Saftey relays - S2 series

S2NGS031 24V DC

Basic device according to EN 60204-1:2007 and EN ISO 13849-1:2007 for single- or two-channel EMERGENCY STOP monitoring

Basic unit also for elevators EN 81-1/2 and heaters EN 50156-1

PL e / category 4 according to EN ISO 13849-1:2007

SIL_{CL} 3 according to DIN EN 62061:2005

Manual and automatic start

Stop category 0 according to EN 60204-1

Single- and two-channel control

Crossover detection

3 enabling current paths, 1 signaling current path

Technical data

1. Applications
Emergency stop monitoring, Safety door monitoring
Evaluation unit for BWS 4 according to EN 61496-1
Safety mat monitoring according to EN 1760-1
Elevator systems monitoring according to EN 81-1
Combustion plant monitoring according to EN 50156-1

2. Functions
The device is a two-channel safety switching device for EMERGENCY STOP equipment according to EN 60204-1. It performs self-monitoring during each ON-OFF cycle and is equipped with positively driven relays. The device is suitable for connection in series with short-circuiting pressure sensitive mats, pressure sensitive bumpers or switching edges with 4-wire technology (without a monitoring resistor).

3. Mechanical design
Degree of protection according to EN 60529, IP40/IP20 - case/terminals
Mounted on DIN rail TS 35 according to EN 60715

Tightening torque:	0.5 to 0.6Nm
Stripping length:	max. 7mm
AWG conductor size:	26-14 (only use Cu wires)
Terminal capacity:	
1 x 0.14 to 2.5mm² rigid or flexible	
2 x 0.14 to 0.75mm² rigid or flexible	
1 x 0.25 to 2.5mm² flexible with wire end ferrule (DIN 46228)	
2 x 0.25 to 1.5mm² flexible with wire end ferrule (DIN 46228)	

4. Indicators

Green LED U ON:	indication of supply voltage
Green LED K1 ON/OFF:	saftey channel 1 enabled
Green LED K2 ON/OFF:	saftey channel 2 enabled

5. Input ciruit

Rated voltage U_N:	24V DC
	terminals A1-A2
Tolerance:	-15% to +10%
Rated frequency:	50 to 60Hz
Rated consumption:	1,6W
Availability time:	max. 3,5s

6. Control circuit

Nominal output voltage:	22,5V DC
Input voltage:	19,2 to 26,4V DC
Input current (typ. / max.)	
S12 / S22:	25mA / 100mA
S14 / S34:	3mA / 5mA
Response time:	
t_{A1} (manual start):	250ms
t_{A2} (automatic start):	250ms
Minimum activation time t_M:	
manual start (min. / max.):	125ms / 5s
Recovery time t_W:	120ms
Release time t_R (typ. / max.):	12 / 35ms
Synchronous time monitoring t_S:	1,5s
Test pulse S11 (length / interval):	4ms / 200ms
Test pulse S12, S22 (length / interval @ installation 3):	< 0,8ms / > 5,5ms
Test pulse ratio S12, S22 (length / interval @ installation 3):	< 7%
Test pulse length t_{TR} of the incomming test pulse:	< 16ms
Delay time t_D (time between test puls and incomming test pulse):	< 48ms
Max. line resistance per channel [2]:	(5 + ((1,176 x U_B / 24V) - 1) x 200) Ω

7. Output circuit

Enabling current paths:	terminals 13/14, 23/24, 33/34
Contact:	normally open, positively driven
Contact material:	AG alloy, gold plated
Rated voltage U_N:	230V AC
max. thermal continuous current I_{TH}:	6A
max. total current I_N^2:	
55°C:	25A² (UL 508: 9A²)
65°C:	9A²
Utilisation category according to EN 60947-5-1:	
AC-15:	230V AC / 5A
DC-13:	24V DC / 5A
Short circuit protection:	6A class gG fuse, fuse internal < 100A²s
Signalling current paths:	terminals 41 / 42
Contact:	normally closed, positively driven
Contact material:	AG alloy, gold plated
Rated voltage U_N:	230V AC
max. thermal continuous current I_{TH}:	2A
max. total current I_N^2:	
55°C:	25A² (UL 508: 9A²)
65°C:	9A²
Conditional short circuit current:	1000A
Mechanical life:	10 x 10^6 operations

8. General data

Air gap and creepage paths between the circuits according to EN 60664-1	
Output circuit 1:	13/14, 23/24
Output circuit 2:	33/34, 41/42
Power circuit:	A1/A2
Control circuit:	S11, S12, S21, S22, S14 und S34
Safety seperation:	
Rated insulation voltage 300V / Over voltage category III (6kV)	
Output circuit 1 - Output circuit 2	
Output circuit 1 and 2 - Power circuit	
Output circuit 1 and 2 - Control circuit	
Basic insulation:	
Rated insulation voltage 300V / Over voltage category III (4kV)	
Output circuit 1, output circuit 2	
Ambient operating temperature:	-25 to +65°C
	-25 to +55°C according to UL 508
Storage temperature:	-25 to +75°C
Weight:	200g
Standards:	EN ISO 13849-1, EN 62061, EN 81-1, EN 50156-1
Approvals:	TÜV

[2] If only one of the channels on a 2-channel device is used, the value is halved.

Functions

Single-channel activation
Both safety channels are activated by only one contact of the safety actuator. (e.g. single-channel E-Stop switch)

Two-channel activation
Each safety channel of the safety relay is activated by an own contact of the safety actuator. (e.g. two-channel E-Stop switch)

Cross Monitoring:
The Cross Monitoring function detects short circuits between the two safety channels. To activate Cross Monitoring, the safety channels are connected to positive voltage (terminals S11 - S12, S21 - S22 or S11 - S22, S21 - S12). To disable Cross Monitoring both channels are connected to terminal S21 (terminals S12/S22 - S21).

Synchronous Time Check
Synchronous Time Check is only possible in Automatic Start mode.
If the contact at safety channel 1 is closed, contact at safety channel 2 has to be activated within the synchronous time t_S to activate the enabling current paths. If channel 2 is activated after the synchronous time has elapsed, the enabling current paths are not closed. In this case both channels have to be deactivated first before a new activation cycle can be started.
If safety channel 2 is closed before safety channel 1, synchronous time is set to ∞ to disable this monitoring function.

Starting Lockout
If the supply voltage is connected to terminals A1 and A2 and the safety contacts are closed, the output relays do not pick up until the reset button is actuated.

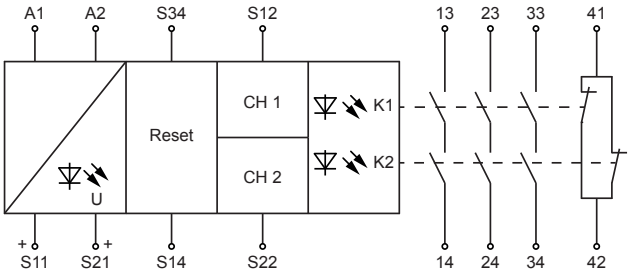
Restarting Lockout
If the safety contacts are opened and closed again, the output relays do not pick up until the reset botton is actuated.

Automatic Start
If safety channels are closed correctly, the bridge at terminals S11-S34 provides an automatic start of the safety relay and the enabling current paths are closed. This function disables Starting and Restarting Lockout.

Manual Start with Reset Monitoring
After closing the safety channels the output relays can be activated by pushing and releasing the reset button at terminals S21-S34. This ensures the correct operation of the connected reset button.

OSSD-Compatibility
The two input channels of the safety relay can be actuated alternatively by semiconductor outputs of safety actuators (e.g. light grills). Test pulses of these output channels do not influence the function of the safety relay, as long as they do not exceed the maximum permissible test pulse time t_{TR}. Test pulses that do exceed t_{TR} will be monitored as a line break of the depending safety channel.

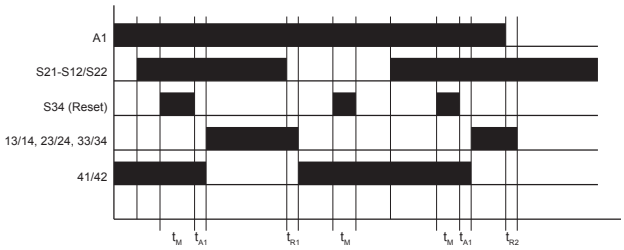
Internal scheme logic



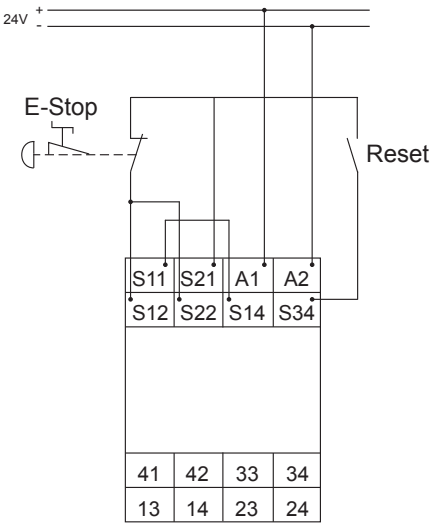
Possible applications

Single channel E-stop with Manual Start and Reset Monitoring
When the supply voltage is applied to terminals A1 and A2 (LED U illuminated) and the E-stop switch is not actuated (terminals S21-S12/S22 closed), the Starting Lockout is effective. If the reset button at terminals S21-S34 is closed and opened again (Manual Start with Reset Monitoring) the output relays pick up within the response time t_{A1} (LED K1, K2 illuminated). If the E-stop switch is actuated, the output relays release within the release time t_{R1}. If the supply voltage fails, the output relays release within the release time t_{R2}. A reset of the safety relay can only be provided, if the e-stop switch has been unlocked again.

Function diagram:

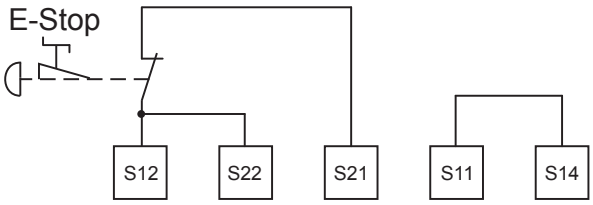


Connections:

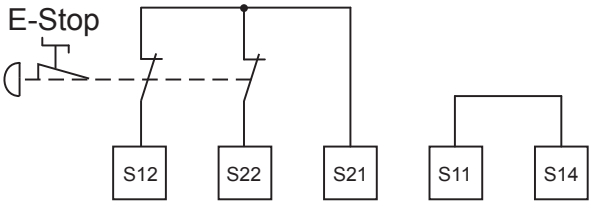


Installation

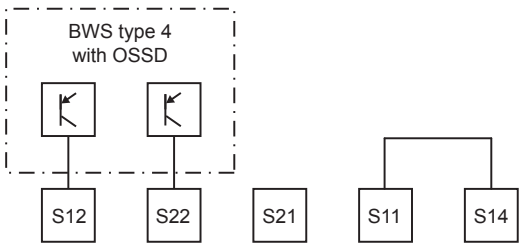
1 - Emergency Stop button, single-channel



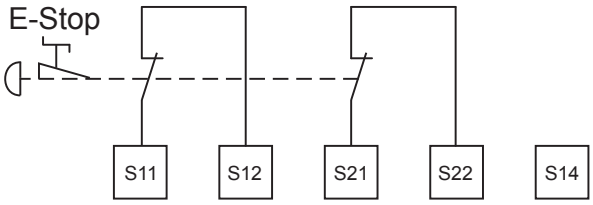
2 - Emergency Stop button, two-channel without crossover detection



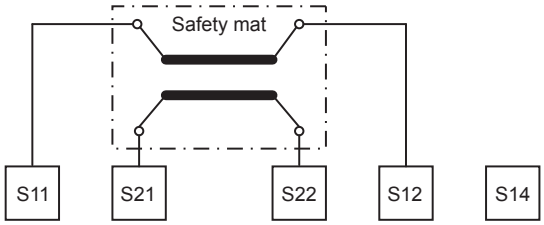
3 - Safety light curtain BWS type 4, two-channel with crossover detection by BWS



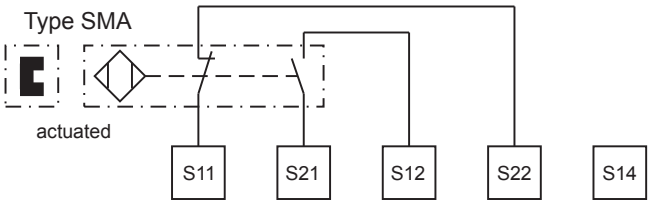
4 - Emergency Stop button, two-channel with crossover detection



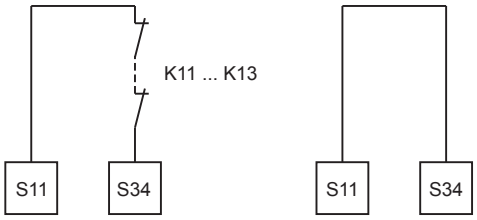
5 - Pressure sensitive mat, two-channel with crossover detection



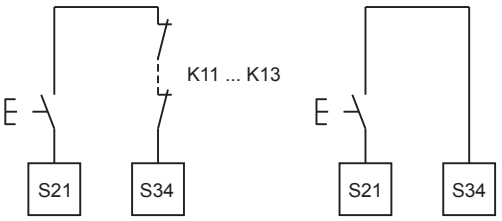
6 - Solenoid switch, two-channel, non-equivalent, with crossover detection



7 - Reset, automatic, with and without feedback circuit

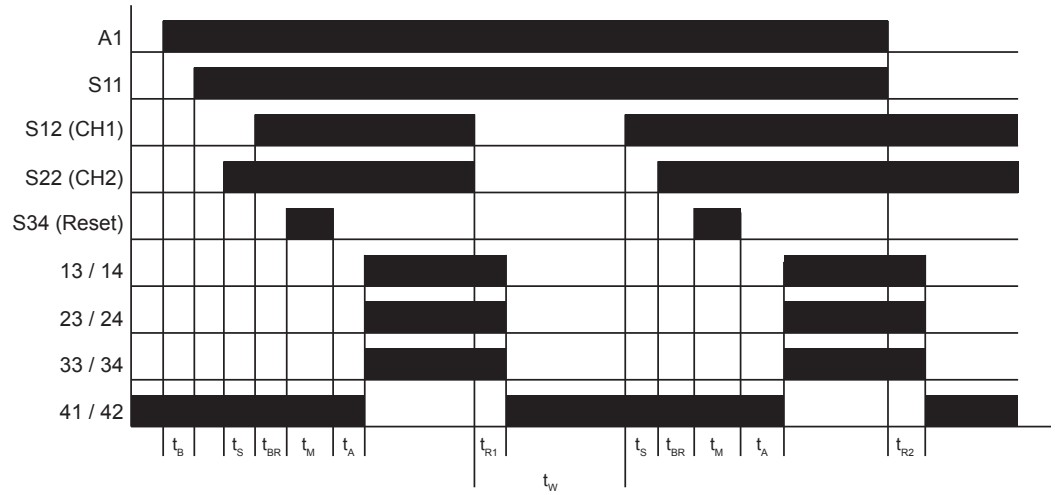


8 - Reset, manual, monitored, with and without feedback circuit

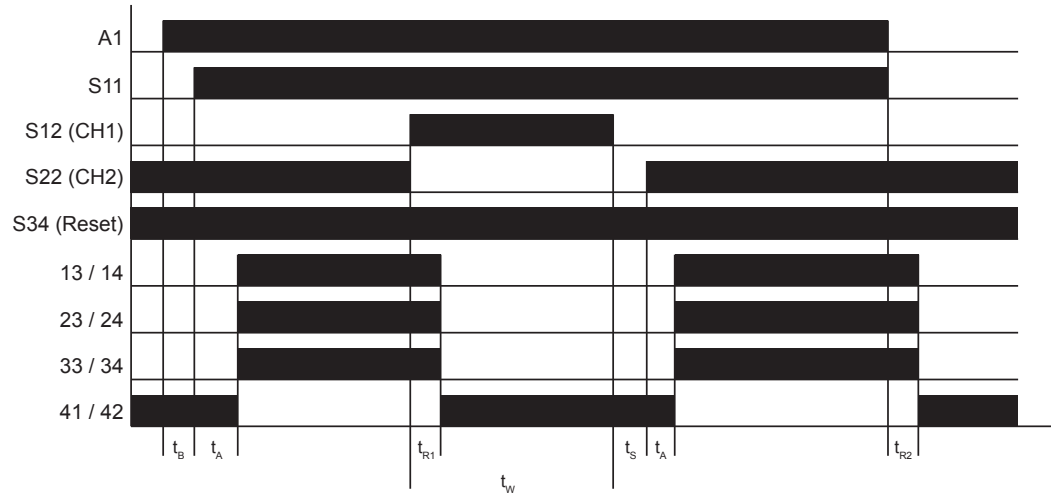


Function diagrams

Equivalent actuation with manual start (installation 1, 2, 3, 4, 5, 8)



Non-equivalent actuation with automatic start (installation 6, 7)



Dimensions