Stopping in the event of an emergency (Emergency-stop disconnection)

1.5 Two-channel with safety relay

Application

- When the immediate disconnection of the power supply does not cause hazardous states (uncontrolled stopping - STOP category 0 to EN ISO 13850).
- When danger can arise for the operator or the machine.

→ The Emergency-stop function is an additional safety function. It is not permissible as a sole means of protection!

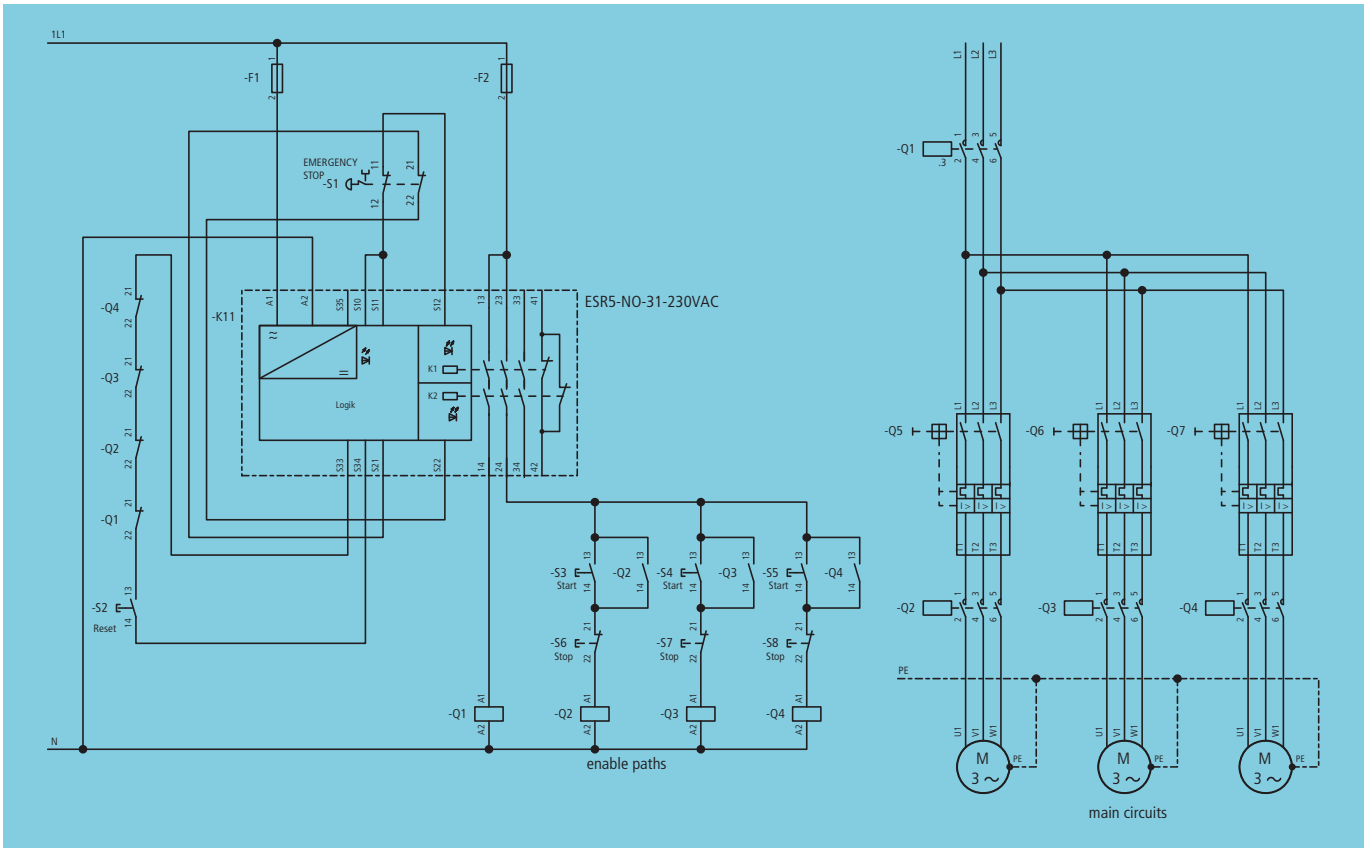


Figure 6: Two-channel emergency stop with ESR5

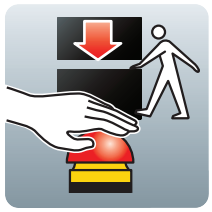
Requirements

- Emergency-stop actuator with positive opening to IEC 60947-5-1, Annex K, and wire function with two-channel circuit and with cross-circuit detection on easySafety to EN ISO 13850.
- Install redundant contactors and with mechanically linked and feedback contacts.
- Hard wire with electromechanical components.
- Acknowledgement with reset required after releasing of Emergency-stop actuator.
- Activate hazardous movements after enable with separate Start command.
- Observe additional applicable standards, e.g. IEC 60204-1.

Properties

- Design according to basic and well-tried safety principles (EN ISO 13849-1 and EN ISO 13849-2)
- Control circuit device, supply conductor and command processing are redundant and self-monitoring.
- Single faults: Wire break, connection fault and cross circuit are detected immediately or with the next start command.
- Accumulation of undetected faults can not lead to the loss of the safety function.
- Increasing the enable paths with additional contacts possible (e.g. with ESR5-NE-51-24VAC-DC).

Cat	B	1	2	3	4
PL	a	b	c	d	e
SIL	1	2	3		



Function

If the input voltage of 230 V AC is applied to A1 and A2, the Power LED indicates readiness to activate the enable paths. When the RESET pushbutton S2 is actuated, the NC contacts of the feedback circuit Q1-Q4 check first of all that the contactors are in their rest position. If this state is present, the internal enable relays pick up with a rising edge, which is indicated via LEDs K1 and K2. The not safety related signalling path (terminal 41-42) is opened and the enable paths (terminal 13-14, 23-24 and 33-34) are closed.

The contactors Q2, Q3 and Q4 can be activated via the corresponding start command S3, S4, S5. The enable contactor Q1 is used for central safe disconnection of the drives.

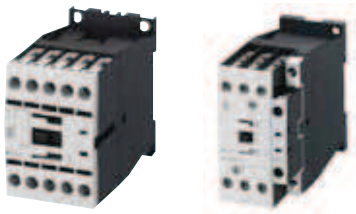
Condition	EN ISO 13849-1:2008
Structure	Cat. 4
$MTTF_d$	100 years
$B10_d$	S1: 100000, Q1 - Q4: 1300000
n_{op}	S1, Q1: 1800, Q2 - Q4: 18000
CCF	80
DC_{avg}	99 %
PL	e
$T10_d$	>20 years

Condition	IEC 62061:2005
Structure	SS D, asymmetrical
PFH_d	2.96×10^{-8}
B10	S1: 20000, Q1 - Q4: 975000
λ_d/λ	S1: 0.2, Q1 - Q4: 0.75
CSA	S1, Q1: 0.3125, Q2 - Q4: 3.125
ß	0.05
DC	S1: 99 %, K1: 99 %, Q1 - Q4: 99 %
SIL	3

Safety-related switching devices

Emergency-stop actuator M22-PVT45P-MPI + M22-A + M22-CK02

Safety relays ESR5-NO-31-230VAC



DILM12 and DILM25 contactors

Safety standards

Standard	Contents	→ page
EN ISO 13849-1/2	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design Part 2: Validation	**96**
IEC 62061	Safety of machinery – functional safety of safety-related electrical, electronic and programmable electronic control systems	**97**
IEC 60947-4-1	Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor starters; electromechanical contactors and motor starters	–
EN ISO 13850	Safety of machinery - Emergency-stop equipment - Principles for design	**101**
IEC 60947-5-1 **IEC 60947-5-5**	Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices Part 5-5: Emergency-stop devices with mechanical latching	–