CE

Operating instructions
Flow sensor
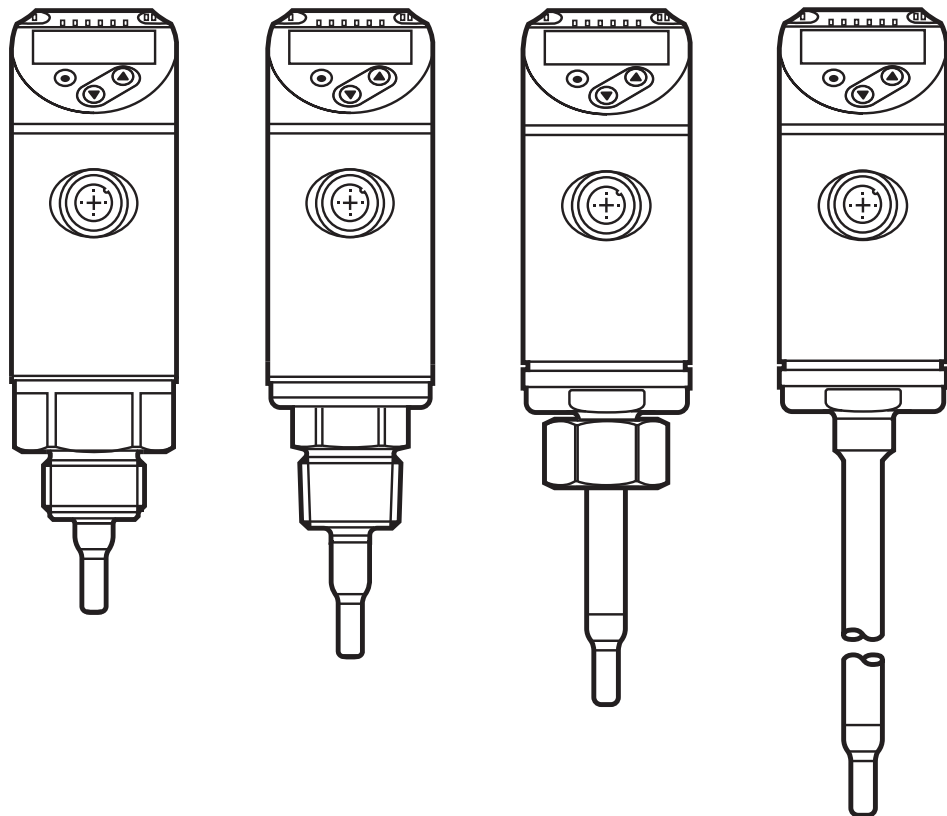
SAxx00
SAxx10
SAxx30
SAxx40

Contents

UK

1 Preliminary note

Technical data, approvals, accessories and further information at www.ifm.com.

▶   Instructions

\>   Reaction, result

[…]   Designation of keys, buttons or indications

→   Cross-reference

⚠ Important note
Non-compliance may result in malfunction or interference.

ⓘ Information
Supplementary note.

⚠ CAUTION

Warning of personal injury.
Slight reversible injuries may result.

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2 Safety instructions

- 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 (→ 3 Functions and features).

- Only use the product for permissible media (→ 12 Technical data).

- 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 unit must be carried out by qualified personnel authorised by the machine operator.

- Protect units and cables against damage.

3 Functions and features

The unit monitors liquids and gases.
It detects the process categories flow and medium temperature.

Application area

- Air

- Water

- Glycol solutions (reference medium: 35 % ethylene glycol solution)

- Low-viscosity oils (viscosity: ≤ 40 mm²/s at 40 °C / ≤ 40 cSt at 104 °F)

- High-viscosity oils (viscosity: ≥ 40 mm²/s at 40 °C / ≥ 40 cSt at 104 °F)

Selection of the medium to be monitored → 10.4.3.

> [!] This is a class A product.
> The unit may cause radio interference in domestic areas.
>
> ▶ If required, take appropriate EMC screening measures.

4 Function

- The unit detects flow based on the calorimetric measuring principle.

- The unit also detects the medium temperature.

- It features an IO-Link interface.

- The unit displays the current process value.
  It generates 2 output signals according to the parameter setting:

OUT1/IO-Link: 2 selection options	Parameter setting
- Switching signal for flow limit values	→ 10.2.3
- Frequency signal for flow	→ 10.2.5

OUT2: 7 selection options	Parameter setting
- Switching signal for flow limit values	→ 10.2.4
- Switching signal for temperature limit values	→ 10.3.1
- Analogue signal for flow	→ 10.2.7
- Analogue signal for temperature	→ 10.3.3
- Frequency signal for flow	→ 10.2.6
- Frequency signal for temperature	→ 10.3.2
- Input for external teach signal	→ 10.2.9

4.1 Operating modes (ModE)

The unit provides three selectable operating modes for flow measurement:

Operating mode	Medium	Display unit
REL	Liquids, air	% (of the taught range) → 10.2.8
LIQU	Liquids	m/s, l/min, m3/h (fps, gpm, cfm)
GAS	Air	m/s, l/min, m3/h (fps, gpm, cfm)

> ℹ The selected operating mode has no effect on the temperature measurement, only absolute values in °C or °F are indicated.

> ℹ The parameter settings are saved in the respective operating mode, i.e. when the operating mode is changed, the settings are not lost.

> ℹ If the operating modes LIQU and GAS are selected:
> ▶ Define the medium and the internal pipe diameter (→ 10.2.1).
> ▶ If required, calibrate curve of measured values (→ 10.4.9).

4.2 Select the medium (MEdI)

The unit has characteristic curves for different media. Depending on the operating mode, the following media can be selected in the menu (→ 10.4.3):

Medium	Operating mode		
	REL	LIQU	GAS
H2O	x	x	
OIL1*	x	x	
OIL2**	x	x	
GLYC	x	x	
AIR	x		x

*OIL1:
viscosity ≥ 40 mm²/s at 40 °C / ≥ 40 cSt at 104 °F

**OIL2:
viscosity ≤ 40 mm²/s at 40 °C / ≤ 40 cSt at 104 °F

4.3 Define the internal pipe diameter (diA)

In the operating modes LIQU and GAS the internal pipe diameter has to be entered to define the volumetric flow (→ 10.2.2).

4.4 Customer-specific calibration (CGA)

Via the calibration factor CGA the sensor can be adjusted to a reference flow in the application.

The customer-specific calibration allows changing the gradient of the curve of measured values. It influences the display and the outputs.
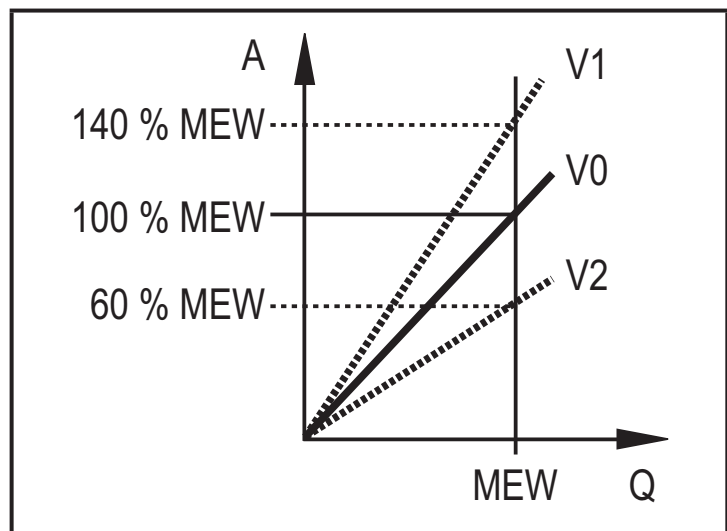
A	=	Operating value for display and output signals
Q	=	Flow
MEW	=	Final value of the measuring range
V0	=	Curve of measured values at factory setting
V1, V2	=	Curve of measured values after calibration

The change in the gradient is indicated in percentage.
Factory setting: CGA = 100 %.
After a change the calibration can be reset to factory setting (→ 10.5.2).

Depending on the set CGA factor, it may not be possible to use the complete measuring range.

4.5 Switching function

OUTx changes its switching status if it is above or below the set switching limits (flow or temperature). Hysteresis or window function can be selected. Example of flow monitoring:

Hysteresis function	Window function
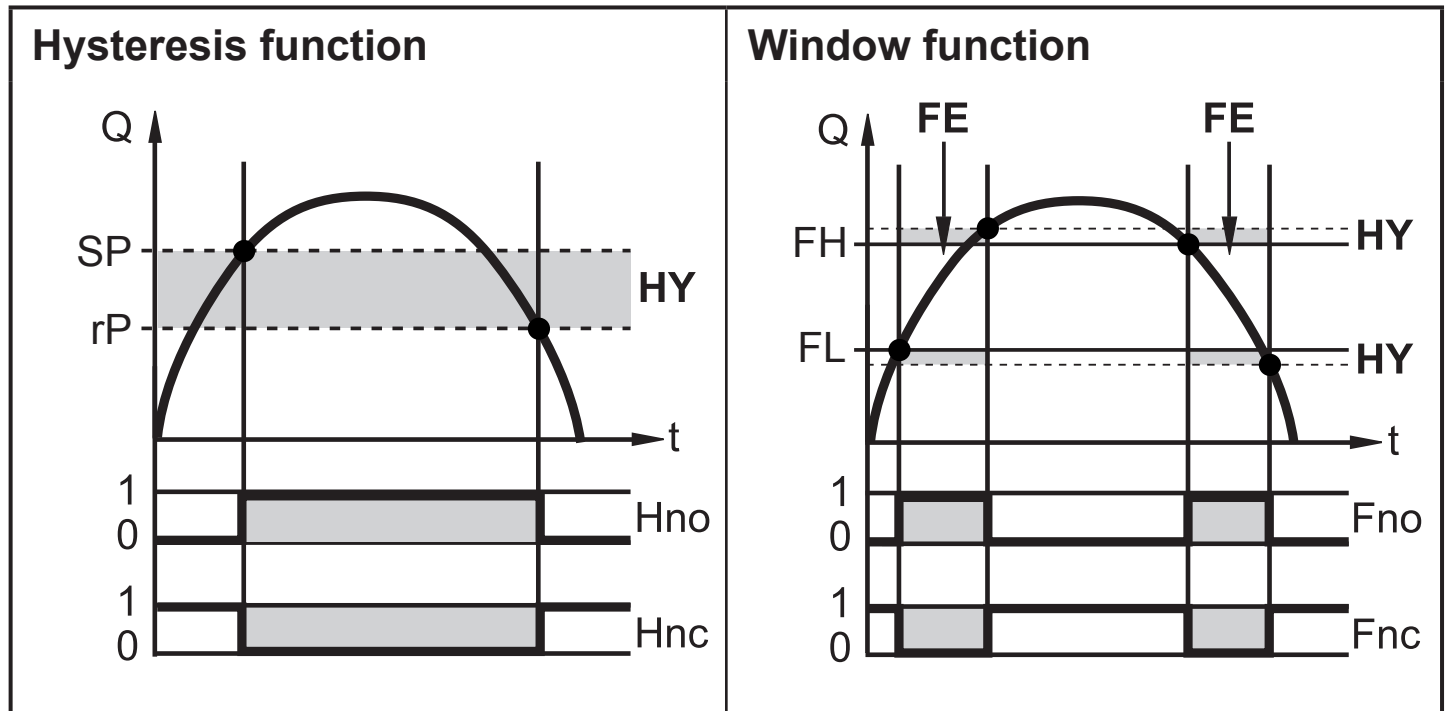
SP = set point
rP = reset point
HY = hysteresis
Hno = hysteresis NO (normally open)
Hnc = hysteresis NC (normally closed)

FH = upper limit value
FL = lower limit value
FE = window
Fno = window NO (normally open)
Fnc = window NC (normally closed)

> ℹ When the hysteresis function is set, the set point SP and the reset point rP are defined. The rP value must be lower than the SP value. The distance between SP and rP is at least 4 % of the final value of the measuring range (= hysteresis).
> If only the set point is changed, the reset point is changed automatically; the difference remains constant.

> ℹ When set to the window function the upper limit value FH and the lower limit value FL are defined. The distance between FH and FL is at least 4 % of the final value of the measuring range.FH and FL have a fixed hysteresis of 0.25 % of the final value of the measuring range. This keeps the switching status of the output stable if the flow rate varies slightly.

4.6 Analogue function

The unit provides an analogue signal that is proportional to the flow quantity or the medium temperature.

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

The measuring range is scalable:

* [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.

> ⓘ For flow measurement in the operating mode [ModE] = REL, [ASP2] and [AEP2] are not available. In this operating mode, the characteristic curve of the analogue output is defined by the flow adjustment:
> high flow = 20 mA; low flow = 4 mA.

If the measured value is outside the measuring range or in the event of an internal error, the current signals indicated in figure 1 are provided.

For measured values outside the display range or in case of a fault, messages are displayed (UL, OL, Err; → 13).

The analogue signal in case of a fault is adjustable (→ 10.4.8):

* [FOU] = On determines that the analogue signal goes to the upper final value (22 mA) in case of an error.

* [FOU] = OFF determines that the analogue signal goes to the lower final value (3.5 mA) in case of an error.
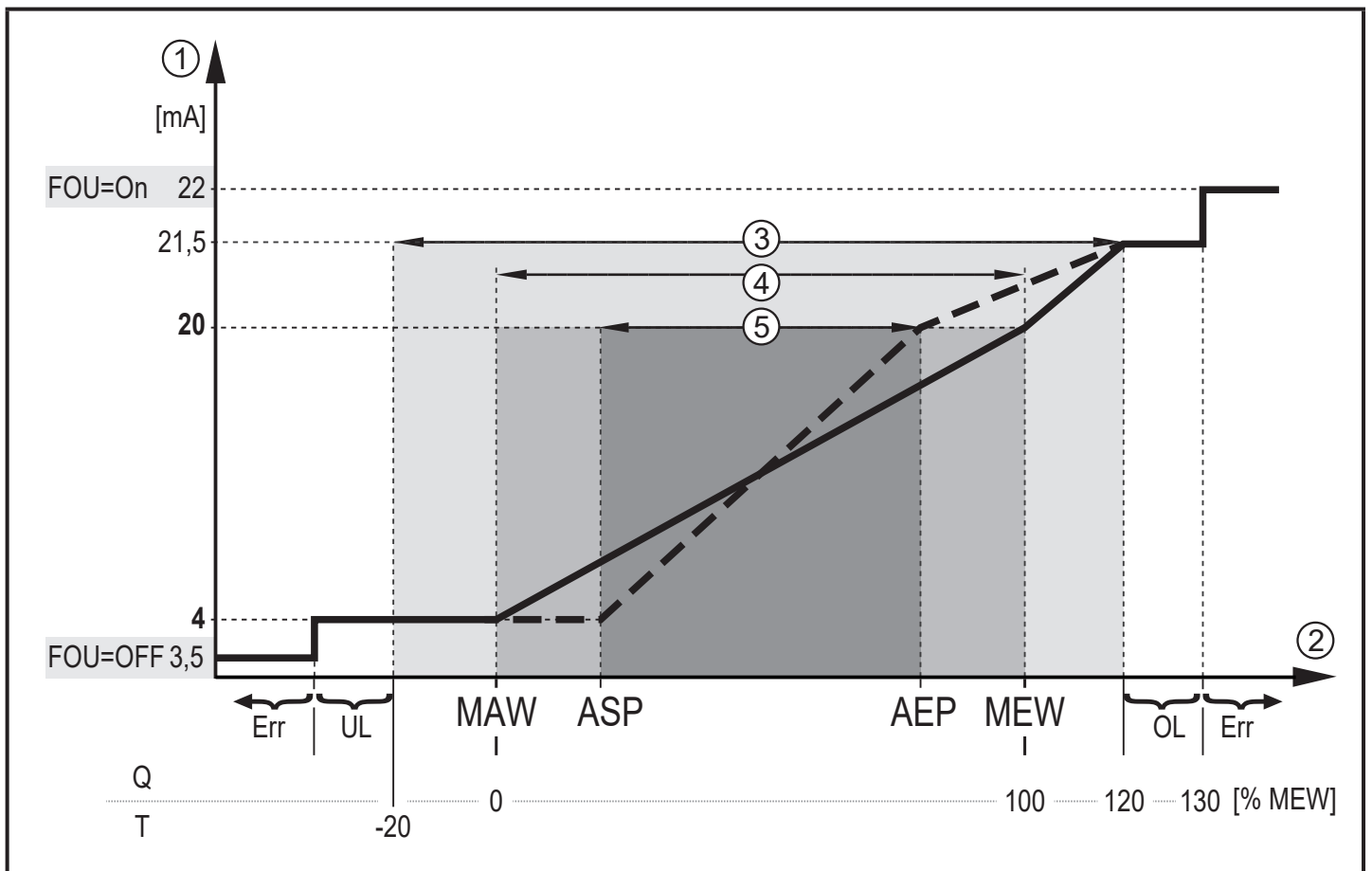
Figure 1: Characteristics of the analogue output according to the standard IEC 60947-5-7.

Q: Volumetric flow
T: Medium temperature
MAW: Initial value of the measuring range for non-scaled measuring range
MEW: Final value of the measuring range for non-scaled measuring range
ASP: Analogue start point with scaled measuring range
AEP: Analogue end point with scaled measuring range
UL: Below the display range
OL: Above the display range
Err: The unit is in the error state

①   Analogue signal
②   Measured value (flow or temperature)
③   Display range
④   Measuring range
⑤   Scaled measuring range

4.7 Frequency output

The unit provides a frequency signal that is proportional to the volumetric flow and the medium temperature.

Within the measuring range the frequency signal is between 0 and 100 Hz for the factory setting.

The frequency signal is scalable:

- [FrPx] determines the frequency signal in Hz provided when the upper measured value (MEW or FEPx) is reached.

The measuring range is scalable:

- [FSP2] determines the lower temperature value from which a frequency signal is provided.

  > ⓘ FSP2 is not adjustable for flow measurement.

- [FEPx] determines at which measured value the frequency signal is FrPx.

  > ⓘ FEPx is not available for flow measurement in the operating mode [ModE] = REL.

> ⓘ Minimum distance between [FSP2] and [FEP2] = 20 % MEW.

If the measured value is outside the measuring range or in the event of an internal error, the frequency signals indicated in figure 2 are provided.

For measured values outside the display range or in case of a fault, messages are displayed (UL, OL, Err; → 13).

The frequency signal in case of a fault is adjustable (→ 10.4.8):

- [FOU] = On determines that the frequency signal goes to the upper final value (130 % FrPx) in case of an error.
- [FOU] = OFF determines that the frequency signal is 0 Hz in case of an error.
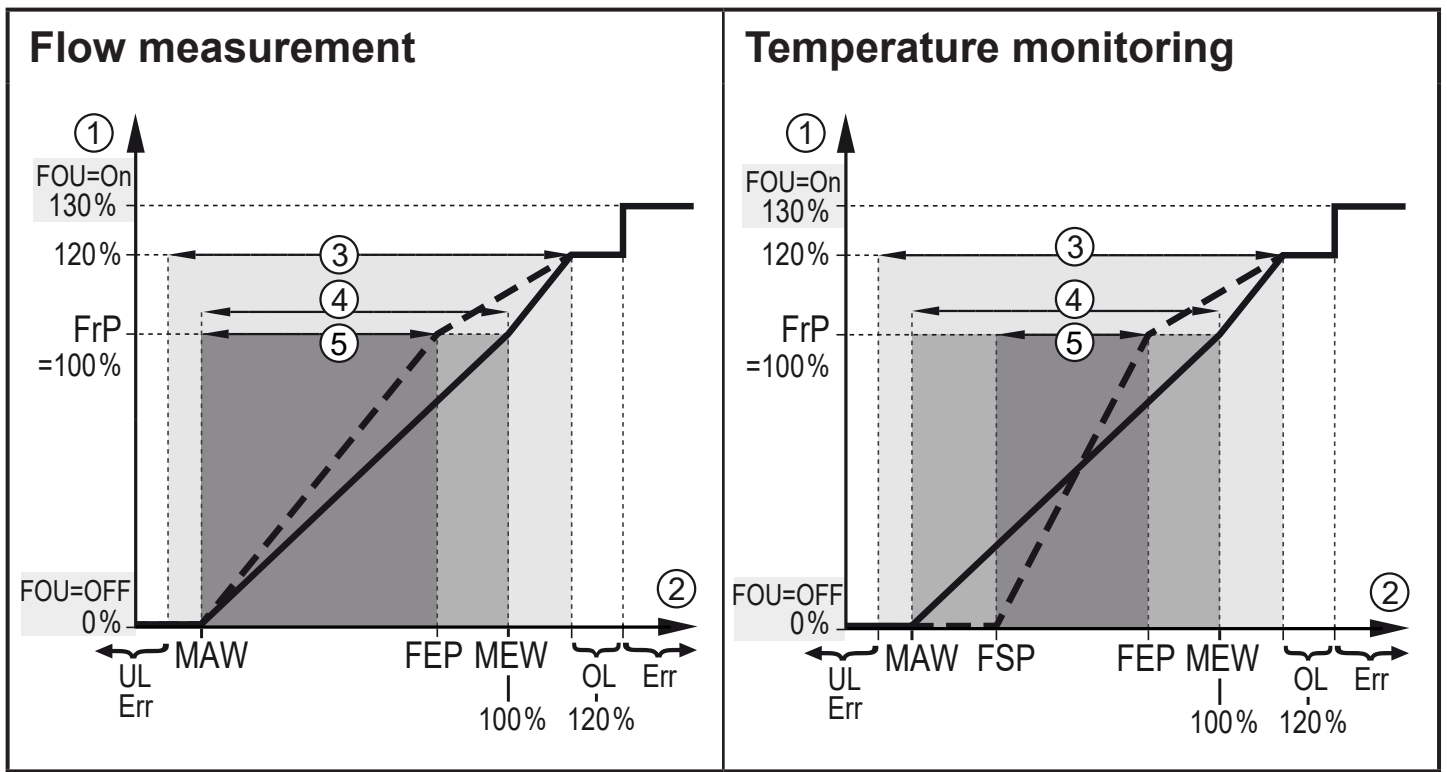
Figure 2: Output curve frequency output

MAW: Initial value of the measuring range for non-scaled measuring range
MEW: Final value of the measuring range for non-scaled measuring range
FSP: Frequency start point with scaled measuring range (only temperature)
FEP: Frequency end point with scaled measuring range
FrP: Frequency signal for upper measured value
OL: Above the display range
Err: The unit is in the error state

①   Frequency signal (FrP at factory setting = 100 Hz)
②   Measured value (flow or temperature in % MEW)
③   Display range
④   Measuring range
⑤   Scaled measuring range

4.8 Measured value damping (dAP)

The damping time enables setting how many seconds after the output signal has reached 63 % of the final value if the flow value changes suddenly. The set damping time stabilises the outputs, the display and the process value transfer via the IO-Link interface. The signals [UL] and [OL] (→ 13 Troubleshooting) are defined under consideration of the damping time.

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## 4.9 Colour change display (coLr)

The colour of the characters in the display can be set via the parameter [coLr]
(→ 10.4.4). With the set parameters rED (red) and GrEn (green), the display is
permanently set to one colour. If the parameters rxou and Gxou are set, the colour
of the characters changes depending on the process value:

	OUT1	OUT2	Colour change to ...
Parameter settings	r1ou	r2ou	red
	G1ou	G2ou	green
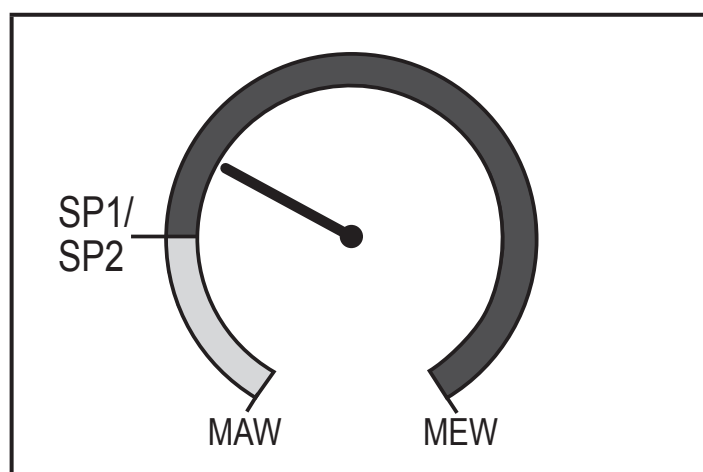
Hysteresis function:

Colour change if process value
is above the set point
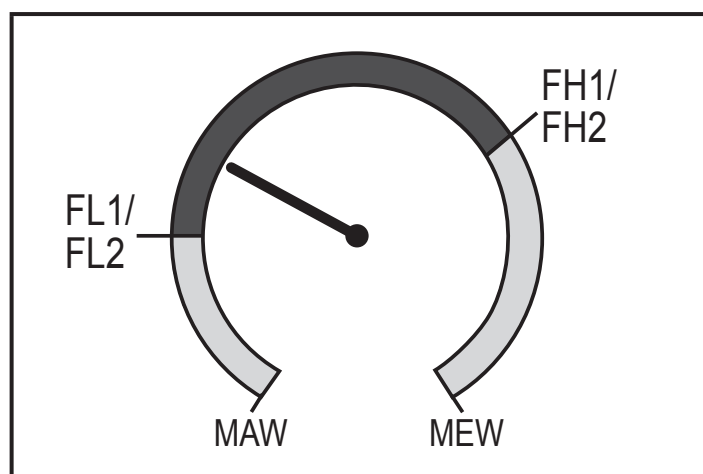
Window function:

Colour change if process value
is within the window range

MAW = initial value of the measuring range, MEW = final value of the measuring range

4.10 IO-Link

This unit has an IO-Link communication interface which enables direct access to
process and diagnostic data. In addition it is possible to set the parameters of the
unit during operation. Operation of the unit via IO-Link interface requires an IO-
Link capable module (IO-Link master).

With a PC, suitable IO-Link software and an IO-Link adapter cable communication
is possible when the system is not in operation.

The IODDs necessary for the configuration of the unit, detailed information about process data structure, diagnostic information, parameter addresses and the necessary information about the required IO-Link hardware and software can be found at www.ifm.com.

4.10.1 IO-Link process values

The process values for flow and temperature are transmitted via IO-Link in the following units of measurement:

Operating mode	Unit of the transmitted process values			
	SAxx00, SAxx30, SAxx40		SAxx10	
REL	%	°C	%	°F
LIQU	m/s	°C	fps	°F
GAS	m/s	°C	fps	°F

ⓘ   A change of [uni] does not affect the IO-Link process values.

More information → IO Device Description at www.ifm.com.

5 Mounting

> ⚠ **CAUTION**
>
> For medium temperatures above 50 °C (122 °F) some parts of the housing can heat up to over 65 °C (149 °F).
>
> > Risk of burns.
>
> ▶ Protect the housing against contact with flammable substances and unintentional contact.

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

Using process adapters the unit can be adapted to different process connections. Adapters have to be ordered separately as accessories.

• Information about the available mounting accessories at www.ifm.com.

- A correct fit of the unit and ingress resistance of the connection are only ensured using ifm adapters.

! ▶ Observe the instructions of the mounting accessories.

▶ Use a lubricating paste which is suitable and approved for the application. Grease the threads of the process connection, adapter and sensor. Ensure no grease is applied to the sensor tip.
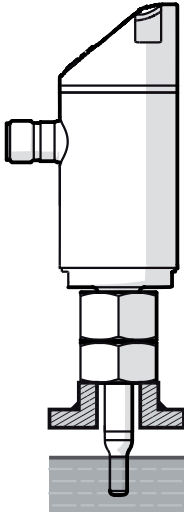
! ▶ Take the tightening torques of sensor and fixing elements into account.
The following tightening torques apply to ifm sensors:
Types M18 x 1.5 and G1/2: 25 Nm
Types 1/2" NPT: 100 Nm
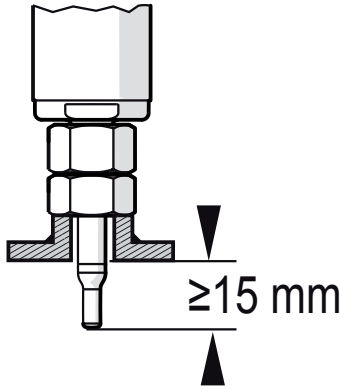
5.1 Installation position

General

The sensor tip must be completely surrounded by the medium.

Internal pipe diameter (diA)	Immersion depth
< 120 mm	~ 15 mm
≥ 120 mm	~ ⅛ diA

Table 1: Immersion depth of the probe

! For strong leverage on the measuring probe, e.g. due to high-viscosity or strongly flowing media:

▶ Do not exceed the immersion depth indicated in table 1.

Recommended
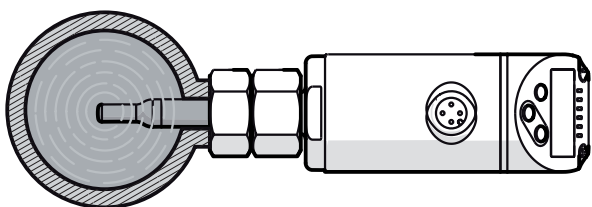
For horizontal pipes: mounting from the side.
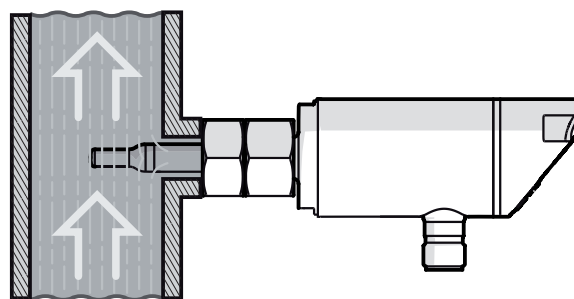
For vertical pipes:
mounting in the rising pipe.

Conditionally possible
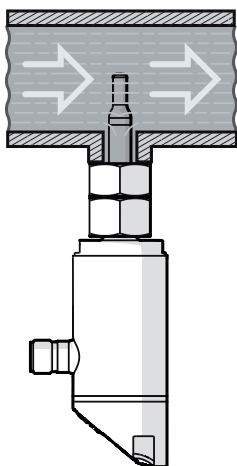
Horizontal pipe /mounting from the bottom:
if the pipe is free from build-up.
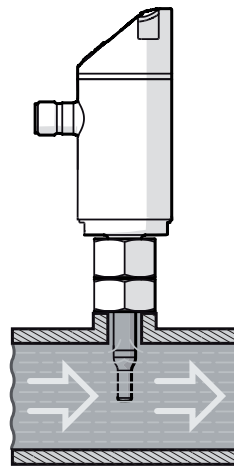
Horizontal pipe /mounting from the top: if
the pipe is completely filled with medium.

Not allowed
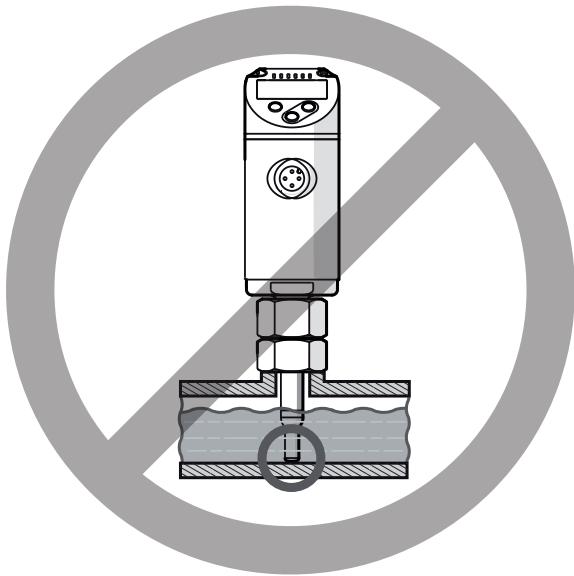
The sensor tip must not be in contact with the pipe wall.
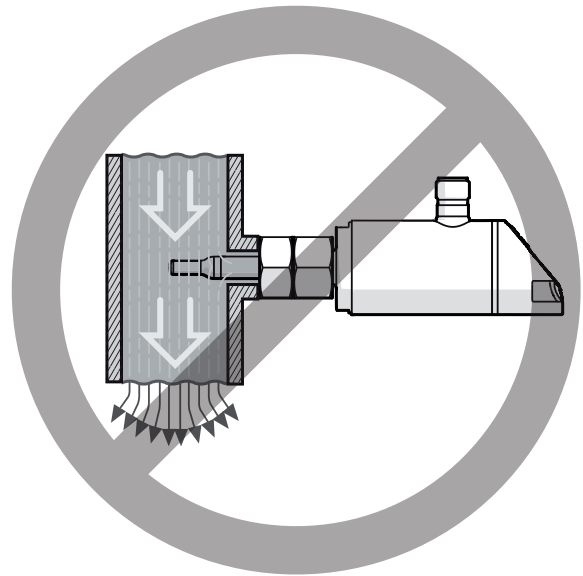
Do not mount in downpipes that are open at the bottom.

5.2 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.

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

5...10 x D

3...5 x D
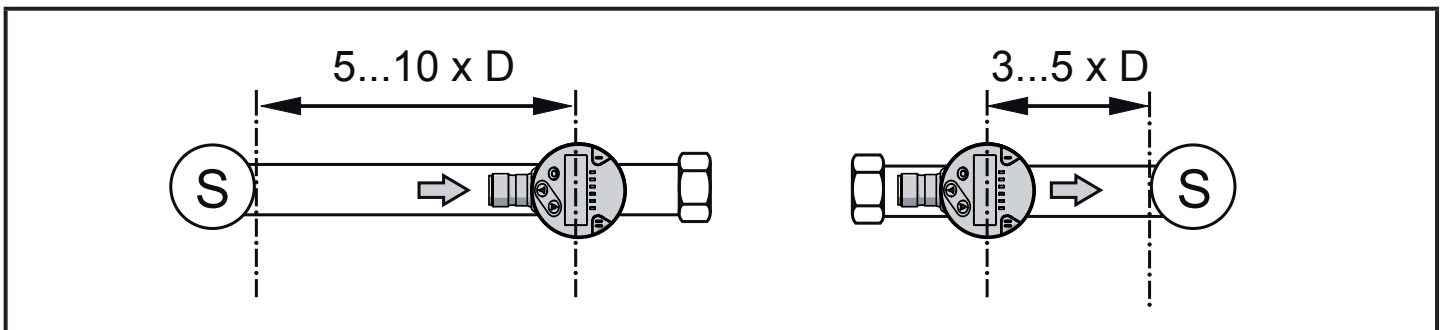
D = pipe diameter; S = sources of interference

5.3 Alignment

▶ To achieve the optimum measuring accuracy: mount the sensor in a way that the flow goes to the larger of the two key surfaces (1).

[i] On units with an external thread, a bore hole in the key surface (2) indicates the flow direction.
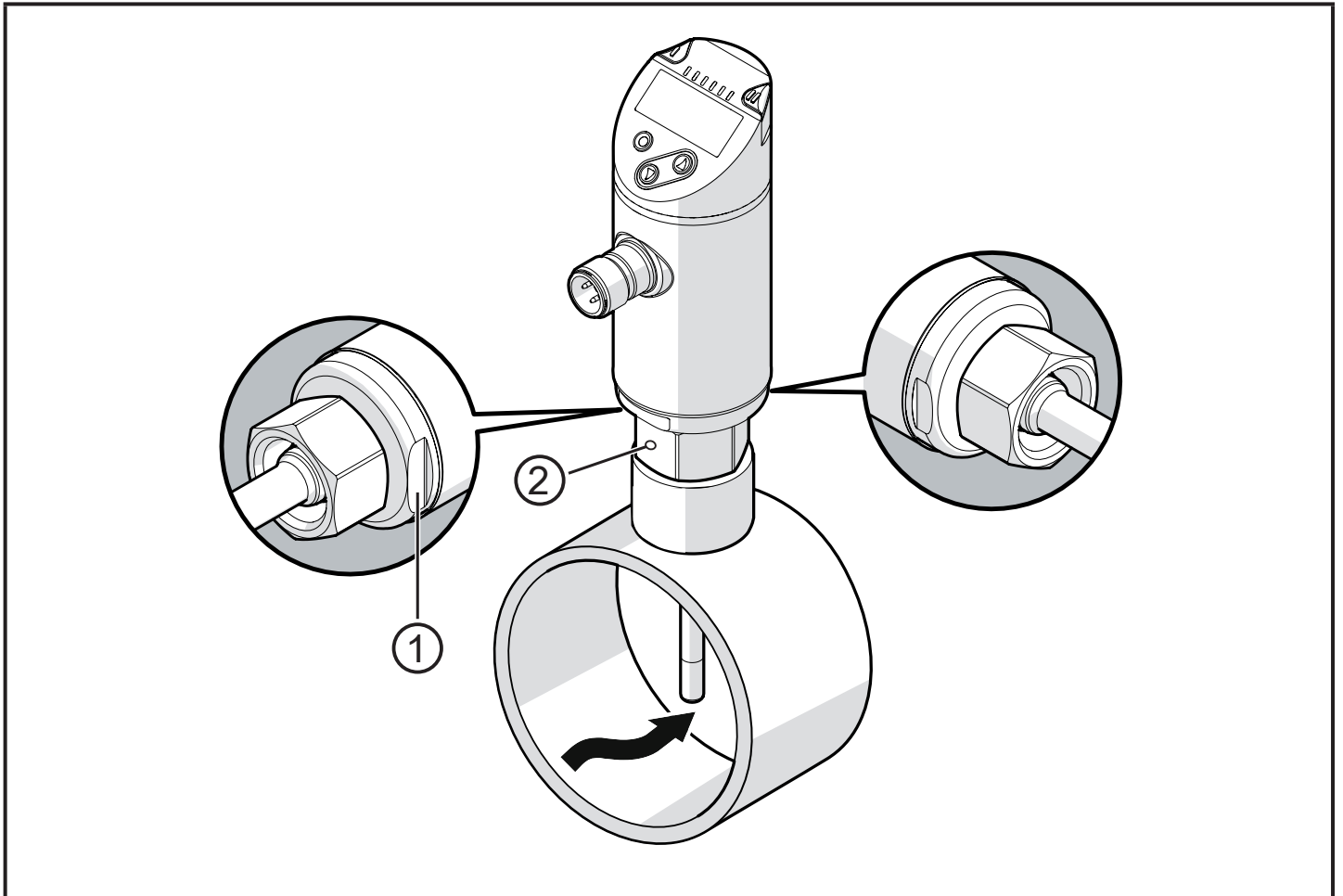
For easier readability of the display the sensor housing can be rotated by 345° with regard to the process connection.

[!] Do not go beyond the end stop.

6 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 according to EN 50178, SELV, PELV.

▶ Disconnect power.

▶ Connect the unit as follows:
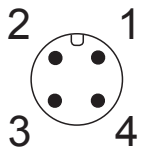
BK: black
BN: brown
BU: blue
WH: white

1	BN	L+
2	WH	OUT2
4	BK	OUT1
3	BU	L−
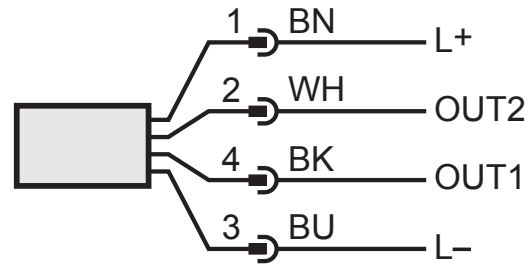
Colours to DIN EN 60947-5-2

Sample circuits:

2 x positive switching

1 BN — L+
2 WH
4 BK
3 BU — L−

2 x negative switching

1 BN — L+
2 WH
4 BK
3 BU — L−

1 x positive switching / 1 x analogue

1 BN — L+
2 WH
4 BK
3 BU — L−

1 x negative switching / 1 x analogue

1 BN — L+
4 BK
2 WH
3 BU — L−

Pin 1	L+
Pin 3	L-
Pin 4 (OUT1)	• Switching signal: limit flow value • Frequency signal for flow • IO-Link
Pin 2 (OUT2)	• Switching signal: limit flow value • Switching signal: limits for temperature • Analogue signal for flow • Analogue signal for temperature • Frequency signal for flow • Frequency signal for temperature • Input for external teach signal (remote calibration)

7 Operating and display elements
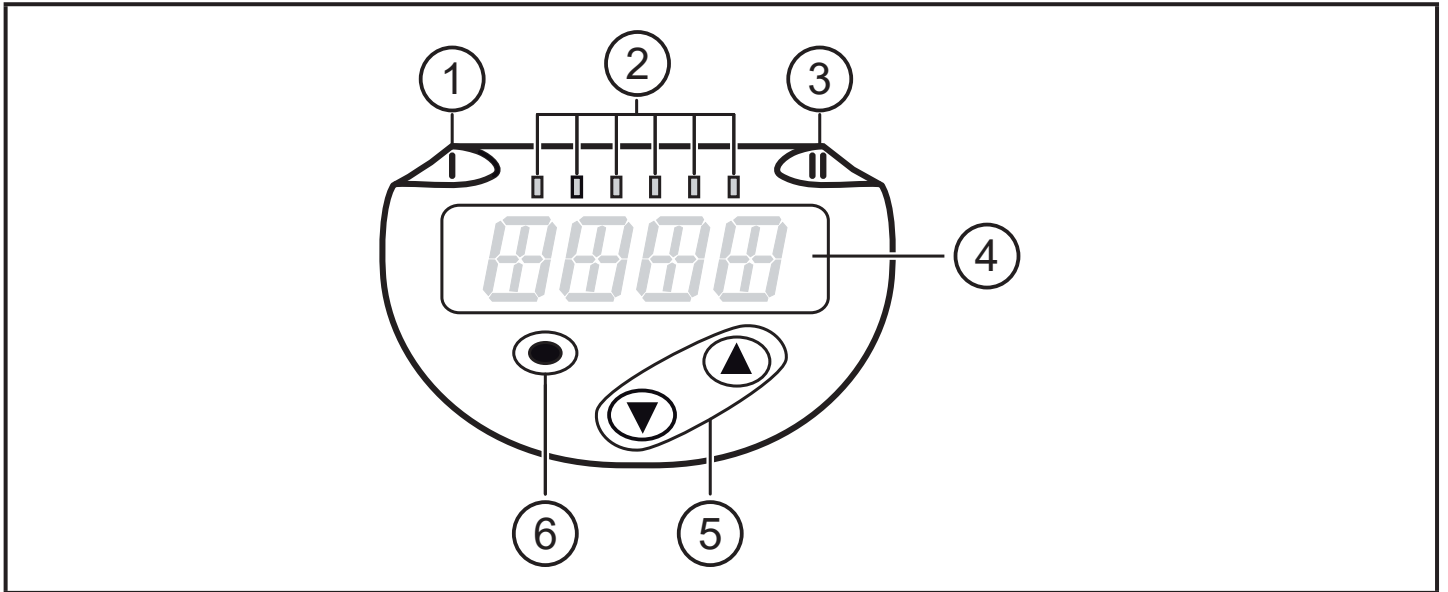
1, 2, 3: Indicator LEDs

- LED 1 = switching status OUT1 (lights if output 1 is switched)
- LED 2 = process value in the indicated unit of measurement:

SAxx00 SAxx30 SAxx40	%, m/s, l/min, m3/h, °C, 10^3
SAxx10	%, fps, gpm, cfm, °F, 10^3

- LED 3 = switching status OUT2 (lights if output 2 is switched)

4: Alphanumeric display, 4 digits

- Indication of the current process values in red or green characters → 4.9.
- Display of the parameters and parameter values

5: Buttons up [▲] and down [▼]

- Select parameter
- Change parameter value (hold button pressed)
- Change of the display unit in the normal operating mode (Run mode)
- Lock / Unlock (buttons pressed simultaneously > 10 seconds)

6: Button [●] = Enter

- Change from the RUN mode to the main menu
- Change to the setting mode
- Acknowledge the set parameter value

8 Menu

8.1 Main menu
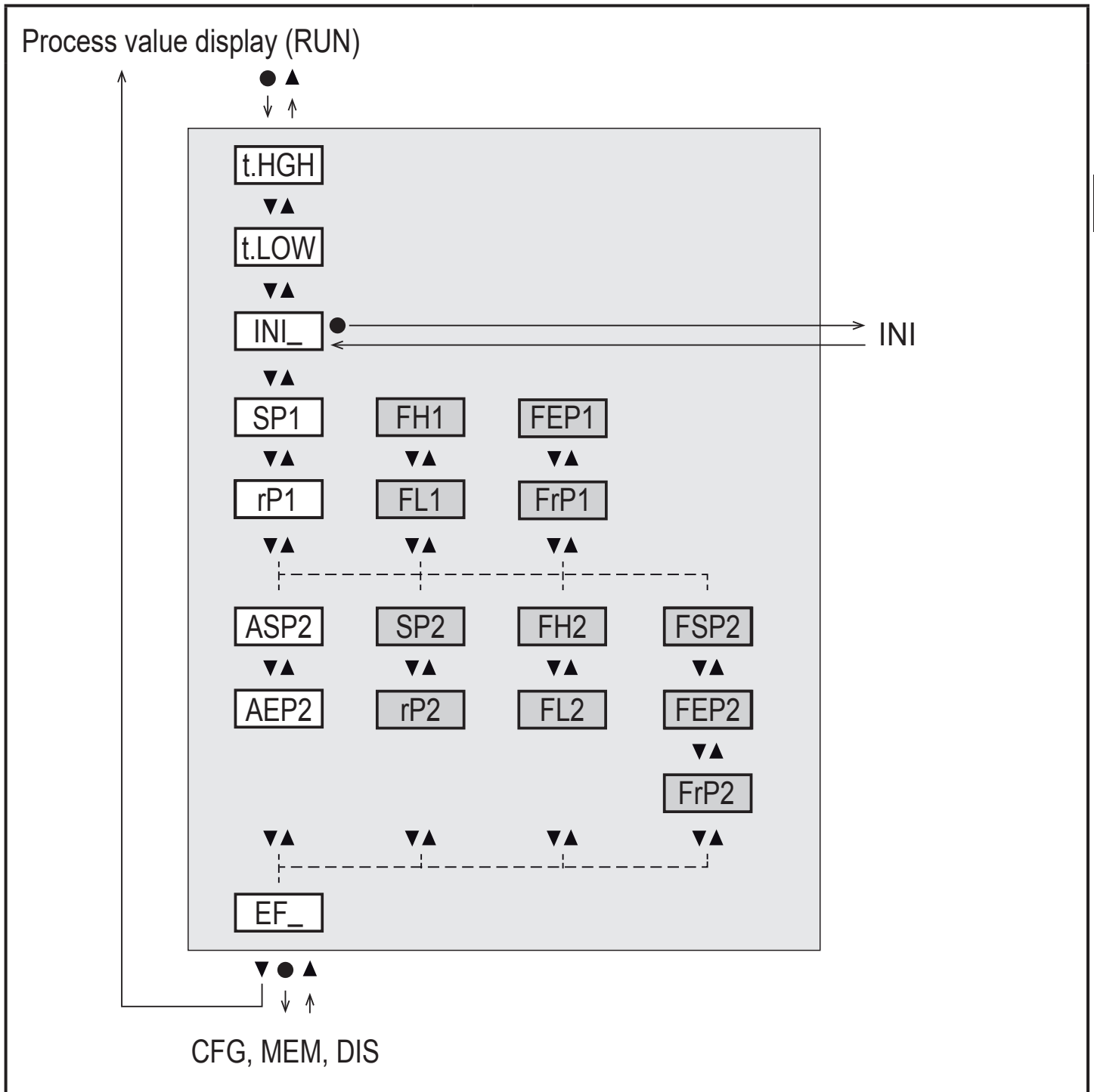
Process value display (RUN)

● ▲
↓ ↑

| t.HGH |
▼▲
| t.LOW |
▼▲
| INI_ | ● ──────────────────────→ INI
←──────────────
▼▲

| SP1 | | FH1 | | FEP1 |
▼▲   ▼▲   ▼▲
| rP1 | | FL1 | | FrP1 |
▼▲   ▼▲   ▼▲

| ASP2 | | SP2 | | FH2 | | FSP2 |
▼▲   ▼▲   ▼▲   ▼▲
| AEP2 | | rP2 | | FL2 | | FEP2 |
                             ▼▲
                             | FrP2 |

▼▲   ▼▲   ▼▲   ▼▲

| EF_ |

▼ ● ▲
↓ ↑

CFG, MEM, DIS

☐ Parameters with white background are indicated in case of factory setting (→ 15).

▨ Parameters with grey background are indicated depending on the operating mode [ModE] and output functions [ou1] and [ou2].

Explanation main menu

t.HGH	Flow adjustment to maximum value (high teach) = 100 % flow with the operating mode REL.
t.LOW	Flow adjustment to minimum value (low teach) = 0 % flow with the operating mode REL.
INI	Opening of the initialisation menu.
EF	Extended functions. Opening of the lower menu level.
Switching output with hysteresis function:	
SP1	Set point OUT1.
rP1	Reset point OUT1.
SP2	Set point OUT2.
rP2	Reset point OUT2.
Switching output with window function:	
FH1	Upper limit for window OUT1.
FL1	Lower limit for window OUT1.
FH2	Upper limit for window OUT2.
FL2	Lower limit for window OUT2.
Frequency output:	
FEP1	End point for flow OUT1.
FrP1	Frequency at the end point (FEP1) OUT1.
FEP2	End point for flow or temperature OUT2.
FrP2	Frequency at the end point (FEP2) OUT2.
FSP2	Start point for temperature OUT2, only for SEL2 = TEMP.
Analogue output:	
ASP2	Analogue start point at OUT2 = flow or temperature value at which the output signal is 4 mA.
AEP2	Analogue end point at OUT2 = flow or temperature value at which the output signal is 20 mA.

8.2 Initialisation menu (INI)

Main menu

| ModE | ⟷ | REL | LIQU | GAS | | INI |

▼▲

| MEdI | ⟷ | H2O | GLYC | OIL1 | OIL2 | AIR |

▼▲
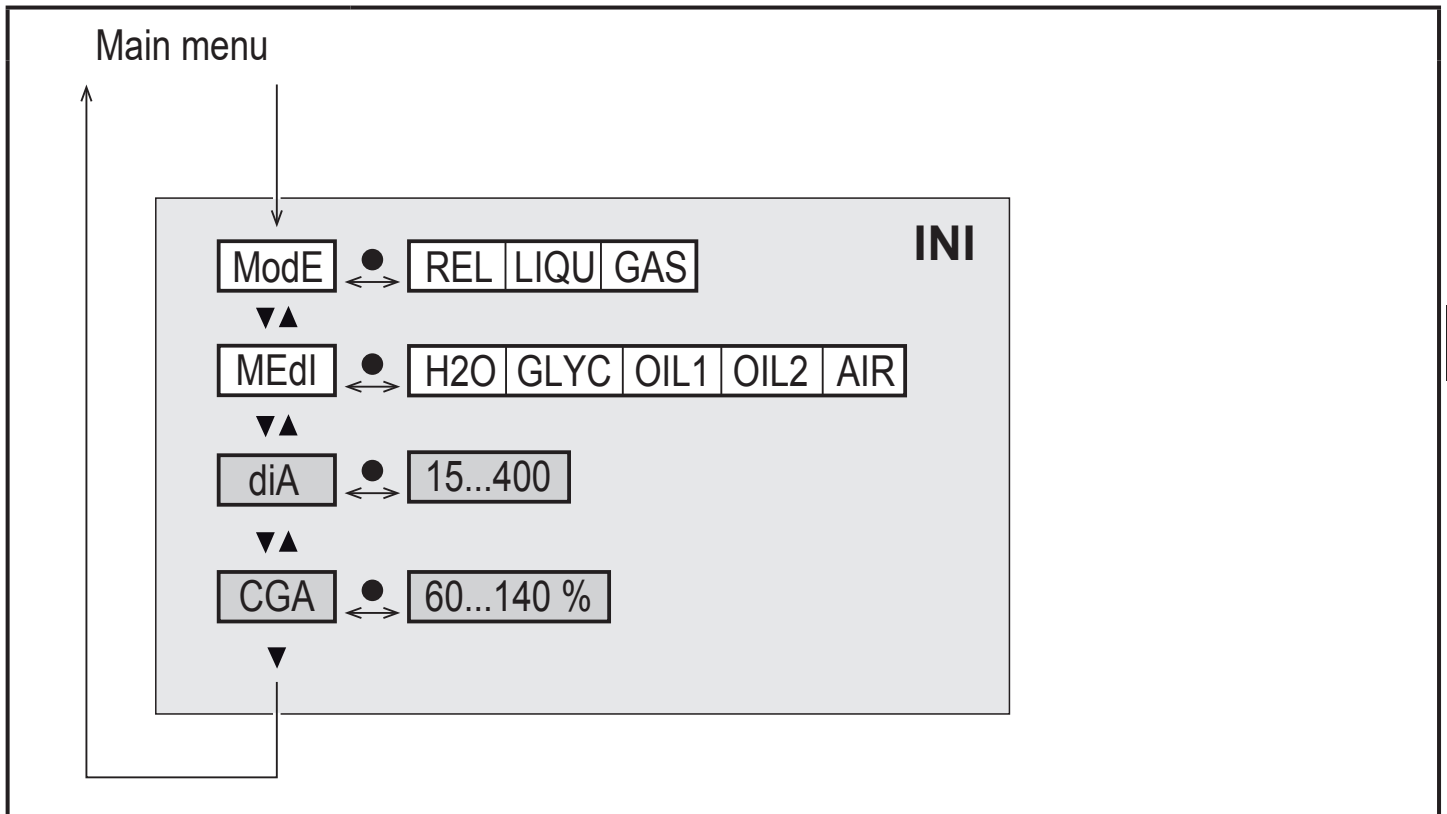
| diA | ⟷ | 15...400 |

▼▲

| CGA | ⟷ | 60...140 % |

▼

☐ Parameters with white background are indicated in case of factory setting (→ 15).

▨ Parameters with grey background are displayed depending on the operating mode [ModE].

Explanation initialisation menu (INI)

ModE	Selection of the operating mode for flow measurement: REL = Display of relative process values (liquids or air) LIQU = Display of absolute process values (liquids) GAS = Display of absolute process values (air)
MEdI	Medium selection
diA	Setting the internal pipe diameter in mm or inch.
CGA	Calibration of the measurement graph (pitch)

8.3 Extended functions (EF) – Basic settings (CFG)

Main menu

RUN

EF

rES ●▲→ - - - - ●

CFG_ ●

MEM_

DIS_

CFG

ou1 → Hno | Hnc | Fno | Fnc | FRQ

ou2 → Hno | Hnc | Fno | Fnc | tch | FRQ | I

dS1 → 0,0...60 s

dr1 → 0,0...60 s

dS2 → 0,0...60 s

dr2 → 0,0...60 s

uni → l/min | m³/h | m/s *

P-n → PnP | nPn

dAP → 0,0...5,0 s

FOU1 → On | OFF | OU

FOU2 → On | OFF | OU
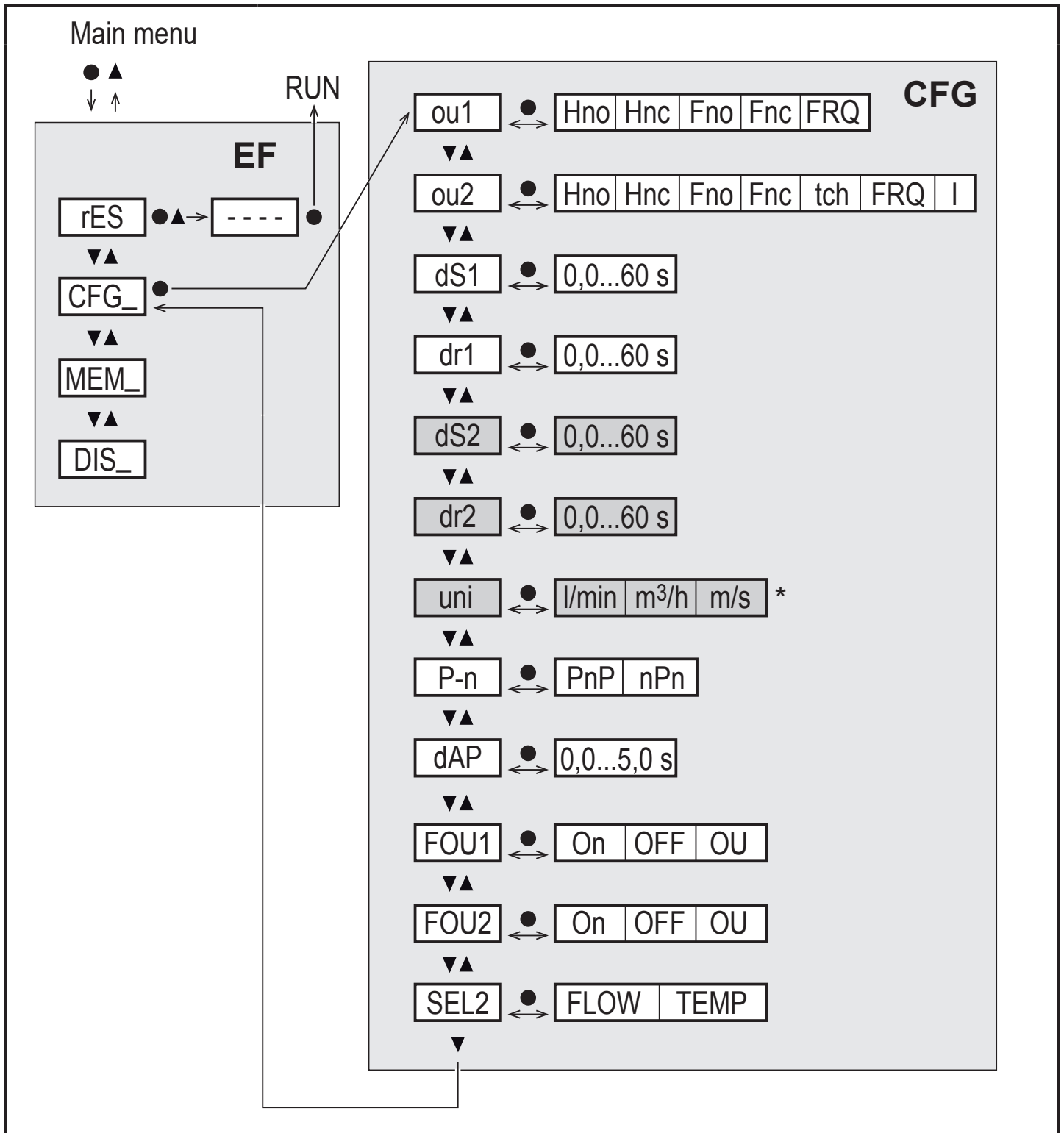
SEL2 → FLOW | TEMP

* for SAxx10 units: cfm / gpm / fps

☐ Parameters with white background are indicated in case of factory setting (→ 15).

▨ Parameters with grey background are indicated depending on the operating mode [ModE] and output functions [ou1] and [ou2].

Explanation extended functions (EF)

rES	Restore factory setting
CFG	Submenu basic settings
MEM	Submenu min/max memory
DIS	Submenu display settings

Explanation basic settings (CFG)

ou1 / ou2	Output functions OUT1 / OUT2 Hno = Hysteresis function normally open Hnc = Hysteresis function normally closed Fno = Window function normally open Fnc = Window function normally closed FRQ = Frequency output I = Analogue signal 4...20 mA. tch = Input for external teach signal
dS1 / dS2	Switch-on delay on OUT1 / OUT2
dr1 / dr2	Switch-off delay on OUT1 / OUT2
uni	Standard unit of measurement for flow
P-n	Output logic: pnp / npn
dAP	Measured value damping (only for flow)
FOU1 / FOU2	Behaviour of output OUT1 / OUT2 in case of an error
SEL2	Standard unit of measurement for evaluation via OUT2

8.4 Min/Max memory (MEM) − Display (DIS)
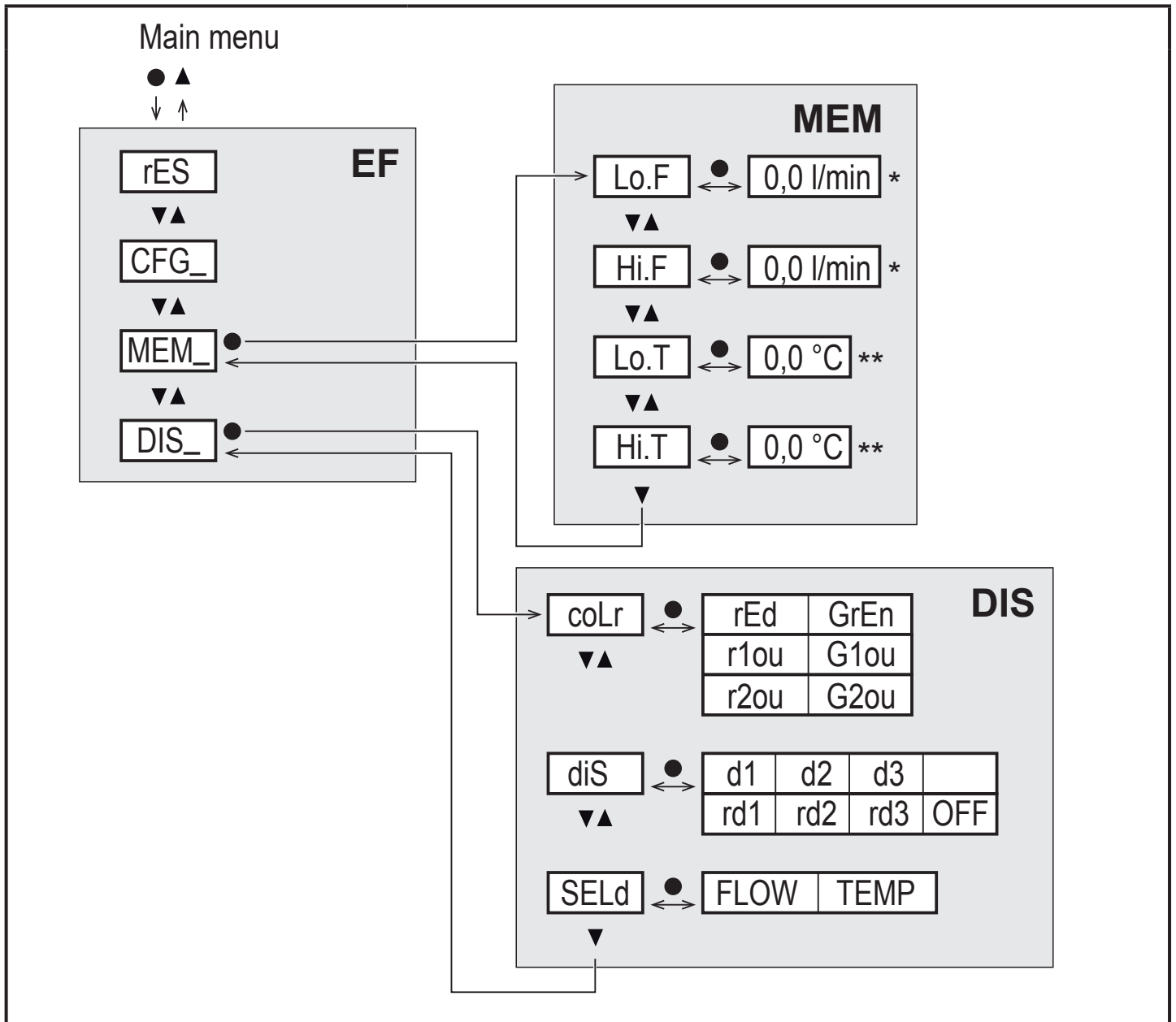
* measured value in the standard unit of measurement for SAxx10 units: cfm / gpm / fps
** for SAxx10 units: °F

Explanation min/max memory (MEM)

Lo.F	Min. value of the flow measured in the process
Hi.F	Max. value of the flow measured in the process
Lo.T	Min. value of the temperature measured in the process
Hi.T	Max. value of the temperature measured in the process

Explanation display settings (DIS)

coLr	Colour configuration of the display
	rEd = Display always red
	GrEn = Display always green
	r1ou = Display red in case of switched output OUT1
	G1ou = Display green in case of switched output OUT1
	r2ou = Display red in case of switched output OUT2
	G2ou = Display green in case of switched output OUT2
diS	Update rate and orientation of the display
	d1 = update of the measured values every 50 ms.
	d2 = update of the measured values every 200 ms.
	d3 = update of the measured values every 600 ms.
	rd1, rd2, rd3 = display as for d1, d2, d3; rotated by 180°.
	OFF = the measured value display is deactivated in the Run mode.
SELd	Standard display: flow or medium temperature

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 start up delay time the outputs are switched as programmed:

- ON with normally open function (Hno / Fno)

- OFF with normally closed function (Hnc / Fnc)

- OFF for frequency output (FRQ)

- 20 mA for current output (I)

10 Parameter setting

> ⚠ **CAUTION**
>
> For medium temperatures above 50 °C (122 °F) some parts of the housing can heat up to over 65 °C (149 °F).
>
> > Risk of burns.
>
> ▶ Do not touch the device with your hands.
>
> ▶ Use another object (e.g. a ballpoint pen) to carry out settings 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.

[ⓘ] The parameters can also be set via the IO-Link interface (→ 4.10).

10.1 Parameter setting in general

1. Change from the RUN mode to the main menu	[●]
2. Select the requested parameter	[▲] or [▼]
3. Change to the setting mode	[●]
4. Change the parameter value	[▲] or [▼] > 1 s
5. Acknowledge the set parameter value	[●]
6. Return to the RUN mode	> 30 seconds (timeout) or press [▲] + [▼] simultaneously until the RUN mode is reached.

[ⓘ] By pressing [▲] + [▼] simultaneously you exit the setting mode without saving the changed parameter.

10.1.1 Switch between the menus

1. Change from the RUN mode to the main menu	[●]
2. Select the parameter EF	[▼]
3. Change to sub-menu EF	[●]
4. Select the parameters CFG, MEM, DIS	[▼]
5. Change to the sub-menus CFG, MEM, DIS	[●]
6. Return to the next higher menu level	Press [▲] + [▼] simultaneously

10.1.2 Change to the process value display (RUN mode)

There are 3 possibilities:

I.	Wait for 30 seconds (→ 10.1.4 Timeout).
II.	Press [▲] until the RUN mode is reached.
III.	Press [▲] + [▼] simultaneously until the RUN mode is reached.

10.1.3 Locking / Unlocking

The unit can be locked electronically to prevent unintentional settings.
On delivery: not locked.

Locking	▶ Make sure that the unit is in the normal operating mode. ▶ Press [▲] and [▼] simultaneously for 10 s until [Loc] is displayed.
Unlocking	▶ Make sure that the unit is in the normal operating mode. ▶ Press [▲] and [▼] simultaneously for 10 s until [uLoc] is displayed.

10.1.4 Timeout

If no button is pressed for 30 s during parameter setting, the unit returns to the operating mode with unchanged values.

10.2 Settings for volumetric flow monitoring

▶ Select the operating mode [ModE] first before doing all the other settings (→ 10.2.1).

[!] For the operating modes GAS and LIQU, the flow values are set in the unit defined in [uni].

    ▶ If necessary, change the unit before setting the flow values.

    For the operating mode REL the unit % is always used.

10.2.1 Define the operating mode

▶ Select [ModE] and define the operating mode: REL, GAS, LIQU.	Menu INI: [ModE]
[ℹ] A medium and an internal pipe diameter must be entered for the operating modes LIQU and GAS. When the factory setting is changed (ModE = REL), the unit displays [≡≡≡≡] to force these entries: ▶ Press [●]. > [MEdI] is displayed. ▶ Define the medium. > [diA] is displayed. ▶ Define the internal pipe diameter in mm or inch.	
[ℹ] The operating mode REL requires a flow adjustment → 10.2.8.	
[ℹ] A change of the operating mode leads to a restart of the unit. The settings are saved in the respective operating mode, i.e. after a change of the operating mode the settings are not lost.	

10.2.2 Define the internal pipe diameter

▶ Select [diA] and define the internal pipe diameter: SAxx00 SAxx30 15...400 mm SAxx40 SAxx10 0.6...16 inch	Menu INI: [diA]
[ℹ] [diA] is only available if the operating mode GAS or LIQU is selected.	

10.2.3 Configure the limit value monitoring for flow for OUT1

▶ Select [ou1] and set the switching function: Hno, Hnc, Fno or Fnc 1. When the hysteresis function is selected: ▶ Select [SP1] and set the value at which the output is set. ▶ Select [rP1] and set the value at which the output is reset. 2. When the window function is selected: ▶ Select [FH1] and set the upper limit value of the window. ▶ Select [FL1] and set the lower limit value of the window.	Menu CFG: [ou1] Main menu: [SP1] [rP1] [FH1] [FL1]

10.2.4 Configure the limit value monitoring for flow for OUT2

▶ Select [SEL2] and set FLOW. ▶ Select [ou2] and set the switching function: Hno, Hnc, Fno or Fnc 1. When the hysteresis function is selected: ▶ Select [SP2] and set the value at which the output switches. ▶ Select [rP2] and set the value at which the output is reset. 2. When the window function is selected: ▶ Select [FH2] and set the upper limit value of the window. ▶ Select [FL2] and set the lower limit value of the window.	Menu CFG: [SEL2] [ou2] Main menu: [SP2] [rP2] [FH2] [FL2]

10.2.5 Configure the frequency signal for flow for OUT1

▶ Select [ou1] and set FRQ. ▶ Select [FEP1] and set the flow value at which the frequency set in FrP1 is provided. ▶ Select [FrP1] and set the frequency: 100 Hz...1000 Hz. 　[ⅈ] [FEP1] is only available if the operating mode GAS or LIQU is selected.	Menu CFG: [ou1] Main menu: [FEP1] [FrP1]

10.2.6 Configure the frequency signal for flow for OUT2

▶ Select [SEL2] and set FLOW. ▶ Select [ou2] and set FRQ. ▶ Select [FEP2] and set the upper flow value at which the frequency set in FrP2 is provided. ▶ Select [FrP2] and set the frequency: 100 Hz...1000 Hz. 　[ⅈ] [FEP2] is only available if the operating mode GAS or LIQU is selected.	Menu CFG: [SEL2] [ou2] Main menu: [FEP2] [FrP2]

10.2.7 Configure the analogue output for flow for OUT2

▶ Select [SEL2] and set FLOW.
▶ Select [ou2] and set the function:
    I = flow-proportional current signal 4…20 mA
▶ Select [ASP2] and set the flow value at which the output signal is 4 mA.
▶ Select [AEP2] and set the flow value at which the output signal is 20 mA.
 	
   [i]   [ASP2] and [AEP2] are only available if the operating mode GAS or LIQU is selected.
	Menu CFG:
	[SEL2]
	[ou2]
	
	Main menu:
	[ASP2]
	[AEP2]

10.2.8 Carry out the flow adjustment

1. High-flow adjustment:
▶ Switch on the supply voltage.
▶ Activate the maximum flow in the installation.
▶ Select [t.HGH] and press [●].
> [tch] is displayed.
▶ Keep [▲] or [▼] pressed.
> [----] is displayed.
▶ Briefly press [●].
> Display [donE]: adjustment successful.
   Display [FAIL]: Repeat the adjustment.
> The unit defines the existing flow as maximum flow (final value of the measuring range = 100 %).
▶ Briefly press [●].
 	
2. Low-flow adjustment:
▶ Switch on the supply voltage.
▶ Activate the minimum flow in the installation.
▶ Select [t.LOW] and press [●].
> [tch] is displayed.
▶ Keep [▲] or [▼] pressed.
> [----] is displayed.
▶ Briefly press [●].
> Display [donE]: adjustment successful.
   Display [FAIL]: Repeat the adjustment.
> The unit defines the existing flow as minimum flow (0 %).
▶ Briefly press [●].
 	
   [i]   [t.HGH] and [t.LOW] are only available if the operating mode REL is selected.
	Main menu:
	[t.HGH]
	[t.LOW]

10.2.9 Carry out the remote calibration

▶ Select [ou2] and set [tch].	Menu CFG: [ou2]
1. High-flow adjustment:	
▶ Apply the operating voltage to pin 2 for 5 to 10 s.	
2. Low-flow adjustment:	
▶ Apply the operating voltage to pin 2 for 10 to 15 s.	
> OUT2 high for 2 s: adjustment successful.	
> OUT2 high for 1 s: adjustment failed. ▶ Repeat the adjustment.	

10.3 Settings for temperature monitoring

10.3.1 Configure the limit value monitoring for temperature for OUT2

▶ Select [SEL2] and set TEMP. ▶ Select [ou2] and set the switching function: Hno, Hnc, Fno or Fnc	Menu CFG: [SEL2] [ou2]
1. When the hysteresis function is selected: ▶ Select [SP2] and set the value at which the output switches. ▶ Select [rP2] and set the value at which the output is reset.	Main menu: [SP2] [rP2] [FH2] [FL2]
2. When the window function is selected: ▶ Select [FH2] and set the upper limit value of the window. ▶ Select [FL2] and set the lower limit value of the window.	

10.3.2 Configure the frequency signal for temperature for OUT2

▶ Select [SEL2] and set TEMP. ▶ Select [ou2] and set FRQ. ▶ Select [FSP2] and set the lower temperature value at which 0 Hz is provided. ▶ Select [FEP2] and set the upper temperature value at which the frequency set in FrP2 is provided. ▶ Select [FrP2] and set the frequency: 100 Hz...1000 Hz.	Menu CFG: [SEL2] [ou2] Main menu: [FSP2] [FEP2] [FrP2]

10.3.3 Configure the analogue output for temperature for OUT2

▶ Select [SEL2] and set TEMP. ▶ Select [ou2] and set the function: I = temperature-proportional current signal 4…20 mA ▶ Select [ASP2] and set the temperature value at which the output signal is 4 mA. ▶ Select [AEP2] and set the temperature value at which the output signal is 20 mA.	Menu CFG: [SEL2] [ou2] Main menu: [ASP2] [AEP2]

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10.4 User settings (optional)

10.4.1 Configuration of the standard display

▶ Select [SELd] and determine the standard unit of measurement:
  - FLOW = the current flow in the standard measuring unit is displayed.
  - TEMP = the current medium temperature in °C (SAxx10: °F) is
    displayed.
▶ Select [diS] and set the update rate and orientation of the display:
  - d1, d2, d3: update of the measured values every 50, 200, 600 ms.
  - rd1, rd2, rd3: display as for d1, d2, d3; rotated by 180°.
  - OFF = the measured value display is deactivated in the Run mode.
 	
   ⓘ The LEDs remain active even if the display is deactivated. Error
       messages are displayed even if the display is deactivated.
	Menu DIS:
	[SELd]
	[diS]

10.4.2 Set the standard unit of measurement for flow

▶ Select [uni] and set the unit of measurement:
 	
SAxx00
SAxx30   l/min, m3/h, m/s
SAxx40
───────────
SAxx10   cfm, gpm, fps
 	
ⓘ [uni] is only available if the operating mode GAS or LIQU is selected.
   For the operating mode REL the flow value is always displayed in %
   of the measuring range.
	Menu CFG:
	[uni]

10.4.3 Select the medium

▶ Select [MEdI] and define the medium to be monitored: H2O, OIL1*, OIL2**, GLYC, AIR. ⓘ Depending on the operating mode different media are available (→ 4.2). *OIL1 = high-viscosity oil (≥ 40 mm²/s at 40 °C / ≥ 40 cSt at 104 °F) **OIL2 = low-viscosity oil (≤ 40 mm²/s at 40 °C / ≤ 40 cSt at 104 °F)	Menu INI: [MEdI]

10.4.4 Configure colour change display

▶ Select [coLr] and define the colour of the process value display: rEd, GrEn, r1ou, r2ou, G1ou, G2ou (→ 4.9).	Menu DIS: [coLr]

10.4.5 Setting the output logic

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

10.4.6 Set the measured value damping

▶ Select [dAP] and set the damping constant in seconds (Tvalue 63 %): 0...5 s (→ 4.8).	Menu CFG: [dAP]

10.4.7 Setting the switching delays

▶ Select [dSx] and set the delay for switching OUTx in seconds: 0...60 s. ▶ Select [drx] and set the delay for resetting OUTx in seconds: 0...60 s.	Menu DIS: [dS1] [dS2] [dr1] [dr2]

10.4.8 Set output status in fault condition

▶ Select [FOU1] or [FOU2] and set the value:
1. Switching output:
   - On = output 1 / output 2 switches ON in case of an error.
   - OFF = output 1 / output 2 switches OFF in case of an error.
   - OU = output 1 / output 2 switches irrespective of the fault as defined with the parameters.
2. Frequency output:
   - On = frequency signal: 130 % of FrP1 / FrP2 (→ 4.7).
   - OFF = frequency signal: 0 Hz (→ 4.7).
   - OU = frequency signal output continues to run without changes.
3. Analogue output:
   - On = the analogue signal goes to the upper fault value (→ 4.6).
   - OFF = the analogue value goes to the lower fault value (→ 4.6).
   - OU = the analogue signal corresponds to the measured value.
	Menu CFG:
	[FOU1]
	[FOU2]

10.4.9 Calibration of the curve of measured values

▶ Select [CGA] and set a percentage between 60 and 140 → 4.4. (100 % = factory calibration)	Menu INI: [CGA]
🛈 [CGA] is only available if the operating mode GAS or LIQU is selected.	

10.5 Service functions

10.5.1 Read min/max values

	Menu MEM:
▶ Select [Lo.x] or [Hi.x]. 　　[Lo.F] = minimum flow value , [Hi.F] = maximum flow value 　　[Lo.T] = minimum temperature value , [Hi.T] = maximum temperature 　　value	[Lo.F] [Hi.F]
Delete memory: ▶ Select [Lo.x] or [Hi.x]. ▶ Keep [▲] or [▼] pressed. > [----] is displayed. ▶ Briefly press [●]. ⚇ It is recommended to delete the memories as soon as the unit oper- 　　ates under normal operating conditions for the first time. 　　In the operating mode REL a new teaching process deletes the 　　memory.	

10.5.2 Reset all parameters to factory setting

	Menu EF:
▶ Select [rES] and press [●]. ▶ Keep [▲] or [▼] pressed. > [----] is displayed. ▶ Briefly press [●]. ⚇ We recommend noting down your own settings before carrying out 　　a reset .	[rES]

11 Operation

After power on, the unit is in the RUN mode (= normal operating mode). It carries out its measurement and evaluation functions and provides output signals according to the set parameters.

11.1 Read the process value

It can be preset whether flow or temperature is indicated as default (→ 10.4.1 Configuration of the standard display).
A standard unit of measurement can be defined for the flow measurement (l/min or m3/h or m/s; for SAxx10: gpm, cfm or fps → 10.4.2). For the operating mode REL flow is always displayed in %.

The display can be changed to another display unit in addition to the preset standard display:

▶ Press [▲] or [▼].

> The display changes, the indicator LEDs indicate the current display unit.

> After 30 seconds the display changes to the standard display.

11.2 Read the set parameters

▶ Briefly press [●]

▶ Press [▼] to select the parameter.

▶ Briefly press [●]

> The currently set value is displayed for 30 s. Then the unit returns to the process value display.

12 Technical data

Technical data and scale drawing at www.ifm.com.

13 Troubleshooting

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

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

Display	Type	Description	Troubleshooting
Err	Error	• Unit faulty / malfunction.	▶ Replace the unit.
No display	Error	• Supply voltage too low. • Setting [diS] = OFF.	▶ Check the supply voltage. ▶ Change the setting [diS] → 10.4.1.
PArA	Error	Parameter setting outside the valid range.	▶ Check parameter setting.
Loc	Warning	Setting pushbuttons on the unit locked, parameter change rejected.	▶ Unlock the unit → 10.1.3.
C.Loc	Warning	Setting buttons on the unit temporarily locked, parameter setting via IO-Link communication active.	▶ Finish parameter setting via IO-Link communication.

Display	Type	Description	Troubleshooting
S.Loc	Warning	Setting buttons locked via parameter software, parameter change rejected.	▶ Unlock the unit via IO-Link interface using the parameter setting software.
UL	Warning	Below the display range. Temperature value < - 20 % MEW (→ 4.6).	▶ Check temperature range. ▶ Repeat low-flow adjustment.
OL	Warning	Above the display range: measured value > 120 % of MEW (→ 4.6).	▶ Check flow range / temperature range. ▶ Repeat high-flow adjustment.
SC1	Warning	Switching status LED for OUT1 flashing: short circuit OUT1.	▶ Check switching output OUT1 for short-circuit or excessive current.
SC2	Warning	Switching status LED for OUT2 flashing: short circuit OUT2.	▶ Check switching output OUT2 for short-circuit or excessive current.
SC	Warning	Switching status LEDs for OUT1 and OUT2 flashing: short circuit OUT1 and OUT2.	▶ Check switching outputs OU1 and OUT2 for short-circuit or excessive current.
FAIL	Warning	Faulty low-flow or high-flow adjustment (e.g. the distance between maximum and minimum flow is too small)	▶ Repeat flow adjustment.

MEW = final value of the measuring range

14 Servicing

▶ From time to time check the sensor tip visually for build-up.

▶ Clean with soft cloth. Stubborn build-up, for example lime can be removed using a common vinegar cleaning agent.

15 Factory setting

Parameter	Factory setting	User setting
SP1	20 %	
rP1	15 %	
FH1	20 %	
FL1	15 %	
FEP1	100 %	
FrP1	100 Hz	
SP2	40 %	
rP2 (FLOW)	35 %	
rP2 (TEMP)	38 %	
FH2	40 %	
FL2 (FLOW)	35 %	
FL2 (TEMP)	38 %	
FSP2	0 %	
FEP2	100 %	
FrP2	100 Hz	
ASP2	0 %	
AEP2	100 %	
diA	----	
ou1	Hno	
ou2	I	
dS1	0 s	
dr1	0 s	
dS2	0 s	
dr2	0 s	

Parameter	Factory setting		User setting
uni	SAxx00 SAxx30 SAxx40	l/min	
	SAxx10	gpm	
P-n	PnP		
dAP	0.6 s		
MEdl	H2O		
FOU1	OFF		
FOU2	OFF		
SEL2	FLOW		
CGA	100 %		
ModE	REL		
coLr	rEd		
diS	d2		
SELd	FLOW		

The percentage values refer to the final value of the measuring range (MEW).