

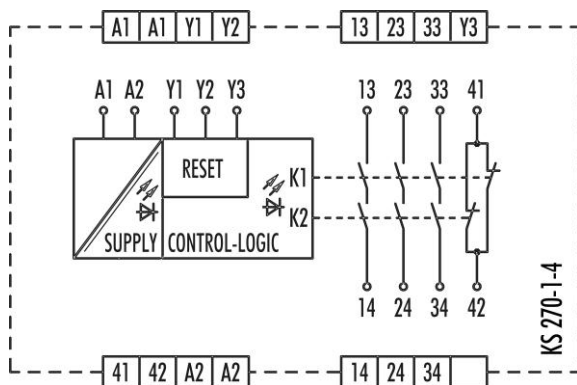
SNO 4003 K *plus*

Safety relay for emergency stop and guard door applications

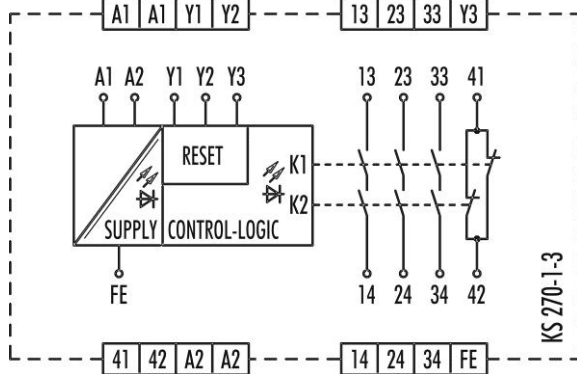
- SILCL2 in accordance with EN 62061
- PL d, Category 3 in accordance with EN ISO 13849-1
- Stop category 0 in accordance with DIN EN 60204-1
- Manual or automatic start
- With cross circuit detection of the reset inputs
- Feedback circuit for external contactor monitoring
- 3 enable circuits, NO positively guided, 1 signal generator current circuit
- Input debouncing
- Error message by SUPPLY-LED

Connection circuit diagrams

SNO 4003K (-A/-C) *plus* (DC 24 V)



SNO 4003K (-A/-C) *plus* (AC 115 V/AC 230 V)



Areas of application for the unit

The safety relay SNO 4003K *plus* can be used

- in accordance with EN 62061 to SILCL2
- in accordance with EN ISO 13 849-1 to PL d and Category 3

The actual performance level achieved and the safety category as per EN ISO 13 849-1 depends on external switching, execution of the wiring, selection of command generator and its setup on the machine.

Tactile safety sensors are connected to the safety relay (e.g. safety switch, emergency stop switch). The switching outputs of the safety relay can be used to safely switch off the associated actuators on the machine or installation.

Intended use

The SNO 4003K *plus* is a safety switch unit. It must only be used as part of the protection devices on machines for the purpose of personal, material and machine protection.

It may only be used by competent persons and only on the machine it has been fitted and commissioned by a competent person in accordance with the operating instructions. In the event of any other use and in the event of modifications to the unit - even in the framework of fitting and installation - any claim under warranty against Schleicher Electronic GmbH & Co. KG becomes invalid.

- The user must carry out a risk assessment in accordance with DIN EN ISO 12100.
- On this basis you must carry out validation of the entire installation/machine in accordance with the applicable standards.
- The quoted performance level (PL) is only reached if an average number of switching cycles per year is not exceeded, depending on the loading of the unit (EN ISO 13849-1 Table C.1) and the specific application (EN ISO 13849-1, C.2.4 and Table K.1). Using an assumed B_{10d} value for maximum load 400,000 we get, for example, a maximum cycle number of $400,000 / (0.1 \times 30) = 133,333$ switching cycles/year.

Equipment and functional description

The unit is a single-channel safety switch unit that is self-monitoring in every ON-OFF cycle, for emergency stop devices as per EN 60204-1, which is fitted with a positively guided relay.

Switching (input circuit A1) is carried out by the supply voltage. The unit has the two reset inputs Y2 (automatic reset) or Y3 (manually monitored reset). The two relays K1 and K2 are controlled after actuating the reset button (on Y1-Y3) or automatically (bridge Y1-Y2). The release current circuits are closed after this switch-on phase and the signal current circuit is opened. If the electrical connections between terminal A1 and the supply voltage are interrupted, the release current circuits are opened and the signal current circuit is closed.

The LED SUPPLY (green) shows the presence of the supply voltage. The LED K1, K2 (green) shows the status of the release current circuits.

Setting up an emergency stop device according to stop category 0 is possible (EN 60204-1). The unit corresponds to category 3 for safety-relevant parts of control systems (EN ISO 13 849-1).

Competent persons

The safety relay SNO 4003K *plus* may only be fitted, installed, commissioned and tested by competent persons. A competent person is someone who ...

- has had an appropriate technical education and
- has been instructed by the machine operator on operation and the applicable safety guidelines and
- has access to the operating instructions of the safety relay SNO 4003K *plus*, and has read and duly noted its content.



Display elements

LED display	Significance
K1,K2 (green)	Current circuit K1/K2 switched
SUPPLY (green)	Supply voltage is present
SUPPLY 2x flashing	Cross-circuit Y2 to Y3 on Y1
SUPPLY 3x flashing	Reset error
SUPPLY 6x flashing	Over-voltage only on U_N 24 V DC
SUPPLY flickers	Internal error
SUPPLY aus	No voltage, under-voltage

Additional description see behavior in the event of a fault

Terminal allocation

Allocation	Description
A1	Supply voltage U _B + /L1
A2	Supply voltage GND/N
Y1 – Y2	Automatic reset
Y1 – Y3	Manual reset
13 – 14	Release current circuit 1
23 – 24	Release current circuit 2
33 – 34	Release current circuit 3
41 – 42	Signal current circuit (not safe)

Input switching

Single channel operation:

The safety sensor is connected between U_B+ and A1

Two-channel operation:

One safety sensor is connected between U_B+ and A1, the second between GND and A2.

Reset

Manual reset:

Wire the reset button with NO contact between contacts Y1 and Y3 (monitored reset). The reset button must be installed outside the danger area in such a way that it cannot be actuated from the danger area. In addition, the user must have a complete overview of the danger area when actuating.

Automatic reset:

Connect a wire bridge between Y1–Y2.

Contact monitoring:

Contact monitoring only becomes active in reset. Connecting the NC contacts of the switched gate in series with the reset circuit effects static contactor monitoring.

Function test

Function test with manual reset

If the safety sensor is not actuated (e.g. emergency stop not pushed) and if the supply voltage is present, the unit is ready (LED SUPPLY lights up). After actuating the reset button, the release current circuits close or the signal current circuit opens (LED K1, K2 lights up). Actuating the sensor opens the release current circuits and closes the signal current circuit (LED K1,K2 and LED SUPPLY off)

Function test with automatic reset

If the safety sensor is not actuated (e.g. emergency stop not pushed) and if the supply voltage is present, the release current circuits close or the signal generator current circuit opens (LED SUPPLY and LED K1, K2 light up). Actuating the sensor opens the release current circuits and closes the signal generator current circuit (LED K1, K2 and LED SUPPLY off).

Electrical installation



Make the installation free from voltage!

- **Only on 24 V DC units:**
The supply voltage must comply with the regulations for small voltages with safe isolation (SELV, PELV) in accordance with EN 60664 and EN 50178.
- **Design the insulation of the input lines for the highest voltage!**
The insulation of the input lines of the supply circuit (A1/A2) and the components connected to Y1 to Y3 must be designed for the highest voltage that may occur in the unit.
- Operate signal and input current circuits in the same voltage range.
- With AC power supply and single channel switching, the maximum line length in the safety current circuit must be observed (see instructions concerning line length and technical data).
- All connected command generators and subsequent control systems, together with wiring and routing must comply with the stipulated category, (e.g. protected routing, individual sleeve line with screening etc.).
- In order to protect the safety outputs and to increase service life, the external loads must be fitted with varistors and RC elements. When doing so, remember that this will increase the response times, depending on the type of protection switching.
- The safety outputs and the contactor monitor (EDM) must be wired within the switchgear cabinet.
- To duplicate the enable circuits you can use the extension units from the SNE range or external contactors with positively guided contacts.
- To prevent the contacts on the fitted relays from welding together, you must select an over-current protection device or a short-circuit protector (operating class gG) according to the appropriate utilization category and integrate this in the release current circuit.

Notes

- Operating the unit outside the specification can lead to functional errors or destruction of the unit.
- The units are equipped with an overload protection (in the event of a short-circuit). After elimination of the cause of the fault, the unit will be ready for operation after approx. 1.5 seconds.
- The control output Y1 is to be used exclusively for connecting command generators as per the instruction manual and not for connecting external consumers, such as lamps, relays or contactors.

Commissioning and regular testing



No commissioning without testing by a competent person!

Before commissioning the installation where you are fitting a safety relay SNO 4003K plus for the first time, this must be checked by a competent person and released, with documentation of this action.



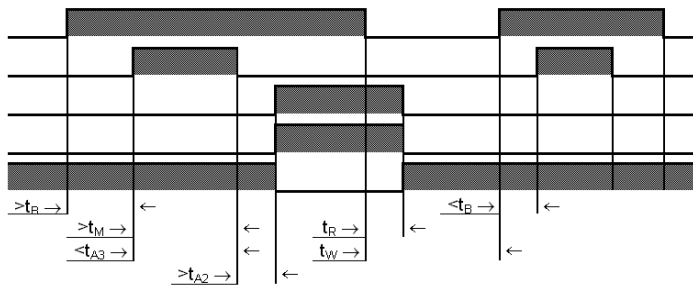
Check the danger area

Before commissioning you must ensure that there is nobody in the danger area. Check the danger area and secure the area against access by persons. Observe the relevant laws and local regulations.

Regular testing of the protection equipment by competent persons

- Test the installation in accordance with the applicable national regulations at the intervals quoted therein. This is to show any changes to the machine or manipulation of the protection equipment since initial commissioning.
- Each safety application must be tested at the time intervals that you have stipulated. The effectiveness of the protection equipment must be checked by competent and appointed persons.
- If changes have been made to the machine or the protection equipment or if the safety relay has been replaced or repaired, you should test the installation again.

Function diagram SNO 4003K plus manual start with start-up block



A1, SUPPLY LED

Y3

K1/K2, K1/K2 LED

13/14, 23/24, 33/34

41/42

t_{A2} = response time

t_{A3} = maximum switch-on time

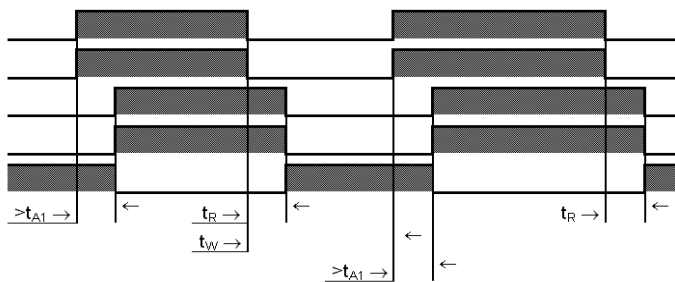
t_B = readiness time

t_M = minimum switch-on time

t_R = fallback time

t_W = time required to be ready for operation again

Function diagram SNO 4003K plus automatic start



A1, SUPPLY LED

Y2

K1/K2, K1/K2 LED

13/14, 23/24, 33/34

41/42

t_{A1} = response time

t_R = fallback time

t_W = time required to be ready for operation again

Notes concerning line length

Max. line length of the input circuit with alternating voltage



Caution!

The values for max. line capacity C_L must always be maintained, otherwise the unit can react in a faulty manner.

Line data

Cross-section 1.5 mm²

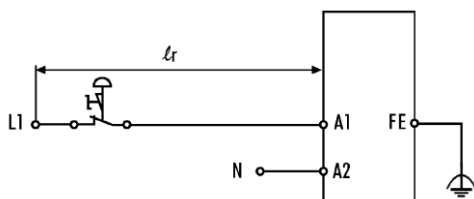
Capacity 150 nF/km

Resistance 28 Ω/km

Temperature +25 °C

Ring line

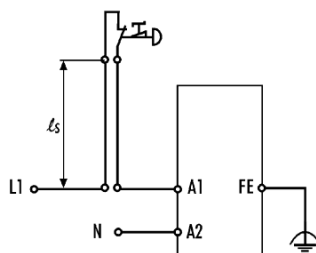
Alternating current line not routed in parallel, max. length l_r : 1 km



Stub

Max. length of stub l_s and max. line capacity C_L depending on supply voltage U_B :

U_B	115 V	230 V
C_L	37.5 nF	7.5 nF
l_s	250 m	50 m



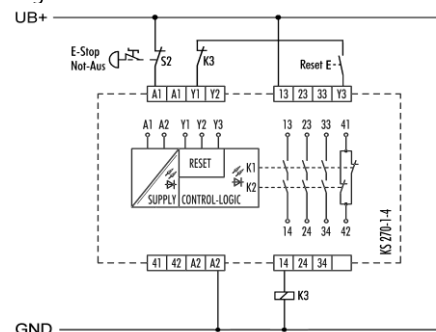
Application examples

Emergency stop application,

single channel, manual start with reset button monitoring

The single channel emergency stop application already fulfills the stop category 0 in accordance with EN 60204-1 and the category 2 in accordance with EN ISO 13849. The emergency stop sensor circuit is not redundant. Short-circuits to ground are detected in the emergency stop sensor circuit.

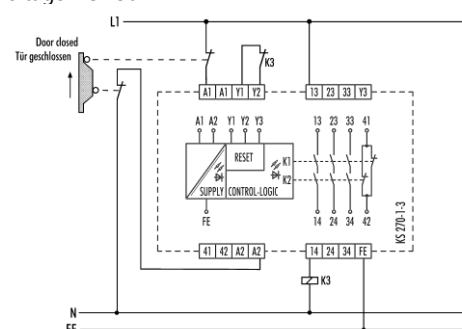
Supply voltage DC 24 V



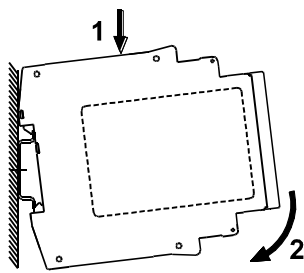
Guard door application, twin channel, automatic start

The twin channel emergency stop application already fulfills the requirements of stop category 0 in accordance with EN 60204-1 and the category 3 in accordance with EN ISO 13849. The guard door circuit is not redundant. Short-circuits to ground are detected in the guard door circuit.

Supply voltage AC 230 V

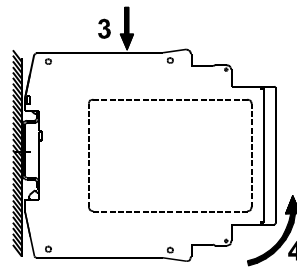


Assembly



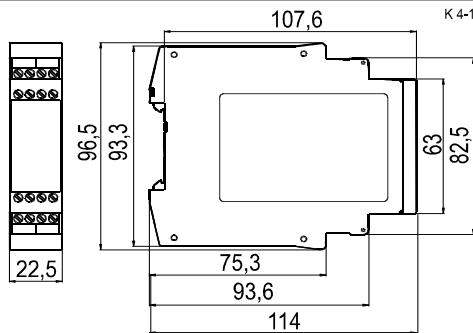
- 1 Hook the relay onto the top-hat rail.
- 2 Snap the relay onto the top-hat rail using slight pressure in the direction of the arrow.

Disassembly

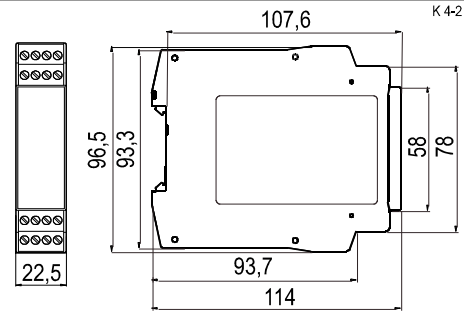


- 3 Push the relay down in the direction of the arrow.
- 4 When the relay is pushed down, release it from the retainer in the direction of the arrow and remove it from the top-hat rail.

Dimensions SNO 4003K plus



Dimensions SNO 4003K-A/-C plus



Behavior in the event of a fault



No operation in the event of unclear malfunction!

The machine must be taken out of service if you cannot find a cause for a fault and safely rectify it.

- Observe the LED SUPPLY, the flashing code indicates possible causes of faults.
- Reset fault (LED flashes 3x): faulty initiation of the reset input (too long, at start already). If the fault has been rectified, the SUPPLY LED lights up permanently. After valid reset, release of circuits follows.
- Cross short (LED flashes 2x) cross short detection Y2 to Y3 takes place with reset request on Y1. Switch off power to the unit, rectify cross short. With correct wiring, circuits are released in accordance with the reset condition.
- **Only 24 V DC unit:** over-voltage (LED flashes 6x): switch off power to the unit, check the supply voltage. With permissible operating voltage, circuits are released in accordance with the reset condition.
- Under-voltage (LED off): check the supply voltage. With permissible operating voltage, circuits are released in accordance with the reset condition.
- Internal fault (LED flickers): the unit is defective and must be replaced.

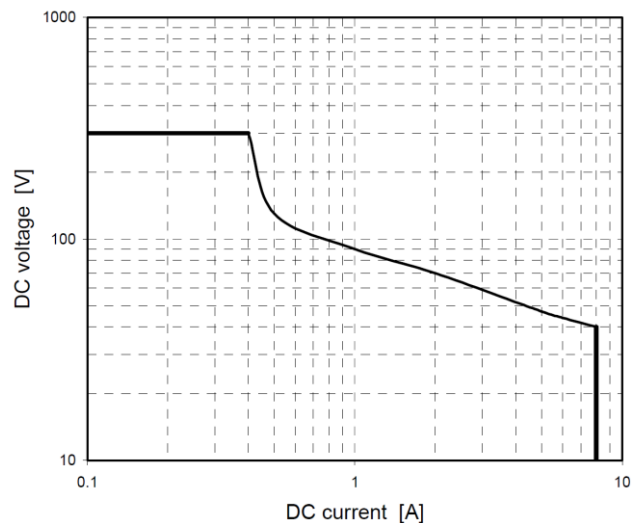


Complete function test after fault rectification!

Carry out a complete function test after rectification of a fault.

Also, please observe the information provided by your professional association

DC switch-off capacity



Overview of devices / Part numbers

Type	Rated voltage	Terminals	Part no.
SNO 4003K	DC 24 V	screw terminals, fixed	R1.188.0409.1
	AC 115-120 V 50-60 Hz	screw terminals, fixed	R1.188.0889.1
	AC 230 V 50-60 Hz	screw terminals, fixed	R1.188.0899.1
SNO 4003K-A	DC 24 V	screw terminals, pluggable	R1.188.0509.1
	AC 115-120 V 50-60 Hz	screw terminals, pluggable	R1.188.0909.1
	AC 230 V 50-60 Hz	screw terminals, pluggable	R1.188.0919.1
SNO 4003K-C	DC 24 V	spring terminals, pluggable	R1.188.1999.0



Technical data		SNO 4003K plus	
Nominal voltage U _N		AC 115 - 120 V, AC 230 V	
Rated power		AC 2.1 W / 3 VA	
Ripple U _{pp}		2.4 V	
Nominal frequency		50 ... 60 Hz	
Operating voltage range		0.85 ... 1.1 x U _N	
Fusing for control circuit supply		Short-circuit resistant	
Control circuit			
Output (Y1)			
Rated output voltage (Y1 on Y2, Y3)		max U _N (DC), min U _N (DC)-2V	
Idle running voltage (only AC units)		< 40 V	
Short-circuit resistant / current limiting		yes / --	
Inputs (Y2, Y3)			
Input voltage range (only on DC units)		Low ≤5 V DC, High ≥15 V DC	
Rated current / peak current (reset inputs Y2, Y3)		5 mA / 20 mA	
Times at U _N			
Response time t _{A1} (reset input Y2)		max. 600 ms	
Response time t _{A2} (reset input Y3)		max. 70 ms	
Switch-on duration t _M , t _{A3} (reset input Y3)		50 ms - 5000 ms	
Readiness time Y3 t _B		max. 400 ms	
Reavailability time t _W		max. 200 ms	
Reavailability time t _W in the event of a fault		max. 1.5 s	
Fallback time t _R (K1, K2)		max. 80 ms	
Output circuit (13/14, 23/24, 33/34 NO and 41/42 NC)			
Relay contacts			
Release current circuits (NO), safety-relevant		3, positively guided	
Signal generator circuits (NC) not safety-relevant		1, positively guided	
Nominal switching voltage U _n		AC 230 V / DC 300 V (see illustration DC switch-off capability)	
Max. steady current I _n per current path		8 A	
Max. total current of all circuits	DC 24 V	12 A	
	AC 115 - 120 V, AC 230 V	8 A	
Use category as per DIN EN 60947-5-1		AC-15: U _e 230 V, I _e 5A	
		DC-13: U _e 24 V, I _e 5A	
Contact fusing, gG or		max. 8 A	
Line protection switch characteristic B or C		> 10 ⁷ switching cycles	
General Data			
Contact protection		in accordance with DIN EN 60664-1, EN 60947-1	
Rated surge voltage		4 kV	
Over-voltage category		II	
Rated voltage		AC 300 V	
Test voltage U _{eff} (50 Hz)		2 kV	
Protection rating housing/terminals as per DIN EN 60529		IP 40 / IP 20	
Ambient/storage temperature		-25 ... +55 °C / -25 ... +75 °C	
Weight		0,25 kg	
Terminal and connection data			
Single wire/fine wire		1 x 0.14 mm ² - 2.5 mm ² / 2 x 0.14 mm ² - 0.75 mm ²	
Stripped length		max. 8 mm	
Fine wire with core ferule as per DIN 46228		1 x 0.25 mm ² - 2.5 mm ² / 2 x 0.25 mm ² - 0.5 mm ²	
Maximum tightening torque		0,5 Nm - 0,79 Nm	
Connection cross-sections for UL and CSA applications		AWG 26 – 14: only Cu lines to be used; 60 °C / 75 °C	
Max. tightening torque for UL and CSA applications		5 – 7 lb in (0,56 – 0,79 Nm)	
General system data			
Safety integration level		SILCL2 (EN 62061)	
Safe Failure Fraction (SFF)		90 % (EN 62061)	
Hardware fault tolerance (HFT)		0 (EN 62061)	
Category		Category 3 (EN ISO 13849-1)	
Performance Level		PL d (EN ISO 13849-1)	
DCAVG		90 %	
MTTFd		100 years	
B _{10d} - value (relay)			
AC-15, 230 V, I = 5 A		300 × 10 ³ switching cycles	
DC-13, 24 V, I = 2 A		2 × 10 ⁶ switching cycles	
I = 1 A		7 × 10 ⁶ switching cycles	
PFHd		≥ 2 × 10 ⁻⁷	
TM (use duration)		20 years (EN ISO 13849)	
Stop category		0 (EN 60204-1)	