

EN

English

Commissioning Instructions

Electromagnetic Flowmeter
FEP300/FEH300



HART 
COMMUNICATION PROTOCOL

ABB

Electromagnetic Flowmeter ProcessMaster / HygienicMaster

Commissioning Instruction - EN

CI/FEP300/FEH300-EN

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1 Safety

1.1 General information and notes for the reader

Read these instructions carefully prior to installing and commissioning the device.

These instructions are an important part of the product and must be kept for later use.

These instructions are intended as an overview and do not contain detailed information on all designs for this product or every possible aspect of installation, operation and maintenance.

For additional information or in case specific problems occur that are not discussed in these instructions, contact the manufacturer.

The content of these instructions is neither part of any previous or existing agreement, promise or legal relationship nor is it intended to change the same.

This product is built based on state-of-the-art technology and is operationally safe. It has been tested and left the factory in a safe, maintenance-free state. The information in the manual must be observed and followed in order to maintain this state throughout the period of operation.

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

Only by observing all of the safety information and all safety/warning symbols in these instructions can optimum protection of both personnel and the environment, as well as safe and fault-free operation of the device, be ensured.

Information and symbols directly on the product must be observed. They may not be removed and must be fully legible at all times.



Important

For a list of all additional documents associated with the product, see section 9.1, "Additional documents".



Important

- An additional document with Ex safety information is available for measuring systems that are used in potentially explosive areas.
- Ex safety information is 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:



1.2 Intended use

This device is intended for the following uses:

- To transmit fluid, pulpy or pasty substances with electrical conductivity.
- To measure the flowrate of the operating volume or mass flow units (at constant pressure / temperature), if a mass engineering unit is selected.

The following items are included in the intended use:

- Read and follow the instructions in this manual.
- Observe the technical ratings; refer to the section "Technical limit values".
- Use only allowed liquids for measurement; refer to the section "Allowed fluids".

1.3 Improper use

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

- Operation as a flexible adapter in piping, e.g., to compensate for pipe offsets, pipe vibrations, pipe expansions, etc.
- As a climbing aid, e. g., for mounting purposes
- As a support for external loads, e. g., as a support for piping, etc.
- Adding material, e. g., by painting over the name plate or welding/soldering on parts
- Removing material, e. g., by spot drilling the housing

Repairs, alterations, and enhancements, or the installation of replacement parts, are only permissible insofar as these are described in the manual. Approval by ABB Automation Products GmbH must be sought for any activities beyond this scope. Repairs performed by ABB-authorized specialist shops are excluded from this.

1.4 Target groups and qualifications

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

Prior to using corrosive and abrasive materials for measurement purposes, the operator must check the level of resistance of all parts coming into contact with the materials to be measured. ABB Automation Products GmbH will gladly support you in selecting the materials, but cannot accept any liability in doing so.

The operators must strictly observe the applicable national regulations with regards to installation, function tests, repairs, and maintenance of electrical products.

1.5 Warranty provisions

Using the device in a manner that does not fall within the scope of its intended use, disregarding this instruction, 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.

1.5.1 Safety/warning symbols, note symbols



DANGER – <Serious damage to health / risk to life>

This symbol in conjunction with the signal word "Danger" indicates an imminent danger. Failure to observe this safety information will result in death or severe injury.



DANGER – <Serious damage to health / risk to life>

This symbol in conjunction with the signal word "Danger" indicates an imminent electrical hazard. Failure to observe this safety information will result in death or severe injury.



WARNING – <Bodily injury>

This symbol in conjunction with the signal word "Warning" indicates a possibly dangerous situation. Failure to observe this safety information may result in death or severe injury.



WARNING – <Bodily injury>

This symbol in conjunction with the signal word "Warning" indicates a potential electrical hazard. Failure to observe this safety information may result in death or severe injury.



CAUTION – <Minor injury>

This symbol in conjunction with the signal word "Caution" indicates a possibly dangerous situation. Failure to observe this safety information may result in minor or moderate injury. This may also be used for property damage warnings.



ATTENTION – <Property damage>!

The symbol indicates a potentially damaging situation.

Failure to observe this safety information may result in damage to or destruction of the product and/or other system components.



IMPORTANT (NOTICE)

This symbol indicates operator tips, particularly useful information, or important information about the product or its further uses. It does not indicate a dangerous or damaging situation.

1.6 Transport safety information

- Depending on the device, the center of gravity may not be in the center of the equipment.
- The protection plates or protective caps installed on the process connections of devices lined with PTFE / PFA must not be removed until just before installation; to prevent possible leakage, make sure that the liner on the flange is not cut or damaged.

1.7 Installation safety information

Observe the following instructions:

- The flow direction must correspond to the direction indicated on the device, if labeled.
- Comply with the maximum torque for all flange bolts.
- Install the devices without mechanical tension (torsion, bending).
- Install flange and wafer type units with coplanar counter flanges.
- Only install devices for the intended operating conditions and with suitable seals.
- Secure the flange bolts and nuts against pipeline vibrations.

1.8 Electrical installation safety information

The electrical connection may only be performed by authorized specialists according to the electrical plans.

Comply with electrical connection information in the manual. Otherwise, the electrical protection can be affected.

Ground the flowmeter and sensor housing.

The line for the supply power must be installed according to the relevant national and international standards. A separate fuse must be connected upstream and in close proximity to each unit. The fuses must be identified accordingly. The unit has a protection class of I and overvoltage class II (IEC664).

The power supply and the electrical circuit for the coils of the sensor are dangerous and pose a contact risk.

The coils and signal circuit can be connected with ABB sensors only. Use the supplied cable.

Only electrical circuits that do not pose a contact risk can be connected to the remaining signal inputs and outputs.

1.9 Safety instructions for operation

During operation with hot fluids, contact with the surface may result in burns.

Aggressive fluids may result in corrosion or abrasion of the parts that come into contact with the medium. As a result, pressurized fluids may escape prematurely.

Wear to the flange gasket or process connection gaskets (e.g., aseptic threaded pipe connections, Tri-Clamp, etc.) may enable a pressurized medium to escape.

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

If pressure shocks exceeding the device's permissible nominal pressure occur continuously during operation, this can have a detrimental effect on the device's service life.



Warning – Risk to persons!

Bacteria and chemical substances can contaminate or pollute pipeline systems and the materials they are made of.

The appropriate installation conditions must be observed in order to achieve an installation that complies with EHEDG requirements.

For an installation to comply with EHEDG requirements, the process connection/gasket combinations created by the operator must always be made of parts that conform to EHEDG stipulations (EHEDG Position Paper: "Hygienic Process connections to use with hygienic components and equipment").

1.10 Technical limit values

The device is designed for use exclusively within the stated values on the name plate and within the technical limit values specified in the data sheets.

The following technical limit values must be observed:

- The permissible operating pressure (PS) in the permissible temperature (TS) may not exceed the pressure-temperature ratings.
- The maximum operating temperature may not be exceeded.
- The permitted operating temperature may not be exceeded.
- The housing protection system must be observed.
- The flowmeter sensor may not be operated in the vicinity of powerful electromagnetic fields, e.g., motors, pumps, transformers, etc. A minimum spacing of approx. 1 m (3.28 ft) should be maintained. For installation on or to steel parts (e.g., steel brackets), a minimum spacing of approx. 100 mm (3.94 inch) should be maintained (based on IEC801-2 and IECTC77B).

1.11 Allowed Fluids

When measuring fluids, the following points must be observed:

- Fluids may only be used if, based on state-of-the-art technology or the operating experience of the user, it is assured that chemical and physical properties of the components coming into contact with the fluids (signal electrodes, ground electrodes, liners and, possibly, process connections, protective plates or protective flanges) are not affected during the operating life.
- Fluids with unknown properties or abrasive fluids may only be used if the operator can perform regular and suitable tests to ensure the safe condition of the device.
- Observe the information on the name plate.

2 Device designs



Important

An additional document with Ex safety instructions is available for measuring systems that are used in explosion hazardous areas. As a result, it is crucial that the specifications and data it lists are also observed.

2.1.1 Compact design

The transmitter and the sensor comprise a single mechanical entity.



Fig. 1

2.1.2 Remote design

The transmitter is mounted at a separate location from the sensor. The electrical connection between the transmitter and the sensor is provided by a signal cable.

Up to 50 m (164 ft) cable length for a minimum conductivity of 5 $\mu\text{S}/\text{cm}$ without pre-amplifier.

With pre-amplifier, the maximum signal cable length is 200m (656 ft).

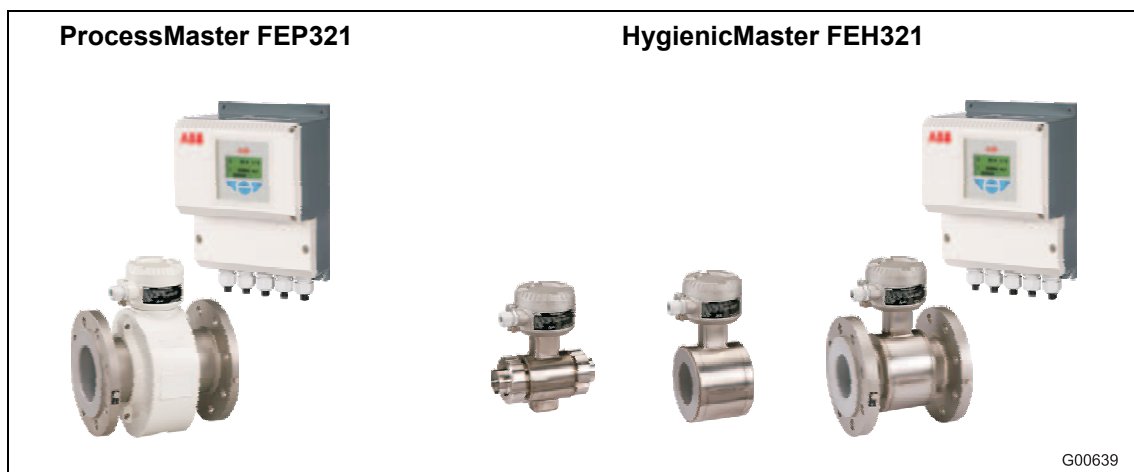


Fig. 2

3 Transport

3.1 Inspection

Check the devices for possible damage that may have occurred during transport. Damages in transit must be recorded on the transport documents. All claims for damages must be claimed without delay against the shipper and before the installation.

3.2 Transport of flanged units smaller than DN 450



Warning – Danger of injuries due to slipping meter.

The center of gravity for the complete device may be higher than the lifting straps. Make sure the device has not rotated or slipped unintentionally during transport. Support the meter laterally.

For transport of flanged units smaller than DN 450 use a lifting strap. Wrap the straps around both process connections when lifting the device. Avoid chains since these may damage the housing.

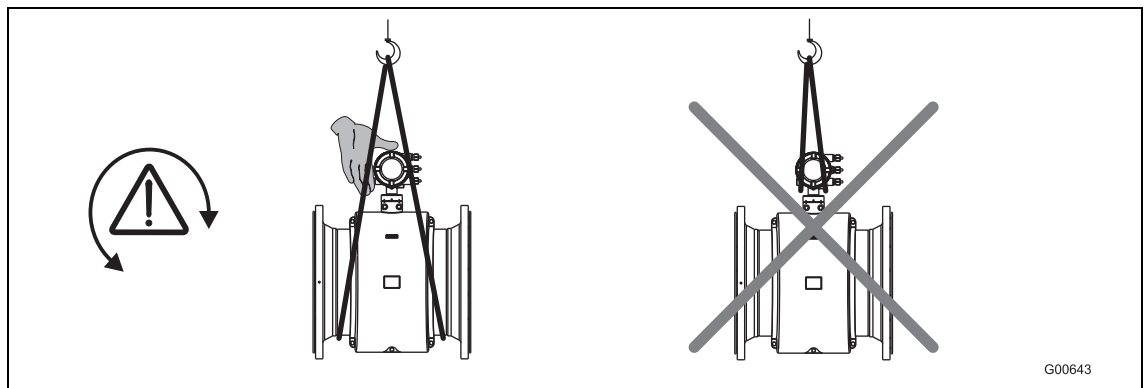


Fig. 3: Transport of flanged units smaller than DN 450

3.3 Transport of flanged units larger than DN 400



Notice - Potential damage to device!

Use of a forklift to transport the device can bend the housing and damage the internal magnet coils.

Flanged units may not be lifted at the middle of the housing when transporting via forklift.

Flanged units may not be lifted by the terminal box or at the middle of the housing. Use only the eye bolts on the device to lift and install it in the pipeline.

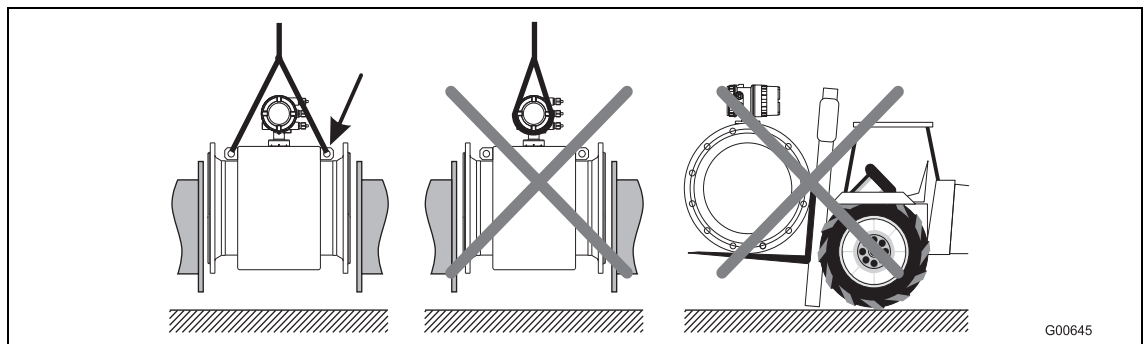


Fig. 4: Transport of flanged units larger than DN 400

4 Mounting

4.1 General information on installation



Important

An additional document with Ex safety instructions is available for measuring systems that are used in explosion hazardous areas. As a result, it is crucial that the specifications and data it lists are also observed.

The following points must be observed for the installation:

- The flow direction must correspond to the identification if present.
- The maximum torque for all flange connections must be complied with.
- The devices must be installed without mechanical tension (torsion, bending).
- Install flange and wafer type units with coplanar counter flanges and use only appropriate gaskets.
- Use only gaskets made from a compatible material for the fluid and fluid temperatures.
- Gaskets must not extend into the flow area since possible turbulence could influence the device accuracy.
- The pipeline may not exert excessive forces or torques on the device.
- Do not remove the plugs in the cable connectors until you are ready to install the electrical cable.
- Make sure the gaskets for the housing cover are seated properly. Carefully seal the cover. Tighten the cover fittings.
- A separate transmitter must be installed at a largely vibration-free location.
- Do not expose the transmitter and sensor to direct sunlight. Provide appropriate sun protection if necessary.
- When installing the transmitter in a control cabinet, make sure adequate cooling is provided.

4.1.1 Supports for meter sizes larger than DN 400



Notice - Potential damage to device!

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

Place the supports at the edge of the housing (see arrows in the figure).

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

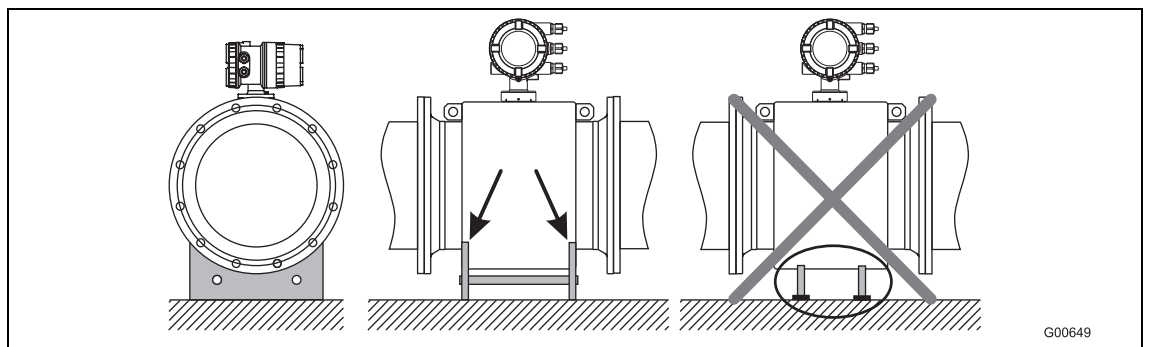


Fig. 5: Support for meter sizes larger than DN 400

4.1.2 Mounting the measuring tube

The device can be installed at any location in a pipeline under consideration of the installation conditions.



Notice - Potential damage to device!

Use of graphite with the flange or process connection gaskets is prohibited. In some instances, an electrically conductive coating may form on the inside of the measuring tube. Vacuum shocks in the pipelines should be avoided to prevent damage to the liners (PTFE). Vacuum shocks can destroy the device.

1. Remove protective plates, if present, to the right and left of the measuring tube. To prevent possible leakage, make sure that the liner on the flange is not cut or damaged.
2. Position the measuring tube coplanar and centered between the pipes.
3. Install gaskets between the surfaces.

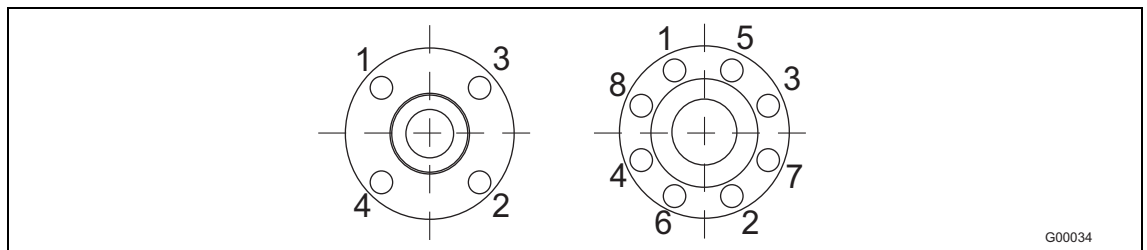


Important

For best results, make sure the flowmeter sensor gaskets fit concentrically with the measuring tube.

4. Use the appropriate bolts for the flanges as per the section "Torque information".
5. Slightly grease the threaded nuts.
6. Tighten the nuts in a crosswise manner as shown in the figure. Observe the torque values specified under "Torque information".

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



G00034

Fig. 6

4.2 Torque information

4.2.1 Flanged units ProcessMaster and HygienicMaster

Meter size DN		Nominal pressure	Screws	Max. tightening torque
mm	Inch	PN		Nm
3 ... 10 ¹⁾	1/10 ... 3/8 ¹⁾	40	4 x M12	8
		CL 150	4 x M12	6
		CL 300	4 x M12	7
15	1/2"	40	4 x M12	10
		CL 150	4 x M12	6
		CL 300	4 x M12	7
20	3/4"	40	4 x M12	16
		CL 150	4 x M12	8
		CL 300	4 x M16	13
25	1"	40	4 x M12	21
		CL 150	4 x M12	10
		CL 300	4 x M16	18
32	1 1/4"	40	4 x M16	34
		CL 150	4 x M12	15
		CL 300	4 x M16	27
40	1 1/2"	40	4 x M16	43
		CL 150	4 x M12	20
		CL 300	4 x M20	43
50	2"	40	4 x M16	56
		CL 150	4 x M16	39
		CL 300	8 x M16	28
65	2 1/2"	16	4 x M16	34
		40	8 x M16	39
		CL 150	4 x M16	49
		CL 300	8 x M20	43
80	3"	40	8 x M16	49
		CL 150	4 x M16	69
		CL 300	8 x M20	62
100	4"	16	8 x M16	47
		40	8 x M20	77
		CL 150	8 x M16	49
		CL 300	8 x M20	92
125	5"	16	8 x M16	62
		40	8 x M24	120
		CL 150	8 x M20	76
		CL 300	8 x M20	120
150	6"	16	8 x M20	83
		40	8 x M24	155
		CL 150	8 x M20	96
		CL 300	8 x M20	100
200	8"	10	8 x M20	120
		16	12 x M20	81
		25	12 x M24	120
		40	12 x M27	200
		CL 150	8 x M20	135
		CL 300	12 x M24	170

Continued on next page

Meter size DN		Nominal pressure	Screws	Max. tightening torque
mm	Inch	PN		Nm
250	10"	10	12 x M20	97
		16	12 x M24	120
		25	12 x M27	175
		40	12 x M30	320
		CL 150	12 x M24	135
		CL 300	16 x M27	185
300	12"	10	12 x M20	115
		16	12 x M24	160
		25	16 x M27	175
		40	16 x M30	340
		CL 150	12 x M24	180
		CL 300	16 x M30	265
350	14"	10	16 x M20	145
		16	16 x M24	195
		25	16 x M30	280
400	16"	10	16 x M24	200
		16	16 x M27	250
		25	16 x M33	365
500	20"	10	20 x M24	200
600	24"	10	20 x M27	260
700	28"	10	24 x M27	300
800	32"	10	24 x M30	390
900	36"	10	28 x M30	385
1000	40"	10	28 x M33	480

¹⁾ Connection flange DIN EN1092-1 = DN10 (3/8"), connection flange ASME = DN15 (1/2")

4.2.2 Wafer type unit (HygienicMaster)

Meter size DN		Nominal pressure	Screws	Max. tightening torque
mm	Inch	PN		Nm
3 ... 8 ¹⁾	1/10 ... 5/16 ¹⁾	40	4 x M12	2,3
		CL 150	4 x M12	upon request
		CL 300	4 x M12	upon request
10	3/8 ¹⁾	40	4 x M12	7
		CL 150	4 x M12	upon request
		CL 300	4 x M12	upon request
15	1/2"	40	4 x M12	7
		CL 150	4 x M12	upon request
		CL 300	4 x M12	upon request
20	3/4"	40	4 x M12	11
		CL 150	4 x M12	upon request
		CL 300	4 x M16	upon request
25	1"	40	4 x M12	15
		CL 150	4 x M12	upon request
		CL 300	4 x M16	upon request
32	1 1/4"	40	4 x M16	26
		CL 150	4 x M12	upon request
		CL 300	4 x M20	upon request
40	1 1/2"	40	4 x M16	33
		CL 150	4 x M12	upon request
		CL 300	4 x M20	upon request
50	2	40	4 x M16	46
		CL 150	4 x M16	upon request
		CL 300	8 x M16	upon request
65	2 1/2"	16	8 x M16	30
		CL 150	4 x M16	upon request
80	3	16	8 x M16	40
		CL 150	4 x M16	upon request
100	4	16	8 x M20	67
		CL 150	8 x M16	upon request

¹⁾ Connection flange DIN EN1092-1 = DN10 (3/8"), connection flange ASME = DN15 (1/2")

4.2.3 Variable process connections (HygienicMaster)

Meter size DN		Max. tightening torque
mm	inch	Nm
3 ... 10	3/8"	8
15	1/2"	10
20	3/4"	21
25	1	31
32	1 1/4"	60
40	1 1/2"	80
50	2	5
65	2 1/2"	5
80	3	15
100	4	14

4.3 Information on EHEDG conformity



Warning – Risk to persons!

Bacteria and chemical substances can contaminate or pollute pipeline systems and the materials they are made of.

The appropriate installation conditions must be observed in order to achieve an installation that complies with EHEDG requirements.

For an installation to comply with EHEDG requirements, the process connection/gasket combinations created by the operator must always be made of parts that conform to EHEDG stipulations (EHEDG Position Paper: "Hygienic Process connections to use with hygienic components and equipment").

All weld stub combinations provided by ABB are approved.

The threaded pipe connection conforming to DIN11851 is approved when used in conjunction with an EHEDG-approved process gasket (e.g. Siersema brand).

4.4 Information on 3A conformity

The device may not be installed vertically with the terminal box or transmitter housing pointing downward. The "bracket mounting" option no longer applies.

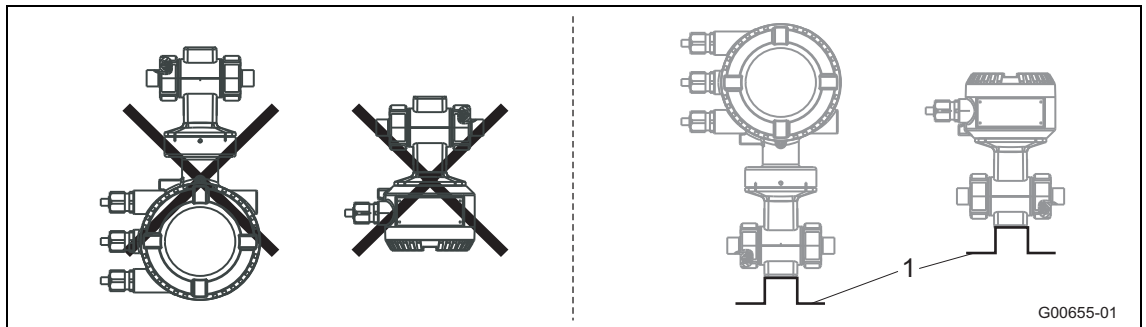


Fig. 7

1 Bracket

Please ensure that the leakage hole of the process connection is located at the deepest point of the installed device.

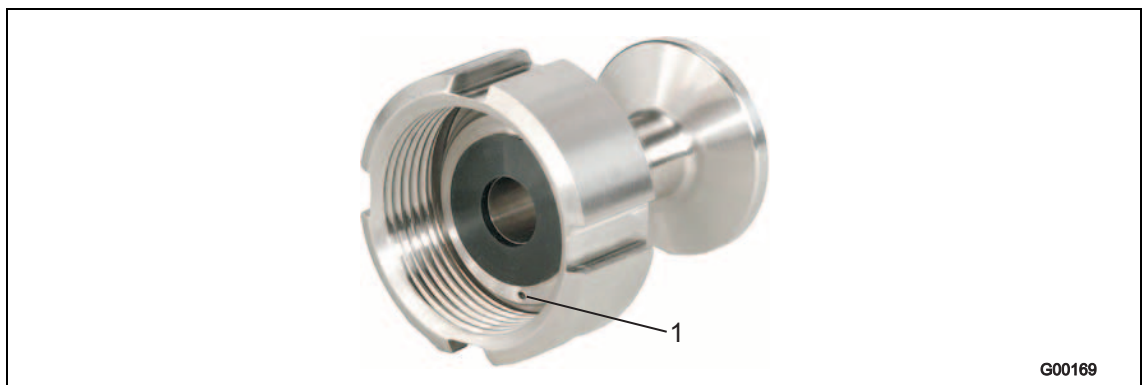


Fig. 8

1 Leakage hole

4.5 Installation Requirements

The device measures the flowrate in both directions. Forward flow is the factory setting, as shown in Fig. 9.

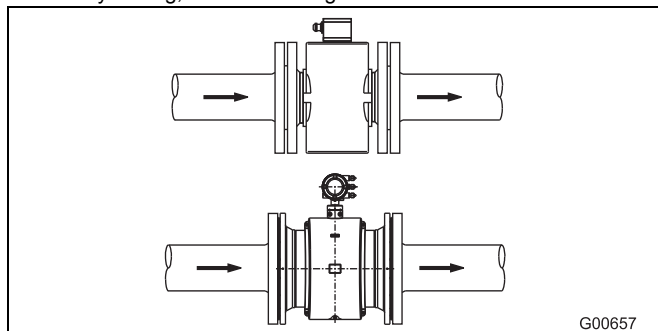


Fig. 9

4.5.1 Electrode axis

Electrode axis (1) should be horizontal if at all possible or no more than 45° from horizontal.

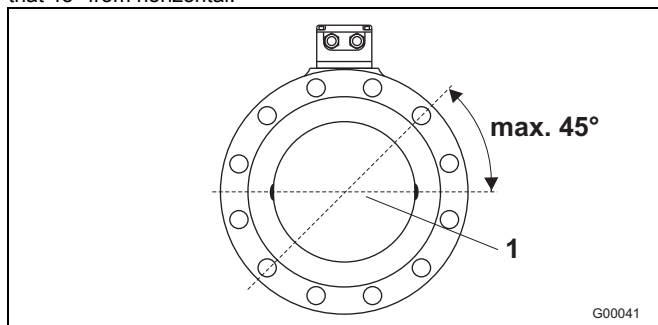


Fig. 10

4.5.2 In- and outlet pipe sections

Straight inlet section	Straight outlet section
$\geq 3 \times \text{DN}$	$\geq 2 \times \text{DN}$

DN = Flowmeter sensor size

- Do not install fittings, manifolds, valves etc. directly in front of the meter tube (1).
- Butterfly valves must be installed so that the valve plate does not extend into the flowmeter sensor.
- Valves or other turn-off components should be installed in the outlet pipe section (2).
- For compliance with the measuring accuracy, observe the inlet and outlet pipe sections.

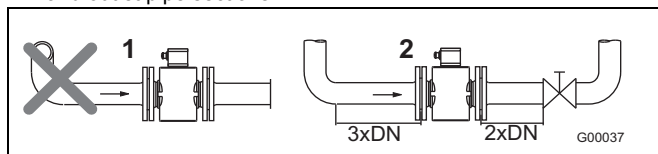


Fig. 11

4.5.3 Vertical connections

- Vertical installation for measurement of abrasive fluids, flow preferably from below to above.

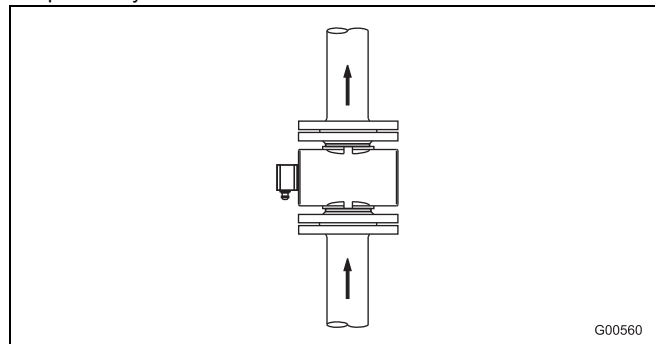


Fig. 12

4.5.4 Horizontal connections

- Meter tube must always be completely full.
- Provide for a slight incline of the connection for degassing.

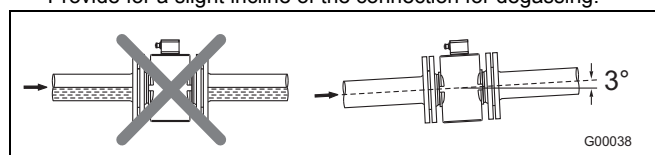


Fig. 13

4.5.5 Free inlet or outlet

- Do not install the flowmeter at the highest point or in the draining-off side of the pipeline, flowmeter runs empty, air bubbles can form (1).
- Provide for a siphon fluid intake for free inlets or outlets so that the pipeline is always full (2).

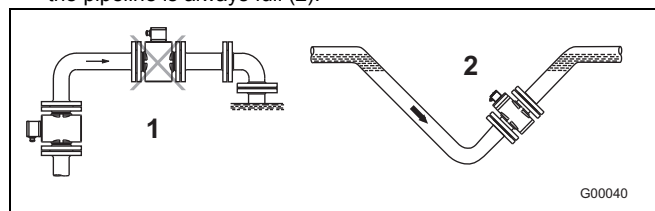


Fig. 14

4.5.6 Strongly contaminated fluids

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

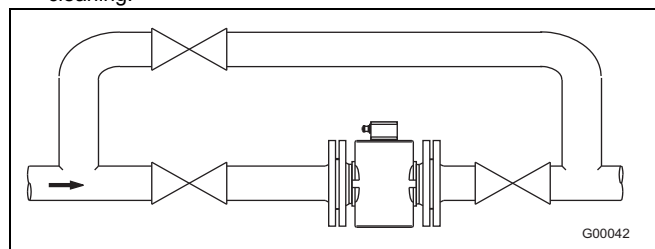


Fig. 15

Mounting

4.5.7 Installation in the vicinity of pumps

- For flowmeter primaries which are to be installed in the vicinity of pumps or other vibration generating equipment, the utilization of mechanical snubbers is advantageous.

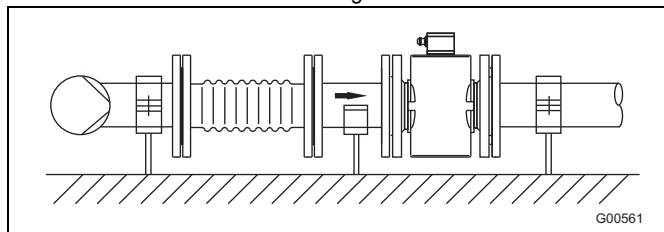


Fig. 16

4.5.8 Installing the high temperature design

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

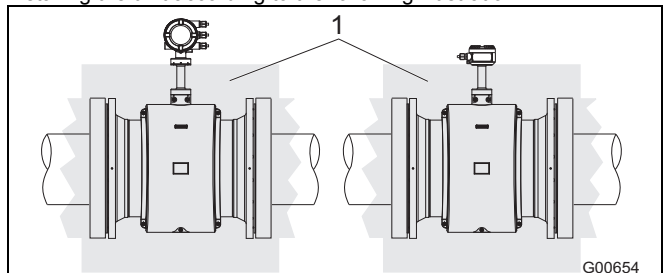


Fig. 17

1 Insulation

4.5.9 Installation in pipelines with larger nominal diameters

Determine the resulting pressure loss when using reduction pieces (1):

1. Calculate the diameter ratio d/D .
2. Determine the flow velocity based on the flow range nomograph (Fig. 19).
3. Read the pressure drop on the Y-axis in Fig. 19.

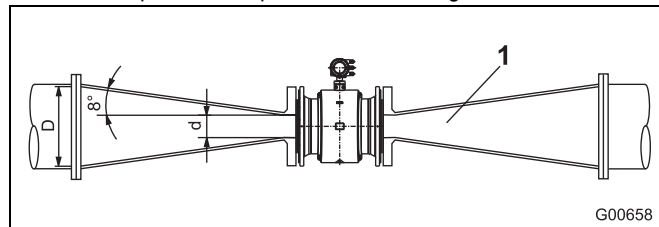


Fig. 18

- 1 = Flange transition piece
 d = Inside diameter of the flowmeter
 V = flow velocity [m/s]
 Δp = pressure loss [mbar]
 D = Inside diameter of the pipeline

Nomograph for pressure drop calculations

For flange transition piece with $\alpha/2 = 8^\circ$

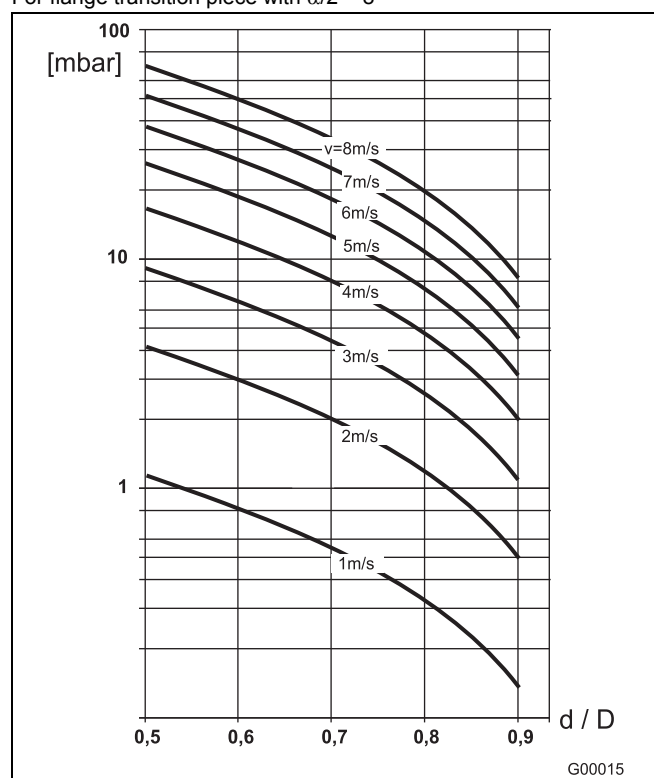


Fig. 19

4.6 Ground

4.6.1 General information on ground connections

Observe the following items when grounding the device:

- For plastic pipes or pipes with insulating lining, the ground is provided by the grounding plate or grounding electrodes.
- When stray potentials are present, install a grounding plate at the front and back of the flowmeter.
- For measurement-related reasons, the potentials in the station ground and in the pipeline should be identical.
- An additional ground on the terminals is not required.

i

Important

If the flowmeter is installed in plastic or earthenware pipelines, or in pipelines with an insulating lining, transient current may flow through the grounding electrode in special cases. In the long term, this may destroy the sensor, since the ground electrode will in turn degrade electrochemically. In these special cases, the connection to the ground must be performed using grounding plates.

4.6.2 Metal pipe with fixed flanges

Use a copper wire (at least 2.5 mm² (14 AWG)) to establish the ground connection between the sensor (1), the pipeline flanges and an appropriate grounding point.

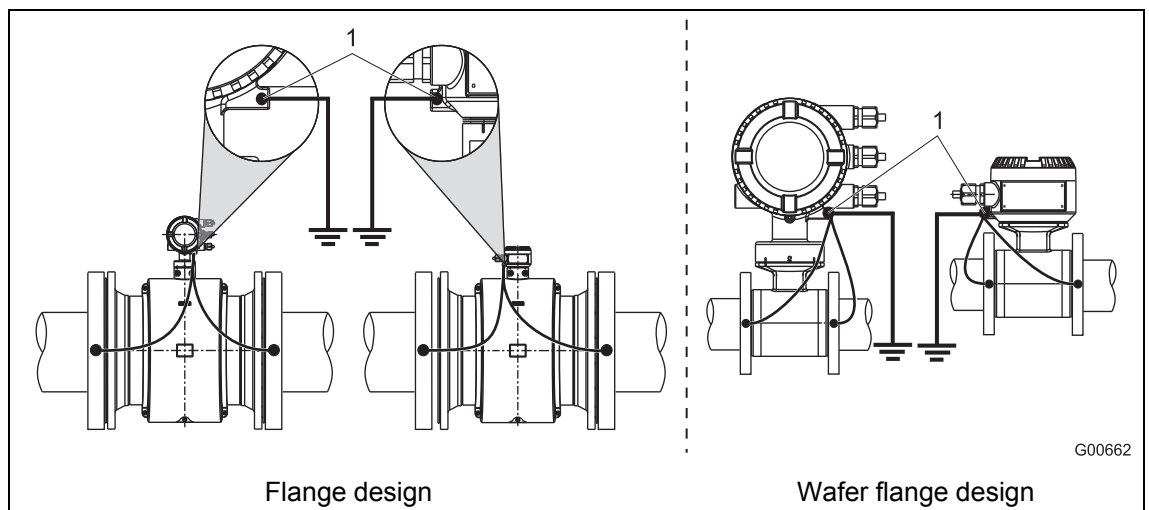


Fig. 20: Metal pipe, without liner

4.6.3 Metal pipe with loose flanges

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

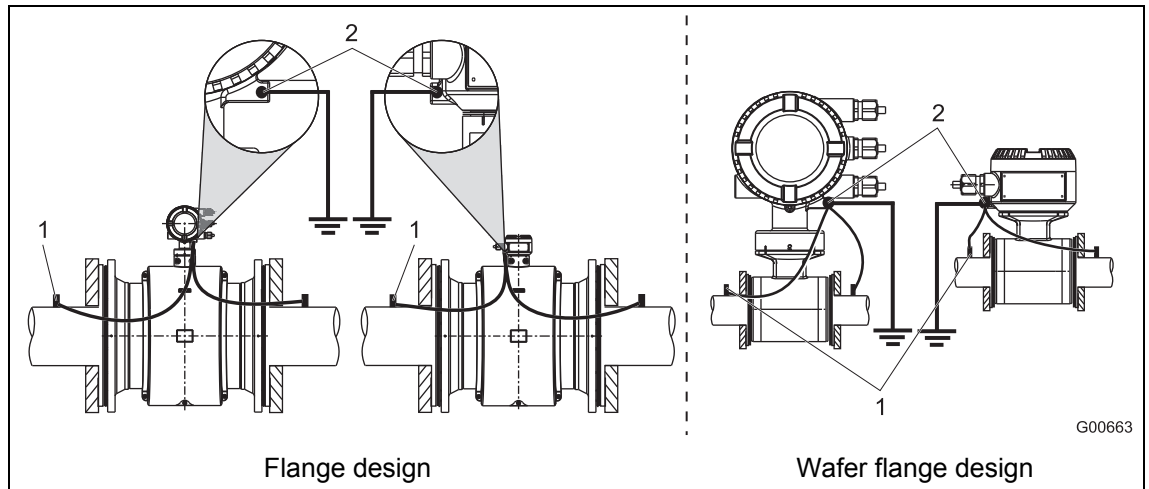


Fig. 21: Metal pipe, without liner

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

For plastic pipes or pipes with insulating lining, the ground for the measuring agent 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 flowmeter sensor with grounding plate (3) in the pipeline.
2. Connect the terminal lug (2) for the grounding plate (3) and ground connection (1) on the flowmeter sensor with the grounding strap.
3. Use a copper wire (min. 2.5 mm^2 (14 AWG)) to link the ground connection (1) to a suitable grounding point.

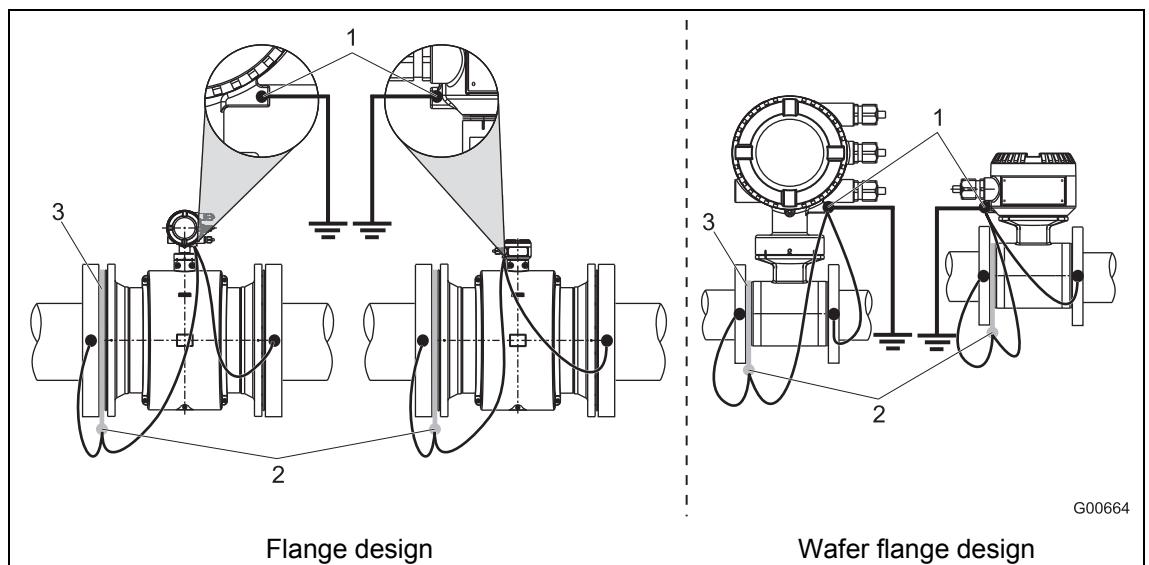


Fig. 22: Plastic pipes, non-metallic pipes or pipes with insulating liner

4.6.5 Sensor type HygienicMaster

Ground the stainless steel model as shown in the figure. The measuring fluid is grounded via the adapter (1) and an additional ground is not required.

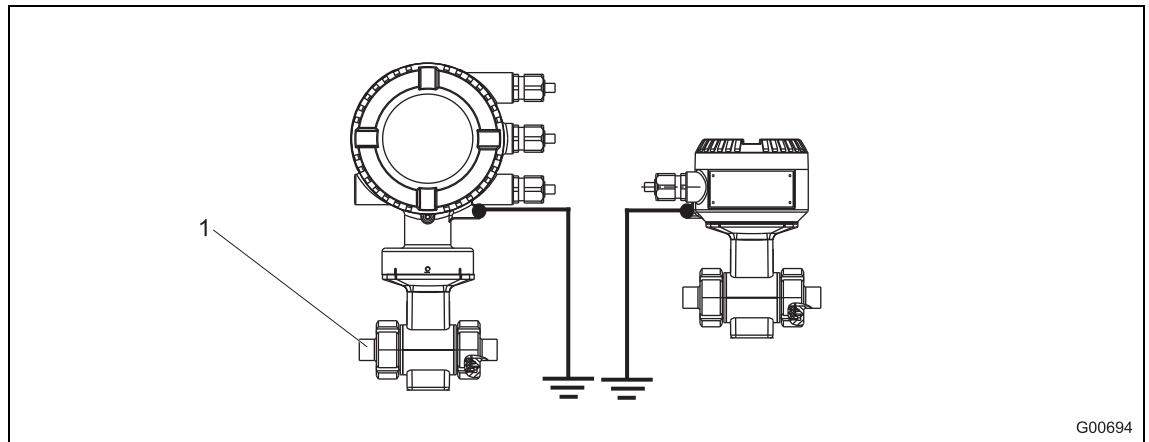


Fig. 23

4.6.6 Ground for devices with hard rubber lining

For devices with meter sizes DN 100 and larger, the liner contains a conductive element. This element grounds the measuring fluid.

4.6.7 Ground for devices with protective plates

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

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

4.6.8 Ground with conductive PTFE grounding plate

For devices with a meter size between DN 10 ... 150, grounding plates made of conductive PTFE are available. These are installed similar to conventional grounding plates.

5 Electrical connection

5.1 Preparing and routing the signal and magnet coil cable

Cut both cable ends to length and terminate them as shown.

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Important

Use wire end sleeves.

- Wire end sleeves 0.75 mm²(AWG 19), for shielding (S1, S2)
- Wire end sleeves 0.5 mm²(AWG 20), for all other wires

The shields may not touch (signal short circuit).

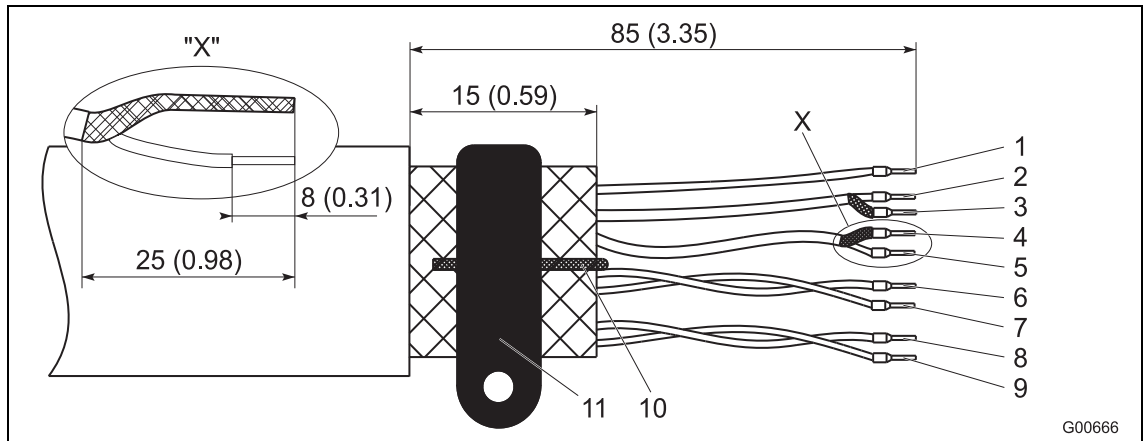


Fig. 24: Flowmeter sensor side, dimensions in mm (inch)

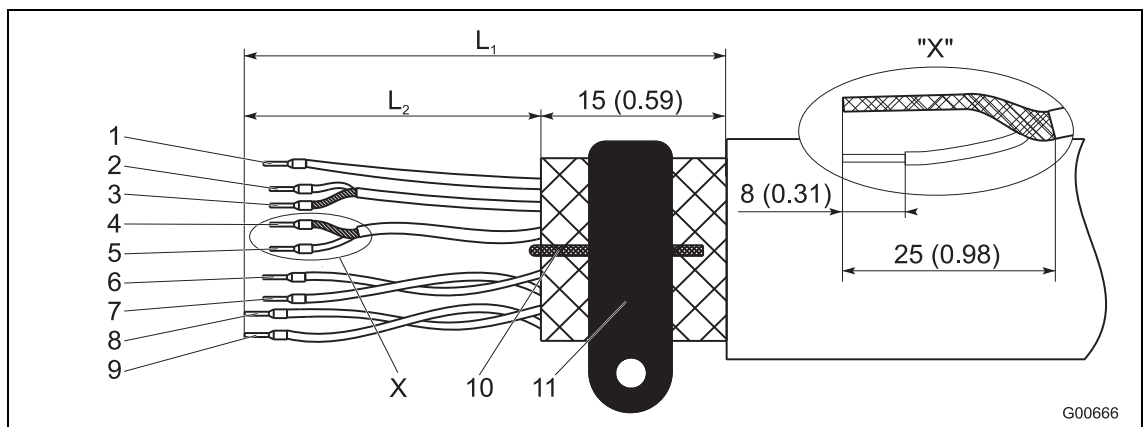


Fig. 25: Transmitter side, dimensions in mm (inch)

L_1 max. stripped length = 105 (4.10)

1 Measurement potential 3, green

$L_2 = 70$ (2.76)

2 Signal line E1, violet

$L_2 = 60$ (2.36)

3 Shield 1S

$L_2 = 60$ (2.36)

4 Shield 2S

$L_2 = 60$ (2.36)

5 Signal line, E2, blue

$L_2 = 60$ (2.36)

6 Data line, D2, yellow

$L_2 = 70$ (2.76)

7 Data line, D1, orange

$L_2 = 70$ (2.76)

8 Magnet coil, M2, red

$L_2 = 90$ (3.54)

9 Magnet coil, M1, brown

$L_2 = 90$ (3.54)

10 Groundwire, steel

11 SE clamp

Observe the following points when routing cables:

- A magnet coil cable (red and brown) is run parallel to the signal lines (violet and blue). As a result, only one cable is required between the flowmeter sensor and the transmitter. Do not run the cable over junction boxes or terminal blocks
- The signal cable carries a voltage signal of only a few millivolts and must, therefore, be routed over the shortest possible distance. The max. allowable signal cable length is 50 m (164 ft) without a pre-amplifier and 200 m (656 ft) with a pre-amplifier.
- Avoid routing the cable in the vicinity of electrical equipment or switching elements that can create stray fields, switching pulses, and induction. If this is not possible, run the signal/magnet coil cable through a metal pipe and connect this to the station ground.
- All leads must be shielded and connected to earth ground.
- To shield against magnetic interspersion, the cable features outer shielding which must be attached to the SE clamp.
- The incorporated steel wire must also be connected to the SE clamp
- Do not damage the sheathing of the cable during installation.
- Make sure during installation that the cable is provided with a water trap (1). For vertical installation, align the cable glands pointing downward.

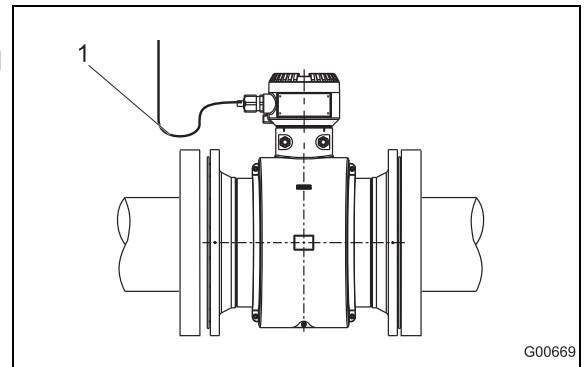


Fig. 26

5.1.1 Protection class IP 68

For flowmeter sensors with protection class IP 68, the maximum flooding height is 5 m (16.4 ft). The supplied cable (part no. D173D027U01) fulfills all submersion requirements.

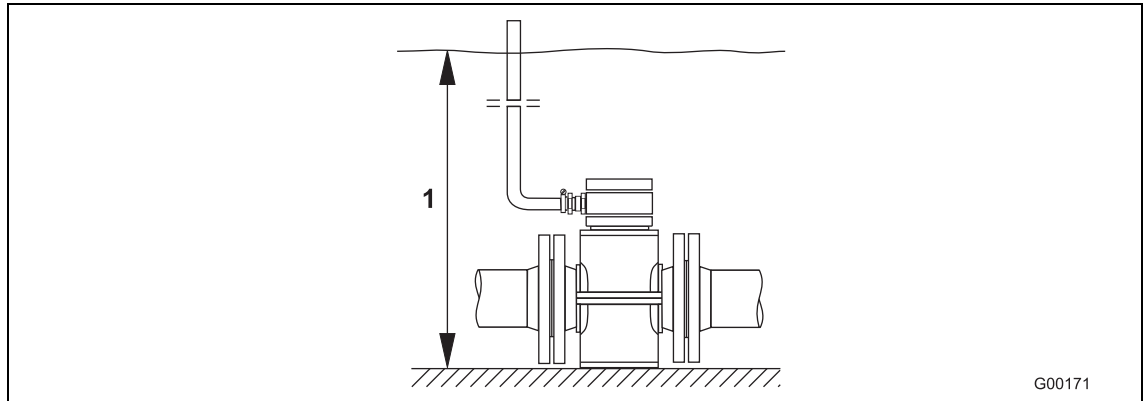


Fig. 27

1 Maximum flooding height 5 m (16.4 ft)

The flowmeter sensor has been type-tested in accordance with EN60529. Testing conditions: 14 days with a flooding height of 5 m (16.4 ft).

5.1.1.1 Connection

1. The supplied cable must be used to connect the flowmeter sensor and transmitter.
2. Connect the cable in the flowmeter sensor's terminal box.
3. Route the cable from the terminal box to above the maximum flooding height of 5 m (16.4 ft).
4. Tighten the cable gland.
5. Carefully seal the terminal box. Make sure the gaskets for the cover are seated properly.



Warning - Potentially adverse effect on IP 68 protection class

The sensor's IP 68 protection class may be impaired by damage to the signal cable. The sheathing of the signal cable must not be damaged. Otherwise, the protection class IP 68 for the sensor cannot be ensured.



Important

As an option, the flowmeter sensor can be ordered with signal cable already connected and a molded terminal box.

5.1.1.2 Sealing the connection box

If the terminal box is to be sealed subsequently on-site, a special 2-part sealing compound can be ordered separately (order no. D141B038U01). Sealing is only possible if the flowmeter sensor is installed horizontally. Observe the following instructions during work activity:



Warning - General risks!

The sealing compound is toxic. Observe all relevant safety measures.

Risk notes: R20, R36/37/38, R42/43

Harmful by inhalation. Avoid direct skin contact. Irritating to eyes.

Safety advice: P4, S23-A, S24/25, S26, S37, S38

Wear suitable protective gloves and ensure sufficient ventilation.

Follow the instructions that are provided by the manufacturer prior to starting any preparations.

Preparation

- Complete the installation before beginning sealing activities in order avoid moisture penetration. Before starting, check all the connections for correct fitting and stability.
- Do not overfill the terminal box. Keep the sealing compound away from the O-ring and the seal/groove (see fig. Fig. 28).
- Prevent the sealing compound from penetrating a thermowell if an NPT ½" thread is used.

Procedure

1. Cut open the protective enclosure of the sealing compound (see packaging).
2. Remove the connection clamp associated with the sealing 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 sealing compound until the connecting 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.

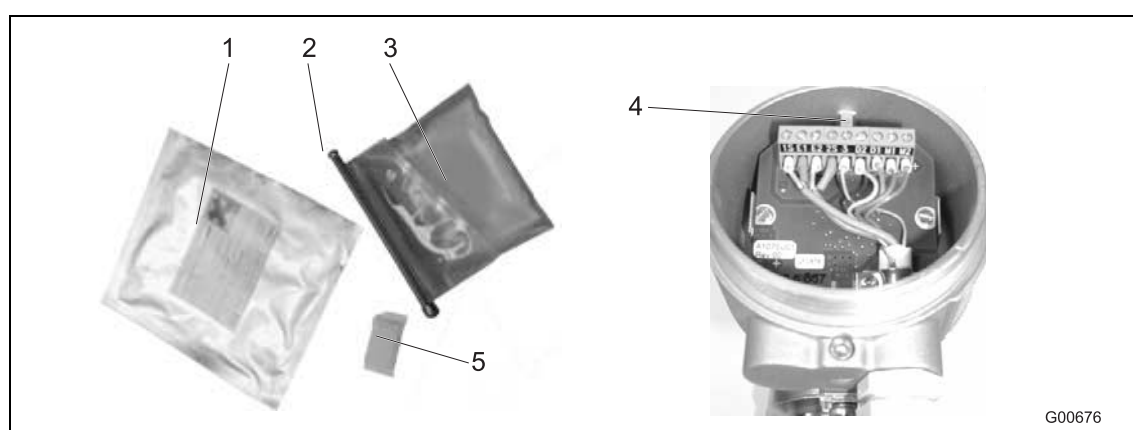


Fig. 28

- 1 Packaging bag
- 2 Connection clamp
- 3 Sealing compound

- 4 Max. filling level
- 5 Drying bag

5.2 Connecting the transmitter

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Important

An additional document with Ex safety instructions is available for measuring systems that are used in explosion hazardous areas. As a result, it is crucial that the specifications and data it lists are also observed.

5.2.1 Connecting the supply power

The mains voltage and power consumption are provided on the name plate for the transmitter. The wire cross-section for the supply power must meet the requirements for the main fuse (VDE 0100).

The supply power is connected to terminal L (phase), N (neutral) or 1+, 2- and PE, as stated on the name plate. The supply power connecting cable must be rated for the current consumption of the flowmeter system. The cables must comply with IEC 227 or IEC 245. Connect a switch or a line switch in the supply power feed to the transmitter. This switch should be located near the transmitter and marked as being associated with the device. The transmitter and the flowmeter sensor have to be connected to a functional ground.

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Important

- Observe the limit values for the supply power provided in the data sheet and operating instructions.
- Observe the voltage drop for large cable lengths and small cable cross-sections. The voltage at the terminals of the device may not fall below the minimum value required.
- Complete the electrical connection according to the connection diagram.

The terminals for the supply power can be found under the terminal cover (1).

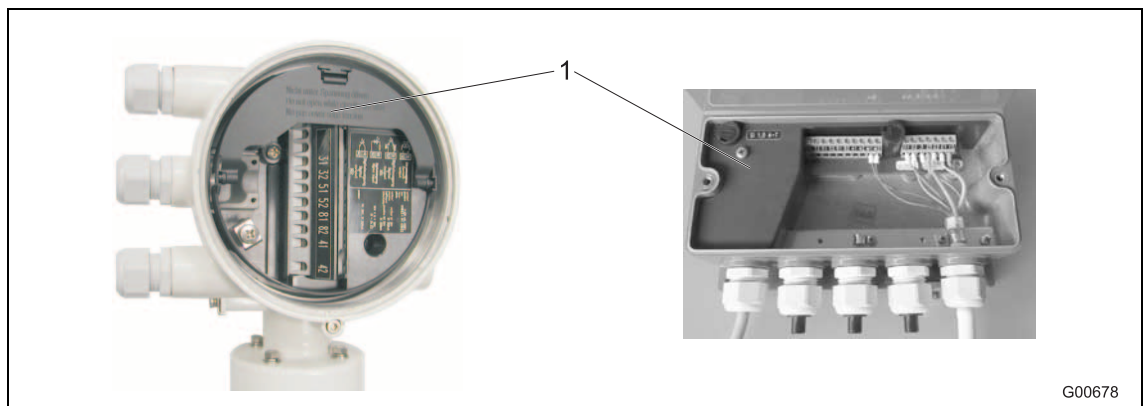


Fig. 29

1 Terminal cover

5.2.2 Transmitter

The outer shielding of the cable is attached to the busbar via the clip (3) (from the accessory bag in the connection area).

The shielding for the signal wires function as a driven shield to transmit the measurement signal.

The cable is attached to the sensor and transmitter according to the connection diagram.

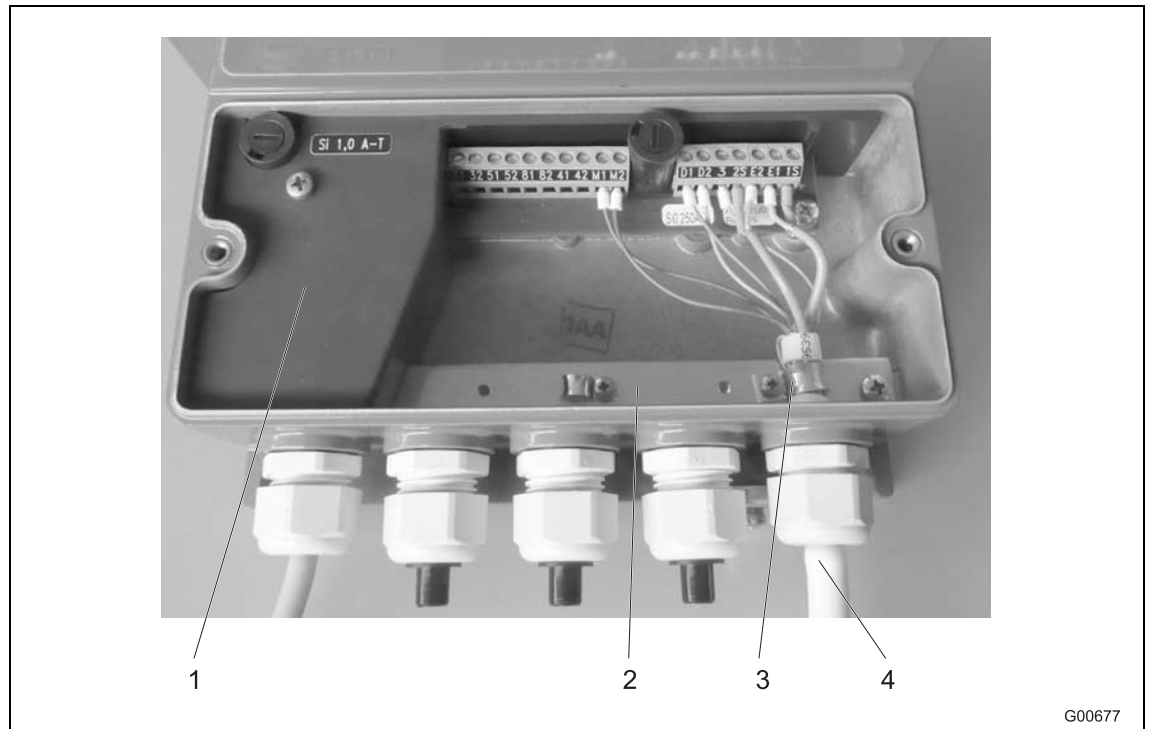


Fig. 30

- 1 Terminal cover
- 2 Busbar (SE)

- 3 Clip
- 4 Signal and magnet coil cable

i

Important

The power supply for the optional pre-amplifier is provided via terminals 1S and 2S. The transmitter automatically detects the sensor and switches to the required supply voltage on terminals 1S and 2S.

5.2.3 Interconnection Diagrams



Important

An additional document with Ex safety instructions is available for measuring systems that are used in explosion hazardous areas. As a result, it is crucial that the specifications and data it lists are also observed.

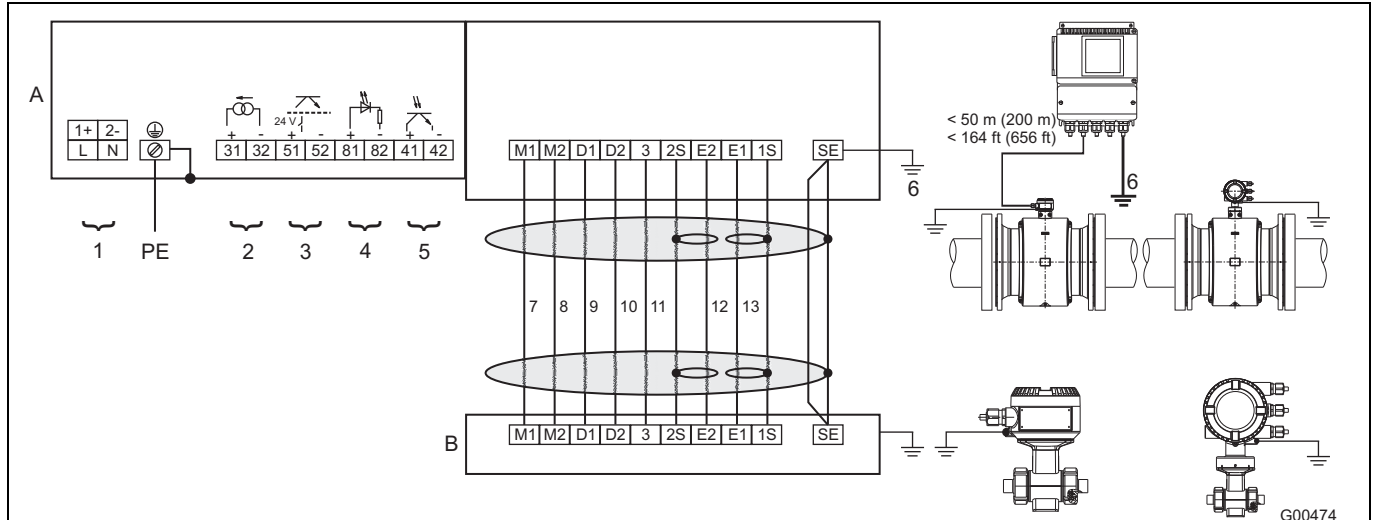


Fig. 31

- A Transmitter**
B Flowmeter sensor
- 1 Supply power:**
See name plate
 - 2 Current output (terminals 31/32)**
The current output can be operated in "active" or "passive" mode.
 - Active: 4 ... 20 mA, HART protocol (standard), load: $250 \Omega \leq R \leq 650 \Omega$
 - Passive: 4 ... 20 mA, HART protocol (standard), load: $250 \Omega \leq R \leq 650 \Omega$
 Supply voltage for the current output: Min. 11 V, max. 30 V
 - 3 Digital output DO1 (terminals 51/52) (pulse output or digital output)**
Function can be configured locally as "Pulse Output" or "Digital Output" using software. Factory setting is "Pulse Output".
The output can be configured as an "active" or "passive" output.
Configuration is performed using software.
 - Configuration as pulse output
Max. pulse frequency: 5,250 Hz.
Pulse width: 0.1 ... 2,000 ms.
The pulse factor and pulse width are interdependent and are calculated dynamically.
 - Configuration as contact output
Function: System alarm, empty pipe alarm, max./min. alarm, flow direction signaling, other
 - Configuration as "active" output
 $U = 19 \dots 21 \text{ V}$, $I_{\text{max}} = 220 \text{ mA}$, $f_{\text{max}} \leq 5,250 \text{ Hz}$
 - Configuration as "passive" output
 $U_{\text{max}} = 30 \text{ V}$, $I_{\text{max}} = 220 \text{ mA}$, $f_{\text{max}} \leq 5,250 \text{ Hz}$
 - 4 Digital input (terminals 81/82) (contact input)**
Function can be configured locally using software:
External output switch-off, external totalizer reset, external totalizer stop, other
Data for the optocoupler: $16 \text{ V} \leq U \leq 30 \text{ V}$, $R_i = 2 \text{ k}\Omega$
 - 5 Digital output DO2 (terminals 41/42) (pulse output or digital output)**
Function can be configured locally as "Pulse Output" or "Digital Output" using software.
Factory setting is "Digital Output", flow direction signaling.
The output is always a "passive" output (optocoupler).
Data for the optocoupler: $U_{\text{max}} = 30 \text{ V}$, $I_{\text{max}} = 220 \text{ mA}$, $f_{\text{max}} \leq 5,250 \text{ Hz}$
 - 6 Functional ground**
 - 7 Brown**
 - 8 Red**
 - 9 Orange**
 - 10 Yellow**
 - 11 Green**
 - 12 Blue**
 - 13 Violet**

Connection examples for the peripherals
current output

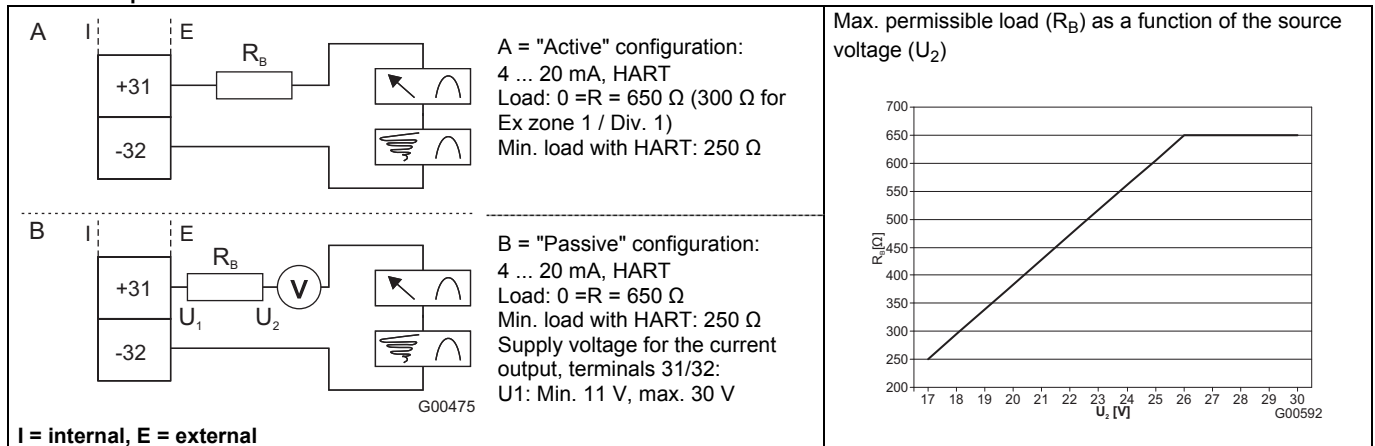


Fig. 32

Digital output DO1

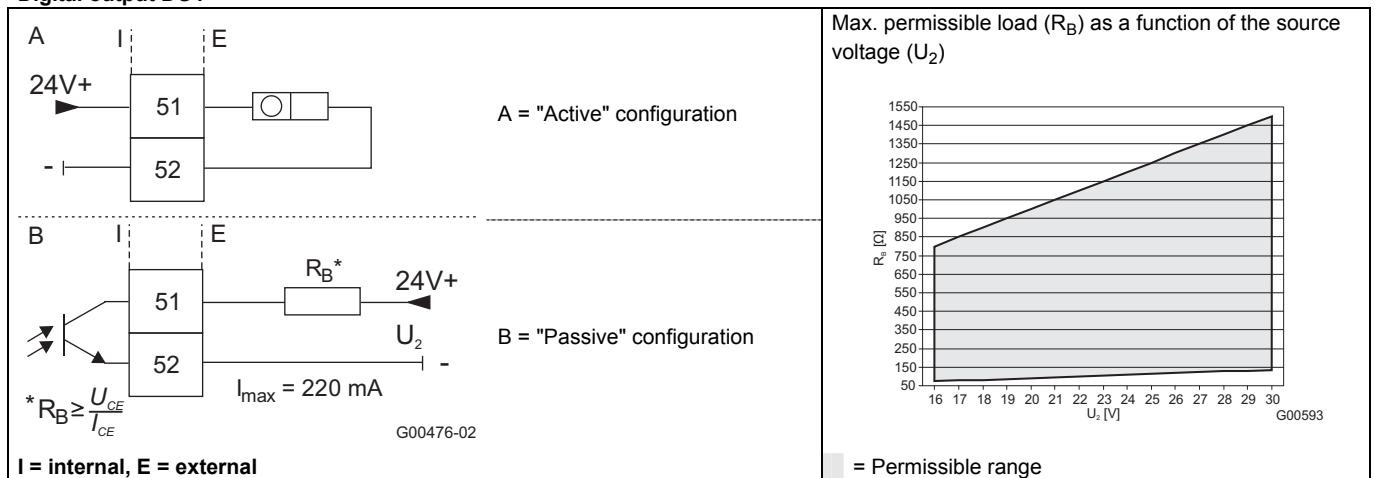
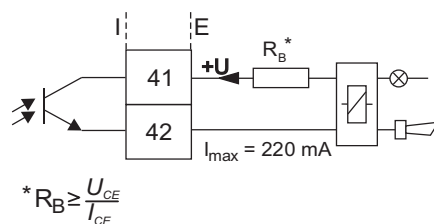


Fig. 33

Digital output DO2, e.g., for system monitoring, max./min. alarm, empty meter tube or forward/reverse signal, or counting pulses (function can be configured using software)



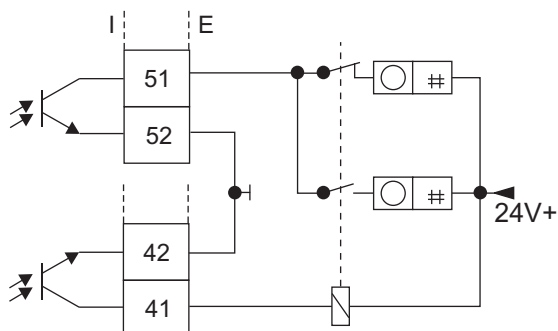
G00792

I = internal, E = external

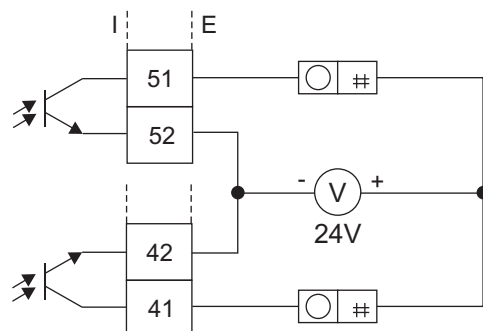
Fig. 34

Digital outputs DO1 and DO2, separate forward and reverse pulses

Digital outputs DO1 and DO2, separate forward and reverse pulses (alternative connection)



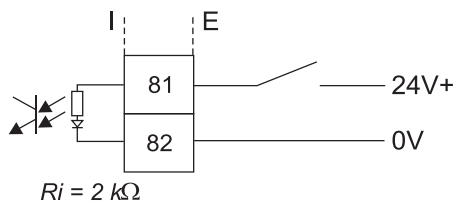
I = internal, E = external



G00791

Fig. 35

Digital input for external output switch-off or external totalizer reset



I = internal, E = external

G00477

Fig. 36

6 Commissioning



Important

An additional document with Ex safety instructions is available for measuring systems that are used in explosion hazardous areas. As a result, it is crucial that the specifications and data it lists are also observed.

6.1 Preliminary checks prior to start-up

The following points must be checked before commissioning:

- The supply power must be switched off.
- The supply power must match information on the name plate.
- The pin assignment must correspond to the connection diagram.
- Sensor and transmitter must be grounded properly.
- The temperature limits must be observed.
- The sensor must be installed at a largely vibration-free location.
- The housing cover and the cover safety device must be sealed before switching on the supply power.

6.2 Operation

The LCD display features capacitive keys for operation. These enable the device to be operated with the housing cover closed.



Important

The transmitter routinely calibrates the capacitive keys automatically. If the cover is opened during operation, the sensitivity of the keys will initially increase and this can result in operating errors. However, the level of key sensitivity will return to normal as soon as the next automatic calibration routine is performed.

6.2.1 Menu navigation

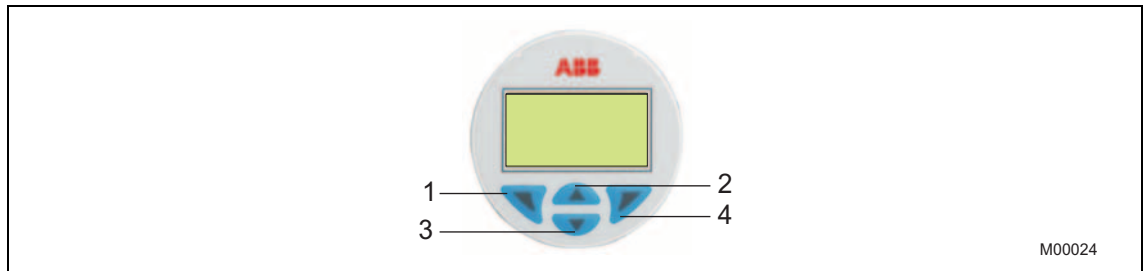


Fig. 37

- The ◀ (1), ▶ (4), ▲ (2) and ▼ (3) buttons are available for the menu-controlled configuration.
- The menu/submenu name is displayed above in the LCD display.
- The number/line of the currently selected menu item is displayed in the upper right of the LCD display.
- A scroll bar is located on the right edge of the LCD display which shows the relative position of the currently selected menu item within the menu.
- Both of the ◀ and ▶ buttons can have various functions assigned to them. The meaning of these buttons is displayed below in the LCD display above the respective button. The following functions are possible.

Button ◀ functions	Meaning
Exit	Exit menu.
Back	Back one submenu.
Cancel	Exit without saving the selected parameter value.
Next	Select next position for entering numerical values or letters.

Button ▶ functions	Meaning
Select	Select submenu/parameter.
Edit	Edit parameter.
OK	Save selected parameter and display stored parameter value.

- You can browse through the menu or select a number within a parameter value using both ▲ or ▼ buttons. The ▶ button selects the desired menu item.

6.2.2 Process display



G00686

The process display appears after switching on the unit.

Q Current flowrate

Σ+ Totalizer value for forward flow direction

Σ- Totalizer value for reverse flow direction

The meter location is displayed on the upper left (for example, "Boiler 9"). The meter location can be entered in the menu "Device Setup / Sensor / Meter Location TAG".

If several operator pages are preconfigured and the Multiplex mode is activated, the U icon appears on the lower left of the screen.

The lock at the bottom middle of the screen indicates that the user is not currently logged in and that the unit's setup cannot be changed.

6.3 Configuring the current output

The factory setting for the current output is 4 ... 20 mA.

The signal can be configured as either "active" or "passive".

The current setting is contained in the order confirmation.

If the signal is configured as "active", no external power may be used as far as the current output is concerned.

If the signal is configured as "passive", external power from the current output is required (similar to pressure and temperature transmitters).

Set the current output as follows:

1. Switch off the supply power.
2. Open the housing cover.
3. Remove the mounting screws for the transmitter electronics unit.
4. Pull out the transmitter electronics unit.
5. Plug in the jumper on the backplane in the transmitter housing to Position A or B.
 - A = 4 ... 20 mA output, passive
 - B = 4 ... 20 mA output, active

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Important

The backplane is not installed in the transmitter electronics unit (3) but rather in the transmitter housing (1).

6. Reinstall the transmitter electronics unit in reverse order.

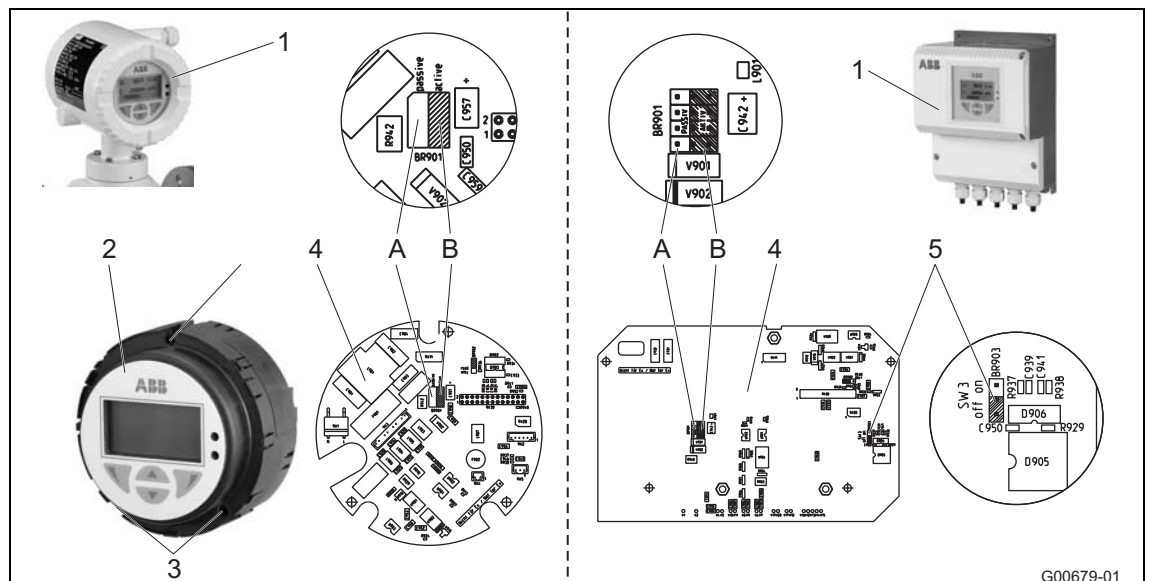


Fig. 38

- 1 Housing cover
- 2 Transmitter electronics unit
- 3 Mounting screws for the transmitter electronics unit
- 4 Backplane (in the transmitter housing)

- 5 Jumper SW3
 - off: SensorMemory available in flowmeter sensor (standard)
 - on: No SensorMemory available in flowmeter sensor

6.4 Commissioning the unit



Important

For additional information about operation and menu navigation, refer to the operating instruction for the device.

6.4.1 Downloading the system data

1. Switching on supply power. After switching on the supply power, the following messages are displayed in the LCD window:

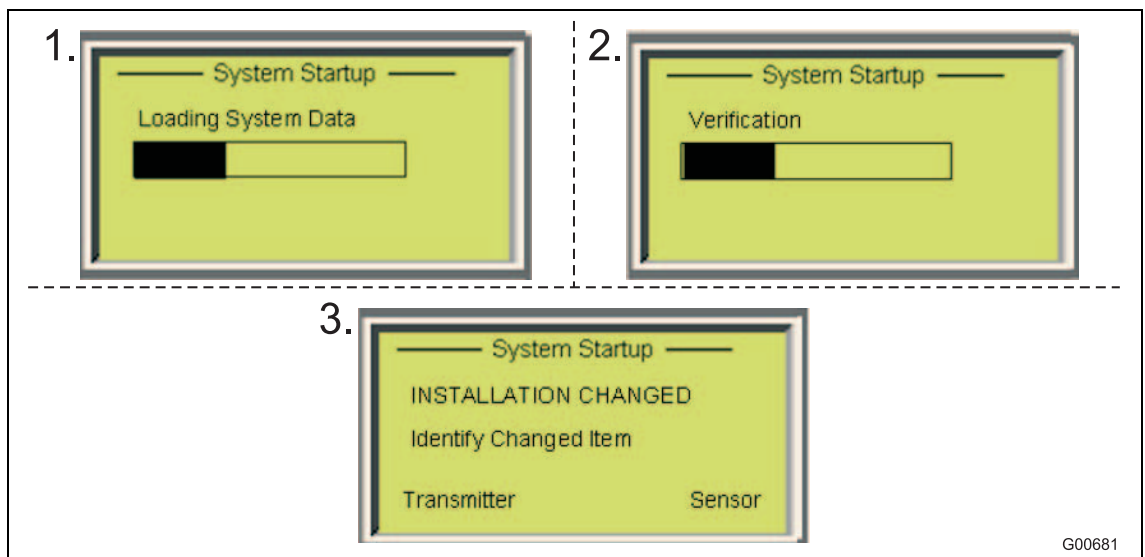


Fig. 39

2. Download the system data as follows:

For a completely new system or initial startup

The flowmeter sensor's calibration data and the transmitter settings are loaded from the SensorMemory¹⁾ into the transmitter.

After replacing the complete transmitter or transmitter electronics unit

Select "Transmitter" by pressing the ◀ key. The flowmeter sensor's calibration data and the transmitter settings are loaded from the SensorMemory¹⁾ into the transmitter.

After replacing the sensor

Select "Sensor" by pressing the ▶ key. The flowmeter sensor's calibration data and the transmitter settings are loaded from the SensorMemory¹⁾ into the transmitter. The transmitter settings are saved in the SensorMemory¹⁾. If the new sensor is a different size, check the currently configured flow range.

3. The flowmeter is ready for operation and will operate with factory settings or settings requested by the customer. To change the factory settings, refer to chapter "Parametrizing via the "Easy Set-up" menu function".



Important

System data must only be loaded during initial startup. If the supply power is later switched off, the transmitter automatically loads the data once again the next time it is switched on. A selection as described below (1-3) is not required.

1) The SensorMemory is a data memory integrated into the flowmeter sensor.

6.4.2 Parametrizing via the "Easy Set-up" menu function

The device can be factory parametrized to customer specifications upon request.

If no customer information is available, the device is delivered with factory settings.

The setting of the most current parameters is summarized in the "Easy Set-up" menu. This menu provides the quickest way to configure the device.

The Easy Set-up menu allows you to select the language, engineering unit for flowrate, flow range, totalizer unit, pulse/frequency mode, pulse per unit, pulse width, damping, status of current output during alarm (lout at Alarm, lout Low Alarm, lout High Alarm).

For detailed descriptions of these menus and parameters, see the chapter on the "Parameter overview" menu.

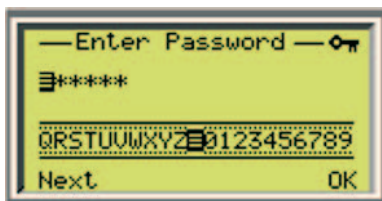
The following section describes parametrization via the "Easy Set-up" menu function.



Press the ► key to change to the setup level of the process display.



Use the ▲ + ▼ keys to select the "Standard" menu item.

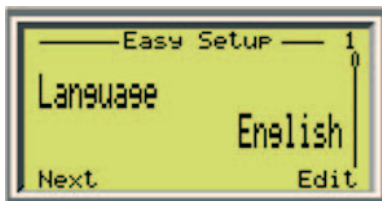


In the password menu, select "ok" (► key). There is no factory default password.

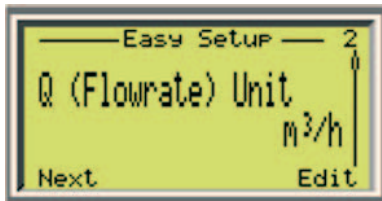
Select "ok" (► key) to switch to the configuration level without entering a password.



In the configuration level, use the ▲ + ▼ keys to scroll to the "Easy Set-up" menu item and select it by pressing the ► key.

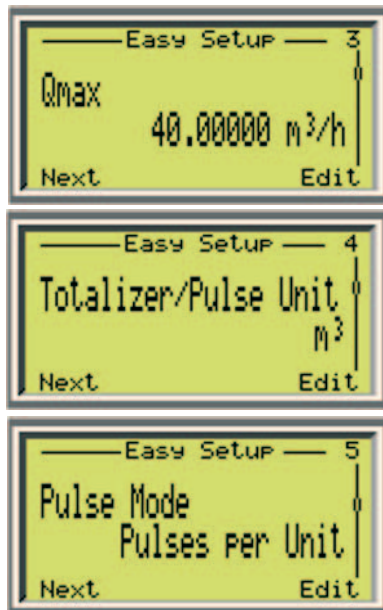


Press the ► key and select the language. After entering the settings, press the ◀ key to move to the next menu item.



Press the ► key and select the mass flow unit. After entering the settings, press the ◀ key to move to the next menu item.

G00682



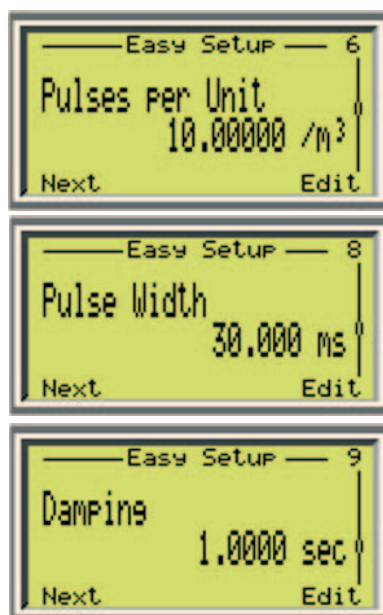
Press the ► key and set the flow range end value Qmax. After entering the settings, press the ◀ key to move to the next menu item.

Press the ► key and set the totalizer unit. After entering the settings, press the ◀ key to move to the next menu item.

Press the ► key and set the operating mode for the pulse output. There are two operating modes available:

- "Pulse mode": In pulse mode, pulses per unit are output. The relevant settings are provided in the next menu.
- "Frequency mode": In the frequency mode, a frequency proportional to the flowrate is output. The maximum frequency corresponding to the mass flow range is configurable.

The factory default is "pulse mode".

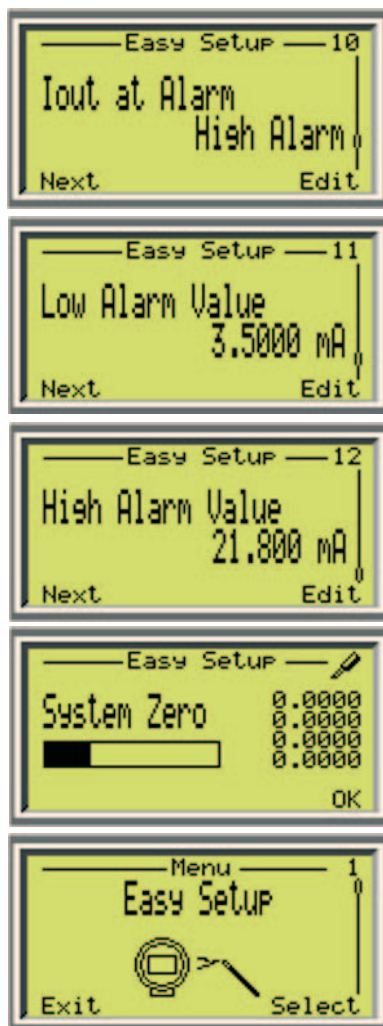


Press the ► key and set the pulses per unit for the pulse output. After entering the settings, press the ◀ key to move to the next menu item.

Press the ► key and set the pulses width for the pulse output. After entering the settings, press the ◀ key to move to the next menu item.

Press the ► key and set the damping. After entering the settings, press the ◀ key to move to the next menu item.

G00683



G00684

In this menu, the status of the current output can be set in case of alarm (low or high alarm).

Press the ► key and selected the corresponding parameter.

Press the ► key and set the value for the low Alarm.

Setting range: 3.5 ... 3.6 mA

Factory setting: 3.5 mA

Press the ► key and set the value for the high Alarm.

Setting range: 21 ... 23 mA

Factory setting: 21.8 mA

Press the ► to set the system zero. Valve must be closed. The sensor must be filled completely. The fluid must be at standstill. Press "OK" to start the automatic adjust.

Once you have set all the parameters, you return to the "Easy Set-up" menu. The most important parameters are now set.

Press the ◀ key to "Exit" and return to the process display.

i

Important

- For additional information regarding operation of the LCD display, refer to chapter "Operation".
- For detailed descriptions of all menus and parameters, see chapter "Parameterization" of the operating instruction.

Instructions on using the Qmax menu (flow range end value)

The device is factory calibrated to the flow range end value Q_{maxDN} , unless other customer information is available. The ideal flow range end values are approximately 2-3 m/s ($0.2 \dots 0.3 \times Q_{maxDN}$).

Information regarding factory settings for further parameters (unless customer has requested a specific parametrization)

• Current output

The factory setting for the current output is 4 ... 20 mA (active).

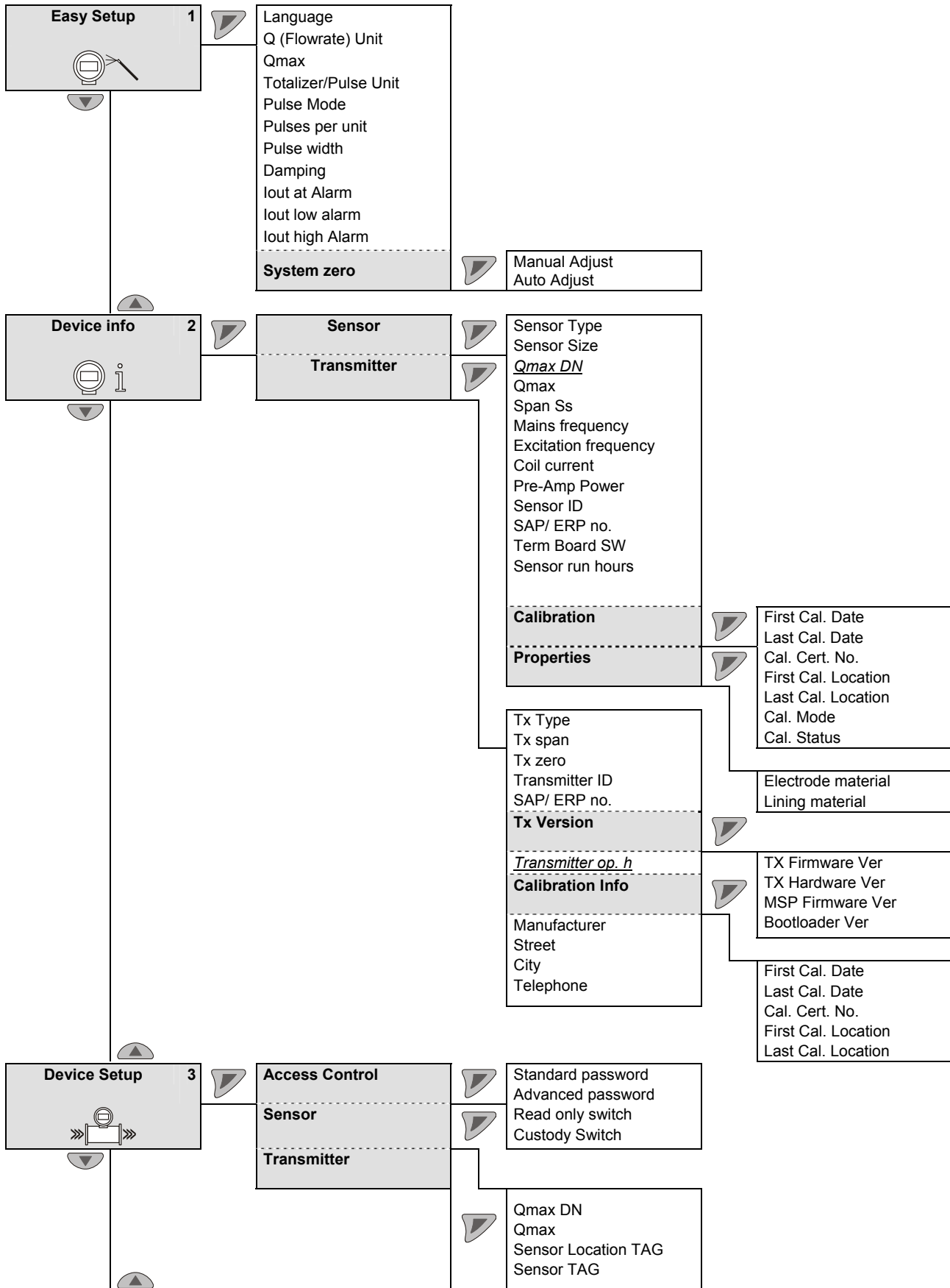
• Digital output DO1 (terminals 51/52)

Digital output DO1 is preconfigured as a passive pulse output (factory default).

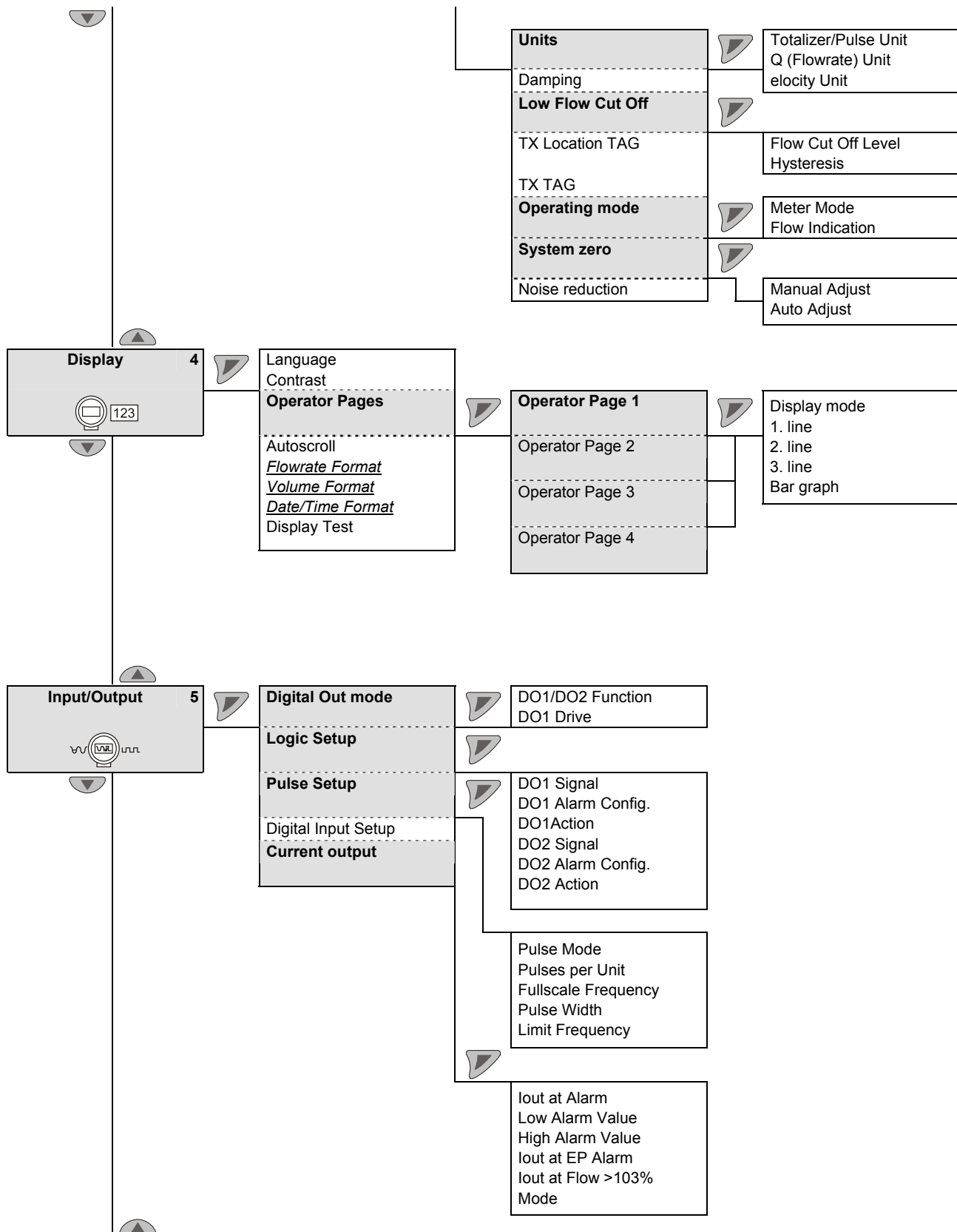
• Empty pipe detection

Empty pipe detection is deactivated (factory default).

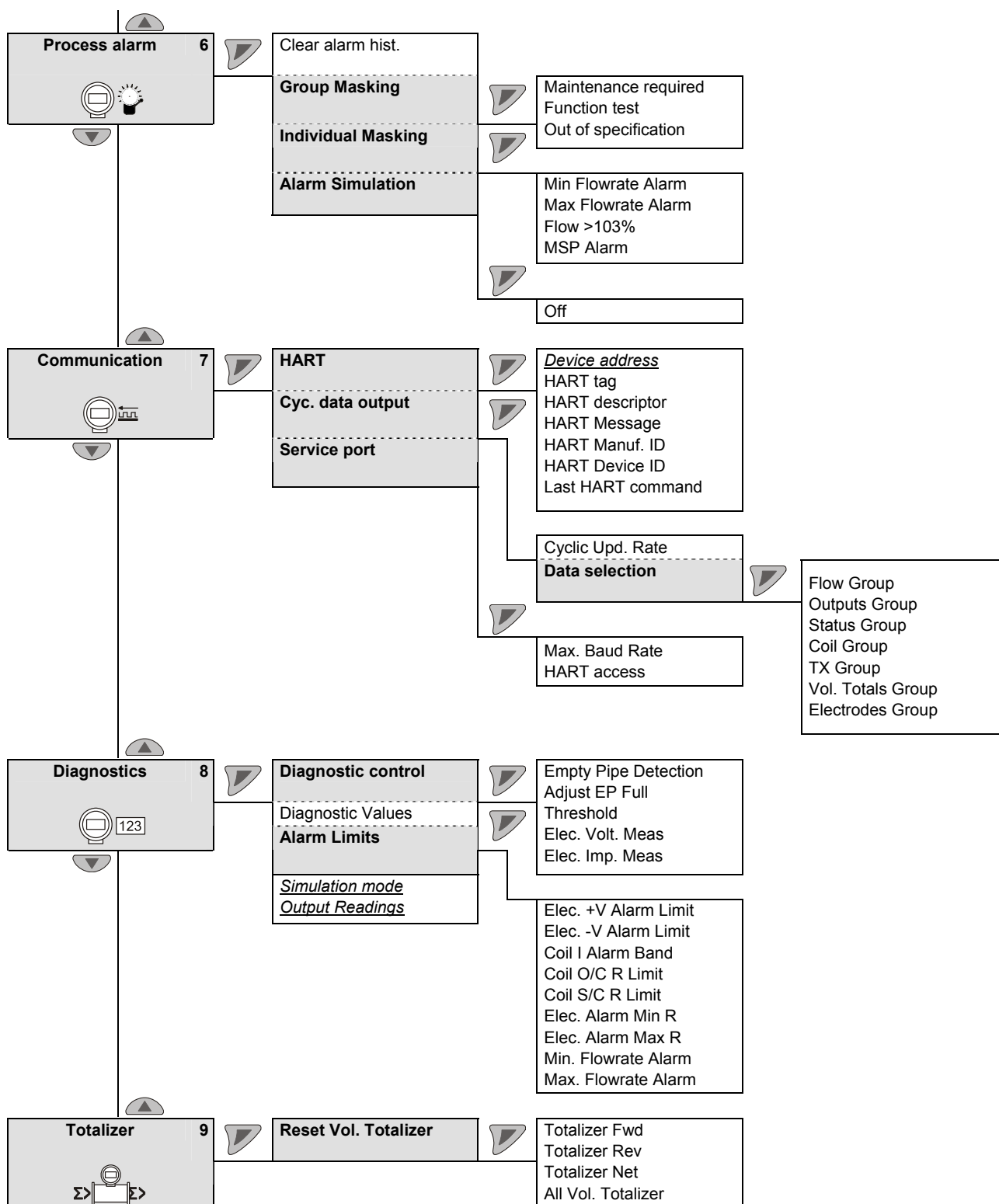
7 Parameter overview



italics = Parameter can only be changed at the "advanced" password level.



italics = Parameter can only be changed at the "advanced" password level.



italics = Parameter can only be changed at the "advanced" password level.

8 Error messages

8.1 LCD display

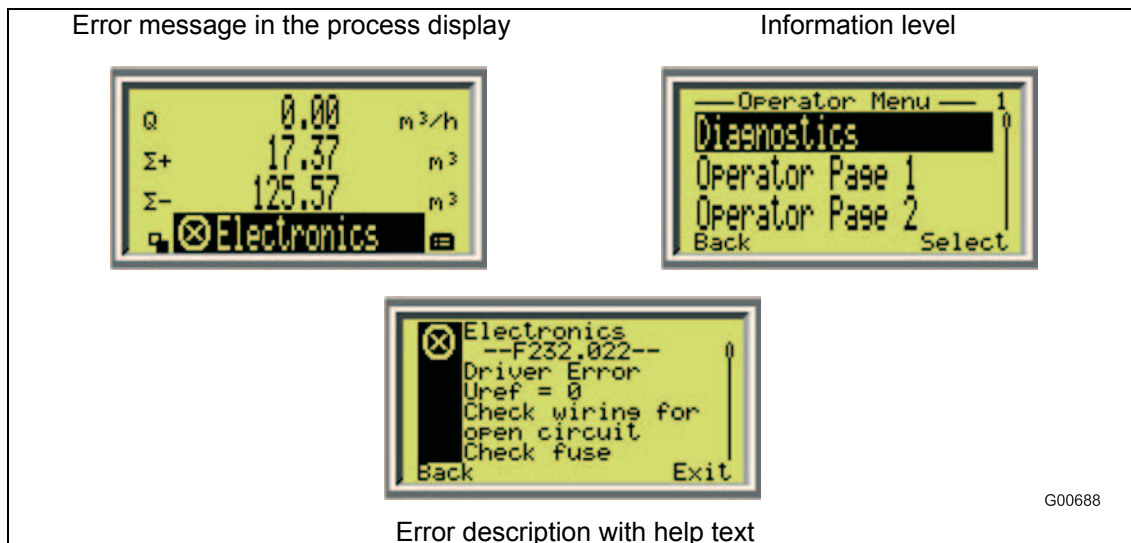


Fig. 40: Error message on LCD display (example)

In case of an alarm, a message consisting of an icon and text appears at the bottom of the process display. Use the ◀ key to call up the information level. Use the "Diagnostics" menu to call up the error description with a help text.

In the error description, the error number is displayed in the second line (F232.022). Two further lines are used to describe the error. The last three lines provide help or troubleshooting instructions for the operator.

Use the ▲ and ▼ keys to scroll through the accumulated errors.

The device status is divided into four groups.

Icon	Description
	Error / Failure
	Functional check (e.g., during simulation)
	out of spec (e.g., operating with empty meter pipe)
	Maintenance required






The message text beside this icon in the display provides information about where to look for the error. There are the following areas: Electronic unit, sensor, status, operating conditions.

9 Appendix

9.1 Additional documents

- Operating Instructions (OI/FEP300/FEH300)
- Ex Safety Instructions (SM/FEP300/FEH300/ATEX/IECEX)
- Ex Safety Instructions (SM/FEP300/FEH300/FM/CSA)
- Data Sheet for ProcessMaster (DS/FEP300)
- Data Sheet for HygienicMaster (DS/FEH300)

9.2 Approvals and certifications

CE mark		<p>The version of the meter in your possession meets the requirements of the following European directives:</p> <ul style="list-style-type: none"> - EMC directive 2004/108/EC - Low voltage directive 2006/95/EC - Pressure equipment directive (PED) 97/23/EC - ATEX directive 94/9/EC
Explosion Protection	   	<p>Identification for intended use in potentially explosive atmospheres according to:</p> <ul style="list-style-type: none"> - ATEX directive (marking in addition to CE marking) - IEC standards - FM Approvals (US) - cFM Approvals (Canada)



Important

All documentation, declarations of conformity, and certificates are available in ABB's download area.

www.abb.com/flow



EG-Konformitätserklärung EC-Declaration of Conformity

Hiermit bestätigen wir die Übereinstimmung der aufgeführten Geräte mit den Richtlinien des Rates der Europäischen Gemeinschaft, welche mit dem CE-Zeichen gekennzeichnet sind. Die Sicherheits- und Installationshinweise der Produktdokumentation sind zu beachten.
We herewith confirm that the listed instrument are in compliance with the council directives of the European Community and are marked with the CE marking. The safety and installation requirements of the product documentation must be observed.

Hersteller:
Manufacturer: ABB Automation Products GmbH,
Dransfelder Straße 2, 37079 Göttingen - Germany

Gerät:
Device: Electromagnetic Flowmeter
ProcessMaster & HygienicMaster

Modellnr.:
Model no.: FE_3_

Richtlinie:
Directive: EMV Richtlinie 2004/108/EG *
EMC directive 2004/108/EC *

Europäische Norm:
European Standard: EN 61326-1, 10/2006 * EN 61326-2-3, 05/2007
EN 61326-1, 10/2006 * EN 61326-2-3, 05/2007

Richtlinie:
Directive: Niederspannungsrichtlinie 2006/95/EG *
Low voltage directive 2006/95/EC *

Europäische Norm:
European Standard: EN 61010-1, 08/2002 *
EN 61010-1, 08/2002 *

* einschließlich Nachträge / including alterations

Göttingen, 19. März 2008

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(R&D Manager)

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(R&D Electrical Safety)

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BZ-13-5112, Rev.01, 11119

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EG-Konformitätserklärung EC-Declaration of Conformity



Hiermit bestätigen wir die Übereinstimmung des aufgeführten Gerätes mit den Richtlinien des Rates der Europäischen Gemeinschaft, welche mit dem CE-Zeichen gekennzeichnet sind. Die Sicherheits- und Installationshinweise der Produktdokumentation sind zu beachten.

Herewith we confirm that the listed instrument is in compliance with the council directives of the European Community and are marked with the CE marking. The safety and installation requirements of the product documentation must be observed.

Hersteller: <i>manufacturer:</i>	ABB Automation Products GmbH, 37070 Göttingen - Germany
Modell: <i>model:</i>	FXE4000, FXM2000, FSM4000, FXL4000, FXT4000, FXF2000 FEP ..., FEH..., (SE2_F, D_2_F, SE4_F, D_4_F)
Richtlinie: <i>directive:</i>	Druckgeräterichtlinie 97/23/EG <i>pressure equipment directive 97/23/EC</i>
Einstufung: <i>classification:</i>	Ausrüstungsteile von Rohrleitungen <i>piping accessories</i>
Normengrundlage: <i>technical standard:</i>	AD 2000 Merkblätter
Konformitätsbewertungsverfahren: <i>conformity assessment procedure:</i>	B1 (EG-Entwurfsprüfung) + D (Qualitätssicherung Produktion) <i>B1 (EC design-examination) + D (production quality assurance)</i>
EG-Entwurfsprüfbescheinigungen: <i>EC design-examination certificates:</i>	Nr. 07 202 0124 Z 0052/2/0002 Nr. 07 202 0124 Z 0052/2/0002a Nr. 07 202 4534 Z 0601/3/H Nr. 07 202 0124 Z 0205/6/1
Benannte Stelle: <i>notified body:</i>	TÜV Nord Systems GmbH & Co. KG Große Bahnstr. 31 22525 Hamburg - Germany
Kennnummer: <i>identification no.</i>	0045

Göttingen, den 28.08.2007

ppa 
(J. Harri, Standortleiter APR Göttingen)

BZ-25-0002 Rev.05

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