



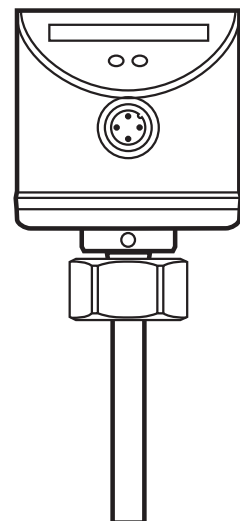
Operating instructions
Flow monitors

efector 300[®]

SI0556

UK

704656 / 01 08 / 2010












Contents

| | |
|-------------------------------------------------------------------|----|
| 1 Preliminary note..... | 3 |
| 1.1 Explanation of symbols..... | 3 |
| 2 Safety instructions | 3 |
| 3 Functions and features | 4 |
| 3.1 Application area | 4 |
| 3.2 Flow and temperature monitoring with output S1 | 4 |
| 3.3 Temperature monitoring with output S2..... | 4 |
| 4 Installation | 5 |
| 4.1 Installation location..... | 5 |
| 4.2 Sources of interference in the pipe system | 6 |
| 4.3. Mounting operation..... | 6 |
| 5 Electrical connection..... | 7 |
| 6 Operating and display elements | 7 |
| 7 Set-up and settings for water..... | 8 |
| 7.1 Change switch point SP1 (flow monitoring), optional | 8 |
| 7.2 High flow adjustment (optional) | 9 |
| 7.3 Set the switch point SP2 (temperature)..... | 9 |
| 8 Additional settings (optional)..... | 10 |
| 8.1 Low flow adjustment..... | 10 |
| 8.2 Configure the switching outputs | 10 |
| 8.3 Restore the factory setting (reset) | 11 |
| 8.4 Lock / unlock the unit..... | 11 |
| 9 Error during adjustment..... | 12 |
| 10 Operation..... | 12 |
| 10.1 Indication of the current temperature and switch point SP2.. | 12 |
| 10.2 Operating indicators | 13 |
| 10.3 Interference indicators | 13 |
| 12 Scale drawing | 14 |
| 13 Technical data | 14 |

1 Preliminary note

1.1 Explanation of symbols

| | |
|-------------------------------------------------------------------------------------|-----------------------------------------------|
|  | Instruction |
|  | Reaction to the action |
|  | Reference to another section of this document |
|  | Important note, especially to be adhered to |
|  | Important note on the electrical connection |
|  | LED lights green |
|  | LED lights orange |
|  | LED lights red |
|  | LED flashes |

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2 Safety instructions

- Please read the product description prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.
- Improper or non-intended use may lead to malfunctions of the unit or to unwanted effects in your application.
- That is why installation, electrical connection, set-up, operation and maintenance of the unit must only be carried out by qualified personnel authorised by the machine operator.

3 Functions and features

3.1 Application area

The unit monitors the flow and the temperature of liquid and gaseous media.

3.2 Flow and temperature monitoring with output S1

The unit detects the flow velocity and the current medium temperature. It links the two measured signals (logical function: AND) and switches output S1:

| | output S1 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| flow \geq switch point SP1 and medium temperature \geq switch point SP2 | closed |
| <ul style="list-style-type: none">• flow < SP1 or• temperature < SP2 or• flow < SP1 and temperature < SP2 | open |

This applies to the unit on delivery: output = normally open. If necessary you can change the outputs to normally closed function (\rightarrow 8.2). It then applies: output S1 open if flow \geq switch point SP1 and medium temperature \geq switch point SP2.

On flow monitoring function:

- If the flow velocity increases, signal SP1 changes when the switch point is reached.
- If the flow velocity falls again, signal SP1 changes when the value "SP1 minus hysteresis" is reached.

The hysteresis changes with the flow speed and it is essentially influenced by the set monitoring range.

It is 2...5 cm/s for the setting 5...100 cm/s (= factory setting), it increases with higher flow speeds.

3.3 Temperature monitoring with output S2

The unit detects the current medium temperature and switches the output S2:

- Output S2 closed if medium temperature \geq SP2 / output open if medium temperature < SP2.

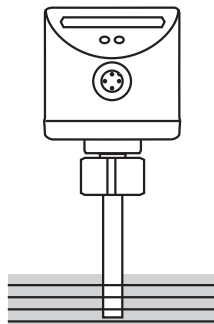
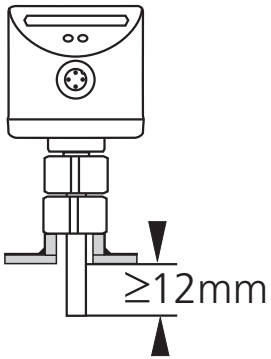
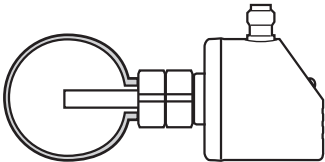
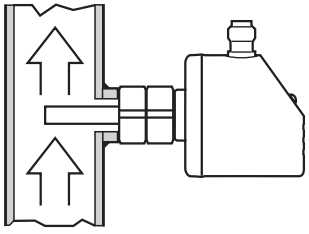
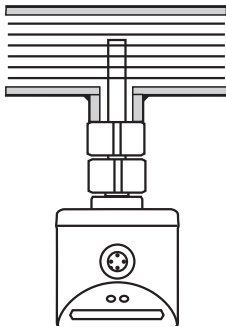
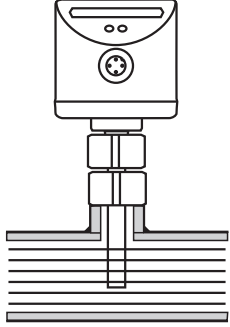
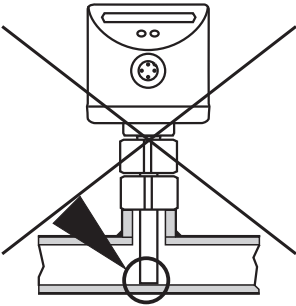
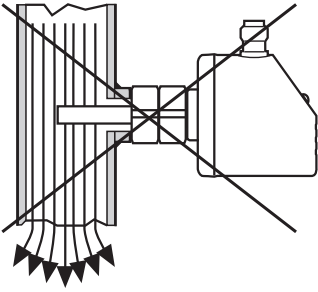
This applies to the unit on delivery: output = normally open. In case of need you can change the outputs to normally closed (\rightarrow 8.2). It then applies: output S2 open if medium temperature \geq SP2.

4 Installation

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

- Adapters have to be ordered separately as accessories.
A correct fit of the unit and ingress resistance of the connection are only ensured using ifm adapters.
- For small flow rates ifm adapter blocks are available.

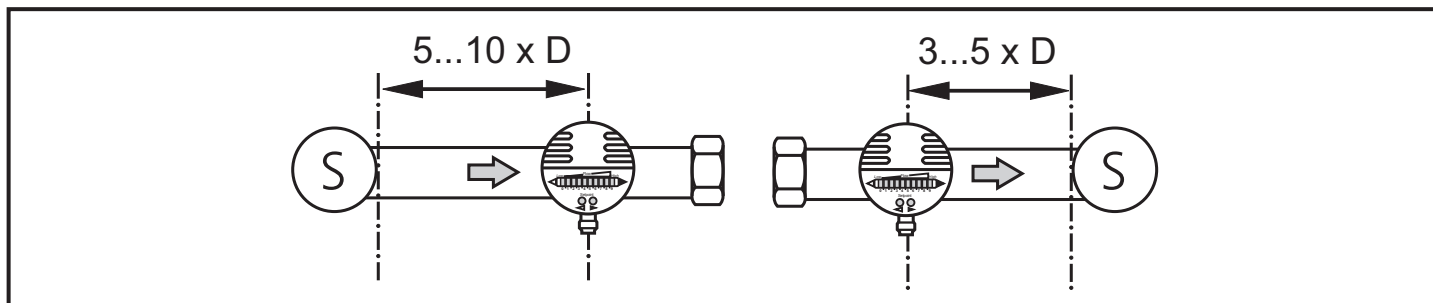
4.1 Installation location

| | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <p>General</p> <ul style="list-style-type: none"> • The sensor tip is to be completely surrounded by the medium. • Insertion depth of the sensor: minimum 12 mm. |  |  |
| <p>Recommended</p> <ul style="list-style-type: none"> • For horizontal pipes: mounting from the side. • For vertical pipes: mounting in the rising pipe. |  |  |
| <p>Conditional</p> <ul style="list-style-type: none"> • Horizontal pipe /mounting from the bottom: if the pipe is free from build-up. • Horizontal pipe /mounting from the top: if the pipe is completely filled with medium. |  |  |
| <p>To avoid</p> <ul style="list-style-type: none"> • The sensor tip must not be in contact with the pipe wall. • Do not mount in downpipes that are open at the bottom! |  |  |

4.2 Sources of interference in the pipe system

Components integrated in the pipes, bends, valves, reductions, etc. lead to turbulence of the medium. This affects the function of the unit.

Recommendation: Adhere to the distances between sensor and sources of interference:

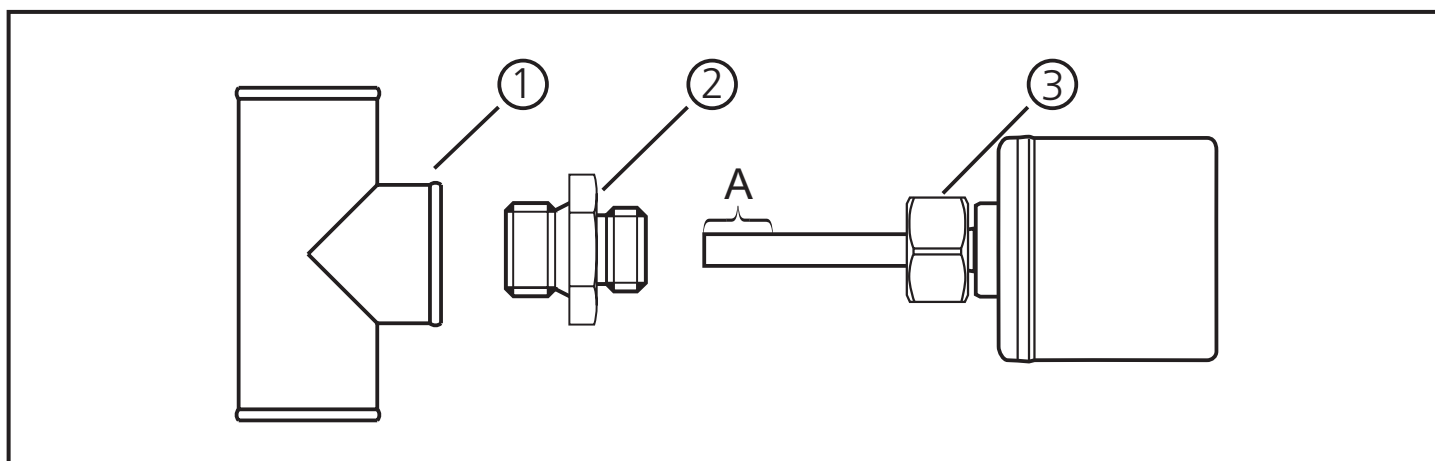


D = pipe diameter; S = sources of interference

4.3. Mounting operation



- ▶ Ensure that the system is free of pressure during installation.
- ▶ Ensure that no media can leak at the mounting location during installation.



- ▶ Grease the threads of the process connection (1), adapter (2) and nut (3).
Note: The sensor tip (A) must not be in contact with grease.
- ▶ Screw the suitable adapter into the process connection.
- ▶ Place the flow monitor onto the adapter and tighten the nut. Tightening torque 25 Nm. Ensure that the unit is correctly oriented.

5 Electrical connection

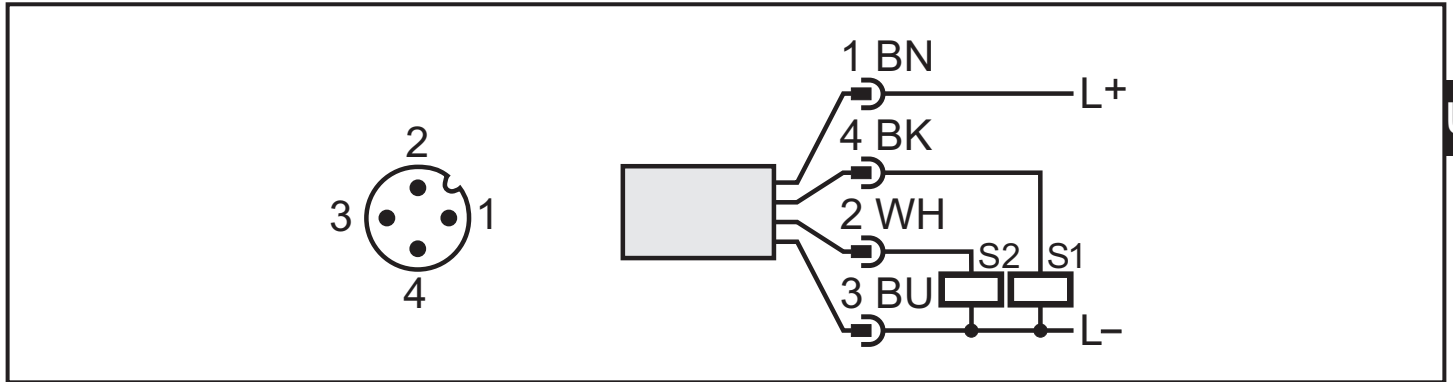


The unit must be connected by a qualified electrician.

The national and international regulations for the installation of electrical equipment must be adhered to.

Voltage supply to EN 50178, SELV, PELV.

- ▶ Disconnect power.
- ▶ Connect the unit as follows:

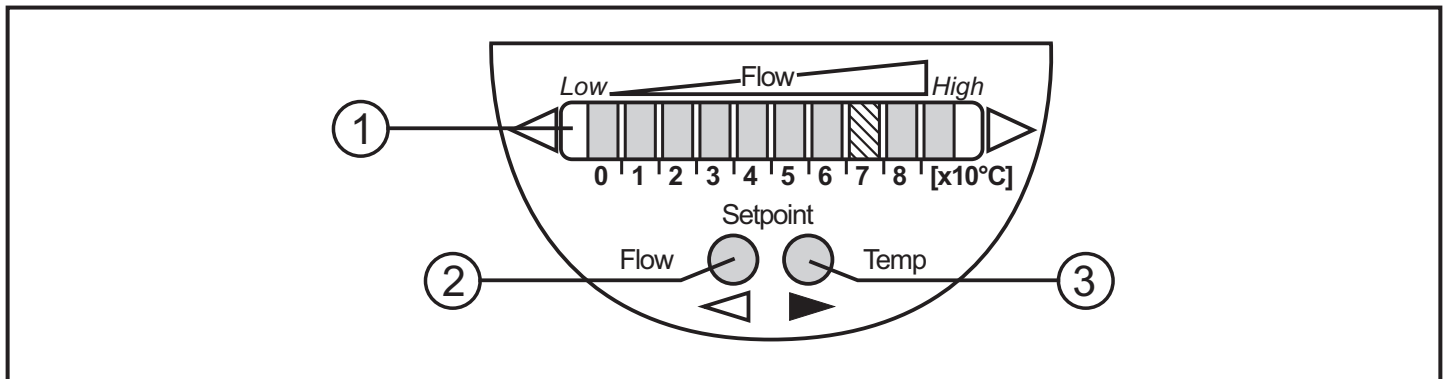


S1: flow and temperature monitoring; S2: temperature monitoring

Core colours of ifm sockets:

1 = BN (brown), 2 = WH (white), 3 = BU (blue), 4 = BK (black)

6 Operating and display elements



1: Operation display

- The green LEDs indicate the current flow (the LEDs 0 to 9 represent the range between no flow and maximum flow).
- A lighting LED indicates the position of the flow switch point (S1) (orange = output closed, red = output open).

2, 3: Setting buttons for adjustment and configuration

7 Set-up and settings for water

(For media other than water → 8.1: Low flow adjustment).

- ▶ Switch on the supply voltage.
- > All LEDs light and go out again step by step. During this time the output S1 is closed (if configured as normally open). The unit is in the operating mode.
- ▶ Let the normal flow circulate in the installation.
- ▶ Check the display and determine further actions.

| | | |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <p style="text-align: center;">Low Flow High 0 1 2 3 4 5 6 7 8 [x10°C]</p> | <p>The factory setting is suitable for the application.</p> <ul style="list-style-type: none"> ▶ No further settings are required for flow monitoring. |
| 2 | <p style="text-align: center;">Low Flow High 0 1 2 3 4 5 6 7 8 [x10°C]</p> | <p>Your normal flow is below the representation range of the display.</p> <p>2 setting options:</p> <ul style="list-style-type: none"> ▶ Change the switch point (→ 7.1). ▶ Carry out high flow adjustment (→ 7.2). |
| 3 | <p style="text-align: center;">Low Flow High 0 1 2 3 4 5 6 7 8 [x10°C]</p> | <p>Your normal flow exceeds the representation range of the display (LED 9 flashes).</p> <ul style="list-style-type: none"> ▶ Carry out high flow adjustment (→ 7.2). |

You can restore the factory setting any time. (→ 8.3).

7.1 Change switch point SP1 (flow monitoring), optional


For the factory setting the switch point is at LED 7. A change makes sense if:

- the display shows example 2.
 - the flow fluctuates much or pulsates.
 - if a faster response time of the unit is requested (low switch point = fast response with rising flow, high switch point = fast response with falling flow).
- ▶ Briefly press the pushbutton ◀.
 - > The switch point LED flashes.
 - ▶ Press the pushbutton ◀ or ▶ as often as required. Each press of the pushbutton shifts the LED by one position in the indicated direction.

Note: If no pushbutton is pressed for 2 s, the unit returns to the operating mode with the newly set value.

7.2 High flow adjustment (optional)

The unit determines the existing flow as normal flow and adapts the display representation (all LEDs except the switch point LED light green).


- ▶ Let the normal flow circulate in the installation.
- ▶ Press the pushbutton  and keep it pressed.
- > LED 9 lights, after approx. 5 s it flashes.
- ▶ Release the pushbutton.

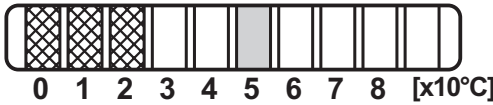
The unit is now adapted to your flow conditions. It passes into the operating mode, the display should now show example 1.


Note: The adjustment affects the switch point: It is increased proportionally (maximum up to LED 7).

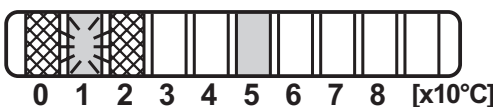
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7.3 Set the switch point SP2 (temperature)

- ▶ Briefly press the pushbutton .
- > The current temperature and the current setting of the switch point are indicated for 5 seconds in steps of 10°C (→ 10.1).

| | |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
|  | <p>Row of LEDs red = current temperature, LED green or orange = current switch point.</p> |
| <p>LED green if OUT = OFF; LED orange if OUT = ON</p> | |

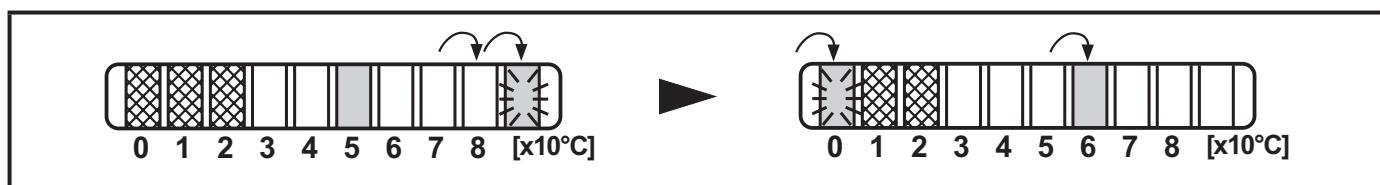
- ▶ Briefly press the pushbutton  within 5 s another time.
- > The current setting of the switch point is displayed in steps of 1°C and can be changed.

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
|  | <p>LED green = 1st digit (10 times X °C) LED green, flashing = 2nd digit (X °C) here: 51°C.</p> |
| <p>LED green if OUT = OFF; LED orange if OUT = ON. In addition the current temperature is indicated in steps of 10°C by red LEDs.</p> | |

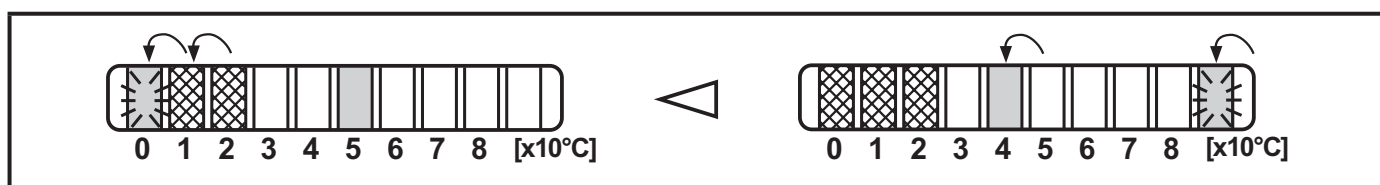
- ▶ Press the pushbutton  or  as often as required. Each press of the pushbutton shifts the flashing LED (1st digit) by one position in the indicated direction.

| | |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|

After LED 9 has been reached the cycle starts again at LED 0. The LED which is constantly lit (2nd digit) moves on by one position to the right (if pushbutton ► is used).



After LED 0 has been reached the cycle starts again at LED 9. The LED which is constantly lit (2nd digit) moves on by one position to the left (if pushbutton ◀ is used).



Note: 5 s after the last press of the pushbutton the display returns to the temperature and switch point display mode (step 1). After another 5 s the unit goes to the operating mode with the newly set value.

8 Additional settings (optional)

8.1 Low flow adjustment

If the unit is used in media other than water, you should additionally adapt the unit to the minimum flow.

Note: The following adjustment must only be carried out after the high flow adjustment.

- ▶ Let the minimum flow circulate in the installation or ensure flow standstill.
- ▶ Press the pushbutton ◀ and keep it pressed.
- > LED 0 lights, after approx. 5 s it flashes.
- ▶ Release the pushbutton. The unit adopts the new value and passes into the operating mode.

8.2 Configure the switching outputs

The unit is delivered as normally open. In case of need you can change the outputs to normally closed (the changing applies to both outputs):

- ▶ Press the pushbutton ◀ for at least 15 s.
- > LED 0 lights, after approx. 5 s it flashes.

- > After 10 s the current setting is displayed: LEDs 5...9 light orange (= outputs normally open).
 - > After approx. 15 s LEDs 0...4 flash orange.
 - ▶ Release the pushbutton. The outputs are changed to normally closed operation
- For a new changeover repeat the operation.

8.3 Restore the factory setting (reset)

- ▶ Press the pushbutton ▶ for at least 15 s.
- > LED 9 lights, after approx. 5 s it flashes.
- > After approx. 15 s LEDs 0...9 flash orange.
- ▶ Release the pushbutton. All settings are reset to the factory setting:
 - operating area: 5 ...100 cm/s for water
 - switch point S1 (flow): LED 7
 - switch point S2 (temperature): LED 0 (4°C)
 - output function: NO
 - unlocked.

8.4 Lock / unlock the unit

The unit can be locked electronically to prevent unintentional settings.

- ▶ Press both setting pushbuttons simultaneously for at least 10 s in the operating mode.
- > The indication goes out, the unit locks or unlocks.

On delivery: unlocked.

9 Error during adjustment

If no adjustment is possible, all LEDs flash red. The unit then passes into the operating mode with unchanged values.

Possible cause /aid:

| | |
|--------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Error during installation. | ▶ Read chapter 4 Installation. Check whether all requirements have been met. |
| The difference between maximum flow and minimum flow is too small. | ▶ Increase the flow difference and carry out the adjustment once again. |
| The sequence high flow /low flow adjustment was not adhered to. | ▶ Carry out the two adjustment operations again in the right sequence. |

10 Operation

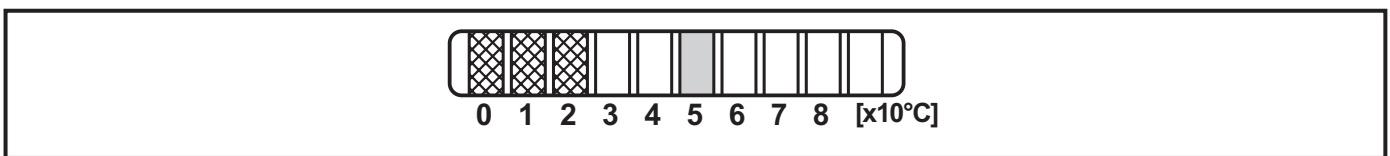
After every power on all LEDs light and go out again step by step (during this time the outputs are closed if configured as normally open). The unit is then ready for operation.

In case of power failure or interruption all settings remain.

10.1 Indication of the current temperature and switch point SP2

▶ Briefly press the pushbutton ▶ .

> The current temperature and the current setting of the switch point are indicated for 5 seconds in steps of 10°C.



Row of LEDs red = current temperature T in °C.

| | | | | | | |
|-----|-------|---------|---------|---------|-----|---------|
| LED | 0 | 0...1 | 0...2 | 0...3 | ... | 0...9 |
| T | 0...9 | 10...19 | 20...29 | 30...39 | | 90...99 |

LED green or orange = current switch point S2 in °C

| | | | | | | | | | | |
|-----|-------|--------|---------|---------|---------|---------|---------|---------|---------|-----|
| LED | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| S2 | 2...4 | 5...14 | 15...24 | 25...34 | 35...44 | 45...54 | 55...64 | 65...74 | 75...80 | --- |

LED green if OUT = OFF; LED orange if OUT = ON

10.2 Operating indicators

| | |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | <p>Green LED bar: Current flow within the representation range.</p> <p>Indication of the flow switch point (S1):</p> <ul style="list-style-type: none"> - LED orange: output closed. - LED red: output open. |
| | <p>LED 9 flashes: current flow above the representation range.</p> |
| | <p>LED 0 flashes: current flow far below the representation range.</p> |

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10.3 Interference indicators

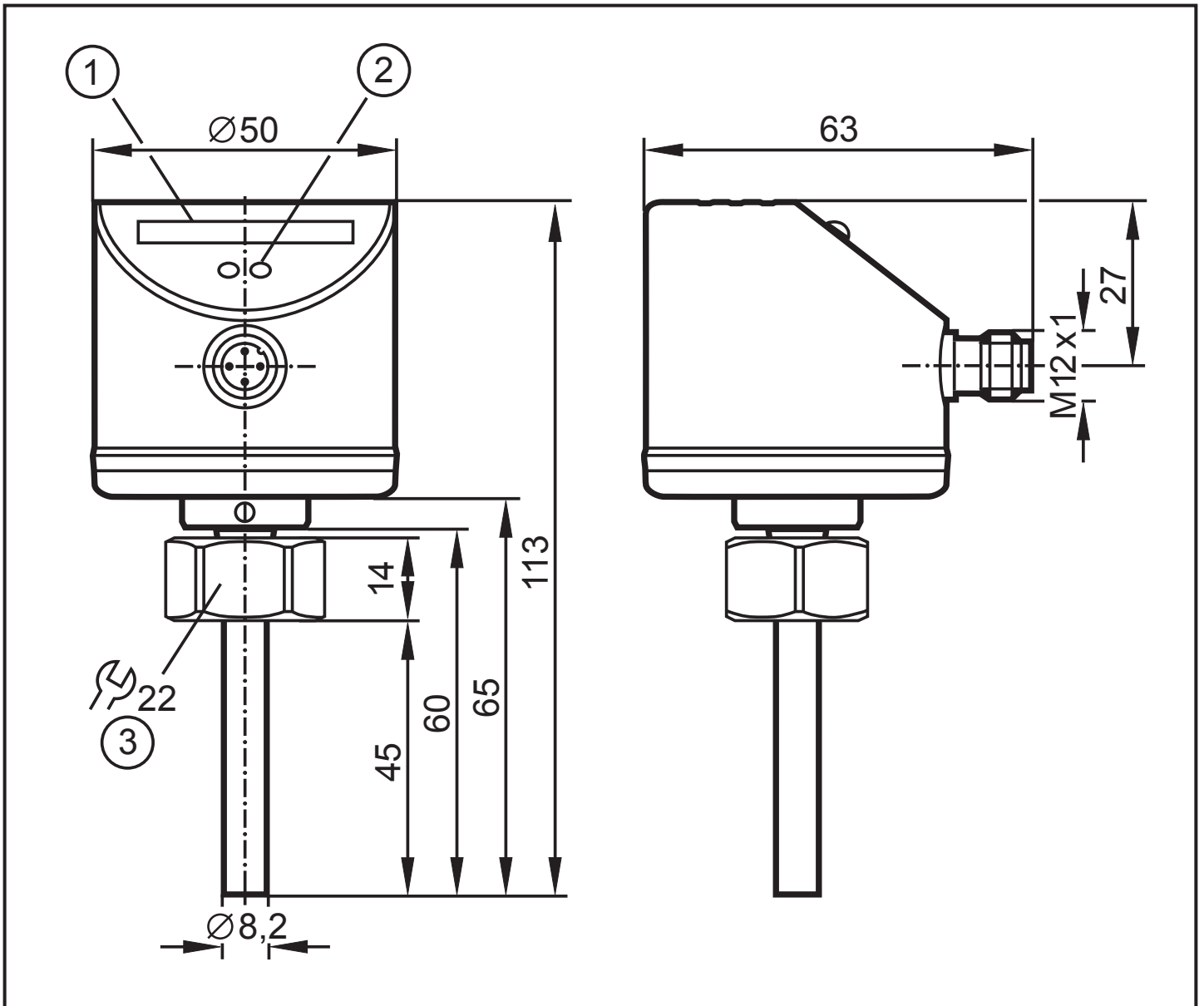
| | |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | <p>Short circuit at the switching output S1.</p> <p>The operating indicator and 5 red LEDs on the left hand light alternately.</p> <p>If the short circuit has been rectified, the unit immediately passes into the normal operating state. The current operating state is displayed.</p> |
| | <p>Short circuit at the switching output S2.</p> <p>The operating indicator and 5 red LEDs on the right hand light alternately.</p> <p>If the short circuit has been rectified, the unit immediately passes into the normal operating state. The current operating state is displayed.</p> |
| <p>Display OFF (no LED lights):</p> | <p>Operating voltage too low (< 19 V) or failed.</p> <p>Ensure a correct voltage supply.</p> |

11 Maintenance

Recommended maintenance:

- ▶ Check the sensor tip for build-up from time to time.
- ▶ Clean it using a soft cloth. Stubborn build-up (e.g. lime) can be removed using a common vinegar cleaning agent.

12 Scale drawing



- 1: LED bar display
- 2: set button
- 3: tightening torque 25 Nm

13 Technical data

| | |
|--------------------------------------------------------------------------|----------------------------|
| Application area | Liquids and gases |
| Operating voltage [V] | 19 ... 36 DC ¹⁾ |
| Current rating [mA] | 2 x 250 |
| Short-circuit protection, pulsed; reverse polarity / overload protection | |
| Voltage drop [V] | < 2.5 |
| Current consumption [mA] | < 60 |
| Power-on delay time [s] | 10, optically indicated |

Flow monitoring

Liquids

| | |
|------------------------------------|-------------|
| Medium temperature [°C] | -25 ... +80 |
| Setting range [cm/s]..... | 3 ... 300 |
| Greatest sensitivity [cm/s] | 3...100 |
| Temperature gradient [K/min] | 300 |

Gases

| | |
|-------------------------------------|----------------------------|
| Medium temperature [°C] | -25 ... +80 |
| Setting range [cm/s]..... | 200 ... 3000 |
| Greatest sensitivity [cm/s]..... | 200 ... 800 |
| Switch point accuracy [cm/s] | ± 2 ... ± 10 ²⁾ |
| Hysteresis [cm/s] | 2 ... 5 ²⁾ |
| Repeatability [cm/s] | 1 ... 5 ²⁾ |
| Temperature drift [cm/s x 1/K]..... | 0.1 ³⁾ |
| Response time [s]..... | 1 ... 10 |

Temperature monitoring

| | |
|--------------------------------------------|---------------------------|
| Setting range [°C] | 2...80 |
| Resolution [K] | 1 |
| Hysteresis [K] | 2 |
| Repeatability [K] | ± 2 |
| Accuracy of switch point [K] | ± 3 (v > 5cm/s; liquids)) |
| Response time temperature (typ.) [s] | 5 |

| | |
|----------------------------------|---------------------------------------------------------------------------------------------------------------|
| Pressure resistance [bar]..... | 300 |
| Operating temperature [°C] | -25 ... 80 |
| Protection rating | IP 67 |
| Protection class | III |
| Shock resistance [g] | 50 (DIN / IEC 68-2-27, 11 ms) |
| Vibration resistance [g] | 20 (DIN / IEC 68-2-6, 55-2000 Hz) |
| Housing materials..... | stainless steel 316L / 1.4404; stainless steel 304 / 1.4301; PC (Makrolon); PBT-GF 20; EPDM/X (Santoprene) |
| Materials (wetted parts)..... | stainless steel 316L / 1.4404 O-ring: FPM 8x1.5 gr 80° Shore A |

EMC

| | |
|----------------------------------|-------------------|
| EN 61000-4-2 ESD: | 4 kV CD / 8 kV AD |
| EN 61000-4-3 HF radiated: | 10 V/m |
| EN 61000-4-4 Burst: | 2 kV |
| EN 61000-4-6 HF conducted: | 10 V |

¹⁾ to EN50178, SELV, PELV;

²⁾ for water; 5...100 cm/s; 25°C (factory setting)

³⁾ for water; 5...100 cm/s; 10...70°C

The sensor conforms to the standard EN 61000-6-2

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