GP01151F/00/EN/01.20
71499380
2020-08-31

Description of Device Parameters
Prosonic S FMU90

Level measurement
Flow measurement over open channels

Endress+Hauser
People for Process Automation

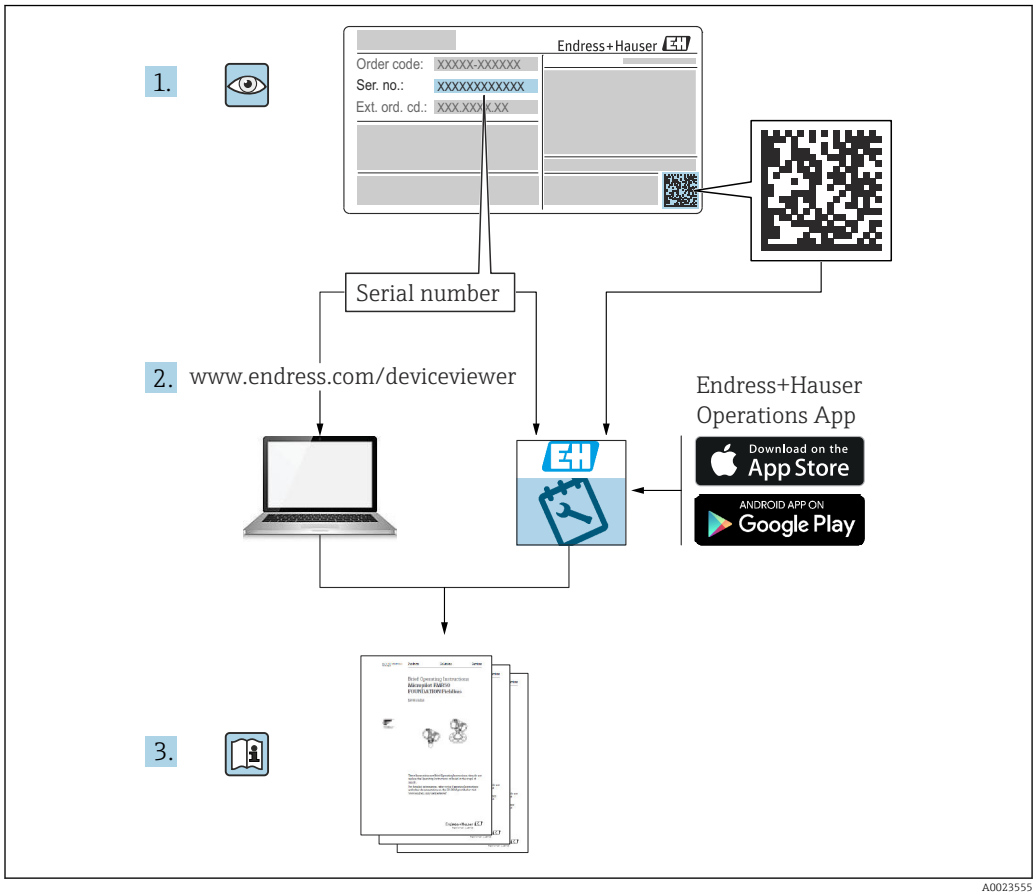
1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX XXX XX XX
Serial number
2. www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.
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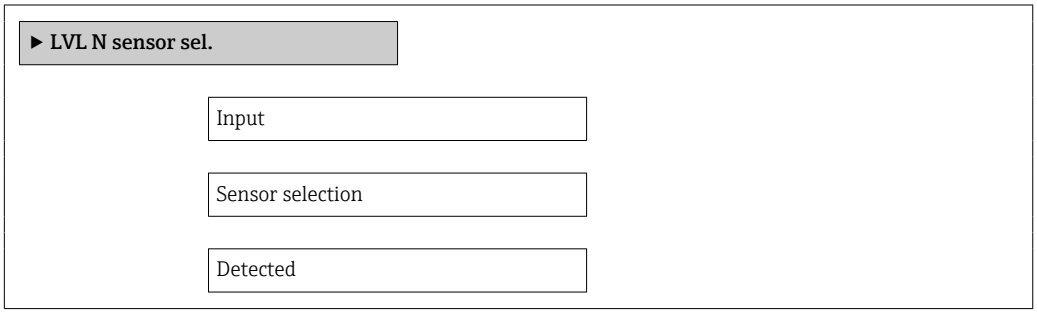
Table of contents

1 Menu "Level → Level (LVL) N"

1.1 Submenu "Basic setup"

1.1.1 Parameter set "LVL N sensor sel."

Navigation Level → Level (LVL) N → Basic setup → LVL N sensor sel.



Input

Navigation Level → Level (LVL) N → Basic setup → LVL N sensor sel. → Input

Description Assign a sensor to the channel N.

Selection
- No sensor
- Sensor 1
- Sensor 2 (for devices with 2 sensor inputs)

Sensor selection

Navigation Level → Level (LVL) N → Basic setup → LVL N sensor sel. → Sensor selection

Description Specify the type of sensor that is connected.

Factory setting Automatic

Additional information
- **For FDU9x sensors**:
  Select the **Automatic** option. Prosonic S then automatically detects the type of sensor that is connected.
- **For FDU8x sensors**:
  Specify the sensor type explicitly.

Following sensor replacement
Prosonic S automatically detects the new type of sensor. Measurement is resumed. To ensure smooth and correct measurement:
- Check the **Empty E** and **Full F** parameters and adjust them if necessary. In doing so, pay attention to the blocking distance of the new sensor.
- Check the distance displayed in the **LVL N check value** parameter set. Perform a new interference echo suppression (mapping) if necessary.

Detected

Navigation Level → Level (LVL) N → Basic setup → LVL N sensor sel. → Detected

Prerequisite **Sensor selection** = **Automatic**

Description Displays the type of sensor detected automatically.

1.1.2 Parameter set "LVL N appl. param."

Navigation Level → Level (LVL) N → Basic setup → LVL N appl. para.

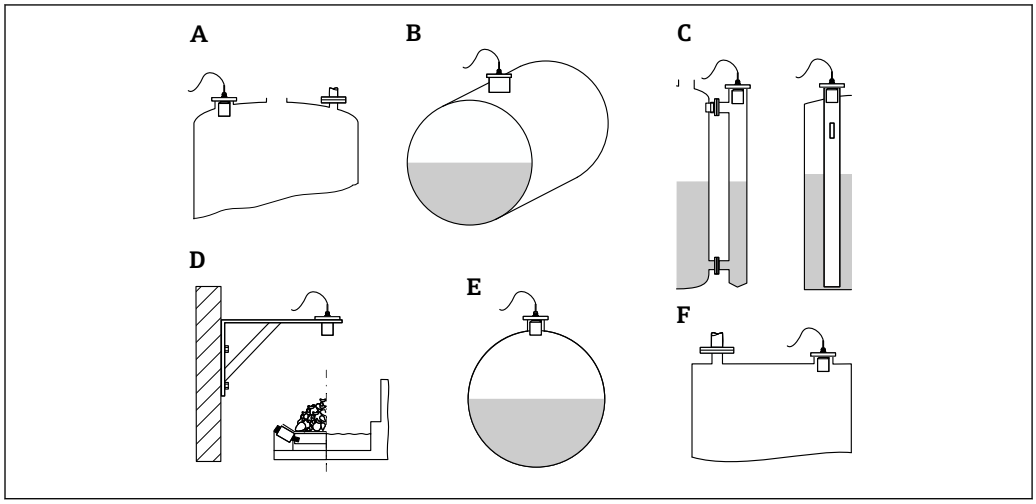
Tank shape

Navigation Level → Level (LVL) N → Basic setup → LVL N appl. para. → Tank shape

Description Specify the tank shape.

Factory setting Flat ceiling

Additional information



1 Tank shape

A Dome ceiling
B Horizontal cyl.
C Bypass/stilling well
D No ceiling
E Sphere
F Flat ceiling

Medium property

Navigation Level → Level (LVL) N → Basic setup → LVL N appl. para. → Medium property

Description Specify the medium property.

Selection
- Liquid
- Paste-like
- Solid <4 mm
- Solid >4 mm
- Unknown

Factory setting Liquid

Additional information

If the medium property cannot be categorized clearly and unequivocally, select the **Unknown** option.

Process conditions

Navigation

Level → Level (LVL) N → Basic setup → LVL N appl. para. → Process conditions

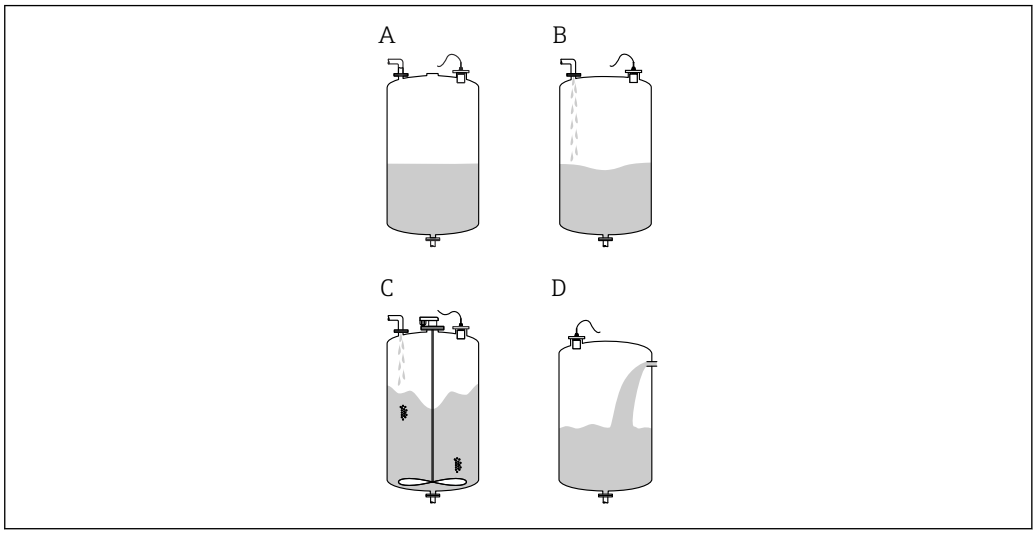
Description

Specify the process conditions.

Factory setting

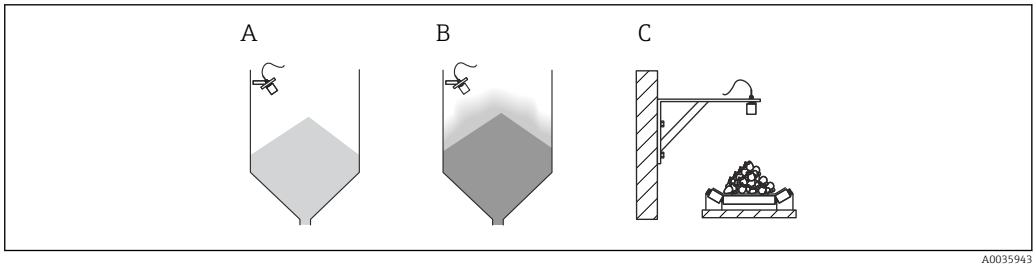
Calm surface

Additional information



2 *Process conditions for liquids*

A Calm surface
B Turb. surface
C Add. agitator
C Fast change



3 *Process conditions for bulk solids*

A Standard solid
B Solid dusty
C Conveyor belt

Meaning of the options

- **Standard liq.**
  - For liquid applications that do not fall into any of the following categories.
  - Average filter values and output damping
- **Calm surface**
  - For storage tanks with an immersion tube or bottom filling
  - Large filtering range and output damping
    → Stable measured value, accurate measurement, slow response time
- **Turb. surface**
  - For storage and buffer tanks with turbulent surfaces due to free filling, mixing nozzles or small bottom agitators
  - Emphasis on filters to stabilize the input signal.
    → Steady measured value, medium response time
- **Add. agitator**
  - For agitated surfaces due to agitators (possibly with vortex formation)
  - Large values are set for filters to stabilize the input signal.
    → Stable measured value, medium response time
- **Fast change**
  - For fast changes in the level, particularly in small tanks
  - Low values are set for the filters.
    → Fast response, possibly unstable measured value
- **Standard solid**
  - For bulk solid applications that do not fall into any of the following categories.
  - Average filter values and output damping
- **Solid dusty**
  - For dusty bulk solids
  - The filters are set in such a way that even relatively weak wanted signals are detected.
- **Conveyor belt**
  - For bulk solids with rapid changes in the level (e.g. on conveyor belts)
  - Low values are set for the filters.
    → Fast response, possibly unstable measured value
- **Test: no filter**
  For service and diagnostics only
  All the filters are switched off.

1.1.3 Parameter set "LVL N empty cal."

Navigation Level → Level (LVL) N → Basic setup → LVL N empty cal.

Empty E

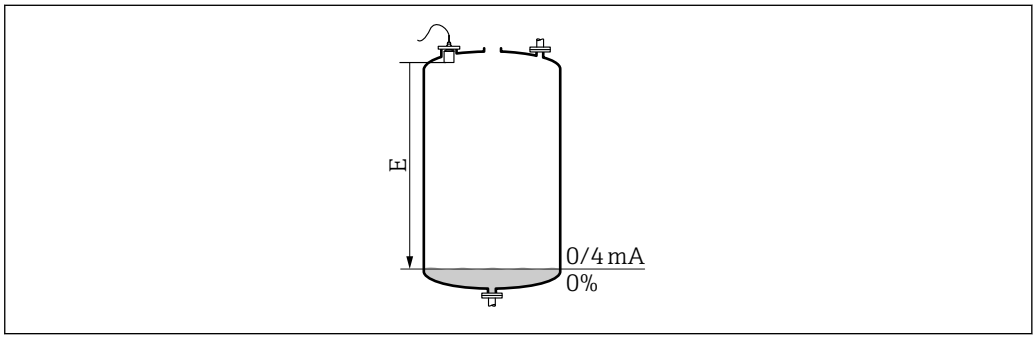
Navigation Level → Level N → Basic setup → LVL N empty cal. → Empty E

Description Specify the empty distance **E**.

User entry Depends on the sensor

Factory setting Maximum sensor measuring range

Additional information



4 *Definition of empty distance "E"*

E may not be lower than the point where the ultrasonic wave hits the tank floor.

1.1.4 Parameter set "LVL N full cal."

Navigation Level → Level (LVL) N → Basic setup → LVL N full cal.

Full F

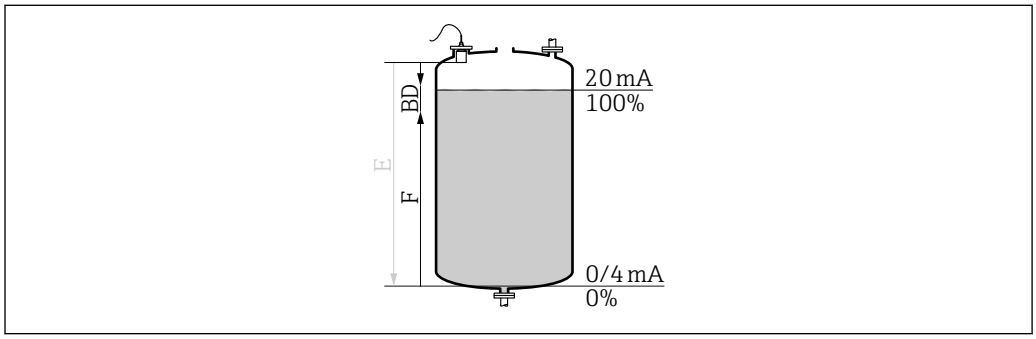
Navigation Level → Level (LVL) N → Basic setup → LVL N full cal. → Full F

Description Specify the span **F**.

User entry Depends on the sensor

Factory setting Depends on the sensor

Additional information



5 Definition of the span "F" and the blocking distance "BD"

F may not project into the blocking distance (BD) of the sensor.

Blocking distance

Navigation Level → Level (LVL) N → Basic setup → LVL N full cal. → Blocking distance

Description Indicates the blocking distance (BD) of the sensor.

1.1.5 Parameter set "LVL N unit"

Navigation Level → Level (LVL) N → Basic setup → LVL N unit

Unit level

Navigation Level → Level (LVL) N → Basic setup → LVL N unit → Unit level

Description Select the level unit.

Selection
- m
- mm
- ft
- inch
- %

Factory setting %

Additional information The level is output linearly in this unit if linearization is not performed.

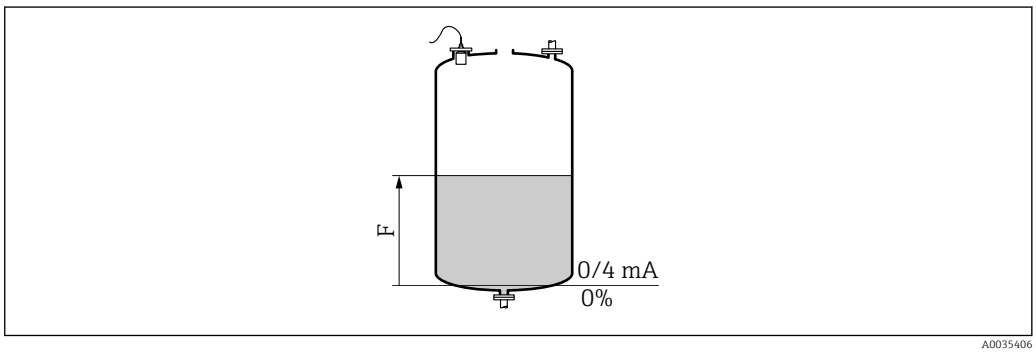
After changing the level unit, adjust the switch points of the limit relay and the pump control relay.

Level N

Navigation Level → Level (LVL) N → Basic setup → LVL N unit → Level N

Description Displays the level **F** currently measured.

Additional information



6 *Definition of level "F"*

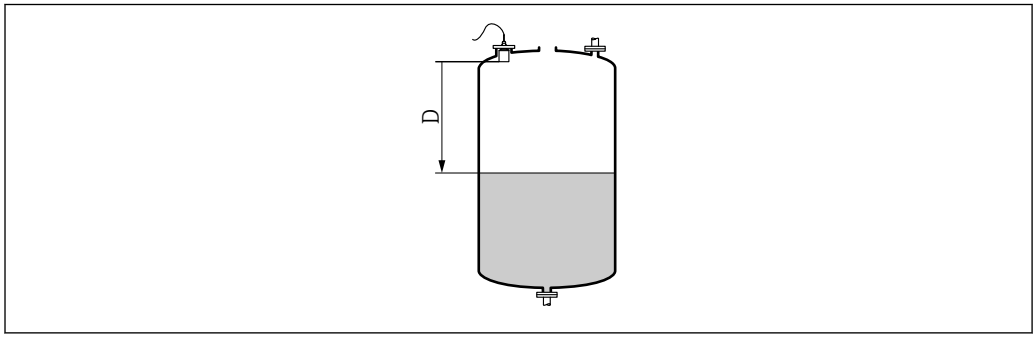
F is displayed in the level unit: **Level → Level (LVL) N → Basic setup → LVL N unit → Unit level**.

Distance

Navigation Level → Level (LVL) N → Basic setup → LVL N unit → Distance

Description Displays the distance **D** between the reference point of the sensor and the surface of the product.

Additional information



7 *Definition of distance "D"*

D is displayed in the distance unit:
Device properties → Operating param. → Distance unit.

If the displayed value deviates from the actual distance:
Perform interference echo suppression (mapping).

1.1.6 Parameter set "LVL N linearisat."

Using the linearization function

Linearization is used to convert the level to other units. In particular, it can be used to calculate the volume or mass in a vessel of any shape. Prosonic S provides different types of linearization. In addition, a linearization table can be created for vessels of any shape.

Navigation Level → Level (LVL) N → Basic setup → LVL N linearisat.

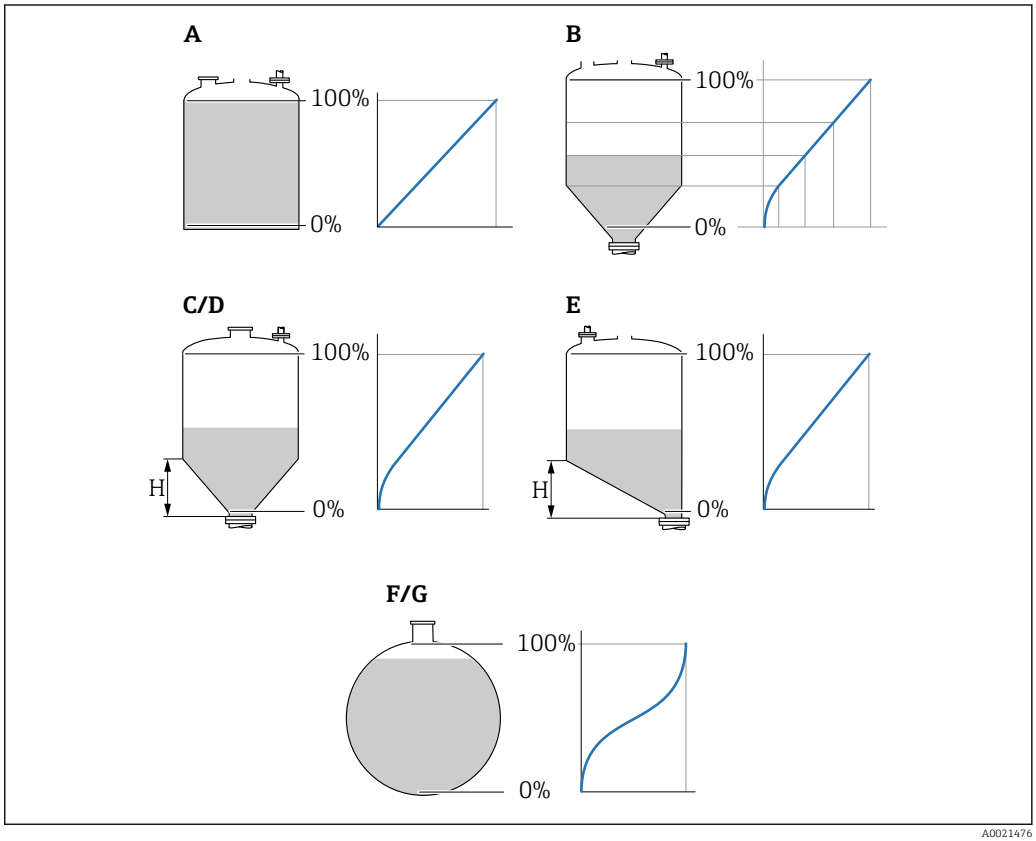
Type

Navigation Level → Level (LVL) N → Basic setup → LVL N linearisat. → Type

Description Select the type of linearization.

Factory setting None

Additional information



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8 *Types of linearization*

A Linear
B Table
C Pyramid bottom
D Conical bottom
E Angled bottom
F Sphere
G Horizontal cyl.

Customer unit

Navigation Level → Level (LVL) N → Basic setup → LVL N linearisat. → Customer unit

Prerequisite **Type** ≠ **None**

Description Select the unit for the linearized value.

Additional information
- The unit is for display purposes only. The values are not converted.
- To enter a unit that does not appear in the picklist:
  Select the **"Customer spec."** option. Then enter the unit in the **"Customized text"** parameter.

Free text

Navigation Level → Level (LVL) N → Basic setup → LVL N linearisat. → Free text

Prerequisite **Customer unit** = **Customer spec.**

Description Specify the unit symbol for the linearized value.

User entry Max. 5 alphanumeric characters

Max. scale

Navigation Level → Level (LVL) N → Basic setup → LVL N linearisat. → Max. scale

Prerequisite **Type** ≠ **None** or **Table**

Description Specify the maximum vessel content in the customer unit.

Additional information If **Type** = **Sphere** or **Horizontal cyl.**, the **Max scale** must always refer to a completely full tank.

Diameter

Navigation Level → Level (LVL) N → Basic setup → LVL N linearisat. → Diameter

Prerequisite **Type** = **Horizontal cyl.** or **Sphere**

Description Specify the vessel diameter D.

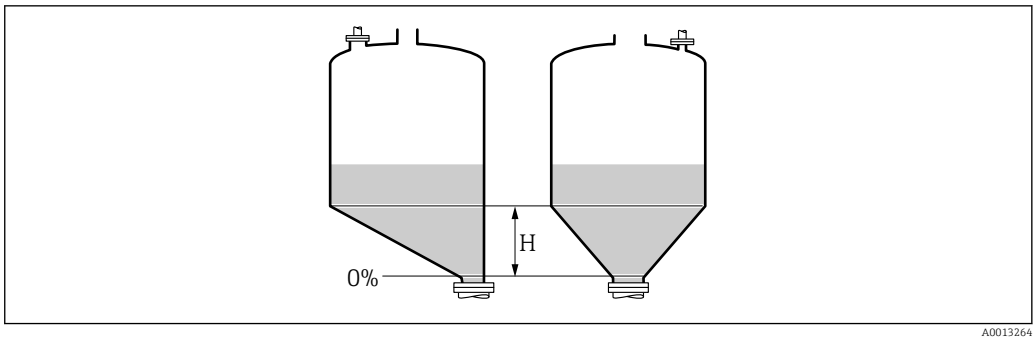
Intermediate height (H)

Navigation Level → Level (LVL) N → Basic setup → LVL N linearisat. → Intermediate height (H)

Prerequisite **Type** = **Angled bottom**, **Pyramid bottom** or **Conical bottom**

Description Specify the intermediate height H.

Additional information



9 Definition of the intermediate height H

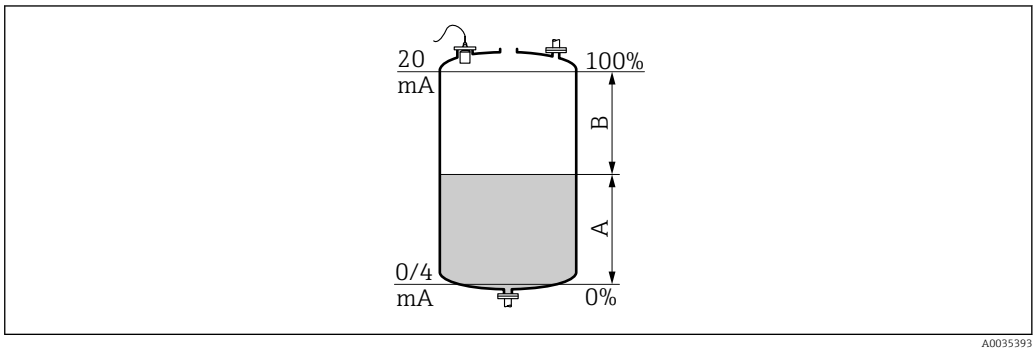
Mode

Navigation Level → Level (LVL) N → Basic setup → LVL N linearisat. → Mode

Description Specify whether the linearization refers to the level or the ullage.

Factory setting Level

Additional information



10 Definition of level and ullage

A Level
B Ullage

Edit

Navigation Level → Level (LVL) N → Basic setup → LVL N linearisat. → Edit

Prerequisite **Type** = **Table**

Description

Select the entry mode for the linearization table.

Additional information

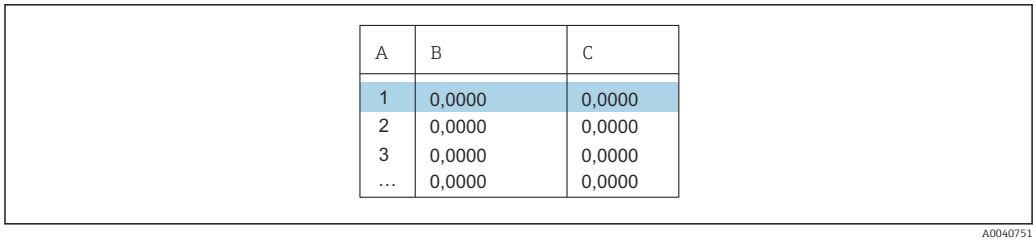
Meaning of the options

- **Read**
  The table editor is opened. The table can be read but cannot be edited.
- **Manual**
  The table editor is opened. Points in the table can be entered and changed.
- **Semi-automatic**
  The table editor is opened. The level value is automatically read by the Prosonic S. The user must enter the associated linearized value.
- **Clear**
  The linearization table is deleted.

Conditions for the linearization table:
- Up to 32 "Level/volume" value pairs
- Monotonically decreasing or increasing

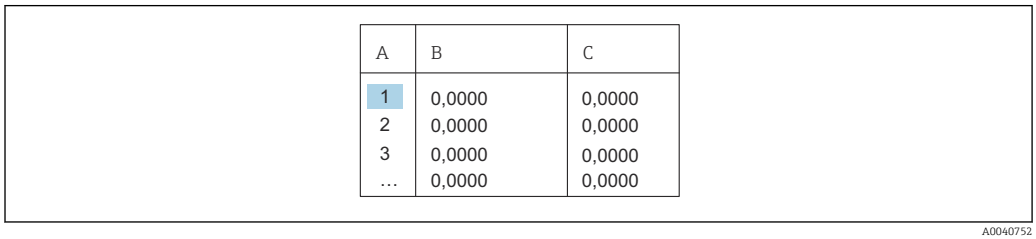
Table editor

Linearization table conditions:
- Up to 32 "Level to volume" value pairs.
- Monotonically increasing or decreasing. (The monotonicity is checked when the table is activated).
- Once entered, must be activated by the **Status table** parameter.



A Line number
B Column for level
C Column for values

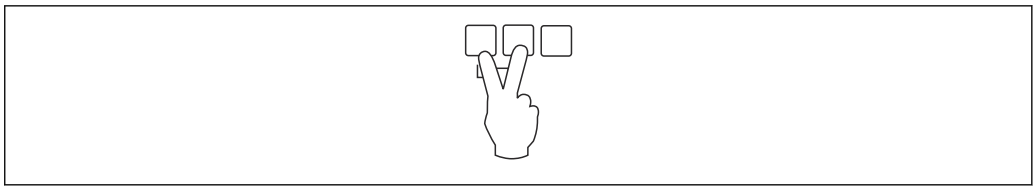
1. Press [redacted] to jump to the next line.
2. Press [redacted] to jump to the previous line.
3. Press [redacted] to open the selected line for editing.



A Line number
B Column for level
C Column for values

1. Press [redacted] or [redacted] to navigate inside the table.
2. Press [redacted] or [redacted] to navigate inside the column with the line numbers.
3. Press [redacted] to delete the entire line, insert or move a line.

Press **Escape** to return to the previous step.



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Status table

Navigation Level → Level (LVL) N → Basic setup → LVL N linearisat. → Status table

Description Enable or disable the linearization table.

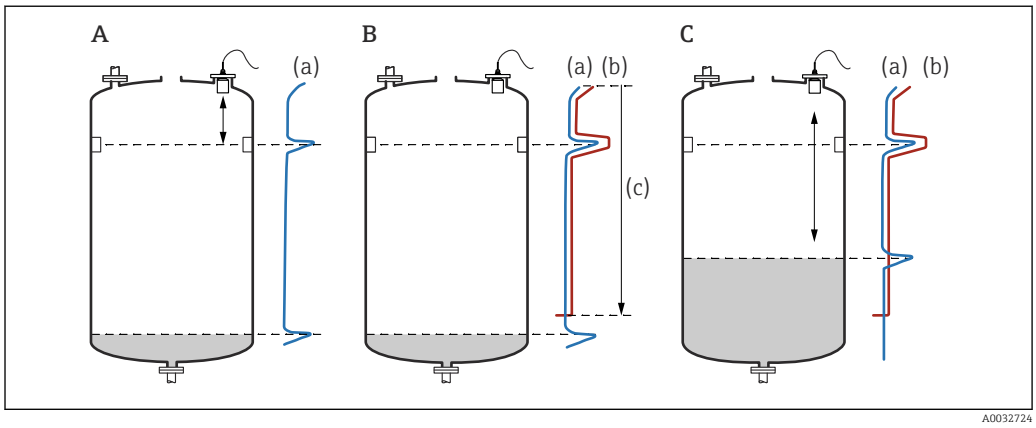
Additional information

Meaning of the options

- **Enabled**
  The linearized value is output.
- **Disabled**
  The unlinearized value is output.

If the **Disabled** option is selected, the table remains stored in the device. It can be enabled again at any time.

1.1.7 Parameter set "LVL N check value" (interference echo suppression)



11 *Operating principle of the mapping (interference echo suppression) function*

A The echo curve (a) contains an interference echo and the level echo. Without mapping, the interference echo would also be evaluated.

B Mapping generates the mapping curve (b). This suppresses all the echoes that are inside the range of mapping (c).

C Afterwards, only echoes that are higher than the mapping curve are evaluated. The interference echo is below the mapping curve and is therefore ignored (not evaluated).

To record all the interference echoes:
- Perform mapping at the minimum level possible (ideally with an empty vessel).
- If it is not possible to empty the vessel during commissioning, record preliminary mapping when the vessel is partially filled. Repeat mapping when the level reaches approximately 0% for the first time.

Navigation Level → Level (LVL) N → Basic setup → LVL N check value

Act. distance N

Navigation Level → Level (LVL) N → Basic setup → LVL N check value → Act. distance N

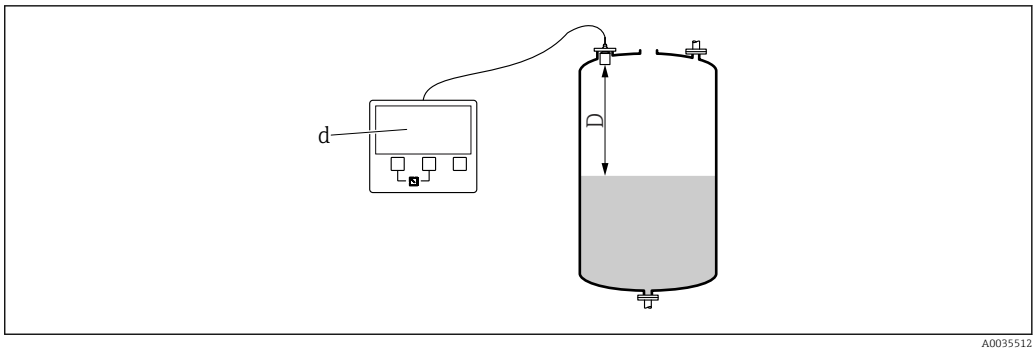
Description Displays the distance D measured between the sensor membrane and the surface of the product.

Check distance

Navigation Level → Level (LVL) N → Basic setup → LVL N check value → Check distance

Description Check whether the displayed distance d matches the actual distance D. Depending on the option selected, the device suggests a suitable range of mapping.

Additional information



12 Displayed distance d and actual distance D

Meaning of the options

- **Distance = ok**
  Select if d = D.
- **Dist. too small**
  Select if d < D.
- **Dist. too big**
  Select if d > D.
  This error is not due to an interference echo. Therefore interference echo suppression is not performed. Check the following parameters to rectify the error:
  - **Tank shape**
  - **Medium property**
  - **Process conditions**
- **Dist. unknown**
  Select if D is unknown. No interference echo suppression is performed.
- **Manual**
  Select in order to manually define the range of mapping in the **Range of mapping** parameter.

1.1.8 Parameter set "LVL N dist. map."

Navigation Level → Level (LVL) N → Basic setup → LVL N dist. map.

Range of mapping

Navigation Level → Level (LVL) N → Basic setup → LVL N dist. map. → Range of mapping

Description Define the range of mapping.

Additional information
- For **Check distance** = **Distance ok** or **Distance too small**, a suitable range of mapping is already entered.
- Enter a suitable range of mapping for **Check distance** = **Manual**.

Start mapping

Navigation Level → Level (LVL) N → Basic setup → LVL N dist. map. → Start mapping

Description Start recording the mapping curve.

Additional information

Meaning of the options
- **Yes**
  The mapping curve is recorded.
- **No**
  No mapping curve is recorded.

1.1.9 Parameter set "LVL N status"

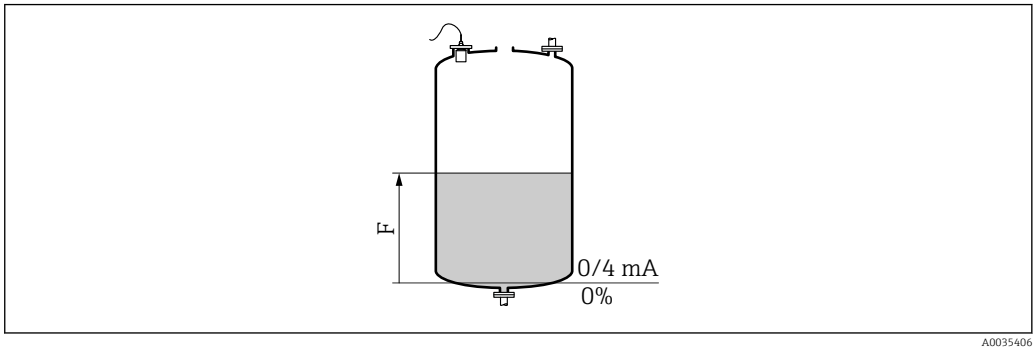
Navigation Level → Level (LVL) N → Basic setup → LVL N status

Level N

Navigation Level → Level (LVL) N → Basic setup → LVL N unit → Level N

Description Displays the level **F** currently measured.

Additional information



13 *Definition of level "F"*

F is displayed in the level unit: **Level → Level (LVL) N → Basic setup → LVL N unit → Unit level**.

Act. distance N

Navigation Level → Level (LVL) N → Basic setup → LVL N check value → Act. distance N

Description Displays the distance D measured between the sensor membrane and the surface of the product.

Status

Navigation Level → Level (LVL) N → Basic setup → LVL N status → Status

Description Specify the status of interference echo suppression (mapping).

Additional information

Meaning of the options

- **Enable map**
  The mapping curve is taken into consideration during signal evaluation.
- **Disable map**
  The mapping curve is not taken into consideration during signal evaluation. The curve remains stored in the device, however.
- **Delete map**
  The existing mapping curve is deleted.

1.2 Submenu "Extended calibr."

1.2.1 Parameter set "LVL N dist. map."

→ 20

1.2.2 Parameter set "LVL N check value"

Navigation Level → Level (LVL) N → Extended calib. → LVL N check value

Correction

Navigation Level → Level (LVL) N → Extended calib. → LVL N check value → Correction

Description Specify the distance correction.

Factory setting 0 mm

Additional information The value entered is added to the measured distance before the level is calculated.

1.2.3 Parameter set "LVL N correction"

Navigation Level → Level (LVL) N → Extended calib. → LVL N correction

Offset

Navigation Level → Level (LVL) N → Extended calib. → LVL N correction → Offset

Description Specify the level offset.

Factory setting 0 mm

Additional information The value entered is added to the measured level.

If linearization is enabled:
The corrected level is used for linearization.

1.2.4 Parameter set "LVL N blocking distance"

Navigation Level → Level (LVL) N → Extended calib. → LVL N blocking distance

Blocking distance

Navigation Level → Level (LVL) N → Basic setup → LVL N full cal. → Blocking distance

Description Indicates the blocking distance (BD) of the sensor.

1.2.5 Parameter set "LVL N limitation"

Navigation Level → Level (LVL) N → Extended calib. → LVL N limitation

Limitation

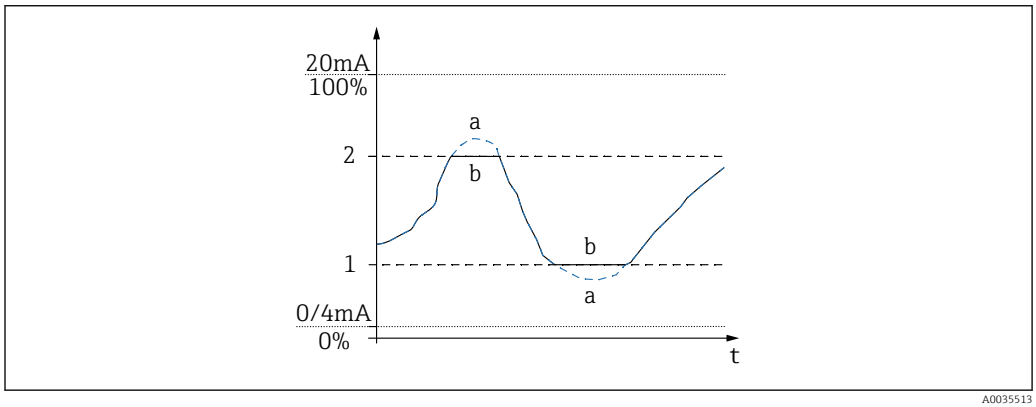
Navigation Level → Level (LVL) N → Extended calib. → LVL N limitation → Limitation

Description Specify whether a lower or upper threshold limit is to be set for the measured value.

Additional information

Meaning of the options

- **Off**
  The measured value is not limited.
- **Lower limit**
  A lower threshold limit is set for the measured value. The limit value is defined in the **Low limit** parameter.
- **Upper limit**
  An upper threshold limit is set for the measured value. The limit value is defined in the **High limit** parameter.
- **Low/high limit**
  A lower threshold limit and an upper threshold limit are set for the measured value. The limit values are defined in the **Low limit** and **High limit** parameters.



14 Measured value limitation

1 Lower limit
2 Upper limit
a Unlimited signal
b Limited signal

Upper limit

Navigation Level → Level (LVL) N → Extended calib. → LVL N limitation → Upper limit

Prerequisite **Limitation** = **high limit** or **low/high limit**

Description Specify the high limit for the measured value.

Lower limit

Navigation Level → Level (LVL) N → Extended calib. → LVL N limitation → Lower limit

Prerequisite **Limitation** = **low limit** or **low/high limit**

Description Specify the low limit for the measured value.

1.2.6 Parameter set "LVL N ext. input M"

The parameters in this parameter set assign one or two external point level switches M (e.g. a minimum and a maximum point level switch) to the level channel N. If one of the switches issues a signal, the level adopts a certain value, irrespective of the current echo signal.

Only available on devices with an additional input (FMU90-********B***)

Additional conditions

- If both external inputs issue a signal simultaneously, the value of the second input is set.
- The switching direction of point level switch K (K = 1 to 4) can be inverted under: **Sensor management** → **FDU sensor** → **External digin** → **External digin K** → **Invert**
- If the output signal has been limited (parameter set **LVL N limitation**), this limitation specifies the maximum and minimum output signal - irrespective of the behavior of the point level switches.
- The output signal defined by this parameter set has priority over the value of the external send controller (**Sensor management**→ **Input** → **FDU sensor N** → **Ext. send ctrl.** → **value**)

Navigation Level → Level (LVL) N → Extended calib. → LVL N ext. input M

Input M

Navigation Level → Level (LVL) N → Extended calib. → LVL N ext. input M → Input M

Description Assign the point level switch M to the level channel N.

Factory setting Disabled

Additional information

Meaning of the options

- **Disabled**
  No point level switch assigned
- **Ext. digin 1**
  Point level switch at terminals 71, 72, 73
- **Ext. digin 2**
  Point level switch at terminals 74, 75, 76
- **Ext. digin 3**
  Point level switch at terminals 77, 78, 79
- **Ext. digin 4**
  Point level switch at terminals 80, 81, 82

Function

Navigation Level → Level (LVL) N → Extended calib. → LVL N ext. input M → Function

Description Use this function to specify which value the output signal adopts if the external switch issues a signal.

Factory setting Off

Additional information

Meaning of the options
- **Off**
  No effect on the output signal
- **Min (0%)**
  Output signal: 0%
- **Max (100%)**
  Output signal: 100%
- **Hold**
  Output signal: When the point level switch issues a signal, the level value is held at its current value.
- **User specific**
  The output signal is defined in the **Value** parameter.

Value

Navigation Level → Level (LVL) N → Extended calib. → LVL N ext. input M → Value

Prerequisite **Function** = **User specific**

Description Use this function to specify which value the level adopts if the point level switch issues a signal.

Additional information The unit is specified in the **LVL N unit (→ 11)** parameter set.

1.3 Submenu "Simulation"

1.3.1 Parameter set "LVL N simulation"

Navigation Level → Level (LVL) N → Simulation → LVL N simulation

Simulation

Navigation Level → Level (LVL) N → Simulation → LVL N simulation → Simulation

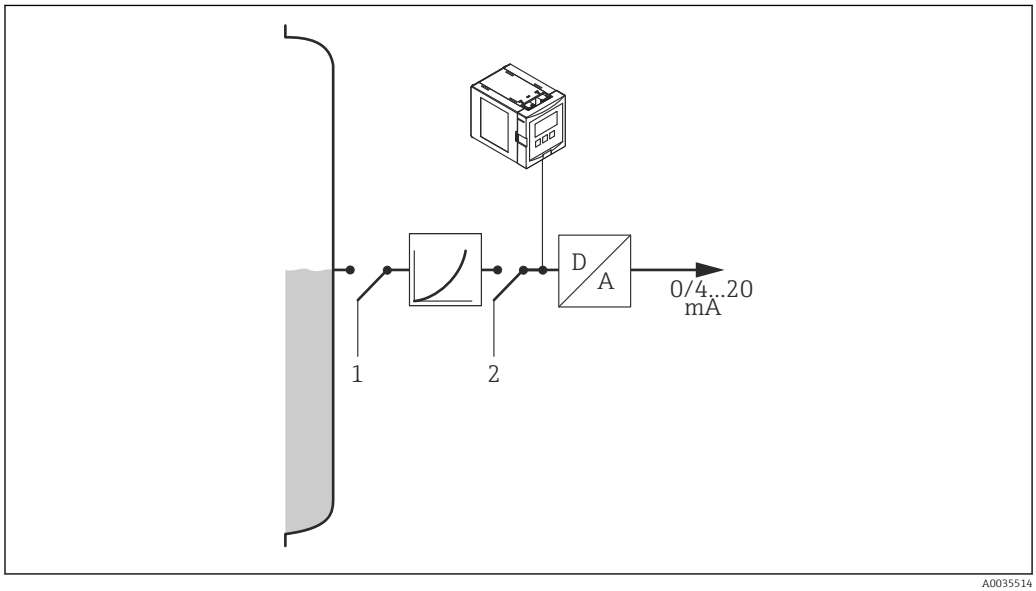
Description Select the simulation mode

Factory setting Sim. off

Additional information

Meaning of the options

- **Sim. off**
  No simulation (normal measuring mode)
- **Sim. level**
  Enter a level in the **Sim. level value** parameter. The displayed measured value and the signal output follow this value.
- **Sim. volume**
  Enter a volume or weight (depending on the linearization) in the **Sim. vol. value** parameter. The displayed measured value and the signal output follow this value.



15 Simulation modes

1 Level simulation
2 Volume simulation

If simulation is active, the device displays an error message to this effect.

Sim. level value

Navigation Level → Level (LVL) N → Simulation → LVL N simulation → Sim. level value

Prerequisite **Simulation** = **Sim. level**

Description Enter the level to be simulated.

Sim. volume value

Navigation Level → Level (LVL) N → Simulation → LVL N simulation → Sim. volume value

Prerequisite **Simulation** = **Sim. volume**

Description Enter the volume to be simulated.

2 Menu "Flow N"

Navigation to the menu:
- If **Operating mode** = **Level + flow**:
  Flow → Flow → Flow N
- If **Operating mode** = **Flow**:
  Flow → Flow → Flow N
- If **Operating mode** = **Flow + backwater**:
  Flow → Flow 1 + backwater → Flow N

2.1 Submenu "Flow N → Basic setup"

2.1.1 Parameter set "Flow N sensor sel."

Navigation Flow → Flow → Flow N → Basic setup → Flow N sensor sel.

Navigation Flow → Flow 1+ backwater → Flow → Basic setup → Flow N sensor sel.

Input

Navigation
Flow → Flow → Flow N → Basic setup → Flow N sensor sel. → Input
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N sensor sel. → Input

Description
Assign a sensor to the channel N.

Selection
- No sensor
- Sensor 1
- Sensor 2 (for devices with 2 sensor inputs)
- Average level (for devices with 2 sensor inputs if two level measurements were configured beforehand)

Factory setting
Sensor 1

Sensor selection

Navigation
Flow → Flow → Flow N → Basic setup → Flow N sensor sel. → Sensor selection
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N sensor sel. → Sensor selection

Description
Specify the type of sensor that is connected.

Factory setting
Automatic

Additional information

- For **FDU9x** sensors:
  Select the **Automatic** option. Prosonic S then automatically detects the type of sensor that is connected.
- For **FDU8x** sensors:
  Specify the sensor type explicitly.

Following sensor replacement
Prosonic S automatically detects the new type of sensor. Measurement is resumed. To ensure smooth and correct measurement:
- Check the **Empty E** parameter and adjust it if necessary.
- Check the distance displayed in the **Flow N check value** parameter set. Perform a new interference echo suppression (mapping) if necessary.

Detected

Navigation

Flow → Flow → Flow N → Basic setup → Flow N sensor sel. → Sensor selection

Flow → Flow 1+ backwater → Flow → Basic setup → Flow N sensor sel. → Sensor selection

Prerequisite

Sensor selection = **Automatic**

Description

Displays the type of sensor detected automatically.

2.1.2 Parameter set "Flow N linearisat."

Linearization is used to calculate the flow from the measured level **h**.

Prosonic S offers the following types of linearization for calculating the flow:
- Pre-programmed flow curves for frequently used flumes and weirs
- User-editable linearization table (up to 32 points)
- Configurable flow formula: $Q = C (h^{\alpha} + \gamma h^{\beta})$

Navigation Flow → Flow → Flow N → Basic setup → Flow N linearisat.

Navigation Flow → Flow 1+ backwater → Flow → Basic setup → Flow N linearisat.

Type

Navigation
Flow → Flow → Flow N → Basic setup → Flow N linearisat. → Type
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N linearisat. → Type

Description
Select the type of flow linearization

Factory setting
None

Additional information
Meaning of the options
- **None**
  No linearization takes place.
- **Flume/weir**
  Select a flume or a weir in the **Curve** parameter. The linearization then calculates the associated flow **Q** from the measured level **h**.
- **Table**
  The flow **Q** is calculated from the measured level **h** using a linearization table.
- **Formula**
  The flow **Q** is calculated from the measured level **h** and the parameters α (**alpha**), β (**beta**), γ (**gamma**) and **C** according to the following formula: $Q = C (h^{\alpha} + \gamma h^{\beta})$.

Flow unit

Navigation
Flow → Flow → Flow N → Basic setup → Flow N linearisat. → Flow unit
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N linearisat. → Flow unit

Prerequisite
Type ≠ None

Description
Select the flow unit.

Additional information
After changing the flow unit, adjust the switch points of the limit relay.

Curve

Navigation

Flow → Flow → Flow N → Basic setup → Flow N linearisat. → Curve

Flow → Flow 1+ backwater → Flow → Basic setup → Flow N linearisat. → Curve

Prerequisite

Type = **Flume/weir**

Description

Select the type of flume or weir. After this, another range of options appears with different sizes for the flume/weir.

Width

Navigation

Flow → Flow → Flow N → Basic setup → Flow N linearisat. → Width

Flow → Flow 1+ backwater → Flow → Basic setup → Flow N linearisat. → Width

Prerequisite

Curve = **Rectangular weir**, **NFX** or **Trapezoidal weir**

Description

Specify the width of the weir.

Edit

Navigation

Flow → Flow → Flow N → Basic setup → Flow N linearisat. → Edit

Flow → Flow 1+ backwater → Flow → Basic setup → Flow N linearisat. → Edit

Prerequisite

Type = **Table**

Description

Select the entry mode for the linearization table.

Additional information

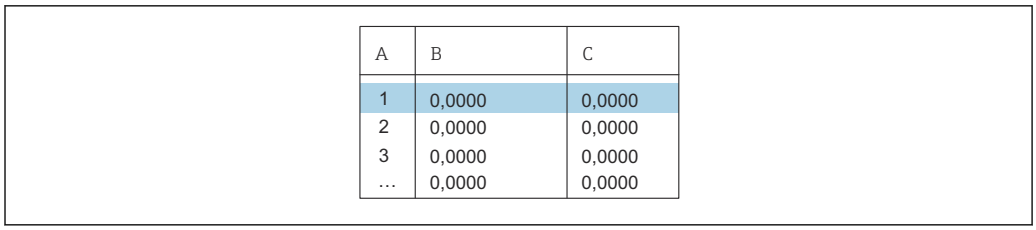
Meaning of the options

- **Read**
  The table editor is opened. The table can be read but cannot be edited.
- **Manual**
  The table editor is opened. Points in the table can be entered and changed.
- **Clear**
  The linearization table is deleted.

Conditions for the linearization table:
- Up to 32 "Level/flow" value pairs
- Monotonically decreasing or increasing

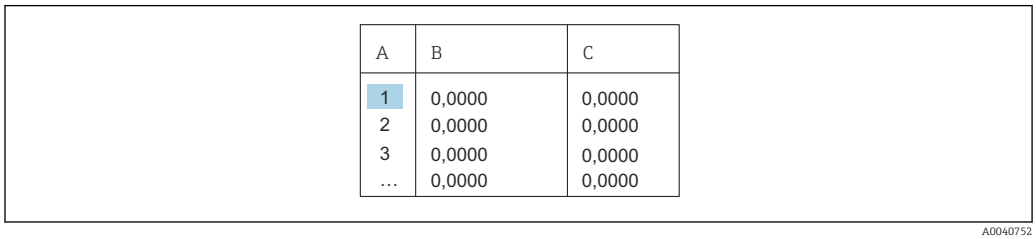
Table editor

Linearization table conditions:
- Up to 32 "Level h/flow Q" value pairs.
- Monotonically increasing or decreasing. (The monotonicity is checked when the table is activated).
- Once entered, must be activated by the **Status table** parameter.



A Line number
B Column for level
C Column for flow

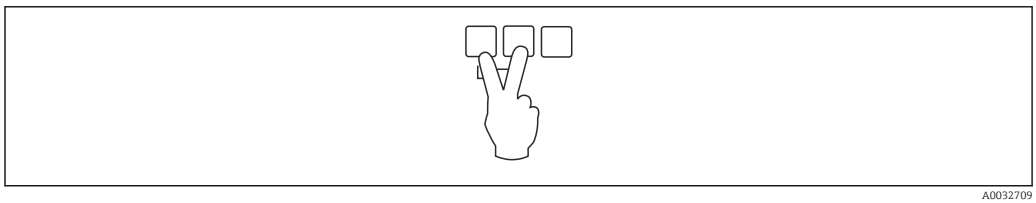
1. Press [redacted] to jump to the next line.
2. Press [redacted] to jump to the previous line.
3. Press [redacted] to open the selected line for editing.



A Line number
B Column for level
C Column for flow

1. Press [redacted] or [redacted] to navigate inside the table.
2. Press [redacted] or [redacted] to navigate inside the column with the line numbers.
3. Press [redacted] to delete the entire line, insert or move a line.

Press **Escape** to return to the previous step.



Status table

Navigation

Flow → Flow → Flow N → Basic setup → Flow N linearisat. → Status table

Flow → Flow 1+ backwater → Flow → Basic setup → Flow N linearisat. → Status table

Description

Enable or disable the linearization table.

Additional information

Meaning of the options
- **Enabled**
  The flow is output.
- **Disabled**
  The measured level is output.

If the **Disabled** option is selected, the table remains stored in the device. It can be enabled again at any time.

alpha

Navigation

Flow → Flow → Flow N → Basic setup → Flow N linearisat. → alpha

Flow → Flow 1+ backwater → Flow → Basic setup → Flow N linearisat. → alpha

Prerequisite

Type = **Formula**

Description

Define exponent α of the flow formula.

beta

Navigation

Flow → Flow → Flow N → Basic setup → Flow N linearisat. → beta

Flow → Flow 1+ backwater → Flow → Basic setup → Flow N linearisat. → beta

Prerequisite

Type = **Formula**

Description

Define exponent β of the flow formula.

gamma

Navigation

Flow → Flow → Flow N → Basic setup → Flow N linearisat. → gamma

Flow → Flow 1+ backwater → Flow → Basic setup → Flow N linearisat. → gamma

Prerequisite

Type = **Formula**

Description

Define factor γ of the flow formula.

C

Navigation

Flow → Flow → Flow N → Basic setup → Flow N linearisat. → C

Flow → Flow 1+ backwater → Flow → Basic setup → Flow N linearisat. → C

Prerequisite

Type = **Formula**

Description Define factor C of the flow formula.

Max. flow

Navigation
Flow → Flow → Flow N → Basic setup → Flow N linearisat. → Max. flow
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N linearisat. → Max. flow

Prerequisite **Type** = **Flume/weir** or **Formula**

Description Specify the maximum flow of the flume or weir. This flow corresponds to an output value of 100 %.

Additional information A suitable value is set for each of the pre-programmed flumes and weirs. This value can be modified, however, if the flume or weir is operated at lower flow rates for example.

2.1.3 Parameter set "Flow N empty cal."

Navigation Flow → Flow → Flow N → Basic setup → Flow N empty cal.

Navigation Flow → Flow 1+ backwater → Flow → Basic setup → Flow N empty cal.

Empty E

Navigation Flow → Flow → Flow N → Basic setup → Flow N empty cal. → Empty E

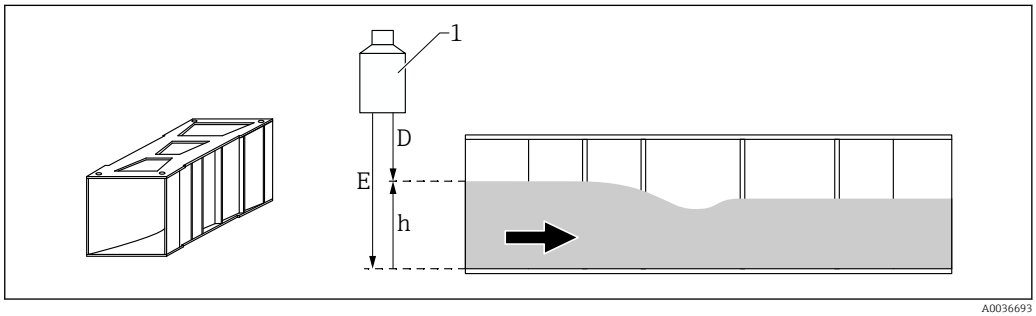
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N empty cal. → Empty E

Description Specify the empty distance **E**.

User entry Depends on the sensor

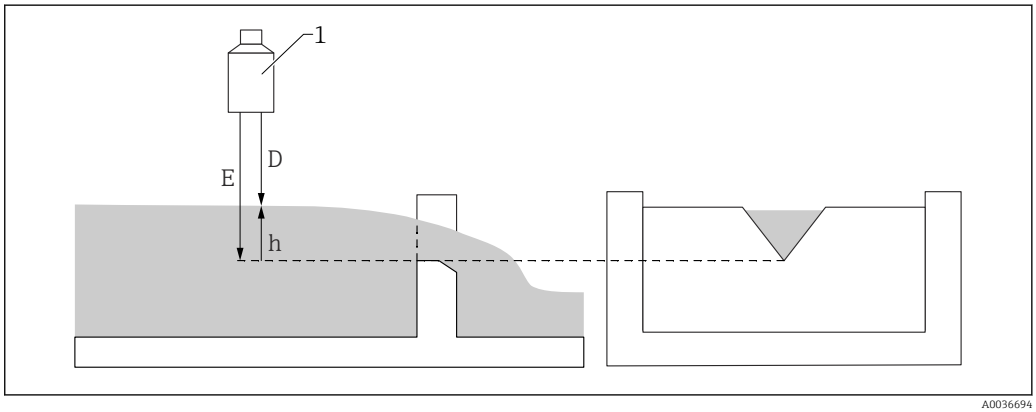
Factory setting Maximum sensor measuring range

Additional information



16 Empty calibration in flumes: floor at the narrowest point of the flume

1 Ultrasonic sensor
E "Empty E" parameter
D Measured distance
h Level



17 Empty calibration in weirs: lowest point of the weir crest

1 Ultrasonic sensor
E "Empty E" parameter
D Measured distance
h Level

Blocking distance

Navigation

Flow → Flow → Flow N → Basic setup → Flow N empty cal. → Blocking distance

Flow → Flow 1+ backwater → Flow → Basic setup → Flow N empty cal. → Blocking distance

Description

Indicates the blocking distance (BD) of the sensor.

2.1.4 Parameter set "Flow N"

Navigation Flow → Flow → Flow N → Basic setup → Flow N

Navigation Flow → Flow 1+ backwater → Flow → Basic setup → Flow N

Flow N

Navigation
Flow → Flow → Flow N → Basic setup → Flow N → Flow N
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N → Flow N

Description
Displays the flow **Q** currently measured.

Level

Navigation
Flow → Flow → Flow N → Basic setup → Flow N → Level
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N → Level

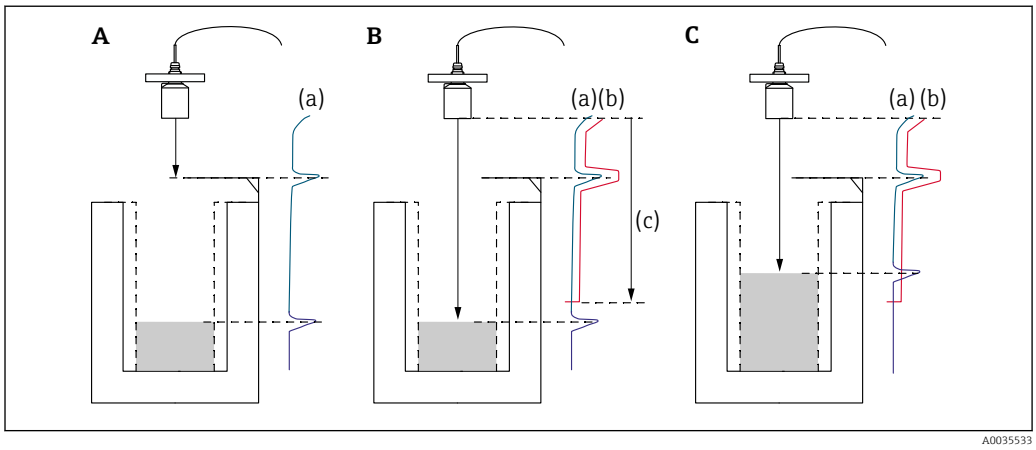
Description
Displays the level **h** currently measured.

Distance

Navigation
Flow → Flow → Flow N → Basic setup → Flow N → Distance
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N → Distance

Description
Displays the distance **d** currently measured between the reference point of the sensor and the surface of the liquid.

2.1.5 Parameter set "Flow N check value" (interference echo suppression)



18 *Operating principle of the mapping (interference echo suppression) function*

A The echo curve (a) contains an interference echo and the level echo. Without mapping, the interference echo would also be evaluated.

B Mapping generates the mapping curve (b). This suppresses all the echoes that are inside the range of mapping (c).

C Afterwards, only echoes that are higher than the mapping curve are evaluated. The interference echo is below the mapping curve and is therefore ignored (not evaluated).

To record all the interference echoes, mapping should be performed at the minimum level possible (ideally in an empty channel). If it is not possible to empty the channel sufficiently during commissioning, it is recommended to repeat mapping at a later date (as soon as the level is approximately 0%).

Navigation Flow → Flow → Flow N → Basic setup → Flow N check value

Navigation Flow → Flow 1+ backwater → Flow → Basic setup → Flow N check value

Distance

Navigation

Flow → Flow → Flow N → Basic setup → Flow N → Distance

Flow → Flow 1+ backwater → Flow → Basic setup → Flow N → Distance

Description

Displays the distance **d** currently measured between the reference point of the sensor and the surface of the liquid.

Check distance

Navigation

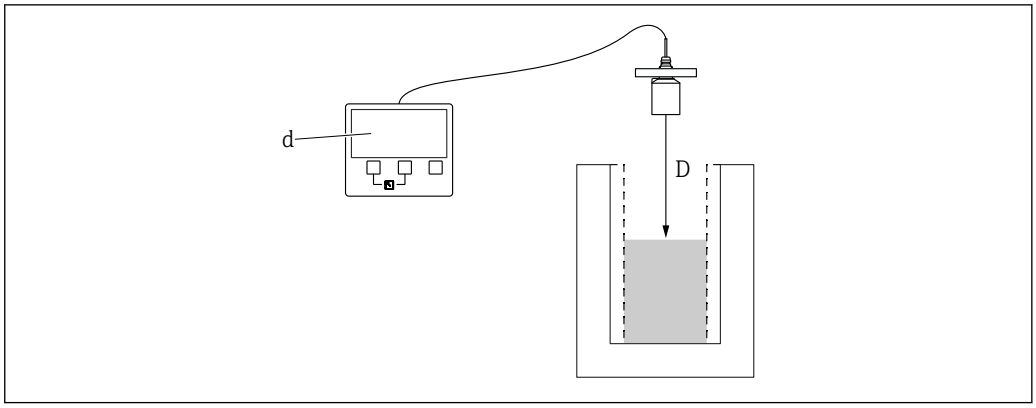
Flow → Flow → Flow N → Basic setup → Flow N check value → Check distance

Flow → Flow 1+ backwater → Flow → Basic setup → Flow N check value → Check distance

Description

Check whether the displayed distance d matches the actual distance D. Depending on the option selected, the device suggests a suitable range of mapping.

Additional information



19 Definition of d and D

Meaning of the options

- **Distance = ok**
  Select if d = D.
- **Distance too small**
  Select if d < D.
- **Distance too big**
  Select if d > D.
  This error is not due to an interference echo. Therefore interference echo suppression is not performed.
- **Distance unknown**
  Select if D is unknown. No interference echo suppression is performed in this case.
- **Manual**
  Select in order to manually define the range of mapping in the **Range of mapping** parameter.

2.1.6 Parameter set "Flow N mapping"

Navigation Flow → Flow → Flow N → Basic setup → Flow N mapping

Navigation Flow → Flow 1+ backwater → Flow → Basic setup → Flow N mapping

Distance

Navigation
Flow → Flow → Flow N → Basic setup → Flow N → Distance
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N → Distance

Description
Displays the distance **d** currently measured between the reference point of the sensor and the surface of the liquid.

Range of mapping

Navigation
Flow → Flow → Flow N → Basic setup → Flow N mapping → Range of mapping
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N mapping → Range of mapping

Description
Define the range of mapping.

Additional information
- For **Check distance** = **Distance = ok** and **Distance too small**, a suitable range of mapping is already entered.
- Enter a suitable range of mapping for **Check distance** = **Manual**.

Start mapping

Navigation
Flow → Flow → Flow N → Basic setup → Flow N mapping → Start mapping
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N mapping → Start mapping

Description
Start mapping.

Additional information
Meaning of the options
- **Yes**
  The mapping curve is recorded.
- **No**
  No mapping curve is recorded.

2.1.7 Parameter set "Flow N status"

Navigation Flow → Flow → Flow N → Basic setup → Flow N status

Navigation Flow → Flow 1+ backwater → Flow → Basic setup → Flow N status

Level

Navigation
Flow → Flow → Flow N → Basic setup → Flow N → Level
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N → Level

Description
Displays the level **h** currently measured.

Distance

Navigation
Flow → Flow → Flow N → Basic setup → Flow N → Distance
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N → Distance

Description
Displays the distance **d** currently measured between the reference point of the sensor and the surface of the liquid.

Flow N

Navigation
Flow → Flow → Flow N → Basic setup → Flow N → Flow N
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N → Flow N

Description
Displays the flow **Q** currently measured.

Status

Navigation
Flow → Flow → Flow N → Basic setup → Flow N status → Status
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N status → Status

Description
Specify the status of interference echo suppression (mapping).

Additional information

Meaning of the options

- **Enable map**
  The mapping curve is taken into consideration during signal evaluation.
- **Disable map**
  The mapping curve is not taken into consideration during signal evaluation. The curve remains stored in the device, however.
- **Delete map**
  The existing mapping curve is deleted.

2.2 Submenu "Flow N → Extended calibr."

2.2.1 Parameter set "Flow N mapping"

→ 44

2.2.2 Parameter set "Flow N low cut off" (low flow cut off)

Navigation Flow → Flow → Flow N → Extended calib. → Flow N low cut off

Navigation Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N low cut off

Low flow cut off

Navigation

Flow → Flow → Flow N → Extended calib. → Flow N low cut off → Low flow cut off

Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N low cut off → Low flow cut off

Description

Enter the low flow cutoff.

Additional information

- The low flow cut off is defined as a percentage of the maximum flow (**Max. flow** parameter).
- Flows below the low flow cut off point are ignored during counting.

Flow N

Navigation

Flow → Flow → Flow N → Basic setup → Flow N → Flow N

Flow → Flow 1+ backwater → Flow → Basic setup → Flow N → Flow N

Description

Displays the flow **Q** currently measured.

2.2.3 Parameter set "Flow N dist. corr."

Navigation Flow → Flow → Flow N → Extended calib. → Flow N dist. corr.

Navigation Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N dist. corr.

Correction

Navigation
Flow → Flow → Flow N → Extended calib. → Flow N dist. corr. → Correction
Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N dist. corr. → Correction

Description Specify the distance correction

Factory setting 0 mm

Additional information The value entered is added to the measured distance before the level is calculated.

Flow N

Navigation
Flow → Flow → Flow N → Basic setup → Flow N → Flow N
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N → Flow N

Description Displays the flow **Q** currently measured.

2.2.4 Parameter set "Flow N level corr."

Navigation Flow → Flow → Flow N → Extended calib. → Flow N level corr.

Navigation Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N level corr.

Offset

Navigation
Flow → Flow → Flow N → Extended calib. → Flow N level corr. → Offset
Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N level corr. → Offset

Description
Specify the level offset.

Factory setting
0 mm

Additional information
The value entered is added to the measured level **h**.
Level correction takes effect prior to linearization.

Flow N

Navigation
Flow → Flow → Flow N → Basic setup → Flow N → Flow N
Flow → Flow 1+ backwater → Flow → Basic setup → Flow N → Flow N

Description
Displays the flow **Q** currently measured.

2.2.5 Parameter set "Flow N blocking distance"

Navigation Flow → Flow → Flow N → Extended calib. → Flow N blocking distance

Navigation Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N blocking distance

Blocking distance

Navigation

Flow → Flow → Flow N → Extended calib. → Flow N blocking distance → Blocking distance

Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N blocking distance → Blocking distance

Description Indicates the blocking distance of the sensor.

2.2.6 Parameter set "Flow N limitation"

Navigation Flow → Flow → Flow N → Extended calib. → Flow N limitation

Navigation Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N limitation

Limitation

Navigation

Flow → Flow → Flow N → Extended calib. → Flow N limitation → Limitation

Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N limitation → Limitation

Description

Specify whether a lower or upper threshold limit is to be set for the measured value.

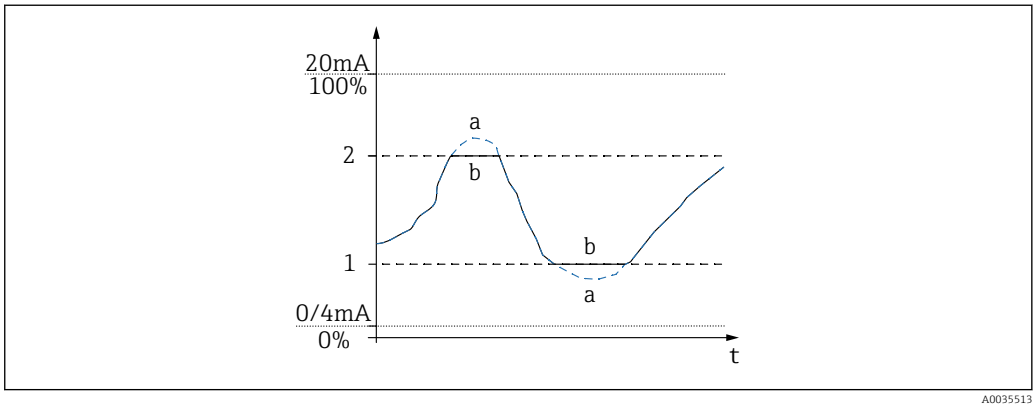
Selection

- Off
- Lower limit
- Upper limit
- Low/high limit

Additional information

Meaning of the options

- **Off**
  The measured value is not limited.
- **Lower limit**
  A lower threshold limit is set for the measured value. The limit value is defined in the **Low limit** parameter.
- **Upper limit**
  An upper threshold limit is set for the measured value. The limit value is defined in the **High limit** parameter.
- **Low/high limit**
  A lower threshold limit and an upper threshold limit are set for the measured value. The limit values are defined in the **Low limit** and **High limit** parameters.



20 Measured value limitation

1 Lower limit
2 Upper limit
a Unlimited signal
b Limited signal

Upper limit

Navigation
- Flow → Flow → Flow N → Extended calib. → Flow N limitation → Upper limit
- Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N limitation → Upper limit

Prerequisite
Limitation = **high limit** or **low/high limit**

Description
Specify the high limit for the measured value.

Lower limit

Navigation
- Flow → Flow → Flow N → Extended calib. → Flow N limitation → Lower limit
- Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N limitation → Lower limit

Prerequisite
Limitation = **low limit** or **low/high limit**

Description
Specify the low limit for the measured value.

2.2.7 Parameter set "Flow N ext. input M"

The parameters in this parameter set assign one or two external point level switches M (e.g. a minimum and a maximum point level switch) to the flow channel N. If one of the switches issues a signal, the output signal adopts a certain value, irrespective of the flow actually measured.

Only available on devices with an additional input (FMU90-********B***)

Additional conditions

- If both external inputs issue a signal simultaneously, the value of the second input is set.
- The switching direction of point level switch K (K = 1 to 4) can be inverted under: **Sensor management** → **FDU sensor** → **External digin** → **External digin K** → **Invert**
- If the output signal has been limited (parameter set **LVL N limitation**), this limitation specifies the maximum and minimum output signal - irrespective of the behavior of the point level switches.
- The output signal defined by this parameter set has priority over the value of the external send controller (**Sensor management**→ **Input** → **FDU sensor N** → **Ext. send ctrl.** → **value**)

Navigation Flow → Flow → Flow N → Extended calib. → Flow N ext. input M

Navigation Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N ext. input M

Input M

Navigation

Flow → Flow → Flow N → Extended calib. → Flow N ext. input M → Input M

Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N ext. input M → Input M

Description

Assign the point level switch M to the flow channel N.

Factory setting

Disabled

Additional information

Meaning of the options

- **Disabled**
  No point level switch assigned
- **Ext. digin 1**
  Point level switch at terminals 71, 72, 73
- **Ext. digin 2**
  Point level switch at terminals 74, 75, 76
- **Ext. digin 3**
  Point level switch at terminals 77, 78, 79
- **Ext. digin 4**
  Point level switch at terminals 80, 81, 82

Function

Navigation

Flow → Flow → Flow N → Extended calib. → Flow N ext. input M → Function

Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N ext. input M → Function

Description

Use this function to specify which value the output signal adopts if the external switch signals that a value is out of range (limit overshoot or undershoot).

Factory setting

Off

Additional information

Meaning of the options

- **Off**
  No effect on the output signal
- **Min (0%)**
  Output signal: 0%
- **Max (100%)**
  Output signal: 100%
- **Hold**
  Output signal: When the point level switch issues a signal, the level (and therefore the flow) value is held at its current value.
- **User specific**
  The output signal is defined in the **Value** parameter.

Value

Navigation

Flow → Flow → Flow N → Extended calib. → Flow N ext. input M → Value

Flow → Flow 1+ backwater → Flow → Extended calib. → Flow N ext. input M → Value

Prerequisite

Function = **User specific**

Description

Use this function to specify which value the level adopts if the point level switch issues a signal. The flow follows this value in line with the linearization.

Additional information

The unit is defined in the **Level unit (→ 11)** parameter.

2.3 Submenu "Flow N → Simulation"

2.3.1 Parameter set "Flow N simulation"

Navigation Flow → Flow → Flow N → Simulation → Flow N simulation

Navigation Flow → Flow 1+ backwater → Flow → Simulation → Flow N simulation

Simulation

Navigation Flow → Flow → Flow N → Simulation → Flow N simulation → Simulation

Flow → Flow 1+ backwater → Flow → Simulation → Flow N simulation → Simulation

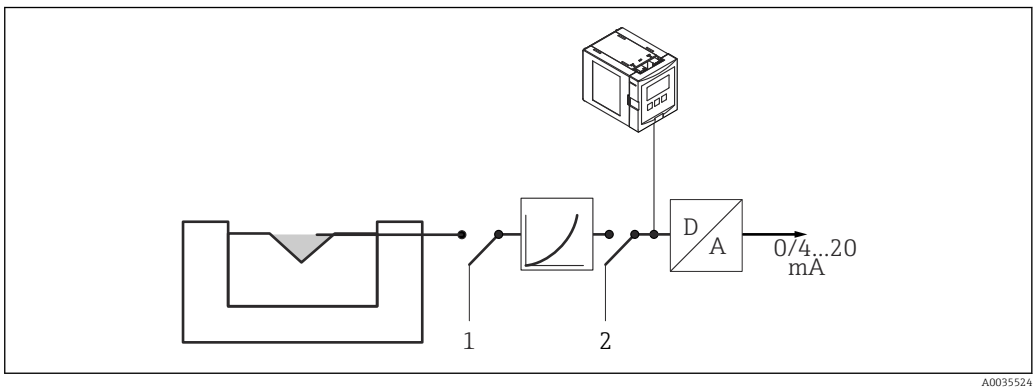
Description Select the simulation mode

Factory setting Simulation off

Additional information

Meaning of the options

- **Sim. off**
  No simulation (normal measuring mode)
- **Sim. level**
  Enter a level **h** in the **Sim. level value** parameter. The displayed measured value and the signal output follow this value.
- **Flow**
  In the **Sim. flow value** parameter, enter a flow **Q**. The displayed measured value and the signal output follow this value.



21 Simulation modes

1 Level simulation
2 Flow simulation

If simulation is active, the device displays an error message to this effect.

Sim. level value

Navigation

Flow → Flow → Flow N → Simulation → Flow N simulation → Sim. level value

Flow → Flow 1+ backwater → Flow → Simulation → Flow N simulation → Sim. level value

Prerequisite

Simulation = **Sim. level**

Description

Enter the level **h** to be simulated.

Sim. flow Value

Navigation

Flow → Flow → Flow N → Simulation → Flow N simulation → Sim. flow Value

Flow → Flow 1+ backwater → Flow → Simulation → Flow N simulation → Sim. flow Value

Prerequisite

Simulation = **Flow**

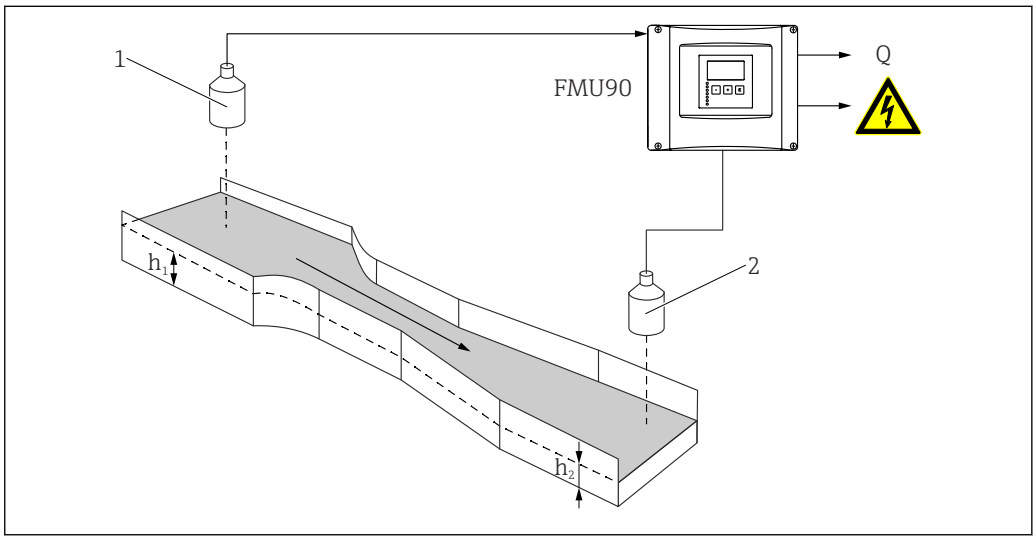
Description

Enter the flow **Q** to be simulated.

3 Menu "Backwater"

Navigation to the submenu
Flow → Flow 1+ backwater → Backwater

3.1 Submenu "Backwater → Basic setup"



22 *Backwater detection with two ultrasonic sensors*

1 *Upstream sensor*
h_1 *Upstream level*
2 *Downstream sensor*
h_2 *Downstream level*

General principles of backwater and dirt detection
Flow measurement can be compromised by backwater on the downstream side or by dirt within the flume. These problems can be detected by the backwater and dirt detection function. Two sensors are required for backwater and dirt detection - one on the upstream side and the other on the downstream side. The device evaluates the ratio of the downstream level h_2 to the upstream level h_1.

Backwater detection
The device detects the buildup of backwater when the ratio h_2/h_1 exceeds a critical value (typically 0.8 for Venturi flumes). It then continuously reduces the displayed flow to 0. In addition, a backwater alarm relay can be configured that signals an alert when backwater builds up.

Dirt detection
Dirt within the flume is detected if the ratio h_2/h_1 drops below a critical value (typically 0.1). A dirt alarm relay can be configured that signals an alert when there is dirt in the flume.

Position of the downstream sensor
Mount the sensor on the downstream side at a sufficient distance from the flume discharge point. Select the measuring point in such a way that the surface of the water is calm and the level is not influenced by the flume.

3.1.1 Parameter set "Backwater sensor selection"

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backw. sensor sel.

Input

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backw. sensor sel. → Input

Description Specify the downstream sensor.

Selection
- No sensor
- Sensor 1
- Sensor 2 (for devices with 2 sensor inputs)

Factory setting Sensor 1

Sensor selection

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backw. sensor sel. → Sensor selection

Description Specify the type of sensor that is connected.

Factory setting Automatic

Additional information
- For **FDU9x** sensors:
  Select the **Automatic** option. Prosonic S then automatically detects the type of sensor that is connected.
- For **FDU8x** sensors:
  Specify the sensor type explicitly.

Following sensor replacement
Prosonic S automatically detects the new type of sensor. Measurement is resumed. To ensure smooth and correct measurement:
- Check the **Backwater empty cal.** parameter and adjust it if necessary.
- Check the distance displayed in the **Backwater check value** parameter set. Perform a new interference echo suppression (mapping) if necessary.

Detected

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backw. sensor sel. → Detected

Prerequisite **Sensor selection** = **Automatic**

Description Displays the type of sensor detected automatically.

3.1.2 Parameter set "Backw. empty cal."

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backw. empty cal.

Empty E

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backw. empty cal. → Empty E

Description Specify the empty distance **E** of the downstream sensor.

User entry Depends on the sensor

Factory setting Maximum sensor measuring range

Additional information For the definition of the empty distance: → 39

Blocking distance

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backw. empty cal. → Blocking distance

Description Indicates the blocking distance (BD) of the sensor.

3.1.3 Parameter set "Backwater detection"

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backwater detection

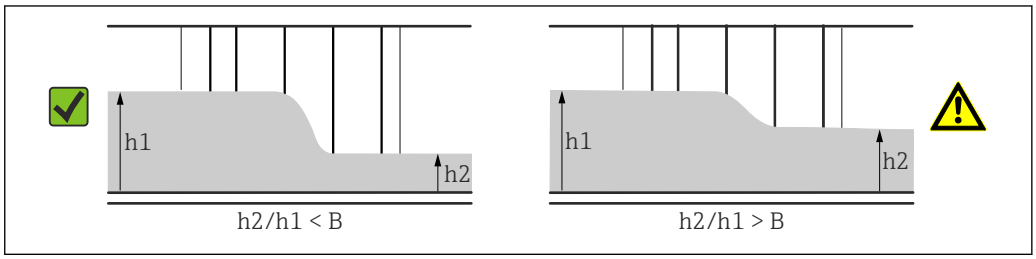
Ratio B

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backwater detection → Ratio B

Description Specify the upper limit for the quotient h_2/h_1.

Factory setting 0.8

Additional information



23 Backwater detection: the quotient h_2/h_1 exceeds the defined limit B.

Response if backwater detected
If the ratio of the two levels exceeds the specified value during measurement, backwater is reported, i.e.:
- Warning W 00 692 is displayed.
- The backwater relay (defined in the **Relay/controls** menu) is de-energized.
- If the downstream level h_2 continues to rise, the flow (indicated on the display and registered by the counters) is continuously reduced to 0.

Regarding the selection of B
The factory setting B = 0.8 is the optimum setting for Venturi flumes and should not be exceeded.

3.1.4 Parameter set "Dirt detection"

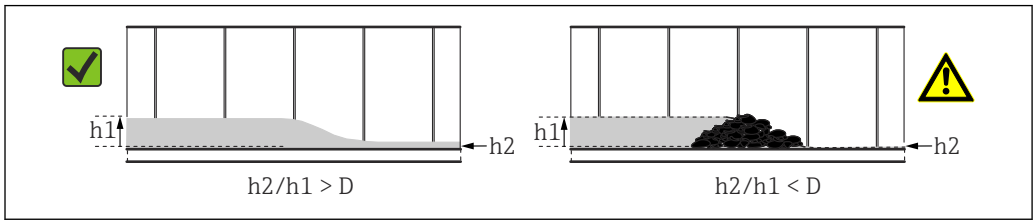
Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Dirt detection

Ratio D

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Dirt detection → Ratio D

Description Specify the lower limit for the quotient h_2/h_1.

Additional information



24 Dirt detection: the quotient h_2/h_1 drops below the limit D.

Response if dirt is detected
If the ratio of the two levels drops below the specified value during measurement, dirt is reported, i.e.:
- Warning W 00 693 is displayed.
- The dirt detection relay (defined in the **Relay/controls** menu) is de-energized.

3.1.5 Parameter set "Backwater"

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backwater

Act. backw. level

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backwater → Act. backw. level

Description Displays the current downstream level h_2.

Act. flow level

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backwater → Act. flow level

Description Displays the current upstream level h_1.

Act. ratio

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backwater → Act. ratio

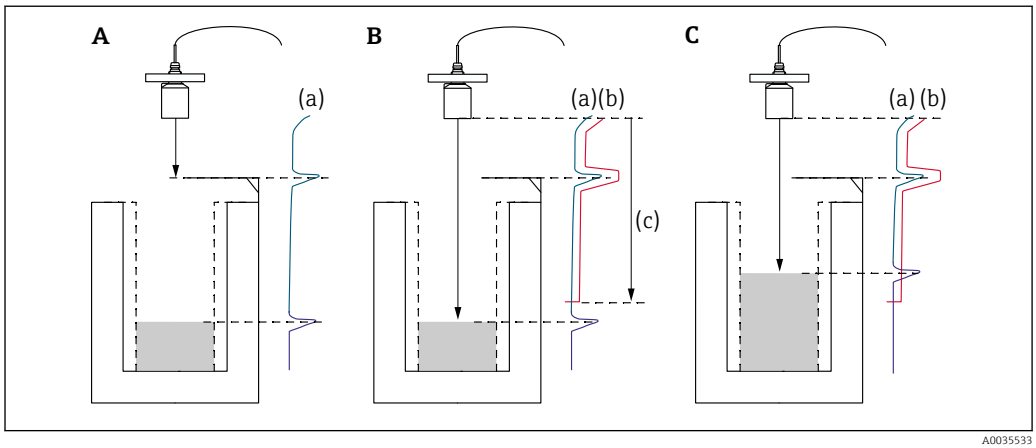
Description Displays the current value for the quotient h_2/h_1.

Flow 1

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backwater → Flow 1

Description Displays the current flow Q.

3.1.6 Parameter set "Backwater check value" (interference echo suppression)



25 *Operating principle of the mapping (interference echo suppression) function*

A The echo curve (a) contains an interference echo and the level echo. Without mapping, the interference echo would also be evaluated.

B Mapping generates the mapping curve (b). This suppresses all the echoes that are inside the range of mapping (c).

C Afterwards, only echoes that are higher than the mapping curve are evaluated. The interference echo is below the mapping curve and is therefore ignored (not evaluated).

To record all the interference echoes, mapping should be performed at the minimum level possible (ideally in an empty channel). If it is not possible to empty the channel sufficiently during commissioning, it is recommended to repeat mapping at a later date (as soon as the level is approximately 0%).

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backw. check value

Distance

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backw. check value → Distance

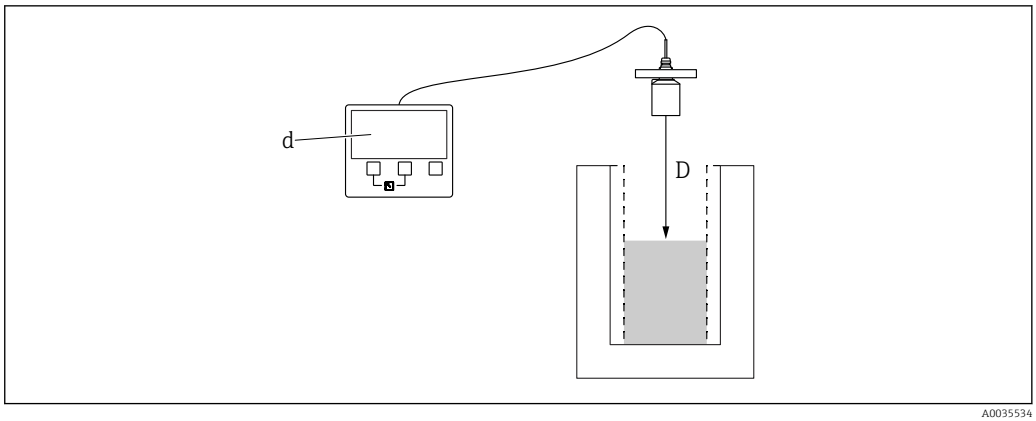
Description Displays the distance d currently measured for the downstream sensor.

Check distance

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backw. check value → Check distance

Description Check whether the displayed distance d of the downstream sensor matches the actual distance D. Depending on the option selected, the device suggests a suitable range of mapping.

Additional information



26 *Definition of d and D*

Meaning of the options

- **Distance = ok**
  Select if d = D.
- **Distance too small**
  Select if d < D.
- **Distance too big**
  Select if d > D.
  This error is not due to an interference echo. Therefore interference echo suppression is not performed.
- **Distance unknown**
  Select if D is unknown. No interference echo suppression is performed in this case.
- **Manual**
  Select in order to manually define the range of mapping in the **Range of mapping** parameter.

3.1.7 Parameter set "Backwater mapping"

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backwater mapping

Distance

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backw. check value → Distance

Description Displays the distance d currently measured for the downstream sensor.

Range of mapping

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backwater mapping → Range of mapping

Description Specify the range of mapping for the downstream sensor.

Additional information
- For **Check distance** = **Distance = ok** and **Distance too small**, a suitable range of mapping is already entered.
- Enter a suitable range of mapping for **Check distance** = **Manual**.

Start mapping

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backwater mapping → Start mapping

Description Start mapping.

Additional information

Meaning of the options
- **Yes**
  The mapping curve is recorded.
- **No**
  No mapping curve is recorded.

3.1.8 Parameter set "Backwater status"

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Status backwater

Act. backw. level

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backwater → Act. backw. level

Description Displays the current downstream level h_2.

Distance

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backw. check value → Distance

Description Displays the distance d currently measured for the downstream sensor.

Flow 1

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Backwater → Flow 1

Description Displays the current flow Q.

Status

Navigation Flow → Flow 1+ backwater → Backwater → Basic setup → Status backwater → Status

Description Specify the status of interference echo suppression (mapping) for the downstream sensor.

Additional information

Meaning of the options
- **Enable map**
  The mapping curve is taken into consideration during signal evaluation.
- **Disable map**
  The mapping curve is not taken into consideration during signal evaluation. The curve remains stored in the device, however.
- **Delete map**
  The existing mapping curve is deleted.

3.2 Submenu "Backwater → Extended calibr."

3.2.1 Parameter set "Backwater mapping"

3.2.2 Parameter set "Backw dist. corr"

Navigation Flow → Flow 1+ backwater → Backwater → Extended calibration → Backw dist. corr

Sensor offset

Navigation Flow → Flow 1+ backwater → Backwater → Extended calibration → Backw dist. corr → Sensor offset

Description Specify the distance correction for the downstream sensor.

Factory setting 0 mm

Additional information The value entered is added to the measured distance.

3.2.3 Parameter set "Backw. correction"

Navigation Flow → Flow 1+ backwater → Backwater → Extended calibration → Backw. correction

Offset

Navigation Flow → Flow 1+ backwater → Backwater → Extended calibration → Backw. correction → Offset

Description Specify the level offset.

Factory setting 0 mm

Additional information The value entered is added to the measured downstream level $\mathbf{h_2}$.

3.2.4 Parameter set "Backw. blocking distance"

Navigation Flow → Flow 1+ backwater → Backwater → Extended calibration → Backw. Blocking distance

Blocking distance

Navigation Flow → Flow 1+ backwater → Backwater → Extended calibration → Backw. Blocking distance → Blocking distance

Description Displays the blocking distance of the downstream sensor.

3.2.5 Parameter set "Backw. limitation"

Navigation Flow → Flow 1+ backwater → Backwater → Extended calibration → Backw. limitation

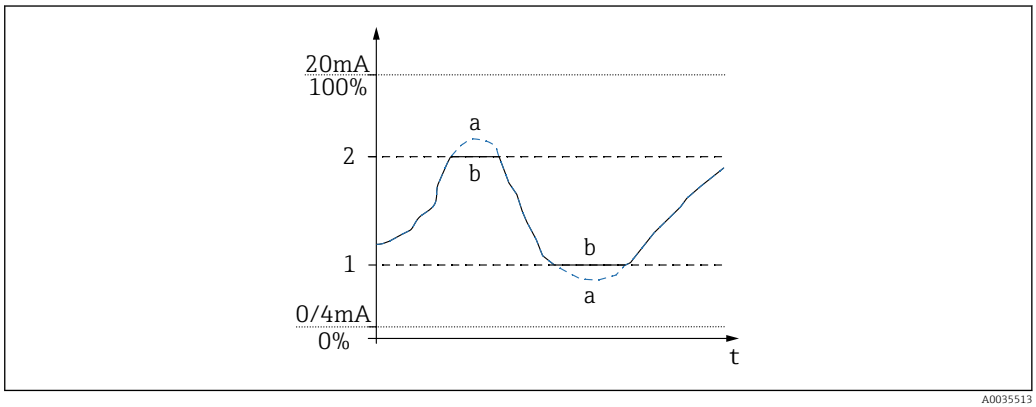
Limitation

Navigation Flow → Flow 1+ backwater → Backwater → Extended calibration → Backw. limitation → Limitation

Description Specify whether a lower/upper threshold limit is to be set for the measured value.

Selection
- Off
- Lower limit
- Upper limit
- Low/high limit

Additional information The value for the limits is defined in the **High limit** and **Low limit** parameters:



27 *Measured value limitation*

1 Lower limit
2 Upper limit
a Unlimited signal
b Limited signal

Upper limit

Navigation Flow → Flow 1+ backwater → Backwater → Extended calibration → Backw. limitation → Upper limit

Prerequisite **Limitation** = **high limit** or **low/high limit**

Description Specify the high limit for the downstream level.

Lower limit

Navigation Flow → Flow 1+ backwater → Backwater → Extended calibration → Backw. limitation → Lower limit

Prerequisite **Limitation** = **low limit** or **low/high limit**

Description Specify the low limit for the downstream level.

3.2.6 Parameter set "Backw. ext. input M"

The parameters in this parameter set assign one or two point level switches M (e.g. a minimum and a maximum point level switch) to the downstream sensor. If one of the switches issues a signal, the backwater level adopts a certain value, irrespective of the current echo signal.

Only available on devices with an additional input (FMU90-********B***)

Additional conditions

- If both assigned point level switches issue a signal simultaneously, the value of the second input is set.
- The switching direction of point level switch K (K = 1 to 4) can be inverted under: **Sensor management** → **FDU sensor** → **External digin** → **External digin K** → **Invert**
- If the output signal has been limited (parameter set **Backw.limitation**), this limitation specifies the maximum and minimum output signal - irrespective of the behavior of the point level switches.
- The output signal defined by this parameter set has priority over the value of the external send controller (**Sensor management**→ **Input** → **FDU sensor N** → **Ext. send ctrl.** → **value**)

Navigation Flow → Flow 1+ backwater → Backwater → Extended calibration → Backw. ext. input M

Input M

Navigation Flow → Flow 1+ backwater → Backwater → Extended calibration → Backw. ext. input M → Input M

Description Assign the point level switch M to the downstream sensor.

Factory setting Disabled

Additional information

Meaning of the options

- **Ext. digin 1**
  Point level switch at terminals 71, 72, 73
- **Ext. digin 2**
  Point level switch at terminals 74, 75, 76
- **Ext. digin 3**
  Point level switch at terminals 77, 78, 79
- **Ext. digin 4**
  Point level switch at terminals 80, 81, 82

Function

Navigation Flow → Flow 1+ backwater → Backwater → Extended calibration → Backw. ext. input M → Function

Description Specify the value of the downstream level h_2 if limit value overshoot or undershoot is detected.

Factory setting Off

Additional information

Meaning of the options
- **Off**
  No effect on the backwater level
- **Min (0%)**
  Backwater level: 0%
- **Max (100%)**
  Backwater level: 100%
- **Hold**
  The backwater level is held at its current value.
- **User specific**
  Backwater level: The level defined in the **Value** parameter

Value

Navigation

Flow → Flow 1+ backwater → Flow → Extended calibration → Backw. ext. input M → Value

Prerequisite

Function = **User specific**

Description

Use this function to specify the value the backwater level adopts if the point level switch issues a signal. The value is indicated in the level unit.

3.3 Submenu "Backwater → Simulation"

3.3.1 Parameter set "Backw. simulation"

Navigation Flow → Flow 1+ backwater → Backwater → Simulation → Backwater simulation Backwater

Simulation

Navigation Flow → Flow 1+ backwater → Backwater → Simulation → Backwater simulation Backwater → Simulation

Description Select the simulation mode

Factory setting Sim. off

Additional information

Meaning of the options
- **Sim. off**
  No simulation (normal measuring mode)
- **Sim. level**
  Enter a downstream level in the **Sim. level value** parameter. Backwater detection follows this value.

If simulation is active, the device displays an error message to this effect.

Sim. level value

Navigation Flow → Flow 1+ backwater → Backwater → Simulation → Backwater simulation Backwater → Sim. level value

Prerequisite **Simulation** = **Sim. level**

Description Enter the downstream level to be simulated.

4 Menu "Flow counter"

Navigation to the submenu:
Flow → Flow counter

4.1 Submenu "Flow counter → Totalizer"

Totalizers are non-resettable flow counters. For resettable flow counters, see the **Flow counter → Daily counter** submenu.

4.1.1 Parameter set "Totalizer N" (N = 1 - 3)

Navigation Flow → Flow counter → Totalizer → Totalizer N

Allocation

Navigation Flow → Flow counter → Totalizer → Totalizer N → Allocation

Description Assign a flow channel, or a value calculated from several channels (sum, difference, average), to the counter.

Counter unit

Navigation Flow → Flow counter → Totalizer → Totalizer N → Counter unit

Description Select the volume unit for flow counting.

Value

Navigation Flow → Flow counter → Totalizer → Totalizer N → Value

Description Displays the flow currently measured.

Overflow x 10^7

Navigation Flow → Flow counter → Totalizer → Totalizer N → Overflow x 10^7

Description Indicates the number of times the flow counter has passed the overflow point. Therefore the total flow is calculated as follows:

V_{total} = overflow x 10^7 + value

Failure mode

Navigation Flow → Flow counter → Totalizer → Totalizer N → Failure mode

Description Specify the behavior of the counter if an operating error occurs.

Additional information

Meaning of the options

- **Stop**
  The counter is stopped.
- **Hold**
  The counter continues counting, and uses the flow value which was present when the error occurred.
- **Actual value**
  The counter continues counting, and uses the flow value currently measured (although its reliability is no longer guaranteed).

4.2 Submenu "Flow counter → Daily counter"

4.2.1 Parameter set "Daily counter" (N = 1 - 3)

Navigation Flow → Flow counter → Daily Counter → Daily counter N

Allocation

Navigation Flow → Flow counter → Daily Counter → Daily counter N → Allocation

Description Assign a flow channel, or a value calculated from several channels (sum, difference, average), to the counter.

Counter unit

Navigation Flow → Flow counter → Daily Counter → Daily counter N → Counter unit

Description Select the volume unit for flow counting.

Value

Navigation Flow → Flow counter → Daily Counter → Daily counter N → Value

Description Displays the flow currently measured.

Overflow x 10^7

Navigation Flow → Flow counter → Daily Counter → Daily counter N → Overflow x 10^7

Description Indicates the number of times the flow counter has passed the overflow point. Therefore the total flow is calculated as follows:

V_{total} = overflow x 10^7 + value

Reset

Navigation Flow → Flow counter → Daily Counter → Daily counter N → Reset

Description Select the **Yes** option to reset the daily counter to **0**.

Additional information

Meaning of the options
- **No**
  Value and **Overflow x 10^7** retain their values.
- **Yes**
  Value and **Overflow x 10^7** are reset to **0**.

Failure mode

Navigation Flow → Flow counter → Daily Counter → Daily counter N → Failure mode

Description Specify the behavior of the counter if an operating error occurs.

Additional information

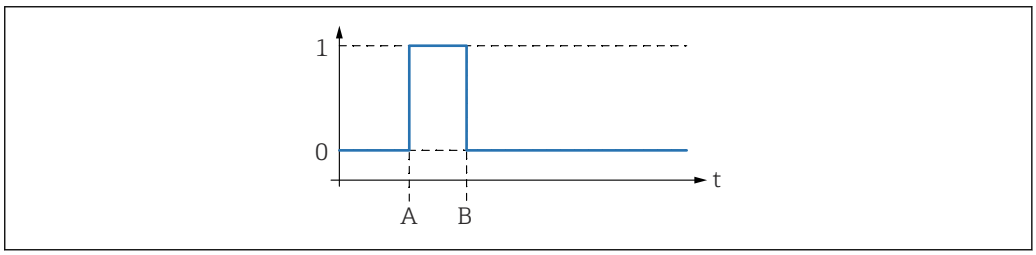
Meaning of the options
- **Stop**
  The counter is stopped.
- **Hold**
  The counter continues counting, and uses the flow value which was present when the error occurred.
- **Actual value**
  The counter continues counting, and uses the flow value currently measured (although its reliability is no longer guaranteed).

External reset

Navigation Flow → Flow counter → Daily Counter → Daily counter N → External reset

Description Select one of the digital outputs (DO), or one of the external switch inputs (DigIn) in the case of devices with additional digital inputs (FMU90- ********B**), with which the daily counter is reset.

Additional information



28 Daily counter reset using the external switch

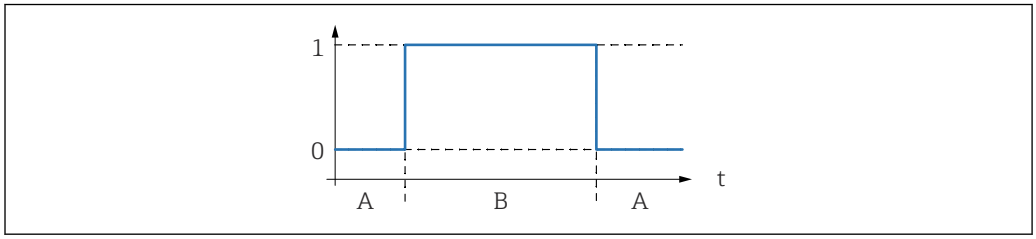
A When the external signal changes from "0" to "1", the daily counter is reset to "0".
B When the external signal changes from "1" to "0", the daily counter starts again.

External start

Navigation Flow → Flow counter → Daily Counter → Daily counter N → External start

Description Select one of the digital outputs (DO), or one of the external switch inputs (DigIn) in the case of devices with additional digital inputs (FMU90- ********B**), with which the daily counter can be started and stopped.

Additional information



29 Daily counter started and stopped using the external switch

A If the external signal is "0", the daily counter is stopped.
B If the external signal is "1", the daily counter starts.

5 Menu "Safety settings"

5.1 Parameter set "Output on alarm"

Navigation Safety settings → Output on alarm

Output N

Navigation Safety settings → Output on alarm → Output N

Description Specify the behavior of the current output in the event of an alarm.

Additional information

Meaning of the options
- **Min (3.6 mA)**
  Output current on alarm: 3.6 mA
- **Max (22 mA)**
  Output current on alarm: 22 mA
- **Hold**
  Output current on alarm: the last value before the alarm occurred
- **User specific**
  Output current on alarm: defined in the **Output value N** parameter

Output value N

Navigation Safety settings → Output on alarm → Output value N

Prerequisite **Output N** = **User specific**

Description Specify the value of the current output in the event of an alarm.

5.2 Parameter set "Outp. echo loss"

Navigation Safety settings → Outp. echo loss

Level N

Navigation Safety settings → Outp. echo loss → Level N

Description Specify the behavior of the level signal in the event of echo loss.

Additional information

Meaning of the options

- **Hold**
  The level value is held if an echo loss occurs.
- **Ramp %/min**
  After the set delay time (**Delay echo loss** parameter set) the level output value is shifted towards 0% (for a negative ramp) or towards 100% (for a positive ramp) with a configurable ramp (**Ramp level N** parameter).
- **User specific**
  After the set delay time (**Delay echo loss** parameter set), the level output adopts the value defined in the **Value level N** parameter.
- **Alarm**
  After the set delay time (**Delay echo loss** parameter set), the device adopts the alarm condition.

Ramp level N

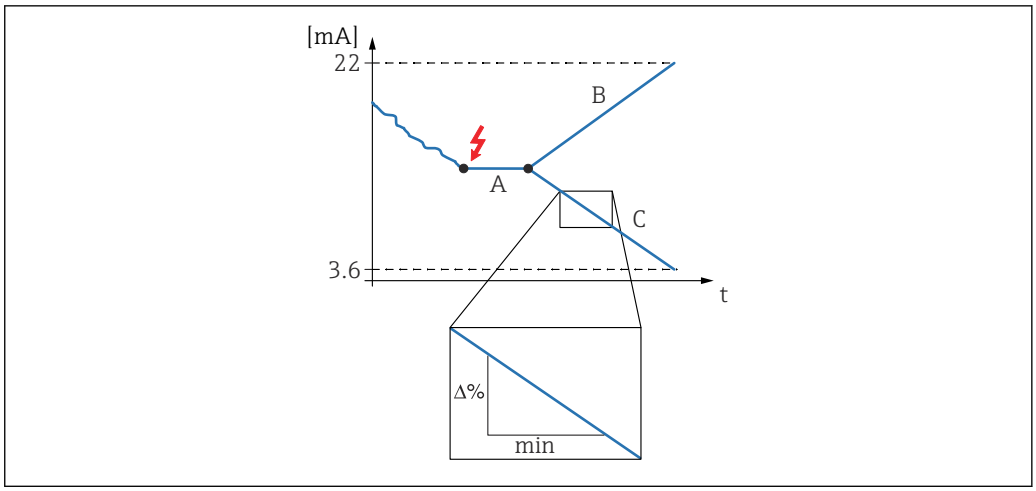
Navigation Safety settings → Outp. echo loss → Ramp level N

Prerequisite **Level N** = **Ramp %/min**

Description Define the slope of the ramp in the event of echo loss.

Unit: percentage of the measuring range per minute

Additional information



30 Ramp in event of echo loss

A Delay time
B Positive ramp
C Negative ramp

Value level N

Navigation Safety settings → Outp. echo loss → Value level N

Prerequisite **Level N** = **User specific**

Description Define the value of the level signal in the event of echo loss.

Flow N

Navigation Safety settings → Outp. echo loss → Flow N

Description Specify the behavior of the flow signal in the event of echo loss.

Additional information

Meaning of the options

- **Hold**
  The flow value is held if an echo loss occurs.
- **User specific**
  After the set delay time (**Delay echo loss** parameter set), the flow output adopts the value defined in the **Value flow N** parameter.
- **Alarm**
  After the set delay time (**Delay echo loss** parameter set), the device adopts the alarm condition.

Value flow N

Navigation Safety settings → Outp. echo loss → Value flow N

Prerequisite **Flow N** = **User specific**

Description Define the value of the flow signal in the event of echo loss.

5.3 Parameter set "Delay echo loss"

Navigation Safety settings → Delay echo loss

Delay Sensor N

Navigation Safety settings → Delay echo loss → Delay Sensor N

Description Define the delay time for echo loss.

Factory setting 60 s

Additional information After an echo loss, Prosonic S waits for the time specified in this parameter to pass before "Outp. echo loss" becomes active. This ensures that the measurement is not unnecessarily interrupted by temporary interferences.

5.4 Parameter set "Safety distance"

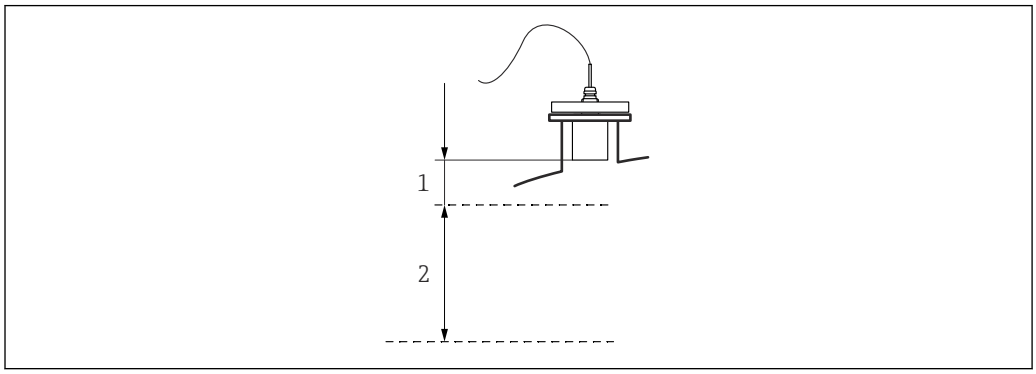
Navigation Safety settings → Safety distance

Saf. dist.sen N

Navigation Safety settings → Safety distance → Saf. dist.sen N

Description Define the safety distance for sensor N.

Additional information *Definition of the safety distance*

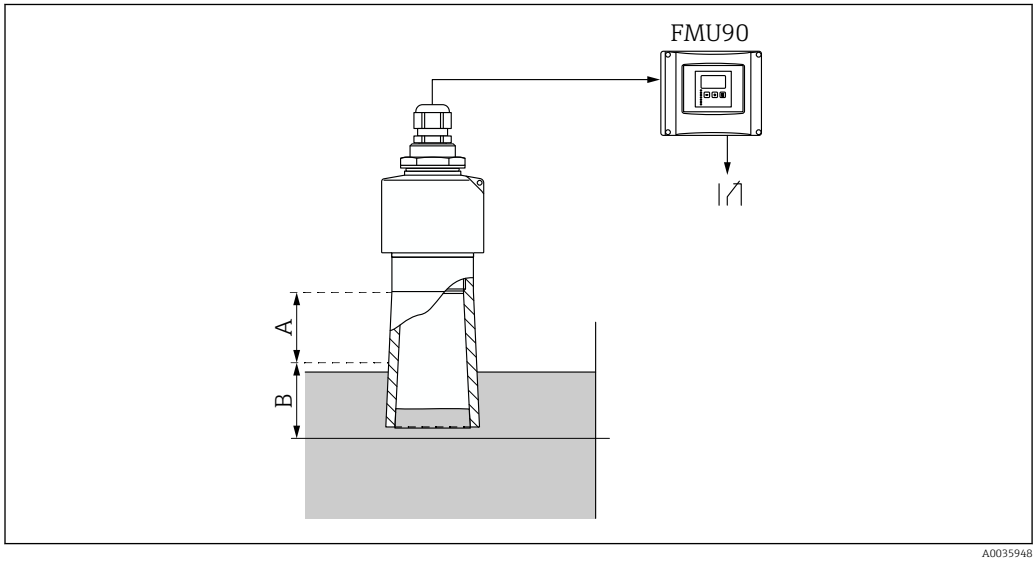


31 Definition of the safety distance

1 Blocking distance of the sensor (depends on the sensor type)
2 Safety distance

The safety distance is located immediately below the blocking distance. If the level enters the safety distance, Prosonic S generates a warning or an alarm.

Application example: flooding detection with FDU90 sensor with a flooding protection tube



32 Flooding detection with FDU90 sensor with a flooding protection tube

A Blocking distance FDU90 = 7 cm (2.8 in)
B Set the safety distance to 4 cm (1.6 in)

- To detect flooding, set the safety distance to 4 cm (1.6 in).
  A warning or an alarm is then generated shortly before the level reaches the flooding protection tube.
- In order to indicate that flooding is detected, configure the diagnostics relay with **Allocation M** = **Level in safety distance sensor N**

5.5 Parameter set "In safety dist."

Navigation Safety settings → In safety dist.

In saf. dist.s N

Navigation Safety settings → In safety dist. → In saf. dist.s N

Description Define how the device reacts if the safety distance is undershot.

Additional information

Meaning of the options

- **Warning**
  The device generates a warning (A01651 or A02651) but continues measuring.
  The warning disappears as soon as the level is no longer in the safety distance.
- **Alarm**
  The device adopts a defined output state (**Output on alarm** parameter set), and a warning (A01651 or A02651) is generated.
  The warning disappears as soon as the level is no longer in the safety distance, and the device continues measuring.
- **Self holding**
  The device adopts a defined output state (**Output on alarm** parameter set), and a warning (A01651 or A02651) is generated.
  The alarm state is maintained when the error leaves the safety distance. The self-holding function must first be reset (**Reset sen N** parameter) before the warning disappears and the device continues measuring.

Reset sen N

Navigation Safety settings → In safety dist. → Reset sen N

Prerequisite **In saf. dist.s N** = **Self holding**

Description Select the **Yes** option to reset the alarm.

Additional information

Meaning of the options

- **No**
  The alarm remains active.
- **Yes**
  The alarm is reset. Measurement is resumed.

5.6 Parameter set "React. high temp."

Navigation Safety settings → React. high temp.

Overtemp. sen N (N = 1 - 2)

Navigation Safety settings → React. high temp. → Overtemp. sen N

Description Define the behavior of the device if the maximum sensor temperature is exceeded.

Additional information

Meaning of the options
- **Warning**
  The device continues measuring but generates an error message (E01661 or E02661).
- **Alarm**
  The device adopts a defined output state (**Output on alarm** parameter set), and an error message (E01661 or E02661) is generated.

Max. temp. sen. N

Navigation Safety settings → React. high temp. → Max. temp. sen. N

Description Displays the maximum permissible temperature of the sensor.

5.7 Parameter set "Defect temp. sen."

Navigation Safety settings → Defect temp. sen.

Def.temp.sen N

Navigation Safety settings → Defect temp. sen. → Def.temp.sen N

Description Define the behavior of the device in the event of a defective temperature sensor.

Additional information

Meaning of the options

- **Warning**
  The device continues measuring but generates an error message (A01281 or A02281).
- **Alarm**
  The device adopts a defined output state (**Output on alarm** parameter set), and an error message (A01281 or A02281) is generated.

5.8 Parameter set "Relay delay"

Navigation Safety settings → Relay delay

Start delay relay

Navigation Safety settings → Relay delay → Start delay relay

Description Define the switching delay for the relays.

Factory setting 1 s

Additional information The relays do not all switch immediately after the supply voltage is switched on. Instead each relay switches after the defined relay delay. This prevents an overload of the power supply system.

6 Menu "Relay/controls"

6.1 Submenu "Relay configurat."

6.1.1 Parameter set "Relay N" (N = 1 - 6) (relay function)

Navigation Relay/controls → Relay configurat. → Relay N

Function

Navigation Relay/controls → Relay configurat. → Relay N → Function

Description Define the function of the relay.

Additional information

Meaning of the options

- **Limit**
  The relay indicates if the threshold limit of a selected measured variable is exceeded or undershot. Once this option has been selected, a picklist appears for the measured variable to be monitored.
  Additional parameters for the configuration of the limit value relay:
  - **Limit type**
  - **Switch-on point**
  - **Switch-off point**
  - **Switch on /min**
  - **Switch off /min**
  - **Upper switchpt.**
  - **Low switch point**
  - **Hysteresis**
- **Time pulse** (only available for flow measurements)
  A relay generates a pulse at regular intervals.
  Additional parameters for the configuration of the time pulse relay:
  - **Pulse width**
  - **Pulse time**
- **Counting pulse** (only available for flow measurements)
  The relay generates a pulse each time after a certain flow rate.
  Once this option has been selected, a picklist appears for the flow channel to which the counting should refer.
  Additional parameters for the configuration of the counting pulse relay:
  - **Counter unit**
  - **Pulse value**
  - **Pulse width**
  - **Pulse counter**
  - **Overflow x 10^7**
  - **Reset counter**
  - **Start counter**
  - **Stop counter**
- **Alarm / diagnost. → Alarm relay**
  The relay displays "Alarm"-type errors.
- **Alarm / diagnost. → Diagnostics**
  The relay indicates the occurrence of certain diagnostic messages. Up to two diagnostic messages can be assigned to a relay.
  Additional parameters for the configuration of the diagnostic relay:
  Allocation M

- **Alarm / diagnost. → Backw. alarm**
  Requirement: Backwater detection has been configured.
  The relay indicates that a backwater alarm has occurred.
- **Alarm / diagnost. → Dirt alarm**
  Requirement: Dirt detection has been configured.
  The relay indicates that a dirt alarm has occurred.
- **Fieldbus** (only for devices with PROFIBUS communication)
  The relay is coupled with a DO Block and switches according to the Block's value.
- **None**
  The relay is not used.

Limit relay for the sensor temperature
If a limit relay is linked to the temperature of a sensor N, then the temperature that was set in **Sensor management** → **US sensor N** → **Temp. measurement** is used. This temperature can be:
- Sensor temperature
- Average of the sensor temperature and the temperature of the external sensor
- Temperature of the external sensor

Limit type

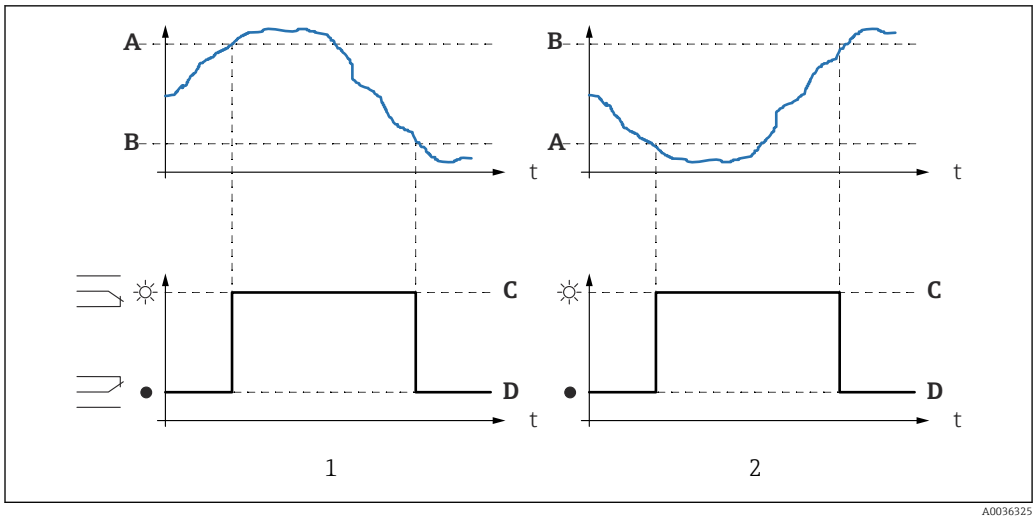
Navigation Relay/controls → Relay configurat. → Relay N → Limit type

Prerequisite **Function** = **Limit**

Description Define the limit type.

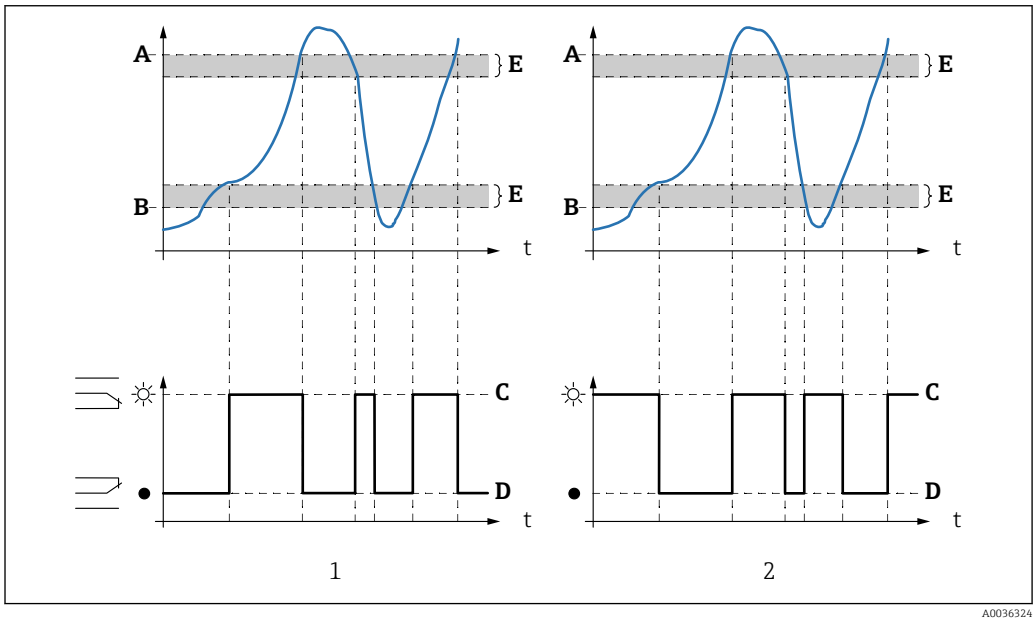
Additional information

Meaning of the options
- **Limit type = Standard**
  The switching behavior is based on the relative position of the two switch points (**Switch-on point** and **Switch-off point** parameters):
  - **Switch-on point > Switch-off point:**
    The relay is energized when the measured value exceeds the switch-on point.
    The relay is de-energized when the measured value drops below the switch-off point.
  - **Switch-on point < Switch-off point:**
    The relay is energized when the measured value drops below the switch-on point.
    The relay is de-energized when the measured value exceeds the switch-off point.
- **Limit type = Tendency/speed**
  Identical to the **Standard** limit type. The only difference is that temporal variations of the measured value are examined for limit value overshoot instead of the measured value itself (**Switch-on /min** and **Switch-off /min** parameters).
- **Limit type = Inband**
  The switching behavior is defined by two switch points (**Upper switchpt.** and **Lower switchpt.** parameters):
  - The relay is energized when the measured value is between the two switch points.
  - The relay is de-energized when the measured value is outside the two switch points.
- **Limit type = Out of band**
  The switching behavior is defined by two switch points (**Upper switchpt.** and **Lower switchpt.** parameters):
  - The relay is energized when the measured value is outside the two switch points.
  - The relay is de-energized when the measured value is between the two switch points.



33 *Relay switching behavior for "Limit type" = "Standard" or "Tendency/speed"*

1 "Switch-on point" > "Switch-off point"
2 "Switch-off point" > "Switch-on point"
A Switch-on point
B Switch-off point
C Relay energized
D Relay de-energized



34 *Relay switching behavior for "Limit type" = "Inband" and "Out of band"*

1 "Limit type" = "Inband"
2 "Limit type" = "Out of band"
A Upper switch point
B Lower switch point
C Relay energized
D Relay de-energized
E Hysteresis

Switch-on point

Navigation Relay/controls → Relay configurat. → Relay N → Switch-on point

Prerequisite **Limit type**= **Standard**

Description Define the switch-on point.

Switch-off point

Navigation Relay/controls → Relay configurat. → Relay N → Switch-off point

Prerequisite **Limit type**= **Standard**

Description Define the switch-off point.

Switch on /min

Navigation Relay/controls → Relay configurat. → Relay N → Switch on /min

Prerequisite **Limit type**= **Tendency/speed**

Description Define the switch-on point (measured value change / min).

Switch off /min

Navigation Relay/controls → Relay configurat. → Relay N → Switch off /min

Prerequisite **Limit type**= **Tendency/speed**

Description Define the switch-off point (measured value change / min).

Upper switchpt.

Navigation Relay/controls → Relay configurat. → Relay N → Upper switchpt.

Prerequisite **Limit type** = **Inband** or **Out of band**

Description Define the upper switch point.

Low switch point

Navigation Relay/controls → Relay configurat. → Relay N → Low switch point

Prerequisite **Limit type** = **Inband** or **Out of band**

Description Define the lower switch point.

Hysteresis

Navigation Relay/controls → Relay configurat. → Relay N → Hysteresis

Prerequisite **Limit type** = **Inband** or **Out of band**

Description Define the hysteresis for the upper and lower switch point.

Pulse width

Navigation Relay/controls → Relay configurat. → Relay N → Pulse width

Prerequisite **Function** = **Time pulse** or **Counting pulse**

Description Define the duration of each individual pulse.

User entry 200 to 60 000 ms

Factory setting 200 ms

Additional information

- **Maximum pulse width**
  The selected pulse width must be small enough to ensure that the maximum frequency can be output without the pulses overlapping:
  Pulse width < (pulse value) / (max. flow)
- **Maximum pulse width for PROFIBUS DP devices**
  1 000 ms

Pulse time

Navigation Relay/controls → Relay configurat. → Relay N → Pulse time

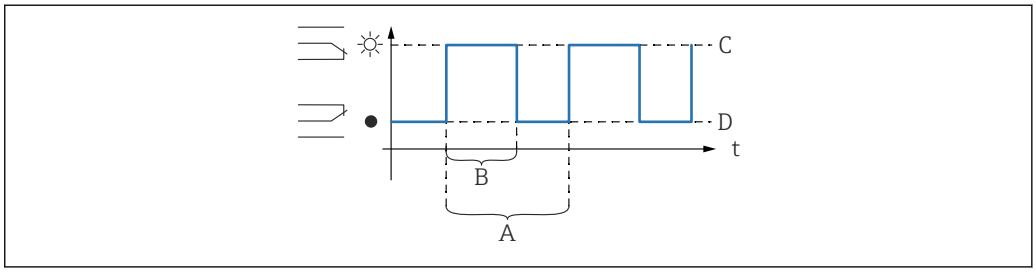
Prerequisite **Function** = **Time pulse**

Description Define the time interval between the individual pulses.

User entry 1 to 65 000 min

Factory setting 1 min

Additional information



35 *Configuration of a time pulse relay*

A Pulse time
B Pulse width
C Relay energized
D Relay de-energized

Counter unit

Navigation Relay/controls → Relay configurat. → Relay N → Counter unit

Prerequisite **Function** = **Counting pulse**

Description Select the volume unit for flow counting.

Selection

- l
- hl
- Ml
- m^3
- dm^3
- cm^3
- ft^3
- $inch^3$
- us gal
- us mgal
- i gal
- barrels

Factory setting l

Pulse value

Navigation Relay/controls → Relay configurat. → Relay N → Pulse value

Prerequisite **Function** = **Counting pulse**

Description Select the flow volume after which a pulse is generated.

Factory setting 100 m^3

Additional information

Minimum pulse value
The selected pulse value must be such that the maximum relay switching frequency of 2 Hz is not exceeded even at the maximum flow of the flume or weir:
Pulse value > (max. flow) / (2 Hz)

Allocation M (M = 1 or 2)

Navigation Relay/controls → Relay configurat. → Relay N → Allocation M

Prerequisite **Function** = **Alarm / diagnostics → Diagnostics**

Description Assign a diagnostic message to the relay.

Additional information

Meaning of the options
- **Echo loss sen N**
  Echo loss of sensor N
- **Def. temp. sen N**
  The temperature sensor of sensor N is defective.
- **Def. ext. temp S N**
  The external temperature sensor is defective.
- **Acc. def. T**
  One of the temperature sensors is defective.
- **Overtemp. sen N**
  The maximum permitted temperature of sensor N is exceeded.
- **Acc. overtemp.**
  The maximum permitted temperature of one of the connected sensors is exceeded.
- **Level in safety distance sensor N**
  The measured distance has dropped below the safety distance for sensor N.
- **Acc safetydist**
  The measured distance has dropped below the safety distance for one of the connected sensors.

6.1.2 Parameter set "Relay N" (pulse counter)

The parameter set is only available if the **Function** = **Counting pulse**.

Navigation Relay/controls → Relay configurat. → Relay N

Pulse counter

Navigation Relay/controls → Relay configurat. → Relay N → Pulse counter

Prerequisite **Function** = **Counting pulse**

Description Indicates how many pulses have already been generated.

Overflow x 10^7

Navigation Relay/controls → Relay configurat. → Relay N → Overflow x 10^7

Prerequisite **Function** = **Counting pulse**

Description Indicates how often the counter has passed the overflow point of $1 \cdot 10^7$ counting pulses.

Additional information The total flow rate is:
V_{total} = (overflow x 10^7 + pulse counter) x pulse value

Reset counter

Navigation Relay/controls → Relay configurat. → Relay N → Reset counter

Prerequisite **Function** = **Counting pulse**

Description Select the **Yes** option to reset the counter.

Additional information **Meaning of the options**
- **No**
  Pulse counter and **overflow x 10^7** keep their values.
- **Yes**
  Pulse counter and **overflow x 10^7** are reset to 0.

Start counter

Navigation Relay/controls → Relay configurat. → Relay N → Start counter

Prerequisite **Function** = **Counting pulse**

Description Specify the lower flow limit for counting. Flows below this value are ignored during counting.

Unit: % of the maximum flow (**Max. flow** parameter)

Factory setting 0 %

Additional information This parameter can be used for flumes or weirs with a graduated (stepped) structure in order to limit the flow measurement to the upper part of the flume/weir.

Stop counter

Navigation Relay/controls → Relay configurat. → Relay N → Stop counter

Prerequisite **Function** = **Counting pulse**

Description Specify the upper flow limit for counting. Flows above this value are ignored during counting.

Unit: % of the maximum flow (**Max. flow** parameter)

Factory setting 100 %

Additional information This parameter can be used for flumes or weirs with a graduated (stepped) structure in order to limit the flow measurement to the lower part of the flume/weir.

6.1.3 Parameter set "Relay N" (switching behavior)

Navigation Relay/controls → Relay configurat. → Relay N

Switch delay

Navigation Relay/controls → Relay configurat. → Relay N → Switch delay

Prerequisite **Function** = **Limit**

Description Define the switching delay for the relay.

Unit: seconds

Additional information When the value passes the switch-on point, the relay is not energized immediately. Instead it is only energized after the specified switching delay. The measured value must be above the switch-on point during the entire delay time.

Invert

Navigation Relay/controls → Relay configurat. → Relay N → Invert

Description Specify the switching direction of the relay.

Additional information **Meaning of the options**
- **No**
  The relay switches as described in the sections above.
- **Yes**
  The switching direction of the relay is inverted in relation to the description in the sections above.

Failure mode

Navigation Relay/controls → Relay configurat. → Relay N → Failure mode

Prerequisite Not available for alarm and diagnostics relays.

Description Specify the behavior of the relay if an error occurs.

Additional information

Meaning of the options

- **Actual value**
  The relay switches according to the current measured value (even though the reliability of the measured value is not guaranteed).
- **Hold**
  - Limit value relay: the current switching state of the relay is held.
  - Counting pulse relay: counting continues, using the flow which was present when the error occurred.
- **Switch on** (only available if **Function** = **Limit**)
  The relay is energized.
- **Switch off** (only available if **Function** = **Limit**)
  The relay is de-energized.
- **Stop** (only available if Function = **Time pulse** or **Counting pulse**)
  No pulses are generated as long as the error is present.

6.2 Submenu "Pump control " (standard)

This section applies to devices with standard pump control:
- FMU90-*1**********
- FMU90-*2**********

For devices with extended pump control, see: → 113

6.2.1 Parameter set "Pump control N" (allocation of pumps)

Navigation Relay/controls → Pump control N

Reference

Navigation Relay/controls → Pump control N → Reference

Description Specify the level to which the pump control refers.

Selection
- None
- Level 1
- Level 2 (for devices with two sensor inputs)

Factory setting None

Number of pumps

Navigation Relay/controls → Pump control N → Number of pumps

Description Specify the number of pumps to be controlled.

User entry 1 to 6

Factory setting 1

Additional information A free relay must be available on the Prosonic S for each pump.

6.2.2 Parameter set "Pump control N" (function)

Navigation Relay/controls → Pump control N

Function

Navigation Relay/controls → Pump control N → Function

Description Select the pump control function.

Additional information

Meaning of the options
- **Limit control**
  Each pump has its own switch-on and switch-off point.
- **Rate control**
  The switch-on and switch-off points are identical for all the pumps. If the switch limit has been exceeded, multiple pumps are switched on in succession until a defined pump rate is reached.

6.2.3 Parameter set "Pump M / control N" (pump configuration for limit value control)

Navigation Relay/controls → Pump M/control N

Switch-on point

Navigation Relay/controls → Pump M/control N → Switch-on point

Description Define the switch-on point for pump M.
Use the level unit (LVL unit) selected beforehand for your entry.

Switch-off point

Navigation Relay/controls → Pump M/control N → Switch-off point

Description Define the switch-off point for pump M.
Use the level unit (LVL unit) selected beforehand for your entry.

Switch-on delay

Navigation Relay/controls → Pump M/control N → Switch-on delay

Description Define the switch-on delay for pump M.

Additional information Define different switch-on delays for different pumps. This makes it possible to avoid overloading the power supply system, which can happen if several pumps are switched on simultaneously.

Alternate

Navigation Relay/controls → Pump M/control N → Alternate

Description Specify whether pump M is to be included in the alternating pump control system.

Additional information **Meaning of the options**
- **No**
  The pump is switched according to its own switch points.
- **Yes**
  The pump is included in the alternating pump control system.

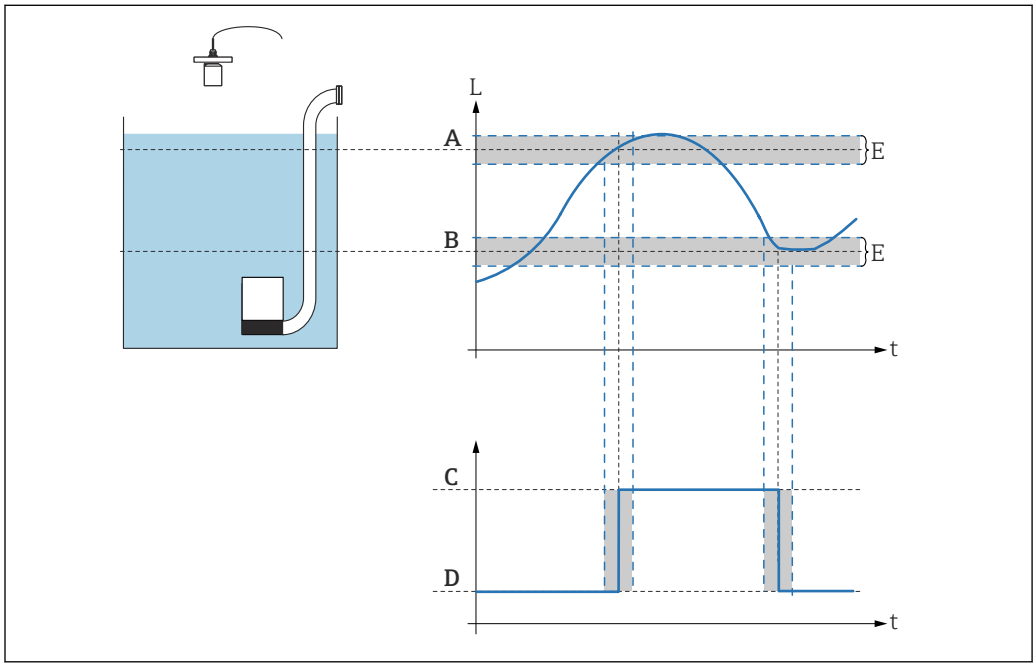
Alternating pump control
With alternating pump control, the switch points are not assigned to any specific pump. Instead the relays are switched in such a way that shares the workload as evenly as possible among all the pumps.

Crust reduction

Navigation Relay/controls → Pump M/control N → Crust reduction

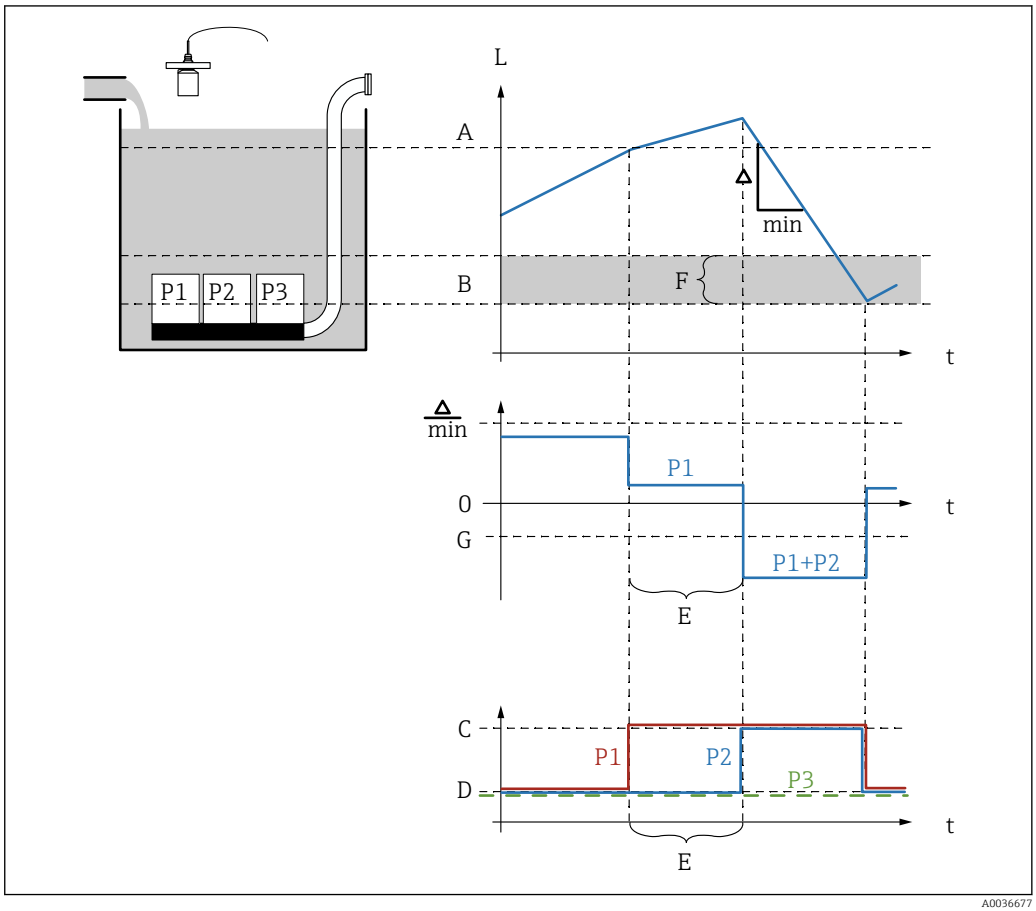
Description Define a percentage fluctuation for the switch-on and switch-off point of pump M.

Additional information The position of the switch points randomly varies within the given fluctuation range. This helps avoid buildup and crust formation:



6.2.4 Parameter set "Pump control N" (configuration of pump rate control)

Operating principle of pump rate control



36 *Operating principle of pump rate control*

A Switch-on point
B Switch-off point
C Pump on
D Pump off
E Hook up interval
F Switch on border
G Min. pump rate/min

Description of the parameters

Navigation Relay/controls → Pump control N

Switch-on point

Navigation Relay/controls → Pump control N → Switch-on point

Description Define the switch-on point for pump rate control.

Switch-off point

Navigation Relay/controls → Pump control N → Switch-off point

Description Define the switch-off point for pump rate control.

Min. pump rate/min

Navigation Relay/controls → Pump control N → Min. pump rate/min

Description Define the minimum pump rate.

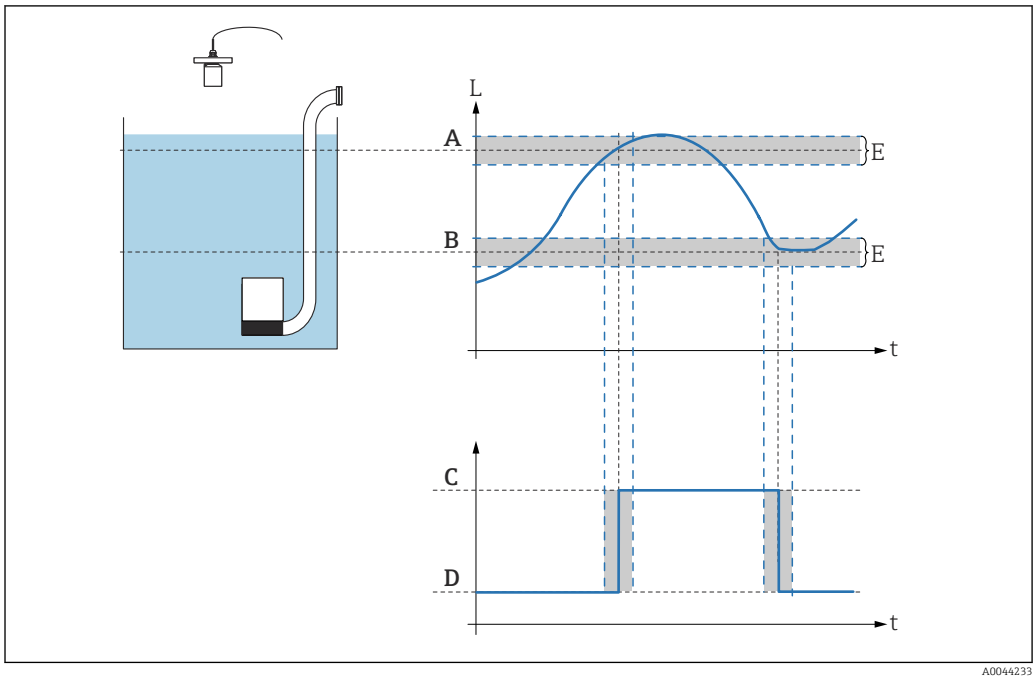
Additional information When the switch-on point has been exceeded (or undershot), additional pumps are switched on gradually until the set minimum pump rate is reached.

Crust reduction

Navigation Relay/controls → Pump M/control N → Crust reduction

Description Define a percentage fluctuation for the switch-on and switch-off point.

Additional information The position of the switch points randomly varies within the given fluctuation range. This helps avoid buildup and crust formation:



A0044233

Switch on border

Navigation Relay/controls → Pump control N → Switch on border

Description Define the switch-on border for pump rate control.

Additional information If the distance between the level and the switch-off point is smaller than the switch-on border, no additional pumps are switched on even if the pump rate has not yet been reached.

Hook up interval

Navigation Relay/controls → Pump control N → Hook up interval

Description In the case of pump rate control, define the interval after which the next pump is switched on.

Alternate

Navigation Relay/controls → Pump M/control N → Alternate

Description Specify whether alternating pump control is to be used for pump rate control.

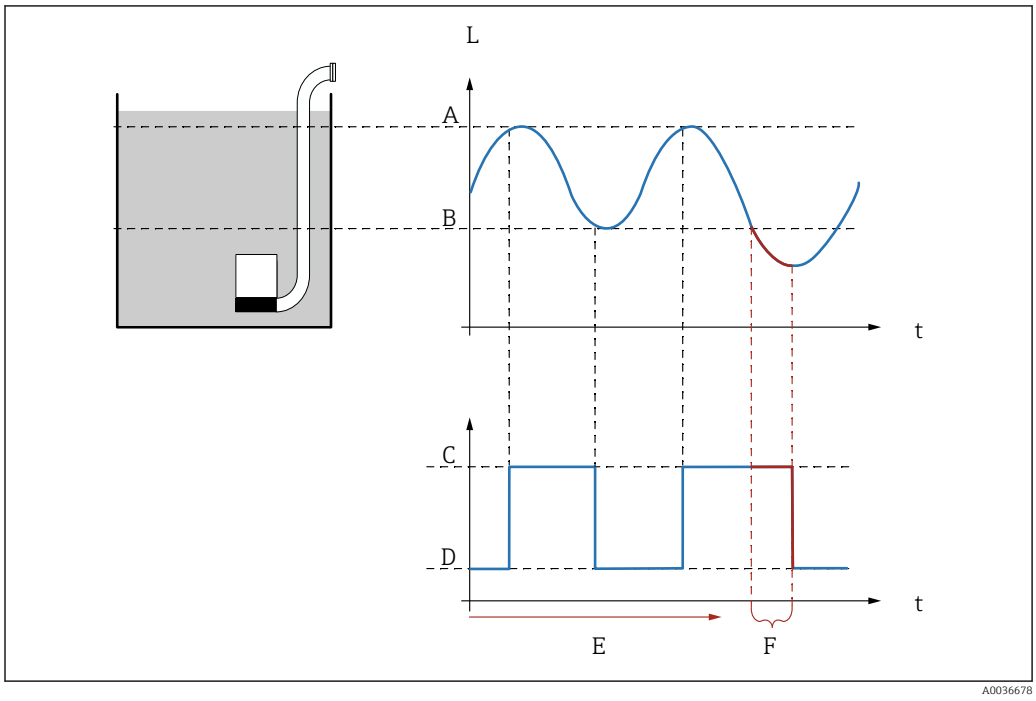
Additional information

Meaning of the options

- **No**
  The pumps are switched on and off in a fixed sequence.
- **Yes**
  The pumps are switched on and off alternately to ensure the workload is shared as equally as possible among the pumps.

6.2.5 Parameter set "Pump M / control N" (pump switching behavior)

Pump switching behavior



37 *Pump switching behavior*

A Switch-on point
B Switch-off point
C Pump on
D Pump off
E Backlash interval
F Backlash time

Description of the parameters

Navigation Relay/controls → Pump M/control N

Backlash interval

Navigation Relay/controls → Pump M/control N → Backlash interval

Description Define the interval after which a pump chamber should continue to be pumped after the configured switch-off point has been reached.

Backlash time

Navigation Relay/controls → Pump M/control N → Backlash time

Description Define the duration of the additional pumping process.

Failure mode

Navigation Relay/controls → Pump M/control N → Failure mode

Description Define the failure mode of the pump relay.

Additional information

Meaning of the options

- **Hold**
  The current switching state of the relay is maintained.
- **Switch on**
  The relay is energized (i.e. the pump is switched on).
- **Switch off**
  The relay is de-energized (i.e. the pump is switched off).
- **Actual value**
  The relay switches according to the current measured value (even though the reliability of the measured value is not guaranteed).

6.2.6 Parameter set "Relay allocation → Relay K" (K = 1 - 6)

Navigation Relay/controls → Pump control N → Relay allocation → Relay K

Function

Navigation Relay/controls → Pump control N → Relay allocation → Relay K → Function

Description Select the **Pump M control N** option to allocate the relay K to the pump M of pump control N.

Invert

Navigation Relay/controls → Pump control N → Relay allocation → Relay K → Invert

Description Specify the switching direction of the relay.

Additional information

Meaning of the options

- **No**
  The relay switches as described in the sections above.
- **Yes**
  The switching direction of the relay is inverted in relation to the description in the sections above.

6.3 Submenu "Pump control" (extended)

This section applies to devices with standard pump control:
- FMU90-*3**********
- FMU90-*4**********

For devices with standard pump control, see: → 103

6.3.1 Submenu "Basic setup"

Parameter set "Pump control N" (allocation of pumps)

Navigation Relay/controls → Pump control N

Reference

Navigation Relay/controls → Pump control N → Reference

Description Specify the level to which the pump control refers.

Selection
- None
- Level 1
- Level 2 (for devices with two sensor inputs)

Factory setting None

Number of pumps

Navigation Relay/controls → Pump control N → Number of pumps

Description Specify the number of pumps to be controlled.

User entry 1 to 6

Factory setting 1

Additional information A free relay must be available on the Prosonic S for each pump.

Standby pump

Navigation Relay/controls → Pump control N → Standby pump

Prerequisite Device with external switch input: FMU90-********B***

Description Specify whether one of the pumps acts as a standby pump.

Additional information

Meaning of the options
- **No**
  There is no standby pump.
- **Yes**
  The last pump acts as the standby pump.

Example
Number of pumps = 5
Standby pump = Yes
→ Pump control for pumps 1 - 4; pump 5 is the standby pump.

If a pump failure is reported, the standby pump takes over from the failed pump and adopts its configured values (switch points, etc.).

Reset

Navigation Relay/controls → Pump control N → Reset

Description Select **Yes** to restart pump control.

Additional information

Meaning of the options
- **No**
  Pump control is not restarted.
- **Yes**
  Pump control is restarted.

The reset acts like a power supply interruption. It does not affect the configuration of the pump control. Pump error messages are reset.

Parameter set "Pump control N" (function)

Navigation Relay/controls → Pump control N

Function

Navigation Relay/controls → Pump control N → Function

Description Select the pump control function.

Additional information

Meaning of the options
- **Limit parallel**
  Each pump has a switch-on point and a switch-off point. Several pumps can be switched on simultaneously.
- **Limit single**
  Each pump has a switch-on point and a switch-off point. Only one pump can be switched on at a time.
- **Rate control**
  There is only one switch-on point and one switch-off point. If the switch limit has been exceeded, multiple pumps are switched on in succession until a defined pump rate is reached.

Load control

Navigation Relay/controls → Pump control N → Load control

Description Specify how the load of the pumps is measured.

Additional information

Meaning of the options
- **In order**
  - If a pump is to be switched on, the system chooses the pump that has currently been switched off longer than any other pump.
  - If a pump is to be switched off, the system chooses the pump that has currently been switched on longer than any other pump.
- **Time of use**
  The total operating time so far is considered for each pump.
- **Starts**
  The number of starts is considered for each pump, irrespective of the length of time the pump was running after each individual start.
- **Starts + time**
  Like the "Starts" option, but a maximum use time is also defined for each pump (**Max.time of use** parameter). If the pump has been running for this time since the last start, it is automatically switched off and replaced by another pump.

Parameter set "Pump M / control N" (pump configuration for limit value control)

Navigation Relay/controls → Pump M/control N

Switch-on point

Navigation Relay/controls → Pump M/control N → Switch-on point

Description Define the switch-on point for pump M.
Use the level unit (LVL unit) selected beforehand for your entry.

Switch-off point

Navigation Relay/controls → Pump M/control N → Switch-off point

Description Define the switch-off point for pump M.
Use the level unit (LVL unit) selected beforehand for your entry.

Switch-on delay

Navigation Relay/controls → Pump M/control N → Switch-on delay

Description Define the switch-on delay for pump M.

Additional information Define different switch-on delays for different pumps. This makes it possible to avoid overloading the power supply system, which can happen if several pumps are switched on simultaneously.

Alternate

Navigation Relay/controls → Pump M/control N → Alternate

Description Specify whether pump M is to be included in the alternating pump control system.

Additional information

Meaning of the options
- **No**
  The pump is switched according to its own switch points.
- **Yes**
  The pump is included in the alternating pump control system.

Alternating pump control
With alternating pump control, the switch points are not assigned to any specific pump. Instead the relays are switched in such a way that shares the workload as evenly as possible among all the pumps.

Degree of use

Navigation Relay/controls → Pump M/control N → Degree of use

Prerequisite **Load control** = **Time of use** or **Starts**

Description Define the desired percentage degree of usage of the pump.

Additional information

- The percentage degree of usage is only achieved if alternating pump control is set for this pump (**Alternate** = **Yes**).
- The total degree of usage of all pumps participating in alternating pump control should be 100%.

Max. use time

Navigation Relay/controls → Pump M/control N → Max. use time

Prerequisite **Load control** = **Starts + time**

Description Specify the maximum use time for the pump.

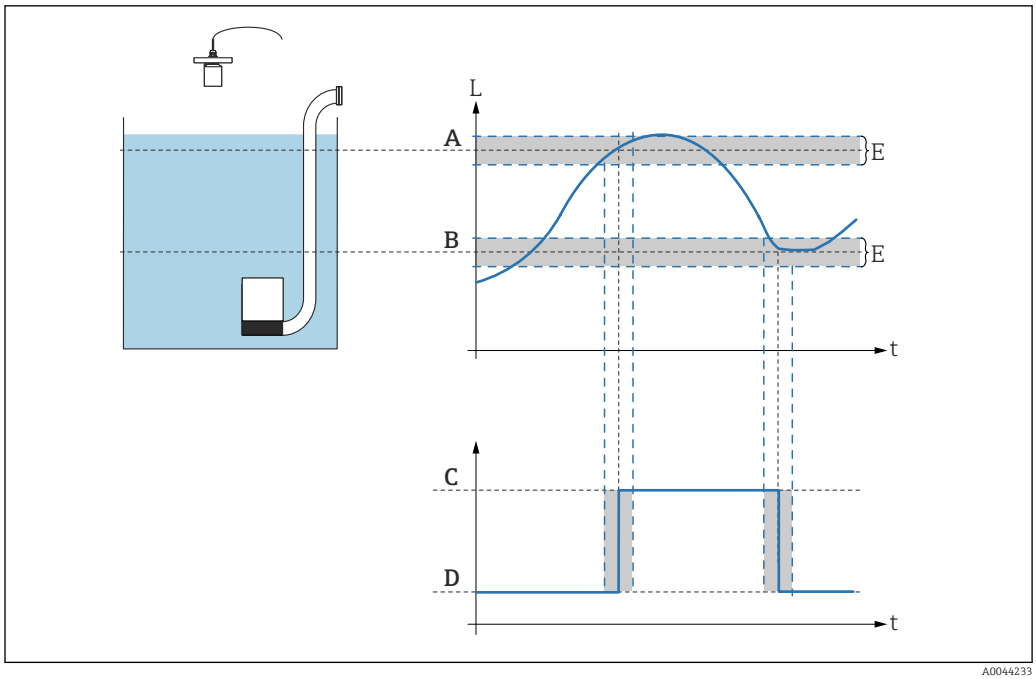
Additional information Once the pump has been running for this time, it is automatically switched off and replaced by another pump.

Crust reduction

Navigation Relay/controls → Pump M/control N → Crust reduction

Description Define a percentage fluctuation for the switch-on and switch-off point of pump M.

Additional information The position of the switch points randomly varies within the given fluctuation range. This helps avoid buildup and crust formation: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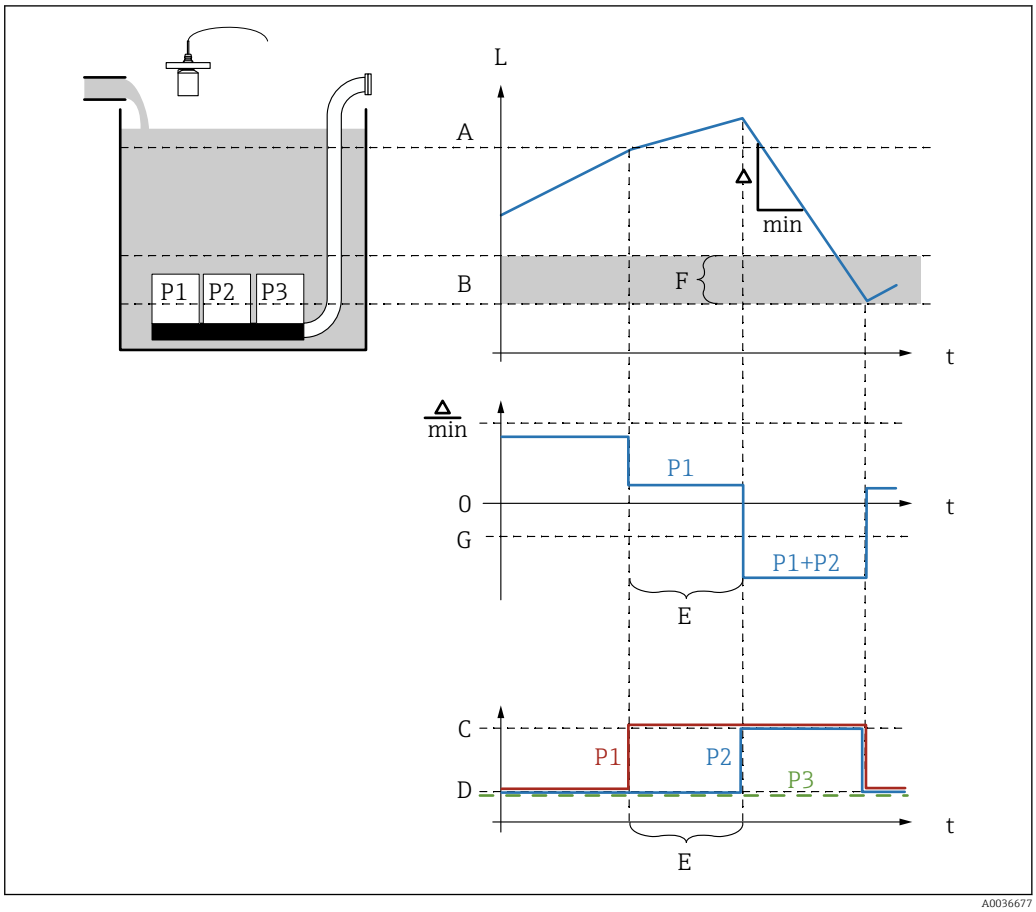
Parameter set "Pump control N" (configuration of pump rate control)

Operating principle of pump rate control



38 *Operating principle of pump rate control*

A Switch-on point
B Switch-off point
C Pump on
D Pump off
E Hook up interval
F Switch on border
G Min. pump rate/min

Description of the parameters

Navigation Relay/controls → Pump control N

Switch-on point

Navigation Relay/controls → Pump control N → Switch-on point

Description Define the switch-on point for pump rate control.

Switch-off point

Navigation Relay/controls → Pump control N → Switch-off point

Description Define the switch-off point for pump rate control.

Min. pump rate/min

Navigation Relay/controls → Pump control N → Min. pump rate/min

Description Define the minimum pump rate.

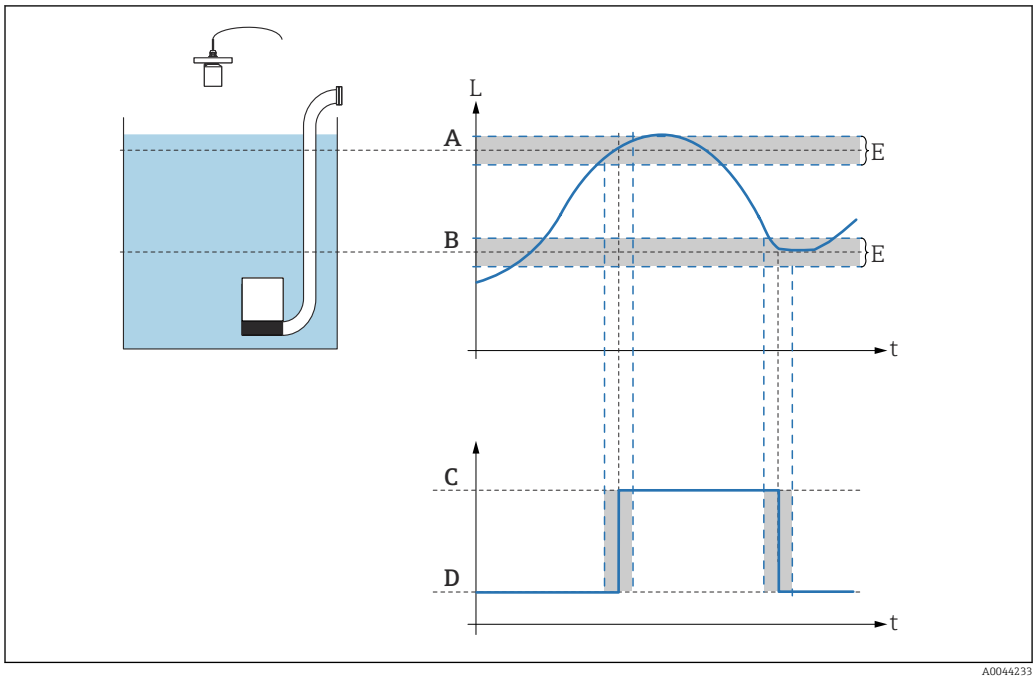
Additional information When the switch-on point has been exceeded (or undershot), additional pumps are switched on gradually until the set minimum pump rate is reached.

Crust reduction

Navigation Relay/controls → Pump M/control N → Crust reduction

Description Define a percentage fluctuation for the switch-on and switch-off point.

Additional information The position of the switch points randomly varies within the given fluctuation range. This helps avoid buildup and crust formation:



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Switch on border

Navigation Relay/controls → Pump control N → Switch on border

Description Define the switch-on border for pump rate control.

Additional information If the distance between the level and the switch-off point is smaller than the switch-on border, no additional pumps are switched on even if the pump rate has not yet been reached.

Hook up interval

Navigation Relay/controls → Pump control N → Hook up interval

Description In the case of pump rate control, define the interval after which the next pump is switched on.

Alternate

Navigation Relay/controls → Pump M/control N → Alternate

Description Specify whether alternating pump control is to be used for pump rate control.

Additional information

Meaning of the options

- **No**
  The pumps are switched on and off in a fixed sequence.
- **Yes**
  The pumps are switched on and off alternately to ensure the workload is shared as equally as possible among the pumps.

Parameter set "Pump M / control N" (pump configuration for pump rate control)

Navigation Relay/controls → Pump M/control N

Switch-on delay

Navigation Relay/controls → Pump M/control N → Switch-on delay

Description Define the switch-on delay for pump M.

Additional information Define different switch-on delays for different pumps. This makes it possible to avoid overloading the power supply system, which can happen if several pumps are switched on simultaneously.

Degree of use

Navigation Relay/controls → Pump M/control N → Degree of use

Prerequisite **Load control** = **Time of use** or **Starts**

Description Define the desired percentage degree of usage of the pump.

Additional information

- The percentage degree of usage is only achieved if alternating pump control is set for this pump (**Alternate** = **Yes**).
- The total degree of usage of all pumps participating in alternating pump control should be 100%.

Max. use time

Navigation Relay/controls → Pump M/control N → Max. use time

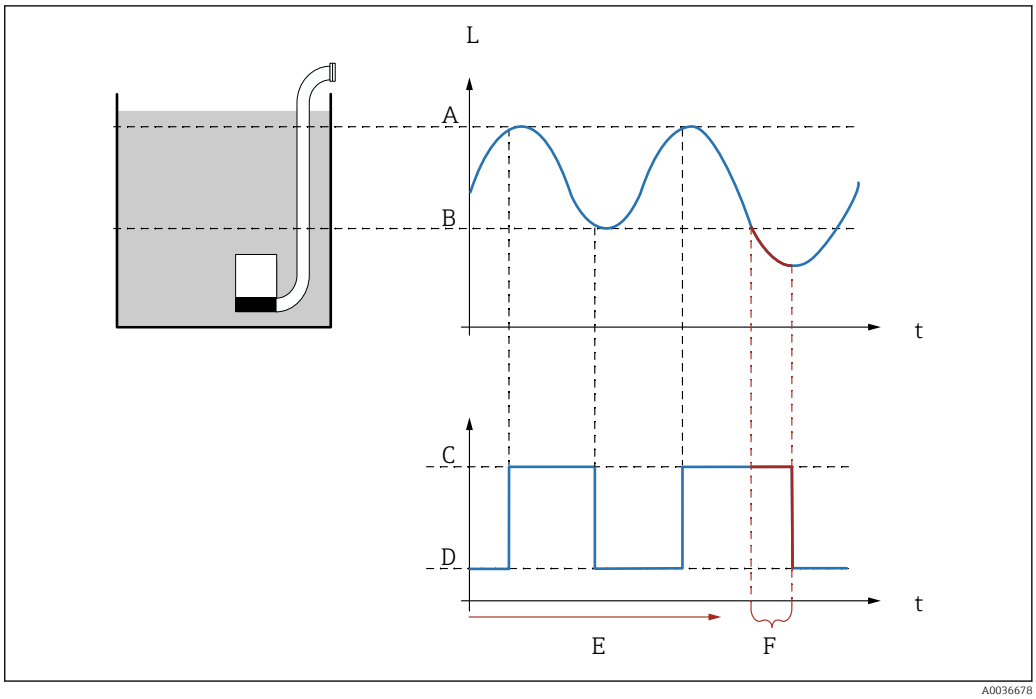
Prerequisite **Load control** = **Starts + time**

Description Specify the maximum use time for the pump.

Additional information Once the pump has been running for this time, it is automatically switched off and replaced by another pump.

Parameter set "Pump M / control N" (pump switching behavior)

Pump switching behavior



39 *Pump switching behavior*

A Switch-on point
B Switch-off point
C Pump on
D Pump off
E Backlash interval
F Backlash time

Description of the parameters

Navigation Relay/controls → Pump M/control N

Backlash interval

Navigation Relay/controls → Pump M/control N → Backlash interval

Description Define the interval after which a pump chamber should continue to be pumped after the configured switch-off point has been reached.

Backlash time

Navigation Relay/controls → Pump M/control N → Backlash time

Description Define the duration of the additional pumping process.

Failure mode

Navigation Relay/controls → Pump M/control N → Failure mode

Description Define the failure mode of the pump relay.

Additional information

Meaning of the options

- **Hold**
  The current switching state of the relay is maintained.
- **Switch on**
  The relay is energized (i.e. the pump is switched on).
- **Switch off**
  The relay is de-energized (i.e. the pump is switched off).
- **Actual value**
  The relay switches according to the current measured value (even though the reliability of the measured value is not guaranteed).

Parameter set "Pump M / control N" (pump feedback)

Navigation Relay/controls → Pump M/control N

Pump feedback

Navigation Relay/controls → Pump M/control N → Pump feedback

Description Specify the switch input via which pump feedback is sent.

Additional information

Meaning of the options
- **Disabled**
  No feedback
- **Ext. digin 1**
  Terminals 71, 72, 73
- **Ext. digin 2**
  Terminals 74, 75, 76
- **Ext. digin 3**
  Terminals 77, 78, 79
- **Ext. digin 4**
  Terminals 80, 81, 82

Feedback delay

Navigation Relay/controls → Pump M/control N → Feedback delay

Description Specify the time frame within which feedback from the pump is required after the pump has started. Feedback after this time is not taken into consideration.

Additional information When setting the feedback delay, it is necessary to also consider the start delay for the relay defined in the **Safety settings** submenu. Depending on the number of pumps connected, the feedback delay must be at least the "Number of pumps x start delay".

Feedb. meaning

Navigation Relay/controls → Pump M/control N → Feedb. meaning

Description Define the meaning of the feedback.

Additional information

Meaning of the options

- **Pump start**
  The feedback confirms the pump is started. If no feedback is given within the feedback delay, the standby pump is started if one has been configured.
- **Pump failure**
  The feedback signals a pump failure. If a standby pump has been configured, it takes over from the failed pump.

- The standby pump can only be used to replace a defective pump.
- If a pump feedback error is also to be reported via a relay, a pump alarm relay must also be programmed in the **Relay configurat.** submenu.

Behavior of the Prosonic S if a pump error is reported via the external switch inputs:

- If a pump failure is reported to the FMU90 or if the start of pump operation is not confirmed to the FMU90, the FMU90 reports a pump malfunction on the display and via the error code.
- The relay of the pump concerned remains energized in order to indicate the pump error. A reset can only be performed by switching the supply voltage off and on or via the menu "Relay/controls/Pump control N/Basic setup/Reset".
- If a standby pump has been configured, it is switched on.
- If the problem at the pump has been rectified, the supply voltage for the Prosonic S must be briefly switched off and then on again, or the pump control must be reset via the menu ("Relay/ controls/Pump control N/Basic setup/Reset") before enabling the pump manually at the local pump switch

NOTICE! When troubleshooting pump errors: If the pumps are taken out of service due to error messages reported by the active pumps, also disconnect the Prosonic S controller from the power supply in order to remedy pending errors.

Parameter set "Relay allocation → Relay K"

Navigation Relay/controls → Pump control N → Relay allocation → Relay K

Function

Navigation Relay/controls → Pump control N → Relay allocation → Relay K → Function

Description Select the **Pump M control N** option to allocate the relay K to the pump M of pump control N.

Invert

Navigation Relay/controls → Pump control N → Relay allocation → Relay K → Invert

Description Specify the switching direction of the relay.

Additional information

Meaning of the options

- **No**
  The relay switches as described in the sections above.
- **Yes**
  The switching direction of the relay is inverted in relation to the description in the sections above.

6.3.2 Submenu "Storm function"

Parameter set "Storm function"

Navigation Relay/controls → Pump control N → Storm function

Storm function

Navigation Relay/controls → Pump control N → Storm function

Description Switch the storm function on or off.

Selection
- Off
- On

Factory setting Off

Additional information The storm function is used to prevent the unnecessary operation of the pumps if the plant is flooded for a short time (e.g. in the event of strong rainfall).

Switch-on point

Navigation Relay/controls → Pump control N → Switch-on point

Description Define the switch-on point for the storm function.

Factory setting 95 %

Additional information If the level exceeds this value, the storm function becomes active, i.e. all the pumps are switched off.

Storm detection is not signaled by an alarm.

Switch-off point

Navigation Relay/controls → Pump control N → Switch-off point

Description Define the switch-off point for the storm function.

Factory setting 90 %

Additional information If the level drops below this value, the storm function is deactivated, i.e. normal pump control is activated again.

- The switch-off point must be below the switch-on point.
- It must be ensured that the switch-off point is also reached without the use of the pumps (e.g. by an overflow outlet).

Storm time

Navigation Relay/controls → Pump control N → Storm time

Description Define the maximum duration of a storm.

User entry 0 to 2 000 min

Factory setting 60 min

Additional information If the storm function has been active for the time specified here, it is automatically deactivated, even if the level has not yet fallen below the switch-off point or the level rises above the switch-on point once again. The pumps start running again.

6.3.3 Submenu "Function test"

Parameter set "Function test N"

Navigation Relay/controls → Pump control N → Function test N

Function test

Navigation Relay/controls → Pump control N → Function test N → Function test

Description Switch the automatic function test on or off.

Selection
- Off
- On

Factory setting Off

Additional information Pumps that have been switched off for too long are automatically switched on for a certain amount of time with the function test in order to avoid encrustation.

The function test applies to all pumps, including the standby pump.

Max. downtime

Navigation Relay/controls → Pump control N → Function test N → Max. downtime

Description Define the maximum downtime for the pumps.

User entry 0 to 9 999 h

Factory setting 0 h

Additional information If a pump was switched off for the maximum downtime, it is switched on for the function test.

Max. test time

Navigation Relay/controls → Pump control N → Function test N → Max. test time

Description Define the maximum test time for the pumps.

User entry 0 to 2 000 s

Factory setting 60 s

Additional information During a function test, the pump is automatically switched off again after this time.

Switch-on point

Navigation Relay/controls → Pump control N → Function test N → Switch-on point

Description Define the switch-on point for the function test.

Factory setting 20 %

Additional information The **Switch-on point** and **Switch-off point** parameters define the conditions for switching the pumps on for the function test. The behavior depends on the relative position of these two switch points:

- **Switch-on point > Switch-off point ("emptying")**
  The function test is only performed if the level is above the switch-on point. The function test ends as soon as the level falls below the switch-off point even if the maximum test time has not yet elapsed.
- **Switch-on point < Switch-off point ("filling")**
  The function test is only performed if the level is below the switch-on point. The function test ends as soon as the level exceeds the switch-off point even if the maximum test time has not yet elapsed.

Switch-off point

Navigation Relay/controls → Pump control N → Function test N → Switch-off point

Description Define the switch-off point for the function test.

Factory setting 10 %

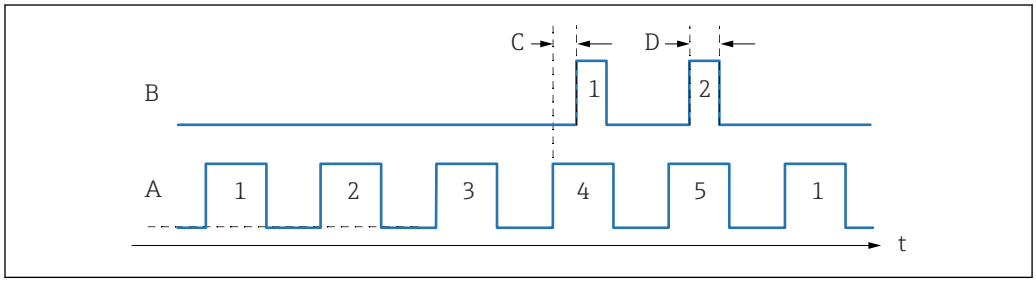
6.3.4 Submenu "Flush control N"

Parameter set "Flush control N"

Operating principle of flush control

The flush control function is used to switch on an additional relay for a certain number of **flush cycles** within a defined number of **pump cycles**. This flush relay then remains switched on during the defined **flush time**. The exact time when the flush relay is switched on is defined by the **flush delay**.

A **pump cycle** always starts with one or more pumps being switched on and ends when all the pumps are switched off again.



40 Operating principle of flush control

A Pump cycles (here: 5)
B Flush cycles (here: 2)
C Flush delay
D Flush time

Description of the parameters

Navigation Relay/controls → Pump control N → Flush control N

Flush control

Navigation Relay/controls → Pump control N → Flush control N → Flush control

Description Switch flush control on or off.

Selection
- Off
- On

Factory setting Off

Pump cycles

Navigation Relay/controls → Pump control N → Flush control N → Pump cycles

Description Define the total number of pump cycles within which the flush cycles are started.

Factory setting 0

Flush cycles

Navigation Relay/controls → Pump control N → Flush control N → Flush cycles

Description Define the number of consecutive pump cycles in which the flush relay is started.

Factory setting 0

Additional information The number of flush cycles must be less than or equal to the number of pump cycles.

Flush time

Navigation Relay/controls → Pump control N → Flush control N → Flush time

Description Define how long the flush relay remains switched on.

User entry 0 to 255 s

Factory setting 0 s

Flush delay

Navigation Relay/controls → Pump control N → Flush control N → Flush delay

Description Define the interval between the start of the pump cycle and the time the flush relay is switched on.

User entry 0 to 255 s

Factory setting 0 s

Parameter set "Relay allocation → Relay K"

Navigation Relay/controls → Pump control N → Flush control → Relay allocation → Relay K

Function

Navigation Relay/controls → Pump control N → Relay allocation → Relay K → Function

Description Select the **Flush control N** option.

Invert

Navigation Relay/controls → Pump control N → Relay allocation → Relay K → Invert

Description Specify the switching direction of the relay.

Additional information

Meaning of the options

- **No**
  The relay switches as described in the sections above.
- **Yes**
  The switching direction of the relay is inverted in relation to the description in the sections above.

6.3.5 Submenu "Tariff control"

Tariff control can only be found in devices with external switch inputs (FMU90-********B***).

Parameter set "Tariff control N" (N = 1 - 2)

Navigation Relay/controls → Pump control N → Tariff control

Tariff control

Navigation Relay/controls → Pump control N → Tariff control → Tariff control

Description Specify whether tariff control should be applied.

Selection
- No
- Yes

Factory setting No

Additional information Two different switch-on and switch-off points can be defined for each pump with the tariff control function. A switch input defines which of these switching points are currently valid. By connecting an external timer to the digital input, pumping can preferably be performed at times when low-price electricity is available.

Tariff input

Navigation Relay/controls → Pump control N → Tariff control → Tariff input

Description Assign a switch input to tariff control.

Selection
- Disabled
- Ext. digin 1 (terminals 71, 72, 73)
- Ext. digin 2 (terminals 74, 75, 76)
- Ext. digin 3 (terminals 77, 78, 79)
- Ext. digin 4 (terminals 80, 81, 82)

Parameter set "Tariff ctrl N P M" (N = 1 - 2; M = 1 - 6) (configuration of the switch points for pump M)

Navigation Relay/controls → Pump control N → Tariff control → Tariff ctrl.N P M

Switch-on point

Navigation Relay/controls → Pump control N → Tariff control → Tariff ctrl.N P M → Switch-on point

Description Displays the switch-on point which applies as long as the tariff input has not been activated. (Corresponds to the switch-on point defined in the basic setup.)

Switch-on tariff

Navigation Relay/controls → Pump control N → Tariff control → Tariff ctrl.N P M → Switch-on tariff

Description Define the switch-on point which applies if the tariff switch has been activated.

Switch-off point

Navigation Relay/controls → Pump control N → Tariff control → Tariff ctrl.N P M → Switch-off point

Description Displays the switch-off point which applies as long as the tariff input has not been activated. (Corresponds to the switch-off point defined in the basic setup.)

Switch-off tariff

Navigation Relay/controls → Pump control N → Tariff control → Tariff ctrl.N P M → Switch-off tariff

Description Define the switch-off point which applies if the tariff switch has been activated.

6.3.6 Submenu "Pump data (PC N)"

All the pump data displayed in this parameter set are also reset when the device is reset.

Parameter set "Pump dat. P M" (data for pump M from pump control N)

Navigation Relay/controls → Pump control N → Pump data → Pump dat. P M

Operating hours

Navigation Relay/controls → Pump control N → Pump data → Pump dat. P M → Operating hours

Description Indicates how long the pump has been switched on since the last reset.

Reset op. hours

Navigation Relay/controls → Pump control N → Pump data → Pump dat. P M → Reset op. hours

Description Select the **Yes** option to reset the operating hours counter to **0**.

Total op. hours

Navigation Relay/controls → Pump control N → Pump data → Pump dat. P M → Total op. hours

Description Indicates how long the pump has been switched on in total since commissioning. This value cannot be reset.

Number of starts

Navigation Relay/controls → Pump control N → Pump data → Pump dat. P M → Number of starts

Description Indicates the number of times the pump has been started so far.

Starts per h

Navigation Relay/controls → Pump control N → Pump data → Pump dat. P M → Starts per h

Description Displays the average number of starts per hour for the pump up to now.

Backlash starts

Navigation Relay/controls → Pump control N → Pump data → Pump dat. P M → Backlash starts

Description Indicates the number of times the backlash time has been active for the pump since the last reset.

Reset backlstart

Navigation Relay/controls → Pump control N → Pump data → Pump dat. P M → Reset backlstart

Description Select the **Yes** option to reset the counter for backlash starts to **0**.

Last run time

Navigation Relay/controls → Pump control N → Pump data → Pump dat. P M → Last run time

Description Indicates how long the pump was in operation when it was last switched on.

6.3.7 Submenu "Op. hours alarm"

Parameter set "Op. hours alarm N"

Navigation Relay/controls → Pump control N → Op. hours alarm → Op. hours alarm N

Op. hours alarm

Navigation Relay/controls → Pump control N → Op. hours alarm → Op. hours alarm N → Op. hours alarm

Description Select **Yes** to activate operating hours monitoring.

Additional information A maximum operating time can be defined for every pump. The operating hours alarm indicates when the operating time of one of the pumps has been exceeded.

Alarm delay

Navigation Relay/controls → Pump control N → Op. hours alarm → Op. hours alarm N → Alarm delay

Description Define the delay time for the operating hours alarm.

Factory setting 0 s

Parameter set "Op. hour alarm N P M" (operating hours alarm for pump M)

Navigation Relay/controls → Pump control N → Op. hours alarm → Op. hour alarm N P M

Operating hours

Navigation Relay/controls → Pump control N → Op. hours alarm → Op. hours alarm N → Operating hours

Description Indicates how long the pump has been switched on in total since the last reset.

Max. op. hours

Navigation Relay/controls → Pump control N → Op. hours alarm → Op. hours alarm N → Max. op. hours

Description Define the maximum operating time of the pump. An operating hours alarm is generated as soon as this operating time is exceeded.

Additional information The alarm is reset by resetting the operating hours of the pump in the "Pump data" submenu (e.g. following pump maintenance).

Parameter set "Relay allocation → Relay K"

Navigation Relay/controls → Pump control N → Op. hours alarm → Op. hours alarm N → Relay allocation → Relay K

Function

Navigation Relay/controls → Pump control N → Op. hours alarm → Op. hours alarm N → Relay allocation → Relay K → Function

Description Select the **Op. hours alarm N** option.

Invert

Navigation Relay/controls → Pump control N → Op. hours alarm → Op. hours alarm N → Relay allocation → Relay K → Invert

Description Specify the switching direction of the relay.

Additional information

Meaning of the options

- **No**
  The relay switches as described in the sections above.
- **Yes**
  The switching direction of the relay is inverted in relation to the description in the sections above.

6.3.8 Submenu "Pump alarm"

Parameter set "Pump alarm N"

Navigation Relay/controls → Pump control N → Pump alarm → Pump alarm N

Pump alarm

Navigation Relay/controls → Pump control N → Pump alarm → Pump alarm N → Pump alarm

Description Switch the pump alarm function on or off.

Selection
- Off
- On

Factory setting Off

Additional information The pump alarm is used to signal a pump failure via one of the relays. This is only possible if a pump monitoring system is connected to one of the digital inputs and if "Pump feedback" has been configured in the **Basic setup** submenu

Waiting time

Navigation Relay/controls → Pump control N → Pump alarm → Pump alarm N → Waiting time

Description Define the waiting time for the pump alarm.

Factory setting 0 s

Additional information The waiting time is the same for all the pumps.

Parameter set "Relay allocation → Relay K"

Navigation Relay/controls → Pump control N → Pump alarm → Relay allocation → Relay K

Function

Navigation Relay/controls → Pump control N → Pump alarm → Relay allocation → Relay K → Function

Description Select the **Pump alarm N** option.

Invert

Navigation Relay/controls → Pump control N → Pump alarm → Relay allocation → Relay K → Invert

Description Specify the switching direction of the relay.

Additional information

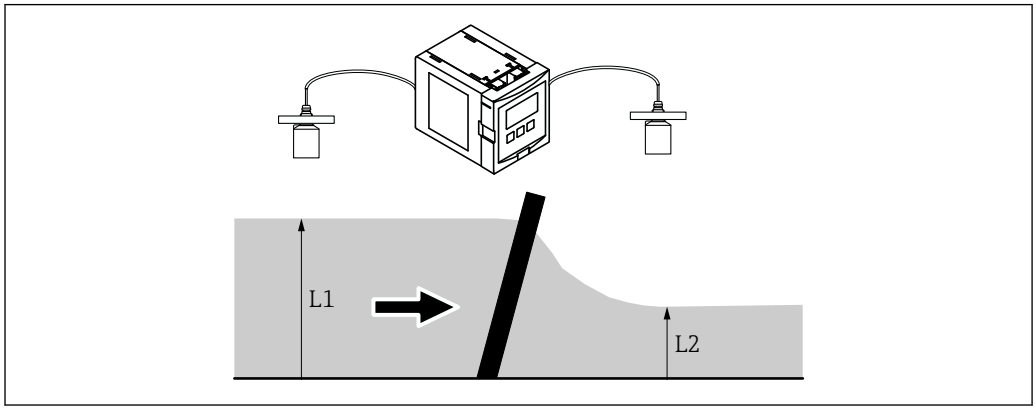
Meaning of the options

- **No**
  The relay switches as described in the sections above.
- **Yes**
  The switching direction of the relay is inverted in relation to the description in the sections above.

6.4 Submenu "Rake control"

The **Rake control** submenu only appears if the **Rake control** option was selected under **Device configurat.** → **Operating param.** → **Controls**.

6.4.1 General principles



41 Operating principle of the rake control function

To detect rake clogging, the Prosonic S measures the upstream level L_1 and the downstream level L_2. If L_2 is much lower than L_1, this is a clear indication that the rake is clogged. Therefore, rake control evaluates either the difference L_1 - L_2 or the ratio L_2/L_1.

Rake clogging is indicated by a relay that can be used to trigger a rake cleaning mechanism, for example.

6.4.2 Parameter set "Rake control" (Allocation)

Navigation Relay/controls → Rake control

Upstream water

Navigation Relay/controls → Rake control → Upstream water

Description Define which level signal corresponds to the upstream level.

Selection
- Level 1
- Level 2

Factory setting Level 1

Downstream water

Navigation Relay/controls → Rake control → Downstream water

Description Define which level signal corresponds to the downstream level.

User entry
- Level 1
- Level 2

Factory setting Level 2

Function

Navigation Relay/controls → Rake control → Function

Description Define the criterion that is used to detect clogging of the rake.

Factory setting Difference

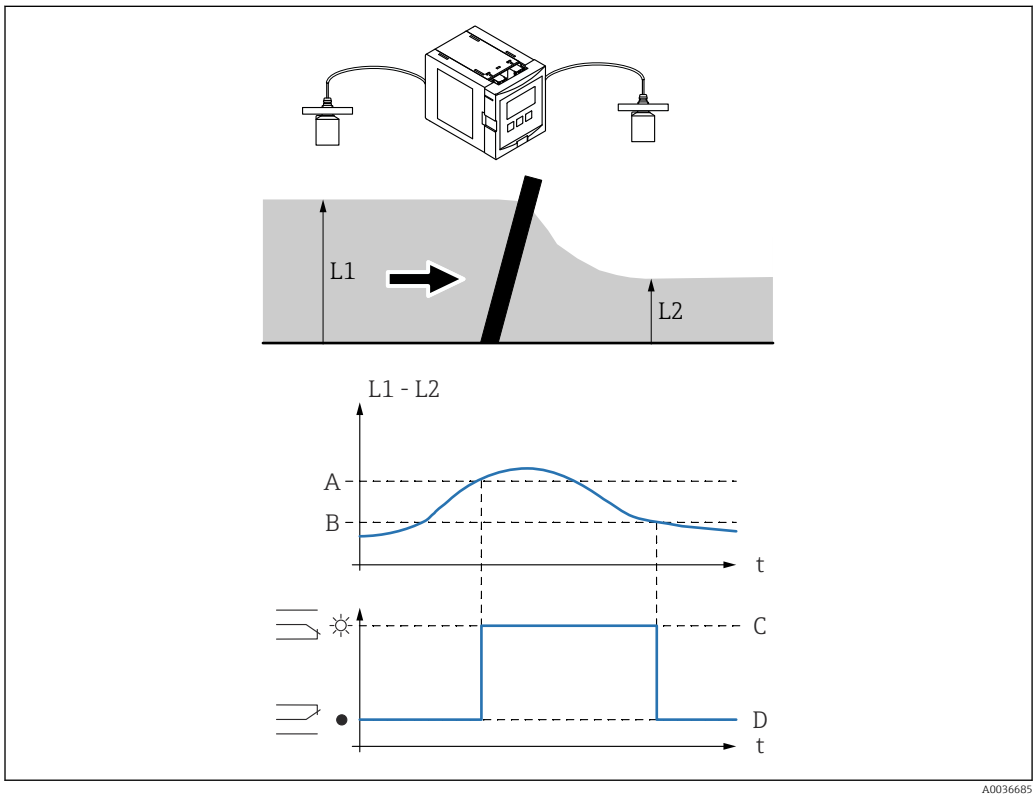
Additional information

Meaning of the options
- **Difference**
  The rake is clogged if the difference L1 L_1 - L_2 exceeds a critical value.
- **Ratio**
  The rake is clogged if the ratio L_2/L_1 drops below a critical value.

6.4.3 Parameter set "Rake control" (Switch points)

Meaning of the switch points if "Function" = "Difference"

- The switch-on and switch-off points are indicated in the level unit. The switch-on point must be greater than the switch-off point.
- The rake control relay is energized if the difference L_1 - L_2 exceeds the switch-on point.
- The rake control relay is de-energized if the difference L_1 - L_2 drops below the switch-off point.

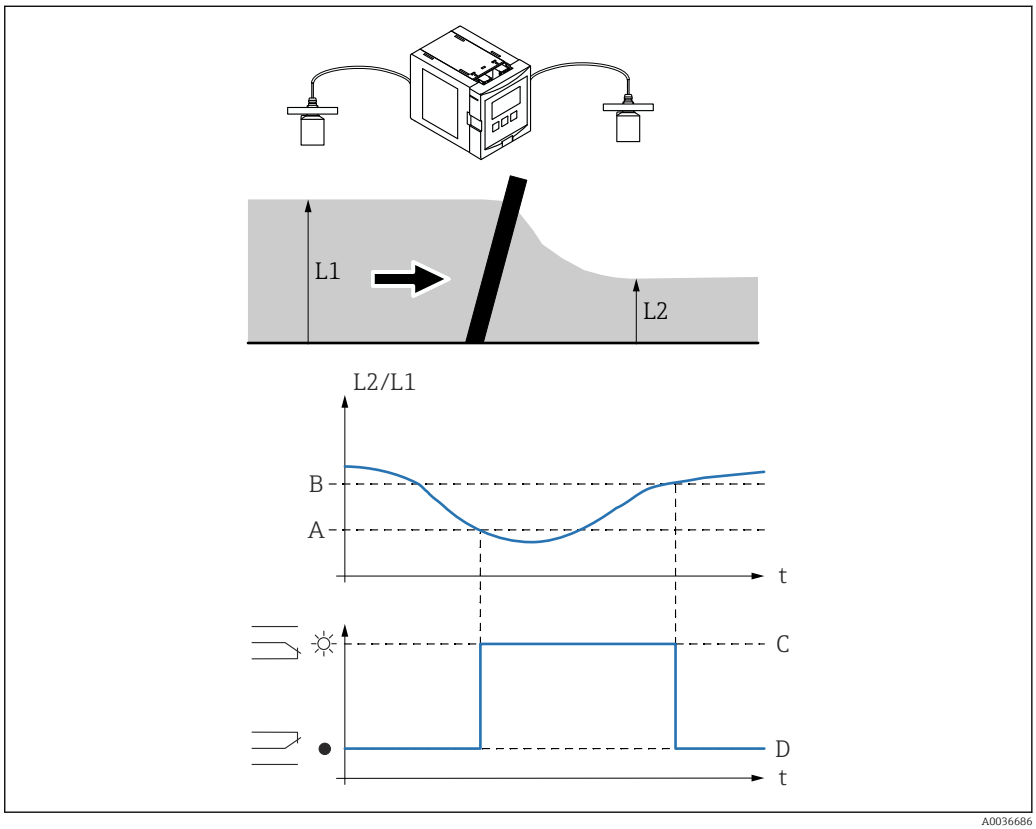


42 *Switch points for "Function" = Difference"*

A Switch-on point
B Switch-off point
C Relay energized (i.e. rake cleaning is on)
D Relay de-energized (i.e. rake cleaning is off)

Meaning of the switch points if "Function" = "Ratio"

- The switch-on and switch-off points are numbers between 0 and 1. The switch-on point must be below the switch-off point.
- The rake control relay is energized if the ratio L_2/L_1 falls below the switch-on point.
- The rake control relay is de-energized if the ratio L_2/L_1 exceeds the switch-off point.



43 *Switch points for "Function" = "Ratio"*

A Switch-on point
B Switch-off point
C Relay energized (i.e. rake cleaning is on)
D Relay de-energized (i.e. rake cleaning is off)

Description of the parameters

Navigation Relay/controls → Rake control

Switch-on point

Navigation Relay/controls → Rake control → Switch-on point

Description Define the switch-on point for rake control.

Switch-off point

Navigation Relay/controls → Rake control → Switch-off point

Description Define the switch-off point for rake control.

6.4.4 Parameter set "Rake control" (Switch parameters)

Navigation Relay/controls → Rake control

Switching delay

Navigation Relay/controls → Rake control → Switching delay

Description Define the switch-on delay for rake control.

Additional information When the value passes the switch-on point, the relay does not switch immediately. Instead it only switches after the specified switching delay. This ensures that brief fluctuations of the L_1 or L_2 value do not unnecessarily activate the rake cleaning function.

Failure mode

Navigation Relay/controls → Rake control → Failure mode

Description Specify the behavior of the rake control relay in the event of an operating error.

Additional information

Meaning of the options

- **Actual value**
  The relay switches according to the current measured values (even though the reliability of the measured values is not guaranteed).
- **Hold**
  The current switching state of the relay is held.
- **Switch on**
  The relay is energized.
- **Switch off**
  The relay is de-energized.

6.4.5 Parameter set "Relay allocation"

Navigation Relay/controls → Rake control → Relay allocation

Function

Navigation Relay/controls → Rake control → Relay allocation → Relay K → Function

Description Select the **Rake control** option in order to assign relay K to the rake control function.

Invert

Navigation Relay/controls → Rake control → Relay allocation → Relay K → Invert

Description Specify the switching direction of the relay.

Additional information

Meaning of the options

- **No**
  The relay switches as described in the sections above.
- **Yes**
  The switching direction of the relay is inverted in relation to the description in the sections above.

6.5 Submenu "Relay simulation"

6.5.1 Parameter set "Relay N"

Navigation Relay/controls → Relay simulation → Relay N

Simulation

Navigation Relay/controls → Relay simulation → Relay N → Simulation

Description Select the **On** option to switch on simulation.

Selection
- Off
- On

Factory setting Off

Simulation value

Navigation Relay/controls → Relay simulation → Relay N → Simulation value

Prerequisite **Simulation** = **On**

Description Specify the switching state of the relay.

Selection
- Switch off
- Switch on

Factory setting Switch off

7 Menu "Output/calculat." (HART)

7.1 Submenu "Allocat./calculat."

7.1.1 Parameter set "Allocat. curr. N" (N = 1 or 2)

Navigation Output/calculat. → Current output N → Allocat./calculat. → Allocat. curr. N

Output

Navigation Output/calculat. → Current output N → Allocat./calculat. → Allocat. curr. N → Output

Description Define which value is output via the current output.

Selection The range of options depends on the device version, the connected sensors and the configuration. The following measured values and calculated values are possible:
- Level 1
- Level 2
- Flow 1
- Flow 2
- Average level
- Level 1-2
- Level 2-1
- Level 1+2
- Flow average
- Flow 1-2
- Flow 2-1
- Flow 1+2
- Ratio backwat.
- Ratio rake

Output current

Navigation Output/calculat. → Current output N → Allocat./calculat. → Allocat. curr. N → Output current

Description Indicates the output current in mA.

7.2 Submenu "Extended calibr."

7.2.1 Parameter set "Mode current N"

Navigation Output/calculat. → Current output N → Extended calib. → Mode current N

Current span

Navigation Output/calculat. → Current output N → Extended calib. → Mode current N → Current span

Description Specify the current span to which the measuring range is mapped.

Additional information

Meaning of the options
- **4-20 mA**
  The measuring range (0%-100%) is mapped to the current range 4-20 mA.
- **0-20 mA**
  The measuring range (0%-100%) is mapped to the current range 0-20 mA.
- **Fix. current**
  A fixed current is output. The value of this current can be defined in the **mA value** parameter. The measured value is only transmitted via the HART signal.

mA value

Navigation Output/calculat. → Current output N → Extended calib. → Mode current N → mA value

Prerequisite **Current span** = **Fixed current**

Description Define the value of the fixed current.

User entry 3.6 to 22 mA

Factory setting 4 mA

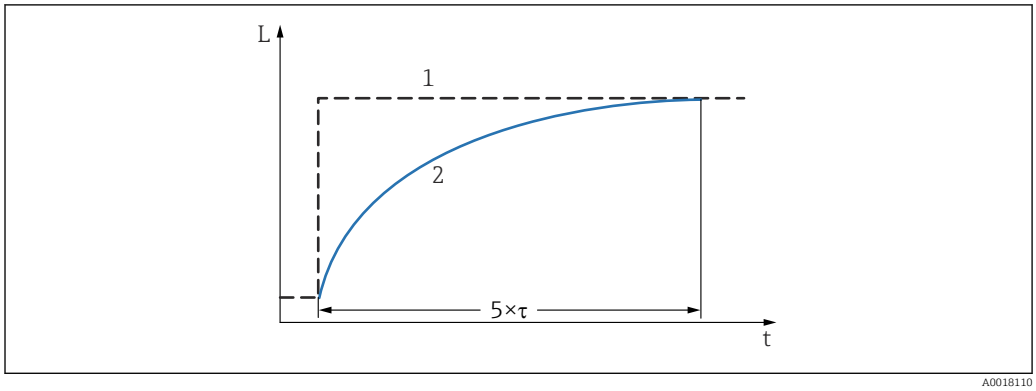
Output damping

Navigation Output/calculat. → Current output N → Extended calib. → Mode current N → Output damping

Description Define the output damping τ by which a change in the measured value is attenuated.

Factory setting 1 s

Additional information After an increase in the measured value, it takes 5 τ until the output has largely adopted the new value.



44 *Effect of output damping*

1 Measured value
2 Output current

4mA threshold

Navigation Output/calculat. → Current output N → Extended calib. → Mode current N → 4mA threshold

Prerequisite **Current span = 4-20 mA**

Description Switch the 4-mA threshold on or off.

Additional information The 4-mA threshold ensures that the current never falls below 4 mA, even if the measured value is lower.

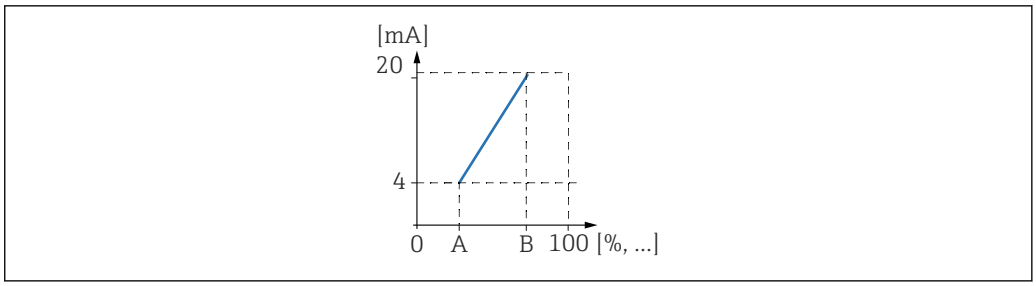
Curr. turn down

Navigation Output/calculat. → Current output N → Extended calib. → Mode current N → Curr. turn down

Prerequisite **Current span ≠ Fixed current**

Description Switch the current turn down function on or off.

Additional information When the current turn down is switched on, the current output refers to a user-definable section of the measuring range. This selected section is enlarged on the display.



45 *Operating principle of the current turn down*

A Turn down 0/4mA
B Turn down 20mA

Turn down 0/4mA

Navigation Output/calculat. → Current output N → Extended calib. → Mode current N → Turn down 0/4mA

Prerequisite **Curr. turn down** = **On**

Description Specify the measured value for which the current is 0 or 4 mA (depending on the selected current span).

Turn down 20mA

Navigation Output/calculat. → Current output N → Extended calib. → Mode current N → Turn down 20mA

Prerequisite **Curr. turn down** = **On**

Description Specify the measured value for which the current is 20 mA.

7.3 Submenu "HART settings"

The **HART settings** submenu is only available for current output 1.

7.3.1 Parameter set "HART settings"

Navigation Output/calculat. → Current output N → HART settings → HART settings

HART address

Navigation Output/calculat. → Current output N → HART settings → HART settings → HART address

Description Specify the HART communication address for the device.

Additional information

Possible values
- For standard operation: 0
- For Multidrop operation: 1 to 15

In the Multidrop mode, the output current is 4 mA as standard. It can, however, be changed in the **mA value** parameter (**Mode current N** parameter set).

No. of preambles

Navigation Output/calculat. → Current output N → HART settings → HART settings → No. of preambles

Description Specify the number of preambles for the HART protocol.

Additional information It may be advisable to increase this value for lines with communication problems.

Short TAG HART

Navigation Output/calculat. → Current output N → HART settings → HART settings → Short TAG HART

Description Define the short TAG for the device.

7.3.2 Parameter set "Add.HART value M" (M = 2, 3 or 4)

HART value 1 is always equal to the main measured value which is connected to current output 1.

Navigation Output/calculat. → Current output N → HART settings → Add. HART value M

Measured value M

Navigation Output/calculat. → Current output N → HART settings → Add. HART value M → Measured value M

Description Define which value is output via the specific HART channel.

Selection The range of options depends on the device version, the connected sensors and the configuration. The following measured values and calculated values are possible:
- None
- Level N
- Flow N
- Average level
- Level 1-2
- Level 2-1
- Level 1+2
- Ratio rake
- Ratio backwat.
- Temperature external sensor
- Temperature sensor N
- Daily counter N
- Totalizer N
- Flow average
- Flow 1-2
- Flow 2-1
- Flow 1+2
- Dist. Sensor N

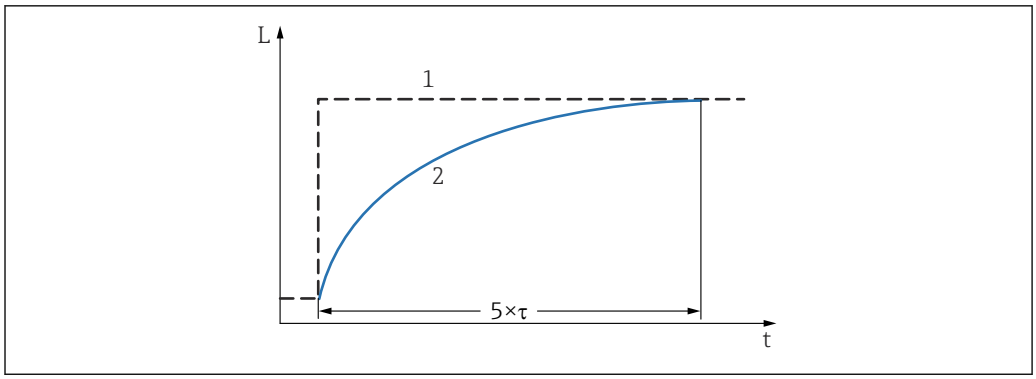
Additional information The **Temperature sen. N** option always refers to the temperature which has been assigned to the sensor in the **Sensor management → US sensor N → Temperature measurement** parameter.

Output damping N (N = 2/3/4)

Navigation Output/calculat. → Current output N → HART settings → Add. HART value M → Output damping N

Description Define the output damping τ by which a change in the measured value is attenuated.

Additional information After an increase in the measured value, it takes 5 τ until the output has largely adopted the new value.



46 Effect of output damping

1 Measured value
2 Output value

7.4 Parameter set "Simulation"

Navigation Output/calculat. → Current output N → Simulation

Simulation

Navigation Output/calculat. → Current output N → Simulation → Simulation

Description Switch current simulation on or off.

Additional information

Meaning of the options
- **Off**
  No simulation takes place. The device is in the normal measuring mode.
- **On**
  The device is in simulation mode. No measured value is output. Instead, the current output adopts the value defined in the **Simulation value** parameter.

Simulation value

Navigation Output/calculat. → Current output N → Simulation → Simulation value

Prerequisite **Simulation** = **On**

Description Specify the current value to be simulated.

8 Menu "Output/calculat." (PROFIBUS DP)

8.1 Submenu "Analog input"

8.1.1 Parameter set "Analog input N" (N = 1 - 10)

There is an **Analog input N** parameter set for each AI Block in the device.

Navigation Output/calculat. → Analog input → Analog input N

Measured value N

Navigation Output/calculat. → Analog input → Analog input N → Measured value N

Description Select the measured variable which should be output via the Analog Input Block.

Additional information The **Temperature sen. M** option always refers to the temperature which has been assigned to the sensor in the **Sensor management → US sensor M → Temperature measurement** parameter.

Value

Navigation Output/calculat. → Analog input → Analog input N → Value

Description Displays the current value of the selected measured variable.

Status

Navigation Output/calculat. → Analog input → Analog input N → Status

Description Displays the status that is transmitted together with the measured variable.

8.2 Submenu "Digital input"

8.2.1 Parameter set "Digital input N" (N = 1 - 10)

There is a **Digital input N** parameter set for each DI Block in the device.

Navigation Output/calculat. → Digital input → Digital input N

Allocation

Navigation Output/calculat. → Digital input → Digital input N → Allocation

Description Select a relay whose switch state is to be output as a binary signal via the DI Block.

Additional information

Meaning of the options

- **Relay**
  The DI Block is connected to one of the relays of the device. Once this option has been selected, the **Relay** function appears where you can select one of the relays.
- **Pump control N (N = 1 or 2)**
  The DI Block is connected to a pump control relay. Once this option has been selected, a picklist containing the configured pump control relays appears.
- **Rake control**
  The DI Block is connected to a rake control relay. Once this option has been selected, a picklist containing the configured rake control relays appears.
- **None**
  The DI Block is not used.

Value

Navigation Output/calculat. → Digital input → Digital input N → Value

Description Displays the current switch state of the selected relay.

Status

Navigation Output/calculat. → Digital input → Digital input N → Status

Description Displays the status that is transmitted together with the binary signal.

8.3 Parameter set "PROFIBUS DP"

Navigation Output/calculat. → PROFIBUS DP

Profile version

Navigation Output/calculat. → PROFIBUS DP → Profile version

Description Displays the version of the PROFIBUS profile that is used.

Instrument address

Navigation Output/calculat. → PROFIBUS DP → Instrument address

Description Displays the bus address of the device

Additional information The bus address can be set as follows:
- Via the DIP switches in the connection compartment
- Via an operating tool (e.g. FieldCare)

Ident number

Navigation Output/calculat. → PROFIBUS DP → Ident number

Description Specify the ident number of the device.

Factory setting Manufacturer

Additional information **Meaning of the options**
- **Profile**
  The ident number of the PROFIBUS profile is used.
- **Manufacturer**
  The ident number of the device-specific GSD file is used.

9 Menu "Device properties"

9.1 Submenu "Operating param."

9.1.1 Parameter set "Distance unit"

Navigation Device properties → Operating parameters → Distance unit

Distance unit

Navigation Device properties → Operating parameters → Distance unit → Distance unit

Description Specify the distance unit.

Selection
- m
- ft
- mm
- inch

Factory setting m

9.1.2 Parameter set "Temperature unit"

Navigation Device properties → Operating parameters → Temperature unit

Temperature unit

Navigation Device properties → Operating parameters → Temperature unit → Temperature unit

Description Define the temperature unit.

Selection
- °C
- °F

Factory setting °C

9.1.3 Parameter set "Operating mode"

Navigation Device properties → Operating parameters → Mode

Mode

Navigation Device properties → Operating parameters → Mode → Mode

Description Specify the operating mode.

Selection Different operating modes are available depending on the device version.
- Level
- Level+flow
- Flow
- Flow+backwater

9.1.4 Parameter set "Controls"

Navigation Device properties → Operating parameters → Controls

Controls

Navigation Device properties → Operating parameters → Controls → Controls

Prerequisite **Operating mode** = **Level** or **Level+flow**

Description Specify which controls the device should apply.

Selection
- No
- Pump control
- Rake control

9.2 Submenu "Tag marking"

9.2.1 Parameter set "Tag marking"

Navigation Device properties → Tag marking → Tag marking

Output N (N = 1 or 2)

Navigation Device properties → Tag marking → Tag marking → Output N

Description Enter a string consisting of max. 16 alphanumeric characters as the name for current output N.

Device marking

Navigation Device properties → Tag marking → Tag marking → Device marking

Description Enter a string consisting of max. 16 alphanumeric characters as the name for the entire device.

9.3 Parameter set "Language"

Navigation Device properties → Language

Language

Navigation Device properties → Language → Language

Description Select the language for the display module.

Additional information The "Language" feature in the product structure determines which languages can be selected:

Language = 1:
- English
- Deutsch
- Français
- Español
- Italiano
- Nederlands
- Português

Language = 2:
- English
- Deutsch
- Russian
- Polish
- Czech

Language = 3:
- English
- Chinese
- Japanese
- Korean
- Thai
- Bahasa (Indonesia, Malaysia)

9.4 Parameter set "Password/reset"

Navigation Device properties → Password/reset

Reset

Navigation Device properties → Password/reset → Reset

Description Enter the reset code to reset the parameters to their default values.

Additional information

Reset code:
- HART: 333
- PROFIBUS DP: 33 333

Response of the linearization function in the event of a reset
In the event of a reset, the linearization method (level) or type of linearization (flow) is reset to **None**. If a linearization table is present it is not deleted, however, and can be reactivated if necessary.

Effect of a reset on the 5-point linearity protocol
With the creation of a 5-point linearity protocol, the FDU9x sensor and the FMU9x transmitter electronics (the measuring system) are perfectly adjusted to one another and the measuring accuracy is optimized for the specified range. The **Zero distance** service parameter is fine-adjusted for this purpose. Following a reset, this parameter must be reconfigured in the Service menu according to the data indicated on the 5-point linearity protocol for the FDU9x sensor. Contact Endress+Hauser customer service for this purpose.

Code

Navigation Device properties → Password/reset → Code

Description
- To unlock the device, enter the access code.
- To lock the device, enter any other number of your choice.

Additional information

Access code
- HART: 100
- PROFIBUS DP: 2 457

Status

Navigation Device properties → Password/reset → Status

Description Displays the current locking state of the device.

Additional information

Meaning of the information displayed

- **Unlocked**
  All parameters (apart from Service parameters) can be edited.
- **Code locked**
  The device has been locked via the operating menu. It can only be unlocked by entering the access code in the **Code** parameter.
- **Key-locked**
  The device has been locked via the operating keys. It can only be unlocked again by pressing all three keys simultaneously.
- **Switch locked**
  The device has been locked via the write protection switch in the terminal compartment. It can only be unlocked again using this switch.

10 Menu "System informat."

10.1 Submenu "Device information"

10.1.1 Parameter set "Device family"

Navigation System informat. → Device information → Device family

Device family

Navigation System informat. → Device information → Device family → Device family

Description Displays the device family.

10.1.2 Parameter set "Device name"

Navigation System informat. → Device information → Device name

Device name

Navigation System informat. → Device information → Device name → Device name

Description Displays the device name.

10.1.3 Parameter set "Device marking"

Navigation System informat. → Device marking → Device marking

Device marking

Navigation System informat. → Device information → Device marking → Device marking

Description Displays the device marking.

10.1.4 Parameter set "Serial no."

Navigation System informat. → Serial no. → Serial no.

Serial no.

Navigation System informat. → Device information → Serial no. → Serial no.

Description Displays the serial number.

10.1.5 Parameter set "Software version"

Navigation System informat. → Software version → Software version

Software version

Navigation System informat. → Device information → Software version → Software version

Description Displays the software version.

Additional information This function displays the version of the protocol, hardware and software: Vxx.yy.zz.prot.
- xx: HW version
- yy: SW version
- zz: SW revision
- prot: communication protocol

10.1.6 Parameter set "Dev. rev."

Navigation System informat. → Dev. rev. → Dev. rev.

Dev. rev.

Navigation System informat. → Device information → Dev. rev. → Dev. rev.

Description Displays the device revision.

10.1.7 Parameter set "DD version"

Navigation System informat. → DD version → DD version

DD version

Navigation System informat. → Device information → DD version → DD version

Description Displays the DD version that is needed to operate the device via FieldCare.

10.2 Submenu "In/output info"

10.2.1 Parameter set "Level N" (N = 1 -2)

Navigation System informat. → In/output info → Level N

Input

Navigation System informat. → In/output info → Level N → Input

Description Indicates which sensor input is connected to the level channel.

Sensor selection

Navigation System informat. → In/output info → Level N → Sensor selection

Description Displays the type of sensor that is connected. **Automatic** is displayed for FDU9x sensors because Prosonic S detects these sensors automatically.

Detected

Navigation System informat. → In/output info → Level N → Detected

Prerequisite **Sensor selection** = **Automatic**

Description Displays the type of sensor detected automatically.

10.2.2 Parameter set "Flow N" (N = 1 - 2)

Navigation System informat. → In/output info → Flow N

Input

Navigation System informat. → In/output info → Flow N → Input

Description Indicates which sensor input is connected to the flow channel.

Sensor selection

Navigation System informat. → In/output info → Flow N → Sensor selection

Description Displays the type of sensor that is connected. **Automatic** is displayed for FDU9x sensors because Prosonic S detects these sensors automatically.

Detected

Navigation System informat. → In/output info → Flow N → Detected

Prerequisite **Sensor selection** = **Automatic**

Description Displays the type of sensor detected automatically.

10.2.3 Parameter set "Current output N" (N = 1 - 2)

Only available on HART devices.

Navigation System informat. → In/output info → Current output N

Output

Navigation System informat. → In/output info → Current output N → Output

Description Indicates which measured value is output via this current output.

10.2.4 Parameter set "Relay N"

Navigation System informat. → In/output info → Relay N

Function

Navigation System informat. → In/output info → Relay N → Function

Description Indicates which function has been assigned to the relay.

10.3 Submenu "Trend display"

Only available on HART devices.

10.3.1 Parameter set "Trend output N" (N = 1 - 2)

Navigation System informat. → Trend display → Trend output N

Time interval

Navigation System informat. → Trend display → Trend output N → Time interval

Description Specify the amount of time the trend information is to be displayed.

Additional information The (measured value) trend is displayed in the following parameter set. To exit the trend visualization function, press the left and middle key simultaneously.

Trend display

Navigation System informat. → Trend display → Trend output N → Trend display

Description Displays the (measured value) trend. To exit the trend visualization function, press the left and middle key simultaneously.

10.4 Submenu "Min/max values"

10.4.1 Parameter set "Level N" (N = 1 - 2)

Navigation System informat. → Min/max values → Level

Max. value

Navigation System informat. → Min/max values → Level → Max. value

Description Displays the maximum level measured so far.

Min. Value

Navigation System informat. → Min/max values → Level → Min. Value

Description Displays the minimum level measured so far.

Reset

Navigation System informat. → Min/max values → Level → Reset

Description Select the suitable reset option.

Factory setting Keep

Additional information

Meaning of the options
- **Keep**
  Max. value and **Min. value** are not reset.
- **Clear**
  Max. value and **Min. value** are reset, i.e. they adopt the current value of the measured variable again.
- **Reset min.**
  Min. value is reset, i.e. it adopts the current value of the measured variable again.**Max. value** keeps its value.
- **Reset max.**
  Max. value is reset, i.e. it adopts the current value of the measured variable again. **Min. value** keeps its value.

10.4.2 Parameter set "Flow N" (N = 1 - 2)

Navigation System informat. → Min/max values → Flow

Max. value

Navigation System informat. → Min/max values → Flow → Max. value

Description Displays the maximum flow rate measured so far.

Min. Value

Navigation System informat. → Min/max values → Flow → Min. Value

Description Displays the minimum flow rate measured so far.

Reset

Navigation System informat. → Min/max values → Flow → Reset

Description Select the suitable reset option.

Factory setting Keep

Additional information **Meaning of the options**
- **Keep**
  Max. value and **Min. value** are not reset.
- **Clear**
  Max. value and **Min. value** are reset.
- **Reset min.**
  Min. value is reset. **Max. value** keeps its value.
- **Reset max.**
  Max. value is reset. **Min. value** keeps its value.

10.4.3 Parameter set "Temperature sen. N" (N = 1 - 2)

Navigation System informat. → Min/max values → Temperature

Max. value

Navigation System informat. → Min/max values → Temperature → Max. value

Description Displays the maximum temperature measured so far.

Additional information
- **Max. value** refers to the temperature of the internal temperature detector in the sensor.
- The value can only be reset by Endress+Hauser Service.

Min. Value

Navigation System informat. → Min/max values → Temperature → Min. Value

Description Displays the minimum temperature measured so far.

Additional information
- **Min. value** refers to the temperature of the internal temperature detector in the sensor.
- The value can only be reset by Endress+Hauser Service.

10.5 Submenu "Envelope curve"

10.5.1 Parameter set "En. curve sen. N" (N = 1 - 2)

Navigation System informat. → Envelope curve → En. curve sen. N

Plot settings (1)

Navigation System informat. → Envelope curve → En. curve sen. N → Plot settings

Description Select the information to be displayed.

Selection
- Envelope curve
- Env. curve+FAC
- Env.curve+cust.map

Factory setting Envelope curve

Plot settings (2)

Navigation System informat. → Envelope curve → En. curve sen. N → Plot settings

Description Select whether the envelope curve should only be read once or should be read cyclically.

Selection
- Single curve
- Cyclic

Factory setting Single curve

Additional information If cyclic envelope curve display is active, the measured value is updated at a slower cycle time. It is therefore advisable to exit the envelope curve display again after optimizing the measuring point.

Plot settings (2)

Navigation System informat. → Envelope curve → En. curve sen. N → Envelope curve

Description Displays the envelope curve.

Additional information To exit the visualization function, press the left and middle key simultaneously.

10.6 Submenu "Error list"

10.6.1 Parameter set "Actual error"

Displays a list of the error messages currently pending. Help text can be displayed for every error message.

10.6.2 Parameter set "Last error"

Displays a list of the errors last fixed. Help text can be displayed for every error message.

10.7 Submenu "Diagnostics"

10.7.1 Parameter set "Operating hours"

Navigation System informat. → Diagnostics → Operating hours

Operating hours

Navigation System informat. → Diagnostics → Operating hours → Operating hours

Description Indicates how long the device has been in operation.

10.7.2 Parameter set "Actual distance"

Navigation System informat. → Diagnostics → Actual distance

Act. distance N (N = 1 - 2)

Navigation System informat. → Diagnostics → Actual distance → Act. distance N

Description Displays the distance currently measured between the sensor membrane and the surface of the product.

10.7.3 Parameter set "Act. meas. value"

Navigation System informat. → Diagnostics → Act. meas. value

Level N (N = 1 - 2)

Navigation System informat. → Diagnostics → Act. meas. value → Level N

Description Displays the level currently measured, or (in the case of linearization) the volume currently measured.

Flow N (N = 1 - 2)

Navigation System informat. → Diagnostics → Act. meas. value → Flow N

Description Displays the flow currently measured.

10.7.4 Parameter set "Application par."

Navigation System informat. → Diagnostics → Application par.

Sensor N (N = 1 - 2)

Navigation System informat. → Diagnostics → Application par. → Sensor N

Description Indicates whether a setting that depends on the application parameters ("Tank shape", "Medium property", "Process cond.") has been modified subsequently.

10.7.5 Parameter set "Echo quality sen."

Navigation System informat. → Diagnostics → Echo quality sen.

Echo quality N (N = 1 - 2)

Navigation System informat. → Diagnostics → Echo quality sen. → Echo quality N

Description Displays the echo quality.

Additional information The echo quality is the distance (in dB) between the echo and the echo evaluation curve FAC.

11 Menu "Display"

11.1 Parameter set "Display"

Navigation Display → Display

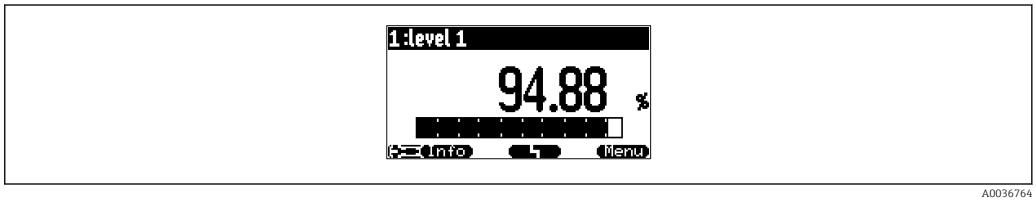
Type

Navigation Display → Display → Type

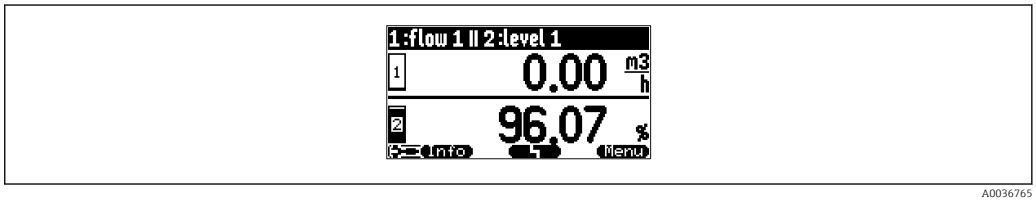
Description Select the display visualization format.

Factory setting 1x value+bargr.

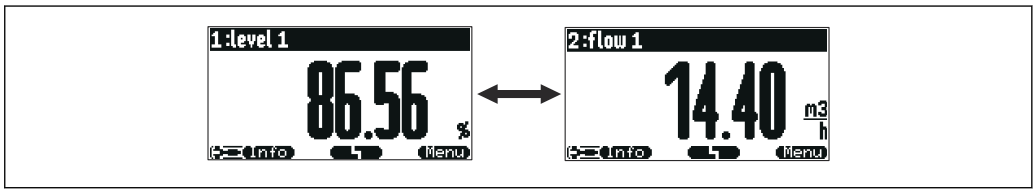
Additional information *Meaning of the options*



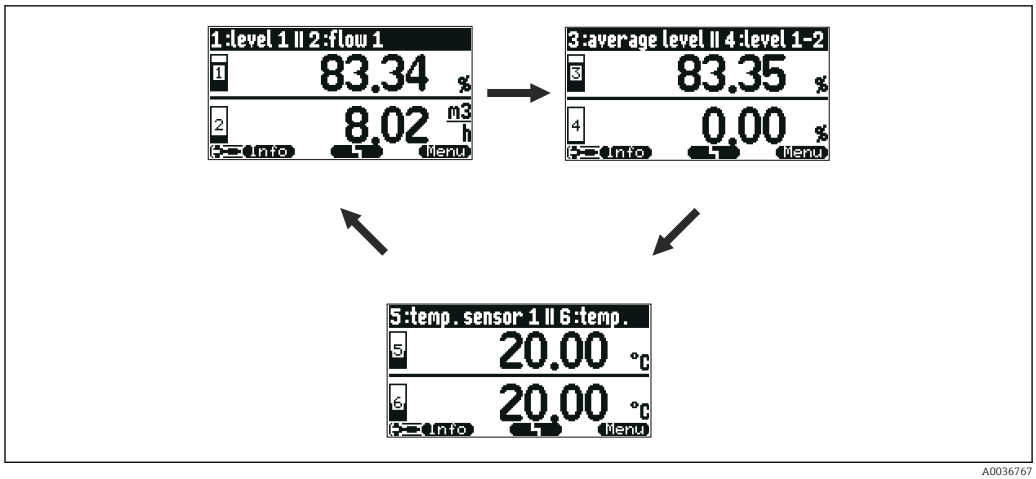
47 *"Type" = "1x value+bargr."*



48 *"Type" = "2x value+bargr."*



49 *"Type" = "Value max. size"*



50 *"Type" = "Alter. 3x2 val."*

Time

Navigation Display → Display → Time

Prerequisite **Type** = **Value max. size** or **Alter. 3x2 val.**

Description Specify the time after which the next value should be displayed.

Additional information To change to the next value immediately in the main display screen, press .

Value N (N = 1 - 2)

Navigation Display → Display → Value N

Description Specify which measured value or calculated value should appear as value N on the display.

Additional information The number of values that can be displayed depends on the **Type** parameter.

Customized text N (N = 1 - 2)

Navigation Display → Display → Customized text N

Description Specify the display text for value N.

Additional information The display text entered is displayed along with the value if the option **Customized text** = **Yes** has been selected.

11.2 Parameter set "Display format"

Navigation Display → Display format

Format

Navigation Display → Display format → Format

Description Select the format for displaying the length.

Selection
- Decimal
- ft-in-1/16

Factory setting Decimal

No. of decimals

Navigation Display → Display format → No. of decimals

Description Select the number of decimal places.

Selection
- x
- x.x
- x.xx
- x.xxx

Factory setting x.xx

Sep. character

Navigation Display → Display format → Sep. character

Description Select the decimal separator.

Selection
- . (point)
- , (comma)

Factory setting . (point)

Free text

Navigation Display → Display format → Free text

Description Specify whether **Customized text 1** to **Customized text 6** are displayed together with the corresponding value.

11.3 Parameter set "Back to home"

Navigation Display → Back to home

Back to home

Navigation Display → Back to home → Back to home

Description Specify the time after which the onsite display automatically returns to home (measured value display screen).

User entry 3 to 9 999 s

Factory setting 900 s

12 Menu "Sensor management"

12.1 Submenu "FDU sensor → Sensor management → FDU sensor N" (N = 1 - 2)

12.1.1 Parameter set "US sensor N" (N = 1 - 2) (sensor settings)

Navigation Sensor management → Sensor management → US sensor N

Sensor operation

Navigation Sensor management → Sensor management → US sensor N → Sensor operation

Description Switch the sensor on or off.

Factory setting On

Additional information **Meaning of the options**
- **On**
  The sensor is switched on.
- **Hold**
  The sensor is switched off. The last measured value is held.
- **Off**
  The sensor is switched off. No measured value is transmitted.

Sensor priority

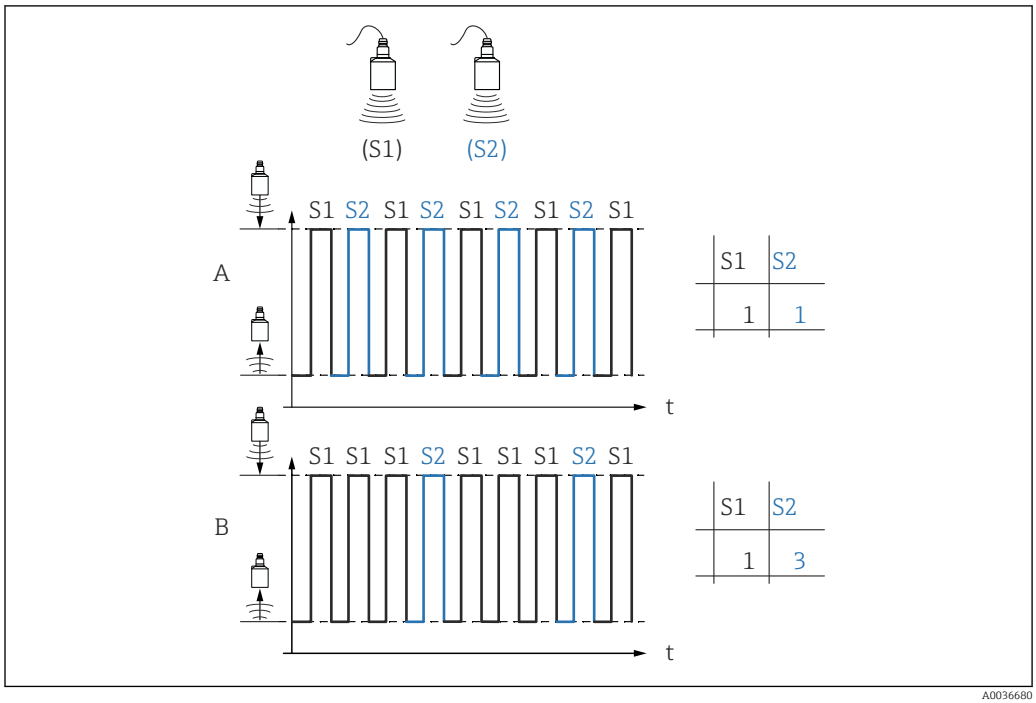
Navigation Sensor management → Sensor management → US sensor N → Sensor priority

Prerequisite The device has two sensor inputs.

Description Specify the priority of sensor N.

Additional information A high-priority sensor sends pulses more frequently than a lower priority sensor.

Example



A
- Priority sensor 1 = 1
- Priority sensor 2 = 1
- → Both sensors send one pulse each time on an alternating basis.

B
- Priority sensor 1 = 1
- Priority sensor 2 = 3
- → After three pulses from sensor 1, sensor 2 sends one pulse.

Detected

Navigation Sensor management → Sensor management → US sensor N → Detected

Prerequisite **Sensor selection** = **Automatic**

Description Displays the type of sensor detected automatically.

Sensor selection

Navigation Sensor management → Sensor management → US sensor N → Sensor selection

Description Specify the type of sensor that is connected.

Factory setting Automatic

Additional information

- **For FDU9x sensors**:
  Select the **Automatic** option. Prosonic S then automatically detects the type of sensor that is connected.
- **For FDU8x sensors**:
  Specify the sensor type explicitly.

Following sensor replacement
Prosonic S automatically detects the new type of sensor. Measurement is resumed. To ensure smooth and correct measurement:
- Check the **Empty E (→ 9)** and **Full F (→ 10)** parameters and adjust them if necessary. In doing so, pay attention to the blocking distance of the new sensor.
- Check the distance displayed in the **LVL N check value (→ 18)** parameter set. Perform a new interference echo suppression (mapping) if necessary.

Detection window

Navigation Sensor management → Sensor management → US sensor N → Detection window

Description Switch the detection window on and off.

Additional information If the detection window function is switched on, a window is defined around the current level echo (typical width 1 - 2.5 m (3.3 - 8.2 ft); depending on the application parameters). The device searches for echoes within this window. The window moves with the level echo when the level increases or decreases. Echoes outside this window are ignored and are not analyzed.

Meaning of the options
- **Off**
  The detection window is switched off.
- **On**
  The detection window is switched on.
- **Reset**
  The current window is deleted. The device searches for the level echo in the entire measuring range. A new window is defined around the level echo that is found.

The window width can be set by Endress+Hauser Service if necessary.

12.1.2 Parameter set "US sensor N" (additional settings)

Navigation Sensor management → Sensor management → US sensor N

Temp. measurement

Navigation Sensor management → Sensor management → US sensor N → Temp. measurement

Prerequisite Only provided in device versions with external switch inputs (FMU90-********B***).

Description Specify which temperature sensor is used for time-of-flight correction.

Additional information

Meaning of the options
- **US sensor**
  The temperature probe integrated in the ultrasonic sensor is used.
- **Extern. temp.**
  The external temperature sensor that is connected to terminals 83 - 85 is used.
- **Avg.US sens/ext.**
  The average of the integrated temperature probe and an external temperature sensor is used.

This parameter also specifies which temperature value is used on the display, for the relay limit values and at the outputs (HART or PROFIBUS DP).

Ext. send ctrl.

Navigation Sensor management → Sensor management → US sensor N → Ext. send ctrl.

Prerequisite Only provided in device versions with external switch inputs (FMU90-********B***).

Description Specify whether and how the sensor is controlled by an external switch input.

Additional information

Meaning of the options
- **Off**
  The sensor is not controlled by an external switch input.
- **Hold**
  If a signal is present at the external switch input, the current measured value is held.
- **Value**
  If a signal is present at the external switch input, the distance adopts a value defined by the user (**Distance** parameter).

- If level limitation is also configured, this defines the upper and lower threshold limit, even if an external input is switched.
- The behavior defined in the following functions has priority over external send control:
  - **Level** → **Level (LVL) N** → **Extended calibr.** → **LVL N ext. input M** → **Input M**
  - **Flow** → **Flow** →**Flow N** → **Extended calibr.** → **Flow N ext. input M** → **Input M**
  - **Flow** → **Flow 1+ backwater** →**Flow** → **Extended calibr.** → **Flow N ext. input M** → **Input M**
  - **Flow** → **Flow 1+ backwater** →**Backwater** → **Extended calibr.** → **Backw ext. input M** → **Input M**

Input

Navigation Sensor management → Sensor management → US sensor N → Input

Prerequisite Only provided in device versions with external switch inputs (FMU90-********B***).

Description Specify which switch input is used for external send control.

Selection
- Disabled
- Ext. digin 1 (terminals 71, 72, 73)
- Ext. digin 2 (terminals 74, 75, 76)
- Ext. digin 3 (terminals 77, 78, 79)
- Ext. digin 4 (terminals 80, 81, 82)

Factory setting Disabled

Distance

Navigation Sensor management → Sensor management → US sensor N → Distance

Prerequisite **Ext. send ctrl.** = **Value**

Description Define the distance value when an external switch signal is active.

12.2 Submenu "Ext. temp. sensor"

12.2.1 Parameter set "Ext. temp. sensor" (configuration)

Navigation Sensor management → Ext. temp. sensor → Ext. temp. sensor

Sensor type

Navigation Sensor management → Ext. temp. sensor → Ext. temp. sensor → Sensor type

Description Specify the type of sensor that is connected.

Selection
- No sensor
- FMT131
- PT100

Factory setting No sensor

Temperature unit

Navigation Sensor management → Ext. temp. sensor → Ext. temp. sensor → Temperature unit

Description Displays the temperature unit.

Additional information Set the temperature unit: **Device properties** → **Operating param.** → **Temperature unit** → **Temperature unit**

12.2.2 Parameter set "Ext. temp. sensor" (minimum/maximum indicator)

Navigation Sensor management → Ext. temp. sensor → Ext. temp. sensor

Max. value

Navigation Sensor management → Ext. temp. sensor → Ext. temp. sensor → Max. value

Description Displays the maximum temperature reached so far.

Min. Value

Navigation Sensor management → Ext. temp. sensor → Ext. temp. sensor → Min. Value

Description Displays the minimum temperature reached so far.

Actual value

Navigation Sensor management → Ext. temp. sensor → Ext. temp. sensor → Actual value

Description Displays the temperature currently measured.

Reset

Navigation Sensor management → Ext. temp. sensor → Ext. temp. sensor → Reset

Description Select the action to reset the minimum/maximum indicators.

Additional information

Meaning of the options
- **Keep**
  The minimum/maximum indicators are not reset.
- **Clear**
  The minimum/maximum indicators are reset to the temperature currently measured.
- **Reset min.**
  - **Min value** is reset to the temperature currently measured.
  - **Max. value** keeps its value.
- **Reset max.**
  - **Max. value** is reset to the temperature currently measured.
  - **Min. value** keeps its value.

12.2.3 Parameter set "Ext. temp. sensor" (error handling)

Navigation Sensor management → Ext. temp. sensor → Ext. temp. sensor

Failure mode

Navigation Sensor management → Ext. temp. sensor → Ext. temp. sensor → Failure mode

Description Specify how the Prosonic S reacts to a failure (e.g. disconnected power supply) of the external temperature sensor.

Additional information

Meaning of the options
- **Alarm**
  An error message is generated. The error is displayed via the alarm relay.
- **Warning**
  An error message is generated, but measuring continues. The temperature defined in **Value at warning** is used for signal evaluation.

Value at warning

Navigation Sensor management → Ext. temp. sensor → Ext. temp. sensor → Value at warning

Prerequisite **Error handling** = **Warning**

Description Define the temperature that is used for signal evaluation when a warning is present.

12.3 Submenu "External digin"

12.3.1 Parameter set "External digin N"

Navigation Sensor management → External digin → External digin N

Invert

Navigation Sensor management → External digin → External digin N → Invert

Description Specify whether the switching behavior (open ↔ closed) of the switch input is inverted.

Additional information

Meaning of the options
- **No**
  - Switch status 0 = "Inactive"
  - Switch status 1 = "Active"
- **Yes**
  - Switch status 0 = "Active"
  - Switch status 1 = "Inactive"

The switch statuses are defined as follows:
- 0: Input voltage $U_i \leq 8$ V or + and Π not connected
- 1: Input voltage $U_i \geq 16$ V or + and Π connected

Value

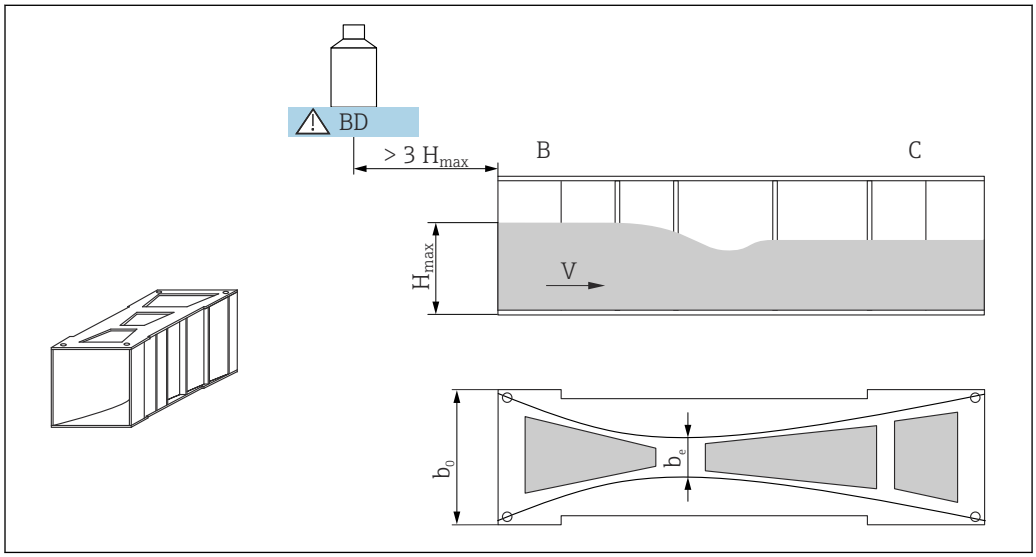
Navigation Sensor management → External digin → External digin N → Value

Description Displays the current value of the digital switch input ("0" or "1").

13 Flow curves and flow formulas

13.1 Pre-programmed flow curves

13.1.1 Khafagi-Venturi flumes



51 *Parameters for Khafagi-Venturi flumes*

BD Blocking distance of the sensor

Khafagi-Venturi QV 302
- b_0 = 120 mm
- b_e = 48 mm
- H_{max} = 220 mm
- Q_{max} = 40.09 m^3/h

Khafagi-Venturi QV 303
- b_0 = 300 mm
- b_e = 120 mm
- H_{max} = 250 mm
- Q_{max} = 104.3 m^3/h

Khafagi-Venturi QV 304
- b_0 = 400 mm
- b_e = 160 mm
- H_{max} = 350 mm
- Q_{max} = 231.5 m^3/h

Khafagi-Venturi QV 305
- b_0 = 500 mm
- b_e = 200 mm
- H_{max} = 380 mm
- Q_{max} = 323.0 m^3/h

Khafagi-Venturi QV 306
- b_0 = 600 mm
- b_e = 240 mm
- H_{max} = 400 mm
- Q_{max} = 414.0 m^3/h

Khafagi-Venturi QV 308
- b_0 = 800 mm
- b_e = 320 mm
- H_{max} = 600 mm
- Q_{max} = 1 024 m^3/h

Khafagi-Venturi QV 310
- b_0 = 1 000 mm
- b_e = 400 mm
- H_{max} = 800 mm
- Q_{max} = 1 982 m^3/h

Khafagi-Venturi QV 313
- b_0 = 1 300 mm
- b_e = 520 mm
- H_{max} = 950 mm
- Q_{max} = 3 308 m^3/h

Khafagi-Venturi QV 316
- b_0 = 1 600 mm
- b_e = 640 mm
- H_{max} = 1 250 mm
- Q_{max} = 6 181 m^3/h

Khafagi-Venturi flumes with elevated side walls

The pre-programmed curves can also be used for Khafagi-Venturi flumes with elevated side walls. To do so, simply adjust the Q_{max} value (**Max. flow** parameter).

Khafagi-Venturi QV 302
- H_{max} = 330 mm
- Q_{max} = 81.9 m^3/h

Khafagi-Venturi QV 303
- H_{max} = 360 mm
- Q_{max} = 187.9 m^3/h

Khafagi-Venturi QV 304
- H_{max} = 460 mm
- Q_{max} = 359.9 m^3/h

Khafagi-Venturi QV 305
- H_{max} = 580 mm
- Q_{max} = 637.7 m^3/h

Khafagi-Venturi QV 306
- H_{max} = 580 mm
- Q_{max} = 748.6 m^3/h

Khafagi-Venturi QV 308
- H_{max} = 850 mm
- Q_{max} = 1 790 m^3/h

Khafagi-Venturi QV 310
- H_{max} = 1 200 mm
- Q_{max} = 3 812 m^3/h

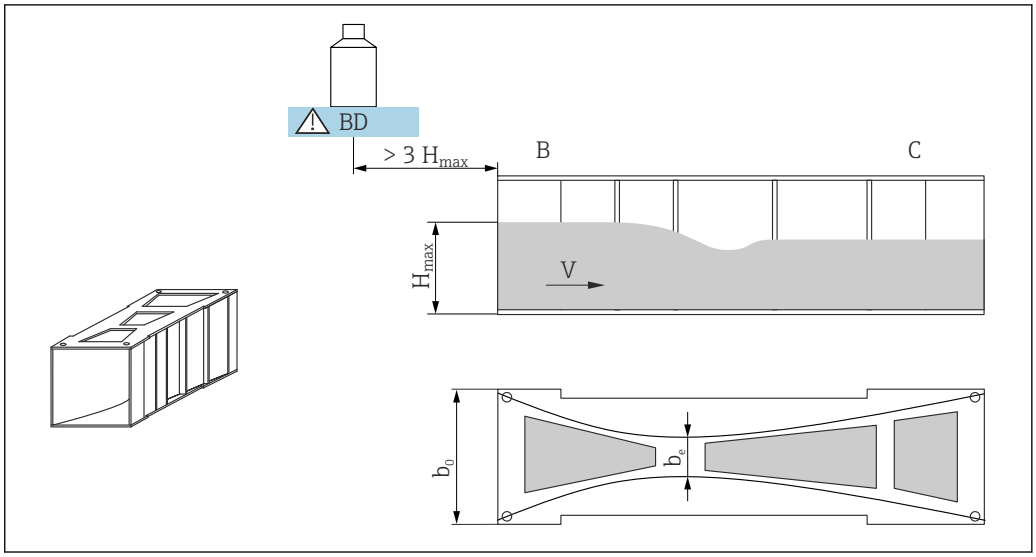
Khafagi-Venturi QV 313
- H_{max} = 1 350 mm
- Q_{max} = 5 807 m^3/h

Khafagi-Venturi QV 316

- H_{max} = 1 800 mm
- Q_{max} = 11 110 m^3/h

Once the type of flume has been selected, Q_{max} can be adapted to the flow conditions in the **Max. flow** parameter. Q_{max} defines the flow at which the output current is 20 mA.

13.1.2 ISO Venturi flumes



52 *Parameters for ISO-Venturi flumes*

BD Blocking distance of the sensor

ISO-Venturi 415
- b_0 = 150 mm
- b_e = 75 mm
- H_{max} = 200 mm
- Q_{max} = 42.5 m^3/h

ISO-Venturi 425
- b_0 = 250 mm
- b_e = 125 mm
- H_{max} = 300 mm
- Q_{max} = 130.3 m^3/h

ISO-Venturi 430
- b_0 = 400 mm
- b_e = 200 mm
- H_{max} = 400 mm
- Q_{max} = 322.2 m^3/h

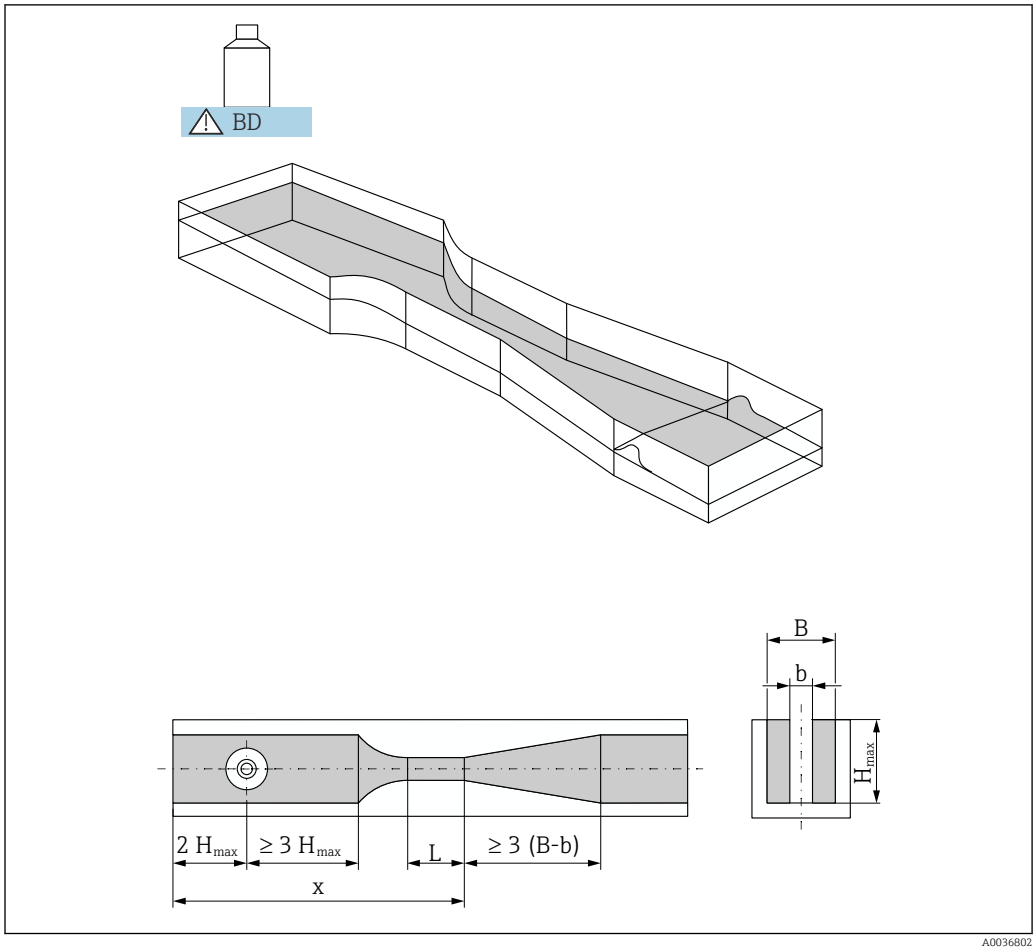
ISO-Venturi 440
- b_0 = 400 mm
- b_e = 267 mm
- H_{max} = 625 mm
- Q_{max} = 893.6 m^3/h

ISO-Venturi 450
- b_0 = 500 mm
- b_e = 333 mm
- H_{max} = 700 mm
- Q_{max} = 1318.9 m^3/h

ISO-Venturi 480
- b_0 = 800 mm
- b_e = 480 mm
- H_{max} = 800 mm
- Q_{max} = 1862.5 m^3/h

Once the type of flume has been selected, Q_{max} can be adapted to the flow conditions in the **Max. flow** parameter. Q_{max} defines the flow at which the output current is 20 mA.

13.1.3 Venturi flumes according to British Standard (BS 3680)



53 *Parameters for Venturi flumes according to British Standard (BS 3680)*

BD Blocking distance of the sensor

The bottom of the flume may not be sloped over the length x (i.e. no measuring flume with data threshold).

BST Venturi 4"
- b = 4 in
- H_{max} = 150 mm
- Q_{max} = 36.25 m^3/h

BST Venturi 7"
- b = 7 in
- H_{max} = 190 mm
- Q_{max} = 90.44 m^3/h

BST Venturi 12"
- b = 12 in
- H_{max} = 340 mm
- Q_{max} = 371.1 m^3/h

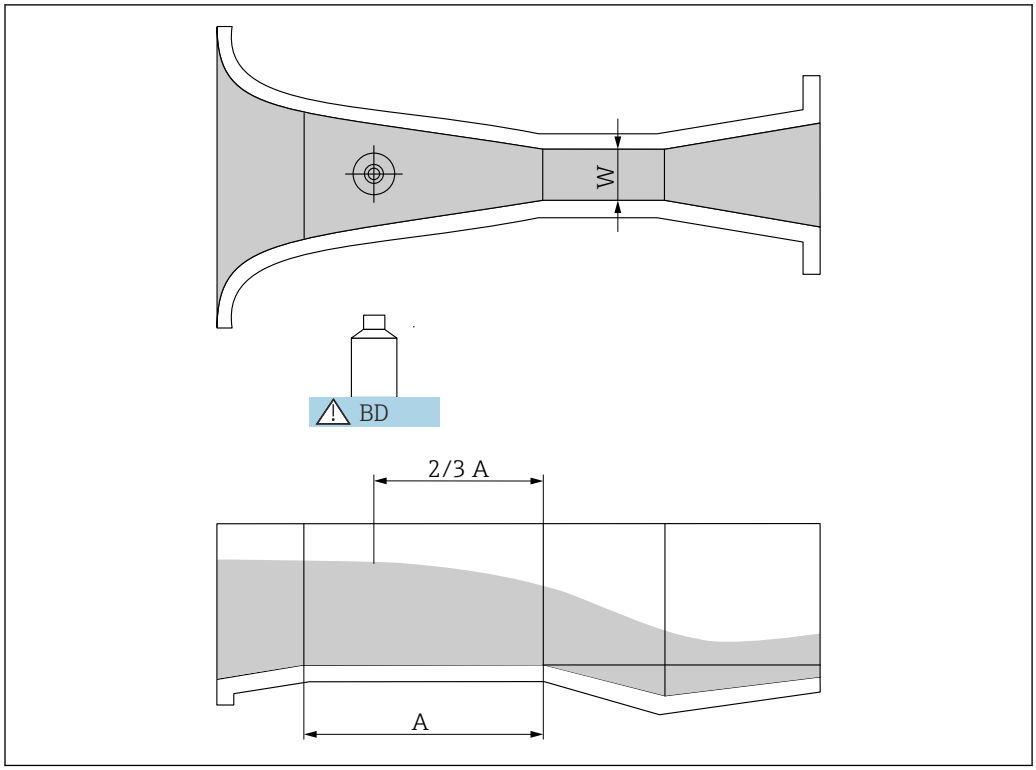
BST Venturi 18"
- b = 18 in
- H_{max} = 480 mm
- Q_{max} = 925.7 m^3/h

BST Venturi 30"

- b = 30 in
- H_{max} = 840 mm
- Q_{max} = 3 603 m^3/h

Once the type of flume has been selected, Q_{max} can be adapted to the flow conditions in the **Max. flow** parameter. Q_{max} defines the flow at which the output current is 20 mA.

13.1.4 Parshall flumes



54 *Parameters for Parshall flumes*

BD Blocking distance of the sensor
A Horizontal bottom of the channel

Parshall 1"
- W = 1 in
- H_{max} = 180 mm
- Q_{max} = 15.23 m^3/h

Parshall 2"
- W = 2 in
- H_{max} = 180 mm
- Q_{max} = 30.46 m^3/h

Parshall 3"
- W = 3 in
- H_{max} = 480 mm
- Q_{max} = 203.8 m^3/h

Parshall 6"
- W = 6 in
- H_{max} = 480 mm
- Q_{max} = 430.5 m^3/h

Parshall 9"
- W = 9 in
- H_{max} = 630 mm
- Q_{max} = 950.5 m^3/h

Parshall 1 ft
- W = 1 ft
- H_{max} = 780 mm
- Q_{max} = 1 704 m^3/h

Parshall 1.5 ft
- W = 1.5 ft
- H_{max} = 780 mm
- Q_{max} = 2 595 m^3/h

Parshall 2 ft
- W = 2 ft
- H_{max} = 780 mm
- Q_{max} = 3 498 m^3/h

Parshall 3 ft
- W = 3 ft
- H_{max} = 780 mm
- Q_{max} = 5 328 m^3/h

Parshall 4 ft
- W = 4 ft
- H_{max} = 780 mm
- Q_{max} = 7 185 m^3/h

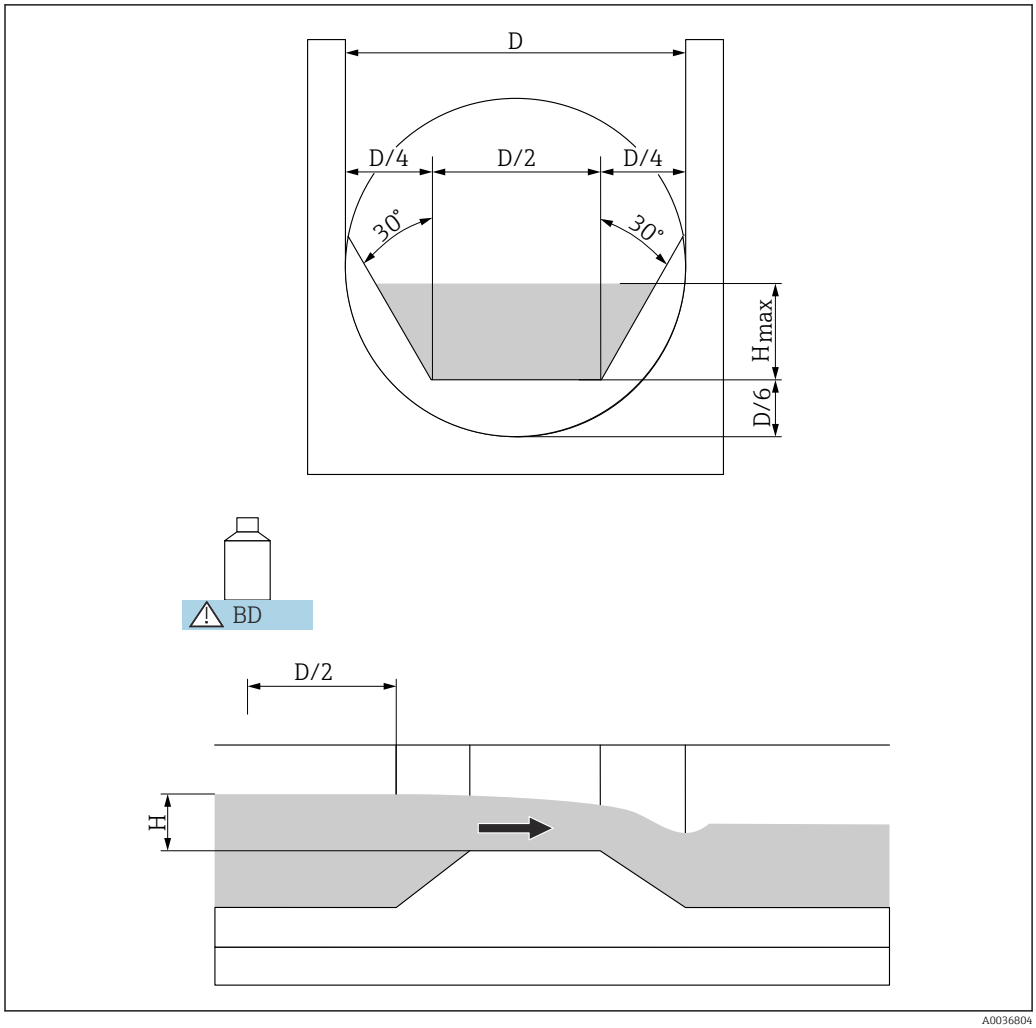
Parshall 5 ft
- W = 5 ft
- H_{max} = 780 mm
- Q_{max} = 9 058 m^3/h

Parshall 6 ft
- W = 6 ft
- H_{max} = 780 mm
- Q_{max} = 10 951 m^3/h

Parshall 8 ft
- W = 8 ft
- H_{max} = 780 mm
- Q_{max} = 14 767 m^3/h

Once the type of flume has been selected, Q_{max} can be adapted to the flow conditions in the **Max. flow** parameter. Q_{max} defines the flow at which the output current is 20 mA.

13.1.5 Palmer-Bowlus flumes



55 *Parameters for Palmer-Bowlus flumes*

BD Blocking distance of the sensor

Palmer-Bowlus 6"
- D = 6 in
- H_{max} = 120 mm
- Q_{max} = 37.94 m^3/h

Palmer-Bowlus 8"
- D = 8 in
- H_{max} = 150 mm
- Q_{max} = 68.62 m^3/h

Palmer-Bowlus 10"
- D = 10 in
- H_{max} = 210 mm
- Q_{max} = 150.55 m^3/h

Palmer-Bowlus 12"
- D = 12 in
- H_{max} = 240 mm
- Q_{max} = 215.83 m^3/h

Palmer-Bowlus 15"
- D = 15 in
- H_{max} = 300 mm
- Q_{max} = 376.97 m^3/h

Palmer-Bowlus 18"
- D = 18 in
- H_{max} = 330 mm
- Q_{max} = 499.86 m^3/h

Palmer-Bowlus 21"
- D = 21 in
- H_{max} = 420 mm
- Q_{max} = 871.05 m^3/h

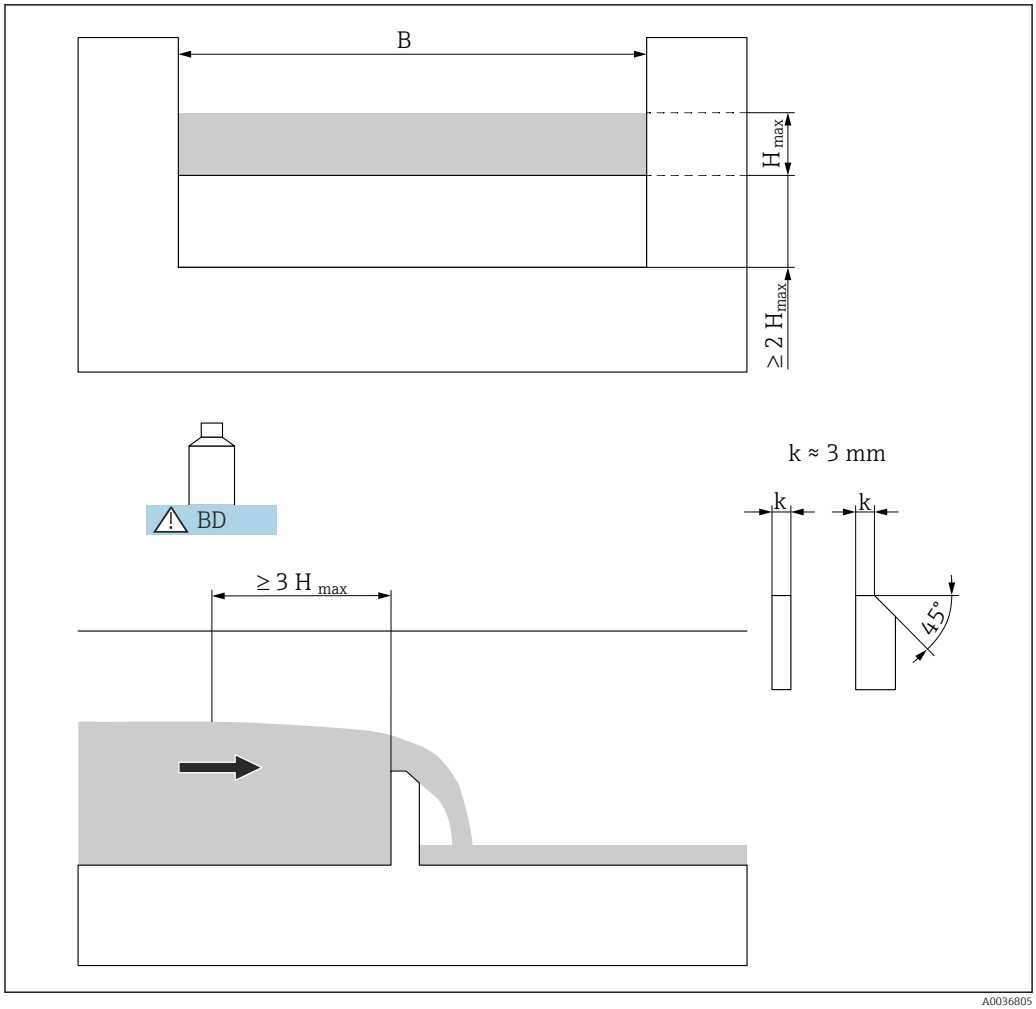
Palmer-Bowlus 24
- D = 24 in
- H_{max} = 450 mm
- Q_{max} = 1075.94 m^3/h

Palmer-Bowlus 27"
- D = 27 in
- H_{max} = 540 mm
- Q_{max} = 1625.58 m^3/h

Palmer-Bowlus 30"
- D = 30 in
- H_{max} = 600 mm
- Q_{max} = 2 136.47 m^3/h

Once the type of flume has been selected, Q_{max} can be adapted to the flow conditions in the **Max. flow** parameter. Q_{max} defines the flow at which the output current is 20 mA.

13.1.6 Rectangular weirs



56 *Parameters for rectangular weirs*

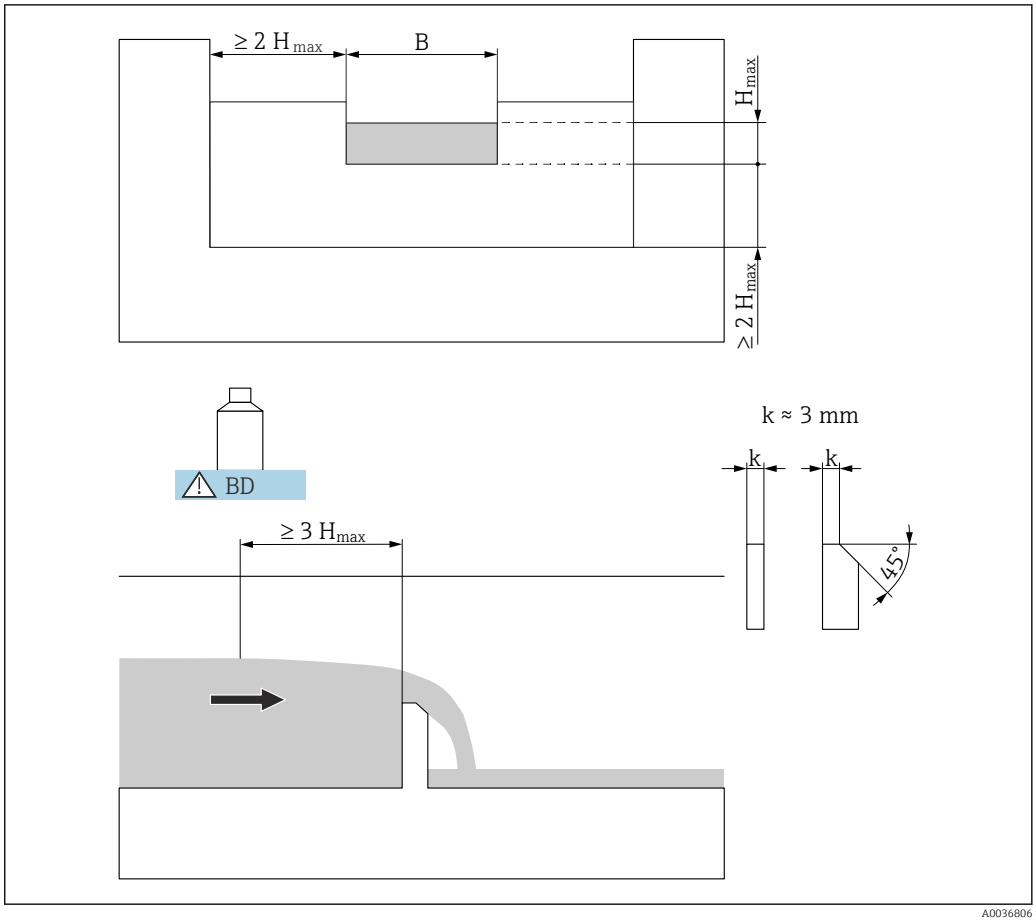
BD Blocking distance of the sensor

RectWT0/5H
- B =1 000 mm
- H_{max} = 500 mm
- Q_{max} = 2 418 m^3/h

RectWT0/T5
- B =1 000 mm
- H_{max} = 1 500 mm
- Q_{max} = 12 567 m^3/h

- The weir width B can be adjusted subsequently in the **Width** parameter. The flow curve is then adjusted automatically.
- Once the type of weir has been selected, Q_{max} can be adapted to the flow conditions in the **Max. flow** parameter. Q_{max} defines the flow at which the output current is 20 mA.

13.1.7 Constricted rectangular weirs



57 *Parameters for constricted rectangular weirs*

BD Blocking distance of the sensor

RectWThr 2H
- B =200 mm
- H_{max} = 120 mm
- Q_{max} = 51.18 m^3/h

RectWThr 3H
- B =300 mm
- H_{max} = 150 mm
- Q_{max} = 108.4 m^3/h

RectWThr 4H
- B =400 mm
- H_{max} = 240 mm
- Q_{max} = 289.5 m^3/h

RectWThr 5H
- B =500 mm
- H_{max} = 270 mm
- Q_{max} = 434.6 m^3/h

RectWThr 6H
- B =600 mm
- H_{max} = 300 mm
- Q_{max} = 613.3 m^3/h

RectWThr 8H
- B =800 mm
- H_{max} = 450 mm
- Q_{max} = 1493 m^3/h

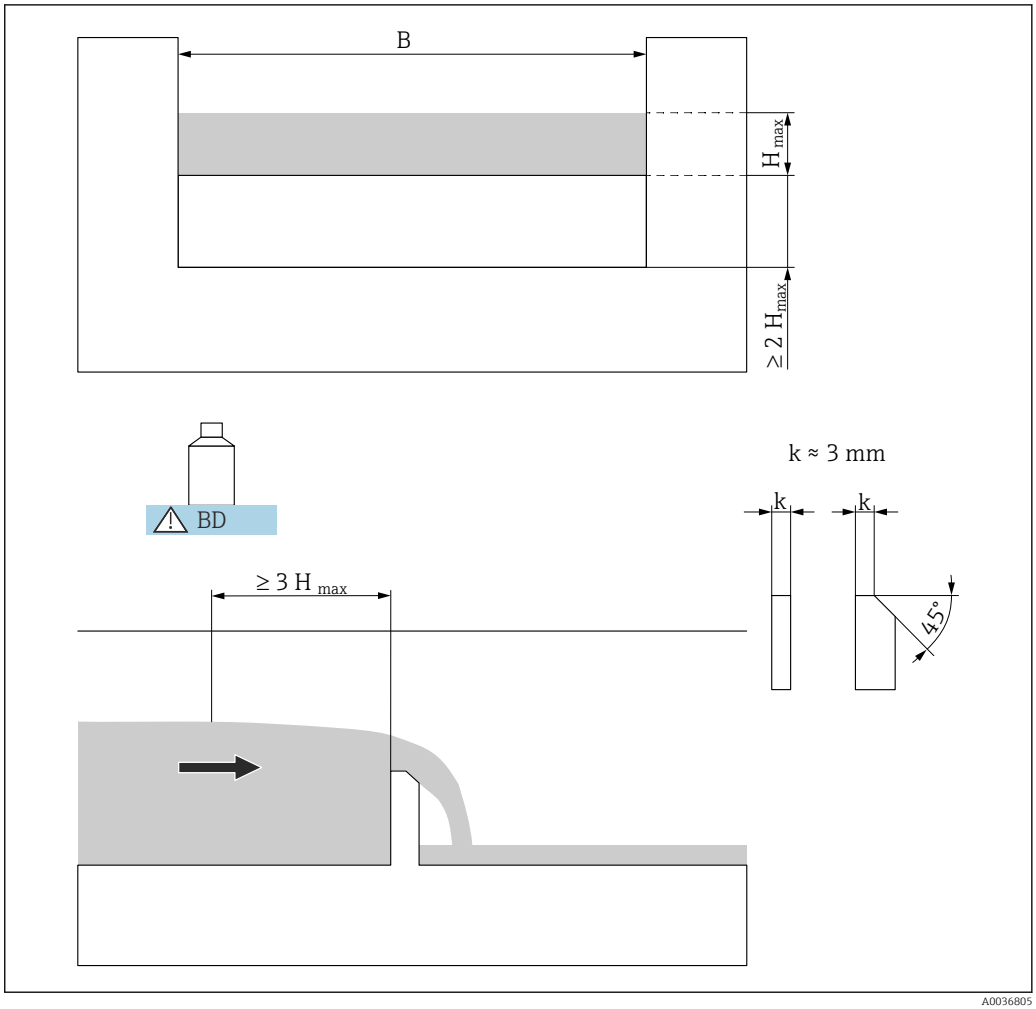
RectWThr T0
- B =1000 mm
- H_{max} = 600 mm
- Q_{max} = 2861 m^3/h

RectWThr T5
- B =1500 mm
- H_{max} = 725 mm
- Q_{max} = 6061 m^3/h

RectWThr 2T
- B =2000 mm
- H_{max} = 1013 mm
- Q_{max} = 13352 m^3/h

- The weir width B can be adjusted subsequently in the **Width** parameter. The flow curve is then adjusted automatically.
- Once the type of weir has been selected, Q_{max} can be adapted to the flow conditions in the **Max. flow** parameter. Q_{max} defines the flow at which the output current is 20 mA.

13.1.8 Rectangular weirs according to French Standard NFX



58 *Parameters for rectangular weirs according to French Standard NFX*

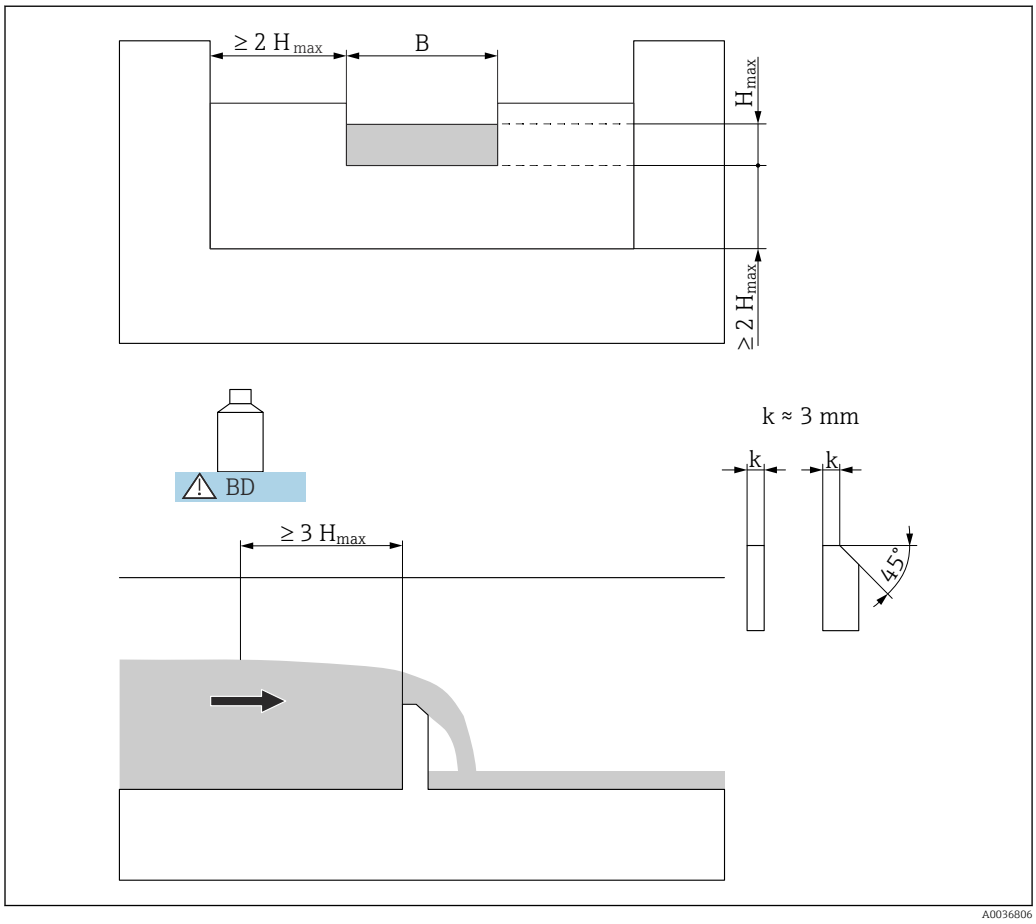
BD Blocking distance of the sensor

NFX Rect T0/5H
- B =1 000 mm
- H_{max} = 500 mm
- Q_{max} = 2 427.3 m^3/h

NFX Rect T0/T5
- B =1 000 mm
- H_{max} = 1 500 mm
- Q_{max} = 12 582.5 m^3/h

- The weir width B can be adjusted subsequently in the **Width** parameter. The flow curve is then adjusted automatically.
- Once the type of weir has been selected, Q_{max} can be adapted to the flow conditions in the **Max. flow** parameter. Q_{max} defines the flow at which the output current is 20 mA.

13.1.9 Constricted rectangular weirs according to French Standard NFX



59 *Parameters for constricted rectangular weirs according to French Standard NFX*

BD Blocking distance of the sensor

NFX Rect WThr 2H
- B =200 mm
- H_{max} = 120 mm
- Q_{max} = 53.5 m^3/h

NFX Rect WThr 3H
- B =300 mm
- H_{max} = 150 mm
- Q_{max} = 111.7 m^3/h

NFX Rect WThr 4H
- B =400 mm
- H_{max} = 240 mm
- Q_{max} = 299.1 m^3/h

NFX Rect WThr 5H
- B =500 mm
- H_{max} = 270 mm
- Q_{max} = 445.8 m^3/h

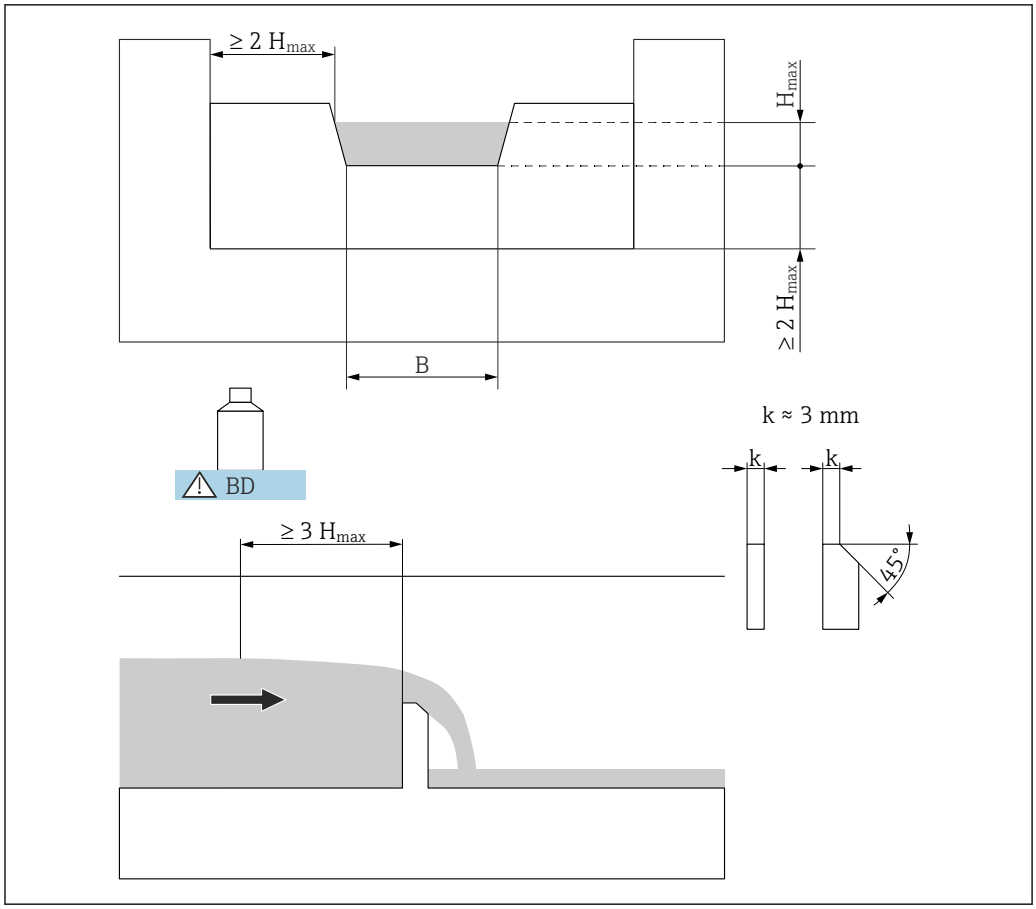
NFX Rect WThr 6H
- B =600 mm
- H_{max} = 300 mm
- Q_{max} = 626.2 m^3/h

NFX Rect WThr 8H
- B =800 mm
- H_{max} = 450 mm
- Q_{max} = 1 527.8 m^3/h

NFX Rect WThr T0
- B =1 000 mm
- H_{max} = 600 mm
- Q_{max} = 2 933.8 m^3/h

Once the type of weir has been selected, Q_{max} can be adapted to the flow conditions in the **Max. flow** parameter. Q_{max} defines the flow at which the output current is 20 mA.

13.1.10 Trapezoidal weirs



60 *Parameters for trapezoidal weirs*

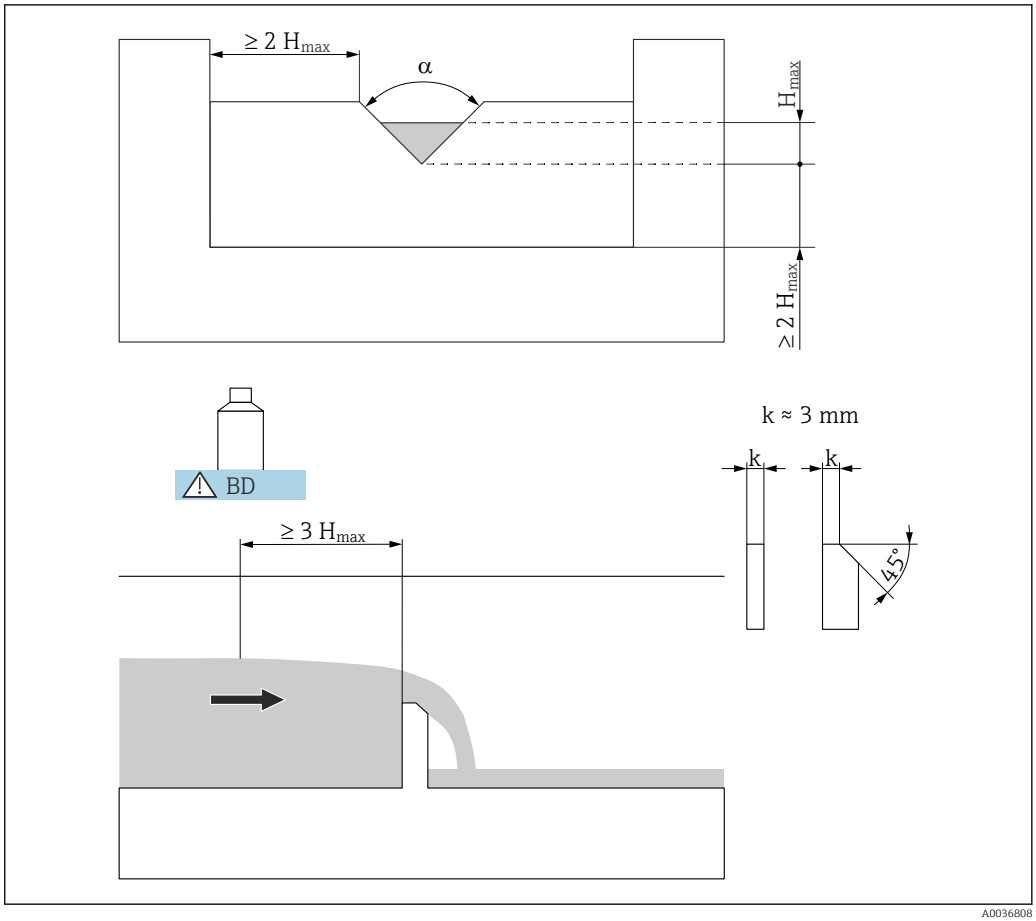
BD Blocking distance of the sensor

Trap.W T0/3H
- B =1000 mm
- H_{max} = 300 mm
- Q_{max} = 1049 m^3/h

Trap.W T0/T5
- B =1000 mm
- H_{max} = 1500 mm
- Q_{max} = 11733 m^3/h

- The weir width B can be adjusted subsequently in the **Width** parameter. The flow curve is then adjusted automatically.
- Once the type of weir has been selected, Q_{max} can be adapted to the flow conditions in the **Max. flow** parameter. Q_{max} defines the flow at which the output current is 20 mA.

13.1.11 Triangular weirs



61 *Parameters for triangular weirs*

BD Blocking distance of the sensor

V-Weir 22.5
- α = 22.5 °
- H_{max} = 600 mm
- Q_{max} = 276.0 m^3/h

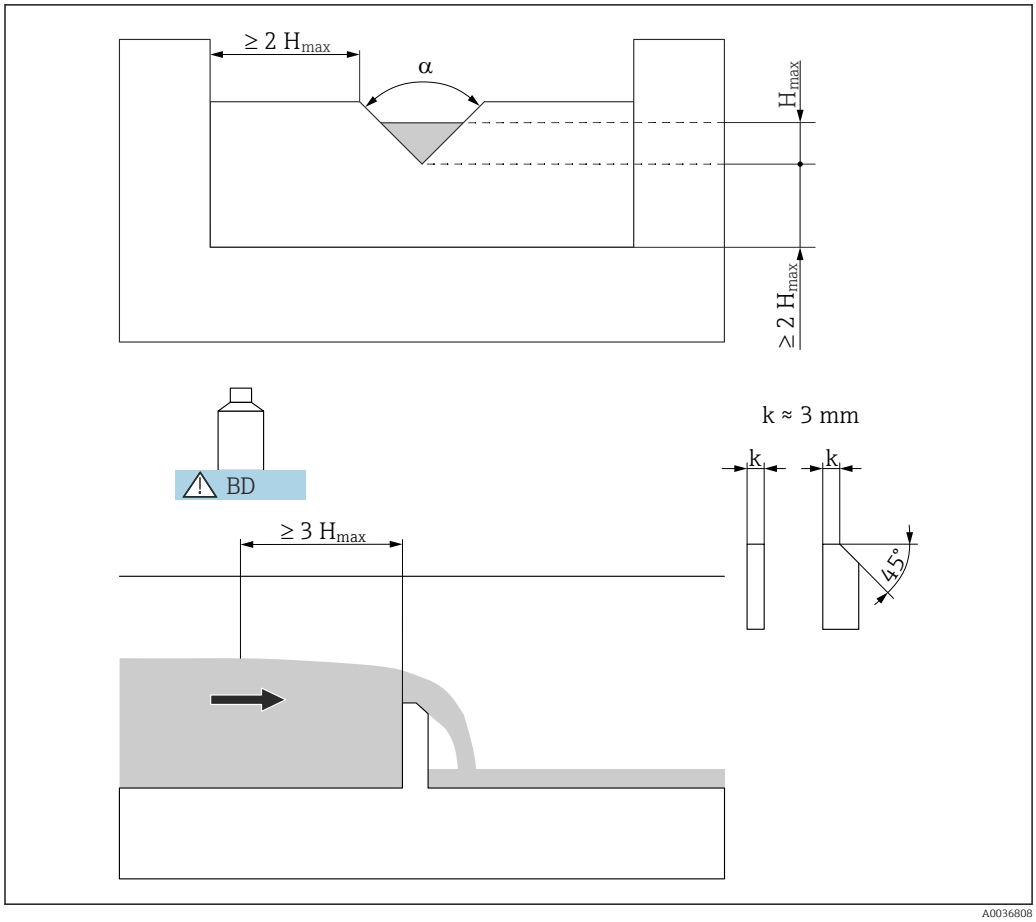
V-Weir 30
- α = 30 °
- H_{max} = 600 mm
- Q_{max} = 371.2 m^3/h

V-Weir 45
- α = 30 °
- H_{max} = 600 mm
- Q_{max} = 574.1 m^3/h

V-Weir 60
- α = 60 °
- H_{max} = 600 mm
- Q_{max} = 799.8 m^3/h

V-Weir 90
- α = 90 °
- H_{max} = 600 mm
- Q_{max} = 1 385 m^3/h

13.1.12 Triangular weirs according to British Standard (BS 3680)



62 *Parameters for triangular weirs according to British Standard (BS 3680)*

BD Blocking distance of the sensor

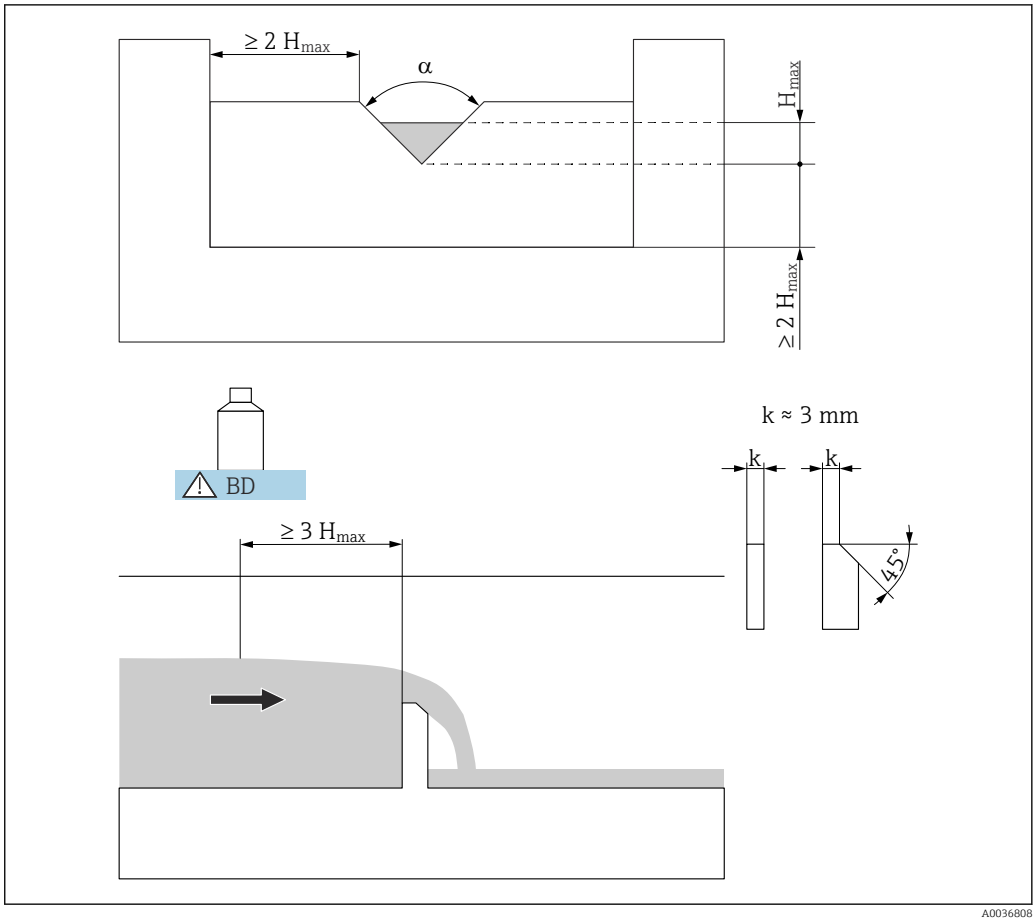
BST V-Weir 22.5 (1/4 90°)
- α = 22.5 °
- H_{max} = 390 mm
- 120.1 m^3/h

BST V-Weir 45 (1/2 90°)
- α = 45 °
- H_{max} = 390 mm
- 237.0 m^3/h

BST V-Weir 90
- α = 90 °
- H_{max} = 390 mm
- 473.2 m^3/h

Once the type of weir has been selected, Q_{max} can be adapted to the flow conditions in the **Max. flow** parameter. Q_{max} defines the flow at which the output current is 20 mA.

13.1.13 Triangular weirs according to French Standard NFX



63 *Parameters for triangular weirs according to French Standard NFX*

BD Blocking distance of the sensor

NFX V-Weir 30
- α = 30 °
- H_{max} = 600 mm
- Q_{max} = 375.9 m^3/h

NFX V-Weir 45
- α = 45 °
- H_{max} = 600 mm
- Q_{max} = 573.1 m^3/h

NFX V-Weir 60
- α = 60 °
- H_{max} = 600 mm
- Q_{max} = 793.1 m^3/h

NFX V-Weir 90
- α = 90 °
- H_{max} = 600 mm
- Q_{max} = 1 376.7 m^3/h

Once the type of weir has been selected, Q_{max} can be adapted to the flow conditions in the **Max. flow** parameter. Q_{max} defines the flow at which the output current is 20 mA.

13.2 Formula for flow calculation

If **Formula** has been selected for the linearization type (see **Type→** 🖹 **34** parameter), the flow is calculated according to the following formula:

$Q = C(h^{\alpha} + \gamma h^{\beta})$

Where:
- Q: is the flow in m^3/h
- C: is a scaling constant
- h: is the upstream level
- α, β: are the flow exponents
- γ: is a weighting factor

The values for the parameters α, β, γ and C for a variety of flumes and weirs are summarized in the following lists.

13.2.1 Khafagi-Venturi flumes

QV 302
- Q_{max} = 40.09 m^3/h
- α = 1.500
- β = 2.500
- γ = 0.0013140
- C = 0.0095299

QV 303
- Q_{max} = 104.3 m^3/h
- α = 1.500
- β = 2.500
- γ = 0.0004301
- C = 0.0238249

QV 304
- Q_{max} = 231.5 m^3/h
- α = 1.500
- β = 2.500
- γ = 0.0003225
- C = 0.0317665

QV 305
- Q_{max} = 323.0 m^3/h
- α = 1.500
- β = 2.500
- γ = 0.0002580
- C = 0.0397081

QV 306
- Q_{max} = 414.0 m^3/h
- α = 1.500
- β = 2.500
- γ = 0.0002150
- C = 0.0476497

QV 308
- Q_{max} = 1024 m^3/h
- α = 1.500
- β = 2.500
- γ = 0.0001613
- C = 0.0635329

QV 310
- Q_{max} = 1 982 m^3/h
- α = 1.500
- β = 2.500
- γ = 0.0001290
- C = 0.0794162

QV 313
- Q_{max} = 3 308 m^3/h
- α = 1.500
- β = 2.500
- γ = 0.0000992
- C = 0.1032410

QV 316
- Q_{max} = 6 181 m^3/h
- α = 1.500
- β = 2.500
- γ = 0.0000806
- C = 0.1270659

13.2.2 ISO Venturi flumes

ISO 415
- Q_{max} = 42.5 m^3/h
- α = 1.500
- β = 2.100
- γ = 0.0009336
- C = 0.0146865

ISO 425
- Q_{max} = 130.3 m^3/h
- α = 1.500
- β = 1.600
- γ = 0.0959719
- C = 0.0214406

ISO 430
- Q_{max} = 322.2 m^3/h
- α = 1.500
- β = 2.000
- γ = 0.0032155
- C = 0.0379104

ISO 440
- Q_{max} = 893.6 m^3/h
- α = 1.600
- β = 1.700
- γ = −0.2582633
- C = 0.0590888

ISO 450
- Q_{max} = 1318.9 m^3/h
- α = 1.600
- β = 1.800
- γ = −0.0895791
- C = 0.0553654

ISO 480
- Q_{max} = 1862.5 m^3/h
- α = 1.600
- β = 1.800
- γ = −0.0928186
- C = 0.0795737

13.2.3 Venturi flumes according to British Standard (BS 3680)

BST Venturi 4"
- Q_{max} = 36.25 m^3/h
- α = 1.500
- β = 1.000
- γ = 0.0000000
- C = 0.019732

BST Venturi 7"
- Q_{max} = 90.44 m^3/h
- α = 1.500
- β = 1.000
- γ = 0.0000000
- C = 0.034532

BST Venturi 12"
- Q_{max} = 371.2 m^3/h
- α = 1.500
- β = 1.000
- γ = 0.0000000
- C = 0.059201

BST Venturi 18"
- Q_{max} = 925.7 m^3/h
- α = 1.500
- β = 1.000
- γ = 0.0000000
- C = 0.088021

BST Venturi 30"
- Q_{max} = 3 603 m^3/h
- α = 1.500
- β = 1.000
- γ = 0.0000000
- C = 0.148003

13.2.4 Parshall flumes

Parshall 1"
- Q_{max} = 15.23 m^3/h
- α = 1.550
- β = 1.000
- γ = 0.0000000
- C = 0.0048651

Parshall 2"
- Q_{max} = 30.46 m^3/h
- α = 1.550
- β = 1.000
- γ = 0.0000000
- C = 0.0097302

Parshall 3"
- Q_{max} = 203.8 m^3/h
- α = 1.547
- β = 1.000
- γ = 0.0000000
- C = 0.0144964

Parshall 6"
- Q_{max} = 430.5 m^3/h
- α = 1.580
- β = 1.000
- γ = 0.0000000
- C = 0.0249795

Parshall 9"
- Q_{max} = 950.5 m^3/h
- α = 1.530
- β = 1.000
- γ = 0.0000000
- C = 0.0495407

Parshall 1 ft
- Q_{max} = 1 704 m^3/h
- α = 1.522
- β = 1.000
- γ = 0.0000000
- C = 0.0675749

Parshall 1.5 ft
- Q_{max} = 2 595 m^3/h
- α = 1.538
- β = 1.000
- γ = 0.0000000
- C = 0.0924837

Parshall 2 ft
- Q_{max} = 3 498 m^3/h
- α = 1.550
- β = 1.000
- γ = 0.0000000
- C = 0.1151107

Parshall 3 ft
- Q_{max} = 5 328 m^3/h
- α = 1.566
- β = 1.000
- γ = 0.0000000
- C = 0.1575984

Parshall 4 ft
- Q_{max} = 7 185 m^3/h
- α = 1.578
- β = 1.000
- γ = 0.0000000
- C = 0.1962034

Parshall 5 ft
- Q_{max} = 9 058 m^3/h
- α = 1.587
- β = 1.000
- γ = 0.0000000
- C = 0.2329573

Parshall 6 ft
- Q_{max} = 10 951 m^3/h
- α = 1.595
- β = 1.000
- γ = 0.0000000
- C = 0.2670383

Parshall 8 ft
- Q_{max} = 14 767 m^3/h
- α = 1.607
- β = 1.000
- γ = 0.0000000
- C = 0.3324357

13.2.5 Palmer-Bowlus flumes

Palmer-Bowlus 6"
- Q_{max} = 37.94 m^3/h
- α = 0.200
- β = 2.000
- γ = 0.01176
- C = 0.22063

Palmer-Bowlus 8"
- Q_{max} = 68.62 m^3/h
- α = 0.200
- β = 2.000
- γ = 0.00661
- C = 0.45306

Palmer-Bowlus 10"
- Q_{max} = 150.55 m^3/h
- α = 0.200
- β = 2.000
- γ = 0.00512
- C = 0.65826

Palmer-Bowlus 12"
- Q_{max} = 215.83 m^3/h
- α = 0.200
- β = 2.000
- γ = 0.0033
- C = 1.11787

Palmer-Bowlus 15"
- Q_{max} = 376.97 m^3/h
- α = 0.200
- β = 2.000
- γ = 0.00213
- C = 1.93489

Palmer-Bowlus 18"
- Q_{max} = 499.86 m^3/h
- α = 0.200
- β = 2.000
- γ = 0.00152
- C = 2.96269

Palmer-Bowlus 21"
- Q_{max} = 871.05 m^3/h
- α = 0.200
- β = 2.000
- γ = 0.00113
- C = 4.29769

Palmer-Bowlus 24"
- Q_{max} = 1075.94 m^3/h
- α = 0.200
- β = 2.000
- γ = 0.00091
- C = 5.73322

Palmer-Bowlus 27"
- Q_{max} = 1625.58 m^3/h
- α = 0.200
- β = 2.000
- γ = 0.00073
- C = 7.51238

Palmer-Bowlus 30"
- Q_{max} = 2 136.47 m^3/h
- α = 0.200
- β = 2.000
- γ = 0.00061
- C = 9.57225

13.2.6 Rectangular weirs

RectWT0/5H

- Q_{max} = 2 418 m^3/h
- α = 1.500
- β = 1.000
- γ = 0.0000000
- C = 0.21632686

RectWT0/T5

- Q_{max} = 12 567 m^3/h
- α = 1.500
- β = 1.000
- γ = 0.0000000
- C = 0.21632686

13.2.7 Constricted rectangular weirs

RectWThr 2H
- Q_{max} = 51.18 m^3/h
- α = 1.500
- β = 1
- γ = 0.0000000
- C = 0.038931336

RectWThr 3H
- Q_{max} = 108.4 m^3/h
- α = 1.500
- β = 1
- γ = 0.0000000
- C = 0.059018248

RectWThr 4H
- Q_{max} = 289.5 m^3/h
- α = 1.500
- β = 1
- γ = 0.0000000
- C = 0.077862671

RectWThr 5H
- Q_{max} = 434.6 m^3/h
- α = 1.500
- β = 1
- γ = 0.0000000
- C = 0.097949584

RectWThr 6H
- Q_{max} = 613.3 m^3/h
- α = 1.500
- β = 1
- γ = 0.0000000
- C = 0.118036497

RectWThr 8H
- Q_{max} = 1 493 m^3/h
- α = 1.500
- β = 1
- γ = 0.0000000
- C = 0.156346588

RectWThr T0
- Q_{max} = 2 861 m^3/h
- α = 1.500
- β = 1
- γ = 0.0000000
- C = 0.194656679

RectWThr T5
- Q_{max} = 6 061 m^3/h
- α = 1.500
- β = 1
- γ = 0.0000000
- C = 0.3106200

RectWThr 2T
- Q_{max} = 13 352 m^3/h
- α = 1.500
- β = 1
- γ = 0.0000000
- C = 0.4141600

13.2.8 Rectangular weirs according to French Standard NFX

NFX Rect T0/5H

- Q_{max} = 2 427.3 m^3/h
- α = 1.400
- β = 2.000
- γ = 0.0107097
- C =0.2801013

NFX Rect T0/T5

- Q_{max} = 12 582.5 m^3/h
- α = 1.500
- β = 0.000
- γ = 0.0000000
- C =0.1951248

13.2.9 Constricted rectangular weirs according to French Standard NFX

NFX RectWThr 2H
- Q_{max} = 53.5 m^3/h
- α = 1.500
- β = 1.600
- γ = −0.1428487
- C = 0.0528094

NFX RectWThr 3H
- Q_{max} = 111.7 m^3/h
- α = 1.500
- β = 1.600
- γ = −0.1115842
- C = 0.0744722

NFX RectWThr 4H
- Q_{max} = 299.1 m^3/h
- α = 1.500
- β = 1.600
- γ = −0.0975777
- C = 0.0966477

NFX RectWThr 5H
- Q_{max} = 445.8 m^3/h
- α = 1.500
- β = 1.600
- γ = −0.0884398
- C = 0.1187524

NFX RectWThr 6H
- Q_{max} = 626.2 m^3/h
- α = 1.500
- β = 1.600
- γ = −0.0816976
- C = 0.1407481

NFX RectWThr 8H
- Q_{max} = 1 527.8 m^3/h
- α = 1.500
- β = 1.600
- γ = −0.0634245
- C = 0.1810272

NFX RectWThr T0
- Q_{max} = 2 933.8 m^3/h
- α = 1.500
- β = 1.600
- γ = −0.0671398
- C = 0.2285268

13.2.10 Trapezoidal weirs

Trap.W T0/3H
- Q_{max} = 1049 m^3/h
- α = 1.500
- β = 1.000
- γ = 0.0000000
- C = 0.2067454

Trap.W T0/T5
- Q_{max} = 11733 m^3/h
- α = 1.500
- β = 1.000
- γ = 0.0000000
- C = 0.2067454

13.2.11 Triangular weirs

V-Weir 22.5
- Q_{max} = 276.0 m^3/h
- α = 2.500
- β = 1.000
- γ = 0.0000000
- C = 0.0000313

V-Weir 30
- Q_{max} = 371.2 m^3/h
- α = 2.500
- β = 1.000
- γ = 0.0000000
- C = 0.0000421

V-Weir 45
- Q_{max} = 574.1 m^3/h
- α = 2.500
- β = 1.000
- γ = 0.0000000
- C = 0.0000651

V-Weir 60
- Q_{max} = 799.8 m^3/h
- α = 2.500
- β = 1.000
- γ = 0.0000000
- C = 0.0000907

V-Weir 90
- Q_{max} = 1 385 m^3/h
- α = 2.500
- β = 1.000
- γ = 0.0000000
- C = 0.0001571

13.2.12 Triangular weirs according to British Standard (BS 3680)

BST V-Weir 22.5
- Q_{max} = 120.1 m^3/h
- α = 2.314
- β = 2.649
- γ = 0.1430720
- C = 0.0000590

BST V-Weir 45
- Q_{max} = 237.3 m^3/h
- α = 2.340
- β = 2.610
- γ = 0.2659230
- C = 0.0000880

BST V-Weir 90
- Q_{max} = 473.2 m^3/h
- α = 2.314
- β = 2.650
- γ = 0.1904230
- C = 0.0001980

13.2.13 Triangular weirs according to French Standard NFX

NFX V-Weir 30
- Q_{max} = 375.9 m^3/h
- α = 2.400
- β = 2.800
- γ = 0.0241095
- C = 0.0000616

NFX V-Weir 45
- Q_{max} = 573.1 m^3/h
- α = 2.476
- β = 0.000
- γ = 0.0000000
- C = 0.0000757

NFX V-Weir 60
- Q_{max} = 793.1 m^3/h
- α = 2.486
- β = 0.000
- γ = 0.0000000
- C = 0.0000983

NFX V-Weir 90
- Q_{max} = 1376.7 m^3/h
- α = 2.491
- β = 0.000
- γ = 0.0000000
- C = 0.0001653

14 Overview of the operating menu

14.1 Menu "Level → Level (LVL N)"

14.1.1 Submenu "Basic setup"

Parameter set L1003 "LVL N sensor sel."
- Input
- Sensor selection
- Detected

Parameter set L1004 "LVL N appl. param."
- Tank shape
- Medium property
- Process conditions

Parameter set L1005 "LVL N empty cal."
Empty E

Parameter set L 1006 "LVL N full cal."
- Full F
- Blocking distance

Parameter set L1007 "LVL N unit"
- Unit level
- Level N
- Distance

Parameter set L1008 "LVL N linearisat."
- Type
- Customer unit
- Customized text
- Max. scale
- Diameter
- Intermediate height (H)
- Mode
- Edit
- Status table

Parameter set L100B "LVL N check value"
- Act. distance N
- Check distance

Parameter set L100B "LVL N dist. map."
- Act. distance N
- Range of mapping
- Start mapping
- Status

Parameter set L100C "LVL N status"
- Level N
- Act. distance N
- Status

14.1.2 Submenu "Extended calibr."

Parameter set L1016 "LVL N dist. map."
- Act. distance N
- Range of mapping
- Start mapping
- Status

Parameter set L1017 "LVL N check value"
Correction

Parameter set L1018 "LVL N correction"
Offset

Parameter set L1020 "LVL N blocking distance"
Blocking distance

Parameter set L1019 "LVL N limitation"
- Limitation
- Upper limit
- Lower limit

Parameter set L1020/L1021 "LVL N ext. input M"
Only for devices with additional digital inputs (FMU90********B***)
- Input M
- Function
- Value

14.1.3 Submenu "Simulation"

Parameter set L1022 "LVL N simulation"
- Simulation
- Sim. level value
- Sim. volume value

14.2 Menu "Flow N"

Navigation to the menu:
- If **Operating mode** = **Level + flow**:
  Flow → Flow → Flow N
- If **Operating mode** = **Flow**:
  Flow → Flow → Flow N
- If **Operating mode** = **Flow + backwater**:
  Flow → Flow 1 + backwater → Flow N

14.2.1 Submenu "Basic setup"

Parameter set F1003 "Flow N sensor sel."
- Input
- Sensor selection
- Detected

Parameter set F1004 "Flow N linearisat."
- Type
- Flow unit
- Curve
- Width
- Edit
- Status table
- alpha
- beta
- gamma
- C
- Max. flow

Parameter set F1010 "Flow N empty cal."
- Empty E
- Blocking distance

Parameter set F1005 "Flow N"
- Flow N
- Level
- Distance

Parameter set F1006 "Flow N check value"
- Distance
- Check distance

Parameter set F1008 "Flow N mapping"
- Distance
- Range of mapping
- Start mapping
- Status

Parameter set "Flow N status"
- Level
- Distance
- Flow N
- Status

14.2.2 Submenu "Extended calibr."

Parameter set F1010 "Flow N mapping"
- Distance
- Range of mapping
- Start mapping
- Status

Parameter set F1011 "Flow N low cut off"
- Low flow cut off
- Flow N

Parameter set F1012 "Flow N dist. corr."
- Correction
- Flow N

Parameter set F1013 "Flow N level corr."
- Offset
- Flow N

Parameter set F1016 "Flow N blocking distance"
Blocking distance

Parameter set F1014 "Flow N limitation"
- Limitation
- Upper limit
- Lower limit

Parameter set F1015/F1016 "Flow N ext. input M"
- Input M
- Function
- Value

14.2.3 Submenu "Simulation"

Parameter set F1020 "Flow N simulation"
- Simulation
- Sim. level value
- Sim. flow Value

14.3 Menu "Backwater"

Navigation to the submenu
Flow → Flow 1+ backw. → Backwater

14.3.1 Submenu "Basic setup"

Parameter set F1304 "Backwater sensor selection"
- Input
- Sensor selection
- Detected

Parameter set F1305 "Backw. empty cal."
- Empty E
- Blocking distance

Parameter set F1306 "Backwater detection"
Ratio B

Parameter set F1306 "Dirt detection"
Ratio D

Parameter set F1307 "Backwater"
- Act. backw. level
- Act. flow level
- Actual ratio
- Flow 1

Parameter set F1308 "Backwater check value"
- Distance
- Check distance

Parameter set F1309 "Backwater mapping"
- Distance
- Range of mapping
- Start mapping
- Status

14.3.2 Submenu "Extended calibr."

Parameter set F1500 "Backwater mapping"
- Distance
- Range of mapping
- Start mapping
- Status

Parameter set F1501 "Backw dist. corr."
Sensor offset

Parameter set F1502 "Backw. correction"
Offset

Parameter set F1504 "Backw. block.dist."
Blocking distance

Parameter set F1503 "Backw. limitation"
- Limitation
- Upper limit
- Lower limit

Parameter set F1504/F1505 "Backw. ext. input M"
- Input M
- Function
- Value

14.3.3 Submenu "Simulation"

Parameter set F1600 "Backw. simulation"
- Simulation
- Sim. level value

14.4 Menu "Flow counter"

Navigation to the submenu:
Flow → Flow counter

14.4.1 Submenu "Totalizer"

Parameter set F1202 "Totalizer N"
- Allocation
- Counter unit

Parameter set F1203 "Totalizer N"
- Value
- Overflow x 10^7

Parameter set F1204 "Totalizer N"
Failure mode

14.4.2 Submenu "Daily counter"

Parameter set F1102 "Daily counter N"
- Allocation
- Counter unit

Parameter set F1103 "Daily counter N"
- Value
- Overflow x 10^7
- Reset

Parameter set F1104 "Daily counter N"
Failure mode

Parameter set F1105 "Daily counter N"
Only for devices with additional digital inputs (FMU90-********B***)
- External reset
- External start

14.5 Menu "Safety settings"

Parameter set AX101 "Output on alarm"
- Output N
- Output value N

Parameter set AX102 "Outp. echo loss"
- Level N
- Ramp level N
- Value level N
- Flow N
- Value flow N

Parameter set AX103 "Delay echo loss"
Delay Sensor N

Parameter set AX104 "Safety distance"
Saf. dist.sen N

Parameter set AX105 "In safety dist."
- In saf. dist.s N
- Reset sen N

Parameter set AX107 "React. high temp."
- Overtemp. sen. N
- Max. temp. sen. N

Parameter set A0000 "Defect temp. sen."
Def. temp. sen. N

Parameter set A0000 "Relay delay"
Start delay relay

14.6 Menu "Relay/controls"

14.6.1 Submenu "Pump control N" (standard - limit control)

Valid for:
- FMU90-*1**********
- FMU90-*2**********

Parameter set R1300 "Pump control N"
- Reference
- Number of pumps

Parameter set R1301 "Pump control N"
Function = Limit control

Parameter set R1302 "Pump control N"
Pump M

Parameter set R1303 "Pump M /control N"
- Switch-on point
- Switch-off point
- Switch-on delay
- Alternate
- Crust reduction

Parameter set R1304 "Pump M /control N"
- Backlash interval
- Backlash time
- Failure mode

Parameter set R1306 "Relay allocation → Relay K"
- Function
- Invert

14.6.2 Submenu "Pump control N" (standard - pump rate control)

Valid for:
- FMU90-*1**********
- FMU90-*2**********

Parameter set R1300 "Pump control N"
- Reference
- Number of pumps

Parameter set R1301 "Pump control N"
Function = Pump rat. contr.

Parameter set R13A3 "Pump control N"
- Switch-on point
- Switch-off point
- Min. pump rate/min
- Crust reduction
- Switch on border
- Hook up interval
- Alternate

Parameter set R13A2 "Pump control N"
Pump M

Parameter set R13A3 "Pump M / control N"
- Switch-on delay
- Backlash interval
- Backlash time
- Failure mode

Parameter set R13A6 "Relay allocation → Relay K"
- Function
- Invert

14.6.3 Submenu "Pump control N → Basic setup" (extended - limit control)

Valid for:
- FMU90-*3**********
- FMU90-*4**********

Navigation to the submenu:
Relay/controls → Pump control N → Basic setup

Parameter set R1401 "Pump control N"
- Reference
- Number of pumps
- Standby pump
- Reset

Parameter set R1402 "Pump control N"
- Function = Limit single/limit parallel
- Load control

Parameter set R1403 "Pump control N"
Pump M

Parameter set R1404 "Pump M /control N"
- Switch-on point
- Switch-off point
- Switch-on delay
- Alternate
- Degree of use
- Max. use time
- Crust reduction

Parameter set R1405 "Pump M /control N"
- Backlash interval
- Backlash time
- Failure mode

Parameter set R1406 "Pump M /control N"
- Pump feedback
- Feedback delay
- Feedb. meaning

Parameter set R1408 "Relay allocation → Relay K"
- Function
- Invert

14.6.4 Submenu "Pump control N → Basic setup" (extended - pump rate control)

Valid for:
- FMU90-*3**********
- FMU90-*4**********

Navigation to the submenu:
Relay/controls → Pump control N → Basic setup

Parameter set R1401 "Pump control N"
- Reference
- Number of pumps
- Standby pump
- Reset

Parameter set R1402 "Pump control N"
- Function = Pump rat. contr.
- Load control

Parameter set R1504 "Pump control N"
- Switch-on point
- Switch-off point
- Min. pump rate/min
- Hook up interval
- Switch on border
- Alternate
- Crust reduction

Parameter set R1505 "Pump control N"
Pump M

Parameter set R1505 "Pump M /control N"
- Switch-on delay
- Degree of use
- Max. use time

Parameter set R1506 "Pump M /control N"
- Backlash interval
- Backlash time
- Failure mode

Parameter set R1507 "Pump M /control N"
- Pump feedback
- Feedback delay
- Meaning of the feedback

Parameter set R1509 "Relay allocation → Relay K"
- Function
- Invert

14.6.5 Submenu "Pump control N → Storm function"

Valid for:
- FMU90-*3**********
- FMU90-*4**********

Navigation to the submenu:
Relay/controls → Pump control N → Storm function

Parameter set R1601 "Storm function N"
- Storm function
- Switch-on point
- Switch-off point
- Storm time

14.6.6 Submenu "Pump control N → Function test"

Valid for:
- FMU90-*3**********
- FMU90-*4**********

Navigation to the submenu:
Relay/controls → Pump control N → Function test

Parameter set R1602 "Function test N"
- Function test
- Max. downtime
- Max. test time
- Switch-on point
- Switch-off point

14.6.7 Submenu "Pump control N → Flush control"

Valid for:
- FMU90-*3**********
- FMU90-*4**********

Navigation to the submenu:
Relay/controls → Pump control N → Flush control

Parameter set R1603 "Flush control N"
- Flush control
- Pump cycles
- Flush cycles
- Flush time
- Flush delay

Parameter set R1605 "Relay allocation → Relay M"
- Function
- Invert

14.6.8 Submenu "Pump control N → Tariff control"

Valid for:
- FMU90-*3******B***
- FMU90-*4******B***

Navigation to the submenu:
Relay/controls → Pump control N → Tariff control

Parameter set R1607 "Tariff control N"
- Tariff control
- Tariff input

Parameter set R1608 "Tariff control N"
Pump M

Parameter set R1619 "Tariff ctrl N/pump M"
- Switch-on point
- Switch-on tariff
- Switch-off point
- Switch-off tariff

14.6.9 Submenu "Pump control N → Pump data"

Valid for:
- FMU90-*3**********
- FMU90-*4**********

Navigation to the submenu:
Relay/controls → Pump control N → Pump data → Pump M

Parameter set R1611 "Pump dat. P M"
- Operating hours
- Reset op. hours
- Total op. hours
- Number of starts
- Starts per h
- Backlash starts
- Reset backlstart
- Last run time

14.6.10 Submenu "Pump control N → Op. hours alarm"

Valid for:
- FMU90-*3**********
- FMU90-*4**********

Navigation to the submenu:
Relay/controls → Pump control N → Op. hours alarm

Parameter set R1612 "Op. hours alarm"
- Op. hours alarm
- Alarm delay

Parameter set R1613 "Op. hours alarm"
Pump M

Parameter set R1613 "Op. hours alarm N P M"
- Operating hours
- Max. op. hours

Parameter set R1615 "Relay allocation → Relay K"
- Function
- Invert

14.6.11 Submenu "Pump control N → Pump alarm"

Valid for:
- FMU90-*3******B***
- FMU90-*4******B***

Navigation to the submenu:
Relay/controls → Pump control N → Pump alarm

Parameter set R1617 "Pump alarm N"
- Pump alarm
- Waiting time

Parameter set R1619 "Relay allocation → Relay K"
- Function
- Invert

14.6.12 Submenu "Rake control"

Parameter set R1200 "Rake control"
- Upstream water
- Downstream water
- Function

Parameter set R1201 "Rake control"
- Switch-on point
- Switch-off point

Parameter set R1202 "Rake control"
- Switching delay
- Failure mode

Parameter set R2204 "Relay allocation → Relay N"
- Function
- Invert

14.6.13 Submenu "Relay configurat. → Relay N" (function: limit)

Parameter set R1203 "Relay N"
- Function → Limit → Limit XXX
- Limit type
- Switch-on point
- Switch-off point
- Switch on/min.
- Switch off/min.
- Upper switchpt.
- Low switch point
- Hysteresis

Parameter set R1204 "Relay N"
- Switch delay
- Invert
- Failure mode

14.6.14 Submenu "Relay configurat. → Relay N" (function: time pulse)

Parameter set R2103 "Relay N"
- Function → Time pulse
- Pulse width
- Pulse time

Parameter set R2104 "Relay N"
- Invert
- Failure mode

14.6.15 Submenu "Relay configurat. → Relay N" (function: counting pulse)

Parameter set R1203 "Relay N"
- Function → Counting pulse → Pulse flow N
- Counter unit
- Pulse value
- Pulse width

Parameter set R1205 "Relay N"
- Pulse counter
- Overflow x 10^7
- Reset counter
- Start counter
- Stop counter

Parameter set R1204 "Relay N"
- Invert
- Failure mode

14.6.16 Submenu "Relay configurat. → Relay N" (function: alarm/ diagnost.)

Parameter set R2103 "Relay N"
- Function → Alarm/diagnost.
  - Alarm relay
  - Diagnostics
  - Backw. alarm
  - Dirt alarm
- Allocation M

Parameter set R2104 "Relay N"
Invert

14.6.17 Submenu "Relay configurat. → Relay N" (function: fieldbus)

Parameter set R1203 "Relay N"
Function → Fieldbus

Parameter set R201E "Function"
- None
- DO1
- ...
- DO10

14.6.18 Submenu "Relay simulation"

Parameter set R2106 "Relay N"
- Simulation
- Simulation value

14.7 Menu "Output/calculat. → Current output N"

14.7.1 Submenu "Allocat./calculat."

Parameter set O1201 "Allocat. curr. N"
- Output
- Output current

14.7.2 Submenu "Extended calibr."

Parameter set OX202 "Mode current N"
- Current span
- mA value
- Output damping
- 4mA threshold
- Curr. turn down
- Turn down 0/4mA
- Turn down 20mA

14.7.3 Submenu "HART settings"

Only for current output 1

Parameter set O1203 "HART settings"
- HART address
- No. of preambles
- Short TAG HART

Parameter set O2205/O3206/O4207 "Add. HART value M"
- Measured value M
- Output damping M

14.7.4 Submenu "Simulation"

Parameter set O1204 "Current output N"
- Simulation
- Simulation value

14.8 Overview of the "Output/calculat." menu (PROFIBUS DP)

14.8.1 Submenu "Analog input"

Parameter set OXA01 "Analog input N"
- Measured value N
- Value
- Status

14.8.2 Submenu "Digital input"

Parameter set O1B03 "Digital input N"
- Allocation
- Value
- Status

14.8.3 Submenu "PROFIBUS DP"

Parameter set O1C01 "PROFIBUS DP"
- Profile version
- Instrument address
- Ident number

14.9 Overview of the "Device properties" menu

14.9.1 Submenu "Operating param."

Parameter set D1101 "Distance unit"
Distance unit

Parameter set D110B "Temperature unit"
Temperature unit

Parameter set D110C "Operating mode"
Operating mode

Parameter set D110D "Controls"
Controls

14.9.2 Submenu "Tag marking"

Parameter set D1102 "Tag marking"
- Output N
- Device marking

14.9.3 Submenu "Language"

Parameter set D1103 "Language"
Language

14.9.4 Submenu "Password/reset"

Parameter set D1104 "Password/reset"
- Reset
- Code
- Status

14.10 Menu "System informat."

14.10.1 Submenu "Device information"

Parameter set IX101 "Device family"
Device family

Parameter set IX102 "Device name"
Device name

Parameter set IX103 "Device marking"
Device marking

Parameter set IX105 "Serial no."
Serial number

Parameter set IX106 "Software version"
Software version

Parameter set IX107 "Dev. rev."
Dev. rev.

Parameter set IX108 "DD version"
DD version

14.10.2 Submenu "In/output info"

Parameter set IX108 "Level N"
- Input
- Sensor selection
- Detected

Parameter set IX109 "Flow N"
- Input
- Sensor selection
- Detected

Parameter set IX10A "Current output N"
Output

Parameter set IX10B "Relay N"
Function

14.10.3 Submenu "Trend display → Trend output N"

Parameter set IX10F Trend output N
Time interval

14.10.4 Submenu "Min/max values"

Parameter set IX302 "Level → Level (LVL) N"
- Max. value
- Min. Value
- Reset

Parameter set IX302 "Flow → Flow N"
- Max. value
- Min. Value
- Reset

Parameter set IX302 "Temperature → Temperature sen. N"
- Max. value
- Min. Value

14.10.5 Submenu "Envelope curve"

Parameter set IX126 "En. curve sen. N"
- Plot settings (choice of displayed curves)
- Plot settings (choice between an individual curve and cyclic presentation)

14.10.6 Submenu "Error list"

Parameter set E1002 "Actual error"
- 1:
- 2:
- ...

Parameter set E1003 "Last error"
- 1:
- 2:
- ...

14.10.7 Submenu "Diagnostics"

Parameter set E1403 "Operating hours"
Operating hours

Parameter set E1404 "Actual distance"
Act. distance N

Parameter set E1405 "Act. meas. value"
- Level N
- Flow N

Parameter set E1405 "Application par."
Sensor N

Parameter set E1406 "Echo quality sen."
Echo quality N

14.11 Menu "Display"

Parameter set DX202 "Display"
- Type
- Value N
- Customized text N

Parameter set DX201 "Display format"
- Format
- No. of decimals
- Sep. character
- Customized text

Parameter set DX200 "Back to home"
Back to home

14.12 Menu "Sensor management"

14.12.1 Submenu "Sensor management → FDU sensor → Sensor management"

Parameter set D1019 "Input"
FDU sensor N

Parameter set D1106 "US sensor N"
- Sensor operation
- Sensor priority
- Detected
- Sensor selection
- Detection window

Parameter set D1107 "US sensor N"
- Temp. measurement
- Ext. send ctrl.
- Input
- Distance

14.12.2 Submenu "Sensor management → FDU sensor → Ext. temp. sensor"

Parameter set D1020 "Ext. temp. sensor"
- Sensor type
- Temperature unit

Parameter set D1021 "Ext. temp. sensor"
- Max. value
- Min. Value
- Actual value
- Reset

Parameter set D1022 "Ext. temp. sensor"
- Failure mode
- Value at warning

14.12.3 Submenu "Sensor management → FDU sensor → External digin"

Parameter set D1025 "Ext. digin N"
- Invert
- Value

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