

ifm electronic



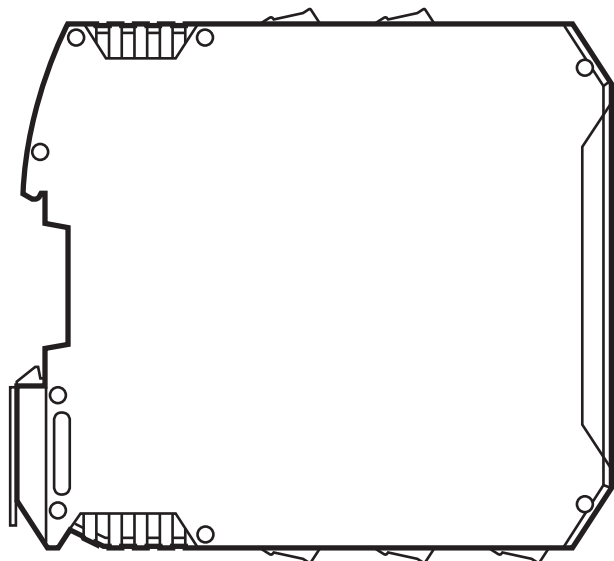
Operating instructions
Switching amplifier

efector300®

SR307A / VS4000 Exi

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1 Preliminary note

1.1 Explanation of symbols

- Instructions
- > Reaction, result
- [...] Designation of pushbuttons, buttons or indications
- Cross-reference
-  Important note
Non-compliance can result in malfunction or interference.
-  LED lights green
-  LED lights orange
-  LED lights red
-  LED flashes

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2 Safety instructions

- The instructions are part of the unit. They contain information about the correct handling of the product. Read them before use to familiarise yourself with operating conditions, installation and operation. Adhere to the safety instructions. The operating instructions are intended for authorised persons according to the EMC and low voltage directives.
- The units must only be installed, connected and set up by qualified staff. The qualified staff must have knowledge of protection classes, regulations and provisions for apparatus in hazardous areas.
- The unit must only be installed, connected and put into operation by a qualified electrician as during the installation dangerous voltages may be exposed. The safe function of the unit and the plant is only guaranteed when installation is correctly carried out.
- Be careful when handling the connected unit. This is only allowed by qualified personnel due to the protection rating IP 20.
- The design of the unit corresponds to the protection class II except for the terminal blocks. Protection against accidental contact (finger-touch to IP 20) for qualified personnel is only guaranteed if the terminal screw has been complete-

ly screwed in. Therefore the unit must always be mounted in a control cabinet of at least IP 54 which can only be opened using a tool.

- In case of malfunction of the unit or queries please contact the manufacturer. Tampering with the unit can seriously affect the safety of operators and machinery. This is not permitted and leads to an exclusion of liability and warranty.

3 Functions and features

The switching amplifier is part of the VS4000 Exi series and designed to work with flow sensors of intrinsically safe design Ex"i" (e.g. SP321A). The unit conforms to the requirements of EN 60079-0 (IEC 60079-0) and EN 60079-11 (IEC 60079-11) (intrinsic safety "i").

The explosion group indicated on the unit as well as special conditions have to be taken into account according to the following EC type examination certificates:

EC type examination certificate

ZELM 11 ATEX 0466

IECEx type examination certificate

IECEx ZLM 11.0004

ATEX marking:

 II (1) G [Ex ia Ga] IIC

IECEx marking:

 [Ex ia Ga] IIC

4 Function

4.1 Flow monitoring

The unit provides intrinsically safe voltage supply for the sensors, evaluates the signals from the sensors and signals whether a preset flow value has been reached:

- flow above the preset value: output relay is energised.
- flow below the preset value: output relay is de-energised.

Flows of either liquids or gases can be monitored.

4.2 Temperature monitoring

When the set switch point for temperature (SPTemp) is exceeded, the output relay for the temperature is de-energised, the yellow LED [Temp] goes out:

- temperature above the preset value: output relay is de-energised.
- temperature below the preset value: output relay is energised.

The set hysteresis is 2 °C.

4.3 Fault monitoring

- In case of wire break, reverse polarity or short circuit of the sensor cable or in case of undervoltage, the monitoring relay Error is de-energised and the red LED [Error] flashes.
- In case of an internal error the monitoring relay Error is de-energised, the red LED [Error] lights.

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5 Installation



The switching amplifier must be mounted outside the Ex zone.

- ▶ Mount the unit in a control cabinet with a protection rating of at least IP 54 to guarantee protection against accidental contact with dangerous contact voltages and against atmospheric influence. The control cabinet should be installed in accordance with local and national rules and regulations.

The immediate environmental conditions must at least meet the requirements for pollution degree 2.

- ▶ Mount the unit on a DIN rail. Mount it vertically and leave enough space between the unit and the top and bottom of the control cabinet to allow clear space for convection cooling.



When several units are mounted side by side: take into account the internal heating of all units. The ambient temperature for the individual unit must not exceed the permissible value of +60 °C.

- ▶ Adhere to the distances between the units. Identical SR307A units can be mounted side by side. For units from other companies the permissible distance is to be determined by measurements.
- ▶ Prevent the penetration of conductive or other dirt during installation and wiring.

5.1 Mounting of the sensors

Adhere to the installation instructions supplied with the sensor.

6 Electrical connection



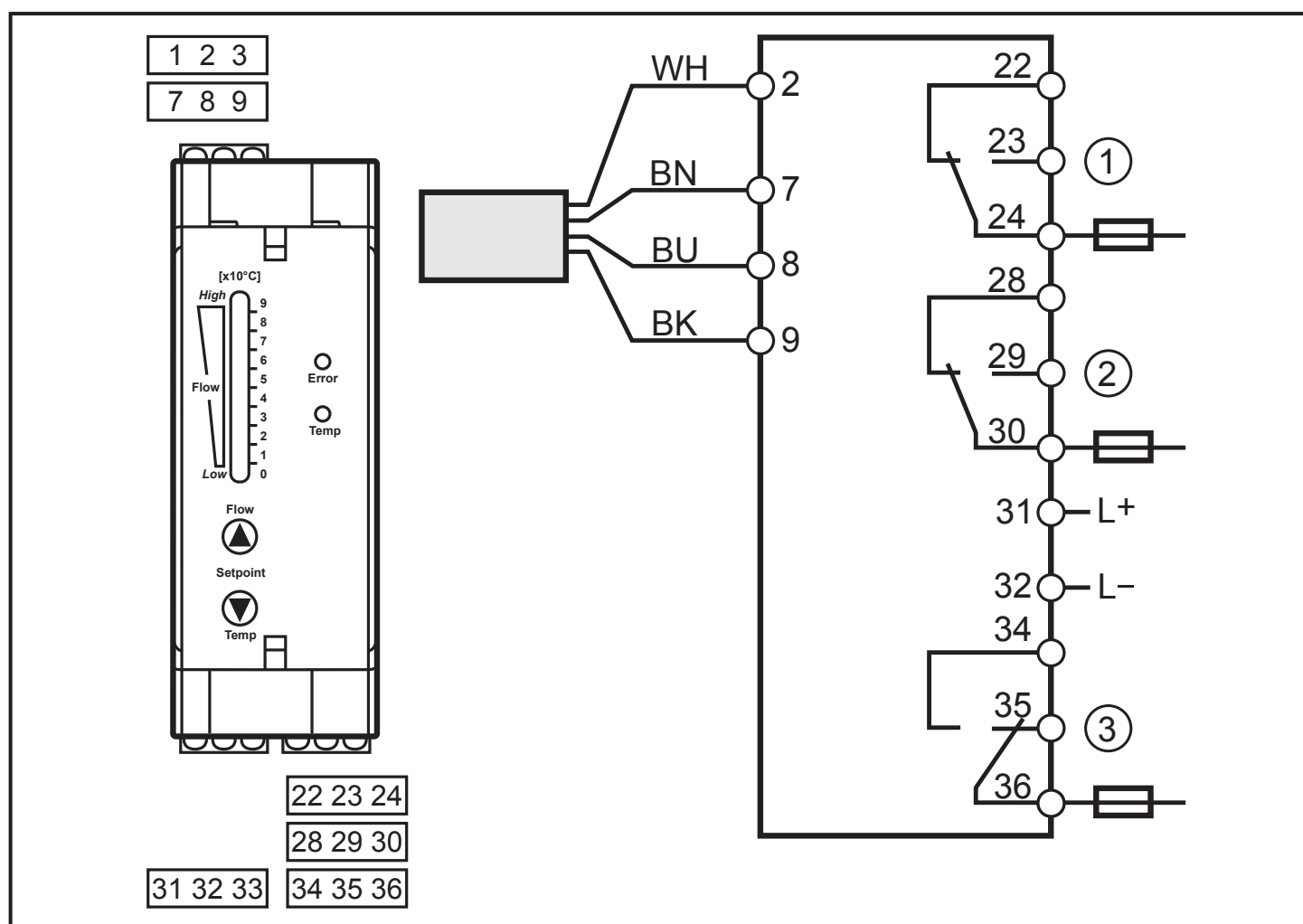
The unit must be connected by a qualified electrician.

Isolate from mains supply before wiring!

Check if the relays are connected to voltages of external power supplies.

The rules and regulations for the installation and operation of electrical equipment in hazardous areas must be observed.

6.1 Terminal connection



1 = flow monitoring

2 = fault monitoring (wire break, reverse polarity or short circuit of the sensor cable, under-voltage, internal fault)

3 = temperature monitoring

Core colours: BN (brown), WH (white), BU (blue), BK (black)

6.2 Voltage supply (power)

- 24 V DC \pm 15 %, at the terminals 31 (+) and 32 (-).

6.3 Connection of the sensors

Max. permissible values of the control circuits

	type of protection intrinsic safety [Ex ia Ga] IIC, [Ex ia Ga] IIB, [Ex ib Gb] IIC, [Ex ib Gb] IIB			
Voltage	$U_0 = 9.6 \text{ V}$			
Current	$I_0 / I_e = 332 \text{ mA}$			
Power	$P_0 = 531 \text{ mW}$			
	type of protection intrinsic safety			
	[Ex ia Ga] IIC	[Ex ia Ga] IIB	[Ex ib Gb] IIC	[Ex ib Gb] IIB
External inductance	0.7 mH	3 mH	0.7 mH	3 mH
External capacitance	3.15 μF	27.55 μF	3.15 μF	27.55 μF

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To prevent negative effects on the functions caused by noise voltages, sensor cables and load cables should be laid separately. Maximum length of the sensor cable: 100 m. Note: Extension cables for sensors must only be connected by means of screw terminals.

Adhere to the maximum permissible values for the external inductance and capacitance.

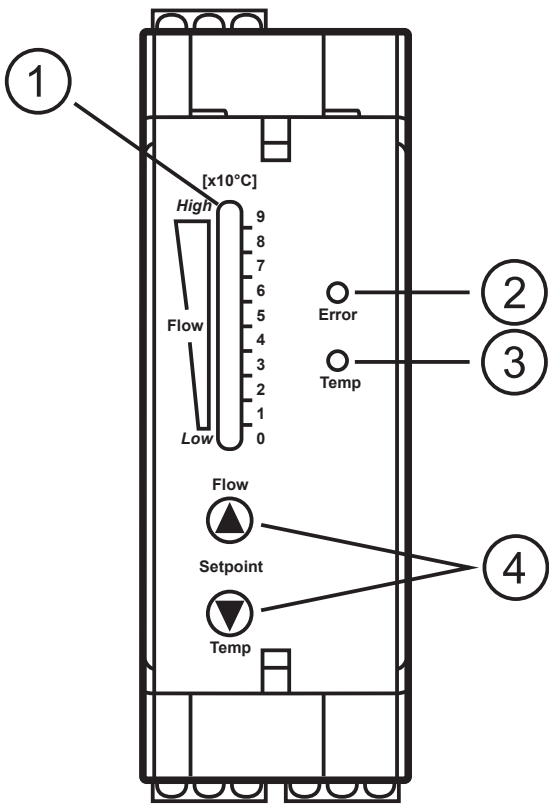
6.4 Output relay

- Flow monitoring: terminals 22, 23, 24.
- Fault monitoring: terminals 28, 29, 30.
- Temperature monitoring: terminals 34, 35, 36.

Switching capacity: max. 250 V AC, 4 A (\rightarrow 13 Technical data).

- The current must be externally limited to these values by taking appropriate measures.
- External interference suppression of inductive loads is required.
- Insert a miniature fuse according to IEC 60127-2 Sheet 1 ($\leq 5 \text{ A}$ fast acting).
- Position the fuse outside of the hazardous area.


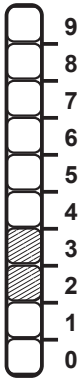
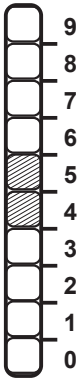


7 Operating and display elements

	1	Operation display • The green LEDs indicate the current flow (LEDs 0 to 9 represent the range between minimum flow and maximum flow). • One LED indicates the position of the switch point Flow (orange = relay energised, red = relay de-energised).
	2	LED red [Error]: - flashes in case of wire break, reverse polarity or short circuit of the sensor cable or in case of undervoltage; - lights permanently in case of an internal error.
	3	LED yellow [Temp]: lights if medium temperature $\leq SP_{Temp}$ / goes out if medium temperature exceeds SP_{Temp} .
	4	Setting buttons for adjustment and configuration

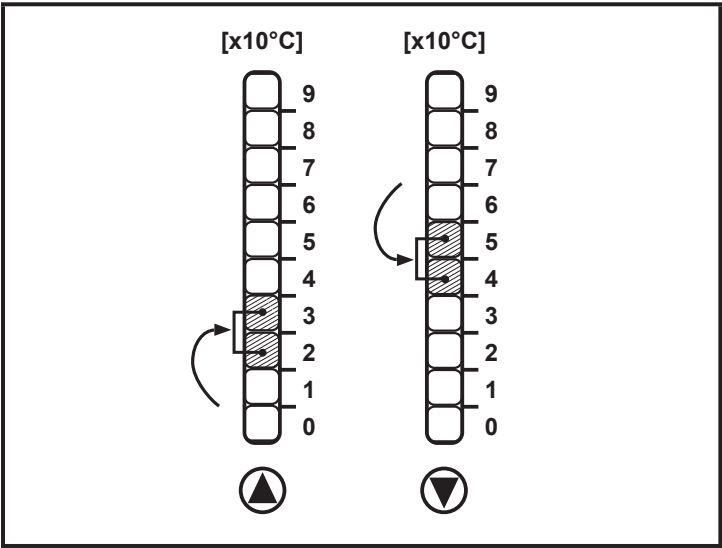
8 Set-up

8.1 Setting to the medium

- Press the button [▼] for at least 10 s.
- > LED 0 lights, after approx. 5 s it flashes.
 - > After 10 s the current setting is displayed (2 LEDs at a time light orange, corresponding to the following media):

water (= factory setting)	water-glycol solution (25 %)	oil, viscosity 10 mm ² /s at 40° C	oil, viscosity 68 mm ² /s at 40° C	air-like gases
[x10°C] 	[x10°C] 	[x10°C] 	[x10°C] 	[x10°C] 

- ▶ Release the button.
- ▶ Press [▲] or [▼] as often as required. Each push of the button shifts the two LEDs by a double position in the indicated direction.
- ▶ Release the button.
- > After 5 s the unit returns to the operating mode with the newly set value.



8.2 High-flow adjustment

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

The unit is now adapted to your flow conditions.

- > With normal flow the display should now show example 1.

<p>Example 1: unit adjusted</p>	<p>Example 2: unit not adjusted. Your normal flow is below the representation range of the display.</p>	<p>Example 3: unit not adjusted. Your normal flow exceeds the representation range of the display (LED 9 flashes).</p>

8.3 Low-flow adjustment

Note: The low-flow adjustment has to be made after the high-flow adjustment.

- ▶ Let the minimum flow circulate in the installation or ensure flow standstill.
- ▶ Press [▼] and keep it pressed.

- > LED 0 lights, after approx. 5 s it flashes.
- ▶ Release the button. The unit adopts the new value and returns to the operating mode.

8.4 Error during adjustment

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

Possible cause / aid:

Error during installation of the flow sensor.	▶ Read the installation instructions of the sensor. 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 again.
The sequence of the two adjustment operations (high-flow / low-flow adjustment; → 8.2 and 8.3) was not adhered to.	▶ Carry out the two adjustment operations again in the right sequence.

8.5 Change the switch point for flow (optional)

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

- the flow fluctuates much or pulsates.
- 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).

▶ Press [▲] briefly.

> The switch point LED flashes.

▶ Press [▲] 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 5 s, the unit returns to the operating mode with the newly set value.

8.6 Set the switch point for temperature (SP_{Temp})

The current temperature in °C is indicated by a row of red LEDs in steps of 10 °C (a total of 10 LEDs). At the same time one LED of this row is reserved for the switch point:

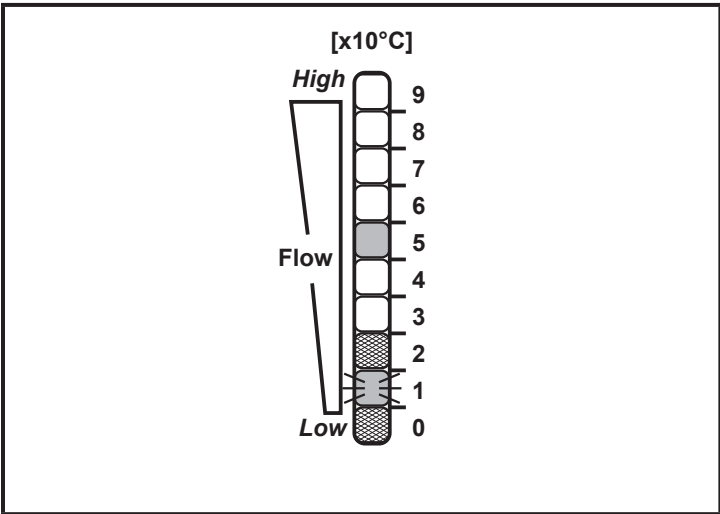
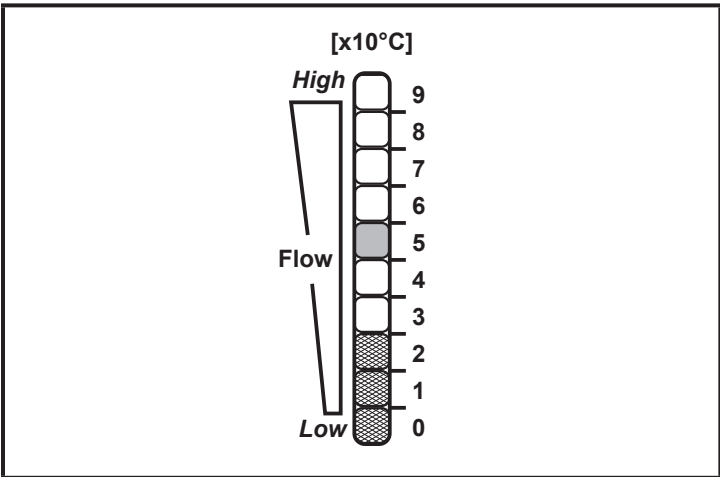
- temperature < SP: LED for SP is green (output relay energised).
- temperature > SP: LED for SP is orange (output relay de-energised).

LED	0	1	2	3	4	5	6	7	8	9
°C	0...9	10...19	20...29	30...39	40...49	50...59	60...69	70...79	80...89	90...99

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Set the switch point as follows:

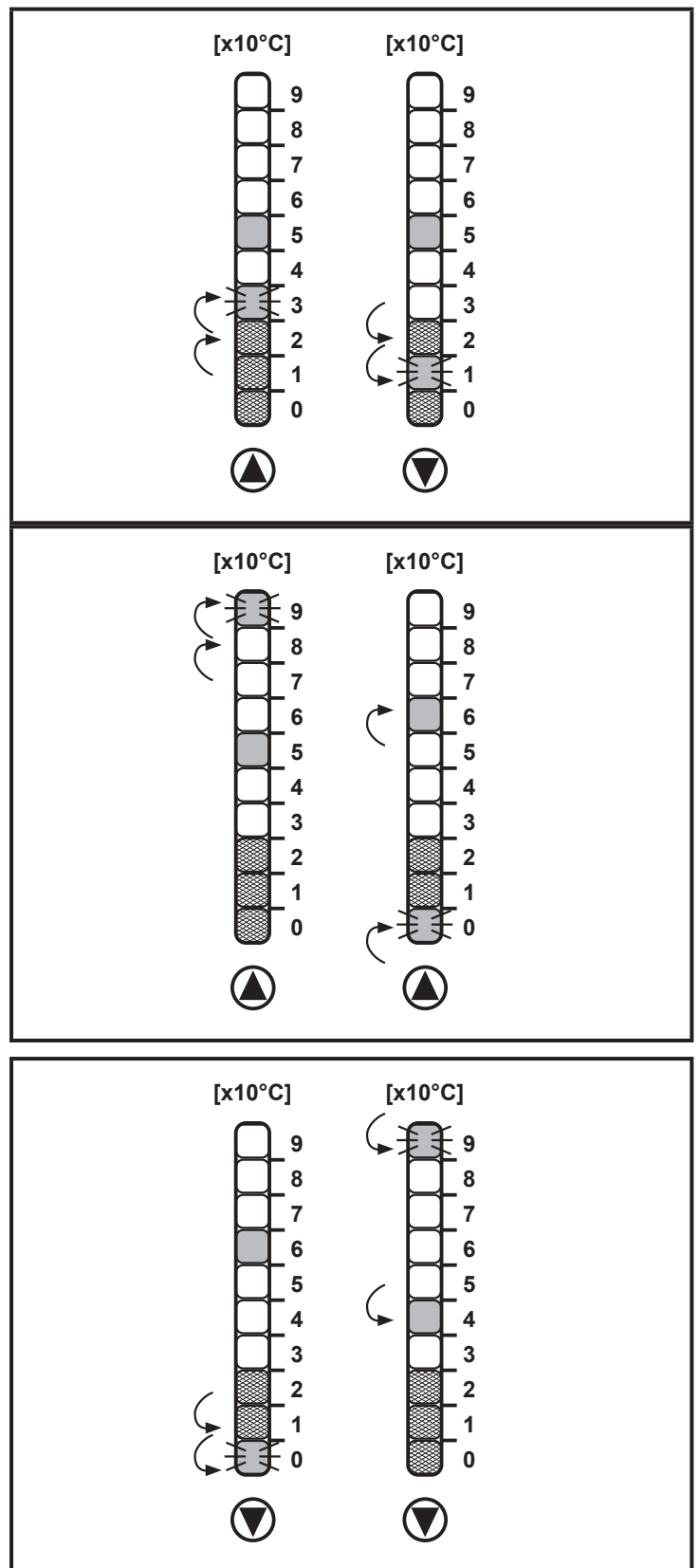
- ▶ Press [▼] briefly.
 - > The unit indicates the current temperature and the current setting of the switch point (SP) in steps of 10 °C for approx. 5 s.
- ▶ Briefly press [▼] again within 5 s.
 - > The current setting of the switch point is indicated in steps of 1 °C and can be changed.
Lit LED = tens digit (10 times X °C), flashing LED = units digit (X °C).
Here: 51 °C.



- Press [▲] or [▼] as often as required. Each press of the pushbutton shifts the flashing LED (units digit) by one position in the indicated direction.

After LED 9 has been reached the cycle starts again at LED 0; the continuously lit LED (tens digit) moves one position up (when setting is made with [▲]).


After LED 0 has been reached the cycle of the flashing LED starts again at LED 9; the continuously lit LED (tens digit) moves one position down (when setting is made with [▼]).



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 returns to the operating mode with the newly set value.

9 Additional settings (optional)

9.1 Restore the factory setting (reset)

- ▶ Press the button [] 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 button. All settings are reset to the factory setting:
 - monitoring of liquid media
 - operating range: 5 ...100 cm/s for water
 - switch point flow: LED 7
 - switch point temperature: LED 0 (4 °C)
 - unlocked.

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9.2 Lock / unlock the unit

The unit can be locked electronically to prevent unintentional settings.

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

Factory setting: unlocked.



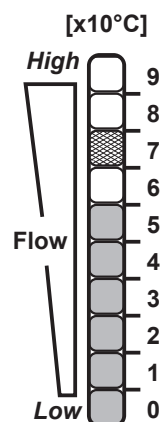
If the unit is locked, it can only display the measurement results for flow and temperature.

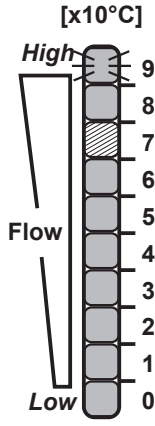
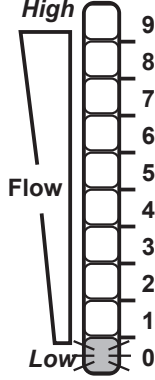
10 Operation

After every power on all LEDs light and go out again step by step. The unit is then ready for operation.

Operating indicators for flow

- Green LED bar: current flow within the display range.
- Indication of the switch point flow:
 - LED orange: output relay energised.
 - LED red: output relay de-energised.

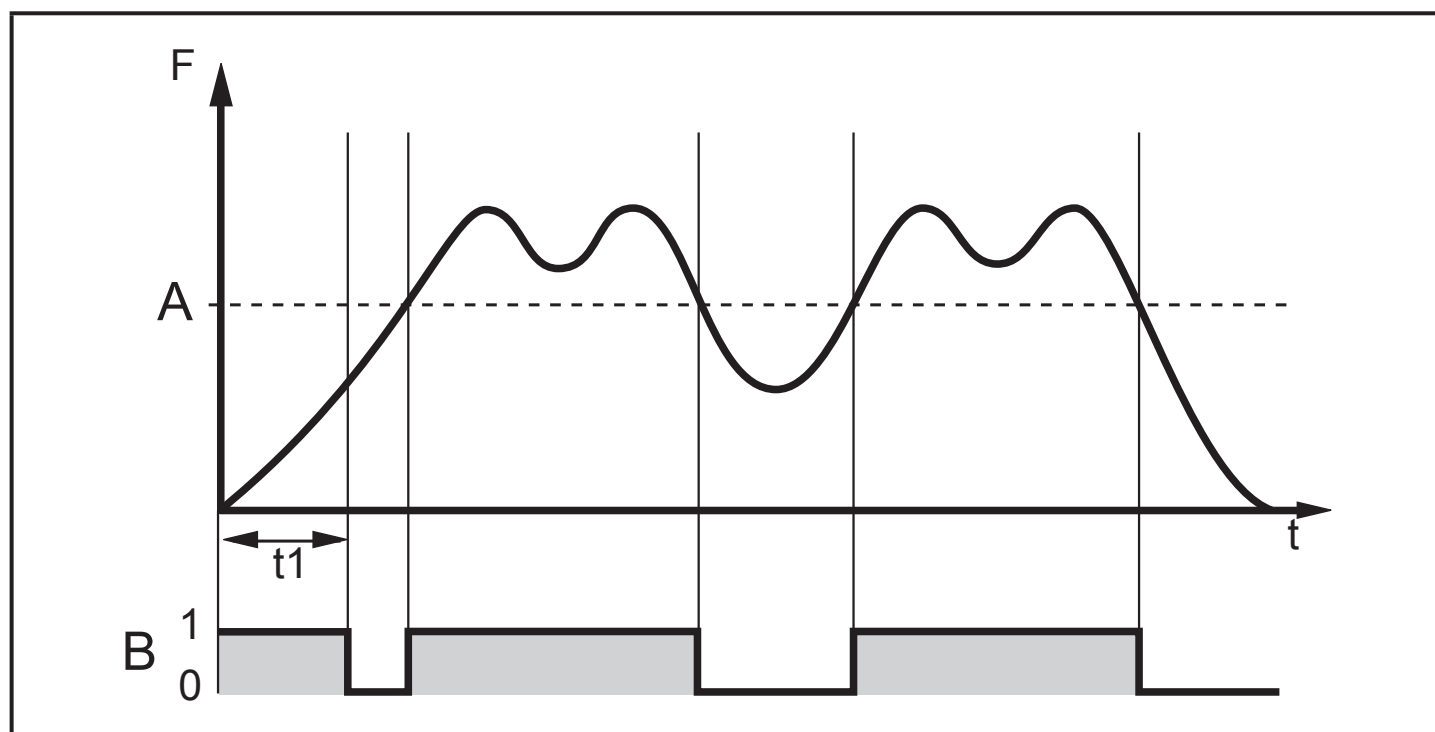


<p>LED 9 flashes: current flow above the display range.</p>	
<p>LED 0 flashes: current flow far below the display range.</p>	

- In case of wire break, reverse polarity or short circuit of the sensor cable or in case of undervoltage, the monitoring relay Error is de-energised and the red LED [Error] flashes.
- In case of an internal error the monitoring relay Error is de-energised, the red LED [Error] lights.

After rectification of the fault the switching amplifier is again ready for operation.

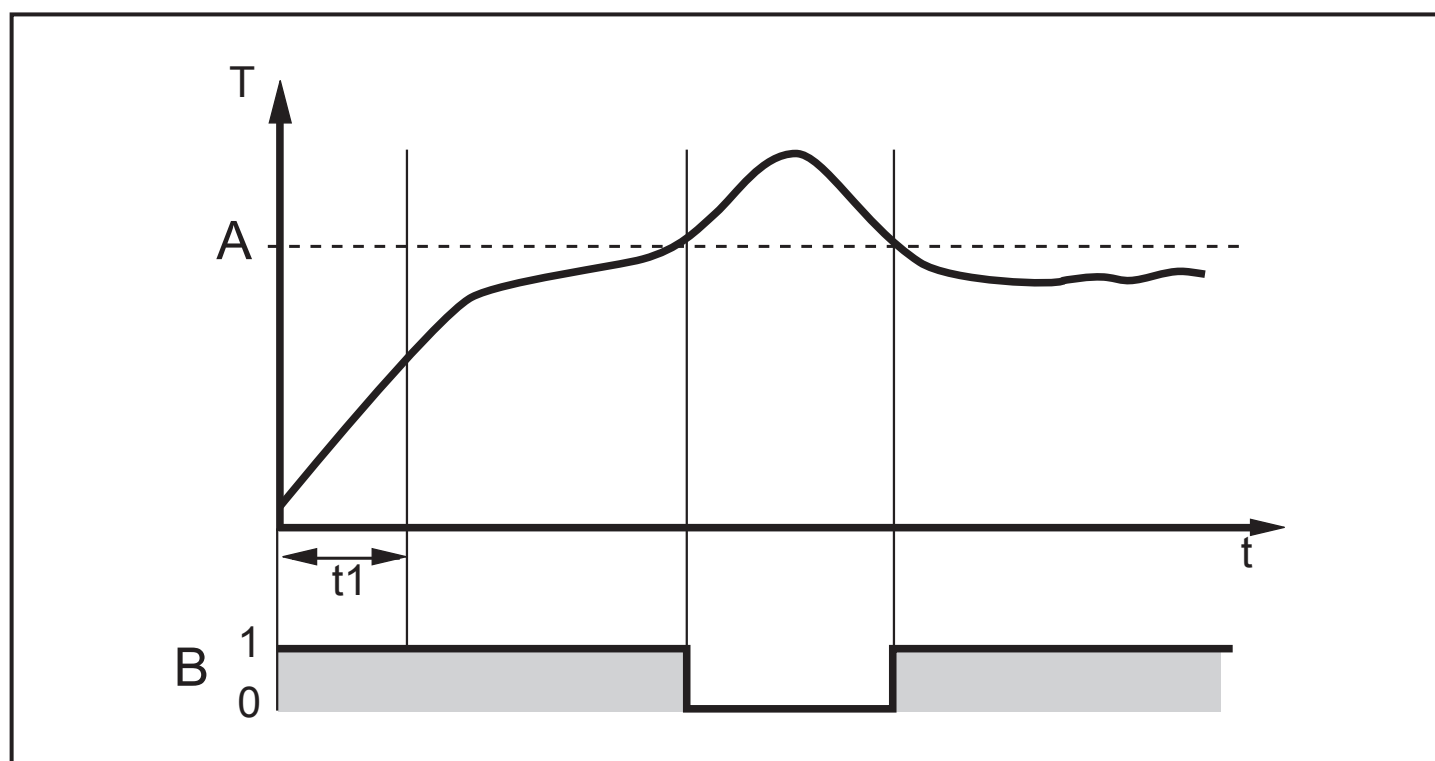
10.1 Function diagram flow monitoring



F = flow; A = switch point; B = output relay

t_1 = power-on delay time

10.2 Function diagram temperature monitoring



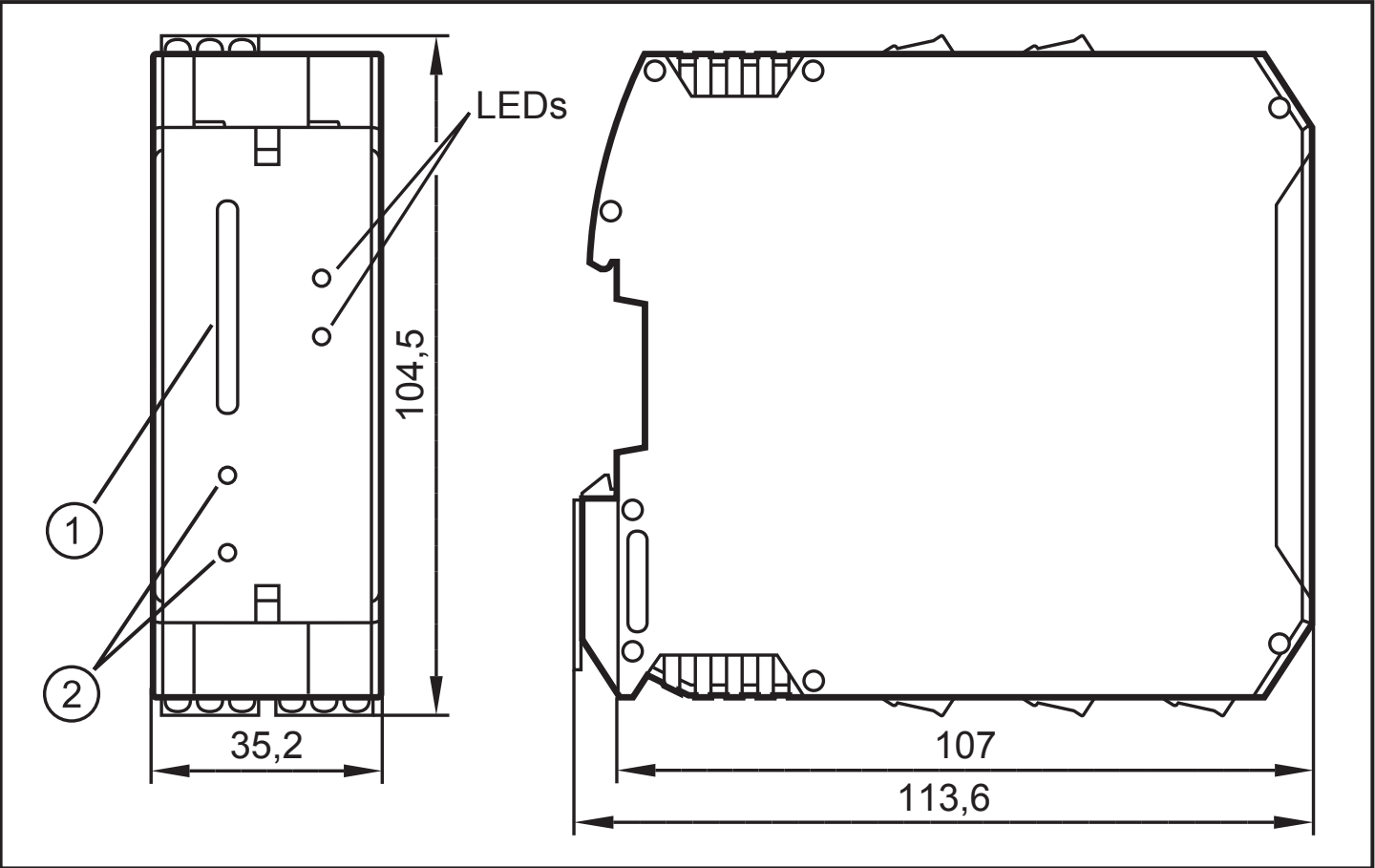
T = temperature; A = switch point; B = output relay

t_1 = power-on delay time

11 Maintenance, repair, disposal

If used correctly, no maintenance and repair measures are necessary.
Recommendation: check the safe functioning of the unit after a short circuit.
Only the manufacturer is allowed to repair the unit.
After use dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.

12 Scale drawing



Dimensions in mm
1: LED bar display
2: setting buttons

13 Technical data

Operating voltage [V]	24 DC
Voltage tolerance [%]	+/-15
Current consumption [mA]	100
Contact rating of the relays	max. 4 A (250 V AC, cos φ ≥ 0.7); 0.2 A (250 V DC); 4 A (24 V DC)

Flow monitoring

- Switching function the relay is energised if the flow exceeds the switch point and during the power-on delay time

Temperature monitoring

- Switching function the relay is de-energised if the temperature exceeds the switch point and during the power-on delay time
- Switching status indication LED yellow
- Temperature range [°C] 0...80
- Setting range [°C] 2...80
- Repeatability of the set switch point [°C] ± 1

Fault monitoring

- Switching function relay is de-energised in case of the following faults: wire break, reverse polarity or short circuit of the sensor cable, undervoltage, internal fault
- Switching status indication LED red
- Response time [s] max. 30

Power-on delay time [s] 10

Ambient temperature [°C] -20...60
(in case of sufficient clear space for convection cooling)

Storage temperature [°C] -25...80

Protection terminals IP 20

Protection housing IP 20

Housing materials PA (polyamide)

14 Factory setting

	Factory setting	User setting
Monitored medium	water	
Operating area	5 ...100 cm/s	
Switch point flow	LED 7	
Switch point temperature	LED 0 (4 °C)	
Locking	unlocked	

More information at www.ifm.com