ifm electronic

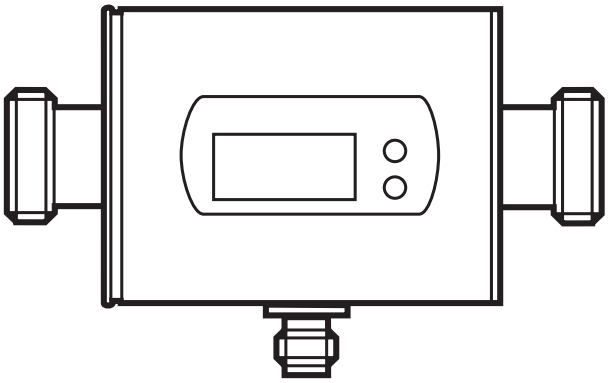
CE

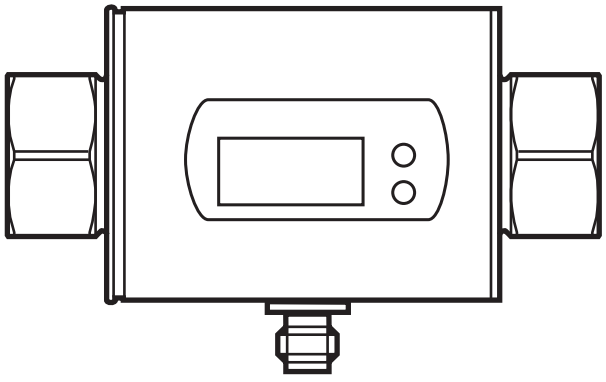
Operating instructions
Magnetic-inductive flow meter

UK

efector300

SM4x00
SM6x00
SM7x00
SM8x00
SM6x01
SM7x01
SM8x01





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1 Preliminary note

▶ 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.

2 Safety instructions

- Please read this document prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property can occur.
- Improper or non-intended use may lead to malfunctions of the unit or to unwanted effects in your application. That is why installation, electrical connection, set-up, operation and maintenance of the unit must only be carried out by qualified personnel authorised by the machine operator.
- In order to guarantee the correct condition of the device for the operating time it is necessary to use the device only for media to which the wetted materials are sufficiently resistant (→ Technical data).
- The responsibility whether the measurement devices are suitable for the respective application lies with the operator. The manufacturer assumes no liability for consequences of misuse by the operator. Improper installation and use of the devices result in a loss of the warranty claims.
- For medium temperatures above 50 °C (122 °F) some parts of the housing can heat up to over 65 °C (149 °F). Moreover, during installation or in case of a fault

(e.g. housing damage) media under high pressure or hot media can leak from the system. To avoid personal injury, take the following measures:

- ▶ Install the units according to the applicable rules and regulations.
- ▶ Ensure that the system is free of pressure during installation.
- ▶ Protect the housing against contact with flammable substances and unintentional contact. To do so, equip the units with suitable protection (e.g. protective cover).
- ▶ Do not press the pushbuttons manually. instead use another object (e.g. ballpoint pen).

3 Functions and features

The unit monitors liquid media. It detects the 3 process categories volumetric flow, consumed quantity, medium temperature.

Pressure Equipment Directive (PED)

The units comply with the Pressure Equipment Directive and are designed and manufactured for group 2 fluids in accordance with the sound engineering practice. Use of group 1 fluids on request.

Application area

Conductive liquids with the following properties:

- Conductivity: ≥ 20 µS/cm
- Viscosity: < 70 mm^2/s at 40 °C; < 70 cSt at 104 °F

4 Function

- The unit detects the flow based on the magnetic-inductive volumetric flow measuring principle.
- The unit also detects the medium temperature.
- It features an IO-Link interface.
- The unit displays the current process value.

4.1 Processing of the measured signals

The unit generates 2 output signals according to the parameter settings:

OUT1/IO-Link: 4 selection options	Parameter setting
- Switching signal for volumetric flow quantity limit	→ 10.2.1
- Pulse signal for quantity meter	→ 10.3.1
- Switching signal for preset counter	→ 10.3.2
- Switching signal for direction of flow	→ 10.2.4

OUT2: 6 selection options	Parameter setting
- Switching signal for volumetric flow quantity limit	→ 10.2.2
- Switching signal for temperature limit	→ 10.4.1
- Analogue signal for volumetric flow quantity	→ 10.2.3
- Analogue signal for temperature	→ 10.4.2
- Switching signal for direction of flow	→ 10.2.4
- Input for external counter reset signal (InD)	→ 10.3.7

4.2 Direction of flow

In addition to the flow velocity and the volumetric flow quantity, the unit also detects the direction of flow.

4.2.1 Determination of the direction of flow (Fdir)

An arrow with the text "flow direction" on the unit indicates the positive flow direction. The flow direction can be inversed (→ 10.5.9).

▶ Use the supplied label to mark the changed flow direction (new positive direction of flow).

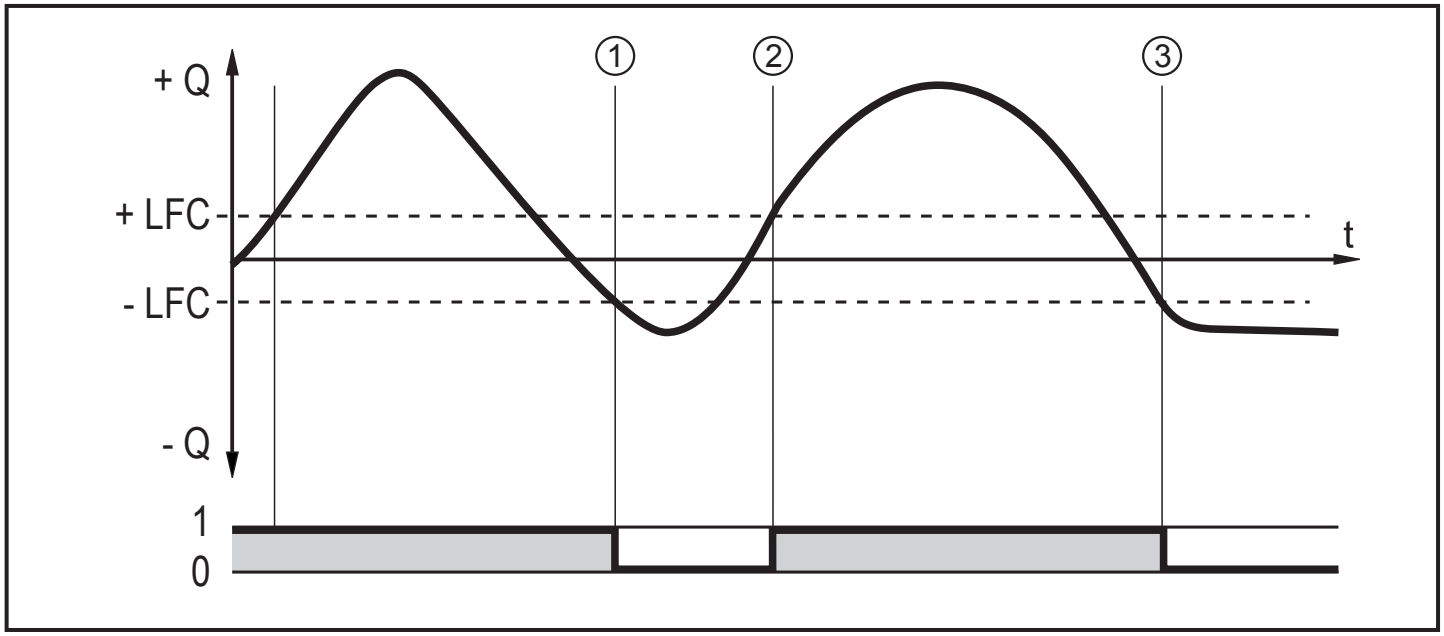
Flow...	Process value display
corresponds to the marked flow direction	+ (positive)
against the marked flow direction	- (negative)

4.2.2 Detection of the direction of flow (dir.F)

When dir.F is activated (→ 10.2.4), the direction of flow is indicated by a switching signal.

The output is switched on until the set minimum volumetric flow quantity in negative direction of flow (- LFC) is not reached (1).
Afterwards the following applies:

- The output switches ON when + LFC is exceeded (2).
- The output switches OFF when - LFC is not reached (3).



+ Q : Flow in positive direction of flow
- Q : Flow in negative direction of flow
+ LFC: Minimum volumetric flow quantity in positive direction of flow
- LFC : Minimum volumetric flow quantity in negative direction of flow

Positive direction of flow = marked direction of flow,
with the factory setting marked by the arrow on the unit or after change via Fdir marked by the attached label (→ 4.2.1).

4.3 Consumed quantity monitoring (ImP)

The unit has an internal quantity meter (totaliser). It continuously totals the consumed quantity after the last reset. Pulse signals or a switching signal can be used to monitor the consumed quantity.
→ 10.3.1 Quantity monitoring by pulse output (OUT1)
→ 10.3.2 Quantity monitoring by preset counter (OUT1)

4.3.1 Display and counting method of the quantity meter

Meter reading:

- The current meter count can be indicated (→ 11.2).
- In addition the value before the last reset is saved. This value can also be displayed (→ 11.2).

The meter saves the totalled volumetric flow quantity every 10 minutes. After a power failure this value is available as the current meter reading. If a time-controlled reset is set, the elapsed time of the set reset interval is also saved. So the possible data loss can be maximum 10 minutes.

Counter reset:

- There are different ways to reset the quantity meter.
  → 10.3.4 Manual counter reset
  → 10.3.5 Time-controlled counter reset
  → 10.3.7 Counter reset using an external signal
- If the quantity meter is not reset using one of the above-mentioned processes, an automatic reset will be made when the maximum volumetric flow quantity that can be displayed is exceeded (overflow).

Taking into consideration the direction of flow:

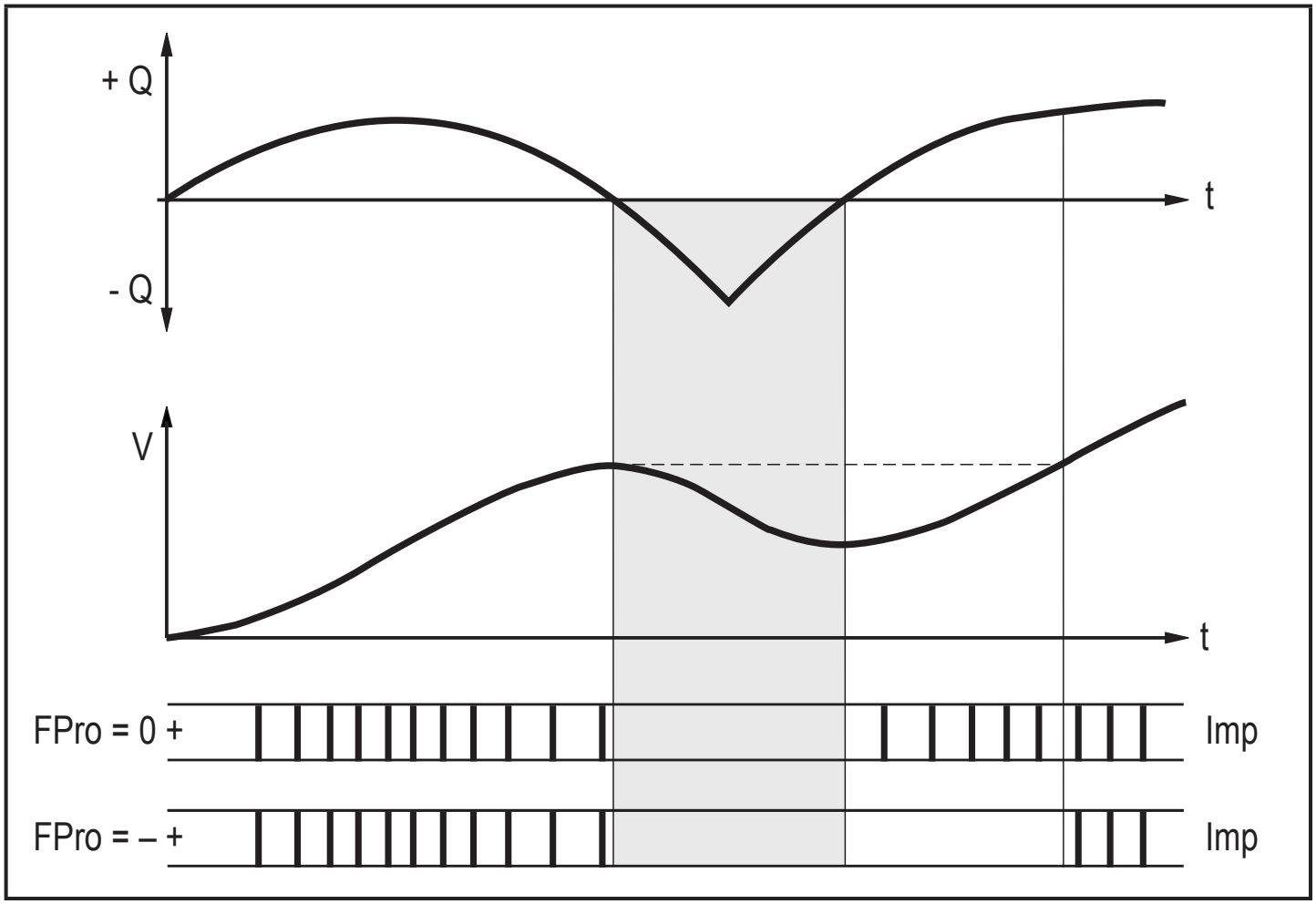
- The quantity meter takes account of the flow direction for totalisation. The following counting methods can be defined via the parameter [FPro] (→ 10.5.8):

[FPro]	Counting method
0+	Negative flow values (against the marked direction of flow) are not taken into consideration for totalling.
– +	Negative flow values are subtracted from the consumed quantity.

4.3.2 Consumed quantity monitoring via pulse output

Output 1 indicates a pulse signal when the set volumetric flow quantity has been reached (pulse value → 10.3.3).

Depending on the setting of the counting method [FPro] totalling of the volumetric flow quantity takes into account the flow in negative direction of flow (– +) or does not take it into account (0+) → 4.3.1.



+ Q = volumetric flow quantity in positive direction
- Q = volumetric flow quantity in negative direction
V = volumetric flow quantity absolute (= sum of negative and positive flow)

4.3.3 Consumed quantity monitoring via preset counter

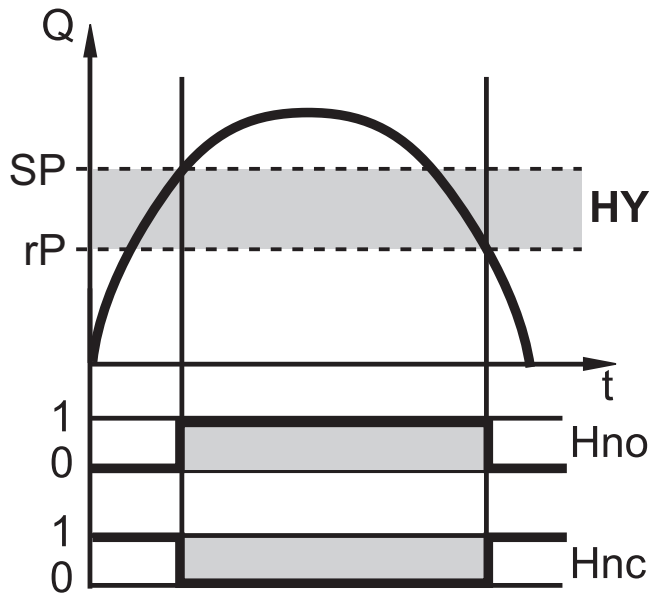
2 kinds of monitoring are possible which can be set via the parameter [rTo].

[rTo]	Output	Counter reset
OFF (→ 10.3.6)	OUT1 switches when the volumetric flow quantity set with [ImPS] has been reached.	The preset counter is only reset - when a manual reset is made (→ 10.3.4) or - when the maximum display range has been exceeded.
1, 2,... h 1, 2,... d 1, 2,... w (→ 10.3.5)	OUT1 switches when the volumetric flow quantity set with [ImPS] is reached within the set time.	The preset counter is reset automatically when the time has elapsed and counting starts again.

4.4 Switching function

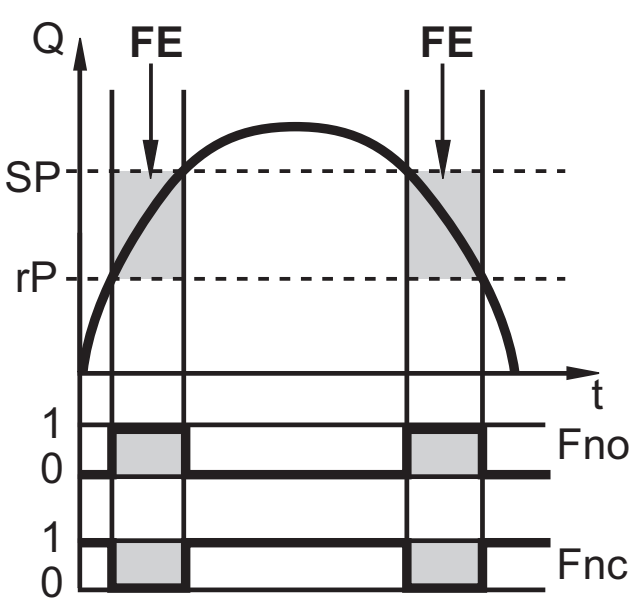
OUTx changes its switching status if it is above or below the set switching limits (flow or temperature). Hysteresis or window function can be selected. Example of volumetric flow monitoring:

Hysteresis function



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

Window function



SP = upper limit
rP = lower limit
FE = window
Fno = window NO (normally open)
Fnc = window NC (normally closed)

When the hysteresis function is set, the set point [SP] is defined first and then the reset point [rP] which must have a lower value. If only the set point is changed, the reset point remains constant.

When set to the window function, the upper limit [SP] and the lower limit [rP] have a fixed hysteresis of 0.5 % of the final value of the measuring range. This keeps the switching status of the output stable if the flow rate varies slightly.

4.5 Analogue function

- The unit provides an analogue signal that is proportional to the volumetric flow quantity and the medium temperature.
- The analogue signal can be provided as current or voltage signal.
- Within the measuring range the analogue signal is 4...20 mA (current output) or 0...10 V (voltage output).
- If the measured value is outside the measuring range or in the event of an internal error, the current or voltage signals indicated in Figure 1 are provided.
- The measuring range is scalable:
  [ASP2] determines at which measured value the output signal is 4 mA or 0 V.
  [AEP2] determines at which measured value the output signal is 20 mA or 10 V.

  Minimum distance between [ASP2] and [AEP2] = 20 % of the final value of the measuring range.

MAW	Initial value of the measuring range	For non-scaled measuring range (= factory setting)
MEW	Final value of the measuring range	
ASP2	Analogue start point	For scaled measuring range
AEP2	Analogue end point	

Table 1: Definitions

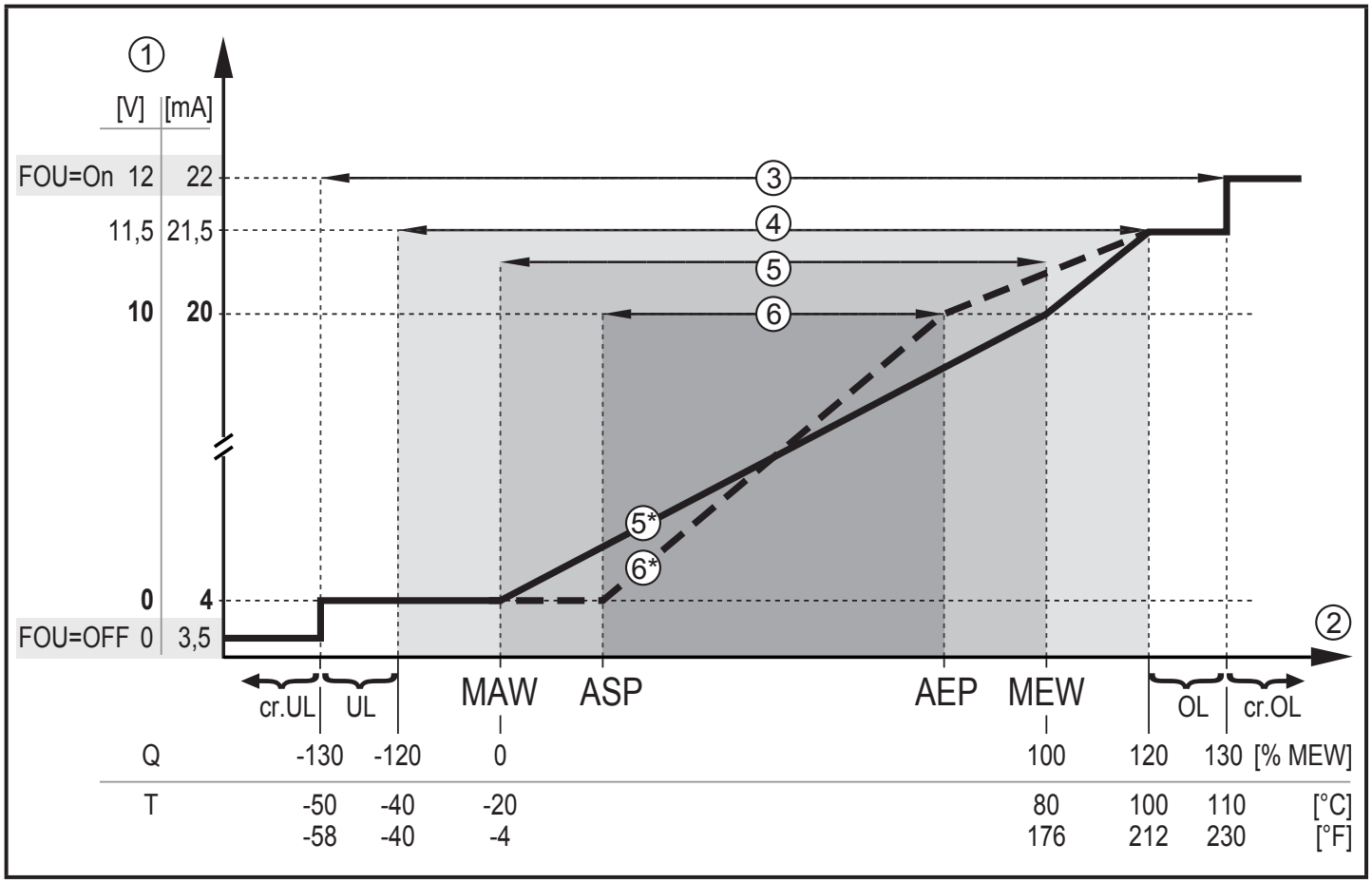


Figure 1: Characteristics of the analogue output according to the standard IEC 60947-5-7.

Q: Flow (a negative flow value means flow against the marked flow direction)
T: Temperature
UL: Below the display range
OL: Above the display range
cr.UL: Below the detection zone (error)
cr.OL: Above the detection zone (error)
FOU=On: Default setting at which the analogue signal goes to the upper final value in case of an error.*
FOU=OFF: Default setting at which the analogue signal goes to the lower final value in case of an error.*

* The type of error is displayed: cr.UL, cr.OL, Err (→ 12).

① Analogue signal (voltage or current)
② Measured value (flow or temperature)
③ Detection zone
④ Display range
⑤ Measuring range
⑤* Analogue signal in the measuring range with factory setting
⑥ Scaled measuring range
⑥* Analogue signal for scaled measuring range

4.6 Measured value damping (dAP)

The damping time allows to set after how many seconds 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] (→ 12 Troubleshooting) are defined under consideration of the damping time.

4.7 Start-up delay (dST)

The start-up delay [dST] influences the switching outputs of the volumetric flow monitoring.

If the start-up delay is active ([dST] > [0]), note: As soon as the volumetric flow exceeds the LFC value (→ 4.8), the following processes are carried out:

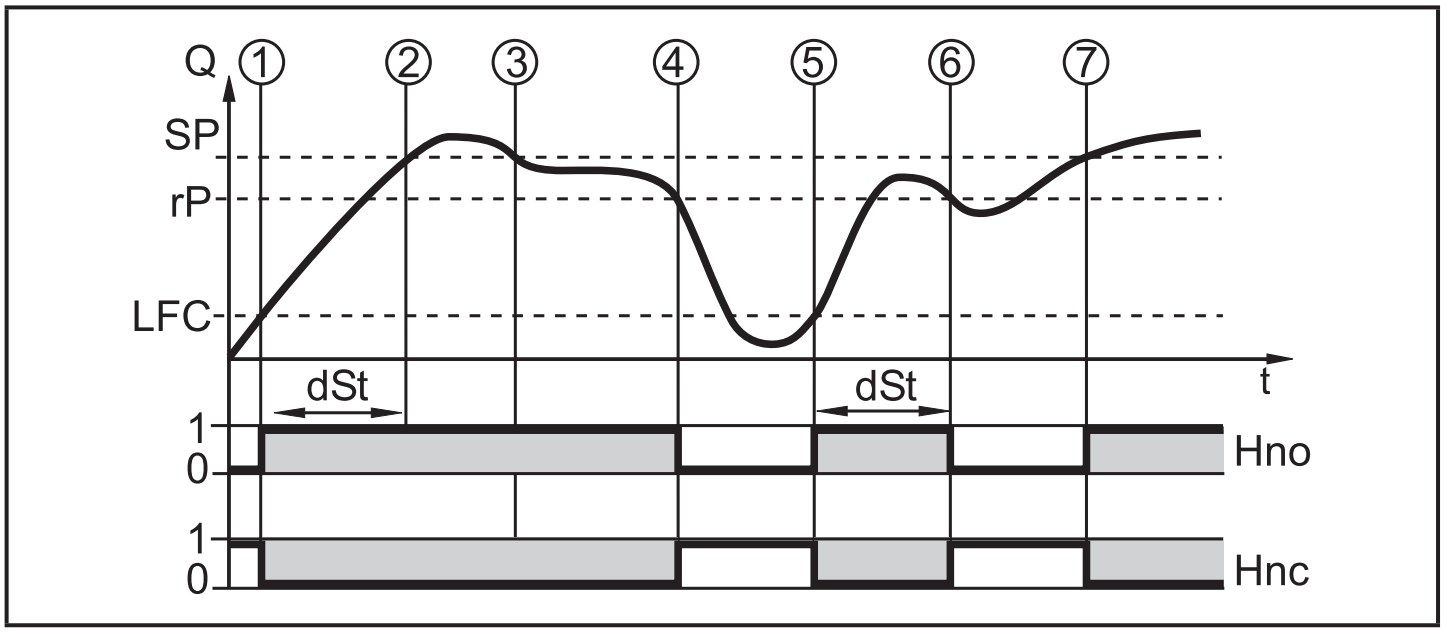
> The start-up delay is activated.

> The outputs switch as programmed: ON for NO function, OFF for NC function.

After the start of the start-up delay there are 3 options:

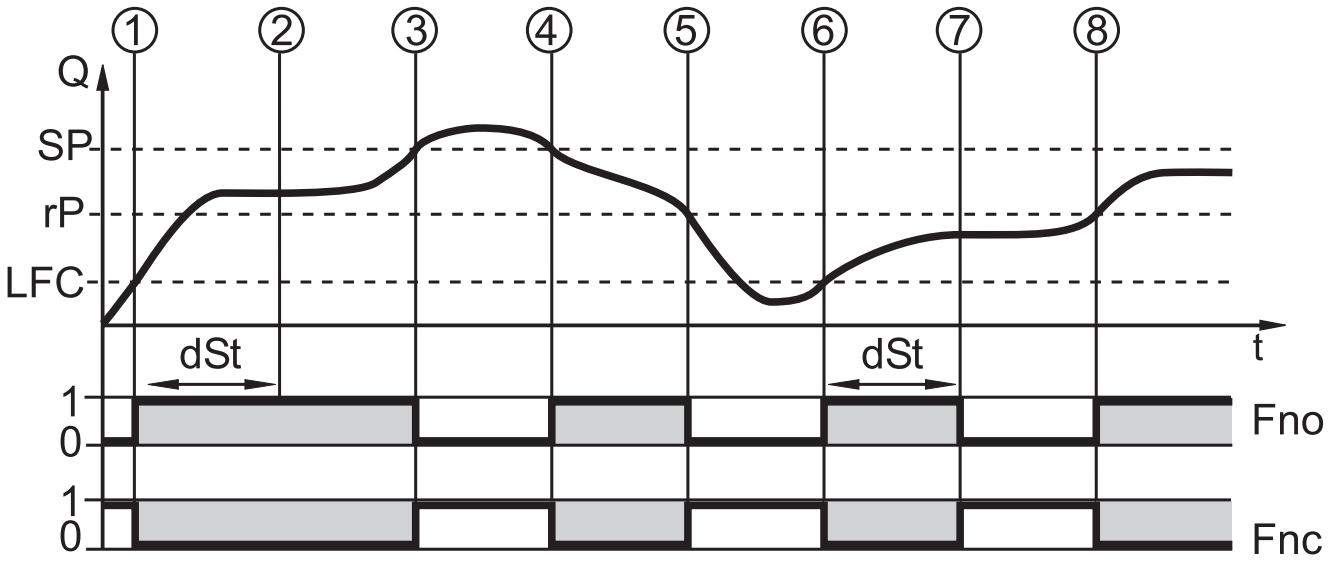
1. The volumetric flow increases quickly and reaches the set point / good range within [dST].
   > Outputs remain active.
2. The volumetric flow increases slowly and does not reach the set point /good range within [dST] > Outputs are reset.
3. Volumetric flow quantity falls below [LFC] within [dST].
   > Outputs are reset at once; [dST] is stopped.

Example: dST for hysteresis function



	Condition	Reaction
1	Volumetric flow quantity Q reaches LFC	dST starts, output becomes active
2	dST elapsed, Q reached SP	Output remains active
3	Q below SP but above rP	Output remains active
4	Q below rP	Output is reset
5	Q reaches again LFC	dST starts, output becomes active
6	dST elapsed, Q has not reached SP	Output is reset
7	Q reaches SP	Output becomes active

Example: dST for window function



	Condition	Reaction
1	Volumetric flow quantity Q reaches LFC	dST starts, output becomes active
2	dST elapsed, Q reached good range	Output remains active
3	Q above SP (leaves good range)	Output is reset
4	Q again below SP	Output becomes active again
5	Q below rP (leaves good range)	Output is reset again
6	Q reaches again LFC	dST starts, output becomes active
7	dST elapsed, Q has not reached good range	Output is reset
8	Q reaches good range	Output becomes active

4.8 Low flow cut-off (LFC)

With the function Low Flow cut-off small volumetric flow quantities can be suppressed (→ 10.5.7). Flows below the LFC value are evaluated by the sensor as standstill (Q = 0).

4.9 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.

For 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 visit www.ifm.com.

5 Mounting

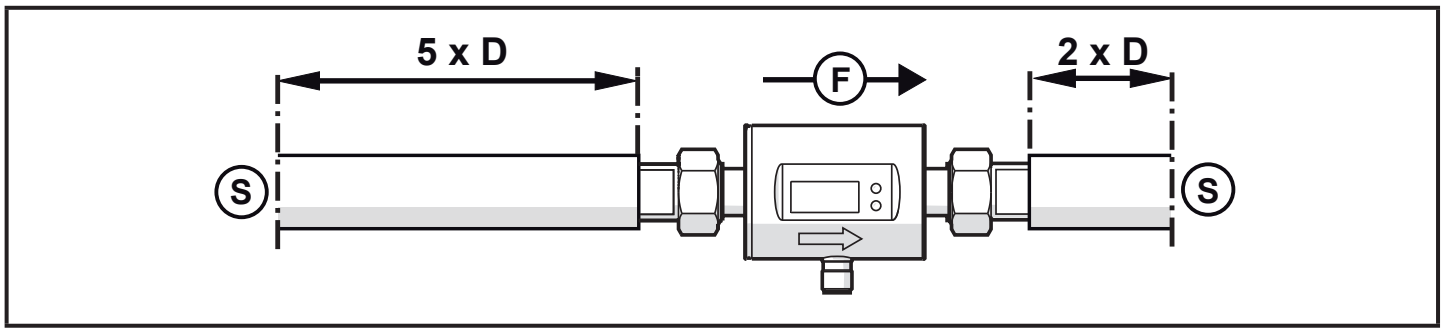
- ▶ Ensure that the system is free of pressure during installation.
- ▶ Ensure that no media can leak at the mounting location during installation.

The unit can be installed independently of the orientation if the following is ensured:

- No air bubbles can form in the pipe system.
- The pipes are always completely filled.

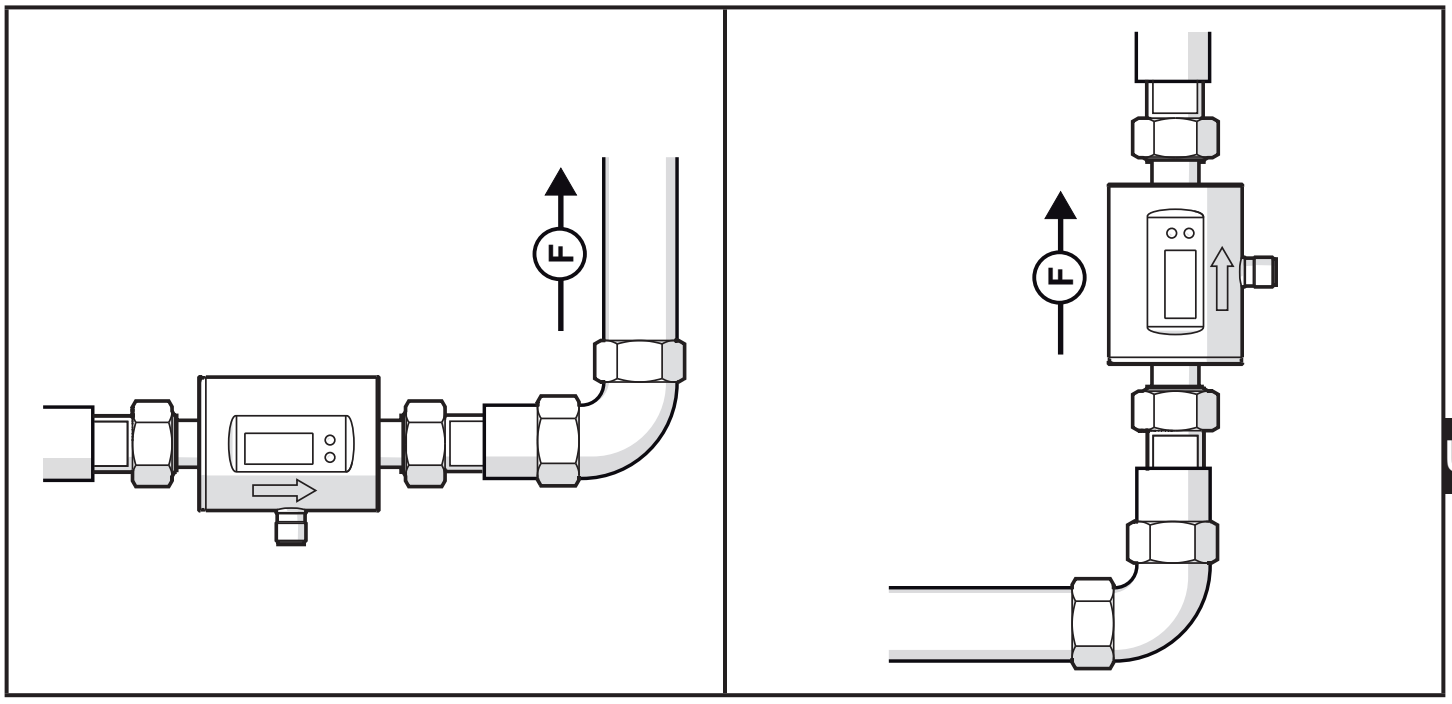
5.1 Recommended installation position

- ▶ Install the unit so that the measuring pipe is always completely filled.
- ▶ Arrange for inlet and outlet pipe lengths. Disturbances caused by bends, valves, reductions, etc. are compensated for. It applies in particular: no shut-off and control devices are allowed directly in front of the unit.



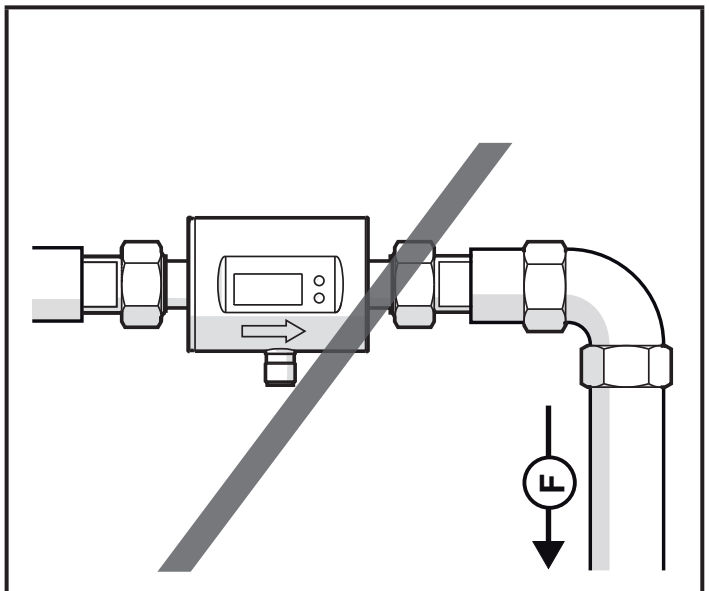
S = disturbance (e.g. shut-off / control device, pump, bends)
D = pipe diameter
F = direction of flow

▶ Install in front of or in a rising pipe.

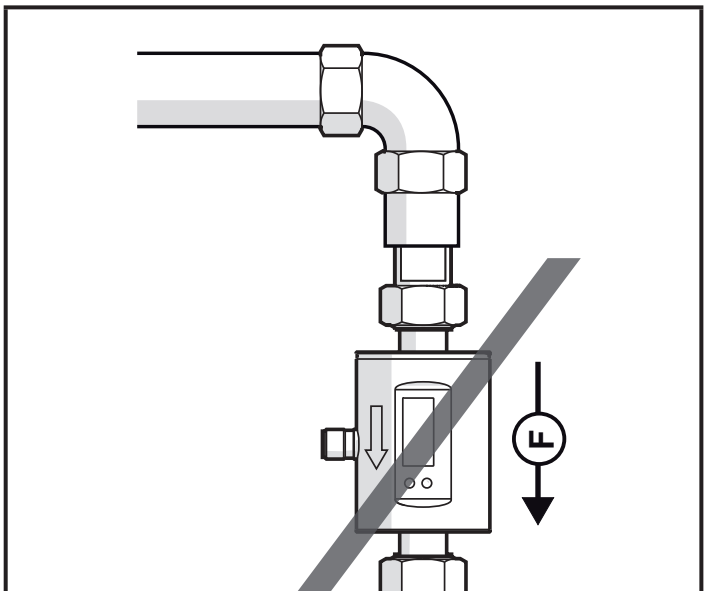


5.2 Not recommended installation position

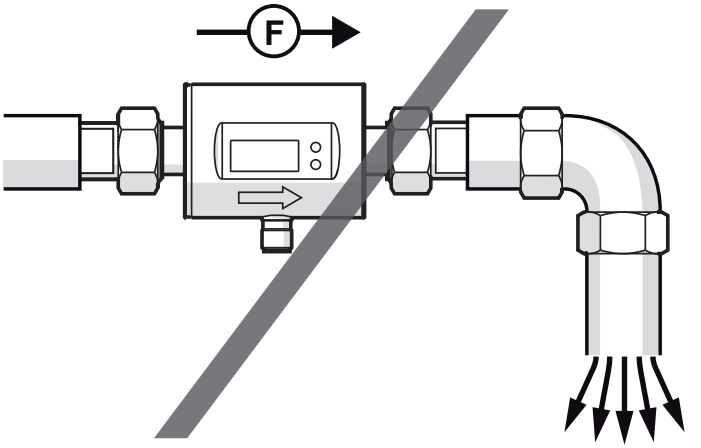
▶ Avoid the following installation positions:



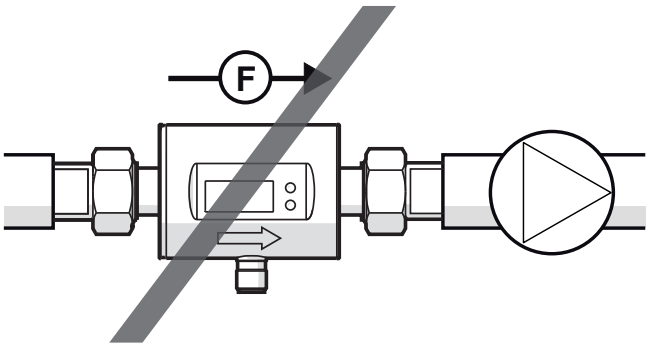
Directly in front of a falling pipe.



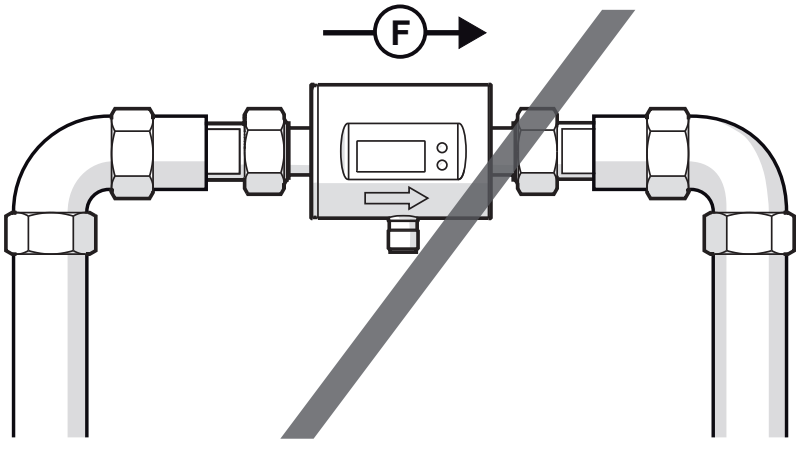
In a falling pipe.



Directly in front of
the spout of the pipe.



On the suction side of a pump.



At the highest point
of the pipe system.

F = flow direction

5.3 Grounding

If installed in an ungrounded pipe system (e.g. plastic pipes), the unit must be grounded (functional earth).

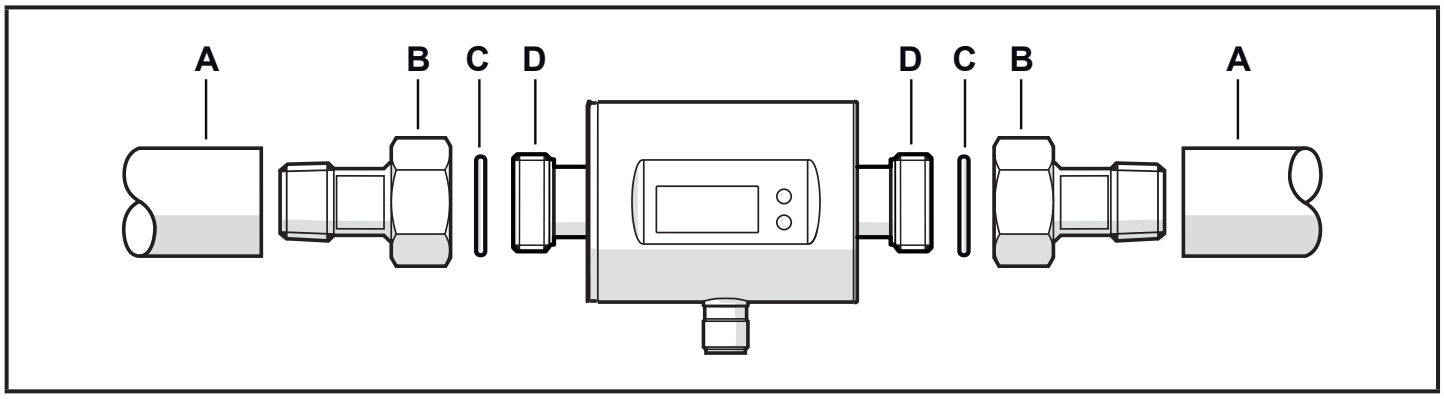
Ground brackets for the M12 connector are available as accessories
→ www.ifm.com.

5.4 Installation in pipes

The units with a G thread can be installed in the pipes using adapters.

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.



1. Grease the threads of the process connection, adapter and sensor. Use a lubricating paste which is suitable and approved for the application.
2. Screw the adapter (B) into the pipe (A).
3. Place the seals (C) and install the unit according to the marked flow direction.
4. Screw the adapter (B) with the threads (D) until it is hand-tight.
5. Tighten the two adapters in opposite direction:
   Tightening torque: SM6/SM7/SM8 = 30 Nm; SM4 = 15 Nm.

After installation air bubbles in the system can affect the measurement.

▶ Corrective measures: Rinse the system after installation for ventilation.

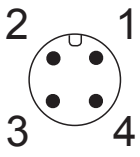
In case of horizontal installation:
As a result of design requirements a small quantity of the medium always remains in the measuring channel after switching off the pump.

6 Electrical connection

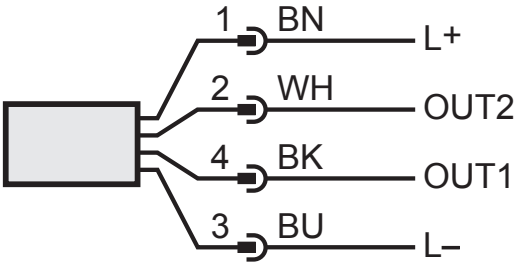
The unit must be connected by a qualified electrician.
The national and international regulations for the installation of electrical equipment must be adhered to.
Voltage supply according to EN 50178, SELV, PELV.

▶ Disconnect power.

▶ Connect the unit as follows:



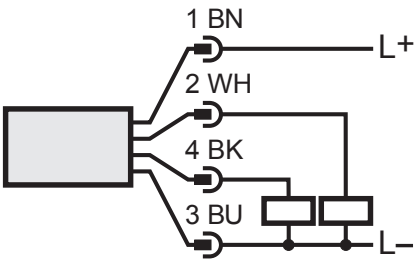
BK: black
BN: brown
BU: blue
WH: white



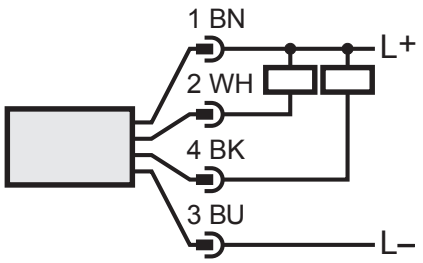
Colours to DIN EN 60947-5-2

Sample circuits:

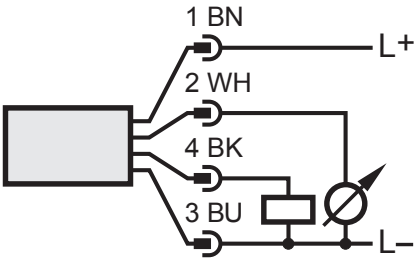
2 x positive switching



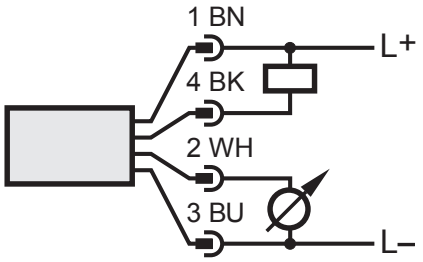
2 x negative switching



1 x positive switching / 1 x analogue

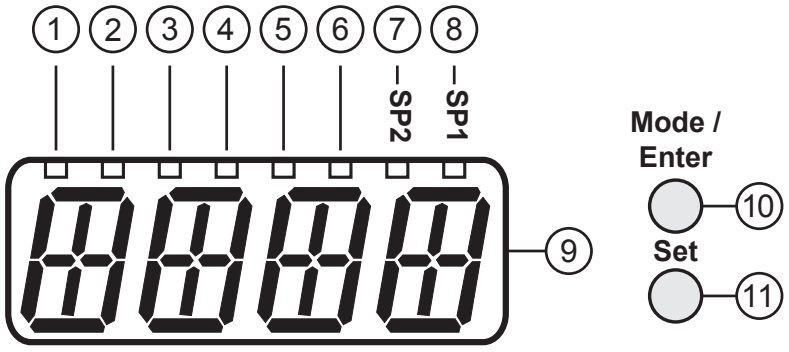


1 x negative switching / 1 x analogue



Pin 1	L+
Pin 3	L-
Pin 4 (OUT1)	• Switching signal: limits for volumetric flow • Pulse signal: 1 pulse every time the defined volumetric flow quantity is reached • Switching signal: quantity meter reached preset value • Switching signal for direction of flow • IO-Link
Pin 2 (OUT2/ InD)	• Switching signal: limits for volumetric flow • Switching signal: limits for temperature • Analogue signal for volumetric flow quantity • Analogue signal for temperature • Switching signal for direction of flow • Input for external counter reset signal (InD)

7 Operating and display elements



1-6: Indikator-LEDs für Prozesswertanzeige

SMxx00: LED		Process value display		Unit SMxx00	Unit SM4x00
1	□	Current flow volume per minute		l/min	ml/min
2	□	Current flow volume per hour		m^3/h	l/h
3	□	Current consumed quantity (= meter reading) since the last reset	Totaliser *	l	ml
4	□			m^3	l
4 + 6	□			$m^3 \times 10^3$	l x 10^3
3	⌑	Consumed quantity (= meter reading) before the last reset		l	ml
4	⌑			m^3	l
4 + 6	⌑			$m^3 \times 10^3$	l x 10^3
5	□	Current medium temperature		°C	°C

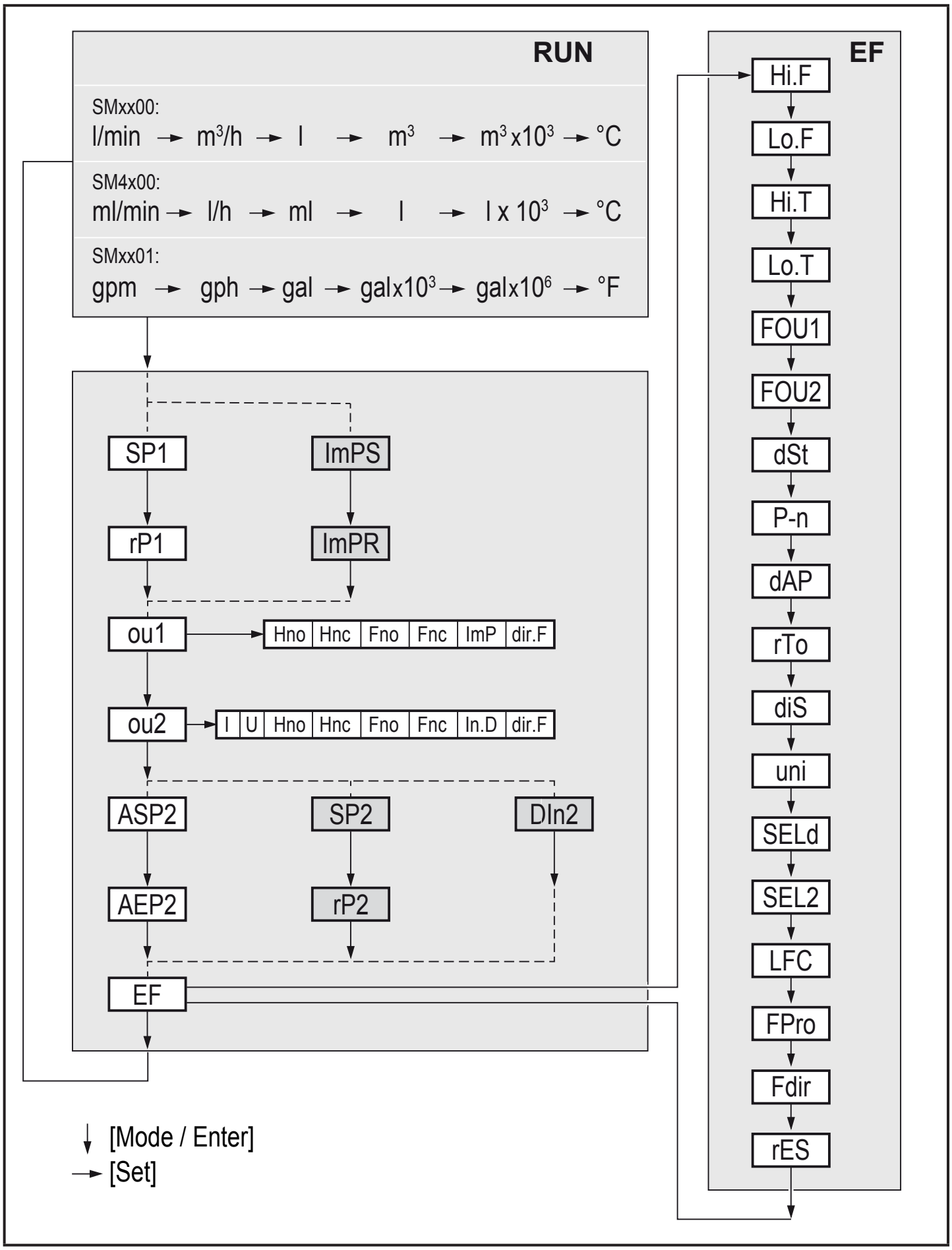
SMxx01: LED		Process value display		Unit
1	□	Current flow volume per minute		gpm
2	□	Current flow volume per hour		gph
3	□	Current consumed quantity (= meter reading) since the last reset	Totaliser *	gal
3 + 5	□			gal x 10^3
3 + 6	□			gal x 10^6
3	⌑	Consumed quantity (= meter reading) before the last reset		gal
3 + 5	⌑			gal x 10^3
3 + 6	⌑			gal x 10^6
4	□	Current medium temperature		°F

□ LED is lit; ⌑ LED flashes

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

7-8: Indicator LEDs for switching output
LED 7: Switching status OUT2 (lights when output 2 is switched) LED 8: Switching status OUT1 (lights when output 1 is switched)
9: Alphanumeric display, 4 digits
• Current volumetric flow quantity with setting [SELd] = FLOW • Meter reading of the totaliser with setting [SELd] = TOTL • Current medium temperature with setting [SELd] = TEMP • Parameters and parameter values
10: [Mode/Enter] button
• Change from the RUN mode to the main menu • Select parameters • Acknowledge the set parameter value
11: [Set] button
• Change parameter values (hold button pressed) • Change of the display unit in the normal operating mode (RUN mode)

8 Menu



Parameters with white background are indicated in case of factory setting (→ 14). Parameters with grey background are indicated in case of changes of the preset for ou1 and ou2.

Parameters	Explanation and setting options (→ 4 Function)
SP1 / rP1	Maximum / minimum value for volumetric flow on OUT1.
ImPS	Pulse value = volumetric flow quantity at which 1 pulse is delivered.
ImPR	Configuration of the output for consumed quantity monitoring: YES (pulse signal), no (switching signal).
ou1	Output function for OUT1 (volumetric flow): - Hno, Hnc, Fno, Fnc: switching signal for the limits - ImP: consumed quantity monitoring (totaliser function) - dir.F: detection of direction
ou2	Output function for OUT2 (volumetric flow or temperature): - Hno, Hnc, Fno, Fnc: switching signal for the limits - I (current signal 4...20 mA), U (voltage signal 0...10 V) - dir.F: detection of direction Input function for OUT2: - In.D: input for external meter reset signal
ASP2 / AEP2	Analogue start point / analogue end point for volumetric flow or temperature on OUT2.
SP2 / rP2	Maximum / minimum value for volumetric flow or temperature on OUT2.
DIn2	Configuration of the input for external meter reset signal: HIGH, +EDG, LOW, -EDG (→ 10.3.7)
EF	Extended functions: opening of the lower menu level.
Hi.F / Hi.T	Maximum value memory for volumetric flow / temperature.
Lo.F / Lo.T	Minimum value memory for volumetric flow / temperature.
FOU1 / FOU2	Behaviour of OUT1 / OUT2 in case of an internal fault: OU, On, OFF (→ 10.5.6).
dST	Start-up delay in seconds.
P-n	Output logic: PnP, nPn.
dAP	Measured value damping: damping constant in seconds.
rTo	rES.T (meter reset: manual), h/d/w (time-controlled: hours/days/weeks), OFF.
diS	Update rate and orientation of the display: d1...d3, rd1...rd3, OFF (→ 10.5.2).
uni	Standard unit of measurement for volumetric flow
SELd	Standard measured variable of the display: FLOW (volumetric flow value), TEMP (medium temperature), TOTL (meter reading).
SEL2	Standard unit of measurement for evaluation by OUT2: FLOW (volumetric flow) or TEMP (temperature).

LFC	Low flow cut-off.
FPro	Counting method of the totaliser: –+ or 0+ (→ 10.5.8).
Fdir	Direction of flow: + or - (→ 10.5.9).
rES	Restoring the factory settings.

9 Set-up

After power on and expiry of the power-on delay time of approx. 5 s the unit is in the RUN mode (= 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:
  - ON with normally open function (Hno / Fno)
  - OFF with normally closed function (Hnc / Fnc).
  - ON for detection of direction (dir.F)
- If output 2 is configured as analogue output, the output signal is at 20 mA (current output) or 10 V (voltage output).

10 Parameter setting

Parameters can be set before installation or during operation.

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

▶ 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 (→ 4.9).

⚠ CAUTION

For medium temperatures above 50 °C (122 °F) some parts of the housing can heat up to over 65 °C (149 °F).

▶ Do not press the pushbuttons manually. Instead use another object (e.g. ballpoint pen).

10.1 Parameter setting in general

1. Change from the RUN mode to the main menu and selection of the requested parameter	[Mode/Enter]
2. Acknowledge the set parameter value	[Set]
3. Change the setting mode	[Set] > 5 s
4. Modification of the parameter value - incrementally by pressing once - continuously by keeping the button pressed To reduce the value: let the display move to the maximum setting value. Then the cycle starts again at the minimum setting value.	[Set]
5. Acknowledge the set parameter value	[Mode/Enter]
6. Return to the RUN mode	> 30 seconds (timeout) or [Mode/Enter] until the RUN mode is reached.

10.1.1 Change to the menu "Extended functions"

1. Change from the RUN mode to the main menu and selection of the parameter EF	[Mode/Enter]
2. Change to sub-menu EF	[Set]

10.1.2 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 [Mode/Enter] and [Set] simultaneously for 10 s until [Loc] is displayed.
Unlocking	▶ Make sure that the unit is in the normal operating mode. ▶ Press [Mode/Enter] and [Set] simultaneously for 10 s until [uLoc] is displayed.

10.1.3 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

10.2.1 Limit monitoring volumetric flow (OUT1)

- ▶ Select [ou1] and set the switching function: Hno, Hnc, Fno or Fnc.
- ▶ Select [SP1] and set the upper limit of the volumetric flow.
- ▶ Select [rP1] and set the lower limit of the volumetric flow.

10.2.2 Limit monitoring volumetric flow (OUT2)

- ▶ Select [SEL2] and set FLOW.
- ▶ Select [ou2] and set the switching function: Hno, Hnc, Fno or Fnc.
- ▶ Select [SP2] and set the upper limit of the volumetric flow.
- ▶ Select [rP2] and set the lower limit of the volumetric flow.

10.2.3 Analogue output flow rate (OUT2)

- ▶ Select [SEL2] and set FLOW.
- ▶ Select [ou2] and set the analogue function: I (4...20 mA) or U (0...10 V).
- ▶ Select [ASP2] and set the volumetric flow value at which the minimum current or voltage value is provided.
- ▶ Select [AEP2] and set the volumetric flow value at which the maximum current or voltage value is provided.

10.2.4 Detection of the direction of flow (OUT1 or OUT2)

- ▶ Select [ou1] or [ou2] and set dir.F.

10.3 Settings for consumed quantity monitoring

10.3.1 Quantity monitoring by pulse output (OUT1)

- ▶ Select [ou1] and set ImP.
- ▶ Select [ImPR] and set YES.
- ▶ Select [ImPS] and set the volumetric flow quantity at which 1 pulse is provided (→ 10.3.3).

10.3.2 Quantity monitoring by preset counter (OUT1)

- ▶ Select [ou1] and set ImP.
- ▶ Select [ImPR] and set no.
- ▶ Select [ImPS] and set the volumetric flow quantity at which output 1 switches (→ 10.3.3).

10.3.3 Pulse value

- ▶ Select [ou1] and set the consumed quantity monitoring: → 10.3.1 or → 10.3.2.
- ▶ Select [ImPS].
- ▶ Press [Set] briefly.
- > The currently set value is displayed.
- ▶ Keep [Set] pressed until "⊏⊏⊏⊏" is displayed.
- ▶ Press [Set] to select the setting range.
- > With each press of the pushbutton the display changes to the next setting range (decimal point shifts and / or LED* changes).
- ▶ Press [Mode/Enter] to confirm the setting range.
- ▶ Press [Set] until the requested numerical value is displayed.
- ▶ Press [Mode/Enter] briefly.

* LED 1...6 → 7 Operating and display elements

10.3.4 Manual counter reset

- ▶ Select [rTo] and set rES.T.
- > The counter is reset to zero.

10.3.5 Time-controlled counter reset

- ▶ Select [rTo] and set the requested value (intervals of hours, days or weeks).
- > The counter is reset automatically with the value now set.

10.3.6 Deactivation of the counter reset

▶ Select [rTo] and set OFF.
> The meter is only reset after overflow (= factory setting).

10.3.7 Counter reset using an external signal

▶ Select [ou2] and set In.D.
▶ Select [DIn2] and set the counter reset signal:
HIGH = reset for high signal
LOW = reset for low signal
+EDG = reset for rising edge
-EDG = reset for falling edge

10.4 Settings for temperature monitoring

10.4.1 Limit monitoring temperature (OUT2)

▶ Select [SEL2] and set TEMP.
▶ Select [ou2] and set the switching function: Hno, Hnc, Fno or Fnc.
▶ Select [SP1] and set the upper temperature limit.
▶ Select [rP2] and set the lower temperature limit.

10.4.2 Analogue output temperature (OUT2)

▶ Select [SEL2] and set TEMP.
▶ Select [ou2] and set the analogue function: I (4...20 mA) or U (0...10 V).
▶ Select [ASP2] and set the temperature value at which the minimum current or voltage value is provided.
▶ Select [AEP2] and set the temperature value at which the maximum current or voltage value is provided.

10.5 User settings (optional)

10.5.1 Standard unit of measurement for volumetric flow

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

The setting only has an effect on the volumetric flow value. The consumed quantity (meter reading) is automatically displayed in the unit of measurement providing the highest accuracy.

10.5.2 Standard display

▶ Select [SELd] and define the standard unit of measurement
FLOW = display shows the current volumetric flow value in the standard unit of measurement.
TOTL = display shows the current meter reading in the unit providing the highest accuracy.
TEMP = the current medium temperature in °C / F° is displayed.
▶ Select [diS] and set the 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 like d1, d2, d3; rotated by 180.
OFF = the display is switched off in the operating mode. The LEDs remain active even if the display is deactivated. Error messages are displayed even if the display is deactivated.

10.5.3 Output logic

▶ Select [P-n] and set PnP or nPn.

10.5.4 Start-up delay

▶ Select [dST] and set the numerical value in seconds.

10.5.5 Measured value damping

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

10.5.6 Error behaviour of the outputs

▶ Select [FOU1] and set the value:
- On = Output 1 switches ON in case of a fault.
- OFF = Output 1 switches OFF in case of an error.
- OU = Output 1 switches irrespective of the fault as defined with the parameters.

▶ Select [FOU2] and set the value:

1. Switching output:
   - On = Output 2 switches ON in case of a fault.
   - OFF = Output 2 switches OFF in case of a fault.
   - OU = Output 2 switches irrespective of the fault as defined with the parameters.
2. Analogue output:
   - On = The analogue signal goes to the upper fault value (→ 4.5).
     OFF = The analogue value goes to the lower fault value (→ 4.5).
     OU = The analogue signal corresponds to the measured value.

10.5.7 Low flow cut-off

▶ Select [LFC] and set the limit.

10.5.8 Counting method of the totaliser

▶ Select [FPro] and set the value:
-+ = totalling the volumetric flow values with the correct sign.
0+ = totalling only positive volumetric flow values.

10.5.9 Direction of flow

▶ Select [Fdir] and set the direction of flow:
+ = flow in the direction of the flow arrow (= factory setting)
- = flow against the flow arrow ▶ label over the arrow

10.6 Service functions

10.6.1 Read min/max values

Read minimum or maximum measured values:
▶ Select Hi.x or Lo.x.
Hi.F = maximum volumetric flow, Lo.F = minimum volumetric flow
Hi.T = maximum temperature, Lo.T = minimum temperature

Delete memory:
▶ Select Hi.x or Lo.x.
▶ Press and hold [Set] until [----] is displayed.
▶ Briefly press [Mode/Enter].

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

10.6.2 Restoring the factory settings

▶ Select [rES].
▶ Press and hold [Set] until [----] is displayed.
▶ Briefly press [Mode/Enter].

→ 14 Factory setting. We recommend taking down your own settings in that table before carrying out a reset.

11 Operation

11.1 Reading the process value

The LEDs 1-6 signal which process value is currently displayed.
The process value to be displayed as standard (temperature, volumetric flow quantity or meter reading of the totaliser) can be preset → 10.5.2 Standard display.
A standard unit of measurement can be defined for the volumetric flow quantity → 10.5.1.

11.2 Changing the process value display in the RUN mode

▶ Briefly press [Set] in the RUN mode. Press the pushbutton to move to the next display unit.

> The unit displays the current measured value in the selected display unit for approx. 30 s, the corresponding indicator LED lights (→ 7).

11.3 Reading the set parameters

▶ Briefly press [Mode/Enter] to scroll through the parameters.

▶ Briefly press [Set] when the requested parameter is displayed.

> The unit displays the corresponding parameter value. After about 30 s it returns to the RUN mode.

12 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	Fault correction
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] → 10.5.2
Loc	Warning	Setting pushbuttons on the unit locked, parameter change rejected.	▶ Unlock the unit → 10.1.2
C.Loc	Warning	Setting buttons on the unit temporarily locked, parameter setting via IO-Link communication active.	▶ Finish parameter setting via IO-Link communication.
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. • Current value between -130 % ... -120 % MEW • Temperature value between -50...-40 °C or -58...-40 °F	▶ Check flow range / temperature range.
cr.UL	Error	Below the detection zone. • Flow value < -130 % MEW • Temperature value < - 50 °C or -58 °F	▶ Check flow range / temperature range.
OL	Warning	Display range exceeded. • Current value between 120 % ... 130 % MEW • Temperature value between 100...110 °C or 212...230 °F	▶ Check flow range / temperature range.
cr.OL	Error	Detection zone exceeded. • Flow value > 130 % MEW • Temperature value > 110 °C or 230 °F	▶ Check flow range / temperature range.

Display	Type	Description	Fault correction
PArA	Error	Parameter setting outside the valid range.	▶ Repeat parameter setting.
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 in both outputs.	▶ Check switching outputs OUT1 and OUT2 for short-circuit or excessive current.

MEW = final value of the measuring range

13 Technical data

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

14 Factory setting

Parameter	Factory setting	User setting
SP1	20 %	
rP1	19.5 %	
ImPS	SM4x00: 0.001 l SMxx00: 0.01 l SMxx01: 0.01 gal	
ImPR	Yes	
OU1	Hno	
OU2	I	
SP2 (FLOW)	40 %	
rP2 (FLOW)	39.5 %	
SP2 (TEMP)	40 %	
rP2 (TEMP)	39.5 %	
ASP2 (FLOW)	0 %	
AEP2 (FLOW)	100 %	
ASP2 (TEMP)	0 %	
ASP2 (TEMP)	100 %	
Fdir	+	
FPro	0+	
LFC	MAW	
DIn2	+EDG	
FOU1	OFF	
FOU2	OFF	
dST	0	
P-n	PnP	
dAP	0.6 s	

Parameter	Factory setting	User setting
rTo	OFF	
diS	SM6/7/8: d3 SM4: d2	
Uni	SM4x00: ml/min SMxx00: l/min SMxx01: gpm	
SELd	FLOW	
SEL2	FLOW	

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

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