



Operating instructions
Mechatronic flow sensor

GB

SB1xxx
SB2xxx
SB3xxx
SB4xxx
SB5xxx
SB6xxx
SB7xxx
SB8xxx
SB9xxx
SB03xx



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1 Preliminary note

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

	ATTENTION Warning of damage to property
<hr/>	
	CAUTION Warning of personal injury ▷ Slight reversible injuries may result.

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.

3 Intended use

The unit monitors industrial oils.

The unit detects the process categories volume flow (volumetric flow quantity/time) and medium temperature.

ATTENTION

Frost formation of the medium.

▷ The sensor may be damaged.

▶ Ensure that the medium in the sensor does not freeze during operation and transport.

4 Function

- The unit detects the flow rate according to the principle of differential pressure by means of a permanent magnet and a measuring cell.
- As additional process value the unit detects the medium temperature.
- The unit can be operated in SIO mode (standard input-output) or in IO-Link mode.
- The unit displays the current process values.
- The unit generates two output signals according to the parameter setting.

4.1 Output OUT1 selection options

- Switching signal flow
- Switching signal temperature
- Frequency signal flow
- Frequency signal temperature
- IO-Link

4.2 Output OUT2 selection options

- Switching signal flow
- Switching signal temperature
- Analogue signal flow
- Analogue signal temperature

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

During installation or in case of a fault (e.g. housing damage) media under high pressure or hot media can leak from the system.

- ▷ Risk of injury caused by pressure or burns.
- ▶ Ensure that the system is free of pressure during installation.
- ▶ Ensure that no media can leak at the mounting location during installation.
- ▶ Equip the unit with suitable protection (e.g. cover) to avoid hazard to personnel from leaking media.

5.1 Process connection

- ▶ Avoid major changes of cross section on the inlet side. Use max. one connection size smaller.
- ▶ Fit the unit in the pipe in accordance with the flow direction (arrow) and tighten at the spanner flats.



Do not clamp the housing in a vice.

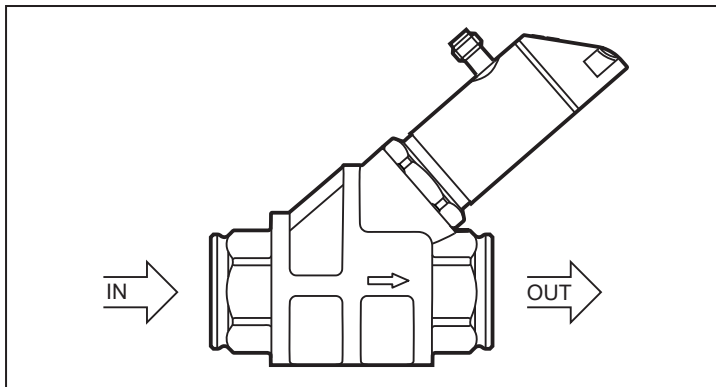


Fig. 1: Process connection

IN: inlet
OUT: outlet



Calming sections on the sensor's inlet or outlet side are not necessary.



The sensor can also prevent backflow.



The sensor head can be rotated by 360°.

5.2 Interference

- ▶ The following minimum distances must be adhered to:

Distance between the sensor and ferromagnetic materials	≥ 30 mm *
Distance between the sensor and constant / alternating fields	≥ 500 mm
Distance between the sensor axes for side-by-side installation	≥ 50 mm

* The pipe may consist of ferromagnetic material.

5.3 Mounting accessories

- ▶ If necessary, fasten the unit on the mounting plate (not supplied) from underneath.

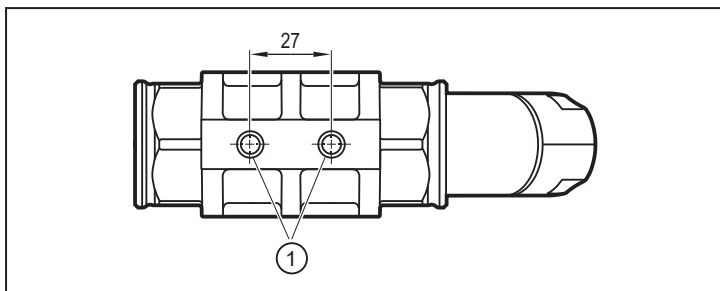


Fig. 2: Installation with mounting plate

- 1: threaded hole M8 (depth 6 mm) on the bottom side of the unit



Information about available accessories at www.ifm.com

5.4 Installation in case of medium containing dirt

- ▶ Use a 200-micron filter in front of the inlet (IN).
- ▶ Install sensor horizontally.
- ▶ Adhere to the inclination angle to the horizontal axis:

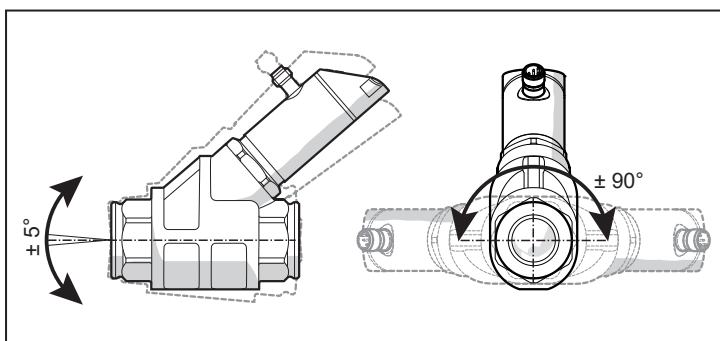


Fig. 3: Alignment in case of medium containing dirt



In clean medium, installation in vertical pipes is also possible.



Information about available filters at www.ifm.com.

6 Electrical connection



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.

► Disconnect power.

► Connect the unit as follows:

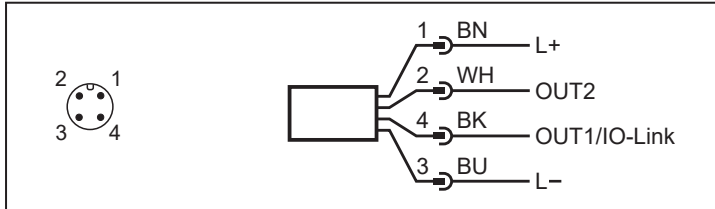


Fig. 4: Wiring diagram (colours to DIN EN 60947-5-2)

BK: black
BU: blue

BN: brown
WH: white

Pin	Assignment
1	L+
3	L-
4 (OUT1)	<ul style="list-style-type: none"> • Switching signal flow • Switching signal temperature • Frequency signal flow • Frequency signal temperature • IO-Link
2 (OUT2)	<ul style="list-style-type: none"> • Switching signal flow • Switching signal temperature • Analogue signal flow • Analogue signal temperature

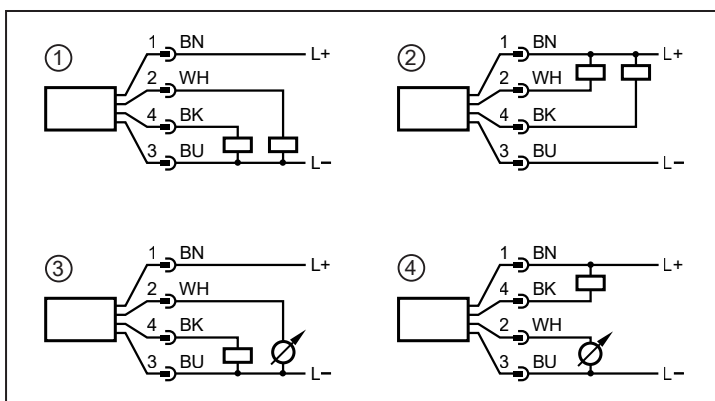
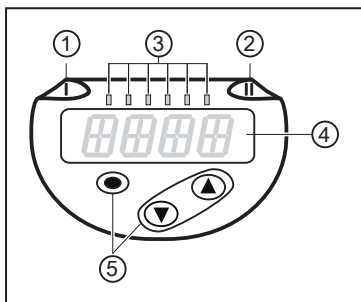


Fig. 5: Circuit examples

- 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



- 1: Switching status LED for OUT1
- 2: Switching status LED for OUT2
- 3: Process value in the indicated unit of measurement *
- 4: 4-digit alphanumeric display
- 5: Keys for changing views and parameter setting

Fig. 6: Operating and display elements

* l/min, m³/h, gpm, gph, °C, °F

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.

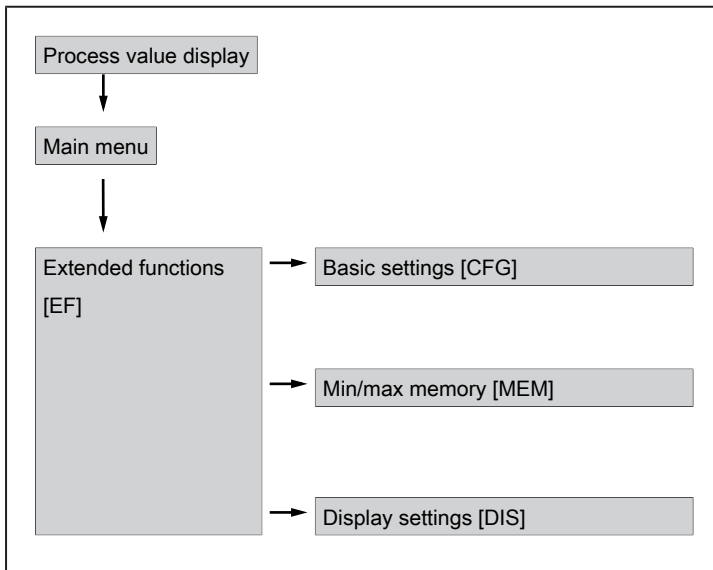


Fig. 7: Menu overview

8.1 Main menu and submenus



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

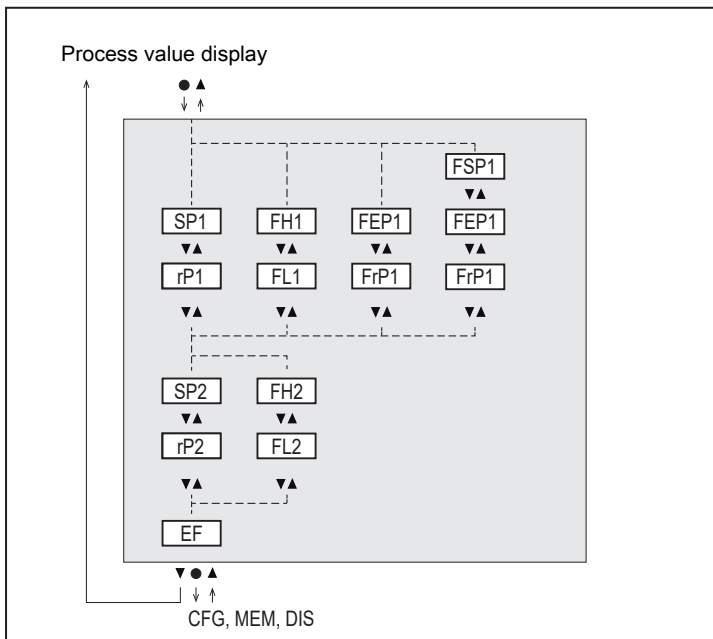


Fig. 8: Main menu

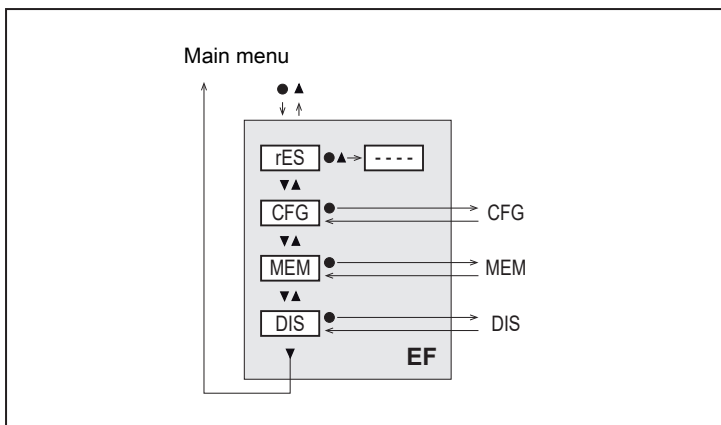


Fig. 9: Extended functions [EF] menu

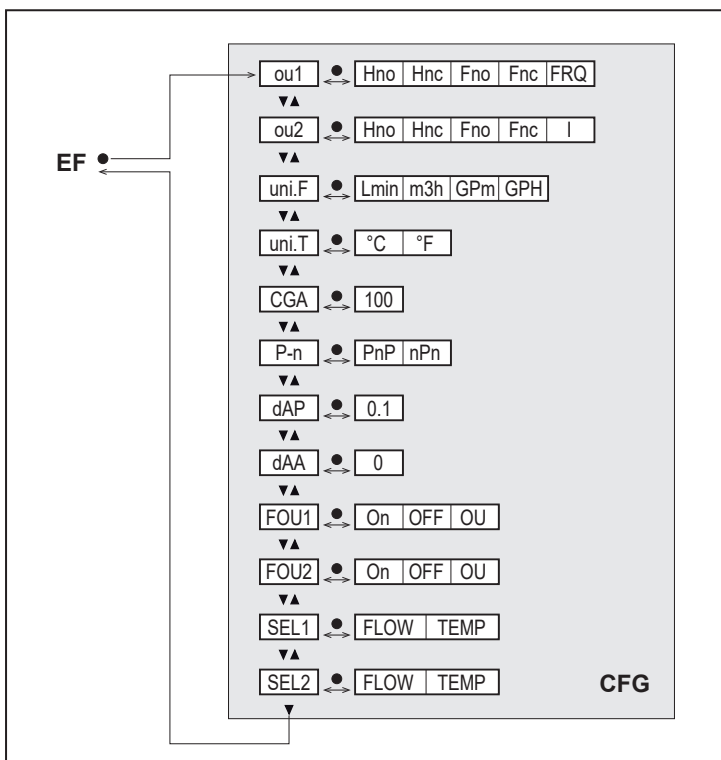


Fig. 10: Basic settings [CFG] menu

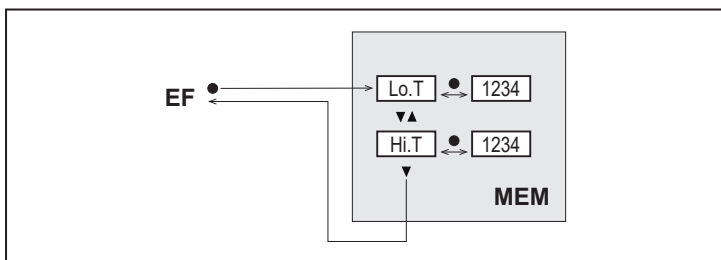


Fig. 11: Min/max memory [MEM] menu

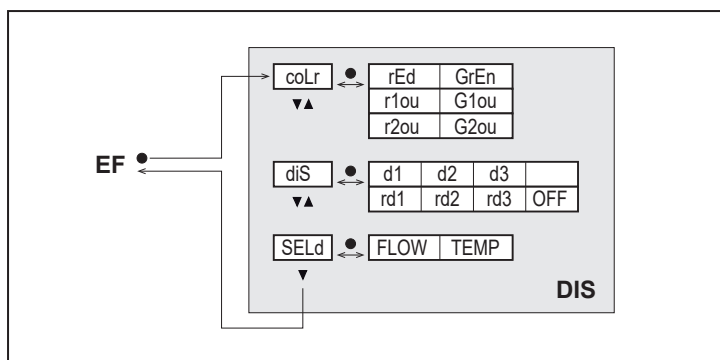


Fig. 12: Display settings [DIS] menu

8.2 Available parameters

Parameter	Explanation
CFG	Change to the submenu CGF (basic settings)
CGA	Calibration factor in % for adapting the measured value curve to the application
colr	Colour configuration of the display
dAA	Damping time in seconds for analogue signal flow
dAP	Damping time in seconds for switching signal flow
DIS	Change to the submenu DIS (display settings)
diS	Update rate and orientation of the display
EF	Change to the submenu EF (extended functions)
FEPx	Frequency end point for OUTx = Upper measured value at which the frequency signal set under FrPx is output.
FHx	Upper limit for switching signal OUTx with window function
FLx	Lower limit for switching signal OUTx with window function
FOUx	Behaviour of output OUTx in case of an error
FrPx	Frequency signal that is output when the upper measured value (MEW or FEPx) is reached.
FSPx	Frequency start point for OUTx = Lower measured value from which a frequency signal is output (only for temperature measurement).
Hi.T	Maximum temperature value measured
Lo.T	Minimum measured temperature value
MEM	Change to the submenu MEM (memory)
oux	Output configuration for output OUTx (e.g. switching output with hysteresis function)
P-n	Output logic
rES	Reset to factory settings
rPx	Reset point for switching output OUTx with hysteresis function
SEld	Standard process value of the display
SELx	Process value for output OUTx
SPx	Switch point for switching output OUTx with hysteresis function
uni.F	Standard unit of measurement for flow
uni.T	Standard unit of measurement for 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 power-on delay time the outputs are switched as programmed:

- OFF with normally open function (Hno / Fno)
- OFF with normally closed function (Hnc / Fnc)
- OFF for frequency output (FRQ)
- 0 mA for current output (I)

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



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
- ▶ Do not touch the device with your hands.
- ▶ Use another object (e.g. a ballpoint pen) to carry out settings on the unit.

Parameter setting process in general:

Intent	Action
Change from the process value display to the main menu	[●]
Change to the submenu	Use [▼] to navigate to the submenu (e.g. EF), then [●]
Selection of the desired parameter	▲ or [▼]
Change to setting mode	[●]
Changing the parameter value	▲ or [▼] > 1 s
Acceptance of the set parameter	[●]
Exit parameter setting without saving	[▲] + [▼]
Return to next higher menu (Repeat several times to reach process value display)	[▲] + [▼]
Return to the process value display	> 30 seconds (timeout)

10.2 Parameter setting via IO-Link

Requirements for parameter setting via the IO-Link interface:

- ✓ A suitable parameter setting software, e.g. ifm moneo|configure
- ✓ The Input Output Device Description (IODD) for the device, see documentation.ifm.com
- ✓ One IO-Link master
- ▶ Connect the IO-Link master to a parameter setting software.
- ▶ Set the port of the master to the IO-Link operating mode.
- ▶ Connect the device to a free port of the IO-Link master.
- ▷ The unit switches to IO-Link mode.

- ▶ Change parameter settings in the software.
- ▶ Write parameter settings to the unit.



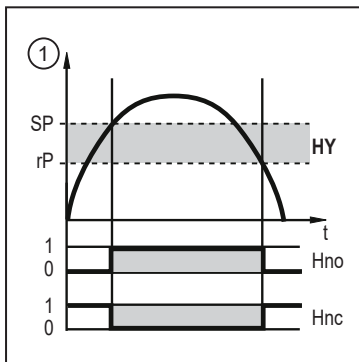
Notes on parameter setting → Manual of the parameter setting software

10.3 Output functions

10.3.1 Switching signal

A switching signal can be output for process value monitoring. OUTx changes its switching state when the set switching limits are exceeded or not reached. You can choose between hysteresis and window function.

Hysteresis function:



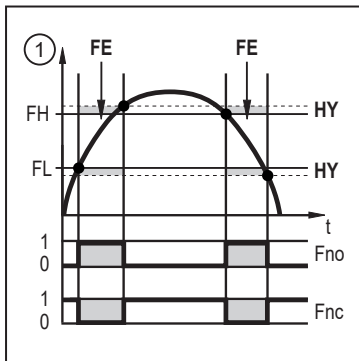
1: Process value
 t: Time
 SP: Set point
 rP: Reset point
 HY: Hysteresis
 Hno: Hysteresis function NO (normally open)
 Hnc: Hysteresis function NC (normally closed)

Fig. 13: Hysteresis function



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 0.6 % 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.

Window function:



1: Process value
 t: Time
 FH: Upper limit value
 FL: Lower limit value
 HY: Hysteresis
 FE: Window area
 Fno: Window function NO (normally open)
 Fnc: Window function NC (normally closed)

Fig. 14: Window function



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 0.6 % 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 helps keep the switching status of the output stable if the flow rate varies slightly.

10.3.1.1 Parameter setting via unit keys: Switching signal

- ✓ Standard unit of measurement is selected: [EF] > [CFG] > [uni.x].
- ✓ Process value for OUTx is selected: [EF] > [CFG] > [SELx].

- ▶ Set hysteresis function or window function.

Hysteresis function:

- ▶ Call up the menu [EF] > [CFG].
- ▶ Select [oux] and set the switching signal: Hno or Hnc.
- ▶ Call up the [main menu].
- ▶ Select [SPx] and set the measured value at which the output switches.
- ▶ Select [rPx] and set the measured value at which the output switches back.

Window function:

- ▶ Call up the menu [EF] > [CFG].
- ▶ Select [oux] and set the switching signal: Fno or Fnc.
- ▶ Call up the [main menu].
- ▶ Select [FHx] and set the upper limit of the window.
- ▶ Select [FLx] and set the lower limit of the window.

10.3.1.2 Parameter setting via IO-Link: Switching signal

- ✓ Standard unit of measurement is selected: [Parameter] > [Display setting] > [uni.x].
- ✓ Process value for OUTx is selected: [Parameters] > [Output configuration] > [SELx].
- ▶ Set hysteresis function or window function.

Hysteresis function:

- ▶ Call up [Parameters] > [Output Configuration].
- ▶ Select [oux] and set the switching signal: Hno or Hnc.
- ▶ Call up [Parameters] > [Digital Output x].
- ▶ Call up [flow] or [temperature].
- ▶ Select [SP_FHx_FLOW] or [SP_FHx_TEMP] and set the measured value at which the output switches.
- ▶ Select [rP_FLx_FLOW] or [rP_FLx_TEMP] and set the measured value at which the output switches back.

Window function:

- ▶ Call up [Parameters] > [Output Configuration].
- ▶ Select [oux] and set the switching signal: Fno or Fnc.
- ▶ Call up [Parameters] > [Digital Output x].
- ▶ Call up [flow] or [temperature].
- ▶ Select [SP_FHx_FLOW] or [SP_FHx_TEMP] and set the upper limit for the switching signal.
- ▶ Select [rP_FHx_FLOW] or [rP_FHx_TEMP] and set the lower limit for the switching signal.

10.3.2 Analogue signal

The unit provides an analogue signal of 4...20 mA proportional to the process value.

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 a fault, messages are displayed (UL, OL, Err).

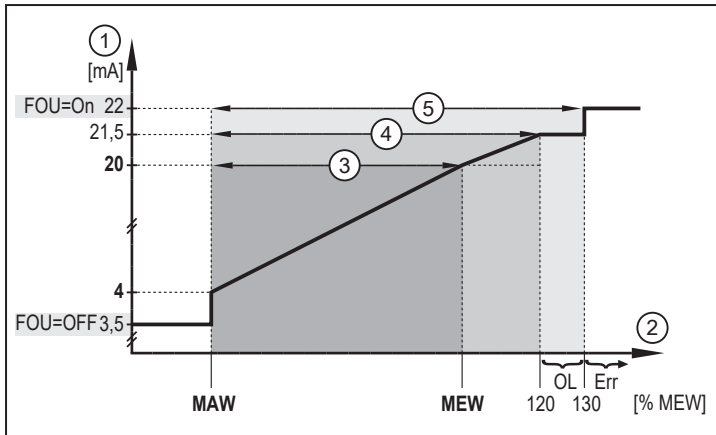


Fig. 15: Output characteristics of the analogue output, flow

- | | |
|--------------------|---|
| 1: Analogue signal | MAW: Initial value of the measuring range |
| 2: Flow | MEW: Final value of the measuring range |
| 3: Measuring range | OL: Above the display range |
| 4: Display range | Err: Error state |
| 5: Detection zone | |

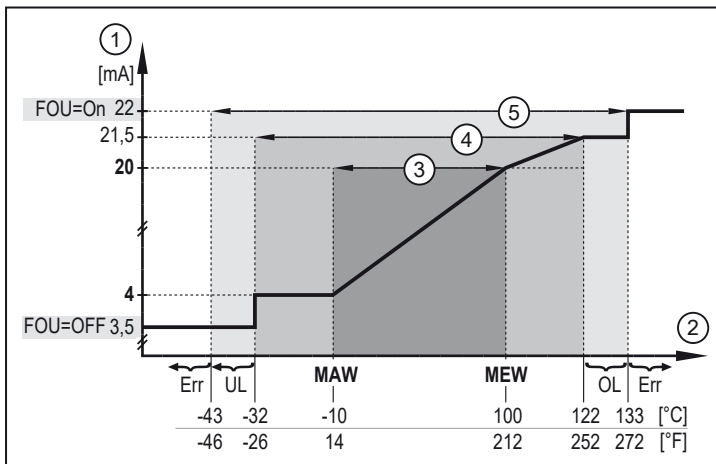


Fig. 16: Output characteristics of the analogue output, temperature

- | | |
|--------------------|---|
| 1: Analogue signal | MAW: Initial value of the measuring range |
| 2: Temperature | MEW: Final value of the measuring range |
| 3: Measuring range | OL: Above the display range |
| 4: Display range | UL: Below the display range |
| 5: Detection zone | Err: Error state |

10.3.2.1 Parameter setting via unit keys: Analogue signal

- ✓ Standard unit of measurement is selected: [EF] > [CFG] > [uni.x].
- ✓ Process value for OUT2 is selected: [EF] > [OUT2] > [SEL2].
- ▶ Call up the menu [EF] > [CFG].
- ▶ Select [ou2] and set the function: I: Analogue signal 4...20 mA.

10.3.2.2 Parameter setting via IO-Link: Analogue signal

- ✓ Standard unit of measurement is selected: [Parameter] > [Display setting] > [uni.x].
- ✓ Process value for OUT2 is selected: [Parameters] > [Output configuration] > [SEL2].
- ▶ Call up [Parameters] > [Output Configuration].
- ▶ Select [ou2] and set the function: I: Analogue signal 4...20 mA.

10.3.3 Frequency signal

The unit provides a frequency signal proportional to the process value.

The frequency signal is scalable:

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

The measuring range is scalable:

- [FSPx] defines the lower measured value from which a frequency signal is provided.
 - FSPx is only available for temperature measurement.
- [FEPx] defines the upper measured value at which the output signal has the frequency set under FrPx.



Minimum distance between FSPx and FEPx:

6.5 % of the final value of the measuring range (flow rate measurement).

20 % of the final value of the measuring range (temperature measurement).

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

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

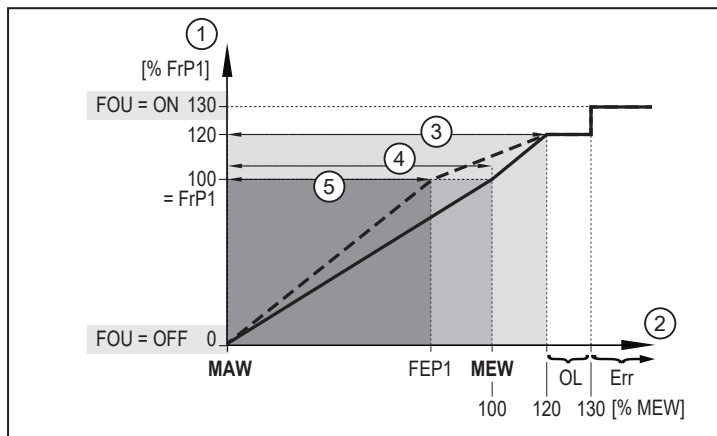


Fig. 17: Output characteristic frequency output, flow rate

- 1: Frequency signal
- 2: Flow
- 3: Display range
- 4: Measuring range
- 5: Scaled measuring range

- MAW: Initial value of the measuring range
- MEW: Final value of the measuring range
- FEP1: Frequency end point
- FrP1: Frequency signal (Hz) for upper measured value
- OL: Above the display range
- Err: Error

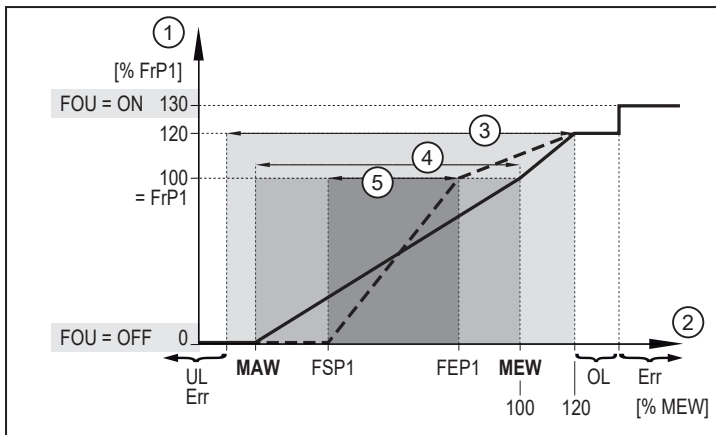


Fig. 18: Output characteristics frequency output, temperature

1:	Frequency signal	FSP1:	Frequency start point
2:	Temperature	FEP1:	Frequency end point
3:	Display range	FrP1:	Frequency signal (Hz) for upper measured value
4:	Measuring range	MAW:	Initial value of the measuring range
5:	Scaled measuring range	MEW:	Final value of the measuring range
Err:	Error	OL:	Above the display range

10.3.3.1 Parameter setting via unit keys: Frequency signal

- ✓ Standard unit of measurement is selected: [EF] > [CFG] > [uni.x].
- ✓ Process value for OUT1 is selected: [EF] > [CFG] > [SEL1].
- ▶ Select the [EF] > [CFG] menu.
- ▶ Select [ou1] and set FRQ.
- ▶ Call up the [main menu].
- ▶ Select [FSP1] and set the lower measured value at which 0 Hz is output.



[FSP1] is only available for temperature measurement.

- ▶ Select [FEP1] and set the upper measured value at which the frequency set at [FrP1] (= 100 %) is output.
- ▶ Select [FrP1] and set the frequency for the upper measured value in Hz.

10.3.3.2 Parameter setting via IO-Link: Frequency signal

- ✓ Standard unit of measurement is selected: [Parameter] > [Display setting] > [uni.x].
- ✓ Process value for OUT1 is selected: [Parameters] > [Output configuration] > [SEL1].
- ▶ Call up [Parameters] > [Output Configuration].
- ▶ Select [ou1] and set FRQ.
- ▶ Call up [Parameters] > [Frequency Output 1].
- ▶ Select [FrP1] and set the frequency for the upper measured value in Hz.
- ▶ Call up [flow] or [temperature].
- ▶ Select [FSP1 - TEMP] and set the lower measured value at which 0 Hz is output.



[FSP1] is only available for temperature measurement.

- ▶ Select [FEP1_FLOW] / [FEP1_TEMP] and set the upper measured value at which the frequency set at [FrP1] (= 100 %) is output.

10.3.4 Error behaviour of the outputs

The response of the OUTx output in case of a fault can be set via the parameter [FOUx]. Depending on the selected output function, the following signals are provided in case of a fault:

- Switching signal:
 - On: The output switches ON in case of a fault.
 - OFF: The output switches OFF in case of a fault.
 - OU: The output switches irrespective of the fault as defined with the parameters.
- Analogue signal:
 - On: The analogue signal goes to 22 mA.
 - OFF: The analogue signal goes to 3.5 mA.
 - OU: The analogue signal still corresponds to the measured value.
- Frequency signal:
 - On: The frequency signal goes to 130 % of [FrPx].
 - OFF: The frequency signal goes to 0 Hz.
 - OU: The frequency signal still corresponds to the measured value.

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

- ▶ Call up the menu [EF] > [CFG].
- ▶ Select [FOUx] and set the error behaviour for OUTx: On, OFF, OU.

10.3.4.2 Parameter setting via IO-Link: Error behaviour of the outputs

- ▶ Call up [Parameters] > [Error Configuration Output x].
- ▶ Select [FOUx] and set the error behaviour for OUTx: On, OFF, OU.

10.4 User settings

The chapter describes setting options for adaptation to the customer-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:

Flow rate: l/min, m³/h; gpm; gph.

Temperature: °C or °F.

10.4.1.1 Parameter setting via unit keys: Standard unit of measurement

- ▶ Call up the menu [EF] > [CFG].
- ▶ Select [uni.F] and set the unit of measurement.
- ▶ Select [uni.T] and set the unit of measurement.

10.4.1.2 Parameter setting via IO-Link: Standard unit of measurement

- ▶ Call up [Parameters] > [Display Setting].

- ▶ Select [uni.F] and set the unit of measurement.
- ▶ Select [uni.T] and set the unit of measurement.

10.4.2 Process value for OUT1 and OUT2

For both outputs, you can select which process value is to be monitored. All further parameter settings are based on this selection.

Selectable values:

- TEMP: Temperature
- FLOW: Flow

10.4.2.1 Parameter setting via unit keys: Process value OUT1 and OUT2

- ▶ Call up the menu [EF] > [CFG].
- ▶ [SELx] select Set process value for output OUTx.

10.4.2.2 Parameter setting via IO-Link: Process value OUT1 and OUT2

- ▶ Call up [Parameters] > [Output Configuration].
- ▶ [SELx] select Set process value for output OUTx.

10.4.3 Calibration

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

The sensor is suitable for oils with indicated viscosity (→ Technical data at documentation.ifm.com). The indicated viscosity applies to an oil temperature of 40 °C. For this oil, the sensor automatically compensates the viscosity change in the temperature range of 20...70 °C. The viscosity at 40 °C is not variable.

The specified compensation characteristic is openly documented in an ifm calculation tool. See also www.ifm.com - Service - Technical support: Selection help - Download:

- Calculation tool CGA for SB flow sensors

If the viscosity behaviour deviates via the temperature due to additives in the oil used, the deviation can be reduced through calibration.

- ▶ In this case adapt the calibration factor [CGA], see example:

Medium	Temperature	Viscosity	[CGA]
Reference oil	20 °C	430 mm ² /s	100%(factory setting)
Oil 1	20 °C	540 mm ² /s	80%
Oil 2	20 °C	360 mm ² /s	120%



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

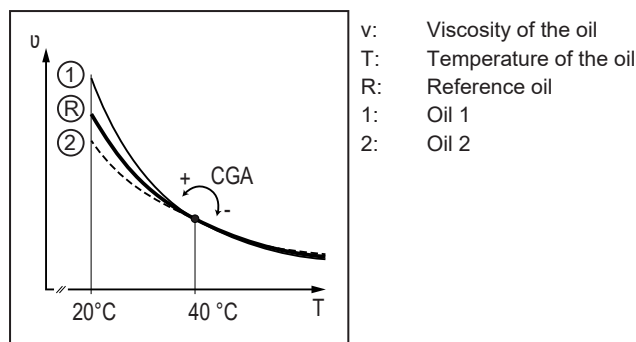


Fig. 19: Measured value characteristic for 3 oils

10.4.3.1 Parameter setting via unit keys: Calibration

- ▶ Call up the menu [EF] > [CFG].
- ▶ Select [CGA] and set the slope of the measuring characteristic in per cent.

10.4.3.2 Parameter setting via IO-Link: Calibration

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

10.4.4 Output polarity of the switching outputs

The parameter [P-n] can be used to select whether the outputs are plus-switching or negative-switching.

10.4.4.1 Parameter setting via unit keys: Output polarity

- ▶ Call up the menu [EF] > [CFG].
- ▶ Select [P-n] and set PnP or nPn.

10.4.4.2 Parameter setting via IO-Link: Output polarity

- ▶ Call up [Parameters] > [Output Configuration].
- ▶ Select [P-n] and set PnP or nPn.

10.4.5 Damping

Damping can be used to set a delay time during which the unit does not output erratically occurring measured value changes.

The set delay time stabilises the output signals.

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

Selectable values:

- [dAP] = damping time for switching signal, display and IO-Link signal (63% rise time)
- [dAA] = damping time for analogue signal (10...90% rise time)

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

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



Measured value damping only has an effect on the measured variable flow.

10.4.5.1 Parameter setting via unit keys: Measured value damping

- ▶ Call up the menu [EF] > [CFG].
- ▶ Select [dAP] and set the damping time in seconds (τ -value 63 %).
- ▶ Select [dAA] and set a damping time in seconds.

10.4.5.2 Parameter setting via IO-Link: Measured value damping

- ▶ Call up [Parameters] > [Damping].
- ▶ Select [dAP] and set the damping time in seconds (τ -value 63 %).
- ▶ Select [dAA] and set a damping time in seconds.

10.4.6 Memory

The unit stores the maximum and minimum measured process values.

Selectable values:

- [Lo.T]: Minimum value memory for temperature
- [Hi.T]: Maximum value memory for temperature



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

10.4.6.1 Parameter setting via unit keys: Memory

Show memory:

- ▶ Go to the [EF] > [MEM] menu.
- ▶ Select [Lo.T] or [Hi.T] to read the highest or lowest process value measured.

Clear memory:

- ▶ Go to the [EF] > [MEM] menu.
- ▶ Select [Lo.T] or [Hi.T].
- ▶ Briefly press [●].
- ▶ Keep [▲] and [▼] pressed.
 - ▷ [----] is displayed.
- ▶ Briefly press [●].

10.4.7 Device reset

The unit can be reset to factory settings.



We recommend documenting your own settings in the chapter Factory setting before carrying out a reset.

10.4.7.1 Parameter setting via unit keys: Device reset

- ▶ Select the [EF] menu.
- ▶ Select [rES].
- ▶ Briefly press [●].
- ▶ Keep [▲] or [▼] pressed.
 - ▷ [----] is displayed.

- ▶ Briefly press [●].
- ▷ The unit carries out a reboot.

10.4.7.2 Parameter setting via IO-Link: Device reset

- ▶ Select [Parameter] > [Basic settings].
- ▶ Click on the system command [Restore Factory Settings].
- ▷ The unit carries out a reboot.

10.5 Display

10.5.1 Display standard process value

Use the [SELD] parameter to choose which process value is shown in the display by default.

Selectable values:

- FLOW: The display shows the current process value for flow.
- TEMP: The display shows the current process value for temperature.

10.5.1.1 Parameter setting via unit keys: Display standard process value

- ▶ Call up the menu [EF] > [DIS].
- ▶ Select [SELD] and set the standard process value.

10.5.1.2 Parameter setting via IO-Link: Display standard process value

- ▶ Call up [Parameters] > [Display Setting].
- ▶ Select [SELD. Displayed measurement] and set the standard process value.

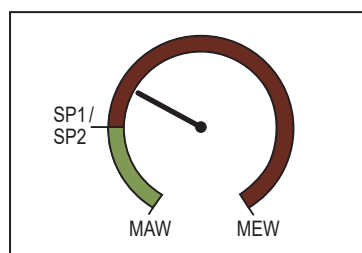
10.5.2 Display colour setting

The colour of the characters in the display can be set via the parameter [coLr].

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 setting	r1ou	r2ou	red
	G1ou	G2ou	green

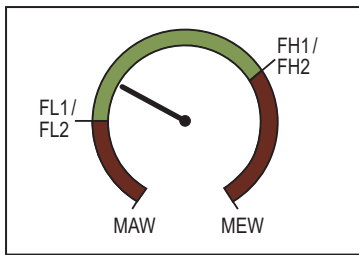
When the hysteresis function is set, the colour changes if the process value is above the set point:



MAW: Initial value of the measuring range
 MEW: Final value of the measuring range
 SPx: Switch point

Fig. 20: Hysteresis function, [coLr] = rxou

When the window function is set, the colour changes if the process value is within the window section:



MAW: Initial value of the measuring range
 MEW: Final value of the measuring range
 FLx: Lower limit of the window section
 FHx: Upper limit of the window section

Fig. 21: Window function, [coLr] = Gxou

10.5.2.1 Parameter setting via unit keys: Display colour setting

- ▶ Call up the menu [EF] > [DIS].
- ▶ Select [coLr] and define the colour of the characters in the process value display.

10.5.2.2 Parameter setting via IO-Link: Display colour setting

- ▶ Call up [Parameters] > [Display Setting].
- ▶ Select [coLr] and define the colour of the characters in the process value display.

10.5.3 Display update rate

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

Selectable values:

- d1: fast (every 50 ms)
- d2: medium (every 200 ms)
- d3: slow (every 600 ms)

10.5.3.1 Parameter setting via unit keys: Display update rate

- ▶ Call up the menu [EF] > [DIS].
- ▶ Select [diS] and set the update rate.

10.5.3.2 Parameter setting via IO-Link: Display update rate

- ▶ Call up [Parameters] > [Display Setting].
- ▶ Select [diS. Update rate] and set the update rate.

10.5.4 Display orientation

The text in the display can be rotated for better readability.

10.5.4.1 Parameter setting via unit keys: Display orientation

- ▶ Call up the menu [EF] > [DIS].
- ▶ Select [diS] and set the display rotation simultaneously with the update rate:
 - rd1: every 50 ms and rotated by 180°
 - rd2: every 200 ms and rotated by 180°
 - rd3: every 600 ms and rotated by 180°

10.5.4.2 Parameter setting via IO-Link: Display orientation

- ▶ Call up [Parameters] > [Display Setting].
- ▶ Select [diS. Display orientation] and set the clockwise rotation of the display:
 - not rotated.
 - rotated by 180°.

10.5.5 Switch off the display

The process value display can be permanently switched off in the operating mode.

Pressing a key switches the display on. In case of inactivity, the display switches off again after a few seconds.



The LEDs remain active even if the display is deactivated. Error messages are displayed even if the display is deactivated.

10.5.5.1 Parameter setting via unit keys: Display off

- ▶ Call up the menu [EF] > [DIS].
- ▶ Select [diS] and set OFF.

10.5.5.2 Parameter setting via IO-Link: Display off

- ▶ Call up [Parameters] > [Display Setting].
- ▶ Select [diS. Display On / OFF] and set OFF.

11 Operation

11.1 Process value display

It is possible to switch between different process value indications during operation:

- ▶ Press [▲] or [▼].
- ▷ The display changes between the standard indication with set standard unit of measurement and other views.
- ▷ After 30 s, the unit returns to the standard display.

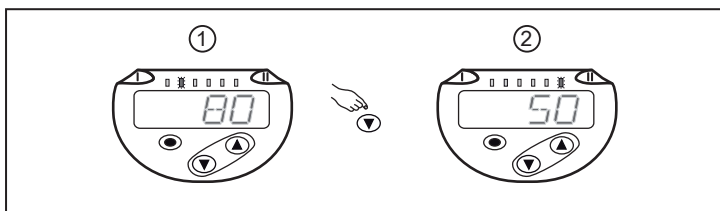


Fig. 22: Process value display

- 1: Standard display as set under [SELD] and [uni].
Example: [SELD] = FLOW and [uni] = m³/h
- 2: Further view. The LED indicates in which unit the current process value is displayed.
Example: temperature in °C.

11.2 Reading the parameter setting

- ▶ 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 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.

If the measured temperature value fails, the process value for flow rate is still available.



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

12.1 Error messages

Indication	Problem/remedy
Display off	Supply voltage too low. ▶ Check the supply voltage. Display switched off. ▶ Check whether [diS] = OFF is set and change setting if necessary.
Err	Unit faulty / malfunction. ▶ Replace the unit. Measured value outside the detection zone. • Flow value > 130% of the final value of the measuring range. • Temperature value < -43 °C (< -46 °F) or > 133 °C (> 272 °F) ▶ Check volumetric flow range / temperature range.
IOE.n	Malfunctioning. The unit is defective. ▶ Replace the unit.
SC1	Switching status LED for OUT1 flashing: short circuit OUT1. ▶ Check switching output OU1 for short circuit or excessive current.
SC2	Switching status LED for OUT2 flashing: short circuit OUT2. ▶ Check switching output OUT2 for short circuit or excessive current.
SC	Switching status LEDs for OUT1 and OUT2 flashing: short circuit OUT1 and OUT2. ▶ Check switching outputs OUT1 and OUT2 for short circuit or excessive current.
Loc	Setting keys on the unit locked, parameter change rejected. ▶ Unlock the unit using the unit keys.
C.Loc	Setting buttons on the unit temporarily locked, parameter setting via IO-Link communication active. ▶ Finish parameter setting via IO-Link communication.
S.Loc	Setting keys locked via parameter setting software, parameter change rejected. ▶ Unlock the unit via IO-Link interface using the parameter setting software.
PARA	Parameter setting outside the valid range. ▶ Check parameter setting.
OL	Display range of volumetric flow or temperature exceeded: • flow value between 120...130 % of the final value of the measuring range. • temperature value between 122...133 °C (252...272 °F). ▶ Check volumetric flow range / temperature range.
UL	Value below the minimum value of temperature display range: • temperature value between -32...-43 °C (-26...-46 °F). ▶ Check the temperature range.

13 Maintenance, repair and disposal

The operation of the unit is maintenance-free.

Only the manufacturer is allowed to repair the unit.

- ▶ After use dispose of the device in an environmentally friendly way in accordance with the applicable national regulations.

13.1 Cleaning the device

If measurement errors occur because of an insufficient filtration cleaning may be required:

- ▶ Unscrew sensor head.
- ▶ Remove float and spring.
- ▶ Clean the inside of the float, spring and housing, e.g. by means of compressed air.
- ▶ Before re-assembly check O-ring for damage. If necessary, replace and grease.
- ▶ After cleaning install components again.
- ▶ Tighten sensor head with a tightening torque of 100 Nm.
- ▶ To restore the measurement accuracy, press the float until you feel a mechanical stop using something non-magnetic, e.g. a finger and hold for at least 2 seconds.

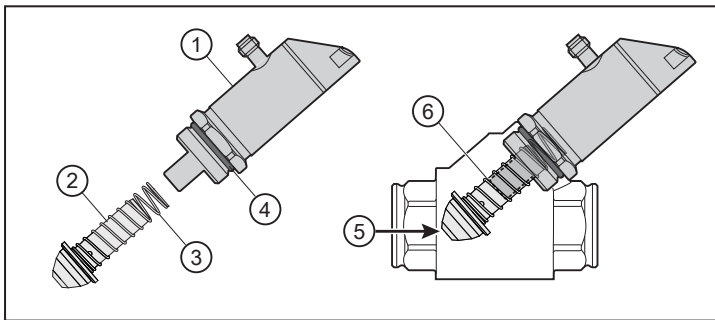


Fig. 23: Cleaning the sensor

- | | |
|----------------------|--------------------|
| 1: sensor head | 2: float |
| 3: spring | 4: O-ring |
| 5: non-magnetic tool | 6: mechanical stop |

14 Factory settings

Parameter	Factory setting	User setting
SP1 / FH1 (FLOW)	20%	
rP1 / FL1 (FLOW)	19%	
SP1 / FH1 (TEMP)	70 °C	
rP1 / FL1 (TEMP)	20 °C	
FrP1 (FLOW)	10%	
FrP1 (TEMP)	10%	
FSP1 (TEMP)	-10 °C	
FEP1 (TEMP)	100 °C	
FEP1 (FLOW)	100%	
SP2 / FH2 (FLOW)	40%	
rP2 / FL2 (FLOW)	39%	
SP2 / FH2 (TEMP)	34 °C	
rP2 / FL2 (TEMP)	33 °C	
ou1	Fno	
ou2	l	
uni.F	l/min	
uni.T	°C	
CGA	100%	
P-n	PnP	
dAP (FLOW)	0.1 s	
dAA (FLOW)	0.0 s	
FOU1	ou	
FOU2	ou	
SEL1	TEMP	
SEL2	FLOW	
coLr	rEd	
diS	d2	
SEld	FLOW	

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