

Operating instructions for Magnetic inductive flow meter



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2. note

The devices may only be used, maintained and repaired by persons who are familiar with the operating instructions and the applicable regulations via workplace safety and accident prevention.

When used in machines, the measuring instrument may only be put into operation if the machine complies with the EC Machinery Directive.

according to Pressure Equipment Directive 2014/68/EU

no CE marking, see article 4, paragraph 3, "Good engineering practice", Directive 2014/68/EU (Diagram 8, Piping, Group 1 hazardous fluids)

2.1 Overview of the device functions



Depending on the device firmware installed, the device may have a different range of functions. The functional extensions can be found in the following table.

Function extension
Dosing function
Menu languages
Simulation function
User key function
Analog output 2-10V _{DC}
Behavior of analog outputs according to NAMUR NE43
control input
Additional flow units L/s and mL/s
Filter function for flow and temperature measured value

The installed software version is displayed below the manufacturer's logo in the form REVxxxxxx for approx. 2 seconds after the device is started.

3. Checking the devices

The devices are checked before shipping and are sent in perfect status. If damage to the device is visible, we recommend an accurate check of the delivery packaging. In the event of damage, please inform the parcel service/forwarding agent immediately, as the transport company is liable for transport damage.

Scope of delivery:

The standard scope of delivery includes:

- Flow meter magnetic inductive in metal design (Type: SMxxxxxx)
- Operating instructions

4. Intended use

The flowmeter has been specially developed for the measurement, display and transmission of both flow rates and temperature of conductive liquids. The device is equipped via a graphic TFT display rotatable in 90° steps and can display flow rate, temperature, daily volume counter (resettable) and total volume counter in the measuring units selected by the operator. Clear menu navigation guides the user through the parameterization of the device, largely eliminating the need to consult the operating instructions.

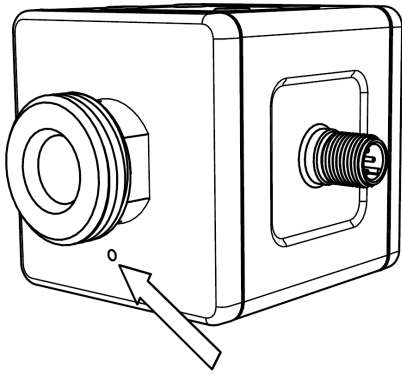
Trouble-free operation of the device is only guaranteed if all points in these operating instructions are observed. We cannot accept any liability for damage resulting from non-compliance with these instructions.

5. Surroundings

The device with stainless steel housing and stainless steel electrodes is weather-resistant and complies with degree of protection IP67. The measuring instrument is suitable for harsh indoor and outdoor environments and complies with EC Directive 2014/30/EU (electromagnetic compatibility).

A pressure equalization element is integrated into the front of the device to prevent moisture in the device due to condensation.

This element must not be penetrated.



6. mode of operation

6.1 General

The new IPF electronic flow meter type SMxx002x is used for the measurement and monitoring of small and medium flow rates of conductive liquids in pipelines.

The device works according to the magnetic-inductive measuring principle. According to Faraday's law of induction, a voltage is induced in a conductor that moves in a magnetic field. The electrically conductive measuring medium corresponds to the moving conductor in the process. The voltage induced by the measuring medium is proportional to the flow rate and is therefore a measure of the volume flow rate. A minimum electrical conductivity of the flowing medium is a prerequisite. The induced voltage is fed to a measuring amplifier via two electrodes that are in conductive contact with the medium. The volume flow is calculated via the defined pipe diameter.

The measurement is independent of the medium and its physical properties such as density, viscosity and temperature. The devices can be configured via the display. A total of two outputs are available. These can be configured as alarm, frequency, pulse, voltage and current outputs.

The device also provides a dosing function. The dosing function can be activated at any time in measuring mode via the four diffuse reflection sensors. The dosing function controls simple filling tasks and also measures the flow rate and partial quantity.

6.2 Minimum electrical conductivity / entrained gases

For the device to function correctly, the flow channel must always be completely filled with medium. From a minimum electrical conductivity of 20 $\mu\text{S}/\text{cm}$, the sensor operates within the specified error limits. The conductivity of the medium is constantly monitored by the device electronics. If the electronics detect that the value has fallen below the minimum value, this is reported by displaying the error message "Empty Pipe" and the measured flow value is set to "0". Air bubbles in the flowing medium or media with changing conductivity in the range of the minimum conductivity can interfere with the measuring function and reduce the measuring accuracy of the sensor. Gases contained in the liquid are also measured as volume flow and lead to measurement errors. If necessary, suitable vents must be installed in the flow line of the device.

6.3 Deposits

Minor deposits on the measuring tube do not generally affect the measuring accuracy, provided their conductivity does not deviate significantly from the liquid. For liquids that have a tendency to form deposits, the measuring tube must be checked at regular intervals and cleaned if necessary.

6.4 Meter electrodes

The SMxx002x uses electrodes with a galvanic tap. They are in direct contact with the medium. The standard electrodes are made of stainless steel 1.4404.

In rare cases, electrically insulating deposits on the meter electrodes (e.g. oils or greases in the medium) cannot be ruled out. The measurement may then fail.

In such cases, the electrodes must be cleaned with a soft brush and a grease solvent.

7. Mechanical connection

7.1 Check operating conditions

- flow rate
- Max. Operating pressures
- Max. Operating temperature

The sensor is generally exposed to the same loads as the pipeline in which it is installed. Therefore, the SMxx002x must be kept away from extreme loads, e.g. pressure surges with strong dynamic pipeline movements, vibrations in the vicinity of centrifugal pumps, high medium temperatures, flooding, etc.

7.2 installation

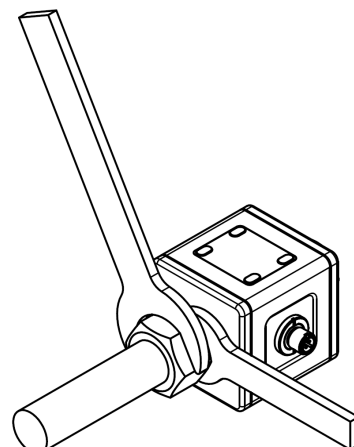
- Remove all transport locks and make sure that there are no packaging parts left in the device.
- Installation can be in vertical, horizontal or rising lines. Flow in the direction of the arrow.
- Avoid pressure and tensile load.
- Mechanically fasten the input and output cable at a distance of 50 mm from the connections.
- Avoid valves or larger reductions on the inlet section (measurement uncertainty is increased as a result).
- Check the tightness of the connections.



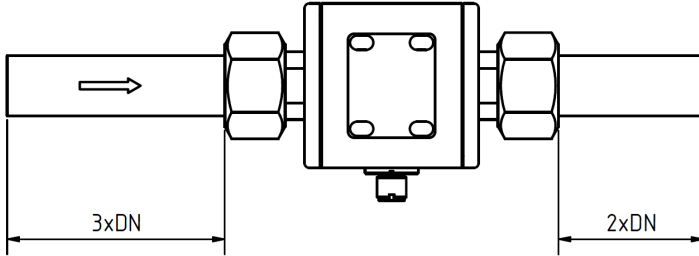
Attention!

**Lock SMxx002x on the wrench flat during assembly (not on the housing).
Observe the tightening torques.**

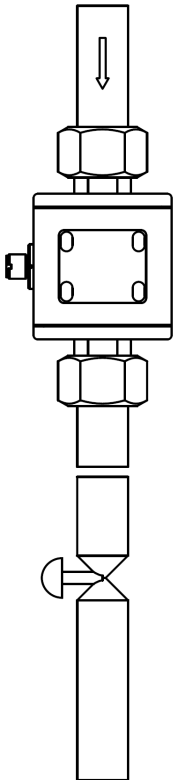
Connection size	torque
1/2"	22 to 24 Nm
3/4"	28 to 30 Nm
1"	28 to 30 Nm



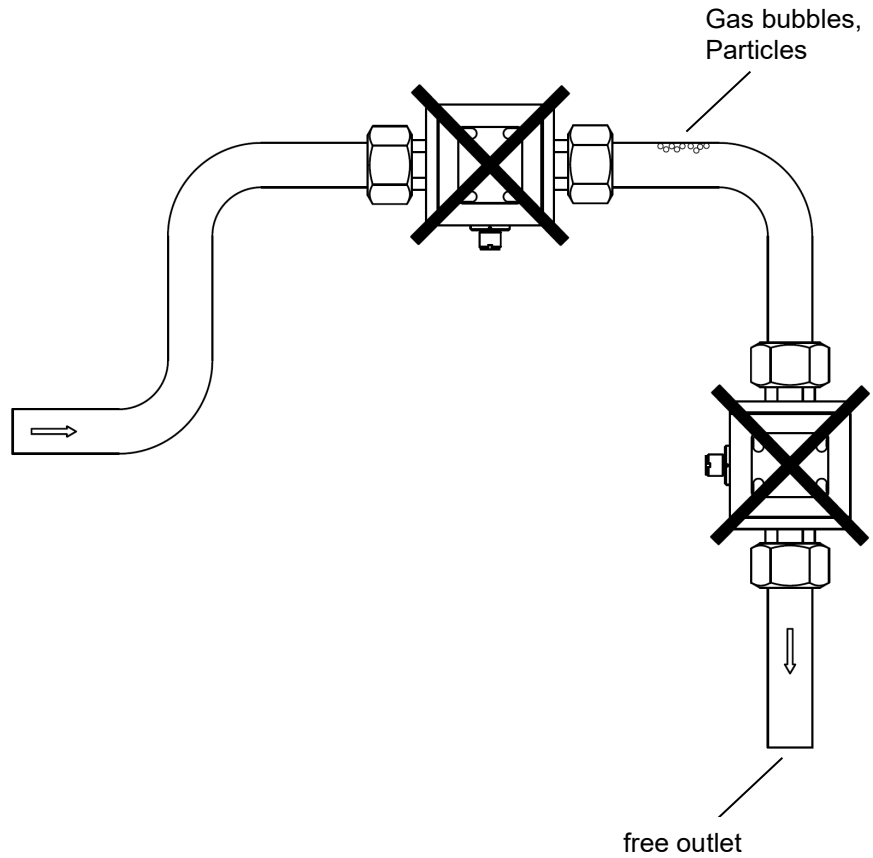
Inlet and outlet section



Installation from top to bottom



Avoid these installation locations



8. Electrical connection

8.1 General



Attention!

Make sure that the voltage values of your system comply with the voltage values of the measuring instrument.

- Make sure that the electrical supply lines are de-energized.
- Connect the supply voltage and the output signal to the PINs of the connector specified below.
- We recommend a supply cable cross-section of at least 0.25 mm².



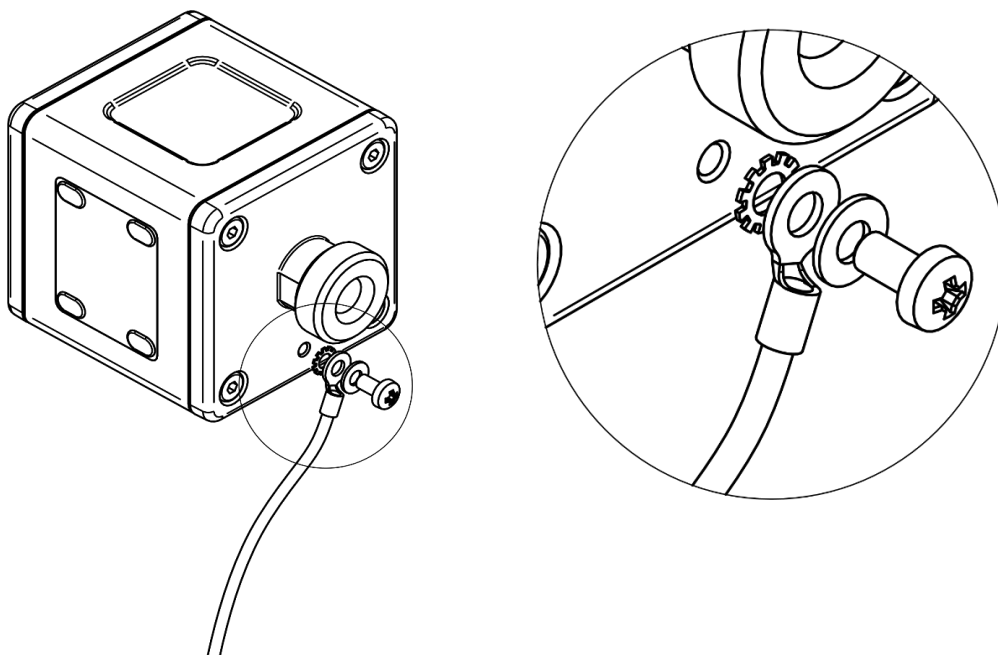
Attention!

The meter electrodes are galvanically isolated from the reference potential of the supply voltage and the signal output.

8.1.1 Earthing

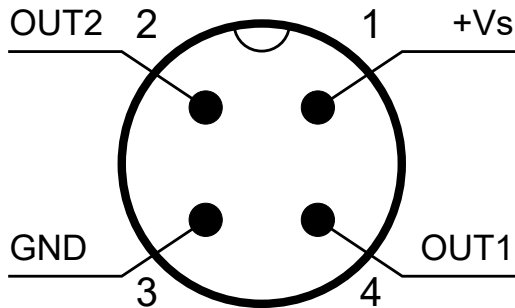
If the device is installed in a continuously earthed, metallic pipe, no additional earthing of the housing is normally necessary. For installation in a plastic pipe or a non-earthed pipe, the housing must be earthed at the lateral threaded boring (M4) to ensure the functionality of the SMxx002x. **If a class 2 switching power supply (insulated, without external safety contact) is used for the voltage supply, the earthing must be connected to ensure the function.** An M4 screw (thread length max. 8 mm), a suitable washer, a ring cable lug and a toothed lock washer are required for correct installation.

These individual mechanical parts are not included in the delivery.



8.2 pin configuration

8.2.1 External connection M12x1 4-pin plug connector



8.2.2 Sensor connection

In the remote versions with PVC cable or ETFE cable, the sensor and transmitter are supplied from the factory with the cable tail connected. On-site installation may make it necessary to remove the cable tail and reconnect it later.



note:

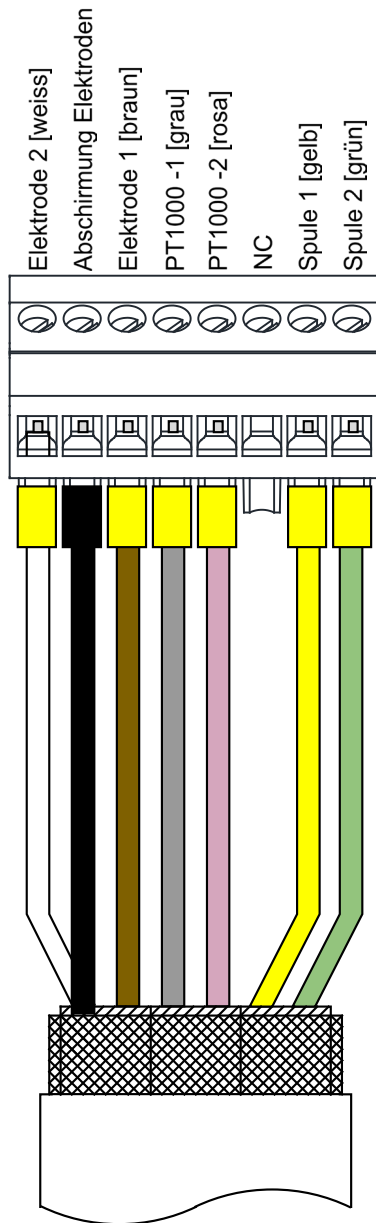
The cable tail can always be shortened by the user on the transmitter side and reconnected to the transmitter after appropriate assembly.



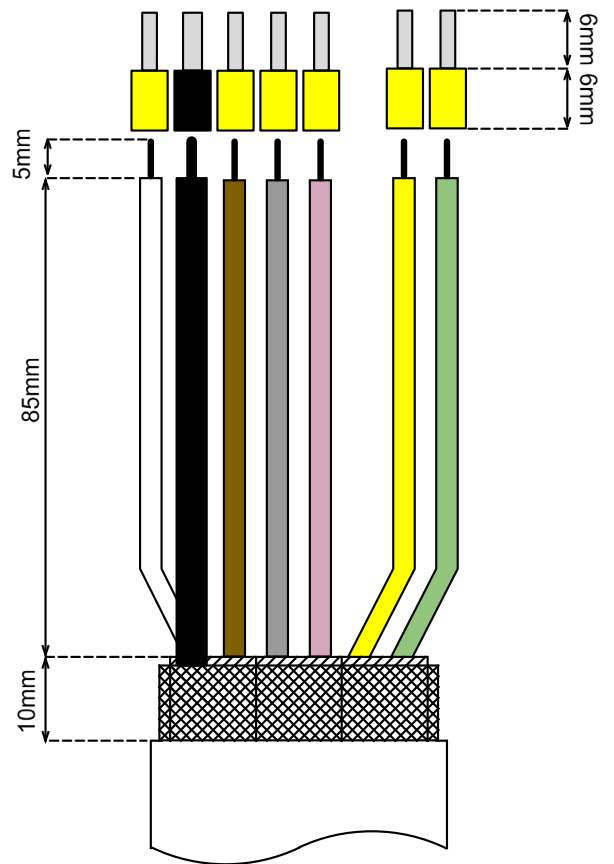
Attention!

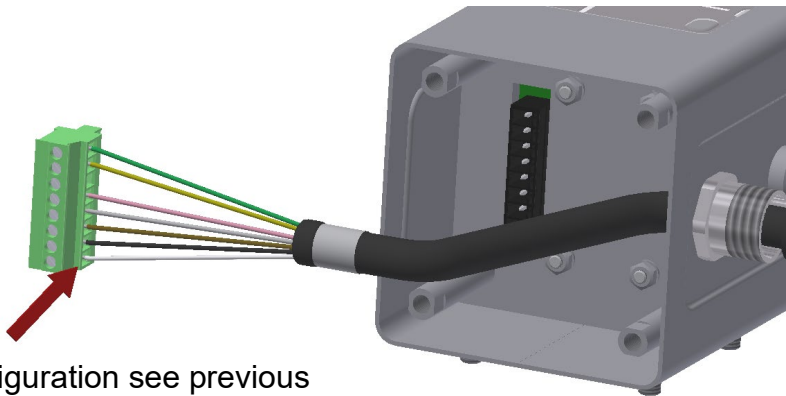
An extension of the connection cable by the customer is not recommended due to the necessary continuous screening / shielding and will cause the device to malfunction. The cable tail permanently connected to the sensor must not be removed.

Transmitter wiring diagram



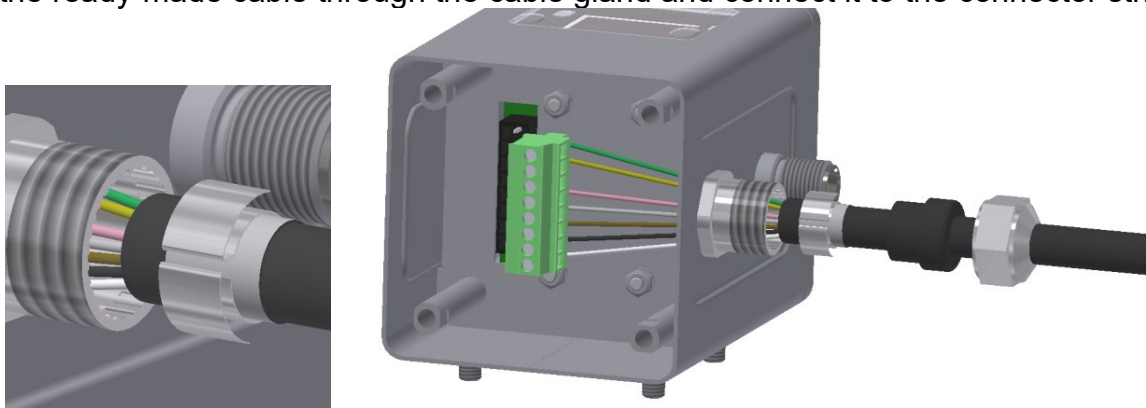
**Connection cable assembly
(PVC and ETFE cable)**



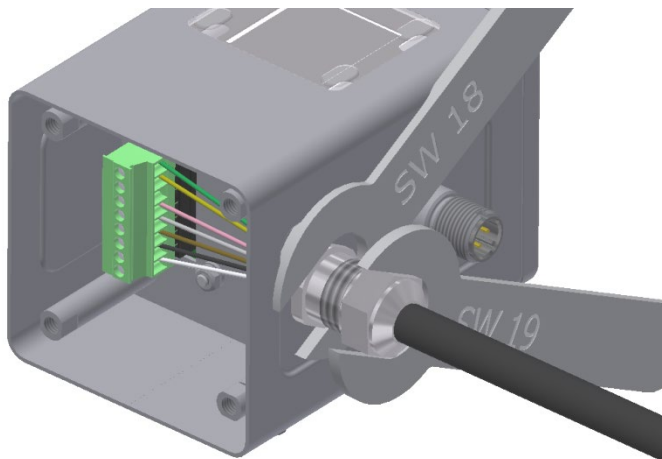


Pin configuration see previous page

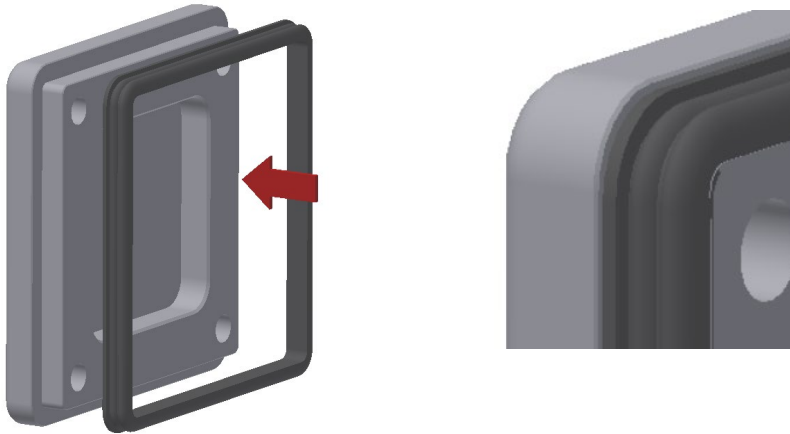
Insert the ready-made cable through the cable gland and connect it to the connector strip



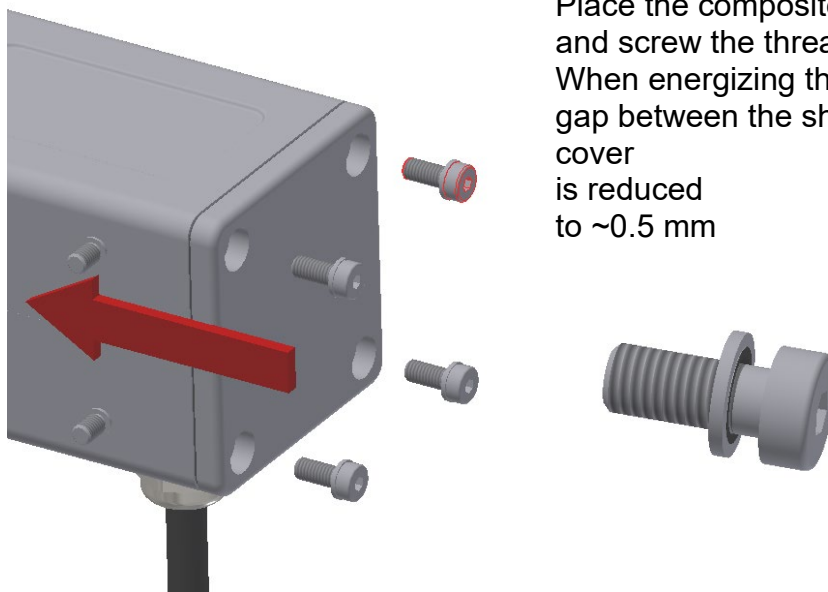
Pull back the cable tail and plug the contact spring onto the outer shield



Push the cable tail into the cable gland, insert the plug connector and energize the hexagon nut of the cable gland with SK wrench SW19 and counter with SW 18



Insert the seal, ensure that the seal is seated correctly

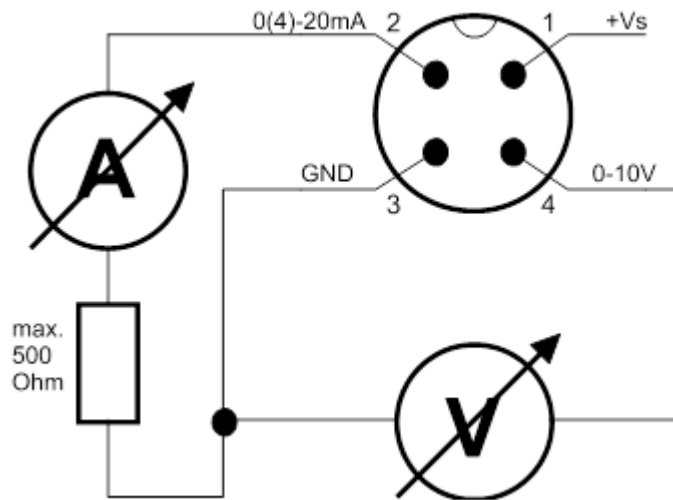


Place the composite sealing washer on the screw and screw the threaded connection to the housing. When energizing the screws, the gap between the sheet metal housing and the cover is reduced to ~0.5 mm

8.3 Connection example outputs

OUT2: Analog output 4-20 mA

OUT1: Analog output 0-10 V



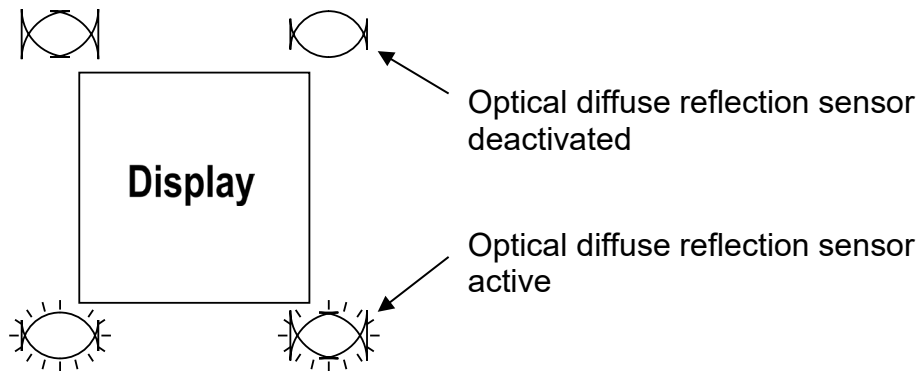
Configurable output functions

Out 1	Out 2
Analog output 4-20 mA	Analog output 4-20 mA
Analog output 0-20 mA	Analog output 0-20 mA
Analog output 2-10 V	Analog output 2-10 V
Analog output 0-10 V	Analog output 0-10 V
alarm output	alarm output
Pulse output	Pulse output
Frequency output	Frequency output
Communication mode KofiCom	
control input	
Dosing function control mode	Dosing output

9. Operation and menu structure

9.1 General

9.1.1 Operation of the optical diffuse reflection sensors



An optical button is located at each corner of the diffuse reflection sensor display. The operability of the respective button is signaled by a blue backlight, therefore non-backlit diffuse reflection sensors are deactivated and cannot be operated.

To operate the diffuse reflection sensors, the finger must be placed on the button dome and lifted up again. As visual feedback for a recognized button press, the orange background of the button symbols is briefly displayed in blue.





To prevent accidental operation, the operator must press and hold the menu button for 3-5 seconds in measurement mode to activate the function. If the menu button is held down for longer than 3 seconds, the blue backlighting starts to flash to notify the user that the button has been released.

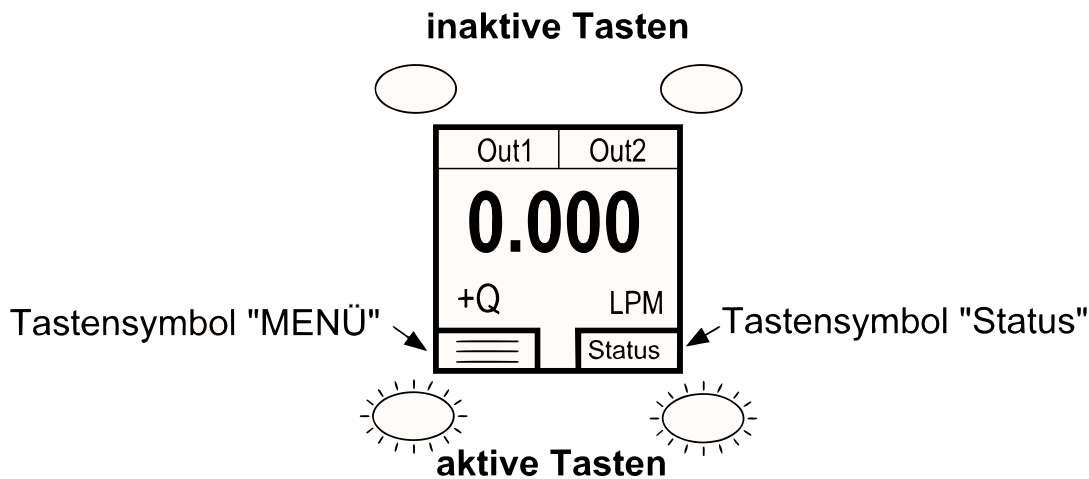
The optical diffuse reflection sensors can also be operated with gloves or other optically reflective objects. Suitable glove types are: Cotton and textile gloves, light-colored leather gloves, hygiene gloves made of latex and light-colored rubberized work gloves. Black coated work gloves of all types are not suitable. Slight soiling on the surface does not usually interfere with the button function.

9.1.2 Function of the operating keys

The function of each operating key can be recognized by the symbol shown in the corners of the TFT display.

Key symbol	description	function	
		Measuring mode	Menu mode
	Menu mode	Activate menu mode Press and hold for 3-5 sec .	-
	Info display	Normally closes (nc) the info menu	-

Key symbol	description	function	
		Measuring mode	Menu mode
	Down	-	Scroll down the menu / decrease the numerical value when entering numerical values
	High	-	Menu scroll up / Increase the numerical value when entering numerical values
	Before	-	Menu level down/up (last menu level: Save value)
	Back	-	Menu function: Menu level up/back (last step: Exit menu)

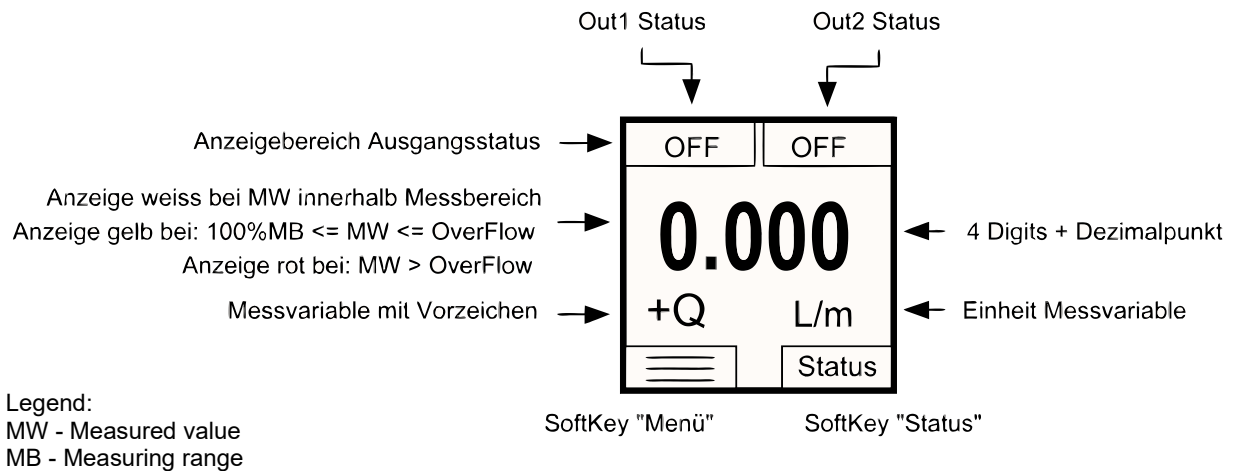


9.2 Measuring mode

After the supply voltage is applied, the device starts in measuring mode. In this mode, the measured values of the respective measurement variables are continuously recorded, the current instantaneous flow rate values, temperature values and the volume counter readings are calculated cyclically and displayed according to the display type.

The display shows the status and configuration of the outputs in addition to the main display. If the corresponding output is configured as an alarm output, the status is also displayed with a green or red background color. If the background color is green, the set threshold value has been overrun; if it is red, the threshold value has been undershot.

Measuring mode Display layout "Single"



The measurement variables are represented by their corresponding symbols:

Menu entry	Measurement variables Icon	description
Flow rate	Q	Flow rate
Volume	AC	Total volume counter
Temperature	T	Medium temperature
Partial volume	PT	Partial volume

The outputs and their status are shown on the display as follows:

Output function OUT1/2	Icon	Presentation / Commentary
inactive	From	
Analog output 4-20mA	4-20 mA	
Analog output 0-20mA	0-20 mA	
Analog output 0-10V	0-10 V	
Analog output 2-10V	2-10 V	
Switching output PushPull	SW+-	Background gray/green
Switching output PNP	SW+	Background gray/green
Switching output NPN	SW-	Background gray/green
Pulse output	PLS	
Frequency output	FRQ	
Communication mode KofiCom (OUT1 only)	KofiCom	Use only for factory service
Control input (OUT1 only)	X CTL	"X" symbol of the selected measurement variable

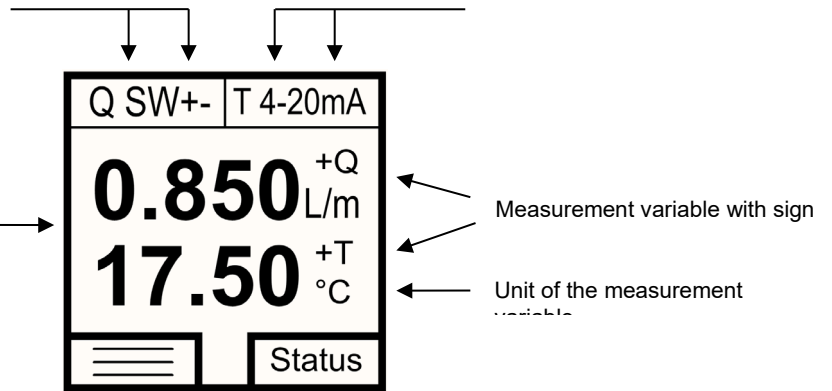
The measured variables flow rate, temperature and volume counter can in principle be assigned to any output function. The assignment of the respective output is shown by displaying the symbol of the measurement variable. The display of the assignment is independent of the set display layout (single, double).

Measuring mode Display layout "Double"

Out 1 configured as switching output push-pull and assigned to the flow rate

Out 2 configured as analog output 4-20 mA and assigned to the temperature

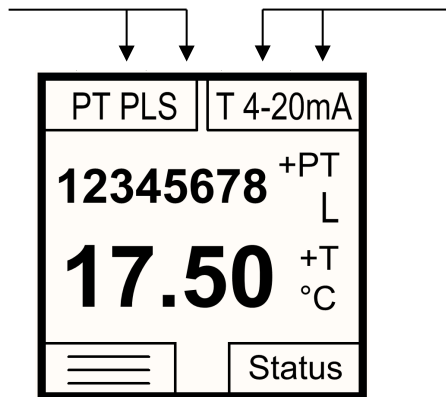
Font color white: Value within MB
 Font color yellow: 100% MB <= MW <= OverFlow
 Font color red: MW > OverFlow



Legend:
 MW - Measured value
 MB - Measuring range

Out 1 configured as pulse output and assigned to the partial volume

Out 2 configured as analog output 4-20 mA and assigned to the temperature



9.2.1 Display range of the volume counters

The number of digits shown on the display for volume counters (partial and total volume counters) is limited to a maximum of 8 digits. The partial and total volume meters therefore have a smaller font size than the flow rate and temperature display. If the 8-digit display range of the counter is overrun, this is signaled by the display of 8 minus signs (-----). In this case, the counter reading can no longer be read. The user now has the option of bringing the counter reading back into the display range by changing the volume counter unit.

9.3 Menu mode

All device parameters can be set in menu mode. The individual parameters are arranged in menu groups according to function. While menu mode is activated, signal processing and the outputs are still active in the background. However, all display parameters and outputs are updated after exiting menu mode or in measurement mode.

Note: Menu mode is exited automatically after a certain time without operation of the buttons if the "Menu timeout" parameter is set to a value other than "0".

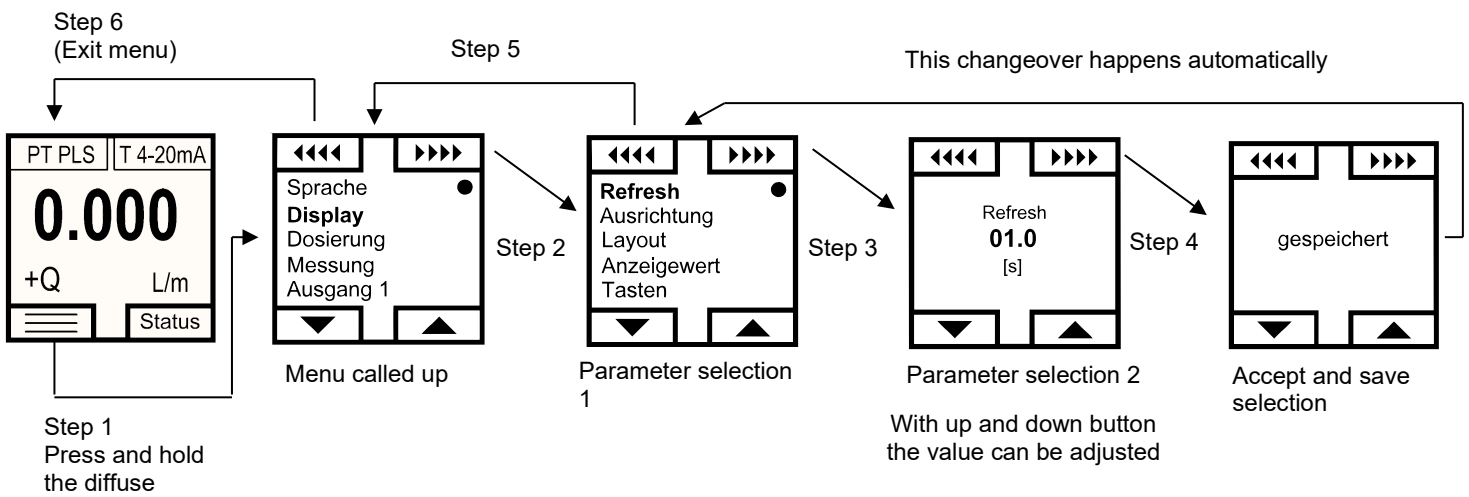
9.3.1 Parameter setting

9.3.1.1 List selection

Parameters with predefined selection values are defined using list selection. The currently selected menu item is displayed in orange.






Use the buttons to move the selection and the button to accept the selection. To activate the menu mode, press the button for 3-5 seconds. The parameters are divided into main groups and subgroups. Use the button to select the main groups. In the main menu, not all menu groups can be shown on the display at the same time; the list of individual menu items then scrolls up or down when the selection is at the top or bottom. To make a selection, press the button and the device jumps to the corresponding submenu or parameter setting level. The and buttons are used to select and choose predefined parameter values.

After changing the parameter value and confirming with , the parameter is saved and you return to the higher menu level. To return to the main menu or exit menu mode, press the (several times).



9.3.1.2 Numerical value input

When setting parameters with a numerical value, the assigned unit is always displayed in square brackets below the input field in the input function . The maximum size and the number of decimal places are fixed and cannot be changed. After calling up the input function, the outer left-hand digit is initially displayed in orange.

This digit can now be changed from 0 to 9 using the   buttons . Pressing the  diffuse reflection sensor moves the input digit to the right and the next digit can be changed. Press the  button to move the editing position to the left again. If the editing position is on the far right, pressing the  button again saves the set value and switches to the higher-level menu function.

10. Device parameterization

10.1 Device parameterization procedure

The flow rate sensor is pre-parameterized at the factory. In the event of subsequent changes to the volume or flow rate units, the dependent parameters are converted and adjusted accordingly. However, the limit value parameters of the switching outputs must always be checked and adjusted manually when volume or flow rate units are adjusted - they are not converted automatically.

An inadvertent change to the parameterization can be revised using the function "Reset factory settings " in the menu/ User service/ Factory reset den.

10.2 Language

In this menu item, the menu language can be changed to English, German, French or Spanish (default: English).

Language parameter table

Sub-level	Parameter level	Under-parameter level 1	Under-parameter level 2	Under-parameter level 3	description	Value range / value list	Standard value LPM version	Standard value GPM version
English					Selects English as the menu language		English	
German					Selects German as the menu language			
French					Selects French as the menu language			
Espanol					Select Spanish as the menu language			

10.3 Display

10.3.1 Refresh

The "Refresh" parameter defines the time interval within which the measurement variables are displayed. The "refresh rate" can be increased in steps of 0.5 s to 10 s. Increasing the refresh rate time results in increased "filtering" of the display value.

10.3.2 alignment

With the "Alignment" menu item, the display can be rotated either clockwise or counterclockwise in 90° steps. Both the display content and the function of the 4 operating keys are rotated during the revolution of the display.

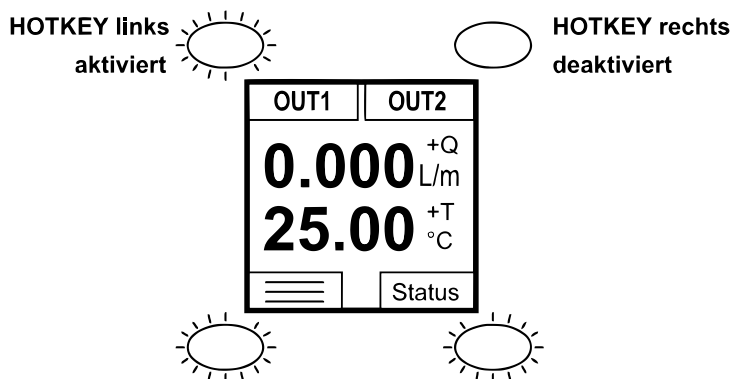
10.3.3 Layout

This parameter can be used to configure the display to show either one measurement variable or two measurement variables.

10.3.4 Display value



This parameter can be used to display the measurement variables provided by the sensor. Depending on the 'Layout' display, either one or two measurement variables can be displayed.

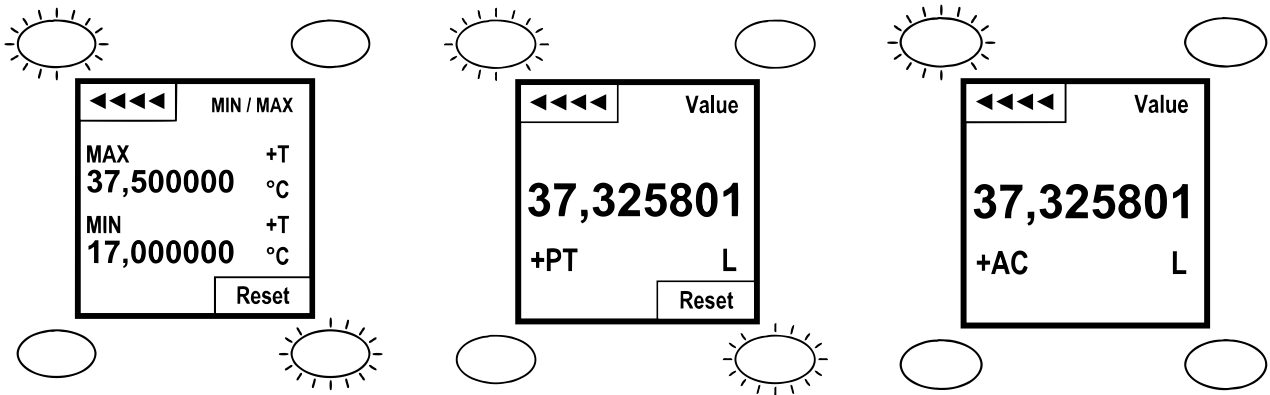
10.3.5 Diffuse reflection sensors - HOTKEY's



Two independent user buttons are available for the user, which can be individually assigned with different display functions. The 2 user buttons are available at the top right and left in measuring mode. If the diffuse reflection sensors are activated, they are backlit in blue and the programmed function can be versioned by pressing them. The following functions are available for selection:

measured value	MIN/MAX / Reset	Value display / reset
Flow rate	Yes / Yes	Yes / No
Temperature	Yes / Yes	Yes / No
Partial quantity counter	Not available	Yes / Yes
Total volume counter	Not available	Yes / No

The hotkey function called up remains permanently activated and can only be exited by pressing the   button. A direct reset function is available for the MIN/MAX function and the partial quantity counter.



10.3.6 Timeout menu

The menu timeout time defines the time after which the menu function is automatically exited again if no button is pressed. With the setting "0 s", this function is deactivated and the menu function can only be exited manually by pressing the Back button (several times).

Display parameter table

Sub-level	Parameter level	Sub-parameter level 1	Under-parameter level 2	Sub-parameter level 3	description	Value range / value list	Standard value LPM version	Standard value GPM version
Refresh	<i>Value input</i>				Sets the display refresh rate	<i>0.5 to 10 s</i>	<i>0,5 s</i>	
Alignment	<i>turn CW</i>				Turns the display 90° clockwise		<i>Landscape format</i>	
	<i>turn CCW</i>				Turns the display 90° counter-clockwise			
Layout	Single				Displays a measured value in the display range			
	Double				Shows two measured values in the display area			
Display value	Upper display	<i>List selection</i>			Sets the measured value for the upper display	<i>Flow rate, Volume, Temperature, Partial volume</i>	<i>Flow rate</i>	
	Lower display				Sets the measured value for the lower display		<i>Temperature</i>	
Diffuse reflection sensors	Hotkeys	Links	<i>Flow-through</i>	<i>List selection</i>	Sets the measured value and the function for the left hotkey	<i>Off, value, min/max</i>	<i>From</i>	
			<i>Volume</i>					
			<i>Temperature</i>					
			<i>Partial volume</i>					
	Right	<i>Flow-through</i>	<i>List selection</i>	Sets the measured value and the function for the right hotkey	<i>Off, value, min/max</i>			
		<i>Volume</i>						
<i>Temperature</i>								
	<i>Partial volume</i>							
	Sensitivity	<i>List selection</i>			Sets the sensitivity for the optical diffuse reflection sensors	<i>Low</i>	<i>Low</i>	
Timeout menu	<i>Value input</i>				Defines the time after which the settings menu is automatically exited if no button is pressed (0 = deactivated)	<i>0.5 to 60 s</i>	<i>15 s</i>	

10.4 Measurement

The measurement variables provided by the flowmeter are listed under the 'Measurement' menu. For magnetic inductive flowmeters, these are:

- Volume flow rate
- Total volume counter
- Temperature
- Partial volume counter

Each measurement variable is also divided into its own submenu. All parameters relating to the respective measurement variables can be adjusted in the submenu.

10.4.1 Flow rate

10.4.1.1 Unit

The displayed unit for the flow measurement can be selected from various predefined standard units. It is also possible to define a user-defined unit "User".

The "user unit" must be programmed here in liters/min:

e.g. unit "User" = 100 LPM, if Q = 500 LPM, then "User" is shown on display 5.

10.4.1.2 Filter function

The measured value filter filters the display value and most electrical output signals (analog outputs / frequency outputs / switching outputs).

A separately adjustable filter is available for each measured value (flow rate and temperature).

In the factory settings, the standard filter with low filtering and active jump detector is activated.

Volume counters and pulse outputs are generally not filtered.

Three different filter types are available so that a suitable filter function is available for as many applications as possible. The time base of the filter function is approx. 20 ms.

Filter type	Filter factor [n]	Jump detector	description
Standard	1 - 250	Yes	Rolling filter type, the size of the filter factor determines the number of measured values buffered and used for averaging. $MW_{AVG} = \frac{MW_0 + MW_{-1} + \dots + MW_{-n}}{n}$
IIR		No	With this filter type, a part of the last average value is added to the current average value depending on the filter factor. The filter corresponds to a 1st order digital low-pass filter with infinite step response. The filter effect achieved is not linear to the filter factor parameter. A high filter effect is only achieved with filter values > 200. $MW_{AVG} = b * MW_0 + (1 - b) * MW_{AVG-1}$ with $b = \frac{251 - Filterfaktor}{250}$
Exp. Smoothing		no	The filter type works according to the principle of exponential smoothing, the step response has an exponential curve. The filter factor is proportional to the response time t_{90} of the step response. This allows the greatest filter effect to be realized. $t_{90} \sim Filterfaktor * 75ms$ $MW_{AVG} = \frac{MW_{AVG-1} * (n - 1) + MW_0}{n}$
with: MW_{AVG} = filtered measured value, MW_{AVG-1} = last filtered measured value, MW_0 = current measured value MW_{0-1} = last measured value,			

Application range of the filter types

Standard **standard filter** with step detector with fast reaction time for real measured value changes. This filter type has a max. time lag of *Filterfaktor * 20 ms*

This filter smoothes slight to medium measured value fluctuations without the disadvantage of increased reaction time in flow monitoring applications.

IIR

Simple digital filter with tracking, no step detector

This filter can be used for slight to medium pulsating measured value fluctuations. Strong filtering results in a correspondingly long lag of the filtered measured value in the event of real measured value changes.

Not suitable for flow monitoring applications with a large filter factor.

Exp. Smoothing

Simple smoothing filter with tracking, no jump detector

This filter can be used for strong pulsating measured value fluctuations. Strong filtering results in a long lag of the filtered measured value in the event of real measured value changes.

The overrun can be determined via the filter factor to:

*t₉₀ ~ Filterfaktor * 75ms*

Not suitable for flow monitoring applications with a large filter factor.

Step detector (only available with standard filter)

The jump detector integrated in the standard filter can recognize the tendency of a real measured value change and temporarily bypass the filter function after the detection of a measured value jump in order to minimize the reaction time to the measured value jump. A measured value jump can be recognized both when the measured value is rising and when it is falling. The jump detector is set by the jump threshold (*JD threshold*) and an interference suppression factor (*JD ConfFactor*). The *0 ConfFactor* parameter can be used to suppress the behavior at the start of the measuring range.

JD threshold

The value of the jump threshold is standardized to the span of the measuring range, the default value 0.1 means 10% of the measuring range end value.

JD ConfFactor

Defines the factor by which the jump threshold must be overrun consecutively without interruption before the jump detector actually becomes active. If the final value of the suppression counter is not reached, it is reset. However, if the final value of the counter is reached, the jump detector is active and all filter buffers are overwritten with the current measured value.

0 confFactor

If the measured values are at the start of the measuring range, below which the measured values are set to 0, the zero measurement interference suppression function may become active. The *0 ConfFactor* parameter defines a counter value for how many

consecutive times the measured value must fall below the lower range value without undershooting before the measured value is actually set to "0". This function is used to stabilize the measured value in the range of the lower range value. Like the step detector, this function works in both directions, i.e. from measuring range => 0 and from 0 => measuring range

Notes for applications with pulsating currents:

If pumps that generate pulsating currents (e.g. peristaltic pumps or diaphragm pumps) are used to generate the flows, the following notes must be observed:

- The pulsation flow peaks must always be within the measuring range of the devices
- Install pulsation damper if possible
- The pulsation frequency of the pump should not be close to the frequency 50 Hz or its divider (25 Hz, 12.5 Hz, 6.25 Hz etc.), otherwise cyclical measurement fluctuations may occur.
- The measured value indication (and the electrical outputs analog and frequency) can be most effectively attenuated with the filter function "exp. Smoothing" filter function

10.4.1.3 Separation

The Separation parameter defines the flow rate value below which the measured value is set to "0". If this function is active, the flow rate value "0" is shown in blue on the display. If the parameter value is set lower than the measuring range start value (see technical data), the display value and all signal outputs assigned to it remain at "0" as long as the measured value does not overrun the measuring range start value.

10.4.1.4 Simulation mode

See section 10.4.5

10.4.2 Volume

10.4.2.1 Meter type

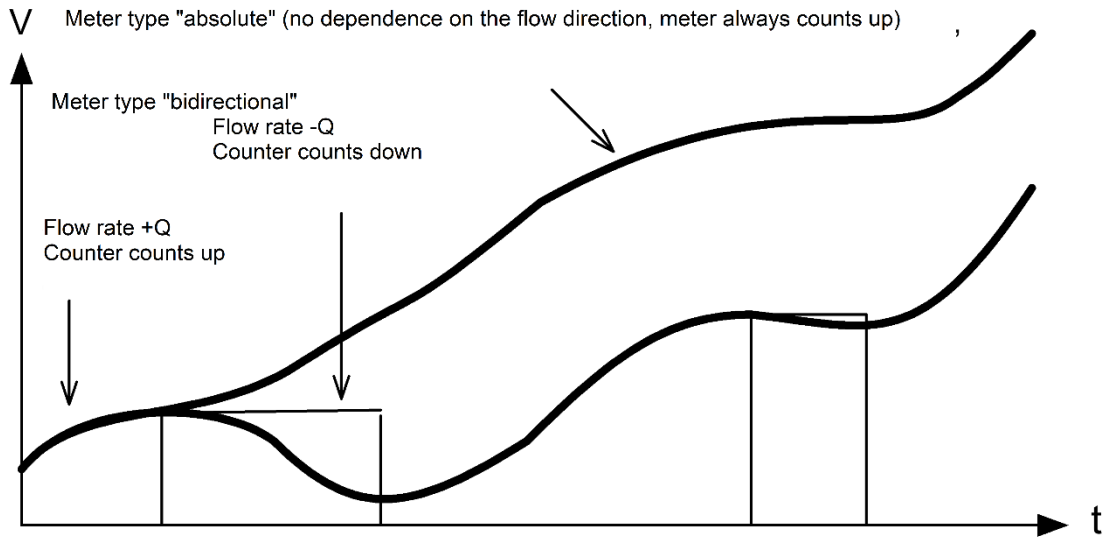
Absolutely:

Regardless of the flow direction, the calculated partial volume is added to the counters.

Bidirectional:

Depending on the flow direction, the calculated partial volume is added to or subtracted from the counters. If the measured flow value is negative, the volume value runs down from measurement to measurement (possibly into the negative range).

Volume calculation for the various meter types



10.4.2.2 Unit of the total volume counter

The "Unit" parameter defines the volume unit of the total volume counter. The volume units listed are available for selection. When the volume unit is changed, the current counter reading is converted to the new volume unit.

It is also possible to define a user-specific "User" unit.

The "user unit" in liters must be programmed here:

e.g. unit "User" = 100 L, if the internal volume value reaches 500 L, then "User" is shown on display 5.

10.4.3 Temperature

10.4.3.1 Temperature unit

The displayed unit for the temperature measurement can be selected from various predefined standard units. It is also possible to define a user-defined unit "User".

The "user unit" must be programmed in °C here:

e.g. unit "User" = 50°C, if T = 50°C then "User" is shown on display 1.

10.4.3.2 Simulation function

See section 10.4.5

10.4.4 Partial volume

10.4.4.1 Meter type

Absolutely:

Regardless of the flow direction, the calculated partial volume is added to the counters.

Bidirectional:

Depending on the flow direction, the calculated partial volume is added to or subtracted from the counters. If the measured flow value is negative, the volume value runs down from measurement to measurement (possibly into the negative range)

10.4.4.2 Unit of the partial volume meter

The "Unit" parameter defines the volume unit of the partial volume counter. The volume units listed are available for selection. When the volume unit is changed, the current counter reading is converted to the new volume unit.

It is also possible to define a user-specific "User" unit.

The "user unit" in liters must be programmed here:

e.g. unit "User" = 100 L, if the internal volume value reaches 500 L, then "User" is shown on display 5.

10.4.4.3 Memory reset

The partial quantity counter can be reset in this menu.

10.4.4.4 Simulation function

See section 10.4.5

10.4.5 Simulation function

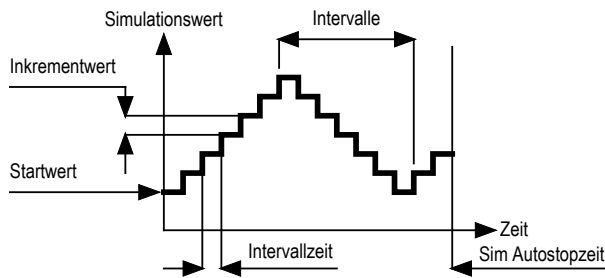
With the simulation function, all available measured values can be simulated independently of each other for a limited period of time. The simulated measured values have a full effect on the displays and outputs.

Every simulation that is started is automatically ended after the time set in the "Sim Autostop time" parameter (user service) (1 to 30 min) or after the programmed intervals have elapsed.

The following measured values can be simulated:
Volume flow, temperature and partial volume counter.

The simulation starts as soon as the simulation is activated and the settings menu is exited. The simulation is interrupted or stopped if the settings menu is called up in the meantime. There are 3 different simulation types available for every purpose:

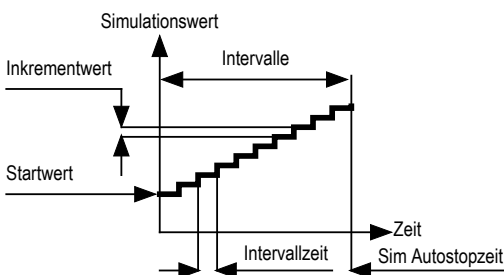
a.) "Triangle" mode



In "Triangle" mode, the simulation value increases continuously in the increment of the "Increment value" parameter and in the time interval "Interval time" with the "Start value". After the number of the "Intervals" parameter, the simulation value decreases again in the same way and then increases again. This process is repeated

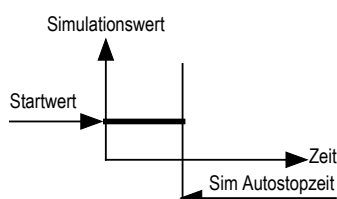
continuously until the set time "Sim Autostop time" has elapsed and the simulation ends.

b.) "Monotone" mode

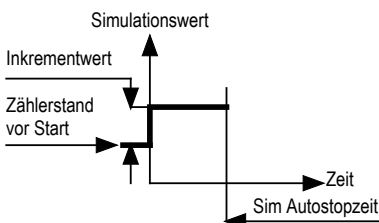


In "Monotone" mode, the simulation value increases continuously in the increment of the "Increment value" parameter and in the time interval "Interval time" with the "Start value". The simulation is ended after the number of "Intervals" or the "Sim Autostop time" has elapsed.

c.) "Static" mode



In "Static" mode, a constant value is output for the measured values flow rate and temperature. The simulation ends after the set simulation time.



In the "static" simulation for the partial quantity counter, the counter is only changed once by the set "increment value" after the start.

When simulating the partial quantity counter, please note that in triangle mode the partial quantity counter must be in "bidirectional" operational mode to achieve the expected effect.

Measurement parameter table

Sublevel	Parameter level	Sub-parameter level 1	Sub-parameter level 2	Sub-parameter level 3	description	Value range / value list	Standard value LPM version	Standard value GPM version
Flow rate	Unit	List selection			Sets the flow unit	ml/m, L/m, L/h, m3/h, galUS/m, galUS/h, galUK/m, galUK/h, User	L/m	gals/m
	Filter	Type	List selection		See description	Standard / IIR / exp. smoothing	Standard	
		Filter factor	Value input	1 - 250		25		
		JD threshold		0.05 - 1.00 [xFs]		0,1		
		JD ConfFactor		1 - 25		1		
	0 ConfFactor	1 - 25		1				
Separation	Value input			Sets the value for the creep-quantity-under-pressure	$0 \leq \text{Value} \leq$ Start of measuring range	Start of measuring range		
Simulation mode	See table <i>Simulation mode</i>							
Volume	Meter type	absolute/ bi-directional			Sets the counting mode		absolute	
	Unit	List selection			Defines the volume unit	ml, L, m3, galUS, galUK, User	L	L
Temperature	Unit	List selection			Defines the temperature unit	°C, °F, User	°C	°C
	Filter	Type	List selection		See description	Standard / IIR / exp. smoothing	Standard	
		Filter factor	Value input	1 - 250		1		
		JD threshold		0.05 - 1.00 [xFs]		0,1		
		JD ConfFactor		1 - 25		1		
	0 ConfFactor	1 - 25		1				
Simulation mode	See table <i>Simulation mode</i>							

Sublevel	Parameter level	Sub-parameter level 1	Sub-parameter level 2	Sub-parameter level 3	description	Value range / value list
Partial volume	Meter type	absolute/bi-directional		Sets the counting mode		<i>absolute</i>
	Unit	List selection		Defines the volume unit	<i>ml, L, m3, galUS, galUK, User</i>	<i>L</i> <i>galUs</i>
	Memory reset	Yes/No		Sets the counter value to "0"		
	Simulation mode	See table <i>Simulation mode</i>				

10.5 Dosing function

See section 12.

10.6 Outputs

The flowmeter provides a total of 2 freely configurable outputs. The outputs (output 1 and output 2) are configured via a wizard function. The wizard function guides the user step by step through all the necessary settings.

Steps:

- Select output
- Selection of the source or the measurement variable to be output (flow rate, volume, temperature, partial volume)
- Selection of an output type (4-20 mA, 0-20 mA, 0-10 V, 2-10 V, alarm, pulse, frequency output, control input)
- Setting the output (scaling, thresholds, function)
- Saving the configuration

The different output types are optimized for different types of applications. The following table contains the application recommendations for the various output types. If the outputs are not used in accordance with the recommendations, measurement deviations may occur and the desired functionality will not be achieved.

application	Output type			
	Analog output (all versions)	Frequency output	Pulse output	Alarm output
Remote measured value transmission	✓	✓		
limit value monitoring				✓
Window monitoring				✓
External dosing			✓	
External volume counting			✓	

Application table output types

10.6.1 alarm output

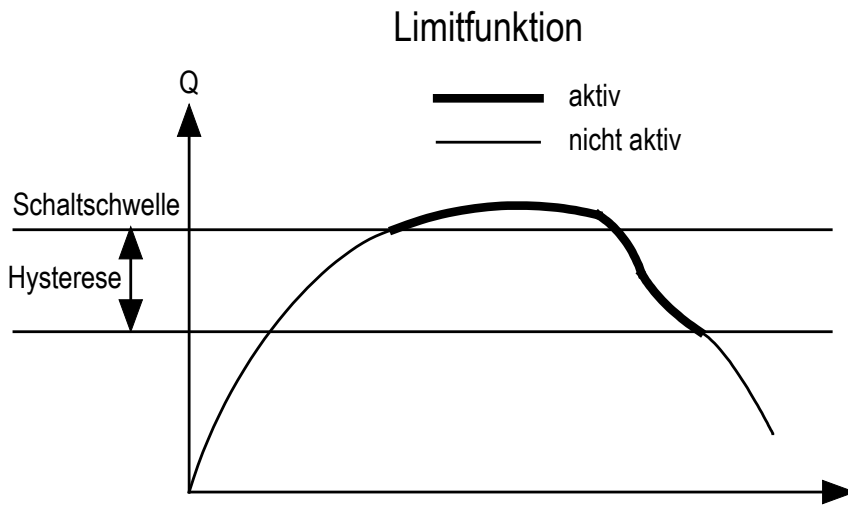
The alarm outputs can be parameterized with a limit or a window function.

10.6.1.1 function

The "Function" parameter defines the basic function. Limit function and window function are available.

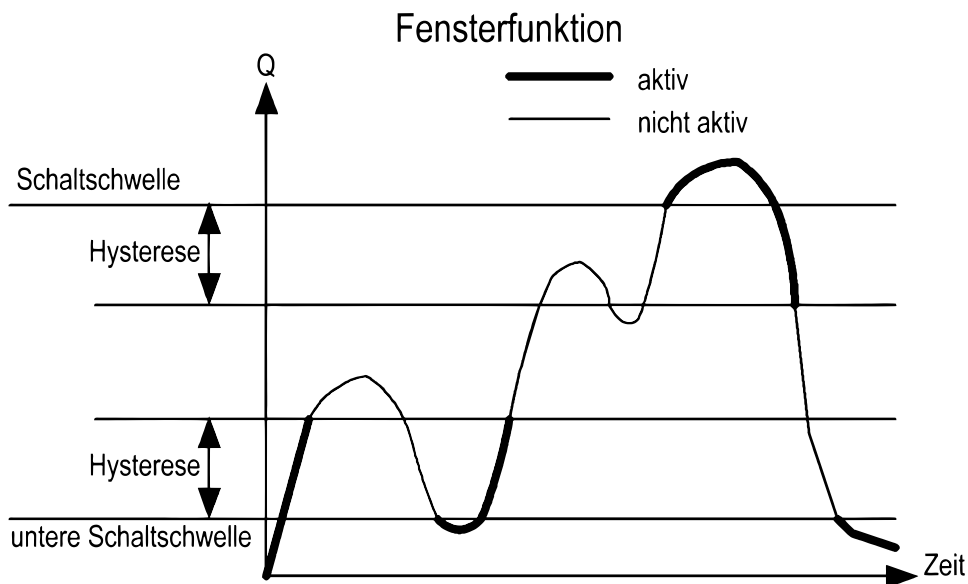
Limit function:

The switching output is **active** when the current measured flow value is above the switching threshold. It remains **active** until the measured value has undershot the switching threshold minus the hysteresis.



window function:

The switching output is **active** when the current measured flow value is outside a window formed by the "switching threshold" and the "lower threshold". The monitored window is reduced by the amount of the "hysteresis". If the switching output is to be **active** within the window, the "Switching function" parameter must be changed from N/O to N/C.



10.6.1.2 Output type

The "*Output type*" parameter defines the function of the transistor output. NPN, PNP or PP (push-pull) output types are available. The push-pull type combines NPN and PNP and is therefore the best choice for most wires. All outputs are short-circuit and overload protected.

10.6.1.3 switching function

The "*switching function*" defines the mode of action of the outputs. In the default setting "normally open", the output is activated (switched) when the measured value overruns the switching threshold. This function is also referred to as the "normally open contact function", "normally closed principle" or "N.O.". (normally open).

In the "*Normally closed*" setting, the output is already active below the switching threshold and is deactivated when the measured value overruns the switching threshold. This function is also referred to as the "normally closed contact" or "N.C." principle. (normally closed).

10.6.1.4 switching threshold

The "*Switching threshold*" parameter defines the limit value for the limit function and upper limit for the window function.

10.6.1.5 Lower threshold

The "*lower switching threshold*" defines the lower limit value when using the window function. When using the limit function, this parameter remains ineffective. The switching thresholds can be set both positively and negatively.

10.6.1.6 hysteresis

The appropriate setting of the "Hysteresis" parameter ensures that the switching outputs do not constantly switch on and off when the current measured value fluctuates around the switching threshold. The hysteresis value should therefore always be selected to be greater than the real measured value fluctuations. This allows targeted interference suppression to be achieved.

10.6.1.7 Filter factor (switching delay)

Further interference suppression of the switching outputs from fluctuating measurement signals can be achieved by setting the "*Filter factor*" parameter. If this parameter is selected greater than 0, the switching of the output is delayed accordingly. The "*Supp direction*" parameter is used to specify whether the delay should take effect via or undershooting the switching threshold (alternatively in both directions).

"*High*" means that the delay is active when the measured value overruns the switching threshold, "*Low*" means that the delay is active when the measured value undershoots the switching threshold.

The measured value must continuously be via or undershooting the switching threshold with the value of [FILTER FACTOR] before the switching output is activated.

This function can be used to reliably suppress sporadic limit value violations.

The reaction time of the output is generally prolonged according to the value of the "*Filter factor*" parameter.

10.6.2 Analog outputs

10.6.2.1 Current output 0-20 mA / 4-20 mA

The current output provides a measurement variable (flow rate or temperature) in scaled form as a 0-20 mA or 4-20 mA current signal.

The current output is scaled via the parameters "Value 20 mA" and "Value 0 mA" or "Value 4 mA". The "Value 20 mA" parameter is set by default to the value for the end of the measuring range, but can be parameterized as required within the measuring range, although this must always be greater than the value at the start of the measuring range.

The parameters "Value 0 mA" or "Value 4 mA" define the measured values for the start current value. These can also be set freely within the measuring range.

Note 1: If the "Value 20 mA" parameter is set lower than the end of the measuring range, the accuracy of the output current value is reduced.

Note 2: The burden for the current output must not be greater than 500 Ω.

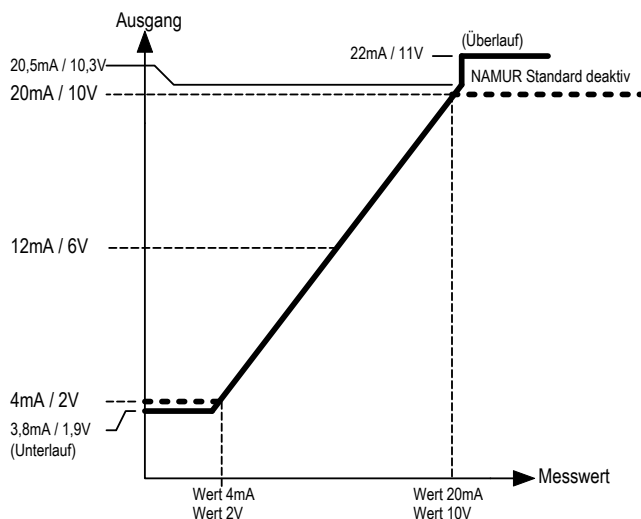
10.6.2.2 Voltage output 0-10V / 2-10V

The voltage output provides a measurement variable (flow rate or temperature) in scaled form as a 0-10 V / 2-10 V voltage signal.

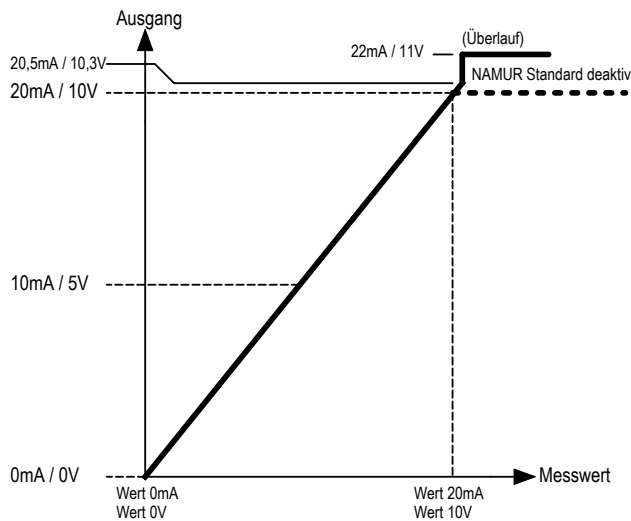
The voltage output is scaled via the parameters "Value 10 V" and "Value 0 V" or "Value 2 V". The "Value 10 V" parameter is set by default to the value for the end of the measuring range, but can be parameterized as required within the measuring range, but must always be greater than the start of the measuring range value.

The parameters "Value 0 V" or "Value 2 V" define the measured values for the start voltage value. These can also be set freely within the measuring range.

Note 1: If the value is set lower than the end of the measuring range, the accuracy of the voltage value output is reduced.



Output behavior 4-20 mA and 2-10 V



Output behavior 0-20 mA and 0-10 V

10.6.2.3 Activation of behavior according to NAMUR recommendation NE43

The output behavior according to NAMUR recommendation NE43 can be activated for all analog outputs (current and voltage). When this function is activated, e.g. the linear output of the 4 to 20 mA signal is extended to 3.8 to 20.5 mA. Above 20.5 mA, the current value jumps to approx. 22 mA to signal that the measuring range has been exceeded. Current output values between 3.8 and 4.0 mA signal an underrange. The output of approx. 3.6 mA signals a device or process error (e.g. empty pipe signaling).

10.6.3 Pulse output

The flowmeter provides a scalable pulse output. If the pulse output is activated, the cyclically incoming volume is output as a pulse sequence at the output. The pulse width of the output pulses is constant and can be set in a range from 1 ms to 20 s. The pulse output is updated in a cycle of approx. 20 ms. At the beginning of each update, the amount of volume accumulated during the last update time is determined. The corresponding number of pulses is then output as a pulse sequence according to this volume and the set pulse volume.



The pulse signal is not suitable for determining the volume flow with an external frequency measurement.

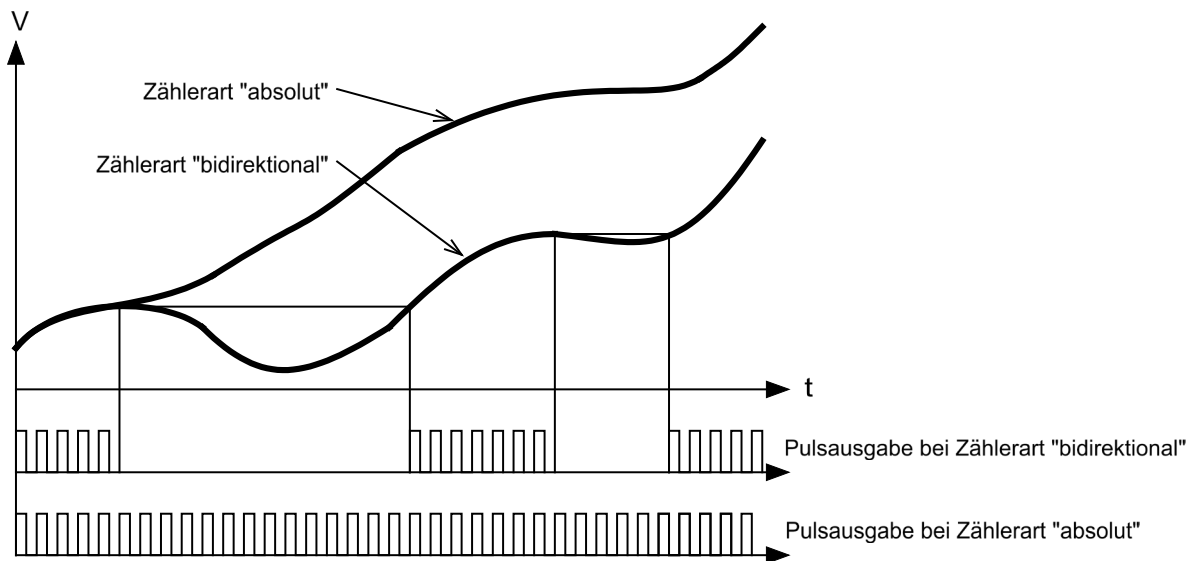


The reaction time of the pulse output is directly dependent on the flow parameter "Separation" (cutoff). The shortest reaction time is achieved when this parameter is set to the value "0.0" (factory settings: start of measuring range).



The electrical output type of the pulse output is push-pull, therefore HIGH and LOW are actively connected through at the output.

Pulsausgabefunktion bei den verschiedenen Zählermodi



Behavior with OVERFLOW:

If the volume flow measurement is in the OVERFLOW range, the pulse output is switched off and a constant HIGH level is switched on at the output.

Generation of the output pulse sequence:

The pulse volume (pulse value volume per output pulse) can be freely set over a wide range. Together with the adjustable pulse width and the measuring range of the device, this results in a limited range in which the pulse output takes place without delay.

This is the case if the following condition is met:

$$\frac{\text{Messbereichsende [L/min]} * \text{Pulsbreite [ms]}}{\text{Pulsvolumen[L]}} \leq 22500$$

or

$$\text{Pulsvolumen [L]} \geq \frac{\text{Messbereichsende [L/min]} * \text{Pulsbreite [ms]}}{22500}$$

If the condition is not met, the pulse output may be delayed. This is particularly undesirable if dosing tasks are to be carried out with the pulse signal.

The following table shows the various combinations of pulse volume and pulse width for the different measuring ranges for which the above limit condition is met.

Measuring range [LPM]	Pulse width [ms]	min. Pulse volume [L]	max. Pulse rate [pulses/L]
350	20	0,31111	3,21
	10	0,15556	6,43
	5	0,7778	12,86
	1	0,01556	64,29
100	20	0,08889	11,25
	10	0,04444	22,50
	5	0,02222	45,00
	1	0,00444	225,00
50	20	0,04444	22,50
	10	0,02222	45,00
	5	0,01111	90,00
	1	0,00222	450,00
25	20	0,02222	45,00
	10	0,01111	90,00
	5	0,00556	180,00
	1	0,00111	900,00
10	20	0,00889	112,50
	10	0,00444	225,00
	5	0,00222	450,00
	1	0,00044	2250,00
03	20	0,0026	375
	10	0,0013	750
	5	0,0006	1500
	1	0,0001	7500
01	20	0,00089	1125,00
	10	0,00044	2250,00
	5	0,00022	4500,00
	1	0,00004	22500,00

Pulse output only takes place in measurement mode; no pulses are output while menu mode is active. The pulses accumulated in menu mode are output as soon as measurement mode is active again. Depending on the situation, there may be a longer pulse lag.

10.6.3.1 Pulse volume

The parameter "*Pulse volume*" is defined as the volume quantity for the output of a pulse at the output, the unit is correspondingly [volume quantity/pulse]. The pulse rate [pulses/volume unit], which is also commonly used, corresponds to the reciprocal value of the pulse volume.

Example: Desired pulse rate at the output 10 pulses/liter => pulse volume = 1/pulse rate = 1/10 L = 0.1 L

10.6.3.2 Unit of volume

The volume unit to be set is the input unit for the "*Pulse volume*" parameter. It is also possible to define a user-defined unit ("User") and can be programmed in "Liters".

Example:

Unit "User" = 10 [L], pulse volume = 2 [User]

The total pulse volume would be 2*10 = 20 [L]. A pulse is output after 20 liters.

10.6.3.3 Pulse width

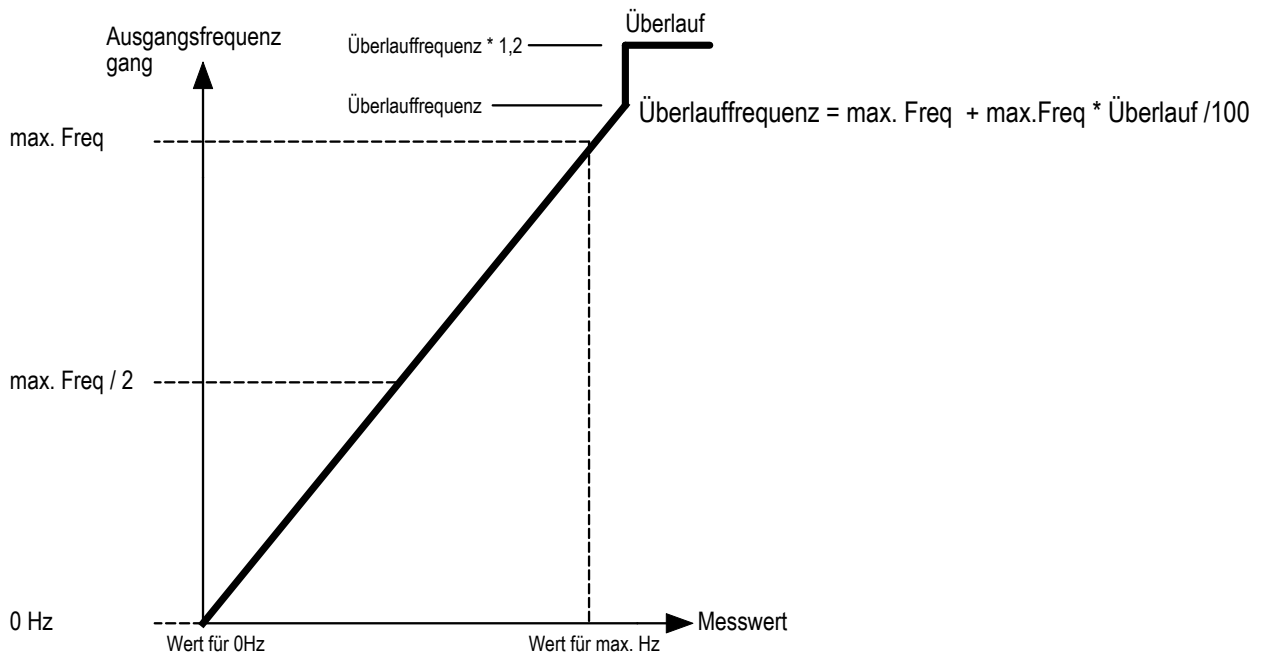
The pulse width of the pulse output can be flexibly adjusted from 1 ms to 20000 ms.

10.6.4 Frequency output

The flowmeter provides a scalable frequency output. If this output is activated, the measurement variable assigned to the frequency output (flow rate or temperature) is output proportionally as a frequency with a 1:1 pulse/pause duration. The output frequency at the end of the measuring range is adjustable ("*max. frequency*" parameter). The frequency output can be freely scaled within the measuring range using the two parameters "*Value at 0 Hz*" and "*Value at max. Hz*".

Behavior with OVERFLOW:

If the measured value is in the overflow range, a constant frequency is output.



Output behavior Frequency output

10.6.5 control input

Output 1 can be configured as a control input. Depending on the assigned measurement variable, this can be used to reset the MIN/MAX memory or the partial quantity counter.

function	Measurement variable	Control pulse duration
MIN/MAX reset	Flow rate, temperature	$0.5s < t_{high} < 4s$
Partial quantity counter reset	Partial quantity counter	$0.5s < t_{high} < 4s$

Parameter table output 1/2 - flow rate

Sub-parameter level 1	Sub-parameter level 2	Sub-parameter level 3	description	Value range / value list	Standard value LPM version	Standard value GPM version
<i>Deactivated</i>			<i>Output deactivated</i>		4-20mA	
alarm output	function	<i>List selection</i>	Sets the basic function	<i>Limit function / window function</i>	<i>Limit function</i>	
	Output type		Sets the electrical output type	<i>NPN/PNP/PP</i>	<i>NPN</i>	
	switching function		Sets the log. Switching function	<i>NO/NC</i>	<i>NO</i>	
	Threshold	<i>Value input</i>	Sets the switching threshold firm	<i>MB start ≤ value ≤ MB end</i>	<i>1</i>	
	Lower threshold		Sets the lower switching threshold for window function firm	<i>Value for threshold ≤ value ≤ MB start</i>	<i>1</i>	
	hysteresis		Defines the switching hysteresis	<i>0 ≤ Value ≤ (MB end - MB start)</i>	<i>1</i>	
	Filter factor		Factor for the switching delay x100 ms	<i>0x ≤ value ≤ 60x</i>	<i>0</i>	
	Direction		Determines the effective direction of the switching delay	<i>Up / Down / Both</i>	<i>Downwards</i>	
4-20 mA	NAMUR Standard	Activates the behavior according to NAMUR NE43	<i>activated/deactivated</i>	<i>deactivated</i>		
	<i>Value 4 mA</i>	Measured value for 4 mA output	<i>MB start ≤ value ≤ value 20 mA</i>	<i>0</i>		
	<i>Value 20 mA</i>	Measured value for 20 mA output	<i>Value 4 mA ≤ Value ≤ MB end</i>	<i>MB end</i>		
0-20 mA	NAMUR Standard	Activates the behavior according to NAMUR NE43	<i>activated/deactivated</i>	<i>deactivated</i>		
	<i>Value 0 mA</i>	Measured value for 0 mA output	<i>MB start ≤ value ≤ value 20 mA</i>	<i>0</i>		
	<i>Value 20 mA</i>	Measured value for 20 mA output	<i>Value 0 mA ≤ Value ≤ MB end</i>	<i>MB end</i>		
2-10 V	NAMUR Standard	Activates the behavior according to NAMUR NE43	<i>activated/deactivated</i>	<i>deactivated</i>		
	<i>Value 2 V</i>	Measured value for 2 V output	<i>MB start ≤ value ≤ value 10 V</i>	<i>0</i>		
	<i>Value 10 V</i>	Measured value for 10 V output	<i>Value 2 V ≤ Value ≤ MB end</i>	<i>MB end</i>		
0-10 V	NAMUR Standard	Activates the behavior according to NAMUR NE43	<i>activated/deactivated</i>	<i>deactivated</i>		
	<i>Value 0 V</i>	Measured value for 0 V output	<i>MB start ≤ value ≤ value 10 V</i>	<i>0</i>		
	<i>Value 10 V</i>	Measured value for 10 V output	<i>Value 0 V ≤ Value ≤ MB end</i>	<i>MB end</i>		

Sub-parameter level 1	Sub-parameter level 2	Sub-parameter level 3	description	Value range / value list	Standard value LPM version	Standard value GPM version
Frequency output	max. frequency	Value input	Frequency output at "Value at max. Hz"	50-1000 Hz	500 Hz	
	Overflow		Overflow value in % of the "Value at max. frequency"	1-100 [%]	1%	
	Value at 0 Hz		Value at 0 Hz	$MB\ start \leq value \leq value\ at\ max.\ Hz$	0	
	Value at max. Hz		Value at max. frequency	$Value\ at\ 0\ Hz < value \leq MB\ end$	MB end	
Control input (OUT 1 only)			Control function for MIN/MAX memory reset	OFF, memory reset	From	
KofiCom	Mode for factory calibration at output 1					

Parameter table **output 1/2 - volume**

Sub-parameter level 1	Sub-parameter level 2	Sub-parameter level 3	description	Value range / value list	Default value LPM version	Default value GPM version
Deactivated			Output deactivated		deactivated	
Pulse output	Pulse unit	List selection	Defines the pulse unit for the pulse volume	ml, L, m3, galUS, galUK, User	L	galUs
	Pulse volume	Value input	Defines the value for the pulse volume	0,001-999	1	
	Pulse width		Defines the pulse width	1-20.000	1 ms	
KofiCom	Mode for factory calibration at output 1					

Parameter table output 1/2 - temperature

Sub-parameter level 1	Sub-parameter level 2	Sub-parameter level 3	description	Value range / value list	Standard value LPM version	Standard value GPM version
Deactivated			Output deactivated		deactivated	
Alarm output	function	List selection	Sets the basic function	Limit function / window function	Limit function	
	Output type		Sets the electrical output type	NPN/PNP/PP	NPN	
	switching function		Sets the log. Switching function	NO/NC	NO	
	Threshold		Sets the switching threshold firm	$MB\ start \leq value \leq MB\ end$	1	
	Lower threshold		Sets the lower switching threshold Fixed for window function	$Value\ for\ threshold \leq value \leq MB\ start$	1	
	hysteresis		Defines the switching hysteresis	$0 \leq Value \leq (MB\ end - MB\ start)$	1	
	Filter factor		Factor for the switching delay x100 ms	$0x \leq value \leq 60x$	0	
Direction	Determines the effective direction of the switching delay	Up / Down / Both	Downwards			
4-20 mA	NAMUR Standard	Value input	Activates the behavior according to NAMUR NE43	activated/deactivated	deactivated	
	Value 4 mA		Measured value for 4 mA output	$MB\ start \leq value \leq value\ 20\ mA$	0	
	Value 20 mA		Measured value for 20mA output	$Value\ 4\ mA \leq Value \leq MB\ end$	MB end	
0-20 mA	NAMUR Standard		Activates the behavior according to NAMUR NE43	activated/deactivated	deactivated	
	Value 0 mA		Measured value for 0mA Output	$MB\ start \leq value \leq value\ 20\ mA$	0	
	Value 20 mA		Measured value for 20mA output	$Value\ 0\ mA \leq Value \leq MB\ end$	MB end	
2-10 V	NAMUR Standard		Activates the behavior according to NAMUR NE43	activated/deactivated	deactivated	
	Value 2 V		Measured value for 2V Output	$MB\ start \leq value \leq value\ 10\ V$	0	
	Value 10 V		Measured value for 10V output	$Value\ 2\ V \leq Value \leq MB\ end$	MB end	
0-10 V	NAMUR Standard	Activates the behavior according to NAMUR NE43	activated/deactivated	deactivated		
	Value 0 V	Measured value for 0V Output	$MB\ start \leq value \leq value\ 10\ V$	0		
	Value 10 V	Measured value for 10V output	$Value\ 0\ V \leq Value \leq MB\ end$	MB end		

Continuation of parameter table **output 1/2 - temperature**

Sub-parameter level 1	Sub-parameter level 2	Sub-parameter level 3	description	Value range / value list	Standard value LPM version	Standard value GPM version
Frequency output	<i>max. frequency</i>	<i>Value input</i>	Frequency output for "Value at max. Hz"	<i>50-1000 Hz</i>	<i>500 Hz</i>	
	<i>Overflow</i>		Overflow value in % of the "value at max. frequency"	<i>1-100 [%]</i>	<i>1%</i>	
	<i>Value at 0 Hz</i>		Value at 0 Hz	<i>MB start ≤ value ≤ value at max. Hz</i>	<i>0</i>	
	<i>Value at max. Hz</i>		Value at max. frequency	<i>Value at 0 Hz <value ≤ MB end</i>	<i>MB end</i>	
Control input (OUT1 only)			Control function for MIN/MAX memory reset	<i>OFF, memory reset</i>	<i>From</i>	
KofiCom (OUT1 only)	<i>Mode for factory calibration at output 1</i>					

Parameter table output 1/2 - partial volume

Sub-parameter level 1	Sub-parameter level 2	Sub-parameter level 3	description	Value range / value list	Standard value LPM version	Standard value GPM version
<i>Deactivated</i>			<i>Output deactivated</i>		<i>deactivated</i>	
Pulse output	Pulse unit	<i>List selection</i>	Defines the pulse unit for the pulse volume	<i>ml, L, m3, galUS, galUK, User</i>	<i>L</i>	<i>galUs</i>
	Pulse volume	<i>Value input</i>	Defines the value for the pulse volume	<i>0-999</i>	<i>1</i>	
	Pulse width		Defines the pulse width	<i>1-20.000</i>	<i>1ms</i>	
Control input (OUT1 only)			Control function for counter reset	<i>OFF, memory reset</i>	<i>From</i>	
KofiCom (OUT1 only)	<i>Mode for factory calibration at output 1</i>					

10.7 User service / factory service

A reset function and password setting are available to the user in the user service. Together with the activation of a user password, menu access for the user can therefore be blocked by a master user.

10.7.1 User service / Change password

In the factory settings, the user password is set to "00000", which means that the user functions are freely accessible. If the user password is changed to something other than "00000", the password prompt is activated the next time the user menu is accessed. If the set password is no longer known, a master password can be requested from IPF.

10.7.2 User service / factory settings

By activating this function, the user can reset the device to the factory settings. All user settings will then be lost and the device will return to its factory settings.

User menu parameter table

Sublevel	Parameter level	description	Value range / value list	Standard value LPM version	Standard value GPM version
password	Value input	Contactors the user service menu with a password prompt if the password is not "00000"	00000-99999	00000	
Factory reset	Yes / No	Resets the device to factory settings			
Menu lock	normally open / closed	<i>When "locked", menu access is only possible via the password prompt</i>	<i>unlocked / locked</i>	<i>unlocked</i>	
Sim Autostop	Value input	<i>Defines the time for which the simulation mode remains active</i>	<i>1 - 31 min.</i>	<i>10 min.</i>	

10.8 Factory service

Access is exclusively for authorized persons and is password-protected.

10.9 Info

10.9.1 General

This info option displays the measuring ranges of the device for flow rate and temperature.

10.9.2 Version

This info option displays the hardware and software version of the device.

Parameter table info

Menu level	Sub-level	description
Info	General	Displays the measuring ranges of the device
	Version	Displays the hardware and software version

10.10 Device delivery status

The flow meter is set and delivered from the factory with the following configuration:

Display - Double

Upper display - flow rate

Lower display - temperature

Output 1: 4-20mA

Output 2: deactivated

11. Device status

The magnetic inductive flow meter can recognize and display various device or application errors.

If there is a status or error message, the STATUS symbol in the display flashes orange / red alternately. To call up the status/error information, the status button must be pressed; the status window that then appears lists all the messages that have accumulated up to this point. By pressing the <<< diffuse reflection sensor, the user confirms knowledge of the displayed errors, the status memory is deleted and the status window is closed. If one of the displayed errors persists, this is indicated again by the status symbol flashing. The following status/error messages are generated:

Display text	description	Troubleshooting
<i>Empty Pipe</i>	Measuring tube is not completely filled with medium or medium with too low conductivity is used.	Check filling of the measuring circuit or conductivity of the medium (>20 µs/cm)
<i>Temp Sens Error</i>	Error in the temperature measuring circuit	Repair by IPF Service necessary
<i>Meas saturated</i>	Flow measuring circuit overloaded	Reduce flow rate
<i>No Subslave</i>	Internal hardware error	Repair by IPF Service necessary
<i>Simulation</i>	Simulation function active	-

12. Dosing function

A simple dosing function is available in the SMxxxxxx as standard. This can be permanently activated or deactivated in the settings menu under the "Dosing" menu item. If the dosing function is activated, the 2 outputs are assigned fixed functions that cannot be changed as long as the dosing function is activated:

- OUT2 (connection pin 2): Dosing output in push-pull mode
- OUT1 (connection pin 4): Control input for START/STOP/RESET function



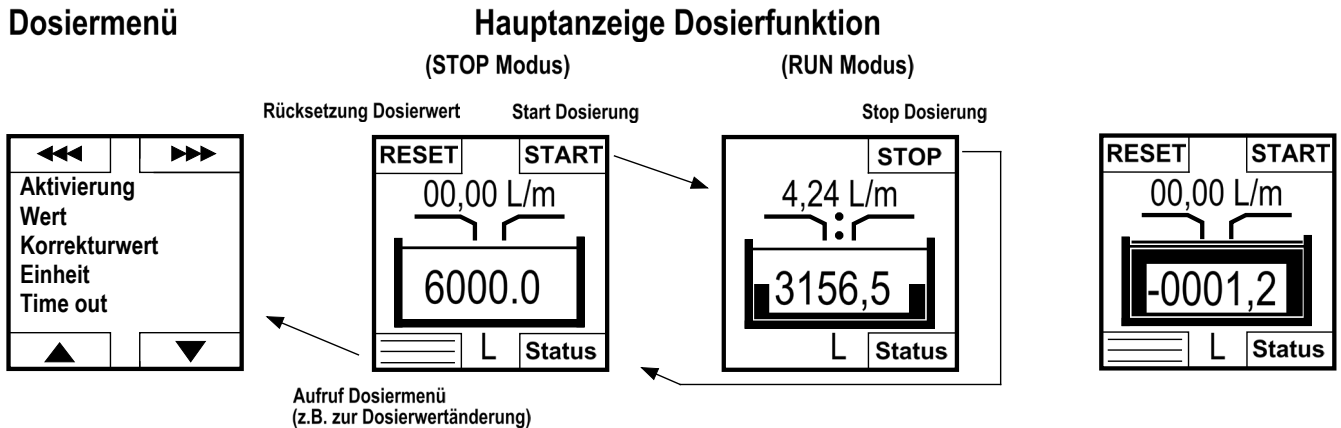
Attention!

If the control input is used, **OUT1 (PIN4) must always be polarized, either to 24 VDC or to GND (PIN3). If a mechanical diffuse reflection sensor is used to switch the supply voltage to the control input, a 10 kOhm pull-down resistor is recommended.**

The control input must not be left open!

If the dosing function is deactivated, both outputs are switched to **OFF** (deactivated) by default, but these can then be freely configured again.

Dosiermenü



The main display of the dosing function shows both the quantity to be dosed in a preselectable unit and the current flow rate value. The progress of the dosing process is also shown by a graphic animation in which the displayed container fills up as a percentage and overflowing is also shown.

Soft keys: All soft keys in dosing mode must be held down by the user for at least 2 seconds and then released again to trigger the corresponding function. This is to prevent accidental operation.

Control input: Connection OUT1 can be used as a control input for the start/stop/reset functions when the dosing function is activated.

function	Trigger dependencies	Control pulse duration
----------	----------------------	------------------------

START	Stop mode	$0.5\text{ s} < t_{\text{high}} < 4\text{ s}$
STOP	Run mode	$0.5\text{ s} < t_{\text{high}} < 4\text{ s}$
RESET	Stop mode	$t_{\text{high}} > 5\text{ s}$

START dosing:

Dosing can be started either by pressing the "START" softkey or by applying a high pulse to the control input.

After triggering the START function, the dosing output is switched to active (High) and the dosing counter is counted down in the standard direction if there is a flow.

If the dosing process is stopped incompletely by hand, it can be restarted using the START function.

STOP the dosing:

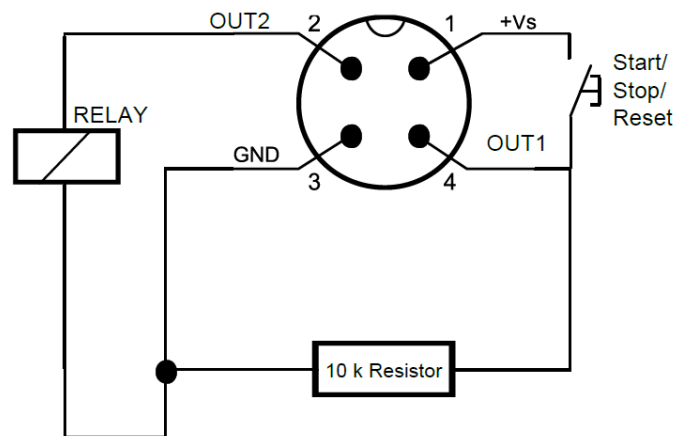
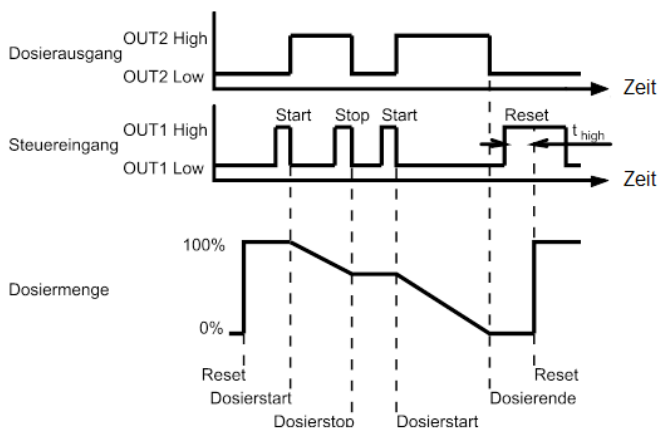
Once the dosing process has started, it can be ended or interrupted using the STOP function. The dosing process can be restarted to reach the total dosing quantity by pressing START.

Just like the START function, the STOP function can be controlled remotely via the control input.

RESET of the dosing value:

Once the dosing process has been completed or stopped, the dosing quantity can be reset to the default value using the RESET function.

This function can also be triggered at the control input.



Description of the dosing parameters

Dosing quantity "Value"

The "Value" parameter defines the dosing volume. The volume unit is defined in the "Unit" parameter.

The maximum size is limited to **9999.9** (one decimal place); the absolute quantity can be extended or restricted by selecting a suitable dosing unit.

Dosing unit "Unit"

The "Unit" parameter defines the dosing volume unit. The following can be selected: *mL*, *L*, *m³*, *galUS*, *galUK*, *barrel*, *user*

Dosing correction value "Correction value"

The "Correction value" parameter can be used to correct a system-related, constant "incorrect dosing" without having to change the self-test dosing quantity. The correction value can be either positive or negative. If the system doses a smaller volume than intended, the correction value must be positive; if the actual volume is larger, it must be negative. e.g.

Dosing quantity = 10 L

Correction value = -1 L

In this case, the counter will count from 10 L to '0', but will stop at 1 L because the quantity to be dosed is 9 L based on the correction value of -1 L.

With a correction value of +1 L, the dosing counter will stop counting at -1 L, because the dosing quantity is mathematically 11 L.

$10 - (-1 \text{ L}) = 11 \text{ L}$

The following must always apply to the adjustable value of the correction value:

(value + correction value) > 0

If this condition is not met, this is indicated by a warning message and the correction value is preset to the value $-(\text{Value}-0.1)$.

Dosing parameter "Timeout"

During the dosing process, the presence of a flow rate value not equal to 0 is constantly monitored. For this purpose, the "Timeout" parameter is used to specify the time after which the "Time Out" status message is triggered.

The timeout value can be set between 0.5 s and 10 s.

Dosing parameter table

Sub-level	Parameter level	Sub-parameter level 1	Sub-parameter level 2	Sub-parameter level 3	description	Value range / value list	Standard value LPM version	Standard value GPM version
Activation	deactivated				Dosing function deactivated		<i>deactivated</i>	
	activated	Activation			Dosing function activated			
		Value	Value input			$0 \leq \text{Value} \leq 9999.99 \text{ [unit]}$	0	
		Correction value	Value input			$-999.99 \leq \text{Value} \leq +999.99 \text{ [unit]}$	0	
		Unit	List selection			<i>ml, L, m3, galUS, galUK, User</i>	L	galUs
		Time out	Value input			0,5 - 10 s	0,5 s	

13. technical data

Measuring method:	magnetic inductive	
Measuring ranges:	see table Ordering data	
Media:	conductive liquids	
Minimum conductivity: ≥ 20	$\mu\text{S/cm}$	
Max. Medium viscosity:	70 mm ² /s	
Pressure stage:	16 bar	
Measuring accuracy:	$\pm (0.8\% \text{ of MW} + 0.5\% \text{ of ME})^*$	
Repeat accuracy:	$\pm 0.2\%$ of the ME	
Response time flow t ₉₀		
(alarm/pulse/frequency output)	:<100 ms	
(analog output)	:<1 s	
Temperature measurement		
Sensor:	PT1000	
Measuring accuracy: $\leq \pm 2$	°C (flow > 0.2 m/s)	
Measuring range:	Medium temperature range	
Response time temperature t ₉₀		
(signal output):	<20 s	
Installation position:	any	
Inlet/outlet section:	3 x DN/2 x DN	
Pressure drop (max. at ME)	MB 01110	mbar
	MB 05400	mbar
	MB 1050	mbar
	MB 15250	mbar (3/4"), 30 mbar (1")
	MB 20	110 mbar
	MB 35120	mbar
Operation: with gloves**	4 optical diffuse reflection sensors, can be operated	
Housing:	Stainless steel 1.4404, display window PMMA	
Materials in contact with media		
Connection fittings and housing:	Stainless steel 1.4404	
Insulating part:	PEEK	
Electrodes:	Stainless steel 1.4404	
Sealing:	FKM or EPDM	
Degree of protection:	IP 67	

Temperature ranges

design	Electronics	Sealing material	Medium temperature	Ambient temperature
Compact version	C3T	FKM	-20 °C ... +70 °C ¹⁾	-20 °C ... +60 °C
		EPDM		
Separate version (PVC cable)	P02	FKM	-20 °C ... +85 °C	-20 °C ... +60°C (display electronics)
		EPDM		-20 °C ... +85°C (sensor)
Separate version (ETFE cable tail)	E02	FKM	-20 °C ... +140 °C	-20 °C ... +60°C (display electronics)
				-20 °C ... +140°C (sensor)
		EPDM	-40 °C ... +140 °C	-20 °C ... +60°C (display electronics)
				-40 °C ... +140°C (sensor)

¹⁾ Permanently -20 °C...+70 °C, briefly up to max. +85 °C (for max. 60 min. at max. 40 °C ambient temperature and repeated after 4 h at the earliest). **The use of the electrical outputs is limited to the temperature range -20 °C ... +70 °C.**

Electrical data

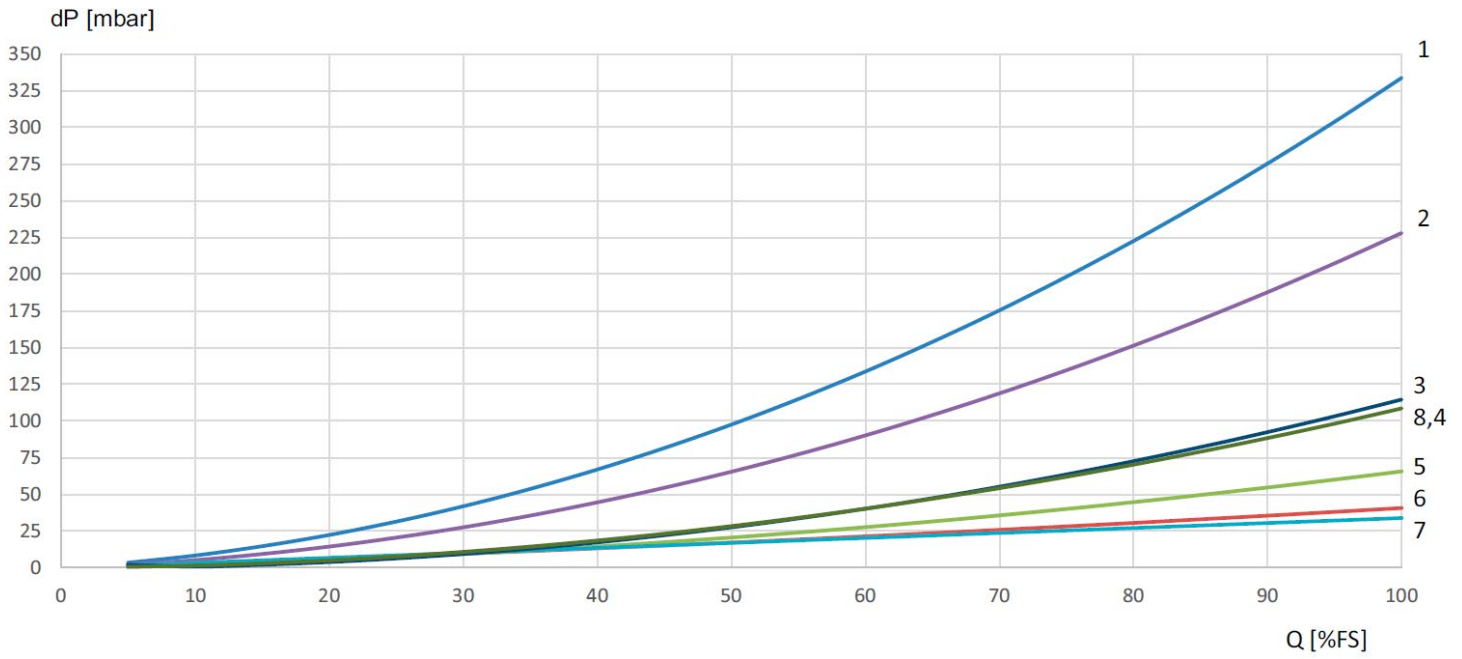
Supply voltage:	19 - 30 VDC , current consumption max. 200 mA (without outputs)
Display:	TFT display, 128 x 128 color pixels, 1.4" display orientation in 90° steps adjustable
Display repetition rate:	0.5 ... 10 s, adjustable
Pulse output:	Push-pull, freely scalable, configurable for partial or total volume counter
Frequency output:	Push-pull, freely scalable
Alarm output:	NPN, PNP, push-pull configurable max. 30 VDC , max. 200 mA short-circuit protection
Analog output: active, 3-wire, 0(4)-20 mA,	Max. burden 500 Ω or 0(2)-10 VDC , ($R_i = 500 \Omega$)
Control input (MIN/MAX/partial volume RESET)	OUT1, High active $0 < U_{Low} < 10 \text{ V}_{DC}$ $15 \text{ V}_{DC} < U_{High} < V_s$ No internal pull-ups available, Active high/low signal required!
Total and partial quantity counters:	Overflow (reset) at $15 \cdot 10^6$ liters (independent of the set unit)
Electrical connection:	M12x1 connector, 4-pin
Dosing function	
Dosing quantity:	0.1 ...99999.9 [<i>unit</i>]
Dosing output:	OUT2 PushPull, High active
Control input:	OUT1, High active $0 < U_{Low} < 10 \text{ V}_{DC}$ $15 \text{ V}_{DC} < U_{High} < V_s$ No internal pull-ups available, Active high/low signal required!
START/STOP pulse:	$0.5 \text{ s} < t_{high} < 4 \text{ s}$
RESET pulse	$t_{high} > 5 \text{ s}$

*Under reference conditions: Medium temperature: 15 °C ... 30 °C, 1 cSt,500 μS/cm, 1 bar

Ambient temperature: 15 °C ... 30 °C

** Limited operation with black rubberized gloves

Pressure loss



- 1 = SM900021
- 2 = SM910021
- 3 = SM95002x
- 4 = SM920021
- 5 = SM910020
- 6 = SM900020
- 7 = SM920020
- 8 = SM890020

14. Order data

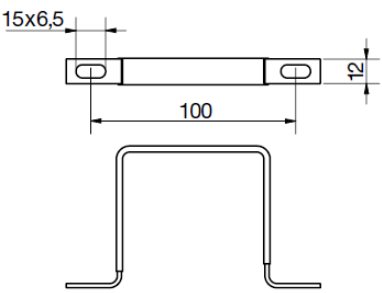

Order data

	connecti on	Inner diameter (DN)	measuring range
SM890020	G 1/4 ¹⁾	2.4 x 3mm	0.01 ... 1 l/min
SM900020	G 1/2 ¹⁾	5mm ²⁾	0.03 ... 3 l/min
SM900021	G 1/2 ¹⁾	5mm ²⁾	0.04 ... 10 l/min
SM910020	G 3/4 ¹⁾	10mm ²⁾	0.1 ... 25 l/min
SM910021	G 3/4 ¹⁾	10mm ²⁾	0.2 ... 50 l/min
SM920020	G 1 ¹⁾	15mm ²⁾	0.2 ... 50 l/min
SM920021	G 1 ¹⁾	15mm ²⁾	0.4 ... 100 l/min
SM950020	G 2 ¹⁾	see drawing	1.5 ... 350 l/min
SM950021	G 2 ¹⁾	see drawing	3.0 ... 600 l/min

¹⁾ l/min package (nameplate (l/min, °C, bar), set measuring range (MB) Temperature °C

²⁾ Complies with Regulation (EC) No. 1935/2004 via materials and articles intended to come into contact with food. (sealing material must be certified in advance).

accessories

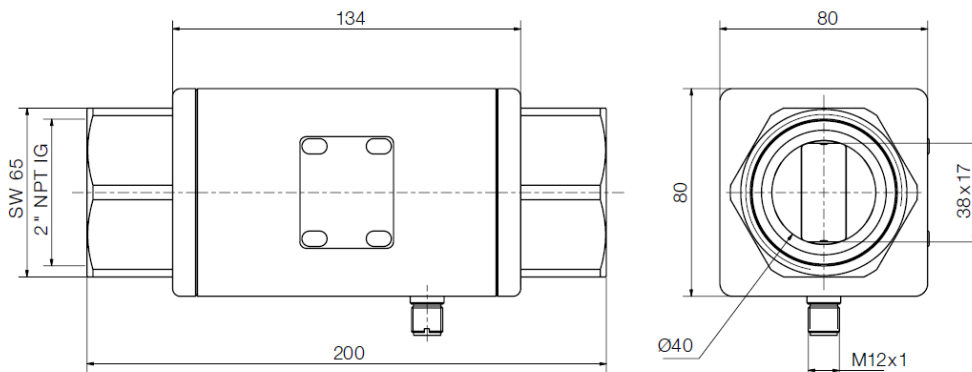
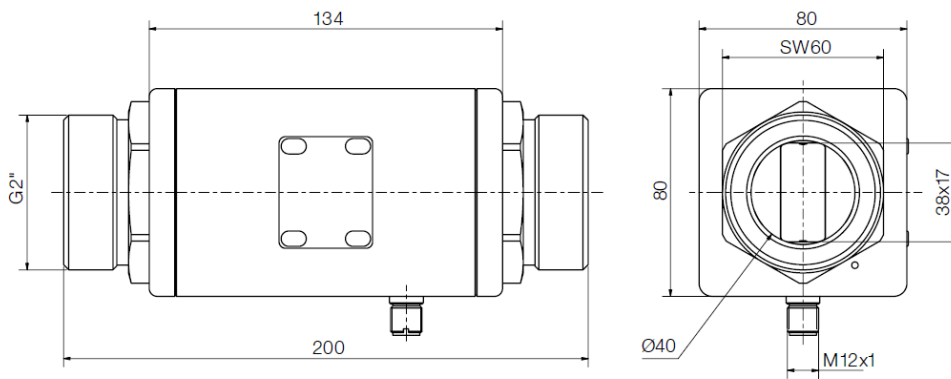
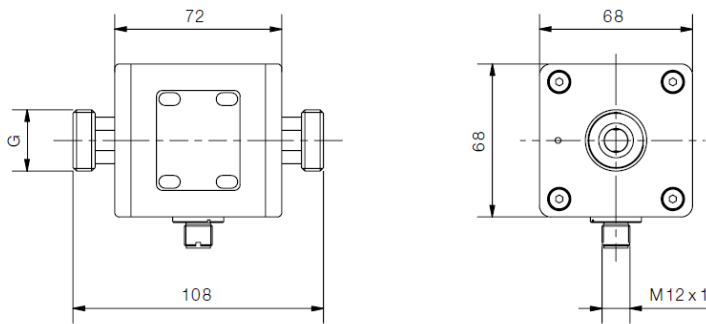
description	Type	Dimensions [mm]	Image
Clamping bracket set for SMxxxxxx up to 1" (stainless steel with partial polyolefin coating)	AS000017		

15. dimensions

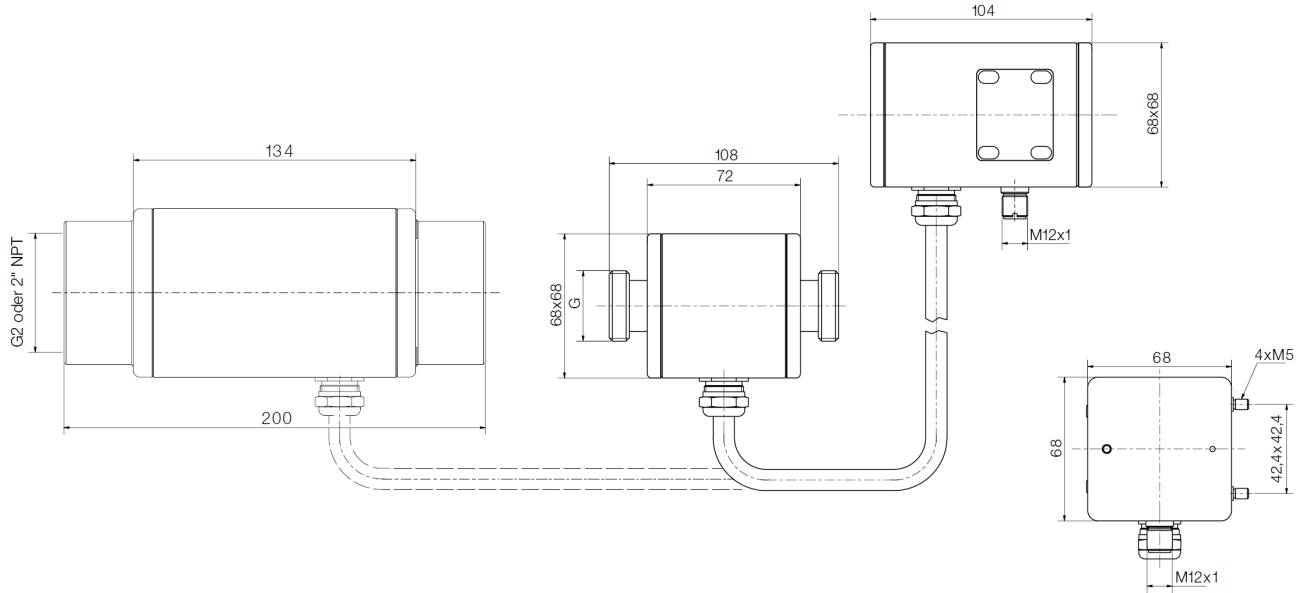
[mm]

Compact version

G
1/4
1/2
3/4
1



Separate version
Without wall bracket



Wall bracket included

