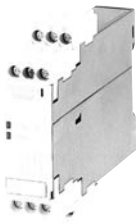
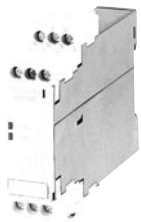
For Monitoring of Circuits for Emergency-STOPS, Protected Guards and Presses

Ordering Data:



3TK28 21
3TK28 22
3TK28 23
3TK28 24

3TK28 25
3TK28 27
3TK28 28



3TK28 30

3TK28 34
+ 3TK28 35

Width mm	Enabling Contacts①	Signaling Contacts	Obtainable Category② Acc. to EN954-1	Operating Voltage	Screw Terminal Catalog Number	Cage Clamps Catalog Number
1-channel or 2-channel **Automatic or Manual Start**						
22.5	3 NO	1 NC	B,1,2,3	24 V AC/DC	**3TK28 21-1CB30**	**3TK28 21-2CB30**
22.5	2 NO	–	B,1,2,3	24 V AC/DC	**3TK28 24-1CB30**	**3TK28 24-2CB30**
22.5	2 NO	–	B,1,2,3	24 VDC	**3TK28 24-1BB40**	**3TK28 24-2BB40**
Automatic Start						
22.5	2 NO	–	B,1,2,3,4	24 VAC/DC	**3TK28 22-1CB30**	**3TK28 22-2CB30**
Manual Start						
22.5	2 NO	–	B,1,2,3,4	24 VAC/DC	**3TK28 23-1CB30**	**3TK28 23-2CB30**
Automatic or Manual Start						
45	3 NO	2NC	B,1,2,3,4	24 VDC	**3TK28 25-1BB40**	**3TK28 25-2BB40**
45	3 NO	2NC	B,1,2,3,4	24 VAC	**3TK28 25-1AB20**	**3TK28 25-2AB20**
45	3 NO	2NC	B,1,2,3,4	120 VAC	**3TK28 25-1AJ20**	**3TK28 25-2AJ20**
45	3 NO	2NC	B,1,2,3,4	230 VAC	**3TK28 25-1AL20**	**3TK28 25-2AL20**
Manual Start with Adjustable Time Delay for Stop Category③						
45	2 NO + 2 NO TD	1 NC	B,1,2,3,4	24 VDC	**3TK28 27-1BB4❐**	**3TK28 27-2BB4❐**
45	2 NO + 2 NO TD	1 NC	B,1,2,3,4	24 VAC	**3TK28 27-1AB2❐**	**3TK28 27-2AB2❐**
45	2 NO + 2 NO TD	1 NC	B,1,2,3,4	120 VAC	**3TK28 27-1AJ2❐**	**3TK28 27-2AJ2❐**
45	2 NO + 2 NO TD	1 NC	B,1,2,3,4	230 VAC	**3TK28 27-1AL2❐**	**3TK28 27-2AL2❐**
Automatic Start with Adjustable Time Delay for Stop Category③						
45	2 NO + 2 NO TD	1 NC	B,1,2,3,4	24 VDC	**3TK28 28-1BB4❐**	**3TK28 28-2BB4❐**
45	2 NO + 2 NO TD	1 NC	B,1,2,3,4	24 VAC	**3TK28 28-1AB2❐**	**3TK28 28-2AB2❐**
45	2 NO + 2 NO TD	1 NC	B,1,2,3,4	120 VAC	**3TK28 28-1AJ2❐**	**3TK28 28-2AJ2❐**
45	2 NO + 2 NO TD	1 NC	B,1,2,3,4	230 VAC	**3TK28 28-1AL2❐**	**3TK28 28-2AL2❐**

↑ 0 adjustable time delay **0.5 to 30** sec.
↑ 1 adjustable time delay **0.05 to 3** sec.

Expansion Module for Use with Base Devices 3TK28 2

Increase number of enabling contacts. Requires one NO enabling contact of the base unit.

22	4 NO	—	Same as base unit	24 VAC/DC	**3TK28 30-1CB30**	**3TK28 30-2CB30**
Two-Hand Press Control Relay 2-channel						
45	2 NO	2 NC	4	24 VDC	**3TK2834-1BB40**	**3TK2834-2BB40**
45	2 NO	2 NC	4	24 VAC	**3TK2834-1AB20**	**3TK2834-2AB20**
45	2 NO	2 NC	4	120 VAC	**3TK2834-1AJ20**	**3TK2834-2AJ20**
45	2 NO	2 NC	4	230 VAC	**3TK2834-1AL20**	**3TK2834-2AL20**
Breaking Distance Monitoring Relay (Used in combination with the Two-Hand Press Control Relay.)						
45	3 NO	1 NC	4	24 VDC	**3TK2835-1BB40**	**3TK2835-2BB40**
45	3 NO	1 NC	4	24 VAC	**3TK2835-1AB20**	**3TK2835-2AB20**
45	3 NO	1 NC	4	120 VAC	**3TK2835-1AJ20**	**3TK2835-2AJ20**
45	3 NO	1 NC	4	230 VAC	**3TK2835-1AL20**	**3TK2835-2AL20**

① The enabling contacts can be used for signaling purposes.

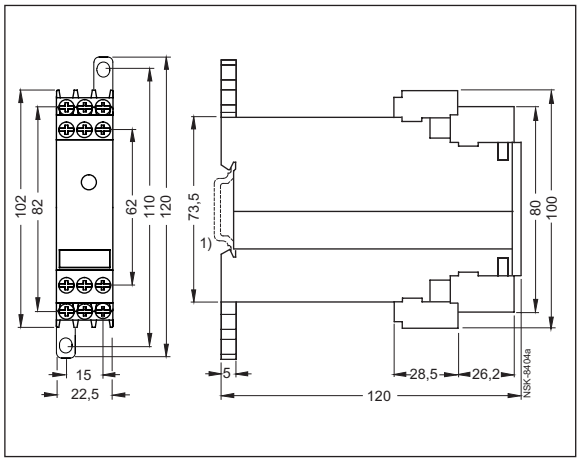
② The highest achievable risk category depends on the category of the base device. The category depends also on the external connection of the sensors (Limit switch, E-STOP, etc.) and on the physical arrangement of the machine. The relevant machine safety requirements must be observed.

③ Category 4 applies only to the non-time delayed contacts.

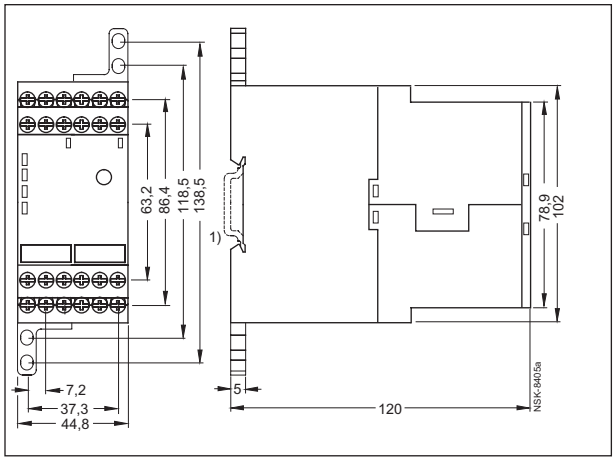
Accessories:

	Product	Description	Order No.
	Sealing Cap	For use with 3TK28 27 and 3TK28 28 to prevent access to adjustment	**3RP19 02**
	Screw Mounting Clips	Snap into housing, permits screw mounting 1 set = 2 pieces	**3RP19 03**

Dimensions:



3TK28 21, -22, 23, 24, -30
Shown with Screw Mounting Clip



3TK28 25, -27, -28, -34, -35
Shown with Screw Mounting Clips

Technical Information:

Type	3TK28 21	3TK28 22	3TK28 23	3TK28 24	3TK28 30	3TK28 25	3TK28 27 3TK28 28	3TK28 34	3TK28 35
Specifications	EN 60 2004-1 (VDE 0113 Park 1), EN 292, EN 954-1								
Test Certificates	BG, SUVAS, UL, CSA								
Category Acc. to EN 954-1	3	4	4	3	same as basic unit	4	4 3(TD)	4	4
Mechanical Endurance	10 million operating cycles								
Electrical Endurance at I_e	100,000 operating cycles								
Insulation Rating U_i Pollution Degree 3 Over Voltage Category III Acc. to DIN VDE 0100	300 V								
Rated Impulse Strength U_{imp}	4kV								
Permissable Ambient Temperature In Operation When Stored	 -25°C to +60°C (suitable for butt-mounting: 70°C possible with restrictions) -40°C to +80°C								
Degree of Protection Acc. to EN 60 529	IP 40 enclosure, IP 20 terminals					IP20			
Rated Power W DC-/AC Operation at 1.0 x U_s	1.5	1.5	1.5	1.5	1.5	3	4	3	3
Operating Range AC Operation DC Operation	0.85 to 1.1 x U_s 0.85 to 1.2 x U_s					0.85 to 1.1 x U_s 0.85 to 1.2 x U_s			
Operating Frequency	100/h at current I_e								
Shock Resistance Semi-Simusoidal Acc. to IEC60 068	 8 *g*/10ms								
Short-Circuit Protection (Weld-Free Protection at I_k = 1kA)	 Fusible Links NH Type 3 NA, DIAZED Type 5SB NEOZED Type 5SE: 6 A Operational Class gL/gG 6 A (slow), quick 10 A[3]								
Rated Operational Currents Acc. to IEC 60 947-5-1 Continuous Thermal Current I_{th} I_e/AC-15 115 V 230 V I_e/DC-13 24 V	 5A 5A 5A 5A					6A 6A 6A 6A	5A 5 A/2 A[4] 5 A/2 A[4] 5 A/2 A[4]	6A 6A 6A 6A	5A 5 A/2 A[5] 5 A/2 A[5] 5 A/2 A[5]
Continuous Thermal Current I_{th} for Enabling Contacts and UT 70° C and UT 60° C and UT 50° C	 2 4A 4,5A 5A	 3 3,5A 4A 4,5A	 4 3A 3,5A 4A			 5A 6A 6A	 4A 5A 5A	 5A 6A 6A	 4A 5A 5A
Response Time Monitored Start Autostart	 – ≤200ms	 – ≤80ms	 ≤30ms –	 – ≤200ms	≤30ms – –	 ≤25ms ≤150ms	 ≤80ms ≤80ms	≤100ms – –	≤50ms – –
Release Time for EMERGENCY-STOP for Supply Failure	 ≤150ms ≤150ms	 ≤20ms ≤100ms	 ≤20ms ≤150ms	 ≤150ms ≤150ms	 – ≤200ms	 ≤25ms ≤350ms	 ≤25ms ≤100ms	≤20ms – –	≤50ms – –
Recovery Time for EMERGENCY-STOP for Supply Failure	 ≤200ms ≤200ms	 ≤200ms ≤400ms	 ≤400ms ≤600ms	 ≤200ms ≤200ms	 – ≤200ms	 ≤200ms ≤500ms	 after delay ≤1s	≤250ms – –	≤250ms – –
Bridging of Supply Failures	40ms	30ms	80ms	40ms	100ms	100ms	30ms	40ms	40ms
Minimum Command EMERGENCY STOP **Duration** ON Button	≤100ms ≤150ms	≤25ms ≤40ms	≤25ms ≤25ms	≤100ms ≤150ms	– –	≤25ms ≤25ms	≤25ms ≤25ms	– –	– –
Conductor finely stranded with end sleeve **Cross-Sections** solid	2 x (0.5 … 1.5) mm², 1 x (0.5 … 2.5) mm² 2 x (0.5 … 2.5) mm², 1 x (0.5 …4) mm²								
Tightening Torque, M 3.5 Screw	0.8 to 1.2 Nm								
Cage Clamp Terminals solid finely stranded with end-sleeve finely stranded without end-sleeve AWG wires, solid or stranded	2 x (0.25 … 1.5) mm² 2 x 1 mm² 2 x 1.5 mm² 2 x AWG 24-16								
Permissible Mounting Protection	Any								

Selection Guide:

SIGUARD Safety Relays 3TK28

MLFB	Size	Voltage	EN 60954–1 Category	Input Characteristics One Channel	Two Channel	Cross Circuit	Output Characteristis Enabling Contacts	Signaling Contacts	Restart Characteristics Auto Start	Monitored Start
3TK28 21	22.5mm	24V DC/AC	3		Yes	Yes	3NO	1NC	Yes	Yes (Start Pushbutton not monitored)
			2	Yes			3NO	1NC	Yes	Yes (Start Pushbutton not monitored)
3TK28 22	22.5mm	24V DC/AC	4		Yes	Yes	2NO		Yes	
3TK28 23	22.5mm	24V DC/AC	4		Yes	Yes	2NO			Yes
3TK28 24	22.5mm	24V DC/AC 24V DC	3		Yes	Yes	2NO		Yes	Yes (Start Pushbutton not monitored)
			2	Yes			2NO		Yes	Yes (Start Pushbutton not monitored)
3TK28 25	45mm	24V DC; 24V, 115V, 230V AC	4		Yes	Yes	3NO	2NC	Yes	Yes
			2	Yes			3NO	2NC	Yes	Yes
3TK28 27	45mm	24V DC; 24V, 115V, 230V AC	4;3 (instant enabling contacts)		Yes	Yes	2NO	1NC		Yes
			3 (delayed enabling contacts)		Yes	Yes	2 NO (TD, 0.5–30s or 0.05–3s)			Yes
			2	Yes			2NO; 2NO (TD, 0.5–30s or 0.05–3s)	1NC		Yes
3TK28 28	45mm	24V DC; 24V, 115V, 230V AC	4;3 (instant enabling contacts		Yes	Yes	2NO	1NC	Yes	
			3 (delayed enabling contacts)		Yes	Yes	2NO (TD, 0.5-30s or 0.05–3s)		Yes	
			2	Yes			2NO; 2NO (TD, 0.5–30s or 0.05–3s)	1NC	Yes	
3TK28 30	22.5mm	24V DC/AC	Expansion unit, same category as basic unit.				4NO			
3TK28 34	45mm	24V DC; 24V, 115v, 230V AC	4		Yes	Yes	2NO	2NC		
3TK28 35	45mm	24V DC; 24V, 115V, 230V AC	4		Yes	Yes	3NO	1NC		

Certifications:

The complete range of SIGUARD 3TK28 Safety Relays has been especially designed for the requirements of state-of-the-art safety technology. SIGUARD Safety Relays can be simply used for the configuration and evaluation of safety circuits according to worldwide machine safety regulations such as:

- ANSI B11 (Safeguarding of Machine Tools)
- OSHA CFR 1910
- NFPA 79 (Electrical Standard for Industrial Machinery)
- EU Machinery Directive 98/37/EC
- CE Marking

For the North American and Canadian markets, the devices are UL and CSA listed. All devices fulfill IEC60204-1 and are certified by the German Trade Association (BIA) and the Swiss Accident Insurance Institution (SUVA) Acc. to EN954-1.

The whole safety circuit always comprises more components than a relay unit. It is important to select all safety related devices according to the required safety level and follow applicable safety standards when installing and wiring these components.

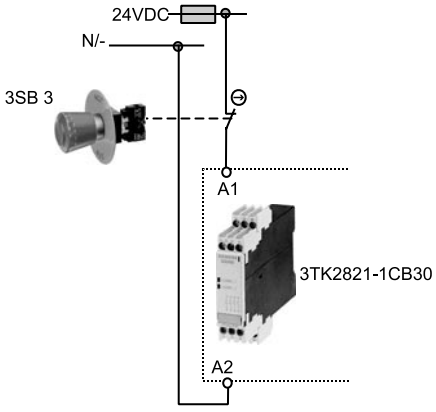
Functionalities:

Safety and Signaling Contacts:

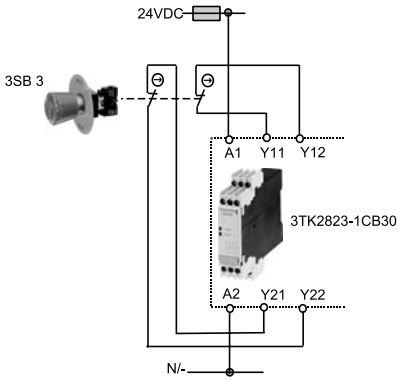
SIGUARD Safety Relays 3TK28 monitor and evaluate the safety circuit, detect failures, shut off the proper part of the machine and prevent it from restarting until the failure has been repaired. The NC contact of the command device (E-STOP, Interlocking Switch, Light Curtain…) acts directly on the Safety Relay Unit. The Safety Relay obtains the safe Shut-Off of the power contactors. Each Safety Relay Unit provides several failsafe NO outputs. Other NC output contacts are available for signaling or to be connected to the main PLC. Only the mechanically linked NO-Contacts shall be used as safety contacts and connected to the power contactors.

Single-Channel and Two-Channel Wiring:

Category 1 and Category 2 safety circuits do not require redundancy. Not all faults will be detected and a fault may lead to the loss of the safety function. Only one NC Input Contact to the safety relay unit is sufficient to obtain the safety level (-> Single Channel).



For 2-Channel Wiring (Category 3 and 4), a second NC Input Contact will be added and connected to the Safety Relay Unit. This provides redundancy. A short circuit between the two inputs will be detected as well as a bridged or welded contact and the second channel will obtain the safety function.

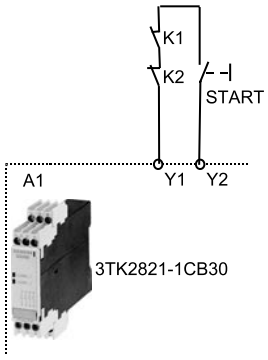


Manual and Automatic Start:

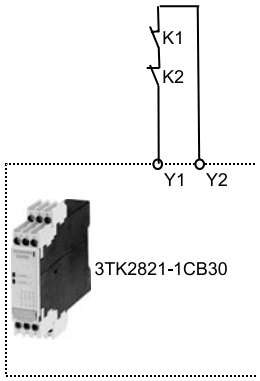
SIGUARD Safety Relay Units 3TK28 offer the possibility to choose between Manual or Automatic Start.

When the system is shut down the application very often requires a manual restart. This restart can be included directly in the Safety Relay Unit. A NO contact is required to start the device. To reach Category 4 the Manual Start button has to be monitored by the Relay Unit itself to detect a failure. Otherwise the whole circuit will be reduced to maximum Category 3.

When using Automatic Start, the Relay Unit will restart as soon as the failure has been repaired and the protective device (E-STOP, Interlocking Switch, Light Curtain…) has been reset. Often this may lead to a dangerous situation, when personnel still remain inside the hazardous area and the machine will be able to start (e.g. perimeter protection or safeguarding with light curtains or interlocking switches).



Manual START



Automatic START

Expansion Unit:

Limited to the housing width and the number of terminals, many applications require more safety outputs in one circuit than available in one Relay Unit. Regarding to the number of drives which have to be shut off more contacts are required. Each SIGUARD 3TK28 basic unit can be expanded by four more safety outputs using the expansion unit 3TK2830. Expansion units may not be used seperately in safety circuits. One enabling contact of the basic unit is required to connect the expansion unit. The Category of a control system with expansion unit corresponds to the Category of the Basic Unit. One basic unit may be connected to several expansion units.

(For wiring details, please see section "Applications")

Time Delayed Safety Contacts:

For STOP-Category 1 applications time delayed safety output contacts might be required. SIGUARD Safety Relays 3TK28 provide the functionality of time delayed contacts within a 45mm housing. The time delay is adjustable for each unit. Two different types offer a time delay from 0.05s up to 3s or 0.5s up to 30s. While standard safety contacts in these units are certified up to Category 4, time delayed outputs only reach a Category 3 level according to EN954-1.

(For wiring details, please see section "Applications")

Press Control Relay (Two-Hand Control):

Relay Units for Two Hand Control provide special functionality used in press applications. The devices are equipped to monitor two different, redundant input signals and evaluate the simultanious actuation.

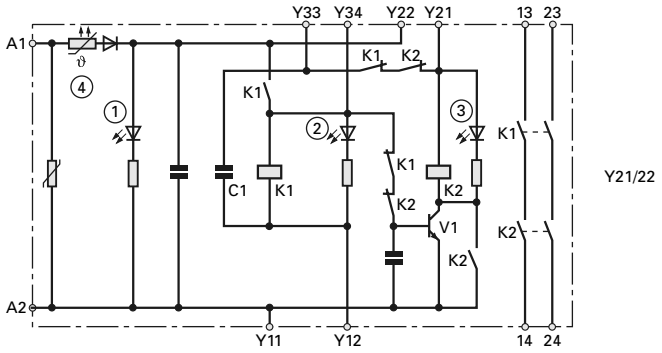
EN574 "Safety of Machinery – Two Hand Controls" requires the following:

- The output signal may only appear when both input signals are activated within 0.5 seconds
- It is only possible to reinitiate the output signal after both input signals have been released
- Both input signals shall maintain the output as long as they are present
- EN574 also require a special, tamper-proof design of the Two Hand Control panel used in connection with the 3TK28 press relay unit. (See section 2.)

Press applications require in most of the cases category 4 (EN954-1) for the whole safety circuitry. The SIGUARD press relay units 3TK2834 do meet these requirements and provide together with our two-hand control panels a complete solution acc. to EN574 and EN954-1.

Circuitry and Connection Diagrams:

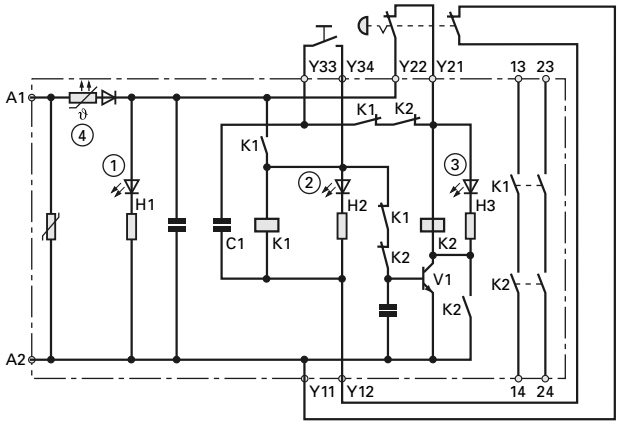
Internal Circuit Diagram 3TK2823



Terminal Description

A1/A2	power supply
Y33/34	"ready ON" Feedback circuit
Y11/12	sensor (e.g. EMERGENCY OFF pushbutton)
	sensor (e.g. EMERGENCY OFF pushbutton two-channel)
13/14	enable circuit
23/24	enable circuit
①	"POWER" LED
②	"Channel 1" LED
③	"Channel 2" LED
④	PTC fuse

Function Description 3TK28



Function Description

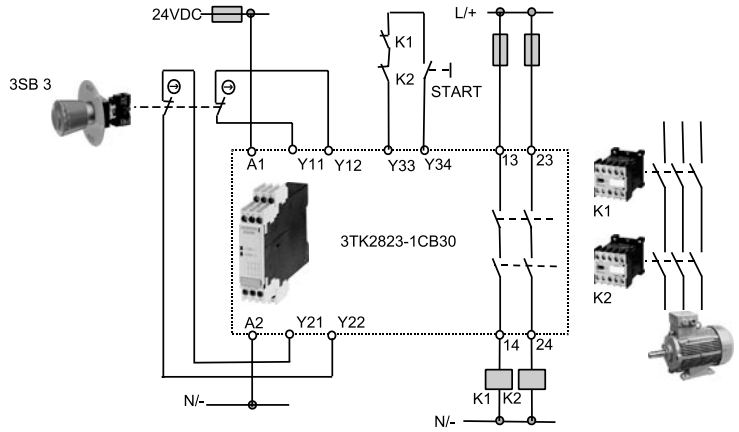
- Power-on
  Connect the power;
  the "Power" LED is lit, EMERGENCY OFF closed,
  C1 is charged, press ON,
  C1 is charged, K1, V1 are energized,
  ...K2 starts, K1 + K2 latch,
  "Channel 1" and "Channel 2" LEDs are lit.

- ON monitoring
  ON is pressed ⟶ fault!
  EMERGENCY OFF closed,
  V1 immediately starts K2, C1 is not charged
  ⟶ K1 does not start.
  Only the "Channel 2" LED is lit

- Cross-circuit
  If EMERGENCY OFF 1 and EMERGENCY OFF 2 are short-circuited, a short-circuit current flows through the PTC fuse.
  The PTC goes into a high-ohmic state.
  None of the LEDs are lit.

Emergency-STOP and Protected Doors with and without Interlocking:

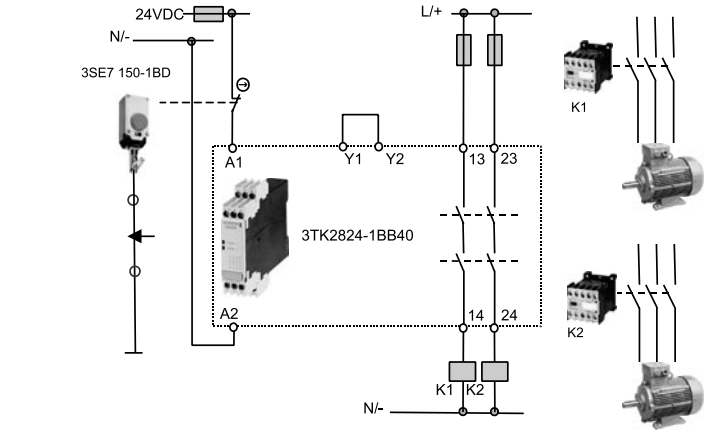
SIGUARD E-STOP
Category 4
Manual Start



Safety Relay 3TK2823
- 22.5 mm housing for DIN rail mounting
- Two channel evaluation
- Feedback loop
- START button monitored
- 2NO safety contacts

E-STOP 3SB
- Latching acc.to EN418
- 2NC contacts with direct opening action
- Signalling contacts available

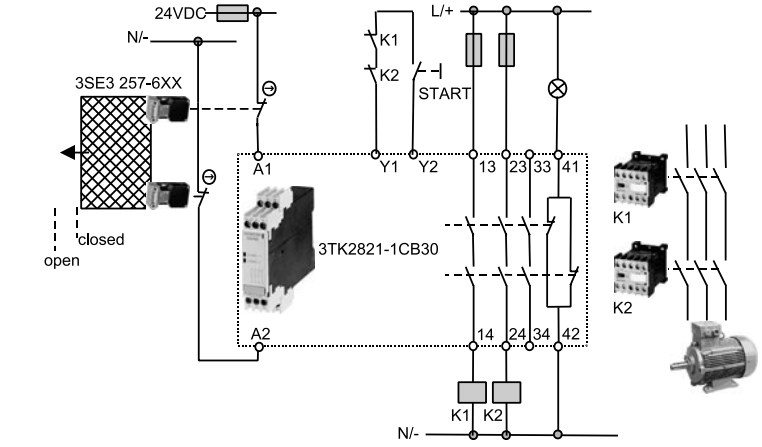
SIGUARD E-STOP w/ Rope Pull Switches
Category 1 or 2
Autostart



Safety Relay 3TK2824
- 22.5 mm housing for DIN rail mounting
- One channel evaluation
- 2NO safety outputs

Rope Pull Switch 3SE7
- Latching acc.to EN418
- 1NC Contact with direct opening action
- Actuation when rope pulled or released
- 1NO contact left for signaling

SIGUARD Protected Door
Category 3
Manual; two 3SE3 Limit Switches

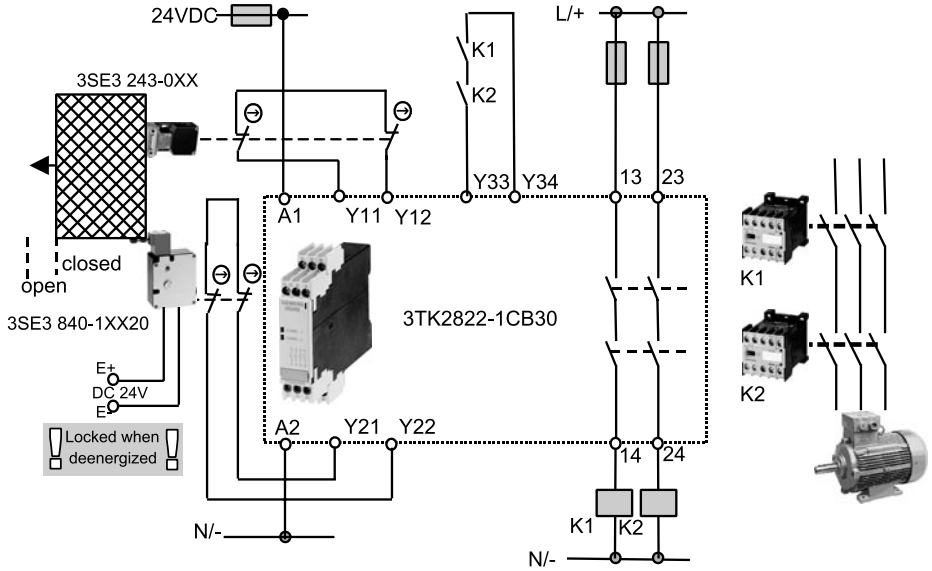


Safety Relay 3TK2821
- 22.5 mm housing for DIN rail mounting
- Two channel evaluation
- Feedback loop
- 2NO safety contacts
- 1NC monitoring contact

Limit Switch 3SE3
- 2x1NC contact with direct opening action
- Separate actuator

Emergency-STOP and Protected Doors with and without Interlocking (continued):

SIGUARD Protected Door w/ Locking
Category 4
Autostart; two 3SE3 Limit Switches

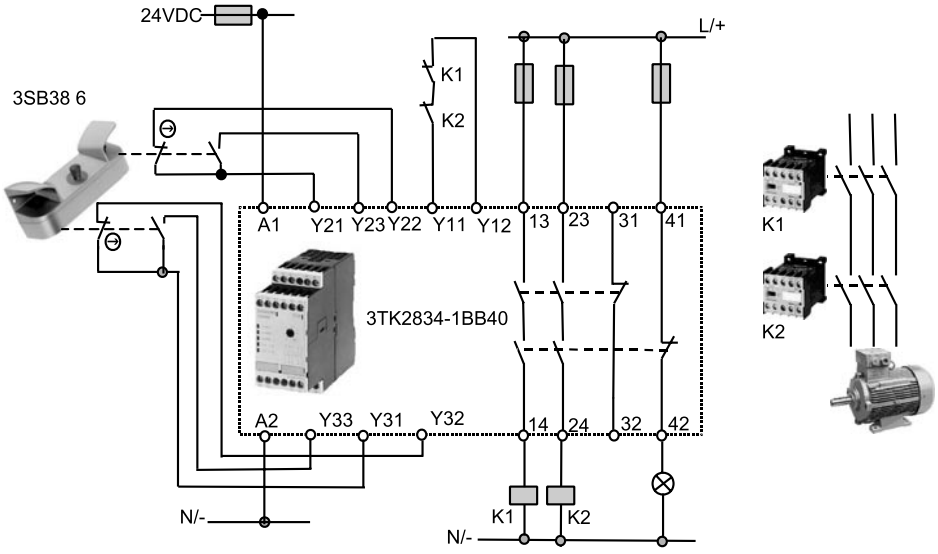


Safety Relay 3TK2822
- 22.5 mm housing for DIN rail mounting
- Two channel evaluation
- Feedback loop
- 2NO safety contacts

Limit Switch 3SE3
- 2x2NC contacts with direct opening action
- Separate actuator

Two-Hand Controls:

SIGUARD Two-Hand Control
Category 4

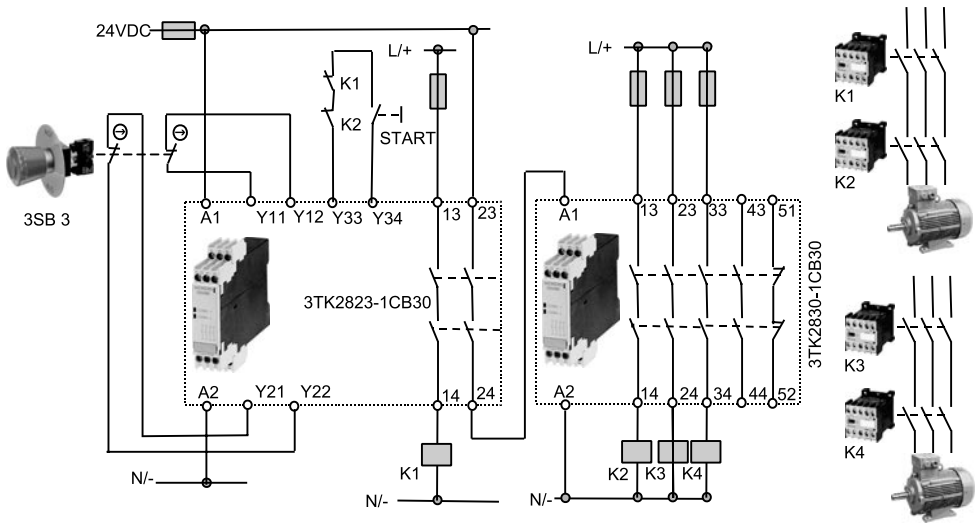


Safety Relay 3TK2834
- 45 mm housing for DIN rail mounting
- Two channel evaluation
- Feedback loop
- 2NO safety outputs
- 2NC signalling outputs

Two-Hand Control Panel 3SB38 6
- Tamper proof design acc. to EN574
- 1NO + 1NC contacts with direct opening action
- Additional E-STOP integrated

Output Contact Expansion:

SIGUARD E-STOP
Category 4
Manual Start + Expansion Unit

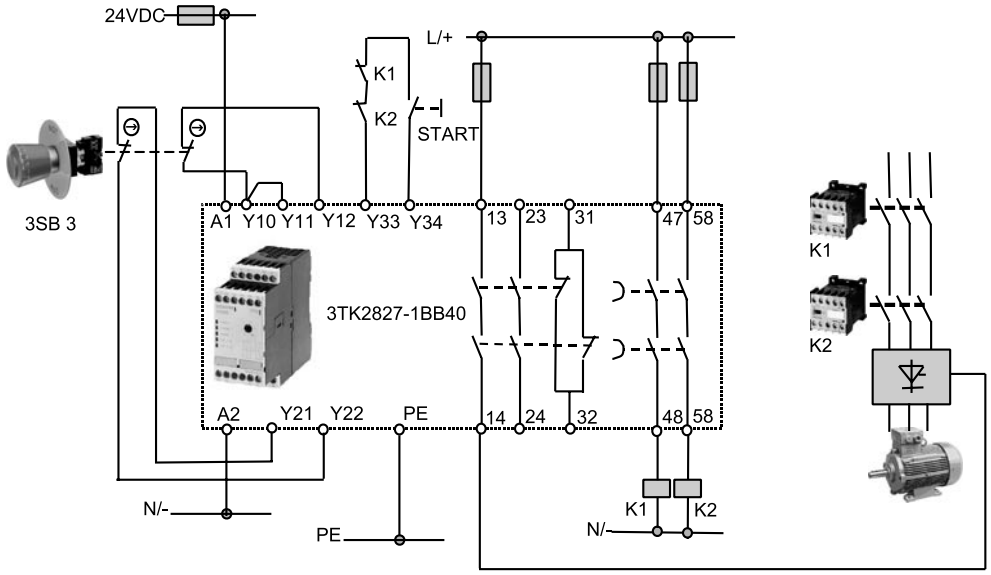


Safety Relay 3TK2823 + Expansion Unit 3TK2830
- 2x22.5 mm housings for DIN rail mounting
- Two channel evaluation
- Feedback loop
- START button monitored
- Up to 5NO safety output

E-STOP 3SB
- Latching acc.to EN418
- 2NC contacts with direct opening action
- Signalling contacts available

Integrated Time Delays:

SIGUARD E-STOP
Category 4 (3 TD)
Manual Start + Time Delayed (TD) Outputs



Safety Relay 3TK2827 Time Delayed (TD)
- 45 mm housing for DIN rail mounting
- Two channel evaluation
- Feedback loop
- START button monitored
- 4NO safety outputs (2TD 0.5s–30s)

E-STOP 3SB
- Latching acc.to EN418
- 2NC contacts with direct opening action
- Signalling contacts available