FSM4000

Electromagnetic flowmeter

Valid for software versions C.10 and higher

Measurement made easy

FSM4000-SE41F
FSM4000-SE21
FSM4000-S4

Introduction

The FSM4000 is a robust flowmeter for high process requirements. It masters critical applications and conserves valuable resources with highly accurate measurement of process parameters in a wide range of sectors.

The design of the flowmeter allows for a wide range of sector-specific liner materials, electrodes and nominal diameters in accordance with respective needs. The high-performance transmitter is easy to use and offers a highly stable signal output. Maximum measuring accuracy in applications with high cellulose or high solids content, pulsating flows and other applications with disruptions.

Additional Information

Additional documentation on FSM4000 is available for download free of charge at www.abb.com/flow. Alternatively simply scan this code:

Table of contents

1 Safety

General information and instructions

These instructions are an important part of the product and must be retained for future reference.
Installation, commissioning, and maintenance of the product may only be performed by trained specialist personnel who have been authorized by the plant operator accordingly. The specialist personnel must have read and understood the manual and must comply with its instructions.
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 nor an amendment to any previous or existing agreement, promise or legal relationship.
Modifications and repairs to the product may only be performed if expressly permitted by these instructions.
Information and symbols on the product must be observed.
These may not be removed and must be fully legible at all times.
The operating company must strictly observe the applicable national regulations relating to the installation, function testing, repair and maintenance of electrical products.

Warnings

The warnings in these instructions are structured as follows:

⚠ DANGER

The signal word '**DANGER**' indicates an imminent danger. Failure to observe this information will result in death or severe injury.

⚠ WARNING

The signal word '**WARNING**' indicates an imminent danger. Failure to observe this information may result in death or severe injury.

⚠ CAUTION

The signal word '**CAUTION**' indicates an imminent danger. Failure to observe this information may result in minor or moderate injury.

NOTICE

The signal word '***NOTICE***' indicates possible material damage.

Note
'**Note**' indicates useful or important information about the product.

Intended use

This device is intended for the following uses:

- For the transmission of fluid, pulpy or pasty measuring media with electrical conductivity.
- For volume flow measurement (in operating conditions).
- For mass flow measurement (based on a non-adjustable density value).

The device has been designed for use exclusively within the technical limit values indicated on the identification plate and in the data sheets.

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

- Wetted parts such as measuring electrodes, liner, grounding electrodes, grounding plates or protection plates must not be damaged by the chemical and physical properties of the measuring medium during the operating time.
- Measuring media with unknown properties or abrasive measuring media may only be used if the operator is able to perform regular and suitable tests to ensure the safe condition of the device
- The indications on the name plate must be observed
- Before use of corrosive or abrasive measuring media, the operator must clarify the level of resistance of wetted parts.
  ABB will gladly support you in the selection, but cannot accept any liability in doing so.

Improper use

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

- Operation as a flexible compensating adapter in piping, for example for compensating pipe offsets, pipe vibrations, pipe expansions, etc.
- For use as a climbing aid, for example for mounting purposes.
- For use as a bracket for external loads, for example as a support for piping, etc.
- Material application, for example by painting over the housing, name plate or welding/soldering on parts.
- Material removal, for example by spot drilling the housing.

Cyber security disclaimer

This product is designed to be connected to and to communicate information and data via a network interface.
It is operator's sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be).
Operator shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.
ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

On www.abb.com/cybersecurity under 'Additional resources', 'Alerts and notifications' you will find notifications about newly discovered software vulnerabilities. It is recommended that you visit this website regularly and activate 'Subscribe to email alerts' to receive email notifications about 'ABB cyber security alerts and notifications'.

Software downloads

By visiting the web page indicated below, you will find options to download the latest software. It is recommended that you visit this web page regularly:

ABB Libary - FSM4000

Manufacturer's address

ABB Limited
Measurement & Analytics
Oldends Lane, Stonehouse
Gloucestershire, GL10 3TA
UK
Tel: +44 (0)1453 826661
Fax: +44 (0)1453 829671
Email: instrumentation@gb.abb.com

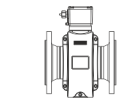
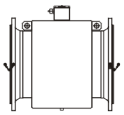
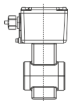
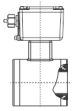
ABB Engineering (Shanghai) Ltd.
Measurement & Analytics
No. 4528, Kangxin Highway, Pudong New District
Shanghai, 201319,
P.R. China
Tel: +86(0) 21 6105 6666
Fax: +86(0) 21 6105 6677
Email: china.instrumentation@cn.abb.com

Customer service center

Customer service center
Tel: +49 180 5 222 580
Email: automation.service@de.abb.com

2 Design and function

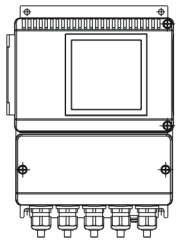
Overview

Housing material	**Alu. Housing, Series 4000**	**Stainless Steel Housing, Series 2000**
	 DN 3 ... 400 (1/10 ... 16")  DN 450 ... 1000 (18 ... 40")	 DN 3 ... 40 (1/10 ... 1 1/2")  DN 50 ... 100 (2 ... 4")
	Fixed Flange	Wafer type

Sensor				
Model number	SE41F		SE21W	
Measured error	0.5% of rate (> DN 2)			
	DN	PN	DN	PN
Wafer type	—		3 to 50	10 to 40
			65 to 100	10 to 16
Flange DIN 2501/EN 1092–1	3 to 1000	10 to 40	—	—
Flange ASME B16.5/B16.47	1/10 to 40"	CL 150	—	—
JIS B2210–10K	1/10 to 12"	CL 300		
Liner	Hard/soft rubber, ceramic carbide, PTFE, PFA, ETFE, other		PFA (vacuum-tight)	
Conductivity	≥ 20 µS/cm (optional ≥ 5/0.5 µS/cm)			
Electrodes	Stainless steel 1.4571 (316 Ti), 1.4539 (904 L), Hastelloy B-3/C-4, platinum-iridium, tantalum, titanium			
Process connection material	Steel, stainless steel		—	
IP degree of protection in accordance with EN 60529	IP 65 / IP 67 / IP 68		IP 65 / IP 67 / IP 68	
Measuring medium temperature	–25 to 130 °C / 180 °C (–13 to 266 °F / 356 °F)		–40 to 130 °C (–40 to 266 °F)	

Approvals		
Model number	SE41F	SE21W
Pressure Equipment Directive 97/23/EC	Conformity assessment in accordance with category III, fluid group 1	
CRN (Canadian Reg. Number)	On request	

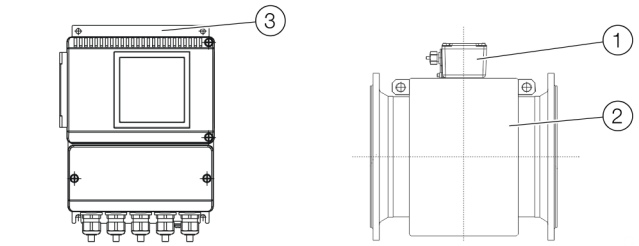
Transmitter	
Model number	S4
Power supply	85 to 253 V AC, 24 V AC/DC
Current output	0/2 to 10 mA, 0/4 to 20 mA
Pulse output	active (24 V), optocoupler (220 mA)
Ext. output switch-off	yes
Ext. totalizer reset	yes
Forward / reverse flow measurement	yes
Communication	HART® protocol
Pipe empty detection std.	yes, DN 10 or higher and ≥ 20 µS/cm
Self-monitoring, extended diagnosis functions	yes, extended diagnostic functions / fingerprint only in connection with sensors SE21 and SE41F for DN 10 or higher
Local display / totalization	yes
Density correction	yes, manual entry (totalize and display in mass units)
IP rating in accordance with EN 60529	IP 65 / IP 67, NEMA 4X
Chassis	Field mount housing



3 Product identification

Position of the name plate / factory plate

The factory tag or name plate can be found in the following places on the meter housing:



① Name plate sensor
② Factory plate sensor
③ Name plate transmitter

Figure 1: Plate positions

Identification of the device design

1. Identifying the model:
   The model number of the flowmeter primary or transmitter (see nos. 1 or 2 in the description of the model plates) can be found on the model plate. The electrical connection for the respective model can be found in the chapter 'Electrical connections'. Technical data, material load curves, etc., appear sorted by model in the chapter 'Specification'.
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.

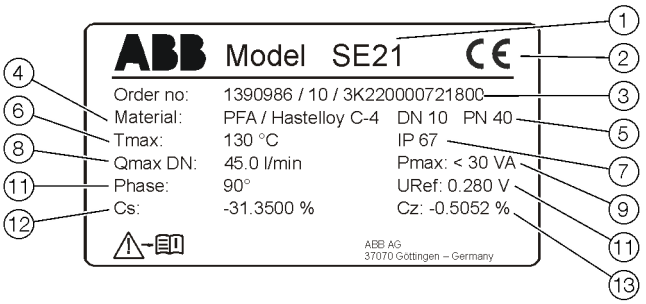
Note

Products that are marked with the adjacent symbol may **not** be disposed of as unsorted municipal waste (domestic waste).
They should be disposed of through separate collection of electric and electronic devices.

Name plate

Note
The name plates displayed are examples. The device identification plates affixed to the device can differ from this representation.

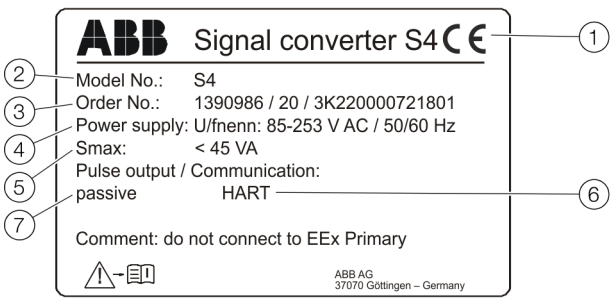
Sensor



① Model no.
② CE mark (EG conformity)
③ Order number
④ Meter tube lining / electrode material
⑤ Nominal diameter / Nominal pressure
⑥ Max. measuring medium temperature
⑦ IP rating of the housing
⑧ Max. flow rate 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

Figure 2: Name plate sensor

Transmitter



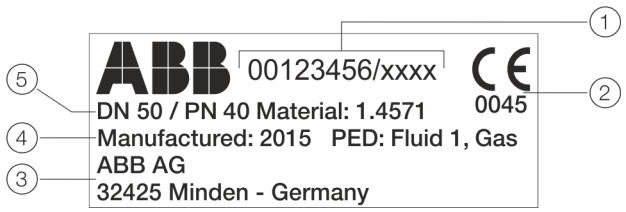
① CE mark (EG conformity)
② Model no.
③ Order number
④ Power supply - voltage range / frequency
⑤ Power consumption transmitter and sensor
⑥ Design according to order with/without HART® protocol
⑦ Design according to order active (24 V pulse) or passive (optoelectronic coupler) (Switch to active or passive) can be made on site)

Figure 3: Name plate transmitter S4

Factory tag

The factory plate is on the flowmeter in addition to the name plate. Depending on the nominal diameter of the flowmeter (> DN 25 or ≤ DN 25), it is identified with two different factory plates (also refer to article 4, paragraph 3, Pressure Equipment Directive 2014/68/EU):

Pressure equipment in the scope of the Pressure Equipment Directive



1. Serial number of the sensor
2. CE mark with notified body
3. Manufacturer address
4. Year of manufacture and specification of the fluid group in accordance with the PED
5. Nominal diameter / nominal pressure rating and material of the pressure-bearing part (wetted part)

Figure 4: Factory plate for nominal diameter > DN 25 (example)

The number of the notified body is specified underneath the CE mark to confirm that the device meets the requirements of the Pressure Equipment Directive.
The respective fluid group in accordance with the Pressure Equipment Directive is indicated under PED.
Example: Fluid Group 1 = hazardous fluids, gaseous.

Pressure equipment outside the scope of the Pressure Equipment Directive

1. Serial number of the sensor
2. Reason for exception article 4, paragraph 3 of the Pressure Equipment Directive
3. Manufacturer address
4. Year of manufacture
5. Nominal diameter / nominal pressure rating and material of the pressure bearing part (wetted part)

Figure 5: Factory plate for nominal diameter ≤ DN 25 (example)

In PED the exception to article 4 paragraph 3 of the Pressure Equipment Directive is specified.
The pressure equipment is classified in the SEP (= Sound Engineering Practice) 'Good Engineering Practice' category.

Note
If the factory plate is missing all together, the device is not in compliance with the requirements of the Pressure Equipment Directive 2014/68/EU. Networks for the supply, distribution and discharge of water and related specific accessories are classed as an exception in accordance with guideline 1/16 of Art. 1, Para. 3.2 of the Pressure Equipment Directive.

4 Transport and storage

Inspection

Check the devices immediately after unpacking for possible damage that may have occurred from improper transport. Details of any damage that has occurred in transit must be recorded on the transport documents.
All claims for damages must be submitted to the shipper without delay and before installation.

Transport

⚠ DANGER

Life-threatening danger due to suspended loads.
In the case of suspended loads, a danger of the load falling exists.

- Standing under suspended loads is prohibited.

⚠ WARNING

Risk of injury due to device slipping.
The device's center of gravity may be higher than the harness suspension points.

- Make sure that the device does not slip or turn during transport.
- Support the device laterally during transport.

NOTICE

Potential damage to the device!
The protection plates or protection caps mounted at the process connections on devices with PTFE / PFA liners may only be removed immediately before installation.

- To prevent possible leakage, make sure that the liner on the flange is not cut or damaged.

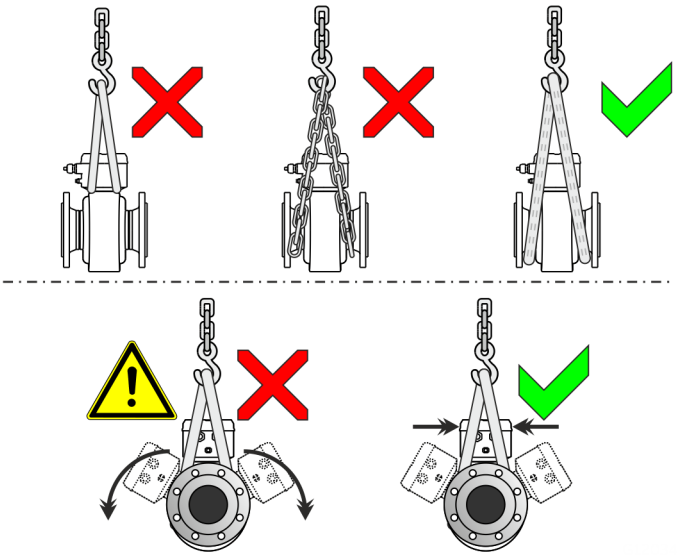


Figure 6: Transport instructions - ≤ DN 450

Flange devices ≤ DN 450

- Use carrying straps to transport flange designs smaller than DN 450.
- Wrap the carrying straps around both process connections when lifting the device.
- Chains should not be used, since these may damage the housing.

Flange devices > DN 450

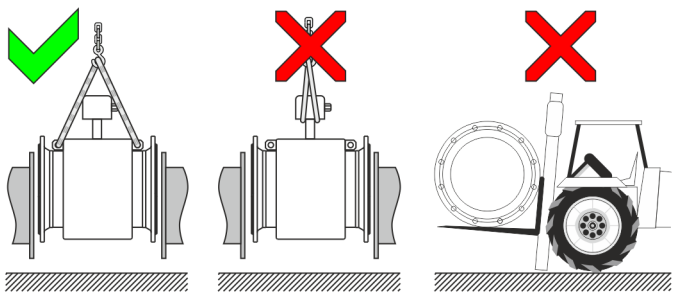


Figure 7: Transport instructions - > DN 450

- Using a forklift to transport flange device can dent the housing.
- Flange devices must not be lifted by the center of the housing when using a forklift for transport.
- Flange devices must not be lifted by the terminal box or by the center of the housing.
- Only the transport lugs fitted to the device can be used to lift the device and insert it into the piping.

Storing the device

Bear the following points in mind when storing devices:

- Store the device in its original packaging in a dry and dust-free location.
- Observe the permitted ambient conditions for transport and storage.
- Avoid storing the device in direct sunlight.
- In principle, the devices may be stored for an unlimited period. However, the warranty conditions stipulated in the order confirmation of the supplier apply.

Temperature data

Storage temperature

Model SE41F

−20 to 70 °C (−4 to 158 °F)

Model SE21_

−25 to 70 °C (-13 to 158 °F)

The ambient conditions for the transport and storage of the device correspond to the ambient conditions for operation of the device.
Adhere to the device data sheet!

Returning devices

Use the original packaging or a secure transport container of an appropriate type if you need to return the device for repair or recalibration purposes.
Fill out the return form (see **Return form** on page 60) and include this with the device.
In accordance with the EU Directive governing 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 must be free from any hazardous materials (acids, alkalis, solvents, etc.).

Address for returns:
Please contact Customer Center Service acc. to page **Fehler! Textmarke nicht definiert.** for nearest service location.

5 Installation

Safety instructions

⚠ WARNING

Risk of injury due to process conditions.
The process conditions, for example high pressures and temperatures, toxic and aggressive measuring media, can give rise to hazards when working on the device.

- Before working on the device, make sure that the process conditions do not pose any hazards.
- If necessary, wear suited personal protective equipment when working on the device.
- Depressurize and empty the device / piping, allow to cool and purge if necessary.

⚠ WARNING

Risk of injury due to live parts!
When the housing is open, contact protection is not provided and EMC protection is limited.

- Before opening the housing, switch off the power supply.

Installation conditions

General

The following points must be observed during installation:

- The flow direction must correspond to the marking, if present
- The maximum torque for all flange screws must be complied with
- Secure flange screws and nuts against pipe vibration.
- The devices must be installed without mechanical tension (torsion, bending)
- Install flange devices / wafer-type devices with plane parallel counterflanges and use appropriate gaskets only
- Use gaskets made from a material that is compatible with the measuring medium and measuring medium temperature.
- Gaskets must not extend into the flow area, since possible turbulence could influence the accuracy of the device
- The piping may not exert any inadmissible forces or torques on the device.
- Make sure that the temperature limits are not up-scaled during operation of the device.
- Vacuum shocks in the piping should be avoided to prevent damage to the liners (PTFE liner). Vacuum shocks can destroy the device.
- Do not remove the sealing plugs in the cable glands until you are ready to install the electrical cable
- Make sure the gaskets for the housing cover are seated correctly. Carefully seal the cover. Tighten the cover fittings
- The transmitter with a remote mount design must be installed at a largely vibration-free location
- Do not expose the transmitter and sensor to direct sunlight. Provide appropriate sun protection as necessary If necessary, provide a suited means of sun protection.
- When installing the transmitter in a control cabinet, make sure adequate cooling is provided

Brackets

NOTICE

Potential damage to the device!
Improper support for the device may result in a deformed housing and damage to internal magnetic coils.

- Place the supports at the edge of the sensor housing (see arrows in **Figure 8**).

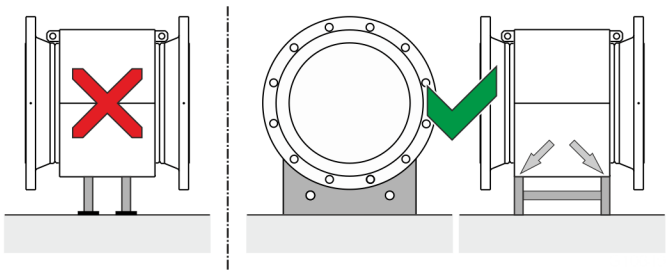


Figure 8: Support for nominal diameters greater than DN 400

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

Gaskets

The following points must be observed when installing gaskets:

- To achieve the best results, make sure that the gaskets and meter tube fit concentrically.
- To make sure that the flow profile is not distorted, the gaskets may not intrude in the piping cross-section.
- The use of graphite with the flange or process connection gaskets is prohibited. This is because, in some instances, an electrically conductive coating may form on the inside of the meter tube.

Devices with hard rubber or soft rubber liner

- Devices with a hard / soft rubber liner always require additional gaskets
- ABB recommends using gaskets made from rubber or rubber-like sealing materials
- When selecting the gaskets, make sure that the tightening torques specified in chapter **Torque information** on page 18 are followed.

Devices with a PTFE, PFA or ETFE liner

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

Flow direction

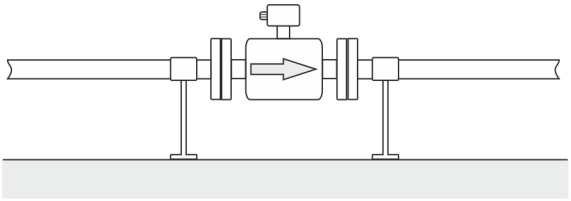


Figure 9: Flow direction

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

Electrode axis

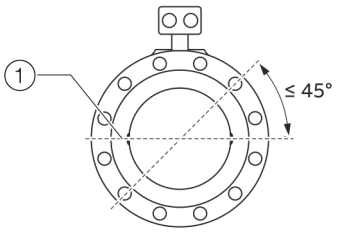


Figure 10: Orientation of the electrode axis

The electrode axis ① should be horizontal if at all possible or no more than 45° from horizontal.

… 5 Installation

… Installation conditions

Mounting position

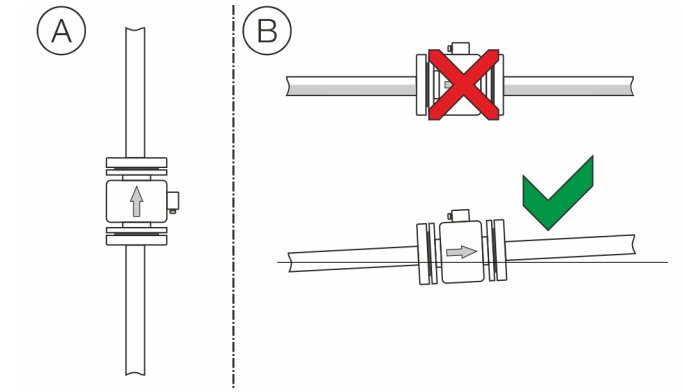


Figure 11: Mounting position

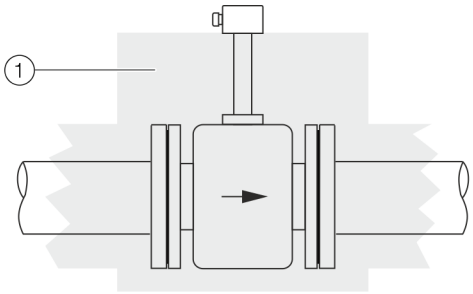
Ⓐ Vertical installation for measuring abrasive materials, preferably with flow in upward direction.
Ⓑ For a horizontal installation, the meter tube must always be completely filled with the measuring medium.
Provide for a slight incline of the connection for degassing.

Note
For hygienic applications, the vertical mounting position is preferred.
For a horizontal mounting position, make sure that the sensor is installed to be self-draining.

Grounding

The flowmeter sensor must be connected to ground potential. For technical reasons, this potential must be identical to the potential of the measuring medium.
For plastic or insulated lined pipelines, the measuring medium is grounded by installing grounding rings.
When there are stray potentials present in the pipeline, a grounding ring is recommended on both ends of the flowmeter sensor.

Sensor insulation

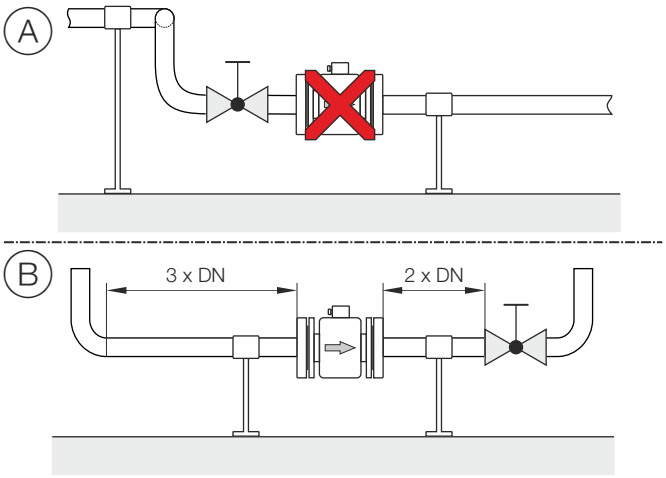


① Insulation

Figure 12: Insulation of the flowmeter sensor

In the high temperature design, the flowmeter sensor can be completely thermally insulated. After the unit is installed, the piping and sensor must be insulated in accordance with the figure.

Inlet and outlet sections



① Double elbow ② Turn-off device

Figure 13: Inlet and outlet section, turn-off devices

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

Ⓐ Do not install fittings, manifolds, valves, etc., right before the flowmeter sensor.

Ⓑ Inlet / outlet sections: length of the straight piping upstream and downstream on the sensor.
Experience has shown that, in most installations, straight inlet sections 3 × DN long and straight outlet sections 2 × DN long are sufficient (DN = nominal diameter of the flowmeter sensor).
For test stands, the reference conditions of 10 × DN straight inlet and 5 × DN straight outlet must be provided, in accordance with EN 29104 / ISO 9104.
Valves or other turn-off devices should be installed in the outlet section.
Valve flaps must be installed so that the valve damper plate does not extend into the flowmeter sensor.
Butterfly valves should not be installed upstream the flowmeter.

Free inlet or outlet

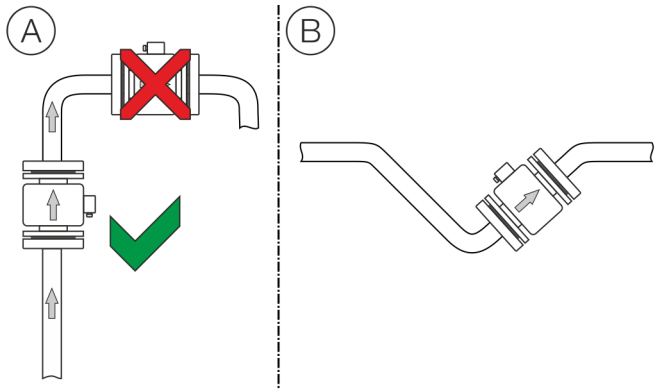


Figure 14: Free inflow and outflow

Ⓐ For a free outflow, do not install flowmeter at the highest point of the piping or on its outflow side, since the measuring tube may run empty, creating air bubbles.

Ⓑ For free inflow/outflow, provide an invert to make sure that the piping is always full

Mounting with heavily contaminated measuring media

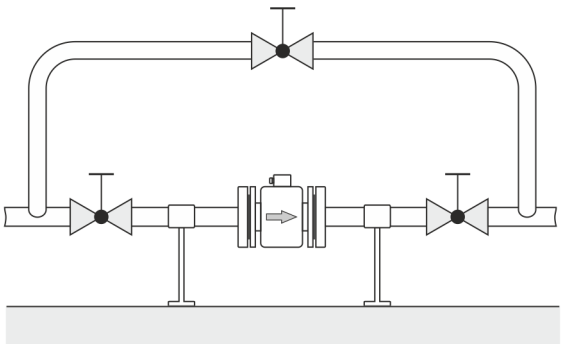


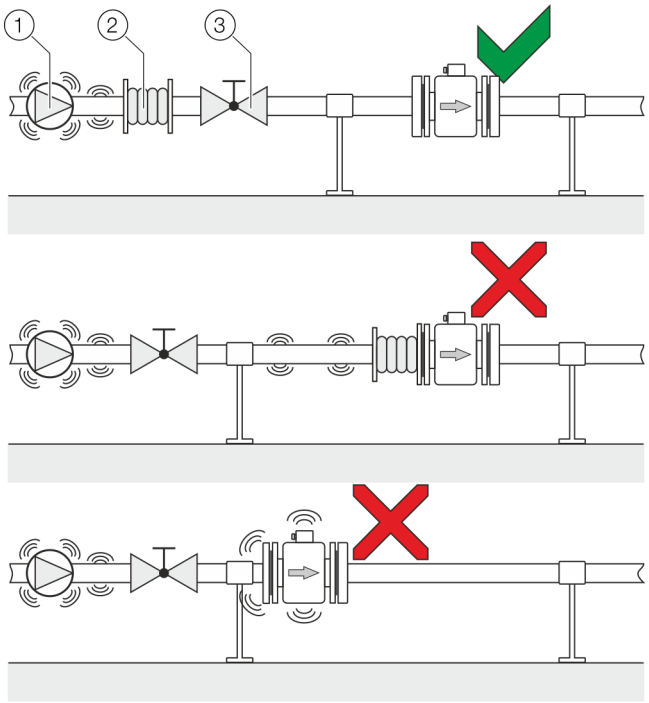
Figure 15: Bypass line

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

… 5 Installation

… Installation conditions

Mounting with pipe vibration



① Pump
② Damping device
③ Shut-off device

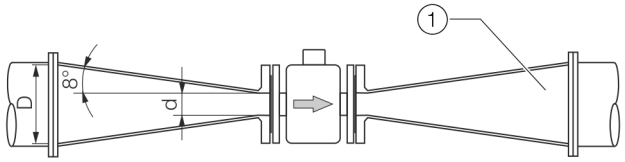
Figure 16: Vibration damping

Strong vibrations in the pipeline must be damped using flexible damping devices.

The damping devices must be installed beyond the supported flowmeter section and outside of the section between the shut-off devices.

Do not connect flexible damping devices directly to the flowmeter sensor.

Installation in piping with larger nominal diameter



① Reducer

Figure 17: Using reducers

Determine the resulting pressure loss when using reducers:

1. Determine diameter ratios d/D.
2. Determine the flow velocity based on the flow rate nomogram (Figure 18).
3. Read the pressure loss on the Y-axis in Figure 18.

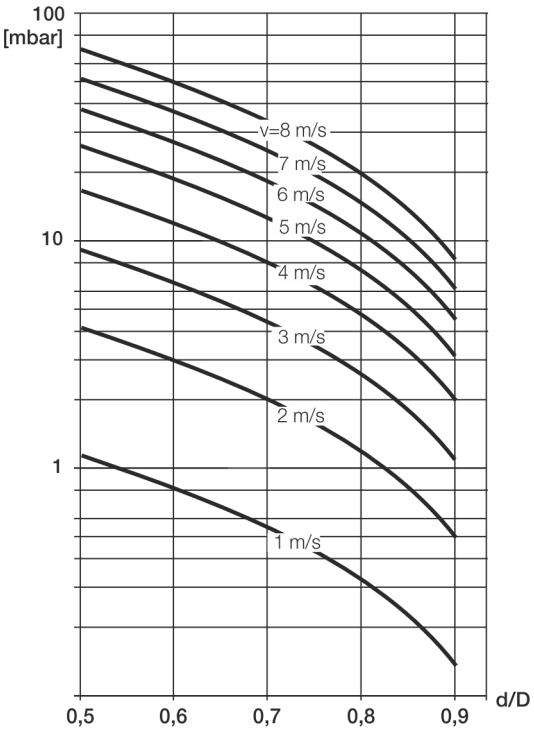


Figure 18: Flow rate nomogram for flange transition piece at α/2 = 8°

Installing the sensor

NOTICE

Damage to the device

Damage to the device due to improper assembly.

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

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

1. Remove protective plates, if present, to the right and left of the meter tube. To prevent possible leakage, make sure that the liner on the flange is not cut or damaged.
2. Position the flowmeter sensor plane parallel and centered between the piping.
3. Install gaskets between the surfaces, see **Gaskets** on page 13.

Note

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

To guarantee that the flow profile is not distorted, the gaskets must not protrude into the piping.

4. Use the appropriate screws for the holes in accordance with **Torque information** on page 18.
5. Slightly grease the threaded nuts.
6. Tighten the nuts in a crosswise manner as shown in the figure. Observe the tightening torques in accordance with **Torque information** on page 18!
   First tighten the nuts to approx. 50 % of the maximum torque, then to 80 %, and finally a third time to the maximum torque. Do not exceed the max. torque.

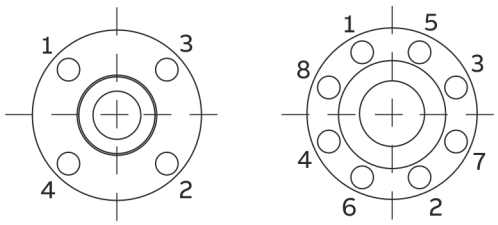


Figure 19: Tightening sequence for the flange screws

… 5 Installation

Torque information

Flange and wafer type devices, model SE41F / SE21W

Note

The specified torques are valid only for greased threads and piping that is not subject to tensile stress.
The specified torque values are dependent on variables (temperature, bolt material, gasket material, lubricants, etc.) which are not within the control of the manufacturer. Therefore the values should be regarded as indicative only.

Nominal diameter DN		Nominal pressure	Max. tightening torque [Nm]			
mm	In	PN	Hard/soft rubber lining		PTFE, PFA, ETFE lining	
			Steel flange	Stainless steel flange	Steel flange	Stainless steel flange
3 to 10[1)]	1/10 to 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	½"	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	¾"	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	1¼"	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	1½"	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/EN1092-1 = DN10 (3/8"), connection flange ASME = DN15 (1/2")

Nominal diameter 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	2½”	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

… 5 Installation

… Torque information

Nominal diameter 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

Nominal diameter 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

Variable process connections model SE21

Nominal diameter DN		Max. tightening torque
mm	inch	Nm
3 to 10	⅜”	8
15	½”	10
20	¾”	21
25	1”	31
32	1¼”	60
40	1½”	80
50	2”	5
65	2½”	5
80	3”	15
100	4”	14

… 5 Installation

Measuring range table

Nominal diameter DN		Min. flow velocity measuring range 0 to 0.5 m/s						Max. flow velocity measuring range 0 to 10 m/s					
3	1/10	0	up to	0.2	l/min	0.0529	US gal/min	0	up to	4	l/min	1.06	US gal/min
4	5/32	0	up to	0.4	l/min	0.1	US gal/min	0	up to	8	l/min	2.1	US gal/min
6	¼	0	up to	1	l/min	0.3	US gal/min	0	up to	20	l/min	5.3	US gal/min
8	5/16	0	up to	1.5	l/min	0.4	US gal/min	0	up to	30	l/min	7.9	US gal/min
10	⅜	0	up to	2.25	l/min	0.6	US gal/min	0	up to	45	l/min	12	US gal/min
15	½	0	up to	5.0	l/min	1.3	US gal/min	0	up to	100	l/min	36	US gal/min
20	¾	0	up to	7.5	l/min	2.0	US gal/min	0	up to	150	l/min	40	US gal/min
25	1	0	up to	10	l/min	2.6	US gal/min	0	up to	200	l/min	53	US gal/min
32	1 ¼	0	up to	20	l/min	5.3	US gal/min	0	up to	400	l/min	106	US gal/min
40	1 ½	0	up to	30	l/min	7.9	US gal/min	0	up to	600	l/min	159	US gal/min
50	2	0	up to	3	m3/h	13	US gal/min	0	up to	60	m3/h	264	US gal/min
65	2 ½	0	up to	6	m3/h	26	US gal/min	0	up to	120	m3/h	528	US gal/min
80	3	0	up to	9	m3/h	40	US gal/min	0	up to	180	m3/h	793	US gal/min
100	4	0	up to	12	m3/h	53	US gal/min	0	up to	240	m3/h	1057	US gal/min
125	5	0	up to	21	m3/h	92	US gal/min	0	up to	420	m3/h	1849	US gal/min
150	6	0	up to	30	m3/h	132	US gal/min	0	up to	600	m3/h	2642	US gal/min
200	8	0	up to	54	m3/h	238	US gal/min	0	up to	1080	m3/h	4755	US gal/min
250	10	0	up to	90	m3/h	396	US gal/min	0	up to	1800	m3/h	7925	US gal/min
300	12	0	up to	120	m3/h	528	US gal/min	0	up to	2400	m3/h	10567	US gal/min
350	14	0	up to	165	m3/h	726	US gal/min	0	up to	3300	m3/h	14529	US gal/min
400	16	0	up to	225	m3/h	991	US gal/min	0	up to	4500	m3/h	19813	US gal/min
450	18	0	up to	300	m3/h	1321	US gal/min	0	up to	6000	m3/h	26417	US gal/min
500	20	0	up to	330	m3/h	1453	US gal/min	0	up to	6600	m3/h	29059	US gal/min
600	24	0	up to	480	m3/h	2113	US gal/min	0	up to	9600	m3/h	30380	US gal/min
700	28	0	up to	660	m3/h	2906	US gal/min	0	up to	13200	m3/h	58118	US gal/min
800	32	0	up to	900	m3/h	3963	US gal/min	0	up to	18000	m3/h	79252	US gal/min
900	36	0	up to	1200	m3/h	5283	US gal/min	0	up to	24000	m3/h	105669	US gal/min
1000	40	0	up to	1350	m3/h	5944	US gal/min	0	up to	27000	m3/h	118877	US gal/min

Grounding

General information on grounding

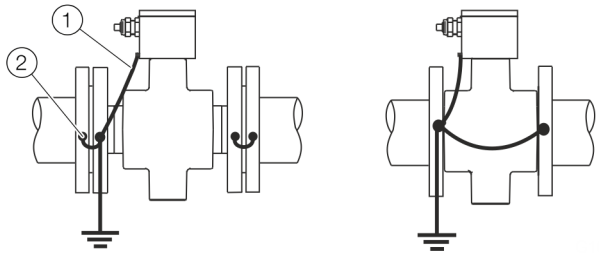
Observe the following items when grounding the device:

- Use the supplied green/yellow cable as a grounding wire.
- Connect the ground screw for the sensor (on flange and transmitter housing) to the station ground.
- The terminal box must also be grounded.
- For plastic piping or piping with insulating liner, the ground is provided by the grounding plate or grounding electrodes.
- When stray potentials are present, install a grounding plate upstream and downstream of the sensor.
- For measurement-related reasons, the potential in the station ground and in the piping should be identical.
- Additional grounding on the terminals is not required.

Note

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

Metal pipe with fixed flanges



Flange design **Wafer type design**

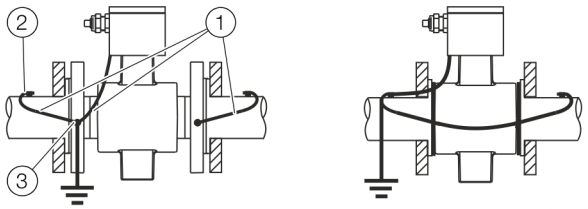
Figure 20: Grounding connections

1. Insert M6×12 threads (2) in the flanges for the piping and the sensor.
2. Secure the ground straps (1) with screw, spring washer and washer in accordance with the figure.
3. Use a copper wire (minimum 2.5 mm² (14 AWG)) to establish a connection between the ground connection of the sensor and a suited grounding point.

… 5 Installation

… Grounding

Metal pipe with loose flanges

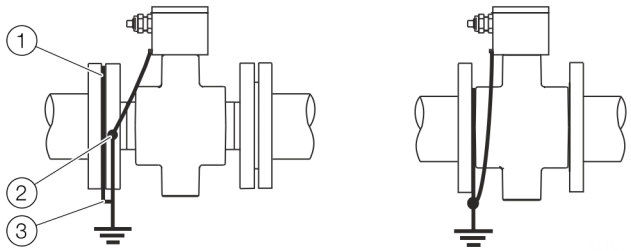


Flange design **Wafer type design**

Figure 21: Grounding connections

1. Solder the threaded nuts (2) M6 to the piping.
2. Insert M6×12 threads (3) in the flanges of the sensor.
3. Secure the ground straps (1) with nuts, spring washer and washer in accordance with the figure, and connect to the 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 a suited grounding point.

Non-metallic pipes or pipes with insulating liner



Flange design **Wafer type design**

Figure 22: Grounding connections

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

1. Install the sensor with grounding plate (1) in the piping.
2. Insert M6x12 threads (2) in the flange of the sensor.
3. Connect the terminal lug for the grounding plate (3) and ground connection on the 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.

Ground for devices with protection plates

The protection plates are used to protect the edges of the meter tube liner, e.g. for abrasive media. In addition, they function as a grounding plate.

- For plastic protection plates or piping with an insulating liner, electrically connect in the same manner as a grounding plate.

Grounding with conductive PTFE grounding plate

Grounding plates made of conductive PTFE are optionally available for nominal diameter ranges of DN 10 to 250.
These are installed similar to conventional grounding plates.

6 Electrical connections

Safety instructions

⚠ WARNING

Risk of injury due to live parts.
Improper work on the electrical connections can result in electric shock.

- Connect the device only with the power supply switched off.
- Observe the applicable standards and regulations for the electrical connection.

The electrical connection may only be established by authorized specialist personnel and in accordance with the connection diagrams.

The electrical connection information in this manual must be observed; otherwise, the IP rating may be adversely affected.
Ground the measurement system according to requirements.

… 6 Electrical connections

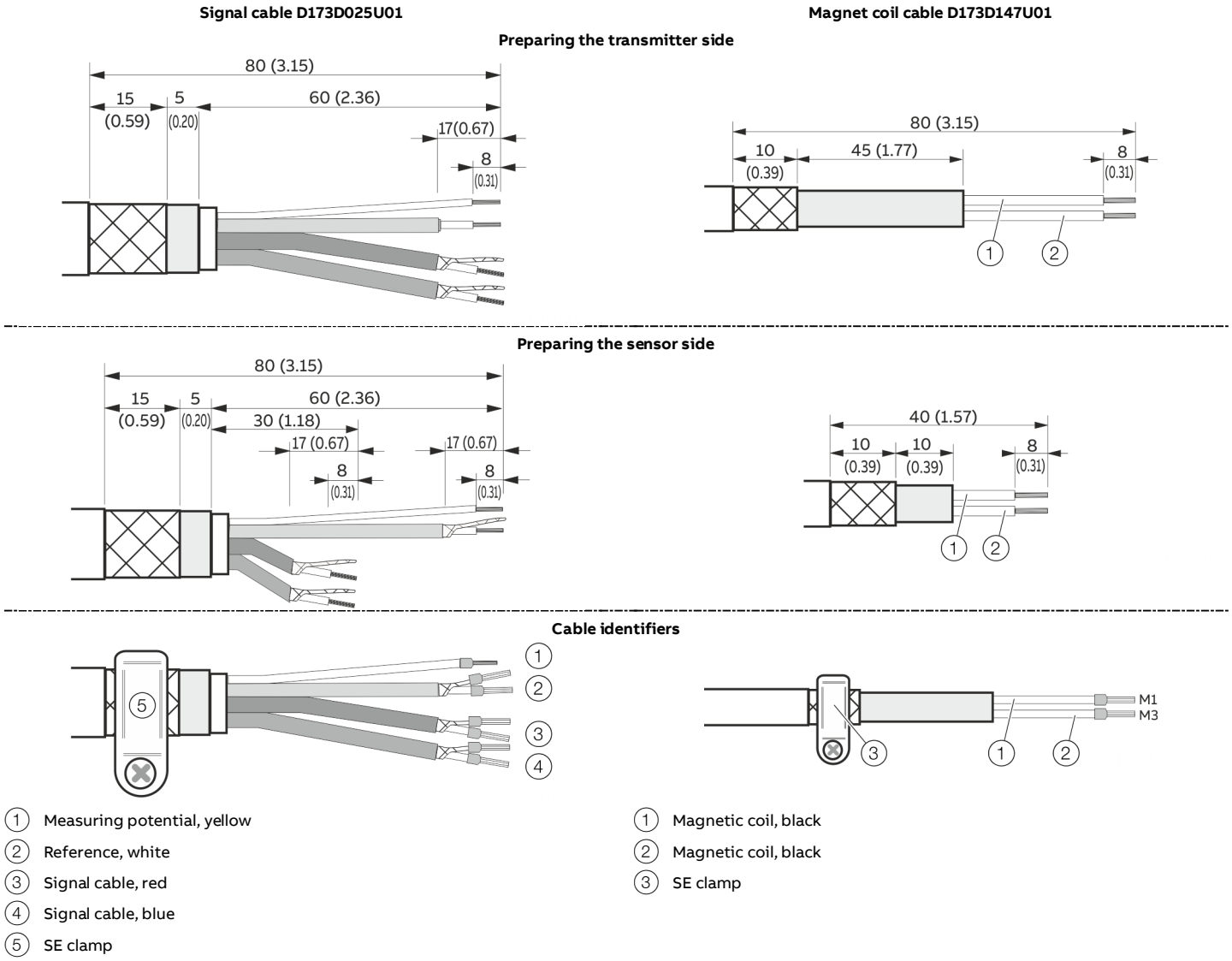
Preparing and routing the signal and magnetic coil cable

Preparing for sensor model SE21

Cut to length and terminate both cables as shown.

Note

Use wire end sleeves.



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

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

Figure 23: Preparing the signal and magnetic coil cable sensor model SE21

Note

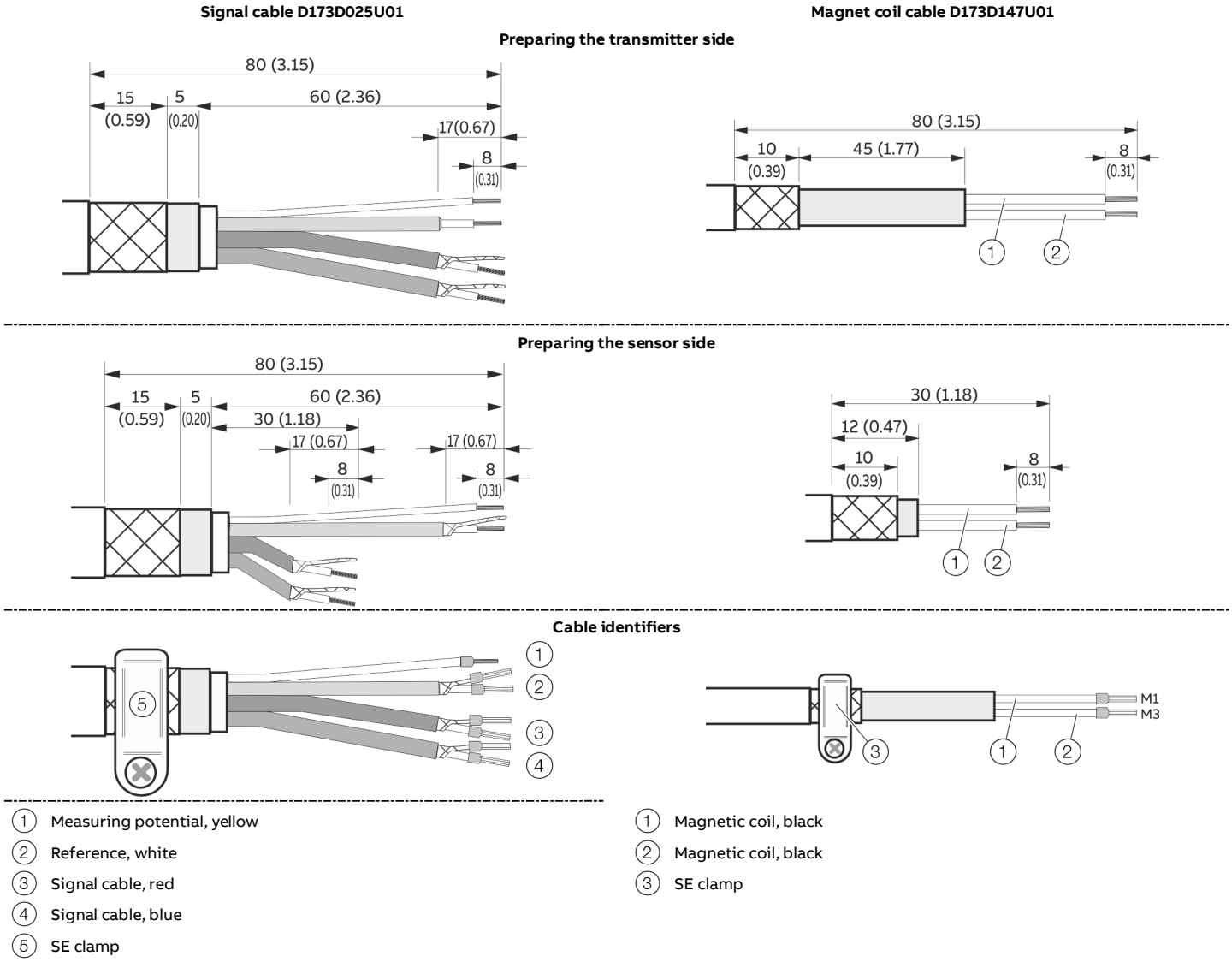
The shielding may not touch (signal short circuit).

Preparing for sensor model SE41F

Cut to length and terminate both cables as shown.

Note

Use wire end sleeves.



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

1. Magnetic coil, black
2. Magnetic coil, black
3. SE clamp

Figure 24: Preparing the signal and magnetic coil cable sensor model SE21, SE21F

Note

The shielding may not touch (signal short circuit).

… 6 Electrical connections

… Preparing and routing the signal and magnetic coil cable

Routing the signal and magnetic coil cable

Observe the following points when routing cables:

- The signal and magnetic 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 primary is equipped with a preamplifier.
- Avoid 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 lines must be shielded and connected to operational ground.
- Do not run the signal cable and the magnetic 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.

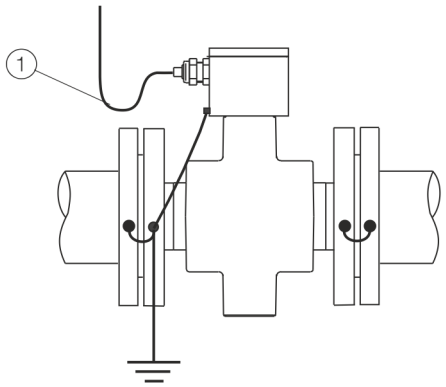
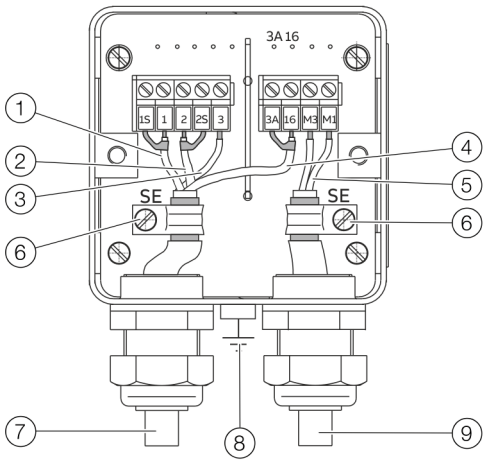


Figure 25: Water trap

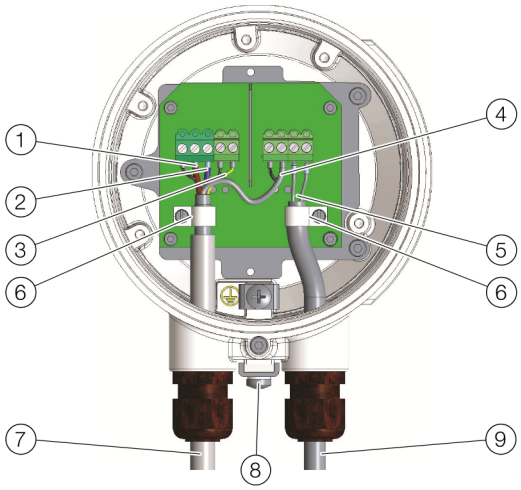
Connecting the sensor

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 sensor in accordance with the following drawing, using a screwdriver with proper size and width.



Terminal box model SE21, SE21F



Terminal box model SE41F

1. red
2. blue
3. yellow
4. white
5. black
6. SE clamp
7. signal cable
8. ground connection
9. magnetic coil cable

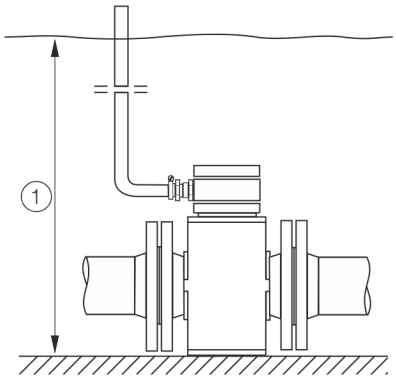
1. red
2. blue
3. yellow
4. white
5. black
6. SE clamp
7. signal cable
8. ground connection
9. magnetic coil cable

Figure 26: Connection to sensor

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

… 6 Electrical connections

Connection with IP rating IP 68



① Maximum flooding height 5 m (16.4 ft)

Figure 27: Maximum flooding height for IP 68 sensors

For sensors with IP rating IP 68, the maximum flooding height is 5 m (16.4 ft).
The supplied signal cable fulfills all the submersion requirements.

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

Electrical connection

NOTICE

Adverse effect on the IP rating IP 68
The IP rating IP 68 of the sensor may be adversely affected as a result of damage to the signal cable.
- The sheathing of the signal cable must not be damaged.

1. Use the supplied signal cable to connect the 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 gasket for the cover is seated properly.

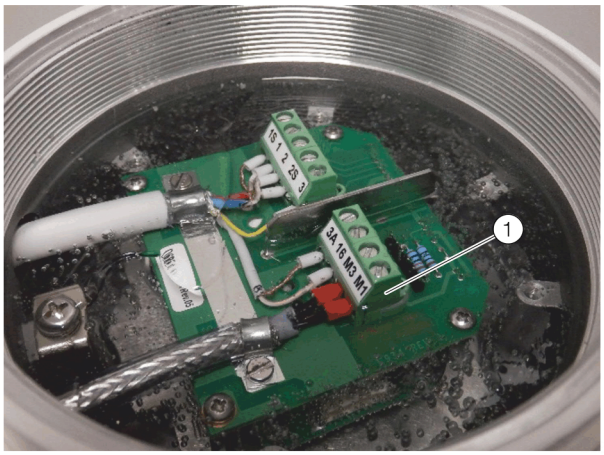
Note
As an option, the sensor can be ordered with the signal cable already connected to the sensor and the terminal box already potted.

Potting the terminal box on-site

⚠ CAUTION

Danger to health!
The two-component potting compound is toxic – observe all relevant safety measures!
Comply with the safety data sheet of the two-component potting compound before preparations are started.
Risk notes:
- R20: Damaging to health when inhaled.
- R36/37/38: Irritates the eyes, respiratory organs and the skin.
- R42/43: Sensitization through inhaling and skin contact is possible.

Safety advice:
- S23: Do not inhale gas/smoke/humidity/aerosol.
- S24: Avoid contact with the skin.
- S37: Wear suited protective gloves.
- S63: In case of an accident due to inhaling: take the injured person out into the fresh air to rest.



① Maximum fill level

Figure 28: Maximum fill level

If the terminal box is to be potted subsequently on-site, a special two-component potting compound can be ordered separately. Potting is only possible if the sensor is installed horizontally.

Observe the following instructions during work activity:

- Complete the installation before potting in order to avoid moisture penetration. Before starting, check all the connections for correct fitting and stability
- Do not overfill the terminal box. Keep the potting compound away from the O-ring and the gasket / groove (see Figure 28).
- Prevent the two-component potting compound from penetrating the cable conduit (Conduit) for an ½ in NPT installation (if used).

Connecting the transmitter

Connecting the power supply

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

The power supply is connected to terminal L (phase), N (neutral), or 1+, 2-, and ⏚, in accordance with the information on the name plate.

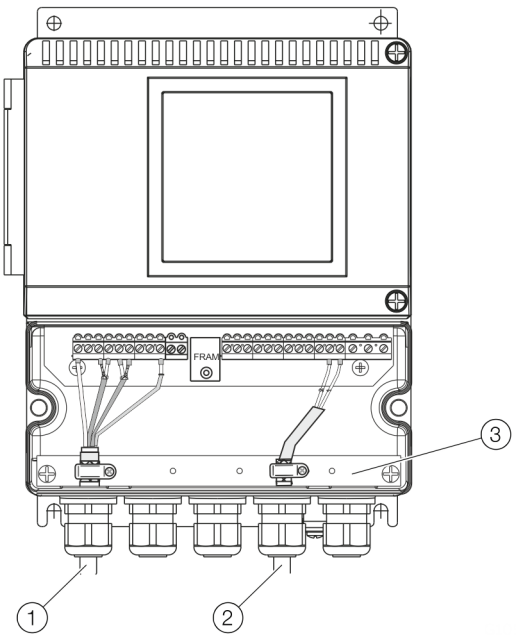
The power supply cable must be rated for the current consumption of the flowmeter system. The leads must comply with IEC 227 and/or IEC 245.
Connect a switch or a line switch in the power supply line to the transmitter. This switch should be located near the transmitter and marked as being associated with the device. The transmitter and the sensor should be connected to functional ground ⏚ in accordance with international standards.

Note
Please observe the limit values of the power supply (see ‘Specification’). Please note that there is a voltage drop of the 24 V AC/DC power supply line if the cables are extremely long or if the conductor cross section is extremely small.
The pin configuration must be made in accordance with the electrical connections in **Terminal assignment** on page 33.

… 6 Electrical connections

… Connecting the transmitter

Connecting the signal and magnet coil cables



① signal cable
② magnetic coil cable
③ Busbar (SE)

Figure 29: Transmitter

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 chamber). 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 sensor and transmitter according to the electrical connection.

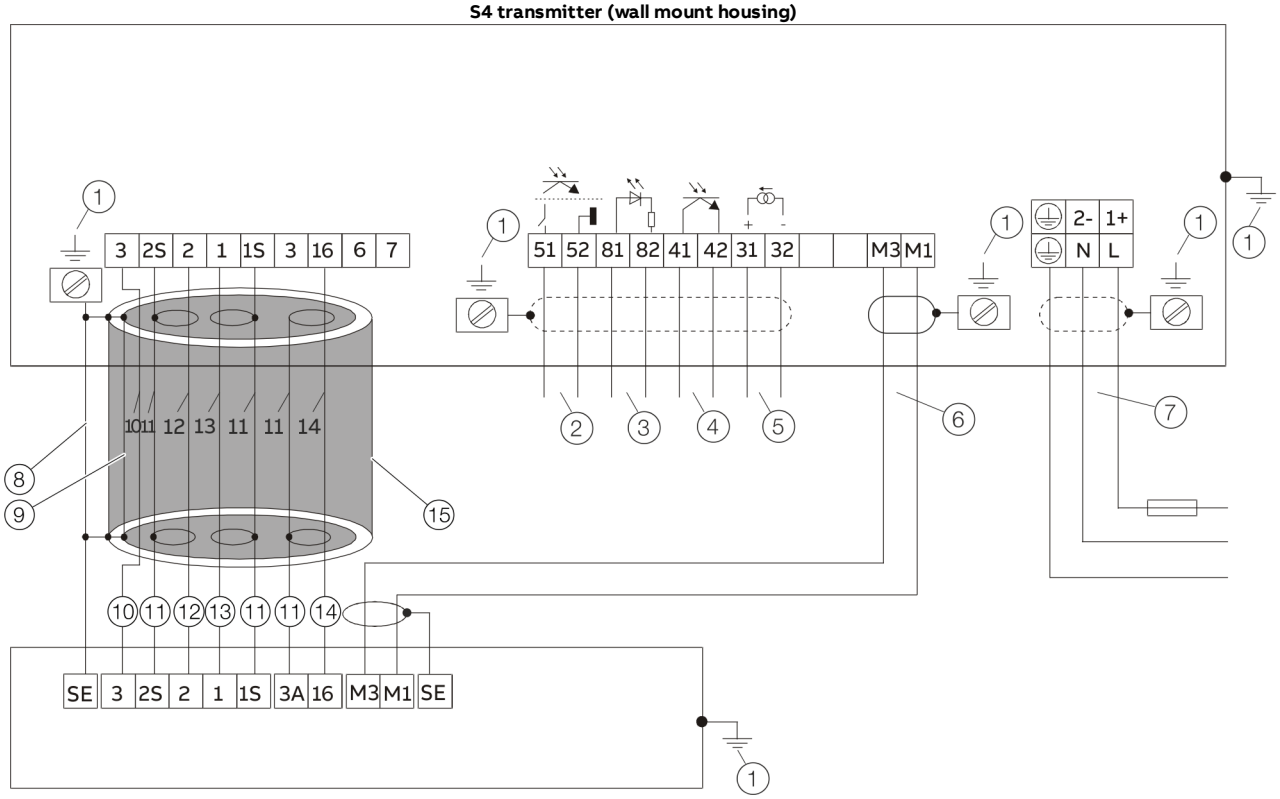
Note
The power supply of the FSM4000 with preamplifier is connected via -U and +U, instead of 1S and 2S. If the flow indicator shows the incorrect flow direction after successful commissioning of the measuring system, e.g., reverse instead of forward, correct this in the ‘Operating mode submenu’ of the transmitter.
First switch off the programming protection (‘Prog. Level / Specialist”). Then select the parameter ‘Directional display’ in the ‘Operating mode submenu’ and change ‘normal’ to ‘inverse’. Finally, reactivate programming protection by selecting ‘Prog. Level / Locked”).

Note
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).

Terminal assignment

Standard DN 3 to DN 1000 (1/10 to 40")

S4 transmitter (wall mount housing)



Sensor

① Functional ground (busbar)

② Pulse output[1)]

③ Switch input[1)]

④ Switch output[1)]

⑤ Current output[1)]

⑥ Magnetic coil cable:
shielded 2 x 1 mm2 CE type 227 TEC 74
ABB order no. D173D147U01, 10 m included in shipment, standard

⑦ Power supply
Low voltage: 100 ... 230 V AC, terminals L, N, ⏚
Extra-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 power supply
56 Hz ≤ f ≤ 64 Hz; 60 Hz power supply

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 delivery

Figure 30: Electrical connection sensor standard DN 10 ... DN 1000 (⅜ ... 40")

1) See the chapter 'Connection examples for peripherals' in the operating instruction and/or on the data sheet

Note

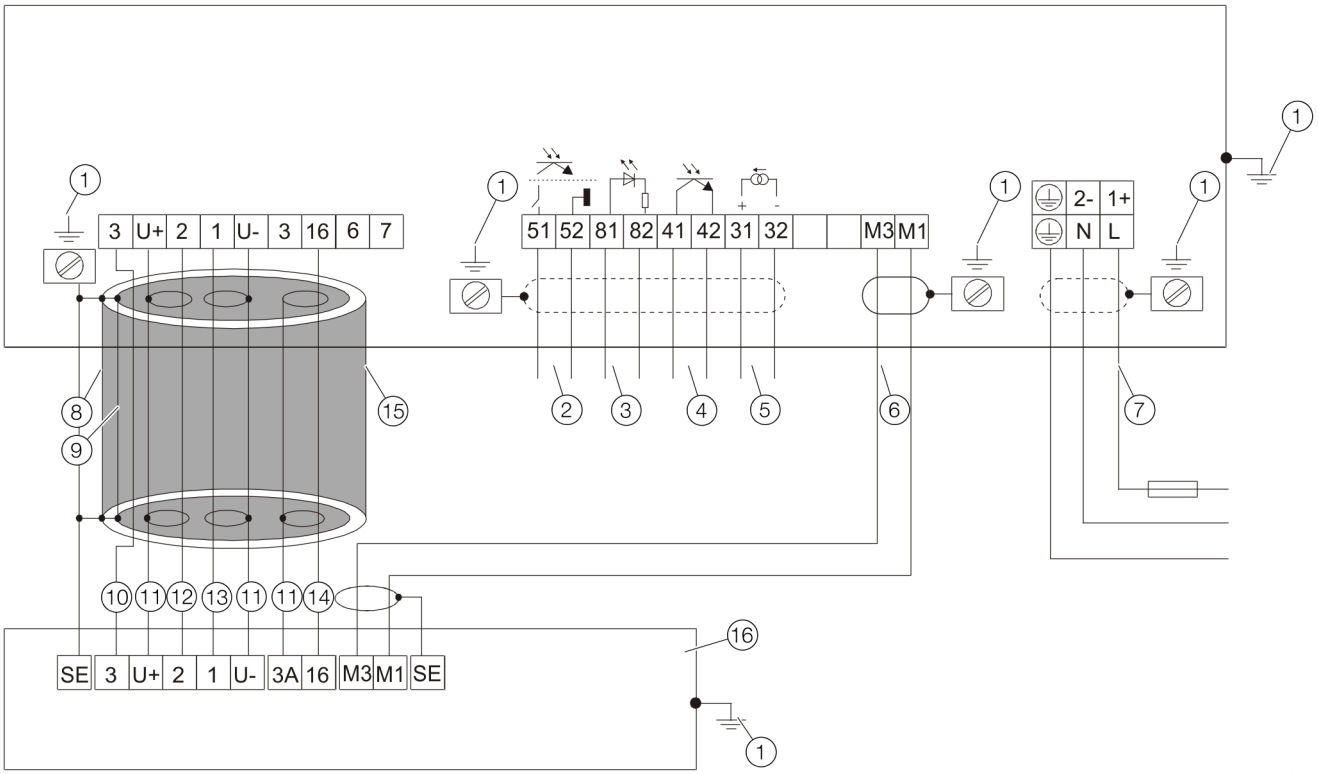
We recommend that shielded output cables be used with the shields connected to the functional ground at one end.

… 6 Electrical connections

… Terminal assignment

With preamplifier DN 3 to DN 1000 (1/10 to 40”)

S4 transmitter (wall mount housing)



Sensor

1. Functional ground (busbar)
2. Pulse output[1)]
3. Switch input[1)]
4. Switch output[1)]
5. Current output[1)]
6. Magnetic coil cable:
   shielded 2 x 1 mm2 CE type 227 TEC 74
   ABB order no. D173D147U01, 10 m included in shipment, standard
7. Power supply
   Low voltage: 100 to 230 V AC, terminals L, N, ⏚
   Extra-low voltage: 20.4 to 26.4 V AC;
   20.4 to 31.2 V DC
   Terminals 1+, 2-, ⏚
   Frequency: 47 Hz ≤ f ≤ 53 Hz; 50 Hz power supply
   56 Hz ≤ f ≤ 64 Hz; 60 Hz power supply
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 delivery
16. with preamplifier (always at DN 3 to DN 8 [1/10 to 5/16”])

Figure 31: Electrical connection sensor with preamplifier DN 3 to DN 1000 (1/10 to 40”), transmitter field mount housing

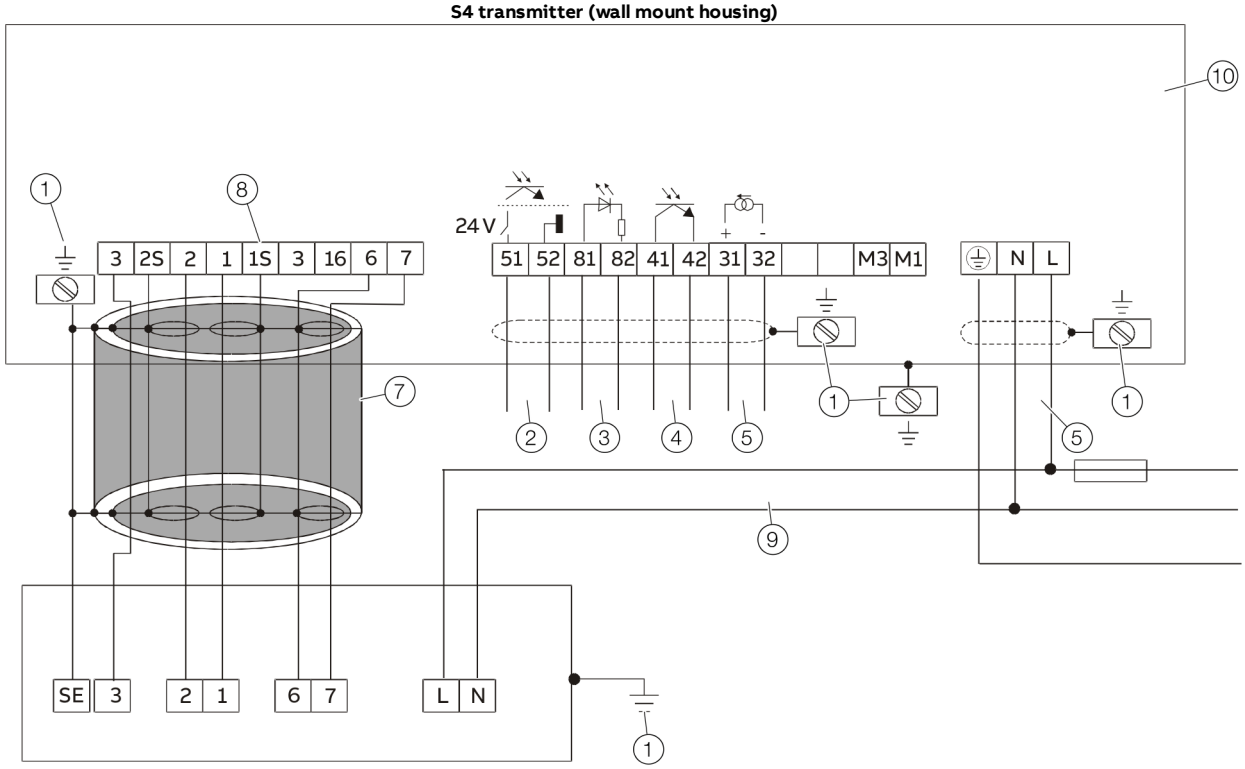
1) See the chapter ‘Connection examples for peripherals’ in the operating instruction and/or on the data sheet

Note

- We recommend that shielded output cables be used with the shields connected to the functional ground at one end.
- If the sensor is equipped with a preamplifier for low conductivity or in nominal diameter range of DN 3 to DN 8 (1/10 to 5/16”), the shieldings of the signal wires must be connected to terminals U+ and U− on both the sensor and the transmitter.

Retrofit for model 10D1422: DN 3 to DN 1000 (1/10 to 40”); model 10DI1425 and 10DS3111A-E: DN 500 to DN 1000 (20 to 40”)

S4 transmitter (wall mount housing)



Sensor

1. Functional ground (busbar)
2. Pulse output[1)]
3. Switch input[1)]
4. Switch output[1)]
5. Current output[1)]
6. Power supply

   Low voltage: 100 to 230 V AC, terminals L, N, ⏚

   Frequency: 47 Hz ≤ f ≤ 53 Hz; 50 Hz power supply

   56 Hz ≤ f ≤ 64 Hz; 60 Hz power supply
7. Shielded signal cable: ABB order no. D173D025U01 or incorporate in existing wiring
8. Reference cable:

   Only for connection to model 10D1422

   Close terminals: 6,7 and hook switch S903
9. Magnetic coil supply:

   Magnet coil supply via supply power
10. Terminal board: D685A1020U03

Figure 32: Sensor standard DN 3 to DN 1000 (1/10 to 40”), transmitter field mount housing

1) See the chapter ‘Connection examples for peripherals’ in the operating instruction and/or on the data sheet

Note

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

… 6 Electrical connections

Digital communication

HART® protocol

The device is registered with the HART Communication Foundation.

Note

The HART® protocol is an unsecured protocol (in terms of IT and cyber security), as such the intended application should be assessed to ensure that this protocol is suitable before implementation.

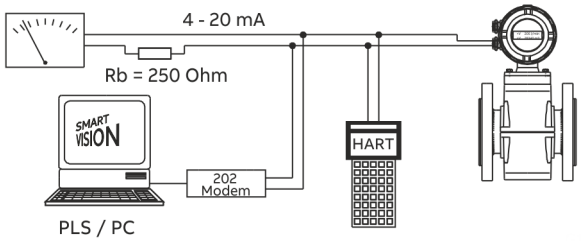


Figure 33: HART communication

HART protocol	
Configuration	Directly on the device Software DAT200 Asset Vision Basic (+ HART-DTM)
Transmission	FSK modulation on current output 4 to 20 mA according to Bell 202 Standard
Max. signal amplitude	1.2 mAss
Current output load	Min. 250 Ω, max. = 560 Ω
Cable	AWG 24 twisted
Max. cable length	1500 m
Baud rate	1200 baud
Display	Log. 1: 1200 HZ Log. 0: 2200 Hz

For additional information, see the separate interface description.

System integration

In conjunction with the DTM (Device Type Manager) available for the device (software version B.10 and higher), communication (configuration, parameterization) can occur with the corresponding framework applications according to FDT 1.21 (DAT200 Asset Vision Basic).

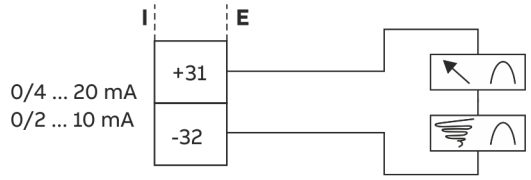
Other tool/system integrations (e.g., Emerson AMS/Siemens S7) are available upon request.

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

The required DTMs are contained on the DAT200 Asset Vision Basic DVD or in the DTM Library. They can also be downloaded from www.abb.com/flow.

Connection examples for peripherals (incl. HART)

Current output

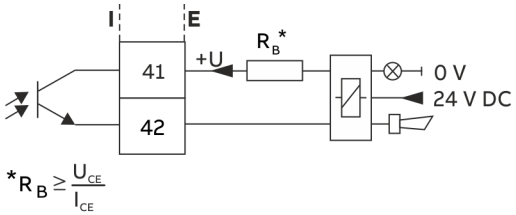


I internal E external

Figure 34: Current output active with / without HART protocol (4 ... 20 mA)

Current output active with / without HART protocol (4 ... 20 mA)	
Terminals	31, 32
Current output	can be selected via software
Function	Active 0/4 ... 20 mA (0 Ω ≤ RB ≤ 560 Ω) 0/2 ... 10 mA (0 Ω ≤ RB ≤ 1120 Ω) (for HART only 4 ... 20 mA)

Switch output



I internal E external

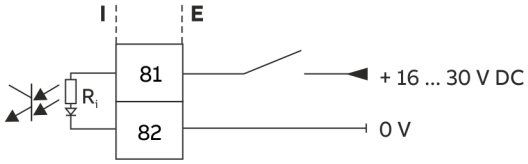
Figure 35: Switch output for system monitoring, Max. / Min. alarm for empty meter tube or forward / reverse signal

Switch output for system monitoring	
Terminals	41, 42
Current output	can be selected via software
Function	Passive • 'closed': 0 V ≤ UCEL ≤ 2 V, 2 mA ≤ ICEL ≤ 220 mA • 'open': 16 V ≤ UCEH ≤ 30 V, 0 mA ≤ ICEH ≤ 2 mA

Note

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

Switch input



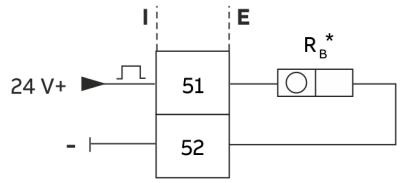
I internal E external

Figure 36: Switch input for external totalizer reset and external zero return

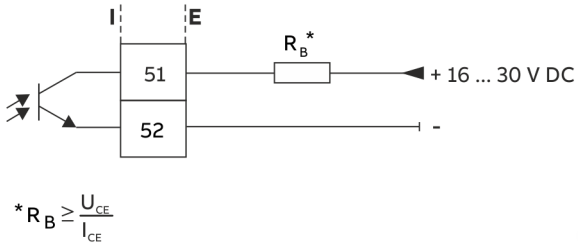
Switch input, passive	
Terminals	81, 82
Current output	can be selected via software
Function	Passive • 'On': 16 V ≤ UKL ≤ 30 V • 'Off': 0 V ≤ UKL ≤ 2 V Ri = 2 kΩ

Pulse output

Active pulse output



Pulse output, passive, optocoupler



I internal E external

Figure 37: Pulse output, active and passive, optoelectronic coupler

Current output active with / without HART protocol (4 ... 20 mA)	
Terminals	51, 52
Current output	can be selected via software
Operating mode	Active / passive, selectable via jumper (see 'Commissioning' chapter in operating instruction)
f_{max}	5 kHz
f_{min}	0.00016 Hz
Adjustment range	Pulse / unit, pulse width (observe dynamic limits)
Function	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 ≤ U_{CEL} ≤ 2 V, 2 mA ≤ I_{CEL} ≤ 220 mA • 'open': 16 V ≤ U_{CEH} ≤ 30 V, 0 mA ≤ I_{CEH} ≤ 2 mA

7 Commissioning

Safety instructions

⚠ CAUTION

Risk of burns due to hot measuring media

The device surface temperature may exceed 70 °C (158 °F), depending on the measuring medium temperature!

- Before starting work on the device, make sure that it has cooled sufficiently.

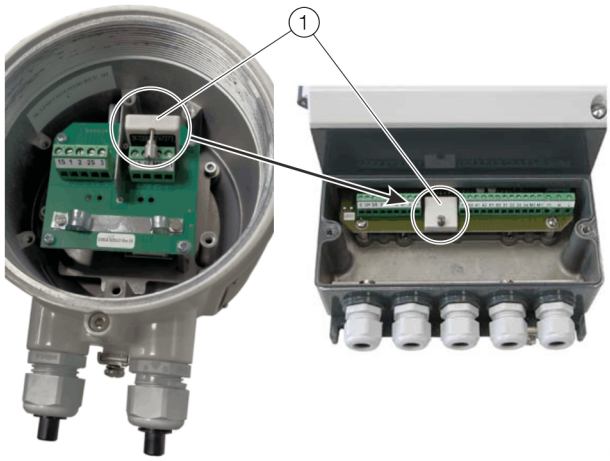
Aggressive or corrosive media may lead to the damage of wetted parts of the sensor. As a result, measuring medium under pressure can leak out.
Wear to the flange gasket or process connection gaskets (e.g. pipe fitting, Tri-clamp, etc.) may caused a pressurized measuring medium to escape.
When using internal flat gaskets, they can become brittle through CIP- / SIP processes.
If pressure surges above the permissible nominal pressure of the device occur permanently during operation, this may affect the service life of the device.

If there is a chance that safe operation is no longer possible, take the device out of operation and secure it against unintended startup.

Checks before commissioning

The following points must be checked before commissioning:

- The power supply must be switched off.
- The power supply used must match the information on the name plate.
- The terminal assignment must be made in accordance with the electrical connection.
- Sensor and transmitter must be grounded properly.
- The temperature limit values 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 terminal board for the installed transmitter. Then screw to the connection board (captive).

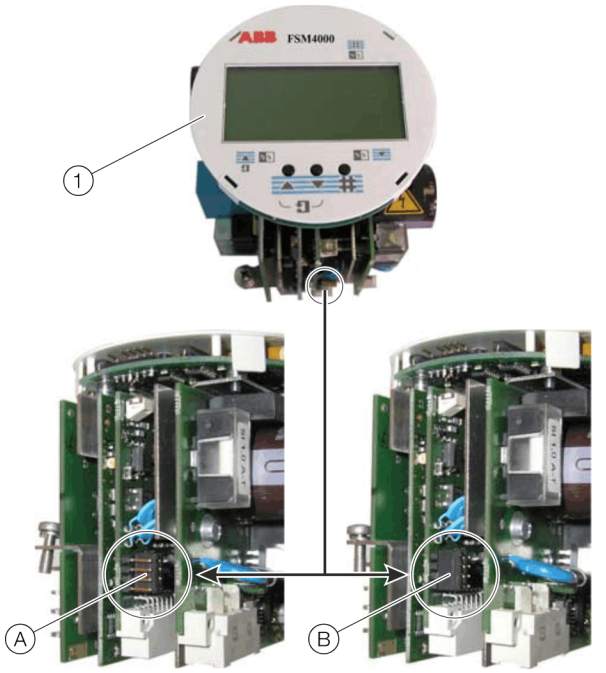


(1) External FRAM

Figure 38: Plugging the FRAM into the transmitter

Note
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 flowmeters primary from older product lines. In this regard, see also **S4 operation with older sensor** on page 46.

- The transmitter must be installed at a location largely free of vibrations.
- 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.



1 Display board
A Pulse passive (inner bridge)
B Pulse active (outer bridge)

Figure 39: Setting the pulse output using jumpers

Commissioning

Power Supply Power-Up

After switching on the power supply, the 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 '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.

… 7 Commissioning

… Commissioning

Device configuration

The device can be factory calibrated 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 entry or selection of parameters, refer to the section titled 'Entering data in short form'. A short overview of the menu structure can be found in the section titled 'Parameter overview'. The Easy Set-up menu enables users to configure the unit quickly and conveniently, see **Easy Set-up, for uncomplicated parameterization** on page 41.

The following parameters should be checked or set for commissioning:

1. **Upper range value** (menu item 'Q_{max}' and menu item 'Unit'). The device is factory calibrated to the largest flow range end value, unless customer information to the contrary is available. Upper range values that correspond to a flow velocity of 2 to 3 m/s are ideal. First set the unit Q_{max} (e.g. m3/h oder l/s) in the menu item 'Unit' and then the upper range value in menu item 'Q_{max}'. The smallest and largest possible upper range values are shown in Table **Measuring range table** on page 22.
2. **Current output** (menu item 'Current output') Selected the desired current range here (0 to 20 mA or 4 to 20 mA)
3. For devices with a fieldbus, the bus address must be set (menu item 'Interface').
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 in the menu item '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 at terminals 51 and 52, the pulse width can be set between 0.1 ms and 2000 ms.
6. **System zero point** (menu item 'Syst.-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 on the transmitter via the 'System zero point' parameter. Select the parameter by pressing ENTER, use the arrow keys for example 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 calibration is performed. The adjustment can also be performed via the external switch input / ext. sys. zero point (see parameter description in the operating instruction).
7. **Detector empty pipe** (Menu item 'Detector e. pipe'), for devices with nominal diameter DN 10 and/or without preamplifier. When the 'Standard' DEP mode is selected, you do not need to perform an adjustment on site. 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. (Submenu Diagnosis/Adjustment, see parameter description in the operating instruction) or **Additional information regarding use of enhanced diagnosis functions** in the operating instruction.

Note

If the flow indicator shows the incorrect flow direction after successful commissioning of the measuring system, 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' in the 'Operating mode submenu' and change 'normal' to 'inverse'. Finally, reactivate programming protection by selecting 'Prog. Level' → 'Locked').

Easy Set-up, for uncomplicated parameterization

The Easy Set-up function enables users to configure the transmitter for quick and convenient startup. For further setup options, see Parameter description in the operating instruction.

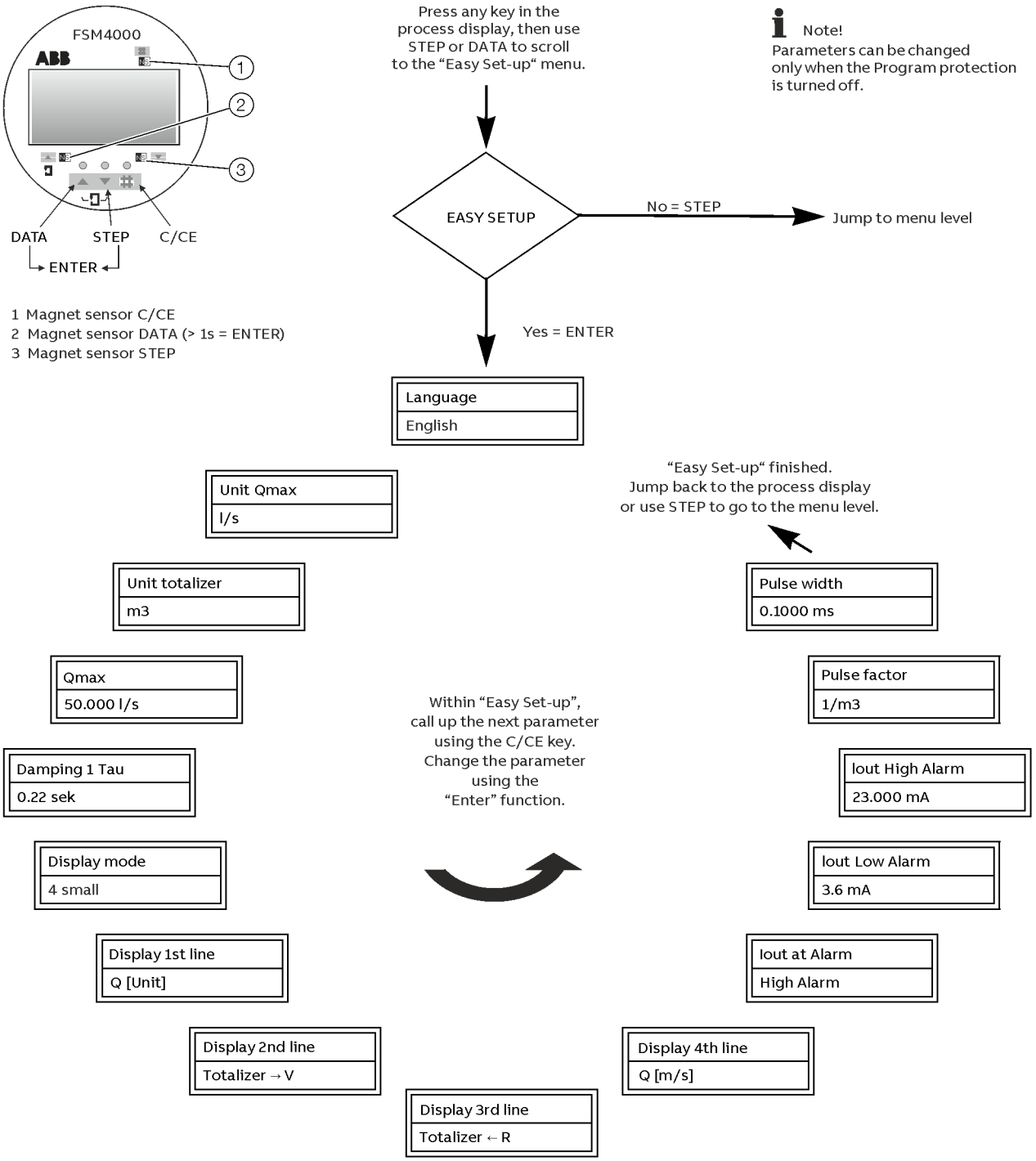


Figure 40: Easy Set-up function

8 Operation

Safety instructions

⚠ CAUTION

Risk of burns due to hot measuring media

The device surface temperature may exceed 70 °C (158 °F), depending on the measuring medium temperature!

- Before starting work on the device, make sure that it has cooled sufficiently.

Aggressive or corrosive media may lead to the damage of wetted parts of the sensor. As a result, measuring medium under pressure can leak out.
Wear to the flange gasket or process connection gaskets (e.g. pipe fitting, Tri-clamp, etc.) may caused a pressurized measuring medium to escape.
When using internal flat gaskets, they can become brittle through CIP- / SIP processes.
If pressure surges above the permissible nominal pressure of the device occur permanently during operation, this may affect the service life of the device.

If there is a chance that safe operation is no longer possible, take the device out of operation and secure it against unintended startup.

Display options

After switching on the power supply, 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 the current flowrate with 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 → **V** 12.30000 **m³** ← **R** 516.0000 **m³**	1. line 2. line 3. line	Current upstream flow rate Totalizer value, forward 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 Totalizer submenu by using the 'Reset totalizer' function.

Error condition

In the event of an error, an error or warning message is displayed in the 4th display line.

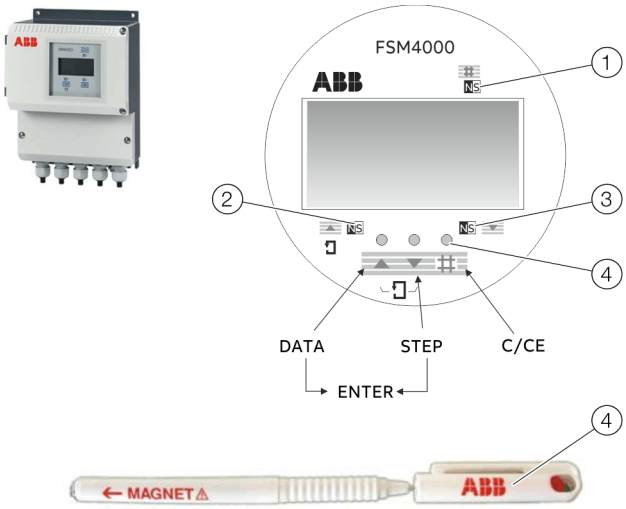
Flow rate > 103 %

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, refer to the chapter 'Error messages'.
In addition to the error message, the current output is set to the limit value (menu 'Iout for alarm'). The alarm can be indicated optionally via the switch output, if selected.

Note

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

Data entry



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

Figure 41: Controls on the transmitter

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

When entering data, the transmitter remains online, i.e., current and pulse outputs still show the current operating mode.

The functions of the individual keys are explained below:

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 required 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 required 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.

Initiating the ENTER function when using the magnet stick for operation

The ENTER function is initiated when the DATA/ENTER sensor is activated for longer than 3 seconds. The display flashes to indicate that the function is active.
There are two different methods of entering data:

- Numerical entry
- Entry from specified table

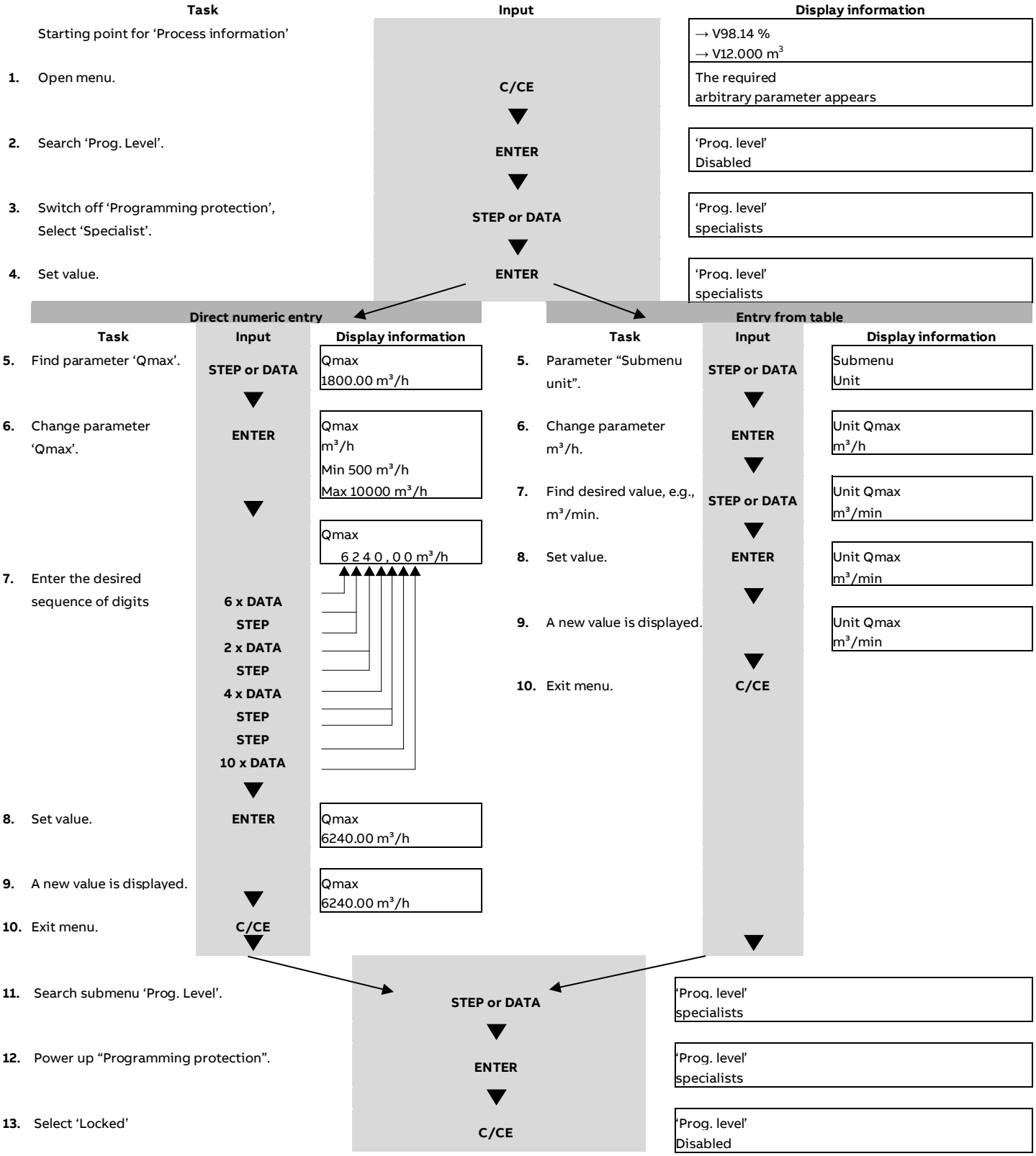
Note

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

… 8 Operation

… Data entry

Entering data in short form



Software history

For transmitters without communication or HART protocol

Software D200S021U01

Software version	Type of changes	Documentation / Supplements
B.10	Original software	–
B.11	Improve min. contrast limit. After changing from 50 → 60 Hz the system data now displays the correct frequency.	–
B.12	Shortened Finnish texts. Aut. simulator detection for counter management improved.	–
B.14	FRAM management optimized.	–
B.20	Added Turkish as new language. Added error E (DC too high) Updated flowmeter sensor 10D1462/72.	Added documentation for the additional points.
B.22	Always display the flowrate with 4 decimal places.	–
B.30	Menu item for noise reduction Menu item Meter factor Support for sensors SE21, DN 1 to DN 2	Added documentation for the additional points.
B.31	Hardware compatibility for C-level hardware	–
B.32	Improved totalizer management	–
B.33/B.34	FRAM management optimized	–
C.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.
C.11	Improved support for older flowmeter sensor	-
C.20	Improved display operation	–
D.13	Firmware update due to a new microprocessor	–
D.14	Troubleshooting, display freeze	–

… 8 Operation

S4 operation with 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 is equipped as such and the devices are mounted according to the electrical connection (see page **Terminal assignment** on page 33and on), the menu ‘Primary Setup’ is displayed after power-up of the power supply. Press any key to enter the following information. If you need to correct your entry, you can do so afterward in the system data submenu ‘Sensor’: in ‘Primary Setup’. See page Parameter description in the operating instruction.

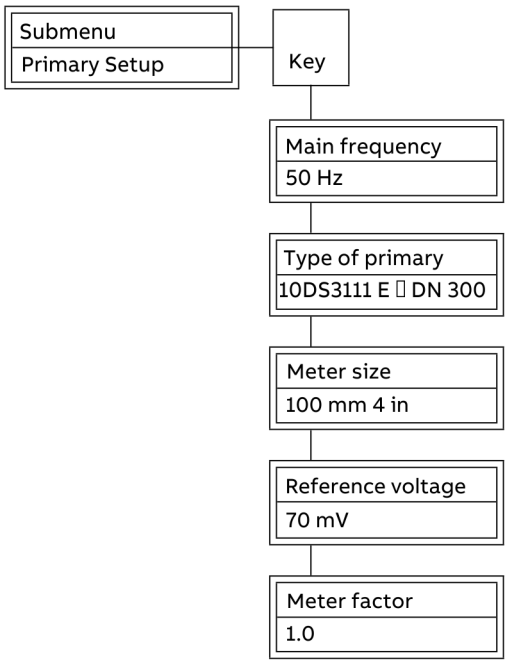


Figure 42: ‘Primary Setup’ submenu

Entries can be made one after another. In the submenu ‘Primary Setup’, select the line frequency at which the 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 sensor model 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).

Note
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

Note
If the flow indicator shows the incorrect flow direction after successful commissioning of the measuring system, e.g., reverse flow instead of forward flow, you should 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’ in the submenu ‘Operating Mode’. Change ‘normal’ to ‘inverse’. Finally, reactivate programming protection by selecting ‘Prog. Level’ → ‘Locked’).

⚠ WARNING

Danger due to electric current!

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

- Power to all connection leads must be switched off.

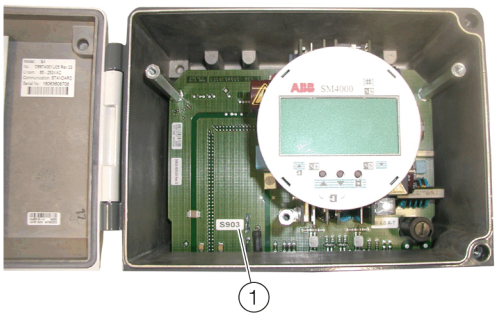
Adapting the transmitter to the sensor 10D1422 (DN 3 to 1000), 10DI1425 (≥ DN 500):

1. Switch off the power supply. After waiting 40 minutes, remove the housing cover from the field housing unit.
2. Remove the shock protection cover ① by loosening the 3 ② screws.

① Shock protection cover ② Fixing screw cover

Figure 43: Screwing on the shock protection cover

3. Then close switch S903 ① .



① Switch S903

Figure 44: Close switch S903

… 8 Operation

… S4 operation with older sensor

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

9 Maintenance / Repair

Safety instructions

⚠ WARNING

Risk of injury due to live parts!
When the housing is open, contact protection is not provided and EMC protection is limited.
- Before opening the housing, switch off the power supply.

⚠ CAUTION

Risk of burns due to hot measuring media
The device surface temperature may exceed 70 °C (158 °F), depending on the measuring medium temperature!
- Before starting work on the device, make sure that it has cooled sufficiently.

NOTICE

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

Note
For detailed information on the maintenance of the device, consult the associated operating instructions (OI)!

10 Recycling and disposal

Dismounting

⚠ WARNING

Risk of injury due to process conditions.
The process conditions, for example high pressures and temperatures, toxic and aggressive measuring media, can give rise to hazards when dismantling the device.
- If necessary, wear suited personal protective equipment during disassembly.
- Before disassembly, make sure that the process conditions do not pose any safety risks.
- Depressurize and empty the device / piping, allow to cool and purge if necessary.

Bear the following points in mind when dismantling the device:
- Switch off the power supply.
- Disconnect electrical connections.
- Allow the device / piping to cool and depressurize and empty. Collect any escaping medium and dispose of it in accordance with environmental guidelines.
- Use suited tools to disassemble the device, taking the weight of the device into consideration.
- If the device is to be used at another location, the device should preferably be packaged in its original packing so that it cannot be damaged.
- Observe the notices in **Returning devices** on page 11.

Disposal

Note

Products that are marked with the adjacent symbol may **not** be disposed of as unsorted municipal waste (domestic waste).
They should be disposed of through separate collection of electric and electronic devices.

This product and its packaging are manufactured from materials that can be recycled by specialist recycling companies.

Bear the following points in mind when disposing of them:
- As of 8/15/2018, this product will be under the open scope of the WEEE Directive 2012/19/EU and relevant national laws (for example, ElektroG - Electrical Equipment Act - in Germany).
- The product must be supplied to a specialist recycling company. Do not use municipal waste collection points. These may be used for privately used products only in accordance with WEEE Directive 2012/19/EU.
- If there is no possibility to dispose of the old equipment properly, our Service can take care of its pick-up and disposal for a fee.

11 Specification

Note
The device data sheet is available in the ABB download area at www.abb.com/flow.

Measuring accuracy

Reference conditionsin accordance with EN 29104

Measuring medium temperature	20 °C (68 °F) ±2 K
Ambient temperature	20 °C (68 °F) ±2 K
Power supply	Nominal voltage as per name plate U_N ± 1 %
Installation conditions	• Inlet section. > 10 × DN straight section • Outlet section: > 5 × DN straight section DN = Sensor nominal diameter
Warm-up phase	30 min

Maximum measuring error

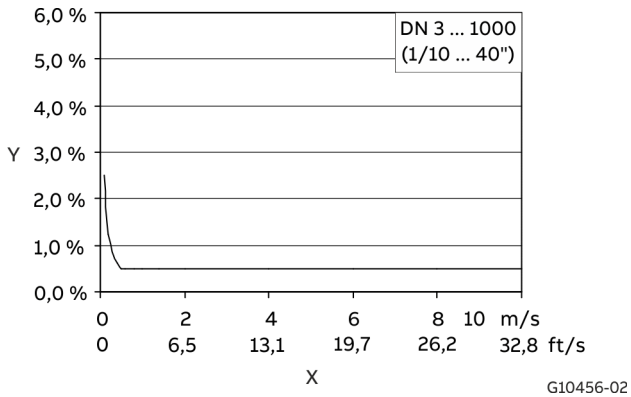
Pulse output

- DN 3 to DN 1000 (1/10 to 40"):
  Q > 0.05 Q_{max}DN ±0.5 % of measured value
- Q < 0.05 Q_{max}DN ± 0.00025 Q_{max}DN

Q_{max}DN = maximum flow rate of the nominal diameter at 10 m/s

Analog output effects

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



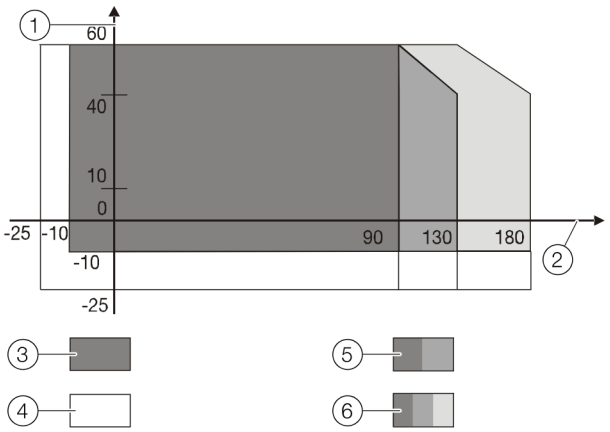
Y Measured error ± of measured value

X Flow velocity v

Figure 45: Analog output effects

Sensor SE41F

Temperature graph



1 Ambient temperature °C

2 Measuring medium temperature °C

3 Standard flange (steel): Hard/soft rubber max. 90/60 °C (194 to 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)

Figure 46: Measuring medium temperature dependent on the ambient temperature

Max. permissible 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, the difference must be subtracted from the max. cleaning temperature.
T_{max} - Δ °C.Δ °C = ($T_{amb.}$ - 25 °C)

Min. permissible pressure as a function of measuring medium temperature

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

Sensor material

Parts	Standard	Others
Liner	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 to DN 15 (1/10 to 1/2″)	stainless steel*	stainless steel*
DN 20 to DN 300 (3/4 to 12″)	Steel galvanized**	
DN 350 to DN 1000 (14 to 40″)	Steel painted**	
Chassis		
DN 3 to 300 (1/10 to 12″)	Pair case cast aluminum, painted, paint coat, ≥ 80 µm thick, RAL 9002	—
DN 350 to DN 1000 (14 to 40″)	Steel welded construction, painted, paint coat, ≥ 80 µm thick, RAL 9002	—
Terminal box	Aluminum alloy, painted, ≥ 80 µm thick, frame: dark gray, RAL 7012 Cover: light gray, RAL 9002	—
Meter tube	Stainless steel 1.4301 (304)	—
Cable gland	Polyamide	—

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

* 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

** 1.0038, 1.0460, 1.0570, 1.0432, ASTM A105, Q255A, 20#, 16Mn

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… Sensor SE41F

Storage temperature
−20 to 70 °C (−4 to 158 °F)

IP rating in accordance with EN 60529
IP 65/IP 67
IP 68 (option)

Pipe vibration according to EN 60068-2-6
Transmitter

- In the range of 10 to 55 Hz, max. deflection 0.15 mm

Sensor

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

Designs
The flange devices are compliant with the installation lengths determined according to ISO 13359.

Material loads for process connections
The limits of the permissible measuring medium temperature (T_{medium}) and permissible pressure (P_{medium}) are calculated on the basis of the liner and flange material used in the device (see device name plate).

Temperature limits

Liner	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)	—

Devices with DN 3 to 600 (1/10 to 24 in)

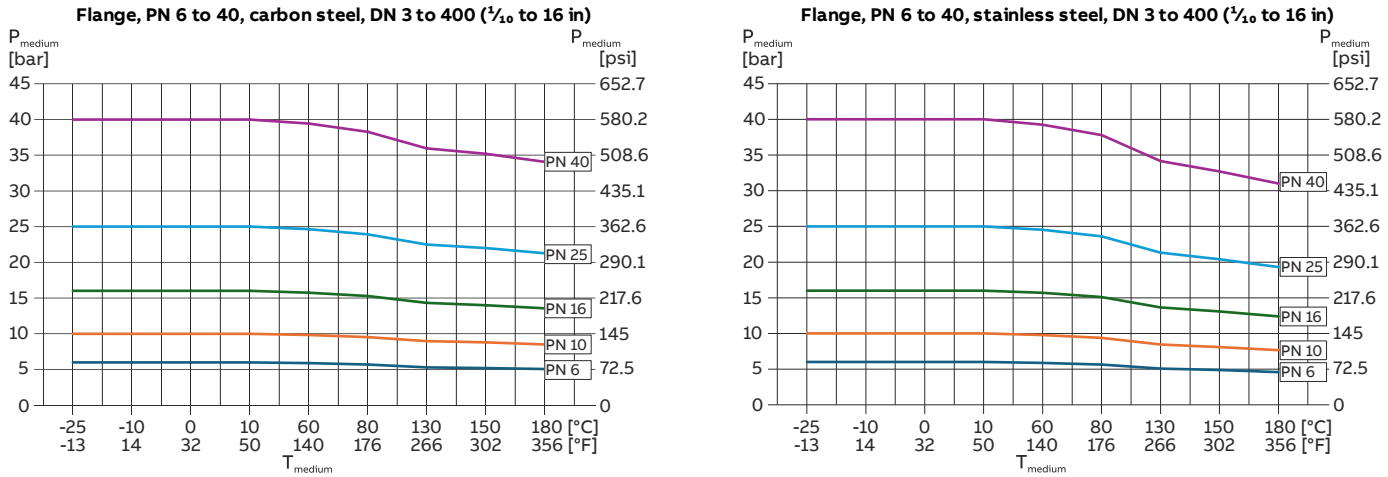


Figure 47: Flowmeter sensor with carbon steel flange or stainless steel flange, Nominal Diameter DN 3 to 400, Pressure Rating PN 6 to 40

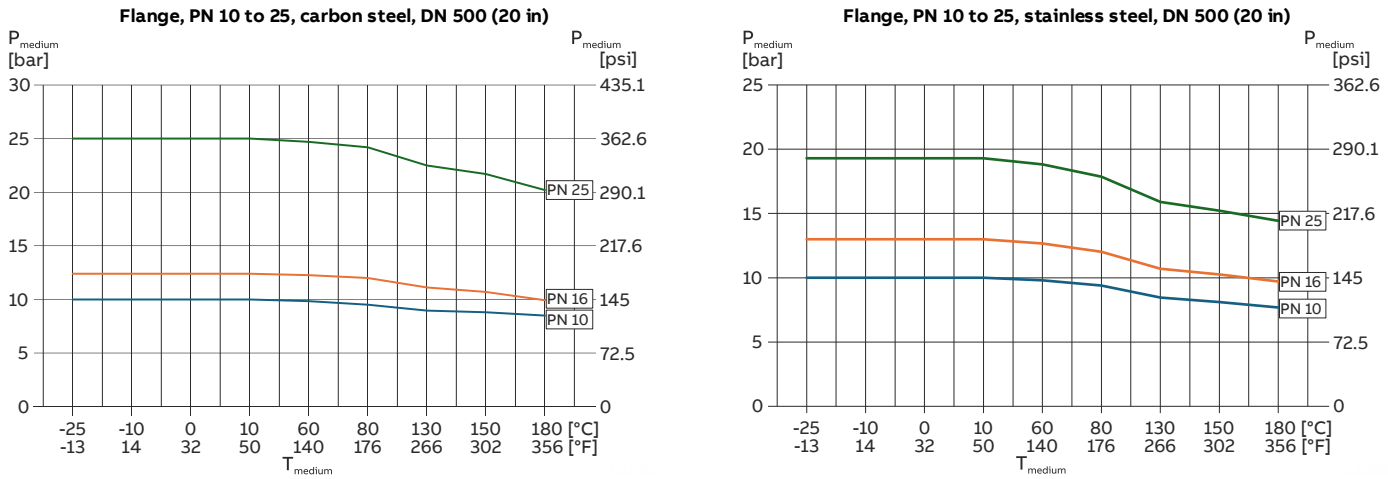
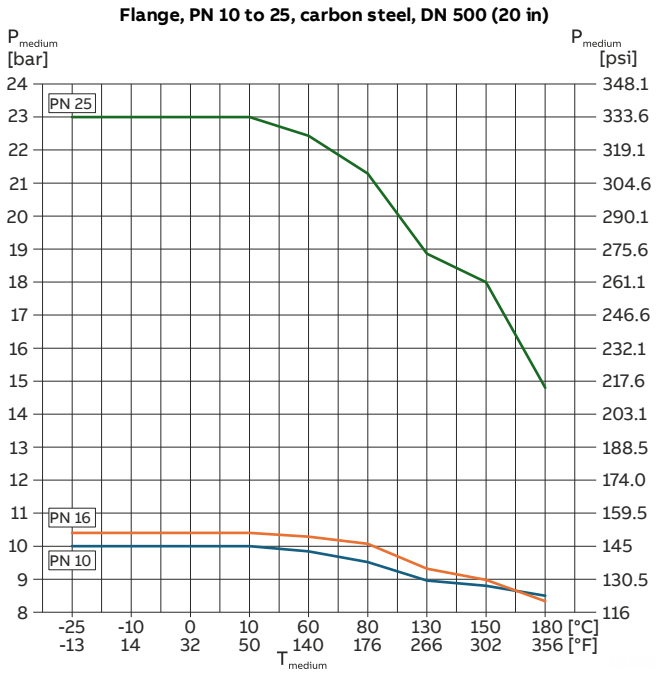


Figure 48: Flowmeter sensor with carbon steel flange or stainless steel flange, Nominal Diameter DN 500, Pressure Rating PN 10 to 25

… 11 Specification

… Sensor SE41F



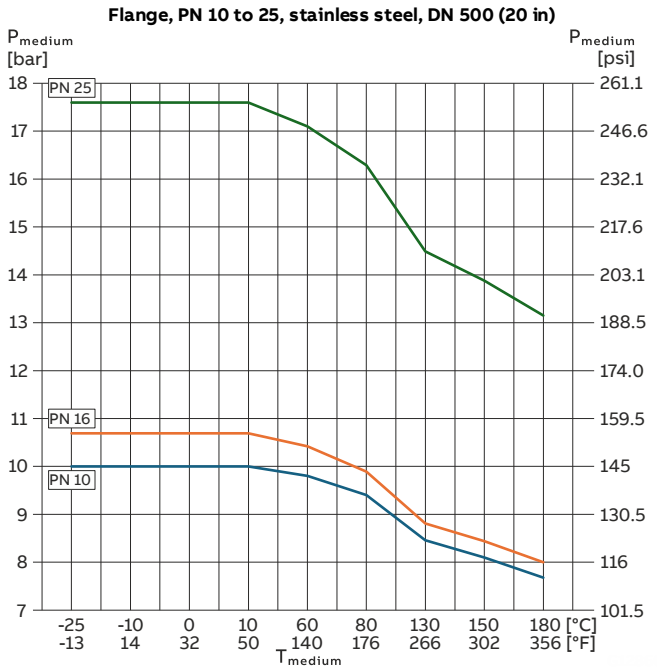
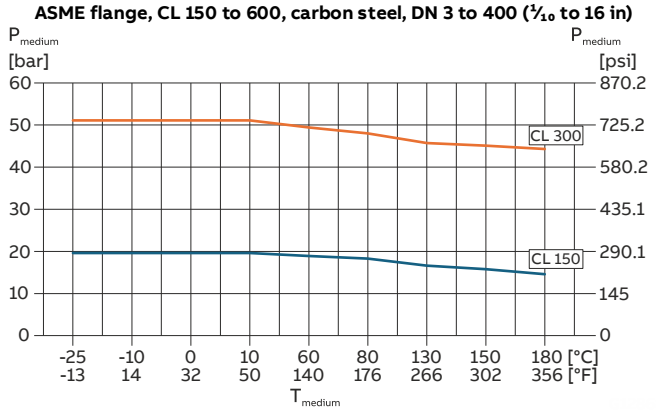


Figure 49: Flowmeter sensor with carbon steel flange or stainless steel flange, Nominal Diameter DN 500, Pressure Rating PN 10 to 25



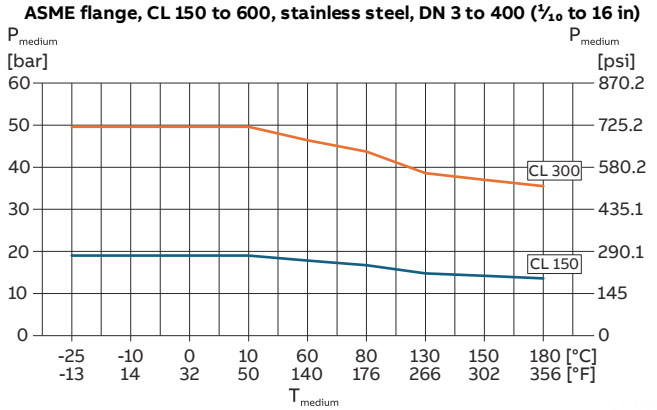
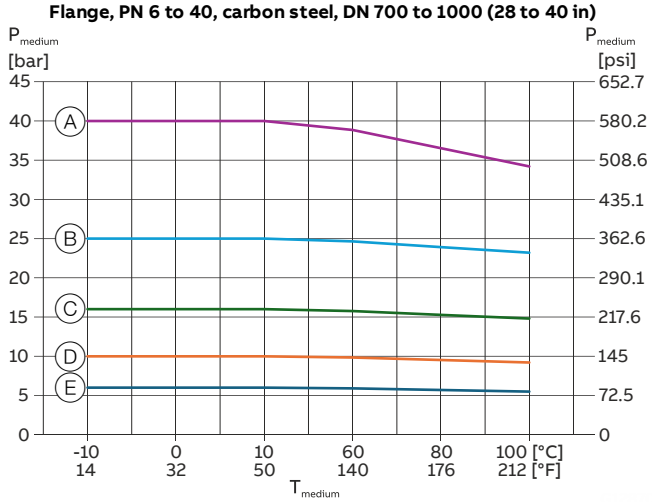


Figure 50: Flowmeter sensor with carbon steel flange or stainless steel flange, Nominal Diameter DN 3 to 400 (⅛ to 24 in), Pressure Rating CL 150 to 600

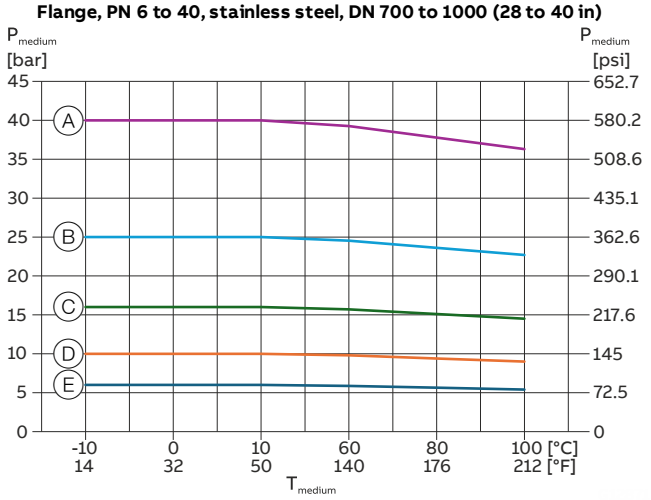
Devices with DN 700 to 1000 (28 to 40 in)

Flange, PN 6 to 40, carbon steel, DN 700 to 1000 (28 to 40 in)



(A) DN 700 to 1000 (28 to 40 in), PN 40
(B) DN 700 to 1000 (28 to 40 in), PN 25
(C) DN 700 to 1000 (28 to 40 in), PN 16
(D) DN 700 to 1000 (28 to 40 in), PN 10
(E) DN 1000 (40 in), PN 6

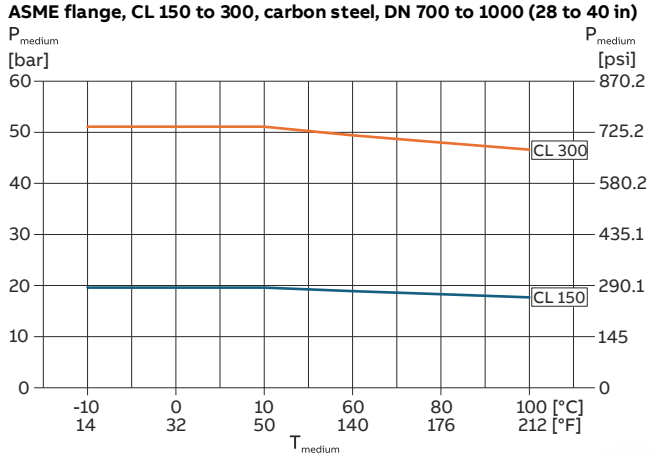
Flange, PN 6 to 40, stainless steel, DN 700 to 1000 (28 to 40 in)



(A) DN 700 to 1000 (28 to 40 in), PN 40
(B) DN 700 to 1000 (28 to 40 in), PN 25
(C) DN 700 to 1000 (28 to 40 in), PN 16
(D) DN 700 to 1000 (28 to 40 in), PN 10
(E) DN 1000 (40 in), PN 6

Figure 51: Flowmeter sensor with carbon steel flange or stainless steel flange, nominal diameter DN 700 to 100 (28 to 40 in), pressure Rating PN 6 to 40

ASME flange, CL 150 to 300, carbon steel, DN 700 to 1000 (28 to 40 in)



ASME flange, CL 150 to 300, stainless steel, DN 700 to 1000 (28 to 40 in)

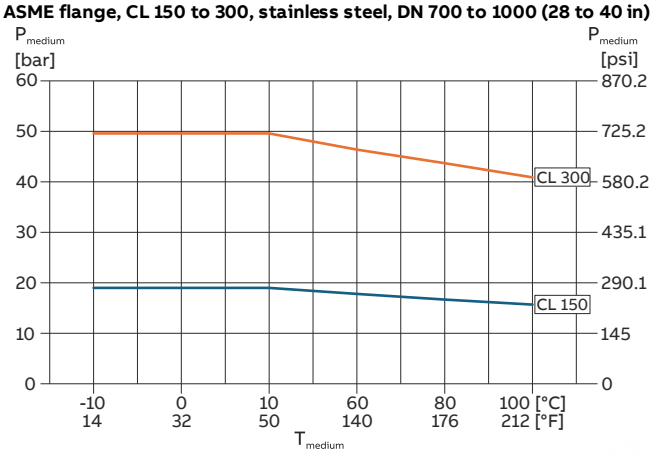
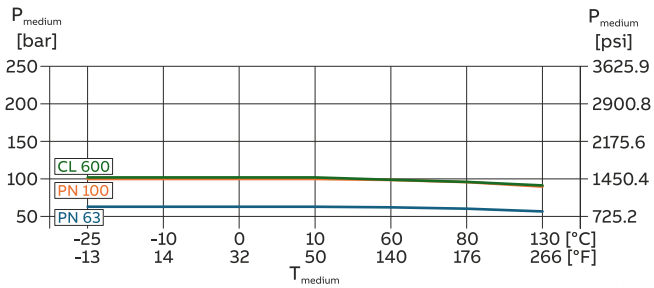


Figure 52: Flowmeter sensor with carbon steel flange or stainless steel flange, nominal diameter DN 700 to 1000 (28 to 40 in), pressure Rating CL 150 to 300

Devices in high pressure design, DN 25 to 400 (¾ to 16 in), pressure rating PN 63 to 100 (CL 600)

ASME flange, CL 150 and CL300, carbon steel, DN 25 to 400 (¾ to 16 in)



ASME flange, CL 150 and CL300, stainless steel, DN 25 to 400 (¾ to 16 in)

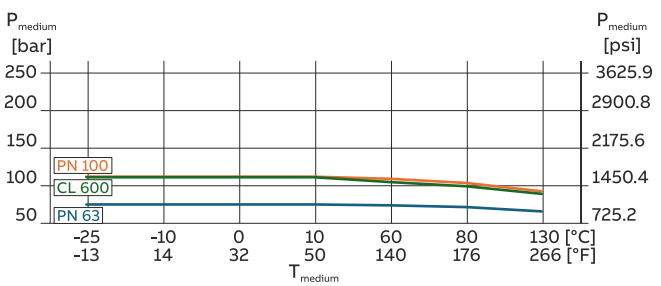


Figure 53: Flowmeter sensor with carbon steel flange and stainless steel flange, nominal diameter DN 25 to 400 (¾ to 16 in), high pressure design

… 11 Specification

Sensor SE21_

Minimum permissible absolute pressure

Liner	Nominal diameter DN	$P_{Betrieb}$ mbar abs	at	$T_{Betrieb}$ [1] °C
PFA	3 to 100 (1/10 to 4“)	0	≤	130 °C (266 °F)

1) For CIP/SIP cleaning, higher temperatures are permitted for limited time periods; refer to the table entitled ‘Maximum permissible cleaning temperature’.

Maximum permissible cleaning temperature

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

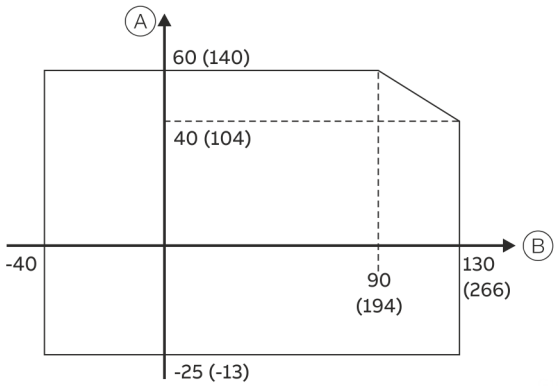
If the ambient temperature is > 25 °C (77 °F), then the difference must be subtracted from the max. cleaning temperature.

$T_{max} – Δ$ °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

Maximum permissible ambient temperature as a function of measuring medium temperature



Ⓐ Ambient temperature $T_{amb.}$

Ⓑ Measuring medium temperature T_{medium}

Figure 54: Temperature graph

Sensor material

Liner	Electrode material		Electrode design	
	Standard	Others	Standard	Others
PFA	Hast.-C4 (2.4610), 1.4539 (904 L), 1.4571 (316 Ti), Titanium, Tantalum, Platinum-iridium	Hast.-B3 (2.4600), 1.4539 (904 L)	Flat head	Pointed head (≥ DN 10) 1.4539, (904 L)

Process connection material

Process connection	Standard
Wafer type	without
Terminal box	
• without/with preamplifier, type A	Stainless steel 1.4301 (304)
• with preamplifier, type B	Aluminum alloy, painted, paint coat frame: dark gray, RAL 7012 cover: light gray, RAL 9002
Meter tube	Stainless steel 1.4301 (304)
Cable gland	Polyamide
Flowmeter sensor housing	Stainless steel 1.4301 (304)

Storage temperature

–25 to 70 °C (-13 to 158 °F)

IP rating in accordance with EN 60529

- IP 67
- IP 68 (Option)

Pipe vibration according to EN 60068-2-6

Transmitter

- In the range of 10 to 55 Hz, max. deflection 0.15 mm

Sensor

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

Material loads for process connections

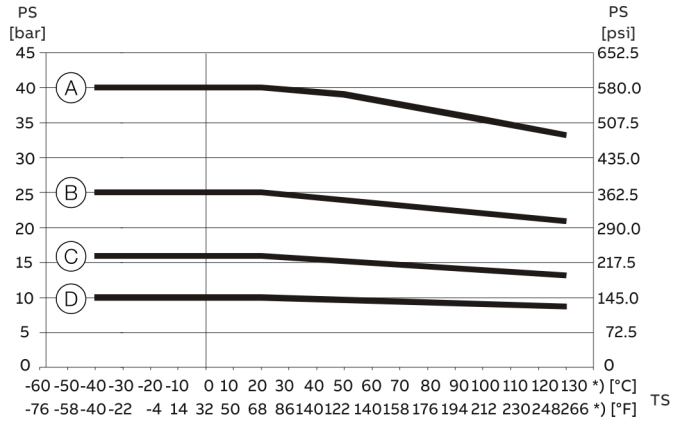
The limits of the permissible measuring medium temperature (T_{medium}) and permissible pressure (P_{medium}) are calculated on the basis of the liner and flange material used in the device (see device name plate).

Devices with variable process connections / wafer type SE21 DN 3 to 100 (1/10 to 4 in)

Process connection PFA liner	Nominal diameter DN	PS_{max} Bar (psi)	TS_{min}	TS_{max}
Wafer type	3 to 50 (1/10 to 2 in) 65 to 100 (2½ to 4 in)	40 (580.2) 16 (232.1)	−40 °C (−40 °F)	130 °C (266 °F)

Material load for wafer type design model SE21W

Liner: PFA wafer type



Ⓐ PN 40/CL 300
Ⓑ PN 25
Ⓒ PN 16/CL 150
Ⓓ PN 10

Figure 55: Wafer type design model SE21W

*) Higher temperatures are allowed for CIP/SIP cleaning for limited time periods, see Table 'Maximum permissible cleaning temperature'.

Transmitter

Meas. 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 to DN 1000 (⅜ to 40")
	≥ 20 µS/cm with preamplifier	DN 3 to DN 8 (1/25 to 5/16")
	≥ 5 µS/cm with preamplifier	DN 3 to 1000 (1/25 to 40")
	≥ 0.5 µS/cm with preamplifier	DN 10 to DN 1000 (⅜ to 40")
Repeatability (measurement period = 100 s)	DN 3 to 1000 (1/10 to 40"): ≤ ± (0.1 % of measured value + 0.01 % of Q_{max}DN)	
Response time	1τ = 70 ms (0 to 66 %) Fast operating mode 1τ = 200 ms (0 to 66 %) Standard/piston pump operating mode	
Power supply	U = 100 to 230 V, 50/60 Hz U_{rat} = 85 to 253 V, 50/60 Hz 50/60 Hz ± 6% 20.4 to 26.4 V AC, 20.4 to 31.2 V DC, ripple ≤ 5 %	
Power consumption	S ≤ 45 VA (sensor including transmitter)	
Ambient temperature	−20 to 60 °C (−4 to 140 °F)	
Storage temperature	−20 to 80 °C (−4 to 176 °F)	

IP rating in accordance with EN 60529

IP 67 for field-mount housing and NEMA 4X

Relative humidity

Acc. to IEC 60068-2-30 classification of environmental conditions, natural factors, temperature and air humidity.

No effect under the following operating conditions: temperature ranging from 25 to 55 °C (77 to 131 °F) and a relative air humidity of 94 to 97 %.

… 11 Specification

… Transmitter

Vibration
In accordance with IEC 60068-2-6 (03/95), grouping of devices according to table C2 for general industry applications. No additional effect on the following levels of vibration. Frequency range 10 to 55 Hz; amplitude max. 0.15 mm.

Design
Field-mount housing made of cast aluminum per DIN 1725, painted.
Paint coat thickness 80 µm. Lower section (RAL 7012), upper section (RAL 9002). For dimensions, see **Dimensions** in the Datasheet. Weight, approx. 3.3 kg.

Signal 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 5 m signal cable is included with each flowmeter. If a cable longer than 5 m is required, refer to the ordering information for the sensor.

Coil supply cable
Is required to connect the flowmeter sensor to the transmitter. For EMC reasons, the 2-wire cable is shielded. A 5 m cable is included with each flowmeter. If a cable longer than 5 m is required, refer to the ordering information for the sensor.

12 Additional documents

Note
All documentation, declarations of conformity, and certificates are available in ABB's download area.
www.abb.com/flow

13 Appendix

Overview of setting parameters and technical design

Measuring point:		TAG no.:
Sensor model:		Transmitter type:
Order no.:	Device no.:	Order no.:
Measuring medium temperature:		Voltage supply:
Lining:	Electrodes:	Exciter frequency:
C_{zero}:	C_{Span}:	System zero point:

Parameter		**Adjustment 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/Sensor'
Nominal size:	.....	DN 1 to DN 1000
Q_{max}:	.....	0.05 Q_{max}DN to 1 Q_{max}DN
Pulse factor:	.....	Imp./phys. Unit
Pulse width:	.....	0.100 to 2000 ms
Offset suppression:	.....	0 to 10 % of upper range value
Damping:	.....	0.2 (0.07) to 20 seconds
Noise reduction	.....	OFF / 1 / 2/ 3 / 4
Density:	.....	0.01 g/cm^3 to 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:	.....	%
Switching output:	.....	Max. Alarm, Min. Alarm, Max./Min. Alarm, General alarm, empty conduit etc.
Contact input:	.....	External zero return, Totalizer reset, External system zero, no function
Current output:	.....	0/4 to 20 mA, 0/2 to 10 mA, 0 to 5 mA, 0 to 10-20 mA, 4 to 12 to 20 mA
I_{out} with alarm:	.....	0 %, 103 %, 3.8 mA, Low, High
Detector e. pipe:	.....	ON / OFF
Calibrate e. pipe:	.....	0 to 10000
Alarm e. pipe:	.....	ON / OFF
I_{out} for e. pipe:	.....	0 %, 103 %, 3.8 mA, Low, High
Totalizer function:	.....	Standard, difference totalizer
1. display line:	.....	Q (%), Q (unit), Q (mA), counter V/R, TAG number, blank line, bar graph
2. display line:	.....	Q (%), Q (unit), Q (mA), counter V/R, TAG number, blank line, bar graph
3. display line:	.....	Q (%), Q (unit), Q (mA), counter V/R, TAG number, blank line, bar graph
4. display line:	.....	Q (%), Q (unit), Q (mA), counter V/R, TAG number, blank line, bar graph
Operating mode:	.....	Standard / Piston Pump / Fast
Flow direction:	.....	Forward / reverse flow, Forward flow
Directional display:	.....	Standard, inverse

Pulse output:	□ Active		□ Passive							
Communication:	□ HART								□ Without	
Diagnosis	Measured value		E/W	Min.	Max.	Measured value		E/W	Min.	Max.
Threshold monitoring	Coil current AC					Coil voltage DC				
Error (E)	Coil resistance					Coil temperature				
Warning (W)	Coil insulation resistance					DAC value				
	Electrode voltage					Electrode balance				
	Signal-to-noise ratio					Magnetic linearity				

… 13 Appendix

Return form

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:	Email:

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

Trademarks

Notes

Notes

ABB Measurement & Analytics

For your local ABB contact, visit:
www.abb.com/contacts

For more product information, visit:
www.abb.com/flow

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