Operating instructions

Magnetic-inductive flow meter

SMxx2x
SMxx3x

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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 documentation.ifm.com.

1.1 Symbols used

✓	Requirement
▶	Instruction
▷	Reaction, result
bold	Designation of keys, buttons or indications
	Cross-reference without link
	Cross-reference with link
	Important note Non-compliance may result in malfunction or interference
	Information Supplementary note

1.2 Warnings

Warnings indicate the possibility of personal injury and damage to property. This enables safe product handling. Warnings are graded as follows:

WARNING

Warning of serious personal injury

▷ If the warning is not observed, fatal and serious injuries are possible.

CAUTION

Warning of minor to moderate personal injury

▷ If the warning is not observed, minor to moderate injuries are possible.

ATTENTION

Warning of damage to property

▷ If the warning is not observed, damage to property is possible.

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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.

2.1 Cybersecurity

Installation

The device is suitable for operation in a secure environment according to IEC 62443-1-1.

The device was designed for operation behind a firewall.

▶ Carry out a risk assessment of the system according to IEC 62443-1-1.

▶ Take measures to ensure physical security.

Operation

▶ Observe the security functions described in the product documentation and the recommendations for their use.

Maintenance

▶ Back up system configuration and system data in accordance with your company's change management processes.

Decommissioning

▶ Ensure that no sensitive information can fall into unauthorised hands.

▶ Always reset the system settings to the factory settings before decommissioning the device.

3 Transport, handling and storage

- Store the device in its original packaging.
- When the device is to be stored again, use the original packaging.
- Otherwise, provide unused connections with either a mating connector or a protective cap and pack the device in suitable packaging.
- Observe the permissible ambient conditions for the device during storage (→ Technical data).

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4 Intended use

The unit monitors liquid media.

The unit detects the flow velocity, the volume flow (volumetric flow quantity/time), the consumed quantity and the medium temperature.

4.1 Application area

Liquids with the following properties:

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

This is a class A product. This product may cause radio interference in domestic areas.

▶ If required, take appropriate EMC screening measures.

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 media from group 1 fluids on request.

5 Function

- The device detects the volumetric flow on the magnetic-inductive volumetric flow measuring principle.
- 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 has many self-diagnostic options.
- A simulation mode allows simplified set-up of the sensor.
- The unit displays the current process values.
- The unit generates two output signals according to the parameter setting.
- The device has the following output functions:
  - Switching signal for limit value monitoring 26:
    flow, temperature
  - Switching signal for flow direction 27
  - Consumed quantity monitoring (totaliser function) 28:
    switching signal or pulse signal
  - Analogue signal 31:
    flow, temperature
  - Frequency signal 32:
    flow, temperature
- The device also offers the following additional functions:
  - Read totaliser values 47
  - Memory 47
  - Simulation 46
  - Optical localisation 47
  - Lock / unlock 42
  - Device reset 42
  - Display settings 43
  - Application configuration 35: e.g. standard unit of measurement, measured value damping, start-up delay, output polarity, low flow cut-off, flow direction, totaliser reset, totaliser counting method, error behaviour of the outputs.

When used with the factory setting, the device monitors the flow via a switching signal at OUT1 and an analogue signal at OUT2 52.

5.1 Output OUT1 selection options

- Switching signal flow
- Switching signal temperature
- Switching signal for flow direction
- Switching signal totaliser
- Pulse signal totaliser
- Frequency signal flow
- Frequency signal temperature
- IO-Link
- OFF (output switched to high impedance)

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5.2 Output OUT2 selection options

- Switching signal flow
- Switching signal temperature
- Switching signal for flow direction
- Analogue signal flow
- Analogue signal temperature
- Input for external totaliser reset
- OFF (output switched to high impedance)

5.3 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

6 Mounting

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.

▶ Protect the housing against contact with flammable substances and unintentional contact.

ATTENTION

No functional earthing when installed in an ungrounded pipe system (e.g. plastic pipes).

▷ Deficient operating function.

▶ Ground the device. Ground brackets for the M12 connector are available as accessories, see documentation.ifm.com.

▶ Make sure that no pressure is applied to the system.

▶ Ensure that no media can leak at the mounting location during installation.

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

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

▶ Rinse the system after installation for ventilation.

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

6.1 Process connection

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

Adapters have to be ordered separately as accessories.

- Information about the available mounting accessories at www.ifm.com.
- A correct fit of the device and ingress resistance of the connection are only ensured using ifm adapters.

▶ Observe the instructions of the mounting accessories.

▶ Take the tightening torques for sensor and fixing elements into account.

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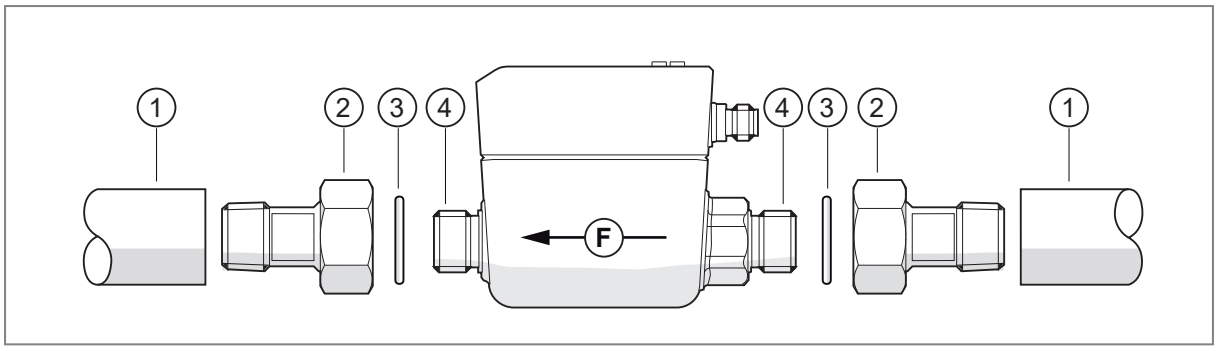


Fig. 1: Process connection for devices with G-thread; F = flow direction

1: Pipe
2: Adapter
3: Sealing
4: G-thread

- ▶ Grease the threads of the process connection, adapter and sensor. Use a lubricating paste which is suitable and approved for the application.
- ▶ Screw the adapters into the pipe.
- ▶ Insert the seals and insert the device according to the marked flow direction.
- ▶ Screw the adapters to the sensor thread until they are hand-tight.
- ▶ Tighten both adapters in opposite direction by applying the defined tightening torque:
- 15 Nm for devices with DN6
- 30 Nm for devices with DN15...DN25

6.2 Installation position

6.2.1 Recommended mounting position

- ▶ Install the unit so that the measuring pipe is always completely filled.
- ▶ Install in front of or in a rising pipe.

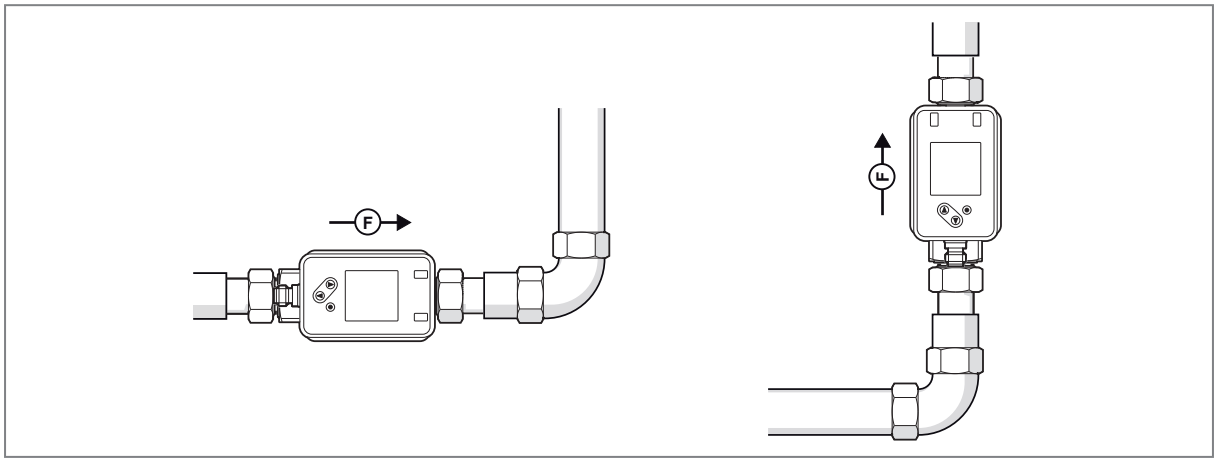


Fig. 2: Recommended mounting positions. F = flow direction

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.

In case of horizontal installation: as a result of horizontal mounting a small quantity of the medium always remains in the measuring channel, even after switching off the pump.

6.2.2 Non recommended installation position

- Directly in front of a falling pipe.
- In a falling pipe.
- Directly in front of the spout of a pipe.
- On the suction side of a pump.
- At the highest point of the pipe system.

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7 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:

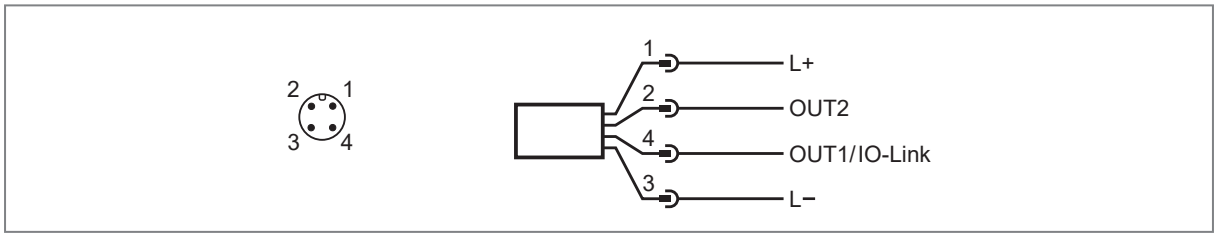
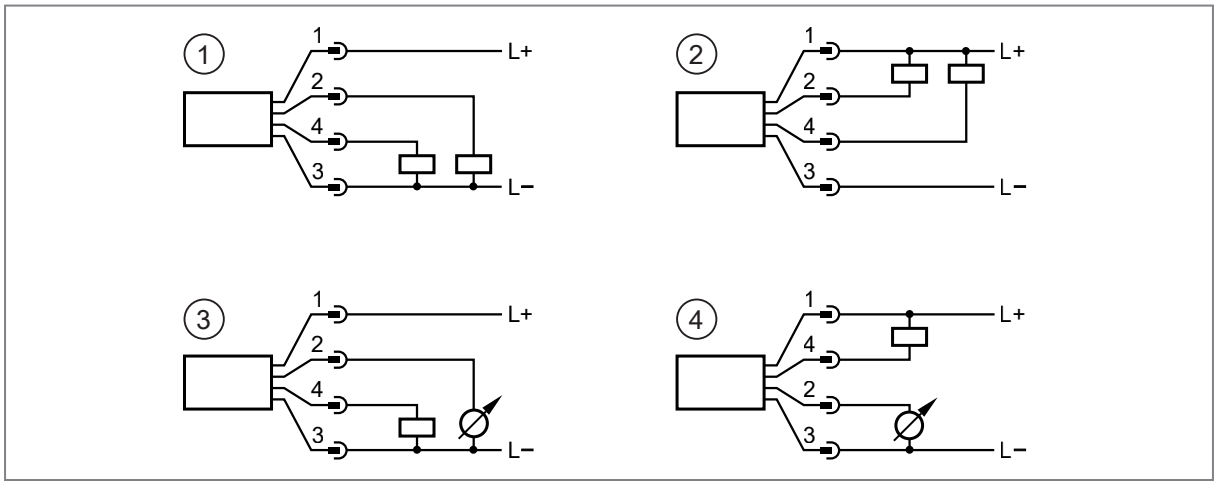


Fig. 3: Wiring diagram

Pin	Assignment
1	L+
3	L-
4 (OUT1)	• Switching signal flow • Switching signal temperature • Switching signal for flow direction • Switching signal totaliser • Pulse signal totaliser • Frequency signal flow • Frequency signal temperature • IO-Link • OFF (output switched to high impedance)
2 (OUT2/ InD)	• Switching signal flow • Switching signal temperature • Switching signal for flow direction • Analogue signal flow • Analogue signal temperature • Input for external totaliser reset • OFF (output switched to high impedance)

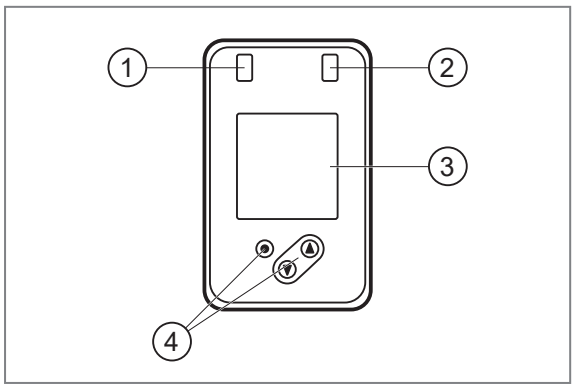
Circuit examples:



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

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8 Operating and display elements



1: Switching status LED for OUT1
2: Switching status LED for OUT2
3: TFT display
4: Keys for changing the displays and for parameter setting

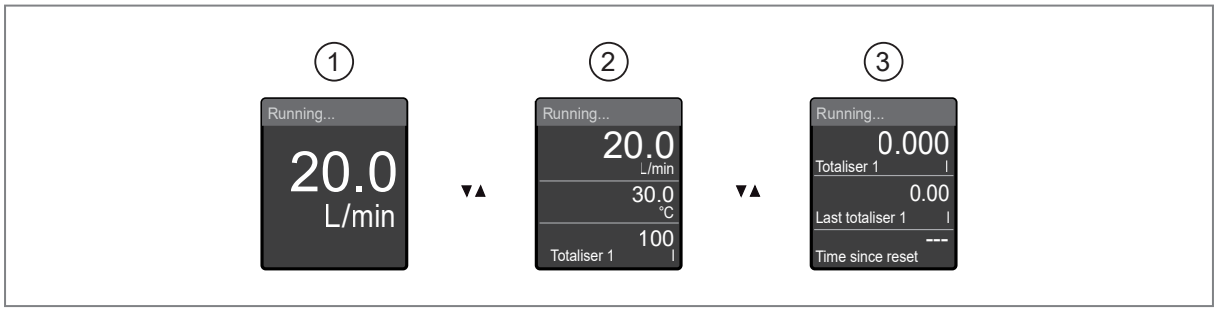
Fig. 4: Operating and display elements

If the unit measures a high internal temperature, the display brightness is automatically adjusted:
Internal temperature of the unit > 70 °C: brightness is reduced to 25%.
Internal temperature of the unit ≥ 100 °C: display is automatically switched off.

Switching between display screens:

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.



1: Standard display as set under **diS.L**, **coL.x** and **uni.x**
2: Overview of all process values
3: Overview totaliser values

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

9 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.

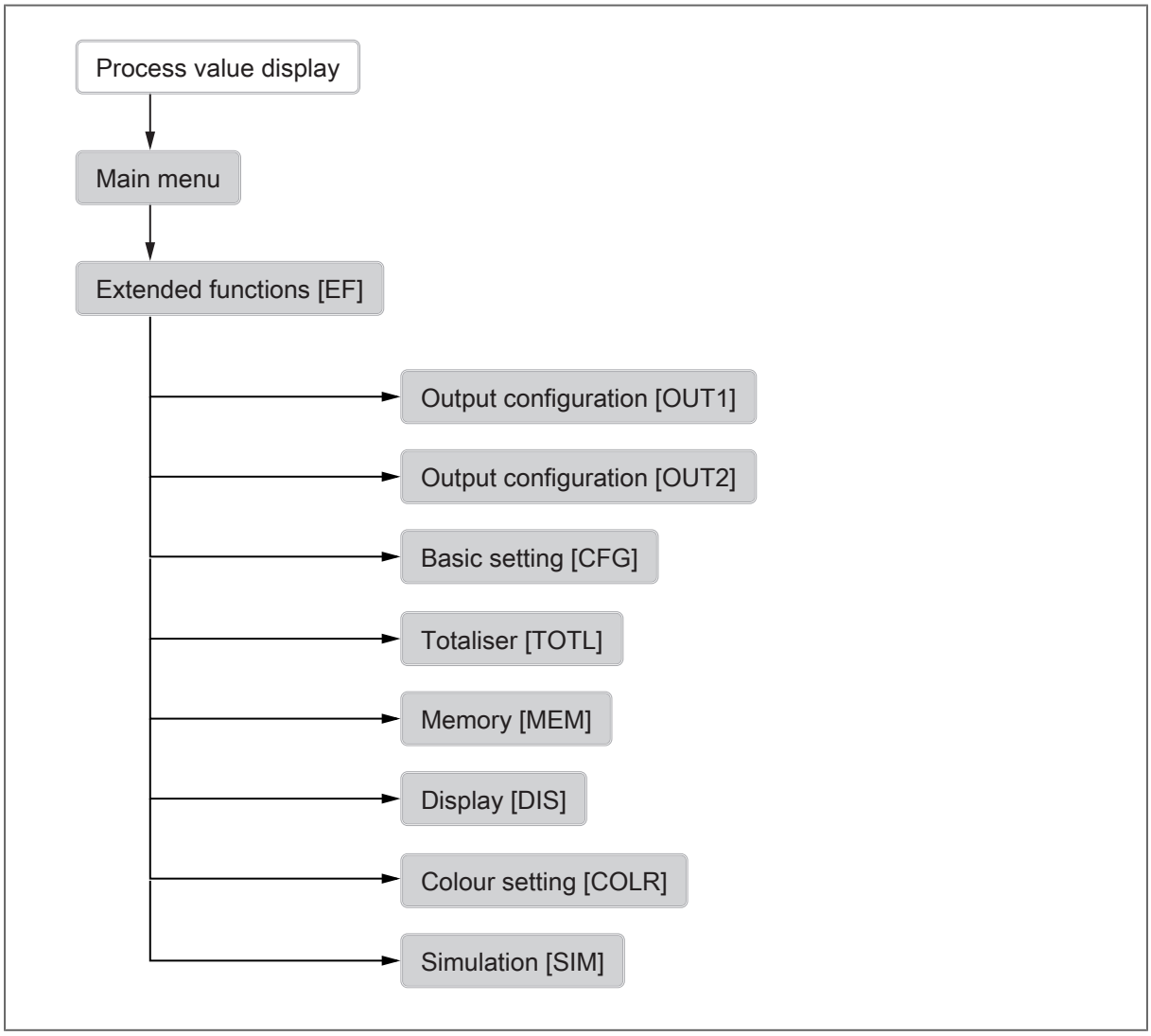


Fig. 5: Menu overview

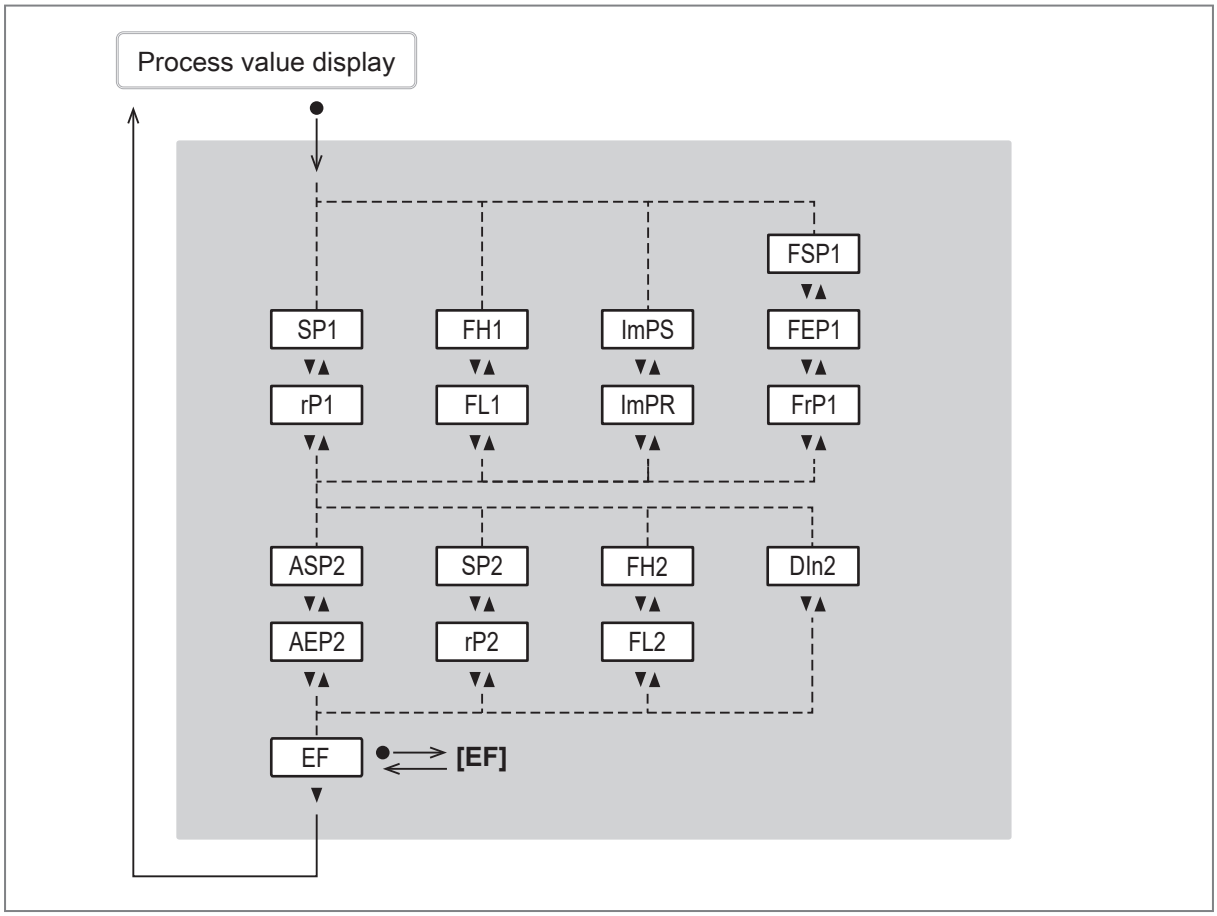
9.1 Main menu and submenus

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

The designation of the parameters in the parameter setting software may differ from the designations in the device display.

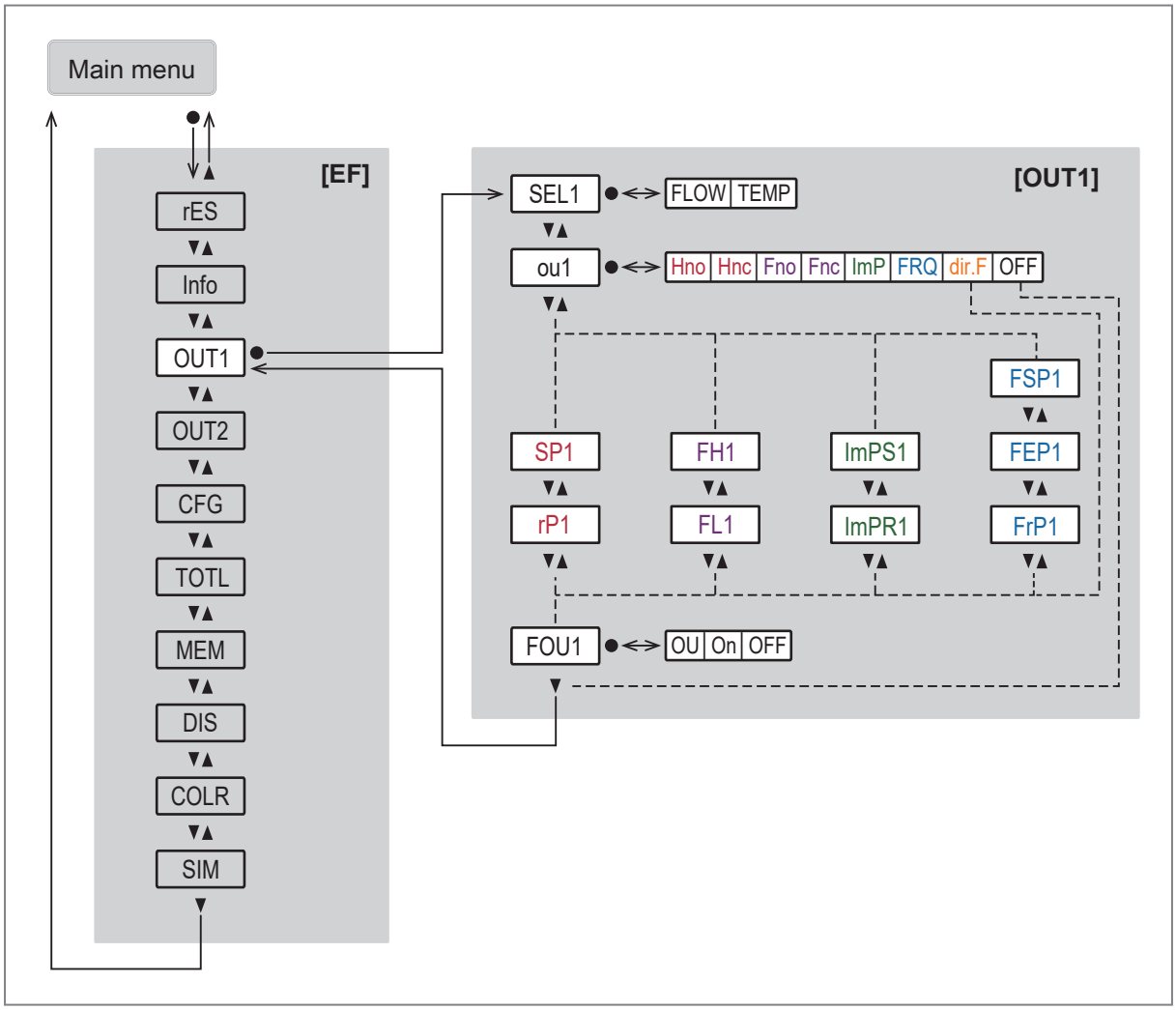
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Main menu:



Parameter	Explanation
SPx	Switch point for switching output OUTx with hysteresis function
rPx	Reset point for switching output OUTx with hysteresis function
FHx	Upper limit for switching signal OUTx with window function
FLx	Lower limit for switching signal OUTx with window function
ASP2	Analogue start point for OUT2 = process value at which the output signal is 4 mA.
AEP2	Analogue end point for OUT2 = process value at which the output signal is 20 mA.
ImPS1	Pulse value (= flow value at which 1 pulse is provided)
ImPR1	Totaliser function: pulse signal (ImPR1 = YES) or switching signal (ImPR1 = NO)
FSP1	Frequency start point for OUT1 = Lower measured value from which a frequency signal is provided (only for temperature measurement).
FEP1	Frequency end point for OUT1 = Upper measured value at which the frequency signal set under FrP1 is provided.
FrP1	Frequency signal which is provided when the upper measured value (MEW or FEP1) is reached.
DIn2	Reset signal for external totaliser reset
EF	Change to the EF (extended functions) submenu

Output configuration **OUT1** menu:



Parameter	Explanation
OUT1	Change to submenu OUT1 (output configuration of output 1)
SEL1	Process value for output OUT1
ou1	Output function for output OUT1: • Hno/Fno/Hnc/Fnc = switching signal hysteresis/window, NO/NC • ImP = totaliser function (pulse signal or switching signal preset counter) • FRQ = frequency signal • dir.F = switching signal for flow direction • OFF = output off
SP1	Setpoint for switching output OUT1 with hysteresis function
rP1	Reset point for switching output OUT1 with hysteresis function
FH1	Upper limit value for switching signal OUT1 with window function
FL1	Lower limit value for switching signal OUT1 with window function
ImPS1	Pulse value (= flow value at which 1 pulse is provided)
ImPR1	Totaliser function: pulse signal (ImPR1 = YES) or switching signal (ImPR1 = NO)
FSP1	Frequency start point for OUT1 = Lower measured value from which a frequency signal is provided (only for temperature measurement).
FEP1	Frequency end point for OUT1 = Upper measured value at which the frequency signal set under FrP1 is provided.

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Parameter	Explanation
FrP1	Frequency signal which is provided when the upper measured value (MEW or FEP1) is reached.
FOU1	Behaviour of output OUT1 in case of an error

Output configuration **OUT2** menu:

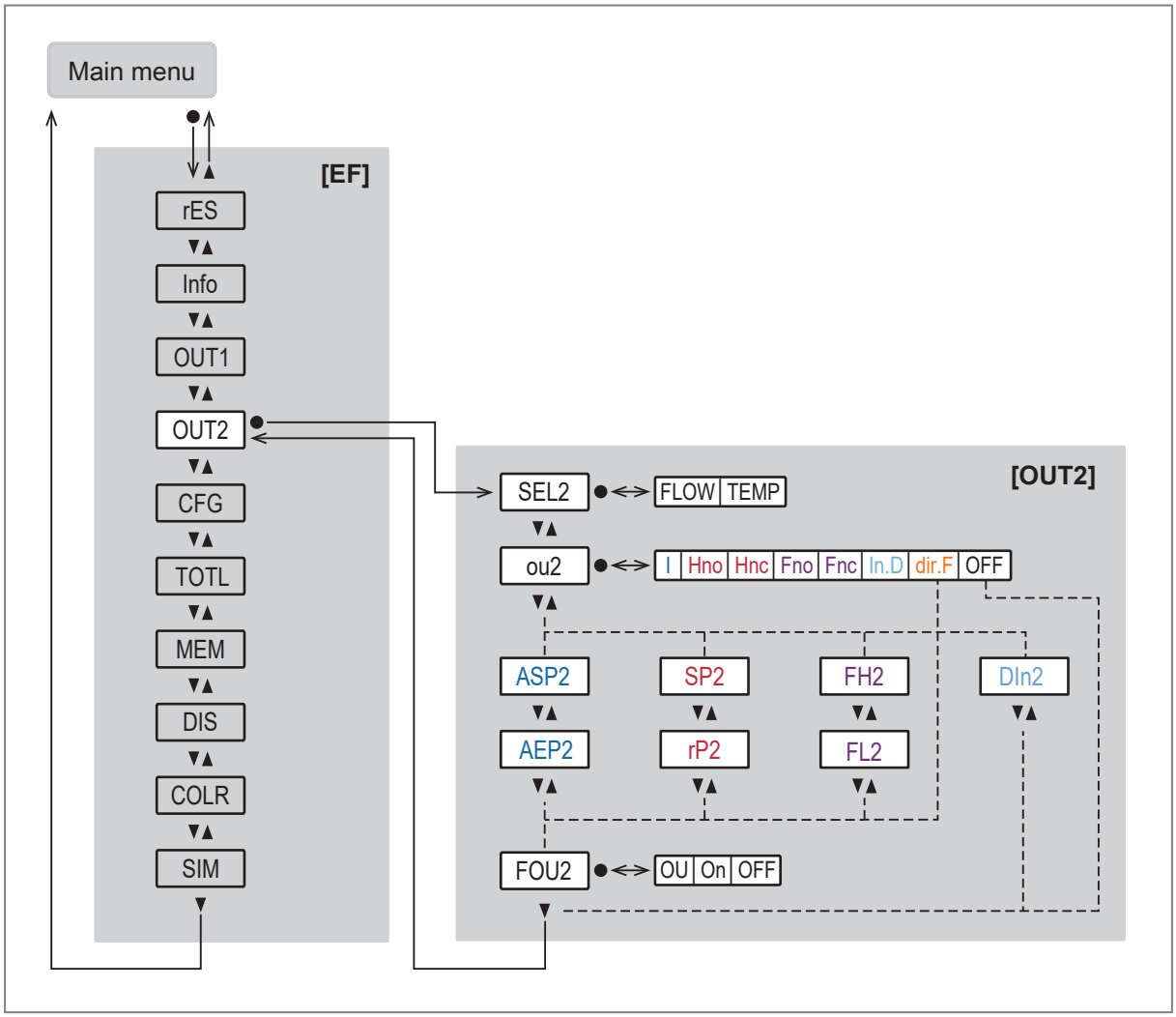
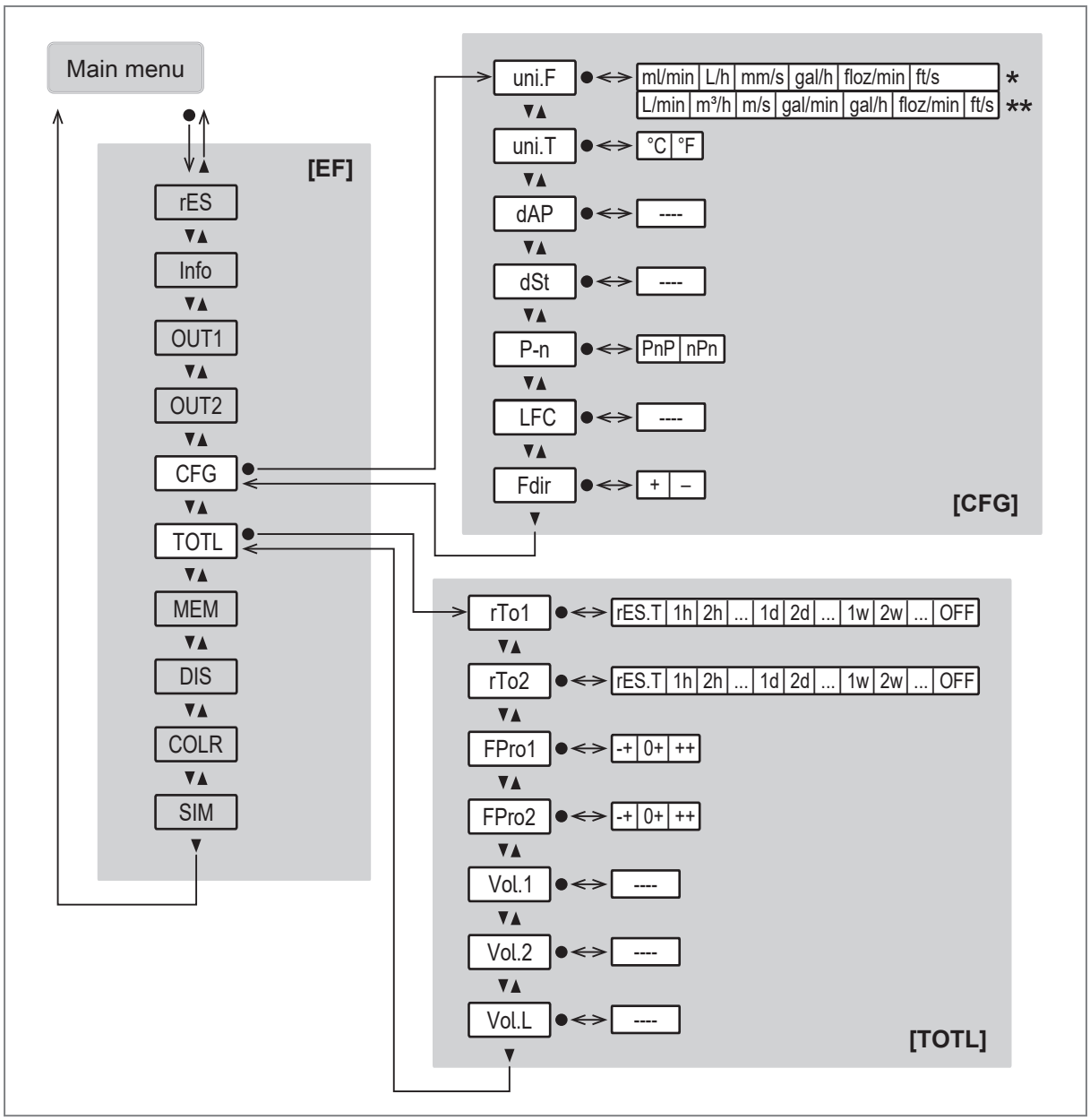


Fig. 6: Menu OUT2 [SM small]

Parameter	Explanation
OUT2	Change to submenu OUT2 (output configuration of output 2)
SEL2	Process value for output OUT2
ou2	Output function for output OUT2: • Analogue signal 4...20 mA • Hno/Fno/Hnc/Fnc = switching signal hysteresis/window, NO/NC • In.D = totaliser reset via external signal • dir.F = switching signal for flow direction • OFF = output off
ASP2	Analogue start point for OUT2 = process value at which the output signal is 4 mA.
AEP2	Analogue end point for OUT2 = process value at which the output signal is 20 mA.
SP2	Setpoint for switching output OUT2 with hysteresis function
rP2	Reset point for switching output OUT2 with hysteresis function

Parameter	Explanation
FH2	Upper limit value for switching signal OUT2 with window function
FL2	Lower limit value for switching signal OUT2 with window function
DIn2	Reset signal for external totaliser reset
FOU2	Behaviour of output OUT2 in case of error

Basic settings **CFG** and totaliser **TOTL** menu:



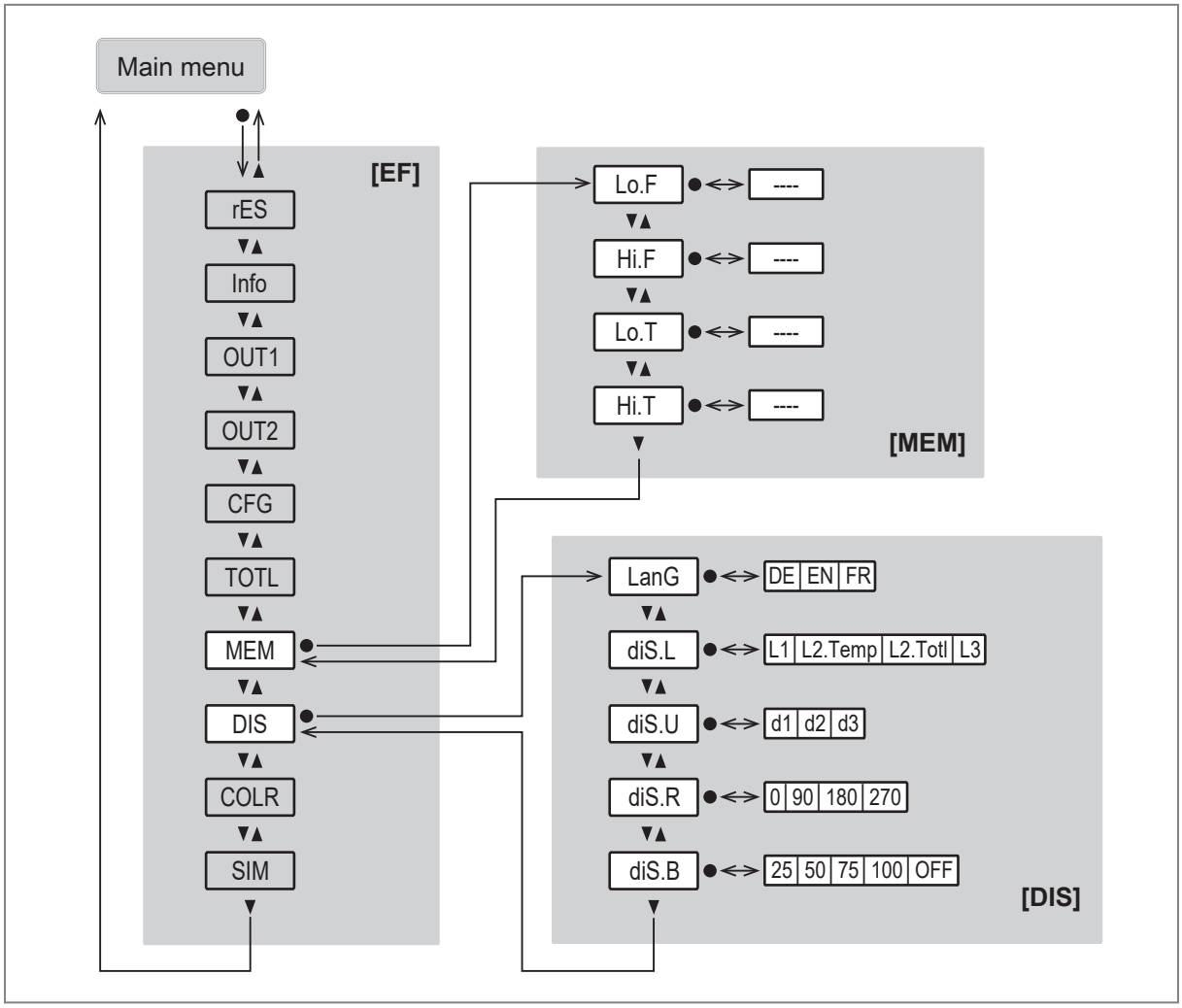
* SM4; **SM6/SM7/SM8

Parameter	Explanation
CFG	Change to the submenu CFG (basic settings)
TOTL	Change to the submenu TOTL (totaliser)
uni.F	Standard unit of measurement for flow
uni.T	Standard unit of measurement for temperature
dAP	Damping constant in seconds (63 % rise time τ).

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Parameter	Explanation
dSt	Start-up delay for volumetric flow monitoring
P-n	Output polarity for the switching outputs
LFC	Low flow cut-off
Fdir	Direction of flow
rTox	Setting for the totaliser reset (manually or time-controlled)
FProx	Counting method of the totaliser: consideration of the direction of flow
Vol.x	Current counter reading for totaliser Vol.x
Vol.L	Current counter reading for totaliser Vol.L over the whole lifetime

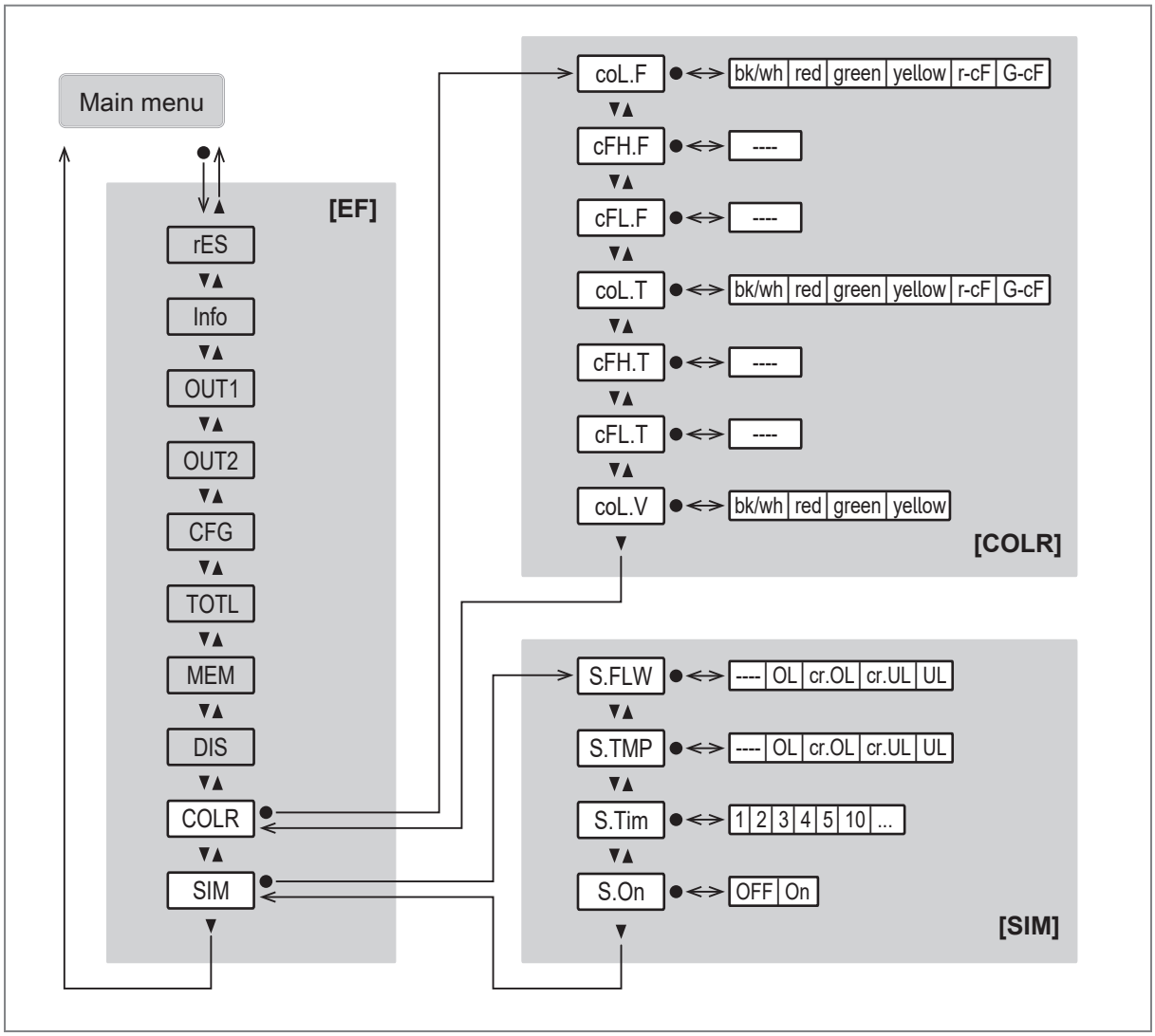
Memory **MEM** and display **DIS** menus:



Parameter	Explanation
MEM	Change to the MEM (memory) submenu
DIS	Change to the DIS (display) submenu.
Lo.F	Lowest flow value measured
Hi.F	Highest flow value measured
Lo.T	Minimum measured temperature value
Hi.T	Maximum temperature value measured
LanG	Language selection for the display
diS.L	Display layout

Parameter	Explanation
diS.U	Update rate of the display
diS.R	Orientation of the display
diS.B	Brightness of the display

Colour setting **COLR** and simulation **SIM** menu:



Parameter	Explanation
COLR	Change to the submenu COLR (colour settings)
SIM	Change to the submenu SIM (simulation)
coL.F	Font colour for flow
coL.T	Font colour for temperature
coL.V	Font colour for totaliser indication
cFH.F	Upper limit value for colour change (flow)
cFL.F	Lower limit value for colour change (flow)
cFH.T	Upper limit value for colour change (temperature)
cFL.T	Lower limit value for colour change (temperature)
S.FLW	Simulated flow value in simulation mode
S.TMP	Simulated temperature value in simulation mode

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Parameter	Explanation
S.Tim	Duration of the simulation in minutes
S.On	Starts the simulation mode

10 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 in the following status according to the set parameters:

- ON with normally open function (Hno / Fno)
- OFF with normally closed function (Hnc / Fnc)
- ON for detection of direction (dir.F)
- OFF for frequency output (FRQ)
- OFF for consumed quantity monitoring (ImP)
- 20 mA for current output (I)

When an IO-Link master is connected, the device automatically goes from SIO mode (standard input-output) into IO-Link mode if the port of the master is set to IO-Link mode.

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11 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.

11.1 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:

Intention	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 ●
Select the required parameter	▲ or ▼
Change to the setting mode	●
Modify the parameter value	▲ or ▼ > 1 s
Apply the set parameter	●
Exit parameter setting without saving	▲ + ▼
Return to the next higher menu level (repeat several times to reach process value display)	▲ + ▼
Return to the process value display	> 30 seconds (timeout)

If 🔒 is displayed when attempting to change a parameter value, the device keys are locked ➔ Lock / Unlock.

11.2 Parameter setting via IO-Link

The device parameters can be set via the IO-Link interface in the following ways, for example:

- Parameter setting via a suitable parameter setting software, e.g. ifm moneo|configure
- Parameter setting via a PLC
- Parameter setting via an IIoT application

Requirements for parameter setting via the IO-Link interface:

- ✓ The Input Output Device Description (IODD) for the device in case of parameter setting via a parameter setting software, see documentation.ifm.com
- ✓ The IO-Link interface description (PDF) for the device in case of parameter setting via a PLC or IIoT application, see documentation.ifm.com
- ✓ An IO-Link master
- ▶ Connect the IO-Link master to the parameter setting software, the PLC or the IIoT application.
- ▶ Connect the device to a suitable free port of the IO-Link master.
- ▶ Set the port of the IO-Link master to the IO-Link operating mode.
- ▷ The device changes to the IO-Link mode.
- ▶ Change the parameter settings in the software.
- ▶ Write the parameter settings to the device.

Support for system integration and parameter setting via IO-Link:
→ Manual of the parameter setting software (e.g. moneo)
→ Explanations and startup packages at ifm.com/cnt/io-link-system-integration.

11.3 Output configuration

This chapter describes the options for the output signals at OUT1 and OUT2.

11.3.1 Switching signal for limit value monitoring

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:

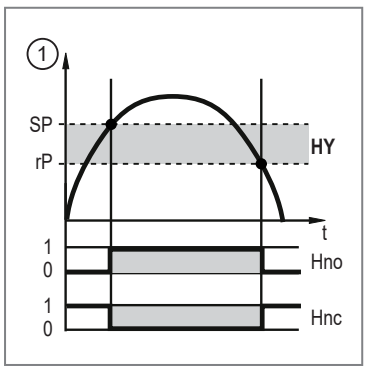


Fig. 7: Hysteresis function

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)

When the hysteresis function is set, the switch point **SP** and the reset point **rP** are defined. **rP** must have a lower value than **SP**. If only the switch point is changed, the reset point is changed automatically; the difference remains constant.

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Window function:

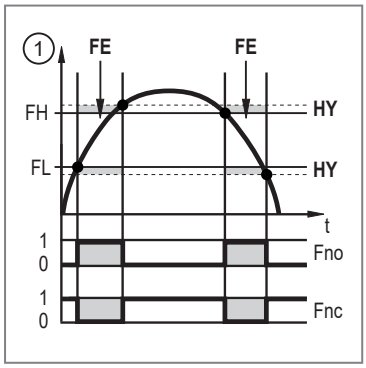


Fig. 8: Window function

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)

When set to the window function, the upper limit value **FH** and the lower limit value **FL** are defined. **FH** and **FL** have a fixed hysteresis of 0.25 % of the final value of the measuring range (MEW). This keeps the switching status of the output stable if the flow varies slightly.

11.3.1.1 Parameter setting via unit keys: Switching signal

✓ The standard unit of measurement is selected: **EF** > **CFG** > **uni.x**.

✓ The process value is selected: **EF** > **OUTx** > **SELx**.

▶ Go to **EF** > **OUTx** to configure the output OUTx.

Hysteresis function:

▶ Select **oux** and set the switching signal: **Hno** or **Hnc**.

▶ 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:

▶ Select **oux** and set the switching signal: **Fno** or **Fnc**.

▶ Select **FHx** and set the upper limit of the window.

▶ Select **FLx** and set the lower limit of the window.

The parameter settings for **SP**, **rP**, **FH** and **FL** can be changed subsequently in the main menu.

11.3.2 Switching signal for flow direction

A flow direction change can be monitored by providing a switching signal.

The output is switched on until the flow rate falls below the set minimum flow rate in negative flow direction (- LFC)(1).

Then the following applies:

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

LFC = Low flow cut-off: Low flow cut-off 38. The unit of the minimum flow rate corresponds to the selection under **uni.F**.

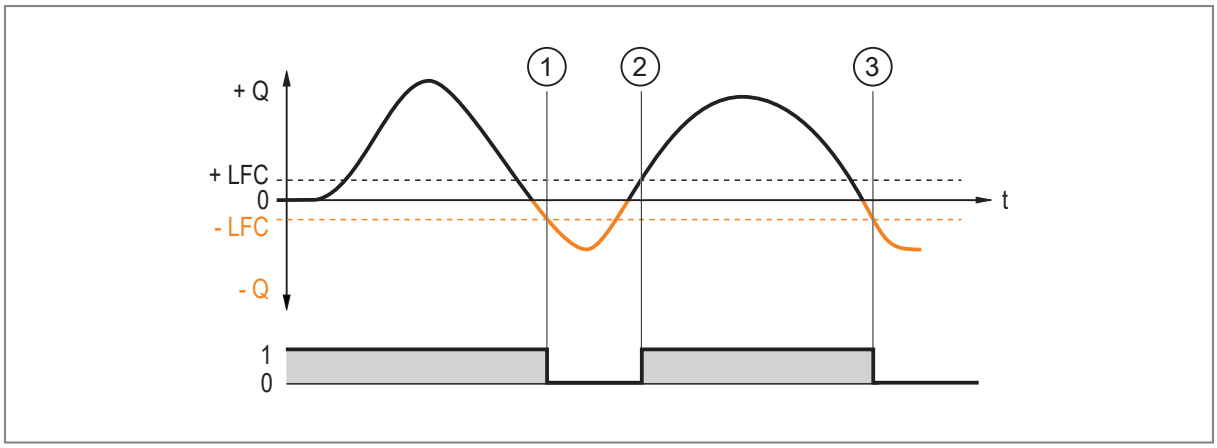


Fig. 9: Monitoring of the flow direction by switching signals

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

An arrow with the text “flow direction” on the device indicates the positive flow direction. The direction of the flow measurement can be reversed using the parameter **Fdir**.

Flow direction 39.

11.3.2.1 Parameter setting via unit keys: switching signal for flow direction

- Go to the **EF** > **OUTx** menu.
- Select **SELx** and set the process value: **FLOW**.
- Select **oux** and set **dir.F**.
- If necessary, check or change the set flow direction 39.

11.3.3 Consumed quantity monitoring (totaliser function)

The unit has 3 internal quantity meters (totalisers Vol.1, Vol.2 and Vol.L). The totalisers continuously sum up the consumed quantity and provide this process value both on the display and via the IO-Link interface.

Totaliser	Process value	Read access via IO-Link
Vol.1	Consumed quantity 1 (This value is used for consumed quantity monitoring by switching or pulse signals)	Cyclic
Vol.2	Consumed quantity 2	Acyclic
Vol.L	Consumed quantity over the whole lifetime (lifetime totaliser)	Acyclic

- The totalisers Vol.1 and Vol.2 can be reset. Totaliser Vol.L cannot be reset.

Totaliser reset 39.

- The totalisers Vol.1 and Vol.2 take account of the following parameter settings when totalising the consumed quantity:

1. Flow direction 39.
2. Counting method of the totalisers 41.
3. Low flow cut-off 38.

- The Life Time Totalisator Vol.L totals all flow quantities regardless of the flow direction and counting method.

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- When the detection range (cr.OL) is exceeded, the totalisers use the last valid flow rate value (measuring range end value) and continue counting with this value.
- In addition to the current consumed quantity, the value before the last reset is saved. This value and the time since the last reset can also be displayed.

→ Read totaliser values → 47.

The totaliser saves the totalled flow quantity at regular intervals. 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. This means that the possible data loss can amount to a maximum of a few seconds.

- The accuracy of the consumed quantity measurement depends on the accuracy of the flow measurement.
- A switching signal or pulse signals can be provided for consumed quantity monitoring:

→ Switching signal totaliser → 29.

→ Pulse signal totaliser → 30.

11.3.3.1 Switching signal totaliser

A switching signal can be provided for consumed quantity monitoring.

When totaliser Vol.1 has totalled the flow quantity (pulse value) set under **ImPS**, the output provides a switching signal.

The flow direction is taken into account when totalling the flow quantity → 41.

The output remains switched until a totaliser reset is carried out. When the totaliser has been reset, metering starts again.

The totaliser is reset automatically or manually.

The conditions for the totaliser reset and the switching signal can be set via the parameter **rTo**:

- **rTo** = **OFF**:
  - The totaliser is only reset with a manual reset or after overflow.
  - The output is switched when the totaliser has reached the flow quantity **ImPS**.
- **rTo** = …**h** / **d** / **w** (hours / days / weeks):
  - The totaliser is automatically reset after the set time.
  - The output is only switched when the totaliser reaches the flow quantity **ImPS** by the set time.

The totalisers can be reset manually at any time via the **rTox** parameter. Totaliser Vol.1 can additionally be reset via an external signal at pin 2.

→ Totaliser reset → 39.

11.3.3.1.1 Parameter setting via the device keys: Switching signal totaliser

✓ The standard unit of measurement is selected: **EF** > **CFG** > **uni.F**.

✓ The process value is selected: **EF** > **OUT1** > **SEL1** = **FLOW**.

▶ Go to **EF** > **OUT1** to configure output OUT1.

▶ Select **ou1** and set **ImP**.

▶ Select **ImPS1** and set the flow quantity at which the output switches.

- Press ▲ or ▼ to select the setting range.
- Briefly press ● to confirm the setting range.

- Press ▲ or ▼ to set the requested numeric value.
- Briefly press ● to apply the value.

The setting range depends on the flow unit selected under **uni.F**:

uni.F	Setting range ImPS
L/min or m^3/h or m/s	L…m^3…10^3m^3
gal/min or gal/h	10^{-3}gal…gal…10^3gal…10^6gal
fl oz/min or ft/s	fl oz…10^3fl oz…10^6fl oz

▶ Select **ImPR1** and set **No**.

The parameter settings for **ImPS** and **ImPR** can be changed subsequently in the main menu.

▶ Setting for the totaliser reset 39.

11.3.3.2 Pulse signal totaliser

Pulse signals can be provided for consumed quantity monitoring.

Pulse signals are not available via the IO-Link interface.

The output provides a pulse signal each time totaliser Vol.1 has totalled the flow quantity (pulse value) set under **ImPS**.

The flow direction is taken into account when totalling the flow quantity 41.

The pulse signal consists of a short switching on and off of the output.

The switching status LEDs do not display the switching operation.

11.3.3.2.1 Parameter setting via unit keys: Pulse signal totaliser

✓ The standard unit of measurement is selected: **EF** > **CFG** > **uni.F**.

✓ The process value is selected: **EF** > **OUT1** > **SEL1** = **FLOW**.

▶ Go to **EF** > **OUT1** to configure output OUT1.

▶ Select **ou1** and set **ImP**.

▶ Select **ImPS1** and set the flow quantity at which 1 pulse is provided (pulse value).

- Press ▲ or ▼ to select the setting range.
- Briefly press ● to confirm the setting range.
- Press ▲ or ▼ to set the requested numeric value.
- Briefly press ● to apply the value.

The setting range depends on the flow unit selected under **uni.F**:

uni.F	Setting range ImPS
L/min or m^3/h or m/s	L…m^3…10^3m^3
gal/min or gal/h	10^{-3}gal…gal…10^3gal…10^6gal
fl oz/min or ft/s	fl oz…10^3fl oz…10^6fl oz

▶ Select **ImPR1** and set **Yes**.

The parameter settings for **ImPS** and **ImPR** can be changed subsequently in the main menu.

11.3.4 Analogue signal

The device provides an analogue signal proportional to the process value.

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

- **ASP2** determines at which measured value the output signal is 4 mA.
- **AEP2** determines at which measured value the output signal is 20 mA.

Minimum difference between **ASP2** and **AEP2** = 20 % of the measuring span.

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 an error, messages are displayed (cr.UL, UL, OL, cr.OL, Err).

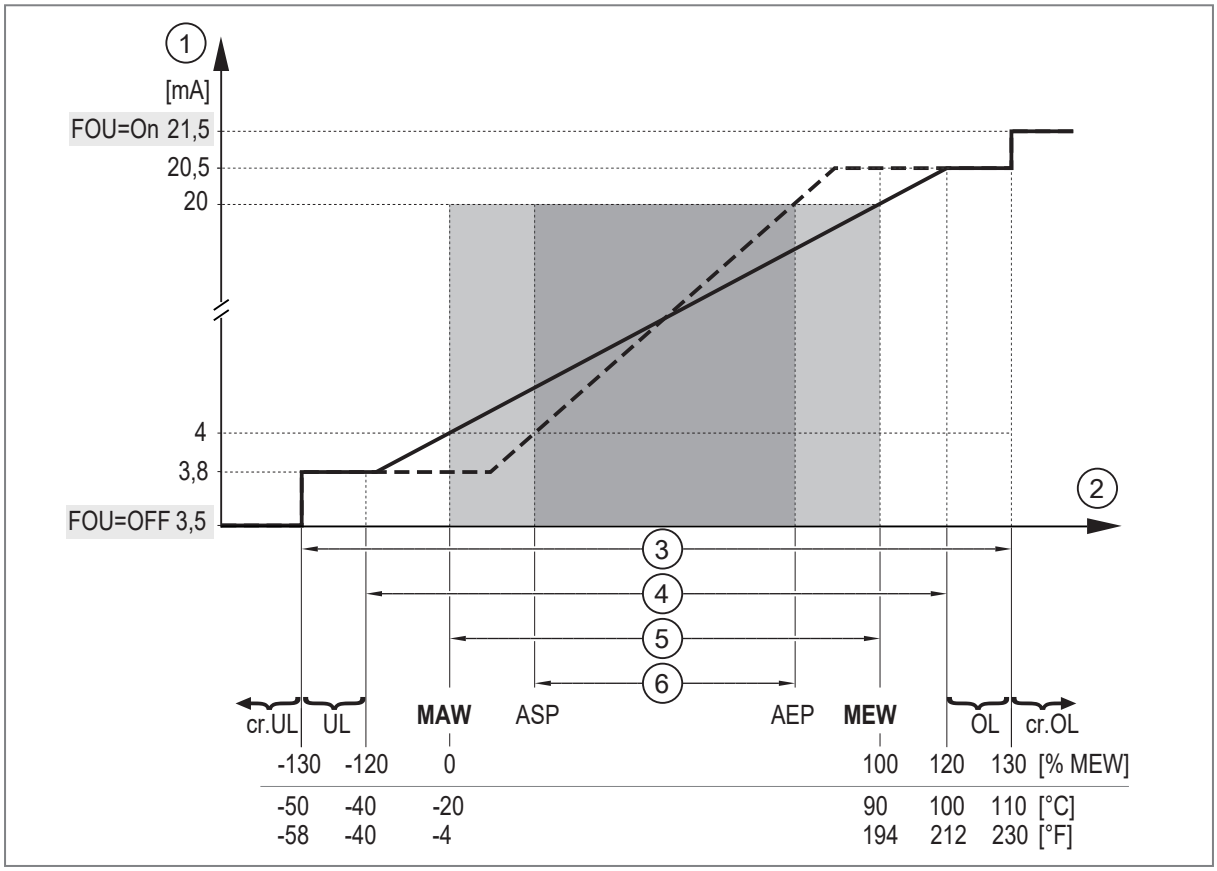


Fig. 10: Characteristics of the analogue output according to the standard IEC 60947-5-7

1: Analogue signal
2: Measured value (FLOW or TEMP)
3: Detection zone
4: Display range
5: Measuring range
6: Scaled measuring range

MAW: Initial value of the measuring range
MEW: Final value of the measuring range
ASP: Analogue start point
AEP: Analogue end point
UL: Below the display range
cr.UL: Below the detection range
OL: Above the display range
cr.OL: Above the detection range

A negative flow value means flow against the flow direction 39 set under **Fdir**.

The analogue signal in case of a fault can be set via the parameter **FOU**: Error behaviour of the outputs 35.

Parameter setting via unit keys: Analogue signal

- ✓ Standard unit of measurement is selected: **EF** > **CFG** > **uni.x**.
- ▶ Go to **EF** > **OUT2** to configure output OUT2.
- ▶ Select **SEL2** and set the process value. **FLOW** or **TEMP**.
- ▶ Select **ou2** and set the function: **I** (analogue signal 4...20 mA.).
- ▶ Select **ASP2** and set the measurement value at which the output signal is 4 mA.
- ▶ Select **AEP2** and set the measurement value at which the output signal is 20 mA.

The parameter settings **ASP** and **AEP** can be changed subsequently in the main menu.

11.3.5 Frequency signal

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

The frequency signal is adjustable:

- **FrP1** defines the frequency signal in Hz that is provided when the upper measured value is reached.

Setting range: 1 Hz…10 kHz.

The measuring range is scalable:

- **FSP1** defines the lower measured value from which a frequency signal is provided.
- **FEP1** defines the upper measured value at which the output signal has the frequency set under **FrP1**.

FSP1 is only available for temperature measurement. Minimum difference between **FSP1** and **FEP1** = 20 % of the measuring span.

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).

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Frequency signal for flow:

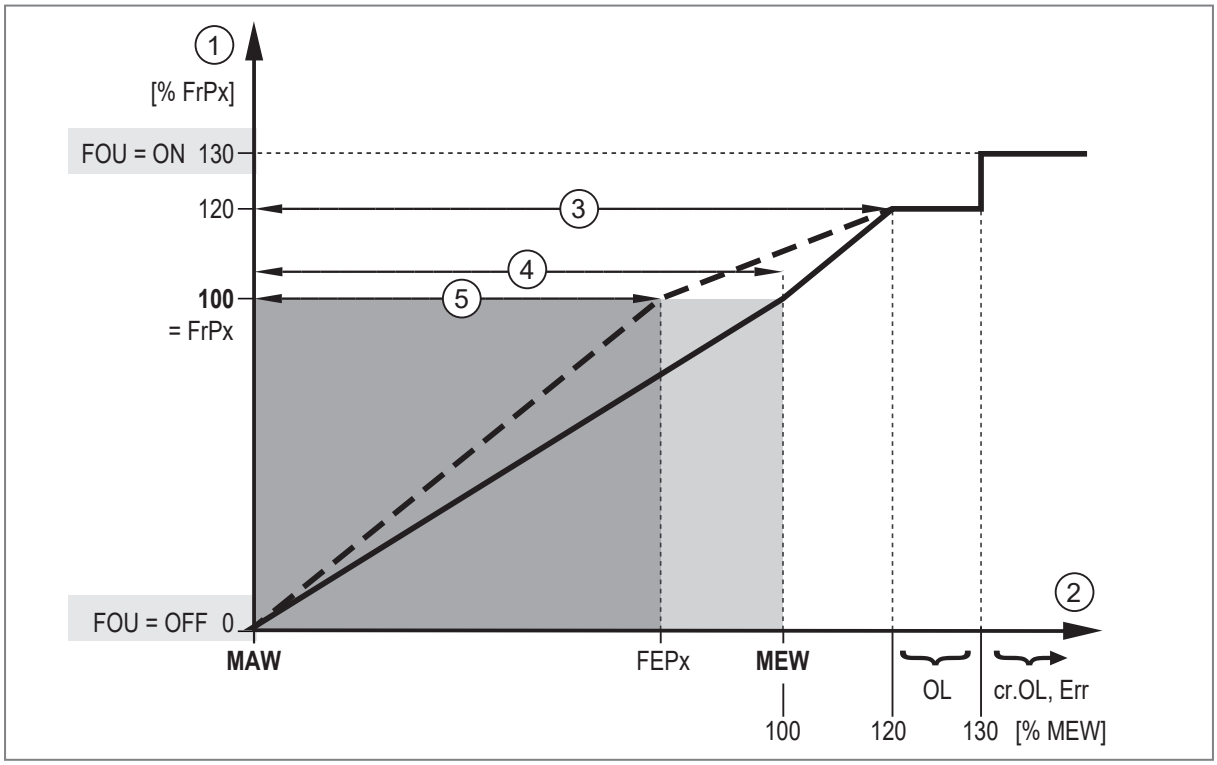


Fig. 11: Output characteristic of the frequency output, flow

1:	Frequency signal	MAW:	Initial value of the measuring range
2:	Measured value flow	MEW:	Final value of the measuring range
3:	Display range	FEPx:	Frequency end point
4:	Measuring range	FrPx:	Frequency signal (Hz) for upper measured value
5:	Scaled measuring range	OL:	Above the display range
Err:	Error	cr.OL:	Critically above the display range

Frequency signal temperature:

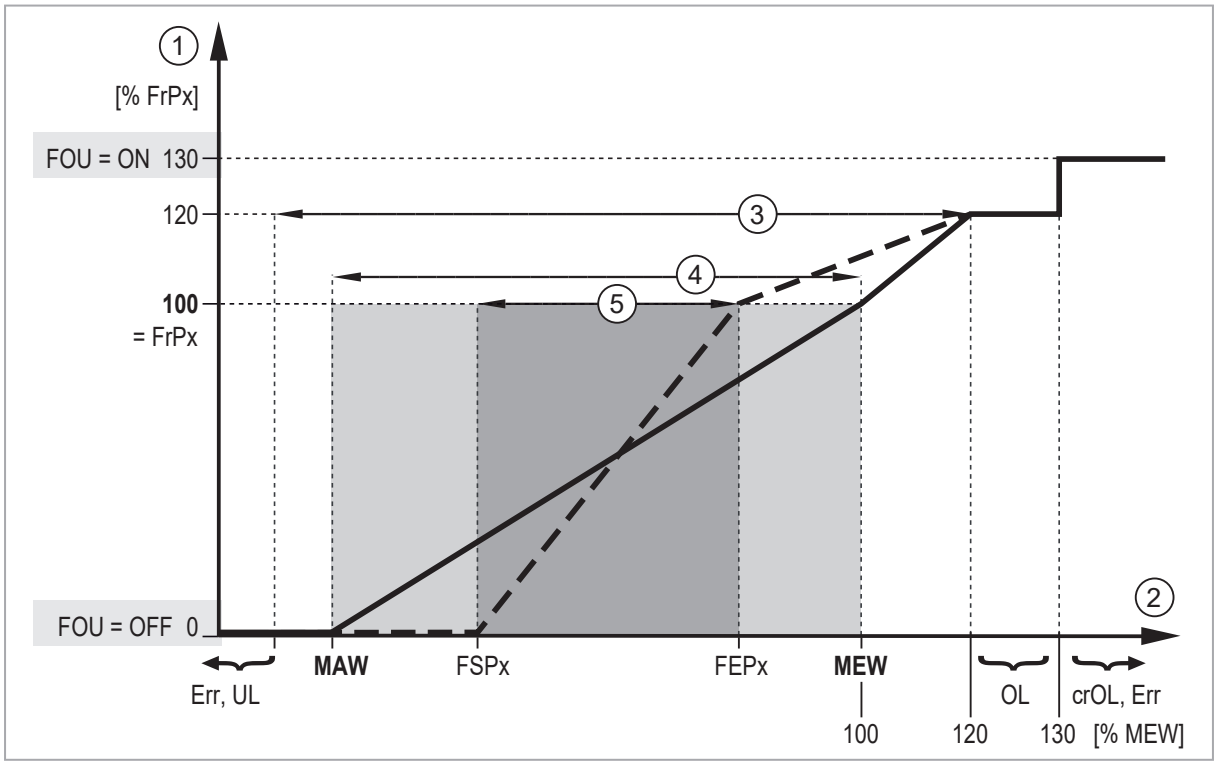


Fig. 12: Output characteristic of the frequency output, temperature

1:	Frequency signal	MAW:	Initial value of the measuring range
2:	Measured value temperature	MEW:	Final value of the measuring range
3:	Display range	FSPx:	Frequency start point
4:	Measuring range	FEPx:	Frequency end point
5:	Scaled measuring range	FrPx:	Frequency signal (Hz) for upper measured value
Err:	Error	cr.OL:	Critically above the display range
UL:	Below the display range	cr.UL:	Critically below the display range

Parameter setting via unit keys: Frequency signal

✓ Standard unit of measurement is selected: **EF** > **CFG** > **uni.x**.

▶ Go to **EF** > **OUT1** to configure output OUT1.

▶ Select **SEL1** and set the process value: **FLOW** or **TEMP**.

▶ Select **ou1** and set **FRQ**.

▶ 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.

The parameter settings for **FSP**, **FEP** and **FrP** can be changed subsequently in the main menu.

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11.3.6 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 31:
  - **On**: the analogue signal goes to the upper end stop value.
  - **OFF**: the analogue signal goes to the lower end stop value.
  - **OU**: the analogue signal still corresponds to the measured value.
- Frequency signal 32:
  - **On**: the frequency signal goes to 130 % of **FrP1**.
  - **OFF**: the frequency signal goes to 0 Hz.
  - **OU**: the frequency signal still corresponds to the measured value.

FOUx is not available for consumed quantity monitoring: Even in case of a fault, a switching or pulse signal is emitted when the set flow quantity is reached.

Parameter setting via unit keys: Error behaviour of the outputs

▶ Go to the **EF** > **OUTx** menu.

▶ Select **FOUx** and set the error behaviour for OUTx: **On**, **OFF**, **OU**.

11.3.7 Output off

The output signal can be switched off via the parameter **oux** = **OFF**. The output then goes to high impedance.

Communication via the IO-Link interface on OUT1 remains active.

11.3.7.1 Parameter setting via device keys: Output off

▶ Go to the **EF** > **OUTx** menu.

▶ Select **oux** and set **OFF**.

11.4 Application configuration

11.4.1 Standard unit of measurement

A standard unit of measurement to be displayed with the process value can be selected. All further parameter settings are based on this unit.

Changing the unit has no effect on the IO-Link process value, which is always transmitted in the SI unit.

Selectable values:

- Flow **uni.F**:

  - SM4: mm/s; ml/min; l/h; gal/h; floz/min; ft/s.
  - SM6/SM7/SM8: m/s; l/min; m^3/h; gal/min; gal/h; floz/min; ft/s.
- Temperature **uni.T**: °C or °F.

▶ Select the unit of measurement before configuring further parameters for OUTx.

11.4.1.1 Parameter setting via device buttons: Standard unit of measurement

▶ Call up the menu **EF** > **CFG**.

▶ Select **uni.x** and set the unit of measurement.

11.4.2 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:

- **FLOW**: Flow
- **TEMP**: Temperature

Parameter setting via unit keys: process values OUT1 and OUT2

▶ Go to the **EF** > **OUTx** menu.

▶ Select **SELx** and set process value for output OUTx.

11.4.3 Damping

The set damping constant stabilises the output signals. Abrupt changes in the physical process values are smoothed out.

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

The damping constant **dAP** is used to set after how many seconds the output signal reaches 63 % of the final value if the measured value changes suddenly.

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

The signals UL, cr.UL, OL and cr.OL are defined under consideration of the damping constant.

Measured value damping only has an effect on the process value flow.

11.4.3.1 Parameter setting via device buttons: Damping

▶ Call up the menu **EF** > **CFG**.

▶ Select **dAP** and set the damping time in seconds (τ-value 63 %).

11.4.4 Start-up delay

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

If the start-up delay is active (dSt > 0), the following applies: as soon as the flow quantity exceeds the LFC value, the following processes are carried out:

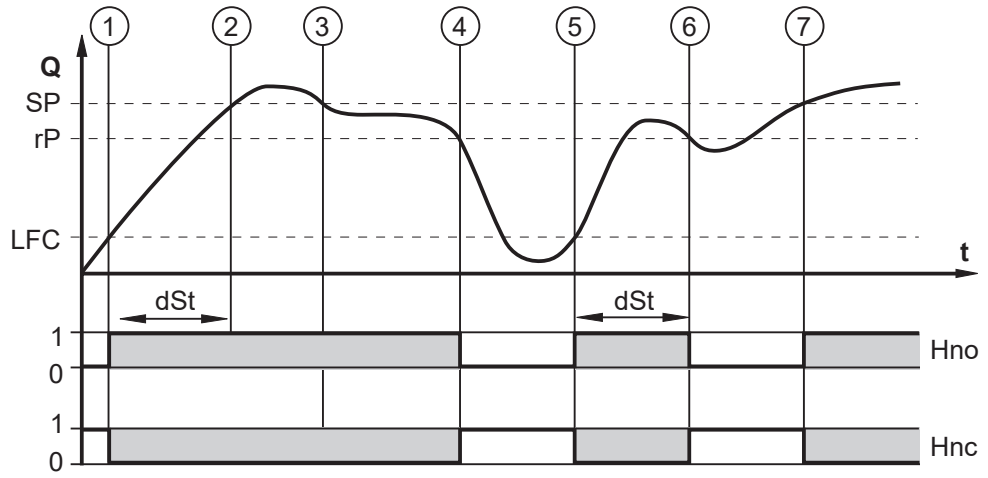
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- The start-up delay is activated.
- The outputs switch as programmed: ON for NO function, OFF for NC function.

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

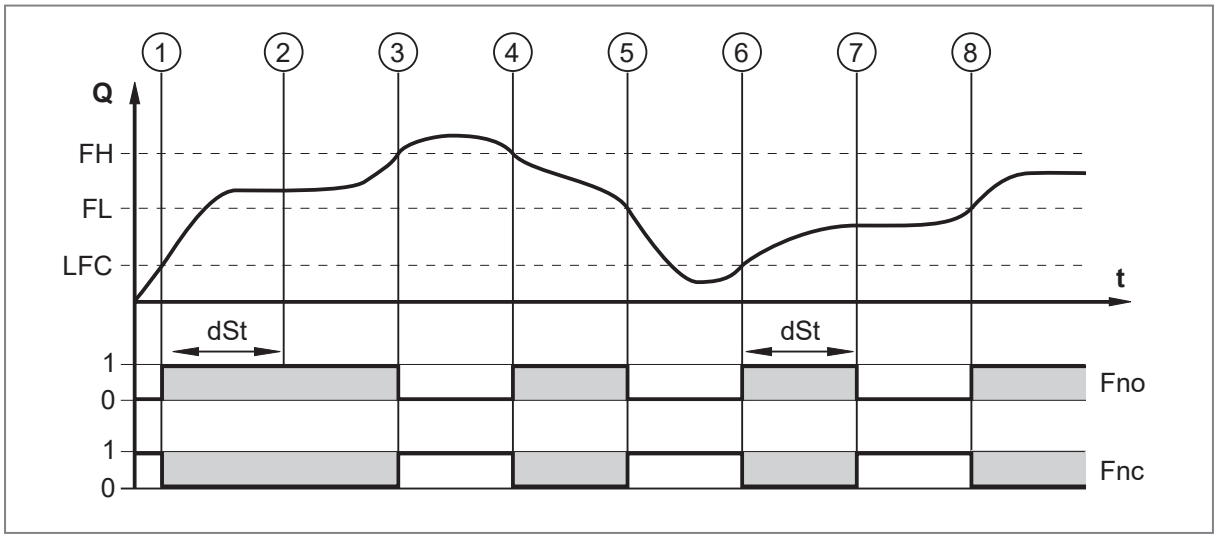
	Condition	Reaction
1:	The flow quantity increases quickly and reaches the switch point / acceptable range within dSt.	The outputs remain active.
2:	The flow quantity increases slowly and does not reach the switch point / acceptable range within dSt.	All outputs are reset.
3:	The flow quantity falls below LFC within dSt.	The outputs are reset at once; dSt is stopped.

Example: flow monitoring with hysteresis function



	Condition	Reaction
1:	The flow quantity Q reaches LFC	dSt starts, the output becomes active
2:	dSt elapsed, Q has reached SP	The output remains active
3:	Q falls below SP but stays above rP	The output remains active
4:	Q falls below rP	The output is reset
5:	Q reaches LFC again	dSt starts, the output becomes active
6:	dSt elapsed, Q has not reached SP	The output is reset
7:	Q reaches SP	The output becomes active

Example: flow monitoring with window function



	Condition	Reaction
1:	The flow quantity Q reaches LFC	dSt starts, the output becomes active
2:	dSt elapsed, Q has reached acceptable range	The output remains active
3:	Q above FH (leaves acceptable range)	The output is reset
4:	Q falls below FH again	The output becomes active
5:	Q falls below FL (leaves acceptable range)	The output is reset
6:	Q reaches LFC again	dSt starts, the output becomes active
7:	dSt elapsed, Q has not reached acceptable range	The output is reset
8:	Q reaches acceptable range	The output becomes active

11.4.4.1 Parameter setting via device buttons: Start-up delay

- ▶ Call up the menu **EF** > **CFG**.
- ▶ Select **dSt** and set a start-up delay in seconds.

11.4.5 Output polarity

The output polarity is set via the parameter **P-n**.

The setting affects both switching outputs.

- **PnP**: The switching output is positive switching.
- **nPn**: The switching output is negative switching.

Parameter setting via unit keys: Output polarity

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

11.4.6 Low flow cut-off

Low flow quantities can be ignored using the parameter **LFC** (Low flow cut-off). Flow below the LFC value is evaluated by the sensor as standstill (Q = 0).

The LFC value influences:

- the process value for flow shown on the display
- The switching signal for flow
- the analogue signal for flow
- The frequency signal for flow
- the consumed quantity monitoring (switching or pulse signal for flow)
- The totalisation of the consumed quantity by the totalisers.
- the memory values for minimum and maximum flow

Parameter setting via unit keys: low flow cut-off

▶ Call up the menu **EF** > **CFG**.

▶ Select **LFC** and set the limit below which a flow is evaluated as standstill.

11.4.7 Flow direction

The positive flow direction can be defined by the user. This setting affects the following functions:

Consumed quantity monitoring (totaliser function) 28

Switching signal for flow direction 27

An arrow with the text “flow direction” on the device indicates the positive flow direction (factory setting). The direction of the flow rate measurement can be reversed using the parameter **Fdir**:

Fdir	Direction of flow
+	Flow direction in case of factory setting
-	Flow direction contrary to the factory setting

Parameter setting via unit keys: flow direction

▶ Call up the menu **EF** > **CFG**.

▶ Select **Fdir** and set the direction of media flow.

11.4.8 Totaliser reset

The totalisers Vol.1 and Vol.2 can be reset in different ways:

Type of reset		Parameter
1.	Manual reset	• **rTox** = **rES.T**
2.	Time-controlled reset	• **rTox** = – **... h** = hours – **... d** = days – **... w** = weeks

Type of reset		Parameter
3.	Reset via external signal	• **ou2** = **In.D** • **DIn2**: – **+EDG** = reset for rising edge – **-EDG** = reset for falling edge – **HIGH** = reset for high signal – **LOW** = reset for low signal
4.	Reset via overflow (maximum display range is reached)	• **rTox** = **OFF**

Totaliser Vol.L cannot be reset.

If totaliser Vol.1 is reset in one of the above ways, the output is also reset in the case of consumed quantity monitoring.

Switching signal totaliser 29.

11.4.8.1 Parameter setting via unit keys: Totaliser reset

1. Manual reset:

- Go to the **EF** > **TOTL** menu.
- Select **rTo** and set **rES.T**.
- The totaliser is reset.

2. Time-controlled reset:

- Go to the **EF** > **TOTL** menu.
- Select **rTox**, then set time in weeks (w), days (d) or hours (h).
- The totaliser is automatically reset after the set time.

3. Reset via external signal:

- Go to the **EF** > **OUT2** menu.
- Select **ou2** and set digital input: **In.D**.
- 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

> The totaliser Vol.1 is reset when receiving the reset signal via pin 2.

An external reset is only possible for totaliser Vol.1.

The parameter setting for **DIn2** can be changed subsequently in the main menu.

4. Reset via overflow:

- Go to the **EF** > **TOTL** menu.
- Select **rTox** and set **OFF**.
- The totaliser is reset as soon as the maximum display range is exceeded.

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11.4.9 Counting method of the totalisers

The totalisers Vol.1 and Vol.2 take account of the flow direction when totalising the consumed quantity. The following counting methods can be defined via the parameter **FProx**:

FProx	Counting method
0+	Negative flow values (against the marked flow direction) are not taken into account for totalisation
-+	Negative flow values are subtracted from the consumed quantity.
++	All flow values are totalised irrespective of the flow direction.

Tab. 1: Counting method of the totalisers

The counting method of Vol.L cannot be set. The lifetime totaliser totals all volumetric flow quantities irrespective of the flow direction.

The counting method affects the output signals for consumed quantity monitoring.

Consumed quantity monitoring (totaliser function) 28.

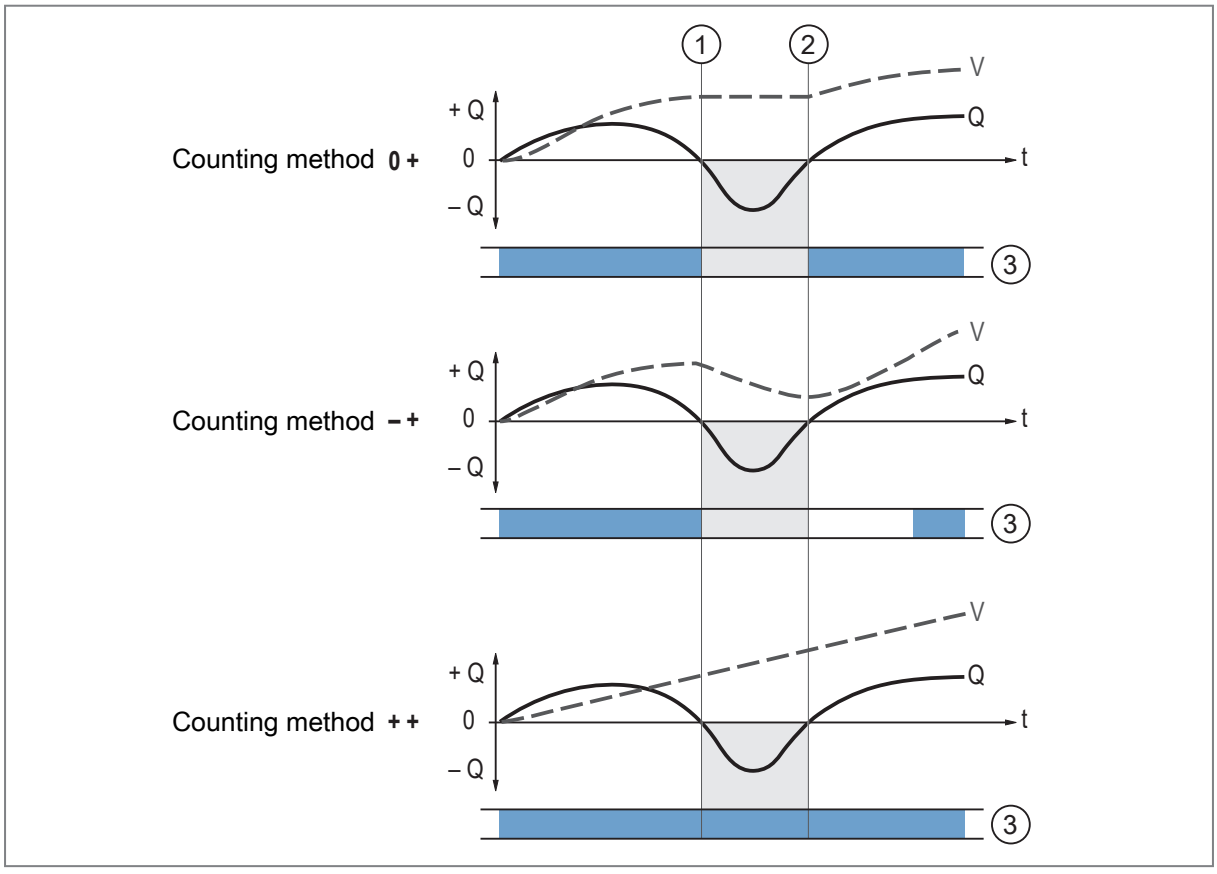


Fig. 13: Taking into account the flow direction when totalising the consumed quantity

+Q: Flow quantity in positive direction
-Q: Flow quantity in negative direction
V: Flow quantity absolute (= sum of negative and positive flow)
1: Flow changes to negative direction
2: Flow changes to positive direction
3: Flow taken into account for totalisation

When the direction of flow is changed, the minimum flow quantity **LFC** is taken into account.

Figure Switching signal for flow direction 28.

Parameter setting via unit keys: counting method of the totalisers

- Go to the **EF** > **TOTL** menu.
- Select **FPro1** and set the counting method for totaliser Vol.1.
- Select **FPro2** and set the counting method for totaliser Vol.2.

11.4.10 Lock / unlock

The unit can be locked electronically to prevent unauthorised setting.

This lock prevents the settings from being changed via the keys on the unit.

Factory setting: not locked.

If the device is locked via the IO-Link interface, it can only be unlocked via IO-Link.

11.4.10.1 Parameter setting via unit keys: lock / unlock

Locking:

- Make sure that the unit is in the normal operating mode.
- Press▲ and ▼ simultaneously for 10 seconds until the progress bar in the title bar has reached the end.
- The device is locked for parameter setting via the device keys. When trying to change a parameter value, the symbol appears in the display.

The locking can only be removed via the device keys. Changing the parameter setting is still possible via the IO-Link interface.

Unlocking:

- Make sure that the unit is in the normal operating mode.
- Press▲ and ▼ simultaneously for 10 seconds until the progress bar in the title bar has reached the end.
- The locking of the device keys is removed.

11.4.11 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.

11.4.11.1 Parameter setting via unit keys: Device reset

- Select the **EF** menu.
- Select **rES**.
- Keep ▲ or ▼ pressed.
  - **----** is displayed.
- Briefly press ●.
- The device carries out a reboot.

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11.5 Display settings

The presentation in the display can be adjusted via various parameters. The parameters described below are set as follows:

▶ Call up the menu **EF** > **DIS**.

Colour setting:

▶ Go to **EF** > **COLR**.

11.5.1 Display language

The display language can be set via the parameter **LanG**.

Selectable languages:

- **DE**: German
- **EN**: English
- **FR**: French

11.5.2 Display layout

Use the **diS.L** parameter to choose which process values are shown in the display by default.

Selectable values:

- **L1**: current process value for flow
- **L2.Temp**: current process value for flow and temperature
- **L2.Totl**: current process value for flow and totaliser Vol.1
- **L3**: current process value for flow, temperature and totaliser Vol.1

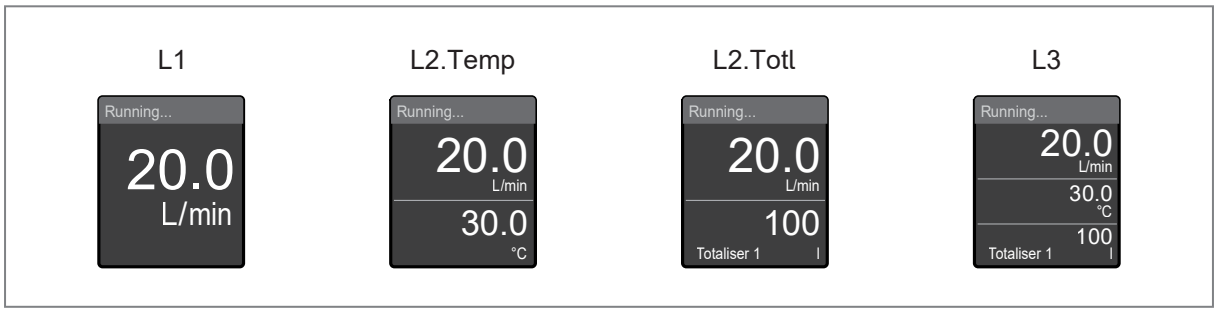


Fig. 14: Display layout

11.5.3 Display update rate

The update rate of the display can be set via the parameter **diS.U**.

Selectable values:

- **d1**: fast
- **d2**: medium
- **d3**: slow

11.5.4 Display rotation

Use the parameter **diS.R** to rotate the text in the display clockwise for better readability.

Selectable values:

- **0°** (not rotated)
- **90°**
- **180°**
- **270°**

11.5.5 Display brightness

The display brightness can be set via the parameter **diS.B**.

Selectable values:

- **25 %**
- **50 %**
- **75 %**
- **100 %**
- **OFF**: energy-saving mode. The display is switched off in the operating mode.
  - The setting takes effect after a delay of 30 seconds.
  - Display activation by pressing any key. After 30 s of inactivity, the display is switched off again.

In case of warnings or error messages and in case of optical localisation, the display will come back on even with the setting **OFF**.

If the unit measures a high internal temperature, the display brightness is automatically adjusted:
Internal temperature of the unit > 70 °C: brightness is reduced to 25%.
Internal temperature of the unit ≥ 100 °C: display is automatically switched off.

11.5.6 Display colour setting

The font colour in the display can be set via the parameter **coL.x**.

- **coL.F**: font colour for flow
- **coL.T**: font colour for temperature
- **coL.V**: font colour for totaliser Vol.1

11.5.6.1 Permanent colour selection

The font colour is permanently set to one colour:

- **coL.x** = **bk/wh**: font colour white
- **coL.x** = **red**: font colour red
- **coL.x** = **green**: font colour green
- **coL.x** = **yellow**: font colour yellow

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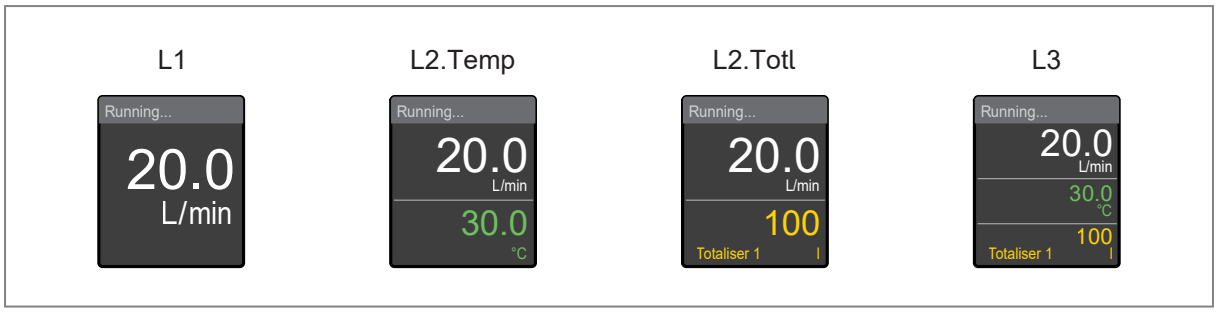


Fig. 15: Permanent colour setting. Example: **coL.F** = **bk/wh**; **coL.T** = **green**; **coL.V** = **yellow**, illustration of all display layouts 43

11.5.6.2 Colour change depending on freely definable limit values

If the measured value is within the limits of **cFL.x**…**cFH.x**, the following applies depending on the parameter selection:

- **coL.x** = **r-cF**: font colour red
- **coL.x** = **G-cF**: font colour green

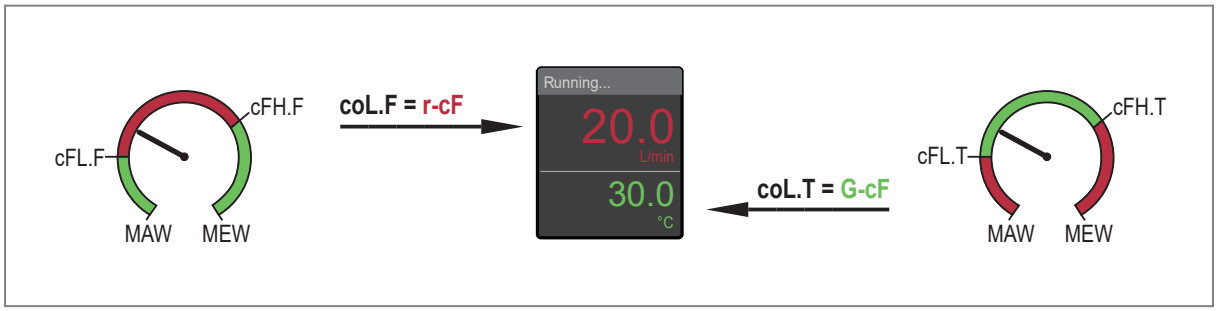


Fig. 16: Colour change. Example: **coL.F** = **r-cF**; **coL.T** = **G-cF**; current measured values between the limit values.

A colour change is not available for the totaliser display.

The limit values of the window range can be freely selected within the measuring range and are independent of the output function:

- Flow: **cFL.F** = lower limit value; **cFH.F** = upper limit value
- Temperature: **cFL.T** = lower limit value; **cFH.T** = upper limit value

The **cFL.x** and **cFH.x** parameters will only appear in the menu if the **r-cF** or **G-cF** setting has been selected for **coL.x**.

11.6 Diagnostics and service functions

11.6.1 Device information

Unalterable device information is stored on the unit. This includes:

- Product name
- Product ID
- Serial number
- Hardware revision

- Software revision

In addition, further freely definable tags with a maximum length of 32 characters can be assigned to the unit via the IO-Link interface using suitable parameter setting software. This includes:

- application-specific tag
- function tag
- location tag

11.6.1.1 Reading via the unit keys: device information

▶ Go to **EF** > **Info**.
▶ Read the unit information.

11.6.2 Simulation

This function is used to simulate process values or error states and check the sensor behaviour.

The simulation time is adjustable: 1...60 minutes.

The following values can be simulated:

- process values for flow and temperature
- process values outside the measuring range (cr.UL, UL, OL, cr.OL)
- The consumed quantity of totaliser Vol.1, taking into account the set counting method

During the simulation:

- The title line of the display shows that the simulation is active.
- The simulated values are shown on the display:
  - Simulated process values or events (e.g. UL) for flow and temperature.
  - Simulated totaliser Vol.1. The totaliser starts at 0.
- The switching status LEDs are on according to the simulated values and the set output configuration.
- The simulation has no effect on the current process values. The outputs operate as previously set.
- The original totaliser values remain saved without any changes. A real flow during the simulation is not counted.
- The display does not show warning or error messages of the current real application.

If the simulation is started via IO-Link, it can also only be finished via IO-Link. If you try to stop the simulation using the device keys, 🔒 will be displayed.

11.6.2.1 Parameter setting via unit keys: simulation

▶ Go to the **EF** > **SIM** menu.
▶ Select **S.FLW** or **S.TMP** and set the process value to be simulated:
- Press ▲ or ▼ until the required process value has been reached.
- The warning/error indications **OL**, **crOL**, **UL** and **crUL** appear when the measuring range is exceeded or not reached.

▶ 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 under **S.Tim**. Abort by pressing any key.

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- **OFF**: The simulation is not active.

11.6.3 Optical localisation

The sensor can be located remotely in the system via the IO-Link interface.

This function is only available via the IO-Link interface.

When the command is executed via the IO-Link interface, the switching status LEDs flash and the “IO-Link” indication flashes in the display.

▶ Deactivate the function via IO-Link or by pressing any button on the device.

11.6.4 Read totaliser values

For the totalisers, the following values can be read at any time:

Totaliser values Vol.1 and Vol.2

- Current flow quantity (= consumed quantity since the last totaliser reset)
- Value before the last totaliser reset
- Time since the last totaliser reset

Lifetime totaliser (for the entire operating time)

- Flow quantity in preferred direction (= positive direction of flow)
- Flow quantity in non-preferred direction (= negative direction of flow)
- Total flow rate (regardless of the flow direction)

Reading via unit keys: totaliser values

▶ Go to the **EF** > **TOTL** menu.

▶ Select **Vol.x** and read consumption values.

11.6.5 Memory

The unit stores the maximum and minimum measured process values.

The current value can be read from the unit’s display or via the IO-Link interface.

Selectable values:

- **Lo.F**: Minimum value memory for volumetric flow
- **Hi.F**: Maximum value memory for volumetric flow
- **Lo.T**: Minimum value memory for temperature
- **Hi.T**: Maximum value memory for temperature

The stored values can only be reset via the IO-Link interface.

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

11.6.5.1 Parameter setting via unit keys: Memory

Show memory:

- Go to the **EF** > **MEM** menu.
- Select **Lo.x** or **Hi.x** to show the highest or lowest process value measured.

Clear memory:

- Go to the **EF** > **MEM** menu.
- Select **Lo.x** or **Hi.x**.
- Keep ▲ or ▼ pressed.
  - ▷ **----** is displayed.
- Briefly press ●.

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 Warning messages

Indication	Problem / remedy
• Short circuit OUT1 • Switching status LED for OUT1 flashing	Short circuit output 1. ▶ Check OUT1 for short circuit or excessive current.
• Short circuit OUT2 • Switching status LED for OUT2 flashing	Short circuit output 2. ▶ Check OUT2 for short circuit or excessive current.
• Short circuit OUT1 / OUT2 • Switching status LEDs for OUT1 and OUT2 flashing	Short circuit in both outputs. ▶ Check OUT1 and OUT2 for short circuit or excessive current.
• Over limit (OL)	Above the display range. ▶ Check the measuring range.
• Under limit (UL)	Below the display range. ▶ Check the measuring range.
• 🔒 (when trying to change a parameter setting)	Parameter setting via keys is locked. ▶ Unlock the device using the keys. - or - ▶ Finish parameter setting via IO-Link. - or - ▶ Unlock the device via IO-Link.
• Display dimmed	Internal device temperature too warm (➔ Operating and display elements). ▶ Allow the device to cool down.
• IO-Link (flashing) • Switching status LEDs for OUT1 and OUT2 flashing fast	IO-Link function for optical identification of the device is active. ▶ Deactivate IO-Link function.

In the event of a warning, the outputs react according to the setting under **FOU** = OU. Exception: Short circuit.

12.2 Error messages

Indication	Problem / remedy
• ERROR	Device faulty / malfunction. ▶ Replace the device.

Indication	Problem / remedy
• Display off.	Device temperature too warm (↪ Operating and display elements). ▶ Allow the device to cool down. - or - The display is off. ▶ Under **diS.B** deselect the setting **OFF**. - or – Supply voltage too low. ▶ Check the supply voltage.
• Parameter Error (PARA)	Parameter setting outside the valid range. ▶ Check parameter setting.
• Flow Error (ERROR)	Error in flow measurement. ▶ Check flow measurement. ▶ Replace the device.
• Temp Error (ERROR)	Error in temperature measurement. ▶ Check temperature measurement. ▶ Replace the device.
• Critical over limit (cr.OL)	Above the measuring range. ▶ Check the measuring range.
• Critical under limit (cr.UL)	Below the temperature measuring range. ▶ Check the temperature range.

In the event of an error, the outputs react according to the setting under **FOU**.

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13 Maintenance, repair and disposal

Maintenance:

- Define regular calibration intervals according to the process requirements. Recommendation: every 12 months.
- Clean the display when heavily soiled.

If media with a tendency to build-up are used:

- Check measuring pipe at regular intervals and clean it, if necessary.

Maintenance:

Only the manufacturer is allowed to repair the unit.

- Contact ifm in case of malfunction.

Disposal:

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

14 Factory setting

Parameter	SM4020 SM4120	SM6020 SM6120 SM6420	SM6621	SM7020 SM7120 SM7420	SM7621	SM8020 SM8120 SM8420	SM8621	SM8030 SM8130
SEL1	FLOW	FLOW	FLOW	FLOW	FLOW	FLOW	FLOW	FLOW
ou1	Hno	Hno	Hno	Hno	Hno	Hno	Hno	Hno
SP1 / FH1	600 ml/min	5.00 l/min	1.32 gal/min	10.0 l/min	2.64 gal/min	20 l/min	5.28 gal/min	33.3 l/min
rP1 / FL1	548 ml/min	4.64 l/min	1.22 gal/min	9.2 l/min	2.44 gal/min	18.4 l/min	4.87 gal/min	30.7 l/min
FSP1	-20 °C	-20 °C	-4 °F	-20 °C	-4 °F	-20 °C	-4 °F	-20 °C
FEP1	3000 ml/min 80 °C	25 l/min 80 °C	6.6 gal/min 176 °F	50 l/min 80 °C	13.21 gal/min 176 °F	100 l/min 80 °C	26.42 gal/min 176 °F	166.7 l/min 80 °C
FrP1	1000 Hz	1000 Hz	1000 Hz	1000 Hz	1000 Hz	1000 Hz	1000 Hz	1000 Hz
ImPS	0.001	0.001	0.0002	0.01	0.002	0.01	0.002	0.01
ImPR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FOU1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
SEL2	FLOW	FLOW	FLOW	FLOW	FLOW	FLOW	FLOW	FLOW
ou2	I	I	I	I	I	I	I	I
ASP2	0	0	0	0	0	0	0	0
AEP2	3000 ml/min	25 l/min	6.6 gal/min	50 l/min	13.21 gal/min	100 l/min	26.42 gal/min	250 l/min
SP2 / FH2	1200 ml/min	10 l/min	2.64 gal/min	20 l/min	5.28 gal/min	40 l/min	10.57 gal/min	66.7 l/min
rP2 / FL2	1148 ml/min	9.63 l/min	2.54 gal/min	19.2 l/min	5.07 gal/min	38.4 l/min	10.15 gal/min	64 l/min
DIn2	+EDG	+EDG	+EDG	+EDG	+EDG	+EDG	+EDG	+EDG
FOU2	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
uni.F	ml/min	l/min	gal/min	l/min	gal/min	l/min	gal/min	l/min
uni.T	°C	°C	°F	°C	°F	°C	°F	°C
dAP	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
dST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P-n	PnP	PnP	PnP	PnP	PnP	PnP	PnP	PnP
LFC	5.0 ml	0.05 /min	0.01 gal/min	0.01 l/min	0.03 gal/min	0.2 l/min	0.05 gal/min	0.2 l/min
Fdir	+	+	+	+	+	+	+	+
rTo1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
rTo2	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
FPro1	0+	0+	0+	0+	0+	0+	0+	0+
FPro2	0+	0+	0+	0+	0+	0+	0+	0+
LanG	EN	EN	EN	EN	EN	EN	EN	EN
diS.L	L3	L3	L3	L3	L3	L3	L3	L3
diS.U	d3	d3	d3	d3	d3	d3	d3	d3
diS.B	75%	75%	75%	75%	75%	75%	75%	75%
coL.F	bk/wh	bk/wh	bk/wh	bk/wh	bk/wh	bk/wh	bk/wh	bk/wh
col.T	bk/wh	bk/wh	bk/wh	bk/wh	bk/wh	bk/wh	bk/wh	bk/wh

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Parameter	SM4020 SM4120	SM6020 SM6120 SM6420	SM6621	SM7020 SM7120 SM7420	SM7621	SM8020 SM8120 SM8420	SM8621	SM8030 SM8130
col.V	bk/wh	bk/wh	bk/wh	bk/wh	bk/wh	bk/wh	bk/wh	bk/wh