



Operating instructions
Magnetic-inductive flow meter
SMFx5x

GB

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1 Preliminary note

You will find instructions, technical data, approvals and further information using the QR code on the unit / packaging or at documentation.ifm.com.

1.1 Symbols used

- ✓ Requirement
- Instructions
- ▷ Reaction, result
- [...] Designation of keys, buttons or indications
- Cross-reference
-  Important note
Non-compliance may result in malfunction or interference.
-  Information
Supplementary note

1.2 Warnings

Warnings indicate the possibility of personal injury and damage to property. This enables safe product handling. Warnings are graded as follows:



WARNING

Warning of serious personal injury

▷ If the warning is not observed, fatal and serious injuries are possible.



CAUTION

Warning of minor to moderate personal injury

▷ If the warning is not observed, minor to moderate injuries are possible.

ATTENTION

Warning of damage to property

▷ If the warning is not observed, damage to property is possible.

2 Safety instructions

- The unit described is a subcomponent for integration into a system.
 - The system architect is responsible for the safety of the system.
 - The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Intended use).
- Only use the product for permissible media.
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.
- Store the device in its original packaging.



CAUTION

Transport of heavy devices.

- ▷ Personal injury or damage to devices is possible if heavy devices fall during transportation.
- ▶ Transport the device to the assembly site in its original packaging.
- ▶ After unpackaging the device but leaving the protective caps in place, transport it using the suitable tools (e.g. carrying straps).

ATTENTION

Applications where steam is applied

- ▷ Risk of mechanical damage of the sensor or the piping system due to steam surge.
- ▶ Protect the sensor from excessive stress due to cavitation and steam surge.
- ▶ Design the piping system according to the state of the art.
- ▶ Do not install the sensor in the direct vicinity of fittings, pipe bends and the like in order to prevent unnecessary maximisation of steam surges.
- ▶ Preheat the system before the steam enters and remove liquid residues from the pipes, e.g. by blowing out or other suitable measures.
- ▷ The permissible temperatures of the sensor must not be exceeded → Data sheet.

2.1 Cybersecurity

Installation

The device is suitable for operation in a secure environment according to IEC 62443-1-1.

The device was designed for operation behind a firewall.

- ▶ Carry out a risk assessment of the system according to IEC 62443-1-1.
- ▶ Take measures to ensure physical security.

Operation

- ▶ Observe the security functions described in the product documentation and the recommendations for their use.

Maintenance

- ▶ Back up system configuration and system data in accordance with your company's change management processes.

Decommissioning

- ▶ Ensure that no sensitive information can fall into unauthorised hands.
- ▶ Always reset the system settings to the factory settings before decommissioning the device.

3 Intended use

The unit monitors liquid media.

The device measures the flow velocity, the volume flow (consumed quantity / time), the consumed quantity, the medium temperature and the conductivity.

3.1 Application area

Use in hygienic areas for liquid media with a conductivity of $\geq 5 \mu\text{S/cm}$.



This is a class A product. This product may cause radio interference in domestic areas.

► If required, take appropriate EMC screening measures.



Pressure Equipment Directive (PED):

The units comply with the Pressure Equipment Directive and are designed and manufactured for group 2 fluids in accordance with the sound engineering practice. Use of media from group 1 fluids on request.

4 Function

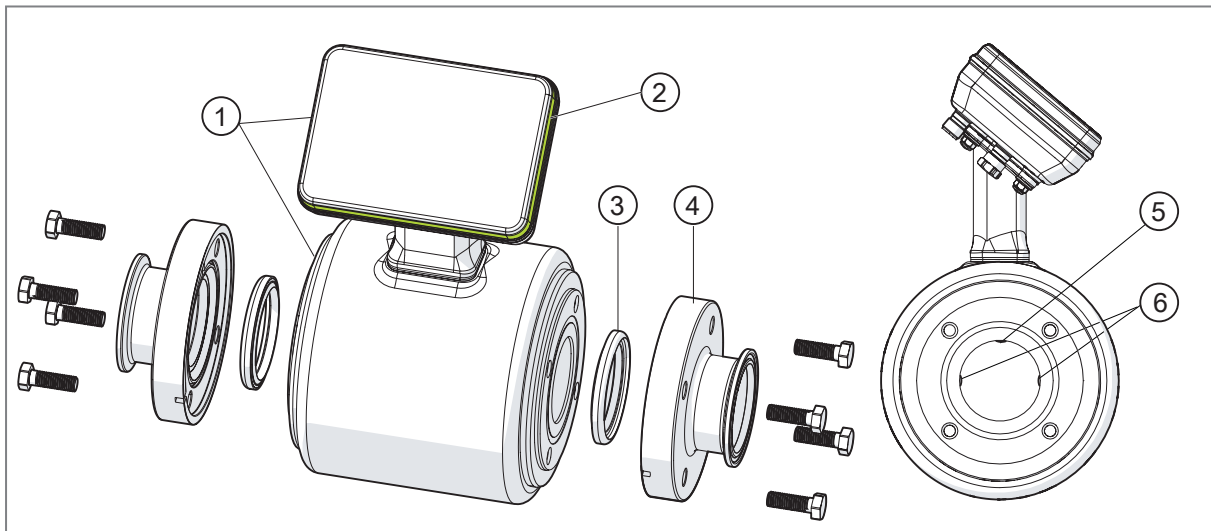


Fig. 1: Product description

- 1: SMFx5x device: measuring section and electronic unit (converter)
- 2: Operating status LED (LED ring)
- 3: Exxxxx seal, can be ordered separately from www.ifm.com
- 4: Exxxxx process adapter, can be ordered separately from www.ifm.com
- 5: Temperature-measuring electrode in the measuring tube
- 6: Flow-measuring electrodes in the measuring tube

Operating principle:

- The device detects the volumetric flow on the magnetic-inductive volumetric flow measuring principle.
- As additional process values the device measures the temperature of the medium.
- The unit can be operated in SIO mode (standard input-output) or in IO-Link mode.
- The device indicates all self-diagnostic options through the colour signals of an operating status LED.
- A simulation mode allows simplified set-up of the sensor.
- The device has the following output functions:
 - [Analogue signal \(→ □ 27\)](#):
flow, temperature, conductivity
 - [Consumed quantity monitoring \(totaliser function\) \(→ □ 30\)](#):
switching signal or pulse signal
 - [Switching signal diagnostics \(→ □ 28\)](#):
Flow direction, fluid detection
 - [Digital switching signal \(→ □ 32\)](#):
limit value monitoring of flow, temperature, conductivity, totaliser
- In addition, the device provides other diagnostic and service functions:
 - [Read totaliser values \(→ □ 41\)](#)
 - [Memory \(→ □ 42\)](#)
 - [Operating hours counter \(→ □ 42\)](#)
 - [Internal temperature \(→ □ 42\)](#)
 - [Operating status LED \(→ □ 42\)](#)
 - [Event history \(→ □ 43\)](#)
 - [Device information \(→ □ 43\)](#)

- [Simulation](#) (→ [43](#))
- [Binary data transmission \(BLOB\)](#) (→ [44](#))
- [Optical localisation](#) (→ [44](#))
- [Reset the device](#) (→ [41](#))
- [Application configuration](#) (→ [35](#)), e.g. measured value damping, output polarity, low flow cut-off, calibration.

4.1 Output OUT1 selection options

- Pulse signal totaliser
- Switching signal totaliser
- Switching signal diagnosis
 - Direction of flow
 - Fluid detection
- IO-Link
- OFF (output switched to high impedance)

4.2 Output OUT2 selection options

- Pulse signal totaliser
- Switching signal totaliser
- Analogue signal flow
- Analogue signal temperature
- Analogue signal for conductivity
- Switching signal diagnosis
 - Direction of flow
 - Fluid detection
- Input for external totaliser reset
- OFF (output switched to high impedance)

4.3 IO-Link

IO-Link is a communication system for connecting intelligent sensors and actuators to automation systems. IO-Link is standardised in the IEC 61131-9 standard.



General information on IO-Link at io-link.ifm



Input Output Device Description (IODD) with all parameters, process data and detailed descriptions of the device at documentation.ifm.com

IO-Link offers the following advantages:

- Interference-free transmission of all data and process values
- Parameter setting in the running process or presetting outside the application
- Parameters for identifying the connected devices in the system
- Additional parameters and diagnostic functions

- Automatic backup and restore of parameter sets in case of device replacement (data storage)
- Logging of parameter sets, process values and events
- Device description file (IODD - Input Output Device Description) for easy project planning
- Standardised electrical connection
- Remote maintenance

5 Mounting



CAUTION

If the medium temperature is above 50 °C (122 °F), parts of the housing can increase in temperature to over 65 °C (149 °F).

- ▷ Risk of burns.
- ▶ Protect the housing against contact with flammable substances and unintentional contact.
- ▶ Apply the supplied warning label to the sensor cable.

ATTENTION

No functional earthing when installed in an ungrounded pipe system (e.g. plastic pipes).

- ▷ Reduction in measurement accuracy or damage to the device.
- ▶ Attach the grounding cable to the ground connection and establish an equalisation of potential between the medium and the device (→ Electrical connection).

- ▶ Make sure that no pressure is applied to the system.
- ▶ Ensure that no media can leak at the mounting location during installation.
- ▶ Avoid deposits, accumulated gas and air in the pipe system.

After installation, air bubbles in the system can affect the measurement. Corrective measures:

- ▶ After installation, rinse the system for ventilation.

5.1 Device dimensions

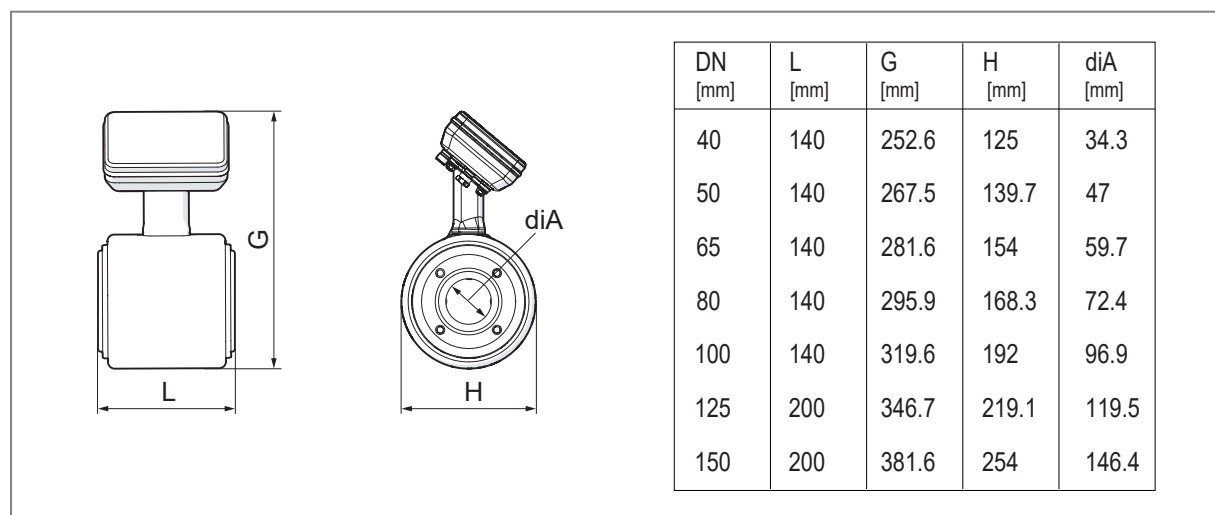


Fig. 2: Dimensions of the sensors depending on the design (nominal width DN)

5.2 Installation position

- ▶ Install the unit so that the measuring pipe is always completely filled.
- ▶ Install in front of or in a rising pipe.

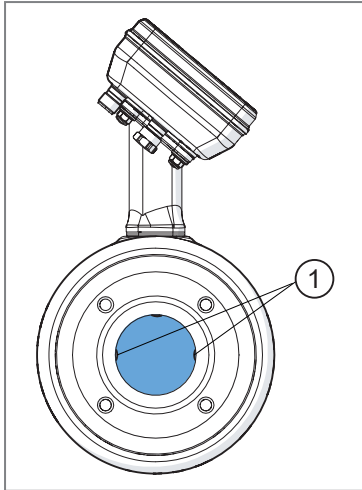


Fig. 3: Orientation of the flow-measuring electrodes



When installed in a vertical position, the electrodes for flow measurement (1) should be in the same plane. Any deviation from this can lead to measurement inaccuracies.

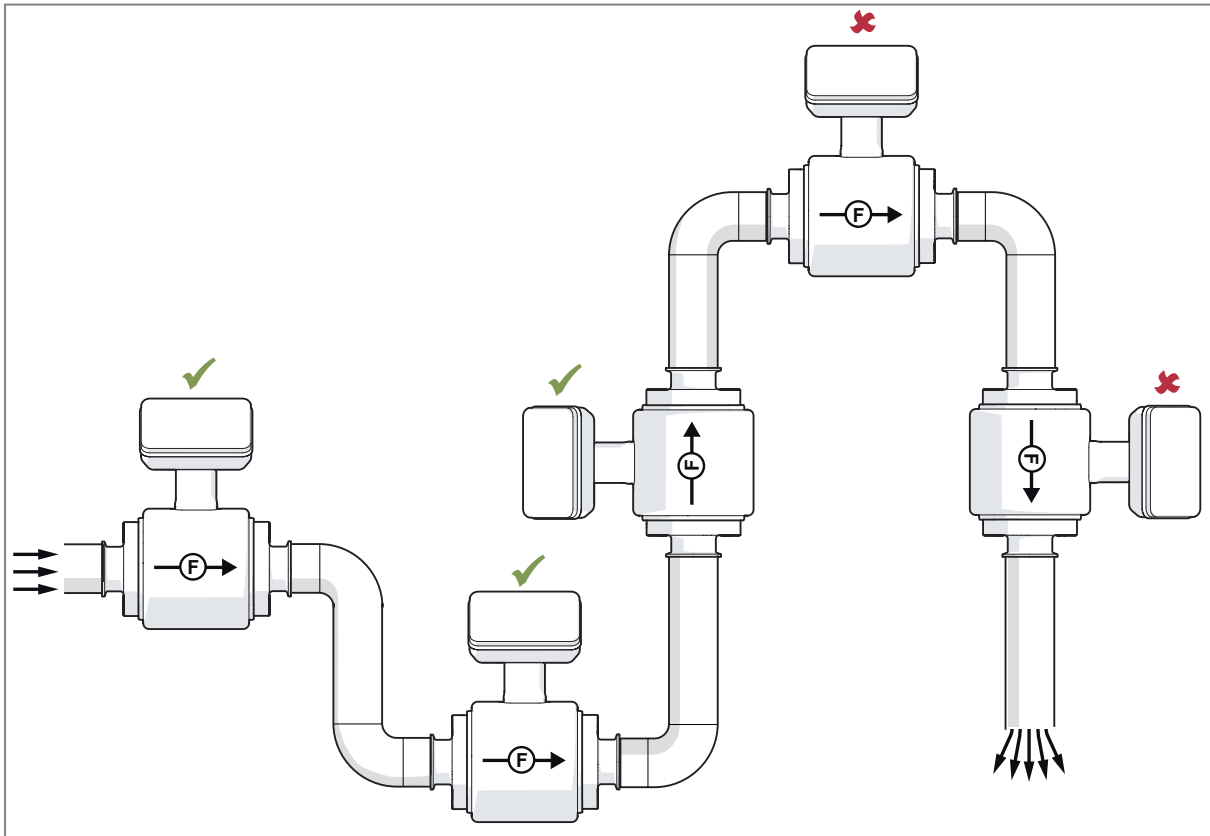


Fig. 4: Recommended and non-recommended installation positions

—(F)—→ Flow direction



The unit can be installed independently of the orientation if the following is ensured:

- No air bubbles can form in the pipe system.
- The pipes are always completely filled.



In case of horizontal installation: as a result of design requirements a small quantity of the medium always remains in the measuring channel after switching off the pump.

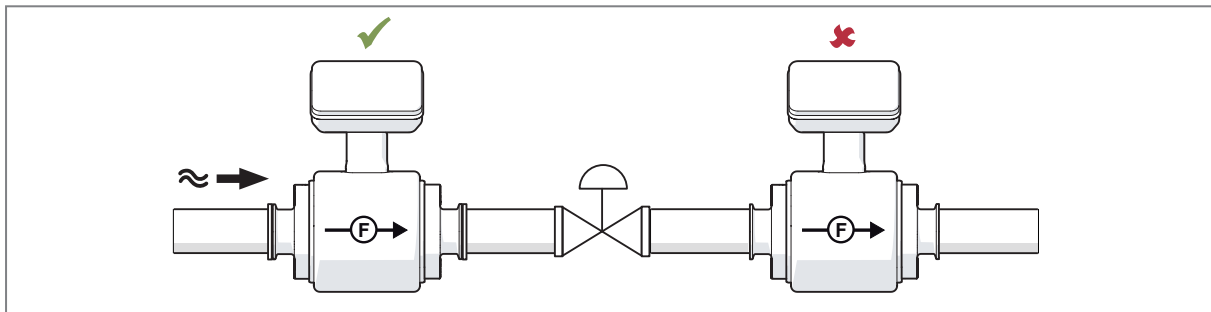
- Ensure that no medium remains in the measuring channel.

Avoid the following installation positions:

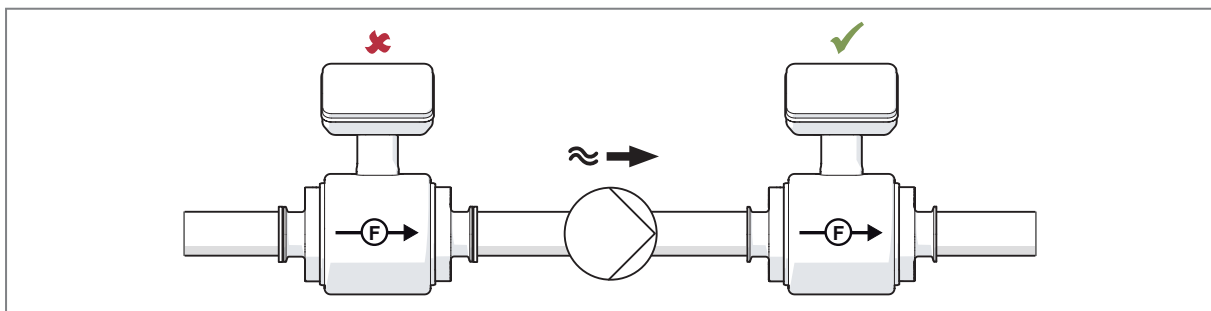
- At the highest point of the pipe system.
- Directly upstream of a free pipe spout in a downpipe
- On the suction side of a pump.

Installation in the vicinity of control valves:

- Install the device upstream of the control valve in the direction of flow:

**Installation in the vicinity of pumps:**

- Install the device downstream of the pump in the direction of flow to avoid negative pressure in the measuring pipe:



When installed upstream of a pump, cavitation may occur if the pump is under low pressure or high vacuum conditions.

- ▷ This can lead to the sensor being damaged.

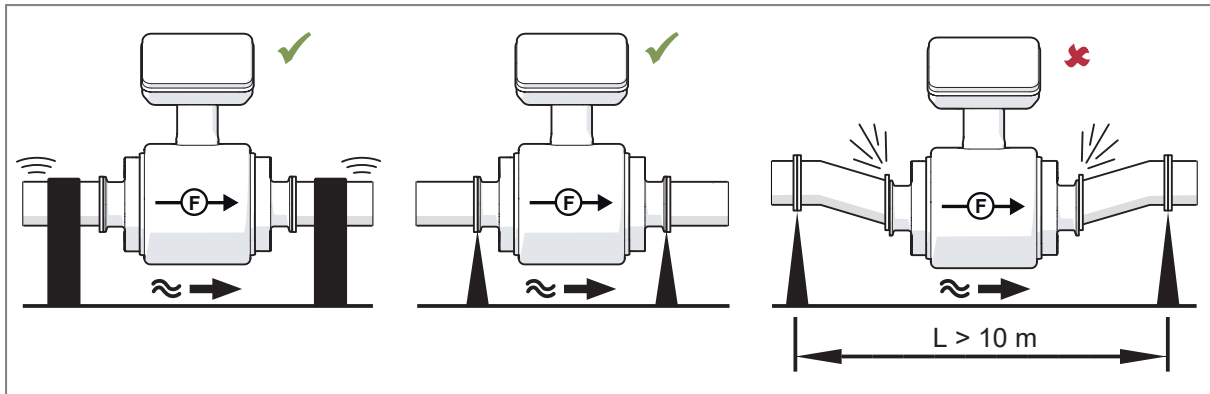


When using piston pumps, piston diaphragm pumps or peristaltic pumps:

- Install pulsation damper.

Installation with very strong vibrations:

- Support and secure the device and the pipe:



5.3 Inlet and outlet pipe lengths

Structures in the pipe, bends, valves, reducing pieces and the like affect the function of the unit.

► Adhere to the distances between sensor and interference.



Shut-off valves and control devices are not allowed directly in front of the unit.

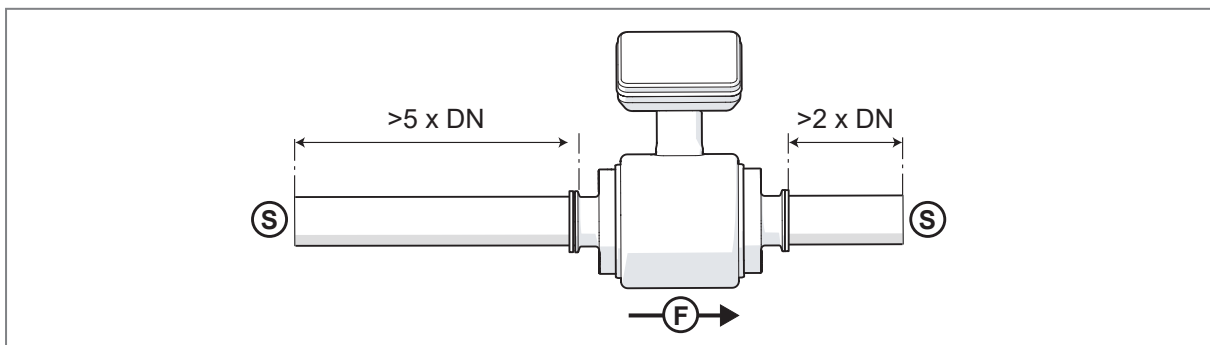


Fig. 5: Inlet and outlet pipe lengths

DN: Nominal width of the sensor

S: Interference

5.4 Process connection

Using process adapters the unit can be adapted to different process connections.

ifm offers hygienic process adapters and seals made of the materials FKM, EPDM and VMQ, which must be ordered separately as accessories.



Information about available accessories at documentation.ifm.com.



► Adhere to the installation instructions for use in hygienic areas.

ATTENTION

Sensitive sealing areas on the flange of the process adapters.

- The PFA material on the flange can be easily damaged after removing the protective caps, which can lead to leaks in the process connection.
- Carefully remove the protective caps.
- Avoid any impact on or scratching of the PFA sealing area.

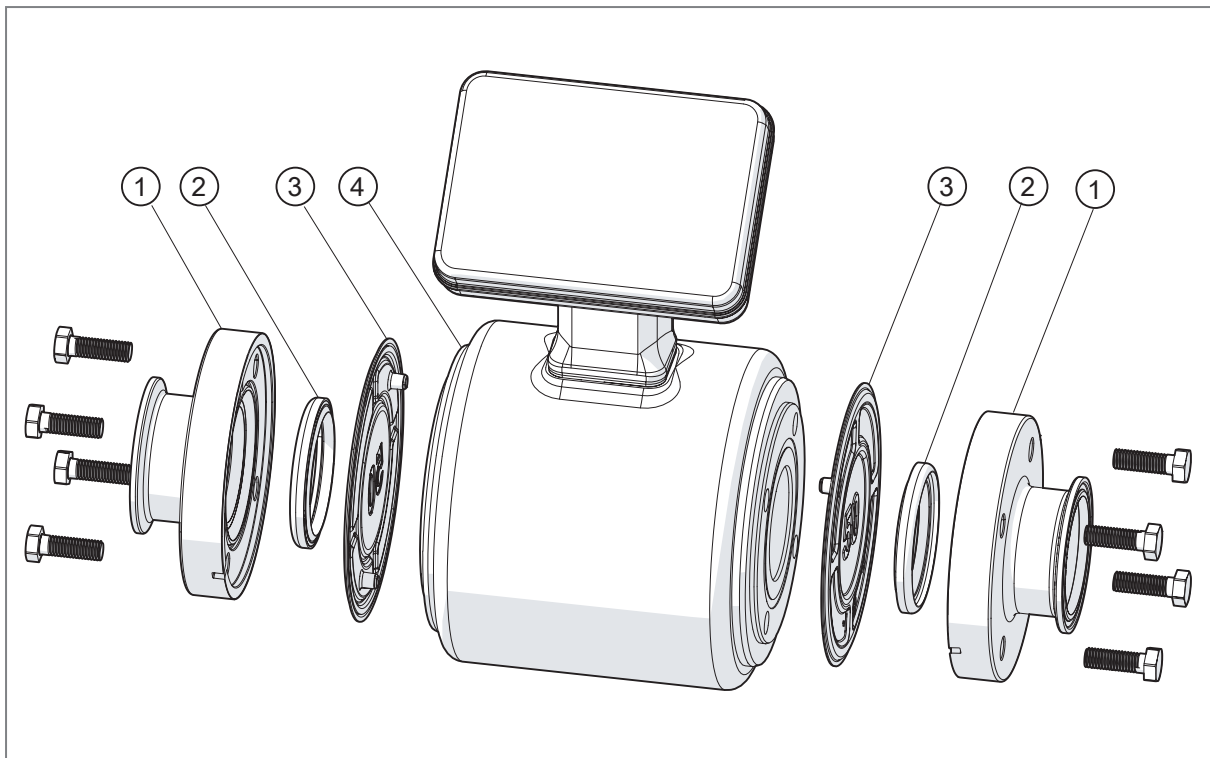


Fig. 6: Installation of the device in the process

- 1: Process adapters
- 2: Seal
- 3: Protective cap
- 4: Sensor

Procedure:



The sensor, the process adapters and the seals must be ordered separately.



Additional instructions for the respective process adapters are described in the following chapters.

► Remove the seal that fixes the protective caps to the sensor.



No replacement is possible after the product seal has been removed.

► Carefully remove the protective caps from the sensor.

► Insert the seals carefully into the grooves of the process adapters. Ensure that the seals are clean, undamaged and correctly centred.

► Fasten the process adapters to the device hand-tight using the enclosed screws.

► Tighten the screw heads evenly in three steps and observe the maximum tightening torque:

- Step 1 approx. 50% of the specified maximum tightening torque.
- Step 2: approx. 80% of the specified maximum tightening torque.
- Step 3: 100% of the specified maximum tightening torque.

Nominal width	Pressure rating	Screws	Maximum tightening torque
DN 40	PN 40	4 x M8x25	16 Nm
DN 50	PN 25	4 x M8x25	16 Nm
DN 65	PN 25	6 x M8x25	16 Nm
DN 80	PN 25	6 x M8x25	16 Nm

Nominal width	Pressure rating	Screws	Maximum tightening torque
DN 100	PN 25	6 x M8x25	16 Nm
DN 125	PN 10	6 x M10x35	32.5 Nm
DN 150	PN 10	6 x M10x35	32.5 Nm

Tab. 1: Maximum tightening torque

- Connect the device with the mounted process adapters to the pipe on both sides in the marked direction of flow.

5.4.1 Clamp adapters

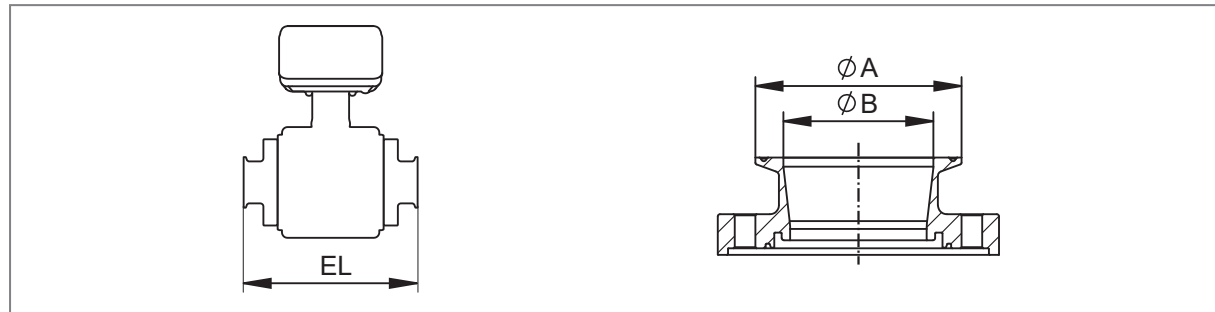


Fig. 7: Installation with clamp adapter

EL: Installation depth of sensor + adapter

Ø A: Outer diameter of the adapter

Ø B: Inner diameter of the adapter

ifm electronic offers clamp adapters in compliance with ISO 2852, DIN 32676-A (DIN) and DIN 32676-C (ASME BPE) for various pipe standards:

Type	Nominal width	ifm adapters available	Dimensions in mm (→ Figure above)			Applicable pipe standard		
			EL	Ø B	Ø A	ISO 2037	DIN EN 10357 series D	BS 4825 part 1
SMF3xx	DN40	✓	220	36	50.5	✓	✓	×
SMF4xx	DN50	✓	220	49	64	✓	✓	×
SMF5xx	DN65	✓	220	60	77.5	✓	✓	✓
SMF6xx	DN80	✓	220	73	91	✓	✓	×
SMF7xx	DN100	✓	220	98	119	✓	✓	✓
SMF8xx	DN125	✓	300	136	155	✓	✓	✓
SMF9xx	DN150	✓	300	163	183	✓	✓	✓

Tab. 2: Clamp ISO 2852

Type	Nominal width	ifm adapters available	Dimensions in mm (→ Figure above)			Applicable pipe standard			
			EL	Ø B	Ø A	DIN EN 10357 series A	DIN 11850 series 2	DIN 11866 series A	DIN 11850 series 1
SMF3xx	DN40	✓	220	38.1	50.5	✓	✓	✓	✓
SMF4xx	DN50	✓	220	50.1	64	✓	✓	✓	✓
SMF5xx	DN65	✓	220	66.1	91	✓	✓	✓	×
SMF6xx	DN80	✓	220	81.1	106	✓	✓	✓	×
SMF7xx	DN100	✓	220	100.1	119	✓	✓	✓	×
SMF8xx	DN125	✓	300	125	155	✓	✓	✓	×

Type	Nominal width	ifm adapters available	Dimensions in mm (→ Figure above)			Applicable pipe standard			
SMF9xx	DN150	✓	300	150	183	✓	✓	✓	×

Tab. 3: Clamp DIN 32676-A (DIN)

Type	Nominal width	ifm adapters available	Dimensions in mm (→ Figure above)			Applicable pipe standard			
		DIN 32676-C (ASME BPE)	EL	Ø B	Ø A	DIN EN 10357 series C	DIN 11850 series C	BS 4825 part 1	ISO 2037
SMF3xx	DN40	✓	220 mm	35	50.5	✓	✓	✓	✓
SMF4xx	DN50	✓	220 mm	48	64	✓	✓	✓	✓
SMF5xx	DN65	✓	220 mm	60	77.5	✓	✓	✓	×
SMF6xx	DN80	✓	220 mm	73	91	✓	✓	✓	×
SMF7xx	DN100	✓	220 mm	97	119	✓	✓	✓	×
SMF8xx	DN125	×							
SMF9xx	DN150	✓	300 mm	146.96	167	✓	✓	×	×

Tab. 4: Clamp DIN 32676-C

5.4.2 Welding adapter

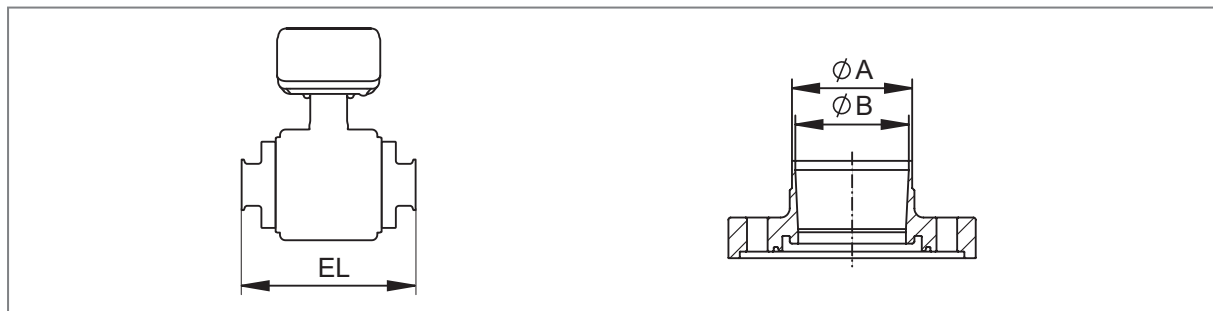


Fig. 8: Installation with welding adapter

EL: Installation depth of sensor + adapter

Ø A: Outer diameter of the adapter

Ø B: Inner diameter of the adapter

ifm electronic offers welding adapters in compliance with EN 10357 series A (DIN), C (ASME BPE) and D (SMS) for various pipe standards:

Type	Nominal width	ifm adapters available	Dimensions in mm (→ Figure above)			Applicable pipe standard			
		EN 10357 EN10357 series A (DIN)	EL	Ø A	Ø B	DIN EN 10357 series A	DIN 11850 series 2	DIN 11866 series A	DIN 11850 series 1
SMF3xx	DN40	✓	220	41	38	✓	✓	✓	✓
SMF4xx	DN50	✓	220	53	50	✓	✓	✓	✓
SMF5xx	DN65	✓	220	70	66	✓	✓	✓	×
SMF6xx	DN80	✓	220	85	81	✓	✓	✓	×
SMF7xx	DN100	✓	220	104	100	✓	✓	✓	×
SMF8xx	DN125	✓	300	129	125	✓	✓	✓	×
SMF9xx	DN150	✓	300	154	150	✓	✓	✓	×

Tab. 5: Welding adapter EN 10357 series A (DIN)

Type	Nominal width	ifm adapt-ers availa-ble	Dimensions in mm (→ Fig-ure above)			Applicable pipe standard				
		EN 10357 Series C (ASME BPE)	EL	Ø A	Ø B	DIN EN 10357 series C	DIN 11866 series C	BS 4825 part 1	ISO 2037	DIN EN 10357 series D
SMF3xx	DN40	✓	220	38	35	✓	✓	✓	✓	×
SMF4xx	DN50	✓	220	51	48	✓	✓	✓	×	×
SMF5xx	DN65	✓	220	64	60	✓	✓	✓	✓	✓
SMF6xx	DN80	✓	220	76	73	✓	✓	✓	✓	✓
SMF7xx	DN100	✓	220	102	97	✓	✓	✓	✓	✓
SMF8xx	DN125	×								
SMF9xx	DN150	✓	300	152	147	✓	✓	×	×	×

Tab. 6: Welding adapter EN 10357 series C (ASME BPE)

Type	Nominal width	ifm adapters available	Dimensions in mm (→ Figure above)			Applicable pipe standard		
		EN 10357 EN10357 series D (SMS)	EL	Ø A	Ø B	ISO 2037	DIN EN 10357 series D	BS 4825 part 1
SMF3xx	DN40	✓	220	38	36	✓	✓	×
SMF4xx	DN50	✓	220	51	49	✓	✓	×
SMF5xx	DN65	*						
SMF6xx	DN80	*						
SMF7xx	DN100	✓	220	102	98	✓	✓	✓
SMF8xx	DN125	×						
SMF9xx	DN150	×						

Tab. 7: Welding adapter EN 10357 series A (SMS)

* design identical to welding adapter EN 10357 series C

Procedure:**ATTENTION****Welding work**

- ▷ Destruction of the measuring electronics due to improper welding.
- ▶ The welding must only be carried out by qualified personnel according to the state of the art.
- ▶ Prepare the pipe ends carefully. The surfaces must be free from any contamination.
- ▶ The welding materials must be suitable for the adapter and pipe.
- ▶ The welds should be executed in such a way that the pipe and adapter do not warp during welding.
- ▶ Only install the device after the welding and subsequent cooling phase.
- ▶ Do not ground the welding system via the device.

- ▶ Carefully remove the protective caps from the sensor.
- ▶ Fasten the process adapters to the device hand-tight using the enclosed screws.
- ▶ Insert the device with the pre-mounted process adapters into the pipe and weld the adapters to the pipe with sufficient adhesive force using several welding spots.

- ▶ Disconnect the device from the process adapters by loosening the screws and carefully remove the device.
- ▶ Carefully replace the protective caps on the two sensor connections.
- ▶ Now weld the two process adapters firmly to the pipe.
- ▶ Ensure sufficient intervals between the individual welding operations to avoid glowing through or warping of the adapter due to overheating.
- ▶ Let the adapters and the pipe cool down.
- ▶ Clean welding residue from the adapters, pipe and weld seams.
- ▶ Carefully remove the protective caps from the sensor.
- ▶ Insert the seals carefully into the grooves of the process adapters. Ensure that the seals are clean, undamaged and correctly centred.
- ▶ Position the device in the marked flow direction between the two process adapters.
- ▶ Fasten the process adapters to the device hand-tight using the enclosed screws.
- ▶ Tighten the screw heads in three steps with the maximum tightening torque ([→ Process connection](#) [□ 15](#)).

5.4.3 Screw adapter

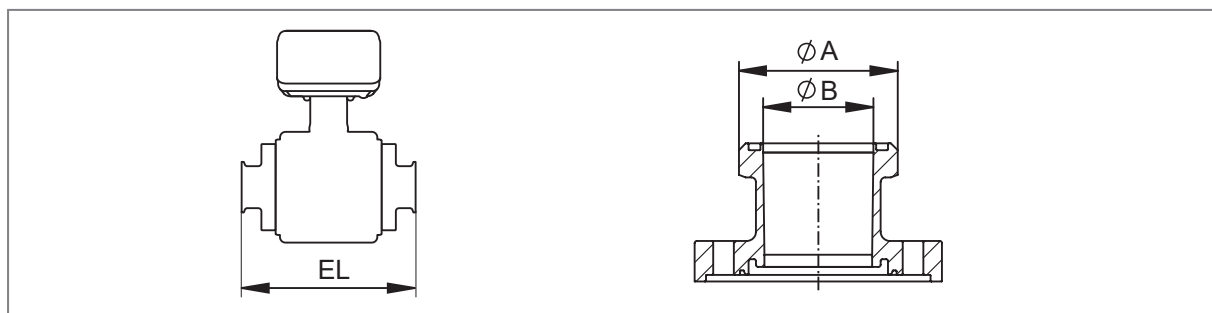


Fig. 9: Installation with screw adapter

EL: Installation depth of sensor + adapter

Ø A: Outer diameter of the adapter

Ø B: Inner diameter of the adapter

ifm electronic offers screw adapters in compliance with DIN 11851 (pipe fitting) and SMS 1145 for various pipe standards:

Type	Nominal width	ifm adapters available	Dimensions in mm (→ Figure above)			Applicable pipe standard			
			EL	Ø B	Ø A	DIN EN 10357 series A	DIN 11850 series 2	DIN 11866 series A	DIN 11850 series 1
SMF3xx	DN40	✓	260	38	Rd 65 x 1/6	✓	✓	✓	✓
SMF4xx	DN50	✓	260	50	Rd 78 x 1/6	✓	✓	✓	✓
SMF5xx	DN65	✓	270	66	Rd 95 x 1/6	✓	✓	✓	✗
SMF6xx	DN80	✓	280	81	Rd 110 x 1/4	✓	✓	✓	✗
SMF7xx	DN100	✓	290	100	Rd 130 x 1/4	✓	✓	✓	✗
SMF8xx	DN125	✓	380	125	Rd 160 x 1/4	✓	✓	✓	✗
SMF9xx	DN150	✓	390	150	Rd 190 x 1/4	✓	✓	✓	✗

Tab. 8: Screw connection DIN 11851 (pipe fitting)

Type	Nominal width	ifm adapters available	Dimensions in mm (→ Figure above)			Applicable pipe standard		
			EL	Ø B	Ø A	ISO 2037	DIN EN 10357 series D	BS 4825 part 1
SMF3xx	DN40	✓	256	35.6	Rd 60 x 1/6	✓	✓	×
SMF4xx	DN50	✓	256	48.6	Rd 70 x 1/6	✓	✓	×
SMF5xx	DN65	✓	266	60.3	Rd 85 x 1/6	✓	✓	✓
SMF6xx	DN80	✓	276	72.9	Rd 98 x 1/6	✓	✓	×
SMF7xx	DN100	✓	286	97.6	Rd 132 x 1/6	✓	✓	✓
SMF8xx	DN125	×						
SMF9xx	DN150	×						

Tab. 9: Screw connection SMS 1145

5.4.4 Flange adapter

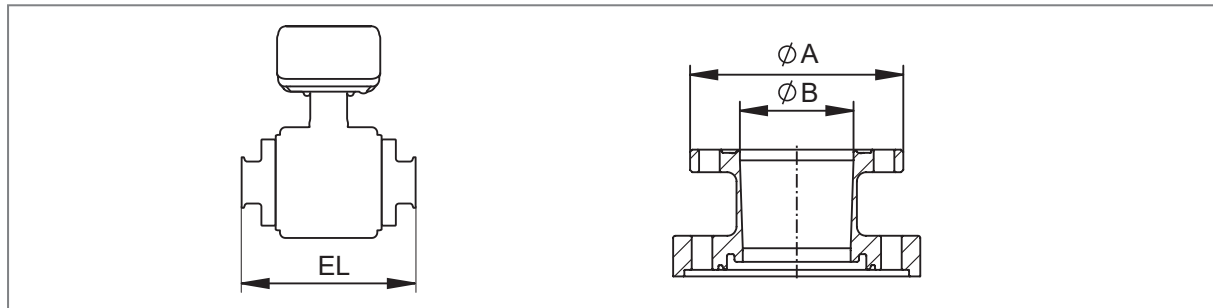


Fig. 10: Installation with flange adapter

EL: Installation depth of sensor + adapter

Ø A: Outer diameter of the adapter

Ø B: Inner diameter of the adapter

ifm electronic offers aseptic flange adapters in compliance with DIN 11864-2A:

Type	Nominal width	ifm adapters available	Dimensions in mm (→ Figure above)			Applicable pipe standard			
			EL	Ø B	Ø A	DIN EN 10357 series A	DIN 11850 series 2	DIN 11866 series A	DIN 11850 series 1
SMF3xx	DN40	✓	246	38	82	✓	✓	✓	✓
SMF4xx	DN50	✓	246	50	94	✓	✓	✓	✓
SMF5xx	DN65	✓	246	66	113	✓	✓	✓	×
SMF6xx	DN80	✓	270	81	133	✓	✓	✓	×
SMF7xx	DN100	✓	278	100	159	✓	✓	✓	×
SMF8xx	DN125	✓	362	125	183	✓	✓	✓	×
SMF9xx	DN150	✓	362	150	213	✓	✓	✓	×

Tab. 10: Aseptic flange adapter DIN 11864-2A

5.5 Use in hygienic areas



The sensor is suited for CIP (cleaning in process) and SIP (sterilisation in place) when installed correctly.

- Observe the application limits (temperature and material resistance) according to the data sheet.

- ▶ Install the device so that there is a minimum gradient in the measuring channel and no medium remains in the pipe after switching off the pump.
- ▶ Use self-draining installation.
- ▶ Align the leakage ports of the process adapters so that they are clearly visible and point downwards.

5.6 Use in hygienic areas according to 3-A

- ▶ Ensure that the installation of the device in the system complies with 3-A guidelines.
- ▶ Use only process adapters and seals with 3-A certification and marked with the 3-A symbol (→ Accessories at www.ifm.com).



- ▶ For use according to 3-A, take note of the corresponding regulations for cleaning and maintenance.

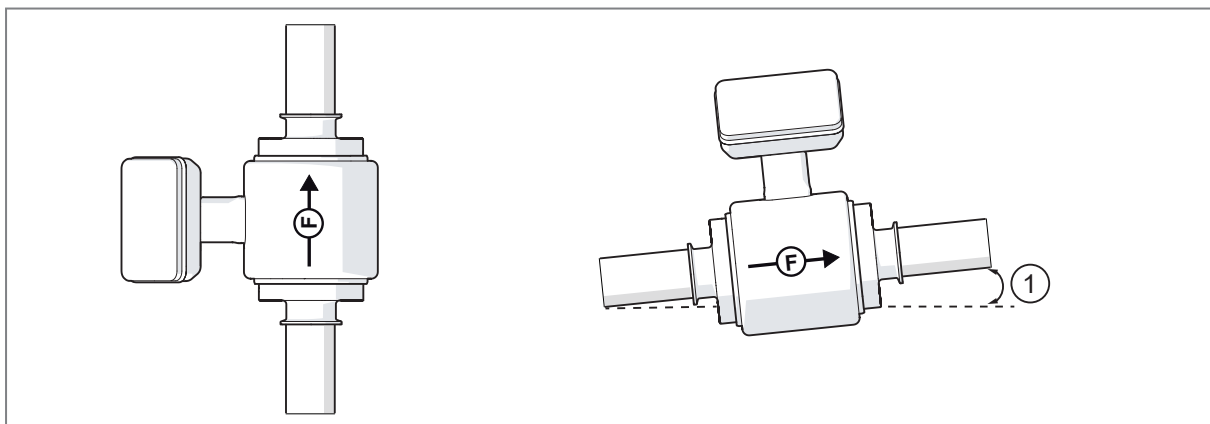


Fig. 11: Process connection according to 3-A

1: Minimum gradient

- ▶ To allow the medium to flow out of the process adapter, mount the device in the following installation position:

- Vertical installation in a rising pipe (→ Installation position □ 11).

- or -

- Horizontal position with a slight gradient so that the medium does not come to a standstill:

DN	DIN32676-A	DIN32676-C	ISO 2852	EN10357-A	EN10357-C	EN10357-D	DIN11864-2A	DIN11851	SMS 1145
DN 40	6°	3°	4°	6°	3°	4°	6°	6°	4°
DN 50	6°	3°	4°	6°	3°	4°	6°	6°	4°
DN 65	10°	3°	3°	10°	3°	×	7°	7°	3°
DN 80	13°	3°	3°	13°	3°	×	8°	8°	3°
DN 100	6°	3°	3°	6°	3°	3°	6°	6°	3°
DN 125	7°	×	16°	7°	×	×	5°	5°	×
DN 150	5°	3°	16°	5°	3°	×	4°	4°	×

Tab. 11: Minimum gradient for drainage capacity

* Installation in rising pipe recommended; × Adapter not available

- ▶ Regularly check the seals between the device and the process adapter for deposits and damage.
- ▶ In case of soiling, clean the seals with a suitable cleaning liquid (e.g. alcoholic solution).
- ▶ Replace the seals if necessary.



The frequency of the seal replacement depends on the frequency of the cleaning cycles, the media temperature and the cleaning temperature.

- Define regular cleaning cycles according to the process requirements.

6 Electrical connection

The device has two M12 connectors:

1. The operating connector is for the operation of the device.
 2. The service connector must only be used by ifm staff when the device is being serviced.
- Cover the connectors with protective caps when they are not in use. Protective caps can be ordered individually from documentation.ifm.com.

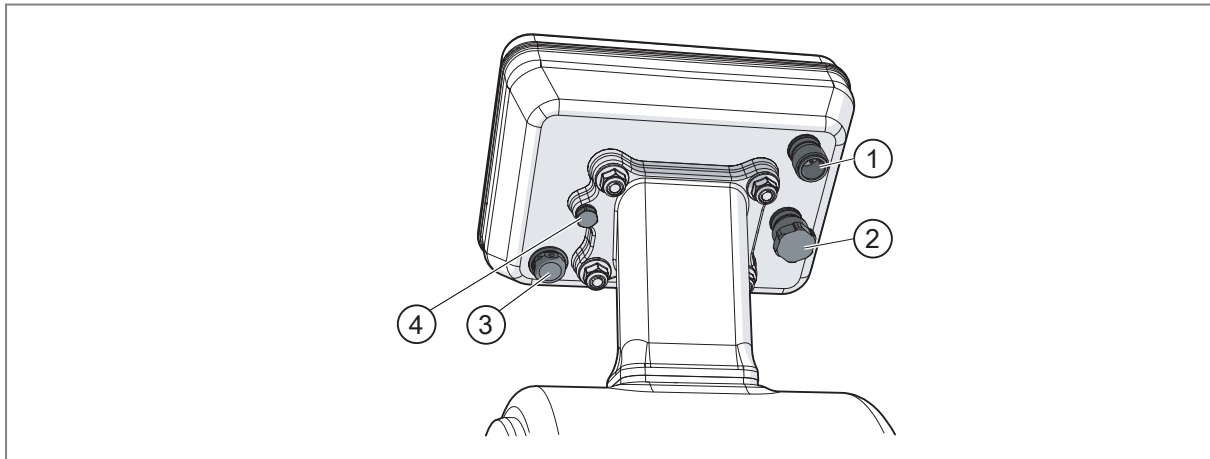


Fig. 12: Connectors

- 1: Operating connectors (see wiring diagram)
- 2: Service connector (only for service personnel; on delivery: with protective cap)
- 3: Ventilation diaphragm (ensures reliable pressure compensation in the housing to prevent moisture build-up inside the housing. The ventilation diaphragm is protected against damage by a screwed filter cover with circumferential ports.)
- 4: Ground connection. Grounding clamps for M12 connectors can be ordered at www.ifm.com.



The unit must be connected by a qualified electrician.

Observe the national and international regulations for the installation of electrical equipment.

Voltage supply according to SELV, PELV.

The input and output circuits are insulated from each other and from device surfaces that could be touched with basic insulation according to IEC 61010-1 (secondary circuit with max. 32 V DC, supplied from the mains circuit up to 300 V of overvoltage category II).

The external wiring has to be carried out in a way that ensures the required separation from other circuits.

- Disconnect power.
- Connect the unit as follows:

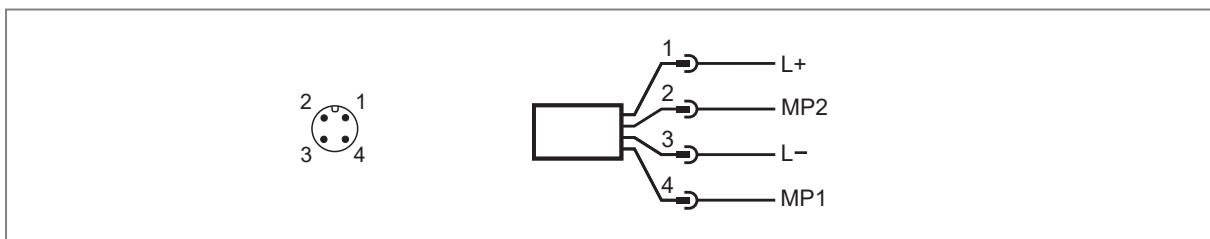
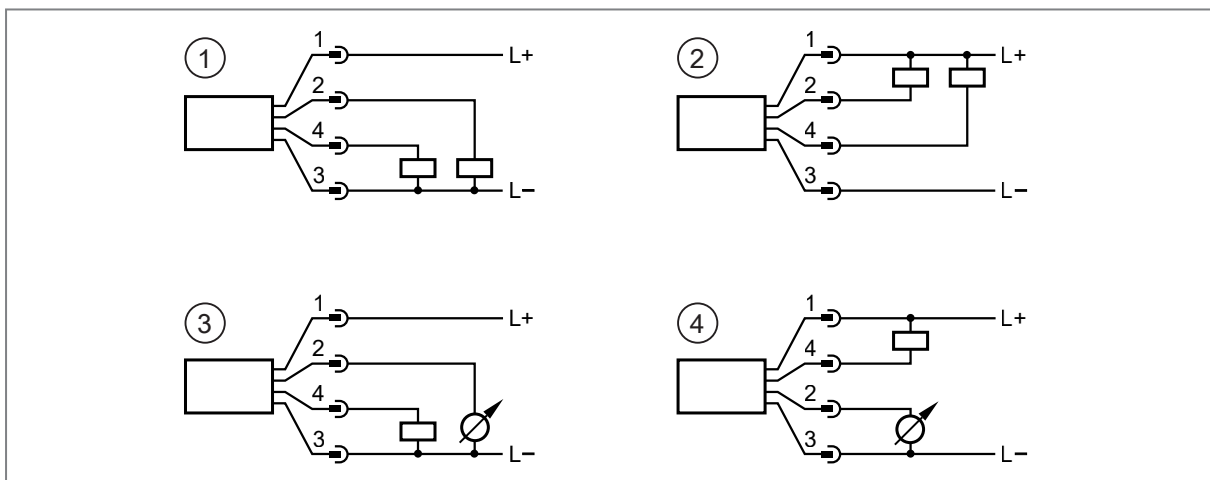


Fig. 13: Wiring diagram; MP: multifunction (IN, OUT, Data)

Pin	Assignment
1	L+
3	L-

Pin	Assignment
4 (MP1)	- Pulse signal totaliser - Switching signal totaliser - Switching signal diagnosis - IO-Link - OFF (output switched to high impedance)
2 (MP2)	- Pulse signal totaliser - Switching signal totaliser - Analogue signal flow - Analogue signal temperature - Analogue signal for conductivity - Switching signal diagnosis - Input for external totaliser reset - OFF (output switched to high impedance)

Circuit examples:



- 1: 2 x positive switching
 2: 2 x negative switching
 3: 1 x positive switching / 1 x analogue
 4: 1 x negative switching / 1 x analogue

7 Operating and display elements

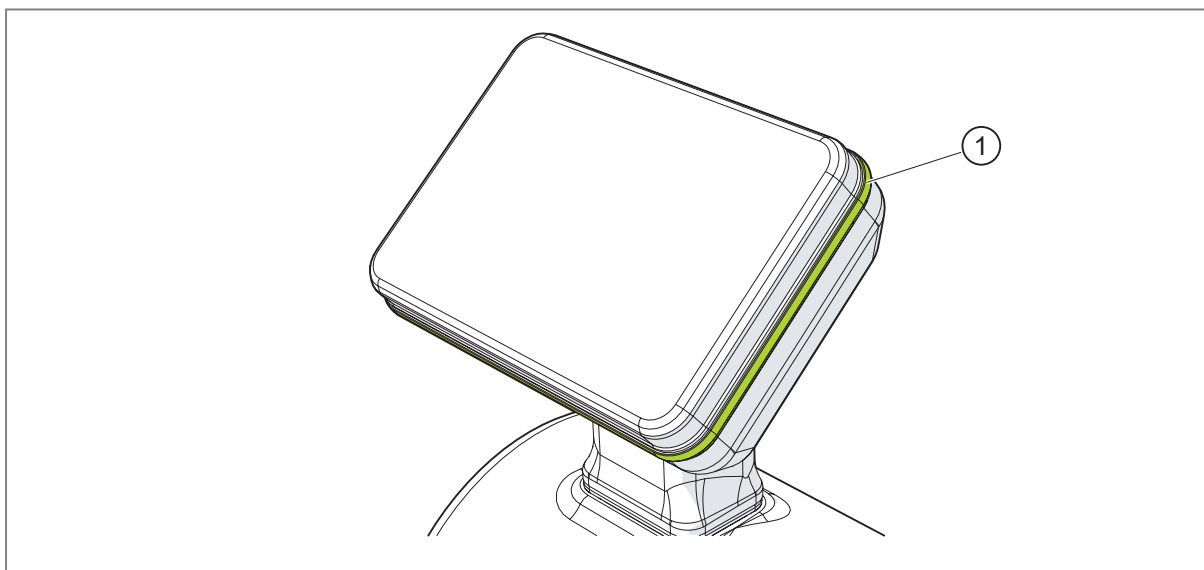


Fig. 14: Display elements

1: Operating status LED (LED ring): Changes colour to signal the status of the device (→ [Operating status LED](#)  42).

8 Set-up

After power on and expiry of the power-on delay time, the unit is in the normal operating mode. It carries out its measurement and evaluation functions and generates output signals according to the set parameters.

During the power-on delay time, the outputs are in the following status according to the set parameters:

- ON for diagnostic function (dOU)
- ON for detection of direction (F.Dir)
- OFF for consumed quantity monitoring (ImP)
- 20 mA for current output (I)



When an IO-Link master is connected, the device automatically goes from SIO mode (standard input-output) into IO-Link mode if the port of the master is set to IO-Link mode.

9 Parameter setting

Parameters can be set before installation or during operation.



If you change parameters during operation, this will influence the function of the plant.

- ▶ Ensure that there will be no malfunctions in your plant.

During parameter setting the unit remains in the operating mode. It continues to monitor with the existing parameter until the parameter setting has been completed.

The device parameters can be set via the IO-Link interface in the following ways, for example:

- Parameter setting via a suitable parameter setting software, e.g. ifm moneo|configure
- Parameter setting via a PLC
- Parameter setting via an IIoT application

Requirements for parameter setting via the IO-Link interface:

- ✓ The Input Output Device Description (IODD) for the device in case of parameter setting via a parameter setting software, see documentation.ifm.com
- ✓ The IO-Link interface description (PDF) for the device in case of parameter setting via a PLC or IIoT application, see documentation.ifm.com
- ✓ An IO-Link master
 - ▶ Connect the IO-Link master to the parameter setting software, the PLC or the IIoT application.
 - ▶ Connect the device to a suitable free port of the IO-Link master.
 - ▶ Set the port of the IO-Link master to the IO-Link operating mode.
 - ▷ The device changes to the IO-Link mode.
 - ▶ Change the parameter settings in the software.
 - ▶ Write the parameter settings to the device.



Support for system integration and parameter setting via IO-Link:

- Manual of the parameter setting software (e.g. moneo)
- Explanations and startup packages at ifm.com/cnt/io-link-system-integration.

9.1 Output configuration

9.1.1 Analogue signal

The device provides an analogue signal proportional to the process value.

Within the measuring range the analogue signal is between 4...20 mA.

The measuring range can be scaled between -100% and 100% of the final value of the measuring range.



A negative flow value means flow against the flow direction set under Fdir (→ [Flow direction](#) □ 36).

- [ASP2] determines at which measured value the output signal is 4 mA.
- [AEP2] determines at which measured value the output signal is 20 mA.



Minimum distance between [ASP2] and [AEP2] = 20 % of the final value of the measuring range.

If the measured value is outside the measuring range or in the event of an internal error, the current signal indicated in the following figure is provided.



The analogue signal in case of a fault can be set via the parameter FOU (→ [Error behaviour of the analogue output](#) 35).

The analogue signal can be stabilised by setting the damping time dAP (→ [Damping](#) 36).

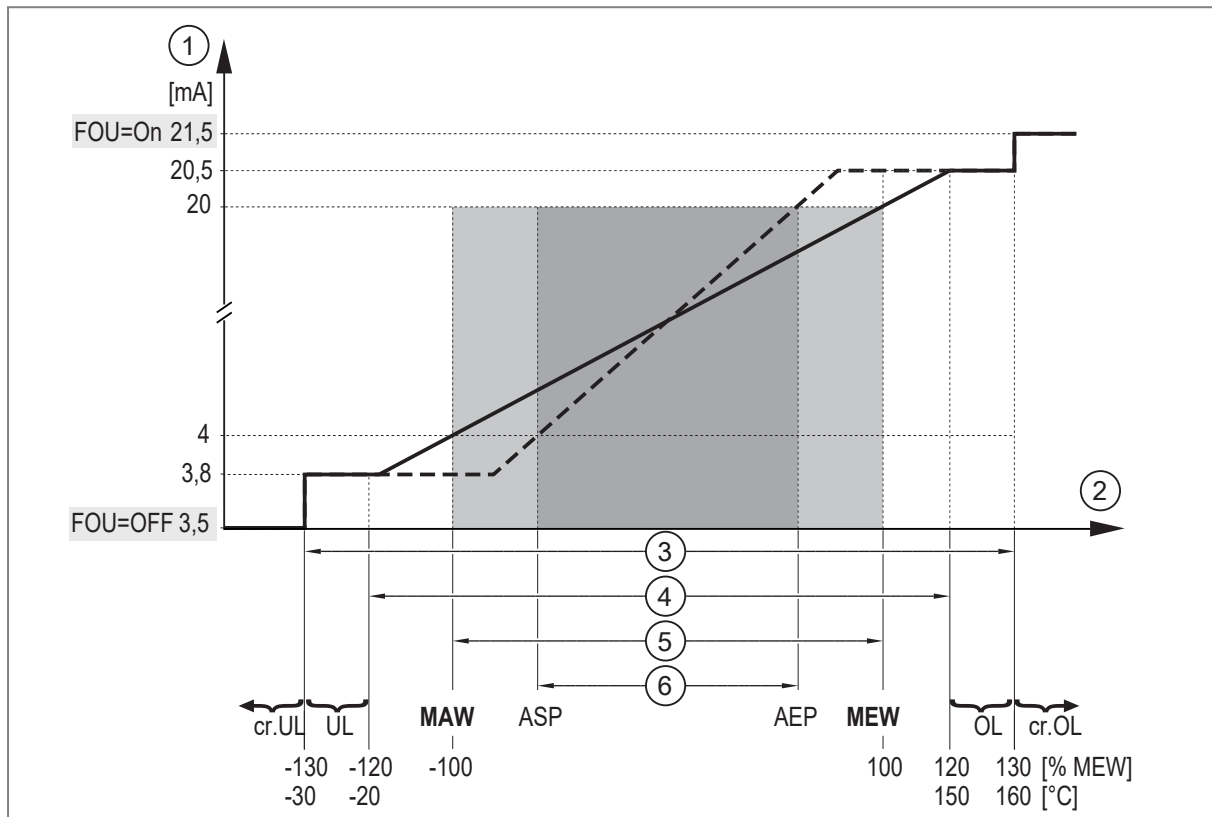


Fig. 15: Characteristics of the analogue output according to the standard IEC 60947-5-7

1: Analogue signal	MAW: Initial value of the measuring range
2: Measured value	MEW: Final value of the measuring range
3: Detection range	ASP: Analogue start point
4: Display range	AEP: Analogue end point
5: Measuring range	UL: Below the display range
6: Scaled measuring range	cr.UL: Below the detection range
	OL: Above the display range
	cr.OL: Above the detection range

Parameters to be set:

- $[ou2] = [I / 4 \dots 20 \text{ mA}]$
- Analogue start point [ASP2]
- Analogue end point [AEP2]

9.1.2 Switching signal diagnostics

The device features an integrated diagnostic function. When the diagnostic function is used, a switching signal is provided via the hardware output.

The switching output is switched on in normal operation (normally closed). If the device detects a diagnostic case, the output will be switched off.

Diagnostic cases include:

- reversal of the flow direction (→ [Switching signal for flow direction](#) 29)
- no medium detected (→ [Switching signal for fluid detection](#) 29)

9.1.2.1 Switching signal for flow direction

A flow direction change can be monitored by providing a switching signal.

An arrow with the text “flow direction” on the device indicates the positive flow direction. The direction of the flow measurement can be reversed using the parameter [Fdir].

See [Flow direction](#) (→ [36](#)).

Switching signal with setting [Fdir] = [+]:

- The output switches ON when a flow greater than +LFC is measured (1).
- The output switches OFF as soon as a flow standstill ($Q = 0$) or a negative flow is measured (2).
- The output switches ON again as soon as the flow is greater than +LFC (3) again.

Switching signal with setting [Fdir] = [-]:

- The output switches ON when a flow less than -LFC is measured (1).
- The output switches OFF as soon as a flow greater than 0 is measured (2).
- The output switches ON again as soon as the flow is less than -LFC (3) again.

 [LFC] = low flow cut-off: [Low flow cut-off](#) (→ [36](#)).

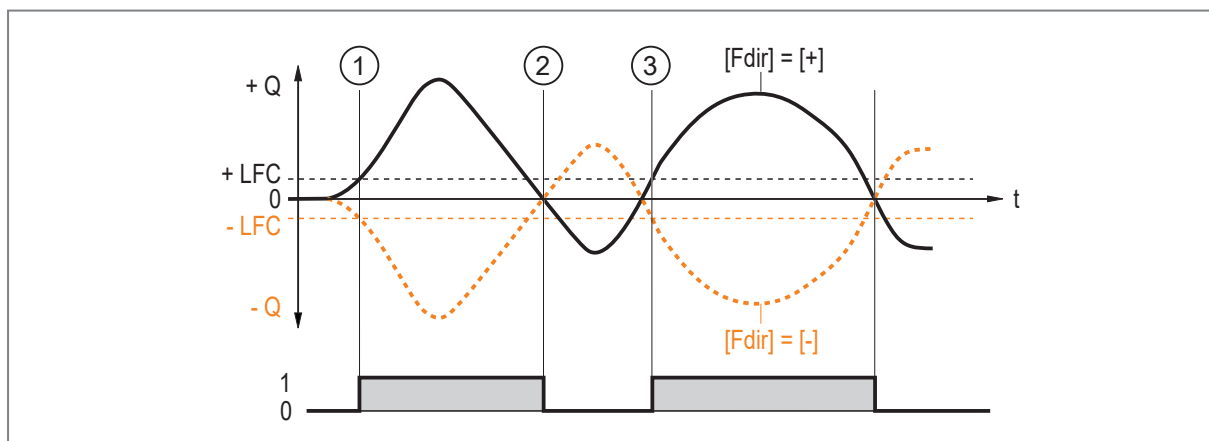


Fig. 16: Monitoring of the flow direction by switching signals

+Q	Volumetric flow in positive flow direction
-Q	Volumetric flow in negative flow direction
+LFC	Minimum volumetric flow (low flow cut-off) in positive flow direction
-LFC	Minimum volumetric flow (low flow cut-off) in negative flow direction

Parameters to be set:

- [oux] = [dOU]
- Select diagnostic function: [Flow Direction] (dir.F)

9.1.2.2 Switching signal for fluid detection

The device can provide a switching signal when it cannot detect a medium in the pipe.

The device uses this diagnostic function to identify whether the temperature electrode is wetted by fluid. If this is not the case, the device interprets this as an empty pipe and provides a switching signal. The flow process value is set to zero.

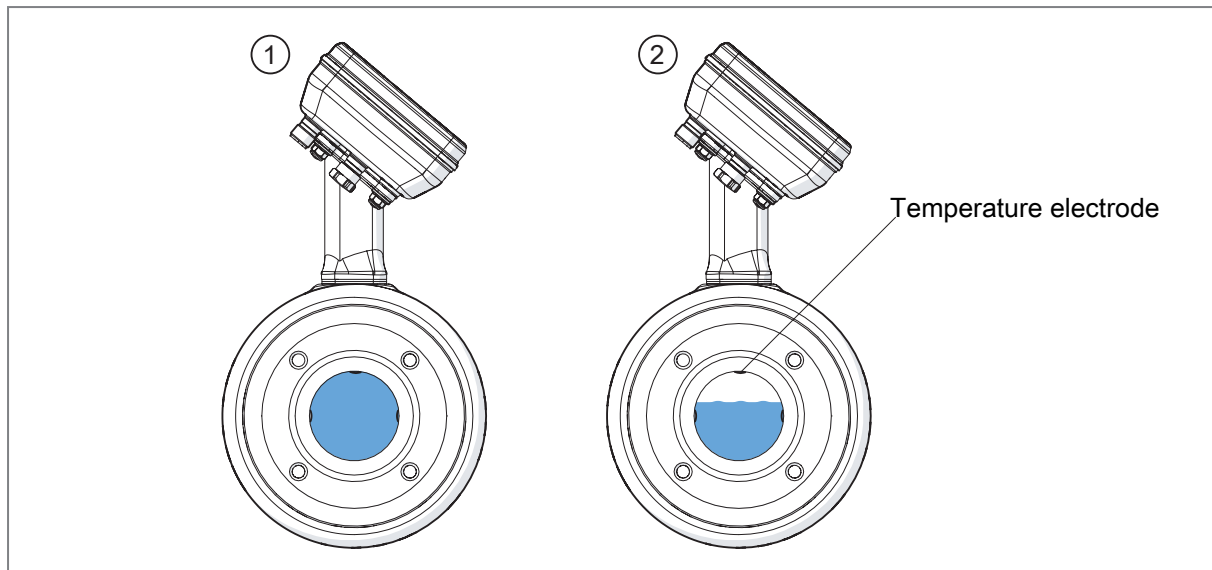


Fig. 17: Fluid detection

- 1: Medium detected
- 2: Medium not detected

Parameters to be set:

- [oux] = [dOU]
- Select diagnostic function: [Fluid Detection] (FD)
- To start: [Fluid Detection] = [On]

9.1.3 Consumed quantity monitoring (totaliser function)

The device has 3 internal quantity meters (totalisers VTOTL1, VTOTL2 and Vol.L). The totalisers continuously sum up the consumed quantity and provide this process value via the IO-Link interface.

Totaliser	Process value	Read access via IO-Link
VTOTL1	Consumed quantity 1 (This value is used for consumed quantity monitoring by switching or pulse signals)	Cyclic
VTOTL2	Consumed quantity 2	Acyclic
Vol.L	Consumed quantity over the whole lifetime (lifetime totaliser)	Acyclic

- The totalisers VTOTL1 and VTOTL2 can be reset. Totaliser Vol.L cannot be reset.
- The totalisers take account of the flow direction when totalling the consumed quantity.
- [Counting method of the totalisers \(→ 39\)](#)
- When the detection range (cr.OL) is exceeded, the totalisers use the last valid flow rate value (measuring range end value) and continue counting with this value.
- In addition to the current consumed quantity, the value before the last reset is saved. This value and the time since the last reset can also be displayed.



The totaliser saves the totalled consumed quantity at regular intervals. After a power failure this value is available as the current meter reading. If a time-controlled reset is set, the elapsed time of the set reset interval is also saved. This means that the possible data loss can amount to one minute.

- The accuracy of the consumed quantity measurement depends on the accuracy of the flow measurement.
- A switching signal or pulse signals can be provided for consumed quantity monitoring:

→ [Switching signal totaliser \(→ 31\)](#).

→ [Pulse signal totaliser \(→ 31\)](#).

9.1.3.1 Switching signal totaliser

A switching signal can be provided for consumed quantity monitoring.

When the VTOTL1 totaliser has totalled the volumetric flow quantity set under [ImPS], the output provides a switching signal. The output remains switched until a totaliser reset is carried out.

The flow rate depends on the counting method of the totalisers: Depending on the setting of the [FPro] parameter, the direction of flow is taken into account in different ways when totalling the flow rate.

→ [Counting method of the totalisers \(→ 39\)](#)

The totaliser reset for the totalisers VTOTL1 and VTOTL2 can be set via the parameter [Reset Totaliser1] or [Reset Totaliser 2]. When the totaliser has been reset, metering starts again.

- [Reset Totaliser x] = OFF:
Automatic reset of totaliser switched off.
A reset is done manually or in case of overflow of the display (>999.99 m³).
- [Reset Totaliser x] = ...h/d/w (hours/days/weeks):
Automatic reset of the totaliser after the set time.
 - If totaliser VTOTL1 reaches the flow quantity [ImPSx] before the set time, no automatic reset occurs. The output remains switched until totaliser VTOTL1 is reset manually or via overflow.
 - Totaliser VTOTL2 is independent of the settings of [ImPSx]. Its count is not taken into account for the switching and pulse signals.



The totalisers can be reset manually at any time via the [Reset Totaliser x] parameter. Totaliser VTOTL1 can additionally be reset via an external signal at pin 2.

→ [Totaliser reset \(→ 39\)](#).

Parameters to be set:

- [oux] = [ImP]
- Pulse value [ImPSx]
- Activate pulse repetition: [Pulse repetition OUTx] (ImPRx) = [no]

9.1.3.2 Pulse signal totaliser

Pulse signals can be provided for consumed quantity monitoring.



Pulse signals are not available via the IO-Link interface.

Every time the consumed quantity (pulse value) set under [ImPS] has been reached, the output provides a pulse signal.

The flow rate depends on the counting method of the totalisers: Depending on the setting of the [FPro] parameter, the direction of flow is taken into account in different ways when totalling the flow rate.

→ [Counting method of the totalisers \(→ 39\)](#).

The pulse signal consists of a short switching on and off of the output.

The pulse width depends on the pulse value and the flow speed: The lower the pulse value and the higher the flow speed, the greater the pulse width. This applies up to a pulse width of 2 s. Beyond this, it remains at 2 s.

DN	Minimum pulse value [ImPS1]
40	2 ml
50	2 ml

DN	Minimum pulse value [ImPS1]
65	4 ml
80	5 ml
100	9 ml
125	13 ml
150	38 ml

Tab. 12: Lower setting range for [ImPS1] by device

Parameters to be set:

- [oux] = [ImP]
- Pulse value [ImPSx]
- Activate pulse repetition: [Pulse repetition OUTx] (ImPRx) = [YES]

9.1.4 Digital switching signal

The device provides digital switching signals via switching signal channels (SSC = Switching Signal Channel).

The device has 2 digital switching signal channels SSCx.1 and SSCx.2 for each process value:

- SSC1.1 and SSC1.2 = switching signal channels for consumed quantity (totaliser)
- SSC2.1 and SSC2.2 = switching signal channels for flow
- SSC3.1 and SSC3.2 = switching signal channels for temperature
- SSC4.1 and SSC4.2 = switching signal channels for conductivity



Explanation of the numbering of the switching signal channels SSCx.y:
x = process value; y = switching signal channel

The switching signal channels can only be evaluated via the IO-Link interface.

The parameters for each switching signal channel can be set individually.

The switch point mode, switch points and the switch point logic are set when the switching signal channel parameters are set.

Switch point mode

You can choose between the following switch point modes according to the IO-Link smart sensor profile – Function Class “Object Detection”:

- [Deactivated]
- [Single Point Mode]
- [Two Point Mode]
- [Window Mode]

The switching signal channel changes to the active state depending on the process data value (PDV).

The active state is above the switch point in [Single Point Mode] and [Two Point Mode] and within the window section in [Window Mode].

Switch point logic

By setting the switch point logic [High active] or [Low active], you can specify which value the switching signal channel has in the active state:

- [High active]: The switching signal channel is “high” in the active state (= ON = normally open = 1)
- [Low active]: The switching signal channel is “low” in the active state (= OFF = normally closed = 0)

The following figures show the status of the switching signal channels depending on the switch point mode, switch point logic and process data value (PDV).

Deactivated

If the [Deactivated] switch point mode is set for a switching signal channel, then the switching signal channel will permanently have the following value regardless of the process value:

- For switch point logic [High active]: permanently “low”.
- For switch point logic [Low active]: permanently “high”.

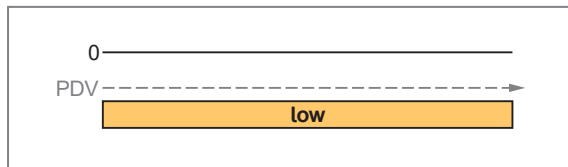


Fig. 18: [Deactivated] / [High active]

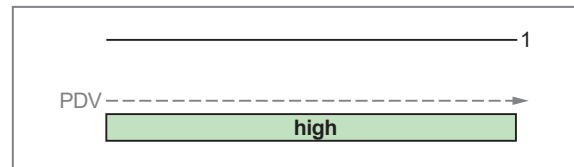


Fig. 19: [Deactivated] / [Low active]

Single Point Mode

Only one switch point (SP1) is manually set or taught.

The reset point (SP1-H) results from the switch point and the set hysteresis.

When teaching, the switch point is set below the taught process value (TP1) by the hysteresis.

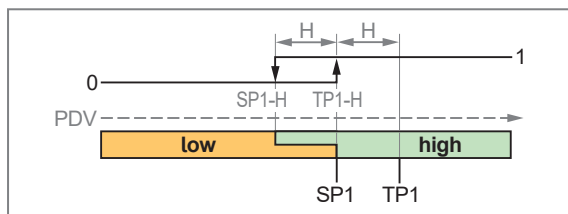


Fig. 20: [Single Point Mode] / [High active]

H: Hysteresis
 SP1: Switch point
 TP1: Teach point
 TP1-H: Switch point during teach (= SP1)
 SP1-H: Reset point

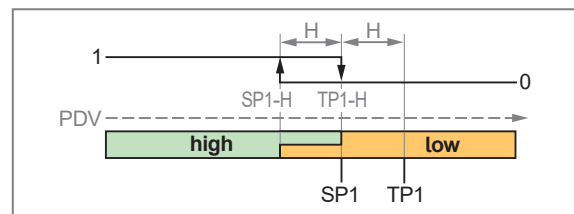


Fig. 21: [Single Point Mode] / [Low active]

H: Hysteresis
 SP1: Switch point
 TP1: Teach point
 TP1-H: Switch point during teach (= SP1)
 SP1-H: Reset point

Two Point Mode

One switch point SP1 and one switch point SP2 are manually set or taught.

The position of the switch points is freely selectable: SP1 can be below or above SP2. The lower switch point is the reset point. In the example shown, SP1 is the switch point and SP2 is the reset point.

When teaching, the switch point is set directly to the taught process value. The following applies: [Teach SP1] sets SP1, [Teach SP2] sets SP2.

The hysteresis will be ignored in Two Point Mode.

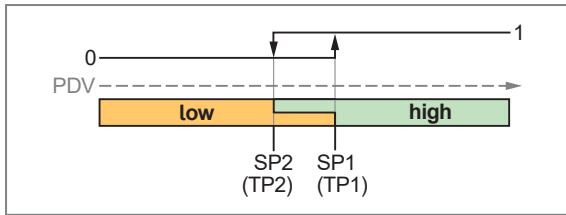


Fig. 22: [Two Point Mode] / [High active]

SP1: Switch point 1
 SP2: Switch point 2
 TP1: Teach point 1 (= SP1)
 TP2: Teach point 2 (= SP2)

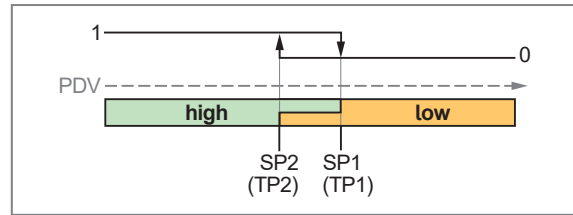


Fig. 23: [Two Point Mode] / [Low active]

SP1: Switch point 1
 SP2: Switch point 2
 TP1: Teach point 1 (= SP1)
 TP2: Teach point 2 (= SP2)

Window mode

Two switch points (SP1) and (SP2) are manually set or taught.

The two switch points define a window area.

The position of the switch points is freely selectable: SP1 can be below or above SP2. The lower switch point is the lower limit value, the higher switch point is the upper limit value of the window area.

When teaching, the switch point is set directly to the taught process value. The following applies: [Teach SP1] sets SP1, [Teach SP2] sets SP2.

When the process data value enters the window area, the status of the switching signal channel changes immediately when the switch points are exceeded/not reached.

If the process data value leaves the window area, the status of the switching signal channel changes when the switch point plus hysteresis (SP1+H or SP2-H) is exceeded/not reached.

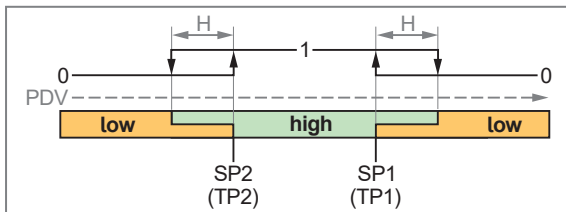


Fig. 24: [Window Mode] / [High active]

H: Hysteresis
 SP1: Switch point 1
 SP2: Switch point 2
 TP1: Teach point 1 (= SP1)
 TP2: Teach point 2 (= SP2)

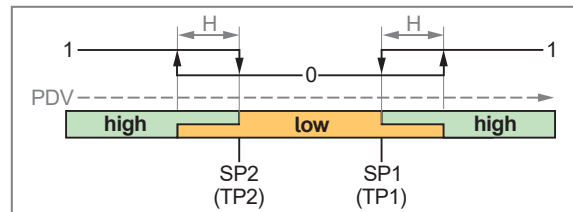


Fig. 25: [Window Mode] / [Low active]

H: Hysteresis
 SP1: Switch point 1
 SP2: Switch point 2
 TP1: Teach point 1 (= SP1)
 TP2: Teach point 2 (= SP2)

Parameters to be set:

- Switch point mode [SSCx.y Config.Mode]
- Switch points [SSCx.y Param.SPx]
- Hysteresis [SSCx.y Config.Hyst]
- Switch-point logic [SSCx.y Config.Logic]
- Switch-on delay [SSCx.y Switching delay]
- Switch-off delay [SSCx.y Reset delay]

9.1.5 Output off

- The physical hardware outputs OUT1 and OUT2 can be switched off via the parameter [oux] = [OFF]. The corresponding output becomes highly resistive so that no signal can be output. The state of the switching channels SSCx.y is still transmitted if the IO-Link connection is active.

- The switching channels can be deactivated individually via the parameter [SSCx.y Konfig.Modus] = [Deactivated]. The switching status of the corresponding switching channel is then permanently in the disabled state: With [High active] setting permanently “low”, with [Low active] setting permanently “high”.

9.2 Application configuration

The chapter describes the setting options for adaptation to your specific application.

9.2.1 Standard unit of measurement

A unit of measurement can be set for each process value, on which further parameter settings are based (e.g. switching points, cOF, LFC).

Selectable values:

- [uni.F] for flow:
 - SMFxx0: m/s, l/min, l/h, hl/h, hl/min, m³/h, m³/min
 - SMFxx1: m/s, l/min, l/h, hl/h, hl/min, m³/h, m³/min, ft/s, gpm, gph
- [uni.T] for temperature:
 - SMFxx0: °C
 - SMFxx1: °C or °F
- [uni.C] for conductivity:
 - SMFxx0: mS/cm, µS/cm, S/m
 - SMFxx1: mS/cm, µS/cm, S/m

► Select the unit of measurement before configuring further parameters for OUTx.

9.2.2 Process value for OUT2

For output OUT2, you can select which process value is to be output.



No selection is possible for the OUT1 output. OUT1 is only for monitoring flow.

Selectable values:

- [FLOW]: Flow
- [TEMP]: Temperature
- [COND]: conductivity

► Select the process value before configuring further parameters for OUT2.

9.2.3 Error behaviour of the analogue output

The behaviour of the analogue output OUT2 in the event of an error can be set via the parameter [FOU2]. The following signals are output in the event of an error:

[FOU2]	[SEL2]	Output signal	Explanation
ON	FLOW TEMP COND	In case of an error the output goes to 21.5 mA.	As soon as a defective process value is present, the device sets all process values to invalid.
OFF	FLOW TEMP COND	In case of an error the output goes to 3.5 mA.	

[FOU2]	[SEL2]	Output signal	Explanation
OU	FLOW	In case of an error the output goes to 3.5 mA.	If the process value "Flow" is defective, the device continues to provide the other process values.
	TEMP	In case of an error the output goes to 21.5 mA.	If the process value "Temperature" is defective, the device continues to provide the other process values.
	COND	In case of an error the output goes to 3.5 mA.	If the process value "Conductivity" is defective, the device continues to provide the other process values.



The parameter [FOU] has no influence on the pulse signal, the diagnostic switching signal and the IO-Link process data transmission.

9.2.4 Damping

The set damping constant stabilises the output signals. Abrupt changes in the physical process values are smoothed out.

This concerns the switching outputs and the process value transmission via the IO-Link interface.

The damping constant [dAP] is used to set after how many seconds the output signal reaches 63 % of the final value if the measured value changes suddenly.

The damping constant is added to the response time of the sensor (→ Technical data).

The UL and OL signals are defined under consideration of the damping time.



Measured value damping only has an effect on the process value flow.

Setting range:

0...5 s

9.2.5 Low flow cut-off

Low flow quantities can be ignored using the parameter [LFC] (Low flow cut-off). Flow below the LFC value is evaluated by the sensor as standstill ($Q = 0$).

The LFC value influences:

- the digital switching signal for flow
- the analogue signal for flow
- the consumed quantity monitoring (switching or pulse signal for flow)
- the memory values for minimum and maximum flow



The accuracy indicated in the data sheet applies to the factory-set LFC value. If a lower LFC value is set, the accuracy of the sensor will decrease.

9.2.6 Output polarity

The output polarity is set via the parameter [P-n].

The setting affects both switching outputs.

- [PnP]: The switching output is positive switching.
- [nPn]: The switching output is negative switching.

9.2.7 Flow direction

The positive flow direction can be defined by the user. This setting affects the following functions:

→ Consumed quantity monitoring (totaliser function) (→ 30)

→ [Switching signal for flow direction \(→ 29\)](#)

An arrow with the text “flow direction” on the device indicates the positive flow direction (factory setting). The direction of the flow rate measurement can be reversed using the parameter [Flow direction]:

[Fdir]	Flow direction
+	Flow direction in case of factory setting
-	Flow direction contrary to the factory setting

9.2.8 Zero calibration

The combination of electronic unit (converter) and measuring circuit can lead to measurement inaccuracies, particularly depending on the respective ambient conditions.

If there is a systematic deviation between the measured value and the actual process value, this measurement inaccuracy can be corrected using the correction factor [coF.x].

- [coF.F] = correction factor for measuring flow
- [coF.C] = correction factor for measuring conductivity

The internal zero point is shifted by the set value.

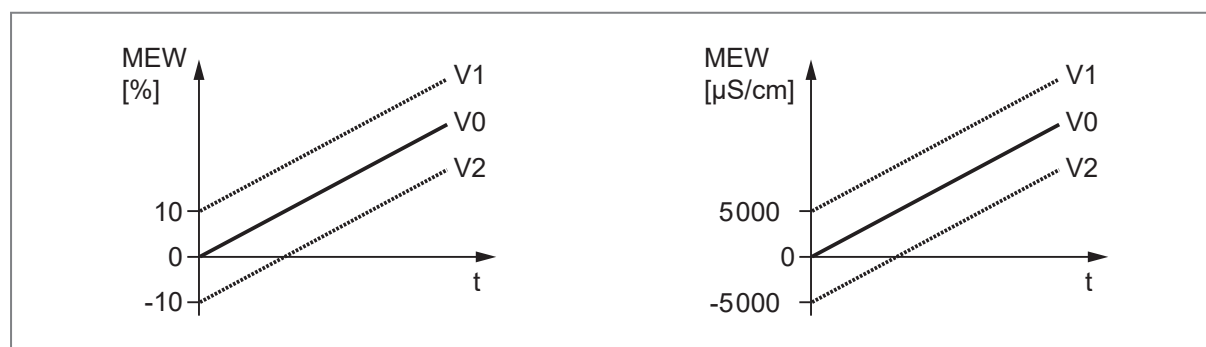


Fig. 26: Zero-point calibration (calibration offset)

MEW: Final value of the measuring range
t: time
V0: Curve of measured values at factory setting
V1: Curve of measured values after offset
V2: Curve of measured values after offset

Setting range:

[coF.F] = -10 % to +10 %; [coF.C] = -50000 $\mu\text{S/cm}$ to +50000 $\mu\text{S/cm}$



The parameter is reset to the factory setting both via an application reset and a back-to-box reset.

Factory calibration:

The sensor is calibrated for flow measurement at the factory.

The correction factor used to calibrate the device in the factory can be read via the [OF] parameter via the IO-Link interface and cannot be configured.

The correction factor (offset value) is also listed in the calibration certificate.

9.2.9 Calibration of the measurement characteristic

The calibration factor [CGA.x] is used to adjust the temperature-viscosity compensation of the sensor to the characteristics of the medium used. The calibration factor influences the gradient of the flow measurement characteristic.

- [CGA.F] = calibration factor for measuring flow

- [CGA.C] = calibration factor for measuring conductivity



The slope modification of the measurement characteristic is indicated in percent. The factory setting is [CGA] = 100%. After a change the calibration can be reset to factory setting.

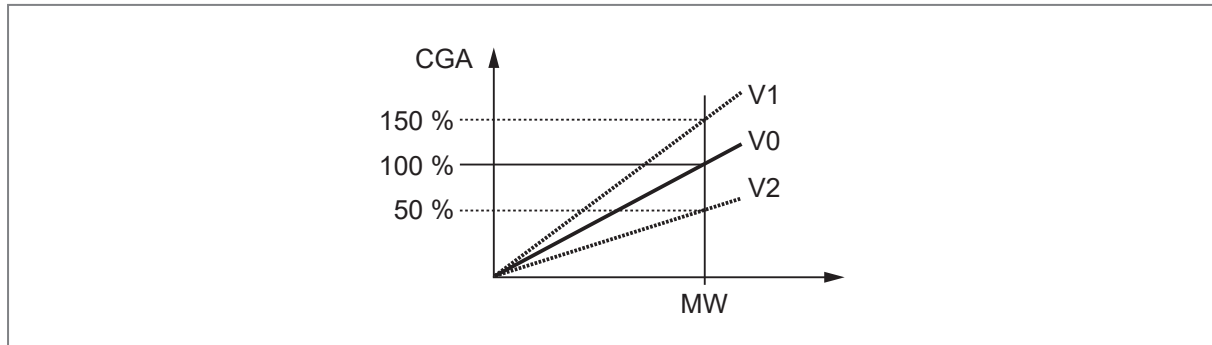


Fig. 27: Calibration of the measurement characteristic

MW: Measured value

V0: Measurement characteristic at factory setting

V1: Measurement characteristic after offset by +50%

V2: Measurement characteristic after offset by -50%

Setting range:

50 % to 150 %



The parameter is reset to the factory setting both via an application reset and a back-to-box reset.

Factory calibration:

The sensor is calibrated for flow measurement at the factory.

The calibration factor that was used to calibrate the device in the factory can be read via the [CF] parameter via the IO-Link interface and cannot be configured.

The calibration factor is also listed in the calibration certificate.

9.2.10 Influence of the medium on the temperature

The conductivity depends on the temperature. When the temperature increases, the conductivity changes. This temperature influence depends on the respective medium and can be compensated by the unit if the temperature coefficient (tempco) of the medium is known. The temperature compensation is set via the parameter [T.Cmp]. Then the temperature-compensated conductivity value corresponds to the conductivity at standard temperature (25 °C; factory setting of the parameter [rEF.T]).



For medium that is not changed the same tempco value has to be set for all sensors (unit-independent characteristic value). There is no further dependence on the measuring principle, the lot or the manufacturer of the sensors.



If the temperature coefficient of the medium is not known, it can be determined.

See: [Determination of the temperature coefficient tempco](#) (→ [38](#))



In an IO-Link environment, existing tempcos of the media can be stored as recipe in the controller so that the accuracy of the values to be detected is improved.

9.2.10.1 Determination of the temperature coefficient tempco

1. Set the parameters [T.Cmp] and [dAP] to zero: [T.Cmp] = [0], [dAP] = [0].

► Write the changed values to the sensor.

1. Adjust the medium to 25 °C, for example, and take down the value of the conductivity after 2 min.
2. Heat up the medium to 45 °C, for example, and take down the value of the conductivity after 2 min.

Example of values taken down:

Medium at 25°C = 500 µS/cm; medium at 45°C = 800 µS/cm

Temperature change = 20 K

1. Calculate the change of the conductivity in percent.
The conductivity has increased by 300 µS/cm.
The percentage change is $300/500 = 60\%$.
2. Calculate the temperature coefficient tempco: The tempco is calculated from the change in percent and the temperature change: $Tk = 60\% / 20\text{ K} = 3\% / \text{K}$
3. The calculated tempco can now be adopted into the parameter [T.Cmp].
Example: [T.Cmp] = [3]. If necessary, set the damping (parameter [dAP]) again.

► Write values to the sensor.

9.2.11 Date/time

Setting the date and time serves to provide events and measurements with a time stamp.

For this, the date and time must be set during set-up. When setting the time, with a 12hr or 24hr format can be chosen. If the time is not set, the clock will start from an initial value (2024/01/01).

9.2.12 Totaliser reset

The totalisers VTOTL1 and VTOTL2 can be reset in different ways:

Type of reset		Parameter
1.	Manual reset	Command [Reset Totaliser x]
2.	Time-controlled reset	[Reset Totaliser x] = • [... h] (hours) • [... d] (days) • [... w] (weeks)
3.	Reset via external signal	• [ou2] = [In.D] • [DIn2]: – [+EDG] = reset for rising edge – [-EDG] = reset for falling edge – [HIGH] = reset for high signal – [LOW] = reset for low signal
4.	Reset via overflow (maximum display range is reached)	[Reset Totaliser x] = [OFF]

Totaliser Vol.L cannot be reset.

→ [Consumed quantity monitoring \(totaliser function\)](#) (→ [30](#)).

9.2.13 Counting method of the totalisers

The totalisers VTOTL1 and VTOTL2 take account of the flow direction when totalising the consumed quantity. The following counting methods can be defined:

[Counting method]	Counting method
0+	Negative flow values (against the marked flow direction) are not taken into account for totalling.
-0	Positive flow values (corresponding to the marked flow direction) are not taken into account for totalling.

[Counting method]	Counting method
-+	Negative flow values are subtracted from the consumed quantity.
++	All flow values are totalled irrespective of the flow direction.

Tab. 13: Counting method of the totalisers

The counting method of Vol.L cannot be set. The lifetime totaliser totals all volumetric flow quantities irrespective of the flow direction.

The counting method affects the output signals for consumed quantity monitoring.

→ [Consumed quantity monitoring \(totaliser function\)](#) (→ [□ 30](#)).

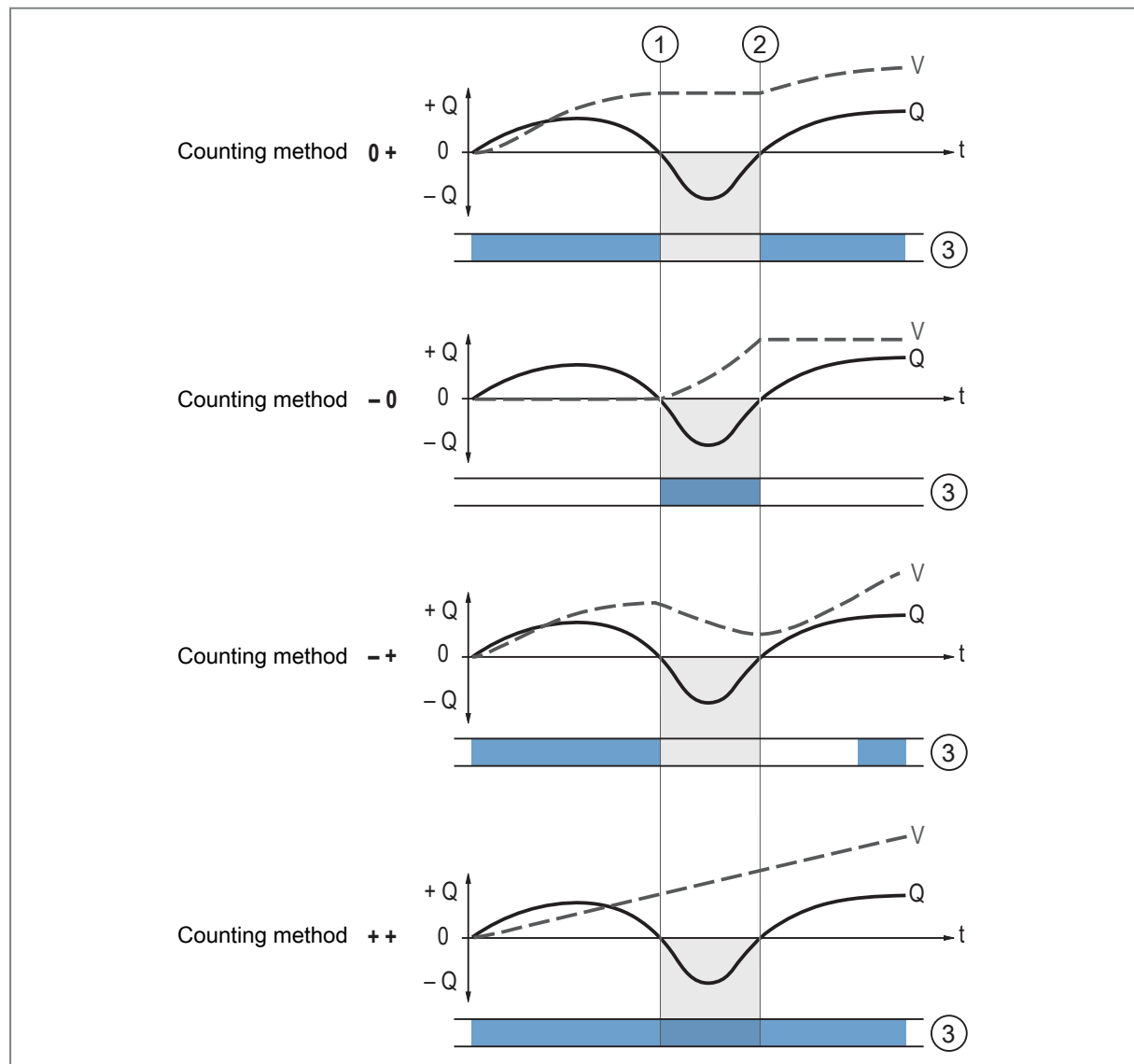


Fig. 28: Taking into account the flow direction when totalling the consumed quantity

- +Q: Flow quantity in positive direction
- Q: Flow quantity in negative direction
- V: Flow quantity absolute (= sum of negative and positive flow)
- 1: Flow changes to negative direction
- 2: Flow changes to positive direction
- 3: Flow taken into account for totalisation

When the direction of flow is changed, the minimum flow quantity [LFC] is taken into account.

→ [Figure Switching signal for flow direction](#) (→ [□ 29](#)).

9.2.14 Reset the device

The device can be reset in two ways.



With both reset applications, the operating hours since the first set-up are not reset.

[APPL] = application reset

The following is reset to the factory setting:

- All parameters and device settings except the device identification parameters such as [Application Specific Tag], [Function Tag] and [Location Tag].



If IO-Link data storage is activated, this immediately triggers a parameter update in the master.

[BtB] = Back to Box

The following is reset to the factory setting:

- All parameters and device settings including the device identification parameters such as [Application Specific Tag], [Function Tag] and [Location Tag].
- Diagnostic parameters, status parameters, events.
- Minimum and maximum memory value



After the Back to Box reset, the sensor suspends communication and measurement operation until the voltage is interrupted. The IO-Link data storage is not triggered.

9.3 Diagnostics

The device continuously monitors itself during operation and provides the results of its self-diagnosis in the following ways:

- The device indicates a warning or error by changing the colour of the LED ring ([→ Operating status LED](#) [42](#)).
- The device provides diagnostic messages as a switching signal or via the IO-Link interface ([→ Switching signal diagnostics](#) [28](#)).

In addition, the following diagnostic information can be read via the IO-Link interface:

- [Read totaliser values](#) ([→ 41](#))
- [Memory](#) ([→ 42](#))
- [Operating hours counter](#) ([→ 42](#))
- [Internal temperature](#) ([→ 42](#))
- [Event history](#) ([→ 43](#))

9.3.1 Read totaliser values

For the totalisers, the following values can be read at any time via the IO-Link interface:

Totaliser values VTOTL1 and VTOTL2

- Current flow quantity (= consumed quantity since the last totaliser reset)
- Value before the last totaliser reset
- Time since the last totaliser reset

Totaliser values Vol.L (lifetime totaliser for the entire operating time)

- Volumetric flow quantity in preferred direction (= positive flow direction)

- Volumetric flow quantity in non-preferred direction (= negative flow direction)
- Total flow quantity (= positive + negative flow direction)

9.3.2 Memory

The unit stores the maximum and minimum measured process values.

The current value can be read via the IO-Link interface.

Selectable values:

- minimum flow value
- maximum flow value
- minimum temperature value
- maximum temperature value
- Minimum conductivity value
- Maximum conductivity value



It makes sense to delete the memories as soon as the unit operates under normal operating conditions for the first time.

9.3.3 Operating hours counter

The operating hours since the first set-up are stored by the unit.

The current value can be read via the IO-Link interface.



In case of a voltage interruption, no more than the count of the last hour will be lost.

9.3.4 Internal temperature

The sensor measures the internal temperature.

The current value can be read via the IO-Link interface.

9.3.5 Operating status LED

The device is equipped with an operating status LED ring, which is clearly visible from all sides and shows the current status of the device ([→ Operating and display elements □ 25](#)):

LED ring red (1 Hz)	Device operating outside the specification
LED ring red	Error
LED ring blue	Maintenance required
LED ring green	Power supply and operation normal

Tab. 14: Status signal in compliance with Namur NE107 standard

If several diagnostic events occur simultaneously, only the diagnostic message of the event with the highest priority is displayed.

See also:

- [Warning messages \(→ □ 46\)](#)
- [Error messages \(→ □ 46\)](#)

The function and colour of the operating status LED can be changed via the [LED.M] parameter:

LED mode	Operating status LED
On	The LED ring is permanently on. Green in normal operation, blue or red for diagnostics.
OFF	The LED ring is permanently off.
Noti	The LED ring is off during normal operation. The LED ring is only on for diagnostics (blue or red).
PdOU	The LED ring is controlled via the IO-Link process data interface PD OUT.
PArA	The LED ring is permanently lit in the set colour (red, green, blue or yellow).

9.3.6 Event history

The device records incoming and outgoing events with an event description and time stamp. For this, it is important that the date and time are set on the sensor.

A total of 200 events can be saved on the device. These can be exported from the device via the IO-Link interface (→ [Binary data transmission \(BLOB\)](#)  44).

9.4 Service functions

9.4.1 Device information

Unalterable device information is stored on the unit. This includes:

- Product name
- Product family
- Manufacturer
- Manufacturer ID
- Device ID
- Serial number
- Hardware / firmware revision
- Description

In addition, further freely definable tags with a maximum length of 32 characters can be assigned to the unit via the IO-Link interface using suitable parameter setting software. This includes:

- application-specific tag
- function tag
- location tag

9.4.2 Simulation

With this function, process values are simulated and their signal path is checked.

Process values that lead to an error message or warning can be simulated (e.g. OL).

When the simulation is started, the values of the totaliser are frozen and the simulated totaliser is set to 0. The simulated flow value then has an effect on the simulated totaliser. When the simulation is ended, the initial totaliser values are restored.

During the simulation:

- The simulation has no effect on the current process values. The outputs operate as previously set.
- The original totaliser value remains saved without any changes even if there is a real flow.
- No error messages of the current application are available. They are suppressed by the simulation.

The following values can be simulated:

- Process values for flow, temperature and conductivity
- process values outside the measuring range (cr.UL, UL, OL, cr.OL)
- The sensor is receiving no data (NoData)
- No medium in the measuring pipe (Fluid Detection).

Parameters to be set:

- Simulation time [S.Tim]
- Process values:
 - For flow [S.FLW]: process value, [OL], [cr.OL], [UL], [cr.UL], [NoData]
 - For temperature [S.TMP]: process value, [OL], [cr.OL], [UL], [cr.UL], [NoData]
 - For conductivity [S.CND]: process value, [OL], [cr.OL], [UL], [cr.UL], [NoData]
- Diagnostic case: [No Diagnose] / [Fluid Detection]
- Simulation time [S.Tim]
- Command [Start simulation]

9.4.3 Binary data transmission (BLOB)

The device offers a function for reading binary data from the device as one large file (BLOB = Binary Large Object).

The data is exported as a BIN file.

This requires a software tool (e.g. ifm moneo) that supports the IO-Link BLOB interface.

The BIN file contains the following logbook information:

- device information for identification
- number of operating hours
- event logging:
 - event history with time stamp
 - event code
 - event description
 - event frequency
 - device restarts

Only the last 200 events are saved.



In case of a voltage interruption, the events of the last 10 minutes can be lost.

9.4.4 Optical localisation

The sensor can be located remotely in the system via the IO-Link interface.

When using the command [Locator Start], the LED ring flashes green.

10 Operation

After power on and expiry of the power-on delay time, the unit is in the normal operating mode. It carries out its measurement and evaluation functions and generates output signals according to the set parameters.

11 Troubleshooting

The device has many self-diagnostic options. It monitors itself automatically during operation.

Warning and error messages are output as an event via the IO-Link interface.

The status signals are classified according to NAMUR recommendation NE107.

In addition, warning and error messages are displayed by the device as follows:

- Switching signals when using the diagnostic function (→ [Switching signal diagnostics](#)  28)
- Colour signals of the operating status LED (→ [Operating status LED](#)  42)

If a process value fails, the other process values are still available. Exception: If the process value for flow fails, no other process values are output.

11.1 Warning messages

Status*	Operating status LED	IO-Link event	Problem	Corrective measures
2	red flashing (1 Hz)	0x4210	Admissible device temperature exceeded.	► Eliminate heat sources.
2	red flashing (1 Hz)	0x4220	Admissible device temperature not reached.	► Insulate device.
3	depending on the simulated value	0x8C01	Simulation active.	► Stop simulation.
2	red flashing (1 Hz)	0x8C10	Process value above the valid range.	► Check the application.
2	red flashing (1 Hz)	0x8C30	Process value below the valid range.	► Check the application.
1	blue	0x8CE0	Local user interface disturbed.	► Check the device's user interface.
2	red flashing (1 Hz)	0x8CC1	Measuring tube not sufficiently filled or medium has too low conductivity.	► Check the application.

Tab. 15: Warning messages. * Status: 1 = maintenance required; 2 = outside the specification; 3 = function test



In case of a warning the analogue output behaves according to the setting [FOU] = [OU].
Exception: Short circuit.

11.2 Error messages

Status*	Operating status LED	IO-Link event	Problem	Corrective measures
4	red	0x5000	Hardware error in the device / device is defective.	► Replace the device.
3	red flashing (1 Hz)	0x5010	A process value is defective.	► Repair or replace the device.
3	red	0x6320	Parameter error	► Perform a back-to-box reset.
3	red flashing (1 Hz)	0x7710	Short circuit	► Check device wiring.
3	red flashing (1 Hz)	0x8C20	Measurement range exceeded	► Check the application.
3	red flashing (1 Hz)	0x8C20	Measurement range underrun	► Check the application.

Tab. 16: Warning messages. * Status: 3 = function test; 4 = failure



In case of a fault the analogue output behaves as set under [FOU2].

12 Maintenance, repair and disposal

The goods can only be replaced if the product seal on the packaging is not damaged.

A defective device can be returned to the manufacturer for repair.

Only the manufacturer is allowed to repair the unit.

- ▶ In case of return shipment, ensure that the unit is free from soiling, especially from dangerous and toxic substances.

12.1 Maintenance

Seals:

- ▶ Regularly check the two seals between the device and the process adapter for deposits and damage.
- ▶ Clean the device from dirt using a soft, chemically untreated and dry micro-fibre cloth, or replace the seals. The time between replacing the seals depends on the frequency of the cleaning cycles, the media temperature and the cleaning temperature.

Device:

- ▶ Do not touch the measuring electrodes (→ [Function 8](#)) with your fingers.



Touching the electrodes with your fingers, especially when touching the temperature electrode, can lead to measurement deviations in conductivity. Finger perspiration and finger grease influence the measurement signal.

12.2 Replacing the electronic unit

A defective electronic unit can be replaced with a new one by the customer.



An electronic unit without display cannot be replaced by an electronic unit with display. Information about suitable accessories at www.ifm.com.

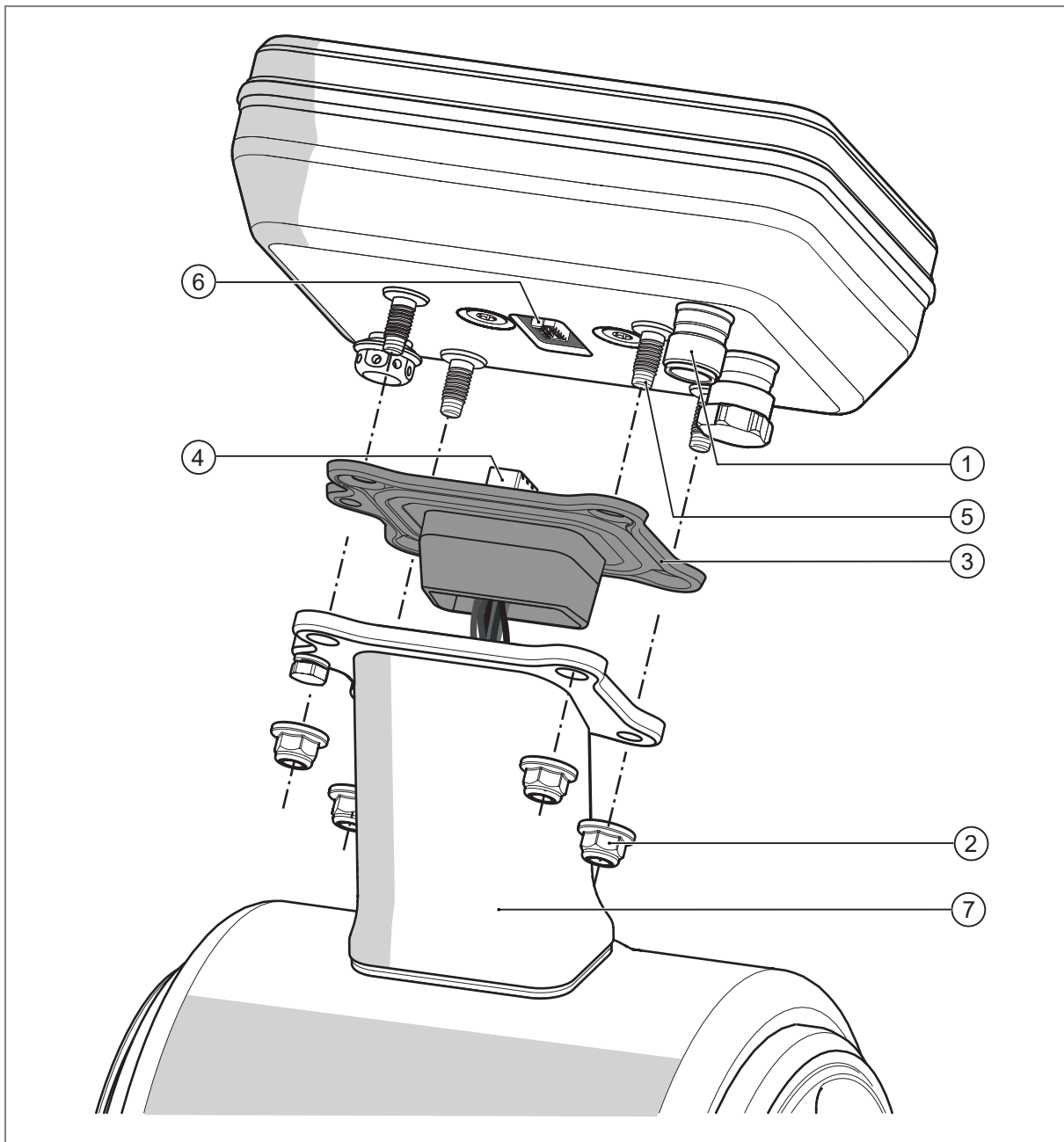


Fig. 29: Mounting / removal

- 1: Connector for electrical connection
- 2: 4 x M5 hexagon nuts
- 3: Seal (firmly bonded to circuit board and socket)
- 4: Circuit board with socket (permanently wired to the electronics in the measuring tube)
- 5: Threaded bolt
- 6: Plug of the electronic unit
- 7: Bracket



The electronic unit is supplied without a seal. In case of replacement, the original seal is reused.

**CAUTION**

Risk of electric shock

▷ Touching live parts can result in personal injury.

► Ensure that the power supply is disconnected before installing or removing the electronic unit.

Procedure:**ATTENTION**

Damage to the device when replacing the electronic unit

- ▷ Improper replacement will invalidate the warranty.
- ▶ Ensure that the internal cabling is not damaged.
- ▶ Ensure that ingress of moisture and foreign substances is avoided when the device is open.

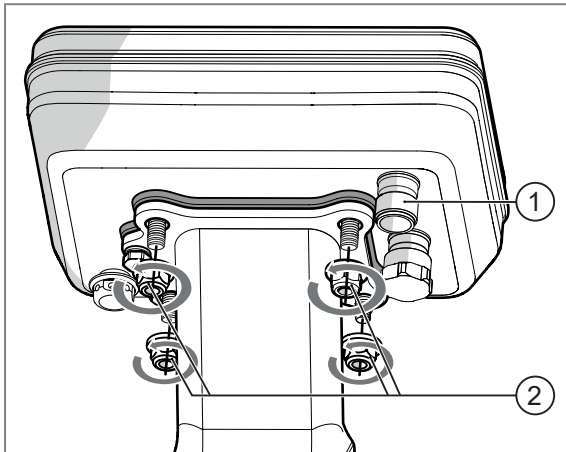


Fig. 30: Unscrew the defective electronic unit.

- ▶ Loosen the connector for the electrical connection (1).
- ▶ Loosen the four M5 hexagonal nuts (2) at the bottom of the electronic unit.

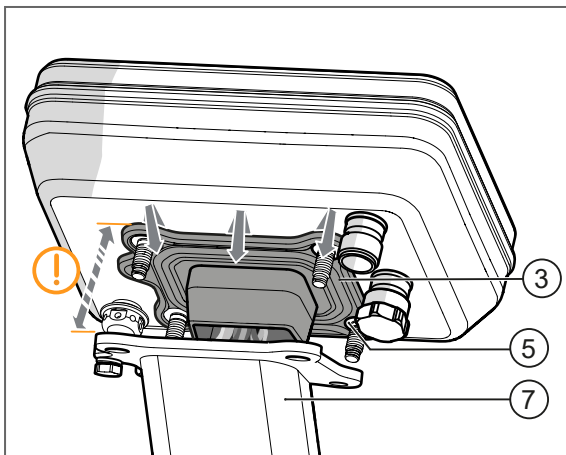


Fig. 31: Remove seal.

- ▶ Lift the defective electronic unit slightly off the bracket (7).
- ▶ Remove the seal (3) from the threaded bolts (5).



Do not pull the cabling too far out of the bracket.

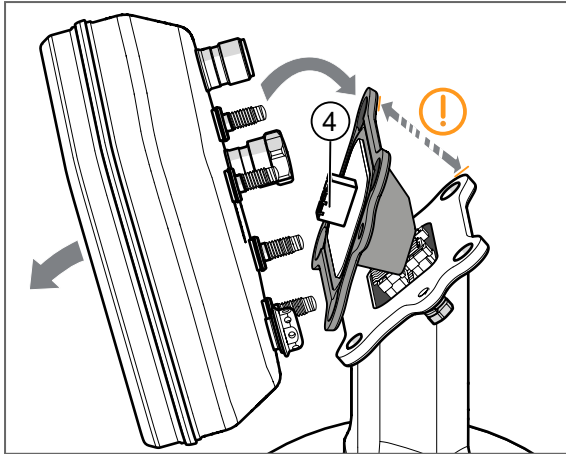


Fig. 32: Remove the defective electronic unit.

- Remove the seal together with the circuit board and socket (4) from the electronics unit to release the plug connection.



Do not pull the cabling too far out of the bracket.

- Remove the faulty electronic unit.

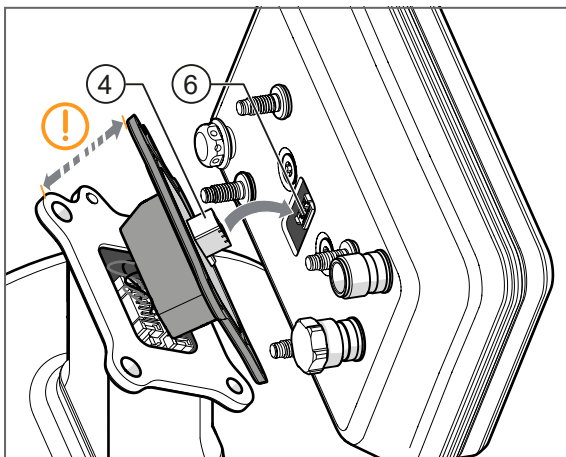


Fig. 33: Connect the new electronic unit.

- Have the new electronic unit ready.
- Carefully plug the socket (4) onto the plug (6) of the new electronic unit.



Do not pull the cabling too far out of the bracket.

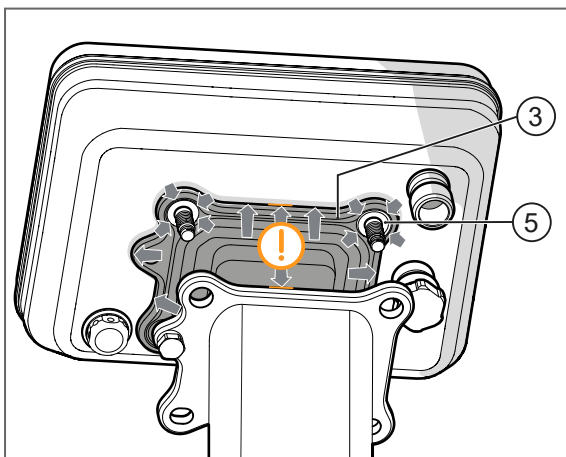


Fig. 34: Install the seal.

- Press the seal (3) with the four outer holes precisely onto the collar of the four threaded bolts (5) of the new electronics unit.



Do not pull the cabling too far out of the bracket.

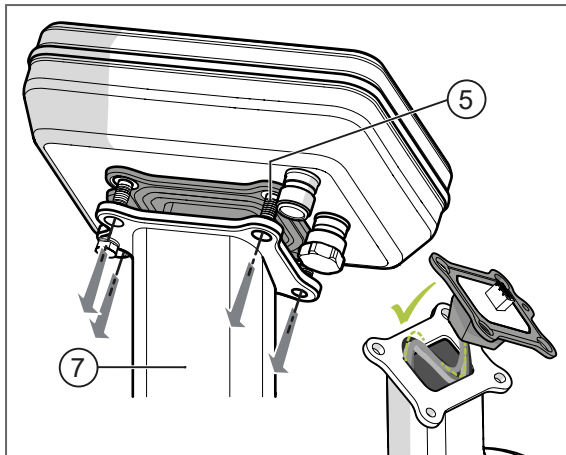


Fig. 35: Install the new electronic unit.

- Insert the new electronic unit with the threaded bolts (5) into the holes of the bracket (7).



Do not pinch the cabling. If the cabling has been pulled out too far, insert it into the bracket in an S-shape without kinks.

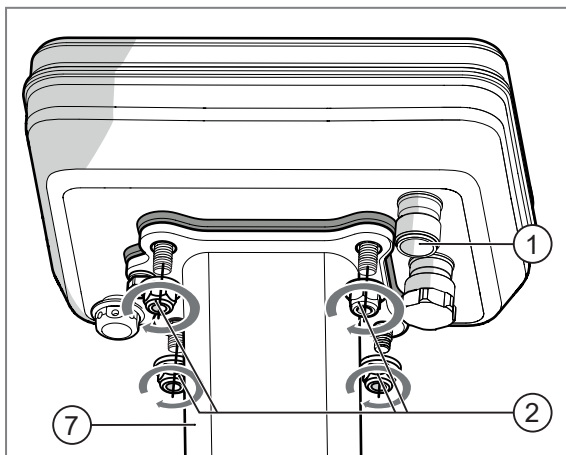


Fig. 36: Screw on the new electronic unit.

- Screw the new electronics unit to the bracket (7) using the four M5 hexagon nuts (2). Tightening torque: 4 Nm.



The seal must lie completely flat against the electronics unit.

- Restore the electrical connection via the connector (1).
- ▷ After a restart, the device works with the same parameter settings as before the replacement.

12.3 Disposal

- After use dispose of the product or components in an environmentally friendly way in accordance with the applicable national regulations.
- Dispose of used batteries in accordance with national environmental regulations. Do not dispose of used batteries as household waste.

13 Factory settings

General settings:

Parameter	Factory setting
uni.F	m ³ /h
uni.T	°C
uni.C	μS/cm
Counting method TOTL1	0+
Counting method TOTL2	0+
Reset Totaliser 1 (rTo1)	OFF
Reset Totaliser 2 (rTo2)	OFF
dAP.F	0.6
P-n	PnP
Low flow cut-off (LFC)	SMF350: 0.3 m ³ /h SMF450: 0.6 m ³ /h SMF550: 1.2 m ³ /h SMF650: 1.8 m ³ /h SMF750: 3.0 m ³ /h SMF850: 4.5 m ³ /h SMF950: 6.0 m ³ /h
Flow direction (F.dir)	+
coF.F	0
CGA.F	100
rEF.T	25 °C

Settings for OUT1:

Parameter	Factory setting
ou1	ImP
ImPS1	SMF350: 0.002 l SMF450: 0.002 l SMF550: 0.004 l SMF650: 0.005 l SMF750: 0.009 l SMF850: 0.013 l SMF950: 0.017 l
Pulse repetition (ImPR1)	YES
Diagnostic signal (for ou1 = dOU)	Flow Direction (dir.F)

Settings for OUT2:

Parameter	Factory setting
ou2	I / 4...20 mA
Process value OUT2 (SEL2)	FLOW
ASP2	0 m ³ /h

Parameter	Factory setting
AEP2	SMF350: 11 m ³ /h SMF450: 18 m ³ /h SMF550: 30 m ³ /h SMF650: 45 m ³ /h SMF750: 70 m ³ /h SMF850: 110 m ³ /h SMF950: 160 m ³ /h
Failure logic (FOU2)	OFF
Diagnostic signal (for ou2 = dOU)	Flow Direction (dir.F)
DIn2	+EDG