Safety switching device
Emergency stop and safety gate monitor SNO 2005

safety

Base device for emergency stop and safety gate applications

- Stop category 0 according to EN 60204-1
- Applications up to safety category 4 according to EN 954-1
- Safety category of the device: 4 according to EN 954-1
- Single-channel or two-channel control through contacts or semiconductors
- Cross monitoring
- Reset button monitoring
- 3 enabling current paths, 1 signaling current path

Applications

- Protection of people and machinery
- Monitoring of sliding safety gates
- Protective measures in sections of the safety system
- In association with automation systems

Function

With supply voltage applied to terminals A1/A2 and the emergency stop button not operated, the relay K1 is activated by pressing the reset button. The control logic of relay K1 controls relays K2 and K3. which become self-locking through their own contacts. After this switch-on phase the three enabling current paths defined for the output are closed (terminals 13/14, 23/24, 33/34) and the signaling current path opened (terminals 41/42). This is indicated by 3 LEDs that are assigned to safety channels K2, K3 as well as to the supply voltage. If the emergency stop button is activated, the current supplies for the relays K2 and K3 are interrupted. The enabling current paths on the output are opened or the signaling current path is closed.
With a two-channel wiring of the emergency stop button and cross-monitoring wiring of the emergency stop button circuit, additional errors such as shunt fault or ground fault can be detected. An electronic fuse protects the emergency stop relay against damage. After the cause of the malfunction has been removed, the device is operational again after approx. 2 s.

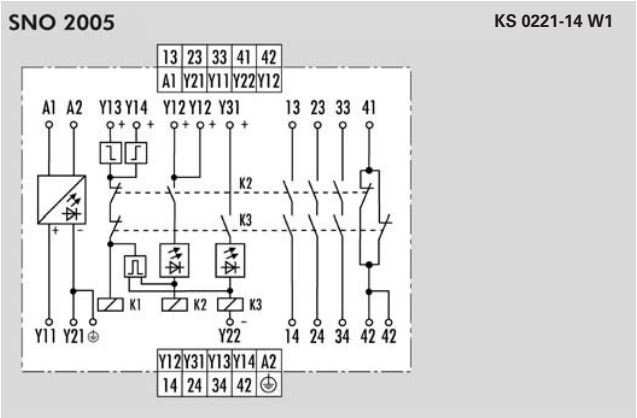
Reset button monitoring

The emergency stop relay is equipped with/without reset button monitoring. During reset button monitoring (terminal Y13) the device is only enabled with the falling edge of the reset button. This feature only allows a static operation of the device. For starting the reset button must always be pressed and released. It is not possible to perform an automatic start by jumpering the reset button (see function diagram FD 0221-14-1 W1). Operation without reset button monitoring (terminal Y14) is suitable for dynamic operation (automatic start). The reset button can be jumpered. This function is required for safety gate applications (see function diagram FD 0221-14-2 W1).

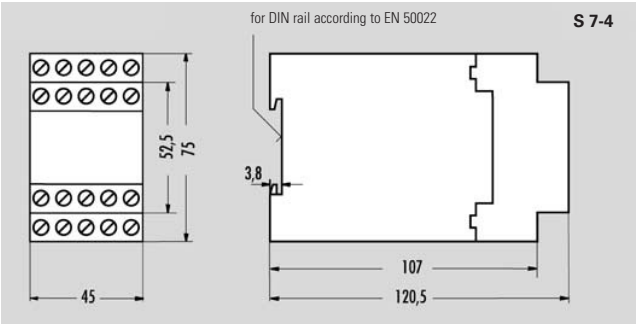
Notes

- The emergency stop control circuit can be monitored for a ground fault through the device's ground connection.
- The ground connection is omitted for DC devices.
- Expansion devices or external contactors with positively driven contacts can be used to multiply the enabling current paths.
- The devices must be installed in a control cabinet with a protection degree of at least IP 54.
- If channel 1 (Y12) is actuated before channel 2 (Y22) during closing, a synchrocheck of approx. 0.5 s is performed. Actuation of channel 2 (Y22) before channel 1 (Y12) during closing switches off the synchrocheck (t=∞).

Circuit diagram



Dimension diagram



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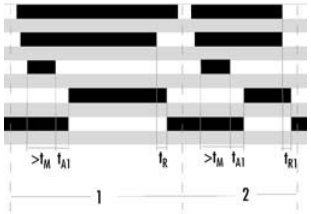
Function diagram

SNO 2005

Emergency stop application

FD 0221-14-1 W1

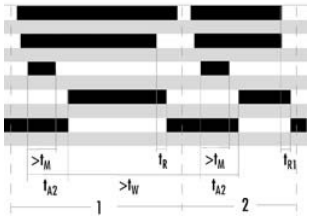


A1/A2 supply voltage, LED SUPPLY
Y12, Y31 emergency stop
Y13 reset (with reset button monitoring)
K2, K3, 13/14, 23/24, 33/34, LED K2, LED K3
41/42

t_{A1} = response time (with reset button monitoring)
t_R = release time at emergency stop (Y12, Y13)
t_{R1} = release time at supply voltage interruption
t_M = minimum ON time
1 = emergency stop through Y12, Y31
2 = supply voltage interruption (A1/A2)

Emergency stop application

FD 0221-14-2 W1

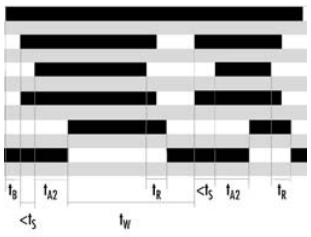


A1/A2 supply voltage, LED SUPPLY
Y12, Y31 emergency stop
Y14 reset (without reset button monitoring)
K2, K3, 13/14, 23/24, 33/34, LED K2, LED K3
41/42

t_{A2} = response time (without reset button monitoring)
t_R = release time at emergency stop (Y12, Y13)
t_{R1} = release time at supply voltage interruption
t_M = minimum ON time
t_W = recovery time
1 = emergency stop through Y12, Y31
2 = supply voltage interruption (A1/A2)

Safety gate application

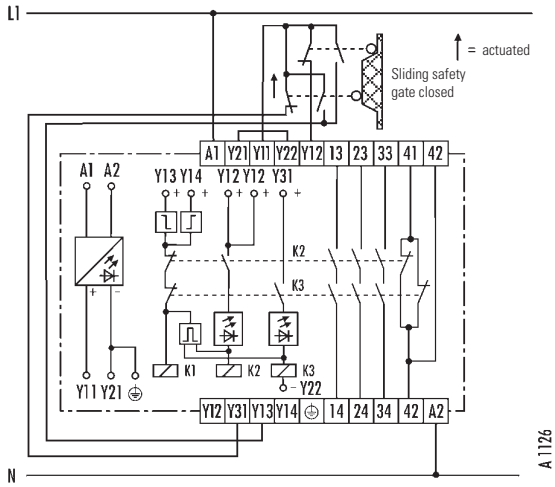
FD 0221-14-3 W1



A1/A2 supply voltage, LED SUPPLY
Y12, safety gate contact channel 1
Y22, safety gate contact channel 2
Y14 Reset
K2, K3, 13/14, 23/24, 33/34, LED K2, LED K3
41/42

t_{A2} = response time
t_B = stand-by time; it is only required for AC devices and must be ≥ 100 ms
t_R = release time, t_S = synchronous time
t_W = recovery time

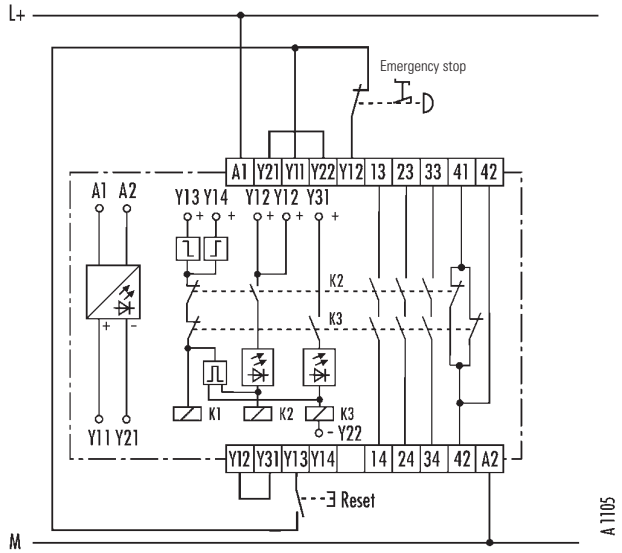
Application example



Two-channel sliding safety gate monitoring with automatic start (without cross monitoring)

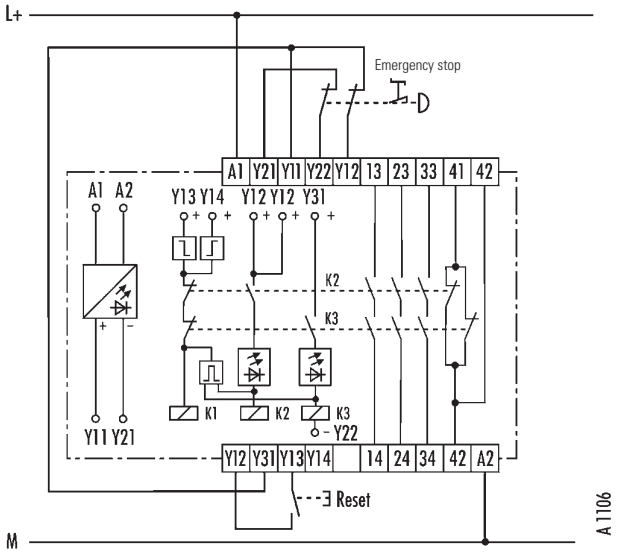
This application example does not provide the synchrocheck function ($t_S = \infty$).

Application examples



Single-channel emergency stop circuit with manual start and reset button monitoring

From the relay K3 both control connections (Y31, Y22) are conducted to terminals. Thus, the connection to be switched can be selected as required. The opposite side must be set permanently to plus (Y11) or minus (Y21) by a wire shunt. If the terminal (Y22) is permanently connected to minus (Y21), an emergency stop button with only one contact can be used.



Two-channel emergency stop circuit with reset button monitoring (with cross monitoring)

The two-channel emergency stop application switches off the device even if one of the two contacts of emergency stop button does not open. If an error occurs (for example when the emergency stop contact connected to terminal Y12 does not open), the second (redundant) contact Y22 will activate safety circuit. The enabling current paths 13/14, 23/24 and 33/34 open. In case of a short circuit in the lines leading to the emergency stop button, the voltage applied to Y11, Y21 is short-circuited (cross monitoring). The relays K2 and K3 switch back into the initial position and the electronic fuse is triggered. If a line short circuit occurs in the reset button after the relay has been activated, this will be recognized by the cyclical self test when reactivating the device. This will inhibit the enabling current paths from closing again.

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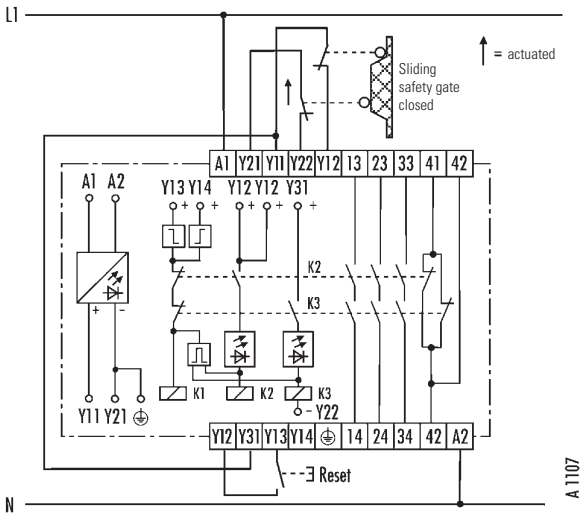
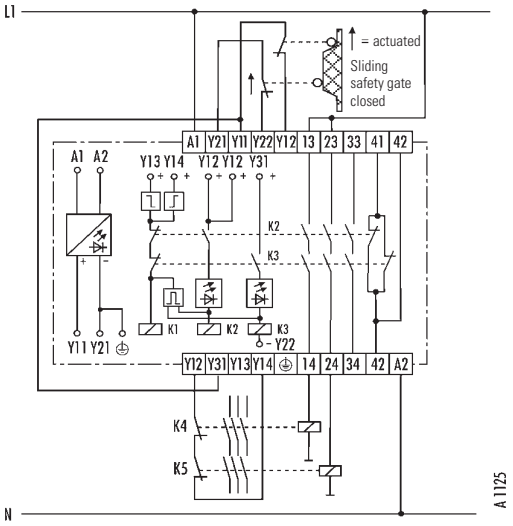


Application example

Two-channel sliding safety gate monitoring (with cross monitoring) with manual start and reset button monitoring

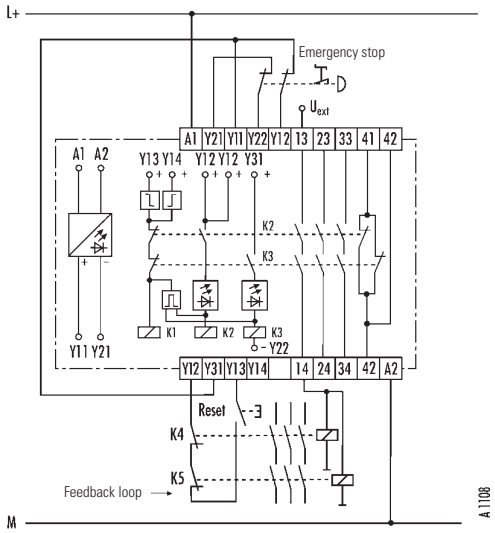
Channel 1 (Y12) and channel 2 (Y22) monitor the position of the sliding safety gate. The SNO 2005 is activated by pressing the reset button. If the sliding safety gate opens, the emergency stop relay switches back into the OFF position (enabling current paths 13/14, 23/24, 33/34 open). If the safety gate is closed again, the emergency stop relay can be activated again by pressing the reset button.



Application example

Two-channel sliding safety gate monitoring (with cross monitoring) with automatic start

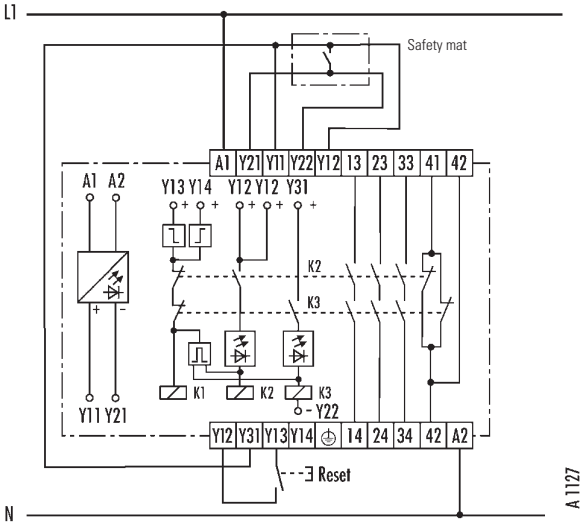
Channel 1 (Y12) and channel 2 (Y22) monitor the position of the sliding safety gate. If channel 1 (Y12) is actuated before channel 2 (Y22) during closing, a synchrocheck of approx. 0.5 s is performed. Actuation of channel 2 (Y22) before channel 1 (Y12) during closing switches off the synchrocheck (t=∞). If the sliding safety gate opens, the emergency stop relay switches back into the OFF position (enabling current paths 13/14, 23/24, 33/34 open). When the safety gate is closed again, the emergency stop relay is again activated through NC contacts K4 and K5 (automatic start).



Application example

External contact expansion

If the number of enabling current paths is not sufficient, two external contactors can be used for expansion. They are controlled through one of the enabling current paths of the SNO 2005. The function of the external contactors is monitored by their own NC contacts. that are connected in series to relay K1 (Y13). Contactors K4 and K5 must have positively driven contacts.



Application example

Two-channel safety mat monitoring (with cross monitoring) with manual start and reset button monitoring

The function corresponds to that of application example A 1106.

In addition, all short-circuit forming safety mats, switching strips or switching edges can be connected through positively driven, floating contacts. The safety mats, safety strips and safety edges cause a short circuit between two conductors. With resistance in the safety mat, safety strip or safety edge < 50 Ω/channel and a short circuit between the channels (terminals Y11/Y12 and Y21/Y22) the device is switched off. The cross-monitoring version of this device enables this evaluation and requires two-channel control.

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Technical data		SNO 2005				
Function according to EN 60204-1		Emergency stop relay				
Function display		3 LEDs green				
Function diagram		FD 0221-14-x W1				
Power supply circuit						
Rated voltage U_N	AC		24V	115 V	120 V	230 V
Rated voltage U_N	DC	24 V				
Rated consumption at 50 Hz and U_N (AC)			3.2 VA	3.2 VA	3.2 VA	3.2 VA
Rated consumption at 50 Hz and U_N (AC)			2.5 W	2.5 W	2.5 W	2.5 W
Rated consumption at U_N (DC)		1.0 W				
Residual ripple		2.4 V_{ss}				
Rated frequency		50 – 60 Hz				
Operating voltage range		0.8 – 1.1 x UN				
Control circuit only for supplying the control inputs						
Electrical isolation between A1, A2 and Y11, Y21, PE		yes for AC devices				
Line resistance (control inputs)		≤ 70 Ω				
Rated output voltage		DC 24 V				
Open-circuit voltage (AC devices)		≤ DC 40 V				
Nominal current		40 mA				
Short-circuit current I_K max.		1000 mA				
Fuse		AC: short-circuit resistant transformer DC: PTC thermistor				
Response time (PTC)		3 s				
Recovery time (PTC)		2 s				
Control input Y12, Y13, Y14, Y31:						
Rated current input	Y13, Y14	40 mA				
Rated current input	Y12, Y31	15 mA				
Response time t_{A1}	K2, K3 (with reset button monitoring) on Y13	150 ms				
Response time t_{A2}	K2, K3 (without reset button monitoring) on Y14	800 ms				
Release time at emergency stop		50 ms				
Release time t_{R1} at supply voltage interruption		100 ms				
Synchronous time t_S		≤ 500 ms				
Stand-by time t_B		≥ 100 ms (only for AC devices)				
Recovery time t_W (without reset button monitoring)		500 ms				
Output circuit						
Contact assignment		3 enabling current paths (NO contact) 1 signaling current path (NC contact)				
Contact type		positively driven				
Contact material		Ag alloy, gold-plated				
Rated operating voltage U_n		230/230 V AC/DC				
Max. continuous current I_n per contact		6 A				
Max. total current of all current paths		18 A				
Application category according to EN 60947-5-1		AC-15: U_e 230 V AC, I_e 4 A (3600 switching cycles/h) DC-13: U_e 24 V DC, I_e 6 A (360 switching cycles/h) DC-13: U_e 24 V DC, I_e 3 A (3600 switching cycles/h)				
Short-circuit protection, max. fuse insert		6 A class gG or circuit breaker with trigger characteristic B or C				
Permissible switching frequency		≤ 3600 switching cycles/h				
Mechanical life		10x10^6 switching cycles				
General data						
Creepage distances and clearances between the circuits		according to EN 60664-1				
Rated impulse voltage		4 kV				
Overvoltage category		III				
Degree of pollution		3 outside, 2 inside				
Rated voltage		300 V AC				
Test voltage U_{eff} 50 Hz		2 kV				
Protection degree according to DIN EN 60529 (housing / terminals)		IP 40/IP 20				
Ambient temperature, operating range		-25 – +55 °C				
Dimension diagram		S 7-4				
Rated cross sections fine-stranded/solid		2x0.75 – 1.5 mm^2/2x0.75 – 2.5 mm^2				
or fine-stranded with ferrules		1 or 2x0.5 – 1.5 mm^2				
Permissible tightening torque		0.8 – 1 Nm				
Weight		0.36 kg (AC device), 0.3 kg (DC device)				
Accessories		Holder Z 31-1 (R9.211.0140.0)				
Approvals						

Subject to change without further notice

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Overview of the devices/Part numbers				
Type	**Rated voltage**	**Terminals**	**Part No.**	**Std. Pack**
SNO 2005	DC 24 V	Terminal block, rising cage termination	R1.188.0350.1	1
	AC 24 V 50 – 60 Hz	Terminal block, rising cage termination	R1.188.0390.1	1
	AC 115 V 50 – 60 Hz	Terminal block, rising cage termination	R1.188.0370.1	1
	AC 120 V 50 – 60 Hz	Terminal block, rising cage termination	R1.188.0360.1	1
	AC 230 V 50 – 60 Hz	Terminal block, rising cage termination	R1.188.0380.1	1

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