Operating Instruction
D184B140U02

Electromagnetic Flowmeter
FSM4000

Valid for software versions C.10 and higher

Model FSM4000-SE41F
FSM4000-SE21
FSM4000-SE21F
FSM4000-S4

HART COMMUNICATION PROTOCOL
PROFIBUS
Fieldbus Foundation

ABB

Electromagnetic Flowmeter
FSM4000

Operating Instruction

D184B140U02

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Original instruction

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1 Safety

1.1 General information and notes for the reader

You must read these instructions carefully prior to installing and commissioning the device.

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

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

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

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

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

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

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

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

1.2 Intended use

This device is intended for the following uses:

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

The following items are included in the intended use:

- Read and follow the instructions in this manual.
- Observe the technical ratings; refer to the section 1.10 „Technical limit values“.
- Use only allowed liquids for measurement; refer to the section 1.11 „Allowed Fluids ”..

1.3 Improper use

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

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

1.4 Target groups and qualifications

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

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

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

1.5 Warranty provisions

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

1.5.1 Safety-/ warning symbols, note symbols

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

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

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

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

WARNING – <Bodily injury>

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

WARNING – <Bodily injury>

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

CAUTION – <Minor injury>

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

ATTENTION – <Property damage>!

The symbol indicates a potentially damaging situation.

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

IMPORTANT (NOTICE)

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

1.5.2 Name Plate / Factory Tag

The factory tag or name plate can be found at the following locations on the unit housing:

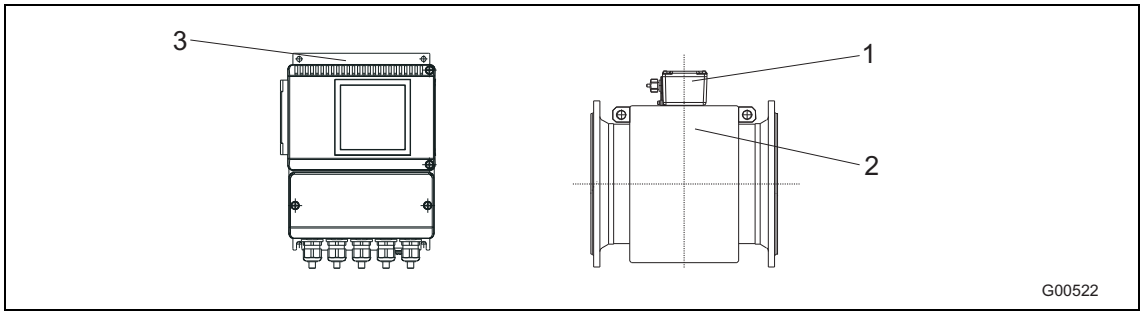


Fig. 1

1 Name plate, flowmeter sensor
2 Factory tag plate, flowmeter sensor
3 Name plate, transmitter

1.5.2.1 Identifying the device design

1. Identifying the model:

   The model number of the flowmeter sensor or transmitter (see nos. 1 or 2 in the description of the name plates) can be found on the name plate. The connection diagram for the respective model is contained in the section “Terminal connection diagrams”. Technical data, material load curves, etc., are organized by model in the section “Technical data”.

2. Identifying the transmitter design:

   The transmitter design can be identified from the name plate on the transmitter housing.

3. Identifying the software version:

   The software version can be displayed when the transmitter is switched on.

1.5.2.2 Name plate

Flowmeter sensor

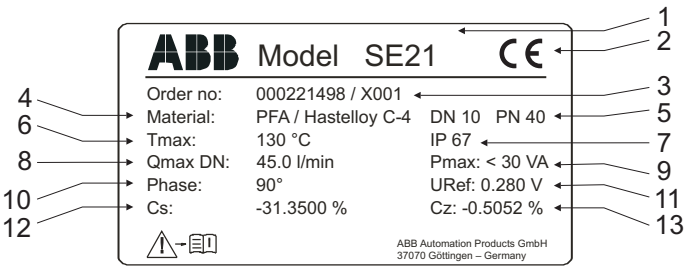


Fig. 2

1 Model no.
2 CE mark (EC conformity)
3 Order no.
4 Measuring tube lining / Electrode material
5 Nominal size / Nominal pressure
6 Max. fluid temperature
7 Protection class of housing
8 Max. flowrate at v = 10 m/s
9 Power consumption
10 Phase relationship between signal and reference voltages
11 Reference voltage
12 Cs calibration factor “span”
13 Cz calibration factor "zero point"

Transmitter

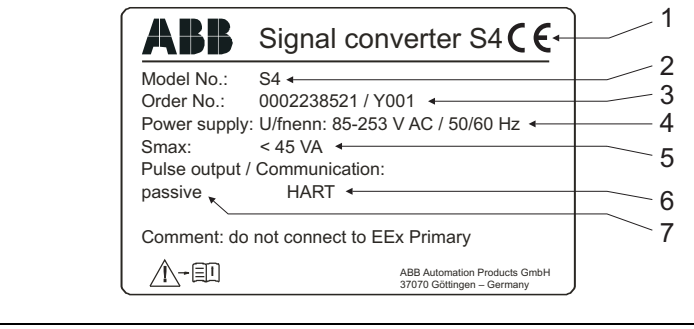


Fig. 3

1 CE mark (EC conformity)
2 Model no.
3 Order no.
4 Power supply - Voltage range / frequency
5 Power for transmitter and flowmeter sensor
6 Version acc. to order with/without HART protocol or PROFIBUS PA or FOUNDATION Fieldbus
7 Version acc. to active (24 V pulse) or passive (optocoupler) (active or passive can be changed onsite)

1.5.2.3 Factory Tag

The factory tag is located on the flowmeter sensor housing. If the pressure equipment is subject to the PED (see section 3 para. 3 PED 2014/68/EU), two labels are required:

Pressure equipment subject to PED

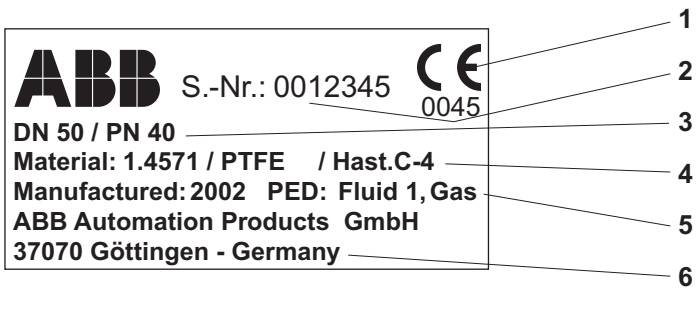


Fig. 4

1 CE mark (with number of labeled location) to confirm the device meets the requirements of pressure equipment directive 2014/68/EU.
2 Serial number for identification of the pressure equipment by the manufacturer.
3 Nominal size and nominal pressure rating of pressure equipment.
4 Flange material, liner material and electrode material (wetted parts).
5 Year of manufacture and specification of fluid group as per the **p**ressure **e**quipment **d**irective (PED). Fluid group 1 = hazardous liquids, gaseous.
6 Manufacturer of the pressure equipment.

Pressure equipment outside the applicable range of the PED

Fig. 5

The factory tag contains most of the specifications included on the plate described above with the following differences:

- There is no CE mark because the pressure equipment, as per section 3 para. 3 of the PED, is outside the applicable range of the pressure equipment directive 2014/68/EU.
- The reason for the exception is specified in section 3 para. 3 of the PED. The pressure equipment is categorized as SEP (= sound engineering practice).

Important

If the factory tag is not present, the device is not in compliance with directive 2014/68/EU. The exception applies for water, power and connected equipment accessories in accordance with guideline 1/16 of sec. 1 para. 3.2 of the pressure equipment directive.

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.

Check the devices for possible damage that may have occurred from improper transport. Damages 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 Electrical installation safety information

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

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

Ground the flowmeter and sensor housing.

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

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

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

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

1.9 Safety instructions for operation

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

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

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

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

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

1.10 Technical limit values

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

The following technical limit values must be observed:

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

1.11 Allowed Fluids

When measuring fluids, the following points must be observed:

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

1.12 Maintenance and inspection safety information

Warning – Risk to persons!

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

Warning – Risk to persons!

The inspection screw (for draining condensate fluid) for devices ≥ DN 350 can be under pressure. The fluid which spurts out can cause severe injuries.
Depressurize pipes before opening the inspection screw.

Corrective maintenance work may only be performed by trained personnel.

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

1.13 Returning devices

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

According to EC guidelines for hazardous materials, the owner of hazardous waste is responsible for its disposal or must observe the following regulations for shipping purposes:

All devices delivered to ABB Automation Products GmbH must be free from any hazardous materials (acids, alkalis, solvents, etc.).

Rinse out and neutralize hazardous materials from all hollow spaces such as between meter tube and housing. For flowmeter sensors with a nominal diameter larger than DN 350, the service screw (for draining condensate fluid) at the lower point of the housing must be opened to dispose of hazardous substances and to neutralize the coil and electrode chamber. These activities must be confirmed in writing using the return form.

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

1.14 Integrated management system

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

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

Environmental awareness is an important part of our company policy.

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

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

1.15 Disposal

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

1.15.1 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 Design and function

2.1 Measuring principle

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

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

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

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

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

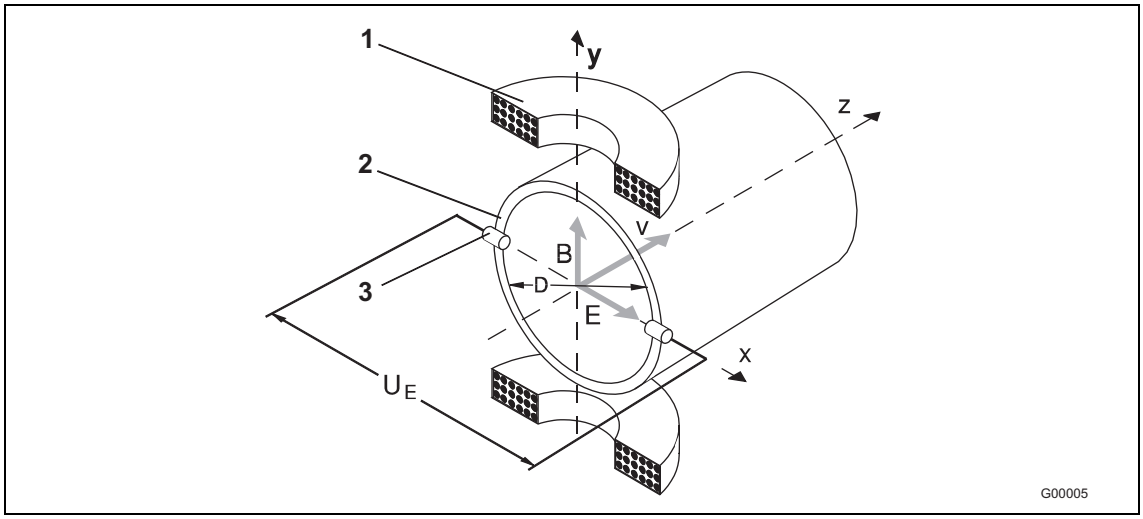


Fig. 6: Electromagnetic flowmeter schematic

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

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

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

$$U_E \sim q_v$$

2.2 Design

An electromagnetic flowmeter system consists of a flowmeter sensor and a transmitter. The flowmeter sensor (model SE41F, SE21W, SE21F, SE21) is installed in the specified pipeline while the transmitter (S4) is mounted locally or at a central location.

2.3 Device designs

The µP transmitter is mounted at a separate location from the flowmeter sensor. Up to 50 m cable length for a minimum conductivity of 20 µS/cm. For flowmeters with preamplifiers, the signal length is increased to 200 m. The electrical connection between the transmitter and the flowmeter sensor is provided by a signal cable and a magnet coil cable in the terminal box.

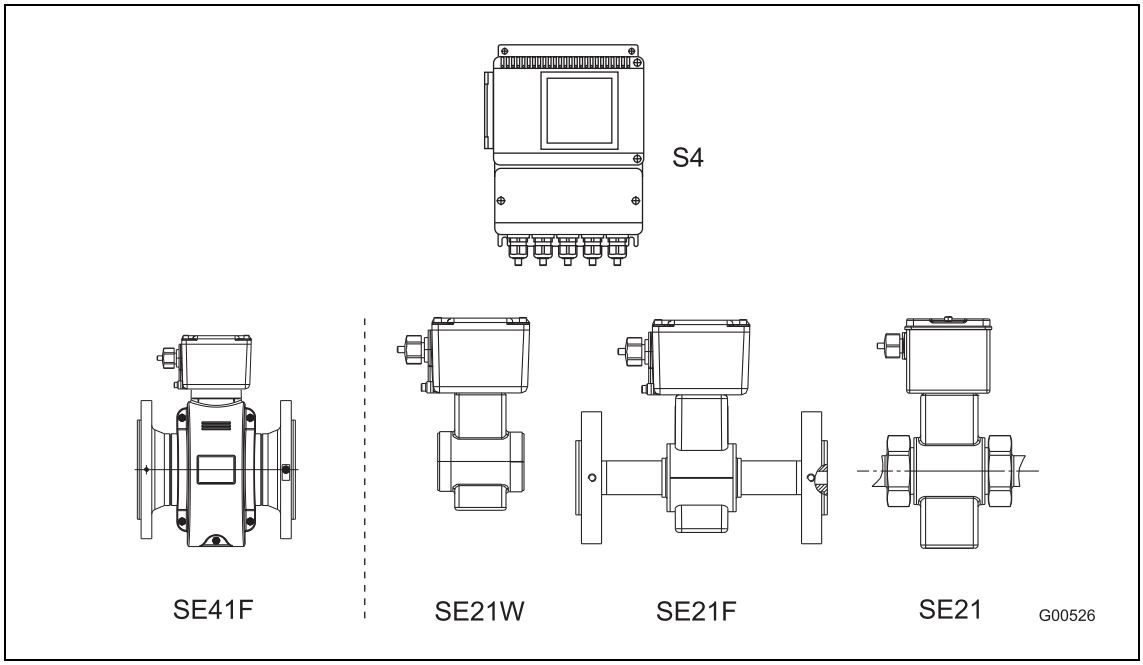


Fig. 7

The transmitter is available in the design:

- Field housing unit model S4

The flowmeter sensor comes with aluminum or stainless steel housing:

- Aluminum housing: Model FSM4000-SE41F
- Stainless steel housing: Model FSM4000 SE21W / SE21F / SE21

Important

Also older model flowmeters sensor can be connected to S4 transmitters. For additional information, see chapter "6.1 Preliminary checks prior to start-up" or "11 Operating S4 with an older sensor".

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 General information on transport

Observe the following when transporting the device to the measurement site:

- The center of gravity may not be in the center of the device.
- The protective plates or dust caps mounted at the process connections of devices equipped with PTFE/PFA may only be removed before installation. To prevent possible leakage, make sure that the liner is not cut or damaged.
- Flanged units may not be lifted by the transmitter housing or terminal box.

3.3 Transport of flanged units up to nominal diameter DN 300

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

Lifting straps must be used to transport flanged units up to a nominal diameter of DN 300. Wrap the straps around both process connections when lifting the meter. Chains should not be used, since these may damage the housing.

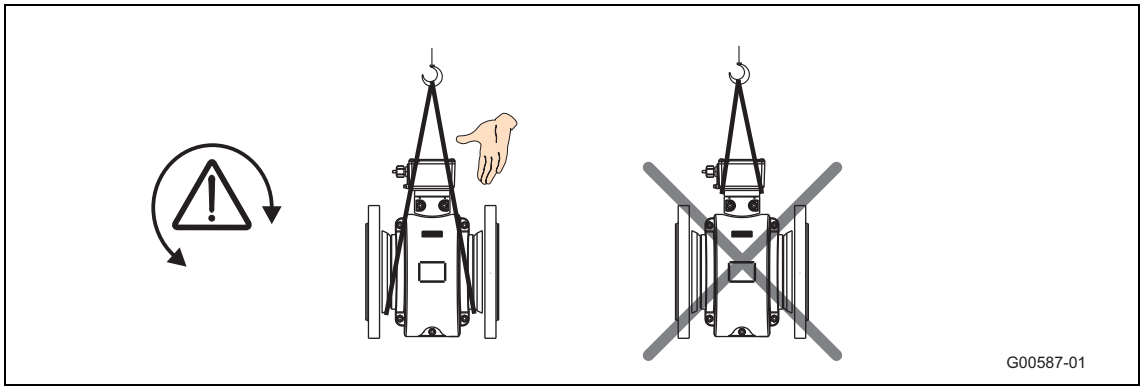


Fig. 8: Transport of flanged units up to nominal diameter DN 300

3.4 Transport of flanged units larger than nominal diameter DN 350

Notice - Potential damage to parts!

Use of a forklift to transport the device can dent the housing and damage the internal magnet coils.
Flanged units must not be lifted by the center of the housing when using a forklift for transport.

Flanged units must not be lifted by the terminal box or by the center of the housing. Only the eyebolts fitted to the meter must be used to lift the meter and set it down in the pipeline.

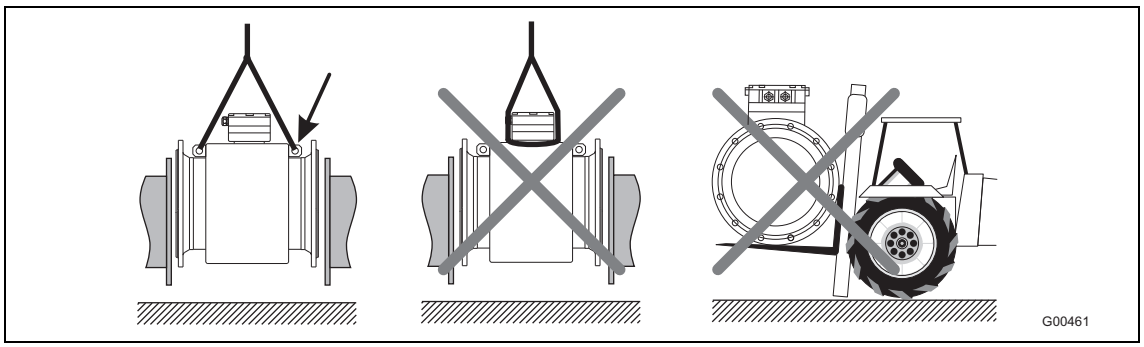


Fig. 9: Transport of flanged units larger than nominal diameter DN 350

4 Mounting

4.1 General information on installation

The following points must be observed for the installation:

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

4.2 Supports for nominal diameters larger than DN 350

Notice - Potential damage to parts!

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 a nominal diameter larger than DN 350 must be mounted with support on a sufficiently strong foundation.

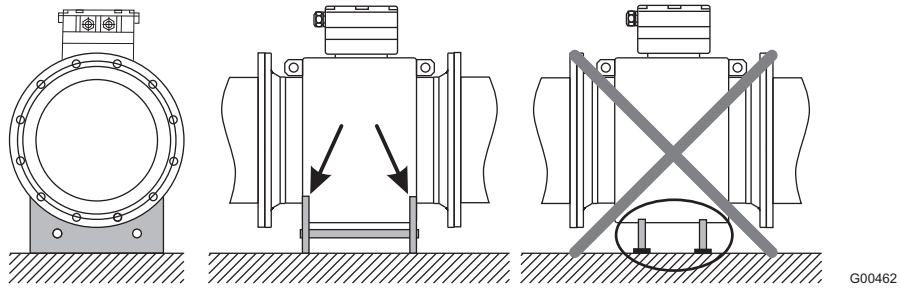


Fig. 10: Support for nominal diameters larger than DN 350

4.3 Mounting the meter tube

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

Warning - Potential damage to device!

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

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

Important

- Ideally, flowmeter sensors with PTFE, PFA, or ETFE linings should be installed without gaskets.
- For best results, make sure the flowmeter sensor gaskets fit concentrically with the meter tube.

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

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

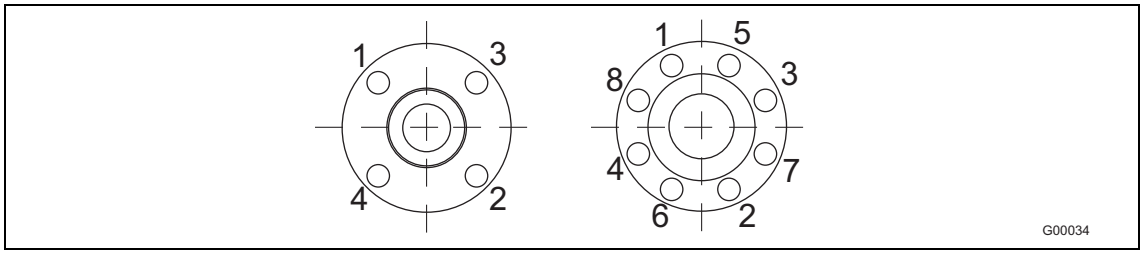


Fig. 11

4.4 Torque information

4.4.1 Flanged units and units with adapter flange, model SE41F / SE21F / SE21W

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

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

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

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

Meter size DN		Nominal pressure	Max. tightening torque [Nm]			
mm	Inch	PN	Hard/soft rubber lining		ETFE lining	
			Steel flange	Stainless steel flange	Steel flange	Stainless steel flange
800	32“	PN10	391.7	304.2	On request	On request
		PN16	646.4	511.8	On request	On request
		PN25	1358	1087	On request	On request
		CL150	410.8	380.9	493.3	380.9
		CL300	2187	On request	On request	On request
900	36“	PN10	387.7	296.3	On request	On request
		PN16	680.8	537.3	On request	On request
		PN25	1399	1119	On request	On request
		CL150	336.2	394.6	511	458.5
		CL300	1972	On request	On request	On request
1000	40“	PN10	541.3	419.2	On request	On request
		PN16	955.5	756.1	On request	On request
		PN25	2006	1612	On request	On request
		CL150	654.2	598.8	650.6	385.1
		CL300	2181	On request	On request	On request

4.4.2 Variable process connections model SE21

Meter size DN		Max. tightening torque
mm	inch	Nm
1 ... 2	1/25 ... 3/32“	PVC/POM: 0,2 Messing/1.4571: 3
3 ... 10	3/8“	8
15	1/2“	10
20	3/4“	21
25	1	31
32	1 1/4“	60
40	1 1/2“	80
50	2	5
65	2 1/2“	5
80	3	15
100	4	14

4.5 Information on 3A conformity

Important

Only process connections which comply with "3A Sanitary Standard 63" may be used.

The device must only be installed vertically with the terminal box or transmitter housing pointing upward. The "bracket mounting (1)" option no longer applies.

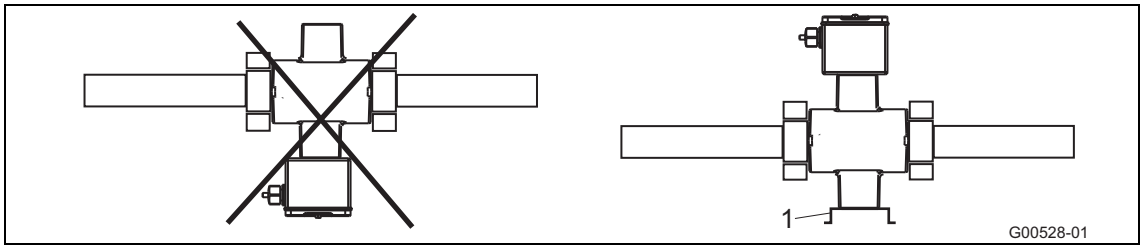


Fig. 12

If concentric reducers are installed on the device, it must be mounted in a vertical position. Refer to the section 4.6.9 "Installation in pipelines with larger nominal diameter".

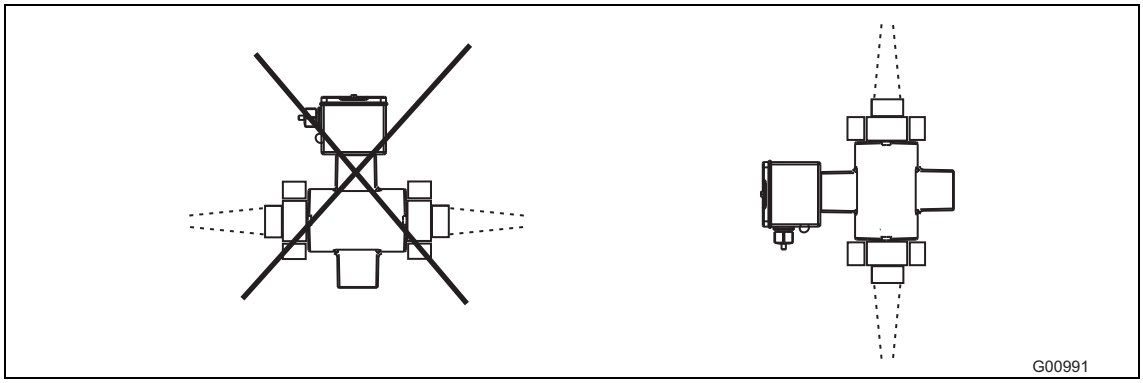


Fig. 13

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

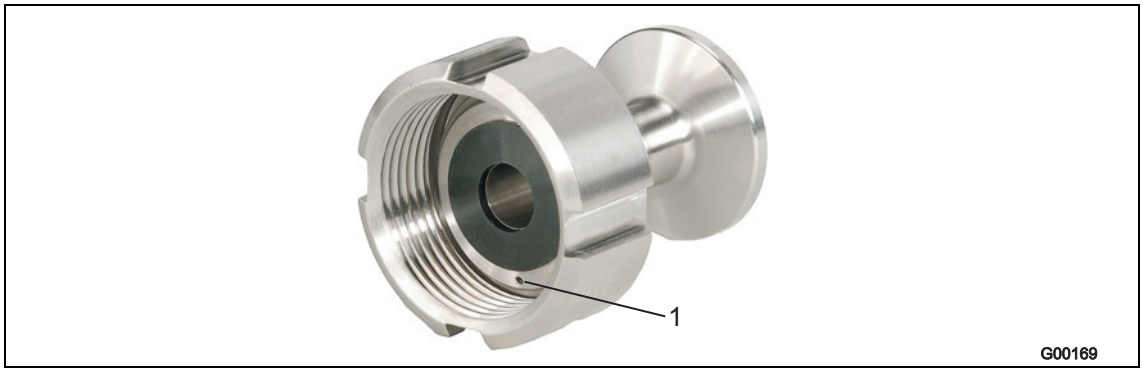


Fig. 14

1 Leakage hole

4.6 Installation Requirements

The device measures the flowrate in both directions. Forward flow is the factory setting, as shown in Fig. 15.

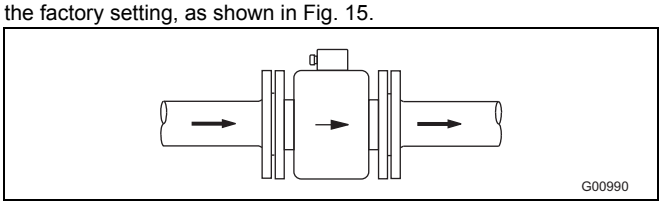


Fig. 15

The following items must be observed:

4.6.1 Electrode axis

Electrode axis (1) as level as possible or rotated max. 45°.

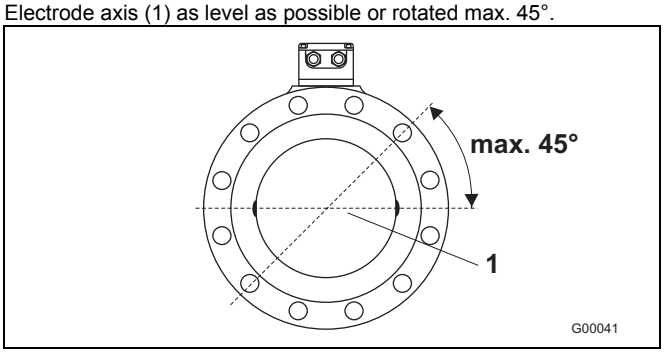


Fig. 16

4.6.2 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. 17).
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.

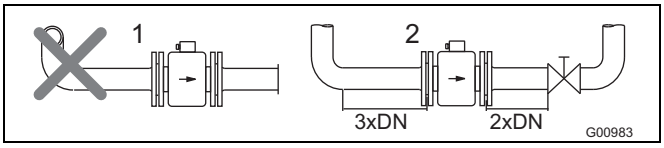


Fig. 17

4.6.3 Vertical connections

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

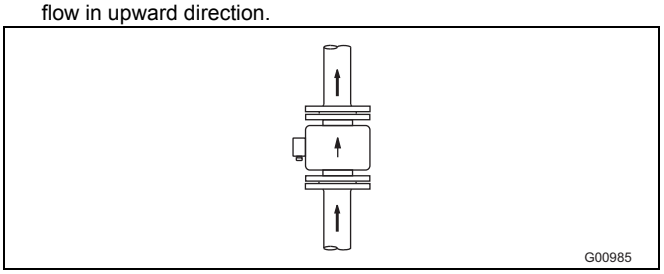


Fig. 18

4.6.4 Horizontal connections

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

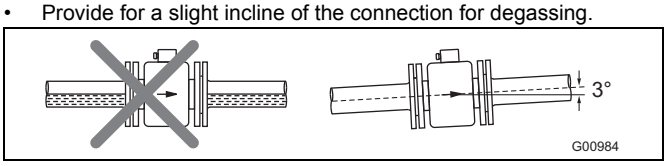


Fig. 19

4.6.5 Free inlet or outlet

- For a free outflow, do not install flowmeter at the highest point in the pipeline, since measuring tube may empty, creating bubbles (1).
- For free inflow/outflow, provide an invert, to ensure that the pipeline is always full (2).

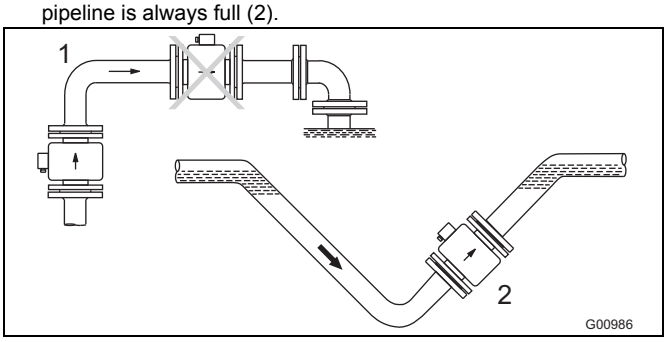


Fig. 20

4.6.6 Strongly contaminated fluids

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

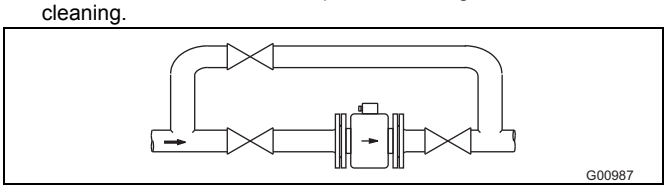


Fig. 21

4.6.7 Installation in the vicinity of pumps

- For flowmeter sensors that are installed near pumps or other vibration-causing fixtures, the use of mechanical vibration control components is mandatory.

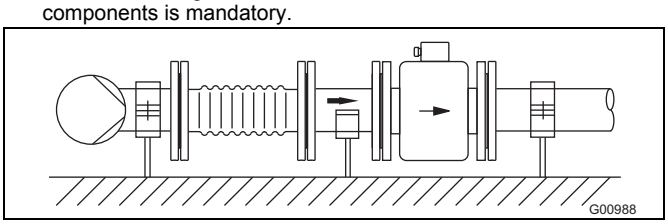


Fig. 22

4.6.8 Installing the high temperature design

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

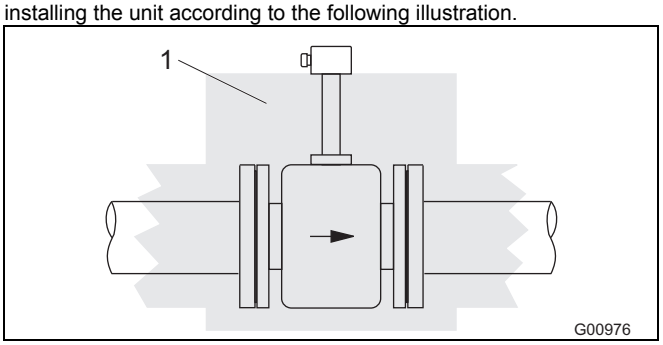


Fig. 23
1 Insulation

4.6.9 Installation in pipelines with larger nominal diameter

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. 25).
3. Read the pressure drop on the Y-axis in Fig. 25.

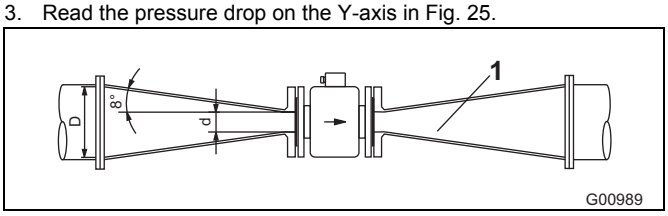


Fig. 24
d Inside diameter of the flowmeter
v Flow velocity [m/s]
Δp Pressure loss [mbar]
D Inside diameter of the pipeline

Nomograph for pressure drop determinations

For adaptor with α/2 = 8°

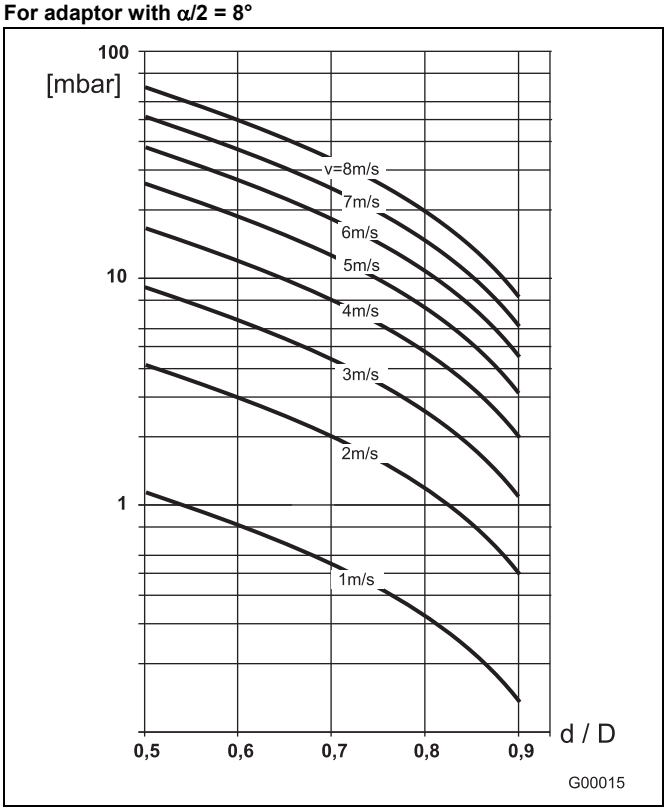


Fig. 25

4.7 Flowmeter Sizes, Pressure Ratings, Flow Range

Meter size DN		Standard pressure rating PN	Min. flow velocity measuring range 0 … 0.5 m/s						Max. flow velocity measuring range 0 … 10 m/s					
1	1/25	10	0 …	0.03	l/min	0.00792	US gal/min		0 …	0.6	l/min	0.158	US gal/min	
1.5	1/16	10	0 …	0.06	l/min	0.0159	US gal/min		0 …	1.2	l/min	0.317	US gal/min	
2	1/12	10	0 …	0.1	l/min	0.0265	US gal/min		0 …	2	l/min	0.529	US gal/min	
3	1/10	40	0 …	0.2	l/min	0.0529	US gal/min		0 …	4	l/min	1.06	US gal/min	
4	5/32	40	0 …	0.4	l/min	0.1	US gal/min		0 …	8	l/min	2.1	US gal/min	
6	1/4	40	0 …	1	l/min	0.3	US gal/min		0 …	20	l/min	5.3	US gal/min	
8	5/16	40	0 …	1.5	l/min	0.4	US gal/min		0 …	30	l/min	7.9	US gal/min	
10	3/8	40	0 …	2.25	l/min	0.6	US gal/min		0 …	45	l/min	12	US gal/min	
15	1/2	40	0 …	5.0	l/min	1.3	US gal/min		0 …	100	l/min	36	US gal/min	
20	3/4	40	0 …	7.5	l/min	2.0	US gal/min		0 …	150	l/min	40	US gal/min	
25	1	40	0 …	10	l/min	2.6	US gal/min		0 …	200	l/min	53	US gal/min	
32	1 1/4	40	0 …	20	l/min	5.3	US gal/min		0 …	400	l/min	106	US gal/min	
40	1 1/2	40	0 …	30	l/min	7.9	US gal/min		0 …	600	l/min	159	US gal/min	
50	2	40	0 …	3	m^3/h	13	US gal/min		0 …	60	m^3/h	264	US gal/min	
65	2 1/2	40	0 …	6	m^3/h	26	US gal/min		0 …	120	m^3/h	528	US gal/min	
80	3	40	0 …	9	m^3/h	40	US gal/min		0 …	180	m^3/h	793	US gal/min	
100	4	16	0 …	12	m^3/h	53	US gal/min		0 …	240	m^3/h	1057	US gal/min	
125	5	16	0 …	21	m^3/h	92	US gal/min		0 …	420	m^3/h	1849	US gal/min	
150	6	16	0 …	30	m^3/h	132	US gal/min		0 …	600	m^3/h	2642	US gal/min	
200	8	10/16	0 …	54	m^3/h	238	US gal/min		0 …	1080	m^3/h	4755	US gal/min	
250	10	10/16	0 …	90	m^3/h	396	US gal/min		0 …	1800	m^3/h	7925	US gal/min	
300	12	10/16	0 …	120	m^3/h	528	US gal/min		0 …	2400	m^3/h	10567	US gal/min	
350	14	10/16	0 …	165	m^3/h	726	US gal/min		0 …	3300	m^3/h	14529	US gal/min	
400	16	10/16	0 …	225	m^3/h	991	US gal/min		0 …	4500	m^3/h	19813	US gal/min	
450	18	10/16	0 …	300	m^3/h	1321	US gal/min		0 …	6000	m^3/h	26417	US gal/min	
500	20	10	0 …	330	m^3/h	1453	US gal/min		0 …	6600	m^3/h	29059	US gal/min	
600	24	10	0 …	480	m^3/h	2113	US gal/min		0 …	9600	m^3/h	30380	US gal/min	
700	28	10	0 …	660	m^3/h	2906	US gal/min		0 …	13200	m^3/h	58118	US gal/min	
800	32	10	0 …	900	m^3/h	3963	US gal/min		0 …	18000	m^3/h	79252	US gal/min	
900	36	10	0 …	1200	m^3/h	5283	US gal/min		0 …	24000	m^3/h	105669	US gal/min	
1000	40	10	0 …	1350	m^3/h	5944	US gal/min		0 …	27000	m^3/h	118877	US gal/min	

4.8 Ground

4.8.1 General information on ground connections

Observe the following items when grounding the device:

- Use the supplied green-yellow cable as a ground wire.
- Connect the ground screw for the flowmeter sensor (on flange and transmitter housing) to the station ground.
- The connection box must also be grounded.
- For plastic pipes or pipes with insulating lining, the ground is provided by the grounding plate or grounding electrodes.
- When stray potentials are present, install a grounding plate at the front and back of the flowmeter sensor.
- For measurement-related reasons, the potentials in the station ground and in the pipeline should be identical.
- An additional ground via the terminals is not required.

Important

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 flowmeter sensor, since the ground electrode will in turn degrade electrochemically. In these special cases, the connection to the ground must be performed using grounding plates.

4.8.2 Metal pipe with fixed flanges

1. Insert M6x12 threads (2) in the flanges for the pipeline and the flowmeter sensor.
2. Secure the ground straps (1) with screw, spring washer, and shim as shown in the figure.
3. Use a copper wire (minimum 2.5 mm² (14 AWG)) to establish a connection between the ground connection of the flowmeter sensor and an appropriate grounding point.

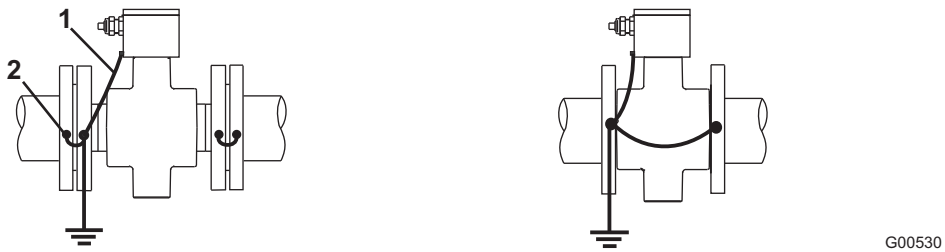
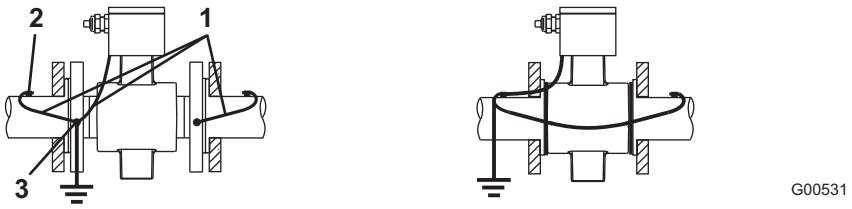


Fig. 26

4.8.3 Metal pipe with loose flanges

1. Solder the threaded nuts (2) M6 to the pipeline.
2. Insert M6x12 threads (3) in the flanges for the flowmeter sensor.
3. Secure the ground straps (1) with nut, spring washer, and shim as shown in the figure, and connect to the flowmeter sensor with ground connection (3).
4. Use a copper wire (minimum 2.5 mm² (14 AWG)) to establish a connection between the ground connection (3) and an appropriate grounding point.



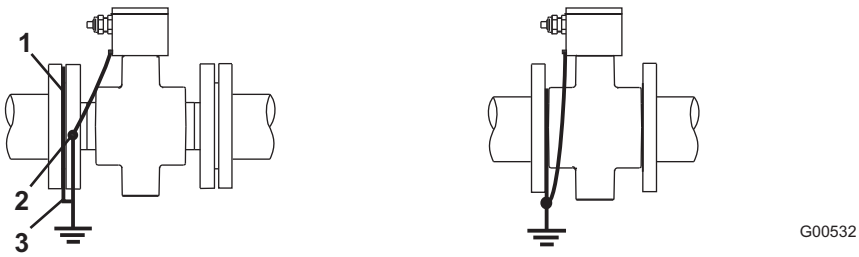
Flange design Wafer design

Fig. 27

4.8.4 Non-metallic pipes or pipes with insulating liner

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

1. Install the flowmeter sensor with grounding plate (1) in the pipeline.
2. Insert M6x12 threads (2) in the flange for the flowmeter sensor.
3. Connect the terminal lug for the grounding plate (3) and the ground connection on the flowmeter sensor (2) with the grounding strap.
4. Use a copper wire (minimum 2.5 mm² (14 AWG)) to establish a connection between the ground connection (2) and a good grounding point.



Flange design Wafer design

Fig. 28

4.8.5 Flowmeter sensor in stainless steel design model SE21

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

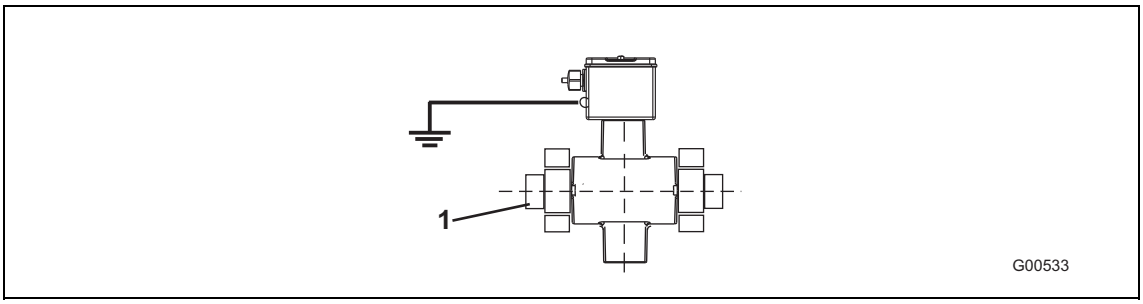


Fig. 29

4.8.6 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.

4.8.7 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 Preparing and routing the signal and magnet coil cable

Cut to length and terminate both cables as shown.

Important
Use wire end sleeves.

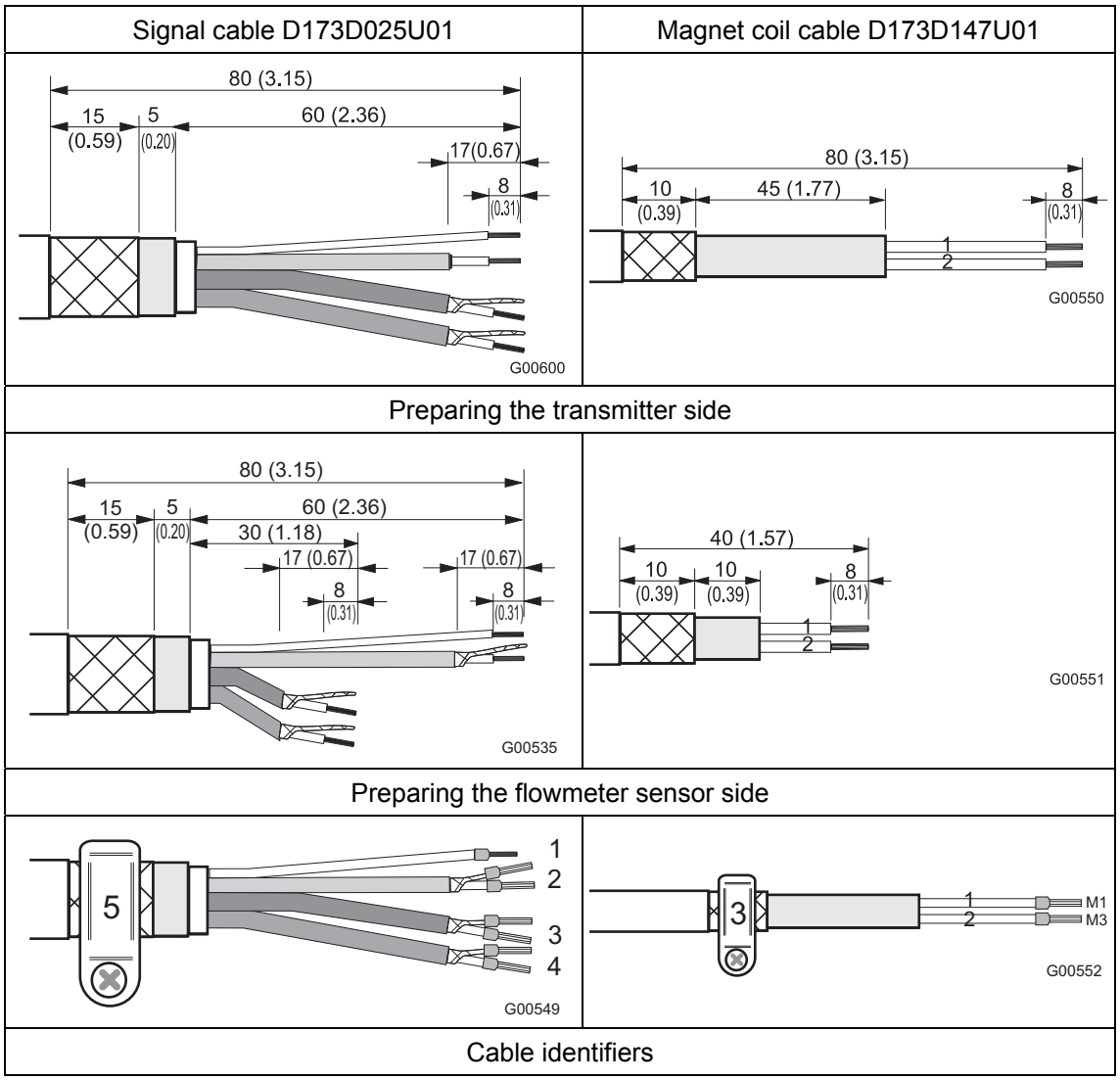


Fig. 30: Dimensions in mm (inch)

1 Measurement potential, yellow
2 Reference, white
3 Signal cable, red
4 Signal cable, blue
5 SE clamp

1 Magnet coil, black
2 Magnet coil, black
3 SE clamp

Important
The shields may not touch (signal short circuit).

Observe the following items when routing cables:

- The signal and magnet coil cable carries a voltage signal of only a few millivolts and therefore must be routed the shortest distance possible. The maximum permissible signal cable length is 50 m or 200 m, if the flowmeter sensor is equipped with a preamplifier.
- 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 station ground.
- Do not run the signal cable and the magnet coil cable over junction boxes or terminal blocks.
- To shield against magnetic interspersion, the cable contains outer shielding that is attached to the SE clamp.
- Make sure during installation that the cable is provided with a water trap (1). For vertical installation, align the cable glands pointing downward.

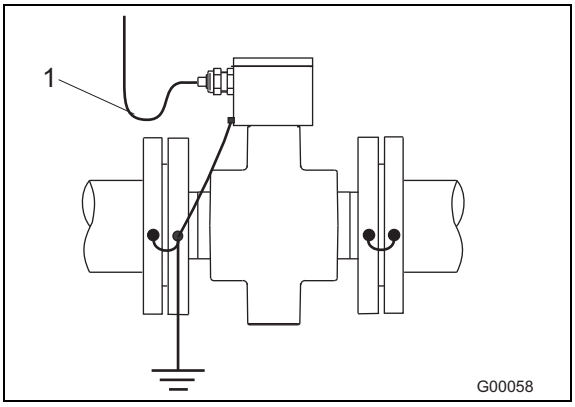
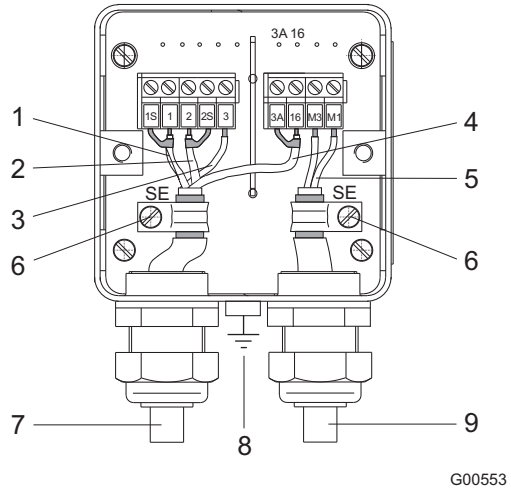


Fig. 31

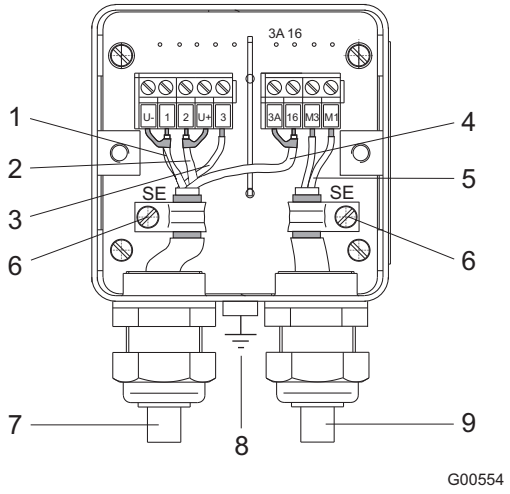
5.2 Connecting the flowmeter sensor

5.2.1 Connecting the signal and magnet coil cables

The flowmeter sensor is connected to the transmitter via the signal / magnet coil cables (part no. D173D025U01 / D173D147U01). The coils of the flowmeter sensor are supplied with a field voltage by the transmitter over terminals M1/M3. Connect the cables to the flowmeter sensor according to the following drawing, using a screwdriver with proper size and width.



Terminal box without preamplifier



Terminal box with preamplifier

Fig. 32

1 red
2 blue
3 yellow
4 white
5 black
6 SE clamp
7 Signal cable
8 Grounding screw
9 Magnet coil cable

1 red
2 blue
3 yellow
4 white
5 black
6 SE clamp
7 Signal cable
8 Grounding screw
9 Magnet coil cable

Terminal designation	Connection
1 + 2	Wires for the measuring signal
1S, 2S	Shielding for signal wires
U+, U-	Power supply for preamplifier via signal cable shielding
16	Cable for reference signal
3A	Shielding for reference signal cable
3	Measuring ground (yellow)
M1 + M3	Connections for magnetic field excitation (black)
SE	Outer cable shield

5.2.2 Protection class IP 68

For flowmeter sensors with IP 68 degree of protection, the maximum flooding height is 5 m (16.4 ft). The supplied cable (signal cable part no. D173D025U01 / magnet coil cable part no.: D173D147U01) fulfill the submersion requirements.

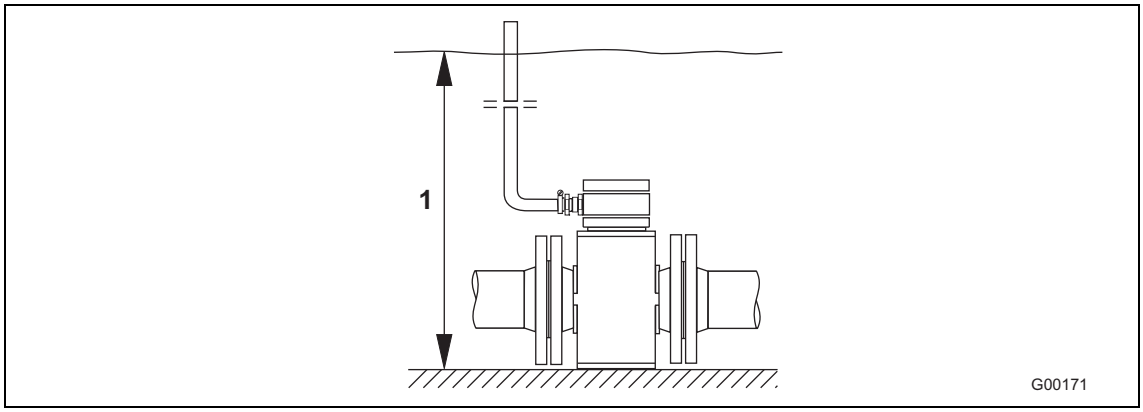


Fig. 33

1 Max. flooding height 5 m (16,4 ft)

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

5.2.2.1 Connection

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

Warning - Potentially adverse effect on IP 68 protection class

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

Important

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

5.2.2.2 Sealing the connection box

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

Observe the following instructions during work activity:

Warning - General risks!

The sealing compound is toxic. Observe all relevant safety measures.
Risk notes: R20, R36/37/38, R42/43
Harmful by inhalation. Avoid direct skin contact. Irritating to eyes.
Safety advice: P4, S23-A, S24/25, S26, S37, S38
Wear suitable protective gloves and ensure sufficient ventilation.

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

Preparation

- Complete the installation before beginning sealing activities in order avoid moisture penetration. Before starting, check all the connections for correct fitting and stability.
- Do not overfill the terminal box. Keep the sealing compound away from the O-ring and the seal/groove (see Fig. 34).
- Prevent the sealing compound from penetrating a thermowell if an NPT ½" thread is used.

Procedure

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

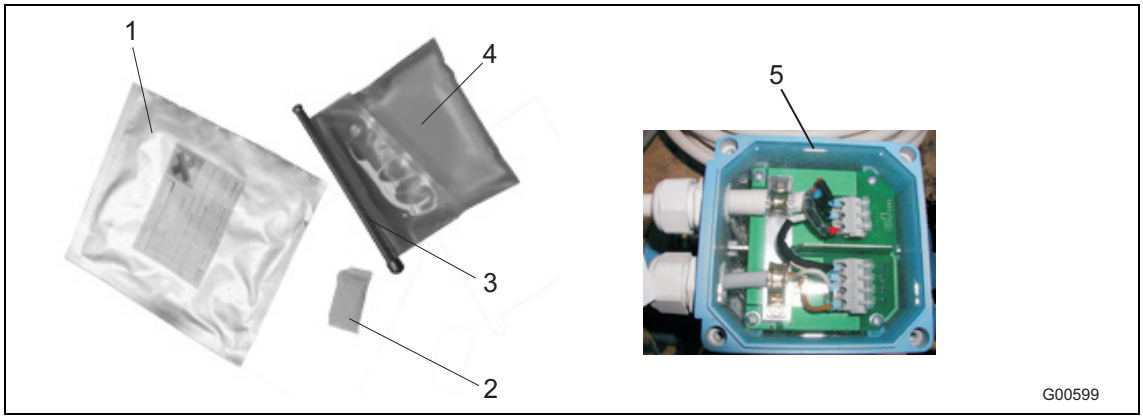


Fig. 34

1 Packaging bag
2 Drying bag
3 Clamp
4 Sealing compound
5 Filling height

5.3 Connecting the transmitter

5.3.1 Supply power connection

The line voltage and power consumption are indicated on the name plate for the transmitter. The wire cross-section for the supply power must meet the requirements for the main fuse (VDE 0100). The power consumption is ≤ 45 VA (flowmeter sensor, including transmitter).

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

Important

Please observe the limit values of the supply power (see "Technical Data"). Please note that there is a voltage drop of the 24 V AC/DC supply power line if the cables are extremely long or if the conductor cross section is extremely small.
The pin configuration must be as specified in the connection diagrams in Section 5.4 "Terminal connection diagrams".

5.3.2 Connecting the signal and magnet coil cables

The outer shielding of the magnet coil cable is attached to the busbar via the 6 mm clip (from the accessory bag in the connection area). The outer shielding of the signal is routed in a similar manner. Use the 7 mm clip (from the accessory bag in the connection area). The shielding for the signal wires function as a driven shield to transmit the measurement signal. The signal-reference voltage cable is attached to the flowmeter sensor and transmitter according to the connection diagram.

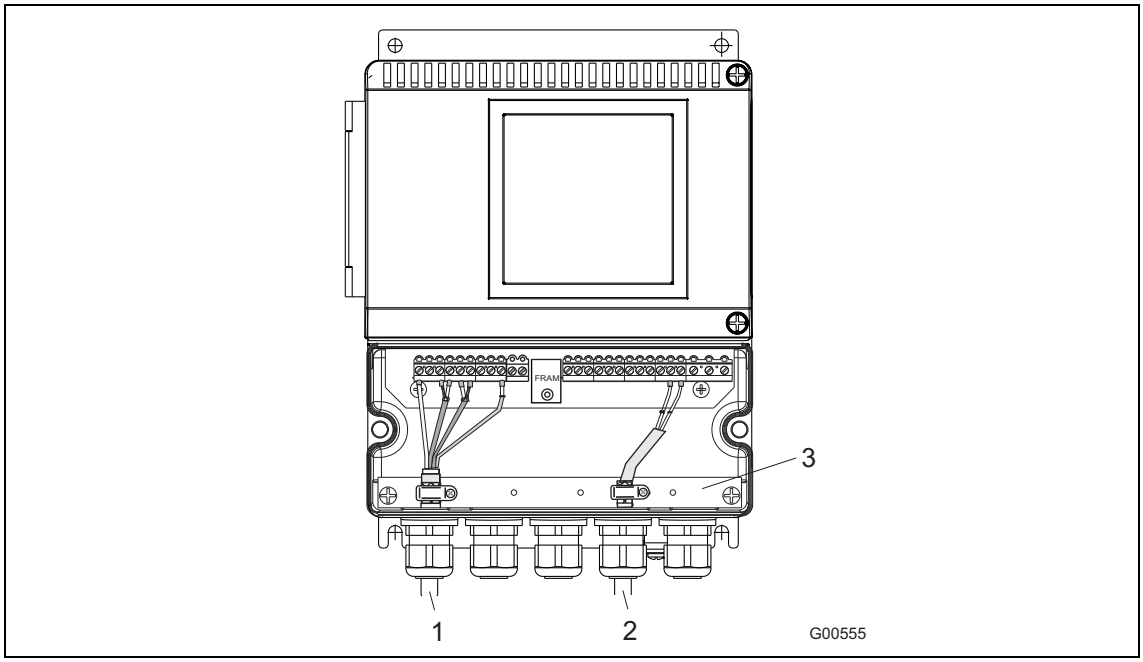


Fig. 35

1 Signal cable
2 Magnet coil cable
3 Busbar (SE)

Important

The power supply of the FSM4000 with preamplifier is connected via -U and +U, instead of 1S and 2S. If the flow indicator shows the incorrect direction after successful startup of the meter, e.g., reverse instead of forward, correct this in the Operating Mode submenu of the transmitter.
First switch off the Programming Protection ("Prog. Level" → "Specialist"). Then select the parameter "Flow indication" and change "Standard" to "inverse". Finally, activate Programming Protection via "Prog. Level" → "Locked").

Important

If the flowmeter sensor for older model meters (10D1422, 10DI1425, 10DS3111, DS4_, DS2_, 10D1462/72) is not yet equipped with the SE clamp, the outer shielding is connected to one side of the transmitter only. Use the 12 mm clip (from the accessory bag), if necessary (e.g., 10D1422).

5.4 Terminal connection diagrams

Standard DN 10 ... DN 1000 (3/8 ... 40")

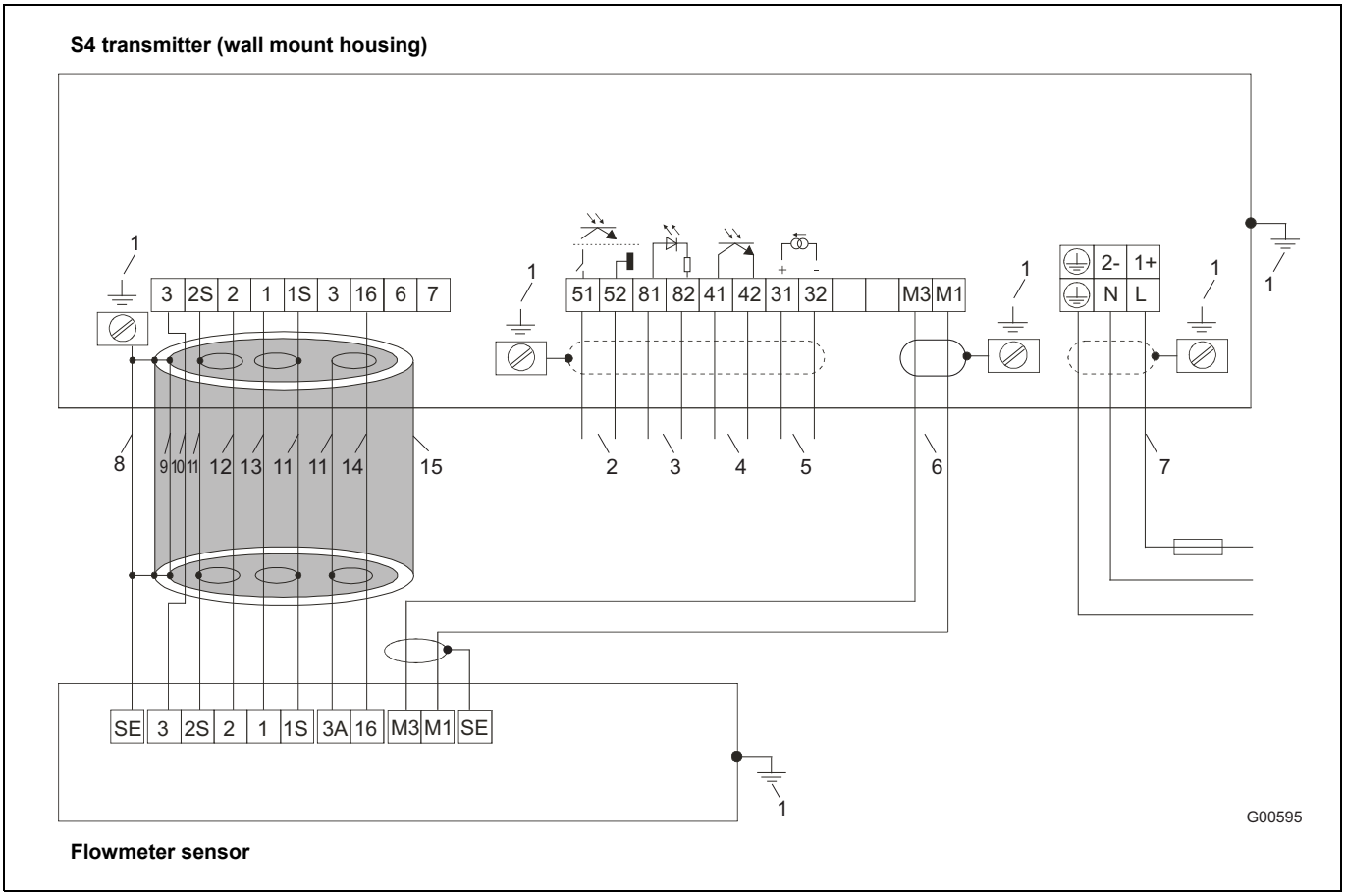


Fig. 36: Connection diagram: Flowmeter sensor standard DN 10 ... DN 1000 (3/8 ... 40")

1 Functional ground (busbar)
2 Pulse output[1)]
3 Contact input[1)]
4 Contact output[1)]
5 Current output[1)]
6 Magnet coil cable:
shielded 2 x 1 mm^2 CE Typ 227 TEC 74
ABB order no. D173D147U01, 10 m included in shipment, standard
7 Supply power
Low voltage: 100 ... 230 V AC, terminals L, N, ⏚
Low voltage: 20.4 ...26.4 V AC;
20.4 ... 31.2 V DC
Terminals 1+, 2-, ⏚
Frequency: 47 Hz ≤ f ≤ 53 Hz; 50 Hz supply power
56 Hz ≤ f ≤ 64 Hz; 60 Hz supply power
8 Steel shielding
9 Aluminum foil
10 Yellow
11 Shield
12 Blue
13 Red
14 White
15 Shielded signal cable: ABB order no. D173D025U01, 10 m included in shipment

1) See the section "Connection examples for peripherals" in the operating instructions and/or on the data sheet

Comment:
We recommend that shielded output cables be used with the shields connected to the functional ground at one end.

with preamplifier DN 1 ... DN 1000 (1/25 ... 40")

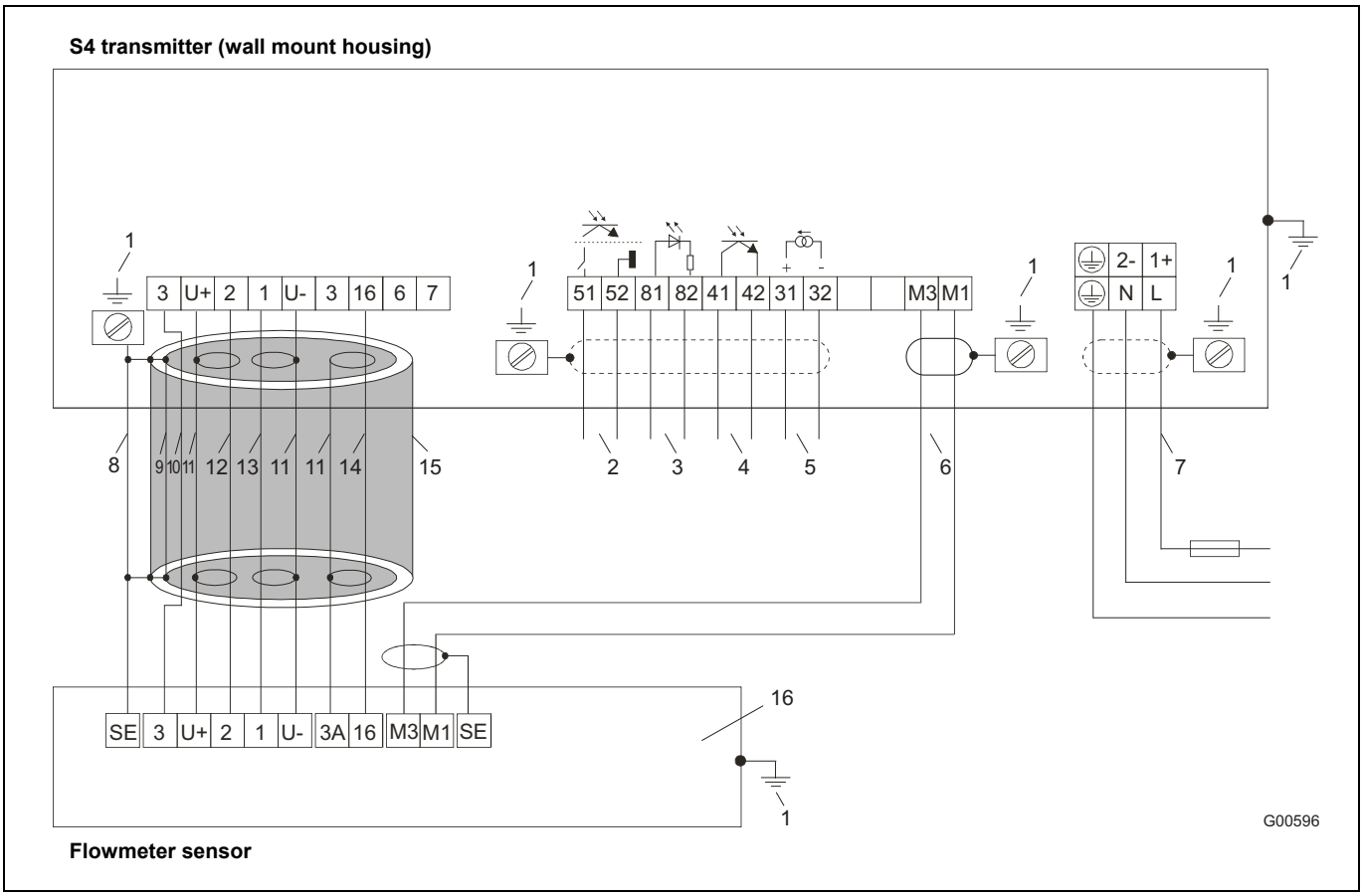


Fig. 37: Connection diagram: Flowmeter sensor with preamplifier DN 1 ... DN 1000 (1/25 ... 40"), transmitter field-mount housing

1 Functional ground (busbar)
2 Pulse output[1)]
3 Contact input[1)]
4 Contact output[1)]
5 Current output[1)]
6 Magnet coil cable:
shielded 2 x 1 mm^2 CE Typ 227 TEC 74
ABB order no. D173D147U01, 10 m included in shipment, standard
7 Supply power
Low voltage: 100 ... 230 V AC, terminals L, N, ⏚
Low voltage: 20.4 ...26.4 V AC;
20.4 ... 31.2 V DC
Terminals 1+, 2-, ⏚
Frequency: 47 Hz ≤ f ≤ 53 Hz; 50 Hz supply power
56 Hz ≤ f ≤ 64 Hz; 60 Hz supply power
8 Steel shielding
9 Aluminum foil
10 Yellow
11 Shield
12 Blue
13 Red
14 White
15 Shielded signal cable: ABB order no. D173D025U01, 10 m, included in shipment
16 With preamplifier (always with DN 1 ... DN 8 [1/25 ... 5/16"])

1) See the section "Connection examples for peripherals" in the operating instructions and/or on the data sheet

Comment:
We recommend that shielded output cables be used with the shields connected to the functional ground at one end.

Important
If the flowmeter sensor is equipped with a preamplifier for low conductivity or in nominal diameter DN 1 ... DN 8 (1/25 ... 5/16"), the shieldings of the signal wires must be connected to terminals U+ and U- on both the flowmeter sensor and the transmitter.

Retrofitting for model 10D1422: DN 3 ... DN 1000 (1/10 ... 40“); model 10DI1425 and 10DS3111A-E: DN 500 ... DN 1000 (20 ... 40“)

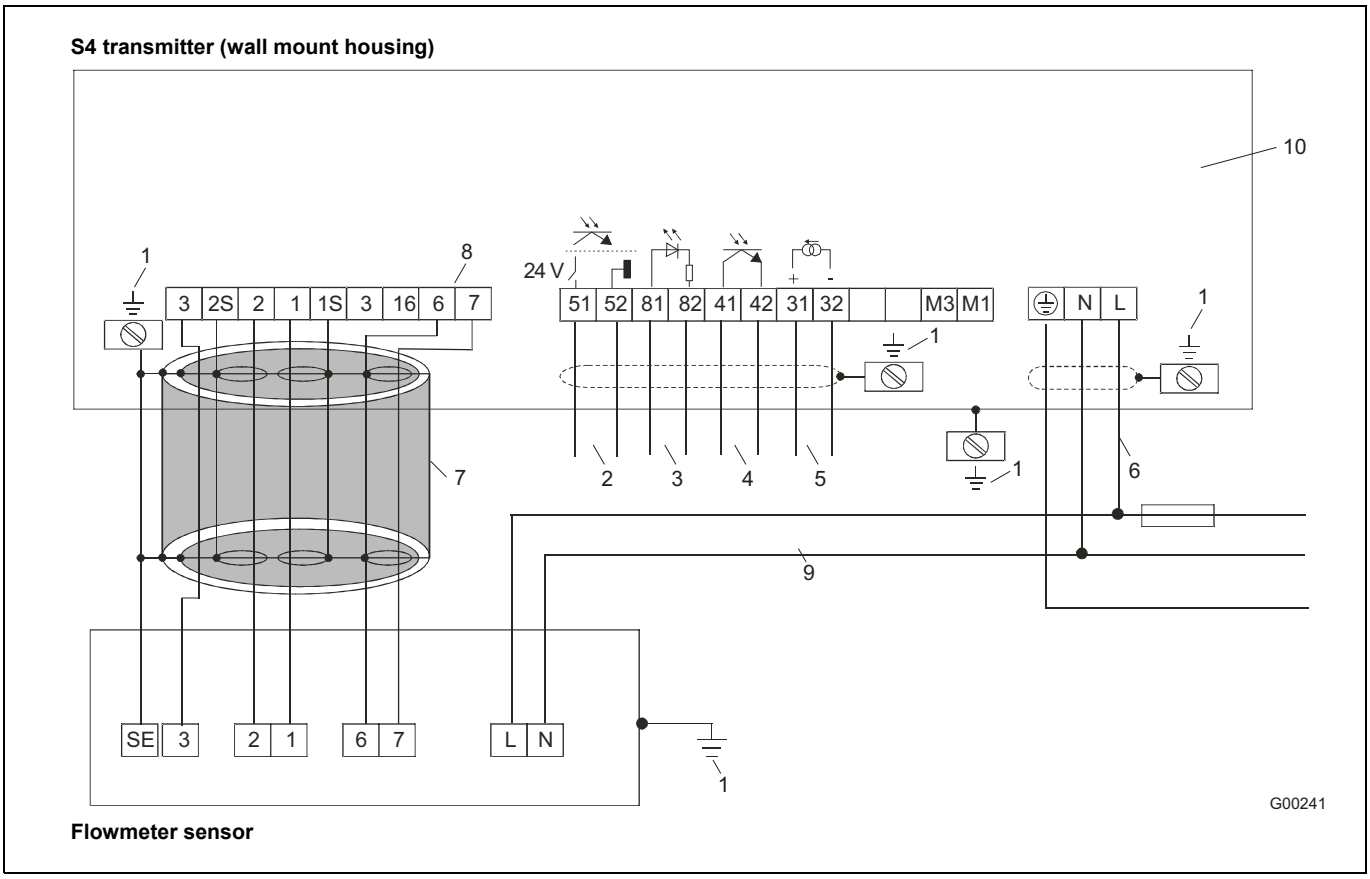


Fig. 38: Flowmeter sensor standard DN 3 ... DN 1000 (1/10 ... 40"), transmitter field-mount housing

1 Functional ground (busbar)
2 Pulse output[1)]
3 Contact input[1)]
4 Contact output[1)]
5 Current output[1)]
6 Supply power
Low voltage: 100 ... 230 V AC, terminals L, N, ⏚
Frequency: 47 Hz ≤ f ≤ 53 Hz; 50 Hz supply power
56 Hz ≤ f ≤ 64 Hz; 60 Hz supply power
7 Shielded signal cable: Use ABB order no. D173D025U01 or incorporate in existing wiring
8 Reference cable:
Only for connection to model 10D1422
Terminals: close 6,7 and the hook switch S903
9 Magnet coil supply:
Magnet coil supply via supply power
10 Connection board: D685A1020U03

1) See the section "Connection examples" in the operating instructions and/or on the data sheet

Comment:
We recommend that shielded output cables be used with the shields connected to the functional ground at one end.

DN 1 ... DN 1000 (1/25 ... 40") with PROFIBUS PA / FOUNDATION Fieldbus

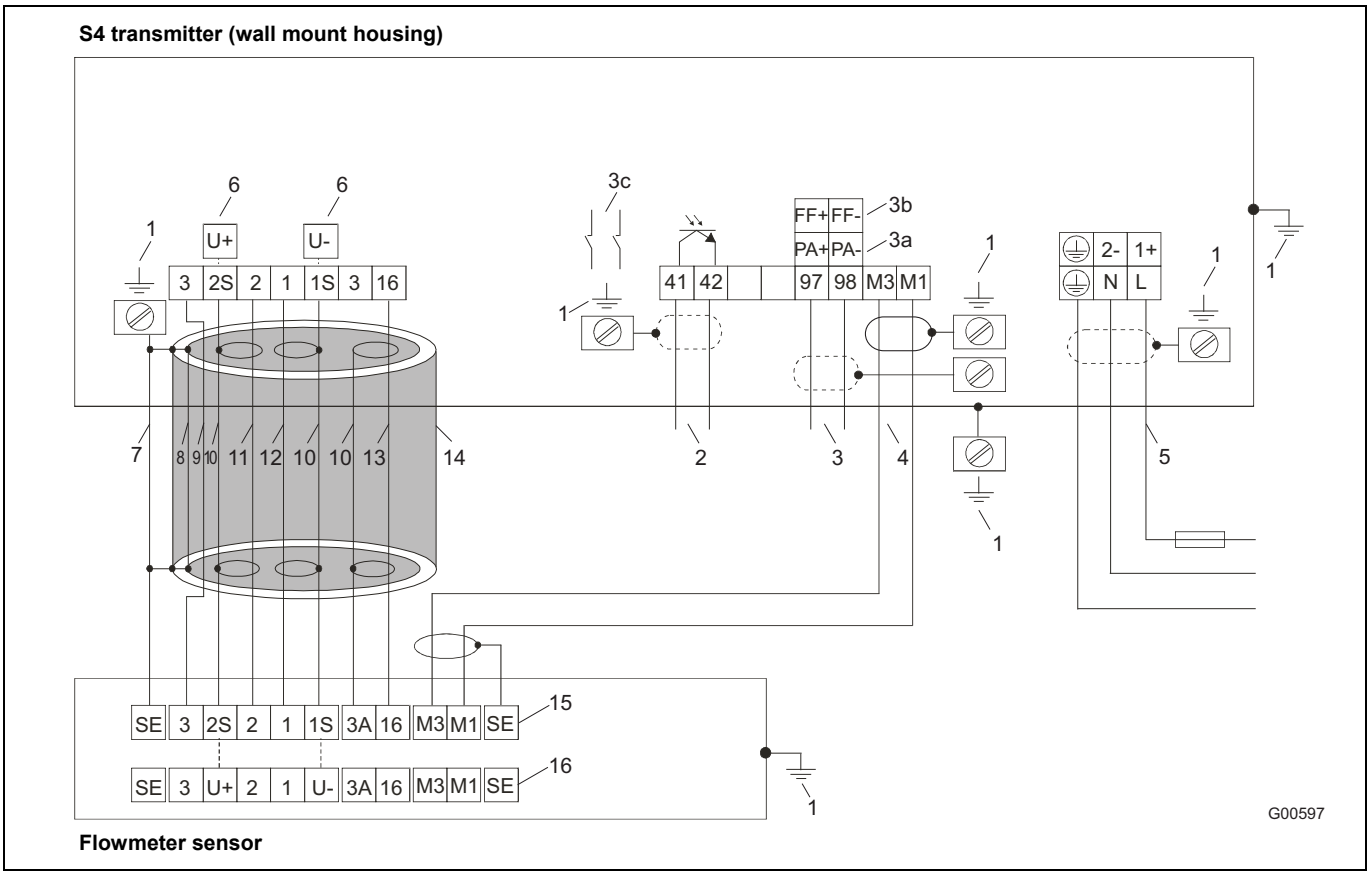


Fig. 39: Connection diagram: transmitter SF with PROFIBUS PA / FOUNDATION Fieldbus

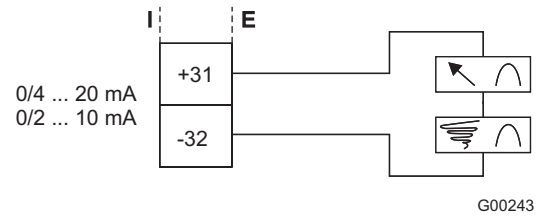
1 Functional ground (busbar)
2 Contact output (see the section "Connection examples for peripherals" in the operating instructions and/or on the data sheet)
3 Digital communication
3a: PROFIBUS PA design according to IEC 61158-2 (Profile 3.0)
U = 9 ... 32 V, I = 10 mA (normal operation)
I = 13 mA (in the event of error/FDE)
Terminals: 97/98, PA+/PA-
(see the section "Connecting via M12 plug" in the operating instructions and/or on the data sheet)
3b: FOUNDATION Fieldbus design conforming to IEC 61158-2
U = 9 ... 32 V, I = 10 mA (normal operation)
I = 13 mA (in the event of error/FDE)
Terminals: 97/98, FF+/FF-
(see the section "Connecting via M12 plug" in the operating instructions and/or on the data sheet)
3c: Bus termination with installed bus termination components with hook switches closed
4 Magnet coil cable:
shielded 2 x 1 mm^2 CE Typ 227 TEC 74
ABB order no. D173D147U01, 10 m included in shipment, standard
5 Supply power
Low voltage: 100 ... 230 V AC, terminals L, N, ⏚
Low voltage: 20.4 ...26.4 V AC;
20.4 ... 31.2 V DC
Terminals 1+, 2-, ⏚
Frequency: 47 Hz ≤ f ≤ 53 Hz; 50 Hz supply power
56 Hz ≤ f ≤ 64 Hz; 60 Hz supply power
6 Shielded signal cable:
Power supply for flowmeter sensor with preamplifier
Terminals U+, U- instead of 2S and 1S in standard unit
7 Steel shielding
8 Aluminum foil
9 Yellow
10 Shield
11 Blue
12 Red
13 White
14 Shielded signal cable: ABB order no. D173D025U01, 10 m, included in shipment
15 Without preamplifier
16 With preamplifier (always with DN 1 ... DN 8 [1/25 ... 5/16"])

Comment:
We recommend that shielded output cables be used with the shields connected to the functional ground at one end.

Important
If the flowmeter sensor is equipped with a preamplifier for low conductivity or in nominal diameter DN 1 ... DN 8 (1/25 ... 5/16"), the shieldings of the signal wires must be connected to terminals U+ and U- on both the flowmeter sensor and the transmitter.

5.5 Connection examples for peripherals (incl. HART)

Current output

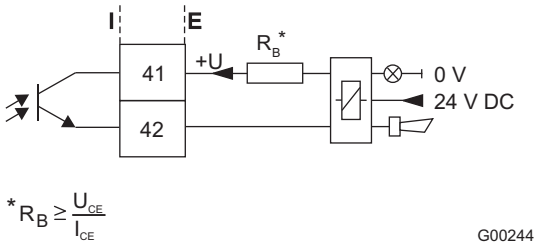


I = internal
E = external

Current output: selectable in software
Function: Active
0/4 ... 20 mA (0 Ω ≤ RB ≤ 560 Ω)
0/2 ... 10 mA (0 Ω ≤ RB ≤ 1120 Ω) (with HART only 4 ... 20 mA)
Terminals: 31, 32

Fig. 40: Current output active with/without HART protocol (4 ... 20 mA)

Contact output

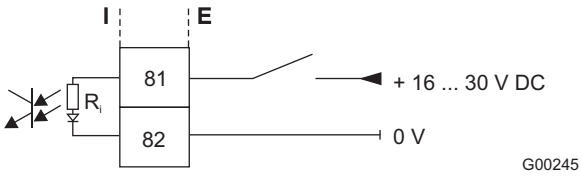


Note
Horn and alarm light are shown only as examples. Other suitable devices such as bells, sirens, buzzers, etc., can also be used.

Contact output: selectable in software
Function: Passive
"closed" 0 V ≤ U_{CEL} ≤ 2 V, 2 mA ≤ I_{CEL} ≤ 220 mA
"open" 16 V ≤ U_{CEH} ≤ 30 V, 0 mA ≤ I_{CEH} ≤ 2 mA
Terminals: 41, 42

Fig. 41: Contact output for system monitoring, Max.-Min. alarm for empty tube or forward/reverse signal

Contact input

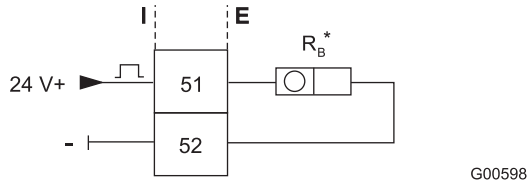


Contact input: selectable in software
Function: Passive
"On" 16 V ≤ U_{KL} ≤ 30 V
"Off" 0 V ≤ U_{KL} ≤ 2 V
Ri = 2 kΩ
Terminals: 81, 82

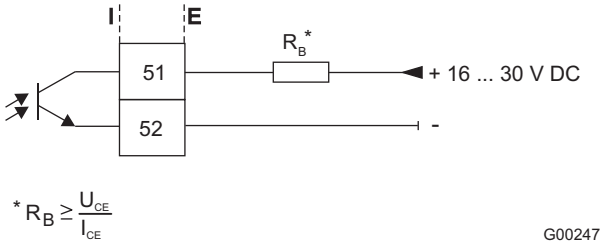
Fig. 42: Contact input for external totalizer reset and external zero return

Pulse output

Pulse output active



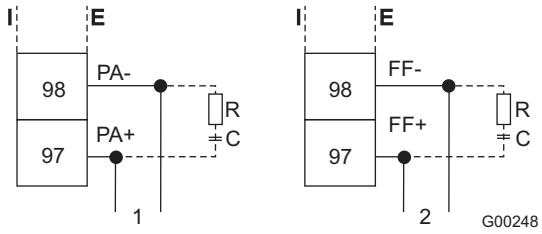
Pulse output, passive, optocoupler



Function:	active/passive, selectable via jumper (see "Commissioning" in operating instructions)
fmax:	5 kHz,
fmin:	0.00016 Hz
Setting range:	Pulses/unit, pulse width (observe dynamic limits)
Active:	150 Ω ≤ Load < 10 kΩ Pulse width ≤ 50 ms, max. pulse frequency ≤ 3 Hz, 500 Ω ≤ Load < 10 kΩ Pulse width ≥ 0.1 ms, max. pulse frequency: 5 kHz
Passive:	"closed": 0 V ≤ UC_{EL} ≤ 2 V, 2 mA ≤ I_{CEL} ≤ 220 mA "open": 16 V ≤ U_{CEH} ≤ 30 V, 0 mA ≤ I_{CEH} ≤ 2 mA
Terminals:	51, 52

Fig. 43: Pulse output, active and passive, optocoupler

PROFIBUS PA / FOUNDATION Fieldbus



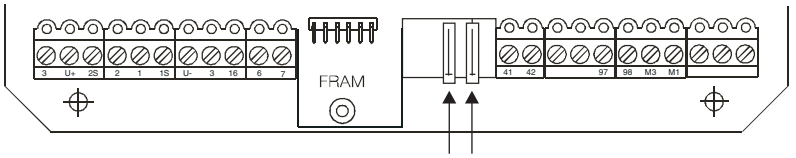
The resistance R and capacitor C form the bus termination. They must be installed when the device is connected to the end of the entire bus cable.
R = 100 Ω; C = 1 µF
1 PROFIBUS PA
2 FOUNDATION Fieldbus
I = Internal
E = external

Fig. 44

Bus termination for S4 transmitter

To terminate the bus if the instrument is at the end of the bus cable, the termination components in the S4 transmitter can be used. To do so, close both hook switches in the connection area of the transmitter.

Important
If the transmitter plug-in module is removed, bus termination is also canceled.



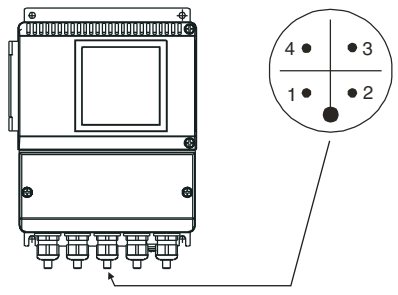
Connection board for field housing unit

Hook switches for
bus termination must be closed

Fig. 45

Connection via M12 plug (for PROFIBUS PA only)

As an option, the bus can also be connected via an M12 plug instead of the cable gland (see order information for device). The device can be shipped completely prewired. For information about suitable connectors (type EPG300) and other accessories, refer to the data sheet 10/63.6.44 DE.



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

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.
- When the sensor (SE41F, SE21, SE21F) and transmitter (S4) are delivered as a pair, the data memory module (external FRAM) is located in the sensor. The data module stores the sensor data, e.g., size, Cs, Cz, type, etc., as well as the setup data on the transmitter after commissioning.
- Prior to commissioning, plug the external FRAM for the appropriate sensor (order no. is printed on the FRAM and, if available, a TAG no.) to the connection board for the installed transmitter. Then screw to the connection board (captive).

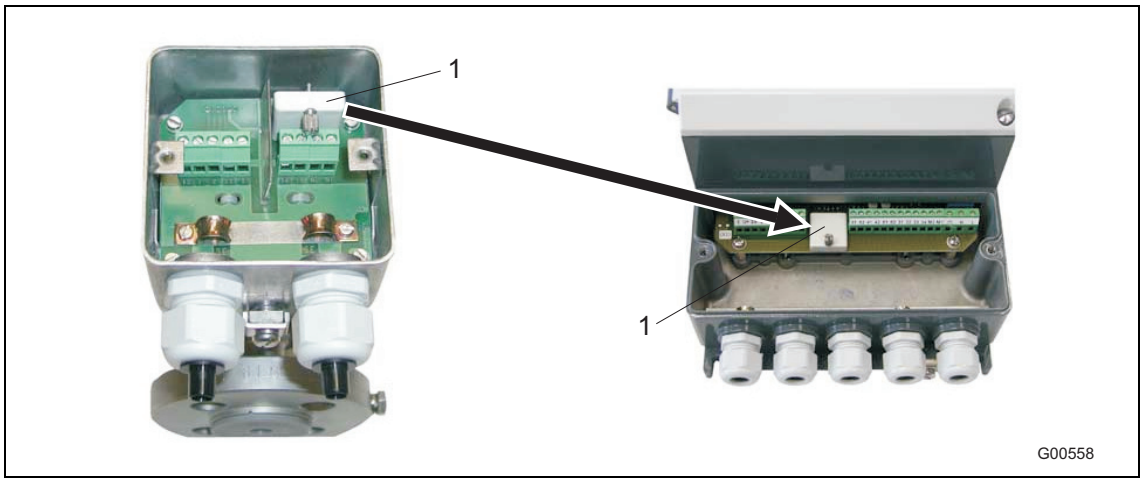


Fig. 47

1 External FRAM

Important

If a transmitter is ordered for an older model sensor (see model number), an external FRAM is already connected to the connection board. You will also find the information Cs = 100% and Cz = 0%, which is required for sensors from older product lines. See also chapter 11 "Supplementary information: Operating S4 with an older model" in the operating instructions.

- The sensor must be installed at a largely vibration-free location.
- The sensor and the converter must be assigned properly for the model FSM4000: The sensors have an end number of X1, X2, etc., on the name plate. The transmitters have the end numbers Y1, Y2, etc. End numbers X1 and Y1 are considered a unit.
- Monitoring of pulse output.

  The pulse output can be operated as active output (24 VDC pulse) or as passive output (optocoupler). The current setting is provided on the name plate for the transmitter. Modification as shown in the following illustration.

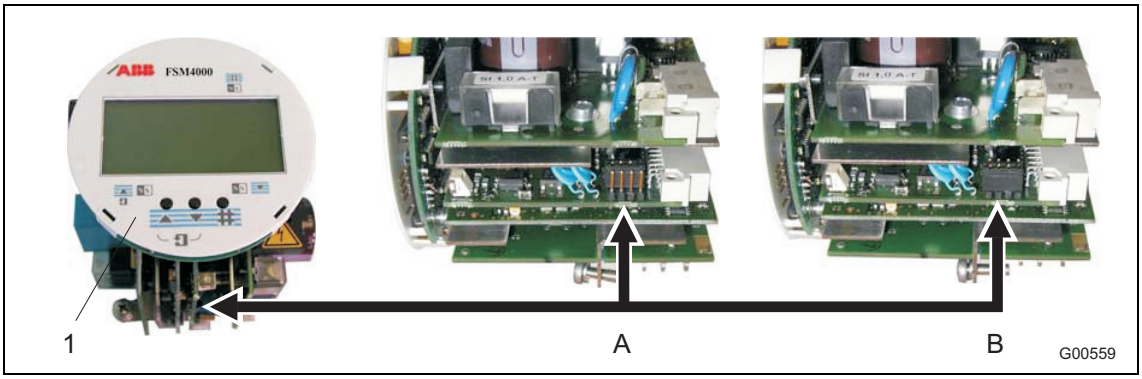


Fig. 48: Setting the pulse output using jumpers

1 Display board

A Pulse passive (jumper inner)
B Pulse active (jumper outer)

6.2 Commissioning the unit

6.2.1 Switching on supply power

After switching on the supply power, the flowmeter sensor data in the external FRAM is compared with the data saved internally. If the data is not identical, the transmitter data is replaced automatically. Once completed, Warning 7 "Flowmeter sensor data loaded" and Warning 8b "Update external FRAM" are displayed. The measuring equipment is now ready for operation.

The display shows the current flowrate.

6.2.2 Device configuration

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

On-site configuration requires only a few parameter settings. For information on settings, refer to the "Entering data in short form". A short overview of the menu structure can be found in the section "Parameter overview".

The Easy Set-up menu enables users to configure the unit quickly and conveniently, see chapter "6.3 Easy Set-up: For uncomplicated configuration".

The following parameters should be checked or set before start-up:

1. **Flow range end value** (menu items “Q_{max}” and “Unit”).

   The devices factory setting is largest flow range end value, unless other customer information is available. The ideal flow range end values are approximately 2 ... 3 m/s. First set the unit Qmax (e.g., m^3/h or l/s) under menu item “Unit”, and then set the flow range end value under “Qmax”. The smallest and largest possible flow range end values are shown in table "Flowmeter Sizes, Pressure Ratings, Flow Range" page 29.

2. **Current output** (menu item “Current output”)

   Select the desired current range (0 … 20 mA or 4 … 20 mA)

3. For devices with a fieldbus, the bus address must be set (menu item “Data Link”).

4. **Pulse output** (menu items “Pulse” and “Unit”).

   To set the number of pulses per volume flow unit, a unit for the totalizer (e.g., m^3 or l) must be selected under “Unit”. Afterward the number of pulses has to be entered in the menu item “Pulse output”.

5. **Pulse width** (menu item “Pulse output”)

   For external processing of the counting pulses, the pulse width at terminals 51 and 52 can be set between 0.1 ms and 2.000 ms.

6. **System zero point** (menu item “System Adjust”)

   When commissioning an older model flowmeter sensor or checking the system, you can set the system zero point on the transmitter after a warmup period. The fluid in the flowmeter sensor must be at absolute standstill. The measuring tube must be completely full. The adjustment can now be made manually or automatically via the "System zero point" parameter. Select the parameter by pressing ENTER. Use the arrow keys to call up "automatic" and press ENTER again to start the adjustment. The adjustment runs approx. 60 seconds and should be within a range of ± 10%. If the value measured is outside this limit, no adjustment is performed. The adjustment can also be performed via the external Contact Input / Ext. Sys. Zero Point, page 74.

7. **Detector empty pipe**

   (menu item “Detector e. pipe”), for devices with meter size from DN 10 and/or without preamplifier.

   When the DEP mode "Standard" is selected, it is not required to perform an adjustment onsite. The transmitter works with standard setup data. If the function is not performed correctly, a new adjustment must be run with the fluid onsite. The adjustment can be made with a full or empty meter pipe.

8. **Extended diagnostic functions**

   To measure the DC resistance or the coil temperature, the signal cable length must be entered. To use the functions Electrode voltage, Electrode balance and Electrode state, the electrode zero must be adjusted. See the "Diagnostics/Adjustment" submenu, page 85 or chapter "7.4 Additional information regarding use of enhanced diagnostic functions".

Important

If the flow indicator shows the incorrect direction after successful startup of the meter, e.g., reverse instead of forward, correct this in the Operating Mode submenu of the transmitter.

First switch off the Programming Protection ("Prog. Level" → "Specialist"). Then select the parameter "Flow indication" and change "Standard" to "inverse". Finally, activate Programming Protection via "Prog. Level" → "Locked").

6.3 Easy Set-up: For uncomplicated configuration

The Easy Set-up function enables users to configure the transmitter for quick and convenient startup. For additional information about configuration options, see the chapter **"Parameterization"**.

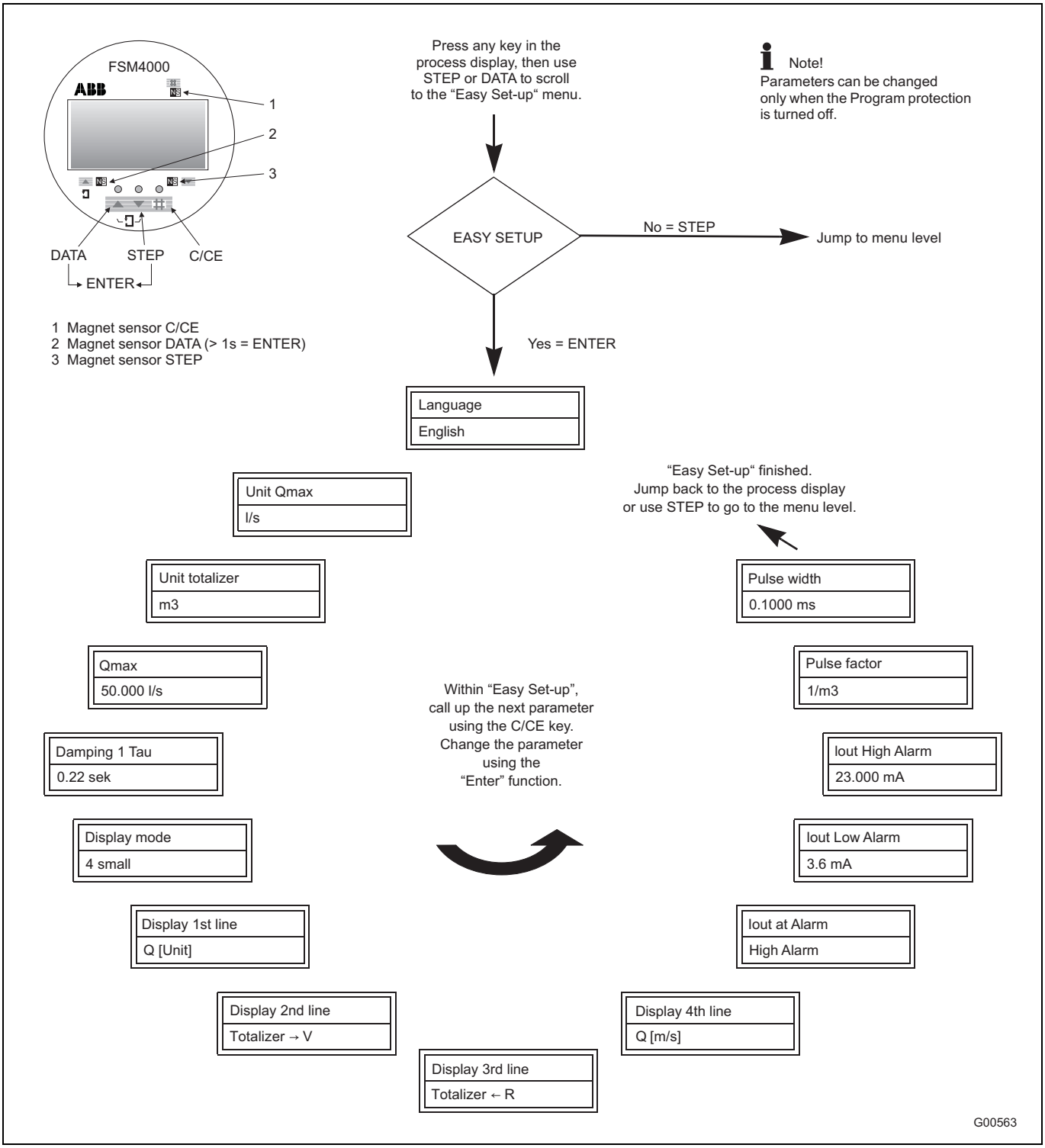


Fig. 49

6.4 Commissioning PROFIBUS PA units

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

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

Important
The address selected may only appear once in the segment.

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

The factory setting for DIP switch 8 is OFF, i.e. the address is set using the fieldbus.
The front cover can be unscrewed to change the settings. It is also possible to set the address via menu by using the keys on the display board.

The PROFIBUS PA interface conforms with Profile 3.0 (fieldbus standard PROFIBUS, EN 50170, DIN 19245 [PRO91]). The transmitter transmission signal is designed according to IEC 61158-2.

Important
The manufacturer-specific PROFIBUS PA ID no. is: 0x078C hex.
The unit can also be operated with the PROFIBUS standard ID nos. 0x 9700 or 0x9740.

Example of local address setting (DIP switch 8 = On)

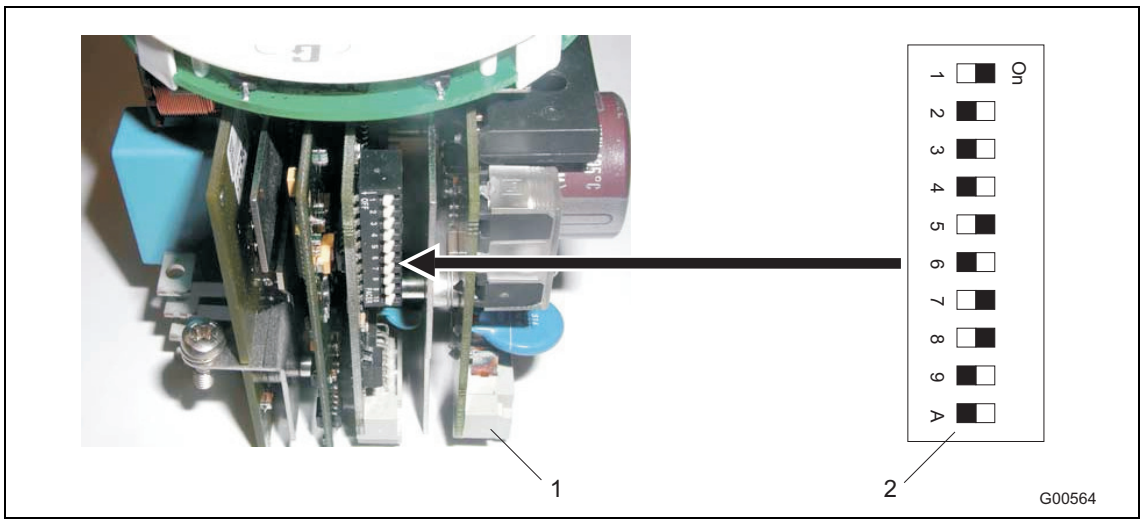


Fig. 50 Position of DIP switches

1 Transmitter plug-in module 2 DIP switch

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

Switch	1	2	3	4	5	6	7	8	9	A
Status	Unit address							Address mode	no function	no function
Off	0	0	0	0	0	0	0	Bus	no function	no function
On	1	2	4	8	16	32	64	Local	no function	no function

Switch assignments

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

Device behaviour during turning on the power supply

After switching on the auxiliary power, DIP switch 8 is polled:

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

Device behavior after replacing transmitter plug-in module

If the transmitter is located at the bus end and if the bus termination is activated via both hook switches, the bus termination is canceled when the transmitter plug-in module is removed. The bus is no longer terminated properly. To ensure proper operation, the bus termination must be connected at another location. If the transmitter plug-in module is reinstalled, the old bus termination can be used again.

Important

The selector is preconfigurd with the ID no. 0x078C hex. The IDs 0x9700 or 0x9740 can also be used.

6.4.1 Information on voltage/current consumption

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

The average current draw by the unit on the fieldbus is 10 mA. The voltage on the bus line must be within 9 … 32 V DC.

Important

The upper limit of the current is electronically limited. In the event of an error, the integrated FDE function (Fault Disconnection Electronic) integrated in the device ensures that the current consumption can rise to a maximum of 13 mA.

6.4.2 System integration

Use of PROFIBUS PA profile B, B3.0 ensures interoperability and interchangeability of units. Interoperability means that devices from different manufacturers can be physically connected to a bus and are communication-ready. In addition, third-party devices can be interchanged without having to reconfigure the process control system.

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

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

Important

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

The following table describes the available GSD files:

Number and type of function blocks	ID number	GSD file name
1 x AI	0x9700	PA139700.gsd
1 x AI; 1 x TOT	0x9740	PA139740.gsd
1 x AI; 2 x TOT; and all manufacturer-specific parameters	0x078C	ABB_078C.gsd

The manufacturer-specific GSD file ABB_078C is available to download from the ABB homepage http://www.abb.com/flow.

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

6.5 Commissioning FOUNDATION Fieldbus units

For units with a FOUNDATION fieldbus, the settings of the DIP switch must be checked prior to commissioning.

When integrating the unit in a process control system, a DD file (device description) and a CFF file (common file format) are required. The DD file contains the device description. The CFF file is required for segment engineering. Engineering can be performed online or offline. The DD and CFF files are available to download from the ABB homepage http://www.abb.com/flow.

The DIP switches on the unit must be set correctly as follows:
DIP switch 1 must be OFF.
DIP switch 2 must also be OFF. Otherwise, the hardware write protection and the process control system prevent the unit from recording information.

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

The device is registered with the FOUNDATION fieldbus. The registration number is: IT 027200.

Registration for the FOUNDATION fieldbus is recorded under manufacturer ID 0x000320 and unit ID 0x0017.

Seating of DIP switches

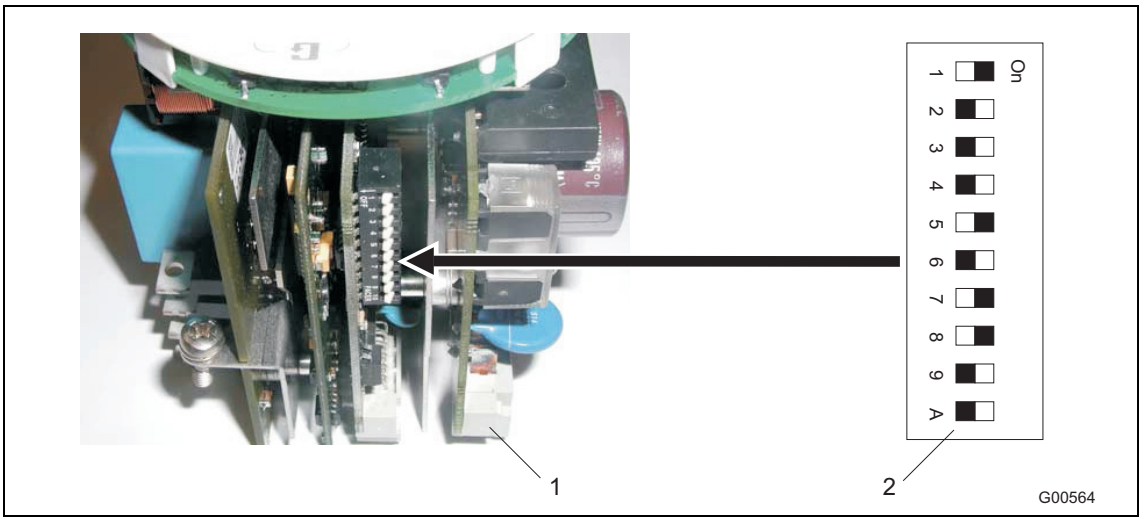


Fig. 51: Position of DIP switches

1 Transmitter plug-in module 2 DIP switch

Assigning of DIP switches

DIP switch 1:

Releases the simulation of the AI function blocks.

DIP switch 2:

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

DIP switch	1	2	3 ... 10
status	Simulation Mode	Write protect	no function
Off	Disabled	Disabled	no function
On	Enabled	Enabled	no function

Bus address settings

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

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

The average current draw of the unit is 10 mA. The voltage on the bus line must lie in the range of 9 … 32 V DC.

Important

The upper limit of the current is electronically limited. In the event of an error, the integrated FDE function (Fault Disconnection Electronic) integrated in the device ensures that the current consumption can rise to a maximum of 13 mA.

7 Parameterization

7.1 Display options

After switching on the auxiliary power, the current process information for the measuring point is displayed.

In the first line of the display, the current flow direction (→F for forward, ←R for reverse) is displayed along with the flowrate as a percentage or a physical unit. The second line of the display shows the totalizer value (7-digit) for the current flow direction, followed by the relevant unit.

Independent of the pulse factor, the totalizer value is always displaying the current flowrate with the relevant unit. This indicator is displayed in the following text as process information.

The 4 lines of the display can be customized in the "Display" submenu.

Examples:

→V 98.14 l/h	1. Line	Instantaneous flow forward
→**V** 12.30000 **m³**	2. Line	Totalizer value, forward
←**R** 516.0000 **m³**	3. Line	Totalizer value, reverse (multiplex mode)

Totalizer overflow always occurs at a value of 9.999.999 units. If the totalizer value for a flow direction is larger than 9.999.999 units, Warning 9 is displayed in the 4th line. The totalizer software can register up to 250 overflows. The overflow notification can be cleared in the "Reset totalizer" submenu.

Error condition

When an error occurs, an error or warning message appears in the 4th line of the display.

Flowrate > 103 %

This message is displayed alternatively in plain text and with the relevant error or warning number. The plain text error message provides the error or warning with the highest priority only. However, all existing errors and warnings are shown in the number display.

For a list of all possible error messages, see “Error messages”.

In addition to the error message, the current output is set to the alarm value (menu "Iout for alarm"). The alarm can be indicated optionally via the contact output, if selected.

Important

Error messages for "enhanced diagnostics" are only indicated on the display or optionally via the contact output (select "General Alarm" or "ext. Diag. Alarm").

7.2 Data entry

Use the keys (4) to enter data when housing is open. If closed, use the magnet stick (5) and the magnet sensors. The stick is held over the appropriate NS symbol.

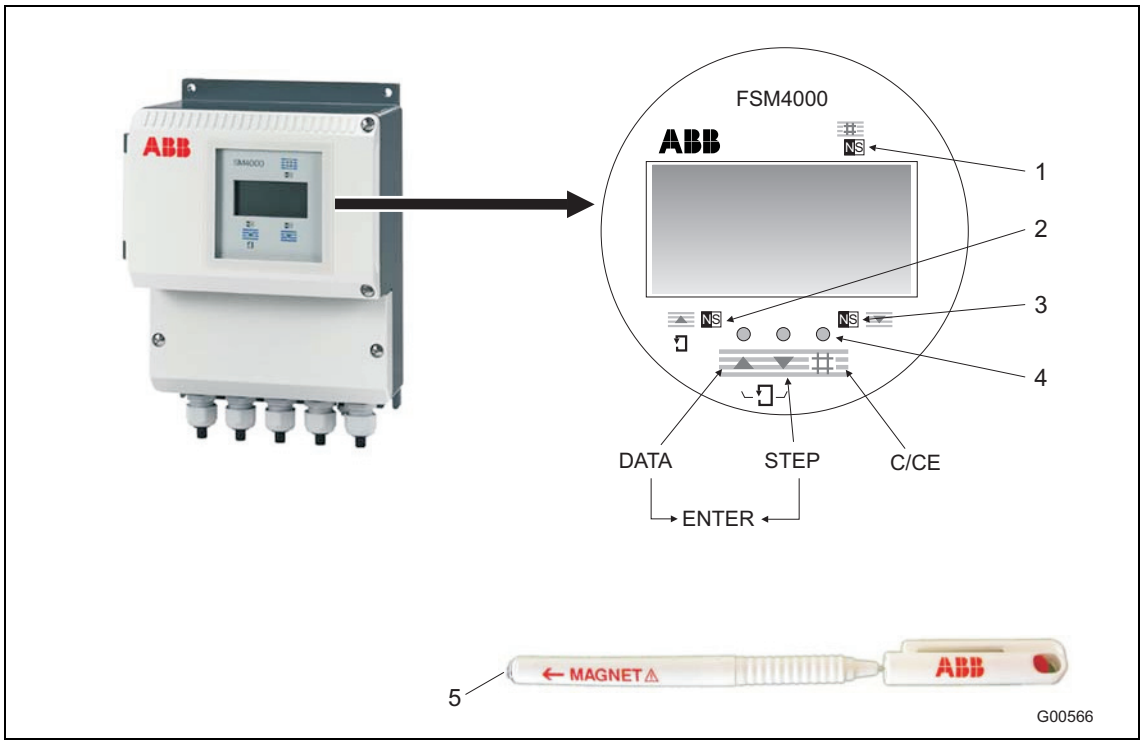


Fig. 52

1 Magnet sensor C/CE
2 Magnet sensor DATA/ENTER
3 Magnet sensor STEP
4 Control buttons
5 Magnet

When entering data, the transmitter remains online, i.e., current and pulse outputs show the current operating mode. The functions of the individual keys are explained in the following:

C/CE — Toggle between operating mode and menu.

STEP ↓ — The STEP key is one of two arrow keys. Use STEP to scroll forward through the menu. All the desired parameters can be called up.

DATA ↑ — The DATA key is one of two arrow keys. Use DATA to scroll backward through the menu. All the desired parameters can be called up.

ENTER — The ENTER function requires that both arrow keys, STEP and DATA, be pressed simultaneously. ENTER has the following functions:

- Access the parameter to be changed and set the new, selected or default parameter.

The ENTER function is effective for approx. 10 s only. If a new value is not entered within 10 s, the display reverts to the old value.

ENTER function for magnet stick operation

The ENTER function is initiated when the DATA/ENTER sensor is activated for more than 3 seconds. The display flashes to indicate that the function is active.

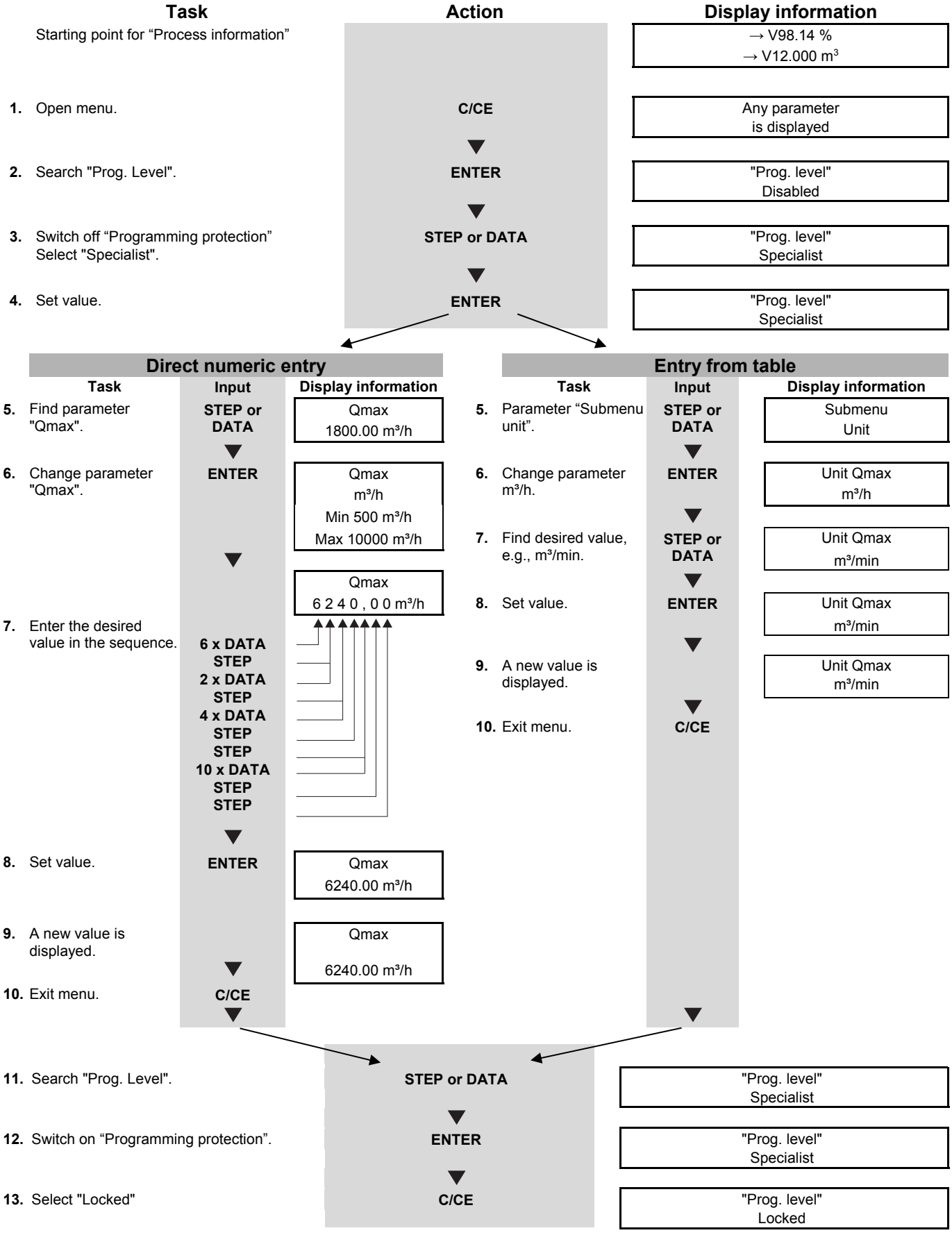
There are two different methods of entering data:

- Numeric entry
- Entry from specified table

Important

When entering data, the values are checked for plausibility and, if necessary, rejected with an appropriate message. The limit values (min/max) are displayed in the 3rd and 4th lines.

7.3 Entering data in “short form”



Submenu/parameter	Value range	Comment
Prog. Level Locked		"Locked": All entries in the standard menus can be read
Prog. Level Locked		All "Standard" menus are shaded in gray
Prog. Level Standard		"Standard": Contains all menu items needed to operate the device.
Prog. Level Specialist		"Specialist": Contains all menu items accessible by the customer.
Prog. Level Service		"Service": Additional menus can be displayed by entering the correct service code number (for ABB Service only).
Servicecode? 0		
Prog. Level Pg.prot.code		
Old Pg.prot.code: 0	1 ... 9999	The Prog. Protection Code is normally "0". If Prog. Protection is selected, the question "New PP code?" is displayed. If the user enters an incorrect code between 1 ... 9999, a message **Prog.Prot.** appears, indicating that the menu is locked and requires the correct PP code. To suspend the PP-Code function, you must access the "PP-Code" menu. Select ENTER and you will be asked for the old PP code. You must enter the correct old code before the message "New PP-Code?" is displayed. Enter a new code or select "0" to disable the PP-Code function.
New Pg.prot.code 0	1 ... 9999	
Submenu EASY SETUP	Language Unit Qv Unit Zv Qmax Damping 1,000 Display mode Display line 1 Display line 2 Display line 3 Display line 4 Iout Art Iout Alarm Low Alarm High Alarm Pulse factor Vol. Pulse width	The EASY SETUP function allows you to configure the system in an easy manner for operation. Menus are displayed in sequential order by EASY SETUP. If the display mode 1 big, 1 small is selected, the selection menus for Display 3rd line and Display 4th line are not displayed. For HART devices, the selection menu "Iout type" is also not displayed. The ENTER function allows you to change parameters; the C/CE button jumps to the next entry. Press ENTER again to change parameters and, if necessary, you can call the next parameter via the STEP button. For numeric entries, the minimum and maximum settings are displayed.
EASY SETUP		

Submenu/parameter	Value range	Comment
Language English	German English French Finnish Spanish Italian Dutch Danish Swedish Turkish	The languages available are displayed in the present language selection. Menus in the Service Code section are displayed in English.
Language English		
Submenu Operating mode		
Operating mode Standard	Standard Fast Piston Pump	"Standard": Selection used for continuous flow metering. "Fast": Accelerated processing of flowrate (e.g., short batch operation). "Piston Pump": For pulsating flows. In this operating mode, data logging improves reproducibility for pulsating flows and during pump operation. The totalizer is automatically set for the operating mode Difference Totalizer. Any reverse flow that may occur is automatically deducted from the totalizer value.
Flow indication Standard	Standard, inverse	Standard/inverse, reverse the flow direction indicators in the display for forward and reverse flow.
Noise reduction Off	Off, 1, 2, 3, 4	The noise reduction is switched on when the measured value is: - very unstable or - temporarily or permanently frozen (error E) Note: Activating noise reduction increases the response time.
Flow direction Forward/Reverse	Forward/Reverse Forward	When the flow indication "Forward/Reverse" is selected, the flow direction is indicated in the display by "→ F" for forward and "← R" for reverse. If "Forward" is selected, the totalizer only totalizes flow in the forward direction. If the flow is reversed, warning 10 "Reverse Q" is displayed.
Submenu Unit		
Unit totalizer ml	ml; l; m^3; ugl; igl; bbl; g; kg; t; lb; Prog Unit[1]; ft^3 [2]	Select the engineering units for volume and mass flowrate totalization. If these units are changed, the transmitter checks and updates the flow range, pulse factor and pulse width (0.1 ms ... 2000 ms). The transmitter first changes the pulse factor and then the pulse width. [1] kgal = Factory setting [2] ft^3 = added only for PROFIBUS PA

Submenu/parameter	Value range	Comment
Unit Qmax l/s	l/s; l/min; l/h; m^3/s; m^3/min; m^3/h; m^3/d; usgps; usgpm; usgph; usmgd; igps; igpm; igph; igpd; bbl/s; bbl/m; bbl/h; bbl/d; g/s; g/min, g/h; kg/s;kg/min; kg/h; kg/d; t/min; t/h; t/d; lb/s; lb/min; lb/h; lb/d; ml/s, ml/min Prog. Unit/s[1)] Prog. Unit/min[1)] Prog. Unit/h[1)] Prog. Unit/d[1)]	Select the unit for volume and mass flow. This unit refers to Qmax DN, Qmax and the instantaneous status, if these are displayed in engineering units. For PROFIBUS PA, the following units are also displayed: en ft^3/s; ft^3/min; ft^3/h; ft^3/d. For PROFIBUS PA, the following units are not displayed: Prog. unit and ml/s. [1)] kgal = Factory setting
Submenu Prog. Unit		This menu does not appear for the PROFIBUS PA or FOUNDATION fieldbus.
Unit name kgal	Text entry	Four character name for the user programmable unit. kgal = Factory setting.
Unit factor 3785.1	Numeric entry	Reference factor for the user-defined units based on liters; default value in kgal units (factory setting).
Prog. Unit without density	Without density With density	Unit for mass (with density) or volume (without density).
Density 1 g/cm^3	Numeric entry	Density range 0.1 ... -5 g/cm^3. Mass flowrate for display and totalization. The density is only considered when mass flow units are and/or totalizer mass units are selected.
Submenu System data		
Submenu Converter		
Submenu Data 50 Hz		This menu does not appear with an excitation frequency of 60 Hz or 70 Hz.
Channel -123 µs	View only	Adjustment value for Channel can be monitored for the excitation frequency setting (displayed when an older sensor 50 Hz has been selected).
Zero 0 %	View only	Adjustment value for Zero can be monitored for the excitation frequency setting (displayed when an older sensor 50 Hz has been selected).
Span → V 91 %	View only	Adjustment value for Span Forward can be monitored for the excitation frequency setting (displayed when an older sensor 50 Hz has been selected).
Span ← R -91 %	View only	Adjustment value for Span Reverse can be monitored for the excitation frequency setting (displayed when an older sensor 50 Hz has been selected).

Submenu/parameter	Value range	Comment
Submenu Data 60 Hz		This menu does not appear with an excitation frequency of 50 Hz or 70 Hz.
Channel -123 µs	View only	Adjustment value for Channel can be monitored for the excitation frequency setting (displayed when an older sensor 60 Hz has been selected).
Zero 0 %	View only	Adjustment value for Zero can be monitored for the excitation frequency setting (displayed when an older sensor 60 Hz has been selected).
Span → V 91 %	View only	Adjustment value for Span Forward can be monitored for the excitation frequency setting (displayed when an older sensor 60 Hz has been selected).
Span ← R -91 %	View only	Adjustment value for Span Reverse can be monitored for the excitation frequency setting (displayed when an older sensor 60 Hz has been selected).
Submenu Data 70 Hz		This menu does not appear with an excitation frequency of 50 Hz or 60 Hz.
Channel -123 µs	View only	Adjustment value for Channel can be monitored for the excitation frequency setting (displayed when a new sensor has been selected).
Zero 0 %	View only	Adjustment value for Zero can be monitored for the excitation frequency setting (displayed when a new sensor has been selected).
Span → V 91 %	View only	Adjustment value for Span Forward can be monitored for the excitation frequency setting (displayed when a new sensor has been selected).
Span ← R -91 %	View only	Adjustment value for Span Reverse can be monitored for the excitation frequency setting (displayed when a new sensor has been selected).
Submenu Data Iout		This menu does not appear for the PROFIBUS or FOUNDATION fieldbus.
Adjust Iout 4 mA 4.0 mA	View only	Display adjustment value for transmitter for the current output at 4.0 mA.
Adjust Iout 4 mA 20.0 mA	View only	Display adjustment value for transmitter for the current output at 20.0 mA.

Submenu/parameter	Value range	Comment
Submenu Primary		
Type of primary DS2_, DS4		Display the connected flowmeter model: The selection is imported with the FRAM automatically by the transmitter. If an older flowmeter sensor model (see list) is selected, the FRAM with Cs = 100%, Cz = 100% must be used. The models 10D1422 (10DI1425, 10DS3111A-C ≥ DN 500) can only be connected to a specially designed connection board on the transmitter. Close switch S903 on the connection board. The other models are put into operation with their assigned FRAM. For this reason, when older model sensors are connected to the transmitter, a "Primary Setup" menu is displayed at initial startup. Additional settings can be entered in the system data submenu "Primary". See chapter 11.
Frequency 50 Hz	View only	Display the mains frequency for which the flowmeter sensor was calibrated. Displayed only for 50/60 Hz older models. Not displayed, if new flowmeter sensor is selected.
Meter size 1 mm 1/25 in	View only 1 mm 1/25 in 1,5 mm 1/17 in 2 mm 1/12 in 3 mm 1/10 in 4 mm 5/32 in 6 mm 1/4 in 8 mm 5/16 in 10 mm 3/8 in 15 mm 1/2 in 20 mm 3/4 in 25 mm 1 in 32 mm 1-1/4 in 40 mm 1-1/2 in 50 mm 2 in 65 mm 2-1/2 in 80 mm 3 in 100 mm 4 in 125 mm 5 in 150 mm 6 in 200 mm 8 in 250 mm 10 in 300 mm 12 in 350 mm 14 in 400 mm 16 in 450 mm 18 in 500 mm 20 in 600 mm 24 in 700 mm 28 in 750 mm 30 in 800 mm 32 in 900 mm 36 in 1000 mm 40 in	Display the flowmeter size. Not displayed, if no flowmeter type is selected (sensor type = none).

Submenu/parameter	Value range	Comment
Span Cs 100.0 %	View only	Flowmeter sensor span value Cs.
Zero Cz 0.0 %	View only	Flowmeter sensor zero value Cz. For "Older model" always 0%.
Phase 90	View only	Phase relationship between reference and signal voltages.
Referencevoltage 70 mV	View only	Display the reference voltage, for "Older Model" selection. Not displayed for model 10D1422.
Meter factor 1.0	View only	Displayed only if flowmeter sensor 10D1462/72 is selected
Order-Number „----------“	View only	Display the ABB order number for the flowmeter sensor.
Submenu Primary Setup	Option available only with "Older Model"	Display required for "Older Model". Use ENTER and STEP to access the parameters: Mains Frequency, Type of Sensor, Meter Size and Reference Voltage. Not displayed, if new sensor (SE41F/SE21) is selected. See chapter 11.
Frequency 50 Hz	50, 60 Hz	Displays the mains frequency for the flowmeter sensor. Option available only with new "Flowmeter sensor".
Type of primary DS4_	Select the original model	Display the connected flowmeter sensor model:
Meter size 100 mm 4 in	Select the size of the connected flowmeter sensor	Select the size of the flowmeter sensor. Option available only with "Older Model".
Referencevoltage 70 mV	Enter the reference voltage	Display the reference voltage, only for "Older Model" option, see name plate for flowmeter sensor. Not displayed for models 10D1422, 10D1462/72.
Meter factor 1.0	Numeric entry	Display the meter factor, only for older model 10D1462/72; see name plate for flowmeter sensor. See chapter 11.

Submenu/parameter	Value range	Comment
Cal-fact 10m/s 50 m^3/h	View only	Display the max. possible flow range. Automatically selected based on size.
Qmax 50 m^3/h	Numeric entry	Flow range end value for forward and reverse flow. Flow range end value configurable from 0.5 ... 10 m/s.
Damping [1\xE0] 1 sec	Numeric entry	Response time, after 1τ the value displayed has reached 63% of its end value (after 5τ). The following values can be selected, operating mode: Standard 0.2 ... 20 s, fast/piston pump 0.07 ... 20 s.
Low flow cut off 1.0 %	Numeric entry 0 ... 10% of Qmax	Applicable for display and all outputs. The switching limit for the low flow cutoff has a built-in hysteresis of 0.1%.
Submenu Detector e. pipe		**i** Important: The meter pipe must be completely filled to ensure proper measurement. The function "Detector empty pipe" can be used to continuously monitor this condition. If the fluid level drops below the electrode level, all outputs can be automatically set to zero. This ensures false pulses or incorrect displays are avoided when the meter pipe is empty. In addition to the message in the display, this condition can be reported via the switch contact output. If the meter pipe is filled, the error message "empty pipe" is turned off and the meter returns to normal operation.
Detector e. pipe Off	Off On	Turn on/off the "Detector empty pipe" function. Not configurable for sizes: 1 mm 1/25 in 1,5 mm 1/17 in 2 mm 1/12 in 3 mm 1/10 in 4 mm 5/32 in 6 mm 1/4 in 8 mm 5/16 in **i** Important: The "empty pipe" function is not available for flowmeter primaries with preamplifiers. The menu is hidden.
DEP Mode Standard	Standard New Adjust	Select the function "Standard" or "New Adjust". The transmitter is shipped in "Standard" DEP mode. For most applications, the DEP function will run properly in "Standard" mode. For all other applications, the DEP mode "New Adjust" should be selected. The adjustment can be made with a full and/or empty meter pipe. Not displayed, if DEP is switched off.

Submenu/parameter	Value range	Comment
Adj. empty pipe 1000	Manual Autom. Adjust	Adjustment value for empty meter pipe. The pipeline must be empty. After the adjustment is completed, the transmitter displays the adjustment value and calculates a new threshold value. Not displayed, if DEP is switched off or DEP mode is standard.
Adj. full pipe 500	Manual Autom. Adjust	Adjustment value for full meter pipe. The pipeline must be filled. After the adjustment is completed, the transmitter displays the adjustment value and calculates a new threshold value. Not displayed, if DEP is switched off or DEP mode is standard.
Threshold 100000	Numeric entry	Threshold value for turning off the "Empty pipe" function. This value is calculated and entered internally after the adjustment "Empty pipe" or "Full pipe" is completed. It can also be entered manually (e.g., after both adjustment values (full and empty) are determined and the threshold, based on these values, is optimized (the transmitter always uses only the most recent adjustment value)). The threshold value is the basic criteria used for the DEP function. The adjustment values are used only to calculate the threshold. Not displayed, if DEP is switched off or DEP mode is standard.
Alarm. e. pipe Off	Off On	If the alarm is switched on, the empty pipe contact is actuated when the pipe empties. The "empty pipe" or "General alarm" functions must be selected in the "Progr. in/output" submenu. When the function is turned off, the alarm does not respond. Not displayed, if DEP is switched off.
Iout at e. pipe Low Alarm	Low Alarm High Alarm 0%	Set the current output value to Low or High in event of error. Not displayed, if DEP is switched off.
Submenu Display		Select each different line displayed for the process indicators in this submenu. You can also adapt the contrast of the display to local conditions by pressing the arrow keys.
Display mode 1 big, 1 small	1 big, 1 small, 4 small	Select 1 big and 1 small line or 4 small lines.

Submenu/parameter	Value range	Comment
1st line Q [Prozent]	Q [percent]; Q [unit]; Iout [mA]; Q [m/s]; Q BargraphTotalizer; Totalizer → V; Totalizer ← R; Totalizer Diff.; HART TAG Empty pipe Blank Add. choice at enhanced diagnostic functions: Fprt1; Fprt2; Fprt3; Fprt4; Hist Max Err; Hist Min Err; Act Max Err; Ac Min Err; Act Max Warn; Act Min Warn; Connect Warn; Connect Err	Display 1st line Notes regarding the values Fprt1 ... Fprt4 (assignment of values in the submenu Diagnostic / Fingerprint) as well as the diagnostic error register, see chapter "7.4 Additional information regarding use of enhanced diagnostic functions".
1st line PA Adr + State		For devices with PROFIBUS PA, the following options are available: Flowrate in percentage, engineering unit, in m/s, Bar graph, Totalizer, Totalizer→ F, Totalizer ← R, Totalizer diff., Detector empty pipe; additional options: **PA Addr+State.** The bus address and status of cyclic communication is displayed (STOP, CLEAR or OPERATE).
1st line TB VolFlow Value		**TB VolFlow Value.** Displays the value for Volume_Flow (Transducer block Index 17).
1st line TB VolFlow Status		**TB VolFlow Status.** Displays the status of Volume_Flow (Transducer block Index 17).
1st line TBT → Value		**TB Total → F Value.** Displays the value for Totalizer → F (Transducer block Index 102). **TB Total → Status.** Displays the status of the Totalizer → F (Transducer block Index 102). **TB Total ← R Value.** Displays the value for Totalizer ← R (Transducer block Index 104). **TB Total ← R Status.** Displays the status of Totalizer ← R (Transducer block Index 104). **TB Total Diff Value.** Displays the value for the diff. totalizer (Transducer block Index 106). **TB Total Diff Status.** Displays the status of the diff. totalizer (Transducer block Index 106).
1st line TBT → Status		
1st line FB AI OUT		**FB AI OUT.** Displays the OUT value of the AI block. The decimal places are generated from the OUT_SCALE structure. The unit displayed is UNIT_INDEX from the OUT_SCALE structure.
1st line FB AI Status		**FB AI Status.** Displays the current mode of the particular block and the status of the output variables (OUT. Status). The substatus is displayed after the status, if applicable. Example: BAD 3 means status is BAD, substatus 3 = device failure. For information about the numeric code, refer to the interface documentation.

Submenu/parameter	Value range	Comment
Anzeige 1. Zeile TBT → Value		**FB TOT1 Total.** Displays the total value for the totalizer block. The displayed unit is UNIT_TOTAL. **FB TOT1 Status.** Displays the current mode of the particular block and the status of the output variables (Total. Status). The substatus is displayed after the status, if applicable. Example: BAD 3 means status is BAD, substatus 3 = device failure. **FB TOT2 Total.** Displays the total value for the totalizer block. The displayed unit is UNIT_TOTAL. **FB TOT2 Status.** Displays the current mode of the particular block and the status of the output variables (Total. Status). The substatus is displayed after the status, if applicable. Example: BAD 3 means status is BAD, substatus 3 = device failure. For information about the numeric code, refer to the interface documentation.
1st line TBT → Status		For devices with FOUNDATION Fieldbus, the following options are available: Flowrate in percentage, engineering unit, in m/s, Bar graph, Totalizer, Totalizer→ F, Totalizer ← R, Totalizer diff., Detector empty pipe; additional options: FF address, displayed in hexadecimal.
1st line TB VolFlowValue		Displays the value or status of the flowrate (TB Primary_Value, Index 14).
1st line TB Total → V Value		Displays the value or status of the Totalizer →Forward (TB Secondary_Value, Index 28).
1st line TB Total ← R Value		Displays the value or status of the Totalizer ← R (TB Third_Value, Index 30).
1st line TB TotalDiffValue		Displays the value or status of the totalizer (TB Fourth_Value, Index 31).
1st line TB AI1 Out. Value		Displays the value or status of the parameter Out for the function block AI1.
1st line TB AI2 Out. Value		Displays the value or status of the parameter Out for the function block AI2.
1st line TB AI3 Out. Value		Displays the value or status of the parameter Out for the function block AI3.
1st line PID In. Value		Displays the value or status of the parameter In for the function block PID.
1st line PID Out. Value		Displays the value or status of the parameter Out for the function block PID.
1st line PID Cas_In. Value		Displays the value or status of the parameter Cas_In for the function block PID.
1st line PID FF_Val.Value		Displays the value or status of the parameter FF_Val for the function block PID.

Submenu/parameter	Value range	Comment
1st line PID Trk_Value		Displays the value or status of the parameter Trk_Val for the function block PID.
1st line TB VolF GOOD0		**Example:** The status is displayed in plain text format, the substatus in numeric form after the status.
1st line AI1 Auto GOOD0		Displays the current mode for the function blocks.
2nd line Q [percent]	Similar to display of 1st line	Select the 2nd display line
3rd line Q [percent]	Similar to display of 1st line	Option unavailable if 1 big, 1 small is selected for the display mode
4th line Q [percent]	Similar to display of 1st line	Option unavailable if 1 big, 1 small is selected for the display mode
Contrast		Set the contrast for the display to adjust to local conditions, STEP = darker; DATA = lighter. **i** Important: Adjust the contrast so that the display remains readable.
Submenu Alarm		
Min. Alarm 0 %	Numeric entry 0% – Max. Alarm	Range for the Min. Alarm 0% – Max. Alarm of configured flow range. Configurable in 1% increments, 1% switching hysteresis.
Max. Alarm 100 %	Numeric entry Min. Alarm – 103%	Range for the Max. Alarm Min. Alarm – 103% of configured flow range. Configurable in 1% increments, 1% switching hysteresis.
Submenu Totalizer		The totalizer function is set automatically in the "Operating mode" submenu. Standard operating mode = standard totalizer function, Piston pump mode = Totalizer function Diff. totalizer. Standard = For the standard totalizer function, the counting pulse for forward and reverse flow is registered on two separate totalizers. If Forward is selected as flow direction, only the forwards totalizer counts. Difference totalizer = in the totalizer function Difference totalizer a single totalizer is used for both flow directions. For the forward flow direction the totalizer adds the pulses while in the reverse flow direction they are subtracted. If the totalizer value is negative, i.e., the reverse flow totals are greater than the forward flow totals, the flow direction indicator in the display changes from "F" to "R". The pulse output (active or passive) is not affected by this switch.
Overflow → F 0	Display only	Overflow counter max. 65535. 1 overflow = pulse totalizer of 9,999,999 units. Resets the display status and increments the overflow counter by one. Overflow example: Overflow 012 12 x 10.000.000 units = 120.000.000 units + 23.455 current totalizer value results in a total of 120.023.455 units

Submenu/parameter	Value range	Comment
Totalizer → F 0.0 kg/h	Numerical entry 0 ... 9999999	Display or input the forward totalizer value.
Overflow ← R 0	Display only	Overflow counter max. 65535. 1 overflow = pulse totalizer of 9,999,999 units. Resets the display status and increments the overflow counter by one.
Totalizer ← R 0	Numerical entry 0 ... 9999999	Display or input the reverse totalizer value.
Reset totalizer		Select ENTER to reset the forward/reverse flow totalizer and overflow counters.
Overflow Diff. 0	Display only	Display the overflow for the diff. totalizer.
Totalizer Diff. 0.0 kg/h	Numerical entry 0 ... 9999999	Display or input the diff. totalizer value.
Submenu Current output		This menu does not appear for the PROFIBUS PA or FOUNDATION fieldbus.
Current output 0 - 20 mA	0 - 20 mA, 4 - 20 mA 0 - 10 mA, 2 - 10 mA	Select the current output range. For HART protocol always 4 - 20 mA.
Iout for alarm Low Alarm	Low Alarm High Alarm	Behavior of the current output during an alarm. Low-Alarm is available only for current output of 2 - 10 mA and 4 - 20 mA. If error 0 (empty pipe) occurs, the current output is set to the value programmed for the parameter "Iout during empty pipe" in the submenu "Detector empty pipe". If error 3 (flowrate > 103 %) occurs, "High Alarm" is always signaled.
Iout low alarm 3.60 mA	Numerical entry	Low-Alarm is available only for current output of 2 -10 mA or 4 - 20 mA. Set the current output value during Low Alarm condition. No selection available if High Alarm is selected for the current output selection for Iout during alarm and if the transmitter version is standard and the current output range is 0 - 20 mA 0 - 10 mA .
Iout high Alarm 21.80 mA	Numerical entry	Set the current output value during High Alarm condition. If error 3 (flowrate > 103 %) occurs, "High Alarm" is always signaled. No selection available for current output if Low Alarm is selected for Iout during Alarm.
Error 3 mask Off	Off, On	Deactivates error 3 (flowrate > 103%), if masking = on
Error 4 mask Off	Off, On	Deactivates error 4 (ext. zero return), if masking = on

Submenu/parameter	Value range	Comment
Submenu Pulse output		This menu does not appear for the PROFIBUS PA or FOUNDATION fieldbus.
Qmax Pulses 2.5 m^3/h	Numerical entry	Expanded flow totalization to the maximum flow range Qmax DN. This parameter is displayed only if the measuring range specified is less than Qmax DN.
Pulse Factor 100/m^3	Numerical entry Dynamic limits	The pulse width is configurable only for the limits calculated by the transmitter. The limits are based on the pulse factor. The transmitter cannot leave the max. limits of 2000 ms and 0.1 ms.
Pulse width 0.1 ms	Numerical entry Dynamic limits	The pulse width is configurable only for the limits calculated by the transmitter. The limits are based on the pulse factor. The transmitter cannot leave the max. limits of 2000 ms and 0.1 ms.
Pulse (Act./Pas.) Active	Display only	Displays the "active" or "passive" jumper position (see page 47).
Submenu Switched contacts		
Contact input No function	No function Totalizer reset Ext. cut-off Ext. Syst. NP.	The contact input function is not displayed for PROFIBUS PA or FOUNDATION Fieldbus. Select the function for the contact input terminals 81/82. "Totalizer Reset" resets the internal totalizer and overflow values when a switching voltage is connected. For "Ext. Zero Return" all outputs are switched off, if a switching voltage is connected. Example: Undefined filled pipeline condition after turning off pumps or cyclic cleaning or flushing procedures whose flowrates must be hidden. Select "Ext. Syst. NP" to adjust the system zero point. The fluid must be at absolute standstill during the adjustment. The message "Warning 13" is displayed during the adjustment.
Contact output No function	No function F/R signal /_ F/R Signal __ General Alarm /_ General Alarm _ _ Max/Min Alarm/_ Max/Min Alarm _ _ Min Alarm /_ Min Alarm _ _ Max Alarm /_ Max Alarm _ _ Empty Pipe /_ Empty Pipe _ _ Ext. Diag. Alarm /_ Ext. Diag. Alarm __	The switching behavior for the contact outputs (terminal 41/42) can be selected as normally open (/_ _) or normally closed (_ _). For the "General Alarm" all detected errors (0 - 6, A, B, C, D, E, F, G) are signaled via the terminals. Only diagnostic errors are signaled when "ext. Diag. Alarm" is selected. If you want to report a low flow condition, select "Min Alarm". Similarly, a high flow condition is signaled with "Max Alarm". If the signal is set for "Max/Min Alarm", then a signal is sent over the terminals when the flowrate is above or below the range between the "Max-Alarm" value and the "Min-Alarm" value, i.e., when the flowrate is larger than the "Max-Alarm" value or less than the "Min-Alarm" value.

Submenu/parameter	Value range	Comment
Submenu Label		
Curr. Variant Active pulse without HART	Display only Active pulse without HART Active pulse with HART Passive pulse without HART Passive pulse with HART PROFIBUS PA FOUNDATION Fieldbus FF Variant error	Displays the pulse output and communication configuration for the shipped model.
Sensor TAG „----------“	User-defined text	A TAG number to identify the flowmeter sensor, max. 32-character limit.
Transmitter TAG „----------“	User-defined text	A TAG number to identify the transmitter, max. 32-character limit.
Submenu Interface		
Communication None	None HART	**1. HART communication** Set the HART communication to ON or OFF. When HART communication is not required, Current Output ranges 0-20, 0-10, 2-10 mA can be selected. For HART communication, the current output is always 4 - 20 mA. No selection available for standard devices (without HART hardware).
Device address 0	Numerical entry 0 ... 15	For devices with HART protocol, an address between 0 ... 15 can be selected. If the address entered is 0, the current output varies with the flowrate in the range of 4-20 mA. If multiple devices are connected to the bus and an address between 1 and 15 is assigned, the transmitter runs in multidrop mode. The current output value then remains frozen at 4 mA. In this case, the output values can only be read using HART communication. Warning 11 is displayed. No entry for standard devices (without HART hardware).
HART TAG "HART TAG"	User-defined text	Unique identifier for unit using HART TAG number. Max. 8-character TAG number (PCKASCII string). Only capital letters are recognized, no special characters can be used. No entry for standard devices (without HART hardware).
HART descriptor "HART descriptor"	User-defined text	Description max. 16-character (PCKASCII string). Only capital letters are recognized, no special characters can be used. No entry for standard devices (without HART hardware).

Submenu/parameter	Value range	Comment
HART Date 03.11.2003	Day Month Year	Enter and output a date in this submenu. No entry for standard devices (without HART hardware).
PA Address 126	Numeric entry 0 - 125	**2. PROFIBUS PA communication** Only available if PROFIBUS PA version was ordered. Displays the slave address. Factory setting 126 (valid addresses 0 - 125). The PA address can be set via the following functions: Hardware switch (see chapter Commissioning PROFIBUS PA units), bus or the PA address menu. The hardware switch has highest priority. The hardware switch setting has the highest priority. An address using this setting switch cannot be changed, either by bus or menu. If the switch address is not active (DIP switch 8 = off), the address can be changed via the bus or via the menu, however, only when no cyclical communication is running.
Dip Switch 123456789A - - - - - - -	Display only	Displays the settings for the DIP switches (- = OFF, X = ON). If DIP switch 8 = ON: The address is binary coded using switches 1 - 7. Switches and 9 and A have no function. Example: Use switches to set address 50. 50dec = 32hex = 110010 binary → DIP switches 2, 5, 6 and 8 to ON = PA address 50. The changed address switch setting is only imported after the device is rebooted, not if changed during normal operation. The factory setting of the switch is: OFF
IdentNo Selector FSM4000 0x078C AI + 2* TOT		Setting the ID no. for the selector. Modes can only be changed when in STOP and not during cyclic communication. Profile 0x078C: AI + 2* TOT (AI-Block + 2 Totalizer).
IdentNo Selector Profile 0x9700 AI		Profile 0x9700 (AI-Block)
IdentNo Selector Profile 0x9700 AI + TOT		Profile 0x9740 (AI-Block + Totalizer)
AI Channel TB Flow Value		Channel setting for AI block. When setting the channel, the unit for the channel is also copied to the AI block (from OUT_SCALE. UNIT_INDEX). Selection: TB (Transducer Block) Flow Value TB Total → F TB Total ← R TB Diff Total
AI Channel TB Total → F		
AI Channel TB Total ← R		
AI Channel TB Diff Total		

Submenu/parameter	Value range	Comment
TOT 1 Channel TB Flow Value		Channel setting for totalizer block. Available only as option TB Flow Value. When setting the channel, the volume and mass unit is also copied from UNIT_TOT (e.g.: $m^3/h \rightarrow m^3$).
TOT 2 Channel TB Flow Value		See TOT 1.
Software Rev. Communication: 0	Display only	Displays the communication software version.
FF Address 0x15 Dev. ID 0003200017_FSM40 00_12345		**3. FOUNDATION Fieldbus communication.** Displays the address and device ID: 000320 = manuf. code ABB, hex 0017 = Device Type Code FSM4000, hex _FSM4000_ = Device name 12345 = serial number of device, 5-digit
Dip Switch		Hardware switch.
IdentNo Selector Profile 0x9700 AI		There is a 10-position DIP switch in the transmitter. It can be accessed after opening the cover of the housing. The switch position is displayed on the device in the data link submenu. It can also be read via the FF communication in the transducer block. An open switch is shown as –, a closed switch as x. The following switches are assigned: Switch 1 = Simulate Enable off = Simulation mode disable on = Simulation Mode enabled. Switch 2 = Write Protect Off = Simulation Mode disabled on = Write protect enabled. "Simulation mode enabled" only allows you to run a simulation, not to actually start the AI block simulation. Simulation is switched on/off via the "Simulate" parameter. "Write protect enabled" prevents overwriting of block parameters. Switches 3-10 have no function.
Error Mask		This menu shows the screen for the error register (TB Index 95).
Bitstring 0 ON EF0F0000 Error A Max. alarm		Line 1 shows the setting of the bit (on/off), which is indicated by its bitstring number. Line 2 shows the complete screen in hex characters. Lines 3 and 4 provide plaintext descriptions of each bit. Select the bits via the keys Data and Step, and select ENTER to switch the bit on/off. See the "Error Register" in the interface description D184B093U31.

Submenu/parameter	Value range	Comment
Warning Mask		This menu shows the screen for the warning register (TB Index 96).
Bitstring 0 OFF 020000100 Warning: 10 Reverse Q		Operation is identical to Error screen. See Warning Register 9.8.3 and interface description D184B093U31, page 47.
Software Rev. Communication: 1	Display only	Displays the communication software version.
Submenu Function test		**i** Important! Once the self-test function is initiated, the transmitter no longer operates in online mode, i.e., the outputs no longer track the flowrate.
Memory Test		Test the memory. Internal FRAM, ext. FRAM and calc. Flash can be queried in order via ENTER function.
Pulse output 0 Hz	Numerical entry	This menu does not appear for the PROFIBUS PA or FOUNDATION fieldbus. Test the pulse output. Enter a value directly in Hz.
Current output 4 mA	0 - 20 mA, 4 - 20 mA 0 - 10 mA, 2 - 10 mA	This menu does not appear for the PROFIBUS PA or FOUNDATION fieldbus. Test the current output. Check the value displayed at the connection terminals using a digital voltmeter or the process instrumentation. Enter a value directly in mA. No selection available if the HART device address is anything other than 0.
Contact input Off	Off On	This menu does not appear for the PROFIBUS PA or FOUNDATION fieldbus. Test the contact input. Before a signal is applied to the contact input, the text "Off" is displayed in this menu. Once a signal is applied, the text "On" is displayed (to check via simulator, use the Totalizer Reset key).
Contact output Off	Off On	Test the contact output. When you set the value to "On", the contact output selected is displayed for the configured contact logic under the item Switch Contacts - Contact Output.
Display		Test the display. Every point in the dot matrix is activated one after another. Once all points are activated, a missing point is easily detected.
Test Mode Off	Off On	Only for checking the transmitter using Simulator 55XC4000.

Submenu/parameter	Value range	Comment
Simulation Mode Off	Off On	On/Off function for Simulation mode. Before operation with flow, a flowrate can be simulated. The output values correspond to the simulated flowrate entered. The information ** Q Simulation** is displayed in the lower line of the display. After completing the simulation, change the parameter in the Simulation Mode menu to "Off".
Simulation Value 0.0 %	Numerical entry -130 % - +130 %	Select the simulation value for the display and outputs. Current and pulse output follow the flowrate value.
Submenu Diagnostics		Menu available only if the required hardware is available.
Diagnostics Manual		Menu is displayed only with "Manual" diagnostic interval.
Start? Yes → Enter	Yes, exit via C/CE	Manually start manual diagnostic. The value is displayed after a delay of 30 s.
Submenu Diag. Interval		
Cycle Time Manual	Manual; 10 s; 60 s; 10 min; 60 min; 6 h; 12 h; 24 h; 7 d	Select the time interval between the individual diagnostic measurements. For the values for Coil Resistance, Coil Temperature, Insulation Resistance, and Magnetic Linearity, however, there are minimum measurement intervals for technical reasons related to the measurement: • 60 seconds for Coil Resistance and Coil Temperature • 5 minutes for Magnetic Linearity • 10 minutes for measurement of Insulation Resistance These times are not undershot independently of the configured diagnostic cyclic.
Submenu Alarm Settings		In this menu you can set minimum and maximum values for each measurement value. Depending on the selected configuration, you can select for no message, a warning, or an error message to be displayed, if the value falls below or exceeds this threshold.
Submenu Alarm Coil Voltage		Set the time-out limits and alarm behavior for values over or under the coil AC voltage.
Min. value 1.0 V	0 ... 150	Lower range limit for alarm
Max. value 150 V	0 ... 150	Upper range limit for alarm
Message Off	Off, warning, error	Defines the alarm behavior

Submenu/parameter	Value range	Comment
Submenu Alarm Coil Current		Set the time-out limits and alarm behavior for values over or under the coil AC.
Min. value 20.0 mA	0 ... 500	Lower range limit for alarm.
Max. value 500.0 mA	0 ... 500	Upper range limit for alarm.
Message Off	Off, warning, error	Defines the alarm behavior.
Submenu Alarm Coil Resist		Set the time-out limits and alarm behavior for values over or under the coil resistance. Note: To correctly display the coil resistance or coil temperature, an adjustment is required or the cable length must be entered. For additional information, see "Submenu Adjustment" on page 85.
Min. value 2 ohms	0 ... 1500	Lower range limit for alarm.
Max. value 500 ohms	0 ... 500	Upper range limit for alarm.
Message Off	Off, warning, error	Defines the alarm behavior. **Note:** If coil resistance is being measured (at least every 60 s), the most recently acquired flowrate is retained during the measurement (2 s approx.).
Submenu Alarm Coil Temp		Set the time-out limits and alarm behavior for values over or under the coil temperature. Note: To correctly display the coil resistance or coil temperature, an adjustment is required or the cable length must be entered. For additional information, see "Submenu Adjustment" on page 85.
Min. value -50 °C	-100 ... 200	Lower range limit for alarm.
Max. value 200 °C	-100 ... 200	Upper range limit for alarm.
Message Off	Off, warning, error	Defines the alarm behavior. **Note:** If coil resistance is being measured (at least every 60 s), the most recently acquired flowrate is retained during the measurement (2 s approx.).

Submenu/parameter	Value range	Comment
Submenu Alarm Ins Resist		Set the time-out limits and alarm behavior for values over or under the coil temperature.
Min. value 1 megaohm	0 ... 100000	Lower range limit for alarm.
Max. value 50 megaohm	0 ... 100000	Upper range limit for alarm.
Message Off	Off, warning, error	Defines the alarm behavior. **Note:** If coil insulation resistance is being measured (at least every 10 minutes), the most recently acquired flowrate is retained during the measurement (2 s approx.).
Submenu Alarm E1 Voltage		Set the time-out limits and alarm behavior for values over or under the electrode AC voltage for electrode E1.
Min. value 0.0 µV	0 ... 3000	Lower range limit for alarm.
Max. value 3000.0 µV	0 ... 3000	Upper range limit for alarm.
Message Off	Off, warning, error	Defines the alarm behavior. **Note:** To properly display the electrode voltage, the electrode zero must be adjusted. For additional information, see "Submenu Adjustment" on page 85.
Submenu Alarm E2 Voltage		Set the time-out limits and alarm behavior for values over or under the electrode AC voltage for electrode E2.
Min. value 0.0 µV	0 ... 3000	Lower range limit for alarm.
Max. value 3000.0 µV	0 ... 3000	Upper range limit for alarm.
Message Off	Off, warning, error	Defines the alarm behavior. **Note:** To properly display the electrode voltage, the electrode zero must be adjusted. For additional information, see "Submenu Adjustment" on page 85.

Submenu/parameter	Value range	Comment
Submenu Alarm Elec Bal		Set the time-out limits and alarm behavior for values over or under the electrode balance. The electrode balance is calculated as the ratio between the electrode AC voltages E1/E2. This value is displayed in [%]. If the electrode voltage E2 is larger than E1, the value is assigned a minus sign and the ratio E2/E1 is displayed.
Min. value 0.0 %	100 ... 300	Lower range limit for alarm.
Max. value 300.0 %	100 ... 300	Upper range limit for alarm.
Message Off	Off, warning, error	Defines the alarm behavior. **Note:** To properly display the electrode voltage, the electrode zero must be adjusted. For additional information, see "Submenu Adjustment" on page 85.
Submenu Alarm Mag Lin		Set the time-out limits and alarm behavior for values over or under the magnetic linearity.
Min. value 0.0 %	0 ... 100	Lower range limit for alarm.
Max. value 100.0 %	0 ... 100	Upper range limit for alarm.
Message Off	Off, warning, error	Defines the alarm behavior. **Note:** If magnetic linearity is being measured (at least every 5 minutes), the most recently acquired flowrate during the measurement is retained (approx. 2 s).
Submenu Alarm SNR		Set the time-out limits and alarm behavior for values over or under the signal-to-noise ratio.
Min. value 0.0 %	0 ... 100	Lower range limit for alarm.
Max. value 100.0 %	0 ... 100	Upper range limit for alarm.
Message Off	Off, warning, error	Defines the alarm behavior.

Submenu/parameter	Value range	Comment
Submenu Alarm DAC Value		Set the time-out limits and alarm behavior for values over or under the DAC value. The DAC value is a criterion for the amount of coil current.
Min. value 16	0 ... 1024	Lower range limit for alarm.
Max. value 700	0 ... 1024	Upper range limit for alarm.
Message Off	Off, warning, error	Defines the alarm behavior.
Submenu Alarm Factory Set		Sets the status of all alarms to "Off" and the max./min. alarms to the default values.
Accept Yes → Enter	Yes, exit via C/CE	
Submenu Wiring Error		
Submenu CoilShtCircGnd		Defines alarm behavior in case of an accidental coil ground. **Note:** If the coil circuit is being checked (at least every 10 minutes) for an accidental ground, the most recently acquired flowrate is maintained (approx. 2 s).
Message Off	Off, warning, error	
Submenu Electrode State		Defines alarm behavior in case of a short circuit or a wire break in the electrode circuit. **Note:** This function can only be used after the electrode zero has been adjusted. For additional information, see "Submenu Adjustment" on page 85.
Message Off	Off, warning, error	

Submenu/parameter	Value range	Comment
Submenu Fingerprint		Preselect the diagnostic measurement values that you want to display and manage in the Fingerprint data.
Submenu Fprt1		Assign the rate for Fprt1. The display line for the process indicator is assigned in the submenu.
Diagnostic Value AC volt. coil	AC volt. coil; AC curr. coil; Ohm. coil res.; Temp. coil; Insul. coil res.; Volt. E1; Volt. E2; Electr. balan.; Magn. linear; SNR; Max. DAC value; Oprtg. hrs trn; Oprtg. hrs sens	Select the value: AC volt. Coil: Coil voltage AC AC curr. Coil: Coil current AC Ohm. coil res.: Ohmic resistance of coil Temp. coil: Coil temperature Insul. coil res.: Insulation resistance of coil Volt. E1: AC voltage at electrode 1 Volt. E2: AC voltage at electrode 2 Electr. balan.: Electrode balance Magn. Linear: Magnetic linearity SNR: Signal-to-noise ratio Max. DAC value: Max. DAC value Oprtg. hrs trn: Operating hours for transmitter Oprtg. hrs trn: Operating hours for flowmeter sensor These values are updated only if the status was set to Warning or Error in the "Alarm Settings" submenu.
Data record Current	Current; Prod1; Prod2; Startup; Factory; Hist1; Hist2; Hist3; Hist4; Hist5; Hist6; Hist7; Hist8; Hist9	Current: Data record for current value Prod1: Product1-Fingerprint Prod2: Product2-Fingerprint Start: Startup for Fingerprint Factory: Factory for Fingerprint Hist1-9: Data record 1 ... 9 for the preceding measurements
Submenu Fprt4	As for Fprt1	Assign the rate for Fprt1. The display line for the process indicator is assigned in the submenu.
Submenu Transfer		Import the current data record in a Fingerprint.
As Product1		Copies the current data record in the Fingerprint "as Product1".
Accept Yes → Enter	Yes, exit via C/CE	
As Product2		Copies the current data record in the Fingerprint "as Product2".
Accept Yes → Enter	Yes, exit via C/CE	

Submenu/parameter	Value range	Comment
As Startup		Copies the current data record in the Fingerprint "as Startup" (commissioning fingerprint).
Accept Yes → Enter	Yes, exit via C/CE	
Submenu Calibration		
Submenu Coil Temp		Enter the current coil temperature to readjust the coil resistance at 20 °C. Perform adjustment only on a "cold" device. See also chapter "7.4 Additional information regarding use of enhanced diagnostic functions".
Temp. in °C 0.0	-100 ... 100	
Submenu CabLength		Enter the length of the signal cable. **Note:** Information must be entered to calculate the coil resistance / coil temperature.
Length [m] 0.0	0 ... 200	
Submenu Temp. Offset		Offset correction for temperature display.
Temp. in °C 0.0	-100 ... 100	
Import RT20		Import the reference resistance for the coil. See also chapter "7.4 Additional information regarding use of enhanced diagnostic functions". **Note:** This menu is displayed only when the coil resistance or coil temperature are enabled as an error or warning message.
Accept New 500 ohms Old 450 ohms Yes → Enter	Yes, exit C/CE	
Electr. Zero Point		This adjustment is required in order to use the diagnostic measurement values for the electrode voltage E1/E2 and the electrode balance as well as the wiring errors for the electrode state.
Electr. Zero Point New 150 180 µV Old 200 190 µV Yes → Enter	Yes, exit C/CE	Display the current (new) and stored (old) zero values for electrode E1/E2. Select "Enter" to import the current zero points **Note:** The fluid in the flowmeter sensor must be at absolute standstill.
Electr. Analysis		Displays stored electrode zero and current electrode AC voltage acc. to amount and phase. Where N1: Current measured electrode AC voltage E1 N2: Current measured electrode AC voltage E2 A1: Stored zero E1 A2: Stored zero E2
N1: 12 µV 286° N2: 10 µV 283° A1: 650 µV 133° A2: 670 µV 135°	Yes, exit C/CE	

Submenu/parameter	Value range	Comment
Submenu status		
Error register Number: 1		After calling up the error register, the error register text is displayed with the number of pending errors. Press ENTER again to display the pending errors with error number and text. If you press ENTER again, you will be asked whether you want to reset the error or view the help text. Select STEP to display all of the pending errors with error numbers and text. Press ENTER to reset the pending errors.
C (Current) Ext. Database		
Reset: Enter Help text: Step		
0 Empty pipe		
Warning register Number: 2		After calling up the warning register, the warning register text is displayed with the number of pending warnings. Press ENTER again to display the pending warnings with warning number and text. If you press ENTER again, you will be asked whether you want to reset the warnings or view the help text. Select STEP to display all of the pending warnings with warning numbers and text. Press ENTER to reset the pending warnings.
3 (Pending) * Test Mode *		
Reset: Enter Help text: Step		
2 Totalizer reset		
Power outage 0		Display the power outages during operation.
HMx ----------		Status register for enhanced diagnostics. For additional information, see chapter "7.4 Additional information regarding use of enhanced diagnostic functions".
HMi ----------		
EMx ----------		
EMi ----------		
WMx ----------		
WMi ----------		
ConWarn ----- -----		
ConErr----------		

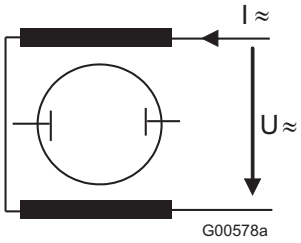
Submenu/parameter	Value range	Comment
Submenu Syst. Adjust		
Start System Zero 0.0 %	Manual Autom. Calibration	Check zero, if necessary (when adapting an older flowmeter sensor). Manual entry, e.g., when replacing the transmitter.
System zero point 0.0 %	Numerical entry	Automatic adjustment: Valve must be closed, fluid in flowmeter sensor must be at absolute standstill. Press ENTER to perform the automatic adjustment. The limit for the zero point is ± 10%. If the value is outside this limit, no calibration is performed.
FSM4000 01/2010 D699G004U01 C0.11	Display only	Display software version. 01.2010 specifies the date of the release. C0.11 = Version level, for standard and HART protocol models.
FSM4000 PA3.0 D699G004U02 C0.13	Display only	For PROFIBUS PA software.
FSM4000 FF D699G004U03 C0.14	Display only	For FOUNDATION Fieldbus communication software.

7.4 Additional information regarding use of enhanced diagnostic functions

Additional diagnostic functions are available for flowmeters sensor SE41F, SE21 and SE21F are available for meter sizes DN 8 and larger. The following section describes how to determine individual values.

7.4.1 Determining measurement values for diagnostics

7.4.1.1 Determining the coil alternating current or coil alternating voltage

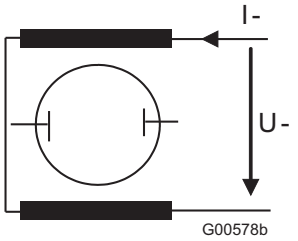


For detecting changes in the coil circuit.

The current and voltage are measured directly. These do not influence the flow measurements.

To perform the measurement, it is necessary to switch on one of the relevant errors or warnings in the submenu "Diagnostics/Alarm Settings" (see page 80).

7.4.1.2 Determining the coil DC resistance



$$R_{Coil} = \frac{U_{Coil}}{I_{Coil}}$$

For monitoring changes in the coil circuit, e.g., fine short of coil.

When measuring the coil DC resistance, a DC field excitation of approx. 1 sec is used as a test signal. Because the incoming test signal prevents flow measurement, the most recent value is retained.

To perform this test, it is necessary to switch on one of the relevant errors or warnings in the submenu "Diagnostics/Alarm Settings" (see page 80).

Important

To ensure information is displayed properly, the cable length must be entered in the submenu "Diagnostic / Adjustment / CabLength“ (see page 85).

7.4.1.3 Determining the coil temperature

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 (ABB patent GB 2 348 011).

To perform this measurement, it is necessary to switch on one of the relevant errors or warnings in the submenu "Diagnostics / Alarm Settings" (see page 82).

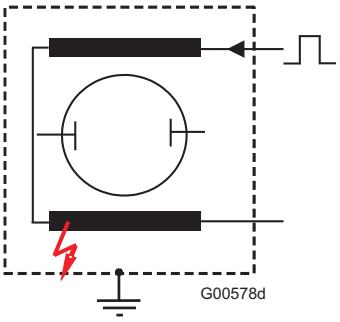
$$T_{Coil} = \frac{R_{Coil} - R_{Ref}}{\alpha_{Ref} \bullet R_{Ref}} + 20\ °C$$

T_{Coil}	Coil temperature	R_{Ref}	Reference coil resistance at 20 °C
R_{Coil}	Coil resistance	α_{Ref}	Temperature coefficient of copper at 20 °C (0.39%/K)

Important

The coil resistance of the flowmeter sensor must be adjusted for a reference temperature. This applies to newly shipped systems SE41F / SE21 and S4. When connecting an S4 transmitter to already shipped transmitters SE41F / SE21, it is also necessary to perform the adjustment. For additional information, see chapter "7.4.4 Readjusting the coil temperature".

7.4.1.4 Determining the insulation resistance for the coil



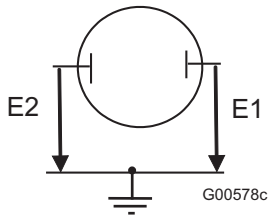
Detecting problems with the coil insulation. Can be caused, e.g., by dampness in the flowmeter sensor or in the connection box.

When determining the insulation resistance of the coil to ground, a DC field test signal of approx. 1 sec is sent to the coil, separating the ground connection in the transmitter. In spite of the separation provided by the coil, the current flowing to ground is used to calculate the insulation resistance.

During this measurement, the flowrate cannot be measured and the most recent value is retained.

To perform this test, it is necessary to switch on one of the relevant errors or warnings in the submenu "Diagnostics/Alarm Settings" (see page 80).

7.4.1.5 Determining the electrode AC voltage for E1 and E2



Primary signal for determining the electrode balance.

The electrode AC voltages are measured at the electrodes E1 and E2 to ground. The voltage measured is proportional to the flowrate.

The electrode AC voltage can be measured without affecting the flow measurement in any way.

To perform this measurement, it is necessary to switch on one of the relevant errors or warnings in the submenu "Diagnostics / Alarm Settings" (see page 82).

Important

The electrode zero point must be adjusted under the submenu "Diagnostics / Adjustment / Electr. Zero Point" (see page 85).

7.4.1.6 Determining the electrode balance

$E1 \geq E2 \rightarrow EB = \frac{E1}{E2}\ \%$

$E1 < E2 \rightarrow EB = (-)\frac{E2}{E1}\ \%$

Detect distorted flow profile, e.g., due to improper installation. Detect interference in electrode circuit, e.g., failure of electrode due to insulating coating or a collapsed liner (vacuum shock).

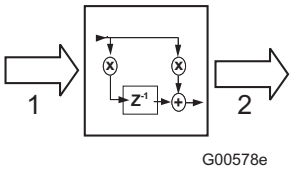
The electrode balance (EB) is calculated as the ratio between the electrode AC voltages E1/E2 or E2/E1. This value is displayed in [%]. To prevent false alarms, alarms are not triggered for electrode AC voltages below 20 µV, regardless of the alarm setting which has been selected.

The EB is measured without affecting the flow measurement in any way. To perform this measurement, it is necessary to switch on one of the relevant errors or warnings in the submenu "Diagnostics / Alarm Settings" (see page 82).

Important

The electrode zero point must be adjusted under the submenu "Diagnostics / Adjustment / Electr. Zero Point" (see page 85).

7.4.1.7 Determining the signal-to-noise ratio



1 Signal from flowmeter sensor
2 Filtered signal

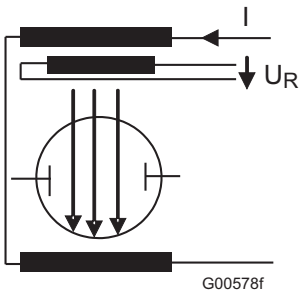
Detect changes in fluid, e.g., gas bubbles, increased/reduced amount of solids.

To determine the signal-to-noise ratio (SNR), the electrode AC voltage - raw signal for the flowmeter sensor is set in relation to the digitally filtered signal.

$$SNR = \frac{\text{Filtered signal}}{\text{Signal from flowmeter sensor}}$$

The SNR is measured without impairing the flow measurement in any way. To perform this calculation, it is necessary to switch on one of the relevant errors or warnings in the submenu "Diagnostics / Alarm Settings" (see page 82).

7.4.1.8 Determining the magnetic linearity



$$ML = \frac{I_1 * U_{R2}}{I_2 * U_{R1}}$$

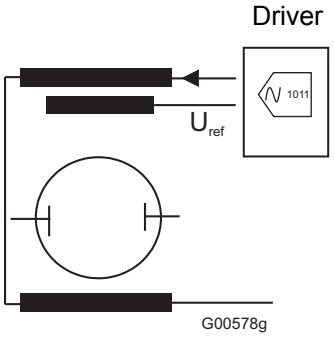
Detect magnetic field interference. This can affect the accuracy of the measurement.

When measuring magnetic linearity (ML), the coil current I_1 is measured at current reference voltage U_{R1} and coil current I_2 at approximately half the reference voltage U_{R2}.

The operating time at half the reference voltage is approx. 1 sec. During this period, the most recently acquired value is retained.

To perform this test, it is necessary to switch on one of the relevant errors or warnings in the submenu "Diagnostics/Alarm Settings" (see page 82).

7.4.1.9 Determining the maximum DAC value



For detecting changes in the coil circuit.

To compensate the set reference voltage Uref, the level of the digital/analog converter (DAC) value is manipulated in the transmitter's driver circuit to vary the coil's excitation signal. The amplitude of this value then serves as an indicator of the level of the excitation signal.

The DAC value is measured without affecting the flow measurement in any way.

To perform this measurement, it is necessary to switch on one of the relevant errors or warnings in the submenu "Diagnostics / Alarm Settings" (see page 82).

7.4.2 Recommended settings for diagnostic limit values

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

Parameter	Minimum value		Maximum value	
Electrode voltage 1	These values depend on the flowrate, so no recommendations can be made here.			
Electrode voltage 2				
Electrode balance [1)]	-150 %		150 %	
Coil current	Factory or commissioning fingerprint x 0.95		Factory or commissioning fingerprint x 1.05	
Coil voltage	This value depends on the fluid temperature T_{medium}.			
	T_{medium}		T_{medium}	
	-40 °C (-40 °F)	Factory fingerprint x 0.81	-40 °C (-40 °F)	Factory fingerprint x 0.89
	-20 °C (-4 °F)	Factory fingerprint x 0.86	-20 °C (-4 °F)	Factory fingerprint x 0.95
	0 °C (32 °F)	Factory fingerprint x 0.9	0 °C (32 °F)	Factory fingerprint x 1
	20 °C (68 °F)	Factory fingerprint x 0.95	20 °C (68 °F)	Factory fingerprint x 1.05
	60 °C (140 °F)	Factory fingerprint x 1.05	60 °C (140 °F)	Factory fingerprint x 1.16
	90 °C (194 °F)	Factory fingerprint x 1.14	90 °C (194 °F)	Factory fingerprint x 1.26
	130 °C (266 °F)	Factory fingerprint x 1.24	130 °C (266 °F)	Factory fingerprint x 1.37
	180 °C (356 °F)	Factory fingerprint x 1.33	180 °C (356 °F)	Factory fingerprint x 1.47
Coil resistance	This value depends on the fluid temperature T_{medium}.			
	T_{medium}		T_{medium}	
	-40 °C (-40 °F)	Factory fingerprint * 0.71	-40 °C (-40 °F)	Factory fingerprint * 0.79
	-20 °C (-4 °F)	Factory fingerprint * 0.81	-20 °C (-4 °F)	Factory fingerprint * 0.89
	0 °C (32 °F)	Factory fingerprint * 0.9	0 °C (32 °F)	Factory fingerprint * 1
	20 °C (68 °F)	Factory fingerprint * 0.95	20 °C (68 °F)	Factory fingerprint * 1.05
	60 °C (140 °F)	Factory fingerprint * 1.19	60 °C (140 °F)	Factory fingerprint * 1.31
	90 °C (194 °F)	Factory fingerprint * 1.28	90 °C (194 °F)	Factory fingerprint * 1.42
	130 °C (266 °F)	Factory fingerprint * 1.43	130 °C (266 °F)	Factory fingerprint * 1.58
	180 °C (356 °F)	Factory fingerprint * 1.62	180 °C (356 °F)	Factory fingerprint * 1.79
Coil temperature	This value depends on the ambient / fluid temperature, so no recommendations can be made here.			

1) This function is only guaranteed if an electrode zero point adjustment has been carried out (see page 85).

<table>
<tr><th>Parameter</th><th>Minimum value</th><th colspan="3">Maximum value</th></tr>
<tr><td>Accidental coil ground</td><td>10 MΩ</td><td colspan="3">99.9 MΩ</td></tr>
<tr><td rowspan="16">DAC max</td><td rowspan="16">100</td><td></td><td colspan="2">Design level of the flowmeter sensor</td></tr>
<tr><td>Nominal diameter</td><td>A</td><td>B</td></tr>
<tr><td>DN 1 ... 2
(1/25 ... 1/12")</td><td>500</td><td>-</td></tr>
<tr><td>DN 3 ... 10
(1/10 ... 3/8")</td><td>300</td><td>300</td></tr>
<tr><td>DN 15 (1/2")</td><td>400</td><td>300</td></tr>
<tr><td>DN 20 ... 25
(3/4 ... 1")</td><td>400</td><td>400</td></tr>
<tr><td>DN 32 (1 1/4")</td><td>400</td><td>500</td></tr>
<tr><td>DN 40 ... 50
(1 1/2 ... 2")</td><td>500</td><td>500</td></tr>
<tr><td>DN 65 (2 1/2")</td><td>400</td><td>300</td></tr>
<tr><td>DN 80 (3")</td><td>500</td><td>300</td></tr>
<tr><td>DN 100 ... 125
(4 ... 5")</td><td>500</td><td>600</td></tr>
<tr><td>DN 150 (6")</td><td>400</td><td>600</td></tr>
<tr><td>DN 200 ... 300
(8 ... 12")</td><td>400</td><td>700</td></tr>
<tr><td>DN 350 ... 400
(14 ... 16")</td><td>500</td><td>700</td></tr>
<tr><td>DN 450 ... 1000
(18 ... 40")</td><td>700</td><td>700</td></tr>
<tr><td>Magn. linearity</td><td colspan="2">This value depends on the fluid temperature T_{medium}.
T_{medium}
-40 °C (-40 °F) Factory fingerprint x 0.86
-20 °C (-4 °F) Factory fingerprint x 0.90
0 °C (32 °F) Factory fingerprint x 0.93
20 °C (68 °F) Factory fingerprint x 0.95
60 °C (140 °F) Factory fingerprint x 1
90 °C (194 °F) Factory fingerprint x 1.05
130 °C (266 °F) Factory fingerprint x 1.09
180 °C (356 °F) Factory fingerprint x 1.14</td><td colspan="2">T_{medium}
-40 °C (-40 °F) Factory fingerprint x 0.95
-20 °C (-4 °F) Factory fingerprint x 1
0 °C (32 °F) Factory fingerprint x 1.03
20 °C (68 °F) Factory fingerprint x 1.05
60 °C (140 °F) Factory fingerprint x 1.10
90 °C (194 °F) Factory fingerprint x 1.16
130 °C (266 °F) Factory fingerprint x 1.21
180 °C (356 °F) Factory fingerprint x 1.26</td></tr>
<tr><td>SNR (signal-to-noise ratio)</td><td colspan="2">60 % of the commissioning fingerprint or a higher value, depends on the application.</td><td colspan="2">100 %</td></tr>
</table>

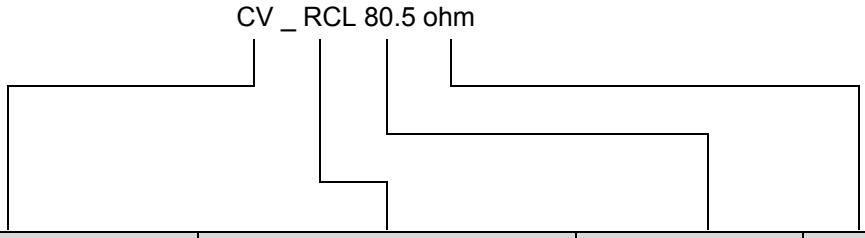
7.4.3 Displaying the diagnostic values

7.4.3.1 Measurement values

A maximum of four diagnostic values can be displayed (Fprt1, Fprt2, Fprt3, Fprt4). Values can be selected in the submenu Diagnostics / Fingerprint / Fprt1 - 4. In addition to the type of measurement value, the desired data record has to be configured. Through the combination of these two settings, every stored measured value can be displayed. To differentiate between the values in the display an identification code (ID) is prefixed before to each value.

As a result, each line appears as follows:

e.g., CV_RCL 80.5 ohm for the current coil resistance.



Data record	Type	Numerical value	Unit
CV_: Current value	UAC: Coil voltage (AC)	X.X	V
H1_: History 1	IAC: Coil current (AC)	X	mA
H2_: History 2	RCL: Coil resistance	Value > 100 X Value < 100 X.X	Ohm
H3_: History 3	TCL: Coil temperature	X	°C
H4_: History 4	RIS: Insulation resistance	Value > 100 X Value < 100 X.X	MOhm
H5_: History 5	UE1: Electrode voltage E1	X	µV
H6_: History 6	UE2: Electrode voltage E2	X	µV
H7_: History 7	BAL: Electrode balance	E1 ≥ E2 → +X E1 < E2 → -X	% %
H8_: History 8	LIN: Magnetic linearity	X	%
H9_: History 9	SNR: Signal-to-noise ratio	X	%
FV_: Factory Fingerprint	DAC: Max. DAC value	X	Dig = Digits
DF_: Startup Fingerprint			
P1_: Product 1-Fingerprint			
P2_: Product 2-Fingerprint			

When displaying the operating hours / log time, the ID code combines data record and type without underscore.

Data record	Type	Numerical value	Unit
CVC: Current transmitter operating hours counter		H:Min:Sec	-
P1C: Product1-Fingerprint transmitter log time		H:Min:Sec	-
P2C: Product2-Fingerprint transmitter log time		H:Min:Sec	-
DFC: Startup-Fingerprint transmitter log time		H:Min:Sec	-
FVC: Factory Fingerprint transmitter log time		H:Min:Sec	-
H1C – H9C: History 1 – 9 transmitter log time		H:Min:Sec	-
CVP: Current flowmeter sensor operating hours counter		H:Min:Sec	-
P1P: Product1-Fingerprint flowmeter sensor log time		H:Min:Sec	-
P2P: Product2-Fingerprint flowmeter sensor log time		H:Min:Sec	-
DFP: Startup-Fingerprint flowmeter sensor log time		H:Min:Sec	-
FVP: Factory Fingerprint flowmeter sensor log time		H:Min:Sec	-
H1P – H9P: History 1 – 9 flowmeter sensor log time		H:Min:Sec	-

7.4.3.2 Diagnostic warning and error messages

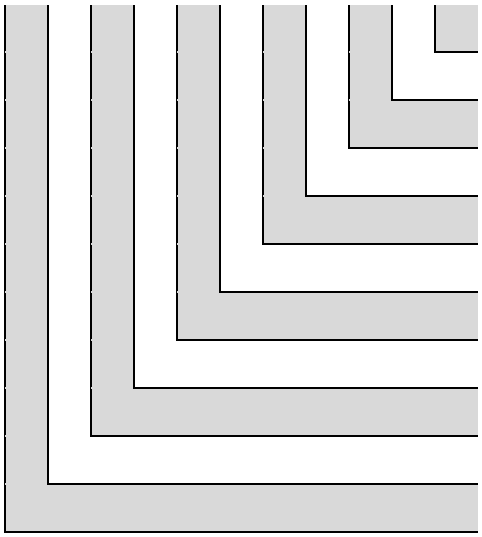
All values acquired during diagnostics or a wiring error can trigger warnings or error messages.

Warnings are displayed in the fourth line only. In the event of an error, the contact output may as an option (setting "General Alarm" or "ext. Diag. Alarm") be set to alarm state (in addition to the information displayed in the fourth line).

To activate this option, select in the submenu "Diagnostics / Alert Settings" whether the error or warning is triggered in the event of over or undershooting the specified range. To check for wiring errors, you can activate this function under "Diagnostics / Wiring Error".

For additional information, refer to the relevant error registers. These can be selected and accessed in the Submenus Display or Status.

The error registers for diagnostic values are structured as follows:



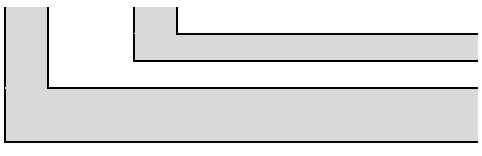
ID code	Set	Off	Description
S	–		Signal quality
L	–		Magnetic linearity
B	–		Electrode balance
e	–		Electrode voltage E1
E	–		Electrode voltage E2
D	–		DAC value
I	–		Insulation resistance
T	–		Coil temperature
L	–		Coil resistance
R	–		Coil voltage
C	–		Coil current

↓

ID code	Register name	Content of register
HMx	Hist Max Errors	**Error / Warning:** (Max.) values overshot while transmitter is in operation.
HMi	Hist Min Errors	**Error / Warning:** (Min.) values undershot while transmitter is in operation.
EMx	Curr Max Errors	**Error:** (Max.) present available current overshoots.
EMi	Curr Min Errors	**Error:** (Min.) present available current undershoots.
WMx	Curr Max Warn	**Warning:** (Max.) present available current overshoots.
WMi	Curr Min Warn	**Warning:** (Min.) present available current undershoots.

The information EMx _R_____B__ indicates Max. Alarm in the current values for the coil voltage and electrode balance.

The error registers for wiring errors are structured as follows:



ID code	Set	Off	Description
M	–		Coil short-circuit to ground
E	–		Wiring error for electrodes

↓

ID code	Register name	Content of register
ConWarn	Wiring warning	Current warnings for wiring
ConErr	Wiring Error	Current errors for wiring

7.4.4 Readjusting the coil temperature

If a readjustment is required, make sure that the flowmeter sensor and coil are relatively close to ambient temperature. You might need to allow the flowmeter to cool off overnight.

Work steps:

- Switch on the transmitter.
- Under "Diagnostics / Adjustment / CabLength", enter or check the cable length.
- Enter the ambient temperature in the submenu "Diagnostics / Adjustment / Coil Temp".
- Store the new reference resistance in the submenu "Diagnostics / Adjustment / Transfer RT20".

7.5 Software history

7.5.1 For transmitters without communication or HART protocol

Software D200S021U01		
Software version	**Type of changes**	**Documentation / Supplements**
B0.10	Original Software	–
B0.11	Improve min. contrast limit. After changing from 50 → 60 Hz the system data now displays the correct frequency.	–
B0.12	Shortened Finnish texts. Aut. simulator detection for counter management improved.	–
B0.14	Improved FRAM management.	–
B0.20	Added Turkish as new language. Added error E (DC too high) Updated flowmeter sensor 10D1462/72.	Added documentation for the additional points.
B0.22	Always display the flowrate with 4 decimal places.	–
B0.30	Menu item for noise reduction Menu item Meter factor Support for flowmeter sensors SE21, DN 1 ... DN 2	Added documentation for the additional points.
B0.31	Hardware compatibility for C-level hardware	–
B0.32	Improved totalizer management	–
B.33/B.34	Improved FRAM management	–
C0.10	Extended diagnostic functions. Extended noise reduction by 2 more levels. Software supports external zero point adjustment via contact input.	Added documentation for the additional points.
C0.11	Improved support for older flowmeter sensor	-

7.5.2 For transmitter with PROFIBUS PA communication

Software D200S021U02		
Software version	**Type of changes**	**Documentation / Supplements**
B0.11	Original Software	–
B0.14	Shortened Finnish texts. Aut. Simulator detection for counter management improved; FRAM management improved.	–
C0.10	Extended diagnostic functions, etc.	Added documentation for the additional points
C0.12	Improved PA stack	–
C0.13	Improved support for older flowmeter sensor	-

7.5.3 For transmitter with FOUNDATION Fieldbus communication

Software D200S021U03		
Software version	**Type of changes**	**Documentation / Supplements**
B0.14	Original Software	–
B0.15	Improved FF stack	–
C0.10	Extended diagnostic functions, etc.	Added documentation for the additional points
C0.12	Improved FF stack	–
C0.13	Control response of the PID block adapted	–
C0.14	Improved support for older flowmeter sensor	-

8 Messages and tests

8.1 Overview of error states and alarms

State / Error	Flowrate indicator display	Notification with simulation at current output	Current output	Pulse output	Contact output						Message with HART
					General Alarm	Min. alarm	Max. alarm	Max-Min alarm	Empty pipe	Ext. Diag. Alarm	
0 = "Empty pipe"	0 %	–	Prog.Al. DLR	0 %	Alarm				Alarm		More Stat avai.
1 = "AD Converter/DSP"	0 %	–	Prog.Al.	0 %	Alarm						Trans Mal F.
2 = "Driver"	0 %	–	Prog.Al.	0 %	Alarm						Trans Mal F.
3= "Flow > 103%"	103 %	Yes	High.Al	103 %	Alarm						PV out Limits
4 = "Zero return"	0 %	–	0 %	0 %	Alarm						More Stat avai.
5 = "Data base"	0 %	Yes	Prog.Al.	0 %	Alarm						Trans Mal F.
6 = "Totalizer"	–	Yes	–	–	Alarm						More Stat avai.
A = "Max Alarm"	–	Yes	–	–	Alarm		Alarm	Alarm			More Stat avai.
B = "Min Alarm"	–	Yes	–	–	Alarm	Alarm		Alarm			More Stat avai.
C = "Ext. data base"	0 %	Yes	Prog.Al.	0 %	Alarm						Trans Mal F.
F = "FRAM in Primary"	0 %	Yes	Prog.Al.	0 %	Alarm						Trans Mal F.
D = "Old Primary"	0 %	Yes	Prog.Al.	0 %	Alarm						Trans Mal F.
E = "DC to high"	0 %	Yes	Prog.Al.	0 %	Alarm						Trans Mal F.
G = "Error Diagnosis"	–	–	–	–	Alarm					Alarm	Trans Mal F.

8.2 Error messages during operation and with data entry

The error messages listed below include explanations of the error codes shown in the display. When entering information, the error codes 0 ... 6, A, B, C, D, E, G do not appear.

Error code and clear text message	Priority	Description	Possible cause	Corrective action
Error: 0 Empty pipe	5	The meter tube is not full.	The pipeline is empty and the electrodes are not coming into contact with the fluid.	Refill the meter tube. Detector empty pipe is on, but the adjustment has not been run. Adjust DEP.
Error: 1 AD Converter/DSP	4	The AD converter is saturated and is not responding.	Input metering signal is too large.	Check ground (flowmeter sensor). Check the signal cable and the measuring range setting; the measuring range selected may be too low.
			The AD converter/DSP is defective.	Replace the DSP board.
Error: 2 Driver	7	Positive or negative reference too small.	Check the cables, no reference voltage is present. The current limiter in the driver has responded because the driver current is insufficient. Defective driver fuse.	Check connection board and transmitter.
Error: 3 Flow > 103%	6	The max. measuring range was exceeded by more than 3%.	The flowrate is set too high or the measuring range is set too small.	Increase the measuring range, reduce the flowrate.
Error: 4 Zero Return	8	The flowrate is set to zero; the totalizer is stopped.	The external contact is closed.	The external contact is open again.
Error: 5 Database	2	Loss of the internal database.	Data memory module is defective.	Turn unit off and on again, call up and run functional test for transmitter.
Error: 6 Totalizer	9	Error in totalizer > F.	The forward totalizer is damaged.	Reset forward/reverse totalizer or preset new values in totalizer.
		Error totalizer < R	The reverse totalizer is damaged.	Totalizer forward, reverse defective.
		Error totalizer	The totalizer forward, reverse or diff. totalizer is damaged.	Check transmitter and wiring.

Error code and clear text message	Prior-ity	Description	Possible cause	Corrective action
Error: A Max. Alarm	10, 11	Max alarm limit value.	The configured Max alarm for the flowrate was exceeded.	Reduce flowrate.
Error: B Min. Alarm		Min alarm limit value.	The flowrate is below the configured Min alarm	Increase flowrate.
Error: C Ext. data base	3	External database FRAM is defective or not available.	Missing FRAM or defective FRAM[1].	Install and screw in place the FRAM for the associated flowmeter sensor to the connection board in the field housing unit. See chapter 6. If the FRAM cannot be read, it must be replaced.
Error: D Old Primary	12	Flowmeter sensor type from the older model flowmeter series was selected.	Configuration under the parameter "Primary Setup" is incomplete.	Complete configuration under "Primary Setup". See also chapter 11 at the operating instruction.
Error: E DC to high	13	Increased analog reset, measurement signal with large DC	Air bubbles, deposits on electrodes, too high interference signal. Empty pipe.	Activate "Noise reduction" in the operating mode submenu. Use a air separator, clean electrodes, activate empty pipe detector. Contact ABB Service.
Error: F FRAM in Primary	1	Missing data from external FRAM.	FRAM for the flowmeter sensor is still installed in the terminal box.	Install and screw in place the FRAM for the associated flowmeter sensor to the connection board in the field housing unit. See chapter 6.
Error: G Error Diagnosis	14	Diagnostic or wiring error	Min-Max over/undershoot for diagnostic values.	Retrieve details of error message under the Status submenu in the Diagnostic error register. Adjust thresholds, if necessary.
			Wiring error for electrode circuit. Coil short-circuit to ground	Retrieve details of error message under the Status submenu in the Wiring error register.

1) Replacing a defective FRAM.
If the FRAM is defective and startup cannot be performed, a new FRAM can be requested from the Göttingen plant. To properly process requests, you must include the ABB order number and unit number of the flowmeter sensor. After installing the FRAM and switching on the power, you can start up the system. Review all flowmeter sensor data and setup data for the system, and enter this information again, if necessary.

8.3 Warning messages during operation

Warning code and ID letter	Prior-ity	Description	Possible cause	Corrective action
Warning: 1 Q Simulation	2	Before operation with flow, a flowrate can be simulated. The output values correspond to the simulated flowrate entered.	Simulation mode on.	After completing the simulation program, switch off the parameter "Simulation Mode".
Warning: 2 Totalizer reset	1	All totalizers (forward/reverse, diff. and overflow counters are reset.)	External totalizer reset was performed.	Open the switch at the contact input (terminal 81, 82).
Warning: 3 Test Mode	3	Only for checking the transmitter using Simulator 55XC4000.	Test Mode on.	After running the simulation on the simulator, switch off the parameter "Test Mode".
Warning: 4 Function test	4	If during HART communication, the functional test for the contact output or contact input was started, the Warning 4 is displayed.	Function test on.	After completing the self check test, exit the routine.
Warning: 7[1)] Ext.Dat.loaded	9	Transmitter has recognized different flowmeter sensor data and loaded it in the internal FRAM. Loaded are the system and flowmeter sensor data.	Defective FRAM, repair unit, replace instrument.	Write down all totalizer values, totalizers should be reset.
Warning: 8a[1)] Update int.Dat	10	Transmitter has detected an error in the internal FRAM and has repaired the data with content of the external FRAM.	Defective FRAM, repair unit, replace instrument.	Check the setup data and correct, if necessary.
Warning: 8b[1)] Update ext.Dat.		Transmitter has detected an error in the external FRAM and has repaired the data with content of the internal FRAM.	Defective FRAM or data was modified.	Check the setup data and correct, if necessary.
Warning: 9a Overflow > F	5	Forward totalizer has reached the maximum count and has restarted at zero.	Max. totalizer overshot, 1 overflow as value was totalized.	Reset totalizer, if necessary.
Warning: 9b Overflow < R	6	Reverse totalizer has reached the maximum count and has restarted at zero.	Max. totalizer overshot, 1 overflow as value was totalized.	Reset totalizer, if necessary.
Warning: 9c Overflow Diff.	7	Diff. totalizer has reached the maximum count and has restarted at zero.	Max. totalizer overshot, 1 overflow as value was totalized.	Reset totalizer, if necessary.

Warning code and ID letter	Prio-rity	Description	Possible cause	Corrective action
Warning: 10 Reverse Q	8	If the flow direction is forward, the warning is displayed in case of reverse flow.	Reverse flow direction, possibly defective check valve.	Prevent reverse flow or change flow direction to forward/reverse.
Warning: 11[2)] Poll. Adr. > 0	12	The HART unit address was changed to an address other than zero. The current output remains frozen at 4 mA.	Address 1 ... 15 selected. The current output thereby remains set at 4 mA.	Select 0 as address, if the current output should be 4 ... 20 mA.
Warning. 12a[2) 3)] Simulation Iout	13	Test the current output. Check the value displayed at the connection terminals using a digital voltmeter or the process instrumentation.	Function test, enter current output directly in mA for simulation.	Exit the functional test of current output.
Warning. 12b[2) 3)] Simulat. Pulse	14	Test the pulse output. Check the value of output frequency with a counter.	Simulation pulse output on.	Exit the functional test of the pulse output.
Warning. 13[2) 3)] Auto. Adjust	15	Adjustment started for system zero point adjustment via the contact input for internal adjustment (for ABB Service only).	The external contact is closed For ABB Service personnel only.	The external contact is open again. For ABB Service personnel only.
Warning. 14 Hold MV	16	Warning results only when the "Noise reduction" function is activated.	Measuring signal affected by powerful interference signal.	Set noise reduction to lower level or deactivate. If necessary, contact ABB Service.
Warning F Warn. Diagnosis	17	Diagnosis or wiring warning	Min-Max over/undershoot for diagnostic values. Wiring error for electrode circuit. Coil short-circuit to ground	Retrieve details of the warning message under the Status submenu in the Diagnostic warning register. Adjust the limit value, if necessary. Retrieve details of warning message under the Status submenu in the Wiring warning register.

1) Warning is displayed for 30 seconds.
2) Transmitter must be equipped with HART communication protocol.
3) Warning is displayed only if the function is called by an external HART protocol command.

9 Maintenance / Repair

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

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

Notice - Potential damage to parts!

The electronic components of the printed circuit board can be damaged by static electricity (observe ESD guidelines). Make sure that the static electricity in your body is discharged when touching electronic components.

9.1 Flowmeter sensor

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

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

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

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

Important

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

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

9.2 Gaskets

Some device designs are shipped with special gaskets. These gaskets must be used and installed properly to prevent leakage.

For all other device designs, use commercially available gaskets made from a compatible material for the fluid and prevailing temperature (rubber, PDFE, lt, EPDM, silicon, Viton, etc.).

Important

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

9.3 Replacing the transmitter

The transmitter plug-in module can be replaced without loss of function for sizes DN 1 ... DN 1000.

When replacing the FRAM-calibrated flowmeter sensor (identifiable by the Cs and Cz values on the model plate), please take into consideration the following points:

- Does the replacement transmitter plug-in module use the same supply power?
- Does the replacement transmitter plug-in module have the same input/output functions or use the same type of communication?

Important for plug-ins with PROFIBUS PA / FOUNDATION Fieldbus

If the transmitter is located at the bus end and if the bus termination is activated via both hook switches, the bus termination is canceled when the transmitter plug-in module is removed. The bus is no longer terminated properly.

Warning – Electrical voltage risk!

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

- Power to all connecting cables must be switched off.

1. Switch off the supply power before installing the replacement transmitter plug-in. After waiting 40 minutes, remove the housing cover from the field housing unit. First, remove the protective cover (3 screws). Next, remove the upper mounting screw and the center stay-bolt on the plug-in. The plug-in module can now be pulled up and off the connection plug. Install the replacement transmitter plug-in in reverse order.

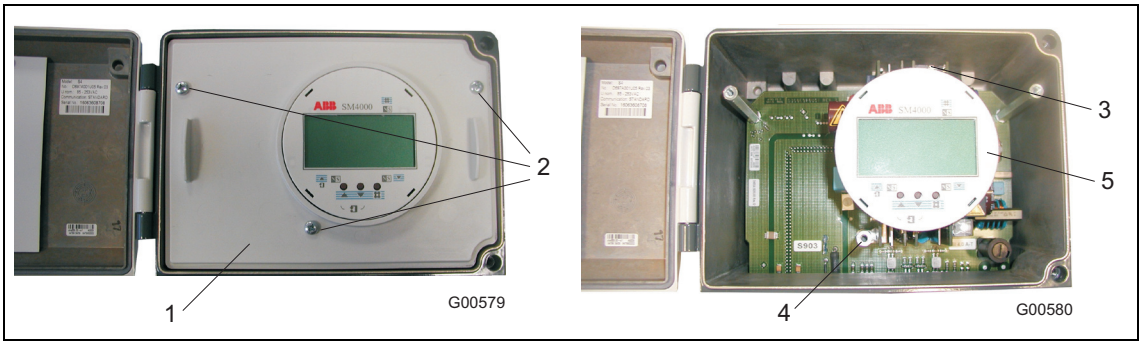


Fig. 53

1 Protective cover
2 Screws for cover
3 Mounting screw for plug-in module
4 Stay-bolt for plug-in module
5 Transmitter plug-in module

2. Switch on the supply power; the model number of the transmitter and the current software version are displayed.

   The flowmeter sensor and system data from the external FRAM are imported:

   a) The following information is displayed:

   - Warning 7 - Primary data loaded.

   When replacing the transmitter all flowmeter sensor and measuring point parameters are loaded into the replacement transmitter. After successful data transfer, the "Warning 7" message is deleted after approx. 30 sec.

   b) Transmitter and flowmeter sensor are put into operation again (e.g., after a power failure):

   No warning is displayed; the transmitter runs automatically with the data from the internal and external FRAM.

   c) Only the transmitter is replaced; order numbers are not identical. The external flowmeter sensor and system data is imported. The following message is displayed:

   - Warning 7 - Primary data loaded.

   d) If the order number, unit number, Cs, Cz and size are identical (e.g., if the transmitter from the delivery is used with identical configuration data), the process data is imported from the internal to external FRAM. The flowmeter sensor data continues to be imported from the external to internal FRAM. The following message is displayed:

   - Warning 8b – (Update external FRAM).

   If the external data cannot be loaded in scenarios a) to d), the program attempts to repair the defective data. The following messages may be displayed:

   - Warning 8a – (Update internal data) - for data flow direction external → internal
   - Warning 8b – (Update external data) - for data flow direction internal → external

   Both messages can be displayed simultaneously.

   If this occurs, the following error is displayed:

   - Error C - for the external FRAM, the FRAM must be replaced
   - Error 5 - for the internal FRAM, the transmitter starts automatically with default values. In some instances, it may be possible to eliminate this error by turning the supply power off and on. If this does not work, the transmitter must be replaced.

3. Check whether the language, display format, flow ranges, alarm settings and flowmeter sensor data match the values listed on the name plate for the flowmeter sensor. If parameters are subsequently changed, these are stored automatically in the external FRAM.

4. The measuring system is ready for operation.

10 Spare parts list

Important

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

10.1 Fuses for transmitter electronics

Warning – Electrical voltage risk!

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

- Power to all connecting cables must be switched off.

Replacing the fuse

1. Switch off supply power. After waiting 40 minutes, remove the housing cover from the field housing unit.
2. To replace the fuses for the remove the protective cover (1), loosen and remove the 3 screws (2).

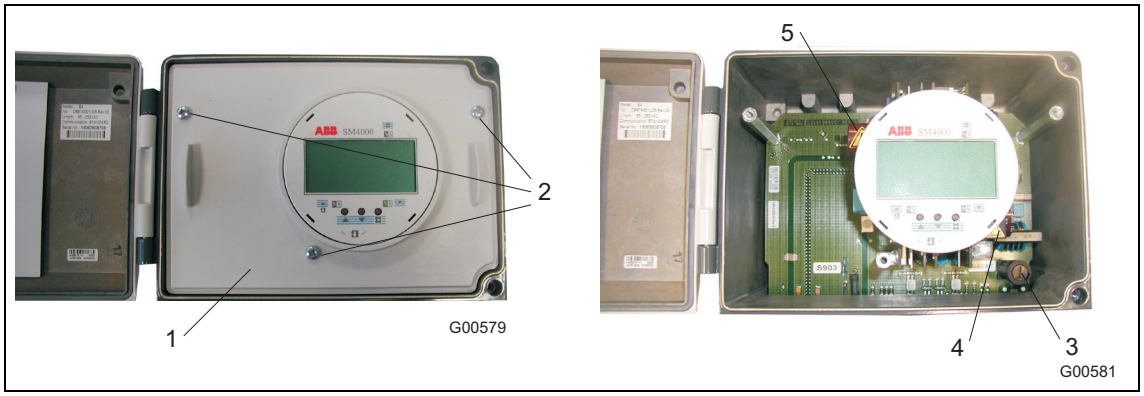


Fig. 54

1 Protection cover
2 Screws for cover
3 Pre fuse for supply power on the backplane
4 Fuse for supply power on the transmitter electronic unit
5 Fuse for driver circuit on the backplane

	Parameter	Order number
3	Pre fuse for supply power on backplane (4 A-T)	D151B003U08
4	Fuse for supply power on the transmitter electronic unit Fuse for 24 V AC/DC (4 A-T) Fuse for 100 -230 V AC (1 A-T)	 D151B003U08 D151B003U05
5	Driver circuit fuse F103 (0.8 A)	D151F003U18

10.2 Spare parts for transmitter S4

10.2.1 Field housing unit

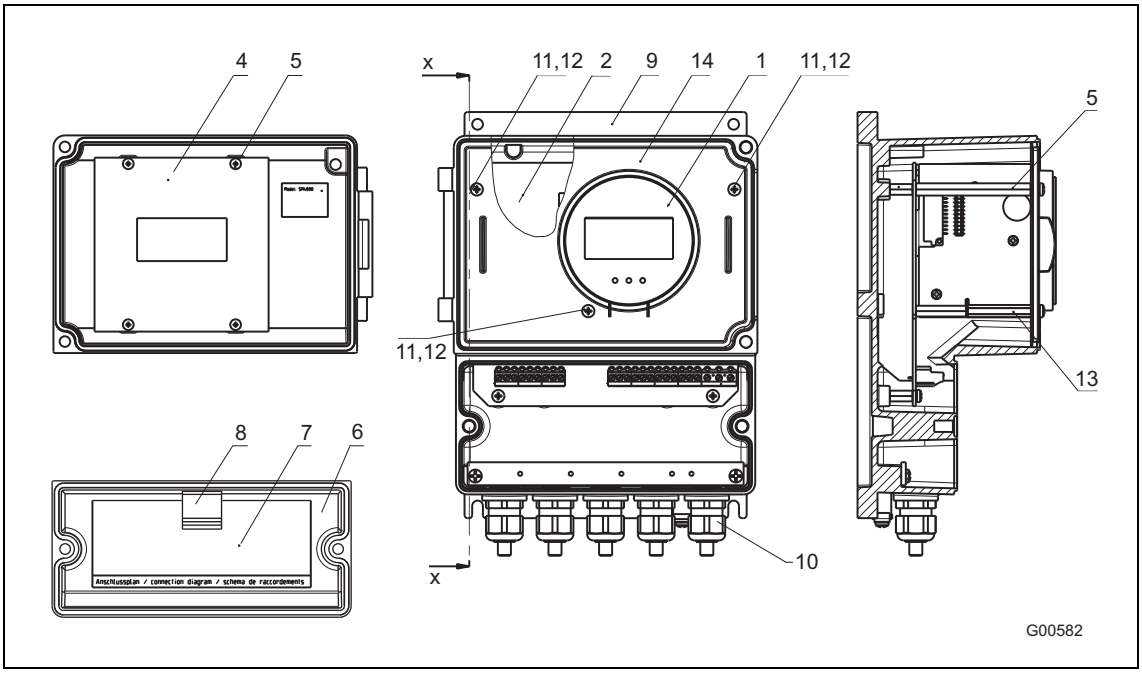


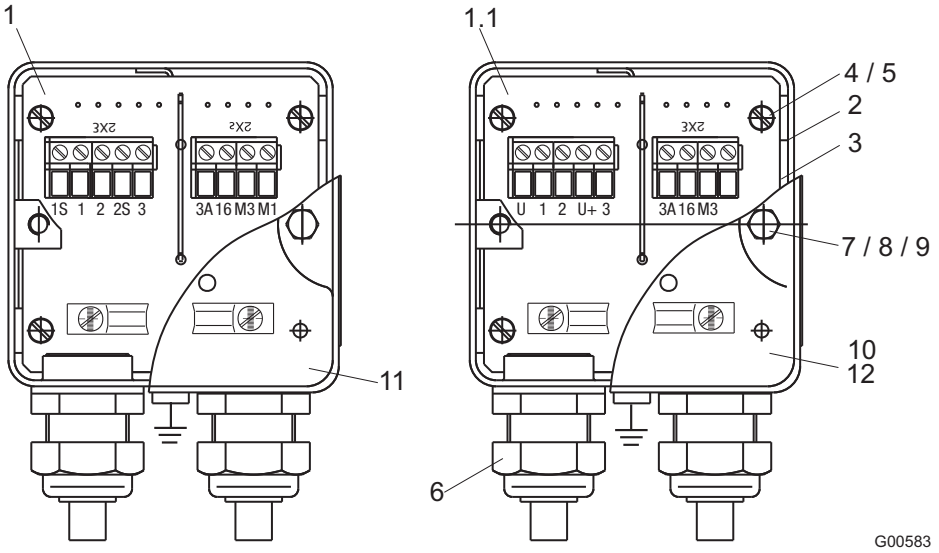
Fig. 55

No.	Parameter	Order number
1	Transmitter (100 ... 230 V AC) without HART Transmitter (100 ... 230 V AC) with HART Transmitter (100 ... 230 V AC) with PROFIBUS PA / FF[1)] Transmitter (24 V AC/DC) with HART Transmitter (24 V AC/DC) with PROFIBUS PA / FF[1)]	D674A859U04 D674A859U05 D674A859U06 D674A860U03 D674A860U04
2	Connection board, standard Connection board, PA/FF	D685A1020U03 D685A1020U02
3	Cover large, complete	D641A030U01
4	PVC cover	D626A005U01
5	Spacer bolts M4 x 75, galvanized steel	D124E009U20
6	Cover small	D641A029U01
7	Connection diagram, standard / HART Connection diagram, PROFIBUS PA / FF	D338D311U01 D338D311U02
8	Flat cable holder	D174D002U03
9	Field housing unit, empty	D641A033U01
10	Cable gland M 20 x 1.5	D150A008U15
11	Pan head Phillips screw M4 x 10, galvanized steel	D004G108AU01
12	Spring washer A 4.0 DIN 137, SS	D085D020AU20
13	Spacer bolts M4 x 41 l/A, galvanized steel	D403B104U01
14	Protective cover	D355H305U01

1) When ordering spare parts, please provide the communication version to help us select the proper software.

10.3 Spare parts flowmeter sensor

10.3.1 Terminal box, stainless steel, DN 1 ... DN 100



Terminal box for SE21, standard

Terminal box for SE21, with preamplifier

Fig. 56

No.	Name of part	Order number
1	Connection board, standard > DN 8	D685A1025U01
1.1	Connection board with preamplifier	D685A1028U01
2	Lower section SS 1.4301, model SE21_	D612A128U01
3	Seal	D333F016U01
4	Pan head screw M3 x 6, DIN 7985	D004F106AU20
5	Serrated lock washer A3.2, DIN 6798	D085G017AU32
6	Cable gland, plastic, grey	D150A008U02
7	Spacer	D375A018U01
8	Hex-head screw M4 x 14, DIN 7964, SS	D024G110AU20
9	Insert ring "Nyltite Seal" F.M4	D115B004U01
10	Cover SS no. 1.4301	D612A178U01
11	Connection diagram, standard	D338D309U01
12	Connection diagram, with preamplifier	D338D310U01

10.3.2 Terminal box, aluminum, DN 3 ... DN 1000

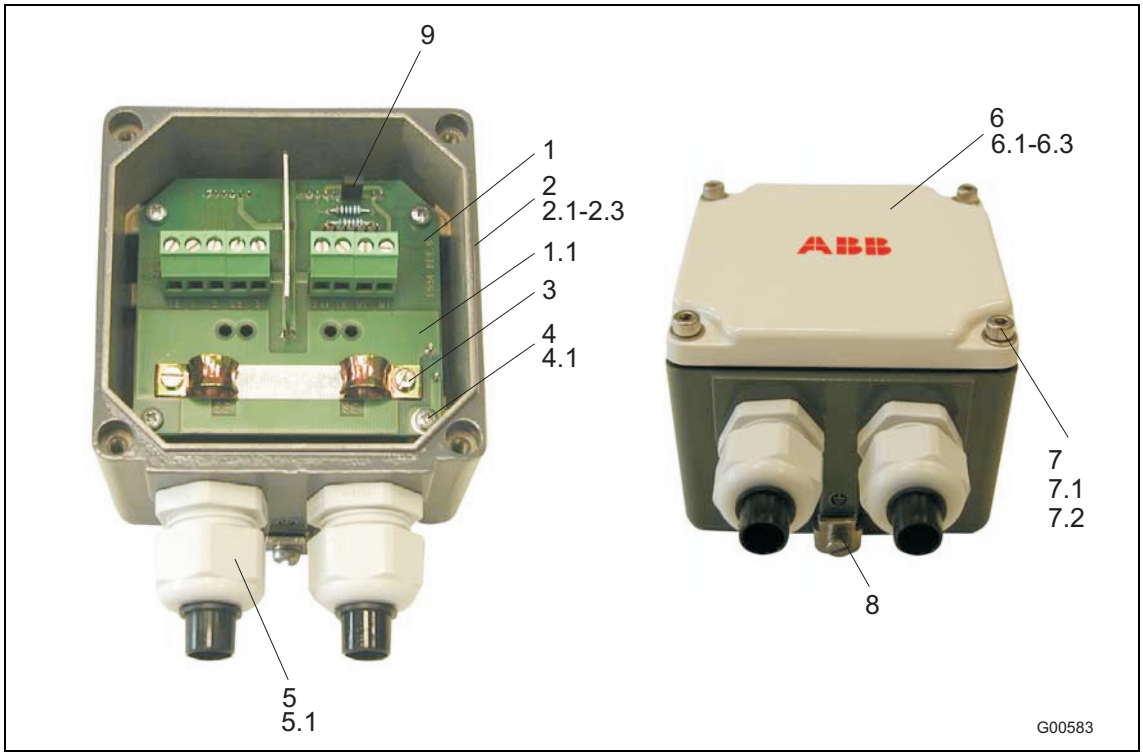
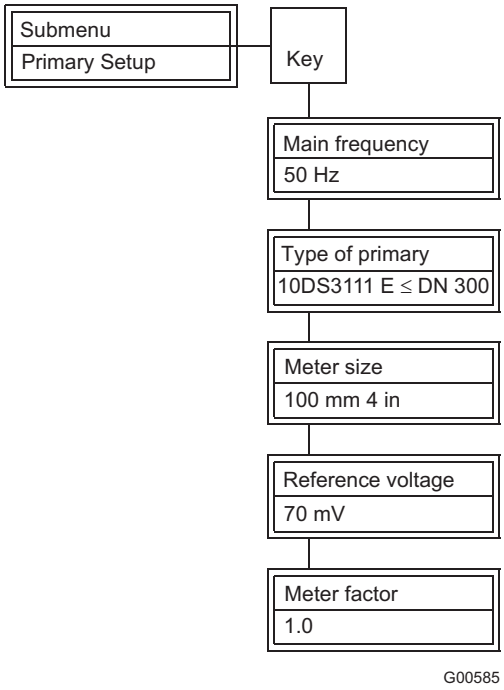


Fig. 57

No.	Name of part	Order number
1	Connection board, standard > DN 8	D685A1025U01
1.1	Connection board, preamplifier	D685A1028U01
2	Lower section with cable gland M 20 x 1.5 ≤ DN 100	D612A153U01
2.1	Lower section with cable gland M 20 x 1.5 > DN 100	D612A153U05
2.2	Lower section with NPT adapter ≤ DN 100	D612A153U03
2.3	Lower section with NPT adapter > DN 100	D612A153U07
3	Cheese head screw M3 x 8, DIN 84	D002F107AU20
3.1	Clamp strap	D108A003U08
4	Sheet metal screw 2.9x6.5 DIN 7981	D055E106CZ01
4.1	Serrated lock washer A3.2, DIN 6798	D085G017AU32
5	Cable gland M 20 x 1.5, standard	D150A008U15
5.1	Cable gland PG 13.5, option	D150A008U02
6	Cover compl.	D612A152U01
6.1	Cover gasket	D333F022U01
6.2	Connection diagram, standard	D338D309U01
6.3	Connection diagram, preamplifier	D338D310U01
7	Cheese head screws M4 x 18, DIN 912	D009G113AU20
7.1	Washer B 4.3, DIN 125	D085A021BU20
7.2	Retaining ring	D106A001U25
8	Grounding accessories	D614L607U01
9	Shorting jumper (RM 2.54)	D172A001U01

11 Operating S4 with an older sensor

When operating a transmitter with an older model, the FRAM must be used with the values Cs = 100% and Cz = 0%. If the transmitter has been set up in this way and the devices have been mounted according to the connection diagram (see page 40 and on), the "Primary Setup" menu appears after switching on the supply power. Press any key to enter the following information. If you need to correct your entry, you can do so afterward under the system data submenu "Flowmeter Primary" in "Primary Setup". See page 67.



Entries can be made one after another. In the submenu "Primary Setup", select the line frequency at which the flowmeter sensor was calibrated. See name plate. Select the flowmeter sensor type from the list in the table. Check that the letter after the model number and the nominal diameter range are correct. Otherwise, the transmitter will not access the correct reference data.

Enter the relevant meter size. The values are listed for DIN and ANSI sizes. Enter the reference voltage (see the name plate on the flowmeter sensor) in numerical format. (For flowmeter sensor 10D1422 or 10DI1425 > DN500, the reference voltage is not required.)

Enter the meter factor (for model 10D1462/72 only). See name plate.

Select the measuring range and other process parameters (damping, low cut-off, current/pulse output, display format, etc.). A system zero adjustment must be performed with a full pipeline at standstill (0 m/s).

Important

If no values are listed for the reference voltage on the name plate, you can request this information from ABB Service. Please provide order number with your request.

e-mail: parts-repair-goettingen@de.abb.com

Phone: +49 180 5222 580

Type of flowmeter sensor, version level	Meter size DN	Connection board with voltage splitter (switch S903 must be closed)	FRAM design	Coil supply current from:	Reference voltage
SE2_, SE4	1 ... 1000	No	With flowmeter sensor calibration values Cs = see name plate Cz = see name plate	Transmitter S4	automatic
DS2_ DS4_ 10DS3111(A-D) 10DS3111(E)	1 ... 1000 ≤ 300 ≤ 400 ≤ 300	No	Cs = calculated; Cz = 0%	Transmitter S4	from name plate
10DI1425	≤ 400	No	Cs = calculated; Cz = 0%	Transmitter S4	90 mV
DS4_ 10DS3111(E)	≥ 350 ... 1000 ≥ 350 ... 400	No	Cs = calculated; Cz = 0%	Transmitter S4	from name plate
10DS3111(A-C) 10DS3111(D) 10DS3111(E)	≥ 500 ≥ 500 ≥ 500	No	Cs = calculated; Cz = 0%	External supply power	from name plate
10D1422, 10DI1425	3 ... 1000 ≥ 500	yes yes	Cs = calculated; Cz = 0%	External supply power	–
10DS3111A 10D1462 10D1472	350 ... 600 150 ... 900 15 ... 100	no, use 1000 Ω adapter board	calculated	External supply power	from name plate

Important

If the flow indicator shows the incorrect direction after successful startup of the meter, e.g., reverse instead of forward, correct this in the Operating Mode submenu of the transmitter. First switch off the programming protection ("Prog. Level" → "Specialist"). Then select the parameter "Directional display" under the parameter "Operating Mode", and change "normal" to "inverse". Finally, reactivate programming protection via "Prog. Level" → "Locked").

Warning – Electrical voltage risk!

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

- Power to all connecting cables must be switched off.

Adapting the transmitter to the flowmeter sensor 10D1422 (DN 3 ... 1000), 10DI1425 (≥ DN 500):

1. Switch off supply power. After waiting 40 minutes, remove the housing cover from the field housing unit.
2. Replace the shock protection cover (1) by removing the 3 screws. Close switch S903 (3).

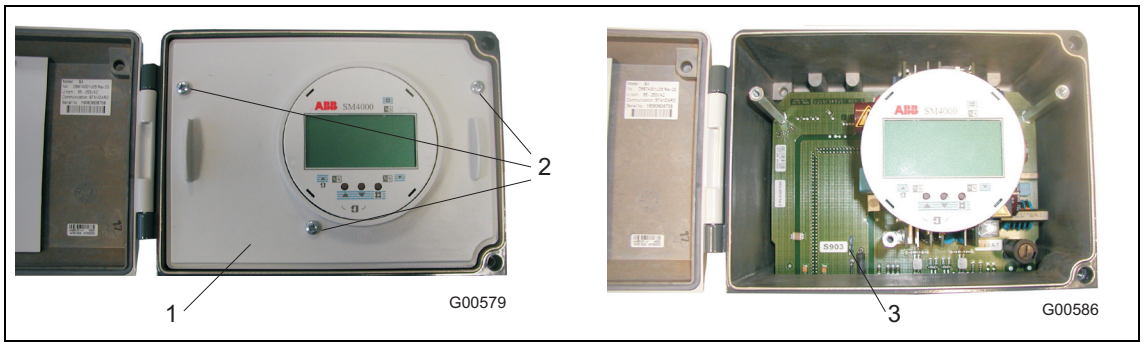


Fig. 58

1 Shock protection cover
2 Cover for mounting screws
3 Switch S903

12 Specifications

12.1 Measuring accuracy

12.1.1 Reference conditionsper EN 29104

Fluid temperature	20 °C (68 °F) ± 2 K
Ambient temperature	20 °C (68 °F) ± 2 K
Power supply	Line voltage as per name plate U_N ± 1 %
Installation conditions	– Upstream > 10 x DN straight section – Downstream > 5 x DN straight section DN = Flowmeter sensor size
Warm-up phase	30 min

12.1.2 Maximum measuring error

Pulse output

– DN 1 ... DN 2 (1/25 ... 1/12"):
  ± 1% of measured value, ± 0.001 Q_{maxDN}
– DN 3 ... DN 1000 (1/10 ... 40"):
  Q > 0.05 Q_{maxDN} ± 0.5% of measured value
– Q < 0.05 Q_{maxDN} ± 0.00025 Q_{maxDN}

Q_{maxDN} = maximum flowrate for the flowmeter size 10 m/s

Analog output effects

Same as pulse output plus ±0.1% of rate ±0.01 mA

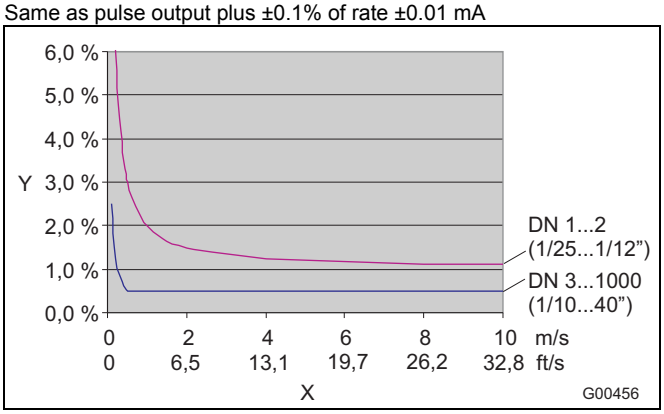


Fig. 59
Y Accuracy ± of rate
X Flow velocity v

12.2 Flowmeter sensor

12.2.1 Flowmeter sensor SE41F

Temperature graph

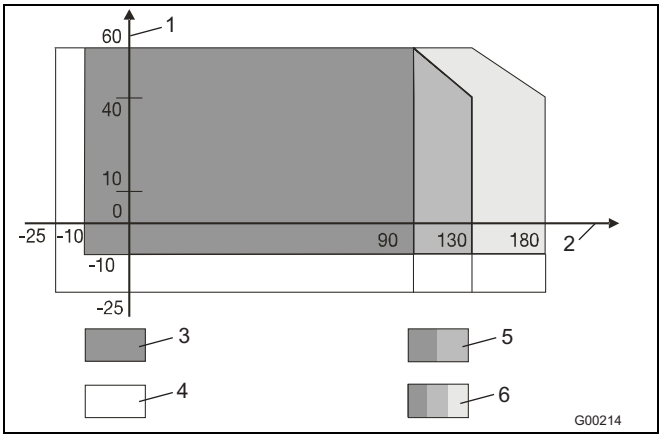


Fig. 60: Fluid temperature as function of ambient temperature

1 Ambient temperature °C
2 Fluid temperature °C
3 Standard flange (steel): Hard/soft rubber max. 90 / 60 °C (194 ... 140 °F)
4 Stainless steel flange
5 Standard flange (steel): PTFE / PFA / ETFE max. 130 °C (266 °F)
6 High temperature: Thick PTFE / PFA max. 180 °C (356 °F)

Max. allowable cleaning temperature PTFE-, PFA-design

CIP cleaning	Liner Flowmeter sensor	T_{max}	t_{max} Min	$T_{amb.}$
Steam cleaning	PTFE, PFA	150 °C (302 °F)	60	25 °C (77 °F)
Wet cleaning	PTFE, PFA	140 °C (284 °F)	60	25 °C (77 °F)

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

Weight
See "Dimensions"

Min. permissible pressure as a function of fluid temperature

Lining	Nominal diameter DN	$P_{Operation}$ at mbar abs	$T_{Operating}$
Hard rubber	15 … 1000 (1/2 … 40“)	0	< 90 °C (194 °F)
Soft rubber	50 … 1000 (2 … 40“)	0	< 60 °C (140 °F)
PTFE	10 … 600 (3/8 … 24“)	270 400 500	< 20 °C (68 °F) < 100 °C (212 °F) < 130°C (266 °F)
Thick PTFE high-temperature design	25 … 80 (1 … 3“) 100…250 (4…10“) 300 (12“)	0 67 27	< 180 °C (356 °F) < 180 °C (356 °F) < 180 °C (356 °F)
PFA	3 … 200 (1/10 … 8“)	0 0	< 130°C (266 °F) < 180 °C (356 °F)
ETFE	25...1000 (1...40“)	100	< 130 °C (266 °F)
Ceramic carbide	25 … 1000 (1 … 40“)	0	< 80 °C (176 °F)

Flowmeter sensor material

Parts	Standard	Others
Lining	PTFE, PFA, hard rubber, soft rubber, ETFE	Ceramic carbide
Signal and ground electrode for - Hard rubber - Soft rubber	Stainless steel 1.4571 (316 Ti)	Hastelloy B-3 (2.4600), Hastelloy C-4 (2.4610), Titanium, tantalum, Platinum-iridium, Stainless steel 1.4539 (904 L)
- PTFE, PFA, ETFE	Hastelloy C-4 (2.4610)	Stainless steel 1.4571 (316 Ti) Hastelloy B-3 (2.4600), Titanium, tantalum, Platinum-iridium, Stainless steel 1.4539 (904 L)
Grounding plate	Stainless steel 1.4571 (316 Ti)	On request
Protection plate	Stainless steel 1.4571 (316 Ti)	On request

Process connection material

Parts	Standard	Others
Flange		
DN 3 ... DN 15 (1/10 ... 1/2“)	Stainless steel 1)	Stainless steel 1)
DN 20 ... DN 300 (3/4 ... 12“)	Galvanized steel 2)	
DN 350 ... DN 1000 (14 ... 40“)	Painted steel 2)	
Housing		
DN 3 ... 300 (1/10 ... 12“)	Dual-shell casing, cast aluminum, painted, paint coat, ≥ 80 µm thick, RAL 9002	–
DN 350 ... DN 1000 (14 ... 40“)	Welded steel design, painted, paint coat, ≥ 80 µm thick, RAL 9002	–
Terminal box	Al alloy, painted, ≥ 80 µm dick, frame: dark gray, RAL 7012 Cover: light gray, RAL 9002	–
Meter tube	Stainless steel 1.4301 (304)	–
cable gland used	Polyamide	–

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

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

Storage temperature
-20 ... 70 °C (-4 ... 158 °F)

Degree of protection acc. to EN 60529
IP 65 / IP 67
IP 68 (option)

Pipeline vibration according to EN 60068-2-6
Transmitter
- In the range of 10…55 Hz, max. deflection 0.15 mm

Flowmeter sensor
- In the range of 10…55 Hz, max. deflection 0.15 mm
- In the range of 10…55 Hz, max. acceleration 2 g

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

Material load

Limits for allowable fluid temperature (TS) and allowable pressure (PS) are a function of the liner and flange material used (see the factory tag and name plate of the unit).

Temperature limits

Lining	Flange material	Min. temperature	Max. temperature	
			Standard	High temperature
Hard rubber	Steel	-10 °C (14 °F)	90 °C (194 °F)	-
	Stainless steel	-15 °C (5°F)	90 °C (194 °F)	-
Soft rubber	Steel	-10 °C (14 °F)	60 °C (140 °F)	-
	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)	-
PTFE / ETFE	Steel	-10 °C (14 °F)	130 °C (266 °F)	-
	Stainless steel	-25 °C (-13 °F)	130 °C (266 °F)	-
Thick PTFE / PFA	Steel	-10 °C (14 °F)	130 °C (266 °F)	180 °C (356 °F)
	Stainless steel	-25 °C (-13 °F)	130 °C (266 °F)	180 °C (356 °F)
Ceramic carbide	Steel	-10 °C (14 °F)	80 °C (176 °F)	-
	Stainless steel	-20 °C (-4 °F)	80 °C (176 °F)	-

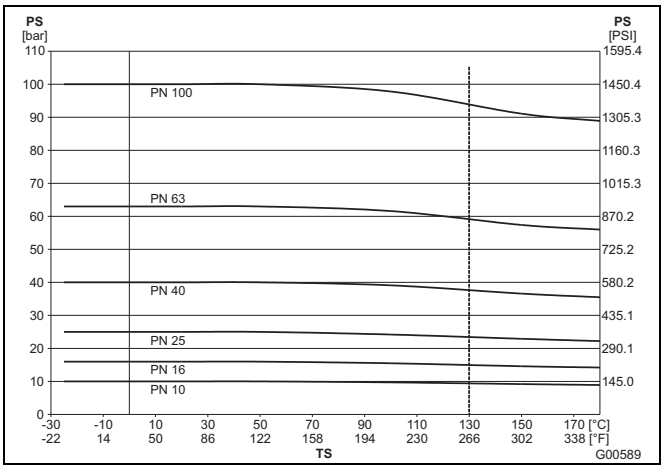


Fig. 61: Stainless steel DIN flange up to DN 600 (24")

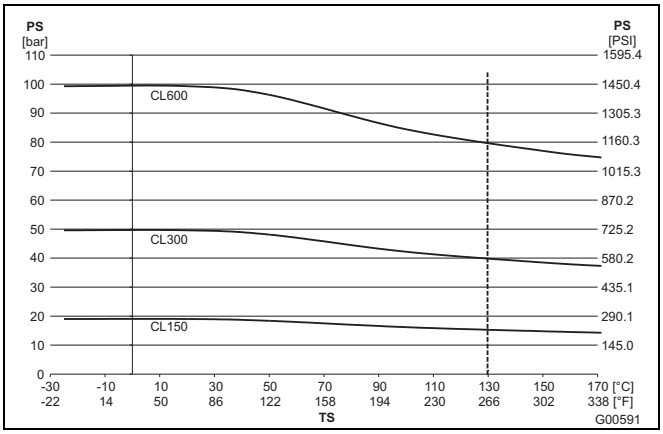


Fig. 62: Stainless steel ASME flange up to DN 400 (16") (CL150/300); up to DN 1000 (40") (CL150); up to DN 200 (8") (CL 600)

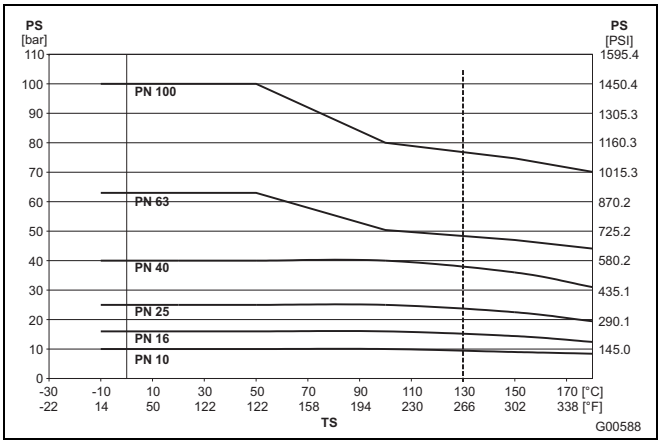


Fig. 63: DIN flange SS to DN 600 (24“)

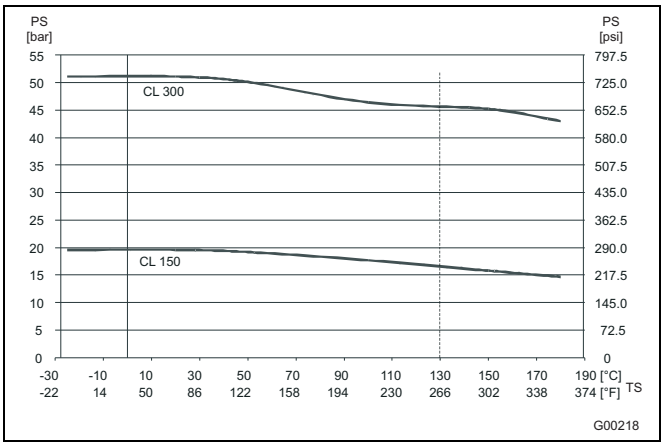


Fig. 64: Steel ASME flange up to DN 400 (16") (CL150/300); up to DN 1000 (40") (CL150)

JIS 10K-B2210 Flange

Nominal size DN	Material	PN	TS	PS [bar]
32 … 400 (1¼ … 16“)	Stainless steel	10	-25 … +180 °C (-13 … +356 °F)	10
32 … 400 (1¼ … 16“)	Steel	10	-10 … +180 °C (14 … 266 °F)	10

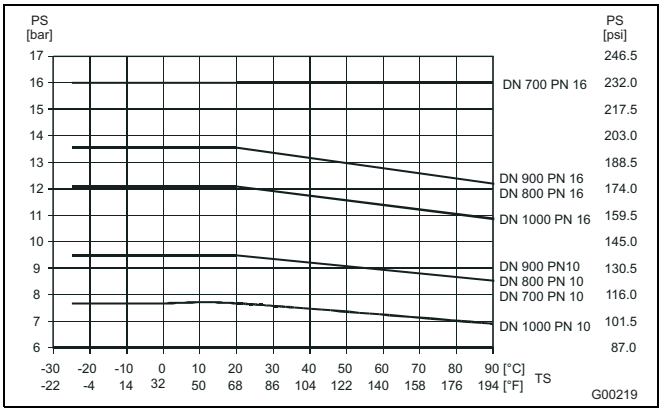


Fig. 65: Stainless steel DIN flange, DN 700 ... DN 1000 (28 ... 40")

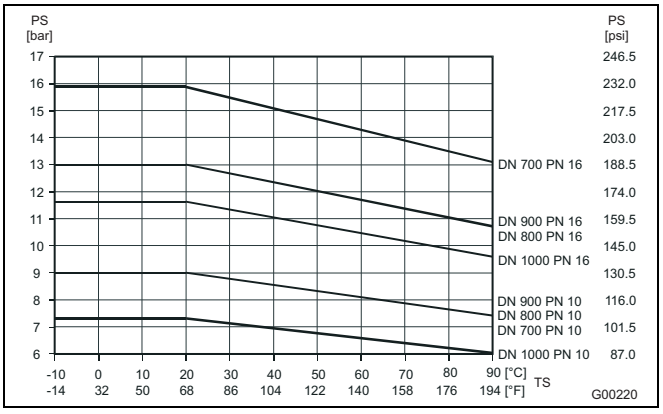


Fig. 66: DIN flange steel, DN 700 ... DN 1000 (28 ... 40“)

12.2.2 Flowmeter sensor SE21 / SE21F

Minimum Allowable Absolute Pressure

Lining	Nominal diameter DN	$P_{Operation}$ mbar abs	at	$T_{Operating}$ [1] °C
PFA	3 … 100 (1/10 … 4“)	0	≤	130 °C (266 °F)
Peek/Torlon	1 …2 (1/25 … 1/12“)	0	≤	120 °C (248 °F)

1) Higher temperatures are allowed for CIP / SIP cleaning for limited time periods, see the table titled "Max. allowable cleaning temperature".

Maximum Allowable Cleaning Temperature

CIP cleaning	Lining	T_{max}	T_{max} Minutes	$T_{amb.}$
Steam cleaning	PFA / Peek	150 °C (302 °F)	60	25 °C (77 °F)
Wet cleaning	PFA / Peek / Torlon	140 °C (284 °F)	60	25 °C (77 °F)

If the ambient temperature is > 25 °C (77 °F), then the difference must be subtracted from the max. cleaning temperature.
$T_{max} – Δ$ °C, Δ °C = (T_{amb} - 25 °C)

Maximum Allowable Temperature Shock

Lining	Temp Shock max. Temp. Diff. °C	Temp. gradient °C/min
PFA	Any	Any
Peek, Torlon	Any	Any

Maximum allowable ambient temperature as function of fluid temperature

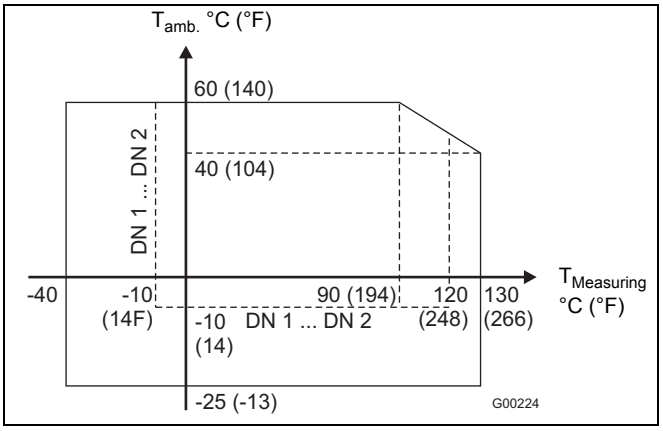


Fig. 67: Temperature graph

The flowmeter sensor must not be isolated.

Fluid temperature DN 1 … DN 2 (1/25 ... 1/12")
-10 … 120 °C (14 ... 248 °F), max. allowable cleaning temperature, see table.

Flowmeter material

Lining	Electrode material		Electrode design	
	Standard	Others	Standard	Others
PFA, Peek, Torlon	Hast.-C4 (2.4610) (1.4539 [904 L] for pipe conn. and Tri-Clamp)	Hast.-B3 (2.4600), 1.4539 (904 L), 1.4571 (316 Ti), Titanium, tantalum, Platinum-iridium	Flat head	Pointed head (≥ DN 10) 1.4539 (904 L)

1/8" sanitary connectors always with 2 grounding electrodes in material for signal electrodes, standard.

Process connection material

Process connection	Standard	Option
Flange	Stainless steel 1.4571 (316 Ti)	On rqst.
Wafer type	None	
Weld stubs	Stainless steel 1.4404 (316 L)	On rqst.
Threaded pipe connection	Stainless steel 1.4404 (316 L)	On rqst.
Tri-Clamp	Stainless steel 1.4404 (316 L)	On rqst.
External threads	Stainless steel 1.4404 (316 L)	On rqst.
1/8" sanitary connectors	Stainless steel 1.4571 (316 Ti)	POM, brass, PVC
Terminal box - without/with preamplifier, type A - with preamplifier, type B	Stainless steel 1.4301 (304) Al alloy, painted, paint coat frame: dark gray, RAL 7012 cover: light gray, RAL 9002	– –
Meter tube	Stainless steel 1.4301 (304)	–
cable gland used	Polyamide	PVDF
Flowmeter sensor housing	Stainless steel 1.4301 (304)	–

Gasket material (internal)

Process connection	Standard	Option
Wafer type	None	–
Weld stubs Threaded pipe connection Tri-Clamp External threads	EPDM (Ethylene-Propylene) with FDA approval, silicone with FDA approval (CIP-resistant, no oils or grease)	Silicon with FDA approval (optional, resistant to oils and grease) PTFE with FDA approval (DN 3 ... 8)
1/8" sanitary connectors	PTFE	Viton (only in combination with PVC process connection)
Flat gaskets	Silicon (resistant to oil, grease)	–

Storage temperature
-25 … 70 °C (-13 ... 158 °F)

Degree of protection acc. to EN 60529
- IP 67
- IP 68 (option)

Pipeline vibration according to EN 60068-2-6
Transmitter
- In the range of 10…55 Hz, max. deflection 0.15 mm

Flowmeter sensor
- In the range of 10…55 Hz, max. deflection 0.15 mm
- In the range of 55…150 Hz, max. acceleration 2 g

Materialload for meters with variable process connections / wafer type SE21 DN 1 ... DN 100 (1/25 ... 4")

Process connection Liner PFA	Nominal diameter DN	PS_{max} [bar]	TS_{min}	TS_{max}
Wafer type	3 … 50 (1/10 … 2“) 65 … 100 (2 1/2 … 4“)	40 16	-40 °C (-40 °F)	130 °C (266 °F)
Weld stubs	3 … 40 (1/10 … 1 1/2“) 50; 80 (2“, 3“) 65, 100 (2 1/2 … 4“)	40 16 10	-25 °C (-13 °F)	130 °C (266 °F)
Threaded pipe connection conforming to DIN 11851	3 … 40 (1/10 … 1 1/2“) 50; 80 (2“, 3“) 65, 100 (2 1/2 … 4“)	40 16 10	-25 °C (-13 °F)	130 °C (266 °F)
Tri-Clamp conforming to DIN 32676	3 … 50 (1/10 … 2“) 65 … 100 (2 1/2 … 4“)	16 10	-25 °C (-13 °F)	121 °C (250 °F)
Tri-Clamp in acc. with ASME BPE	3 ... 100 (1/10 ... 4“)	10	-25 °C (-13 °F)	130 °C (266 °F)
External threads ISO 228	3 … 25 (1/10 … 1“	16	-25 °C (-13 °F)	130 °C (266 °F)
1/8" sanitary connectors	1 … 2 (1/25 … 1/12“)	10	-10 °C (14 °F)	120 °C (248 °F)

JIS B2210-10K wafer type

Meter size DN	Material	PN	TS	PS [bar]
32 … 100 (1¼ … 4“)	1.4404 (316 L), 1.4435 (316 L), 1.4301 (304)	10	-40 … 130 °C (-40 … 266 °F)	10

Material load for flange model SE21F
Lining: PFA

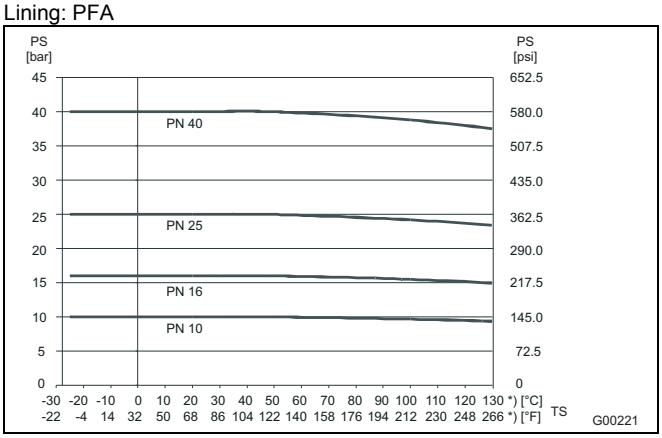


Fig. 68: DIN flange, stainless steel 1.4571 (316 Ti) up to DN 100 (4")

Liner PFA

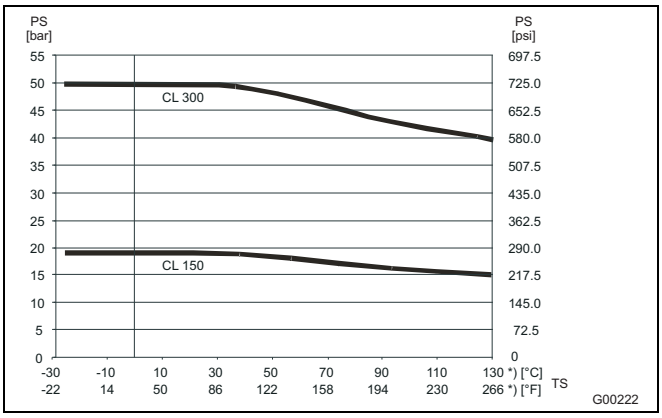


Fig. 69: ASME flange, stainless steel 1.4571 (316 Ti) up to DN 100 (4")

Material load for flange model SE21W
Lining: PFA wafer type

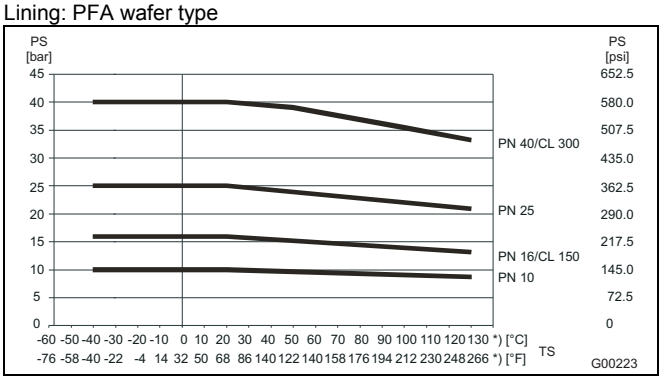


Fig. 70

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

12.3 Transmitter S4

Flow range	Any flow range whose 100% value corresponds to a flow velocity between 0.5 m/s and 10 m/s can be selected.
Minimum conductivity	≥ 20 µS/cm standard DN 10 ... 1000 (3/8 ... 40“) ≥ 20 µS/cm with preamplifier DN 1 ... 8 (1/25 ... 5/16“) ≥ 5 µS/cm with preamplifier DN 1 ... 1000 (1/25 ... 40“) ≥ 0.5 µS/cm with preamplifier DN 10 ... 1000 (3/8 ... 40“)
Reproducibility (measurement period = 100 s)	DN 1 ... 2: ≤ ± (0.3% of meas. value + 0.04% of Q_{maxDN}) DN 3 ... 1000: ≤ ± (0.1% of meas. value + 0.01% of Q_{maxDN})
Response time	1τ = 70 ms (0 ... 66 %) "Fast" mode 1τ = 200 ms (0 ... 66%) "Standard" mode / piston pump
Supply power	U = 100 ... 230 V, 50/60 Hz U_{rat} = 85 ... 253 V, 50/60 Hz 50/60 Hz ± 6% 20,4 ... 26.4 V AC, 20,4 ... 31.2 V DC, ripple ≤ 5%
Power	S ≤ 45 VA (flowmeter sensor including transmitter)
Ambient temperature	-20 ... 60 °C (-4 ... 140 °F)
Storage Temperature	-20 ... 80 °C (-4 ... 176 °F)
Protection Class per EN 60529	IP 67, NEMA 4X
Relative humidity	according to 60068-2-30 classification of environmental conditions, natural factors, temperature and air humidity. No effect under the following conditions: Temperature in range from 25 ... 55 °C (77 ... 131 °F) and a relative humidity of 94 ... 97%.
Shock and vibration resistance	according to 60068-2-6 grouping of devices according to table C2 for general industry applications. No additional effect on the following levels of vibration: Frequency range 10 ... 55 Hz; amplitude max.: 0.15 mm
Cable entry points	M20 x 1.5; NPT ½" option; PF ½" option
Galvanic isolation	The current output, pulse output, switch contact input and switch contact output are galvanically isolated from the input circuit and from each other.

Design

Field-mount housing made of cast aluminum per DIN 1725, painted. Paint coat is 80 µm thick. Lower section (RAL 7012), upper section (RAL 9002). Weight, approx. 3.3 kg.

Signal cable / coil cable

Max. cable length between flowmeter sensor and transmitter is: 50 m for the standard design and versions with automatic zero return, from DN 10 (3/8") and from 20 µS/cm. 200 m for designs with preamplifier. A 10 m signal cable is included with the flowmeter. If more than 10 m is required, the cable can be purchased using order number D173D025U01 or D173D147U01.

13 Appendix

13.1 Other applicable documents

- Data sheet (D184S073Uxx)
- Commissioning instructions (D184B141Uxx)
- Interface description for devices with HART communication (D184B126U01/02)
- Interface description for devices with PROFIBUS PA communication (D184B093U29/30)
- Interface description for devices with PROFIBUS Fieldbus communication (D184B093U31/32)

13.2 Approvals and certifications

CE mark	CE	The version of the meter in your possession meets the requirements of the following European directives: - EMC directive 2014/30/EU - Low voltage directive 2014/35/EU - RoHS Directive 2011/65/EU - Pressure equipment directive (PED) 2014/68/EU Pressure equipment does not receive a CE mark indicating PED compliance on the factory tag in the event of the following conditions prevailing: - The maximum permissible pressure (PS) is less than 0.5 bar - Due to low pressure risks (meter size ≤ DN 25 / 1") no approval procedures are required.

Important

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

www.abb.com/flow

13.3 Overview of setting parameters and technical design

Measuring point:		TAG no.:
Flowmeter model:		Transmitter type:
Order no.:	Device no.:	Order no.:
Measured medium temp.:		Power supply:
Lining:	Electrodes:	Exciter frequency:
C_{zero}:	C_{Span}:	System zero point:

Parameters		Setting range
Prog. Protection code:	.....	0-9999 (0 = factory setting)
Language:	.....	e.g., German, English, French, etc.
Flowmeter sensor	.....	see name plate or the submenu "System Data / Flowmeter Primary"
Nominal size:	.....	DN 1 ... DN 1000
Q_{max}:	.....	0.05 Q_{max}DN ... 1 Q_{max}DN
Pulse factor:	.....	Pulse / phys. unit
Pulse width:	.....	0,100 ... 2000 ms
Low cut-off setting:	.....	0 ... 10% of flow range end value
Damping:	.....	0.2 (0.07) ... 20 seconds
Noise reduction	.....	OFF / 1 / 2/ 3 / 4
Density:	.....	0.01 g/cm^3 ... 5.0 g/cm^3
Unit Q_{max}.:	.....	e.g., l/s, l/min, l/h, hl/s, hl/min, hl/h, etc.
Unit totalizer:	.....	e.g., l, hl, m^3, igal, gal, etc.
Max. alarm:	.....	%
Min. alarm:	.....	%
Contact output:	.....	Max. alarm, Min. alarm, Max./Min. alarm, General alarm, Empty pipe, etc.
Contact input:	.....	External zero return, Totalizer reset, External system zero, no function
Current output:	.....	0/4 ... 20 mA, 0/2 ... 10 mA, 0 ... 5 mA, 0 ... 10-20 mA, 4 ... 12 ... 20 mA
I_{out} with alarm:	.....	0 %, 103 %, 3.8 mA, Low, High
Detector e. pipe:	.....	ON / OFF
Calibrate e. pipe:	.....	0 ... 10000
Alarm e. pipe:	.....	ON / OFF
I_{out} with empty pipe:	.....	0 %, 103 %, 3.8 mA, Low, High
Totalizer function:	.....	Standard, difference totalizer
Display line 1:	.....	Q (%), Q (unit), Q (mA), counter F/R, TAG number, blank line, bar graph
Display line 2:	.....	Q (%), Q (unit), Q (mA), counter F/R, TAG number, blank line, bar graph
Display line 3:	.....	Q (%), Q (unit), Q (mA), counter F/R, TAG number, blank line, bar graph
Display line 4:	.....	Q (%), Q (unit), Q (mA), counter F/R, TAG number, blank line, bar graph
Operating mode:	.....	Standard / Piston Pump / Fast
Flow direction:	.....	Supply/Return, forward
Directional display:	.....	Standard, inverse
Pulse output:	☐ Active	☐ Passive
Communication:	☐ HART	☐ PROFIBUS PA ☐ FOUNDATION Fieldbus ☐ Without

Diagnostics Min-Max threshold monitoring Error (E) Warning (W)	Value	E/W	Min.	Max.	Value	E/W	Min.	Max.
	Coil current AC				Coil voltage DC			
	Coil resistance				Coil temperature			
	Coil insulation resistance				DAC value			
	Electrode voltage				Electrode balance			
	Signal-to-noise ratio				Magnetic linearity			

Statement on the contamination of devices and components

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

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

Customer details:

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

Device details:

Type:	Serial no.:
Reason for the return/description of the defect:	

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

☐ Yes ☐ No

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

Biological	☐	Corrosive / irritating	☐	Combustible (highly / extremely combustible)	☐
Toxic	☐	Explosive	☐	Other toxic substances	☐
Radioactive	☐				

Which substances have come into contact with the device?

1.

2.

3.

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

Town/city, date	Signature and company stamp

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