prosense®

CE

Operating instructions
Magnetic-inductive flow meter

FMM150-1001
FMM200-1001

Scan or Click the above QR Code or go to https://www.automationdirect.com/VID-FL-0004 for a configuration video with live examples.

Scan or Click the above QR Code or go to https://www.automationdirect.com/VID-FL-0005 for a parameter explanation video with live examples.

Scan or Click the above QR Code or go to https://www.automationdirect.com/VID-FL-0006 for an explanation of Magnetic Inductive Flow Meters

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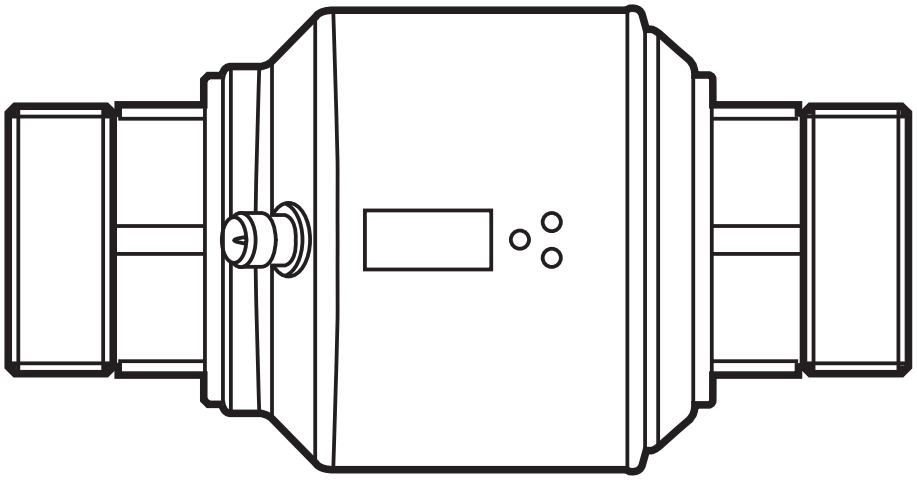

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Contents

1 Preliminary note

1.1 Symbols used

▶ Instructions

> Reaction, result

[…] Designation of pushbuttons, buttons or indications

→ Cross-reference


Important note
Non-compliance can result in malfunction or interference.


Information
Supplementary note.

1.2 Warning signs used

⚠ 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 authorized by the machine operator.
- In order to guarantee the correct condition of the device for the operating time the device must only be used in media to which the wetted parts are sufficiently resistant (→ Technical data).
- The responsibility to determine 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 122 °F some parts of the housing can heat up to over 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 unit 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 unit 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.

The unit detects the 3 process categories flow rate, volumetric totalizer and 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

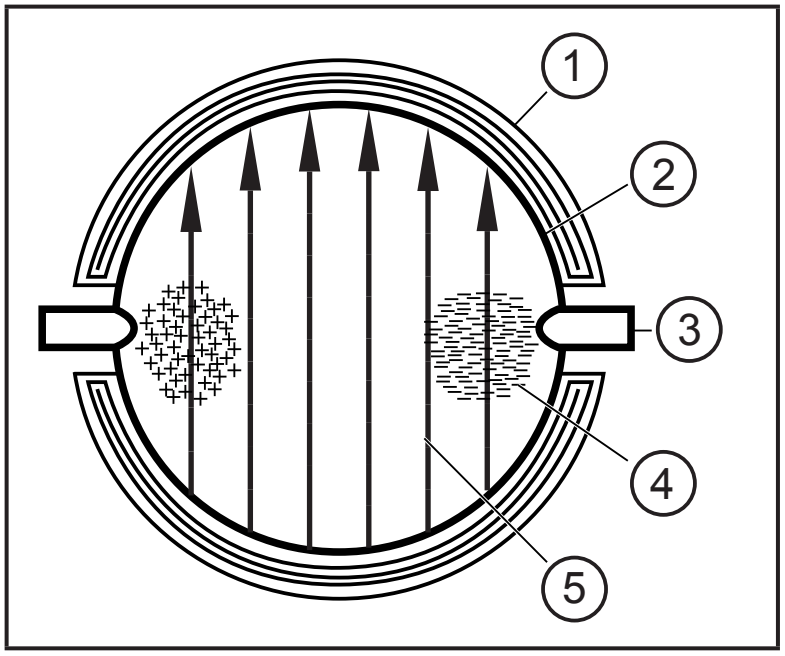
Conductive liquids with the following properties:

- Conductivity: ≥ 20 µS/cm
- Viscosity: < 70 cST at 40 °C / 104 °F

4 Function

4.1 Measuring principle for flow rate monitoring

The magnetic-inductive measuring principle means that a magnetic field is generated in the measuring pipe via current-carrying coils. When a conductive medium flows through the measuring pipe, the ions therein are diverted perpendicularly to the magnetic field. Positive and negative charge carriers flow in opposite directions. The voltage induced is measured by two electrodes that are in contact with the medium. This signal voltage is directly proportional to the average flow velocity. The flow rate is derived from the inside pipe diameter.



1: Field coil
2: Measuring pipe
3: Electrode
4: Charge carrier in the medium
5: Magnetic field

Both electrodes must be wetted by the medium. Otherwise the signal [SEnS] for empty pipe is provided, if empty pipe detection is enabled.

4.2 Processing of the measured signals

The unit displays the current process values.

It generates 2 output signals according to the parameter setting.

OUT1: 5 selection options	Parameter setting
- flow rate switch	(→ 10.2.1)
- or flow rate (frequency)	(→ 10.2.4)
- or volumetric totalizer pulse	(→ 10.3.1)
- or volumetric totalizer preset switch	(→ 10.3.2)
- or empty pipe detection switch	(→ 10.5.9)

OUT2: 6 selection options	Parameter setting
- flow rate switch	(→ 10.2.2)
- or temperature switch	(→ 10.4.1)
- or analog flow rate	(→ 10.2.3)
- or analog temperature	(→ 10.4.2)
- or volumetric totalizer reset (input)	(→ 10.3.7)
- or empty pipe detection switch	(→ 10.5.9)

4.3 Flow rate monitoring

4.3.1 Flow rate

The signals for measuring the flow rate can be provided as follows:

1. Two switching signals for flow rate limit values on output 1 and output 2. On the switching functions → 4.7.
2. A frequency signal (10 Hz...10 kHz) on output 1. On the frequency functions → 4.9.
3. An analog signal (4...20 mA or 0...10 V) on output 2. On the analog functions → 4.8.

4.3.2 Direction of flow

In addition to the flow rate, the unit also detects the flow direction. An arrow on the unit indicates the positive flow direction.

The flow direction can be inversed (→ 10.5.3).

▶ Use the supplied label to mark the changed flow direction.

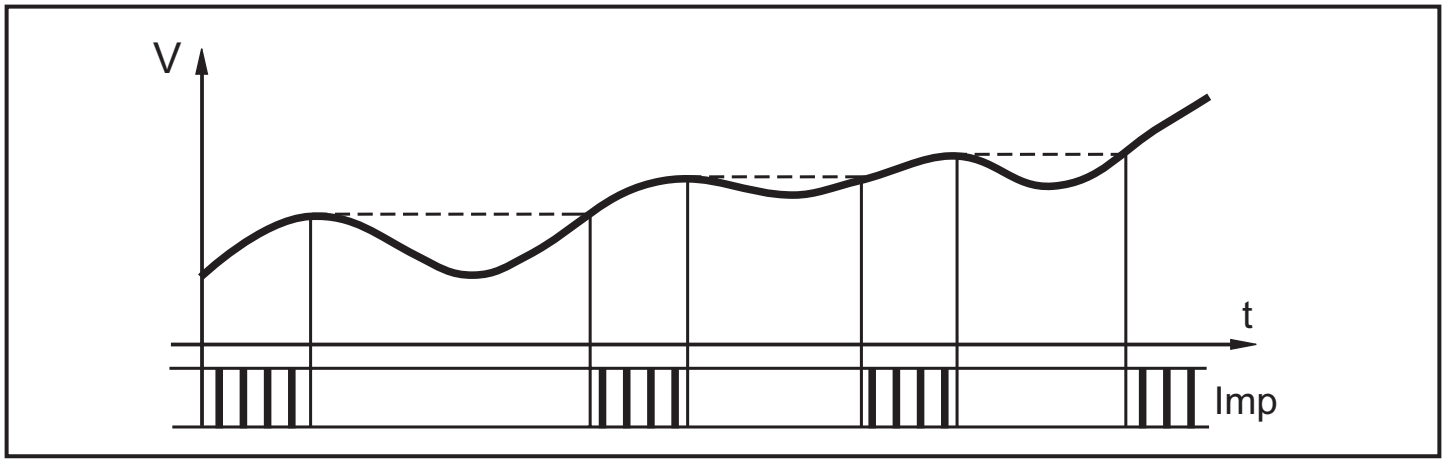
Direction of flow in accordance with "flow direction" > process value and display positive. Direction of flow against the “flow direction” > process value and display negative.

Only positive process values are processed for the signal output (limit values and analog values for flow rate).

4.4 Volumetic totalizer monitoring

The unit has an internal mass flow meter which continuously totals the flow rate. The sum corresponds to the current consumed quantity since the last reset.

- The volumetric totalizer meter takes account of the flow direction for totalization.
  - Flow according to the marked flow direction (arrow "flow direction"): meter adds.
  - Flow against the marked flow direction: meter subtracts (→ 10.5.11).
  - Meter pulses are only provided as the sum increases. After subtraction (consumed quantity decreases), the pulses are only provided again when the consumed quantity has exceeded the previous maximum value.



V = flow volume, Imp = output pulses

- The current meter reading can be displayed (→ 11.1 Reading the process value).
- In addition the value before the last reset is stored. This value can also be displayed (→ 11.1 Reading the process value).
  - The meter saves the totalled consumed quantity every 10 minutes. In the event of a power failure this value is retained as the current meter reading. If a time-controlled reset is set, the elapsed time of the set reset interval is also stored. So the possible data loss can be maximum 10 minutes.

There are different ways to reset the meter
→ 10.3.4 Manual counter reset
→ 10.3.5 Time-controlled counter-reset
→ 10.3.7 Configure counter reset using an external signal

4.4.1 Volumetric totalizer monitoring with pulse output

Output 1 indicates a counting pulse when the set flow volume has been reached (→ 10.3.1).

4.4.2 Volumetric totalizer monitoring with preset counter

Output 1 switches when the set flow volume has been reached (→ 10.3.2). 2 types of monitoring are possible:

1. Time-dependent volume monitoring (→ 10.3.5 Time-controlled counter-reset).
   - If the volume x is reached during t, output 1 switches and remains switched until the meter is reset.
   - If the volume x is not reached during the time t, the meter is automatically reset and counting starts again; output 1 does not switch.

2. Volume monitoring not time-dependent (→ 10.3.6 Deactivation of the counter reset).
   - If the volume x is reached, output 1 switches and remains switched until the meter is reset.

4.5 Temperature monitoring

The following signals are provided for temperature monitoring:

- A switching signal for temperature limit values on output 2. On the switching functions → 4.7.
- An analog signal proportional to the temperature (4...20 mA or 0...10 V) on output 2. On the analog functions → 4.8.

4.6 Empty pipe detection

The unit detects when the two electrodes are not wetted by the medium (→ 4.1 Measuring principle for flow rate monitoring). The empty pipe detection can be activated or deactivated (→ 10.5.9). If it is active and the pipe is empty, the unit reacts as follows:

> [SEnS] is indicated in the display.

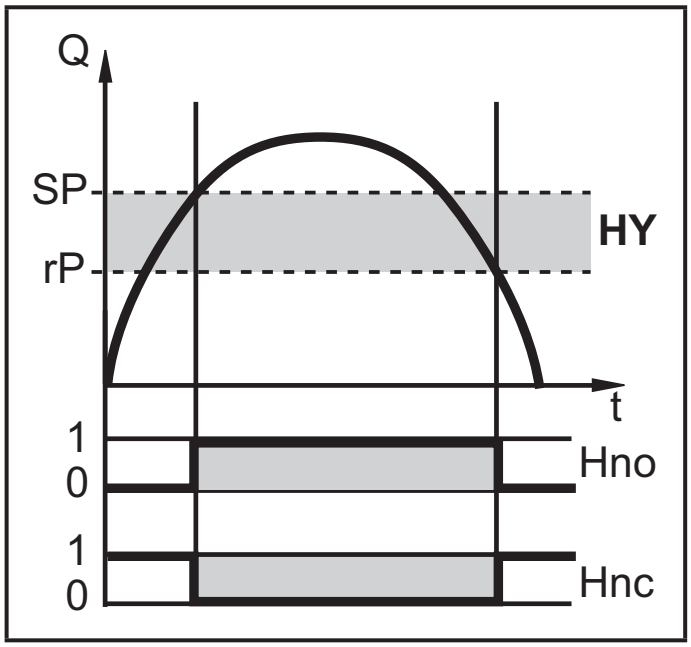
> The flow is set to zero.

The empty pipe detection can be set as time-depending or not time depending (→ 10.5.10).

4.7 Flow rate or temperature monitoring / switching function

OUTx changes its switching state if it is above or below the set switching limits (SPx, rPx). The following switching functions can be selected:

4.7.1 Hysteresis function



Example of flow rate monitoring
HY = hysteresis

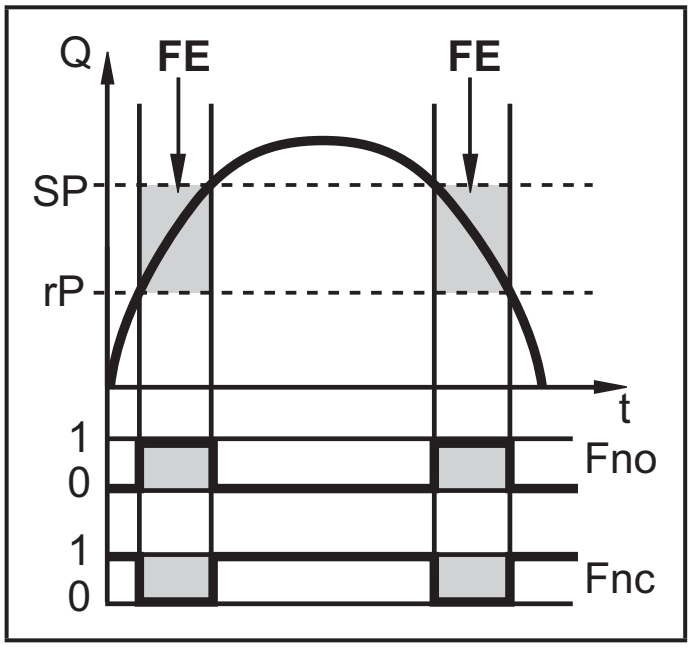
Normally open: [OUx] = [Hno]

Normally closed: [OUx] = [Hnc]

First the set point (SPx) is set, then the reset point (rPx) with the requested difference.

When SPx is adjusted rPx is changed automatically; the difference remains constant.

4.7.2 Window function



Example of flow rate monitoring
FE = window

Normally open: [OUx] = [Fno]

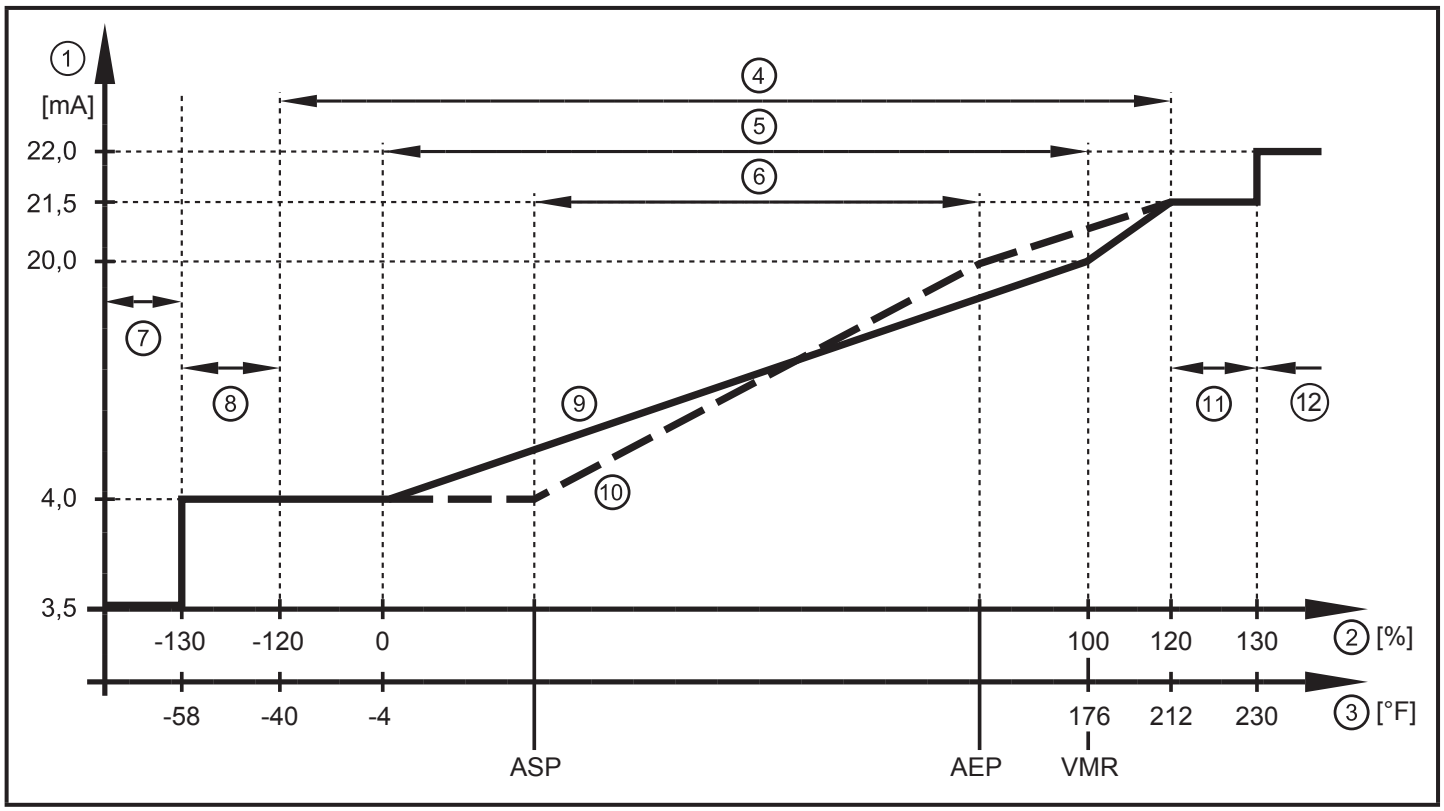
Normally closed: [OUx] = [Fnc]

The width of the window can be set by means of the difference between SPx and rPx.
SPx = upper value
rPx = lower value.

When set to the window function the set and reset points have a fixed hysteresis of 0.25 % of the final value of the measuring range. This keeps the switching state of the output stable if the flow rate varies slightly.

4.8 Flow rate or temperature monitoring / analog function

4.8.1 Current output



Characteristics of the analog output according to the standard IEC 60947-5-7

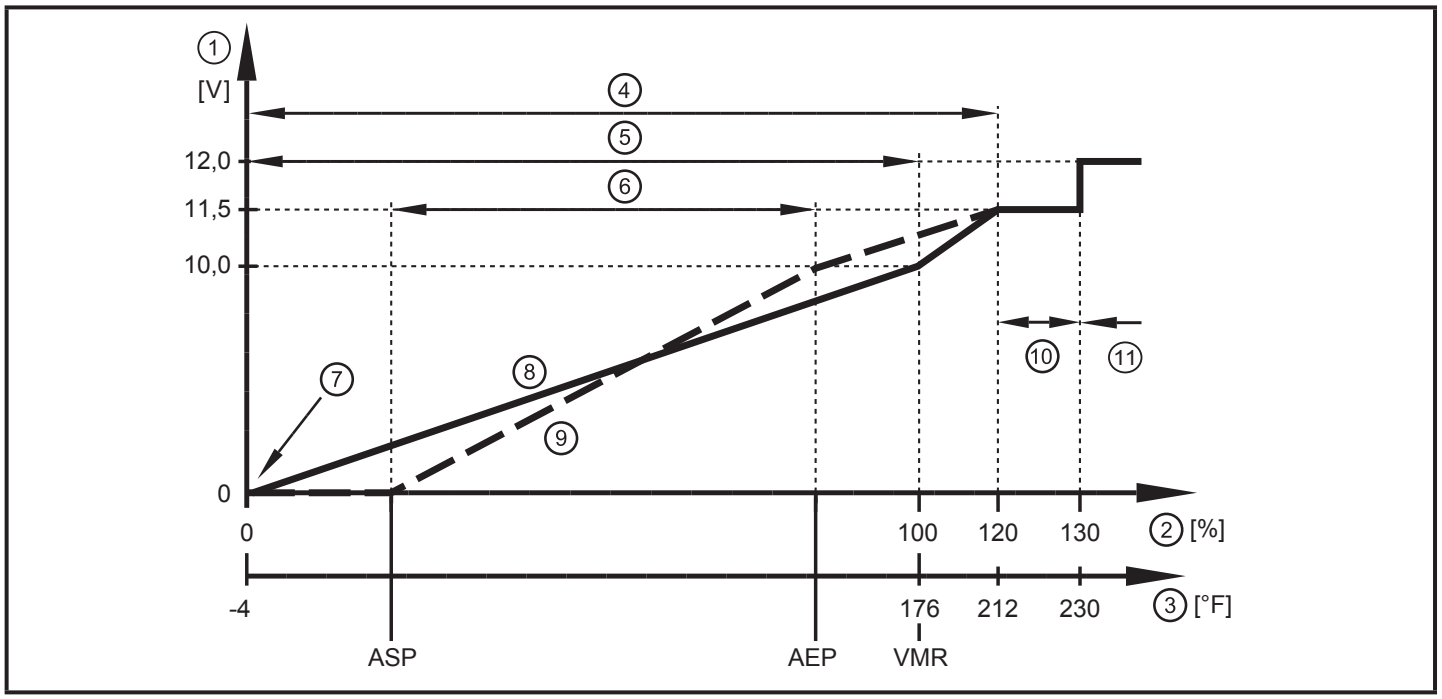
1: Output current
2: Flow rate
3: Temperature
4: Display range
5: Measuring range
6: Range between analog start point and analog end point
7: The unit is in the error state (FOU = OFF).
8: The process value transmitted in an analog way is therefore below the display range.
9: Curve of the analog signal at factory setting
10: Curve of the analog signal with shifted ASP and AEP
11: The process value transmitted in an analog way is therefore above the display range.
12: The unit is in the error state (FOU = ON).

ASP = analog start point: determines at which measured value the output signal is 4 mA
AEP = analog end point: determines at which measured value the output signal is 20 mA
VMR = final value of the measuring range = 100 %

Minimum distance between ASP and AEP = 20 % of the measuring range

In the set scaling range the output signal is between 4 and 20 mA.

4.8.2 Voltage output



Characteristics of the analog output according to the standard IEC 60947-5-7

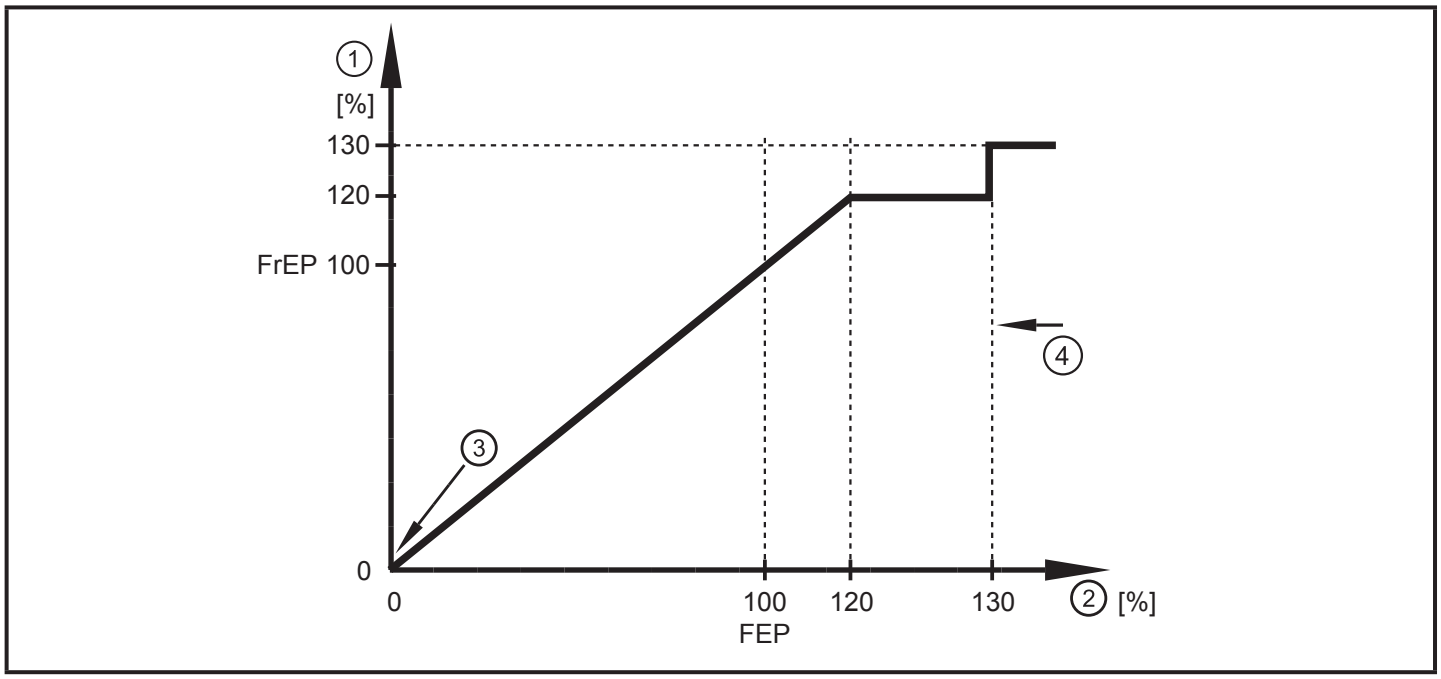
1: Output voltage
2: Flow rate
3: Temperature
4: Display range
5: Measuring range
6: Range between analog start point and analog end point
7: The unit is in the error state (FOU = OFF) or the process value transmitted in an analog way is below the display range.
8: Curve of the analog signal at factory setting
9: Curve of the analog signal with shifted ASP and AEP
10: The process value transmitted in an analog way is therefore above the display range.
11: The unit is in the error state (FOU = ON).

ASP = analog start point: determines at which measured value the output signal is 0 V
AEP = analog end point: determines at which measured value the output signal is 10 V
VMR = final value of the measuring range = 100 %

Minimum distance between ASP and AEP = 20 % of the measuring range

In the set scaling range the output signal is between 0 and 10 V.

4.9 Flow rate monitoring / frequency output



Output curve frequency output
1: Frequency output
2: Flow rate Q
3: The unit is in the error state (FOU = OFF) or the process value transmitted in an analog way is below the display range.
4: The unit is in the error state (FOU = ON).

FrEP = configured frequency at FEP (→ 10.2.4 Setting the frequency value for flow rate)

4.10 Start-up delay

The start-up delay dST influences the switching outputs of the flow rate monitoring.

If the start-up delay is active (dST > 0), note: As soon as the flow rate exceeds the LFC (LFC = low flow cut-off → 4.11), the following processes are carried out:

> The start-up delay is activated.

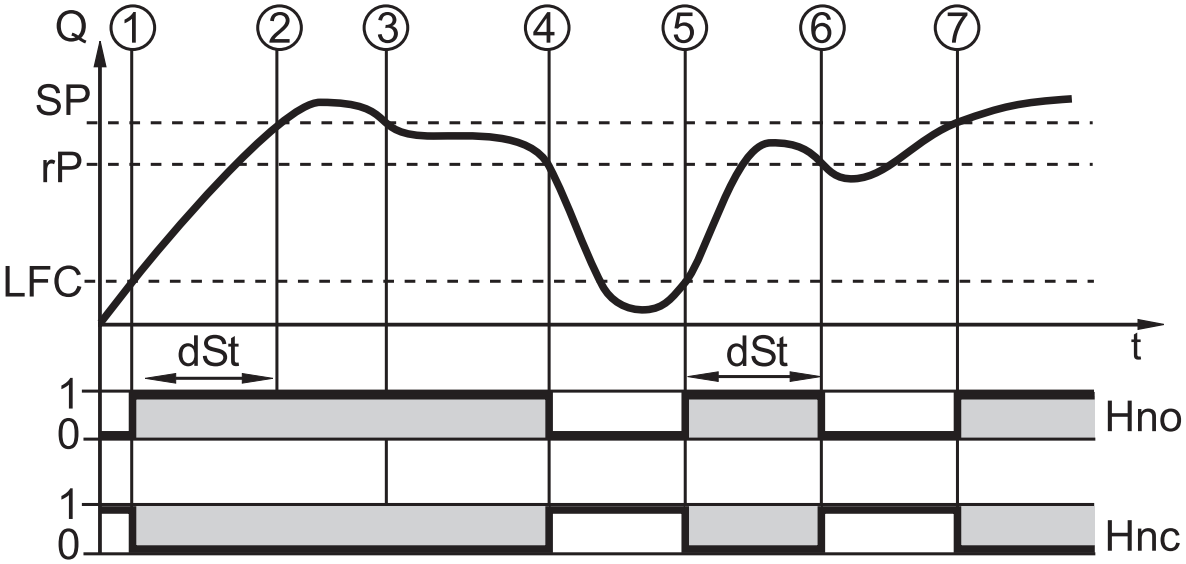
> The outputs switch as programmed:
ON for NO function, OFF for NC function.

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

1. The flow rate increases quickly and reaches the set point / good range within dST.
> Outputs remain active.

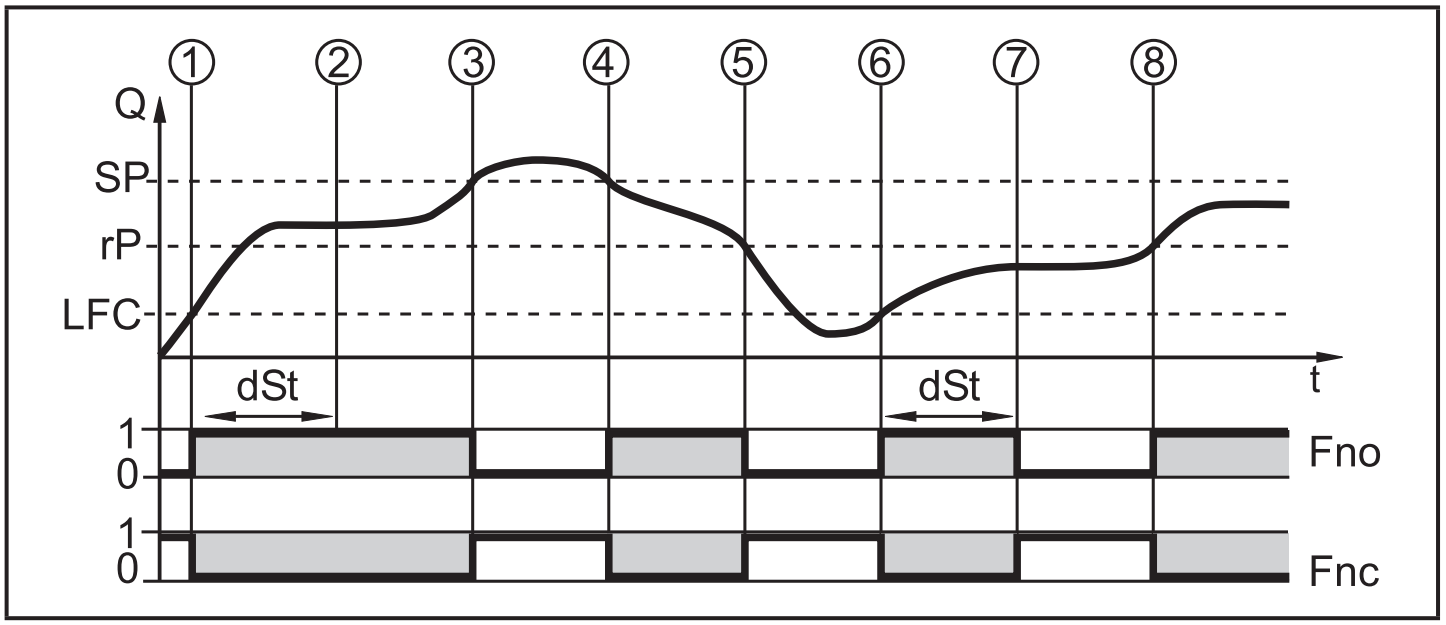
2. The flow rate increases slowly and does not reach the set point /good range within dST.
   > Outputs are reset.
3. Flow rate falls below LFC within dST.
   > Outputs are reset at once; dST is stopped.

Example: dST for hysteresis function



	Condition	Reaction
1	Flow rate 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	Flow rate 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

4.11 Low flow cut-off (LFC)

With this function small flow rates can be ignored (→ 10.5.13). Flows below the LFC value are evaluated by the sensor as standstill (Q = 0).

4.12 Simulation

With this function flow and temperature values can be simulated (→ 10.6.3).
The simulation does not have any effect on the totalizer or the current flow. The outputs operate as previously set.
When the simulation starts, the value of the totalizer is saved and then the simulated totalizer is set to 0. The simulated flow value then has an effect on the simulated totalizer. When the simulation is finished, the original totalizer value is restored.

During the simulation the original totalizer value remains saved without any changes even if there is a real flow.

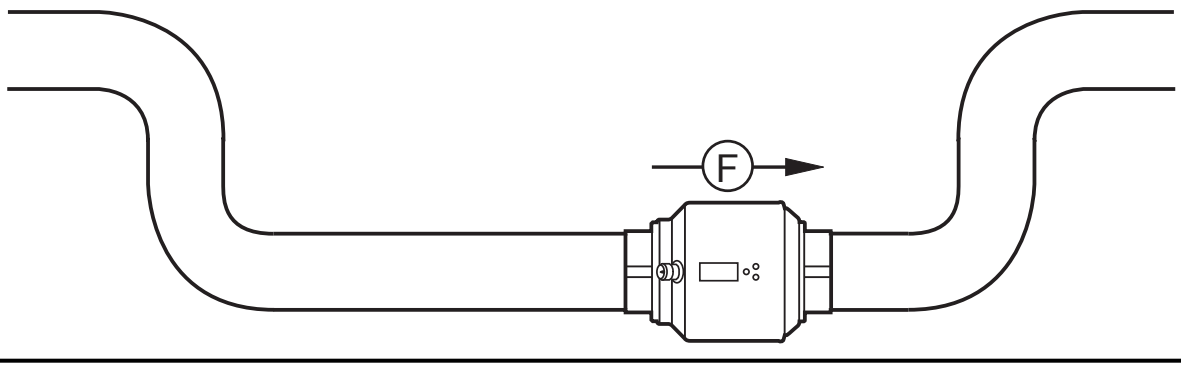
5 Installation

▶ Avoid deposits, accumulated gas and air in the pipe system.

5.1 Recommended installation position

Example of an optimized installation:

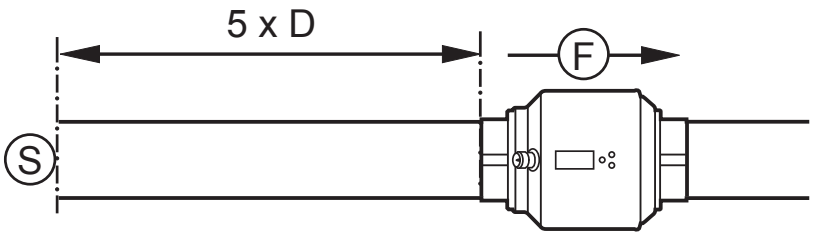
1



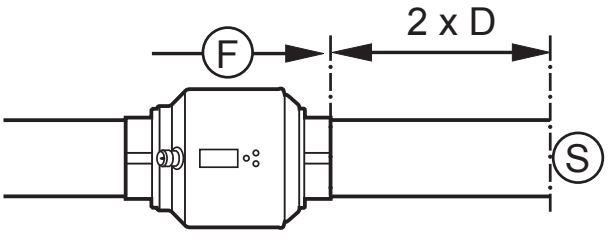
▶ Install the unit so that the measuring pipe is completely filled.

▶ 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.

2

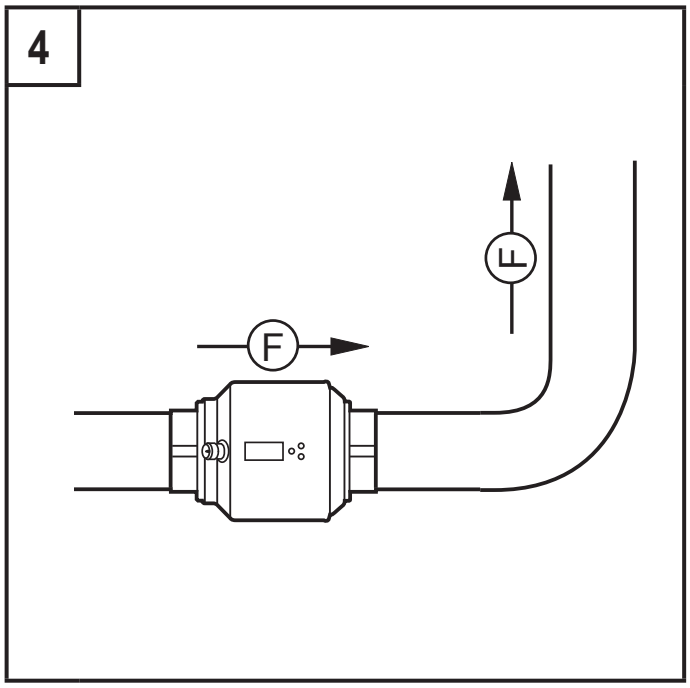


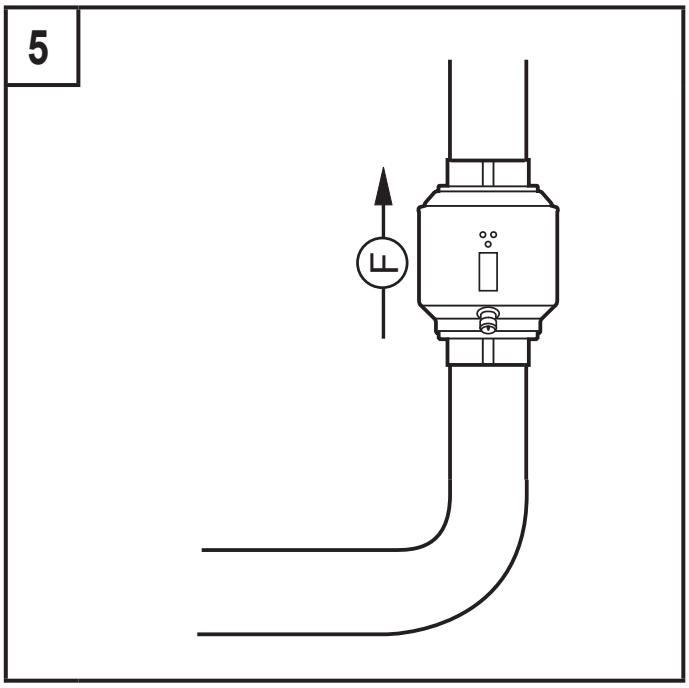
3



S = disturbance; D = pipe diameter; F = flow direction

▶ Install in front of or in a rising pipe:





F = flow direction

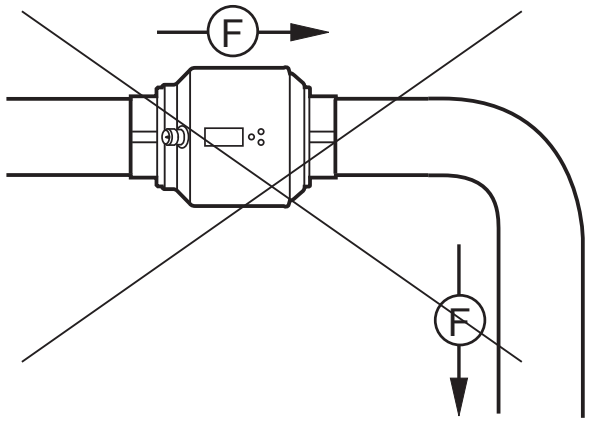
With empty pipe detection:
▶ Install the unit according to figure 1, 4 or 5.

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

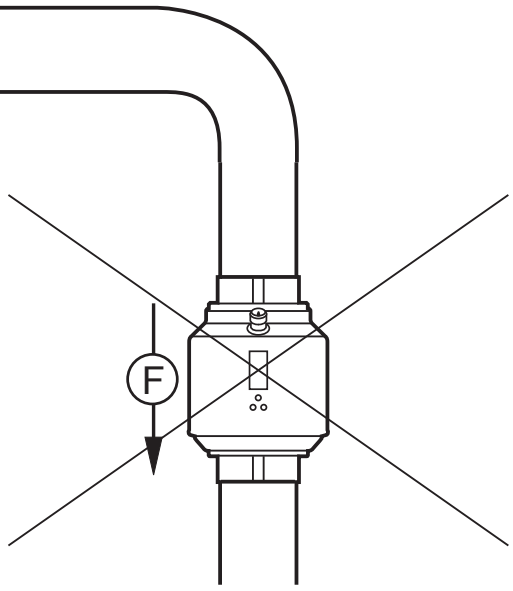
- No air bubbles can form in the pipe system.
- The pipes are always completely filled.

5.2 Not recommended installation position

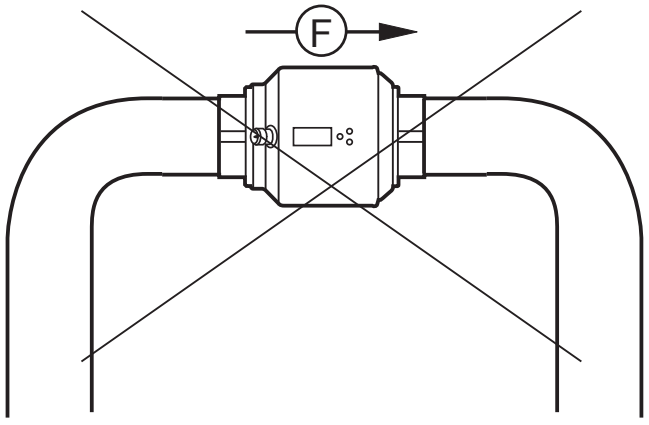
▶ Avoid the following installation positions:



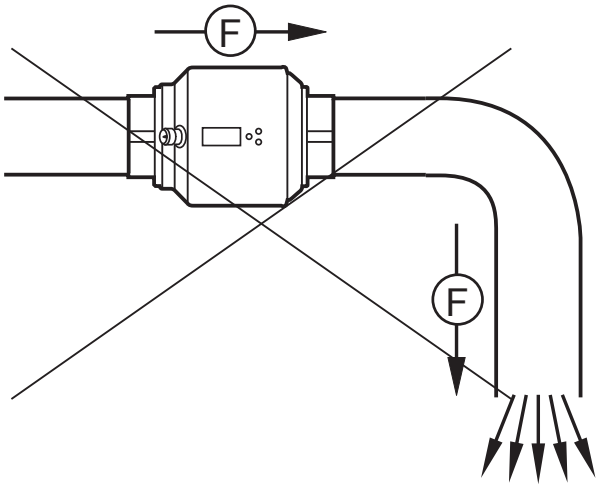
Directly in front of a falling pipe.



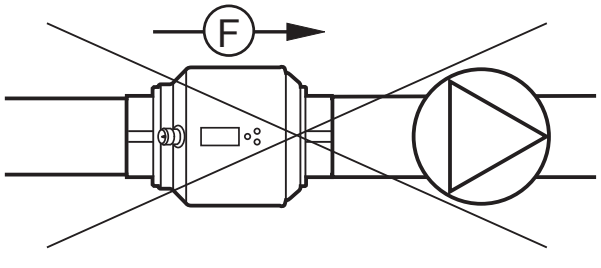
In a falling pipe.



At the highest point of the pipe system.



Directly in front of the spout of the pipe.



On the suction side of a pump.

F = flow direction

5.3 Grounding

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

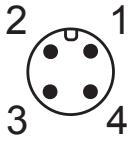
Ground brackets for the M12 connector are available as accessories (→ www.automationdirect.com).

6 Electrical connection

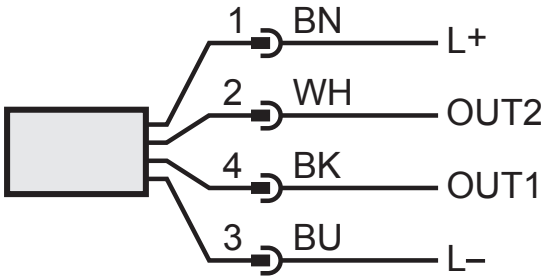
The unit must be connected by a qualified electrician.
The national and international regulations for the installation of electrical equipment must be adhered to.
Voltage supply according to EN 50178, SELV, PELV.

▶ Disconnect power.

▶ Connect the unit as follows:



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



Colors to DIN EN 60947-5-6

Sample circuits:

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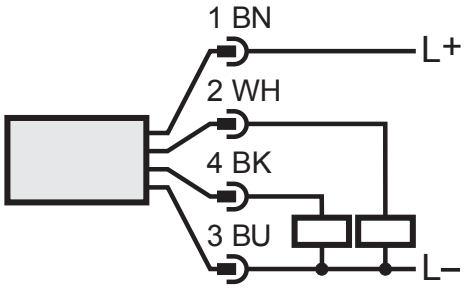
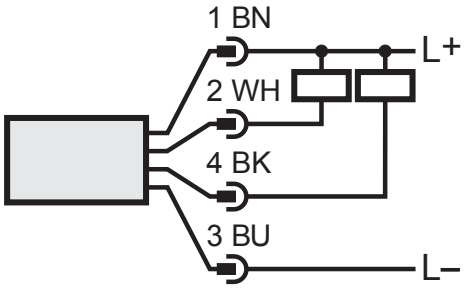
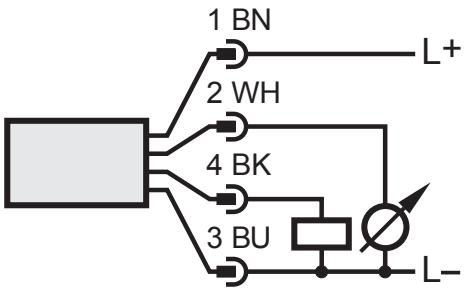
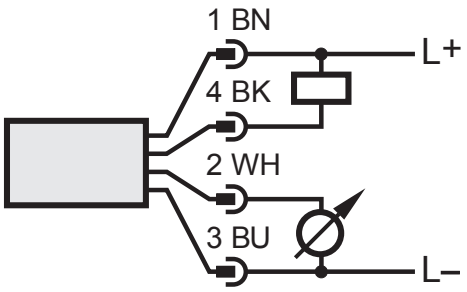
<tr>
<td>2 x positive switching
 
</td>
<td>2 x negative switching
 
</td>
</tr>
<tr>
<td>1 x positive switching / 1 x analog
 
</td>
<td>1 x negative switching / 1 x analog
 
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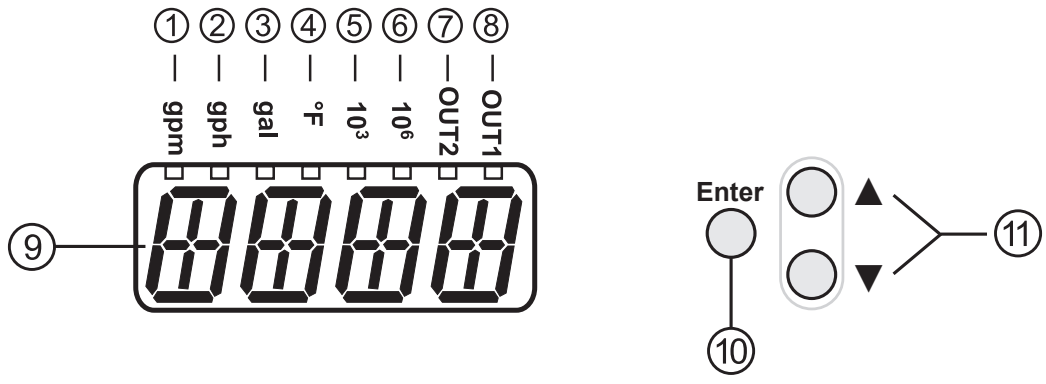
Pin 1	L+
Pin 3	L-
Pin 4 (OUT1)	• Flow rate switch: limit values for flow rate • Volumetric totalizer pulse: 1 pulse every time the defined volumetric total is reached. • Volumetric totalizer preset switch • Flow rate (frequency) • Empty pipe detection switch
Pin 2 (OUT2/ InD)	• Flow rate switch: limit values for flow rate • Temperature switch: limit values for temperature • Analog signal for flow rate • Analog signal for temperature • Empty pipe detection switch • Volumetric totalizer reset (input)

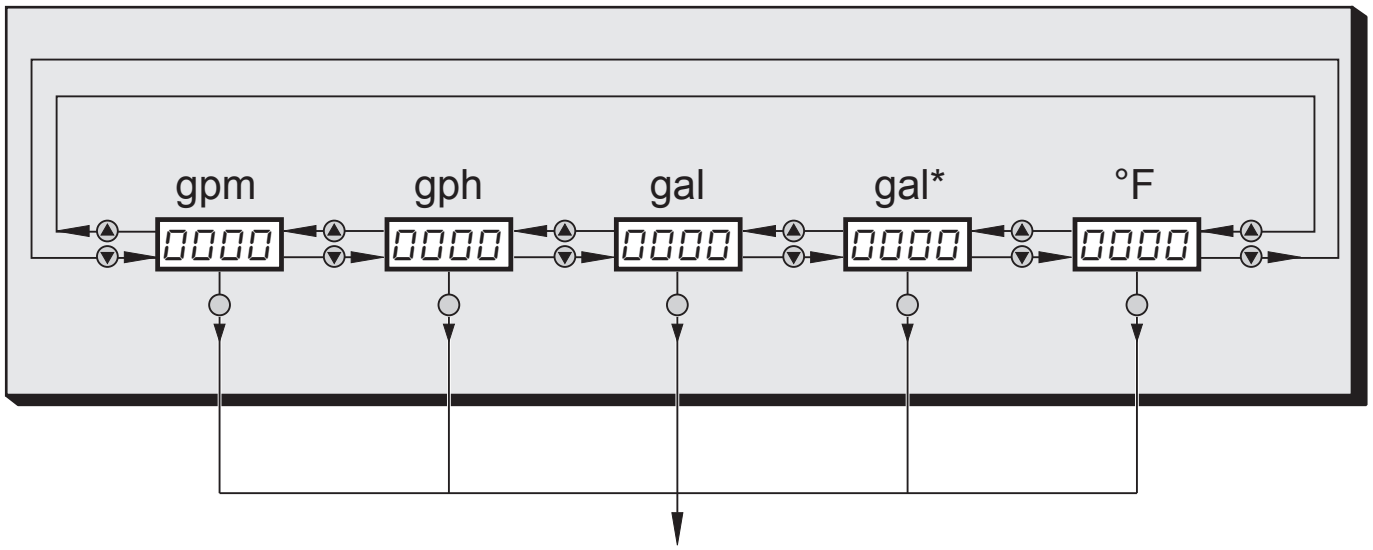
7 Operating and display elements



1 to 8: Indicator LEDs
• LEDs 1-6 = Unit of the currently represented numerical value → 11.1 Reading the process value • LED 7 = switching state of output OUT2 / of input InD • LED 8 = switching status of output OUT1
9: Alphanumeric display, 4 digits
• Current flow rate (with setting [SELd] = [FLOW]) • Meter reading of the totalizer (with setting [SELd] = [TOTL]) • Current medium temperature (with setting [SELd] = [TEMP]) • Parameters and parameter values
10: [Enter] button
• Selecting the parameters • Reading the set values • Confirming the parameter values Representation in → 8 Menu: ○
11: Buttons up [▲] and down [▼]
• Selection of the parameters • Activation of the setting functions • Changing the parameter values • Change of the display unit in the normal operating mode (Run mode) • Locking / unlocking Representation in → 8 Menu: ▲ and ▼

8 Menu

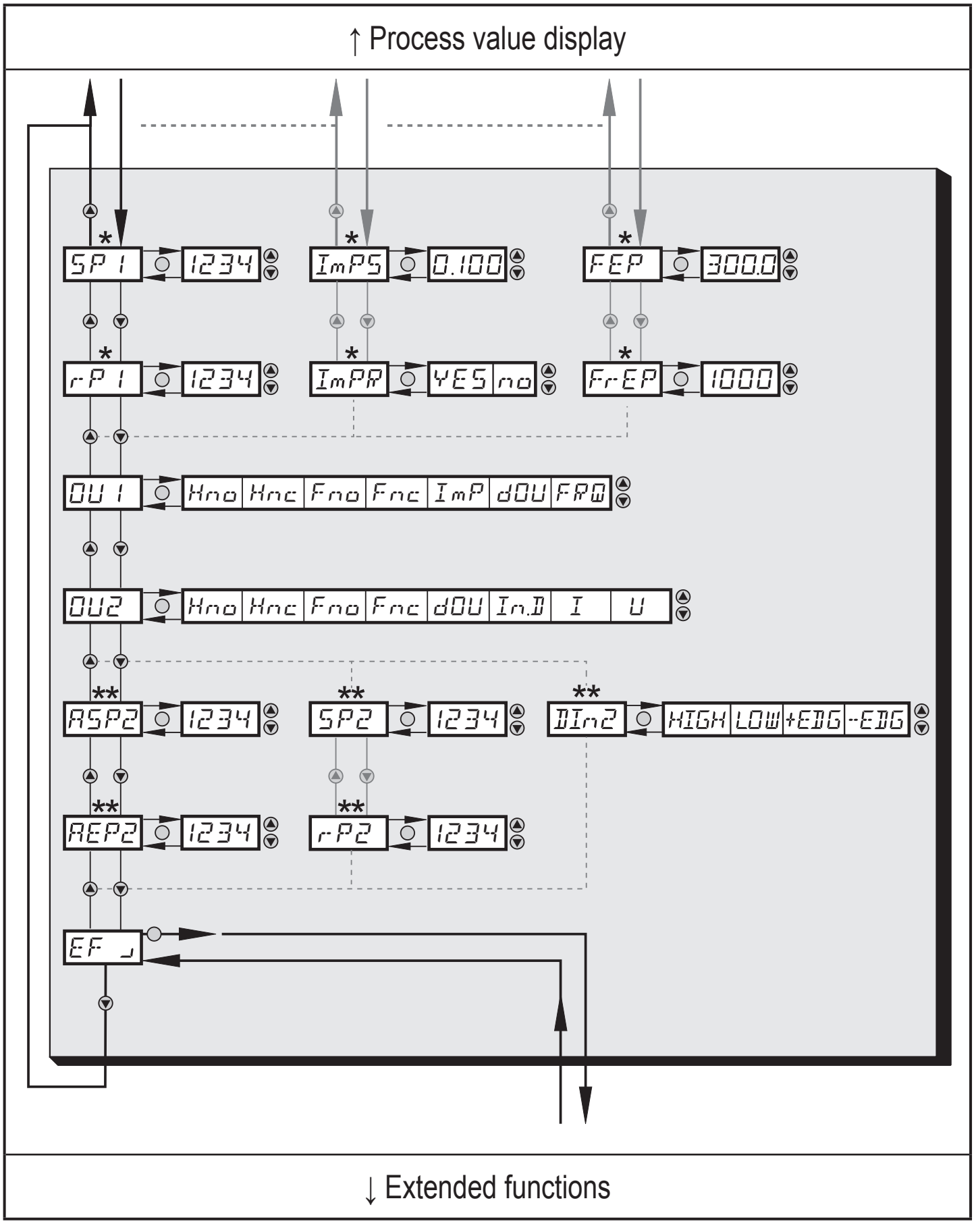
8.1 Process value display



gal = Current volumetric totalizer value since the last reset in 10^3 or 10^6 Gallon
gal* = Volumetric totalizer value before the last reset in 10^3 or 10^6 Gallon

↓ Main menu

8.2 Main menu



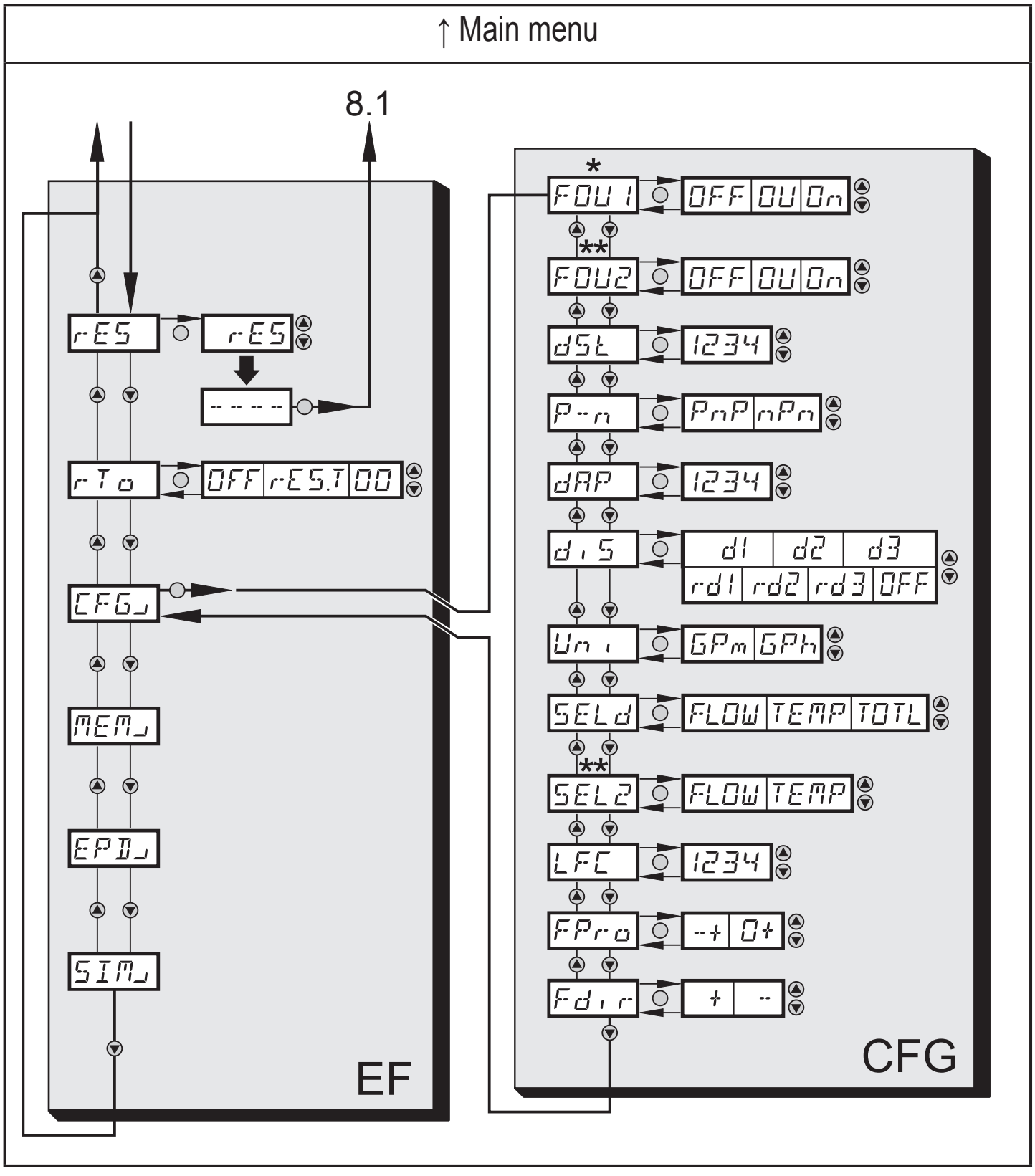
* The parameters are only displayed when selected at OU1.

** The parameters are only displayed when selected at OU2.

8.2.1 Explanation main menu

SP1	Maximum limit value for the set process value
rP1	Minimum limit value for the set process value
ImPS	Pulse value
ImPR	Pulse reset
FEP	Frequency output of the end point of the flow value
FrEP	Frequency output of the end point of the frequency
OU1	Output function for OUT1 (flow rate or volumetric totalizer)
OU2	Output function for OUT2 (flow rate or temperature)
	As an alternative: configure OUT2 (Pin2) as input for external volumetric totalizer reset signal: Setting: [OU2] = [In.D]
Hno	Hysteresis normally open
Hnc	Hysteresis normally closed
Fno	Window normally open
Fnc	Window normally closed
ImP	Pulse output
FRQ	Frequency output
dOU	Diagnostic output
I	Current output
U	Voltage output
In.D	External input
ASP2	Analog start value for the set process value
AEP2	Analog end value for the set process value
SP2	Maximum limit value for the set process value
rP2	Minimum limit value for the set process value
DIn2	Configuration of the input (Pin2) for counter reset
EF	Extended functions / opening of menu level 2

8.3 Extended functions – Basic settings



* The parameters are only displayed when selected at OU1.
** The parameters are only displayed when selected at OU2.

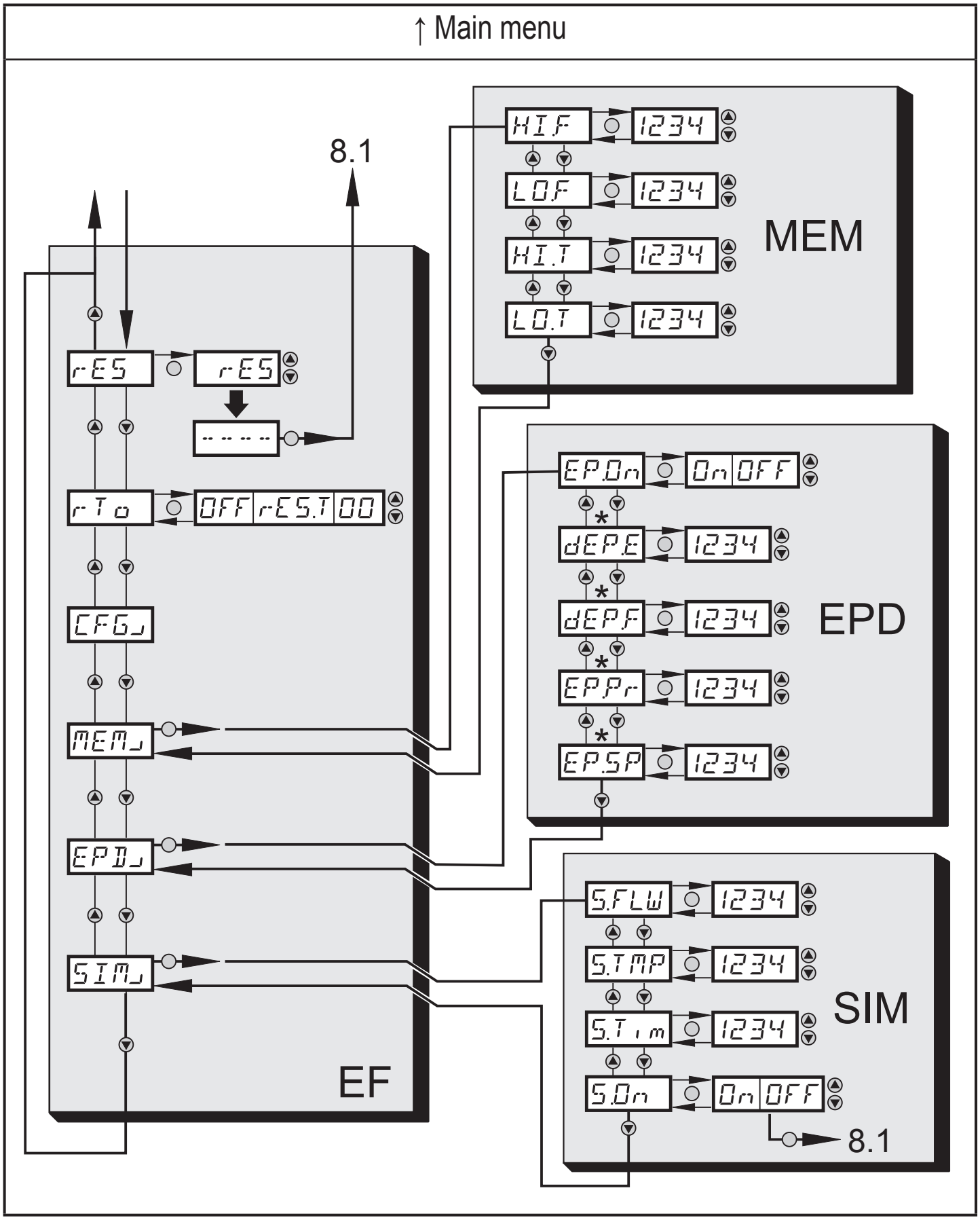
8.3.1 Explanation extended functions (EF)

rES	Restore the factory setting
rTo	Counter reset: manual reset / time-controlled reset
CFG	Submenu basic settings
MEM	Submenu min/max memory
EPD	Submenu empty pipe
SIM	Submenu simulation

8.3.2 Submenu basic settings (CFG)

FOU1	Behavior of output 1 in case of an error
FOU2	Behavior of output 2 in case of an error
dST	Start-up delay of flow rate monitoring
P-n	Output logic: pnp / npn
dAP	Measured value damping / damping constant in seconds
diS	Update rate and orientation of the display
Uni	Standard unit of measurement for flow rate: gallons/minute or gallons/hour
SELd	Standard measuring unit of the display: flow rate value / medium temperature / meter reading
SEL2	Standard unit of measurement for evaluation via OUT2
LFC	Low flow cut-off
FPro	Totalizer: behavior with negative flow
Fdir	Direction of flow

8.4 Extended functions – Min/max memory – Emtpy pipe – Simulation



* Parameters are only displayed for the selection EP.On = On.

8.4.1 Explanation extended functions (EF)

rES	Restore the factory setting
rTo	Counter reset: manual reset / time-controlled reset
CFG	Submenu basic settings
MEM	Submenu min/max memory
EPD	Submenu empty pipe
SIM	Submenu simulation

8.4.2 Submenu min/max memory (MEM)

HI.F	Max. value flow
LO.F	Min. value flow
HI.T	Max. value temperature
LO.T	Min. value temperature

8.4.3 Submenu empty pipe (EPD)

EP.On	Empty pipe detection on / off
dEP.E.	Delay time empty signal
dEP.F	Delay time full signal
EP.Pr	Current measured value of empty pipe detection
EP.SP	Switch point of empty pipe detection

8.4.4 Submenu simulation (SIM)

S.FLW	Simulation flow value
S.TMP	Simulation temperature value
S.TIM	Simulation time
S.ON	Simulation start

9 Set-up

After power on and completion of the power-on delay time (approx. 5 seconds) 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:
  - ON with normally open function (Hno / Fno)
  - OFF with normally closed function (Hnc / Fnc).
- If output 2 is configured as analog output, the output signal is at 20 mA (current output) or 10 V (voltage output).

10 Parameter setting

Parameters can be set before installation and set-up of the unit 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.

⚠ CAUTION

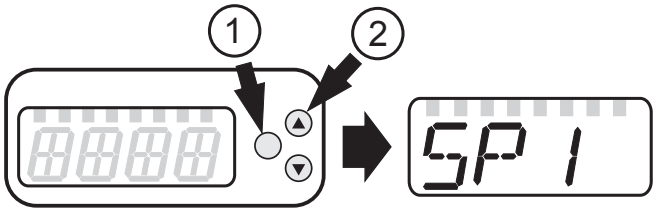
For medium temperatures above 122 °F some parts of the housing can heat up to over 149 °F.

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

10.1 Parameter setting in general

Select the parameter

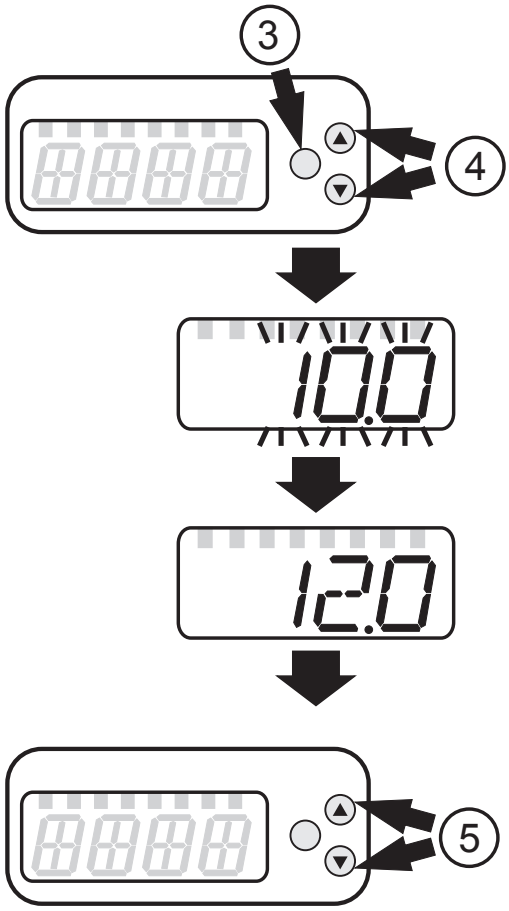
1. Press [Enter] briefly.
2. Press [▲] or [▼] until the requested parameter is displayed.



Changing the parameter value

3. Press [Enter] briefly.
   > The currently set value is displayed.
4. Keep [▲] or [▼] pressed for 1 s
   > Display flashes first, then permanent.
5. Change value by pressing [▲] or [▼].

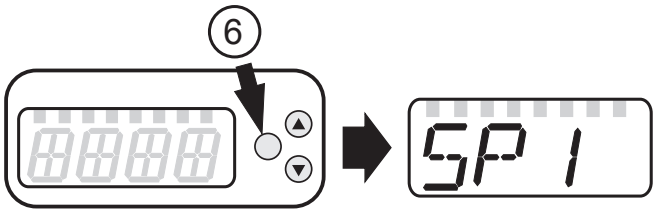
[▲] or [▼] pressed.
> Faster cycle of the numerical values.



Confirm the parameter value

6. Press [Enter] briefly.

> The parameter is displayed again. The new setting value is saved.



Finish parameter setting and change to the process value display:

► Wait for 30 seconds

or

► Change from the submenu to the main menu, from the main menu to the process value display with [▲] or [▼].

10.1.1 Switching between the menu levels

Change to the submenu	Switching to the next submenu via the parameters [EF], [CFG], [MEM], [EPD] or [SIM]. ▶ Select a submenu with [▲] or [▼] and switch to the submenu by pressing [Enter].
Back to the process value display	▶ Wait for 30 seconds or ▶ Change from the submenu to the main menu, from the main menu to the process value display with [▲] or [▼].

10.1.2 Locking / unlocking

The unit can be locked electronically to prevent unintentional settings. Setting at the factory: not locked.

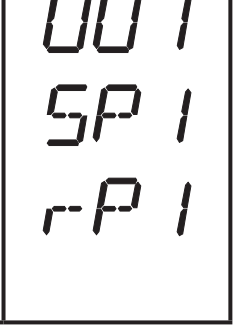
Locking	▶ Make sure that the unit is in the normal operating mode. ▶ Press [▲] and [▼] simultaneously for 10 s. > [Loc] is displayed. During operation: [LOC] is briefly displayed if you try to change parameter values.
Unlocking	▶ Press [▲] and [▼] simultaneously for 10 s. > [uLoc] is displayed.

10.1.3 Timeout

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

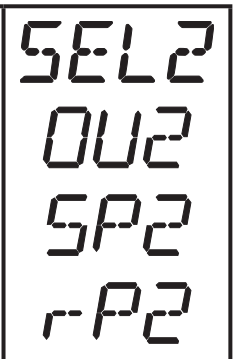
10.2 Settings for volumetric totalizer monitoring

10.2.1 Settings for limit value monitoring with OUT1

▶ Select [OU1] and set the switching function: - [Hno] = hysteresis function/NO, - [Hnc] = hysteresis function/NC, - [Fno] = window function/NO, - [Fnc] = window function/NC. ▶ Select [SP1] and set the value at which the output switches. ▶ Select [rP1] and set the value at which the output switches off.	

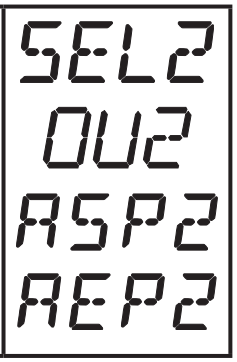
10.2.2 Settings for limit value monitoring with OUT2

- ▶ Select [SEL2] and set [FLOW].
- ▶ Select [OU2] and set the switching function.
  - [Hno] = hysteresis function/NO,
  - [Hnc] = hysteresis function/NC,
  - [Fno] = window function/NO,
  - [Fnc] = window function/NC.
- ▶ Select [SP2] and set the value at which the output switches.
- ▶ Select [rP2] and set the value at which the output switches off.



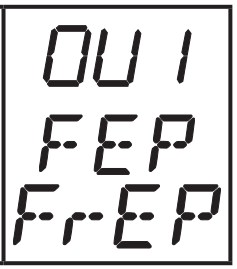
10.2.3 Setting the analog value for flow rate

- ▶ Select [SEL2] and set [FLOW].
- ▶ Select [OU2] and set the function:
  - [I] = current signal proportional to flow rate (4…20 mA);
  - [U] = voltage signal proportional to flow rate (0…10 V).
- ▶ Select [ASP2] and set the value at which the minimum value is provided.
- ▶ Select [AEP2] and set the value at which the maximum value is provided.



10.2.4 Setting the frequency value for flow rate

- ▶ Select [OU1] and set [FRQ].
- ▶ Select [FEP] and set the flow value at which the frequency set in FrEP is provided.
- ▶ Select [FrEP] and set the frequency.

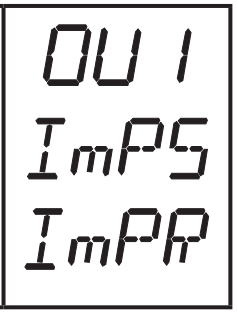


10.3 Settings for volumetric totalizer monitoring

10.3.1 Settings for volume monitoring via pulse output

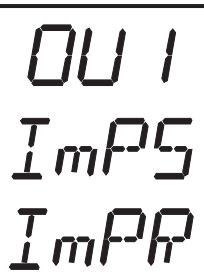
- ▶ Select [OU1] and set [ImP].
- ▶ Select [ImPS] and set the volume at which 1 pulse is provided (→ 10.3.3).
- ▶ Select [ImPR] and set [YES].

> Pulse repetition is active. Output 1 provides a counting pulse each time the value set in [ImPS] is reached.



10.3.2 Settings for volumetric totalizer monitoring via the preset counter

- ▶ Select [OU1] and set [ImP].
- ▶ Select [ImPS] and set the volume at which output 1 switches (→ 10.3.3).
- ▶ Select [ImPR] and set [no].
- > Pulse repetition is not active. The output switches ON if the value set in [ImPS] is reached. It remains set until the counter is reset.



10.3.3 Setting the pulse value

- ▶ Select [ImPS].
- ▶ Press [Enter] briefly.
- > The currently set value is displayed.
- ▶ Keep [▲] or [▼] pressed until "cccc" is displayed.
- ▶ Press [▲] or [▼] 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 [Enter] to confirm the setting range.
- ▶ Press [▲] or [▼] until the requested numerical value is displayed.
- ▶ Press [Enter] briefly.

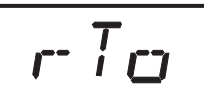
Setting ranges:

LED*	Unit	Display	Value	Step increment
3	gal	00.02...99.98	0.02...99.98 gal	0.02 gal
3	gal	000.2...999.8	0.2...999.8 gal	0.2 gal
3 + 5	gal x 10^3	0.002...9.998	2...9998 gal	2 gal
3 + 5	gal x 10^3	00.02...99.98	20...99 980 gal	20 gal
3 + 5	gal x 10^3	000.2...999.8	200...999 800 gal	200 gal
3 + 6	gal x 10^6	0.002...9.998	2000...9 998 000 gal	2000 gal
3 + 6	gal x 10^6	00.02...80.00	20 000...80 000 000 gal	20 000 gal

* indicator LED → 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

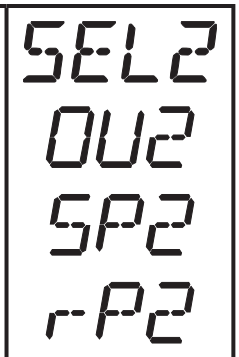
▶ Select [rTo] and set [OFF]. > The meter is only reset after overflow (= factory setting).	

10.3.7 Configure counter reset using an external signal

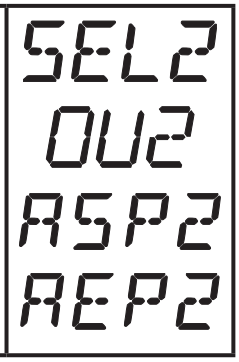
▶ Select [OU2] and set [InD]. ▶ Select [DIn2] and set the reset signal: - [HIGH] = reset for high signal, - [LOW] = reset for low signal, - [+EDG] = reset for rising edge, - [-EDG] = reset for falling edge.	

10.4 Settings for temperature monitoring

10.4.1 Settings for limit value monitoring with OUT2

▶ Select [SEL2] and set [TEMP]. ▶ Select [OU2] and set the switching function. - [Hno] = hysteresis function/NO, - [Hnc] = hysteresis function/NC, - [Fno] = window function/NO, - [Fnc] = window function/NC. ▶ Select [SP2] and set the value at which the output switches. ▶ Select [rP2] and set the value at which the output switches off.	

10.4.2 Setting the analog value for temperature

▶ Select [SEL2] and set [TEMP]. ▶ Select [OU2] and set the function: - [I] = temperature-proportional current signal (4…20 mA); - [U] = temperature-proportional voltage signal (0…10 V). ▶ Select [ASP2] and set the value at which the minimum value is provided. ▶ Select [AEP2] and set the value at which the maximum value is provided.	

10.5 User settings (optional)

10.5.1 Setting of the standard unit of measurement for flow rate

▶ Select [Uni] and set the unit of measurement: [gpm] or [gph]. The setting only has an effect on the flow rate value. The counter values (volumetric totalizer) are automatically displayed in the unit of measurement providing the highest accuracy.	

10.5.2 Configuration of the standard display

▶ Select [SELd] and determine the standard measuring unit: - [FLOW] = the current flow rate value in the standard unit of measurement is displayed. - [TOTL] = display indicates the current meter count in gal, 10^3 gal or 10^6 gal. - [TEMP] = the current medium temperature in °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 as for d1, d2, d3; rotated by 180°. - [OFF] = the display is switched off in the operating mode.	

10.5.3 Changing the direction of the flow rate measurement

▶ 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	

10.5.4 Setting the output logic

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

10.5.5 Setting the start-up delay

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

10.5.6 Setting the measured value damping

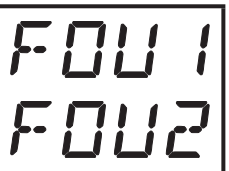
▶ Select [dAP] and set the damping constant in seconds (τ value 63 %).	

10.5.7 Setting the error behavior of the outputs

▶ Select [FOU1] and set the value:

1. Switching output:
   - [On] = output 1 switches ON in case of an error.
   - [OFF] = output 1 switches OFF in case of an error.
   - [OU1] = output 1 switches irrespective of the error as defined with the parameters.
2. Frequency output:
   - [On] = 130% of FrEP
   - [OFF] = 0 Hz
   - [OU1] = continues running

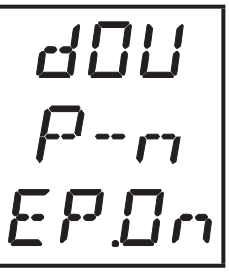
▶ Select [FOU2] and set the value:
- [On] = output 2 switches ON in case of an error, the analog signal goes to the upper error value.
- [OFF] = output 2 switches OFF in case of an error, the analog signal goes to the lower error value.
- [OU2] = output 2 switches irrespective of the error as defined with the parameters. The analog signal corresponds to the measured value.



10.5.8 Configuring the empty pipe detection as diagnostic output

▶ Select [OU1] or [OU2] and set [dOU].
▶ Select [P-n] and set [PnP] or [nPn].

The empty pipe detection is only effective if it is activated at [EP. On] → 10.5.9. When the empty pipe state is detected, the diagnostic output is inactive.

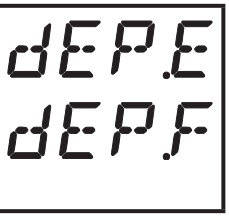


10.5.9 Activating / deactivating empty pipe detection

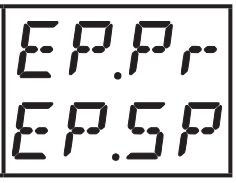
▶ Select [EP.On] and set the function:
- [OFF] = empty pipe detection deactivated.
- [On] = empty pipe detection activated.

10.5.10 Time-delay empty pipe detection

▶ Select [dEP.E] and set the delay time from 0…30 s, at which the signal should be provided when the pipe is empty.
▶ Select [dEP.F] and set the delay time from 0…30 s, at which the signal should be provided when the pipe is full.



10.5.11 Setting of the empty pipe detection

▶ Select [EP.Pr] to display the current value of the empty pipe detection in percent. ▶ Select [EP.SP] and set the switch point of empty pipe detection.	

10.5.12 Setting the counting method of the totalizer

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

10.5.13 Setting the low flow cut-off

▶ Select [LFC] and set the limit value.	

10.6 Service functions

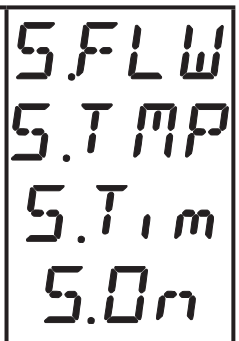
10.6.1 Reading the min/max values for the flow rate

▶ Select [HI.F] or [LO.F] [HI.F] = max. value, [LO.F] = min. value. Delete memory: ▶ Select [HI.F] or [LO.F]. ▶ Press [Enter] briefly. ▶ Keep [▲] or [▼] pressed. > [----] is displayed. ▶ Press [Enter] briefly. It makes sense to delete the memories as soon as the unit operates under normal operating conditions for the first time.	

10.6.2 Reading the min/max values for the temperature

▶ Select [HI.T] or [LO.T] [HI.T] = max. value, [LO.T] = min. value. Delete memory: ▶ Select [HI.T] or [LO.T]. ▶ Press [Enter] briefly. ▶ Keep [▲] or [▼] pressed. > [----] is displayed. ▶ Press [Enter] briefly. It makes sense to delete the memories as soon as the unit operates under normal operating conditions for the first time.	

10.6.3 Simulation menu

▶ Select [S.FLW] and set the flow value to be simulated. ▶ Select [S.TMP] and set the temperature value to be simulated. ▶ Select [S.Tim] and set the time of the simulation in minutes. ▶ Select [S.On] and set the function: - [On]: The simulation starts. The values are simulated for the time set at [S.Tim]. [SIM] is displayed simultaneously with the process values. Cancel with [Enter]. - [OFF]: The simulation is not active.	

10.6.4 Resetting all parameters to factory setting

▶ Select [rES]. ▶ Press [Enter] briefly. ▶ Keep [▲] or [▼] pressed. > [----] is displayed. ▶ Press [Enter] briefly. For the factory settings please refer to the end of these instructions → 13. We recommend recording your own settings in that table before carrying out a reset.	

11 Operation

11.1 Reading the process value

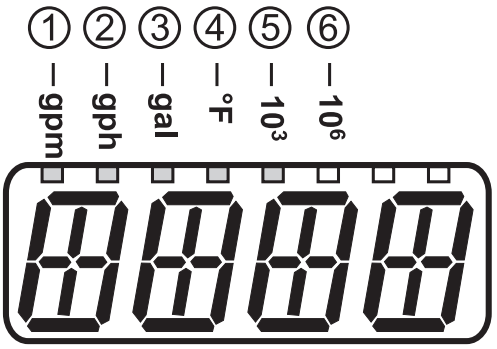
The LEDs 1-6 signal which process value is currently displayed.The process value to be displayed as standard (temperature, flow rate or meter reading of the totalizer) can be preset → 10.5.2 Configuration of the standard display. A standard unit of measurement can be defined for the flow rate (gpm or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

Further process values can be read in addition to the preset standard display:

▶ Press the buttons [▲] or [▼].

> The LED of the selected process value display is lit and the current process value is displayed.

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



LED		Process value display		Unit
1	□		Current flow rate per minute	gpm
2	□		Current flow rate per hour	gph
3	□	Totalizer *	Current volumetric totalizer value since the last reset	gal
3	⌘		Volumetric totalizer value before the last reset	gal
3 + 5	□		Current volumetric totalizer value since the last reset	10^3 gal
3 + 5	⌘		Volumetric totalizer value before the last reset	10^3 gal
3 + 6	□		Current volumetric totalizer value since the last reset	10^6 gal
3 + 6	⌘		Volumetric totalizer value before the last reset	10^6 gal
4	□		Current medium temperature	°F

□ LED is lit; ⌘ LED flashes

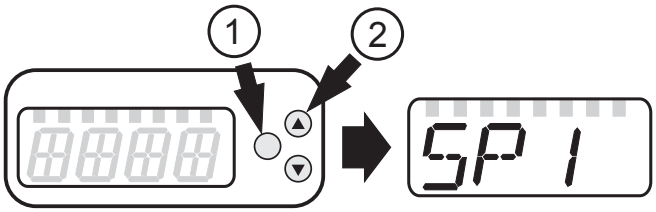
* The volumetric totalizer value is automatically displayed in the unit of measurement providing the highest accuracy.

11.2 Reading the parameter value

To display the currently set parameter value, take the following steps:

Select the parameter

1. Press [Enter] briefly.
2. Press [▲] or [▼] until the requested parameter is displayed.

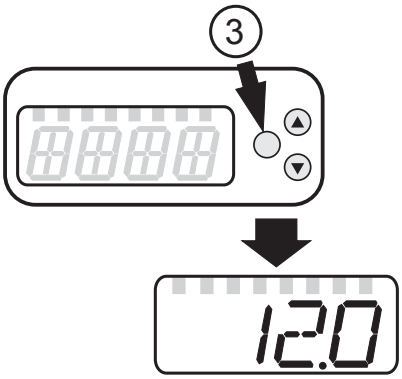


Display the parameter value

3. Press [Enter] briefly.

> The currently set value is displayed for 30 s.

By pressing [Enter] briefly several times, the display switches between parameter and parameter value.



Switching to the process value display

► Wait for 30 seconds

or

► Change from the submenu to the main menu, from the main menu to the process value display with [▲] or [▼].

11.3 Error indications

	Warning message
[SC1]	Short circuit in OUT1. LED8 for OUT1 flashes (→ 7 Operating and display elements).
[SC2]	Short circuit in OUT2. LED7 for OUT2 flashes (→ 7 Operating and display elements).
[SC]	Short circuit in both outputs. LED7 and LED8 flash (→ 7 Operating and display elements).
[OL]	Detection zone of flow rate or temperature exceeded. Measured value between 120 % and 130 % of the final value of the measuring range.
[UL]	Below the detection zone of flow rate or temperature. Measured value between -120 % and -130 % of the final value of the measuring range.
[Err]	• Unit faulty / malfunction. • Measured value greater than 130 % of the final value of the measuring range. • Measured value lower than -130 % of the final value of the measuring range.

[SEnS]	Sensor signal invalid. • Measuring pipe not sufficiently filled. • Medium with too low a conductivity.
[IOE.n]	Malfunctioning. The unit is faulty and must be replaced.

12 Technical data

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

13 Factory setting

	Factory setting	User setting
SP1	**20 % ***	
rP1	**19.5 % ***	
ImPS	**0.1**	
ImPR	**YES**	
OU1	**Hno**	
OU2	**I**	
SP2 (FLOW)	**40 % ***	
rP2 (FLOW)	**39.5 % ***	
SP2 (TEMP)	**68 °F**	
rP2 (TEMP)	**67,3 °F**	
ASP2 (FLOW)	**0 % ***	
AEP2 (FLOW)	**100 % ***	
ASP2 (TEMP)	**-4 °F**	
AEP2 (TEMP)	**176 °F**	
FEP	**100 % ***	
FrEP	**1 kHz**	
FDir	**+**	
FPro	**- +**	
LFC	**1,1 gpm**	
D.In2	**+EDG**	

	Factory setting	User setting
FOU1	OFF	
FOU2	OFF	
dST	0	
P-n	PnP	
dAP	0.6 s	
rTo	OFF	
diS	d2	
Uni	gpm	
SELd	FLOW	
SEL2	FLOW	
EP.On	OFF	
dEP.E	0 s	
dEP.F	2 s	
EP.SP	75 %	
S.FLW	20 %	
S.TMP	68 °F	
S.Tim	3 min	

* of the final value of the measuring range