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

1.3 For interrupting several control circuits with safety relay

Application

- For extensive control systems in which several circuits must be disconnected.
- When the immediate disconnection of the power supply does not cause hazardous states (uncontrolled stopping - STOP category 0 to EN ISO 13850).

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

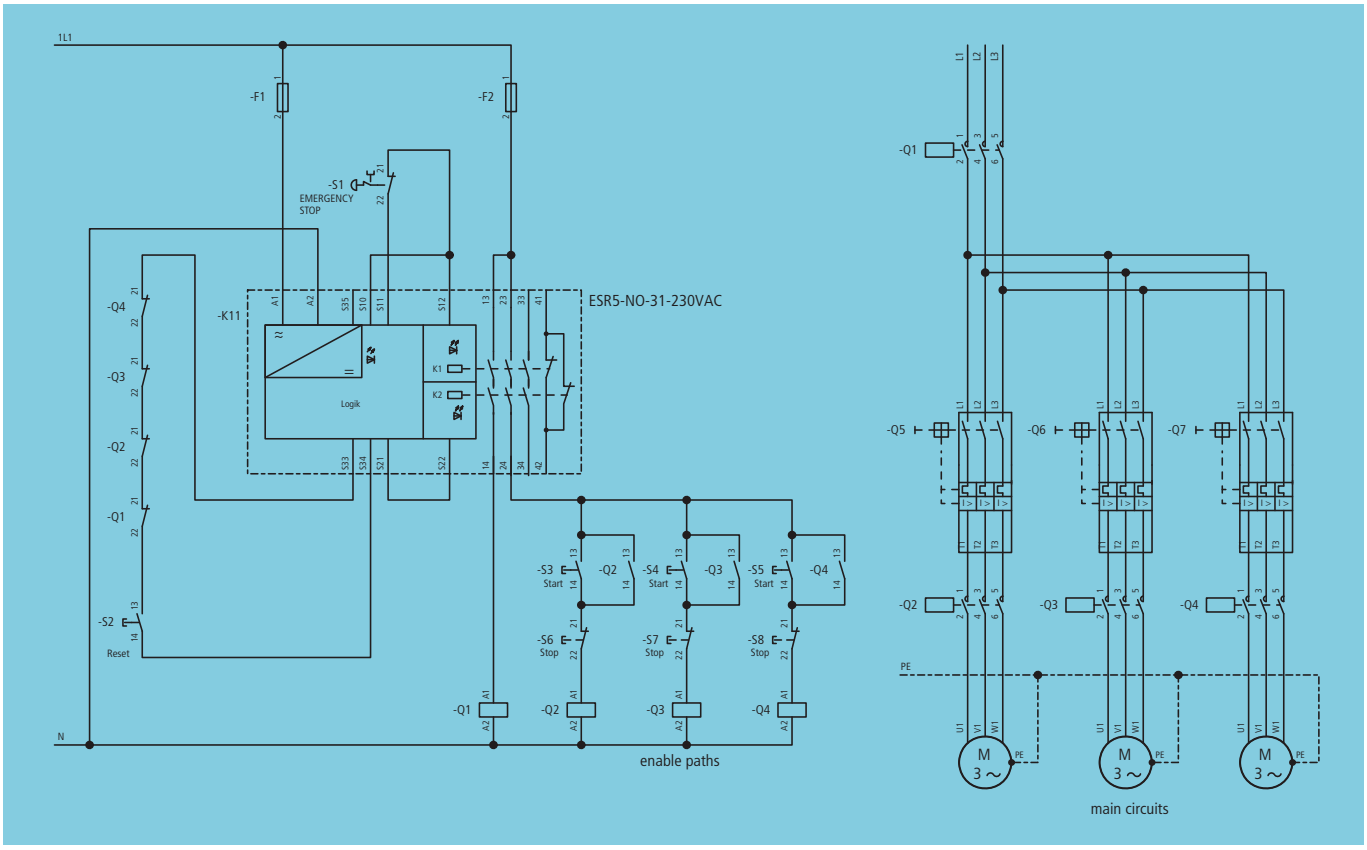


Figure 4: Single-channel emergency stop with ESR5

Requirements

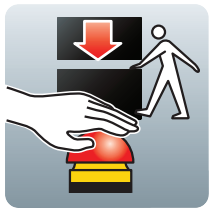
- Emergency-stop actuators with positive opening (IEC 60947-5-1 Annex K) and function to EN ISO 13850.
- Use safety relays with mechanically linked contacts.
- Hard wire with electromechanical components.
- Install the emergency-stop actuator outside of the hazardous zone so that it is recognizable and accessible.
- Activate hazardous movements after enable with separate Start command (S3 to S5).
- Emergency-stop function must be tested regularly.
- Observe additional applicable standards, e.g. IEC 60204-1.

Properties

- Design with well-tried components and operating principles (EN ISO 13849-1 and EN ISO 13849-2).
- Monitoring of redundant contactors via feedback loop (K11).
- Bridging in the Emergency-stop actuator or supply conductor causes the loss of the safety function.

→ A higher safety integrity can be achieved by simple expansion to a redundant emergency-stop disconnection circuit, → chapter 1.5 "Two-channel with safety relay", page 20

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 enabling 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 relays pick up with the rising edge, which is indicated via LEDs K1 and K2. The non-safety signal path (terminal 41-42) is opened and the enabling 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 the redundant safe disconnection of the drives.

Condition	EN ISO 13849-1:2008
Structure	Cat. 1
$MTTF_d$	100 years
$B10_d$	S1: 100000, Q1 - Q4: 1300000
n_{op}	S1, Q1: 1800, Q2 - Q4: 7200
CCF	80
DC_{avg}	61.81 %
PL	c
$T10_d$	>20 years

Condition	IEC 62061:2005
Structure	SS A and SS D, asymmetrical
PFH_d	3.23×10^{-7}
B10	S1: 20000, Q1 - Q4: 975000
λ_d/λ	S1: 0.2, Q1 - Q4: 0.75
CSA	S1, Q1: 0.3125, Q2 - Q4: 1.25
ß	0.05
DC	S1: 0 %, K1: 99 %, Q1 - Q4: 99 %
SIL	1

Safety-related switching devices

M22-PV/KC02/IY Emergency-stop actuator

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	–