Operating Instruction
OI/FEP300/FEH300-EN

# Electromagnetic Flowmeter
# ProcessMaster / HygienicMaster



HART COMMUNICATION PROTOCOL

ABB

# Electromagnetic Flowmeter
# ProcessMaster / HygienicMaster

## Operating Instruction

OI/FEP300/FEH300-EN

06.2009

Rev. B

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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**

- An additional document with Ex safety information is available for measuring systems that are used in potentially explosive areas.
- An icon corresponding to the respective approval and certification body is shown on the front cover of the Ex safety information.
- 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 engeineering 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.

### 1.5.2 Name plate

**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.

#### 1.5.2.1 Name plate for compact design

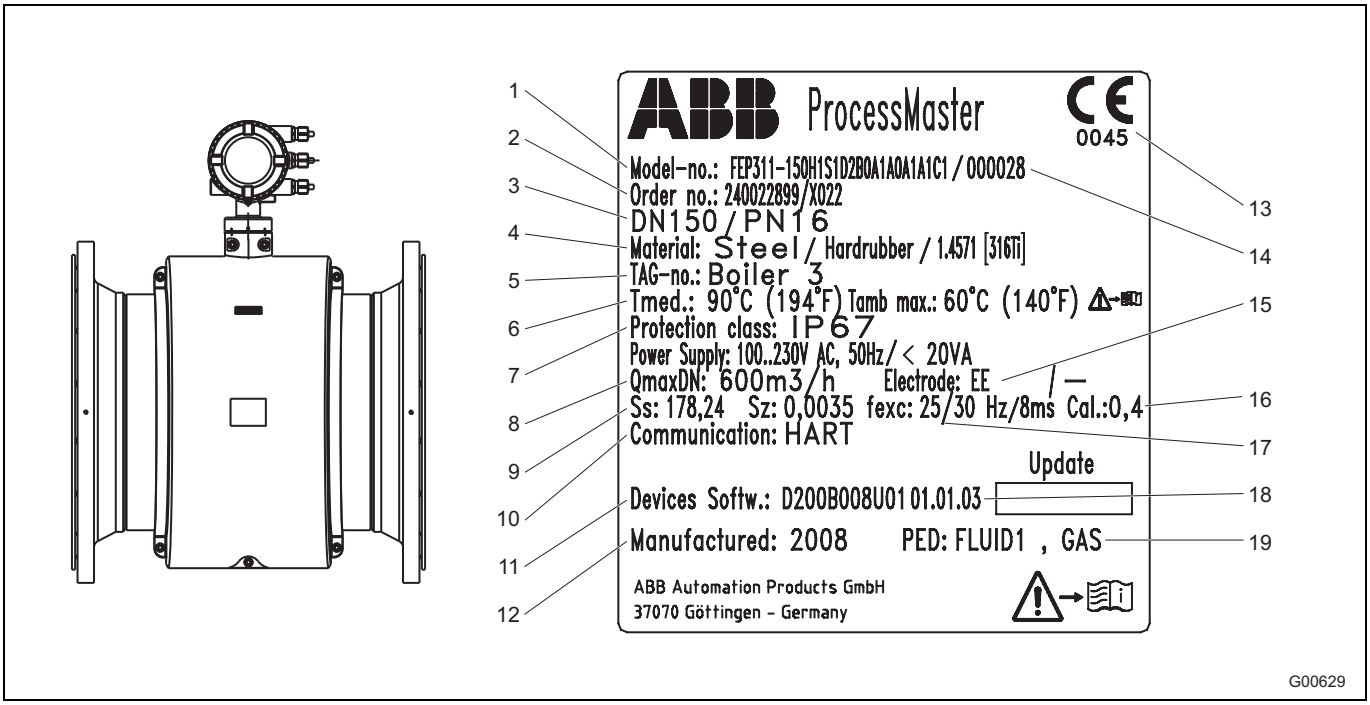



Fig. 1: Compact unit

1 Model number (for more detailed information about the technical design, refer to the data sheet or the order confirmation)
2 Order no.
3 Meter size and nominal pressure rating
4 Material: Flange / Lining / Electrode
5 Client-specific TAG number (if specified)
6 Tmed = max. allowable fluid temperature
Tamb = max. allowable ambient temperature
7 Protection Class per EN 60529
8 Calibration value Qmax DN
9 Calibration value Ss (span)
Calibration value Sz (zero point)
10 Communications protocol of transmitter
11 Software version
12 Year
13 CE mark
14 Serial number for identification by the manufacturer
15 Additional information: EE = Grounding electrodes, TFE = Partial filling electrode
16 Accuracy to which the unit was calibrated (e.g., 0.2% of rate)
17 Excitation frequency of coils for sensor
18 Version level (xx.xx.xx)
19 Label indicating whether the unit complies with the pressure equipment directive (PED).
Information on the relevant fluid group.
Fluid group 1 = hazardous fluids, liquid, gaseous. (Pressure equipment directive = PED).
If the pressure equipment is outside the applicable range of the pressure directive 97/23/EC, it is classified in the range of SEP (= sound engineering practice) according to Art. 3 Para. 3 of the PED.
If this information is not present, the device is not in compliance with pressure equipment directive 97/23/EC. The exception applies for water supplies and connected equipment accessories in accordance with guideline 1/16 of Art. 1 Para. 3.2 of the pressure equipment directive.

**Important**

Meters with 3A approval are labeled with an additional plate.

### 1.5.2.2 Name plate for the remote design

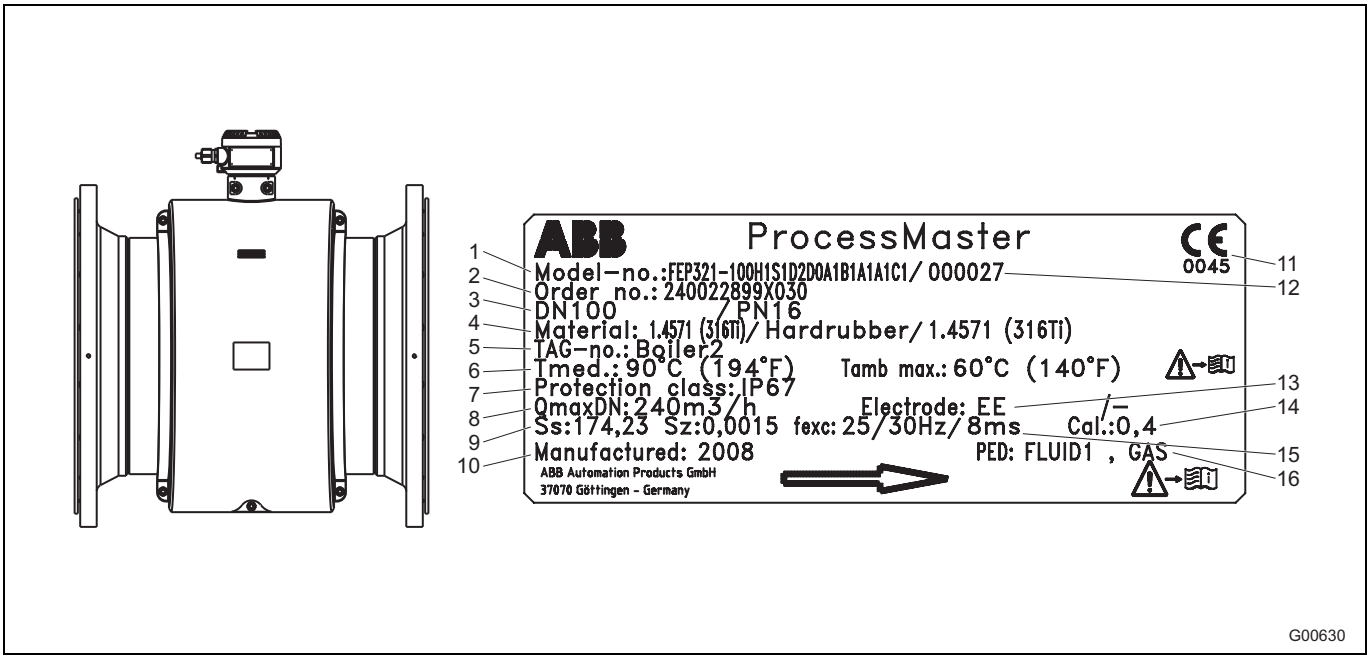



Fig. 2: Remote design

1 Model number (for more detailed information about the technical design, refer to the data sheet or the order confirmation)
2 Order no.
3 Meter size and nominal pressure rating
4 Material: Flange / Lining / Electrode
5 Client-specific TAG number (if specified)
6 Tmed = max. allowable fluid temperature
Tamb = max. allowable ambient temperature
7 Protection Class per EN 60529
8 Calibration value Qmax DN
9 Calibration value Ss (span)
Calibration value Sz (zero point)
10 Year
11 CE mark
12 Serial number for identification by the manufacturer
13 Additional information: EE = Grounding electrodes, TFE = Partial filling electrode
14 Accuracy to which the unit was calibrated (e.g., 0.2% of rate)
15 Excitation frequency of coils for sensor
16 Label indicating whether the unit complies with the pressure equipment directive (PED).
Information on the relevant fluid group.
Fluid group 1 = hazardous fluids, liquid, gaseous.
(Pressure equipment directive = PED).
If the pressure equipment is outside the applicable range of the pressure directive 97/23/EC, it is classified in the range of SEP (= sound engineering practice) according to Art. 3 Para. 3 of the PED.
If this information is not present, the device is not in compliance with pressure equipment directive 97/23/EC. The exception applies for water supplies and connected equipment accessories in accordance with guideline 1/16 of Art. 1 Para. 3.2 of the pressure equipment directive.

**Important**
Meters with 3A approval are labeled with an additional plate.

### 1.5.2.3 Name plate for transmitter

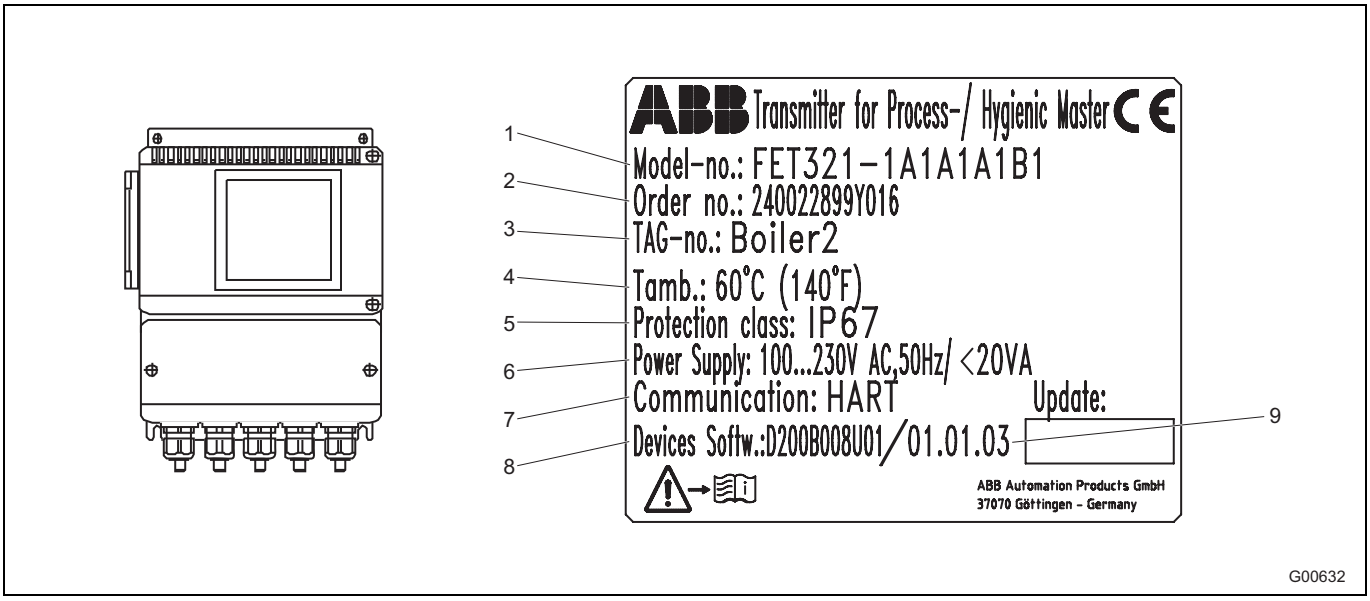



Fig. 3: External transmitter (remote)

1 Model number (for more detailed information about the technical design, refer to the data sheet or the order confirmation)
2 Order no.
3 Client-specific TAG number (if specified)
4 Tamb = max. allowable ambient temperature
5 Protection Class per EN 60529
6 Supply voltage
7 Communications protocol of transmitter
8 Software version
9 Version level (xx.xx.xx)

## 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.

## 1.12 Maintenance and inspection safety information



**Warning – Risk to persons!**

When the housing cover is open, EMC and protection against contact are suspended. There are electric circuits within the housing which pose a contact risk.
The auxiliary power must be switched off before opening the housing cover.



**Warning – Risk to persons!**

The inspection screw (for draining condensate fluid) for devices ≥ DN 450 can be under pressure. The fluid which spurts out can cause severe injuries.
Depressurize pipes before opening the inspection screw.

Corrective maintenance work may only be performed by trained personnel.

- Depressurize the device and adjoining lines or containers before removing the device.
- Check whether hazardous materials are used as materials to be measured before opening the device. Residual amounts of hazardous material may still be present in the device and could escape when the device is opened.
- As far as provided in the scope of the operational responsibility, check the following items through a regular inspection:
  - the pressure-carrying walls / lining of the pressure device
  - the measurement-related function
  - the leak tightness
  - the wear (corrosion)

## 1.13 Returning devices

Use the original packaging or suitably secure shipping containers if you need to return the device for repair or recalibration purposes. Fill out the return form (see the Appendix) and include this with the device.

According to EC guidelines for 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 Automation Products GmbH must be free from any hazardous materials (acids, alkalis, solvents, etc.).

Rinse out and neutralize hazardous materials from all hollow spaces such as between meter tube and housing. For flowmeters larger than DN 400, the service screw (for draining condensate fluid) at the lower point of the housing must be opened to dispose of hazardous substances and to neutralize the coil and electrode chamber. These activities must be confirmed in writing using the return form.

## 1.14 Disposal

ABB Automation Products GmbH actively promotes environmental awareness and has an operational management system that meets the requirements of DIN EN ISO 9001:2000, EN ISO 14001:2004, and OHSAS 18001. Our products and solutions are intended to have minimum impact on the environment and persons during manufacturing, storage, transport, use, and disposal.

This includes the environmentally friendly use of natural resources. ABB conducts an open dialog with the public through its publications.

This product/solution is manufactured from materials that can be reused by specialist recycling companies.

### 1.14.1 Information on WEEE Directive 2002/96/EC (Waste Electrical and Electronic Equipment)

This product/solution is not subject to the WEEE directive 2002/96/EC and relevant national laws (e. g., ElektroG in Germany).

The product/solution must be disposed of at a specialized recycling facility. Do not use municipal garbage collection points. According to the WEEE Directive 2002/96/EC, only products used in private applications may be disposed of at municipal garbage facilities. Proper disposal prevents negative effects on people and the environment, and supports the reuse of valuable raw materials.

If it is not possible to dispose of old equipment properly, ABB Service can accept and dispose of returns for a fee.

### 1.14.2 RoHS directive 2002/95/EC

With the Electrical and Electronic Equipment Act (ElektroG) in Germany, the European directives 2002/96/EC (WEEE) and 2002/95/EC (RoHs) are translated to national law. ElektroG defines the products that are subject to regulated collection and disposal or reuse in the event of disposal or at the end of their service life. ElektroG also prohibits the marketing of electrical and electronic equipment that contains a specific amount of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) (also known as hazardous substances with restricted uses).

The products provided to you by ABB Automation Products GmbH do not fall within the current scope of the directive on waste from electrical and electronic equipment according to ElektroG. If the necessary components are available on the market, these substances will no longer be used in new product development.

# 2 Design and function

## 2.1 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.

This principle is applied to a conductive fluid in the measuring tube through which a magnetic field is generated perpendicular to the flow direction (see schematic).

The voltage induced in the fluid is measured by two electrodes located diametrically opposite each other. This signal voltage $U_E$ is proportional to the magnetic induction B, the electrode spacing D and the average flow velocity v.

Considering that the magnetic induction B and the electrode spacing D are constant values, a proportionality exists between the signal voltage $U_E$ and the average flow velocity v. From the equation for calculating the volume flowrate, it follows that the signal voltage is linearly proportional to the volume flowrate: $U_E \sim q_v$.

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

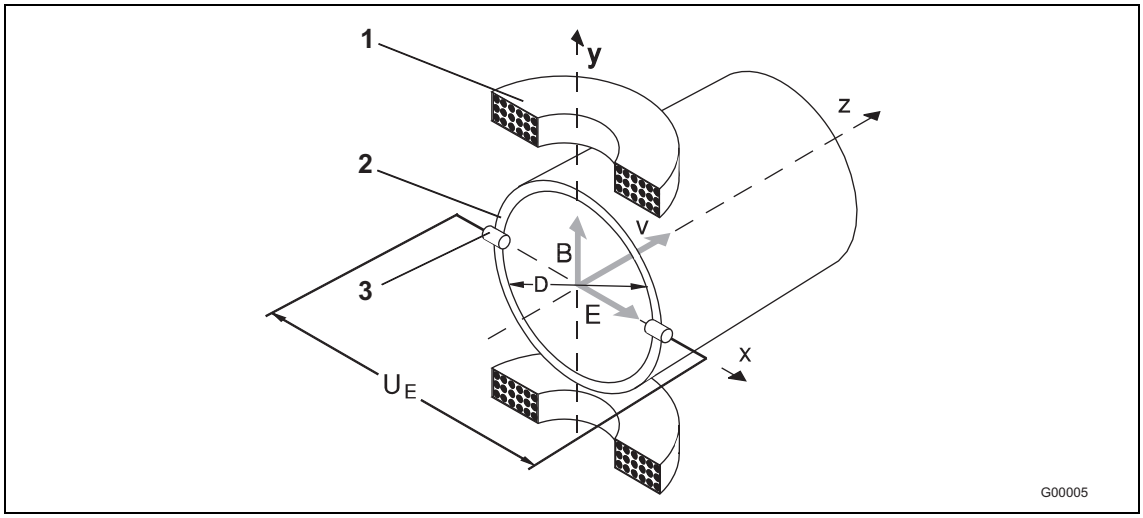



Fig. 4: Electromagnetic flowmeter schematic

1 Magnet coil
2 Measuring tube in electrode plane
3 Signal electrode
$U_E$ Signal voltage
B Magnetic induction
D Electrode spacing
v Average flow velocity
$q_v$ Volume flow

$$U_E \sim B \cdot D \cdot v$$

$$qv = \frac{D^2 \pi}{4} \cdot v$$

$$U_E \sim q_v$$

## 2.2 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.

### 2.2.1 Design

An electromagnetic flowmeter system consists of a sensor and a transmitter. The sensor is installed in the specified pipeline while the transmitter is mounted locally or at a central location.

### 2.2.2 Compact design

The transmitter and the sensor comprise a single mechanical entity.




Fig. 5

### 2.2.3 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 µS/cm without pre-amplifier.

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

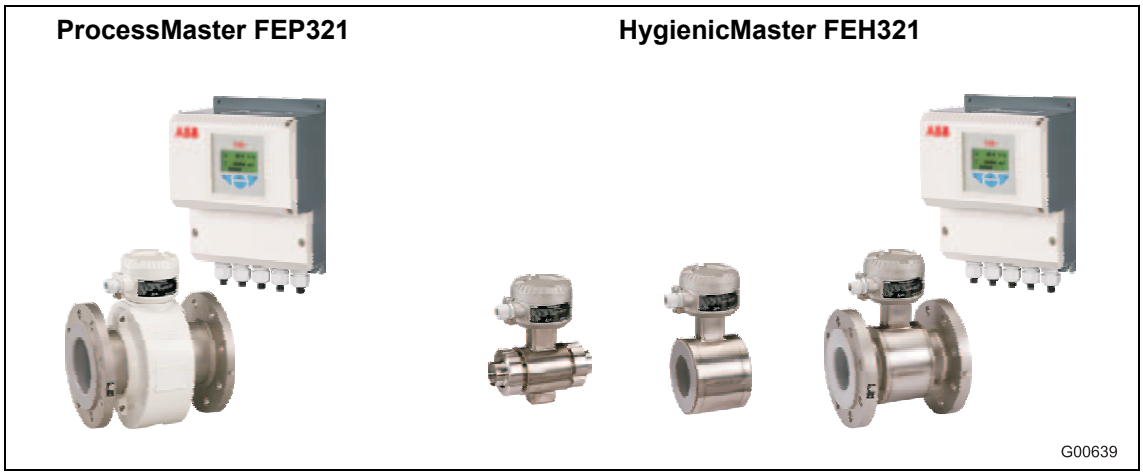



Fig. 6

# 3 Transport and storage

## 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.

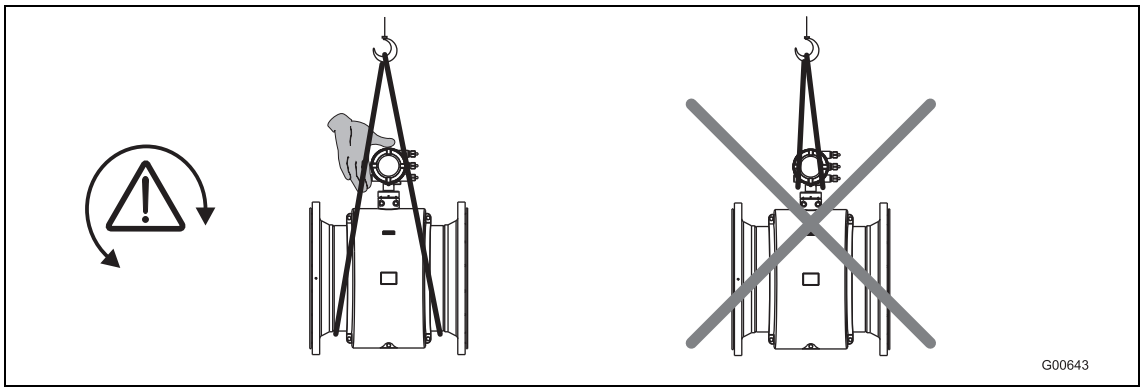



Fig. 7: Transport of flanged units smaller than DN 450

## 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.

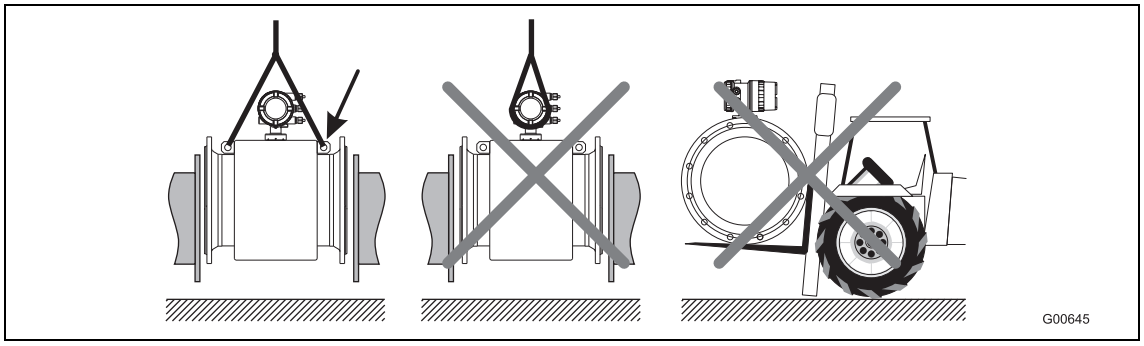



Fig. 8: Transport of flanged units larger than DN 400

## 3.4 Storage conditions

When storing the unit, please note the following points.

- Store the unit in its original packaging in a dry and dust-free location.
- Avoid storing the unit in direct sunlight.

# 4 Mounting

**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.

## 4.1 General information on installation

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.

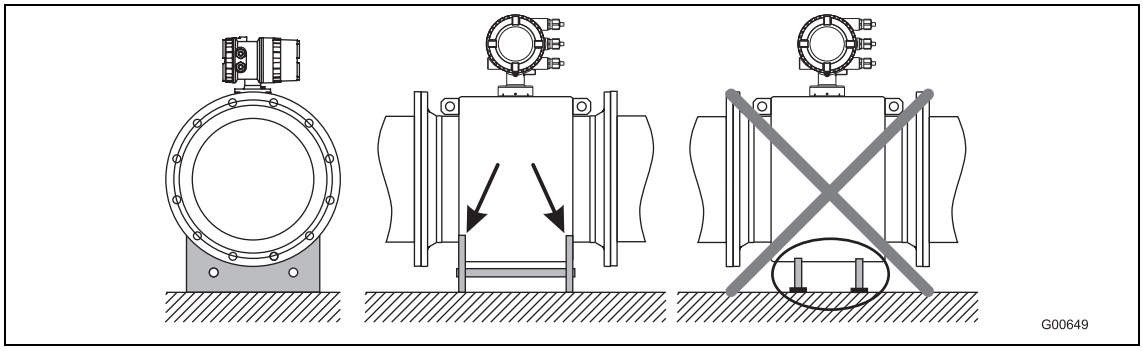



Fig. 9: Support for meter sizes larger than DN 400

### 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.

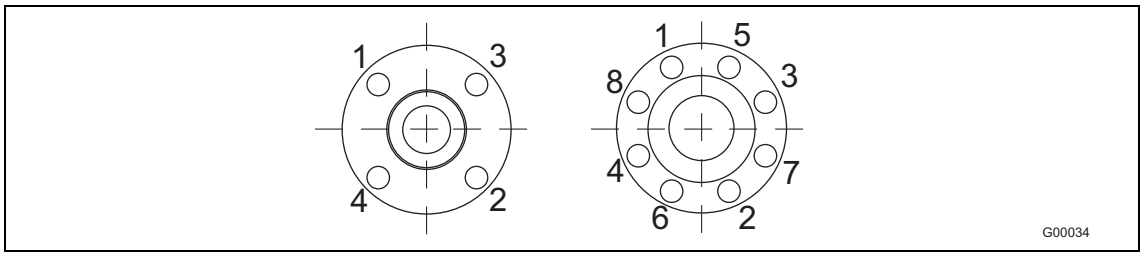



Fig. 10

## 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.

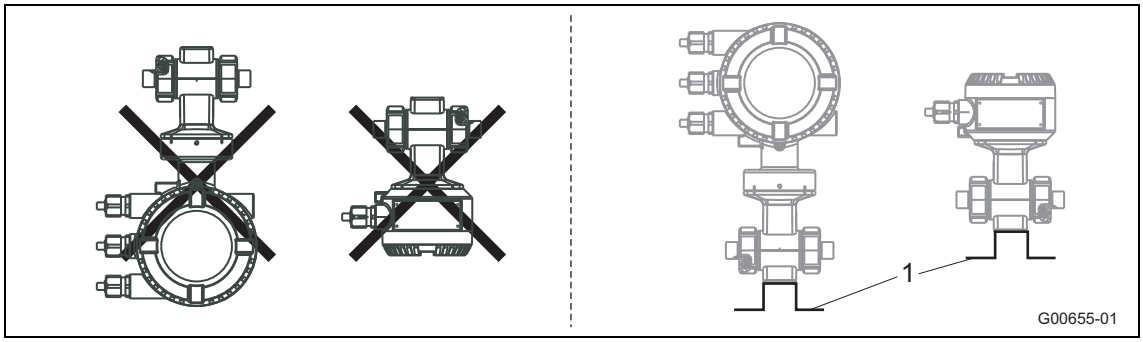



Fig. 11

1 Bracket

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

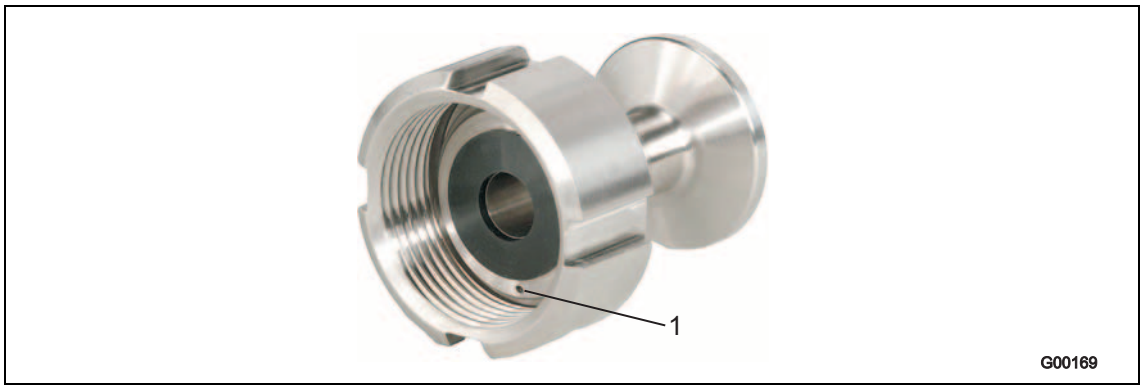



Fig. 12

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. 13.

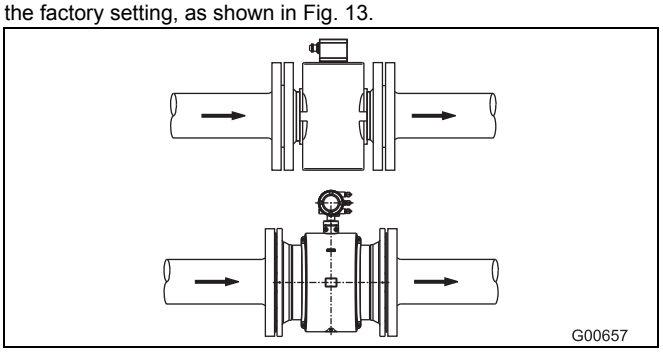



Fig. 13

### 4.5.1 Electrode axis

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

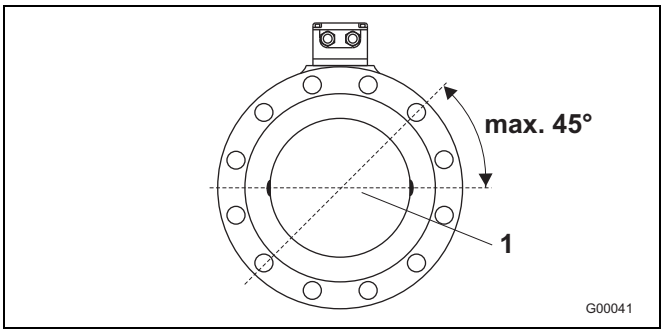



Fig. 14

### 4.5.2 In- and outlet pipe sections

| Straight inlet section | Straight outlet section |
|---|---|
| ≥ 3 x DN | ≥ 2 x 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.

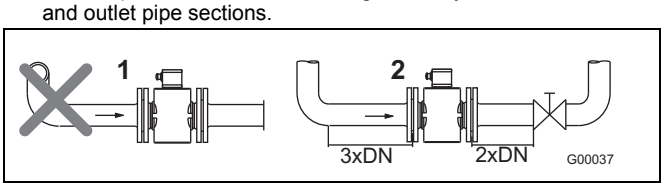



Fig. 15

### 4.5.3 Vertical connections

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

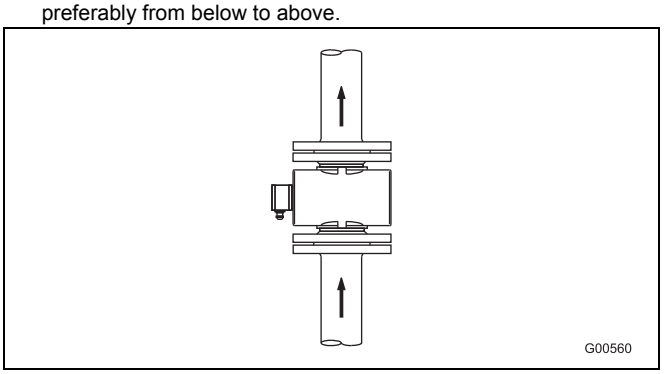



Fig. 16

### 4.5.4 Horizontal connections

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

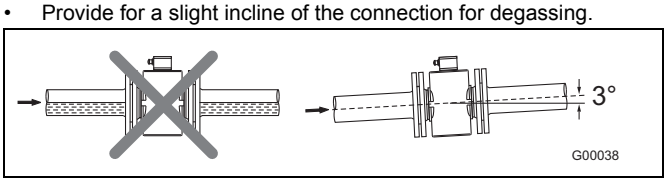



Fig. 17

### 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).

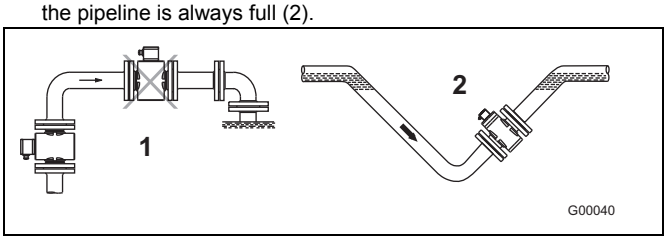



Fig. 18

### 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 the during the mechanical cleaning.

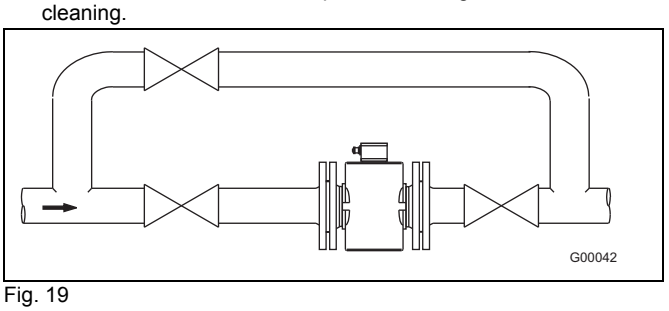



Fig. 19

### 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.

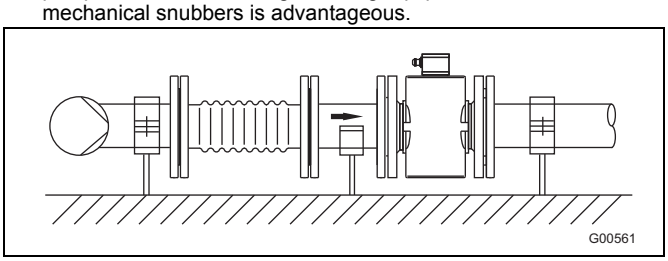



Fig. 20

### 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.

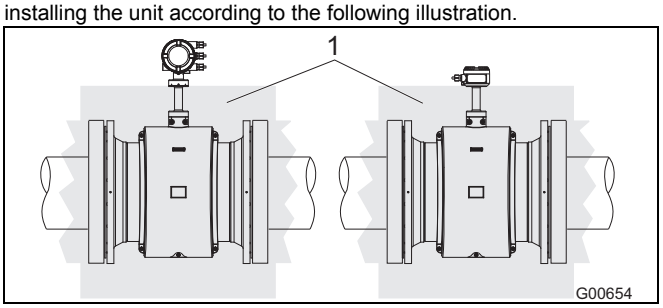



Fig. 21
1 Insulation

### 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. 23).
3. Read the pressure drop on the Y-axis in Fig. 23.

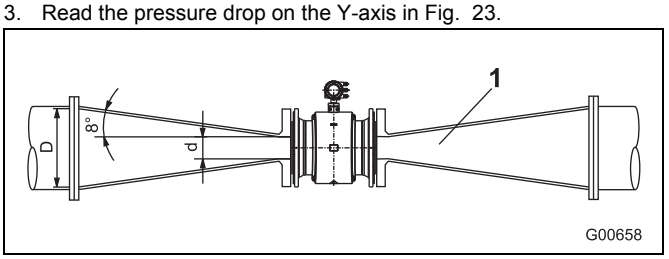



Fig. 22
1 = Flange transition piece
d = Inside diameter of the flowmeter
V = flow velocity [m/s]
Δp = pressure loss [mbar]
D = Inside diameter of the pipeline

**Nomograph for pressure drop calculations**

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

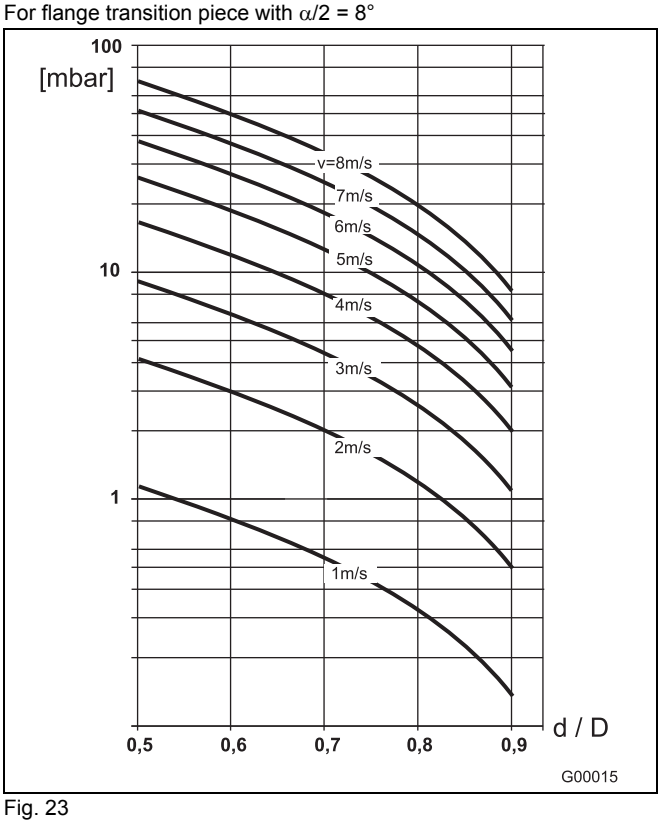



Fig. 23

## 4.6 Rotating the display / Rotating the housing

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

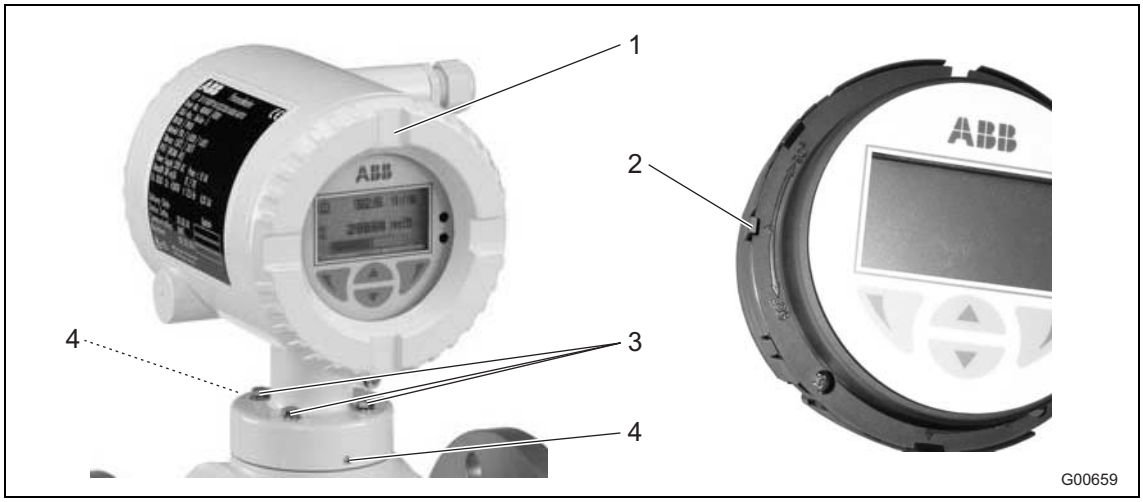



Fig. 24

### 4.6.1 Rotating the display

**Warning – Electrical voltage risk!**

When the housing is open, EMC protection is impaired and protection against contact is suspended.

- Power to all connecting cables must be switched off.

1. Switch off supply power.
2. Unscrew housing cover (1).
3. Pull back the anti-rotation lock (2) and turn the display 90° to the left or right until the lock (2) catches again.
4. Screw on housing cover (1) again.

**Important**

Check that the gaskets are properly seated when sealing the housing cover. Otherwise, the protection class IP 67 is not maintained.

### 4.6.2 Rotating the housing

1. Loosen the Allen screws (4) on the front and back sides, but do not remove entirely.
2. Loosen screws (3) and rotate housing 90° to the left or right.
3. Retighten screws (3) and Allen screws (4).

## 4.7 Ground

**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.

### 4.7.1 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.

**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.

### 4.7.2 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.

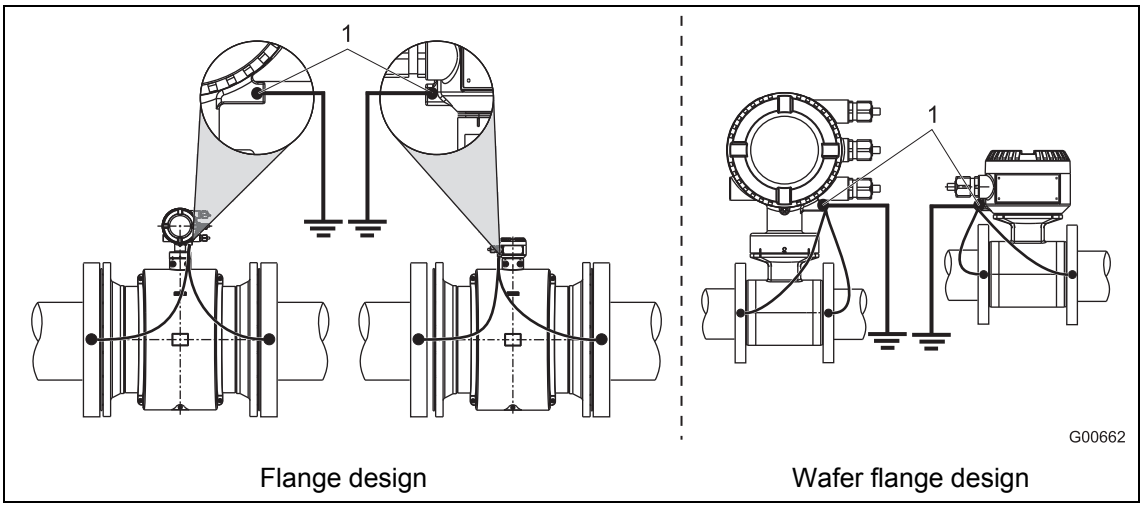



Fig. 25: Metal pipe, without liner

### 4.7.3 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 mm² (14 AWG)) to establish the ground connection between the sensor (2) and an appropriate grounding point.

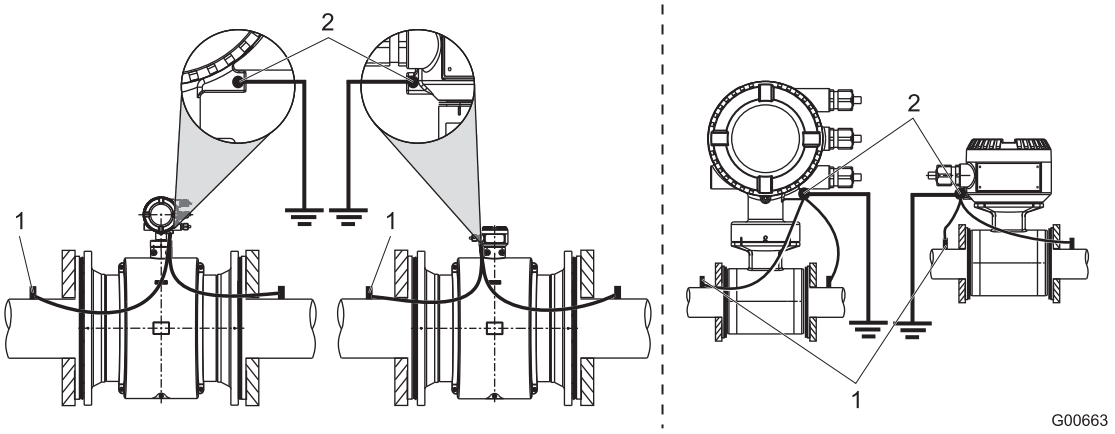



Fig. 26: Metal pipe, without liner

### 4.7.4 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 mm² (14 AWG)) to link the ground connection (1) to a suitable grounding point.

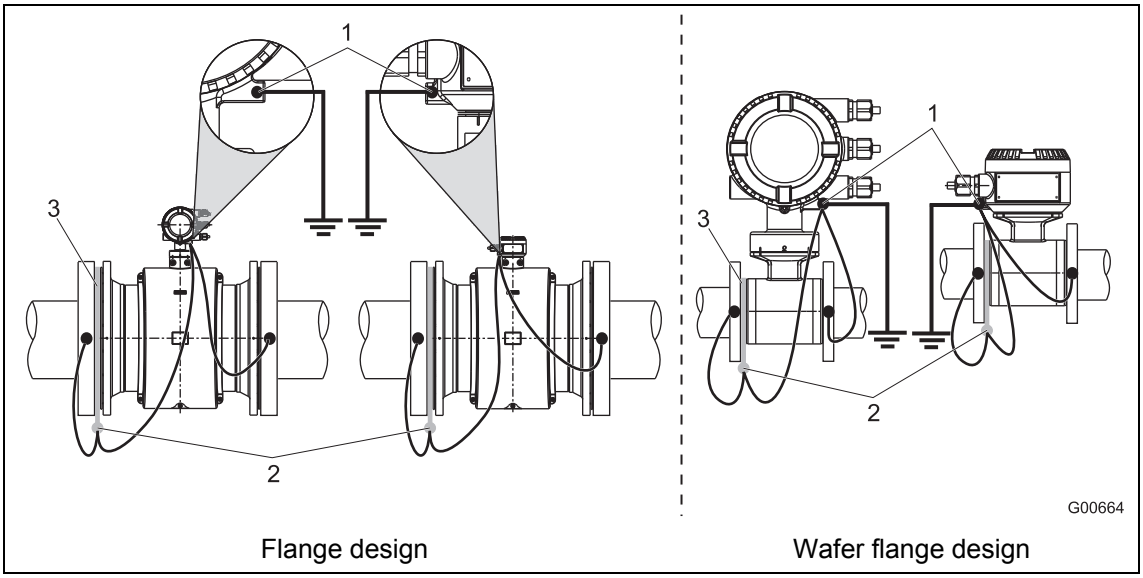



Fig. 27: Plastic pipes, non-metallic pipes or pipes with insulating liner

### 4.7.5 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.

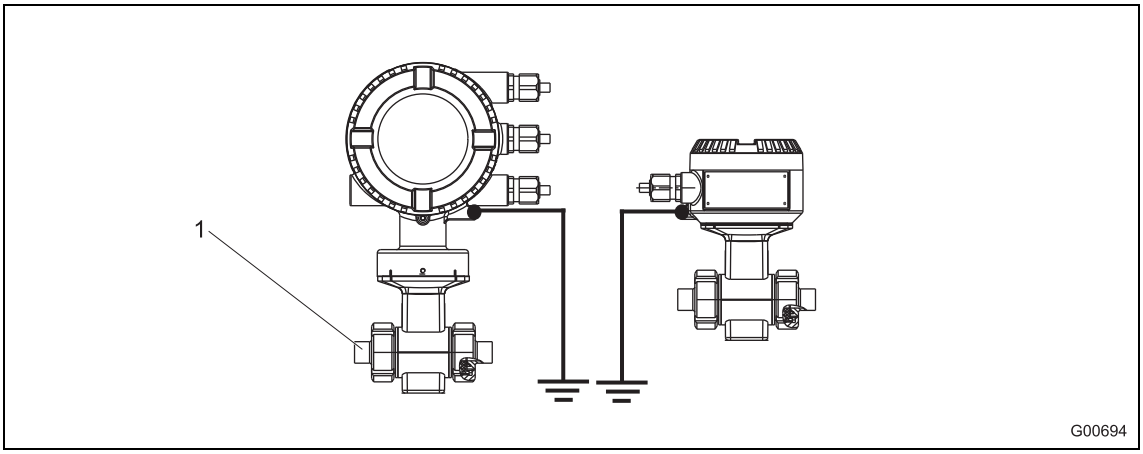



Fig. 28

### 4.7.6 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.

### 4.7.7 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.

### 4.7.8 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.

**Important**

Use wire end sleeves.

- Wire end sleeves 0.75 mm$^2$(AWG 19), for shielding (S1, S2)
- Wire end sleeves 0.5 mm$^2$(AWG 20), for all other wires

The shields may not touch (signal short circuit).

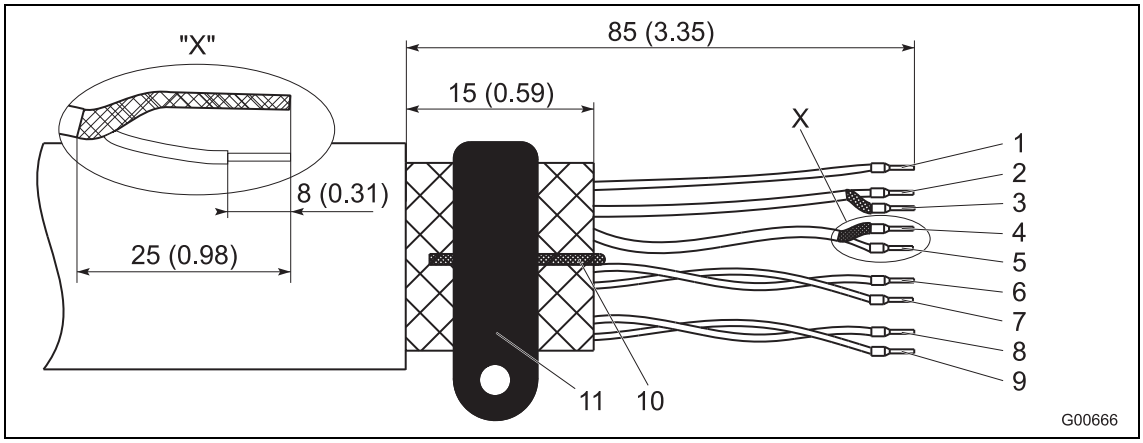



Fig. 29: Flowmeter sensor side, dimensions in mm (inch)

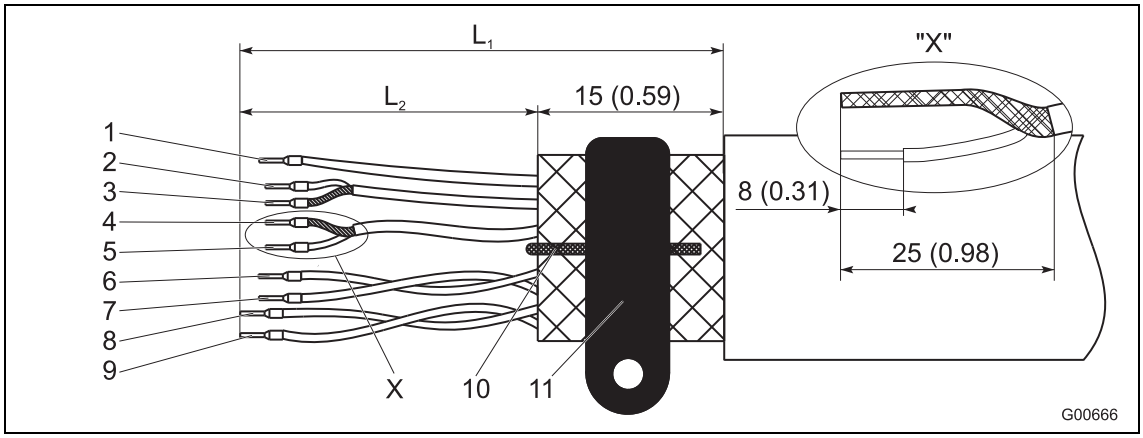



Fig. 30: Transmitter side, dimensions in mm (inch)

$L_1$ max. stripped length = 105 (4.10)

| | | | | | |
|---|---|---|---|---|---|
| 1 | Measurement potential 3, green L2 = 70 (2.76) | | 7 | Data line, D1, orange | L2 = 70 (2.76) |
| 2 | Signal line E1, violet | L2 = 60 (2.36) | 8 | Magnet coil, M2, red | L2 = 90 (3.54) |
| 3 | Shield 1S | L2 = 60 (2.36) | 9 | Magnet coil, M1, brown | L2 = 90 (3.54) |
| 4 | Shield 2S | L2 = 60 (2.36) | 10 | Groundwire, steel | |
| 5 | Signal line, E2, blue | L2 = 60 (2.36) | 11 | SE clamp | |
| 6 | Data line, D2, yellow | L2 = 70 (2.76) | | | |

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.

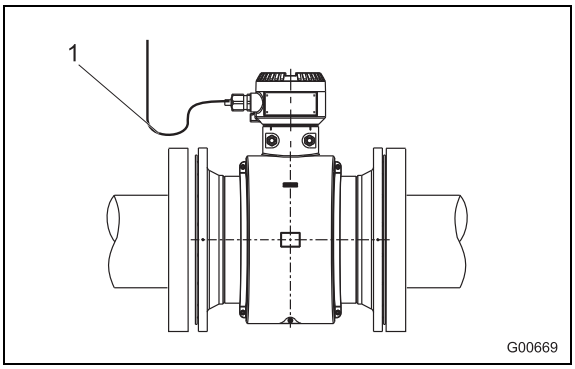



Fig. 31

## 5.2 Connecting the flowmeter sensor

### 5.2.1 Connecting the signal and magnet coil cables

Connections can only be made with the supply power switched off. The unit must be grounded. The sensor is connected to the transmitter via the signal/magnet coil cable (part no. D173D027U01). The coils of the sensor are supplied with a field voltage by the transmitter over terminals M1/M2. Connect the cable to the sensor as shown in the figure.

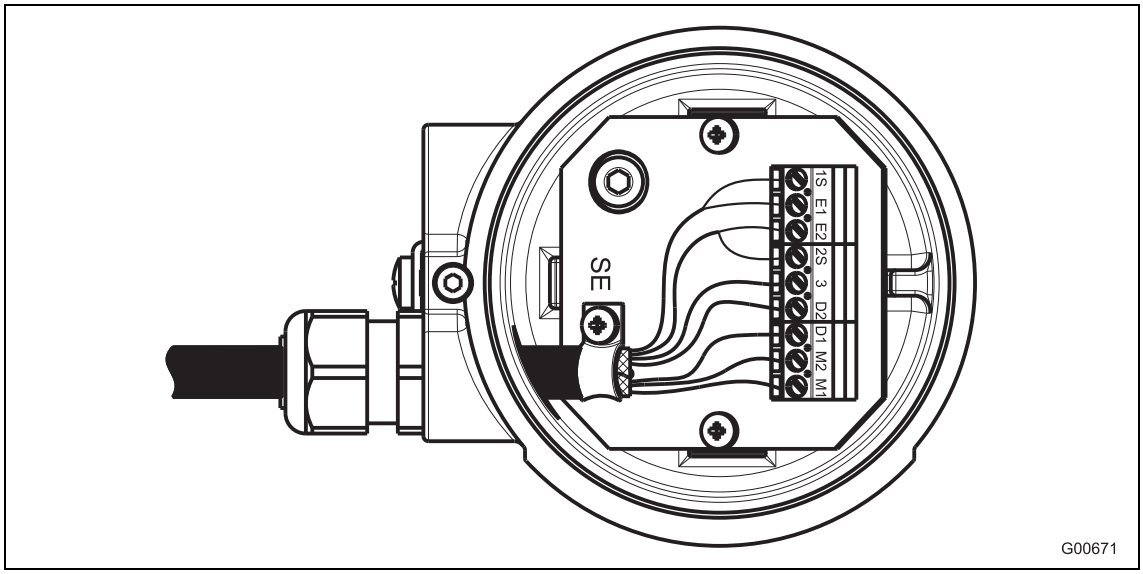



Fig. 32

| Terminal designation | Connection |
|---|---|
| 1S | Shield |
| E1 | Signal line, violet |
| E2 | Signal line, blue |
| 2S | Shield |
| 3 | Measurement potential, green |
| D2 | Data line, yellow |
| D1 | Data line, orange |
| M2 | Connection for magnet coil |
| M1 | Connection for magnet coil |
| SE | Outer cable shield. |

### 5.2.2 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.

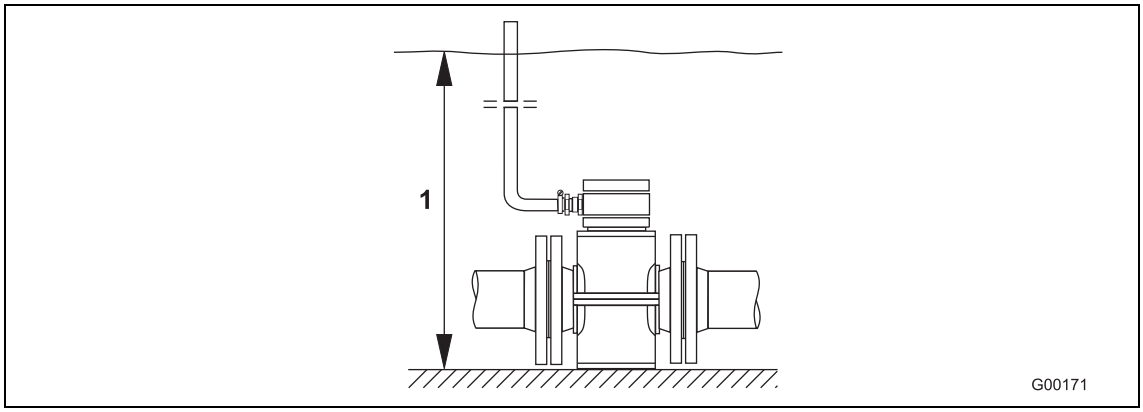



Fig. 33

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).

#### 5.2.2.1 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.

### 5.2.2.2 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. 34).
- 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.

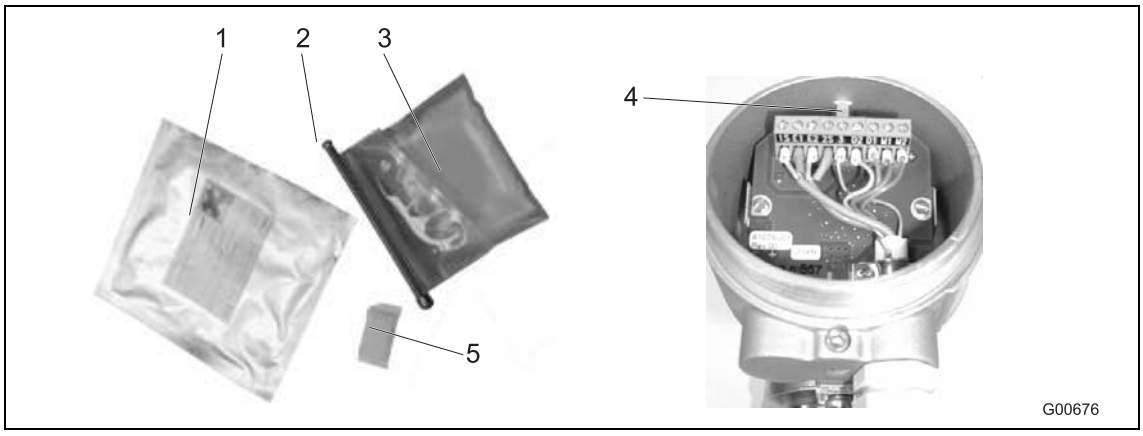



Fig. 34

1 Packaging bag
2 Connection clamp
3 Sealing compound
4 Max. filling level
5 Drying bag

## 5.3 Connecting the transmitter

**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.

### 5.3.1 Connecting the supply power

The mains voltage and power consumption are indicated on the model plate for the sensor. 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 model 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. Connect the transmitter and flowmeter with a functional ground.

**Important**

- Observe the limit values for the supply power provided in chapter "Electrical properties" page 98 .
- 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).

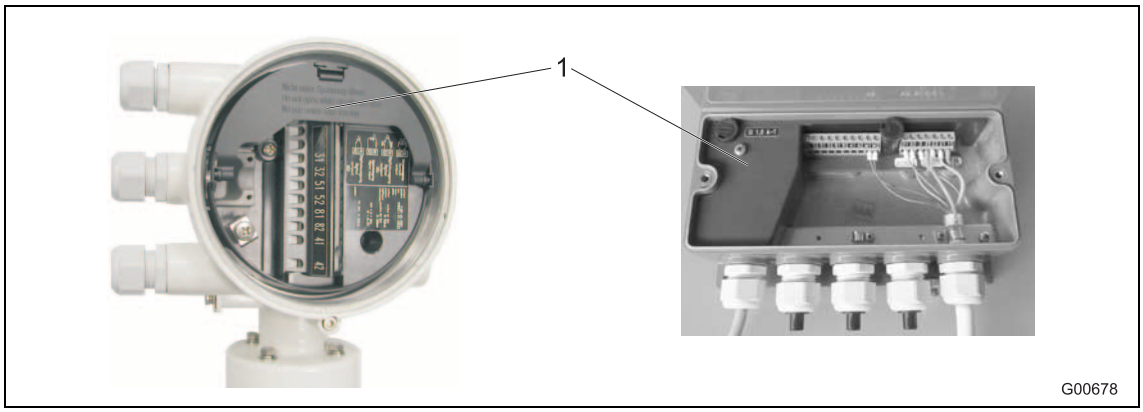



Fig. 35

1 Terminal cover

### 5.3.2 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.

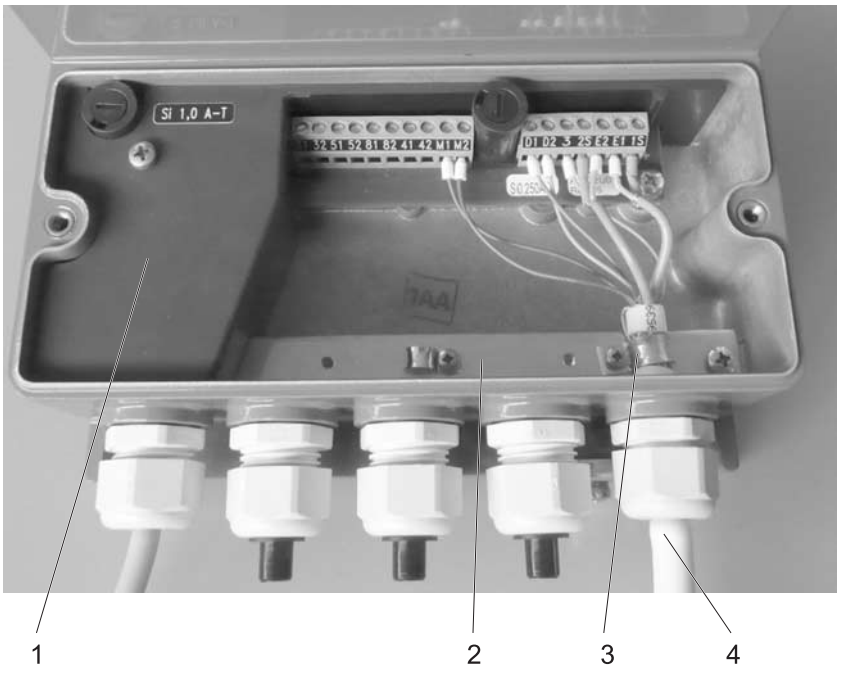



Fig. 36

1 Terminal cover
2 Busbar (SE)
3 Clip
4 Signal and magnet coil cable

**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.

### 5.3.3 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.

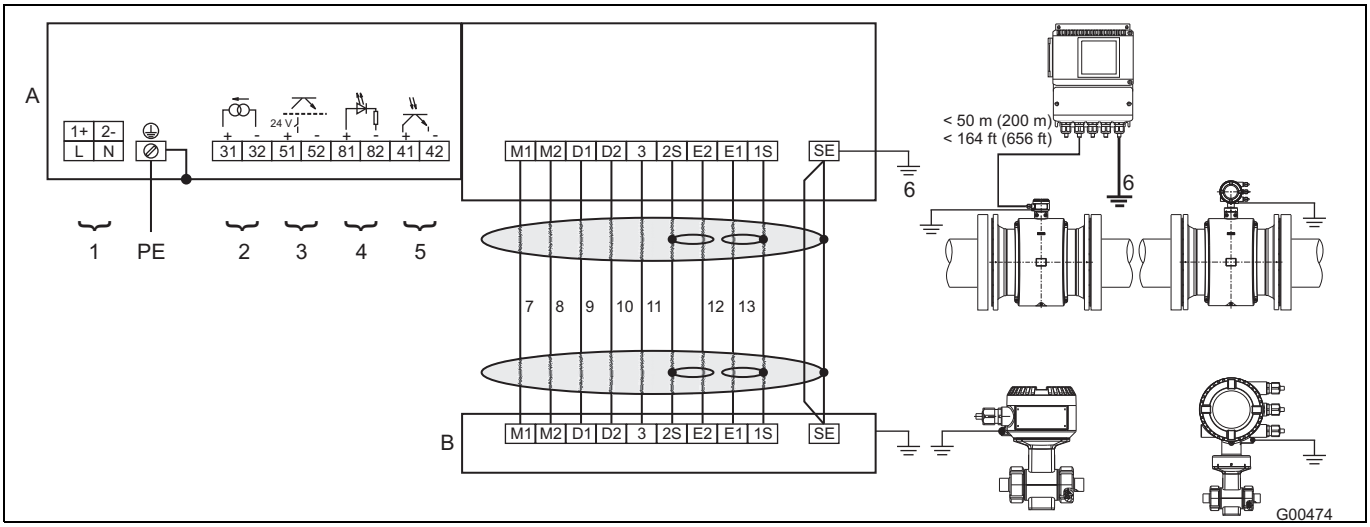



Fig. 37

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 Ω ≤ R ≤ 650 Ω
- Passive: 4 ... 20 mA, HART protocol (standard), load: 250 Ω ≤ R ≤ 650 Ω
  Supply voltage for the current output: Min. 17 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 ... 21 V, $I_{max}$ = 220 mA , $f_{max}$ ≤ 5,250 Hz
- Configuration as "passive" output
  $U_{max}$ = 30 V, $I_{max}$ = 220 mA , $f_{max}$ ≤ 5,250 Hz

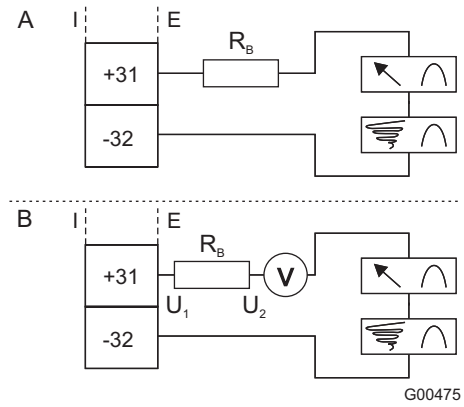
4 **Digital input (terminals 81/82) (contact input)**
Function can be configured locally using software:
External output switch-off, external totalizer reset, external totalizer stop, other

Data for the optocoupler: 16 V ≤ U ≤ 30 V, Ri = 2 kΩ

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: $U_{max}$ = 30 V, $I_{max}$ = 220 mA , $f_{max}$ ≤ 5,250 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**




A = Active configuration:
4 ... 20 mA, HART
Load: 0 =R = 650 Ω
Min. load with HART: 250 Ω

B = Passive configuration:
4 ... 20 mA, HART
Load: 0 =R = 650 Ω
Min. load with HART: 250 Ω
Supply voltage for the current output, terminals 31/32:
U1: Min. 11 V, max. 30 V

**I = internal, E = external**

Max. permissible load ($R_B$) as a function of the source voltage ($U_2$)

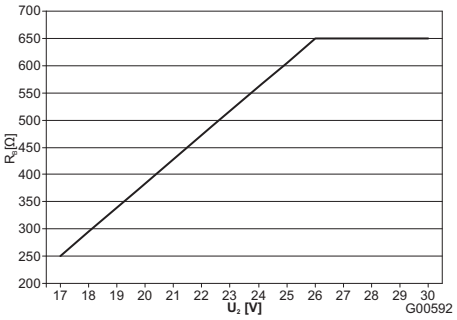
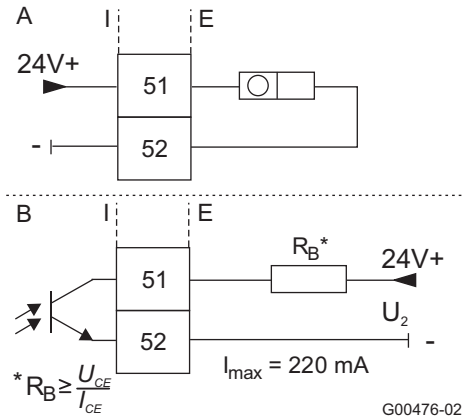



Fig. 38

**Digital output DO1**

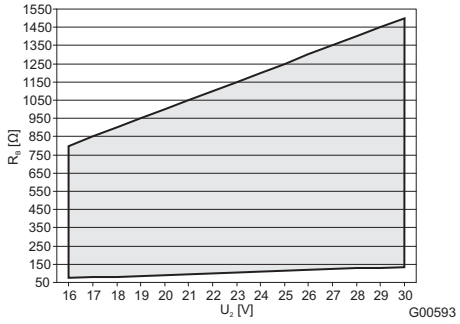



A = Active configuration

B = Passive configuration

**I = internal, E = external**

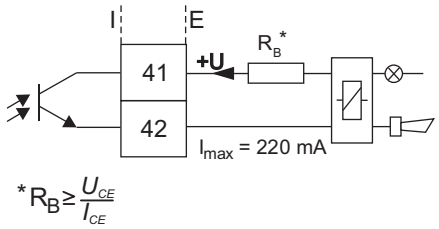
Max. permissible load ($R_B$) as a function of the source voltage ($U_2$)




= Permissible range

Fig. 39

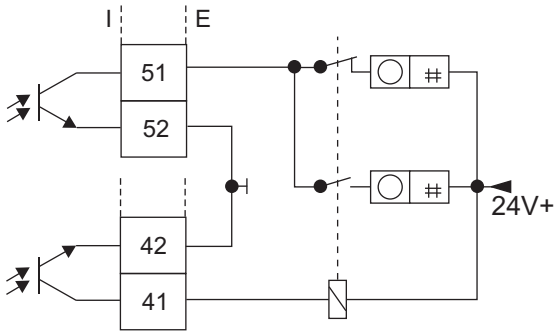
**Digital output DO2, e.g., for system monitoring, max./min. alarm, empty meter tube or forward/reverse signal, or counting pulses (function can be configured using software)**



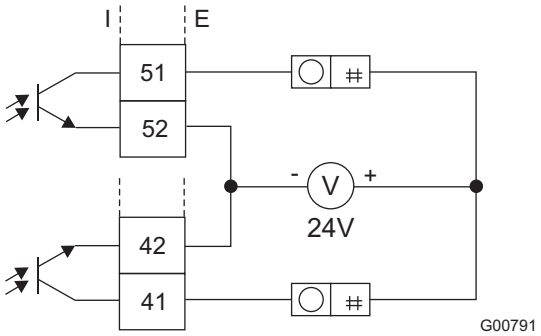

**I = internal, E = external**

Fig. 40

**Digital outputs DO1 and DO2, separate forward and reverse pulses**



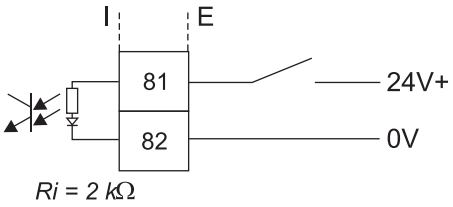

**Digital outputs DO1 and DO2, separate forward and reverse pulses (alternative connection)**




**I = internal, E = external**

Fig. 41

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




**I = internal, E = external**

Fig. 42

**Important**

For additional information on configuring the current output, see chapter 5.2 "Configuration of the current output"

# 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 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

**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.

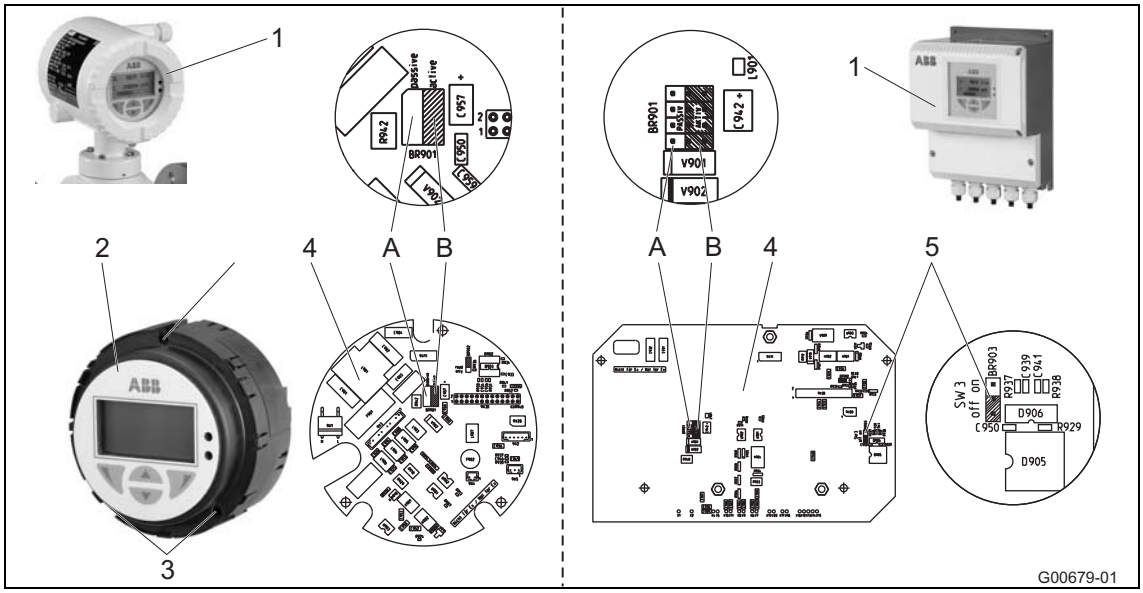



Fig. 43

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

## 6.3 Commissioning the unit

### 6.3.1 Downloading the system data

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

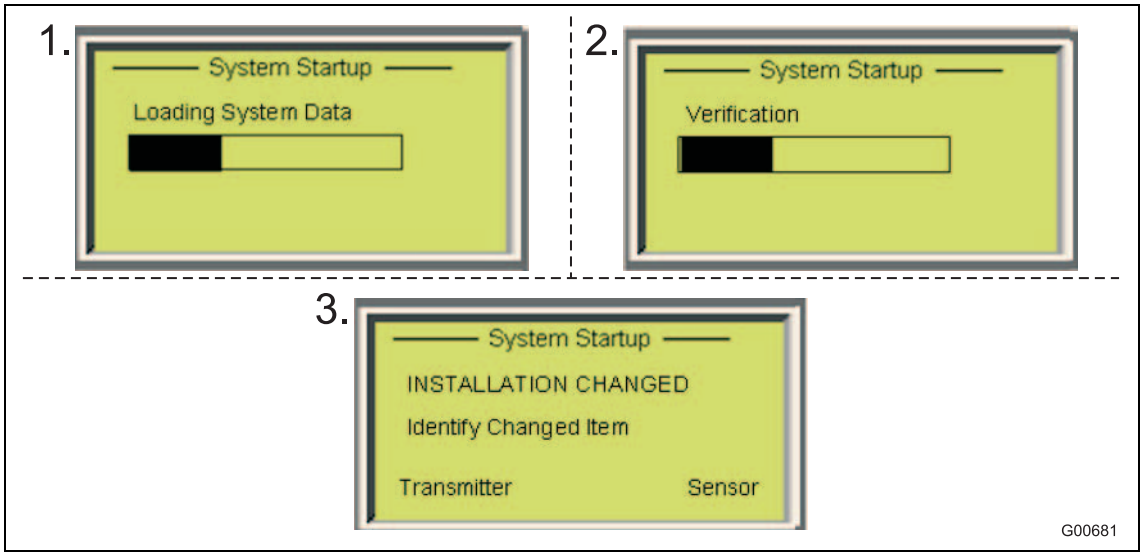



Fig. 44

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 SensorMemory[1)] 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 SensorMemory[1)] 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 SensorMemory[1)] into the transmitter. The transmitter settings are saved in the SensorMemory[1)]. 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.

### 6.3.2 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 (Iout at Alarm, Iout Low Alarm, Iout High Alarm).

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

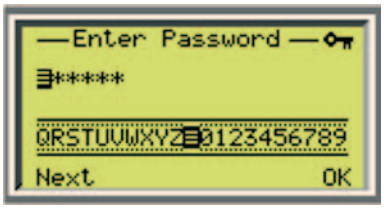
**The following section describes parametrization via the "Easy Set-up" menu function.**




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.

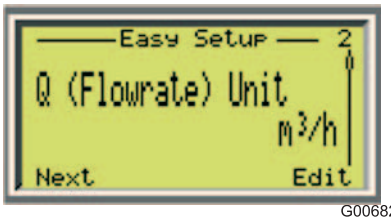
Select "ok" (► key) to switch to the configuration level without entering a password.




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.

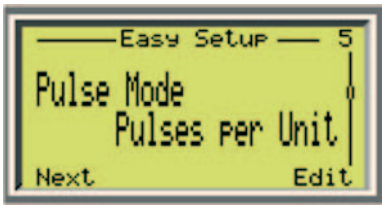
G00682




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.



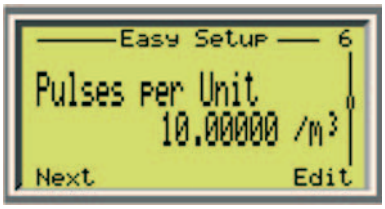

Press the ► key and set the totalizer unit. After entering the settings, press the ◄ key to move to the next menu item.




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. For additional information, see chapter "Parameter overview".

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.

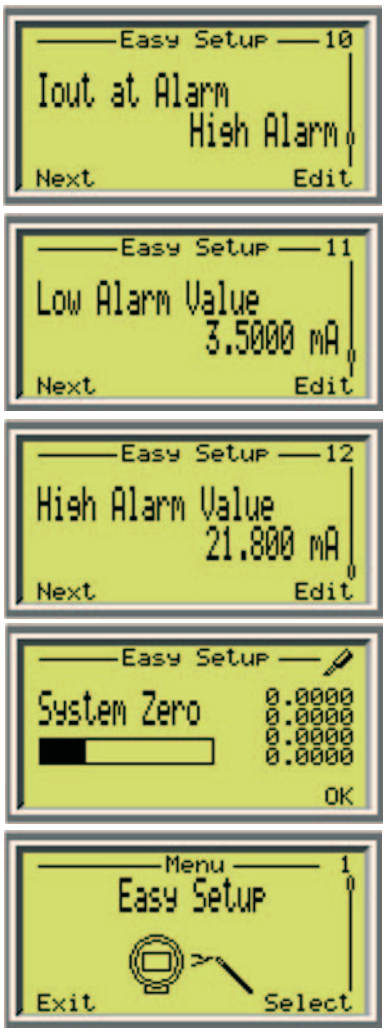



Press the ► key and set the pulses width for the pulse output. After entering the settings, press the ◄ key to move to the next menu item.




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.

**Important**

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

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

The device is factory calibrated to the flow range end value $Qmax_{DN}$, unless other customer information is available. The ideal flow range end values are approximately 2-3 m/s (0.2 ... 0.3 x $Q_{max}$DN). The smallest and largest possible flow range end values are shown in the table in the chapter "Flowmeter sizes. flow range".

**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).

## 6.4 Flowmeter sizes. flow range

| Meter size | | Min. flow range end value | $Qmax_{DN}$ |
|---|---|---|---|
| DN | " | 0.02 x $Q_{max}$DN (≈ 0.2 m/s) | 0 … ≈ 10 m/s |
| 3 | 1/10 | 0.08 l/min (0.02 US gal/min) | 4 l/min (1.06 US gal/min) |
| 4 | 5/32 | 0.16 l/min (0.04 US gal/min) | 8 l/min (2.11 US gal/min) |
| 6 | 1/4 | 0.4 l/min (0.11 US gal/min) | 20 l/min (5.28 US gal/min) |
| 8 | 5/16 | 0.6 l/min (0.16 US gal/min) | 30 l/min (7.93 US gal/min) |
| 10 | 3/8 | 0.9 l/min (0.24 US gal/min) | 45 l/min (11.9 US gal/min) |
| 15 | 1/2 | 2 l/min (0.53 US gal/min) | 100 l/min (26.4 US gal/min) |
| 20 | 3/4 | 3 l/min (0.79 US gal/min) | 150 l/min (39.6 US gal/min) |
| 25 | 1 | 4 l/min (1.06 US gal/min) | 200 l/min (52.8 US gal/min) |
| 32 | 1 1/4 | 8 l/min (2.11 US gal/min) | 400 l/min (106 US gal/min) |
| 40 | 1 1/2 | 12 l/min (3.17 US gal/min) | 600 l/min (159 US gal/min) |
| 50 | 2 | 1.2 $m^3$/h (5.28 US gal/min) | 60 $m^3$/h (264 US gal/min) |
| 65 | 2 1/2 | 2.4 $m^3$/h (10.57 US gal/min) | 120 $m^3$/h (528 US gal/min) |
| 80 | 3 | 3.6 $m^3$/h (15.9 US gal/min) | 180 $m^3$/h (793 US gal/min) |
| 100 | 4 | 4.8 $m^3$/h (21.1 US gal/min) | 240 $m^3$/h (1057 US gal/min) |
| 125 | 5 | 8.4 $m^3$/h (37 US gal/min) | 420 $m^3$/h (1849 US gal/min) |
| 150 | 6 | 12 $m^3$/h (52.8 US gal/min) | 600 $m^3$/h (2642 US gal/min) |
| 200 | 8 | 21.6 $m^3$/h (95.1 US gal/min) | 1080 $m^3$/h (4755 US gal/min) |
| 250 | 10 | 36 $m^3$/h (159 US gal/min) | 1800 $m^3$/h (7925 US gal/min) |
| 300 | 12 | 48 $m^3$/h (211 US gal/min) | 2400 $m^3$/h (10567 US gal/min) |
| 350 | 14 | 66 $m^3$/h (291 US gal/min) | 3300 $m^3$/h (14529 US gal/min) |
| 400 | 16 | 90 $m^3$/h (396 US gal/min) | 4500 $m^3$/h (19813 US gal/min) |
| 450 | 18 | 120 $m^3$/h (528 US gal/min) | 6000 $m^3$/h (26417 US gal/min) |
| 500 | 20 | 132 $m^3$/h (581 US gal/min) | 6600 $m^3$/h (29059 US gal/min) |
| 600 | 24 | 192 $m^3$/h (845 US gal/min) | 9600 $m^3$/h (42268 US gal/min) |
| 700 | 28 | 264 $m^3$/h (1162 US gal/min) | 13200 $m^3$/h (58118 US gal/min) |
| 760 | 30 | 312 $m^3$/h (1374 US gal/min) | 15600 $m^3$/h (68685 US gal/min) |
| 800 | 32 | 360 $m^3$/h (1585 US gal/min) | 18000 $m^3$/h (79252 US gal/min) |
| 900 | 36 | 480 $m^3$/h (2113 US gal/min) | 24000 $m^3$/h (105669 US gal/min) |
| 1000 | 40 | 540 $m^3$/h (2378 US gal/min) | 27000 $m^3$/h (118877 US gal/min) |
| 1050 | 42 | 616 $m^3$/h (2712 US gal/min) | 30800 $m^3$/h (135608 US gal/min) |
| 1100 | 44 | 660 $m^3$/h (3038 US gal/min) | 33000 $m^3$/h (151899 US gal/min) |
| 1200 | 48 | 840 $m^3$/h (3698 US gal/min) | 42000 $m^3$/h (184920 US gal/min) |
| 1400 | 54 | 1080 $m^3$/h (4755 US gal/min) | 54000 $m^3$/h (237755 US gal/min) |
| 1500 | 60 | 1260 $m^3$/h (5548 US gal/min) | 63000 $m^3$/h (277381 US gal/min) |
| 1600 | 66 | 1440 $m^3$/h (6340 US gal/min) | 72000 $m^3$/h (317006 US gal/min) |
| 1800 | 72 | 1800 $m^3$/h (7925 US gal/min) | 90000 $m^3$/h (396258 US gal/min) |
| 2000 | 80 | 2280 $m^3$/h (10039 US gal/min) | 114000 $m^3$/h (501927 US gal/min) |

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

# 7 Parameterization

## 7.1 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.

### 7.1.1 Menu navigation

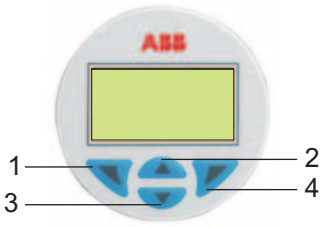



Fig. 45

- 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.

### 7.1.2 Access levels

The unit has 4 access levels (Access Level menu). Passwords can be specified for the standard and advanced access levels. There are no factory default passwords.

**1. Level: Display only**

In the "display only" level, all entries are locked. Parameters are read only and cannot be modified.

**2. Level: Standard**

In the "Standard" level, only parameters with a grey background in the chapter "Parameter overview" can be changed.

**3. Level: Advanced mode**

In the "Advanced" level all parameters can be changed.

**4. Level: Service**

The service menu is exclusively reserved for the after-sales-service of ABB Automation Products.

#### 7.1.2.1 Hardware write protection

**Important**

In addition to password protection, it is possible to turn on hardware write protection. The switch BR902 (2) is located on the backplane in the transmitter housing (1).

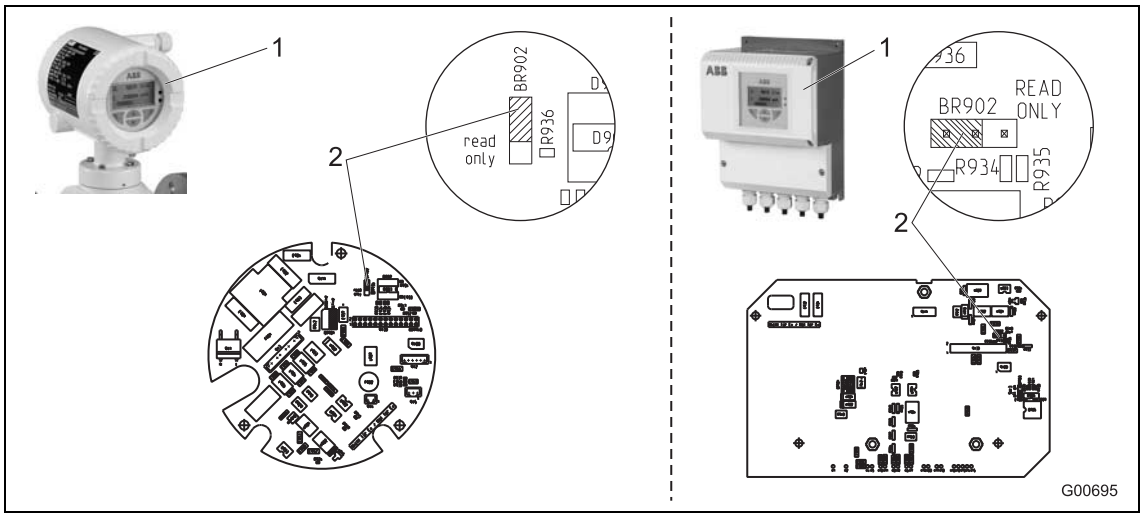
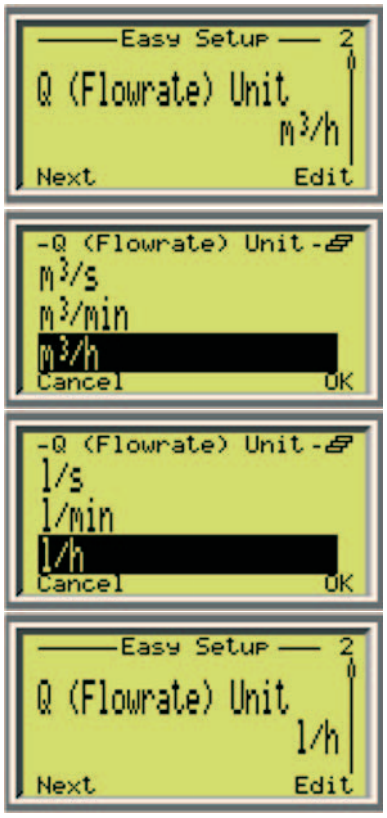



Fig. 46

### 7.1.3 Configuring a parameter value

#### 7.1.3.1 Entry from table




G00696

Select the parameters you want to set in the menu.

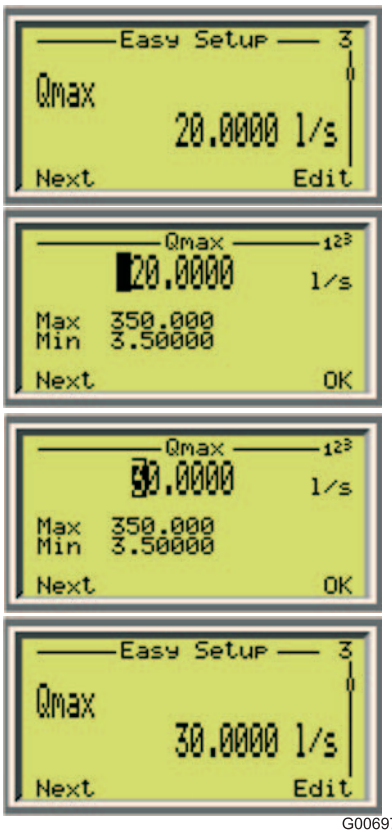
Press the ► key to display the available parameters.

The currently configured parameter value is highlighted.

Use the ▲ + ▼ keys to select the desired parameter value (for example, l/h) and use the ► key (OK) to confirm.

This displays the selected parameter value.

### 7.1.3.2 Numeric entry




G00697

Select the parameters you want to set in the menu.

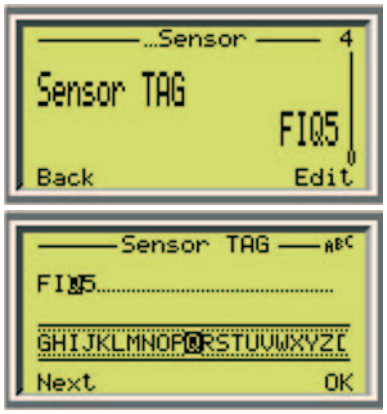
Press the ► key to activate Edit mode.

Press the ◄ key to select the desired decimal position.

Use the ▲ + ▼ keys to set the desired number. Press the ◄ key to select the next decimal position. Use the ► key (OK) to confirm the configured value.

This displays the configured value.

### 7.1.3.3 Alphanumeric entry




G00715

Select the parameters you want to set in the menu.

Press the ► key to activate Edit mode.

Press the ◄ key to select the desired decimal position.

Use the ▲ + ▼ keys to select the desired character. Press the ◄ key to select the next position. Use the ► key (OK) to confirm the alphanumeric value.

#### 7.1.3.4 Exiting the setup

For some menu items, values must be entered. If you do not wish to change the current value, exit the menu item as follows:

1. Press the ◄ “Next” button repeatedly to move the cursor to the right. Once the cursor reaches the end position, “Cancel” is displayed in the lower right.
2. Pressing the button terminates the process and exit the menu item. Press the left button ◄ “Next” to return to the start.

**Important**

If no button is pressed, the menu automatically returns to the configured display after approx. 5 min.

### 7.1.4 Process display



G00686

The process display appears after switching on the unit.

Q Current flowrate

∑+ Totalizer value for forward flow direction

∑- 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 ↻ 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.

### 7.1.5 Changing to the setup level




G00682

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

Use the ▲ + ▼ keys to select the desired access level (for example, "Standard").

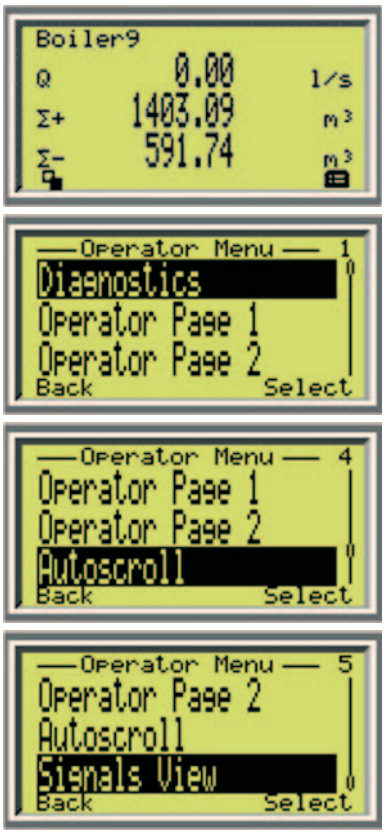
Enter the password and select "ok" to confirm (► key).

(A password is not available as factory default; you can switch to the setup level without entering a password.)

The selected access level remains active for 3 minutes. During this time, you can change between process display and setup level without re-entering a password.

Use the ▲ + ▼ keys in the main menu to select the desired submenu, and use the ► key to select the menu item.

### 7.1.6 Changing to the information level




G00716

Press the ◄ key to change to the information level of the process display.

Use the ▲ + ▼ keys to select the desired information.

The Diagnostics menu contains the help text or troubleshooting instructions. See chapter „Error states and alarms“.

If several operator pages are preconfigured via the "Display" menu, you can switch manually here to the respective operator page.

If the "Multiplex" function is switch on in the "Display" menu, you can automatically switch to the next operator page via "Autoscroll".

The "Signal View" menu is described in detail, for service purposes, in a separate service manual.

## 7.2 Parameter overview

### 7.2.1 Main menu

| Parameters | Access levels | Comment |
|---|---|---|
| | | Use the ▲ and ▼ keys to select the desired submenu and press ► to confirm. |
| Menu **Easy Set-up** Exit Select | Standard | Quick start menu "Easy Set-up". The most important parameters for startup are compiled here. See also chapter "Easy Set-up menu" |
| Menu **Device Info** Exit Select | - | This menu is used only to display the device parameters. The parameters are displayed independently of the configured access level, but cannot be changed. See also chapter "Device info menu" |
| Menu **Device Setup** Exit Select | Standard, Advanced | Device setup. See also chapter "Device Config. menu" |
| Menu **Display** Exit Select | Standard, Advanced | Configure the look of readings for the process display. See also chapter "Display menu" |
| Menu **Input / Output** Exit Select | Standard, Advanced | Configure signal inputs/outputs for the unit. See also chapter "Input / Output menu" |
| Menu **Process Alarm** Exit Select | Standard, Advanced | Configure signal inputs/outputs for the unit. See also chapter "Process alarm menu" |
| Menu **Communication** Exit Select | Standard, Advanced | Configure the HART communication for the unit. See also chapter "Communication menu" |
| Menu **Diagnostics** Exit Select | Standard, Advanced | Configure and display the diagnostic functions for the unit. See also chapter "Diagnostics menu" |
| Menu **Totalizer** Exit Select | Advanced mode | Reset the totalizer for the unit. See also chapter "Totalizer menu" |

**Important**

- For additional information regarding operation of the LCD display, refer to chapter "Operation".

### 7.2.2 Easy Set-up menu

| Parameter | Value range | Comment |
|---|---|---|
| | | Use the ▲ and ▼ keys to select the required parameters and press ► to confirm. |
| Easy Set-up<br>**Language**<br>Next Edit | German, English, French, Spanish, Italian | Select the display language for the LCD indicator. |
| Easy Set-up<br>**Q (Flowrate) Unit**<br>Next Edit | l/s, l/min, l/h, cu ft/s, cu ft/min, cu ft/h, cu ft/day, hl/h, m3/s, m3/min, m3/h, m3/day, igps, igpm, igph, igpd, gps, gpm, gph, gpd, bbl/s, bbl/min, bbl/h, bbl/d, ml/s, ml/min | Select the mass flow unit. |
| Easy Set-up<br>**Qmax**<br>Next Edit | Min. flow range configurable from 0 - 0.2 m/s (0 - 0.02 x Qmax DN).<br>Max. flow range configurable from 0 - 20 m/s (0 - 2 x Qmax DN) | Select the measurement range for forward and reverse flow.<br>Factory setting: 1 x QmaxDN |
| Easy Set-up<br>**Totalizer/Pulse Unit**<br>Next Edit | $m^3$, l, hl, USgal, M USgal, lgal, bbls, ml | Select the unit for the counter. |
| Easy Set-up<br>**Pulse Mode**<br>Next Edit | Pulse mode, Frequency mode | Select the operating mode for the digital output.<br>There are two operating modes available:<br>• "Pulse mode": In pulse mode, pulses per unit are output (e.g., 1 pulse per $m^3$).<br>• "Frequency mode": In the frequency mode, a frequency proportional to the flowrate is output. The maximum frequency corresponding to the flow range end value is configurable (max. 5 kHz).<br>Factory setting: "Pulse mode" |

Continued on next page

| Parameter | Value range | Comment |
|---|---|---|
| | | Use the ▲ and ▼ keys to select the required parameters and press ► to confirm. |
| Easy Set-up<br>**Pulses per Unit**<br>Next Edit | | Number of counting pulses transmitted by the digital output.<br>The max. possible number of pulses is 5250 per second. |
| Easy Set-up<br>**Pulse Width**<br>Next Edit | 0,1 ... 2000 ms | Set the pulse width.<br>The pulse factor and pulse width are interdependent and are calculated dynamically. |
| Easy Set-up<br>**Damping**<br>Next Edit | 0.02 ... 60 s | Set the damping.<br>The damping time constant is 1 T (tau).<br>The value refers to the response time for a step flowrate change.<br>It affects the instantaneous value in the display and at the current output.<br>Factory setting: 1 second |
| Easy Set-up<br>**Iout at Alarm**<br>Next Edit | Low, High | Status of the current output during an error.<br>"Low" or "High" can be selected.<br>The "low" or "high" status is set in the subsequent menu.<br>Factory setting: "High". |
| Easy Set-up<br>**Iout Low Alarm**<br>Next Edit | 3.5 ... 3.6 mA | Range for the "low" status.<br>Factory setting: 3.5 mA. |
| Easy Set-up<br>**High Alarm Value**<br>Next Edit | 21 ... 23 mA | Range for the "high" status.<br>Factory setting: 21.8 mA. |
| Easy Set-up<br>**System Zero**<br>Next OK | | 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. |

### 7.2.3 Device info menu

**Important**

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

| Parameters | Comment |
|---|---|
| | Use the ▲ and ▼ keys to select the parameters and press ► to confirm. |
| Device Info **Sensor** → Sensor **Sensor Type** | Display the sensor type (ProcessMaster, HygienicMaster). |
| Sensor **Sensor Size** | Size of sensor. |
| Sensor **Qmax DN** | This value is the maximum flow at a velocity of 10 m/s. The value is set automatically via the selected meter width. |
| Sensor **Qmax** | Currently configured flow range end value. |
| Sensor **Span Ss** | Calibration value for the sensor (span) |
| Sensor **Zero Sz** | Calibration value for the sensor (zero) |
| Sensor **Mains Frequency** | Display the mains frequency for the supply power. |
| Sensor **Excitation Freq.** | Display the frequency used to operate the magnet coils for the sensor. |
| Sensor **Coil Current** | Display the current used to operate the magnet coils for the sensor. |
| Sensor **Pre-Amp Power** | Display whether the sensor is operating with or without preamplifier. |

Continued on next page

| Parameters | Comment |
|---|---|
| | Use the ▲ and ▼ keys to select the parameters and press ► to confirm. |
| Sensor<br>**Sensor ID** | ID number of the sensor. |
| Sensor<br>**SAP / ERP No.** | Order number of the sensor. |
| Sensor<br>**Term Board SW** | Software version of the sensor memory integrated in the sensor. |
| Sensor<br>**Sensor Run Hours** | Operating hours for the sensor. |
| Sensor<br>**Calibration** | Information related to calibration of the sensor. |
| **First Cal. Date** | Date of first calibration for sensor (calibration of new device). |
| **Last Cal. Date** | Date of last calibration of sensor. |
| **Cal. Cert. No..** | Identification (no.) of the relevant calibration certificate. |
| **First Cal. Location** | Place of first calibration for the sensor. |
| **Last Cal. Location** | Place of last calibration of sensor. |
| **Cal. Mode.** | Calibration mode of the sensor. |
| **Cal. Status** | Calibration status of the sensor. |
| Sensor<br>**Properties** | Properties of the sensor. |
| **Electrode Material** | Electrode material for the sensor. |
| **Lining Material** | Liner material for the sensor. |

Continued on next page

| Parameters | | Comment |
|---|---|---|
| | | Use the ▲ and ▼ keys to select the desired parameters and press ► to confirm. |
| Device Info **Transmitter** | Transmitter **TX Type** | Display the transmitter type. |
| | Transmitter **TX Span** - | Calibration value for the transmitter (span). |
| | Transmitter **TX Zero** - | Calibration value for the transmitter (zero). |
| | Transmitter **Transmitter ID** - | ID number of the transmitter. |
| | Transmitter **SAP/ERP No.** - | Order number of the transmitter. |
| | Transmitter **TX Version** - | Information about software and hardware of the transmitter. |
| | **TX Firmware Ver** | Software version of the transmitter. |
| | **TX Hardware Ver** | Hardware version of the transmitter. |
| | **MSP Firmware Ver** | Software version of the MSP. |
| | **Bootloader Ver** | Software version of the bootloader. |
| | Transmitter **TX Run Hours** - | Operating hours for the transmitter. |

Continued on next page

| Parameters | | Comment |
|---|---|---|
| | | Use the ▲ and ▼ keys to select the desired parameters and press ► to confirm. |
| Transmitter **Calibration** | - | Information related to calibration of the transmitter. |
| **First Cal. Date** | | Date of first calibration for transmitter (calibration of new device). |
| **Last Cal. Date** | | Date of last calibration of transmitter. |
| **Cal. Cert. No..** | | Identification (no.) of the relevant calibration certificate. |
| **First Cal. Location** | | Place of first calibration for the transmitter. |
| **Last Cal. Location** | | Place of last calibration of transmitter. |
| Transmitter **Manufacturer** | | Name of manufacturer |
| Transmitter **Street** | - | Street address. |
| Transmitter **City** | - | City |
| Transmitter **Phone** | - | Telephone number. |

### 7.2.4 Device Config. menu

| Parameter | | Value range | Comment |
|---|---|---|---|
| | | | Use the ▲ and ▼ keys to select the required parameters and press ► to confirm. |
| Device Setup **Access Control** | Access Control **Standard Password** | alphanumeric | Set the password for the "Standard" access level. |
| | Prog.Ebene **ErNextt Passwort** | alphanumeric | Set the password for the "Advanced" access level. |
| | Access Control **Read Only Switch** | ON / OFF | Display the switch settings for hardware write protection. (See chapter "**Hardware write protection**") |
| | Access Control **Custody Switch** | ON / OFF | Display the write protection setting for calibrated devices. |
| Device Setup **Sensor** | Sensor **QmaxDN** | Display only. | This value is the maximum flow at a velocity of 10 m/s. The value is set automatically via the selected meter width. |
| | Sensor **Qmax** | Min. 0 - 0.2 m/s (0 - 0.02 x Qmax DN). Max. 0 - 20 m/s (0 - 2xQmax DN) | Select the measurement range for forward and reverse flow. Factory setting: 1 x Qmax DN |
| | Sensor **Sensor Location TAG** | alphanumeric, max. 20 characters | Enter the meter location for the sensor. (This measuring point is shown in the upper left of the process display) |
| | Sensor **Sensor Location TAG** | alphanumeric, max. 20 characters | Enter the TAG number for the sensor. |
| Device Setup **Transmitter** | Transmitter **Units** | | |
| | **Totalizer/Pulse Unit** | m3, l, hl, USgal, M USgal, lgal, bbls, ml | Select the unit for the counter. |
| | **Q (Flowrate) Unit** | l/s, l/min, l/h, cu ft/s, cuft/min, cu ft/h, cu ft/day, hl/h, m3/s, m3/min, m3/h, m3/day, igps, igpm, igph, igpd, gps, gpm, gph, gpd, bbl/s, bbl/min, bbl/h, bbl/d, ml/s, ml/min | Select the mass flow unit. |
| | **Velocity Unit** | m/s, m/min, cm/min, feet/s, feet/min | Select the unit for the flow velocity. |

Continued on next page

| Parameter | Value range | Comment |
|---|---|---|
| | | Use the ▲ and ▼ keys to select the required parameters and press ► to confirm. |
| Transmitter **Damping** | 0.02 ... 60 s | Set the damping.<br>The damping time constant is 1 T (tau).<br>The value refers to the response time for a step flowrate change.<br>It affects the instantaneous value in the display and at the current output.<br>Factory setting: 1 second |
| Transmitter **Low Flow Cut Off** | 0 ... 10 % | If the low cut-off setting is undershot, the flowrate is not measured. The current output is set to zero.<br>Factory setting for low flow: 1 % |
| **Flow Cut Off Level** | 0 ... 50 % | |
| Transmitter **TX Location TAG** | alphanumeric, max. 20 characters | Enter the meter location for the transmitter. |
| Transmitter **TX TAG** | alphanumeric, max. 20 characters | Enter the TAG number for the transmitter. |
| Transmitter **Operating Mode** | | |
| **Meter Mode** | Supply/Return | Set the measurement direction for the sensor.<br>For “Forward” the device measures only forward direction.<br>For “Forward/Reverse”, the meter reads and counts in both directions. |
| **Flow Indication** | Normal, inverse | Inverts the flow direction displayed.<br>Factory setting: Normal |
| Transmitter **System Zero** | | Adjust the system zero.<br>The valve must be closed, the fluid must be at standstill.<br>The sensor must be filled completely with fluid. Press OK to perform the automatic adjustment. |
| **Manual Adjust** | | |
| **Auto Adjust** | | |
| Transmitter **Noisereduction** | ON / OFF | Activates noise reduction in case of unstable flow signal.<br>Activating noise reduction increases the response time.<br>Factory setting: Off |

### 7.2.5 Display menu

| Parameters | Value range | Comment |
|---|---|---|
| | | Use the ▲ and ▼ keys to select the parameters and press ► to confirm. |
| Display **Language** | German, English, French, Spanish, Italian | Select the display language for the LCD display. |
| Display **Contrast** | 0 ... 100 | Adjust the contrast of the LCD display. |
| Display **Operator Pages** → **Operator Page 1** **Display Mode** **1st Line** **2nd Line** **3rd Line** **Bargraph** | | User-defined setup for process display. Up to four operator pages can be preconfigured and either manually or automatically called up (Multiplex mode). Operator Page 1 is activated in the factory setting. For additional information, see chapter "**Configuring the operator pages** ". |
| **Operator Page 2** | | See the description "Operator Page 1" |
| **Operator Page 3** | | See the description "Operator Page 1" |
| **Operator Page 4** | | See the description "Operator Page 1" |
| Display **Autoscroll** | ON / OFF | If Multiplex mode is on, you can also activate the "Autoscroll" function in the information level. In this function, operator pages appear on the LCD display in ten-second intervals. Factory setting: OFF |
| Display **Flowrate Format** | x, x.x, x.xx, x.xxx, x.xxxx | Set the decimal places for the flow indicator. Factory setting: x.xx |
| Display **Volume Format** | x, x.x, x.xx, x.xxx, x.xxxx | Set the decimal places for the flow totalizer. Factory setting: x.xx |
| Display **Date/Time Format** | DD-MM-YYYY, MM-DD-YYYY, YYYY-MM-DD | Set the display format for the date and time. Factory setting: YYYY-MM-DD |
| Display **Display Test** | - | Select "OK" to start the test of the display for the LCD display. |

### 7.2.6 Input / Output menu

| Parameters | | Value range | Comment |
|---|---|---|---|
| | | | Use the ▲ and ▼ keys to select the parameters and press ► to confirm. |
| Input / Output **Digital Out Mode** | Digital Out Mode **DO1/DO2 Function** | Pulse F / Pulse R, Pulse F / Digital, Pulse FR / Digital, Digital / Digital | Select the functions for the digital outputs DO1 and DO2.<br>**Pulse F / Pulse R:**<br>DO1 = Pulse output forward direction / DO2 = Pulse output reverse direction<br>**Pulse F / Digital:**<br>DO1 = Pulse output forward direction / DO2 = Digital output<br>The function of the digital output (DO2) is defined in the menu "Digital Output Setup".<br>**Pulse FR / Digital:**<br>DO1 = Pulse output forward and reverse direction / DO2 = Digital output<br>The function of the digital output (DO2) is defined in the menu "Digital Output Setup".<br>**Digital / Digital:**<br>DO1 = Digital output / DO2 = Digital output<br>The function of the digital output is defined in the menu "Digital Output Setup".<br>Factory setting: Pulse FR / Digital |
| | Digital Out Mode **DO1 Drive** | Passive, active | The digital output (terminal DO1) can be configured as an "active" or "passive" output. For information on the current configuration, refer to the order confirmation.<br>Factory setting: Passive |
| Input / Output **Logic Setup** | Logic Setup **DO1 Signal** | No function, Forward/Reverse Signal, Alarm Signal | The menu is displayed only if the Digital / Digital function is set in the "Function DO1/DO2" menu.<br>This menu is not displayed in the factory default setup.<br>**Forward/Reverse Signal:**<br>The digital output signals the flow direction.<br>**Alarm Signal:**<br>The digital output functions as alarm output. The alarm type is set in the DO1 Alarm Config menu.<br>Factory setting: Forward/Reverse Signal |
| | Logic Setup **DO1 Alarm Config.** | General Alarm, Min. Alarm Flow., Max. Alarm Flow., Empty Pipe Alarm | The menu is displayed only if the Alarm Signal function is set in the "DO1 Signal" menu. |
| | Logic Setup **DO1 Action** | Normally Open, Normally Closed | Select the switching behavior for the digital output.<br>Factory setting: Normally open. |
| | Logic Setup **DO2 Signal** | No function, Forward/Reverse Signal, Alarm Signal | See the description "DO1 Signal".<br>Factory setting: Forward/Reverse Signal |
| | Logic Setup **DO2 Alarm Config.** | General Alarm, Min. Alarm Flow., Max. Alarm Flow., Empty Pipe Alarm | The menu is displayed only if the Alarm Signal function is set in the "DO2 Signal" menu. |

Continued on next page

| Parameters | Value range | Comment |
|---|---|---|
| | | Use the ▲ and ▼ keys to select the parameters and press ► to confirm. |
| Logic Setup **DO2 Action** | Normally Open, Normally Closed | Select the switching behavior for the digital output.<br>Factory setting: Normally open. |
| Input / Output **Pulse Setup** → Pulse Setup **Pulse Mode** | Pulse mode, Frequency mode | Select the operating mode for the digital output. There are two operating modes available:<br>**Pulse mode:** In pulse mode, pulses per unit are output. (e.g., 1 pulse per $m^3$).<br>**Frequency mode:** In the frequency mode, a frequency proportional to the flowrate is output. The maximum frequency can be configured according to the flow range.<br>Factory setting: "Pulse mode". |
| Pulse Setup **Pulses per Unit** | 1 .... 5250/s | Select the number of counting pulses transmitted by the digital output.<br>The max. possible number of pulses is 5250 per second. |
| Pulse Setup **Pulse Width** | 0,1 ... 2000 ms | Set the pulse width.<br>The pulse factor and the pulse width are interdependent and are calculated dynamically.<br>Factory setting: 30 ms |
| Pulse Setup **Limit Frequency** | Display only | Display the limiting frequency, option unavailable |
| Pulse Setup **Fullscale Frequency** | 0 ... 5000 Hz | In frequency mode, the flow range end value corresponding to the frequency is set here. |
| Input / Output **Digital Input Setup** | No function, totalizer reset (all), ext. cut-off, ext. zero point, totalizer stop (all) | Select the operating mode for the digital input. There are four operating modes available:<br>**Totalizer reset (all):** Totalizer reset for all four totalizers (forward, reverse and differential totalizers).<br>**ext. cut-off:** external switch-off.<br>**ext. zero point adjustment:** external adjustment of zero point.<br>**Totalizer stop (all):** ext. totalizer reset for all four totalizers (forward, reverse and differential totalizers)<br>Factory setting: ext. cut-off |
| Input / Output **Current Output** → Current Output **Iout at Alarm** | High Alarm, Low Alarm | Status of the current output during an error.<br>“Low” or “High” can be selected.<br>The “low” or “high” status is set in the subsequent menu.<br>Factory setting: "High". |

Continued on next page

| Parameters | Value range | Comment |
|---|---|---|
| | | Use the ▲ and ▼ keys to select the parameters and press ► to confirm. |
| Current Output **Low Alarm Value** | 3.5 ... 3.6 mA | Range for the "low" state.<br>Factory setting: 3.5 mA. |
| Current Output **High Alarm Value** | 21 ... 23 mA | Range for the "high" state.<br>Factory setting: 21.8 mA. |
| Current Output **Iout at EP Alarm** | Off, Q = 0%, High Alarm, Low Alarm | Select the status of the current output for an empty pipe.<br>**Off:** Error is not output at the current output.<br>**Q = 0%:** The current output takes on the value for zero flow (4 mA).<br>**High Alarm:** The current output takes on the value set under "Iout High Alarm".<br>**Low Alarm:** The current output takes on the value set under "Iout Low Alarm".<br>Factory setting: OFF. |
| Current Output **Iout at 103 %** | Off, High Alarm, Low Alarm | Select the status of the current output for overshoot of flow range end value.<br>**Off:** Error is not output at the current output.<br>**High Alarm:** The current output takes on the value set under "Iout High Alarm".<br>**Low Alarm:** The current output takes on the value set under "Iout Low Alarm". |
| Current Output **Mode** | 4 - 20 mA, 4 - 12 - 20 mA | Select the operating mode for the current output.<br>**4 - 20 mA:**<br>4mA = no flow, 20mA = max. flow<br>**4 - 12 - 20 mA:**<br>4mA = max. flow reverse, 12mA = no flow, 20mA = max. flow forward. |

### 7.2.7 Process alarm menu

| Parameters | Value range | Comment |
|---|---|---|
| | | Use the ▲ and ▼ keys to select the parameters and press ► to confirm. |
| Process Alarm **Clear Alarm History** | - | Allows you to clear the alarm list. |
| Process Alarm **Group Masking** | | |
| Group Masking **Maintenance Required** | ON / OFF | Alarm messages are divided into groups. If masking is activated for a group (ON), no alarm occurs. Refer to section "Error states and alarms ". |
| Group Masking **Function Check** | ON / OFF | |
| Group Masking **Out of Specification** | ON / OFF | |
| Process Alarm **Individual Masking** | | |
| Individual Masking **Min Flowrate Alarm** | ON / OFF | Individual alarm messages can also be masked. These are not included in the masking for the group. If masking is activated for an alarm (ON), no alarm occurs. Refer to section "Error states and alarms ". |
| Individual Masking **Max Flowrate Alarm** | ON / OFF | |
| Individual Masking **Flow > 103%** | ON / OFF | |
| Individual Masking **MSP Alarm** | ON / OFF | |
| Process Alarm **Alarm Simulation** | | |
| Alarm Simulation **Off** | | A variety of alarm messages and output conditions can be simulated. Refer to section "Alarm Simulation ". |

### 7.2.8 Communication menu

| Parameter | Value range | Comment |
|---|---|---|
| | | Use the ▲ and ▼ keys to select the required parameters and press ► to confirm. |
| Communication **HART** → HART **Device Address** | 0 ... 15 | Select the HART device address<br>The HART protocol has provisions for creating a bus with up to 15 devices (1-15).<br>Note: If an address greater than 0 is set, the device operates in Multidrop mode, i.e., the current output is fixed at 4 mA and there is only digital communication over the current output.<br>Factory setting: 0. |
| HART **HART Tag** | 8 characters, uppercase only, no special characters. | Enter a HART TAG number as unique identifier for the device. |
| HART **HART Descriptor** | 16 characters, uppercase only, no special characters. | Enter a HART descriptor. |
| HART **HART Message** | 32 characters, alphanumeric, read only. | Display an alphanumeric identifier for the meter location. |
| HART **HART Manuf. ID** | 26 | Display the HART manufacturer ID (ABB = 26). |
| HART **HART Device ID** | 30 | Display the HART device ID. |
| HART **Last HART Command** | Display only | Display the most recently sent HART command. |
| Communication **Cyclic Data Out** → Cyclic Data Out **Cyclic Upd. Rate** | 0.2 ... 3600 sec | Select the time interval for outputting diagnostic data via the infrared service port.<br>Details on handling this interface are described in the separate operating instructions for the infrared service port adapter (OI/FZA100).<br>Factory setting: 1 sec. |
| Cyclic Data Out **Cyclic Upd. Select** → **Flow Group** | ON / OFF<br>Contents: Q(%), Q(l/s), v(m/s) | Select the data output via the infrared service interface. Diagnostic data is compiled in groups. Each group can be separately switched on or off, and thereby added to the diagnostic data record. |
| **Outputs Group** | Contents: 20mA output [Io(mA)], frequency at digital output DO1 [f1(Hz)], frequency at digital output DO2 [f2(Hz)] | |

Continued on next page

| Parameter | | | Value range | Comment |
|---|---|---|---|---|
| | | | | Use the ▲ and ▼ keys to select the required parameters and press ► to confirm. |
| | | **Status Group** | Contents: Alarm, Empty Pipe Frequency [EPD1(Hz)], Empty Pipe Frequency [EPD2(Hz)] | |
| | | **Coil Group** | Contents: Coil current [Ic(mA)], VoltageCoil1 [CV1(V)], VoltageCoil2 [CV2(V)], Total coil resistance [CR(Ohm)] | |
| | | **TX Group** | Contents: Reference voltage digits [Ref], Differential signal at ADC [SP], SignalMax [SM], SignalMin [Sm], SignalError from NR filter [SE], Signal DC errors [SDE], Internal amplification [Api], Voltage levels +5 (V), -5 (V), +3 (V), +24 (V), +2.5 (V) | |
| | | **Vol. Totals Group** | Contents: Forward totalizer [Fwd(m3)], Reverse totalizer [Rev(m3)], Differential totalizer [Net(m3)] | |
| | | **Electrodes Group** | Contents: Electrode impedance E1 to ground [R1 (kOhm)], Electrode impedance E2 to ground [R2 (kOhm)], Electrode impedance [R12 (kOhm)] Electrode voltage E1 (uV), Electrode voltage E2 (uV), Differential for electrode voltages DEV (V) | |
| Communication **Service Port** | Service Port **Max. Baud Rate** | | 2400, 4800, 9600, 19200, 38400 | Select the baud rate for the service interface. |
| | Service Port **HART Access** | | ON / OFF | Activate the service interface. |

### 7.2.9 Diagnostics menu

| Parameter | Value range | Comment |
|---|---|---|
| | | Use the ▲ and ▼ keys to select the required parameters and press ► to confirm. |
| Diagnostics **Diagnosis Control** → Diagnosis Control **Empty Pipe Detection** | ON / OFF | Select the "Empty Pipe Detection" function (only with a nominal size ≥ DN 10 and not with a preamplifier).<br>An entirely full measuring tube is essential for an accurate measurement.<br>The "Empty Pipe Detection" function detects the empty pipe.<br>In the event of an alarm, the current output adopts the value that was set in the "Iout for e. pipe" menu. The pulse output stops.<br>Factory setting: OFF |
| Diagnosis Control **Adjust EP Full** | - | Adjust the Empty Pipe Detection function. The sensor must be full. Press OK to perform the calibration automatically. |
| Diagnosis Control **Threshold** | 100 ... 60,000 Hz | Set the threshold for triggering the empty pipe alarm.<br>Factory setting: 4,000 Hz |
| Diagnosis Control **Elec. Volt. Meas** | ON / OFF | For additional diagnostics, the voltage of electrodes E1 and E2 is measured to ground. This measurement procedure is activated or deactivated in this menu (function not available in the case of flowmeter sensors with a preamplifier).<br>Factory setting: OFF |
| Diagnosis Control **Elec. Imp. Meas** | ON / OFF | For additional diagnostics, the impedance between the electrodes E1 and E2 is measured. This measurement procedure is activated or deactivated in this menu.<br>Factory setting: OFF<br>Only when voltage measurement is activated (function not available in the case of flowmeter sensors with a preamplifier). |
| Diagnostics **Diagnosis Values** | Display only | The current values from the diagnostic readings are displayed in this menu.<br>Reference, Signal Ratio, SignalMax, SignalMin, SignalError, NV Resets/sec, Amplification Int., Empty Pipe Detection, Empty Pipe2 Detection, Electrode Volt. E1, electrode voltage E2, coil current, coil voltage, coil resistance, 5V Rail, -5 V Rail, 2.5 V Ref Volt., 3.3 V Rail, 24 V Rail, Elect. Impedance. E1, Elect. Impedance. E2, Elect. Impedance. E12 |
| Diagnostics **Alarm Limits** → Alarm Limits **Elektr. V Max Alarm** | 0 ... 5,000 mV | Set the alarm limits for the diagnostic alarms in this menu.<br>If the limit values are over- or undershot, the diagnostic alarm is triggered. |
| Alarm Limits **Elektr. V Min Alarm** | 0 ... 5,000 mV | These menu items are only displayed if voltage measurement has been activated in the "Diagnostic Functions" menu. |
| Alarm Limits **Coil Max R Limit** | 0 ... 1,000 mV | |

Continued on next page

| Parameter | Value range | Comment |
|---|---|---|
| | | Use the ▲ and ▼ keys to select the required parameters and press ► to confirm. |
| Alarm Limits **Coil Min R Limit** | 0 ... 1000 Ohm | This menu item is only displayed if voltage measurement has been activated in the "Diagnostic Functions" menu. |
| Alarm Limits **Elek.Imp.Max Alarm** | 0 ... 10000 KOhm | This menu item is only displayed if electrode impedance measurement has been activated in the "Diagnostic Functions" menu. |
| Alarm Limits **Elek.Imp.Min Alarm** | 0 ... 10000 KOhm | This menu item is only displayed if electrode impedance measurement has been activated in the "Diagnostic Functions" menu. |
| Alarm Limits **Max. Flowrate Alarm** | 0 ... 130 % | |
| Alarm Limits **Min. Flowrate Alarm** | 0 ... 130 % | |
| Diagnostics **Simulation Mode** | 0 ... 130 % | On/Off function for Simulation mode. The output values correspond to the simulated flowrate entered. The "Configuration" information is displayed in the lower line of the display. Restore the Simulation mode to "Off" once completed. The following simulations are possible: Off, Flow velocity, Q [unit], Q [%], Current output, Freq at Output DO1, Freq at Output DO2, Digital out. DO1, Digital out. DO2, HART Frequency, Digital input |
| Diagnostics **Output Readings** | Display only | This menu displays the current value or status for the following output signals. Current output, DO1 Pulse, DO1 Status, DO2 Frequency, DO2 Status, Status Digital output |

### 7.2.10 Totalizer menu

| Parameters | Value range | Comment |
|---|---|---|
| | | Use the ▲ and ▼ keys to select the parameters and press ► to confirm. |
| Totalizer<br>**Reset Vol. Totals** | | |
| Reset Vol. Totals<br>**Totalizer Fwd** | - | Resets forward totalizer to zero. |
| Reset Vol. Totals<br>**Totalizer Rev** | - | Resets reverse totalizer to zero. |
| Reset Vol. Totals<br>**Totalizer Net** | - | Resets the differential totalizer to zero. |
| Reset Vol. Totals<br>**All Vol. Totalizer** | - | Resets all totalizers to zero. |

## 7.3 Configuring the operator pages

For the process display, up to three additional operator pages can be configured. In the factory setting only Operator Page 1 is enabled.

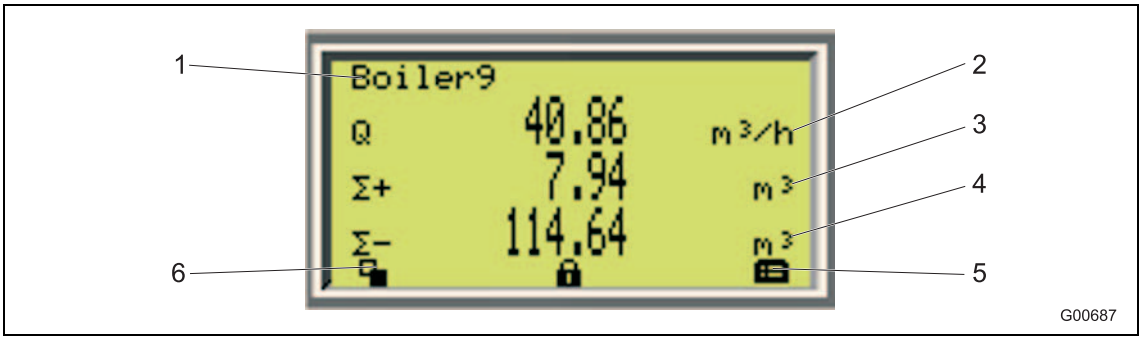



Fig. 47: Operator page (example)

1 Meter location (optional)
2 Line 1
3 Line 2 (or bar graph)
4 Line 3 (or bar graph)
5 Menu icon
6 "Next operator page" icon

Use the softkey (6) to change to the information level (see also chapter "Changing to the information level"). With the (◄ key) you can scroll through the configured operator pages. When Autoscroll mode is enabled, the operator pages are displayed automatically one after another. When Autoscroll mode is enabled, the ↻ icon is displayed on the lower left. The view for operator pages can be configured in the menu "Display / Operator Pages".

| Parameters | Description |
|---|---|
| **Display / Operator Pages** | |
| **... / Operator Page 1** | Parametrization for Operator Page 1 |
| **... / .../ Display mode** | Configure each operator page. The following versions can be selected:<br>• 1 line with 6 characters.<br>• 1 line with 6 characters + bar graph.<br>• 1 line with 9 characters.<br>• 1 line with 9 characters + bar graph.<br>• 2 lines with 9 characters.<br>• 2 lines with 9 characters + bar graph.<br>• 3 lines with 9 characters (factory default).<br>• OFF (the option disables the respective operator page). |
| **... / .../ 1st Line** | Select the value displayed in each line. The following values can be selected:<br>• Flowrate [%]<br>• Flowrate [unit]<br>• Totalizer forward<br>• Totalizer reverse<br>• Differential totalizer<br>• Flow velocity [unit]<br>• Current output [mA]<br>• SignalProportion<br>• Reference<br>• Signal max.<br>• Signal min.<br>• Amplification<br>• DC Error<br>• Elec. |

| Parameters | Description |
|---|---|
| **... / .../ 2nd Line** | Select the value displayed in each line. The following values can be selected:<br>• For the values available, see menu ... / .../ 1. Line. |
| **... / .../ 3rd Line** | Select the value displayed in each line. The following values can be selected:<br>• For the values available, see menu ... / .../ 1. Line. |
| **... / .../ bar graph** | Select the value displayed in the bar graph. The following values can be selected:<br>• Flowrate [%]<br>• Current output [mA] |

| **... / Operator Page 2** | Parametrization for Operator Page 2 |
|---|---|
| **... / .../ Display mode** | For a description of the parameters, see the "Operator Page 1" menu. |
| **... / .../ 1st Line** | |
| **... / .../ 2nd Line** | |
| **... / .../ 3rd Line** | |
| **... / .../ bar graph** | |

| **... / Operator Page 3** | Parametrization for Operator Page 2 |
|---|---|
| **... / .../ Display mode** | For a description of the parameters, see the "Operator Page 1" menu. |
| **... / .../ 1st Line** | |
| **... / .../ 2nd Line** | |
| **... / .../ 3rd Line** | |
| **... / .../ bar graph** | |

| **... / Operator Page 4** | Parametrization for Operator Page 2 |
|---|---|
| **... / .../ Display mode** | For a description of the parameters, see the "Operator Page 1" menu. |
| **... / .../ 1st Line** | |
| **... / .../ 2nd Line** | |
| **... / .../ 3rd Line** | |
| **... / .../ bar graph** | |

## 7.4 Alarm Simulation

A variety of alarms can be simulated in the "Alarm Simulation" menu.

| Parameters | Description |
|---|---|
| **Process alarm** | |
| **... / Alarm Simulation** | |
| Off | Alarm Simulation switched off. |
| 0-Sim.CurrentOut | Simulate current output |
| 1-Sim.Logic on DO1 | Switch on/off contact output (terminals 51, 52) |
| 2-Sim.Pulse on DO1 | Simulate pulse output (terminal 51/52) |
| 3-Sim.Logic on DO2 | Switch on/off contact output (terminals 41, 42) |
| 4-Sim.Pulse on DO2 | Simulate pulse output (terminal 51/52) |
| 5-Min Flowrate Alarm | Simulate flowrate min. alarm |
| 6-Max Flowrate Alarm | Simulate flowrate max. alarm |
| 7-Flowrate > 103 % | Simulate flowrate > 103 % as alarm |
| 8 Flow Simulation | Run flowrate simulation |
| 9-Calbration Mode | Run transmitter alarm on simulator |
| 10-Flowrate to Zero | Simulate external output switch-off |
| 11-Totalizer Stop | Simulate external totalizer stop |
| 12-Tot.Display < 1600 h | Simulate display value < 1600 h for Qmax |
| 13-Totalizer Reset | Simulate external totalizer reset |
| 14-Err.Sensor-Comms | Simulate distorted communication to SensorMemory. |
| 15-HART Adress <> 0 | Simulate HART Multiplex mode |
| 16-FRAM-Com Fail | Simulate FRAM error in the transmitter |
| 17-No Sensor | Simulate error "No communication to SensorMemory" |
| 18-Sim.Digital Input | Simulation of digital input "ON/OFF" |
| 19-ADC saturated | Simulate "AD converter override" error |
| 20-Error Coil circ | Simulate error in coil loop |
| 21-Galvano Voltage | Simulate "Coil resistance out of limits" error |
| 22-Driver Error Uref=0 | Simulate "Reference voltage = 0" error |
| 24-DC to High | Simulate "DC too high, several NV resets" error |
| 25-Empty Pipe | Simulate "Empty pipe" error |
| 26-Electr.Voltage | Simulate "Electrode voltage out of limits" error |
| 29-Electrode Imp. | Simulate "Electrode impedence out of limits" error |
| 30-Hold Last Value | Simulate "Hold last good value" error |
| 31-Voltage Error | Simulate "Internal voltage in transmitter" error |
| 34-CurrentOut Error | Simulate "Loop current output interrupted" error |
| 35-Not Calibtated | Simulate "Not calibrated" error |
| 36-CalibrationFail | Simulate "Calibration Mode Incompatible" error |
| 37-CRC Sum Error | Simulate ROM error in the transmitter |
| 38-Tx Data Mem Err. | Simulate RAM error in the transmitter |
| 39-Sim. HART Freq. | Simulate a HART frequency |
| 44-Pulse Cut Off | Simulate "Pulse output" error |

## 7.5 Software history

| Software D200S062U01 | | |
|---|---|---|
| **Software version** | **Type of changes** | **Operating manual** |
| 00.01.01 | Original Software | OI/FEP300/FEH300 Rev. A |
| 00.01.02 | Enhanced functionality, new HART commands incorporated | OI/FEP300/FEH300 Rev. A |
| 00.02.00 | Optimization of rate processing | OI/FEP300/FEH300 Rev. B |

# 8 Error messages

## 8.1 LCD display

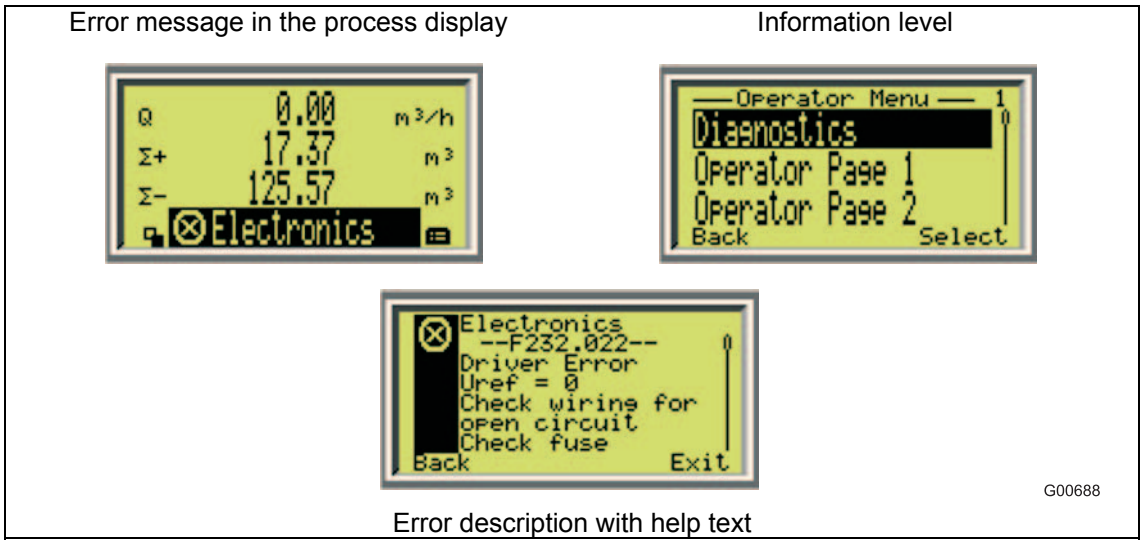


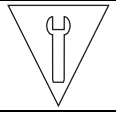

Fig. 48: Error message on LCD display (example)

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.

## 8.2 Error states and alarms

### 8.2.1 Error

| Error no. / Range | Text on the LCD display | Cause | Remedy |
|---|---|---|---|
| **F254.038 Electronics unit** | RAM Error<br>in Transmitter<br>Contact<br>ABB Service | Fault affecting transmitter electronics unit. | Replace the electronic unit or contact ABB Service. |
| **F253.037 Electronics unit** | ROM Error<br>in Transmitter<br>Contact<br>ABB Service | Fault affecting transmitter electronics unit. | Replace the electronic unit or contact ABB Service. |
| **F252.017 Sensor** | No SensorMemory<br>Check wiring<br>Check switch SW3 | Incorrectly wired terminals D1 and D2.<br>Cable short or cable break for the D1 or D2 wires.<br>Jumper SW3 is not correctly plugged into the backpane.<br>Old sensor connected without sensor memory. | Check the wiring for terminals D1, D2.<br>If an old flowmeter sensor (e.g., model DE41F) is connected without a sensor memory, plug the jumper on the backplane in the "ON" position. |
| **F250.016 Electronics unit** | Tx. memory<br>fault detected<br>Contact<br>ABB Service | Fault affecting transmitter electronics unit. | Replace the electronic unit or contact ABB Service. |
| **F248.036 Sensor** | Calibration Mode<br>Incompatible<br>Set Cal.Mode<br>Contact<br>ABB Service | Calibration mode is not compatible. | Contact ABB Service. |
| **F244.031 Electronics unit** | Internal supply<br>voltage error<br>Contact<br>ABB Service | Internal voltage supply for the transmitter is defective (+/- 5, 3.3 or 24 V). | Replace the electronic unit or contact ABB Service. |
| **F236.024 Operation** | DC to High<br>Lot of NV-Resets<br>Refer to instr.<br>Manual | Multi-phase fluids that produce a very high level of noise.<br>Stones or solids that produce a very high level of noise.<br>Galvanic voltages at the signal electrodes.<br>Conductivity of fluid is not evenly distributed (e.g., directly after injection points). | Contact ABB Service.<br>Select "Acquisition" - "Analog Reset" in the Service menu.<br>"NV Reset ON" set to a higher value.<br>"NV Reset OFF" set to a lower value. |
| **F232.022 Electronics unit** | Driver Error<br>Uref = 0<br>Check wiring<br>for open circuit<br>Check fuse | Incorrectly wired (terminals M1, M2) or wire break / short circuit.<br>Defective fuse in the coil circuit or moisture in the connection box. | Check that the wiring (terminals M1, M2) is connected properly, check for wire breaks and short circuits.<br>Test the coil circuit fuse.<br>Check the connection box for moisture. |
| **F228.020 Electronics unit** | Error in Coil<br>circuit<br>Check wiring<br>for short circuit | Incorrectly wired (terminals M1, M2) or wire break / short circuit.<br>Fuse in the coil circuit is defective. | Check that the wiring (terminals M1, M2) is connected properly, check for wire breaks and short circuits.<br>Check the fuse for the coil circuit. |

Continued on next page.

| Error no. / Range | Text on the LCD display | Cause | Remedy |
|---|---|---|---|
| **F226.019 Electronics unit** | AD Converter saturated<br>Check empty pipe or Galv. Voltage | Signal at the input for the AD converter exceeds the maximum value of 2.5 V.<br>No further measurement is possible. | If the pipeline is empty, check whether the empty pipe detection function is activated.<br>In the "Diagnostics" menu, activate Empty Pipe Detection.<br>Check whether the current flowrate exceeds the configured flow range end value. If yes, increase Qmax (= flow range end value). |

### 8.2.2 Functional check

| Error no. / Range | Text on the LCD display | Cause | Remedy |
|---|---|---|---|
| **C190.045 Config.** | An alarm is simulated<br>Switch off alarm simulation | Simulation pulse output is on. | In the "Diagnostics" menu, activate the Simulation mode. |
| **C186.009 Config.** | Tx. Simulator / Calibrator mode<br>Switch off Calibrator Mode | The transmitter is operated on Simulator 55XC4000. | In the "Diagnostics" menu, activate the Simulation mode. |
| **C185.030 Operation** | Hold last good known value<br>Switch OFF Noise Reduction<br>ABB Service | The noise exceeds the bandwidth set for noise reduction for a longer period of time. | Switch off noise reduction in the "Device Config." menu or contact ABB Service. |
| **C184.010 Config.** | The flowrate is set to zero<br>Check digital in terminals 81, 82 | The function of the digital input DI is set to "external output cut-off" and the digital input DI is set to high signal (+24 VDC). | Set the digital input (DI) to Low Signal (0VDC). |
| **C182.008 Config.** | Flowrate Simulation<br>Switch off Simulation Mode | Simulation pulse output is on. One of the following functions is simulated:<br>Flowrate [%] or flowrate [unit] or flow velocity.<br>In Simulation mode, these readings do not represent the system conditions. | In the "Diagnostics" menu, activate the Simulation mode. |
| **C178.000 Config.** | Simulated/Fixed Current Output<br>Simulation Mode?<br>HART address>0 ? | The current output is simulated and is set currently to a specific value.<br>The error message is displayed if the HART address is not 0 (HART Multidrop mode, current output set permanently to 4 mA). | Switch off the simulation mode in the Process Alarm menu or set the HART address to 0 in the Communication menu. |
| **C177.015 Config.** | HART Address <> 0<br>Multidrop Mode<br>Set HART Addr. = 0 | HART address not 0<br>(HART Multidrop mode, current output set permanently to 4 mA). | Set the HART address to 0 in the Communication menu. |
| **C176.011 Config.** | Totalizer Stop<br>Check digital in terminals 81, 82 | The function of the digital input DI is set to "external totalizer stop" and the digital input DI is set to high signal (+24 V DC). | Set the digital input (DI) to Low Signal (0 V DC). |

Continued on next page.

| Error no. / Range | Text on the LCD display | Cause | Remedy |
|---|---|---|---|
| **C175.013 Config.** | Totalizer Reset<br><br>Check digital in terminals 81, 82 | The function of the digital input DI is set to "external totalizer reset" and the digital input DI is set to high signal (+24 V DC). | Set the digital input (DI) to Low Signal (0 V DC). |
| **C174.002 Config.** | Pulse Simulation selected on DO1<br>Switch off Simulation Mode | Simulation mode is activated. | In the "Process Alarm" menu, activate the Simulation mode. |
| **C172.004 Config.** | Pulse Simulation selected on DO2<br>Switch off Simulation Mode | Simulation mode is activated. | In the "Process Alarm" menu, activate the Simulation mode. |
| **C168.001 Config.** | Logic Simulation selected on DO1<br>Switch off Simulation Mode | Simulation mode is activated. | In the "Process Alarm" menu, activate the Simulation mode. |
| **C164.003 Config.** | Logic Simulation selected on DO2<br>Switch off Simulation Mode | Simulation mode is activated. | In the "Process Alarm" menu, activate the Simulation mode. |
| **C158.039** | Simulation of HART frequency<br>Switch off Simulation Mode | Simulation mode is activated. | In the "Process Alarm" menu, activate the Simulation mode. |
| **C154.018 Config.** | Simulation Digital In<br>Switch off Simulation Mode | Simulation mode is activated. | In the "Process Alarm" menu, activate the Simulation mode. |

### 8.2.3 Operating the device out of spec

| Error no. / Range | Text on the LCD display | Cause | Remedy |
|---|---|---|---|
| **S149.021** | 21-Coil Resistor | Coil resistance too high: Coil or fuse for coil circuit is defective, or M1/M2 wired incorrectly, or wire break, or fluid is too hot.<br>Coil resistance too low: Coil is defective or short circuit in wiring for M1/M2. | Check wiring, check fuse for coil circuit, contact ABB Service. |
| **S148.025 Operation** | Empty Pipe<br>Check Pipe | The pipeline in the system is empty. | Fill pipeline. |
| **S140.007 Operation** | Flowrate > 103 %<br><br>Check Flowrate<br>Check Range Setting | The flowrate in the system exceeds the configured flow range end value by more than 3 %. | Increase the flow range end value in the "Easy Set-up - Qmax" menu. |
| **S136.006 Operation** | Max Alarm Flowrate | The current flowrate in the pipeline is greater than the max. alarm configured. | Reduce the flowrate or increase the value for the max. alarm. |
| **S132.005 Operation** | Min Alarm Flowrate | The current flowrate in the pipeline is smaller than the min. alarm configured. | Reduce the flowrate or increase the value for the min. alarm. |

Continued on next page.

| Error no. / Range | Text on the LCD display | Cause | Remedy |
|---|---|---|---|
| **S124.029 Operation** | Electr.Impedance too high Coating? Conductivity? Empty Pipe ? | This could be caused by an insulating coating on the electrodes, a fluid conductivity that is too low, or an empty meter tube. | If the pipeline is empty, check whether the empty pipe detection function is activated.<br>In the "Diagnostics" menu, activate Empty Pipe Detection.<br>Check conductivity, check coating on the electrodes.<br>Increase the value for the Elec.Imp. Max. Alarm in the "Diagnotistics - Alarm Limits" menu. |
| **S122.026 Operation** | Electr. voltage out of Range Check Range or Galv. Voltage | Galvanic voltages. | Increase the value in the menu "Diagnostics - Alarm Limits - Elect. V Max Alarm" and decrease the value for Electr. V Min Alarm. |
| **S110.035 Operation** | Sensor setup Cal-Status Set Cal-Status to "calibrated" | Sensor is uncalibrated or Cal status is not set to "calibrated". | Contact ABB Service |
| **S108.044 Operation** | Pulse output is cutted off. Check pulse out configuration | Incorrect configuration. | In the "Easy Set-up" menu, decrease the "Pulses per unit" value. |

### 8.2.4 Maintenance

| Error no. / Range | Text on the LCD display | Cause | Remedy |
|---|---|---|---|
| **M094.034 Electronic unit** | Currentout fault Comms. to MSP Check wiring ! 20 mA passive ? Check BR901 ! | 20 mA loop open, wire break or operation as passive 20-mA output, no power is connected, max. allowable load exceeded or hardware defective. | Check for incorrect wiring, wire break.<br>Check that the jumper for switching between 20-mA active/passive is connected correctly to the backplane in the transmitter housing.<br>Check whether the external power is connected during operation as 20-mA passive. |
| **M090.014 Sensor** | Errors Sensor Comms. Bad EMC environment Check wiring | EMC environment or loose wire on the D1 or D2 terminals, or incorrect wiring, or short circuit, or moisture in the connection box. | Check for incorrect wiring (terminals D, D2), check connection box. |
| **M080.012 Operation** | Display value is < 1600 h at Qmax Change eng. Unit for Totalizer | Display value <1600 h for Qmax. | Change the totalizer unit. |

## 8.3 Overview of error states and alarms

| Error no. / Range | Text on the LCD display | Current output behavior | Digital output behavior | Pulse output behavior | Display | Error maskable? |
|---|---|---|---|---|---|---|
| **F254.038 Electronics unit** | RAM Error<br>in Transmitter<br>Contact<br>ABB Service | Iout for alarm | Collective Alarm | 0 Hz | 0 % | No |
| **F253.037 Electronics unit** | ROM Error<br>in Transmitter<br>Contact<br>ABB Service | Iout for alarm | Collective Alarm | 0 Hz | 0 % | No |
| **F252.017 Sensor** | No SensorMemory<br>Check wiring<br>Check switch SW3 | Iout for alarm | Collective Alarm | 0 Hz | 0 % | No |
| **F250.016 Electronics unit** | Tx. memory<br>fault detected<br>Contact<br>ABB Service | Iout for alarm | Collective Alarm | 0 Hz | 0 % | No |
| **F248.036 Sensor** | Calibration Mode<br>Incompatible<br>Set Cal.Mode<br>Contact<br>ABB Service | Iout for alarm | Collective Alarm | 0 Hz | 0 % | No |
| **F244.031 Electronics unit** | Internal supply<br>voltage error<br>Contact<br>ABB Service | Iout for alarm | Collective Alarm | 0 Hz | 0 % | No |
| **F236.024 Operation** | DC to High<br>Lot of NV-Resets<br>Refer to instr.<br>Manual | Iout for alarm | Collective Alarm | 0 Hz | 0 % | No |
| **F232.022 Electronics unit** | Driver Error<br>Uref = 0<br>Check wiring<br>for open circuit<br>Check fuse | Iout for alarm | Collective Alarm | 0 Hz | 0 % | No |
| **F228.020 Electronics unit** | Error in Coil<br>circuit<br>Check wiring<br>for short circuit | Iout for alarm | Collective Alarm | 0 Hz | 0 % | No |
| **F226.019 Electronics unit** | AD Converter<br>saturated<br>Check empty pipe<br>or Galv. Voltage | Iout for alarm | Collective Alarm | 0 Hz | 0 % | No |

| Error no. / Range | Text on the LCD display | Current output behavior | Digital output behavior | Pulse output behavior | Display | Error maskable? |
|---|---|---|---|---|---|---|
| **C190.045 Configuration** | An alarm is simulated Switch off alarm simulation | Current value | No response | Current value | Current value | No |
| **C186.009 Configuration** | Tx. Simulator / Calibrator mode Switch off Calibrator Mode | Current value | Current value | Current value | Current value | Group mask |
| **C185.030 Operation** | Hold last good known value Switch OFF Noise Reduction ABB Service | Current value | No response | Current value | Current value | Group mask |
| **C184.010 Configuration** | The flowrate is set to zero Check digital in terminals 81, 82 | 4 mA (0 % flow) | No response | 0 Hz | 0 % | Group mask |
| **C182.008 Configuration** | Flowrate Simulation Switch off Simulation Mode | Current Value or High Alarm (flow > 105 %) | No response, Min/Max or General Alarm | Current value | Current value | Group mask |
| **C178.000 Configuration** | Simulated/Fixed Current Output Simulation Mode? HART address>0 ? | Simulated value | No response | Current value | Current value | Group mask |
| **C177.015 Configuration** | HART Address <> 0 Multidrop Mode Set HART Addr. = 0 | 4 mA | Current value | Current value | Current value | Group mask |
| **C176.011 Configuration** | Totalizer Stop Check digital in terminals 81, 82 | Current value | No response | 0 Hz | Current value | Group mask |
| **C175.013 Configuration** | Totalizer Reset Check digital in terminals 81, 82 | Current value | No response | Current value | Current value | Group mask |
| **C174.02 Configuration** | Pulse Simulation selected on DO1 Switch off Simulation Mode | Current value | No response | Simulated value | Current value | Group mask |
| **C172.04 Configuration** | Pulse Simulation selected on DO2 Switch off Simulation Mode | Current value | No response | Simulated value | Current value | Group mask |
| **C168.01 Configuration** | Logic Simulation selected on DO1 Switch off Simulation Mode | Current value | Simulated value | No response | Current value | Group mask |
| **C164.003 Configuration** | Logic Simulation selected on DO2 Switch off Simulation Mode | Current value | Simulated value | No response | Current value | Group mask |
| **C158.039 Configuration** | Simulation of HART frequency Switch off Simulation Mode | Current value | No response | Current value | Current value | Group mask |

| Error no. range | Text on the LCD display | Current output behavior | Digital output behavior | Pulse output behavior | Display | Error maskable? |
|---|---|---|---|---|---|---|
| **C154.018 Configuration** | Simulation Digital In Switch off Simulation Mode | Current value | No response | Current value | Current value | Group mask |
| **C149.021 Sensor** | 21-Coil Resistor | Current value | No response | Current value | Current value | Group mask |
| **S148.025 Operation** | Flowrate > 103 %<br><br>Check Flowrate Check Range Setting | Programmed alarm | Programmed alarm | 0 Hz | 0% | Single Alarm mask |
| **S149.021 Operation** | Max Alarm Flowrate | No response | No response | No response | No response | Group mask |
| **S140.007 Operation** | Min Alarm Flowrate | Programmed alarm | Collective Alarm | Current value | Current value | Single Alarm mask |
| **S136.006 Operation** | Electr.Impedance too high Coating? Conductivity? Empty Pipe ? | Current value | Programmed alarm | Current value | Current value | Single Alarm mask |
| **S132.05 Operation** | Electr. voltage out of Range Check Range or Galv. Voltage | Current value | Programmed alarm | Current value | Current value | Single Alarm mask |
| **S124.029 Operation** | Sensor setup Cal-Status Set Cal-Status to "calibrated" | Current value | No response | Current value | Current value | Group mask |
| **S122.026 Operation** | Pulse output is cutted off. Check pulse out configuration | Current value | No response | Current value | Current value | Group mask |
| **S110.035 Sensor** | Currentout fault Comms. to MSP Check wiring ! 20 mA passive ? Check BR901 ! | Current value | Current value | Current value | Current value | Group mask |
| **S108.044 Operation** | 21-Coil Resistor | Current value | No response | Maximum possible value | Current value | Group mask |
| **M94.034 Electronics unit** | Flowrate > 103 %<br><br>Check Flowrate Check Range Setting | Low Alarm | No response | Current value | Current value | Single Alarm mask |

| Error no. range | Text on the LCD display | Current output behavior | Digital output behavior | Pulse output behavior | Display | Error maskable? |
|---|---|---|---|---|---|---|
| **M90.014 Sensor** | Errors<br>Sensor Comms.<br>Bad EMC environment<br>Check wiring | Current value | No response | Current value | Current value | Group mask |
| **M80.012 Operation** | Display value is < 1600 h at Qmax<br>Change eng. Unit for Totalizer | Current value | No response | Current value | Current value | Group mask |

### 8.3.1 Error message during commissioning

Once the device has been switched on, the flowmeter sensor's calibration data and the transmitter settings are loaded from the SensorMemory into the transmitter.
If no communication link can be established with the SensorMemory[1)], the message below will appear on the LCD display.

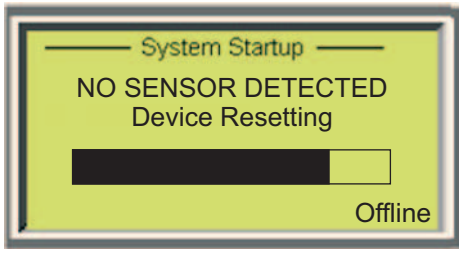



Fig. 49

| Possible cause | Remedy |
|---|---|
| Terminals D1/D2 incorrectly wired | Check wiring. |
| Short circuit or wire break affecting wires D1/D2. | Check the signal cable. |
| Jumper SW3 is not correctly plugged into the backplane. | Check jumper SW3. Refer to section 6.2 "Configuring the current output".<br>• off: SensorMemory available in flowmeter sensor (standard)<br>• on: No SensorMemory available in flowmeter sensor |
| Data memory (SensorMemory[1)]) defective. | Contact ABB Service. |

The device starts again once the end of the progress bar is reached, and this continues until communication with the SensorMemory[1)] has been re-established or the process is canceled by selecting "Offline".

In offline mode, the device can be operated or parameterized, but no measurements can be performed.

In offline mode, error message "F252.017" is set.

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

# 9 Maintenance

Repair and maintenance activities may only be performed by authorized customer service personnel.

When replacing or repairing individual components, original spare parts must be used.

**Notice - Potential damage to parts!**

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 when touching electronic components.

## 9.1 Flowmeter sensor

Essentially maintenance is not required for the flowmeter sensor. The following items should be checked annually:

- Ambient conditions (air circulation, humidity)
- Seal integrity of the process connections
- Cable entry points and cover screws,
- Operational reliability of the auxiliary power feed, the lightning protection and the grounds

The flowmeter sensor electrodes must be cleaned when the flowrate information on the transmitter changes when recording the identical flowrate volume. If the display shows a higher flowrate, the contamination is insulating. If the flowrate displayed is lower, the contamination results in a short-circuit.

For repairs to the lining, electrodes or magnet coil, the flowmeter must be returned to the local office of ABB.

**Important**

When sending the flowmeter sensor to the local office of ABB, complete the return form in the appendix and include with device.

When cleaning the exterior of meters, make sure that the cleaning agent used does not corrode the housing surface and the gaskets.

## 9.2 Gaskets

Some device designs are shipped with special gaskets. These gaskets must be used and installed properly to prevent leakage and ensure 3A and EHEDG conformity.

For all other device designs, use commercially available gaskets made from a compatible material for the fluid and prevailing temperature (rubber, PDFE, It, EPDM, silicon, Viton, etc.) or use 3A-compliant gasket material for HygienicMaster devices.

**Important**

A wafer type sensor is installed without gaskets directly in the pipeline.

## 9.3 Replacing the transmitter or sensor

### 9.3.1 Transmitter

**Warning – Electrical voltage risk!**

When the housing is open, EMC protection is impaired and protection against contact is suspended.

- Power to all connecting cables must be switched off.




Fig. 50

Replace the transmitter plug-in as follows:

1. Switch off supply power.
2. Open the housing cover (1).
3. Loosen screws (3) and pull out transmitter plug-in (2).
4. Replace transmitter plug-in and retighten screws (3).
5. Close the housing cover (1).
6. Download system data (see chapter "9.3.3 Downloading the system data")

### 9.3.2 Flowmeter sensor

**Warning – Electrical voltage risk!**
When the housing is open, EMC protection is impaired and protection against contact is suspended.
- Power to all connecting cables must be switched off.

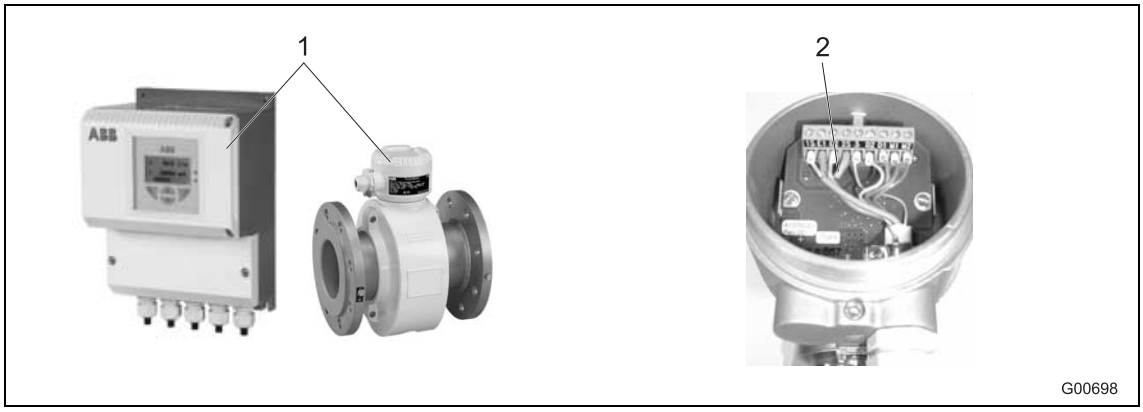



Fig. 51

Replace the flowmeter sensor as follows:

1. Switch off supply power.
2. Open the housing cover (1).
3. Disconnect the signal cable (if necessary, remove the sealing compound).
4. Install the new sensor according to the installation instructions.
5. Complete the electrical connection according to the connection diagram.
6. Close the housing cover (1).
7. Download system data (see chapter "9.3.3 Downloading the system data")

### 9.3.3 Downloading the system data

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

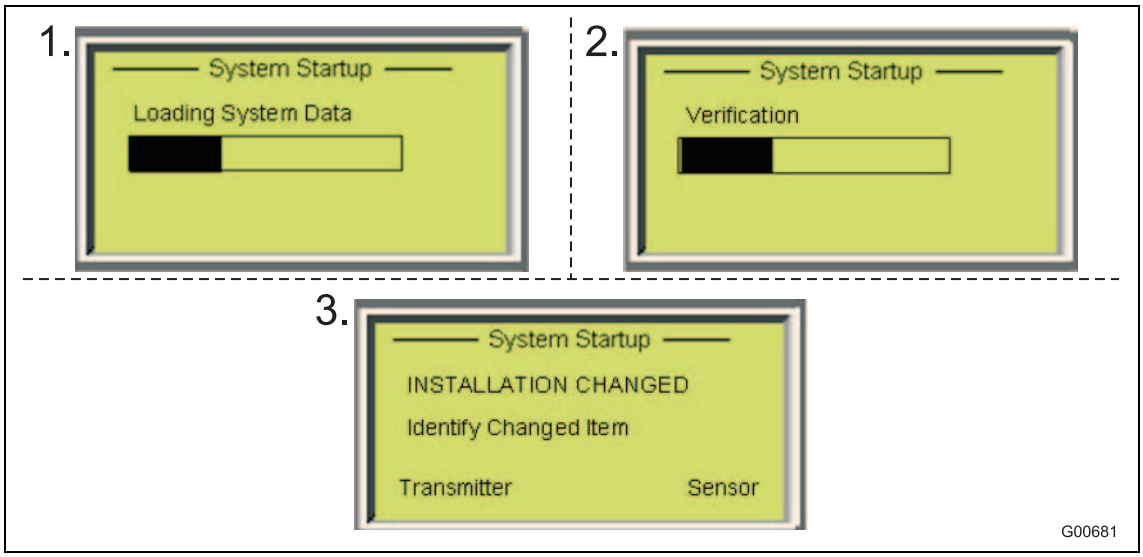



Fig. 52

2. Download the system data as follows:

**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 SensorMemory[1)] 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 SensorMemory[1)] into the transmitter.

3. The flowmeter is now ready for operation.

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

# 10 Spare parts list

## 10.1 Fuses for transmitter electronics

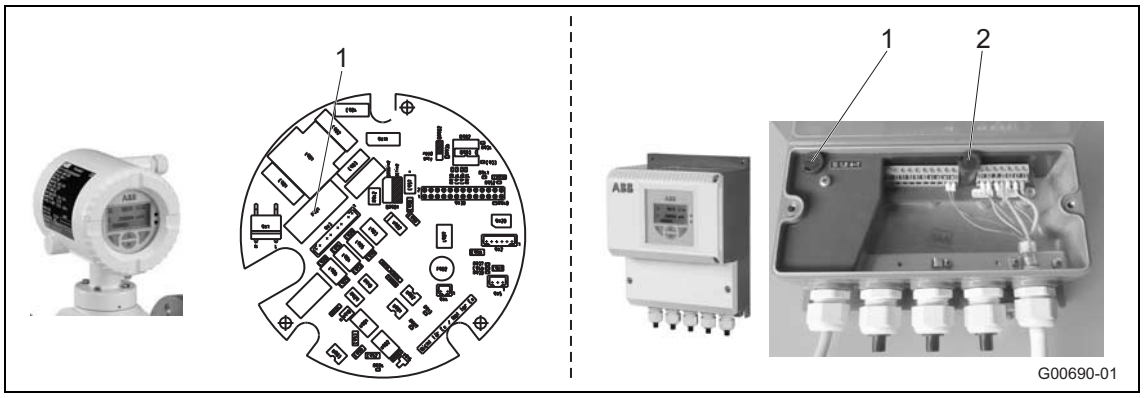



Fig. 53

| No. | Name of part | Order number |
|---|---|---|
| 1 | Fuse for supply power (1.0 A) | D151B003U05 |
| 2 | Fuse for coil circuit in the field housing unit (0.25 A) | D151B003U02 |

## 10.2 Spare parts for the compact design




Fig. 54

| No. | Name of part | Order number |
|---|---|---|
| 1 | Cable gland M20 x 1.5 | D150A008U15 |
| 2 | Housing cover with window | D612A197U01 |
| 3 | O-ring 118 x 3.7 (covered) | D101A034U05 |
| 4 | Housing cover without window | D379D172U01 |

## 10.3 Spare parts for remote design

### 10.3.1 Field-mount housing

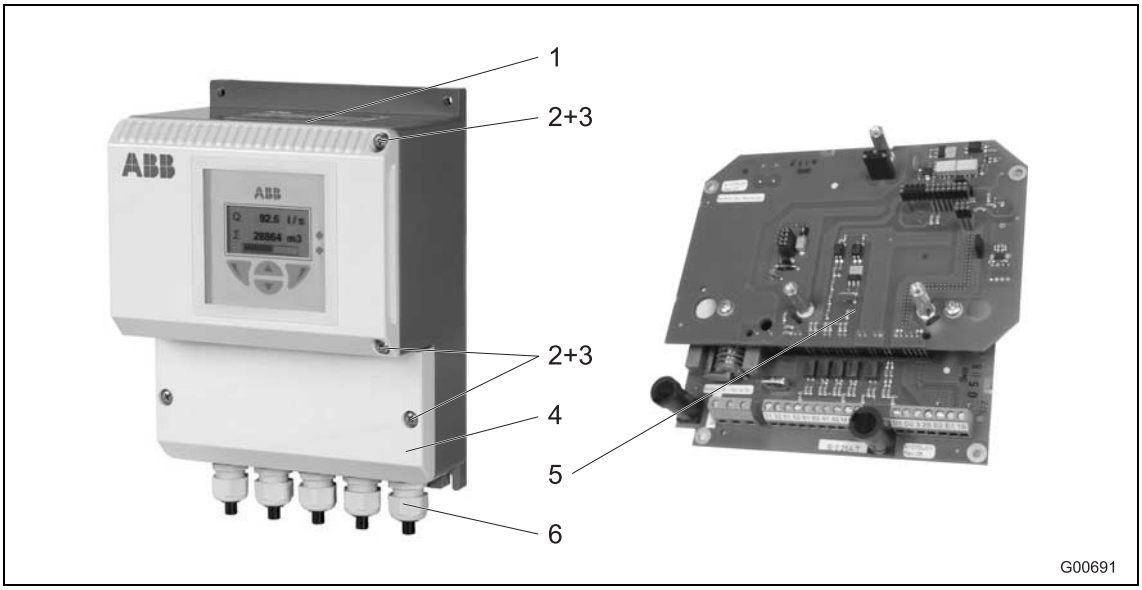



Fig. 55

| No. | Name of part | Order number |
|---|---|---|
| 1 | Field housing unit without transmitter plug-in and contact board | D641A033U06 |
| 2 | Screw | D004G108AU01 |
| 3 | spring washer | D085D020AU20 |
| 4 | Cover for connection area | D641A029U01 |
| 5 | Contact board assy | D682A016U01 |
| 6 | Cable gland M20 x 1.5 | D150A008U15 |
| 7 | Cover for supply power connection (not shown) | D355H303U01 |

### 10.3.2 Flowmeter sensor

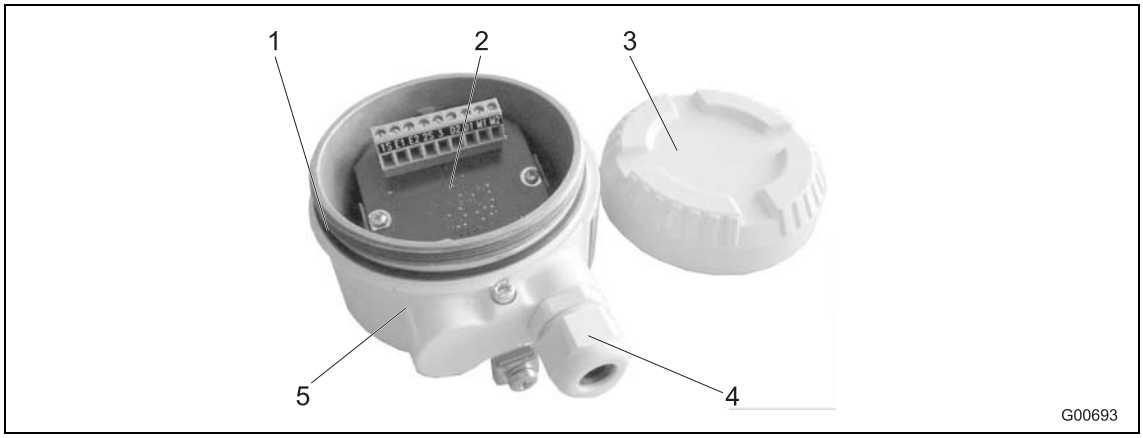



Fig. 56

| No. | Name of part | Order number | |
|---|---|---|---|
| | | for FEH model | for FEP model |
| 1 | O-ring | D101A034U06 | D101A034U06 |
| 2 | Connection board (without preamplifier) | D685A1090U01 | D685A1090U01 |
| | Connection board (with preamplifier) | D685A1089U01 | D685A1089U01 |
| 3 | Housing cover | D379D179U01 | D379D174U01 |
| 4 | Cable gland M20 x 1.5 | D150A008U15 | D150A008U15 |
| 5 | Terminal box bottom section M20 x 1.5 | D612A202U07 | D612A202U01 |
| | Terminal box bottom section 1/2“ NPT | D612A202U08 | D612A202U02 |

# 11 Performance specifications

## 11.1 General

### 11.1.1 Reference conditions according to EN 29104

| | |
|---|---|
| Fluid temperature | 20 °C (68 °F) ± 2 K |
| Ambient temperature | 20 °C (68 °F) ± 2 K |
| Supply power | Nominal voltage acc. to name plate $U_n$ ± 1 %, frequency f ± 1 % |
| Installation conditions | - Upstream >10 x DN, straight section<br>- Downstream >5 x DN, straight section |
| Warm-up phase | 30 min. |

### 11.1.2 Maximum measuring error

**Pulse output**

- Standard calibration:
  ± 0.4 % of measured value, ± 0.02 % $Qmax_{DN}$
- Optional calibration:
  ± 0.2 % of measured value, ± 0.02 % $Qmax_{DN}$

$Qmax_{DN}$: See table in Section 6.4, "Flowmeter sizes. flow range".

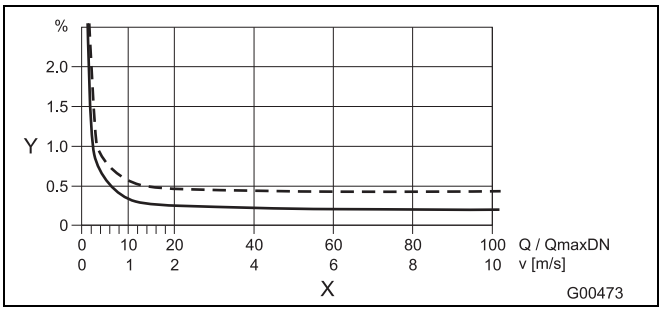



Fig. 57

Y Accuracy ± of measured value in [%]

X Flow velocity v in [m/s], Q/QmaxDN [%]

**Analog output effects**

Same as pulse output plus ± 0.1 % of measured value ± 0.01 mA

## 11.2 Reproducibility, response time

| | |
|---|---|
| Reproducibility | ≤ 0.11 % of measured value, $t_{meas}$ = 100 s, v = 0.5 ... 10 m/s |
| Response time | As step function 0 ... 99 %<br>5 τ ≥ 200 ms at 25 Hz excitation frequency<br>5 τ ≥ 400 ms at 12.5 Hz excitation frequency |

## 11.3 Transmitter

### 11.3.1 Electrical properties

| | |
|---|---|
| **Supply power** | AC: 100 ... 230 V (-15 % / +10 %)<br>AC: 24 V (-30 % / +10 %)<br>DC: 24 V (-30 % / +30 %)<br>Ripple: < 5 % |
| **Line frequency** | 47 ... 64 Hz |
| **Excitation frequency** | 6 1/4 Hz, 7 1/2 Hz, 12 1/2 Hz, 15 Hz, 25 Hz, 30 Hz (50/60 Hz supply power) |
| **Power consumption** | S ≤ 20 VA (flowmeter sensor incl. transmitter) |
| **Electr. connection** | Screw terminals |

#### 11.3.1.1 Inputs/outputs

**Isolation of input/outputs**

The current output, digital outputs DO1 and DO2, and digital input are electrically isolated from the flowmeter sensor input circuit and from each other.

#### 11.3.1.2 Empty pipe detection

The "Empty Pipe Detection" function requires:

The fluid that is being measured to have a conductivity of ≥ 20 µS/cm, and also calls for a signal cable length of ≤ 50 m (164 ft), a nominal size DN ≥ DN 10, and the absence of a preamplifier.

### 11.3.2 Mechanical properties

| | |
|---|---|
| **Compact design (Transmitter installed directly on the sensor)** | |
| **Housing** | Cast aluminum, coated |
| **Paint** | Paint coat,≥ 80 µm thick, RAL 9002, light gray |
| **Cable gland** | Polyamide |
| **Remote design** | |
| **Housing** | Cast aluminum, coated |
| **Paint** | Paint coat ≥ 80 µm thick, mid-section RAL 7012, dark gray, front cover / rear cover RAL 9002, light gray |
| **Cable gland** | Polyamide |
| **Weight** | 4.5 kg (9.92 lb) |

#### 11.3.2.1 Storage temperature, ambient temperature

**Ambient temp.**

-20 ... 60 °C (-4 ... 140 °F) standard
-40 ... 60 °C (-40 ... 140 °F) Advanced mode

**Storage Temperature**

-20 ... 70 °C (-4 ... 158 °F)

#### 11.3.2.2 Protection class for transmitter housing

IP 65 / IP 67, NEMA 4X

#### 11.3.2.3 Vibration according to EN 60068-2

Transmitter
• In the range 10 ... 58 Hz max. 0.15 mm (0.006 inch) deflection*
• In the range 58 ... 150 Hz max. 2 g acceleration*
* = Peak load

# 12 Functional and technical properties - ProcessMaster

## 12.1 Flowmeter sensor

### 12.1.1 Protection type according to EN 60529

IP 65, P 67, NEMA 4X

IP 68 (for external flowmeter sensors only)

### 12.1.2 Pipeline vibration according to EN 60068-2-6

The following applies to compact devices:

(transmitter mounted directly on the flowmeter sensor)

- In the 10 ... 58 Hz range with max. 0.15 mm (0.006 inch) deflection
- In the 58 ... 150 Hz range with max. 2 g acceleration

The following applies to devices with a separate transmitter:

Transmitter

- In the 10 ... 58 Hz range with max. 0.15 mm (0.006 inch) deflection
- In the 58 ... 150 Hz range with max. 2 g acceleration

Flowmeter sensor

- In the 10 ... 58 Hz range with max. 0.15 mm (0.006 inch) deflection
- In the 58 ... 150 Hz range with max. 2 g acceleration

### 12.1.3 Installation length

The flanged units comply with the installation lengths specified in VDI/VDE 2641, ISO 13359, or according to DVGW (process sheet W420, design WP, ISO 4064 short).

### 12.1.4 Signal cable (for external transmitters only)

A 5 m (16.4 ft) cable is supplied.

If you require more than 5 m (499.87 cm), a cable can be purchased using order number D173D027U01.

In the case of the transmitter design intended for use in Zone 1, Div 1 (Model FET325), 10 m (32.8 ft) signal cables are permanently connected to the transmitter.

#### Preamplifier

Max. signal cable length between flowmeter sensor and transmitter:

a) Without preamplifier:

- Max. 50 m (164 ft) for conductivity ≥ 5 µS/cm

A preamplifier is required for cables > 50 m (164 ft).

b) With preamplifier

- Max. 200 m (19,994.88 cm) for conductivity ≥ 5 µS/cm

### 12.1.5 Temperature range

#### Storage temperature

-20 ... 70 °C (-4 ... 70.00 °C)

**Min. permissible pressure as a function of fluid temperature:**

| Lining | Nominal size | $P_{Operating}$ at mbar abs. | $T_{Operating}$ 1) |
|---|---|---|---|
| Hard rubber | 15 ... 2000 (1/2 ... 80") | 0 | < 90 °C (194 °F) |
| Soft rubber | 50 ... 2000 (2 ... 80") | 0 | < 60 °C (140 °F) |
| PTFE<br>KTW-approved | 10 ... 600 (3/8 ... 24") | 270<br>400<br>500 | < 20 °C (68 °F)<br>< 100 °C (212 °F)<br>< 130 °C (266 °F) |
| Thick PTFE, high-temp. design | 25 … 80<br>100 … 250<br>300 | 0<br>67<br>27 | < 180 °C (356 °F)<br>< 180 °C (356 °F)<br>< 180 °C (356 °F) |
| PFA | 3 ... 200 (1/10 ... 8") | 0 | < 180 °C (356 °F) |
| ETFE | 25 ... 1000 (1 ... 40") | 100 | < 130 °C (266 °F) |

1) For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to the table titled "Max. permissible cleaning temperature".

**Max. permissible cleaning temperature:**

| CIP cleaning | Sensor lining | $T_{max}$ | $T_{max}$ minutes | $T_{amb.}$ |
|---|---|---|---|---|
| Steam cleaning | PTFE, PFA | 150 °C (302 °F) | 60 | 25 °C (77 °F) |
| Fluids | PTFE, PFA | 140 °C (284 °F) | 60 | 25 °C (77 °F) |

If the ambient temperature is > 25 °C, the difference must be subtracted from the max. cleaning temperature. $T_{max}$ - Δ °C.

( Δ °C = $T_{amb}$ - 25 °C)

### Max. ambient temperature as a function of fluid temperature:

**Important**
When using the device in potentially explosive atmospheres, please observe the additional temperature specifications in the section of this data sheet titled "Ex relevant specifications" and the separate Ex safety instructions (SM/FEP300/FEH300/ATEX/IECEX) and (SM/FEP300/FEH300/FM/CSA).

**Models FEP311, FEP315 (standard temperature version)**

| Lining | Flange material | Ambient temperature | | Fluid temperature | |
|---|---|---|---|---|---|
| | | Min. temp. | Max. temp. | Min. temp. | Max. temp. |
| Hard rubber | Steel | -10 °C (14°F) | 60 °C (140 °F) | -10 °C (14°F) | 90 °C (194 °F) |
| Hard rubber | Stainless steel | -15 °C (5 °F) | 60 °C (140 °F) | -15 °C (5 °F) | 90 °C (194 °F) |
| Soft rubber | Steel | -10 °C (14°F) | 60 °C (140 °F) | -10 °C (14°F) | 60 °C (140 °F) |
| Soft rubber | Stainless steel | -15 °C (5 °F) | 60 °C (140 °F) | -15 °C (5 °F) | 60 °C (140 °F) |
| PTFE | Steel | -10 °C (14°F) | 60 °C (140 °F)<br>45 °C (113 °F) | -10 °C (14°F) | 90 °C (194 °F)<br>130 °C (266 °F) |
| PTFE | Stainless steel | -20 °C (-4 °F) | 60 °C (140 °F)<br>45 °C (113 °F) | -25 °C (-13 °F) | 90 °C (194 °F)<br>130 °C (266 °F) |
| PFA [1] | Steel | -10 °C (14°F) | 60 °C (140 °F)<br>45 °C (113 °F) | -10 °C (14°F) | 90 °C (194 °F)<br>130 °C (266 °F) |
| PFA [1] | Stainless steel | -20 °C (-4 °F) | 60 °C (140 °F)<br>45 °C (113 °F) | -25 °C (-13 °F) | 90 °C (194 °F)<br>130 °C (266 °F) |
| Thick PTFE [2] | Steel | -10 °C (14°F) | 60 °C (140 °F)<br>45 °C (113 °F) | -10 °C (14°F) | 90 °C (194 °F)<br>130 °C (266 °F) |
| Thick PTFE [2] | Stainless steel | -20 °C (-4 °F) | 60 °C (140 °F)<br>45 °C (113 °F) | -25 °C (-13 °F) | 90 °C (194 °F)<br>130 °C (266 °F) |
| ETFE [3] | Steel | -10 °C (14°F) | 60 °C (140 °F)<br>45 °C (113 °F) | -10 °C (14°F) | 90 °C (194 °F)<br>130 °C (266 °F) |
| ETFE [3] | Stainless steel | -20 °C (-4 °F) | 60 °C (140 °F)<br>45 °C (113 °F) | -25 °C (-13 °F) | 90 °C (194 °F)<br>130 °C (266 °F) |

**Models FEP311, FEP315 (high-temperature version)**

| Lining | Flange material | Ambient temperature | | Fluid temperature | |
|---|---|---|---|---|---|
| | | Min. temp. | Max. temp. | Min. temp. | Max. temp. |
| PFA [1] | Steel | -10 °C (14°F) | 60 °C (140 °F) | -10 °C (14°F) | 180 °C (356 °F) |
| PFA [1] | Stainless steel | -20 °C (-4 °F) | 60 °C (140 °F) | -20 °C (-13 °F) | 180 °C (356 °F) |
| Thick PTFE [2] | Steel | -10 °C (14°F) | 60 °C (140 °F) | -10 °C (14°F) | 180 °C (356 °F) |
| Thick PTFE [2] | Stainless steel | -20 °C (-4 °F) | 60 °C (140 °F) | -20 °C (-13 °F) | 180 °C (356 °F) |
| ETFE [3] | Steel | -10 °C (14°F) | 60 °C (140 °F) | -10 °C (14°F) | 130 °C (266 °F) |
| ETFE [3] | Stainless steel | -20 °C (-4 °F) | 60 °C (140 °F) | -20 °C (-13 °F) | 130 °C (266 °F) |

1) PFA (high-temperature version) can be obtained for nominal sizes ≥ DN 10
2) Thick PTFE can be obtained for nominal sizes ≥ DN 25
3) ETFE can be obtained for nominal sizes ≥ DN 25

**Important**
When using the device in potentially explosive atmospheres, please observe the additional temperature specifications in the section of this data sheet titled "Ex relevant specifications" and the separate Ex safety instructions (SM/FEP300/FEH300/ATEX/IECEX) and (SM/FEP300/FEH300/FM/CSA).

**Models FEP321, FEP325 (standard temperature version)**

| Lining | Flange material | Ambient temperature | | Fluid temperature | |
|---|---|---|---|---|---|
| | | Min. temp. | Max. temp. | Min. temp. | Max. temp. |
| Hard rubber | Steel | -10 °C (14°F) | 60 °C (140 °F) | -10 °C (14°F) | 90 °C (194 °F) |
| Hard rubber | Stainless steel | -15 °C (5 °F) | 60 °C (140 °F) | -15 °C (5 °F) | 90 °C (194 °F) |
| Soft rubber | Steel | -10 °C (14°F) | 60 °C (140 °F) | -10 °C (14°F) | 60 °C (140 °F) |
| Soft rubber | Stainless steel | -15 °C (5 °F) | 60 °C (140 °F) | -15 °C (5 °F) | 60 °C (140 °F) |
| PTFE | Steel | -10 °C (14°F) | 60 °C (140 °F) | -10 °C (14°F) | 130 °C (266 °F) |
| PTFE | Stainless steel | -25 °C (-13 °F) | 60 °C (140 °F) | -25 °C (-13 °F) | 130 °C (266 °F) |
| PFA [1] | Steel | -10 °C (14°F) | 60 °C (140 °F) | -10 °C (14°F) | 130 °C (266 °F) |
| PFA [1] | Stainless steel | -25 °C (-13 °F) | 60 °C (140 °F) | -25 °C (-13 °F) | 130 °C (266 °F) |
| Thick PTFE [2] | Steel | -10 °C (14°F) | 60 °C (140 °F) | -10 °C (14°F) | 130 °C (266 °F) |
| Thick PTFE [2] | Stainless steel | -25 °C (-13 °F) | 60 °C (140 °F) | -25 °C (-13 °F) | 130 °C (266 °F) |
| ETFE [3] | Steel | -10 °C (14°F) | 60 °C (140 °F) | -10 °C (14°F) | 130 °C (266 °F) |
| ETFE [3] | Stainless steel | -25 °C (-13 °F) | 60 °C (140 °F) | -25 °C (-13 °F) | 130 °C (266 °F) |

**Models FEP321, FEP325 (high-temperature version)**

| Lining | Flange material | Ambient temperature | | Fluid temperature | |
|---|---|---|---|---|---|
| | | Min. temp. | Max. temp. | Min. temp. | Max. temp. |
| PFA [1] | Steel | -10 °C (14°F) | 60 °C (140 °F) | -10 °C (14°F) | 180 °C (356 °F) |
| PFA [1] | Stainless steel | -25 °C (-13 °F) | 60 °C (140 °F) | -25 °C (-13 °F) | 180 °C (356 °F) |
| Thick PTFE [2] | Steel | -10 °C (14°F) | 60 °C (140 °F) | -10 °C (14°F) | 180 °C (356 °F) |
| Thick PTFE [2] | Stainless steel | -25 °C (-13 °F) | 60 °C (140 °F) | -25 °C (-13 °F) | 180 °C (356 °F) |
| ETFE [3] | Steel | -10 °C (14°F) | 60 °C (140 °F) | -10 °C (14°F) | 130 °C (266 °F) |
| ETFE [3] | Stainless steel | -25 °C (-13 °F) | 60 °C (140 °F) | -25 °C (-13 °F) | 130 °C (266 °F) |

1) PFA (high-temperature version) can be obtained for nominal sizes ≥ DN 10
2) Thick PTFE can be obtained for nominal sizes ≥ DN 25
3) ETFE can be obtained for nominal sizes ≥ DN 25

## 12.1.6 Material load

Limits for the permissible fluid temperature (TS) and permissible pressure (PS) are calculated on the basis of the lining and flange material used in the device (refer to the name plate on the device).

**DIN flange, stainless steel, 1.4571 [316Ti] up to DN 600 (24")**

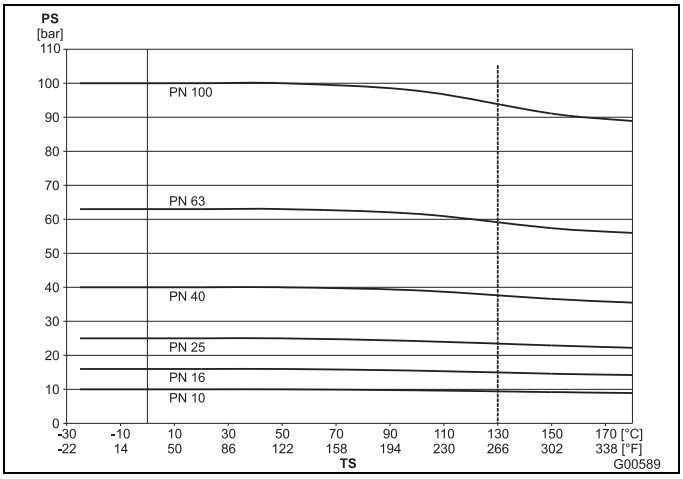



Fig. 58:

**ASME flange, stainless steel 1.4571 [316TI], up to DN 300 (12") (CL150/300); up to DN 1000 (40") (CL150)**

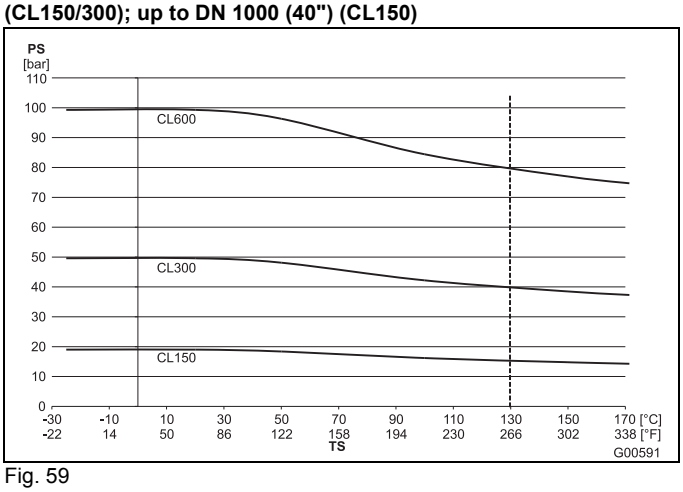



Fig. 59

**DIN flange, steel, up to DN 600 (24")**

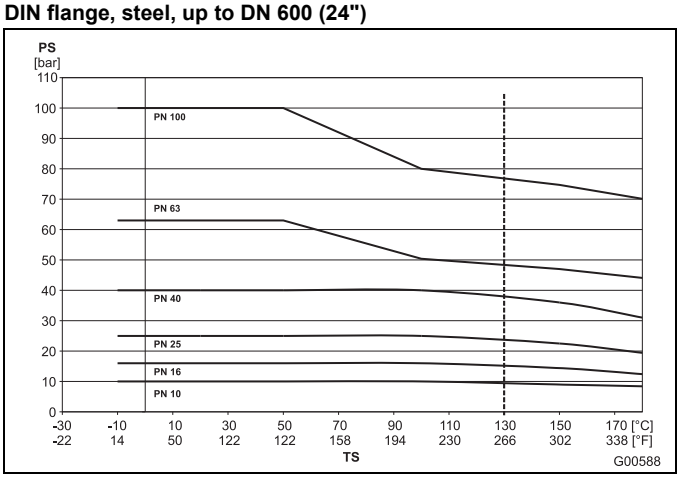



Fig. 60

**ASME flange, steel, up to DN 300 (12") (CL150/300); up to DN 1000 (40") (CL150)**

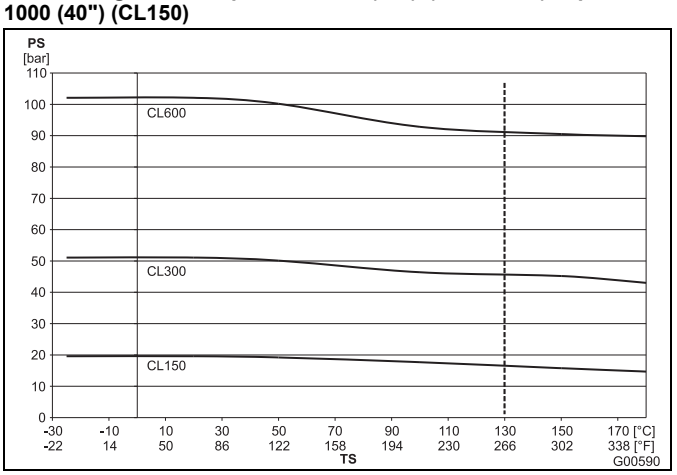



Fig. 61

**JIS 10K-B2210 flange**

| Nominal size | Material | PN | TS | PS [bar] |
|---|---|---|---|---|
| 32 ... 100 (1 1/4 ... 4") | Stainless steel 1.4571[316Ti] | 10 | -25 ... 180 °C (-13 ... 356 °F) | 10 (145 psi) |
| 32 ... 100 (1 1/4 ... 4") | Steel | 10 | -25 ... 180 °C (14 ... 356 °F) | 10 (145 psi) |

**DIN flange, stainless steel 1.4571 [316Ti], DN 700 (28") up to DN 1000 (40")**

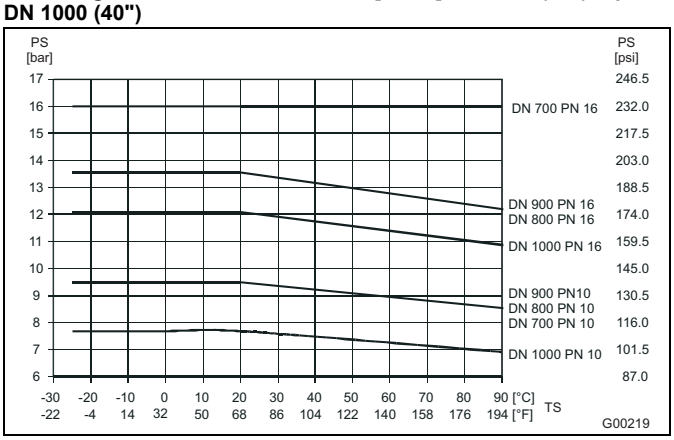



Fig. 62

**DIN flange, steel, DN 700 (28") up to DN 1000 (40")**

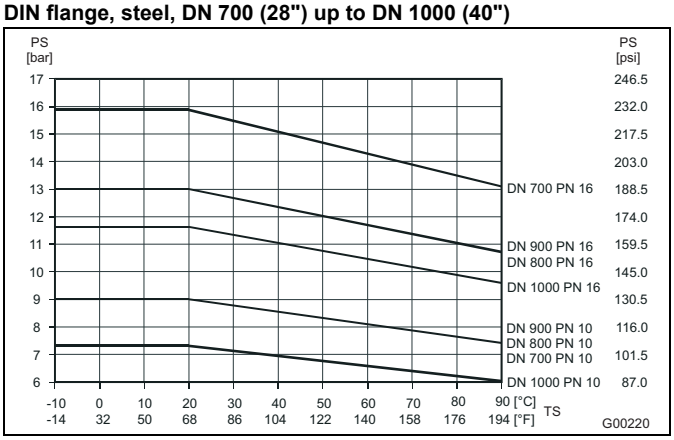



Fig. 63

### 12.1.7 Sensor

**Process-wetted parts**

| Part | Standard | Option |
|---|---|---|
| **Liner** | PTFE, PFA, ETFE, hard rubber, soft rubber | – |
| **Measurement and grounding electrode for:**<br>- Hard rubber<br>- Soft rubber | Stainless steel 1.4571 [316Ti] | Hastelloy B-3 (2.4600), Hastelloy C-4 (2.4610) , titanium, tantalum, platinum-iridium, 1.4539 [904L] |
| - PTFE, PFA, ETFE | Stainless steel 1.4539 [904L] | Stainless steel 1.4571 [316Ti]<br>Hast. C-4 (2.4610)<br>Hast. B-3 (2.4600)<br>Titanium, tantalum, platinum-iridium |
| **Grounding plate** | Stainless steel 1.4571 [316Ti] | upon request |
| **Protection plate** | Stainless steel 1.4571 [316Ti] | upon request |

**Non-wetted parts**

| | Standard | Option |
|---|---|---|
| **Flanges**<br>DN 3 ... 15 (1/10 ... 1/2")<br>DN 20 ... 400 (3/4 ... 16") | Stainless steel 1.4571 [316Ti] (standard)<br>Steel (galvanized)<br>DIN/EN flange: RST37/ST52/C22-8<br>ASME flange: A105/C21 | Stainless steel 1.4571-[316Ti] |
| DN 450 ... 2000 (18 ... 80") | Steel (painted)<br>DIN/EN flange: RST37/ST52/C22-8<br>ASME flange: A105/C21 | Stainless steel 1.4571-[316Ti] |

**Sensor housing**

| | Standard | Option |
|---|---|---|
| **Housing**<br>DN 3 ... 400 (1/10 ... 16") | Dual-shell casing, cast aluminum, painted, paint coat, ≥ 80 µm thick, RAL 9002 | – |
| DN 450 ... 2000 (18 ... 80") | Welded steel design, painted, paint coat, ≥ 80 µm thick, RAL 9002 | – |
| **Connection box** | Aluminum alloy, painted, ≥ 80 µm thick, light gray, RAL 9002 | – |
| **Meter tube** | SS 1.4301 | – |
| **PG-Connector** | Polyamide | – |

# 13 Functional and technical properties - HygienicMaster

## 13.1 Flowmeter sensor

### 13.1.1 Protection type according to EN 60529

IP 65, IP 67, NEMA 4X

IP 68 (for external flowmeter sensors only)

### 13.1.2 Pipeline vibration according to EN 60068-2-6

The following applies to compact devices:

(transmitter mounted directly on the flowmeter sensor)

- In the 10 ... 58 Hz range with max. 0.15 mm (0.006 inch) deflection
- In the 58 ... 150 Hz range with max. 2 g acceleration

The following applies to devices with a separate transmitter:

Transmitter

- In the 10 ... 58 Hz range with max. 0.15 mm (0.006 inch) deflection
- In the 58 ... 150 Hz range with max. 2 g acceleration

Flowmeter sensor

- In the 10 ... 58 Hz range with max. 0.15 mm (0.006 inch) deflection
- In the 58 ... 150 Hz range with max. 2 g acceleration

### 13.1.3 Installation length

The flanged units comply with the installation lengths specified in VDI/VDE 2641, ISO 13359, or according to DVGW (process sheet W420, design WP, ISO 4064 short).

### 13.1.4 Signal cable (for external transmitters only)

A 5 m (16.4 ft) cable is supplied.

If you require more than 5 m (16.4 ft), a cable can be purchased using order number D173D027U01.

#### Preamplifier

Max. signal cable length between flowmeter sensor and transmitter:

a) Without preamplifier:

- Max. 50 m (164 ft) for conductivity ≥ 5 µS/cm

A preamplifier is required for cables > 50 m (164 ft).

b) With preamplifier

- Max. 200 m (656 ft) for conductivity ≥ 5 µS/cm

### 13.1.5 Temperature range

#### Storage temperature

- 20 ... 70 °C (-4 ... 158 °F)

#### Min. permissible pressure as a function of fluid temperature

| Lining | Nominal size | $P_{Operating}$ at mbar abs. | $T_{Operating}$* |
|---|---|---|---|
| PFA | 3 ... 100 (1/10 ... 4") | 0 | < 180 °C (356 °F) |

* For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to the table titled "Maximum permissible cleaning temperature".

#### Max. permissible cleaning temperature

| CIP cleaning | Flowmeter sensor lining | $T_{max}$ | $T_{max}$ minutes | $T_{amb.}$ |
|---|---|---|---|---|
| Steam cleaning | PFA | 150 °C (302 °F) | 60 | 25 °C (77 °F) |
| Liquid cleaning | PFA | 140 °C (284 °F) | 60 | 25 °C (77 °F) |

If the ambient temperature is > 25 °C, the difference must be subtracted from the max. cleaning temperature. $T_{max}$ - Δ °C.

( Δ °C = $T_{amb}$ - 25 °C)

#### Max. permissible temperature shock

| Lining | Max. temp. shock Temp. diff. in °C | Temp. gradient °C/min |
|---|---|---|
| PFA | Any | Any |

### Max. ambient temperature as a function of fluid temperature

**Important**
When using the device in potentially explosive atmospheres, please observe the additional temperature specifications in the section of this data sheet titled "Ex relevant specifications" and the separate Ex safety instructions (SM/FEP300/FEH300/ATEX/IECEX) and (SM/FEP300/FEH300/FM/CSA).

**Models FEH311, FEH315 (standard temperature version)**

| Lining | Process connection | Ambient temperature | | Fluid temperature | |
|---|---|---|---|---|---|
| | | Min. temp. | Max. temp. | Min. temp. | Max. temp. |
| PFA | Flange | -20 °C (-4 °F) | 60 °C (140 °F)<br>40 °C (104 °F) | -25 °C (-13 °F) | 100 °C (212 °F)<br>130 °C (266 °F) |
| PFA | Variable process connections | -20 °C (-4 °F) | 60 °C (140 °F)<br>40 °C (104 °F) | -25 °C (-13 °F) | 100 °C (212 °F)<br>130 °C (266 °F) |

**Models FEH311, FEH315 (high-temperature version)**

| Lining | Process connection | Ambient temperature | | Fluid temperature | |
|---|---|---|---|---|---|
| | | Min. temp. | Max. temp. | Min. temp. | Max. temp. |
| PFA | Flange | -20 °C (-4 °F) | 60 °C (140 °F) | -25 °C (-13 °F) | 180 °C (356 °F) |

Comment:
PFA (high-temperature version) can be obtained for nominal sizes ≥ DN 10

**Models FEH321, FEH325 (standard temperature version)**

| Lining | Process connection | Ambient temperature | | Fluid temperature | |
|---|---|---|---|---|---|
| | | Min. temp. | Max. temp. | Min. temp. | Max. temp. |
| PFA | Flange | -25 °C (-13 °F) | 60 °C (140 °F)<br>40 °C (104 °F) | -25 °C (-13 °F) | 100 °C (212 °F)<br>130 °C (266 °F) |
| PFA | Variable process connections | -25 °C (-13 °F) | 60 °C (140 °F)<br>40 °C (104 °F) | -25 °C (-13 °F) | 100 °C (212 °F)<br>130 °C (266 °F) |

**Models FEH321, FEH325 (high-temperature version)**

| Lining | Process connection | Ambient temperature | | Fluid temperature | |
|---|---|---|---|---|---|
| | | Min. temp. | Max. temp. | Min. temp. | Max. temp. |
| PFA | Flange | -25 °C (-13 °F) | 60 °C (140 °F) | -25 °C (-13 °F) | 180 °C (356 °F) |

### 13.1.6 Material load

Limits for the permissible fluid temperature (TS) and permissible pressure (PS) are calculated on the basis of the lining and flange material used in the device (refer to the name plate on the device).

| Process connection | Nominal size | PS max bar (PSI) | TS |
|---|---|---|---|
| Wafer flange | DN 3 ... 50 (1/10 ... 2“)<br>DN 65 ... 100 (2 1/2 ... 4“) | 40 (580)<br>16 (232) | -25 ... 130 °C (-13 ... 266 °F) |
| Weld stubs | DN 3 ... 40 (1/10 ... 1 1/2“)<br>DN 50, DN 80 (2“, 3“)<br>DN 65, DN 100 (2 1/2“, 4“) | 40 (580)<br>16 (232)<br>10 (145) | -25 ... 130 °C (-13 ... 266 °F) |
| Threaded pipe connection in acc. with DIN 11851 | DN 3 ... 40 (1/10 ... 1 1/2“) | 40 (580) | -25 ... 130 °C (-13 ... 266 °F) |
| | DN 50, DN 80 (2“, 3“) | 16 (232) | |
| | DN 65, DN 100 (2 1/2“, 4“) | 10 (145) | |
| Tri-Clamp in acc. with DIN 32676 | DN 3 ... 50 (1/10 ... 2“)<br>DN 65 ... 100 (2 1/2 ... 4“) | 16 (232)<br>10 (145) | -25 ... 121 °C (-13 ... 250 °F) |
| Tri-Clamp in acc. with ASME BPE | DN 3 ... 100 (1/10 ... 4“) | 10 (145) | -25 ... 130 °C (-13 ... 266 °F) |
| External threads ISO 228 | DN 3 ... 25 (1/10 ... 1“) | 16 (232) | -25 ... 130 °C (-13 ... 266 °F) |
| OD tubing | DN 3 ... 100 (1/10 ... 4“) | 10 (145) | -25 ... 130 °C (-13 ... 266 °F) |

**DIN flange, stainless steel, 1.4571 [316Ti] up to DN 100 (4")**

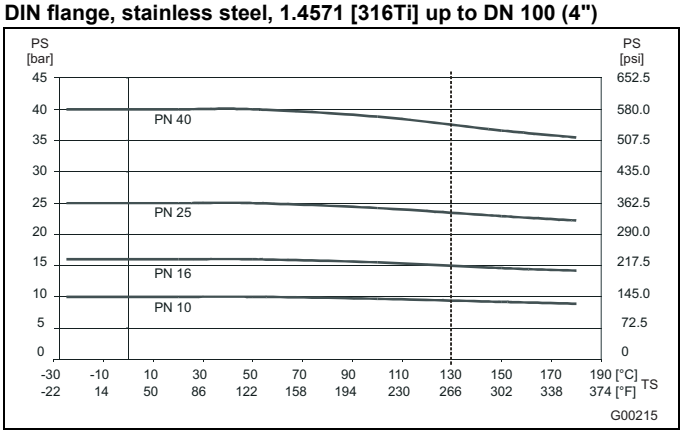



Fig. 64

**ASME flange, stainless steel 1.4571 [316TI], up to DN 100 (4") (CL150/300)**

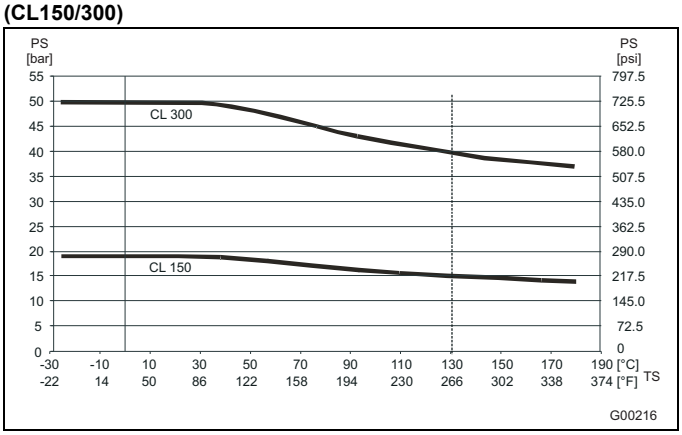



Fig. 65

For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to the table titled "Maximum permissible cleaning temperature".

**JIS 10K-B2210 flange**

| Nominal size | Material | PN | TS | PS [bar] |
|---|---|---|---|---|
| 25 ... 100 (1 ... 4") | Stainless steel 1.4571 [316Ti] | 10 | -25 ... 180 °C (-13 ... 356 °F) | 10 (145 psi) |

**Wafer flange design**

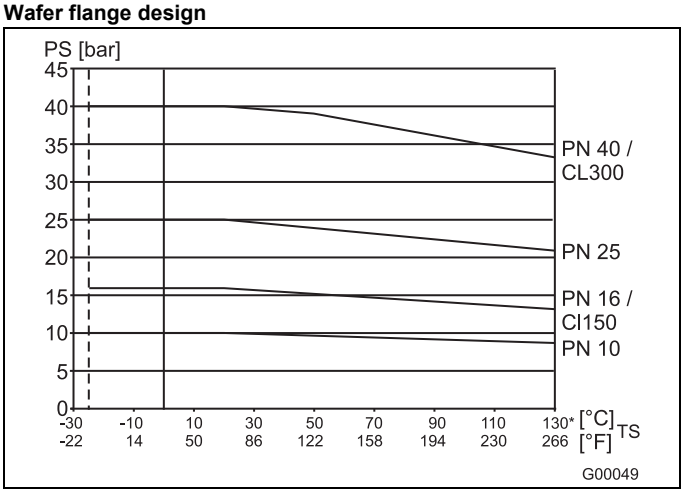



Fig. 66

**JIS 10K-B2210 wafer flange design**

| Nominal size | Material | PN | TS | PS [bar] |
|---|---|---|---|---|
| DN 32 ... 100 (1 1/4 ... 4") | 1.4404<br>1.4435<br>1.4301 | 10 | -25 ... 130 °C (-13 ... 266 °F) | 10 (145 psi) |

### 13.1.7 Mechanical properties

**Parts that come into contact with fluid**

| Part | Standard | Option |
|---|---|---|
| **Lining** | PFA | - |
| **Signal and grounding electrode** | Stainless steel 1.4539 [904L] | Stainless steel 1.4571 [316Ti]<br>Hast. C-4 (2.4610)<br>Hast. B-3 (2.4600)<br>Titanium, tantalum, platinum-iridium |
| **Gaskets** | EPDM | Silicone |
| **Process connection (welded stubs, Tri-Clamp, etc.)** | Stainless steel 1.4404 [316L] | - |

**Parts that do not come into contact with fluid**

| | Standard | Option |
|---|---|---|
| **Flange** | Stainless steel 1.4571 [316Ti] | - |

**Flowmeter sensor housing**

| | Standard | Option |
|---|---|---|
| **Housing** | Deep-drawn housing<br>Stainless steel 1.4301 [304], 1.4308 | – |
| **Connection box** | Stainless steel 1.4308 [304] | – |
| **Meter tube** | Stainless steel 1.4301 [304] | – |
| **PG cable gland** | Polyamide | – |

# 14 Appendix

## 14.1 Additional documents

- Commissioning Instructions (CI/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)

## 14.2 Approvals and certifications

| | | |
|---|---|---|
| CE mark | CE | The version of the meter in your possession meets the requirements of the following European directives:<br>- EMC directive 2004/108/EC<br>- Low voltage directive 2006/95/EC<br>- Pressure equipment directive (PED) 97/23/EC<br>- ATEX directive 94/9/EC |
| Explosion Protection | Ex | Identification for intended use in potentially explosive atmospheres according to:<br>- ATEX directive (marking in addition to CE marking) |
| | IECEx | - IEC standards |
| | FM APPROVED | - FM Approvals (US) |
| | C FM APPROVED | - cFM Approvals (Canada) |

# EG-Konformitätserklärung
# *EC-Declaration of Conformity*

CE

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 instrumenst 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:<br>*Manufacturer:* | ABB Automation Products GmbH,<br>Dransfelder Straße 2, 37079 Göttingen - Germany |
| Gerät:<br>*Device:* | Electromagnetic Flowmeter<br>ProcessMaster & HygienicMaster |
| Modellnr.:<br>*Model no.:* | FE_3_ |
| Richtlinie:<br>*Directive:* | EMV Richtlinie 20004/108/EG *<br>*EMC directive 2004/108/EC* |
| Europäische Norm:<br>*European Standard:* | EN 61326-1, 10/2006 * EN 61326-2-3, 05/2007<br>*EN 61326-1, 10/2006 * EN 61326-2-3, 05/2007* |
| Richtlinie:<br>*Directive:* | Niederspannungsrichtlinie 2006/95/EG *<br>*Low voltage directive 2006/95/EC* |
| Europäische Norm:<br>*European Standard:* | EN 61010-1, 08/2002 *<br>*EN 61010-1, 08/2002* |

* einschließlich Nachträge / *including alterations*

Göttingen, 19. März 2008

ppa Dr. Dieter Binz
(R&D Manager)

i.A. Dirk Steckel
(R&D Electrical Safety)

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BZ-13-5112, Rev.01, 11119

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# EG-Konformitätserklärung
# *EC-Declaration of Conformity*

CE 0045

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

Göttingen, den 28.08.2007

ppa .....
(J. Harr, Standortleiter APR Göttingen)

2310 BZ-25-0002 Rev.05

## 14.3 Overview of setting parameters and technical design

| | | |
|---|---|---|
| Measuring point: | | TAG no.: |
| Sensor model: | | Transmitter type: |
| Order no.: | Device no.: | Order no.: |
| Measured medium temp.: | | Voltage supply: |
| Lining: | Electrodes: | |
| $S_s$: | $S_z$: | |

| Parameter | | Setting range |
|---|---|---|
| Language: | ..... | e.g., German, English, French, etc. |
| Nominal size: | ..... | DN 3 ... 2400 |
| $Q_{max}$: | ..... | 0.05 $Q_{max}$DN -2 $Q_{max}$DN |
| Pulse factor: | ..... | 0.001 - 1000 pulse/phys. unit |
| Pulse width: | ..... | 0.100 - 2,000 ms |
| Low cut-off setting: | ..... | 0 ... 10% of flow range end value |
| Damping: | ..... | 0.5 ... 99.99 seconds |
| Noise reduction: | ..... | ON / OFF |
| Unit $Q_{max}$.: | ..... | e.g., l/s, l/min, l/h, hl/s, hl/min, hl/h, etc. |
| Unit totalizer: | ..... | e.g., l, hl, $m^3$, igal, gal, etc. |
| Max. alarm: | ..... | % |
| Min. alarm: | ..... | % |
| Digital output DO1: | ..... | Pulse output or digital output |
| Mode for digital output DO1: | ..... | Active or Passive |
| Digital output DO2: | ..... | Forward/reverse direction signal, Max. alarm, Min. alarm, General alarm |
| Digital input DI: | ..... | External cutoff, totalizer reset, no function |
| Current output: | ..... | 4-20 mA, 4-12-20 mA |
| $I_{out}$ with alarm: | ..... | Low, High |
| Detector e. pipe: | ..... | ON / OFF |
| Alarm e. pipe: | ..... | ON / OFF |
| $I_{out}$ with empty pipe: | ..... | Low, High |
| Totalizer function: | ..... | Standard, difference totalizer |
| Display line 1: | ..... | Q (%), Q (unit), Q (mA), counter V/R, TAG number, blank line, bar graph |
| Display line 2: | ..... | Q (%), Q (unit), Q (mA), counter V/R, TAG number, blank line, bar graph |
| Flow direction: | ..... | Supply/Return, forward |
| Directional display: | ..... | Standard, inverse |

# Statement on the contamination of devices and components

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

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

**Customer details:**

| | |
|---|---|
| Company: | |
| Address: | |
| Contact person: | Telephone: |
| Fax: | E-mail: |

**Device details:**

| | |
|---|---|
| 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 |

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Printed in the Fed. Rep. of Germany (06.2009)

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3KXF231300R4201

OI/FEP300/FEH300-EN Rev. B

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