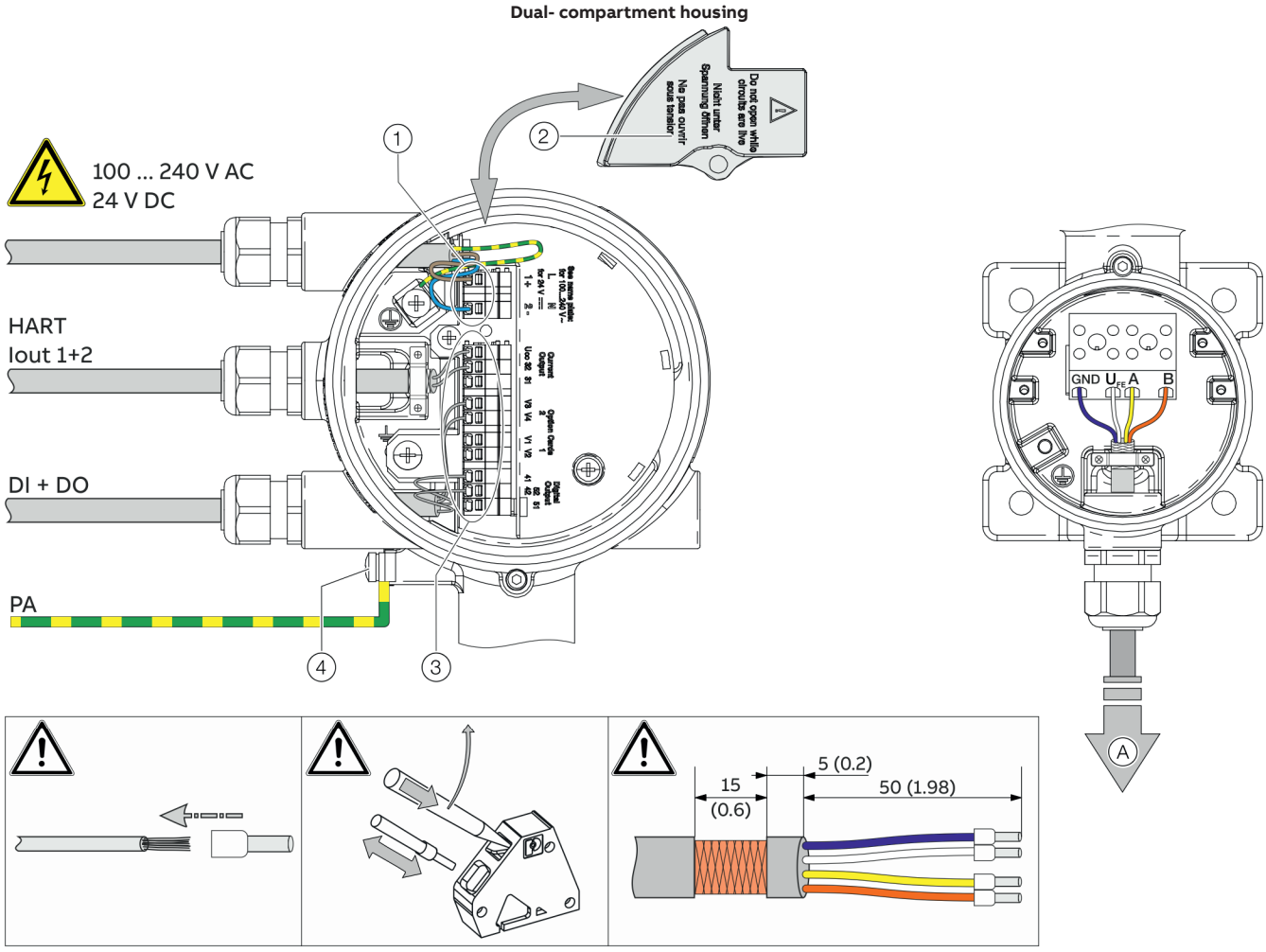
- Lead the power supply cable into the housing through the top cable entry.
- Lead the cables for signal inputs and signal outputs into the housing through the middle and, where necessary, bottom cable entries.
- Connect the cables in accordance with the electrical connection. If present, connect the 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.

… 5 Electrical connections

… Pin assignment

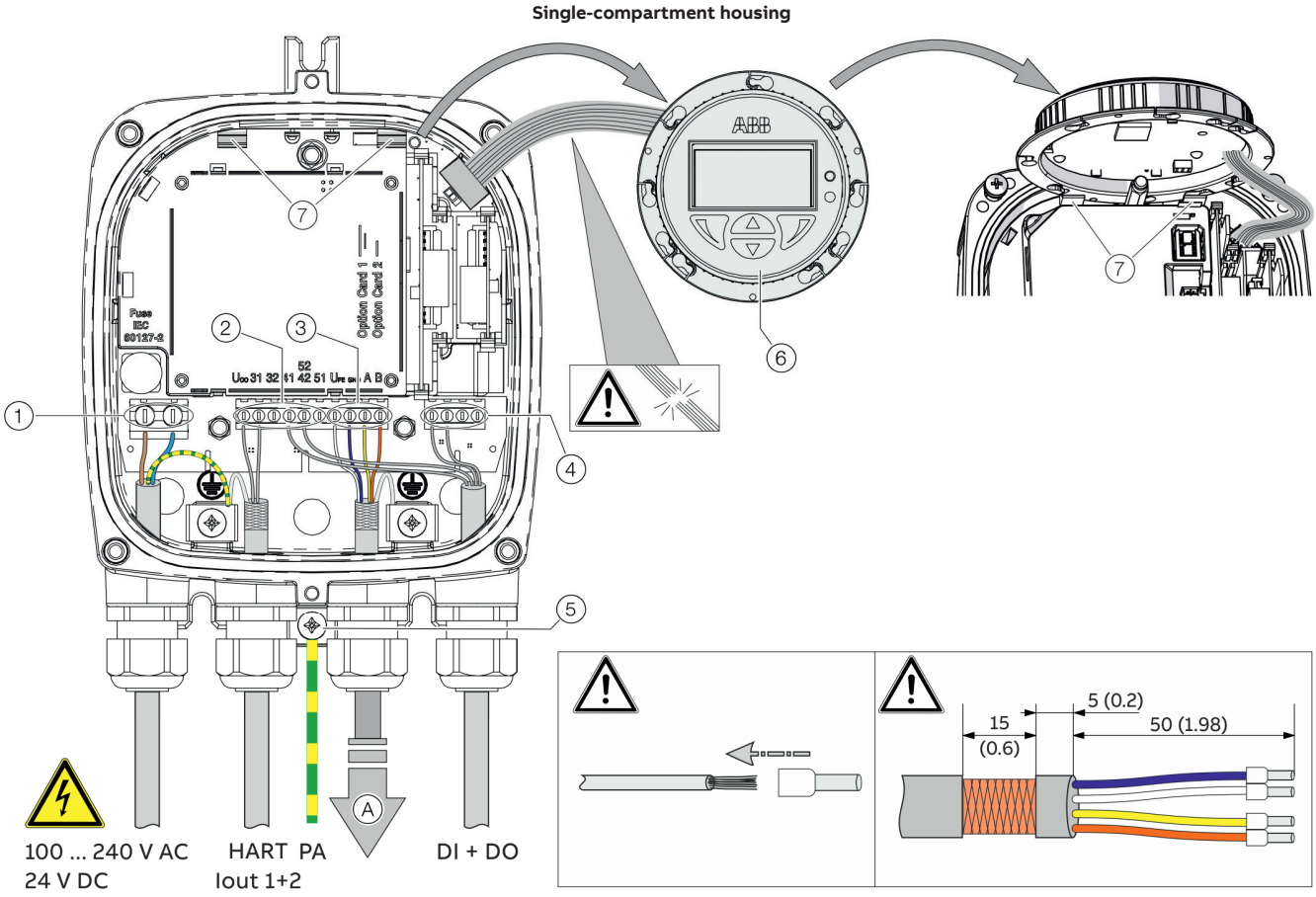
Connection to remote mount design

Transmitter



Ⓐ Upper terminal box (back side)
Ⓑ Lower terminal box
Ⓒ Signal cable to sensor
① Terminals for power supply
② Cover for power supply terminals
③ Terminals for signal cable
④ Terminals for inputs and outputs
⑤ Terminal for potential equalization

Figure 57: Electrical connection to transmitter in remote mount design [example, dimensions in mm (in)]

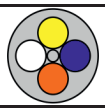
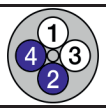


Ⓐ Signal cable to sensor
① Terminals for power supply
② Terminals for inputs and outputs (base device)
③ Terminals for signal cable
④ Terminals for inputs and outputs (plug-in cards)
⑤ Terminal for potential equalization
⑥ LCD indicator
⑦ Bracket for LCD indicator (park position)

Figure 58: 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.

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)

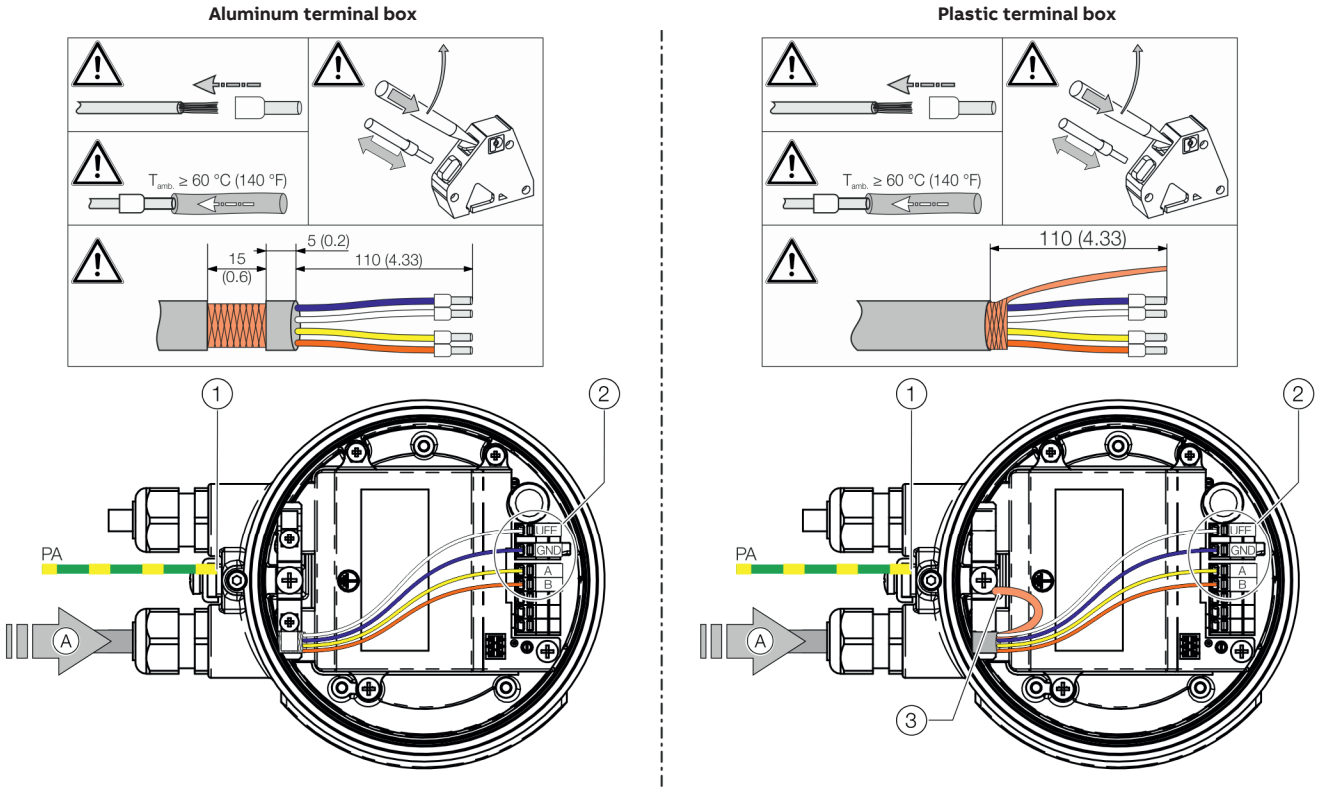
Observe the following points when connecting to an electrical supply:

- 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.

… 5 Electrical connections

… Pin assignment

Flowmeter sensor

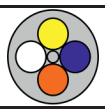
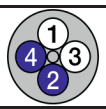


(A) Signal cable from the sensor
(1) Terminal for potential equalization
(2) Terminals for signal cable
(3) Terminals for signal cable shielding

Figure 59: 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.

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)

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 $T_{amb.}$ ≥ 60 °C (≥ 140 °F) additionally insulate the wires with the enclosed silicone hoses.
- Close unused cable entries using suited plugs.

Digital communication

HART® Communication

Note
The HART protocol is not secure, 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 (DSV401 R2).
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.

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)	Q_m – Mass flow
Secondary Value (SV)	Q_v – Volume flow rate
Tertiary Value (TV)	p – Density
Quaternary Value (QV)	T_m – Measuring medium temperature

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

Modbus® communication

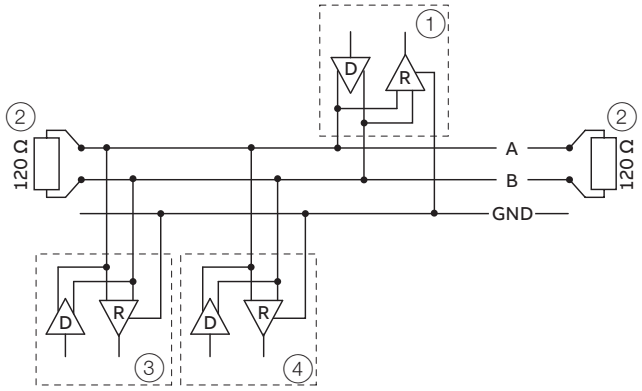
Note
The Modbus protocol are not secure, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

Modbus is an open standard owned and administrated by an independent group of device manufacturers styled the Modbus Organization (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 Asset Vision Basic (DAT200) and 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

… 5 Electrical connections

… Digital communication



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

Figure 60: 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^2 (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 are not secure, as such the intended application should be assessed to ensure that these protocols are suitable before implementation

PROFIBUS DP interface	
Terminals	V1 / V2
Configuration	Via the PROFIBUS DP interface or via the local operating interface in connection with Asset Vision Basic (DAT200) and a corresponding Device Type Manager (DTM)
Transmission	In accordance with 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

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.

The files required for operation can also be downloaded from 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.

Limits and rules when using ABB fieldbus accessories

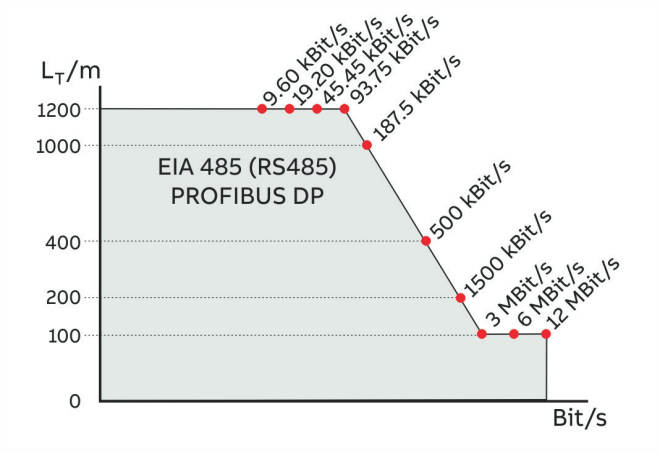


Figure 61: Bus cable length depends on the transmission rate

Per 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 ≤ 126 (addresses 0 to 125)

Per PROFIBUS DP segment

- Number of DP nodes ≤ 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 ≥ 1500 kBit/s!
- Spur cable length (L_S), at ≤ 1500 kBit/s: LS ≤ 0.25 m, at > 1500 kBit/s: LS = 0.00 m!
- At 1500 kBit/s and ABB DP cable type A:
  - Sum of all spur cable lengths (L_S) ≤ 6.60 m, trunk cable length (L_T) > 6.60 m, total length = L_T+ (Σ L_S) ≤ 200 m, maximum 22 DP nodes (= 6.60 m / (0.25 m + 0.05 m spare))

6 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

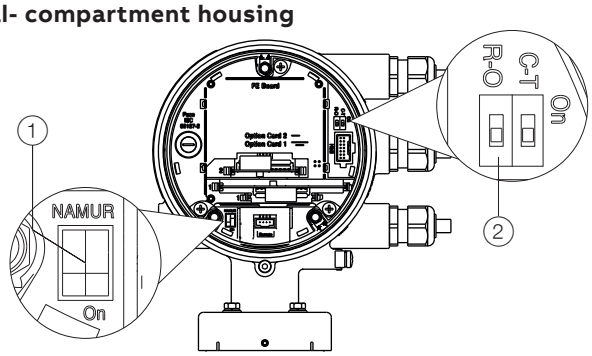
- An additional document with Ex safety instructions is available for measuring systems that are used in potentially explosive atmospheres.
- Ex safety instructions are an integral part of this manual. As a result, it is crucial that the installation guidelines and connection values it lists are also 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 62: 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

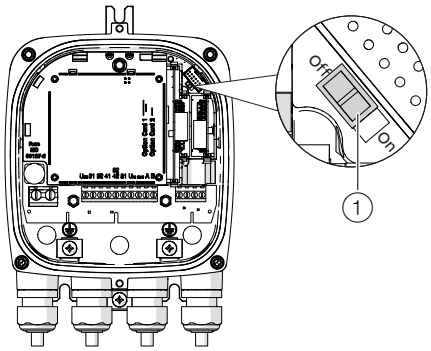
Number	Function
On	Write protection active
Off	Write protection deactivated.

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.

Single-compartment housing



(1) DIP switch, Write protection

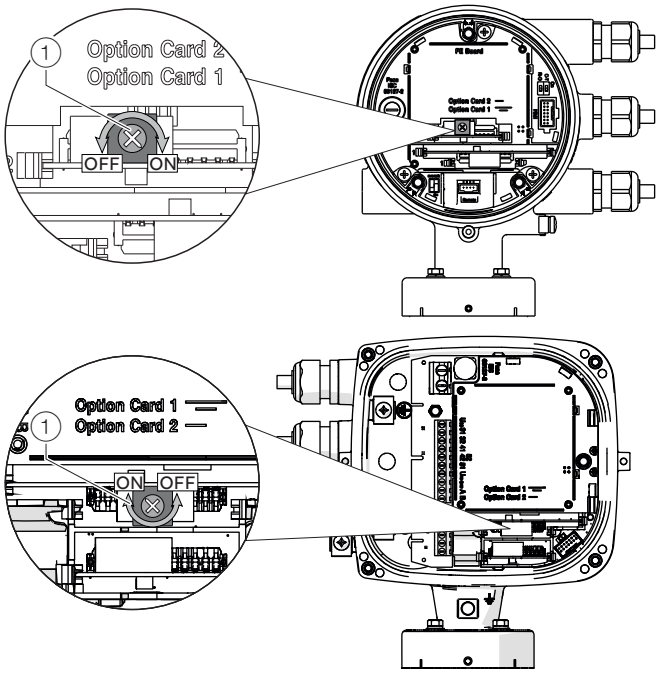
Figure 63: Position of the DIP switch

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 64: 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.

… 6 Commissioning

Checks prior to commissioning

The following points must be checked before commissioning the device:

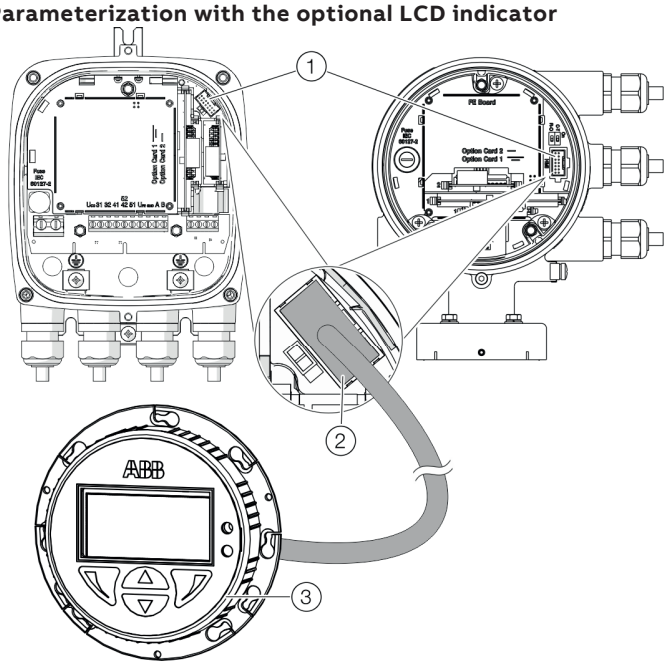
- Correct wiring in accordance with **Electrical connections** on page 23.
- Correct grounding of the sensor.
- The ambient conditions must meet the requirements set out in the specification.
- The power supply must meet the requirements set out on the name plate.

Parameterization of the device

The FEP630, FEH630 can be commissioned and operated via the integrated LCD indicator (option, see **Parameterization via the menu function Easy Setup** on page 50).

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

Parameterization with the optional LCD indicator



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

Figure 65: Optional LCD indicator

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

Parameterization via the local operating interface

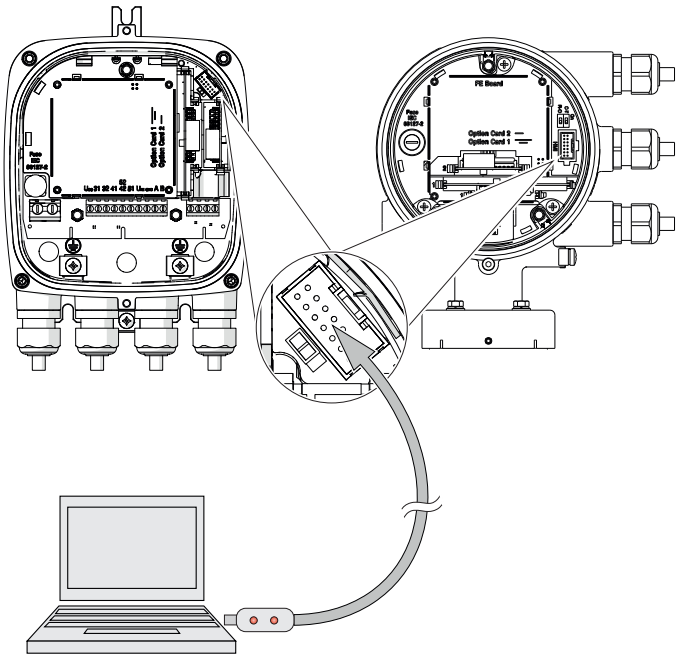
⚠ DANGER

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 HART-DTM and the software**flow** available at www.abb.com/ABB AssetVision, all parameters can also be set without a fieldbus connection.



① Local operating interface
② USB-interface cable
③ PC / Notebook

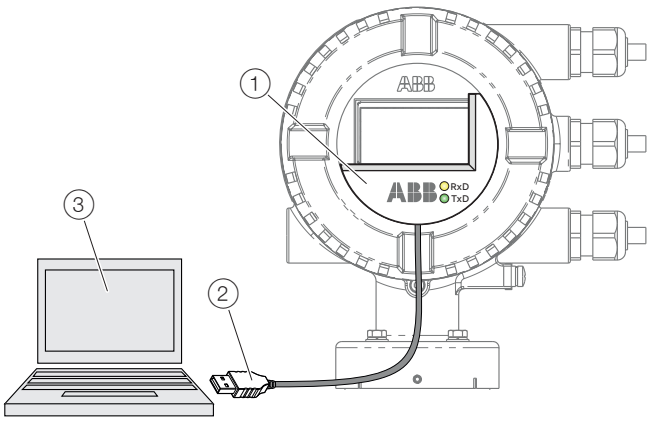
Figure 66: Connection to the local operating interface

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 AssetVision and perform the parameterization of the equipment.

Detailed information on operating the software is available in the relevant operating instructions and the DTM online help.

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 HART-DTM and the software 'flow' available at www.abb.com/ABB AssetVision, all parameters can also be set without a HART connection.



① Infrared service port adapter
② USB-interface cable
③ PC / Notebook running ABB AssetVision and HART DTM

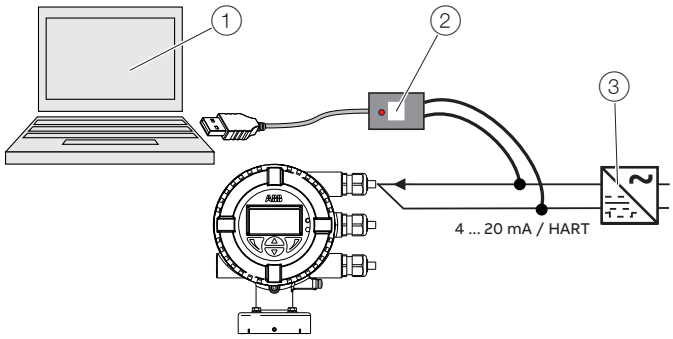
Figure 67: Infrared service port adapter on the transmitter (example)

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 ABB AssetVision and perform the parameterization of the equipment.

Detailed information on operating the software is available in the relevant operating instructions and the DTM online help.

Parameterization via HART®

Configuration via the HART interface of the device requires a PC / Notebook and a suited HART® Modem.
All parameters can also be set via the HART protocol, using the HART DTM available at www.abb.com/**flow** and theABB AssetVisionsoftware.



① PC / Notebook running ABB AssetVision and HART DTM
② HART modem
③ Power supply unit

Figure 68: 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.

… 6 Commissioning

Factory settings

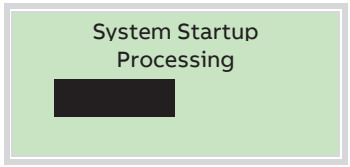
The device can be factory parameterized to customer specifications upon request. If no customer information is available, the device is delivered with factory settings.

Parameter	Factory setting
Qv Max 1	Q_{max}DN (see Table **Measuring range table** on page 54)
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:

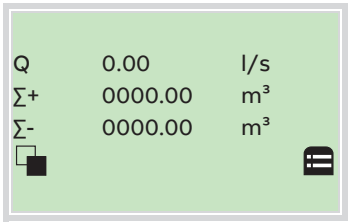


The process display is displayed after the startup process.

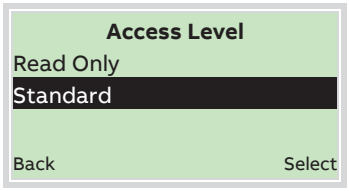
Parameterization via the menu function Easy Setup

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

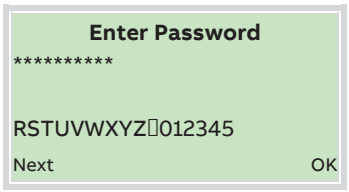
The following section describes parameterization via the ‘Easy Setup’ menu function.



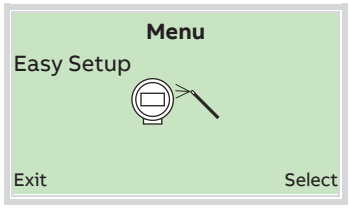
1. Switch to the configuration level with .



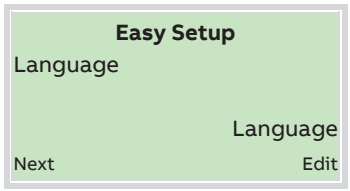
2. Use / to select ‘Standard’.
3. Confirm the selection with .



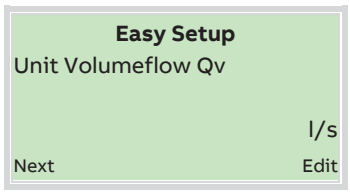
4. Use to confirm the password. A password is not available as factory default; you can continue without entering a password.



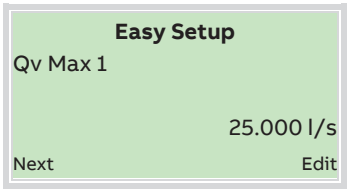
5. Use ▲ / ▼ to select ‘Easy Setup’.
6. Confirm the selection with ◤.



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

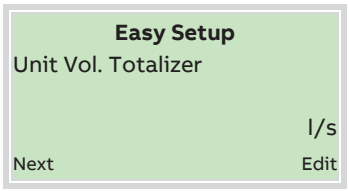


10. Use ◤ to call up the edit mode.
11. Use ▲ / ▼ to select the desired unit for the volume flow rate.
12. Confirm the selection with ◤.

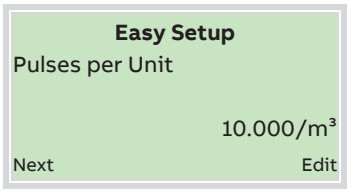


13. Use ◤ to call up the edit mode.
14. Use ▲ / ▼ to set the desired upper range value.
15. Confirm the selection with ◤.

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 × $Q_{max}DN$)
The adjustable upper range values are listed in the table at **Measuring range table** on page 54.



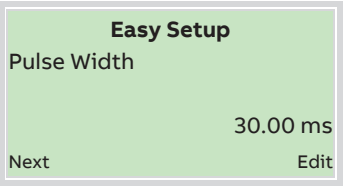
16. Use ◤ to call up the edit mode.
17. Use ▲ / ▼ to select the desired unit for the volume totalizer.
18. Confirm the selection with ◤.



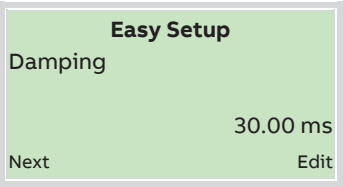
19. Use ◤ to call up the edit mode.
20. Use ▲ / ▼ to select the desired pulse per unit for the pulse output.
21. Confirm the selection with ◤.

… 6 Commissioning

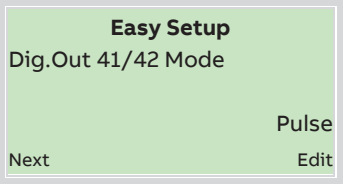
… Parameterization via the menu function Easy Setup



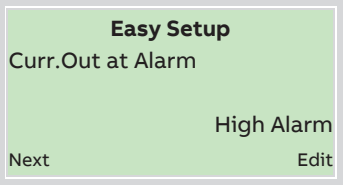
22. Use to call up the edit mode.
23. Use / to select the desired pulse width for the pulse output..
24. Confirm the selection with .



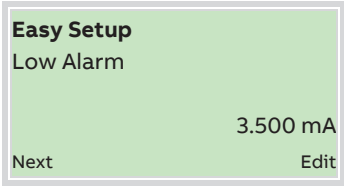
25. Use to call up the edit mode.
26. Use / to set the desired damping.
27. Confirm the selection with .



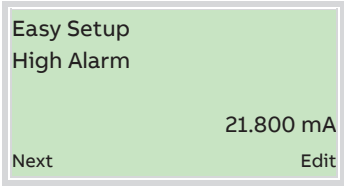
28. Use to call up the edit mode.
29. Use / to select the desired operating modeOff, Logic, Pulse, Frequencyfor the digital output.
30. Confirm the selection with .



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 .

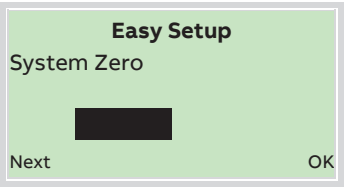


37. Use to call up the edit mode.
38. Use / to set the desired current for High Alarm.
39. Confirm the selection with .

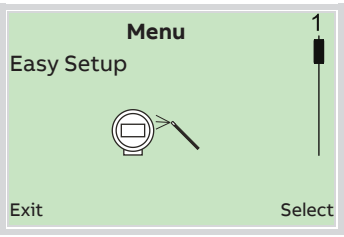
Zero point adjustment of the flowmeter

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.

… 6 Commissioning

Measuring range table

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

Nominal diameter		Min. flow range end value	Q_{max}DN	Max. flow range end value
DN	in	0.02 × Q_{max}DN (≈ 0.2 m/s)	0 to ≈ 10 m/s	2 × Q_{max}DN (≈ 20 m/s)
1	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	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	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	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	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	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	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	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	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	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 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 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^3/h (5.28 US gal/min)	60 m^3/h (264 US gal/min)	120 m^3/h (528 US gal/min)
65	2 1/2	2.4 m^3/h (10.57 US gal/min)	120 m^3/h (528 US gal/min)	240 m^3/h (1057 US gal/min)
80	3	3.6 m^3/h (15.9 US gal/min)	180 m^3/h (793 US gal/min)	360 m^3/h (1585 US gal/min)
100	4	4.8 m^3/h (21.1 US gal/min)	240 m^3/h (1057 US gal/min)	480 m^3/h (2113 US gal/min)
125	5	8.4 m^3/h (37 US gal/min)	420 m^3/h (1849 US gal/min)	840 m^3/h (3698 US gal/min)
150	6	12 m^3/h (52.8 US gal/min)	600 m^3/h (2642 US gal/min)	1200 m^3/h (5283 US gal/min)
200	8	21.6 m^3/h (95.1 US gal/min)	1080 m^3/h (4755 US gal/min)	2160 m^3/h (9510 US gal/min)
250	10	36 m^3/h (159 US gal/min)	1800 m^3/h (7925 US gal/min)	3600 m^3/h (15850 US gal/min)
300	12	48 m^3/h (211 US gal/min)	2400 m^3/h (10567 US gal/min)	4800 m^3/h (21134 US gal/min)
350	14	66 m^3/h (291 US gal/min)	3300 m^3/h (14529 US gal/min)	6600 m^3/h (29059 US gal/min)
400	16	90 m^3/h (396 US gal/min)	4500 m^3/h (19813 US gal/min)	9000 m^3/h (39626 US gal/min)
450	18	120 m^3/h (528 US gal/min)	6000 m^3/h (26417 US gal/min)	12000 m^3/h (52834 US gal/min)
500	20	132 m^3/h (581 US gal/min)	6600 m^3/h (29059 US gal/min)	13200 m^3/h (58117 US gal/min)
600	24	192 m^3/h (845 US gal/min)	9600 m^3/h (42268 US gal/min)	19200 m^3/h (84535 US gal/min)
700	28	264 m^3/h (1162 US gal/min)	13200 m^3/h (58118 US gal/min)	26400 m^3/h (116236 US gal/min)
760	30	312 m^3/h (1374 US gal/min)	15600 m^3/h (68685 US gal/min)	31200 m^3/h (137369 US gal/min)
800	32	360 m^3/h (1585 US gal/min)	18000 m^3/h (79252 US gal/min)	36000 m^3/h (158503 US gal/min)
900	36	480 m^3/h (2113 US gal/min)	24000 m^3/h (105669 US gal/min)	48000 m^3/h (211337 US gal/min)
1000	40	540 m^3/h (2378 US gal/min)	27000 m^3/h (118877 US gal/min)	54000 m^3/h (237754 US gal/min)
1050	42	616 m^3/h (2712 US gal/min)	30800 m^3/h (135608 US gal/min)	61600 m^3/h (271217 US gal/min)
1100	44	660 m^3/h (3038 US gal/min)	33000 m^3/h (151899 US gal/min)	66000 m^3/h (290589 US gal/min)
1200	48	840 m^3/h (3698 US gal/min)	42000 m^3/h (184920 US gal/min)	84000 m^3/h (369841 US gal/min)
1400	54	1080 m^3/h (4755 US gal/min)	54000 m^3/h (237755 US gal/min)	108000 m^3/h (475510 US gal/min)
1500	60	1260 m^3/h (5548 US gal/min)	63000 m^3/h (277381 US gal/min)	126000 m^3/h (554761 US gal/min)
1,600	66	1440 m^3/h (6340 US gal/min)	72000 m^3/h (317006 US gal/min)	144000 m^3/h (634013 US gal/min)
1800	72	1800 m^3/h (7925 US gal/min)	90000 m^3/h (396258 US gal/min)	180000 m^3/h (792516 US gal/min)
2000	80	2280 m^3/h (10039 US gal/min)	114000 m^3/h (501927 US gal/min)	228000 m^3/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 **Measuring range table** on page 54.
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
7/1/2000	2018	Bug fixing	PROFIBUS DP® and Modbus® integrated. New bootloader	3KXF002044U0100_01.07.00

7 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.

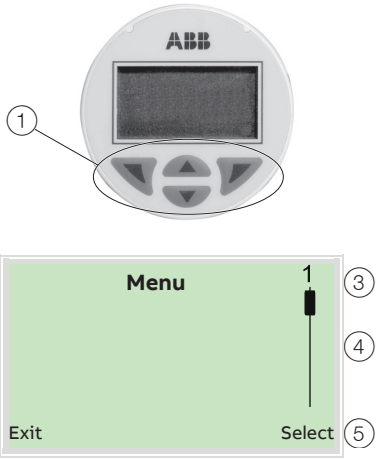
Aggressive or corrosive media may lead to the damage of wetted parts of the sensor. As a result, measuring medium under pressure can leak out.
Wear to the flange gasket or process connection gaskets (e.g. pipe fitting, Tri-clamp, etc.) may caused a pressurized measuring medium to escape.
When using internal 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
2. Menu name display
3. Menu number display
4. Marker for indicating relative position within the menu
5. Display showing the current functions of the and operating buttons

Figure 69: 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.

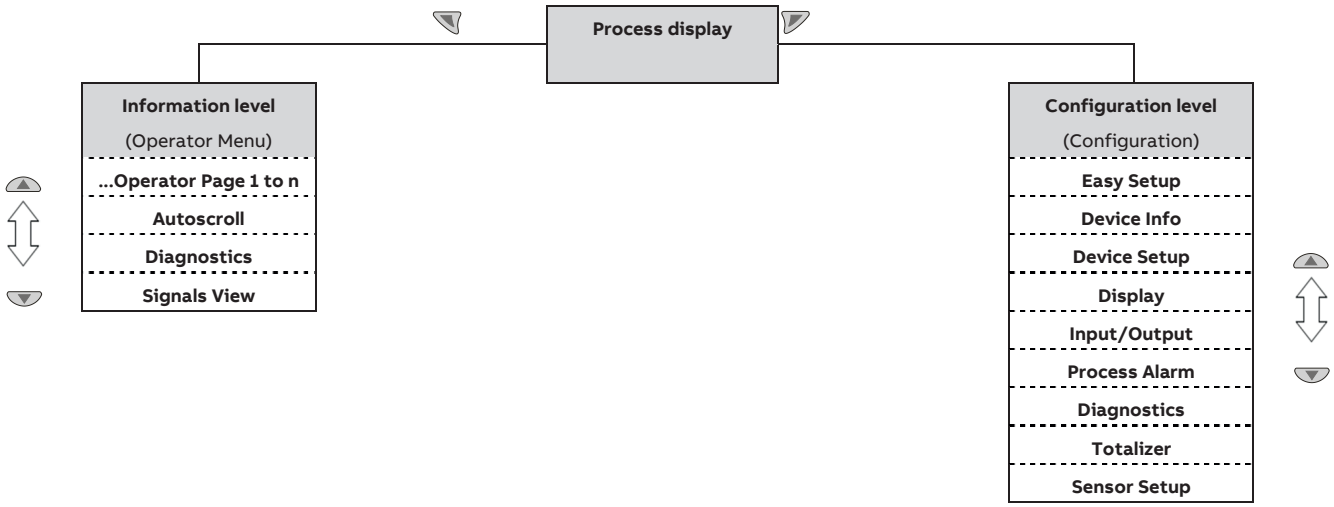
Control button functions

◥	**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

… 7 Operation

Menu levels

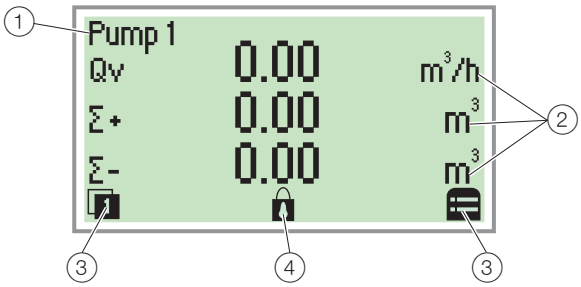


Process display
The process display shows the current process values.
There are two menu levels under the process display.

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



1. Measuring point tagging
2. Current process values
3. 'Button function' symbol
4. 'Parameterization protected' symbol

Figure 70: Process display (example)

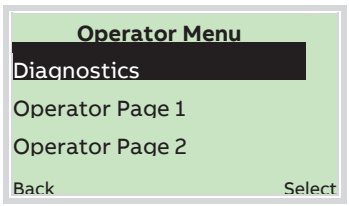
The process display appears on the LCD display when the device is powered on. It shows information about the device and current process values.
The way in which the current process values are shown can be adjusted on the configuration level.
The symbols at the bottom of the process display are used to 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 .

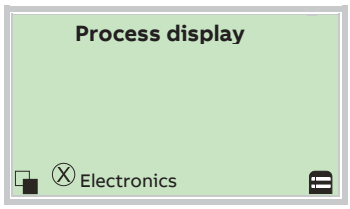
Menu	Description
... / Operator Menu	
Diagnostics	Selection of sub-menu 'Diagnostics'; see also **Error messages on the LCD display** on page 60.
Operator Page 1 to n	Selection of operator page to be displayed.
Autoscroll	When 'Autoscroll' is activated, automatic switching of the operator pages is initiated on the process screen.
Signals View	Selection of submenu 'Signals View' (only for service purposes).

… 7 Operation

… Switching to the information level

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:

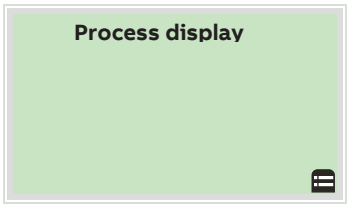
Range	Description
Operation	Error / alarm due to the current operating conditions.
Sensor	Error / alarm of the flowmeter sensor.
Electronics	Error / alarm of the electronics.
Configuration	Error / alarm due to device configuration.

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

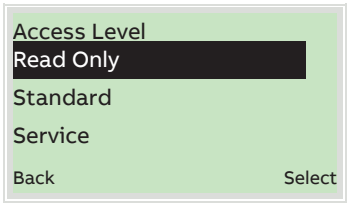
Switching to the configuration level (parameterization)

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  .



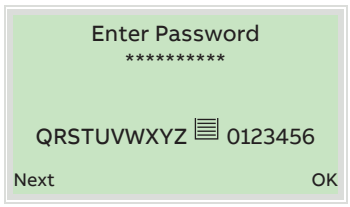
2. Select the desired level of access using  /  .
3. Confirm the selection with .

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 46).

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.



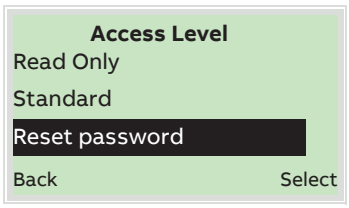
4. Enter the appropriate password. No password is preset in the factory settings. Users can switch to the configuration level without entering a password.
   The selected access level remains active for 3 minutes. Within this time period you can toggle between the process display and the configuration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

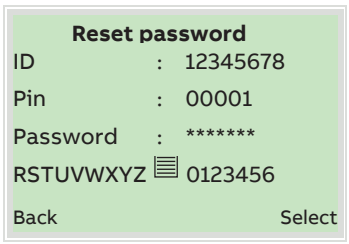
6. Select a menu using ▲ / ▼.
7. Confirm the selection with ◤.

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 password' then appears in the list of access levels.

1. Switch to the configuration level with ◤.



2. Use ▲ / ▼ to select the 'Reset password' 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.

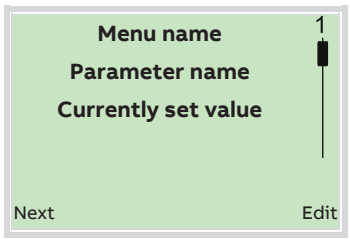
… 7 Operation

… Switching to the configuration level (parameterization)

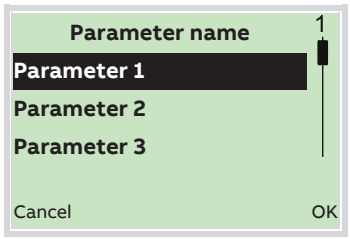
Selecting and changing parameters

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.

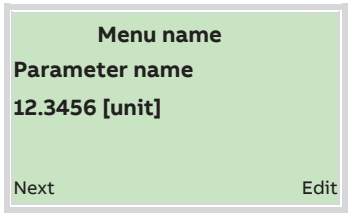


3. Select the desired value using / .
4. Confirm the selection with .

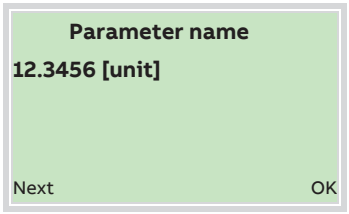
This concludes the procedure for selecting a parameter value.

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.

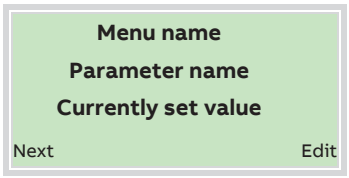


3. Use to select the decimal place to change.
4. Use / to set the desired value.
5. Use to select the next decimal place.
6. If necessary select and set additional decimal places in accordance with steps 3 to 4.
7. Use to confirm your setting.

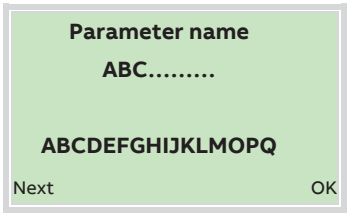
This concludes the procedure for changing a parameter value.

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
Input/Output / Dig.Out 41/42 / ...		
Mode	⇒	Pulse
Outp. Flow Direction	⇒	Forward
Input/Output / ...Setup Pulse Output		
Output Value Pulse	⇒	Pulse Volume Flow
Pulses per Unit	⇒	Setting in accordance with requirement
Pulse Width	⇒	Setting in accordance with requirement
Input/Output / Dig.Out 51/52		
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	
Standard	Empty pipe detection (EPD)
	Partial filling detection (TFE)
	Noise / grounding check
	Fingerprint verification
	Service interval
	Transmitter temperature
Software package 'Extended diagnostic functions' (optional)	Coil/sensor temperature
	Coil inductance
	Gas bubble detection
	Conductivity monitoring
	Electrode impedance / Leakage Monitoring
Filling function (optional)	Filling function

… 7 Operation

… Extended diagnostic functions

Detection of partial filling

A partially filled sensor influences the measured values of the flow meter as well as the measuring accuracy.
If the flowmeter sensor is ordered with a full pipe detection electrode located at the top of the flowmeter sensor, the function '…Diagnosis Tfe' of the transmitter triggers an alarm when the meter tube goes into partial filling.

Requirements for use:

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

Installation conditions:

- The flow sensor must be installed horizontally with the terminal box pointing upwards.

Setup

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

Menu / parameter	Description
Diagnostics / …Diagnosis Control / …Diagnosis Tfe	
Tfe On/Off	Activate the function.
Start Tfe Adjust	Automatic adjustment of the TFE function. Prior to starting, make sure that: • There is no flow • Sensor is completely filled
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 influence the flow measurement values and the measuring accuracy.
It is possible to issue a gas bubble alarm if the actual gas bubble value exceeds the configured threshold.
This alarm message is shown on the display. The digital output triggers an alarm if configured accordingly.

Requirements for use:

- Nominal diameter DN 10 to DN 300 (⅜ 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 / …Diagnosis Gas Bub.	
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: • There is no flow • Sensor is completely filled and free of gas bubbles
Gas Bubble Threshold	Manual fine adjustment of the switching threshold.

Monitoring the conductivity

The conductivity of the liquid can be monitored by setting minimum / maximum alarm thresholds.
As soon as the alarm thresholds are up-scaled, the digital output triggers an alarm, if configured accordingly.
The conductivity is available as 4 to 20 mA output (option card).

Requirements for use:

- Conductivity of the measuring medium: 20 to 20000 µS/cm.
- Nominal diameter DN 10 to 300 (⅜ to 12 in).

Installation conditions:

- The measuring electrodes must be free of coverings.

Setup

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

Menu / parameter	Description
Diagnostics / ...Diagnosis Control / ...Diagnosis Conductiv	
Conductivity On/Off	Activate the function.
Conductivity [µS/cm]	Indicator of the conductivity in µS/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 to the upper and lower range of the conductivity value.
Cond. Iout Max Value	
Cond.Min Alarm Value	Set the alarm for minimum and maximum conductivity. In the case of down-scale, an alarm is triggered.
Cond.Max Alarm Value	
Elec. Imp. E1-GND	Impedance between electrode E1 and GND (ground potential).
Input/Output / ...Curr.Out V1/V2	
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 µS/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.

… 7 Operation

… Extended diagnostic functions

Measurements on the flowmeter

Coil inductance, coil current, coil resistance
The diagnosis of the coil in the sensor includes coil inductance, current and resistance.

Flowmeter sensor temperature
The coil temperature monitoring triggers an alarm via the digital output, if configured.
The minimum and maximum alarm value for the coil temperature can be set.
The coil temperature is a function of the ambient temperature and measuring medium temperature.
Compliance with the temperature specification of the sensor liner can thus be monitored.

Setup

Menu / parameter	Description
Diagnostics / …Diagnosis Control / …Diagnosis Coil	
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 temperature). Can be used to monitor the temperature limit of the meter tube liner
Coil Temp. Max Alarm	

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 / …Noise Check	
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 spectrum in µV with the associated frequency.
Frequency 1 … 4	

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
Diagnostics / ...Diagnosis Control / ...Fingerprints	
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, E2-GND
Se Factory Imp.E2	
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, E2-GND
Se Customer Imp. E2	

8 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)!

9 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.

10 Specification

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

Permitted pipe vibration

In accordance with EN 60068-2-6
Valid for sensors in remote mount and 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

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_{medium}, the ambient temperature T_{amb}, operating pressure P_{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.

… 10 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_{amb})		Measuring medium temperature (T_{medium})	
		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_{amb})**		**Measuring medium temperature (T_{medium})**	
		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’

… 10 Specification

… ProcessMaster – Temperature data

Remote mount design

Flowmeter sensor in standard version

Lining material	Flange material	Ambient temperature range (T_{amb})		Measuring medium temperature (T_{medium})	
		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)	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)

* 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 ($T_{amb.}$)		Measuring medium temperature (T_{medium})	
		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’

… 10 Specification

ProcessMaster – Material load for process connections

The limits of the permissible measuring medium temperature (T_{medium}) and permissible pressure (P_{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_{medium}) as a function of the measuring medium temperature (T_{medium}) and the liner material.

Design Level 'A'

Lining material	Nominal diameter	P_{medium} [mbar abs]	T_{medium}*
Hard rubber	DN 25 to DN 2000	0	< 85 °C (185 °F)
	(1 to 80 in)		< 80 °C (176 °F)**
Soft rubber	DN 50 to DN 2000	0	< 60 °C (140 °F)
	(2 to 80 in)		
PTFE	DN 10 to DN 600	270	< 20 °C (68 °F)
	(⅜ to 24 in)	400	< 100 °C (212 °F)
		500	< 130 °C (266 °F)
Thick PTFE	DN 25 to DN 80	0	< 180 °C (356 °F)
	(1 to 3 in)		
	DN 100 to DN 250	67	< 180 °C (356 °F)
	(4 to 10 in)		
	DN 300 (12 in)	27	< 180 °C (356 °F)
PFA	DN 3 to DN 200	0	< 180 °C (356 °F)
	(1/10 to 8 in)		
ETFE	DN 25 to DN 600	100	< 130 °C (266 °F)
	(1 to 24 in)		
Ceramic carbide	DN 25 to DN 1000	0	< 80 °C (176 °F)
	(1 to 40 in)		
Linatex**	DN 50 to DN 600	0	< 70 °C (158 °F)
	(6 to 24 in)		

* For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to **Maximum permissible cleaning temperature** on page 69.

** Only for China production site

Design level 'B'

Lining material	Nominal diameter	P_{medium} [mbar abs]	T_{medium}*
PTFE	DN 25 to DN 300	270	< 20 °C (68 °F)
	(1 to 12 in)	400	< 100 °C (212 °F)
		500	< 130 °C (266 °F)

* For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to **Maximum permissible cleaning temperature** on page 69.

Liner approvals on request; please contact ABB.

Material load

Flowmeter sensor Design Level 'A'

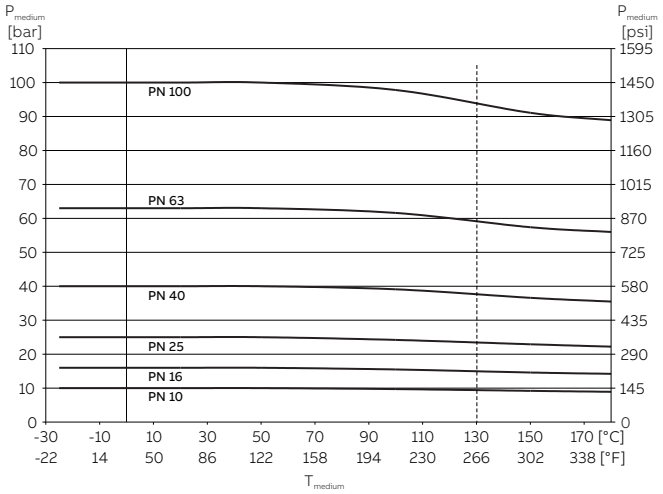


Figure 71: DIN-flange, stainless steel, to DN 600 (24 in); Design Level 'A'

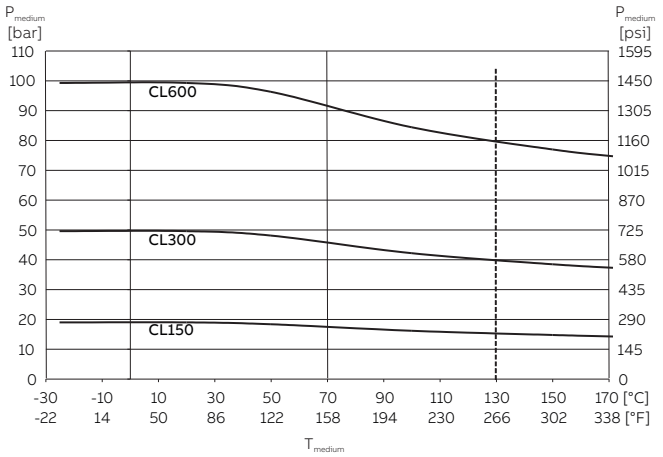


Figure 72: ASME-flange, stainless steel, to DN 400 (16 in) (CL150/300) to DN 1000 (40 in) (CL150); Design Level 'A'

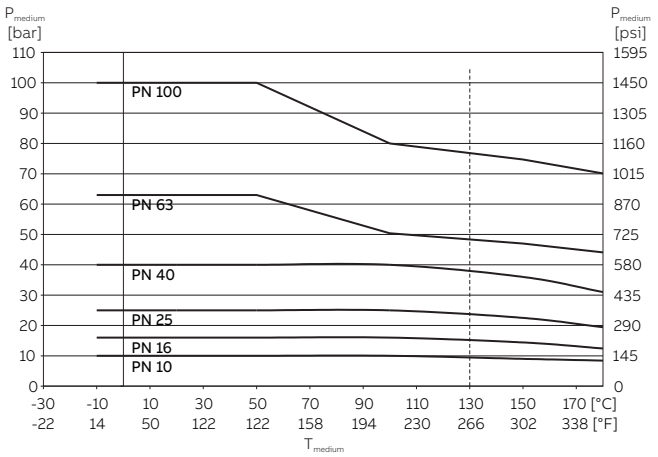


Figure 73: DIN flange, steel up to DN 600 (24 in); Design Level 'A'

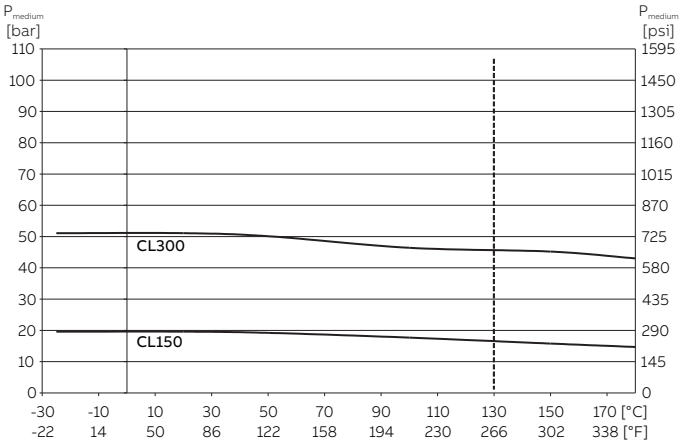


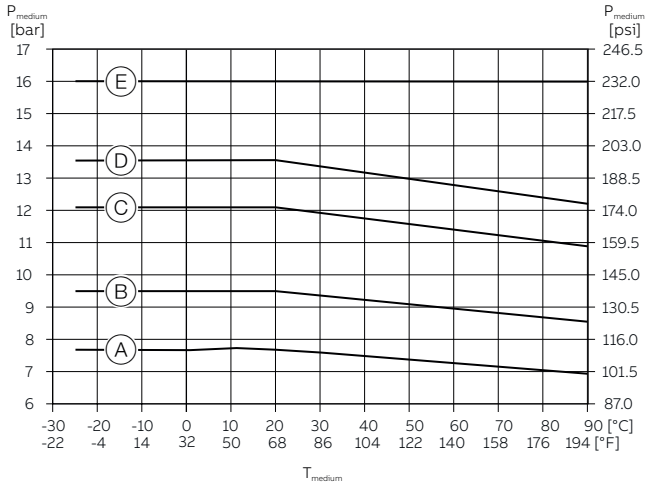
Figure 74: ASME-flange, steel up to DN 400 (16 in) (CL150/300) to DN 1000 (40 in) (CL150); Design Level 'A'

JIS 10K-B2210 flange

DN	Material	PN	T_{medium}	P_{medium}
DN 32 to 400	Stainless steel	10	−25 to 180 °C	10 bar (290 psi)
(1 ¼ to 16 in)			(−13 to 356 °F)	(145 psi)
DN 32 to 400	Steel	10	−10 to 180 °C	10 bar (290 psi)
(1 ¼ to 16 in)			(14 to 356 °F):	(145 psi)

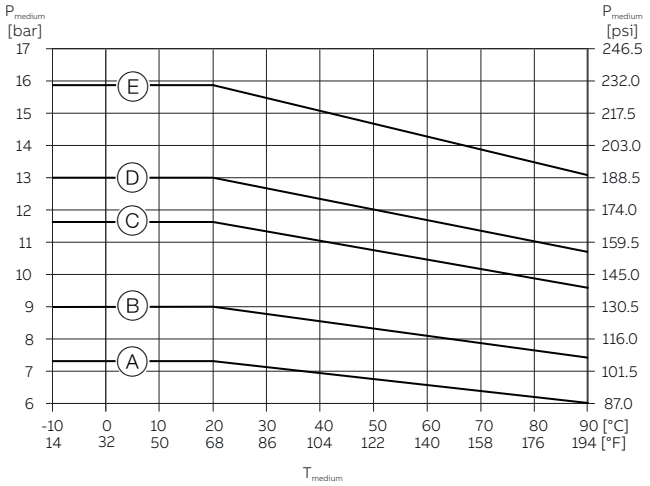
… 10 Specification

… ProcessMaster – Material load for process connections



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

Figure 75: DIN-flange, stainless steel, up to DN 700 (28 in) to DN 1000 (40 in); Design Level 'A'



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

Figure 76: DIN-flange, steel, up to DN 700 (28 in) to DN 1000 (40 in); Design Level 'A'

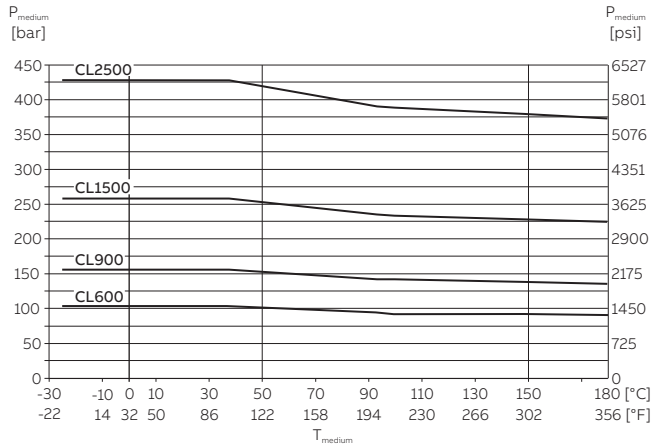


Figure 77: ASME flange, steel, DN 25 to 400 (1 to 24 in); Design Level 'A'

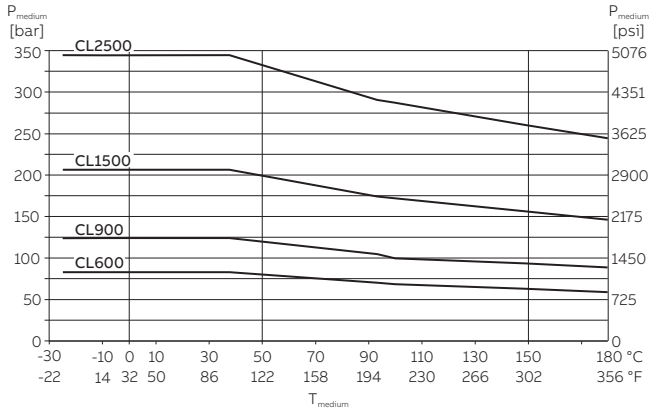


Figure 78: ASME flange, stainless steel, DN 25 to 400 (1 to 24 in); Design Level 'A'

Flowmeter sensor Design Level ‘B’

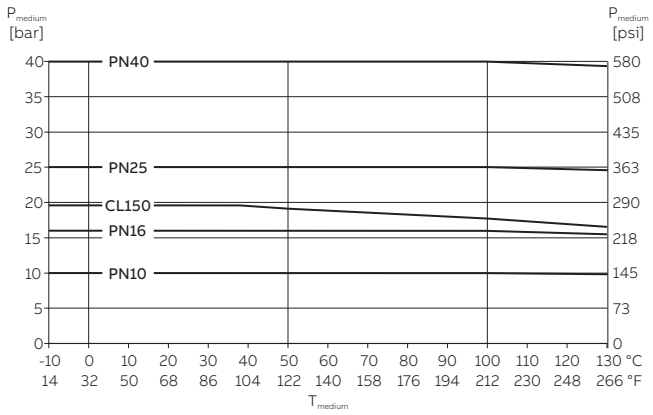


Figure 79: Cast iron housing, DN 25 to 600 (1 to 24 in); Design Level ‘B’

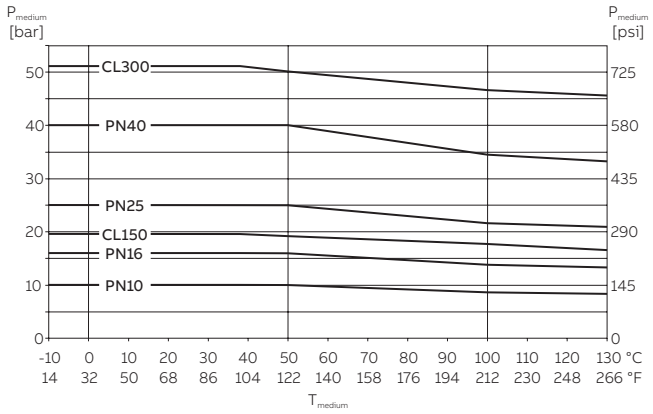


Figure 80: Welded tubular steel housing, DN 25 to 600 (1 to 24 in); Design Level ‘B’

… 10 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_{medium}, the ambient temperature T_{amb}, operating pressure P_{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.

Maximum Allowable Temperature Shock

Maximum allowable temperature shock difference in °C: Any
Temperature gradient °C/min: Any

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_{amb})		Measuring medium temperature (T_{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 (⅜ in)

Process connection	Ambient temperature range (T_{amb})		Measuring medium temperature (T_{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 78.

*** 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_{medium}) and permissible pressure (P_{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_{medium}) as a function of the measuring medium temperature (T_{medium}) and the liner material.

Lining material	Nominal diameter	P_{medium} [mbar abs]	T_{medium}*
PFA	DN 3 to DN 100 (1/10 to 4 in)		0 < 130 °C (266 °F)
PEEK	DN 1 to DN 2 (1/25 to 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 78.

Liner approvals on request; please contact ABB.

Overview – Material load

Process connection	DN	P_{medium} max.	T_{medium}
Wafer type	DN 3 to 50 (1/10 to 2 in)	40 bar (580 psi)	−25 to 130 °C (−13 to 266 °F)
	DN 65 to 100 (2 ½ to 4 in)	16 bar (232 psi)	
Welded spuds DIN 2463, ISO 1127, DIN 11850	DN 3 to 40 (1/10 to 1 ½ 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 ½ in, 4 in)	10 bar (145 psi)	
Welded spuds 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)
Threaded pipe connection DIN 11851	DN 3 to 40 (1/10 to 1 ½ 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 ½ in, 4 in)	10 bar (145 psi)	
Tri-Clamp DIN 32676	DN 3 to 50 (1/10 to 2 in)	16 bar (232 psi)	−25 to 130 °C (−13 to 266 °F)
	DN 65 to 100 (2 ½ to 4 in)	10 bar (145 psi)	
Tri-Clamp ASME BPE	DN 3 to 80 (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)	
External threads ISO 228, DIN 2999	DN 3 to 25 (1/10 to 1 in)	16 bar (232 psi)	−25 to 130 °C (−13 to 266 °F)
Welded spuds OD tubing	DN 3 to 50 (1/10 to 2 in)	10 bar (145 psi)	−25 to 130 °C (−13 to 266 °F)
⅛ in hygiene connection	DN 1 to DN 2 (1/25 to 1/12 in)	10 bar (145 psi)	−10 to 120 °C (−14 to 248 °F)

… 10 Specification

… HygienicMaster – Material load for process connections

Flange devices

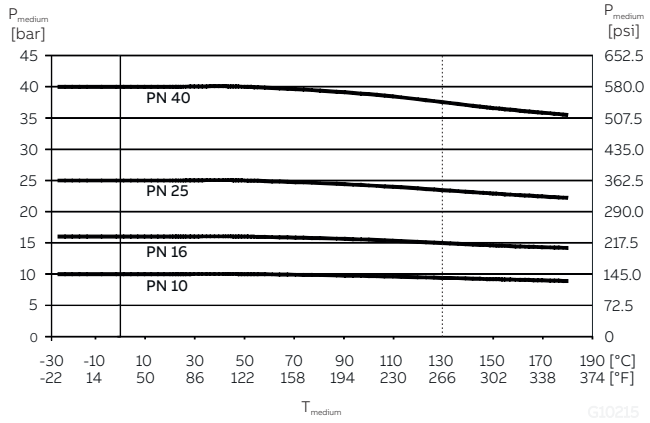


Figure 81: DIN flange, stainless steel, up to DN 100 (4 in)

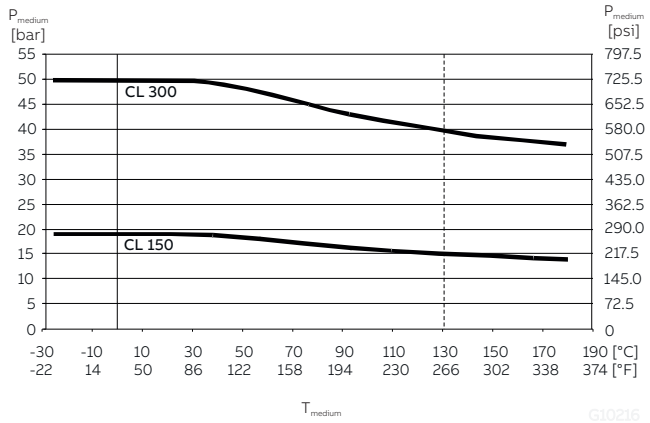


Figure 82: DIN flange, stainless steel, up to DN 100 (4 in) (CL 150 / 300)

JIS 10K-B2210 flange

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

Wafer type devices

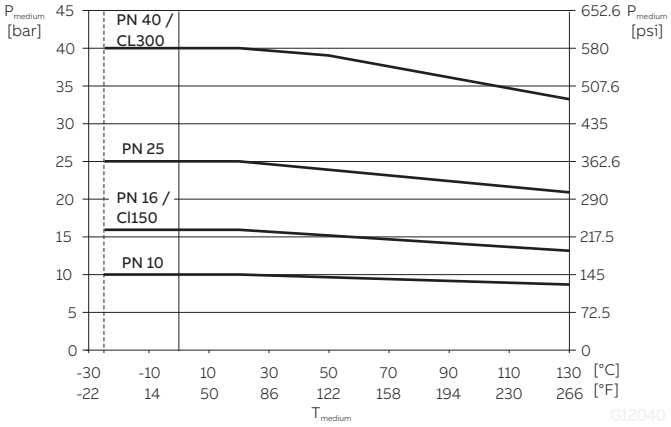


Figure 83: Wafer type design

JIS 10K-B2210 wafer type design

DN	Material	PN	T_{medium}	P_{medium}
DN 32 to 100	1.4404	10	−25 to 130 °C	10 bar (290 psi)
(1 ¼ to 4 in)	1.4435		(−13 to 266 °F)	(145 psi)
	1.4301			

11 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, and certificates are available in ABB's download area.
www.abb.com/flow

Trademarks

HART is a registered trademark of FieldComm Group, Austin, Texas, USA

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12 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

… 12 Appendix

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*	PN40	–	–	12.43	12.43	–	–
(1/10 to 3/8 in)*	PN63/100	–	–	12.43	12.43	–	–
	CL150	–	–	12.98	12.98	–	–
	CL300	–	–	17.38	17.38	–	–
	JIS 10K	–	–	12.43	12.43	–	–
DN 15 (½ 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 (¾ 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 ¼ 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 (3/8 in), connection flange ASME = DN 15 (½ in)

** 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 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.

… 12 Appendix

… Torque information

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.

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.

… 12 Appendix

… Torque information

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 transducers with design level 'B'

Note

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

Nominal diameter [mm (in)]	Pressure rating	Hard / soft rubber		PTFE	
		** [Nm]	*** [Nm]	** [Nm]	*** [Nm]
DN 25 (1 in)	PN40	—	—	13.32	8.6
	CL150	—	—	23.98	23.98
	CL300	—	—	65.98	38.91
	JIS 10K	—	—	26.94	26.94
DN 32 (1 ¼ in)	PN40	—	—	45.08	45.08
	CL150	—	—	29.44	29.44
	CL300	—	—	45.52	45.52
	JIS 10K	—	—	45.08	45.08
DN 40 (1 ½ in)	PN40	—	—	56.06	56.06
	CL150	—	—	36.12	36.12
	CL300	—	—	73.99	73.99
	JIS 10K	—	—	56.06	56.06
DN 50 (1 ½ in)	PN40	—	—	71.45	71.45
	CL150	—	—	66.22	66.22
	CL300	—	—	38.46	38.46
	JIS 10K	—	—	71.45	71.45
DN 65 (2 ½ in)	PN16	—	—	37.02	39.1
	PN40	—	—	43.03	44.62
	CL150	—	—	89.93	89.93
	CL300	—	—	61.21	61.21
	JIS 10K	—	—	37.02	39.1
DN 80 (3 in)	PN40	—	—	51.9	53.59
	CL150	—	—	104.6	104.6
	CL300	—	—	75.54	75.54
	JIS 10K	—	—	45.07	47.16
DN 100 (4 in)	PN16	—	—	49.68	78.19
	PN40	—	—	78.24	78.19
	CL150	—	—	76.2	76.2
	CL300	—	—	102.6	102.6
	JIS 10K	—	—	49.68	78.19
DN 125 (5 in)	PN16	—	—	61.4	64.14
	PN40	—	—	123.7	109.6
	CL150	—	—	98.05	98.05
	CL300	—	—	139.4	139.4
DN 150 (6 in)	PN16	—	—	81.23	85.08
	PN40	—	—	162.5	133.5
	CL300	—	—	111.4	111.4

** Flange material: steel.

*** Flange material: stainless steel.

… 12 Appendix

… Torque information

Nominal diameter [mm (in)]	Pressure rating	Hard / soft rubber		PTFE	
		** [Nm]	*** [Nm]	** [Nm]	*** [Nm]
DN 200 (8 in)	PN10	—	—	123.6	123.6
	PN16	—	—	113	116.9
	PN25	—	—	70.42	73
	PN40	—	—	109.9	112.5
	CL150	—	—	208.6	136.8
	CL300	—	—	158.1	158.1
DN 250 (10 in)	PN10	—	—	86.06	89.17
	PN16	—	—	99.42	103.1
	PN25	—	—	166.5	133.9
	PN40	—	—	279.9	241
	CL150	—	—	146.1	148.3
	CL300	—	—	246.4	246.4
DN 300 (12 in)	PN10	—	—	91.29	94.65
	PN16	—	—	113.9	114.8
	PN25	—	—	151.1	106.9
	PN40	—	—	254.6	252.7
	CL150	—	—	203.5	198
	CL300	—	—	421.7	259.1
DN 350 (14 in)	PN10	—	—	72.49	75.22
	PN16	—	—	124.9	104.4
	PN25	—	—	226.9	167.9
	CL150	—	—	270.5	263
	CL300	—	—	463.9	259.4
DN 400 (16 in)	PN10	—	—	120.1	113.9
	PN16	—	—	191.4	153.8
	PN25	—	—	404	246.7
	CL150	—	—	229.3	222.8
	CL300	—	—	635.8	328.1
DN 450 (18 in)	CL150	—	—	267.3	192.3
	CL300	—	—	660.9	300
DN 500 (20 in)	PN10	—	—	153.9	103.5
	PN16	—	—	312.1	224.8
	PN25	—	—	477.1	286
	CL150	—	—	237.3	230.4
	CL300	—	—	786.8	363.1
DN 600 (24 in)	PN10	—	—	238.7	149.1
	PN16	—	—	496.7	365.3
	PN25	—	—	750.7	539.2
	CL150	—	—	451.6	305.8
	CL300	—	—	1376	587.4

** 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	⅜ in	8
DN 15	½ in	10
DN 20	¾ in	21
DN 25	1	31
DN 32	1 ¼ in	60
DN 40	1 ½ in	80
DN 50	2	5
DN 65	2 ½ in	5
DN 80	3	15
DN 100	4	14

Notes

Notes

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3KXF231601R4401

CI/FEP630/FEH630-EN Rev. D 08.2018