

V4LM4S30 24-240V AC/DC

Art.Nr.: 2104500



MONITORING RELAY / LEVEL MONITORING

- ✓ Level monitoring in conductive liquids
- ✓ 4 probe inputs for level monitoring
- ✓ Multifunction
- ✓ Adjustable sensor voltage
- ✓ Supply voltage 24-240V AC/DC
- ✓ Protective separation of measuring circuit
- ✓ 3 normally open contacts with common root
- ✓ Width 45 mm

Control elements

- ✓ Sensitivity
- ✓ Sensor voltage / Measuring range
- ✓ Function
- ✓ Delay / Operating mode

Status indication

- ✓ LED U/t: Supply voltage / time lapse
- ✓ LED R1: Relay status Rel1
- ✓ LED R2: Relay status Rel2
- ✓ LED R3: Relay status Rel3
- ✓ LED PP1: Pump performance 1
- ✓ LED PP2: Pump performance 2



TECHNICAL DATA

SUPPLY CIRCUIT

Terminals	A1-A2	
Supply voltage	24 ... 240 V AC/DC	
Supply voltage tolerance	AC	-10 / +10 %
	DC	-25 / +25 %
Rated frequency	16,6 ... 400 Hz or DC	
Rated frequency tolerance	16,0 ... 420 Hz	
Rated consumption	230 V AC	typ. 0,9 W / 1,3 VA
	24 V DC	typ. 0,65 W
Duty-cycle	100 %	
Backup power time	> 20 ms	
Recovery time	< 500 ms	
Drop-out voltage	≥ 6 V	

MEASURING CIRCUIT

Terminals	E0-E0-E1-E2-E3-E4 (E0-E0 internal connected)
Measurand	Liquid level with conductive probes (type SK1, SK5)
Measuring method	Resistance measurement E1-E0, E2-E0, E3-E0, E4-E0
Monitoring function	Level monitoring of conductive liquids with adjustable delay (measuring filter)
Measuring range	Low (L): 250Ω - 12.5kΩ High (H): 10kΩ - 500kΩ
Sensor voltage V _{SENS}	AC, 18.33Hz, 100% = 2.3Vrms open-circuit voltage
Sensor current @ V _{SENS} = 100%	Range L: max. 1mA, Range H: max. 0.1mA

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MEASURING CIRCUIT

Wiring distance to level probes (capacity of cable 100nF/km)	@Vsens H = 100% Sensitivity \leq 50%	1000 m
	@Vsens L = 100% Sensitivity \leq 100%	1000 m
Measuring mode		sequentially (delay = 1 ... 10 s)
		simultaneously (concurrent sensing)
Hysteresis		approx. 2 % of adjusted sensitivity

RANGE OF FUNCTIONS

Functions	10	2uA = Pump up; Min- / Max-Alarm (1 container, 4 probes)
		2dA = Pump down; Min- / Max-Alarm (1 container, 4 probes)
		3b- = Pump up and down; Min-Alarm (1 container, 3 (4) probes)
		3b+ = Pump up and down; Max-Alarm (1 container, 3 (4) probes)
		2u2 = Pump up (2 independent containers, 2 probes each)
		2d2 = Pump down (2 independent containers, 2 probes each)
		2uc = Pump up with pump change (1 container, 2 probes)
		2dc = Pump down with pump change (1 container, 2 probes)
		3w- = Well control; Min-Alarm (2 containers, 3 probes)
		4ce = Level code (up to 4 containers, 4 probes)
Potentiometers		Sensitivity (threshold): Low = 0,25 ...12,5 k Ω ; High = 10 ... 500 k Ω
		Delay (measuring filter): 1 ... 10 s
Rotary switch		Vsense[%] (20, 40, 60, 80, 100%) Sensitivity range Low / High
		Function selector

TIMING CIRCUIT

Measuring filter	DELAY	1 ... 10 s
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STATUS INDICATION

Supply voltage	LED U/t (green) on	supply voltage applied
Measuring filter (Delay)	LED U/t (green) flashes	indication of time lapse for measuring filter
Relay status	Rel1 (yellow) on	output relay 1 energized
	Rel2 (yellow) on	output relay 2 energized
	Rel3 (yellow) on	output relay 3 energized
Pump performance	PP1 (yellow) on	Pump performance pump 1
	PP2 (yellow) on	Pump performance pump 2

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OUTPUT CIRCUIT		
Terminals	Rel1	17-18
	Rel2	17-28
	Rel3	17-38
Kind of output	Relay (normally open contacts with common root)	
Number of contacts	normally open contacts	3
Contact material	AgNi / Au	
Rated voltage (IEC 60947-1)	250 V	
Maximum switching voltage	250 V AC	
Minimum switching voltage / switching current	5 V DC / 10 mA	
Rated current (IEC 60947-5-1)	AC-1	5 A / 250 V
	AC-15	1,5 A / 240 V (B300)
	DC-12	5 A / 24 V
Endurance	mechanical	1 x 10 ⁶ switching cycles
	electrical (AC-1)	1 x 10 ⁵ switching cycles
Rated frequency of operation	with load	6/min
	without load	1200/min
Fuse rating	5 A fast acting	

ACCURACY		
Base accuracy	-	
Setting accuracy	-	
Temperature influence	-	
Voltage influence	-	

ENVIRONMENTAL CONDITIONS		
Ambient temperature	operation	-25 ... +60°C
	storage	-40 ... +70°C
Relative humidity	5 ... 95 %	
Vibration	EN 60947-1	2 ... 13,2 Hz: 1 mm; 13,2 ... 100 Hz: 7 m/s ²
Shock	EN 60947-1	150 m/s ² 11 ms

GENERAL DATA		
Dimensions	W × H × D	45 x 67 x 76 mm
Mounting	DIN rail (EN60715)	
Mounting position	any	
Housing material	PA 66, self-extinguishing plastic, class V-0	

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GENERAL DATA

Degree of protection	housing	IP40
	terminals	IP20
Electrical connection	Screw terminal	
Wire size	flexible with wire end ferrule	0,5 ... 2,5 mm ² (20 AWG ... 13 AWG)
	flexible without wire end ferrule	0,5 ... 4 mm ² (20 AWG ... 12 AWG)
	rigid	0,5 ... 4 mm ² (20 AWG ... 12 AWG)
Stripping length	8 mm	
Tightening torque	max. 1Nm	
MTTF	-	
Weight	-	

ISOLATION DATA

Pollution degree (IEC 60947-5-1)	2	
Overvoltage category (IEC 60947-5-1)	III	
Rated insulation voltage (IEC 60947-1)	supply circuit / output circuit	300 V
	measuring circuit / output circuit	300 V
	supply circuit / measuring circuit	300 V
Rated impulse withstanding voltage (IEC 60947-1)	supply circuit / output circuit	6 kV
	measuring circuit / output circuit	6 kV
	supply circuit / measuring circuit	6 kV
Insulation test voltage (IEC 60947-1)	supply circuit / output circuit	3780 V
	measuring circuit / output circuit	3780 V
	supply circuit / measuring circuit	3780 V
Degree of protection	supply circuit / output circuit	protective separation
	measuring circuit / output circuit	protective separation
	supply circuit / measuring circuit	protective separation

STANDARDS

Product standard	IEC 60947-5-1
Interference immunity	IEC 61000-6-2
Interference emission	IEC 61000-6-4
Approvals	CE



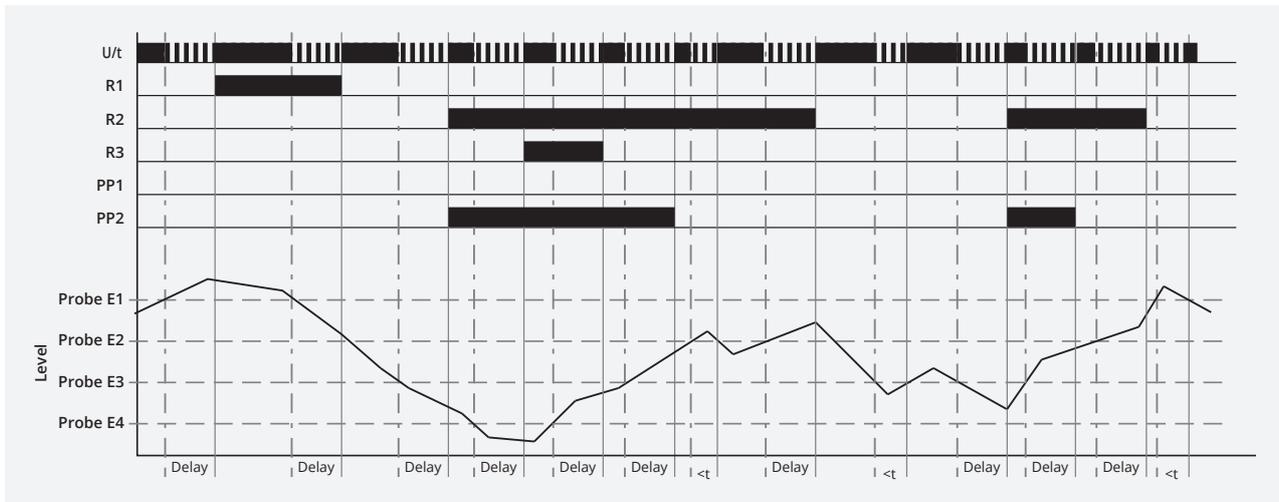
FUNCTIONS

Pump up with MIN and MAX alarm (2uA)

1 container, 4 probes

Connection of the probes E0 - E4. Instead of the reference probe E0, the electroconductive container can be connected. When the liquid level drops below the probe E3 the set delay interval is triggered. After the delay time has elapsed the output relay R2 is energised. Simultaneously the yellow LED PP2 (pump performance) is switched on and stays on until the liquid reaches a stable level at probe E3 (delay time elapsed). As soon as probe level E2 is reached and the delay time has elapsed the output relay R2 is de-energised.

The minimum probe E4 and the maximum probe E1 are used for extreme value monitoring and are linked to the output relays R1 (maximum alarm probe E1) and R3 (minimum alarm probe E4) and can be used to control alarm lamps, additional pumps or inflow and discharge valves.

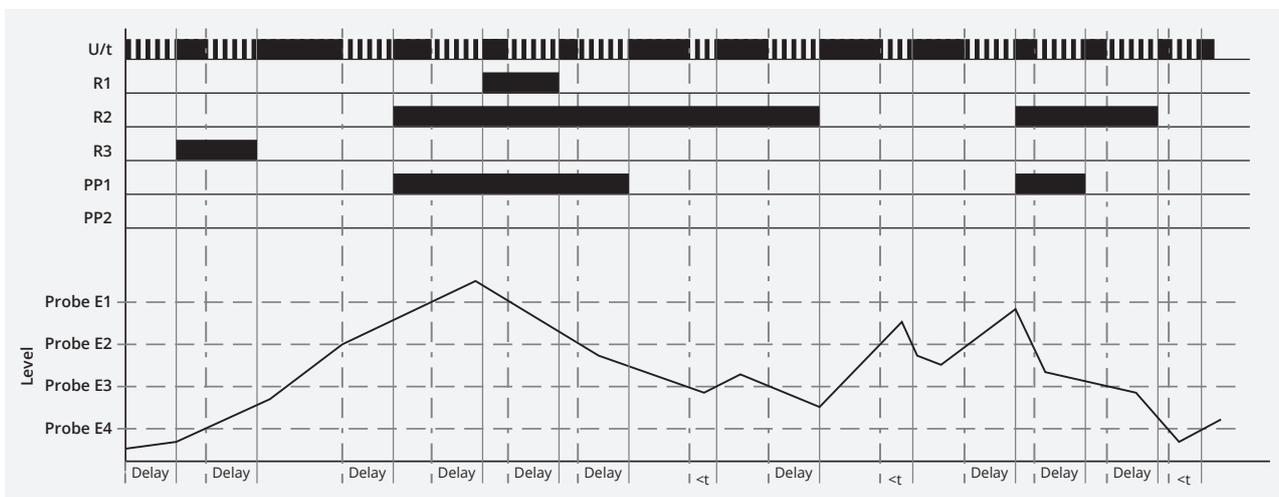


Pump down with MIN and MAX alarm (2dA)

1 container, 4 probes

Connection of the probes E0 - E4. Instead of the reference probe E0 the electroconductive container can be connected. When the liquid level rises above the probe E2 the set delay interval is triggered. After the delay time has elapsed the output relays R2 is energised. Simultaneously the yellow LED PP1 (pump performance) is switched on and stays on until the liquid level stably drops below the probe level E2 (delay time elapsed). As soon as the level drops below probe level E3 and the delay time has elapsed the output relays R2 is de-energised.

The minimum probe E4 and the maximum probe E1 are used for extreme value monitoring and are linked to the output relays R1 (maximum alarm probe E1) and R3 (minimum alarm probe E4) and can be used to control alarm lamps, additional pumps or inflow and discharge valves.





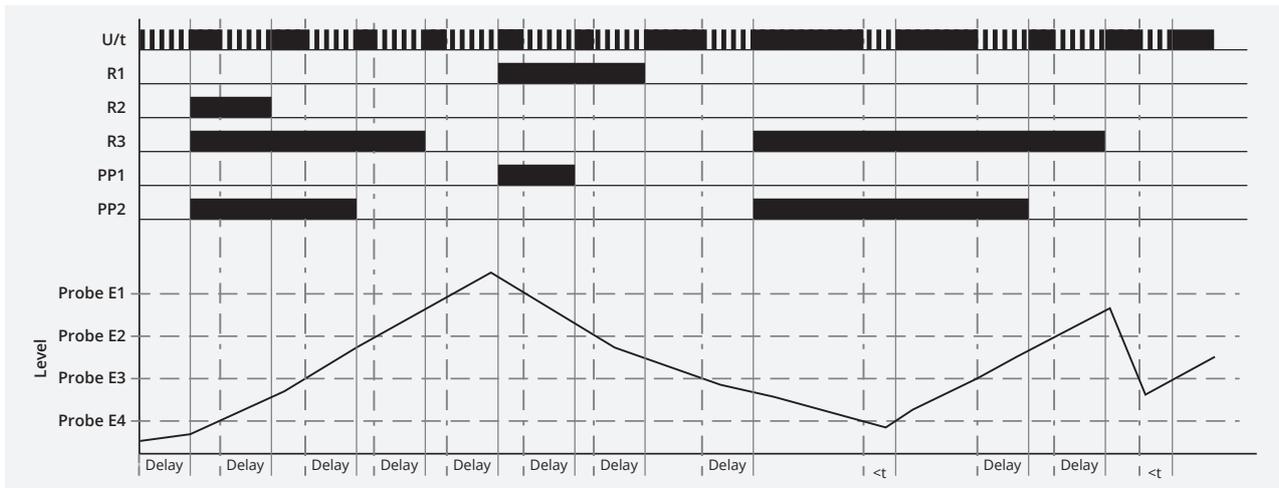
MONITORING RELAY / LEVEL MONITORING

Pump up and down with MIN alarm (3b-)

1 container, 3(4) probes

Connection of the probes E0 - E4. Instead of the reference probe E0, the electroconductive container can be connected. This function controls the liquid level around probe E2. When the liquid level rises above the probe E1 the set delay interval is triggered. After the delay time has elapsed the output relay R1 (pump down) is energised. Simultaneously the yellow LED PP1 (pump performance) is switched on and stays on until the liquid reaches a stable level at probe E1 (delay time elapsed). As soon as the level drops below probe level E2 and the delay time has elapsed the output relay R1 is de-energised. When the liquid level drops below the probe E3 the set delay interval is triggered. After the delay time has elapsed the output relay R3 (pump up) is energised. Simultaneously the yellow LED PP2 (pump performance) is switched on and stays on until the liquid reaches a stable level at probe E3 (delay time elapsed). As soon as probe level E2 is reached and the delay time has elapsed the output relay R2 is de-energised.

The minimum probe E4 serves for dry running monitoring and is coupled to the output relay R2 and can be used to control alarm lamps, additional pumps or inflow valves.

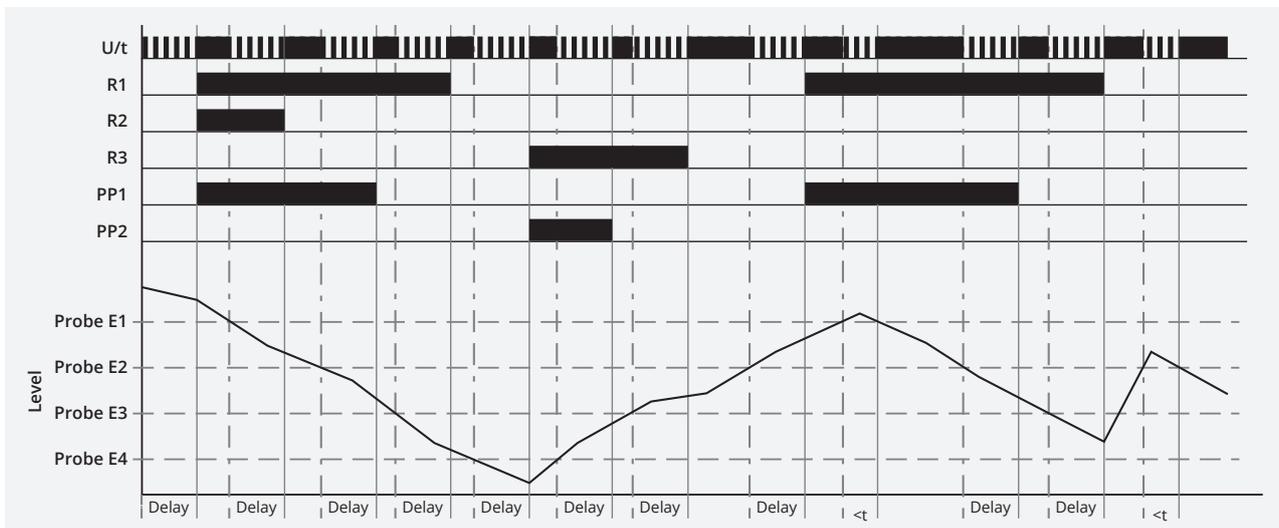


Pump up and down with MAX alarm (3b+)

1 container, 3(4) probes

Connection of the probes E0 - E4. Instead of the reference probe E0 the electroconductive container can be connected. This function controls the liquid level around probe E3. When the liquid level rises above the probe E2 the set delay interval is triggered. After the delay time has elapsed the output relay R1 (pump down) is energised. Simultaneously the yellow LED PP1 (pump performance) is switched on and stays on until the liquid reaches a stable level at probe E2 (delay time elapsed). As soon as the level drops below probe level E3 and the delay time has elapsed the output relay R1 is de-energised. When the liquid level drops below the probe E4 the set delay interval is triggered. After the delay time has elapsed the output relay R3 (pump up) is energised. Simultaneously the yellow LED PP2 (pump performance) is switched on and stays on until the liquid stably reaches the probe level E4 (delay time elapsed). As soon as probe level E3 is reached and the delay time has elapsed the output relay R2 is de-energised.

The maximum probe E1 serves for overflow monitoring and is coupled to the output relay R2 and can be used to control alarm lamps, additional pumps or discharge valves.





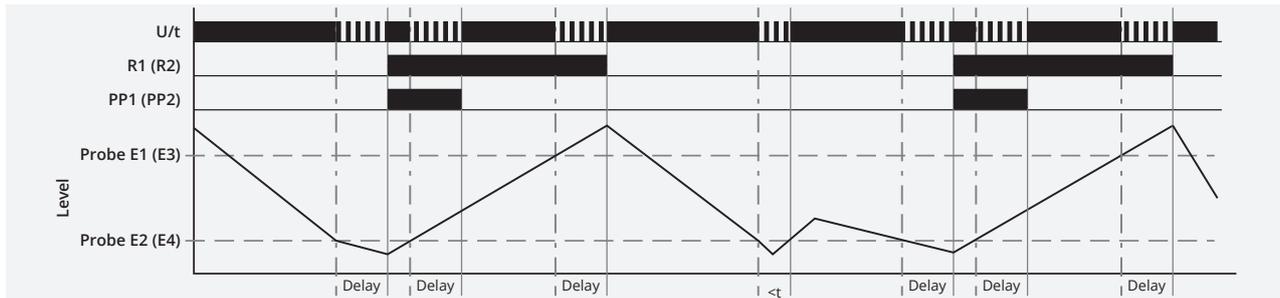
MONITORING RELAY / LEVEL MONITORING

Pump up (2u2)

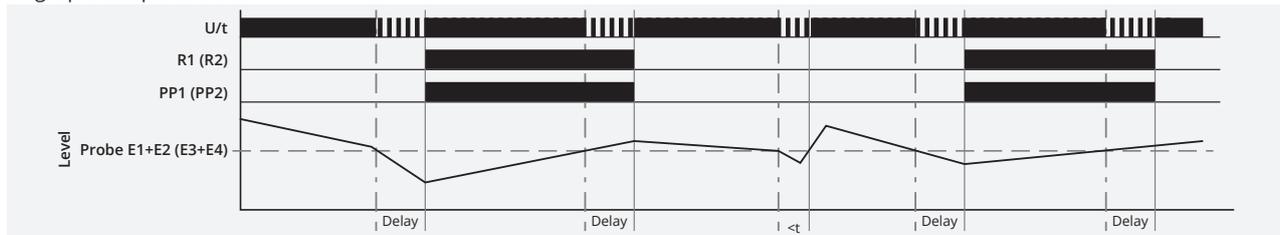
2 independent containers, 2 probes each

This function serves the level control in two separate tanks. A pair of probes and an output relay are available for each of the tanks. Both level controls work independently. Connection of the probes E0, E1, E2 (second tank E0, E3, E4). Instead of the reference probe E0 the electroconductive containers can be connected. When the liquid level drops below the probe E2 (resp. E4) the set delay interval is triggered. After the delay time has elapsed the output relay R1 (resp. R2) is energised. Simultaneously the yellow LED PP1 (resp. PP2) (pump performance) is switched on and stays on until the liquid reaches a stable level at probe E2 (resp. E4) (delay time elapsed). As soon as probe level E1 (resp. E3) is reached and the delay time has elapsed the output relay R1 (resp. R2) is de-energised.

The use of this function is also possible with a single probe per container - in this case a single probe is connected to both inputs E1 and E2 (resp. E3 and E4). The „Concurrent Sensing“ mode is deactivated in function 2u2 in order to avoid measuring inaccuracies.



Single probe operation:

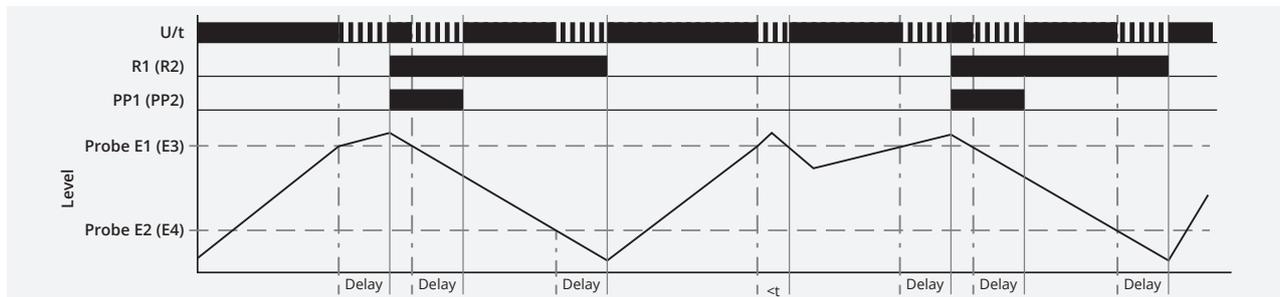


Pump down (2d2)

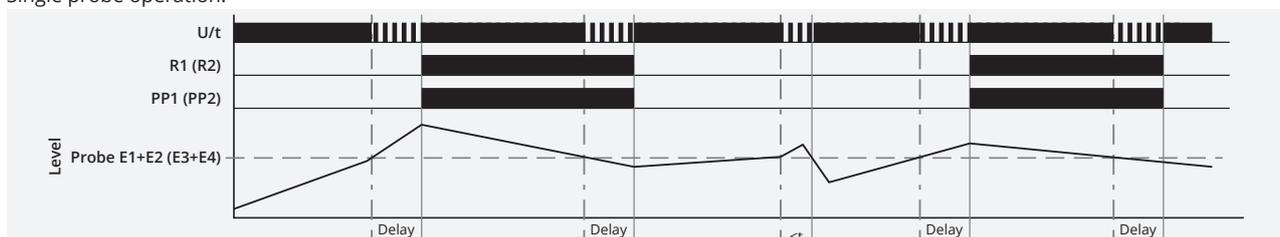
2 independent containers, 2 probes each

This function serves the level control in two separate tanks. A pair of probes and an output relay are available for each of the tanks. Both level controls work independently. Connection of the probes E0, E1, E2 (second tank E0, E3, E4). Instead of the reference probe E0 the electroconductive containers can be connected. When the liquid level rises above the probe E1 (resp. E3) the set delay interval is triggered. After the delay time has elapsed the output relay R1 (resp. R2) is energised. Simultaneously the yellow LED PP1 (resp. PP2) (pump performance) is switched on and stays on until the liquid reaches a stable level at probe E2 (resp. E4) (delay time elapsed). As soon as the level drops below probe level E2 (resp. E4) and the delay time has elapsed the output relay R1 (resp. R2) is de-energised.

The use of this function is also possible with a single probe per container - in this case a single probe is connected to both inputs E1 and E2 (resp. E3 and E4). The „Concurrent Sensing“ mode is deactivated in function 2u2 in order to avoid measuring inaccuracies.



Single probe operation:



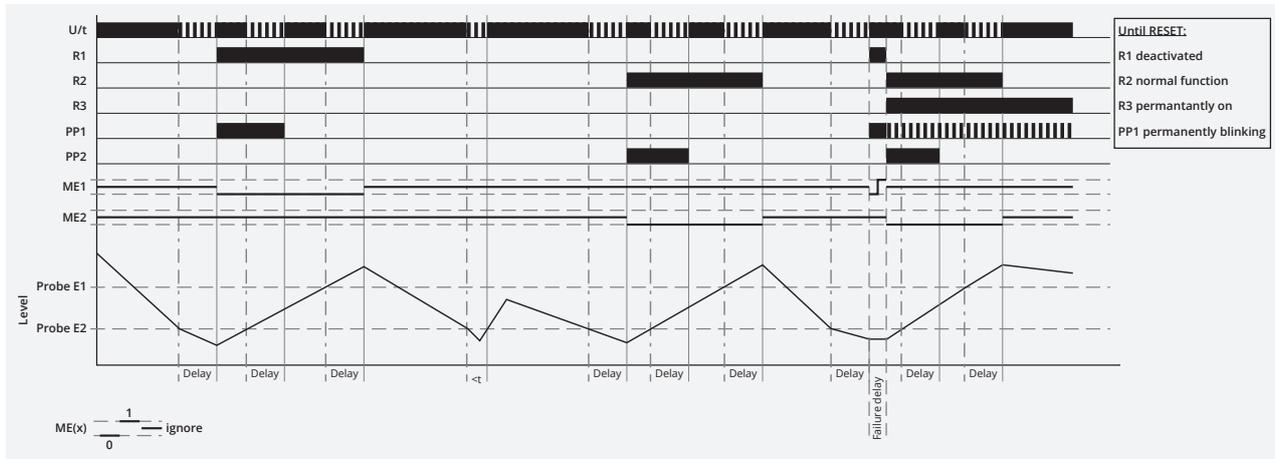


MONITORING RELAY / LEVEL MONITORING

Pump up with pump change (2uc)

1 container, 2 probes, 2 pumps

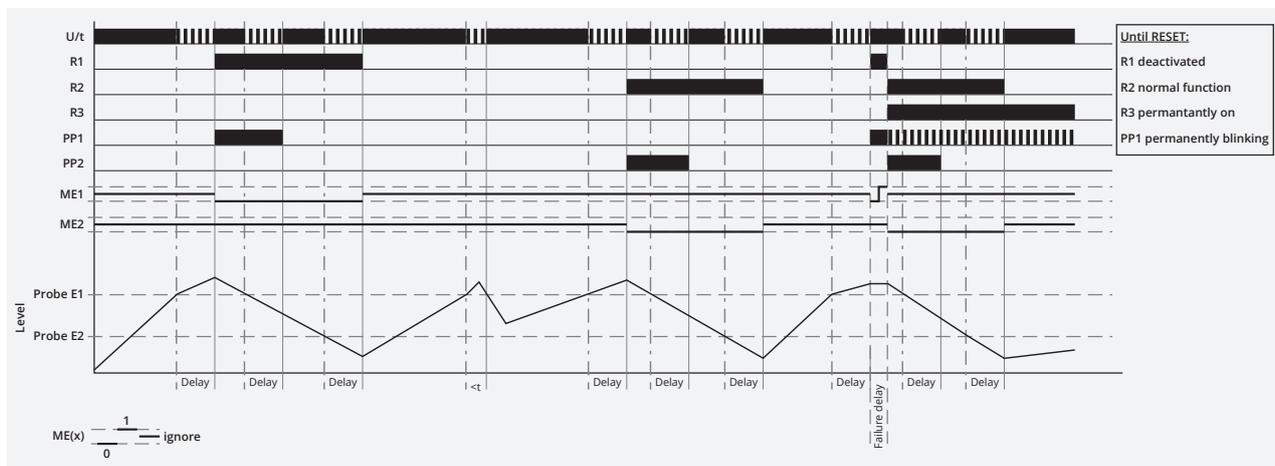
Connection of the probes E0 - E4. Instead of the reference probe E0 the electroconductive container can be connected. The probe inputs E3 and E4 are optionally available for pump monitoring (blockage or dry running monitoring e.g. V2IM10AL10 / V4IM100AL20, coupling to the monitoring inputs E3, E4 via the NC contacts of the monitoring relays). When the liquid level drops below the probe E2 the set delay interval is triggered. After the delay time has elapsed the output relay R1 (resp. R2) is energised. Simultaneously the yellow LED PP1 (resp. PP2) (pump performance) is switched on and stays on until the liquid reaches a stable level at probe E2 (delay time elapsed). As soon as probe level E1 is reached and the delay time has elapsed the output relay R1 (resp. R2) is de-energised. The two output relays R1 and R2 for pump control are triggered alternately to ensure balanced utilization of the pumps. In the event of an error of the currently prioritized pump, the NC contact of the monitoring relay closes and the error signal is transferred to the respective monitoring input (E3 or E4). The faulty pump is deactivated and the alternative relay output gets energized. Simultaneously the relay output R3 (pump failure) gets permanently energized and the pump efficiency LED of the affected pump (PP1 or PP2) starts flashing. The fault-free pump remains permanently prioritized. The fault status is reset by temporarily switching to a different function or disconnecting the device from the mains.



Pump down with pump change (2dc)

1 container, 2 probes, 2 pumps

Connection of the probes E0 - E4. Instead of the reference probe E0 the electroconductive container can be connected. The probe inputs E3 and E4 are optionally available for pump monitoring (blockage or dry running monitoring e.g. V2IM10AL10 / V4IM100AL20, coupling to the monitoring inputs E3, E4 via the NC contacts of the monitoring relays). When the liquid level rises above the probe E1 the set delay interval is triggered. After the delay time has elapsed the output relay R1 (resp. R2) is energised. Simultaneously the yellow LED PP1 (resp. PP2) (pump performance) is switched on and stays on until the liquid reaches a stable level at probe E1 (delay time elapsed). As soon as the level drops below probe level E2 and the delay time has elapsed the output relay R1 (resp. R2) is de-energised. The two output relays R1 and R2 for pump control are triggered alternately to ensure balanced utilization of the pumps. In the event of an error of the currently prioritized pump, the NC contact of the monitoring relay closes and the error signal is transferred to the respective monitoring input (E3 or E4). The faulty pump is deactivated and the alternative relay output gets energized. Simultaneously the relay output R3 (pump failure) gets permanently energized and the pump efficiency LED of the affected pump (PP1 or PP2) starts flashing. The fault-free pump remains permanently prioritized. The fault status is reset by temporarily switching to a different function or disconnecting the device from the mains.



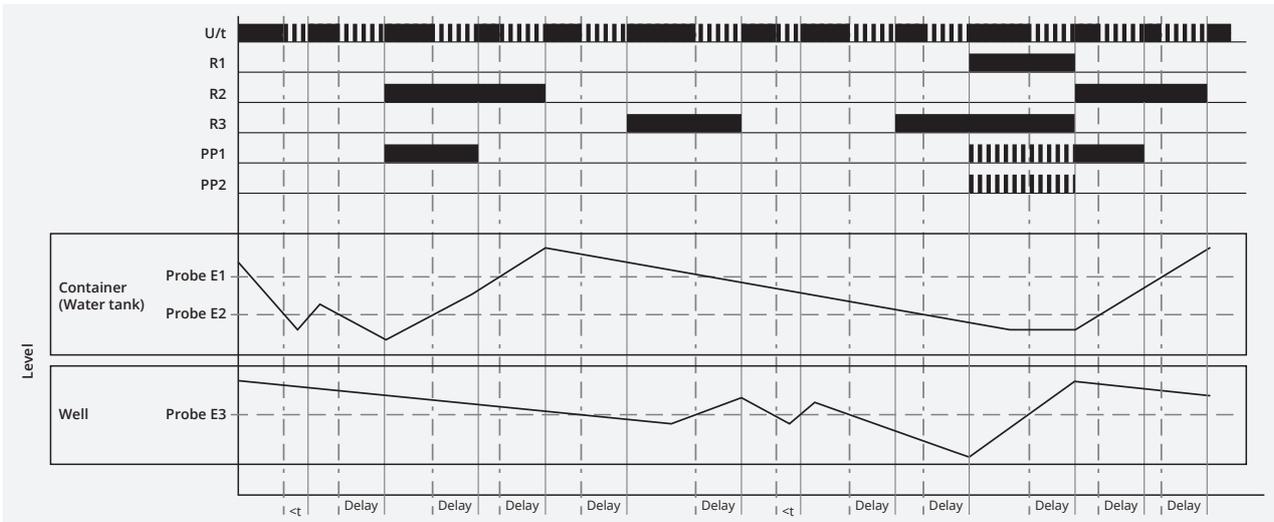


MONITORING RELAY / LEVEL MONITORING

Well control with MIN alarm (3w-)

2 containers, 3 probes

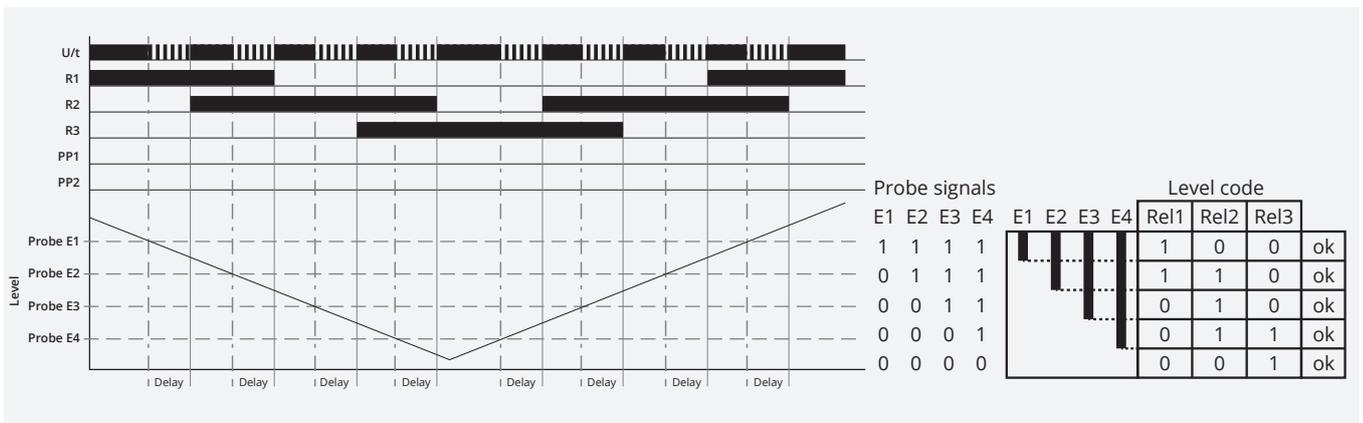
The function is used to ensure the water supply by means of a water tower and a well. Connection of the probes E0 - E2 (water tower) and E0 and E3 (well). Instead of the reference probe E0 the electroconductive container can be connected. When the liquid level in the water tower drops below the probe E2 the set delay interval is triggered. After the delay time has elapsed the output relay R2 is energised and water from the well is pumped up. Simultaneously the yellow LED PP1 (pump performance) is switched on and stays on until the liquid reaches a stable level at probe E2 (delay time elapsed). As soon as probe level E1 is reached and the delay time has elapsed the output relay R2 is de-energised. When the liquid level in the well drops below the probe E3 the set delay interval is triggered. After the delay time has elapsed the output relay R3 (well alarm) is energised and remains in this state until the liquid level stably reaches the probe E3 again (delay time elapsed). Only then pumping up into the water tower can be ensured again. If the liquid level in the well as well as the liquid level in the water tower fall below the respective minimum levels (E2 and E3 dry), the output relay R1 (dry alarm) is energized after the delay time has elapsed and the two LEDs PP1 and PP2 start to flash. This state remains until the probe E3 is once again stably wetted (delay time elapsed) and thus pumping up into the water tower is again possible.



Level code (4ce)

Up to 4 containers, 4 probes

Connection of the probes E0 - E4. Instead of the reference probe E0 the electroconductive container can be connected. This function maps the probe states of the probes E1-E4 as a code to the relay outputs R1-R3. Each status change is subject to the set delay time. By using an external decision logic (e.g. PLC), reactions to the respective probe states may be programmed as desired. Undefined signal sequences provide the error code 1 - 0 - 1 to the output relay R1 - R3. Overflow or dry-running monitoring for 4 separate containers is possible by means of simple functional wiring (see next page).



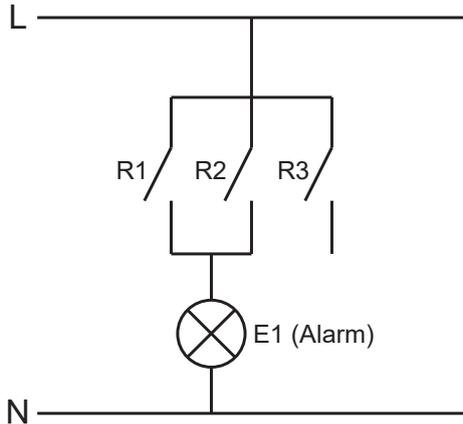


MONITORING RELAY / LEVEL MONITORING

Level code functional wiring for overflow or dry-running monitoring of 4 separate containers

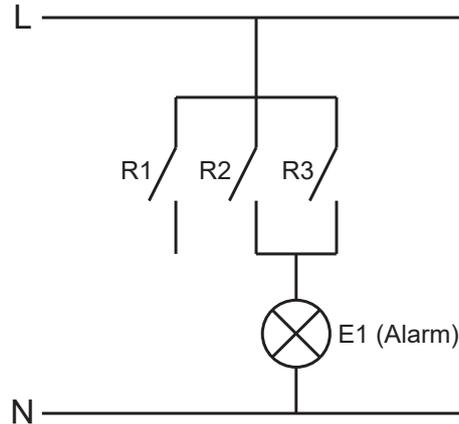
Overflow monitoring

(Alarm if liquid level rises above one of the probes)



Dry-running monitoring

(Alarm if liquid level falls below one of the probes)



Probe inconsistencies:

All undefined binary states on E1-E4 indicate a probe failure (cable break / ground fault / short circuit).

Functions 5 & 6 do not detect a logical probe error since they are also suitable for use with only one probe per container.

Function 10 (level code) returns undefined binary states of the probes as 1-0-1 status at R1 to R3.

	LED's PP1 & PP2	Pumps
t probe inconsistency < delay time	Immediate error code alternating blink	Pump status unchanged Alarm contacts unchanged
Probe inconsistency ends within t < delay time	Automatic return to normal operation	Pump status unchanged Alarm contacts unchanged
t probe inconsistency > delay time	Error code LED (blinking) remains ⁽¹⁾	All pumps off All Alarm contacts on
Probe inconsistency ends after t > = delay time	Error code LED (blinking) remains ⁽¹⁾	Pump status is automatically reset Pumps perform as in normal operation Reset all alarm contacts

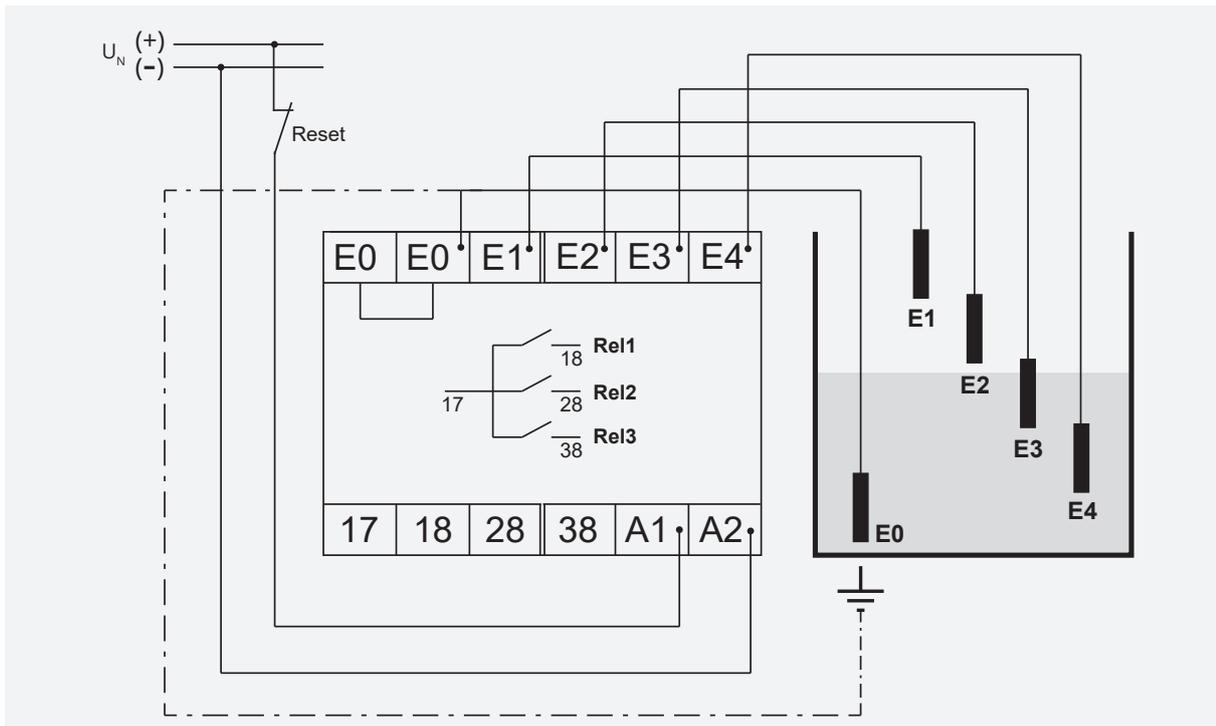
⁽¹⁾ Stored errors can be reset by interrupting the supply voltage or a change of the function by turning the function selector. The change of function can result in uncontrolled states of the relay output!



MONITORING RELAY / LEVEL MONITORING

CONNECTIONS

Functions: 2uA, 2dA, 3b-, 3b+, 4ce
1 container, 4 probes

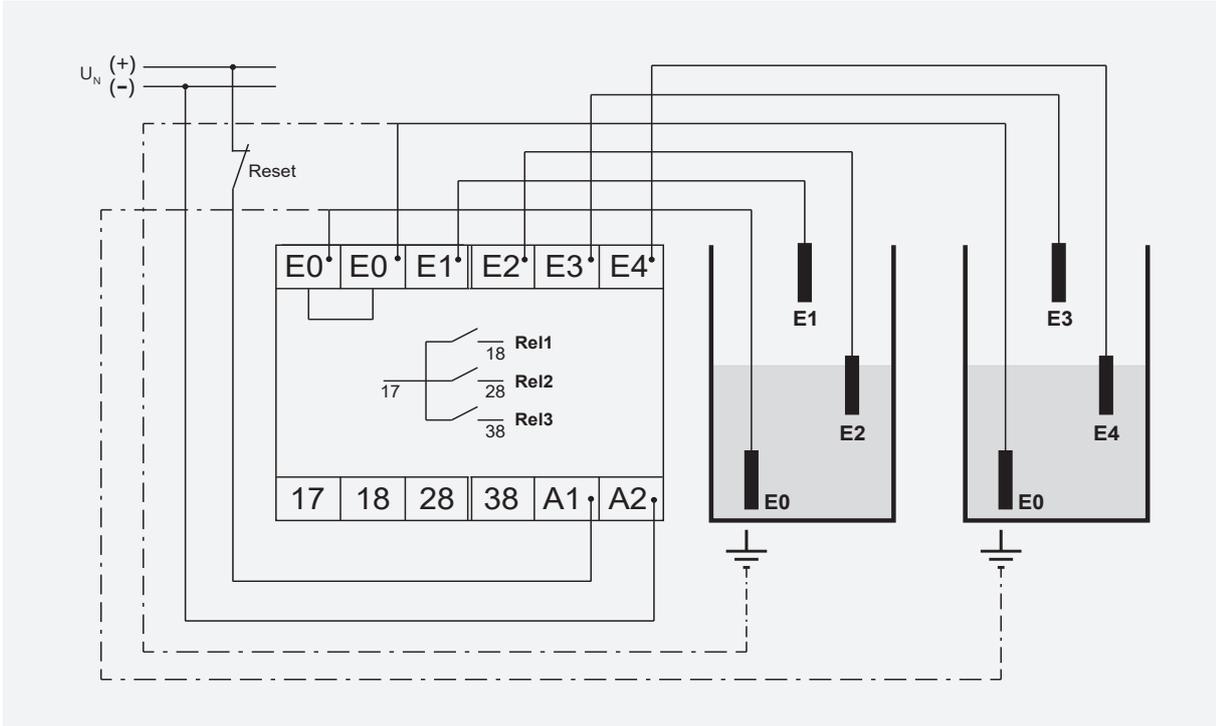




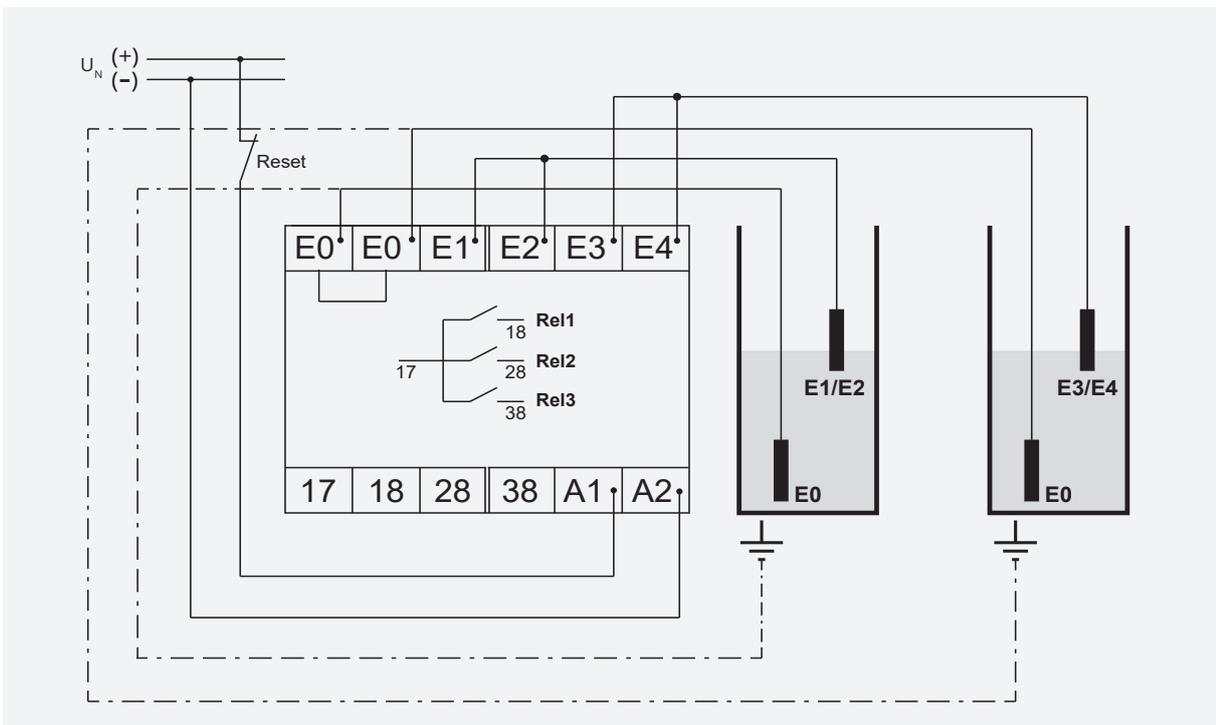
MONITORING RELAY / LEVEL MONITORING

CONNECTIONS

Functions: 2u2, 2d2
2 containers, 2 probes each



Functions: 2u2, 2d2
2 containers, 1 probe connected to E1 and E2, 1 probe connected to E3 and E4

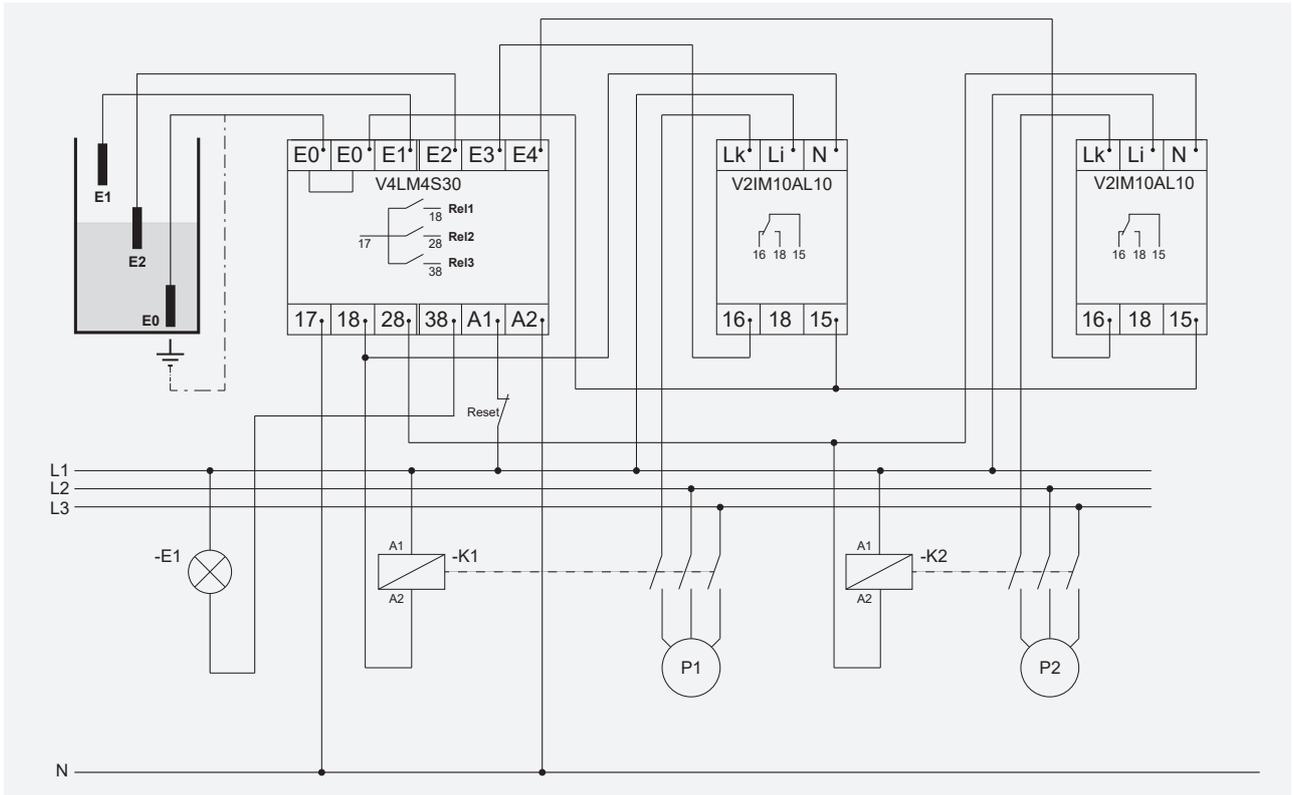




MONITORING RELAY / LEVEL MONITORING

CONNECTIONS

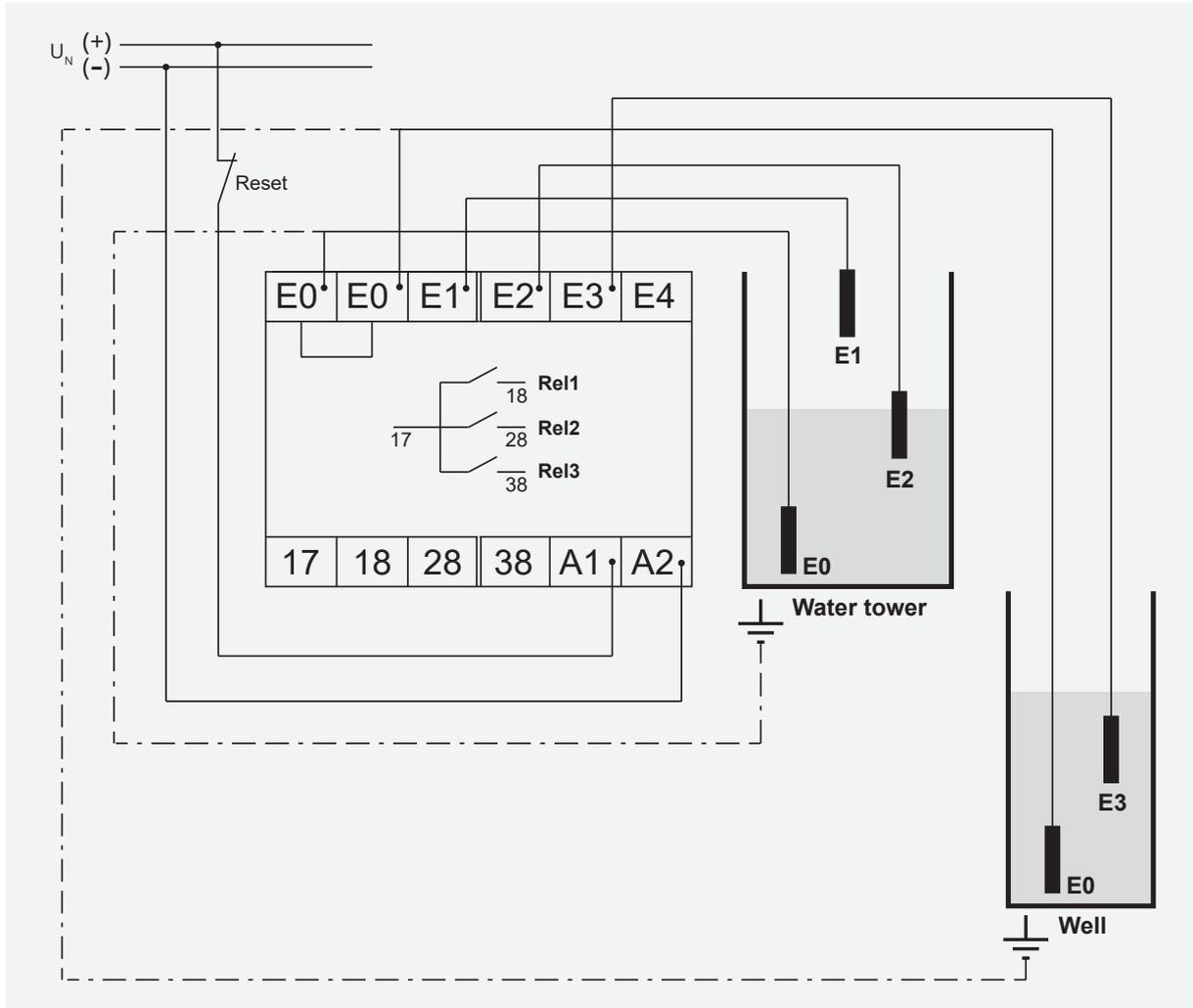
Functions: 2uc, 2dc
1 container, 2 probes





CONNECTIONS

Functions: 3w-
1 container (water tower) with 2 probes, 1 well with 1 probe





MONITORING RELAY / LEVEL MONITORING

DIMENSIONS

