ABB MEASUREMENT & ANALYTICS | COMMISSIONING INSTRUCTION

ProcessMaster FEP630, HygienicMaster FEH630

Electromagnetic flowmeter

Measurement made easy

Further information

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

Short product description
Electromagnetic flowmeter can measure the volume flowrate and the mass flowrate (based on a fixed density to be programmed).

Devices firmware version: 00.04.00

Further 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

1.1 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.

1.2 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.

i NOTICE

The signal word "NOTICE" indicates useful or important information about the product.
The signal word "NOTICE" is not a signal word indicating a danger to personnel. The signal word "NOTICE" can also refer to material damage.

1.3 Intended use

This device is intended for the following uses:

- To transmit fluid, pulpy or pasty measurement media with electrical conductivity.
- For volume flow measurement (under operating conditions).
- For mass flow measurement (based on a fixed density to be programmed).

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

In terms of the measuring medium, observe following points:

- Wetted parts such as measuring electrodes, liner, grounding electrodes, grounding rings, protection flanges must not be damaged because of the chemical and physical characteristic of the measuring medium.
- Media with unknown properties or abrasive measuring media may only be used if regular and suitable tests can be performed to ensure the safe condition of the device.
- The information on the name plate must be observed.
- Prior to using corrosive and abrasive measurement media, the operator must check the level of resistance of all parts coming into contact with the measuring medium.
  ABB will gladly support you in selecting the materials, but cannot accept any liability in doing so.

1.4 Improper use

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

- For operating as a flexible adapter in piping, e.g. for compensating pipe offsets, pipe vibrations, pipe expansions, etc.
- For use as a climbing aid, e.g. for mounting purposes
- For use as a support for external loads, e.g. as a support for piping, etc.
- Material application, e.g. by painting over the housing, name plate or welding/soldering on parts.
- Material removal, e.g. by spot drilling the housing.

1.5 Notes on data security

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.

2 Product identification

2.1 Name plate

2.1.1 Integral mount design

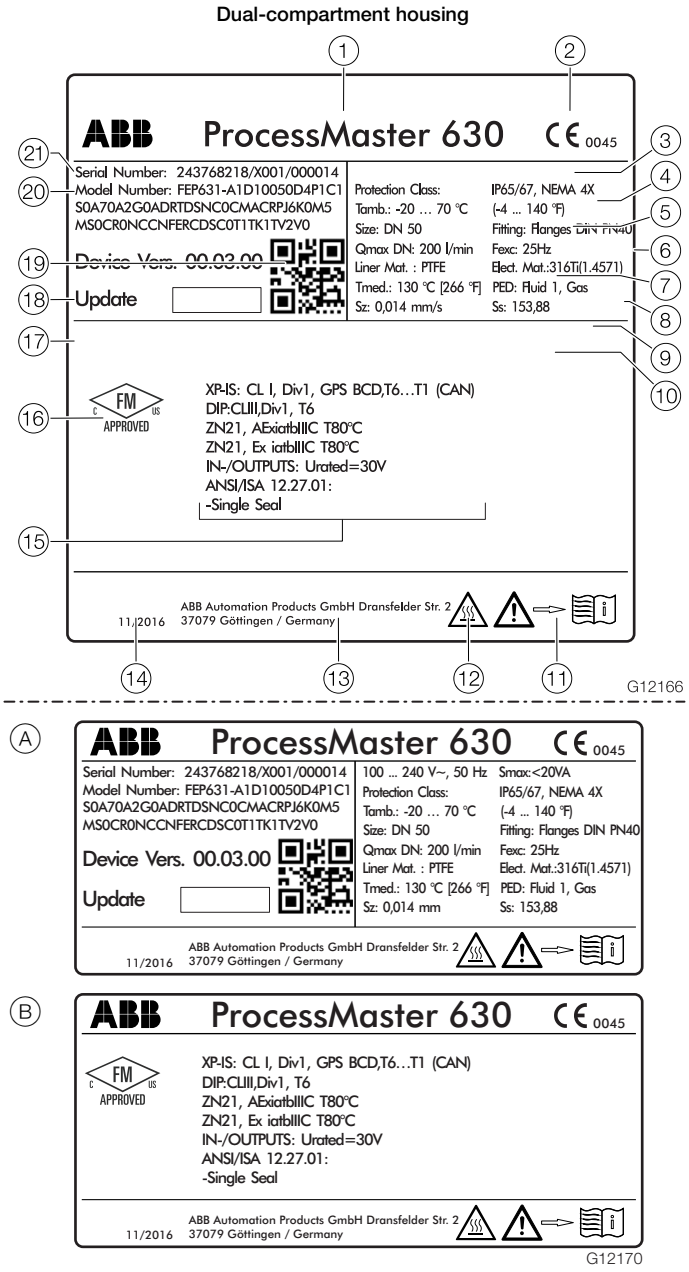


Fig. 1: Name plate (example)
(A) Name plate (B) Additional name plate for appovals and Ex marking (1) Type designation (2) CE mark (3) Power supply (4) IP rating (5) Ambient temperature range (6) Nominal diameter / Process connection / pressure rating (7) Q_{max}DN / Excitation frequency (8) Liner material / Electrode material (9) Medium temperature / PED marking (10) Calibration value (11) "Follow operating instructions" symbol (12) "Hot surface" symbol (13) Manufacturer address (14) Year of manufacture (month / year) (15) Ex marking (16) Approval symbols (17) Device Firmware update field (18) Device Firmware version (19) QR code (20) Order code (21) Serial number

Remote mount design

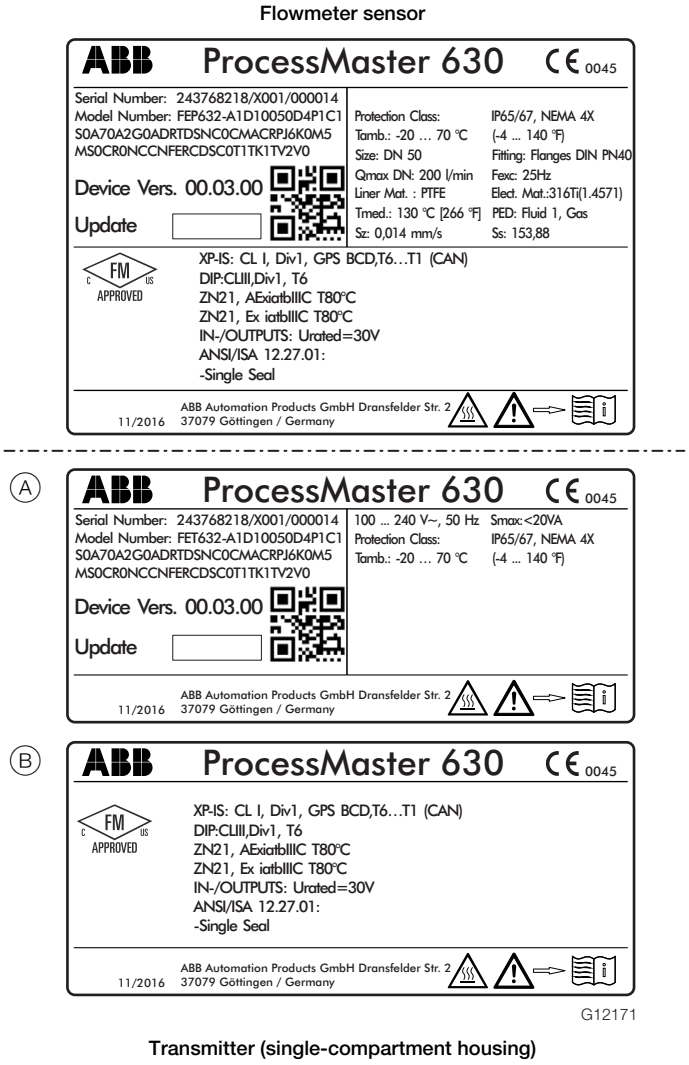


Fig. 2: Name plate (example)
(A) Name plate (B) Additional name plate for appovals and Ex marking

2.2 Marking according to Pressure Equipment Directive

The marking according to the Pressure Equipment Directive (PED) can be found on the name plate.

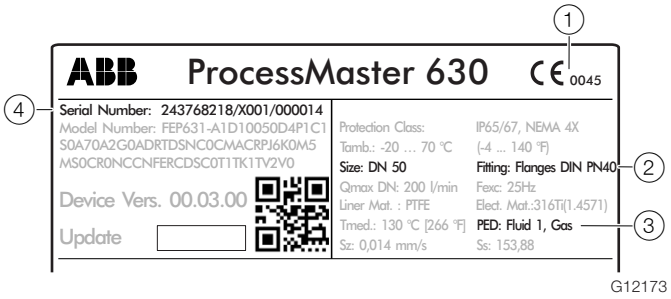


Fig. 3: PED marking (example)
(1) CE mark (with number of notified body) (2) Nominal size / nominal pressure rating (3) Fluid group resp. reason for the exception
(4) Serial number of the flowmeter sensor

The marking is applied depending to the nominal size (> DN 25 or ≤ DN 25) of the flowmeter (also refer to Pressure Equipment Directive 2014/68/EU).

Pressure equipment subject to PED

Below the CE mark, the number of the designated authority to confirm that the device meets the requirements of Pressure Equipment Directive is specified.
The respective fluid group in accordance with the Pressure Equipment Directive is indicated under PED.
Example: Fluid group 1 = hazardous fluids, gaseous.

Pressure equipment outside the applicable range of the PED

Under PED, the reason for the exception in article 3, paragraph 3 of the Pressure Equipment Directive is specified.
The pressure equipment is classified in the SEP (= Sound Engineering Practice) "Good Engineering Practice" category.

2.3 Additional warning plate

Devices for use in hazardous areas are labeled with an additional warning plate.

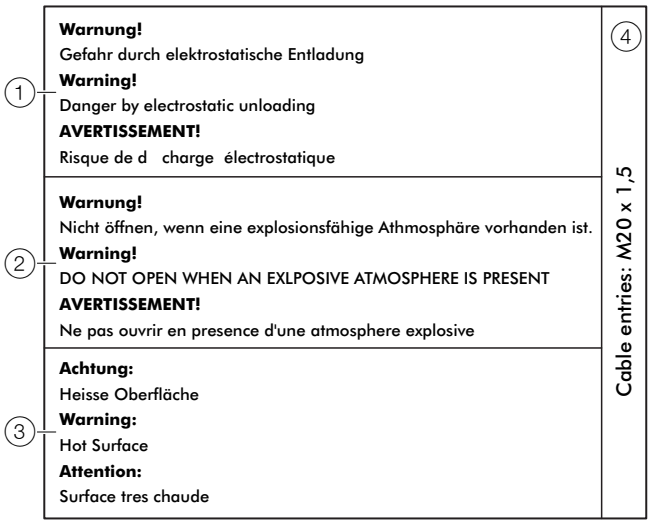


Fig. 4: Additional warning plate

1. WARNING - Danger by electrostatic unloading.
2. WARNING - Do not open when an exlposive atmosphere is present.
3. WARNING - Hot surface.
4. Thread for cable glands.

3 Transport and storage

3.1 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.

3.2 Transport

⚠ DANGER

Life-threatening danger due to suspended loads.
In the case of suspended loads, a danger of the load falling exists.
Remaining 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.

i NOTICE

Potential damage to device!
The protection plates or protective caps installed on the process connections of devices lined with PTFE / PFA must not be removed until just before installation.
To prevent possible leakage, make sure that the liner on the flange is not cut or damaged

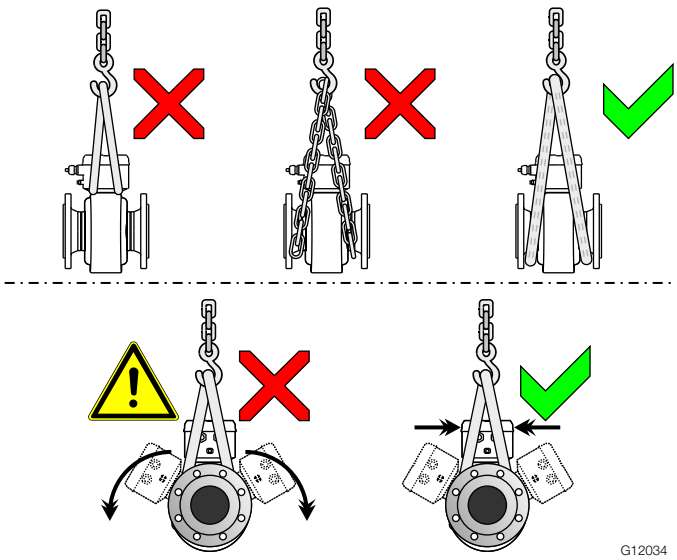


Fig. 5: Transport instructions - ≤ DN 450

Flange devices ≤ DN 450

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

Flange devices > DN 450

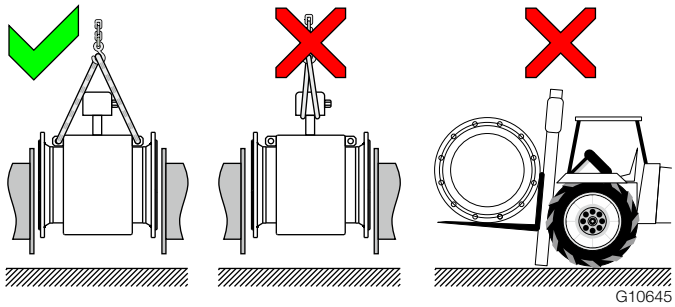


Fig. 6: Transport instructions - > DN 450

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

3.3 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 the Appendix) and include this with the device.
According to the EU Directive governing hazardous materials, the owner of hazardous waste is responsible for its disposal or must observe the following regulations for shipping purposes: All devices delivered to ABB must be free from any hazardous materials (acids, alkalis, solvents, etc.).

Please contact Customer Center Service acc. to page 2 for nearest service location.

4 Installation

NOTICE

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

4.1 Installation conditions

4.1.1 General information

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 the 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.
- Only gaskets made from a material that is compatible with the measuring medium and measuring medium temperature may be used.
- 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 temperature limits are not exceeded operating the device.
- Vacuum shocks in the piping should be avoided to prevent damage to the liners (PTFE). 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 gasket 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.
- When installing the transmitter in a control cabinet, make sure adequate cooling is provided.

4.1.2 Devices with extended diagnostic functions

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

For further information read and observe chapter ‘Extended diagnostic functions’ on page 49.

4.1.3 Devices equipped with venting Goretex membrane

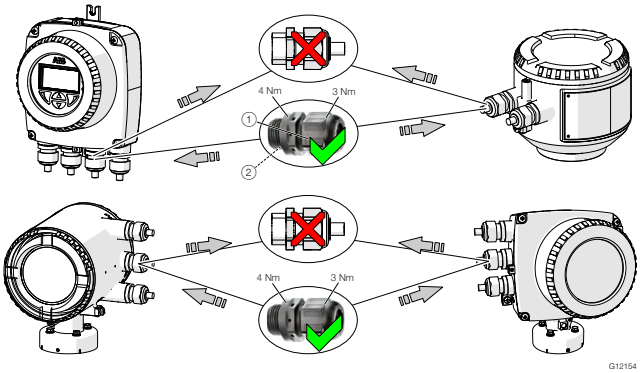


Fig. 7: Installing venting cable gland
(1) Venting cable gland (2) Flat gasket

There is an option to equip the flowmeter with a venting element.

For this purpose, one of the existing cable glands needs to be replaced with the venting cable gland, supplied with the flowmeter.

The venting cable gland has a diaphragm which provides venting between the inner housing and the environment.

Make sure the flat gasket is correctly seated when mounting the venting cable gland.

— Maximum torque when screwing the cable gland in the housing: 4 Nm
— Maximum torque tightening the nut: 3 Nm

4.1.4 Brackets and supports

NOTICE

Potential damage to device!

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

Place the supports at the edge of the flowmeter sensor housing (see arrows in Fig. 8).

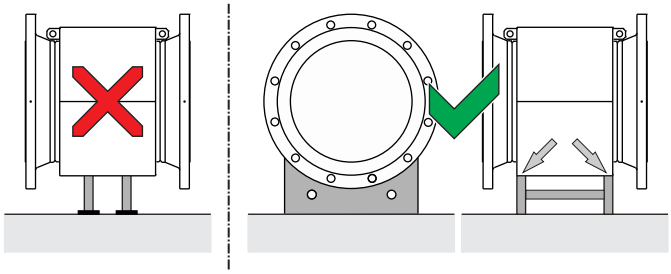


Fig. 8: Support for meter sizes larger than DN 400

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

4.1.5 Gaskets

The following points must be observed when installing gaskets:

— 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.
— The use of graphite with the flange or process connection gaskets is prohibited, because an electrically conductive coating may form on the inside of the meter tube.

Devices with a hard rubber, 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, ensure that the tightening torques specified in chapter ‘Torque information’ on page 61 are not exceeded.

Devices with a PTFE, PFA or ETFE liner

— Devices with a PTFE, PFA or ETFE liner do not require additional gaskets.

4.1.6 Devices with a wafer-type design

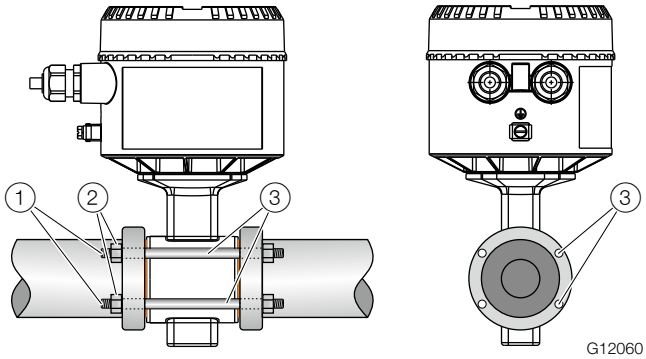


Fig. 9: Installation set for wafer-type installation (example)
(1) Threaded rod (2) Nut with washer (3) Centering sleeves

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.

4.1.7 Flow direction

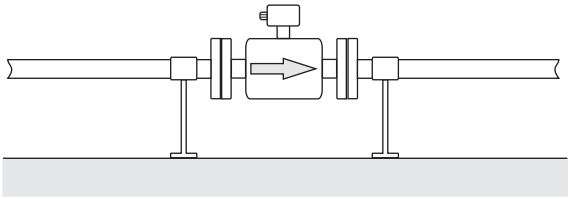


Fig. 10: Flow direction

The device measures the flowrate in both directions. Forward flow is the factory setting, as shown in Fig. 10.

4.1.8 Elektrode axis

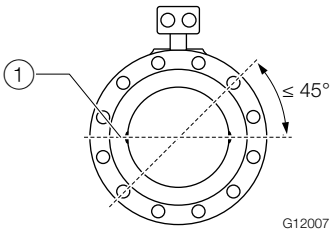


Fig. 11: Orientation of the electrode axis
(1) Elektrode axis

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

4.1.9 Mounting position

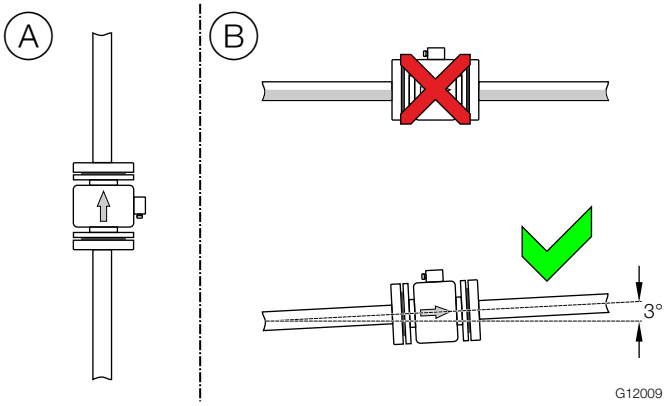


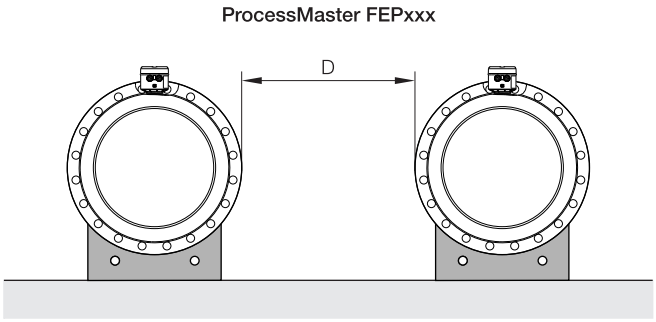
Fig. 12: Mounting position

(A) Vertical installation for measuring abrasive fluids, preferably with flow in upward direction.
(B) In case of horizontal installation, the Meter tube must always be completely full.
Provide for a slight incline of the connection for degassing.

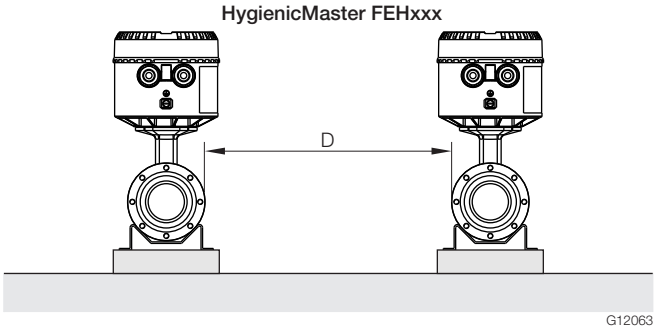
NOTICE

Prefer vertical installation in hygienic applications!
With horizontal installation assure the sensor is self-drainable.

4.1.10 Minimum distance



Distance D: ≥ 1.0 m (3.3 ft) for design level "A", ≥ 0.7 m (2.3 ft) for design level "B"



Distance D: ≥ 1.0 m (≥ 3.3 ft)

Fig. 13: Minimum distance

- In order to prevent the devices from interfering with each other, a minimum distance as shown in Fig. 13 must be maintained between the devices.
- The flowmeter sensor may 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) should be maintained.
- For installation on or to steel parts (e.g. steel brackets), a minimum spacing of approx. 100 mm (3.94 inch) should be maintained (based on IEC801-2 and IECTC77B.

4.1.11 Grounding

The flowmeter sensor must be connected to ground potential. For technical reasons, this potential should be identical to the potential of the measuring medium.
For plastic or insulated lined pipelines, the measuring medium is grounded by installing ground plates.
When there are stray potentials present in the pipeline, a ground plate is recommended on both ends of the flowmeter sensor.

4.1.12 Inlet and outlet sections

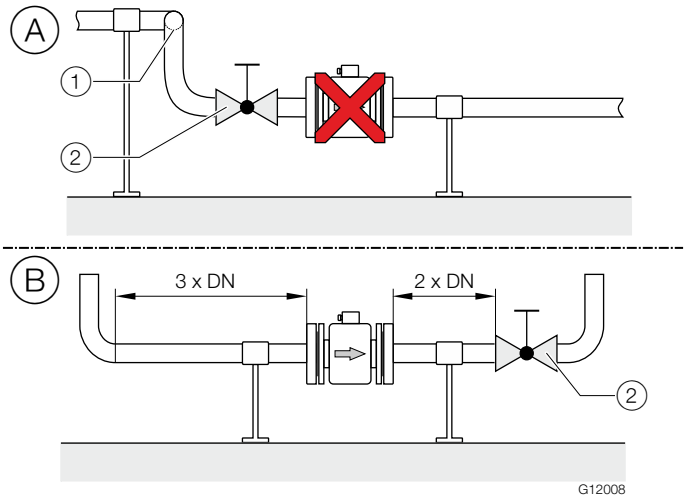


Fig. 14: In- and outlet section, turn-off component
(1) Double elbow (2) Turn-off device

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

(A) Do not install fittings, manifolds, valves, etc., directly in front of the flowmeter sensor.

(B) Inlet and outlet section: Length of straight inlet and outlet section of the flowmeter sensor.
Experience has shown that, in most installations, inlet sections 3 x DN long and outlet sections 2 x DN long are sufficient (DN = nominal diameter of the flowmeter sensor).
For test stands, the reference conditions of 10 x DN inlet section and 5 x DN outlet section must be provided, in accordance with EN 29104 / ISO 9104.
Valves or other turn-off components should be installed in the outlet section.
Butterfly valves must be installed so that the valve plate does not extend into the flowmeter sensor.

4.1.13 Free inlet or outlet

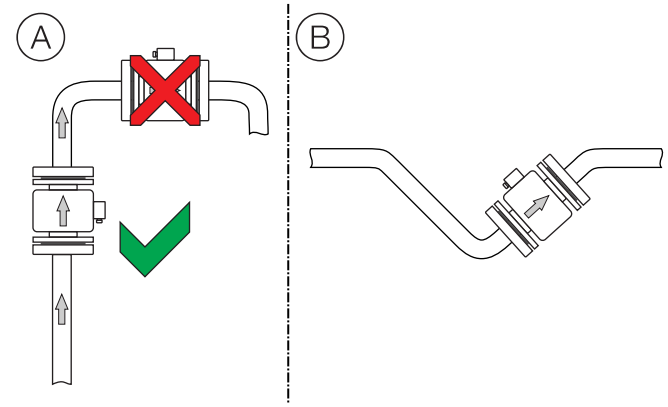


Fig. 15: Free inlet or outlet

(A) Do not install the flowmeter at the highest point or in the draining off side of the pipeline, flowmeter runs empty, air bubbles can form.
(B) Provide for a siphon fluid intake for free inlets or outlets so that the pipeline is always ful.

4.1.14 Strongly contaminated measuring media

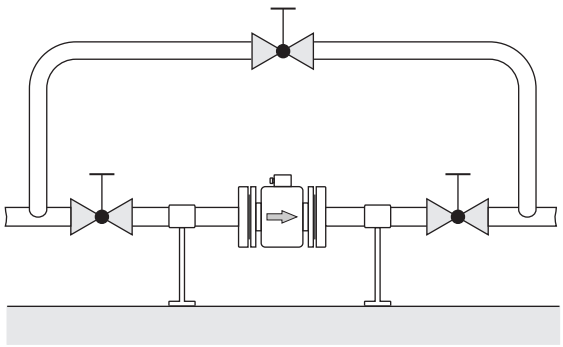


Fig. 16: Bypass connection

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

4.1.15 Installation in the vicinity of pumps

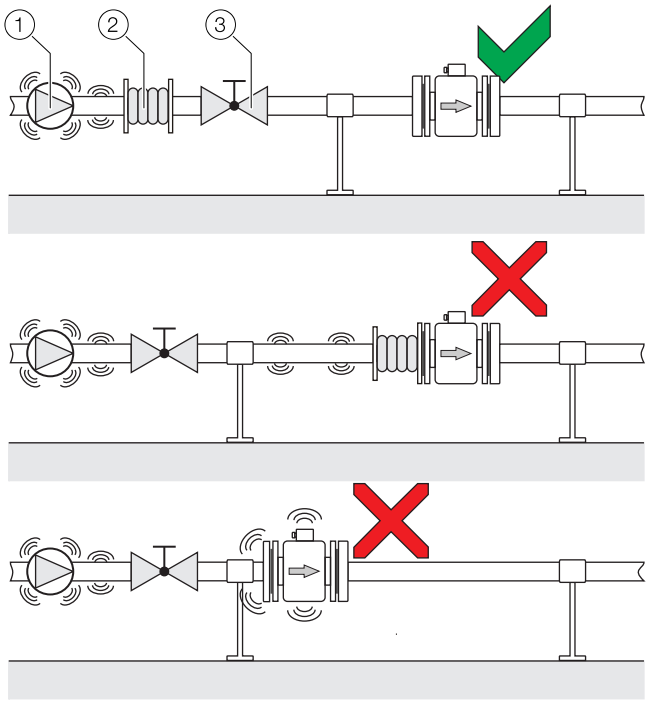


Fig. 17: Vibration damping
(1) Pump (2) Damping device (3) Shut-off device

Strong vibrations in the pipeline must be damped using flexible damping devices.
The damping devices must be installed beyond the supported flowmeter section and outside of the section between the shut-off devices.
Do not connect flexible damping devices directly to the flowmeter sensor.

4.1.16 Sensor insulation

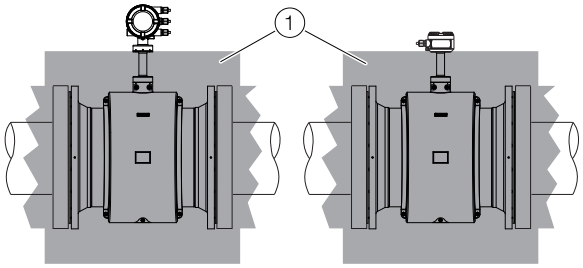


Fig. 18: Insulation of the flowmeter sensor
(1) Insulation

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

4.1.17 Installation in pipelines with larger nominal diameters

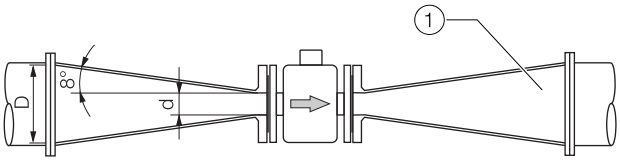


Fig. 19: using reduction pieces
(1) Transition piece

Determine the resulting pressure loss when using transition pieces:

1. Calculate the diameter ratio d/D.
2. Determine the flow velocity based on the flow rate nomogram (Fig. 20).
3. Read the pressure drop on the Y-axis in Fig. 20.

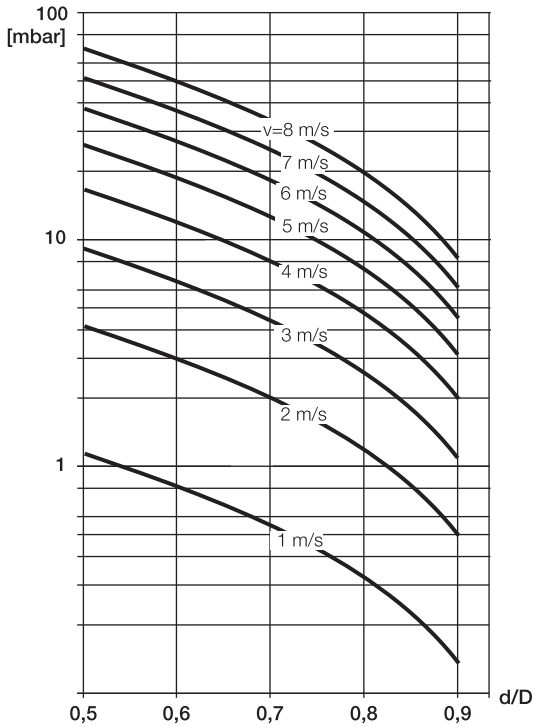


Fig. 20: Flow rate nomogram for pressure drop calculations for flange transition piece with α/2 = 8°

4.1.18 Installation in EHEDG-compliant installations

⚠ WARNING

Risk of poisoning!

Bacteria and chemical substances can contaminate or pollute pipeline systems and the materials they are made of.
In EHEDG-compliant installations, the instructions below must be observed.

- The required self-draining functionality of the sensor can only be guaranteed when the vertical mounting position is used.
- The combination of process connections and gaskets selected by the operator may comprise only EHEDG-compliant components. Note the information in the current version of the EHEDG Position Paper entitled "Hygienic Process connections to use with hygienic components and equipment".
- All weld spud combinations provided by ABB are approved.
- The pipe fitting in accordance with DIN 11851 is approved for use in conjunction with an EHEDG-compliant gasket.

4.1.19 Installation in 3A-compliant installations

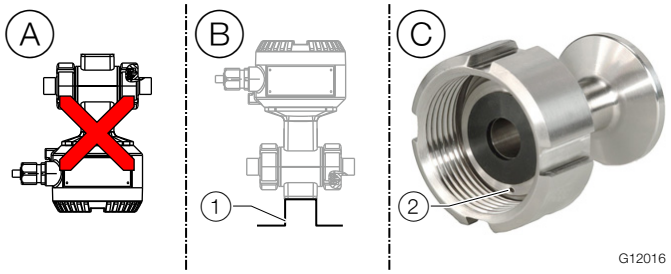


Fig. 21: 3A-compliant installation
(1) Mounting bracket (2) Leakage hole

Please observe the following points:

(A) Do not install the device horizontally with the terminal box or transmitter housing pointing downward.
(B) The "mounting bracket" option is not 3A-compliant.
(C) Please ensure that the leakage hole of the process connection is located at the deepest point of the installed device.

- Prefer vertical installation. With horizontal installation make sure the sensor is self-drainable
- Make sure the sensor terminal compartment cover and/or the transmitter housing cover is tightened properly to ensure there is no gap between the base of the housing and the cover.

Only devices with following process connections are 3A-compliant:

- Welded spuds
- Tri-Clamp

4.2 Installing the sensor

NOTICE

Potential damage to device!

- 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). 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 coplanar and centered between the piping.
3. Install gaskets between the surfaces; see chapter ‘Gaskets’ on page 10 .

NOTICE

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 chapter ‘Torque information’ on page 61 .
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 chapter ‘Torque information’ on page 61 !
   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 maximum torque.

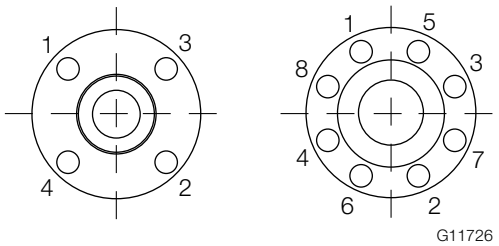


Fig. 22: Tightening sequence for the flange screws

4.3 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 the protection class 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 exceed 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 appropriate fasteners for the base material.

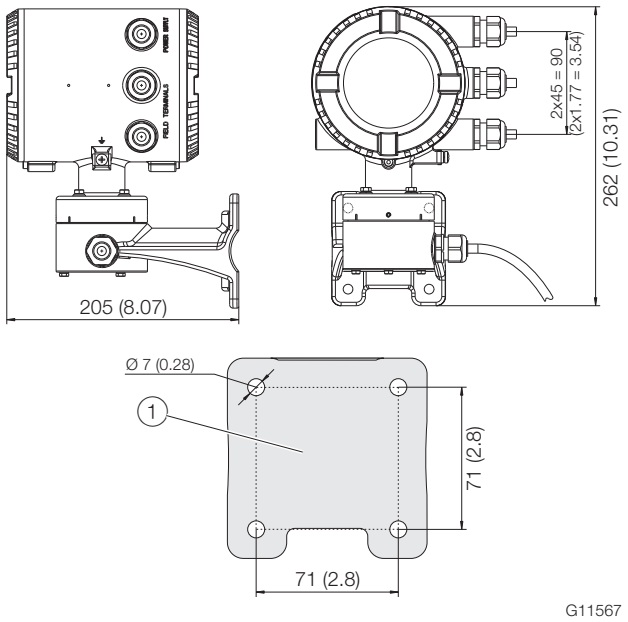


Fig. 23: Mounting dimensions of double-compartment housing
(1) Hole pattern for mounting holes

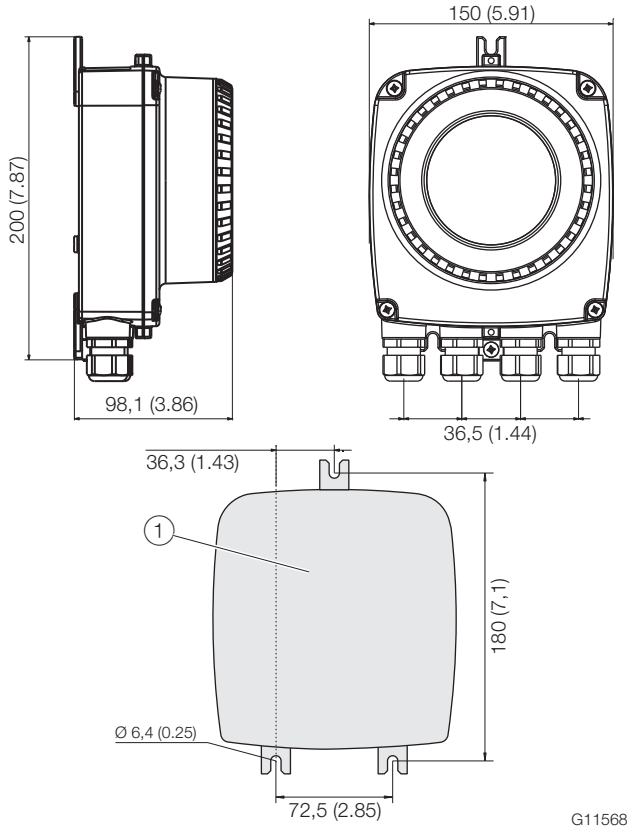


Fig. 24: Mounting dimensions for single-compartment housing
(1) Hole pattern for mounting holes

4.4 Opening and closing the 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

Adverse effect on 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.

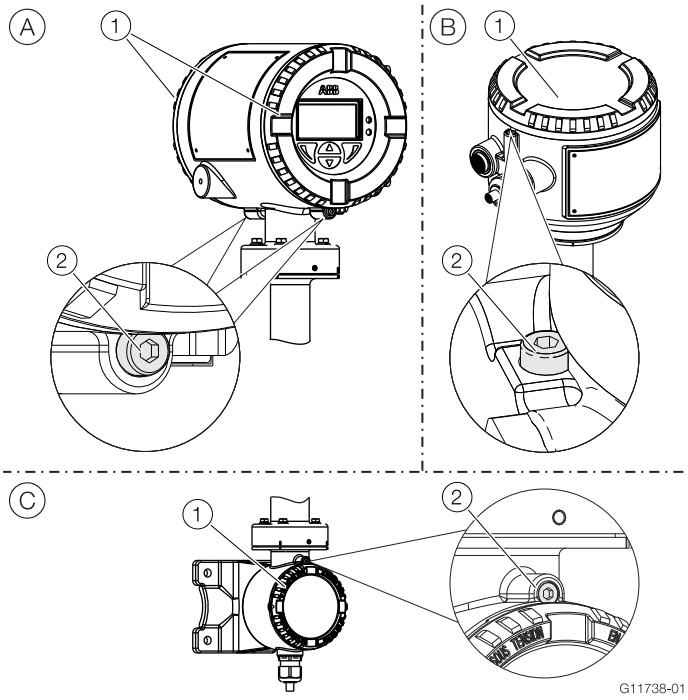


Fig. 25: Cover lock (example)
(A) Integral mount design (B) Remote mount design (C) Transmitter, terminal space, signal cable

Open the housing:

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

Close the housing:

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

NOTICE

Adverse effect on IP rating

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

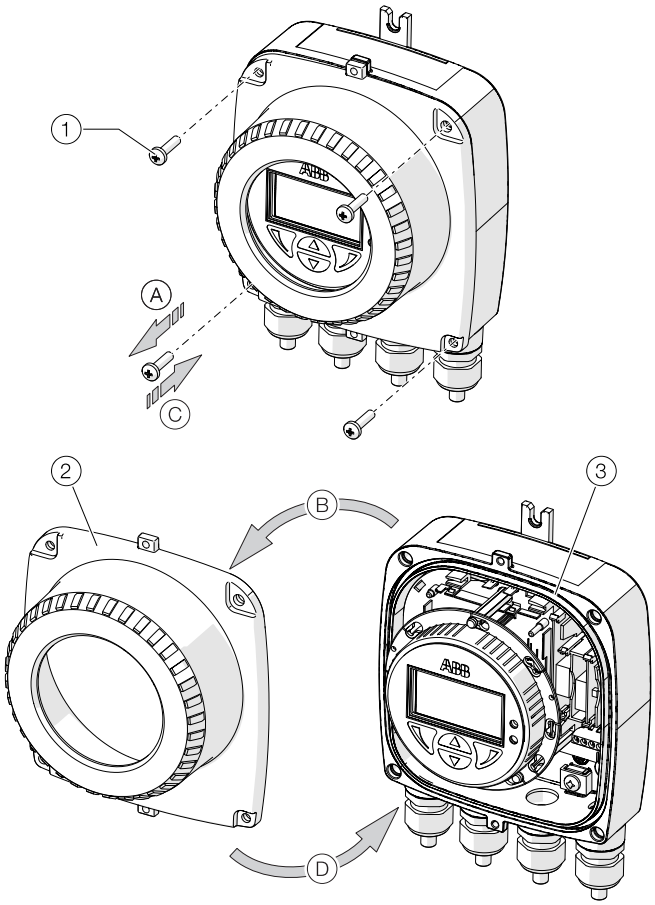


Fig. 26: Opening / closing single-compartment housing
(1) Screws for housing cover (4x) (2) Transmitter housing cover (3) Gasket

To open the housing: Perform steps (A) and (B).
To close the housing: Perform steps (C) and (D).

4.4.1 Rotating the transmitter housing and LCD display

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

Transmitter enclosure

DANGER

Damaging the device carries a risk of explosion!

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

Rotating the transmitter housing: Perform steps (A) ... (C).

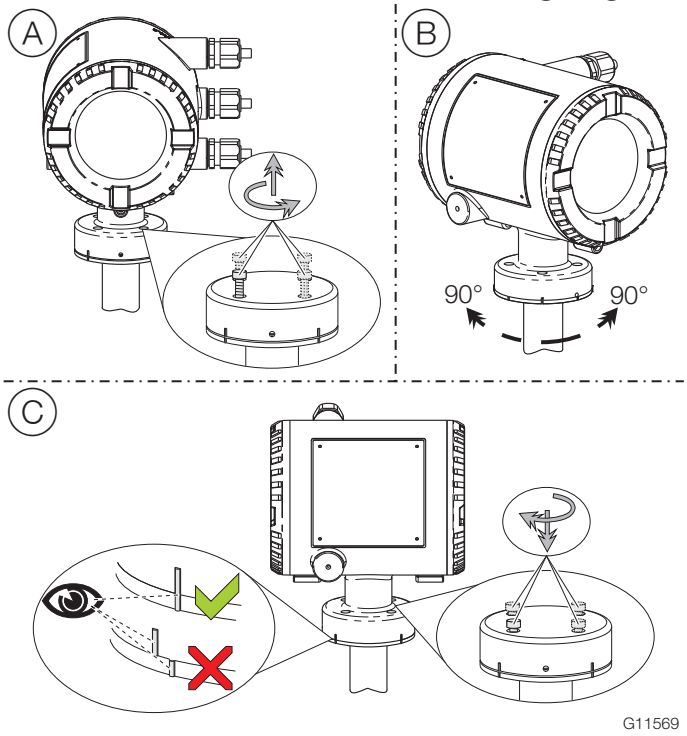


Fig. 27: Rotating the transmitter housing

LCD indicator - dual-compartment housing

The LCD indicator can be rotated in 3 increments of 90°.

Refer to chapter ‘Opening and closing the housing’ on page 16 !

Rotating the LCD indicator: Perform steps Ⓐ … Ⓕ.

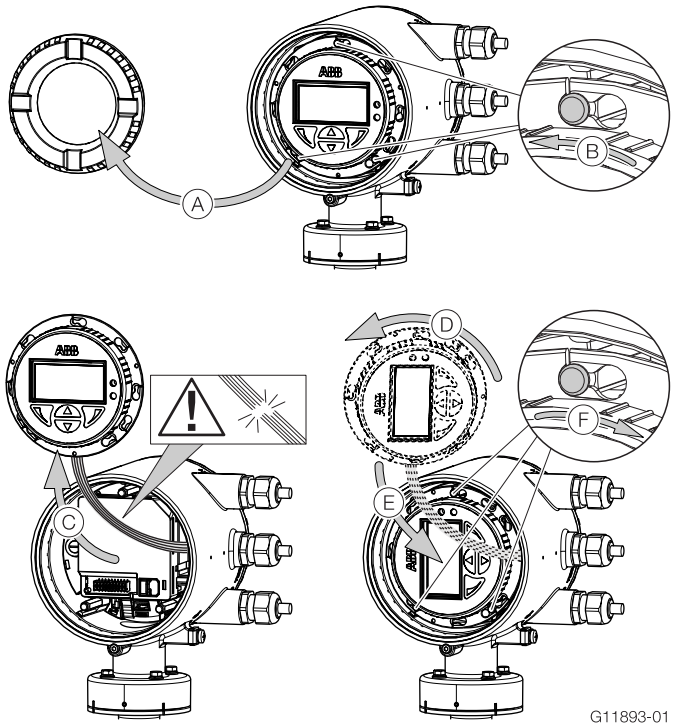


Fig. 28: Rotating the LCD indicator

LCD indicator - single-compartment housing

The LCD indicator can be rotated in 3 increments of 90°.

Refer to chapter ‘Opening and closing the housing’ on page 16 !

Rotating the LCD indicator: Perform steps Ⓐ … Ⓕ.

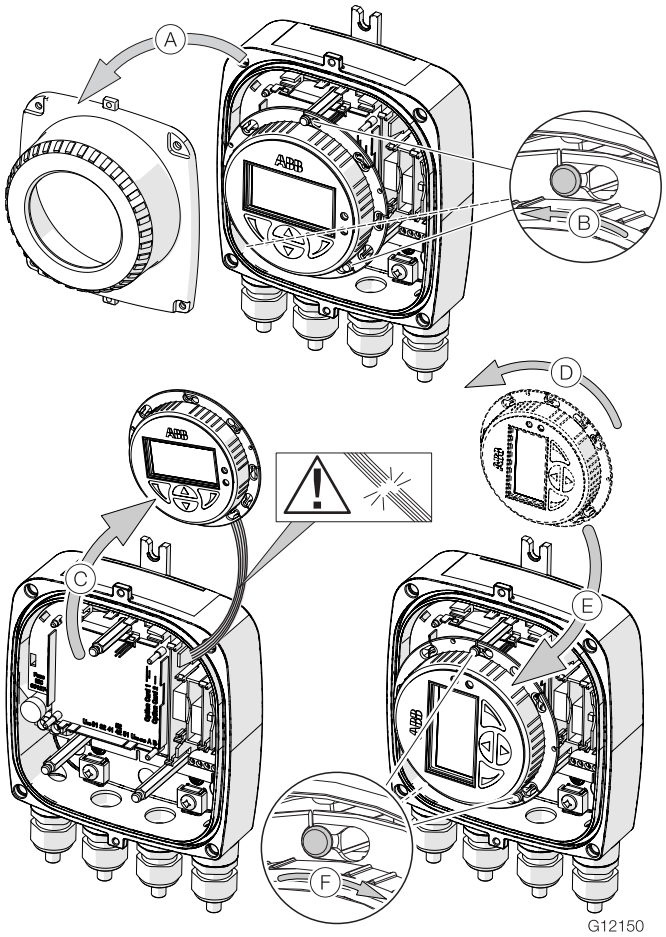


Fig. 29: Rotating the LCD indicator

4.5 Installing the plug-in cards

⚠ WARNING

Loss of Ex-approval!

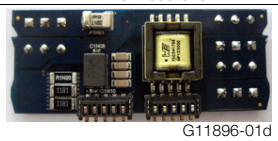
Loss of Ex approval due to retrofitting of plug-in cards on devices for use in potentially explosive atmospheres.

— Devices for use in potentially explosive atmospheres must 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) in which plug-in cards can be inserted to provide additional 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	Number[1)]
 G11896-01a	Passive current output, 4 ... 20 mA (red) Order no.: 3KQZ400029U0100	Maximum two plug-in cards
 G11896-01b	Passive digital output (green) Order no.: 3KQZ400030U0100	Maximum one plug-in card
 G11896-01c	Passive digital input (yellow) Order no.: 3KQZ400032U0100	Maximum one plug-in card
 G11896-01d	24 V DC transmitter loop power supply (blue) Order no.: 3KQZ400031U0100	Maximum one plug-in card

1) The "Number" column indicates the maximum number of plug-in cards of the same type that can be used.

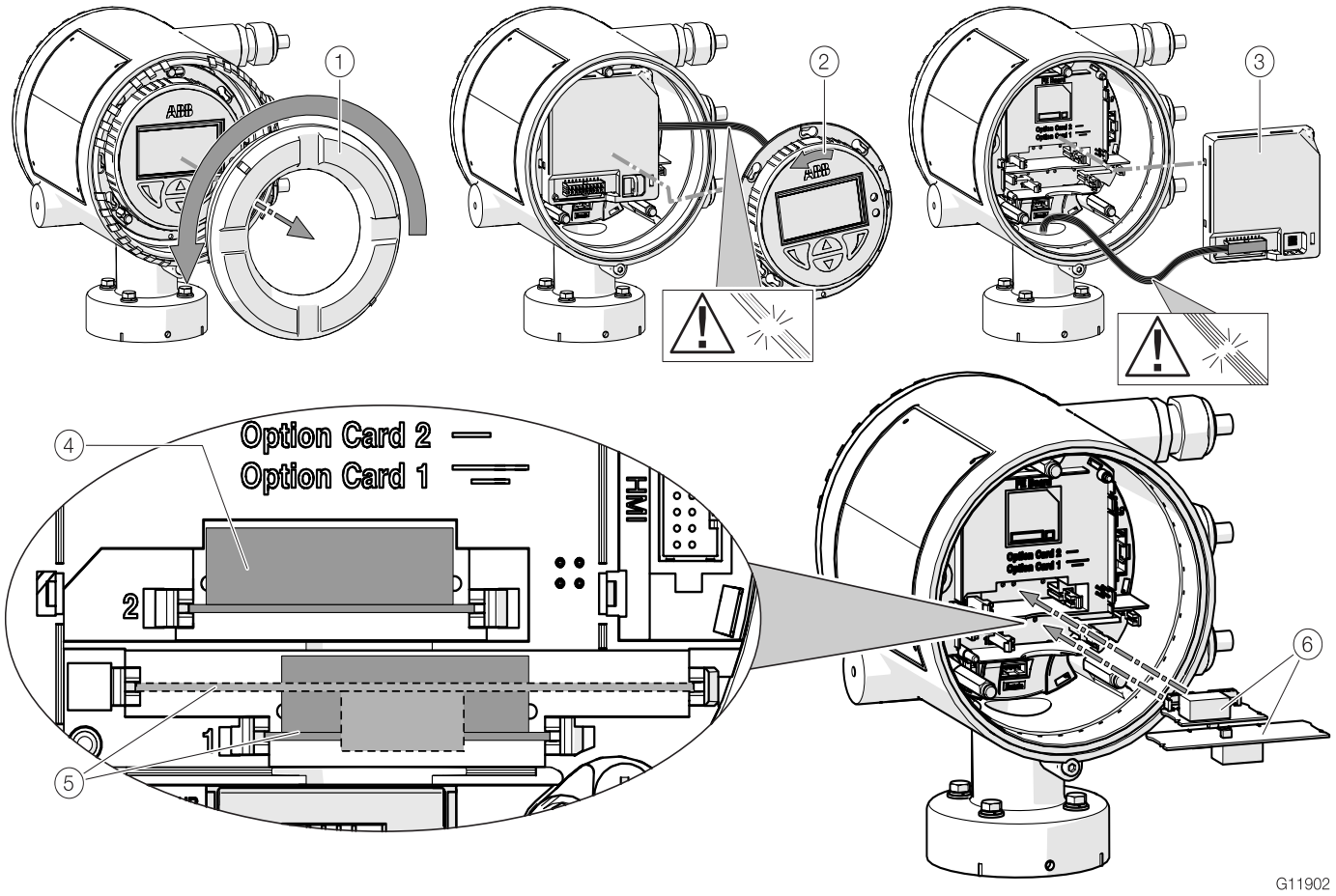


Fig. 30: Installation of plug-in cards (example representation, dual-compartment housing)
(1) Cover (2) LCD indicator (3) Frontend board (FE board, on integral mount design only) (4) Slot OC2 (5) Slot OC1 (6) Plug-in cards

⚠ 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.

i 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.
4. Pull out the frontend board (on integral mount design only). 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 FE board, insert the LCD indicator and screw on / replace the cover.
7. Connect outputs V1 / V2 and V3 / V4 in accordance with chapter ‘Electrical connections’ on page 24.
8. Once the power supply is switched on, configure the plug-in card functions.

4.6 Grounding the flowmeter sensor

4.6.1 General information on ground connections

Observe the following items when grounding the device:

— For plastic pipes or pipes with insulating lining, the earth is provided by the grounding ring or grounding electrodes.
— When stray potentials are present, install a grounding ring upstream and downstream of the flowmeter sensor.
— For measurement-related reasons, the potentials in the station ground and in the pipeline should be identical.

NOTICE

If the flowmeter sensor is installed in plastic or earthenware pipelines, or in pipelines with an insulating lining, transient current may flow through the grounding electrode in special cases.
In the long term, this may destroy the sensor, since the grounding electrode will in turn degrade electrochemically. In these special cases, the connection to the earth must be performed using grounding rings. Install a grounding ring upstream and downstream of the device in this case.

4.6.2 Metal pipe with fixed flanges

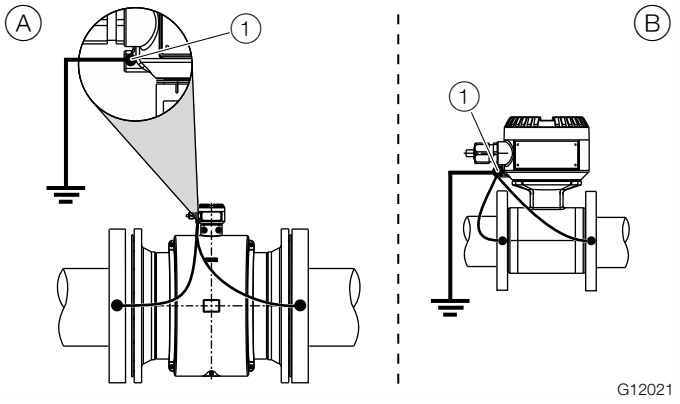


Fig. 31: Metal pipe, without liner (example)
(A) Flange design (B) Wafer-type design
(1) Ground terminal

Use a copper wire (at least 2.5 mm² (14 AWG)) to establish the ground connection between the sensor, the pipeline flanges and an appropriate grounding point.

4.6.3 Metal pipe with loose flanges

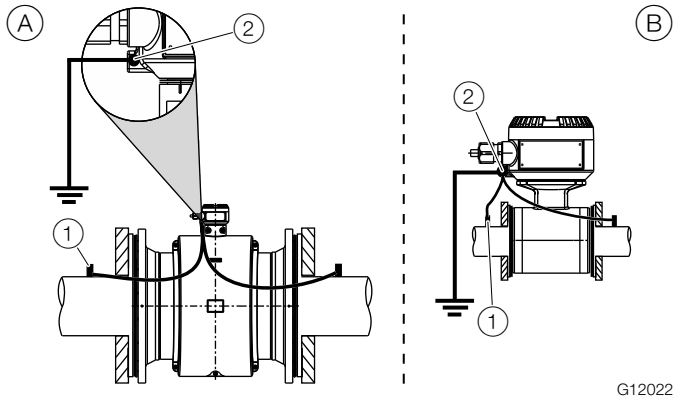


Fig. 32: Metal pipe, without liner (example)
(A) Flange design (B) Wafer-type design
(1) Threaded nuts M6 (2) Ground terminal

1. Solder the threaded nuts M6 to the pipeline and connect the ground as shown in the illustration.
2. Use a copper wire (at least 2.5 mm^2 (14 AWG)) to establish the ground connection between the sensor and an appropriate grounding point.

4.6.4 Plastic pipes, non-metallic pipes or pipes with insulating liner

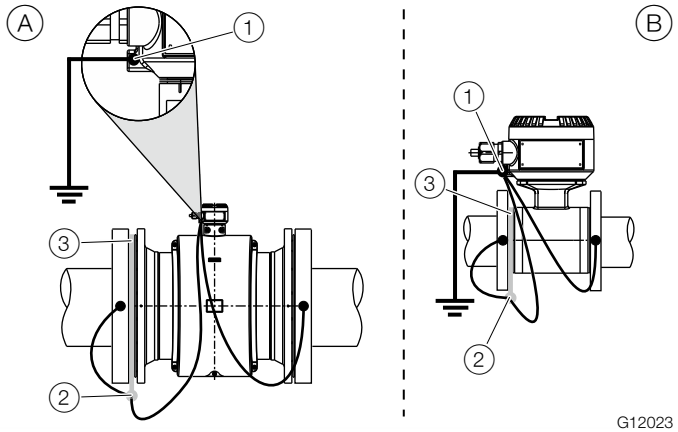


Fig. 33: Plastic pipes, non-metallic pipes or pipes with insulating liner
(A) Flange design (B) Wafer-type design
(1) Earth connection (2) Terminal lug (3) Grounding ring

For plastic pipes or pipes with insulating lining, the grounding for the measuring medium is provided by the grounding ring 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 ring is not necessary.

1. Install the flowmeter sensor with grounding ring in the pipeline.
2. Connect the terminal lug for the grounding ring and ground connection on the flowmeter sensor with the grounding strap.
3. Use a copper wire (min. 2.5 mm² (14 AWG)) to link the ground connection to a suitable grounding point.

4.6.5 Sensor type HygienicMaster

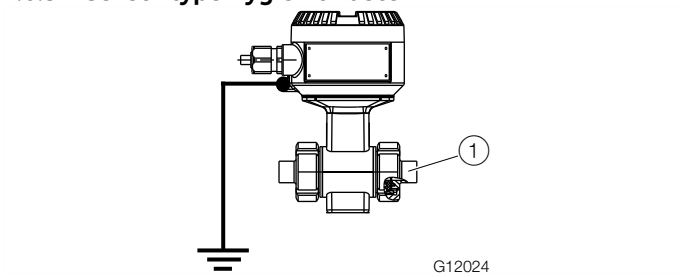


Fig. 34
(1) Process connection adapter

Ground the stainless steel model as shown in the figure. The measuring fluid is grounded via the process connection adapter and an additional ground is not required.

4.6.6 Grounding for devices with protective plates

The protective plates are used to protect the edges of the liner in the meter tube, e.g., for abrasive fluids. In addition, they function as a grounding ring.

— For plastic or pipes with insulating lining, electrically connect the protective plate in the same manner as a grounding ring.

4.6.7 Grounding with conductive PTFE grounding plate

For devices with a meter size between DN 10 … 250, grounding rings made of conductive PTFE are available. These are installed in a similar way to conventional grounding ring.

4.6.8 Devices with extended diagnostic functions

For devices with extended diagnostic functions different installation conditions may be valid.
For further information read and observe chapter Extended diagnostic functions.

4.6.9 Installation and grounding in pipelines 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. Pipelines completely or for the most part with cathodic corrosion protection (CCP) or mixed systems with CCP areas and PE areas.

— When installing an electromagnetic flowmeter in pipes with insulating inner lining and free from foreign matter, it should be insulated with grounding rings on the upstream and downstream side. The corrosion protection potential is diverted. The grounding rings upstream and downstream of the electromagnetic flowmeter are connected to functional earth (Fig. 35 / Fig. 36).

— If the occurrence of external stray currents is to be expected in pipelines with internal insulation (e.g. in the case of long pipe sections in the vicinity of power supply units), an uninsulated pipe of approx. 1/4 x DN of length should be provided upstream and downstream of the flowmeter sensor in order to deviate these currents away from the measuring system (Fig. 37).

Internally insulated pipelines with cathodic corrosion protection potential

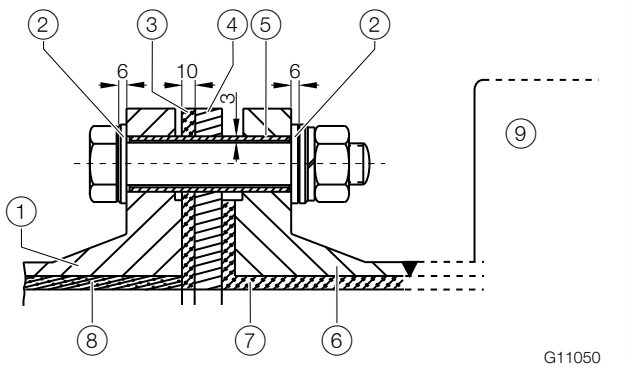


Fig. 35: Bolt screw view
(1) Pipe flange (2) Insulating plate (3) Gasket / insulating ring (4) Grounding plate (5) Insulating pipe (6) Flange (7) Lining (8) Insulation (9) Flowmeter sensor

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

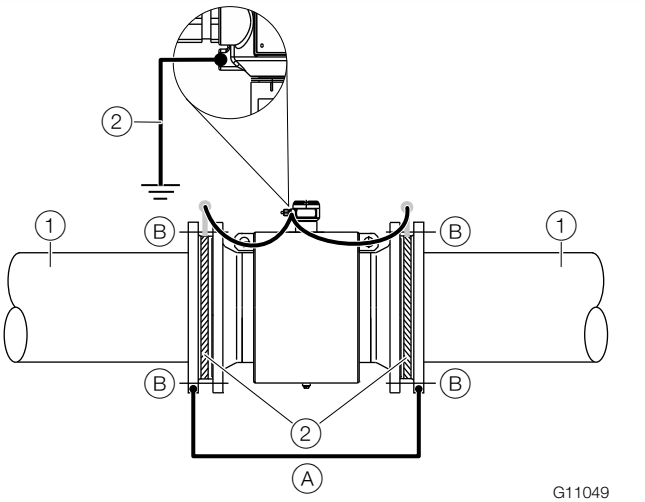


Fig. 36: Flowmeter sensor with grounding plate and functional earth
(A) Connecting line for corrosion protection potential[1] (B) Insulated screw bolts without grounding rings
(1) Insulated pipe (2) Functional earth (3) Grounding plate

1) ≥ 4 mm^2 Cu, not included in the delivery, to be provided onsite.

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

Mixed system pipeline with cathodic corrosion protection and functional earth potentials

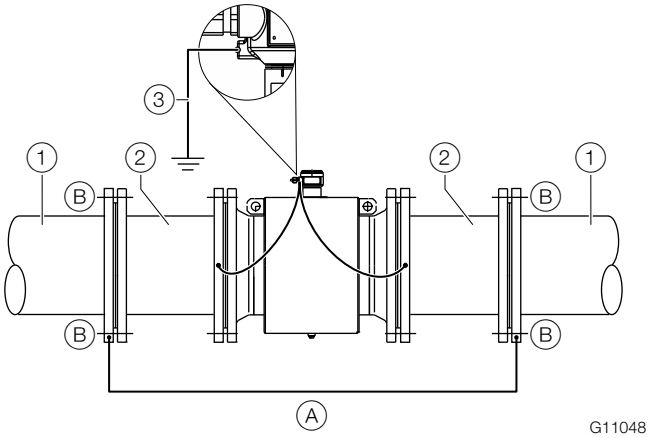


Fig. 37: Flowmeter sensor with functional earth
(A) Connecting line for corrosion protection potential[1] (B) Insulated screw bolts without grounding rings
(1) Insulated pipe (2) Bare metal pipe (3) Functional earth

1) ≥ 4 mm^2 Cu, not included in the delivery, to be provided onsite.

This mixed system has an insulated pipeline with corrosion protection potential and an uninsulated bar metal pipe (L = 1/4 x flowmeter sensor size) with functional earth potential upstream and downstream of the flowmeter sensor.
The Fig. 37 shows the preferred installation for cathodic corrosion protection systems.

4.7 Electrical connections

⚠ 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.

4.7.1 Connecting the power supply

i NOTICE

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

The power supply is connected to terminal L (phase), N (neutral), or 1+, 2-, and PE, as stated on the name plate.
A circuit breaker with a maximum rated current of 16 A must be installed in the power supply line of the transmitter.
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 should be located near the transmitter and marked as being associated with the device.
Connect the transmitter and sensor to functional earth.

4.7.2 Cable entries

The electrical connection is made via cable entries with a 1/2" NPT or M20 x 1.5 thread.
Devices with an M20 x 1.5 or 1/2" NPT thread are supplied 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 before commissioning using sealing plugs in accordance with the applicable local standards.

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

4.7.3 Installing the connecting cables

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.

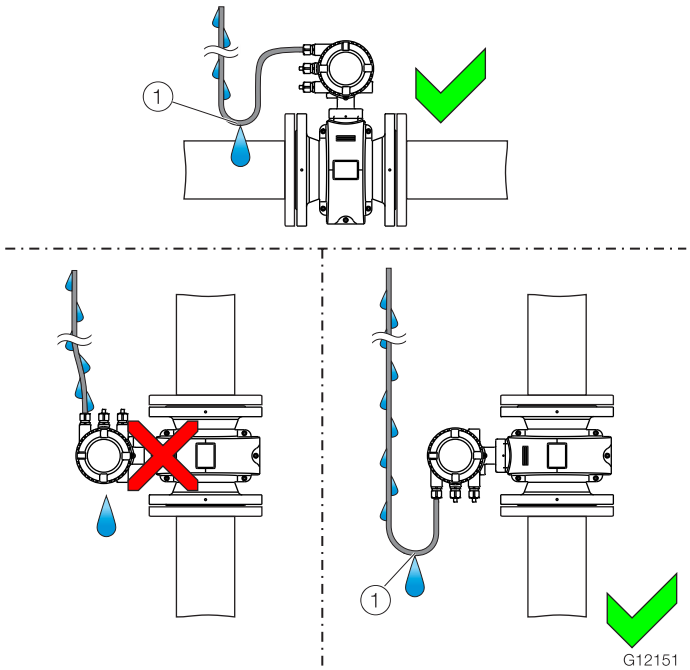


Fig. 38: Laying of the connecting cable
(1) Drip loop

Instructions how to lay the signal cable

(Remote mount design only)

Observe the following points when routing the signal cable:

— The maximum signal cable length is 200 m (565 ft).

— Avoid routing the cable in 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 interference, the cable contains outer shielding. This is to attach to the SE clamp.

— Do not damage the sheathing of the cable during installation.

Cable specification	
Impedance	100 ... 200 Ω
Withstand voltage	120 V
Outer diameter	6 ... 12 mm (0.24 ... 0.47 inch)
Cable design	Two wire pairs as a star-quad cable
Conductor cross-section	Length-dependent
Shielding	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 connection cable fulfills all above specifications and is suitable up to $T_{amb.}$ = 80 °C (176 °F) without limitations.

For marine applications, an appropriate certified signal cable must be used. ABB recommends the cable HELKAMA RFE-FRHF 2x2x0,75 QUAD 250V (HELKAMA order number 20522).

4.7.4 Connection using a cable conduit

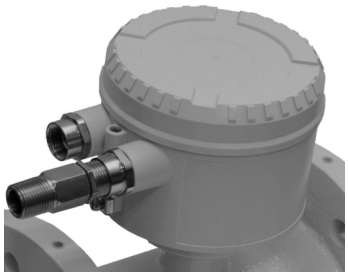


Fig. 39: Installation set for cable conduit

NOTICE

Condensate formation in terminal box

If the flowmeter sensor is connected to cable conduits, there is a possibility that humidity may get into the terminal box because of condensate formation in the cable conduit.
Ensure that the cable entry points on the terminal box are sealed.

An installation set for sealing the cable conduit is available via order number 3KXF081300L0001.

4.7.5 Connection with IP rating IP 68

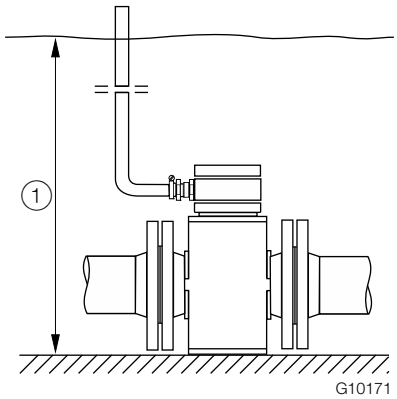


Fig. 40
(1) Maximum flooding height 5 m (16.4 ft)

For sensors with IP rating IP 68, the maximum flooding height is 5 m (16.4 ft). The supplied cable fulfills all submersion requirements.
The sensor is type-tested in accordance with EN 60529. Test conditions: 14 days at a flooding height of 5 m (16.4 ft).

Electrical connection

NOTICE

Potential adverse effect on 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.

NOTICE

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

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.

WARNING

Health hazard!

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

Follow the Material Safety Data Sheet that are provided by the manufacturer prior to starting any preparations.

Hazard warnings:

— R20: Harmful by inhalation.
— R36 / 37 / 38: Irritating to eyes, respiratory system and skin.
— R42 / 43: May cause sensitization by inhalation and skin contact.

Safety advice:

— S23: Do not breathe gas/fumes/vapor/spray.
— S24: Avoid contact with skin.
— S37: Wear suitable gloves
— S63: In case of accident by inhalation: remove casualty to fresh air and keep at rest.

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 Fig. 41).
— Prevent the two-component potting compound from penetrating the cable conduit if an NPT 1/2" installation is used.

Procedure

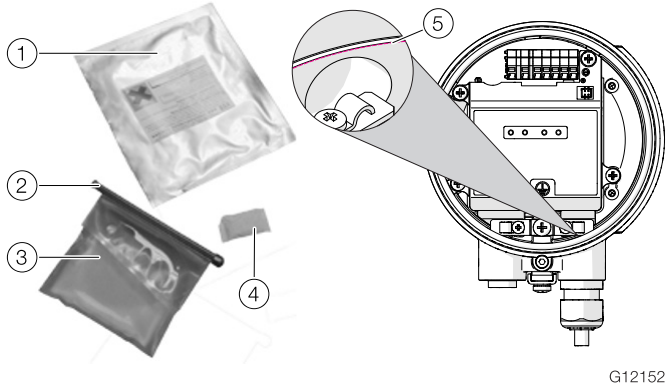


Fig. 41
(1) Packing bag (2) Connection clamp (3) Two-component potting compound (4) Drying bag (5) Maximum filling level

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.

4.7.6 Electrical connection

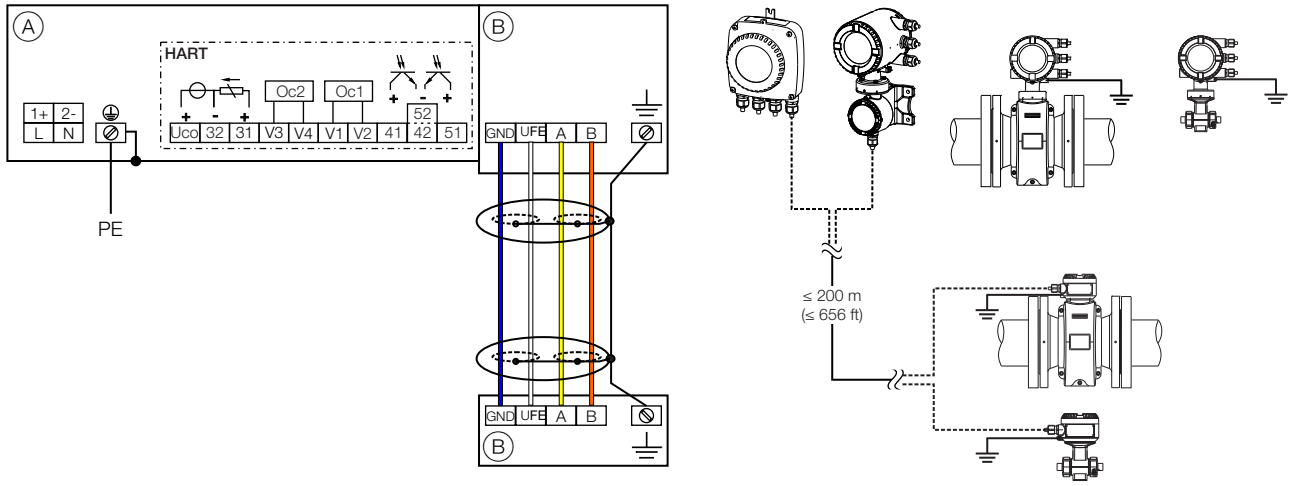


Fig. 42: Electrical connections
(A) Connections for power supply and inputs / outputs (B) Connections for signal cable (remote mount design only)

NOTICE

For detailed information about grounding the transmitter and the sensor, please refer to chapter 'Grounding the flowmeter sensor' on page 21!

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	Active 4 ... 20 mA current output / HART or
31 / 32	Passive 4 ... 20 mA current output / HART
41 / 42	Passive digital output DO1
51 / 52	Passive digital output DO2
V1 / V2 V3 / V4	Plug-in card, slot Oc1 Plug-in card, slot Oc2 For details, see chapter 'Optional plug-in cards' on page 19 .

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

4.7.7 Electrical data for inputs and outputs

Power supply

AC power supply	
Terminals	L / N
Operating voltage	100 ... 240 V AC (-15 % / +10 %), 47 ... 64 Hz
Power consumption	Smax: < 20 VA
Switch-on current	18.4 A, t < 3 ms

DC voltage supply	
Terminals	1+ / 2-
Operating voltage	16.8 ... 30 V DC
Ripple	< 5 %
Power consumption	Pmax: < 20 W
Switch-on current	21 A, t < 10 ms

HART communication

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

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

NOTICE

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

Current output Uco / 32, 31 / 32

Can be configured for outputting mass flow and volume flow.

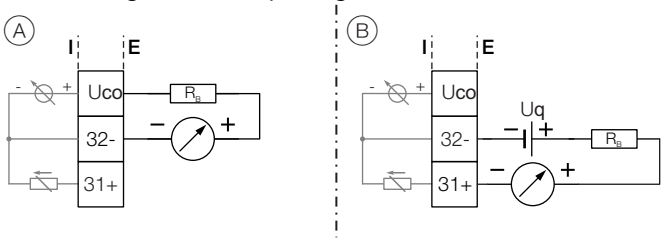
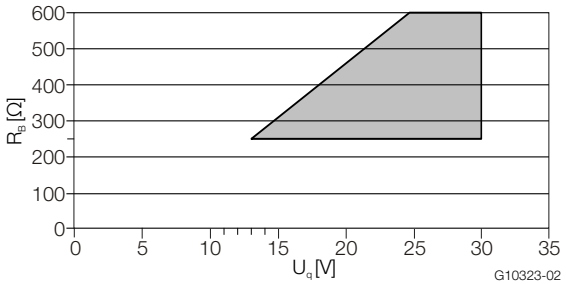


Fig. 43: (I = internal, E = external, R_B = load, U_q = Source voltage)
Ⓐ Active current output Uco / 32 Ⓑ Passive current output 31 / 32



Permissible source voltage U_q for passive outputs in relation to load resistance where Imax = 22 mA. ▒▒▒ = Permissible range

Fig. 44: Source voltage for passive outputs

Current output	**Active**	**Passive**
Terminals	Uco / 32	31 / 32
Output signal	4 … 20 mA or 4 … 12 ... 20 mA, switchable	4 … 20 mA
Load R_B	250 Ω ≤ R_B ≤ 300 Ω	250 Ω ≤ R_B ≤ 600 Ω
Source voltage U_q[1)]	—	13 V ≤ U_q ≤ 30 V
Measuring error	< 0.1 % of measured value	
Isolation	The current ouput and the digital outputs are electrically isolated from each other.	

1) The source voltage U_q depends on the load R_B and must be within the permissible range.

Digital output 41 / 42, 51 / 52

Can be configured as pulse, frequency or binary output.

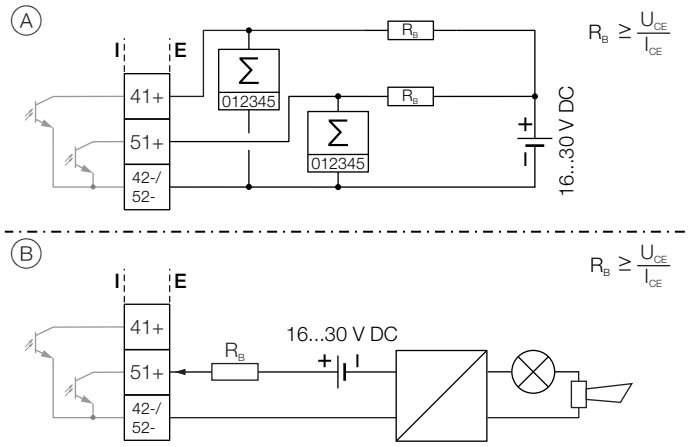


Fig. 45: (I = internal, E = external, R_B = load)
(A) Passive digital output 41 / 42, 51 / 52 as pulse or frequency output
(B) Passive digital output 51 / 52 as binary output

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
fmax	10.5 kHz
Pulse width	0.1 … 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	Configurable See chapter '"Parameter descriptions" in the operating instruction' on page 59.

NOTICE

— The Terminals 42 / 52 have a common ground. The Digital outputs 41 / 42 and 51 / 52 are not electrically isolated from each other. An electrically isolated digital output can be realized using a plug-in card.

— For mechanical counters, we recommend setting the pulse width to ≥ 30 ms and a maximum frequency of f_{max} ≤ 3 kHz.

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

Up to **two additional** current outputs can be implemented via the "Passive current output (red)" plug-in card.
The plug-in card can be used in slot OC1 or in OC2.

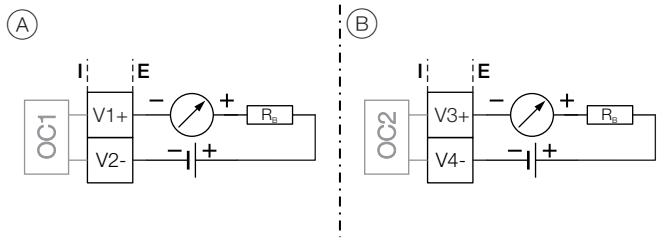
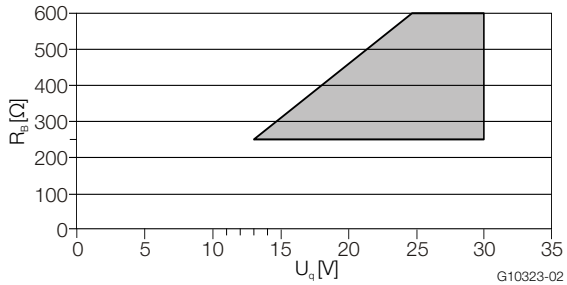


Fig. 46: (I = internal, E = external, R_B = load)
(A) Passive current output V1 / V2 (B) Passive current output V3 / V4



Permissible source voltage U_q for passive outputs in relation to load resistance where Imax = 22 mA. ▒▒▒ = Permissible range

Fig. 47: Source voltage for passive outputs

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

1) The source voltage U_q depends on the load R_B and must be within the permissible range.

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

An additional binary output can be implemented via the "Passive digital output (green)" plug-in card.

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

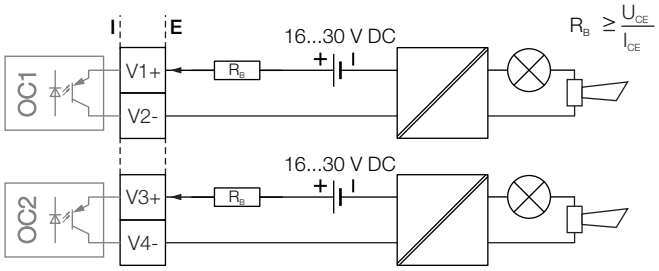


Fig. 48: Plug-in card as binary output (I = internal, E = external, R_B = load)

Binary output (passive)	
Terminals	V1 / V2, V3 / V4
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	Configurable. See chapter '"Parameter descriptions" in the operating instruction' on page 59.

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

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

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

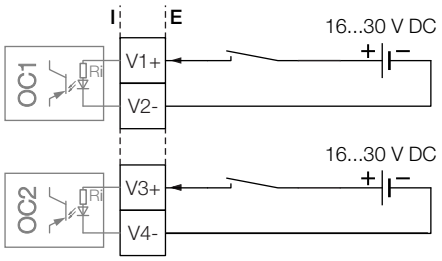


Fig. 49: Plug-in card as digital input (I = internal, E = external)

Digital input	
Terminals	V1 / V2, V3 / V4
Input "On"	16 V ≤ U_{KL} ≤ 30 V
Input "Off"	0 V ≤ U_{KL} ≤ 3 V
Internal resistance	Ri = 6.5 kΩ
Function	Configurable See chapter '"Parameter descriptions" in the operating instruction' on page 59.

24 V DC power supply V1 / V2 (plug-in card)

The power supply plug-in card allows a passive output on the transmitter to be used as an active output. See chapter 'Connection examples' on page 30.

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

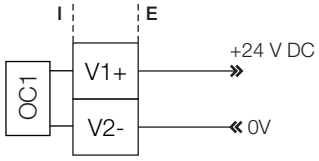


Fig. 50: (I = Internal, E = External)

24 V DC power supply	
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

NOTICE

When using the device in potentially explosive atmospheres, the power supply plug-in card must only be used to power one passive output. It must not be connected to multiple passive outputs!

4.7.8 Connection examples

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

See chapter '"Parameter descriptions" in the operating instruction' on page 59.

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.

NOTICE

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

It must not be connected to two outputs (e.g. digital output 41 / 42 and 51 / 52)!

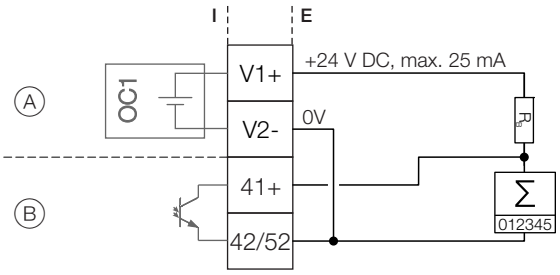


Fig. 51: Active digital output 41 / 42 (example)
(A) Plug-in card "loop power supply (blue)" in slot 1
(B) Digital output, digital output 41 / 42

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

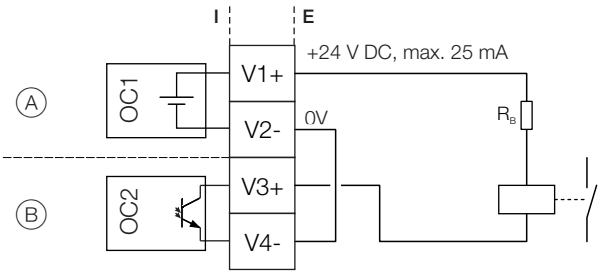


Fig. 52: Active digital output V3 / V4 (example)
(A) Plug-in card "loop power supply (blue)" in slot 1
(B) Plug-in card "digital output (green)" in slot 2

Digital output 41 / 42, 51 / 52 passive connected to a Process Control System

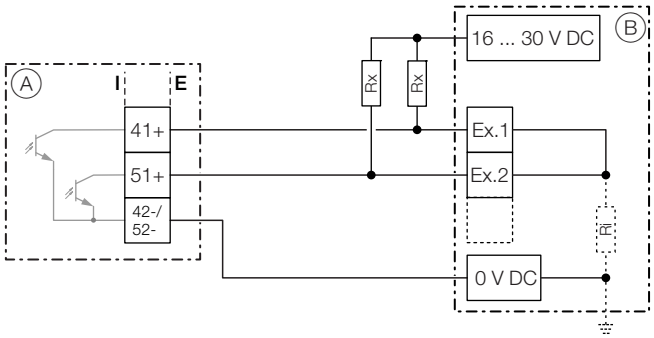


Fig. 53: Digital output 41 / 42, 51 / 52 passive connected to a Process Control System (Example)
(A) Transmitter (B) Process Control System

Legend	
Ex. 1	Input 1
Ex. 2	Input 2
R_x	Resistor limiting the current
R_i	Inner Resistor within the Process Control System

Resistor R_X limits the current of the transmitter's Optocoupler output. The max. current is 25 mA. With 24 V DC voltage R_X should be 1000 Ω / 1 W.
With „1" (high state) at the digital output of the transmitter, the Input of the Process Control System will switch from 24 V DC to 0 V (low state).

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.

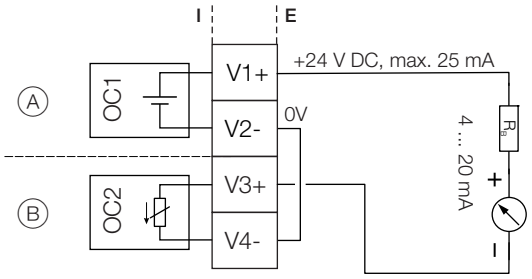


Fig. 54: Active current output V3 / V4 (example)
(A) Plug-in card "loop power supply (blue)" in slot 1
(B) Plug-in card "Passive current output (red)" in slot 2

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.

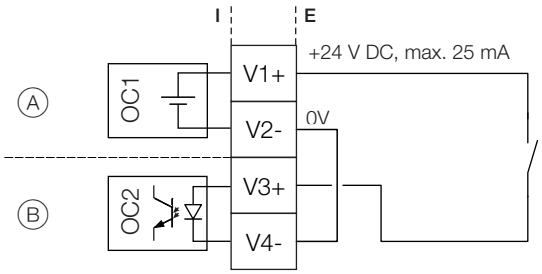


Fig. 55: Active digital input V3 / V4 (example)
(A) Plug-in card "loop power supply (blue)" in slot 1
(B) Plug-in card "passive digital input (yellow)" in slot 2

4.7.9 Connection to integral mount design

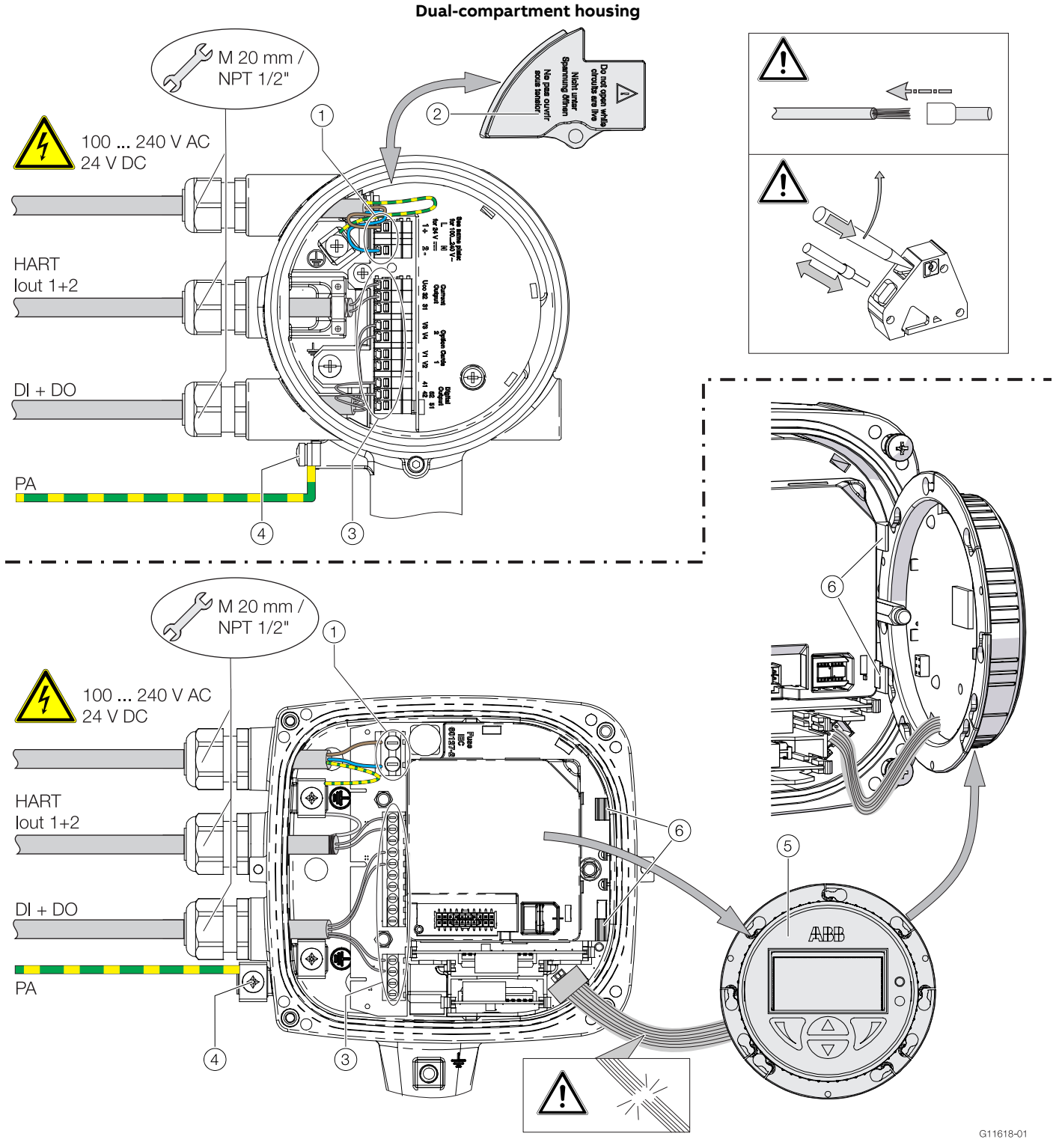


Fig. 56: Connection to integral mount design (example)
(1) Terminals for power supply (2) Cover for power supply terminals (3) Terminals for inputs and outputs (4) Terminal for potential equalization (5) LCD display (6) Holder for LCD display (parking position)

NOTICE

If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class.
Follow the instructions in chapter ‘Opening and closing the housing’ on page 16 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 diagram. 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 suitable plugs.

4.7.10 Connection to remote mount design

Transmitter

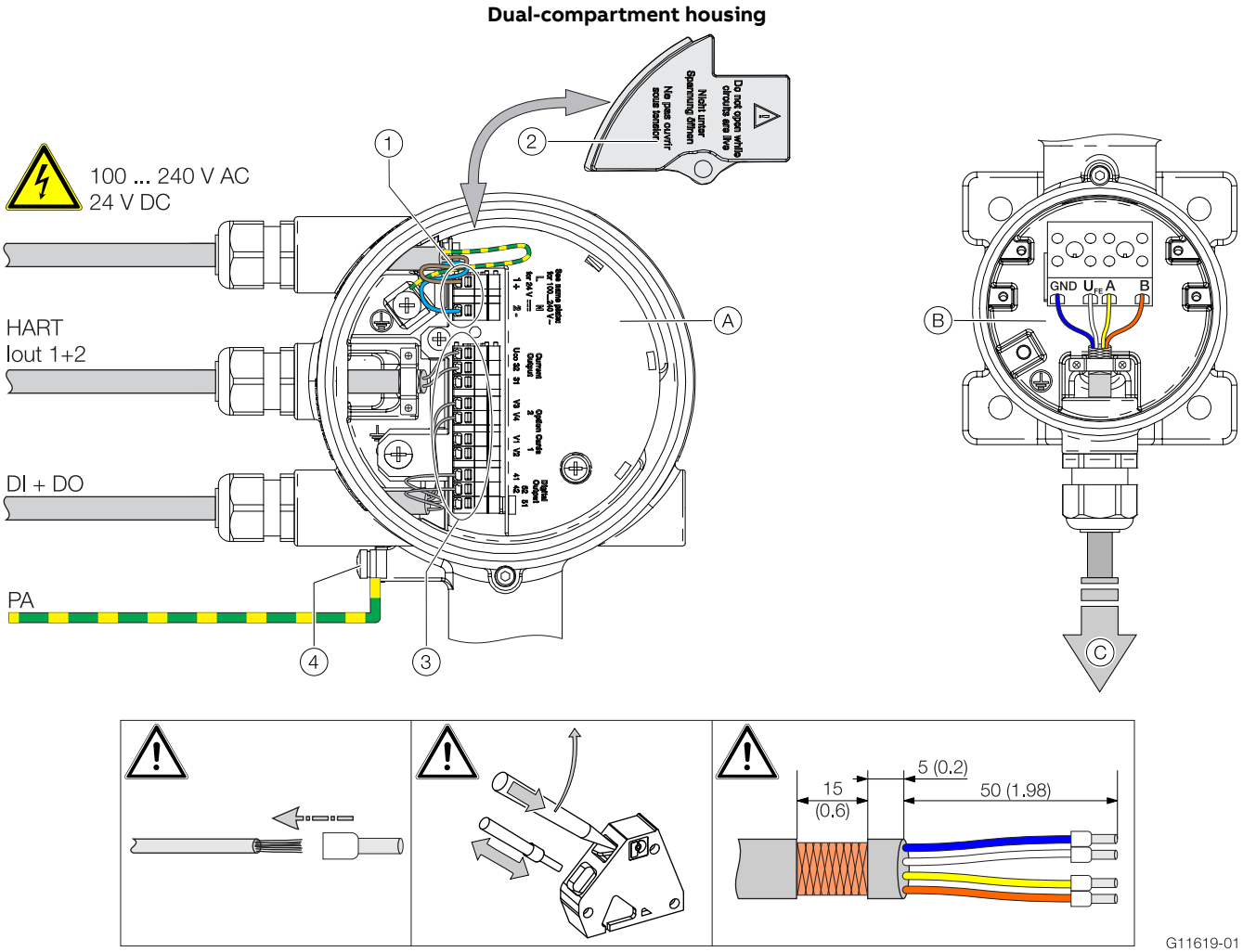


Fig. 57: Connection to transmitter in remote mount design (example, dimensions in mm (inch))
(A) Upper terminal compartment (backside) (B) Lower terminal compartment (C) Signal cable to flowmeter sensor
(1) Terminals for power supply (2) Cover for power supply terminals (3) Terminal for signal cable (4) Terminals for inputs and outputs
(5) Terminal for potential equalization

Single-compartment housing

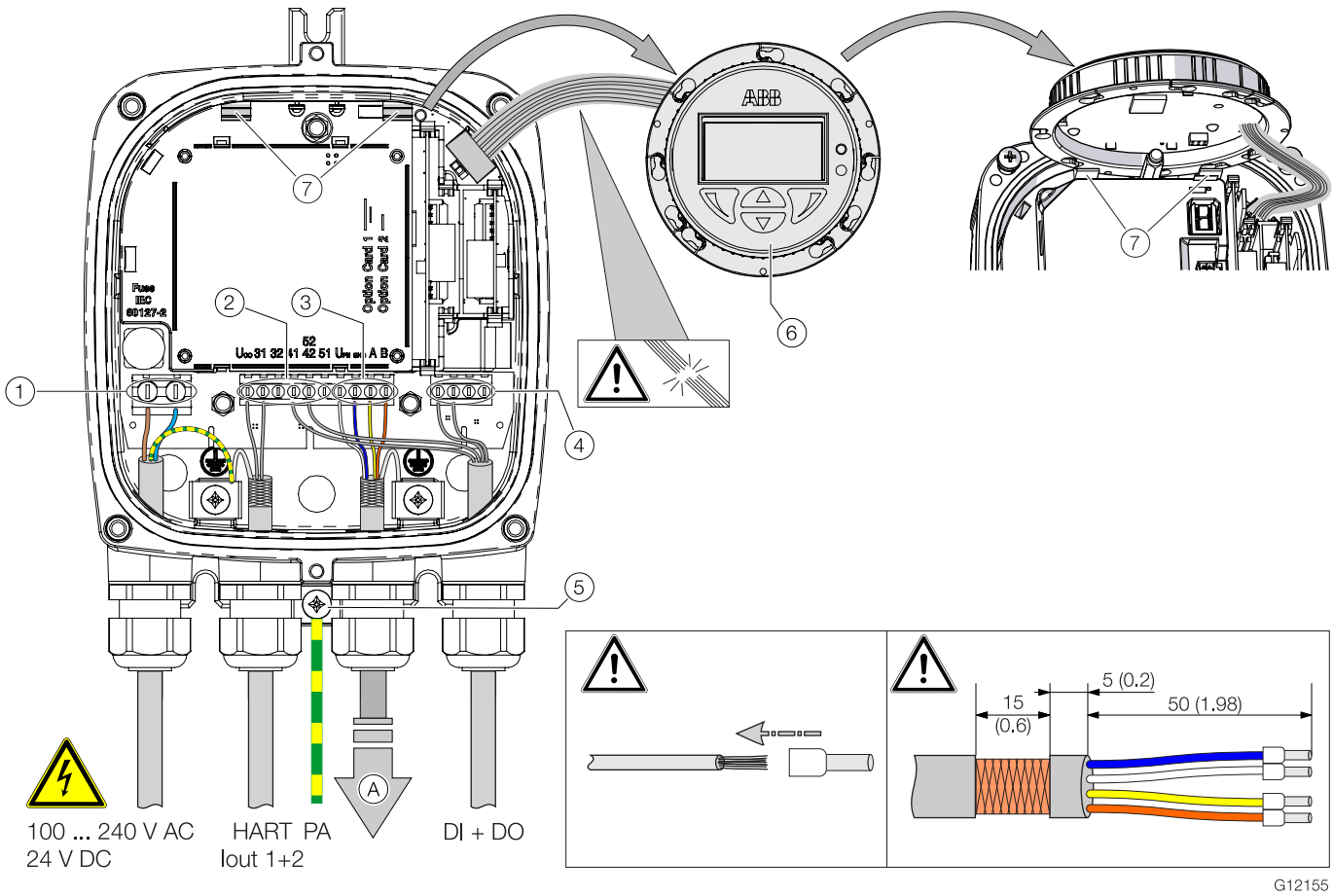
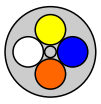
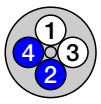


Fig. 58: Connection to transmitter in remote mount design (example, dimensions in mm (inch))
(A) Signal cable to flowmeter sensor
(1) Terminals for power supply (2) Terminals for inputs and outputs (basic device) (3) Terminal for signal cable (4) Terminals for inputs and outputs (plug-in modules) (5) Terminal for potential equalization (6) LCD display (7) Holder for LCD display (parking position)

NOTICE

If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class.
Follow the instructions in chapter ‘Opening and closing the housing’ on page 16 to open and close the housing safely.

Terminal	ABB signal cable 3KQZ407123U0100	HELKAMA signal cable 20522
	 G11748a	 G11748b
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.

Flowmeter sensor

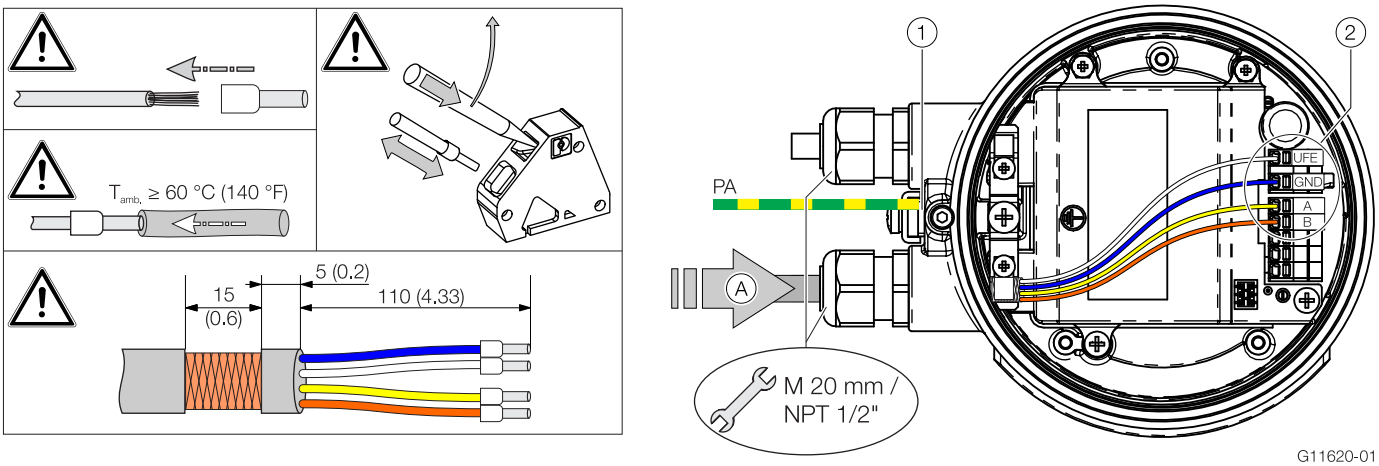
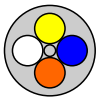
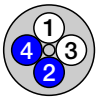


Fig. 59: Connection to sensor in remote mount design (example)
(A) Signal cable from Transmitter
(1) Terminal for potential equalization (2) Terminals for signal cable

NOTICE

If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class.
Follow the instructions in chapter ‘Opening and closing the housing’ on page 16 to open and close the housing safely.

Terminal	ABB signal cable 3KQZ407123U0100	HELKAMA signal cable 20522
	 G11748a	 G11748b
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 diagram. If present, connect the cable shielding to the earthing clamp provided.
- Use wire end ferrules when connecting.
- At $T_{amb.}$ ≥ 60 °C (140 °F) the cable leads within the connection box of the sensor have to be insulated with supplied silicon tubes.
- Close unused cable entries using suitable plugs.

5 Commissioning

5.1 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 abrasive measuring medium may result in damage to the wetted parts of the flowmeter sensor. As a result, pressurized measuring medium may escape prematurely. Due to wear on the flange seal or process connection gaskets (e.g., threaded pipe connections, Tri-Clamp, etc.), a pressurized measuring medium may escape.
When using internal flat gaskets, these can become embrittled through CIP/SIP processes.
If there is a chance that safe operation is no longer possible, take the device out of operation and secure it against unintended startup.

5.2 Hardware settings

5.2.1 Dual-compartment housing

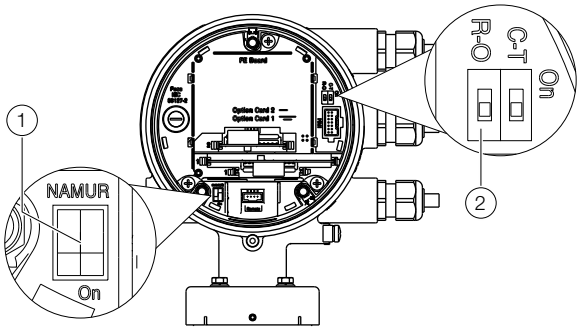


Fig. 60: Position of DIP switches
① DIP switch, NAMUR ② DIP switch, write protection

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

i NOTICE

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

Position	Function
On	Write protection active
Off	Write protection deactivated.

Configuration for 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.

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

5.2.2 Single-compartment housing

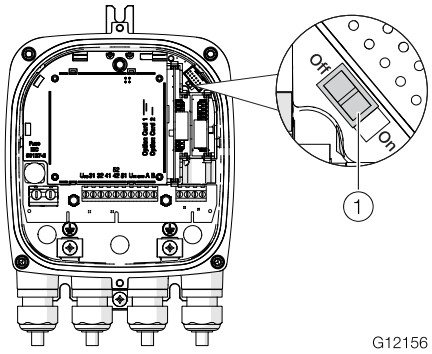


Fig. 61: Position of DIP switch
(1) DIP switch, write protection

The DIP switch is used to configure specific hardware functions. The power supply to the transmitter must be briefly interrupted or an device reset have to be performed 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.

NOTICE

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

Position	Function
On	Write protection active
Off	Write protection deactivated.

Configuration for digital outputs V1 / V2 or V3 / V4

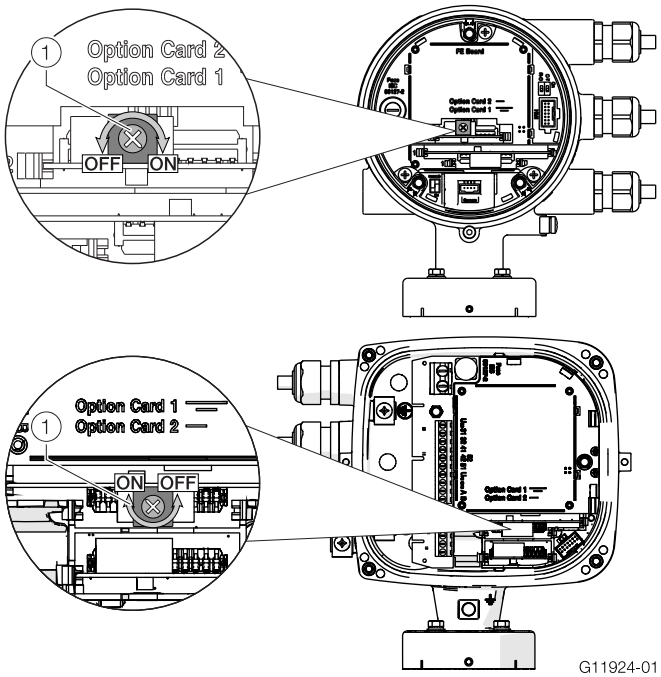


Fig. 62: Position of rotary switch on the plug-in card
(1) NAMUR rotary switch

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.

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

5.3 Checks prior to commissioning

The following points must be checked before commissioning the device:

- The wiring must have been completed as described in the chapter ‘Electrical connections’ on page 24.
- The correct grounding of the sensor.
- The ambient conditions must meet the requirements set out in the technical data.
- The power supply must meet the requirements set out on the identification plate.

5.4 Parameterization of the device

The ProcessMaster FEP630, HygienicMaster FEH630 can be commissioned and operated via the integrated LCD indicator (option, see chapter ‘Parameterization via the "Easy Setup" menu function’ on page 41).

Alternatively, the ProcessMaster FEP630, HygienicMaster FEH630 can also be commissioned and operated via ABB Asset Vision Basic (FEx61x DTM).

Flowmeter without display operated through a hot pluggable display

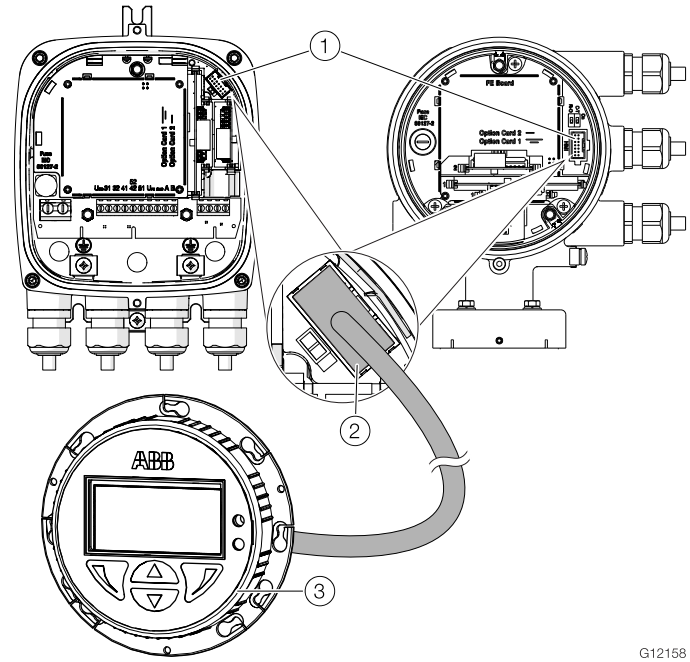


Fig. 63: Optional LCD display
(1) Local operating interface (2) Connector plug for LCD display (3) LCD display

The “non display” version of the device can be parameterized using a display which is available as an accessory to the flowmeter.

5.4.1 Parameterization via the local operating interface

⚠ DANGER

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

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

A PC / notebook and the USB interface cable are required to configure the device via the device's local operating interface. In conjunction with the HART-DTM and the software "ABB AssetVision" available at www.abb.com/flow, all parameters can also be set without a fieldbus connection.

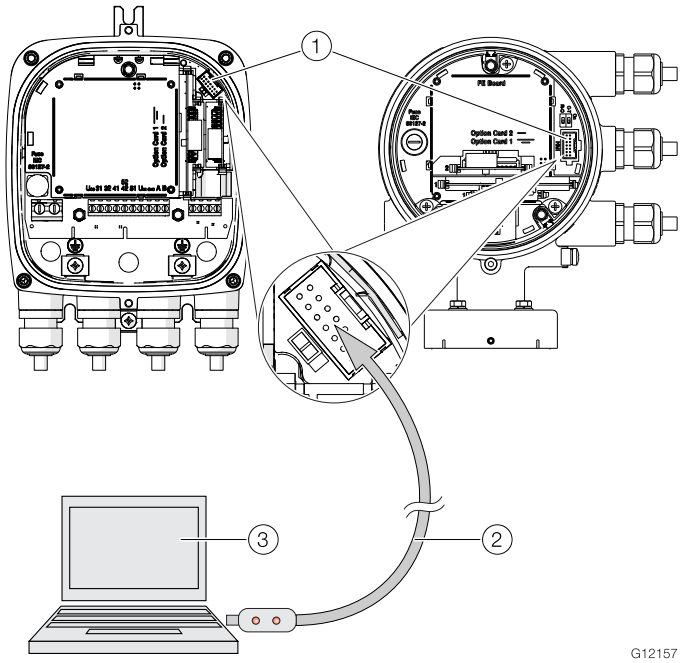


Fig. 64: Connection to the local operating interface
(1) Local operating interface (2) USB interface cable (3) PC / notebook

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.

5.4.2 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.
All parameters can also be set without a HART connection, using the HART DTM available at www.abb.com / flow and the "ABB AssetVision" software.

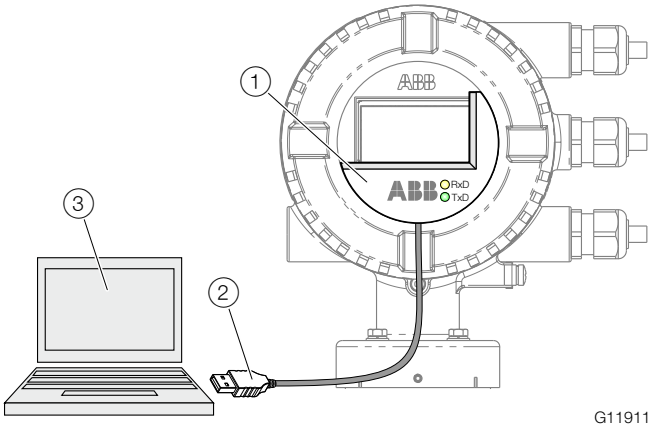


Fig. 65: Infrared service port adapter on transmitter (example)
(1) Infrared service port adapter (2) USB interface cable
(3) PC / notebook running ABB AssetVision and HART DTM

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.

5.4.3 Parameterization via HART

Configuration via the HART interface on the device requires a PC / notebook and a suitable HART modem.
All parameters can also be set via the HART protocol, using the HART DTM available at www.abb.com / flow and the "ABB AssetVision" software.

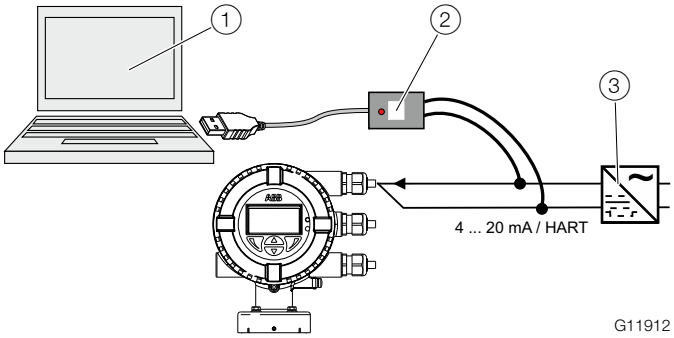


Fig. 66: HART modem on transmitter (example)
(1) PC / notebook running ABB AssetVision and HART DTM
(2) HART modem (3) Power supply unit

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

5.5 Factory settings

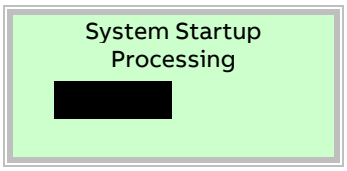
The device can be factory parameterized to customer specifications upon request. If no customer information is available, the device is delivered with factory settings.

Parameter	Factory setting
Qv Max 1	Q_{max}DN (see table in chapter 'Measuring range table' on page 44)
Sensor Tag	None
TX Location TAG	None
Unit Volumeflow Qv	l/min
Unit Volume Tot.	l (liter)
Pulses per Unit	1
Pulse Width	100 ms
Damping	1 s
Digital output 41 / 42	Impulse für 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 flowrate > 20.5 mA	Off
Low Flow Cut Off	1 %
EPD Alarm	Off

5.6 Switching on the power supply

— Switch on the power supply.

The LCD display shows the following display during the startup process:

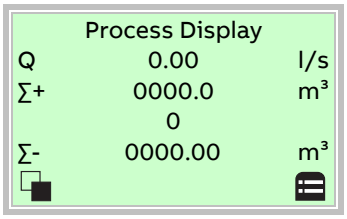


The process display is displayed after the startup process.

5.7 Parameterization via the "Easy Setup" menu function

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

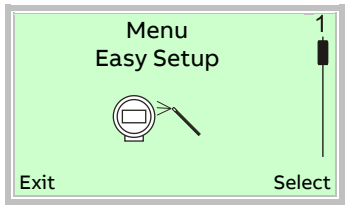
The following section describes parameterization via the "Easy Setup" menu function.



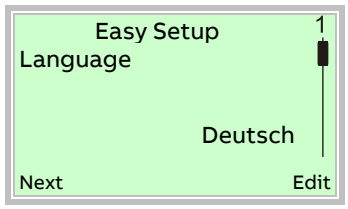
1. Use to switch to the configuration level.

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

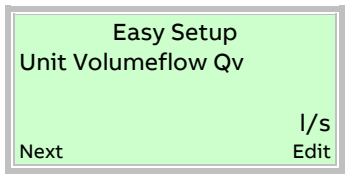
4. Use to confirm the password. A password is not available as factory default; you can continue without entering a password.



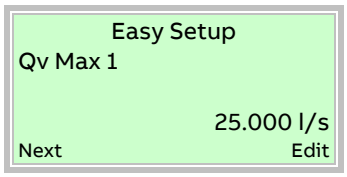
5. Use / to select "Easy Setup".
6. Confirm the selection with .



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



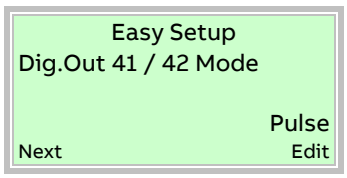
10. Use to call up the edit mode.
11. Use / to select the desired unit for the volume flow.
12. Confirm the selection with .



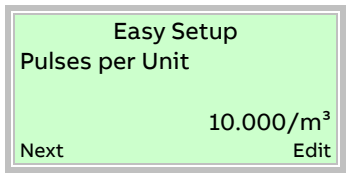
13. Use to call up the edit mode.
14. Use / to select the desired upper range value.
15. Confirm the selection with .

The device is factory calibrated to the flow range end value $Q_{max}DN$, unless other customer information is available. The ideal flow range end values are approximately 2 ... 3 m/s (0.2 ... 0.3 x $Q_{max}DN$).
The possible flow range end values are shown in the table in chapter ‘Measuring range table’ on page 44 .

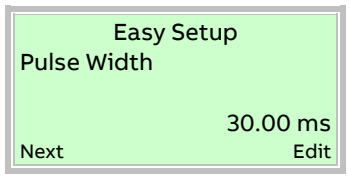
16. Use to call up the edit mode.
17. Use / to select the desired unit for the volume totalizer.
18. Confirm the selection with .



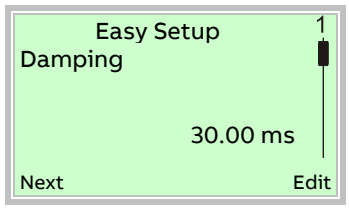
19. Use to call up the edit mode.
20. Use / to select the desired operating mode (Off, Logic, Pulse, Frequency) for the digital output.
21. Confirm the selection with .



22. Use to call up the edit mode.
23. Use / to set the desired value.
24. Confirm the selection with .

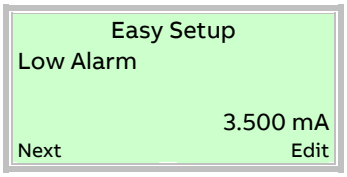


25. Use to call up the edit mode.
26. Use / to set the desired pulse width.
27. Confirm the selection with .

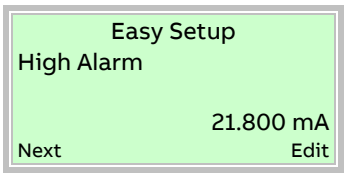


28. Use to call up the edit mode.
29. Use / to set the damping for the volume flow.
30. Confirm the selection with .

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 alarm current for "Low Alarm".
36. Confirm the selection with .



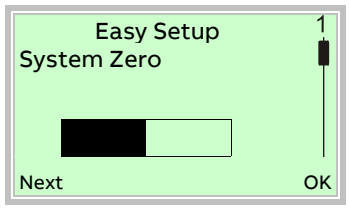
37. Use to call up the edit mode.
38. Use / to set the alarm current for "High Alarm".
39. Confirm the selection with .

Zero point adjustment of the flowmeter

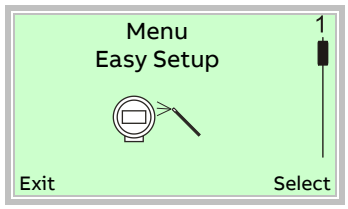
NOTICE

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

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



— Use to start automatic balancing 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.

5.8 Measuring range table

The flow range end value can be set between 0.02 x Q_{max}DN and 2 x Q_{max}DN.

Nominal diameter		Minimum flow range end value	Q_{max}DN	Maximum flow range end value
DN	inch	0.02 x Q_{max}DN (≈ 0.2 m/s)	0 … ≈ 10 m/s	2 x Q_{max}DN (≈ 20 m/s)
1	1/25	0.0012 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)
1600	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)

6 Operation

6.1 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 abrasive measuring medium may result in damage to the wetted parts of the flowmeter sensor. As a result, pressurized measuring medium may escape prematurely. Due to wear on the flange seal or process connection gaskets (e.g., threaded pipe connections, Tri-Clamp, etc.), a pressurized measuring medium may escape.

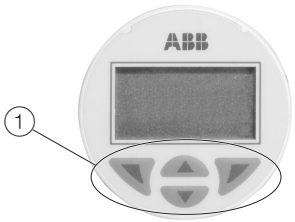
When using internal flat gaskets, these can become embrittled through CIP/SIP processes.

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

6.2 Menu navigation

NOTICE

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



M10145-01

Fig. 67: LCD display
(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

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

NOTICE

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.

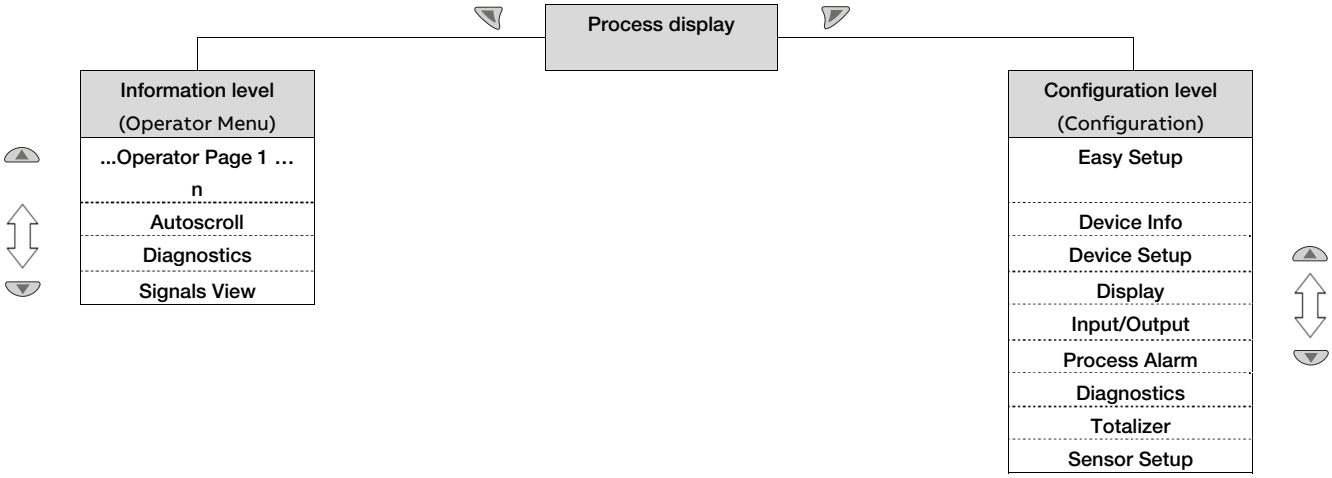
Different functions can be assigned to the ◥ and ◢ operating buttons. The function (5) that is currently assigned to them is shown on the LCD display.

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

6.3 Menu levels



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

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

Configuration level (Configuration)
The configuration level contains all the parameters required for device commissioning and configuration. The device configuration can be changed on this level. For detailed information on the parameters, see chapter "Parameter descriptions" in the operating instruction.

6.3.1 Process display

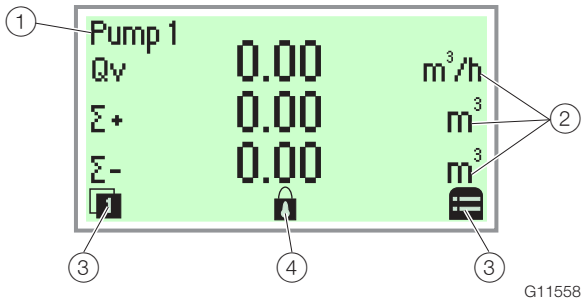


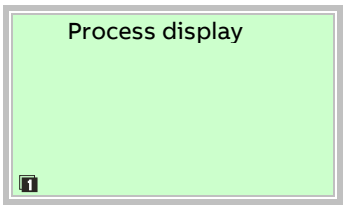
Fig. 68: Process display (example)
(1) Measuring point tag (2) Current process values (3) "Button function" icon (4) "Parameterization protected" icon

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

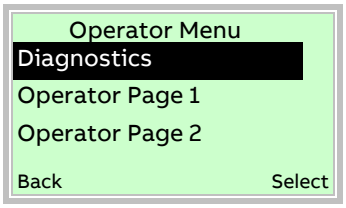
Symbol	Description
/	Call up information level. When Autoscroll mode is activated, the - icon appears here and the operator pages are automatically displayed one after the other.
	Call up configuration level.
	The device is protected against changes of the parameter settings.

6.3.2 Switching to the information level (operator menu)

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



1. Open the Operator Menu using .

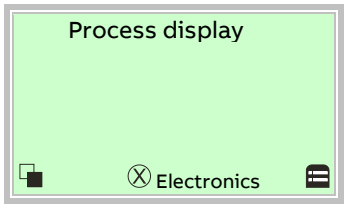


2. Select the desired submenu using / .
3. Confirm the selection with .

Menu	Description
… / Operator Menu	
Diagnostics	Selection of sub-menu "Diagnostics"; see also chapter 'Error messages on the LCD display' on page 48 .
Operator Page 1 … 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).

6.3.3 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.

NOTICE

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

6.3.4 Switching to the configuration level (parameterization)

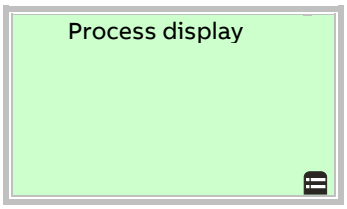
NOTICE

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

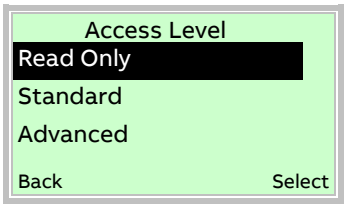
NOTICE

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

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



1. Use ◤ to switch to the configuration level.



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

NOTICE

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.

Access Level	Description
Read Only	All parameters are locked. Parameters are read only and cannot be modified.
Standard	All the parameters can be altered. The Customer could configure a password to lock the access to whole device parameters.
Service	The Customer Service has access to the Service menu. In case a Standard password is set than Service level is not accessible with Standard log-in.

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

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

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

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

6.4 Extended diagnostic functions

NOTICE

- The extended diagnostic functions are available for ProcessMaster FEP630 and HygienicMaster FEH630 only.
- The "Partial Filling Detector" function is **not** available for HygienicMaster FEH630.
- To facilitate initial start-up, the extended diagnostic functions are deactivated (factory default).
- Each diagnostic function (e.g. Gas Bubble Detector or Electrode Coating) 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.

6.4.1 Detection of partial filling

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

Pre-requisites using the functionality:

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

Installation conditions:

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

6.4.2 Detection of gas bubbles

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

Pre-requisites using the functionality:

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

Installation conditions:

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

7 Maintenance

7.1 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 and any adjacent lines or containers.
— Check whether hazardous materials have been used as materials to be measured before opening the device. Residual amounts of hazardous 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:

— the pressure-carrying walls / lining of the pressure device
— the measurement-related function
— the leak tightness
— the wear (corrosion)

NOTICE

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

8 Specification

NOTICE

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

8.1 Permitted pipe vibration

In accordance with EN 60068-2-6.

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

— Maximum deflection: 0.15 mm (0.006 inch) in the 10 ... 58 Hz range
— Maximum acceleration: 2 g, in the 58 ... 150 Hz range

8.2 ProcessMaster - Temperature data

The temperature range offered depends on a number of different factors.

These factors include the measuring medium temperature T_{medium}, the ambient temperature $T_{amb.}$, the operating pressure P_{medium}, the liner material and the approvals for the explosion protection.

Storage temperature range

-40 ... 70 °C (-40 ... 158 °F)

8.2.1 Maximum permissible cleaning temperature

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

— The specified cleaning temperature applies for a maximum ambient temperature of 25 °C (77 °F).
If the ambient temperature is > 25 °C (> 77 °F), the difference to the actual ambient temperature must be subtracted from the maximum cleaning temperature.
— The specified cleaning temperature may be applied for a maximum of 60 minutes.

8.2.2 Ambient temperature as a function of measuring medium temperature

Integral mount design

Standard flowmeter sensor design

Liner material	Flange material	Ambient temperature range ($T_{amb.}$)		Measuring medium temperature range (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)[1]	80 °C (176 °F)[1]
Hard rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)	-15 °C (5 °F)	85 °C (185 °F)
				-5 °C (23 °F)[1]	80 °C (176 °F)[1]
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)[2]	45 °C (113 °F)		130 °C (266 °F)
Thick PTFE[3]	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[3]	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-25 °C (-13 °F)	90 °C (194 °F)
		-40 °C (-40 °F)[2]	45 °C (113 °F)		130 °C (266 °F)
PFA[3]	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[3]	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-25 °C (-13 °F)	90 °C (194 °F)
		-40 °C (-40 °F)[2]	45 °C (113 °F)		130 °C (266 °F)
ETFE[3]	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[3]	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-25 °C (-13 °F)	90 °C (194 °F)
		-40 °C (-40 °F)[2]	45 °C (113 °F)		130 °C (266 °F)
Linatex[1]	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	70 °C (158 °F)
Linatex[1]	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)

High-temperature flowmeter sensor design[3]

Liner material	Flange material	Ambient temperature range ($T_{amb.}$)		Measuring medium temperature range (T_{medium})	
		Minimum	Maximum	Minimum	Maximum
Thick PTFE[3]	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	180 °C (356 °F)
Thick PTFE[3]	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-20 °C (-4 °F)	180 °C (356 °F)
		-40 °C (-40 °F)[2]			
PFA[3]	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	180 °C (356 °F)
PFA[3]	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-20 °C (-4 °F)	180 °C (356 °F)
		-40 °C (-40 °F)[2]			
ETFE[3]	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	130 °C (266 °F)
ETFE[3]	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-20 °C (-4 °F)	130 °C (266 °F)
		-40 °C (-40 °F)[2]			

1) For China production site only.
2) For low-temperature version only (option).
3) For design level "A" only.

Remote mount design

Standard flowmeter sensor design

Liner material	Flange material	Ambient temperature range ($T_{amb.}$)		Measuring medium temperature range (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)[1]	80 °C (176 °F)[1]
Hard rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)	-15 °C (5 °F)	85 °C (185 °F)
				-5 °C (23 °F)[1]	80 °C (176 °F)[1]
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) -40 °C (-40 °F)[2]	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)
Thick PTFE[3]	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	130 °C (266 °F)
Thick PTFE[3]	Stainless steel	-25 °C (-13 °F) -40 °C (-40 °F)[2]	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)
PFA[3]	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	130 °C (266 °F)
PFA[3]	Stainless steel	-25 °C (-13 °F) -40 °C (-40 °F)[2]	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)
ETFE[3]	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	130 °C (266 °F)
ETFE[3]	Stainless steel	-25 °C (-13 °F)	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)
Linatex[1]	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	70 °C (158 °F)
Linatex[1]	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)

High-temperature flowmeter sensor design[3]

Liner material	Flange material	Ambient temperature range ($T_{amb.}$)		Measuring medium temperature range (T_{medium})	
		Minimum	Maximum	Minimum	Maximum
Thick PTFE[3]	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	180 °C (356 °F)
Thick PTFE[3]	Stainless steel	-25 °C (-13 °F) -40 °C (-40 °F)[2]	60 °C (140 °F)	-25 °C (-13 °F)	180 °C (356 °F)
PFA[3]	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14 °F)	180 °C (356 °F)
PFA[3]	Stainless steel	-25 °C (-13 °F) -40 °C (-40 °F)[2]	60 °C (140 °F)	-25 °C (-13 °F)	180 °C (356 °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) -40 °C (-40 °F)[2]	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)

1) For China production site only.
2) For low-temperature version only (option).
3) For design level "A" only.

8.3 ProcessMaster - Material loads for process connections

The limits for the permissible measuring medium temperature (T_{medium}) and permissible pressure (P_{medium}) are calculated on the basis of the lining and flange material used in the device (refer to the name plate on the device).

Minimum permissible operating pressure

The following tables show the minimum permissible operating pressure (P_{medium}) depending on measuring medium temperature (T_{medium}) and the liner material.

Design level "A"

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

1) For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to the chapter 'Maximum permissible cleaning temperature' on page 50 .
2) For China production site only.

Design level "B"

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

1) For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to the chapter 'Maximum permissible cleaning temperature' on page 50 .

Liner approvals on request; please contact ABB.

Material load

Flowmeter sensor design level "A"

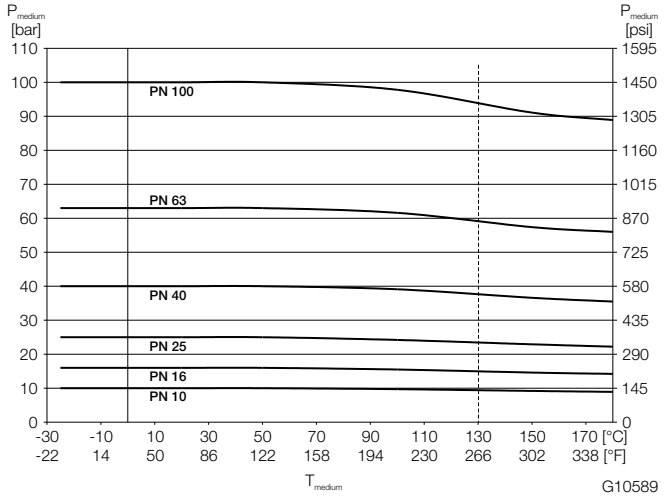


Fig. 69: DIN flange stainless steel up to DN 600 (24"); design level "A"

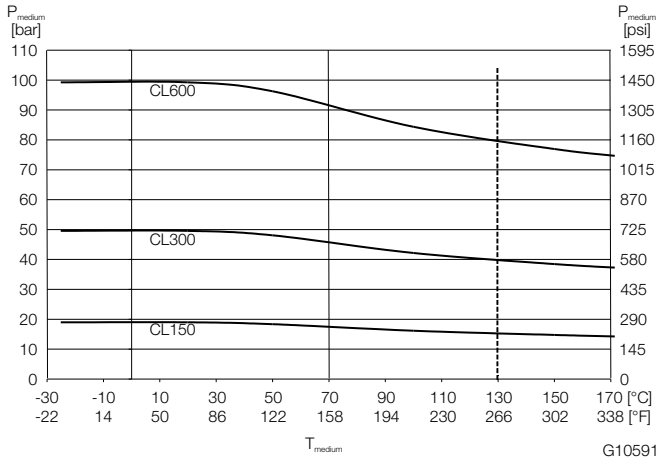


Fig. 70: ASME flange, stainless steel, up to DN 400 (16") (CL150/300) up to DN 1000 (40") (CL150); design level "A"

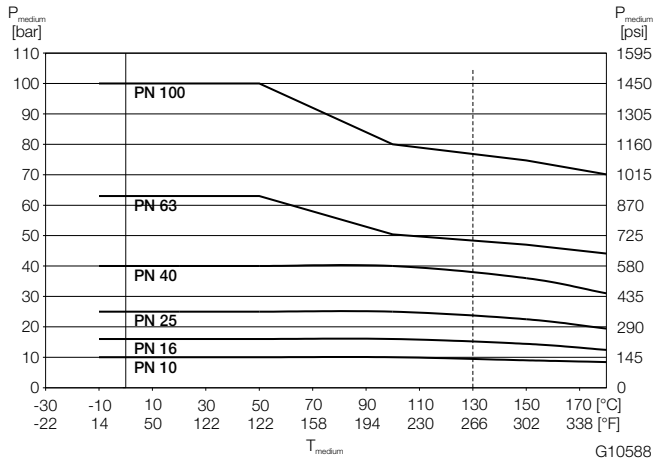


Fig. 71: DIN flange, steel, up to DN 600 (24"); design level "A"

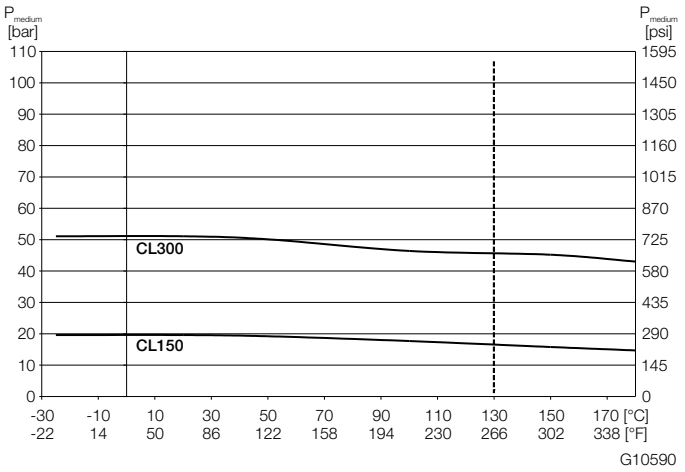


Fig. 72: ASME flange, steel, up to DN 400 (16") (CL150/300); up to DN 1000 (40") (CL150); design level "A"

JIS 10K-B2210 flange				
DN	**Material**	**PN**	**T_{medium}**	**P_{medium}**
DN 32 ... 400 (1 1/4 ... 16")	Stainless steel	10	-25 ... 180 °C (-13 ... 356 °F)	10 bar (145 psi)
DN 32 ... 400 (1 1/4 ... 16")	Steel	10	-10 ... 180 °C (14 ... 356 °F)	10 bar (145 psi)

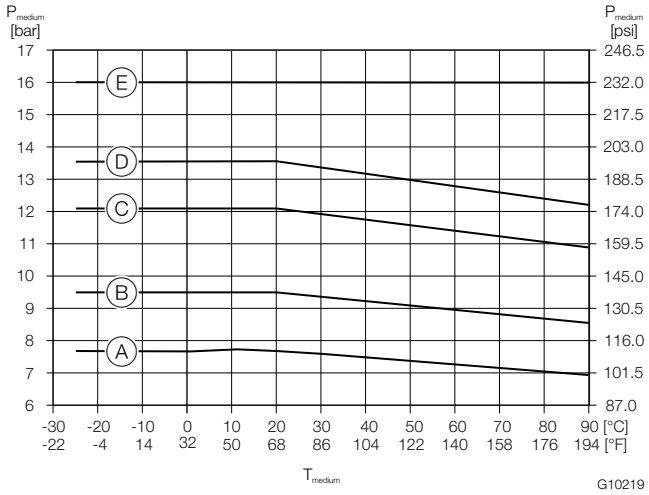


Fig. 73: DIN flange, stainless steel, DN 700 (28") up to DN 1000 (40"); design level "A"

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

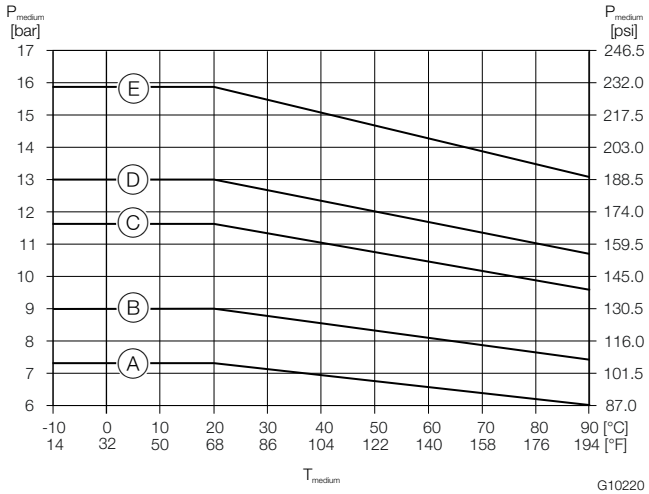


Fig. 74: DIN flange, steel, DN 700 (28") up to DN 1000 (40"); design level "A"

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

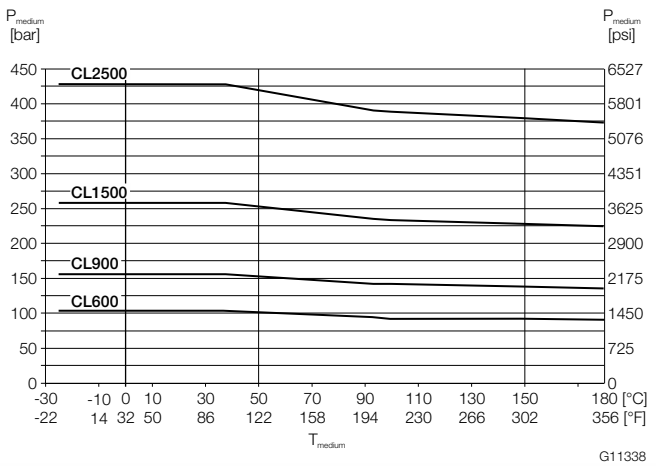


Fig. 75: ASME flange, Steel, DN 25 ... 400 (1 ... 24“); design level "A"

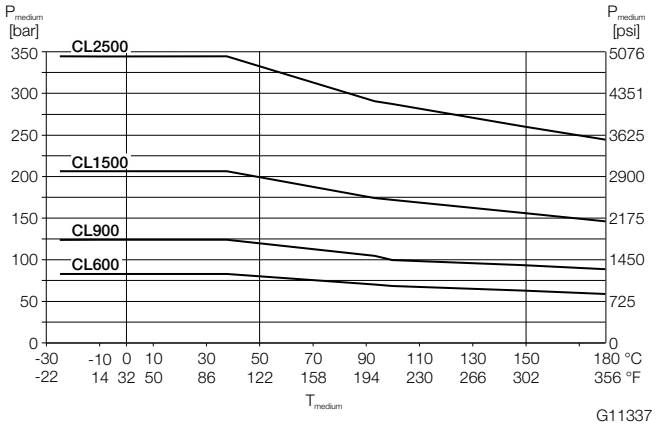


Fig. 76: ASME flange, stainless steel, DN 25 ... 400 (1 ... 24“); design level "A"

Flowmeter sensor design level “B”

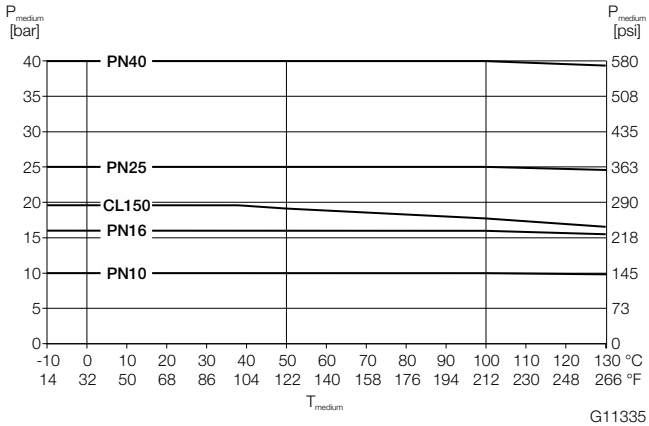


Fig. 77: Cast iron housing, DN 25 ... 600 (1 ... 24“); design level "B"

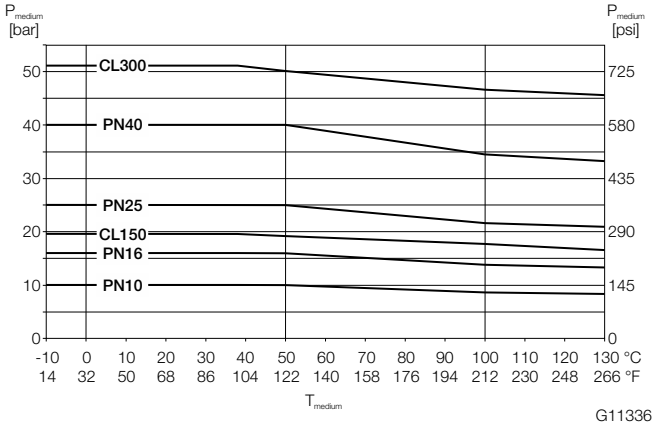


Fig. 78: Welded steel housing, DN 25 ... 600 (1 ... 24“); design level "B"

8.4 HygienicMaster - Temperature data

The temperature range offered depends on a number of different factors.
These factors include the measuring medium temperature T_{medium}, the ambient temperature $T_{amb.}$, the operating pressure P_{medium}, the liner material and the approvals for the explosion protection.

Storage temperature range
-40 ... 70 °C (-40 ... 158 °F)

8.4.1 Maximum permissible cleaning temperature

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

— The specified cleaning temperature applies for a maximum ambient temperature of 25 °C (77 °F).
If the ambient temperature is > 25 °C (> 77 °F), the difference to the actual ambient temperature must be subtracted from the maximum cleaning temperature.
— The specified cleaning temperature may be applied for a maximum of 60 minutes.

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

8.4.2 Ambient temperature as a function of measuring medium temperature

Integral and remote mount design

Standard flowmeter sensor design				
Process connection	**Ambient temperature range ($T_{amb.}$)**		**Measuring medium temperature range (T_{medium})**	
	Minimum[1)]	**Maximum**	**Minimum**	**Maximum[2)]**
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)[3)]
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)[3)]

High temperature design – from size DN 10 (3/8“)				
Process connection	**Ambient temperature range ($T_{amb.}$)**		**Measuring medium temperature range (T_{medium})**	
	Minimum[1)]	**Maximum**	**Minimum**	**Maximum**
Flange	-20 °C (-4 °F)	60 °C (140 °F)	-25 °C (-13 °F)	180 °C (356 °F)

1) There is an option for a low temperature design with minimum ambient temperature -40°C (-40°F).
2) For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to chapter ‘Maximum permissible cleaning temperature’ on page 50 .
3) For devices with nominal diameter of DN 1 ... 2 the maximum measuring medium temperature is limited to 120 °C (248 °F).

8.5 HygienicMaster - Material loads for process connections

The limits for the permissible measuring medium temperature (T_{medium}) and permissible pressure (P_{medium}) are calculated on the basis of the lining and flange material used in the device (refer to the name plate on the device).

Minimum permissible operating pressure

The following tables show the minimum permissible operating pressure (P_{medium}) depending on measuring medium temperature (T_{medium}) and the liner material.

Liner material	Nominal diameter	P_{medium} [mbar abs]	T_{medium} [1)]
PFA	DN 3 ... 100 (1/10 ... 4")	0	< 130 °C (266 °F)
PEEK	DN 1 ... 2 (1/25 ... 1/2")	0	< 120 °C (248 °F)

1) For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to the chapter 'Maximum permissible cleaning temperature' on page 57 .

Liner approvals on request, please contact ABB.

Overview – Material load

Process connection	DN	P_{medium} max.	T_{medium}
Wafer type	DN 3 ... 50 (1/10 ... 2“)	40 bar (580 psi)	-25 ... 130 °C (-13 ... 266 °F)
	DN 65 ... 100 (2 1/2 ... 4“)	16 bar (232 psi)	
Welded spuds DIN 2463, ISO 1127, DIN 11850	DN 3 ... 40 (1/10 ... 1 1/2“)	40 bar (580 psi)	-25 ... 130 °C (-13 ... 266 °F)
	DN 50, DN 80 (2“, 3“)	16 bar (232 psi)	
	DN 65, DN 100 (2 1/2“, 4“)	10 bar (145 psi)	
Welded spuds SMS 1145	DN 25, DN 40 ... 100 (1“,1,5 ... 4“)	6 bar (87 psi)	-25 ... 130 °C (-13 ... 266 °F)
Threaded pipe connection DIN 11851	DN 3 ... 40 (1/10 ... 1 1/2“)	40 bar (580 psi)	-25 ... 130 °C (-13 ... 266 °F)
	DN 50, DN 80 (2“, 3“)	16 bar (232 psi)	
	DN 65, DN 100 (2 1/2“, 4“)	10 bar (145 psi)	
Tri-Clamp DIN 32676	DN 3 ... 50 (1/10 ... 2“)	16 bar (232 psi)	-25 ... 130 °C (-13 ... 266 °F)
	DN 65 ... 100 (2 1/2 ... 4“)	10 bar (145 psi)	
Tri-Clamp ASME BPE	DN 3 ... 80 (1/10 ... 3“)	10 bar (145 psi)	-25 ... 121 °C (-13 ... 250 °F)
	DN 100 (4")	8.6 bar (124.7 psi)	
External thread ISO 228, DIN 2999	DN 3 ... 25 (1/10 ... 1“)	16 bar (232 psi)	-25 ... 130 °C (-13 ... 266 °F)
Welded spuds OD tubing	DN 3 ... 50 (1/10 ... 2“)	10 bar (145 psi)	-25 ... 130 °C (-13 ... 266 °F)
1/8" sanitary connector	DN 1 ... 2 (1/25 … 1/12“)	10 bar (145 psi)	-10 ... 120 °C (-14 ... 248 °F)

Flange devices

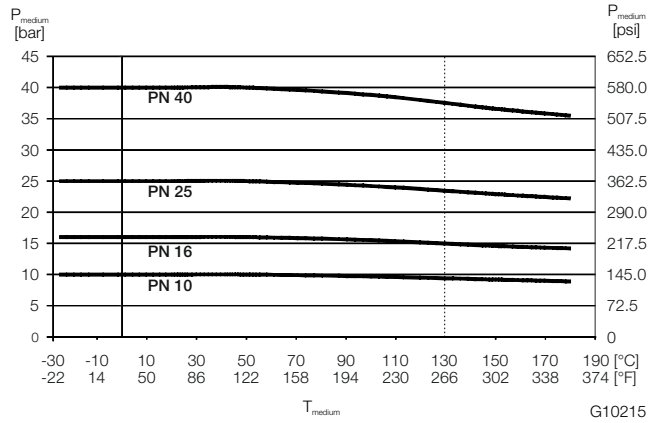


Fig. 79: DIN flange stainless steel to DN 100 (4")

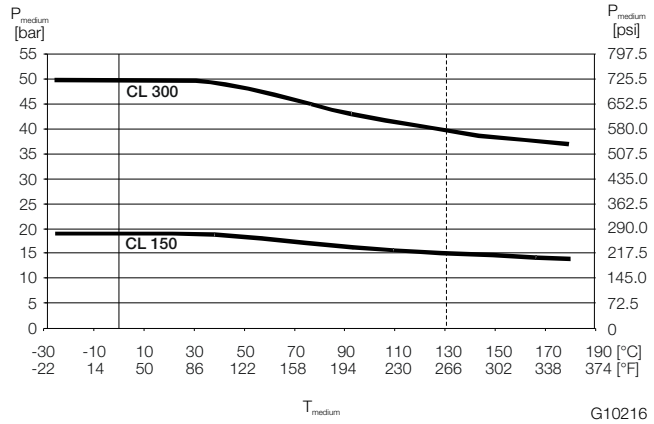


Fig. 80: ASME flange, stainless steel, up to DN 100 (4") (CL 150 / CL 300)

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

Wafer type devices

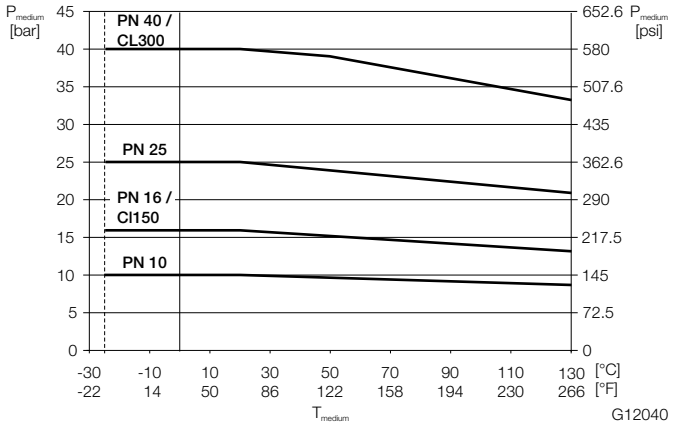


Fig. 81: Wafer type design

JIS 10K-B2210 wafer type design				
DN	**Material**	**PN**	**T_{medium}**	**P_{medium}**
DN 32 ... 100 (1 1/4 ... 4")	1.4404 1.4435 1.4301	10	-25 ... 130 °C (-13 ... 266 °F)	10 bar (145 psi)

9 Additional documents

NOTICE

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

Trademarks

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™ Hastelloy C is a trademark of Haynes International

10 Appendix

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:	E-Mail:

Device details:

Typ:	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	☐	Explosiv	☐	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

10.1 Torque information

10.1.1 Torque information for sensors designLevel A

NOTICE

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 (inch)]	Nominal pressure rating	Maximum tightening torque [Nm]					
		Hard / soft rubber		PTFE, PFA, ETFE		Ceramic carbide	
		2)	3)	2)	3)	2)	3)
DN 3 ... 10 [1]	PN40	–	–	12.43	12.43	–	–
(1/10 ... 3/8“[1])	PN63/100	–	–	12.43	12.43	–	–
	CL150	–	–	12.98	12.98	–	–
	CL300	–	–	17.38	17.38	–	–
	JIS 10K	–	–	12.43	12.43	–	–
DN 15 (1/2“)	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 (3/4“)	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“)	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 1/4“)	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
DN 40 (1 1/2“)	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 1/2“)	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

1) Connection flange DIN / EN1092-1 = DN 10 (3/8"), connection flange ASME = DN 15 (1/2").
2) Flange material: steel.
3) Flange material: stainless steel.

Nominal diameter [mm (inch)]	Nominal pressure rating	Maximum tightening torque [Nm]					
		Hard / soft rubber		PTFE, PFA, ETFE		Ceramic carbide	
		2)	3)	2)	3)	2)	3)
DN 65 (2 1/2“)	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“)	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“)	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“)	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	–	–	–	–
DN 150 (6“)	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“)	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“)	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

2) Flange material: steel.
3) Flange material: stainless steel.

Nominal diameter [mm (inch)]	Nominal pressure rating	Maximum tightening torque [Nm]					
		Hard / soft rubber		PTFE, PFA, ETFE		Ceramic carbide	
		2)	3)	2)	3)	2)	3)
DN 300 (12“)	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“)	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“)	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“)	CL150	218.6	120.5	267.3	192.3	267.3	192.3
	CL300	553.8	327.2	660.9	300	660.9	300
DN 500 (20“)	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“)	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“)	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“)	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“)	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“)	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

2) Flange material: steel.
3) Flange material: stainless steel.

Nominal diameter [mm (inch)]	Nominal pressure rating	Maximum tightening torque [Nm]					
		Hard / soft rubber		PTFE, PFA, ETFE		Ceramic carbide	
		2)	3)	2)	3)	2)	3)
DN 1000 (40“)	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“)	CL150	749.1	682.6	741.3	345.9	–	–
	CL300	2607	On request	On request	On request	–	–
DN 1200 (48“)	PN 6	363.5	On request	–	–	–	–
	PN10	705.9	On request	–	–	–	–
	PN16	1464	On request	–	–	–	–
	CL150	815.3	731.6	–	–	–	–
	CL300	3300	On request	–	–	–	–
DN 1350 (54“)	CL150	1036	983.7	–	–	–	–
	CL300	5624	On request	–	–	–	–
DN 1400 (56“)	PN 6	515	On request	–	–	–	–
	PN10	956.3	On request	–	–	–	–
	PN16	1558	On request	–	–	–	–
DN 1500 (60“)	CL150	1284	1166	–	–	–	–
	CL300	6139	On request	–	–	–	–
DN 1600 (64“)	PN 6	570.7	On request	–	–	–	–
	PN10	1215	On request	–	–	–	–
	PN16	2171	On request	–	–	–	–
DN 1800 (72“)	PN 6	708.2	On request	–	–	–	–
	PN10	1492	On request	–	–	–	–
	PN16	2398	On request	–	–	–	–
DN 2000 (80“)	PN 6	857.9	On request	–	–	–	–
	PN10	1840	On request	–	–	–	–
	PN16	2860	On request	–	–	–	–

2) Flange material: steel.
3) Flange material: stainless steel.

10.1.2 Torque information for sensors Design Level B

NOTICE

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

Nominal diameter [mm (inch)]	Nominal pressure rating	Hard / Soft rubber		PTFE	
		2) [Nm]	3) [Nm]	2) [Nm]	3) [Nm]
DN 25 (1“)	PN40	—	—	13.32	8.6
	CL150	—	—	23.98	23.98
	CL300	—	—	65.98	38.91
	JIS 10K	—	—	26.94	26.94
DN 32 (1 1/4“)	PN40	—	—	45.08	45.08
	CL150	—	—	29.44	29.44
	CL300	—	—	45.52	45.52
	JIS 10K	—	—	45.08	45.08
DN 40 (1 1/2“)	PN40	—	—	56.06	56.06
	CL150	—	—	36.12	36.12
	CL300	—	—	73.99	73.99
	JIS 10K	—	—	56.06	56.06
DN 50 (1 1/2“)	PN40	—	—	71.45	71.45
	CL150	—	—	66.22	66.22
	CL300	—	—	38.46	38.46
	JIS 10K	—	—	71.45	71.45
DN 65 (2 1/2“)	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“)	PN40	—	—	51.9	53.59
	CL150	—	—	104.6	104.6
	CL300	—	—	75.54	75.54
	JIS 10K	—	—	45.07	47.16
DN 100 (4“)	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“)	PN16	—	—	61.4	64.14
	PN40	—	—	123.7	109.6
	CL150	—	—	98.05	98.05
	CL300	—	—	139.4	139.4
DN 150 (6“)	PN16	—	—	81.23	85.08
	PN40	—	—	162.5	133.5
	CL300	—	—	111.4	111.4
DN 200 (8“)	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

2) Flange material: steel.
3) Flange material: stainless steel.

Nominal diameter [mm (inch)]	Nominal pressure rating	Hard / Soft rubber		PTFE	
		2) [Nm]	3) [Nm]	2) [Nm]	3) [Nm]
DN 250 (10“)	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“)	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“)	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“)	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“)	CL150	—	—	267.3	192.3
	CL300	—	—	660.9	300
DN 500 (20“)	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“)	PN10	—	—	238.7	149.1
	PN16	—	—	496.7	365.3
	PN25	—	—	750.7	539.2
	CL150	—	—	451.6	305.8
	CL300	—	—	1376	587.4

2) Flange material: steel.
3) Flange material: stainless steel.

Torque information for HygienicMaster with variable process connections

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

10.2 Overview parameter settings (factory default settings)

Parameter	Possible parameter settings	Factory default settings
Sensor Tag	Alphanumeric, max. 20 characters	None
Sensor Location Tag	Alphanumeric, max. 20 characters	None
Qv Max 1	Depending on nominal diameter of the flowmeter sensor.	Set to Q_{max}DN according to chapter 'Measuring range table' on page 44 .
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 Volume Tot.	m3; l; ml; hl; g; kg; t	Liter (l)
Pulses per Unit	1 ... 10000	1
Pulse Width	0,1 ... 2000 ms	100 ms
Damping	0,02 ... 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° phase shift)	Digital output 51 / 52 as binary output for 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 ... 23 mA oder Low Alarm 3.5 ... 3.6 mA	High Alarm, 21.8 mA
Current at flow > 103 % (I=20,5 mA)	Off (Current output remains at 20.5 mA), High Alarm, Low Alarm.	Off
Low flow cut-off	0 ... 10 %	1 %
Empty conduit detector	On / Off	Off

10.3 Software history

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

Device software package FEx630 (Device Firmware Package)				
Version	**Issue date**	**Type of change**	**Description**	**Order number**
00.04.00	3.2.2017	First release	–	3KXF002044U0100_00.04.00
00.04.01	27.06.2017	Bug fixing	Piston Pump Filter	3KXF002044U0100_00.04.01

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