Operating Instruction

OI/FEX300/FEX500-EN

Electromagnetic Flowmeter ProcessMaster, HygienicMaster FEX300, FEX500

Valid as of software version

- 01.01.00 with HART
- 00.01.00 with PROFIBUS PA or FOUNDATION fieldbus

HART COMMUNICATION PROTOCOL

PROFIBUS PROCESS FIELD BUS

Fieldbus Foundation

ABB

Electromagnetic Flowmeter
ProcessMaster, HygienicMaster
FEX300, FEX500

Operating Instruction

OI/FEX300/FEX500-EN

05.2012
Rev. F

Translation of the original instruction

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1 Safety

1.1 General information and notes for the reader

You must 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 future reference.

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 if 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 perfect working order from a safety perspective. 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 instructions 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 (Note)

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

The icon on the name plate indicates the following:

1.2 Intended use

This device is intended for the following uses:

- To transmit fluid, pulpy or pasty substances with electrical conductivity.
- To measure the flowrate of the operating volume or mass flow units (at constant pressure / temperature), if a mass 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 1.11 „Technical limit values“.
- Use only allowed liquids for measurement; refer to the section 1.12 „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

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.

1.6 Plates and symbols

1.6.1 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.

NOTICE – <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 (NOTE)

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

1.6.2 Name plate

Important (Note)

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.

1.6.2.1 Name plate for compact design

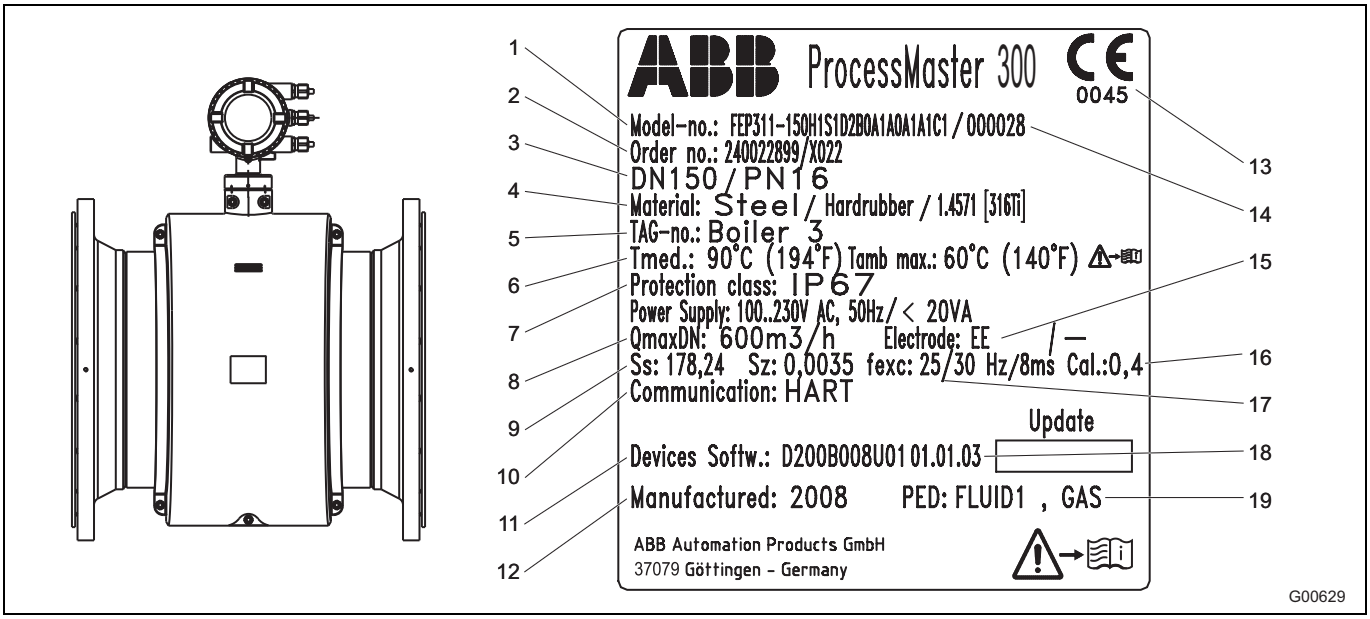


Fig. 1: Compact device (e.g., transmitter with dual-compartment housing)

1 Model number (for more detailed information about the technical design, refer to the data sheet or the order confirmation)
2 Project number
3 Meter size and nominal pressure rating
4 Material: Flange / lining / electrode
5 Client-specific TAG number (if specified)
6 T_{med} = maximum permissible fluid temperature
T_{amb} = maximum permissible ambient temperature
7 Protection type according to 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 of manufacture
13 CE mark
14 Serial number for identification by the manufacturer
15 Supplementary 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 sensor coils
18 Version level (xx.xx.xx)
19 Label indicating whether the unit is subject to 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 not subject to the Pressure Equipment Directive 97/23/EC, it is classified in accordance with SEP (= sound engineering practice) as per Art. 3 Para. 3 of the PED.
If no such information is present, it means that the device does not claim to comply with the requirements of the Pressure Equipment Directive 97/23/EC. Water supplies and connected equipment accessories are classed as an exception in accordance with guideline 1/16 of Art. 1, Para. 3.2 of the Pressure Equipment Directive.

Important (Note)

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

1.6.2.2 Name plate for the remote design

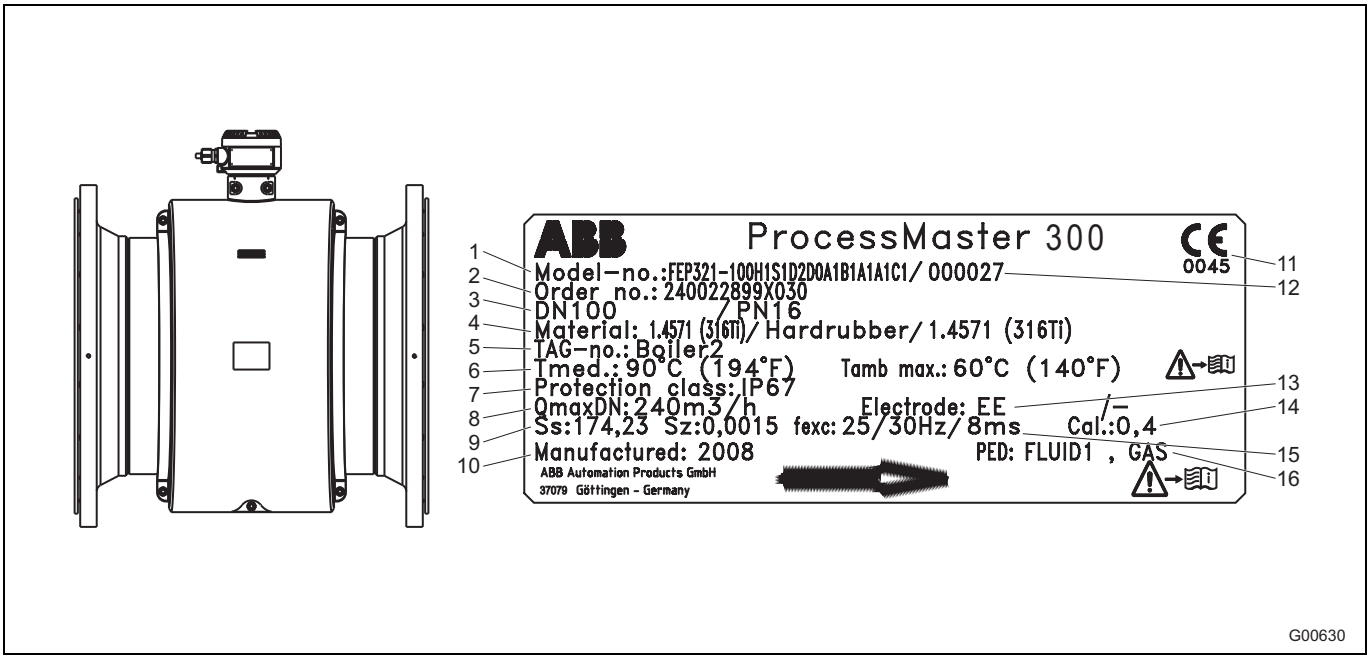


Fig. 2: Remote design

1 Model number (for more detailed information about the technical design, refer to the data sheet or the order confirmation)
2 Project number
3 Meter size and nominal pressure rating
4 Material: Flange / lining / electrode
5 Client-specific TAG number (if specified)
6 T_{med} = maximum permissible fluid temperature
T_{amb} = maximum permissible ambient temperature
7 Protection type according to EN 60529
8 Calibration value Qmax DN
9 Calibration value Ss (span)
Calibration value Sz (zero point)
10 Year of manufacture
11 CE mark
12 Serial number for identification by the manufacturer
13 Supplementary 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 sensor coils
16 Label indicating whether the unit is subject to 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 not subject to the Pressure Equipment Directive 97/23/EC, it is classified in accordance with SEP (= sound engineering practice) as per Art. 3 Para. 3 of the PED.
If no such information is present, it means that the device does not claim to comply with the requirements of the Pressure Equipment Directive 97/23/EC. Water supplies and connected equipment accessories are classed as an exception in accordance with guideline 1/16 of Art. 1, Para. 3.2 of the Pressure Equipment Directive.

Important (Note)

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

1.6.2.3 Name plate for transmitter

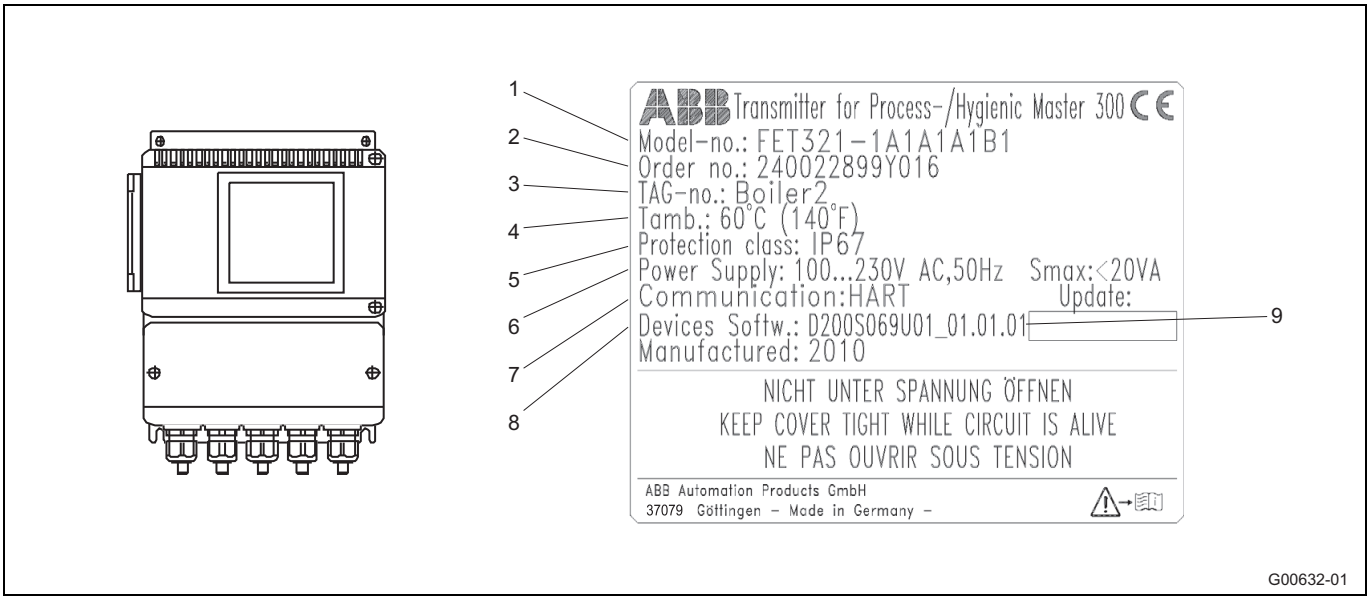


Fig. 3: External transmitter (e.g., transmitter with dual-compartment housing)

1 Model number (for more detailed information about the technical design, refer to the data sheet or the order confirmation)
2 Project number
3 Client-specific TAG number (if specified)
4 T_{amb} = maximum permissible ambient temperature
5 Protection type according to EN 60529
6 Supply voltage
7 Communications protocol of transmitter
8 Software version
9 Version level (xx.xx.xx)

1.7 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.

1.8 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.

1.9 Safety instructions for electrical installation

Electrical connections may only be established by authorized specialist personnel in accordance with the electrical circuit diagrams.

The electrical connection information in the manual must be observed; otherwise, the type of electrical protection may be adversely affected.

Ground the flowmeter and the 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 rated current of the circuit breaker must not exceed 16 A.

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 flowmeter sensor are dangerous and pose a contact risk.

The coil and signal circuit may be connected with the corresponding ABB flowmeter 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.

1.10 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").

1.11 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).

1.12 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.

1.13 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)

1.14 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.

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

1.15 Integrated management system

ABB Automation Products GmbH operates an integrated management system, consisting of:

- Quality management system to ISO 9001:2008
- Environmental management system to ISO 14001:2004
- Occupational health and safety management system to BS OHSAS 18001:2007 and
- Data and information protection management system

Environmental awareness is an important part of our company policy.

Our products and solutions are intended to have a minimal impact on the environment and on people during manufacturing, storage, transport, use, and disposal.

This includes the environmentally-friendly use of natural resources. We conducts an open dialog with the public through our publications.

1.16 Disposal

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

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

This product is not subject to WEEE Directive 2002/96/EC or relevant national laws (e.g., ElektroG in Germany).

The product must be disposed of at a specialist 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.

1.16.2 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 into 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 certain amounts 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 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 at the right time, in the future 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.

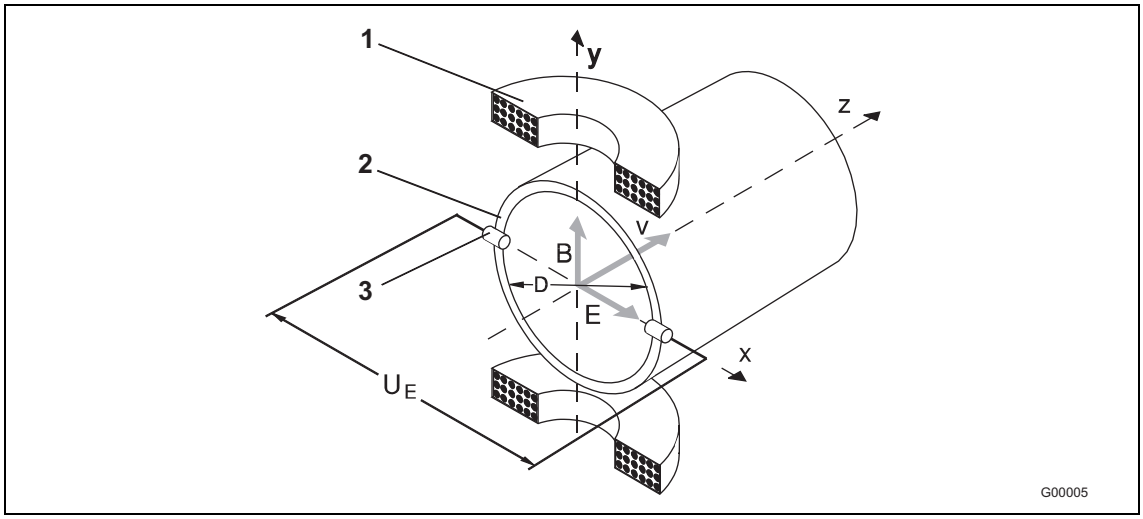


Fig. 4: Electromagnetic flowmeter schematic

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 (Note)

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.

ProcessMaster / HygienicMaster is available in two series.

ProcessMaster / HygienicMaster 300 with basic functionality and ProcessMaster / HygienicMaster 500 with extended functions and options. The following table gives an overview.

	ProcessMaster		HygienicMaster	
	FEP300	**FEP500**	**FEH300**	**FEH500**
Measuring accuracy 0.4 % (optional 0.2 %) of rate	**X**	**-**	**X**	**-**
Measuring accuracy 0,3 % (optional 0.2 %) of rate	**-**	**X**	**-**	**X**
Batch functions Presetting counter, overrun correction, external start/stop, batch end contact	**-**	**X**	**-**	**X**
Other software functions Mass units, editable totalizers,	**X**	**X**	**X**	**X**
Two measuring ranges	**-**	**X**	**-**	**X**
Graphic display Line recorder function	**X**	**X**	**X**	**X**
Diagnostic functions Detection of gas bubbles or deposits on electrodes, conductivity monitoring, temperature monitoring, finger print, trend	**-**	**X**	**-**	**X**
Partially filled Recognition through partial filling electrode (TFE)	**X**	**X**	**-**	**-**
Hardware options • Ceramic carbide lining • Wolfram carbide electrodes • Double layer electrodes	**-**	**X**	**-**	**-**
Hardware options DN 1 ... 2	**-**	**-**	**-**	**X**
Startup functions Grounding check	**-**	**X**	**-**	**X**
Fieldbus PROFIBUS PA, FOUNDATION fieldbus	**X**	**X**	**X**	**X**
Verifications / Diagnostic tool ScanMaster	**X**	**X**	**X**	**X**

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 Model with compact design

The transmitter and the flowmeter sensor form a single mechanical entity.

The transmitter is available in two housing designs:

Single-compartment housing:

With the single-compartment housing, the electronics area and the connection area are not separated from each other.

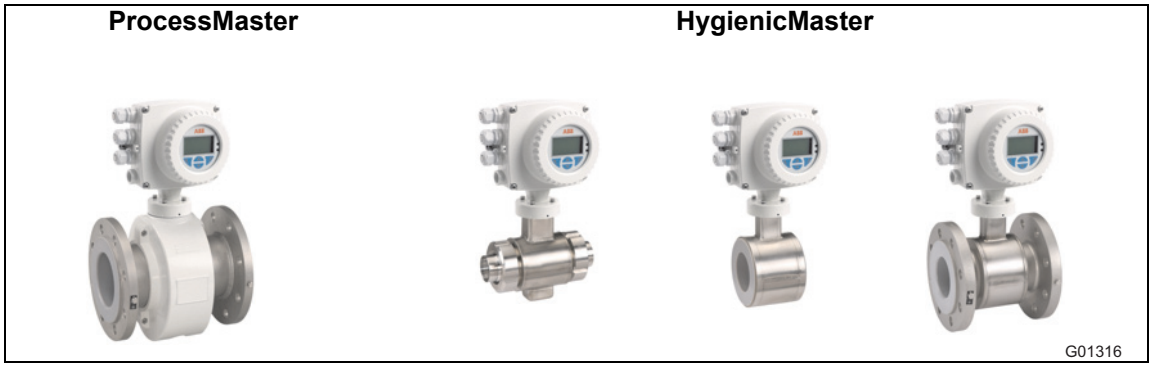


Fig. 5: Transmitter with single-compartment housing

Dual-compartment housing:

With the dual-compartment housing, the electronics area and the connection area are separated from each other.

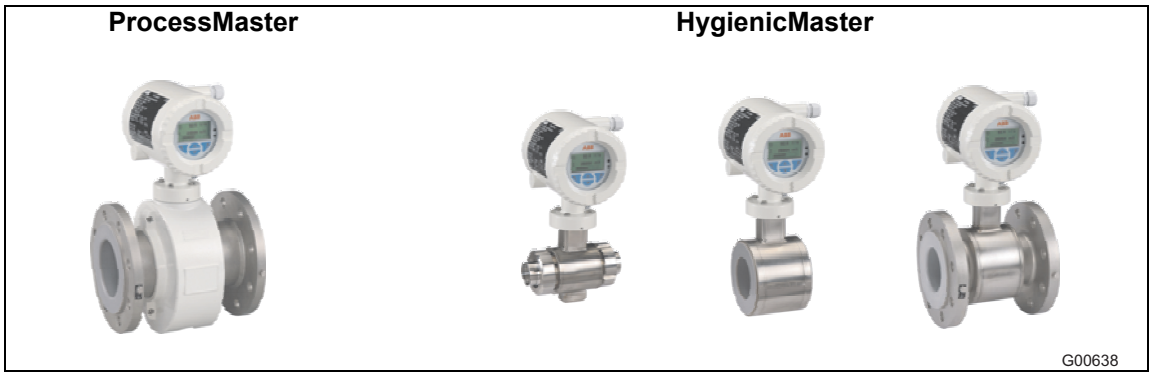


Fig. 6: Transmitter with dual-compartment housing

2.2.3 Model with remount mount design

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

Without a pre-amplifier, the maximum permissible signal cable length is 50 m (164 ft) with a minimum conductivity of 5 µS/cm.

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

Two terminal box variants are available for the ProcessMaster flowmeter sensor:

- Aluminum terminal box
- Plastic terminal box

The external transmitter is available in two housing designs:

Single-compartment housing:

With the single-compartment housing, the electronics area and the connection area are not separated from each other.

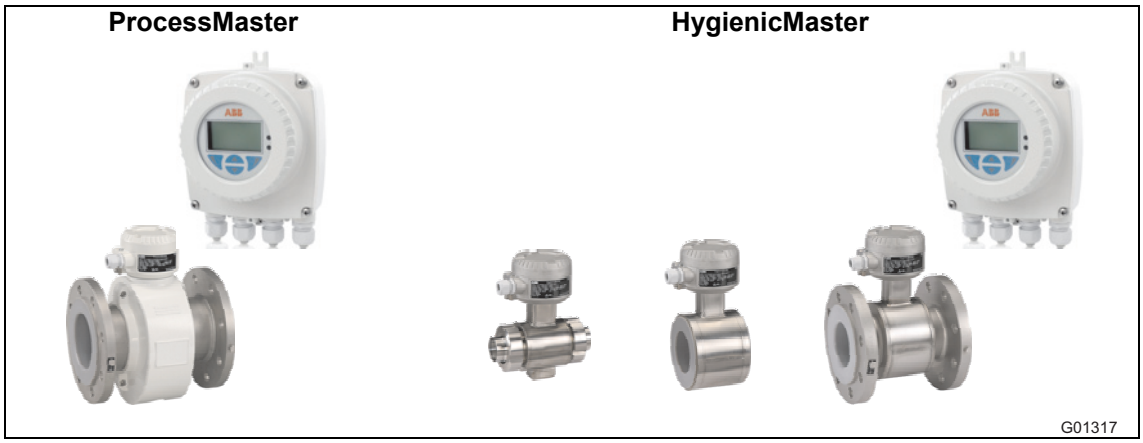


Fig. 7: Transmitter with single-compartment housing

Dual-compartment housing:

With the dual-compartment housing, the electronics area and the connection area are separated from each other.

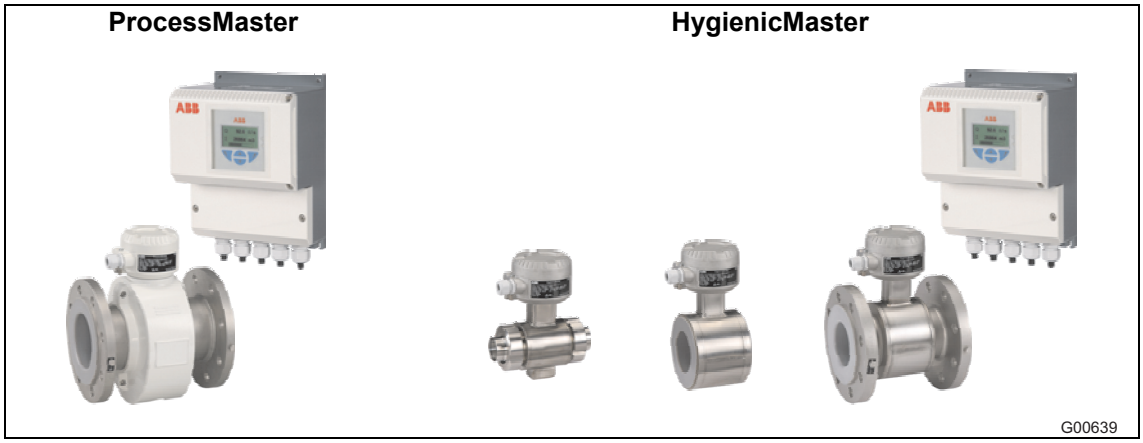


Fig. 8 : Transmitter with dual-compartment housing

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.

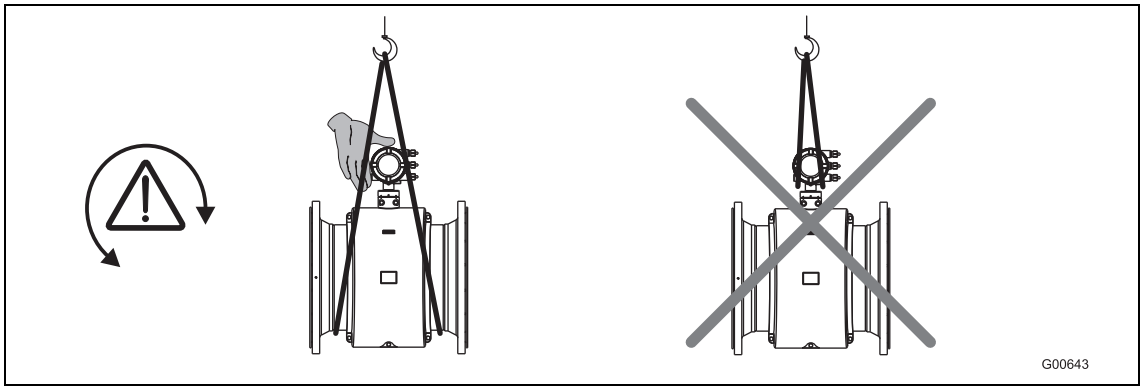


Fig. 9: Transport of flanged units smaller than DN 450

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.

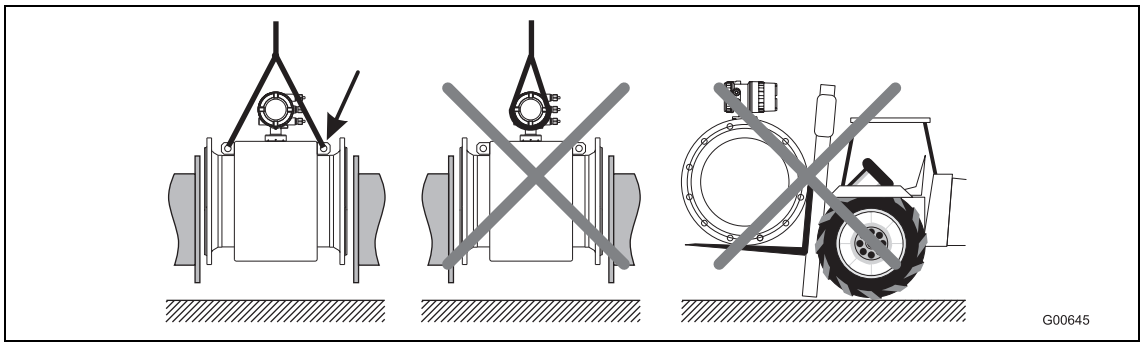


Fig. 10: Transport of flanged units larger than DN 400

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 (Note)

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.

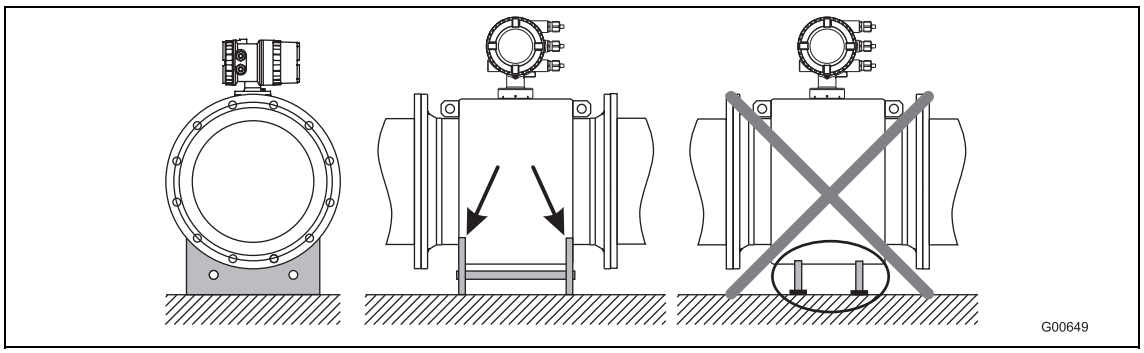


Fig. 11: Support for meter sizes larger than DN 400

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 (Note)

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.

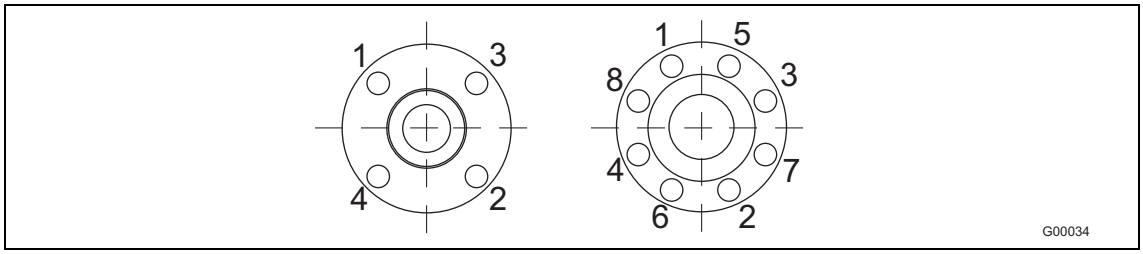


Fig. 12

4.2 Torque information

4.2.1 ProcessMaster in flange design and HygienicMaster in flange or wafer-type design

Meter size DN		Nominal pressure	Max. tightening torque [Nm]			
mm	Inch	PN	Hard/soft rubber lining		PTFE, PFA, ETFE lining	
			Steel flange	Stainless steel flange	Steel flange	Stainless steel flange
3 ... 10[1)]	1/10 ... 3/8“[1)]	PN40	-	-	12.43	12.43
		PN63/100	-	-	12.43	12.43
		CL150	-	-	12.98	12.98
		CL300	-	-	4.94	17.38
		JIS 10K	-	-	12.43	12.43
15	1/2“	PN40	6.74	4.29	14.68	14.68
		PN63/100	13.19	11.2	22.75	22.75
		CL150	3.65	3.65	12.98	12.98
		CL300	4.94	3.86	4.94	17.38
		CL600	9.73	9.73	-	-
		JIS 10K	2.84	1.37	14.68	14.68
20	3/4“	PN40	9.78	7.27	20.75	20.75
		PN63/100	24.57	20.42	42.15	42.15
		CL150	5.29	5.29	18.49	18.49
		CL300	9.77	9.77	33.28	33.28
		CL600	15.99	15.99	-	-
		JIS 10K	4.1	1.88	20.75	20.75
25	1“	PN40	13.32	8.6	13.32	8.6
		PN63/100	32.09	31.42	53.85	53.85
		CL150	5.04	2.84	23.98	23.98
		CL300	17.31	16.42	65.98	38.91
		CL600	22.11	22.11	-	-
		JIS 10K	8.46	5.56	26.94	26.94
32	1 1/4“	PN40	27.5	15.01	45.08	45.08
		PN63/100	42.85	41.45	74.19	70.07
		CL150	4.59	1.98	29.44	29.44
		CL300	25.61	14.22	45.52	45.52
		CL600	34.09	34.09	-	-
		JIS 10K	9.62	4.9	45.08	45.08
40	1 1/2“	PN40	30.44	23.71	56.06	56.06
		PN63/100	62.04	51.45	97.08	97.08
		CL150	5.82	2.88	36.12	36.12
		CL300	33.3	18.41	73.99	73.99
		CL600	23.08	23.08	-	-
		JIS 10K	12.49	6.85	56.06	56.06

Continued on next page

1) Connection flange DIN/EN 1092-1 = DN10 (3/8"), connection flange ASME = DN15 (1/2")

Meter size DN		Nominal pressure	Max. tightening torque [Nm]			
mm	Inch	PN	Hard/soft rubber lining		PTFE, PFA, ETFE lining	
			Steel flange	Stainless steel flange	Steel flange	Stainless steel flange
50	2“	PN40	41.26	27.24	71.45	71.45
		PN63	71.62	60.09	109.9	112.6
		CL150	22.33	22.33	66.22	66.22
		CL300	17.4	22.33	38.46	38.46
		CL600	35.03	35.03	-	-
		JIS 10K	17.27	10.47	71.45	71.45
65	2 1/2“	PN16	14.94	8	37.02	39.1
		PN40	30.88	21.11	43.03	44.62
		PN63	57.89	51.5	81.66	75.72
		CL150	30.96	30.96	89.93	89.93
		CL300	38.38	27.04	61.21	61.21
		CL600	53.91	53.91	-	-
		JIS 10K	14.94	8	37.02	39.1
80	3“	PN40	38.3	26.04	51.9	53.59
		PN63	63.15	55.22	64.47	80.57
		CL150	19.46	19.46	104.6	104.6
		CL300	75.54	26.91	75.54	75.54
		CL600	84.63	84.63	-	-
		JIS 10K	16.26	9.65	45.07	47.16
100	4“	PN16	20.7	12.22	49.68	78.19
		PN40	67.77	47.12	78.24	78.19
		PN63	107.4	95.79	148.5	119.2
		CL150	17.41	7.82	76.2	76.2
		CL300	74.9	102.6	102.6	102.6
		CL600	147.1	147.1	-	-
		JIS 10K	20.7	12.22	49.68	78.19
125	5“	PN16	29.12	18.39	61.4	64.14
		PN40	108.5	75.81	123.7	109.6
		PN63	180.3	164.7	242.6	178.2
		CL150	24.96	11.05	98.05	98.05
		CL300	81.64	139.4	139.4	139.4
		CL600	244.1	244.1	-	-
150	6“	PN16	46.99	23.7	81.23	85.08
		PN40	143.5	100.5	162.5	133.5
		PN63	288.7	269.3	371.3	243.4
		CL150	30.67	13.65	111.4	111.4
		CL300	101.4	58.4	123.6	123.6
		CL600	218.4	218.4	-	-
200	8“	PN10	45.57	27.4	113	116.9
		PN16	49.38	33.82	70.42	73
		PN25	100.6	69.17	109.9	112.5
		PN40	196.6	144.4	208.6	136.8
		PN63	350.4	331.8	425.5	282.5
		CL150	49.84	23.98	158.1	158.1
		CL300	133.9	78.35	224.3	224.3

Continued on next page

Meter size DN		Nominal pressure	Max. tightening torque [Nm]			
mm	Inch	PN	Hard/soft rubber lining		PTFE, PFA, ETFE lining	
			Steel flange	Stainless steel flange	Steel flange	Stainless steel flange
250	10“	PN10	23.54	27.31	86.06	89.17
		PN16	88.48	61.71	99.42	103.1
		PN25	137.4	117.6	166.5	133.9
		PN40	359.6	275.9	279.9	241
		CL150	55.18	27.31	146.1	148.3
		CL300	202.7	113.2	246.4	246.4
300	12“	PN10	58.79	38.45	91.29	94.65
		PN16	122.4	85.64	113.9	114.8
		PN25	180.6	130.2	151.1	106.9
		PN40	On request	On request	On request	On request
		CL150	90.13	50.37	203.5	198
		CL300	333.3	216.4	421.7	259.1
350	14“	PN10	69.62	47.56	72.49	75.22
		PN16	133.6	93.61	124.9	104.4
		PN25	282.3	204.3	226.9	167.9
		CL150	144.8	83.9	270.5	263
		CL300	424.1	252.7	463.9	259.4
400	16“	PN10	108.2	75.61	120.1	113.9
		PN16	189	137.2	191.4	153.8
		PN25	399.4	366	404	246.7
		CL150	177.6	100	229.3	222.8
		CL300	539.5	318.8	635.8	328.1
450	18“	CL150	218.6	120.5	267.3	192.3
		CL300	553.8	327.2	660.9	300
500	20“	PN10	141.6	101.4	153.9	103.5
		PN16	319.7	245.4	312.1	224.8
		PN25	481.9	350.5	477.1	286
		CL150	212.5	116	237.3	230.4
		CL300	686.3	411.8	786.8	363.1
600	24“	PN10	224.7	164.8	238.7	149.1
		PN16	515.1	399.9	496.7	365.3
		PN25	826.2	600.3	750.7	539.2
		CL150	356.6	202.8	451.6	305.8
		CL300	1188	719	1376	587.4
700	28“	PN10	267.7	204.9	On request	On request
		PN16	455.7	353.2	On request	On request
		PN25	905.9	709.2	On request	On request
		CL150	364.1	326.2	449.2	432.8
		CL300	1241	On request	On request	On request
750	30“	CL150	423.8	380.9	493.3	442
		CL300	1886	On request	On request	On request

Continued on next page

Meter size DN		Nominal pressure	Max. tightening torque [Nm]			
mm	Inch	PN	Hard/soft rubber lining		ETFE lining	
			Steel flange	Stainless steel flange	Steel flange	Stainless steel flange
800	32“	PN10	391.7	304.2	On request	On request
		PN16	646.4	511.8	On request	On request
		PN25	1358	1087	On request	On request
		CL150	410.8	380.9	493.3	380.9
		CL300	2187	On request	On request	On request
900	36“	PN10	387.7	296.3	On request	On request
		PN16	680.8	537.3	On request	On request
		PN25	1399	1119	On request	On request
		CL150	336.2	394.6	511	458.5
		CL300	1972	On request	On request	On request
1000	40“	PN10	541.3	419.2	On request	On request
		PN16	955.5	756.1	On request	On request
		PN25	2006	1612	On request	On request
		CL150	654.2	598.8	650.6	385.1
		CL300	2181	On request	On request	On request
1100	44“	CL150	749.1	682.6	741.3	345.9
		CL300	2607	On request	On request	On request
1200	48“	PN 6	363.5	On request	-	-
		PN10	705.9	On request	-	-
		PN16	1464	On request	-	-
		CL150	815.3	731.6	-	-
		CL300	3300	On request	-	-
1350	54“	CL150	1036	983.7	-	-
		CL300	5624	On request	-	-
1400	56“	PN 6	515	On request	-	-
		PN10	956.3	On request	-	-
		PN16	1558	On request	-	-
1500	60“	CL150	1284	1166	-	-
		CL300	6139	On request	-	-
1600	64“	PN 6	570.7	On request	-	-
		PN10	1215	On request	-	-
		PN16	2171	On request	-	-
1800	72“	PN 6	708.2	On request	-	-
		PN10	1492	On request	-	-
		PN16	2398	On request	-	-
2000	80“	PN 6	857.9	On request	-	-
		PN10	1840	On request	-	-
		PN16	2860	On request	-	-

4.2.2 Variable process connections HygienicMaster

Meter size DN		Max. tightening torque
mm	inch	Nm
1 ... 2	1/25 ... 3/32“	PVC/POM: 0.2 Brass/1.4571: 3
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

Important (Note)

If concentric reducers are installed on the device, it must be mounted in a vertical position.

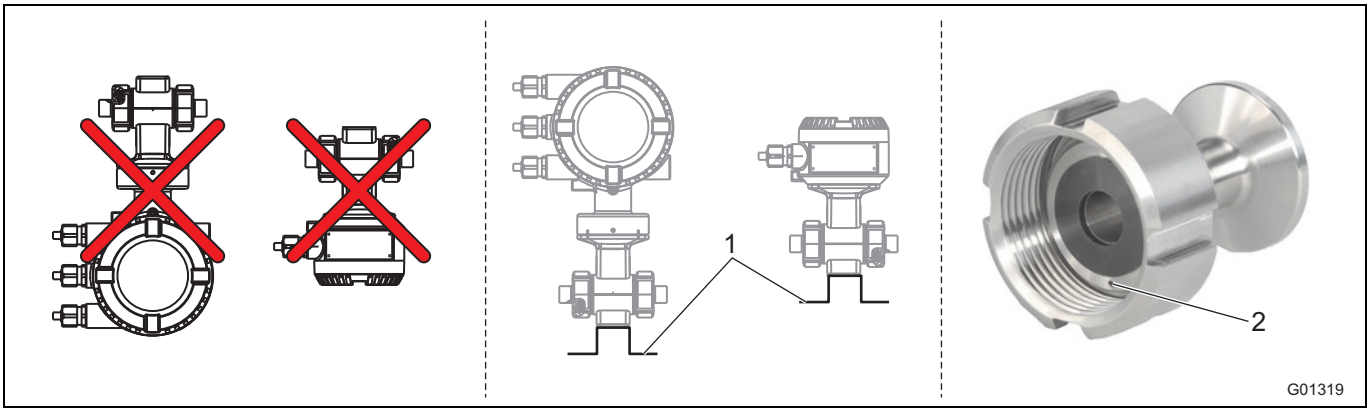


Fig. 13

1 Bracket
2 Leakage hole

Please observe the following points:

- Do not install the device vertically with the terminal box or transmitter housing pointing downward.
- The "angle bracket" option no longer applies.
- Please ensure that the leakage hole of the process connection is located at the deepest point of the installed device.
- Only devices with a transmitter with dual-compartment housing are 3A-compliant.

4.5 Installation Requirements

4.5.1 Flow direction

The device measures the flowrate in both directions. Forward flow is the factory setting, as shown in Fig. 14.

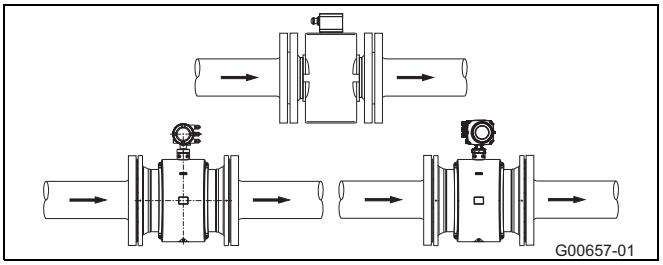


Fig. 14

4.5.2 Electrode axis

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

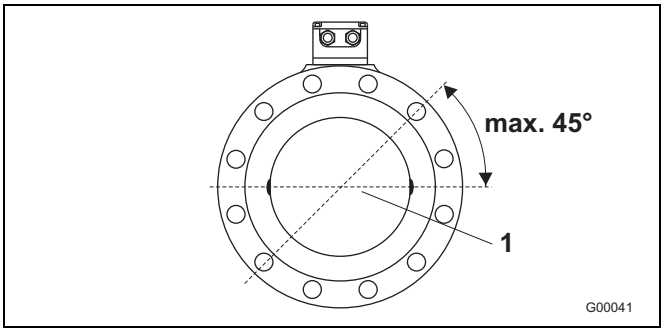


Fig. 15

4.5.3 In- and outlet pipe sections

The metering principle is independent of the flow profile as long as standing eddies do not extend into the metering section, such as may occur after double elbows (1), in the event of tangential inflow, or where half-open gate valves are located upstream of the flowmeter sensor.
In such cases, measures must be put in place to normalize the flow profile.

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

Experience has shown that, in most installations, straight inlet sections 3 x DN long and straight outlet sections 2 x DN long are sufficient (DN = nominal diameter of the sensor Fig. 16).
For test stands, the reference conditions of 10 x DN straight inlet and 5 x DN straight outlet must be provided, in accordance with EN 29104 / ISO 9104.

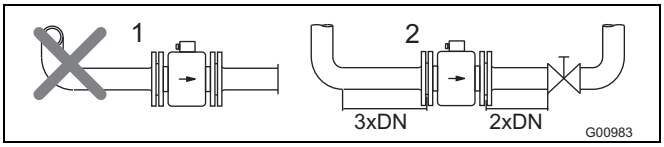


Fig. 16

4.5.4 Vertical connections

- Vertical installation for measuring abrasive fluids, preferably with flow in upward direction.

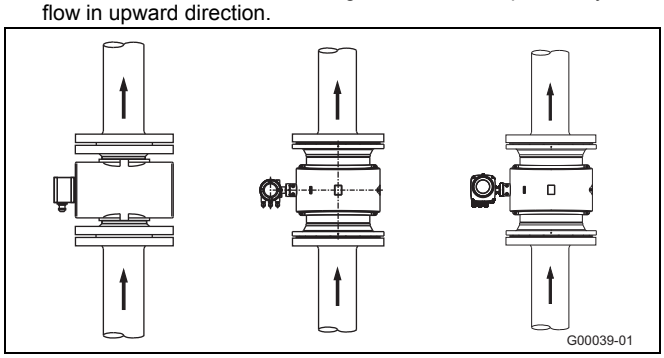


Fig. 17

4.5.5 Horizontal connections

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

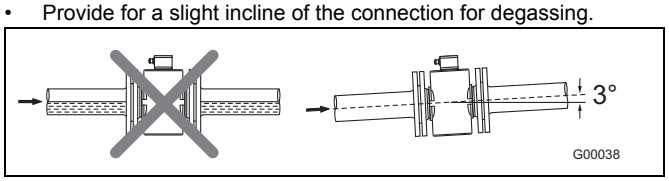


Fig. 18

4.5.6 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).

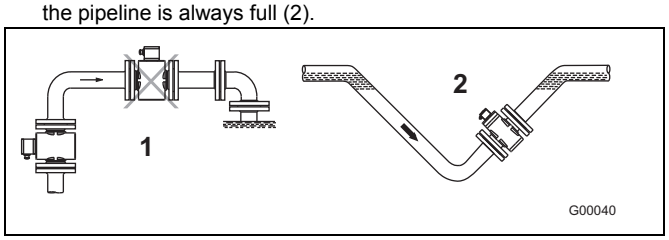


Fig. 19

4.5.7 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.

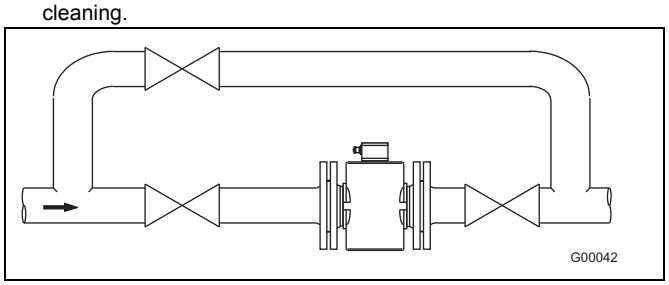


Fig. 20

4.5.8 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.

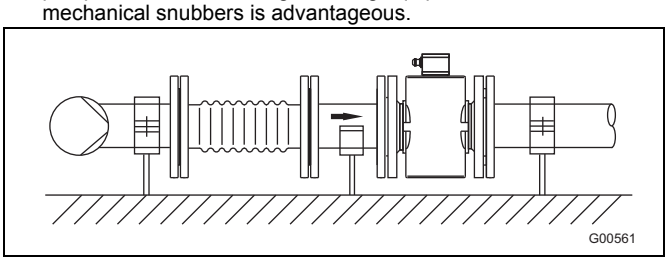


Fig. 21

4.5.9 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.

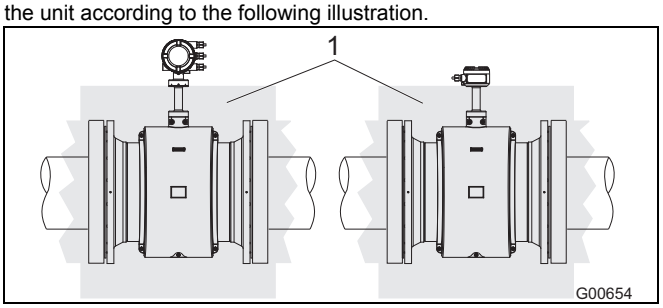


Fig. 22
1 Insulation

4.5.10 Devices with extended diagnostic functions

For devices with extended diagnostic functions different installation conditions may be valid.
For further information read and observe chapter **8** "**Extended diagnostic functions**".

4.5.11 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. 24).
3. Read the pressure drop on the Y-axis in Fig. 24.

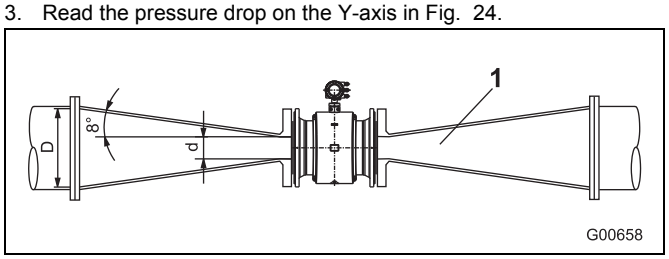


Fig. 23
1 = Flange transition piece
d = Inside diameter of the flowmeter
V = flow velocity [m/s]
Δp = pressure loss [mbar]
D = Inside diameter of the pipeline

Nomograph for pressure drop calculations
For flange transition piece with $\alpha/2 = 8°$

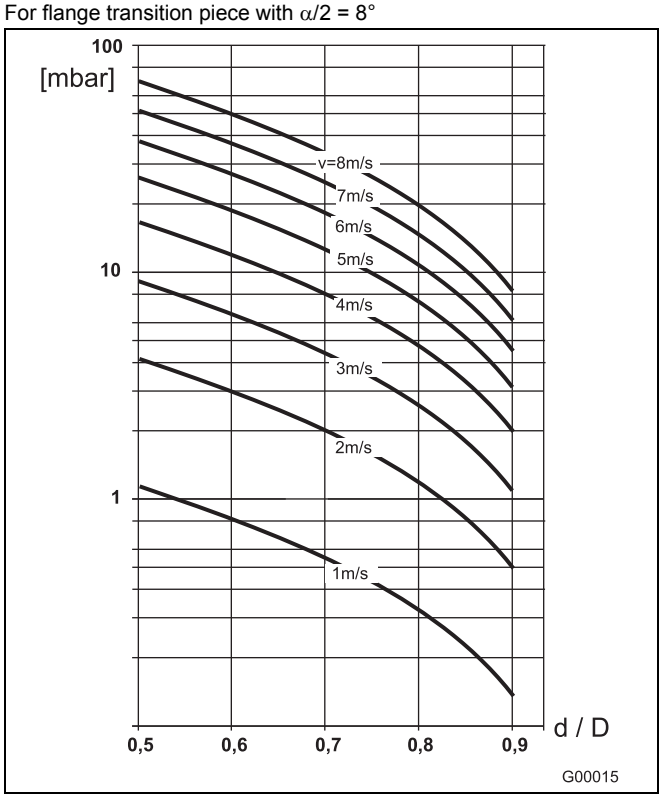


Fig. 24

4.6 Rotating the LCD display / Rotating the housing

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

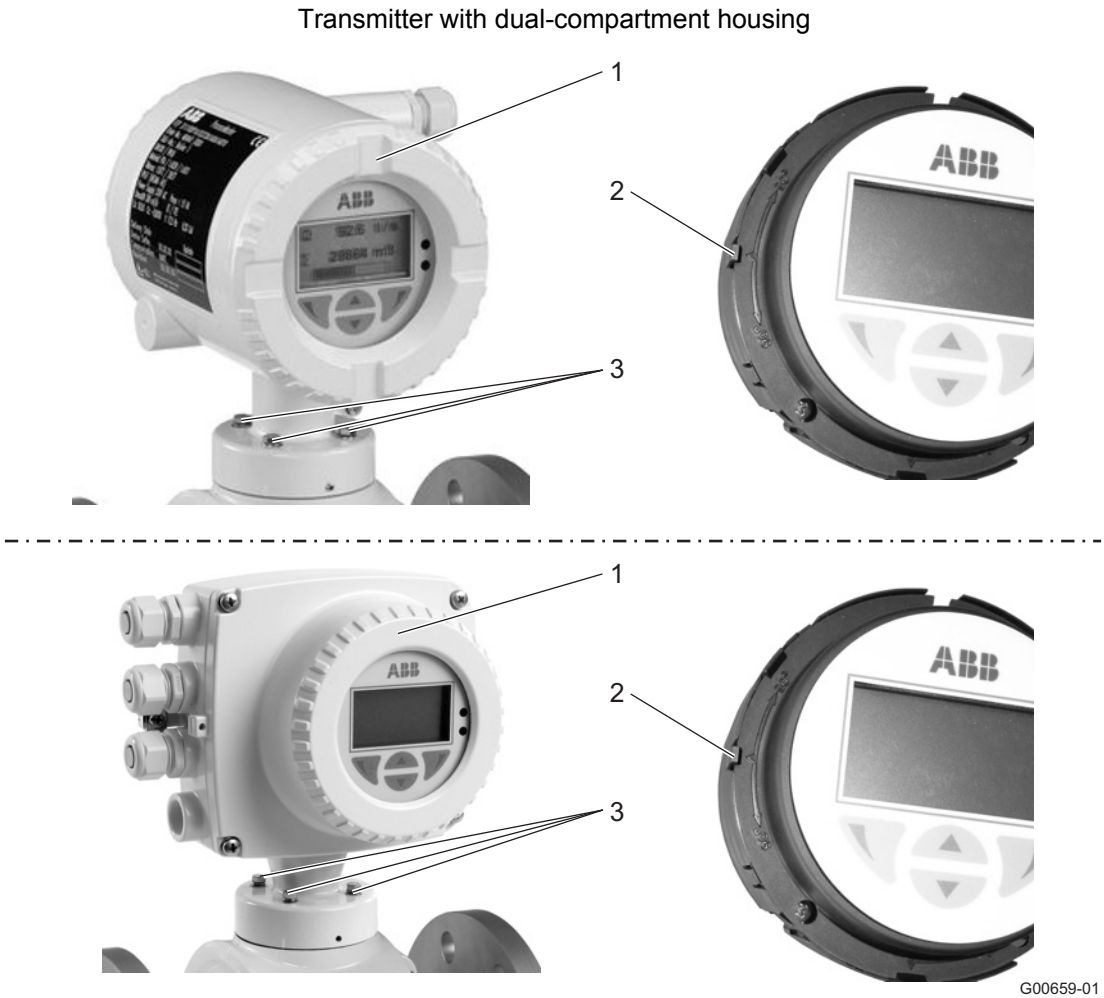


Fig. 25

4.6.1 Rotating the LCD display

Warning – Electrical dangers!

When the housing is open, EMC protection is impaired and there is no longer any protection against accidental contact.

Switch off the power supply before opening the housing.

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

Notice - Potentially adverse effect on housing ingress protection

If the gasket (o-ring) is seated incorrectly or damaged, this may have an adverse effect on the housing ingress protection.

Before closing the housing cover, check the gasket (o-ring) for any damage and replace if necessary. Check that the gasket is properly seated when closing the housing cover.

4.6.2 Rotating the housing

1. Loosen screws (3) and rotate housing 90° to the left or right.
2. Retighten screws (3).

4.7 Ground

Important (Note)

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 upstream and downstream of the flowmeter sensor.
- 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 (Note)

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

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.

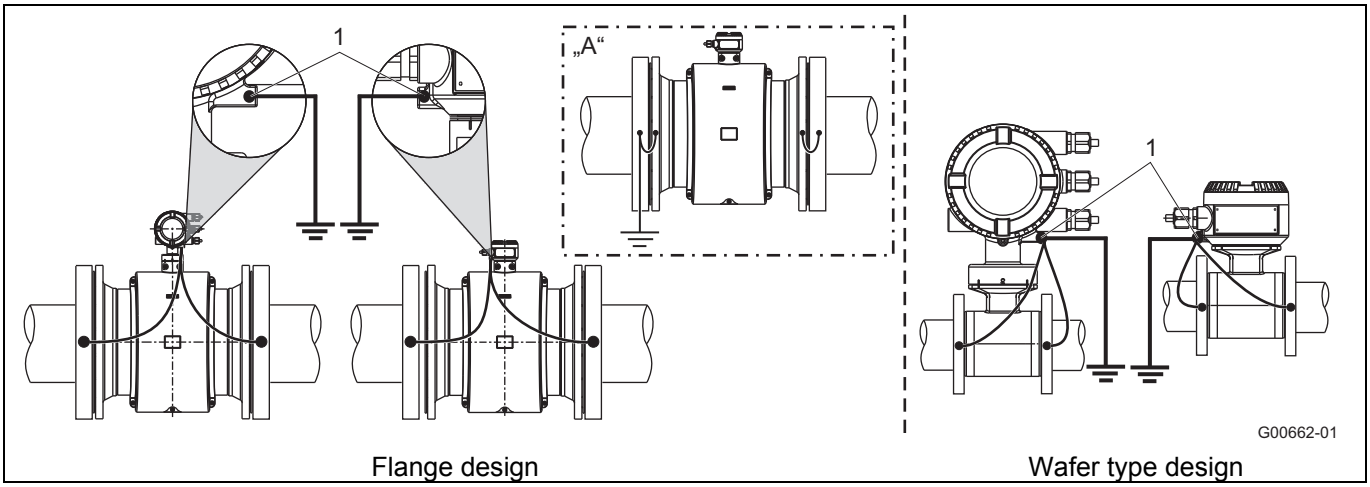


Fig. 26: Metal pipe, without lining (example)
"A" Grounding in the case of a plastic terminal box (ProcessMaster only)

Important (Note)

- Grounding is illustrated using the example of the dual-compartment transmitter housing; in the case of transmitters with single-compartment housing, grounding is to be performed as shown.
- In the case of flowmeter sensors with plastic terminal boxes, perform grounding as shown in "A".

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.

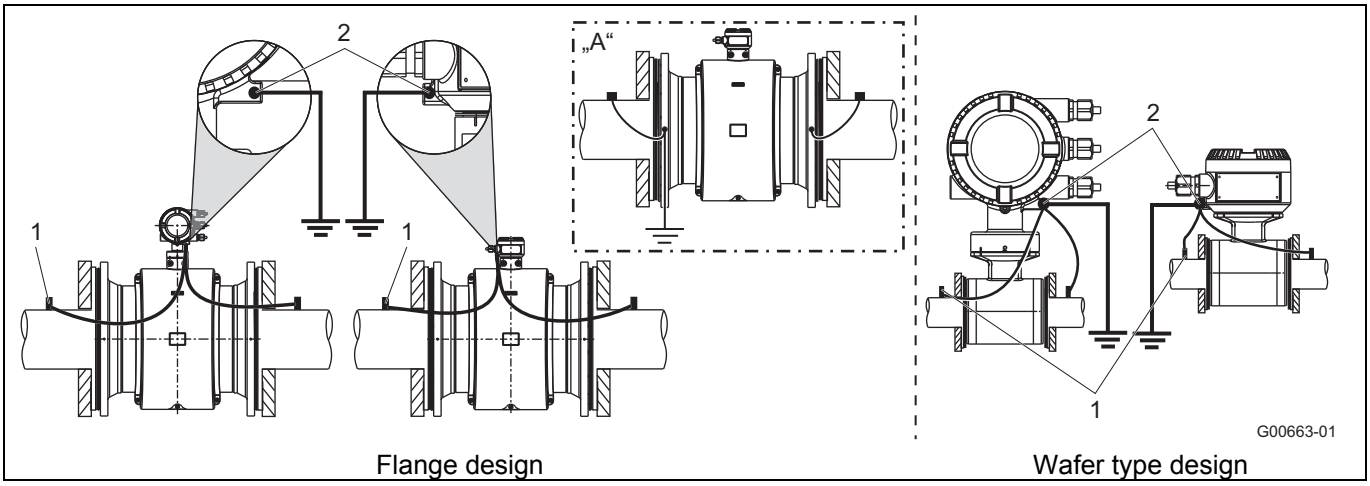


Fig. 27: Metal pipe, without lining (example)
"A" Grounding in the case of a plastic terminal box (ProcessMaster only)

Important (Note)

- Grounding is illustrated using the example of the dual-compartment transmitter housing; in the case of transmitters with single-compartment housing, grounding is to be performed as shown.
- In the case of flowmeter sensors with plastic terminal boxes, perform grounding as shown in "A".

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.

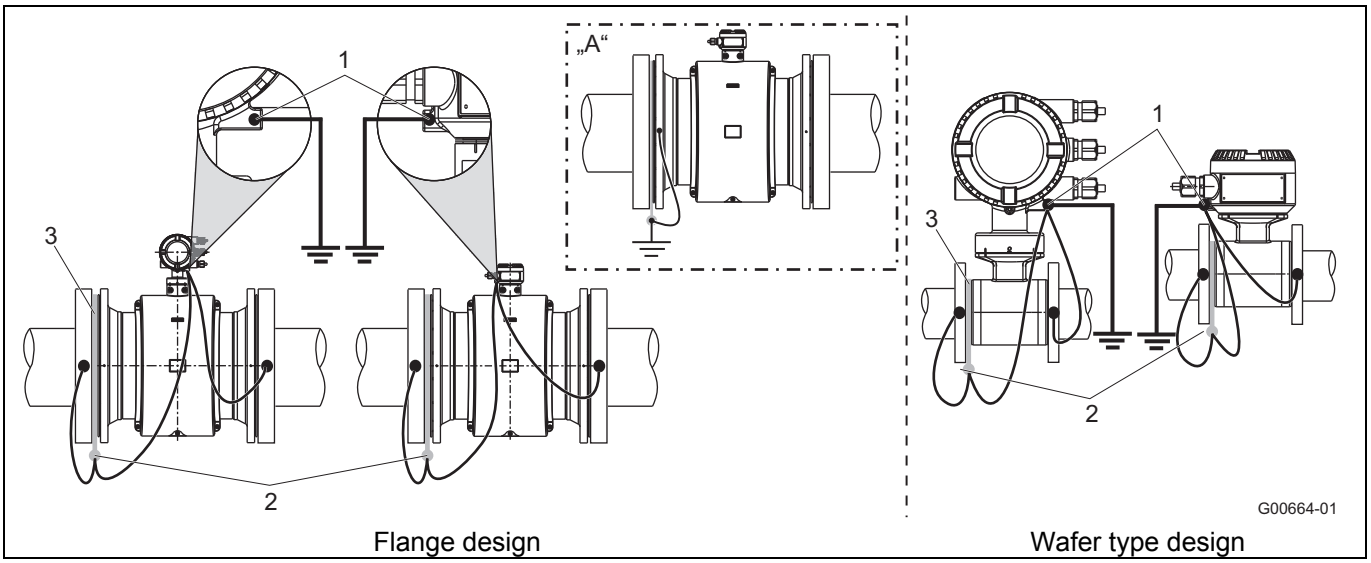


Fig. 28: Plastic pipes, non-metallic pipes or pipes with insulating lining
"A" Grounding in the case of a plastic terminal box (ProcessMaster only)

Important (Note)

- Grounding is illustrated using the example of the dual-compartment transmitter housing; in the case of transmitters with single-compartment housing, grounding is to be performed as shown.
- In the case of flowmeter sensors with plastic terminal boxes, perform grounding as shown in "A".

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.

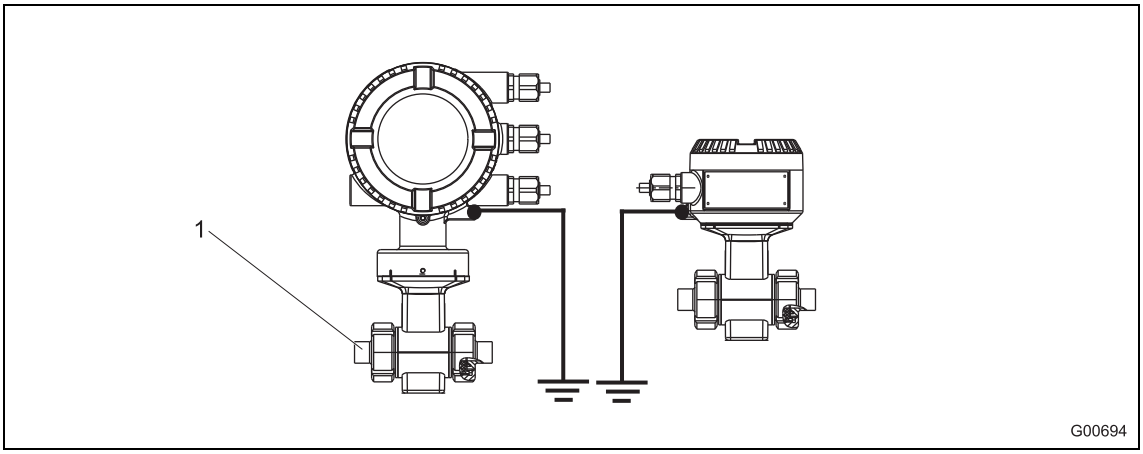


Fig. 29

4.7.6 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.

4.7.7 Ground with conductive PTFE grounding plate

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

4.7.8 Devices with extended diagnostic functions

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

For further information read and observe chapter 8 “Extended diagnostic functions”.

4.7.9 Installation and grounding in pipelines with cathodic corrosion protection (CCP)

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

a) Pipelines inside electrically conductive or insulating.

b) Pipelines completely or for the most part with cathodic corrosion protection (CCP) or mixed systems with CCP areas and PE areas.

- When installing an EMF in pipes with insulating inner lining and free from foreign matter, it should be insulated with grounding plates on the upstream and downstream side. The CCP potential is diverted. The grounding plates upstream and downstream of the EMF are connected to functional ground (Fig. 37 / Fig. 31).
- If the occurrence of external stray currents is to be expected in pipelines with internal insulation (e.g. in the case of long pipe sections in the vicinity of power supply units), an uninsulated pipe of approx. 1/4 DN of length should be provided upstream and downstream of the flowmeter sensor in order to deviate these currents away from the measuring system (Fig. 32).

4.7.9.1 Internally insulated pipelines with cathodic corrosion protection potential

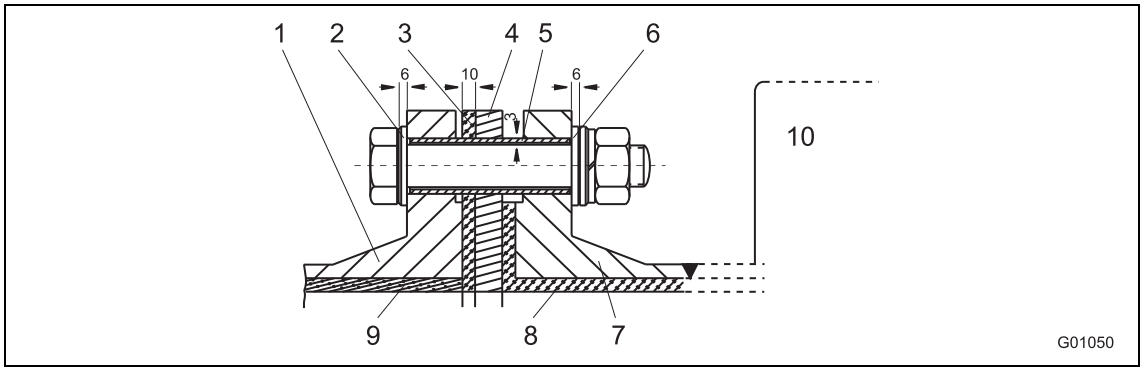


Fig. 30: Bolt screw view

1 Pipe flange
2 Insulating plate
3 Gasket / insulating ring
4 Grounding plate
5 Insulating pipe
6 Insulating plate
7 Flange
8 Lining
9 Insulation
10 Flowmeter sensor

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

The CCP potential must be diverted through a connecting line "A" away from the insulated flowmeter sensor.

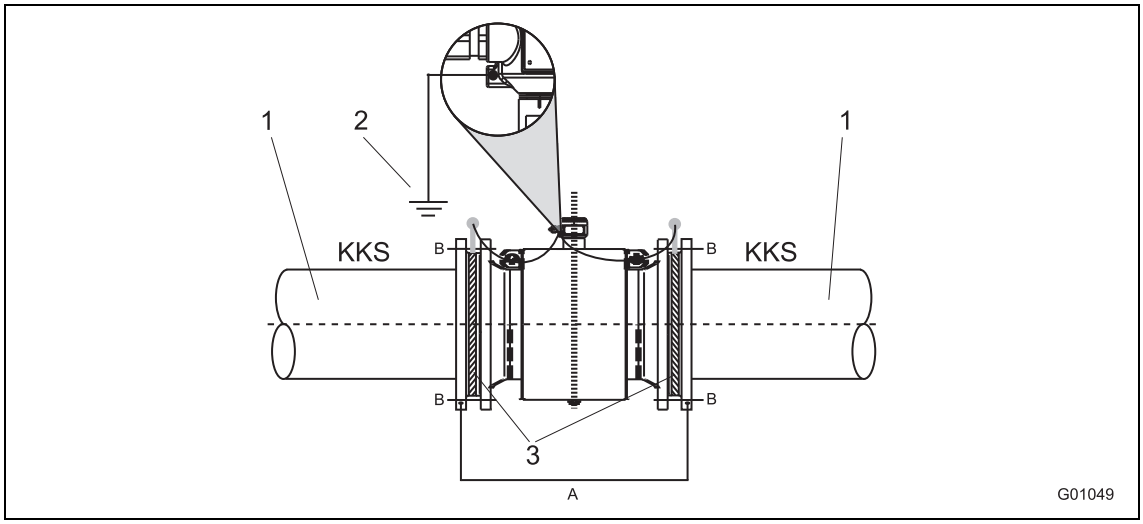


Fig. 31: Flowmeter sensor with grounding plate and functional ground

1 Insulated pipe
2 Functional ground
3 Grounding plate

A Connecting line for CCP potential ≥ 4 mm^2 Cu, not included in the delivery, to be provided onsite
B Insulated screw bolts without grounding plates

4.7.9.2 Mixed system pipeline with CCP and functional ground potentials

This mixed system has an insulated pipeline with CCP potential and an uninsulated bar metal pipe (L = 1/4 x flowmeter sensor size) with functional ground potential upstream and downstream of the flowmeter sensor.

The Fig. 32 shows the preferred installation for cathodic corrosion protection systems.

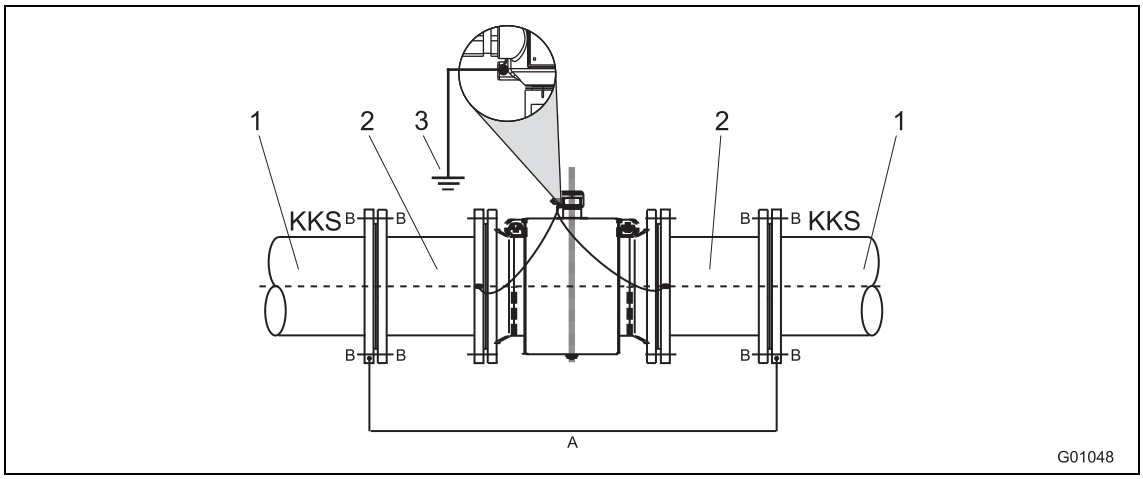


Fig. 32: Flowmeter sensor with functional ground

1 Insulated pipe
2 Bare metal pipe
3 Functional ground

A Connecting line for CCP potential ≥ 4 mm^2 Cu, not included in the delivery, to be provided onsite
B Insulated screw bolts without grounding plates

5 Electrical connections

5.1 Routing the signal and magnet coil cable

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 strips.
- 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 pre-amplifier and 200 m (656 ft) with 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 the station ground potential.
- To shield against magnetic interspersion, the cable contains outer shielding. This is attached to the SE clamp.
- The supplied stranded steel wire is also 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.

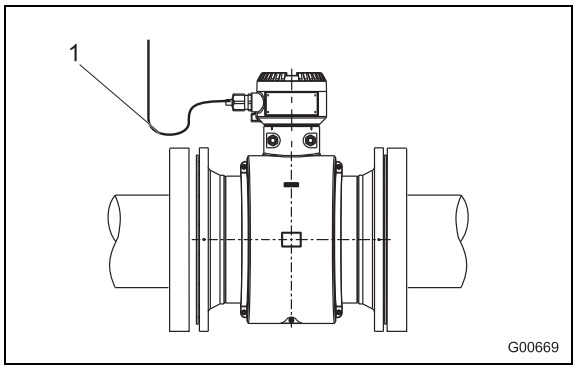


Fig. 33

5.2 Preparing the signal and magnet coil cable in the case of transmitters with dual-compartment housing

5.2.1 Cable with part number D173D027U01

Prepare both cable ends as shown.

Important (Note)

Use wire end sleeves.

- Wire end sleeves 0.75 mm^2 (AWG 19), for shielding (1S, 2S)
- Wire end sleeves 0.5 mm^2 (AWG 20), for all other wires

The shields may not touch (signal short circuit).

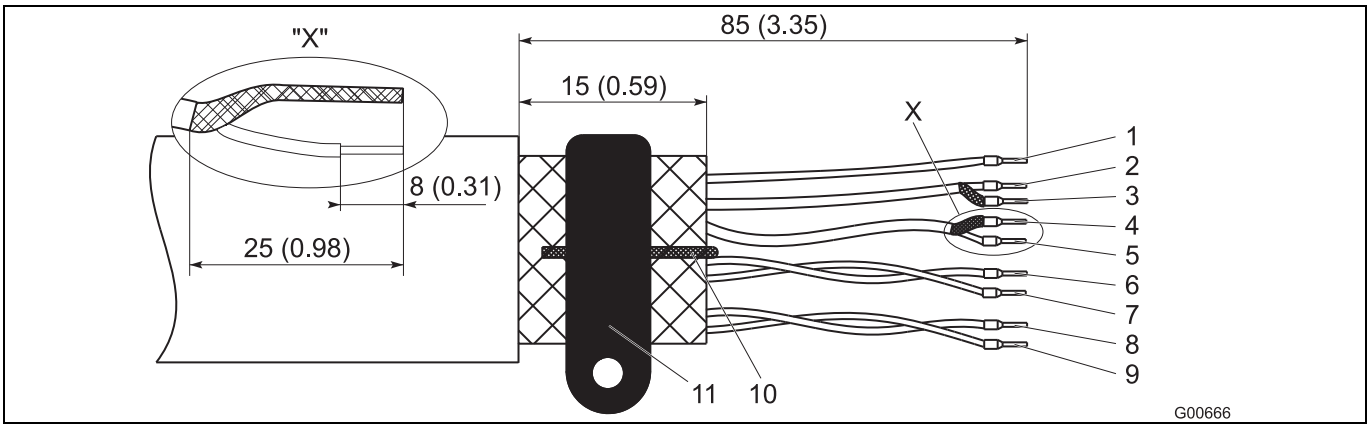


Fig. 34: Flowmeter sensor side, dimensions in mm (inch)

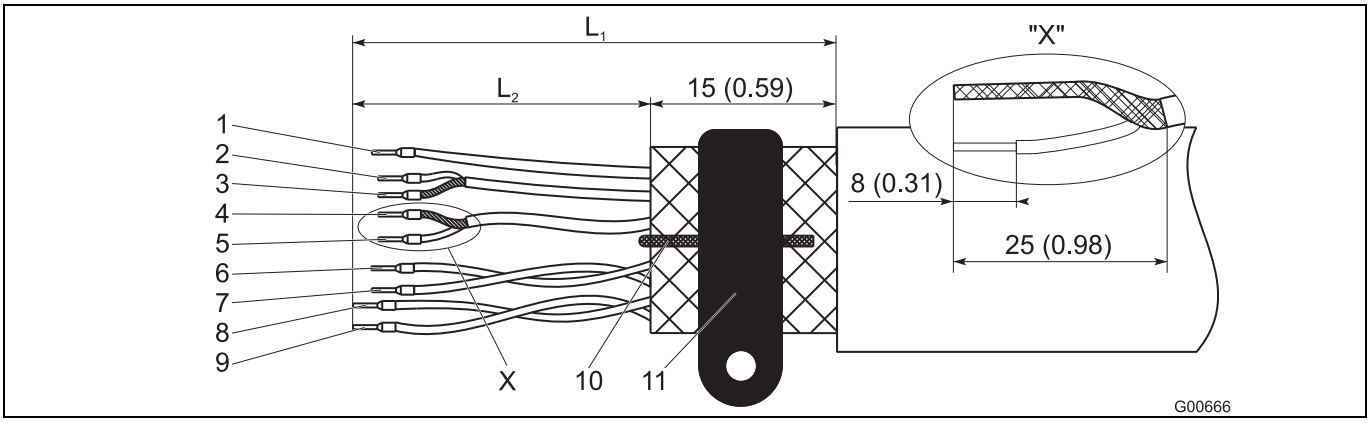


Fig. 35: Transmitter side, dimensions in mm (inch)

L_1 maximum 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	Ground wire, steel	
5	Signal line, E2, blue	L2 = 60 (2.36)	11	SE clamp	
6	Data line, D2, yellow	L2 = 70 (2.76)			

5.2.2 Cable with part number D173D031U01

Prepare both cable ends as shown.

Important (Note)

Use wire end sleeves.

- Wire end sleeves 0.75 mm^2 (AWG 19), for shielding (1S, 2S)
- Wire end sleeves 0.5 mm^2 (AWG 20), for all other wires

The shields may not touch (signal short circuit).

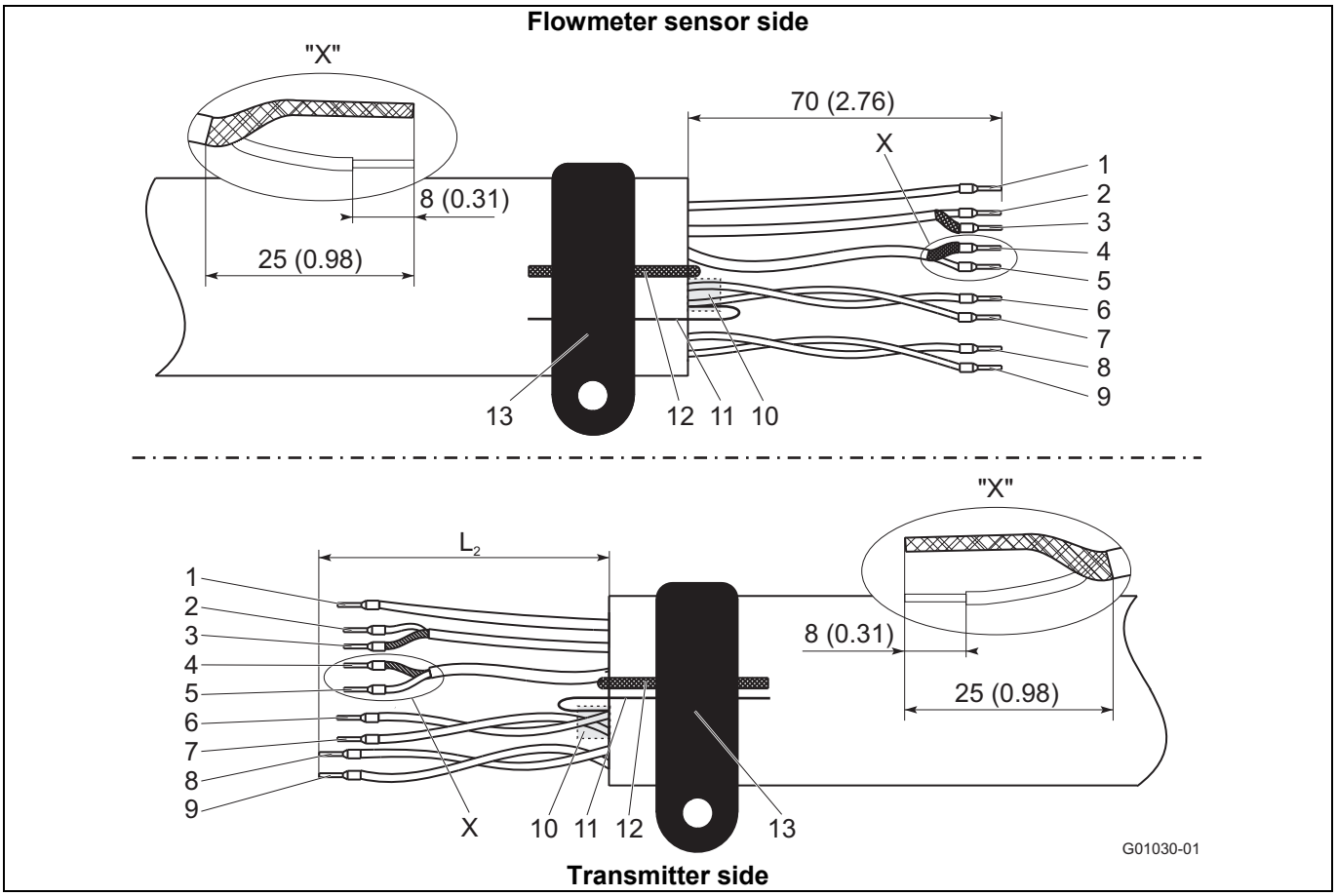


Fig. 36: Flowmeter sensor side, dimensions in mm (inch)

1	Measurement potential 3, green	L2 = 70 (2.76)	8	Magnet coil, M2, red	L2 = 90 (3.54)
2	Signal line E1, violet	L2 = 60 (2.36)	9	Magnet coil, M1, brown	L2 = 90 (3.54)
3	Shield 1S	L2 = 60 (2.36)	10	Foil shield (D1, D2)	
4	Shield 2S	L2 = 60 (2.36)	11	Foil shield continuity wire (D1, D2)	
5	Signal line, E2, blue	L2 = 60 (2.36)	12	Ground wire, steel	
6	Data line, D2, yellow	L2 = 70 (2.76)	13	SE clamp	
7	Data line, D1, orange	L2 = 70 (2.76)			

5.3 Preparing the signal and magnet coil cable in the case of transmitters with single-compartment housing

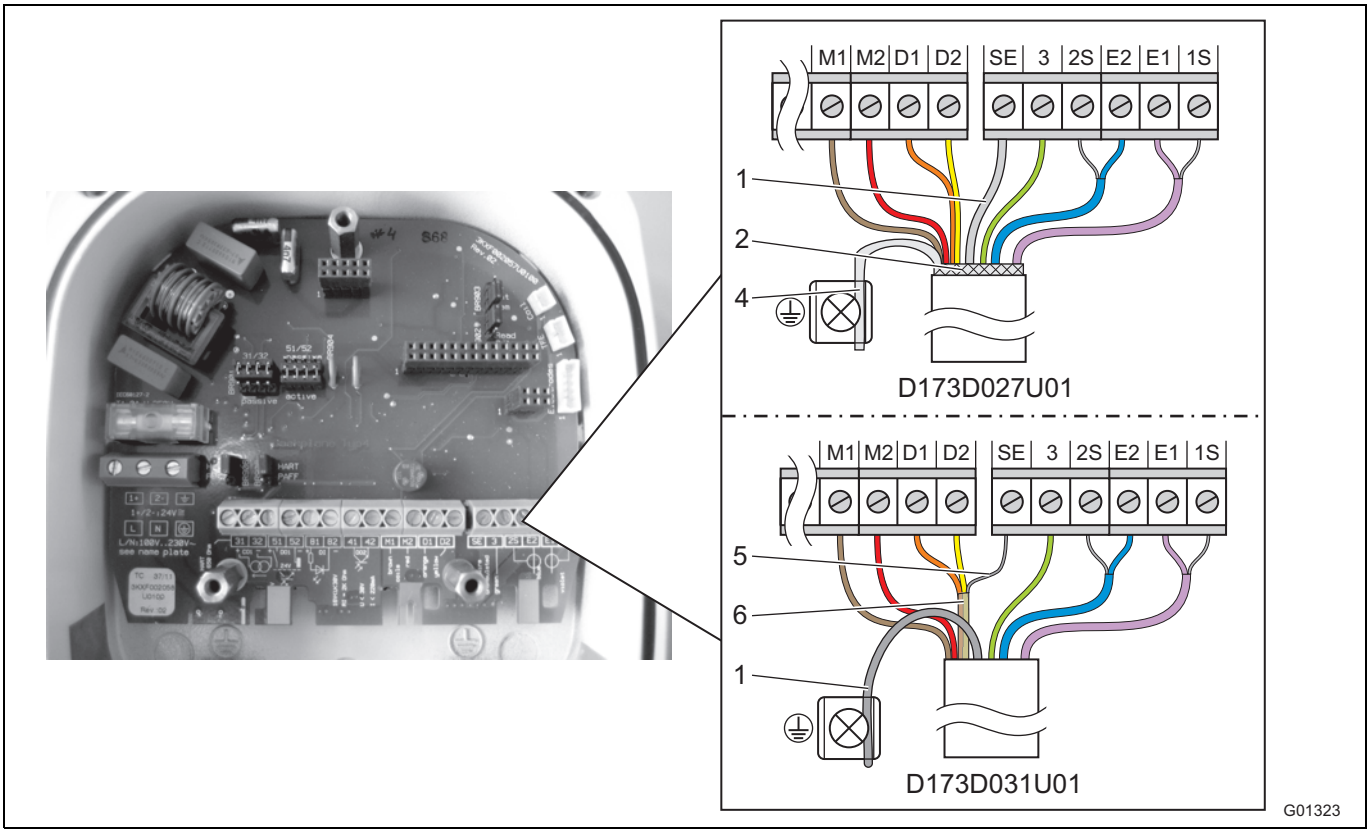


Fig. 37: Transmitter side, dimensions in mm (inch)

1 Ground wire
2 Wire mesh shield (D173D027U01 only)
4 Twisted wire mesh shield (D173D027U01 only)
5 Foil shield continuity wire D1, D2 (D173D031U01 only)
6 Foil shield D1, D2 (D173D031U01 only)

Terminal	Description, wire color	Length in mm (inch)
M1	Magnet coil, brown	70 (2.76)
M2	Magnet coil, red	70 (2.76)
D1	Data line, orange	70 (2.76)
D2	Data line, yellow	70 (2.76)
SE	Shield	-
3	Measurement potential, green	70 (2.76)
2S	Shield for E2	60 (2.36)
E2	Signal line, blue	60 (2.36)
E1	Signal line, violet	60 (2.36)
1S	Shield for E1	60 (2.36)

Important (Note)

- Use wire end sleeves.
  - Wire end sleeves 0.75 mm^2 (AWG 19), for shielding (1S, 2S)
  - Wire end sleeves 0.5 mm^2 (AWG 20), for all other wires
- The shields may not touch (signal short circuit).

Prepare the cable end on the transmitter side as shown in Fig. 37.

5.3.1 Cable with part number D173D027U01

- Twist the wire mesh shield of the cable and connect to the ground terminal.
- Connect the ground wire of the cable to the SE clamp of the terminal strip.
- Connect all other wires as shown in Fig. 37.

5.3.2 Cable with part number D173D031U01

- Connect the cable ground wire together with the foil shield continuity wire from D1, D2 to the SE clamp of the terminal strip.
- When using the flowmeter sensor in systems with cathodic corrosion protection (CCP), connect the cable ground wire together with the foil shield continuity wire from D1, D2 to the SE clamp of the terminal strip.
- Connect all other wires as shown in Fig. 37.

5.4 Connecting the flowmeter sensor

5.4.1 Metal terminal box in the case of ProcessMaster and HygienicMaster

Connections can only be made with the power supply switched off.

The unit must be grounded. The sensor is connected to the transmitter via the signal / magnet coil cable (part no. D173D027U01 or D173D031U01).

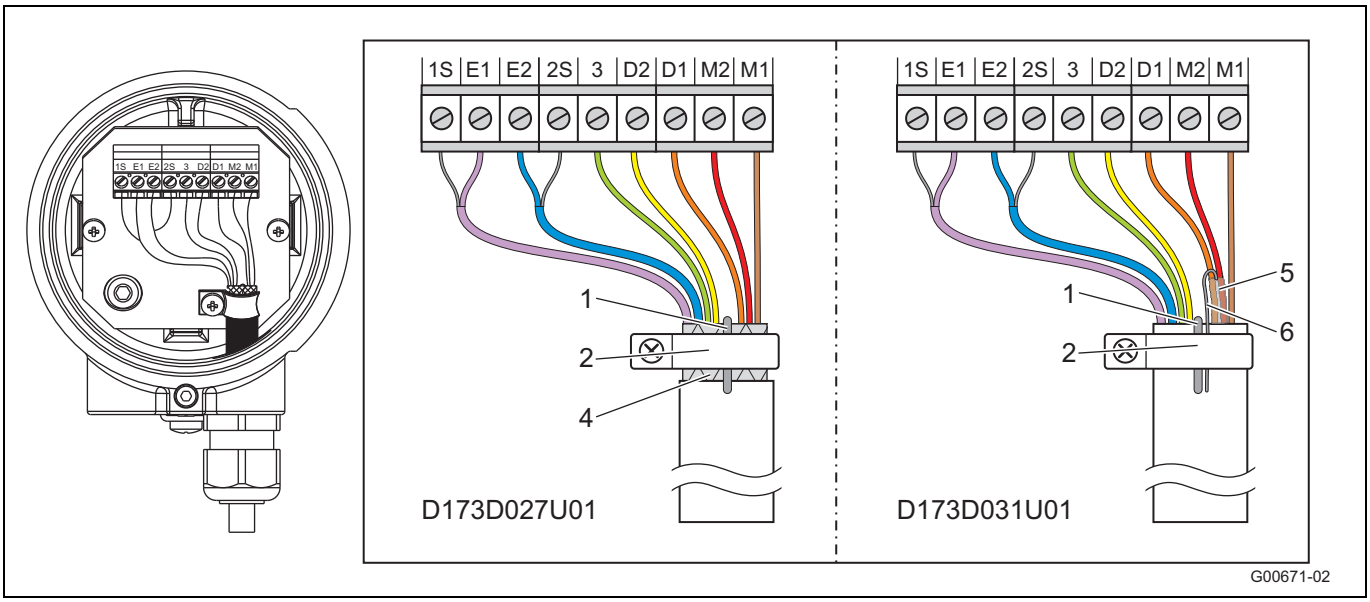


Fig. 38

1 Ground wire
2 Grounding clamp
4 Wire mesh shield (D173D027U01 only)
5 Foil shield D1, D2 (D173D031U01 only)
6 Foil shield continuity wire D1, D2 (D173D031U01 only)

Terminal	Description, wire color
M1	Magnet coil, brown
M2	Magnet coil, red
D1	Data line, orange
D2	Data line, yellow
PE	Shield
3	Measurement potential, green
2S	Shield for E2
E2	Signal line, blue
E1	Signal line, violet
1S	Shield for E1

Important (Note)

The cable with the part number D173D027U01 can be used for all device designs.
The cable with the part number D173D031U01 can be used for all device designs.

- Flowmeter sensor without explosion protection from size DN15 (models FEP321, FEH321, FEP521, FEH521).
- Flowmeter sensor for operation in Zone 2 / Div. 2 from size DN15 (models FEP325, FEH325, FEP525, FEH525).

Cable with part number D173D027U01

- Uncover the wire mesh shield of the cable and connect to the grounding clamp together with the grounding wire.
- Connect all other wires as shown in Fig. 37.

Cable with part number D173D031U01

- Connect the cable ground wire together with the foil shield continuity wire from D1, D2 to the grounding clamp.
- Connect all other wires as shown in Fig. 37.

5.4.2 Plastic terminal box in the case of ProcessMaster

Connections can only be made with the power supply switched off.

The unit must be grounded. The flowmeter sensor must be connected to the transmitter via the signal / magnet coil cable.

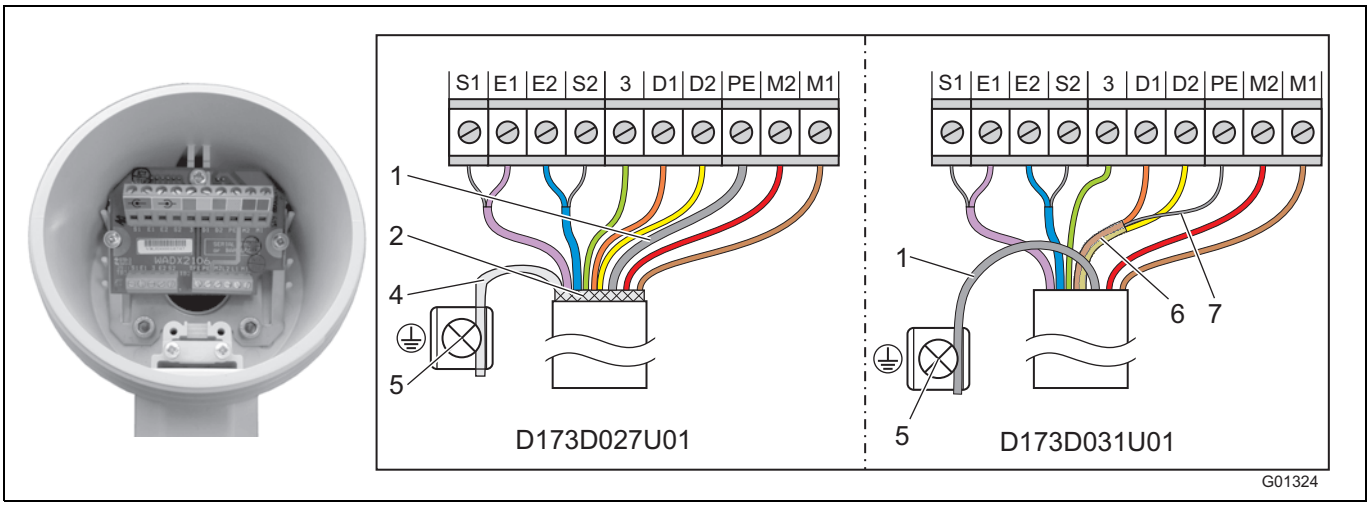


Fig. 39

1 Ground wire
2 Wire mesh shield (D173D027U01 only)
4 Twisted wire mesh shield (D173D027U01 only)
5 Ground terminal
6 Foil shield D1, D2 (D173D031U01 only)
7 Foil shield continuity wire D1, D2 (D173D031U01 only)

Terminal	Description, wire color
M1	Magnet coil, brown
M2	Magnet coil, red
D1	Data line, orange
D2	Data line, yellow
PE	Shield
3	Measurement potential, green
S2	Shield for E2
E2	Signal line, blue
E1	Signal line, violet
S1	Shield for E1

Important (Note)

- Use wire end sleeves.
  - Wire end sleeves 0.75 mm^2 (AWG 19), for shielding (1S, 2S)
  - Wire end sleeves 0.5 mm^2 (AWG 20), for all other wires
- The shields may not touch (signal short circuit).

Connect the cable end on the flowmeter sensor side as shown in Fig. 37.

Cable with part number D173D027U01

- Twist the wire mesh shield of the cable and connect to the ground terminal.
- Connect the ground wire of the cable to the SE clamp of the terminal strip.
- Connect all other wires as shown in Fig. 37.

Cable with part number D173D031U01

- Connect the cable ground wire together with the foil shield continuity wire from D1, D2 to the SE clamp of the terminal strip.
- When using the flowmeter sensor in systems with cathodic corrosion protection (CCP), connect the cable ground wire together with the foil shield continuity wire from D1, D2 to the PE clamp of the terminal strip.
- Connect all other wires as shown in Fig. 37.

5.4.3 Connection via cable conduit

Notice - Condensate formation in terminal box

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

Ensure that the cable entry points on the terminal box are sealed.

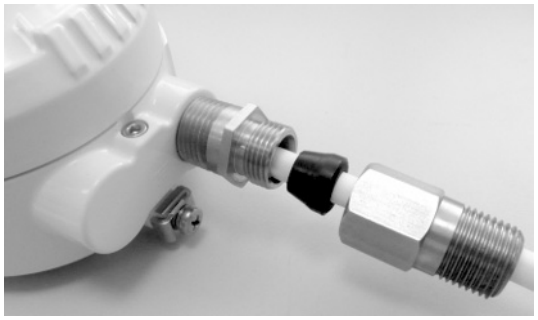


Fig. 40: Installation set for cable conduit

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

5.4.4 Protection class IP 68

For flowmeter sensors with IP 68 degree of protection, the maximum flooding height is 5 m (16.4 ft). The supplied cable (part no. D173D027U01 or D173D031U01) fulfills all submersion requirements

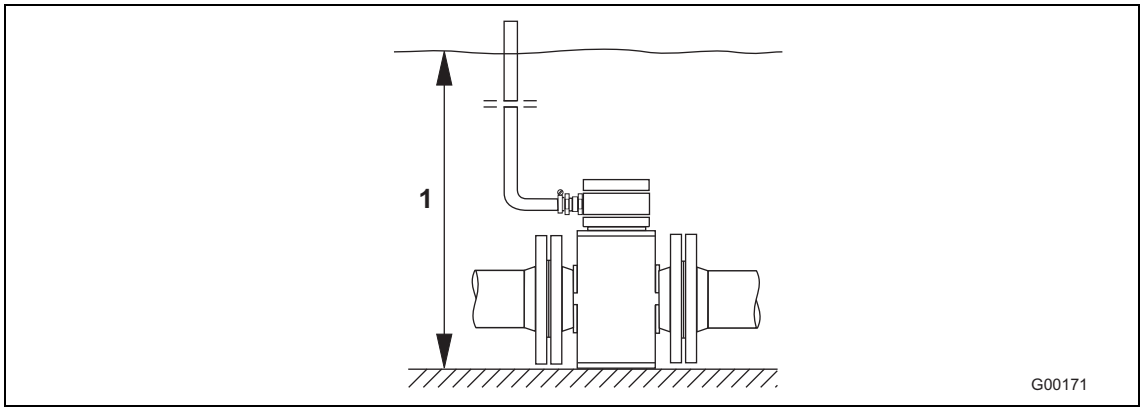


Fig. 41

1 Max. flooding height 5 m (16.4 ft)

The flowmeter sensor is type-tested in accordance with EN 60529. Test conditions: 14 days at a flooding height of 5 m (16.4 ft).

5.4.4.1 Connection

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

Notice- 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 (Note)

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

5.4.4.2 Sealing the connection box

The terminal box of flowmeter sensors without explosion protection or explosion protection Zone 2 / Div 2 can be sealed subsequently.

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. 42).
- Prevent the sealing compound from penetrating a cable conduit 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 of 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.

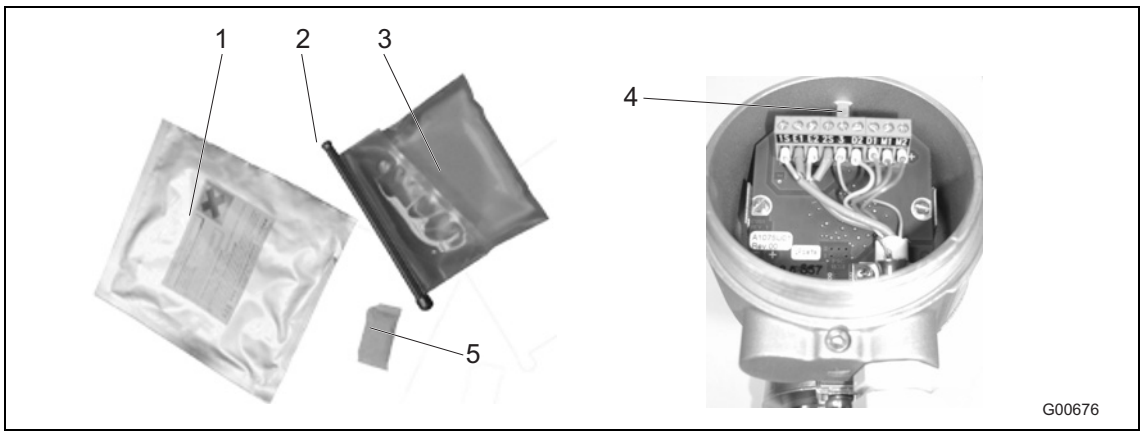


Fig. 42

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

5.5 Connecting the transmitter

Important (Note)

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.

5.5.1 Connecting the power supply

The line voltage and power consumption are indicated on the name plate for the transmitter.

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

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

The circuit breaker should be located near the transmitter and marked as being associated with the device.

The power supply is connected to terminal L (phase), N (neutral), or 1+, 2-, and PE, as stated on the name plate.

Connect the transmitter and flowmeter sensor to functional ground.

Important (Note)

- Observe the limit values for the supply power provided in chapter 12.3.1 "Electrical properties".
- 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.

5.5.2 Transmitter with dual-compartment housing

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

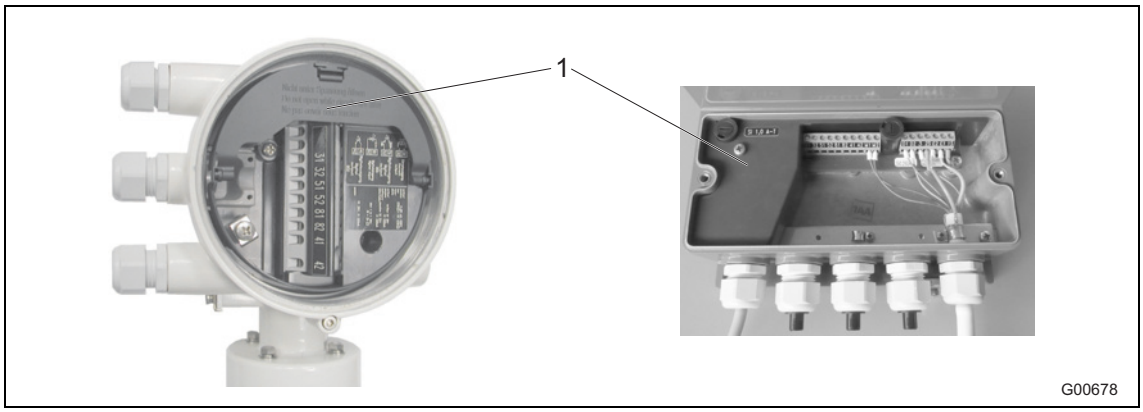


Fig. 43

1 Terminal cover

5.5.3 Transmitter with single-compartment housing

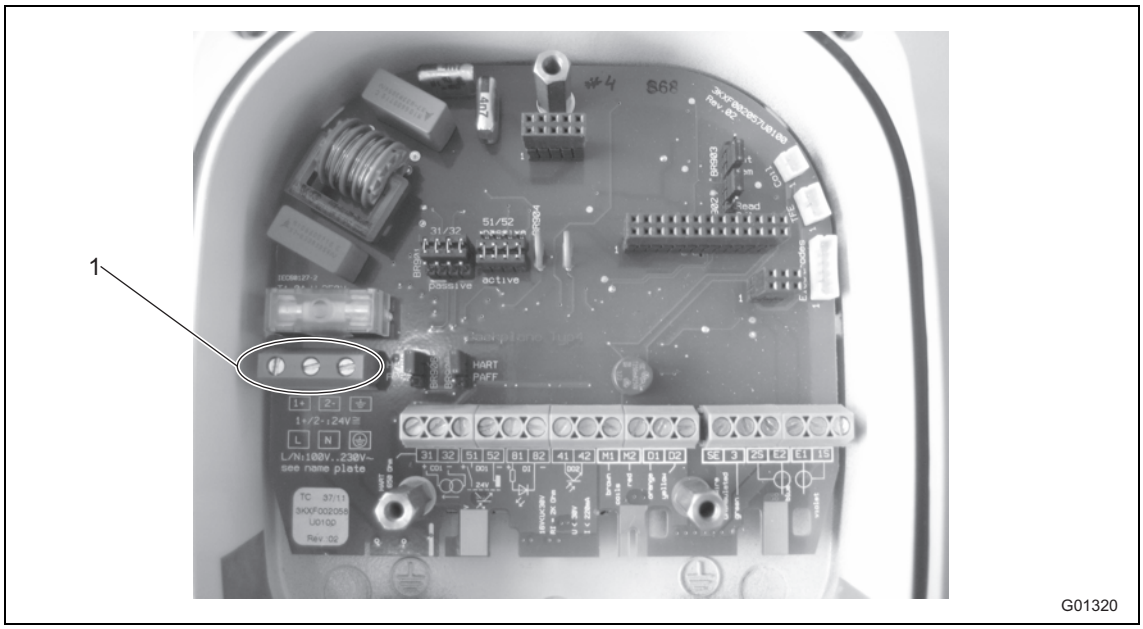


Fig. 44

1 Terminals (power supply)

5.5.4 Connecting the signal and magnet coil cables

The outer shielding of the signal and magnet coil cable is attached to the busbar via the clip (4) (from the accessory bag in the connection area) (dual-compartment transmitter housing only).

In the case of the single-compartment transmitter housing, the outer shielding of the signal and magnet coil cable is connected to the corresponding terminal for the signal and magnet coil cable.

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

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

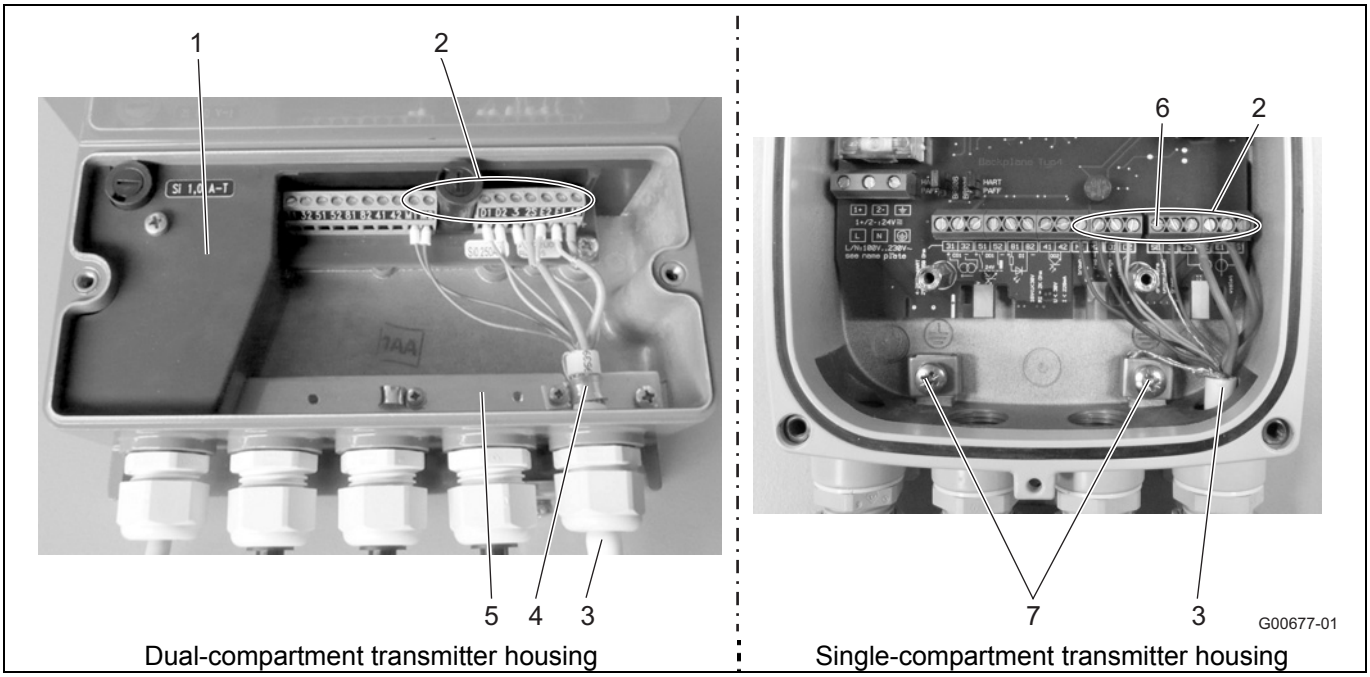


Fig. 45

1 Terminal cover
2 Terminals for signal and magnet coil cable
3 Signal and magnet coil cable
4 Clip
5 Busbar (SE)
6 SE terminal for signal and magnet coil cable shield
7 Terminals for cable shields

Important (Note)

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.

5.6 Terminal connection diagrams

5.6.1 Devices with HART protocol

Important (Note)

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.

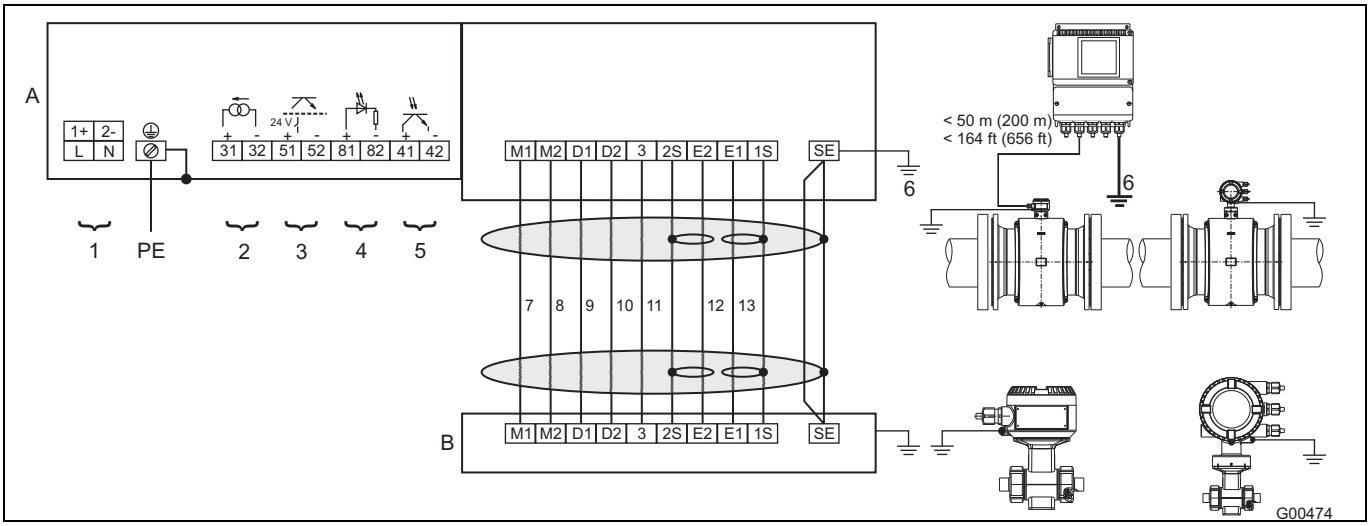


Fig. 46

A **Transmitter**

B **Flowmeter sensor**

1 **Power supply**
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: minimum 11 V, maximum 30 V at terminals 31 / 32.

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 (in the case of the transmitter with the dual-compartment housing, the output is configured using the software; in the case of the transmitter with the single-compartment housing, it is configured by means of jumpers on the transmitter backplane).
Configuration using software.
- Configuration as pulse output.
  Max. pulse frequency: 5250 Hz.
  Pulse width: 0.1 … 2000 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} ≤ 5250 Hz
- Configuration as "passive" output
  U_{max} = 30 V, I_{max} = 220 mA, f_{max} ≤ 5250 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} ≤ 5250 Hz

6	Functional ground	7	Yellow
8	Brown	9	Green
10	Red	11	Blue
12	Orange	13	Violet

Important (Note)

For detailed information about grounding the transmitter and the flowmeter sensor, please refer to the section titled "Installation / grounding".

5.6.2 Devices with PROFIBUS PA or FOUNDATION fieldbus

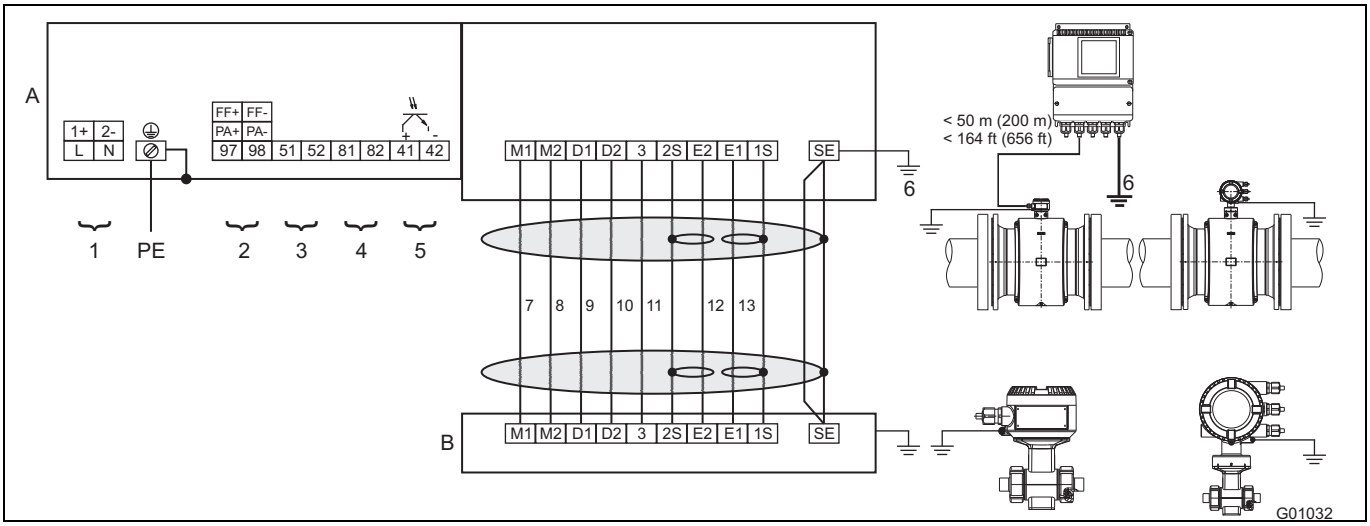


Fig. 47

A **Transmitter**
B **Flowmeter sensor**
1 **Power supply**
See name plate
2 **Digital communication (terminal 97 / 98)**
- **PROFIBUS PA in acc. with IEC 61158-2 (PA+ / PA-)**
  U = 9 ... 32 v, I = 10 mA (normal operation), I = 13 mA (in the event of an error / FDE)
  Bus connection with integrated protection against polarity reversal
  The bus address can be set via the DIP switches in the device (with dual-compartment transmitter housing only), the transmitter display or the fieldbus.

or

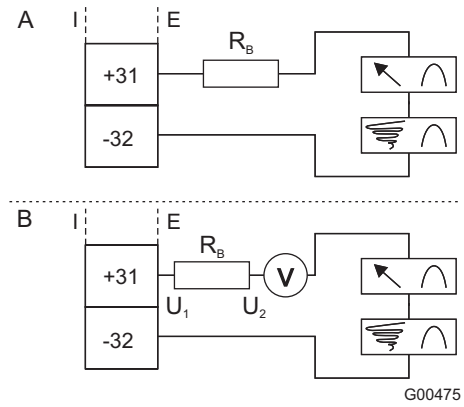
- **FOUNDATION fieldbus in acc. with IEC 61158-2 (FF+ / FF-)**
  U = 9 ... 32 v, I = 10 mA (normal operation), I = 13 mA (in the event of an error / FDE)
  Bus connection with integrated protection against polarity reversal

3 Not assigned
4 Not assigned
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} ≤ 5250 Hz
6 Functional ground
7 Brown
8 Red
9 Orange
10 Yellow
11 Green
12 Blue
13 Violet

Important (Note)
For detailed information about grounding the transmitter and the flowmeter sensor, please refer to the section titled "Installation / grounding".

5.6.3 Connection examples for the peripherals

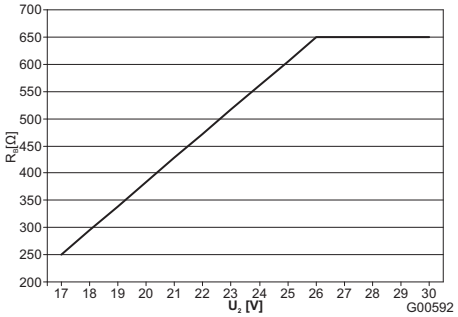
Current output



A = "Active" configuration:
4 ... 20 mA, HART
Load: 0 =R = 650 Ω (300 Ω for Ex Zone 1 / Div. 1)
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

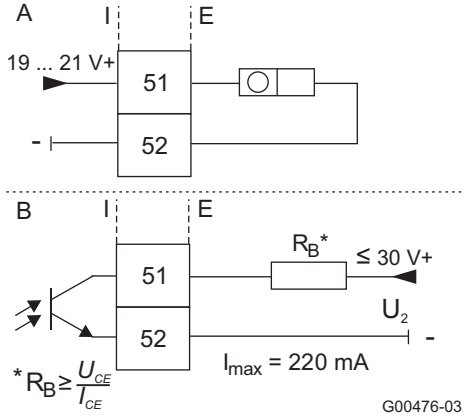
Max. permissible load (R_B) as a function of the source voltage (U_2)



I = internal, E = external

Fig. 48

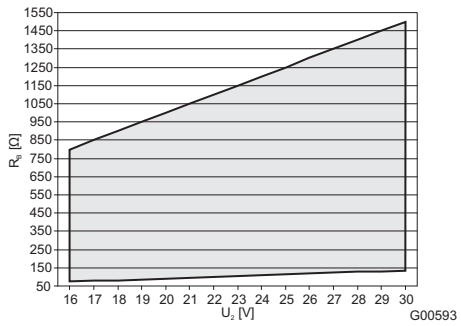
Digital output DO1



A = "Active" configuration

B = "Passive" configuration

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

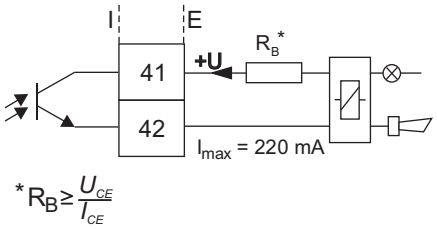


= Permissible range

I = internal, E = external

Fig. 49

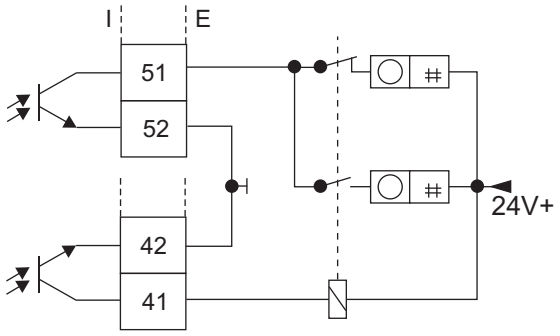
Digital output DO2, e.g., for system monitoring, max. / min. alarm, empty meter tube or forward / reverse signal, or counting pulses (function can be configured using software)



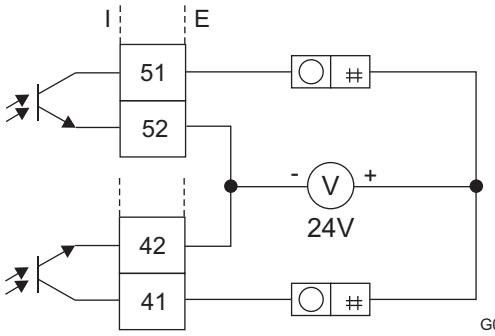
I = internal, E = external

Fig. 50

Digital outputs DO1 and DO2, separate forward and reverse pulses



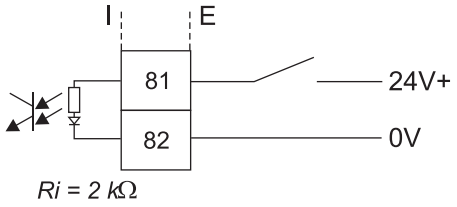
Digital outputs DO1 and DO2, separate forward and reverse pulses (alternative connection)



I = internal, E = external

Fig. 51

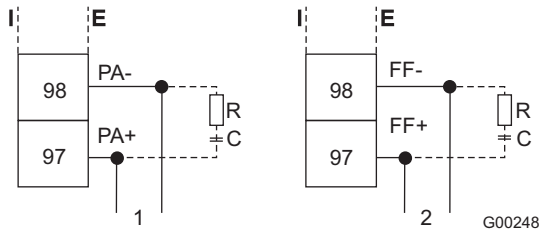
Digital input for external output switch-off or external totalizer reset



I = internal, E = external

Fig. 52

PROFIBUS PA and FOUNDATION fieldbus

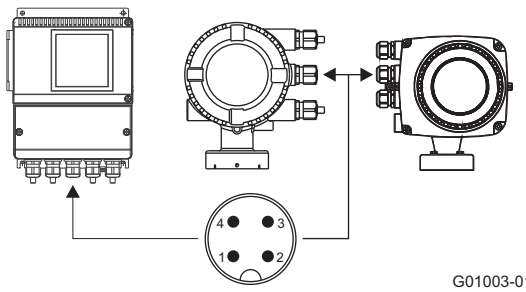


The resistance R and condenser C form the bus termination. They must be installed when the device is connected to the end of the entire bus cable.
R = 100 Ω; C = 1 µF
1 PROFIBUS PA
2 FOUNDATION fieldbus

I = internal, E = external

Fig. 53

Connection via M12 plug (only for PROFIBUS PA in non-hazardous areas)



Pin assignment
(Front view showing pin insert and pins)
PIN 1 = PA+
PIN 2 = nc
PIN 3 = PA-
PIN 4 = shield

Fig. 54

Important (Note)

For additional information on configuring the current output, see chapter **6.2 „Configuring the current output“**

Digital communication

The transmitter has the following options for digital communication:

HART protocol

The unit is registered with the HART Communication Foundation.

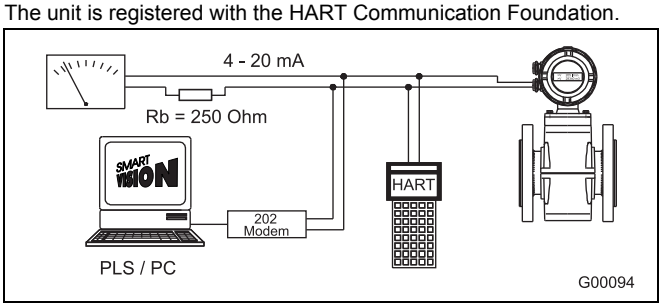


Fig. 55

HART protocol	
Configuration	Directly on the device Software DAT200 Asset Vision Basic (+ HART-DTM)
Transmission	FSK modulation on current output 4 ... 20 mA acc. to Bell 202 standard
Max. signal amplitude	1.2 mA_{ss}
Current output load	Min. 250 Ω, max. = 560 Ω
Cable	AWG 24 twisted
Max. cable length	1500 m
Baud rate	1,200 baud
Display	Log. 1: 1,200 Hz Log. 0: 2200 Hz

For additional information, see the separate interface description.

System integration

In conjunction with the DTM (Device Type Manager) available for the device, communication (configuration, parameterization) can occur with the corresponding framework applications according to FDT 1.21 (DAT200 Asset Vision Basic).

Other tool/system integrations (e.g., Emerson AMS/Siemens PCS7) are available upon request.

A free of charge version of the DAT200 Asset Vision Basic framework application for HART® or PROFIBUS is available upon request.

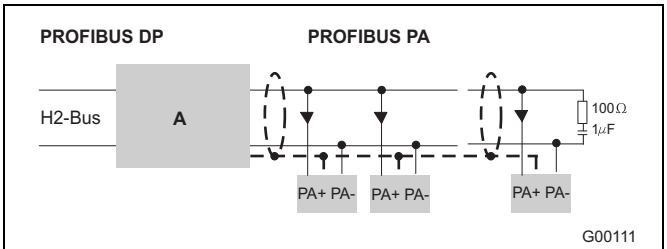
The required DTMs are contained on the DAT200 Asset Vision Basic DVD or in the DTM Library.

They can also be downloaded from www.abb.com/flow.

PROFIBUS PA protocol

The interface conforms to profile 3.01 (PROFIBUS standard, EN 50170, DIN 19245 [PRO91]).

PROFIBUS PA ID no.:	0x3430
Alternative standard ID no.:	0x9700 or 0x9740
Configuration	Directly on the device Software DAT200 Asset Vision Basic (+ PROFIBUS PA-DTM)
Transmission signal	Acc. to IEC 61158-2
Cable	Shielded, twisted cable (acc. to IEC 61158-2, types A or B are preferred)



A = Segment coupler (incl. bus supply and termination)

Fig. 56: Example for PROFIBUS PA interface connection

Bus topology

- Tree and/or line structure
- Bus termination: passive at both ends of the main bus line (RC element R = 100 Ω, C = 1 µF)

Voltage / current consumption

- Average current consumption: 10 mA
- In the event of an error, the integrated FDE function (=Fault Disconnection Electronic) integrated in the device is ensures that the current consumption can rise to a maximum of 13 mA.
- The upper current limit is restricted electronically.
- The voltage on the bus line must lie in the range of 9 ... 32 V DC.

For additional information, see the separate interface description.

System integration

ABB provides three different GSD files (equipment master data) which can be integrated in the system.

Users decide at system integration whether to install the full range of functions or only part.

The change-over is done using the “ID-number selector” parameter.

ID number 0x9700, GSD file name: PA139700.gsd

ID number 0x9740, GSD file name: PA139740.gsd

ID number 0x3430, GSD file name: ABB_3430.gsd

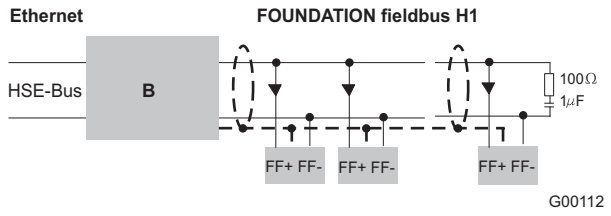
The interface description appears on the CD included in the scope of supply.

The GSD files can also be downloaded from www.abb.com/flow.

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

FOUNDATION fieldbus (FF)

Interoperability test campaign no.	ITK 5.20
Manufacturer ID	0x000320
Device ID	0x0124
Configuration	• Directly on the device • Via services integrated in the system • National configurator
Transmission signal	Acc. to IEC 61158-2



B = Linking device (incl. bus supply and termination)

Fig. 57: Example for FOUNDATION fieldbus interface connection

Bus topology

- Tree and/or line structure
- Bus termination: passive at both ends of the main bus line (RC element R = 100 Ω, C = 1 µF)

Voltage / current consumption

- Average current consumption: 10 mA
- In the event of an error, the integrated FDE function (=Fault Disconnection Electronic) integrated in the device is ensures that the current consumption can rise to a maximum of 13 mA.
- Upper current limit: electronically restricted.
- The voltage on the bus line must lie in the range of 9 ... 32 V DC.

Bus address

The bus address is automatically assigned or can be set in the system manually.

The identifier (ID) is formed using a unique combination of manufacturer ID, device ID, and device serial number.

System integration

The following are required:

- DD (Device Description) file, which includes the device description.
- The CFF (Common File Format) file is required for engineering the segment. Engineering can be performed online or offline.

The interface description appears on the CD included in the scope of supply.

The files can also be downloaded from www.abb.com/flow.

The files required for operation can also be downloaded from http://www.fieldbus.org.

6 Commissioning

Important (Note)

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 its safety locking device must be sealed before switching on the supply power.
- For devices with remote mount design and an accuracy of 0.2 % of rate make sure that the flowmeter sensor and the transmitter match correctly.
  For this purpose, the final characters X1, X2, etc. are printed on the name plates of the flowmeter sensors, whereas the transmitters are identified by the final characters Y1, Y2, etc.
  Devices with the end characters X1 / Y1 or X2 / Y2, etc. fit with each other.

6.2 Configuring the current output

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

For devices without explosion protection or for operation in Zone 2 / Div. 2 the following is valid:

The signal can be configured in "active" or "passive" mode. The current setting is contained in the order confirmation.

For devices for operation in Zone 1 / Div. 1 the following is valid:

For devices designed for use in Ex Zone 1 / Div.1, the current output cannot be reconfigured subsequently. The configuration required for the current output (active / passive) must be specified when the order is placed.

For the correct current output design (active / passive), see the marking contained in the device's terminal box.

If the signal is configured in "active" mode, no external power may be supplied to the current output.

If the signal is configured in "passive" mode, external power must be supplied to the current output (similar to pressure and temperature transmitters).

6.2.1 Transmitter with dual-compartment housing

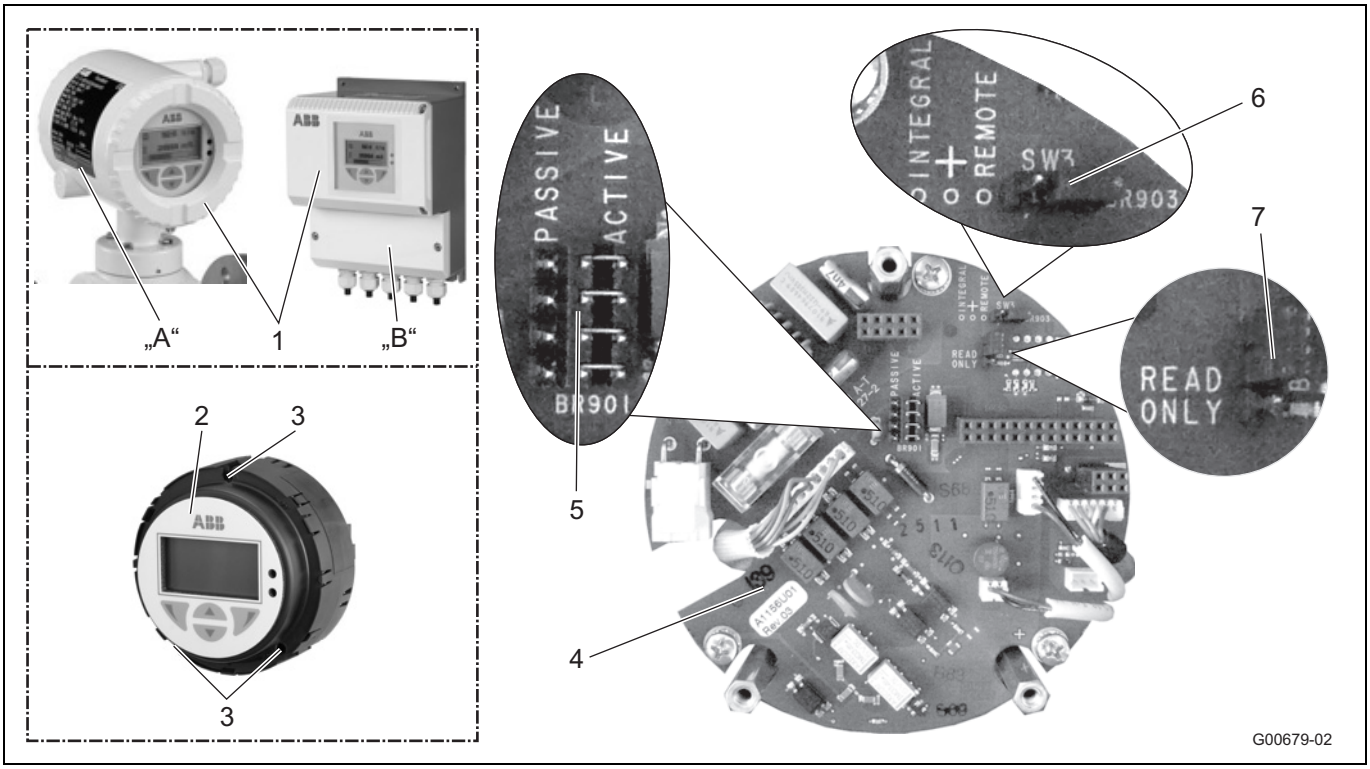


Fig. 58

A Integral mount design
B Remote mount design
1 Housing cover
2 Transmitter plug-in module
3 Fixing screws
4 Backplane (in the transmitter housing)
5 Jumper (BR901) for active / passive current output
6 Jumper (BR903) for integral / remote mount design
7 Jumper (BR902) for hardware write protection

Important (Note)
The backplane is mounted in the transmitter housing (not the transmitter plug-in module).

Configure the outputs as follows:

1. Switch off power supply.
2. Open the housing cover.
3. Remove the mounting screws for the transmitter electronics unit
4. Pull out the transmitter electronics unit
5. Set jumpers on backplane in accordance with the following table.

Jumper	Number	Function
BR901	active	Current output 31 / 32 active
	passive	Current output 31 / 32 passive
BR902	Read only	Hardware write protection active
BR903	integral	Transmitter with integral mount design
	remote	Transmitter with remote mount design

6. Reinstall the transmitter electronic unit in reverse order

6.2.2 Transmitter with single-compartment housing

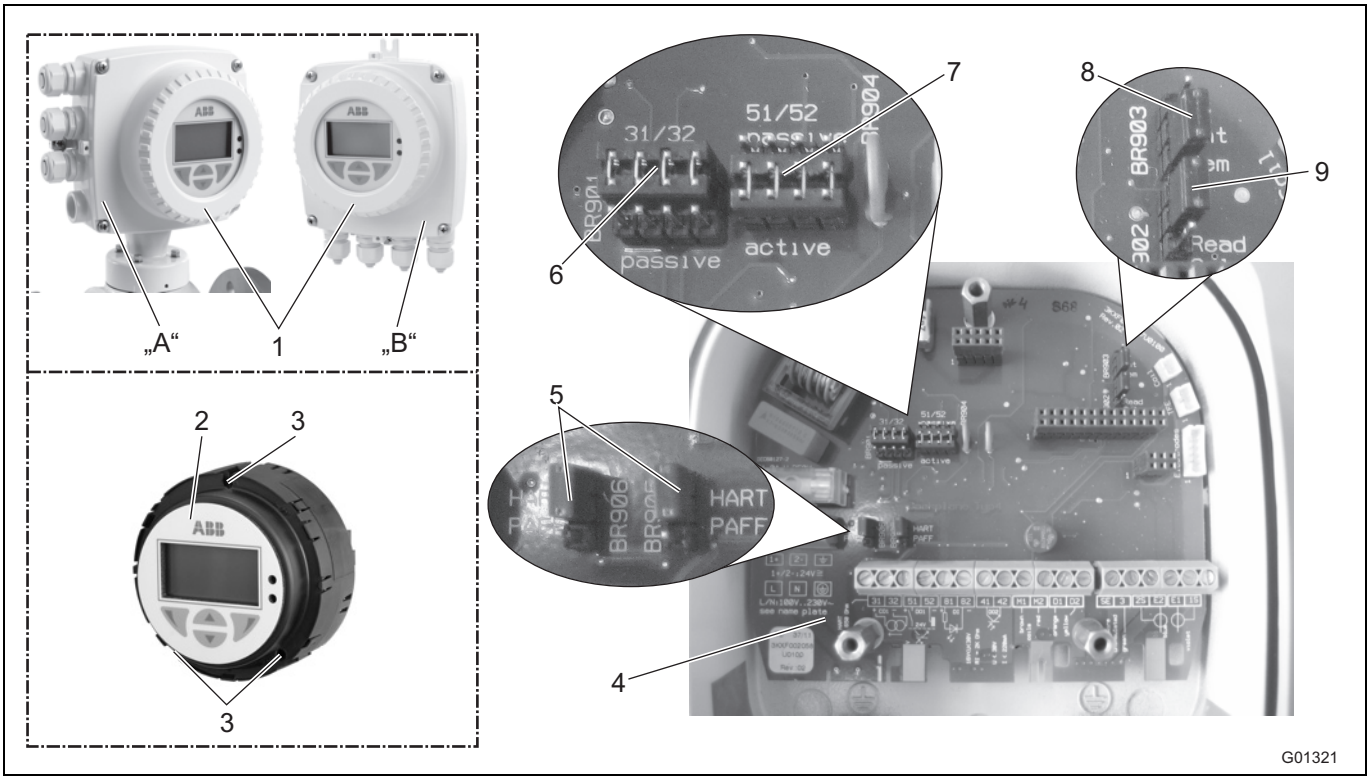


Fig. 59: Jumpers in the single-compartment housing

A Integral mount design
B Remote mount design
1 Housing cover
2 Transmitter plug-in module
3 Fixing screws
4 Backplane (in the transmitter housing)
5 Jumpers (BR905, BR906) for communication
6 Jumper (BR901) for active / passive current output
7 Jumper (BR904) for active / passive pulse output
8 Jumper (BR903) for integral / remote mount design
9 Jumper (BR902) for hardware write protection

Important (Note)

The backplane is mounted in the transmitter housing (not the transmitter plug-in module).

Configure the outputs as follows:

1. Switch off power supply.
2. Open the housing cover.
3. Remove the mounting screws for the transmitter electronics unit
4. Pull out the transmitter electronics unit
5. Set jumpers on backplane in accordance with the following table.

Jumper	Number	Function
BR901	active	Current output 31 / 32 active
	passive	Current output 31 / 32 passive
BR902	Read only	Hardware write protection active
BR903	integral	Transmitter with integral mount design
	remote	Transmitter with remote mount design
BR904	active	Pulse output 51 / 52 active
	passive	Pulse output 51 / 52 passive
BR905, BR906	HART	Digital communication via HART protocol
	PA/FF	Digital communication via PROFIBUS PA or FOUNDATION Fieldbus

6. Install the transmitter in reverse order.

6.3 Start-up of PROFIBUS PA units

For units with PROFIBUS PA, the bus address must be checked or configured prior to start-up. If no bus address information was supplied by the customer, the unit was shipped with its BUS address set to “126”.

The address must be set during start-up to a number within the valid range (0 … 125).

Important (Note)

The address selected may only appear once in the segment.

The PROFIBUS PA interface of the device conforms with Profile 3.01 (fieldbus standard PROFIBUS, EN 50170, alias DIN 19245 [PRO91]).

The transmitter transmission signal is designed according to IEC 61158-2.

Important (Note)

The manufacturer-specific PROFIBUS PA ID no. is: 0x3430.
The unit can also be operated with the PROFIBUS standard ID nos. 0x9700 or 0x9740.

Address setting in the case of transmitters with dual-compartment housing

The address can be set either locally on the device (via the DIP switches on the backplane), using system tools, or via a PROFIBUS DP master class 2 such as Asset Vision Basic (DAT200).

The factory setting for DIP switch 8 is OFF, i.e., the address is set using the fieldbus.

The front cover must be unscrewed to change the settings. It is also possible to set the address via menu by using the keys on the display board.

Address setting in the case of transmitters with single-compartment housing

The address can be set using system tools or via a PROFIBUS DP master class 2 such as Asset Vision Basic (DAT200).

It is also possible to set the address via a menu by using the transmitter LCD display (refer to the the "Parameterization" section).

It is not possible to set the address locally via DIP switch because there are no DIP switches present in the case of transmitters with single-compartment housing.

6.3.1 Local address setting in the case of transmitters with dual-compartment housing

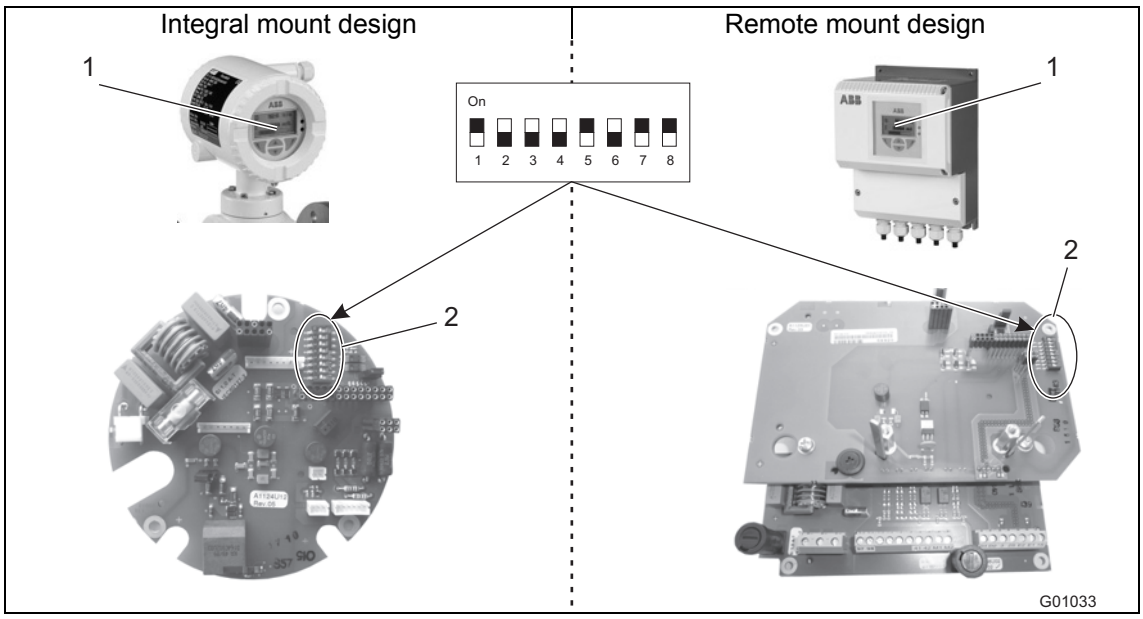


Fig. 60: Position of DIP switches

1 Transmitter plug-in module 2 DIP switch

Switch assignments

Switch	Assignment
1 … 7	PROFIBUS address
8	Defines the addressing mode: Off = Set address via bus (factory setting) On = Set address via DIP switches 1 ... 7 (local)

Device behavior with power supply switched on

After the power supply has been switched on, DIP switch 8 is polled:

Status	
ON	The address defined by DIP switches 1 ... 7 applies. The address can no longer be changed via the bus once the device is in operation, since DIP switch 8 is polled only once when the power supply is turned on.
OFF (Default)	The transmitter uses the address stored in the FRAM of the gateway. At shipment the address is set to “126” or to the address specified by the customer. Once the unit is in operation, the address can be changed via the bus or directly on the unit using the keys on the display board. The unit must be connected to the bus.

Address setting

Switches 1, 5, 7 = ON means: 1+16+64 = 81 → Bus address 81

Switch	1	2	3	4	5	6	7	8
Status	Device address							Address mode
Off	0	0	0	0	0	0	0	Bus
On	1	2	4	8	16	32	64	Local

6.3.2 Configuration in the case of transmitters with single-compartment housing

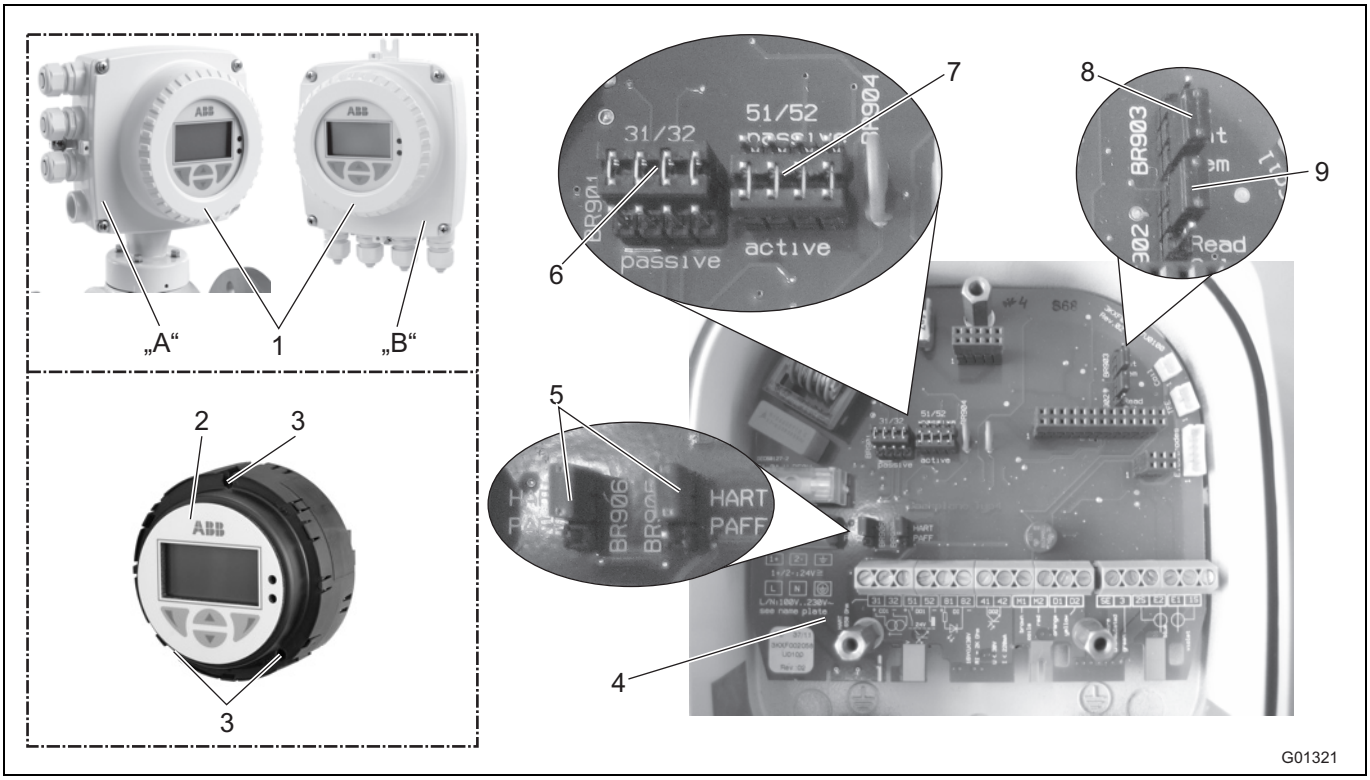


Fig. 61:

A Integral mount design
B Remote mount design
1 Housing cover
2 Transmitter plug-in module
3 Fixing screws
4 Backplane (in the transmitter housing)
5 Jumpers (BR905, BR906) for communication
6 Jumper (BR901) for active / passive current output
7 Jumper (BR904) for active / passive pulse output
8 Jumper (BR903) for integral / remote mount design
9 Jumper (BR902) for hardware write protection

Set jumpers on backplane in accordance with the following table.

Jumper	Number	Function
BR901	passive	For PROFIBUS PA, set position to "passive"
BR903	integral	Transmitter with integral mount design
	remote	Transmitter with remote mount design
BR904	active	For PROFIBUS PA without function
	passive	
BR905, BR906	PA/FF	Digital communication via PROFIBUS PA

6.3.3 Voltage / current consumption

- Average current consumption: 10 mA.
- In the event of an error, the integrated FDE (= Fault Disconnection Electronic) function integrated in the device ensures that the current consumption can rise to a maximum of 13 mA.
- The upper current limit is restricted electronically.
- The voltage on the bus line must lie in the range of 9 ... 32 V DC.

6.3.4 System integration

Use of PROFIBUS PA profile B, B3.01 ensures interoperability and interchangeability of devices. Interoperability means that devices from different manufacturers can be physically connected to a bus and are communication-ready. In addition, third-party devices can be interchanged without having to reconfigure the process control system.

To support interchangeability, ABB provides three different GSD files (equipment master data) that can be integrated in the system.

Users decide at system integration whether to install the full range of functions or only part.

Important (Note)

Devices are interchanged using the parameter "ID number selector", which can only be modified on an acyclical basis.

The following table describes the available GSD files:

Number and type of function blocks	ID number	GSD file name
1 x AI	0x9700	PA139700.gsd
1 x AI; 1 x TOT	0x9740	PA139740.gsd
4 x AI, 2 x TOT, 1 x AO, 1 x DI, 1 x DO and all manufacturer-specific parameters	0x3430	ABB_3430.gsd

The manufacturer-specific GSD file "ABB_3430.gsd" is available to download from the ABB homepage http://www.abb.com/flow.

The standard "PA1397xx.gsd" GSD files are available for download from the Profibus International homepage: http://www.profibus.com

6.4 Start-up of FOUNDATION FIELDBUS devices

For devices with a FOUNDATION Fieldbus, the settings of the DIP switch must be checked prior to start-up.

The DIP switches on the unit must be set correctly as follows:

- DIP switch 1 must be OFF.
- DIP switch 2 must be OFF.

Otherwise, the hardware write protection and the process control system prevent the unit from recording information.

When integrating the unit in a process control system, a DD file (device description) and a CFF file (common file format) are required. The DD file contains the device description. The CFF file is required for segment engineering. Engineering can be performed online or offline.

The DD and CFF files are available to download from the ABB homepage http://www.abb.com/flow.

The FOUNDATION Fieldbus interface for the device is compliant with the standards FF-890/891 and FF-902/90. The transmission signal of the transmitter is designed in accordance with IEC 61158-2.

The device is registered with the FOUNDATION fieldbus.

Registration for the FOUNDATION fieldbus is recorded under Manufacturer ID 0x000320 and Device ID 0x0124.

6.4.1 Configuration of transmitters with dual-compartment housing

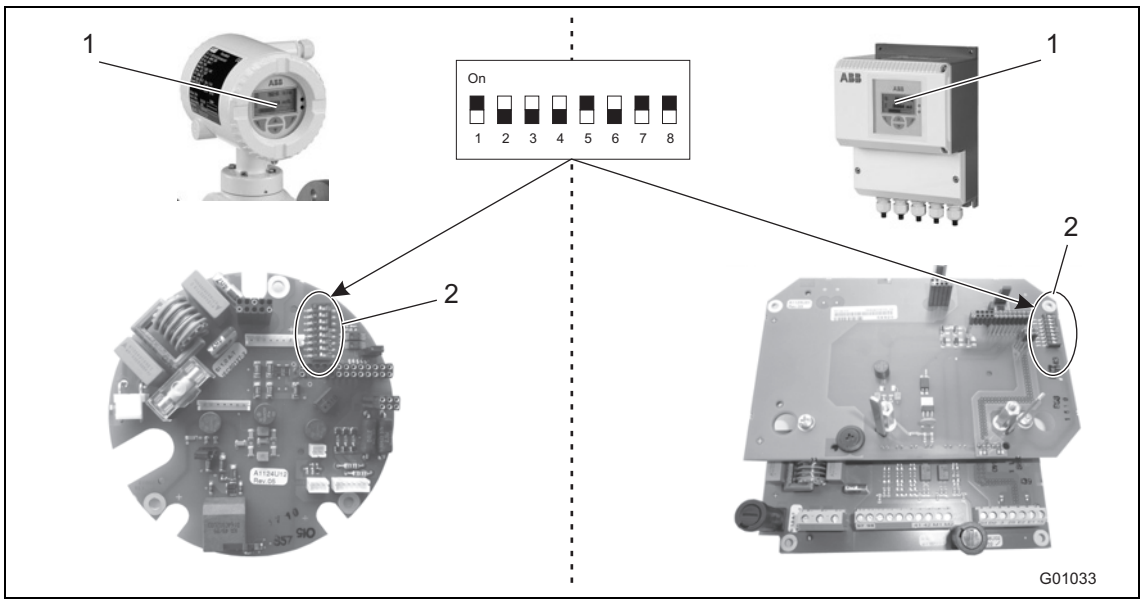


Fig. 62: Position of DIP switches

1 Transmitter plug-in module
2 DIP switch

Assigning of DIP switches

DIP switch 1:

Enables the simulation of the AI function blocks.

DIP switch 2:

Hardware write protection for write access via bus (locks all blocks).

DIP switch	1	2
Status	Simulation Mode	Write Protect
Off	Disabled	Disabled
On	Enabled	Enabled

6.4.2 Configuration of transmitters with single-compartment housing

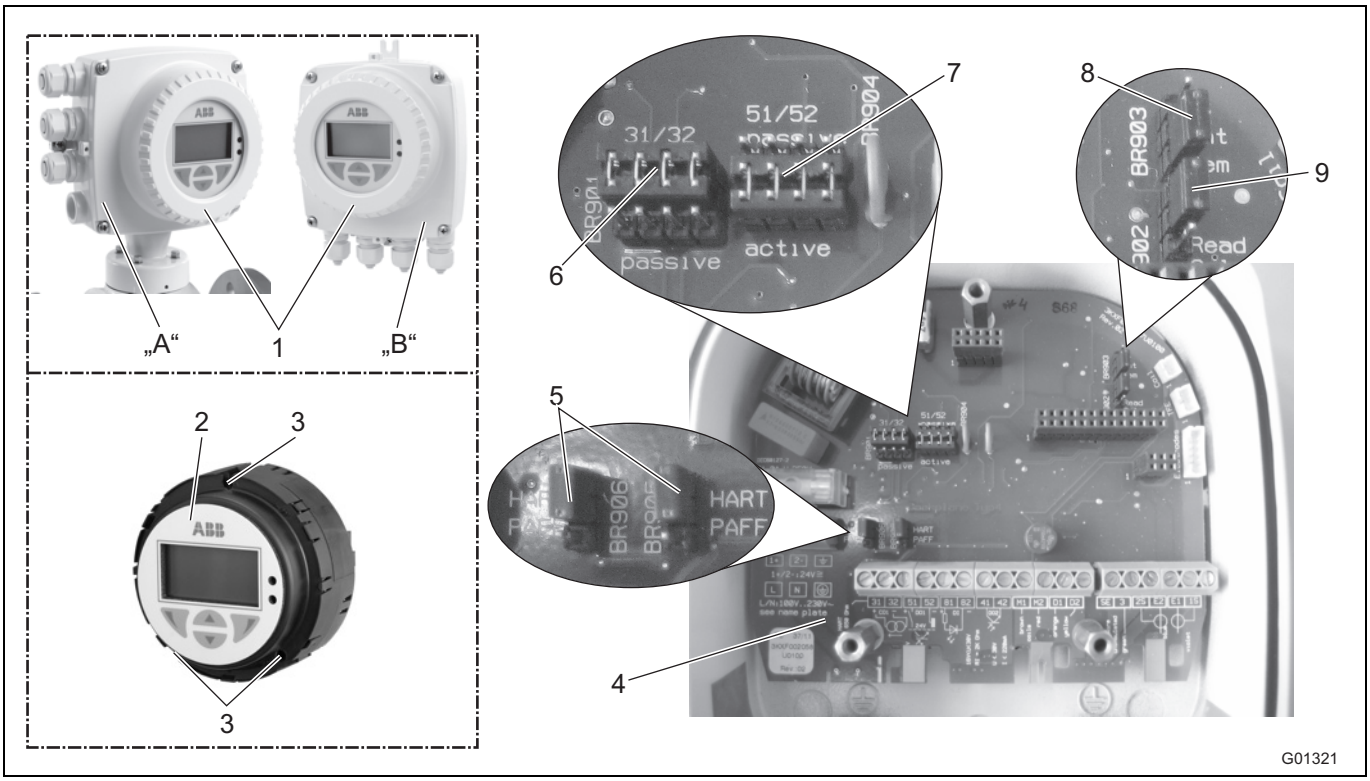


Fig. 63:

A Integral mount design
B Remote mount design
1 Housing cover
2 Transmitter plug-in module
3 Fixing screws
4 Backplane (in the transmitter housing)
5 Jumpers (BR905, BR906) for communication
6 Jumper (BR901) for active / passive current output
7 Jumper (BR904) for active / passive pulse output
8 Jumper (BR903) for integral / remote mount design
9 Jumper (BR902) for hardware write protection

Set jumpers on backplane in accordance with the following table.

Jumper	Number	Function
BR901	passive	For FOUNDATION Fieldbus, set position to "passive"
BR903	integral	Transmitter with integral mount design
	remote	Transmitter with remote mount design
BR904	active	For FOUNDATION Fieldbus without function
	passive	
BR905, BR906	PA/FF	Digital communication via FOUNDATION Fieldbus

6.4.3 Bus address settings

The bus address is automatically allocated at the FF via LAS (link active scheduler). For address detection, a unique number is used (DEVICE_ID). This number is a combination of manufacturer ID, device ID and device serial number.

The behavior when switching on the unit corresponds to Draft DIN IEC/65C/155/CDV of June 1996.

The mean current consumption of the device is 10 mA.

The voltage on the bus line must lie in the range of 9 … 32 V DC.

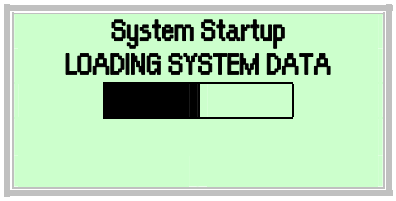
Important (Note)

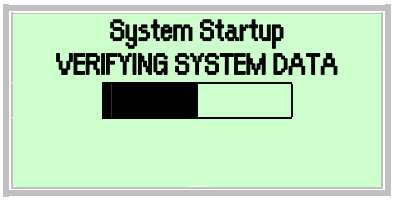
The upper limit of the current is electronically limited. In the event of an error, the FDE (= Fault Disconnection Electronic) function integrated in the device ensures that the current consumption cannot exceed a maximum of 13 mA.

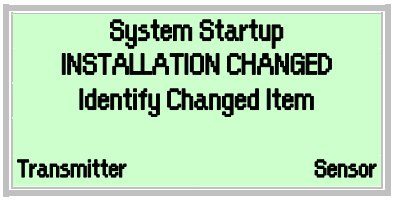
6.5 Commissioning the unit

6.5.1 Downloading the system data

1. Switch on the power supply. After switching on the power supply, the following messages appear in succession on the LCD display:







2. Download the system data as follows:

For a completely new system or initial start-up

- The calibration data of the flowmeter sensor and the transmitter settings are loaded from the SensorMemory[1)] into the transmitter.

After replacing the complete transmitter or transmitter electronic unit

- Select "Transmitter" with  . The calibration data of the flowmeter sensor and the transmitter settings are loaded from the SensorMemory[1)] into the transmitter.

After replacing the sensor

- Select "Sensor" with  . The calibration data of the flowmeter sensor are loaded from the SensorMemory[1)] into the transmitter. The transmitter settings are stored 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 7 "Parameterization".

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

Important (Note)

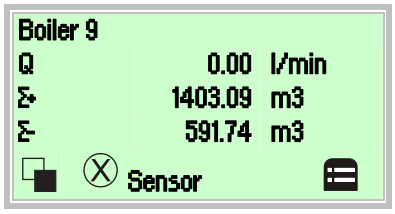
System data must only be loaded during initial start-up. If the power supply is later switched off, the transmitter automatically loads all data the next time the power supply is switched on again.
A selection as described below (1-3) is not required.

6.5.1.1 Error message "Incompatible sensor"

Important (Note)

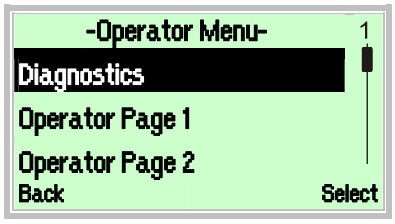
When commissioning the device, make sure that the transmitter is assigned to the sensor correctly. It is not possible to operate a flowmeter sensor of the 300 series with a transmitter of the 500 series.

If the transmitter is operated with a flowmeter sensor of another series, the following message appears on the transmitter display:

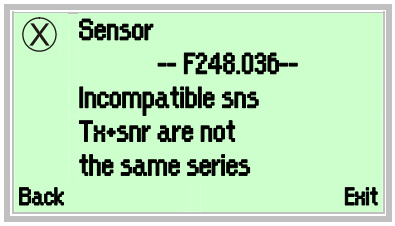


In the process display, a flow of zero flow is indicated, no flow measurement is performed.

1. Use  to switch to the information level.



2. Use  or  , select the "Diagnostics" submenu.
3. Use  to confirm your selection.



When attempting to commission a mixed installation, the shown error message appears.

The device cannot measure.

The indicated value for the current flowrate is zero flow.

The current output assumes its pre-configured state (Iout for alarm).

Make sure that the flowmeter sensor and the transmitter are from the same series.

(e.g., flowmeter sensor ProcessMaster 300, transmitter ProcessMaster 300)

6.5.2 Parameterizing via the "Easy Set-up" menu function

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

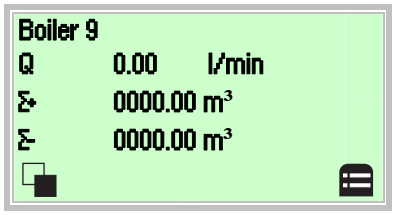
If no customer information is available, the device is delivered with factory settings.

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).

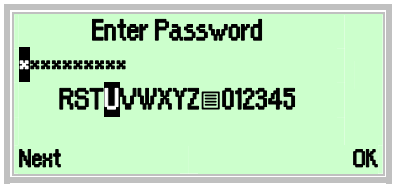
For detailed descriptions of these menus and parameters, see the chapter on the "Parameter overview".

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

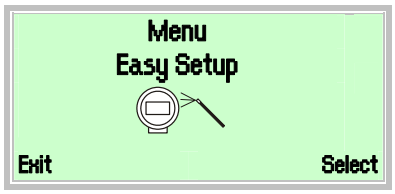


4. Use  to switch to the configuration level:

5. Use  or  to select "Standard".
6. Use  to confirm your selection.

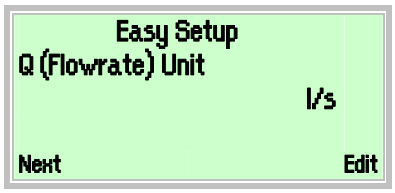


7. Use  to confirm your password. A password is not available as factory default; you can continue without entering a password.



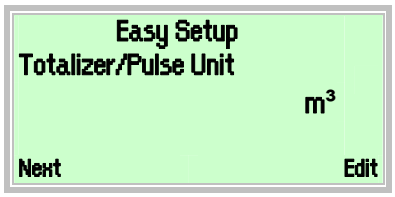
8. Use  or  to select "Easy Setup".
9. Use  to confirm your selection.

10. Use ▼ to call up the edit mode.
11. Use ▲ or ▼ to select the required language.
12. Use ▼ to confirm your selection.

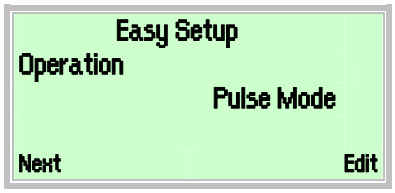


13. Use ▼ to call up the edit mode.
14. Use ▲ or ▼ to select the required unit.
15. Use ▼ to confirm your selection.

16. Use ▼ to call up the edit mode.
17. Use ▲ or ▼ to set the required flow range end value.
18. Use ▼ to confirm your setting.



19. Use ▼ to call up the edit mode.
20. Use ▲ or ▼ to select the required unit.
21. Use ▼ to confirm your selection.

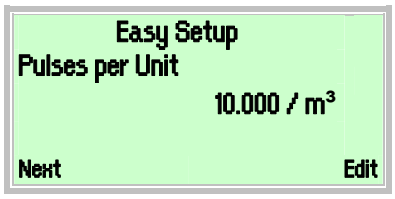


22. Use ▼ to call up the edit mode.
23. Use ▲ or ▼ to select the required operating mode.

- „Pulse Mode“ In pulse mode, pulses per unit are output. The relevant settings are provided in the next menu.
- „Fullscale Frequency“: In the frequency mode, a frequency proportional to the flowrate is output. The maximum frequency can be configured according to the flow measurement range.

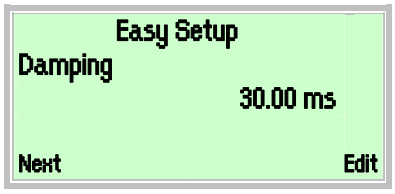
The factory default for the operating mode is "Pulse Mode".

24. Use ▼ to confirm your selection.

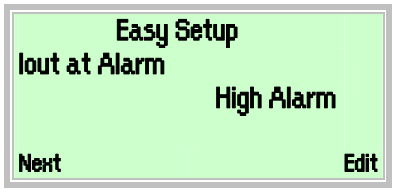


25. Use ◤ to call up the edit mode.
26. Use ▲ or ▼ to set the required value.
27. Use ◤ to confirm your setting.

28. Use ◤ to call up the edit mode.
29. Use ▲ or ▼ to set the required pulse width.
30. Use ◤ to confirm your setting.



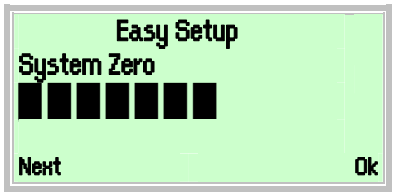
31. Use ◤ to call up the edit mode.
32. Use ▲ or ▼ to set the required damping.
33. Use ◤ to confirm your setting.



34. Use ◤ to call up the edit mode.
35. Use ▲ or ▼ to select the alarm mode.
36. Use ◤ to confirm your selection.

37. Use ◤ to call up the edit mode.
38. Use ▲ or ▼ to set the required current value for low alarm.
39. Use ◤ to confirm your selection.

40. Use ◤ to call up the edit mode.
41. Use ▲ or ▼ to set the required current value for high alarm.
42. Use ◤ to confirm your selection.



43. Use ▼ to start automatic adjustment of system zero.

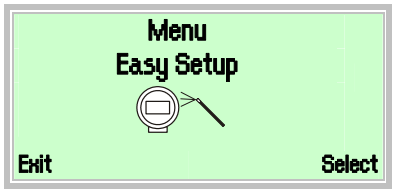
Important (Note)

Prior to starting the zero adjustment, make sure that:

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

Enter the signal cable length between the transmitter and the flowmeter sensor. For devices with a compact design 0.01 m must be entered.

44. Use ▼ to call up the edit mode.
45. Use ▲ or ▼ to set the signal cable length.
46. Use ▼ to confirm your selection.



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

47. Use ◥ to switch to the process display:

Important (Note)

- For additional information regarding operation of the LCD display, refer to chapter "7.1 „Operation".
- For detailed descriptions of all menus and parameters, see chapter 7.4 „Description of parameters“.

The LCD display is provided with capacitive control buttons. These enable you to control the device through the glass of the closed cover.

Important (Note)

The transmitter automatically calibrates the capacitive control buttons on a regular basis. If the cover should be opened during operation, the buttons' sensitivity is at first increased. As a result, operating errors may occur. The button sensitivity will return to normal during the next automatic calibration.

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 chapter **6.6** "**Flowmeter sizes, flow range**".

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

	Possible parameter settings	Factory setting
Qmax	Depending on the size (see table)	QmaxDN (see table)
Sensor TAG	Alphanumeric, max. 20 characters	None
Sensor Location TAG	Alphanumeric, max. 20 characters	None
Q (Flowrate) Unit	l/s; l/min; l/h; ml/s; ml/min; m3/s; m3/min; m3/h; m3/d; hl/h; g/s; g/min; g/h; kg/s; kg/min; kg/h; kg/d; t/min; t/h; t/d	l/min
Totalizer/Pulse Unit	m3; l; ml; hl; g; kg; t	l
Pulses per Unit		1
Pulse Width	0,1 ... 2,000 ms	100 ms
Damping (1 Tau)	0,02 ... 60 sec.	1
DO1 Alarm Config	Pulse F/Pulse R, Pulse F, General Alarm, Min. Flowrate Alarm, Max. Flowrate Alarm, Empty Pipe, TFE Only available for FEP500 / FEH500 are: Gas Bubble, Conductivity, Coating, Sensor Temp	Pulse F/Pulse R
DO1 Action	Active, Passive	Passive
DO2 Alarm Config	F/R Signal, Pulse R, General Alarm, Min. Flowrate Alarm, Max. Flowrate Alarm, Empty Pipe, TFE Only available for FEP500 / FEH500 are: Gas Bubble, Conductivity, Coating, Sensor Temp	F/R Signal

	Possible parameter settings	Factory setting
Digital Input Setup	No Function, Totalizer Reset(All), Flowrate to Zero, System Zero Adjust, Totalizer Stop(All), Only available for FEP500 / FEH500 are: Dual Range, Start/Stop Batching	Flowrate to Zero
Current Output	4 … 20 mA, 4 … 12 … 20 mA	4 - 20 mA
Iout at Alarm	High Alarm, can be set to 21 … 23 mA or Low Alarm, can be set to 3.5 … 3.6 mA	High Alarm, 21.8 mA For details refer to Section 9.2.
Iout at Flow >103%	Off (no signaling, current output holds 20.5 mA), High Alarm, Low Alarm	Off
Low Flow Cut Off	0 … 10 %	1 %
Empty Pipe Detector	On / Off	Off
TFE Detector	On / Off	Off

For PROFIBUS PA version

	Possible parameter settings	Factory setting
PA Addr. (BUS)	0 … 126	126
ID Nr Selector	0x9700, 0x9740, 0x3430	0x3430

6.6 Flowmeter sizes, flow range

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

Nominal diameter		Min. flow range end value	$Qmax_{DN}$	Max. flow range end value
DN	"	0.02 x Q_{max}DN (≈ 0.2 m/s)	0 … ≈ 10 m/s	2 x Q_{max}DN (≈ 20 m/s)
1	1/25	0,012 l/min (0,0032 US gal/min)	0,6 l/min (0,16 US gal/min)	1,2 l/min (0,32 US gal/min)
1,5	1/16	0,024 l/min (0,0063 US gal/min)	1,2 l/min (0,32 US gal/min)	2,4 l/min (0,63 US gal/min)
2	1/12	0,04 l/min (0,0106 US gal/min)	2 l/min (0,53 US gal/min)	4 l/min (1,06 US gal/min)
3	1/10	0.08 l/min (0.02 US gal/min)	4 l/min (1.06 US gal/min)	8 l/min (2.11 US gal/min)
4	5/32	0.16 l/min (0.04 US gal/min)	8 l/min (2.11 US gal/min)	16 l/min (4.23 US gal/min)
6	1/4	0.4 l/min (0.11 US gal/min)	20 l/min (5.28 US gal/min)	40 l/min (10.57 US gal/min)
8	5/16	0.6 l/min (0.16 US gal/min)	30 l/min (7.93 US gal/min)	60 l/min (15.85 US gal/min)
10	3/8	0.9 l/min (0.24 US gal/min)	45 l/min (11.9 US gal/min)	90 l/min (23.78 US gal/min)
15	1/2	2 l/min (0.53 US gal/min)	100 l/min (26.4 US gal/min)	200 l/min (52.8 US gal/min)
20	3/4	3 l/min (0.79 US gal/min)	150 l/min (39.6 US gal/min)	300 l/min (79.3 US gal/min)
25	1	4 l/min (1.06 US gal/min)	200 l/min (52.8 US gal/min)	400 l/min (106 US gal/min)
32	1 1/4	8 l/min (2.11 US gal/min)	400 l/min (106 US gal/min)	800 l/min (211 US gal/min)
40	1 1/2	12 l/min (3.17 US gal/min)	600 l/min (159 US gal/min)	1200 l/min (317 US gal/min)
50	2	1.2 m^3/h (5.28 US gal/min)	60 m^3/h (264 US gal/min)	120 m^3/h (528 US gal/min)
65	2 1/2	2.4 m^3/h (10.57 US gal/min)	120 m^3/h (528 US gal/min)	240 m^3/h (1057 US gal/min)
80	3	3.6 m^3/h (15.9 US gal/min)	180 m^3/h (793 US gal/min)	360 m^3/h (1585 US gal/min)
100	4	4.8 m^3/h (21.1 US gal/min)	240 m^3/h (1057 US gal/min)	480 m^3/h (2113 US gal/min)
125	5	8.4 m^3/h (37 US gal/min)	420 m^3/h (1849 US gal/min)	840 m^3/h (3698 US gal/min)
150	6	12 m^3/h (52.8 US gal/min)	600 m^3/h (2642 US gal/min)	1200 m^3/h (5283 US gal/min)
200	8	21.6 m^3/h (95.1 US gal/min)	1080 m^3/h (4755 US gal/min)	2160 m^3/h (9510 US gal/min)
250	10	36 m^3/h (159 US gal/min)	1800 m^3/h (7925 US gal/min)	3600 m^3/h (15850 US gal/min)
300	12	48 m^3/h (211 US gal/min)	2400 m^3/h (10567 US gal/min)	4800 m^3/h (21134 US gal/min)
350	14	66 m^3/h (291 US gal/min)	3300 m^3/h (14529 US gal/min)	6600 m^3/h (29059 US gal/min)
400	16	90 m^3/h (396 US gal/min)	4500 m^3/h (19813 US gal/min)	9000 m^3/h (39626 US gal/min)
450	18	120 m^3/h (528 US gal/min)	6000 m^3/h (26417 US gal/min)	12000 m^3/h (52834 US gal/min)
500	20	132 m^3/h (581 US gal/min)	6600 m^3/h (29059 US gal/min)	13200 m^3/h (58117 US gal/min)
600	24	192 m^3/h (845 US gal/min)	9600 m^3/h (42268 US gal/min)	19200 m^3/h (84535 US gal/min)
700	28	264 m^3/h (1162 US gal/min)	13200 m^3/h (58118 US gal/min)	26400 m^3/h (116236 US gal/min)
760	30	312 m^3/h (1374 US gal/min)	15600 m^3/h (68685 US gal/min)	31200 m^3/h (137369 US gal/min)
800	32	360 m^3/h (1585 US gal/min)	18000 m^3/h (79252 US gal/min)	36000 m^3/h (158503 US gal/min)
900	36	480 m^3/h (2113 US gal/min)	24000 m^3/h (105669 US gal/min)	48000 m^3/h (211337 US gal/min)
1000	40	540 m^3/h (2378 US gal/min)	27000 m^3/h (118877 US gal/min)	54000 m^3/h (237754 US gal/min)
1050	42	616 m^3/h (2712 US gal/min)	30800 m^3/h (135608 US gal/min)	61600 m^3/h (271217 US gal/min)
1100	44	660 m^3/h (3038 US gal/min)	33000 m^3/h (151899 US gal/min)	66000 m^3/h (290589 US gal/min)
1200	48	840 m^3/h (3698 US gal/min)	42000 m^3/h (184920 US gal/min)	84000 m^3/h (369841 US gal/min)
1400	54	1080 m^3/h (4755 US gal/min)	54000 m^3/h (237755 US gal/min)	108000 m^3/h (475510 US gal/min)
1500	60	1260 m^3/h (5548 US gal/min)	63000 m^3/h (277381 US gal/min)	126000 m^3/h (554761 US gal/min)
1600	66	1440 m^3/h (6340 US gal/min)	72000 m^3/h (317006 US gal/min)	144000 m^3/h (634013 US gal/min)
1800	72	1800 m^3/h (7925 US gal/min)	90000 m^3/h (396258 US gal/min)	180000 m^3/h (792516 US gal/min)
2000	80	2280 m^3/h (10039 US gal/min)	114000 m^3/h (501927 US gal/min)	228000 m^3/h (1003853 US gal/min)

7 Parameterization

7.1 Operation

The LCD display is provided with capacitive control buttons. These enable you to control the device through the glass of the closed cover.

Important (Note)

The transmitter automatically calibrates the capacitive control buttons on a regular basis. If the cover should be opened during operation, the buttons' sensitivity is at first increased. As a result, operating errors may occur. The button sensitivity will return to normal during the next automatic calibration.

7.1.1 Menu navigation

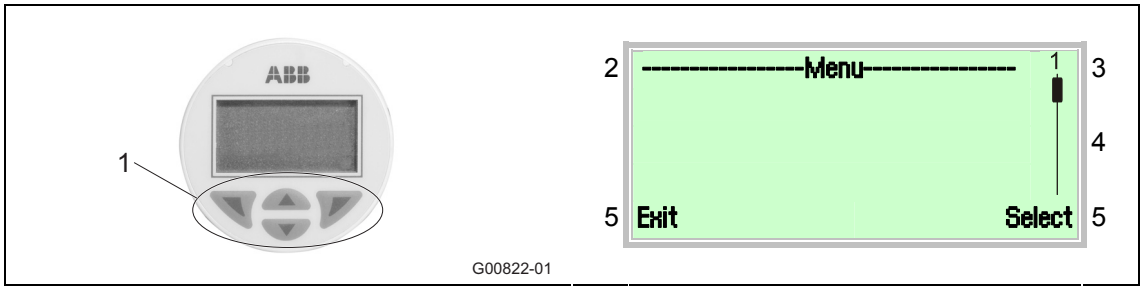


Fig. 64: LCD-indicator

1 Control buttons for menu navigation
2 Menu name
3 Menu number
4 Marker for indicating relative position within the menu
5 Function currently assigned to the and control buttons

You can use the or control buttons to browse through the menu or select a number or character within a parameter value.

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

7.1.1.1 Control button functions

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

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

7.2 Menu levels

Two levels exist under the process display.

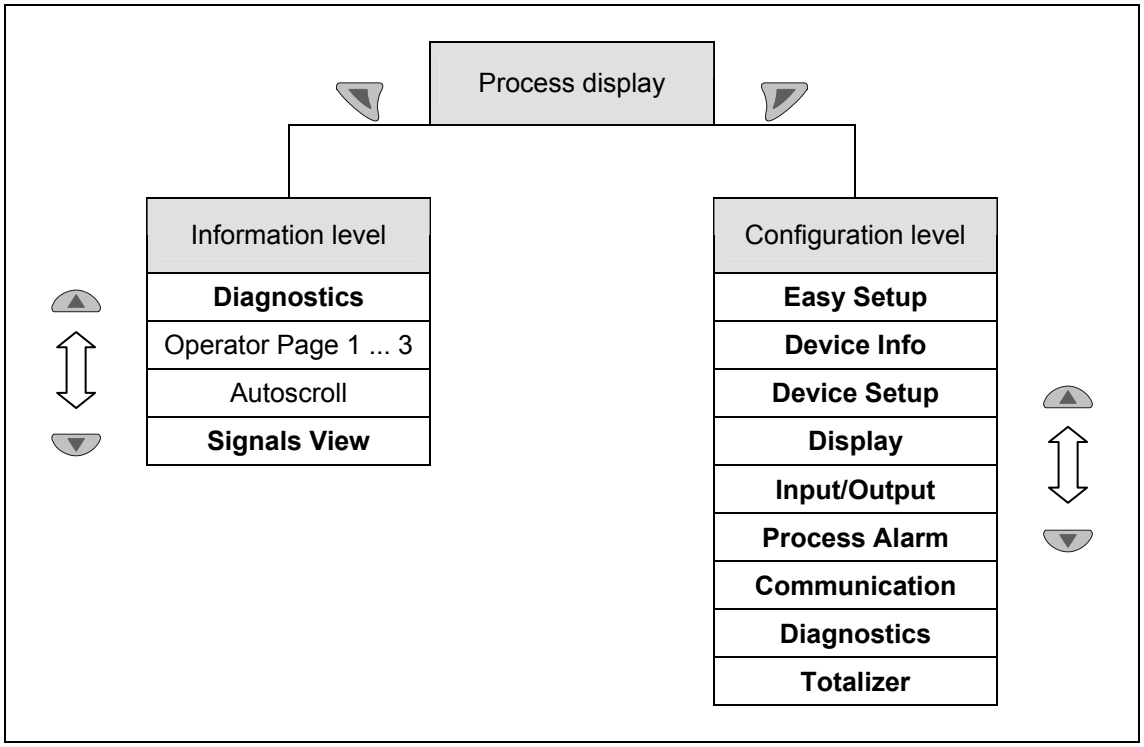


Fig. 65: Menu levels

Process display

The process display shows the current process values.

Information level

The information level contains the parameters and information that are relevant for the user. The device configuration cannot be changed on this level.

Configuration level

The configuration level contains all the parameters required for device commissioning and configuration. The device configuration can be changed on this level.

Note

For a detailed description of the individual parameters and menus on the configuration level refer to the sections **7.3** "**Overview of parameters on the configuration** level" and **7.4** "**Description of parameters**".

7.2.1 Process display

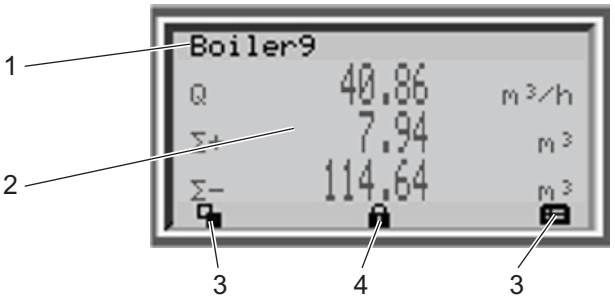


Fig. 66: Process display (example)

1 Measuring point identifier
2 Current process values
3 Symbol indicating button function
4 Symbol indicating "Parameterization protected"

The process display appears on the LC display when the device is switched on. It shows information about the device and current process values.

The way in which the current process values (2) are shown can be adjusted on the configuration level.

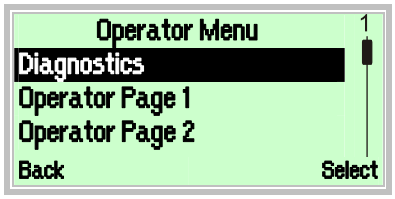
7.2.1.1 Description of symbols

Symbol	Description
	Call up information level. When Autoscroll mode is enabled, a ↻ symbol appears here and the operator pages are automatically displayed one after the other.
	Call up configuration level.
	The device is protected against changes to the parameter settings.
Q	Display of the current flowrate
Σ+	Totalizer status in forward direction
Σ-	Totalizer status in reverse direction

7.2.2 Switching to the information level (operator menu)

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

1. Use ▼ to switch to the information level.



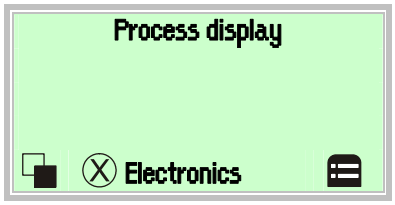
2. Use ▲ or ▼ to select a submenu.
3. Use ▶ to confirm your selection.

Menu	Description

... / Operator Menu	
Diagnostics	Selects the "Diagnostics" submenu, see also Chapter 7.2.2.1 "Error messages on the LCD display".
Operator Page 1	Selects the operator page to be displayed
Operator Page 2	
Operator Page 3	
Operator Page 4	
Autoscroll	When "Multiplex Mode" is enabled, this initiates automatic switching of the operator pages on the process display.
Signals View	Selects the "Signals View" submenu (for service, only).

7.2.2.1 Error messages on the LCD display

In case of an error, a message consisting of an icon and text appears at the bottom of the process display. The text displayed provides information about the area in which the error has occurred.



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

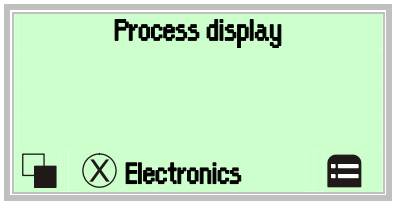
Symbol	Description
	Error / Failure
	Functional check
	Out of specification
	Maintenance required

Additionally, the error messages are divided into the following areas:

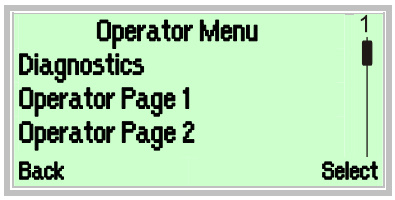
Area	Description
Electronics	Error / alarm of the electronics.
Sensor	Error / alarm of the flowmeter sensor.
Status	Alarm due to the current device status.
Operation	Error / alarm due to the current operating conditions.

7.2.2.2 Invoking the error description

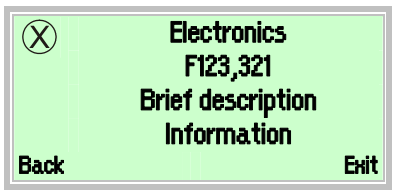
Additional details about the occurred error can be called up on the information level.



1. Use  to switch to the information level.



2. Use  or  , select the "Diagnostics" submenu.
3. Use  to confirm your selection.



The first line shows the area in which the error has occurred.

The second line shows the unique error number.

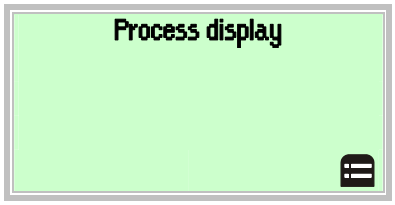
The next lines show a brief description of the error and information on how to remedy it.

Note

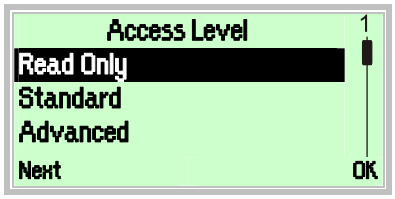
For a detailed description of the errors and information on their remedy refer to Chapter 9 "Error messages".

7.2.3 Switching to the configuration level (parameterization)

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



1. Use ▼ to switch to the information level.



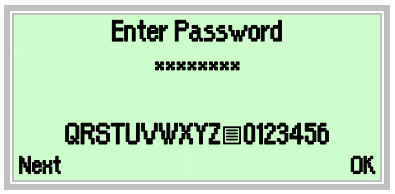
2. Use ▲ or ▼ to select the access level.
3. Use ▼ to confirm your selection.

Important (Note)

There are four access levels: For the **"Standard"** and **"Advanced"** levels you can define passwords. There are no factory default passwords.

- On the **„Read Only“** level all entries are disabled. Parameters are read only and cannot be modified.
- On the **"Standard**" level you can edit all parameters described in Chapter 7.4 "Description of parameters" except for those written in *italics*.
- On the **"Advanced"** level all parameters can be modified.
- The **Service menu** is reserved to the customer service.

Once you have logged on to the corresponding access level, you can edit or reset the password. Resetting to the "No password defined" state is done by selecting "▤" as the password.



4. Enter the corresponding password (see Chapter "Selecting and changing parameters").
   There is no factory default for the password. You can switch to the configuration level without entering a password.
   The selected access level remains active for 3 minutes. Within this time period you can toggle between the process display and the configuration level without re-entering the password.
5. Use ▼ to confirm your password.

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

6. Use ▲ or ▼ to select a menu.
7. Use ▼ to confirm your selection.

7.2.4 Hardware write protection

In addition to password protection, it is possible to activate hardware write protection.

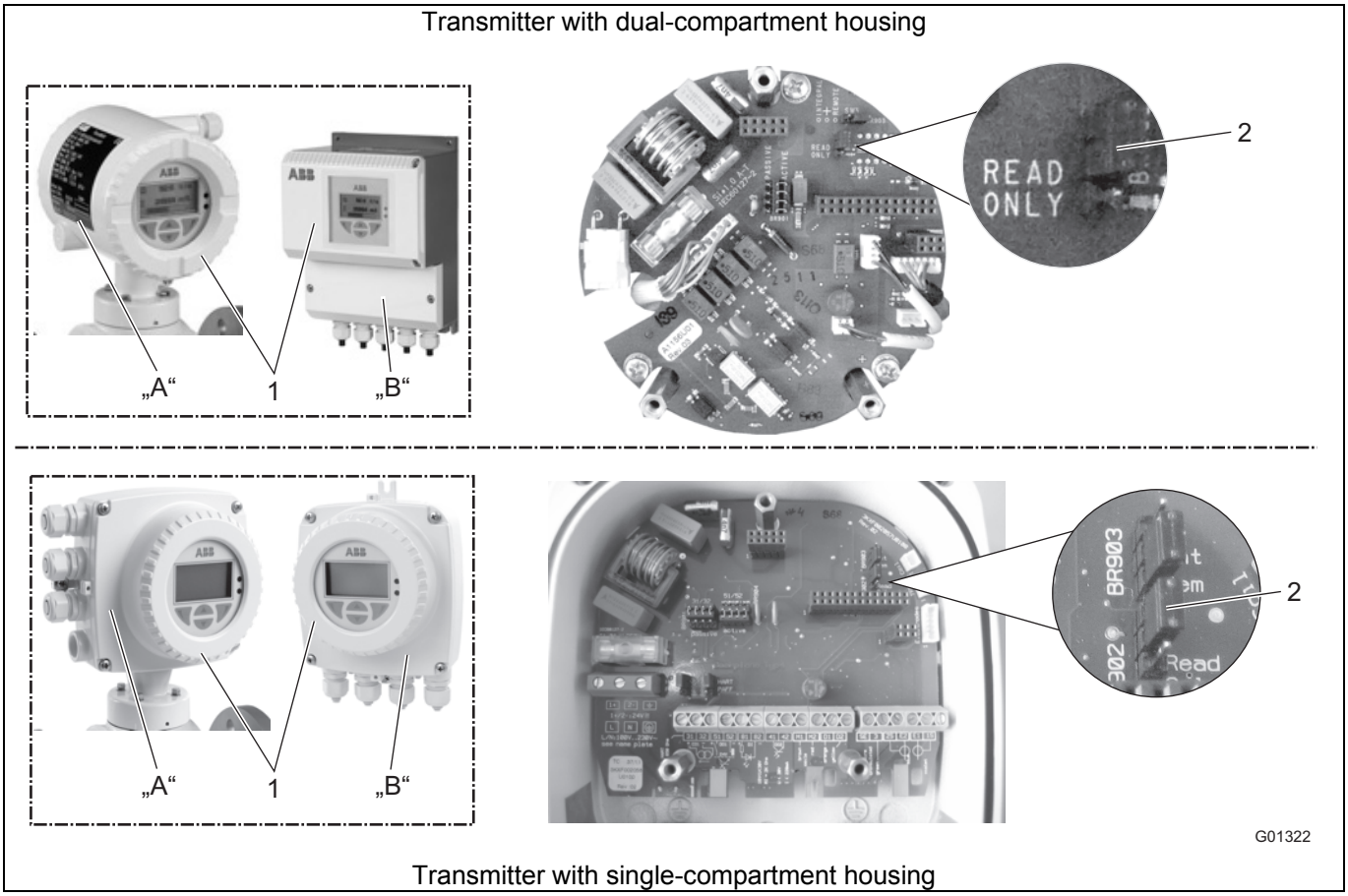


Fig. 67: Jumper for hardware write protection

A Integral mount design
B Remote mount design
1 Housing cover
2 Jumper (BR902) for hardware write protection

1. Switch off power supply.
2. Open the housing cover.
3. Remove the mounting screws for the transmitter electronics unit
4. Pull out the transmitter electronics unit
5. Set jumpers on backplane in accordance with the following table.

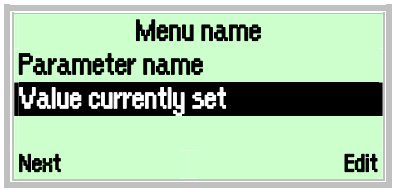
Jumper	Number	Function
BR902	Read only	Hardware write protection active

6. Reinstall the transmitter electronic unit in reverse order

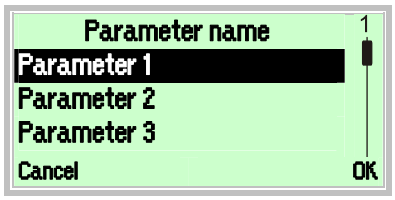
7.2.5 Selecting and changing parameters

7.2.5.1 Entry from table

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



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

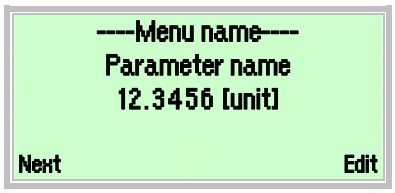


3. Use or to select the required value.
4. Use  to confirm your selection.

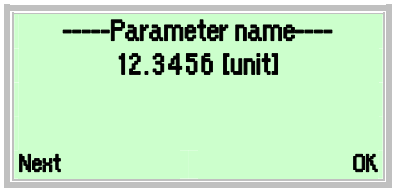
This concludes the procedure for selecting a parameter value.

7.2.5.2 Numerical entry

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



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

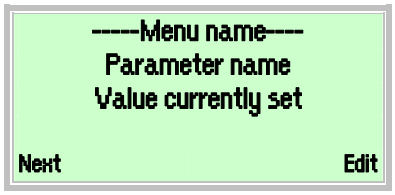


3. Use  to select the decimal position to be changed.
4. Use or to set the required value.
5. Use  to select the next decimal position.
6. If necessary, select and set other decimal positions using the same procedure as described in steps 3 and 4.
7. Use  to confirm your setting.

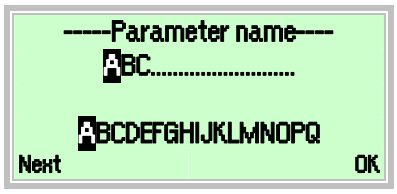
This concludes the procedure for changing a parameter value.

7.2.5.3 Alphanumeric entry

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



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



3. Use to select the position to be changed.
4. Use or to select the required character.
5. Use to select the next position.
6. If necessary, select and set other decimal positions using the same procedure as described in steps 3 and 4.
7. Use to confirm your setting.

This concludes the procedure for changing a parameter value.

7.2.5.4 Exiting the setup

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

1 By pressing (Next) repeatedly you can move the cursor to the right. Once the cursor reaches the end position, "Cancel" is displayed in the lower right.

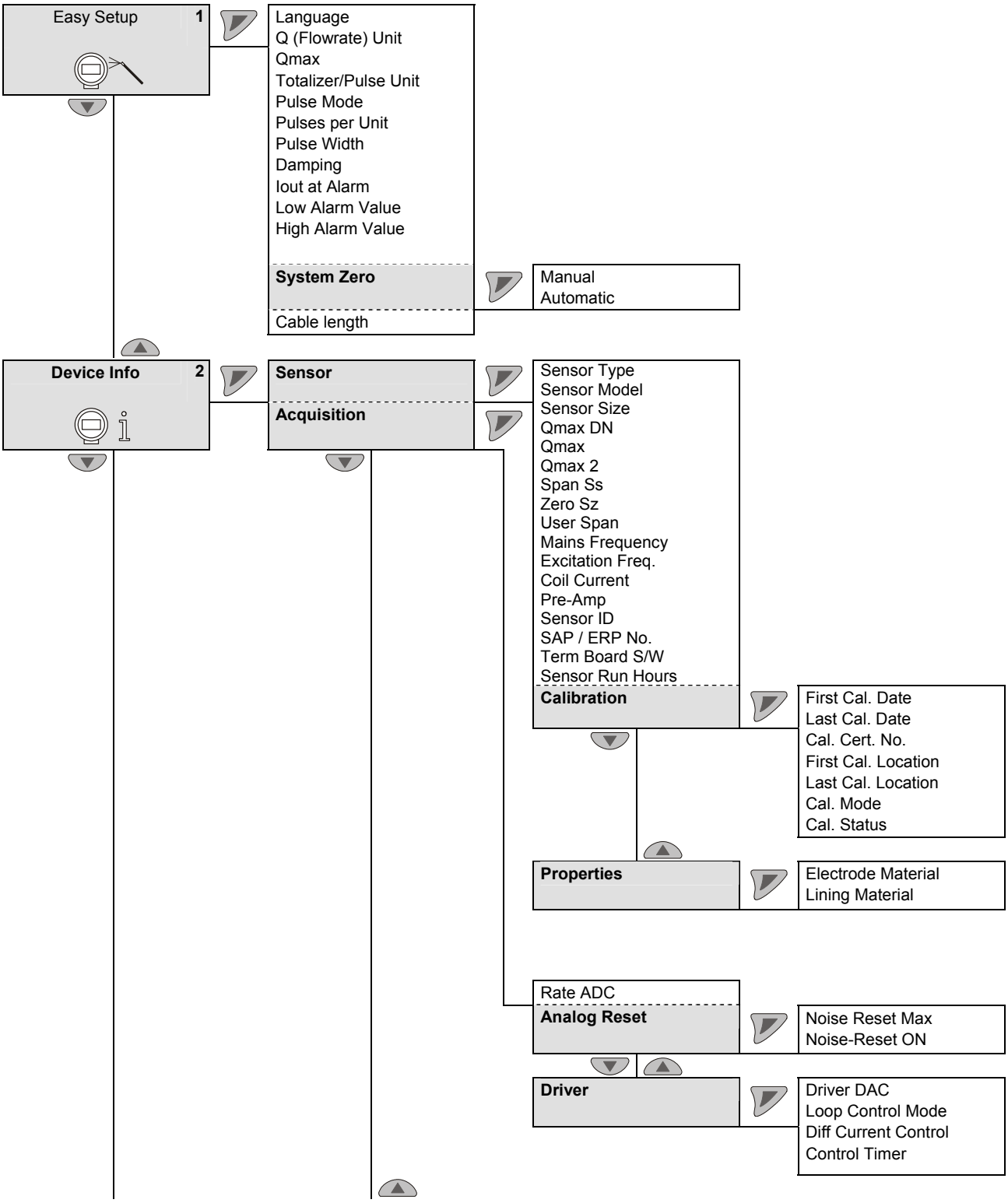
2 With you can terminate editing and exit the menu item. With you can return to the start.

Important (Note)

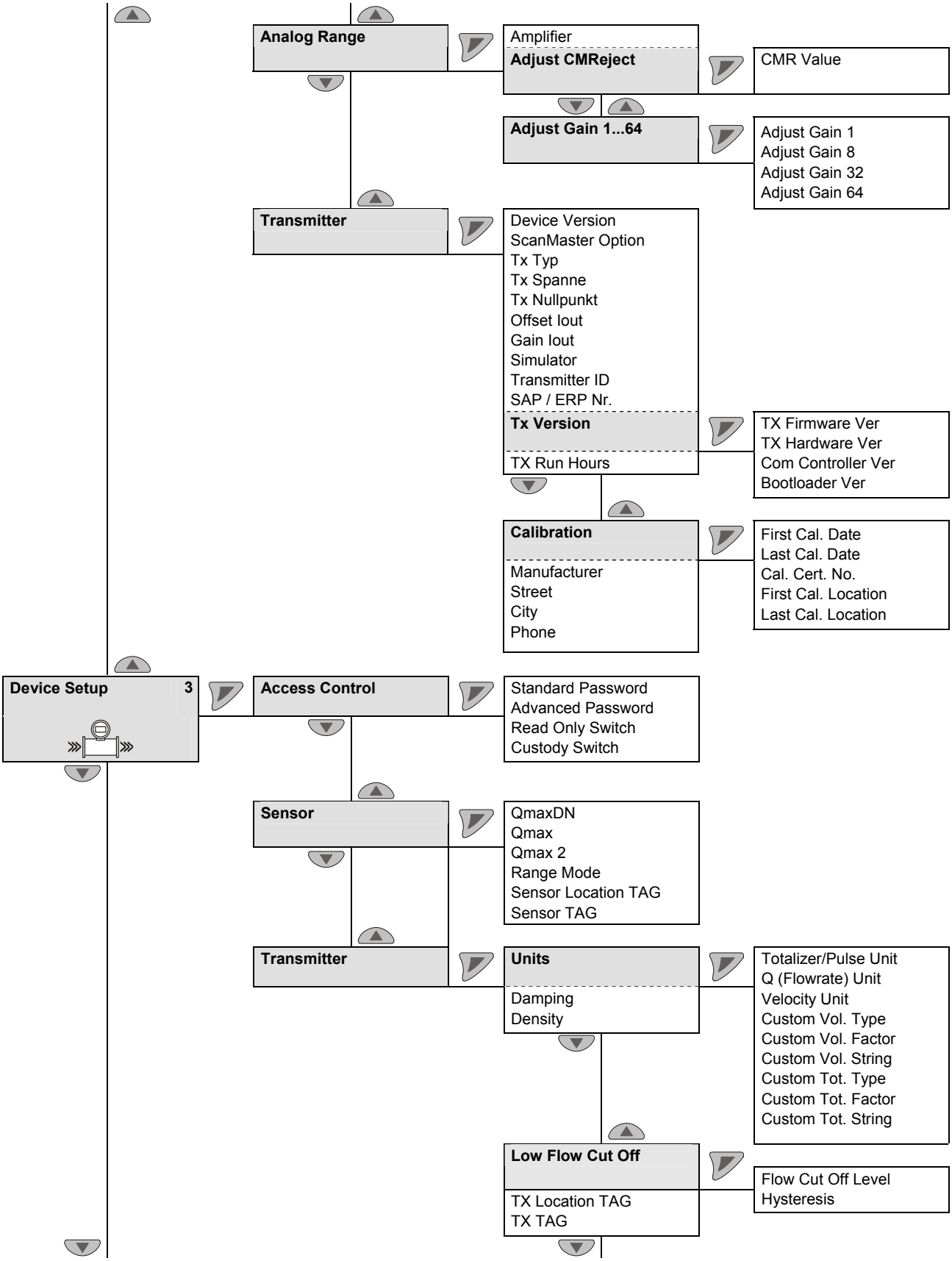
The LCD display automatically returns to the process display three minutes after the last button has been actuated.

7.3 Overview of parameters on the configuration level

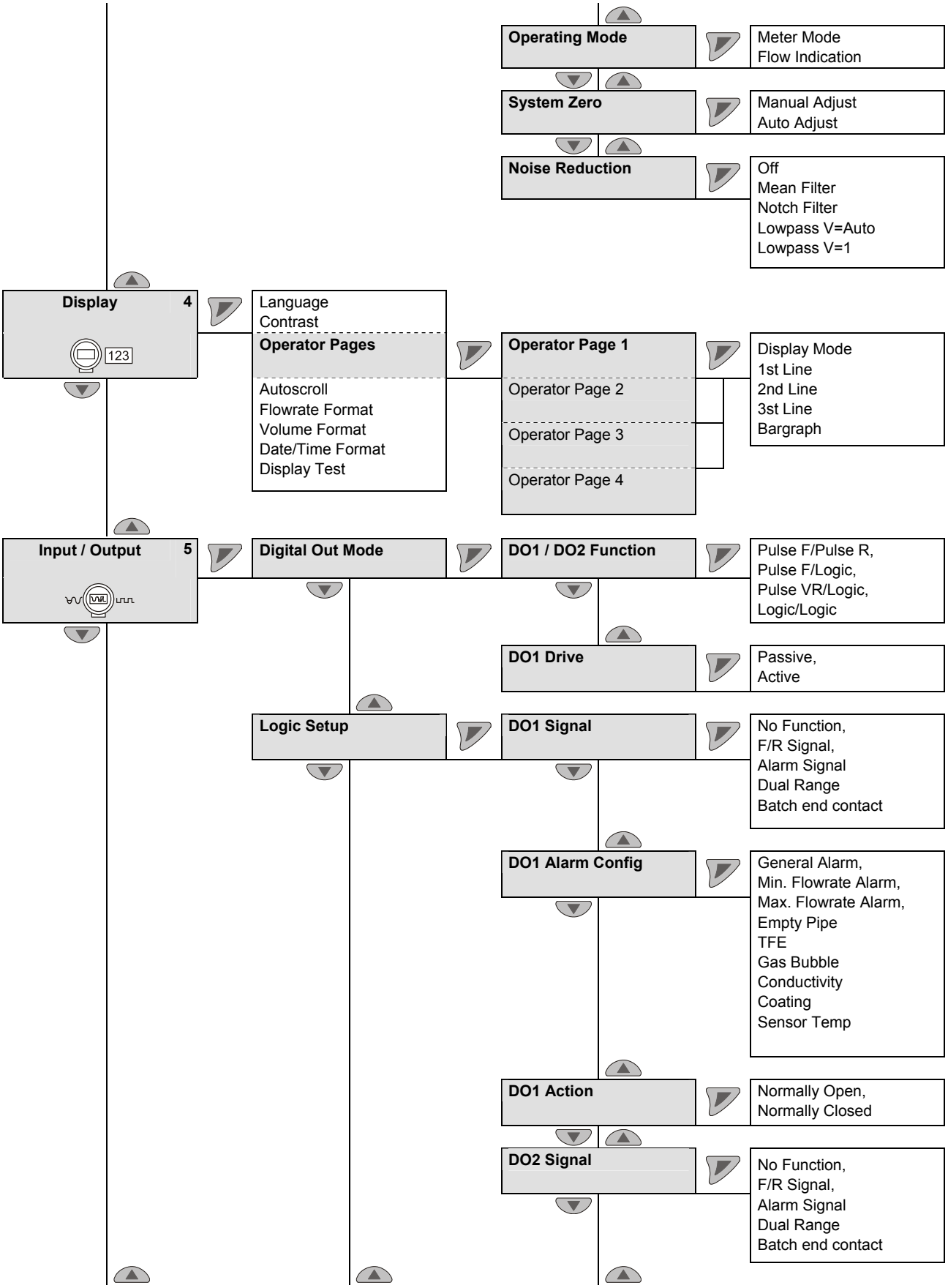
Important (Note)
This overview of parameters shows all the menus and parameters available on the device. Depending on the version and configuration of the device, not all of the menus and parameters may be visible on it.



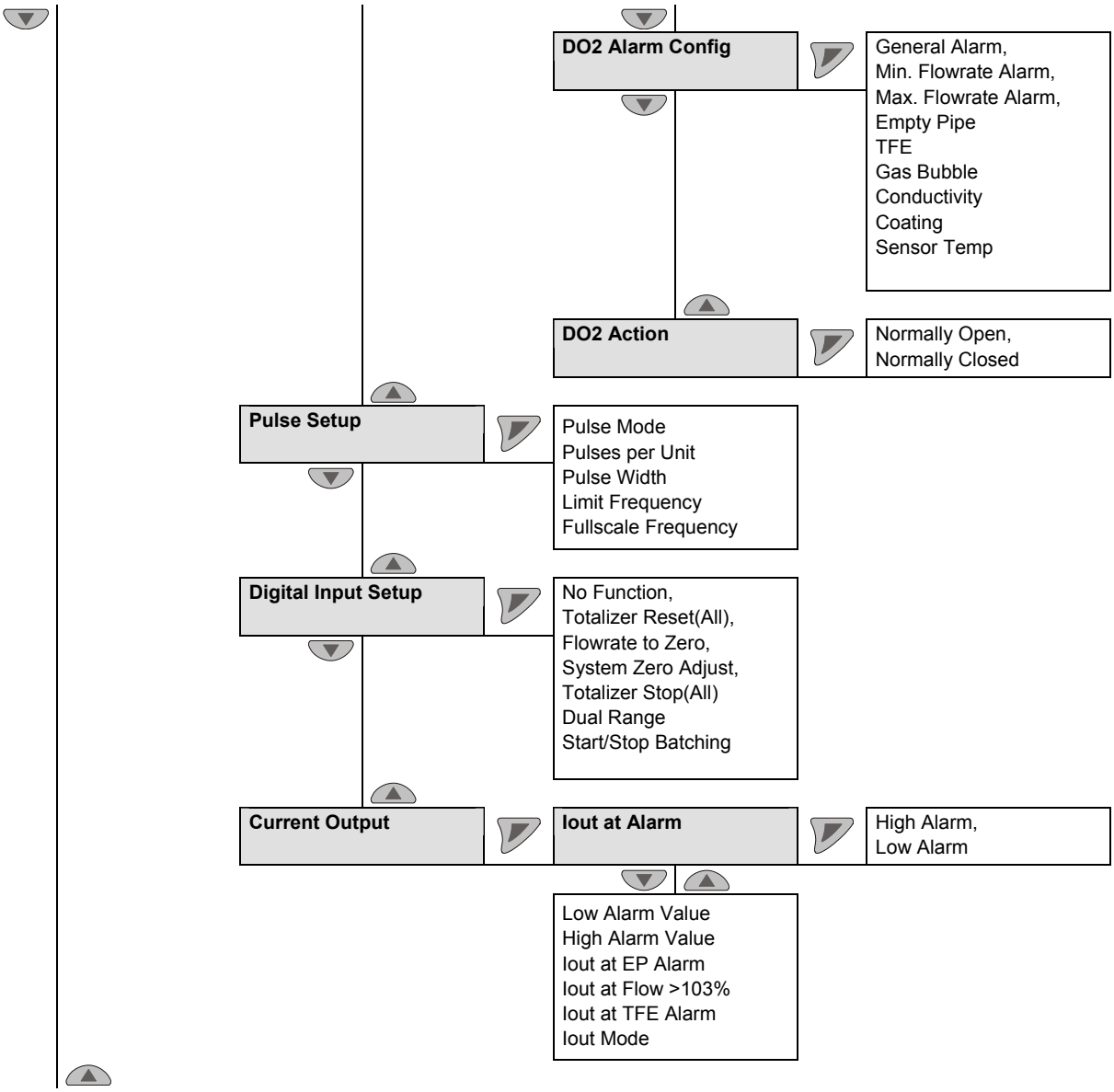
italics = Parameter can only be changed at the "advanced" password level.



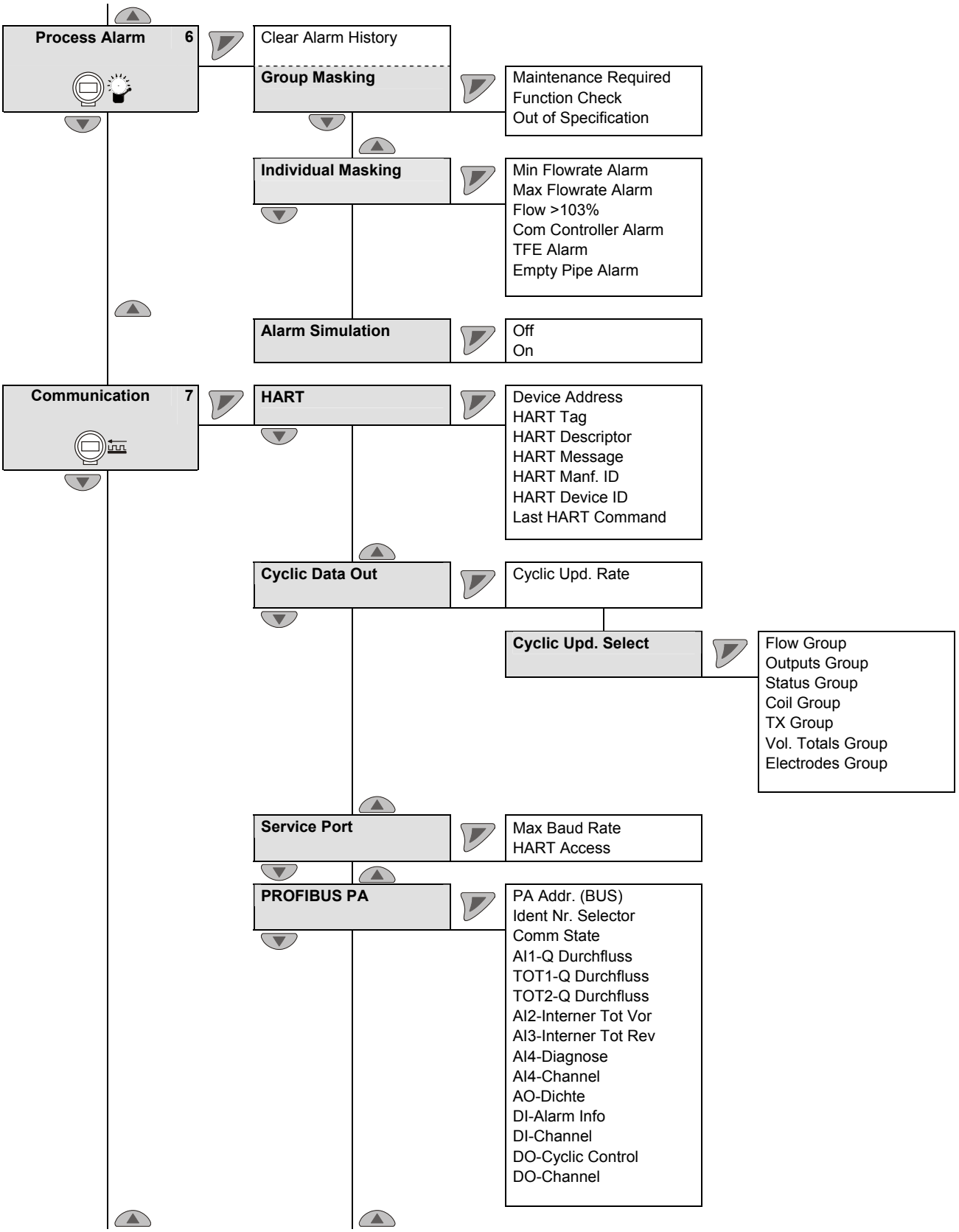
italics = Parameter can only be changed at the "advanced" password level.



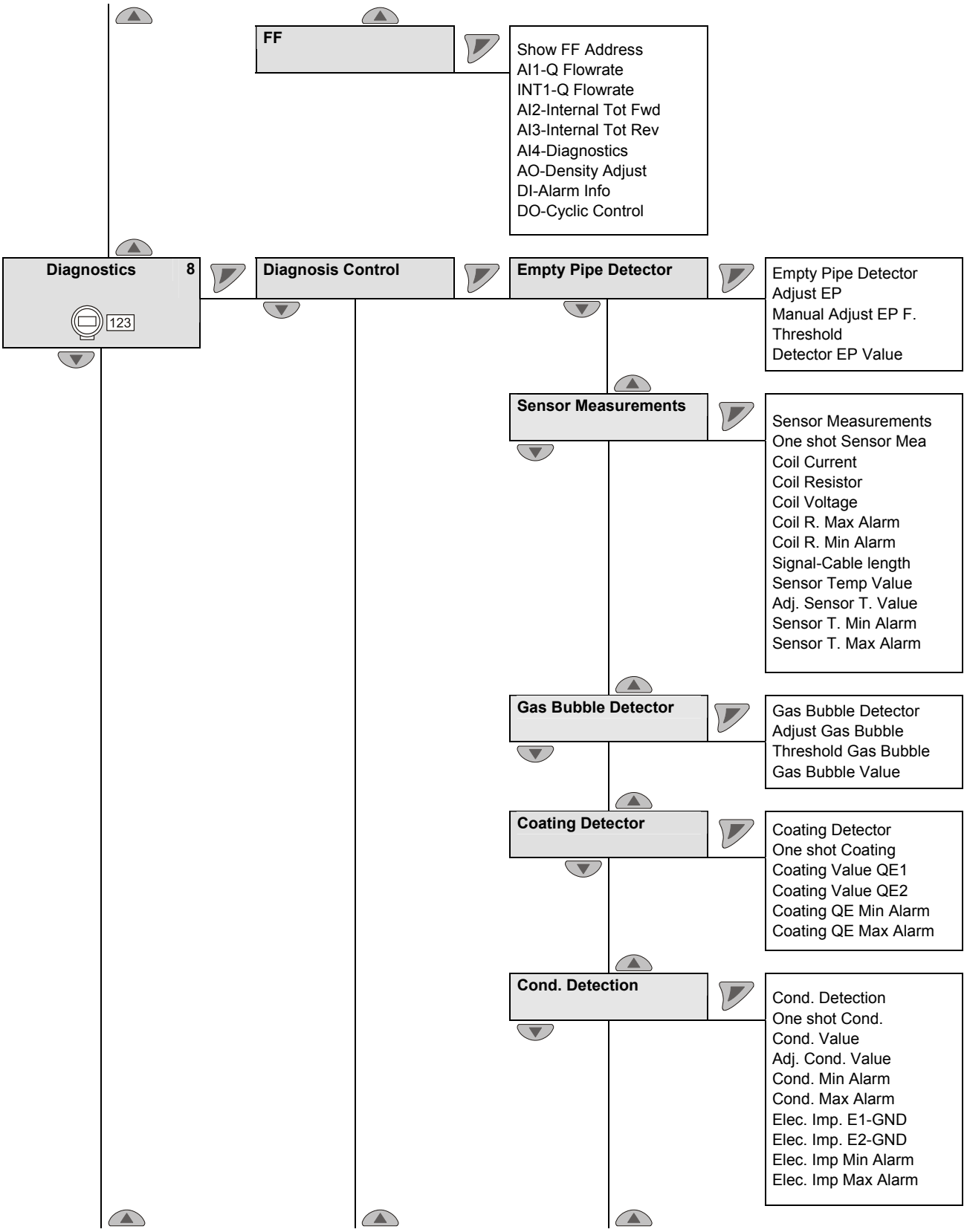
italics = Parameter can only be changed at the "advanced" password level.



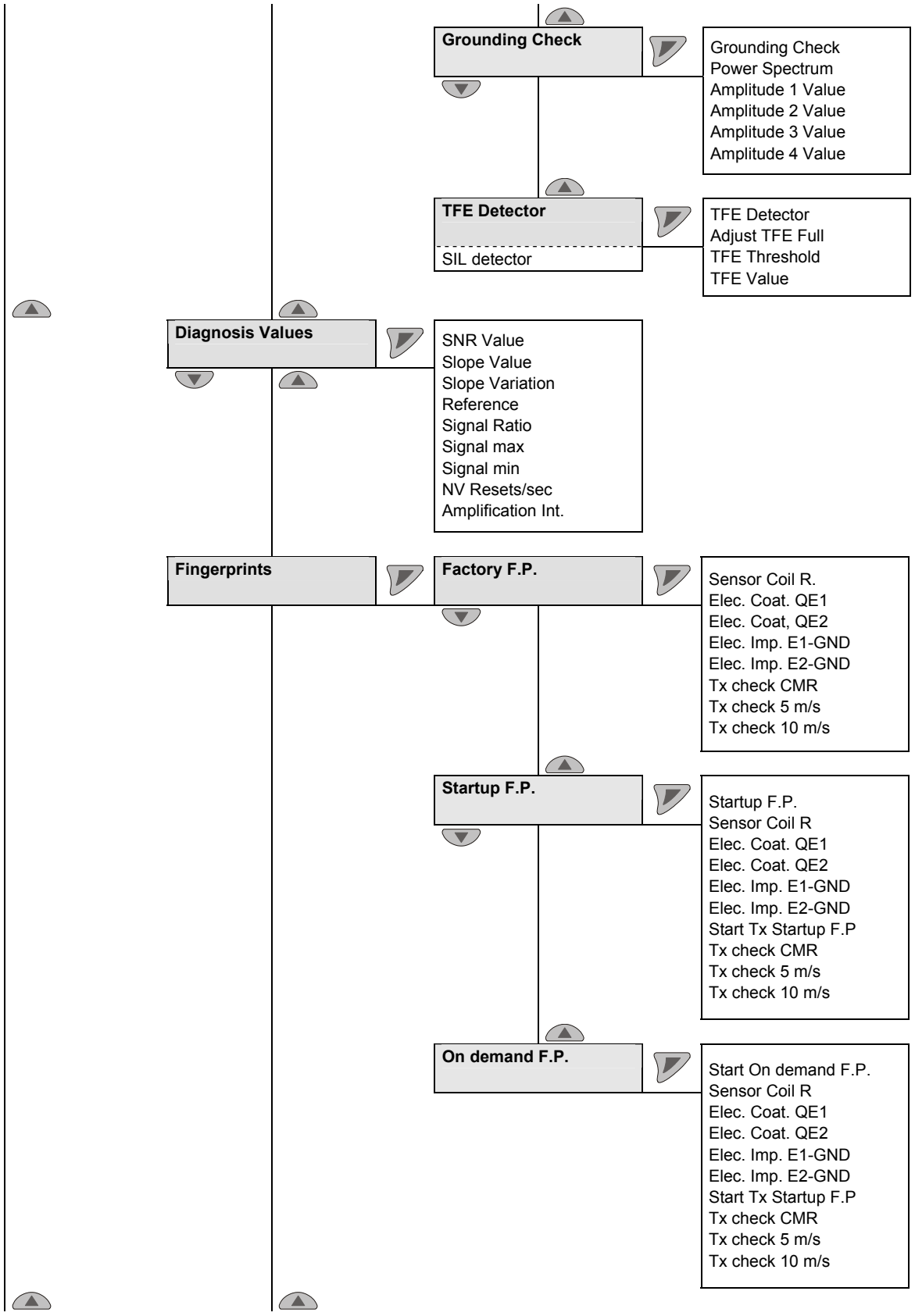
italics = Parameter can only be changed at the "advanced" password level.



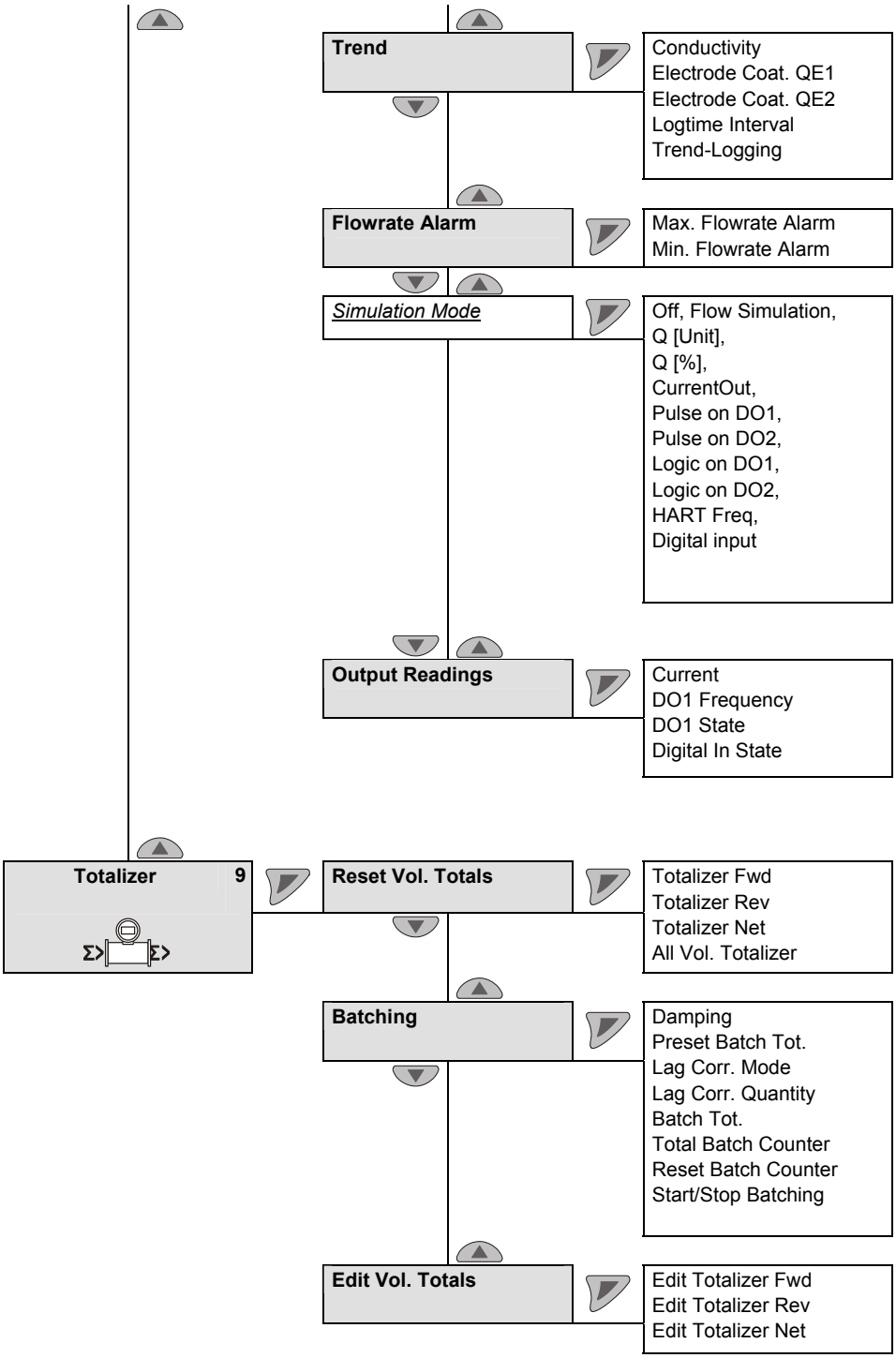
italics = Parameter can only be changed at the "advanced" password level.



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



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



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

7.4 Description of parameters

7.4.1 Menu: Easy Setup

Menu / Parameter	Value range	Description
Easy Setup		**"Easy Setup" Menu**
Language	Deutsch, English, Français, Español, Italiano, Dansk, Svenska, Polski, Russki, Zhongweng, Turkce	Select the menu language.
Q (Flowrate) Unit	l/s; l/min; l/h; ml/s; ml/min; m3/s; m3/min; m3/h; m3/d; Ml/d; ft3/s; ft3/min; ft3/h; ft3/d; ugal/s; ugal/min; ugal/h; ugal/d; Mugal/d; igal/s; igal/min; igal/h; igal/d; bls/s; bls/min; bls/h; bls/d; hl/h; g/s; g/min; g/h; kg/s; kg/min; kg/h; kg/d; t/min; t/h; t/d; lb/s; lb/min; lb/h; lb/d; custom/s	Select the unit for the flow indicator. Default setting: l/min
Qmax	Min. flow range: 0 ... 0.2 m/s (0 ... 0.02 x Q_{max}DN) Max. flow range: 0 ... 20 m/s (0 ...2 x Q_{max} DN)	Select the flow range for forward and reverse flow. Default setting: 1 x Q_{max}DN.
Totalizer/Pulse Unit	m3; l; ml; ft3; hl; g; kg; t; lb; igal; ugal; bls; Ml; Mugal; custom	Select the unit for the flowmeters. Default setting: l
Operation	Pulse Mode, Fullscale Frequency	Select the operating mode for the digital output. There are two operating modes available: • „Pulse Mode“: In pulse mode, pulses per unit are output (e.g., 1 pulse per m^3). • „Fullscale Frequency“: In frequency mode, a frequency proportional to the flowrate is output. The maximum frequency corresponding to the flow range end value is configurable (max. 5.25 kHz). Default setting: „Pulse Mode“
Pulses per Unit	-	Display of the pulses per unit output by the digital output. The max. possible number of pulses is 5250 per second.
Fullscale Frequency	0 ... 5250 Hz	Set the frequency for the flow range end value in Fullscale Frequency operating mode.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description

Easy Setup (continued)		"Easy Setup" Menu
Pulse Width	0.1 ... 2000 ms	Select the pulse width for the digital output. The pulse factor and pulse width are interdependent and are calculated dynamically.
Damping	0.02 ... 60 s	Select the damping. The value set here relates to 1 T (Tau). The value refers to the response time for a step flowrate change. It affects the instantaneous value in the display and at the current output. Default setting: 1 second
Iout at Alarm	Low, High	Status of the current output during an error. The “low” or “high” status is set in the subsequent menu. Default setting: "High".
Low Alarm Value	3.5 ... 3.6 mA	Current for Low Alarm. Default setting: 3.5 mA
High Alarm Value	21 ... 23 mA	Current for High Alarm. Default setting: 21.8 mA
System Zero		Select the "System Zero" submenu.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description

Easy Setup (continued)		"Easy Setup" Menu
Cable length	0.01 ... 200 m	Enter the signal cable length between the transmitter and the flowmeter sensor. For devices with a compact design (FEP311, FEH311, FEP315, FEH315) 0.01 m must be entered.
		Important (Note) The entry is required for FEP500, FEH500 if the diagnostic functions are to be used. When using the ScanMaster verification software you also have to enter the signal cable length.

Easy Setup / **System Zero**		**Submenu "System Zero"**
Manual		Starts the manual zero adjustment.
Automatic		Starts the automatic zero adjustment. **Important (Note)** Prior to starting the zero adjustment, make sure that: • There is no flow through the flowmeter sensor (close all valves, shut-off devices, etc.) • The flowmeter sensor is completely filled with the fluid to be measured.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

7.4.2 Menu: Device Info

Important (Note)

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

Menu / Parameter	Value range	Description
Device Info		
Sensor		Select the "Sensor" submenu.
Acquisition		Select the "Acquisition" submenu.
Analog Range		Select the "Analog Range" submenu.
Transmitter		Select the "Transmitter" submenu.

Device Info / **Sensor**		
Sensor Type	-	Type of flowmeter sensor (ProcessMaster 300 / 500, HygienicMaster 300 / 500). **Important (Note)** When commissioning the device, make sure that the transmitter is assigned to the sensor correctly. It is not possible to operate a flowmeter sensor of the 300 series with a transmitter of the 500 series.
Sensor Model	-	Indication of model number (e.g., FEP315)
Sensor Size	-	Size of sensor.
QmaxDN	-	This value is the maximum flow at a velocity of 10 m/s. The value is set automatically via the selected flowmeter size.
Qmax	-	Set flow range end value for flow range 1. Factory setting: Flow range 1 activated.
Qmax 2	-	Set flow range end value for flow range 2. Factory setting: Flow range 2 deactivated. **Important (Note)** The switchover between the two measuring ranges is done via the digital input or via the menu "Config. Device / Sensor / 2 flow ranges“
Span Ss	-	Calibration value for the sensor (span)
Zero Sz	-	Calibration value for the sensor (zero)

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Device Info / **Sensor**		
User Span		Indication of the correction value for the sensor span
Mains Frequency	-	Mains frequency for the supply power.
Excitation Freq.	-	Frequency used to operate the magnet coils of the flowmeter sensor.
Coil Current	-	Current used to operate the magnet coils of the flowmeter sensor.
Pre-Amp	-	Indication whether a preamplifier exists in the flowmeter sensor or not (Yes / No).
Sensor ID	-	ID number of the sensor.
SAP / ERP No.	-	Order number of the sensor.
Term Board S/W	-	Software version of the sensor memory integrated in the sensor.
Sensor Run Hours	-	Run hours of the flowmeter sensor.
Calibration		Select the "Calibration" submenu.
Properties		Select the "Properties" submenu.
Device Information / Sensor / **Calibration**		
First Cal. Date	-	Date of first calibration of sensor (calibration of new device).
Last Cal. Date	-	Date of last calibration of sensor.
Cal. Cert. No.	-	Identification (no.) of the relevant calibration certificate.
First Cal. Location	-	Place of first calibration of 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.
Device Info / Sensor / **Properties**		
Electrode Material	-	Electrode material of the sensor.
Lining Material	-	Liner material of the sensor.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Device Info / **Acquisition**		
Rate ADC	-	Display for service purposes, only.
Analog Reset		Select the "Analog Reset" submenu.
Driver		Select the "Driver" submenu.
Device Info / Acquisition / **Analog Reset**		
Noise Reset Max	-	Display for service purposes, only.
Noise Reset On	-	
Device Info / Acquisition / **Driver**		
Driver DAC	-	Display for service purposes, only.
Loop Control Mode	-	
Diff Current Control	-	
Control Timer	-	
Device Info / **Analog Range**		
Amplifier	-	Display for service purposes, only.
Adjust CMReject		Select the "Adjust CMReject" submenu.
Adjust Gain 1 ... 64		Select the "Adjust Gain" submenu.
Device Info / Analog Range / **Adjust CMReject**		
CMR Value	-	Display for service purposes, only.
Device Info / Analog Range / **Adjust Gain 1 ... 64**		
Adjust Gain 1	-	Display for service purposes, only.
Adjust Gain 8		
Adjust Gain 16		
Adjust Gain 64		

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Device Info / **Transmitter**		
Device Version		Indication of the transmitter series (300 HART series, 300 PA series, 300 FF series, 500 HART series, 500 PA series, 500 FF series)
Scanmaster option		Indication whether the ScanMaster option is activated or not. For diagnostics or verification, the device can be checked with a separate tool (ScanMaster). This option is available for an extra charge and must be activated in the transmitter.
TX Type	-	Display the transmitter type.
TX Span	-	Calibration value for the transmitter (span)
TX Zero	-	Calibration value for the transmitter (zero)
Offset Iout		Indication of the adjustment value for the current output (zero).
Gain Iout		Indication of the adjustment value for the current output (span).
Simulator		Display for service purposes, only.
Transmitter ID	-	ID number of the transmitter.
SAP / ERP No.	-	Order number of the transmitter.
TX Version		Select the "TX Version" submenu.
TX Run Hours	-	Run hours of the transmitter.
Calibration		Select the "Calibration" submenu.
Manufacturer	-	Name of manufacturer
Street	-	Address of manufacturer (street).
City	-	Address (town) of manufacturer.
Phone	-	Phone number of manufacturer

Device Info / Transmitter / **TX Version**		
TX Firmware Ver.	-	Software version of the transmitter.
TX Hardware Ver.	-	Hardware version of the transmitter.
Com-Controller Ver.	-	Software version of the COM controller.
Bootloader Ver.	-	Software version of the bootloader.

Device Info / Transmitter / **Calibration**		
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.

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1) Parameter / menu only available for FEP500 / FEH500.

7.4.3 Menu: Config. Device

Menu / Parameter	Value range	Description
Device Setup		
Access Control		Select the "Access Control" submenu.
Sensor		Select the "Sensor" submenu.
Transmitter		Select the "Transmitter" submenu.
Device Setup / **Access Control**		
Standard Password	Alphanumeric	Enter / change the password for the "Standard" access level.
Advanced Password	Alphanumeric	Enter / change the password for the "Advanced" access level.
Read Only Switch	Display only (ON / OFF)	Display of switch position of BR902 (hardware write protection). For further information read and observe chapter 7.2.4 „Hardware write protection“.
Custody Switch	Display only (ON / OFF)	Display of the switch position of the calibration circuit breaker (must be activated for calibrated devices).
Device Setup / **Sensor**		
Q_{max} DN	Display only	The displayed value is the flow at a velocity of 10 m/s. The value is determined automatically via the selected flowmeter size.
Qmax	Min. flow range: 0 ... 0.2 m/s (0 ... 0.2 x Q_{max}DN) Max. flow range: 0 ... 20 m/s (0 ...2 x Q_{max} DN)	Select the flow range end value (flow range 1) for forward and reverse flow. Default setting: 1 x Q_{max}DN.
Qmax 2	See Qmax	Select the flow range end value (flow range 2) for forward and reverse flow. Default setting: 1 x Q_{max}DN, flow range 2 is deactivated. **Important (Note)** The switchover between the two measuring ranges is done via the digital input or via the menu "Device Setup / Sensor / Range Mode"

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Device Setup / **Sensor (continued)**		
Range Mode	MB Qmax activated MB Qmax 2 activated	Manual switchover between flow ranges Qmax and Qmax 2.
Sensor Location TAG	Alphanumeric, max. 20 characters	Enter the TAG number of the flowmeter sensor (shown in the upper left of the process display).
Sensor TAG	Alphanumeric, max. 20 characters	Enter the TAG number of the sensor.
Device Setup / **Transmitter**		
Units		Select the "Units" submenu.
Damping	0,02 ... 60 s	Set the damping (the value relates to 1 T (Tau). The value relates to a step flowrate change. It affects the instantaneous value in the display and at the current output. Default setting: 1 second
Density	0,01 ... 5,0 g/cm³	If the flow is measured and indicated in the units g/s, g/min, g/h, kg/s, kg/min, kg/h, kg/d, t/min, t/h, t/d, lb/s, lb/min, lb/h and lb/d, a fixed density must be taken into account for the calculations. To convert the flowrate to mass flow units, a density value from 0.01 to 5.0 g/cm³ can be entered.
Low Flow Cut Off		Select the "Low Flow Cut Off" submenu.
TX Location TAG	Alphanumeric, max. 20 characters	Enter the TAG number for the transmitter.
TX TAG	Alphanumeric, max. 20 characters	Enter the TAG number for the transmitter.
Operating Mode		Select the "Operating Mode" submenu.
System Zero		Select the "System Zero" submenu.
Noise Reduction	Off Mean Filter Notch Filter Lowpass V=Auto Lowpass V=1	Activates noise reduction in case of unstable flow signal. Activating noise reduction increases the response time. Factory setting: Off

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1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Device Setup / Transmitter / **Units**		
Totalizer/Pulse Unit	m3, l, ml, ft3, hl, g, kg, t, lb, igal, ugal, bls, Ml, Mugal, custom	Select the unit for the flowmeters. **Important (Note)** When a mass flow unit is selected, the corresponding density must be set in the "Device Info / Transmitter / Density" menu.
Q (Flowrate) Unit	l/s, l/min, l/h, ml/s, ml/min, m3/s, m3/min, m3/h, m3/d, Ml/d, ft3/s, ft3/min, ft3/h, ft3/d, ugal/s, ugal/min, ugal/h, ugal/d, Mugal/d, igal/s, igal/min, igal/h, igal/d, bls/s, bls/min, bls/h, bls/d, hl/h, g/s, g/min, g/h, kg/s, kg/min, kg/h, kg/d, t/min, t/h, t/d, lb/s, lb/min, lb/h, lb/d, custom	Select the unit for the flow indicator. **Important (Note)** When a mass flow unit is selected, the corresponding density must be set in the "Device Info / Transmitter / Density" menu.
Velocity Unit	m/s, m/min, cm/s, cm/min, feet/s, feet/min, inch/s, inch/min	Select the unit for the display of the flow velocity.
Custom Vol. Type	Volume Flow Mass Flow	Select whether the user-defined flow unit is displayed as a mass flow (with density) or volume flow (without density). **Important (Note)** When a mass flow unit is selected, the corresponding density must be set in the "Device Info / Transmitter / Density" menu.
Custom Vol. Factor	0,0001 ... 100000 l/s	Enter the factor for a user-defined flow unit. The factor relates to the flow per liter.
Custom Vol. String	Alphanumeric, max. 20 characters	Enter the name for the user-defined flow unit.
Custom Tot. Type	Volume Flow Mass Flow	Select whether the used-defined totalizer unit is displayed as a mass flow (with density) or volume flow (without density). **Important (Note)** When a mass flow unit is selected, the corresponding density must be set in the "Device Setup / Transmitter / Density" menu.
Custom Tot. Factor	0,0001 ... 100000 l	Enter the factor for a user-defined totalizer unit. The factor relates to the flow per liter.
Custom Tot. String	Alphanumeric, max. 20 characters	Enter the name for the user-defined totalizer unit.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Device Setup / Transmitter / Low Flow Cut Off		
Flow Cut Off Level	0 ... 10 %	Select the switching threshold for leak flow volume monitoring. If the flowrate is below the switching threshold for the leak flow volume, the flow is not measured. The current output is set to zero. Default setting: 1%
Hysteresis	0 ... 50 %	Set the hysteresis for the leak flow volume.
Device Setup / Transmitter / Operating Mode		
Meter Mode	Forward and Reverse	Set the measuring direction for the flowmeter sensor. • „Forward only“: The device measures only forward direction. • „Forward and Reverse“: The device measures and totalizes both directions. Default setting: „Forward and Reverse“
Flow Indication	Normal, Reverse	Inverts the flow direction displayed. Default setting: „Normal“
Device Setup / Transmitter / System Zero		
Manual Adjust	-50 ... +50 mm/s	Enter the flow velocity for system zero.
Auto Adjust		Starts the automatic zero adjustment. **Important (Note)** Prior to starting the zero adjustment, make sure that: • There is no flow through the flowmeter sensor (close all valves, shut-off devices, etc.) • The flowmeter sensor is completely filled with the fluid to be measured.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

7.4.4 Menu: Display

Menu / Parameter	Value range	Description
Display		
Language	Deutsch, English, Français, Español, Italiano, Dansk, Svenska, Polski, Russki, Zhongweng, Turkce	Select the menu language.
Contrast	0 ... 100 %	Contrast setting for the LCD display
Operator Pages		Select the "Operator Pages" submenu. **Important (Note)** Up to four user-specific operator pages (layouts) can be configured for the process display. If several operator pages have been configured, these can be scrolled **manually**. In the factory setting only Operator Page 1 is enabled.
Autoscroll	On / Off	If Multiplex mode is enabled, you can also activate the "Autoscroll" function on the information level. In this function, operator pages appear on the LCD window in ten-second intervals. Manual scrolling through pre-configured operator pages as described above is no longer necessary. When Autoscroll mode is enabled, the ↻ icon is displayed on the lower left. Default setting: Off
Flowrate Format	x, x.x, x.xx, x.xxx, x.xxxx	Select the decimal places for the flow indicator. Default setting: x.xx
Volume Format	x, x.x, x.xx, x.xxx, x.xxxx	Select the decimal places for the flow totalizer. Factory setting: x.xx
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 Test		Start the test of the LCD display with "OK".

Display / **Operator Pages**		
Operator Page 1		Select the "Operator Page 1" submenu.
Operator Page 2		Select the "Operator Page 2" submenu.
Operator Page 3		Select the "Operator Page 3" submenu.
Operator Page 4		Select the "Operator Page 4" submenu.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Display / Operator Pages / **Operator Page 1 (n)**		
Display Mode	• 1 line with 6 characters. • 1 line with 6 characters + bar graph. • 1 line with 9 characters. • 1 line with 9 characters + bar graph. • 2 lines with 9 characters. • 2 lines with 9 characters + bar graph. • 3 lines with 9 characters (factory default). • Graphic (line recorder) • Off (the option disables the respective operator page)	Configure each operator page. The following variants in the value range can be selected:
1st Line	• Flowrate [%] • Flowrate [Unit] • Totalizer Fwd • Totalizer Rev • Totalizer Net • Flow Velocity [Unit] • Current Output [mA] • SignalProportion • Reference • Signal Max • Signal Min • Amplification • Noise Reset Counter • Total Batch Counter [1] • Batch Totalizer [1] • Conductivity [1] • Sensor Temp [1]	Select the value displayed in each line. The following variants in the value range can be selected:
2nd Line		
3st Line		
Bargraph	• Flowrate [%] • Current Output [mA]	Select the value displayed in the bar graph. The measuring values in the value range can be selected.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

7.4.5 Menu: Input / Output

Menu / Parameter	Value range	Description
Input/Output		
Digital Out Mode		Select the "Digital Output Mode" submenu.
Logic Setup		Select the "Logic Setup" submenu.
Pulse Setup		Select the "Pulse Setup" submenu.
Digital Input Setup	No Function, Totalizer Reset(All), Flowrate to Zero, System Zero Adjust, Totalizer Stop(All), Dual Range, Start/Stop Batching 1)	Select the operating mode for the digital output. There are four operating modes available: • Totalizer reset for all totalizers (forward, reverse and differential totalizers) • Ext. zero return • External adjustment of zero point • External totalizer stop for all totalizers (forward, reverse, and differential totalizers) • Switchover between flow ranges 1 and 2 (Qmax and Qmax 2) • Start / stop of the fill function (batch) 1). Default setting: external switch-off **Important (Note)** If the fill operation is stopped before the configured fill quantity is reached, the fill totalizer is set to zero. When the fill function is restarted, the interrupted fill operation is **not** continued.
Current Output		Select the "Current Output" submenu.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Input/Output / **Digital Output Mode**		
Function DO1 / DO2	Pulse F / Pulse R, Pulse F / Logic, Pulse FR / Logic, Logic / Logic	Select the functions for the digital outputs DO1 and DO2. • Pulse F / Pulse R: - DO1 = Pulse output forward direction - DO2 = Pulse output reverse direction • Pulse F / Logic: - DO1 = Pulse output forward direction - DO2 = Digital output • Pulse FR / Logic: - DO1 = Pulse output forward and reverse direction - DO2 = Digital output • Logic / Logic: - DO1 = Digital output - DO2 = Digital output Default setting: Pulse FR / Logic. **Important (Note)** The function of the digital output is defined in the menu "Logic Setup".
DO1 Drive	Passive, Active	The digital output DO1 can be configured as an "active" or "passive" output. For information on the current configuration, refer to the order confirmation. Default setting: Passive **Important (Note)** In the case of devices with a transmitter with single-compartment housing and devices for use in Zone 1 / Div., this parameter is disabled. In the case of devices with a transmitter with single-compartment housing, configuration is performed via jumpers on the transmitter backplane (refer to "Start-up" chapter).

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Input/Output / **Logic Setup**		
DO1 Signal	No Function, F/R Signal, Alarm Signal, Dual Range 1, Batch end contact 1	The menu is displayed only if in the " DO1 / DO2 Function " menu the Logic / Logic function is set. This menu is not displayed in the factory default setup. • F/R Signal: The digital output signals the flow direction. • Alarm-Signal: The digital output functions as an alarm output. The alarm type is set in the "DO1 Alarm Config" menu. • Dual Range: The digital output is activated when flow range 2 (Qmax 2) is selected. • Batch end contact: The digital output is activated when the configured fill quantity is reached. Default setting: F/R Signal.
DO1 Alarm Config		Select the "DO1 Alarm Config" submenu. The menu is displayed only if in the "DO1 Signal" menu the "Alarm Signal" function is set.
DO1 Action	Normally Open, Normally Closed	Select the switching behavior for the digital output. Default setting: Normally open.
DO2 Signal	No Function, F/R Signal, Alarm Signal, Dual Range 1, Batch end contact 1	Refer to the description "DO1 Signal".
DO2 Alarm Config		Select the "DO2 Alarm Config" submenu. The menu is displayed only if in the "DO2 Signal" menu the "Alarm Signal" function is set.
DO2 Action	Normally Open, Normally Closed	Refer to the description "DO1 Action".

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1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Input/Output / Logic Setup / **DO1 Alarm Config**		
General Alarm	On / Off	Each alarm can be activated separately. This allows to configure individually when the digital output DO1 signals an alarm.
Min. Flowrate Alarm	On / Off	
Max. Flowrate Alarm	On / Off	
Empty Pipe	On / Off	
TFE	On / Off	
Gas Bubble 1)	On / Off	
Conductivity 1)	On / Off	
Coating 1)	On / Off	
Sensor Temp 1)	On / Off	
Input/Output / Logic Setup / **DO2 Alarm Config**		
-	-	See the description "DO1 Alarm Config".
Input/Output / **Pulse Setup**		
Pulse Mode	Pulses per Unit, Frequenzmode	The menu is only displayed if under "Input/Output / Digital Out Mode / DO1/DO2 Function" a Pulse ... function has been selected. Select the operating mode for the digital output. There are two operating modes available: • „Pulses per Unit“: In pulse mode, pulses per unit are output (e.g., 1 pulse per m^3). • „Fullscale Frequency“: In 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). Default setting: „Pulses per Unit“
Pulses per Unit	1 ... 5250/s	Set the pulses per unit in the "Pulses per Unit" operating mode.
Pulse Width	0.1 ... 2000 ms	Set the pulse width in the "Pulses per Unit" operating mode. The pulse factor and pulse width are interdependent and are calculated dynamically.
Limit Frequency	Display only	Display of the limiting frequency for the pulse output.
Fullscale Frequency	0 ... 5000 Hz	Set the frequency for the flow range end value in "Frequenzmode" operating mode.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Input/Output / **Current Output**		
Iout at Alarm	High Alarm Value, Low Alarm Value	Select the status of the current output in error condition. The output "low" or "high" current is set in the subsequent menu. Default setting: "High Alarm Value".
Low Alarm Value	3,5 ... 3,6 mA	Select the current for Low Alarm. Default setting: 3.5 mA.
High Alarm Value	21 ... 23 mA	Select the current for High Alarm. Factory setting: 21.8 mA.
Iout at EP Alarm	Off, Q=0%, High Alarm, Low Alarm	Select the status of the current output for an empty pipe. • Off: Error is not output at the current output. • Q = 0 %: The current output assumes the value for "No flow". • High Alarm: The current output assumes the value for "High Alarm". • Low Alarm The current output assumes the value for "Low Alarm". Default setting: Off.
Iout at Flow >103%	Off, High Alarm, Low Alarm	Select the status of the current output for overshoot of the flow range end value. • Off: Error is not output at the current output. • High Alarm: The current output assumes the value for "High Alarm". • Low Alarm The current output assumes the value for "Low Alarm". Default setting: Off.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Input/Output / Current Output **(continued)**		
Iout at TFE Alarm	Off, Q = 0 %, High Alarm, Low Alarm	Select the status that the current output shall assume in the case of a partial filling alarm. • Off: Error is not output at the current output. • Q = 0 %: The current output assumes the value for "No flow" (4 mA). • High Alarm: The current output assumes the value for "High Alarm". • Low Alarm The current output assumes the value for "Low Alarm". Default setting: "Off"
Iout Mode	4 ... 20 mA, 4 - 12 - 20 mA	Select the operating mode for the current output. • 4 ... 20 mA - 4 mA = No flow - 20 mA = Maximum flow • 4 - 12 - 20 mA - 4 mA = Maximum reverse flow - 12 mA = No flow - 20 mA = Maximum forward flow

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1) Parameter / menu only available for FEP500 / FEH500.

7.4.6 Menu: Process Alarm

Menu / Parameter	Value range	Description
Process Alarm		
Clear Alarm History	-	Allows you to clear the alarm list.
Group Masking		Select the "Group Masking" submenu.
Individual Masking		Select the "Individual Masking" submenu.
Alarm Simulation	Off, ...	A variety of alarm messages and output conditions can be simulated. For further information read and observe chapter “Alarm simulation”.

Process Alarm / **Group Masking**		
Maintenance Required	On / Off	Alarm messages are divided into groups. If masking is activated for a group (On), no alarm occurs. For further information read and observe Chapter "Error conditions and alarms".
Function Check	On / Off	
Out of Specification	On / Off	

Process Alarm / **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. For further information read and observe chapter "Error conditions and alarms".
Max Flowrate Alarm	On / Off	
Flow >103%	On / Off	
Com Controller Alarm	On / Off	
TFE Alarm	On / Off	
Empty Pipe Alarm	On / Off	

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

7.4.7 Menu: Communication

Menu / Parameter	Value range	Description
Communication		
HART		Select the "HART" submenu.
Cyclic Data Out		Select the "Cyclic Data Out" submenu.
Service Port		Select the "Service Port" submenu.
PROFIBUS		Select the "PROFIBUS" submenu. The menu is displayed only for devices with PROFIBUS PA.
FIELDBUS Foundation		Select the "FF" submenu. The menu is displayed only for devices with FOUNDATION Fieldbus.

Communication / **HART**		
Device Address	0 ... 15	Select the HART device address. The HART protocol has provisions for creating a bus with up to 15 devices (1 ... 15). **Important (Note)** If an address greater than 0 is set, the device operates in multidrop mode. The current output is fixed at 4 mA. Apart from that, the current output is only used for HART communication. Default setting: 0
HART TAG	8 characters, uppercase only, no special characters.	Enter a HART TAG number as unique identifier for the device.
HART Descriptor	16 characters, uppercase only, no special characters.	Enter a HART descriptor.
HART Message	Display only.	Display of the alphanumeric TAG number.
HART Manf. ID	Display only.	Display of the HART manufacturer ID. ABB = 26
HART Device ID	Display only.	Display of the HART device ID. FEX300 / FEX500 = 30
Last HART Command	Display only.	Display of the most recently sent HART command.

Communication / **Cyclic Data Out**		
Cyclic Upd. Rate	0,2 ... 3600 sec	Set the interval for data output via the infrared service port Default setting: 1 sec **Important (Note)** For detailed information about how to use the infrared service port refer to the separate operating instructions OI/FZA100.
Cyclic Upd. Select		Select the "Cyclic Upd. Select" submenu.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Communication / Cyclic Data Out / **Cyclic Upd. Select**		
Flow Group	ON / OFF Contents: Q(%), Q(l/s), v(m/s)	Select the data to be output via the infrared service port. Diagnostic data is compiled in groups. Each group can be separately switched on or off, and thereby added to the diagnostic data set.
Outputs Group	ON / OFF Contents: 20mA output [Io(mA)], frequency at digital output DO1 [f1(Hz)], frequency at digital output DO2 [f2(Hz)]	
Status Group	ON / OFF Contents: Alarm, Empty Pipe Frequency [EPD (Hz)], TFE Frequency [TFE (Hz)]	
Coil Group	ON / OFF Contents: Coil current [Ic(mA)], Coil voltage [CV(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], Signal to noise ratio SNR	
Vol. Totals Group	ON / OFF Contents: Forward totalizer [Fwd (m^3)], Reverse totalizer [Rev (m^3)], Differential totalizer [Net (m^3)]	
Electrodes Group	ON / OFF Contents: Electrode impedance E1 to ground [IE1 (kOhm)], Electrode impedance E2 to ground [IE2 (kOhm)], Deposit values of electrode 1 [QE1] and aE1, Electrode values of electrode 2 [QE2] and aE2, Gas bubble value [Gasb], Conductivity [conduS], Sensor temperature [sensorT°C]	

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Communication / **Service Port**		
Max Baud Rate	2400, 4800, 9600, 19200, 38400	Set the transmission rate (baud rate) for the infrared service port.
HART Access	On / Off	Activate / deactivate the infrared service port
Communication / **PROFIBUS**		The menu is displayed only for devices with PROFIBUS PA.
PA Addr. (-BUS-)	0 ... 126	The "PROFIBUS" is displayed only if this option has been ordered for the device. Displays the slave address. Factory setting: 126 Information about the DIP switches (transmitters with dual-compartment housing only): • DIP switches 1 to 7 define the PROFIBUS address, • DIP switch 8 defines the address mode: • DIP switch 8 = Off = Addressing via bus or keypad using the menus for the device. The message "-BUS-" is displayed. • DIP switch 8 = On = Addressing via DIP switches 1-7; the message "(HW Switch)" is displayed. The address switch setting is only adopted when the device is restarted, not during running operation. Factory setting for DIP switch 8: Off For further information read and observe chapter 6.3 “Start-up of PROFIBUS PA units”.
Ident Nr. Selector	0x9700, 0x9740, 0x3430	Selection of the ID No. Selector. The parameter can be changed only when cyclic communication is stopped (Com State = OFF). Default setting: 0x3430
Comm State	Offline, Operate, Clear, Stop	Display of the communication status. • Offline: BUS communication is deactivated. • Operate: Cyclic communication is running. • Clear: Device is being initialized. • Stop: Cyclic communication is stopped, BUS communication remains active.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Communication / PROFIBUS (continued)		The menu is displayed only for devices with PROFIBUS PA.
AI1-Q Flowrate	Display only	Current flow in the selected unit from the Transducer Block Flow, including status.
TOT1-Q Flowrate	Display only	Current totalizer status in the selected unit from the Transducer Block Flow, including status.
TOT2-Q Flowrate	Display only	Current totalizer status in the selected unit from the Transducer Block Flow, including status.
AI2-Internal Tot Fwd	Display only	Current totalizer status of the forward totalizer in the selected unit from the Transducer Block Flow, including status.
AI3-Internal Tot Rev	Display only	Current totalizer status of the reverse totalizer in the selected unit from the Transducer Block Flow, including status.
AI4-Diagnostics	Display only	Current output value, including status. The channel can be selected using the "AI4 Channel" parameter. This function block delivers active values for FEX500 only. For this purpose, the sensor measurement or the conductivity measurement must be switched on. For FEX300 this function block delivers "0".
AI4-Channel	Sensor Temp, Conductivity	Selection of the channel output by AI4. The PV_SCALE and OUT_SCALE structure is not adapted. This channel is active for FEX500 only.
AO-Density Adjust	Display only	Current density output value from the Transducer Block Flow, including status.
DI-Alarm Info	Display only	Current output value, including status. The channel can be selected using the "DI Channel" parameter.
DI-Channel	Maintenance, Out of Spec, Function Check, Failure	Select the channel output by "DI Alarm Info".
DO-Cyclic Control	Display only	Current function, including status. The function can be selected using the "DO Channel" parameter.
DO-Channel	Off, Totalizer Reset(All), Flowrate to Zero, System Zero Adjust, Totalizer Stop(All), Dual Range, Start/Stop Batching	Select the function for "DO Cyclic Control".

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Communication / **FF**		The menu is displayed only for devices with FOUNDATION Fieldbus.
Show FF Address	Display only	Display of the FOUNDATION Fieldbus address. The address is set via the FOUNDATION Fieldbus Master.
AI1-Q Flowrate	Display only	Current flow in the selected unit from the Transducer Block Flow, including status.
INT1-Q Flowrate	Display only	Current output value, with status.
AI2-Internal Tot Fwd	Display only	Current totalizer status of the forward totalizer in the selected unit from the Transducer Block Flow, including status.
AI3-Internal Tot Rev	Display only	Current totalizer status of the reverse totalizer in the selected unit from the Transducer Block Flow, including status.
AI4-Diagnostics	Display only	Current output value, including status. The channel can be selected via the bus, only.
AO-Density Adjust	Display only	Current density output value from the Transducer Block Flow, including status.
DI-Alarm Info	Display only	Current output value, including status. The channel can be selected via the bus, only.
DO-Cyclic Control	Display only	Current function, including status. The channel can be selected via the bus, only.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

7.4.8 Menu: Diagnostics

Menu / Parameter	Value range	Description
Diagnostics		
Diagnosis Control		Select the "Diagnosis Control" submenu.
Diagnosis Values		Select the "Diagnosis Values" submenu.
Fingerprints		Select the "Fingerprints" submenu.
Trend		Select the "Trend" submenu.
Flowrate Alarm		Select the "Flowrate Alarm" submenu.
Simulation Mode	Off, Flow Velocity, Q [units], Q [%],Iout, Freq on DO1, Freq on DO2, Logic DO1, Logic DO2, HART Freq, Digital in	Manual simulation of measured values. 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 values in the "Value range" column can be simulated.
Output Readings		Select the "Output Readings" submenu.

Diagnostics / **Diagnosis Control**		
Empty Pipe Detector		Select the "Empty Pipe Detector" submenu.
Sensor Measurements		Select the "Sensor Measurements" submenu.
Gas Bubble Detector 1)		Select the "Gas Bubble Detector" submenu.
Coating Detector 1)		Select the "Coating Detector" submenu.
Cond. Detection 1)		Select the "Cond. Detection" submenu.
Grounding Check 1)		Select the "Grounding Check" submenu.
TFE Detector		Select the "TFE Detector" submenu.
Sil Detection		Select the "Sil Detection" submenu.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Diagnostics / Diagnosis Control / **Empty Pipe Detector**		
Empty Pipe Detector	On / Off	Activate the "Empty Pipe Detector" function (only for sizes ≥ DN 10 and without preamplifier). An entirely full measuring tube is essential for an accurate measurement. The "Empty Pipe Detector" function detects an empty measuring pipe. In the case of an alarm, the current output assumes the status that was defined in the "Input / Output / Current Output / Iout at EP Alarm" menu, and the pulse output is stopped. Default setting: Off
Adjust EP		The Empty Pipe Detector function must be adjusted according to the conditions on site. The switching threshold is set during the automatic adjustment. Start automatic adjustment of the Empty Pipe Detector function.
Manual Adjust EP F.	0 ... 255	Manually adjust the Empty Pipe Detector function. The value must be modified in such a way that the frequency for empty pipe detection **(Detector EP Value)** is close to 2000 Hz. **Important (Note)** Prior to starting the (manual / automatic) adjustment, make sure that: • There is no flow through the flowmeter sensor (close all valves, shut-off devices, etc.) • The flowmeter sensor is completely filled with the fluid to be measured.
Threshold	100 ... 60000 Hz	Set the switching threshold for empty pipe detection. The switching threshold is set automatically during automatic adjustment. The switching threshold can be changed in order to obtain manual fine adjustment.
Detector EP Value	Display only	Display of the frequency for empty pipe detection. If the current value exceeds the defined switching threshold, a message appears on the display and an alarm is output via the digital output, if configured accordingly.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Diagnostics / Diagnosis Control / **Sensor Measurements**		
One shot Sensor Mea		Start the measurement. The measured values for the start moment are acquired.
Coil Current	Display only	Display the coil current.
Coil Resistor	Display only	Display the coil resistance.
Coil Voltage	Display only	Display the coil voltage.
Coil R. Max Alarm	0 ... 1000 Ω	Set the maximum limit value for the coil resistance. In the case of overshoot an alarm is tripped. Default setting: 1000 Ω
Coil R. Min Alarm	0 ... 1000 Ω	Set the minimum limit value for the coil resistance. In the case of undershoot an alarm is tripped. Default setting: 0 Ω
Signal-Cable length	0.01 ... 200 m	Enter the signal cable length between the transmitter and the flowmeter sensor. For devices with a compact design 0.01 m must be entered. Default setting: 0 m
Sensor Temp Value [1)]	Display only	Display the sensor temperature.
Adj. Sensor T. Value [1)]	-50 ... +200 °C	The sensor temperature must be adjusted according to the conditions on site. The temperature measured with a separate thermometer can be entered here.
Sensor T. Max Alarm [1)]	-50 ... +200 °C	Set the maximum limit value for the sensor temperature. In the case of overshoot an alarm is tripped. Default setting: +200 °C
Sensor T. Min Alarm [1)]	-50 ... +200 °C	Set the minimum limit value for the sensor temperature. In the case of undershoot an alarm is tripped. Default setting: -50 °C

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Diagnostics / Diagnosis Control / **Gas Bubble Detector** [1]		
Gas Bubble Detector	On / Off	Activate the "Gas Bubble Detector" function. Default setting: Off **Important (Note)** The gas bubble detector can be used in the nominal diameter range DN10 ... 300. For further information read and observe chapter “Extended diagnostic functions”.
Adjust Gas Bubble		The Gas Bubble Detector must be adjusted according to the conditions on site. Start automatic adjustment of the Gas Bubble Detector function. **Important (Note)** Prior to starting the adjustment, make sure that: • There is no flow through the flowmeter sensor (close all valves, shut-off devices, etc.) • The flowmeter sensor is completely filled with the fluid to be measured and free from gas bubbles.
Threshold Gas Bubble		Set the switching threshold. If the current value exceeds the defined switching threshold, a message appears on the display and an alarm is output via the digital output, if configured accordingly.
Gas Bubble Value	Display only	Display the current gas bubble value.

Diagnostics / Diagnosis Control / **Coating Detector** [1]		
Coating Detector	On / Off	Activate the "Electrode Deposit Detector" function. Default setting: Off **Important (Note)** The electrode deposit detector can be used in the nominal diameter range DN10 ... 300. For further information read and observe chapter “Extended diagnostic functions”.
One shot Coating		The electrode deposits are measured cyclically at defined intervals. Here, a current measurement can be started.
Coating Value QE1	Display only	Current deposit value for electrode 1
Coating Value QE2	Display only	Current deposit value for electrode 1

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Diagnostics / Diagnosis Control / **Coating Detector (continued)** [1]		
Coating QE Min Alarm	0 ... 100.000	Set the minimum limit value for the electrode deposit detection. When the smaller value, QE1 or QE2, is undershot, an alarm is tripped. Default setting: 0
Coating QE Max Alarm	0 ... 100.000	Set the maximum limit value for the electrode deposit detection. When the greater value, QE1 or QE2, is overshot, an alarm is tripped. Default setting: 100.000
Diagnostics / Diagnosis Control / Cond. Detection [1]		
Cond. Detection	On / Off	Activate the "Cond. Detection" function. Default setting: Off **Important (Note)** The conductivity measurement function can be used in the nominal diameter range DN10 ... 300. For further information read and observe chapter “Extended diagnostic functions”.
One shot Cond.		The conductivity is measured cyclically at defined intervals. Here, a current measurement can be started.
Cond. Value		Display the conductivity.
Adj. Cond. Value	5 ... 20,000 µS/cm	The conductivity must be adjusted according to the fluid on site. The conductivity measured with a separate meter can be entered here.
Cond. Min Alarm	5 ... 20,000 µS/cm	Set the minimum limit value for the conductivity. In the case of undershoot an alarm is tripped. Default setting: 5 µS/cm
Cond. Max Alarm	5 ... 20,000 µS/cm	Set the maximum limit value for the conductivity. In the case of overshoot an alarm is tripped. Default setting: 20,000 µS/cm
Elec. Imp. E1-GND	Display only	Current impedance between electrode E1 and GND (ground potential).
Elec. Imp. E2-GND	Display only	Current impedance between electrode E2 and GND (ground potential).
Elec. Imp Min Alarm	0 ... 20,000 Ω	Set the minimum limit value for the impedance. In the case of undershoot an alarm is tripped. Default setting: 0 Ω
Elec. Imp Max Alarm	0 ... 20,000 Ω	Set the maximum limit value for the impedance. In the case of overshoot an alarm is tripped. Default setting: 20,000 Ω

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Diagnostics / Diagnosis Control / **Grounding Check** [1]		
Grounding Check		Start the "Grounding Check" function.
Power Spectrum	Display only	Current power spectrum.
Amplitude 1 Value	Display only	Display the four highest amplitudes in the power spectrum.
Amplitude 2 Value	Display only	
Amplitude 3 Value	Display only	
Amplitude 4 Value	Display only	
Diagnostics / Diagnosis Control / **TFE Detector**		
TFE detector		Activate the "Partial Filling Detector" (TFE) function. **Important (Note)** This function can be used only if the flowmeter sensor is provided with a measuring electrode for the detection of partially filled tubes (option). The flowmeter sensor must be installed horizontally, with the terminal box pointing upward. This function can be used for flowmeter sensors from size DN50 without explosion protection or with explosion protection for Zone 2 / Div.2. For further information read and observe chapter 8 “Extended diagnostic functions”.
Adjust TFE Full		The partial filling detector must be adjusted according to the conditions on site. Start automatic adjustment of the Partial Filling Detector function. **Important (Note)** Prior to starting the adjustment, make sure that: • There is no flow through the flowmeter sensor (close all valves, shut-off devices, etc.) • The flowmeter sensor is completely filled with the fluid to be measured.
TFE Threshold		Manual fine adjustment of the switching threshold. The switching threshold is automatically set during the automatic adjustment. If the current value exceeds the defined switching threshold, a message appears on the display and an alarm is output via the digital output, if configured accordingly.
TFE Value		Display the current measuring value.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Diagnostics / Diagnosis Control / **Sil Detection**		
SIL Detection	On / Off	By switching on the detector the monitoring of safety-relevant components is increased. With the detector switched on an SFF value of 91.6 is achieved for the FMEDA analysis (SIL2). With the detector switched off an SFF value of 85.5 is achieved for the FMEDA analysis (SIL1). This is valid for all devices with HART protocol. Default setting: Off
Diagnostics / **Diagnosis Values**		
SNR Value	Display only	Display the current diagnostic values for service purposes.
Slope Value		
Slope Variation		
Reference		
Signal Ratio (signal difference)		
Signal Max (Max.value of pos. signal)		
Signal Min (Max.value of neg. signal)		
Signal Error (signal error portion)		
NV Resets/sec		
Amplification Int.		
Diagnostics / **Fingerprints** 1)		
Factory F.P.		Select the "Factory F.P." submenu.
Startup F.P.		Select the "Startup F.P." submenu.
On demand F.P.		Select the "On demand F.P." submenu.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

The “fingerprint” database integrated in the transmitter allows you to compare the values at the time of factory calibration or commissioning with the currently recorded values.
As a result, changes of the measuring system can be detected early, and the appropriate measures can be taken.

Menu / Parameter	Value range	Description
Diagnostics / Fingerprints / **Factory F.P.** [1]		
Sensor Coil R.	Display only	The factory fingerprint is created when the device are calibrated in the factory.
Elec. Coat. QE1		
Elec. Coat, QE2		
Elec. Imp. E1-GND		
Elec. Imp. E2-GND		
Tx check CMR		
Tx check 5 m/s		
Tx check 10 m/s		
Diagnostics / Fingerprints / **Startup F.P.** [1]		
Startup F.P.		Create the commissioning fingerprint for the flowmeter sensor.
Sensor Coil R	Display only	The commissioning fingerprint is created on site during commissioning. The values measured for this fingerprint are indicated here.
Elec. Coat. QE1		
Elec. Coat, QE2		
Elec. Imp. E1-GND		
Elec. Imp. E2-GND		
Start Tx Startup F.P.		Create the commissioning fingerprint for the transmitter.
Tx check CMR	Display only	
Tx check 5 m/s		
Tx check 10 m/s		
Diagnostics / Fingerprints / **On demand F.P.** [1]		
Start On demand F.P.		Creating the manual fingerprint.
Sensor Coil R	Display only	The manual fingerprint can be created at any time. The values measured for this fingerprint are indicated here.
Elec. Coat. QE1		
Elec. Coat, QE2		
Elec. Imp. E1-GND		
Elec. Imp. E2-GND		
Start Tx Startup F.P.		Create the manual fingerprint for the transmitter.
Tx check CMR		
Tx check 5 m/s		
Tx check 10 m/s		

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Diagnostics / **Trend** [1]		
Conductivity		The measured values are shown as a line diagram. When the "Trend-Logging" function is enabled, the measured values are stored at the defined interval (cycle time). The last 12 measured values are stored and indicated as a line diagram. The oldest data record is overwritten.
Electrode Coat. QE1		
Electrode Coat. QE2		
Logtime Interval	1 ... 45,000 min.	Interval for measured value logging.
Trend-Logging	ON / OFF	Activate the "Trend-Logging" function. When the "Trend-Logging" function is enabled, the measured values are stored at the defined interval (cycle time). The data records can be read out by the "ScanMaster" verification software and analyzed as trends.
Diagnostics / **Flowrate Alarm**		
Max. Flowrate Alarm	0 ... 130 %	Set the maximum limit value for the flow.
Min. Flowrate Alarm	0 ... 130 %	Set the minimum limit value for the flow.
Diagnostics / **Output Readings**		
Current	mA	Display the current values and statuses of the listed inputs and outputs.
DO1 Frequency	Hz	
DO2 State	open / closed	
Digital In State	open / closed	

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

7.4.9 Menu: Totalizer

Menu / Parameter	Value range	Description
Totalizer		
Reset Vol. Totals		Select the "Reset Vol. Totals" submenu.
Batching[1)]		Select the "Batching" submenu.
Edit Vol. Totals		Select the "Edit Vol. Totals" submenu.
Totalizer / **Reset Vol. Totals**		
Totalizer Fwd		Resets forward totalizer to zero.
Totalizer Rev		Resets reverse totalizer to zero.
Totalizer Net		Reset the differential totalizer to zero.
All Vol. Totalizer		Resets all totalizers to zero.
Totalizer / **Batching** [1)]		
Damping	On / Off	Switch on / off the damping. Default setting: On
		Important (Note) In order to achieve a shorter response time for the fill function, the damping must be switched off. The fill time should be > 3 seconds.
Preset Batch Tot.	-	Set the fill quantity When the defined fill quantity is reached, the configured digital output is activated.
Lag Corr. Mode	Automatic / Manual	Select the overrun correction. Closing the fill valve takes some time. As a result, some more fluid is added, although the fill quantity is already reached and the contact for closing the valve is actuated. With "Automatic overrun correction" the set fill quantity is corrected with the overrun quantity.
Lag Corr. Quantity	-100.000 ... 100.000	Manual entry of the overrun quantity.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Totalizer / **Batching (continued)** [1]		
Batch Tot.	Display only	Once a fill operation has been started, the quantity already filled in is shown here. The totalizer restarts with zero for each fill operation started and then totalizes the quantity up to the set fill quantity.
Total Batch Counter	Display only	Total number of fill operations.
Reset Batch Counter		Reset fill operation totalizer to zero.
Start/Stop Batching		Manual start / stop of the fill operation. Alternatively, the digital input can be configured for starting / stopping the fill operation.
Totalizer / **Edit Vol. Totals**		
Edit Totalizer Fwd	-	Enter totalizer statuses (e.g., when replacing the transmitter).
Edit Totalizer Rev	-	
Edit Totalizer Net	-	

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

7.5 Alarm Simulation

In the "Process Alarm / Alarm Simulation" menu a variety of alarms can be simulated.

Parameter	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 Alarm Flowrate	Simulate flowrate min. alarm
6-Max Alarm Flowrate	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<1600h	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 Address <> 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	Simulate digital input "ON/OFF"
19-ADC saturated	Simulate "AD converter override" error
20-Error Coil circ	Simulate error in coil loop
21-Coil Resistor	Simulate "Coil resistance out of limits" error
22-Driver Err Uref=0	Simulate "Reference voltage = 0" error
23-El.Noise too High	Simulate "Noise signal too high" error
24-DC to High	Simulate "DC too high, several NV resets" error
25-Empty Pipe	Simulate "Empty pipe" error
27-NV Corrupt	Simulate "NV Corrupt" error
29-Electrode Imp.	Simulate "Electrode impedance out of limits" error

Process Alarm (continued)
... / Alarm Simulation

30-Hold Last Value	Simulate "Hold last good value" error
32-Digi-Pot Error	Simulate "Digital potentiometer" error
33-TFE	Simulate "Partial filling alarm" error
34-CurrentOut Error	Simulate "Loop current output interrupted" error
35-Not Calibrated	Simulate "Not calibrated" error
36-SensorIncompatib.	Simulate "Calibration mode incompatible" error
37-ROM Error	Simulate ROM error in the transmitter
38-RAM Error	Simulate RAM error in the transmitter
39-Sim. HART Freq.	Simulate a HART frequency
40-SIL	Simulate "Self check alarm" error
41-Conductivity	Simulate "Conductivity alarm" error
42-Elec.Coated	Simulate "Electrode deposits" error
43-Gas bubble	Simulate "Gas bubbles" error
44-Pulse Cut Off	Simulate "Pulse output" error
46-Sensor Temp	Simulate "Sensor temperature alarm" error

7.6 Software history

7.6.1 Devices with HART protocol

Software D200S062U01		
Software version	**Type of changes**	**Operating instructions**
00.01.01	Original Software	OI/FEP300/FEH300 Rev. A
00.01.02	Function extension, incorporated new HART commands	OI/FEP300/FEH300 Rev. A
00.02.00	Optimized measured value processing	OI/FEP300/FEH300 Rev. B
00.02.01	Optimized measured value processing	OI/FEP300/FEH300 Rev. B
00.02.04	Optimized boot sequence	OI/FEP300/FEH300 Rev. B
Software D200S069U01		
01.01.02	Optimized access to the service menu. Implemented TFE functionality Added diagnostic functions and batch mode (for 500 series, only)	OI/FEX300/FEX500 Rev. C
01.01.04	Optimized sensitivity of the keys on the display	OI/FEX300/FEX500 Rev. D
01.01.06	Optimized view on the display	OI/FEX300/FEX500 Rev. D
01.02.00	Totalizer preset for ProcessMaster 300 implemented. Error with Swedish menu navigation corrected.	OI/FEX300/FEX500 Rev. E

7.6.2 Devices with PROFIBUS PA or FOUNDATION Fieldbus

Software D200S069U02 (PA)		Software D200S069U03 (FF)
Software version	**Type of changes**	**Operating instructions**
00.01.02	Original software for PROFIBUS PA, FOUNDATION Fieldbus	OI/FEX300/FEX500 Rev. C

8 Extended diagnostic functions

8.1 General remarks

Important (Note)

- The extended diagnostic functions are available for ProcessMaster 500 and HygienicMaster 500 only.
- The "Partial Filling Detector" function is **not** available for HygienicMaster 500.
- When using the extended diagnostic functions the external flowmeter sensor must not be provided with a preamplifier.
- To facilitate initial start-up, the extended diagnostic functions are deactivated (factory default).
- To use the extended diagnostic functions, a "start-up fingerprint" must be created during start-up of the flowmeter.
- Each diagnostic function (e.g. Gas Bubble Detector or Electrode Deposit Detector) can be individually activated. Once activated, the diagnostic function must be calibrated according to the conditions on site and the limit values must be set.

8.1.1 Detection of partial filling

Optionally, a measuring electrode (TFE electrode) is available for detecting a partially filled flowmeter sensor. The alarm for partial filling is output via the programmable digital output.

Conditions for using the function:

- Nominal diameter from DN 50 (2“)
- Max. signal cable length for version with external transmitter 200 m (656 ft).
- Conductivity of the fluid: 20 µS/cm ... 20,000 µS/cm
- The function is only available for ProcessMaster 300 / 500 without explosion protection or with explosion protection for Zone 2 / Div 2.

Additional installation conditions:

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

8.1.2 Detection of gas bubbles

Gas bubbles in the fluid are detected by using an adjustable maximum limit value. When this limit value is exceeded, an alarm is tripped via the programmable digital output, depending on the configuration.

Conditions for using the function:

- This function is available in the nominal diameter range [1)] of DN 10 … 300 (3/8 “ ... 12 “).
- The signal cable length of the external transmitter must not exceed a maximum value of 50 m (164 ft) .
- For this function, the conductivity of the fluid must be in the range 20 µS/cm ... 20,000 µS/cm.

Additional installation conditions:

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

1) The specified nominal diameter range is valid for ProcessMaster, only. The nominal diameter range valid for HygienicMaster is DN 10 … 100 (3/8 “ ... 4 “).

8.1.3 Electrode coating detection

This function provides the opportunity to detect coatings on the measuring electrodes by using an adjustable maximum limit value.

When the set limit value is exceeded, an alarm is tripped via the programmable digital output, depending on the configuration.

Conditions for using the function:

- This function is available in the nominal diameter range [2)] of DN 10 … 300 (3/8 “ ... 12 “).
- The signal cable length of the external transmitter must not exceed a maximum value of 50 m (164 ft) .
- For this function, the conductivity of the fluid must be in the range 20 µS/cm ... 20,000 µS/cm.

Additional installation conditions:

- When using plastic tubes, install a grounding plate at the front and back of the device.

8.1.4 Conductivity monitoring

The conductivity of the fluid is monitored by using an adjustable minimum / maximum limit value.

When the value falls below or exceeds the set limit value, an alarm is tripped via the programmable digital output, depending on the configuration.

Conditions for using the function:

- This function is available in the nominal diameter range [1)] of DN 10 … 300 (3/8 “ ... 12 “).
- The signal cable length of the external transmitter must not exceed a maximum value of 50 m (164 ft) .
- For this function, the conductivity of the fluid must be in the range 20 µS/cm ... 20,000 µS/cm.

Additional installation conditions:

- When using plastic tubes, install a grounding plate at the front and back of the device.
- There must not be any deposits on the measuring electrodes.

1) The specified nominal diameter range is valid for ProcessMaster, only. The nominal diameter range valid for HygienicMaster is DN 10 … 100 (3/8 “ ... 4 “).

8.1.5 Electrode impedance monitoring

The impedance between the electrode and ground is monitored by using a minimum / maximum limit value. This enables the transmitter to detect an electrode fine short or leakage.

When the value falls below or exceeds the set limit value, an alarm is tripped via the programmable digital output, depending on the configuration.

Conditions for using the function:

- This function is available in the nominal diameter range [1)] of DN 10 … 300 (3/8 “ ... 12 “).
- The signal cable length of the external transmitter must not exceed a maximum value of 50 m (164 ft) .
- For this function, the conductivity of the fluid must be in the range 20 µS/cm ... 20,000 µS/cm.

Additional installation conditions:

- When using plastic tubes, install a grounding plate at the front and back of the device.
- There must not be any deposits on the measuring electrodes.
- The measuring tube must always be completely full, and the fluid must feature only minor conductivity variations.

8.1.6 Sensor measurements

This function includes the monitoring of the sensor temperature and the monitoring of the resistance of the flowmeter sensor's coils.

8.1.6.1 Sensor temperature monitoring

The temperature of the coils in the flowmeter sensor can be monitored by using adjustable minimum / maximum limit values. When a set limit value is exceeded, an alarm is tripped via the programmable digital output, depending on the configuration.

The coil temperature is a factor of the ambient and fluid temperatures. The measurement can, e.g., be used to monitor overtemperature due to the fluid. The coil temperature is measured indirectly via the coil DC resistance.

8.1.6.2 Monitoring of the sensor coil resistance

The coils in the flowmeter sensor can be monitored by using adjustable minimum / maximum limit values for the coil resistance. When a set limit value is exceeded, an alarm is tripped via the programmable digital output, depending on the configuration.

1) The specified nominal diameter range is valid for ProcessMaster, only. The nominal diameter range valid for HygienicMaster is DN 10 … 100 (3/8 “ ... 4 “).

8.1.7 Trend

The device has an internal memory where the measured value for the electrode deposits and the conductivity are cyclically stored as a data set with an adjustable time (1 min ... 45000 min). A maximum of 12 data sets is stored. When the thirteenth record is stored, the oldest data set is overwritten automatically.

The data sets can be read out or analyzed as a trend using the external diagnostic tool (ScanMaster).

8.1.8 Fingerprint

The “fingerprint” database integrated in the transmitter allows you to compare the values at the time of factory calibration or commissioning with the currently recorded values.

8.1.9 Checking the grounding

This function allows you to check the electrical grounding of the device.

While the check is in progress, no flow measurement can take place.

Conditions for using the function:

- The measuring tube must be completely full.
- No flow must occur in the flowmeter sensor.

Additional installation conditions:

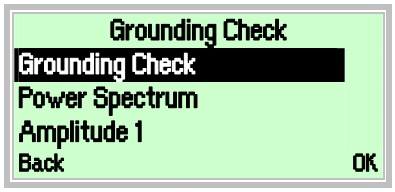
- The flowmeter sensor must not be provided with a preamplifier.

8.2 Performing the grounding check

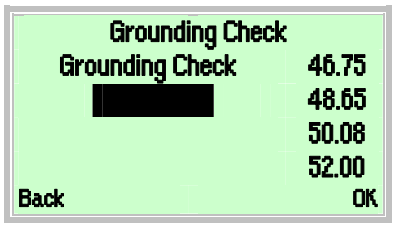
... / Diagnostics / Diagnosis Control / Grounding Check [1]		
Grounding Check		Start the "Grounding Check" function.
Power Spectrum	Display only	Current power spectrum.
Amplitude 1 Value	Display only	Display the four highest amplitudes in the power spectrum.
Amplitude 2 Value	Display only	
Amplitude 3 Value	Display only	
Amplitude 4 Value	Display only	

italics = Parameter can only be viewed at the "Advanced" password level.

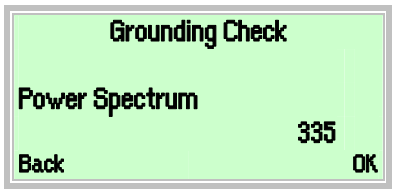
1) Parameter / menu only available for FEP500 / FEH500.



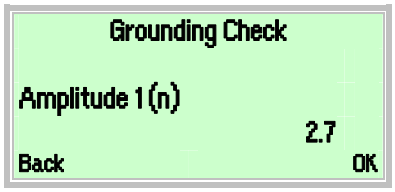
3. Use ▲ or ▼ to select "Grounding Check".
4. Use ▶ to start the "Grounding Check" function.



Once the grounding check has been started, the frequency range up to 250 Hz is measured. The four most intensive frequencies of the spectrum are shown at the right of the display.
The corresponding amplitudes and the power spectrum over the frequency range can be called up for display using the following parameters.



5. Use ▲ or ▼ to select "Power Spectrum".
6. Use ▶ to call up the parameter for display.



7. Use ▲ or ▼ to select "Amplitude 1 (n)".
8. Use ▶ to call up the parameter for display.

The measured values indicate possible disturbances of the device's grounding line at the time of the test.

No or minor disturbance:

- When the power spectrum is below 1000.
- When the four measured amplitude values are above 10.

Check the device grounding (!):

- When the power spectrum is above 1000.
- When the four measured amplitude values are above 10.

8.3 Recommended settings for diagnostic limit values

In the "Diagnostics / Diagnosis Control / ..." menu, limit values for the diagnostic values can be specified.

In order to simplify their setting, recommendations for the individual limit values are shown here.

The values indicated are only intended as a rough guide and may need to be adapted in line with on-site conditions.

8.3.1 Limit values for the coil resistance

Coil resistance monitoring is switched off (factory default).

Monitoring can be switched on in the **"Diagnostics / Diagnosis Control / Sensor Measurements"** menu.

Parameter	Factory setting
Coil R. Min Alarm	0 ohms
Coil R. Max Alarm	1000 ohms

The coil resistance depends on the fluid temperature T_{medium} and the ambient temperature.

	Parameter	
T_{medium}	Coil R. Min Alarm	Coil R. Max Alarm
-40 °C (-40 °F)	Factory for Fingerprint (coil resistance) x 0.71	Factory for Fingerprint (coil resistance) x 0.79
-20 °C (-4 °F)	Factory for Fingerprint (coil resistance) x 0.81	Factory for Fingerprint (coil resistance) x 0.89
0 °C (32 °F)	Factory for Fingerprint (coil resistance) x 0.9	Factory for Fingerprint (coil resistance) x 1.0
20 °C (68 °F)	Factory for Fingerprint (coil resistance) x 0.95	Factory for Fingerprint (coil resistance) x 1.05
60 °C (140 °F)	Factory for Fingerprint (coil resistance) x 1.19	Factory for Fingerprint (coil resistance) x 1.31
90 °C (194 °F)	Factory for Fingerprint (coil resistance) x 1.28	Factory for Fingerprint (coil resistance) x 1.42
130 °C (266 °F)	Factory for Fingerprint (coil resistance) x 1.43	Factory for Fingerprint (coil resistance) x 1.58
180 °C (356 °F)	Factory for Fingerprint (coil resistance) x 1.62	Factory for Fingerprint (coil resistance) x 1.79

8.3.2 Limit values for the electrode deposits

Electrode deposit monitoring is switched off (factory default). Monitoring can be switched on in the **"Diagnostics / Diagnosis Control / Coating Detector"** menu.

Parameter	Factory setting
Coating QE Min Alarm	0 ohms
Coating QE Max Alarm	100.000 ohms

Recommended settings in the "Diagnostics / Diagnostic Functions / Electrode Deposits" menu

- Coating QE Min Alarm = 0.5 x Coating Value QE
- Coating QE Max Alarm = 2.0 x Coating Value QE

Important (Note)

The deposit value QE is the mean value of Startup Fingerprint QE1 and QE2. The value is determined using the following formula:

QE = (Startup Fingerprint QE1 + Startup Fingerprint QE2) / 2

8.3.3 Limit values for the electrode impedance

Electrode impedance monitoring is switched off (factory default). Monitoring can be switched on in the **"Diagnostics / Diagnosis Control / Cond. Detection"** menu.

Parameter	Factory setting
Elec.Imp.Min Alarm	0 ohms
Elec.Imp.Max Alarm	20.000 ohms

The limit values for parameters **"Elec.Imp.Min Alarm"** and **"Elec.Imp.Max Alarm"** depend on the fluid conductivity and must be determined on site.

Recommended settings

- Elec.Imp.Min Alarm = 0.2 x average impedance value
- Elec.Imp.Max Alarm = 3.0 x average impedance value

Important (Note)

The average impedance value is the value of Startup Fingerprint "Elec. Imp. E1-GND" and "Elec. Imp. E2-GND". The value is determined using the following formula:

Average impedance value = (Startup Fingerprint "Elec. Imp. E1-GND" + Startup Fingerprint "Elec. Imp. E2-GND") / 2

8.3.4 Recommended settings for the Trend Logger

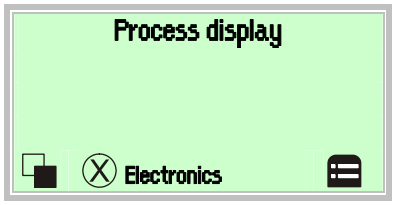
"Diagnostics / Trend" menu

- Logtime Interval = 43,200 minutes

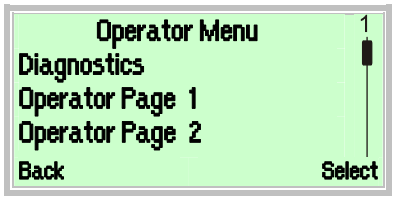
9 Error messages

9.1 Invoking the error description

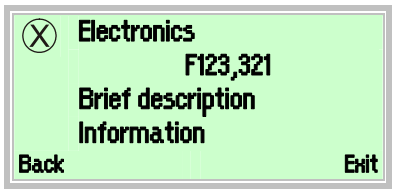
Additional details about the occurred error can be called up on the information level.



1. Use  to switch to the information level.



2. Use  or  , select the "Diagnostics" submenu.
3. Use  to confirm your selection.



The first line shows the area in which the error has occurred.

The second line shows the unique error number.

The next lines show a brief description of the error and information on how to remedy it.

9.2 Error states and alarms

9.2.1 Errors

Error no. / Range	Text on the LCD display	Cause	Remedy
F254.038 Electronics unit	RAM Error in Transmitter Contact ABB Service	Error in the transmitter electronics unit.	Replace the electronics unit or contact ABB Service.
F253.037 Electronics unit	ROM Error in Transmitter Contact ABB Service	Error in the transmitter electronics unit.	Replace the electronics unit or contact ABB Service.
F252.017 Sensor	No Sensor Memory Check wiring Check switch SW3	Incorrectly wired terminals D1 and D2. Short circuit or break in wires for D1, D2. Jumper SW3 is not correctly plugged into the backplane. Old flowmeter sensor connected without SensorMemory.	Check the wiring for terminals D1, D2. If an old flowmeter sensor (e.g., model DE41F) is connected without SensorMemory, plug the jumper on the backplane in the "ON" position.
F251.040 Electronics unit	Self Check Alarm	The SIL monitoring function has detected a transmitter error.	Replace the transmitter or contact ABB Service.
F250.016 Electronics unit	Tx. memory fault detected Contact ABB Service	Error in the transmitter electronics unit.	Replace the electronics unit or contact ABB Service.
F248.036 Sensor	Incompatible snsTx+ snr are not the same series	Calibration mode is not compatible.	Contact ABB Service.
F246.032 Electronics unit	Defect digital potentiometer Transmitter Hardware fault ABB Service	Internal digital potentiometer for common mode rejection is defective.	Replace the electronics unit or contact ABB Service.
F245.047 Electronics unit	Stack NV Corrupt Contact ABB Service	The internal stack memory for PROFIBUS PA / FOUNDATION Fieldbus is defective.	Replace the electronics unit or contact ABB Service.
F244.031 Electronics unit	Internal supply voltage error Contact ABB Service	Failure of transmitter internal power supply.	Replace the electronics unit or contact ABB Service.
F236.024 Operation	DC to High Lot of NV-Resets Refer to instr. Manual	Multi-phase fluids that produce a very high level of noise. Stones or solids that produce a very high level of noise. Galvanic voltages at the measuring electrodes. Conductivity of fluid is not evenly distributed (e.g., directly after injection points).	Check electrical connections and grounding of device. Activate empty pipe detector and calibrate if the meter tube is empty. Contact ABB Service.
F232.022 Electronics unit	Driver Error Uref = 0 Check wiring for open circuit Check fuse	Incorrect wiring (terminals M1, M2) or wire break / short circuit. Defective fuse in the coil circuit or moisture in the terminal box.	Check that the wiring (terminals M1, M2) is connected properly, check for wire breaks and short circuits. Check the coil circuit fuse. Check the connection box for moisture.
F228.020 Electronics unit	Error in Coil circuit Check wiring for short circuit	Incorrect wiring (terminals M1, M2) or wire break / short circuit. Fuse in the coil circuit is defective.	Check that the wiring (terminals M1, M2) is connected properly, check for wire breaks and short circuits. Check the coil circuit fuse.

Continued on next page.

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

9.2.2 Function check

Error no. / Range	Text on the LCD display	Cause	Remedy
C190.045 Config.	An alarm is simulated Switch off alarm simulation	Simulation mode is activated.	In the "Diagnostics" menu, deactivate simulation mode.
C186.009 Config.	Tx Simulator/ Calibrator mode Switch off Calibrator Mode	The transmitter is operated on simulator 55XC4000.	In the "Diagnostics" menu, deactivate simulation mode.
C185.030 Operation	Hold last good known value Switch OFF Noise Reduction ABB Service	The noise exceeds the bandwidth set for noise reduction for a longer period of time.	Switch off noise reduction in the "Device Setup" menu or contact ABB Service.
C184.010 Config.	The Flowrate is set to zero Check digital in terminals 81,82	The function of the digital input (DI) is set to "External output switch-off" and the digital input (DI) is set to high signal (+24 V DC).	Set the digital input (DI) to low signal (0 VDC).
C182.008 Config.	Flowrate Simulation Switch off Simulation Mode	Simulation mode is activated. One of the following functions is simulated: Flowrate [%] or flowrate [unit] or flow velocity. These readings in simulation mode do not represent the system conditions.	In the "Diagnostics" menu, deactivate simulation mode.
C178.000 Config.	Simulated/ Fixed Current Output Simulation Mode? HART address>0?	The current output is simulated and is currently set to a specific value. The error message is displayed if the HART address is not 0 (HART multidrop mode, current output is set permanently to 4 mA).	Deactivate simulation mode in the "Process Alarm" menu or set the HART address to 0 in the "Communication" menu.
C177.015 Config.	HART Address <>0 Multidrop Mode Set HART Addr. = 0	HART address not 0 (HART multidrop mode, current output is set permanently to 4 mA).	Set the HART address to 0 in the "Communication" menu.
C176.011 Config.	Totalizer Stop 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 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 Switch off Simulation Mode	Simulation mode is activated.	In the "Process Alarm" menu, deactivate simulation mode.
C172.004 Config.	Pulse Simulation selected on DO2 Switch off Simulation Mode	Simulation mode is activated.	In the "Process Alarm" menu, deactivate simulation mode.
C168.001 Config.	Logic Simulation selected on DO1 Switch off Simulation Mode	Simulation mode is activated.	In the "Process Alarm" menu, deactivate simulation mode.
C164.003 Config.	Logic Simulation selected on DO2 Switch off Simulation Mode	Simulation mode is activated.	In the "Process Alarm" menu, deactivate simulation mode.
C158.039 Config.	Simulation of HART frequency Switch off Simulation Mode	Simulation mode is activated.	In the "Process Alarm" menu, deactivate simulation mode.
C154.018 Config.	Simulation Digital In Switch off Simulation Mode	Simulation mode is activated.	In the "Process Alarm" menu, deactivate simulation mode.

9.2.3 Operation outside of specifications (Off Spec)

Error no. / Range	Text on the LCD display	Cause	Remedy
S149.021 Operation	Coil resistor out of limits Check wiring Contact ABB Service	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. Coil resistance too low: Coil is defective or short circuit in M1 / M2 wiring.	Check wiring, check fuse for coil circuit, contact ABB Service.
S148.025 Operation	Empty Pipe Check Pipe	The pipeline in the system is empty.	Fill pipeline.
S146.043 Operation	Gas Bubble Alarm	Gas bubbles were detected in the fluid. The measured value is above the set switching threshold.	Check the process.
S144.033 Operation	Partially filled pipe(TFE) Check Pipe Or adjust Detector	Alarm tripped by Partial Filling Detector.	Check process, fill pipeline.
S143.042 Operation	Electrode Coating Alarm	Insulating or conductive deposits detected on measuring electrodes. The deposit value is above the set switching threshold.	Check process, flush pipeline, clean measuring electrodes.
S142.041 Operation	Conductivity Alarm	The fluid conductivity is outside the configured limit values.	Check process, adjust alarm limits if required.
S141.046 Operation	Sensor and or Housing Temperature to high	The flowmeter sensor temperature is outside the configured limit values.	Check process, adjust alarm limits if required.
S140.007 Operation	Flowrate >103% Check Flowrate 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 lower than the min. alarm configured.	Increase 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 insulating deposits on the electrodes, conductivity that is too low, or an empty meter tube.	If the pipeline is empty, check whether the empty pipe detection function is activated. In the "Diagnostics" menu, activate the empty pipe detection function. Check conductivity, check deposits on the electrodes. Increase the value for "Elec. Imp. Max. Alarm" in the "Diagnostics - Alarm Limits" menu.
S122.026 Operation	Short-ciruit E1 E2 with shield.	Galvanic voltages.	Increase the value in the "Diagnostics - Alarm Limits - Electr. V Max Alarm" menu and decrease the value for "Electr. V Min Alarm".
S120.023 Operation	Electrode Noise too high Switch on Noise Reduction	The noise at the measuring electrodes is above the limit value.	Check process.
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, reduce the "Pulses per unit" value.

9.2.4 Maintenance

Error no. / Range	Text on the LCD display	Cause	Remedy
M099.027 Electronics unit	NV Corrupt	NV Memory, SensorMemory, FRAM defective.	Contact ABB Service.
M094.034 Electronics unit	Current out fault Comms. to MSP Check wiring! 20mA passive? Check BR901!	20 mA loop open, wire break or no power connected during operation as passive 20 mA output, max. permissible load exceeded or hardware defective.	Check for incorrect wiring, wire break. Check that the jumper to the 20 mA active / passive switchover is connected correctly to the backplane in the transmitter housing. 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 contact on the D1 or D2 terminals, or incorrect wiring, or short circuit, or moisture in the terminal box.	Check for incorrect wiring (terminals D1, D2), check terminal box.
M080.012 Operation	Display value is <1600h at Qmax Change eng. Unitfor Totalizer	Display value <1,600 h for Qmax.	Change the totalizer unit.

9.3 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 in Transmitter Contact ABB Service	Iout at Alarm	General Alarm	0 Hz	0 %	No
F253.037 Electronics unit	ROM Error in Transmitter Contact ABB Service	Iout at Alarm	General Alarm	0 Hz	0 %	No
F252.017 Sensor	No Sensor Memory Check wiring Check switch SW3	Iout at Alarm	General Alarm	0 Hz	0 %	No
F251.040 Electronics unit	Self Check Alarm	Iout at Alarm	General Alarm	0 Hz	0 %	No
F250.016 Electronics unit	Tx. memory fault detected Contact ABB Service	Iout at Alarm	General Alarm	0 Hz	0 %	No
F248.036 Sensor	Incompatible snsTx+ snr are not the same series	Iout at Alarm	General Alarm	0 Hz	0 %	No
F246.032 Electronics unit	Defect digital potentiometer Transmitter Hardware fault ABB Service	Iout at Alarm	General Alarm	0 Hz	0 %	No
F245.047 Electronics unit	Stack NV Corrupt Contact ABB Service	Iout at Alarm	General Alarm	0 Hz	0 %	No
F244.031 Electronics unit	Internal supply voltage error Contact ABB Service	Iout at Alarm	General Alarm	0 Hz	0 %	No
F236.024 Operation	DC to High Lot of NV-Resets Refer to instr. Manual	Iout at Alarm	General Alarm	0 Hz	0 %	No
F232.022 Electronics unit	Driver Error Uref = 0 Check wiring for open circuit Check fuse	Iout at Alarm	General Alarm	0 Hz	0 %	No
F228.020 Electronics unit	Error in Coil circuit Check wiring for short circuit	Iout at Alarm	General Alarm	0 Hz	0 %	No
F226.019 Electronics unit	AD Converter saturated Check empty pipe or Galv. Voltage	Iout at Alarm	General Alarm	0 Hz	0 %	No

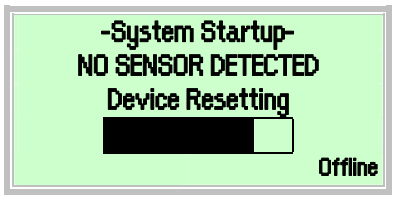
Error no. / Range	Text on the LCD display	Current output behavior	Digital output behavior	Pulse output behavior	Display	Error maskable?
C190.045 Configuration	An alarm is simulated Switch off alarm simulation	Current value	No response	Current value	Current value	No
C186.009 Configuration	Tx Simulator/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

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	Mask group
C149.021 Sensor	Coil resistor out of limits Check wiring Contact ABB Service	Current value	No response	Current value	Current value	Mask group
S148.025 Operation	Empty Pipe Check Pipe	Programmed alarm	Programmed alarm	0 Hz	0%	Mask single alarm
S149.021 Operation	Gas Bubble Alarm	No response	No response	No response	No response	Mask group
S146.043 Operation	Partially filled pipe(TFE) Check Pipe Or adjust Detector	Current value	Programmed alarm	Current value	Current value	Mask group
S144.033 Operation	Electrode Coating Alarm	Programmed alarm	Programmed alarm	Current value	Current value	Mask group
S143.042 Operation	Conductivity Alarm	Current value	Programmed alarm	Current value	Current value	Mask group
S142.041 Operation	Sensor and or Housing Temperature to high	Current value	Programmed alarm	Current value	Current value	Mask group
S141.046 Operation	Flowrate >103% Check Flowrate Check Range Setting	Current value	Programmed alarm	Current value	Current value	Mask group
S140.007 Operation	Max Alarm Flowrate	Programmed alarm	Collective Alarm	Current value	Current value	Mask single alarm
S136.006 Operation	Min Alarm Flowrate	Current value	Programmed alarm	Current value	Current value	Mask single alarm
S132.05 Operation	Coil resistor out of limits Check wiring Contact ABB Service	Current value	Programmed alarm	Current value	Current value	Mask single alarm
S124.029 Operation	Electr.Impedance too high Coating? Conductivity? Empty Pipe?	Current value	No response	Current value	Current value	Mask group
S122.026 Operation	Short-ciruit E1 E2 with shield.	Current value	No response	Current value	Current value	Mask group

Error no. range	Text on the LCD display	Current output behavior	Digital output behavior	Pulse output behavior	Display	Error maskable?
S120.023 Operation	Electrode Noise too high Switch on Noise Reduction	Current value	No response	Current value	Current value	Mask group
S110.035 Sensor	Sensor setup Cal-Status Set Cal-Status to calibrated	Current value	Current value	Current value	Current value	Group mask
S108.044 Operation	Pulse output is cutted off Check pulse out configuration	Current value	No response	Maximum possible value	Current value	Group mask
M099.027 Elektronics unit	NV Corrupt	Current value	No response	Current value	Current value	Group mask
M94.034 Electronics unit	Current out fault Comms. to MSP Check wiring! 20mA passive? Check BR901!	Low Alarm	No response	Current value	Current value	Single Alarm mask
M90.014 Sensor	Errors Sensor Comms Bad EMC environment Check wiring	Current value	No response	Current value	Current value	Group mask
M80.012 Operation	Display value is <1600h at Qmax Change eng. Unitfor Totalizer	Current value	No response	Current value	Current value	Group mask

9.3.1 Error messages during commissioning

9.3.1.1 No sensor detected



Once the device has been switched on, the sensor calibration data and the transmitter settings are loaded from the SensorMemory into the transmitter.
If it is not possible to establish a communication with the SensorMemory[1)], the shown message appears on the LCD display.

Possible cause	Remedy
Terminals D1 / D2 wired incorrectly.	Check wiring.
Short-circuit or wire-break of wires D1 / D2.	Check signal cable.
Jumper SW3 not correctly connected to the backplane.	Check jumper SW3. Refer to Chapter 6.2 "Configuring the current output". • off: SensorMemory provided in the flowmeter sensor (standard) • on: No SensorMemory in flowmeter sensor
SensorMemory[1)] defective.	Contact ABB Service

The device will restart after the progress bar is complete until either the communication with the SensorMemory[1)] is re-established successfully or the process is canceled by selecting "Offline".

In Offline mode the device can be operated or parameterized, but no measurement is performed.

In Offline mode the error message "F252.017" is set.

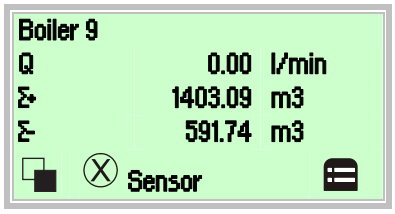
1) The SensorMemory is a data memory integrated in the flowmeter sensor.

9.3.1.2 Error message "Incompatible sensor"

Important (Note)

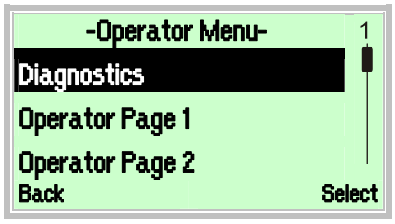
When commissioning the device, make sure that the transmitter is assigned to the sensor correctly. It is not possible to operate a flowmeter sensor of the 300 series with a transmitter of the 500 series.

If the transmitter is operated with a flowmeter sensor of another series, the following message appears on the transmitter display:

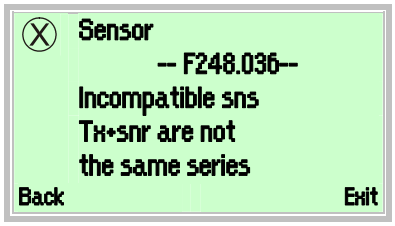


In the process display, a flow of zero flow is indicated, no flow measurement is performed.

1. Use to switch to the information level.



2. Use or , select the "Diagnostics" submenu.
3. Use to confirm your selection.



When attempting to commission a mixed installation, the shown error message appears.

The device cannot measure.

The indicated value for the current flowrate is zero flow.

The current output assumes its pre-configured state (Iout for alarm).

Make sure that the flowmeter sensor and the transmitter are from the same series.

(e.g., flowmeter sensor ProcessMaster 300, transmitter ProcessMaster 300)

10 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.

Caution - 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 before touching electronic components.

10.1 Flowmeter sensor

The flowmeter sensor is largely maintenance-free. 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 power supply feed, the lightning protection, and the station ground.

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 a lower flowrate is displayed, the contamination results in a short-circuit.

For repairs to the lining, electrodes or magnet coil, the flowmeter must be returned to the head office in Göttingen.

Important (Note)

When sending the flowmeter sensor for repair to the head office of ABB Automation Products GmbH, 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.

10.2 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 (Note)

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

10.3 Replacing the transmitter or sensor

Important (Note)

When replacing the transmitter or flowmeter sensor make sure that they are assigned correctly. It is not possible to operate a flowmeter sensor of the 300 series with a transmitter of the 500 series.
The series (e.g., ProcessMaster 300 or ProcessMaster 500) is shown on the name plate of the transmitter or flowmeter sensor.

10.3.1 Transmitter

Warning – Electrical dangers!
When the housing is open, EMC protection is impaired and there is no longer any protection against accidental contact.
Switch off the power supply before opening the housing.

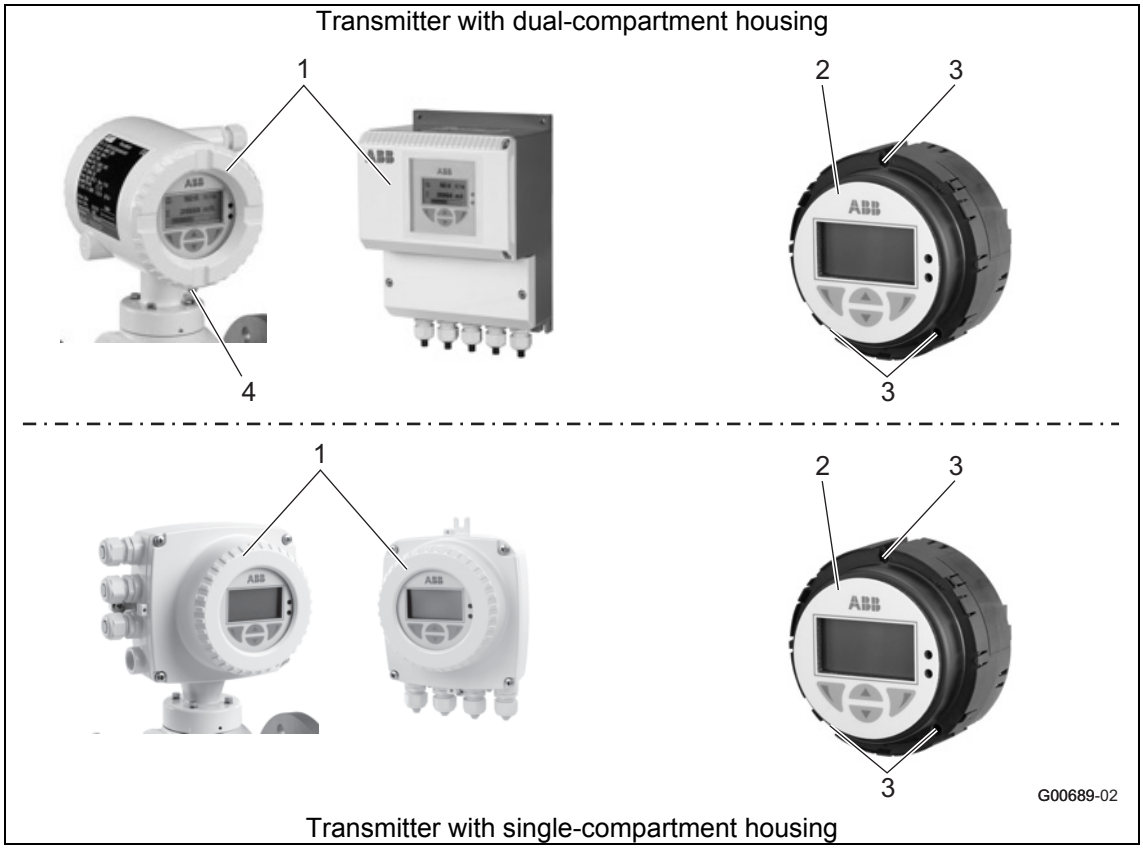


Fig. 68

Replace the transmitter plug-in as follows:

1. Switch off the power supply.
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. Downloading system data (see chapter 10.3.3 "Downloading the system data").

10.3.2 Flowmeter sensor

Warning – Electrical dangers!
When the housing is open, EMC protection is impaired and there is no longer any protection against accidental contact.
Switch off the power supply before opening the housing.

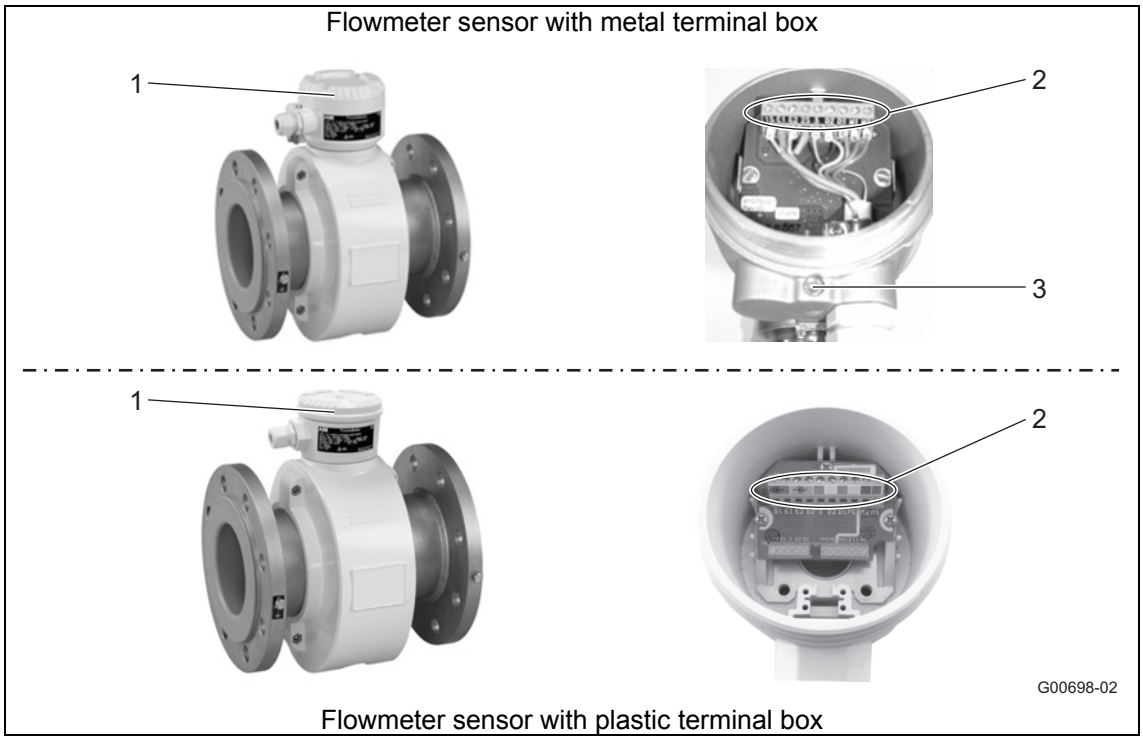


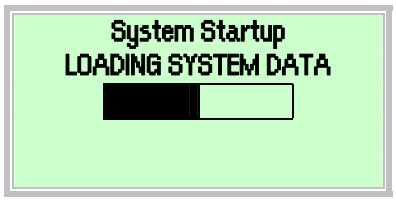
Fig. 69

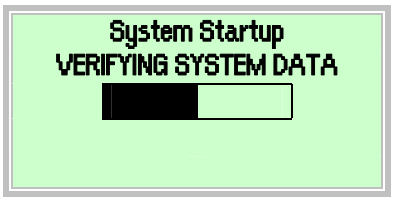
Replace the flowmeter sensor as follows:

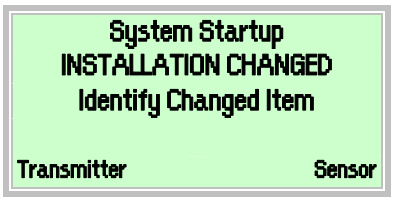
1. Switch off the power supply.
2. Open the cover safety device (3), if necessary.
3. Open the housing cover (1).
4. Disconnect the signal cable (2) (if necessary, remove the sealing compound).
5. Install the new sensor according to the installation instructions.
6. Complete the electrical connection according to the connection diagram.
7. Close the housing cover (1).
8. Downloading system data (see chapter 10.3.3 "Downloading the system data").

10.3.3 Downloading the system data

1. Switch on the power supply. After switching on the power supply, the following messages appear in succession on the LCD display:







2. Download the system data as follows:

For a completely new system or initial start-up

- The calibration data of the flowmeter sensor and the transmitter settings are loaded from the SensorMemory[1)] into the transmitter.

After replacing the complete transmitter or transmitter electronic unit

- Select "Transmitter" with  . The calibration data of the flowmeter sensor and the transmitter settings are loaded from the SensorMemory[1)] into the transmitter.

After replacing the sensor

- Select "Sensor" with  . The calibration data of the flowmeter sensor are loaded from the SensorMemory[1)] into the transmitter. The transmitter settings are stored 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 7 "Parameterization".

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

Important (Note)

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

11 Spare parts list

11.1 Fuses for transmitter electronics

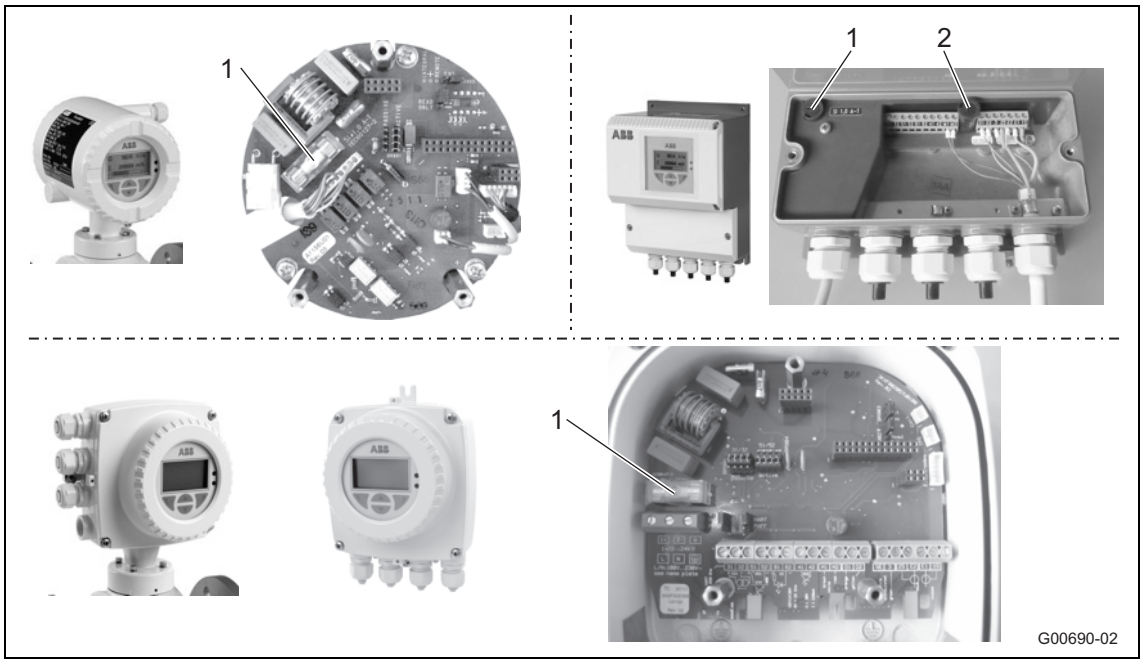


Fig. 70

No.	Name of part	Order number
1	Fuse (1.0 A) for power supply, suitable for all devices	D151B003U05
2	Fuse (0.25 A) for the coil circuit in the field housing, suitable for all devices	D151B003U02

11.2 Spare parts for devices with integral mount design

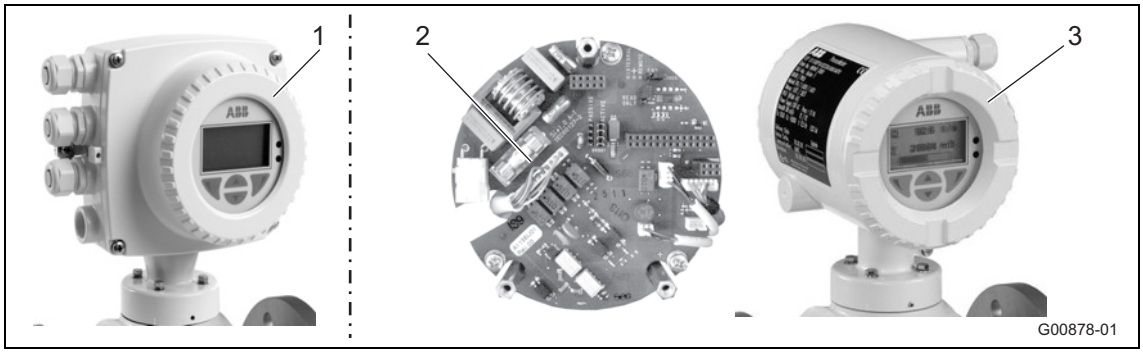


Fig. 71

No.	Name of part	Order number
1	Housing cover for transmitter with single-compartment housing with integral mount design	MJFA9915
2	Universal backplane for transmitter with dual-compartment housing	D685A1156U01
3	Front housing cover for transmitter with dual-compartment housing with integral mount design (standard, Ex Zone 2 / Div. 2)	D612A197U01
	Front housing cover for transmitter with dual-compartment housing with integral mount design (Ex Zone 1 / Div. 1)	D612A197U02

11.3 Spare parts for devices with remote mount design

11.3.1 field-mount housing

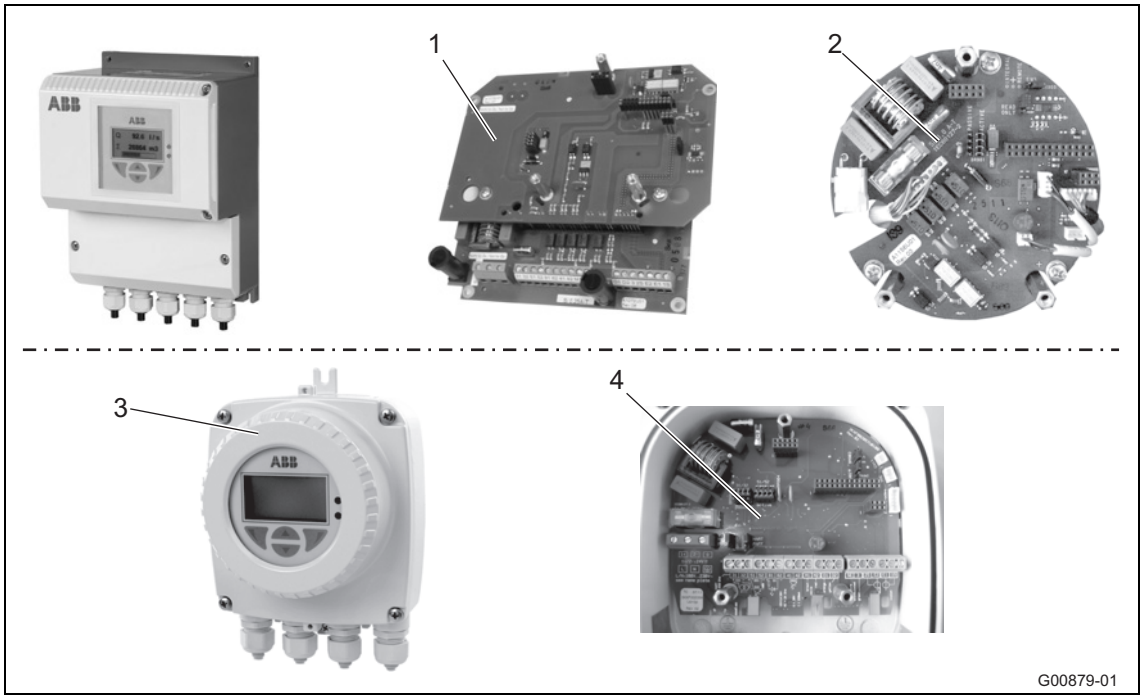


Fig. 72

No.	Name of part	Order number
1	Contact board assy for dual-compartment transmitter housing	D682A016U01
2	Universal backplane for dual-compartment transmitter housing	D685A1156U01
3	Housing cover for transmitter with single-compartment housing with remote mount design	MJBX9905
4	Backplane for transmitter with single-compartment housing with remote mount design	3KXF002058U0100

11.3.2 Round field-mount housing

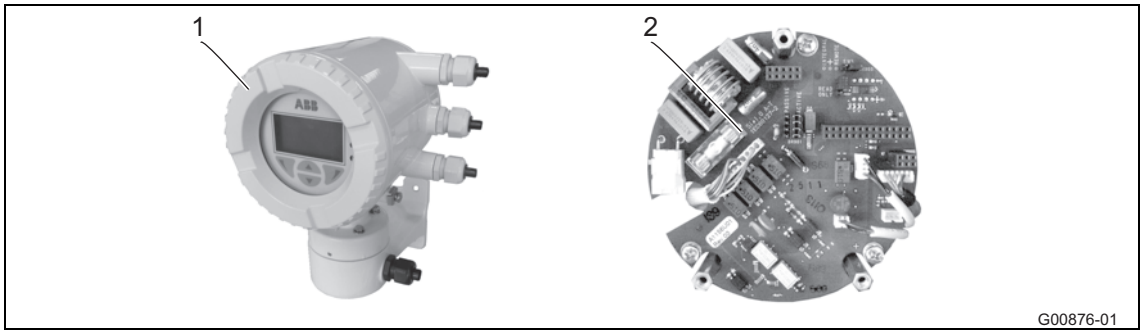


Fig. 73

No.	Name of part	Order number
1	Front housing cover for transmitter with dual-compartment housing with remote mount design (standard, Ex Zone 2 / Div. 2)	D612A197U01
	Front housing cover for transmitter with dual-compartment housing with remote mount design (Ex Zone 1 / Div. 1)	D612A197U02
2	Universal backplane for dual-compartment transmitter housing	D685A1156U01

11.3.3 Flowmeter sensor (Zone 2 / Div 2)

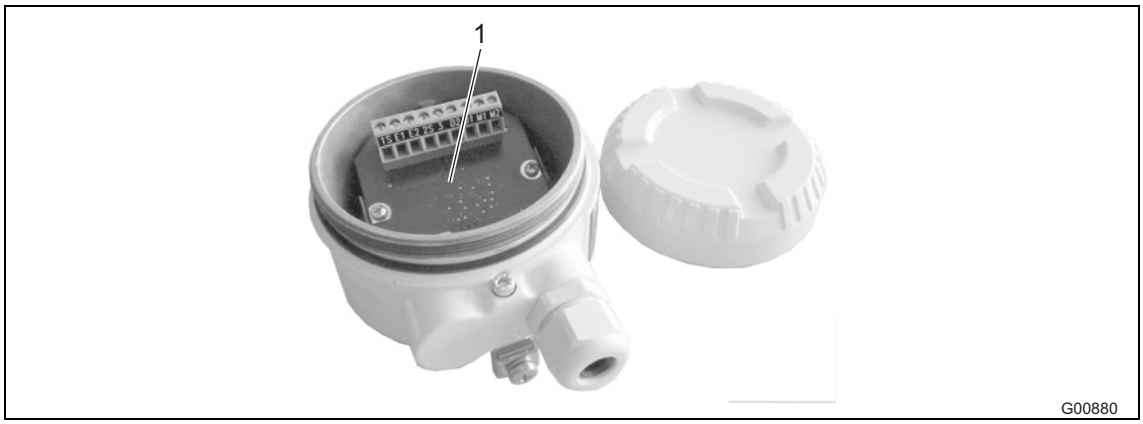


Fig. 74

No.	Name of part	Order number	
		for FEH model	for FEP model
1	Connection board (without preamplifier)	D685A1090U01	D685A1090U01
	Connection board (with preamplifier)	D685A1089U01	D685A1089U01

11.3.4 Flowmeter sensor (Zone 1 / Div 1)

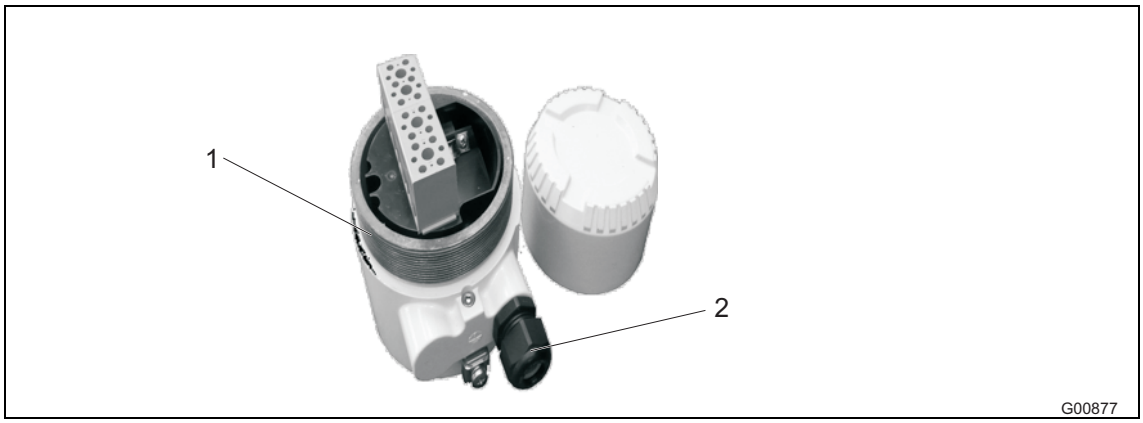


Fig. 75

No.	Name of part	Order number
1	O-ring	D101A034U06
2	Cable gland for Zone 1 / Div. 1, plastic, black, M20 x 1.5	D150A004U15

12 Performance specifications

12.1 General

12.1.1 Reference conditions according to EN 29104

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

12.1.2 Maximum measuring error

Pulse output

- Standard calibration FEP300 / FEH300:
  ± 0.4 % of measured value, ± 0.02 % $Qmax_{DN}$
- Standard calibration FEP500 / FEH500:
  ± 0.3 % of measured value,
  ± 0.02 % $Qmax_{DN}$ (DN 1 … 600, 800)
  ± 0.4 % of measured value,
  ± 0.02 % $Qmax_{DN}$ (DN 700 … 900, 2000)
- Optional calibration: (DN 10 … 600, 800)
  ± 0.2 % of measured value, ± 0.02 % $Qmax_{DN}$
- Only FEH500: (DN 1 … 2)
  ± 0.7 % of measured value, ± 0.02 % $Qmax_{DN}$

$Qmax_{DN}$: See table in Section **6.6**, "**Flowmeter sizes, flow range**".

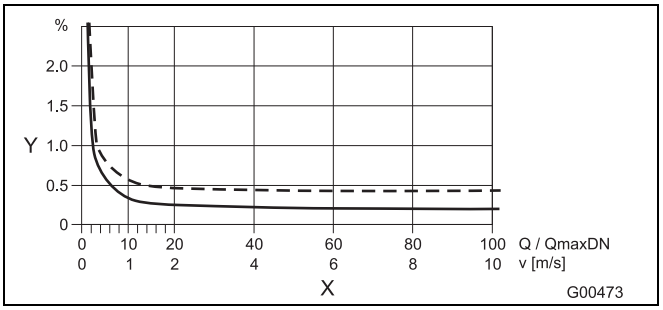


Fig. 76

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

12.2 Reproducibility, response time

Reproducibility	≤ 0.11 % of measured value, t_{meas} = 100 s, v = 0.5 ... 10 m/s
Response time of current output with damping of 0.02 seconds	As step function 0 ... 99 % 5 τ ≥ 200 ms at 25 Hz excitation frequency 5 τ ≥ 400 ms at 12.5 Hz excitation frequency 5 τ ≥ 500 ms at 6.25 Hz excitation frequency

12.3 Transmitter

12.3.1 Electrical properties

Supply power	**AC** 100 ... 230 V (-15 % / +10 %) **AC** 24 V (-30 % / +10 %) **DC** 24 V (-30 % / +30 %), 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 power supply)
Power consumption	(flowmeter sensor including transmitter) **AC** S ≤ 20 VA **DC** P ≤ 12 W (switch-on current 5.6 A)
Electrical connection	Screw terminals

12.3.1.1 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. The same is valid for the signal outputs of the versions with PROFIBUS PA and FOUNDATION fieldbus.

12.3.1.2 Empty pipe detection

The "empty pipe detection" function requires:

A conductivity of the measured fluid ≥ 20 µS/cm, a signal cable length ≤ 50 m (164 ft), a nominal diameter DN ≥ DN 10, and the flowmeter sensor must not be provided with a preamplifier.

12.3.2 Mechanical properties

Integral mount design (transmitter mounted directly on the flowmeter sensor)	
Housing	Cast aluminum, painted
Paint	Paint coat ≥ 80 µm thick, RAL 9002 (light gray)
Cable gland	Polyamide
	Stainless steel (in the case of hazardous area design for ambient temperature of -40 °C (40 °F))
Remote mount design	
Housing	Cast aluminum, painted
Paint	Paint coat ≥ 80 µm thick, mid-section RAL 7012 (dark gray), front cover / rear cover RAL 9002 (light gray)
Cable gland	Polyamide
	Stainless steel (in the case of hazardous area design for ambient temperature of -40 °C (40 °F))
Weight	4.5 kg (9.92 lb)

12.3.2.1 Storage temperature, ambient temperature

Ambient temperature

-20 ... 60 °C (-4 ... 140 °F) Standard range
-40 ... 60 °C (-40 ... 140 °F) Extended range

Storage temperature

-40 ... 70 °C (-40 ... 158 °F)

12.3.2.2 Protection class for transmitter housing

IP 65, IP 67, NEMA 4X

12.3.2.3 Vibration according to EN 60068-2

Transmitter

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

* = Peak load

13 Functional and technical properties - ProcessMaster

13.1 Flowmeter sensor

13.1.1 Protection type according to EN 60529

IP 65, P 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 flange devices 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.
For the transmitter designed for use in Zone 1, Div 1 (model FET325), 10 m (32.8 ft) of signal cable is permanently connected to the transmitter.
Alternatively, the cable with order number AD173D031U01 can be used for transmitters without explosion protection (model FEP321, FEH321) from DN15 and for transmitters for use in Zone 2 (model FEP325, FEH325) from DN15.

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

Important (Note)

The preamplifier is only available for transmitters with an aluminum terminal box.

13.1.5 Temperature range

Storage temperature

-40 ... 70 °C (-40 ... 158 °F)

Min. permissible pressure as a function of fluid temperature

Lining	Nominal diameter	$P_{Operating}$ at mbar abs.	$T_{Operating}$ [1]
Hard rubber	15 ... 2000 (1/2 ... 80")	0	< 90 °C (194 °F) < 80 °C (176 °F) [2]
Soft rubber	50 ... 2000 (2 ... 80")	0	< 60 °C (140 °F)
PTFE KTW-approved	10 ... 600 (3/8 ... 24")	270 400 500	< 20 °C (68 °F) < 100 °C (212 °F) < 130 °C (266 °F)
Thick PTFE, high-temp. design	25 … 80 100 … 250 300	0 67 27	< 180 °C (356 °F) < 180 °C (356 °F) < 180 °C (356 °F)
PFA	3 ... 200 (1/10 ... 8")	0	< 180 °C (356 °F)
Elastomer [3]	50 .. 600 (2 … 24“)	100	< 130 °C (266 °F)
ETFE	25 ... 600 (1 ... 24")	100	< 130 °C (266 °F)
Ceramic Carbide [4]	25 ... 1000 (1 ... 40"	0	< 80 °C (176 °F)

1) For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to the table titled "Maximum permissible cleaning temperature“.
2) Only China production site.
3) Only USA production site.
4) For FEP500 only.

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)

Maximum ambient temperature as a function of fluid temperature

Important (Note)
When using the device in potentially explosive areas, the additional temperature specifications in the section titled "Ex relevant specifications" on the data sheet or in the the separate Ex safety instructions (SM/FEX300/FEX500/ATEX/IECEX) or (SM/FEX300/FEX500/FM/CSA) must be observed.

Models FEP511, FEP515 (standard temperature version)

Lining	Flange material	Ambient temperature		Fluid temperature	
		Minimum temperature	Max. temperature	Minimum temperature	Max. temperature
Hard rubber	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F) -5 °C (23 °F) 4)	90 °C (194 °F) 80 °C (176 °F) 4)
Hard rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)	-15 °C (5 °F) -5 °C (23 °F) 4)	90 °C (194 °F) 80 °C (176 °F) 4)
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) 45 °C (113 °F)	-10 °C (14°F)	90 °C (194 °F) 130 °C (266 °F)
PTFE	Stainless steel	-20 °C (-4 °F) -40 °C (-40 °F) 5)	60 °C (140 °F) 45 °C (113 °F)	-25 °C (-13 °F)	90 °C (194 °F) 130 °C (266 °F)
PFA 1)	Steel	-10 °C (14°F)	60 °C (140 °F) 45 °C (113 °F)	-10 °C (14°F)	90 °C (194 °F) 130 °C (266 °F)
PFA 1)	Stainless steel	-20 °C (-4 °F) -40 °C (-40 °F) 5)	60 °C (140 °F) 45 °C (113 °F)	-25 °C (-13 °F)	90 °C (194 °F) 130 °C (266 °F)
Thick PTFE 2)	Steel	-10 °C (14°F)	60 °C (140 °F) 45 °C (113 °F)	-10 °C (14°F)	90 °C (194 °F) 130 °C (266 °F)
Thick PTFE 2)	Stainless steel	-20 °C (-4 °F) -40 °C (-40 °F) 5)	60 °C (140 °F) 45 °C (113 °F)	-25 °C (-13 °F)	90 °C (194 °F) 130 °C (266 °F)
ETFE 3)	Steel	-10 °C (14°F)	60 °C (140 °F) 45 °C (113 °F)	-10 °C (14°F)	90 °C (194 °F) 130 °C (266 °F)
ETFE 3)	Stainless steel	-20 °C (-4 °F) -40 °C (-40 °F) 5)	60 °C (140 °F) 45 °C (113 °F)	-25 °C (-13 °F)	90 °C (194 °F) 130 °C (266 °F)
Elastomer	Steel	-10 °C (14 °F)	60 °C (140 °F) 45 °C (113 °F)	-10 °C (14°F)	130 °C (266 °F)
Elastomer	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F) 45 °C (113 °F)	-20 °C (-4 °F)	130 °C (266 °F)
Ceramic carbide	Steel	-10 °C (14 °F)	60 °C (140 °F) 45 °C (113 °F)	-10 °C (14°F)	80 °C (176 °F)
Ceramic carbide	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F) 45 °C (113 °F)	-20 °C (-4 °F)	80 °C (176 °F)

Models FEP511, FEP515 (high-temperature version)

Lining	Flange material	Ambient temperature		Fluid temperature	
		Minimum temperature	Max. temperature	Minimum temperature	Max. temperature
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) -40 °C (-40 °F) 5)	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) -40 °C (-40 °F) 5)	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) -40 °C (-40 °F) 5)	60 °C (140 °F)	-20 °C (-13 °F)	130 °C (266 °F)

1) PFA (high-temperature version) available for nominal diameters ≥ DN 10
2) Thick PTFE available for nominal diameters ≥ DN 25
3) ETFE available for nominal diameters ≥ DN 25
4) Only China production site
5) For (optional) low-temperature version, only

Important (Note)
When using the device in potentially explosive areas, the additional temperature specifications in the section titled "Ex relevant specifications" on the data sheet or in the the separate Ex safety instructions (SM/FEX300/FEX500/ATEX/IECEX) or (SM/FEX300/FEX500/FM/CSA) must be observed.

Models FEP521, FEP525 (standard temperature version)

Lining	Flange material	Ambient temperature		Fluid temperature	
		Minimum temperature	Max. temperature	Minimum temperature	Max. temperature
Hard rubber	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F) -5 °C (23 °F) 4)	90 °C (194 °F) 80 °C (176 °F) 4)
Hard rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)	-15 °C (5 °F) -5 °C (23 °F) 4)	90 °C (194 °F) 80 °C (176 °F) 4)
Soft rubber	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F)	60 °C (140 °F)
Soft rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)	-15 °C (5 °F)	60 °C (140 °F)
PTFE	Steel	-10 °C (14°F)	60 °C (140 °F)	-10 °C (14°F)	130 °C (266 °F)
PTFE	Stainless steel	-25 °C (-13 °F) -40 °C (-40 °F) 5)	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) -40 °C (-40 °F) 5)	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) -40 °C (-40 °F) 5)	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)
Elastomer	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14°F)	130 °C (266 °F)
Elastomer	Stainless steel	-20 °C (-4 °F)	60 °C (140 °F)	-20 °C (-4 °F)	130 °C (266 °F)
Ceramic carbide	Steel	-10 °C (14 °F)	60 °C (140 °F)	-10 °C (14°F)	80 °C (176 °F)
Ceramic carbide	Stainless steel	-25 °C (-13 °F)	60 °C (140 °F)	-20 °C (-4 °F)	80 °C (176 °F)

Models FEP521, FEP525 (high-temperature version)

Lining	Flange material	Ambient temperature		Fluid temperature	
		Minimum temperature	Max. temperature	Minimum temperature	Max. temperature
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) -40 °C (-40 °F) 5)	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) -40 °C (-40 °F) 5)	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) -40 °C (-40 °F) 5)	60 °C (140 °F)	-25 °C (-13 °F)	130 °C (266 °F)

1) PFA (high-temperature version) available for nominal diameters ≥ DN 10
2) Thick PTFE available for nominal diameters ≥ DN 25
3) ETFE available for nominal diameters ≥ DN 25
4) Only China production site
5) For (optional) low-temperature version, only

Important (Note)
In the case of model FEP521 with plastic terminal box, a reduced minimum ambient temperature of -20 °C (-4 °F) applies.

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).

DIN flange stainless steel to DN 600 (24")

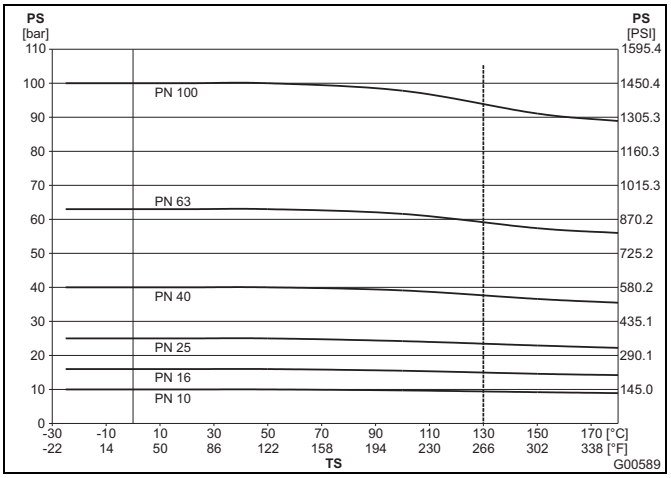


Fig. 77

ASME flange, stainless steel, up to DN 400 (16") (CL150/300) up to DN 1000 (40") (CL150)

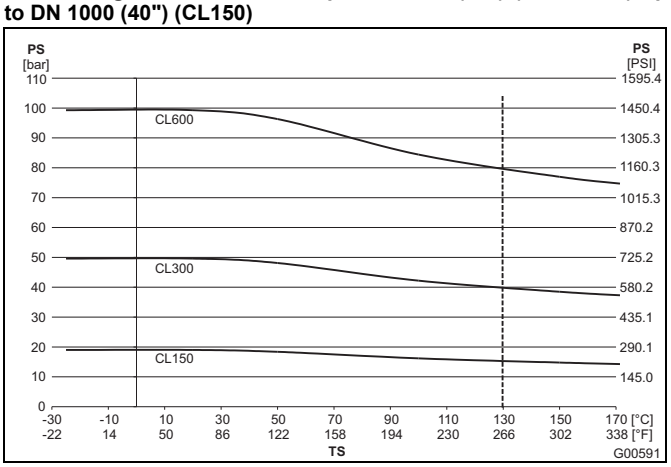


Fig. 78

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

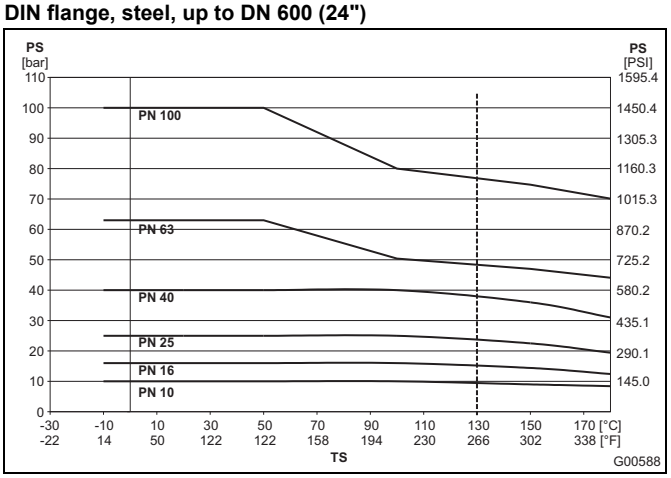


Fig. 79

ASME flange, steel, up to DN 400 (16") (CL150/300); up to DN 1000 (40") (CL150)

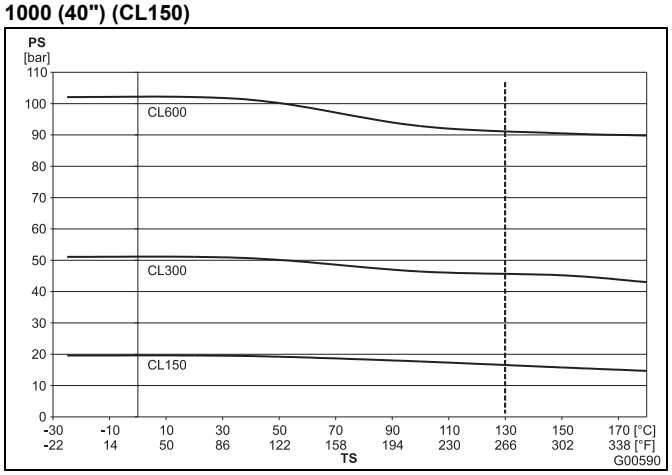


Fig. 80

JIS 10K-B2210 flange

Nominal diameter	Material	PN	TS	PS
32 ... 400 (1 1/4 ... 16")	Stainless steel	10	-25 ... 180 °C (-13 ... 356 °F)	10 bar (145 psi)
32 ... 400 (1 1/4 ... 16")	Steel	10	-25 ... 180 °C (14 ... 356 °F)	10 bar (145 psi)

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

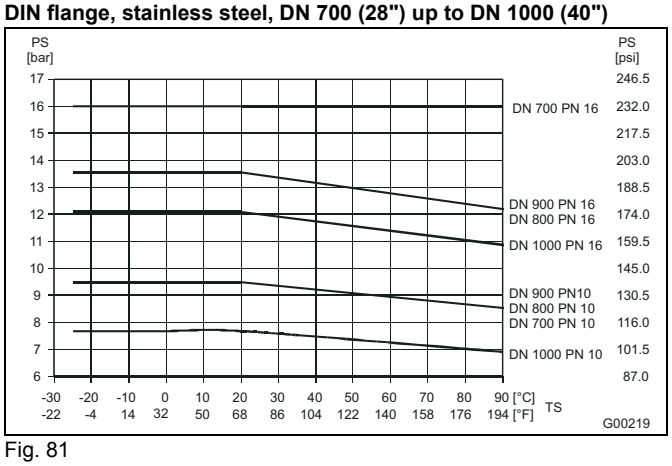


Fig. 81

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

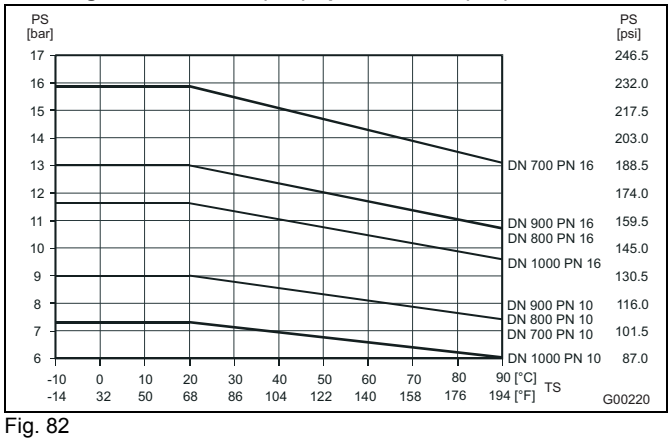


Fig. 82

13.1.7 Flowmeter sensor

Parts that come into contact with fluid

Part	Standard	Option
Lining	PTFE, PFA, ETFE, hard rubber, soft rubber	Ceramic Carbide, Elastomer
Measurement and grounding electrode for: - Hard rubber - Soft rubber	CrNi steel 1.4571 (AISI 316Ti)	Hastelloy B-3 (2.4600), Hastelloy C-4 (2.4610), titanium, tantalum, platinum-iridium, 1.4539 (AISI 904L)
- PTFE, PFA, ETFE	CrNi steel 1.4539 (AISI 904L)	CrNi steel 1.4571 (AISI 316Ti) Hast. C-4 (2.4610) Hast. B-3 (2.4600) Titanium, tantalum, platinum-iridium
Grounding plate	Stainless steel	On request
Protection plate	Stainless steel	On request

Parts that do not come into contact with fluid (process connection)

	Standard	Option
DN 3 ... 15 (1/10 ... 1/2")	Stainless steel [1]	-
DN 20 ... 400 (3/4 ... 16")	Steel (galvanized)[2]	Stainless steel [1]
DN 450 ... 2000 (18 ... 80")	Steel (painted) [2]	-

The process connections are made of one of the materials listed below:

1) 1.4301 (AISI 304), 1.4307, 1.4404 (AISI 316L) 1.4435 (AISI 316L), 1.4541 (AISI 321) 1.4571 (AISI 316Ti), ASTM A182 F304, ASTM A182 F304L, ASTM A182 F316L, ASTM A182 F321, ASTM A182 F316TI, ASTM A182 F316, 0Cr18Ni9, 0Cr18Ni10, 0Cr17Ni13Mo2, 0Cr27Ni12Mo3, 1Cr18Ni9Ti, 0Cr18Ni12Mo2Ti
2) 1.0038, 1.0460, 1.0570, 1.0432, ASTM A105, Q255A, 20#, 16Mn

Flowmeter sensor housing

	Standard
Housing DN 3 ... 400 (1/10 ... 16") DN 450 ... 2000 (18 ... 80")	Dual-shell casing, cast aluminum, painted, paint coat, ≥ 80 µm thick, RAL 9002 Welded steel design, painted, paint coat, ≥ 80 µm thick, RAL 9002
Terminal box	Aluminum alloy, painted, ≥ 80 µm thick, light gray, RAL 9002
or	Plastic, light gray, RAL 9002
Meter tube	Stainless steel [3]
Cable gland	Polyamide
	Stainless steel (in the case of hazardous area design for ambient temperature of -40 °C (40 °F))

The meter tube is made of one of the materials listed below:

3) 1.4301, 1.4307, 1.4404, 1.4435, 1.4541, 1.4571
ASTM materials:
Grade TP304, TP304L, TP316L, TP321, TP316Ti, TP317L,0Cr18Ni9, 00Cr18Ni10, 0CR17Ni14Mo2, 0Cr27Ni12Mo3, 0Cr18Ni10Ti

14 Functional and technical properties - HygienicMaster

14.1 Flowmeter sensor

14.1.1 Protection type according to EN 60529

IP 65, IP 67, NEMA 4X
IP 68 (for external flowmeter sensors only)

14.1.2 Pipeline vibration according to EN 60068-2-6

For devices with integral mount design the following applies:
(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 max. 2 g acceleration (does not apply to DN1…2)

For devices with remote mount design the following applies:
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 max. 2 g acceleration (does not apply to DN1…2)

14.1.3 Installation length

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

14.1.4 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.
Alternatively, the cable with order number AD173D031U01 can be used for transmitters without explosion protection (model FEP321, FEH321) from DN15 and for transmitters for use in Zone 2 (model FEP325, FEH325) from DN15.

Preamplifier

Maximum 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

14.1.5 Temperature range

Storage temperature

- 40 ... 70 °C (-40 ... 158 °F)

Min. permissible pressure as a function of fluid temperature

Lining	Nominal diameter	$P_{Operating}$ at mbar abs.	$T_{Operating}$ [1)]
PFA	DN 3 ... 100 (1/10 ... 4")	0	< 180 °C (356 °F)
PEEK	DN 1 ... 2 (1/25 … 1/12")	0	< 120 °C (248 °F)

1) 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)
Fluids	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
PEEK	Any	Any

Max. ambient temperature as a function of fluid temperature

Important (Note)
When using the device in explosion hazardous areas, the additional temperature specifications in the section titled "Ex relevant specifications" on the data sheet or in the the separate Ex safety instructions (SM/FEX300/FEX500/ATEX/IECEX) or (SM/FEX300/FEX500/FM/CSA) must be observed.

Standard temperature design

Model	Process connection	Ambient temperature		Fluid temperature	
		Min. temp [1]	Max. temp.	Min. temp.	Max. temp [2]
FEH311 FEH315	Flange	-20 °C (-4 °F)	60 °C (140 °F) 40 °C (104 °F)	-25 °C (-13 °F)	100 °C (212 °F) 130 °C (266 °F)
	Variable process connections	-20 °C (-4 °F)	60 °C (140 °F) 40 °C (104 °F)	-25 °C (-13 °F)	100 °C (212 °F) 130 °C (266 °F)
FEH321 FEH325	Flange	-20 °C (-4 °F)	60 °C (140 °F) 40 °C (104 °F)	-25 °C (-13 °F)	100 °C (212 °F) 130 °C (266 °F)
	Variable process connections	-20 °C (-4 °F)	60 °C (140 °F) 40 °C (104 °F)	-25 °C (-13 °F)	100 °C (212 °F) 130 °C (266 °F)

High temperature design (from size DN 10 (3/8“))

Model	Process connection	Ambient temperature		Fluid temperature	
		Min. temp [1]	Max. temp.	Min. temp.	Max. temp.
FEH311 FEH315	Flange	-20 °C (-4 °F)	60 °C (140 °F)	-25 °C (-13 °F)	180 °C (356 °F)
FEH321 FEH325	Flange	-20 °C (-4 °F)	60 °C (140 °F)	-25 °C (-13 °F)	180 °C (356 °F)

1) The following is valid for the low temperature design (option): -40°C (-40°F).
2) For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to the table „Max. permissible cleaning temperature” on page 175.

14.1.6 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 diameter	PS_{max} bar (PSI)	TS
Wafer type	DN 3 ... 50 (1/10 ... 2“) DN 65 ... 100 (2 1/2 ... 4“)	40 (580) 16 (232)	-25 ... 130 °C (-13 ... 266 °F)
Welded spuds	DN 3 ... 40 (1/10 ... 1 1/2“) DN 50, DN 80 (2“, 3“) DN 65, DN 100 (2 1/2“, 4“)	40 (580) 16 (232) 10 (145)	-25 ... 130 °C (-13 ... 266 °F)
Threaded pipe connection conforming to 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 conforming to DIN 32676	DN 3 ... 50 (1/10 ... 2“) DN 65 ... 100 (2 1/2 ... 4“)	16 (232) 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 thread ISO 228 / DIN 2999	DN 3 ... 25 (1/10 ... 1“)	16 (232)	-25 ... 130 °C (-13 ... 266 °F)
OD tubing	DN 3 ... 50 (1/10 ... 2“)	10 (145)	-25 ... 130 °C (-13 ... 266 °F)
1/8" sanitary connectors	DN 1 ... 2 (1/25 ... 1/12“)	10 (145)	-10 ... 120 °C (-14 ... 248 °F)

DIN flange stainless steel to DN 100 (4")

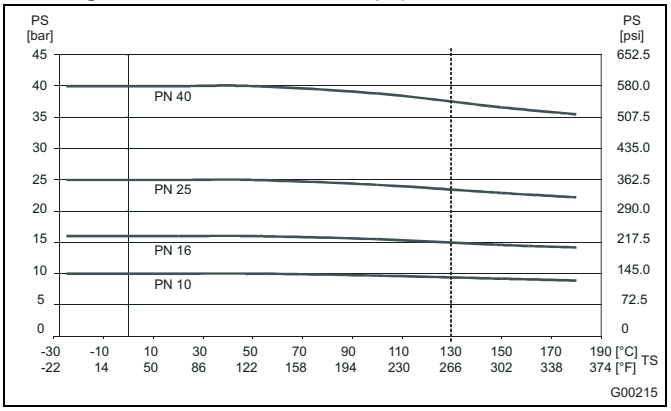


Fig. 83

ASME flange, stainless steel, up to DN 100 (4") (CL150 / 300)

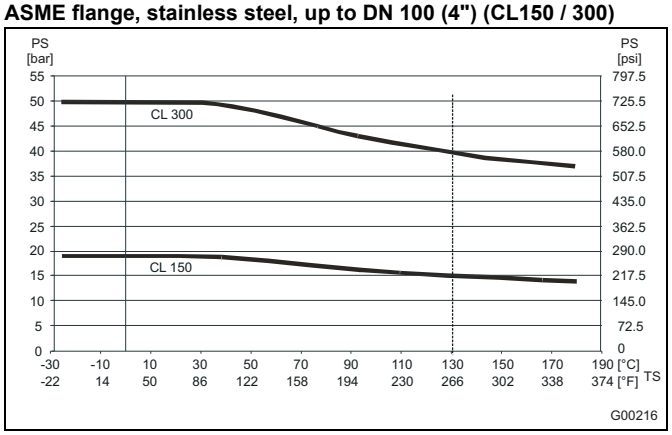


Fig. 84

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 diameter	Material	PN	TS	PS [bar]
25 ... 100 (1 ... 4")	Stainless steel	10	-25 ... 180 °C (-13 ... 356 °F)	10 (145 psi)

Wafer type design

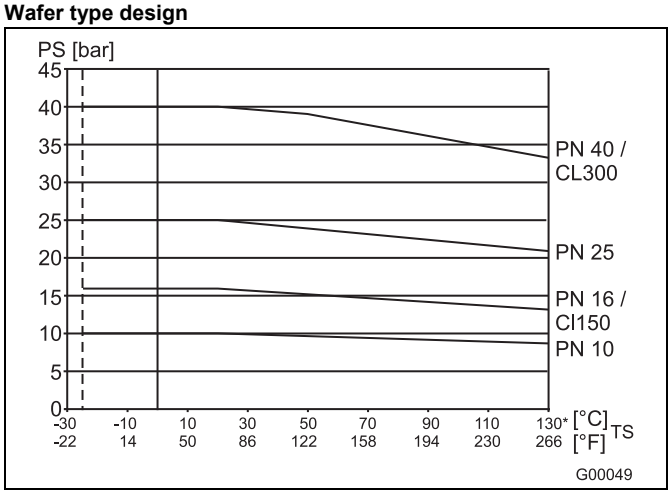


Fig. 85

JIS 10K-B2210 wafer type design

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

14.1.7 Mechanical properties

Parts that come into contact with fluid

Part	Standard	Option
Lining	PFA from DN 3 (1/10“) PEEK DN 1 ... 2 (1/25 ... 1/12“)	-
Signal and grounding electrode	CrNi steel 1.4539 (AISI 904L)	CrNi steel 1.4571 (AISI 316Ti) Hast. C-4 (2.4610) Hast. B-3 (2.4600) Titanium, tantalum, Platinum-iridium
Gaskets (for Weld stubs, threaded connection, Tri-Clamp, external threads)	EPDM (Ethylene-Propylene) with FDA approval, silicone with FDA approval (CIP-resistant, no oils or grease)	Silicone with FDA approval (option, oil or grease resistant) PTFE with FDA approval (DN 3 ... 8 (1/10 ... 5/16“))
Gasket for 1/8" sanitary connectors	PTFE	Viton (only in combination with PVC process connection)
Process connection - Welded spuds, Tri-Clamp, etc. - OD tubing	 CrNi steel 1.4404 (AISI 316L) CrNi steel 1.4435 (AISI 316L)	- - -

Parts that do not come into contact with fluid

	Standard	Option
Flange	CrNi steel 1.4571 (AISI 316Ti)	-

Flowmeter sensor housing

	Standard
Housing	Deep-drawn housing CrNi steel 1.4301 (AISI 304), 1.4308
Terminal box	CrNi steel 1.4308 (AISI 304)
Meter tube	Stainless steel
Cable gland	Polyamide
	Stainless steel (in the case of hazardous area design for ambient temperature of -40 °C (40 °F))

15 Appendix

15.1 Other applicable documents

- Data Sheet for ProcessMaster (DS/FEP300, DS/FEP500)
- Data Sheet for HygienicMaster (DS/FEH300, DS/FEH500)
- Commissioning Instruction (CI/FEX300/FEX500)
- Ex Safety Instructions ATEX/IEC (SM/FEX300/FEX500/ATEX/IECEX)
- Ex Safety Instructions FM/CSA (SM/FEX300/FEX500/FM/CSA)
- HART Interface Description (COM/FEX300/FEX500/HART)
- PROFIBUS PA Interface Description (COM/FEX300/FEX500/PB)
- FOUNDATION fieldbus Interface Description (COM/FEX300/FEX500/FF)

15.2 Approvals and certifications

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

IMPORTANT (NOTE)

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

www.abb.com/flow

EG-Konformitätserklärung
EC-Declaration of Conformity

Hiermit bestätigen wir die Übereinstimmung der aufgeführten Geräte mit den Richtlinien des Rates der Europäischen Gemeinschaft, welche mit dem CE-Zeichen gekennzeichnet sind. Die Sicherheits- und Installationshinweise der Produktdokumentation sind zu beachten.
We herewith confirm that the listed 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: *Manufacturer:*	ABB Automation Products GmbH, Dransfelder Straße 2, D-37079 Göttingen - Germany
Gerät: *Device:*	Electromagnetic Flowmeter ProcessMaster & HygienicMaster
Modellnr.: *Model no.:*	FE_3_ / FE_5_
Richtlinie: *Directive:*	EMV Richtlinie 2004/108/EG * *EMC directive 2004/108/EC* *
Europäische Norm: *European Standard:*	EN 61326-1, 10/2006 * EN 61326-2-3, 05/2007 *EN 61326-1, 10/2006* * EN 61326-2-3, 05/2007*
Richtlinie: *Directive:*	Niederspannungsrichtlinie 2006/95/EG * *Low voltage directive 2006/95/EC* *
Europäische Norm: *European Standard:*	EN 61010-1, 08/2002 * *EN 61010-1, 08/2002* *

* einschließlich Nachträge / *including alterations*

Göttingen, 13. Juli 2010

i.V. Dr. Günter Kuhlmann
(R&D Manager)

i.A. Karl-Heinz Rackebrandt
(R&D Manager Sensors)

ABB Automation Products GmbH BZ-13-5112, Rev.02, 15371

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Hans-Georg Krabbe
Geschäftsführung:
Christian Wendler

Bankverbindung:
Commerzbank AG Frankfurt
Konto: 589 635 200
BLZ: 500 400 00

Important (Note)

This is a class A device (industrial sector). This device can cause radio interferences in residential areas. In this case, the operator may be required to take appropriate measures to remedy the fault.

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

Göttingen, den 28.08.2007

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

2310 BZ-25-0002 Rev.05

15.3 Overview of parameter settings (factory settings)

	Possible parameter settings	Factory setting
Sensor TAG	Alphanumeric, max. 20 characters	None
Sensor Location TAG	Alphanumeric, max. 20 characters	None
Qmax	Depending on nominal diameter (see table in Section 6.6)	QmaxDN (see table in Section 6.6)
Q (Flowrate) Unit	l/s; l/min; l/h; ml/s; ml/min; m3/s; m3/min; m3/h; m3/d; hl/h; g/s; g/min; g/h; kg/s; kg/min; kg/h; kg/d; t/min; t/h; t/d	l/min
Totalizer/Pulse Unit	m3; l; ml; hl; g; kg; t	l
Pulses per Unit		1
Pulse Width	0,1 ... 2,000 ms	100 ms
Damping (1 Tau)	0,02 ... 60 sec.	1
DO1 Alarm Config	Pulse F/Pulse R, Pulse F, General Alarm, Min. Flowrate Alarm, Max. Flowrate Alarm, Empty Pipe, TFE, Only available for FEP500 / FEH500 are: Gas Bubble, Conductivity, Coating, Sensor Temp, Signal	Pulse F/Pulse R
DO1 Drive	Active, Passive	Passive
DO2 Alarm Config	F/R Signal, Pulse R, General Alarm, Min. Flowrate Alarm, Max. Flowrate Alarm, Empty Pipe, TFE, Only available for FEP500 / FEH500 are: Gas Bubble, Conductivity, Coating, Sensor Temp, Signal	F/R Signal
Digital Input DI	No Function, Totalizer Reset(All), Flowrate to Zero, System Zero Adjust, Totalizer Stop(All), Only available for FEP500 / FEH500 are: Switchover Dual Range, Start/Stop Batching	Flowrate to Zero
Current Output	4 … 20 mA, 4 … 12 … 20 mA	4 … 20 mA
Iout at Alarm (in accordance with NE43)	High alarm, adjustable to 21 … 23 mA or Low alarm, adjustable to 3.5 … 3.6 mA	High alarm, 21.8 mA For details refer to Section 9.2.
Iout at Flow >103%	Off (no signaling, current output remains at 20.5 mA), high alarm, low alarm	Off
Low Flow Cut Off	0 … 10 %	1 %
Empty Pipe Detector	On / Off	Off
TFE Detector	On / Off	Off

15.3.1 For Profibus PA version

	Possible parameter settings	Factory setting
PA Addr. (BUS)	0 ... 126	126
Ident Nr. Selector	0 x 9700, 0 x 9740, 0 x 3430	0 x 3430

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

ABB has Sales & Customer Support expertise in over 100 countries worldwide.

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The Company's policy is one of continuous product improvement and the right is reserved to modify the information contained herein without notice.

Printed in the Fed. Rep. of Germany (05.2012)

3KXF231300R4201

OI/FEX300/FEX500-EN Rev. F

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