MINOS SL

Application Note

One safe output to Cat. 4, PL e, SIL 3 - But how?

TÜVRheinland CERTIFIED
Product Safety
Functional Safety
www.tuv.com
ID 0600000000

Application Note MINOS SL

One safe output to Cat. 4, PL e, SIL 3 - But how?

MINOS SL are safety-emergency-stop-modules for the monitoring of emergency-stop -switches, safety doors and light curtains as well as for the safe contact reinforcement of safe outputs (e.g. safe PLC-outputs) at machines and equipment.

A special feature of the MINOS-SL modules is the single, safe semicondutor output (terminal O1) over which connected loads like redundant contactor-combinations, safe and conforming to standards up to cat. 4, PL e, SIL 3 can be switched.

But how can safe shutdowns realized up to Cat. 4, PL e, SIL 3 in accordance with EN ISO 13849-1 and EN 62061 function with a single output?

According to EN ISO 13849-1 a dual-channel structure is required for category 4!

The solution can be found in the wiring of the output!

Fail-Safe based on dual-channel-structure

The required dual-channel for category 4 according to EN ISO 13849-1 serves the one-fault safety. I.e. a single fault should not lead to a complete loss of the safety function.

By driving redundant contactor-combinations, the fault of a cross-circuit in the cable-routing has to be considered. Fig. 1 shows the dual-channel connection of the contactor combination K_A and K_B with two safe semi-conductor outputs.

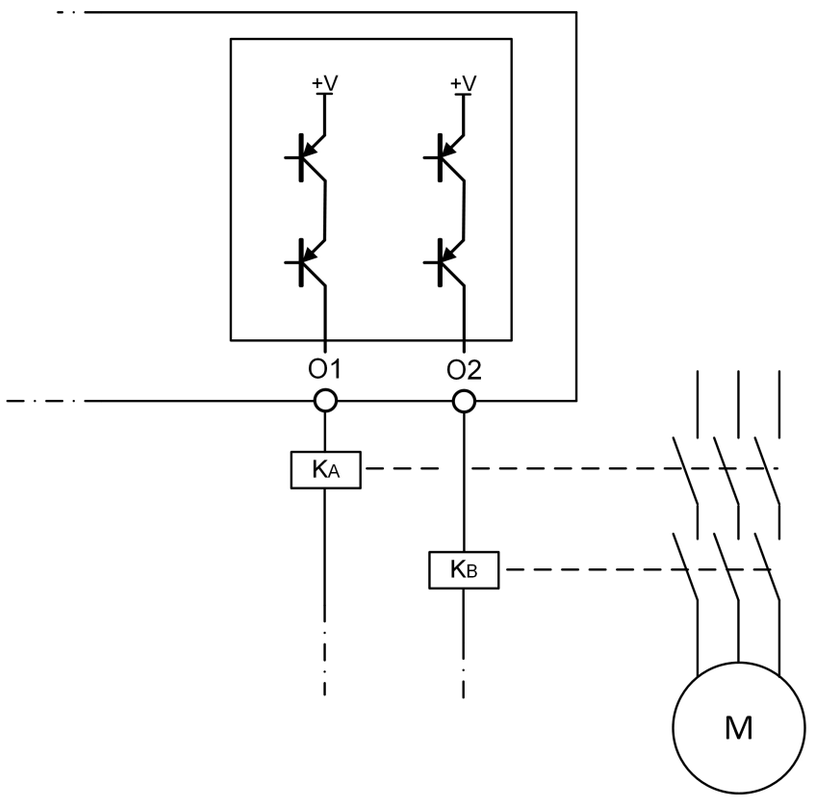

Fig. 1 dual-channel safetymonitoring

A cross-circuit i.e. in the supply line to K_B would not lead to a loss of the safety function in this application, because the safe status can still be reached over K_A. Considering the fault detection over the feedback circuit the requirements of a category 4 structure are fulfilled.

But what about the control of the contactors with only one safe output?

Fault exclusion according to EN ISO 13849-2

With only one safe output, this fault would lead to a loss of the safety function, because switching off the load would no longer be possible.

At this point, however, the possibility of a fault exclusion applies.

If the fault of a cross-circuit can be excluded by suitable wiring or assembly, there is no need for a second output for sufficient fault tolerance.

The EN ISO 13849-2, which lists measures for fault exclusion in Table D.4 for this case, helps here.

As a result, cross-circuits in the cable routing can be excluded, if e.g. the SL module and the extern contactors K_A and K_B are located in the same electrical mounting room.

Thus safety control up to Cat. 4, PL e, SIL 3 according to Fig. 2 can be realized with only one safe output.

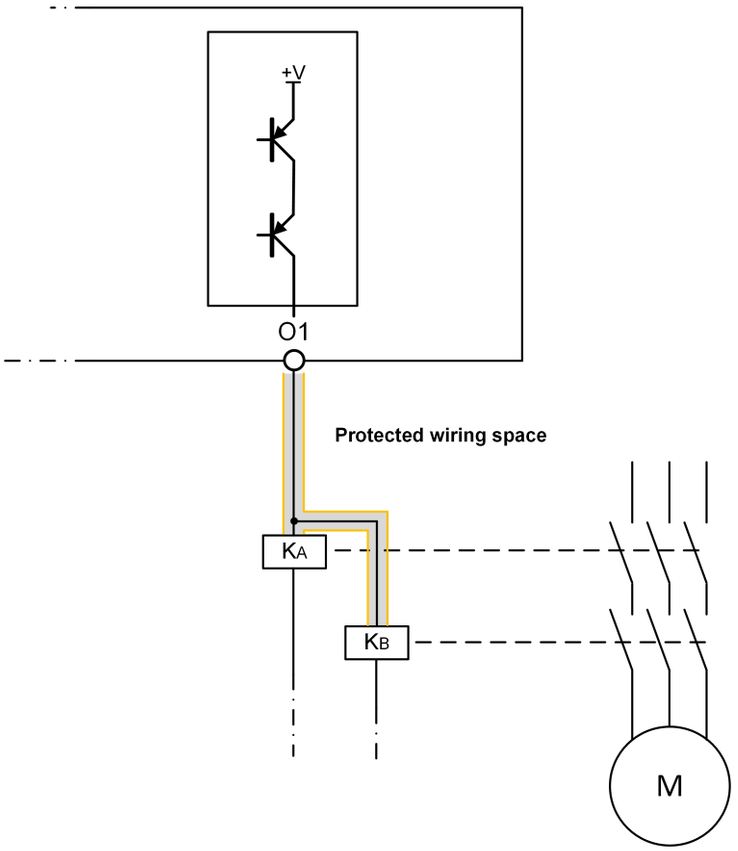

Fig. 2 single-channel safety control in a protected wiring space

Note: Same applies for safe relay contacts

If you have any further questions,

please contact:

Mrs. Claudia Friehe

Fon.: +49 241 910 501-18

c.friehe@zander-aachen.de