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1773 GB 04 25

GB SAFETY RELAYS

Instruction manual (Original instruction)

SRC...

WARNING!
- This equipment is to be installed by qualified personnel, complying to current standards, to avoid damages or safety hazards.
- The manufacturer cannot be held responsible for electrical safety in case of improper use of the equipment.
- Products illustrated herein are subject to alteration and changes without prior notice. Technical data and descriptions in the documentation are accurate, to the best of our knowledge, but no liabilities for errors, omissions or contingencies arising there from are accepted.

ATTENTION !
- Ces appareils doivent être installés par un personnel qualifié, conformément aux normes en vigueur en matière d'installations, afin d'éviter de causer des dommages à des personnes ou choses.
- Le constructeur n'assume aucune responsabilité quant à la sécurité électrique en cas d'utilisation impropre du dispositif.
- Les produits décrits dans ce document sont susceptibles d'évoluer ou de subir des modifications à n'importe quel moment. Les descriptions et caractéristiques techniques du catalogue ne peuvent donc avoir aucune valeur contractuelle.

ACHTUNG!
- Zur Vermeidung von Personen- und Sachschäden dürfen diese Geräte nur von qualifiziertem Fachpersonal und unter Befolgung der einschlägigen Vorschriften installiert werden.
- Bei zweckwidrigem Gebrauch der Vorrichtung übernimmt der Hersteller keine Haftung für die elektrische Sicherheit.
- Die in dieser Broschüre beschriebenen Produkte können jederzeit weiterentwickelt und geändert werden. Die im Katalog enthaltenen Beschreibungen und Daten sind daher unverbindlich und ohne Gewähr.

ADVERTENCIA
- Este dispositivo debe ser instalado por personal cualificado conforme a la normativa de instalación vigente a fin de evitar daños personales o materiales.
- El fabricante no se responsabilizará de la seguridad eléctrica en caso de que el dispositivo no se utilice de forma adecuada.
- Los productos descritos en este documento se pueden actualizar o modificar en cualquier momento. Por consiguiente, las descripciones y los datos técnicos aquí contenidos no tienen valor contractual.

UPOZORNĚNÍ
- Tato zařízení smí instalovat kvalifikovaní pracovníci v souladu s platnými předpisy a normami pro předcházení úrazů osob či poškození věcí.
- Výrobce nenese odpovědnost za elektrickou bezpečnost v případě nevhodného používání regulátoru.
- Výrobky popsané v tomto dokumentu mohou kdykoli projít úpravami či dalším vývojem. Popisy a údaje uvedené v katalogu nemají proto žádnou smluvní hodnotu.

AVERTIZARE!
- Acest echipament va fi instalat de personal calificat, în conformitate cu standardele actuale, pentru a evita deteriorări sau pericolele.
- Producătorul nu poate fi considerat responsabil pentru siguranţa electrică în caz de utilizare incorectă a echipamentului.
- Produsele ilustrate în prezentul sunt supuse modificărilor şi schimbărilor fără notificare anterioară. Datele tehnice şi descrierile din documentaţie sunt precise, în măsura cunoştinţelor noastre, dar nu se acceptă nicio răspundere pentru erorile, omiterile sau evenimentele neprevăzute care apar ca urmare a acestora.

ATTENZIONE!
- Questi apparecchi devono essere installati da personale qualificato, nel rispetto delle vigenti normative impiantistiche, allo scopo di evitare danni a persone o cose.
- Il costruttore non si assume responsabilità in merito alla sicurezza elettrica in caso di utilizzo improprio del dispositivo.
- I prodotti descritti in questo documento sono suscettibili in qualsiasi momento di evoluzioni o di modifiche. Le descrizioni ed i dati a catalogo non possono pertanto avere alcun valore contrattuale.

UWAGA!
- W celu uniknięcia obrażeń osób lub uszkodzenia mienia tego typu urządzenia muszą być instalowane przez wykwalifikowany personel, zgodnie z obowiązującymi przepisami.
- Producent nie przyjmuje na siebie odpowiedzialności za bezpieczeństwo elektryczne w przypadku niewłaściwego użytkowania urządzenia.
- Produkty opisane w niniejszym dokumencie mogą być w każdej chwili udoskonalone lub zmodyfikowane. Opisy oraz dane katalogowe nie mogą mieć w związku z tym żadnej wartości umownej.

警告！
- 本设备只能由合格人员根据现行标准进行安装，以避免造成损坏或安全危害。
- 制造商不负责因设备使用不当导致的电气安全问题。
- 此处说明的产品可能会有变更，恕不提前通知。 我们竭力确保本文档中技术数据和说明的准确性，但对于错误、遗漏或由此产生的意外事件概不负责。

ПРЕДУПРЕЖДЕНИЕ!
- Во избежание травм или материального ущерба монтаж должен существляться только квалифицированным персоналом в соответствии с действующими нормативами.
- Производитель не несет ответственность за обеспечение электробезопасности в случае ненадлежащего использования устройства.
- Изделия, описанные в настоящем документе, в любой момент могут подвергнуться изменениям или усовершенствованиям. Поэтому каталожные данные и описания не могут рассматриваться как действительные с точки зрения контрактов

DİKKAT!
- Bu aparatlar kişilere veya nesnelere zarar verme ihtimaline karşı yürürlükte olan sistem kurma normlarına göre kalifiye personel tarafından monte edilmelidirler
- Üretici aparatın hatalı kullanımından kaynaklanan elektriksel güvenliğe ait sorumluluk kabul etmez.
- Bu dokümanda tarif edilen ürünler her an evrimlere veya değişimlere açıktır. Bu sebeple katalogdaki tarif ve değerler herhangi bir bağlayıcı değeri haiz değildir.

UPOZORENJE!
- Ovaj uređaj mora instalirati, u skladu s važećim normama, obučena osoba kako bi se izbjegle štete ili sigurnosne opasnosti.
- Proizvođač ne snosi odgovornost za električnu sigurnost u slučaju nepravilnog korištenja opreme.
- Ovdje prikazan uređaj predmet je stalnog usavršavanja i promjena bez prethodne najave. Tehnički podaci i opisi u ovim uputama su točni, ali ne preuzimamo odgovornost za možebitne nenamjerne greške.

1. TABLE OF CONTENTS

2. FUNCTIONAL DESCRIPTION

– Intended Use:
  • The safety relay is used for the emergency stop and safety door monitoring.
  • When the sensor circuit is interrupted, the safety relay initiates the safe state.
  • The safety relay interrupts circuits in a safety-related way.
– Possible signal generators:
  • E-stop button.
  • Safe door monitoring.
– Control:
  • Dual channel monitoring emergency stop button, safety door monitoring switch and other safety input monitoring applications
  • Automatic reset/Manual reset(with short-circuit monitoring)
– Achievable safety integrity:
  • Suitable up to category 4, PL e (EN ISO 13849-1)
  • The product can also be used in the application area of EN IEC 62061, that is based on EN/IEC 61508
– Additional features:
  • Dual channels with Cross-short circuiting detection
  • With self monitoring function of built-in safety elements
  • In case of component failure, the safety function is still effective
  • Automatically test the correct opening and closing of the safety function relay in each on-off cycle.
  • Version with screw or Push-in terminal blocks
  • 22.5 mm housing width
– Approvals:

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3. INTRODUCTION

3.1. Target group for this application manual

This manual is aimed at all designers of safety control systems. This manual should provide a simple introduction to the technology of safety-related machines and systems and an overview of safety technology basics. You must always ensure you are familiar with the directives, standards, and regulations relevant to the field of application.

3.2. Definition of Symbols

The following are particularly important information definitions:

DANGER!
This warning must be heeded! It warns of a hazardous situation that poses an immediate threat of serious injury and death and indicates preventive measures that can be taken.

WARNING!
This warning must be heeded! It warns of a hazardous situation that could lead to serious injury and death and indicates preventive measures that can be taken.

CAUTION!
This refers to a hazard that can lead to a less serous or minor injury plus material damage,and also provides information on preventive measures that can be taken.

NOTICE
This describes a situation in which the product or devices could be damaged
and also provides information on preventive measures that can be taken. It also highlights areas within the text that are of particular importance.

3.3. Codes description

Safety Relays

Devices	SRCES20	SRCES20S	SRCES31	SRCE31S
NO safety outputs	2	2	3	3
Aux NC outputs	–	–	1	1
Type of terminals	Screw	Screw	Spring push-in	Spring push-in

3.4. Further documentation

For product information and safety technical characteristics of Lovato Electric safety relays, please refer to the relevant product data sheet, which can be downloaded from the official website at https://www.LovatoElectric.com.

NOTICE
Observe the product documentation valid for the devices you are using. Make sure you always use the latest documentation.

4. TECHNICAL DETAILS

4.1. Parameter

Electrical data	
Supply voltage	24V AC/DC
Voltage tolerance	-15 %/+10 %
Output of external power supply (AC)	5VA
Output of external power supply (DC)	2.5W
Frequency range AC	50 - 60 Hz
Max. inrush current impulse duration A1	0.5A
Max. inrush current impulse duration A1	5ms
External power protection blow-out fuse,slow	1A
Inputs	
Number	2
Current at input circuit DC	50mA
Current at start circuit DC	50mA
Max. Current pulse,input circuit	200mA
Max. Current pulse duration,input circuit	100ms
Max. Current pulse,start circuit	200mA
Max. Current pulse duration,start circuit	15ms
Max. Cable resistance	15Ω
Relay outputs	
Number of output contacts	Section 3.3
Max. Short circuit current	1kA
Category in accordance with the standard	EN 60947-4-1
Category of contacts AC1	250V
AC1 at min. current	10mA
AC1 at max. current	5A
AC1 at max. power	1500VA
Category of contacts DC1	24V
DC1 at min. current	10mA
DC1 at max. current	5A
DC1 at max. power	150W
Category in accordance with the standard	EN 60947-5-1
Category of safety contacts AC15	250V
AC15 at max. current	5A
Category of safety contacts DC13	24V
DC13 at max. current	5A
External contact fuse protection	
Safety contact blow-out fuse,quick	10A
Safety contact blow-out fuse,slow	5A
Safety contact blow-out fuse,gG	10A
Auxiliary contact blow-out fuse,quick	10A
Auxiliary contact blow-out fuse,slow	5A
Auxiliary contact blow-out fuse,gG	10A
Contact material	AgSnO2In2O3+Au

Times	
Switch on delay with auto-start max.	300ms
Switch on delay with auto-start after power on max.	600ms
Switch on delay with manual start max.	100ms
Delay on de-energisation with E-stop max	45ms
Delay on de-energisation with power failure max	45ms
Min. start pulse duration with a monitored start	250ms
Supply interruption before de-energisation	20ms
Simultaneity, channel 1 and 2 max.	∞
Environmental data	
Climatic suitability	EN 60068-2-78
Ambient temperature Temperature range	-20...+55°C
Storage temperature Temperature range	-20...+85°C
Climatic suitability Humidity	RH 93% at 40°C Non condensing
EMC	EN 60947-5-1 EN 61000-6-2,EN 61000-6-4 EN 61326-3-1
Vibration in accordance with the standard	EN 60068-2-6
Frequency	2-13.2Hz
Amplitude	±1mm
Frequency	13.2-100Hz
Acceleration	±0.7g
Airgap creepage in accordance with the standard	EN60947-1
Shock in accordance with the standard	EN 60068-2-27
Over-voltage category	III
Pollution degree	2
Rated insulation voltage	250V
Rated impulse withstand voltage	4kV/6kV
Protection type of housing	IP40
Protection type of terminals	IP20
Protection type at mounting area(e.g. control cabinet)	IP54
Mechanical data	
Mounting position	
Mechanical life	10,000,000
Connection type	Standard type:screw terminals SRC...S: Spring-loaded terminals
Mounting type	Plug-in
Conductor cross section with screw terminals	0.25 - 2.5 mm², 24 - 12AWG
Conductor cross section with spring-loaded terminals	0.25 - 1.5 mm², 24 - 16AWG
Torque setting with screw terminals	0.4Nm
Stripping length with screw terminals	7 mm
Stripping length with spring-loaded terminals	8 mm
Dimensions height (Spring-loaded terminals)	99mm(109.6mm)
Dimensions width	22.5mm
Dimensions depth	114mm
Weight max.	175g

4.2. Safety characteristic data

Parameter name	Symbol
Hardware version of SRC series	g
Software version of SRC series	-/- (No SW)
Operating mode	Low/High or continuous demand
Hardware Fault Tolerance	HFT 0 (1oo1 parts)
	HFT 1 (1oo2 parts)
Performance level	PL e
Category	Cat. 4
The maximum safety integrity level	SIL 3
Device type	Type A
Average frequency of a dangerous failure per hour	PFH_D =2.418E-10
Safety integrity level	SIL 3

Parameter name	Symbol
Probability of failure on demand (low demand)	PFD_{avg}=2.058E-5
Systematic capability	SC 3
Maximum mission time(Year)	TM=20
Safe Failure Fraction	≥99% (1oo1 part)
	≥99% (1oo2 part)
Mean Time To Restoration(MTTR)	0 h
Mean Repair Time(MRT)	0 h
Diagnostic coverage	DC≥99%
Common cause failures	CCF≥65
Year (Relay evaluation based on electrical stress region IV accordance with SN 29500-7) Note: MTTFd can also be calculated according to B10d corresponding to different loads in different applications	MTTFd=1.057E+2

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DANGER & WARNING!

- You must comply with the safety characteristic data in order to achieve the required safety level for your plant/machine.The only dual-channel applications are safety-related applications.Safety characteristic data is based on 1oo2 application evaluation
- The PFD_{avg}/PFH_D only amount to 25% of the complete safety loop.
- Calculation of component failure rate acc. to SN29500,The max. environmental temp. is 60°C.
- The following mentioned parameters are calculated by Lovato Electric without considering external power .supply failure rates.The external power supply must be SELV/PELV.

4.3. Summary of failure rate
– The calculation formula for SFF/PFD_{avg}/PFH_D comes from IEC 61508-6:2010, Annex B
– max. environmental temp. 60°C
– 25% of safety loop, i.e.: PFD <2.5*10E-4 and PFH <2.5* 10E-8

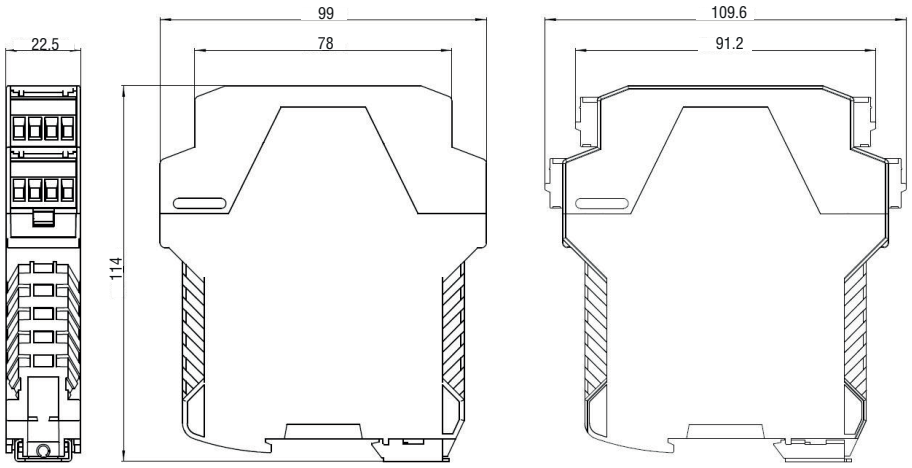
Parameter name	Symbol	Units	Result					
Proof test interval	PTI	h	8760	17520	26280	87600	175200	262800
Mean time to repair	MTTR	h	0					
Maintenance response time	MRT	h	0					
Factor for undertected failure	β	/	2.00%					
Factor for detected failure	β_D	/	1.00%					
Power supply 1oo1 module								
Dangerous undetected failure	λ_{DU}	(h^{-1})	0.000E+00					
Dangerous detected failure	λ_{DD}	(h^{-1})	0.000E+00					
Safe failure	λ_S	(h^{-1})	5.000E-10					
Dangerous failure	λ_D	(h^{-1})	0.000E+00					
No effect or no part failure	λ_{NP} / λ_{NP}	(h^{-1})	5.000E-10					
Total fialure	λ	(h^{-1})	5.000E-10					
Reset circuit 1oo1 module								
Dangerous undetected failure	λ_{DU}	(h^{-1})	0.000E+00					
Dangerous detected failure	λ_{DD}	(h^{-1})	0.000E+00					
Safe failure	λ_S	(h^{-1})	5.000E-10					
Dangerous failure	λ_D	(h^{-1})	0.000E+00					
No effect or no part failure	λ_{NP} / λ_{NP}	(h^{-1})	1.119E-07					
Total fialure	λ	(h^{-1})	5.000E-10					
Channel A module except power supply module & Reset circuit module								
Dangerous undetected failure	λ_{DU}	(h^{-1})	1.105E-08					
Dangerous detected failure	λ_{DD}	(h^{-1})	1.069E-06					
Safe failure	λ_S	(h^{-1})	9.550E-07					
Dangerous failure	λ_D	(h^{-1})	1.080E-06					
Total failure	λ	(h^{-1})	2.035E-06					
Safe failure fraction	SFF	–	99.46%					
Channel B module except power supply module & Reset circuit module								
Dangerous undetected failure	λ_{DU}	(h^{-1})	1.105E-08					
Dangerous detected failure	λ_{DD}	(h^{-1})	1.069E-06					
Safe failure	λ_S	(h^{-1})	9.557E-07					
Dangerous failure	λ_D	(h^{-1})	1.080E-06					
Total failure	λ	(h^{-1})	2.036E-06					
Safe failure fraction	SFF	–	99.46%					
Total PFD_{avg}/PFH_D according to IEC 61508								
Mean time to dangerous failure	MTTFd	years	1.057E+02					
PFD_{AVG}	PFD_{AVG_Total}	–	9.710E-07	1.948E-06	2.931E-06	9.986E-06	2.058E-05	3.179E-05
PFH	PFH_{Total}	(h^{-1})	2.220E-10	2.231E-10	2.241E-10	2.314E-10	2.418E-10	2.521E-10

5. SAFETY PRECAUTIONS WARNING

DANGER & WARNING! Please read and comply with the following terms carefully
– The products may only be assembled, installed, programmed, commissioned, operated,maintained and decommissioned by persons who are competent to do so.
– The following mentioned parameters are calculated by Lovato Electric without considering external power .supply failure rates.The external power supply must be SELV/PELV.
– It is essential to consider the relay's service life graphs. The relay outputs safety-related characteristic data is only valid if the values in the service life graphs are met.
– It is strictly prohibited to disassemble the instrument without permission to prevent the instrument from failure or failure.
– The product power input specified in this article is 24V AC/DC SELV/PELV power supply. It is strictly prohibited to use 220V AC power supply. Please pay attention to avoid using it and causing danger;To prevent over-current from the input power supply and accumulated faults, a fuse should be connected at the power input side.(see "Technical detail").
– If the risk analysis of the applications shows that the interlock is a safety function, then the interlock function have to be realized with external safety devices.
– In order to meet the application of safety characteristic parameters, the requirements of CO-ORDINATION OF NOTIFIED BODIES Machinery Directive 2006/42/EC + Amendment on DTI must be followed according to the different requirements of PL, category and SIL.
  • PL e with Cat. 3 or Cat. 4 (EN ISO 13849-1) or SIL 3 with HFT=1 (EN 62061): one test at least every month.
  • PL d with Cat. 3 (EN ISO 13849-1) or SIL 2 with HFT=1 (EN62061): one test at least every 12 months.

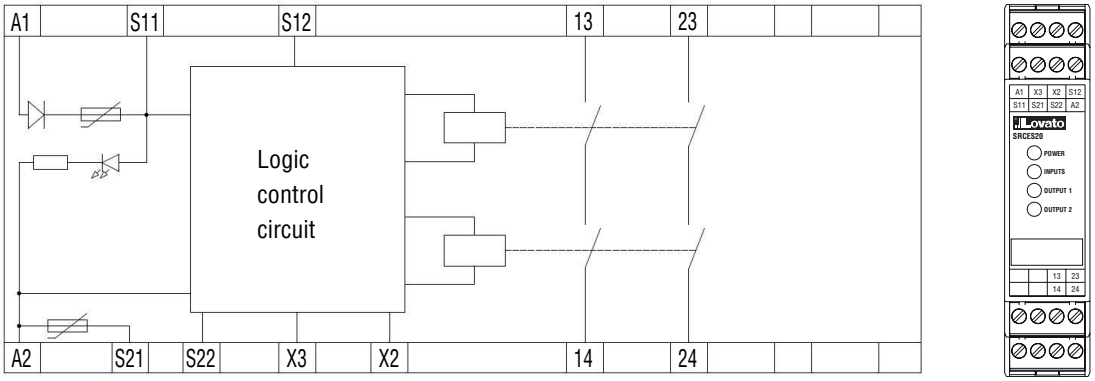
6. DIMENSIONS AND PORT DEFINITION

6.1. Dimensions in (mm) of SRC... series



Structural dimension diagram

6.2. SRCES20 Block diagram/terminal configuration



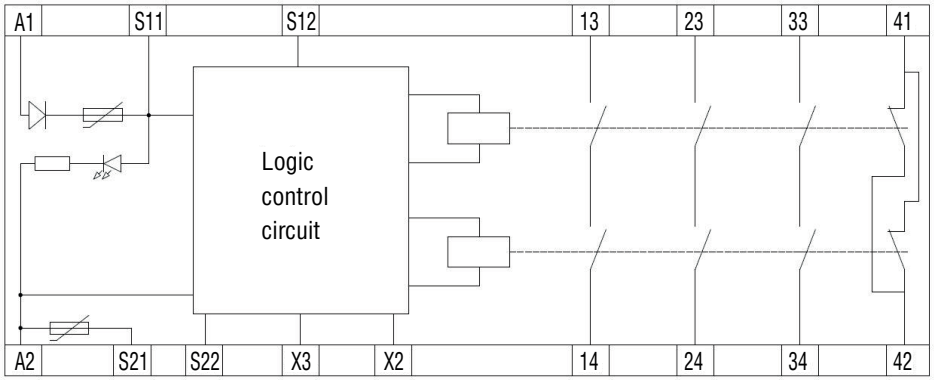
Port definition		
A1/A2	Input ports	Safety relay power input ports
S11/S12	Input ports	Sensor input ports of the channel 1
S21/S22	Input ports	Sensor input ports of the channel 2
S12/X3	Input ports	Reset input ports
S12/X2	Input ports	Reset input ports with short-circuit monitoring
13/14	Output ports	Safe Undelayed contact output 1
23/24	Output ports	Safe Undelayed contact output 2

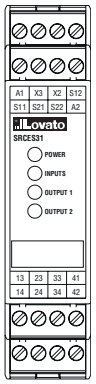
Insulation coordination

	Input port	13/14	23/24
Input port	-	-	-
13/14	RI	-	-
23/24	RI	BI	-

Notes: The clearance and creepage distance between the 24V circuit and relay output contacts (which are able to switch loads up to 250VAC) fulfil the requirements for reinforced insulation.

6.3. SRCES31 Block diagram/terminal configuration





Port definition		
A1/A2	Input ports	Safety relay power input ports
S11/S12	Input ports	Sensor input ports of the channel 1
S21/S22	Input ports	Sensor input ports of the channel 2
S12/X3	Input ports	Reset input ports
S12/X2	Input ports	Reset input ports with short-circuit monitoring
13/14	Output ports	Safe Undelayed contact output 1
23/24	Output ports	Safe Undelayed contact output 2
33/34	Output ports	Safe Undelayed contact output 3
41/42	Output ports	Auxiliary monitoring normally closed contact output

Insulation coordination

	Input port	13/14	23/24	33/34	21/22
Input port	-	-	-	-	-
13/14	RI	-	-	-	-
23/24	RI	BI	-	-	
33/34	R1	BI	BI	-	-
41/42	R1	BI	BI	BI	-

Notes: The clearance and creepage distance between the 24V circuit and relay output contacts (which are able to switch loads up to 250VAC) fulfil the requirements for reinforced insulation.

WARNING!
It must make sure that either all output contacts will switch 24VDC SELV/PELV or all output contacts will switch 230VAC. It is forbidden to use the safety relay in such a way some output contacts will switch 24VDC SELV/PELV while others will switch 230VAC.
For the types:
SRCES20, SRCES31, the clearance and creepage distance between the 24V circuit and relay output contacts(which are able to switch loads up to 250VAC) fulfil the requirements for reinforced insulation.

7. APPLICATION OVERVIEW

WARNING!
The following is deemed improper use in particular.
- Any component,technical or electrical modification to the product.
- Use of the product outside the areas described and the technical detail in this operating manual.

7.1. Safety requirement
7.1.1. Intended use
The safety relay provides a safety-related interruption of a safety circuit.
The safety relay meets the requirement of EN 60947-5-1 and EN 60204-1 and may be used in application with:
- Emergency stop
- Safety door monitoring

This data sheet is therefore aimed at:
- Qualified personnel who plan and design safety equipment for machines and systems and are familiar with regulations governing occupational safety and accident prevention.
- Qualified personnel who install and operate safety equipment in machines and systems.

7.1.2. Safety assessment
Before using a device, a safety assessment in accordance with the Machinery Directive is required.
The product as an individual component according with the functional safety requirements in accordance with EN ISO 13849 and EN 61508. However, this does not guarantee the functional safety of the overall plant/machine. To achieve the relevant safety level of the overall plant/machine's required safety functions, each safety function needs to be considered separately.

7.1.3. Use of qualified personal
The products may only be assembled, installed, programmed, commissioned, operated,maintained and decommissioned by persons who are competent to do so.
A competent person is a qualified and knowledgeable person who, because of their training,experience and current professional activity, has the specialist knowledge required. To be able to inspect, assess and operate devices, systems and machines, the person has to be informed of the state of the art and the applicable national, European and international laws, directives and standards.
It is the company's responsibility only to employ personnel who:
- Are familiar with the basic regulations concerning health and safety / accident prevention,
- Have read and understood the information provided in the section entitled Safety
- Have a good knowledge of the generic and specialist standards applicable to the specific application.
- Familiar knowledge with valid EMC regulations and able to apply them in a standardized manner.

7.1.4. Warranty and liability
All claims to warranty and liability will be rendered invalid if:
- The product was used contrary to the purpose for which it is intended,
- Damage can be attributed to not having followed the guidelines in the manual
- Operating personnel are not suitably qualified
- Any type of modification has been made (e.g. exchanging components on the PCB boards, soldering work etc.).

7.1.5. Disposal
- In safety-related applications, please comply with the mission time TM in the safety-related characteristic data.
- When decommissioning, please comply with local regulations regarding the disposal of electronic devices.

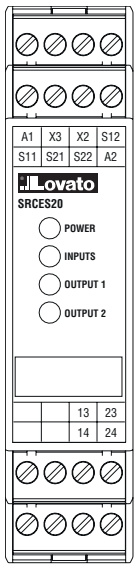
7.1.6. For your safety
The unit meets all the necessary conditions for safe operation. However, please note the following:
- Note for over-voltage category III: If voltages higher than low voltage (>50VAC or >120VDC) are present on the unit, connected control elements and sensors must have a rated insulation voltage of at least 250V.
- The product EMC complies with the requirements of EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, and EN 61326-3-1. In the design of electrical equipment, corresponding measures should be considered to reduce the electromagnetic impact on the product, such as application of the measures described in IEC 60204-1:2016+AMD1:2021,Annex H and/or IEC 61800-3 and/or EN ISO 13849-1:2023,Annex L,etc..
- Please strictly follow the industry standards for installation, wiring, and use, and adhere to the wiring requirements in Section 8.4 of this document.

7.1.7. Other instructions
Please follow the safety regulations of electrical engineering, industrial safety and responsible units.
Ignoring these safety regulations may lead to death, serious personal injury or damage to equipment.
Cut off the power before working on the equipment.
In case of emergency stop application, high-level control system must be used to avoid automatic restart of equipment.
During operation, components of electrical switchgear may carry dangerous voltages.
The maintenance of the equipment, especially the opening of the shell, must only be completed by the manufacturer.
When operating the safety module, at the contact side, the operator must follow the EMC standard EN 61000-6-4 for electrical and electronic equipment, and take appropriate measures if required.
Suitable and effective protection circuit shall be provided for inductive load (such as contactor, solenoid valve, motor, etc.). The protection circuit is in parallel with the load and not with the switch contacts.
Avoid using the product under the condition of strong magnetic field. The external strong magnetic field will cause changes in the product action and release parameters.

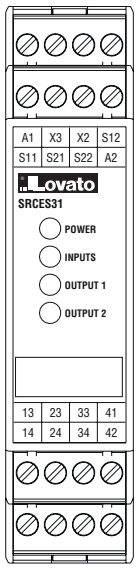
For Lovato Electric, it is impossible to assess all performance parameter requirements of products in each application field and application environment. Therefore, customers should choose the products matching them according to specific use conditions. If you have any questions, please contact Lovato Electric for more technical support. However, the customer is only responsible for the selection of products.
The nominal operating ambient temperature range in this product specification refers to the maximum temperature range that the product can withstand under specific load conditions.
In order to maintain the performance of the safety module, please be careful not to drop the product or suffer strong impact. It is recommended that the dropped product be scrapped.
All performance parameters in the specification are based on the initial values measured under standard test conditions.
Please ensure that there are no organic silicon materials (such as silicone rubber, silicone oil, silicone paint, etc.) around the product, because they will produce volatile gases containing organic silicon, which may cause poor contact of relay contacts built in the product.
Lovato Electric products meet RoHS requirements.
Lovato Electric reserves the right to change the product. The customer should confirm the content of this specification before placing an order for the first time, and may request our company to provide a new specification if necessary.

7.2. Function description

7.2.1. Interface and port description



SRCES20



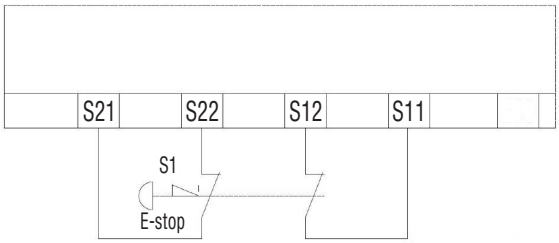
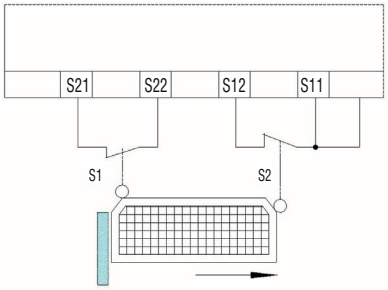
SRCES31

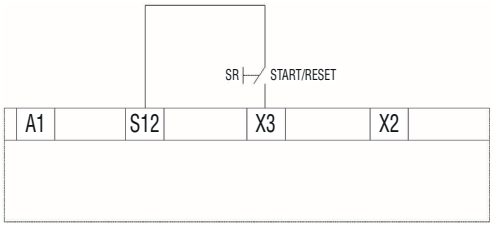
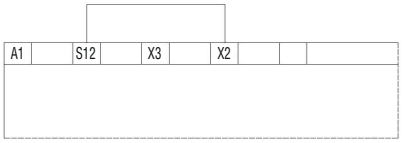
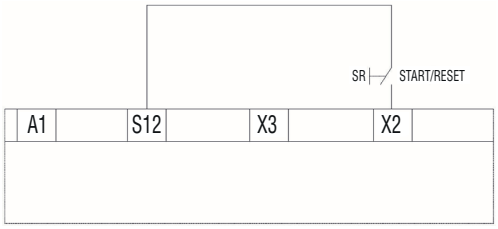
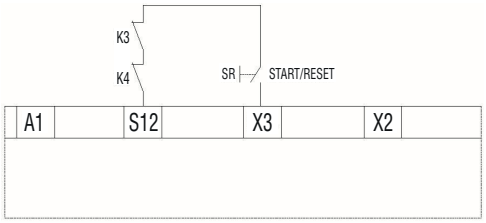
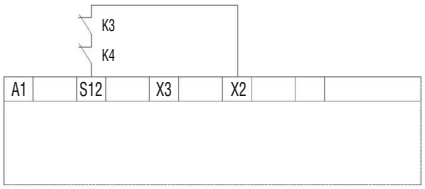
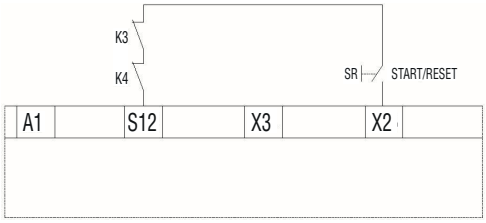
A1/A2	24V power supply input ports
S11/S12	Sensor input ports of the channel 1
S21/S22	Sensor input ports of the channel 2
S12/X3	Start/Reset input ports with short-circuit monitoring
S12/X2	Start/Reset input ports
Power indicator	LED (Yellowish green)
INPUTS	Status indicator for the inputs LED(Yellowish green)
OUTPUT 1	Status indicator safety circuit LED(Yellowish green)
OUTPUT 2	Status indicator safety circuit LED(Yellowish green)
13/14	Safe Undelayed contact output 1
23/24	Safe Undelayed contact output 2
33/34	Safe Undelayed contact output 3
41/42	Auxiliary monitoring normally closed contact output

7.2.2. Functional characteristics

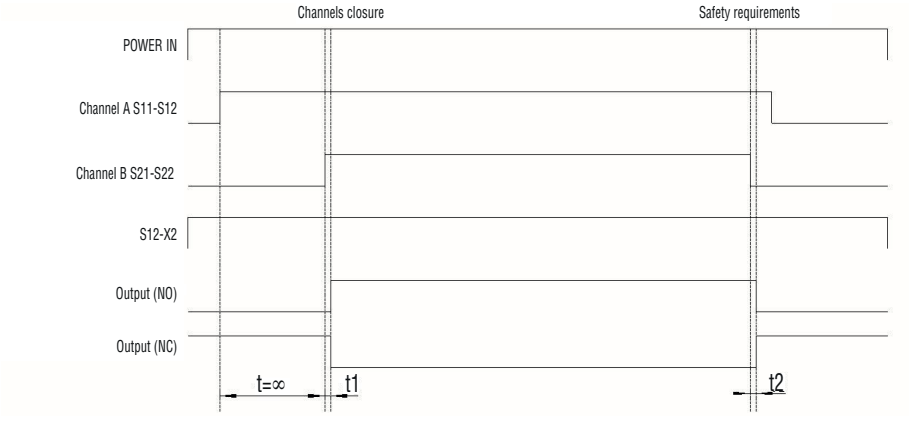
– Single and dual channel input applications
– Cross short circuit detection, for emergency stop and safety door applications
– Support automatic reset and manual reset

7.2.3. Wiring

Function	Dual channel
E-STOP	 Emergency stop button with two normally closed contacts (recommended application). Two input channels are connected to different poles. A short circuit between the 2 inputs can be detected.
Safe door monitoring	 The movable protective door connected with two limit switches is monitored. Each limit switch has a contact in combination mode (switch S1 has a normally open contact and switch S2 has a normally closed contact).

	Automatic reset	Manual reset
Reset circuit		 Reset circuit with monitoring
		 Reset circuit without monitoring
Reset circuit with feedback		 Reset circuit with monitoring
		 Reset circuit without monitoring
	K3 and K4 are auxiliary contacts of external expansion module or output control contacts. For complete application examples, please refer to section 10 typical application example wiring.	

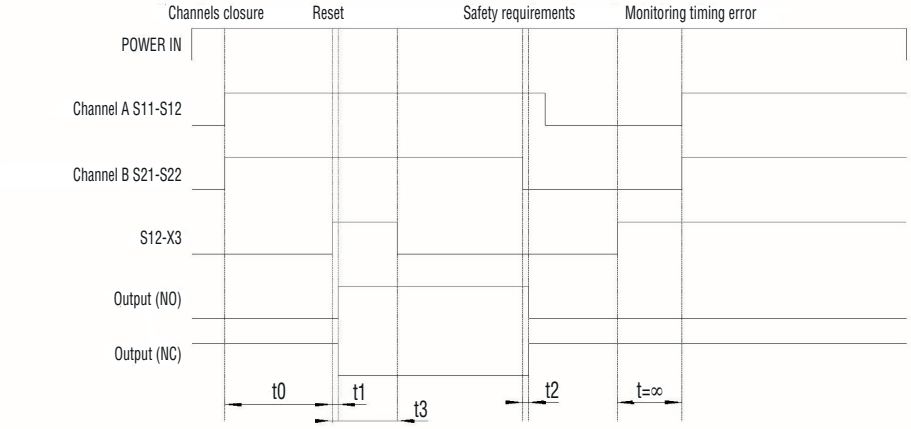
7.2.4. Automatic reset function timing



t1: Switch on delay
t2: Delay on de-energisation

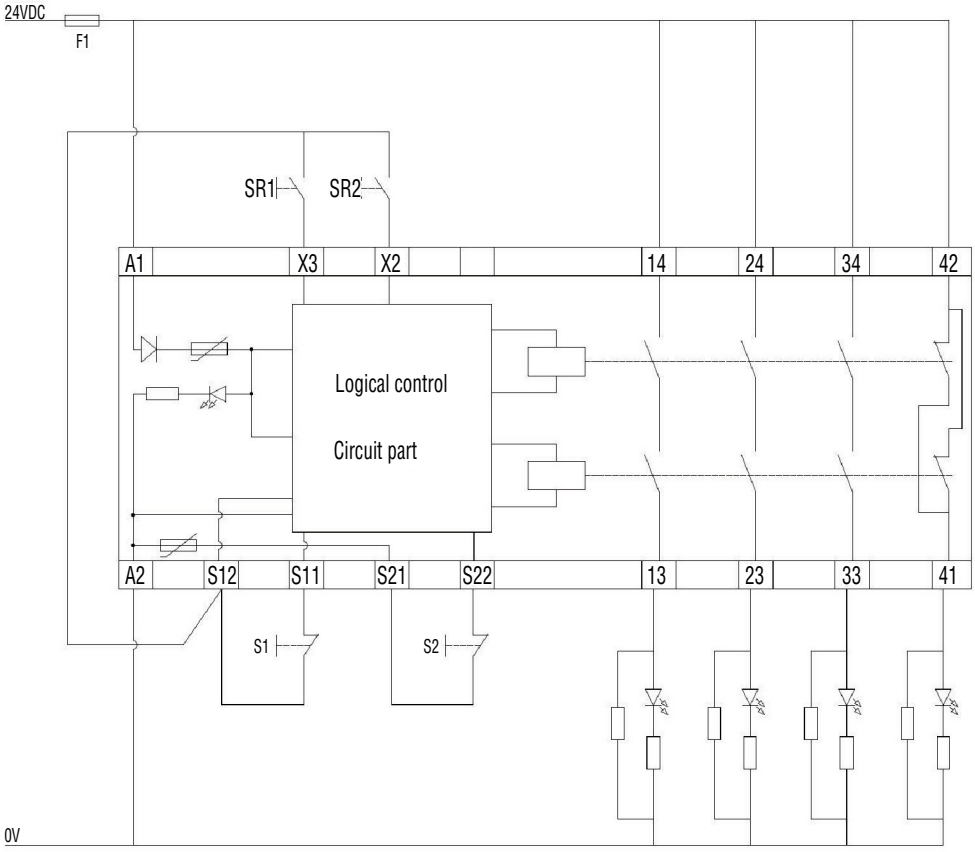
WARNING!
Automatic reset is not recommended in safe applications. It can only be used after sufficient risk analysis proves that the risk is acceptable.
For SRCES... series without short-circuit monitoring, if the restart bottom is stuck,the device will be automatic reset. The restart interlock can not be used as a safety function in accordance with EN ISO 13849-1/-2. When the S12-X2 reset mode is applied, the system needs to have sufficient safety assessment because short circuits in the reset circuit will not be monitored and will enter automatic reset mode.

7.2.5. Manual reset function timing

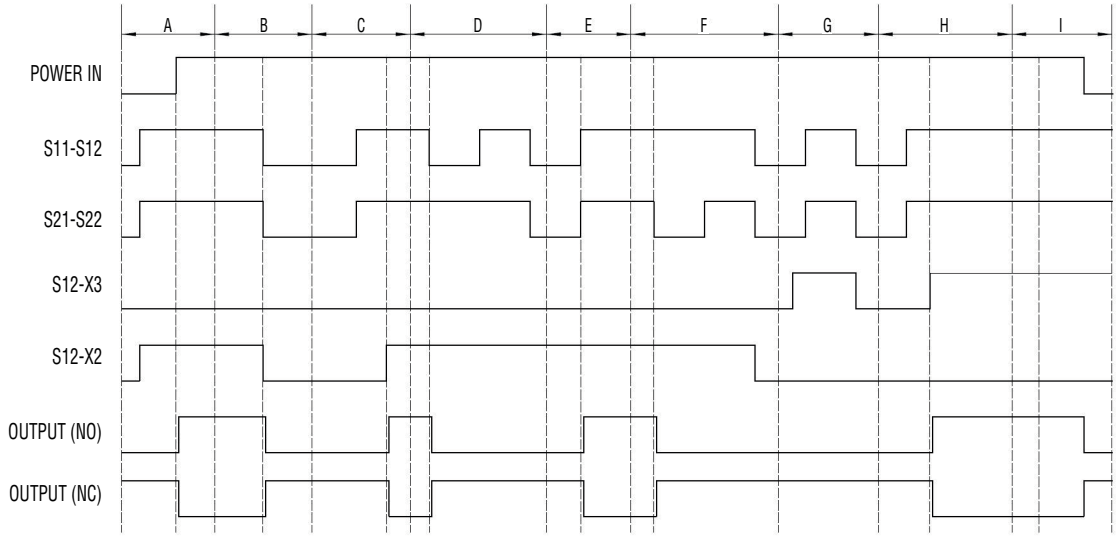


t0: Channels and reset interval time t1: Switch on delay
t2: Delay on de-energisation
t3: ≥100ms Reset pulse width≥100ms

7.2.6. Proof test function timing



Test wiring example

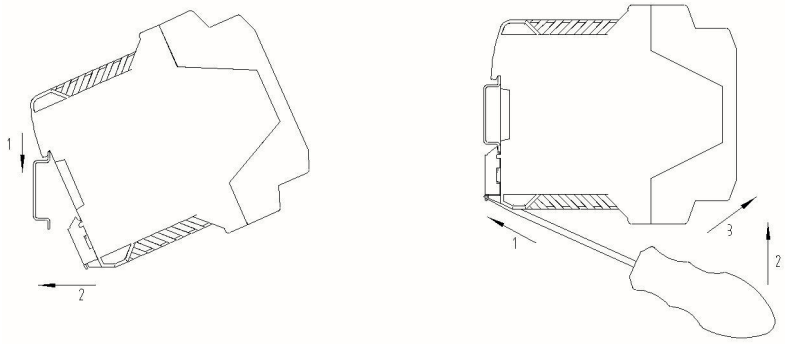


Test timing diagram

7.3. Installation and disassemble

Ensure that the plug terminator is inserted at the side of the unit.

SRCES... series products adopt DIN35mm guide rail installation mode. The side without metal slider is first clamped into the guide rail, and then the guide rail is pushed from the side with metal slider to the guide rail; When removing, insert the metal slider buckled on the guide rail with a slotted screwdriver (knife edge width ≤ 6mm), hold the module shell, push it to the side of the module to loosen the metal slider and din35, and then pull it out with force on the side of the slider.



WARNING!

The safety relay should be installed in a control cabinet with a protection type of at least IP54.

7.3 Please read the wiring requirements in section 7.3 carefully to avoid mistake operation.

According to IEC 60204-1, the reset shall be possible only by a manual action at the device where the command has been initiated. There must be an adequate risk assessment of using automatic reset.

7.4. Wiring

Please note:

- During operation, parts of switching devices carry hazardous voltages.
- Before working on the switching devices, disconnect the power.
- Information given in the “Technical detail”must be followed.
- Output 13-14, 23-24, 33-34, 43-44 are safety contacts;output 21-22, 41-42 are auxiliary contacts (e.g. for display).
- Auxiliary contact 21-22, 41-42 should not be used safety circuits!
- To prevent contact welding, a fuse should be connected before the output (see “Technical detail”).
- To prevent over-current from the input power supply and accumulated faults, a fuse should be connected at the power input side (see “Technical detail”).
- Use copper wiring with a temperature stability of 75°C.
- To EMC immunity the measures described in industry or basic standards in EN 60204-1 and/or EN ISO 13849-1 and/or EN 61800-3, etc must be executed. This includes the separate routing of cables of the control circuits from other cables.
- Adequate protection must be provided on all output contacts with capacitance and inductive loads.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- On 24VDC devices,The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- The soft copper cross-sectional area of the wire on the input side must be greater than 0.5mm^2, the output side must be greater than 1mm^2.
- The exposed length of the conductor is about 7mm, which is locked by M3 screw or spring.
- The terminal screw will cause mistake operation, heating, etc., so please tighten it according to the specified torque. Tightening torque of terminal screw: 0.51Nm.
- Please refer to Section 5.1 for the length of conductor, and the maximum conductor resistance is clearly given in "Technical detail".
- Make sure that the specified cable lengths are not exceeded,so as to ensure error-free operation of the safety relay.

7.5. Proof test

To verify the device function, proceed as follows:

– Demand the safety function by actuating the corresponding safety equipment.
– Check whether the safety function was executed correctly by switching the device on again. If the device does not switch on again, the proof test failed.
– The device requires no maintenance during the permissible duration of use. Refer to the technical data for the duration of use of the device.
– If necessary, carry out proof tests within the specified proof test interval.
– See “Safety characteristic data” section.
– Depending on the application and connected I/O devices, you should test.

WARNING!
Loss of functional safety due failure.
If the proof test contains errors, the device no longer functions correctly. Replace the device.

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7.6. Maintenance

(1) Be sure to regularly check whether the safety function of the safety relay is in good condition, and whether there is any sign that the circuit or the original is tampered with or bypassed;
(2) It is necessary to strictly follow the relevant safety specifications and operate according to the instructions in the product manual, otherwise it may cause fatal accidents or loss of personnel and property.
(3) The products are subject to strict inspection and quality control before leaving the factory. If you find that the work is abnormal and suspect that the internal module is faulty, please contact the nearest agent or directly contact the technical support hotline.
(4) Observe the relevant manufacturer specifications for carrying out maintenance on connected I/O devices.

7.7. Decommissioning and disposal

Carry out decommissioning according to the requirements of the machine or system manufacturer.When decommissioning the system or parts of the system,ensure the following for the devices used.

– The device continues to be used only as intended: Observe the storage and transport requirements.(See “Technical detail” section.)
– The device contains valuable recyclable materials, which should be utilized.
– Do not dispose of the device with household waste; it should instead be disposed of in accordance with the currently applicable national regulations.
– Dispose of packaging materials that are no longer needed (cardboard packaging, paper, bubble wrap sheets, pillow bags, etc.) with household waste in accordance with the currently applicable national regulations.

7.8. Transport,storage and unpacking

7.8.1. Transport

The device is delivered in cardboard packaging.Observe the instructions on how to handle the package indicated on the packaging.
Suitable transport packaging: Only transport the device in its original packaging or in packaging suitable for transport.
Technical data and environmental conditions. For transport, observe the specifications regarding the temperature range, humidity, and air pressure. Please see “parameter data”.

7.8.2. The storage location must meet the following requirements:

– Dry
– Protected against unauthorized access
– Protect against harmful environmental influences such as UV light
– The storage environment range shall meet the requirements of the performance parameter table.

7.8.3. Unpacking

The device is delivered in packaging together with a packing slip that provides installation instructions.
Observing the packing slip: Read the entire packing slip carefully,and than retain the packing slip.
Checking the delivery for damage and completeness. Submit any claims for transport damage immediately.

8. DIAGNOSTIC DESCRIPTION

Meaning of the LED symbols in the tables below
○ LED off
● LED on

8.1. General states

Power	INPUTS	OUTPUT 1	OUTPUT 2	State	Notes
●	○	○	○	No relays are activated. The sensor circuit is inactive.	
				Only channel 1 or channel 2 of the sensor circuit is active.	
●	●	○	○	The sensor circuit is active. Relays OUTPUT 1 and OUTPUT 2 are ready to start and await reset/start command.	Possible error see error messages.
●	●	●	●	The sensor circuit is active. All relays are picked up.	

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8.2. Error messages

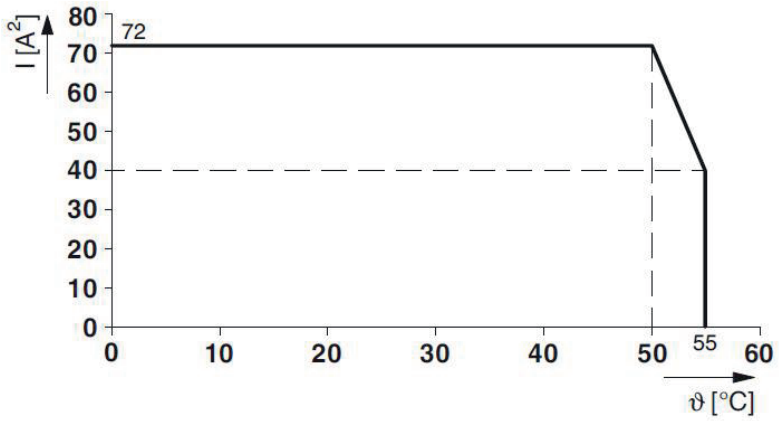
Power	INPUTS	OUTPUT 1	OUTPUT 2	Possible cause	Corrective
○	○	○	○	No supply voltage or undervoltage at A1/A2.	Check the supply voltage.
				Short circuit between A1 and A2.	Check the line.
				Possible cross-circuit in sensor circuit S11/S12 and S21/S22.	Switch off the operating voltage and rectify the cross-circuit. Then perform a function test.
●	●	●	○	No supply voltage or undervoltage at A1/A2.	Check the supply voltage.
				The input channel is blocked or disconnected.	Check the line.
				Faulty reset button, short circuit between S12 and X3. No fault detection on initial start, only on first new demand.	Replace reset button. Remove short circuit.
				Enable contact(s) of OUTPUT 1 faulty.	External error: check whether the second channel opens when the sensor is requested. Internal error: perform a power down reset with subsequent function test. If the error occurs again after the function test, replace the device.
				Channel S11-S12 is short circuited, and the next diagnostic cycle can be diagnosed.	Short circuit elimination.
●	●	○	○	No supply voltage or undervoltage at A1/A2.	Check the supply voltage.
				Internal relay contact is sticky or internal components fail.	Re proof test. If the verification fails, replace the relay.
				Enable contact(s) of OUTPUT 1 and OUTPUT 2 faulty.	External error: check whether the second channel opens when the sensor is requested. Internal error: perform a power down reset with subsequent function test. If the error occurs again after the function test, replace the device.
●	●	○	●	Channel S21-S22 is short circuited, and the next diagnostic cycle can be diagnosed.	
				Enable contact(s) of OUTPUT 2 faulty.	External error: check whether the second channel opens when the sensor is requested. Internal error: perform a power down reset with subsequent function test. If the error occurs again after the function test, replace the device.

9. DERATING

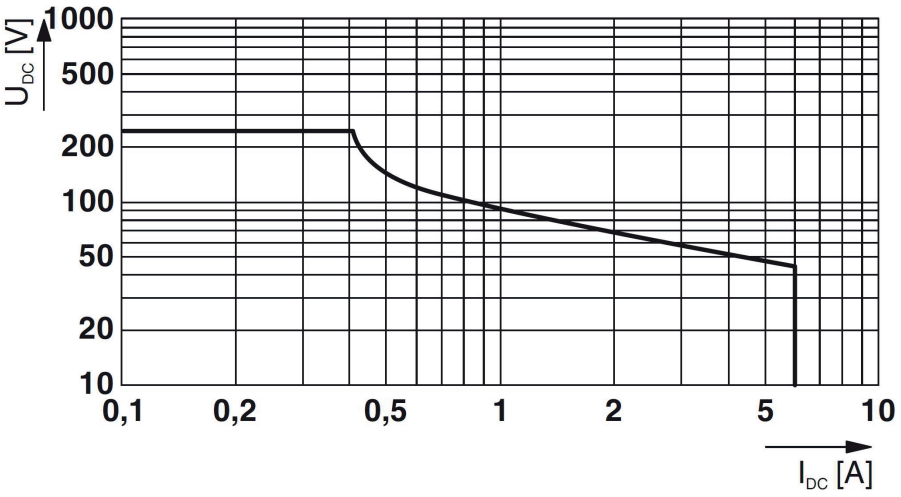
9.1. Derating of load current

When the equipment room is densely installed without separation, and the number of safe output contacts exceeds 3, the load current derating application shall be considered, and the total output load current Imax shall follow the following formula and curve:

$$I^2_{MAX} = I^2_1 + I^2_2 + I^2_3 + I^2_4$$



9.2. Derating of load DC voltage



9.3. Derating of altitudes

Using the device at altitudes greater than 2000 m to max. 5000 m is possible under the following conditions:

1. The safety voltage Us shall be limited to 150VAC/VDC;Or applied under conditions of degradation to overvoltage level II/pollution level 2.

NOTICE

Explanation of the relationship between altitude, insulation performance, and application environment.

According to the IEC 60664-1 standard, the technical parameters described in this document meet the application environment of overvoltage level III/pollution level 2 below an altitude of 2000m, that is, the product design meets the application of insulation voltage 250V below an altitude of 2000m. The strengthened insulation creepage distance is ≥ 5.5mm, and the basic insulation creepage distance is ≥ 3mm.

According to the coefficient requirements in Appendix Table A.2 of IEC 60664-1, the derating coefficient at an altitude of 5000m is 1.48. If the insulation voltage of 250V is to be met under overvoltage level III/pollution level 2, the strengthened insulation creepage distance is ≥ 5.5 * 1.48=8.14mm, and the basic insulation creepage distance is ≥ 3 * 1.48=4.44mm. The creepage distance of HF safety relays is designed to strengthen insulation by 5.5mm, and the basic insulation creepage distance is 3mm, Obviously, it does not meet the 250V insulation voltage application requirements of overvoltage level III/pollution level 2 at high altitude , so it is necessary to consider derating.

There are two methods to derating:

1. Category of insulation voltage reduction: 250V, rated below 150V. Please refer to the relationship between the nominal power supply category and the application environment in Annex Table F.1 of IEC 60664-1;
2. Reduced application environment: overvoltage level II/pollution level 2 application environment. When applied at 250V, the required strengthened insulation creepage distance is ≥ 3 * 1.48=4.44mm, and the basic insulation creepage distance is ≥1.5 * 1.48=2.22mm. The creepage design of the HF safety relay meets the requirements of this application environment. Therefore, this product is applied under the conditions of overvoltage level II/pollution level 2, that is, the insulation voltage is 250V without derating.

Note: According to the electrical clearance derating requirements in Table A.2 of EN IEC 60664-1, select the height that needs to be derated and convert it in accordance with the requirements of F.2 of EN IEC 60664-1 standard.

For example, in an application at an altitude of 3000m, the insulation level between input and output is downgraded to voltage level II/pollution level 2;Insulation capacity refers to Chapter 7 of this document;

The current carrying capacity is not affected by altitude.

1. Reduce the applicable range of the maximum ambient temperature, and the derating coefficient is based on the following table

Altitude above sea level	Temperature derating factor
2000m	1
2500m	0.95
3000m	0.9
3500m	0.85
4000m	0.8
4500m	0.75
5000m	0.67

The minimum temperature environment for temperature reduction is not affected, and the maximum temperature limit is shown in the table below:(The maximum temperature limit under rated load conditions, or a comprehensive consideration of temperature and current sum for derating).

Altitude above sea level	Temperature and load derating table 1		Temperature and load derating table 2	
	Temperature derating	Imax total output load current	Temperature derating	Imax total output load current
2000m	55°C	40A²	70°C	3A²
2500m	55°C	40A²	70°C	3A²
3000m	50°C	72A²	70°C	2A²
3500m	46°C	72A²	70°C	2A²
4000m	44°C	72A²	70°C	1A²
4500m	41°C	72A²	70°C	1A²
5000m	37°C	72A²	70°C	1A²

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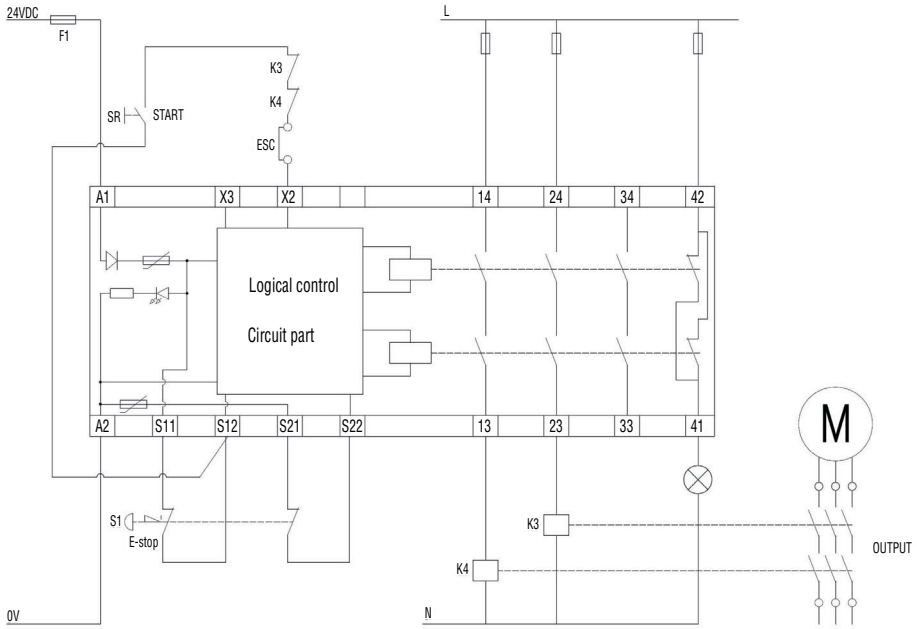
10. APPLICATION EXAMPLES FOR CONVENTIONAL SAFETY RELAY

10.1. SCRES31 dual channels emergency stop monitoring (with short-cross detection), manual/automatic reset application. Suitable to PL e/SIL 3.
E-stop Application example:
– Dual channels E-stop monitoring application(comply with the idle current)
– With cross-short circuit detection
– Manual reset without the short-circuit of the reset button.

WARNING!
Please follow the warning requirements in section 8.2.4 of this documentation of Manual reset without the short-circuit of the reset button

– Feedback of contactor contacts.
– Stop category 0 in accordance with EN 60204-1.
– Monitoring of external contactors (Monitoring of external auxiliary contact).
– Safety level of the example up to PL e (EN ISO 13849-1) and SIL 3 (EN 61508).
– The emergency stop control device is positive opening in accordance with EN 60947-5-1.
– Contactors have mirror contacts in accordance with EN 60947-4-1.
– Stop category 0 describes an immediate stop by removal of power by interrupting a machine or drive element in accordance with EN 60204-1.
– When using the safety relay, take into consideration the maximum permissible number of cycles for observing the SIL/PL safety characteristics in the specific application. The safety characteristics data can be found in this document.



10.2. SCRES31 The example wiring of dual channels emergency stop monitoring.

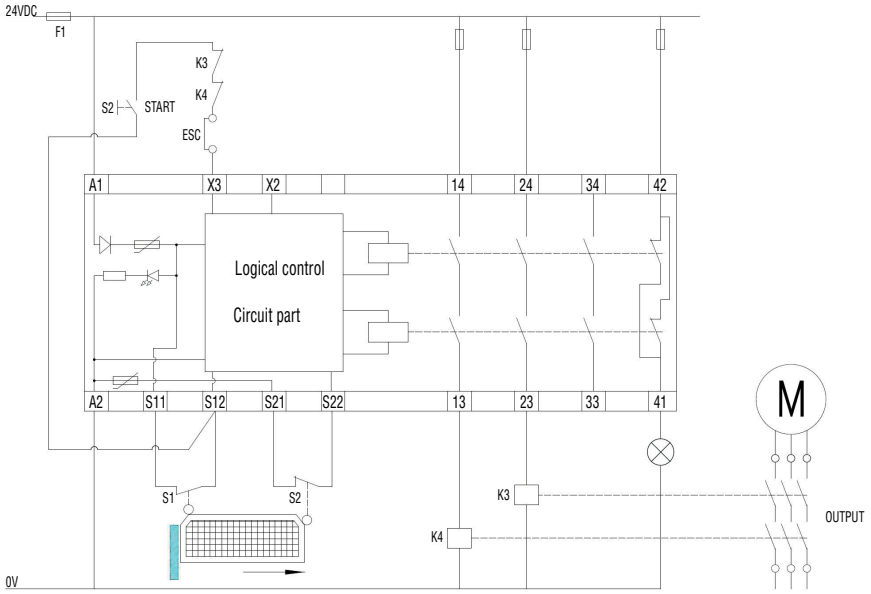
	Operating	Status	LED
Start	Unlock E-stop button S1.	The E-stop button closes enable circuit S11,S12,and S22of the safety relay. Ready to start. The circuit is enabled via the reset button.	● Power ● INPUTS ○ OUTPUT 1 ○ OUTPUT 2
	Press reset button SR.	The SLR starts running Contactors K3, K4 are activated and the mirror contacts (NC contacts of K3,K4) in the reset circuit are opened.	● Power ● INPUTS ● OUTPUT 1 ● OUTPUT 2
Stop	Press E-stop button S1.	The safety function is triggered and contactors K3, K4 drop out. In the reset circuit, the mirror contacts of K3, K4 are closed.	● Power ○ INPUTS ○ OUTPUT 1 ○ OUTPUT 2

Note: For other diagnostic instructions, please refer to the diagnostic description in Section 9 of this document.

10.3. SCRES31 dual channels safety door monitoring (with short-cross detection), manual/automatic reset application.Suitable to PL e/SIL 3.
Safe door monitoring Application example:
– Dual channels application,1 open and 1 close limit switch monitoring (when the door is closed, all limit switches are in the closed state, which comply with the idle current).
– With cross-short circuit detection.

WARNING!
Please follow the warning requirements in section 8.2.4 of this documentation of Manual reset without the short-circuit of the reset button.

– Manual reset without the short-circuit of the reset button.
– Feedback of contactor contacts K3, K4 at X3 port.
– Stop category 0 in accordance with EN 60204-1.
– Monitoring of external contactors (Monitoring of external auxiliary contact).
– Safety level of the example up to PL e (EN ISO 13849-1) and SIL 3 (EN 61508).
– The emergency stop control device is positive opening in accordance with EN 60947-5-1. Contactors K3, K4 have mirror contacts in accordance with EN 60947-4-1.
– Contactors K3, K4 have mirror contacts in accordance with EN 60947-4-1.
– Stop category 0 describes an immediate stop by removal of power by interrupting a machine or drive element in accordance with EN 60204-1.
– When using the safety relay, take into consideration the maximum permissible number of cycles for observing the SIL/PL safety characteristics in the specific application. The safety characteristics can be found in this document.



11. EC DECLARATION OF CONFORMITY

It is possible to download the EC Declaration of COnformity at www.LovatoElectric.com

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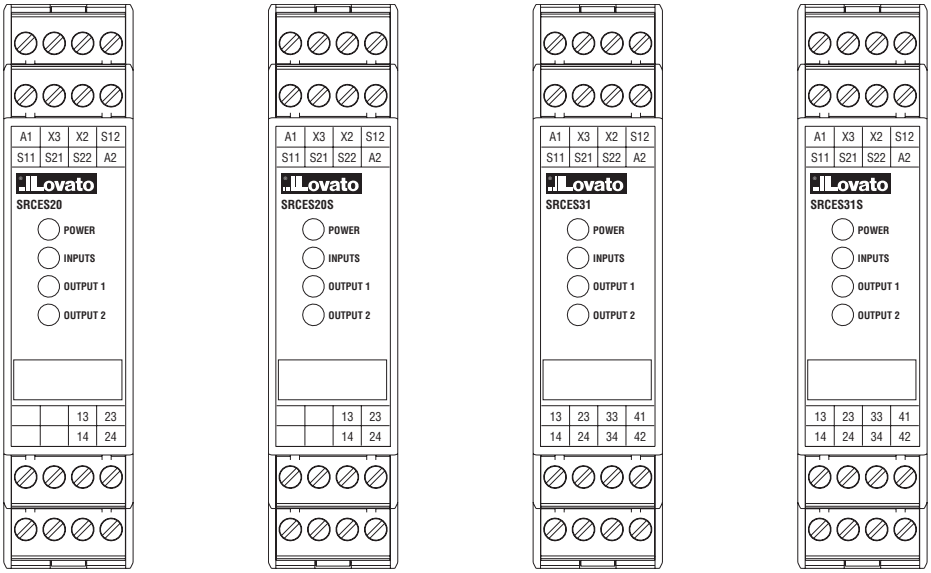
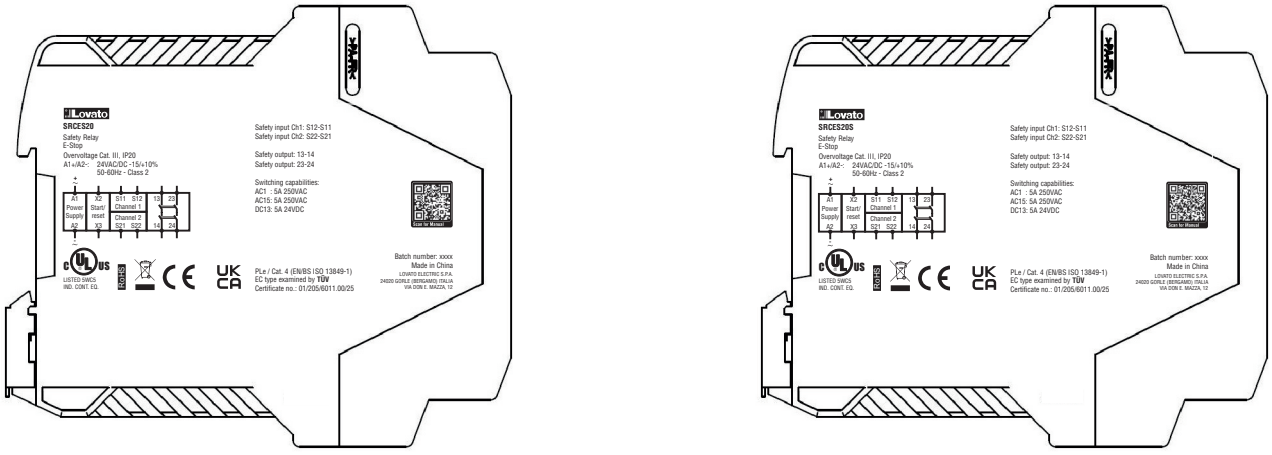
APPENDIX
A1 Explanation of terms

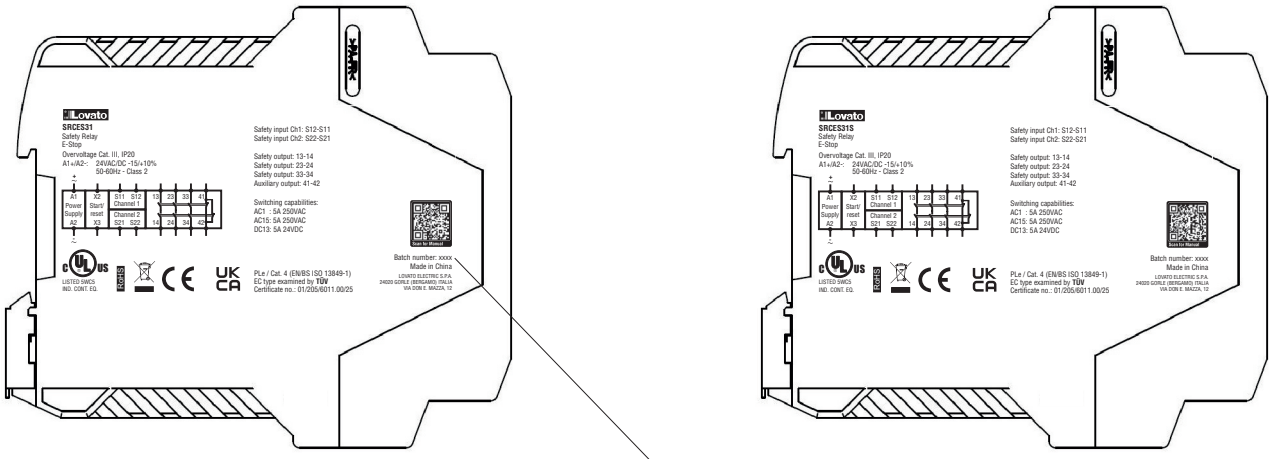
AOPD	Active photo-electronic protective device Device with a sensor function that is generated by photo-electronic transmit and receive elements,which detects the interruption of optical radiation generated in the device by an opaque object located in the specified protective field (or for a photoelectric barrier on the axis of the light beam). In DIN EN 692 (mechanical presses), DIN EN 693 (hydraulic presses), and EN 12622 (hydraulic trimming presses), the abbreviation AOS is used as a synonym for AOPD.
AOPDDR	Active photo-electronic protective device responsive to diffuse reflection Device with a sensor function that is generated by photo-electronic transmit and receive elements,which detects the diffuse reflection of optical radiation generated in the device by an object located in a protective field specified in two dimensions.
ESPE	Electrical sensitivity protective equipment
CCF	Common cause failure
DC	Diagnostic coverage
PL	Performance level Classification of the ability of safety functions to meet a safety demand
Cat. / Category	Classification of the resistance to faults according to EN ISO 13849-1. Mission time tM Duration of use
MTTF / MTTFD	Mean time to failure / mean time to dangerous failure
PFD	Probability of failure on demand (low demand)
PFH_D	Average frequency of a dangerous failure per hour
SIL	Safety integrity level
SILCL	SIL claim limit
SRCF	Safety-related control function - safety function
SRECS	Safety-related electrical control system (Safety-related electrical, electronic, and programmable electronic control system)
SRP / SRP/CS	Safety-related part / safety-related parts of control systems

I773 GB 04 25

A2 Labels







Batch information code annotation

The first digit is a sequential letter identifying the device revision (ex. A= first revision, B = second revision, ...), then two digits for the year and two digits for the week of production.
Then 4 digits identifying the sequential number of each product produced in each week.
Example: A20510010 is the 51st week of 2020, with revision A (first revision), the 10th piece produced .