

MINOS SD1K



Operating Instructions



Safe Coupling Relay MINOS SD1K

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Engl. Translation of the original

Subject to technical modifications,
no responsibility is accepted for the
accuracy of this information.

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1. Scope

This document is valid for the following safety modules:

MINOS SD1K (Order-No.: 472851)

2. Target group

Specialist electricians and assembly, setup and service specialists who possess special knowledge in working with safety components.

3. Safety instructions



ATTENTION!

Safety components are intended to protect people. Not following the safety instructions, improper installation or manipulation may result in fatal injuries to persons and damage to property. Safety devices must not be bypassed, removed or manipulated in any way. Please follow all the safety instructions and warnings mentioned in this document.

Installation, commissioning, maintenance, and decommissioning should be done only by authorised and qualified technician

- who are familiar with proper handling of the safety components,
- who are familiar with the applicable EMC and ESD regulations,
- who are familiar with the local regulations concerning work safety and accident prevention
- who have read and understood these operating instructions.

The user shall be responsible for integrating the device into a safe overall system. For this purpose, the overall system has to be validated, e.g. according to EN ISO 13849-2.

Opening the device, any kind of manipulation to it and bypassing the safety devices are not permitted.

The device version (see nameplate "Ver.") should be stored and checked before every commissioning. If there is a version change, the use of the device in the overall application should be revalidated.

4. Appropriate use

MINOS SD1K is a safety relay for the application of a safe couple relay for galvanic isolated contact reinforcement of safe outputs. The modules are also certified for the operation in furnaces and vessels according to EN 50156-1 / EN 746-2.

The approved operating parameters for use must be complied with (see chapter 20 "Technical data").

A risk assessment should be carried out on the machine before using the device. For example, according to:

EN ISO 13849-1, Safety-related parts of control systems, Appendix A

EN ISO 12100, Safety of machinery - General principals for design - Risk assessment and risk reduction

IEC 62061, Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems

Additional requirements may have to be considered depending on the type of machine or plant.

Appropriate use also includes compliance

with EN ISO 13849-1, Safety-related parts of controllers, EN 60204-1, Electrical equipment in machines.

For further information please refer to the above mentioned documents.



ATTENTION!

The user is responsible for integrating the device into a safe overall system. For this purpose, the overall system has to be validated, e.g. according to EN ISO 13849-2.

- If a operating instruction is enclosed with the product, then the specifications given in the operating instruction are applicable.

5. Disclaimer and warranty

If the above mentioned conditions for appropriate use are not complied with or if the safety instructions are not followed or if any maintenance operations are not carried out as required, this shall lead to an exclusion of liability and loss of warranty.



ATTENTION!

We would like to point out that it is the sole responsibility of the operator to ensure a plant availability.

Using the SD1K, a safety relay according to

- EN ISO 13849-1, EC 62061, IEC 61508, EN 50156-1, EN 746-2, IEC 61511-1

is used, which will be brought into the safe state when the safety function is requested.

This means that the connected load is switched off as soon as a request from connected sensor elements / PLC-Output or diagnostic measures detects a dangerous state, e.g. caused by a component fault. Since process-related applications in particular have high demands on availability, limited availability can also have significant consequences.

It is therefore recommended to stock a second unit to avoid long downtimes in such a case.

These are recommendations of the manufacturer, the evaluation of the importance of the plant availability full responsibility of the operator.

6. Features

- Use up to PL e, Cat. 4, SIL CL 3
- Certified for operation in furnaces and vessels according to EN 50156-1 / EN 746-2.
- Stop Category 0 according to EN 60204-1
- 1 safe relay contact
- 1 auxiliary output (PNP)
- Feedback circuit
- 6.8 mm width
- Extensive monitoring via front LED's

7. Function

Feedback Circuit S21

If a feedback loop is necessary, e.g for the monitoring of contactors, it has to be wired via terminal S21. See details in chapter 15 "Wiring / Applications - Feedback Circuit SD1K"

Safe relay contact 13-14

By applying the control line at A1/A2, the safe relay contact will close immediately. Turning of the power supply leads to an open relay contact.

Auxiliary output C1

The auxiliary output C1 switches inverted to the safe relay contact.

Hint:

The auxiliary contact can be used for the failure monitoring of the SD1K. A non switching of the relay contact with present control line will be detected.

Behaviour in case of a fault

It is ensured that one single fault does not lead to loss of the safety function and that every fault is detected latest when the system is switched off and switched on again through cyclic self-monitoring.

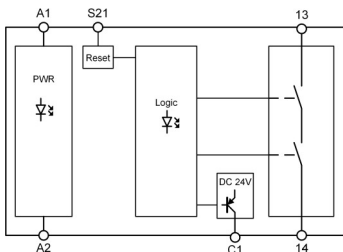


Fig. 1 Block diagram SD1K

8. Application example

Application example

SD1K as contact reinforcement and test pulse filtering for safe PLC output up to PL e / SILCL 3

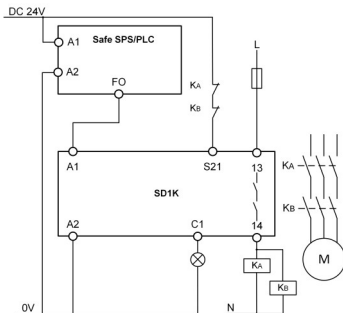


Fig. 2 Contact reinforcement and test pulse filtering for safe PLC output

Prerequisite: Safe PLC output meets the required safety level and short circuit between PLC output and SD1K can be excluded (e.g. wiring inside an electrical installation space - see EN ISO 13849-2:2013:02, Tab D4 / D5).

Legend

KA/KB: Positively driven contactors;

Monitoring via feedback circuit

PL and SILCL: According to EN ISO 13849-1 and IEC 62061.

Specified safety level, considering a fault exclusion in the wiring between SD1K and the connected contactors KA and KB. See details in chapter 15 "Wiring / Applications - Safe relay contact".

9. Mounting

- The device has to be installed in a cabinet having minimum protection class of IP54
- Mount on a 35 mm mounting rail as per EN 60715
- Ensure adequate heat dissipation in the cabinet
- The mounting distance to the adjacent devices depends on the load at the safe contact. See chapter 20 "Technical data - Safe relay contact" and chapter 21 "Derating".

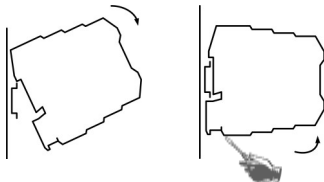


Fig. 3 Mounting / Demounting

10. Electrical connection

- Do not connect any external voltages to the outputs
- The output C1 is short-circuit-proof. Overloading is not allowed and results in damage to the device. (see chapter 20 "Technical data")
- All inductive loads should have adequate protection circuit such as a free-wheeling diode
- Auxiliary output C1 may not be used as safety output
- All electrical connections must either be isolated from the main supply by safety transformers (SELV/PELV) according to IEC 61558-2-6 with limited output voltage in the event of a fault, or by other equivalent isolation measures
- All lines to the device must be supplied by a short circuit proofed power supply.

**ATTENTION!**

By applying the control line at A1/A2, the safe relay contact will close immediately.

11. Commissioning

1. Wiring the feedback circuit:

Wiring the feedback circuit according to your application according Fig. 5 or Fig. 6.

2. Wiring the control line:

Connect the control line to the terminals A1 and A2 (Figure 7).

3. Starting the device:

The safe relay contact will close immediately after turning on the control line. If a feedback loop is used, the feedback loop has to be closed for activating the SD1K.

The LED's start glowing.

4. Triggering the safety function:

Switch off the control line at A1. The safe relay contact switches off immediately. The LED's are off.

5. Switching on again:

Restart the device.

12. Checks and maintenance

The following checks are regularly required to ensure proper and continuous functioning:

- Check the switching function
- Check for signs of manipulation and safety function bypassing
- Check if the device is mounted and connected securely
- Check for soiling.

Check if the safety device is working properly, in particular:

- Every time after initial commissioning
- Every time after replacing a component
- After a long downtime
- After every fault.

Regardless of this, the safe functioning of the safety device should be checked at suitable intervals, e.g. as part of the maintenance schedule of the plant. No maintenance is required for the device itself.



ATTENTION!

Proper operation is no longer guaranteed if the device is damaged, e.g. after a fault. Replace the device in such cases. Only the manufacturer may repair the device and open the housing.

13. Proof-Test

In order to check the proper function of the device, the following steps have to be carried out

- Demand the safety function by deactivating the control line A1/A2. Check that the relay contact (13-14) opened by activation of the safety function.
- Start the device again by applying A1/A2. Check that the relay contact (13-14) is closed again.

If the device doesn't switch on again, the proof-test failed.



ATTENTION!

If the proof-test fails, the device must be replaced. Otherwise there is a risk of loss of functional safety.

14. Terminal assignment and LED display












	A1: Control Line + DC 24 V
	A2: Control Line 0 V
	S21: Control line feedback circuit
	N.C.: Not Connected - No function
SD1K	
	SD1K: Variant label
A1 ↑	
A2	Label - Upper terminal block
S21	
N.C.	
N.C.	Label - Lower terminal block
13	
14	
C1 ↓	
UB 	Monitoring LEDs: UB, K1/2 (see monitoring table)
K1/2 	
	N.C.: Not Connected - No function
	13: Safe Relay Contact
	14: Safe Relay Contact
	C1: Auxilliary Output

Fig. 4 Front View SD1K

15. Wiring / Applications

Depending on application and variant or result of the risk assessment, e.g. according to EN ISO 13849-1, the device should be wired according to Fig. 5 to Fig. 10.

No Feedback Loop

If no contactors have to be monitored, connect terminal S21 with DC 24V.

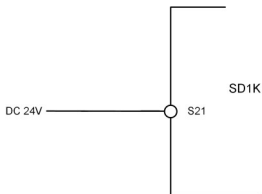


Fig. 5 No feedback loop

With Feedback Loop

If connected contactors have to be monitored, connect to terminal S21 as shown figure 6.

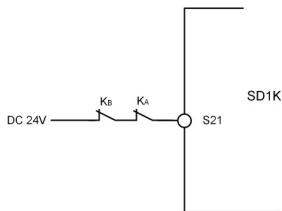


Fig. 6 With feedback loop

KA, KB:
Positively driven NC contacts of the connected contactors or expansion modules.

Control Line

Connect the safe plc output with terminal A1 of the SD1K.

Up to PL e / SIL 3

Prerequisite: Safe output of the PLC meets the requirements for safety level and a cross circuit between plc and SD1K can be excluded (e.g. according EN ISO 13849-2; Tab. D4 / D5)

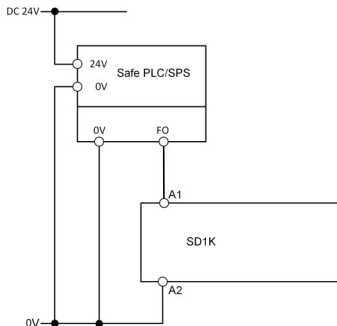


Fig. 7 Controlling SD1K via Safe PLC/SPS

Note:

Make sure that the reference potential 0V is the same at the plc and at A2 of the SD1K

Safe Relay Contact

Safe relay contact suitable for different loads (see chapter 21 "Technical data") with interference suppression.

Note: Fault exclusion of a cross circuit should be carried out in the safety output, e.g. in accordance with EN ISO 13849-2, table D4/D5 - Cables within an electrical installation space in accordance with EN 60204-1.

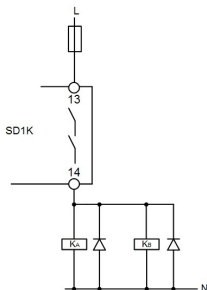


Fig. 8 Safe Relay Contact

Auxiliary Output

Suitable for indicator lamps or control inputs of connected PLC controllers.

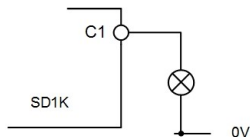


Fig. 9 Auxiliary Output

16. Timing diagrams

SD1K with feedback circuit on S21

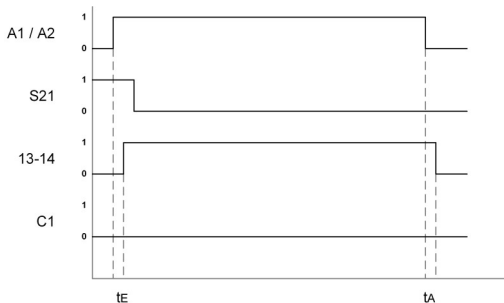


Fig. 10 Timing diagram - SD1K with feedback circuit on S21

t_E : Switch-on delay - typ. 10 ms

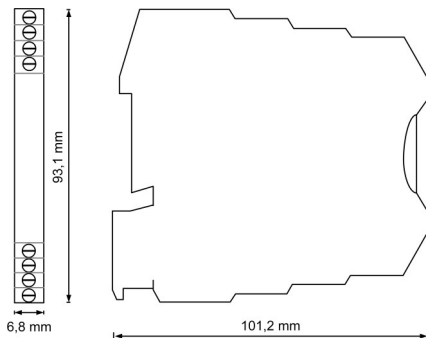
t_A : Switch-off delay - typ. 10 ms

17. Monitoring table

If the device does not respond as expected, a monitoring can be carried out using the front LEDs according to the table below.

LED off: ○ LED on: ●		Explanation / Measure
UB	K _{1/2}	
○	○	<ul style="list-style-type: none"> Check the control line A1/A2 - Voltage has to be within DC 24V ± 10% Check for a short circuit in all circuits of the safety relay
●	○	<p>Overvoltage at A1/A2:</p> <ul style="list-style-type: none"> Measure the voltage at A1/A2. The maximum permissible supply voltage is DC 26.4 V
●	○	<ul style="list-style-type: none"> If a feedback circuit is used - Check if the feedback circuit through some connected contactors or expansion modules work properly. If not, replace the faulty device and perform a reset If no feedback circuit is used - Check that terminal S21 is connected to UB Check the status of auxiliary output C1. If it is high, an internal error has occurred. Replace the safety relay.

18. Dimensions



19. Safety parameters



ATTENTION:

According to CNB / M / 11.050, a request for the safety function is recommended at the following intervals:

Once a month for applications up to PL e with Cat. 3 or Cat. 4 or SIL 3 with HFT = 1

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Once a year for applications up to PL d with Cat. 3 or SIL 2 with HFT = 1

The following tables shows the safety parameters for the SD1K according EN ISO 13849-1 and IEC 61508 for High-Demand and Low-Demand.

Safety parameters according to EN ISO 13849-1

Conditions:

AC-15: 5 A; Max. 10.000 Switching-Cycles / Year

DC-13: 4 A; Max. 15.000 Switching-Cycles / Year

Max. duration of use [Years]	20
Category	4
PL	e
PFHd [1/h]	1.2E-08

Safety parameters according to IEC 61508 - High-Demand, Request Rate < 1 Year

Conditions:

AC-15: 5 A; Max. 10.000 Switching-Cycles / Year

DC-13: 4 A; Max. 15.000 Switching-Cycles / Year

Max. duration of use [Years]	20
Proof-Test-Intervall [Years]	20
PFH [1/h]	1.2E-10
SIL	3

Safety parameters according to IEC 61508 - Low-Demand, Request Rate ≥ 1 Year

Conditions:

AC-15: 5 A

DC-13: 4 A

Max. duration of use [Years]	20
Proof-Test-Intervall [Years]	9
PFD _{AVG}	9.87E-05
SIL	3

20. Technical data

Standards

Meets the following standards	EN ISO 13849-1; IEC 62061; IEC 61508; EN 50156-1; EN 746-2; IEC 61511-1; EN 60204-1
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Electrical data

Control voltage (A1/A2)	U _B : DC 24 V ± 10 %
Power consumption at U _B = 24 V (Module activated. No load)	1.5 W
Filter time at A1, U _B = 2kV	
Dark test pulse	Max. 2 ms pulse width at 200 ms pulse rate
Light test pulse	Max. 1 ms pulse width at 200 ms pulse rate
	Note: It must be ensured that any switch-on pulses (light test) sent by the signal generator do not lead to a short activation of the safety relay and should therefore basically be deactivated.

Feedback circuit S21

Input current at high level	max. 7 mA
Galvanic isolation	no
Low level	0 V to 5 V
High level	21.6 V to 26.4 V

Safe relay contact 13-14

Structure	Redundant relay contact
Max. Contact rating (6 switching cycles / min)	AC-15: 5 A, AC 230 V DC-13: 4 A, DC 24 V See derating characteristics in chapter 21.
Min. switching voltage / current	AC/DC 12 V / 3 mA
Min. switching power	60 mW
External fuses	6 A gG Factor 0.6 for applications acc. to EN 50156-1, chapter 10.5.5.3.4
Mech. Service life	approx. 1×10^7 cycles
Contact material	AgSnO ₂

Auxiliary output C1

Structure	PNP output, single channel
Maximum switching capacity	100 mA
Galvanic isolation	no
Short-circuit-proof	yes
Output voltage at "1" (max. load) / "0"	U _B - 2 V / 0 V

Timings

Max. switch-on delay	< 20 ms
Off-delay	< 20 ms
Recovery time	< 50 ms

Environmental data

Ambient temperature	-15 °C to 55 °C - See chapter 21 "Derating"
Storage temperature	-15 °C to 80 °C
Humidity rating	93 % relative humidity at + 40 °C, non-condensing
Vibration / Shocks	10 Hz to 150 Hz, 2 g / 15 g
EMC	in accordance with EN 61326-3-1
Maximum altitude	2000 m (Above sea level)

General data

Clearance and creepage distances	According EN 60664-1
Overvoltage category	III (in accordance with DIN VDE 0110-1)
Pollution degree	2 (in accordance with DIN VDE 0110-1)
Rated insulation voltage	50 V (For SELV/PELV circuit) 250 V (Between relay circuit and SELV/PELV circuit)
Rated surge voltage strength	800 V - Basic insulation for SELV/PELV circuit 6 kV - Safe insulation, reinforced insulation between relay circuit and SELV/PELV circuit 4kV - Basic insulation between all current paths and housing
Degree of protection	IP20
Minimum degree of protection of installation space	IP54
Mounting	DIN rail
Installation position	vertical, horizontal
Dimensions (W x H x D)	6.8 x 93.1 x 102.5 mm
Weight	50 g (module without packaging)
Housing material	PBT, blue
Cross section of conductor	
- Rigid / flexible	0.2 mm ² to 2.5 mm ²
- AWG min/max	16/14

21. Derating

Maximum permissible current at safe relay contact 13-14 depending on the ambient temperature.

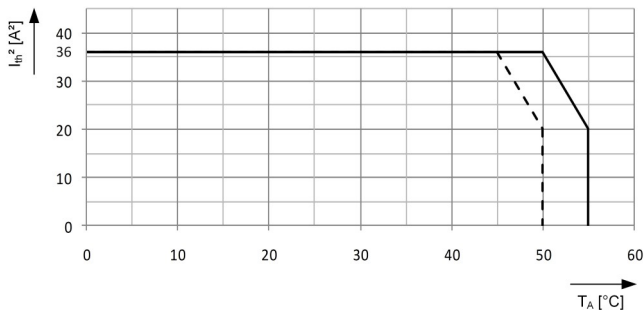


Fig. 11 Derating curve

— $U_B = DC 24 V$ and 0 mm clearance to adjacent devices with same load

- - - $U_B = DC 26,4 V$ and 0 mm clearance to adjacent devices with same load

22. Variants / Order No.

Order No.	Type	Application
472851	SD1K	Safe couple relays for galvanic separated contact reinforcement at machines and plants.

Notes:

23. Contact / Service

For service requirements, contact
H. Zander GmbH & Co. KG
Am Gut Wolf 15
52070 Aachen
Germany

Service line
+49 241 910 501-0

E-mail
info@zander-aachen.de

Internet
www.zander-aachen.de

24. Declaration of Conformity

CE Konformitätserklärung EC Declaration of Conformity Déclaration de conformité

Hersteller: H. ZANDER GmbH & Co. KG
Producer: Am Gut Wolf 15 • 52070 Aachen • Deutschland
Fabricant:

Produktgruppe: Sicherheits-Not-Halt-Schaltgeräte
Product Group: Safety emergency stop switching devices
Groupe de produits: Relais de sécurité d'arrêt d'urgence

Produkt Name Product Name Nom du produit	Anbringung der CE-Kennzeichnung Affixing of CE marking Application du marque CE	Zertifikats-Nr. No of Certificate N° du certificat
SD1E	2023	01/205/5689.01/23
SD1K	2023	01/205/5689.01/23

Die Produkte stimmen mit den Vorschriften folgender Europäischer Richtlinien überein:

The products conform with the essential protection requirements of the following European directives:
 Les produits sont conformes aux dispositions des directives européennes suivantes:

2006/42/EG : Maschinenrichtlinie
 2011/65/EU : RoHS Richtlinie

2014/30/EU : EMV Richtlinie
 2014/30/EU : EMC directive

Die Übereinstimmung der bezeichneten Produkte mit den Vorschriften der o.a. Richtlinie wird, falls anwendbar, nachgewiesen durch die vollständige Einhaltung folgender Normen:

The conformity of the designated products is proved by full compliance with the following standards:
 La conformité des produits désignés sont conformes aux dispositions de la directive susmentionnée.

EN 61236-3-1:2017

EN IEC 61000-6-4:2019

EN IEC 61000-6-2:2019

Gemäß Zertifikat der benannten Stelle:

According to the certificate of the below mentioned organisation:
 Selon de organisme notifié.

EN IEC 62061:2021

EN ISO 13849-1:2015

IEC 61508 Parts 1-2 and 4-7:2010

IEC 61511-1:2017 + A1:2017 in extracts

EN 50156-1:2015 in extracts

EN 746-2:2010 in extracts

EN 60664-1:2007

EN IEC 60664-1:2020 + AC:2020-12

Benannte Stelle / Organisme notifié: NR 0035

TÜV Rheinland Industrie Service GmbH

10982 Berlin

Zertifizierungsstelle für Maschinen

Dokumentationsbeauftragte/r: Christiane Nitschalk

Documentation manager

Autorisé à constituer le dossier technique

Aachen, den 01.09.2023

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F7 3.07/03

25. Editions of listed Standards

The following are the valid editions of the standards and documents listed in this manual:

Standard / Document	Edition
EN ISO 13849-1	2016-06
EN ISO 13849-2	2013-02
IEC 62061	2016-05
IEC 61508	2011-02
IEC 61511	2005-05
EN 50156-1	2016-03
EN 746-2	2011-02
EN ISO 12100	2011-03
EN 60204-1	2007-06
EN 60715	2018-07
EN 61326-3-1	2018-04
EN60664-1	2008-01
CNB/M/11.050	Revision 05

