ABB MEASUREMENT & ANALYTICS | OPERATING INSTRUCTION

ProcessMaster wafer FEM630 minimag

Electromagnetic flowmeter

The wafer flowmeter that delivers the power to solve your most demanding process applications.

Measurement made easy

—

FEM630
FET630

Introduction

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

ProcessMaster FEM630
The first choice for demanding applications in the processing industry.

Additional Information

Additional documentation on FEM630 is available for download free of charge at www.abb.com/flow.

Contents

1 Safety

General information and instructions

These instructions are an important part of the product and must be retained for future reference.

Installation, commissioning, and maintenance of the product may only be performed by trained specialist personnel who have been authorized by the plant operator accordingly. The specialist personnel must have read and understood the manual and must comply with its instructions.

For additional information or if specific problems occur that are not discussed in these instructions, contact the manufacturer. The content of these instructions is neither part of nor an amendment to any previous or existing agreement, promise or legal relationship.

Modifications and repairs to the product may only be performed if expressly permitted by these instructions.

Information and symbols on the product must be observed. These may not be removed and must be fully legible at all times. The operating company must strictly observe the applicable national regulations relating to the installation, function testing, repair and maintenance of electrical products.

Warnings

The warnings in these instructions are structured as follows:

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

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

1 ...Safety

Intended use

This device is intended for the following uses:

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

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

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

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

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

Improper use

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

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

Use in Potentially Explosive Atmospheres

Note

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

The icon on the name plate indicates the following:

Notes on data safety

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

ABB Inc. and its affiliates are not liable for damages and / or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and / or theft of data or information.

1 ...Safety

Warranty provisions

Using the device in a manner that does not fall within the scope of its intended use, disregarding this manual, using underqualified personnel, or making unauthorized alterations releases the manufacturer from liability for any resulting damage. This renders the manufacturer's warranty null and void.

Manufacturer’s address

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2 Design and function

Overview

ProcessMaster

Integral mount design
FEM631

Remote mount design
FEM632 **FET632**

1 Single-compartment transmitter housing
2 Dual-compartment transmitter housing
3 Flowmeter sensor (DN 3 to 10)
4 Flowmeter sensor (DN15 to 100)

Figure 1 Designs

Flowmeter sensor	
Model	ProcessMaster FEM631, FEM632, FET632
Housing	Integral mount design, remote mount design
Measuring accuracy for liquids	0.4 % of the measured value
Permissible measuring medium temperature Tmedium	Standard: −13 to 266 °F (−25 to 130 °C)
Minimum conductivity	> 5 µS/cm, (20 µS/cm for demineralized water)
Nominal pressure rating	ASME CL 150, CL 300
Nominal diameter	1/10“ ... 4“ (DN3 ... DN100)
Process connection	Wafer style connection
Lining material	ETFE (Tefzel)
Electrode material	Hastelloy C®, Platinum-Iridium, Tantalum
IP rating	IP65 / IP67 / IP68, NEMA 4X

Approvals	
CRN (Canadian regulatory number)	Pending
Explosion protection	FM / FMc Cl I, II, III Div. 1, CL I, II, III Div. 2
Additional approvals	At www.abb.com/flow or on request.

2 ...Design and function

Transmitter

(1) Single-compartment transmitter housing (2) Dual-compartment transmitter housing

Figure 2 Designs

Transmitter	
Model	FET632
Housing	Integral mount design, remote mount design
IP rating	IP 65 / IP 67 / NEMA 4X
Cable length	Maximum 164 ft (50m) remote mount design only
Power supply	100 to 240 V AC (−15 / +10 %) 50 / 60 Hz, 16.8 to 30 V DC
Outputs	Current output: 4 to 20 mA active or passive (can be configured on-site) Digital output 1: passive, configurable as pulse, frequency or switch output Digital output 2: passive, configurable as pulse or switch output
Additional outputs	The transmitter has two slots which can be used to insert plug-in cards to extend the outputs. The following plug-in cards are available: • Current output (passive) • Digital output (passive) • Digital input (passive): • 24 V DC power supply for active outputs • Modbus®
Communication	Standard: HART® 7.1 Option: PROFIBUS DP®/ Modbus®

Approvals	
Explosion protection	FM / cFM Cl I Div 1, Cl II Div 2
Additional approvals	At www.abb.com/flow or on request.

2 ...Design and function

Model variants

ProcessMaster is available in two product series:

- FEM610 with base functionality
- FEM630 with extended functions and options

	ProcessMaster	
Characteristics / Functions	**FEM610**	**FEM630**
Measuring accuracy 0.4 % of measured value	–	✓
0.5 % of measured value	✓	–
Explosion protection Option with approval for potentially explosive atmosphere	–	✓
Optional diagnosis functions Detecting gas bubbles, conductivity monitoring, temperature monitoring	–	✓
Grounding check With noise check functions	✓	✓
Batch functions Presetting counter, overrun correction, external start/stop, batch end contact	–	✓
Fieldbus PROFIBUS DP®, Modbus®	–	✓
Verification Optional	✓	✓

Integral mount design
For devices with an integral mount design, the transmitter and flowmeter sensor form a single mechanical unit.

Remote mount design
For devices with a remote mount design, the transmitter and flowmeter sensor are mounted in separate locations.
The electrical connection between the transmitter and the flowmeter sensor is provided by a signal cable.
A maximum signal cable length of 164 ft (50m) is possible.

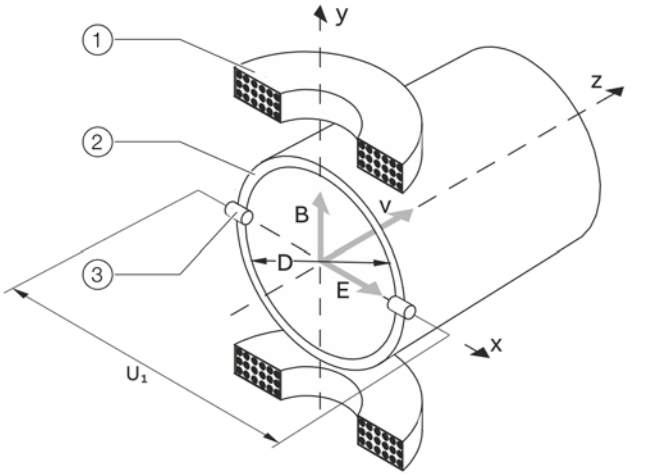
Notes on the transmitter housing
The transmitter is available in two housing designs:

- **Single-compartment housing:**
  In the single-compartment housing, the electronics chamber and the connection chamber in the transmitter are not separated from each other.
- **Dual-compartment housing:**
  In the dual-compartment housing, the electronics chamber and the connection chamber in the transmitter are separated from each other.

2 ...Design and function

Measuring principle

Measurements performed by the electromagnetic flowmeter are based on Faraday's law of induction. A voltage is generated in a conductor when it moves through a magnetic field.



(1) Magnet coil
(2) Measuring tube in electrode plane
(3) Measuring electrode

Figure 3 Electromagnetic flowmeter diagram

$U_1 \sim B \times D \times v$	$qv = \frac{D^2 \times \pi}{4} \times v$	$U_1 \sim qv$
U_1 Measuring span	v Average flow velocity	
B Magnetic induction	qv Volume flow rate	
D Electrode spacing		

With the device-relevant application of this measuring principle, a conductive measuring medium flows through a tube in which a magnetic field is generated perpendicular to the flow direction (see Figure 3).

The voltage induced in the measuring medium is tapped by two diametrically opposed electrodes. This measurement voltage is proportional to the magnetic induction, the electrode spacing and the average medium velocity v.

Taking into account that the magnetic induction and the electrode spacing are constant values results in a proportion between the measurement voltage U1 and the average medium velocity.

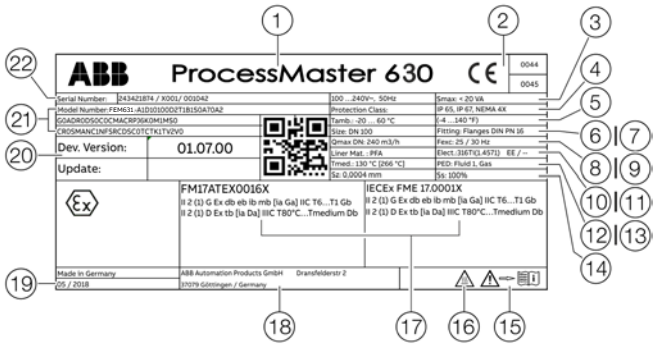
From the calculation of the volume flow rate follows that the measurement voltage is linear and proportional to the volume flow rate.

The induced voltage is converted by the transmitter to standardized, analog and digital signals.

3 Product identification

Name plate

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



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

Figure 4 Name plate (example)

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

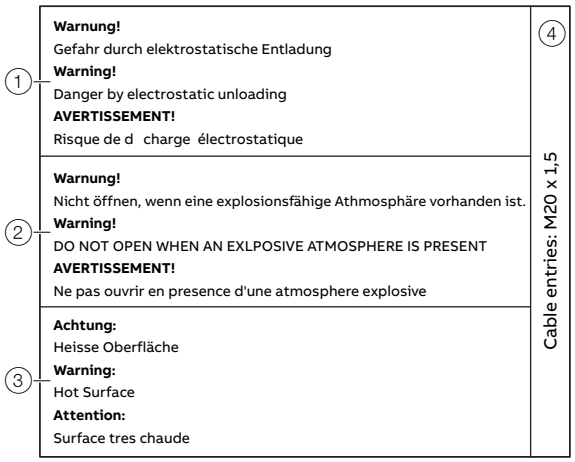
Marking in accordance with Pressure Equipment Directive 2014/68/EU (pending)
Information on the relevant fluid group
(Figure 4, Position 13):

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

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

Additional warning plate

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



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

Figure 5 Additional warning plate

4 Transport and storage

Inspection

Check the devices immediately after unpacking for possible damage that may have occurred from improper transport.

Details of any damage that has occurred in transit must be recorded on the transport documents.

All claims for damages must be submitted to the shipper without delay and before installation.

Transport

DANGER

Life-threatening danger due to suspended loads.

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

- Standing under suspended loads is prohibited.

WARNING

Risk of injury due to device slipping.

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

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

NOTICE

Potential damage to the device!

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

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

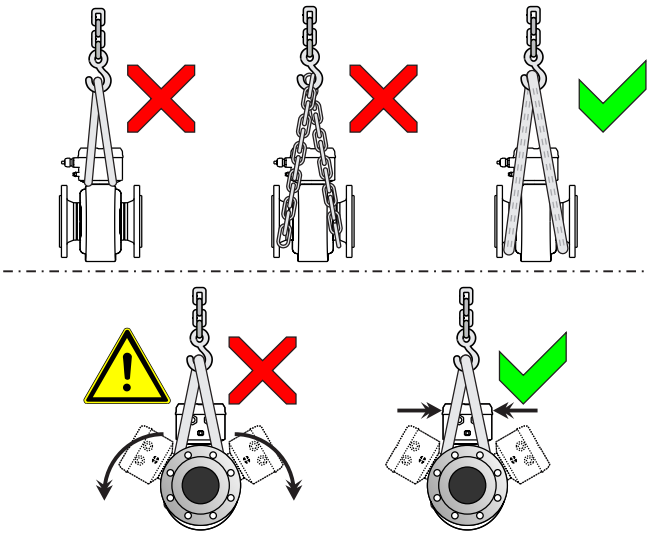


Figure 6 Transport instructions - ≤ 18“ (DN 450)

Flange devices ≤ 18“ (DN 450)

- Use carrying straps to transport flange designs smaller than 18” (DN 450).
- Wrap the carrying straps around both process connections when lifting the device.
- Chains should not be used, since these may damage the housing.

4 Transport and storage

Storing the device

Bear the following points in mind when storing devices:

Store the device in its original packaging in a dry and dust-free location.

Observe the permitted ambient conditions for transport and storage.

Avoid storing the device in direct sunlight.

In principle, the devices may be stored for an unlimited period. However, the warranty conditions stipulated in the order confirmation of the supplier apply.

Temperature data

Storage temperature range
–4 to 149 °F (–20 to 65 °C)

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

Adhere to the device data sheet!

Returning devices

For the return of devices, follow the instructions in **Repair** on page 122.

5 Installation

Safety instructions

⚠ WARNING

Risk of injury due to process conditions.

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

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

⚠ WARNING

Risk of injury due to live parts!

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

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

Use in Potentially Explosive Atmospheres

⚠ DANGER

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

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

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

Note

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

Installation conditions

General

The following points must be observed during installation:

- The flow direction must correspond to the marking, if present
- The maximum torque for all flange screws must be complied with
- Secure flange screws and nuts against pipe vibration.
- The devices must be installed without mechanical tension (torsion, bending)
- Install flange devices / wafer-type devices with plane parallel counterflanges
- The piping may not exert any inadmissible forces or torques on the device.
- Make sure that the temperature limits are not up-scaled during operation of the device.
- Vacuum shocks in the piping should be avoided to prevent damage to the liners. 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
- The transmitter with a remote mount design must be installed at a largely vibration-free location
- Do not expose the transmitter and sensor to direct sunlight. Provide appropriate sun protection as necessary If necessary, provide a suited means of sun protection.
- When installing the transmitter in a control cabinet, make sure adequate cooling is provided

Devices with extended diagnostic functions

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

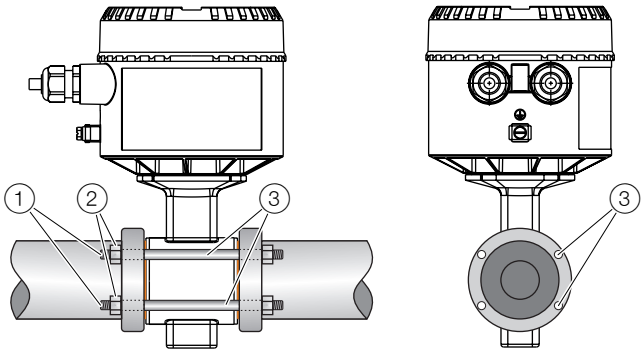
For additional information, see **Extended diagnostic functions** on page 117.

5 ...Installation

Installation conditions

Devices with a ETFE liner
In principle, devices with a ETFE liner do not require additional gaskets.

Devices with a wafer-type design



1 Threaded rod
2 Nut with washer
3 Centering sleeve

Figure 7 Assembly set for wafer type assembly (example)

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

Flow direction

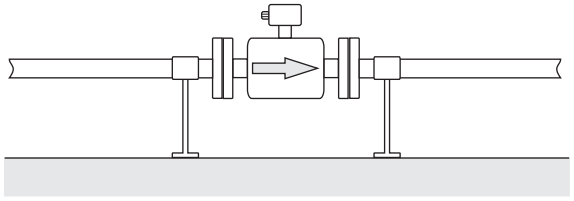
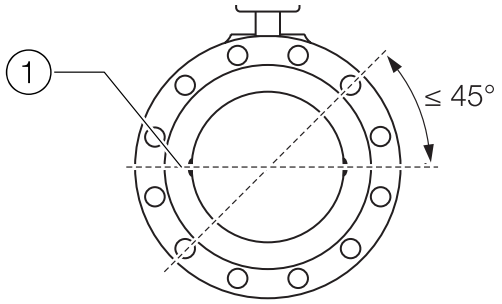


Figure 8 Flow direction

The device measures the flow rate in both flow directions. Forward flow is the factory setting, as shown in Figure 8.

5 ...Installation

Electrode axis



(1) Electrode axis

Figure 9 Orientation of the electrode axis

The flowmeter sensor should be mounted in the piping in such a manner that the electrode axis is oriented as horizontally as possible.

A maximum deviation of 45° from the horizontal position is permissible.

Mounting position

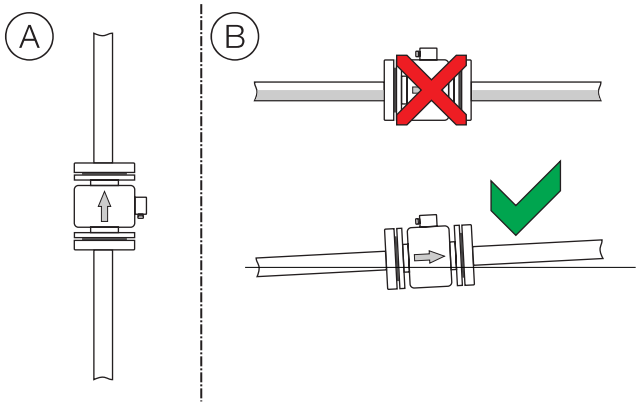


Figure 10 Mounting position

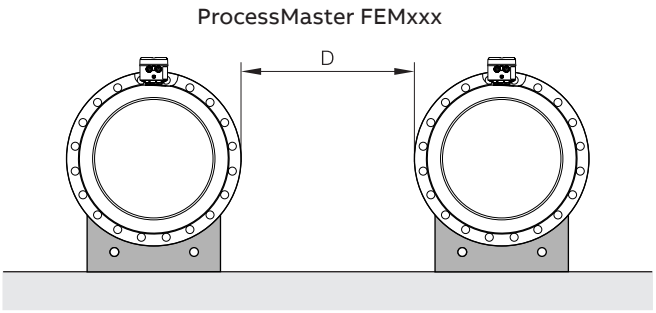
(A) Vertical installation for measuring abrasive materials, preferably with flow in upward direction.

(B) For a horizontal installation, the meter tube must always be completely filled with the measuring medium. Provide for a slight incline of the connection for degassing.

Note

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

Minimum spacing of the devices



Spacing D: ≥ 3.3 ft (1.0 m)

Figure 11 Minimum spacing

- In order to prevent the devices from interfering with each other, a minimum distance as presented in Minimum spacing of the devices must be maintained between the devices.
- The sensor must not be operated in the vicinity of powerful electromagnetic fields, e.g., motors, pumps, transformers, etc. A minimum spacing of approx. 3.28 ft (1 m) must be maintained.
- For installation on or to steel parts (e.g. steel brackets), a minimum spacing of 3.94 in (100 mm) must be maintained.
- These values have been calculated on the basis of IEC 801 2 or IEC TC77B

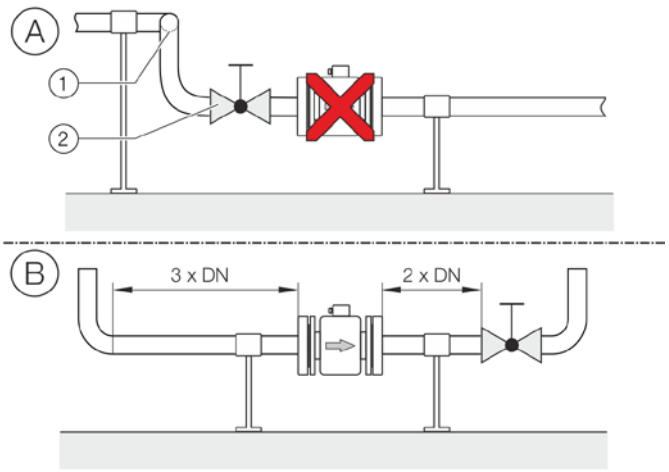
5 ...Installation

...Installation conditions

Grounding

The flowmeter sensor must be connected to ground potential. For technical reasons, this potential must be identical to the potential of the measuring medium.
In piping made of plastic or with insulating liner, grounding of the measuring medium is done by installing grounding plates.
If stray potential is present in the piping, adding a grounding plate on both ends of the flowmeter sensor is recommended.

Inlet and outlet sections



1 Double manifold
2 Turn-off device

Figure 12 Inlet and outlet section, turn-off devices

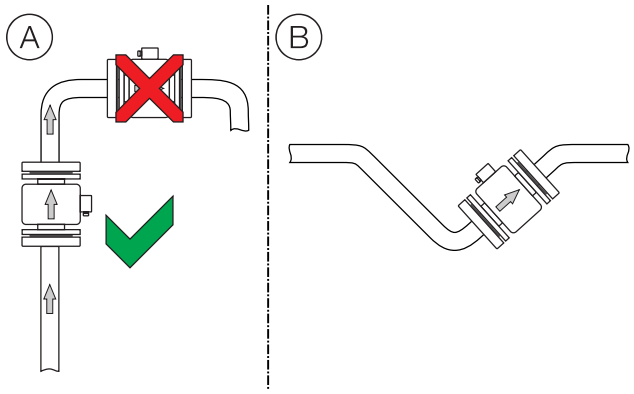
The measuring principle is independent of the flow profile as long as standing eddies do not extend into the measured value formation, such as may for example occur after double manifolds, in the event of tangential inflow, or where half-open gate valves are located upstream of the sensor. In such cases,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

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

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

5 ...Installation

Free inlet or outlet



(A) For a free outflow, do not install flowmeter at the highest point of the piping or on its outflow side, since the measuring tube may run empty, creating air bubbles.

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

Figure 13 Free inflow and outflow

Mounting with heavily contaminated measuring media

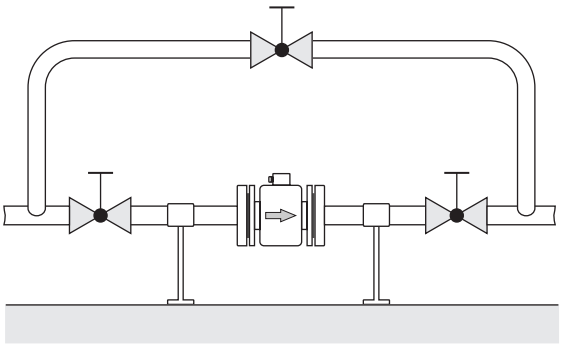


Figure 14 Bypass line

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

Mounting with pipe vibration

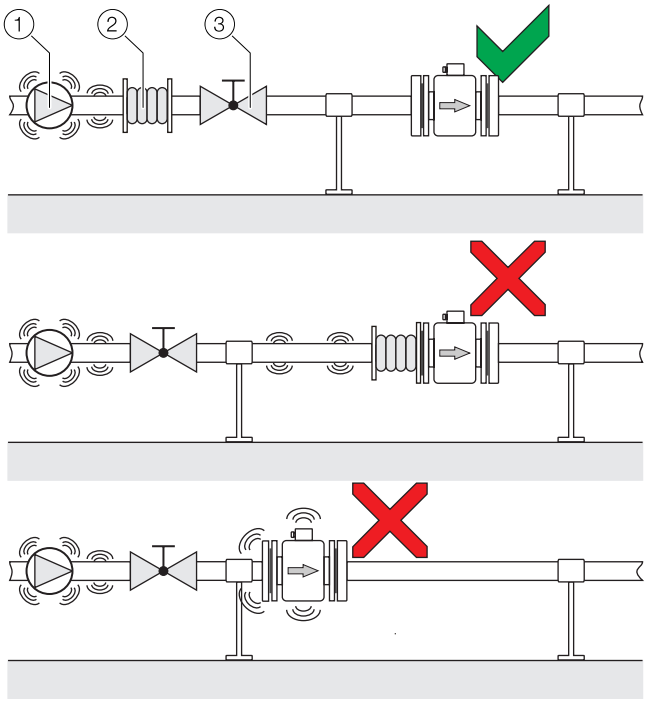


Figure 15 Vibration damping

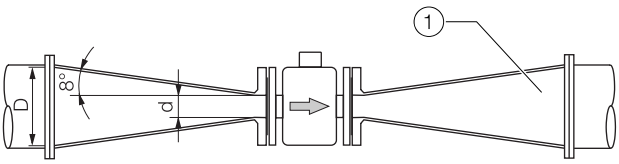
(1) Pump
(2) Damping device
(3) Turn-off device

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

5 ...Installation

...Installation conditions

Installation in piping with larger nominal diameter



① Reducer

Figure 16 Using reducers

Determine the resulting pressure loss when using reducers:

1. Determine diameter ratios d/D.
2. Determine the flow velocity based on the flow rate nomogram (Figure 17).
3. Read the pressure loss on the Y-axis in Figure 17.

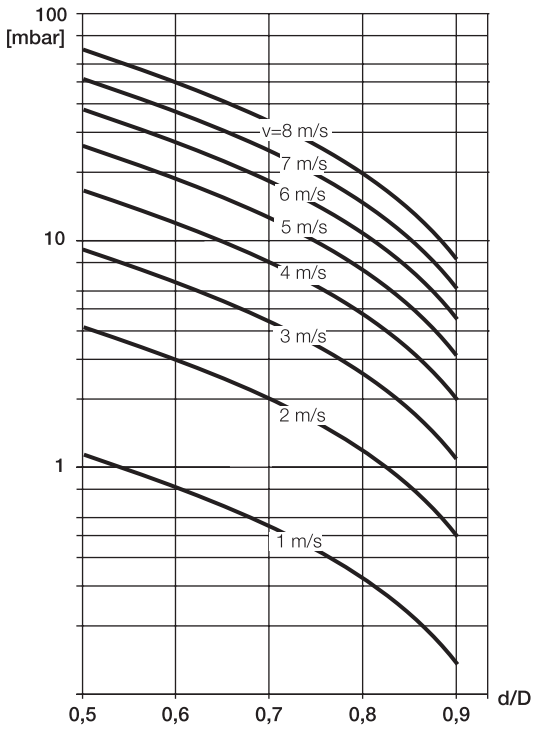


Figure 17 Flow rate nomogram for flange transition piece at α/2 = 8°

5 ...Installation

Installing the sensor

NOTICE

Damage to the device

Damage to the device due to improper assembly.

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

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

1 Remove protective plates, if present, to the right and left of the meter tube. To prevent possible leakage, make sure that the liner on the flange is not cut or damaged.
2 Position the flowmeter sensor plane parallel and centered between the piping.
3 Use the appropriate screws for the holes in accordance with **Torque information** on page 136.
4 Slightly grease the threaded nuts.
5 Tighten the nuts in a crosswise manner as shown in the figure. Observe the tightening torques in accordance with **Torque information** on page 136. First tighten the nuts to approx. 50 % of the maximum torque, then to 80 %, and finally a third time to the maximum torque. Do not exceed the max. torque.

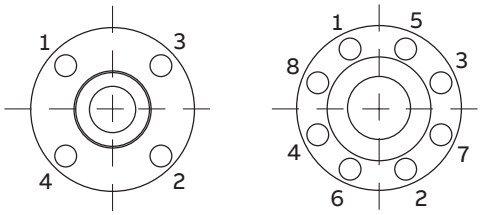


Figure 18 Tightening sequence for the flange screws

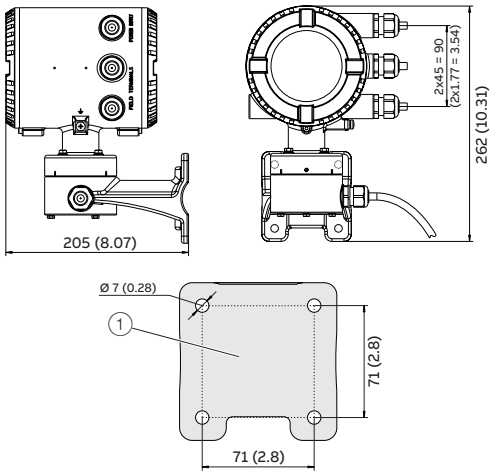
5 ...Installation

Installing the transmitter in the remote mount design

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

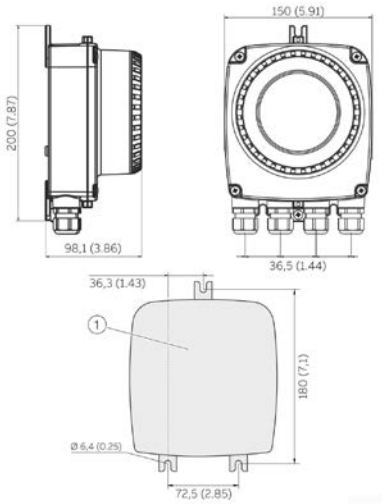
- Observe the information concerning maximum ambient temperature and IP rating on the name plate
- The location must be mostly free from vibration.
- The location must not be exposed to direct sunlight. If necessary provide a sun screen on site.
- Do not up-scale the maximum signal cable length between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

1 Drill mounting holes at mounting location.
2 Attach transmitter securely to the mounting location using suited fasteners for the base material.



1 Hole pattern for mounting holes

Figure 19 Mounting dimensions dual-compartment housing



1 Hole pattern for mounting holes

Figure 20 Mounting dimensions single-compartment housing

5 ...Installation

Opening and closing the housing

DANGER

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

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

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

WARNING

Risk of injury due to live parts!

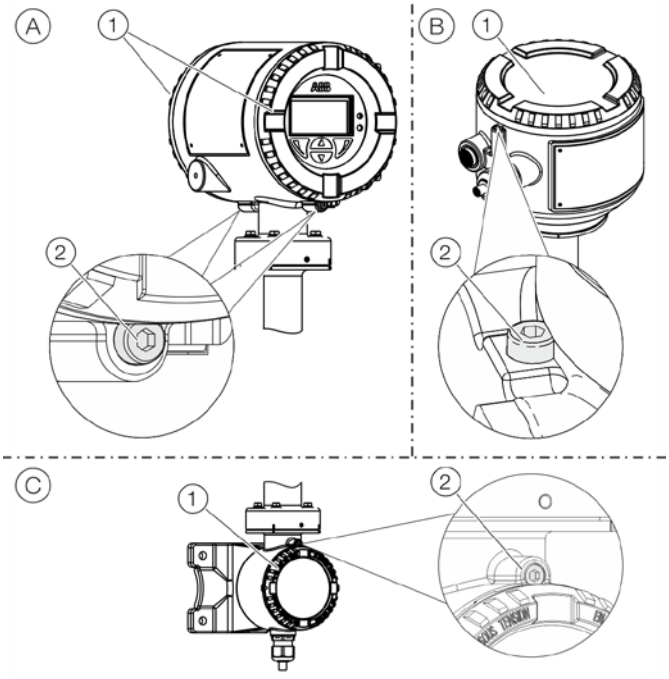
When the housing is open, contact protection is not provided and EMC protection is limited.

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

NOTICE

Potential adverse effect on the IP rating

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



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

Figure 21 Cover lock (example)

Open the housing:

Release the cover lock by screwing in the Allen screw ②.

1 Unscrew cover ①.

Close the housing:

1 Screw on the cover ①.

2 After closing the housing, lock the cover by unscrewing the Allen screw ②.

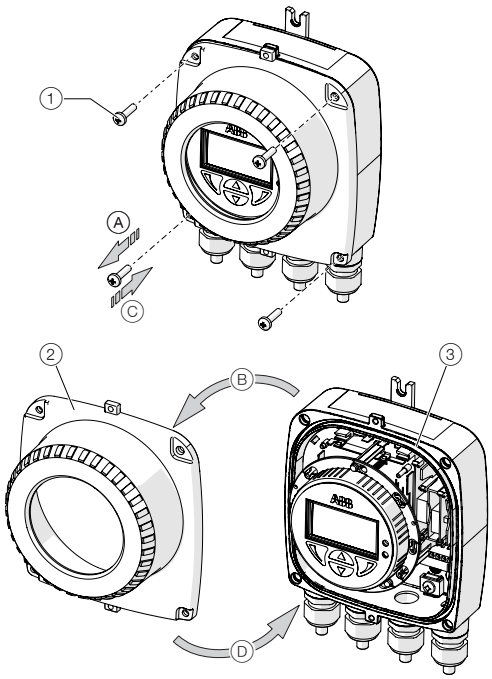
5 ...Installation

...Opening and closing the housing

NOTICE

Potential adverse effect on the IP rating

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



1 Cover screws
2 Transmitter housing cover
3 Gasket

Figure 22 Open / close single-compartment housing

Open transmitter housing: Perform steps A and B.
Close transmitter housing: Perform steps C and D.

Adjusting the transmitter position

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

In addition, the display in the LCD indicator can be rotated by 180° using the parameter 'Display Rotation' (see **Menu: Display** on page 86).

Transmitter housing

DANGER

Damaging the device carries a risk of explosion!

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

Tighten all screws prior to commissioning.

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

Rotate transmitter housing: Perform steps A to C.

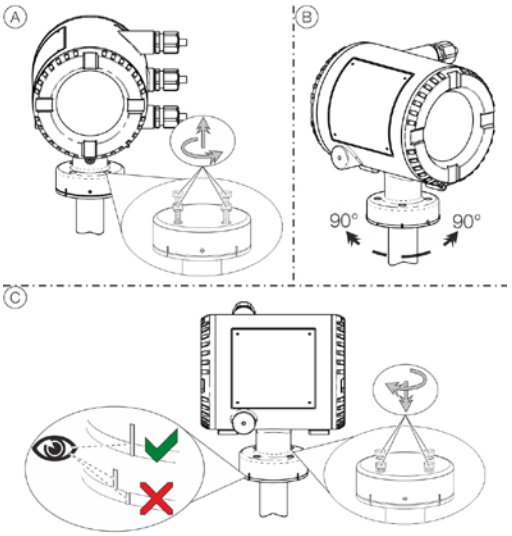


Figure 23 Rotate transmitter housing

5 ...Installation

Rotate LCD indicator – dual-compartment housing

The LCD indicator can be rotated in three increments of 90° each. To open and close the housing, refer to **Opening and closing the housing** on page 22.

Turn the LCD indicator:

Perform steps Ⓐ to Ⓕ.

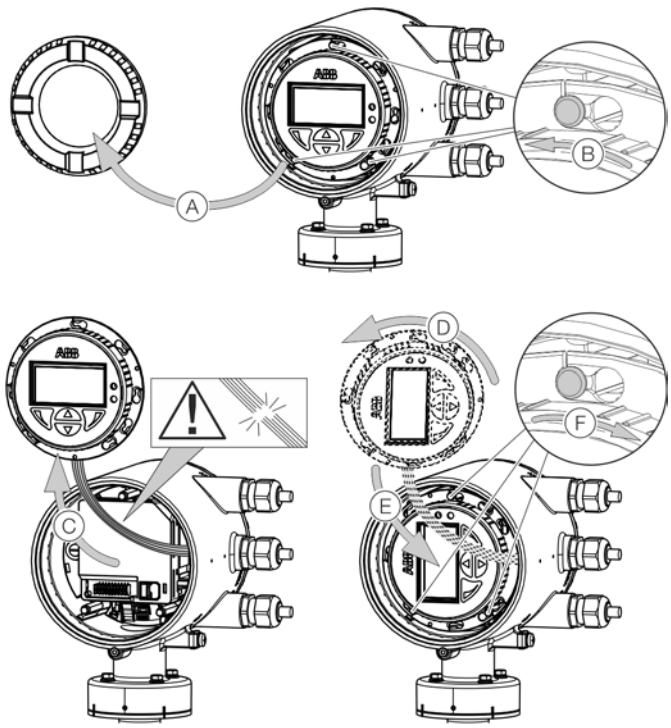


Figure 24 Rotating the LCD indicator

Rotate LCD indicator – single-compartment housing

The LCD indicator can be rotated in three increments of 90° each. To open and close the housing, refer to **Opening and closing the housing** on page 22.

Turn the LCD indicator:

Perform steps Ⓐ to Ⓕ.

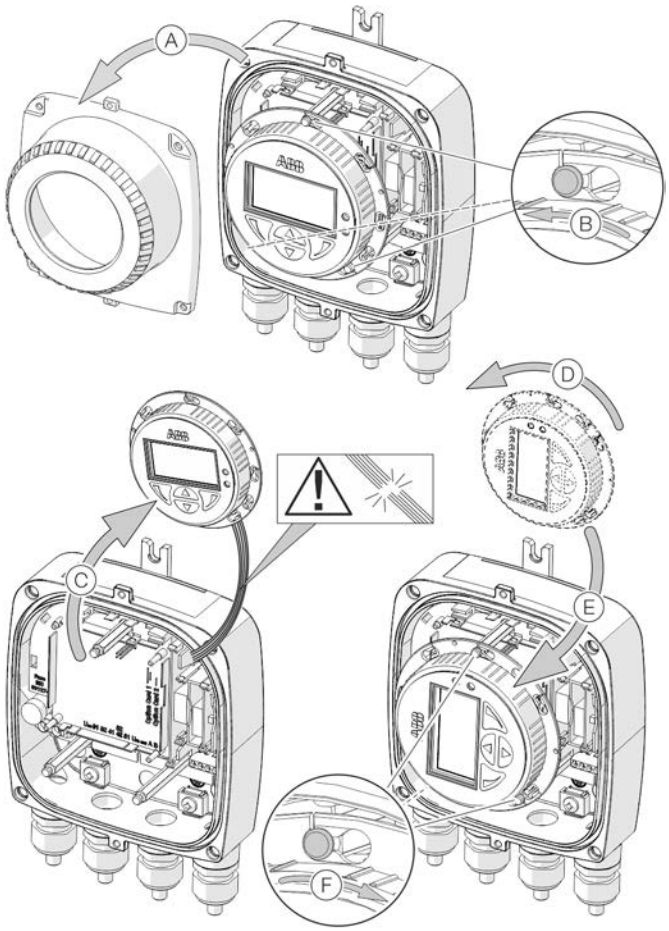


Figure 25 Rotating the LCD indicator

5 ...Installation

Installing the plug-in cards

WARNING

Loss of Ex Approval!

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

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

Optional plug-in cards

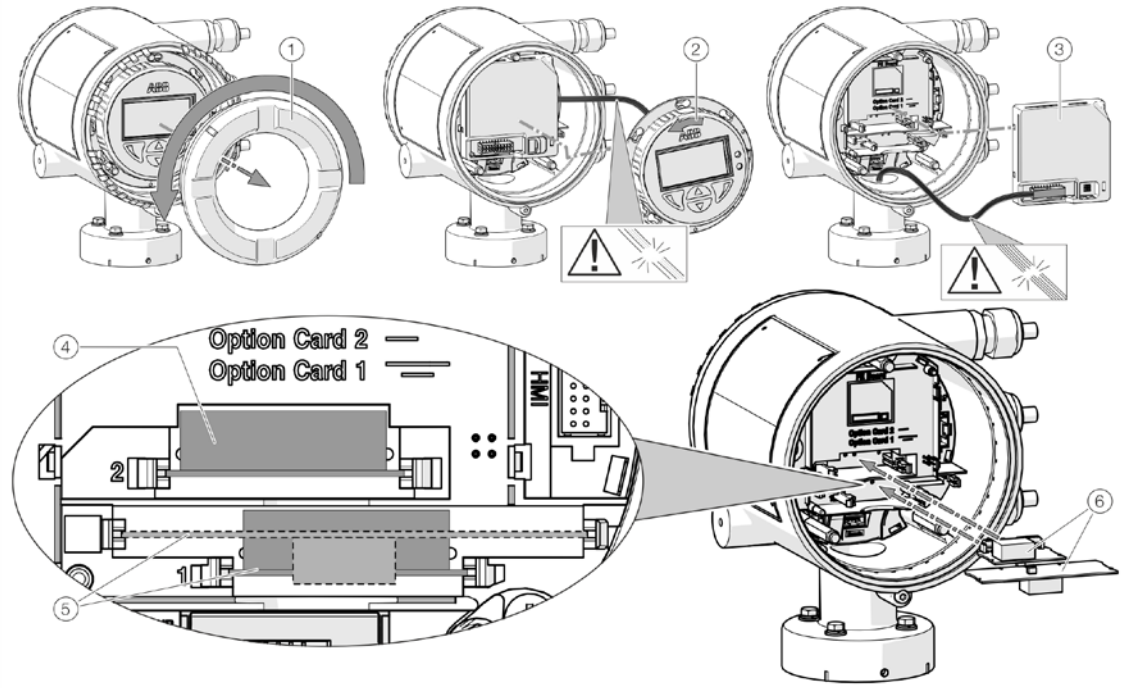
The transmitter has two slots (OC1, OC2) into which plug-in cards can be inserted to extend inputs and outputs. The slots are located on the transmitter motherboard and can be accessed after removing the front housing cover.

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

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

5 ...Installation

...Installing the plug-in cards

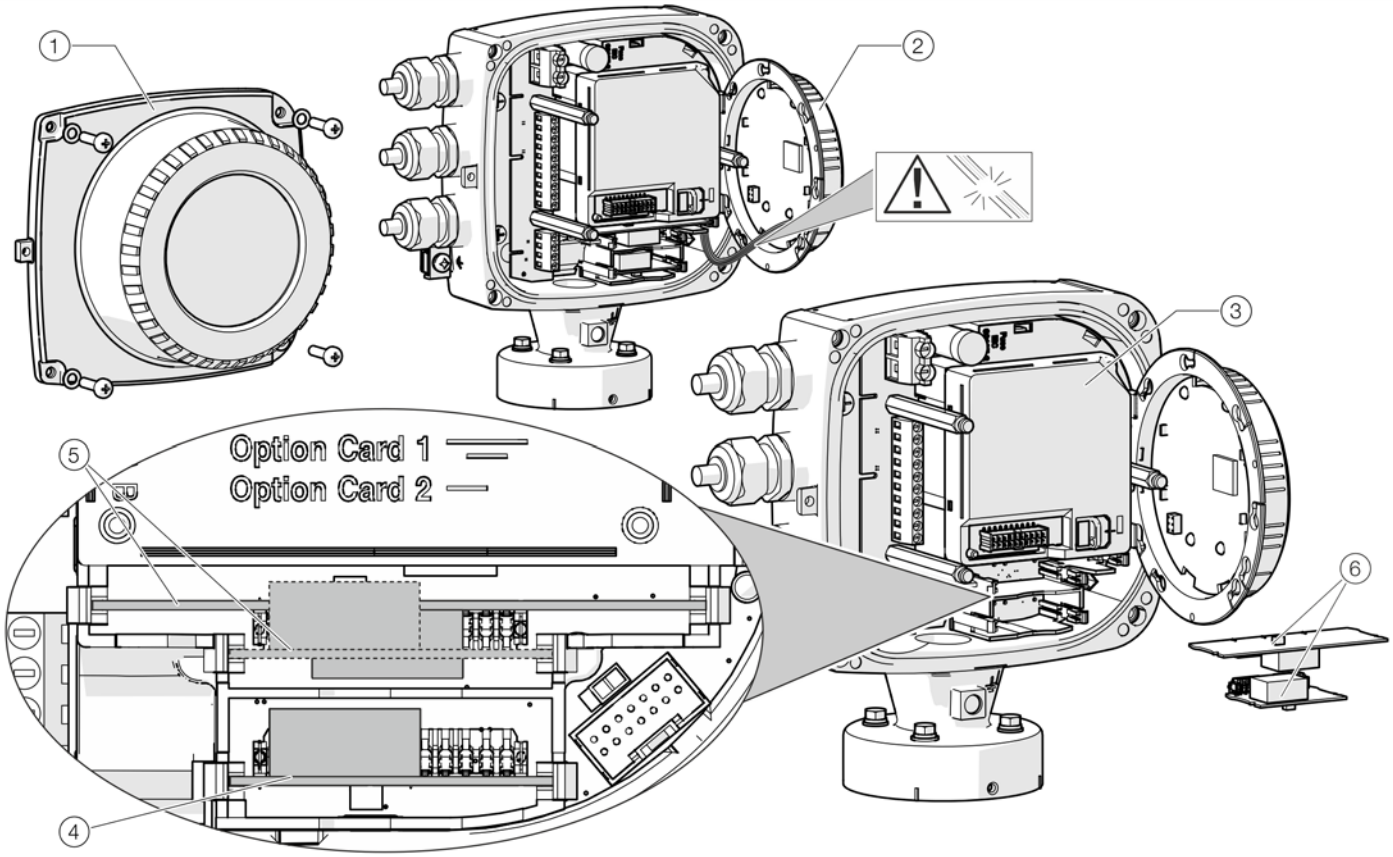


1. Cover
2. LCD indicator
3. Frontend board (FEB, with integral mount design only)
4. Slot OC2
5. Slot OC1
6. Plug-in cards

Figure 26 Installation of plug-in cards (example, dual-compartment housing)

5 ...Installation

...Installing the plug-in cards



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

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

⚠ WARNING

Risk of injury due to live parts!
When the housing is open, contact protection is not provided and EMC protection is limited.

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

NOTICE

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

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

1 Switch off the power supply.
2 Unscrew / remove the cover.
3 Remove the LCD indicator. Ensure that the cable harness is not damaged.
Insert the LCD indicator into the bracket
4 (only for single-compartment housings)
5 Remove frontend board (only in integral mount design and dual-compartment housing). Ensure that the cable harness is not damaged.
6 Insert the plug-in card in the corresponding slot and engage. Ensure that the contacts are aligned correctly.
7 Attach the frontend board, insert the LCD indicator and screw on / replace the cover.
8 Connect outputs V1 / V2 and V3 / V4 in accordance with **Electrical connections** on page 29.
9 After powering up the power supply, configure the plug-in card functions.

6 Electrical connections

Safety instructions

⚠ WARNING

Risk of injury due to live parts.

Improper work on the can result in electric shock.

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

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

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

Use in Potentially Explosive Atmospheres

Note

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

Sensor grounding

General information on grounding

Observe the following items when grounding the device:

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

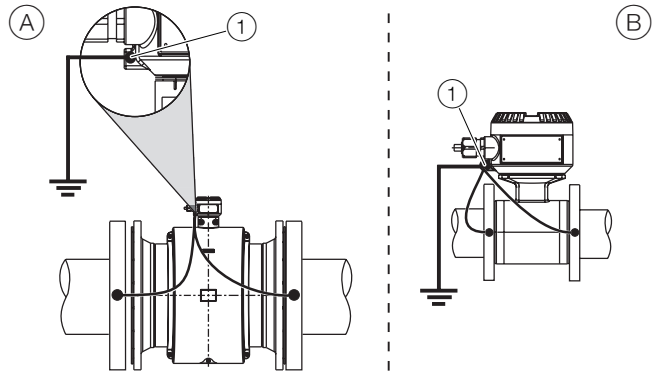
Note

If the sensor is installed in plastic or earthenware pipelines, or in pipelines with an insulating liner, compensating currents may flow through the grounding electrode in special cases (e.g. with corrosive measuring media, acids and bases)
In the long term, this may destroy the sensor, since the ground electrode will in turn degrade electrochemically.
In these special cases, the connection to the ground must be performed using grounding plates. Install a grounding plate upstream and downstream of the device in this case.

6 ...Electrical connections

...Sensor grounding

Metal pipe with fixed flanges

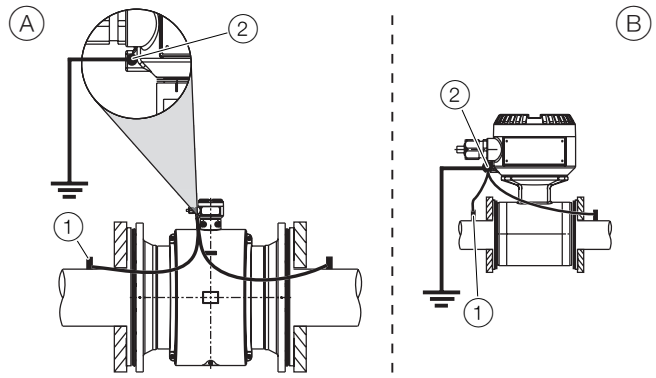


Ⓐ Flange design
Ⓑ Wafer type design
① Ground terminal

Figure 28 Metal pipe, without liner (example)

Use a copper wire [at least 2.5 mm² (14 AWG)] to establish the connection between the ground terminal of the sensor, the pipeline flanges and a suited grounding point in accordance with the figure.

Metal pipe with loose flanges

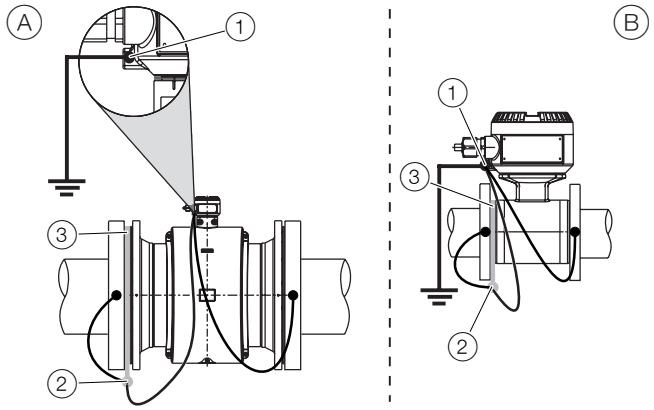


Ⓐ Flange design
Ⓑ Wafer type design
① Threaded bolts M6
② Ground terminal

Figure 29 Metal pipe, without liner (example)

1 Solder the threaded bolts M6 to the piping and connect the ground in accordance with the figure.
2 Use a copper wire [at least 2.5 mm2 (14 AWG)] to establish the connection between the ground terminal of the sensor and a suited grounding point in accordance with the figure.

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



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

Figure 30 Plastic pipes, non-metallic pipes or pipes with insulating liner

For plastic pipes or pipes with insulating lining, the grounding of the measuring medium is provided by the grounding plate as shown in the figure below or via grounding electrodes that must be installed in the device (option).
If grounding electrodes are used, the grounding plate is not necessary.

1 Install the sensor with grounding plate in the piping.
2 Connect the terminal lug of the grounding plate and ground connection on the sensor using the grounding strap.
3 Use a copper wire with at least 2.5 mm2 (14 AWG)) to establish a connection between the ground connection and a suited grounding point.

6 ...Electrical connections

...Sensor grounding

Grounding for devices with protective plates
The protection plates are used to protect the edges of the meter tube liner, e.g. for abrasive media.
In addition, the protection plates function as a grounding plate.

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

Grounding with conductive PTFE grounding plate
Grounding plates made of conductive PTFE are optionally available for nominal diameter ranges of 3/8” to 10” (DN 10 to 250). These are installed similar to conventional grounding plates.

Devices with extended diagnostic functions
For devices with extended diagnostic functions different installation conditions may be valid.
For additional information, see **Extended diagnostic functions** on page 117.

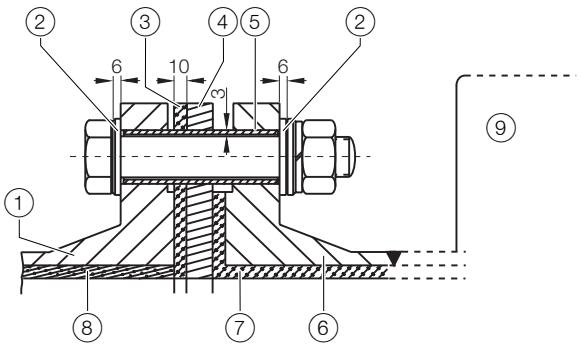
Installation and grounding in piping with cathodic corrosion protection
The installation of electromagnetic flowmeters in systems with cathodic corrosion protection must be made in compliance with the corresponding system conditions. The following factors are especially important:

1. Pipelines inside electrically conductive or insulating.
2. Piping consistently and widely on cathodic corrosion protection potential. Or mixed systems with ranges on cathodic corrosion protection potential and ranges on functional ground potential.
   - In the case of pipes free from stray current and insulated on the inside with liner, the sensor should be installed in the piping insulated with grounding plates (upstream and downstream from the sensor). The cathodic corrosion potential is bypassed around the sensor. The grounding plates upstream and downstream of the sensor are connected to functional ground (Figure 31 / Figure 32).
   - If the occurrence of external stray currents is to be expected in piping with internal insulation (e.g. in the case of long pipe sections in the vicinity of power supply units), an uninsulated pipe of approx. ¼ × DN of length should be provided upstream and downstream of the sensor in order to deviate these external stray currents away from the sensor (Figure 33).

6 ...Electrical connections

...Sensor grounding

Internally insulated piping with cathodic corrosion potential

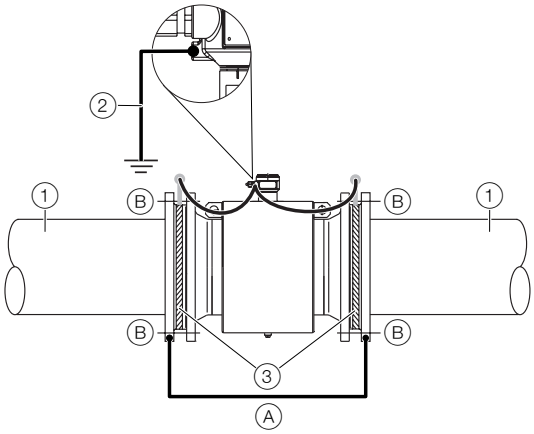


1 Piping flange
2 Insulating plate
3 Gasket / insulating ring
4 Grounding plate
5 Insulating pipe
6 Flange
7 Liner
8 Insulation
9 Sensor

Figure 31 View Screw bolts

Install grounding plates on each side of the flowmeter sensor. Insulate the grounding plates from the pipe flanges and connect them to the flowmeter sensor and to functional ground.

The screw bolts for flange connections should be mounted with insulation. The insulation plates and the insulation pipe are not included in the delivery. They must be provided onsite by the customer.



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

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

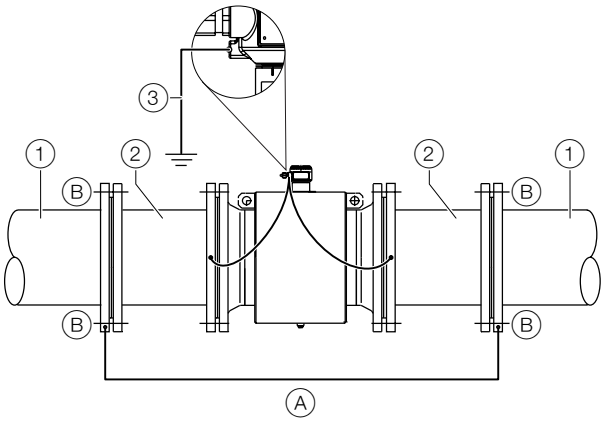
Figure 32 sensor with grounding plate and functional ground

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

6 ...Electrical connections

...Sensor grounding

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



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

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

Figure 33 Sensor with functional ground

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

Figure 33 shows the preferred installation for cathodic corrosion protection.

Power supply

Note

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

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

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

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

The circuit breaker must be located near the device and marked as being associated with the device.
Connect the transmitter and sensor to functional earth.

6 ...Electrical connections

Cable entries

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

Devices with a M20 × 1.5 or ½ in-NPT thread are equipped with protective plugs.

The black protective plugs in the cable glands are intended to provide protection during transport.Any unused cable entries must be sealed with sealing plugs before commissioning in accordance with the applicable national standards.

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

Connection via cable conduit

Figure 34 Installation set for cable conduit (Conduit)

NOTICE

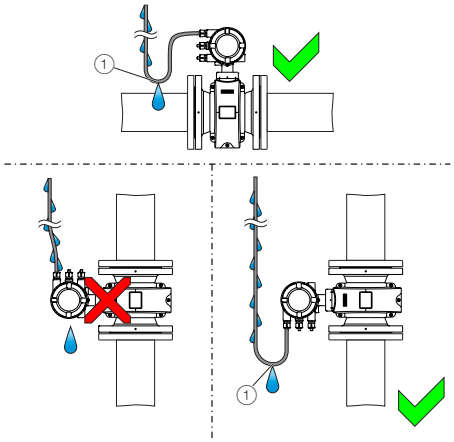
Condensate formation in terminal box!
If the flowmeter sensor is permanently connected to cable conduits, there is a possibility that moisture may get into the terminal box as a result of condensate formation in the cable conduit.

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

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

Installing the connection cables

General information on cable installation
Ensure that a drip loop (water trap) is used when installing the connecting cables for the sensor. When mounting the sensor vertically, position the cable entries at the bottom. If necessary, rotate the transmitter housing accordingly.



① Drip loop

Figure 35 Installation of the connection cable (example, integral mount design)

6 ...Electrical connections

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

Observe the following points when installing the signal cable:

- The maximum signal cable length is 164 ft (50 m).
- Only used signal cable which is in accordance with the following cable specifications.
- Avoid the vicinity of electrical equipment or switching elements that can create stray fields, switching pulses and induction. If this is not possible, run the signal / magnet coil cable through a metal pipe and connect this to the station ground.
- To shield against magnetic interspersion, the cable contains outer shielding. This should be connected to the SE clamp.
- Do not damage the sheathing of the cable during installation.

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

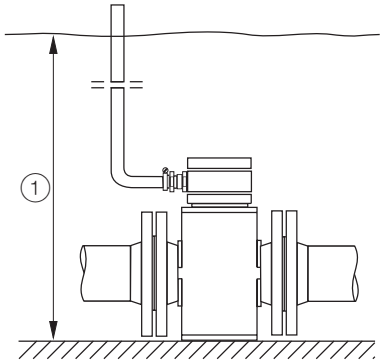
Cable specification	
Impedance	100 to 200 Ω
Withstand voltage	120 V
Outer diameter	0.24 to 0.47 in (6 to 12 mm)
Cable design	Two wire pairs as a star-quad cable
Conductor cross-section	Length-dependent
Shield	Copper braid with approximately 85 % coverage
Temperature range	Depends on application.

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

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

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

Connection with IP rating IP 68



① Maximum flooding height 164 ft (50 m)

Figure 36 Maximum flooding height for IP 68 sensors

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

The sensor is type-tested in accordance with EN 60529. Test conditions:

- 14 days at a flooding height of 16.4 ft (5 m).

6 ...Electrical connections

...Connection with IP rating IP 68

Electrical connection

NOTICE

Adverse effect on the IP rating IP 68
The IP rating IP 68 of the sensor may be adversely affected as a result of damage to the signal cable.
- The sheathing of the signal cable must not be damaged.

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

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

Potting the terminal box on-site

⚠ CAUTION

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

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

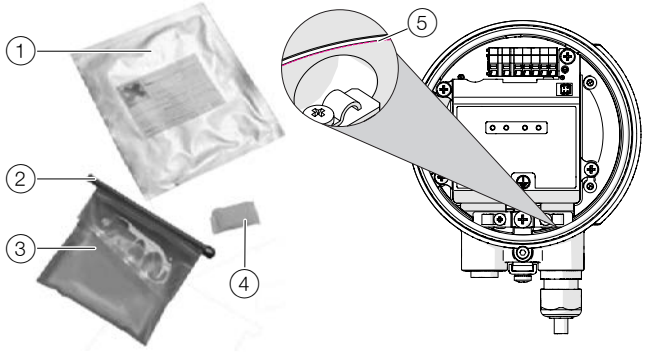
Risk notes:
- R20: Damaging to health when inhaled.
- R36/37/38: Irritates the eyes, respiratory organs and the skin.
- R42/43: Sensitization through inhaling and skin contact is possible.

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

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

Preparation
- Complete the installation before potting in order to avoid moisture penetration. Before starting, check all the connections for correct fitting and stability
- Do not overfill the terminal box. Keep the potting compound away from the O-ring and the gasket / groove (see Figure 37).
- Prevent the two-component potting compound from penetrating the cable conduit (Conduit) for an ½ in NPT installation (if used).

Procedure



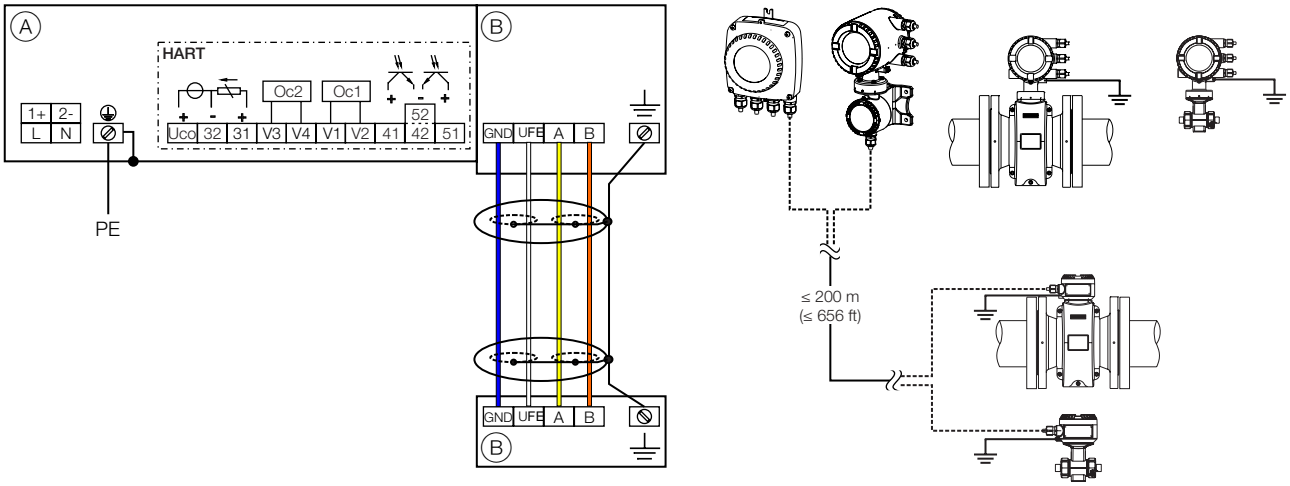
1 Packaging bag
2 Connection clamp
3 Two-component potting compound
4 Drying bag
5 Maximum fill level

Figure 37 Terminal box sealing

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

6 ...Electrical connections

Pin assignment



(A) Connections for power supply and inputs / outputs

(B) Connections for signal cable (remote mount design only)

Figure 38 Electrical connections

Note

For additional information on the grounding of the transmitter, see **Grounding** on page 17.

Connections for the power supply

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

DC power supply	
Terminal	**Function / comments**
1+	+
2-	-
PE / ⏚	Protective earth (PE)

Connections for inputs and outputs

Terminal	**Function / comments**
Uco / 32	Current output 4 to 20 mA- / HART® output, active or
31 / 32	Current output 4 to 20 mA- / HART® output, passive
41 / 42	Passive digital output DO1
51 / 52	Passive digital output DO2
V1 / V2 V3 / V4	Plug-in card, slot OC1 Plug-in card, slot OC2 For details, see **Optional plug-in cards** on page 25.

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

6 ...Electrical connections

...Pin assignment

Electrical data for inputs and outputs

Note

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

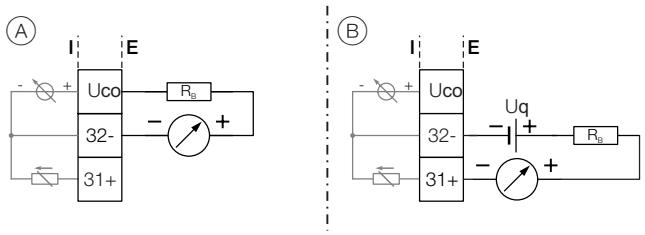
Power supply

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

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

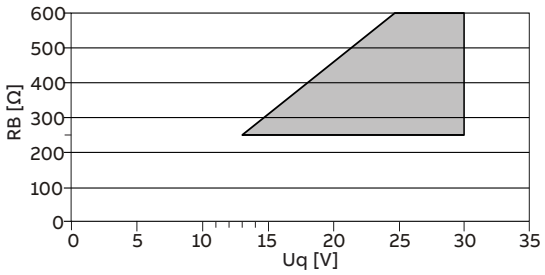
Current output Uco / 32, 31 / 32

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



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

Figure 39 (I = internal, E = external, R_B = load)



Permissible source voltage U_q for passive outputs in relation to load resistance R_B where I_{max} = 22 mA. (unreadable type) = Permissible range

Figure 40 Source voltage for passive outputs

Current output	Active	Passive
Terminals	Uco / 32	31 / 32
Output signal	4 to 20 mA or 4 to 12 to 20 mA switchable	4 to 20 mA
Load RB	250 Ω ≤ RB ≤ 300 Ω	250 Ω ≤ RB ≤ 600 Ω
Source voltage U_q*	—	13 V ≤ Uq ≤ 30 V
Measuring error	< 0.1 % of measured value	
Resolution	0.4 µA per digit	
Insulation	The current output and digital outputs are electrically isolated.	

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

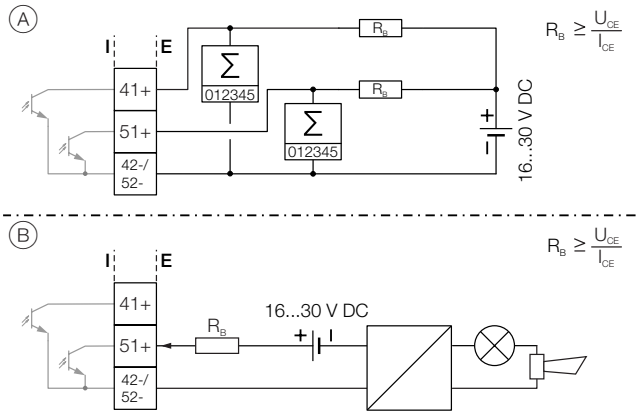
For information on communication via the HART protocol, refer to **HART® communication** on page 48.

6 ...Electrical connections

...Pin assignment

Digital output 41 / 42, 51 / 52

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



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

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

Figure 41 (I = internal, E = external, R_B = load)

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

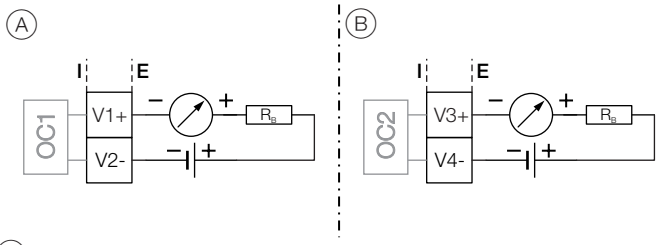
Binary output (passive)	
Terminals	41 / 42, 51 / 52
Output 'closed'	0 V ≤ U_{CEL} ≤ 3 V 2 mA ≤ I_{CEL} ≤ 30 mA
Output 'open'	16 V ≤ U_{CEH} ≤ 30 V DC 0 mA ≤ I_{CEH} ≤ 0.2 mA
Switching function	Parameterization possible. See **Menu: Input/Output** on page 87.

Note

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

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

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

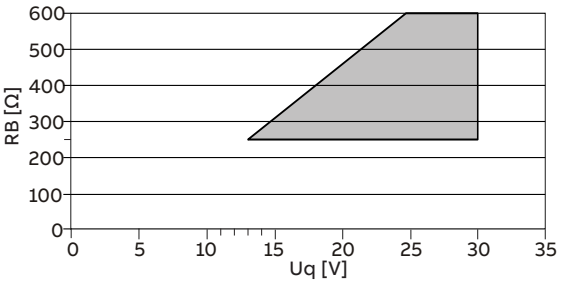


(A) Current output V1 / V2, passive

(B) Current output V3 / V4, passive

Figure 42 (I = internal, E = external, R_B = load)

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



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

Figure 43 Source voltage for passive outputs

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

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

6 ...Electrical connections

...Pin assignment

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

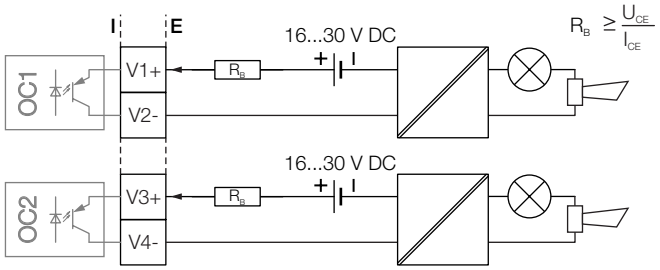


Figure 44 Plug-in card as binary output (I = internal, E = external, R_B = load)

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

Binary output (passive)	
Terminals	V1 / V2, V3 / V4
Output 'closed'	$0 V \leq U_{CEL} \leq 3 V$ $2 mA < I_{CEL} < 30 mA$
Output 'open'	$16 V \leq U_{CEH} \leq 30 V DC$ $0 mA \leq I_{CEH} \leq 0.2 mA$
Switching function	Parameterization possible. See **Menu: Input/Output** on page 87.

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

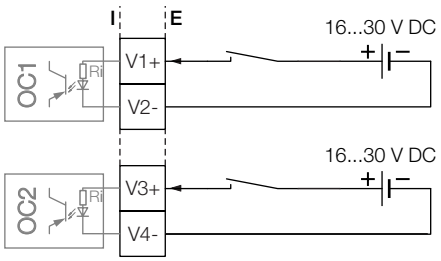


Figure 45 Plug-in card as digital input (I = internal, E = external)

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

Digital input	
Terminals	V1 / V2, V3 / V4
Input 'On'	$16 V \leq U_{KL} \leq 30 V$
Input 'Off'	$0 V \leq U_{KL} \leq 3 V$
Internal resistance R_i	6.5 kΩ
Function	Parameterization possible. See **Menu: Input/Output** on page 87.

6 ...Electrical connections

...Pin assignment

24 V DC loop power supply (plug-in module)
Use of the 'loop power supply (blue)' plug-in card allows a passive output on the transmitter to be used as an active output. See also **Connection examples** on page 41.

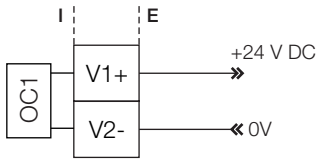


Figure 46 (I = Internal, E = External)

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

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

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

Modbus / PROFIBUS DP interface V1 / V2 (plug-in card)
A Modbus or PROFIBUS DP interface can be implemented by using the 'Modbus RTU, RS485 (white)' or 'PROFIBUS DP, RS485 (white)' plug-in cards.

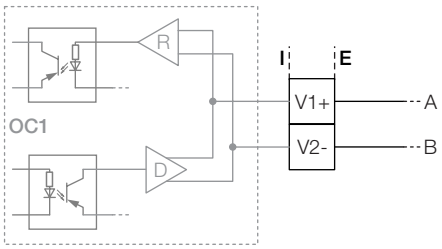


Figure 47 Plug-in card as a Modbus / PROFIBUS DP interface (I = internal, E = external)

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

For information on communication through the Modbus or PROFIBUS DP protocols, refer to chapters **Modbus® communication** on page 48 and **PROFIBUS DP® communication** on page 49.

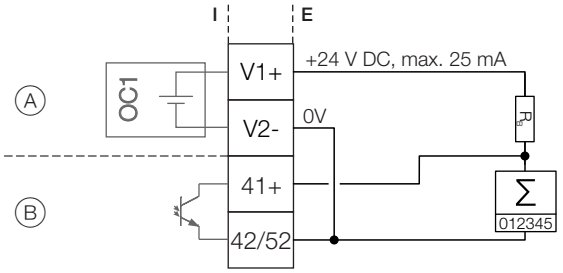
6 ...Electrical connections

...Pin assignment

Connection examples
Input and output functions are configured via the device software in accordance with the desired application.
Parameter descriptions on page 77.

Active digital output 41 / 42, 51 / 52, V3 / V4
When the 'loop power supply 24 V DC (blue)' plug-in card is used, the digital outputs on the basic device and on the option modules can also be wired as active digital outputs.

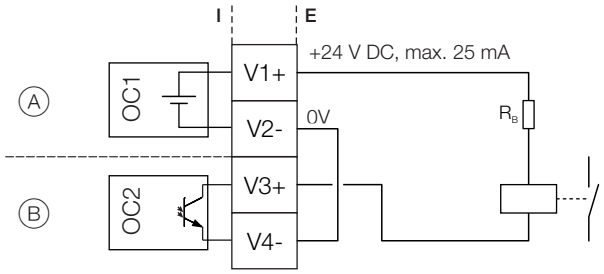
Note
Each 'loop power supply (blue)' plug-in card must only power one output.
It must not be connected to two outputs (for example digital output 41 / 42 and 51 / 52)!



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

Figure 48 Active digital output 41 / 42 (example)

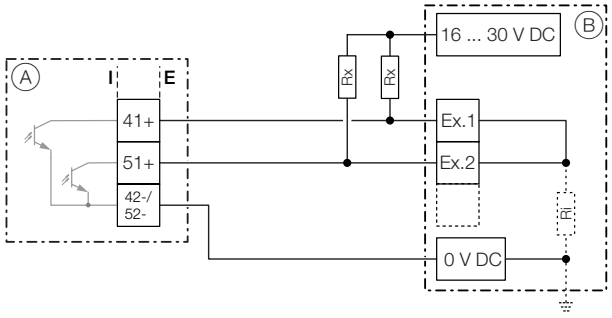
The connection example shows usage for digital output 41 / 42; the same applies to usage for digital output 51 / 52.



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

Figure 49 Active digital output V3 / V4 (example)

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



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

Figure 50 Digital output 41 / 42 on distributed control system (example)

The RX resistors limit the maximum current through the optoelectronic coupler of the digital outputs in the transmitter.

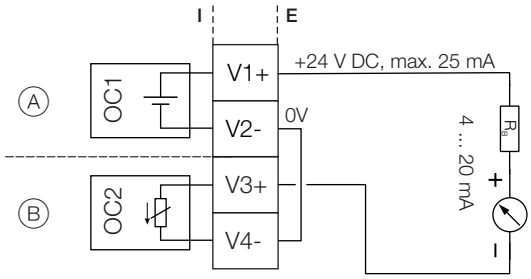
The maximum permissible current is 25 mA. An RX value of 1000 Ω / 1 W is recommended at a voltage level of 24 V DC. The input on the distributed control system is reduced from 24 V DC to 0 V DC (falling edge) with '1' at the digital output.

6 ...Electrical connections

...Pin assignment

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.



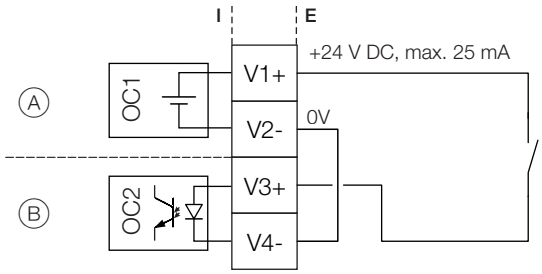
Ⓐ 'Loop power supply (blue)' plug-in card in slot 1

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

Figure 51 Active current output V3 / V4 (example)

Digital input V3 / V4 active

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



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

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

Figure 52 Active digital output V3 / V4 (example)

Connection versions digital output 41 / 42, 51 / 52

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

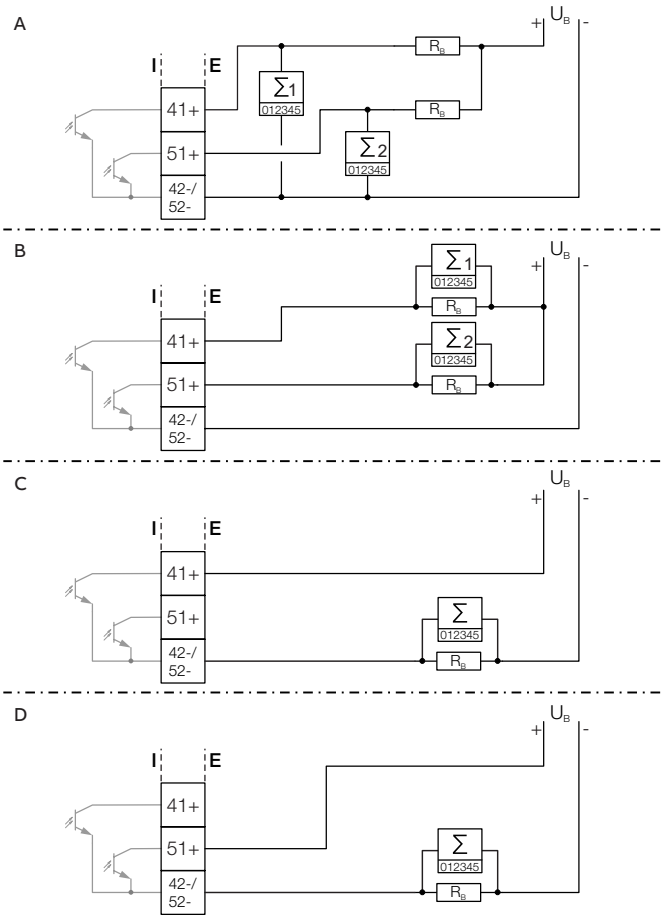


Figure 53 Connection versions digital output 41 / 42 and 51 / 52

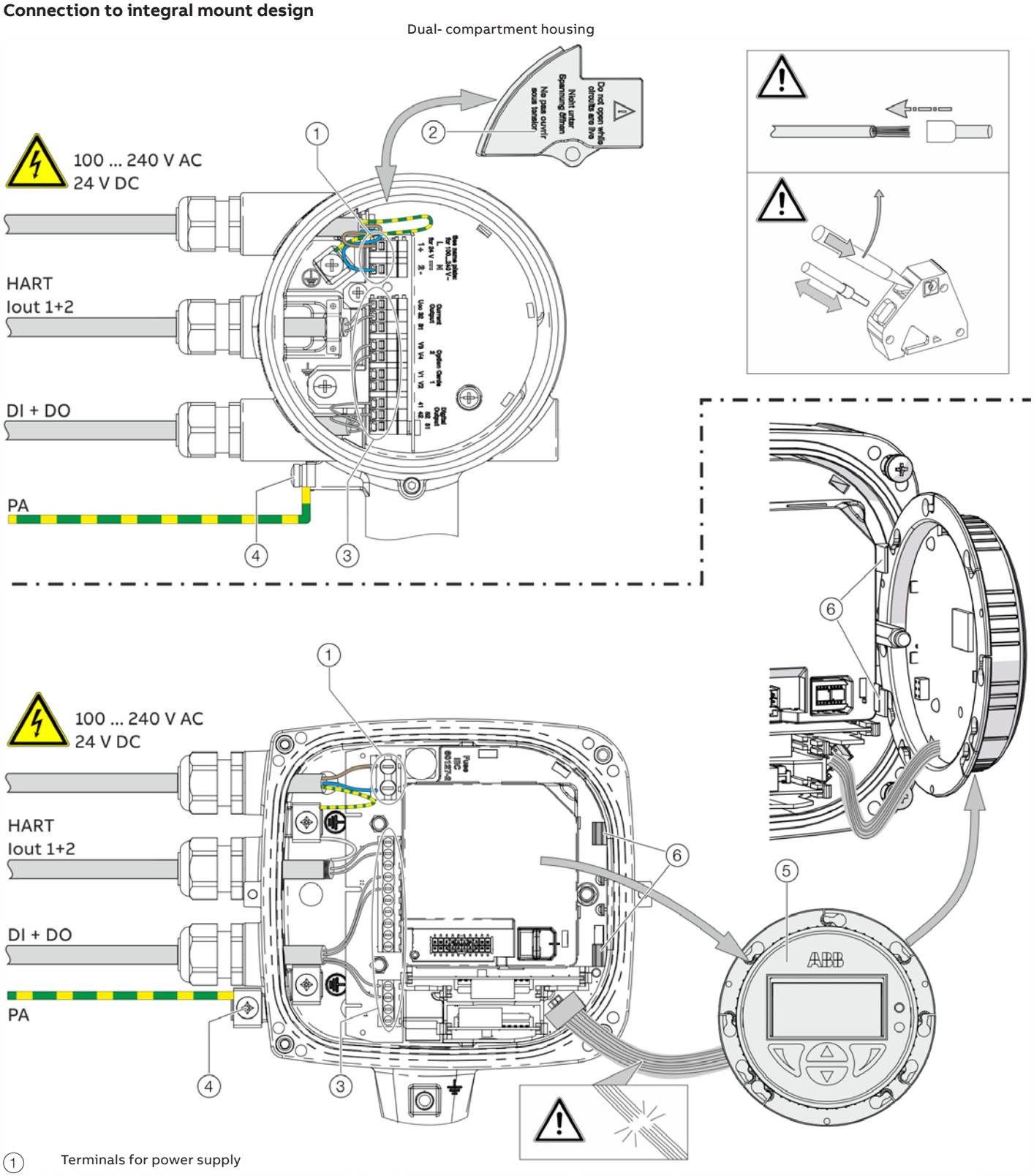
	DO 41 / 42 and 51 / 52 can be used parallel	DO 41 / 42 and 51 / 52 electrically isolated
Ⓐ	Yes	No
Ⓑ	Yes	Yes
Ⓒ	No, only DO 41 / 42 can be used	No
Ⓓ	No, only DO 51 / 52 can be used	No

Table 1 Connection versions digital output

6 ...Electrical connections

...Pin assignment

Connection to integral mount design



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

Figure 54 Connection to device (example), PA = potential equalization

6 ...Electrical connections

...Pin assignment

NOTICE

If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class.
Follow the instructions in **Opening and closing the housing** on page 22 to open and close the housing safely.

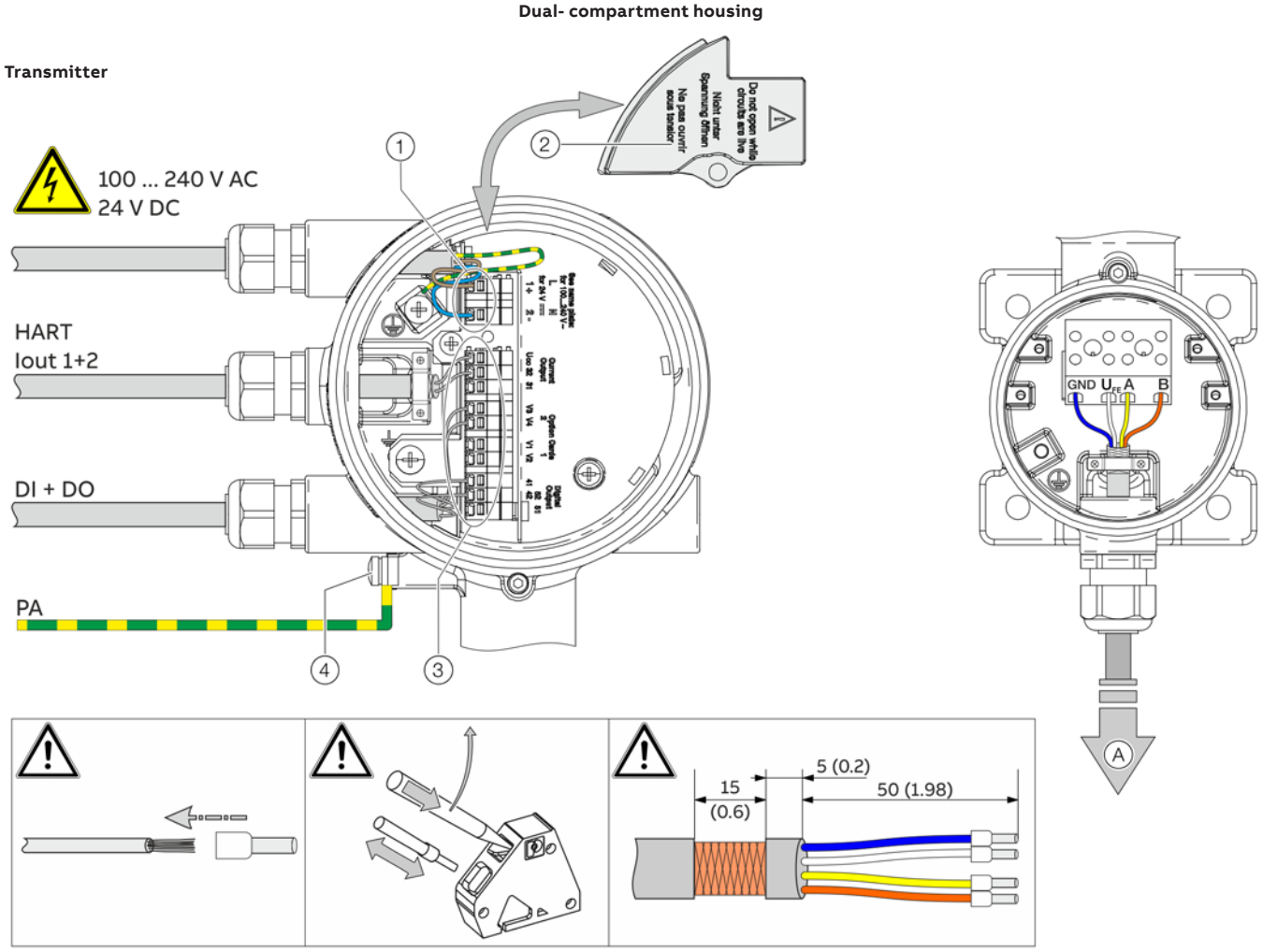
Observe the following points when connecting to an electrical supply:

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

6 ...Electrical connections

...Pin assignment

Connection to remote mount design

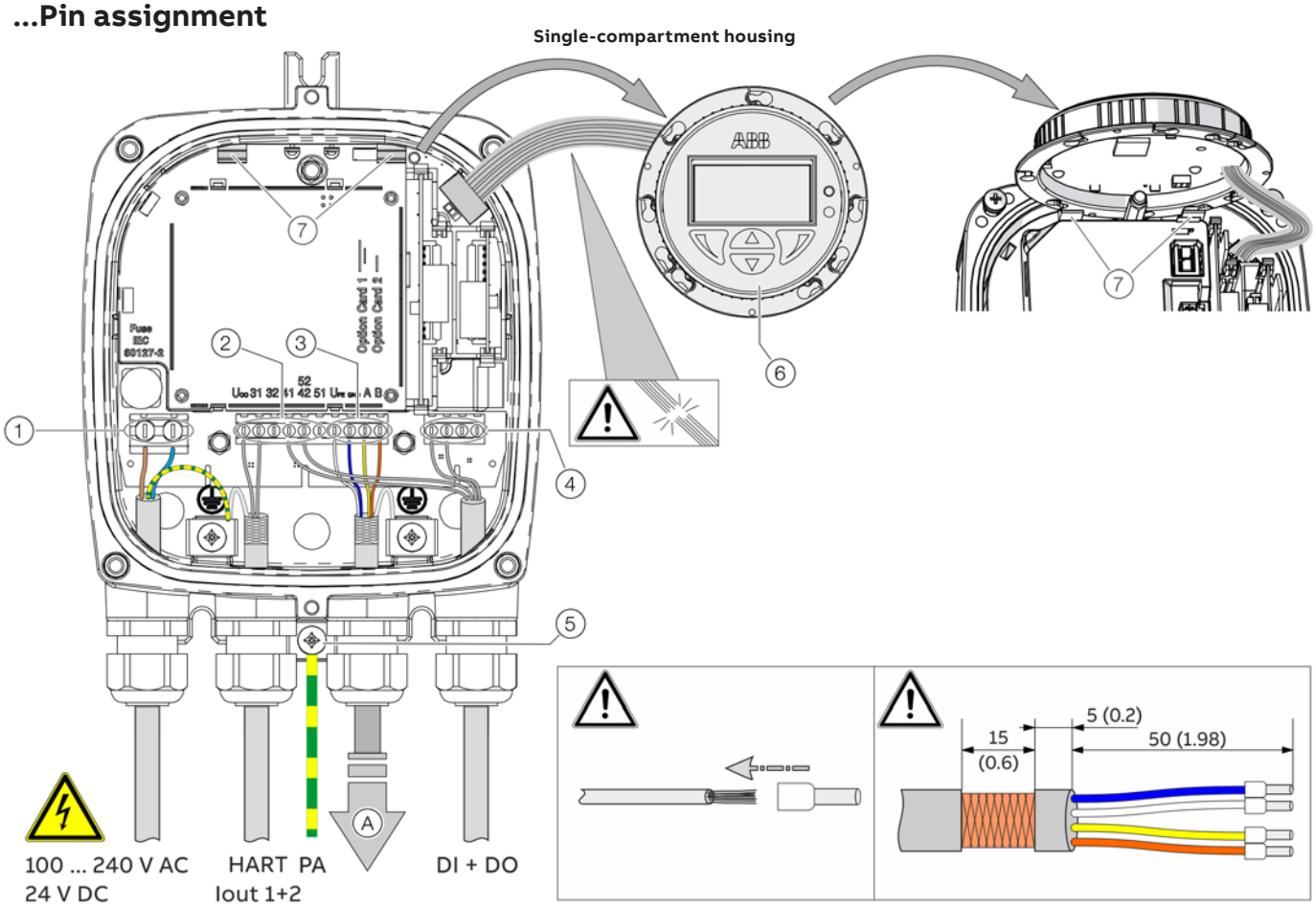


Ⓐ Upper terminal box (back side)
Ⓑ Lower terminal box
Ⓒ Signal cable to sensor
① Terminals for power supply
② Cover for power supply terminals
③ Terminals for signal cable
④ Terminals for inputs and outputs
⑤ Terminal for potential equalization

Figure 55 Electrical connection to transmitter in remote mount design [example, dimensions in mm (in)]

6 ...Electrical connections

...Pin assignment

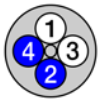


(A) Signal cable to sensor
(1) Terminals for power supply
(2) Terminals for inputs and outputs (base device)
(3) Terminals for signal cable
(4) Terminals for inputs and outputs (plug-in cards)
(5) Terminal for potential equalization
(6) LCD indicator
(7) Bracket for LCD indicator (park position)

Figure 56 Electrical connection to transmitter in remote mount design [example, dimensions in mm (in)]

NOTICE

If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class.
Follow the instructions in **Opening and closing the housing** on page 22 to open and close the housing safely.

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

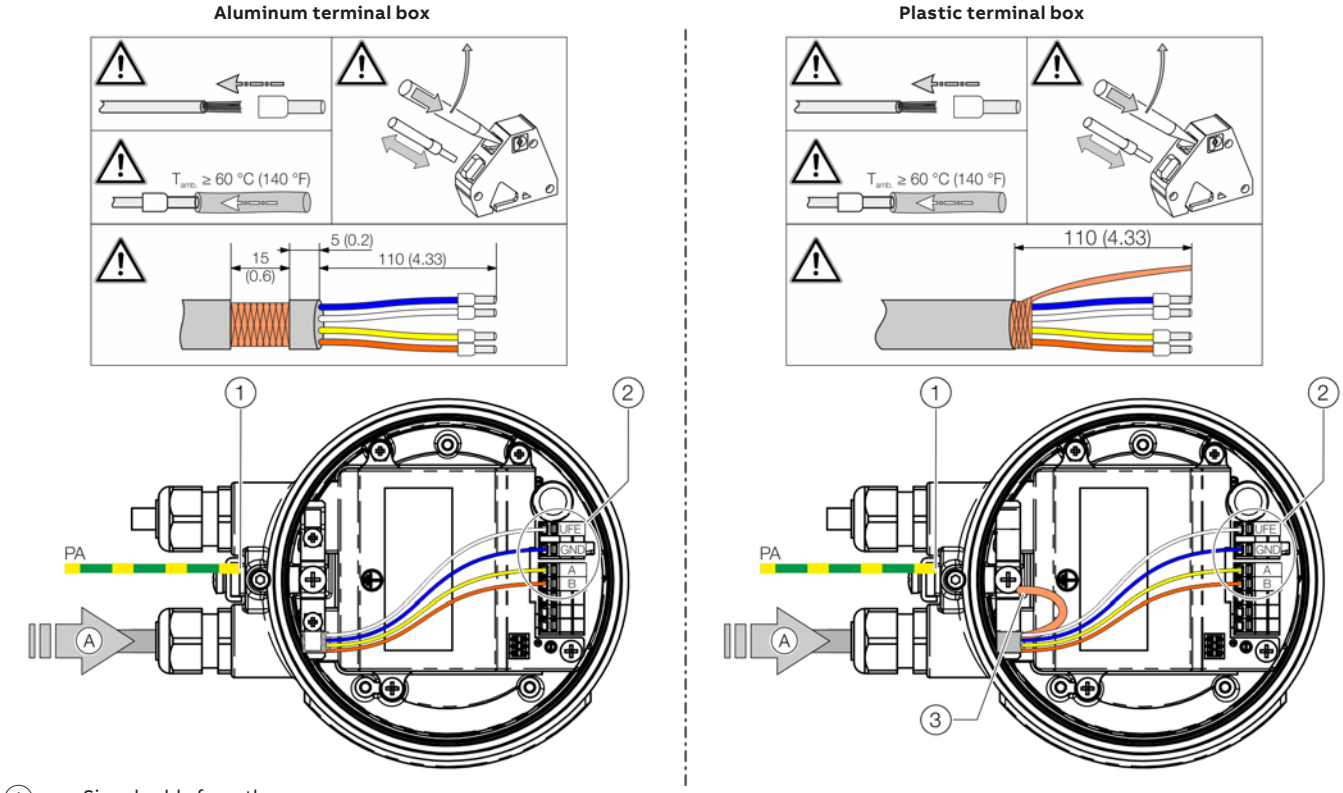
Observe the following points when connecting to an electrical supply:

- aLead 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.

6 ...Electrical connections

...Pin assignment

Flowmeter sensor

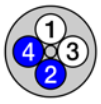


(A) Signal cable from the sensor
(1) Terminal for potential equalization
(2) Terminals for signal cable
(3) Terminals for signal cable shielding

Figure 57 Connection to sensor in remote mount design (example)

NOTICE

If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class.
Follow the instructions in **Opening and closing the housing** on page 22 to open and close the housing safely.

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

Observe the following points when connecting to an electrical supply:

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

6 ...Electrical connections

Digital communication

HART® communication

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

In connection with the DTM (Device Type Manager) available to the device, communication (configuration, parameterization) can be carried out FDT 0.98 or 1.2 (DSV401 R2).

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

The necessary DTMs and other files can be downloaded from www.abb.com/flow.

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

Factory setting of the HART process variables	
HART process variable	**Process value**
Primary Value (PV)	Q_m – Mass flow
Secondary Value (SV)	Q_v – Volume flow rate
Tertiary Value (TV)	p – Density
Quaternary Value (QV)	T_m – Measuring medium temperature

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

Modbus® communication

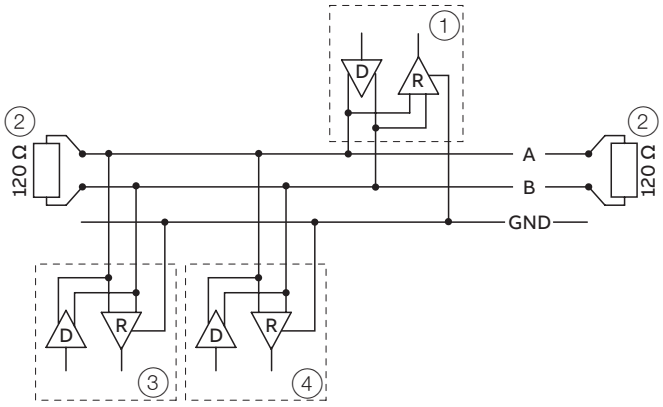
Note
The Modbus® protocol are not secure, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

Modbus is an open standard owned and administrated by an independent group of device manufacturers styled the Modbus Organization (www.modbus.org).
Using the Modbus protocol allows devices made by different manufacturers to exchange information via the same communication bus, without the need for any special interface devices to be used.

Modbus protocol	
Terminals	V1 / V2
Configuration	Via the Modbus interface or via the local operating interface in connection with Asset Vision Basic (DAT200) and a corresponding Device Type Manager (DTM)
Transmission	Modbus RTU - RS485 serial connection
Baud rate	2400, 4800, 9600, 19200, 38400, 56000, 57600, 115200 baud Factory setting: 9600 baud
Parity	None, even, odd Factory setting: odd
Stop bit	One, two Factory setting: One
IEEE format	Little endian, big endian Factory setting: Little endian
Typical response time	< 100 ms
Response delay time	0 to 200 milliseconds Factory setting: 10 milliseconds

6 ...Electrical connections

...Digital communication



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

Figure 58 Communication with the Modbus protocol

Cable specification

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

- At a baud rate of 9600 and with a conductor cross-section of at least 0.14 mm2 (AWG 26), the maximum length is 3280 ft (1000 m).
- When using a 4-core cable as a 2-wire wiring system, the maximum length must be halved.
- The spur lines must be short, a maximum of 66 ft (20 m).
- When using a distributor with 'n' connections, each branch must have a maximum length of 131 ft (40 m) divided by 'n.'

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

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

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

PROFIBUS DP® communication

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

PROFIBUS DP interface	
Terminals	V1 / V2
Configuration	Via the PROFIBUS DP interface or via the local operating interface in connection with Asset Vision Basic (DAT200) and a corresponding Device Type Manager (DTM)
Transmission	In accordance with IEC 61158-2
Baud rate	9.6 kbps, 19.2 kbps, 45.45 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1.5 Mbps The baud rate is automatically detected and does not need to be configured manually
Device profile	PA Profile 3.02
Bus address	Address range 0 to 126 Factory setting: 126

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

You can download EDD, DTM and GSD from www.abb.com/flow.

The files required for operation can also be downloaded from www.profibus.com.

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

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

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

See also **Ident Nr. Selector** on page 95.

6 ...Electrical connections

...Digital communication

Limits and rules when using ABB fieldbus accessories

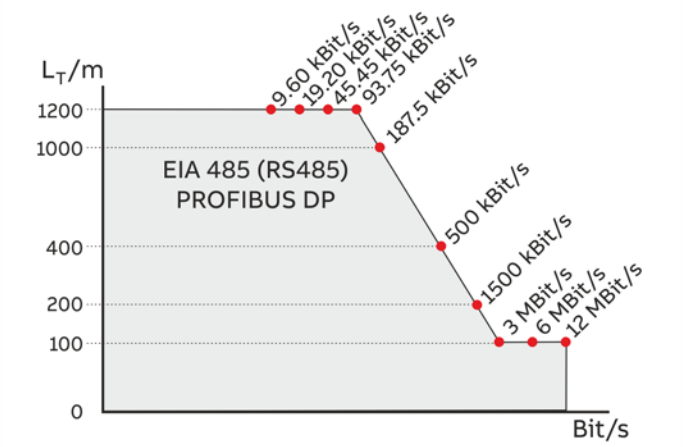


Figure 59 Bus cable length depends on the transmission rate

Pro PROFIBUS Line

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

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

Per PROFIBUS DP segment

Number of DP nodes ≤ 32

- (Node = Devices with / without PROFIBUS address)
- Bus termination required at the beginning and end of each DP segment!
- Trunk cable length (LT) see diagram (length dependent on transfer rate)
- Cable length of at least 1 m between two DP nodes at ≥ 1500 kBit/s!
- Spur cable length (LS), at ≤ 1500 kBit/s: LS ≤ 10”, at > 1500 kBit/s: LS = 0.0”!
- At 1500 kBit/s and ABB DP cable type A:
  - Sum of all spur cable lengths (LS) ≤ 21.6 ft, trunk cable length (LT) > 21.6 ft, total length = LT+ (ΣL_s) ≤ 656 ft, maximum 22 DP nodes (= 21.6 ft / (10” + 2” spare))

7 Commissioning

Safety instructions

Limits and rules when using ABB fieldbus accessories

⚠ CAUTION

Risk of burns due to hot measuring media

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

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

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

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

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

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

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

Use in Potentially Explosive Atmospheres

Note

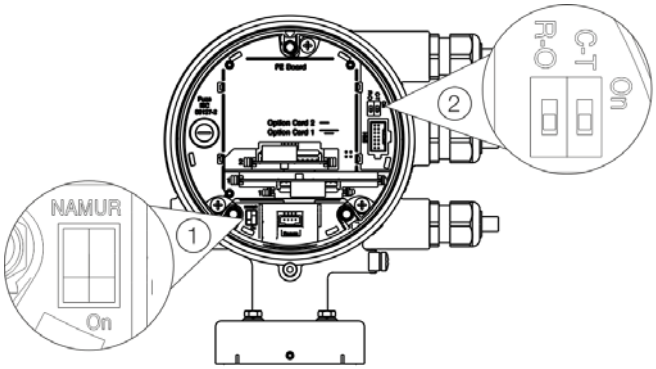
- An additional document with Ex safety instructions is available for measuring systems that are used in potentially explosive atmospheres.
- Ex safety instructions are an integral part of this manual. As a result, it is crucial that the installation guidelines and connection values it lists are also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

Hardware settings

Note

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

Dual-compartment housing



① NAMUR DIP switch
② Write protection DIP switch

Figure 60 Position of the DIP switches

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

Write-protect switch

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

Number	Function
On	Write protection active
Off	Write protection deactivated.

Configuration of digital outputs 41 / 42 and 51 / 52

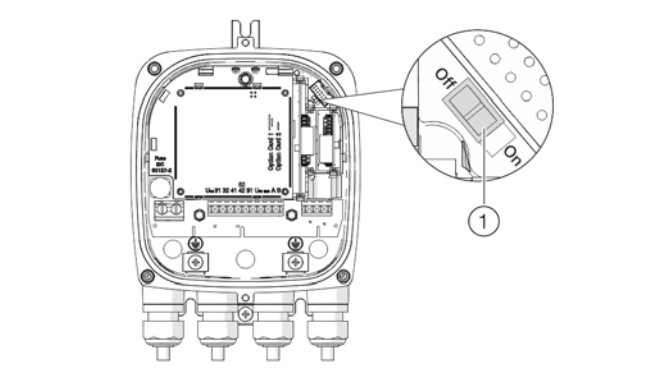
The configuration (NAMUR, optoelectronic coupler) for the digital outputs on the basic device is set via DIP switches in the transmitter.

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

...7 Commissioning

...Hardware settings

Single-compartment housing



(1) DIP switch, Write protection

Figure 61 Position of the DIP switch

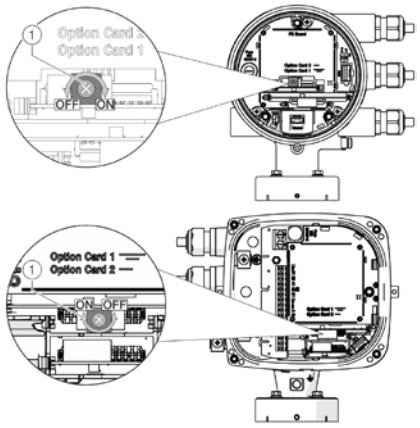
The DIP switches are used to configure specific hardware functions. The power supply to the transmitter must be briefly interrupted or the device reset in order for the modified setting to take effect.

Write-protect switch

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

Number	Function
On	Write protection active
Off	Write protection deactivated.

Configuration of digital outputs V1 / V2 or V3 / V4



(1) NAMUR rotary switch

Figure 62 Position of rotary switch on the plug-in card

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

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

...7 Commissioning

Checks prior to commissioning

The following points must be checked before commissioning the device:

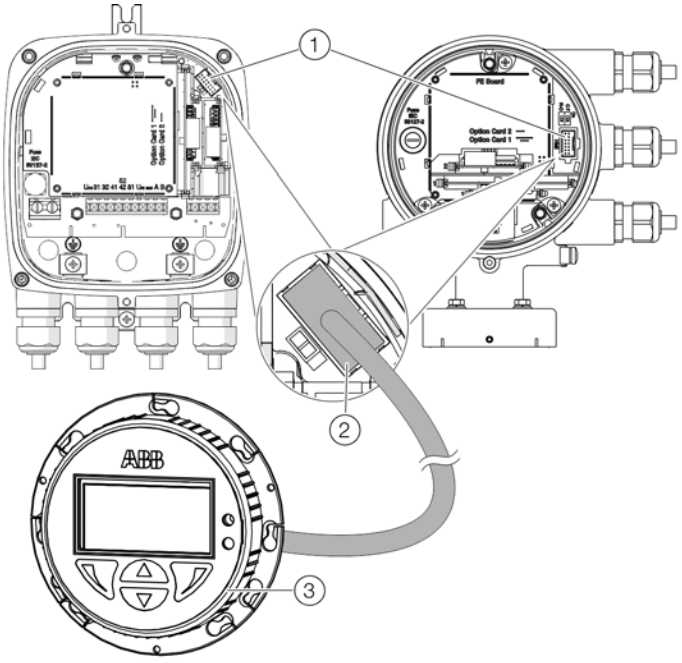
- Correct wiring in accordance with **Electrical connections** on page 28.
- Correct grounding of the sensor.
- The ambient conditions must meet the requirements set out in the specification.
- The power supply must meet the requirements set out on the name plate.

Parameterization of the device

The FEM630 can be commissioned and operated via the integrated LCD indicator (option, see **Parameterization via the menu function Easy Setup** on page 55).

Alternatively, the FEM630 can also be commissioned and operated via ABB Asset Vision Basic (FET6xx DTM).

Parameterization with the optional LCD indicator



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

Figure 63 Optional LCD indicator

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

Parameterization via the local operating interface

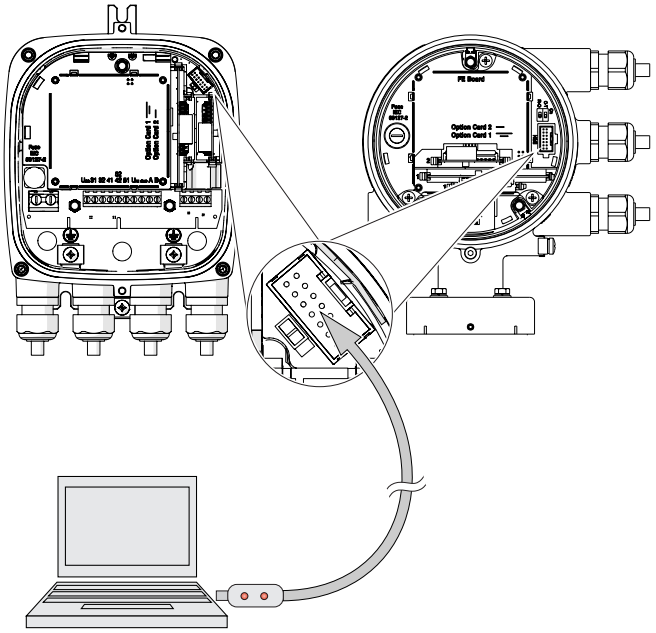
DANGER

Explosion hazard

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

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

A PC / Notebook and the USB interface cable are needed to configure the device via the device local operating interface. By combining the HART-DTM and the softwareflow available at www.abb.com/ABB AssetVision, all parameters can also be set without a fieldbus connection.



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

Figure 64 Connection to the local operating interface

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

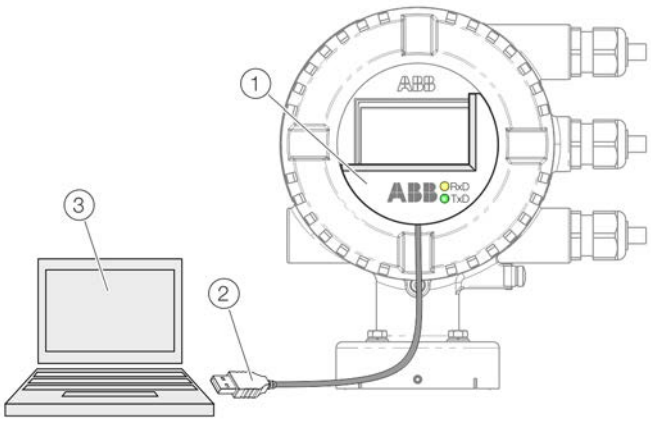
Detailed information on operating the software is available in the relevant operating instructions and the DTM online help.

...7 Commissioning

...Parameterization of the device

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

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



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

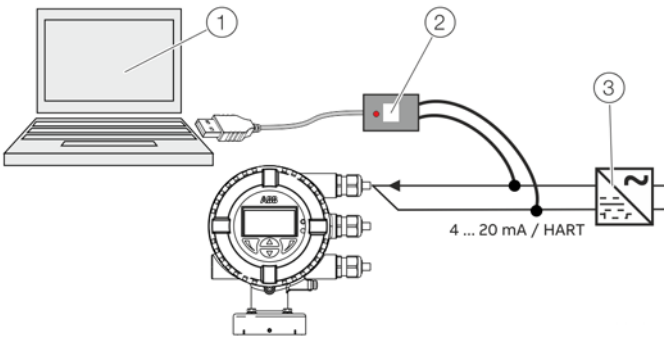
Figure 65 Infrared service port adapter on the transmitter (example)

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

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

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

All parameters can also be set via the HART protocol, using the HART DTM available at www.abb.com/flow and theABB AssetVisionsoftware.



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

Figure 66 HART Modem on the transmitter (example)

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

...7 Commissioning

Factory settings

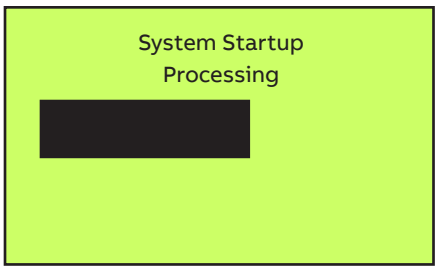
The device can be factory parameterized to customer specifications upon request. If no customer information is available, the device is delivered with factory settings.

Parameter	Factory setting
Qv Max 1	Q_{max}DN (see Table Measuring range table on page 59)
Sensor Tag	None
TX Location TAG	None
Unit Volumeflow Qv	ugal/min (US galon/minute)
Unit Vol. Totalizer	ugal (US gallon)
Pulses per Unit	1
Pulse Width	100 ms
Damping	1 s
Digital output 41 / 42	Impulses for Forward & Reverse
Digital output 51 / 52	Flow Direction
Current output	4-20mA FWD/REV
Curr.Out at Alarm	High Alarm, 21.8 mA
Current at flow > 20.5 mA	Off
Low Flow Cut Off	1 %
EPD Alarm	Off

Switching on the power supply

- Switch on the power supply.

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



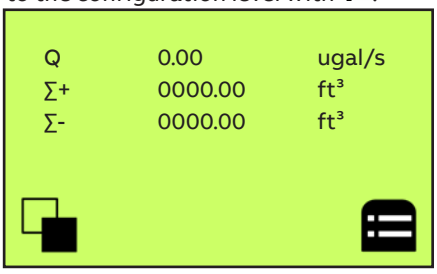
The process display is displayed after the startup process.

Parameterization via the menu function Easy Setup

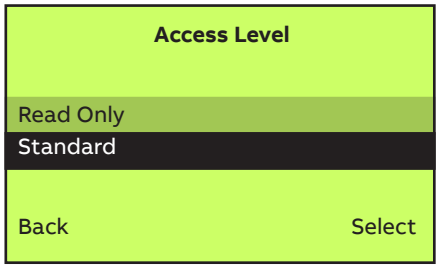
Settings for the most common parameters are summarized in the ‘Easy Setup’ menu. This menu provides the fastest way to configure the device.

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

1 Switch to the configuration level with .



2 Use / to select ‘Standard’.

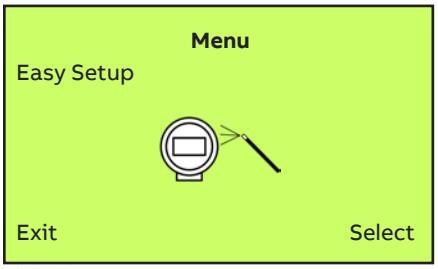


3 Confirm the selection with .

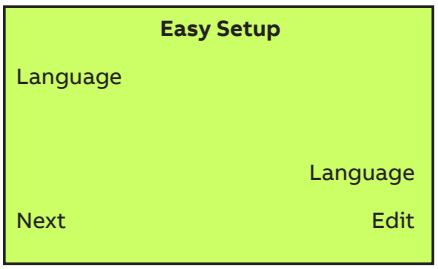
4 Use to confirm the password. A password is not available as factory default; you can continue without entering a password.

...7 Commissioning

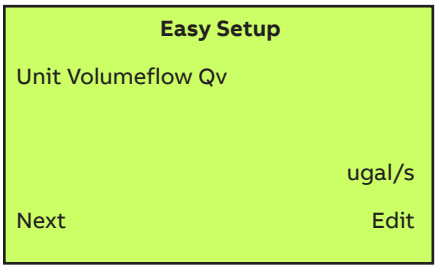
...Parameterization via the menu function Easy Setup



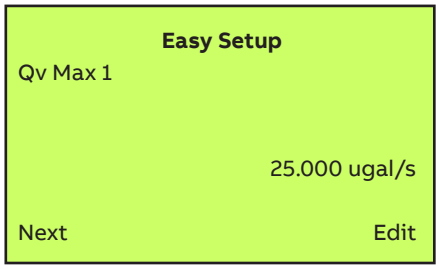
5 Use /▽ to select 'Easy Setup'.
6 Confirm the selection with .



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

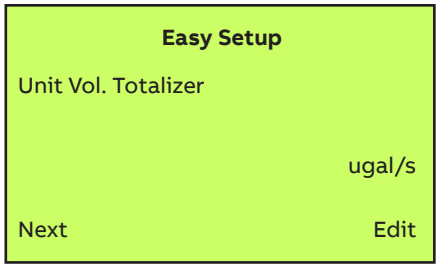


10 Use to call up the edit mode.
11 Use /▽ to select the desired unit for the volume flow rate.
12 Confirm the selection with .

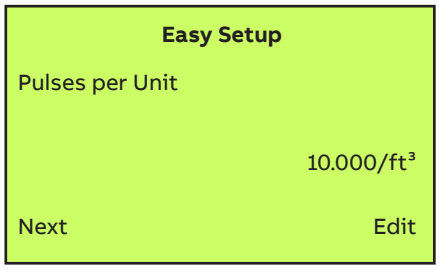


13 Use to call up the edit mode.
14 Use /▽ to set the desired upper range value.
15 Confirm the selection with .

The device is factory calibrated to the flow range end value QmaxDN, unless other customer information is available. The ideal upper range values are those which correspond to a flow velocity of 6.5 to 10 ft/s (2 to 3 m/s) (0.2 to 0.3 × Q_{max}DN) The adjustable upper range values are listed in the table at **Measuring range table** on page 59.



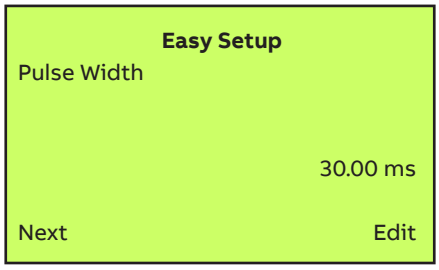
16 Use to call up the edit mode.
17 Use /▽ to select the desired unit for the volume totalizer.
18 Confirm the selection with .



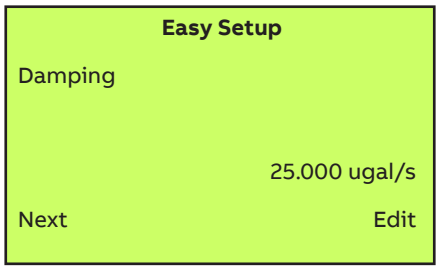
19 Use to call up the edit mode.
20 Use /▽ to select the desired pulse per unit for the pulse output.
21 Confirm the selection with .

...7 Commissioning

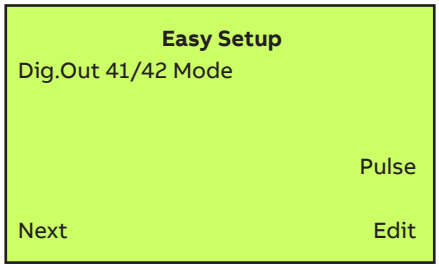
...Parameterization via the menu function Easy Setup



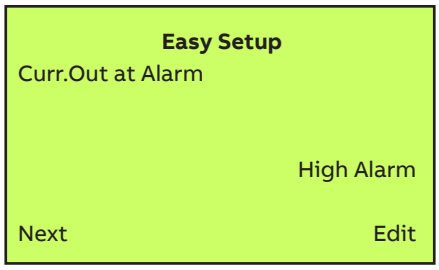
22 Use to call up the edit mode.
23 Use / to select the desired pulse width for the pulse output..
24 Confirm the selection with .



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



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



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

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

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

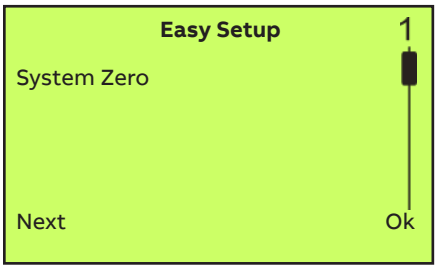
...7 Commissioning

...Parameterization via the menu function Easy Setup

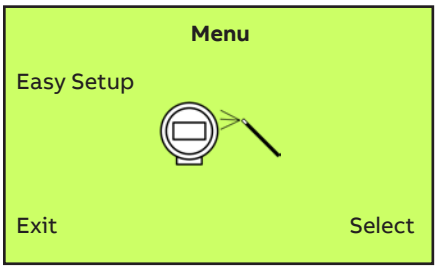
Zero point adjustment of the flowmeter

Note

- Prior to starting the zero point adjustment, make sure that:
- There is no flow through the sensor (close all valves, shut-off devices etc.)
- The sensor is completely filled with the medium to be measured



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



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

40 Use  to switch to the process display.

...7 Commissioning

Measuring range table

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

Nominal diameter		**Min. flow range end value**	**Q_{max}DN**	**Max. flow range end value**
DN	**in**	**0.02 × Q_{max}DN ≈ .656 ft/s (0.2 m/s)**	**0 to ≈ 32.8 ft/s (10 m/s)**	**2 × Q_{max}DN ≈ 65.6 ft/s (20 m/s)**
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	**¼**	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)**
10	**⅜**	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	**½**	2 l/min (0.53 US gal/min)	**100 l/min (26.4 US gal/min)**	**200 l/min (52.8 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)**
40	**1½**	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 m3/h (5.28 US gal/min)	**60 m3/h (264 US gal/min)**	**120 m3/h (528 US gal/min)**
80	**3**	3.6 m3/h (15.9 US gal/min)	**180 m3/h (793 US gal/min)**	**360 m3/h (1585 US gal/min)**
100	**4**	4.8 m3/h (21.1 US gal/min)	**240 m3/h (1057 US gal/min)**	**480 m3/h (2113 US gal/min)**

8 Operation

Safety instructions

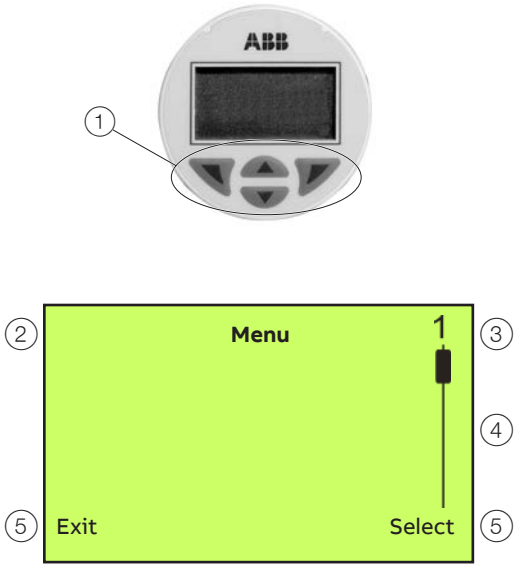
⚠ CAUTION

Risk of burns due to hot measuring media
The device surface temperature may exceed 158 °F (70 °C), depending on the measuring medium temperature!
- Before starting work on the device, make sure that it has cooled sufficiently.

Aggressive or corrosive media may lead to the damage of wetted parts of the sensor. As a result, measuring medium under pressure can leak out. Wear to the flange gasket or process connection gaskets (e.g. pipe fitting, Tri-clamp, etc.) may caused a pressurized measuring medium to escape. When using internal flat gaskets, they can become brittle through CIP- / SIP processes. If pressure surges above the permissible nominal pressure of the device occur permanently during operation, this may affect the service life of the device.

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

Menu navigation



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

Figure 67 LCD display

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

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

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

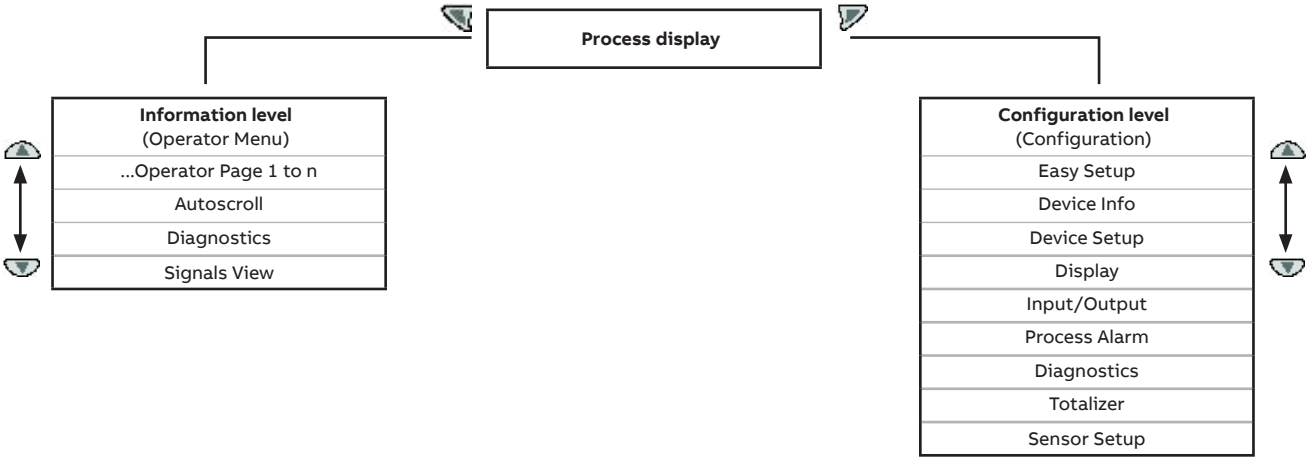
Control button functions

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

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

8 ...Operation

Menu levels



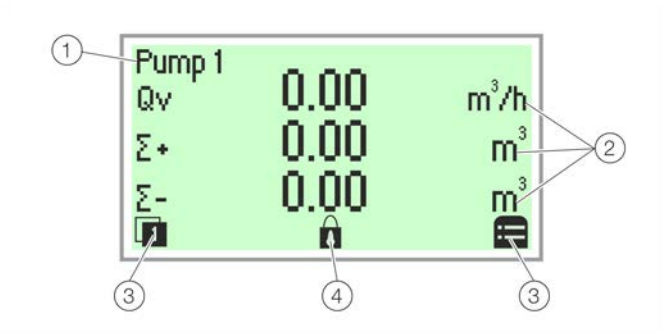
Process display
The process display shows the current process values. There are two menu levels under the process display.

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

Configuration level (Configuration)
The configuration level contains all the parameters required for device commissioning and configuration. The device configuration can be changed on this level.
For additional information on the parameters see **Parameter descriptions** on page 77.

8 ...Operation

Process display



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

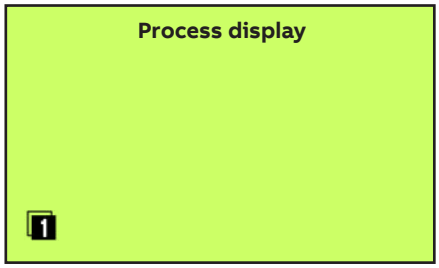
Figure 68 Process display (example)

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

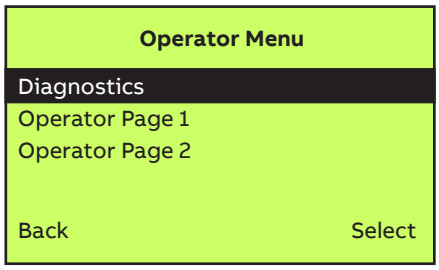
Symbol	Description
/	Call up information level. When Autoscroll mode is activated, the icon appears here and the operator pages are automatically displayed one after the other
	Call up configuration level.
	The device is protected against changes in the parametrization.

Switching to the information level

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



1 Open the using Operator Menu.



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

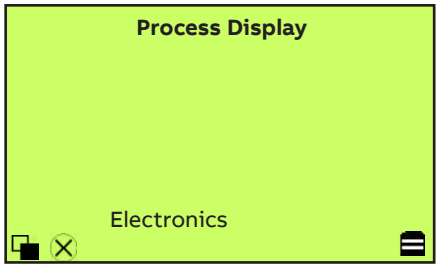
Menu	Description
... / Operator Menu	
Diagnostics	Selection of sub-menu 'Diagnostics'; see also **Error messages on the LCD display** on page 63.
Operator Page 1 to n	Selection of operator page to be displayed.
Autoscroll	When 'Autoscroll' is activated, automatic switching of the operator pages is initiated on the process screen.
Signals View	Selection of submenu 'Signals View' (only for service purposes).

8 ...Operation

...Switching to the information level

Error messages on the LCD display
In the event of an error, a message consisting of a symbol and text (e.g. Electronics) appears at the bottom of the process screen.

The text displayed provides information about the area in which the error has occurred.



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

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

The error messages are also divided into the following areas:

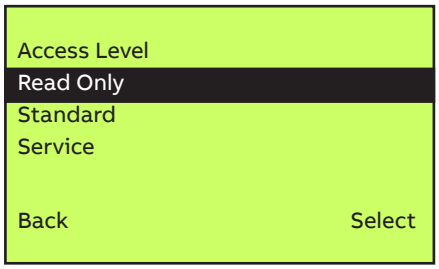
Range	Description
Operation	Error / alarm due to the current operating conditions.
Sensor	Error / alarm of the flowmeter sensor.
Electronics	Error / alarm of the electronics.
Configuration	Error / alarm due to device configuration.

Note
For a detailed description of errors and troubleshooting instructions, please see **Diagnosis / error messages** on page 108.

Switching to the configuration level (parameterization)

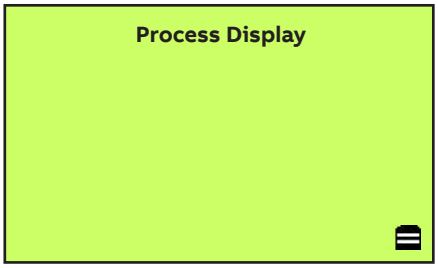
The device parameters can be displayed and changed on the configuration level.

1 Switch to the configuration level with  .



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

Note
There are three levels of access. A password can be defined for level ‘Standard’.
- There is no factory default password. For security reasons it is recommended to set a password.
- The password prevents access to the parameterization via the buttons on the device. For further access protection via DTM or EDD (HART®, PROFIBUS®, Modbus®) the hardware write protection switch must be set (see **Hardware settings** on page 51).

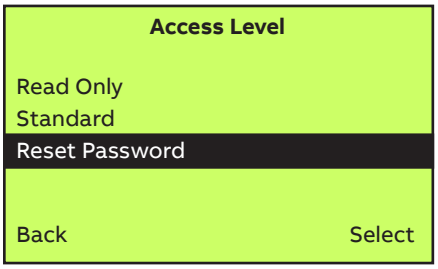


Access Level	Description
Read Only	All parameters are locked. Parameters are read only and cannot be modified.
Standard	All the parameters can be changed.
Service	Only ABB Customer Service has access to the Service menu.

8 ...Operation

...Switching to the configuration level (parameterization)

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



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

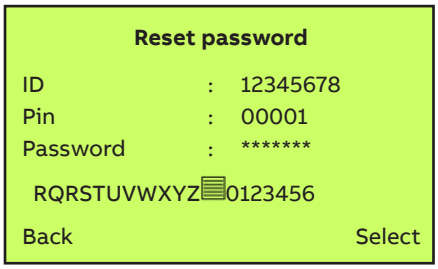
The LCD display now indicates the first menu item on the configuration level.

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

Resetting the customer password
If the set password has been forgotten, the password can be reset and reassigned.
A one-time password is needed for this purpose and can be generated by ABB Service upon request.
To reset the password, the password has to be entered incorrectly once for the 'Standard' user level. When the configuration level is called up again, a new entry 'Reset password' then appears in the list of access levels.

1 Switch to the configuration level with ◢.

2 Use ▲/▼ to select the 'Reset password' entry.
3 Confirm the selection with ◢.



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

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

6 Confirm the input with ◢.

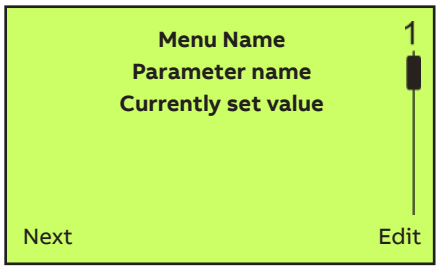
After the one-time password has been entered, the password for the 'Standard' access level is reset and can be reassigned.

8 ...Operation

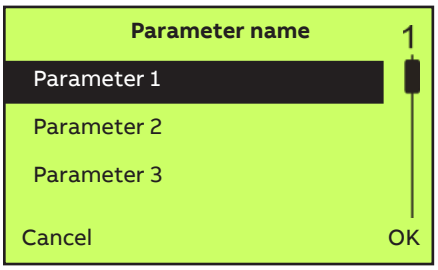
Selecting and changing parameter

Entry from table

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



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

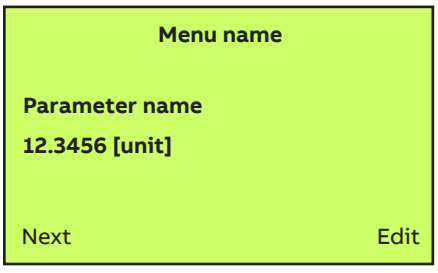


3 Select the desired value using /.
4 Confirm the selection with .

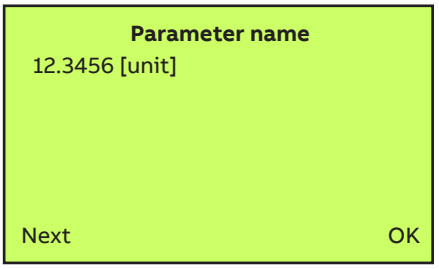
This concludes the procedure for selecting a parameter value.

Numerical entry

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



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

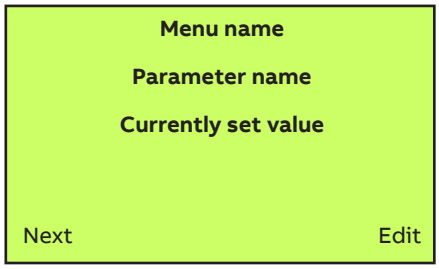


3 Use to select the decimal place to change.
4 Use / to set the desired value.
5 Use to select the next decimal place.
6 If necessary select and set additional decimal places in accordance with steps 3 to 4.
7 Use to confirm your setting.

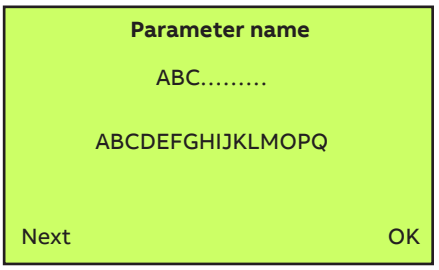
This concludes the procedure for changing a parameter value.

Alphanumeric entry

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



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



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

This concludes the procedure for changing a parameter value.

8 ...Operation

...Selecting and changing parameter

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

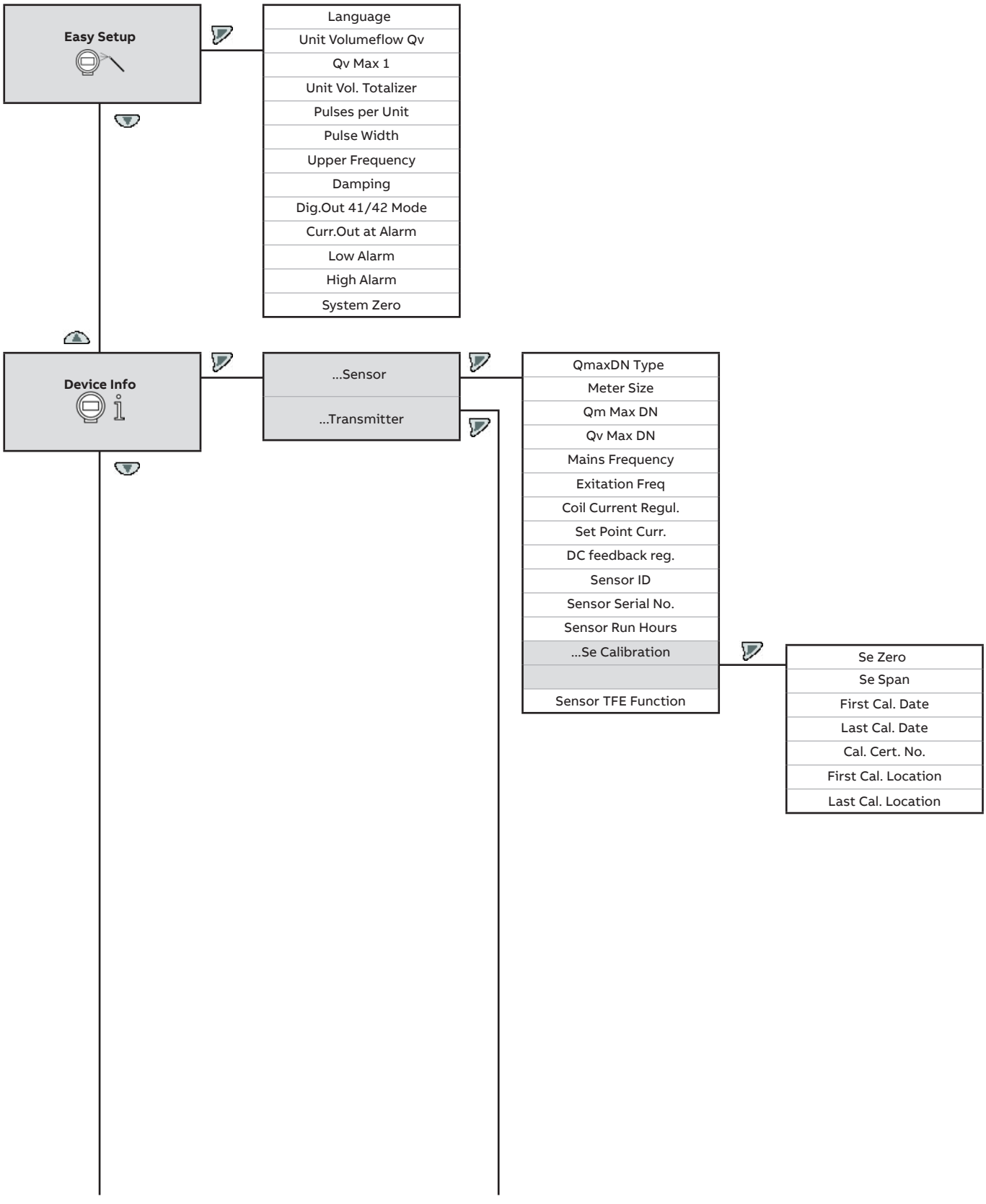
1 Pressing (Next) repeatedly moves the cursor to the right. Once the cursor reaches the end position, 'Cancel' is displayed in the lower right of the screen.
2 terminates editing and exits the menu item. Use to return to the start.

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

8 ...Operation

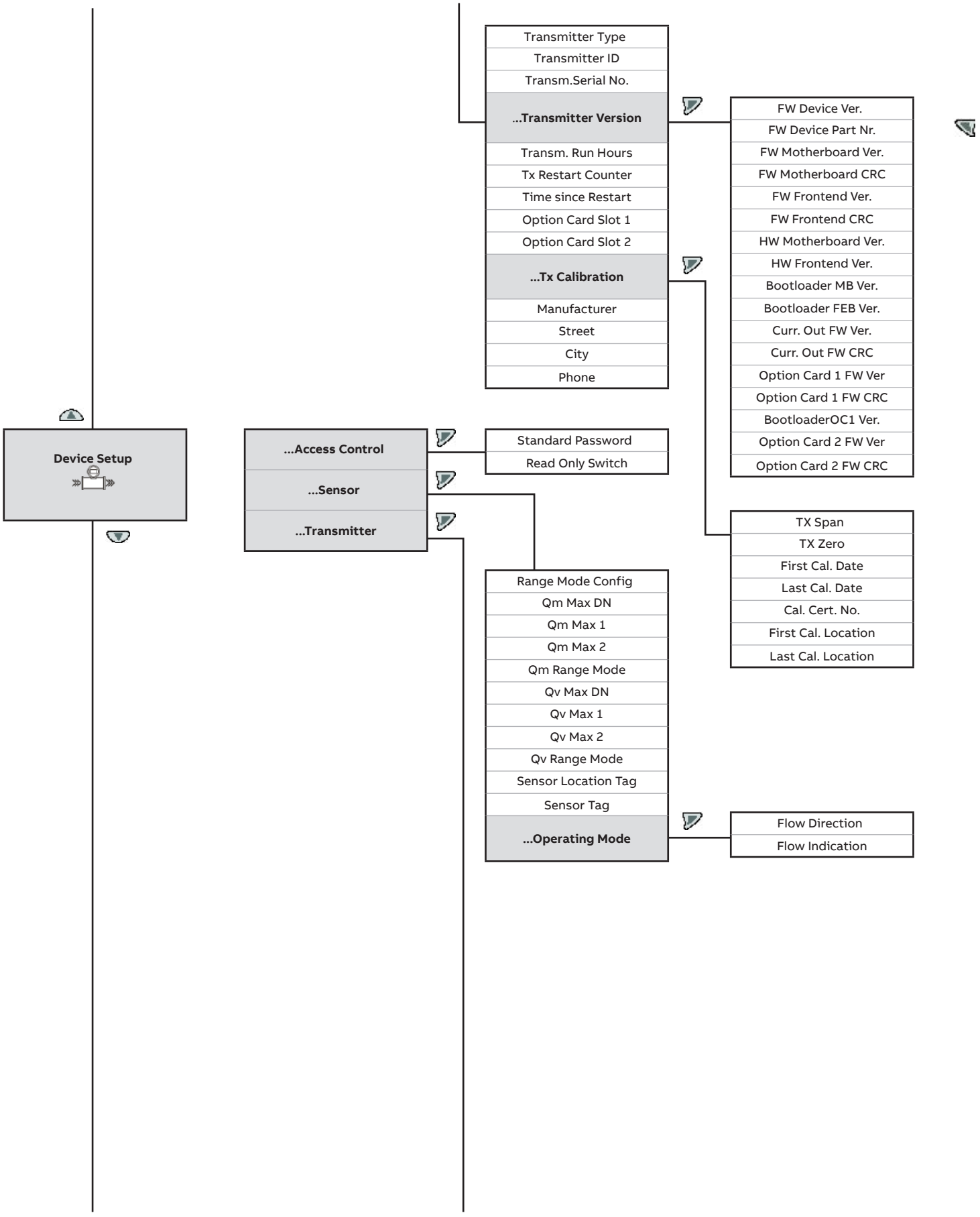
Parameter overview

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



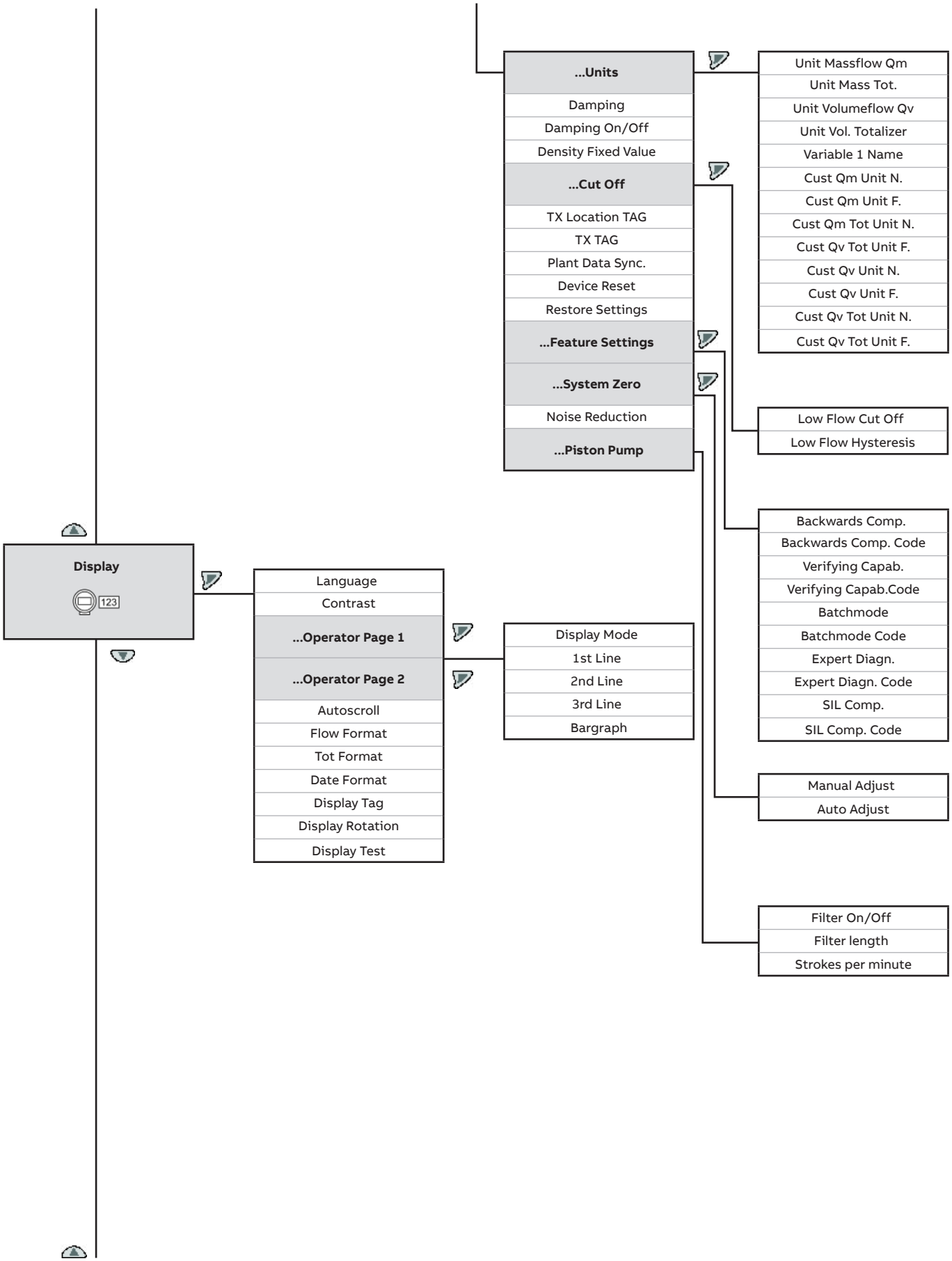
8 ...Operation

...Parameter overview



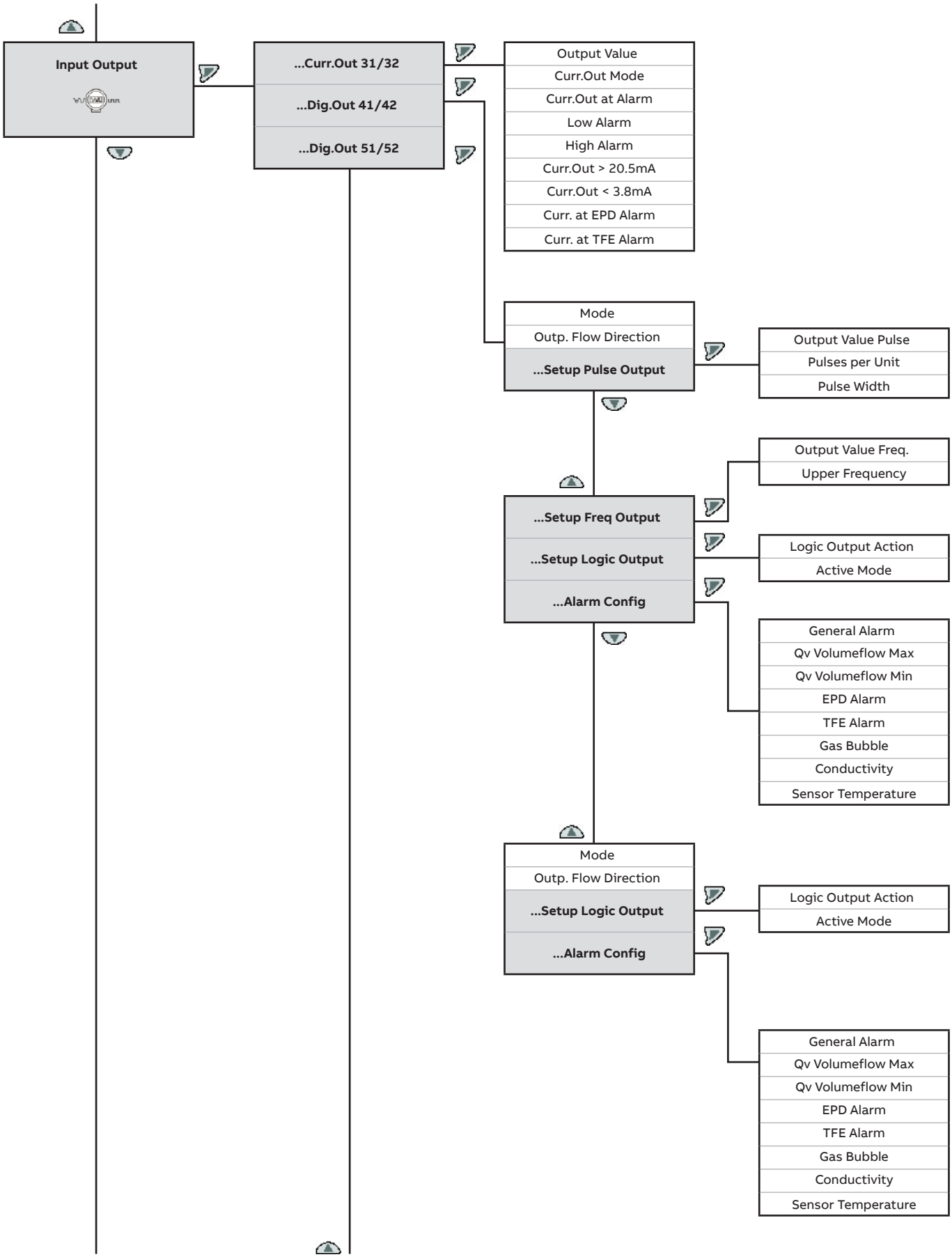
8 ...Operation

...Parameter overview



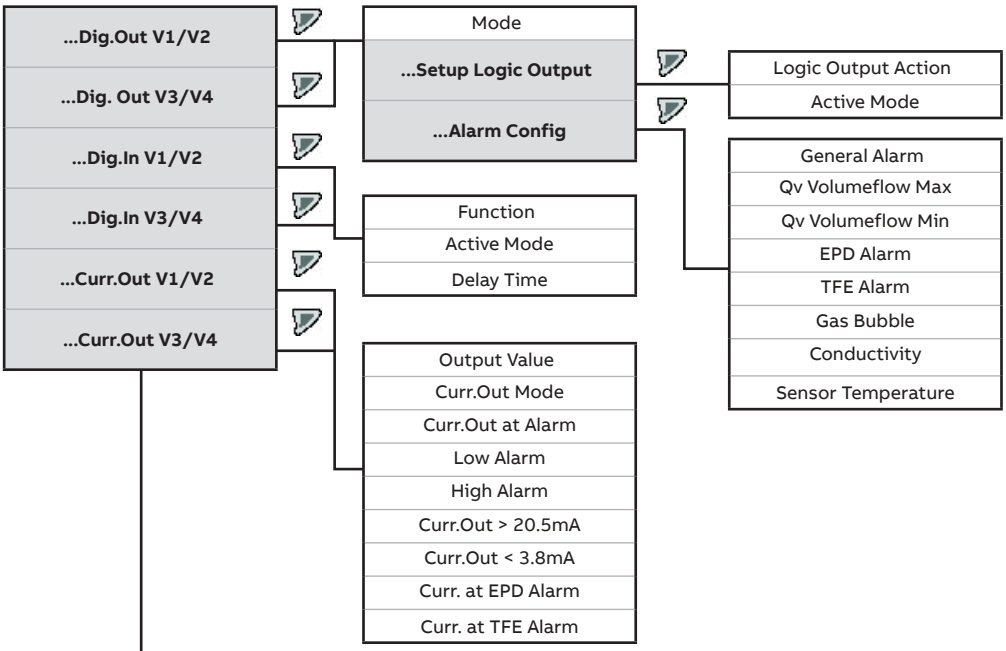
8 ...Operation

...Parameter overview



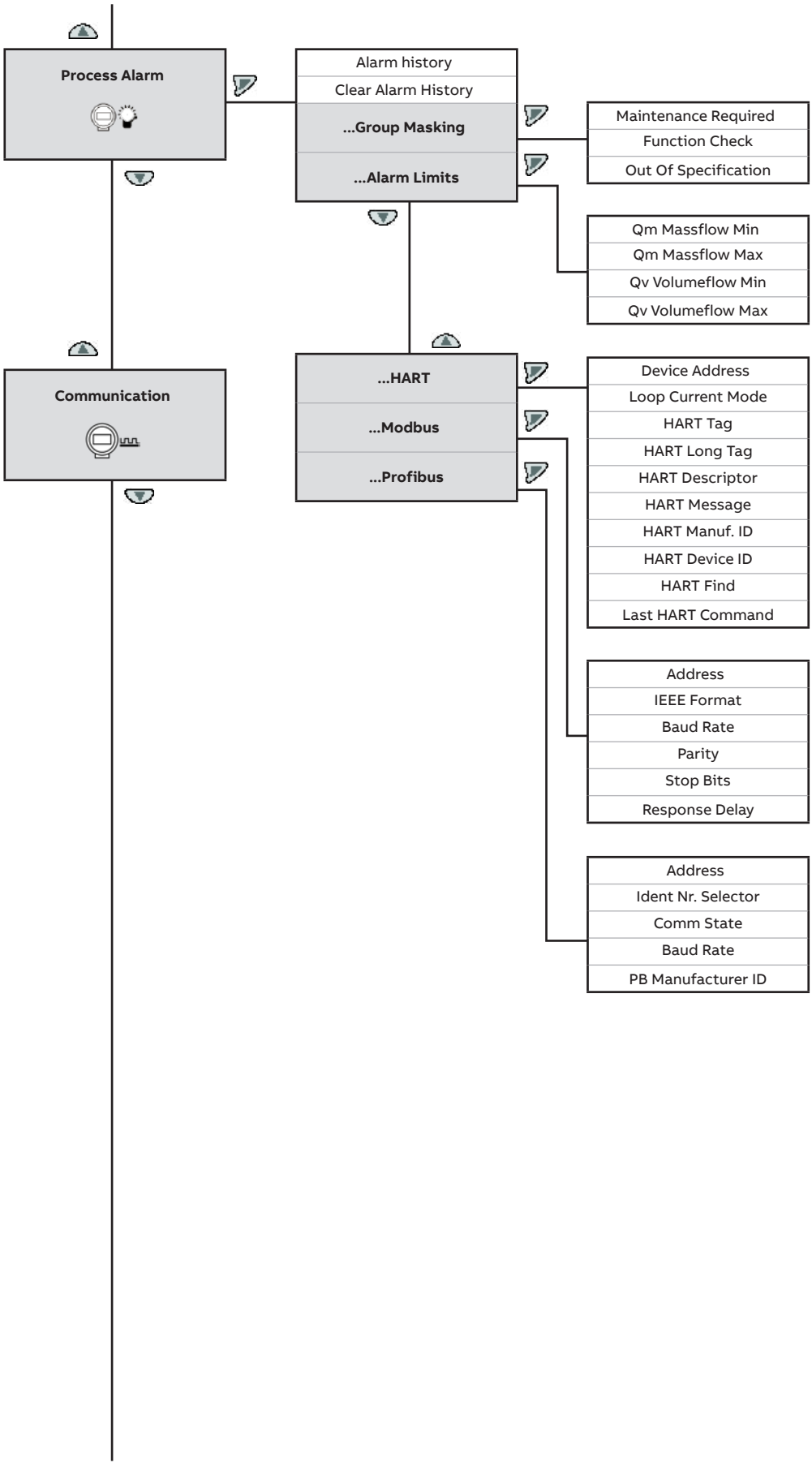
8 ...Operation

...Parameter overview



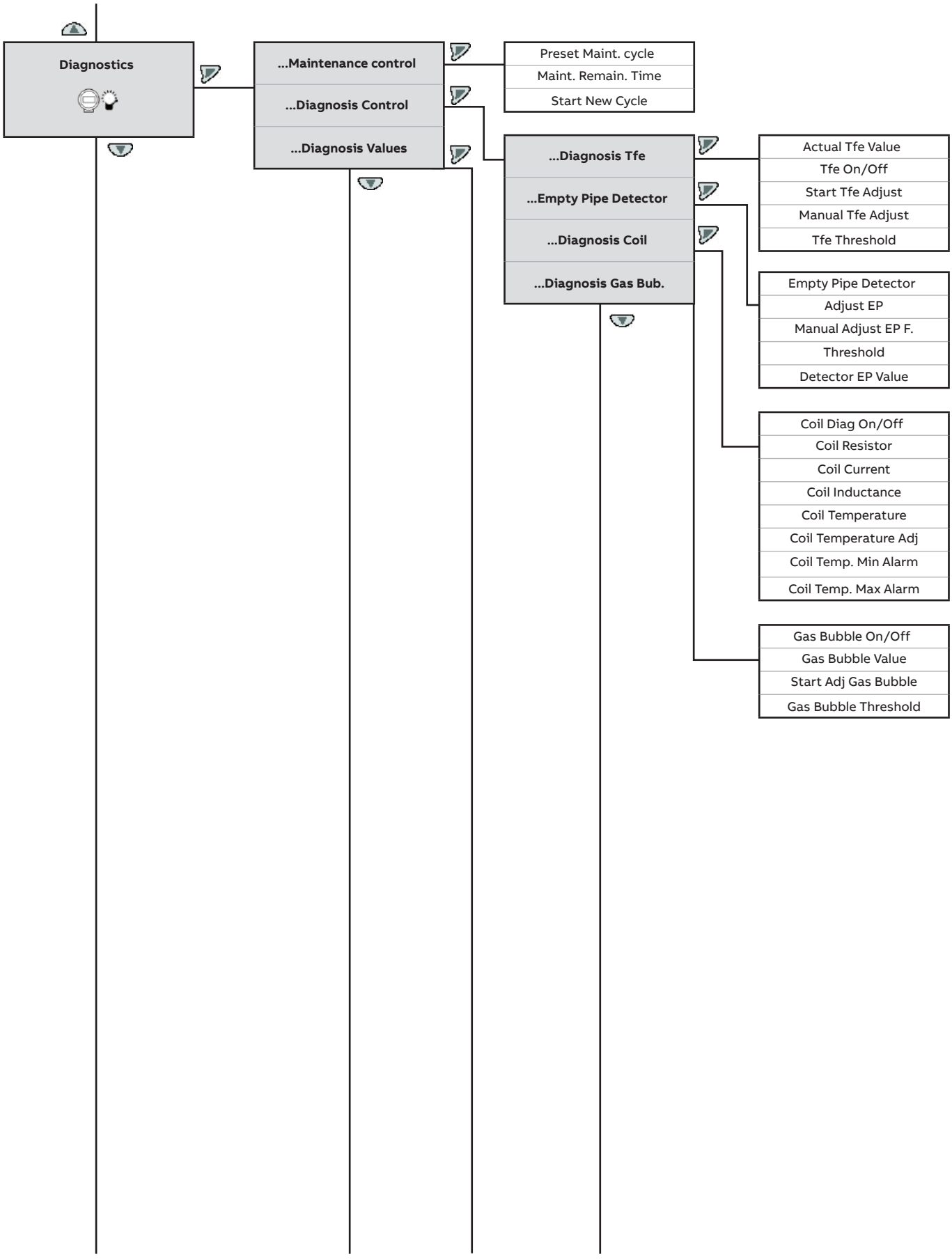
8 ...Operation

...Parameter overview



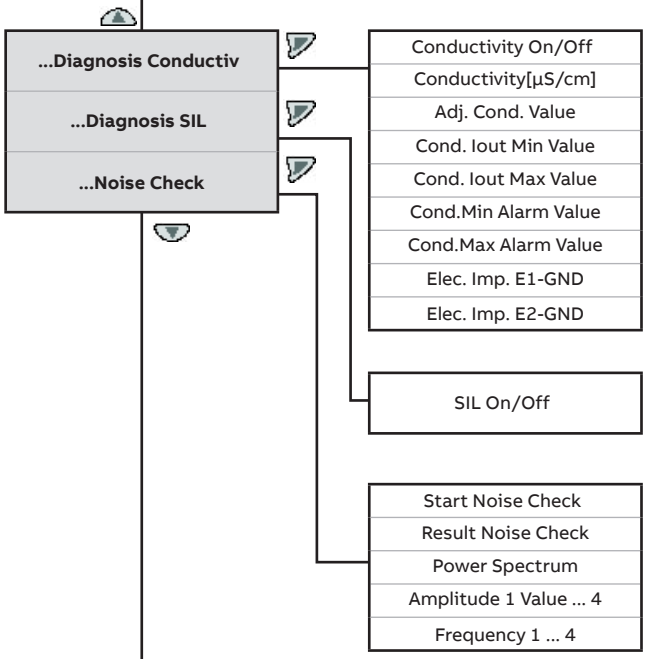
8 ...Operation

...Parameter overview



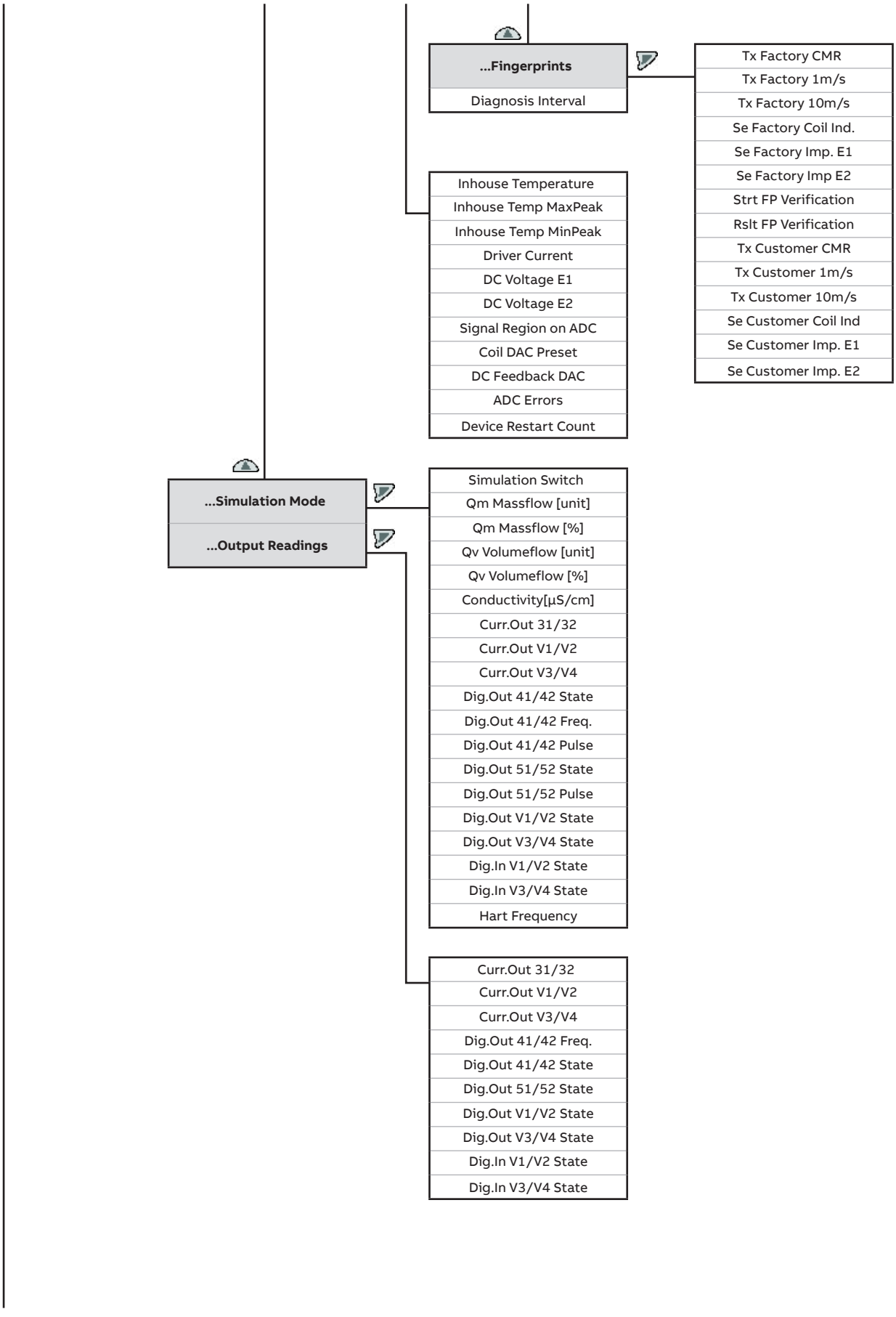
8 ...Operation

...Parameter overview



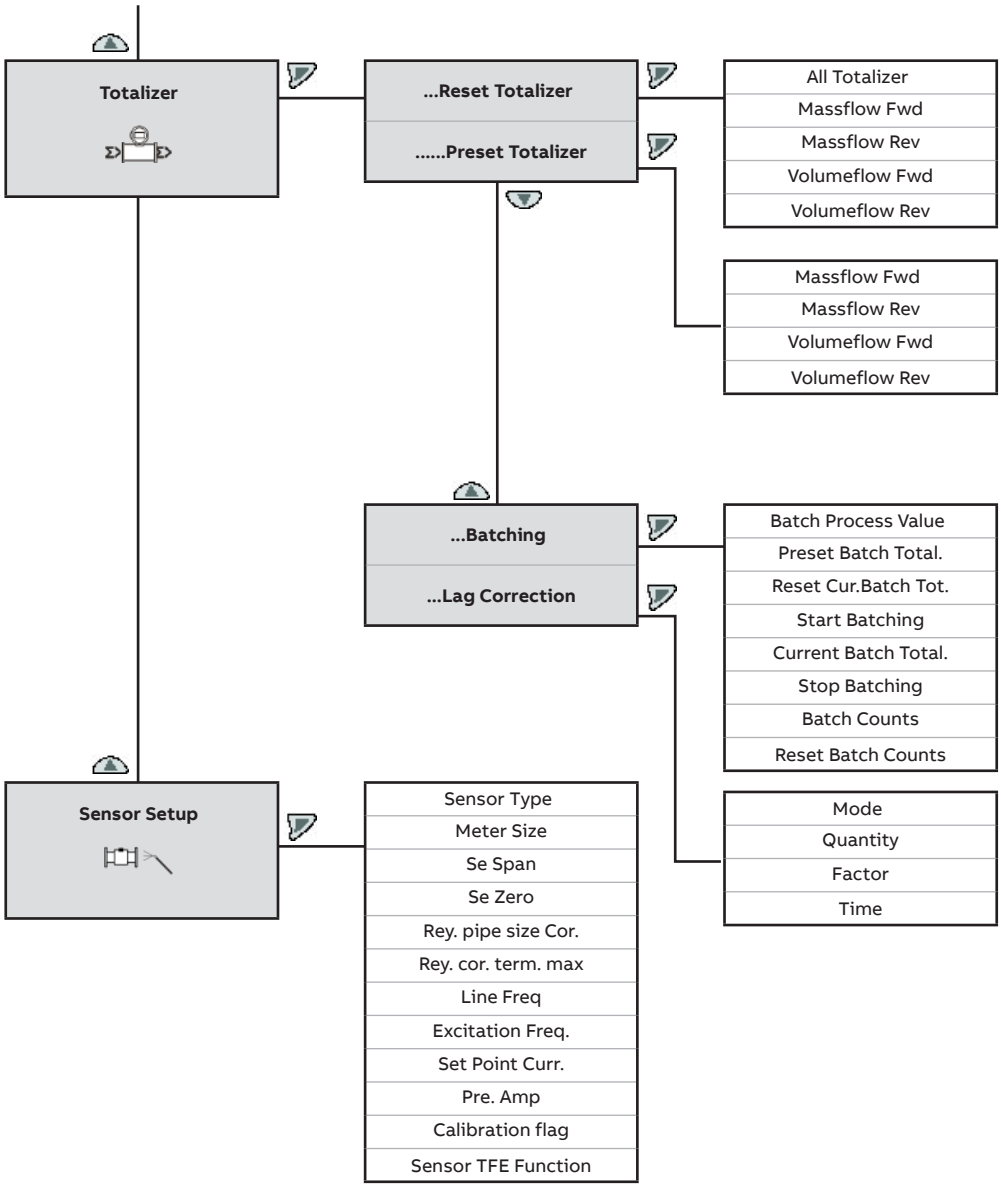
8 ...Operation

...Parameter overview



8 ...Operation

...Parameter overview



8 ...Operation

Parameter descriptions

Available units

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

Note

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

Selection	Code	Description
m3/s	13	Cubic meters per second
m3/min	14	Cubic meters per minute
m3/h	15	Cubic meters per hour
m3/d	16	Cubic meters per day
ft3/s	29	Cubic feet per second
ft3/min	30	Cubic feet per minute
ft3/h	31	Cubic feet per hour
ft3/d	32	Cubic feet per day
ml/s	46	Milliliters per second
ml/min	47	Milliliters per minute
l/s	48	Liters per second
l/min	49	Liters per minute
l/h	50	Liters per hour
l/d	51	Liters per day
hl/h	54	Hectoliters per hour
Ml/d	62	Megaliters per day
ugal/s	71	US gallons per second
ugal/min	72	US gallons per minute
ugal/h	73	US gallons per hour
ugal/d	74	US gallons per day
Mugal/d	82	Mega US gallons per day
igal/s	91	Imperial gallons per second
igal/min	92	Imperial gallons per minute
igal/h	93	Imperial gallons per hour
lgal/d	94	Imperial gallons per day
bbl/s	112	Oil barrels per second
bbl/min	113	Oil barrels per minute
bbl/h	114	Oil barrels per hour
bbl/d	115	Oil barrels per day
bls/s	130	Brew barrels per second
bls/min	131	Brew barrels per minute
bls/h	132	Brew barrels per hour
bls/d	133	Brew barrels per day
xx/yy	254	User-defined unit

Table 2 Units for the volume flow

Selection	Code	Description
g/s	1	Grams per second
g/min	2	Grams per minute
g/h	3	Grams per hour
g/d	4	Grams per day
kg/s	5	Kilograms per second
kg/min	6	Kilograms per minute
kg/h	7	Kilograms per hour
kg/d	8	Kilograms per day
lb/s	9	Pounds (avdp) per second
lb/min	10	Pounds (avdp) per minute
lb/h	11	Pounds (avdp) per hour
lb/d	12	Pounds (avdp) per day
t/min	30	Metric tons per minute
t/h	31	Metric tons per hour
t/d	32	Metric tons per day
xx/yy	254	User-definable unit

Table 3 Units for the mass flow

Selection	Code	Description
kg	2	Kilograms
g	3	Grams
t	5	Tons (metric)
Pounds	8	Pounds (advp)
xx/yy	254	User-definable unit

Table 4 Units for the mass totalizer

Selection	Code	Description
m3	4	Cubic meters
ft3	7	Cubic feet
ml	11	Milliliters
l	13	Liters
hl	14	Hectoliters
ugal	20	US gallons
igal	21	Imperial gallons
bbl	22	Barrels (petroleum, USA)
bls	31	Barrels (beer, USA)
xx/yy	254	User-definable unit

Table 5 Units for the volume totalizer

8 ...Operation

...Parameter descriptions

Menu: Easy Setup

Menu / parameter	Description
Easy Setup	
Language	Selection of the menu language (German, English, French, Spanish, Italian, Chinese, Portuguese).
Unit Volumeflow Qv	Selection of the unit for the volume flow (for example for the parameters QvMax / QvMaxDN and for the corresponding process value). Default setting: ugal/min (US gallon/ min) **Table 2: Units for the volume flow** on page 77
Qv Max 1	Setting the upper range value 1 (Measuring range = 0 to Qv Max 1) for the volume flow for forward flow and reverse flow . Default setting: 1 × Q_{max}DN
Unit Vol. Totalizer	Selection of the unit for the volume totalizers and the pulse outputs. Default: ugal (US gallon) **Table 5: Units for the volume totalizer** on page 77
Dig.Out 41/42 Mode	Selection of the operating mode for the digital output 41 / 42. Off: Digital output 41 / 42 deactivated. • Logic: Digital output 41 / 42 as a binary output (e.g. as an alarm output). • Pulse: Digital output 41 / 42 as a pulse output. In pulse mode, pulses are output per unit (e.g. 1 pulse per m3). • Frequency: Digital output 41 / 42 as a frequency output. In frequency mode, a frequency is issued that is proportional to the flow rate. The maximum frequency can be configured in accordance with the upper range value. Default setting: Pulse
Pulses per Unit Pulse Width	Set pulses per volume or per mass flow unit, and the pulse width for the digital output operating mode 'Pulse'. The pulse value and pulse width are interdependent and calculated dynamically (pulses per unit: 1 to 10000 / s, pulse width: 0.1 to 2000 mS). Only available if a digital output has been configured as a pulse output, and the volume flow or mass flow has been selected as the process variable to be output.
Upper Frequency	Sets the upper range value frequency for the digital output operating mode 'Frequency'. The entered value (0 to 10500 Hz) corresponds to 100 % flow. Only available if a digital output has been configured as a frequency output, and the volume flow or mass flow has been selected as the process variable to be output.
Damping	Select the damping. The value set here (0.02 to 60 s) refers to 1 τ (Tau). The value refers to the response time for a step flowrate change. It affects the instantaneous value in the display and at the current output. Default setting: 1 second
Curr.Out at Alarm	Selection of status of the current output in error condition. The output 'Low Alarm' or 'High Alarm' current is set in the subsequent menu.
Low Alarm	Setting the current (3.5 to 3.6 mA) for low alarm.
High Alarm	Setting the current (21 to 22.6 mA) with high alarm.
System Zero	Starts the automatic zero point balancing using . Automatic zero point balancing takes approx. 60 seconds. **Note** Prior to starting the zero point adjustment, make sure that: • There is no flow through the sensor (close all valves, shut-off devices etc.) • The sensor must be filled completely with measuring medium for measurement.

8 ...Operation

...Parameter descriptions

Menu: Device Info

This menu is only used to display the device parameters. The parameters are displayed independently of the configured access level, but cannot be changed.

Menu / parameter	Description
Device Info	
...Sensor	Selection of submenu '...Sensor' using .
...Transmitter	Selection of submenu '...Transmitter' using .

Device Info / ...Sensor	
QmaxDN Type	For informational purposes only.
Meter Size	Nominal diameter of sensor.
Qm Max DN	The value is the maximum mass flow at a flow velocity of 32.8 ft/s (10 m/s). The value is automatically set through the selected nominal diameter, multiplied by the set density.
Qv Max DN	The value provides the maximum volume flow at a flow velocity of 32.8 ft/s (10 m/s). The value is set automatically via the selected nominal diameter.
Mains Frequency	Supply frequency for the power supply.
Exitation Freq	Frequency used to operate the magnetic coils of the flowmeter sensor.
Coil Current Regul.	For service information only.
Set Point Curr.	Current used to operate the magnetic coils of the flowmeter sensor.
DC feedback reg.	For service information only.
Sensor ID	ID number of the sensor.
Sensor Serial No.	Serial number of the sensor.
Sensor Run Hours	Operating hours of the sensor.
...Se Calibration	Selection of submenu '...Se Calibration' using .
Sensor TFE Function	Shows if the total filling electrode (TFE) has been activated or deactivated.

Device Info / ...Sensor / ...Se Calibration	
Se Span	Calibration value in the forward flow (direction) and reverse flow (direction) of the sensor.
Se Zero	
First Cal. Date	Date of first calibration of sensor (calibration of new device).
Last Cal. Date	Date of last calibration of sensor.
Cal. Cert. No.	Identification (number) of the relevant calibration certificate.
First Cal. Location	Place of first calibration of the sensor.
Last Cal. Location	Place of last calibration of sensor.

8 ...Operation

...Parameter descriptions

Menu / parameter	
Device Info / ...Transmitter	
Transmitter Type	Transmitter type, e.g. B. FExx31 integral.
Transmitter ID	ID number of transmitter.
Transm.Serial No.	Serial number of transmitter.
...Transmitter Version	Selection of submenu '...Transmitter Version' using .
Transm. Run Hours	Run hours of the transmitter.
Tx Restart Counter	Number of device restarts (cyclically switching the power supply off and on).
Time since Restart	Device operating hours since the last restart.
Option Card Slot 1	Display of the assignment of slot OC1 and OC2 e.g. binary output, Profibus®, digital input. If the plug-in card is incorrectly detected or incompatible, a corresponding message will be issued.
Option Card Slot 2	
...Tx Calibration	Selection of submenu '...Tx Calibration' using .
Manufacturer	Name of manufacturer.
Street	Manufacturer's address (street).
City	Manufacturer's address (city).
Phone	Manufacturer's address (phone number).

Device Info / ...Transmitter / ...Transmitter Version	
FW Device Ver.	Version and item number of device software package.
FW Device Part Nr.	
FW Motherboard Ver.	Version and checksum (CRC) of motherboard (MB) software.
FW Motherboard CRC	
FW Frontend Ver.	Version and checksum (CRC) of the frontend board (FEB) software.
FW Frontend CRC	
HW Motherboard Ver.	Hardware version of the motherboard (MB).
HW Frontend Ver.	Hardware version of the frontend board (FEB).
Bootloader MB Ver.	Version of motherboard (MB) bootloader.
Bootloader FEB Ver.	Version of frontend board (FEB) bootloader.
Curr. Out FW Ver.	Current output module software version and checksum (CRC).
Curr. Out FW CRC	
Option Card 1 FW Ver	Software version and checksum (CRC) of the optional plug-in card
Option Card 1 FW CRC	
BootloaderOC1 Ver.	
Option Card 2 FW Ver	
Option Card 2 FW CRC	

Device Info / ...Transmitter / ...Tx Calibration	
TX Span	Calibration value of the transmitter.
TX Zero	
First Cal. Date	Date of first calibration of transmitter (calibration of new device).
Last Cal. Date	Date of last calibration of transmitter.
Cal. Cert. No.	Identification (number) of the relevant calibration certificate.
First Cal. Location	Place of first calibration of transmitter.
Last Cal. Location	Place of last calibration of transmitter.

8 ...Operation

...Parameter descriptions

Menu: Device Setup

Menu / parameter	
Device Setup	
...Access Control	Selection of submenu '...Access Control' using .
...Sensor	Selection of submenu '...Sensor' using .
...Transmitter	Selection of submenu '...Transmitter' using .

Device Setup / ...Access Control	
Standard Password	Entry / change of the password for the 'Standard' access level.
Read Only Switch	Indicator of the position of the write protection switch. For additional information, see **Hardware settings** on page 51.

Device Setup / ...Sensor	
Range Mode Config	Activation of the second measuring range for the mass and volume flow. The setting can be performed separately for the mass flow rate (Qm) and volume flow (Qv). Thus you have the possibility to quickly switch between two measuring ranges (e.g. Qm Max and Qm Max2). The switchover is performed via the parameters 'Qm Range Mode' and 'Qv Range Mode'. • Disabled: Second measuring range for mass and volume flow rate deactivated. • Qm and Qv: Second measuring range for mass and volume flow rate activated. • Qm only: Second measuring range for mass flow activated. • Qv only: Second measuring range for volume flow activated. Default setting: Disabled
Qm Max DN	The value is the lower mass flow at a flow velocity of 32.8 ft/s (10 m/s). The value is automatically set through the selected nominal diameter, multiplied by the set density.
Qm Max 1	Setting the upper range value 1 (Measuring range = 0 to Qm Max 1) for the mass flow for forward flow and reverse flow . Default setting: 1 × Q_{max}DN
Qm Max 2	Setting the upper range value 2 (Measuring range = 0 to Qm Max 2) for the mass flow for forward flow and reverse flow . This parameter is only available if the value 'Max2 active' has been selected for the parameter 'Qm Range Mode'.
Qm Range Mode	Manual switchover between the measuring ranges (Max1 active / Max2 active) for the mass flow measurement. This parameter is only available if the value Qm and Qv or Range Mode Config has been selected for the parameter 'Qm only'.

8 ...Operation

...Parameter descriptions

Menu / parameter	
Device Setup / ...Sensor	
Qv Max DN	The value provides the lower volume flow at a flow velocity of 32.8 ft/s (10 m/s). The value is set automatically via the selected nominal diameter.
Qv Max 1	Setting the upper range value 1 (Measuring range = 0 to Qv Max 1) for the volume flow for forward flow and reverse flow . Default setting: 1 × Q_{max}DN
Qv Max 2	Setting the upper range value 2 (Measuring range = 0 to Qv Max 2) for the volume flow for forward flow and reverse flow . This parameter is only available if the value 'Max2 active' has been selected for the parameter 'Qv Range Mode'. Default setting: 1 × Q_{max}DN
Qv Range Mode	Manual switchover between the measuring ranges (Max1 active / Max2 active) for the volume flow measurement. This parameter is only available if the value Qm and Qv or Range Mode Confighas been selected for the parameter 'Qv only'
Sensor Location Tag	Entry of the measuring point tag for the sensor. Alphanumeric, max. 20 characters
Sensor Tag	Enter the tag number of the sensor. Alphanumeric, max. 20 characters.
...Operating Mode	Selection of submenu '...Operating Mode' using .

Device Setup / ...Sensor / ...Operating Mode	
Flow Direction	Set the measuring direction for the sensor. As delivered, the device measures and counts in both flow directions. • Forward & Reverse: The device measures in both flow directions. • Forward only: The device measures only forward flow direction. • Reverse only: The device measures only reverse flow direction. Default setting: Forward & Reverse
Flow Indication	Inversion of the displayed flow direction. Default setting: Normal

8 ...Operation

...Parameter descriptions

Menu / parameter	
Device Setup / ...Transmitter	
...Units	Selection of submenu '...Units' using .
Damping	Select the damping. The value set here (0.02 to 60 s) refers to 1 τ (Tau). The value refers to the response time for a step flowrate change. It affects the instantaneous value in the display and at the current output. Default setting: 1 second
Damping On/Off	Switches the damping on or off.
Density Fixed Value	If the flow count and display are performed using mass flow units, a fixed density value must be included in the calculations. To convert to mass flow, a density value in the range of 0.01 to 5.0 g/cm3 can be set.
...Cut Off	Selection of submenu '...Cut Off' using .
TX Location TAG	Entry of the measuring point tag for the transmitter. Alphanumeric, max. 20 characters
TX TAG	Enter the tag number for the transmitter. Alphanumeric, max. 20 characters
Plant Data Sync.	Tx -> Sens The settings are redundantly saved in two data modules. One of them is the SensorMemory, the other is the transmitter motherboard (backplane). By selecting 'Tx -> Sens', location-specific settings such as measuring range or damping are replicated from the transmitter motherboard (backplane) to the SensorMemory. Sens -> Tx By selecting 'Sens -> Tx', location-specific settings such as measuring range or damping are replicated from the SensorMemory to the transmitter motherboard (backplane).
Device Reset	For service purposes only. Restart the device without having to switch the power supply on and off.
Restore Factory Def.	All user-accessible parameters will be reset to the factory default settings.
...Feature Settings	Selection of submenu '...Feature Settings' using .
...System Zero	Selection of submenu '...System Zero' using .
Noise Reduction	Activates the filter technology for noise reduction. Filter: Off, Filter 15, 30, 60 (15: lower filtering, 60: strong filtering) Filter setting affects 20 mA signal (damping). Default setting: Off
...Piston Pump	Enables improved measurement performance, especially in piston pump applications. • Filter On/Off: On/Off • Filter length: 3 to 30 sec • Strokes per minute: Indicates the piston pump strokes per minute

8 ...Operation

...Parameter descriptions

Menu / parameter	
Device Setup / ...Transmitter / ...Units	
Unit Massflow Qm	Selection of unit for mass flow. Refer to **Table 3: Units for the mass flow** on page 77. The selection applies to the display of the current mass flow, and for the parameters related to mass flow such as QmMax and Qm_{Max}DN.
Unit Mass Tot.	Select the unit for the mass totalizer. Refer to **Table 4: Units for the mass totalizer** on page 77.
Unit Volumeflow Qv	Selection of unit for volume flow. Refer to **Table 2: Units for the volume flow** on page 77. The selection applies to the display of the current volume flow and for the parameters related to volume flow such as QvMax and Qv_{Max}DN.
Unit Vol. Totalizer	Selection of unit for the volume totalizers. Refer to **Table 5: Units for the volume totalizer** on page 77.
Variable 1 Name	Selection of the unit for external process variables. The transmitter can show two external process variables in the display. The process variables can be transferred from the fieldbus master to the transmitter via the HART, Modbus or PROFIBUS DP protocol. You can configure the display through the 'Display' menu.
Cust Qm Unit N.	Enter the name for the user-defined mass flow unit.
Cust Qm Unit F.	Enter the factor for a user-defined mass flow unit. The factor relates to the flow per liter.
Cust Qm Tot Unit N.	Enter the name of the user-defined totalizer unit for mass flow.
Cust Qm Tot Unit F.	Enter the factor for a user-defined mass flow unit. The factor relates to the flow per liter.
Cust Qv Unit N.	Enter the name for the user-defined volume flow unit.
Cust Qv Unit F.	Enter the factor for a user-defined volume flow unit. The factor relates to the flow per liter.
Cust Qv Unit N.	Enter the name for the user-defined volume flow unit.
Cust Qv Tot Unit F.	Enter the factor for a user-defined volume flow unit. The factor relates to the flow per gallon.

Device Setup / ...Transmitter / ...Cut Off	
Low Flow Cut Off	Set the switching threshold (0 to 10 %) for the low flow cut-off. If the flow rate is below the switching threshold, there is no flow measurement. The setting of 0 % deactivates the low flow cut-off. Default setting: 1.0 %
Low Flow Hysteresis	Set the hysteresis (0 to 50 %) for the low flow cut-off as it is defined in the parameter 'Low Flow Cut Off'. Default setting: 20 %

8 ...Operation

...Parameter descriptions

Menu / parameter	Description
Device Setup / ...Transmitter / ...Feature Settings	
Backwards Comp.	Indicator as to whether the backward compatibility function has been activated.
Backwards Comp. Code	Set the device-specific code for activating the function. To use this function subsequently, contact the ABB service team or sales organization. After entering the code, restart the device (e.g. using the parameter 'Device Reset' or by briefly switching off the power supply).
Verifying Capab.	Indicator as to whether the verification function has been activated.
Verifying Capab.Code	Set the device-specific code for activating the verification function. To use this function subsequently, contact the ABB service team or sales organization. After entering the code, restart the device (e.g. using the parameter 'Device Reset' or by briefly switching off the power supply).
Batchmode	Indicator as to whether the filling function has been activated.
Batchmode Code	Set the device-specific code to activate the filling function. To use this function subsequently, contact the ABB service team or sales organization. After entering the code, restart the device (e.g. using the parameter 'Device Reset' or by briefly switching off the power supply).
Expert Diagn.	Indicator as to whether advanced diagnosis functions such as gas bubble or conductivity have been activated.
Expert Diagn. Code	Set the device-specific code for activating the advanced diagnosis function. To use this function subsequently, contact the ABB service team or sales organization. After entering the code, restart the device (e.g. using the parameter 'Device Reset' or by briefly switching off the power supply).
SIL Comp.	Indicator as to whether the SIL function is active.
SIL Comp. Code	Set the device-specific code for activating the SIL function. To use this function subsequently, contact the ABB service team or sales organization. After entering the code, restart the device (e.g. using the parameter 'Device Reset' or by briefly switching off the power supply).

Device Setup / ...System Zero	
Manual Adjust	Sets the value for zero point adjustment in % of Q_{max}DN Manual adjustment: -2 to +2 inch/s (−50 to +50 mm/s)
Auto Adjust	Starts the automatic zero point balancing using . Automatic zero point balancing takes approx. 60 seconds. **Note** Prior to starting the zero point adjustment, make sure that: • There is no flow through the sensor (close all valves, shut-off devices etc.) • The sensor must be filled completely with measuring medium for measurement.

8 ...Operation

...Parameter descriptions

Menu / parameter	Description
Display	
Language	Selection of menu language. (German, English, French, Spanish, Italian, Chinese, Portuguese).
Contrast	Contrast setting for the LCD display.
...Operator Page 1	Selection of submenu '...Operator Page 1' using .
...Operator Page 2	Selection of submenu '...Operator Page 2' using .
Autoscroll	If Autoscroll is enabled, the 'Autoscroll' function can also be activated on the information level of the operator menu. In this function, operator pages are automatically displayed in succession on the process screen, changing every 10 seconds. Manual scrolling through pre-configured operator pages as described above is no longer necessary. When Auto scroll mode is enabled, the icon is displayed in the lower left corner of the screen. Default setting: Disabled.
Flow Format	Selection of number of decimal places (maximum 6) used to display the corresponding process variables. Default setting: X.XX.
Tot Format	
Date Format	**Set the display format for the date and time.**
Display Tag	Configuration of the top line in the display. Off, Sensor Location Tag, Bus Address, HART Address
Display Rotation	The display on the display can be rotated through software by 180°.
Display Test	Start the test of the LCD display with ''. The display test lasts approx. 10 seconds. Various patterns are shown on the LCD display to check the display.

Display / ...Operator Page 1 (n)	Description
Display Mode	Configure each operator page. The following versions can be selected: Off, Graph View, 1x4, 1x6A, 1x6A Bar, 1x9, 1x9 Bar, 2x9, 2x9 Bar, 3x9. Selecting 'Off' deactivates the corresponding operator page.
1st Line	Selection of process variable displayed in the respective row.
2nd Line	• Qv [unit]: Volume flow rate in the selected unit. • Qv [%]: Volume flow in % • ∑V+: Volume totalizer forward • ∑V-: Volume totalizer reverse • ∑Vn: Volume totalizer net • CO1 Current: Output current in mA • Qm [unit]: Mass flow in the selected unit. • Qm [%]: Mass flow in % • ∑M+: Mass totalizer forward • ∑M-: Mass totalizer reverse • ∑Mn: Mass totalizer net • scaled velocity: Flow velocity
3rd Line	
Bargraph	Selection of process variable displayed as a bar graph. • Qm [%]: Mass flow in % • Qv [%]: Volume flow in % • CO1 Current: Output current in mA

8 ...Operation

...Parameter descriptions

Menu: Input/output

Menu / parameter	Description
Input/Output	
...Curr.Out 31/32	Selection of submenu '...Curr.Out 31/32' using .
...Curr.Out V1/V2	Selection of submenu '...Curr.Out V1/V2' using .
...Curr.Out V3/V4	Selection of submenu '...Curr.Out V3/V4' using .
...Dig.Out 41/42	Selection of submenu '...Dig.Out 41/42' using .
...Dig.Out 51/52	Selection of submenu '...Dig.Out 51/52' using .
...Dig.Out V1/V2	Selection of submenu '...Dig.Out V1/V2' using .
...Dig. Out V3/V4	Selection of submenu '...Dig. Out V3/V4' using .
...Dig.In V1/V2	Selection of submenu '...Dig.In V1/V2' using .
...Dig.In V3/V4	Selection of submenu '...Dig.In V3/V4' using .

Input/Output / ...Curr.Out 31/32 **Input/Output / ...Curr.Out V1/V2** **Input/Output / ...Curr.Out V3/V4**	
Output Value	Selection of process variable issued at the corresponding current output. • Qm [%]: The current output provides the mass flow in percent. • Qv [%]: The current output provides the volume flow in percent. • Conductivity[µS/cm]: The current output provides the conductivity in µS/cm.. The current outputs V1 / V2 and V3 / V4 are only available if the corresponding plug-in cards are available!
Curr.Out Mode	• Select the operating mode for the current output. • '4-20mA FWD' Output flow rate in forward flow: 4 mA = no flow 20 mA = maximum flow • '4-12-20 mA': Output flow rate in forward and reverse flow: 4 mA = maximum flow in reverse flow 12 mA = no flow 20 mA = maximum flow in forward flow • '4-20mA FWD/REV': Output flow rate in forward and reverse flow without distinction of flow direction: 4 mA = no flow 20 mA = maximum flow Default setting: 4-20mA FWD/REV.
Curr.Out at Alarm	Selection of status of the current output in error condition. The output 'low' or 'high' current is set in the subsequent menu. Default setting: High Alarm.
Low Alarm	Sets the current for Low Alarm.
High Alarm	Sets the current for High Alarm.
Curr.Out > 20.5mA	Behavior of current output if 20.5 mA is exceeded. • Hold Last Value: The last measured value is retained and issued. • High Alarm: The high alarm current is issued. • Low Alarm: The low alarm current is issued. Default setting: Hold Last Value.

8 ...Operation

...Parameter descriptions

Menu / parameter	Description
Input/Output / ...Curr.Out 31/32 **Input/Output / ...Curr.Out V1/V2** **Input/Output / ...Curr.Out V3/V4**	
Curr.Out < 3.8mA	Behavior of the current output if 3.8 mA is not reached. • Hold Last Value: The last measured value is retained and issued. • High Alarm: The high alarm current is issued. • Low Alarm: The low alarm current is issued. • Parameter is not available if the parameter 'Curr.Out Mode' 4-20mA FWD/REV has been selected. Default setting: Low Alarm.
Curr. at EPD Alarm	Behavior of the current output with an empty meter tube. • Off: no effect on current output. • Q = 0%: Current output is set to 4 mA, 'no flow'. • High Alarm: The high alarm current is issued. • Low Alarm: The low alarm current is issued. Default setting: Off.
Curr. at TFE Alarm	TFE alarm (complete filling alarm) is issued when the meter tube is partially filled. • Off: no effect on current output. • Q = 0%: Current output is set to 4 mA, 'no flow'. • High Alarm: The high alarm current is issued. • Low Alarm: The low alarm current is issued. Default setting: Off.

Input/Output / ...Dig.Out 41/42	
Mode	Selection of the operating mode for the digital output 41 / 42. • Off: Digital output 41 / 42 deactivated. • Logic: Digital output 41 / 42 as a binary output (e.g. as an alarm output). • Pulse: Digital output 41 / 42 as a pulse output. In pulse mode, pulses are output per unit (e.g. 1 pulse per m3). • Frequency: Digital output 41 / 42 as a frequency output. In frequency mode, a frequency is issued that is proportional to the flow rate. The maximum frequency can be configured in accordance with the upper range value.
Outp. Flow Direction	Selection of flow direction in which the pulse / frequency output issues the selected process value. • The parameter is only available if the digital output has been configured as a pulse or frequency output. • Forward & Reverse: Pulses for both flow directions are output via digital output 41/42. • Forward: Only pulses in the forward flow (direction) (flow in direction of arrow) are output via digital output 41 / 42. • Reverse: Only pulses (in the) reverse flow (direction) (flow in opposite direction to arrow) are output via digital output 41 / 42.
...Setup Pulse Output	Selection of submenu '...Setup Pulse Output' using . Only available if 'ModePulse' has been selected.
...Setup Freq Output	Selection of submenu '...Setup Freq Output' using . Only available if 'ModeFrequency' has been selected.
...Setup Logic Output	Selection of submenu '...Setup Logic Output' using . Only available if 'ModeLogic' has been selected.
...Alarm Config	Selection of submenu '...Alarm Config' using . Only available when 'Logic' Mode is selected in the 'Alarm Signal' ...Setup Logic Output / Logic Output Action menu.

8 ...Operation

...Parameter descriptions

Menu / parameter	Description
Input/Output / ...Dig.Out 41/42 / ...Setup Pulse Output	
Output Value Pulse	Selection of process variable that is issued via the pulse output. • Off: The pulse output is deactivated. • Pulse Mass Flow: The pulse output indicates the mass flow. • Pulse Volume Flow: The pulse output indicates the volume flow.
Pulses per Unit	Sets the pulses per mass unit or volume unit (see table **Available units** on page 77) and the pulse width for the pulse output.
Pulse Width	The potential pulse width depends on the configured pulse value and is calculated dynamically.

Input/Output / ...Dig.Out 41/42 / ...Setup Freq Output	
Output Value Freq.	Selection of process variable that is issued via the frequency output. • Off: The pulse output is deactivated. • Pulse Mass Flow: The pulse output indicates the mass flow. • Pulse Volume Flow: The pulse output indicates the volume flow.
Upper Frequency	Sets the frequency for the upper range value. The entered value corresponds to 100 % flow.

Input/Output / ...Dig.Out 41/42 / ...Setup Logic Output	
Logic Output Action	Selection of binary output function. • Off: The binary output is deactivated. • F/R Signal: The binary output signals the flow direction. • Alarm Signal: The binary output indicates an active alarm. The alarm is selected in the '„...Alarm Config' menu. • Dual Range: The binary output is activated when measuring range 2 (Qm Max 2 / Qv Max 2) is selected. This selection is only available if the parameter 'Dual Range' has been configured to Qm or Qv. • Batch End Contact: The binary output is activated when the set fill quantity is reached (only if the FillMass function is activated).
Active Mode	Select switching properties for the binary output. • Active High: Normally open • Active Low: Normally closed Default setting: Active High.

8 ...Operation

...Parameter descriptions

Menu / parameter	Description
Input/Output / ...Dig.Out 41/42 / ...Alarm Config	
General Alarm	Select error messages signaled via the binary output 41 / 42. Only if the parameter 'Logic Output Action' is set to Alarm Signal.
Qv Volumeflow Max	
Qv Volumeflow Min	
EPD	
TFE	
Gas Bubble	
Conductivity	
Sensor Temperature	
In house Temp	

Input/Output / ...Dig.Out 51/52	
Mode	Selection of the operating mode for the digital output 51 / 52. The following operating mode 'Follow DO 41/42, <90° Shift, 180° Shift' is only available if the digital output 51 / 52 has been configured as a pulse output. • Off: Digital output deactivated. • Logic: Digital output functions as binary output (for function see parameter '...Setup Logic Output'). • Follow DO 41¼42: The digital output 51 / 52 follows the pulses from the digital output 41 / 42. The function depends on the setting of the parameter 'Outp. Flow Direction'. • 90° Shift: 90° phase-shifted output of the same pulses as for digital output 41 / 42. • 180° Shift: 180° phase-shifted output of the same pulses as for digital output 41 / 42.
Outp. Flow Direction	Selection of flow direction in which the pulse / frequency output issues the selected process value. The parameter is only available if Follow DO 41/42 has been configured for digital output 51 / 52 in parameter 'Mode'. • No pulses are issued if 'Forward & Reverse' is selected. Only digital output 41 / 42 is active. • When 'Forward' is selected, pulses for forward flow are issued at digital output 41 / 42 and pulses for reverse flow at digital output 51 / 52. • When 'Reverse' is selected, pulses for forward flow are issued at digital output 41 / 42 and pulses for reverse flow at digital output 51 / 52.
...Setup Logic Output	Selection of submenu '...Setup Logic Output' using . Only available if 'ModeLogic' has been selected.
...Alarm Config	Selection of submenu '...Alarm Config' using . Only available if 'ModeLogic' has been selected.

8 ...Operation

...Parameter descriptions

Menu / parameter	Description
Input/Output / ...Dig.Out 51/52 / ...Setup Logic Output	
Logic Output Action	Selection of binary output function. See description „Input/Output / ...Dig.Out 41/42 / ...Setup Logic Output'.
Active Mode	Select switching properties for the binary output. • Active High: Normally open • Active Low: Normally closed Default setting: Active High.

Input/Output / ...Dig.Out 51/52 / ...Alarm Config	
General Alarm	Selection of error messages signaled via the binary output 51 / 52. Only if the parameter 'Logic Output Action' is set to Alarm Signal.
Qv Volumeflow Max	
Qv Volumeflow Min	
EPD	
TFE	
Gas Bubble	
Conductivity	
Sensor Temperature	
In house Temp	

Input/Output / ...Dig.Out V1/V2 **Input/Output / ...Dig. Out V3/V4**	
Mode	Selection of operating mode for the digital output V1 / V2 or V3 / V4. • Off: Digital output deactivated. • Logic: Digital output functions as binary output (for function see parameter '...Setup Logic Output'). The digital outputs V1 / V2 and V3 / V4 are only available if the corresponding plug-in cards are present!
...Setup Logic Output	Selection of submenu '...Setup Logic Output' using . Only available if 'Mode / Logic' has been selected.
...Alarm Config	Selection of submenu '...Alarm Config' using . Only available if 'Mode / Logic' has been selected.

8 ...Operation

...Parameter descriptions

Menu / parameter	Description
Input/Output / ...Dig.Out V1/V2 / ...Setup Logic Output **Input/Output / ...Dig. Out V3/V4 / ...Setup Logic Output**	
Logic Output Action	Selection of binary output function. See description '„Input/Output / ...Dig.Out 41/42 / ...Setup Logic Output'.
Active Mode	Select switching properties for the binary output. • Active High: Normally open • Active Low: Normally closed Default setting: Active High.

Input/Output / ...Dig.Out V1/V2 / ...Alarm Config **Input/Output / ...Dig. Out V3/V4 / ...Alarm Config**	
General Alarm	Select error messages signaled via the binary output V1 / V2 or V3 / V4. Only if the parameter 'Logic Output Action' is set to Alarm Signal.
Qv Volumeflow Max	
Qv Volumeflow Min	
EPD	
TFE	
Gas Bubble	
Conductivity	
Sensor Temperature	
In house Temp	

Input/Output / ...Dig.In V1/V2 **Input/Output / ...Dig.In V3/V4**	
Function	Select a function for the digital input. • No function: No function. • Reset all Totalizer: Counter reset for all counters (forward flow, reverse flow and difference totalizer) • Stop all Totalizer: External counter stop for all counters (forward flow, reverse flow and difference totalizer) • Auto. Zero Adjust: Start external zero point balancing. • Set Flowrate to zero: Sets flow measurement to 0. • Start/Stop Batching: Start / stop fill operation (only when FillMass function is activated). • Dual Range Mass: Switchover Qm Max 1 / Qm Max 2. • Dual Range Volume: Switchover Qv Max 1 / Qv Max 2.
Active Mode	Select switching properties for the digital input.
Delay Time	Selection of delay time for suppressing EMC faults on the digital input.

8 ...Operation

...Parameter descriptions

Menu: Process Alarm

Menu / parameter	Description
Process Alarm	
Alarm history	Display of the alarm history
Clear Alarm History	Reset of the alarm history.
...Group Masking	Selection of submenu '...Group Masking' using .
...Alarm Limits	Selection of submenu '...Alarm Limits' using .

Process Alarm / ...Group Masking	
Maintenance Required	Alarm messages are divided into groups.
Function Check	If masking is activated for a group (On), no alarm is issued.
Out Of Specification	**For additional information, see Diagnosis / error messages on page 109.**

Process Alarm / ...Alarm Limits	
Qm Massflow Min	Set the minimum / maximum limit value (0 to 110 %) for mass measurement. If the process value 'Qm [unit]' exceeds or falls below the limit value, an alarm is triggered.
Qm Massflow Max	
Qv Volumeflow Min	Set the minimum / maximum limit value (0 to 110 %) for volume measurement. If the process value 'Qv [unit]' exceeds or falls below the limit value, an alarm is triggered.
Qv Volumeflow Max	

8 ...Operation

...Parameter descriptions

Menu: Communication

Menu / parameter	Description
Communication	
...HART	Selection of submenu '...HART' using .
...Modbus	Selection of submenu '...Modbus' using .
...Profibus	Selection of submenu '...Profibus' using .

Communication / ...HART	
Device Address	Selection of HART device address. **Note** The HART protocol has provisions for creating a bus with up to 15 devices (1 to 15)). If an address greater than 0 is set, the device operates in multidrop mode. The current output 31 / 32 / Uco is fixed to 4 mA. HART communication takes place only through current output 31 / 32 / Uco.
Loop Current Mode	Selection of the operating mode for current output with HART communication. • Multidrop Fixed • Normal Signaling
HART Tag	Entry of a HART TAG number as unique identifier for the device. Alphanumeric, a maximum of 8 characters, upper case only, no special characters.
HART Long Tag	Entry of a HART TAG number as unique identifier for the device. Alphanumeric, maximum of 32 characters, ASCII Only starting from HART version 7!
HART Descriptor	Entry of a HART descriptor. Alphanumeric, a maximum of 16 characters, upper case only, no special characters.
HART Message	Display of the alphanumeric TAG number.
HART Manuf. ID	Display of the HART manufacturer ID. ABB = 26
HART Device ID	Display of the HART device ID.
HART Find	Select whether the transmitter must respond to the HART command 73 (Find Device). • Off: The transmitter does not respond to command 73. • Once: The transmitter responds once to command 73. • Continuous: The transmitter always responds to command 73.
Last HART Command	Display of the most recently sent HART command.

8 ...Operation

...Parameter descriptions

Menu / parameter	Description
Communication / ...Modbus	
Address	Setting the Modbus device address (1 to 127).
IEEE Format	Selection of the byte order for the Modbus communication. • Enabled: If the IEEE format is activated, the data words are sent in the 'little endian' format with the lowest value word first. • Disabled: If the IEEE format is deactivated, the data words are sent in the standard Modbus 'bigendian' format. Factory setting: Enabled.
Baud Rate	Selection of the transmission speed (baud rate) for the Modbus communication. Factory setting: 9600 baud.
Parity	Selection of the parity for the Modbus communication. Factory setting: Odd.
Stop Bits	Selection of the stop bits for the Modbus communication. Factory setting: One stop bit
Response Delay	Setting of the pause time in milliseconds after receiving a Modbus command. The device sends a response no earlier than expiration of the set pause time. Factory setting: 10 ms

Communication / ...Profibus	
Address	Set the PROFIBUS DP® device address (1 to 126).
Ident Nr. Selector	Display the PROFIBUS DP® identification number • 9700: 1xAI • 9740: 1xAI + 1xTOT • 3432: ABB-specific
Comm State	Display the PROFIBUS communication status. • Offline: No PROFIBUS® communication. • Stop: Bus active, device not active. • Clear: Device is being initialized. • Operate: Cyclic communication is active.
Baud Rate	Display the transmission speed (baud rate) for the PROFIBUS® communication. The baud rate is automatically detected and does not need to be configured manually.
PB Manufacturer ID	Display the PROFIBUS DP® manufacturer ID • 26: ABB

8 ...Operation

...Parameter descriptions

Menu: Diagnostics

Menu / parameter	Description
Diagnostics	
...Maintenance control	Selection of submenu '...Maintenance control' using .
...Diagnosis Control	Selection of submenu '...Diagnosis Control' using .
...Diagnosis Values	Selection of submenu '...Diagnosis Values' using .
.....Simulation Mode	Selection of submenu '.....Simulation Mode' using .
...Output Readings	Selection of submenu '...Output Readings' using .

Diagnostics / ...Maintenance control	
Preset Maint. cycle	Setting the service interval (0 to 9999 hours). After the service interval has expired, the corresponding error message 'M026.004' (Service interval has been reached) is set. The setting '0' deactivates the maintenance interval.
Maint. Remain. Time	Remaining service interval time until setting of error message 'M026.004.'
Start New Cycle	Resetting of the maintenance interval. The service interval is reset to the value set in 'Preset Maint. cycle'.

Diagnostics / ...Diagnosis Control	Description
...Diagnosis Tfe	Selection of submenu '...Diagnosis Tfe' using .
...Empty Pipe Detector	Selection of submenu '...Empty Pipe Detector' using .
...Diagnosis Coil*	Selection of submenu '...Diagnosis Coil' using .
...Diagnosis Gas Bub.*	Selection of submenu '...Diagnosis Gas Bub.' using .
...Diagnosis Conductiv*	Selection of submenu '...Diagnosis Conductiv' using .
...Diagnosis SIL**	Selection of submenu '...Diagnosis SIL' using .
...Noise Check	Selection of submenu '...Noise Check' using .
...Fingerprints	Selection of submenu '...Fingerprints' using .
Diagnosis Interval	Set the time span between the performance of each individual diagnosis. Default setting: 5 s.

*The menu is only available if the Expert Diagnosis function is activated. See also the 'Device Setup\...Transmitter\...Feature Settings' menu.

**Menu only available if SIL diagnostic function is activated. See also the 'Device Setup\...Transmitter\...Feature Settings' menu.

8 ...Operation

...Parameter descriptions

Menu / parameter	Description
Diagnostics / ...Diagnosis Control / ...Diagnosis Tfe	
Tfe On/Off	Activate the Partial Filling Detection function. **Note** This feature is available if the sensor is equipped with a Partial Filling Detector (optional). This function is available for sensors from size 2" (DN 50) without explosion protection or with explosion protection for Zone 2 / Div 2. The flow sensor must be installed horizontally with the terminal box pointing upwards. The conductivity of the measured medium must be in the range of 20 to 20.000 µS/cm.
Start Tfe Adjust	The partial filling detection must be set in accordance with the conditions on-site. Start the automatic adjustment of the Partial Filling Detection function. **Note** Prior to starting, make sure that: • There is no flow through the sensor (close valves, shut-off devices etc.). • The flowmeter sensor is completely filled with the medium to be measured.
Manual Tfe Adjust	Manual setting of the Partial Filling Detection function.
Tfe Threshold	Manual fine adjustment of the switching threshold. The switching threshold is set automatically during automatic adjustment. If the current value should exceed the defined switching threshold, a message will appear on the display and an alarm will be triggered through the digital output, if appropriately configured.
Actual Tfe Value	Output of the TFE detection value. If the value should exceed the switching threshold, a message will appear on the display and an alarm will be triggered through the digital output, if appropriately configured.

Diagnostics / ...Diagnosis Control / ...Empty Pipe Detector	
Empty Pipe Detector	Activate the 'Empty Pipe Detector' function (only for sizes ≥ 3/8" (DN 10)). A completely filled meter tube is essential for an accurate measurement. The 'Empty Tube Detection' function detects an empty meter tube.. In case of an alarm, the current output records the determined status in the menu 'Input/Output / ...Curr.Out 31/32 / Curr. at EPD Alarm' and the pulse output is stopped.
Adjust EP	The empty tube detection function must be set in accordance with the conditions on-site. The switching threshold is set automatically during automatic adjustment. Start the automatic adjustment of the Empty Tube Detection function.
Manual Adjust EP F.	Manual set the empty tube detection function. The value must be adapted such that the frequency for the empty tube detection (Detector EP Value) is almost 2000 Hz.. **Note** Before starting the (manual / automatic) adjustment, make sure that: • There is no flow through the sensor (close valves, shut-off devices etc.). • The flowmeter sensor is completely filled with the medium to be measured
Threshold	Set the switching threshold for the empty tube detection. The switching threshold is set automatically during automatic adjustment. The switching threshold can be changed for manual fine adjustment.
Detector EP Value	Frequency display for empty tube detection. If the current value should exceed the defined switching threshold, a message will appear on the display and an alarm will be triggered through the digital output, if appropriately configured.

8 ...Operation

...Parameter descriptions

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

Diagnostics / ...Diagnosis Control / ...Diagnosis Gas Bub.*	
Coil Diag On/Off	Activate the 'Gas Bubble Detection' function. Default setting: Off **Note** Gas bubble detection can be used in the nominal diameter range of 3/8" to 12" (DN 10 to 300). For additional information, see **Extended diagnostic functions** on page 117.
Gas Bubble Value	Displays current gas bubble value.
Start Adj Gas Bubble	The gas bubble detection function must be set in accordance with the conditions on-site. Start the automatic adjustment of the gas bubble detection. **Note** Prior to starting, make sure that: • There is no flow through the sensor (close valves, shut-off devices etc.). • The flowmeter sensor must be completely filled with the liquid to be measured and free of gas bubbles.
Gas Bubble Threshold	Set the switching threshold. If the current value should exceed the defined switching threshold, a message will appear on the display and an alarm will be triggered through the digital output, if appropriately configured.

*The menu is only available if the Expert Diagnosis function is activated. See also the 'Device Setup\...Transmitter\...Feature Settings' menu.

8 ...Operation

...Parameter descriptions

Diagnostics / ...Diagnosis Control / ...Diagnosis Conductiv*	
Conductivity On/Off	Activate the conductivity diagnostic function. Default setting: Off **Note** Conductivity diagnostic can be used in the nominal diameter range of 3/8” to 12” (DN 10 to 300). For additional information, see **Extended diagnostic functions** on page 118.
Conductivity[µS/cm]	Indicator of the measured conductivity in µS/cm
Adj. Cond. Value	Conductivity must be set in accordance with the conditions on-site. Measure the conductivity using a conductivity meter on-site and enter the measured value here. Limits: 5 to 20000 µS/cm
Cond. Iout Min Value	The conductivity value is available as a 4 to 20 mA-output (option card).
Cond. Iout Max Value	Set the 4 mA and 20 mA value which correspond to the upper and lower range of the conductivity value.
Cond.Min Alarm Value	Set the alarm for minimum and maximum conductivity. In the case of down-scale, an alarm is triggered.
Cond.Max Alarm Value	Limits: 5 to 20000 µS/cm
Elec. Imp. E1-GND	Electrical impedance E1-GND. Current impedance between electrode E1 and GND (ground potential).
Elec. Imp. E2-GND	Electrical impedance E2-GND. Current impedance between electrode E2 and GND (ground potential).

Diagnostics / ...Diagnosis Control / ...Diagnosis SIL**	
SIL On/Off	For information purposes only. SIL devices are delivered ex works as SIL devices. There is no special SIL mode to activate

* The menu is only available if the Expert Diagnosis function is activated. See also the ‘Device Setup\...Transmitter\...Feature Settings’ menu.

** Menu only available if SIL diagnostic function is activated. See also the ‘Device Setup\...Transmitter\...Feature Settings’ menu.

8 ...Operation

...Parameter descriptions

Menu / parameter	Description
Diagnostics / ...Diagnosis Control / ...Noise Check	
Start Noise Check	Start the 'Noise Check' function, using ✓.
Result Noise Check	The LCD display displays the results of the Noise Check.
Power Spectrum	Current power spectrum.
Amplitude 1 Value	Display the four highest amplitudes in the power spectrum.
Amplitude 2 Value	
Amplitude 3 Value	
Amplitude 4 Value	
Frequency 1	Display the four highest amplitudes in the frequency corresponding to the power spectrum.
Frequency 2	
Frequency 3	
Frequency 4	

Diagnostics / ...Diagnosis Control / ...Fingerprints	
Tx Factory CMR	The 'fingerprint database' allows for a comparison of the values at the time of factory calibration with the currently recorded values. Errors in the integrity of the device can already be detected early on. Corrective measures can be taken. Here: Display of the determined values at the time of the factory calibration.
Tx Factory 1m/s	
Tx Factory 10m/s	
Se Factory Coil Ind.	
Se Factory Imp. E1	
Se Factory Imp.E2	
Start. FP verification	Create a fingerprint and perform verification.
Result FP verification	Display of the verification result. Based on the result, one of the following messages will be issued. 'FP Verificat. passed', 'CMR failed', '1m/s failed', 'CMR, 1m/s failed'10m/s failed', 'CMR, 10m/s failed'1m/s, 10m/s failed', 'All TxFingerp.failed'Coil Fingerp. Failed', 'CMR, Coil failed'1m/s, Coil failed', 'CMR,1m/s,Coil failed'10m/s, Coil failed', 'CMR,10m/s,Coil faile'1, 10m/s,Coil failed', 'All Fingerp. failed'No Verific.performed'
Tx Customer CMR	The manual fingerprint is created on-site prior to verification of the transmitter. Here: Display of the determined values.
Tx Customer 1m/s	
Tx Customer 10m/s	
Se Customer Coil Ind	
Se Customer Imp. E1	
Se Customer Imp. E2	

8 ...Operation

...Parameter descriptions

Menu / parameter	Description
Diagnostics / ...Diagnosis Values	
All values in this menu are for informational and service purposes only.	
Inhouse Temperature	Display of temperature value within the transmitter housing.
Inhouse Temp MaxPeak	
Inhouse Temp MinPeak	
Driver Current	Display of the drive current of the sensor coil.
Signal Region on ADC	Display of the measuring signal within the A / D converter input. (-100 % to +100 %)
Coil DAC Preset	Display of the D / A converter for coil drive.
DC Feedback DAC	D / A converter feedback value.
ADC Errors	A / D converter error
Device Restart Count	Number of device restarts (boots).

Diagnostics / .....Simulation Mode	
Simulation Switch	Manual simulation of measured values. After selecting the value to be simulated, a corresponding parameter is displayed in the menu 'Diagnostics / .....Simulation Mode'. The simulation value can be set here. The output values correspond to the simulated flowrate entered. The 'Configuration' information is displayed in the lower line of the display. Only one measured value / output can be selected for simulation. After power-up / restart of the device, the simulation is switched off.
Off	
Qm Massflow [unit]	
Qm Massflow [%]	
Qv Volumeflow [unit]	
Qv Volumeflow [%]	
Conductivity[µS/cm]	
Curr.Out 31/32	
Curr.Out V1/V2	
Curr.Out V3/V4	
Dig.Out 41/42 State	
Dig.Out 41/42 Freq.	
Dig.Out 41/42 Pulse	
Dig.Out 51/52 State	
Dig.Out 51/52 Pulse	
Dig.Out V1/V2 State	
Dig.Out V3/V4 State	
Dig.In V1/V2 State	
Dig.In V3/V4 State	
Hart Frequency	

8 ...Operation

...Parameter descriptions

Menu / parameter	Description
Diagnostics / ...Output Readings	
Curr.Out 31/32	Display the current values and statuses of the listed inputs and outputs.
Curr.Out V1/V2	
Curr.Out V3/V4	
Dig.Out 41/42 Freq.	
Dig.Out 41/42 State	
Dig.Out 51/52 State	
Dig.Out V1/V2 State	
Dig.Out V3/V4 State	
Dig.In V1/V2 State	
Dig.In V3/V4 State	

8 ...Operation

...Parameter descriptions

Menu: Totalizer

Menu / parameter	Description
Totalizer	
...Reset Totalizer	Selection of submenu '...Reset Totalizer' using .
...Preset Totalizer	Selection of submenu '...Preset Totalizer' using .
...Batching	Selection of submenu '...Batching' using .
...Lag Correction	Selection of submenu '...Lag Correction' using .

Totalizer / ...Reset Totalizer	
All Totalizer	Resets all totalizers to zero.
Massflow Fwd	Resets individual counters.
Massflow Rev	
Volumeflow Fwd	
Volumeflow Rev	

Totalizer / ...Preset Totalizer	
Massflow Fwd	Allows editing / presetting of counter values (e.g. when replacing the transmitter).
Massflow Rev	
Volumeflow Fwd	
Volumeflow Rev	

8 ...Operation

...Parameter descriptions

Menu / parameter	Description
Totalizer / ...Batching	
Batch Process Value	Selection of process variable used during the filling process. • Off: Filler deactivated. • Volume Forward: Volume flow rate in forward flow direction. • Norm Volume Forward: Net volume flow rate in forward flow direction. • Mass Forward: Mass flow in forward flow direction. • Net Volume Forward: Net volume flow rate in forward flow direction. • Net Mass Forward: Net mass flow in forward flow direction.
Preset Batch Total.	Sets the fill quantity using the selected unit. When the defined fill quantity is reached, the configured binary output is activated. **Note** Before setting the fill quantity, the corresponding process value must be selected with the parameter 'Batch Process Value'.
Reset Cur.Batch Tot.	Resets the current fill quantity.
Start Batching	Manual start of the filling function. Alternatively, the digital input can be configured for starting / stopping the fill operation.
Current Batch Total.	Display of the current fill quantity. Once a fill operation has been started, the quantity already filled is shown here. The counter restarts at zero for each fill operation initiated and then counts up to the set fill quantity.
Stop Batching	Manual stop of the filling function. Alternatively, the digital input can be configured for starting / stopping the fill operation.
Batch Counts	Display of the number of fill operations since the last reset.
Reset Batch Counts	Sets the parameter 'Batch Counts' to zero.

Note
In order to achieve a shorter response time for the fill function, the damping must be switched off.
To switch off the damping, switch to the menu. 'Device Setup / ...Transmitter / Damping On/Off'

8 ...Operation

...Parameter descriptions

Menu / parameter	Description
Totalizer / ...Lag Correction	
Mode	Selection of overrun correction. Closing the fill valve takes some time and as a consequence more liquid is added, even though the fill quantity is reached and the contact for closing the valve is actuated. • Manual: The overrun quantity is calculated by the transmitter automatically. • Auto: The overrun quantity must be determined manually and entered in the selected unit via the parameter 'Quantity'.
Quantity	Manual input of the overrun quantity / display of the overrun quantity detected automatically by the transmitter.
Factor	The menu is visible when 'Mode' is set to 'Auto'. Sets the weighting of the last filling process during automatic calculation of the overrun quantity. The calculation is based on the following formula: New correction value = last correction value + (BatchAuto.Lag Corr.Factor × correction value at the last filling) • 0.0: No change to correction value. • 1.0: The correction value is immediately adjusted to the overrun quantity calculated during the last fill operation. Value range: 0 to 1
Time	Sets the time for the overrun quantity correction after the fill valve is closed. Value range: 0.1 to 10° sec.

8 ...Operation

...Parameter descriptions

Menu: Sensor Setup

NOTICE

Damage to components!
Damage to the flowmeter sensor due to incorrect setting of the excitation current possible.

Note
Menu only available if function 'Backwards Comp.' has been ordered and activated (see menu 'Device Setup/...Transmitter/... Feature Settings').
If the function Backwards Comp. is activated, the transmitter can also be used with older transducers.
Setting the parameters in accordance with the specification on the name plate of the older sensor.

Menu / parameter	Description
Sensor Setup	
Sensor Type	Select the sensor type: • Standard QmaxDN: For ProcessMaster, HygienicMaster.
Meter Size	Setting the nominal diameter in accordance with the value provided on the name plate of the flowmeter sensor. Value range: .04" to 96" (DN1 to 2400)
Se Span	Setting the span in accordance with the value provided on the name plate of the flowmeter sensor.
Se Zero	Setting the zero point in accordance with the value provided on the name plate of the flowmeter sensor.
Line Freq	Selection of the mains frequency of the power supply (50Hz or 60Hz)
Excitation Freq.	Setting the excitation frequency in accordance with the value provided on the name plate of the flowmeter sensor. Range: 30 & 25Hz, 15 & 12.5Hz, 7.5 & 6.25Hz, 3.75 & 3.125Hz
Set Point Curr.	Adjustment of the excitation current of the sensor coils. Setting parameter to 200 mA only for models FEP321, FEP521, FEH321, FEH521. For all other sensors contact ABB Service.
Pre. Amp	Selection whether a preamplifier exists in the flowmeter sensor or not Older transducers with sensor sizes smaller than 3/8" (DN 10) or signal cables longer than 164 ft (50 m) have a preamplifier.
Calibration flag	Set to '1' as soon as all parameters have been set in the setup menu of the sensor.
Sensor TFE Function	This activates or deactivates full pipe detection (TFE = complete fill electrode).

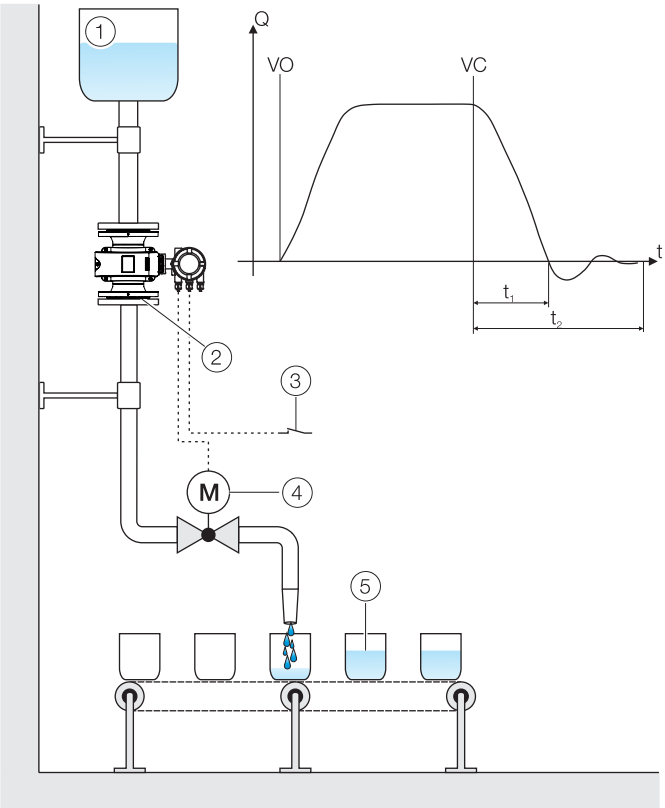
Software history

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

Device software package FEx630 (device firmware package)				
Design	**Issue date**	**Type of change**	**Description**	**Ordering number**
00.04.00	2/3/2017	First publication	–	3KXF002044U0100_00.04.00
00.04.01	6/27/2017	Bug fixing	Piston pumps filter	3KXF002044U0100_00.04.01
00:05:00	1/12/2018	Bug fixing	Integrated Polish language	3KXF002044U0100_00.05.00
7/1/2000	2018	Bug fixing	PROFIBUS DP® and Modbus® integrated. New bootloader	3KXF002044U0100_01.07.00

8 ...Operation

Filling function



1	Supply tank
2	Sensor
3	Start / stop fill operation (digital input through plug-in card)
4	Fill valve
5	Filling tank
VO	Valve open (filling started)
VC	Valve closed (fill quantity reached)
t1	Valve closing time
t2	Overrun time

Figure 69 FillMass fill function

The optional filling function allows filling with filling times> 3 seconds.

Filling quantity is configurable and the filling process can be started via the digital input (plug-in card).
As soon as the filling quantity has been reached, the valve can be closed via the digital output. Filling quantity correction is calculated by measuring the overrun quantity. Additionally, the low flow cut-off can be configured if required.

Setup
For the configuration of the fill function, the following steps must be performed:

1. The fill function must be active. See also the 'Device Setup / ...Transmitter / ...Feature Settings / ...' menu.
2. One digital output must be configured as a binary output with the function 'Batch End Contact'. See also the 'Input/Output / ...' menu. As an option, one digital input (option module) can be configured with the function 'Start/Stop Batching' at the start of the filling process.
3. The parameters for the fill function must be configured. See also the 'Totalizer / ...Batching / ...' menu.

Note
During fast filling processes, the damping should be set to the minimum value to guarantee the greatest possible accuracy of the fill quantity.
See also the 'Device Setup / ...Transmitter / ...' menu.

Brief overview of configurations

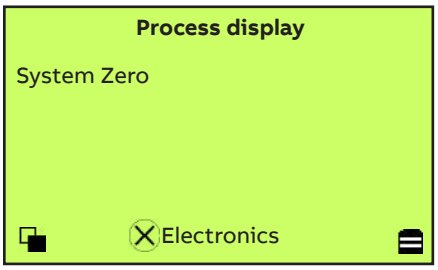
Configuration of digital output 41 / 42 as pulse output for forward flow and digital output 51 / 52 as pulse output for reverse flow.

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

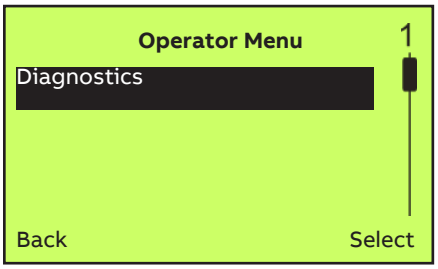
9 Diagnosis / error messages

Calling up the error description

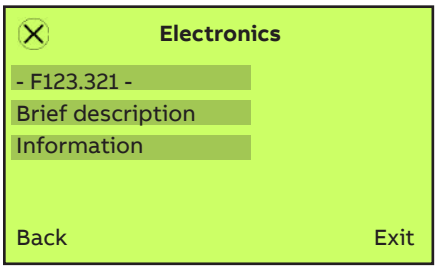
Additional details about the error that has occurred can be called up on the information level.



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



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



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

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

9 ...Diagnosis / error messages

Error messages

The error messages are divided into four groups in accordance with the NAMUR classification scheme.

Errors

Error no. / Range	Text on the LCD display	Cause	Remedy
F099.042 / electronics	ADC overrange alarm. Noise too high. Check applicati. Call service.	Electrode signal overranges max. ADC limits. No flow measurement possible.	If the tube is empty, make sure the empty tube detection is activated. Make sure that the actual flow rate does not up-scaled the configured flow rate. Contact the service department
F098.011 / electronics	No Frontend Board detected. Wrong connection. Defect Frontend. Check wiring.	Frontend board or motherboard hardware defective. Wrong or no connection between frontend board and motherboard.	Check the wiring in the terminal compartment and in the transmitter housing. Contact the service department.
F097.029 / Electronics	Coil regulation error. Check wiring of sensor coils. Call service	Incorrect coil wiring (M1 / M2 terminals) or cable break / short-circuit or defective coil fuse or moisture in terminal compartment.	Check for incorrect coil wiring (M1 / M2 terminals) or cable break / short-circuit or defective coil fuse or humidity in the terminal compartment.
F096.043 / Electronics	SIL self check alarm. Call service.	The SIL monitoring function has detected a transmitter error.	Contact the service department
F095.036 / Electronics	Coil isolation alarm. Call service.	Defective coil or incorrect wiring (short-circuit between M1 / M2 and GND). Flooded sensor	Contact the service department
F094.021 / electronics	Safety Alarm Curr. Out 31 / 32 SIL function detects error. Call Service.	The µController of the current output has detected relevant SIL errors.	Contact the service department
F093.032 / Electronics	Electrode short cuircit. Check wiring of sensor electrode. Call service.	Wrong wiring or electrode leakage or short-circuit of the electrode signal line and shield or flowmeter flooded.	Check for incorrect wiring or electrode leakage or short-circuit of the electrode signal line and the shield or flooded sensor.
F092.033 / Electronics	Electrode open cuircit. Check wiring of sensor electrode. Call service.	Wrong electrode wiring or break in electrode signal line.	Check for incorrect electrode wiring or break in electrode signal line.
F091.030 / Electronics	Coil wiring error. Check wiring of sensor coils. Call service.	Incorrect coil wiring (M1 / M2 terminals) or cable break / short circuit or defective coil fuse or moisture in terminal compartment.	Check for incorrect coil wiring (M1 / M2 terminals) or cable break / short-circuit or defective coil fuse or humidity in the terminal compartment.
F090.035 / Electronics	ADC RX210 com. error. Call service.	Bad EMC environment or defective component.	Replace the electronics unit or contact ABB Service.

9 ...Diagnosis / error messages

...Error messages

Error no. / Range	Text on the LCD display	Cause	Remedy
F088.012 / electronics	FEB communication error. EMC disturbance. Call Service.	EMC interference on the signal cable. Wrong signal cable.	Check signal cables and connection Please contact the service department.
F086.018 / Electronics	Curr.Out 31 / 32 com error. Defective Board. EMC disturbance. Call Service.	Broken motherboard hardware. EMC interference	Please contact the service department.
F084.010 / electronics	NV data defect. Data storage irreparable. Call Service.	Data in SensorMemory corrupt.	Please contact the service department.
F082.013 / Electronics	Incompatible Frontend Board. Frontend not fit to Motherboard. Call Service.	Wrong frontend board or motherboard.	Please contact the service department.
F081.025 / electronics	MB voltages outside range. Defective Motherboard HW. Call Service.	Broken motherboard hardware.	Replace motherboard. Please contact the service department.

Function check

Error no. / Range	Text on the LCD display	Cause	Remedy
C078.003 / Config.	Flowrate to zero. Check digital in terminals.	The Digital Input option card is configured to trigger the 'set flowrate to zero' option and this event.	Check terminals of digital input and configuration.
C076.005 / Config.	All totalizer stop. Check digital in terminals.	The Digital Input option card is configured to trigger the 'All Totalizer stop' option and this event.	Check terminals of digital input and configuration.
C074.006 / Config.	Totalizer reset. Reset of one or more Totalizers.	The Digital Input option card is configured to trigger the Reset Totalizer option and this event.	Check terminals of digital input and configuration.
C072.002 / Config.	Simulation is on. Simulated values. Switch off Simulation Mode	The simulation of a process value or an output is active.	Switch off simulation mode.
C070.026 / Config.	An alarm is simulated. Switch off alarm simulation.	The simulation of an alarm is active.	Set alarm simulation to 'Off'.

9 ...Diagnosis / error messages

...Error messages

Operation outside of specifications (Out Of Spec.)

Error no. / Range	Text on the LCD display	Cause	Remedy
S065.044 / operation	Inhouse temp. alarm. Reduce ambient temperature.	Measuring medium or ambient temperature is outside the spec.	Check process conditions, reduce temperature.
S064.041 / operation	EPD alarm. Secure pipe is completely filled.	Sensor not filled.	Check if pipe is empty. Make sure that the sensor is completely filled.
S063.040 / operation	TFE alarm. Secure pipe is completely filled.	Alarm of the complete filling electrode, but incorrect, because the sensor is not completely filled.	Check installation and process conditions.
S062.039 / operation	Sensor temp. limits alarm. Change limits or change fluid temperature.	The measuring medium temperature is outside the temperature limit.	Check process conditions and adjust alarm threshold.
S061.038 / operation	Conductivity limits alarm. Change limits or Check application.	The conductivity of the measuring medium is outside the limit values.	Check process conditions and adjust alarm threshold.
S060.037 / operation	Gas bubble alarm. Check conditions of application.	Gas bubbles in the measuring medium.	Check the process conditions.
S052.016 / operation	Curr.Out 31 / 32 is saturated. CO process value out of range. Adapt Qmax.	The selected process value of the current output 31/32 is outside the measuring range.	Adjust measuring range.
S051.017 / operation	Curr.Out V1 / V2, V3 / V4 saturated. CO process value out of range. Adapt Qmax.	The selected process value of the current output V1 / V2 or V3 / V4 is outside the measuring range.	Adjust measuring range.
S049.019 / electronics	Option Card 1 com error. Defective Card. Check Card 1. Call Service.	Broken hardware of the motherboard or option card. EMC interference	Check / replace option card in slot 1. Please contact the service department.
S048.020 / electronics	Option Card 2 com error. Defective Card. Check Card 2. Call Service.	Broken hardware of the motherboard or option card. EMC interference	Check / replace option card in slot 2. Please contact the service department.
S047.015 / operation	Pulse output is cut off. Wrong config. Check pulse out configuration.	The calculated output pulse or the calculated output frequency is above the configured cutoff frequency.	Check configuration for the output pulse.
S046.000 / operation	Mass flowrate exceeds limits. Check flowrate and alarm limits.	The mass flow is below or above the configured limit values ‘Qm Massflow Min’ and ‘Qm Massflow Max’.	Check the parameterization in menu ‘Process Alarm / ...Alarm Limits’ and adjust as needed. Check volume flow rate.
S044.001 / operation	Volume flowrate exceeds limits. Check flowrate and alarm limits.	The volume flow rate is below or above the configured limit values ‘Qv Volumeflow Min’ and ‘Qv Volumeflow Max’.	Check the parameterization in menu ‘Process Alarm / ...Alarm Limits’ and adjust as needed. Check volume flow rate.

9 ...Diagnosis / error messages

...Error messages

Error no. / Range	Text on the LCD display	Cause	Remedy
S041.034 / electronics	DC feedback regulation. Check conditions of application. Call service.	Multi-phase measuring media that produce a very high level of noise. Stones or solids that produce a very high level of noise. Galvanic voltages at the measuring electrodes. Conductivity of the measuring medium is not evenly distributed (e.g. directly after the injection points).	Please contact the service department.
S040.031 / electronics	Coil Inductance alarm. Call service.	Coil inductance changed, coil damaged, coil insulation damaged, external magnetic fields.	Please contact the service department.

Maintenance

Error no. / Range	Text on the LCD display	Cause	Remedy
M038.009 / electronics	Sensor memory defective. Mem. or connect. defective. Replace memory.	Defective NV memory module. NV memory module not inserted.	Check if NV memory module is inserted. Please contact the service department.
M037.014 / Electronics	NV chips defect on Motherboard. Defective MB. Replace MB. Call Service.	Defective NV memory.	Replace motherboard. Please contact the service department.
M032.022 / Config.	Curr.Out 31 / 32 not calibrated. Call Service.	Current output 31 / 32, Uco not calibrated.	Please contact the service department.
M031.023 / Config.	Curr.Out V1 / V2 not calibrated. Replace Current Option Card. Call Service.	Current output V1 / V2 not calibrated.	Please contact the service department.
M030.024 / Config.	Curr.Out 31 / 32 not calibrated. Call Service.	Current output V3 / V4 not calibrated.	Please contact the service department.
M028.007 / Config.	Display value is < 1600 h at Qmax. Change mass Unit or vol. Unit for Totalizer.	Counter unit too small.	Change mass or volume totalizer unit.
M020.027 / Electronics unit	Communicat. Card not responding.	Fieldbus plug-in is not reacting. • Plug-in card is defective.	Please contact the service department.
M026.004 / Config.	Maintenance interval is reached. Perform maintenance.	Set ‘Preset Maint. cycle’ to zero to disable the maintenance timer.	Perform maintenance work. Start new cycle.
M024.008 / Config.	Device not calibrated. Call Service.	Device is not calibrated.	Please contact the service department.

9 ...Diagnosis / error messages

Overview

Errors encountered are itemized in tabular form on the following pages. The response of the transmitter on error detection is described therein.

The table lists all possible errors together with a description of their impact on the value of measurement variables, the properties of current outputs and the alarm output.

Error no. / Range	Error text	Current output	Digital output	Pulse output	LCD display	Error maskable?
F099.042 / electronics	ADC overrange alarm. Noise too high. Check applicati. Call service.	High Alarm or Low Alarm, depending on parameter 'Curr.Out at Alarm'.	General Alarm if DO as 'Logic / Alarm Signal' is configured.	0 Hz	0 %	No
F099.011 / electronics	No Frontend Board detected. Wrong connection. Defect Frontend. Check wiring.			0 Hz	0 %	No
F097.029 / Electronics	Coil regulation error. Check wiring of sensor coils. Call service .			0 Hz	0 %	No
F096.043 / Electronics	SIL self check alarm. Call service.			Current value - no change.	Current value - no change.	No
F095.036 / Electronics	Coil isolation alarm. Call service.			Current value - no change.	Current value - no change.	No
F094.021 / electronics	Safety Alarm Curr. Out 31 / 32 SIL function detects error. Call Service.			Current value - no change.	Current value - no change.	No
F093.032 / Electronics	Electrode short cuircit. Check wiring of sensor electrode. Call service.			0 Hz	0 %	No
F092.033 / Electronics	Electrode open cuircit. Check wiring of sensor electrode. Call service.			0 Hz	0 %	No
F091.030 / Electronics	Coil wiring error. Check wiring of sensor coils. Call service.			0 Hz	0 %	No

9 ...Diagnosis / error messages

...Overview

Error no. / Range	Error text	Current output	Digital output	Pulse output	LCD display	Error maskable?
F090.035 / Electronics	ADC RX210 com. error. Call service.			0 Hz	0 %	No
F088.012 / electronics	FEB communication error. EMC disturbance. Call Service.			0 Hz	0 %	No
F086.018 / Electronics	Curr.Out 31 / 32 com error. Defective Board. EMC disturbance. Call Service.			Current value - no change.	Current value - no change.	No
F084.010 / electronics	NV data defect. Data storage irreparable. Call Service.			0 Hz	0 %	No
F082.013 / Electronics	Incompatible Frontend Board. Frontend not fit to Motherboard. Call Service.			0 Hz	0 %	No
F081.025 / electronics	MB voltages outside range. Defective Motherboard HW. Call Service.			0 Hz	0 %	No
C078.003 / Config.	Flowrate to zero. Check digital in terminals.	4 mA (0 % flow)	Current value - no change.	0 Hz	0 %	Menu '...Group Masking'.
C076.005 / Config.	All totalizer stop. Check digital in terminals.	Current value - no change.	Current value - no change.	Current value - no change.	Current value - no change.	
C074.006 / Config.	Totalizer reset. Reset of one or more Totalizers.	Current value - no change.	Current value - no change.	Current value - no change.	Current value - no change.	Menu '...Group Masking'.
C072.002 / Config.	Simulation is on. Simulated values. Switch off Simulation Mode.	Current value - no change.	Current value - no change.	Current value - no change.	Current value - no change.	
C070.026 / Config.	An alarm is simulated. Switch off alarm simulation.	Current value - no change.	Current value - no change.	Current value - no change.	Current value - no change.	

9 ...Diagnosis / error messages

...Overview

Error no. / Range	Error text	Current output	Digital output	Pulse output	LCD display	Error maskable?
S065.044 / operation	Inhouse temp. alarm. Reduce ambient temperature.	Current value - no change.	No Answer	No Answer	Current value - no change.	
S064.041 / operation	EPD alarm. Secure pipe is completely filled.	Alarm - configured as in menu 'Curr. at EPD Alarm'.	Alarm, if DO as 'Logic / Alarm Signal / EPD Alarm' is configured	0 Hz	0 %	Menu '...Group Masking'.
S063.040 / operation	TFE alarm. Secure pipe is completely filled.	Alarm - configured as in menu 'Curr. at TFE Alarm'.	Alarm, if DO as 'Logic / Alarm Signal / TFE Alarm' is configured	Current value - no change.	Current value - no change.	Menu '...Group Masking'.
S062.039 / operation	Sensor temp. limits alarm. Change limits or change fluid temperature.	Current value - no change.	No Answer	Current value - no change.	Current value - no change.	Menu '...Group Masking'.
S061.038 / operation	Conductivity limits alarm. Change limits or Check application.	Current value - no change.	Alarm, if DO as 'Logic / Alarm Signal / Conductivity' is configured	Current value - no change.	Current value - no change.	Menu '...Group Masking'.
S060.037 / operation	Gas bubble alarm. Check conditions of application.	Current value - no change.	Alarm, if DO as 'Logic / Alarm Signal / Gas bubble Alarm' is configured	Current value - no change.	Current value - no change.	Menu '...Group Masking'.
S052.016 / operation	Curr.Out 31 / 32 is saturated. CO process value out of range. Adapt Qmax.	Alarm - configured as in menu „Curr.Out > 20.5mA'.	Current value - no change.	Current value - no change.	Current value - no change.	Menu '...Group Masking'.
S051.017 / operation	Curr.Out V1 / V2, V3 / V4 saturated. CO process value out of range. Adapt Qmax.					
S049.019 / electronics	Option Card 1 com error. Defective Card. Check Card 1. Call Service.	Does not react anymore	Current value - no change.	Current value - no change.	Current value - no change.	Menu '...Group Masking'.
S048.020 / electronics	Option Card 2 com error. Defective Card. Check Card 2. Call Service.	Does not react anymore	Current value - no change.	Current value - no change.	Current value - no change.	Menu '...Group Masking'.

9 ...Diagnosis / error messages

...Overview

Error no. / Range	Error text	Current output	Digital output	Pulse output	LCD display	Error maskable?
S047.015 / operation	Pulse output is cut off. Wrong config. Check pulse out configuration.	Current value - no change.	Current value - no change.	Largest possible pulse rate	Current value - no change.	Menu '...Group Masking'.
S046.000 / operation	Mass flowrate exceeds limits. Check flowrate and alarm limits.	Current value - no change.	Alarm, if DO as 'Qm Massflow Max' Or 'Qm Massflow Min' is configured.	Current value - no change.	Current value - no change.	Menu '...Group Masking'.
S044.001 / operation	Volume flowrate exceeds limits. Check flowrate and alarm limits.	Current value - no change.	Alarm, if DO as 'Qv Volumeflow Max' Or 'Qv Volumeflow Min' is configured.	Current value - no change.	Current value - no change.	Menu '...Group Masking'.
S041.034 / electronics	DC feedback regulation. Check conditions of application. Call service.	4 mA (0 % flow)	No Answer.	0 Hz	0 %	Menu '...Group Masking'.
S040.031 / electronics	Coil Inductance alarm. Call service.	Current value - no change.	No Answer.	Current value - no change.	Current value - no change.	Menu '...Group Masking'.
M038.009 / electronics	Sensor memory defective. Mem. or connect. defective. Replace memory.	Current value - no change.	No Answer.	Current value - no change.	Current value - no change.	Menu '...Group Masking'.
M037.014 / Electronics	NV chips defect on Motherboard. Defective MB. Replace MB. Call Service.					
M032.022 / Config.	Curr.Out 31 / 32 not calibrated. Call Service.					
M031.023 / Config.	Curr.Out V1 / V2 not calibrated. Replace Current Option Card. Call Service.	Current value - no change.	Current value - no change.	Current value - no change.	Current value - no change.	Menu '...Group Masking'.
M030.024 / Config.	Curr.Out 31 / 32 not calibrated. Call Service.					
M028.007 / Config.	Display value is < 1600 h at Qmax. Change mass Unit or vol. Unit for Totalizer.	Current value - no change.	No Answer.	Current value - no change.	Current value - no change.	Menu '...Group Masking'.
M026.004 / Config.	Maintenance interval is reached. Perform maintenance.					
M024.008 / Config.	Device not calibrated. Call Service.		Current value - no change.	Current value - no change.	Current value - no change.	Menu '...Group Masking'.
M020.027 / Electronics	Communicat. Card not responding	Current value - no change.	Current value - no change.	Current value - no change.	Current value - no change.	Menu '...Group Masking'.

9 ...Diagnosis / error messages

Extended diagnostic functions

Overview

Note

- The extended diagnostic functions are only available on the ProcessMaster FEM630 if the 'Extended diagnostic functions' software package has been ordered (see table) .
- To facilitate initial commissioning, the individual diagnosis options of the extended diagnostic functions are deactivated (factory default).
- Each diagnostic function (e.g. Gas Bubble Detector or Electrode Deposit Detector) can be individually activated. Once activated, the diagnostic function must be calibrated according to the conditions on site and the limit values must be set.

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

9 ...Diagnosis / error messages

...Extended diagnostic functions

Detection of gas bubbles

Gas bubbles in the measuring medium influence the flow measurement values and the measuring accuracy.
It is possible to issue a gas bubble alarm if the actual gas bubble value exceeds the configured threshold.
This alarm message is shown on the display. The digital output triggers an alarm if configured accordingly.

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

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

Setup

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

Menu / parameter	
Diagnostics / ...Diagnosis Control / ...Diagnosis Gas Bub.	
Gas Bubble On/Off	Activate the function.
Start Adj Gas Bubble	Automatic adjustment of the Gas Bubble Detection function. Prior to starting, make sure that: • There is no flow • Sensor is completely filled and free of gas bubbles
Gas Bubble Threshold	Manual fine adjustment of the switching threshold.

Monitoring the conductivity

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

Requirements for use:
- Conductivity of the measuring medium: 20 to 20000 µS/cm.
- Nominal diameter ⅜" to 4 in (DN 10 to DN 100).

Installation conditions:
- The measuring electrodes must be free of coverings.

Setup

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

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

9 ...Diagnosis / error messages

...Extended diagnostic functions

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

Requirements for use:
- Conductivity of the measuring medium: 20 to 20000 µS/cm.

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

Measurements on the flowmeter

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

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

Setup

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

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

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

9 ...Diagnosis / error messages

...Extended diagnostic functions

Monitoring the grounding
The function checks for noise in the measuring signal and the electrical grounding of the device. While the check is in progress, no flow measurement can take place.
The noise / grounding check is started manually and delivers a 'successful / failed' result.

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

Requirements for use:
- The sensor must be filled completely with measuring medium.
- There is no flow through the sensor (close all valves, shut-off devices etc.)
- The sensor must be grounded (see **Sensor grounding** on page 28).
- There may not be any deposits on the measuring electrodes.

Menu / parameter	
Diagnostics / ...Diagnosis Control / ...Noise Check	
Start Noise Check	Start of test
Result Noise Check	Test result
Power Spectrum	Current power spectrum.
Amplitude 1 Value ... 4	Display of the four strongest amplitudes of the frequency spectrum in µV with the associated frequency.
Frequency 1 ... 4	

Verification

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

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

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

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

Setup

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

10 Maintenance

Safety instructions

⚠ WARNING

Risk of injury due to live parts!

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

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

⚠ WARNING

Loss of Ex-approval!

Loss of Ex approval due to replacement of components in devices for use in potentially explosive atmospheres.

- Devices for use in potentially explosive atmospheres may be serviced and repaired by qualified ABB personnel only.
- For measuring devices for potentially explosive atmospheres, observe the relevant operator guidelines.

⚠ CAUTION

Risk of burns due to hot measuring media

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

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

NOTICE

Damage to components!

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

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

Corrective maintenance work may only be performed by trained personnel.

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

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

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

...10 Maintenance

Sensor

The flowmeter sensor is largely maintenance-free.
The following items should be checked annually:
- Ambient conditions (air circulation, humidity).
- Tightness of the process connections.
- Cable entries, cover gaskets and cover screws.
- Operational reliability of power supply, lightning protection and grounding.

The sensor electrodes must be cleaned when the flow rate information on the transmitter changes while recording the identical flow rate volume.

If the display shows a higher flowrate, the contamination is insulating. If a lower flowrate is displayed, the contamination results in a short-circuit.
For repairs to the liner, electrodes or magnet coil, the flowmeter must be returned to the manufacturer.
See **Returning devices** on page 128.

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

11 Repair

Safety instructions

DANGER

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

While using the device in potentially explosive atmospheres before opening the transmitter housing or the terminal box, note the following points:
- A valid fire permit must be present.
- Make sure that no flammable or hazardous atmospheres are present.

WARNING

Risk of injury due to live parts!
When the housing is open, contact protection is not provided and EMC protection is limited.
- Before opening the housing, switch off the power supply.

WARNING

Loss of Ex-approval!
Loss of Ex approval due to replacement of components in devices for use in potentially explosive atmospheres.
- Devices for use in potentially explosive atmospheres may be serviced and repaired by qualified ABB personnel only.
- For measuring devices for potentially explosive atmospheres, observe the relevant operator guidelines.

CAUTION

Risk of burns due to hot measuring media
The device surface temperature may exceed 158 °F (70 °C), 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.

...11 Repair

Spare parts

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

Note
Spare parts can be ordered from ABB Service.
www.abb.com/contacts

Replacing the fuse

NOTICE

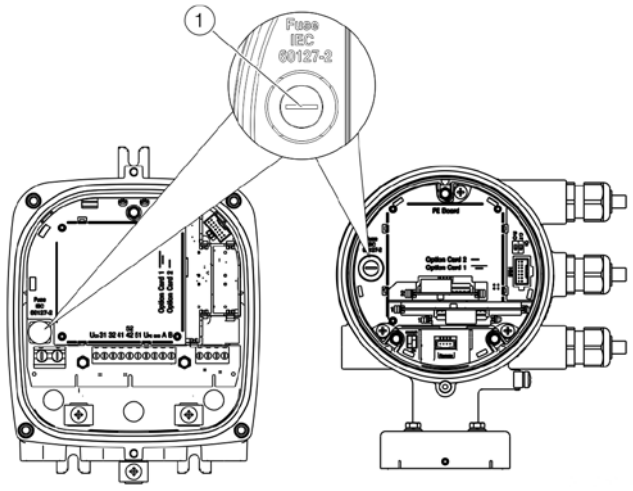
If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class.
Follow the instructions in **Opening and closing the housing** on page 22 to open and close the housing safely.

There is a fuse in the transmitter housing.

Power supply transmitter	11 to 30 V DC	100 to 240 V AC
Rated current of fuse	1.25 A	0.8 A
Nominal voltage of fuse	250 V AC	250 V AC
Design		Device fuse 5 x 20 mm
Breaking capacity		1500 A at 250 V AC
Ordering number	3KQR000757U0100	**3KQR000757U0200**

Perform the following steps to replace the fuse:
1. Switch off the power supply.
2. Open the transmitter housing.
3. Pull out the defective fuse and insert a new fuse.
4. Closing the transmitter housing.
5. Switch on the power supply.
6. Check that the device is working correctly.

If the fuse blows again on activation, the device is defective and must be replaced.



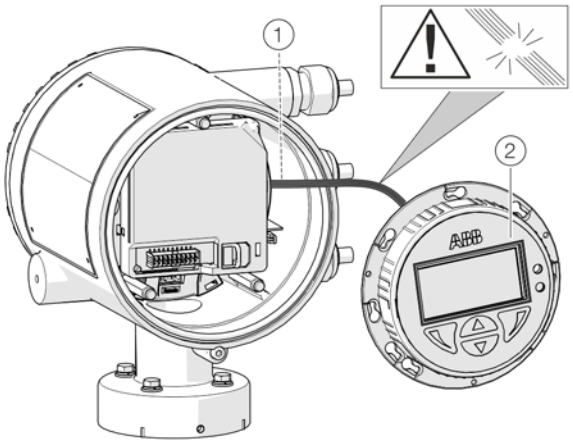
① Fuse holder

Figure 70 Fuse holder position

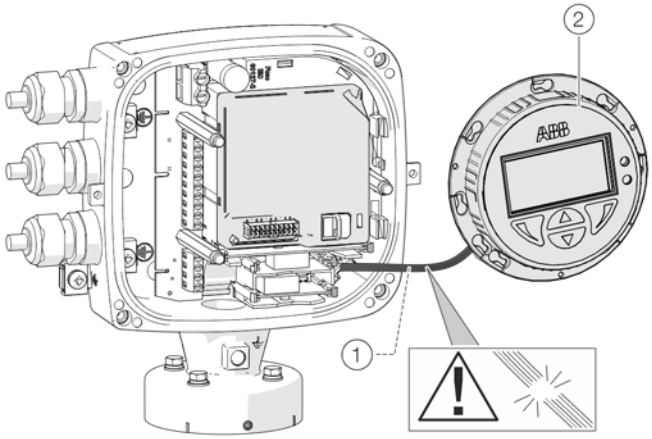
...11 Repair

Replacing the LCD indicator

Dual-compartment housing



Single-compartment housing



① LCD indicator cable harness
② LCD indicator

Figure 71 Replacing the LCD Indicator (example)

NOTICE

If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class.
Follow the instructions in **Opening and closing the housing** on page 22 to open and close the housing safely.

The LCD indicator can be replaced in the event of a malfunction.

Component	Ordering number
LCD indicator (HMI)	3KQZ407125U0100
For integral mount and remote mount design	

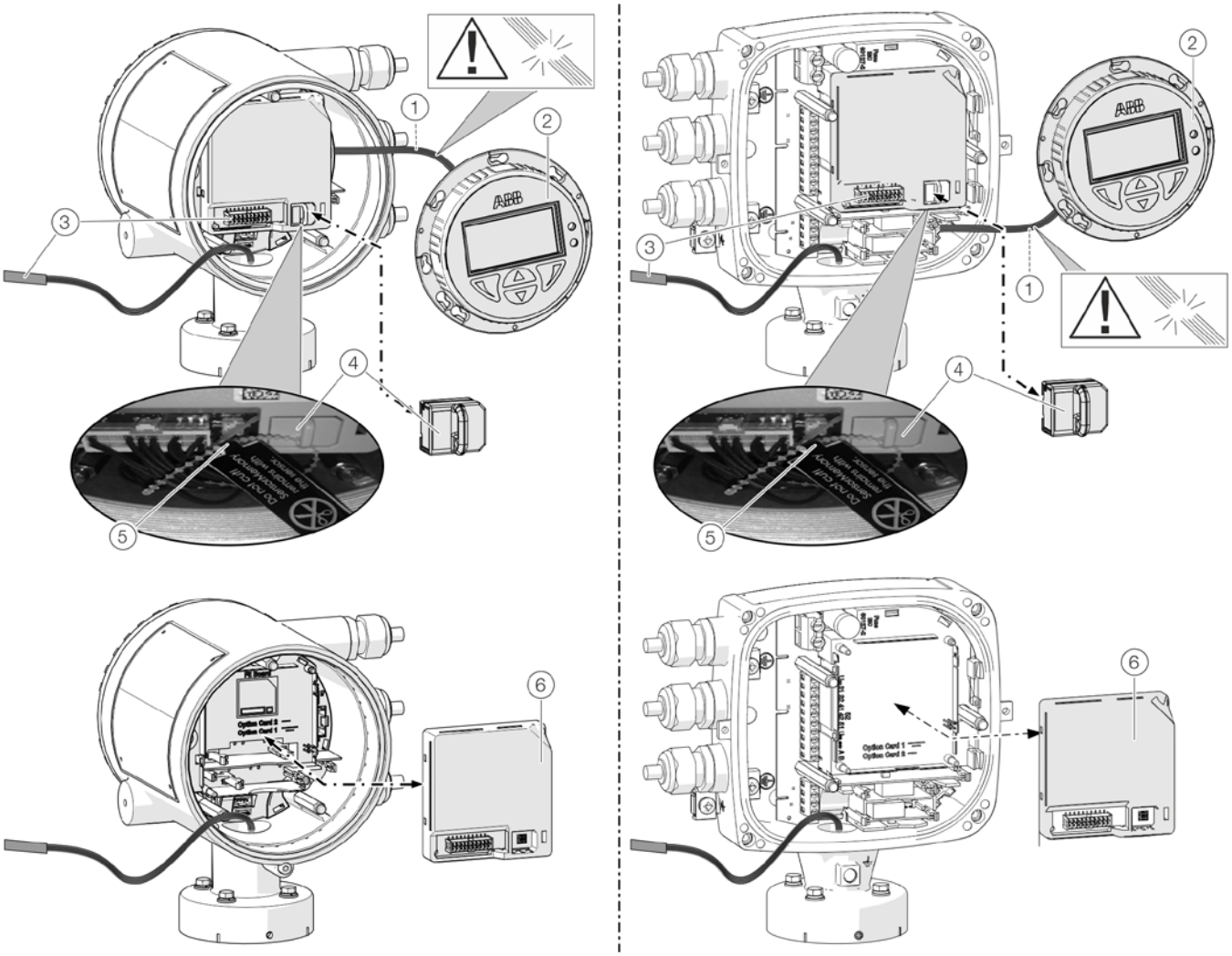
Replace the LCD indicator by following the steps below:

1. Switch off the power supply.
2. Unscrew / remove the cover.
3. Loosen fixing screws for LCD indicator (only in integral mount design).
4. Remove the LCD indicator.
5. Pull the connector out of the motherboard.
6. Attach the connector on the new LCD indicator. Ensure that the cable harness is not damaged.
7. Insert the LCD indicator and tighten if necessary.
8. Unscrew / set down the cover once again
9. Switch on the power supply.

...11 Repair

Replacing the frontend board

Integral mount design



1 LCD indicator cable harness
2 LCD indicator
3 Sensor cable harness
4 SensorMemory
5 Cable retainer
6 Frontend board

Figure 72 Replacing LCD indicator and frontend board (example)

...11 Repair

...Replacing the frontend board

NOTICE

If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class.
Follow the instructions in **Opening and closing the housing** on page 22 to open and close the housing safely.

In the event of a fault, the frontend board can be replaced on flowmeters with an integral mount design.

Replace the frontend board as follows:

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 the connector out of the sensor cable harness.
5 Pull out the SensorMemory

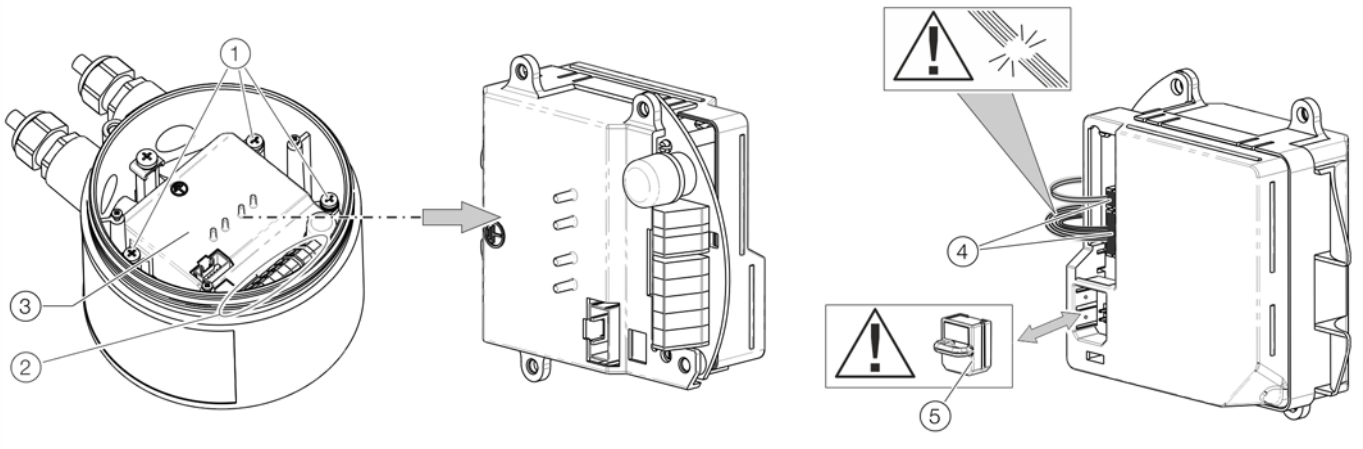
Note
The SensorMemory is assigned to the sensor. The SensorMemory is therefore fastened to the sensor cable harness with a cable retainer.
Ensure that the SensorMemory remains with the sensor and cannot be lost!

Pull the faulty frontend board out forwards.
6 Insert new frontend board.
7 Attach connector from the sensor cable harness.
8 Attach the SensorMemory.
9 Insert the LCD indicator and screw on /replace the cover.
10 Once the power supply is switched on, load the system data from the SensorMemory.

...11 Repair

Replacing the frontend board

Remote mount design



1 Frontend board fixing screw
2 Terminals
3 Frontend board
4 Connections for flowmeter sensor
5 SensorMemory

Figure 73 Replacing the frontend board (flowmeter sensor)

NOTICE

If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class.
Follow the instructions in **Opening and closing the housing** on page 22 to open and close the housing safely.

The frontend board can be replaced in the event of a malfunction.

Replace the frontend board as follows:

1 Switch off the power supply.
2 Unscrew / remove the cover.
3 Loosen the fixing screws (3×) at the frontend board.
4 Remove the faulty frontend board.
5 Pull the connector out of the sensor cable harness. Ensure that the cable harness is not damaged.
6 Pull out the SensorMemory.

Note
The SensorMemory is assigned to the sensor. Ensure that the SensorMemory remains with the sensor and cannot be lost!

7 Insert the SensorMemory into the new frontend board.
8 Connect the plug of the sensor cable harness.
9 Insert the new frontend board and secure it with the fixing screws (3×).
10 After powering up the power supply, the transmitter automatically replicates the system data from the SensorMemory.

...11 Repair

Replacing the sensor

⚠ WARNING

Risk of injury due to process conditions.
The process conditions, for example high pressures and temperatures, toxic and aggressive measuring media, can give rise to hazards when working on the device.
- Before working on the device, make sure that the process conditions do not pose any hazards.
- If necessary, wear suited personal protective equipment when working on the device.
- Depressurize and empty the device / piping, allow to cool and purge if necessary.

NOTICE

If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class.
Follow the instructions in **Opening and closing the housing** on page 22 to open and close the housing safely.

Note
The frontend board of the replacement sensor has a SensorMemory module. The calibration and system data of the sensor is stored in the SensorMemory. After powering-up the power supply, the transmitter automatically replicates the system data from the SensorMemory.

Replace the sensor as described below:
1. Switch off the power supply.
2. Unscrew / remove the cover.
3. Disconnect the signal cable (if necessary, remove the potting compound).
4. Install the new sensor in accordance with **Installation** on page 14.
5. Complete the electrical connection in accordance with **Electrical connections** on page 28.
6. Unscrew / set down the cover once again
7. After powering-up the power supply, the transmitter automatically replicates the system data from the SensorMemory.

Returning devices

Use the original packaging or a secure transport container of an appropriate type if you need to return the device for repair or recalibration purposes.
Fill out the return form (see **Return form** on page 135) and include this with the device.
In accordance with the EU Directive governing hazardous materials, the owner of hazardous waste is responsible for its disposal or must observe the following regulations for shipping purposes:
All devices delivered to ABB must be free from any hazardous materials (acids, alkalis, solvents, etc.).

Address for returns:
Please contact Customer Center Service according to page 6 for nearest service location.

12 Recycling and disposal

Dismounting

⚠ WARNING

Risk of injury due to process conditions.
The process conditions, for example high pressures and temperatures, toxic and aggressive measuring media, can give rise to hazards when dismantling the device.
- If necessary, wear suited personal protective equipment during disassembly.
- Before disassembly, make sure that the process conditions do not pose any safety risks.
- Depressurize and empty the device / piping, allow to cool and purge if necessary.

Bear the following points in mind when dismantling the device:
- Switch off the power supply.
- Disconnect electrical connections.
- Allow the device / piping to cool and depressurize and empty. Collect any escaping medium and dispose of it in accordance with environmental guidelines.
- Use suited tools to disassemble the device, taking the weight of the device into consideration.
- If the device is to be used at another location, the device should preferably be packaged in its original packing so that it cannot be damaged.
- Observe the notices in **Returning devices** on page 128.

Disposal

Note

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

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

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

13 Specification

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

Permitted pipe vibration

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

- Maximum deflection: 0.0006” (0.15 mm) in the frequency range of 10 to 58 Hz
- Maximum acceleration: 2 g in the frequency range of 58 to 150 Hz

ProcessMaster – Temperature data

The temperature range offered by the device is dependent on a number of different factors.
These factors include the measuring medium temperature T_{medium}, the ambient temperature T_{amb}, operating pressure P_{medium}, liner material and the approval for explosion protection.

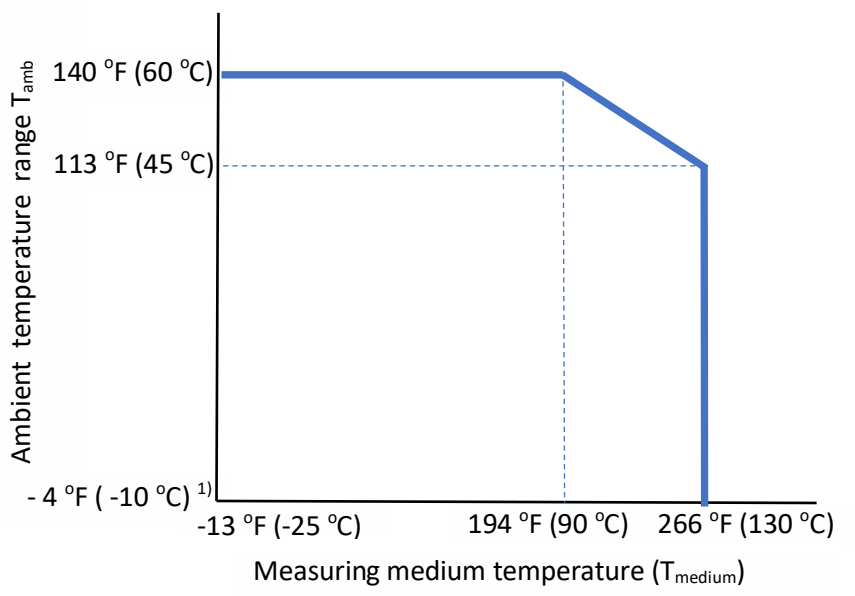
Storage temperature range
–40 to 158 °F (–40 to 70 °C)

...13 Specification

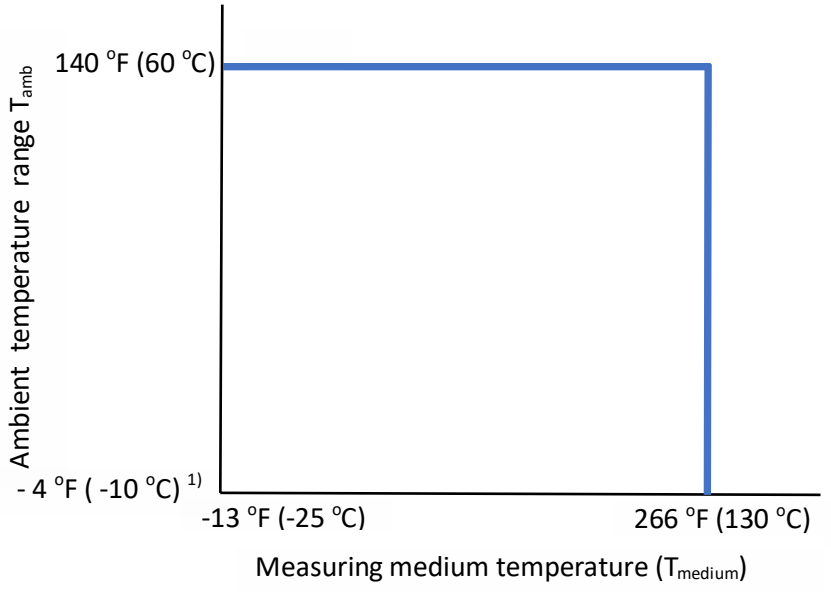
...ProcessMaster – Temperature data

Ambient temperature as a function of measuring medium temperature
Integral and Remote mount designs

Maximum permissible combination of ambient and medium temperatures
(Standard version of the $_{C}FM_{US}$ Class I, Div. 1 and $_{C}FM_{US}$ Class I, Div. 2)



Maximum permissible combination of ambient and medium temperatures
(High temperature version (optional) of the $_{C}FM_{US}$ Class I, Div. 2)



1 Minimum ambient temperature is - 4 °F (-10 °C) with carbon steel mating flanges. Stainless steel mating flanges must be used to reach the - 4 °F (-20 °C) temperature.

...13 Specification

ProcessMaster – Material load for process connections

The limits of the permissible measuring medium temperature (Tmedium) and permissible pressure (Pmedium) are calculated on the basis of the liner and flange material used in the device (see device name plate).

Minimum permissible operating pressure

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

Lining material	Nominal diameter	P_{medium} [mbar abs]	T_{medium}
ETFE	1 to 4 inch (DN 25 to DN 100)	**100**	**< 266 °F (130 °C)**

Liner approvals on request; please contact ABB.

...13 Specification

...ProcessMaster – Material load for process connections

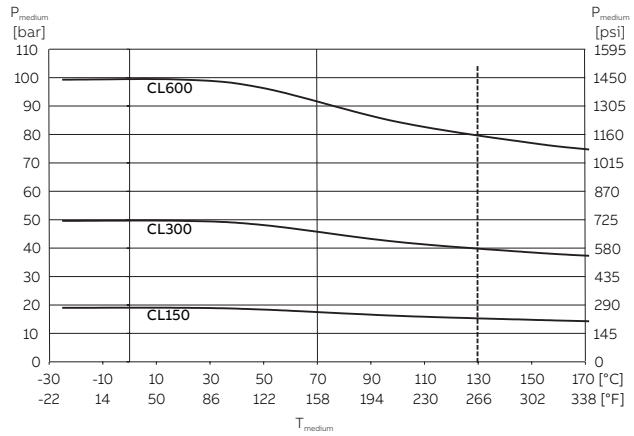


Figure 74 ASME-flange, stainless steel, to 16 inch (DN 400) (CL 150 / 300)

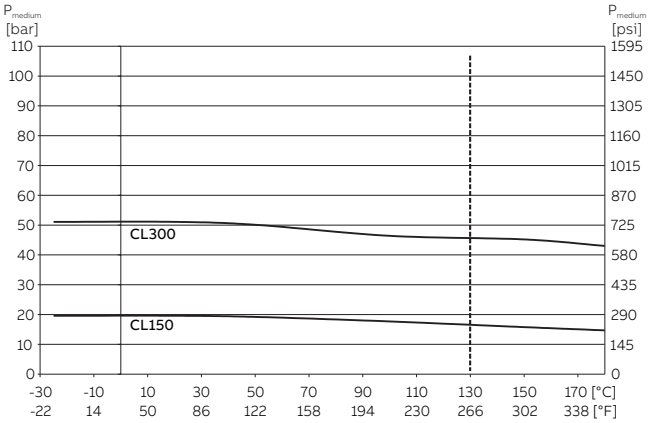


Figure 75 ASME-flange, steel up to 16 inch (DN 400) (CL 150 / 300)

14 Additional documents

Note

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

Note

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

Trademarks

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15 Appendix

Return form

Statement on the contamination of devices and components
Repair and/or maintenance work will only be performed on devices and components if a statement form has been completed and submitted.

Otherwise, the device/component returned may be rejected. This statement form may only be completed and signed by authorized specialist personnel employed by the operator.

Customer details:

Company:

Address:

Contact person: Telephone:

Fax: Email:

Device details:

Type: Serial no.:

Reason for the return/description of the defect:

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

☐ Yes ☐ No

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

☐ biological	☐ corrosive / irritating	☐ combustible (highly / extremely combustible)
☐ toxic	☐ explosive	☐ other toxic substances
☐ radioactive		

Which substances have come into contact with the device?

1.

2.

3.

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

Town/city, date Signature and company stamp

...15 Appendix

Torque information

Tightening torques for ProcessMaster Wafer

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

Meter Size	ANSI Class 150		ANSI Class 300	
	Ft. Lbs	Nm	Ft. Lbs	Nm
≤1/2" (≤ DN15)	10	15	15	20
1" (DN25)	10	15	15	20
1-1/2" (DN 40)	15	20	25	35
2" (DN50)	25	35	15	20
3" (DN80)	40	55	30	40
4" (DN100)	30	40	45	60

...15 Appendix

Parameterization overview (factory settings)

Parameter	Value range	Factory setting
Sensor Tag	Alphanumeric, maximum 20 characters.	None
Sensor Location Tag	Alphanumeric, maximum 20 characters.	None
Qv Max 1	Depending on the nominal diameter of the sensor.	Set to Q_{max}DN in accordance with **Measuring range table** on page 59.
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	g/min
Unit Vol. Totalizer	m3; l; ml; hl; g; kg; t	Gallon (g)
Pulses per Unit	1 to 10000	1
Pulse Width	0.1 to 2000 ms	100 ms
Damping	0.02 to 60 s	1
Operating mode Digital output 41 / 42	Off, Binary output, Pulse output, Frequency output	Digital output 41/42 as pulse output for forward flow and reverse flow
Operating mode Digital output 51 / 52	Off, Binary output, pulse output (follows digital output 41 / 42, 90 ° or 180 ° out of phase)	Digital output 51 / 52 as binary output for output of the flow direction.
Curr.Out 31/32	4-20mA FWD/REV, 4-20mA FWD, 4-12-20 mA	4-20mA FWD/REV
Curr.Out at Alarm	High Alarm 21 to 23 mA or Low Alarm 3.5 to 3.6 mA	High Alarm, 21.8 mA
Current at flow rate> 103 % (I=20.5 mA)	Off (current output remains at 20.5 mA), High Alarm, Low Alarm ,	Off
Low flow cutoff	0 to 10 %	1 %
Empty pipe detection	On / Off	Off

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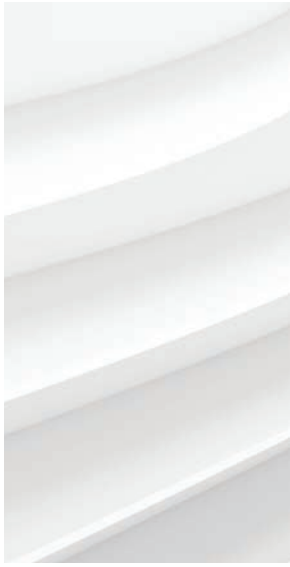

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