GB

Operating instructions
Magnetic-inductive flow meter
SMFx2x

11541382 / 02 03 / 2025

Contents

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 ≥ 5 µS/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

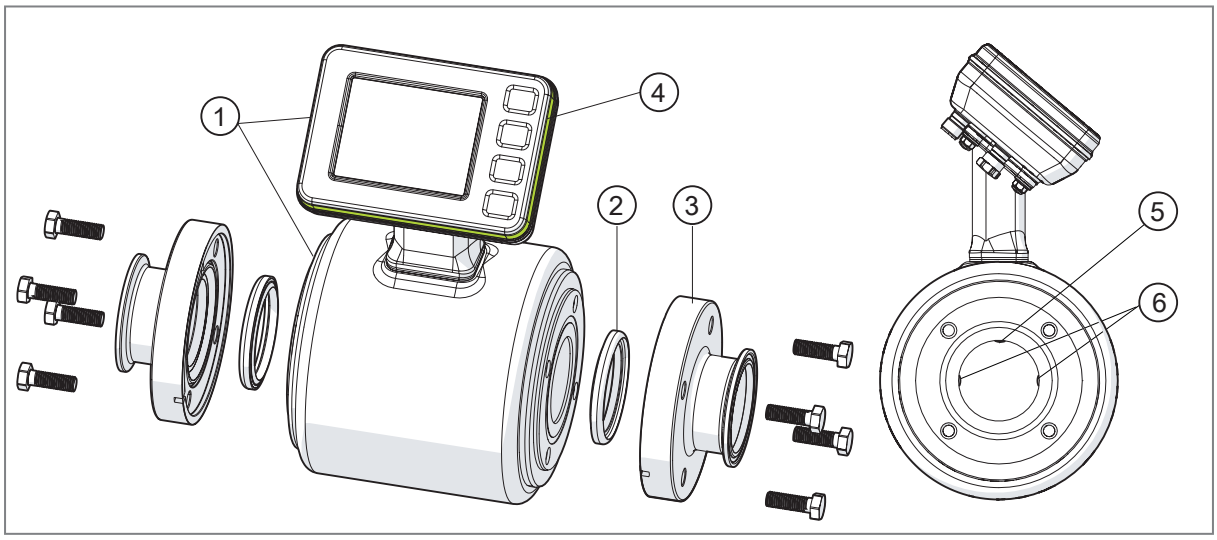


Fig. 1: Product description

1: SMFxxx device (measuring circuit and display)
2: Exxxxx seal, can be ordered separately from www.ifm.com
3: Exxxxx process adapter, can be ordered separately from www.ifm.com
4: Operating status LED (LED ring)
5: Temperature-measuring electrode in the measuring pipe
6: Flow-measuring electrodes in the measuring pipe

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 displays the current process values.
- 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 and guided installation via a wizard enable simplified set-up of the sensor.
- The device has the following output functions:
  - Analogue signal (→ 🗋 36):
    flow, temperature, conductivity
  - Consumed quantity monitoring (totaliser function) (→ 🗋 39):
    switching signal or pulse signal
  - Switching signal diagnostics (→ 🗋 37):
    Flow direction, fluid detection
  - Digital switching signal (→ 🗋 41):
    limit value monitoring of flow, temperature, conductivity, totaliser
- In addition, the device provides other diagnostic and service functions:
  - Read totaliser values (→ 🗋 58)
  - Memory (→ 🗋 58)
  - Operating hours counter (→ 🗋 59)
  - Internal temperature (→ 🗋 59)
  - Operating status LED (→ 🗋 59)
  - Event history (→ 🗋 60)

- Device information (→ 🗋 60)
- Simulation (→ 🗋 61)
- Configuration (→ 🗋 61)
- Documents (→ 🗋 62)
- Binary data transmission (BLOB) (→ 🗋 62)
- Optical localisation (→ 🗋 63)
- Lock / unlock (→ 🗋 63)
- Reset the device (→ 🗋 53)
- Display settings (→ 🗋 54)
- Application configuration (→ 🗋 44), e.g. standard unit of measurement, 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.

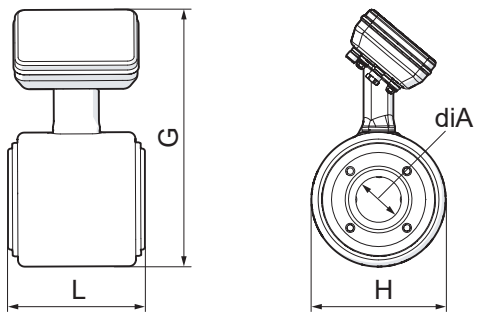
▶ Ensure that no media can leak at the mounting location during installation.

▶ 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



DN [mm]	L [mm]	G [mm]	H [mm]	diA [mm]
40	140	252.6	125	34.3
50	140	267.5	139.7	47
65	140	281.6	154	59.7
80	140	295.9	168.3	72.4
100	140	319.6	192	96.9
125	200	346.7	219.1	119.5
150	200	381.6	254	146.4

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.

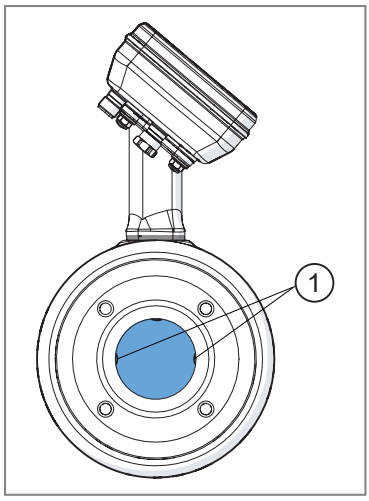


Fig. 3: Orientation of the flow-measuring electrodes

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.

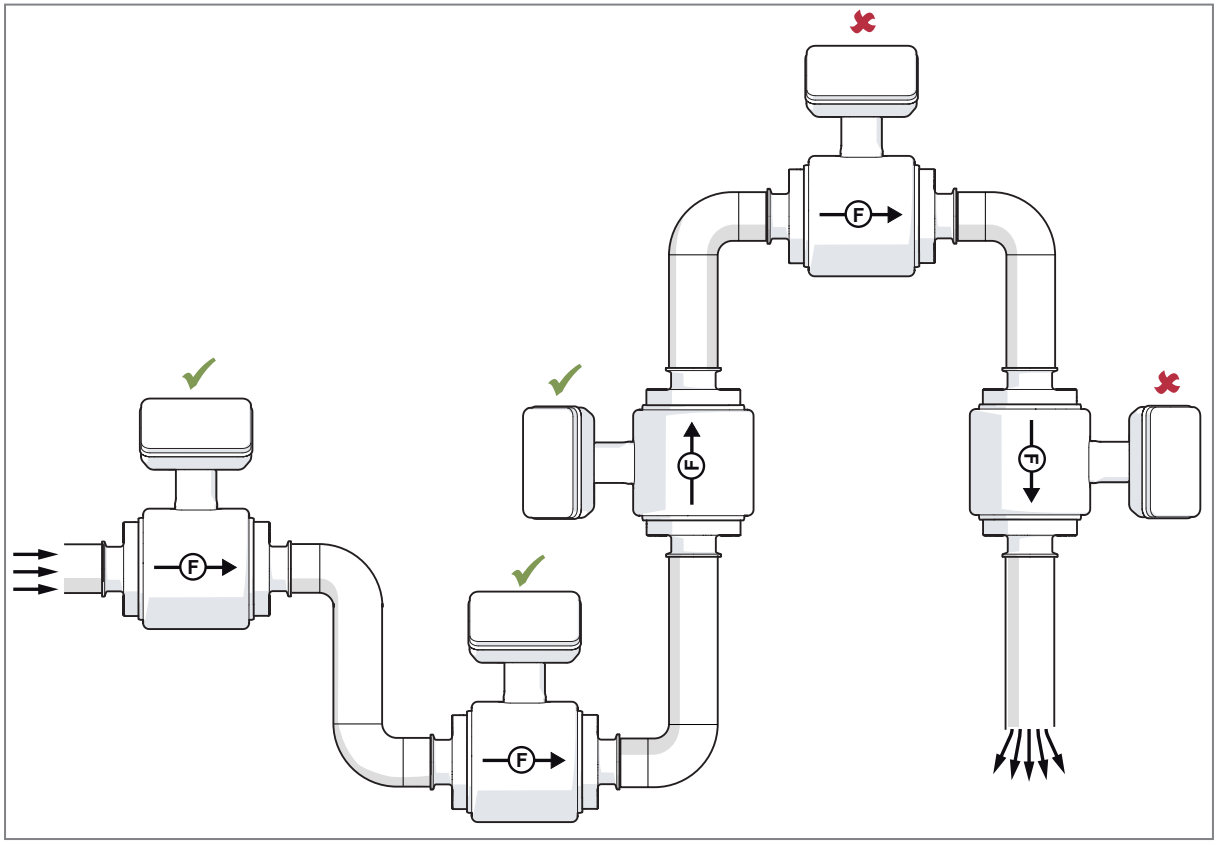


Fig. 4: Recommended and non-recommended installation positions

F Flow direction (→ 🗋 47)

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.

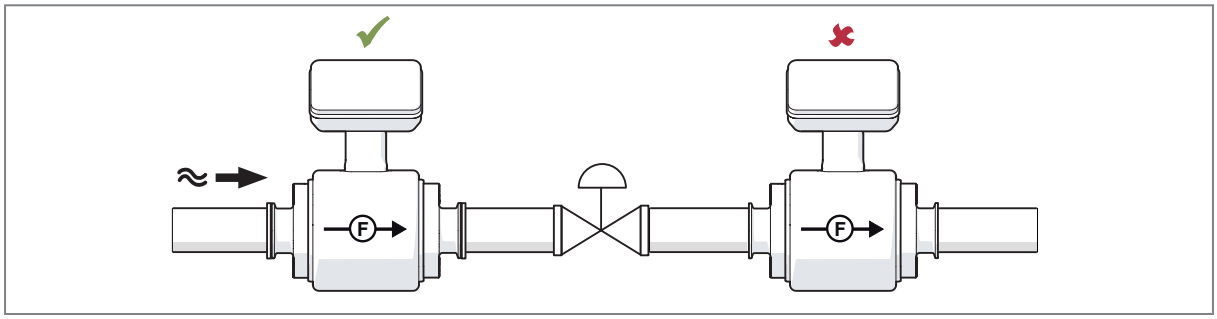
▶ Ensure that no medium remains in the measuring channel.

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.

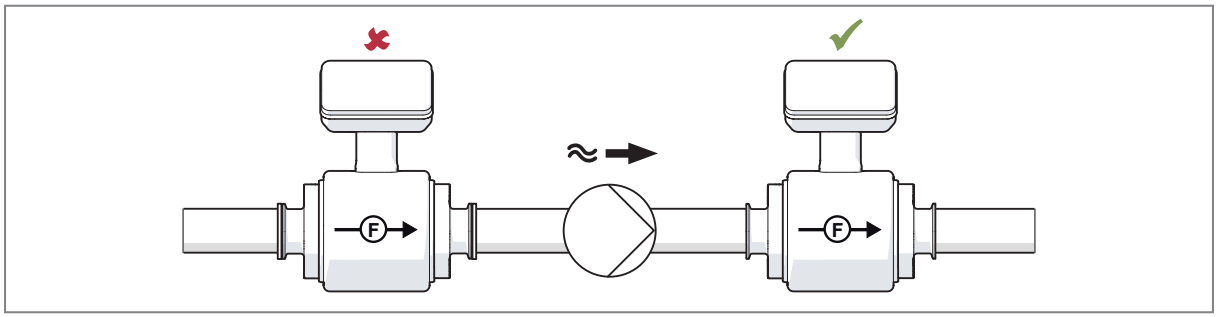
Installation in the vicinity of control valves:

▶ 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.

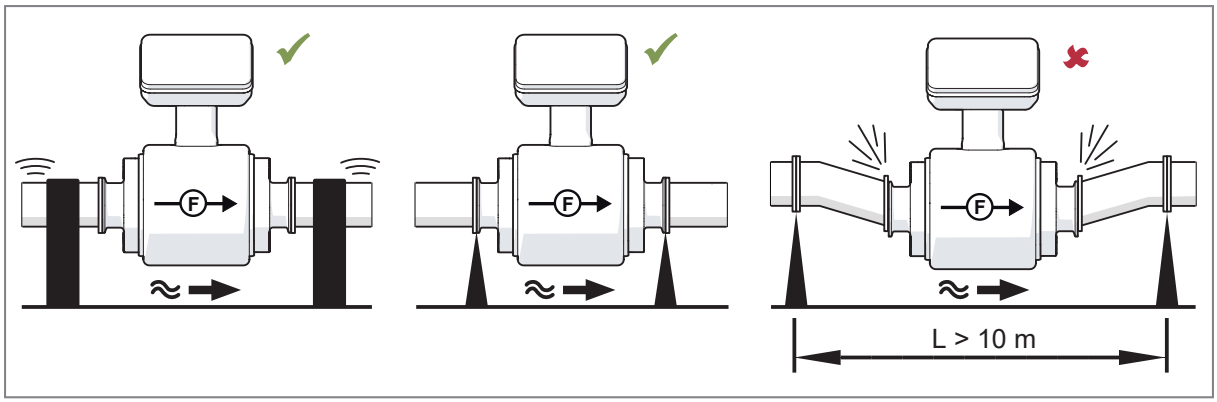
▷ This can lead to the sensor being damaged.

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.

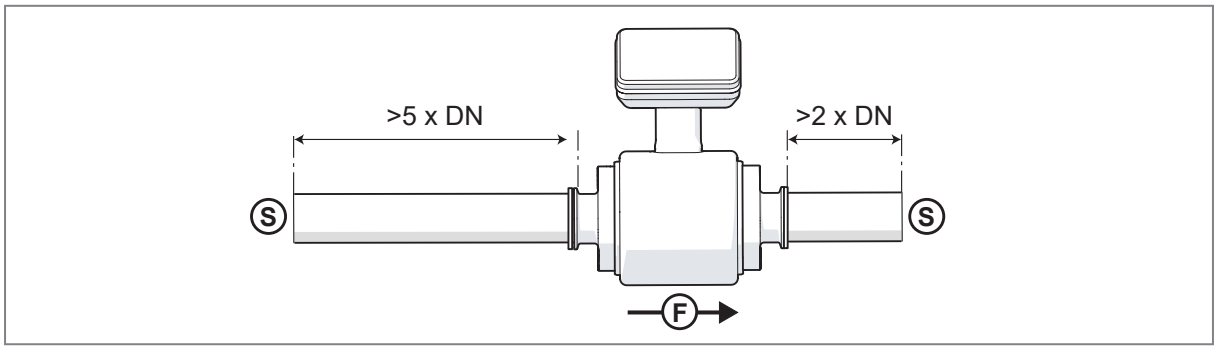


Fig. 5: Inlet and outlet pipe lengths

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.

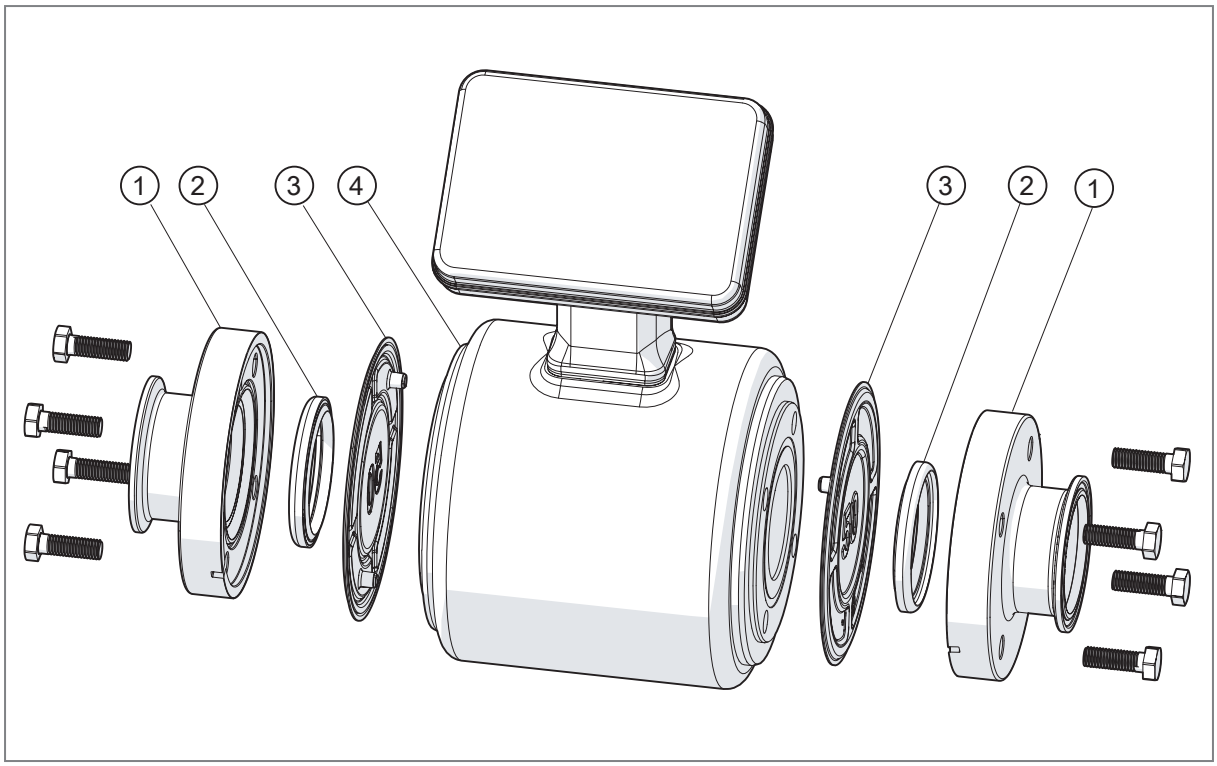


Fig. 6: Installation of the device in the process

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

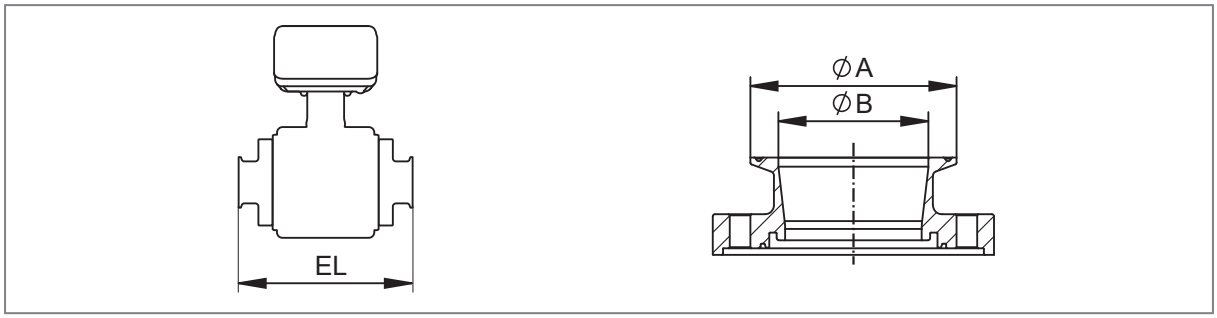


Fig. 7: Installation with clamp adapter

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		
		ISO 2852	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			
		DIN 32676-A (DIN)	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

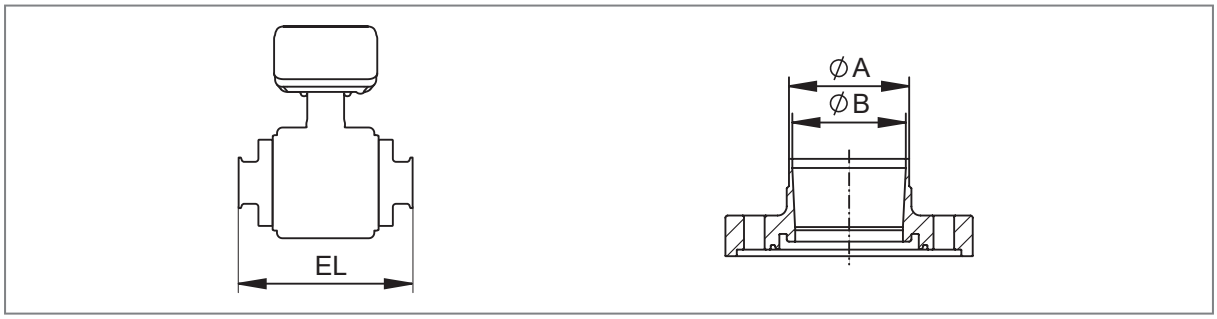


Fig. 8: Installation with welding adapter

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 adapters available	Dimensions in mm (→ Figure 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

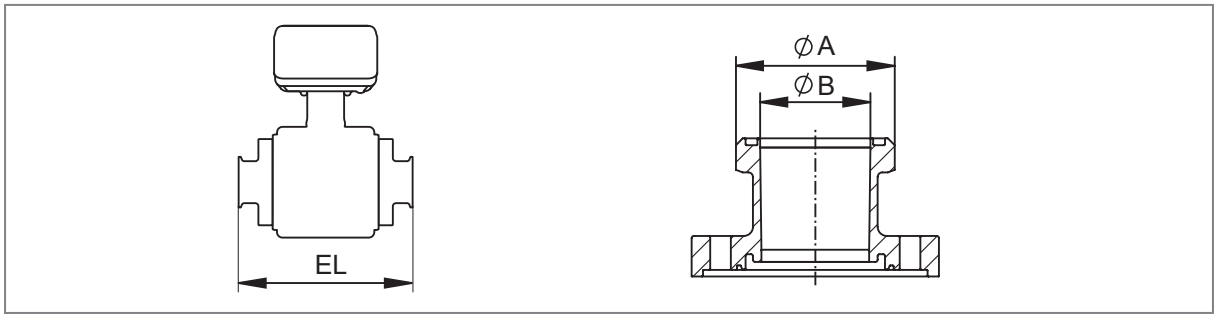


Fig. 9: Installation with screw adapter

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			
		DIN 11851	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		
		SMS 1145	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

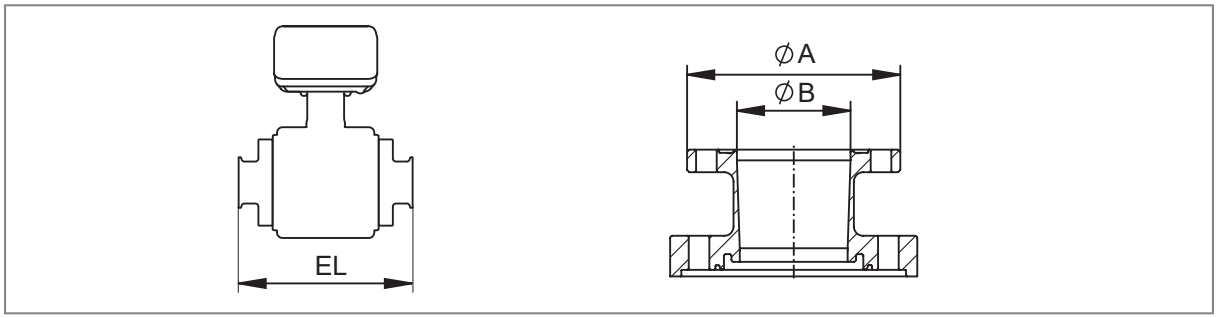


Fig. 10: Installation with flange adapter

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			
		DIN 11864-2A	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.

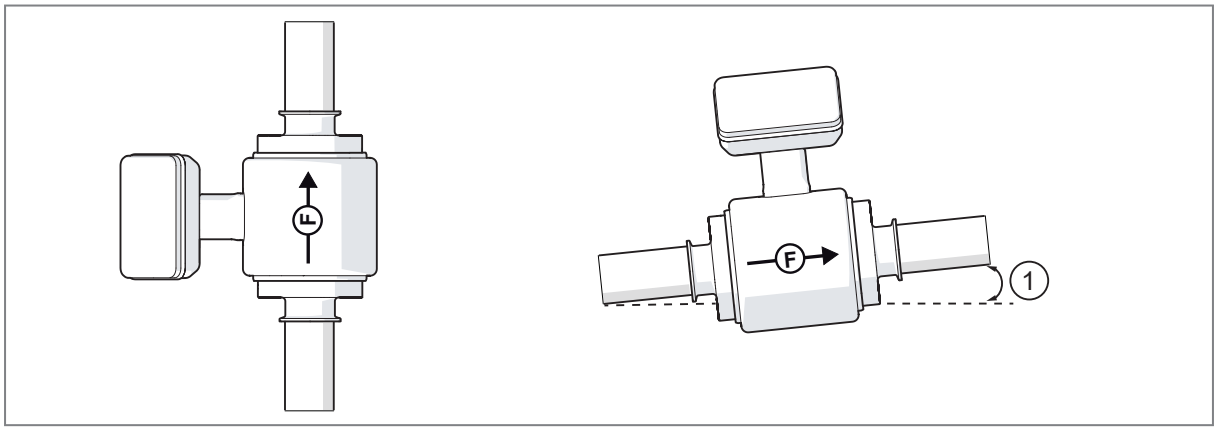


Fig. 11: Process connection according to 3-A

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.

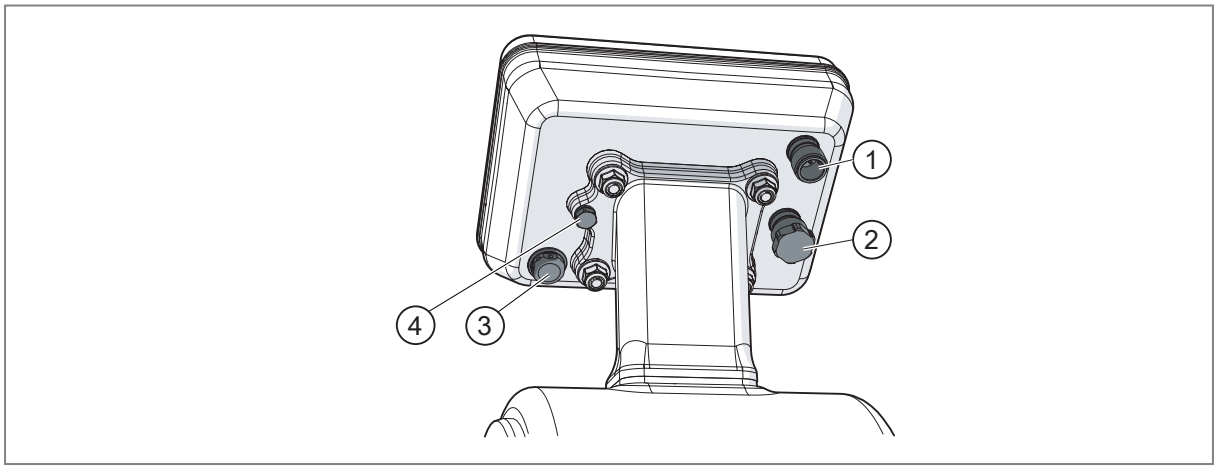


Fig. 12: Connectors

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:

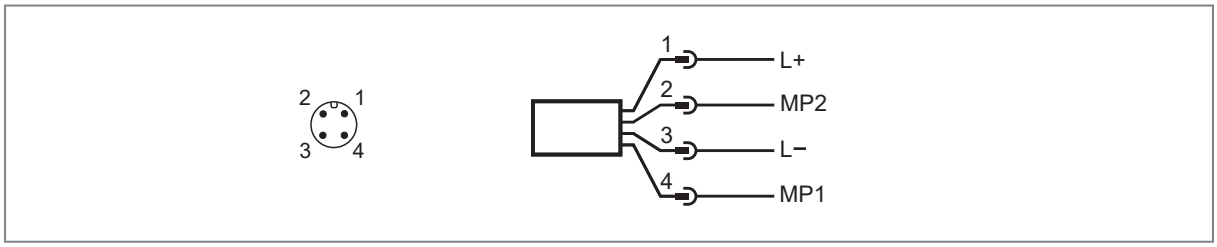
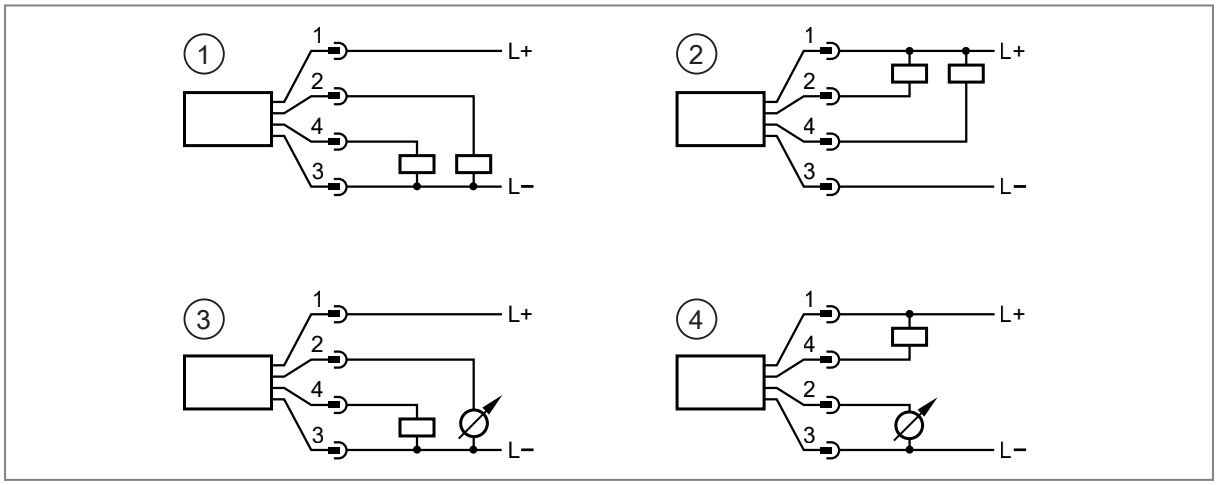


Fig. 13: Wiring diagram; MP: multifunction (IN, OUT, Data)

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

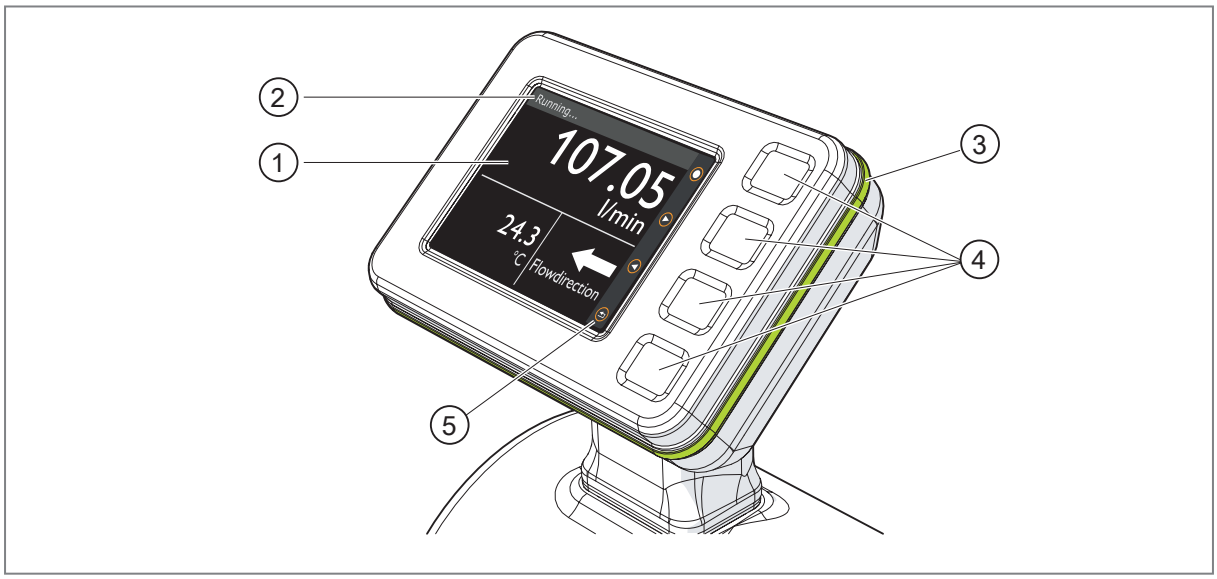


Fig. 14: Operating and display elements

1: TFT-Display 3.5": Shows 1 to 4 process values (→ Display layout 🗋 56).
2: Title line: Describes the status of the device (normal operation, warning messages, error messages).
3: Operating status LED (LED ring): Changes colour to signal the status of the device. (→ Operating status LED 🗋 59)
4: Device keys: Keys for changing views and setting parameters (→ Parameter setting via the unit keys 🗋 35).
5: Key symbols: Indicate the functions of the corresponding device keys on the display.
The key symbols may be different on the process value display and in the individual menus.

Switching between display screens:

The device keys can be used to switch between different process value displays during operation:

▶ Press [►] or [◄].

▷ The display shows the various display options.

▶ Press [►] or [◄] until the desired display screen is highlighted.

▶ Press [●] button.

▷ The display shows all of the available information about the selected display screen.

▶ Press [▲] or [▼] to scroll through the selected display screen.

▷ After 30 s, the device returns to the standard display.

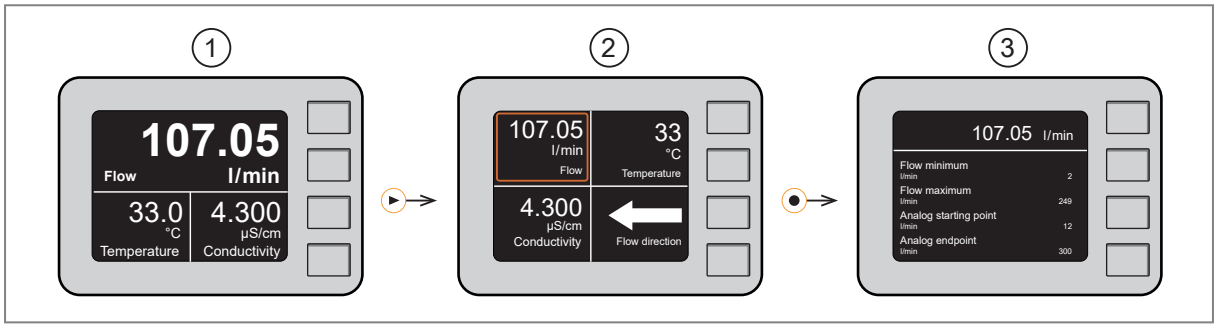


Fig. 15: Switching between display screens

1: Standard, pre-set display screen (→ Display layout 🗋 56).
2: Overview of all display options
3: Detailed view of the selected process value

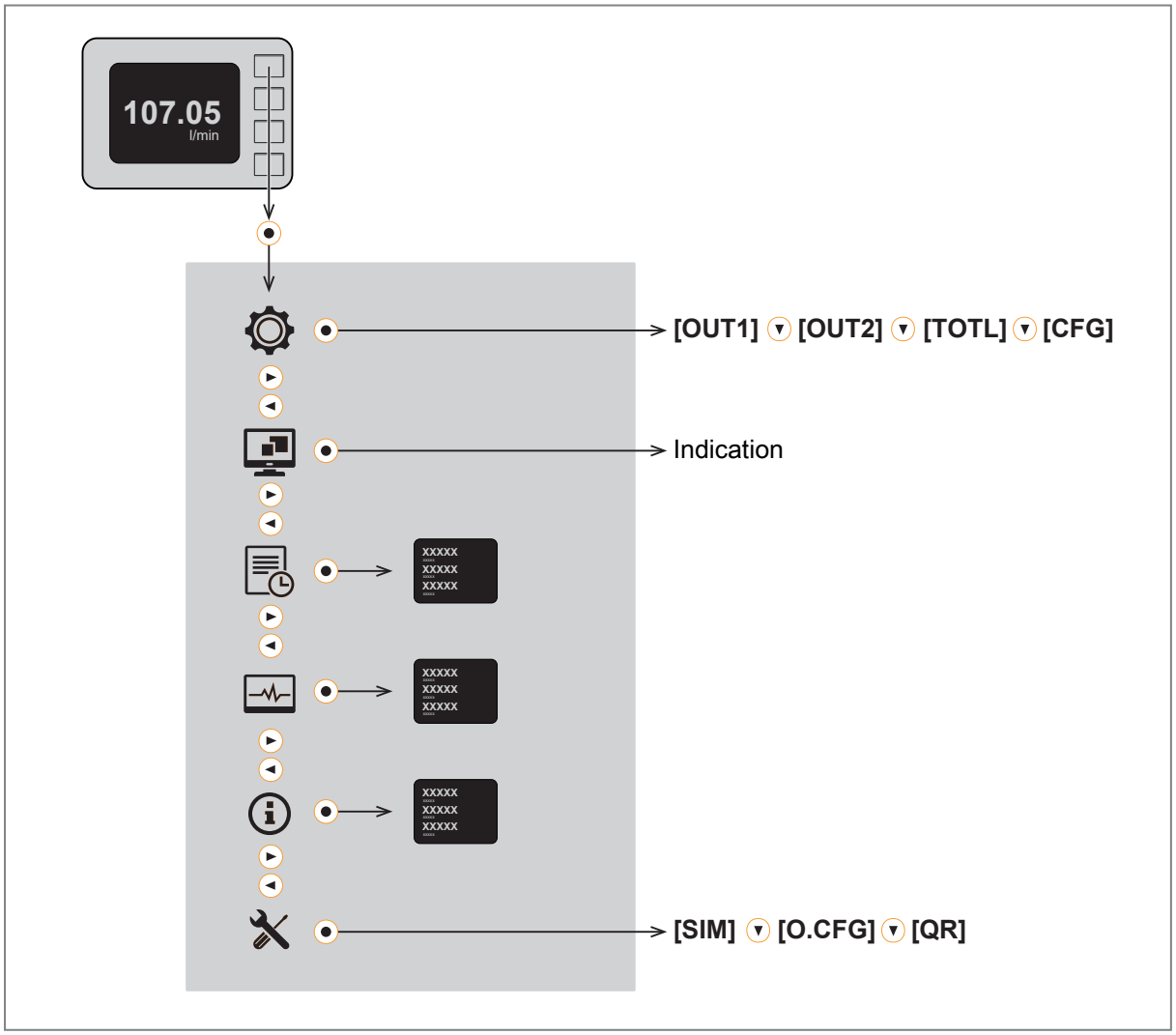
The consumed quantity is automatically displayed in the unit of measurement providing the highest resolution.

If the device measures a high internal temperature, the display brightness is automatically adjusted:
Internal temperature > 75 °C: brightness is reduced to 25%.
Internal temperature ≥ 90 °C: display is automatically switched off.

8 Menu

The figures in which the menus are displayed show the parameters that can be set on the unit by key input. These parameters and other functions are also available via the IO-Link interface.

8.1 Main menu

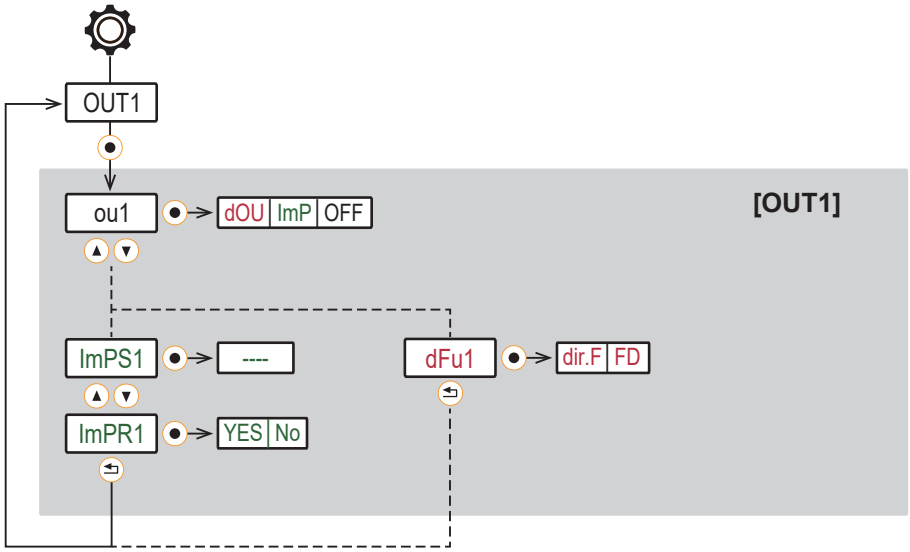


Symbol	Name	Explanation
	Settings	Switch to the following submenus (→ Submenus 🗋 28): [OUT1]: output 1, [OUT2]: output 2, [TOTL]: totaliser, [CFG]: configuration.
	Indication	Switch to the display menu (→ Submenus 🗋 32).
	Event history	Shows previous events (→ Event history 🗋 60).
	Diagnostics	Shows diagnostics information (→ Diagnostics 🗋 57): minimum and maximum flow, operating hours, internal temperature.
	Device info	Shows device-specific information (→ Device information 🗋 60).
	Service	Transition to the following submenus and display screens: • [SIM]: Simulation (→ Submenus 🗋 33). • [O.CFG]: Configuration (→ 🗋 61). • [QR]: Shows the QR codes with links to the data sheet, the operating instructions and the certificate at www.ifm.com (→ Documents 🗋 62).

8.2 Submenus

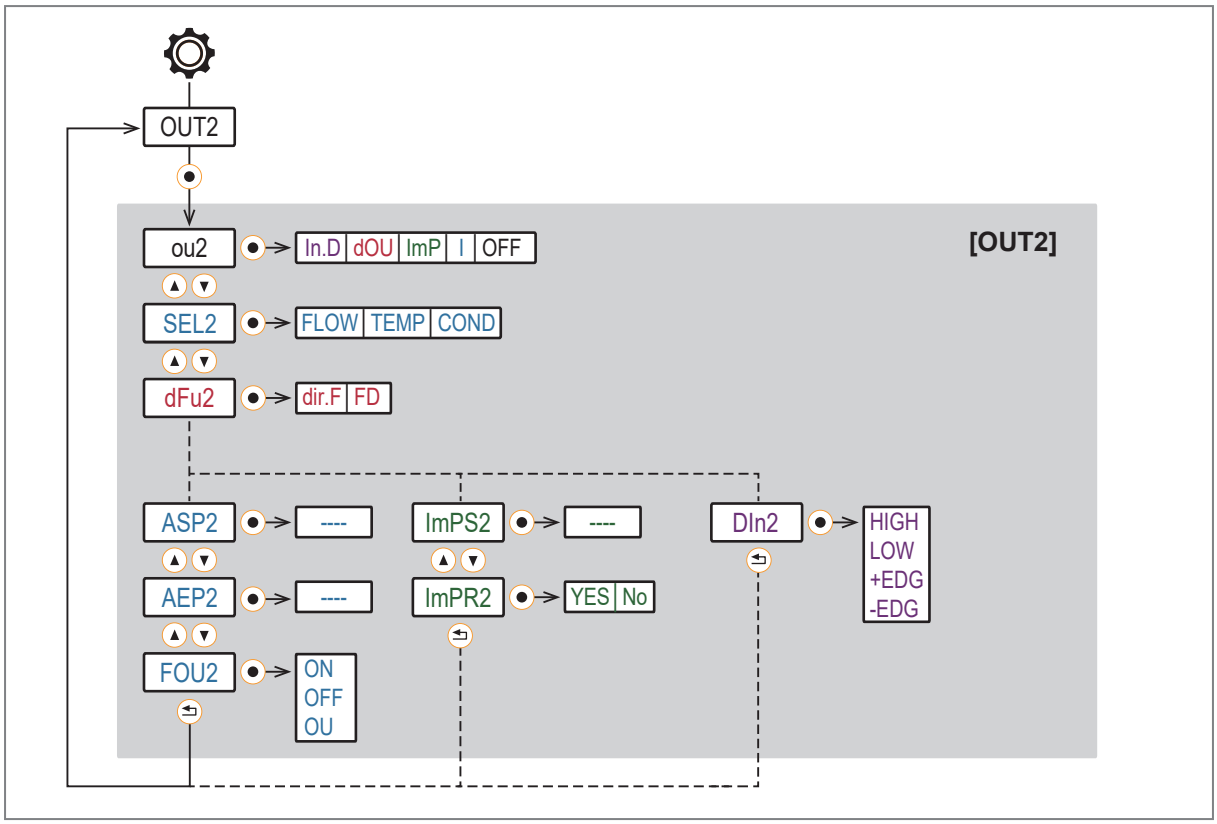
The displayed parameters change when the factory setting is changed. The following menu displays show the maximum available parameters.

Output 1 menu [OUT1]:



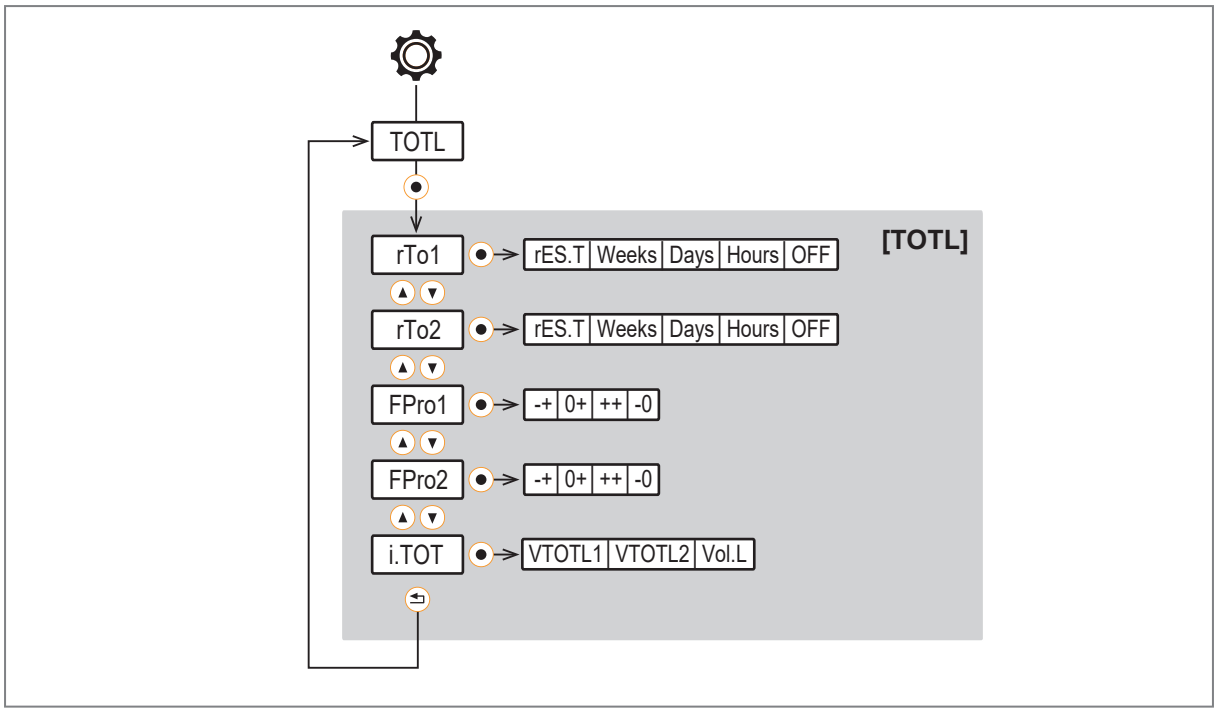
Parameter	Explanation
ou1	Output function for output OUT1
dOU	Diagnostic function
ImP	Totaliser function
OFF	Output off
ImPS1	Pulse value (= flow value at which 1 pulse is provided)
ImPR1	Totaliser function: pulse signal (ImPR1 = YES) or switching signal (ImPR1 = NO)
dFux	Diagnostic switching signal for flow: flow direction (= dir.F) or fluid detection (= FD)

Output 2 menu [OUT2]:



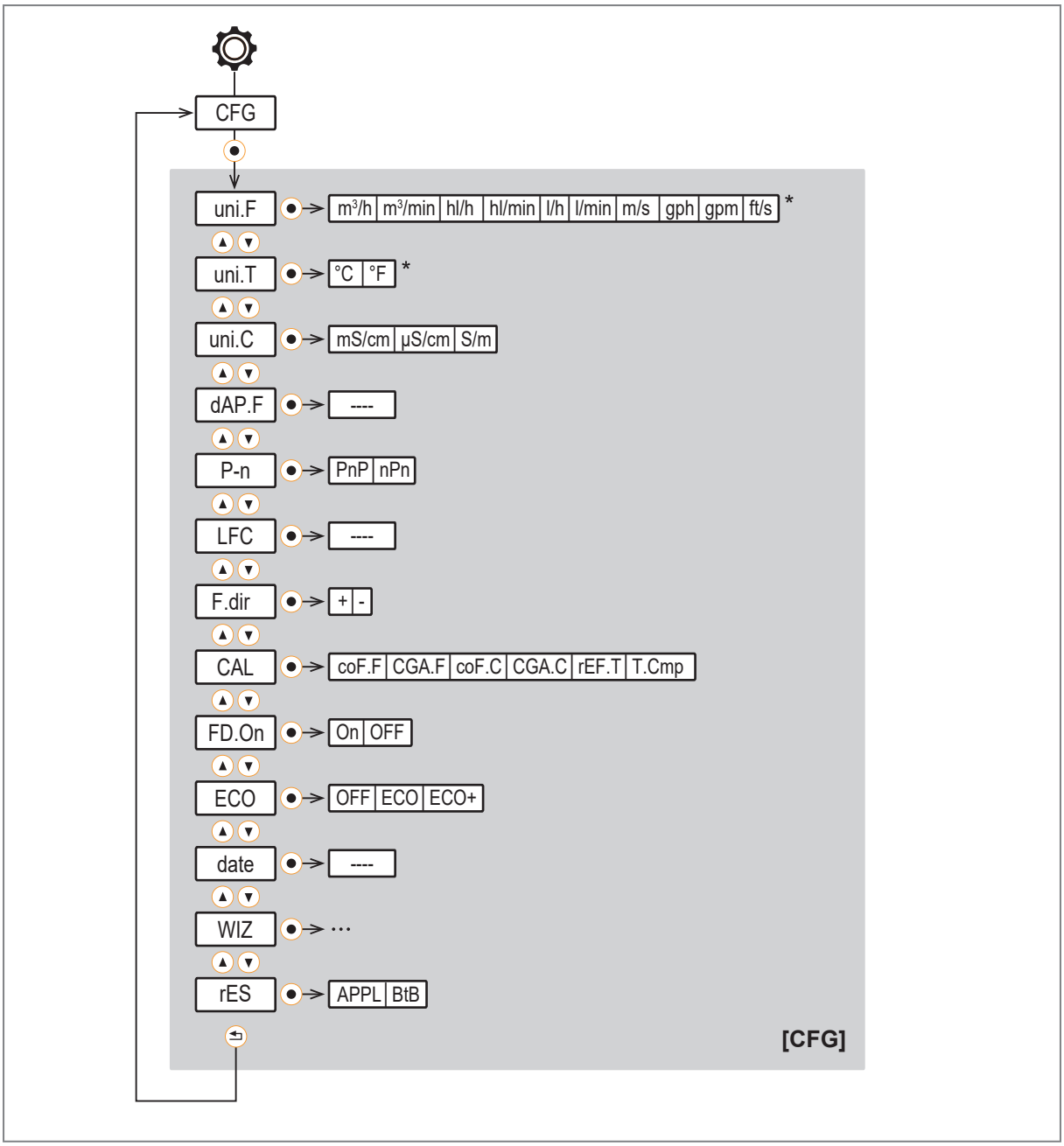
Parameter	Explanation
ou2	Output function for output OUT2
In.D	Totaliser reset via external signal
dOU	Diagnostic function
ImP	Totaliser function
I	Analogue function
OFF	Output off
SEL2	Process value for output OUT2
dFux	Diagnostic switching signal for flow: flow direction (= dir.F) or fluid detection (= FD)
ASP2	Analogue start point for OUT2 = process value at which the output signal is 4 mA.
AEP2	Analogue end point for OUT2 = process value at which the output signal is 20 mA.
ImPS2	Pulse value (= flow value at which 1 pulse is provided)
ImPR2	Totaliser function: pulse signal (ImPR2 = YES) or switching signal (ImPR2 = NO)
DIn2	Reset signal for external totaliser reset
FOU2	Behaviour of output OUT2 in case of error

Totaliser menu [TOTL]:



Parameter	Explanation
rTox	Setting for the totaliser reset: Manual reset (= rES.T), time-controlled reset (= weeks, days, hours) or reset via overflow (= OFF)
FProx	Counting method of the totaliser: consideration of the direction of flow
i.TOT	Indication of totaliser values

Basic settings menu [CFG]:

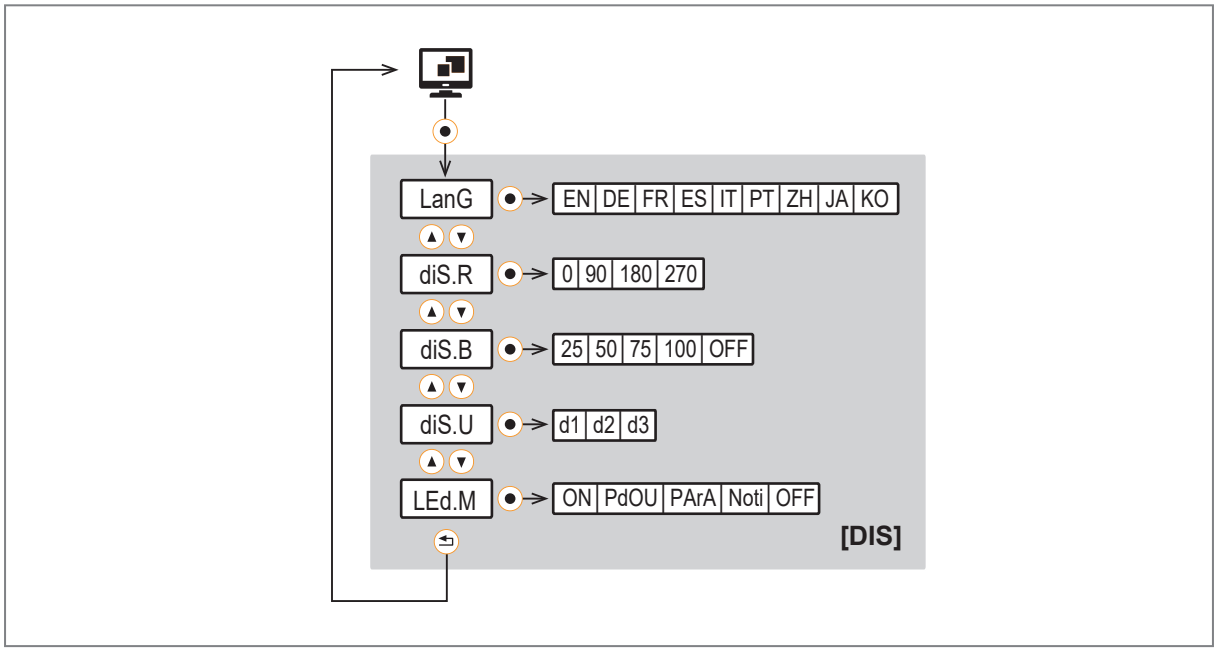


* The options depend on the device type, see technical data at documentation.ifm.com.

Parameter	Explanation
uni.F	Standard unit of measurement for flow
uni.T	Standard unit of measurement for temperature
uni.C	Standard unit of measurement for conductivity
dAP.F	Damping constant in seconds for flow (63 % rise time τ)
P-n	Output polarity for the switching outputs
LFC	Low flow cut-off
Fdir	Direction of flow
CAL	Calibration: zero-point calibration for flow and conductivity (coF.x); measurement characteristic for flow and conductivity (CGA.x); reference temperature (rEF.T) and constant temperature coefficient (T.Cmp) for conductivity.

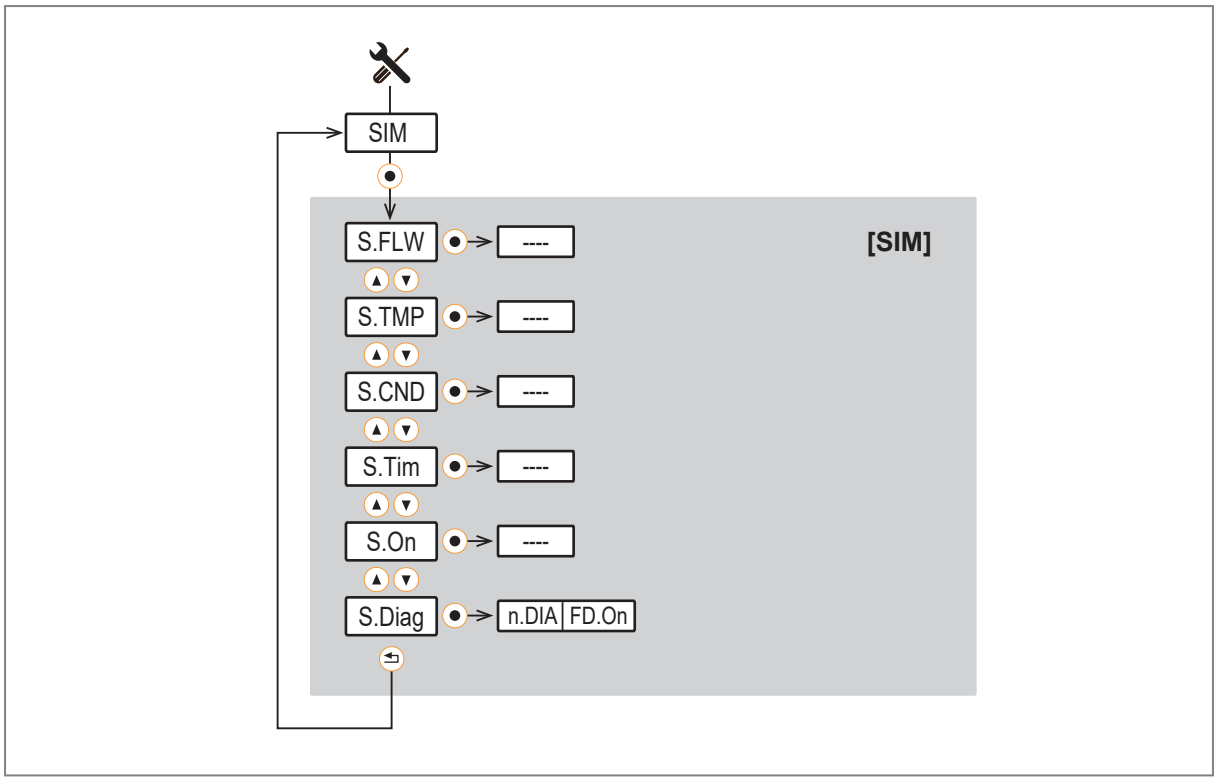
Parameter	Explanation
FD.On	Activate or deactivate fluid detection indication via the operating status LED. If [On] is set, the LED flashes red if no fluid is detected.
ECO	Energy-saving mode [ECO] or [ECO+] or energy-saving mode [OFF]. Setting options for [ECO] and [ECO+]: [E.dib] = display brightness and [E.LED] = LED ring. Additionally only for [ECO+]: [E.rAt] = measuring rate.
Date	Real-time clock (date/time)
WIZ	Activation of the guided installation
rES	Reset to factory settings (Back to Box) or reset of parameter settings (application reset).

Display menu [DIS]:



Parameter	Explanation
LanG	Language selection for the display
diS.R	Orientation of the display
diS.B	Brightness of the display
diS.U	Update rate of the display
LED.M	Setting of the operating status LED

Simulation [SIM] menu:



Parameter	Explanation
S.FLW	Simulated flow value in simulation mode
S.TMP	Simulated temperature value in simulation mode
S.CND	Simulated conductivity value in simulation mode
S.Tim	Duration of the simulation in minutes
S.On	Starts the simulation mode
S.Diag	No diagnostic case simulated (= n.DIA); no medium in the measuring tube (= FD.On)

9 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.

9.1 Guided installation via an installation wizard

New unboxed and factory reset devices – setup via main menu. When changing from process value display to main menu you will be given the option to use the guided installation wizard (if the device has been set up using IO-Link this option is no longer available).

▶ Select [Yes] or [No].

▷ If [Yes] is selected, parameters, questions and instructions appear in succession. Use the [▲] and [▼] keys to choose from the available options and the [●] key to confirm the selection.

▷ If [No] is selected, the main menu appears and the sensor functions according to the factory settings. If necessary, change the parameter settings, see chapter Parameter setting.

The guided installation can be called up again at any time via the parameter [CFG] > [WIZ].

After the message that the guided installation is completed, you are asked whether you want to start the measurement.

▶ Select [Yes], [No] or [Info].

▷ If [Yes] is selected, the installation process is completed.

▷ If [No] is selected, individual parameters can be accessed and modified again, or the guided installation can be restarted from the beginning using the [Restart wizard] command.

▷ If [Info] is selected, the device displays the previously set device configuration.

10 Parameter setting

Parameter setting can be carried out via the IO-Link interface or via the operating elements on the unit.

Parameters can be set before installation or during operation.

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

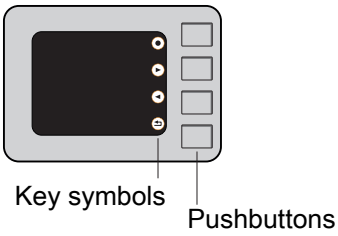
▶ Ensure that there will be no malfunctions in your plant.

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.

Depending on the parameter setting, the parameters available in the menu may change.

10.1 Parameter setting via the unit keys

Parameters are set on the device using capacitive pushbuttons that are operated by pressing gently on them with a finger.



The key symbols on the display show the function of the corresponding device key and may differ in the process value display and the individual menus.

Parameter setting process in general:

▶ Set parameters according to the following table:

Intention	Action
Change from the process value display to the main menu	1. Press any key to make the key symbols appear on the display. 2. ● *
Change from main menu to submenu / other display screens	1. Press ► to reach a symbol, e.g. 🔧. 2. ●
Select the required parameter / the required display screen	▲ or ▼
Change to the setting mode / change to lower-level display screens	●
Modify the parameter value	▲ or ▼
Apply the set parameter	●
Exit parameter setting without saving	← or [Back] in the device menu
Return to the next higher menu level (repeat several times to reach process value display)	← or [Back] in the device menu
Return to the process value display	> 30 seconds (timeout)

Tab. 12: Function of the device keys

* Guided installation is offered for initial set-up (→ Guided installation via an installation wizard 34).

10.2 Parameter setting via IO-Link

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.

10.3 Output configuration

10.3.1 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 🗋 47).

- [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.

For measured values outside the display range or in case of an error, messages are displayed (cr.UL, UL, OL, cr.OL, Err).

The analogue signal in case of a fault can be set via the parameter FOU (→ Error behaviour of the analogue output 🗋 45).

The analogue signal can be stabilised by setting the damping time dAP.F (→ Damping 🗋 46).

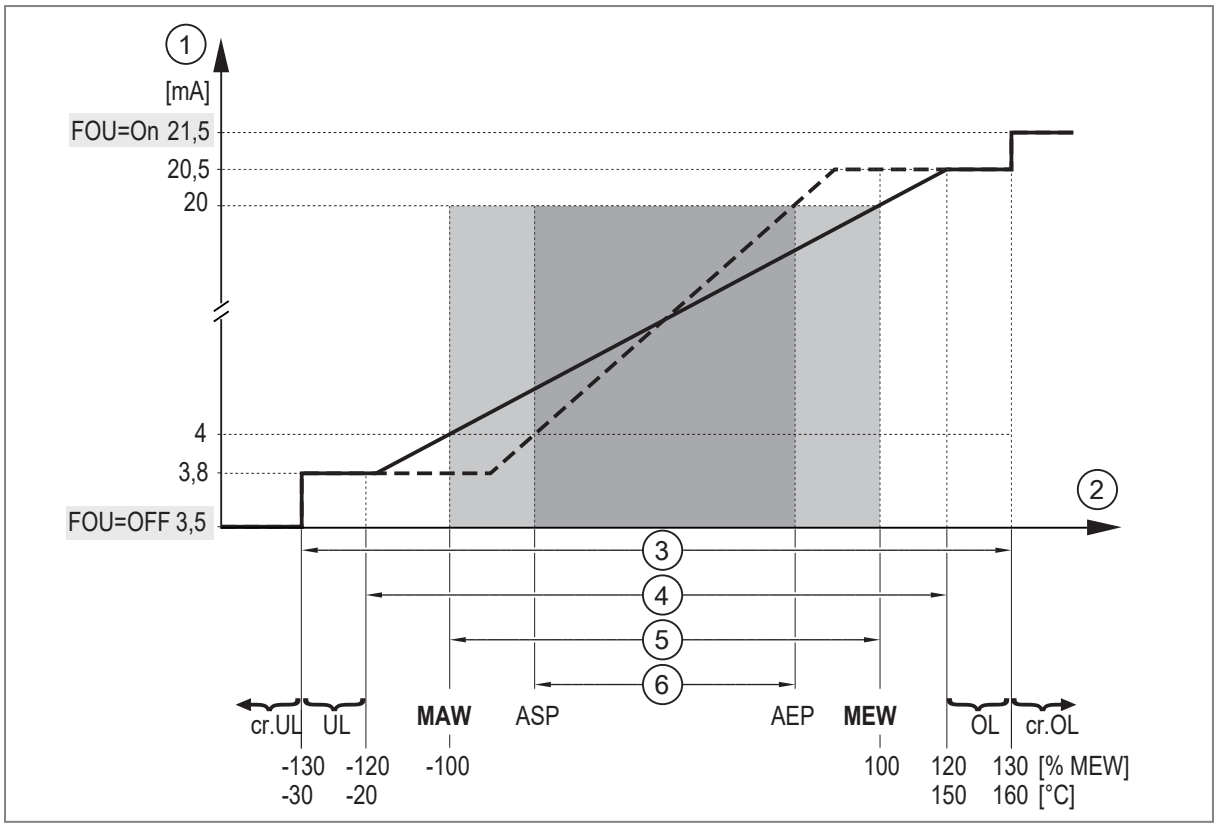


Fig. 16: Characteristics of the analogue output according to the standard IEC 60947-5-7

1: Analogue signal
2: Measured value
3: Detection range
4: Display range
5: Measuring range
6: Scaled measuring range

MAW: Initial value of the measuring range
MEW: Final value of the measuring range
ASP: Analogue start point
AEP: Analogue end point
UL: Below the display range
cr.UL: Below the detection range
OL: Above the display range
cr.OL: Above the detection range

10.3.1.1 Parameter setting via unit keys: Analogue signal

✓ The standard unit of measurement is selected: ⚙ [Settings] > [CFG] > [uni.F].

▶ Go to ⚙ menu [Settings] > [OUT2] to configure output OUT2.

▶ Select [ou2] and set the function: [I] (analogue signal 4...20 mA.).

▶ Select [SEL2] and set the process value: [FLOW], [TEMP] or [COND].

▶ Select [ASP2] and set the measurement value at which the output signal is 4 mA.

▶ Select [AEP2] and set the measurement value at which the output signal is 20 mA.

10.3.2 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 🗋 38)
- no medium detected (→ Switching signal for fluid detection 🗋 38)

10.3.2.1 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 (→ 🗋 47).

The flow direction that is currently indicated as positive can be viewed on the display (→ Operating and display elements 🗋 25).

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 (→ 🗋 46).

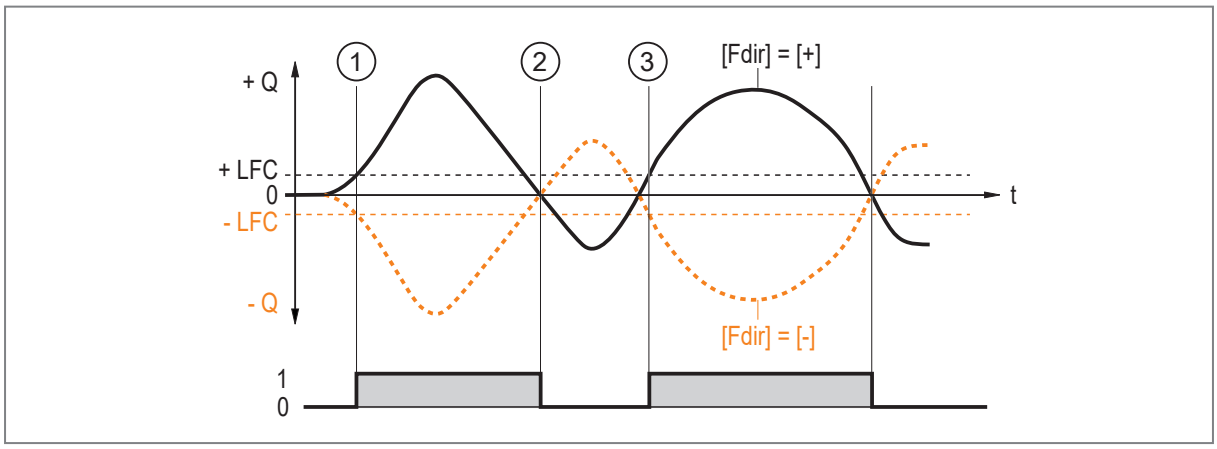


Fig. 17: Monitoring of the flow direction by switching signals

+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

Parameter setting via unit keys: switching signal for flow direction

▶ Go to ⚙ menu [Settings] > [OUTx].

▶ Select [oux] and set [dOU].

▶ Select [dFU] and set [dir.F].

10.3.2.2 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.

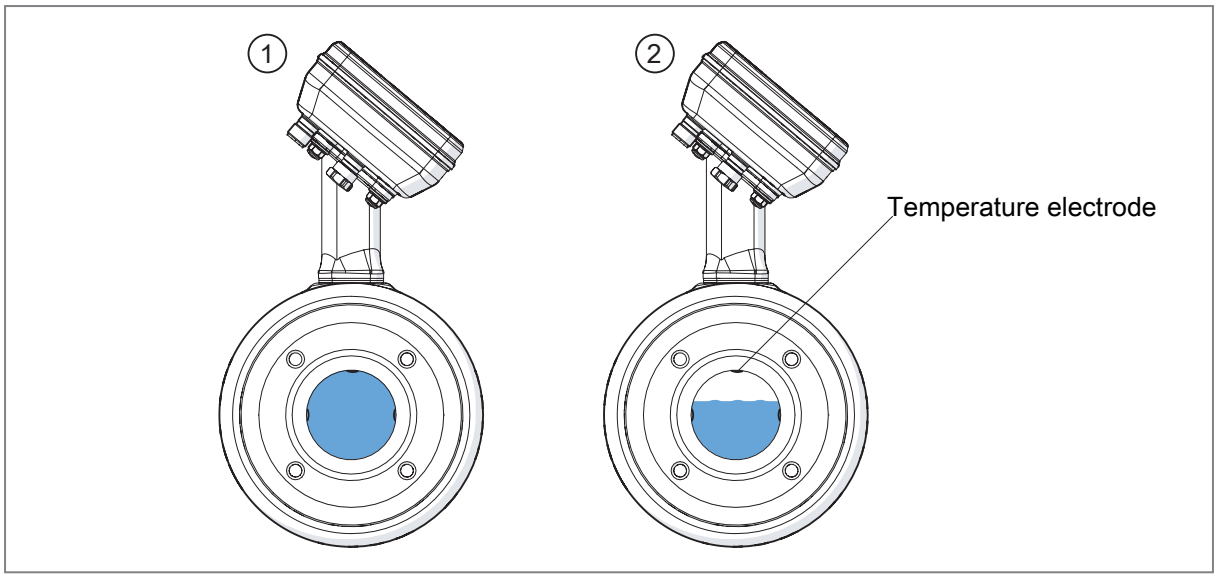


Fig. 18: Fluid detection

1: Medium detected
2: Medium not detected

Parameter setting via the device keys: Switching signal for fluid detection

▶ Go to ⚙ menu [Settings] > [OUTx].

▶ Select [oux] and set [dOU].

▶ Select [dFU] and set [FD].

▶ Go to ⚙ menu [Settings] > [CFG].

▶ Select [FD.On] and set [On].

10.3.3 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 both on the display and 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 🗋 52).
- 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. (→ Read totaliser values 🗋 58)

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 (→ 🗋 40).

→ Pulse signal totaliser (→ 🗋 40).

10.3.3.1 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 (→ 🗋 52).

The totaliser reset for the totalisers VTOTL1 and VTOTL2 can be set via the parameter [rTo1] or [rTo2]. When the totaliser has been reset, metering starts again.

- [rTox] = OFF:
  Automatic reset of totaliser switched off.
  A reset is done manually or in case of overflow of the display (>999.99 m³).
- [rTox] = …h/d/w (hours/days/weeks):
  Automatic reset of the totaliser after the set time.
  - If totaliser VTOTL1 reaches the volumetric flow quantity [ImPS] 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 [ImPS]. Its count is not taken into account for the switching and pulse signals.

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

See also: Totaliser reset (→ 🗋 51).

Parameter setting via unit keys: Switching signal totaliser

✓ The standard unit of measurement is selected: ⚙ [Settings] > [CFG] > [uni.F].

▶ Go to ⚙ menu [Settings] > [OUTx] to configure output OUTx.

▶ Select [oux] and set [ImP].

▶ Select [ImPSx] and set the volumetric flow quantity at which the output switches.

- Press ▲ or ▼ to select the setting range.
- Briefly press ● to confirm the setting range.
- Press ▲ or ▼ to set the requested numeric value.
- Briefly press ● to apply the value.

▶ Select [ImPRx] and set [No].

10.3.3.2 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 (→ 52).

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
65	4 ml
80	5 ml
100	9 ml
125	13 ml
150	38 ml

Tab. 13: Lower setting range for [ImPS1] by device

Parameter setting via unit keys: Pulse signal totaliser

✓ The standard unit of measurement is selected: ⚙ [Settings] > [CFG] > [uni.F].

▶ Go to ⚙ menu [Settings] > [OUTx] to configure output OUTx.

▶ Select [oux] and set [ImP].

▶ Select [ImPSx] and set the volumetric flow quantity at which 1 pulse is provided (pulse value).

- Press ▲ or ▼ to select the setting range.
- Briefly press ● to confirm the setting range.
- Press ▲ or ▼ to set the requested numeric value.
- Briefly press ● to apply the value.

▶ Select [ImPRx] and set [Yes].

10.3.4 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.

The parameters for switching signal channels can only be set via the IO-Link interface.

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”.

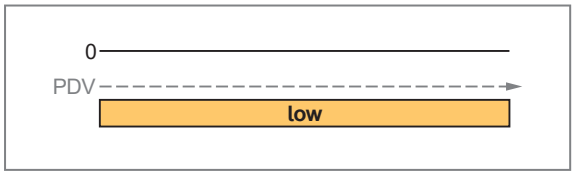


Fig. 19: [Deactivated] / [High active]

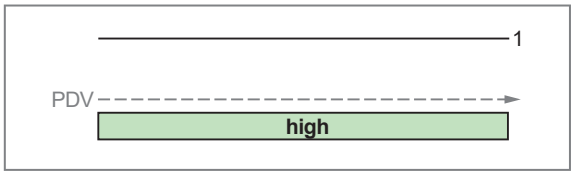


Fig. 20: [Deactivated] / [Low active]

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.

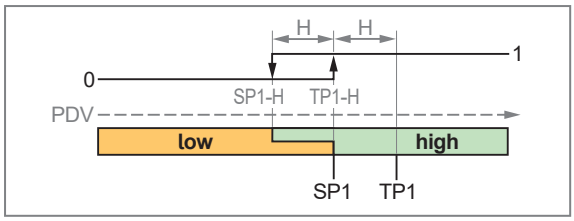


Fig. 21: [Single Point Mode] / [High active]

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

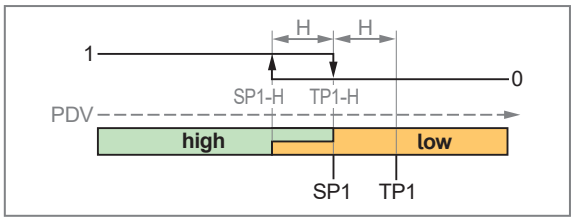


Fig. 22: [Single Point Mode] / [Low active]

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.

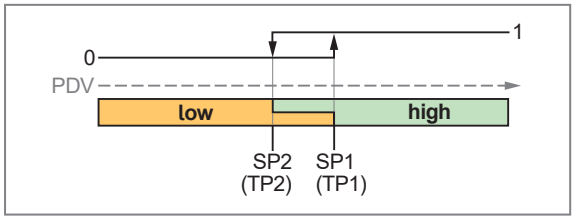


Fig. 23: [Two Point Mode] / [High active]

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

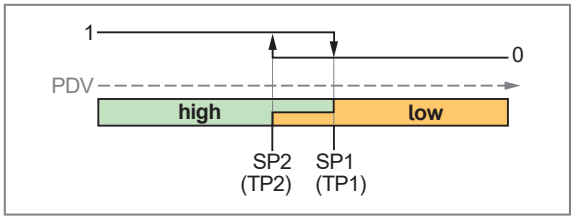


Fig. 24: [Two Point Mode] / [Low active]

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.

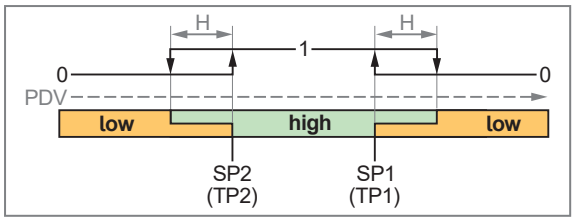


Fig. 25: [Window Mode] / [High active]

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

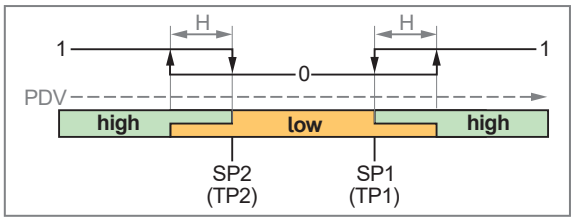


Fig. 26: [Window Mode] / [Low active]

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]

10.3.5 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”.

The parameters for switching signal channels can only be set via the IO-Link interface.

10.3.5.1 Parameter setting via unit keys: output off

▶ Go to menu [Settings] > [OUTx].

▶ Select [oux] and set [OFF].

10.4 Application configuration

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

10.4.1 Standard unit of measurement

A unit of measurement can be selected with which the process value is shown in the display by default. All further parameter settings are based on this unit.

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.

10.4.1.1 Parameter setting via unit keys: Standard unit of measurement

▶ Go to ⚙ menu [Settings] > [CFG].

▶ Select [uni.x] and set the unit of measurement.

10.4.2 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.

10.4.2.1 Parameter setting via the device keys: Process value OUT2

✓ The output function [I] = analogue signal is selected for OUT2: ⚙ > [OUT2] > [ou2].

▶ Go to ⚙ menu > [OUT2].

▶ Select [SEL2] and set the process value for output OUT2.

10.4.3 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.	
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.

10.4.3.1 Parameter setting via unit keys: Error behaviour of the outputs

✓ The output function [I] = analogue signal is selected for OUT2: ⚙ > [OUT2] > [ou2].

▶ Go to ⚙ menu > [OUT2].

▶ Select [FOU2] and set the error behaviour for output OUT2.

10.4.4 Damping

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

This concerns the switching outputs, the display 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

10.4.4.1 Parameter setting via unit keys: Measured value damping

▶ Go to ⚙ menu [Settings] > [CFG].

▶ Select [dAP.F] and set the damping time in seconds (τ value 63%).

10.4.5 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 process value for flow shown on the display
- 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.

10.4.5.1 Parameter setting via unit keys: low flow cut-off

▶ Go to ⚙ menu [Settings] > [CFG].

▶ Select [LFC] and set the limit below which a flow is evaluated as standstill.

10.4.6 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.

10.4.6.1 Parameter setting via unit keys: Output polarity

▶ Go to ⚙ menu [Settings] > [CFG].

▶ Select [P-n] and set [PnP] or [nPn].

10.4.7 Flow direction

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

- Consumed quantity monitoring
- Flow direction monitoring via switching signal

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 [Fdir]:

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

The flow direction that is currently indicated as positive can be viewed on the display (→ Operating and display elements 🗋 25).

See also: Switching signal for flow direction (→ 🗋 38).

10.4.7.1 Parameter setting via unit keys: flow direction

▶ Go to ⚙ menu [Settings] > [CFG].

▶ Select [Fdir] and set the direction of media flow.

10.4.8 Zero calibration

The combination of display 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 unit for [coF.F] and [coF.C] is the set standard unit of measurement for the process values flow and conductivity (→ Standard unit of measurement 🗋 44).

The internal zero point is shifted by the set value.

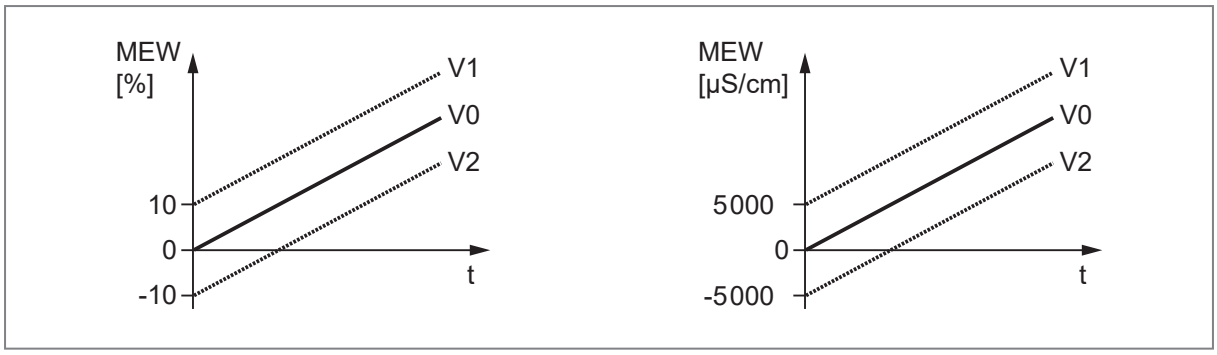


Fig. 27: Zero-point calibration (calibration offset)

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 µS/cm to +50000 µS/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 on the display or via the IO-Link interface and cannot be configured.

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

Reading the factory-set correction factor via the device keys:

▶ Go to ⓘ [Device information] menu and read [OF].

10.4.8.1 Parameter setting via unit keys: Zero calibration

▶ Go to ⚙ menu [Settings] > [CFG] > [CAL].

▶ Select [CoF] and set the correction factor.

10.4.9 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.

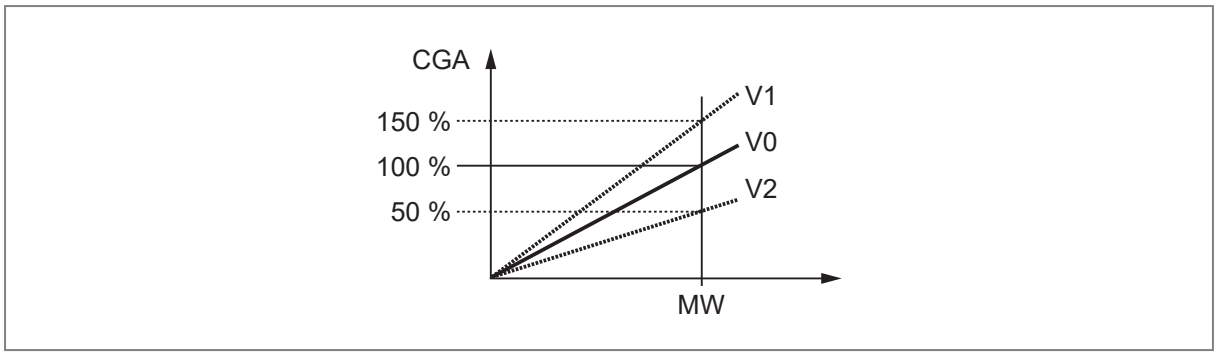


Fig. 28: Calibration of the measurement characteristic

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 on the display or via the IO-Link interface and cannot be configured.

The calibration factor is also listed in the calibration certificate.

Reading via device keys:

▶ Go to ⓘ [Device information] menu and read [CF].

10.4.9.1 Parameter setting via unit keys: calibration

▶ Go to ⚙ menu [Settings] > [CFG] > [CAL].

▶ Select [CGA] and set the slope of the measuring characteristic in per cent.

10.4.10 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 (→ 🗋 50)

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.

10.4.10.1 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 K = 3 % / 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.

10.4.10.2 Parameter setting via the device keys: Temperature compensation

▶ Go to ⚙ menu [Settings] > [CFG] > [CAL].

▶ Select [T.Cmp] and set the temperature coefficient of the medium.

▶ Select [rEF.T] and enter the standard temperature.

10.4.11 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, wither 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).

The device contains an internal energy storage unit so that, in the event of a power failure, the settings are saved for a transitional period. If the power supply is interrupted for too long, the display will show the 🕒 symbol and the message that the date and time are no longer set.

▶ Reset the date and time.

10.4.11.1 Parameter setting via the device keys: Date/time

▶ Go to ⚙ menu [Settings] > [CFG].

▶ Select [Date] and set the date and time:

- Date: year, month, day
- Clock format: 24h or 12h
- Time: hour, minute

▶ Change numerical value changes with [▼] or [▲].

▶ Confirm numerical value and jump to next setting with [●].

10.4.12 Energy-saving mode

The device can be operated in energy-saving mode.

The [ECO] parameter can be used to select between two energy-saving levels: [ECO] and [ECO+].

The energy-saving mode is switched off via the [OFF] setting.

Both energy-saving modes can be configured via the parameters [E.dib] and [E.LED]. In [ECO+] mode, the measuring rate can also be set.

[ECO] =	Setting options		
	Display brightness [E.dib]	**Operating status LED [E.LED]**	**Measuring rate [E.rAt]**
[ECO]	25 %, 50 %, 75 %, 100 %, OFF	On, OFF, Noti, PdOU, PArA See Operating status LED (→ 🗋 59)	---
[ECO+]			Current measuring rate*: 60… 900 s

Tab. 14: Setting options for the two energy-saving modes.
* The accuracy indicated in the data sheet applies to the factory settings. Changing the measuring rate in [ECO+] mode has a direct impact on the sensor's measurement accuracy.

If [ECO] = [OFF] is set, the general settings for Display brightness and Operating status LED (→ 🗋 59) apply.

10.4.12.1 Parameter setting via the device keys: Energy-saving mode

▶ Go to ⚙ menu [Settings] > [CFG].

▶ Select [ECO] and set the mode: [OFF], [ECO] or [ECO+].

▶ Select [E.dib] and set the display brightness: [25 %], [50 %], [75 %], [100 %], [OFF].

▶ Select [E.LED] and select the display options for the operating status LED: [On], [OFF], [Notification], [PArA], [PdOU].

Only if [ECO+] is selected

▶ Select [E.rAt] and set the measuring rate.

10.4.13 Totaliser reset

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

1. Manual reset
2. Time-controlled reset
3. Reset via external signal
4. Reset via overflow (maximum display range of 999,99 m^3 is reached).

Totaliser Vol.L cannot be reset.

10.4.13.1 Parameter setting via unit keys: Totaliser reset

1. Manual reset:

▶ Go to ⚙ menu [Settings] > [TOTL].

▶ Select [rTox] and set [rES.T].

▷ The totaliser is reset.

2. Time-controlled reset:

▶ Go to ⚙ menu [Settings] > [TOTL].

▶ Select [rTox], then set time in weeks (w), days (d) or hours (h).

▷ The totaliser is automatically reset after the set time.

3. Reset via external signal:

▶ Go to ⚙ menu [Settings] > [OUT2].

▶ Select [ou2] and set digital input: [In.D].

▶ Select [DIn2] and set the reset signal:

- [HIGH]: reset for high signal
- [LOW]: reset for low signal
- [+EDG]: reset for rising edge
- [–EDG]: reset for falling edge

The totaliser VTOTL1 is reset when receiving the reset signal via pin 2.

An external reset is only possible for totaliser VTOTL1.

4. Reset via overflow:

▶ Go to ⚙ menu [Settings] > [TOTL].

▶ Select [rTox] and set [OFF].

▷ The totaliser is reset as soon as the maximum display range is exceeded.

10.4.14 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 via the parameter [FProx]:

[FProx]	Counting method
0+	Negative volumetric flow values (against the marked flow direction) are not taken into account for totalling.
-0	Positive volumetric flow values (corresponding to the marked flow direction) are not taken into account for totalling.
-+	Negative flow values are subtracted from the consumed quantity.
++	All volumetric flow values are totalled irrespective of the volumetric flow direction.

Tab. 15: 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) (→ 🗋 39).

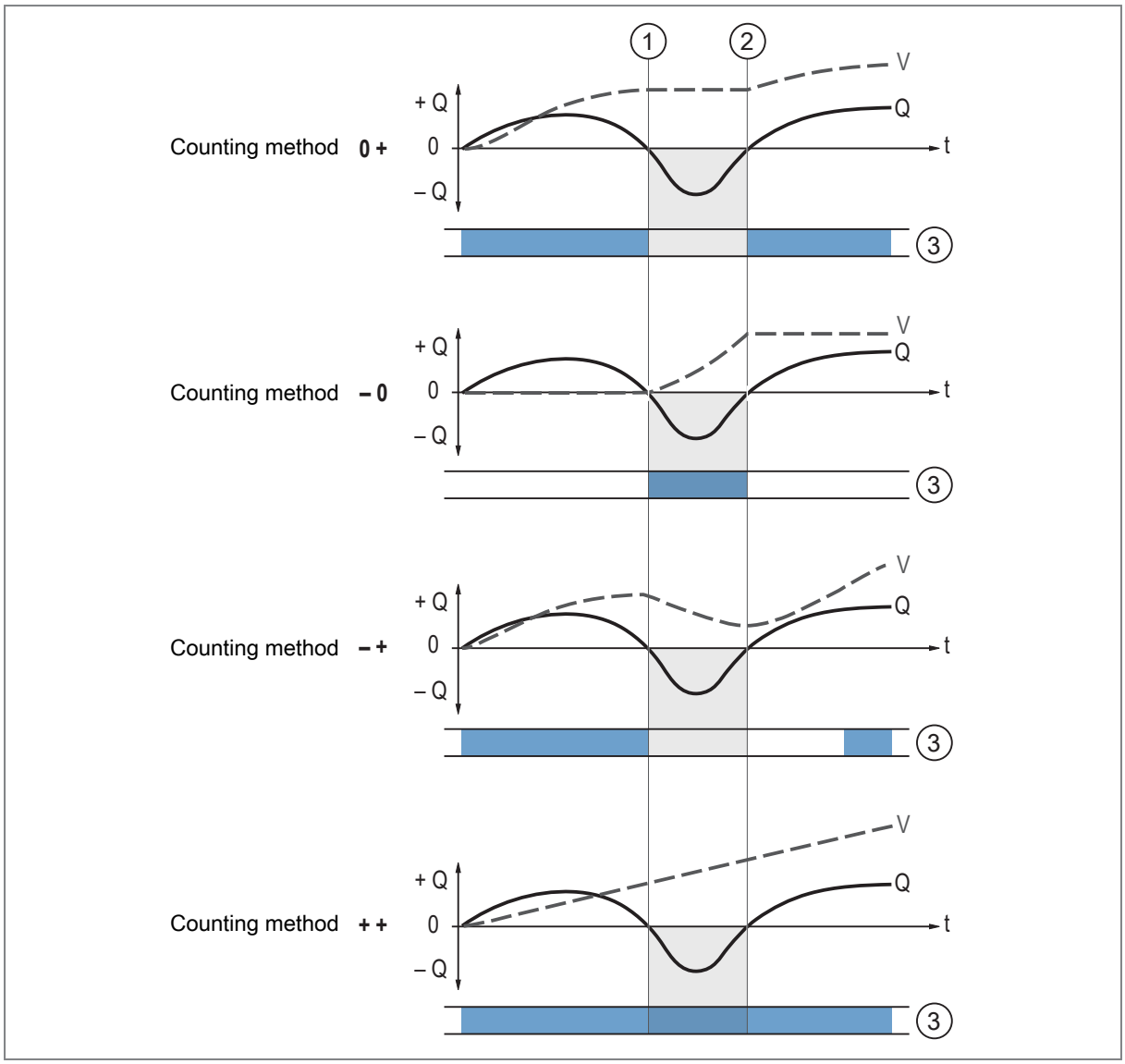


Fig. 29: Taking into account the flow direction when totalling the consumed quantity

+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 (→ 🗋 38).

10.4.14.1 Parameter setting via unit keys: counting method of the totalisers

▶ Go to ⚙ menu [Settings] > [TOTL].

▶ Select [FPro1] and set the counting method for totaliser VTOTL1.

▶ Select [FPro2] and set the counting method for totaliser VTOTL2.

10.4.15 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.

10.4.15.1 Resetting the device using device keys

▶ Go to ⚙ menu [Settings] > [CFG] > [rES].

▶ Select [APPL] or [BtB] and set [Yes].

Only if [BtB] is selected:

▶ Disconnect and reconnect the voltage supply.

▷ The device carries out a reboot.

10.5 Display settings

The presentation in the display can be adjusted via various parameters. The parameters described below are set as follows:

▶ Go to the 🖳 [Display] menu.

10.5.1 Display language

The display language can be set via the parameter [LanG].

Selectable languages:

- DE: German
- EN: English
- ES: Spanish
- FR: French
- IT: Italian
- JA: Japanese
- KO: Korean
- PT: Portuguese
- ZH: Chinese

10.5.1.1 Parameter setting via unit keys: display language

▶ Go to the [Display] menu.

▶ Select [LanG] and set the language.

10.5.2 Display rotation

Use the parameter [diS.R] to rotate the text in the display clockwise for better readability.

Selectable values:

- 0° (not rotated)
- 90°
- 180°
- 270°

10.5.2.1 Parameter setting via unit keys: display rotation

▶ Go to the [Display] menu.

▶ Select [diS.R] and set the display rotation.

10.5.3 Display brightness

The display brightness can be set via the parameter [diS.B].

Selectable values:

- 25%
- 50%
- 75%
- 100%
- OFF: The display is switched off in the operating mode.
  Display activation by pressing any key. After 30 s of inactivity, the display is switched off again.

In case of warnings or error messages and in case of optical localisation, the display will come back on even with the setting [OFF].

If the device measures a high internal temperature, the display brightness is automatically adjusted:
Internal temperature > 75 °C: brightness is reduced to 25%.
Internal temperature ≥ 90 °C: display is automatically switched off.

10.5.3.1 Parameter setting via unit keys: display brightness

▶ Go to the [Display] menu.

▶ Select [diS.B] and set the brightness of the display.

10.5.4 Display update rate

The update rate of the display can be set via the parameter [diS.U].

Selectable values:

- d1: fast
- d2: medium
- d3: slow

10.5.4.1 Parameter setting via unit keys: display update rate

▶ Go to the [Display] menu.

▶ Select [diS.U] and set the update rate.

10.5.5 Display layout

The standard display can be set via the parameter [diS.L].

This function is only available via the IO-Link interface or the wizard.

A maximum of four of the following display screens can be selected:

- Process value: current flow
- Process value: current consumed quantity (totaliser)
- Process value: current temperature
- Process value: current conductivity
- Displays the flow direction defined as positive (→ Flow direction 47)

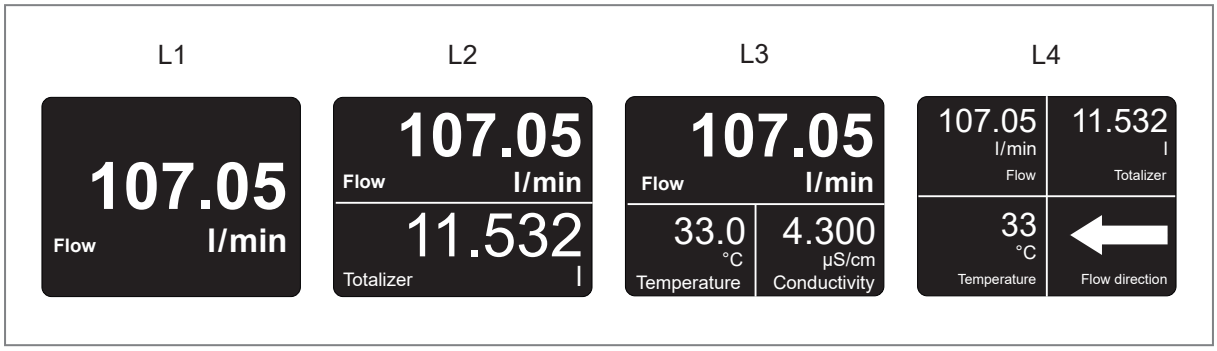


Fig. 30: Display layouts

10.5.5.1 Parameter setting via the device keys: Display layout

▶ Go to menu [Settings] > [CFG].

▶ Select [WIZ].

▶ Press [●] until the device requests that the display layout be set.

▶ Determine number of process values, main process value and other process values.

10.5.6 Display colour setting

This function is only available via the IO-Link interface.

The font colour in the display can be set via the parameter [coL.x].

- [coL.F]: font colour for flow
- [coL.T]: font colour for temperature
- [coL.C]: font colour for conductivity

The colour can be defined individually for each process value using the following parameter settings.

The font colour for the totaliser cannot be set.

Permanent colour selection

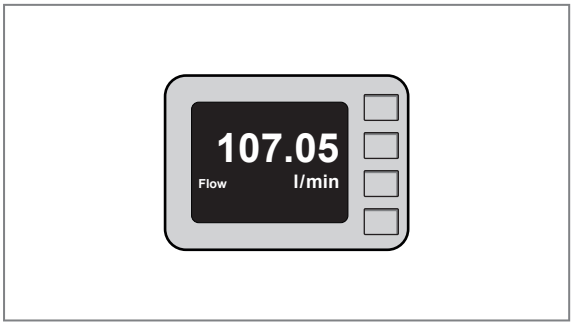


Fig. 31: Example: [coL.F] = [bk/wh]

The font colour is permanently white on a black background:

[coL.F] =	[coL.T] =	[coL.C] =	Font colour
[bk/wh]			White

Colour change depending on freely definable limit values

If the measured value is within the limits of [cFL.x]…[cFH.x], the following applies depending on the parameter selection:

[coL.F] =	[coL.T] =	[coL.C] =	Font colour
[r-cF]			red
[G-cF]			green

Example:

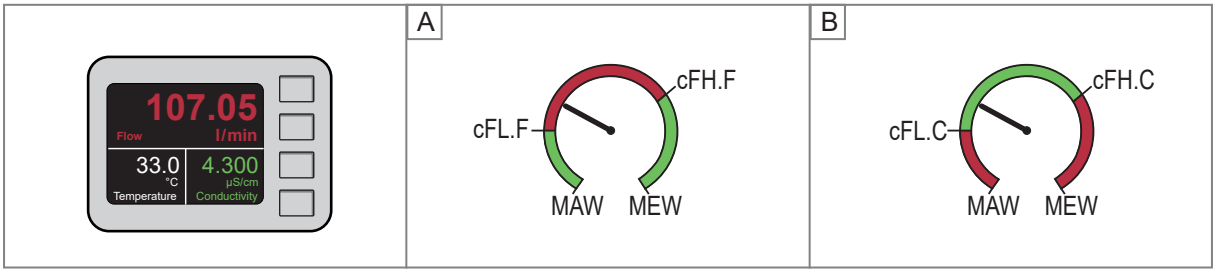


Fig. 32: Temperature [coL.T] = [bk/wh]; A: Flow [coL.F] = [r-cF]; B: Conductivity [coL.C] = [G-cF]

The limit values of the window range can be freely selected within the measuring range and are independent of the output function:

- Flow: [cFL.F] = lower limit value; [cFH.F] = upper limit value
- Temperature: [cFL.T] = lower limit value; [cFH.T] = upper limit value
- Conductivity: [cFL.C] = lower limit value; [cFH.C] = upper limit value

10.6 Diagnostics

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

- The device shows a message on the display (→ Troubleshooting 🗋 65).
- The device indicates a warning or error by changing the colour of the LED ring (→ Operating status LED 🗋 59).
- The device provides diagnostic messages as a switching signal or via the IO-Link interface (→ Switching signal diagnostics 🗋 37).

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

- Read totaliser values (→ 🗋 58)
- Memory (→ 🗋 58)
- Operating hours counter (→ 🗋 59)

10.6.1 Read totaliser values

For the totalisers VTOTL1 and VTOTL2 and the lifetime totaliser Vol.L, the following values can be read at any time on the display or 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)

10.6.1.1 Reading via unit keys: totaliser values

▶ Go to ⚙ menu [Settings] > [TOTL].

▶ Open the [i.TOT].

▶ Select [Vol.x] and read consumption values.

10.6.2 Memory

The unit stores the maximum and minimum measured process values.

The current value can be read from the unit's display or 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.

10.6.2.1 Parameter setting via the device keys: memory

Show memory:

▶ Go to 🖵 menu [Diagnostics].

▶ Select [Lo.x] or [Hi.x] to show the highest or lowest process value measured.

Clear memory:

▶ Go to 🖵 menu [Diagnostics].

▶ [Lo.x] or [Hi.x] > select [Reset] and [Yes].

▷ The memory for process value x (F = flow, T = temperature or C = conductivity) is reset.

10.6.3 Operating hours counter

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

The current value can be read from the unit's display or via the IO-Link interface.

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

10.6.3.1 Read operating hours on device

▶ Go to menu [Diagnostics].

▶ Select [Operating hours] and read value.

10.6.4 Internal temperature

The sensor measures the internal temperature.

The current value can be read from the unit's display or via the IO-Link interface.

A high internal temperature is signalled by the operating status LED ring turning red.

If the device measures a high internal temperature, the display brightness is automatically adjusted:
Internal temperature > 75 °C: brightness is reduced to 25%.
Internal temperature ≥ 90 °C: display is automatically switched off.

10.6.4.1 Read internal temperature on device

▶ Go to menu [Diagnostics].

▶ Select [Internal temperature] and read value.

10.6.5 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. 16: 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 (→ 65)
- Error messages (→ 66)

The function and colour of the operating status LED can be changed:

LED mode	Operating status LED
On	The LED ring is permanently on. Green in normal operation, blue or red for diagnostics.

LED mode	Operating status LED
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).

*can only be set via IO-Link

10.6.5.1 Parameter setting via unit keys: operating status LED

▶ Go to the [Display] menu.

▶ Select [LED.M] and set operating status LED.

10.6.6 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 (→ Date/time 50).

The last 20 events can be read on the device display.

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) 62).

10.6.6.1 Read events on device

▶ Go to menu [Event History] and read the events.

10.7 Service functions

10.7.1 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

10.7.1.1 Reading via the device keys: Device information

▶ Go to ⓘ [Device information] menu and read the device information.

10.7.2 Configuration

All the device settings can be shown on the device display via the Service menu. The parameters, currently set values and original factory settings are shown in a list.

10.7.2.1 Read settings on the device.

▶ Go to 🔧 menu [Service] > [O.CFG].

▶ Select [show configured settings].

▷ Only the parameters that have been changed from the factory settings are listed.

- or –

▶ Select [All settings].

▷ All parameters are listed.

10.7.3 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]

10.7.3.1 Parameter setting via unit keys: simulation

▶ Go to 🔧 menu [Service] > [SIM].

▶ Select [S.FLW] and set the flow value to be simulated, [crUL], [UL], [OL], [crOL] or [NoData].

▶ Select [S.TMP] and set the temperature value to be simulated, [crUL], [UL], [OL], [crOL] or [NoData].

▶ Select [S.CND] and set the conductivity value to be simulated, [crUL], [UL], [OL], [crOL] or [NoData].

The parameters [crUL], [UL], [OL], [crOL] and [NoData] become visible only when the value is above or below the measuring range during throughput.

▶ Select [S.DIAG] and select settings:

- [n.DIA]: Device operating normally
- [FD.On]: No medium in the measuring pipe

▶ Select [S.Tim]and set the time of the simulation in minutes.

▶ Select [S.On] and set the function:

- [On]: The simulation starts. The values are simulated for the time set under [S.Tim]. Abort by pressing any key.
- [OFF]: The simulation is not active.

10.7.4 Documents

The device display can show QR codes which link directly to further product information on the website www.ifm.com.

This function is not available via the IO-Link interface.

10.7.4.1 Read QR codes on device

▶ Go to the [Service] menu > [QR].

▶ Press the keys [►] and [◄] to show the desired QR code.

▶ Scan the QR-code using a smartphone camera and open the link that appears on the smartphone.

10.7.5 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.

10.7.6 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.

10.7.7 Lock / unlock

The unit can be locked electronically to prevent unauthorised setting.

This lock prevents the settings from being changed via the keys on the unit.

Factory setting: not locked.

10.7.7.1 Parameter setting via unit keys: lock / unlock

Locking:

▶ Make sure that the unit is in the normal operating mode.

▶ Press the ◂ and ▸ keys simultaneously for approx. 10 s until [menu locked] is displayed.

Unlocking:

▶ Make sure that the unit is in the normal operating mode.

▶ Press the ◂ and ▸ keys simultaneously for approx. 10 s until [menu unlocked] is displayed.

10.7.8 Guided installation (wizard)

The wizard can be used to help set the parameters via the device keys.

This guided installation will be offered on the display the first time the device is switched on (→ Guided installation via an installation wizard 🗋 34) and can be launched at any time after that via the [WIZ] parameter.

10.7.8.1 Guided installation via the device keys

▶ Go to ⚙ menu [Settings] > [CFG].

▶ Select [WIZ].

▶ Use the keys to set the parameters displayed one after the other and confirm each with [●].

▷ Once all the requested parameters have been set, the installation is completed with a success message and the device changes to the process value display.

The settings can be shown on the device display: Configuration (→ 🗋 61).

11 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.

12 Troubleshooting

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

Warnings and error states are displayed even if the display is switched off. Error indications are also available via IO-Link.

The status signals are classified according to NAMUR recommendation NE107.

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

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

- Switching signals when using the diagnostic function (→ Switching signal diagnostics 37).
- Colour signals of the operating status LED (→ Operating status LED 59).

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.

Additional diagnostic functions are available via IO-Link → IO-Link interface description at documentation.ifm.com.

12.1 Warning messages

Status*	Display		Operating status LED	IO-Link event	Problem	Corrective measures
	Title line	Process value display				
2	Temperature overrun	Current valid process values	red flashing (1 Hz)	0x4210	Admissible device temperature exceeded.	▶ Eliminate heat sources.
2	Internal temperature	Current valid process values	red flashing (1 Hz)	0x4220	Admissible device temperature not reached.	▶ Insulate device.
3	Alternately: ”Simulation active” / “Application Tag”	Simulated process value	depending on the simulated value	0x8C01	Simulation active.	▶ Stop simulation.
2	Over limit	OL	red flashing (1 Hz)	0x8C10	Process value above the valid range.	▶ Check the application.
2	Under limit	UL	red flashing (1 Hz)	0x8C30	Process value below the valid range.	▶ Check the application.
1	Interface disturbed	Current valid process values	blue	0x8CE0	Local user interface disturbed.	▶ Check the device’s user interface.
2	No media detected	0	red flashing (1 Hz)	0x8CC1	Measuring tube not sufficiently filled or medium has too low conductivity.	▶ Check the application.

Tab. 17: 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.

12.2 Error messages

Status*	Display		Operating status LED	IO-Link event	Problem	Corrective measures
	Title line	Process value display				
4	Device error	----	red	0x5000	Hardware error in the device / device is defective.	▶ Replace the device.
3	Component malfunction	All process values that are still valid. The defective process value is displayed as “Err”.	red flashing (1 Hz)	0x5010	A process value is defective.	▶ Repair or replace the device.
3	Parameter error	PArA	red	0x6320	Parameter error	▶ Perform a back-to-box reset.
3	Short circuit	SC OUTx	red flashing (1 Hz)	0x7710	Short circuit	▶ Check device wiring.
3	Critical limit	cr.OL	red flashing (1 Hz)	0x8C20	Measurement range exceeded	▶ Check the application.
3	Critical limit	cr.UL	red flashing (1 Hz)	0x8C20	Measurement range underrun	▶ Check the application.

Tab. 18: Warning messages. * Status: 3 = function test; 4 = failure

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

13 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.

13.1 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:

▶ Before cleaning the device, activate the button lock (→ Lock / unlock 🗋 63).

If the buttons are not locked, unintentional button pushes can occur due to temperature changes or pressure being applied by a high-pressure cleaner. In extreme cases, it may take up to one minute for the button to be actively reset by the software.

▶ 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.

13.2 Replacing the electronic unit

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

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

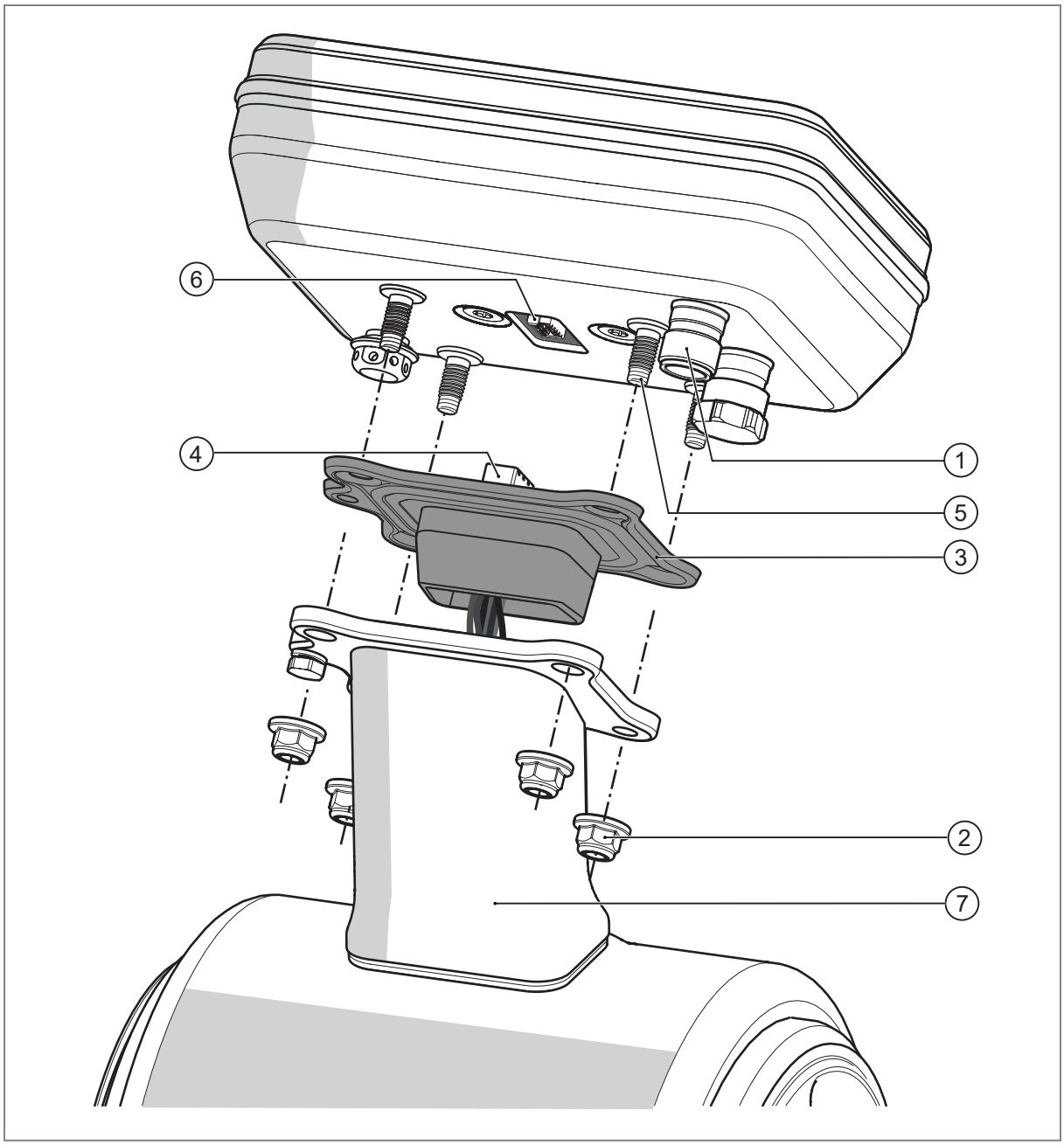


Fig. 33: Mounting / removal

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.

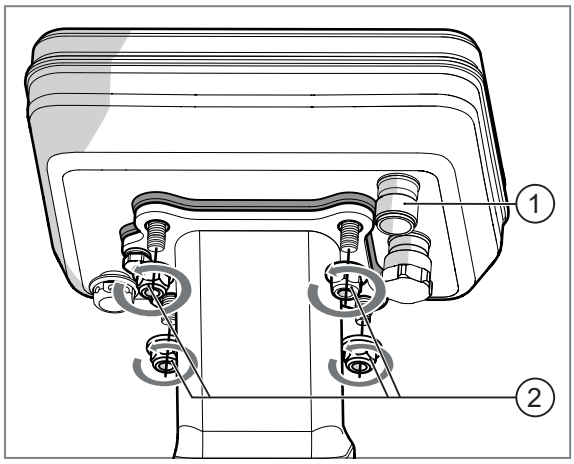


Fig. 34: Unscrew the defective electronic unit.

▶ Loosen the connector for the electrical connection (1).

▶ Loosen the four M5 hexagonal nuts (2) at the bottom of the electronic unit.

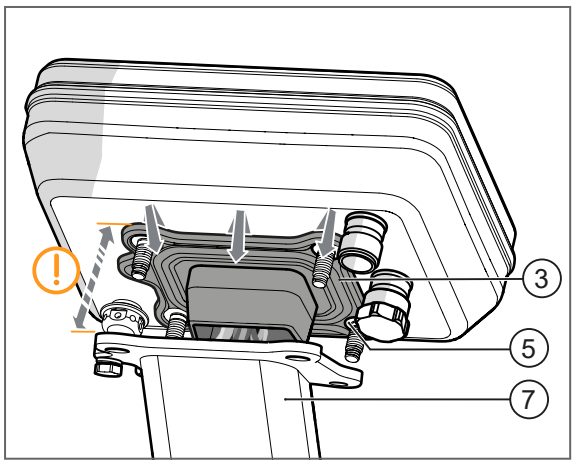


Fig. 35: Remove seal.

▶ 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.

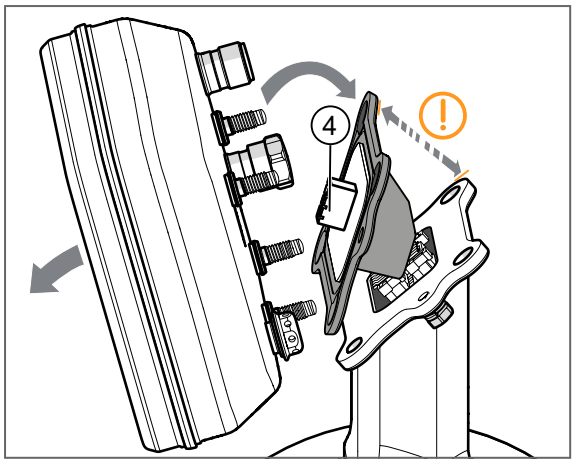


Fig. 36: Remove the defective electronic unit.

- ▶ 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.

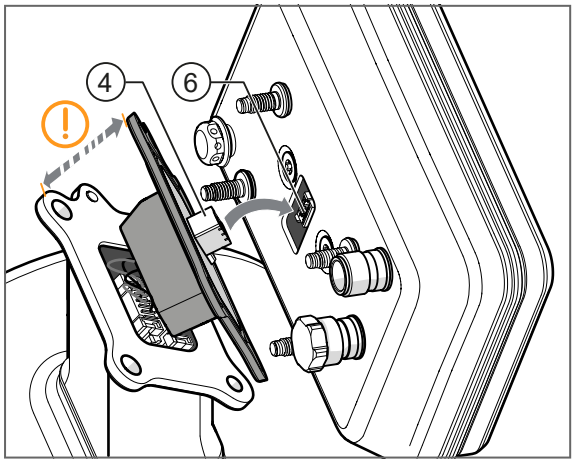


Fig. 37: Connect the new electronic unit.

- ▶ 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.

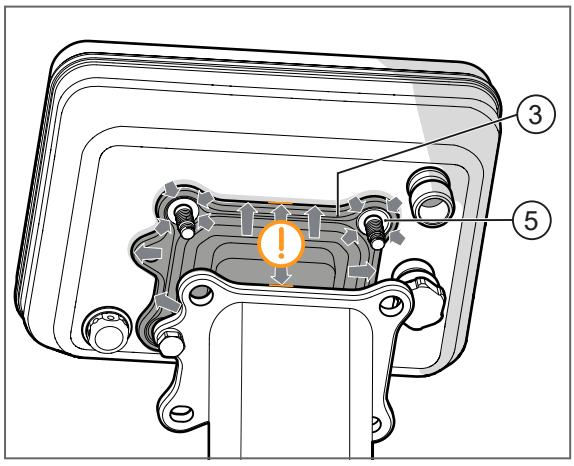


Fig. 38: Install the seal.

- ▶ 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.

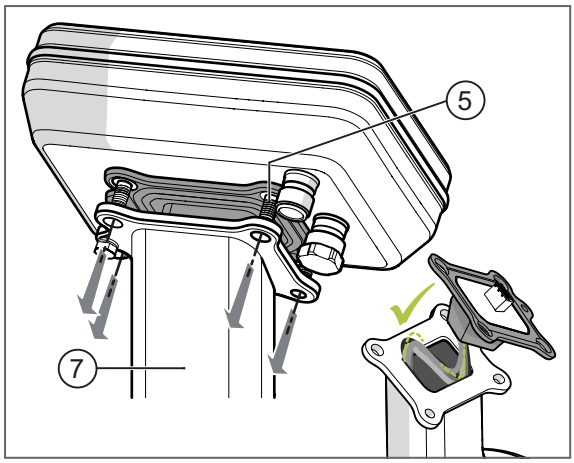


Fig. 39: Install the new electronic unit.

▶ 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.

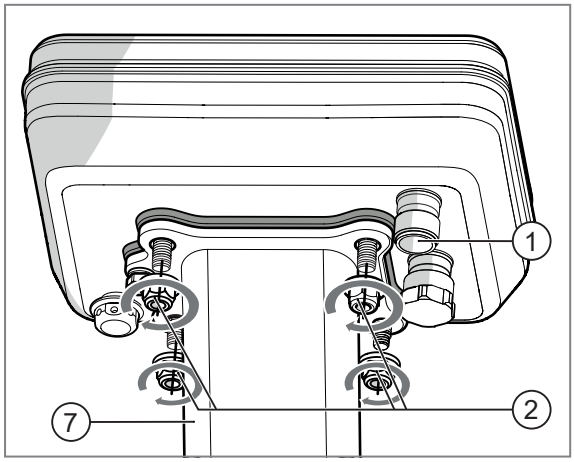


Fig. 40: Screw on the new electronic unit.

▶ 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.

13.3 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.

14 Factory settings

General settings:

Parameter	Factory setting	
uni.F	SMFxx0: m³/h	SMFxx1: gpm
uni.T	SMFxx0: °C	SMFxx1: °F
uni.C	µS/cm	
FPro1	0+	
FPro2	0+	
rTo1	OFF	
rTo2	OFF	
dAP.F	0.6	
P-n	PnP	
LFC	SMF320: 0.3 m³/h SMF420: 0.6 m³/h SMF520: 1.2 m³/h SMF620: 1.8 m³/h SMF720: 3.0 m³/h SMF820: 4.5 m³/h SMF920: 6.0 m³/h	SMF321: 1.4 gpm SMF421: 2.6 gpm SMF521: 5.5 gpm SMF621: 8.0 gpm SMF721: 13.0 gpm SMF821: 20.0 gpm SMF921: 26.0 gpm
F.dir	+	
coF.F	0	
CGA.F	100	
rEF.T	25 °C	
diS.R	0	
LanG	EN	
diS.L	L1	

Settings for OUT1:

Parameter	Factory setting	
ou1	ImP	
ImPS1	SMF320: 0.002 l SMF420: 0.002 l SMF520: 0.004 l SMF620: 0.005 l SMF720: 0.009 l SMF820: 0.013 l SMF920: 0.017 l	SMF321: 0.001 gallons SMF421: 0.001 gallons SMF521: 0.01 gallons SMF621: 0.01 gallons SMF721: 0.01 gallons SMF821: 0.01 gallons SMF921: 0.01 gallons
ImPR1	YES	
dFu	dir.F	

Settings for OUT2:

Parameter	Factory setting	
ou2	I / 4…20 mA	
SEL2	FLOW	
ASP2	SMFx20: 0 m³/h	SMFx21: 0 gpm

Parameter	Factory setting	
AEP2	SMF320: 11 m³/h SMF420: 18 m³/h SMF520: 30 m³/h SMF620: 45 m³/h SMF720: 70 m³/h SMF820: 110 m³/h SMF920: 160 m³/h	SMF321: 50 gpm SMF421: 80 gpm SMF521: 130 gpm SMF621: 200 gpm SMF721: 310 gpm SMF821: 485 gpm SMF921: 700 gpm
FOU2	OFF	
dFu	dir.F	
Dln2	+EDG	