

Operating Manual
for
Flow-Counter/-Dosing Unit/-Controller
Model:

ZOK-ZxP



ZOK-ExK/ZxK



ZOK-ExM/ZxM



ZOK-ZxF

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Manufactured and sold by:

Kobold Messring GmbH
Nordring 22-24
D-65719 Hofheim
Tel.: +49(0)6192-2990
Fax: +49(0)6192-23398
E-Mail: info.de@kobold.com
Internet: www.kobold.com

2. Note

Please read these operating instructions before unpacking and putting the unit into operation. Follow the instructions precisely as described herein.

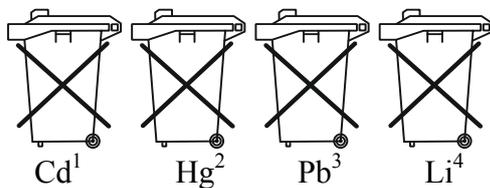
The devices are only to be used, maintained and serviced by persons familiar with these operating instructions and in accordance with local regulations applying to Health & Safety and prevention of accidents.

When used in machines, the measuring unit should be used only when the machines fulfil the EC-machine guidelines.

2.1 Notice According to the Battery Law

Old batteries do not belong in household waste. You can send the batteries back to us or an authorized address, free of charge. As consumer, you are legally obliged to return the used batteries.

Contaminated batteries are provided with a mark consisting of a crossed-out trash and the chemical symbol (Cd, Hg, Li or Pb) of heavy metal for classification as respective contaminant:



1. "Cd" stands for cadmium.
2. "Hg" stands for mercury.
3. "Pb" stands for lead.
4. "Li" stands for lithium.

3. Instrument Inspection

Instruments are inspected before shipping and sent out in perfect condition. Should damage to a device be visible, we recommend a thorough inspection of the delivery packaging. In case of damage, please inform your parcel service / delivery agent immediately, since they are responsible for damages during transit.

Scope of delivery:

The standard delivery includes:

- Flow counter/-dosing unit/-controller in plastic- universal housing with wall or pipe mounting set Model: ZOK-Z with universal housing 'K'
OR
Flow counter/-dosing unit/-controller in panel mounting housing 96x96mm with 2 mounting clips Model: ZOK-Z with panel mount housing 'P'
Flow counter/-dosing unit/-controller in aluminum field housing, plastic cover PA6 with M16x1.5 cable gland
Model: ZOK-Z with field case 'F'
OR
Oval gear flow meter DON- with electronics option -Z in compact version
Model: ZOK-Z with universal housing 'M'
- Operating Manual
- Battery 3.6 V Lithium size AA for data saving function (not for ZOK-Z with 'P')

4. Regulation Use

The electronic units ZOK-xx are specifically designed for the calculation, display and transfer of calculations and flow rates of flow meters with pulse or frequency outputs. The instruments display flow rate, day counter (resettable) and total counter in the operator-selected units. A clear multilingual menu guides you through the programming of the device that largely eliminates the requirement of constant usage of operating manual. All user-specific program settings are retained even when changing the battery.

A trouble-free operation of the device is only guaranteed if all instructions in this manual are complied. We do not accept any liability for damage caused by failure to follow these instructions.

5. Environment

The electronics options ZOK-ZxK are weather resistant and adequately reflect IP66/67 (NEMA 4X). The electronics are housed in a UV-resistant, glass-filled nylon housing with stainless steel screws and FPM seals. The options ZOK-ZxP are in a panel mount housing 96x96 mm with protection class IP44. The option ZOK-ZxF is available in powder coated aluminum extruded housing with Plastic lids and appropriate protection class IP 66/67.

The instruments are suitable for harsh indoor or outdoor environments and comply with EU Directive 2014/30/EU (Electromagnetic Compatibility).

6. Instrument / Functions overview

Function	Z1P/Z1F	Z1K/M/0	Z2P/Z2F	Z2K/M/0	Z3P/Z3F	Z3K/M/0	E1K/M	E2K/M/0	E3K/M/0	E4K/M/0	E5K/M/0
Dual counter	X	X			X	X	X		X	X	X
Dosing function			X	X				X			
Controller function					X	X			X	X	X
Certification											
ATEX/IECEX Certification							X	X	X	X	X
Power supply											
DC-supply	X	X	X	X	X	X	X	X	X	X	X
AC-supply	X		X		X						
Battery operation (output deactivated) ²⁾		X				X	X		X		
Battery included in shipment		X				X	X		X		
Sensor supply (only with external power supply)											
Sensor supply	8 V/ 24 V	8 V	8 V/ 24 V	8 V	8 V/ 24 V	8 V	8 V	8 V	8 V	8 V	8 V
Electrical outputs (only with external supply)											
Relay outputs			X	X	X			with opto-coupler board ¹⁾			with opto-coupler board ¹⁾
Status outputs	X	X	X	X	X	X					
Analogue outputs					3L	2L/ 3L			2L/ 3L	2L/3L HART®	3L
Pulse outputs					X	X					with opto-coupler board ¹⁾
LCD-display											
Selectable units	X	X	X	X	X	X	X	X	X	X	X
Decimal point	X	X	X	X	X	X	X	X	X	X	X
Accumulative total	X	X	X	X	X	X	X	X	X	X	X
Resettable total	X	X	X	X	X	X	X	X	X	X	X
Linearisation	X	X			X	X	X	X	X	X	X
Rate display	X	X	X	X	X	X	X	X	X	X	X
Backlighting	X	X	X	X	X	X					
Arithmetic functions	X	X			X	X	X	X	X	X	X

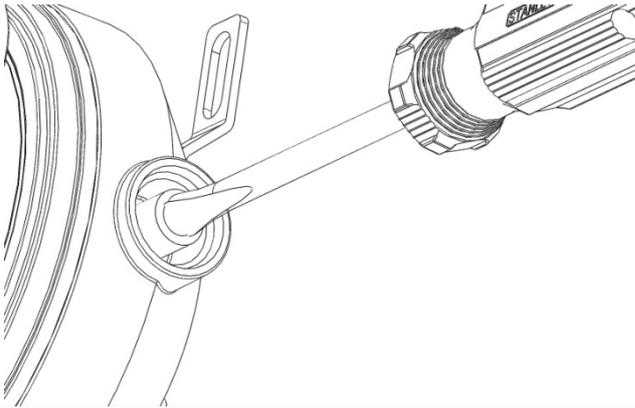
¹⁾ Optocoupler board serves as a galvanic separation to be used in hazardous area

²⁾ Battery operation only applicable with a passive sensor (e.g. reed switch)

7. Electrical connections

7.1 Cable entry for housing option -K

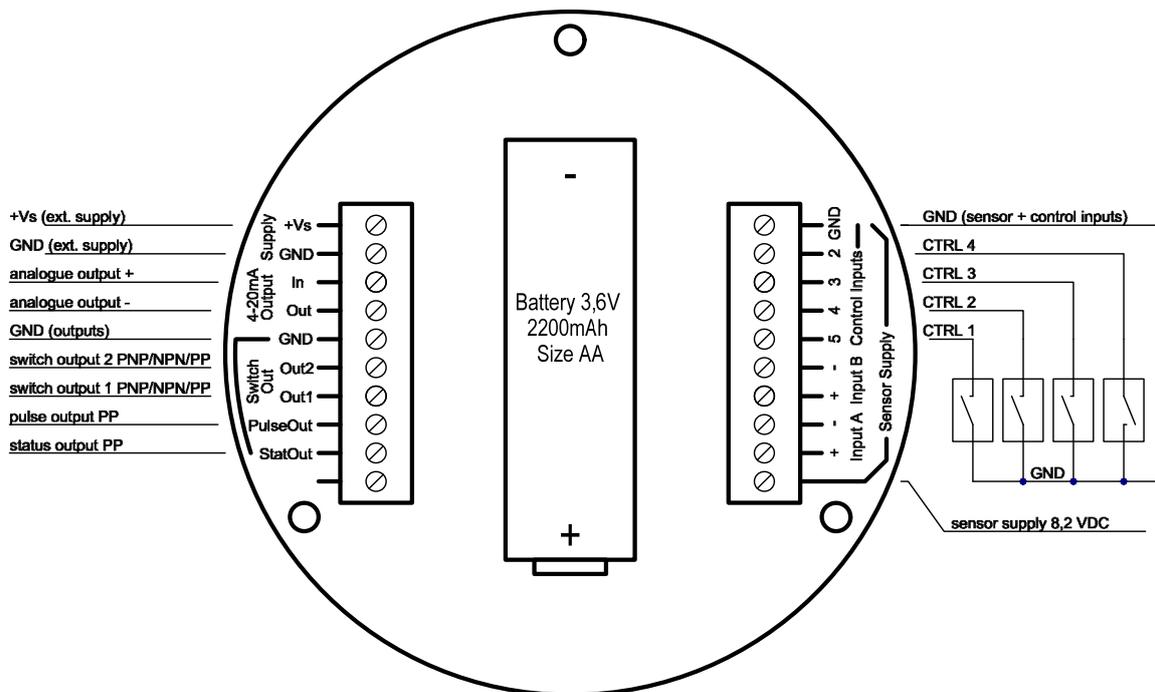
Up to 3 cable entries (M20x1.5 or 1/2 "NPT) are available for electric connection in case of electronics with plastic housing. To use these cable inlets, the existing factory protection caps must be broken with a tool (e.g. screwdriver) and a suitable cable gland should be screwed in. The cable glands are not included in the delivery.



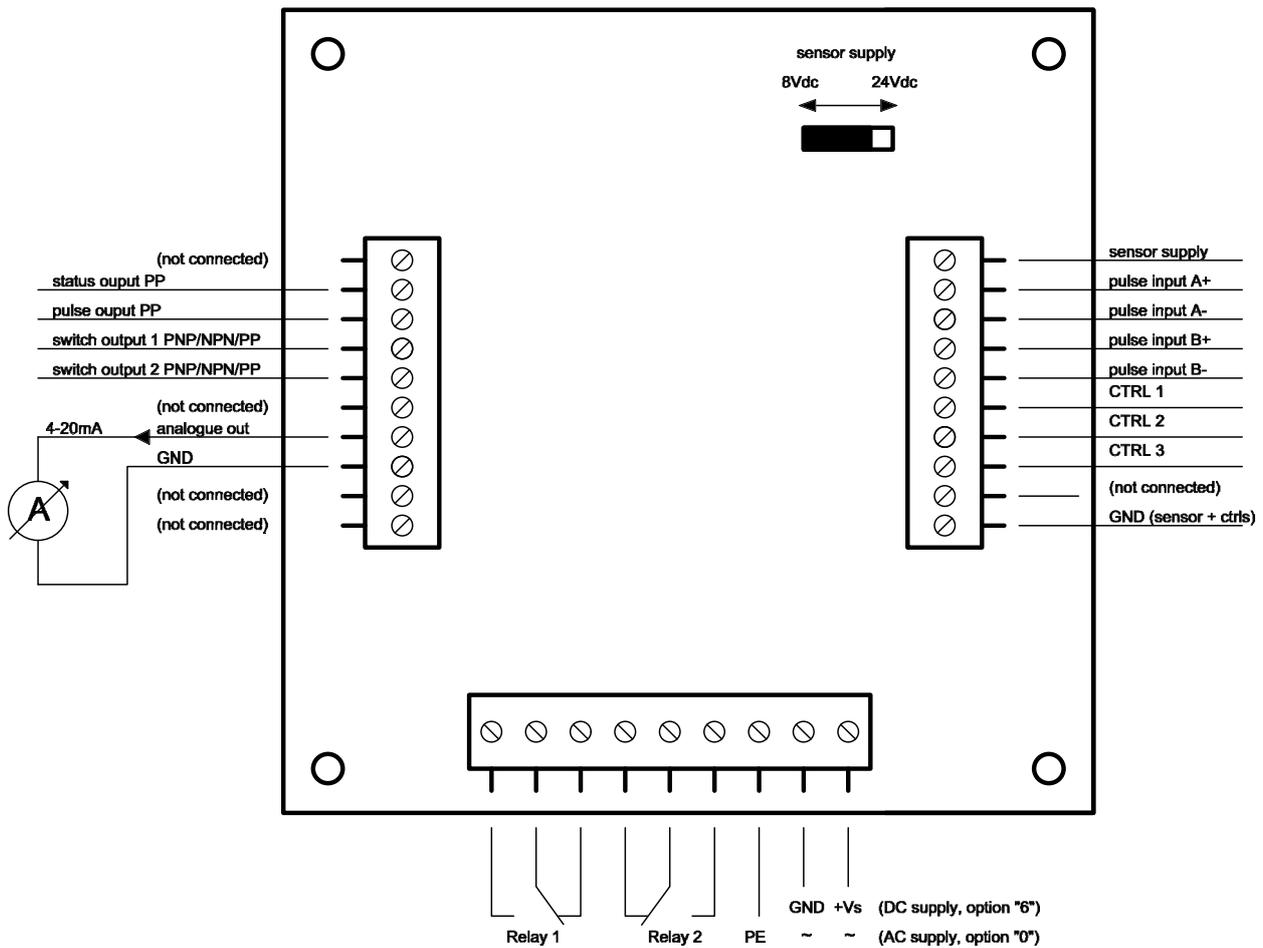
Eruption of cable inlets

In case of electronic option ZOK-Z with housing 'P', the electrical connection is at the rear side above the pluggable screw terminals.

7.2 Overview of Terminals ZOK-E/Z with Supply option 3 and 6



7.3 Overview of Connections ZOK-Z with Supply option 0 and 6



7.4 Power Supply

Depending on functionality and features, the electronics offer different possibilities for power supply:

- Options ZOK-Z2: External DC-Supply
- Options ZOK-Z1: Battery and ext. DC-Supply
- Options ZOK-Z3: Battery and ext. DC-Supply and 4-20 mA Loop current

7.4.1 Storing the counter readings

The storage of meter readings is carried out after each measurement cycle in the internal FRAM. If the power is interrupted and re-applied, than the meter reading revert to the last saved values.

7.4.2 External DC-Supply

When electronic units are supplied with external DC voltage, all functions are available. If no analogue output is used, all instrument functions are ensured on 5 V_{DC}. When using the analogue output in 3-wire circuit, the supply voltage must be minimum 10 VDC (+ load).



If the device is taken out of operation and not used for longer periods, the battery must be removed. Otherwise, the device is always supplied by the battery and remains active. As a result, the battery can get discharged.



For electronics option Z2, no battery can be used due to the relay board.

7.4.3 Supply via 4-20 mA Current Loop (only ZOK-Z3 with supply option '3')

The electronic option ZOK-Z3 can alternatively be operated via 4-20 mA current loop in 2-wire operation. Here we have the following technical limitations:

- All other electrical outputs (switching outputs, pulse output and status output) are disabled
- The backlight of the display is switched off and cannot be turned on.
- Sensors that do not require an additional power supply can be connected (e.g. reed switch). Hall sensors require the additional power supply and can therefore not be used in 2-wire loop operation. In this case, the 3-wire connection must be used with an external power supply.
- To use the 2-wire loop operation, the parameter 'Wiring type' in configuration menu for analogue output must be changed to '2-wire', otherwise the current output will not be scaled correctly.

7.4.4 Battery operation (only ZOK-Z1/-Z3 with supply option 3)

The options ZOK-Z1/-Z3/-E1/-E3 can also be powered by a battery. In battery mode, the device function scope is relatively limited:

- All electrical outputs (switching outputs, analogue output, pulse output, status output) are disabled during battery operation.
- The backlight of the display is switched off and cannot be turned on.
- The sensor may only be used with passive reed switches, as they require no additional power supply. Usage of induction coils reduces the battery life. Other sensors, which require a sensor power for operation, are also not suitable for battery operation.

During battery operation, there are four different types of sleep modes available under menu point 'Display' which can be selected by the user and are numbered from 0-3.

- **Activation of sleep mode**

The duration after which the electronics goes in SLEEP-Mode and SLEEP is displayed on the display can be adjusted, activated and deactivated with Menu point 'Sleep Timeout'. If 'Sleep Timeout' is set to '0', SLEEP-Mode is deactivated and the electronics will always work in Measuring Mode. The 'Sleep Timeout' can be adjusted from 0 to 1800 secs. After the 'Timeout' time has passed, the sleep mode chosen by the user will be activated.

No linearization function is available during sleep modes.

The counter values will be regularly updated in the internal processor.

The flow rate will neither be updated in the processor, nor on the display.

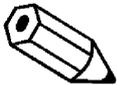
- **Monitoring of battery voltage during sleep mode**

In all sleep modes, after a count of 100 pulses, the battery voltage is monitored. If this monitoring shows that the voltage has gone below 3.2 V, then the counter values will be saved.

NOTE: The counter values will be regularly saved in measuring mode and also in sleep mode if the battery voltage is at a critical level but however it will not happen during sleep mode with healthy battery.

- **Battery status indication during sleep mode**

With the exception of sleep mode 0, the battery status will be indicated in two stages during normal measuring mode and all other sleep modes. In sleep mode with 3.2 battery voltage, 'Low Bat' will be displayed on the display and the symbol 'bat' on the upper left side of the display will begin to flash. Here we recommend a battery replacement. Furthermore, in sleep mode when the voltage drops below 3.1 V, 'CHANGE BAT' appears on the display. In this case, the battery must be replaced.



Note! In the battery mode once the sleep mode is activated, the electronics will not automatically detect the changeover from the battery voltage to the external voltage. The user can wake up the electronics by means of a push button, in order to continue the operation of the electronics with an external supply and to use the outputs. The user can either deactivate the sleep mode by setting the sleep timeout to '0', or he can operate the electronics without a battery (only with external supply) to avoid the above mentioned situation.

- **Description of sleep modes**

Sleep mode 0 (Default)

Sleep mode 0 is a mode with the lowest current consumption since the display will be switched off during this mode and only a key press will reactivate it for the duration of 'Timeout' time. In Menu, the behaviour of the display remains the same. The menu can be further used by pressing keys anytime.

Sleep mode 1

In sleep mode 1, the display will be active with an indication 'SLEEP' on the display. In Menu, if the electronics goes to sleep mode, then the last displayed content will be frozen. The menu can be further used by pressing keys anytime.

Sleep mode 2

In sleep mode 2, the counter values are periodically calculated and displayed on the display, as long as the pulses are present on either Input A or Input B. In the absence of pulses, the display will be turned off. The display and the counter values will be updated after the duration of 'Refresh rate' set by the user. If the refresh rate is set to e.g. 5 sec, the counter values will be calculated and displayed on display after these 5 seconds. Longer refresh rate will increase the battery life.

'BAT LOW' will be displayed on the display if battery voltage falls below 3.2 V and 'CHANGE BAT' will be shown in case if the voltage falls below 3.1 V.

In Menu, if the electronics goes to sleep mode, then the last displayed content will be frozen. The menu can be further used by pressing keys anytime. In measuring mode, instead of flow rate, indication 'SLEEP' will be shown.

Sleep mode 3

Sleep mode 3 is same as sleep mode 2 with the exception that the display is always on.

- The menu mode will not be automatically exited when no key is pressed for a certain time. The menu mode remains active until the user presses the RET button till the normally measuring mode appears. In battery operation, a long stay in menu mode will shorten battery life.

The supplied battery type 3.6 V AA Lithium (2200 mAh) should be inserted in the battery holder on the back side of the electronic (correct polarity is important!). The following type of battery is required to replace the supplied battery:

3.6 V Lithium, Size AA, minimum capacity 2200 mAh, IEC-Type CR14505

e.g: EVE Type ER14505M, SAFT LS14500, TADIRAN SL360S/SL760

Battery life duration: The achievable battery life is dependent on various factors:

- On the frequency of activation of measurement / menu mode (in the measurement / menu mode, power consumption is higher)
- On the total number of detected input pulses and the input frequency (higher frequencies reduce the battery life)
- On the environmental conditions - low temperatures reduce the usable battery capacity.

Battery life (Months)		
SLEEP mode 0	SLEEP mode 1	Menu Mode/ Measuring mode
17-20	9-10	1

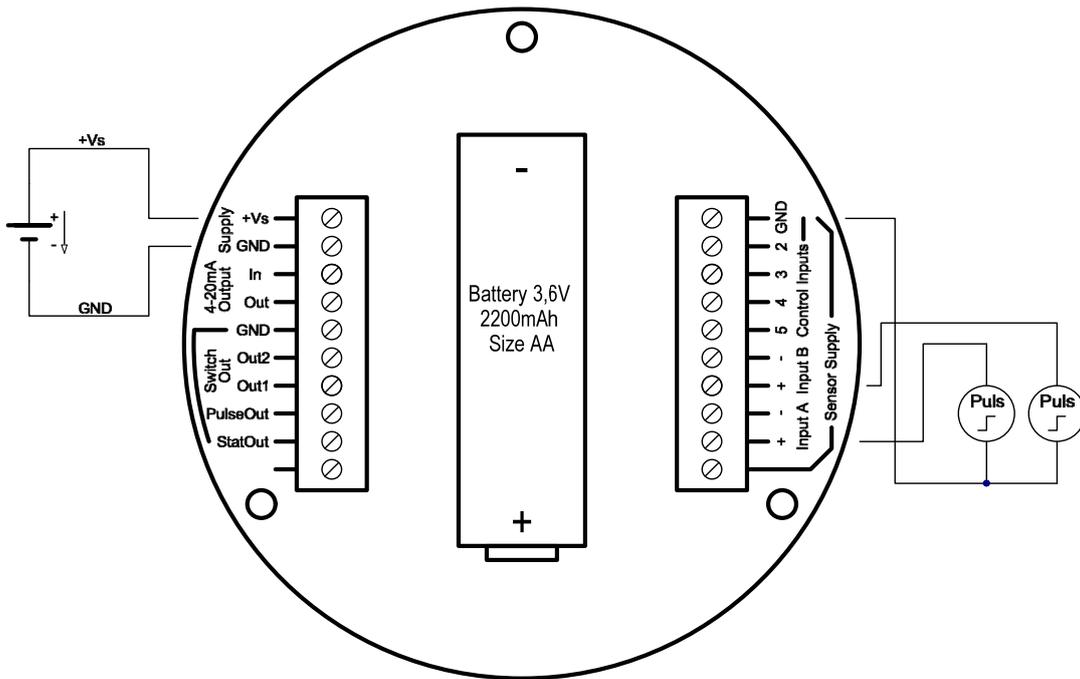
Input signal (Hz)	Battery life (Months)	
	SLEEP mode 2	SLEEP mode 3
0	20	8
1	8	8
100	7	7
1000	3	3

7.5 Sensor Inputs

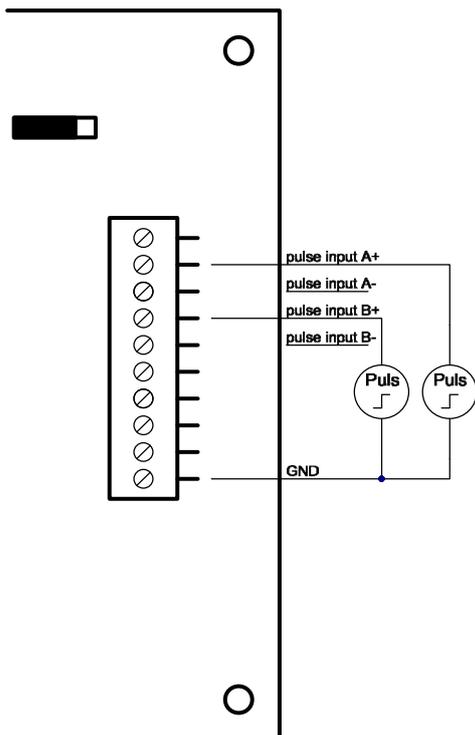
7.5.1 Active pulse signal

Power Supply: External DC-Supply
 Signal input setting: „AKTIVES SIGNAL“

Wiring for ZOK-Z with Supply option 3 and 6:



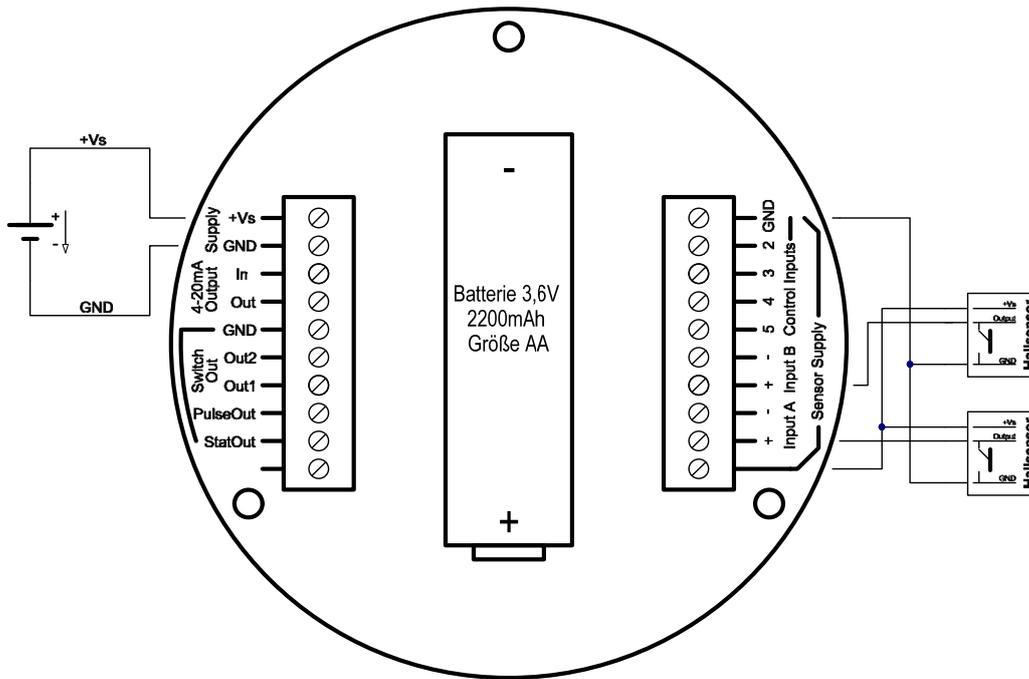
Wiring for ZOK-Z with Supply option 0 and 6:



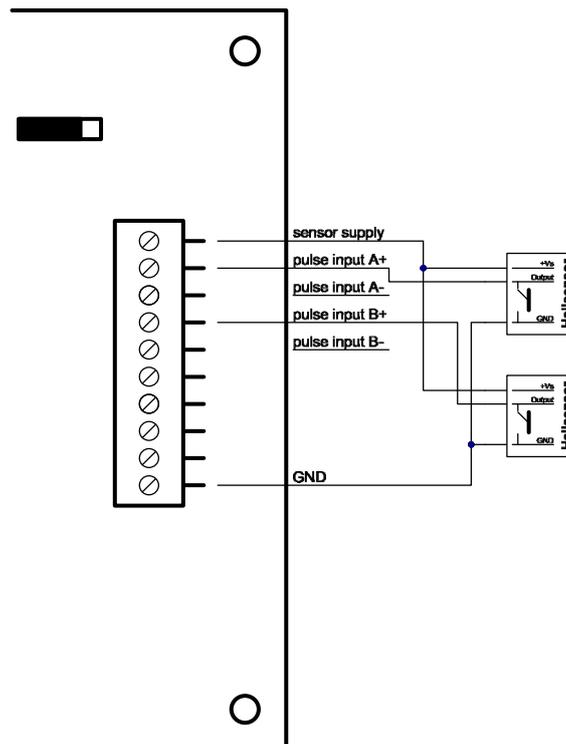
7.5.2 Hall Sensor, NPN- and PNP-Sensors

Power supply: only external DC-supply
 Signal input setting: „HALL“
 Signal input setting: „NPN“
 Signal input setting: „PNP“

Wiring for ZOK-Z Supply option 3 and 6:



Wiring for ZOK-Z with Supply option 0 and 6:

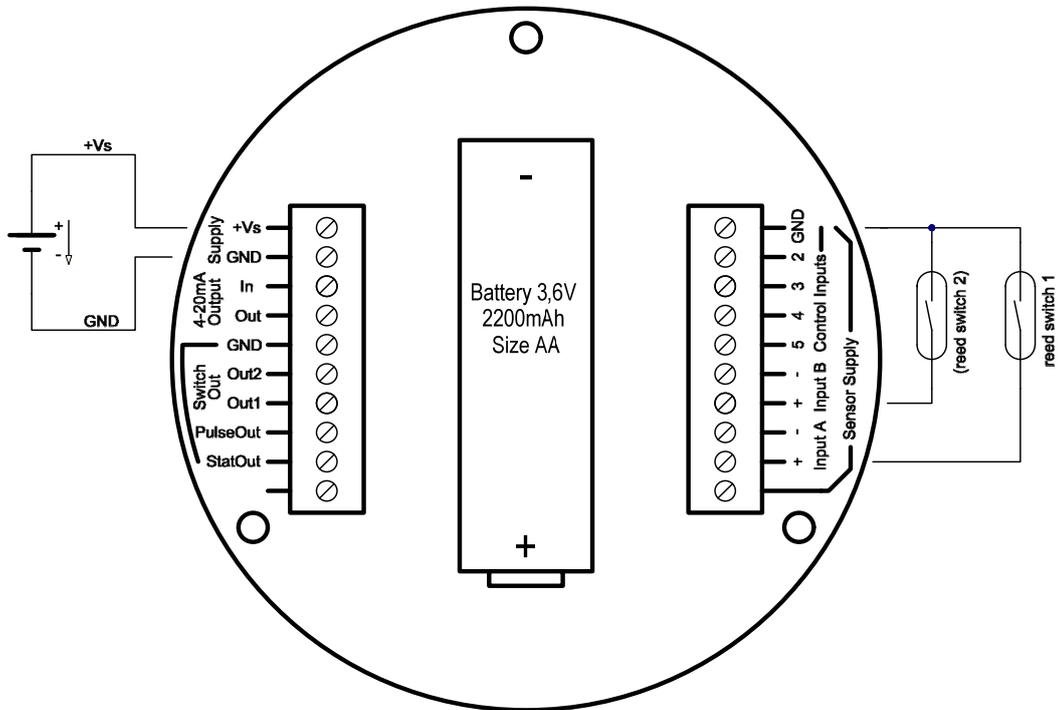


7.5.3 Reed switch (-R0 Sensor option)

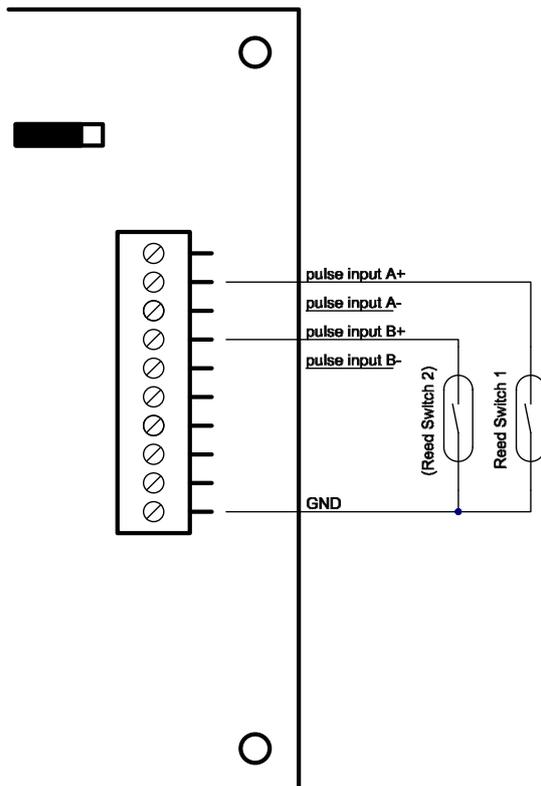
Power supply : External DC-supply, Battery operation or 4-20 mA loop current

Signal input setting: „REED “

Wiring for ZOK-Z with Supply option 3 and 6:



Wiring for ZOK-Z with Supply option 0 and 6:

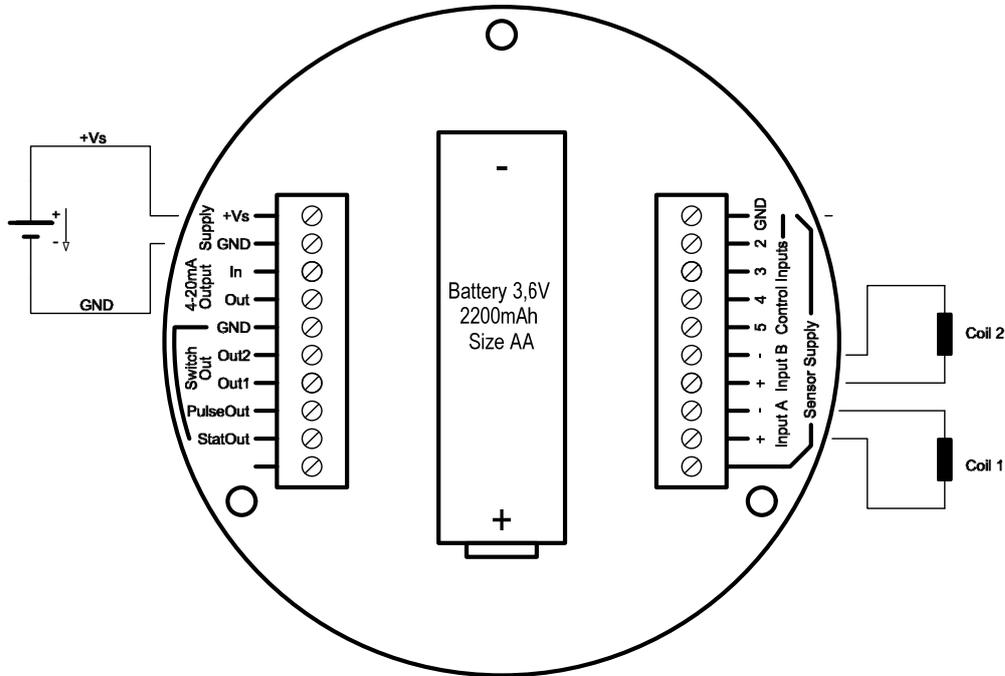


7.5.4 Inductor

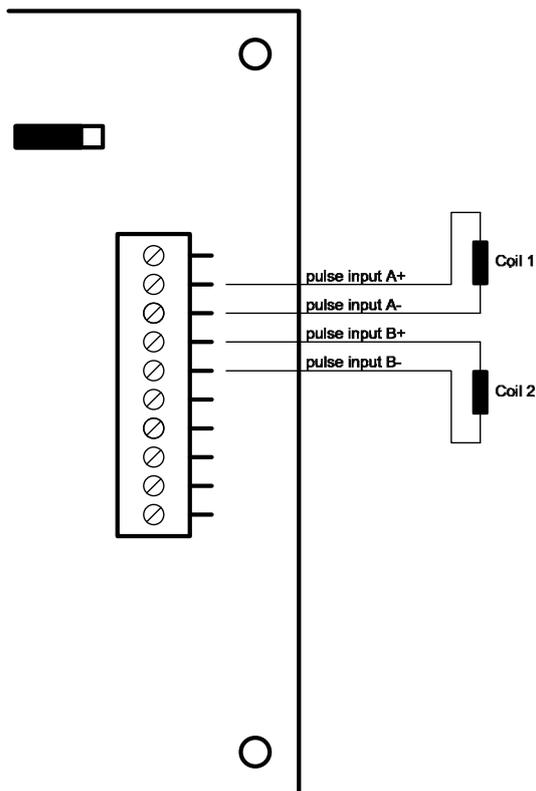
Power supply: External DC-supply and battery operation
(Battery operation reduces battery life)

Signal input setting: „Inductor“

Wiring for ZOK-Z with Supply option 3 and 6:



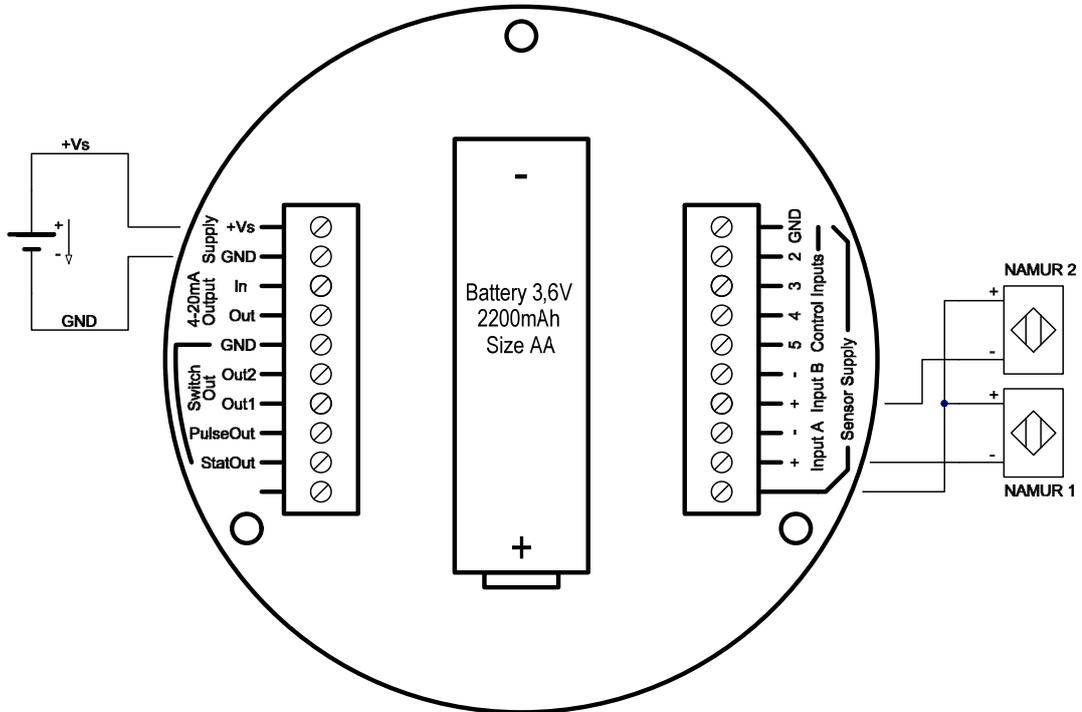
Wiring for ZOK-Z with Supply option 0 and 6:



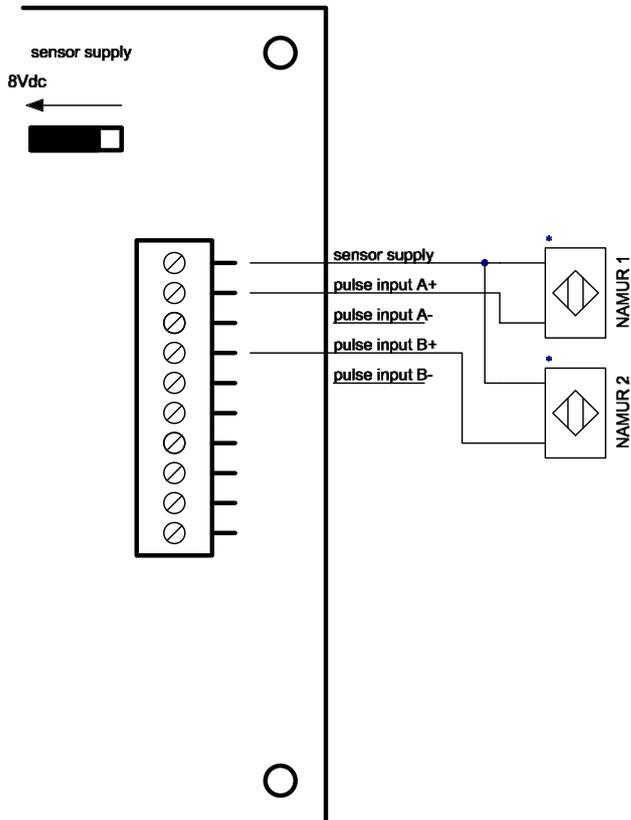
7.5.5 Namur-Sensor

Power supply: only external DC-supply
 Signal input setting: „NAMUR“

Wiring for ZOK-Z with Supply option 3 and 6:



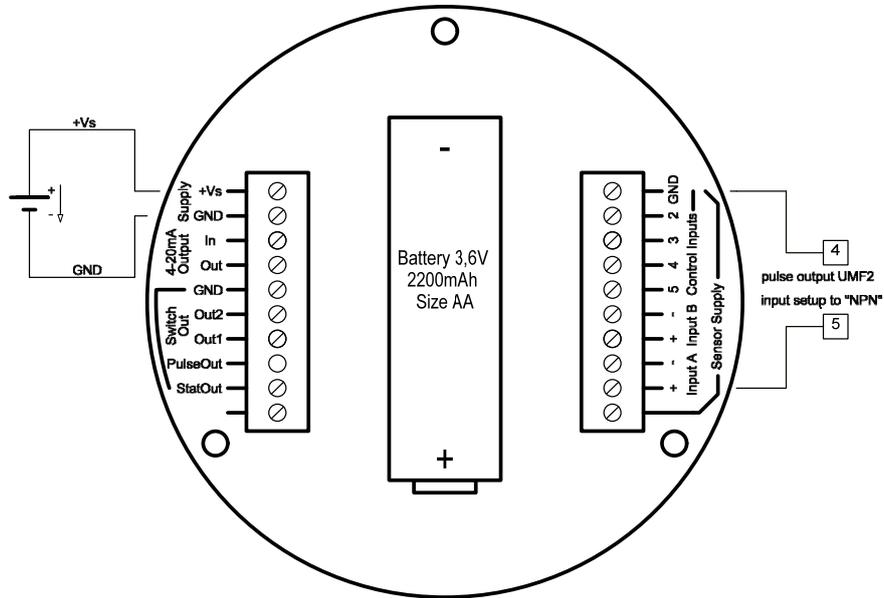
Wiring for ZOK-Z with Supply option 0 and 6:



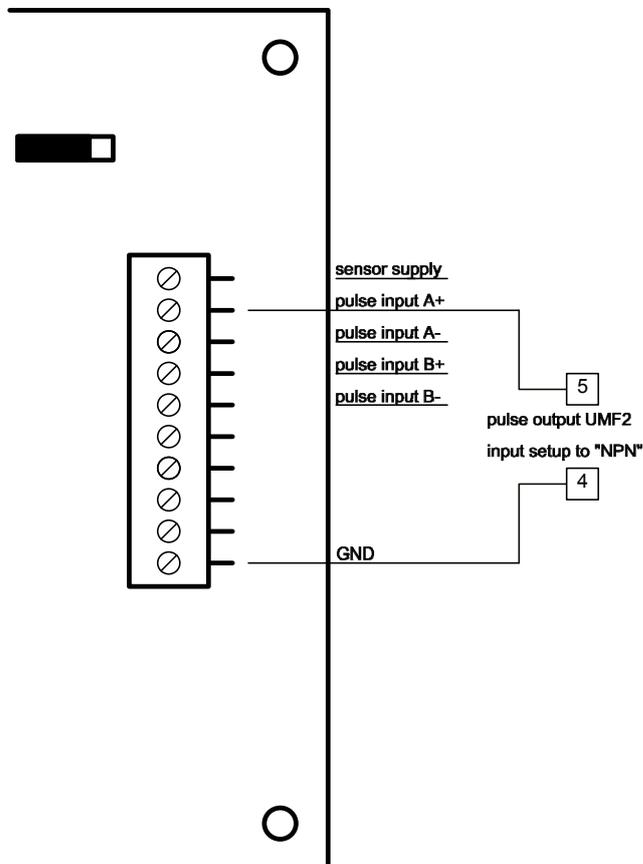
7.5.6 Transducer model UMF2

Power supply: only external DC-supply
 Signal input setting: „NPN“

Wiring for ZOK-Zx with Supply option 3 and 6:



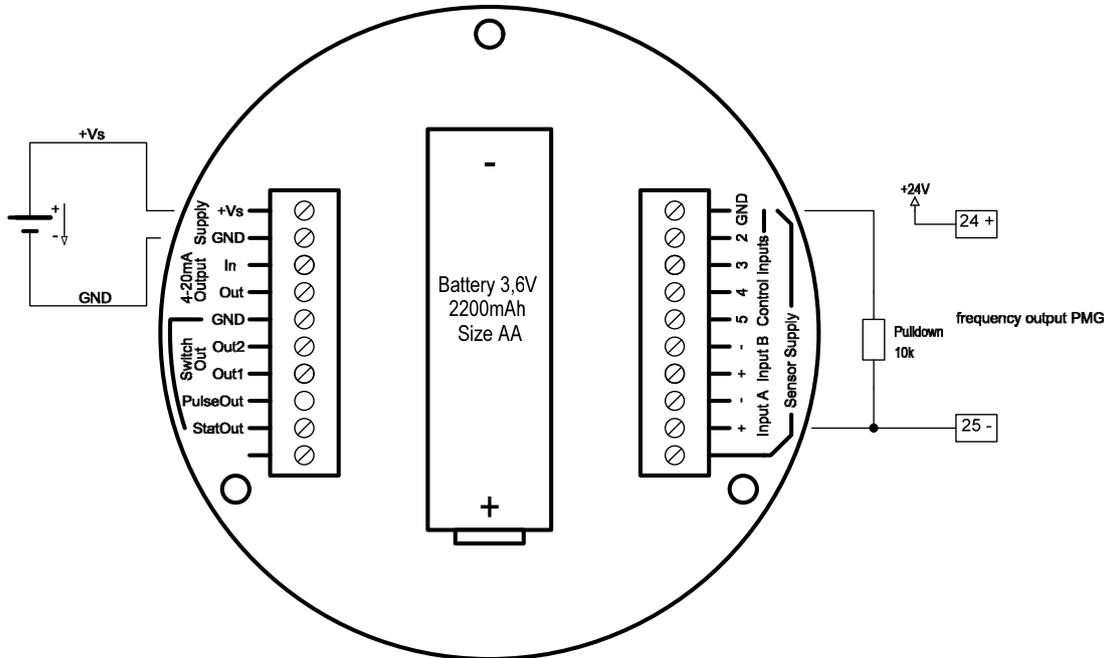
Wiring for ZOK-Zx with Supply option 0 and 6:



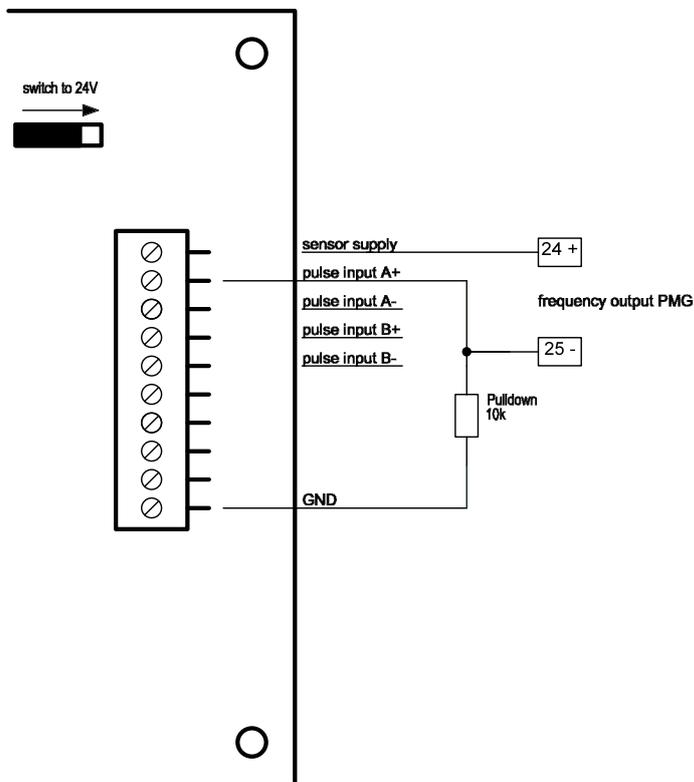
7.5.7 PMG (magnetic inductive with frequency output)

Supply Voltage: only external DC power supply
 Signal input setting: PNP

Wiring for ZOK-Zx with Supply option 3 and 6:

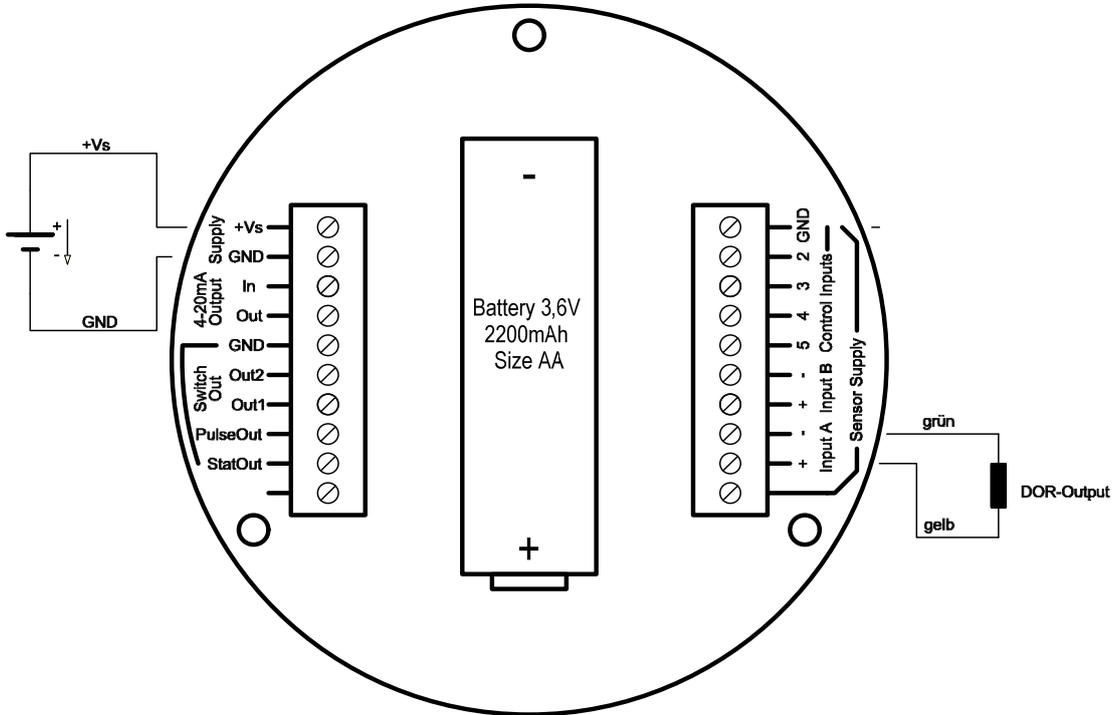


Wiring for ZOK-Zx with Supply option 0 and 6:

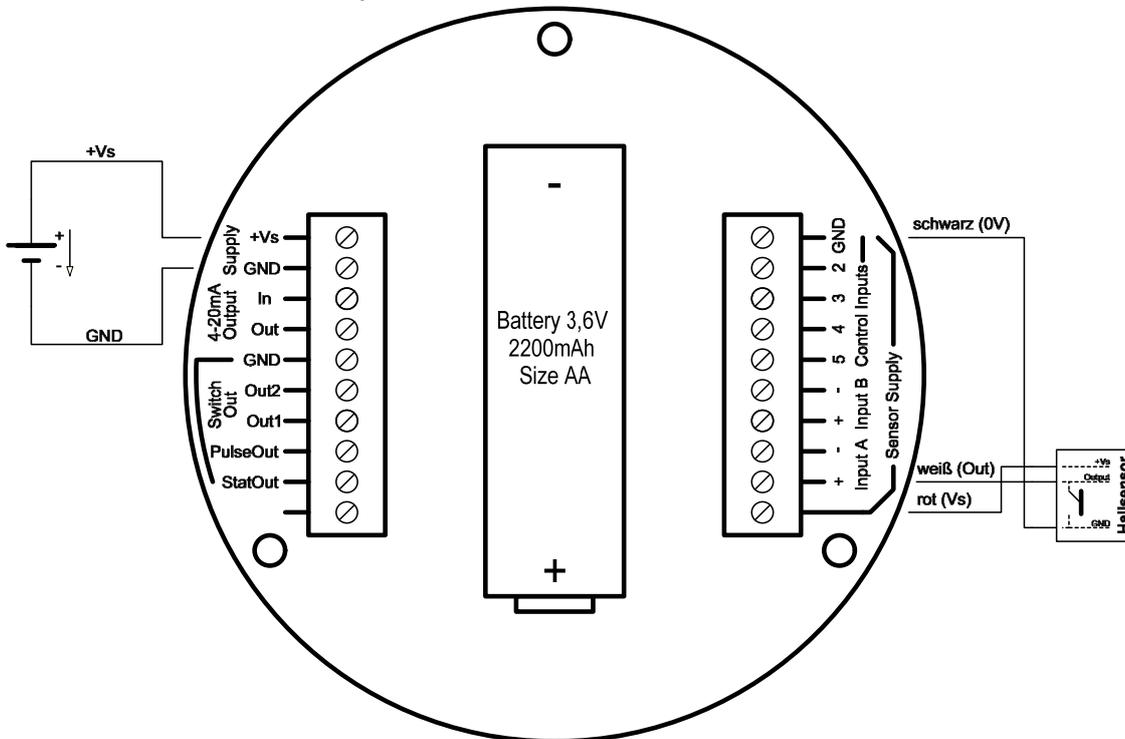


7.5.8 DOR

with voltage pulse output



DOR-with Hall sensor output



7.6 Control Inputs

There are 3 control inputs for external controlling of instrument functions. The activation of each function can be done through:

- a.) an active control input or
- b.) Carried out by a passive N/O contact.

In both cases, the function will be activated on switching from HIGH to LOW level (falling edge).

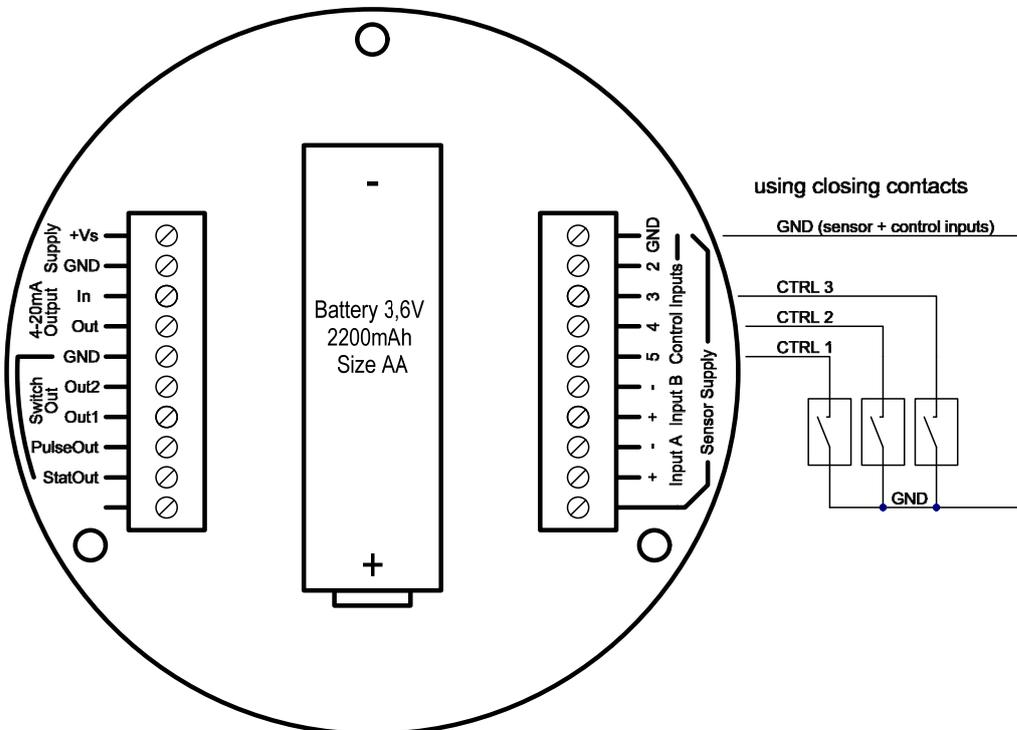
When using an active control signal, the signal amplitude of the HIGH level must be from 5 to 24Vdc. When using simple normally open contact, the input potential is internally pulled of HIGH, if the contact is open. If the contact is closed, the input potential is pulled to GND and the control function is activated.

CTRL4 control input is not used.

Function of control inputs:

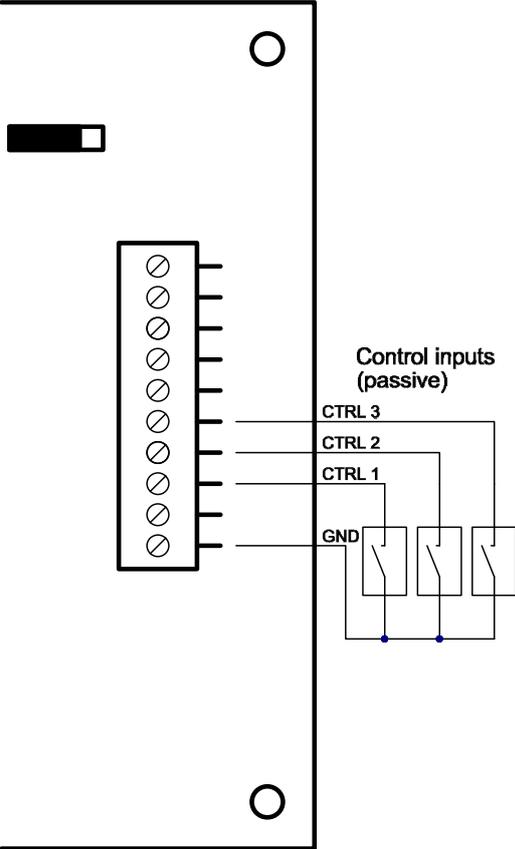
Control input	ZOK-E1/-Z1 ZOK-E3/-Z3	ZOK-Z2
CTRL1	Reset MIN / MAX memory	Dosing Start / Stop
CTRL2	Reset partial input A	Dosing value reset
CTRL3	Reset partial input B	-
CTRL4	-	-

Wiring for ZOK-Z with Supply option 3 and 6:



ZOK-E/-Z

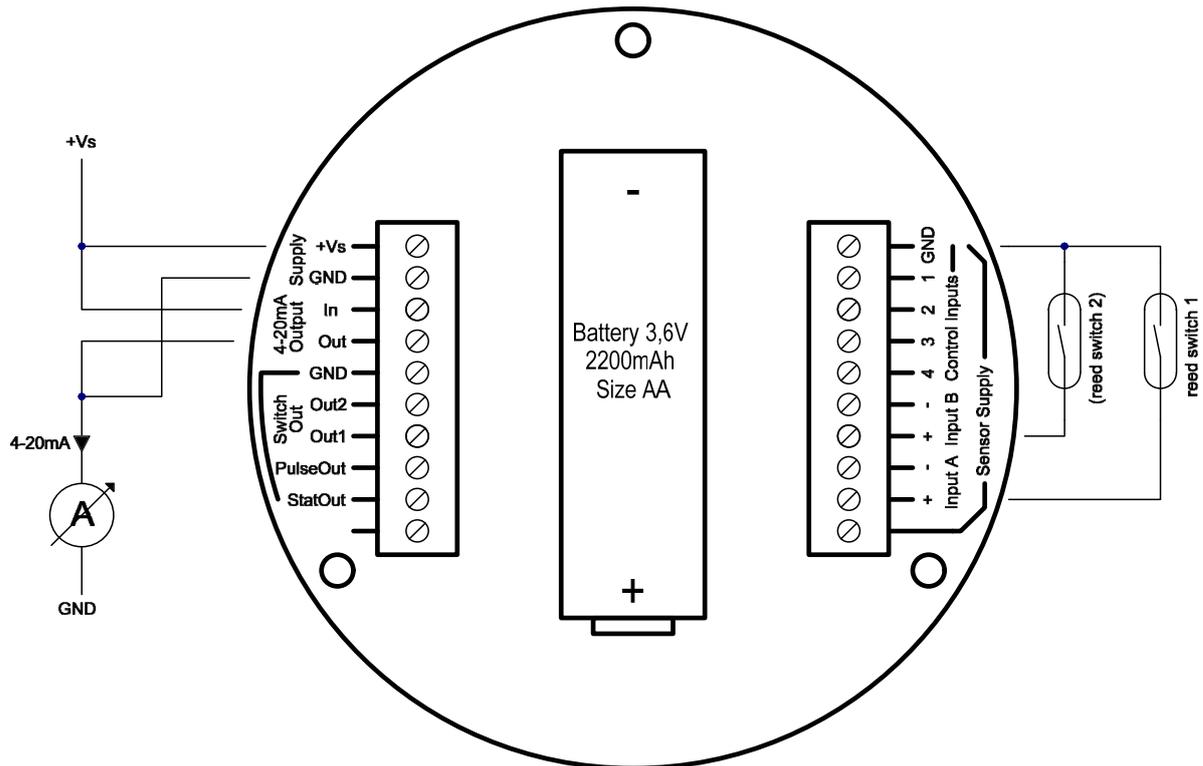
Wiring for ZOK-Z with Supply option 0 and 6:



7.7 Analogue Output (only ZOK-Z3 with Supply option '3/6/0')

7.7.1 2-Wire Configuration 4-20 mA

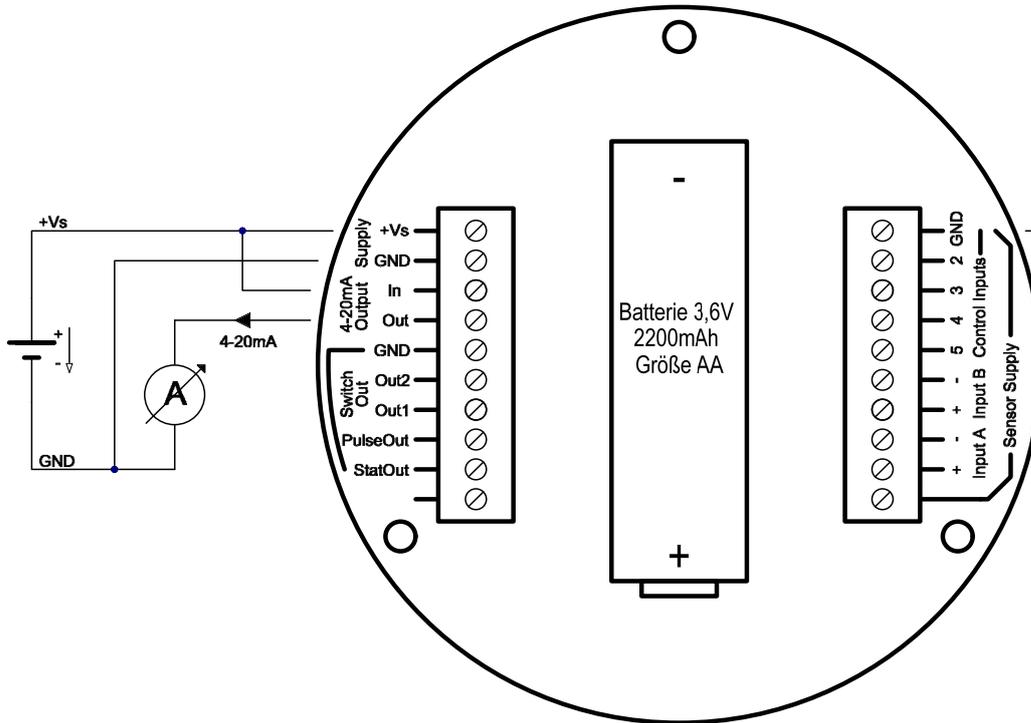
The options ZOK-Z3/-E3 can be operated as a source in a 2-wire 4-20 mA current loop. However, only passive Reed switch (option -R0) should be used as a sensor. In 2-wire loop operation, no other active outputs are available. If the electronics is connected in 2-wire configuration, the display will show „LOOP“ at the top. The wiring type must be set to "2-WIRE" in the Analogue Output menu.



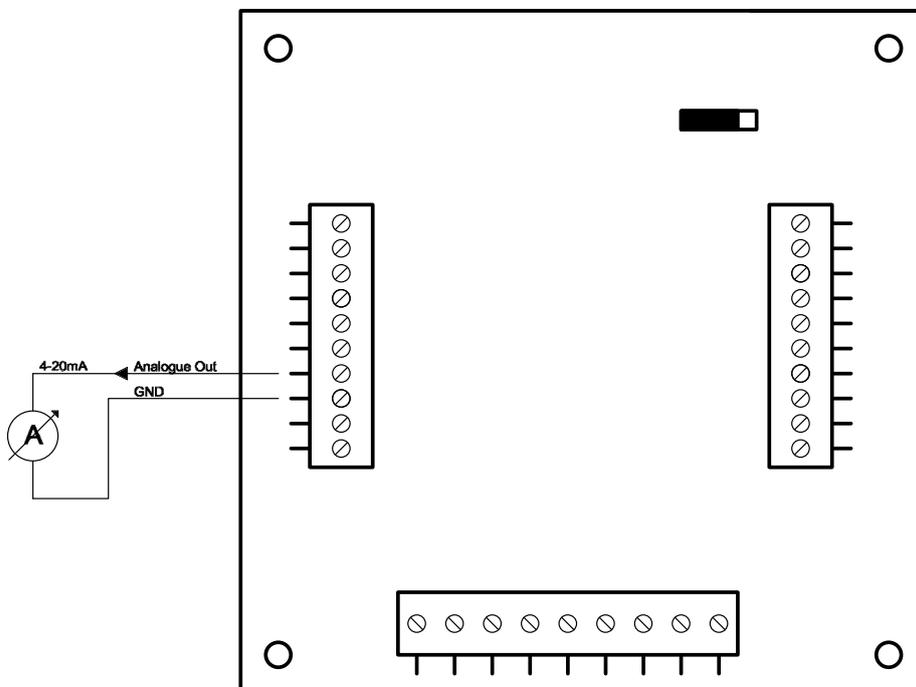
7.7.2 3-Wire Configuration as active output, current source

In the 3-Wire Configuration, the load is connected between current output (-) and GND and all types of sensors can be connected and all other outputs can be used. If the electronics is connected in 3-wires, the display will show „EXT“ at top left (external power supply). The wiring type must be set to "3-WIRE" in the Analogue Output menu. All sensor types can be connected at the signal input.

Wiring for ZOK-Z3 with Supply option ,3/6':

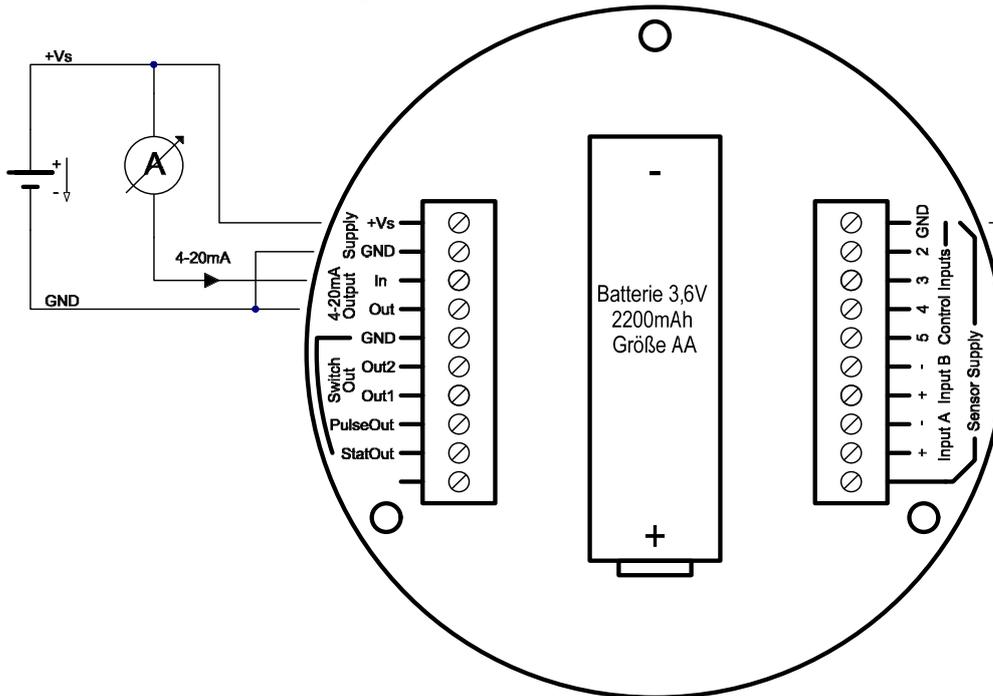


Wiring for ZOK-Z3 with Supply option '0/6':



7.7.3 3-Wire Configuration as passive output, current sink (only ZOK-Z3 with Supply option '3/6')

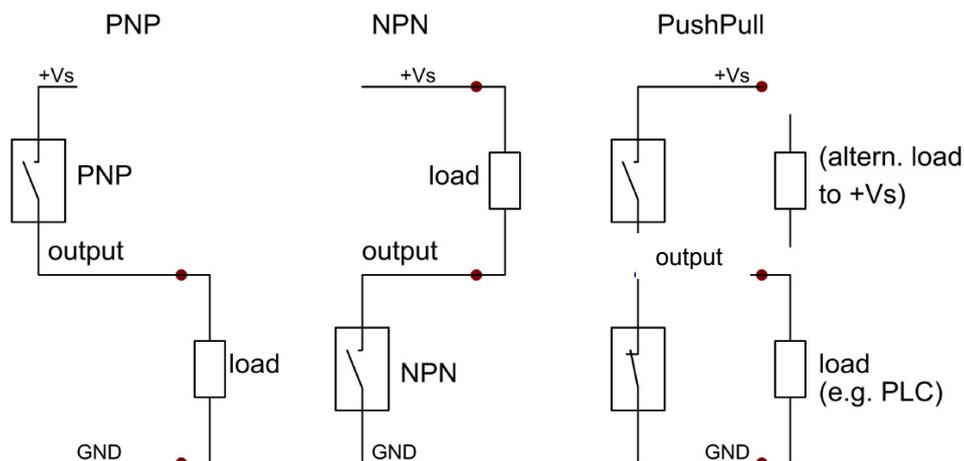
In the wiring 3-wire passive current sink, the load (load) is connected between current output (+) and voltage source (+Vs). In the 3-conductor wiring, all types of sensors can be connected and all other outputs can be used. If the electronic is connected in 3-conductor wiring, the display will show „EXT“ at top left (external power supply). The wiring type must be set to "3-WIRE" in the Analogue Output menu. All sensor types can be connected at the signal input.



7.8 Switching output (only ZOK-Z2/-Z3)

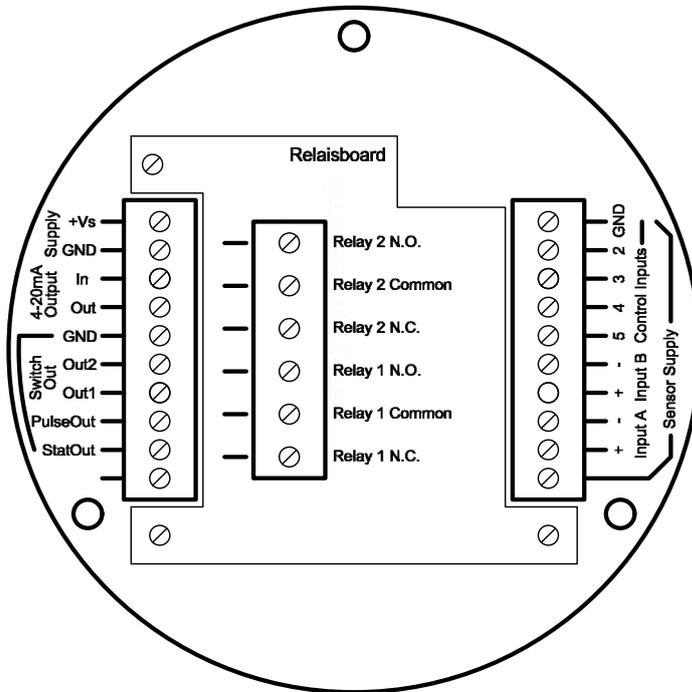
7.8.1 Transistor Output

The transistor outputs can be configured by software as PNP, NPN or push-pull output. In case of push-pull configuration, output will be switched between active-HIGH or LOW potential. The load can either be connected to GND or + Vs. In push-pull mode, no additional pull-up or pull-down resistor is required.



7.8.2 Relay outputs (for ZOK-Z2/-Z3)

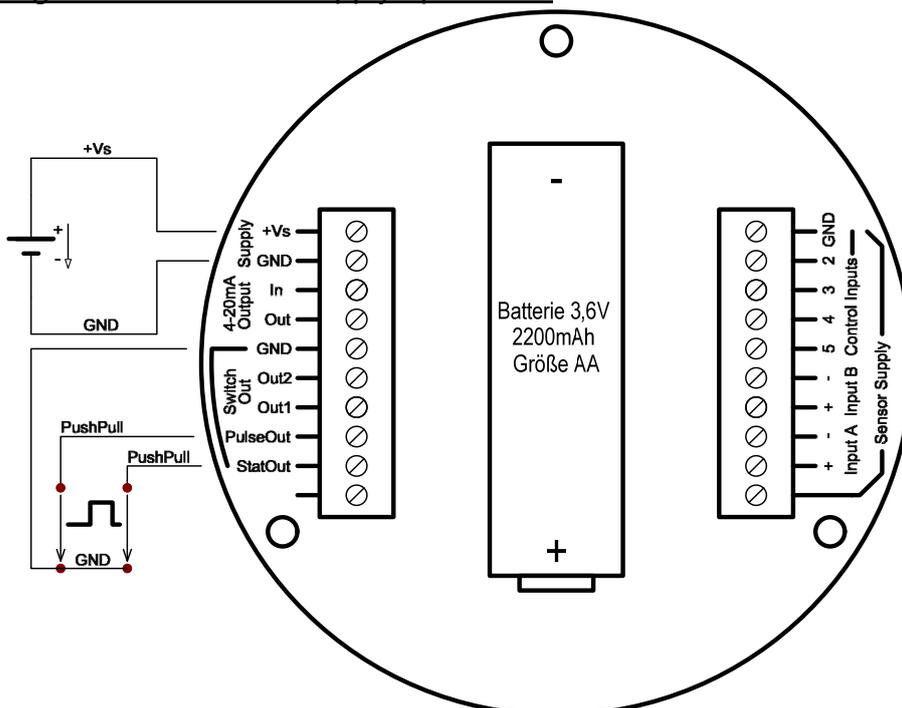
The electronics options ZOK-Z2/-Z3 devices are equipped with potential-free relay outputs as standard. Electronic option ZOK-Z2 is equipped with an additional relay board. These relay outputs can be simultaneously used in parallel with the existing transistor outputs. The outputs of the relay 1 are controlled by the switching output SW1 and of relay 2 by SW2.



7.9 Pulse Output and Status Output

Pulse and status outputs are set to push-pull output type and provide an active digital signal with HIGH amplitude of about + Vs.

Wiring for ZOK-Z3 with Supply option 3/6:



8. Operating and Menu Structure

8.1 Overall

8.1.1 Functions of operating buttons

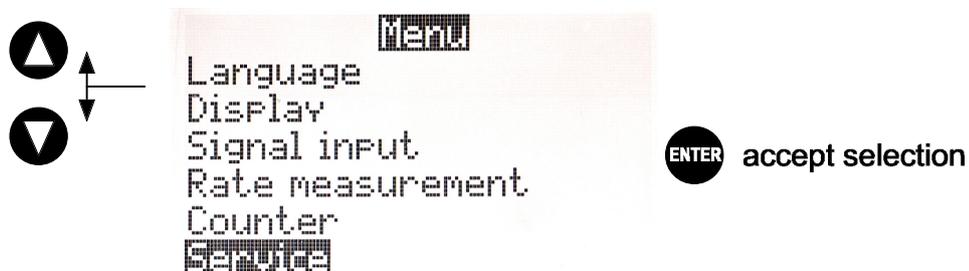
Button	Symbol	Function	
		Measuring mode	Menu mode
	Menu / Return	Enter Menu mode  To be pressed for 3-5 sec	During the parameter setting, back to main menu / return to the measurement mode/jump to the previous decimal position while setting numerical values
	Down	Call MIN-Function	Menu item selection / incrementing and decrementing digits while setting numerical values on the display
	Top	Call MAX-Function	
	Enter	Resets the Partial counters A and B when pressed for 3-5 sec.	Numerical input: Jump to the next decimal position General: Saves the parameter value and returns to the parent menu

8.1.2 Parameter setting

8.1.2.1 Selection list

Parameter with predefined selection values are defined by list selection. The currently selected menu item will be highlighted with dark background.   -buttons are used to move the selection cursor and with  -button, the selection can be confirmed.

menu item selection



8.1.2.2 Numerical value input

While setting parameters with numerical value, the assigned unit is always displayed above the input field in square brackets. The maximum size and the number of decimal places are fixed and cannot be changed. While setting the numerical value of a parameter, the left outer position is highlighted first. These positions can be assigned

with numbers from 0 to 9 with the help of   buttons. By pressing  button, the input cursor moves to right and the next digit can be changed. In case of a false

entry at the previous position, the cursor can be moved again to left by pressing  key and the correction can be made. If the cursor is on the far right, the set value is

saved by pressing the  button and the display changes to the parent menu.

8.2 Measuring Mode

After applying the supply voltage, the electronics starts in measurement mode. In this mode, the input signals are recorded continuously; current instantaneous flow and volume counter readings are periodically calculated and displayed. With options ZOK-Z2, a dosing function is available.

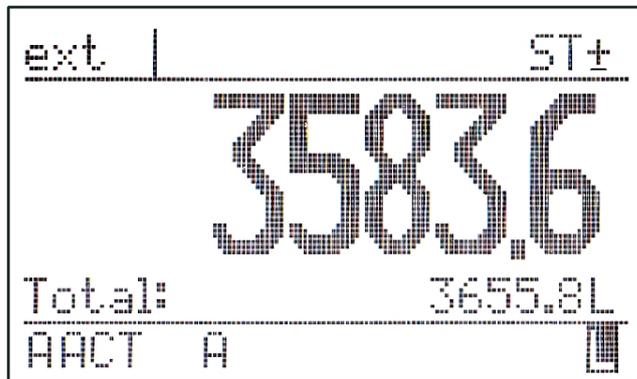
On LCD, in addition to main display, the status and configuration of the pulse inputs, as well as the status of the pulse output, the switching outputs and supply voltage are also displayed.

If a symbol is shown inverted (with dark background), it means that the associated hardware is active and its signal is connected to the electronics.

8.2.1 Display range of the Volume Counter

The number of digits that appear on the display for volume counter (partial and total volume counter) is at limited to maximum 8 digits (without decimal point) and 7digits (with decimal point). If the 7- or 8-digit display range is exceeded, the display will signal/represent it by displaying 8 hash signs (#####). In this case, the counter cannot be read. The user has then the possibility of changing the Unit of the volume counter or of changing the number of decimal points in the Volume Menu so that the counter values can be brought back again within the display range.

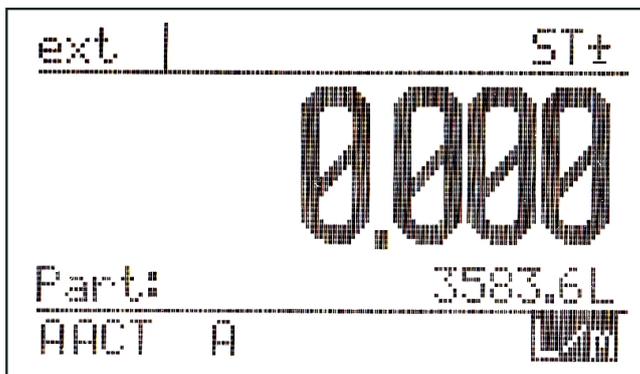
8.2.2 Display layout in measuring mode single channel (ZOK-Z1/E1/Z3/E3)



part- or total volume display input A

part- or total volume display input A

Unit associated to main display

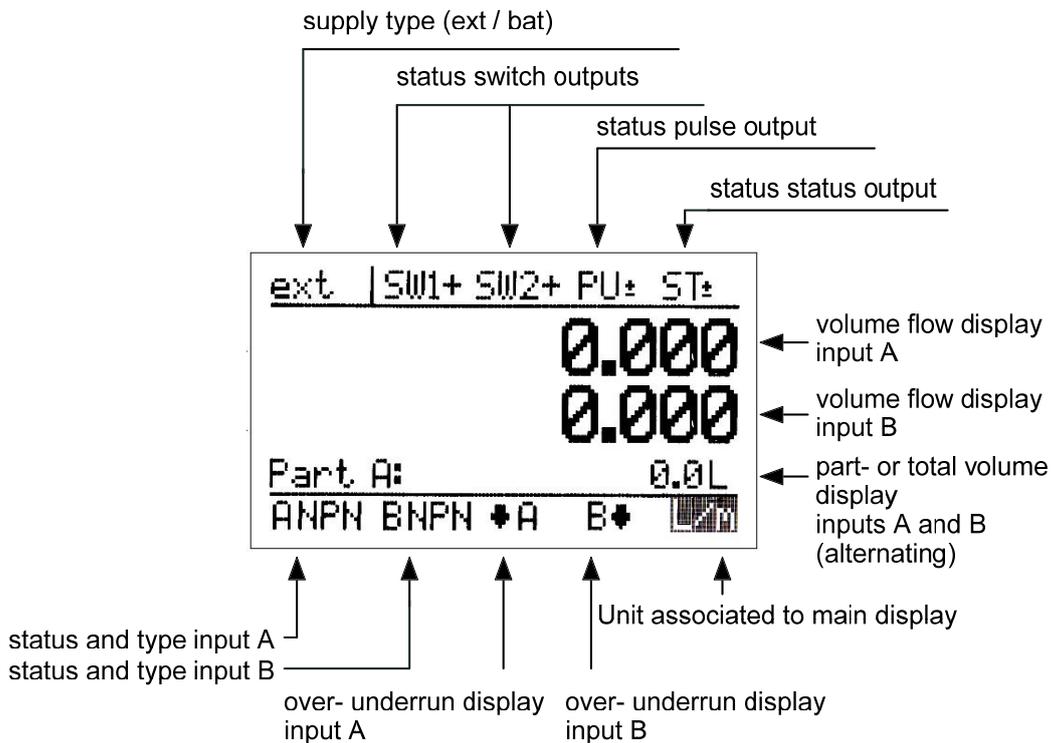
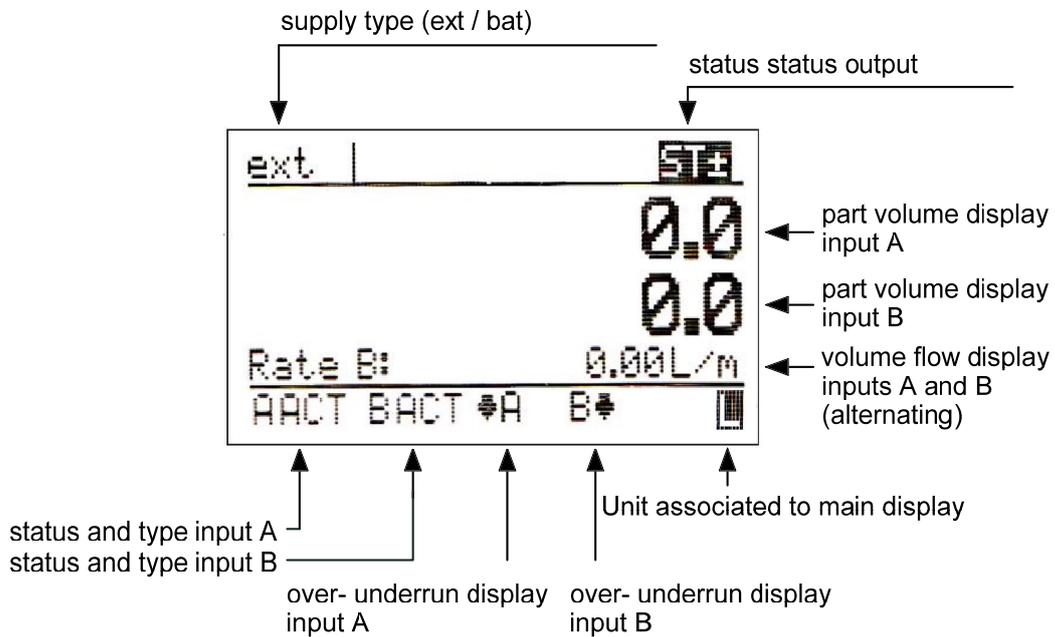


volume flow display input A

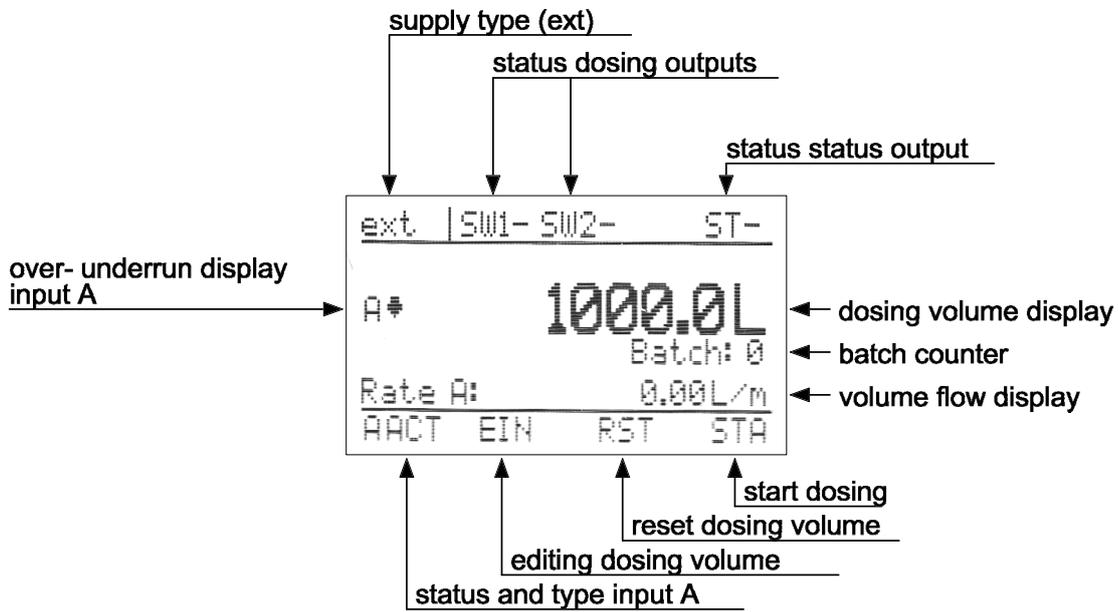
part- or total volume display input A

Unit associated to main display

8.2.3 Display layout in measuring mode for dual channel (ZOK-Z1/E1/Z3/E3)



8.2.4 Display layout in measuring mode for dossier ZOK-Z2



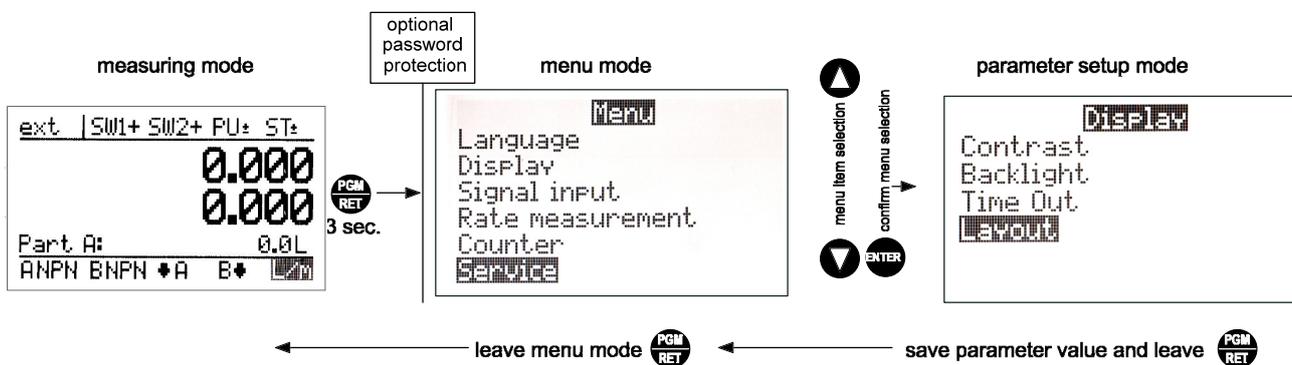
8.3 Menu Mode

In the menu, all device parameters can be set. The individual parameters are organized into groups according to their function. While the menu mode is turned on, the input signal detection and pulse output (option -Z3) are still active in the background. After leaving the menu mode, all display parameters are then updated again in measurement mode.

Note: The menu mode is not exited automatically even after a certain time without key operation. The menu mode remains active (in battery mode) until the user has once

pressed the  button.

In battery mode, a long stay in menu mode shortens battery life.



To activate the Menu mode, the  button must be pressed for 3-5 sec. The parameters are divided into main groups and subgroups. Selected menu parameters

are highlighted with dark background. For selection of main groups,  and  buttons are used. In the main menu, all menu groups can not be displayed simultaneously on the screen so the list of menu items can then be scrolled up or

down. To choose the selected item,  button should be pressed and the device goes into relevant sub-menu i.e. into the parameter setting level. For selection of

predefined parameter values,   and  buttons are used. After changing

the value of the parameter,  button should be pressed to save it and to return to the previous menu level. The return to the main menu or exit to the menu mode takes

place by repeatedly pressing  .

9. General Functions

9.1 MIN- MAX. Memory (not for ZOK-Z2)

The MIN-MAX memory function stores the absolute maximum and minimum measured value of the flow rate since the last reset or since the last device start. The current

memory values can be displayed and if required reset by pressing  or  in measurement mode.

The reset function resets the memory values to the current reading.

Status output

The status output plays the role of an alarm output and is only activated in the following situations:

Electronic type	Function	Event
Dosing unit ZOK-Z2	During dosing	No input pulse during the time "Missing pulse timeout"
Controller ZOK-E3/-Z3	Mode "Dual Direction Detection"	Signal at one of the input i.e. A or B is not recognized or is not available
Controller ZOK-E3 / -Z3	Mode "dual independent" / "Channel A single"	Measuring range endpoint exceeded for input A or B and overflow occurred

In case of dosing, this output monitors the flow of the medium when for example a valve is opened at the start of the dosing and no medium flows or if the sensor has malfunctioned even if the flow is there, then this output will be activated giving indication of some abnormality.

In case of the detection of direction, this output indicates if both the sensors are giving their respective signals. If one of them stops working, this output will be activated.

10. Instrument Parameters

10.1 End of instrument parameterization

All ZOK-E/-Z electronics options are preconfigured at the factory when ordered with Oval Gear meter. A change in the parameters of the menu groups "Signal Input" and "Rate measurement" should not be made.

With subsequent changes of volume or flow rate units, dependent parameters will be converted and adapted accordingly. The threshold parameters of the switching outputs must be checked and adjusted by the user manually in case of change of volume or flow rate units - this will not be converted automatically.

In a basic scaling, all parameters of the menu groups "Input" and "Rate Measurement" must be edited successively.

An accidental change of configuration can be restored through "Factory defaults" function in Service → User Service → Factory defaults.

10.2 Overview of menu functions/ instrument parameters

Menu level	Sublevel	Parameter level	Description	Value range	Default value	available with Electronics type	available with voltage type	
Language				German English Spanish French	English	Z1,Z2,Z3	Battery, external	
Display	Contrast	Contrast	Display contrast	0 -50	45	Z1,Z2,Z3	Battery, external	
		Backlight	Display	0 - 100	100	Z1,Z2,Z3	external	
		Time out	Time out of backlight	OFF, 5s, 10s, 20s, 30s	OFF	Z1,Z2,Z3	external	
	Layout	6 Display layouts			Part/Total	[default]	Z1,Z3	Battery, external
					Total/Part			
					Rate/Part			
					Part/Rate			
					Rate/Total			
		Total/Rate						
Sleep Timeout	saves the battery life when not set to '0'	0-1800 sec	30 sec	Z1,Z3	Battery			
Sleep mode	4 sleep modes			Sleep mode 0	Sleep mode 0	Z1,Z3	Battery	
				Sleep mode 1				
				Sleep mode 2				
				Sleep mode 3				
Signal Input	Sensor type A	NPN	For NPN sensors	List selection	[default]	Z1,Z2,Z3	Battery, external	
		Spule	For induction coils			Z1,Z2,Z3	Battery, external	
		PNP	For PNP sensors			Z1,Z2,Z3	Battery, external	
		Active Signal	For active pulse signals			Z1,Z2,Z3	Battery, external	
		NAMUR	NAMUR Sensor			Z1,Z2,Z3	Battery, external	
		Reed	For Reed sensors			Z1,Z2,Z3	Battery, external	
		Hall	For Hall sensors			Z1,Z2,Z3	Battery, external	
	Sensor type B	NPN	For NPN sensors	List selection	[default]	Z1,Z3	Battery, external	
		Spule	For induction coils			Z1,Z3	Battery, external	
		PNP	For PNP sensors			Z1,Z3	Battery, external	
		Active Signal	For active pulse signals			Z1,Z3	Battery, external	
		NAMUR	NAMUR Sensor			Z1,Z3	Battery, external	
		Reed	For Reed sensors			Z1,Z3	Battery, external	
		Hall	For Hall sensors			Z1,Z3	Battery, external	
	Input type	Input A single	One channel service	List selection	[default]	Z1,Z2,Z3	Battery, external	
		Dual direction det..	Two-channel operation with direction recognition			Z1,Z3	Battery, external	
		Dual independent	Two-channel independent operation			Z1,Z3	Battery, external	
		A+B	Two-channel addition operation			Z1,Z3	Battery, external	

Menu level	Sublevel	Parameter level	Description	Value range	Default value	available with Electronics type	available with voltage type	
		A-B	Two-channel subtraction operation			Z1,Z3	Battery, external	
	Input Signal Timeout		Waiting time	1 – 20 s (Step size 0,5s)	[1 s]	Z1,Z2,Z3	Battery, external	
	Filter	Filter factor	Filter Size	1-50	1	Z1,Z2,Z3	Battery, external	
		Jump det. threshold	Jump threshold for jump-detector function	0,05 – 1,00	0,1 [xFS]	Z1,Z2,Z3	Battery, external	
		Jump det. factor	Factor for jump detector confirmation	1-25	1	Z1,Z2,Z3	Battery, external	
		Hardware filter		active / inactive		Z1,Z2,Z3	Battery, external	
	Scaling A	Linearization	Linearization activation	active / inactive	inactive	Z1,Z2,Z3	Battery, external	
		Linearization points	Number of linearization points	0 - 9	0	Z1,Z2,Z3	Battery, external	
		Menu item "linearization points" dependent on the activation of the linearization function						Battery, external
		Volume unit	Volume unit for scaling factor A	ml, L, m ³ , galUS, galUK, barrel, User	L	Z1,Z2,Z3	Battery, external	
		Scaling-factor A0 / Flowrate A0	Flow rate for scaling point A0	[LPM]	000010.00	Z1,Z2,Z3	Battery, external	
		Scaling-factor A0 / K-Factor K0	K-Factor for scaling point A0	[1 / Volume unit]	000100.00	Z1,Z2,Z3	Battery, external	
		Scaling-factor Ax / Flowrate Ax	Flow rate for scaling point Ax	[LPM]	000020.00	Z1,Z2,Z3	Battery, external	
		Scaling-factor Ax / K-factor Kx	K-factor for scaling point Ax	[1 / Volume unit]	000060.00	Z1,Z2,Z3	Battery, external	
	Parameter points Ax depend on the activation of the linearization function and the number of linearization points.						Battery, external	
	Scaling B	Volume unit	Volume unit for scaling factor B	ml, L, m ³ , galUS, galUK, barrel, User	L	Z1,Z3	Battery, external	
		Scaling-factor B0 / Flowrate B0	Flow rate for scaling point B0	[LPM]	000010.00	Z1,Z3	Battery, external	
Rate measurement	Refreshrate		Measurement repetition rate	0,5 – 10 [s]	0,5	Z1,Z2,Z3	Battery, external	
	Unit		Unit for flow rate measreument	ml/m, L/m, L/h, m ³ /h, galUS/m, galUS/h, galUK/m, galUK/h, User	L/m	Z1,Z2,Z3	Battery, external	
	Start point A		MA-value input A	[User]	00000.000	Z1,Z2,Z3	Battery, external	
	End point A		ME-value input A	[User]	00100.000	Z1,Z2,Z3	Battery, external	
	Start point B		MA-value input B	[User]	00000.000	Z1,Z3	Battery, external	
	End point B		ME-value input B	[User]	00100.000	Z1,Z3	Battery, external	
	Overflow value		Allowable range can exceed to overflow value	0 -100 [%FS]	10	Z1,Z2,Z3	Battery, external	
	Memory reset		Reset of MIN-MAX memory	Yes/ No	No	Z1,Z2,Z3	Battery, external	

Menu level	Sublevel	Parameter level	Description	Value range	Default value	available with Electronics type	available with voltage type
Counter	Volume unit		Overall volume units for counter	mL, L, m ³ , galUS, galUK, barrel, User	L	Z1,Z2,Z3	Battery, external
	Decimal count		sets the decimal points	0-4		Z1,Z3	Battery, external
	Partvolume A reset		Reset subset counter A	Button selection Yes / No	-	Z1,Z2,Z3	Battery, external
	Partvolume B reset		Reset subset counter B			Z1,Z3	Battery, external
Puls-output	Pulsoutput enable		-	Enabled/ disabled	disabled	Z3	external (3-wire)
	Source	List selection	Selection of the associated signal input	According to the ,Input type' in Menu ,Signal Input'	Input A	Z3	external (3-wire)
	Pulse volume		Input volume per output pulse in [L]	4.3 [Volume unit]	1.000	Z3	external (3-wire)
	Volume unit		Volume unit input for pulse output	mL, L, m ³ , galUS, galUK, barrel, User	L	Z3	external (3-wire)
	Pulse width		Sets the pulse width of pulses	1ms-20s	2ms	Z3	external (3-wire)
Switching outputs	Output 1	Function		Disabled / Limit function / Window function	Deaktiviert	Z3	external (3-wire)
		Source	Assigning switching output	According to the ,Input type' in Menu ,Signal Input'	Eingang A	Z3	external (3-wire)
		Output type	Assignment output stage type	NPN / PNP / PP	NPN	Z3	external (3-wire)
		Switching function	Acting direction switching function	Normally open / Normally closed	N.o.	Z3	external (3-wire)
		Switching threshold	Switching threshold	5.1 [Unit]	00035.0	Z3	external (3-wire)
		Lower threshold	Threshold point low	5.1 [Unit]	00010.0	Z3	external (3-wire)
		Hysteresis	Switching hysteresis	5.1 [Unit]	00001.0	Z3	external (3-wire)
		Suppression factor	Switching delay factor	0 – 60 [x Refresh]	0	Z3	external (3-wire)
	Output 2	Function		Disabled / Limit function / Window function	Deaktiviert	Z3	external (3-wire)
		Source	Assigning switching output	According to the ,Input type' in Menu ,Signal Input'	Eingang A	Z3	external (3-wire)
		Output type	Assignment output stage type	NPN / PNP / PP	NPN	Z3	external (3-wire)
		Switching function	Acting direction switching function	Normally open / Normally closed	N.o.	Z3	external (3-wire)
		Switching threshold	Switching threshold	[Unit]	00035.0	Z3	external (3-wire)
		Lower threshold	Threshold point low	[Unit]	00010.0	Z3	external (3-wire)
Hysteresis		Switching hysteresis	[Unit]	00001.0	Z3	external (3-wire)	
Suppression factor		Switching delay factor	0 – 60 [x Refresh]	0	Z3	external (3-wire)	

Menu level	Sublevel	Parameter level	Description	Value range	Default value	available with Electronics type	available with voltage type
Analogue output	Flowrate for 20 mA		-	[Unit]	00100.000	Z3	external
	Wiring type		Establishing external circuit type	2-wire / 3-wire	3-wire	Z3	external
	0' Offset		Setting '0' flow to a particular current	4-20 mA	4 mA	Z3	external
Service	User service	Change password	Changing user password	5-digit number (00000 => open access)	0	Z1,Z2,Z3	Battery, external
		Factory defaults	Reset the device to factory settings	No / Yes	No	Z1,Z2,Z3	Battery, external
		Menu item selection	Hiding function for menu items	All menu items from menu level selectable	No Menu item	Z1,Z2,Z3	Battery, external
	Factory service	Password protected - reserved for factory settings				Z1,Z2,Z3	Battery, external
Device status	Devicetype		Displays devicetype			Z1,Z2,Z3	Battery, external
	Counterstat		Displays counter reading			Z1,Z2,Z3	Battery, external
	Firmwareversion		Displays Firmwareversion			Z1,Z2,Z3	Battery, external
Switching outputs	Output 1	Function		Disabled /Dosing low flow	disabled	Z2	external
		Source	Assigning switching output	Input A	Input A	Z2	external
		Output type	Assignment output stage type	NPN / PNP / PP	NPN	Z2	external
		Switching function	Acting direction switching function	Normally open / Normally closed	N.o.	Z2	external
	Output 2	Function		Disabled /Dosing high flow	disabled	Z2	external
		Source	Assigning switching output	Input A	Input A	Z2	external
		Output type	Assignment output stage type	NPN / PNP / PP	NPN	Z2	external
		Switching function	Acting direction switching function	Normally open / Normally closed	N.o.	Z2	external
Dosing function	Function		Stage 1 / Stage 2	Stage 1 / Stage 2	Stage 1	Z2	external
	Dosing value		Defining dosage amount	[Dosing Unit]	01000.0	Z2	external
	Dosing unit		Unit volume for dosing value	mL, L, m ³ , galUS, galUK, barrel, User	L	Z2	external
	Count direction		Count direction of the dosing value during the dosing	increasing / decreasing	increasing	Z2	external
	Start delay high flow (only with function "stage 2")		Dosage amount up to turning on stage. 2	[Dosing Unit]	00010.0	Z2	external
	Stop delay high flow (only with function "stage 2")		Dosage amount up to turning off stage. 2	[Dosing Unit]	00010.0	Z2	external
	Dosing value max limit		Setting dosing limit	[Dosing Unit]	02000.0	Z2	external
	Dosing correction		Dosing correction value	± [Dosing Unit]	00000.0	Z2	external
	Missing PulseTimeout		Alarm timeout during dosing	[s]	2	Z2	external

10.3 Signal input

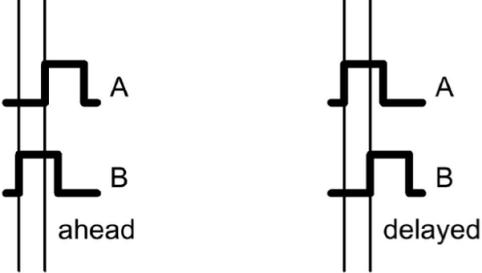
10.3.1 Signal input / Sensor type

Each of the two pulse inputs can be optimally customized to different sensor types in Menu, so that at the time of connection no further additional wiring is required for correct function.

Menu Parameter	Sensor type	Internal wiring
NPN	Hall sensor, Reed switch and all NPN sensors	Pull-Up resistor
Coil	For induction coil (Amplitude > 20 mVpp)	High impedance input
PNP	For all PNP-Sensors	Pull-Down resistor
Active signal	For all sensors with active output signal, e.g. (push-pull outputs)	
NAMUR	For sensors with 2-wire interface according to EN 60947-5-6 (NAMUR)	Pull-Down resistor 1kOhm
Reed	Reed switch	Pull-Up resistor
Hall	For Hall sensors	Pull-Up resistor

10.3.2 Signal input / Input type

The 2 pulse inputs can be configured in different modes together or independently. The following modes are available:

Parameter Menu	Description
Input A single	Single-channel mode, only input A is active. Signals at the input B are not evaluated.
Dual direction det.	Two-channel operation with flow direction detection. At Channel A and B, two signals are applied, both signals have equal frequency and differ only in the phase angle. The flow direction is indicated as positive when the signal at input B lags behind the signal at input B.  volume flow display "-" volume flow display "+"
Dual Independent	Both channels are evaluated, recorded and displayed independently.
A+B	Both channels are recorded independently. The evaluation of the flow indicator and the flow meter is done at any time as a sum of the two signals.
A-B	Both channels are recorded independently. The evaluation of the flow indicator and the flow meter is done at any time as a difference of the two signals..

10.3.3 Signal Input / Input Timeout

For the detection of input signals, the period duration of signal is determined within a measuring cycle i.e. Refresh time. However, if within the "refresh time" the input period is not complete i.e. if the input signal has a frequency lower than the frequency determined from the "Refresh time", then the flow indicator is set to "0". In the shortest "refresh time" of 0.5 seconds, only a minimum input frequency of $1/0.5 = 2$ Hz is recorded. In order to detect even lower frequencies, "Input Timeout" parameter can be configured up to 20 s. After the completion of „Refresh time“, the signal processing waits for the full input period until the additional waiting period is expired. It should be noted that by increasing the waiting time, the reaction time for the detection, for example, a flow failure is greatly increased. The "Input Timeout" should only be large enough so that the smallest frequency signal from the connected sensors can be detected.

10.3.4 Signal Input / Filter

In case of discontinuous input signals, the integrated filter function can filter the display of flow rates, the analogue output and the switching outputs (only options E3/Z3). Despite filtering effect, the reaction time to rapid changes in the flow rate can be kept low by appropriate choice of filter parameters.

The time base for the filtering function is the "Refresh time". The filter function operates on the principle of "moving average", where the parameter "filter factor" specifies the number of measuring values which are used to calculate the current flow value.

If "filter factor" is set to "1", the filter function is virtually eliminated.

For example : „Filterfactor“ = 3, „Refresh time“ = 1,0s

$$\text{Filtered measured value} = \frac{\text{Current measured value} + \text{Previous measured value} + \text{Last to the previous measured value}}{3}$$

The correct flow value is displayed after $3 \times 1 = 3$ s.

In addition, a jump detector is integrated in the filter function, which monitors whether the current measured value has greatly changed compared to the last filtered measured value. With the parameter "jump threshold", the level of threshold is defined. If this „jump threshold „ is exceeded, the filter function is bypassed depending on parameter „jump factor“, thus achieving a faster response time with respect to rapid changes in flow.

The triggering of jump detector due to fluctuations in measurement value can be prevented by setting the "jump factor" > 1.

In addition to the software filter, an analogue low-pass filter with menu 'Hardware filter' can be simultaneously connected at two output signals if required.

The connection is useful when the input signal is affected by higher frequency noise and this can lead to an unstable flow indication.

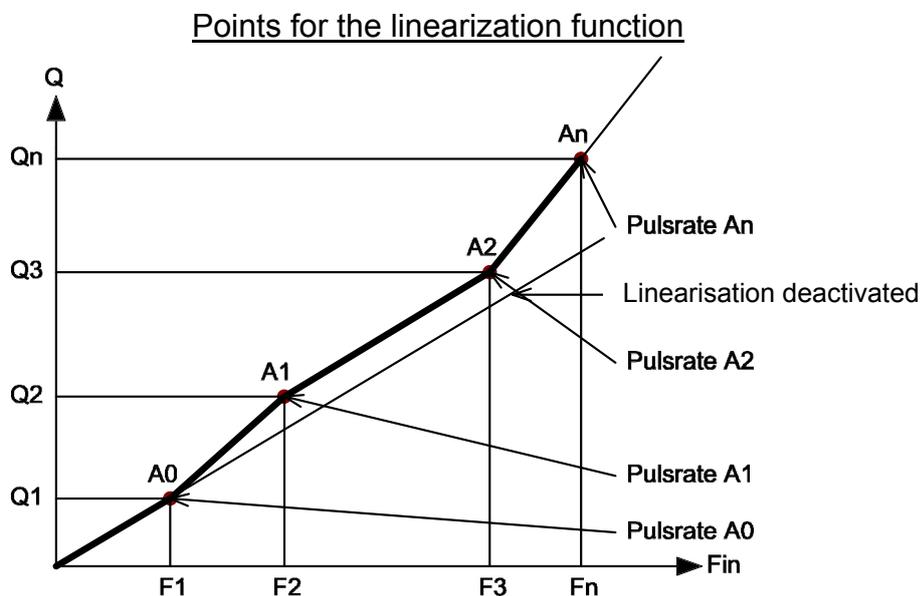
In case if 'Reed' is chosen as sensor under 'Sensor type' Menu, then the hardware filter will be automatically activated. In case of other sensors, it is by default inactive and can be activated by the user anytime using Menu.

10.3.5 Signal Input / Scaling A

The correct scaling of the signal inputs is necessary for exact indication on the display. For this purpose, entering the pulse rate of the connected sensors is necessary. For option ZOK-Z3/-E3 in single-channel mode for input A linearization function with up to 10 points is available. The linearization function is not available in dual channel mode! The linearization function linearizes the flow indicator, volume counters and thereon dependent outputs (analogue output and switching outputs).

The pulse output in principle cannot be linearized and will always be calculated with the pulse rate of scaling point A0. If the linearization function is disabled and only scaling point A0 is active, the curve is linear and goes through "0" and point A0 (see graph).

For a linear function, it is not necessary to enter input parameter "flow rate A0". The "flow rate Ax" parameter is only required for the determination of the reference points when using the linearization function.



With active linearization function, the number of linearization points for parameter „linearization points“ (in addition to point A0) is set fixed. Depending on the setting of this parameter, the other input parameters are shown in the menu. Input signals above the last point linearization are processed with the pulse rate of the last point.

Conditions for the base sequence:

The sensor curve must be monotonically increasing, since the frequency values increase continuously with increasing flow.

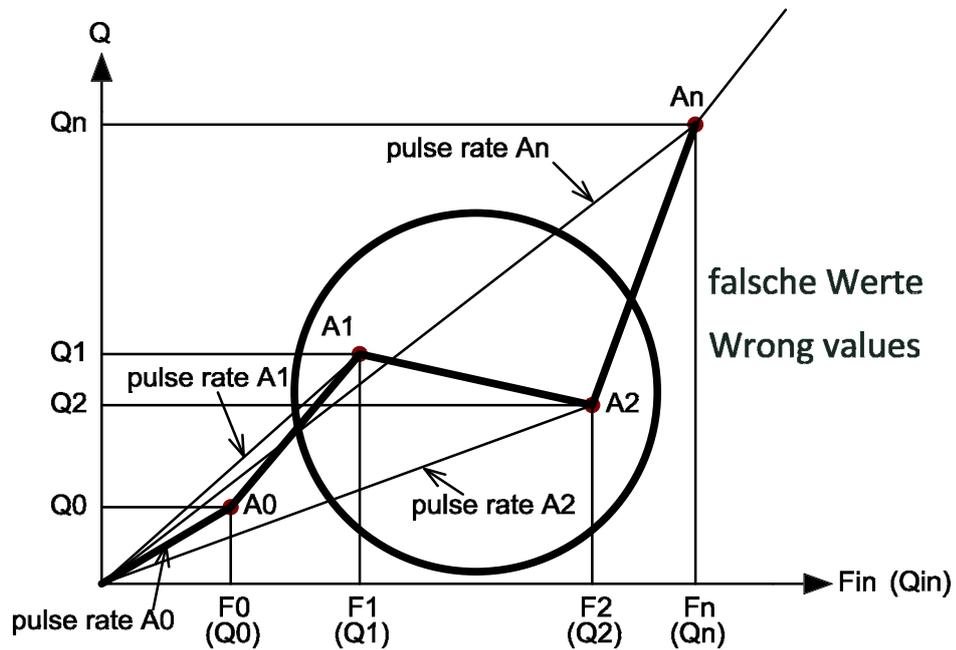
Inconsistent base sequence

After entering the linearization points, a check is carried out for consistency when the user exits the menu item "Signal Input".

Should one or more bases not comply with the Terms Security for the base sequence, the below message box appears:

Linearization Incorrect!
Flowrate Ax
negative slope!

Such a case is illustrated in the graph below, in which $Q_2 < Q_1$, thus having a negative slope between A_2 and A_1 .



To correct this error, the bases must be checked and corrected if necessary. This must always apply:

$$\frac{Q(n+1) - Q_n}{[K(n+1) \cdot Q(n+1) - K_n \cdot Q_n] / 60} > 0$$

10.3.6 Signal Input / Scaling B

The scaling of input B is the same as input A.

The scaling of input B is only required for input type "Dual independent", "A+B" and "A-B". For all other input types, only the scaling of input A is used.

10.4 Rate Measurement

10.4.1 Rate Measurement / Refresh rate

Parameter "Sampling rate" specifies the time interval within which the input signal is recorded, the flow rate is calculated and brought to display. The condition of all other outputs which depends on the flow rate (analogue output, switching outputs and status output) will be recalculated after the measurement time.

The "sampling rate" can be increased in steps of 0.5 sec. up to 10 sec. An increase in the sampling rate time on one hand causes increase in the filtering time of the input signals, but also an increased reaction time in the detection of changes in the flow values.

10.4.2 Rate Measurement / Unit

The unit displayed for the flow rate measurement can be selected from various predefined standard units. The definition of a user-defined unit ("User") is possible, here the „User Unit“ must be programmed in Liter/min.

e.g.:

unit: user = 100 LPM, if flow = 500 LPM then the flowrate shown on display will be 5 user.

10.4.3 Rate measurement / Start point A/B

The parameter "start point" defines the lower flow rate limit for display and further evaluation. If the measured flow rate lies below the measuring range value, the flow rate is set to "0", therefore "hidden". At the same time the "underflow" icon will appear in the display.

If the value of the parameter is set to "0", this feature is effectively disabled.

10.4.4 Rate measurement / End point A/B

With parameter "End point", the upper measurement limit of the connected sensors / transducers and the display format for the flow indicator is set simultaneously.

Depending on the full scale value, the display range varies from 1-5 decimal points.

Measuring range End point	Decimal points on the Display
0.1 to 9.999	5
10 to 99.999	4
100 to 999.999	3
1000 to 9999.999	2
10000 to 99999.999	1

10.4.5 Rate Measurement / Over flow value

The parameter "overflow value" is set in "% of full scale", when the display shows "OVER FLOW" and the status output is active.

Example: "end point" = 100 [L / m], "overflow value" = 10 [%]

⇒ „OVERFLOW“ display and Status output will be active above 110 l/m.

10.4.6 Rate measurement / Memory Reset

The "memory reset" function sets the MIN and MAX memory flow rate values to the current reading.

10.5 Counter

All electronics have options of a (non-resettable) total counter and a (resettable) subset counter for each input channel. For devices with dosing function, only a total count is present, the subset counter acts as a dosing counter. The count of all active counters can be displayed in the "Device Status" menu.

10.5.1 Counter / Volume Unit

Parameter "volume unit" defines the unit volume of all volumetric counters. There are listed volume units to choose from. When changing the unit of volume, the actual meter readings are converted into the new unit volume.

10.5.2 Counter / Part Volume Reset A/B

In this menu you can reset the batch totalizer for ZOK-Z2 and Part Volume Counter for ZOK-Z1/E1/Z3/E3.

10.5.3 Decimal count

The menu item, 'decimal count' adjust the number of decimal points for volume counter. The range of this parameter is from 0 to 4. If this menu item is set to '0', no decimal point is displayed on the display and the number of digits displayed is 8. If the value is between 1 and 4, total number of 7 digits and 1 decimal point will be displayed.

Decimal count	Digits on the Display
0	00000000 (8 digits without decimal point)
1	000000.0 (7 digits with 1 decimal point)
2	00000.00 (7 digits with 2 decimal points)
3	0000.000 (7 digits with 3 decimal points)
4	000.0000 (7 digits with 4 decimal points)

10.6 Pulse output (only Option ZOK-E3/-Z3)

A scalable pulse output is available for the options ZOK-E3/-Z3. When the pulse output is enabled, a scaled pulse output train is given at the output to the input pulses. The pulse width of the pulses is adjustable between the span of 1 ms to 20 sec.

When pulse output is activated, the symbol "PU±" for pulse output is highlighted on the LCD display. The electrical output of the pulse output is push-pull type, so HIGH and LOW is actively switched through to the output.

To generate the output pulses, the input pulse train is directly processed in connection with the scaling factor "A0" or "B0", the output pulses are therefore not derived from the calculated volume flow. The pulse output is based on a linear path of the input signal. Sensors are used with nonlinear characteristic, with the usage of linearization function only the updated volume flow can be linearized, pulse output and volume counter cannot be linearized.

Behaviour at OVERFLOW:

If the measured volumetric flow lies in the OVERFLOW range, the pulse output is switched off and a constant HIGH level is switched at the output.

Generation of the output pulse train:

The maximum adjustable pulse rate for the pulse output is 1000 pulses per liter. This means that the minimum pulse volume that can be represented by the pulse output is 0.001 Liter per pulse. Furthermore, the set pulse volume must meet following condition:

$$\frac{\text{Measuring range end point} * (1 + \frac{\text{Overflow value}}{100})}{60 * \text{Pulse volume}} \leq \frac{0.5}{\text{Pulse width (ms)}}$$

In case if the above mentioned condition is not complied with, it may lead to a long lagged pulse train at pulse output even when the input frequency signal has been interrupted and removed. While configuring the pulse output, if the above condition is violated, the user will be informed via notification on the display with "Lagged pulse train possible. Please check the settings." In case if the measuring range endpoint is changed during the operation of pulse output, the user needs to check the pulse output settings once again.

The pulse output works only in the measurement mode i.e. in the menu mode, no pulses will be generated at the output. The pulses acquired in the menu mode will be given out once the normal measuring mode is activated again, leading to no loss but a delayed pulse train at the output depending on how long the menu mode remains active.

10.6.1 Pulse output / Source

If the "Input type" in menu "Signal Input" is set to Input A or direction detection, the pulse output can be assigned only to the input A. The "Input type" setting to "dual independent" provides both inputs A and B as the source and the selection "A + B" or "A-B" allows the assignment of pulse output both to the partial volume counters A and B as well as the sum or subtraction.

If the "Input type" in "Signal Input" menu is changed during operation, the pulse output is automatically assigned to channel A. It is therefore recommended to check and adjust the source of pulse output in menu manually after the "Input type" is changed.

10.6.2 Pulse output / Pulse volume

The "pulse volume" parameter is defined as the volumetric amount for the output of a pulse at the output; the unit is in accordance with [amount of volume / pulse]. The familiar Pulse rate [pulses / unit volume] corresponds to the reciprocal of the pulse volume.

Example: Required pulse rate at output 10 Pulse/Liter => Pulse Volume = 1/Pulse rate = 1/10 L = 0.1 L

10.6.3 Pulse output / Volume Unit

The volume set unit is the input unit for the parameter "Pulse volume". User can also set a user defined unit which will be given in "Liter". e.g.:

unit: user = 10 [Liter], pulse volume = 2 [user]

In this case the pulse will be generated after 2*10 = 20 Liters

10.6.4 Pulse output with 'A-B' and 'Direction detection function'

With „A-B“ function, it is possible that the flow rate goes into negative and the counter values start decreasing. In this case, any one of the two available switching outputs can be used to indicate the change of sign of flow rate. For this purpose, the switching threshold and the hysteresis of the switching output should be set to '0'. This setting gives the user the possibility of subtracting the volume, after the change of sign, from the volume before the change in order to get the net volume.

Example:

Setting

Input type = A-B

Pulse volume = 1 Liter per Pulse

Source for Pulse- and Switching output = A-B

Cycle 1:

A = 50 LPM

B = 0 LPM

“A-B”_(flow) = 50 LPM

Switching output = not active

After one minute, „A-B“_(Counter) will show 50 Liter and the electronics has given 50 pulses.

Cycle 2:

A = 50 LPM

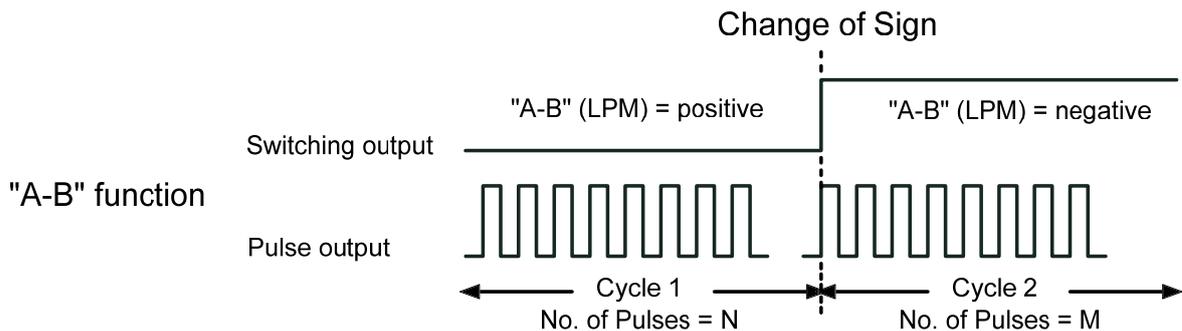
B = 100 LPM

“A-B”_(flow) = -50 LPM

Switching output = active

After two minutes, „A-B“_(Counter) will show 0 Liter and the electronics has given further 50 pulses.

As soon as the flow display changes from „+“ to „-“, the change of sign will be signaled through the switching output and gives the user the possibility at that point to subtract the incoming pulses during cycle 2 from the pulses from cycle 1.



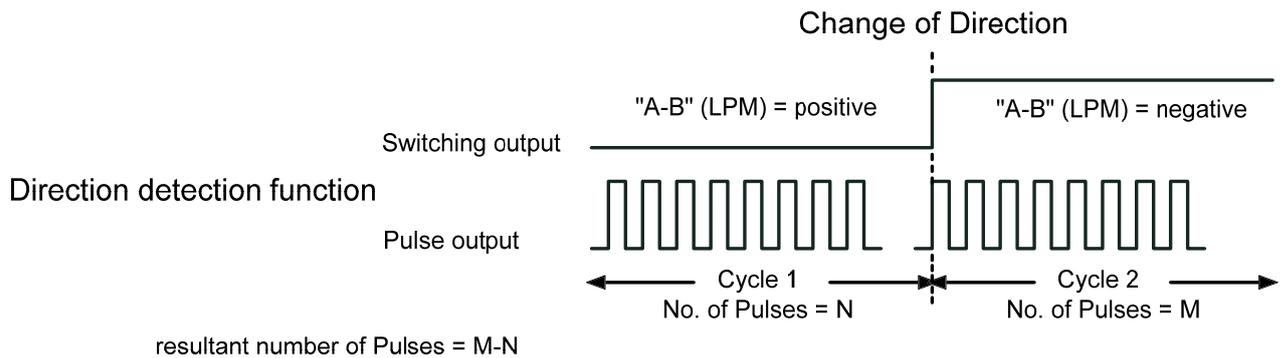
resultant number of Pulses = M-N

With direction detection function, the pulse and the switching outputs together give the user the possibility of determining the net volume after the change of direction.

Setting

Input type = single A

Source for pulse- und switching output = A



The number of pulses before and after the change of direction can be processed via external control system in order to determine the net volume.

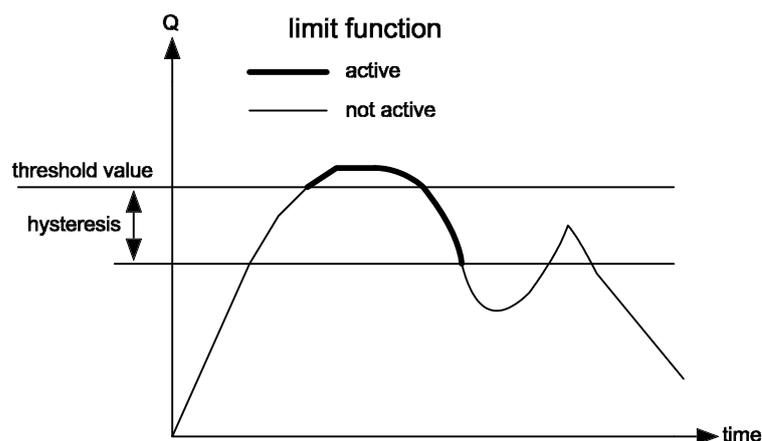
10.7 Switching outputs (only for options ZOK-Z2/-Z3)

There are two independently configurable limit switch outputs. With options ZOK-Z3, these can be parameterized with a limit function or window function. For options ZOK-Z2, these outputs are permanently linked to the dosing.

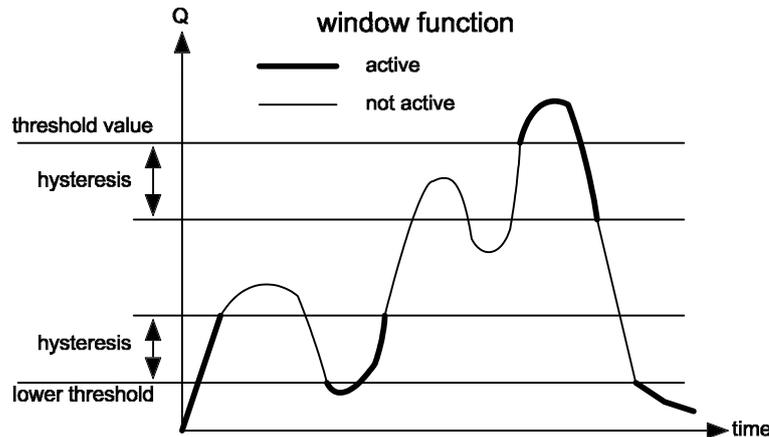
10.7.1 Switching Output / Output 1+2 / Function

"Function" parameter defines the basic function. There are limit function and window function available.

Limit function: The output will be active when the current measured flow value is above the threshold. It remains active until the measured value has fallen below the threshold and the hysteresis.



Window function: The output will be **active** when the actual flow measurement is outside of a window defined by the "Threshold" and "low threshold". The monitored window decreases respectively by the amount of "hysteresis". If the switch output within the window is required to be **active**, change the "Function" parameter from N/O to N/C.



10.7.2 Switching Output/ Output 1+2 / Source

With "Source" parameter, the source of the switching output can be assigned to the "Input type" set in "Signal input" menu.

If the "Input type" in menu "Signal Input" is set to Input A or direction detection, the switching output can be assigned only to the input A. The "Input type" setting to "dual independent" provides both inputs A and B as the source and the selection "A + B" or "A-B" allows the assignment of switching output both to the partial volume counters A and B as well as the sum or subtraction.

If the "Input type" in "Signal Input" menu is changed during operation, the switching output is automatically assigned to channel A. It is therefore recommended to check and adjust the source of switching output in menu manually after the "Input type" is changed.

10.7.3 Switching Output / Output 1+2 / Output type

Parameter "Output" 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 wiring. All outputs are equipped with short circuit and overload protection.

10.7.4 Switching Output / Output 1+2 / Switching function

The "Function" specifies the mode of action of the outputs. In the default setting "normally open", the output is active (connected) if the measured value exceeds the threshold. This feature is also known as "open function", "circuit principle" or "N/O" (normally open).

When setted to "normal closed", the output below the switching threshold is already active and is deactivated when the measured value exceeds the threshold. This feature is also known as "normally closed", closed-circuit principle "or" N/C "(normally close).

10.7.5 Switching output / Output 1+2 / Switching threshold

Switching threshold is a limit value function and a upper window point for window function.

10.7.6 Switching output / Output 1+2 / Lower threshold

The "lower threshold" defines the lower limit value when using the window function. This parameter is invalid when the limit function is used.

The switching thresholds can be either set positive or negative. The setting of the negative switching thresholds finds its use in "A-B" function, wherein the flow rate may be negative. While changing the "input type" in menu "Signal input", the switching thresholds should be checked again and corrected manually.

10.7.7 Switching output / Output 1+2 / Hysteresis

The appropriate setting of the "hysteresis" ensures that the switch outputs do not constantly turn on and off even when the measured value for the switching threshold fluctuates around. The hysteresis value should always be chosen greater than the real measured value fluctuations. In this way, a targeted suppression can be achieved.

10.7.8 Switching output / Output 1+2 / Suppression factor

A further suppression of switching outputs of fluctuating measured signals can be achieved by setting the parameter "suppression factor". If this parameter is chosen to be greater than one, then the switching threshold with the frequency of the set value must be exceeded, before the corresponding switching output is activated. With this function, sporadic exceeding can be safely suppressed. Depending on the height of „suppression factor“, the reactions time increases itself.

10.8 Dosing function (only ZOK-Z2)

The dosing function is exclusively available for the options ZOK-Z2K / -Z2P. To build a dosing system, a flow sensor can be connected to input A and up to 2 switch actuators (valves) can be connected to the switching outputs (relay outputs). The use of the second input signal B is not possible. There is a 1-step and 2-step mode available. In 1-stage mode, output SW1 is active at the start of dosing and inactive at the end of the dosing. In 2-stage mode, output SW2 is active on the dosage of the volume "Start Delay" and is deactivated again on the dosage of the volume ["dosing value" - "Stop Delay"]. The menu items, Start Delay and Stop delay define the ON and OFF points for switching output 2 in the 2-step dosing. Stage 2 is used by a slower metered addition to achieve a higher Dosing value especially. The start, stop and reset can be operated in parallel via the control inputs or the control buttons. After the start of dosing, if no input signal is detected over the period of time defined by menu item "Missing pulse timeout", the status output is activated.

Example for the switching output 2 with 2-stage dosing:

Dosing value = 50 L

Start delay = 10 L

Stop delay = 10 L

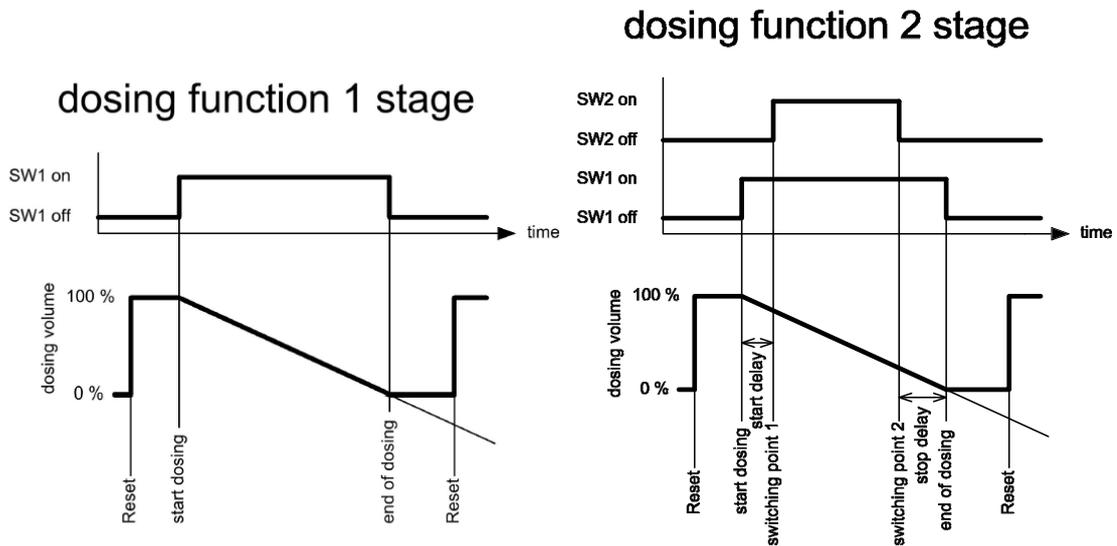
switches on after 'Start delay' volume: 10 L

switches off after volume [dosing value - Stop Delay] = 50 - 10 = 40 L

Switching output 2 is between 10 L and 40 L dosage active.

Note: The sum of the volume defined by, Start delay 'and' Stop delay' must always be smaller than the actual 'Dosing value'. But if the sum is greater than or equal to 'dosing value', switching output 2 will never be activated.

Delayed Start + Stop delay < Dosing value



10.8.1 Dosing function / Function

"Function" parameter specifies the operating mode. (1-stage or 2-stage).

10.8.2 Dosing function / Dosing value

Parameter "dosing value" specifies the dosing volume. The setting for the dosing volume can also be accessed directly from the dosing function by pressing the control key  button (as long as the dosing is not started).

10.8.3 Dosing function / Dosing unit

Parameter "dosing" defines the dosing volume unit. The choices are: mL, L, m3, galUS, galUK, barrel, User

10.8.4 Dosing function / Count direction

Parameter "count direction" sets the display mode for the dosing volume during dosing. In the "descending" mode, the dosing volume is counted from the initial value to "0" and in the "ascending" mode, from "0" to the initial value.

10.8.5 Dosing function / Dosing amount maximum

Parameter "dosing amount maximum" specifies the maximum adjustable dosing quantity. This function can be used as an upper limit for the dosing volume, if, after fixing the value of User in menu "Service / user menu / menu selection", menu "dosing function" is completely hidden and the service is then protected with a password.

10.8.6 Dosing function / Correction value

With parameter „correction value“, a systemic, constant "wrong dosage" can be corrected without having to change the actual dosing value. The correction value can be either positive or negative. If the dosing system has a smaller volume than expected, then the correction value must be positive, and will be negative with a larger volume. e.g.:

Count direction = descending

Dosing value = 10 L

Correction value = -1 L

In this case, the dosing counter will count from 10 L towards '0', but it will stop at 1 L, because the dosing value based on the correction factor of -1 L is mathematically 9 L.

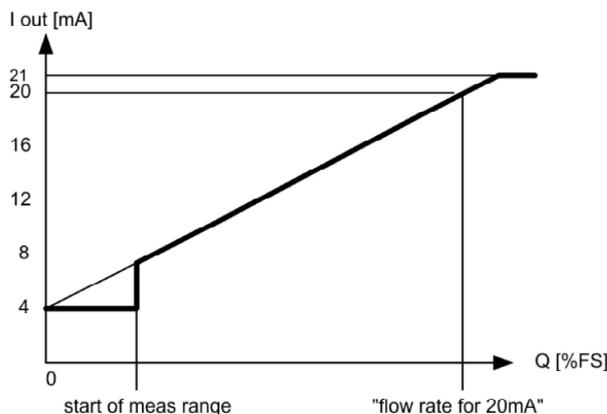
With correction value = +1 L, the dosing counter will stop at -1 L, because the dosing value is 11 L. $10 \text{ L} - (-1 \text{ L}) = 11 \text{ L}$

10.8.7 Dosing function / Missing Pulse Timeout

The activity of the connected flow sensor is continuously monitored during dosing. For this purpose, parameter „Missing Pulse Timeout“ specifies after what time an alarm is triggered at status output, in case there no more pulses from the sensor.

10.9 Analogue output (only option ZOK-E3/-Z3)

The analogue output gives the actual displayed flow rate in a scale form of 4-20 mA current output. The analogue output can only be operated in 2- or 3-wire configuration.



Analogue output / Flow rate for 20 mA

The scaling of the analogue output is done through parameter "flow rate for 20 mA". As a standard, this value is always set at the last value of measuring range. However, this can be defined at any point in the measuring range (however always greater than measuring range starting value).

Note 1: If this value is set smaller than standard measuring range, the resolution and accuracy of the output current value will be reduced.

Note 2: If the parameter "End point value" is changed in the menu "Rate measurement", the parameter for "flow rate for 20 mA" is automatically adjusted. The value for 'Flow rate for 20 mA' cannot be set greater than the set measuring range end point.

Start of measuring range < flow rate of 20 mA ≤ End of measuring range

The analog output is physically associated with input channel A. It cannot be redirected to work with Input B. Alternatively; there is the possibility to configure the analog output for arithmetic functions 'A+B' and 'A-B'.

The zero flow value for analogue output can be flexibly adjusted between the span of 4-20 mA using the menu item '0-Offset'.

This menu item works well for A-B function. The following table shows the function of '0-Offset' with the input types available in the electronics:

Scaling of Analog output with 0-Offset						
	Output current (mA)	Flow rate display (%FS)				
		0-Offset at 4 mA Default	0-Offset at 8 mA	0-Offset at 12 mA	0-Offset at 16 mA	0-Offset at 20 mA
For A-B function	4	0	-25	-50	-75	-100
	8	25	0	-25	-50	-75
	12	50	25	0	-25	-50
	16	75	50	25	0	-25
	20	100	75	50	25	0

	Output current (mA)	Flow rate display (%FS)				
		0-Offset at 4 mA Default	0-Offset at 8 mA	0-Offset at 12 mA	0-Offset at 16 mA	0-Offset at 20 mA
For all other input types	4	0	0	0	0	0
	8	25	0	0	0	0
	12	50	25	0	0	0
	16	75	50	25	0	0
	20	100	75	50	25	0

10.9.1 Analogue output / Wiring type

While using analogue output, correct electrical wiring type must **always** be selected. Otherwise the offset value of 4.0 mA will not be correct.

10.10 Service

10.10.1 Service / User service

A Reset function and Blanking function for selected menu parameters are available for user in Service menu. Together with the activation of a user password, certain device functions and parameters for the user can be locked by a master user.

10.10.2 Service / User service / Change password

The default administrator user password is set to "00000", the user functions are thus freely accessible. If the user's password has been changed from "00000", password request will be generated on next entry to User menu.

If the default password has been forgotten or misplaced, the master password can be requested from KOBOLD.

10.10.3 Service / User service / Factory defaults

By activating this function, the user can reset the device to factory settings. All user settings will be lost and the device is now reset to the factory settings.

10.10.4 Service / User service / Menu item selection

With this function, you can select all menu points from main menu, which are no longer displayed in menu mode and are adequately protected against parameter change. This function displays only the selected menu, the hidden parameters remain unchanged and active. The selection of the menu items are to be suppressed by

selection through   buttons and selector through the  button. The active

marker is indicated by a ">" before the menu item. By repeatedly pressing the  button, the label can be removed.

10.10.5 Service / Factory service

The factory service function is password protected and is not available for the user.

11. Technical Details

External power supply:	5...28 V _{DC} (without using the analogue output) 8...28 V _{DC} (with using the analogue output) 12...28 V _{DC} with relay output max. power consumption: with DC supply voltage approx. 70 mA (with full backlight, without outputs)
<i>See table on page 55 for details</i>	
Battery (battery for operation):	3.6 V/2200 mAh Lithium size AA
Battery life in battery mode:	dependant on the chosen sleep mode max. 17 months, min. 3 months
Display:	LCD, graphic 128x64, backlight adjustable (only with external supply)
Size of main display value:	12.5 mm
Display resolution of main display value:	5 digits, based on measuring range end value
Engineering units displayed:	litres, millilitres, gallons (US or UK), barrel, m ³ , user defined engineering units displayed
Input scaling range:	0.001...99,999.999 with three floating decimal points
Mounting:	meter mount, wall, surface, pipe or panel mount
Measuring inputs:	2 x pulse input type: NPN, PNP, NAMUR, Reed, Hall, active (configureable with software) Input frequency 0.1...1000 Hz, High-low-threshold 1 V _{DC} , max. input amplitude 30 V _{DC}
Basic accuracy of flow measurement:	< 0.1% of measuring value (the accuracy of the displayed value depends on the adjusted scale and display resolution)

Sensor supply: 8 V_{DC}, max. 30 mA (with external supply > 10 V_{DC})
Arithmetic functions: A+B, A-B with scaleable analog output

Outputs

Status output: transistor output, Push pull (PP), max. 300 mA, overload protection

Outputs ZOK-Z2

Relay outputs (only -Z2): potential-free changeover contacts, max. switching voltage 230 V_{AC/DC}, max. current load dependent (see diagram page 51)

Switching outputs (only -Z2/-Z3):

transistor output, PNP, NPN or push-pull (PP), with software configureable, max. output current: 300 mA (source/sink), overload protection

Outputs ZOK-x3*

Pulse output (only-x3): transistor output, Push pull (PP), max. 300 mA, overload protection

Analogue output (only -x3): 4-20 mA, 2-conductor loop operation or 3-wire operation (current source or sink) selectable by external wiring, free scaling, max. load: 750 Ω @ 24 V_{DC}, 250 Ω @ 14 V_{DC}, 150 Ω @ 12 V_{DC}, resolution: 16 bits

Operation:

4 buttons

Housing:

plastic, PA6, GF-enhanced

Protection:

IP 66/67m (not for panel mounting)

Cable entry:

3x M20x1.5 or ½" NPT (prepared, not for panel mounting)

Electrical connection:

plug-in terminals

ATEX Certification:

II 2G Ex ia IIB T4 Gb

Ambient temperature:

ZOK-Z: -20...+80 °C

ZOK-E: -20...+60 °C

Additional data for options ZOK-ZxP and ZOK-ZxF

Power supply: 12...28 V_{DC} option (option -6)
90...260 V_{AC} (option -0)
no battery operation

see table on page 55 for details

Sensor supply: 8 V with supply voltage ≥8.5 V_{DC}(option -3)
8 V or 24 V selectable (option -0)

Relay outputs: potential-free changeover contacts, max. switching voltage 230 V_{AC/DC}, max. current load dependent (see diagram)

Analogue output (at ZOK-Z3P):

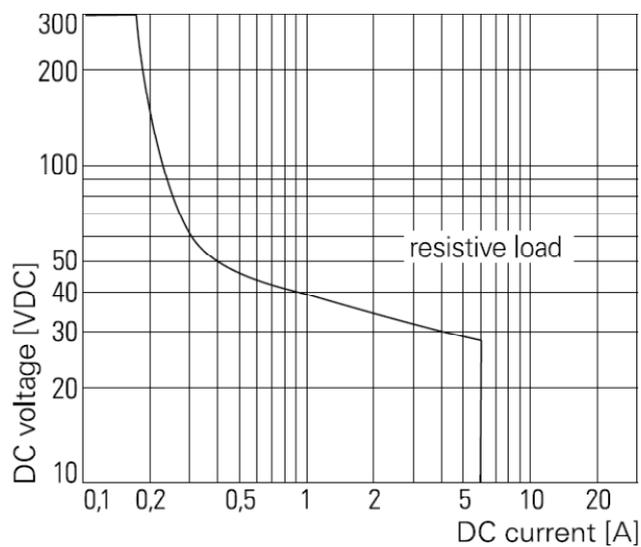
4-20 mA, 3-wire, current source

ZOK-E/-Z

Housing:	ZOK-ZxP panel mounted, 96x96 mm, depth 60 mm degree of protection front IP65, backside IP20 ZOK-ZxF aluminium housing with plastic lid PA6 117x117 mm, depth 127 mm
Protection:	IP 65
Cable entry:	3xM16x1,5/2xPG13.5 for ZOK-ZxF 3x screw terminals for ZOK-ZxP
Retention of meter readings in case of power failure:	in integrated, non-volatile memory
Electrical connection:	plug-in terminals
Ambient temperature:	-20...+80 °C

* x = 'Z' or 'E'

Max. DC load breaking capacity



12. Ordering Details

Example: ZOK-Z1 K M F 3 0 0)

Model	Electronics	Housing Type	Electrical connection/ Cable gland	Input	Power supply	Options	Special		
ZOK-	Z1 = dual totaliser LCD	K = universal mount (standard, round plastic with holder plates)	M ³⁾ = 3xM20x1.5 cable entry	F = Pulse/frequency input	3 ⁴⁾ = 5...28 V _{DC} Battery ⁴⁾ 0 ²⁾ = 85...240 V _{AC} 6 ⁴⁾ = 12...28 V _{DC}	0 = without R ⁶⁾ = 2 relays	0 = without Y = Special (please specify in clear text)		
	Z2 ⁴⁾ = dosing unit LCD								
	Z3 = rate totaliser LCD, 4-20 mA	M = universal mount (round plastic for retrofitting DON)	2 ³⁾ = 3x 1/2" NPT cable entry						
	E1 = as Z1 with ATEX approval (in preparation)							P ¹⁾ = panel mount 96x96	K ²⁾ = terminal on the back
	E3 = as Z3 with ATEX approval (in preparation)								
		F ¹⁾ = field housing	P ⁷⁾ = 2xPG13.5						

¹⁾ not for ZOK-E1 and E3

²⁾ see table

³⁾ only for housing ZOK-xxK, ZOK-xxM

⁴⁾ see table

⁶⁾ see table

⁷⁾ Only for ZOK-ZxF

⁸⁾ in preparation

Overview of electrical options and corresponding housings

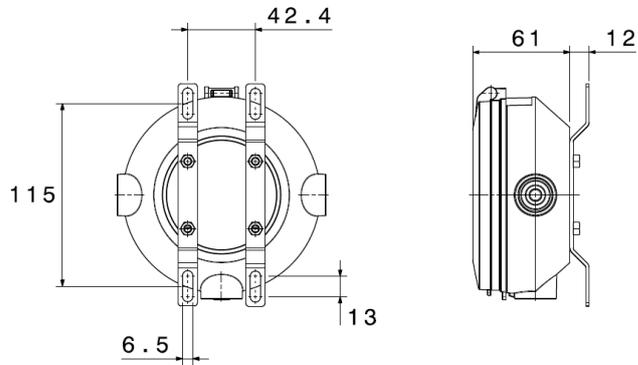
Model	Electronics	Housing	Supply Voltage		Relay option
			Option	Battery option	
ZOK	Z1	K	3	yes	no
		M			
		P			
		F			
	Z2	K	6	no	standard
		M			
		P			
		F			
	Z3	K	3/6	yes (with option3)	yes (with option 6)
		M			
		P			
		F			
E1/E3	K/M	3	3	yes	no
			6/0	no	standard

Accessories

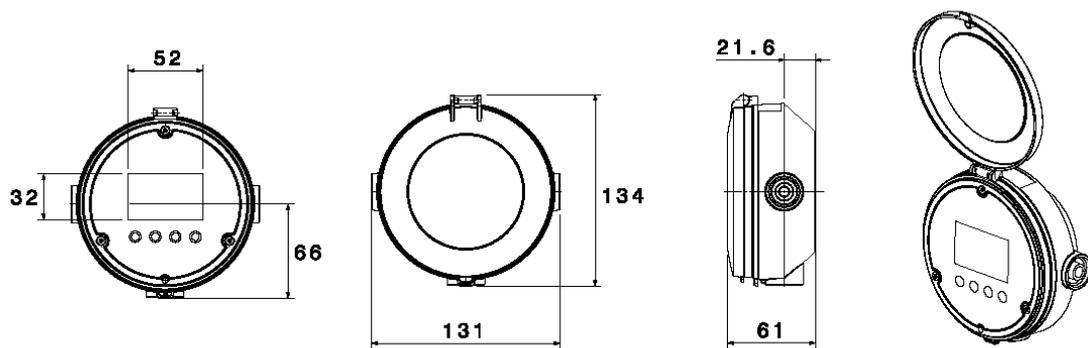
Description	Model
Stainless steel wall mounting kit	ERS-ZOK-023618
Stainless steel 2" pipe mounting kit	ERS-ZOK-003402
Cooling fin for high temperature flowmeter	ERS-ZOK-023619

13. Dimensions

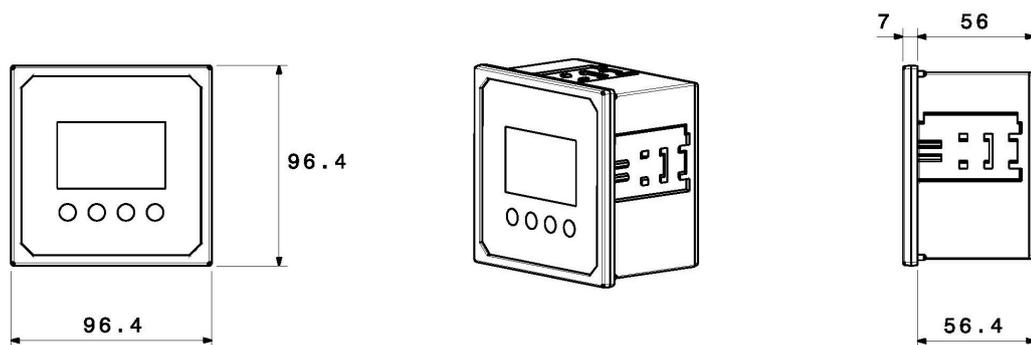
ZOK-ZxK



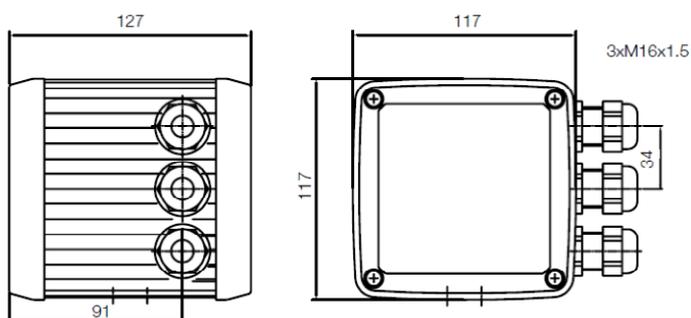
ZOK-Ex/-Zx



ZOK-ZxP



ZOK-ZxF



14. EU Declaration of Conformance

We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Flow-Counter/-Dosing Unit/-Controller **Model: ZOK-Ex and ZOK-Zx**

to which this declaration relates is in conformity with the standards noted below:

EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements
EN 61010-1:2011 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements

Also the following EC guidelines are fulfilled:

2014/30/EU EMC Directive

2014/35/EU Low Voltage Directive

2011/65/EU RoHS (category 9)

EN 50581:2012 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

2006/66/EC Directive Batteries and Accumulators



H. Peters
General Manager



M. Wenzel
Proxy Holder

Hofheim, 29. June 2016