

Electrode controls

Conductive controlling devices,
for automatic control,
regulation and signalling of liquid levels



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Jola Electrode controls

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General information on electrode controls

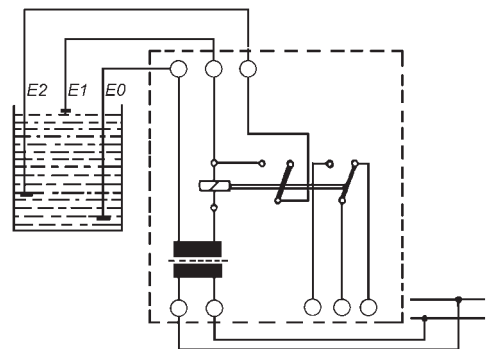
1. Operating principle

Electrode controls are used for the automatic control of pumps or electromagnetic valves as well as overflow or run-dry protection in wells or tanks with conductive liquids.

The liquid levels are monitored by electrodes which give switching commands to the electronic relay if they come into contact with the liquid.

For a two-point control system, you require two control electrodes and one earth electrode. If you only wish to signal a liquid level, the control electrode E1 and the earth electrode will suffice. You can also use a metallic, conductive tank wall as an earth connection in place of the earth electrode.

However, we recommend the use of a separate earth electrode in all cases.



Circuit diagram of an electrode control
E0 = earth electrode
E1 and E2 = control electrodes

2. Recommendations for the use of control electrodes

The conductive liquid to be controlled should have a specific conductivity of min. 50 $\mu\text{S}/\text{cm}$. The specific conductivity of tap water is usually set in a range from 100 $\mu\text{S}/\text{cm}$ to 1,000 $\mu\text{S}/\text{cm}$.

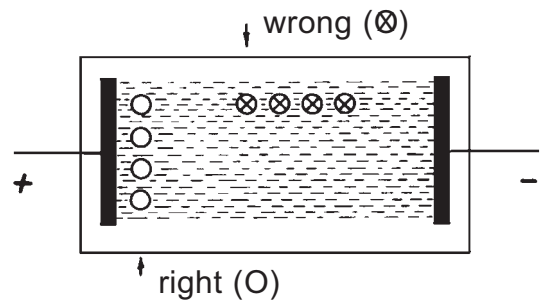
3. Recommendations for the design of the electrodes

- Highly conductive liquids:** if there is sufficient space, we advise you to use **several single electrodes** at a spacing of approx. 100 mm instead of a multiple electrode.
- Poorly conductive liquids:** if electrodes are used in poorly conductive liquids, the electrode rods should be mounted as close as possible to one another. For these applications, we recommend the use of a **multiple electrode** in place of several single electrodes.
- All liquids:** wherever possible, we recommend the use of an **electrode with plastic threaded nipple**, as the plastic acts as an insulator and therefore increases the insulation distance between the electrode rod and the conductive tank. If you use an electrode with metallic threaded nipple, this nipple will take same tank potential (= earth electrode E0). The insulation distance between electrode rod(s) and tank will then be limited to the insulators used in the electrode.

4. Recommendations for special cases – the use of electrode controls in electrolysis baths

When installing electrodes in electrolysis baths, it is always necessary to mount the electrodes **across** the voltage path. They must **not** be mounted **along** the voltage path.

It should be noted that in the case of movable poles (the object to be galvanised itself constitutes a pole) the voltage path can change and therefore cause false alarms.



5. Electrode controls can or should not be used:

- in non-conductive liquids (e.g. in mineral oils);
- in mushy or viscous liquids;
- in liquids with a tendency to foam (e.g. possibly beer, washing sodas etc.);
- in liquids with a high level of steam generation and condensate (e.g. at higher temperatures);
- in liquids with a tendency to form deposits (e.g. in limestone milk, oily waste water etc.);
- in liquids with solid particles (e.g. pieces of wood, remnant etc.).

6. Electrical connection

For the connection of electrode to electrode relay, we recommend the use of standard installation cables (e.g. NYM 2 x 1.5 mm² or 3 x 1.5 mm²). Telephone cables or heavily twisted bell wires should **not** be used.

7. Emptying and filling of a tank via an electrode control

Before you connect up the electrode relay, you must check whether the mains voltage to be connected to the mains terminals is the same as that specified on the rating plate. The built-in transformer steps down the mains voltage to a safe low voltage and forwards it to the electronics of the relay via the connected electrodes.

As soon as the upper electrode E1 comes into contact with the liquid, the energising current flows through the liquid between E1 and E0, and the relay attracts with the electrode relay types NR 5 A, NR 3 A and ES 5/G or drops off with the electrode relay types NR 5, NR 3 or NR 5/G. At the same time, the electrode current between the electrode mounted at the bottom (E2) and the earth electrode (E0) ensures that the switching status is retained until the falling liquid level releases the electrode E2.

The output relay is therefore switched on by E1 at the maximum liquid level and switched off by E2 at the minimum level. The potential-free output contact is suitable for controlling pumps etc. It is designed for max. AC 4 A. The maximum voltage must not exceed AC 250 V and the permanent load of the contacts must not exceed 500 VA (ohmic load).

For the “pumping empty” function, in which the pump pumps a full tank empty, the contactor for the pump motor should be connected in accordance with the diagrams on pages 7-1-17, 7-1-23, 7-1-31 and 7-1-35. In these cases, control is effected by the normally open contact of the electrode relay NR 5 A, NR 3 A und ES 5/G or by the normally closed contact of the types NR 5, NR 3 or NR 5/G. The pump is switched on when the tank is full and switched off when the tank is empty.

For the “pumping full” function, in which the pump pumps an empty tank full, the contactor for the pump motor should be connected in accordance with the diagrams on pages 7-1-18, 7-1-24, 7-1-32 and 7-1-36. In these cases, control is effected by the normally closed contact of the electrode relays NR 5 A, NR 3 A and ES 5/G or by the normally open contact of the types NR 5, NR 3 and NR 5/G. The pump is switched on when the tank is at the minimum liquid level and the electrodes are not in contact with the liquid and switched off when the top electrode comes into contact with the liquid and causes the output relay to attract in the types NR 5 A, NR 3 A and ES 5/G or to drop off with the types NR 5, NR 3 and NR 5/G.



Suspension electrodes



| Technical data | EH | EHK | LWZ | EHE |
|--------------------------------------|--|-------------------------|---|------------------------|
| Design | 1 control electrode or 1 earth electrode | | 1 control electrode and 1 earth electrode | |
| Electrode rods | | stainless steel 316 Ti | | |
| Housing | PP | PP | PP and Duroplast | stainless steel 316 Ti |
| Insulators | 27 mm Ø x ~ 145 mm long | 27 mm Ø x ~ 145 mm long | 2 x 27 mm Ø x ~ 210 mm long | 28 mm Ø x ~ 70 mm long |
| Electrical connection | without, but with connection terminal | 1 x 1.5 cable | 2 x 0.75 cable | 2 x 0.75 cable |
| Mounting orient. | 1 metre, longer on request vertical | | | |
| Temperature application range | max. + 60° C | | | |
| Pressure resistance | for pressureless applications | | | |



EHK 5



Suspension electrodes

with adjustable cable lengths

| Technical data | EHK 2 | EHK 3 | EHK 4 | EHK 5 |
|---------------------|--|-------|-------|-------|
| Design | 2 | 3 | 4 | 5 |
| Screw-in nipple | EHK electrodes (technical data, see above) | | | |
| Pressure resistance | PP, G2, with cable screw connections | | | |
| | for pressureless applications | | | |

Please note that the distance between a control electrode and the earth electrode should not exceed 3 metres. If the distance is higher than 3 metres, we recommend the use of a supplementary earth electrode, which has to be installed just below the control electrode.



Rod electrodes

with G $\frac{1}{2}$ screw-in nipple

| Technical data | SE 1 A | 1/2"-15-30 |
|--------------------------------------|--|---|
| Design | 1 control electrode or earth electrode | |
| Electrode rod | stainless steel 316 Ti, 4 mm Ø, covered with polyolefin shrinkdown tubing as desired (measured from nipple sealing surface) | |
| Length | — | 30 mm |
| Min. length | approx. 2,500 mm | |
| Max. length | cast resin | aluminium oxide |
| Insulators | and polyolefin shrinkdown tubing | |
| Screw-in nipple | stainless steel 316 Ti, G $\frac{1}{2}$ | galvanized steel, G $\frac{1}{2}$ |
| Electrical connection | special angled plug for H07RN-F 1 x 1 mm 2 , protection class IP 34 | |
| Mounting orient. | vertical | |
| Temperature application range | max. + 80°C | max. + 80°C |
| Pressure resistance | max. 10 bar at + 20°C | max. 15 bar at + 20°C |



Rod electrodes

with screw-in nipple made of PP

| Technical data | SE 1/M 8 | SE 1/4" | SE 1/2" | SE 2/3" | SE 2/3" M |
|--------------------------------------|--|--------------------------------------|--|--|--|
| Design | 1 control electrode or earth electrode | | | 2 control electrodes | 1 control electrode and 1 earth electrode |
| Electrode rods | stainless steel 316 Ti, 3 mm Ø 4 mm Ø 4 mm Ø 4 mm Ø 4 mm Ø — covered with polyolefin shrinkdown tubing as desired (measured from nipple sealing surface) | | | | |
| Lengths | ~ 500 mm | | ~ 1,500 mm | ~ 1,000 mm | |
| Max. lengths | PP and cast resin | | PP, | PP, | PP, |
| Insulators | polyolefin shrinkdown tubing and cast resin | | polyolefin shrinkdown tubing and cast resin | | |
| Screw-in nipple | PP, M 8 | PP, G$\frac{1}{4}$ | PP, G$\frac{1}{2}$ | PP, G$\frac{3}{4}$ | PP, G$\frac{3}{4}$ |
| Electrical connection | nut and counternut, protection class IP 00 | | angled plug for H07RN-F 1 x 1 mm 2 , protection class IP 34 | PP connection head with M 16 x 1.5 cable entry, protection class IP 55 | |
| Mounting orient. | vertical | | | | |
| Temperature application range | max. + 60°C | | | | |
| Pressure resistance | max. 2 bar at + 20°C | | | | |





Rod electrodes

with G1 screw-in nipple made of PP

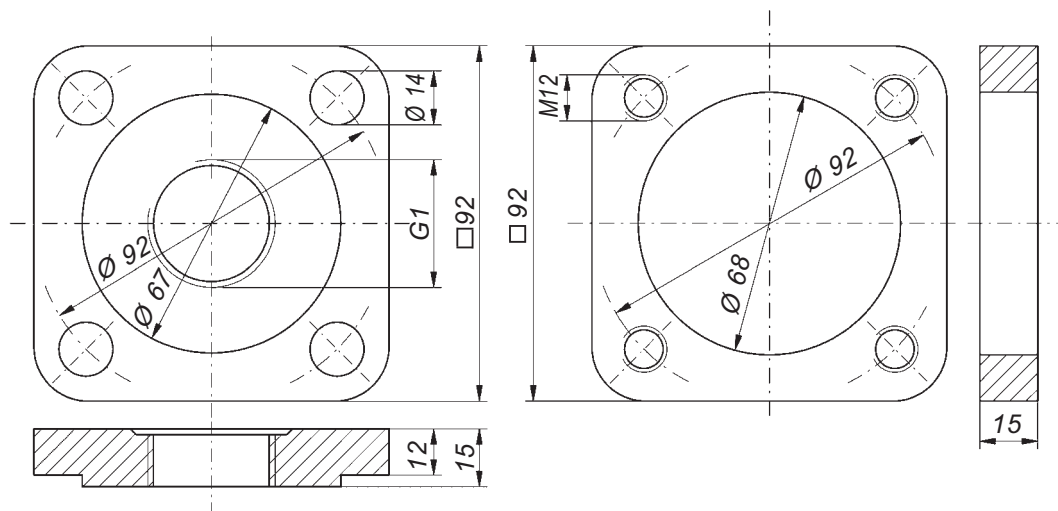
| Technical data | S 1/PP | S 2/PP | S 2 M/PP | S 3 M/PP |
|--------------------------------------|---|----------------------|---|--|
| Design | 1 control electrode or earth electrode | 2 control electrodes | 1 control electrode and 1 earth electrode | 2 control electrodes and 1 earth electrode |
| Electrode rods | stainless steel 316 Ti, 4 mm Ø, covered with polyolefin shrinkdown tubing as desired (measured from nipple sealing surface) | | | |
| Lengths | approx. 2,500 mm | | | |
| Max. lengths | approx. 2,500 mm | | | |
| Insulators | PP, polyolefin shrinkdown tubing and cast resin | | | |
| Screw-in nipple | PP, G1 | | | |
| Electrical connection | PP connection head with M 20 x 1.5 cable entry, protection class IP 54; on request: aluminium connection head, protection class IP 54 | | | |
| Mounting orientation | vertical | | | |
| Temperature application range | max. + 80°C | | | |
| Pressure resistance | max. 2 bar at + 20°C | | | |



S 1/PP

Mounting accessories:

Square flange made of PP for electrodes with G1 screw-in nipple. Counterflange on request.



Square flange

Counterflange



S 3 M/PP



Rod electrodes

with G1 screw-in nipple made of PVDF

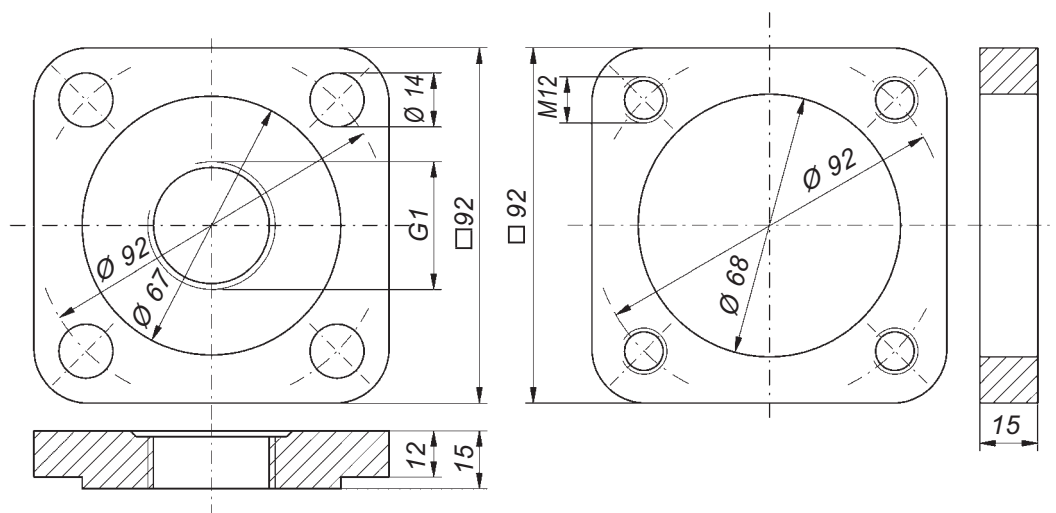
| Technical data | S 1/PVDF | S 2/PVDF | S 2 M/PVDF | S 3 M/PVDF |
|--------------------------------------|---|----------------------|---|--|
| Design | 1 control electrode or earth electrode | 2 control electrodes | 1 control electrode and 1 earth electrode | 2 control electrodes and 1 earth electrode |
| Electrode rods | stainless steel 316 Ti, 4 mm Ø, covered with PVDF shrinkdown tubing | | | |
| Lengths | as desired (measured from nipple sealing surface) | | | |
| Max. lengths | approx. 2,500 mm | | | |
| Insulators | PVDF, PVDF shrinkdown tubing and cast resin | | | |
| Screw-in nipple | PVDF, G1 | | | |
| Electrical connection | PP connection head with M 20 x 1.5 cable entry, protection class IP 54; on request: aluminium connection head, protection class IP 54 | | | |
| Mounting orientation | vertical | | | |
| Temperature application range | max. + 80°C | | | |
| Pressure resistance | max. 2 bar at + 20°C | | | |



S 1/PVDF

Mounting accessories:

Square flange made of PVDF for electrodes with G1 screw-in nipple. Counterflange on request.



Square flange

Counterflange



S 3 M/PVDF



Rod electrodes

with G1 screw-in nipple
made of stainless steel 316 Ti

| Technical data | S 2 A | S 2 AM | S 3 AM | S 4 AM | S 5 AM |
|-------------------------------|---|---|--|--|--|
| Design | 2 control electrodes | 1 control electrode and 1 earth electrode | 2 control electrodes and 1 earth electrode | 3 control electrodes and 1 earth electrode | 4 control electrodes and 1 earth electrode |
| Electrode rods | stainless steel 316 Ti, 4 mm Ø, covered with polyolefin shrinkdown tubing as desired (measured from nipple sealing surface) | | | | |
| Lengths | approx. 2,500 mm | | | | |
| Max. lengths | polyolefin shrinkdown tubing and cast resin | | | | |
| Insulators | stainless steel 316 Ti, G1 | | | | |
| Screw-in nipple | PP connection head with M 20 x 1.5 cable entry, protection class IP 54; on request: aluminium connection head, protection class IP 54 vertical | | | | |
| Electrical connection | | | | | |
| Mounting orient. | vertical | | | | |
| Temperature application range | max. + 80°C | | | | |
| Pressure resistance | max. 10 bar at + 20°C | | | | |



S 2 AM



Rod electrodes

with G1 screw-in nipple
made of stainless steel 316 Ti

| Technical data | S 2 B | S 2 BM | S 3 BM | S 4 BM |
|-------------------------------|--|---|--|--|
| Design | 2 control electrodes | 1 control electrode and 1 earth electrode | 2 control electrodes and 1 earth electrode | 3 control electrodes and 1 earth electrode |
| Electrode rods | stainless steel 316 Ti, 4 mm Ø, covered with PVDF shrinkdown tubing as desired (measured from nipple sealing surface) | | | |
| Lengths | approx. 1,500 mm | | | |
| Max. lengths | PVDF shrinkdown tubing and cast resin | | | |
| Insulators | stainless steel 316 Ti, G1 | | | |
| Screw-in nipple | aluminium connection head with M 20 x 1.5 cable entry, protection class IP 54 vertical | | | |
| Electrical connection | | | | |
| Mounting orient. | vertical | | | |
| Temperature application range | max. + 100°C | | | |
| Pressure resistance | max. 10 bar at + 20°C | | | |



S 3 BM



Rod electrodes, pressure-resistant

with G1 screw-in nipple made of
stainless steel 316 Ti and PEEK or PVDF

| Technical data | S 2 A/D | S 2 AM/D | S 3 AM/D |
|-------------------------------|--|---|--|
| Design | 2 control electrodes | 1 control electrode and 1 earth electrode | 2 control electrodes and 1 earth electrode |
| Electrode rods | stainless steel 316 Ti, 4 mm Ø, covered with polyolefin shrinkdown tubing as desired (measured from nipple sealing surface) | | |
| Lengths | approx. 2,500 mm | | |
| Max. lengths | polyolefin shrinkdown tubing, PEEK or PVDF and cast resin | | |
| Insulators | stainless steel 316 Ti and PEEK or PVDF, G1 | | |
| Screw-in nipple | PP connection head with M 20 x 1.5 cable entry, protection class IP 54; | | |
| Electrical connection | on request: aluminium connection head, protection class IP 54 vertical | | |
| Mounting orient. | vertical | | |
| Temperature application range | max. + 80°C | | |
| Pressure resistance | max. 15 bar at + 20°C | | |



S 2 AM/D



Rod electrodes, pressure-resistant

with G1 screw-in nipple made of
stainless-steel 316 Ti and PEEK or PVDF

| Technical data | S 2 B/D | S 2 BM/D | S 3 BM/D |
|-------------------------------|--|---|--|
| Design | 2 control electrodes | 1 control electrode und 1 earth electrode | 2 control electrodes und 1 earth electrode |
| Electrode rods | stainless steel 316 Ti, 4 mm Ø, covered with PVDF shrinkdown tubing as desired (measured from nipple sealing surface) | | |
| Lengths | approx. 1,500 mm | | |
| Max. lengths | PVDF shrinkdown tubing, PEEK or PVDF and cast resin | | |
| Insulators | stainless steel 316 Ti and PEEK or PVDF, G1 | | |
| Screw-in nipple | aluminium connection head with M 20 x 1.5 cable entry, protection class IP 54 vertical | | |
| Electrical connection | vertical | | |
| Mounting orient. | vertical | | |
| Temperature application range | max. + 100°C | | |
| Pressure resistance | max. 15 bar at + 20°C | | |



S 3 BM/D



Rod electrodes with G1 screw-in nipple made of PP

| Technical data | SE 1 | SE 2 | SE 2 M | SE 3 M | SE 4 M |
|-------------------------------|---|----------------------|---|--|--|
| Design | 1 control electrode or earth electrode | 2 control electrodes | 1 control electrode and 1 earth electrode | 2 control electrodes and 1 earth electrode | 3 control electrodes and 1 earth electrode |
| Electrode rods | stainless steel 316 Ti, 4 mm Ø, covered with polyolefin shrinkdown tubing as desired (measured from nipple sealing surface) approx. 2,500 mm | | | | |
| Lengths | | | | | |
| Max. lengths | | | | | |
| Insulators | PP, polyolefin shrinkdown tubing and cast resin | | | | |
| Screw-in nipple | PP, G1 | | | | |
| Electrical connection | PP connection head with M 16 x 1.5 cable entry, protection class IP 55, PTFE connection head on request | | | | |
| Mounting orient. | vertical | | | | |
| Temperature application range | max. + 80°C | | | | |
| Pressure resistance | max. 2 bar at + 20°C | | | | |



SE 2 M SE 3 M



Rod electrodes with adjustable electrode rods

| Technical data | SEV | SEV/T 1 | SEV/T 2 | SEV/T 3 |
|-------------------------------|---|--|---|--|
| Design | 1 control electrode or earth electrode | 1 control electrode or earth electrode | 2 control electrodes or 1 control electrode and 1 earth electrode | 3 control electrodes or 2 control electrodes and 1 earth electrode |
| Electrode rods | stainless steel 316 Ti, 4 mm Ø, adjustable, covered with polyolefin shrinkdown tubing as desired (measured from nipple sealing surface) approx. 1,000 mm | | | |
| Lengths | | | | |
| Max. lengths | | | | |
| Insulators | PTFE and polyolefin shrinkdown tubing | | | |
| Screw-in nipple | stainless steel 316 Ti, G ¹ / ₂ , on request G1 or G1 ¹ / ₄ | | PP, G1 | |
| Electrical connection | special angled plug for H07RN-F 1 x 1 mm ² , protection class IP 34 | | | |
| Mounting orient. | vertical | | | |
| Temperature application range | max. + 80°C | | max. + 60°C | |
| Pressure resistance | for pressureless applications | | | |



SEV/T 3

SEV, G1

Rod electrodes with more than 3 adjustable electrode rods and G2 screw-in nipple on request.



Rod electrodes

with G2 screw-in nipple made of PP

| Technical data | SR 1/ PP | SR 2/ PP | SR 2 M/ PP | SR 3 M/ PP | SR 4 M/ PP | SR 5 M/ PP |
|-------------------------------|--|-------------|---------------|---------------|---------------|---------------|
| Design | | | | | | |
| - control electrodes | 1 | 2 | 1 | 2 | 3 | 4 |
| - earth electrode | — | — | 1 | 1 | 1 | 1 |
| Electrode rods | stainless steel 316 Ti, 6 mm Ø, covered with polyolefin shrinkdown tubing as desired (measured from nipple sealing surface) approx. 3,000 mm | | | | | |
| Lengths | PP, polyolefin shrinkdown tubing and cast resin | | | | | |
| Max. lengths | PP, G2 | | | | | |
| Insulators | PP connection head with M 20 x 1.5 cable entry, protection class IP 55 | | | | | |
| Screw-in nipple | vertical | | | | | |
| Electrical connection | max. + 80°C | | | | | |
| Mounting orient. | max. 2 bar at + 20°C | | | | | |
| Temperature application range | | | | | | |
| Pressure resistance | | | | | | |



Rod electrodes

with G2 screw-in nipple made of PVDF

| Technical data | SR 1/ PVDF | SR 2/ PVDF | SR 2 M/ PVDF | SR 3 M/ PVDF | SR 4 M/ PVDF | SR 5 M/ PVDF |
|-------------------------------|--|---------------|-----------------|-----------------|-----------------|-----------------|
| Design | | | | | | |
| - control electrodes | 1 | 2 | 1 | 2 | 3 | 4 |
| - earth electrode | — | — | 1 | 1 | 1 | 1 |
| Electrode rods | stainless steel 316 Ti, 6 mm Ø, covered with PVDF shrinkdown tubing as desired (measured from nipple sealing surface) approx. 3,000 mm | | | | | |
| Lengths | PVDF, PVDF shrinkdown tubing and cast resin | | | | | |
| Max. lengths | PVDF, G2 | | | | | |
| Insulators | PVDF connection head with M 20 x 1.5 cable entry, protection class IP 55 | | | | | |
| Screw-in nipple | vertical | | | | | |
| Electrical connection | max. + 80°C | | | | | |
| Mounting orient. | max. 2 bar at + 20°C | | | | | |
| Temperature application range | | | | | | |
| Pressure resistance | | | | | | |

Electrode rods made of titanium, Hastelloy C, Hastelloy B or monel and screw-in nipple made of PVC or PTFE on request.

SR 5 M/PP
or
SR 5 M/PVDF



Rod electrodes made of special materials



Rod electrodes made of titanium

with G1 screw-in nipple made of PVDF



STI or SHC 1

| Technical data | STI 1 | STI 2 | STI 2 M | STI 3 M |
|-------------------------------|--|----------------------|---|--|
| Design | 1 control electrode or earth electrode | 2 control electrodes | 1 control electrode and 1 earth electrode | 2 control electrodes and 1 earth electrode |
| Electrode rods | titanium, ≤ 4 mm \varnothing , covered with PVDF shrinkdown tubing as desired (measured from nipple sealing surface) | | | |
| Lengths | approx. 2,500 mm | | | |
| Max. lengths | PVDF, PVDF shrinkdown tubing and cast resin | | | |
| Insulators | PVDF, G1 | | | |
| Screw-in nipple | PP connection head with M 20 x 1.5 cable entry, protection class IP 54; | | | |
| Electrical connection | on request: aluminium connection head, protection class IP 54 vertical | | | |
| Mounting orient. | vertical | | | |
| Temperature application range | max. + 80°C | | | |
| Pressure resistance | max. 2 bar at + 20°C | | | |

Version with screw-in nipple made of PTFE and/or shrinkdown tubing made of PTFE available on request.



STI 3 M or SHC 3 M



Rod electrodes made of Hastelloy C

with G1 screw-in nipple made of PVDF

| Technical data | SHC 1 | SHC 2 | SHC 2 M | SHC 3 M |
|----------------|---|----------------------|---|--|
| Design | 1 control electrode or earth electrode | 2 control electrodes | 1 control electrode and 1 earth electrode | 2 control electrodes and 1 earth electrode |
| Electrode rods | Hastelloy C, ≤ 4 mm \varnothing , covered with PVDF shrinkdown tubing | | | |

All other technical data as for rod electrodes described above.

Version with screw-in nipple made of PTFE and/or shrinkdown tubing made of PTFE available on request.



Rod electrodes made of Hastelloy B

with G1 screw-in nipple made of PVDF

| Technical data | SHB 1 | SHB 2 | SHB 2 M | SHB 3 M |
|-------------------------------|---|----------------------|---|--|
| Design | 1 control electrode or earth electrode | 2 control electrodes | 1 control electrode and 1 earth electrode | 2 control electrodes and 1 earth electrode |
| Electrode rods | Hastelloy B, ≤ 4 mm \varnothing , covered with PVDF shrinkdown tubing as desired (measured from nipple sealing surface) | | | |
| Lengths | approx. 2,500 mm | | | |
| Max. lengths | PVDF, PVDF shrinkdown tubing and cast resin | | | |
| Insulators | PVDF, G1 | | | |
| Screw-in nipple | PP connection head with M 20 x 1.5 cable entry, protection class IP 54; | | | |
| Electrical connection | on request: aluminium connection head, protection class IP 54 | | | |
| Mounting orient. | vertical | | | |
| Temperature application range | max. + 80°C | | | |
| Pressure resistance | max. 2 bar at + 20°C | | | |

Version with screw-in nipple made of PTFE and/or shrinkdown tubing made of PTFE available on request.



SHB 1,
SMO 1
or
STA 1



Rod electrodes made of monel

with G1 screw-in nipple made of PVDF

| Technical data | SMO 1 | SMO 2 | SMO 2 M | SMO 3 M |
|----------------|---|-------|---------|---------|
| Design | see above | | | |
| Electrode rods | monel, ≤ 4 mm \varnothing , covered with PVDF shrinkdown tubing | | | |

All other technical data as for rod electrodes described above.

Version with screw-in nipple made of PTFE and/or shrinkdown tubing made of PTFE available on request.



SHB 3 M,
SMO 3 M
or
STA 3 M



Rod electrodes made of tantalum

with G1 screw-in nipple made of PVDF

| Technical data | STA 1 | STA 2 | STA 2 M | STA 3 M |
|----------------|--|-------|---------|---------|
| Design | see above | | | |
| Electrode rods | tantalum, ≤ 4 mm \varnothing , covered with PVDF shrinkdown tubing | | | |

All other technical data as for rod electrodes described above.



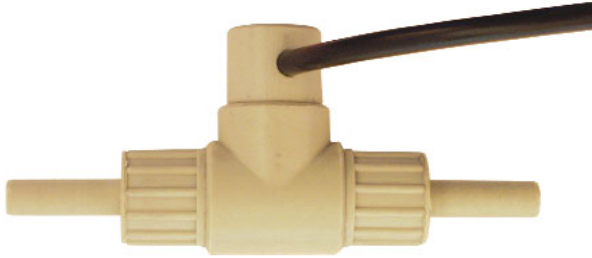
Electrodes for special applications

WME electrode for indication of the lack of water in a hose

- for installation in a hose

Rod electrode without screw-in nipple, with mounting stand

- for installation in shallow collection tubs



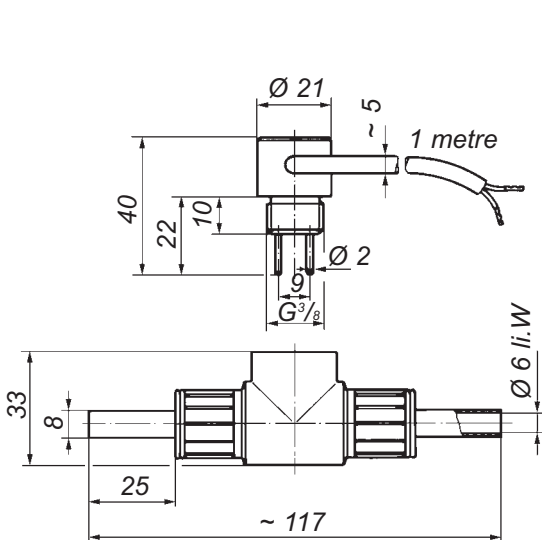
WME

Picture with smaller scale compared to adjacent picture



SON 3 M/ST

| Technical data | WME | SON 3 M/ST |
|--------------------------------|---|--|
| Design | 1 control electrode and 1 earth electrode | 2 control electrodes and 1 earth electrode |
| Electrode rods | stainless steel 316 Ti, 2 mm Ø | stainless steel 316 Ti, 4 mm Ø, covered with polyolefin shrinkdown tubing |
| Lengths | approx. 22 mm (measured from nipple sealing surface) | acc. to drawing below, other lengths on request |
| Insulators | PP and cast resin | PP, polyolefin shrinkdown tubing and cast resin |
| Screw-in nipple | PP, G^{3/8} | — |
| Electrical connection | PVC cable 2 x 0.75; | PVC cable 3 x 0.75; |
| Mounting | 1 metre, longer on request; using the T-piece made of PP, dimensions see drawing below depending on the application | other cable on request using the mounting stand made of stainless steel 316 Ti, dimensions see drawing below |
| Mounting orientation | | vertical |
| Temperature appl. range | max. + 60°C | max. + 80°C |
| Pressure resistance | | for pressureless applications |



View A (reduced)

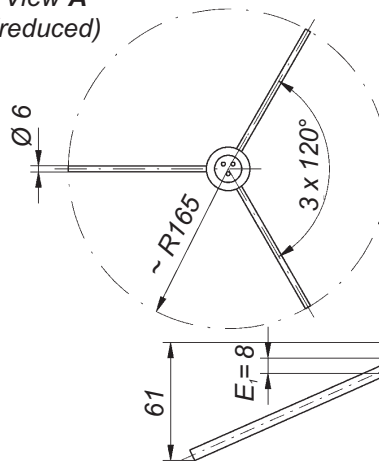
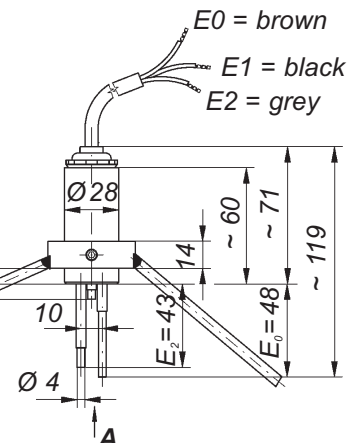


Diagram with smaller scale compared to adjacent drawing





Electrode relays

for automatic level control
or signalling with conductive liquids

Jola electrode relays are used for the automatic control of pumps or electromagnetic valves as well as overflow or run-dry protection in wells or tanks with conductive liquids.

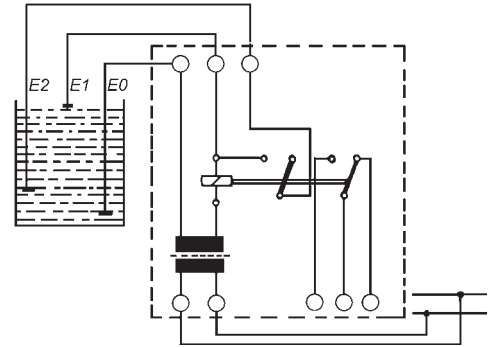
The liquid levels are monitored by electrodes which give switching commands to the electronic relay if they come into contact with the liquid.

For a two-point control system, you require two control electrodes and one earth electrode.

If you only wish to signal a liquid level, the control electrode E1 and the earth electrode will suffice.

You can also use a metallic, conductive tank wall as an earth connection in place of the earth electrode.

However, we recommend the use of a separate earth electrode in all cases.



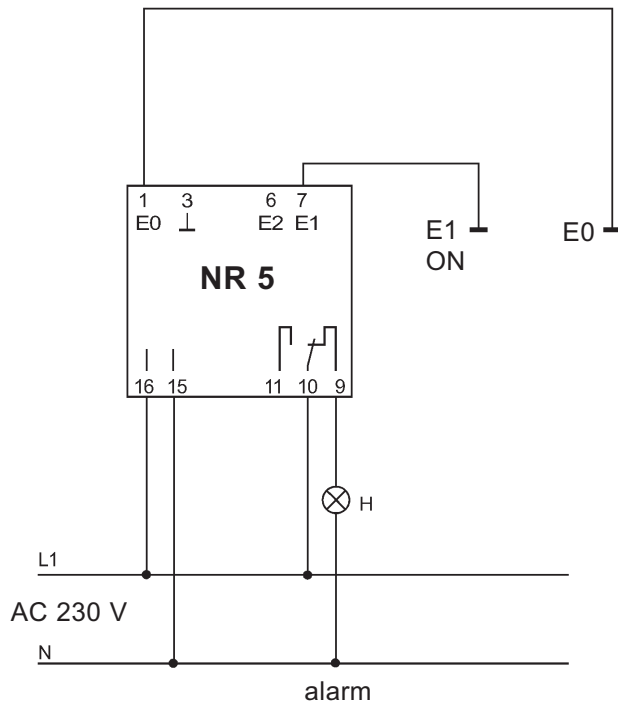
Circuit diagram of an electrode control
E0 = earth electrode,
E1 and E2 = control electrodes

| Function | Type designation | Page | Output | Self-hold |
|---|------------------|--------|---|-----------|
| Relay for signalling 1 limit level or for 1 two-point control | NR 5 NR 5 A | 7-1-15 | 1 potential-free changeover contact based on quiescent current principle based on working current principle | with |
| | NR 3 NR 3 A | 7-1-21 | 1 potential-free changeover contact based on quiescent current principle based on working current principle | with |
| | NR 5/G | 7-1-29 | 1 potential-free changeover contact based on quiescent current principle | with |
| | ES 5/G | 7-1-33 | 1 potential-free changeover contact based on working current principle | with |
| Relay for signalling 3 limit levels | ER 53 | 7-1-37 | 2 make contacts and 1 break contact based on working current principle with common Wurzelkontakt | without |

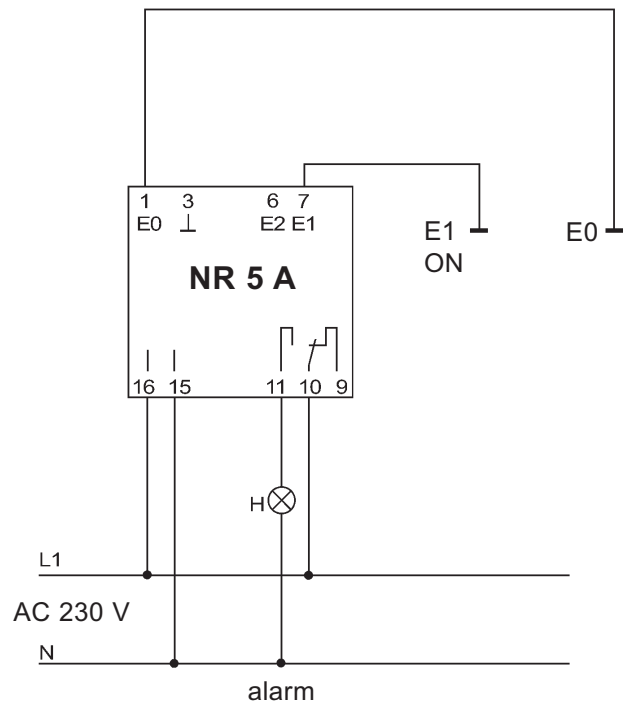
A switch-on and switch-off delay of between 0.5 and 3 seconds depending on the conductivity of the medium renders the units insensitive to short-term contacting (e.g. due to splashes) and short contact interruptions.

Connection diagrams

NR 5

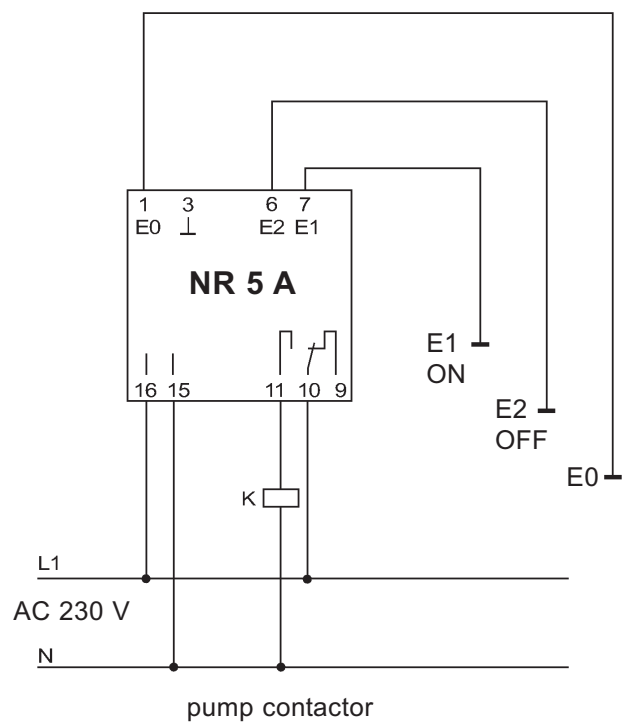
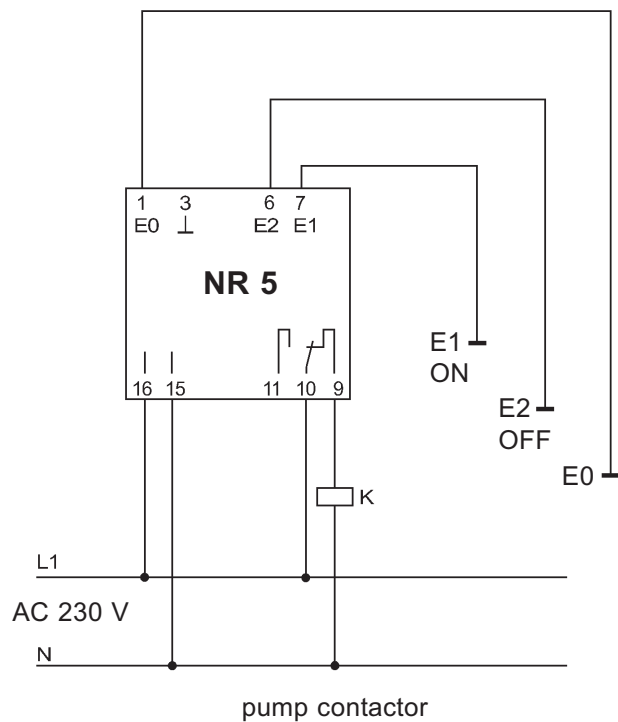


NR 5 A

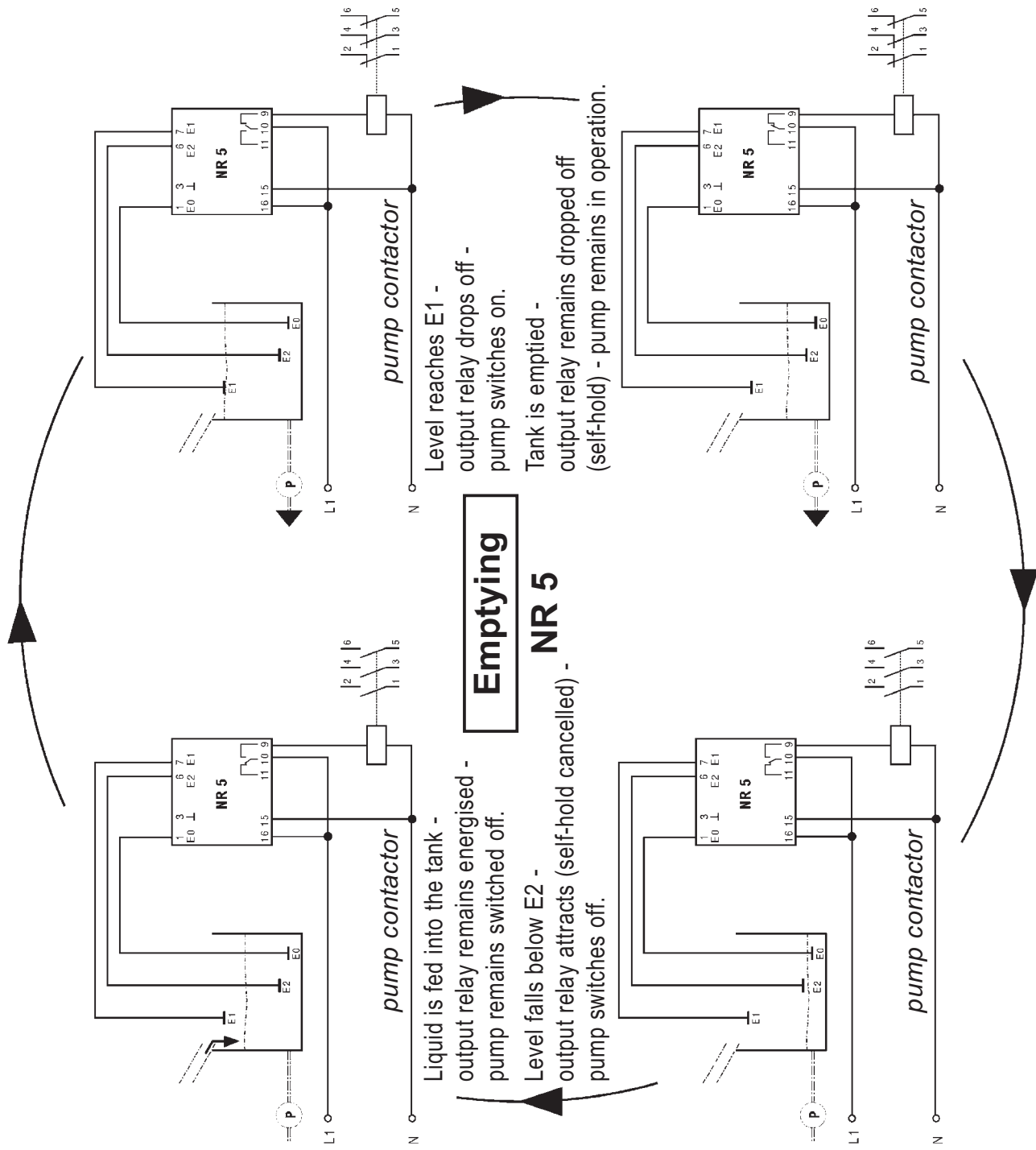


Attention! When several NR 5 or NR 5 A electrode relays are used for automatic level control or signalling in the same tank, the **terminal 3 serves** to connect the earth of each NR 5 or NR 5 A electrode relay.

The protective ground must never be connected to terminal 3!

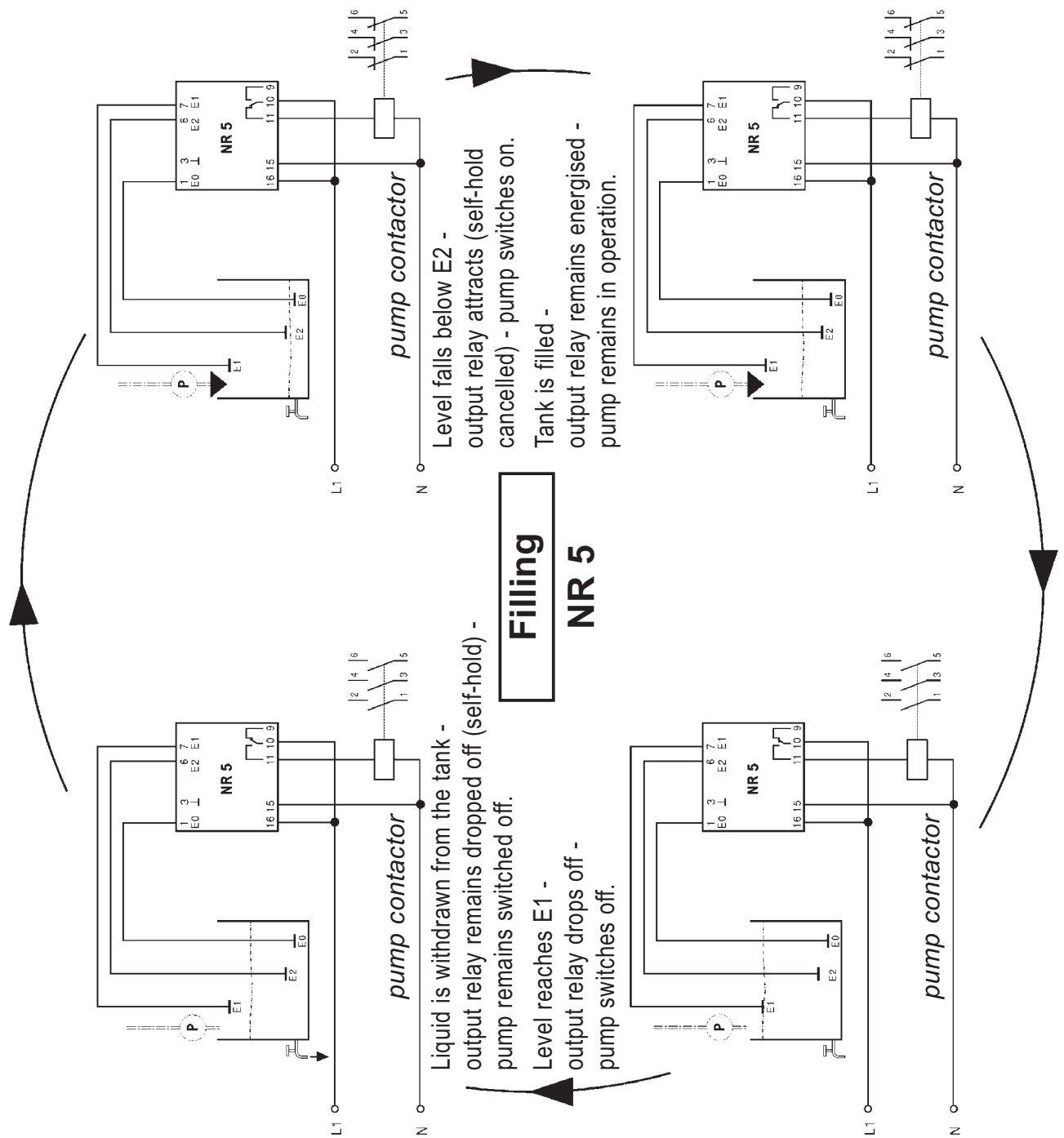


Output contact shown in no-current condition of the relay



N.B.

The connection of electrodes E0, E1 and E2 to the NR 5 electrode relay is always the same. The function selection "Emptying" or "Filling" is made on the basis of the terminal assignment chosen at the relay output.



N.B.

The connection of electrodes E0, E1 and E2 to the NR 5 electrode relay is always the same. The function selection “Emptying” or “Filling” is made on the basis of the terminal assignment chosen at the relay output.

Instructions and notice for the use of one or several NR 5 or NR 5 A electrode relays

- When using several electrode relays for automatic level control or signalling in the same tank, the earth electrode E0 may only be connected to one electrode relay. The other electrode relays must be connected to each other via their earth terminal (terminal 3). It is important to note that only a maximum of 8 inputs can be used. The protective ground must never be connected to terminal 3!

- **Max. connecting cable length between electrode relay(s) and electrodes:**

connection of one electrode relay:

- electrode conductors are laid together in a common cable: 1,000 metres
- each conductor is laid separately: 1,000 metres

connection of several electrode relays (max. 4):

- electrode conductors are laid together in a common cable: 1,000 metres
- each conductor is laid separately: 1,000 metres

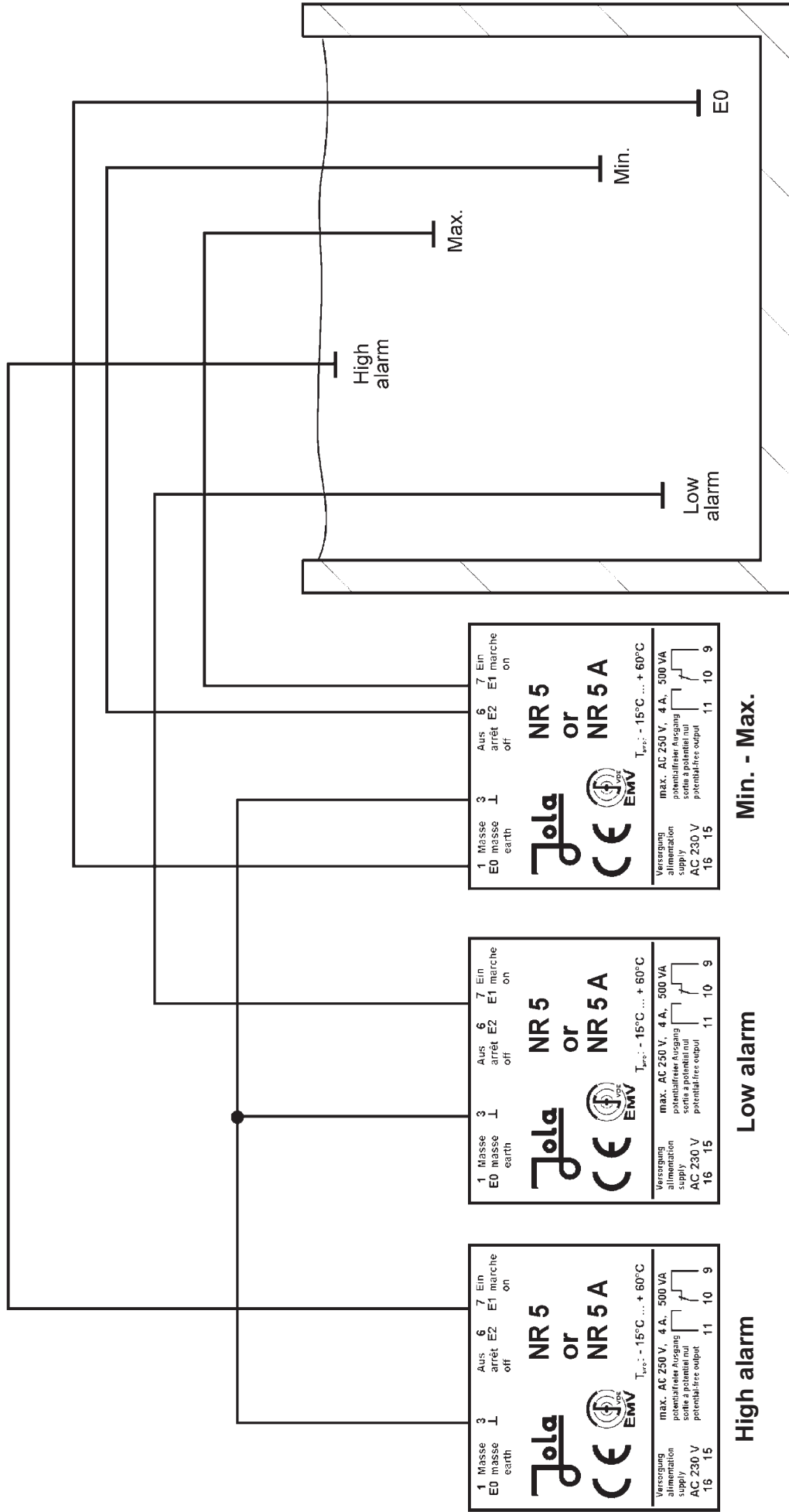
- Relevant information for a safe functioning:

If the conductor for the earth electrode E0 is laid separately and the conductors for the other electrodes are laid together in a common cable, the response sensitivity of the electrode control might be reduced compared to the normal, and that especially with very long cables.

- **Connection of one control electrode to several electrode relays (see pages 7-1-27 and 7-1-28):**

If a control electrode is connected to the inputs (E1 or E2) of several electrode relays, the response sensitivity of these inputs is reduced depending on their number.

- when connecting to 1 input: response sensitivity 30 kOhm
- when connecting to 2 inputs: response sensitivity 15 kOhm
- when connecting to 3 inputs: response sensitivity 10 kOhm
- when connecting to 4 inputs: response sensitivity 7.5 kOhm



Output contact shown in no-current condition of the relays

Example for the input assignment for high alarm + low alarm + level control (min. - max.)

NR 5 (quiescent current principle): the output relay is not activated (e.g. no water in the tank).

NR 5 A (working current principle): the output relay is energised, when the input is activated (e.g. water in the tank).



NR 3 and NR 3 A electrode relays

for signalling a limit level
or for level control

Electrode relay for U-bar mounting, with connection terminals on top of housing and with 2 built-in LEDs for signalling the respective switching status.

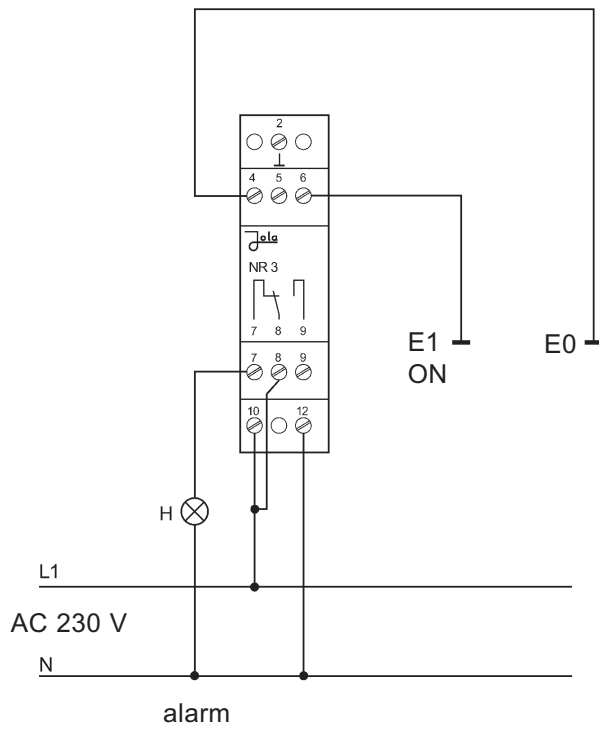
The units are designed for switch cabinet mounting or installation in a suitable protective housing and may therefore only be mounted/installed in these locations. They are suitable for use in clean environments only.



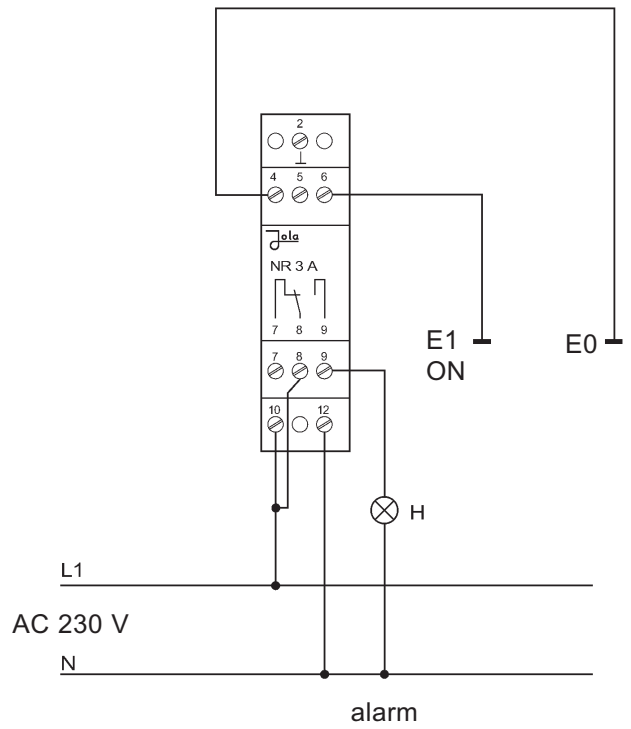
| Technical data | NR 3 | NR 3 A |
|--|---|---|
| Alternative supply voltages (AC versions: terminals 10 and 12; DC versions: - terminal 10: —, - terminal 12: +) | <ul style="list-style-type: none"> - AC 230 V (supplied if no other supply voltage is specified in the order) or - AC 240 V or - AC 115 V or - AC 24 V or - DC 24 V or - DC 12 V or <p>in these two cases, the unit must only be connected to a low safety voltage which corresponds to the safety regulations relating to the application</p> <ul style="list-style-type: none"> - further supply voltages on request | |
| Power input | approx. 3 VA | |
| Electrode circuit (terminals 4, 5, 6) | 3 terminals (under safety extra low voltage SELV), acting on 1 output relay with self-hold | |
| - no-load voltage | 9 V _{eff} □□ 10 Hz (safety extra low voltage SELV) | |
| - short-circuit current | max. 0.5 mA _{eff} | |
| - response sensitivity | approx. 30 kOhm or approx. 33 μS (electric conductance) | |
| Controlled circuit (terminals 7, 8, 9) | 1 single-pole potential-free changeover contact with self-hold | |
| Functioning | based on the quiescent current principle | based on the working current principle |
| Switching status indicators | 1 green LED, lights when output relay is energised 1 red LED, lights when output relay is not energised | |
| Switching voltage | max. AC 250 V | |
| Switching current | max. AC 4 A | |
| Switching capacity | max. 500 VA | |
| Housing | insulating material, 75 x 22.5 x 100 mm | |
| Connection | terminals on top of housing | |
| Protection class | IP 20 | |
| Mounting | clip attachment for U-bar to DIN 46277 and EN 50022 | |
| Mounting orientation | any | |
| Temperature application range | from - 20°C to + 60°C | |
| Max. cable length between electrode relay and electrode(s) | 1,000 metres | |
| EMC | for interference emission in accordance with the appliance-specific requirements for households, business and commerce as well as small companies, and for interference immunity in accordance with the appliance-specific requirements for industrial companies. | |

Connection diagrams

NR 3

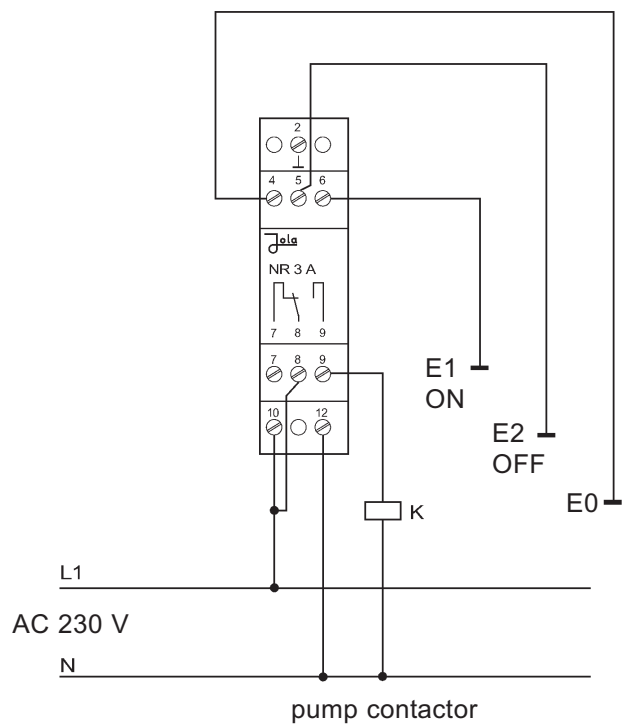
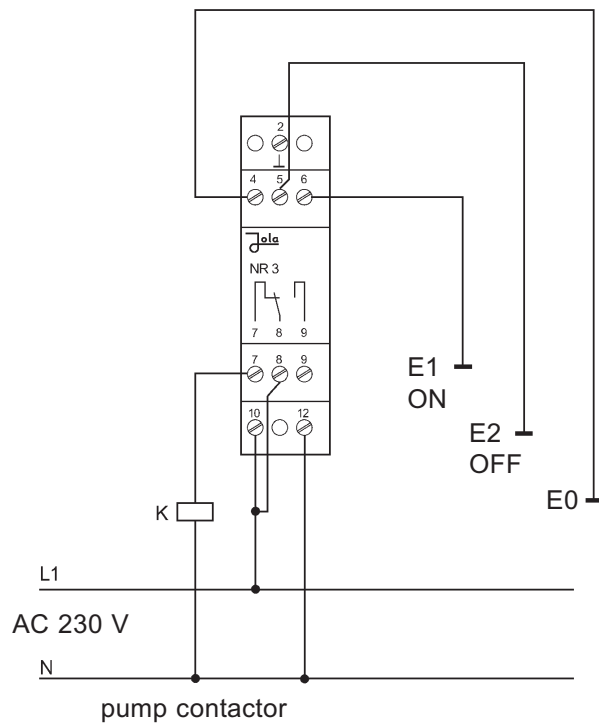


NR 3 A

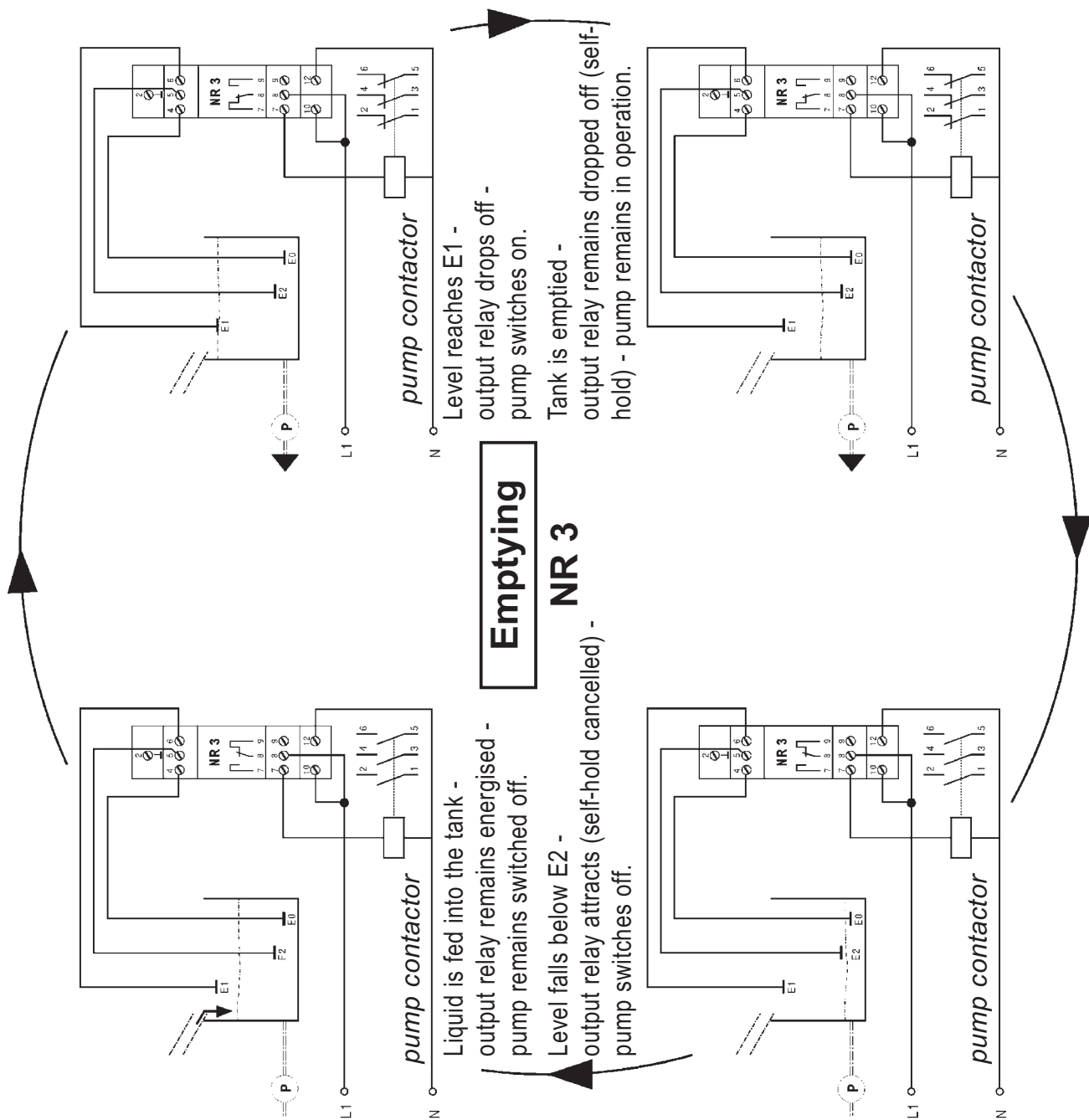


Attention! When several NR 3 or NR 3 A electrode relays are used for automatic level control or signalling in the same tank, the **terminal 2 serves** to connect the earth of each NR 3 or NR 3 A electrode relay.

The protective ground must never be connected to terminal 2!

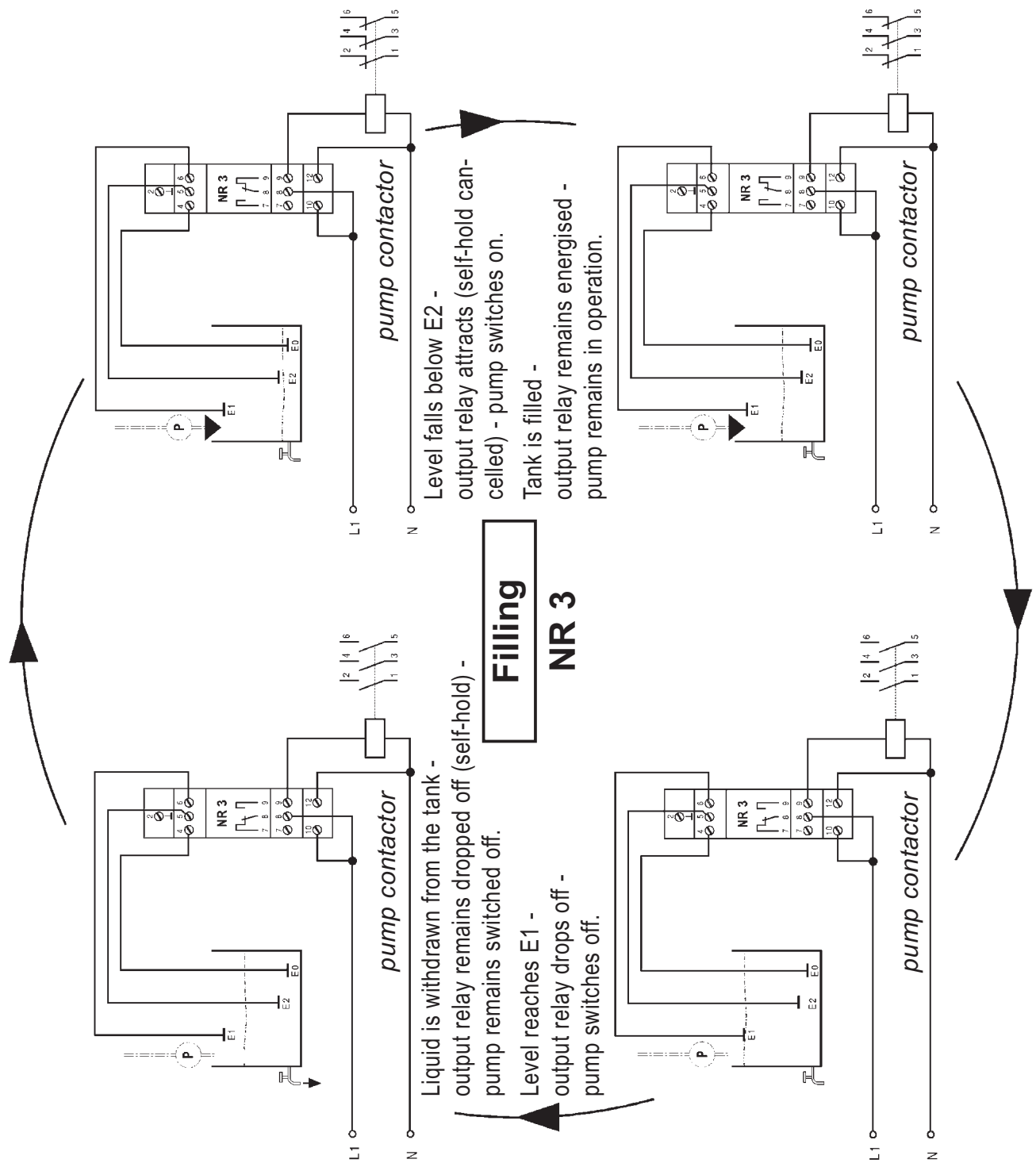


Output contact shown in no-current condition of the relay



N.B.

The connection of electrodes E0, E1 and E2 to the NR 3 electrode relay is always the same. The function selection “Emptying” or “Filling” is made on the basis of the terminal assignment chosen at the relay output.



N.B.

The connection of electrodes E0, E1 and E2 to the NR 3 electrode relay is always the same. The function selection “Emptying” or “Filling” is made on the basis of the terminal assignment chosen at the relay output.

Instructions and notice for the use of one or several NR 3 or NR 3 A electrode relays

- When using several electrode relays for automatic level control or signalling in the same tank, the earth electrode E0 may only be connected to one electrode relay. The other electrode relays must be connected to each other via their earth terminal (terminal 2). It is important to note that only a maximum of 8 inputs can be used. The protective ground must never be connected to terminal 2!

- **Max. connecting cable length between electrode relay(s) and electrodes:**

connection of one electrode relay:

- electrode conductors are laid together in a common cable: 1,000 metres
- each conductor is laid separately: 1,000 metres

connection of several electrode relays (max. 4):

- electrode conductors are laid together in a common cable: 1,000 metres
- each conductor is laid separately: 1,000 metres

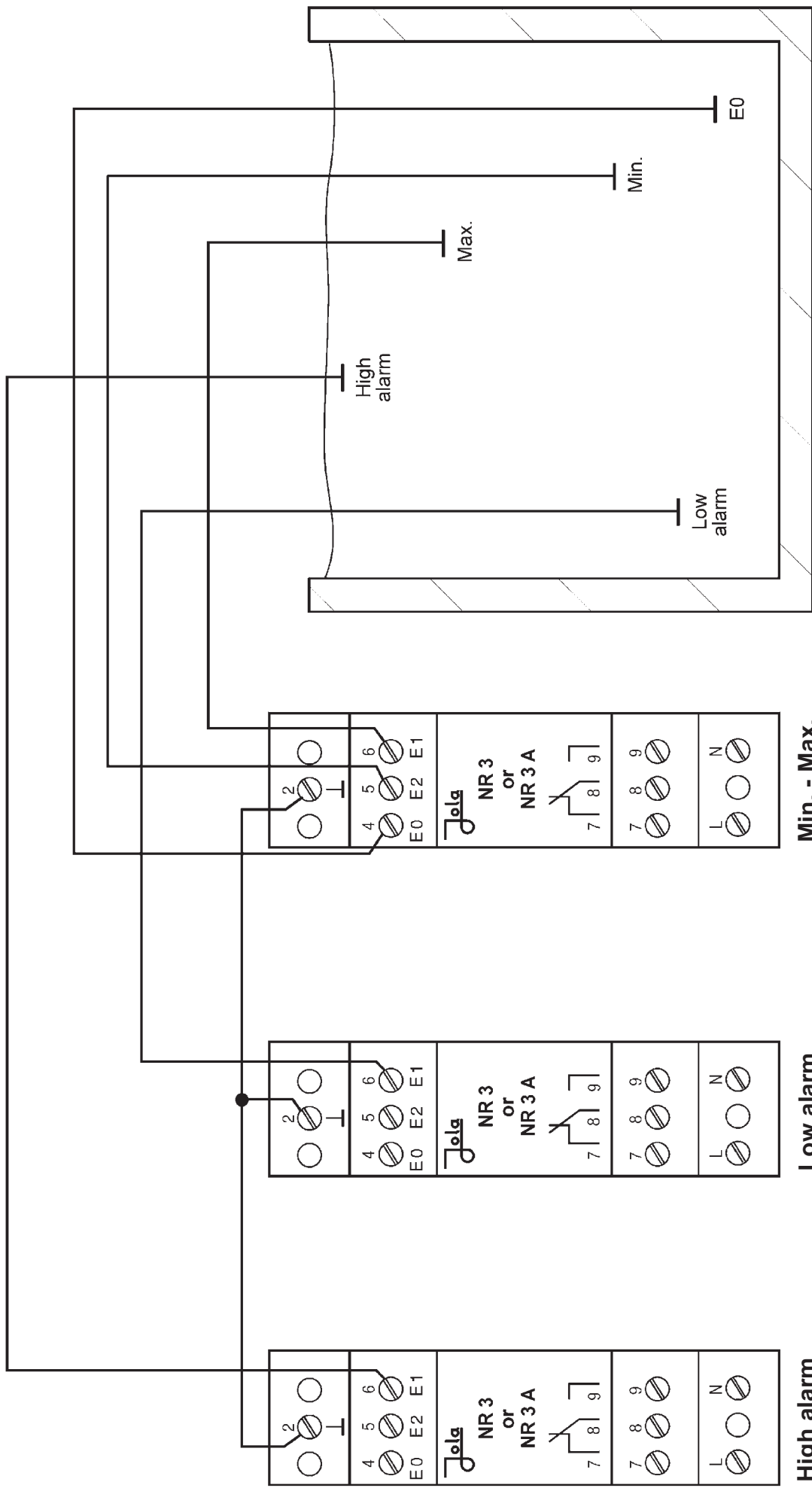
- Relevant information for a safe functioning:

If the conductor for the earth electrode E0 is laid separately and the conductors for the other electrodes are laid together in a common cable, the response sensitivity of the electrode control might be reduced compared to the normal, and that especially with very long cables.

- **Connection of one control electrode to several electrode relays (see pages 7-1-27 and 7-1-28):**

If a control electrode is connected to the inputs (E1 or E2) of several electrode relays, the response sensitivity of these inputs is reduced depending on their number.

- when connecting to 1 input: response sensitivity 30 kOhm
- when connecting to 2 inputs: response sensitivity 15 kOhm
- when connecting to 3 inputs: response sensitivity 10 kOhm
- when connecting to 4 inputs: response sensitivity 7.5 kOhm



Output contact shown in no-current condition of the relays

Example for the input assignment for high alarm + low alarm + level control (min. - max.)

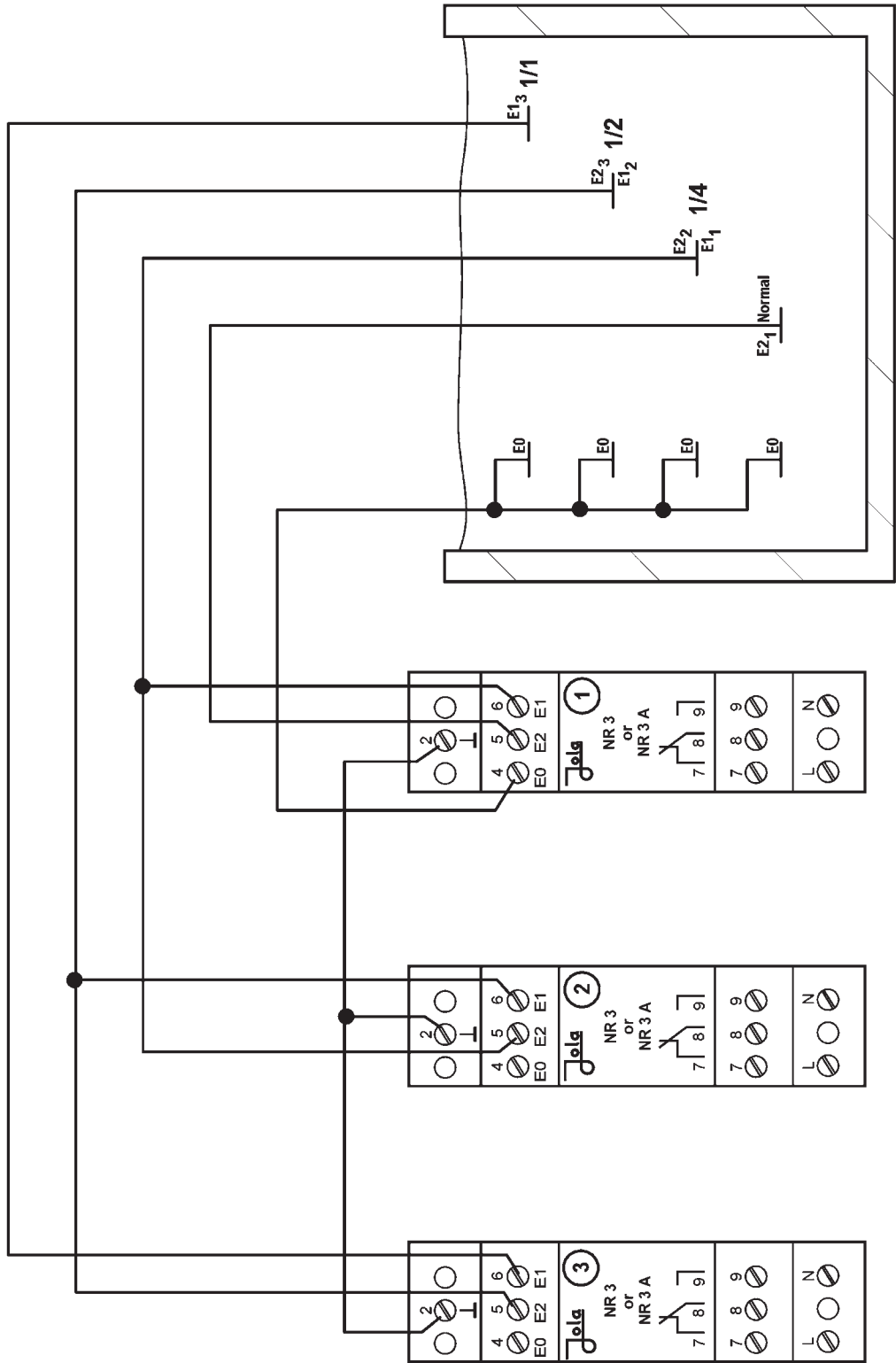
NR 3 (quiescent current principle): the output relay is not activated (e.g. no water in the tank).

NR 3 A (working current principle): the output relay is energised, when the input is activated (e.g. water in the tank).

• **Connection of one control electrode to several electrode relays:**

If a control electrode is connected to the inputs (E1 or E2) of several electrode relays, the response sensitivity of these inputs is reduced depending on their number.

- when connecting to 1 input: response sensitivity 30 kOhm
- when connecting to 2 inputs: response sensitivity 15 kOhm
- when connecting to 3 inputs: response sensitivity 10 kOhm
- when connecting to 4 inputs: response sensitivity 7.5 kOhm



Output contact shown in no-current condition of the relays

Multiple using of control electrodes inputs:

If a control electrode is connected to the inputs (E1 or E2) of several electrode relays, the response sensitivity of these inputs is reduced. The control electrodes for 1/4 and 1/2 act simultaneously on inputs (E1 or E2) of 2 electrode relays. So the response sensitivity of these inputs is reduced to 15 kOhm.

NR 3 (quiescent current principle): the output relay is energised, when the input is not activated (e.g. no water in the tank).

NR 3 A (working current principle): the output relay is energised, when the input is activated (e.g. water in the tank).



NR 5/G electrode relay

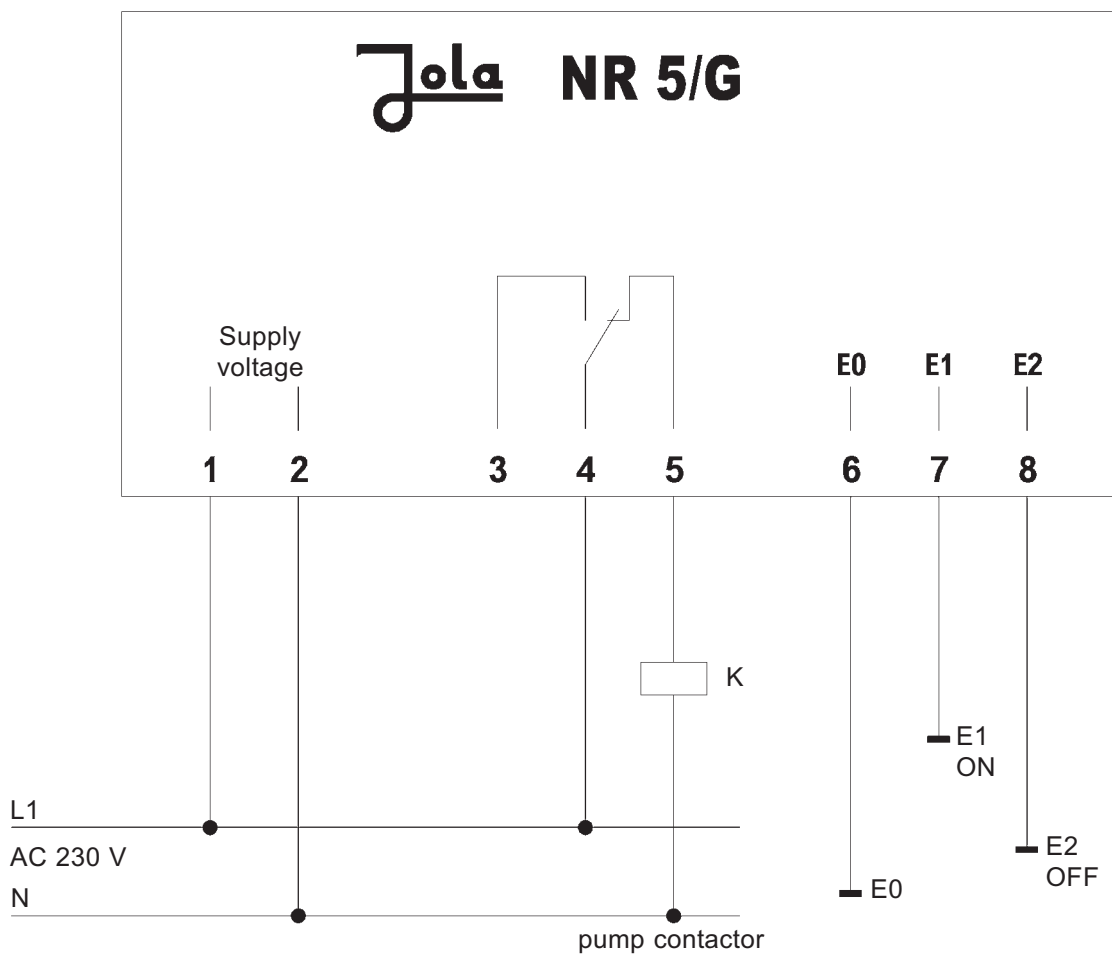
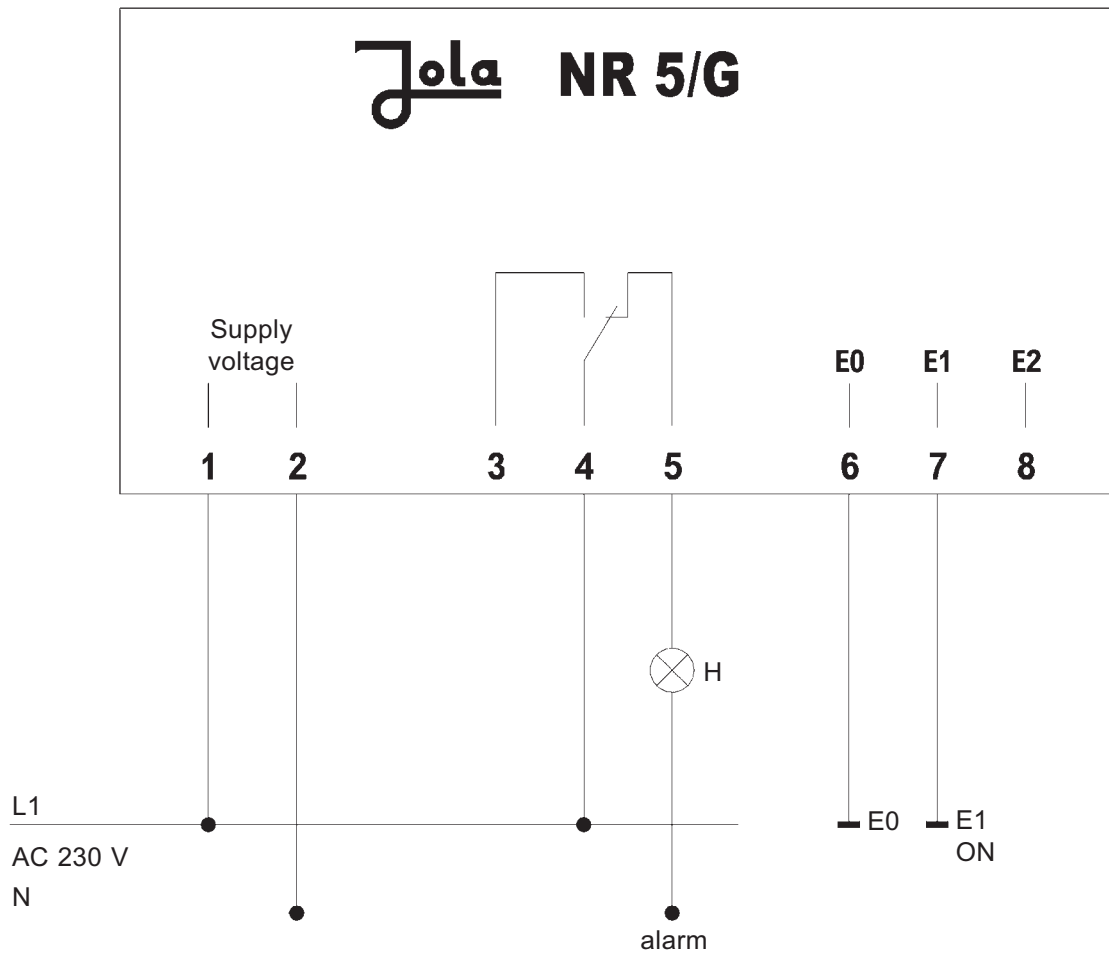
for signalling a limit level or
for level control

Electrode relay in surface-mount housing,
with transparent cover and with 2 built-in
LEDs (inside the housing) for signalling the
respective switching status

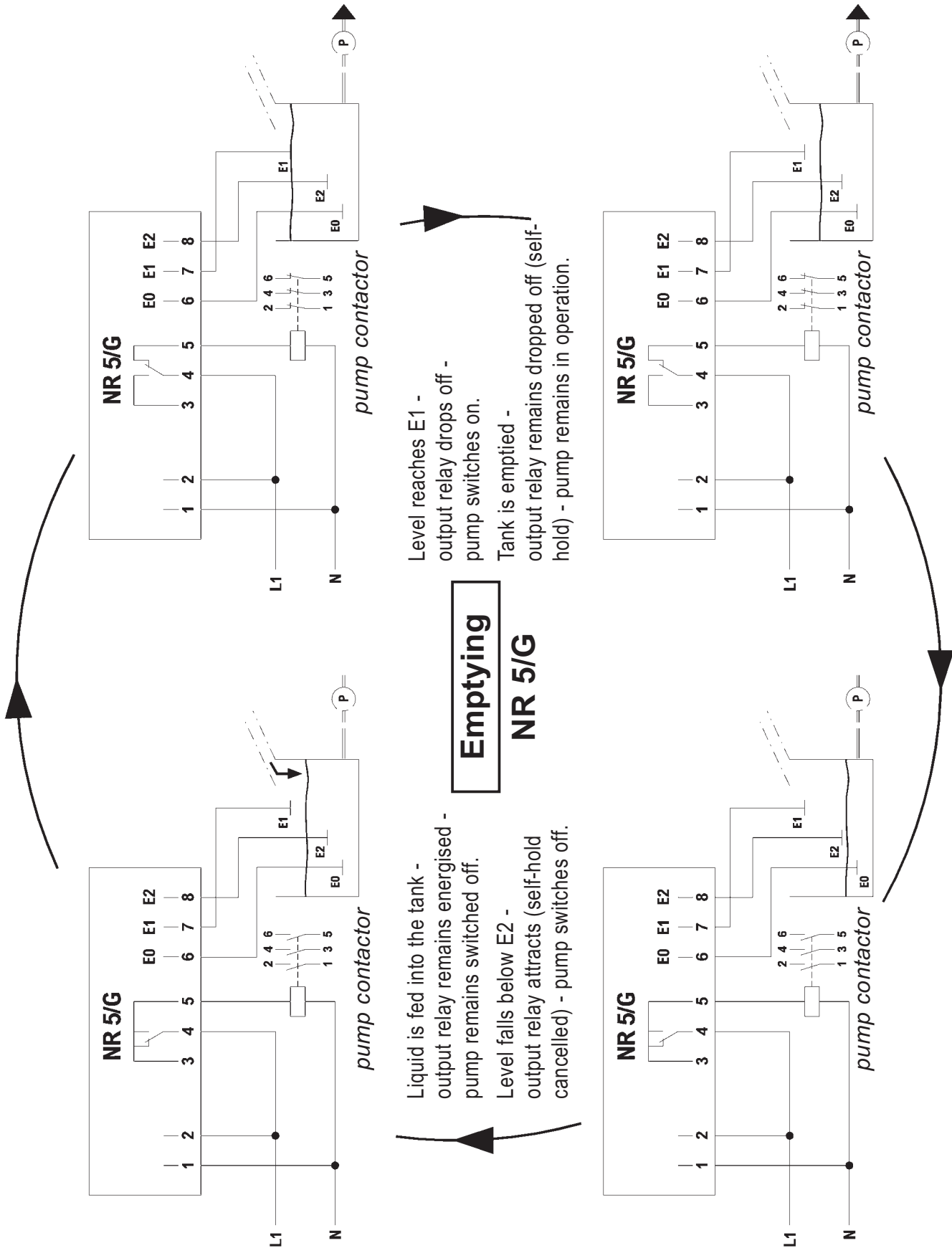


| Technical data | NR 5/G |
|---|--|
| Alternative supply voltages: (AC versions: terminals 1 and 2; DC versions: - terminal 1: -, - terminal 2: +) | <ul style="list-style-type: none"> - AC 230 V (supplied if no other supply voltage is specified in the order) or - AC 240 V or - AC 115 V or - AC 24 V or - DC 24 V or - DC 12 V or <p>in these two cases, the unit must only be connected to a low safety voltage which corresponds to the safety regulations relating to the application</p> <p>- further supply voltages on request</p> |
| Power input Electrode circuit (terminals 6, 7, 8) - no-load voltage - short-circuit current - response sensitivity | <p>approx. 3 VA</p> <p>3 terminals (with safety extra low voltage SELV), acting on 1 output relay with self-hold</p> <p>9 V_{eff} \square 10 Hz (safety extra low voltage SELV) max. 0.5 mA_{eff} approx. 30 kOhm or approx. 33 μS (electric conductance)</p> |
| Controlled circuit (terminals 3, 4, 5) | <p>1 single-pole potential-free changeover contact with self-hold</p> <p>based on the quiescent current principle</p> |
| Functioning Switching status indicators | <p>1 green LED, lights when output relay is energised 1 red LED, lights when output relay is not energised</p> |
| Switching voltage | max. AC 250 V |
| Switching current | max. AC 4 A |
| Switching capacity | max. 500 VA |
| Housing | insulating material, with 3 screw connections |
| Connection | internal terminals |
| Protection class | IP 54 |
| Mounting | using 4 screws |
| Mounting orientation | any |
| Temperature application range | from - 20°C to + 60°C |
| Max. cable length between electrode relay and electrode(s) | 1,000 metres |
| EMC | for interference emission in accordance with the appliance-specific requirements for households, business and commerce as well as small companies, and for interference immunity in accordance with the appliance-specific requirements for industrial companies. |

Connection diagrams

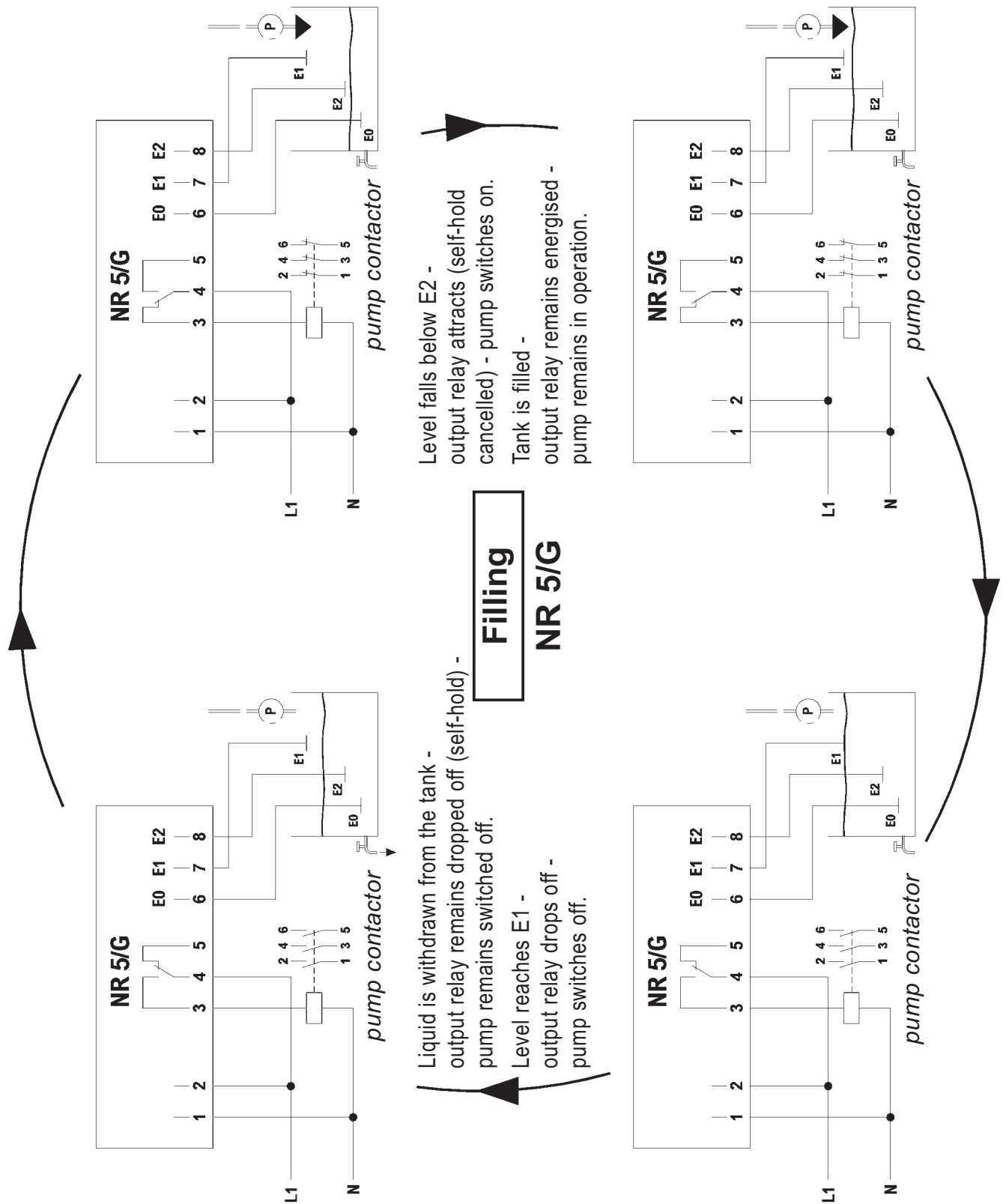


Output contact shown in no-current condition of the relay



N.B.

The connection of electrodes E0, E1 and E2 to the NR 5/G electrode relay is always the same. The function selection “Emptying” or “Filling” is made on the basis of the terminal assignment chosen at the relay output.



N.B.

The connection of electrodes E0, E1 and E2 to the NR 5/G electrode relay is always the same. The function selection “Emptying” or “Filling” is made on the basis of the terminal assignment chosen at the relay output.



ES 5/G electrode relay

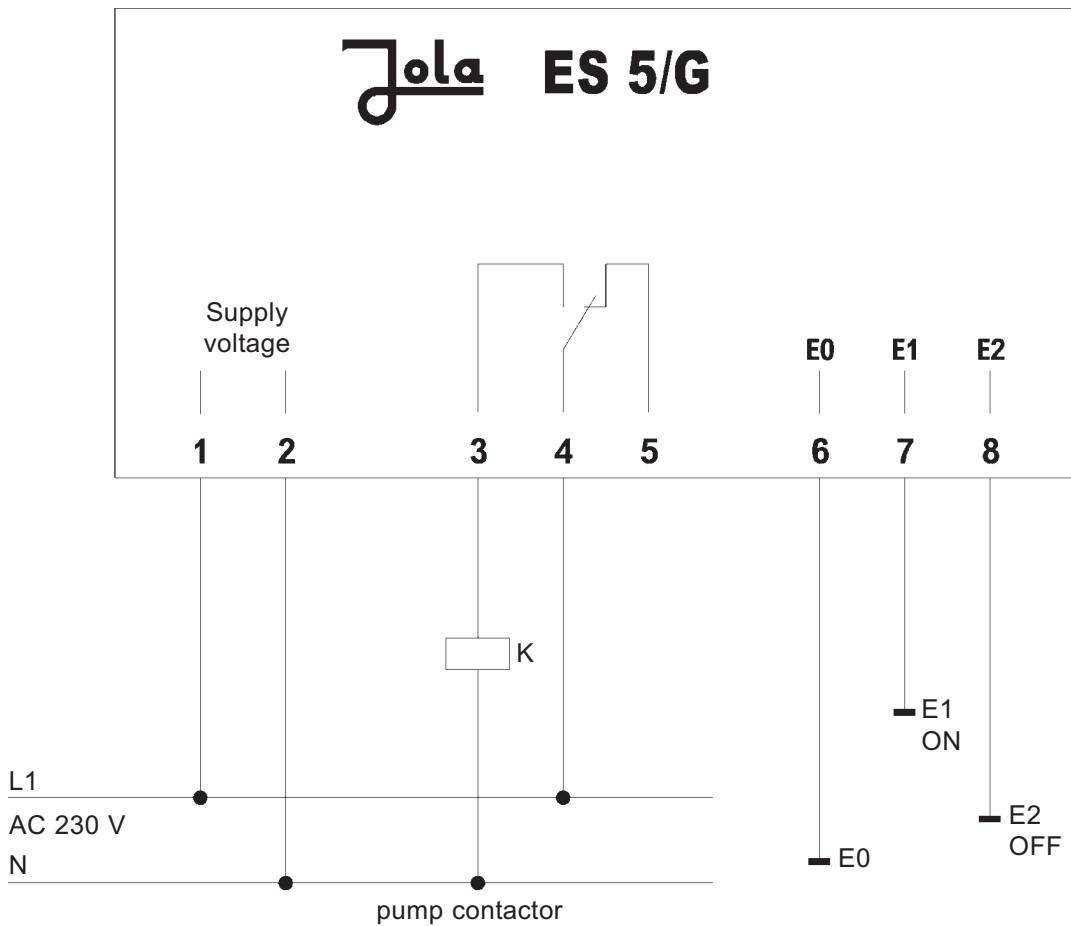
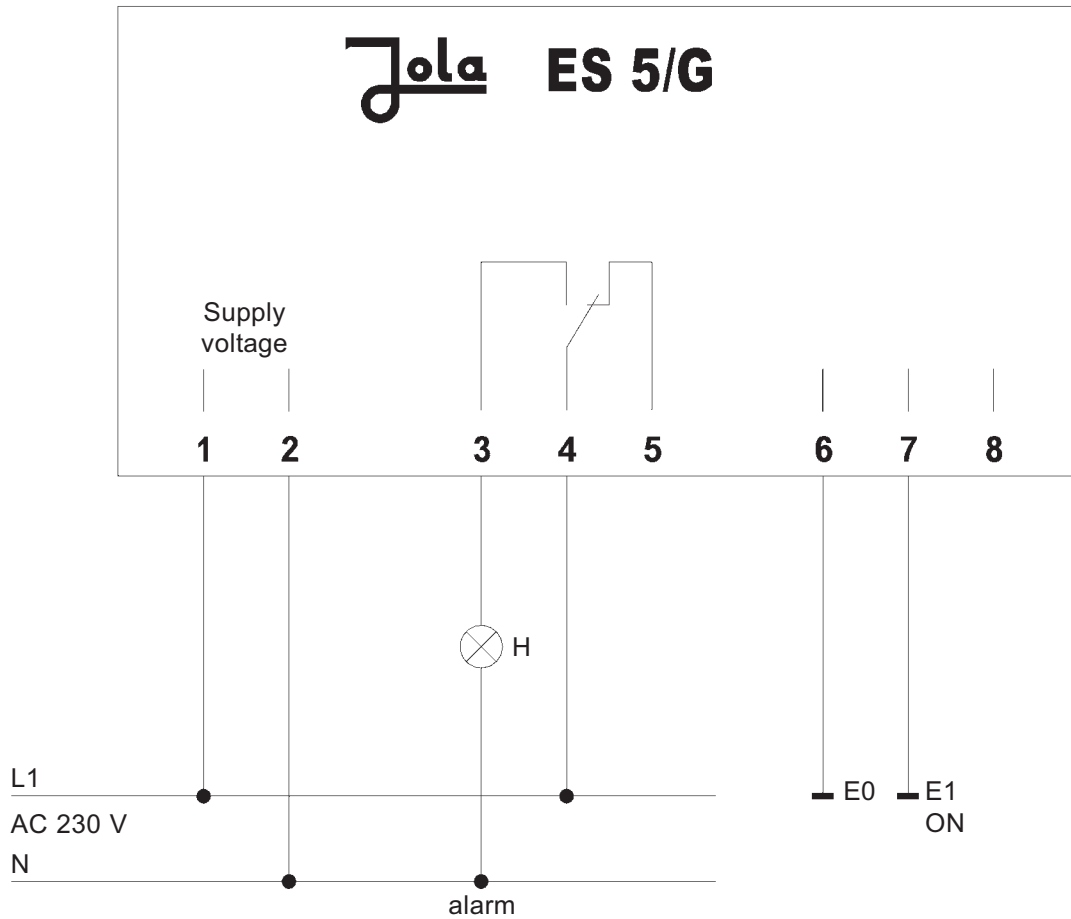
for signalling a limit level or
for level control

Electrode relay in surface-mount housing, with transparent cover, mains monitoring indicator and switching status indicator inside the housing

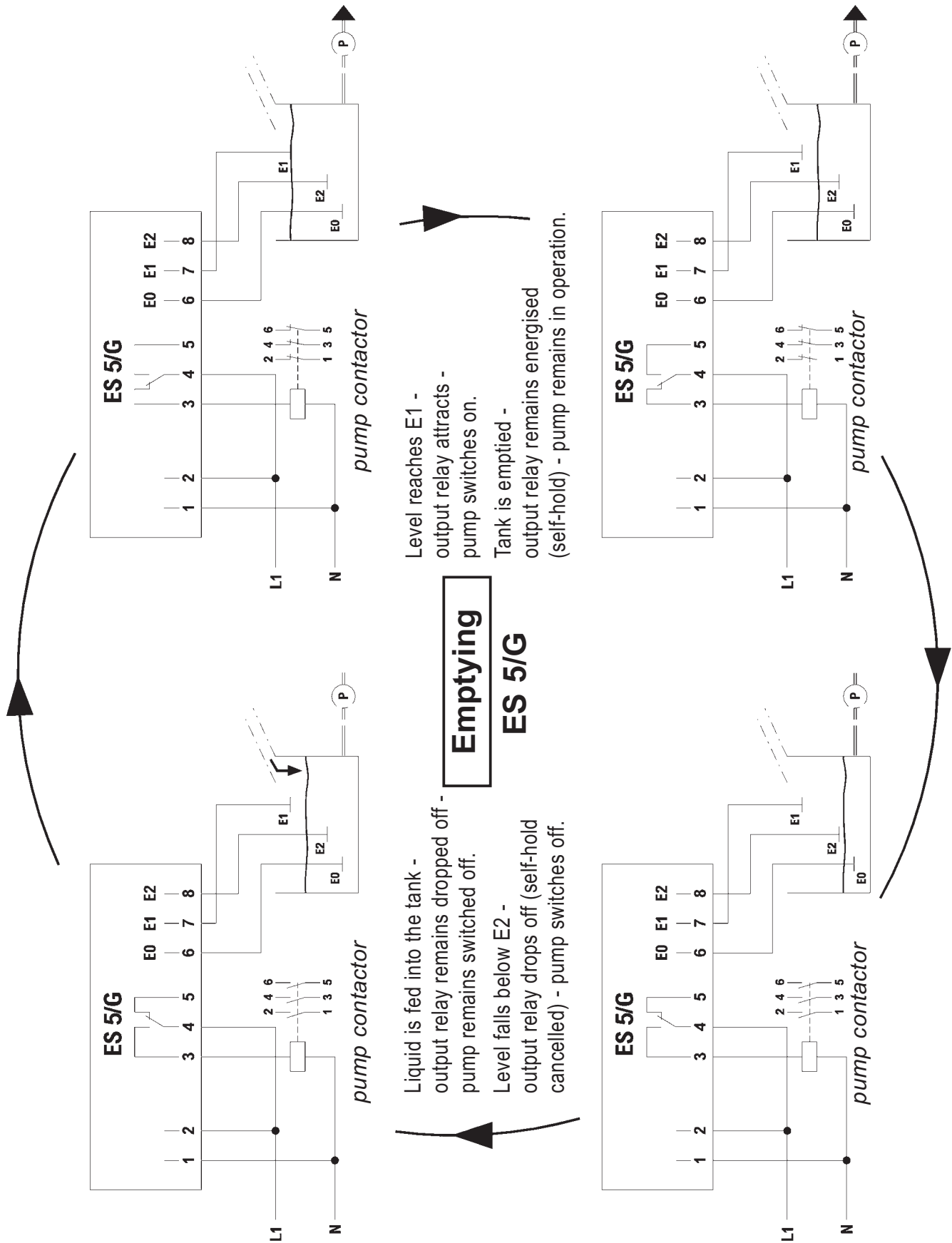


| Technical data | ES 5/G |
|--|---|
| Alternative supply voltages (terminals 1 and 2) | <ul style="list-style-type: none"> - AC 230 V (supplied if no other supply voltage is specified in the order) - AC 240 V or - AC 115 V or - AC 24 V or - further AC supply voltages on request |
| Mains monitoring indicator | 1 green LED |
| Power input | approx. 3 VA |
| Electrode circuit (terminals 6, 7, 8) | 3 terminals (with safety extra low voltage SELV), acting on 1 output relay with self-hold |
| <ul style="list-style-type: none"> - no-load voltage - short-circuit current - response sensitivity | <ul style="list-style-type: none"> approx. AC 22 V (safety extra low voltage SELV) approx. 2 mA approx. 30 kOhm or approx. 33 μS (electric conductance) |
| Controlled circuit (terminals 3, 4, 5) | 1 single-pole potential-free changeover contact with self-hold |
| Functioning | based on the working current principle |
| Switching status indicator | 1 red LED, lights when output relay is energised |
| Switching voltage | max. AC 250 V |
| Switching current | max. AC 4 A |
| Switching capacity | max. 500 VA |
| Housing | insulating material, with 3 screw connections |
| Connection | internal terminals |
| Protection class | IP 54 |
| Mounting | using 4 screws |
| Mounting orientation | any |
| Temperature application range | from - 20°C to + 60°C |
| Max. cable length between electrode relay and electrode(s) | 100 metres |
| EMC | for interference emission in accordance with the appliance-specific requirements for households, business and commerce as well as small companies, and for interference immunity in accordance with the appliance-specific requirements for industrial companies. |

Connection diagrams

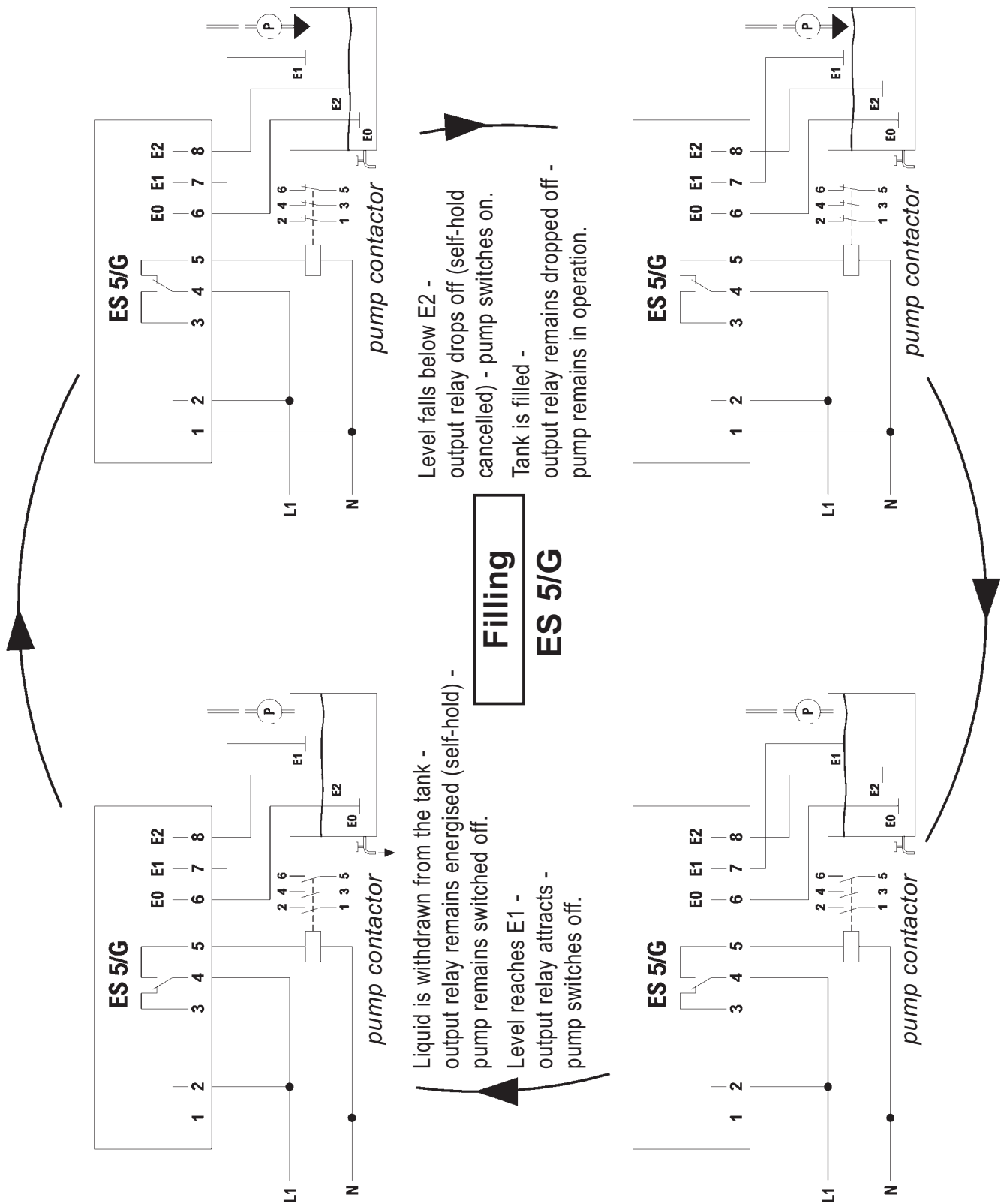


Output contact shown in no-current condition of the relay



N.B.

The connection of electrodes E0, E1 and E2 to the ES 5/G electrode relay is always the same. The function selection "Emptying" or "Filling" is made on the basis of the terminal assignment chosen at the relay output.



N.B.

The connection of electrodes E0, E1 and E2 to the ES 5/G electrode relay is always the same. The function selection “Emptying” or “Filling” is made on the basis of the terminal assignment chosen at the relay output.

Jola ER 53 electrode relay

for signalling 3 limit levels

Electrode relay for U-bar mounting or surface mounting, with connection terminals on top of housing, with mains monitoring indicator and with 3 built-in LEDs for signalling the activation of the 3 inputs.

The unit is designed for switch cabinet mounting or installation in a suitable protective housing and may therefore only be mounted/installed in these locations. It is suitable for use in clean environments only.



Technical data

ER 53

Alternative supply voltages:

(AC versions:
terminals 15 and 16;

DC versions:

- terminal 15: -
- terminal 16: +)

- AC 230 V (supplied if no other supply voltage is specified in the order) or
 - AC 240 V or
 - AC 115 V or
 - AC 24 V or
 - DC 24 V or
 - DC 12 V or
- } in these two cases, the unit must only be connected to a low safety voltage which corresponds to the safety regulations relating to the application
- further supply voltages on request

Mains monitoring indicator

Power input

Electrode circuit

(terminals 1, 5, 6, 7)

- no-load voltage
- short-circuit current
- response sensitivity

Controlled circuit

(terminals 9, 10, 11, 12)

1 yellow LED
approx. 3 VA

4 terminals (with safety extra low voltage SELV), acting on 3 output relays without self-hold
9 V_{eff} \square 10 Hz (safety extra low voltage SELV)
max. 0.5 mA_{eff}
approx. 30 kOhm or approx. 33 μ S (electric conductance)

2 make (NO) contacts (terminals 10 and 11) and 1 break (NC) contact (terminal 9) with common root contact (terminal 12)

based on the working current principle

Functioning

Switching status indicators

3 green LEDs light correspondingly to the activation of the electrode inputs E1, E2 and E3 (each time when a conductive path is created between the rod of the earth electrode E0 and the non-insulated electrode rod sensor surface of a control electrode)

Switching voltage
Switching current
Switching capacity
Housing
Connection
Protection class
Mounting

max. AC 250 V
max. AC 4 A
max. 500 VA
insulating material, 75 x 55 x 110 mm
terminals on top of housing
IP 20
clip attachment for U-bar to DIN 46277 and EN 50022
or fastening via 2 boreholes
any
from - 20°C to + 60°C

Mounting orientation
Temperature application range

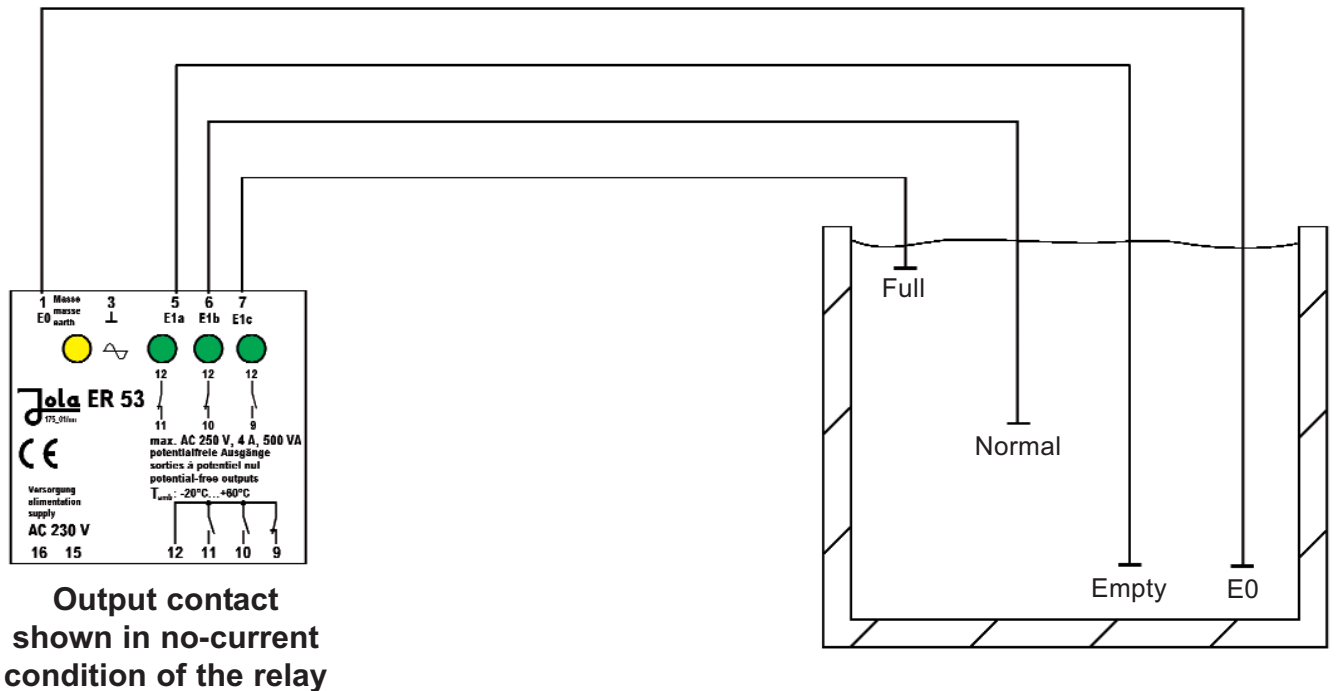
Max. cable length between electrode relay and electrode(s)

EMC

1,000 metres

for interference emission in accordance with the appliance-specific requirements for households, business and commerce as well as small companies, and for interference immunity in accordance with the appliance-specific requirements for industrial companies.

Application example: ER 53 with a 4-rod electrode for signalling 3 limit levels

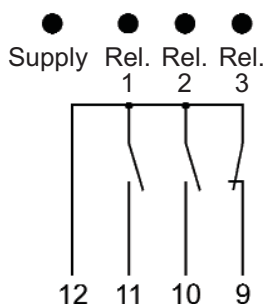


Relevant information:

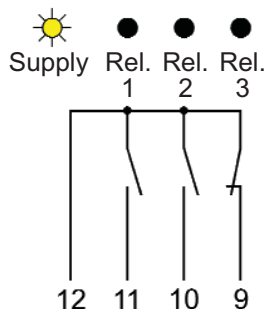
When several electrode relays are used for automatic level control or signalling in the same tank, the earth electrode E0 may only be connected to one electrode relay. The other electrode relays are to be connected to each other via their earth terminal (terminal 3 for NR 5 and ER 53 or terminal 2 for NR 3) as shown on pages 7-1-19/20 and 7-1-25/26. It is important to note that only a maximum of 8 inputs can be used.

The protective ground must never be connected to terminal 2 or 3!

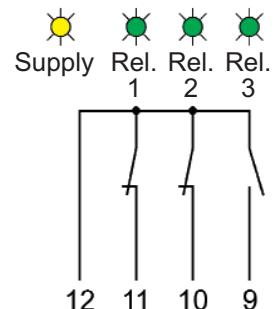
Position of output contacts of the ER 53 electrode relay



LEDs dark:
electrode relay without voltage



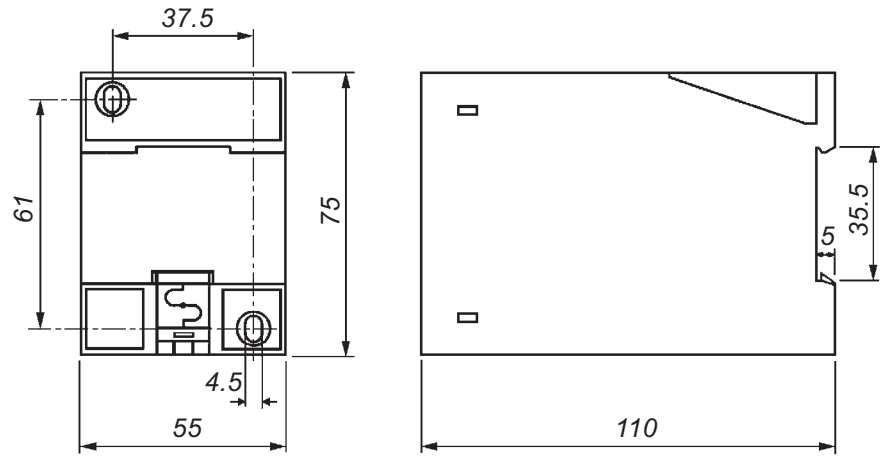
yellow LED lights, green LEDs dark:
electrode relay under voltage, electrodes dry (tank empty)



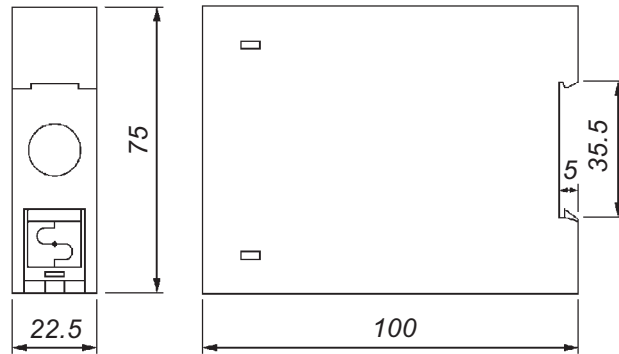
yellow LED lights, green LEDs light:
electrode relay under voltage, electrodes wet (tank full)

Dimensional drawings

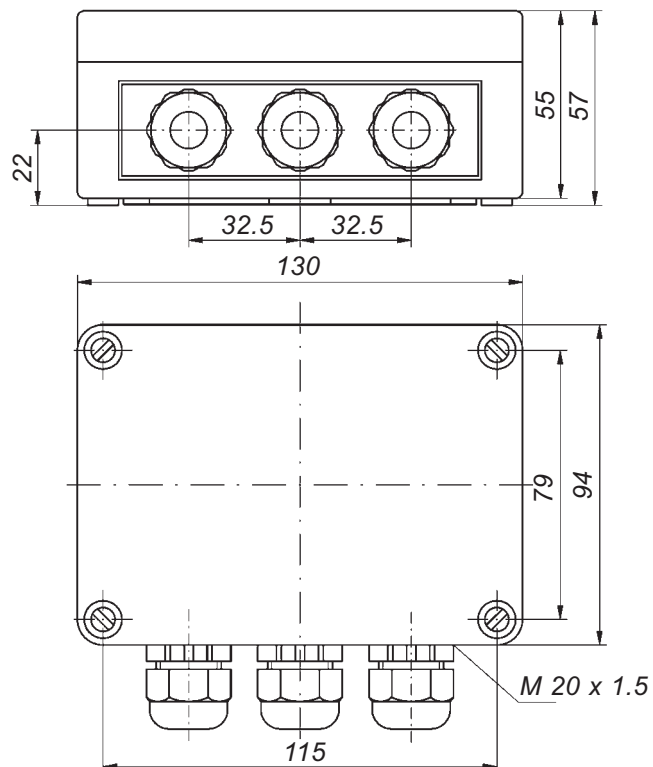
NR 5, NR 5 A, ER 53



NR 3, NR 3 A



NR 5/G, ES 5/G





“Pumpswitch” floor electrode with integrated evaluation electronics and relay output



The Jola “Pumpswitch” device is a conductive floor electrode with integrated evaluation electronics and a delayed switch-off power relay for the direct switching of a flat suction pump.

- Pump switches on from a water level of 3 mm
- If the water level falls below 3 mm, the pump switches off again after a preset shutoff delay
- Connection via three-wire cable:
 - brown: power supply L1
 - black: switching wire for the pump
 - blue: joint reference conductor N
- Reliable galvanic separation of the contactable electrodes:
 - due to creepage and air distances ≥ 8 mm
 - due to safety transformer and safety relay with a voltage resistance ≥ 4 kV



“Pumpswitch” floor electrode with integrated evaluation electronics and relay output



View from below
(looking at the electrode plates)

“Pumpswitch” with mounting stand

Mode of operation

The “Pumpswitch” floor electrode is equipped with two integral single electrodes in the form of two electrode plates: 1 control electrode and 1 earth electrode.

In the electrode housing, there is an evaluation electronics device with output relay with a switching contact which is looped into the pump circuit. As soon as an electrically conductive liquid creates a conductive connection between the two electrode plates, the built-in output relay in the electrode housing is switched on. The output relay operates on the working current principle: in other words, the relay is energised when the electrodes are wet. Once the electrodes are free again after the liquid has been pumped off, the output relay switches off again after a preset time delay.

The electrode circuit is reliably galvanically separated from the supply voltage and the pump circuit.

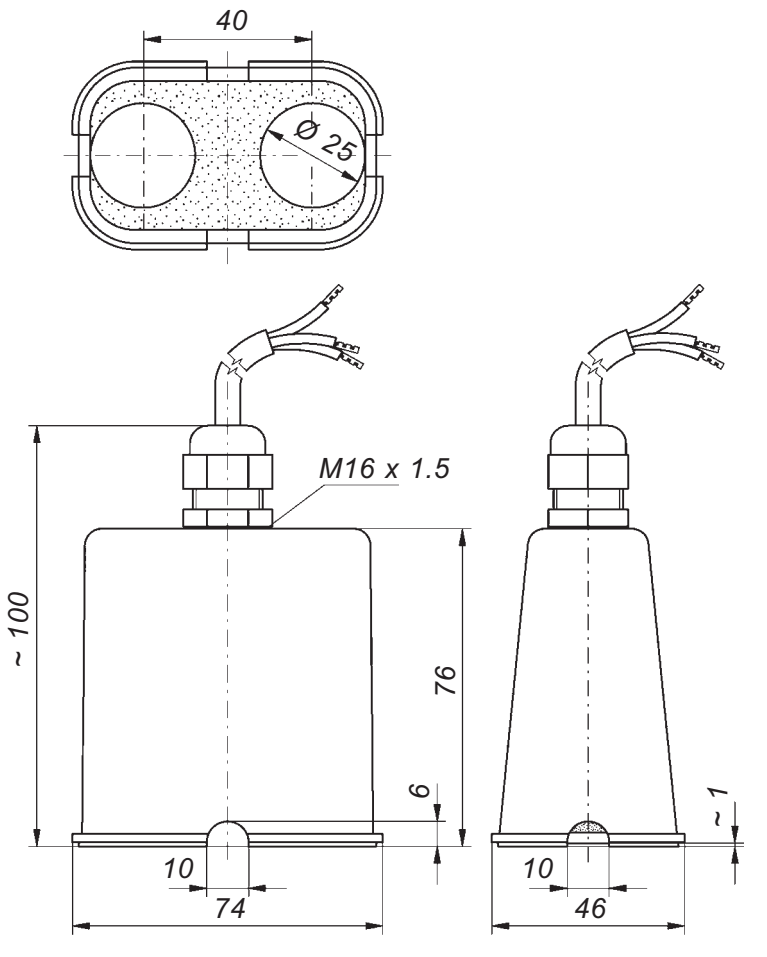
Important notes to ensure safe use

You have to ensure that the rated output of the pump to be switched does not exceed the switching capacity of the integrated output relay.

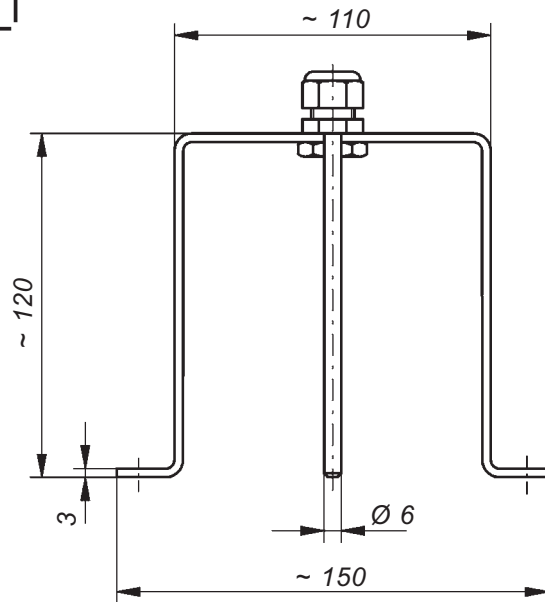
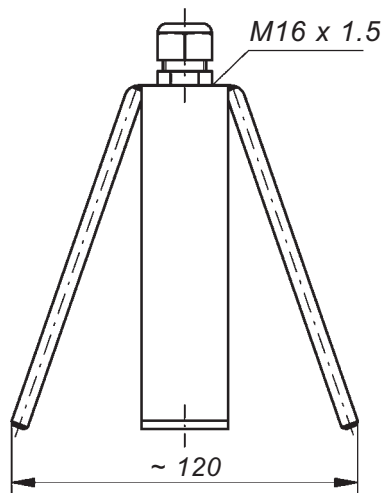
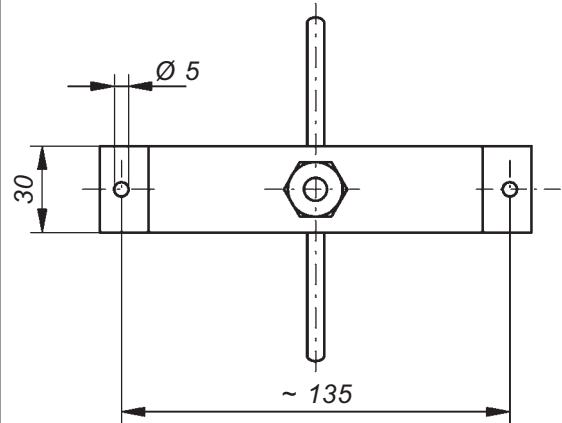
In order to ensure that the unit works as desired, the floor electrode may only be used in cases in which the electrode plates are free again once the liquid has been pumped off. Electrically conductive residues caused by such things as sludge can result in permanent activation of the floor electrode.

The floor electrode may not be used in aggressive liquids that attack the electrode plates, the electrode housing or the connecting cable.

| Technical data | “Pumpswitch” |
|---|--|
| Area of application | for the direct switching of a flat suction pump if a water level rises above a preset low level |
| Electrode plates | 2 electrode plates made of stainless steel 316 Ti |
| Response height | 3 mm |
| Housing | PP and cast resin |
| Weight of electrode | approx. 300 g |
| Electrical connection | H05RN-F cable, 3 x 0.75; length 2 m, other length on request |
| Supply voltage (to brown and blue) | AC 230 V; other supply voltage on request |
| Power requirements of integrated electronics | approx. 3 VA |
| Electrode circuit: | |
| Electrode voltage | approx. 10 V _{eff} 50 Hz |
| Electrode current | max. 0.5 mA _{eff} |
| Response sensitivity | approx. 30 kΩ or approx. 33 μS (conductance) |
| Galvanic separation | air and creepage distances ≥ 8 mm; voltage resistance ≥ 4 kV |
| Pump circuit (to black and blue): | |
| Performance data of the looped relay contact | max. 4 (2) A, max. 500 VA; other values on request |
| Shutoff delay | to be defined when ordering: between 5 seconds and 90 seconds |
| Temperature application range | from - 20°C to + 60°C, higher temperature on request |
| Mounting accessory | mounting stand made of stainless steel 316 Ti (optional) |
| Protection class | IP 68 |
| Operating position | upright on the floor or suspended in a mounting stand |
| EMC | for interference emission in accordance with the appliance-specific requirements for households, business and commerce as well as small companies, and for interference immunity in accordance with the appliance- specific requirements for industrial companies. |



**Option:
mounting stand made of
stainless steel 316 Ti
(diagrams with smaller
scale compared to
adjacent drawings)**



The units described in this documentation may only be installed, connected and started up by suitably qualified personnel!

Subject to deviations from the diagrams and technical data.

The details in this brochure are product specification descriptions and do not constitute assured properties in the legal sense.