ABB MEASUREMENT & ANALYTICS | COMMISSIONING INSTRUCTION

ProcessMaster FEP300, FEP500
HygienicMaster FEH300, FEH500
Electromagnetic flowmeter

Measurement made easy

ProcessMaster
FEP300, FEP500
HygienicMaster
FEH300, FEH500

Short product description

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

Further information

Additional documentation on ProcessMaster FEP300, FEP500/HygienicMaster FEH300, FEH500 is available for download free of charge at www.abb.com/flow.

Alternatively simply scan this code:

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Contents

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 measurement media 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 1.10 „Technical limit values“.
- Use only allowed measurement media; refer to the section 1.11 „Allowed measuring media“.

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 measurement media, the operator must check the level of resistance of all parts coming into contact with the wetted parts. 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 Plates and symbols

1.5.1 Safety- / warning symbols, note symbols

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

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

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

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

WARNING – <Bodily injury>

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

WARNING – <Bodily injury>

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

CAUTION – <Minor injury>

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

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 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.

Prior to installation, check the devices for any damage that may have occurred as a result of improper transport. Details of any damage that has occurred in transit must be recorded on the transport documents. All claims for damages must be submitted to the shipper without delay and before installation.

1.7 Installation safety information

Observe the following instructions:

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

1.8 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.

1.9 Safety instructions for operation

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

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

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

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

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

1.10 Technical limit values

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

The following technical limit values must be observed:

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

1.11 Allowed measuring media

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

- Measuring media (fluids) may only be used if it can be ensured that the chemical and physical properties—which are required for operational security—of the components coming into contact with the media are not affected during the operating life. This can be achieved through the use of state-of-the-art technology or the operating experience of the operator. Components coming into contact with the media include measuring electrodes, lining, and, if applicable, earth electrodes, mating parts, protective washers or protective flanges
- Measuring media with unknown properties or abrasive measuring media may only be used if the operator is able to perform regular and suitable tests to ensure the safe condition of the device
- The information on the name plate must be observed

1.12 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 1 for nearest service location.

1.13 Disposal

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

1.13.1 Information on WEEE Directive 2012/19/EU (Waste Electrical and Electronic Equipment)

This product is not subject to WEEE Directive 2012/19/EU 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 2012/19/EU, 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.

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.

2.1.1 Integral mount design

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

The transmitter is available in two housing designs:

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

ProcessMaster

The ProcessMaster sensor is available in two designs, which are distinguished by the design level.

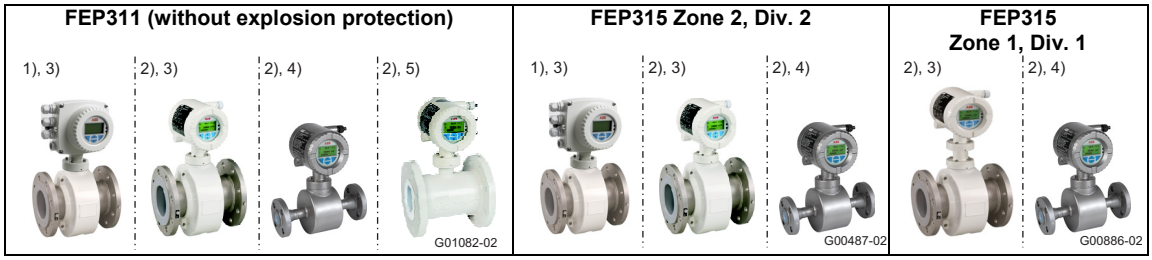


Fig. 1: ProcessMaster versions (example)

1) Single-compartment housing.
2) Dual-compartment housing.
3) Design level "B" sensor.
4) Design level "B" sensor, versions made from stainless steel
5) Design level "C" sensor, nominal diameter: DN 25 ... 600

HygienicMaster

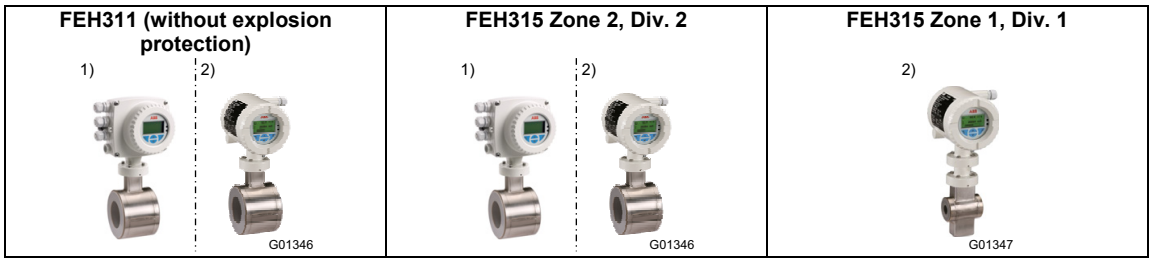


Fig. 2: HygienicMaster versions (example)

1) Single-compartment housing.
2) Dual-compartment housing.

2.1.2 Remote mount design

For devices with a remote mount design, the transmitter and sensor are mounted in separate locations. The electrical connection between the transmitter and the sensor is provided by a signal cable.

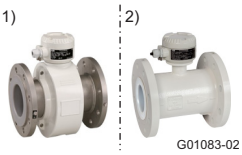
When the minimum conductivity of the measuring medium is 5 µS/cm, a maximum signal cable length of 50 m (164 ft) is possible without fitting an additional preamplifier to the sensor. With a pre-amplifier, the maximum permissible signal cable length is 200 m (656 ft).

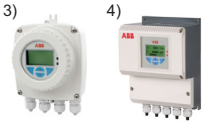
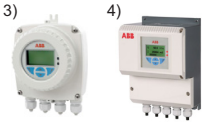
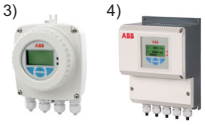
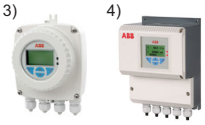
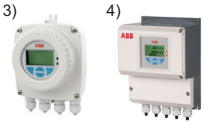
The transmitter is available in two housing designs:

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

ProcessMaster

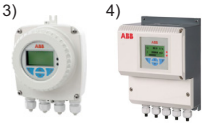
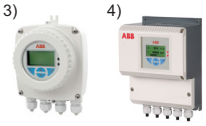
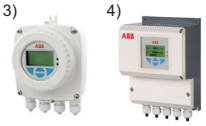
The ProcessMaster sensor is available in two designs, which are distinguished by the design level.

Sensor		
FEP321 / FEP521 (without explosion protection)	**FEP325 / FEP525 Zone 2, Div. 2**	**FEP325 / FEP525 Zone 1, Div. 1**
1) 2)  G01083-02	1)  G00489-01	1)  G00489-01

Transmitter					
FET321 / FET521 (without explosion protection)	**FET325 / FET525 (Zone 2, Div. 2)**	**FET321 / FET521 (without explosion protection)**	**FET325 / FET525 (Zone 1, Div. 1)**	**FET325 / FET525 (Zone 2, Div. 2)**	**FET321 / FET521 (without explosion protection)**
3) 4)  G01084-02	3) 4)  G01084-02	3) 4)  G01084-02	4)  G00863-02	3) 4)  G01084-02	3) 4)  G01084-02

HygienicMaster

Sensor	
FEH321 / FEH521 (without explosion protection)	**FEH325 / FEH525 (Zone 2, Div. 2)**
 G00576	 G00576

Transmitter		
FET321 / FET521 (without explosion protection)	**FET325 / FET525 (Zone 2, Div. 2)**	**FET321 / FET521 (without explosion protection)**
3) 4)  G01084-02	3) 4)  G01084-02	3) 4)  G01084-02

1) Design level "B" sensor.
2) Design level "C" sensor, DN 25 … 600.
3) Single-compartment housing.
4) Dual-compartment housing.

3 Transport

3.1 Inspection

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

3.2 Transport of flanged units smaller than DN 450

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

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

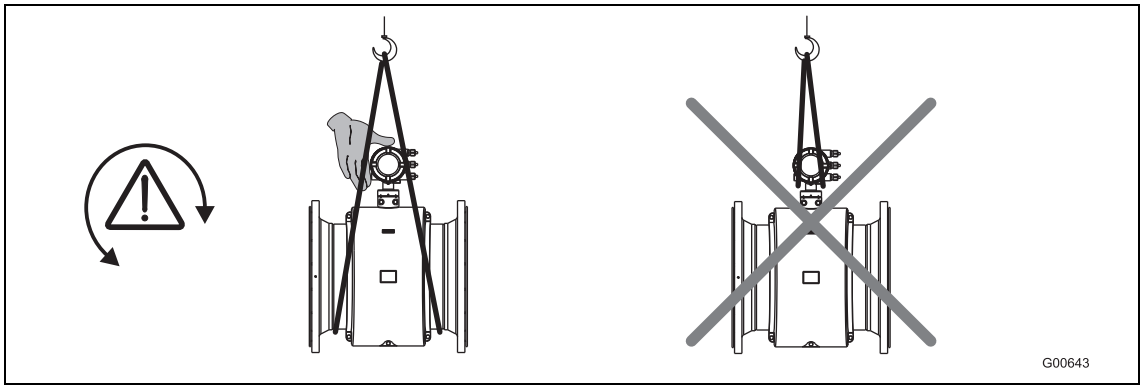


Fig. 3: Transport of flanged units smaller than DN 450

3.3 Transport of flanged units larger than DN 400

NOTICE - Potential damage to device!
Use of a forklift to transport the device can bend the housing and damage the internal magnet coils.
Flanged units may not be lifted at the middle of the housing when transporting via forklift.

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

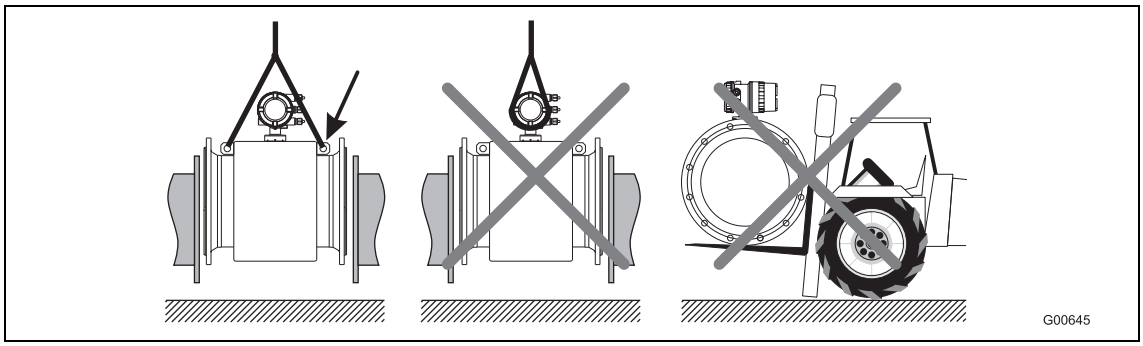


Fig. 4: Transport of flanged units larger than DN 400

4 Mounting

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 during installation:

- The flow direction must correspond to the marking, if present
- The maximum torque for all flange screws must be complied with
- The devices must be installed without mechanical tension (torsion, bending)
- Install flange devices / wafer-type devices with plane parallel counterflanges and use appropriate gaskets only
- Only gaskets made from a material that is compatible with the measuring medium and measuring medium temperature may be used
- Gaskets must not extend into the flow area, since possible turbulence could influence the accuracy of the device
- The piping may not exert any inadmissible forces or torques on the device
- Do not remove the sealing plugs in the cable glands until you are ready to install the electrical cable
- Make sure the gaskets for the housing cover are seated correctly. Carefully gasket the cover. Tighten the cover fittings
- The transmitter with a remote mount design must be installed at a largely vibration-free location
- Do not expose the transmitter and sensor to direct sunlight. Provide appropriate sun protection as necessary
- When installing the transmitter in a control cabinet, make sure adequate cooling is provided
- For devices with a remote mount design and a measuring accuracy of 0.2 % of the measured value, make sure that the sensor and the transmitter have been correctly assigned. Compatible devices have the same end numbers on the name plate, e.g. X001 and Y001 or X002 and Y002

4.1.1 Supports for meter sizes larger than DN 400

NOTICE - Potential damage to device!

Improper support for the device may result in deformed housing and damage to internal magnet coils.
Place the supports at the edge of the housing (see arrows in the figure).

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

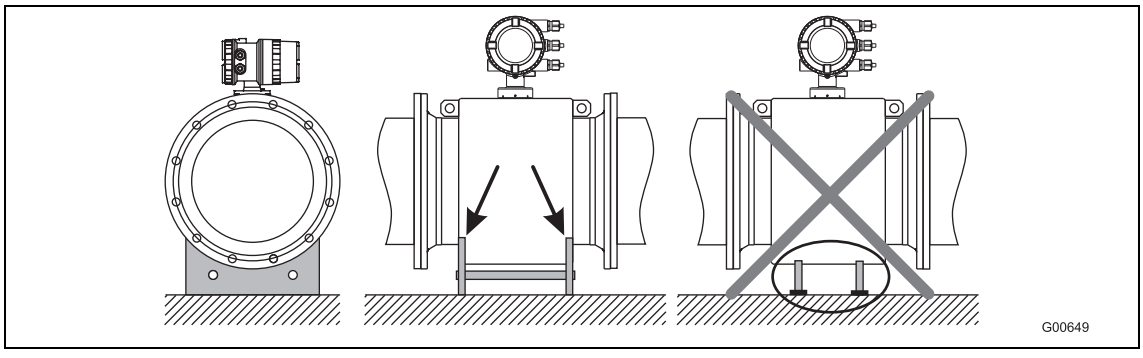


Fig. 5: Support for meter sizes larger than DN 400

4.1.2 Selecting gaskets

The following points must be observed when installing gaskets:

Devices with a hard rubber, soft rubber or ceramic carbide liner

- Devices with a hard / soft rubber liner always require additional gaskets
- ABB recommends using gaskets made from rubber or rubber-like sealing materials
- When selecting the gaskets, ensure that the tightening torques specified in chapter are not exceeded

Devices with a PTFE, PFA or ETFE liner

- In principle, devices with a PTFE, PFA or ETFE liner do not require additional gaskets

4.1.3 Devices with a wafer-type design

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

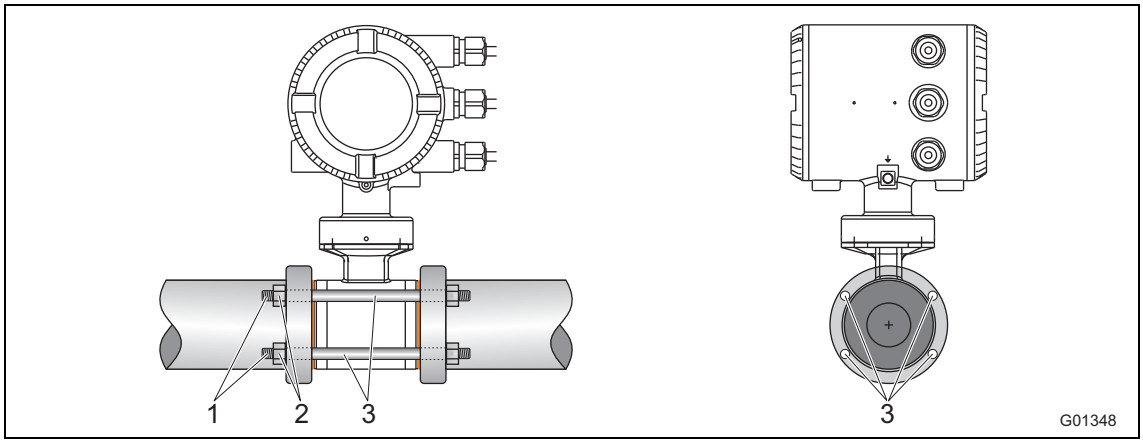


Fig. 6: Installation set for wafer-type installation

1 Threaded rod
2 Nut with washer
3 Centering sleeves

4.1.4 Installing the meter tube

Notice – potential damage to device!

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

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

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

IMPORTANT (NOTE)

For achieve the best results, ensure the gaskets fit concentrically with the meter tube

4. Use the appropriate screws for the holes in accordance with chapter .
5. Slightly grease the threaded nuts.
6. Tighten the nuts in a crosswise manner as shown in the figure. Observe the tightening torques in accordance with chapter !
   First tighten the nuts to approx. 50 % of the maximum torque, then to 80 %, and finally a third time to the maximum torque. Do not exceed the max. torque.

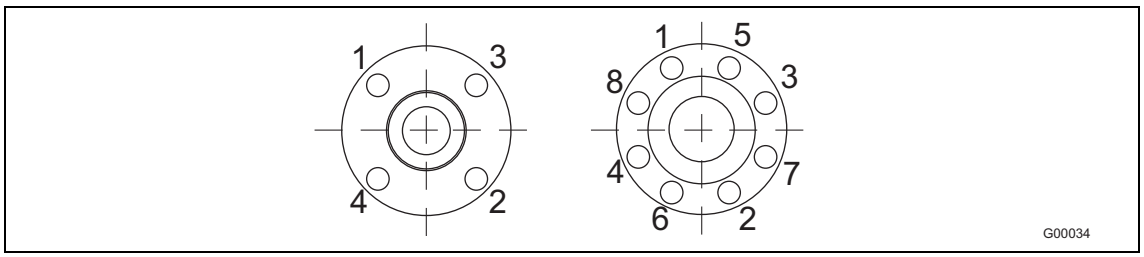


Fig. 7

4.2 Torque information

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

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

Nominal diameter [mm (inch)]	Nominal pressure rating	Maximum tightening torque [Nm]					
		Hard / soft rubber		PTFE, PFA, ETFE		Ceramic carbide	
		2)	3)	2)	3)	2)	3)
DN 3 ... 101) (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	–	–
DN 15 (1/2“)	PN40	6,74	4,29	14,68	14,68	–	–
	PN63/100	13,19	11,2	22,75	22,75	–	–
	CL150	3,65	3,65	12,98	12,98	–	–
	CL300	4,94	3,86	4,94	17,38	–	–
	CL600	9,73	9,73	–	–	–	–
	JIS 10K	2,84	1,37	14,68	14,68	–	–
DN 20 (3/4“)	PN40	9,78	7,27	20,75	20,75	–	–
	PN63/100	24,57	20,42	42,15	42,15	–	–
	CL150	5,29	5,29	18,49	18,49	–	–
	CL300	9,77	9,77	33,28	33,28	–	–
	CL600	15,99	15,99	–	–	–	–
	JIS 10K	4,1	1,88	20,75	20,75	–	–
DN 25 (1“)	PN40	13,32	8,6	13,32	8,6	13,32	8,6
	PN63/100	32,09	31,42	53,85	53,85	53,85	53,85
	CL150	5,04	2,84	23,98	23,98	23,98	23,98
	CL300	17,31	16,42	65,98	38,91	65,98	38,91
	CL600	22,11	22,11	–	–	–	–
	JIS 10K	8,46	5,56	26,94	26,94	26,94	26,94
DN 32 (1 1/4“)	PN40	27,5	15,01	45,08	45,08	45,08	45,08
	PN63/100	42,85	41,45	74,19	70,07	74,19	70,07
	CL150	4,59	1,98	29,44	29,44	29,44	29,44
	CL300	25,61	14,22	45,52	45,52	45,52	45,52
	CL600	34,09	34,09	–	–	–	–
	JIS 10K	9,62	4,9	45,08	45,08	45,08	45,08
DN 40 (1 1/2“)	PN40	30,44	23,71	56,06	56,06	56,06	56,06
	PN63/100	62,04	51,45	97,08	97,08	97,08	97,08
	CL150	5,82	2,88	36,12	36,12	36,12	36,12
	CL300	33,3	18,41	73,99	73,99	73,99	73,99
	CL600	23,08	23,08	–	–	–	–
	JIS 10K	12,49	6,85	56,06	56,06	56,06	56,06
DN 50 (1 1/2“)	PN40	41,26	27,24	71,45	71,45	71,45	71,45
	PN63	71,62	60,09	109,9	112,6	109,9	112,6
	CL150	22,33	22,33	66,22	66,22	66,22	66,22
	CL300	17,4	22,33	38,46	38,46	38,46	38,46
	CL600	35,03	35,03	–	–	–	–
	JIS 10K	17,27	10,47	71,45	71,45	71,45	71,45

Continued on next page

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

Nominal diameter [mm (inch)]	Nominal pressure rating	Maximum tightening torque [Nm]					
		Hard / soft rubber		PTFE, PFA, ETFE		Ceramic carbide	
		2)	3)	2)	3)	2)	3)
DN 65 (2 1/2“)	PN16	14,94	8	37,02	39,1	37,02	39,1
	PN40	30,88	21,11	43,03	44,62	43,03	44,62
	PN63	57,89	51,5	81,66	75,72	81,66	75,72
	CL150	30,96	30,96	89,93	89,93	89,93	89,93
	CL300	38,38	27,04	61,21	61,21	61,21	61,21
	CL600	53,91	53,91	–	–	–	–
	JIS 10K	14,94	8	37,02	39,1	37,02	39,1
DN 80 (3“)	PN40	38,3	26,04	51,9	53,59	51,9	53,59
	PN63	63,15	55,22	64,47	80,57	64,47	80,57
	CL150	19,46	19,46	104,6	104,6	104,6	104,6
	CL300	75,54	26,91	75,54	75,54	75,54	75,54
	CL600	84,63	84,63	–	–	–	–
	JIS 10K	16,26	9,65	45,07	47,16	45,07	47,16
DN 100 (4“)	PN16	20,7	12,22	49,68	78,19	49,68	78,19
	PN40	67,77	47,12	78,24	78,19	78,24	78,19
	PN63	107,4	95,79	148,5	119,2	148,5	119,2
	CL150	17,41	7,82	76,2	76,2	76,2	76,2
	CL300	74,9	102,6	102,6	102,6	102,6	102,6
	CL600	147,1	147,1	–	–	–	–
	JIS 10K	20,7	12,22	49,68	78,19	49,68	78,19
DN 125 (5“)	PN16	29,12	18,39	61,4	64,14	61,4	64,14
	PN40	108,5	75,81	123,7	109,6	123,7	109,6
	PN63	180,3	164,7	242,6	178,2	242,6	178,2
	CL150	24,96	11,05	98,05	98,05	98,05	98,05
	CL300	81,64	139,4	139,4	139,4	139,4	139,4
	CL600	244,1	244,1	–	–	–	–
DN 150 (6“)	PN16	46,99	23,7	81,23	85,08	81,23	85,08
	PN40	143,5	100,5	162,5	133,5	162,5	133,5
	PN63	288,7	269,3	371,3	243,4	371,3	243,4
	CL150	30,67	13,65	111,4	111,4	111,4	111,4
	CL300	101,4	58,4	123,6	123,6	123,6	123,6
	CL600	218,4	218,4	–	–	–	–
DN 200 (8“)	PN10	45,57	27,4	113	116,9	113	116,9
	PN16	49,38	33,82	70,42	73	70,42	73
	PN25	100,6	69,17	109,9	112,5	109,9	112,5
	PN40	196,6	144,4	208,6	136,8	208,6	136,8
	PN63	350,4	331,8	425,5	282,5	425,5	282,5
	CL150	49,84	23,98	158,1	158,1	158,1	158,1
	CL300	133,9	78,35	224,3	224,3	224,3	224,3
	CL600	391,8	391,8	–	–	–	–
DN 250 (10“)	PN10	23,54	27,31	86,06	89,17	86,06	89,17
	PN16	88,48	61,71	99,42	103,1	99,42	103,1
	PN25	137,4	117,6	166,5	133,9	166,5	133,9
	PN40	359,6	275,9	279,9	241	279,9	241
	CL150	55,18	27,31	146,1	148,3	146,1	148,3
	CL300	202,7	113,2	246,4	246,4	246,4	246,4

Continued on next page

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

Nominal diameter [mm (inch)]	Nominal pressure rating	Maximum tightening torque [Nm]					
		Hard / soft rubber		PTFE, PFA, ETFE		Ceramic carbide	
		2)	3)	2)	3)	2)	3)
DN 300 (12“)	PN10	58,79	38,45	91,29	94,65	91,29	94,65
	PN16	122,4	85,64	113,9	114,8	113,9	114,8
	PN25	180,6	130,2	151,1	106,9	151,1	106,9
	PN40	233,4	237,4	254,6	252,7	254,6	252,7
	CL150	90,13	50,37	203,5	198	203,5	198
	CL300	333,3	216,4	421,7	259,1	421,7	259,1
DN 350 (14“)	PN10	69,62	47,56	72,49	75,22	72,49	75,22
	PN16	133,6	93,61	124,9	104,4	124,9	104,4
	PN25	282,3	204,3	226,9	167,9	226,9	167,9
	CL150	144,8	83,9	270,5	263	270,5	263
	CL300	424,1	252,7	463,9	259,4	463,9	259,4
DN 400 (16“)	PN10	108,2	75,61	120,1	113,9	120,1	113,9
	PN16	189	137,2	191,4	153,8	191,4	153,8
	PN25	399,4	366	404	246,7	404	246,7
	CL150	177,6	100	229,3	222,8	229,3	222,8
	CL300	539,5	318,8	635,8	328,1	635,8	328,1
DN 450 (18“)	CL150	218,6	120,5	267,3	192,3	267,3	192,3
	CL300	553,8	327,2	660,9	300	660,9	300
DN 500 (20“)	PN10	141,6	101,4	153,9	103,5	153,9	103,5
	PN16	319,7	245,4	312,1	224,8	312,1	224,8
	PN25	481,9	350,5	477,1	286	477,1	286
	CL150	212,5	116	237,3	230,4	237,3	230,4
	CL300	686,3	411,8	786,8	363,1	786,8	363,1
DN 600 (24“)	PN10	224,7	164,8	238,7	149,1	238,7	149,1
	PN16	515,1	399,9	496,7	365,3	496,7	365,3
	PN25	826,2	600,3	750,7	539,2	750,7	539,2
	CL150	356,6	202,8	451,6	305,8	451,6	305,8
	CL300	1188	719	1376	587,4	1376	587,4
DN 700 (28“)	PN10	267,7	204,9	On request	On request	267,7	204,9
	PN16	455,7	353,2	On request	On request	455,7	353,2
	PN25	905,9	709,2	On request	On request	905,9	709,2
	CL150	364,1	326,2	449,2	432,8	364,1	326,2
	CL300	1241	On request	On request	On request	1241	On request
DN 750 (30“)	CL150	423,8	380,9	493,3	442	423,8	380,9
	CL300	1886	On request	On request	On request	1886	On request
DN 800 (32“)	PN10	391,7	304,2	On request	On request	391,7	304,2
	PN16	646,4	511,8	On request	On request	646,4	511,8
	PN25	1358	1087	On request	On request	1358	1087
	CL150	410,8	380,9	493,3	380,9	410,8	380,9
	CL300	2187	On request	On request	On request	2187	On request
DN 900 (36“)	PN10	387,7	296,3	On request	On request	387,7	296,3
	PN16	680,8	537,3	On request	On request	680,8	537,3
	PN25	1399	1119	On request	On request	1399	1119
	CL150	336,2	394,6	511	458,5	336,2	394,6
	CL300	1972	On request	On request	On request	1972	On request

Continued on next page

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

Nominal diameter [mm (inch)]	Nominal pressure rating	Maximum tightening torque [Nm]					
		Hard / soft rubber		PTFE, PFA, ETFE		Ceramic carbide	
		2)	3)	2)	3)	2)	3)
DN 1000 (40“)	PN10	541,3	419,2	On request	On request	541,3	419,2
	PN16	955,5	756,1	On request	On request	955,5	756,1
	PN25	2006	1612	On request	On request	2006	1612
	CL150	654,2	598,8	650,6	385,1	654,2	598,8
	CL300	2181	On request	On request	On request	2181	On request
DN 1100 (44“)	CL150	749,1	682,6	741,3	345,9	–	–
	CL300	2607	On request	On request	On request	–	–
DN 1200 (48“)	PN 6	363,5	On request	–	–	–	–
	PN10	705,9	On request	–	–	–	–
	PN16	1464	On request	–	–	–	–
	CL150	815,3	731,6	–	–	–	–
	CL300	3300	On request	–	–	–	–
DN 1350 (54“)	CL150	1036	983,7	–	–	–	–
	CL300	5624	On request	–	–	–	–
DN 1400 (56“)	PN 6	515	On request	–	–	–	–
	PN10	956,3	On request	–	–	–	–
	PN16	1558	On request	–	–	–	–
DN 1500 (60“)	CL150	1284	1166	–	–	–	–
	CL300	6139	On request	–	–	–	–
DN 1600 (64“)	PN 6	570,7	On request	–	–	–	–
	PN10	1215	On request	–	–	–	–
	PN16	2171	On request	–	–	–	–
DN 1800 (72“)	PN 6	708,2	On request	–	–	–	–
	PN10	1492	On request	–	–	–	–
	PN16	2398	On request	–	–	–	–
DN 2000 (80“)	PN 6	857,9	On request	–	–	–	–
	PN10	1840	On request	–	–	–	–
	PN16	2860	On request	–	–	–	–

Continued on next page

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

Variable process connections HygienicMaster

Nominal diameter		Max. tightening torque
[mm]	[inch]	[Nm]
DN 1 ... 2	1/25 ... 3/32“	PVC / POM: 0.2 brass / 1.4571: 3
DN 3 ... 10	3/8“	8
DN 15	1/2“	10
DN 20	3/4“	21
DN 25	1	31
DN 32	1 1/4“	60
DN 40	1 1/2“	80
DN 50	2	5
DN 65	2 1/2“	5
DN 80	3	15
DN 100	4	14

4.3 Information on 3A conformity

IMPORTANT (NOTE)

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

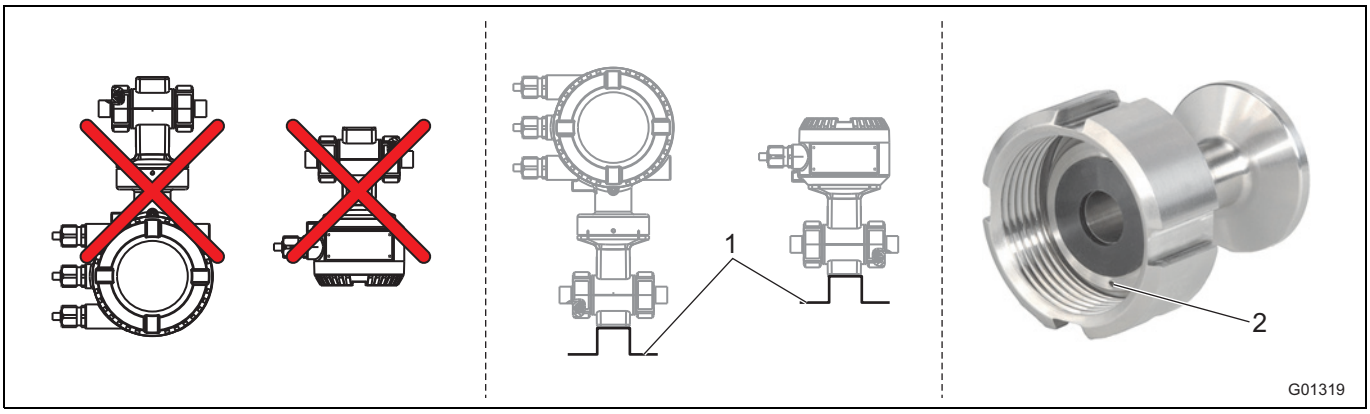


Fig. 8

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.

4.4 Installation Requirements

4.4.1 Flow direction

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

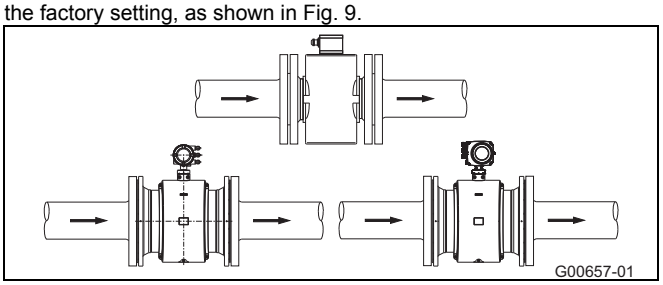


Fig. 9

4.4.2 Electrode axis

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

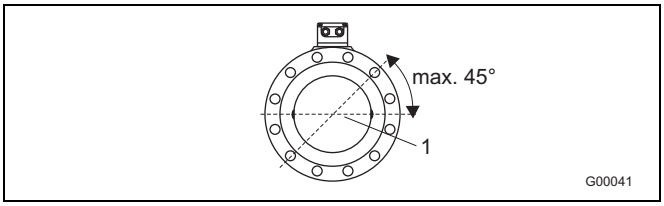


Fig. 10

4.4.3 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. 11).

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.

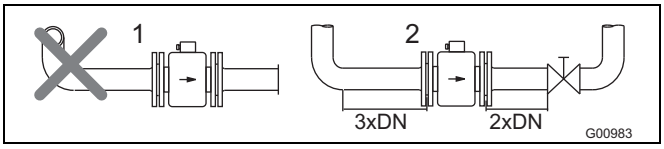


Fig. 11

4.4.4 Vertical connections

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

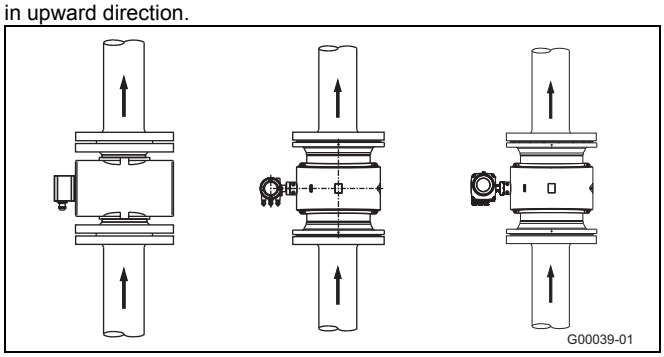


Fig. 12

4.4.5 Horizontal connections

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

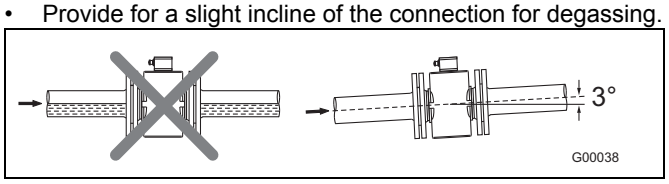


Fig. 13

4.4.6 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).

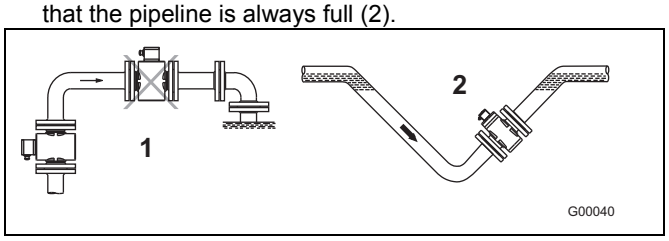


Fig. 14

4.4.7 Strongly contaminated measuring media

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

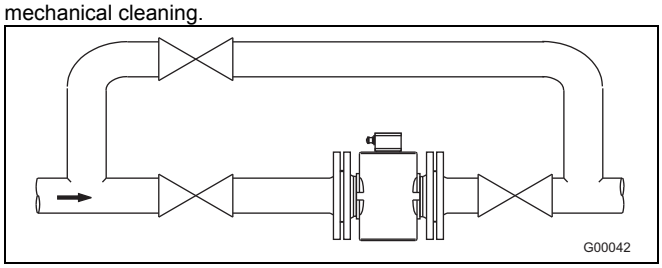


Fig. 15

4.4.8 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.

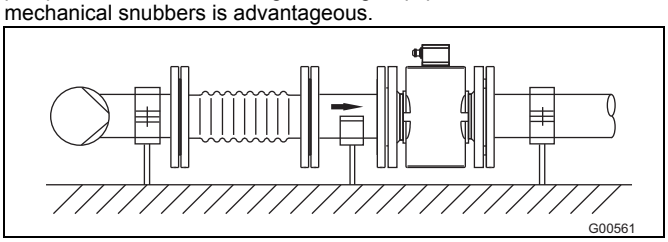


Fig. 16

4.4.9 Installation of the high temperature design

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

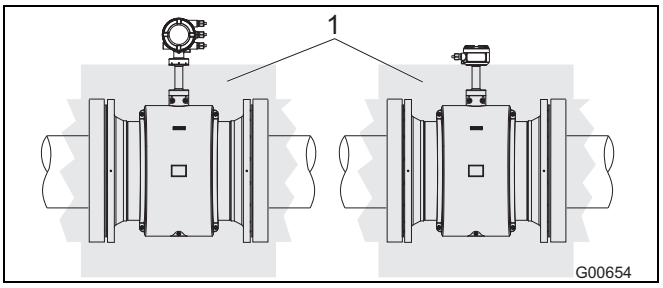


Fig. 17
1 Insulation

4.4.10 Devices with extended diagnostic functions

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

4.4.11 Minimum distance

In order to prevent the devices from interfering with each other, a minimum distance of 0.7 m (2.3 ft) must be maintained between the devices.

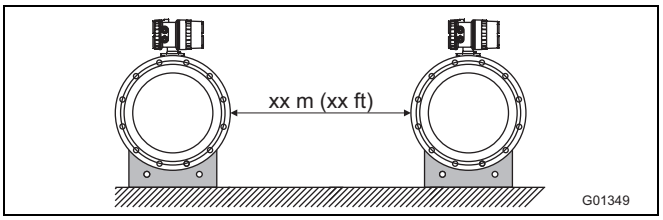


Fig. 18

4.4.12 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. 20).
3. Read the pressure drop on the Y-axis in Fig. 20.

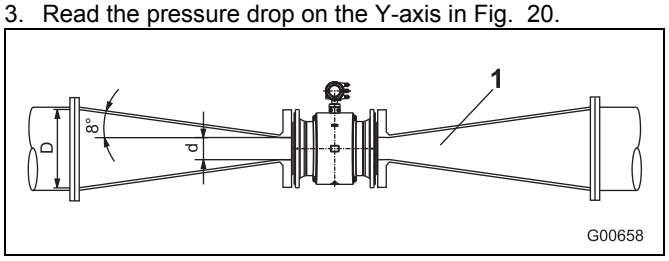


Fig. 19

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

Nomograph for pressure drop calculations

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

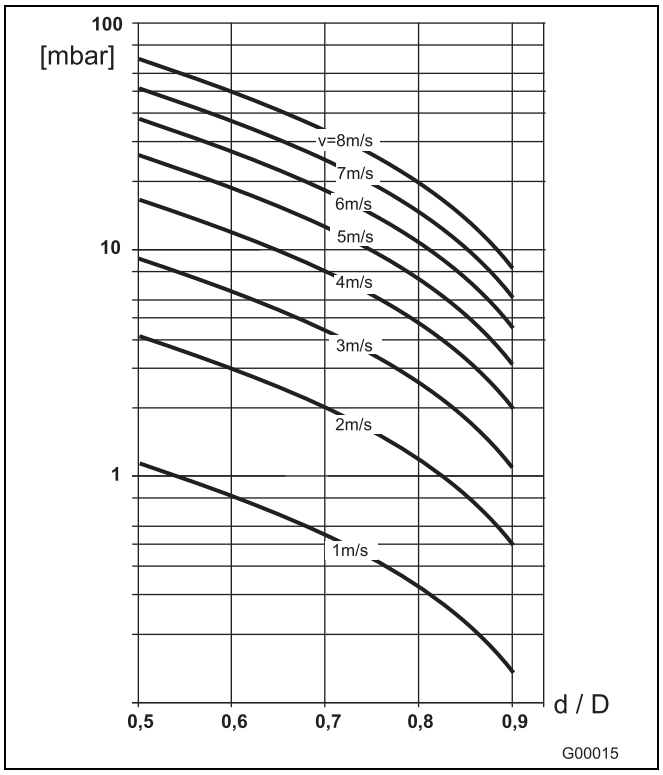


Fig. 20

4.5 Ground

4.5.1 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.

4.5.2 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.

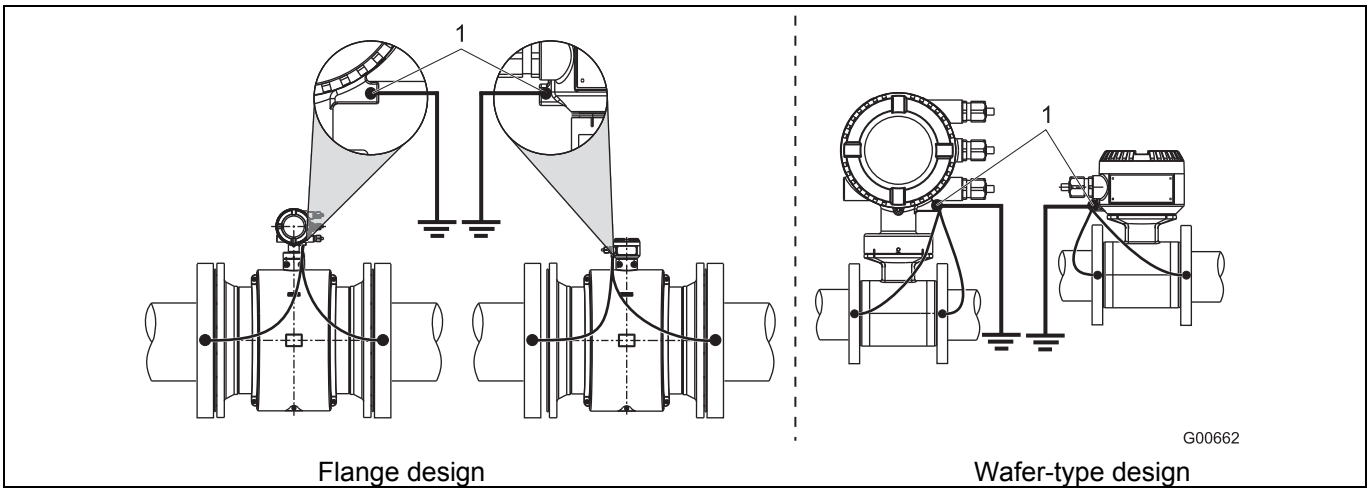


Fig. 21: Metal pipe, without liner (example)

IMPORTANT (NOTE)

- Earthing is illustrated using the example of the dual-compartment transmitter housing; in the case of transmitters with single-compartment housing, earthing is to be performed as shown

4.5.3 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.

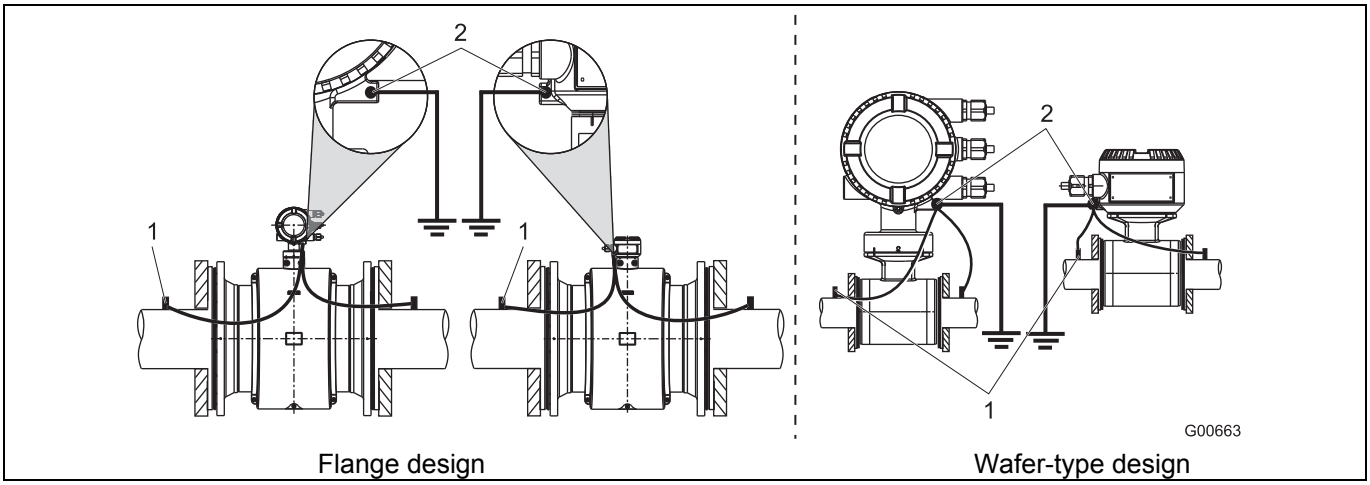


Fig. 22: Metal pipe, without liner (example)

IMPORTANT (NOTE)

- Earthing is illustrated using the example of the dual-compartment transmitter housing; in the case of transmitters with single-compartment housing, earthing is to be performed as shown

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

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

1. Install the 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 earthing terminal (1) to a suitable earthing point.

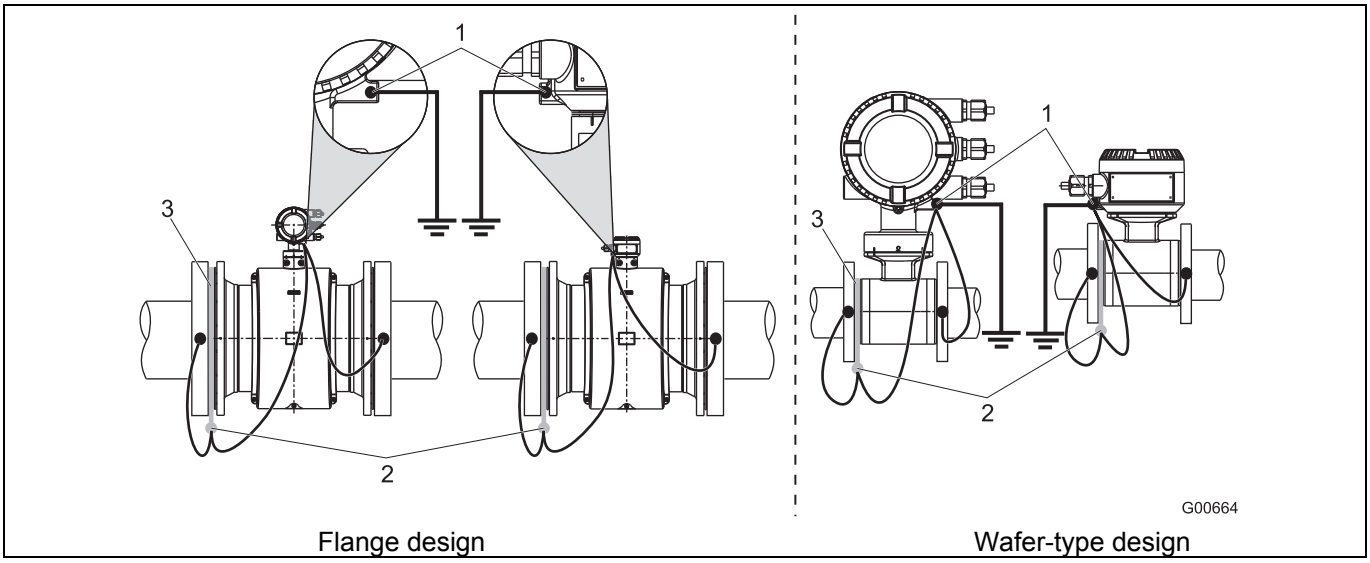


Fig. 23: Plastic pipes, non-metallic pipes or pipes with insulating liner

IMPORTANT (NOTE)

- Earthing is illustrated using the example of the dual-compartment transmitter housing; in the case of transmitters with single-compartment housing, earthing is to be performed as shown

4.5.5 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.

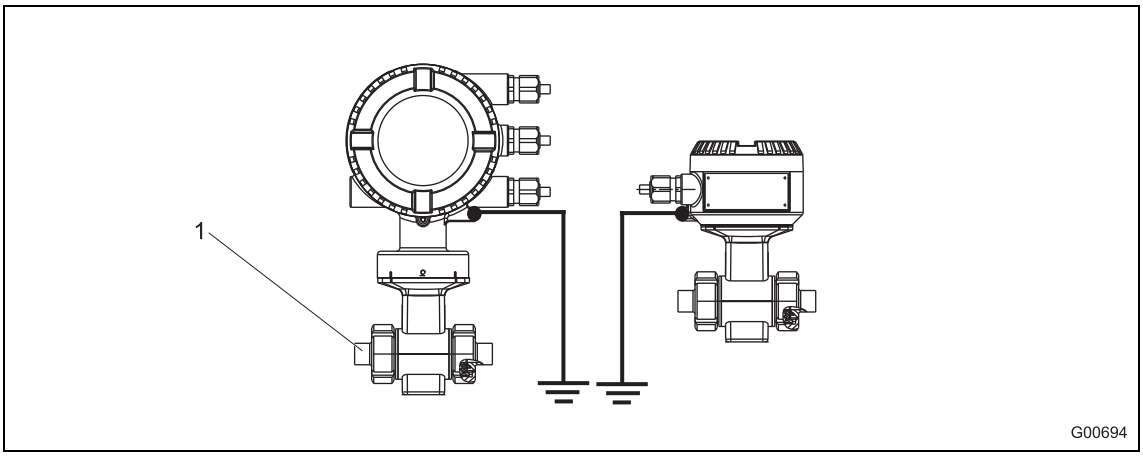


Fig. 24

4.5.6 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.

4.5.7 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.

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.

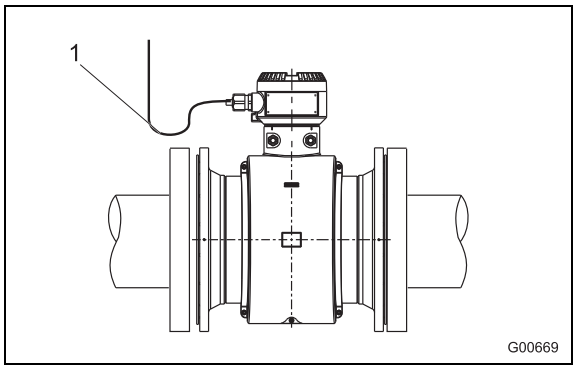


Fig. 25

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).

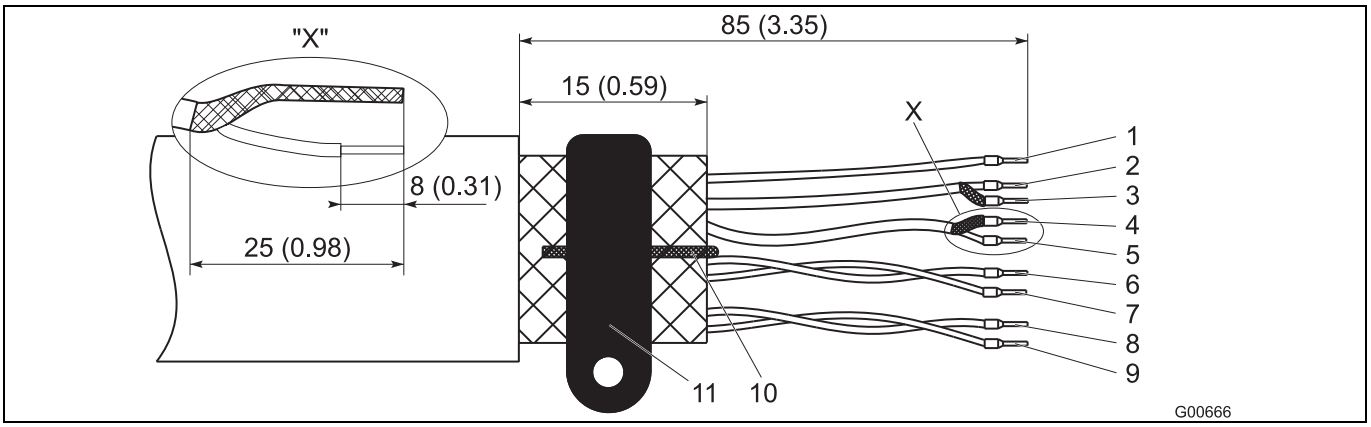


Fig. 26: Flowmeter sensor side, dimensions in mm (inch)

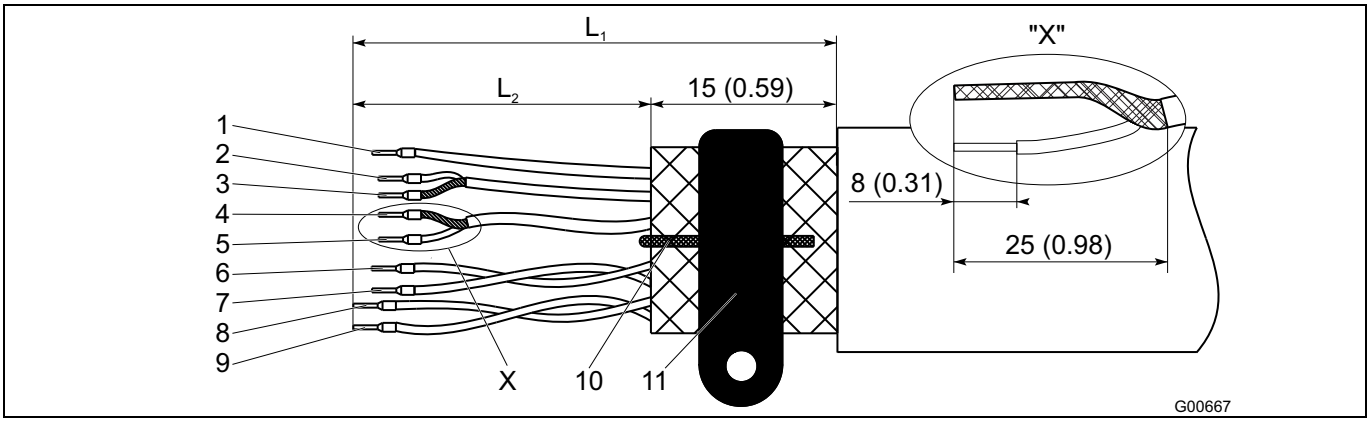


Fig. 27: Transmitter side, dimensions in mm (inch)

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).

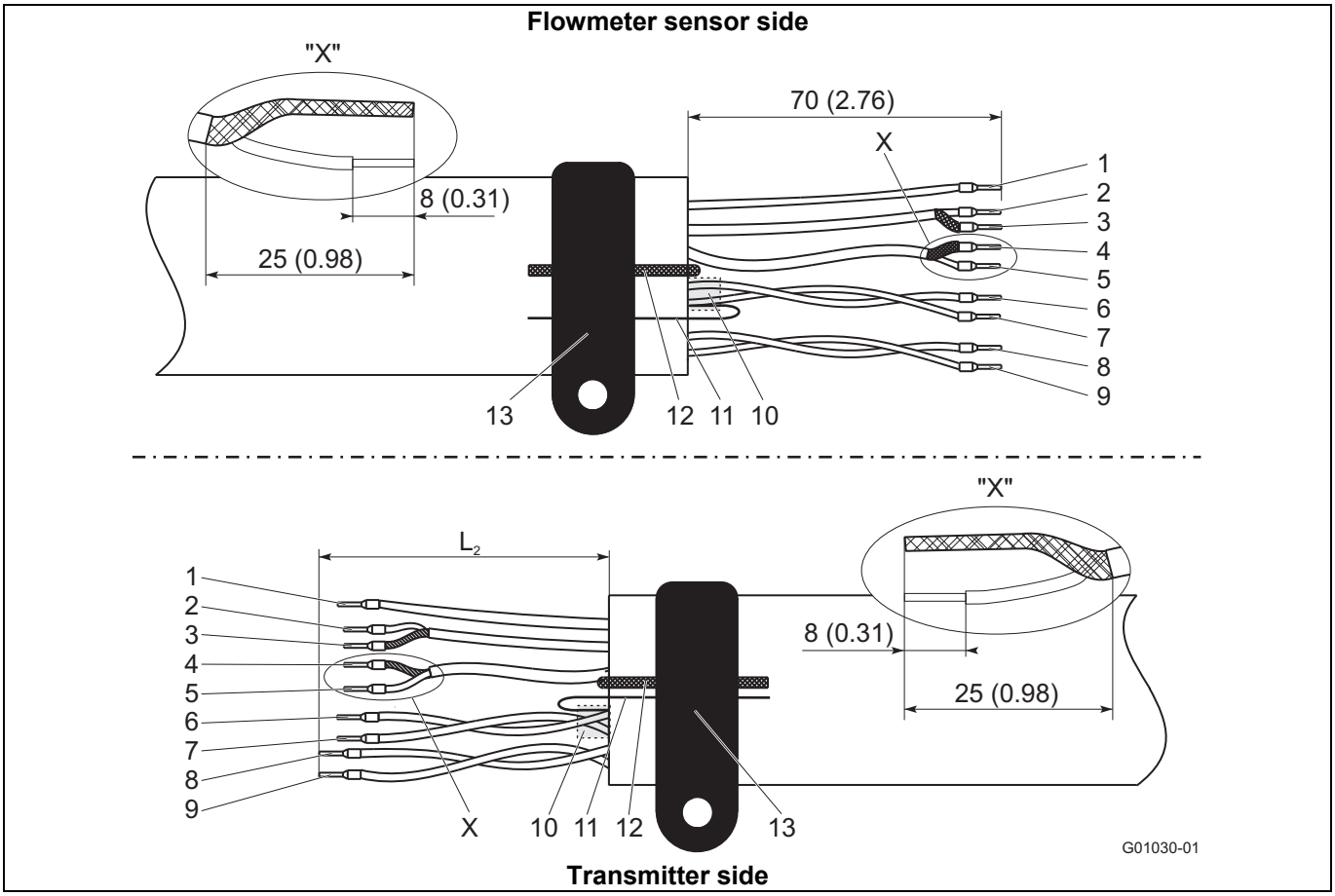


Fig. 28: Flowmeter sensor side, dimensions in mm (inch)

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

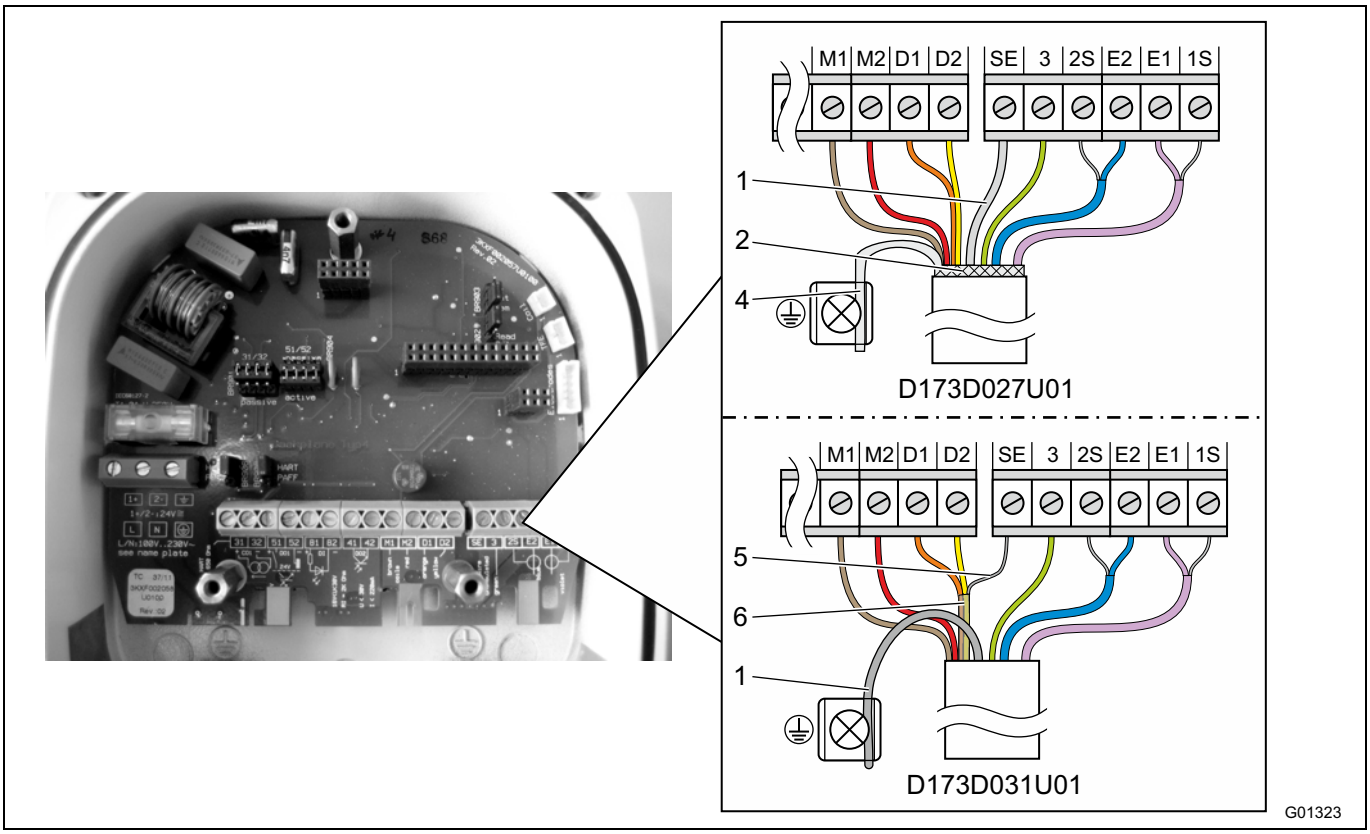


Fig. 29: Transmitter side, dimensions in mm (inch)

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. 29.

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. 29.

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. 29.

5.4 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.

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

5.4.2 Transmitter with dual-compartment housing

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

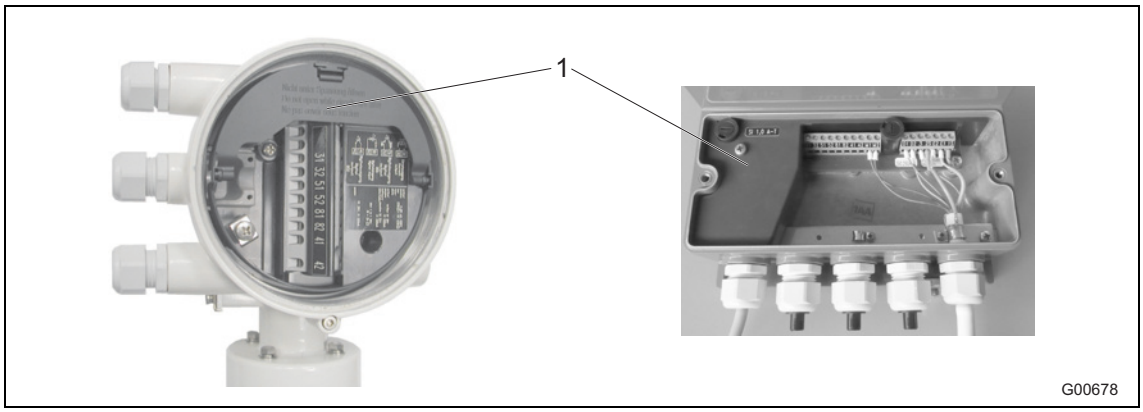


Fig. 30

1 Terminal cover

5.4.3 Transmitter with single-compartment housing

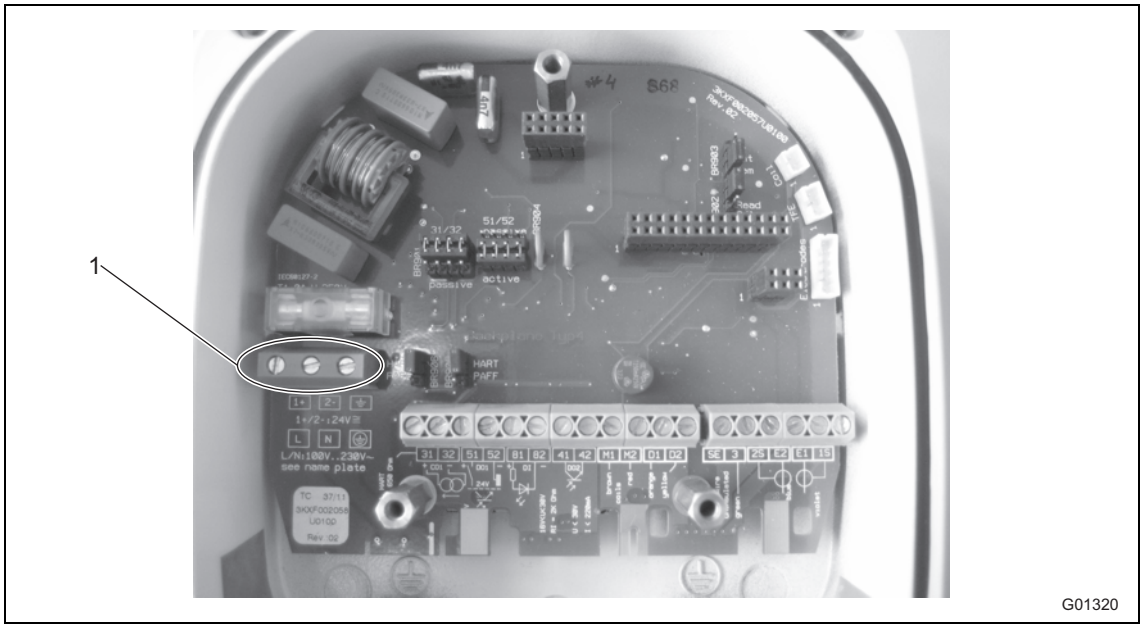


Fig. 31

1 Terminals (power supply)

5.4.4 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.

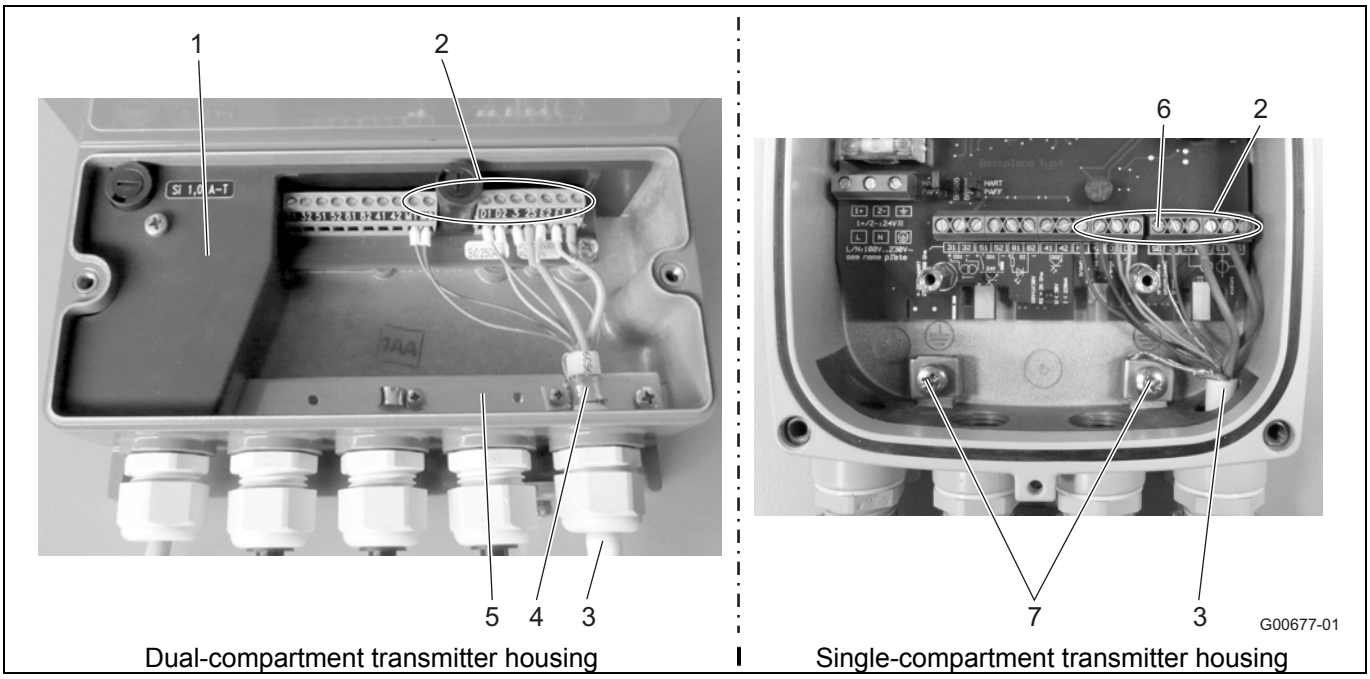


Fig. 32

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.

5.5 Connecting the flowmeter sensor

5.5.1 Metal terminal box for ProcessMaster and HygienicMaster

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

The device must be earthed according to instructions. The sensor is connected to the transmitter via the signal / magnetic coil cable (part no. D173D027U01 or D173D031U01).

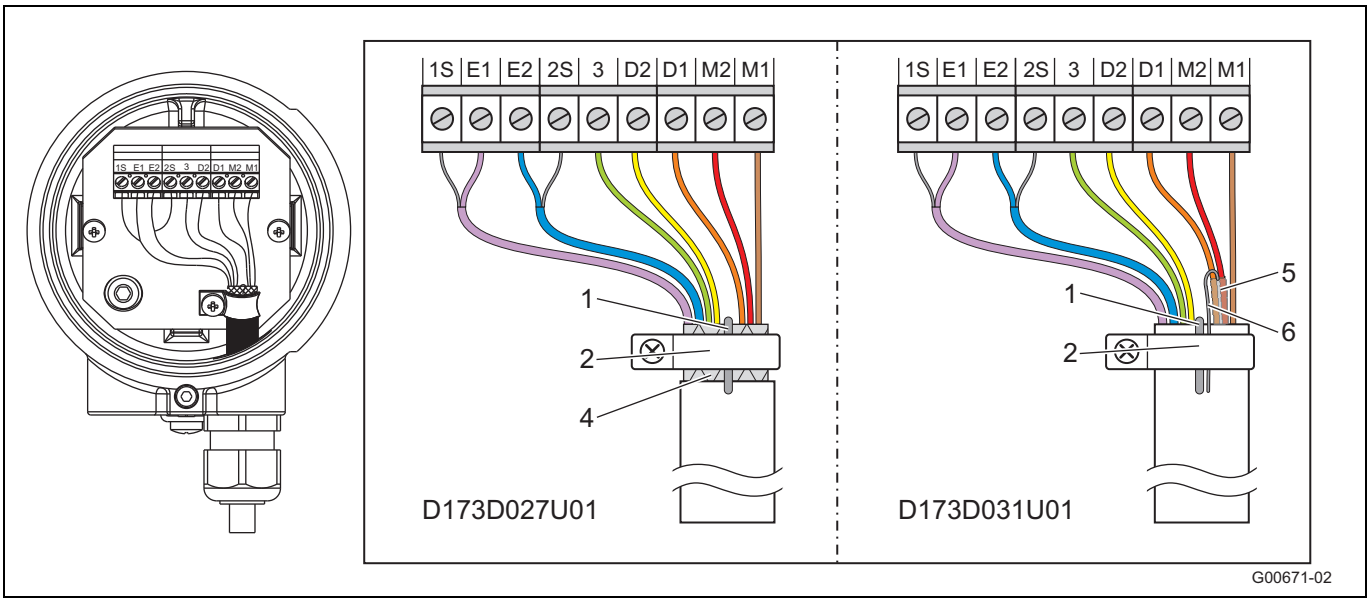


Fig. 33

1 Earth wire.
2 Earth clamp.
4 Braided shield (D173D027U01 only).
5 Foil shield D1, D2 (D173D031U01 only).
6 Continuity wire of the foil shield (D1, D2) (D173D031U01 only).

Terminal	Description, wire color
M1	Magnetic coil, brown
M2	Magnetic coil, red
D1	Data line, orange
D2	Data line, yellow
PE	Shielding
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.

- Sensor without explosion protection from nominal diameter DN 15 (models FEP321, FEH321, FEP521, FEH521)
- Sensor for use in Zone 2, Div. 2 from nominal diameter DN 15 (models FEP325, FEH325, FEP525, FEH525)

IMPORTANT (NOTE)

Use wire end sleeves.

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

The shielding may not touch (signal short circuit).

Cable with part number D173D027U01

- Uncover the braided shield of the cable and connect to the earth clamp together with the earth wire
- Connect all other wires as shown in Fig. 33

Cable with part number D173D031U01

- Connect the earth wire of the cable together with the continuity wire of the foil shield from D1, D2 to the earth clamp
- Connect all other wires as shown in Fig. 33

5.5.2 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.

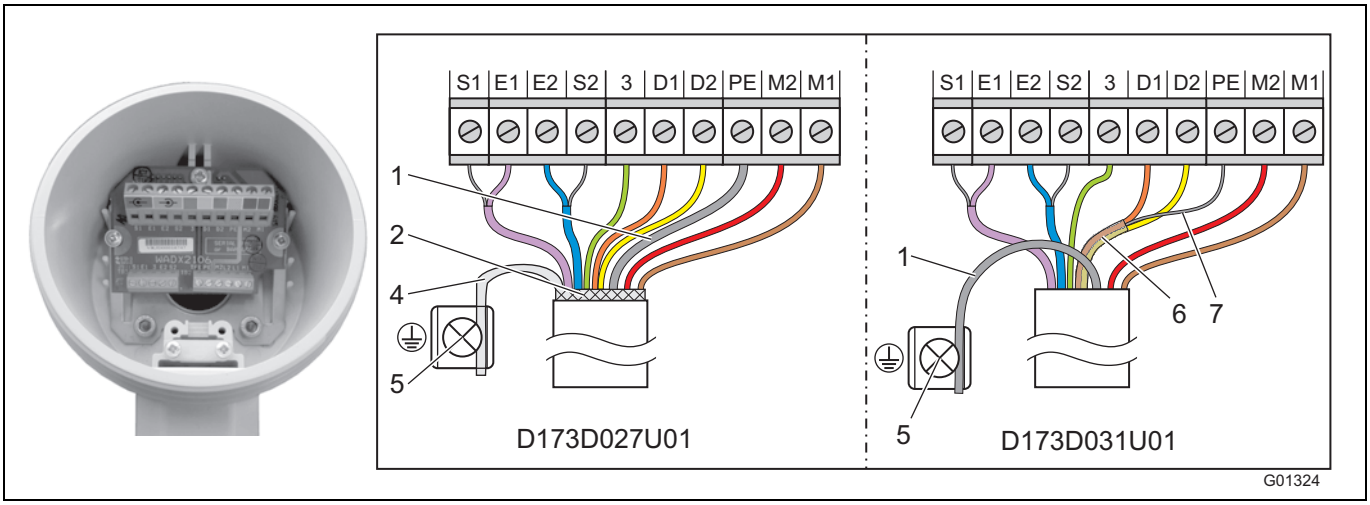


Fig. 34

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 (S1, S2)
  - 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. 34.

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. 34.

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. 34.

5.5.3 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.

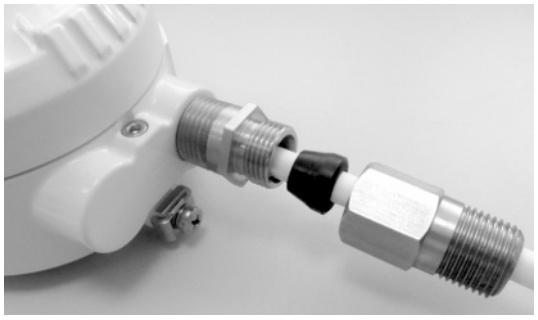


Fig. 35: Installation set for cable conduit

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

5.5.4 IP rating IP 68

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

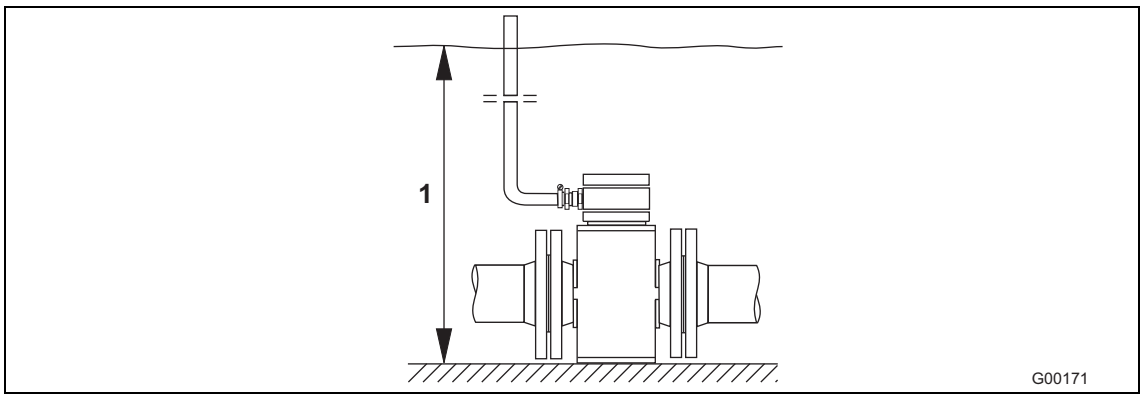


Fig. 36

1 Max. flooding height 5 m (16.4 ft)

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

5.5.4.1 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 – potential adverse effect on IP rating IP 68!

The IP rating IP 68 of the sensor may be adversely affected as a result of damage to the signal cable.
The sheathing of the signal cable must not be damaged. Otherwise, the IP rating IP 68 for the sensor cannot be ensured.

IMPORTANT (NOTE)

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

5.5.4.2 Potting the terminal box

On sensors without explosion protection or explosion protection Zone 2, Div 2, the terminal box can be subsequently potted.

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

WARNING - General dangers!

The two-component potting compound is toxic – observe all relevant safety measures!
Hazard warnings: 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 potting in order to avoid moisture penetration. Before starting, check all the connections for correct fitting and stability
- Do not overfill the terminal box. Keep the potting compound away from the O-ring and the gasket / groove (see fig. Fig. 37)
- Prevent the two-component potting compound from penetrating the cable conduit if an NPT 1/2" installation is used

Procedure

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

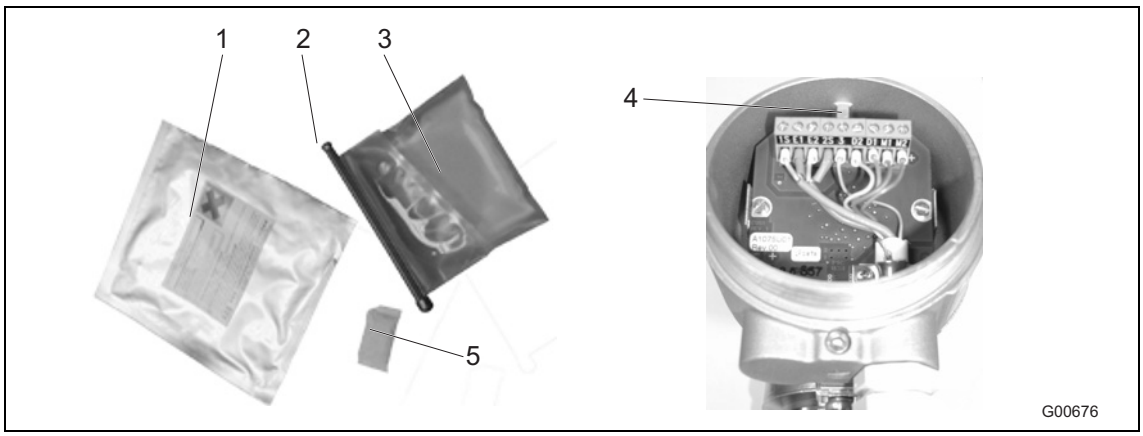


Fig. 37

1 Packing bag
2 Connection clamp
3 Two-component potting compound
4 Max. filling level
5 Drying bag

5.6 Terminal connection diagrams

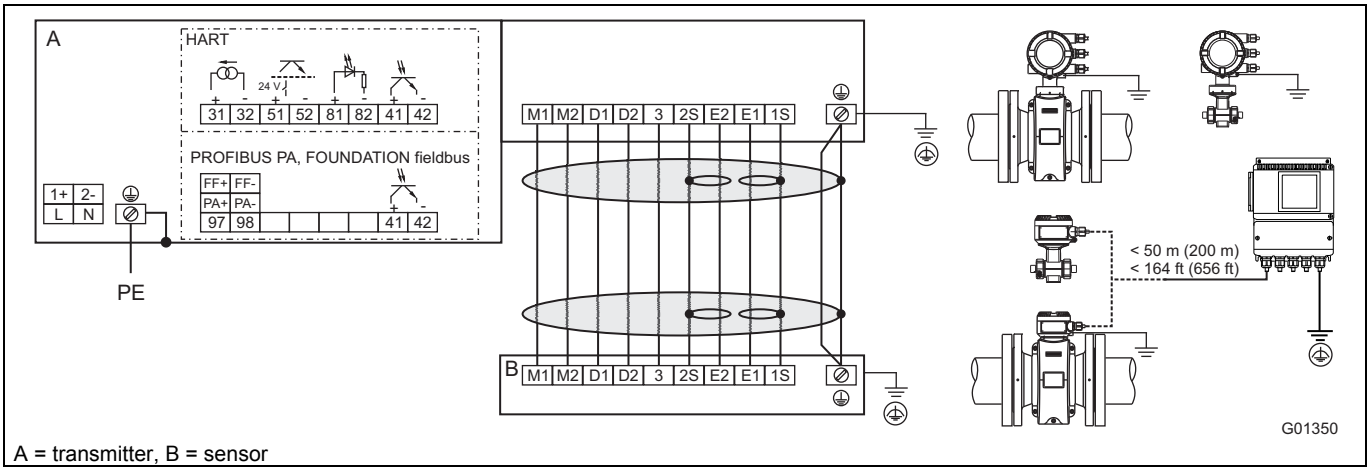
5.6.1 HART, PROFIBUS PA and FOUNDATION fieldbus protocol

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.

Important (Note)

For detailed information about earthing the transmitter and the sensor, please refer to chapter 4.5 "Ground" on page 24!



A = transmitter, B = sensor

Fig. 38

Power supply connections

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

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

Sensor cable terminal connections

Only on remote mount design.

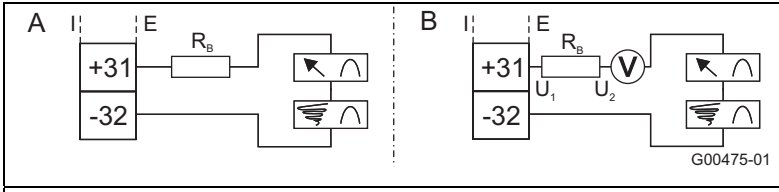
Terminal	Function / Notes	Wire color
M1	Magnet coil	Brown
M2	Magnet coil	Red
D1	Data line	Orange
D2	Data line	Yellow
⏚ / SE	Shield	-
E1	Signal line	Violet
1S	Schield for E1	-
E2	Signal line	Blue
2S	Schield for E2	-
3	Measurement potential	Green

Output connections

Terminal	Function / Notes
31 / 32	**Current / HART output** The current output is available in "active" or "passive" mode.
97 / 98	**Digital communication** PROFIBUS PA (PA+ / PA-) or FOUNDATION fieldbus (FF+ / FF-) in acc. with IEC 61158-2.
51 / 52	**Digital output DO1 active / passive** Function can be configured locally as „Pulse Output" or „Digital Output". Factory setting is „Pulse Output".
81 / 82	**Digital input / contact input** Function can be configured locally as „External output switch-off", „external totalizer reset", „external totalizer stop" or „other".
41 / 42	**Digital output DO2 passive** Function can be configured locally as „Pulse Output" or „Digital Output". Factory setting is „Digital Output", flow direction signaling.
⏚	**Functional ground**

5.7 Electrical data

5.7.1 Current / HART output

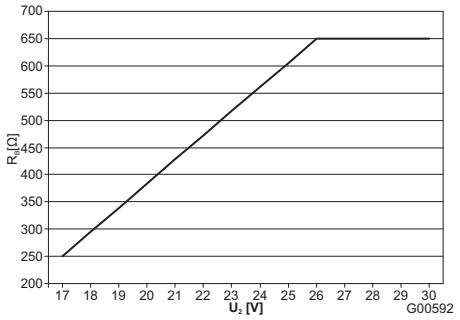


The current / HART output can be operated in "active" or "passive" mode.

A **Active:** 4 ... 20 mA, HART protocol (standard), load: 250 Ω ≤ R ≤ 650 Ω

B **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.

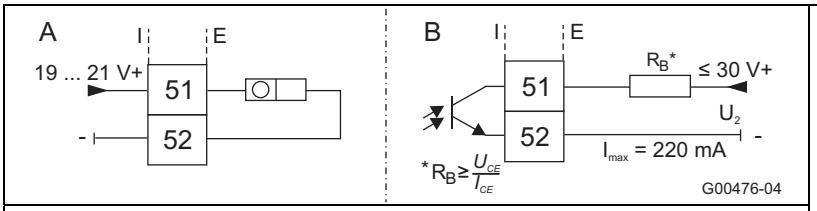
For Ex zone 1 / Div. 1 the maximum load is 300 Ω.



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

Fig. 39: (I = internal, E = external)

5.7.2 Digital output DO1



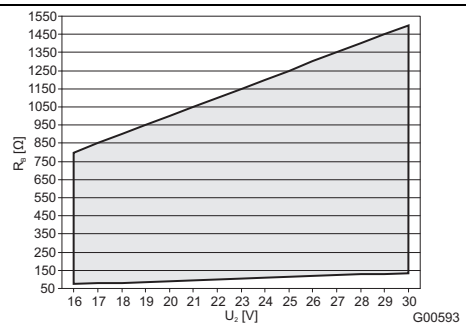
The output can be configured as an "active (A)" or "passive (B)" output (in the case of the transmitter with the dual-compartment housing, the output is configured using the software; in the case of the transmitter with the single-compartment housing, it is configured by means of jumpers on the transmitter backplane).

Configuration as "active" output:
- U = 19 ... 21 V, Imax = 220 mA , fmax ≤ 5250 Hz

Configuration as "passive" output
- Umax = 30 V, Imax = 220 mA, fmax ≤ 5250 Hz

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.

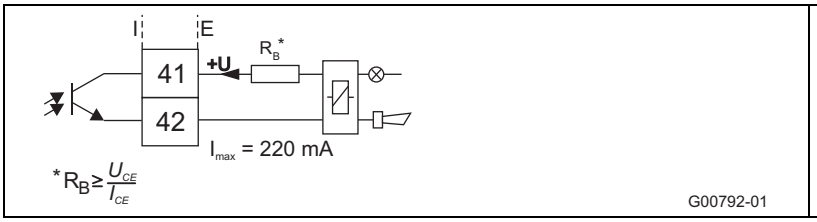
Configuration as contact output:
- Function: System alarm, empty pipe alarm, max. / min. alarm, flow direction signaling, other



Max. permissible load (R_B) as a function of the source voltage (U_2). ▒▒ = Permissible range

Fig. 40: (I = internal, E = external)

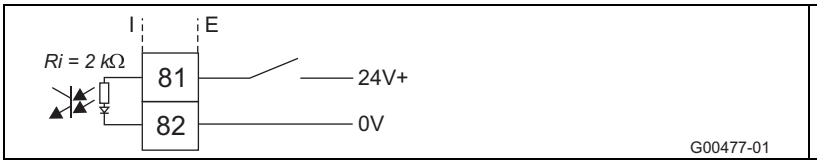
5.7.3 Digital output DO2



The output is always a "passive" output (optocoupler).
Data for the optocoupler:
U_{max} = 30 V, I_{max} = 220 mA, f_{max} ≤ 5250 Hz
For maximum load see diagram Fig. 40.

Fig. 41: (I = internal, E = external)

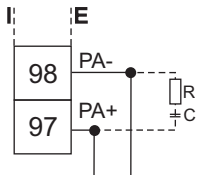
5.7.4 Digital input DI



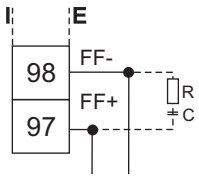
Data for the optocoupler:
16 V ≤ U ≤ 30 V, Ri = 2 kΩ

Fig. 42: (I = internal, E = external)

5.7.5 Digital communication



PROFIBUS PA (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.



G00248-01

FOUNDATION fieldbus (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

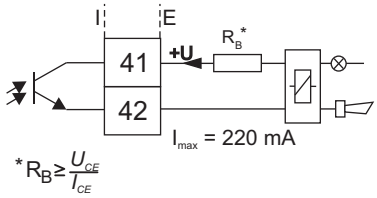
The resistance R and condenser C form the bus termination. They must be installed when the device is connected to the end of the entire bus cable. R = 100 Ω; C = 1 µF

Fig. 43: (I = internal, E = external)

5.8 Connection examples

5.8.1 Digital output DO2

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

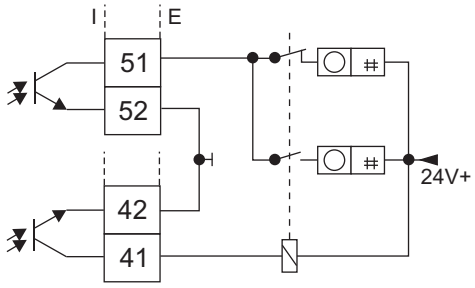


G00792-01

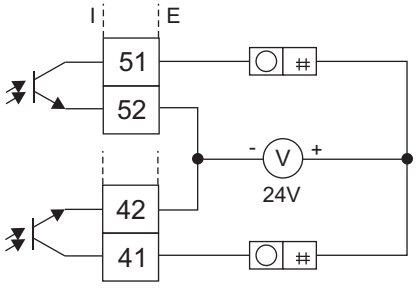
Fig. 44: (I = internal, E = external)

5.8.2 Digital outputs DO1 and DO2

Separate forward and reverse pulses



Separate forward and reverse pulses (alternative connection)

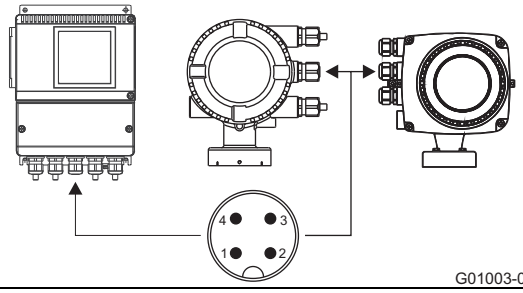


G00791

Fig. 45: (I = internal, E = external)

5.8.3 PROFIBUS PA - Connection via M12 plug

Only in non-hazardous areas



G01003-01

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

Fig. 46

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 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.

6.2.1 Menu navigation

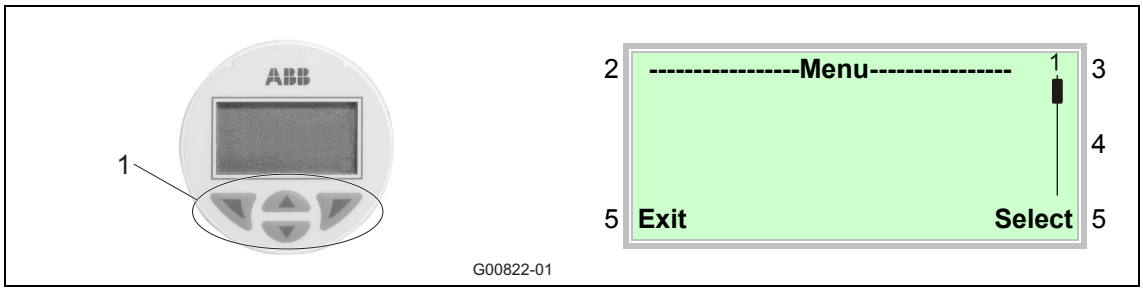


Fig. 47: LCD-indicator

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.

6.2.1.1 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

6.3 Menu levels

Two levels exist under the process display.

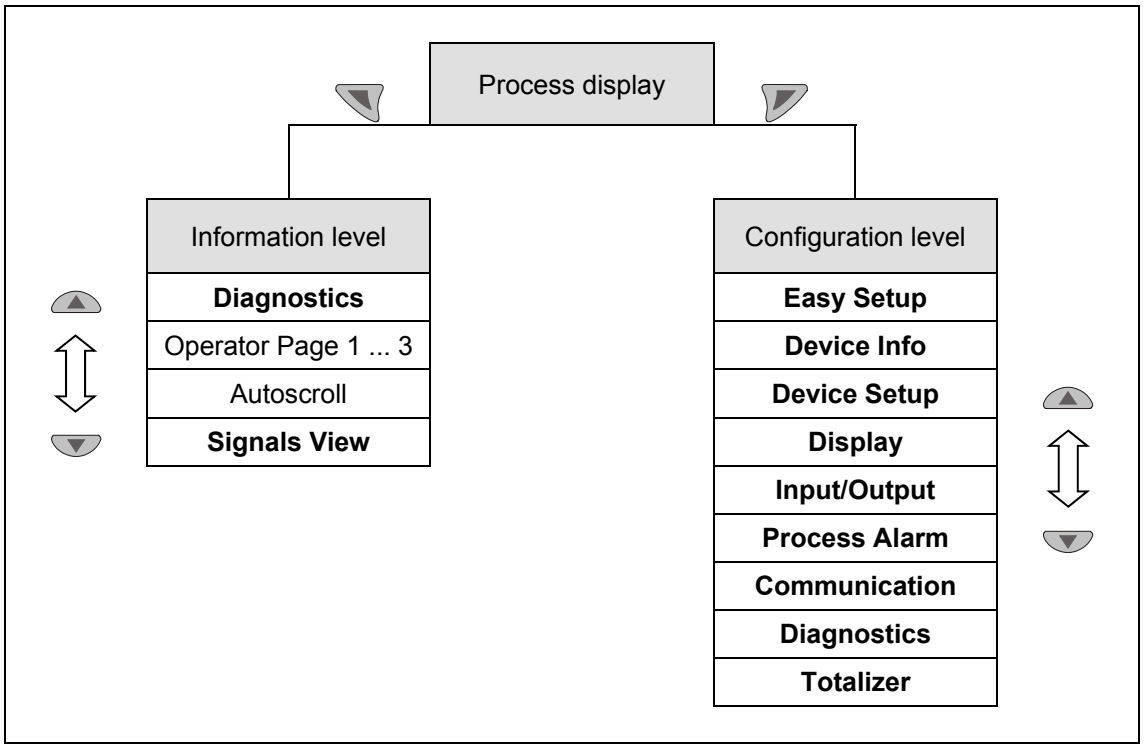


Fig. 48: Menu levels

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.

Notice

For a detailed description of the individual parameters and menus at the configuration level refer to the “Parameterization” section in the corresponding operating instructions.

6.3.1 Process display

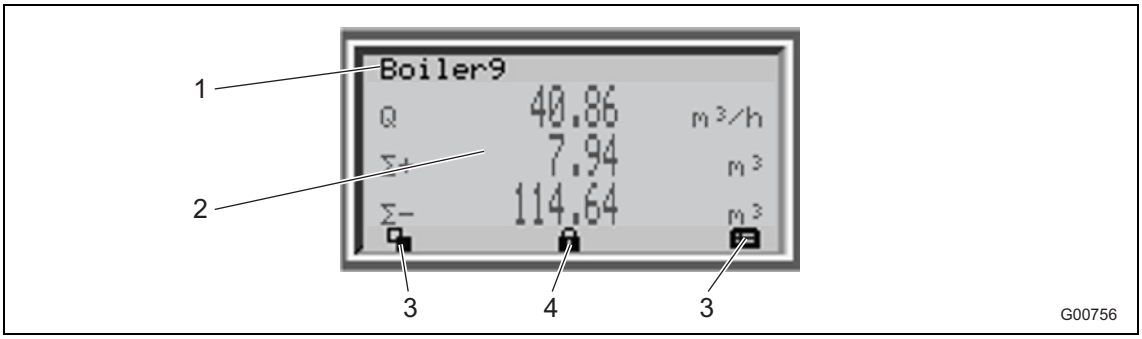


Fig. 49: Process display (example)

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.

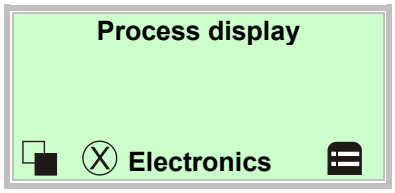
The way in which the current process values (2) are shown can be adjusted on the configuration level.

6.3.1.1 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

6.3.1.2 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:

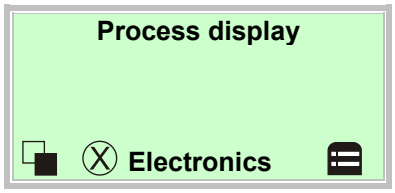
Symbol	Description
	Error / Failure
	Functional check
	Out of specification
	Maintenance required

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

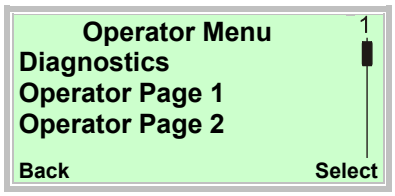
Area	Description
Electronics	Error / alarm of the electronics.
Sensor	Error / alarm of the flowmeter sensor.
Status	Alarm due to the current device status.
Operation	Error / alarm due to the current operating conditions.

6.3.1.3 Invoking the error description

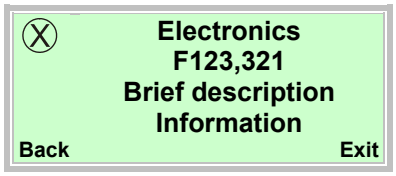
Additional details about the occurred error can be called up on the information level.



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.

Notice

For a detailed error description and information on troubleshooting refer to the “Error messages” section in the corresponding operating instructions.

6.4 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).

6.4.1 Transmitter with dual-compartment housing

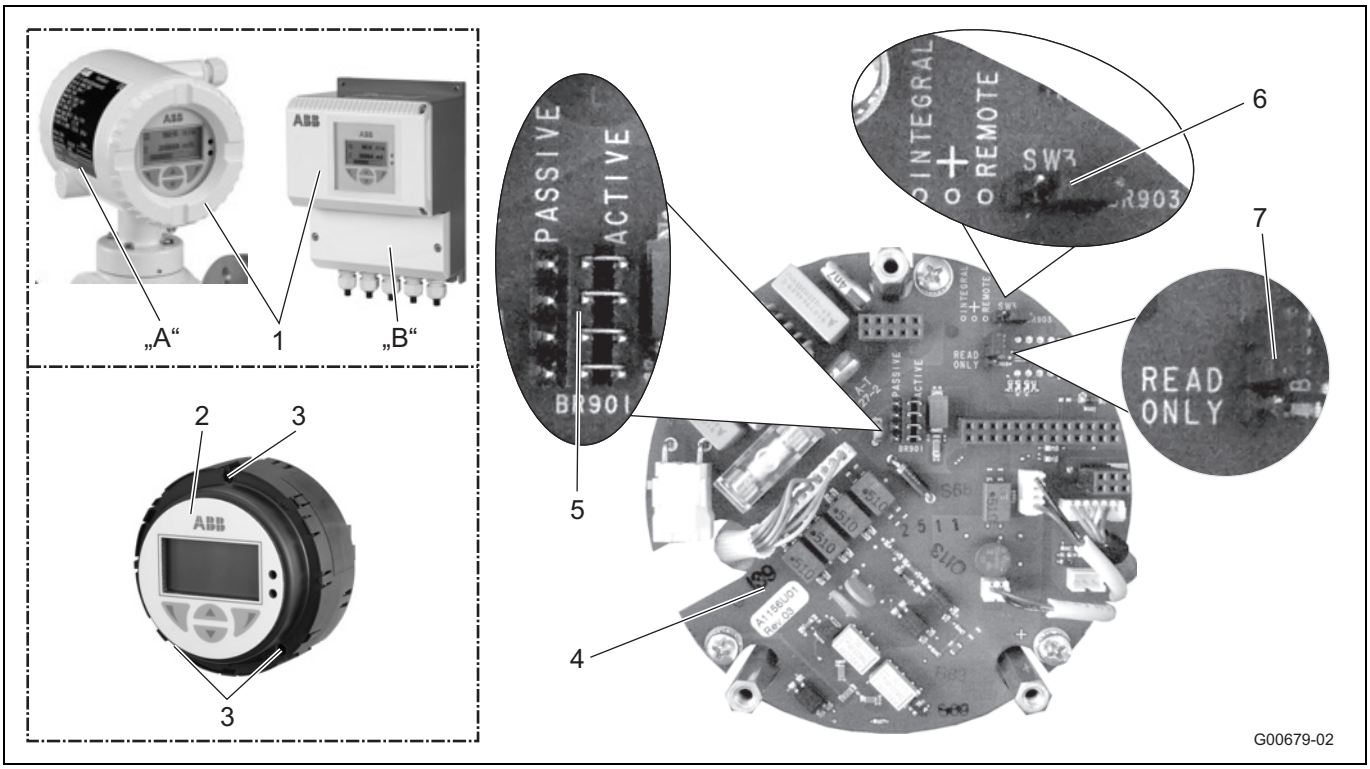


Fig. 50

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

6.4.2 Transmitter with single-compartment housing

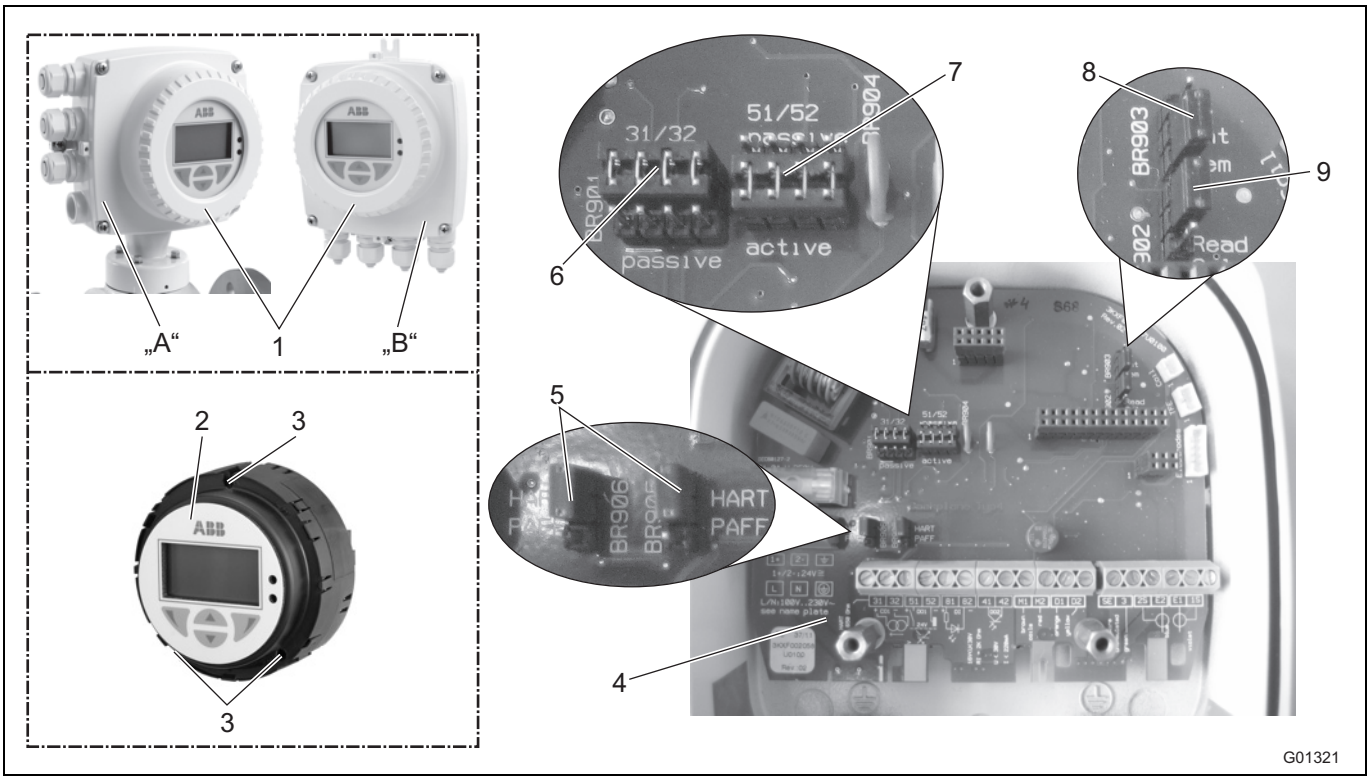


Fig. 51: Jumpers in the single-compartment housing

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.

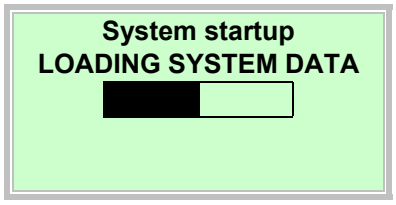
6.5 Commissioning the unit

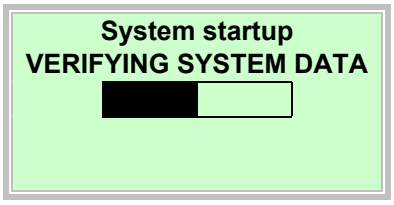
IMPORTANT (NOTE)

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

6.5.1 Downloading the system data

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





2. Download the system data as follows:

For a completely new system or initial startup

- 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

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

After replacing the sensor

- Use to select "Sensor". 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 the "Parameterization" section in the operating instructions.

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

IMPORTANT (NOTE)

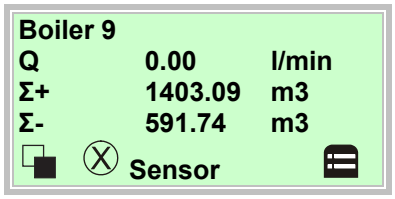
System data must only be loaded during initial startup. If the power supply is later switched off, the transmitter automatically loads all data the next time the power supply is switched on again.
A selection as described below (1-3) is not required.

6.5.1.1 Error message "Incompatible sensor"

IMPORTANT (NOTE)

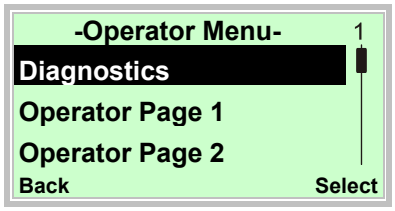
When commissioning the device, make sure that the transmitter is assigned to the sensor correctly. It is not possible to operate a flowmeter sensor of the 300 series with a transmitter of the 500 series.

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

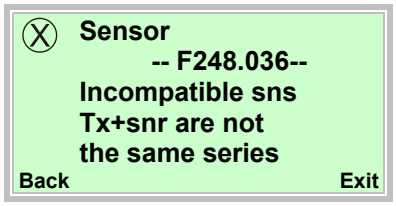


In the process display, a flow of zero flow is indicated, no flow measurement is performed.

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 Parameterization via the "Commissioning" menu function

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

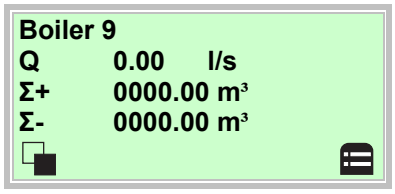
If no customer information is available, the device is delivered with factory settings.

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

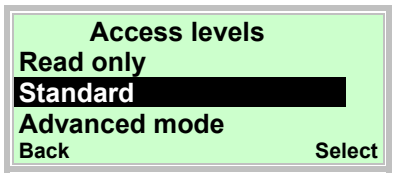
The "Commissioning" menu allows you to select the language, the physical unit for flow rate, the measuring range, the totalizer unit, the pulse / frequency mode, the pulse per unit, the pulse width, damping, and the status of the current output during an alarm (Iout for alarm, Iout: Low Alarm, Iout: High Alarm).

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

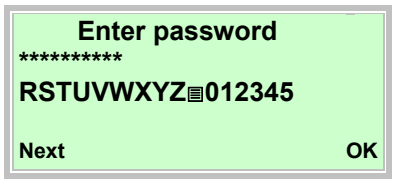
The following section describes parameterization via the "Easy Setup" menu function.



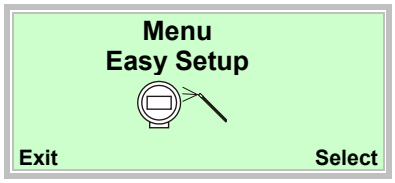
4. Use to switch to the configuration level.



5. Use or to select "Standard".
6. Confirm the selection with .

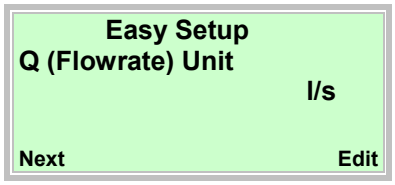


7. Use to confirm the password. A password is not available as factory default; you can continue without entering a password.

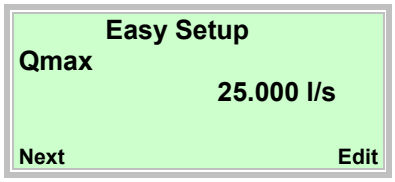


8. Use or to select "Commissioning".
9. Confirm the selection with .

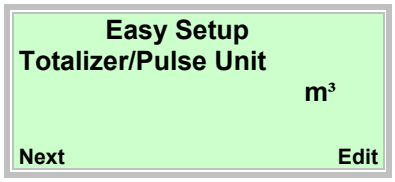
10. Use ▶ to call up the edit mode.
11. Use ▲ or ▼ to select the desired language.
12. Confirm the selection with ▶.



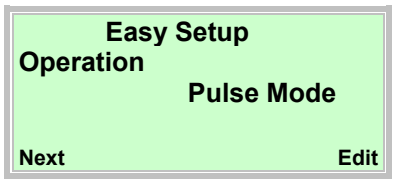
13. Use ▶ to call up the edit mode.
14. Use ▲ or ▼ to select the desired unit.
15. Confirm the selection with ▶.



16. Use ▶ to call up the edit mode.
17. Use ▲ or ▼ to set the desired upper range value.
18. Use ▶ to confirm your setting.



19. Use ▶ to call up the edit mode.
20. Use ▲ or ▼ to select the desired unit.
21. Confirm the selection with ▶.

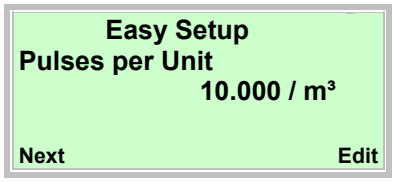


22. Use ▶ to call up the edit mode.
23. Use ▲ or ▼ to select the required operating mode.

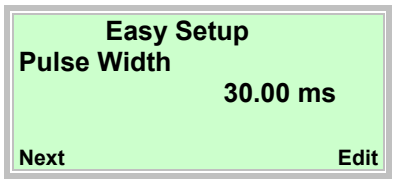
- "Pulse Mode": In pulse mode, pulses per unit are output. The relevant settings are provided in the next menu
- "Fullscale Frequency": In frequency mode, a frequency proportional to the flow rate is output. The maximum frequency can be configured according to the flow measuring range

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

24. Confirm the selection with ▶.



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



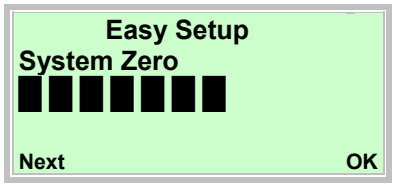
28. Use ▼ to call up the edit mode.
29. Use ▲ or ▼ to set the required pulse width.
30. Use ▼ to confirm your setting.

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

34. Use ▼ to call up the edit mode.
35. Use ▲ or ▼ to select the alarm mode.
36. Confirm the selection with ▼.

37. Use ▼ to call up the edit mode.
38. Use ▲ or ▼ to set the required current for Low Alarm.
39. Confirm the selection with ▼.

40. Use ▼ to call up the edit mode.
41. Use ▲ or ▼ to set the required current for High Alarm.
42. Confirm the selection with ▼.

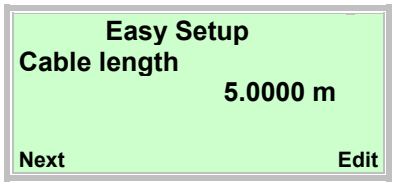


43. Use ◢ to start automatic balancing of the zero point for the system.

IMPORTANT (NOTE)

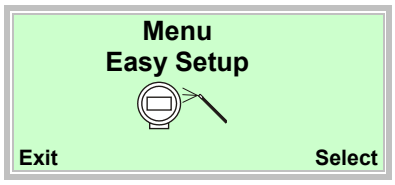
Prior to starting the zero point balancing, make sure that:

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



Enter the signal cable length between the transmitter and the sensor. For devices with an integral mount 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. Confirm the selection with ◢.



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

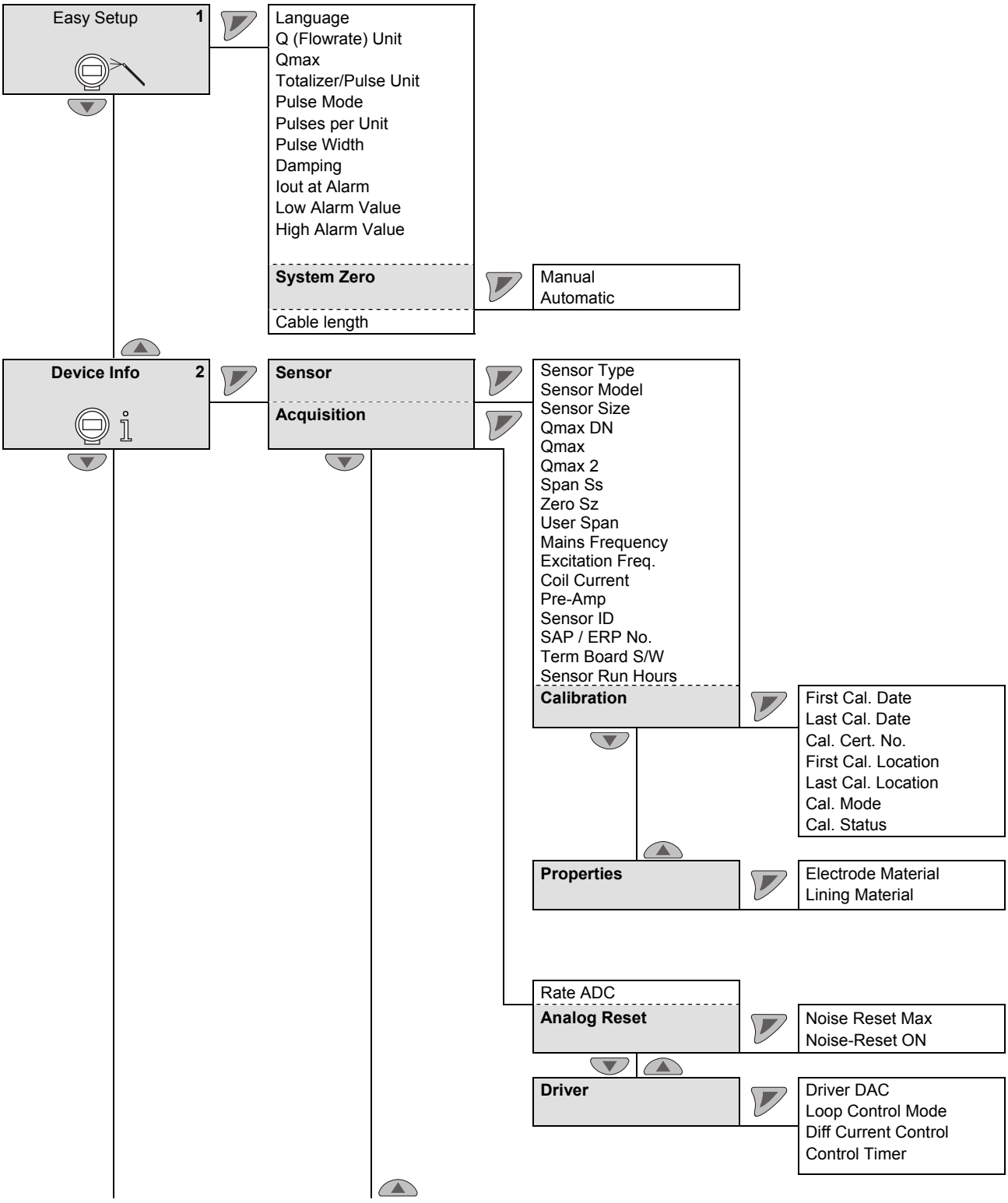
47. Use ◥ to switch to the process display.

IMPORTANT (NOTE)

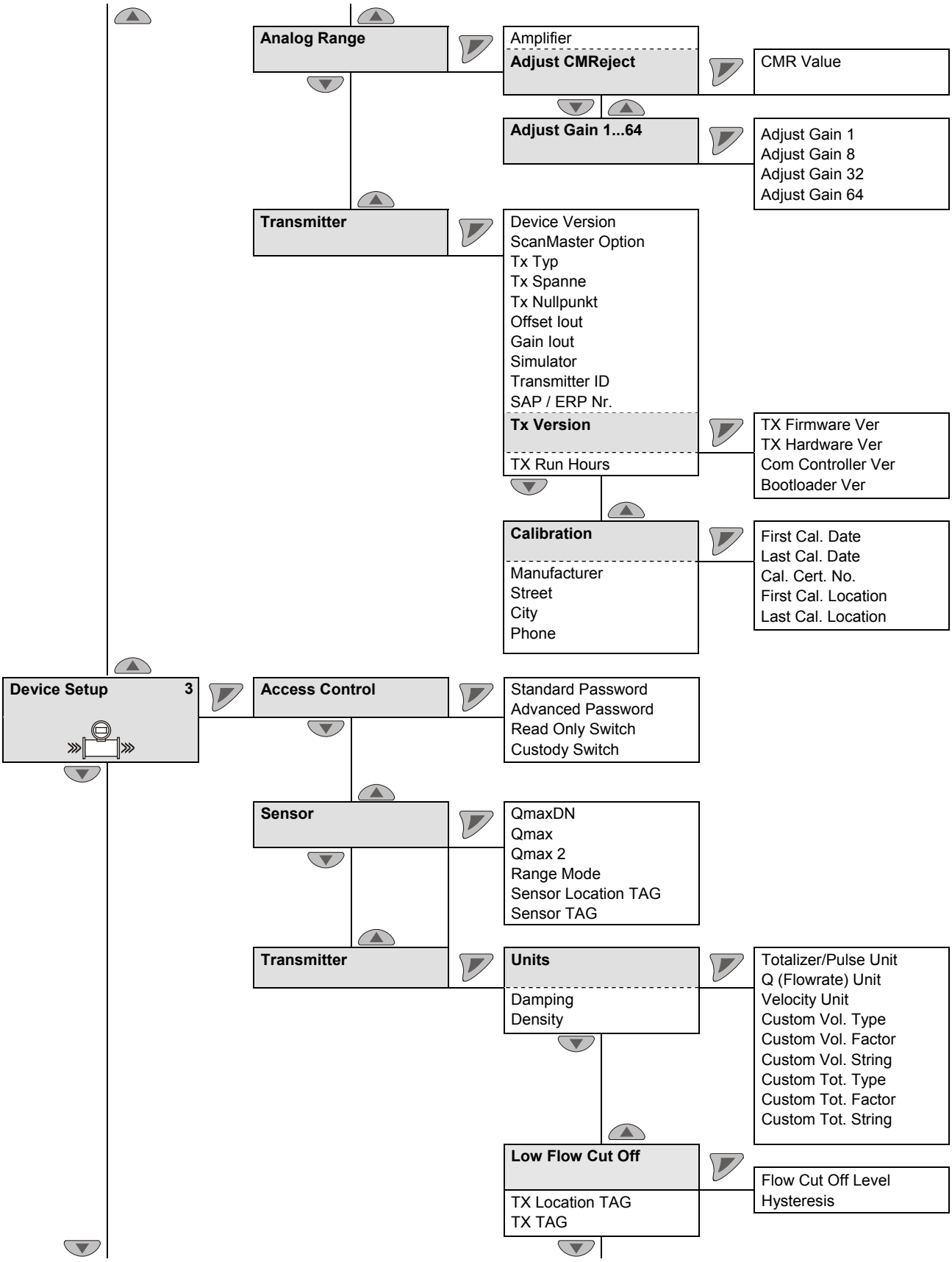
- For additional information regarding operation of the LCD display, refer to chapter "Operation".
- For detailed descriptions of all menus and parameters, see chapter "Parameterization" of the operating instruction.

7 Parameter overview

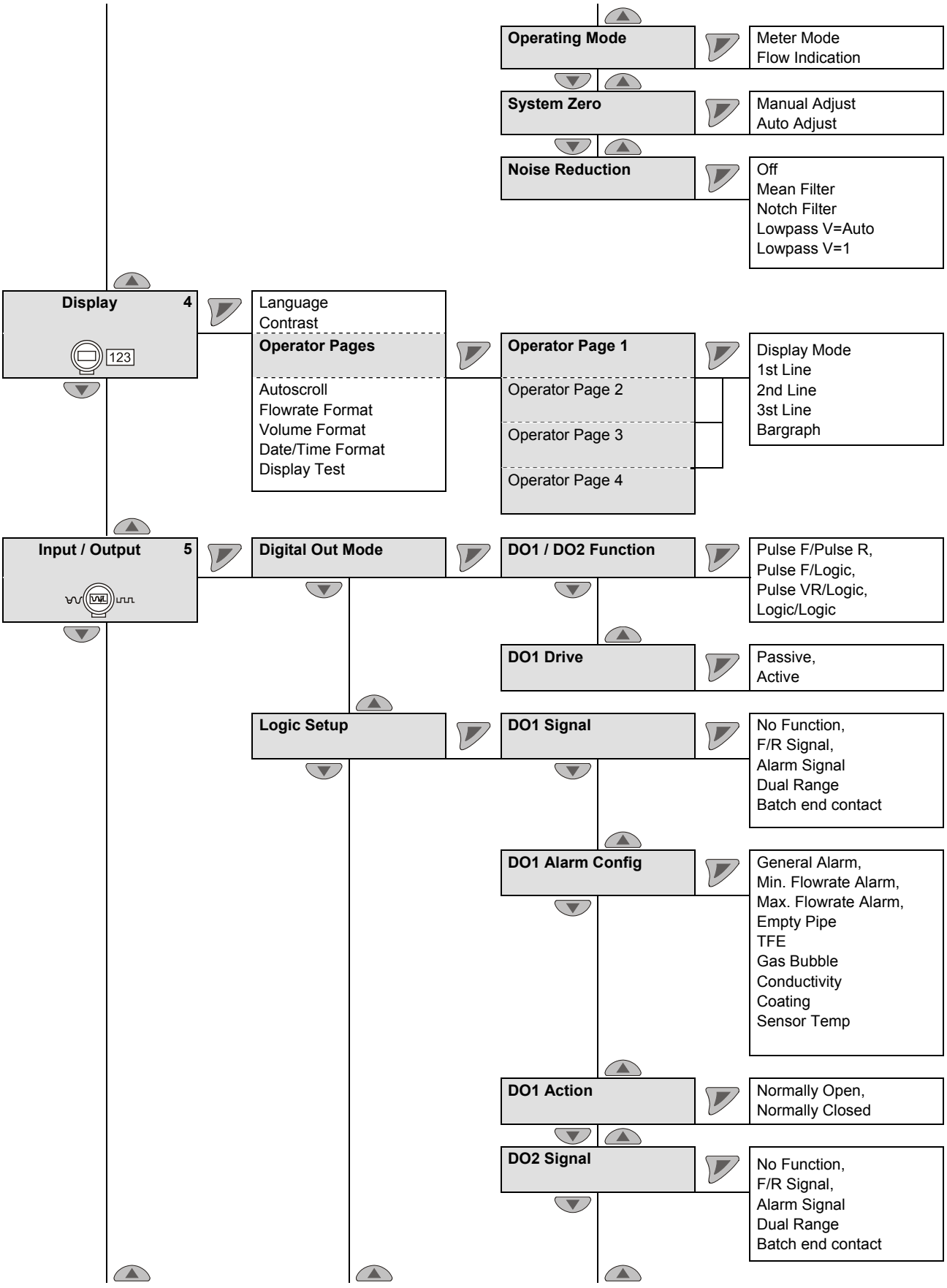
IMPORTANT (NOTE)
This overview of parameters shows all the menus and parameters available on the device. Depending on the version and configuration of the device, not all of the menus and parameters may be visible on it.



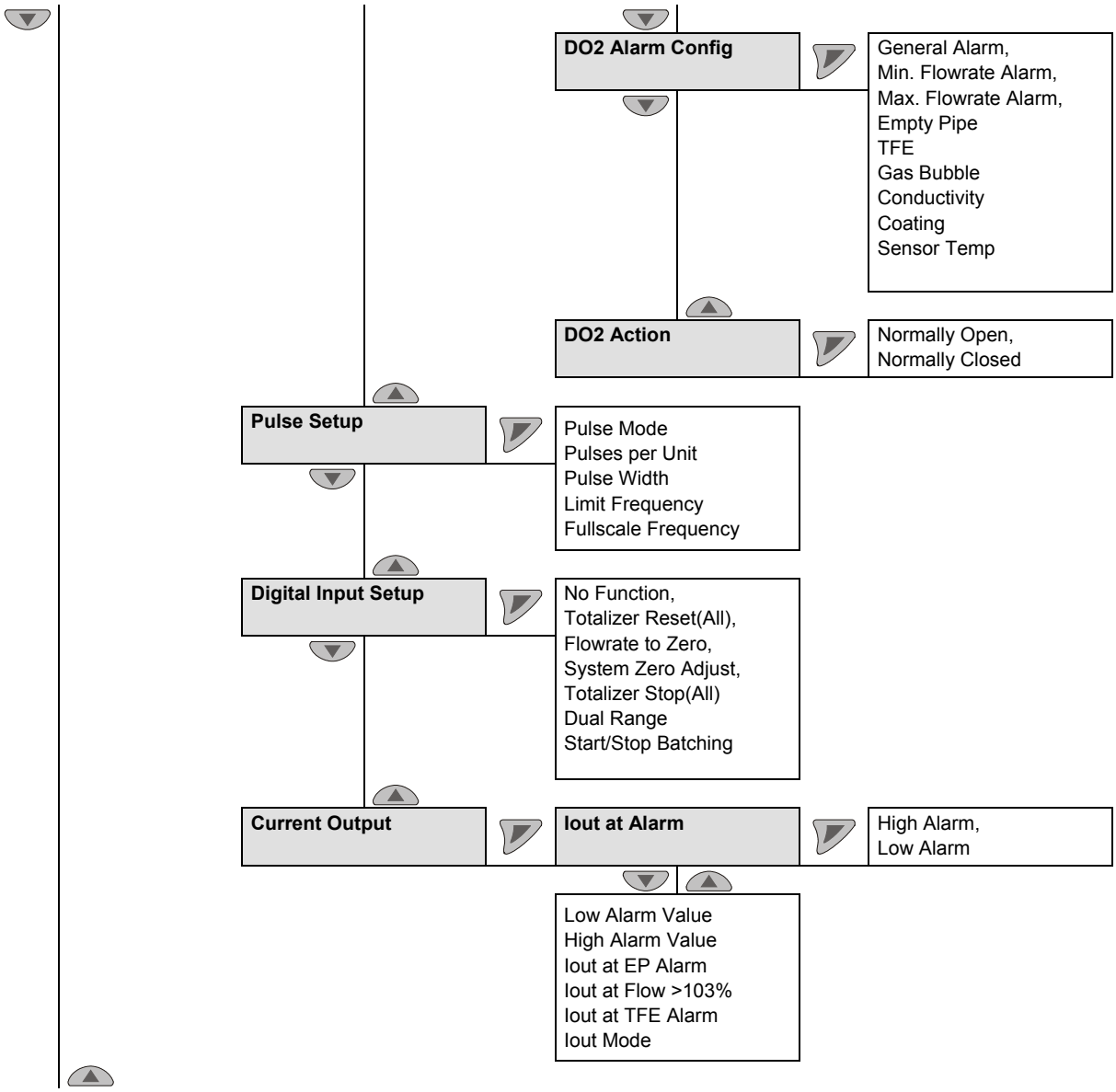
italics = Parameter can only be changed at the "advanced" password level.



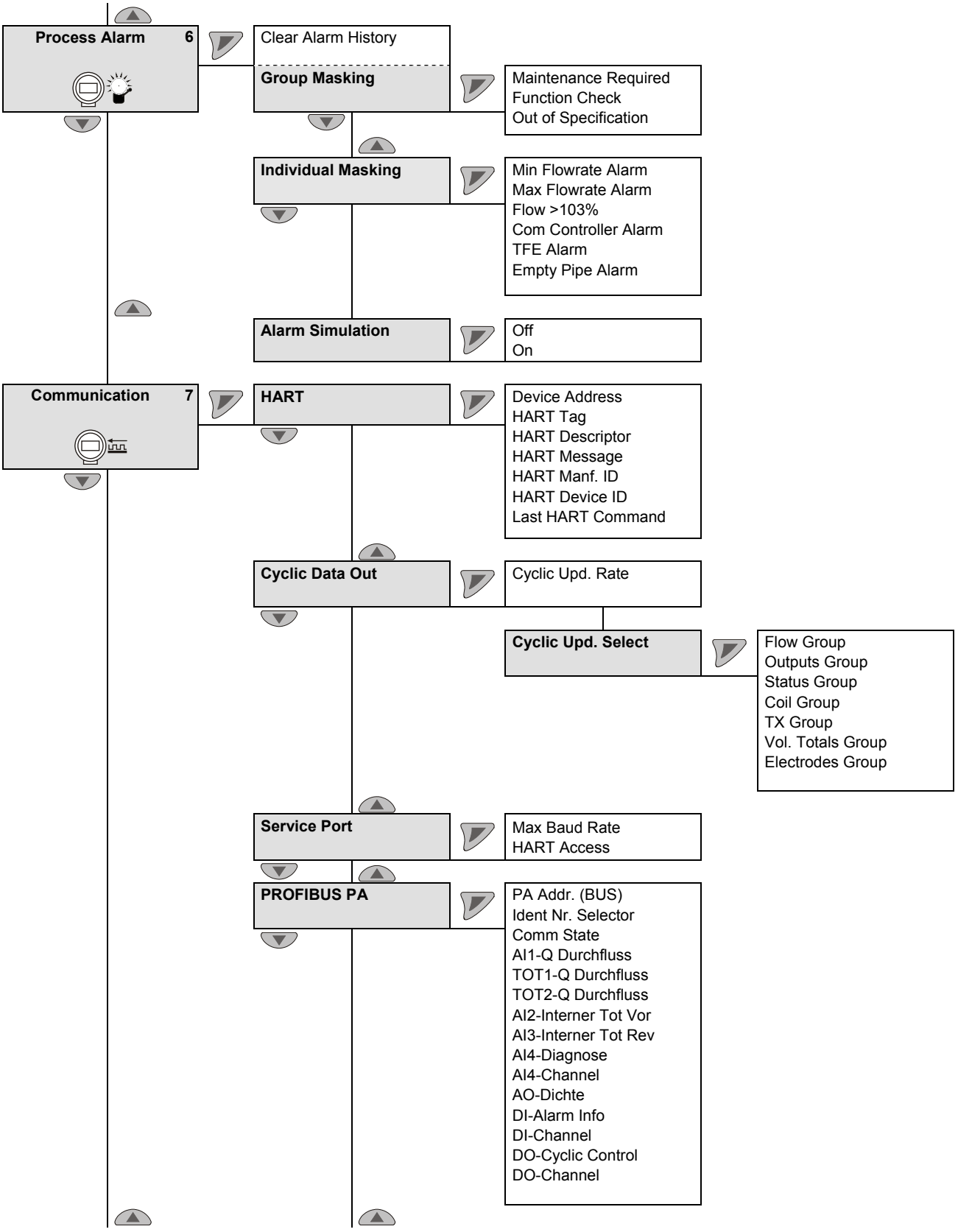
italics = Parameter can only be changed at the "advanced" password level.



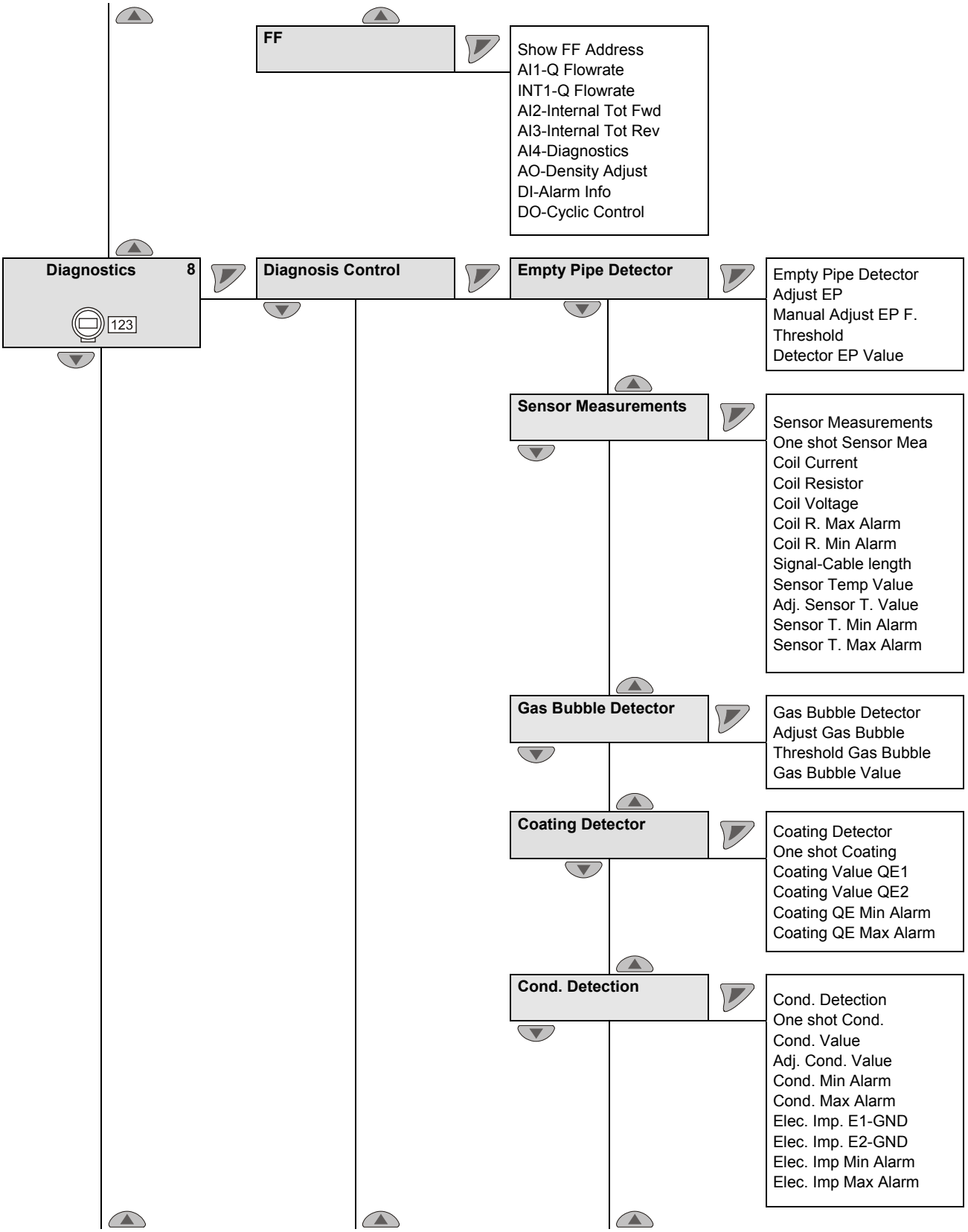
italics = Parameter can only be changed at the "advanced" password level.



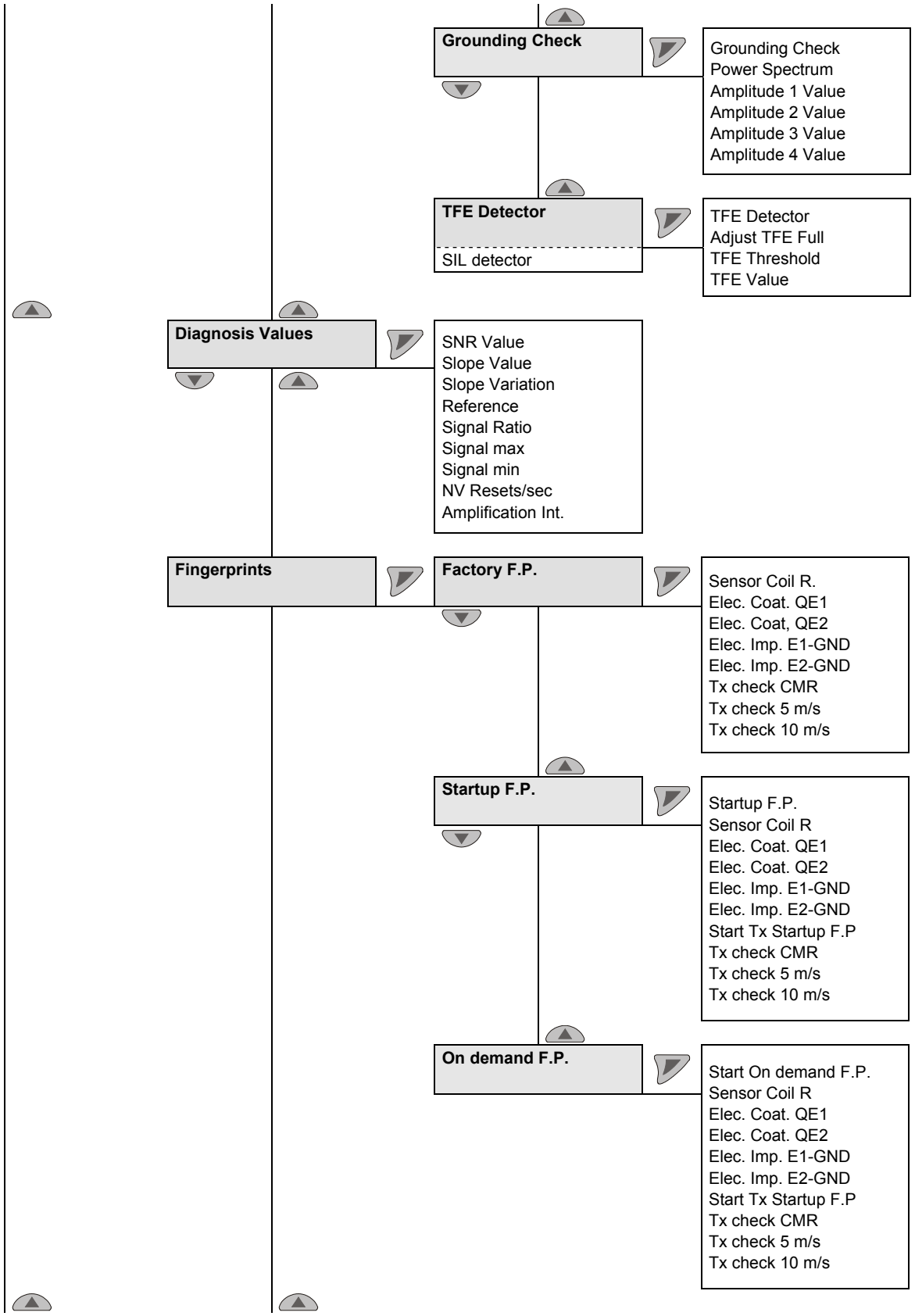
italics = Parameter can only be changed at the "advanced" password level.



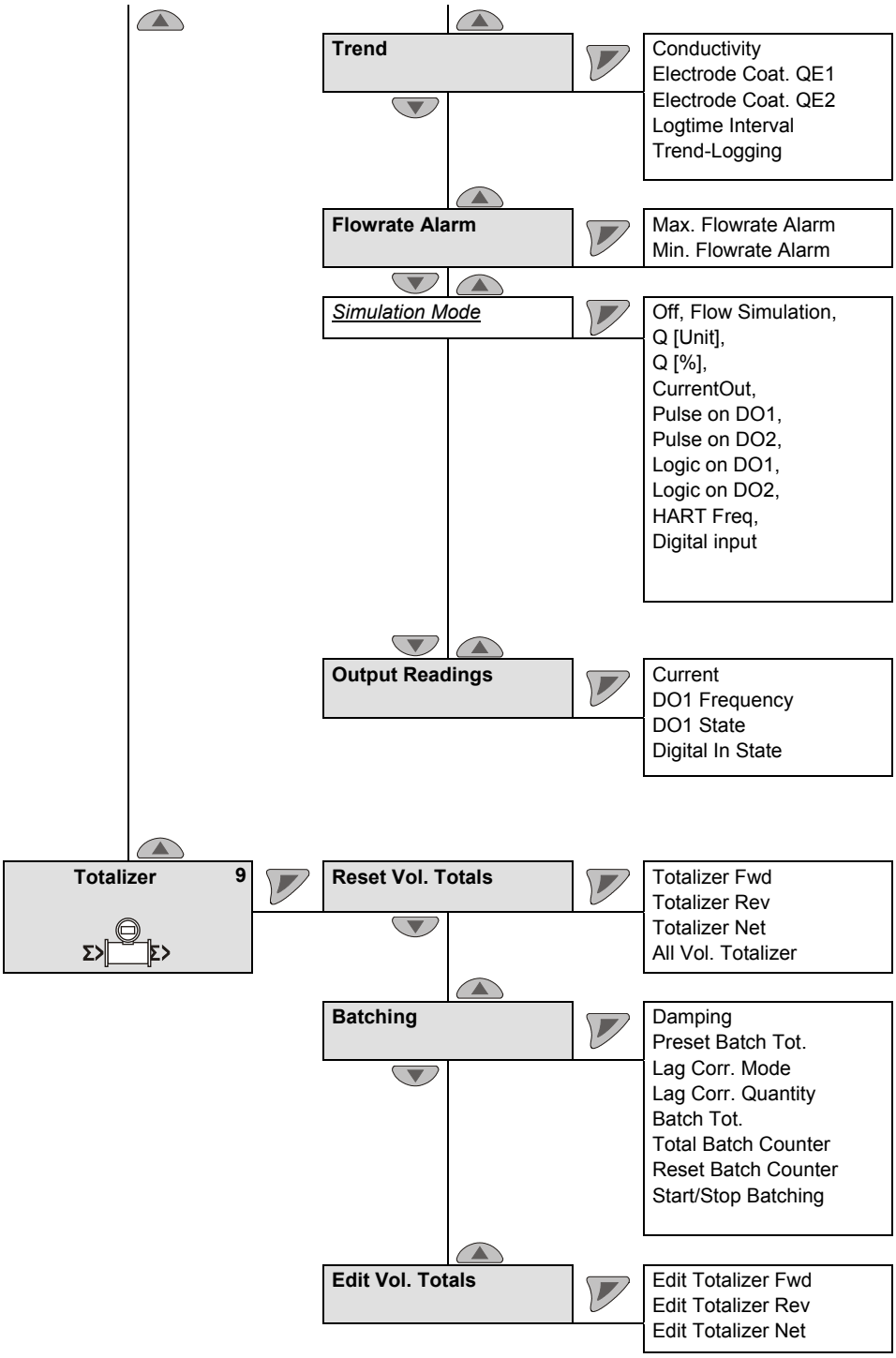
italics = Parameter can only be changed at the "advanced" password level.



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.

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“) with sensor design level B
- Max. signal cable length for version with external transmitter 200 m (656 ft).
- Conductivity of the measuring medium: 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 remote transmitter must not exceed a maximum value of 50 m (164 ft) .
- For this function, the conductivity of the measuring medium 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 remote transmitter must not exceed a maximum value of 50 m (164 ft) .
- For this function, the conductivity of the measuring medium 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 remote transmitter must not exceed a maximum value of 50 m (164 ft) .
- For this function, the conductivity of the measuring medium 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 remote transmitter must not exceed a maximum value of 50 m (164 ft) .
- For this function, the conductivity of the measuring medium 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:

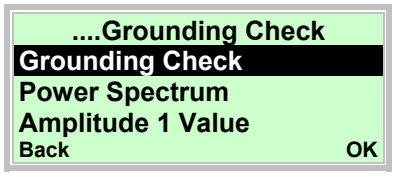
- The flowmeter sensor must not be provided with a preamplifier.

8.2 Performing the earthing check

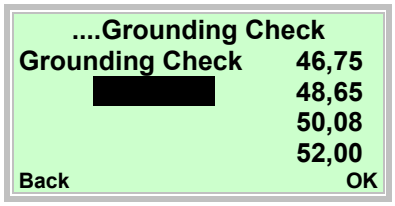
... / Diagnostics / ....Diagnosis Control / **....Grounding Check**[1)]		
Grounding Check		Start the "Grounding Check" function.
Power Spectrum	Read only	Current power spectrum.
Amplitude 1 Value	Read only	Display the four highest amplitudes in the power spectrum.
Amplitude 2 Value	Read only	
Amplitude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

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

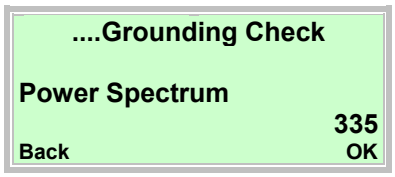
1) Parameter / menu only available for FEP500 / FEH500.



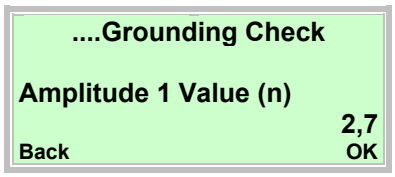
48. Use ▲ or ▼ to select the "Grounding Check" entry.
49. Use ▶ to start the "Grounding Check" function.



Once the earthing 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.



50. Use ▲ or ▼ to select the "Power Spectrum" entry.
51. Use ▶ to display the parameter.



52. Use ▲ or ▼ to select the "Amplitude 1 Value (n)" entry.
53. Use ▶ to display the parameter.

The measured values indicate possible disturbances to the earthing line of the device 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 earthing (!):

- 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 measuring medium temperature T_{medium} and the ambient temperature.

	Parameter	
T_{medium}	R coil min alarm	R coil 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 / Diagnosis Control / Coating Detector" 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 measuring media 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 Appendix

IMPORTANT (NOTE)

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

www.abb.com/flow

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.

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