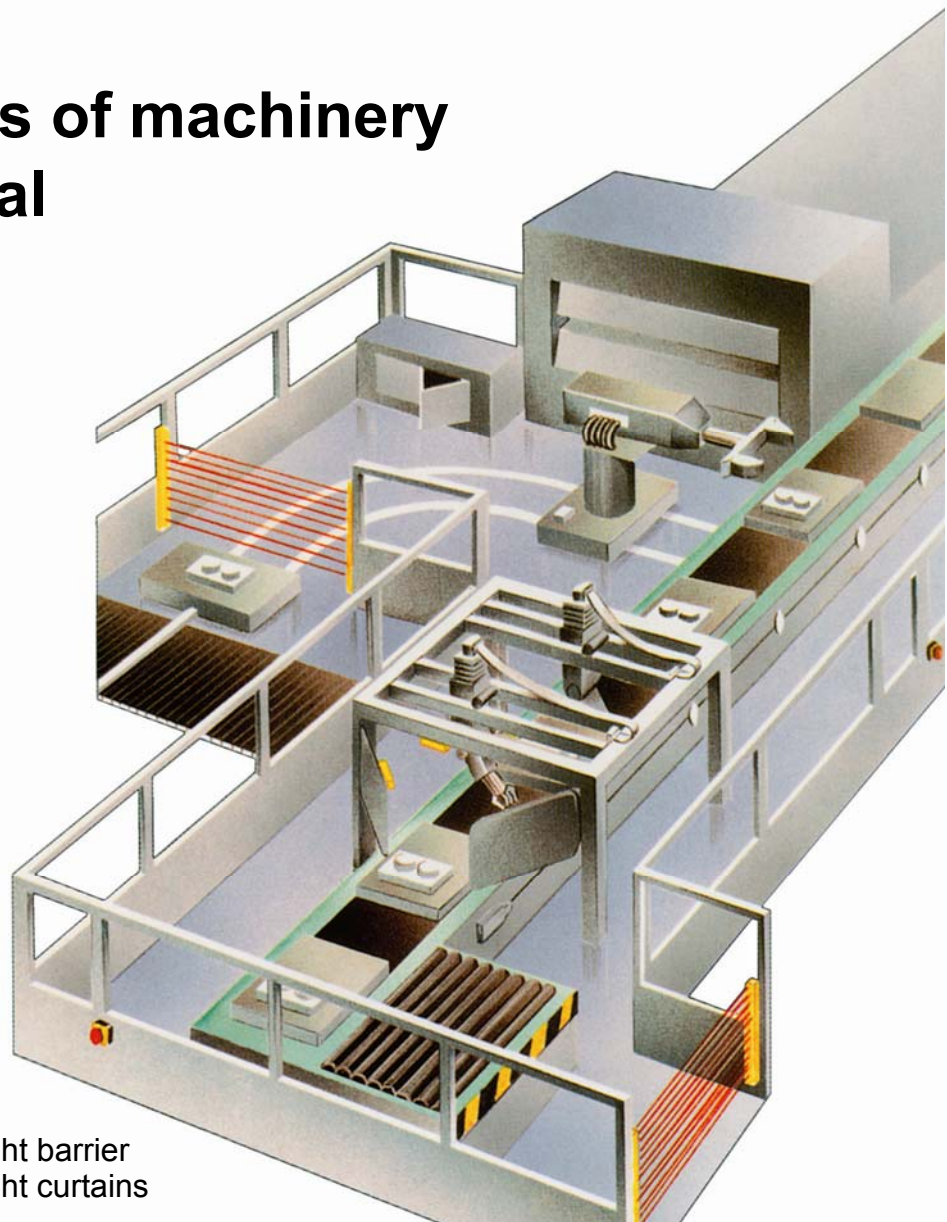


10. edition

Application guide

Safety relays of machinery and technical equipment

with more
than 200
applications
edition 2010



with applications for:

- safety light barrier
- safety light curtains
- muting
- safety gate monitoring relay
- emergency stop
- expansion modules
- two-hand-control
- mat-control, contact edges
- safety on bus-systems
- etc.



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version

19. january 2010

file

H:\user\entwick\Prospekte-Dokumente\Handbuch\2010\english\En_Handbuch_DO_28.12.2009.doc

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This application guide costs 10,- Euro

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A Introduction

Application guide

Safety of machinery and technical equipment is being stressed more and more. Terms like "CE"-symbol, standards and machine guide lines are being used frequently and people need to be updated due to ongoing extension of the safety regulations. This especially applies for the harmonization of the standards within the EU-market.

With this application guide the user will get an overview of most important general standards, terms and individual "B2" standards. The theoretical know-how on application of the safety relays will be backed up by approximately 181 samples.

This booklet is considered to be used for educational purposes as well as a reference guide.

ries.e electronic

ries.e electronic gmbh has been founded in 1958. Approximately 120 employees are working in Horb (Baden-Wuerttemberg) and Zeulenroda (Thuringia).

These are two business units of „ries.e electronic“:
development / manufacturing
distribution / sales

Offering the following product lines...

- safety relays (since 1990)
- time and measuring relays
- customer oriented development and production of electronically building blocks and complete products which carry the private label / logo of the customer.

The innovation and customer oriented philosophy of the company resulted in the leadership in some product groups as well as in innovation awards, such as...

- 1963: first programmable control of the world for punching machines.
- 1966: first electronic control of the world for automatic ticket machine / counters.
- 1979: award "best innovative company of the year" for small to middle size companies.
-
- 1998: smallest size safety relay in the world (SAFE 1 and SAFE 2).
- 2007: SAFE C family
- 2008: 50 years ries.e electronic gmbh

The quality management system of ries.e electronic gmbh has been qualified according to ISO 9001: 2000 since 1995, thus guaranteeing continuous quality of products and services.



Company ries.e electronic in Horb a.N.

B General definitions

Term	Description	
AND operation	Connects two or more devices. Start-up can only occur when all the start-up conditions are met.	
Actuation types of ESPDs	Protection	Releasing the switching output passes autonomous after interrupting the protection area, when no restart interlock is activated.
	Single action	By interrupting once the protection area and releasing the switching output, the start of the machine is carried out.
	Double action	By interrupting twice successively the protection area and releasing the switching output, the start of the machine is carried out.
	Reclosing interlock	Reclosing interlock prevents the automatic start after the protection area is released. The start has to be initiated manually.
B10D	Numbers of cycles, until 10% of the components fail dangerously.	
β (Susceptibility to Common Cause Failure)	Rate of failures, which have a common cause.	
CCF (Common Cause Failure)	Failure as a result of a common cause	
Clocked output	Clock pulse is directed from the clocked outputs to the inputs by corresponding wiring. Thereby it is possible to recognize cross circuits.	
Cross-/ short circuit detection	Detection of cross-/ or short circuits, detection of reduction of the insulation resistance between 2 contacts and respectively short circuit between 2 wires or more.	
Danger zone	Zone within or around machinery in which a person is exposed to risk of injury or damage to health.	
DC (Diagnostic Coverage)	Diagnostic coverage, this can be determined from the ratio of the failure rate “detected dangerous failures” and the failure rate “all dangerous failures”. The Diagnostic Coverage is suited as a parameter for the efficiency of the diagnosis.	
DCavg (Average Diagnostic Coverage)	Average diagnostic coverage	
Enable circuit	A redundant implemented output with forcibly guided contacts. The output is used to switch off a machine.	
Equipment, accessible	The danger zone can be entered through a light barrier.	
Equipment, non-accessible	The area secured by a light barrier is protected, in addition, mechanically (e.g. by a grid)	
Error	Describes the state of a device, which is not able to carry out a requested function, excepted is the inability during maintenance, other planned activities or the failure of external supplies	
ESPD	Electro sensitive protective device (ESPD) can be based on physical principles: Optoelectronics, supersonic, inductive or capacitive sensor technology, infrared movement sensors etc. An ESPD encloses the following elements: Sensor function, control / supervising function, output elements (OSSD).	
ESPE (Electro-sensitive protective equipment)	See ESPD	
Feedback loop	Circuit for monitoring externally connected contactors or relays. The N/C contacts are used to check whether the relays or contactors have assumed their fail safe before they are re-operated.	
Forcibly guided contacts	Contacts which are connected mechanically with each other so that N/Cs and N/Os can never be closed at the same time.	
Functional safety	The part of the entire plant safety, which depends from the correct function of safety related systems, for reducing the risk. These systems have to execute their intended functions (safety functions) under a defined error condition and with a defined probability.	
Housing protection classes	Protection classes characterize the range of protection of a sensor or a machine against contact as well as penetration of foreign objects or water. The protection class indication starts with the letters IP. The first number acts as an indicator for the contact and foreign objects protection, the second number as an	

	indicator against penetration of water. The higher the number is the higher is the respective protection. Protection classes from IP65 became accepted as standard in industrial environments.
Light curtain	A light curtain consists of a multiple number of lined up light barriers, so that the danger zone can be supervised consistently. If the light curtain is mounted near the danger zone, a lower resolution, viz. less light barriers per unit of length, is required than with bigger distances. There are several types: Light curtains for finger guard (14 mm of resolution) or hand guard (30 mm of resolution) as well as for body protection (2 - 4 beams).
Light grid	Multibeam configuration of one way light barriers in one housing.
Light barrier, oneway	A light barrier with which the light of the light transmitter is leaded to an optical and special separated light receiver.
λ (Failure Rate)	Probability of a failure
λ avg (Failure Rate, average)	Average probability of a failure per hour
λ DD (Failure Rate, dangerous, detected)	Dangerous, detected failure
λ DU (Failure Rate, dangerous undetected)	Dangerous undetected failure
λ SD (Failure Rate, safe, detected)	Safe detected failure
λ SU (Failure Rate, safe, undetected)	Safe undetected failure
Machinery safety	After done risk analysis by implemented action achieved minimization of risk on an accepted remaining risk
MTBF (Mean Time Between Failures)	Mean time between two failures
MTTF (Mean Time To Failure)	Mean time to failure
MTTFd (Mean Time To Dangerous Failure)	Mean time to dangerous failure
Muting	Bypass function: A time limited automatic bypass function of the safety function with additional sensor technology, to differ persons from objects
OR operation	Connects two or more units. Start-up occurs when at least one of the start-up conditions is met.
OSSD (Output Signal Switching Device)	Output circuit of an ESPE, which is connected to the machine control and switches in den off-state, as soon as the sensor function acts during the intended operation.
Performance Level	Ability of safety related parts to run a safety function under predictable conditions to achieve the expected reduction of risk.
PFD	Probability of Failure on Demand
PFDavg	Average Probability of Failure on Demand
PFH	Probability Of Failure Per Hour
PFHd	Probability Of Dangerous Failure Per Hour
Readiness delay time	Readiness delay time is the time, between applying the supply voltage and the output of the right switching signal.
Redundancy	The application of more than one identical element, in order to ensure that if one element malfunctions, a second element is available to guarantee that the safety function is maintained.
Reaction time	After supply voltage is applied, the period that elapses before the unit is ready for operation.
Safety Integrity	Average probability, that a safety related system executes the required safety related functions among all specified conditions within an agreed period of time.
Safety Integrity Level	One out of 4 discrete steps for the specification of the requirements for the safety integrity of the safety function, which are assigned to a safety-related system. Safety integrity level 4 represents the highest and safety integrity level 1 the lowest safety level.
Safe output	see OSSD
SFF (Safe Failure Fraction)	The part of safe failures, viz. the rate of failures which direct into the fail safe

Signaling current path	A non redundant conducted output with forcibly guided contacts. These are used as auxiliary contacts for signalling certain states of the machine.	
SIL (Safety Integrity Level)	Safety Integrity Level	
Synchronicity check	The synchronous actuation of the start buttons is monitored and for the two hand control required. The outputs are only switched, if both start buttons are pressed within 0,5s simultaneously.	
Synchronizing-bright connection	For one way and reflex light barriers counts: If the beam of light is not interrupted between transmitter and receiver or reflector, the exit is switched through.	
Synchronizing-dark connection	For one way and reflex light barriers counts: If the beam of light is interrupted between transmitter and receiver or reflector, the exit is switched through.	
Types of standards	Type A- Standards	Contain fundamental terms, design guidelines and general aspects, which could be used for all machines. (basic safety standard)
	Type B- Standards	Treat a safety aspects or a safety equipment, which can be used for a wide range of machines.
	Type B1-Standards for special safety aspects	(e.g. safety clearance, surface temperature, noise) the electric safety of machines (EN60204) the calculation of safety clearance (EN 999). Type B2-standards for safety equipment (e.g. two hand controls, interlock devices, separating protective devices, contactless protective equipments)
	Type C- Standards	(Standards for machinery safety) contain all safety requirements for a special machine or a machine construction. If this standard exists, it takes priority over the B- or the A- standards. However a type C-standard can refer to a type A- or a type B- standard. If no type C-standard exists for a machine, the conformity can be established on the basis of the type A- or B-standard. In any case the requirements of the machine directive have to be achieved.

C Standards-overview

1 Standards-overview

The following information applies only to the European machinery directive. The main requirement of the European machinery directive is, that there is no risk for persons (and, where appropriate, pets and goods) health and safety if the machine is properly installed, maintained and used according to the regulations. Machines have to be conform with their machine type corresponding basic-, safety- and health requirement, according to the 1st appendix of the European machinery directive. The term "used according to the regulations" is defined in DIN EN ISO 12100 part 1. The complete 1st appendix of the European machinery directive is attached to DIN EN ISO 12100 as appendix A.

The 1st appendix of the European machinery directive contains the requirements for a machine safety concept. For the not abolished dangers have to be made the necessary protection measures.



Only for the not abolished residual risks, a fallback on specialized training and protective equipment are allowed.

1.1 Standards-types

The European safety standards are hierarchically structured. There are the standards type A, B1, B2 and C.

Type A - Standards (basic safety standards)

They include basic ideas, design principles and general aspects for devices and systems.

Examples:

DIN EN ISO 12100 1/2	Safety of machines – basic ideas, general design principles
EN 1050	Safety of machines – risk evaluation principles no longer valid, replaced by EN ISO 14121-1
EN ISO 14121-1	Safety of machines – part 1: Principles, replacement for EN 1050
EN/IEC 61508	Functional safety of safety-related electrical, electronical and programmable electronical systems.

Type B - Standards (safety group standards)

Type B standards refer to safety aspects or safety-critical setups. They can be used for a whole series of machines, devices and systems.

Type B1 - Standards

Type B1 standards refer to specific safety aspects (e.g. safety distance, surface temperature, noise).

Examples:

EN ISO 13849-1	Safety of machines – safety-related parts of controls, part 1: General design principles
EN 954	Safety-related parts of control systems, transitional period: Valid until November 2009
EN 62061	Safety of machines – functional safety of safety-related electrical, electronical and programmable electronical control systems
EN 60204-1	Electrical equipment of machines

Type B2 - Standards

They treat safety-critical set-ups (e.g. two-hand controls, interlocks, safety mats, break safety setups)

Examples:

EN 61496-1	Electro-sensitive protective equipment
EN 574	Two-hand control systems
EN 13850	E-stop setups
EN 1088	Interlock setups in connection with interlocking safety door systems
EN 1760-1/2	Safety mats

Type C – Standards (Machine safety standards)

They include detailed safety requirements for a single machine or a group of machines.

Examples:

EN 415-4	Palletizing machines, packaging machines
EN 201	Plastic- and injection die moulding machines
EN 775	Industrial robots
EN 81-1	Elevators
EN 81-3	Elevators for small-sized goods
EN 115	Escalators and moving walkways
EN 692	Mechanical presses
EN 693	Hydraulical presses
EN12415	Automatic lathe

Other examples of product standards:

EN 8901	Safety technological requirements for cooling devices and heat pumps
EN 474-1	Earth-moving machines
EN 1889-1	Mobile machines, locomotives
EN 791	Drilling machines

EN 815	Tunnel drilling machines
EN ISO 11111	Textile machines
EN 60204-31	Electrical equipment, industrial machines

Standards for field bus systems

They include requirements and standards for field bus systems.

Examples:

EN 61158	"Field bus for industrial guide-systems" Interbus
EN 50170	"Universal field communication systems" Profibus
EN 50295	"Low voltage switching devices– control– and device-interface-systems-Actuator Sensor Interface (AS-i)"
EN 50254	Communication subsystem with a high efficiency for small data packages
DIN EN 61158-2	Field bus for industrial guide-systems

At the following publishing companies the standards can be ordered:

Beuth-Verlag: Beuth Verlag GmbH Berlin, 10772 Berlin
Tel.: (0049-30) 2601-2260
Fax: (0049-30) 2601-1260
www.beuth.de

VDE-Verlag: VDE-Verlag GmbH, 10625 Berlin
Tel.: (0049-30) 348001-0
Fax: (0049-30) 3417093
www.vde-verlag.de

2 The replacement of EN 954-1

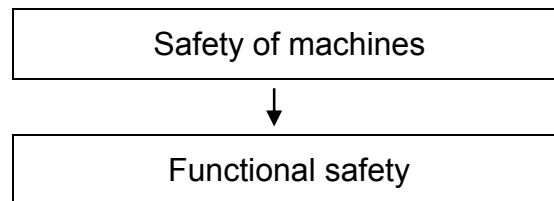
Previously, the machine constructing engineer had, according to the EN 954-1 (safety-related parts of control systems, part 1: General design principles) to proof the compliance of the general safety requirements according to the European machinery directive.

This standard demanded a risk analysis with the resulting safety categories (B, 1, 2, 3, 4). B stands for low and almost no safety respectively, 4 stands for high safety. The safety devices for a system were chosen with the safety category.

The EN 954-1 was replaced because programmable electronic systems were considered insufficiently and the time response (e.g. testing intervals, life cycles) and the failure probability of components were not considered. The following standards **EN 13849-1** (safety of machines – safety-related parts of control systems, part 1: General design principles) and **EN 62061** (safety of machines – functional safety of electrical, electronic and programmable electronic control systems) create remedy and consider the above approaches.

3 Definition of the safety requirements

It is divided into two parts: Safety of machines and the functional safety.

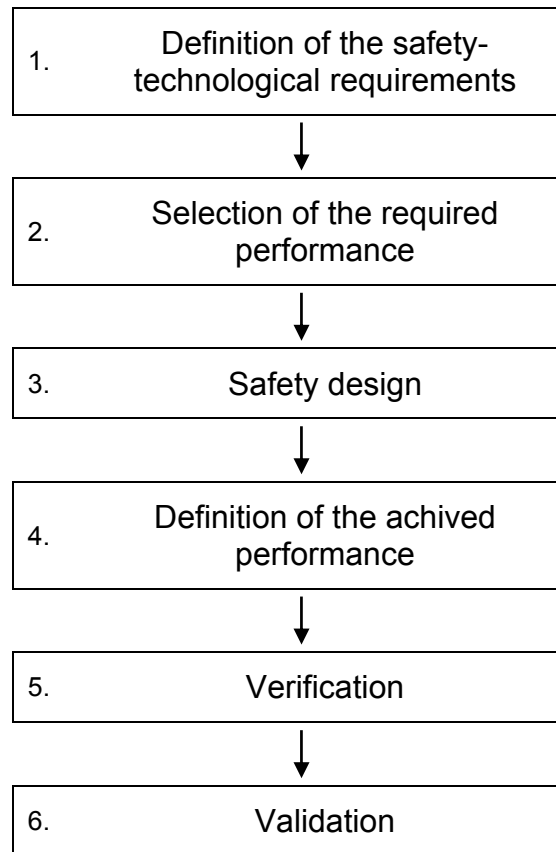


3.1 Safety of machines

After finished risk evaluation according to EN ISO 14121-1, measures for reducing of the detected risks will be defined. Afterwards, the risks will be reduced up to an acceptable residual risk.

3.2 Functional safety

The functional safety follows from the results of the machinery safety. The functional safety is divided into 6 steps:



3.2.1 Functional safety – the single steps:

1. Definition of the safety-technological requirements

The required safety function characteristics are defined e.g. ESPD-function with automatic start, no simultaneity, etc. and a detailed description with the necessary interfaces to the other parts of control systems will be prepared.

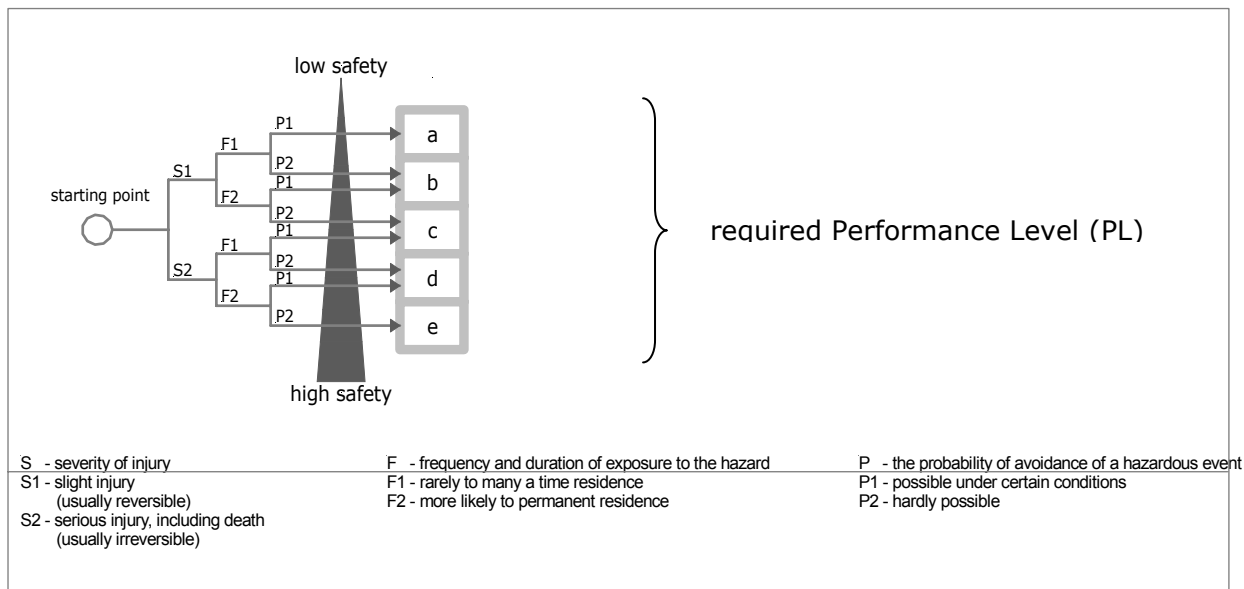
2. Selection of the required performance

The definition is done with a risk graph. For new systems it can be generally done with two standards:

EN 13849-1 (Safety of machines – safety-related parts of control systems, part 1: General design principles)

With the risk graph it is possible to investigate all safety-related functions and areas of a machine respectively. The results are the so-called Performance Level / PL (**a-e**). The PL is needed for the selection of the safety setup and the corresponding components including wiring.

The **a** stands for low safety and the **e** for high safety.



EN 62061 (Safety of machines - functional safety of safety-related electrical, electronic and programmable electronic control systems)

With the risk graph it is possible to investigate all safety-relevant functions and areas of a machine respectively. The results are the so-called Safety Integrity Level / SIL (1 - 3). The SIL is required for the selection of the safety setup and the corresponding components including wiring. The 1 stands for low safety and the 3 for high safety.

Effect and severity	S	Frequency and duration	F	Probability	P	Avoidance	A	Class K (=F+P+A)				
								3-4	5-7	8-10	11-13	14-15
Death, losing an eye or arm	4	≤ 1 h	5	very high	5			SIL2	SIL2	SIL2	SIL3	SIL3
Permanent, losing a finger	3	> 1 h - ≤ 1 day	5	likely	4				OM	SIL1	SIL2	SIL3
Reversible, requiring attention from a medical practioner	2	> 1 day - ≤ 2 weeks	4	possible	3	impossible	5			OM	SIL1	SIL2
Requiring first help	1	> 2 weeks - ≤ 1 year	3	rarely	2	possible	3				OM	SIL1
		> 1 year	2	negligible	1	likely	1					

OM = other measures advised

3. Safety design

The safety function described in step 1 is designed. The single components are defined, e.g. safety relays SAFE CL for the ESPD-function.

4. Definition of the achieved performance

The actual performance of the safety function is detected. The safety function is divided in sensors, logic and actuators. The parameters required to calculation are provided by the component manufactures.

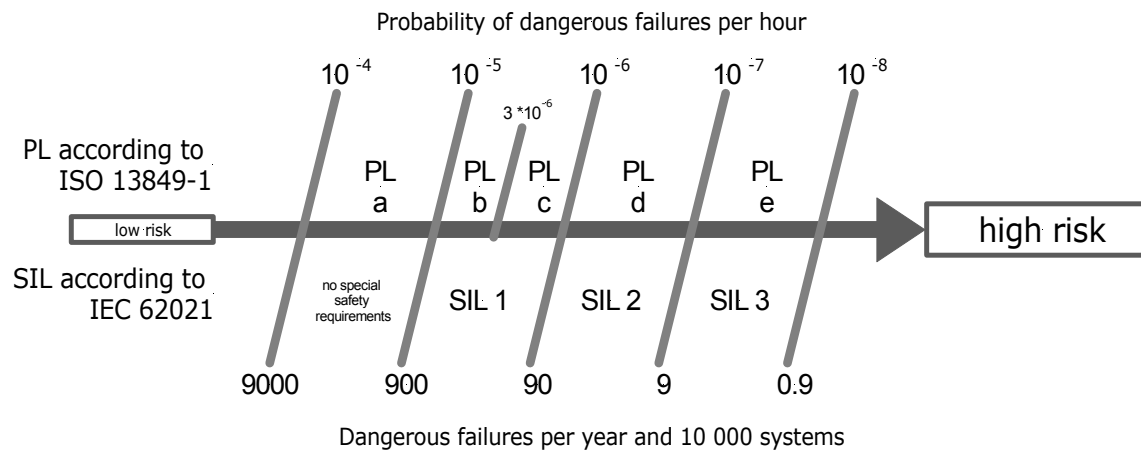
5. Verification

For each single safety function, the in step 4 achieved performance has to be bigger or equal as the in step 2 defined required performance. If this is not the case the safety function has to be improved.

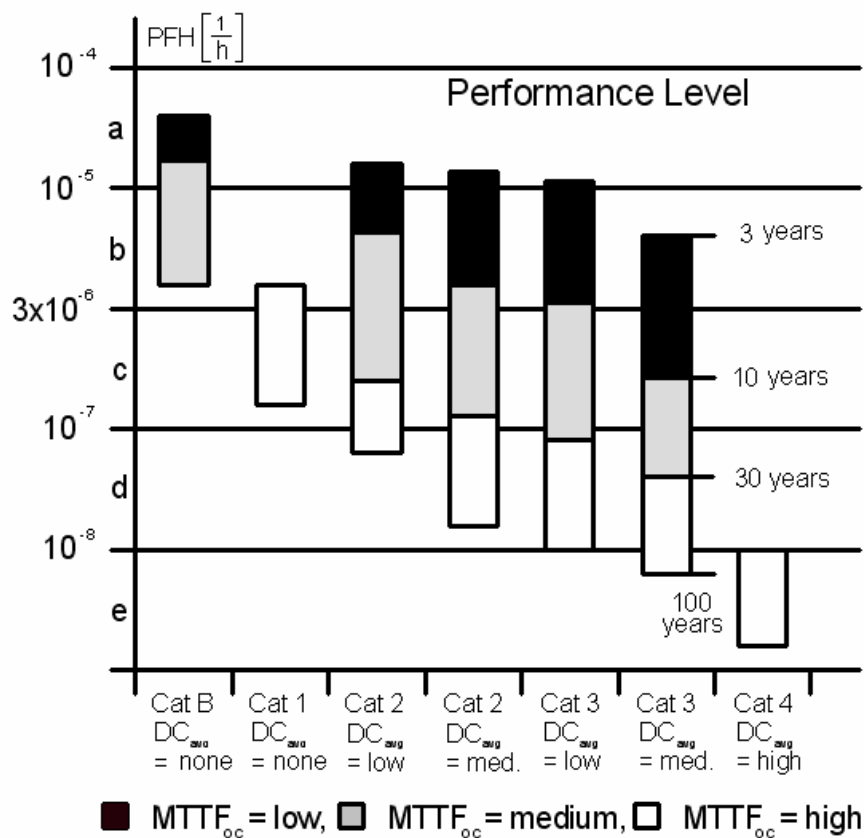
6. Validation

For the safety function, the validation ensures that all safety-relevant parts achieve the requirements.

3.2.2 Relationship between PL and SIL:



3.2.3 Relationship between the categories, DC, MTTF_d and PL:

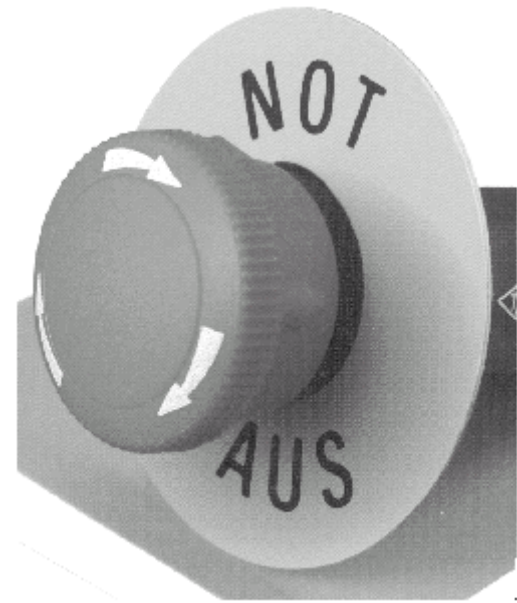


D Important B2-standards

1 E-stop function according to DIN EN 13850

Requirements on the function

- It must always be available (4.1.1)
- It takes priority over all other commands (4.1.1)
- It must not affect the effectiveness of the safety devices (4.1.2) (possibly continuing operation of auxiliary devices, e.g. breaks)
- It must not cause additional hazards (4.1.3) (e.g. the rescue of persons must be possible)
- After the reset command, no activation of restart command is allowed (4.1.6)
- It must avert danger in the best possible way.



2 Stop-function according to DIN EN 60204 part 1

There are the categories of stop-functions:

- | | |
|-------------|---|
| Category 0: | Shutdown by immediate breaking of the power to the machines – drive sections. |
| Category 1: | A controlled shutdown whereas the power to the machines – drive sections is maintained to break. The power will only be interrupted if idleness has been reached. |

E Specifications of riese-electronic safety relays

1 Specifications of possible riese safety relays for emergency stop

In the following table, all products which can be used for emergency stop are listed.
They are designed to be used in category 3 or 4 applications.

type	specialties	safety outputs	auxiliary outputs	opposite polarity between channels	internal reset monitoring	category
SAFE 1 1.)	22.5mm housing	3	1	no	no	2 (3 ^{xx})
SAFE 1.1	22.5mm housing	3	1	no	yes	2 (3 ^{xx})
SAFE 2 2.)	22.5mm housing	2	-	yes	yes	4
SAFE 2.1 3.)	22.5mm housing	2	-	yes	no	4
SAFE 4 / 4.1	22.5mm housing	3	1	yes	Yes / no	4
SAFE 5 / 5.1	22.5mm housing	2	-	no	yes / no	2 (3 ^{xx})
SAFE C 1	22.5mm housing	2	-	yes	selectable	4
SAFE S. 6	45mm housing	2	-	selectable	no	4
SAFE S.10	45mm housing, 10 A	2	-	selectable	no	4
SAFE T..	time delayed 35mm housing	2+2	1	yes	selectable	4
RS-NAGA	45mm housing	3	1	selectable	yes	4
RS-NAGAO	45mm housing	3	1	selectable	no	4
RS-NAGP	100mm	3	2	no	no	3
RS-NAGMP 4.)	100mm housing 8A	3	1	no	no	3
RS-NAGMP.1				selectable		4
RS-NAGT / T.1	with a time delayed output	2+1	-	selectable	no	3+4
RS-NAGV	100mm housing	6	4	yes	yes	4
SAFE IL1	Fieldbus connection over Inline system	2	-	selectable	yes	4
SAFE FLEX	22.5mm housing	2	1	yes	yes	4

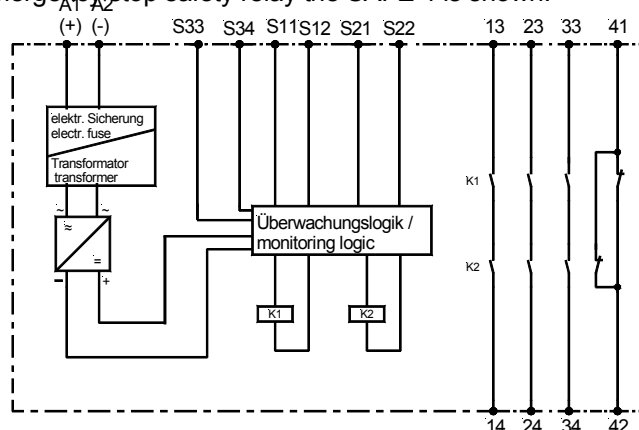
1.) 2.) 3.) 4.) be similar in function and connection PNOZ* X1, X2, X2.1 and PNOZ*

* PNOZ is a registered trademark from Fa.Pilz GmbH & Co.

xx Safety category 3, when attention to special condition - look at page 41.

function diagram SAFE 4

As an example for a emergency stop safety relay the SAFE 4 is shown.

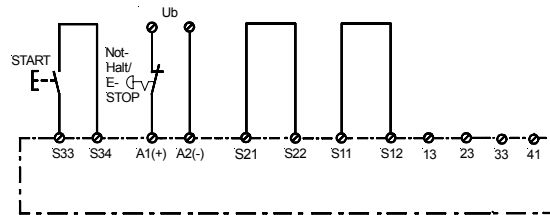


Emergency stop applications SAFE 4

Single-channel emergency stop (without opposite between channels).

Pressing the START-button, the unit will be activated. Contacts 13-14 and close.
Pressing the emergency stop will reset the contacts.

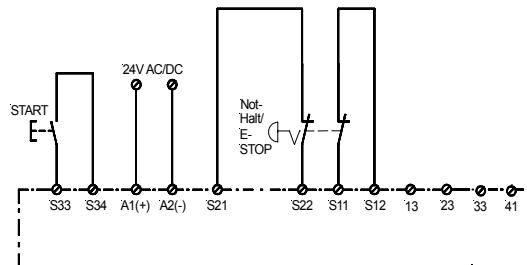
up to category 4; SIL3; PLd reachable*



Dual-channel emergency stop (with opposite between channels)

For this application the terminal wiring S11, S12, S21 and S22 must be used. With the START-button the device will be activated. The contacts 13-14, 23-24 and 33-34 are closed. Pressing the emergency stop initiates a stop and outputs open immediately.

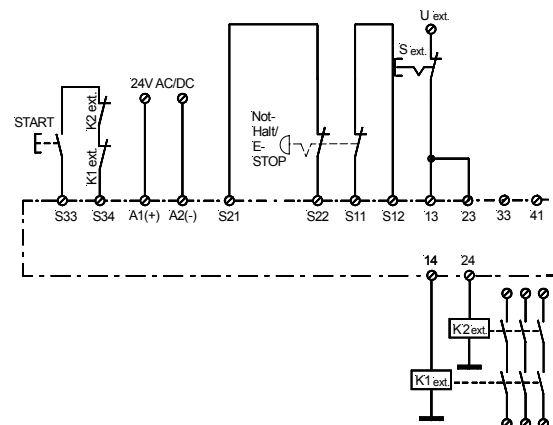
up to category 4; SIL3; PLd reachable*



Dual-channel emergency stop with external contact extension (2 contactors), contact monitoring and opposite polarity between channels.

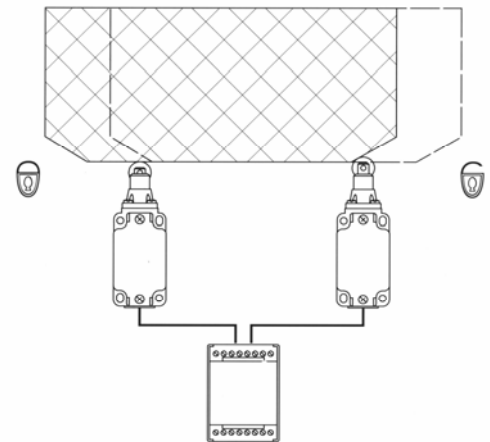
This application uses two external contactors with positive guidance. One normally closed contact of each external contactors must be connected in series to the START-button to the terminals S33 and S34. Through the switch S ext. the external contactors can be operated or turned off at any time if the SAFE 4... is activated.

up to category 4; SIL3; PLd reachable*



2 Safety gates according to EN 1088

Movable covers are required, if the dangerous area has to be entered very often, in order to load, unload or fix the machine. The cover has to be designed in a way, that if it is opened, the machine or the dangerous actions have to stop. If this stop is not possible as quick as the cover can be opened, the cover has to be locked as long as the dangerous action is in effect.



Requirements of a safety switch according to BG-GS-ET-15 :

- positive guided opening of the normally closed contacts
- form conclusiveness of the active part of the switch
- the switching loop can withstand a voltage peak of 2500 V
- galvanic separation of the switching parts
- non reversible with simple tools

Safety switch categories

Category 1 : Switches, where the switching element and the operation element form a unit by design and function.

Category 2 : Switches, where the switching element and the operation element do not form a unit by design, but during opening and closing they will come together by the function.

Specifications of possible riese safety relays for safety gates

In the following table, all products which can be used for safety gates are listed. They are designed to be used in category 2, 3 and 4 applications.

type	specialties	safety outputs	auxiliary outputs	opposite polarity between channels	internal reset monitoring	category
SAFE 1 1.)	22.5mm housing	3	1	no	no	2 (3 ^{xx})
SAFE 1.1	22.5mm housing	3	1	no	yes	2 (3 ^{xx})
SAFE 2 2.)	22.5mm housing	2	-	yes	yes	4
SAFE 2.1 3.)	22.5mm housing	2	-	yes	no	4
SAFE4 /4.1	22.5mm housing	3	1	yes	Yes / no	4
SAFE 5 /5.1	22.5mm housing	2	-	no	yes / no	2 (3 ^{xx})
SAFE C 1	22.5mm housing	2	-	yes	selectable	4
SAFE S. 6	45mm housing	2	-	selectable	no	4
SAFE S.10	45mm housing, 10 A	2	-	selectable	no	4
SAFE T..	time delayed 35mm housing	2+2	1	yes	selectable	4
RS-NAGA	45mm housing, reset monitoring	3	1	selectable	yes	4
RS-NAGAO	45mm housing	3	1	selectable	no	4
RS-NAGP	100mm housing	3	2	no	no	3
RS-NAGMP4.)	100mm housing	3	1	no	no	3
RS-NAGMP.1				selectable	no	4
RS-NAGT /1	One time delayed output	2+1	-	selectable	no	3+4
RS-NAGV	100mm housing	6	4	yes	yes	4
SAFE IL1	Fieldbus connection over Inline system	2	1 + 1	selectable	yes	4
SAFE FLEX	22.5mm housing	2	1	yes	yes	4

(1), (2), (3), (4) : the same function and pins as PNOZ* X1, PNOZ* X2, PNOZ* X2.1 and PNOZ*

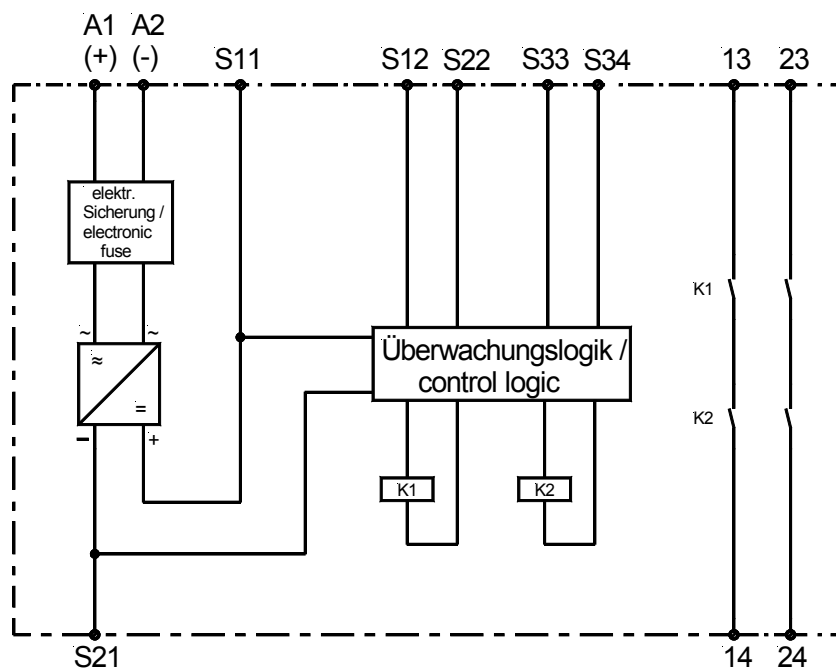
* PNOZ is a trade mark of Pilz GmbH + Co

^{xx} Example for the control to safety category 3

→ look at page 41,47.

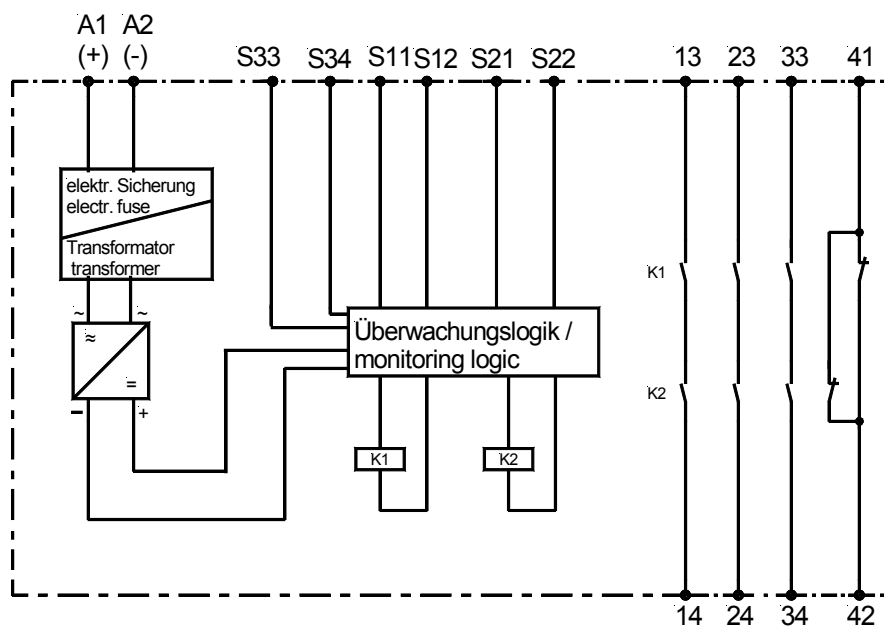
Function diagram

For example:
SAFE 2



Output contacts: 13-14 and 23-24 safety circuits (normally open)

For example:
SAFE 4



Safety gate applications SAFE 2 / 2.1

Single-channel safety gate monitoring.

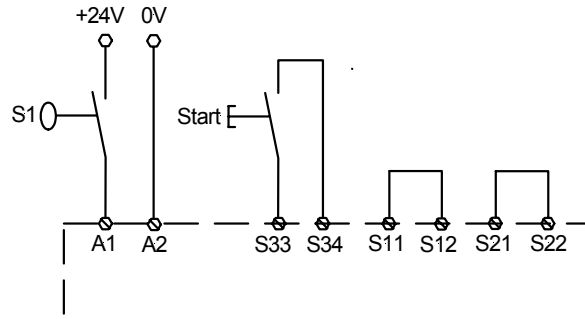
If the button S1 of the safety gate is closed the output contacts do not change. Pressing the START-button activates the SAFE2. The contacts 13-14, 23-24 close.

After the opening of the protection door switch the contacts return to their normal position without delay.

up to category 2; SIL1; PLd reachable

Additional advice

With wiring according to application the user must provide a connection to the machine control for cyclic testing.

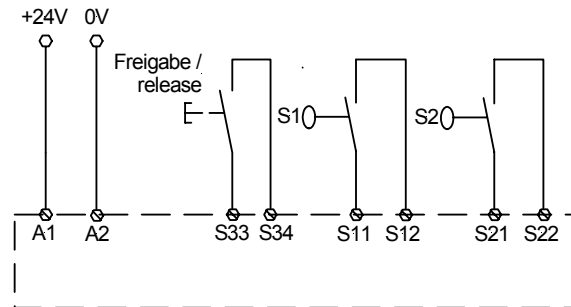


Dual-channel protection door monitoring with opposite polarity between channels.

If the safety gate switches are closed, the output contacts remain unchanged. After the release of the unit, the contacts 13-14 and 23-24 close.

After opening the protection door switches the contacts return to their normal position without delay.

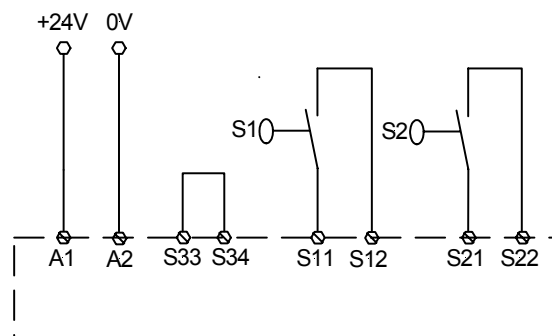
up to category 4; SIL3; PLe reachable



Dual-channel protection door monitoring with automatic activation and with opposite polarity between channels. (only Safe 2.1)

For this application the unit SAFE 2.1 has to be used. The activation works automatically, since the terminals S33/S34 are bridged. If the protection door switches close, the contacts 13-14, 23-24 close. After the opening of the protection door switches the contacts return to their normal position without delay.

up to category 4; SIL3; PLe reachable



3 Two hand controls according to DIN EN 574

There are 3 types of two hand applications :

type I : Requires two buttons to be held simultaneously with each hand during the dangerous motion of the machine. The release of one button during the dangerous motion stops the operation.

example:

Operations where the operator do not frequently enter and leave the hazardous environment.

application :

hedge shears, tools chucks

safety category 1 according to EN 954-1

type II : Like type I, requires release of both buttons before restart of the operation.

example :

Working very close to the dangerous area but normally not inside.

application:

machine preparation

safety category 3 according to EN 954-1

type III : Like type II, but both buttons have to be pushed within .5 s.

example :

Repeated feeding of the machine by hand, in the dangerous area.

application :

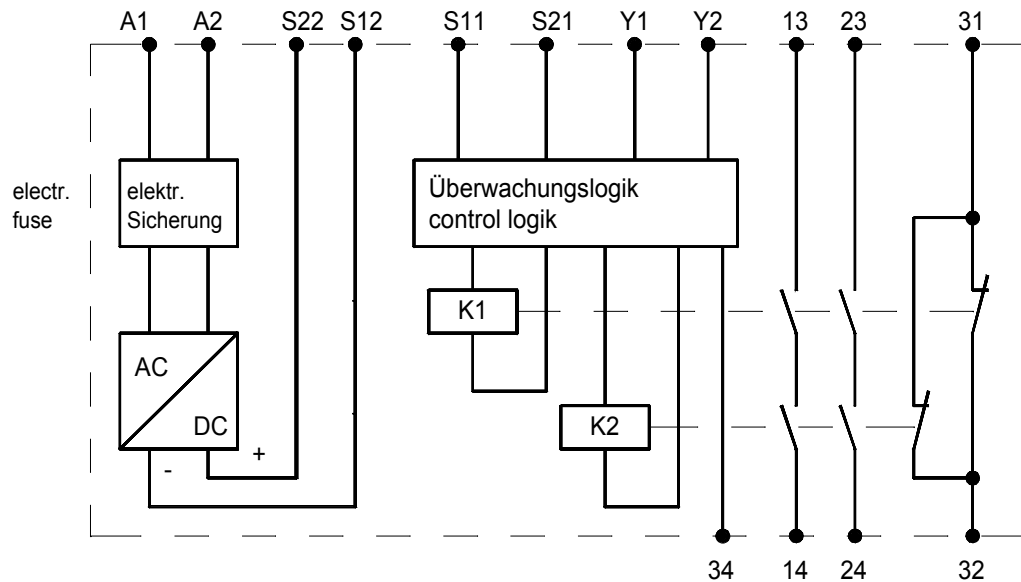
mechanical press

safety category 1 (type III a), 3 (type III b) or 4 (type III c) according to EN 954-1.

Specifications of two hand control relays from riese

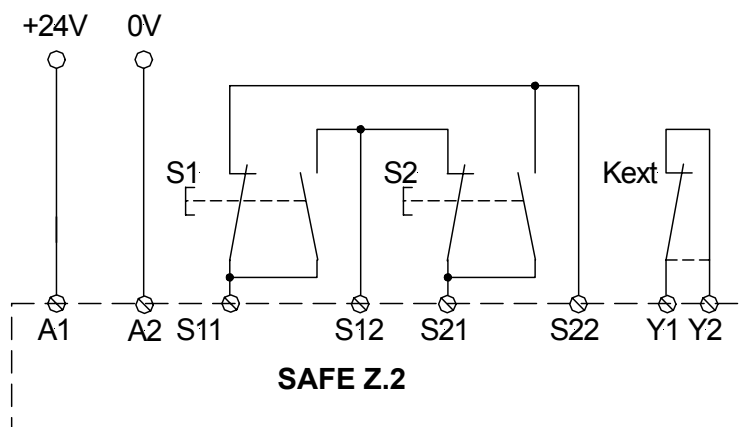
type	specialties	safety outputs	auxiliary outputs	opposite polarity between channels	simultaneity	category
SAFE Z	type III c simultaneity	2	1	yes	0,5 s	4
SAFE Z.2	type III c simultaneity	2	1 + 1 SPS out	yes	0,5 s	4
SAFE ILZ	type III c simultaneity	1+1	1 + 1 SPS out	yes	0,5 s	4
RS-NAGZ	type III b simultaneity	2	2	yes	0,5 s	3
SAFE FLEX	22.5mm housing type IIIc	2	1	yes	0,5 s	4

Function diagram SAFE Z.2

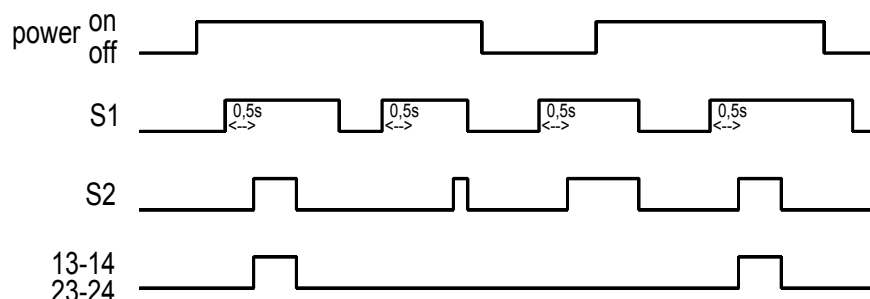


Two hand control application SAFE Z.2

Two hand control relay SAFE Z.2 according BG, section iron and metal III ZH 1/456 (02.78) and DIN EN 574 (02.97) for type 1-3c. The two switches have to be connected as shown. The machine control has to be connected to safety outputs 13-14 and 23-24. The terminal 31-32 (n.c. contact) is not a safety output. An emergency stop button or safety gate switches can be connected in series between the normally open safety outputs.



Impulse plan of two hand control relay type III (III a, III b or III c)



There must be installed an auxiliary voltage at the terminals A1 and A2 in order to operate the device. Then power LED starts illuminating.

By pressing the button S1 simultaneously to S2 the safety outputs 13-14 and 23-24 will switch. This causes an machine connected to the safety outputs gets able to start. Attention: The simultaneousness of the two hand control button S1 and S2 has to be smaller 0,5 sec.

If one or both buttons released, the outputs 13-14 and 23-24 will open immediately. Only after releasing S1 and S2 a new cycles can be started. If the simultaneous time will be bigger than 0,5 sec the outputs will not be released. The outputs 13-14 and 23-24 stay open. The machine cannot be started.

It is possible to connect machine-release-circuits at the terminals S21 and Y2. The contact - extension with external contactors must be following through two outputs and two contactors how for safety category 4.

4 Presence sensing safeguarding devices according to DIN EN 61496-1

The presence sensing safety devices include light curtains and safety light barriers.

There are two different types :

type 2

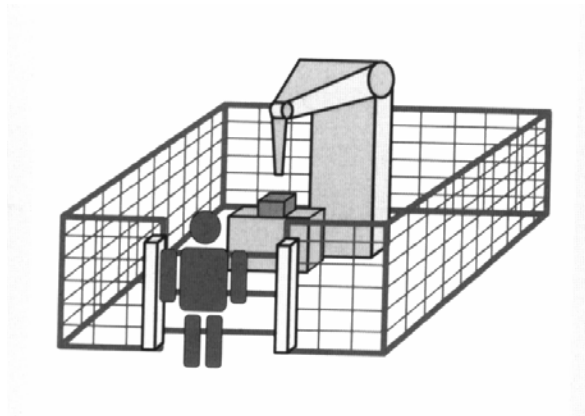
For applications with a low level of risk.

This relates to safety category 2 according to EN 954-1.

type 4

For applications with a high level of risk. This relates to safety category 4 according to EN 954-1.

There are different modes of operation (terms are defined under section B.3, please look at page 12).



Protection mode with restart lock

Specifications of possible riese safety relays

Type	specialties	safety outputs	auxiliary outputs	opposite polarity between channels	internal reset monitoring	category
SAFE L	a) light curtains/barrier application	2	-	no	yes	4
SAFE L.1	a) light curtains/barrier application	2	-	no	no	4
SAFE L.2	a) light curtains/barrier application	3	-	no	selectable	4
SAFE ILL	Fieldbus connection over Inline system	2	-	selectable	yes	2/4
RS-NAGL RS-NAGL.1	light curtains/barrier application	2 2	2 2	yes no	yes yes	4 4
RS-NAGU.1	Muting / semiconductor outputs	3	2*	selectable	yes	4
RS-NAGU.2 f	Muting / relay output	3	2 + 2*	selectable	yes	4
RS-NAGU.1b	Muting / semiconductor outputs	3	2*	selectable	yes	4
RS-NAGU.12	Muting / semiconductors outputs	3	2*	selectable	yes	2
SAFE FLEX	22.5mm housing	2	1	yes	yes	4

* ready for special functions

a) If SAFE L used for safety light curtains: by the reset monitoring one fault is not detected. If necessary, depending on risk assessment (EN954-1) use in that case RS-NAGL.

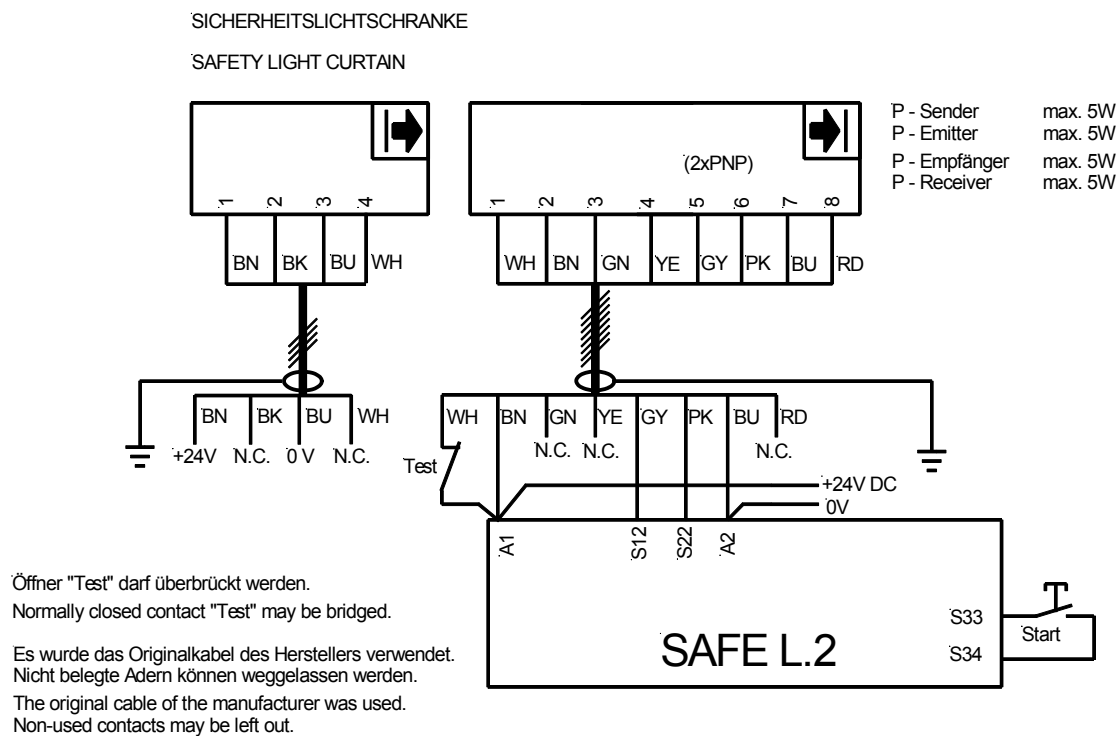
Protection mode with restart lock at SAFE L.2 as example

The connection of the SAFE L.2 to a light curtain or a light barrier is different from manufacturer to manufacturer.

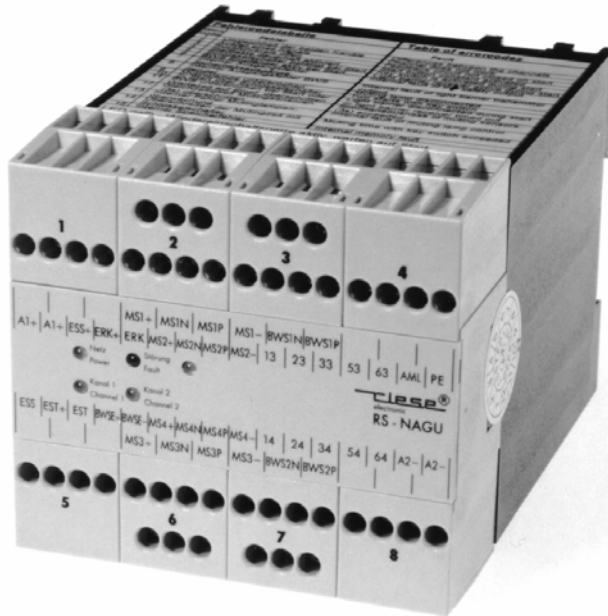
ries.e electronic supplies application drawings for

- Honeywell ▪ Guardscan ▪ Leuze / Lumiflex ▪ Sick ▪ Schneider ▪ Visolux ▪ Wenglor ▪
- Datasensor ▪ SC Safety ▪

► Datasensor light barrier application with SAFE L.2.



Protection mode with restart lock at RS-NAGU.1 / NAGU.2f... as example



RS-NAGU.. light curtain / barrier applications

None of muting sensors will be connected the muting control can work as a light curtain / barrier switch relay.

Muting

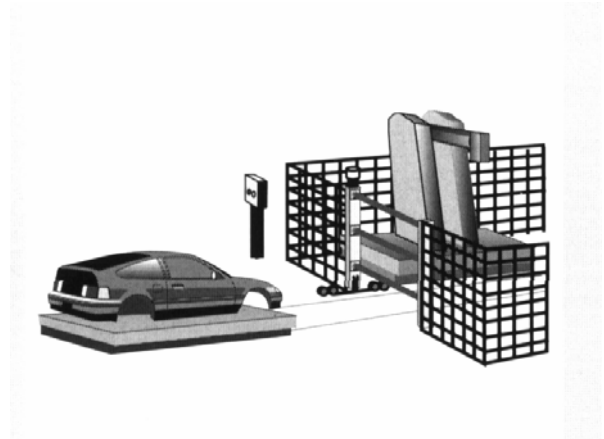
Muting is the intentional by passing of temporary bypassing of a the function of a light curtain or light barrier in order to transport material into or out of the danger area.

RS-NAGU...

The RS-NAGU.. is used for muting of safety light barriers and safety light curtains, so that material-transport to or from a machine can be done. Applications can be found in the automotive industry, packaging machines or at highly automated production systems. The differentiation between human and material is done with up to four muting sensors or two safety light barriers. Inductive sensors or mechanical switches can also be used as muting sensors.

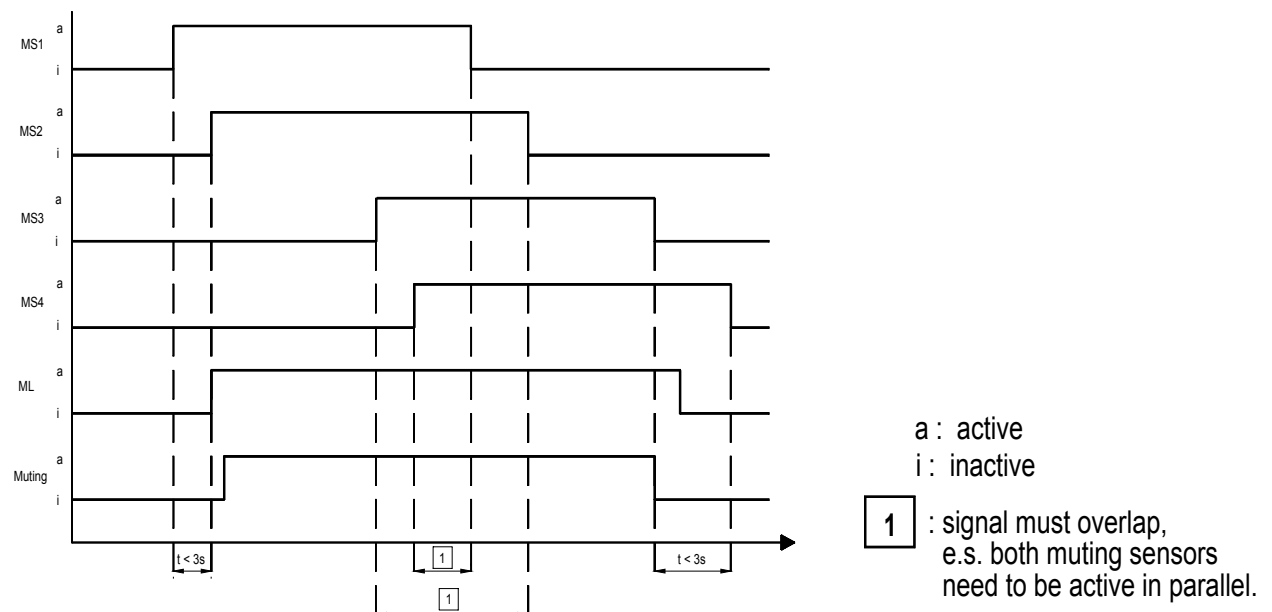
Functions of the muting controllers:

- Connection of an external muting lamp
- Connection of present-sensing safeguarding devices
- Monitoring of external devices and expansion modules
- Connection of different muting-sensors (NPN,PNP and relay output)
- RS-NAGU.1 / RS-NAGU.1b / RS-NAGU.12: 3 electronic safety-semiconductor outputs.
- RS-NAGU.2f: 3 normal open safety outputs.



Muting cycle

If the muting sensors 1 and 2 or 3 and 4 are activated within 3 sec, RS-NAGU.. starts a muting cycle. The controlled muting light is turned on and an interruption of the light barrier will not cause a stop of the machine. If three of the four muting sensors are deactivated, the muting cycle will end after 0,25 sec.



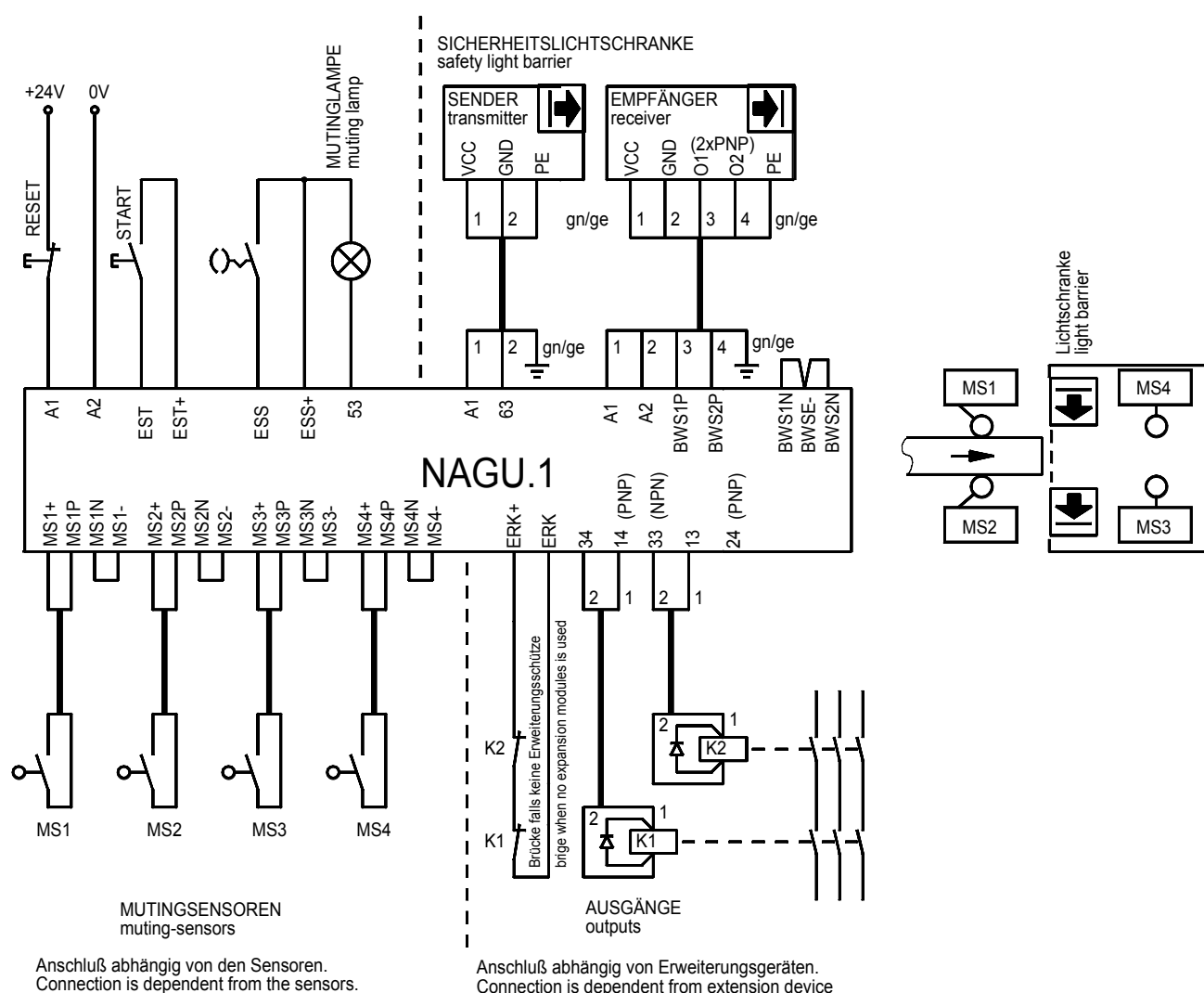
Muting-application according to RS-NAGU

The following example of muting is display the connection of 4 muting-sensors, 1 light barrier with 2 PNP-outputs and 2 extension -contactors. After connecting the device according to the appropriate drawing, the controller is ready to operate. The LED's channel 1, channel 2 and power illuminate. If these LED's blink, a fault exists or a wrong connection has been made. If a muting sensor is blocked by materials or goods, the muting cycle can be activated by engaging the key switch. Please find the list of blink codes in the fault diagnostics section. If the RS-NAGU.. does not respond, then at least one of the muting sensors is blocked or is not connected correctly. So the key-switch is being to locate, that from this position the monitor zone is good to see.

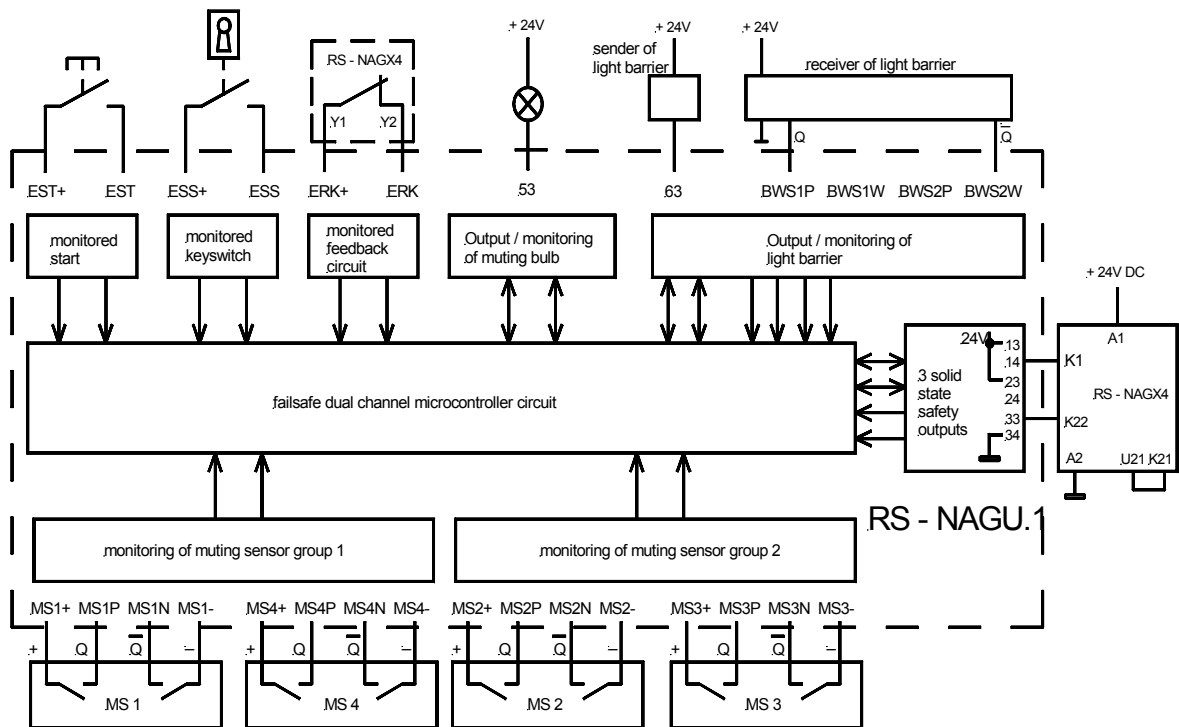
The "key switch should be planed there, where the alonger area is good to see.

If the light barrier or light curtain is interrupted, when the muting cycle is not activated, a stop signal is released. The machine can be started again by pressing the start bottom.

Connection is dependent on the device type and by ESPE. Rest examples – look at application



function diagram RS-NAGU.1



Positive intern voltage (appr. 24 V DC) is supplied at all terminals xx+.

Negative intern voltage (ground) is supplied at all terminals xx-.

Muting sensors 1 and 4 respectively 2 and 3 are considered to be each a group. At ON or OFF condition the time difference between both muting groups must not exceed 3 seconds. Muting will remain as long as two muting sensor group become inactive. Muting will only be switched off 0,25 s after deactivation of three of the four muting sensors. After recognition of errors all safety outputs will be switched off and the appropriate error code will be indicated. Pressing of the RESET button will ensure prompt switch-off of the device. The safety output of the semiconductors as well as the muting lamp will be checked frequently under switched on condition.

RS-NAGU.1 : 3 safety semiconductor outputs.

RS-NAGU.2f : 3 normally open safety (relay) 3 signal outputs (muting and safety light barrier).

- O1 = released
- O2 = no signal from BWS
- 73-74 = muting active

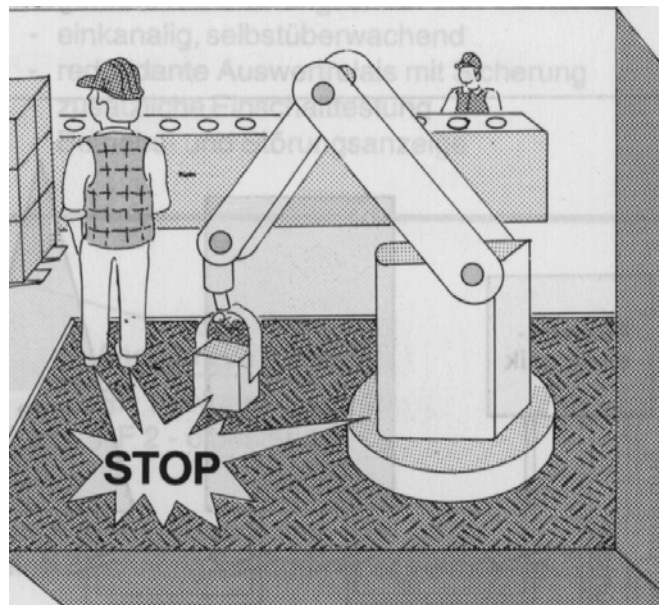
→ Example for the control of the outputs - from page93.

5 Safety mats according to EN 1760

Safety mats are used to protect dangerous areas, which can be found in presses, robotic cells and other movable tools. Stepping on the mat results in a signal to the control stopping the dangerous movement.

Safety contact edges

Safety contact edges were used for protection from squeezing e.g. at roll gates or elevators. If somebody presses the contact edge immediately a stop signal is released.

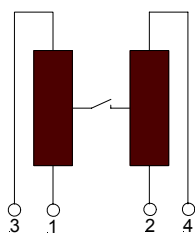


Principle of Safety Mats

Safety Edges and Bumpers follow the same principle as safety mats, so we will focus on the safety mats without loss of generality.

4-Wire-Principle

The 4-wire-mat recognizes an activation by a short circuit between the two elements (R_{12} , R_{34}). Inside of the mat all connectors are connected (1-3, 2-4). Because all 4 wires have to be connected to the controlling device, the amount of wiring is quite high.



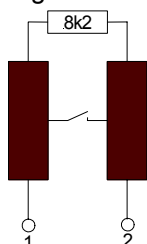
function table	mat free	mat entered	fault (broken wire)
R_{12} , R_{34}	∞	0	-
R_{13} , R_{24}	0	0	> 0

R_{12} means the measured electrical resistance between the clamps 1 and 2, the others resistances respectively.

Category: up to 3

2-Wire-Mat

The structure of the 2-wire-mat is identical to the 4-wire-mat, but two of the clamps are not wired to the controlling device but finalized by a – normally - 8,2 k Ω -resistor. The amount of wiring is less.

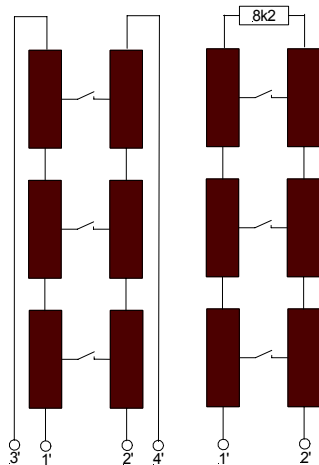


function table	matte frei	mat entered	fault (broken wire)
R_{12}	8,2 k Ω	0	$> 8,2 \text{ k}\Omega$

R_{12} means the measured electrical resistance between the clamps 1 and 2, the others resistances respectively.

Category: 2

Cascading:



Several mats can be cascaded easily. The principle remains the same.

Remark: Normally the switch between the two mat elements will not be drawn.

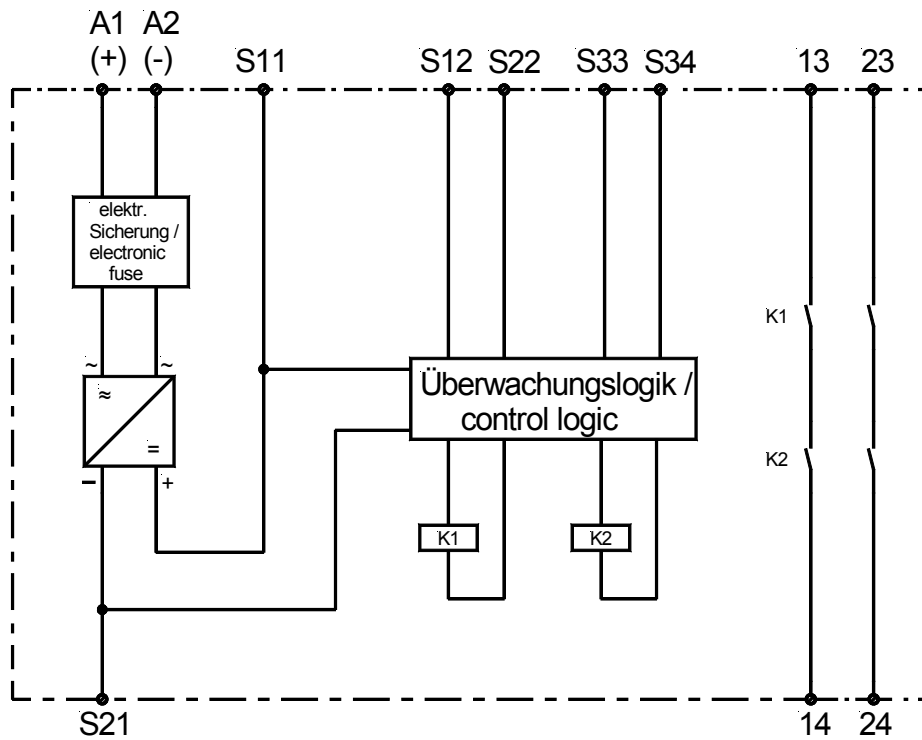
Specifications of possible riese safety relays for safety mats and safety contact edges

type	specialties	safety output	auxiliary outputs	opposite polarity between channels	category
SAFE M	22,5 mm	3	1	yes	3
SAFE 2.2*	22,5 mm	2	-	yes	4
SAFE IL1	Field bus connection over Inline system	1+ 1	-	selectable	4
RS-NAGAO*	45mm housing	3	1	selectable	4

Relevant information:

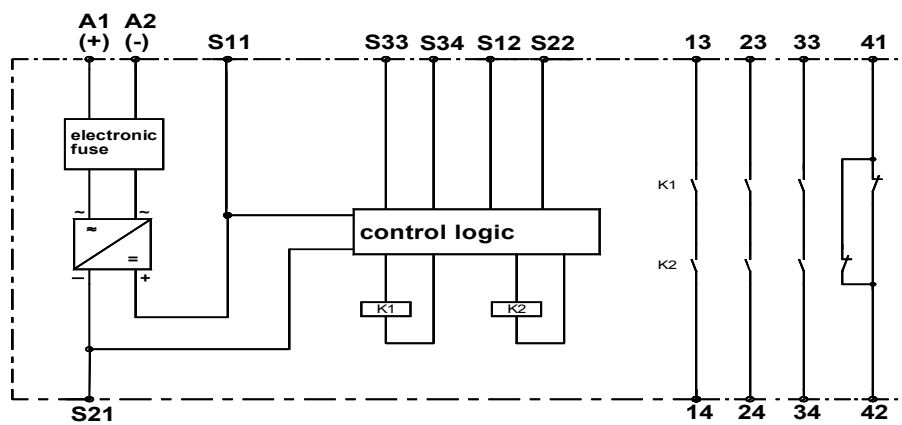
*It must be guaranteed that the safety mat or safety contact edge - during load with a standard weight - does not have a resistance more largely than 1 Ω .

Function diagram SAFE 2.2



Output contacts: 13-14 and 23-24 safety circuits (normally open)

Function diagram SAFE M

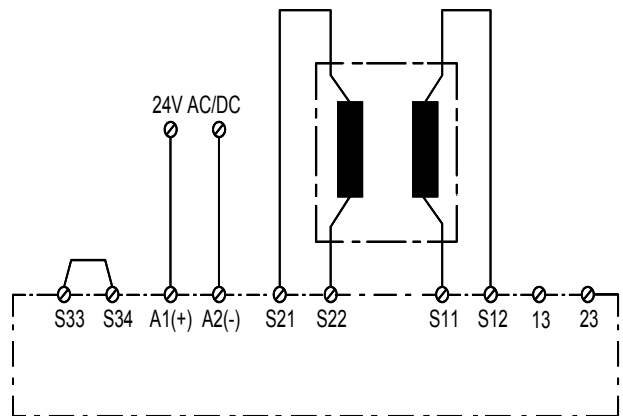


Safety mat application SAFE 2.2

It must be guaranteed that the safety-mat or safety contact edge -during load with standard weight- does not have a resistance higher than 1Ω

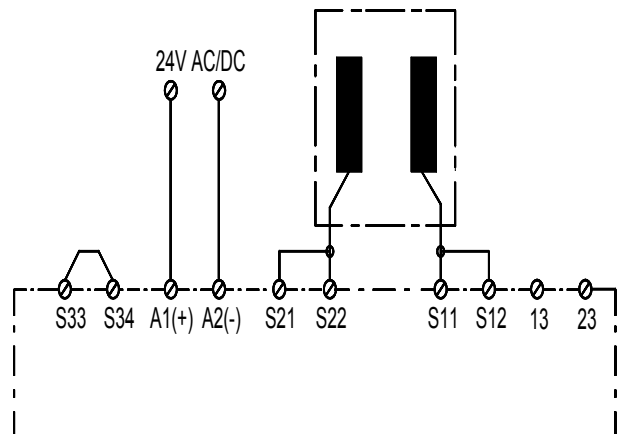
1. Dual-channel application for four-wire safety-mats with opposite polarity between channels (with potential free contacts)

In this application the terminals S33 and S34 are bridged. So this activation of the device works automatically. Contacts 13-14, 23-24 close after power is on or after steps off the safety mat. When the safety mat is stepped on, the contacts fall back into their normal position without delay.
Suitable up to category 4; SIL3; PLe reachable



2. Dual-channel application for two-wire safety-mats with opposite polarity between channels (with potential free contacts)

In this application two connections per channel are each connected to one of the terminals of the safety-mat. Terminals S21/S22 and S12/S11 are connected. The function is like the application with four wire safety mats.
Suitable up to category 1; SIL1; PLc reachable



SAFE M application see page 65

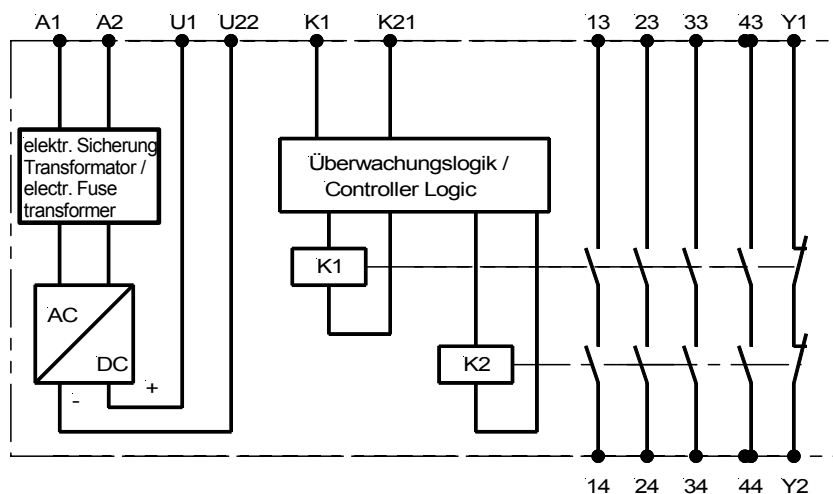
6 Expansion modules

Expansion modules are used to increase the number of safety outputs and can be connected to a normal safety relay. The number of expansion modules connected to a safety relay should not exceed 6. There are two possible versions available :

type	specialties	safety output	auxiliary outputs	opposite polarity between channels	category
SAFE IL2	63 mm housing	5	1	-	4
SAFE X4 / 4.1	22,5 mm housing	4	1	selectable	4
NAGX 5	45 mm housing	5	1	selectable	4
SAFE IRZ.2	22,5 mm housing	1 changer	1	selectable	suitable up to risk category max. 4 control dependent

SAFE IRZ.2 / RS – NAGX 5 : conversion of semiconductor output to relay output
(RS-NAGU, NAGU.1, RS- NAGU.1b, RS-NAGU.12)

Function diagram SAFE X4



A transformer is used for the following voltages:

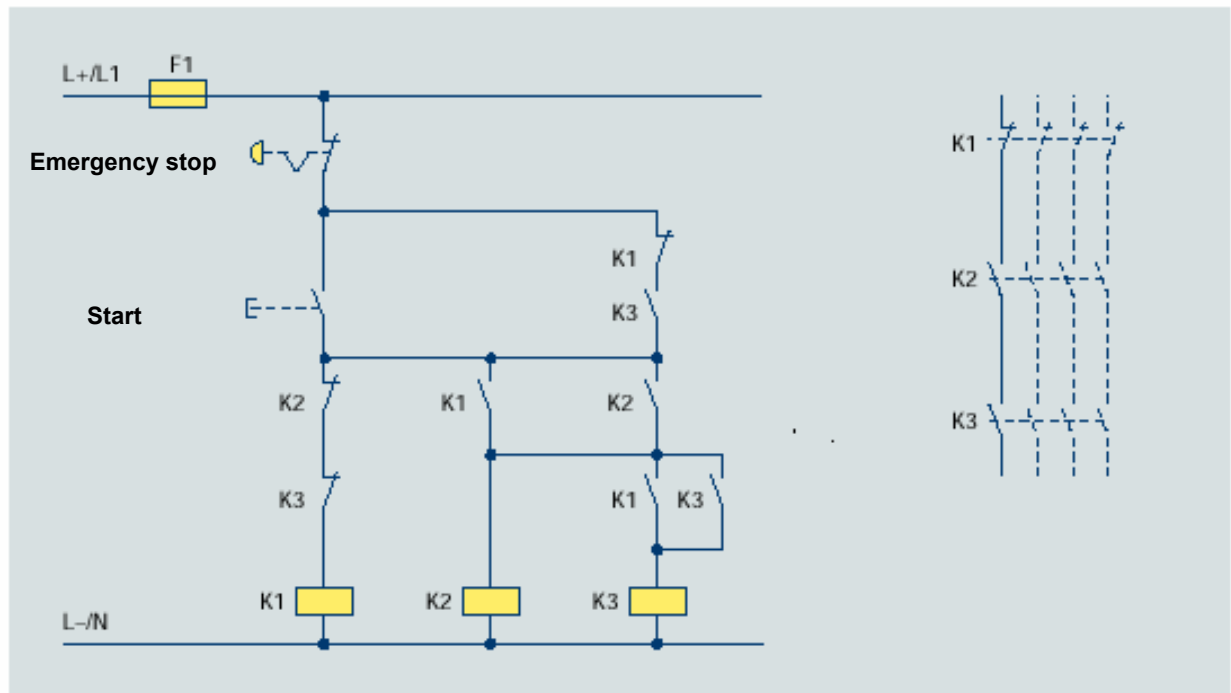
48, 110-127, 230VAC.

A electrical fuse is used instead of an transformer with the 24VAC/DC voltage device.

→ some applications as well as expansions with contactors are shown on page 132.

7 Safety with contactor

Before safety relays were produced all electronic safety circuits were made with contactors. This technology would be replaced by the safety relays.



(part of the siemens application book)

Function

After pressing the start button the contacts of the contactor K1 switch. All normally opened contacts close and all normally closed contacts open. Then contactor K2 and K3 switch. After K2 and K3 had switched K1 falls back in his basic position. Only after pressing the emergency stop button K2 and K3 will fall back in their basic position.

If a failure at K2 or K3 happens for example the normally opened contact will not open then the normally closed contact does not close.

When this happens the circuit could not be restarted.

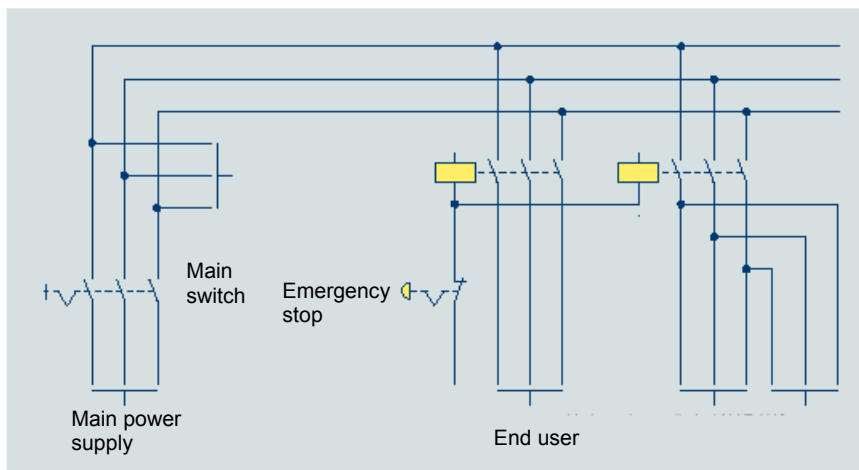
Formally this safety circuit was realized with two contactors not with three. Because of safety reasons this kind of safety circuit will no longer be used.

Safety circuits with safety relays

Safety circuits with safety relays is a young technology. Before the safety relays were established on the safety marked all safety circuits had to be realized with conductors.

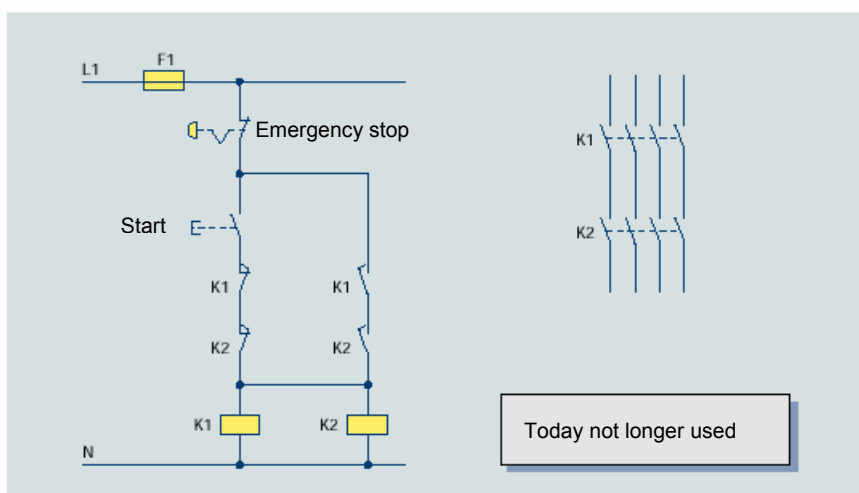
That means a defined number of conductors were connected together so that safety application were realized .

Example: electronic conductor circuit



Example of a machine control unit with two emergency stop conductors. Allowed to use only with restrictions

Application only for very simple machines and under restrictions



Disadvantages of conductor circuits:

- High wiring affords
- High space requirement
- Complicated error detection
- Unclear connection diagrams
- many components
- Wiring errors could happen and no one will notice them

Advantages of safety relays:

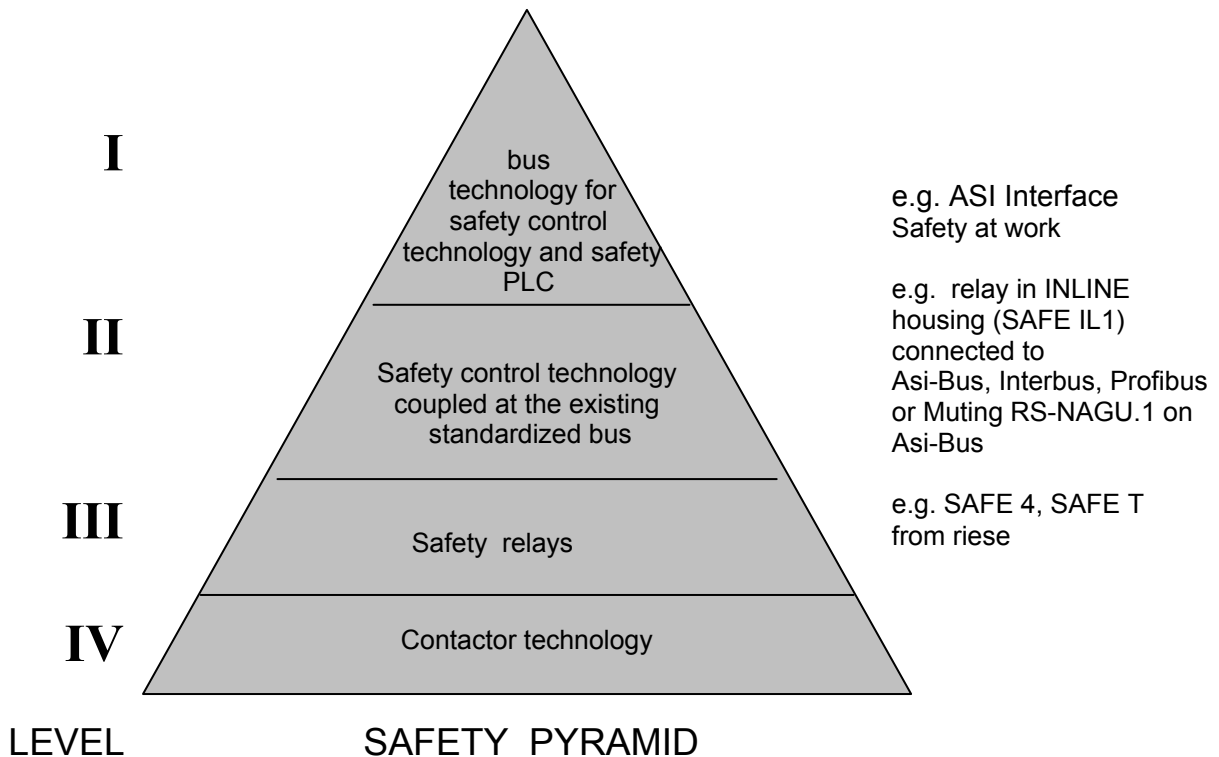
- Low wiring
- Easy connections of components (start bottom)
- Small space requirement
- Good overview about the electronic circuits
- It's easy to say where are safety relevant parts are when they have the signal color (red) like the safety relays from ries.e electronic.
- Optical status report by LEDs
- energy conservation (3 contactor to need more energy than one safety relay)

Remark

- Most manufacturers of contactor combinations have today safety relays in their program

8 Safety at bus

The market for the safety control technology presents itself currently as follows:



At level II (safety control technology coupled at the existing standardized bus) riese electronic has made the decision to connect to an open, free bus system:

At moment 4 products in INLINE system and 6 applications:

- E – STOP relays
- safety mat relays
- light barrier controller
- safety gate monitors
- two hand control devices
- expansion modules for load circuit

and muting application for example RS-NAGU.1 + FA 1 for Asi-bus. (see page 143)

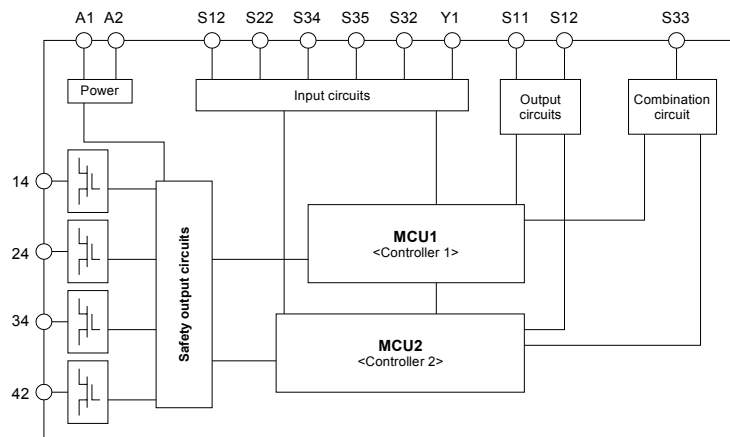
INLINE advantages:

- up to 80% less wiring
- substantiall fewer sources of error
- easier and faster planning and project engineering
- up to 50% less space requirement
- easy introduction and expansion of existing controls
- generally compatible with INLINE series from Phoenix Contact and VersaPoint GE-Fanuc)
- with our INLINE devices all mats, light barriers, without bus support, can be integrated in a bus system

9 Safety combination / Linkage

for example **SAFE C**

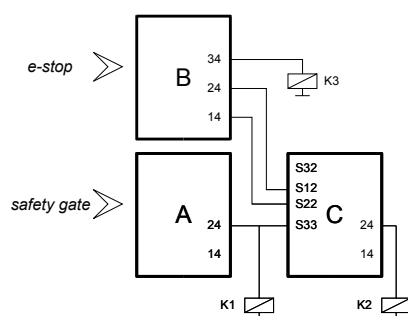
Block diagram



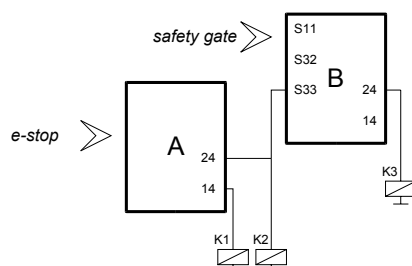
Terminal(s)	Description of function
S11, S12, S21, S22	Activation- and release contacts
S32, S33	Combination circuit configuration
S34	Reset circuit input
S35	Operating mode (1/2-channel)
14, 24, 34	Safety semiconductor outputs
42	Auxiliary output (PLC)

Features:

- Cyclical self-monitoring by internal controllers
- Controllers supervise themselves independently by internal communication
- Wear-free, short circuit proof safety semiconductor outputs (on-state: 24V DC, off-state: 0V DC)
- Wear free, short circuit proof auxiliary output
- Cyclic monitoring of the safety outputs by clocked operation
- Opposite polarity between channels (only with two-channel configuration)
- Up to 3A of load current
- Alternatively single- or two-channel configuration
- Monitoring of the reset circuit
- Monitoring of complete plants by the linkage of several devices among themselves



AND – linkage between three SAFE C1 devices



AND – linkage between two SAFE C1 devices

F Applications of riese safety relays

Attention : Using external contactors in application spark quenching circuits are required and must be connected directly to the contactor.

1 Product application - emergency stop relay safety gate monitoring relay

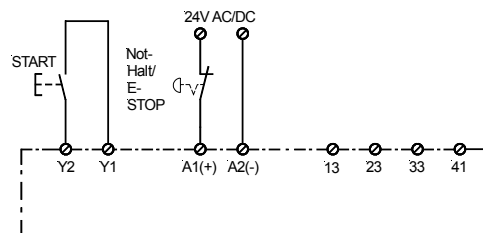
a) SAFE 1 / SAFE 1.1

(SAFE 1 : with start control)
(SAFE1.1: without start control)

Single channel emergency stop

By pressing the START button the unit is activated. Contacts 13-14, 23-24, 33-34 close and contact 41-42 opens. Pressing the emergency stop will reset the contacts.

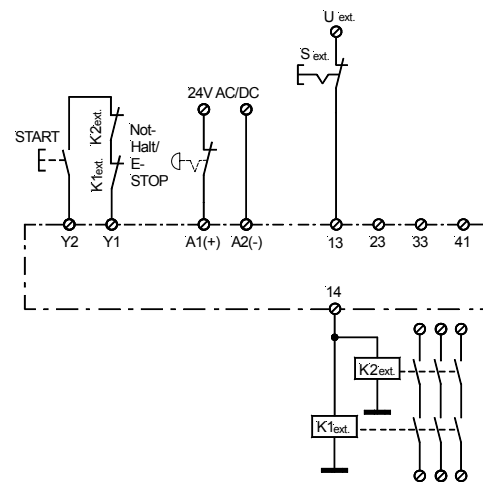
Suitable up to category 2; SIL1; PLd reachable



Single channel emergency stop with external contact extension (1 contactor) and contact monitoring.

This application uses one external positive guided contactor. One normally closed contact of each contactor must be connected in series to the START button. Through the switch S ext. the external contactor can be operated or turned off at any time the SAFE 1 is activated.

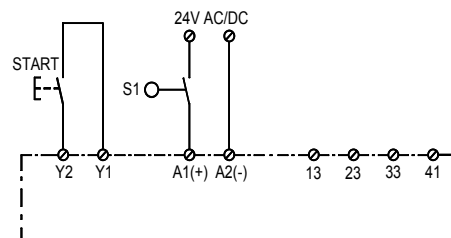
Suitable up to category 2; SIL1; PLd reachable



Single channel safety gate monitoring.

If switch S1 of the safety gate is closed the output contacts do not change state. Pressing the START button activates the SAFE 1. When contacts 13-14, 23-24 and 33-34 close and contact 41-42 opens. Opening S1 of the safety gate the reset immediately.

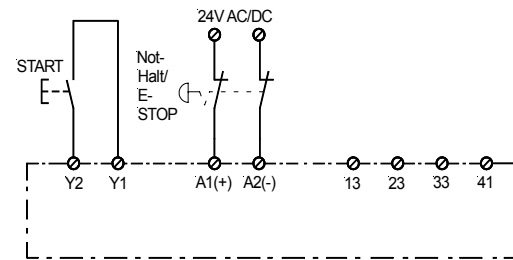
Suitable up to category 2; SIL1; PLd reachable



Dual channel emergency stop

For this application the normally closed contacts of the emergency stop button must be connected in series to the power supply. With the START button the unit is started. The contacts 13-14, 23-24 and 33-34 are closed, contact 41-42 opens. Pressing the emergency stop will reset the contacts.

In case of protected wiring (short current circuit exclusion) and regularly tests, for example during maintenance, up to category 3; SIL2; PLd

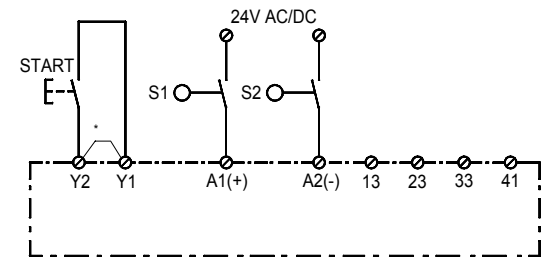


Dual channel safety gate monitoring

Dual channel safety gate monitoring
If the safety gate switches S1 and S2 are connected, the output contacts remain unchanged. The device will

be activated with the Start button. The contacts 13-14, 23-24 and 33-34 are closed, contact 41-42 be activated with the Start button. The contacts 13-14, 23-24 and 33-34 are closed, contact 41-42

In case of protected wiring (short current circuit exclusion) and regularly tests, for example during maintenance, up to category 3; SIL2; PLd reachable



b) SAFE 2 / SAFE 2.1

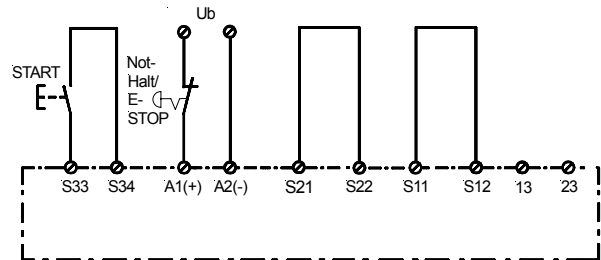
(SAFE 2 : with start control)

(SAFE 2.1 : without start control)

Single-channel emergency stop (without opposite polarity between channels)

By pressing the START button the unit is activated and contacts 13-14 and 23-24 close. Pressing the emergency stop will reset the contacts.

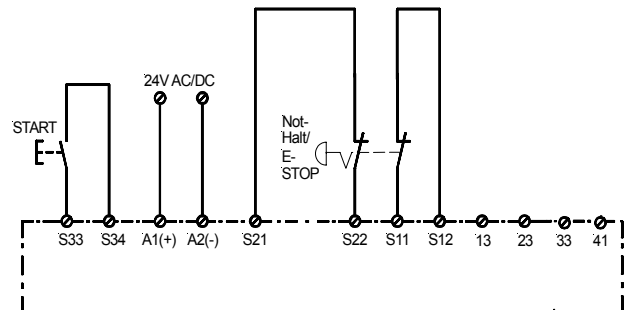
Suitable up to category 2; SIL1; PLd reachable



Dual-channel emergency stop (with opposite polarity between channels)

For this application the terminal wiring S11, S12, S21 and S22 is changed. By pressing the START button the device will be activated and contacts 13-14 and 23-24 close. Pressing the emergency stop initiates a stop and outputs open immediately.

Suitable up to category 4; SIL3; PLe reachable

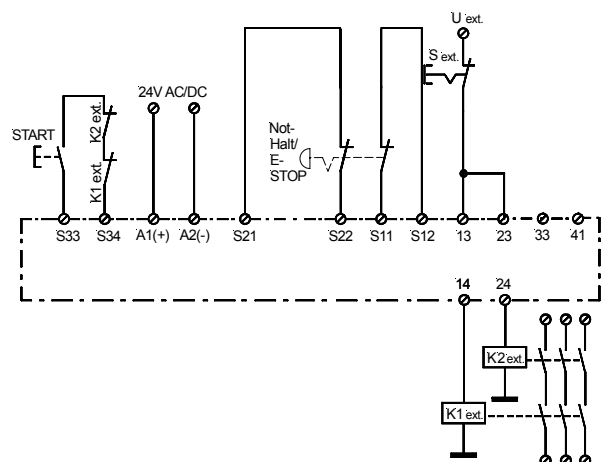


Dual-channel emergency stop with external contact extension (2 contactors), contact monitoring and opposite polarity between channels

This application uses two external contactors with positive guidance. One normally closed contact of each external contactors must be connected in series to the START-button to the terminals S23 and S34. Through the switch S ext. the external contactors can be operated or turned off at any time if the SAFE2.. is activated

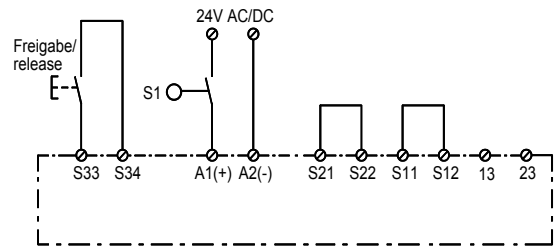
Suitable up to category 4; SIL3; PLe reachable

→ examples for safety mats and contact edges
see operating instructions.



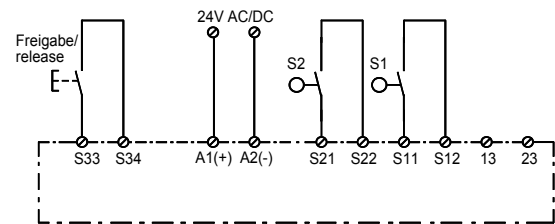
Single channel safety gate monitoring. (without opposite polarity between channels)

If the button S1 of the safety gate is closed the output contacts do not change. Pressing the START button activates the SAFE 2. The contacts 13-14 and 23-24 close. Opening S1 of the safety gate the outputs open immediately .
Suitable up to category 2; SIL1; PLd reachable



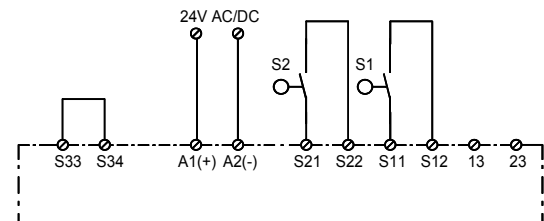
Dual-channel protection door monitoring with opposite polarity between channels.

If the protection door switches are closed, the output contacts remain unchanged. After pressing the start button the unit is active and the contacts 13-14 and 23-24 close.
After opening the protection door switches the contacts return to their normal position without delay.
Suitable up to category 4; SIL3; PLe reachable



Dual-channel protection door monitoring with automatic activation and with opposite polarity between channels.

For this application the unit SAFE 2.1 has to be used. The activation works automatically, since the terminals S33/S34 are bridged. If the protection door switches close, the contacts 13-14, 23-24 close. After opening the protection door switches the contacts return to their normal position without delay.
Suitable up to category 4; SIL3; PLe reachable



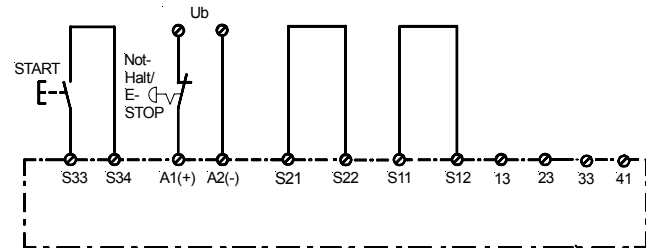
c) SAFE 4 / SAFE 4.1

(SAFE 4.1: without start control)

Single-channel emergency stop (without opposite polarity between channels)

By pressing the START button the unit is activated and contacts 13-14 and 23-24 close. Pressing the emergency stop will reset the contacts.

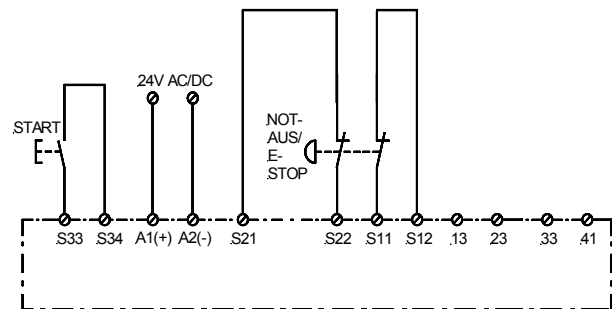
Suitable up to category 4; SIL3; PLd reachable when using restricted guided switches and lend the wiring in separate counted cables.



Dual-channel emergency stop (with opposite polarity between channels)

For this application the terminal wiring S11, S12, S21 and S22 is changed. By pressing the START button the device will be activated and contacts 13-14 and 23-24 close. Pressing the emergency stop initiates a stop and outputs open immediately.

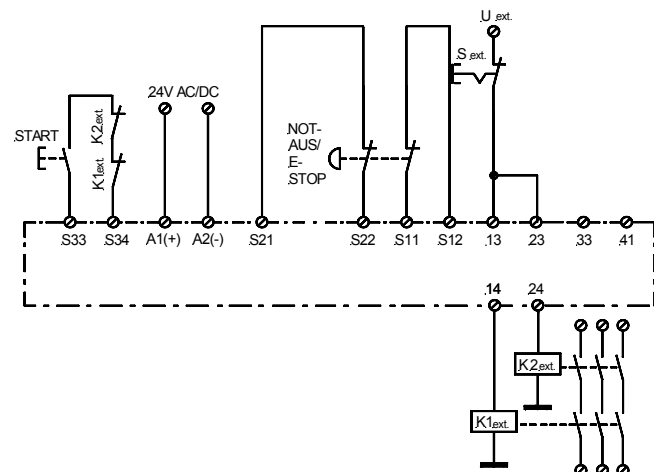
Suitable up to category 4; SIL3; PLe reachable



Dual-channel emergency stop with external contact extension (2 contactors), contact monitoring and opposite polarity between channels

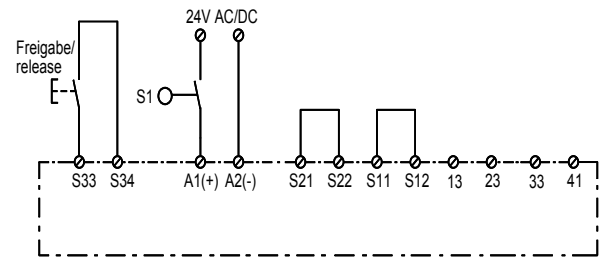
This application uses two external contactors with positive guidance. One normally closed contact of each external contactors must be connected in series to the START-button to the terminals S33 and S34. Through the switch S ext. the external contactors can be operated or turned off at any time if the SAFE4 / SAFE4.1 is activated.

Suitable up to category 4; SIL3; PLe reachable



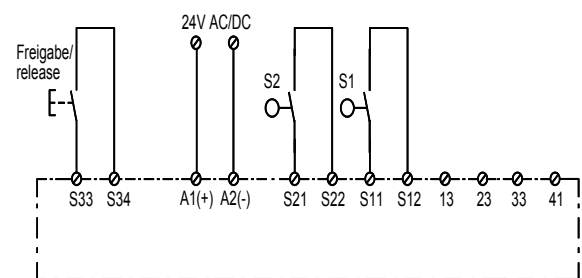
Single channel safety gate monitoring. (without opposite polarity between channels)

If the button S1 of the safety gate is closed the output contacts do not change. Pressing the START button activates the SAFE 4. The contacts 13-14 and 23-24 close. Opening S1 of the safety gate the outputs open immediately .
Suitable up to category 2; SIL1; PLd reachable



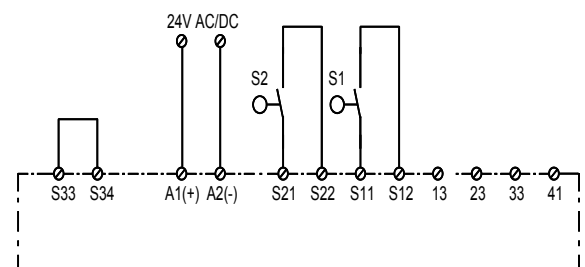
Dual-channel protection door monitoring with opposite polarity between channels.

If the protection door switches are closed, the output contacts remain unchanged. After pressing the start button the unit is active and the contacts 13-14 and 23-24 close. After opening the protection door switches the contacts return to their normal position without delay.
Suitable up to category 4; SIL3; PLe reachable



Dual-channel protection door monitoring with automatic activation and with opposite polarity between channels.

For this application the unit SAFE 4.1 has to be used. The activation works automatically, since the terminals S33/S34 are bridged. If the protection door switches close, the contacts 13-14, 23-24 close. After opening the protection door switches the contacts return to their normal position without delay.
At 24V AC/DC version, the automatic start already takes place when the device is connected to the supply voltage. With other versions the first activation takes place while closing the protection door.
Suitable up to category 4; SIL3; PLe reachable



d) SAFE 5 / SAFE 5.1

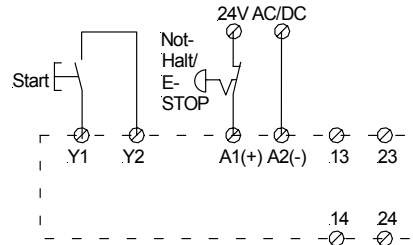
(SAFE 5 : without start control)

(SAFE5.1: with start control)

Single channel emergency stop

By pressing the START button the unit is activated. Contacts 13-14, 23-24, 33-34 close and contact 41-42 opens. Pressing the emergency stop will reset the contacts.

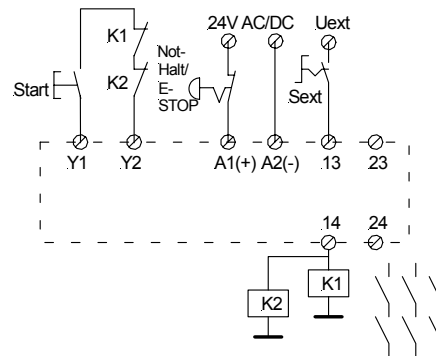
Suitable up to category 2; SIL1;PLd reachable



Single channel emergency stop with external contact extension (1 contactor) and contact monitoring.

This application uses one external positive guided contactor. One normally closed contact of each contactor must be connected in series to the START button. Through the switch S ext. the external contactor can be operated or turned off at any time the SAFE 5.1 is activated .

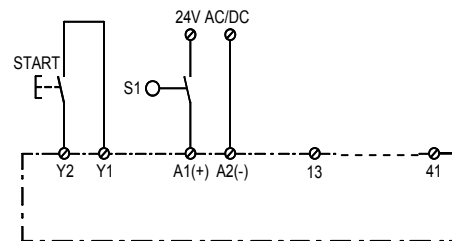
Suitable up to category 2; SIL1;PLd reachable



Single channel safety gate monitoring.

If switch S1 of the safety gate is closed the output contacts do not change state. Pressing the START button activates the SAFE 5.1. When contacts 13-14, 23-24 and 33-34 close and contact 41-42 opens. Opening S1 of the safety gate the reset immediately .

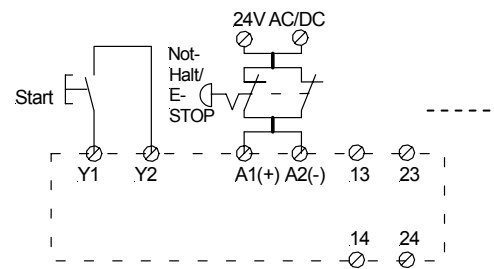
Suitable up to category 2; SIL1;PLd reachable



Dual channel emergency stop

For this application the normally closed contacts of the emergency stop button must be connected in series to the power supply. With the START button the unit is started. The contacts 13-14, 23-24 and 33-34 are closed, contact 41-42 opens. Pressing the emergency stop will reset the contacts.

In case of protecting wiring (short current circuit exclusion) and regularly tests, for example during maintenance, up to category 3; SIL2; PLd reachable.



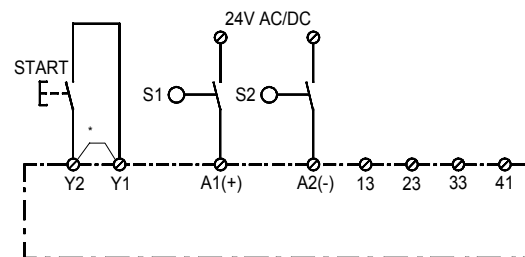
Dual channel safety gate monitoring

Dual channel safety gate monitoring

If the safety gate switches S1 and S2 are connected, the output contacts remain unchanged. The device will be activated with the Start button. The contacts 13-14, 23-24 and 33-34 are closed, contact 41-42

be activated with the Start button. The contacts 13-14, 23-24 and 33-34 are closed, contact 41-42

In case of protecting wiring (short current circuit exclusion) and regularly tests, for example during maintenance, up to category 3; SIL2; PLd reachable.



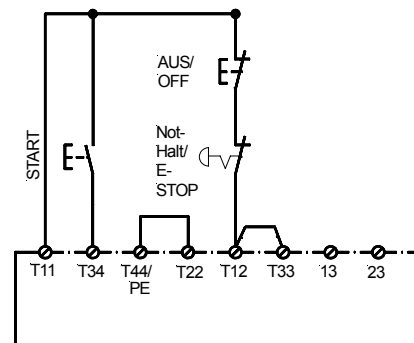
e) SAFE S.6 / SAFE S.10

(SAFE S.10: with 10 A contact capacity)

Single channel emergency stop (without opposite polarity between channels)

Using single channel emergency stop terminals T12-T33 and T33-T44/PE are bridged. By pressing the START button the device is activated. Contacts 13-14 and 23-24 close. By activating the OFF-Button or the E-STOP the contacts return to their normal position.

Suitable up to category 2; SIL1; PLd reachable

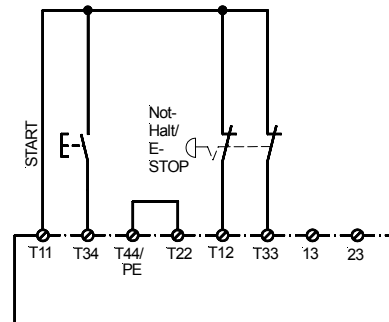


Dual channel emergency stop (without opposite polarity between channels).

Using the dual channel emergency stop button terminals T33 and T12 are not bridged.

The device is activated by pressing the START button. Contacts 13-14 and 23-24 close. By activating the OFF button or the emergency stop button the contacts return to their normal position.

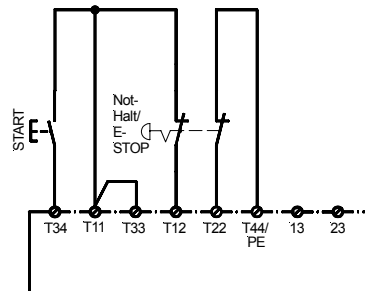
Suitable up to category 3; SIL2; PLd reachable



Dual channel emergency stop (with opposite polarity between channels).

Using the dual channel emergency stop with opposite polarity between channels the wiring of the emergency stop button must be changed. The device is activated by pressing the START button. Contacts 13-14 and 23-24 close. By activating the OFF button or the emergency stop button the contacts return to their normal position.

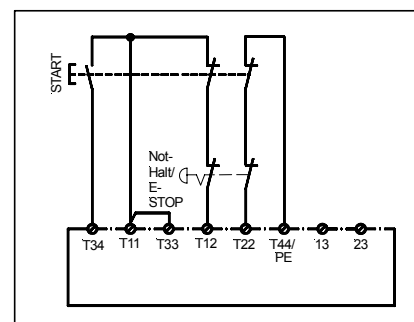
Suitable up to category 4; SIL3; PLe reachable



Dual channel emergency stop but ton with monitoring of the START button and opposite polarity between channels.

In this application the proper turn on and OFF the START button will be monitored. Through a briefly operation of START button contacts 13-14 and 23-24 close after a delay of approximately 100 ms. If there is an emergency stop the contacts return to their normal position without delay.

Suitable up to category 4; SIL3; PLe reachable

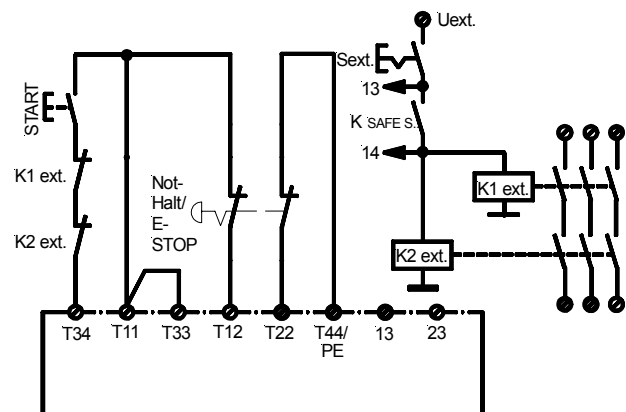


Dual channel emergency circuit with external contact expansion (two contactors), contact monitoring and opposite polarity between channels.

In this application external contactors with positive guided contacts are used. One normally closed contact of each contactor must be connected series to START button and between the terminals T11 and T34. Contacts 13-14 close when the device is activated by pressing the START button. The external contactors will energize. Pressing the OFF or E-STOP button the contacts of the SAFE S.8 / SAFE S.10 and the external contactors return to their normal position.

With the S ext. switch the external contactors can be operated or turned OFF at any time if the SAFE S.8 / SAFE S.10 is activated.

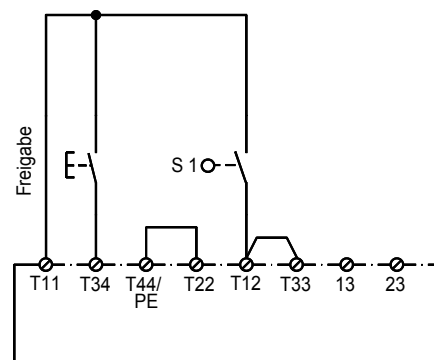
Suitable up to category 4; SIL3; PLe reachable



Single channel safety gate monitoring Without opposite polarity between channels.

If the safety gate switch S1 is closed, the output contacts remain unchanged. The device will be activated by pressing the START button. Contacts 13-14 and 23-24 close with a delay of approximately 100 ms. Opening the safety gate switch returns the contacts to their normal position without delay.

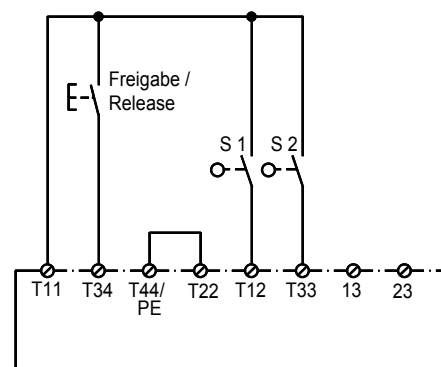
Suitable up to category 2; SIL1; PLd reachable



Dual channel safety gate monitoring without opposite polarity between channels.

If the safety gate switches S1 and S2 are closed, the output contacts remain unchanged. The device will be activated by pressing the Release switch. Contacts 13-14 and 23-24 close with a delay of approximately 100 ms. Opening the safety gate switches returns the contacts to their normal position without delay.

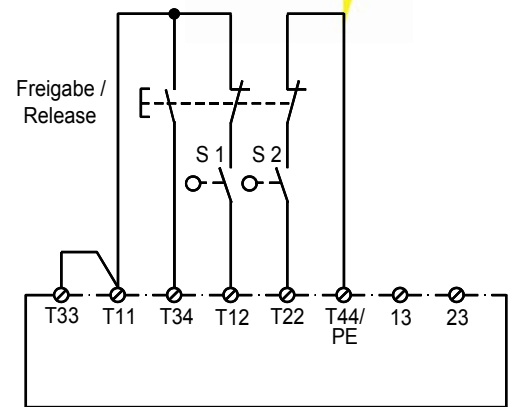
Suitable up to category 3; SIL2; PLd reachable



Dual channel safety gate monitoring with extended control of the release switch and with opposite polarity between channels.

If the safety gate switches S1 and S2 are closed, the output contacts remain unchanged. The device will be activated by pressing the release switch. Contacts 13-14 and 23-24 close with a delay of approximately 100 ms. After opening the safety gate switches the contacts return to their normal position without delay.

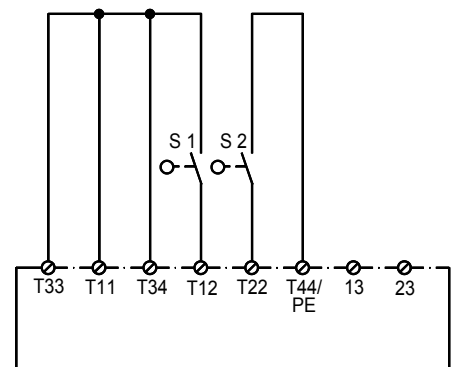
Suitable up to category 4; SIL3; PLe reachable



Dual channel safety gate monitoring with automatic activation and with opposite polarity between channels.

In this application of the device works automatically, since terminals T11 to T34 are bridged. If the safety gate switches S1 and S2 are closed, the contacts close with a delay of approximately 100 ms. After opening the safety gate switches the contacts return to their normal position without delay.

Suitable up to category 4; SIL3; PLe reachable

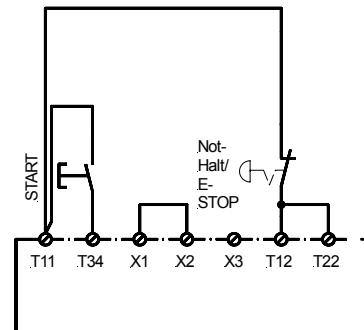


f) RS-NAGP

Using the emergency stop relay in applications requiring a reset function at terminals T11-T34. A failure at the reset button makes the relay automatically restart after the emergency stop is reset and power is applied to the relay. This is not allowed according to VDE 0113 and EN418. In the applications section no. 3 to 6, there are examples given, which show proper connection diagrams to monitor the switch on and off process of the reset function.

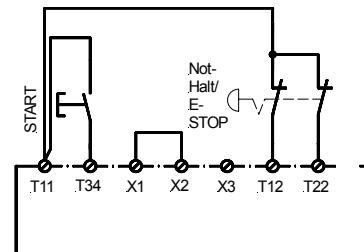
Single channel emergency stop button.

In this application terminals T12 and T22 as well as X1 and X2 must be bridged. The device is activated by pressing the start button. Contacts 13-14, 23-24 and 33-34 close, contact 41-42 opens and contact 53-54 gives a transient contact. By activating the off button or the emergency stop button the contacts return to their normal position. In this application the demand of redundancy in the emergency stop is not accomplished.



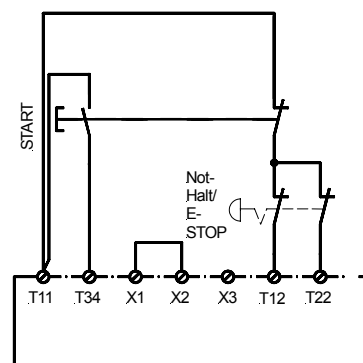
Dual channel emergency stop button.

Using the dual channel emergency stop button the terminals T12 and T22 are not bridged. The function is similar to application No. 1. In this application a fault in the emergency stop button will be detected.



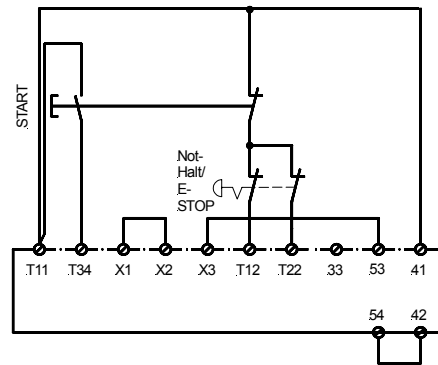
Dual channel emergency stop button with monitoring of the start button.

In this application the proper turn on and off of the start button will be monitored. Through a briefly operation of the start button contacts 13-14, 23-24 and 33-34 close after a delay of approximately 100 ms after releasing the start button. If there is an emergency stop the contacts return to their normal position without delay.



Dual channel emergency stop button with internal contact control.

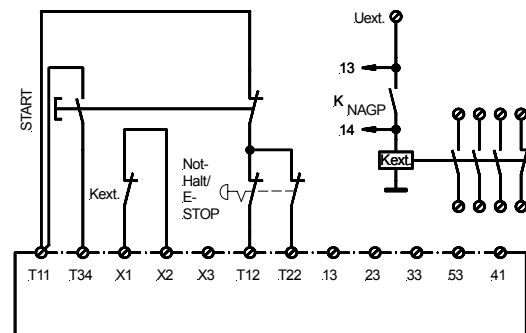
With the dual channel emergency stop button with internal contact control via X3 terminals X1-X2, X3-53 and 41-T11 must be bridged. By pressing the start button the contact K1 energizes and will release if K2 and K3 have switched. So K2 and K3 can be controlled whether they work correctly or not.



Dual channel emergency circuit with external contact expansion (1contactor) and contact monitoring.

Contacts 13-14 close when the safety relay is activated by pressing the start button contact. The external contactor will energize. Since the external contactor has contacts with positive guidance the correct switching of the external contactor can be controlled through terminals X1 and X2.

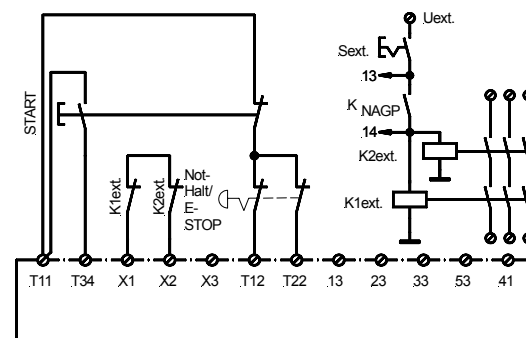
In case of welding of one of the external normally open contacts the normally closed contact remains open. The safety relay and the external contactors can not be activated. In this application the redundancy of the external contacts is not accomplished.



Dual channel emergency circuit with external contact expansion (two contactors) and contact monitoring.

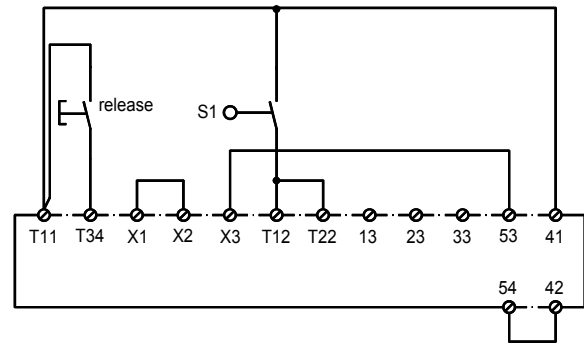
This application uses dual external contactors. Each normally closed contact of these external contactors must be connected in series to X1 and X2. The function is similar to application No 5.

In this application the demand of redundancy of the contacts of the external contactors is accomplished. Through the switch S ext. the external contactors can be operated or turned off at any time if the RS-NAGP is activated.



Single channel protection door monitoring.

Using the single channel protection door monitoring terminals X3 and 53, 54 and 42, 41 and T11, X1 and X2, T22 and T12 must be bridged. In this application these contacts are not available any more. If the protection door monitoring switch S1 is closed the output contacts remain unchanged. The device will be activated by pressing the release switch. Contacts 13-14, 23-24 and 33-34 close with a delay of approximately 100 ms. When opening the protection door switch the contacts return to their normal position without delay. With this application the requirement of redundancy in the protection door switch is not accomplished.

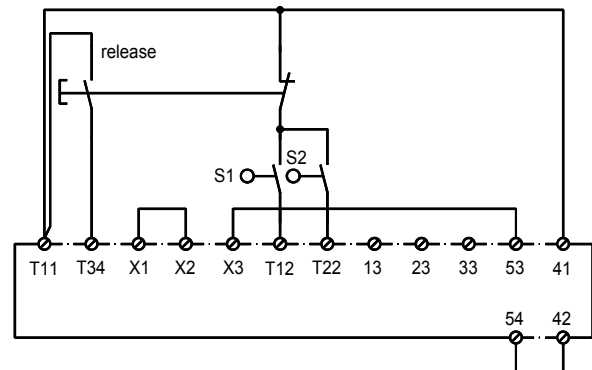


Dual channel protection door monitoring.

With the dual channel protection door monitoring terminals T22 and T12 are not bridged. The function is similar to application No. 7. In this application a fault in the protection door monitoring switch will be detected.

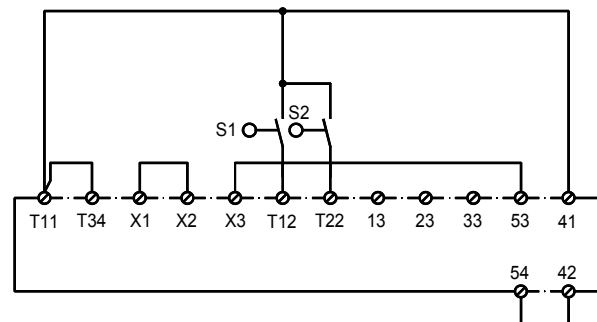
Dual channel protection door monitoring with extended control of the release switch.

If the protection door switch is closed, the output contacts remain unchanged. Through a short operation of the protection door switch contacts 13-14, 23-24 and 33-34 close after the reopening of the switch with a delay of approximately 100 ms. After opening the protection door switches the contacts return to their normal position without delay.



Dual channel protection door monitoring time with automatic activation and infinite delay between channels.

In this application the activation of the device works automatically, since terminals T11 and T34 are bridged. If the protection door switch is closed, the contacts close with a delay of approximately 100 ms. After the opening of the protection door switch the contacts return to their normal position without delay (this application can only be used in a restricted temperature range of +40°C).



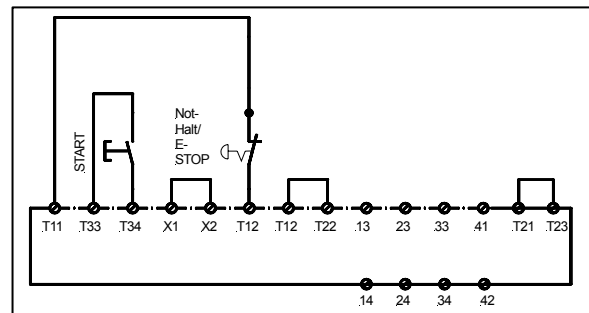
g) RS-NAGMP / RS-NAGMP.1

Both Emergency Stop Relays are the follower of the former RS-NAGM. Compared to the RS-NAGM the RS-NAGMP provides a selectable opposite polarity between channels with the additional terminal T21. The version RS-NAGMP.1 is terminal and functional compatible to the RS-NAGM and provides no opposite polarity between channels.

Single channel emergency stop button with RS-NAGMP

For this application terminals T12 and T22, as well as X1 and X2 must be bridged. The device is activated by pressing the start button. Contacts 13-14, 23-24 and 33-34 close, contact 41-42 opens. By activating the off button or the emergency stop button the contacts return to their normal position. In this application the demand of redundancy in the switch is not accomplished.

Suitable up to category 2; SIL1; PLd reachable.

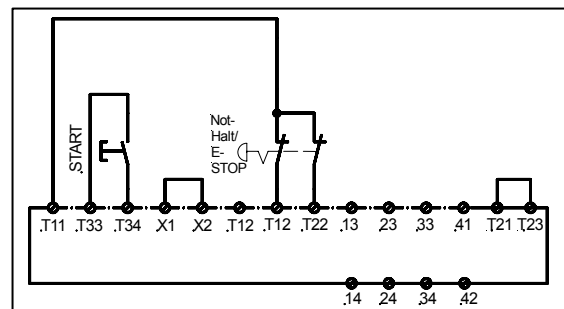


Dual channel emergency stop button with RS-NAGMP

Using the dual channel emergency stop button the terminals T12 and T22 are not bridged. The function is similar to application No. 1.

In this application a fault in the emergency stop button will be detected.

Suitable up to category 3; SIL2; PLd reachable



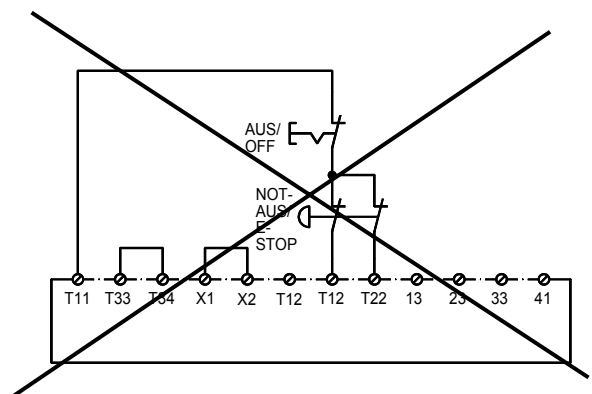
Negative example

Warning:

This application is not accordance to VDE 0113 and isn't reliable, because the emergency stop button can be reset and the device automatically restarted and generates an output.

Dual channel emergency stop button with automatic reset.

In this application the activation of the device works automatically, since terminals T33 and T34 are bridged.



Dual channel emergency circuit with external contact expansion (one contactor) and contact monitoring.

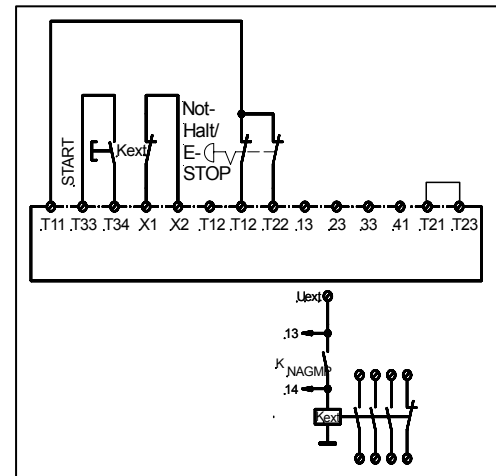
Contacts 13-14 close when the safety relay is activated through the start button contact. The external contactor will energize. Since the external contactor has contacts with positive guidance the correct switching of the external contactor can be controlled through terminals X1 and X2.

In case of welding of one of the external normally open contacts the normally closed contact remains open. The safety relay and the external contactors can not be activated.

In this application the redundancy of the external contacts is not accomplished.

Suitable up to category:

- Safety outputs : 3; SIL2; PLd reachable
- Contacts of Kext. : 2; SIL1; PLd reachable



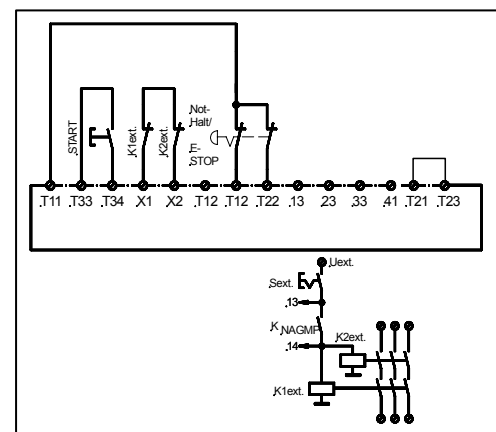
Dual channel emergency circuit with external contact extension (two contactors) and contact monitoring.

This application uses dual external contactors. Each normally closed contact of these external contactors must be connected in series to X1 and X2. The function is similar to application No 4.

In this application the demand of redundancy of the contacts of the external contactors is accomplished. Through the switch S ext. the external contactors can be operated or turned off at any time if the RS-NAGMP.1 is activated.

Suitable up to category:

- Safety outputs: 3; SIL2; PLd reachable
- Contacts of K1ext/K2ext.: 3; SIL2; PLd reachable

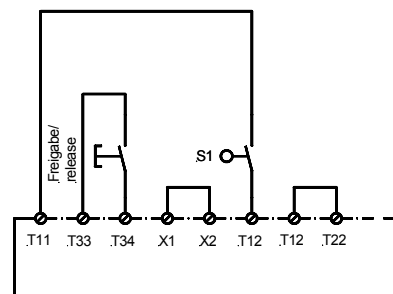


Single channel protection door monitoring.

If the protection door switch S1 is closed the output contacts remain unchanged. The device will be activated by pressing the release switch. Contacts 13-14, 23-24 and 33-34 close with a delay of approximately 100 ms. When opening the protection door switch the contacts return to their normal position without delay.

With this application the requirement of redundancy in the protection door switch is not accomplished.

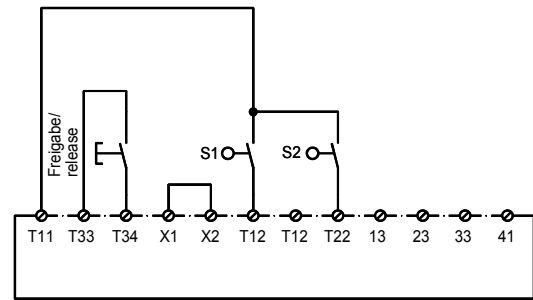
Suitable up to category 2; SIL1; PLd reachable



Dual channel protection door monitoring.

With the dual channel protection door monitoring terminals T22 and T12 are not bridged. The function is similar to application No. 6. In this application a fault in the protection door monitoring switch will be detected.

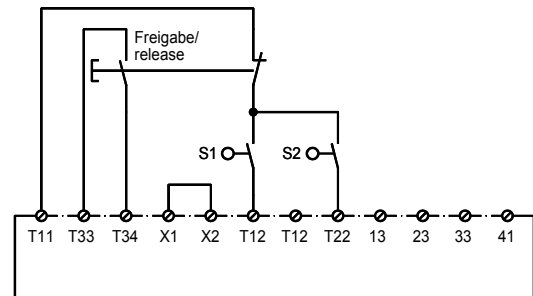
Suitable up to category 3; SIL2; PLd reachable



Dual channel protection door monitoring with extended control of the release switch.

If the protection door switches are closed, the output contacts remain unchanged. Through a short operation of the release contacts 13-14, 23-24 and 33-34 close after the reopening of the switch with a delay of approximately 100 ms. After opening the protection door switches the contacts return to their normal position without delay.

Suitable up to category 3; SIL2; PLd reachable

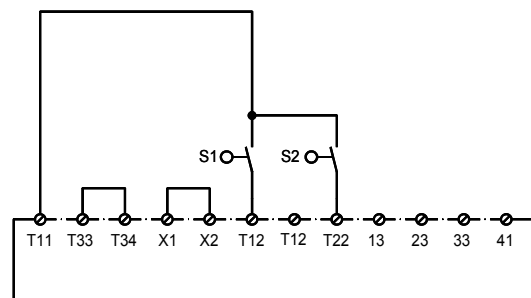


Dual channel protection door monitoring with automatic activation.

In this application the activation of the device works automatically, since the terminals T33 and T34 are bridged. If the protection door switch is closed, the contacts close with a delay of approximately 100 ms.

After opening the protection door switches the contacts return to their normal position without delay.

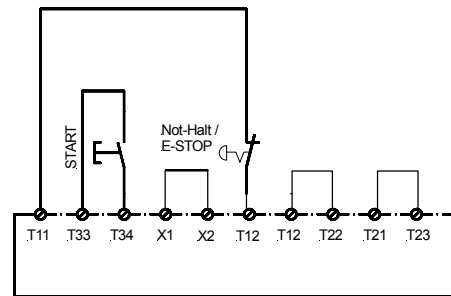
Suitable up to category 3; SIL2; PLd reachable



Single channel emergency stop with RS-NAGMP.1

For this application terminals T12 and T22, T21 and PE as well as X1 and X2 have to be bridged. The device will be activated by pressing the start button. Contacts 13-14, 23-24, 33-34 are closing and contact 41-42 opens. By activating the OFF button or the emergency stop button the contacts return to their normal position. In this application the demand of redundancy in the switch is not accomplished.

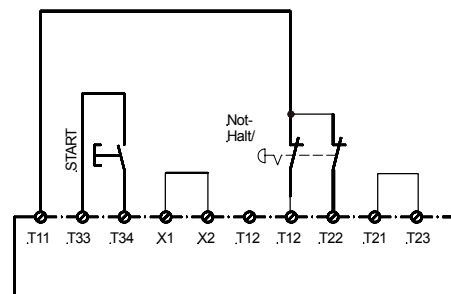
Suitable up to category 2; SIL1; PLd reachable



Dual channel emergency stop with RS-NAGMP.1

Using the dual channel emergency stop button the terminals T12 and T22 are not bridged. The function is similar to application No. 1. In this application a fault in the emergency stop button will be detected.

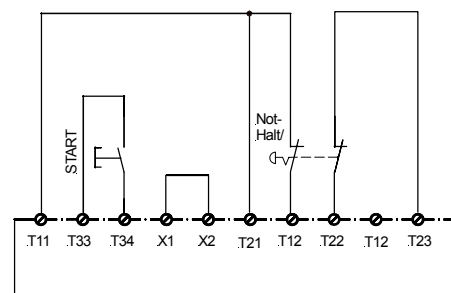
Suitable up to category 3; SIL2; PLd reachable



Dual channel emergency stop with opposite polarity between channels with RS-NAGMP.1

Using this application the terminals T11 and T21 as well as X1 and X2 have to be bridged. The device will be activated by pressing the start button. Contacts 13-14, 23-24, 33-34 are closing and contact 41-42 opens. By pressing the emergency stop button all contacts return to their normal position.

Suitable up to category 4; SIL3; PLe reachable



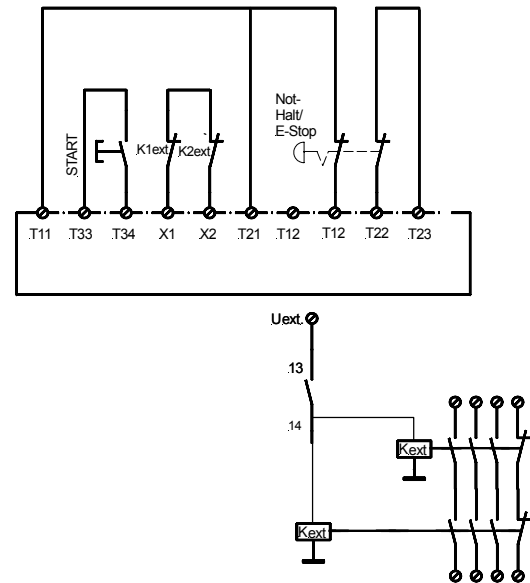
Dual channel emergency stop with external expansion of contacts (two contactors), contact monitoring and opposite polarity between channels with RS-NAGMP.1

This application uses dual external contactors. Each normally closed contact of these external contactors must be connected in series to X1 and X2. The function is similar to application no. 5.

In this application the demand of redundancy of the contacts of the external contactors is accomplished. Through the switch S ext. the external contactors can be operated or turned off at any time if the RS-NAGMP is activated.

Suitable up to risk category:

- Safety outputs of RS-NAGMP.1: 4; SIL3; PLe reachable
- Contacts of K1ext./K2ext.: 3; SIL2; PLd reachable (with separate sheathed cable)



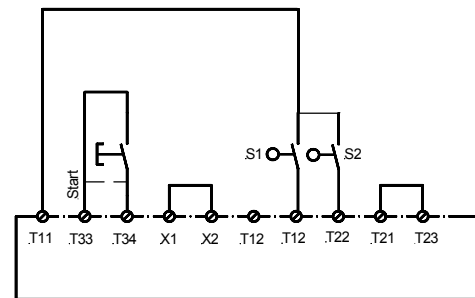
Dual channel protection door monitoring with RS-NAGMP.1 (manual and automatic start)

With the dual channel protection door monitoring terminals T21 and PE as well as X1 and X2 have to be bridged. If using the automatic start, you have to bridge the terminals T33 and T34.

With automatic start the contacts closes with a delay of approximately 100ms.

In this application a fault in the protection door monitoring switch will be detected

Suitable up to category 3; SIL2; PLd reachable



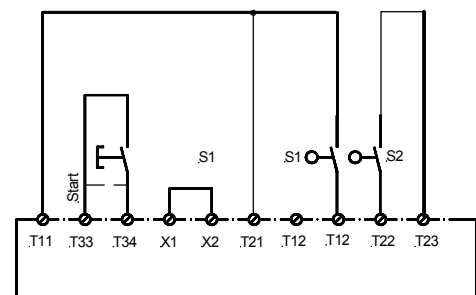
Dual channel protection door monitoring with opposite polarity between channels with RS-NAGMP.1 (manual and automatic start)

In this application terminals T11 and T21 as well as X1 and X2 have to be bridged. If using the automatic start, you have to bridge the terminals T33 and T34.

With automatic start the contacts closes with a delay of approximately 100ms.

The function is similar to application no 14.

Suitable up to category 4; SIL3; PLe reachable



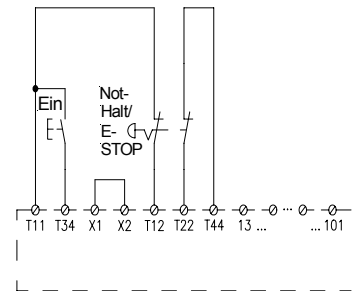
h) RS-NAGV

Two channel emergency switch

With this application terminals X1 and X2 have to be bridged.

Pressing the on switch the device will be activated. The contacts 13-14, 23-24 and 33-34, 43-44, 53-54, 63-64 close and the contacts 71-72, 81-82, 91-92, 101-102 open. By activating the off-switch or the emergency switch the contacts return to their normal position.

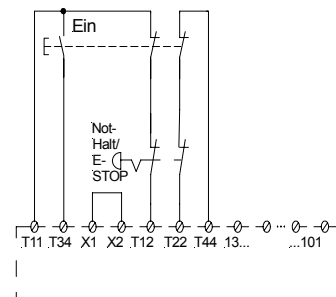
Suitable up to category 4; SIL3; PLe reachable



Two channel emergency switch with monitoring of the on-switch

In this application the proper start and stop of the on-switch will be monitored. Through a short operation of the on-switch, contacts 13-14, 23-24, 33-34, 43-44, 53-54 and 63-64 close with a delay of appr. 100 ms, after releasing the on-switch. When the emergency stop is pressed, the contacts return to their normal position without delay.

Suitable up to category 4; SIL3; PLe reachable

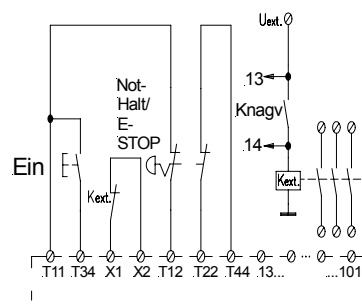


Two channel emergency switch with external contact expansion (1 contactor) and contact control

Contacts 13-14 will close when the safety relay is activated through the on-switch. The external contactor pulls on. Since the external contactor has contacts with positive guidance, the correct operation of terminals X1 and X2 will be controlled. In case of welding of one of the external normally open contacts the normally closed contact remains open. X1 and X2 will be not bridged. The safety relay and the external contactor cannot be activated.

In this application the redundancy of the contacts of the external contactors is not accomplished.

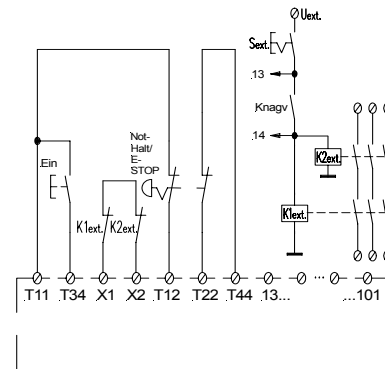
Suitable up to category 2; SIL1; PLd reachable



Two channel emergency switch with external contact expansion (2 contactors) and contact control

In this application two contactors are used with positive guidance of the contacts. Each normally closed contact of these external contactors must be connected in series to X1 and X2. The function is like application No. 3. In this application the demand of redundancy of the external contacts of the external contactors is accomplished. Through the switch S_{ext} , the external contactors can be operated or turned off at any time if RS-NAGV is activate.

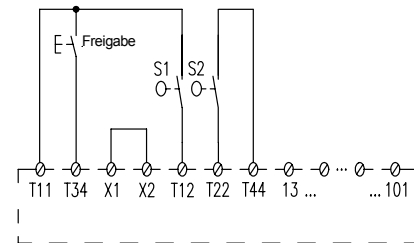
Suitable up to category 4; SIL3; PLe reachable



Two channel protection door monitoring

If you close switches S1 and S2 the output contacts remain unchanged. The device will be activated by pressing the release switch. Contacts 13-14, 23-24, 33-34, 43-33, 53-54 and 63-64 close with a delay of appr. 100ms. When the protection door switches open, the contacts return to their normal position.

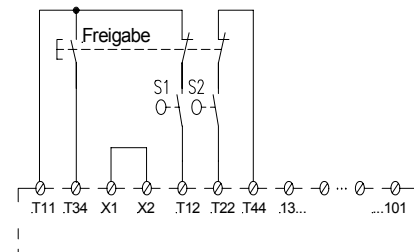
Suitable up to category 4; SIL3; PLe reachable



Two channel protection door monitoring with extended control of the release switch

If the protection door switches S1 and S2 are closed, the output contacts remain unchanged. Through a short operation (opening and closing) of the protection door switches the contacts 13-14, 23-24, 33-34, 43-44, 53-54 and 63-64 close after the releasing of the switch with a delay of appr. 100ms. When the protection door switches open, the contacts return to their normal position without delay.

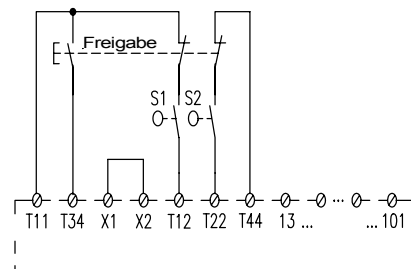
Suitable up to category 4; SIL3; PLe reachable



Two channel protection door monitoring with automatic activation

In this application the activation of the device works automatically, since the terminals T11 to T34 are bridged. If the protection door switch is closed, the contacts close after a delay of appr. 100ms. When the protection door switches open, the contacts return to their normal position without delay.

Suitable up to category 4; SIL3; PLe reachable

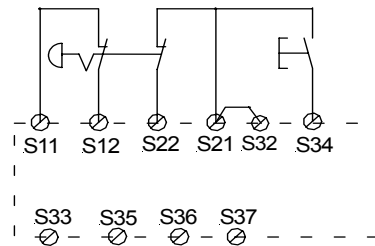


i) SAFE C1

2-channel e-stop application with monitoring of start circuit and cross circuit check.

The e-stop switch (safety gate switch resp.) must be attached to the input circuits (S11/S12, S21/S22), and the start button must be attached to the start circuit (S34/S21). The safety outputs are activated after reclosing the reset circuit (pressing the start button).

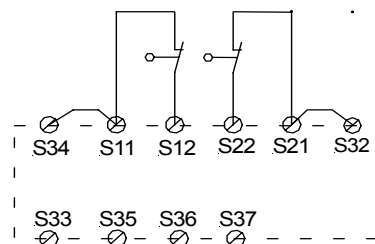
category 4; SIL3; PLe reachable



2-channel safety gate application with auto start and cross circuit check.

The safety gate switches must be connected to the e-stop circuits (S11/S12, S21/S22). The bridge between S34-S11 enables auto start functionality. After applying power supply the outputs will be activated immediately.

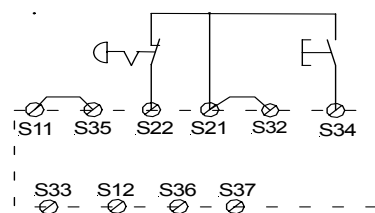
category 4; SIL3; PLe reachable



1-channel application with monitoring of reset circuit.

To enable one-channel functionality S35 and S11 have to be bridged. The e-stop switch or safety gate switch resp. of the safety gate must be connected between terminals S21 and S22. The start button must be attached to the start circuit between S21 and S34 (start-circuit input).

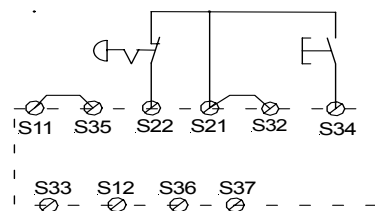
*category: 2; SIL1; PLd reachable,
3*; SIL2; PLd reachable*



1-channel application without monitoring of reset circuit.

Equal as the example from the application 3, but with a bridge between terminals S34 and S11 for disabling of reset circuit monitoring. At closed input circuits the outputs are activated after the connection of supply voltage.

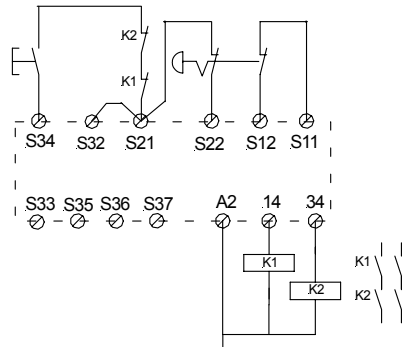
*category: 2; SIL1; PLd reachable,
3*; SIL2; PLd reachable*



2-channel e-stop application with monitoring of start circuit, cross circuit check and contact expansion.

The release switch must be attached to the e-stop circuits (S11/S12, S21/S22) and the start button must be attached to the start-circuit (S34/S21). The outputs will be activated after pressing of the start button.

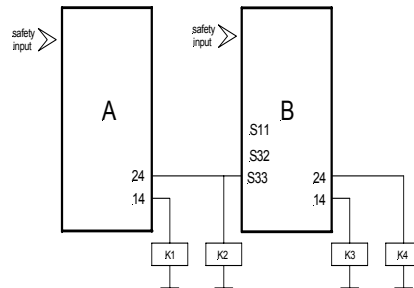
For monitoring of the external conductors, the NC contacts of the force guided contactors must be attached in series to the start circuit. **Safety category 4; SIL3; PLe reachable**



Logical AND circuit of two devices.

After opening the e-stop circuits of the device **A**, the contactors K1/K2 de-energise. Because the safety outputs of device **A** have now a 0V-potential and the device **B** is configured for the AND-combination (due to the open circuit S32), the contactors K3/K4 will be de-energised over the S33 terminal (AND combination) too. If only the release switch of device **B** will be opened, the contactors K3/K4 will be de-energised only. The contactors K1/K2 remains in energised condition. Hence device **A** de-energises all its following devices.

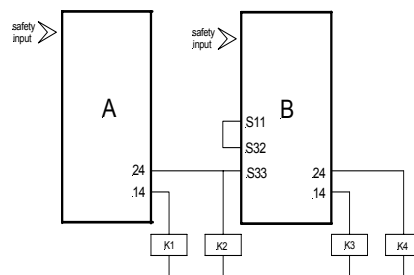
up to category 4; SIL3; PLe reachable



Logical OR circuit of two devices. (For example a key switch for the plant-setup routine)

Both devices (**A** and **B**) are OR combined. If the outputs of the device **A** have a low signal, device **B** takes over control of its own outputs and thus over the contactors K3/K4. If the outputs of the device **A** have of high signal, the outputs of the device **B** have independently of its own input circuits of high signal too, that is contactors K3/K4 are energised.

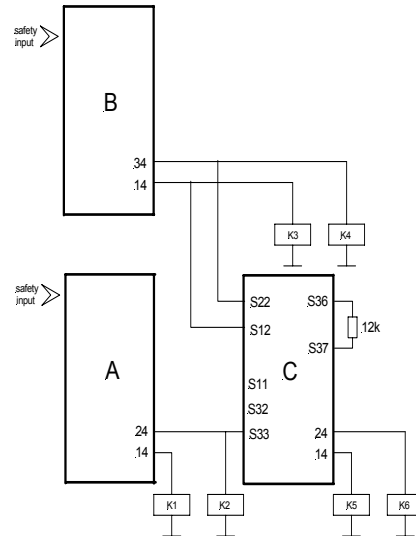
No safety approved application!



Logical AND circuit of two devices.

After opening the e-stop circuits of the device **A**, the contactors K1/K2 de-energise. Because the safety outputs of device **A** have now a 0V-potential and the device **B** is configured for the AND-combination (due to the open circuit S32), the contactors K3/K4 will be de-energised over the S33 terminal (AND combination) too. If only the release switch of device **B** will be opened, the contactors K3/K4 will be de-energised only. The contactors K1/K2 remains in energised condition. Hence device **A** de-energises all its following devices.

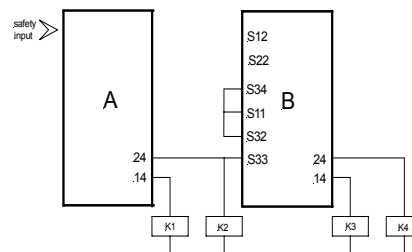
up to category 4; SIL3; PLe reachable



Contact extension over the emergency stop circles.

See also application 6: *Logical AND circuit of two devices.*

up to category 4; SIL3; PLe reachable



2 Product application for

- emergency stop relay
- safety gate monitoring relay
- safety mats and safety contact edges

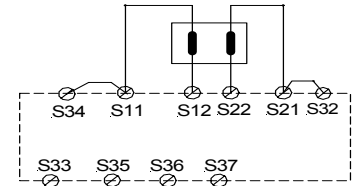
a) SAFE CM

(SAFE CM is adapted for safety gates and safety bars, also with load resistance)

2-channel application with auto-start and broken wire check.

The safety mat switch must close the input circuits (S11/S12, S21/S22), and the S11-S34 has to be bridged for auto-start configuration. The bridge between S21-S32 activates stand-alone application (no AND connection). The outputs will be activated when the contact areas of the mat are not connected (mat not entered)

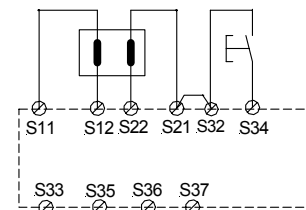
up to category 4; SIL3; PLe reachable



2-channel application with monitoring of reset circuit and broken wire check.

The safety mat switch must close the input circuits (S11/S12, S21/S22). The outputs will be activated when the contact areas of the mat are not connected (mat not entered) and the start button is pressed and released.

up to category 4; SIL3; PLe reachable



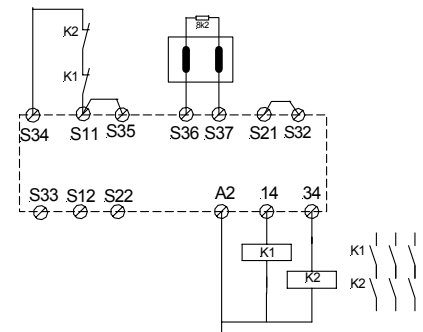
1-channel application with auto start and broken wire check.

The mat with final resistance must be connected to S36 and S37. Auto start is activated by bridge between S34-S11.

The outputs will be activated when the contact areas of the mat are not connected (mat not entered)

For monitoring of the external conductors, the NC contacts of the force guided contactors must be attached in series to the start circuit

up to category 4; SIL3; PLe reachable

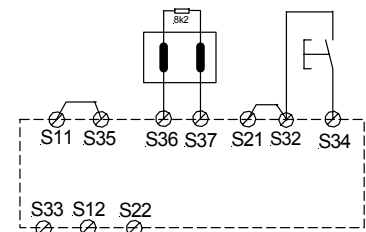


1-channel application with monitoring of reset circuit and broken wire check.

The mat with final resistance must be connected to S36 and S37.

The safety mat switch must close the input circuits (S11/S12, S21/S22). The outputs will be activated when the contact areas of the mat are not connected (mat not entered) and the start button is pressed and released.

up to category 4; SIL3; PLe reachable

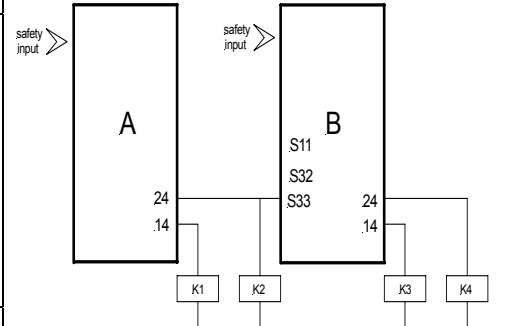


Combination examples:

Logical AND-combination of two SAFE C devices, whereby A and B can be any devices of the Safe C family

After opening the e-stop circuits of the device **A**, the contactors K1/K2 de-energise. Because the safety outputs of device **A** have now a 0V-potial and the device **B** is configured for the AND-combination (through the open circuit S32), the contactors K3/K4 will be de-energised over the S33 terminal (AND combination) too. If only the safety gate will be opened which is connected to the device **B**, the contactors K3/K4 will be de-energised only. The contactors K1/K2 remains in energised condition. The device **A** de-energises all it following devices.

up to category 4; SIL3; PLe reachable



b) SAFE M

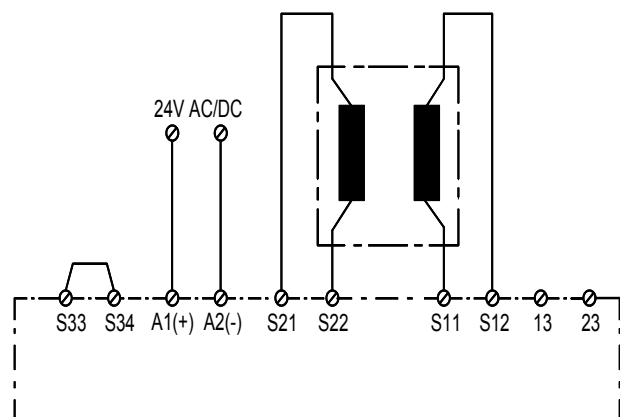
(without start control, the SAFE M can only be used for safety mats and safety contact edges)

It must be guaranteed that the safety mat or safety contact edge – during load with a standard weight – does not have a resistance more largely than 200Ω. The conductor resistance of the same contacts plane should not be greater than 10 Ω.

Dual-channel application for four-wire safety-mats with opposite polarity between channels (with potential free contacts)

In this application the terminals S33 and S34 are bridged. So this activation of the device works automatically. Contacts 13-14, 23-24 close after power is on or after steps off the safety mat. When the safety mat is stepped on, the contacts fall back into their normal position without delay.

Suitable up to category 3; SIL2; PLd reachable

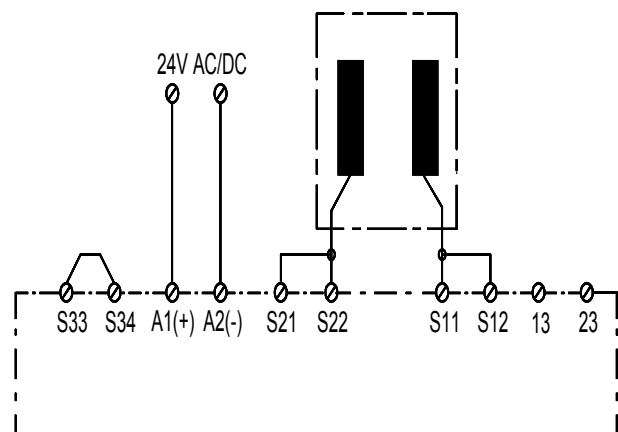


Dual-channel application for two-wire safety-mats with opposite polarity between channels (with potential free contacts)

In this application two connections per channel are each connected to one of the terminals of the safety-mat. Terminals S21/S22 and S12/S11 are connected.

The function is like the application with four wire safety mats.

Suitable up to category 1; SIL1; PLc reachable



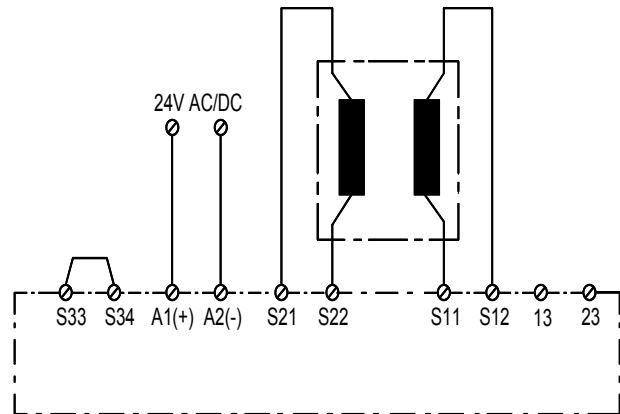
c) SAFE 2. 2

(without start control, the SAFE 2.2 can only be used for safety mats and safety contact edges)

It must be guaranteed that the safety mat or safety contact edge – during load with a standard weight – does not have a resistance more largely than 1Ω.

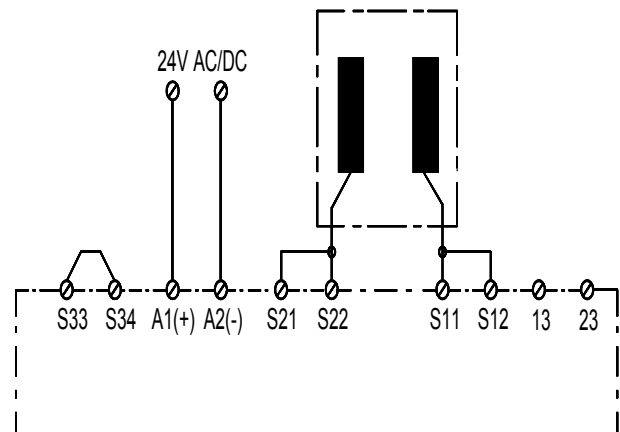
Dual-channel application for four-wire safety-mats with opposite polarity between channels (with potential free contacts)

In this application the terminals S33 and S34 are bridged. So this activation of the device works automatically. Contacts 13-14, 23-24 close after power is on or after steps off the safety mat. When the safety mat is stepped on, the contacts fall back into their normal position without delay.
Suitable up to category 4; SIL3; PLe reachable



Dual-channel application for two-wire safety-mats with opposite polarity between channels (with potential free contacts)

In this application two connections per channel are each connected to one of the terminals of the safety-mat. Terminals S21/S22 and S12/S11 are connected. The function is like the application with four wire safety mats.
Suitable up to category 1; SIL1; PLc reachable



d) RS-NAGA / RS-NAGAO

(RS-NAGA : with start control)

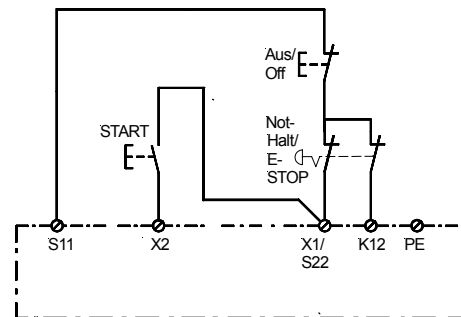
(RS-NAGAO: without start control)

Dual channel emergency stop (without opposite polarity between channels)

By pressing the start button, the unit will be activated. For this application, terminals X1/S22 and K12 are not bridged. Instead, a redundant emergency stop contact is applied. In this application a fault in the emergency stop is detected.

If using RS-NAGAO with automatic start the two emergency stop contact must be used not only one.

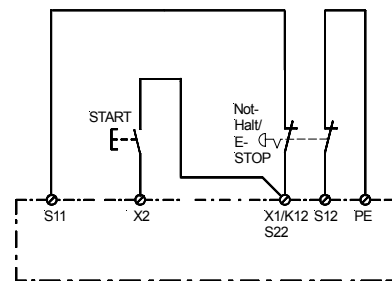
Suitable up to category 3; SIL2; PLd reachable



Dual channel emergency stop (with opposite polarity between channels)

In this application are the terminal connections PE and K12, S12 changed. By pressing the start button the device will be activated. Terminals 13-14, 23-24 and 33-34 close, and contact 41-42 opens. Pressing the emergency stop- or off-button initiates a stop and the outputs open immediately.

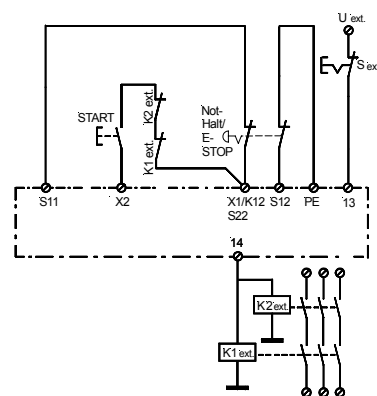
Suitable up to category 4; SIL3; PLe reachable



Dual channel emergency stop with external contact extension (two contactors), contact monitoring and opposite polarity between channels

This application uses two external contactors with positive guidance. Each normally closed contact of these external contactors must be connected in series to the start button to the terminals X1/S22 and X2. The function is similar to application no 2. Through the switch S ext. the external contactors can be operated or turned off at any time if the RS-NAGA / RS-NAGAO is activated.

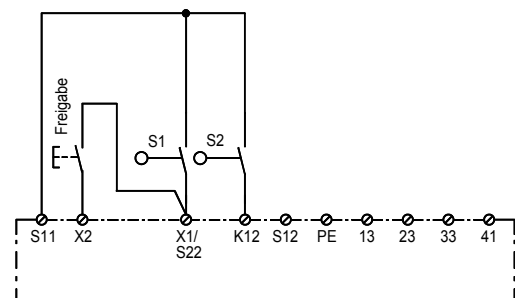
Suitable up to category 4; SIL3; PLe reachable



Dual channel protection door monitoring without opposite polarity between channels

With the dual channel protection door monitoring terminals X1/S22 and K12 are not bridged. The function is like application no 1. In this application a fault in the protection door monitoring switch will be detected.

Suitable up to category 3; SIL2; PLd reachable

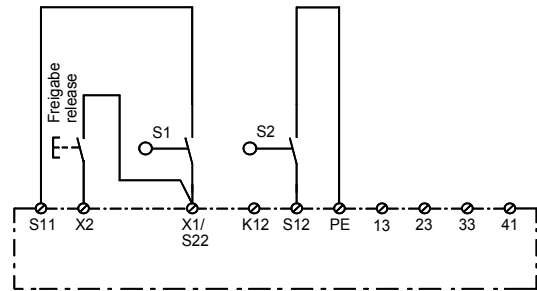


Dual channel protection door monitoring with opposite polarity between channels

If the protection door switches are closed, the output contacts remain unchanged. After pressing release button of the unit, contacts 13-14, 23-24 and 33-34 close and contact 41-42 closes.

After opening the protection door switches the contacts return to their normal position without delay.

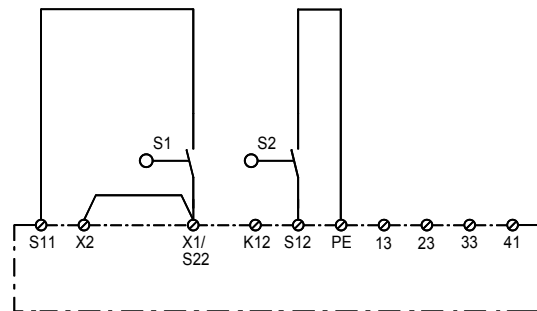
Suitable up to category 4; SIL3; PLe reachable



Dual channel protection door monitoring with automatic activation and with opposite polarity between channels.

For this application the unit RS-NAGAO must to be used. The activation works automatically, since the terminals X2 and X1/S22 are bridged. Once the protection door switches close, the contacts 13-14, 23-24 and 33-34 close and contact 41-42 opens. After opening the protection door switches the contacts return to their normal position without delay.

Suitable up to category 4; SIL3; PLe reachable

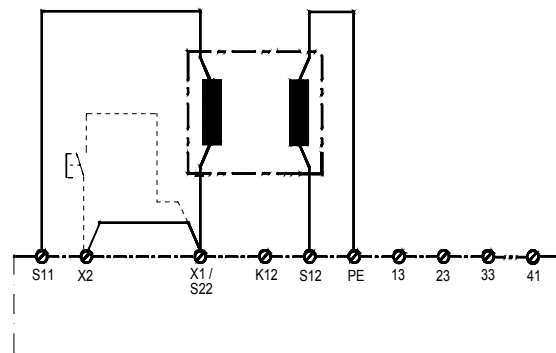


Dual channel application for four wire safety mats with opposite polarity between channels

For this application a RS-NAGAO is needed. The version 24V AC/DC cannot be used for safety-mats. The terminals X2 and X1/S22 are bridged. So the activation works automatically. Contacts 13-14, 23-24 and 33-34 close after power is on or after steps off or the safety mat. When the safety mat is stepped on, the contacts fall back into their normal position without delay.

Suitable up to category 4; SIL3; PLe reachable

→ It must be guaranteed that the safety-mat or safety contact edge -during load with standard weight- does not have a resistance higher than 1Ω



When the start - release is desired, replace the bridge through a start - key.

Single channel application for two wire safety mats with opposite polarity between channels

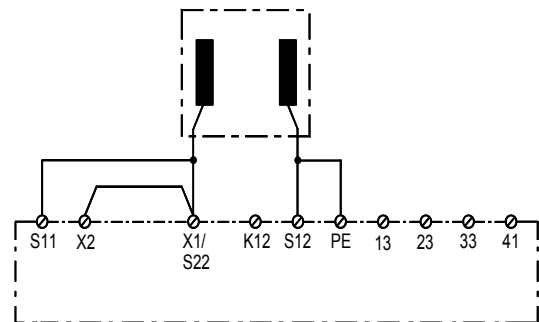
For this application a RS-NAGAO is needed. The version 24V AC/DC cannot be used for safety-mats.

In this application two connections per channel are each connected to one of the terminals of the safety-mat. Terminals S11-X1/S22 and S12-PE are connected.

The function is like the application with four wire safety mats.

Suitable up to category 1; SIL1; PLC reachable

→ It must be guaranteed that the safety-mat or safety contact edge -during load with standard weight- does not have a resistance higher than 1Ω



3 Product application for

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-

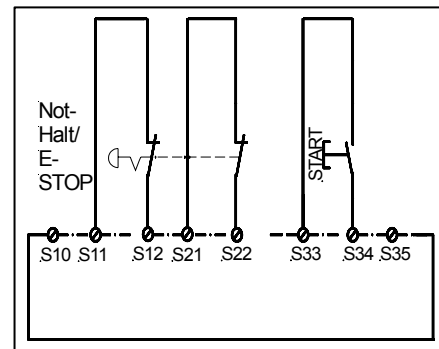
- emergency off-relays
- safety gate monitoring relay
- with time delayed

a) SAFE TA / TN / TR / TU

Dual-channel emergency stop

If the start button will be pressed and released the output contacts 13-14, 23-24, 47-48 and 57-58 will be closed. After the pressing the emergency stop switch the contacts 13-14 and 23-24 will open immediately. The contacts 47-48 and 57-58 remains close during the selected time delay. Before the time delayed contact are not open a restart is not possible.(except SAFE TR)

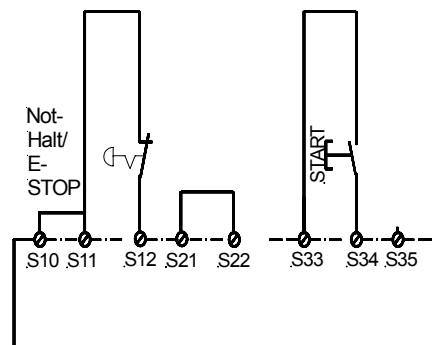
Suitable up to category 4; SIL3; PLe reachable (immediate switching) Suitable up to risk category 4 (time delayed output)



Single-channel emergency stop

If the start button will be pressed and released the output contacts 13-14, 23-24, 47-48 and 57-58 will be closed. After the pressing the emergency stop switch the contacts 13-14 and 23-24 will open immediately. The contacts 47-48 and 57-58 remains close during the selected time delay. Before the time delayed contact are not open a restart is not possible. (except SAFE TR)

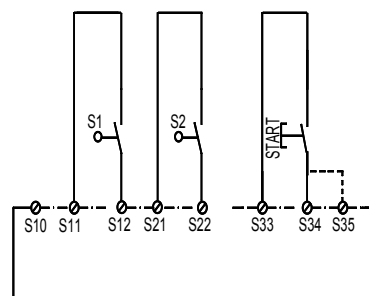
*Suitable up to category 4; SIL3; PLe reachable (immediate switching) ** Suitable up to risk category 4 (time delayed output) ***



Dual channel protection door monitoring

If the safety switches S1 and S2 are closed and the start button will be pressed and released then the output contacts 13-14, 23-24, 47-48 and 57-58 will be closed. With automatic start S34-S35 they will be closed after closing the safety switches. After the opening of the safety switches the contacts 13-14 and 23-24 will open immediately. The contacts 47-48 and 57-58 remains close during the selected time delay. Before the time delayed contact are not open a restart is not possible. (except SAFE TR)

Suitable up to category 4; SIL3; PLe reachable (immediate switching) Suitable up to risk category 4 (time delayed output)



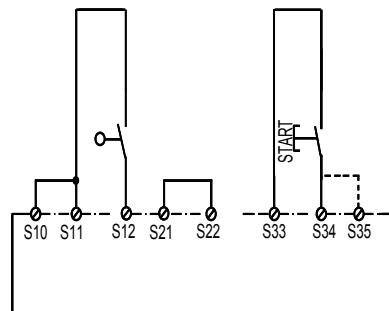
Single channel protection door monitoring

If the safety switch S1 is closed and the start bottom will be pressed and released then the output contacts 13-14, 23-24, 47-48 and 57-58 will be closed. With automatic start S34-S35 they will closed after closing the safety switches. After the opening of the safety switches the contacts 13-14 and 23-24 will open immediately. 47-48 and 57-58 remains close during the selected time delay.

Before the time delayed contact are not open a restart is not possible. (except SAFE TR)

*Suitable up to category 4; SIL3; PLe reachable (immediate switching) ***

*Suitable up to category 4; SIL3; PLe reachable (time delayed output) ***



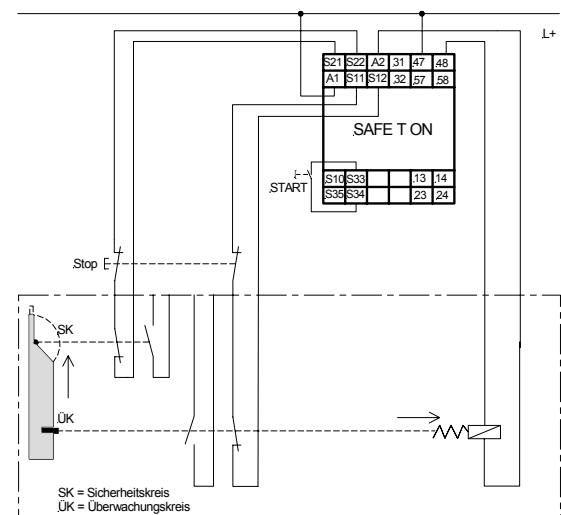
** You have safety category 4, when using restricted guided switches and lead the wiring in separate coated cables.

Using SAFE T. in a category 2 system:

The device SAFE T.. makes a complete self-test. You don't need an external test for the category 2.

b) SAFE T ON

If the input circuits S11, S12 and S21, S22 are closed and the start button is released, the safety circuits 13-14, 23-24 will close. By pressing the stop button, the safety circuits 13-14 and 23-24 open. After the set time period has elapsed, the relay K3 and K4 energise. The safety gate switch is released and the safety gate can be opened. By pressing the start button the relay K3 and K4 are energise, K1 and K2 energise and close the safety circuits 13-14 and 23-24.



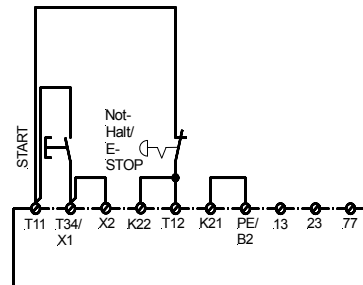
c) RS-NAGT / RS-NAGT.1

Single channel emergency stop button (without opposite polarity between channels)

With power applied to the unit, pressing the start button activates the unit. Safety outputs 13-14, 23-24 and 77-78 close. Pressing the emergency stop initiates a stop and outputs 13-14 and 23-24 open immediately. The contact 77-78 remains closed during the selected time delay. In this application, the demand of redundancy in the emergency stop is not accomplished.

immediately. The contact 77-78 remains closed during the selected time delay. In this application, the demand of redundancy in the emergency stop is not accomplished.

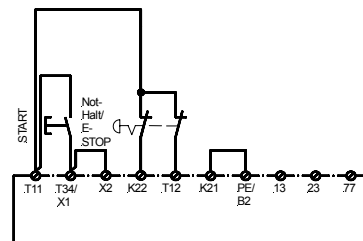
Suitable up to category 2; SIL1; PLd reachable



Dual channel emergency stop (without opposite polarity between channels)

For this application, terminals T12 and K22 are not bridged. Instead, a redundant emergency stop contact is applied. The function is shown in application No. 1. In this application a fault in the emergency stop is detected.

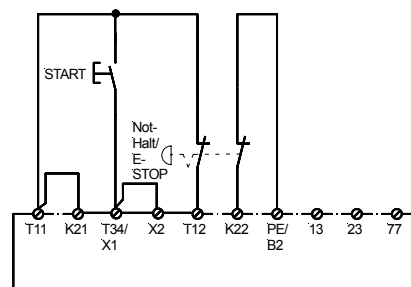
Suitable up to category 3; SIL2; PLd reachable



Dual channel emergency stop (with opposite polarity between channels)

For this application, the terminal connection PE/B2 and K21 are changed. By pressing the start button the device will be activated. Terminals 13-14, 23-24 and 77-78 close. Pressing the emergency stop initiates a stop and outputs 13-14 and 23-24 open immediately. The contact 77-78 remains closed during the selected time delay.

*up to category ...
immediate switching: 4; SIL3; PLe reachable,
time delayed output: 3; SIL2; PLd reachable*

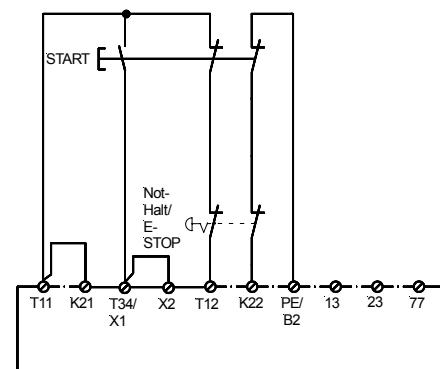


Dual channel emergency stop with start monitoring and opposite polarity between channels

In this application, the proper turn-on and turn-off of the start-button is checked. After pressing the start button contacts 13-14, 23-25 and 77-78 close with 100 ms delay after reopening the start button. Pressing the emergency stop initiates a stop and outputs 13-14 and 23-24 open immediately. The contact 77-78 remains open during the selected time delay.

up to category ...

*immediate switching: 4; SIL3; PLe reachable,
time delayed output: 3; SIL2; PLd reachable*



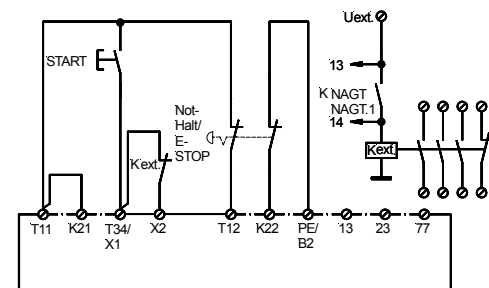
Dual channel emergency stop with external contact expansion (1contactor), contact monitoring and opposite polarity between channels

Contact 13-14 closes when the safety relay is activated by pressing the start button and the external contactor energizes. Since the external contactor has contacts with positive guidance the correct switching of the external contactor can be controlled through terminals T34/X1 and X2. In case of welding of one of the external contactors, the normally open contacts remain open. The safety relay and the external contactor will not be activated. In this application the redundancy of the contactor is not accomplished.

Suitable up to risk category 4 immediate open output

Suitable up to risk category 3 time delayed output.

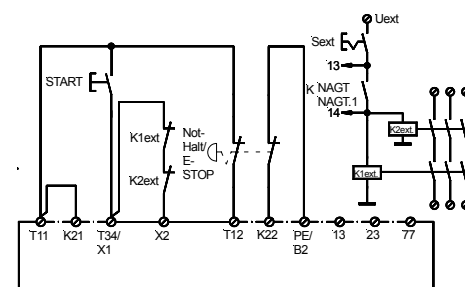
Contacts of Kext. : 2.



Dual channel emergency stop with external contact extension (2contactors), contact monitoring and opposite polarity between channels

This application uses two external contactors. Each normally closed contact of these external contactors must be connected in series to T34/X1 and X2. The function is similar to application No 5. In this application the demand of redundancy of the contacts of the external contactors is accomplished. Through the switch S ext. the external contactors can be operated or turned off at any time if the RS-NAGT is activated.

Suitable up to category 2; SIL1; PLd reachable

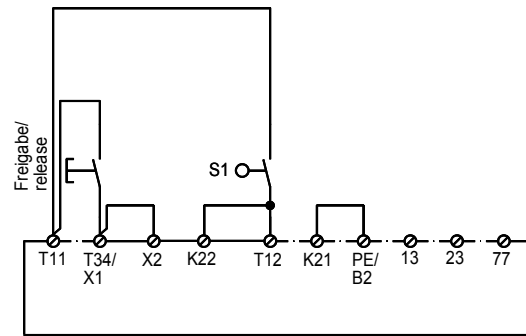


Single channel protection door monitoring with opposite polarity between channels

If the safety switch S1 is closed the output contacts remain unchanged. The device will be activated by pressing the release switch. Contacts 13-14, 23-24 and 77-78 close with a delay of approx. 100 ms. While opening the safety switch the contacts return to their normal position without delay. The contact 77-78 remains open during the selected time delay.

With this application the requirement of redundancy in the protection door switch is not accomplished.

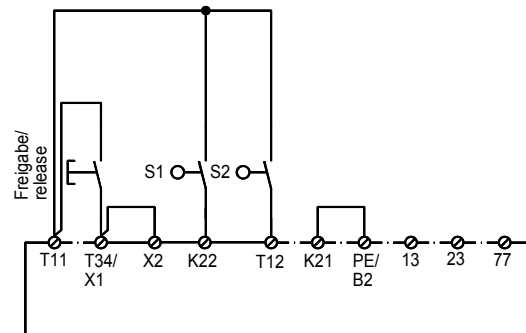
Suitable up to category 2; SIL1; PLd reachable



Dual channel protection door monitoring without opposite polarity between channels

In this application the terminals K22 and K12 are not bridged. The function is similar to application No. 7. In this application a fault in the safety switch will be detected.

Suitable up to category 3; SIL2; PLd reachable



Dual channel protection door monitoring with opposite polarity between channels

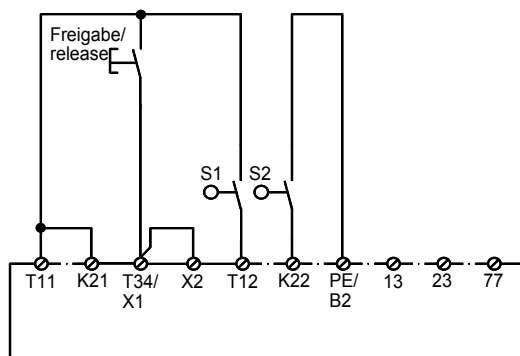
If the safety switches S1 and S2 are closed, the output contacts remain unchanged. Through a short operation of the release switch contacts 13-14, 23-24 and 77-78 close after a delay of approximately 100 ms.

After opening the safety switches the contacts 13-14 and 23-24 return to their normal position without delay. The contact 77-78 remains open during the selected time delay.

up to category ...

immediate switching: 4; SIL3; PLe reachable,

time delayed output: 3; SIL2; PLd reachable



Dual channel protection door monitoring with start monitoring and opposite polarity between channels

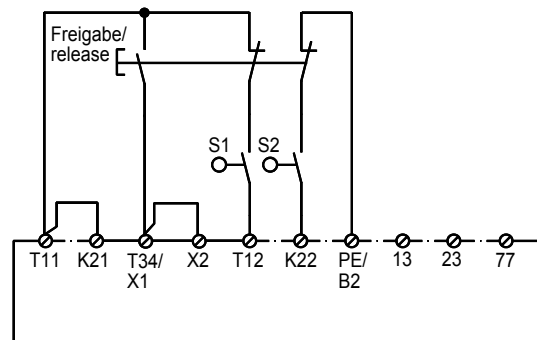
If the safety switches S1 and S2 are closed, the output contacts remain unchanged. Through a short operation of the release switch the contacts 13-14, 23-24 and 77-78 close after the releasing of the switch with a delay of approximately 100 ms.

After opening the safety switches the contacts 13-14 and 23-24 return to their normal position without delay. The contact 77-78 remains open during the selected time delay.

up to category ...

immediate switching: 4; SIL3; PLe reachable,

time delayed output: 3; SIL2; PLd reachable



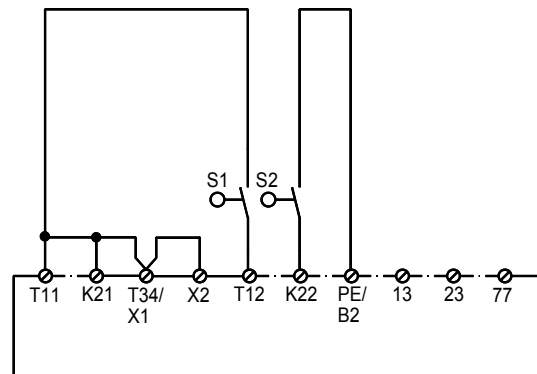
Dual channel protection door monitoring with automatic activation and with opposite polarity between channels

In this application the activation of the device works automatically, since the terminals T11 and T34/X1 are bridged. If the protection door switches are closed, the contacts close with a delay of approximately 100 ms. After opening the protection door switches the contacts 13-14 and 23-24 return to their normal position without delay. The contact 77-78 remains open during the selected time delay.

up to category ...

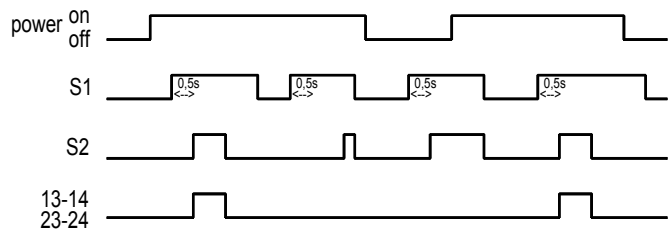
immediate switching: 4; SIL3; PLe reachable,

time delayed output: 3; SIL2; PLd reachable



4 Product application for - two hand control relays

Impulse diagram for two hand control relays type III (III a, III b, III c)



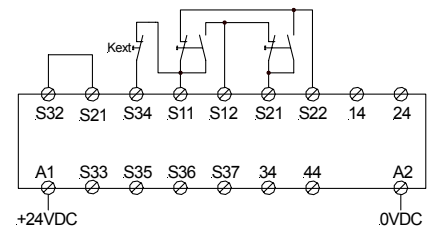
a) **SAFE CZ**

Two-hand application type IIIC with checking of synchronous actuation.

Both keys consist of a n/o and a n/c switch. The first pushbutton switches output S11 from input S22 to S12 and the second one switches output S21 from input S12 to S22. Bridge S21-S32 is configuring the device to work without AND combination (stand alone).

The feedback control must be closed either by a n/c contact of an expanding relay or by a bridge between.

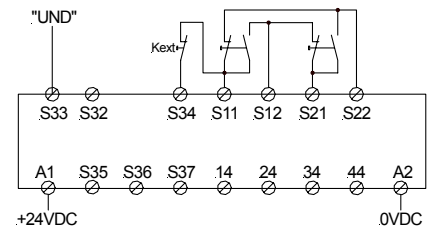
category 4; SIL3; PLe reachable



Two-hand application type IIIC with AND-combination.

The function is the same as in the 1st application, except the open input S32 configures the device without AND-combination. It is attached to the input S33. Allowed are the outputs 14, 24 of all family C devices.

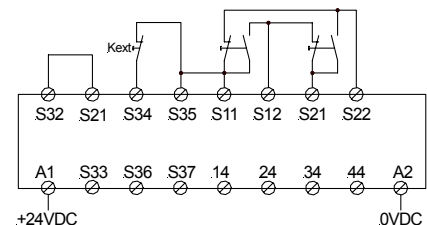
category 4; SIL3; PLe reachable



Two-hand application type II without monitoring of synchronous actuation.

The function is the same as in the 1st application, except the bridge S11-S35 configures the device for a function type II without control of synchronous actuation. Reactivation of the safety outputs 14, 24, 34, 44 is only possible when the two push-buttons are disengaged synchronous a new actuation.

category 3; SIL2; PLd reachable

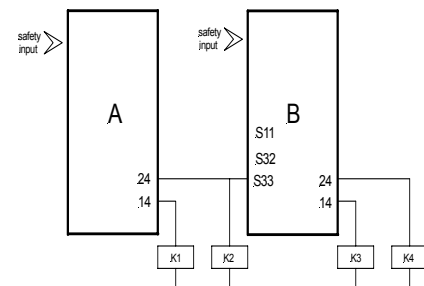


Combination examples

Contact expansion over the emergency stop circles.

If the device **A** switches off (the outputs have low potential), the contactors K1 and K2 will de-energise. Device **B** switches off its safety outputs via its own e-stop circuits, as well, and though contactors K3, K4 de-energize.

Up to category 4; SIL3; PLe reachable



b) SAFE Z.2

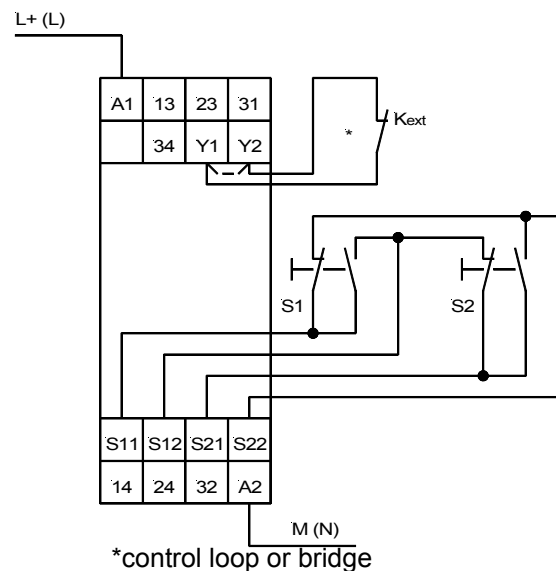
Connection plan

Two hand control relays SAFE Z.2 according to BG,

section iron and metal III ZH 1/456 (o2.78) and DIN EN 574 (02.97) for type I - III c.

Suitable up to category 4; SIL3; PLe reachable

After supply voltage be applied to terminals A1 and A2, the SAFE Z.2 will be ready for operation. The power LED illuminates. If the button S1 is pressed and within 0,5 sec. the button S2 also pressed, the outputs 13-14, 23-24 are closed and 31-32 will be opened. The machine will be started. The PLC-output is connected with 24 V suppl voltage. If one or both buttons are released, the outputs 13-14 and 23-24 opens immediately. Only after releasing of both buttons S1 and S2, a new cycle can be started. The output 31-32 closed. If the time for pressing the buttons S1 and S2 will be longer as 0,5 sec., the outputs was not released. The outputs 13-14 and 23-24 keeps open. The machine cannot be started. On the terminals S21 and Y2 can be connected machinereleasecircuit (repeating contactor control).



c) SAFE Z

Connection plan

Two hand control relays SAFE Z according to BG, section iron and metal III ZH 1/456 (o2.78) and DIN EN 574 (02.97) for type I - III c.

Suitable up to category 4; SIL3; PLe reachable

Operate mode

There must be installed an auxiliary voltage at the terminals A1 and A2 in order to operate the device.

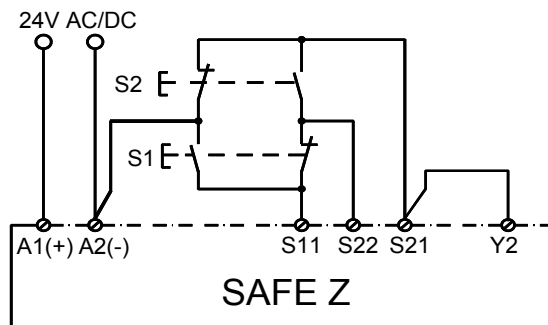
Then power LED starts illuminating. By pressing the button S1 simultaneously to S2 the safety outputs 13-14 and 23-24 will switch. This causes an machine connected to the safety outputs gets able to start.

Attention: The simultaneous of the two hand control button S1 and S2 has to be smaller 0,5 sec.

If one or both buttons released, the outputs 13-14 simultaneous and 23-24 will open immediately. Only after releasing S1 and S2 a new cycles can be started. If the simultaneous time will be bigger than 0,5 sec the outputs will not be released. The outputs 13-14 and 23-24 stay open. The machine cannot be started.

It is possible to connect machine-release-circuits at the terminals S21 and Y2.

The contact extension have to get export.

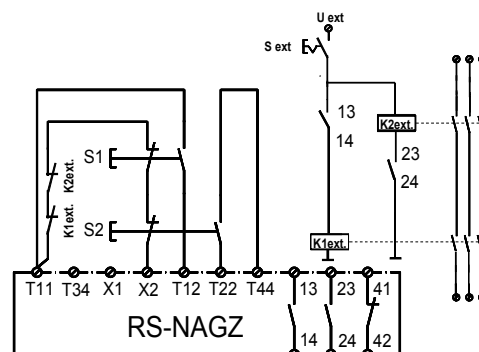


d) RS-NAGZ

Connection plan

Two hand control relays RS-NAGZ according to BG, section iron and metal III ZH 1/456 (o2.78) and DIN EN 574 (02.97) for type I - III b.

Suitable up to category 3; SIL2; PLd reachable



5 Application example for - emergency stop for light barriers / curtains

a) SAFE CL

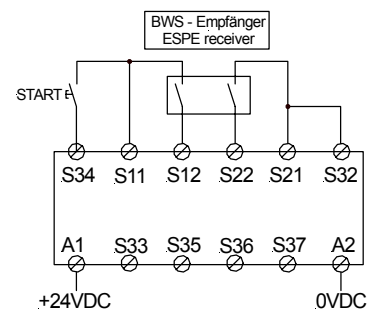
2-channel application for connecting 2 relay outputs of an ESPE (type2/4) with monitored start circuit and cross circuit check.

Connect the ESPE outputs to the inputs S11/S12 and S21/S22 and the start button to S34/S11.

The safety outputs are activated when the relay outputs of the ESPE are closed and the start circuit is closed and reopened. By interrupting the optical path the outputs of the ESPE open and the outputs of the SAFE CL are deactivated.

connecting ESPE type 4:
category 4; SIL3; PLe reachable

connecting ESPE type 2:
category 2; SIL1; PLd reachable



2-channel application for connecting 2 relay outputs of an ESPE (type2/4) with automatic start and cross circuit check.

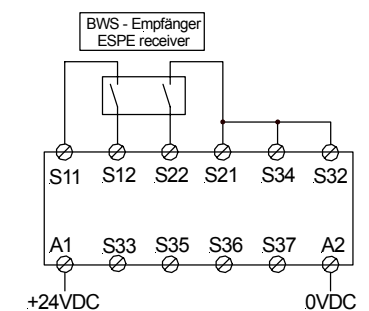
Connect the ESPE outputs to the inputs S11/S12 and S21/S22. The bridge S34-S21 enables the automatic start mode.

The activation of the semiconductor outputs of the Safe CL is done after the relay outputs of the ESPE were activated.

By interrupting the optical path the outputs of the ESPE open and the semiconductor outputs of the SAFE CL are deactivated.

connecting ESPE type 4:
category 4; SIL3; PLe reachable

connecting ESPE type 2:
category 2; SIL1; PLd reachable



2-channel application for monitoring an ESPE or a safety sensor with 2 pnp-outputs and monitored start.

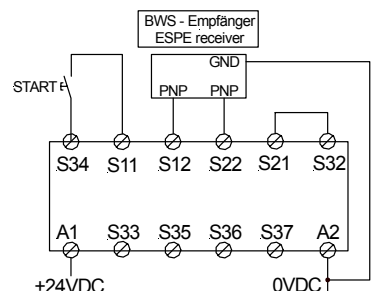
Connect the pnp-outputs of the ESPE to input circuit S12/S22 and the start button to the start circuit S34/S11.

The activation of the outputs results from closing and re opening the start circuit by activated pnp-outputs.

A new start is only possible after simultaneous deactivation and new activation of both inputs S12,S22

connecting ESPE type 4:
category 4; SIL3; PLe reachable

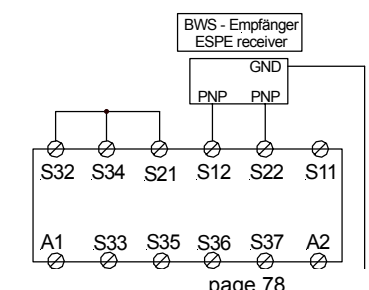
connecting ESPE type 2:
category 2; SIL1; PLd reachable



2-channel application for monitoring an ESPE or a safety sensor with 2 pnp-outputs and automatic start.

Connect the pnp-outputs of the ESPE to input circuit S12/S22. The bridge S34-S21 enables the automatic start mode.

The activation of the semiconductor outputs of the SAFE CL happens after activating the pnp-outputs (OSSDs).



A new start is only possible after simultaneous deactivation and new activation of both inputs S12, S22.

connecting ESPE type 4:

category 4; SIL3; PLe reachable

connecting ESPE type 2:

category 2; SIL1; PLd reachable

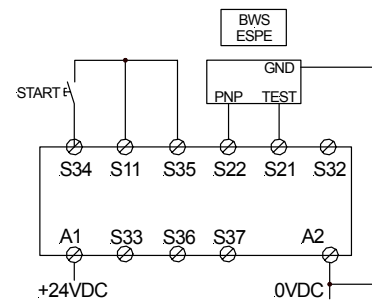
1-channel application for monitoring an ESPE (type 2) or safety sensor with pnp-output (OSSD) and periodic test and monitored start.

Connect the test input of the ESPE to the clocked output S21 of the SAFE CL and the OSSD of the ESPE to the input S22. The terminal S12 must not be used.

The bridge S35-S11 enables the one-channel application mode. The start button is connected to S34/S11. The activation of the semiconductor outputs of the SAFE CL results from closing and re-opening the start circuit while the OSSD is activated.

Additional information: The output signal from S21, which is connected with the test input or with the activation input of the ESPE, is a square wave signal with the period duration of 140ms, an impulse of 100ms and a break of 40ms. The signal, read in at S22 from the ESPE, must be delayed 20 ms at maximum to the source signal at S21.

category 2; SIL1; PLd reachable



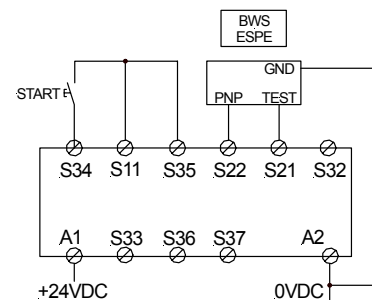
1-channel application for monitoring an ESPE (type 2) or safety sensor with pnp-output (OSSD) and periodic test and automatic start.

Connect the test input of the ESPE to the clocked output circuit S21 and the pnp-output to the input circuit S22. The terminal S12 must not be used. The bridge S34-S12 enables the automatic start mode and the bridge S35 –S11 enables the one channel application. The activation of the semiconductor outputs happens after the activation of the pnp-output of the ESPE.

Additional information: The output signal from S21, which is connected with the test input or with the activation input of the ESPE, is a square wave signal with the period duration of 140ms, an impulse of 100ms and a break of 40ms.

The signal, read in at S22 from the ESPE, must be delayed 20 ms at maximum to the source signal at S21.

category 2; SIL1; PLd reachable



2-channel application for monitoring an ESPE with monitored start circuit, cross circuit check and contact expansion.

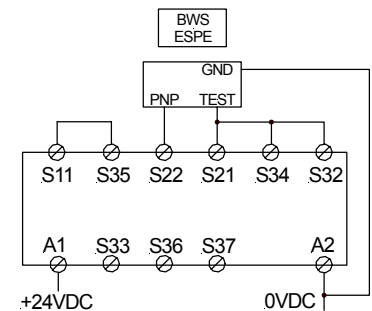
Connect the pnp-outputs of the ESPE to the input circuits S12 and S22 and the start button to the start circuit S34/S11.

The activation of the outputs results from closing and re opening the start circuit by activated pnp-outputs.

A new start is only possible after simultaneous deactivation and new activation of both inputs S12,S22.

For monitoring the external conductors, the NC contacts of the positively driven contactors must be in series to the start button. forcibly guided contacts

category 4; SIL3; PLe reachable



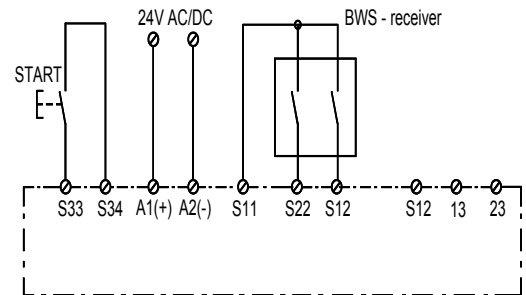
c) **SAFE L / SAFE L.1**

(SAFE L : with start control)

(SAFE L.1: without start control)

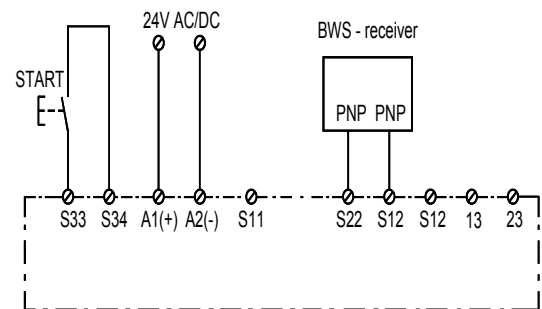
Dual-channel monitoring of light barrier (with relay outputs).

By pressing the START button the unit is activated and contacts 13-14 and 23-24 close. An interruption of the light beam will reset the contacts.



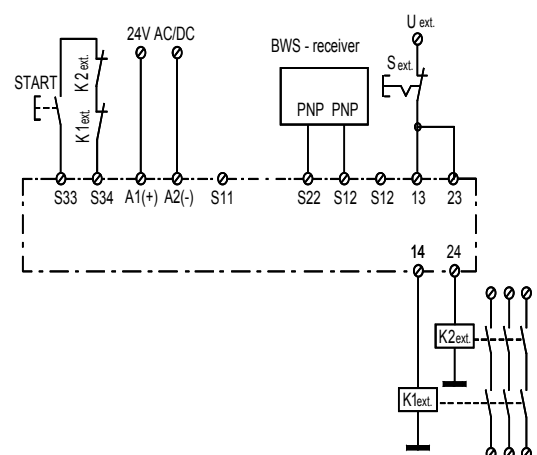
Dual-channel monitoring of light barrier (with semiconductor outputs and short circuit monitoring).

By pressing the START button the unit is activated and contacts 13-14 and 23-24 close. An interruption of the light beam will reset the contacts.



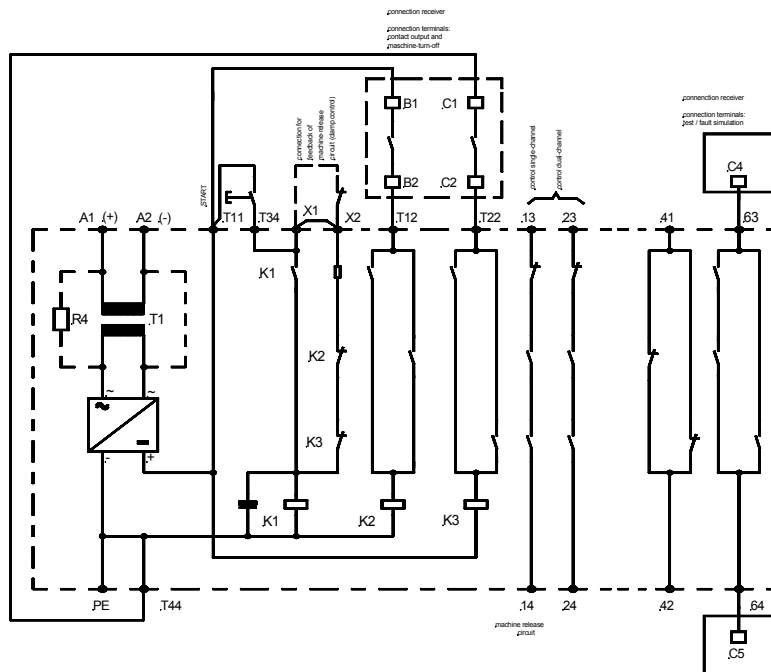
Control such as in application 2 with external contact extension (2 contactors).

This application uses two external contactors with positive guidance. One normally closed contact of each external contactors must be connected in series to the START-button to the terminals S23 and S34. Through the switch S ext. the external contactors can be operated or turned off at any time if the SAFEL.. is activated. The external contactors must connect with separate cable sheaths.

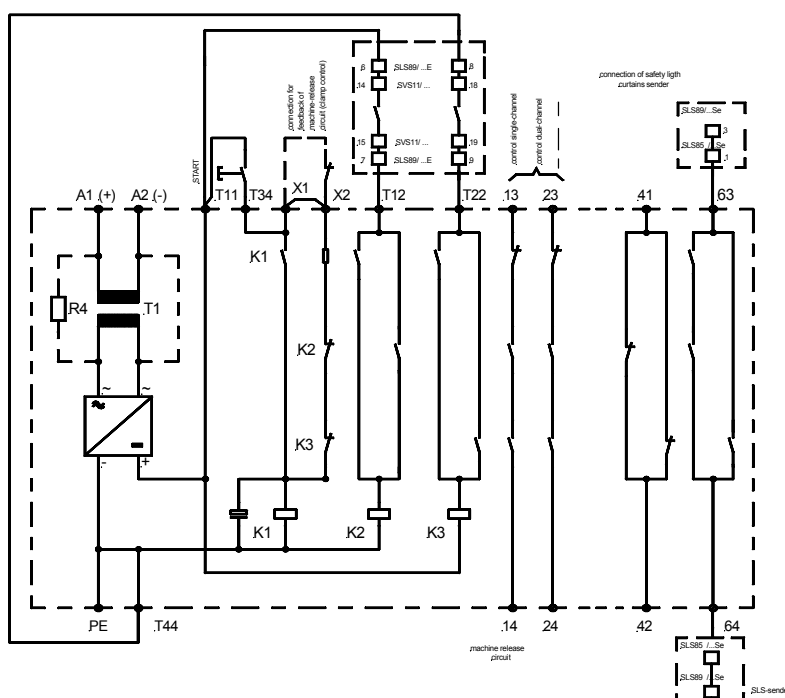


d) RS-NAGL (with opposite polarity between channels) / RS-NAGL.1 (without ...)

Wiring diagram for connection of safety protection gate one-way light barriers with DIN metal plug of series FF-SB 12 and FF-SB 14 as well as for safety light barriers of series FF-SB 15 from HONEYWELL Co.
Suitable up to category 4; SIL3; PLe reachable

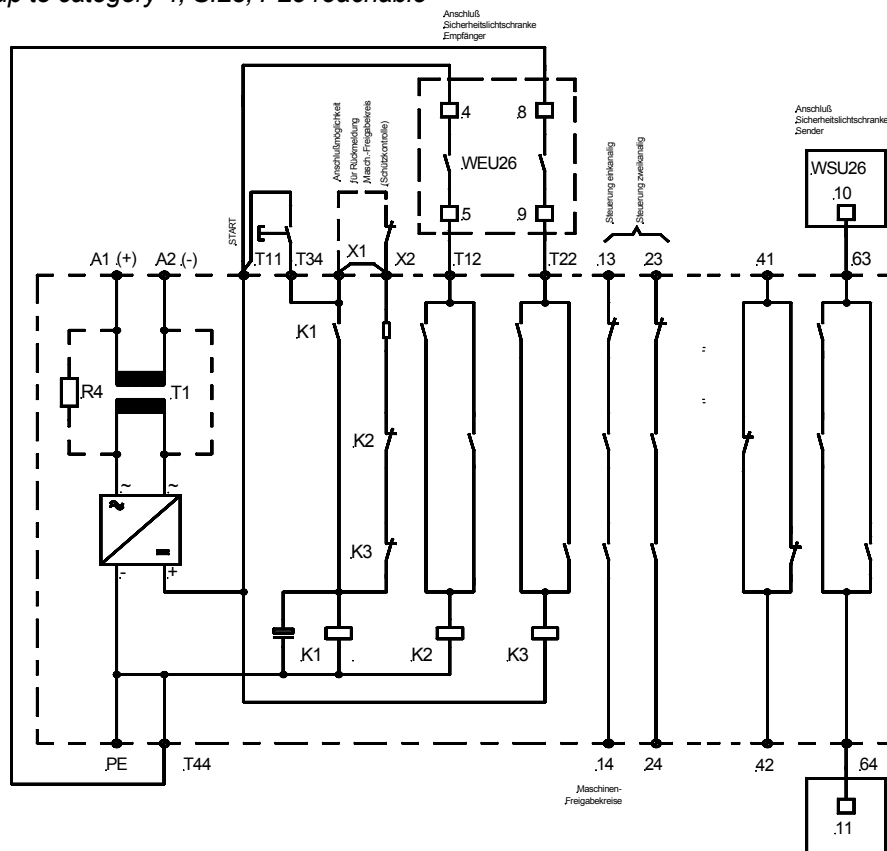


Wiring diagram for connection of safety light barriers SLS 89/ ..., SLS 85/ ... and SVS 11/ ... of LEUZE Lumiflex electronic

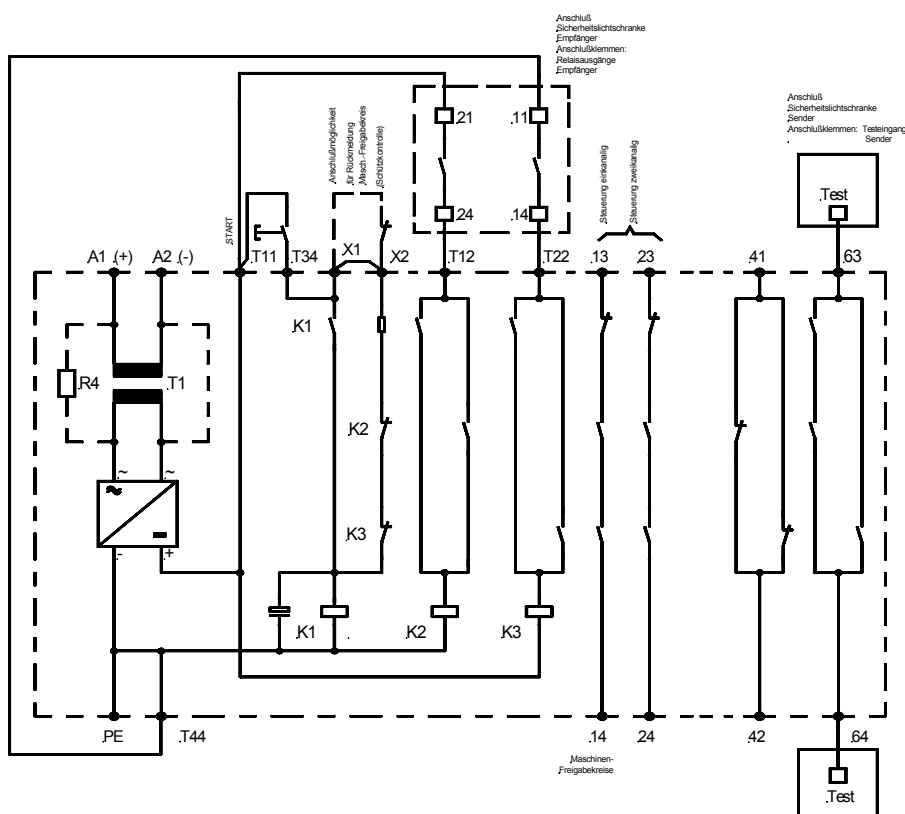


Suitable up to category 4; SIL3; PLe reachable

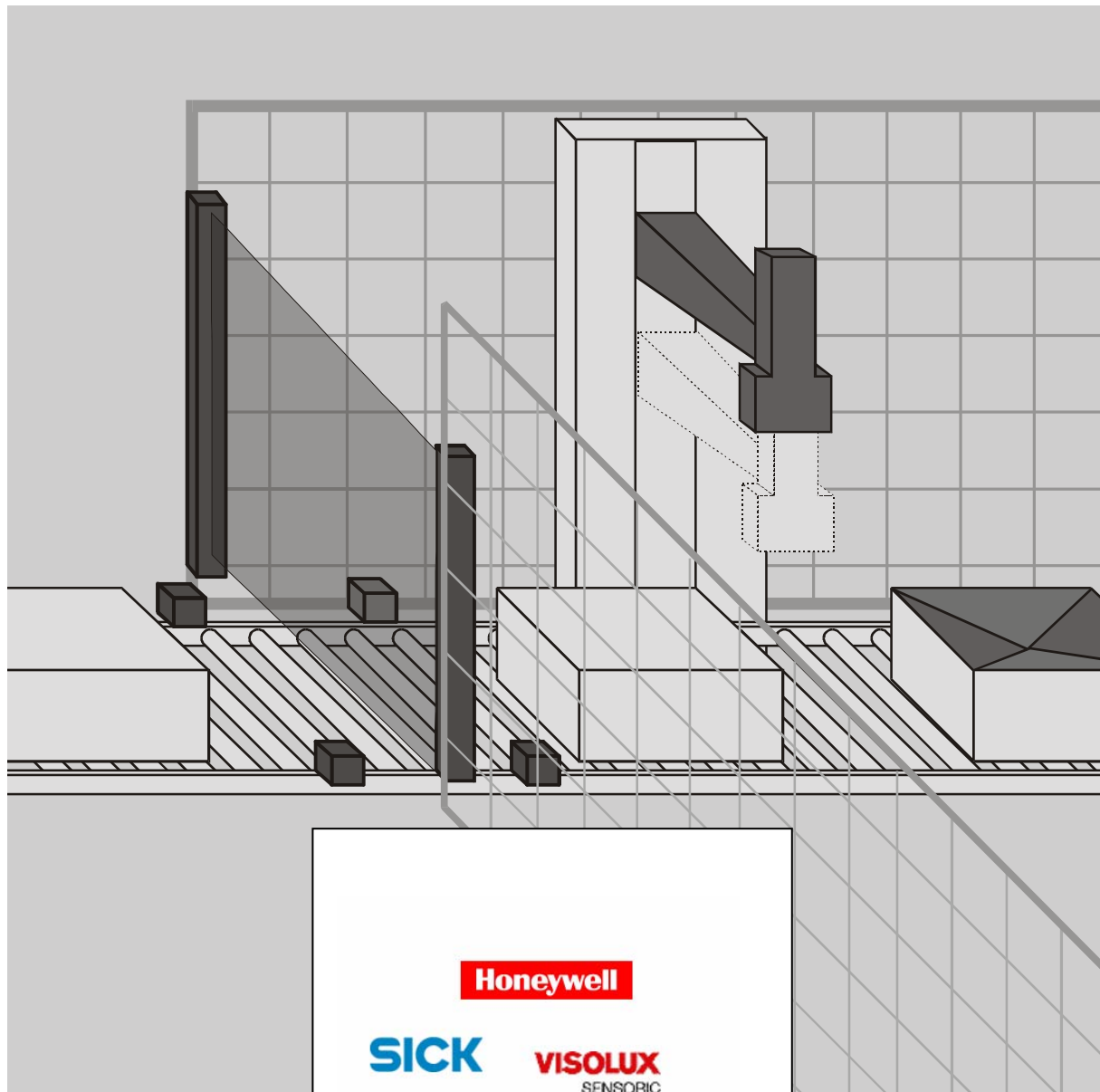
Wiring diagram for connection of safety light barriers WEU 26 and WSU 26 from SICK
Suitable up to category 4; SIL3; PLe reachable



Application of safety light barriers with switching devices SLV -1K, -2K, -3K and -8K from VISOLUX Co
Suitable up to category 4; SIL3; PLe reachable



Applications for muting controllers
RS-NAGU/ NAGU.1/NAGU.2f
with safety light barriers and light gates curtains
Edition 2005/2006



Honeywell

SICK

VISOLUX
SENSORIC

OMRON

Leuze lumiflex

and more...!

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Introduction

The following pages contain a detailed description of how to connect safety light barriers and safety light curtains of different makes and types to the muting controllers RS-NAGU / RS-NAGU.1 and RS-NAGU.2f from riese electronic. Supplementary and more detailed information on the two muting controllers is provided in the operating instructions for the relevant devices.

The table below lists all the safety light barriers and safety light curtains which have been subjected to exhaustive testing by riese electronic in conjunction with the muting controllers.

These tables are updated continuously. We recommend applying for the latest documentation from riese electronic or calling us if you wish to use a safety light barrier or safety light curtain which is not included in the list.

Manufacturer e.g.	Type e.g.	Page
Banner	SGP3	116
Bernstein	OSG4	117
Cedes	Safe 4	102
Datasensor	SE4	124
Fissler	ULTV	125
Guardscan	B0214	106
Guardscan	T-Serie	127
Guardscan	GS120	108
Honeywell	FF-SPR / FF-SPE	119
Ines	Linesmart Lichtgitter	103
Ines	Alfa II	103
Ines	Alfa 4	104
Jay	SMBT/SMBR	105
Leuze Lumiflex	Compact	98
Leuze Lumiflex	Robust 43	99
Leuze Lumiflex	Robust RRT42/44	99
Leuze Lumiflex	PRK525	100
NAIS	UZKA2	121
Omron	F3S-A	101
Pauly	PP2126/2	109
REER	Admiral	123
REER	Argolux	124
Schneider	XUSLA	114
Schneider	XUSLC	115
Sick	FGS	94
Sick	MSL	96
Sick	M2000	95
Sick	WSU-WEU	95
Siemens	SIGUARD 3RG7812	110
SUNX	SF1-AC2	119
SUNX	SF2-EH12P	120
STI	MC4200	111
Technogr	SB2 / SB4	127
Visolux	SLVA-4K	112
Visolux	SCL14-150	113
Wenglor	SEG280V2 / SSG280V2	118

In the connection drawings, only equipment recommended by riese electronic is indicated. On principle, however, all tested safety light barriers and light curtains are suitable for all our muting controllers.

Safety remarks

WARNUNG

- We are unable to guarantee the safety of operating staff or property in cases where the muting controller is not used in accordance with its intended use.
 - The equipment may only be installed and lined up in compliance with the respective operating instructions of the relevant muting controller and the manufacturer's instructions for the respective safety light barrier / light curtain by suitably qualified personnel familiar with the valid working safety and accident prevention regulations. Electrical work may only be performed by suitably qualified electricians.
-

All the following applications have been tested in-house at ries.e electronic using series-produced equipment from the respective manufacturer. To ascertain the date of testing (and thus also an indication of the age/version of the relevant light barrier), please refer to the text above the application in question.

As the individual series devices are manufactured in different sizes, the technical data, for example relating to current consumption, will differ. For this reason, before using a particular light barrier, check whether the device in question is able to operate together with the muting controller (e.g. current consumption when the transmitter is switched on directly).

Note

Please note whether the light barrier manufacturer has brought a modified version of the light barrier onto the market since our tests.

The following applications (from page 94) indicate only part of the necessary wiring. The basic connection (wiring) is indicated on page 93.

6 Application examples for

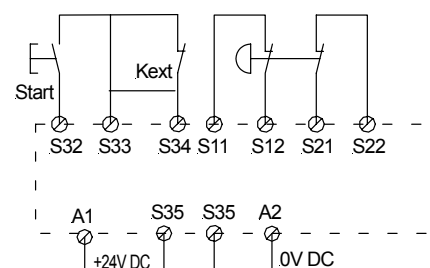
- multifunction relays

a) SAFE Flex

Dual-channel e-stop application with monitoring of the start-button and short-circuit proof.

The e-stop button has to be connected to the input channels (S11/S12 and S21/S22) and the start-button to the reset circuit (S32/S33). Link S33 to S34 with a bridge or the feedback control loop.

The activation of the outputs (13-14,23-24,S31) results after closing and re-opening the start-button, both input channels have to be closed (e-stop-button not pressed). If the e-stop is pressed the outputs of the device fall off immediately, the contacts 13-14 and 23-24 are opened. The auxiliary output S31 becomes inactive.



General information:

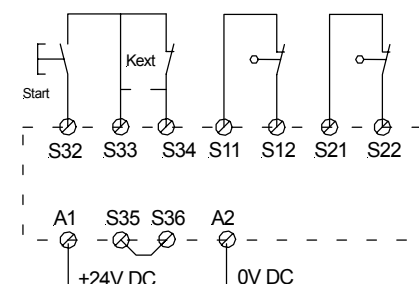
For this operating mode the terminals S35/S36 must be bridged. For the e-stop mode the simultaneity* of the channels is infinite. The two channels must not have different signals when the supply-voltage is switched on. That means both contacts of the e-stop button or safety switch have to be opened or closed. In case of a faulty input-wiring, the device will switch to the FAIL-SAFE mode (safety-switch-off).

Category 4, PLe, SIL 3 reachable

Dual-channel safety gate application with monitoring of the start-button and short-circuit proof.

The safety gate switches have to be connected to the input channels (S11/S12 and S21/S22) and the start-button to the reset circuit (S32/S33). The activation of the outputs (13-14,23-24,S31) results from closing and re-opening of the start-button, both input channels have to be closed (safety gate closed). If one or both safety gate switches are opened (by opening the safety gate) the outputs of the device fall off immediately, the contacts 13-14 and 23-24 are opened. The auxiliary output S31 becomes inactive.

A reset can not be effected until both safety gate switches are opened simultaneously.



General information:

For this operation mode the terminals S35/S36 must be bridged. For the safety gate function the simultaneity* of the channels is infinite. The two channels must not have different signals when the supply-voltage is switched on. That means both contacts of the safety gate switch have to be opened or closed.

In case of a faulty input-wiring, the device will switch to the FAIL-SAFE mode (safety-switch-off).

Category: 4, PL e, SIL 3 reachable

Dual-channel safety gate application with automatic start and short-circuit proof.

The safety gate switch has to be connected to the input circuits (S11/S12 and S21/S22). A bridge or feedback control loop (S32/S33) switches the device into the automatic start mode. The activation of the outputs 13-14, 23-24 and S31 results from closing the contacts of the safety gate switch. By opening one or both contacts of the safety gate switch the outputs of the device fall off

immediately, the contacts 13-14 and 23-24 are opened. The auxiliary output S31 becomes inactive.

A reset can not be effected until both safety gate switches are opened simultaneously.

General information:

For this operation mode the terminals S35/S36 must be bridged. For the safety gate function the simultaneity* of the channels is infinite. The two channels must not have different signals when the supply-voltage is switched on. That means both contacts of the safety gate switch have to be opened or closed.

In case of a faulty input-wiring, the device will switch to the FAIL-SAFE mode (safety-switch-off).

Category: 4, PL e, SIL 3 reachable

Two-hand application

If the push buttons S1 and S2 are pressed simultaneously, the outputs 13-14, 23-24 are closed and output S31 is turned on.

After releasing one or both push buttons the outputs 13-14 and 23-24 are opened and the output S31 is turned off. Only after releasing both push buttons a new cycle can be started.

By asynchronous actuation ($t > 0,5s$) the outputs are not released. The outputs 13-14 and 23-24 remain opened, output S31 remains turned off.

General information

For this operation mode the terminals S35/S36 must be bridged. The time between pressing both switches is limited to max. 0,5s. After exceeding this time a new cycle can only be started after releasing both push buttons. In the moment of turning on the supply voltage the push buttons must not be actuated.

In case of a faulty input-wiring, the device will switch to the FAIL-SAFE mode (safety-switch-off).

For type 3c, Ple, SIL 3 reachable

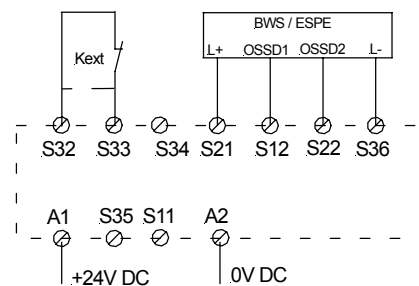
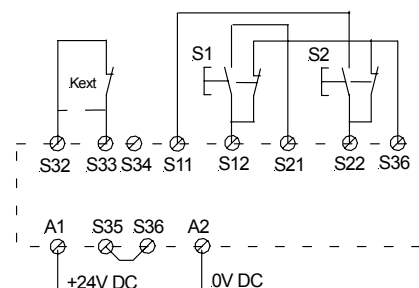
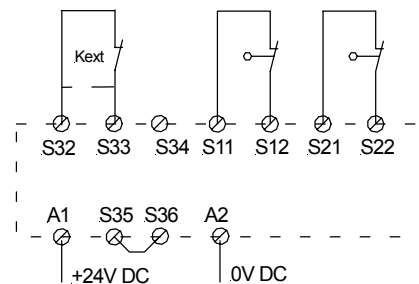
Dual channel application for connecting OSSD contacts (pnp) of an ESPE with automatic start and supply of the ESPE by the SAFE FLEX.

OSSD1 and OSSD2 have to be connected to the input circuits (S11/S12 and S21/S22). The bridge (or the feedback control loop) S32/S33 switches the device into the automatic start mode. The activation of the outputs results from the activation of the outputs of the ESPE (OSSDs outputs have high-signal). When the optical way of the light barrier is interrupted the OSSD outputs of the ESPE turn off (low signal) and the safety outputs of the SAFE FLEX fall off into the initial state. The contacts 13-14 and 23-24 are opened. The auxiliary output S31 is inactive.

The power supply of the light barrier/ light curtain is provided by the SAFE FLEX (negative pole to S36, positive pole to S21, $I_{max} = 50mA$)

General information:

For this operation mode the terminals S35/S36 must not be bridged. The simultaneity is defined by the high signals at the inputs S12 and S22. The high-signal at the input S22 may be activated maximally 0,5s after the high-signal at the input S12. A High-signal at the entrance S12 can be activated as desired after the High-signal at S22. After exceeding the simultaneity a new cycle can only be started after deactivating the OSSDs. The safety inputs



S12/S22 are only monitored when they were activated after turning on the power supply.

Category 4, PLe, SIL 3 reachable

Dual channel application for connecting OSSD contacts (pnp) of an ESPE with monitored start and supply of the ESPE by the SAFE FLEX.

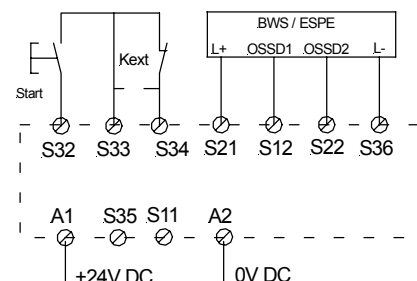
OSSD1 and OSSD2 have to be connected to the input circuits (S11/S12 and S21/S22). Connect the start button to S32-S33 and a bridge or a feedback control loop to S33-S34. The activation of the outputs results from closing and re-opening of the start button while the outputs of the ESPE are activated (high-signal).

When the optical way of the light barrier is interrupted the OSSD outputs of the ESPE turn off (low signal) and the safety outputs of the SAFE FLEX fall off to the initial state. The contacts 13-14 and 23-24 are opened the auxiliary output S31 is turned off.

The power supply of the light barrier/ light curtain is provided by the SAFE FLEX (positive pole to S21, negative pole to S36, $I_{max} = 50mA$)

General information:

For this operation mode the terminals S35/S36 must not be bridged. The simultaneity is defined by the high signals at the inputs S12 and S22. The high-signal at the input S22 may be activated maximally 0,5s after the high-signal at the input S12. A high-signal at the entrance S12 can be activated as desired after the high-signal at S22. After exceeding the simultaneity a new cycle can only be started after deactivating the OSSDs. The safety inputs S12/S22 are only monitored when they were activated after turning on the power supply.



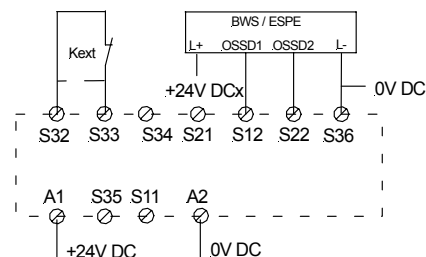
Category 4, PLe, SIL 3 reachable

Dual channel application for connecting OSSD contacts (pnp) of an ESPE with automatic start and supply of the ESPE by an external power supply.

The light barrier / light curtain is supplied by an external power supply. The negative pole of the light barrier / light curtain is connected additionally to terminal S36.

Function same as in application 5

Category 4, PLe, SIL 3 reachable

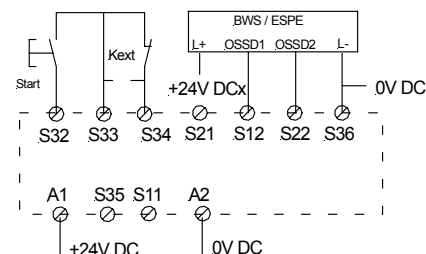


Dual channel application for connecting OSSD contacts (pnp) of an ESPE with monitored start and supply of the ESPE by an external power supply.

The light barrier / light curtain is supplied by an external power supply. The negative pole of the light barrier / light curtain is connected additionally to terminal S36.

Function same as in application 6

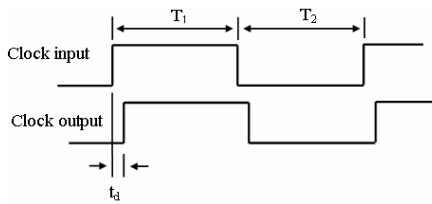
Category 4, PLe, SIL 3 reachable



Monitoring of a clocked safety switch with automatic start and supply of the clocked safety switch by the SAFE FLEX.

The SAFE FLEX provides a clock at terminal S11. Connect S11 to the clock input TE at the safety switch. The timing of the clock for the safety switch is as

followed:



T_1 and T_2 are approximately 60ms. By enabling the clock output S11 the clock is delayed at the clock output of the safety switch and is read in at terminal S22. The delay from clock output (S11) to clock input (S22) should be between 1ms and 20ms. Is at terminal S22 a signal detected identical to the signal provided at terminal S11 the outputs are activated automatically. Is the detected signal not identical the outputs fall off into the initial state. The contacts 13-14 and 23-24 are opened. The auxiliary output S31 is inactive.

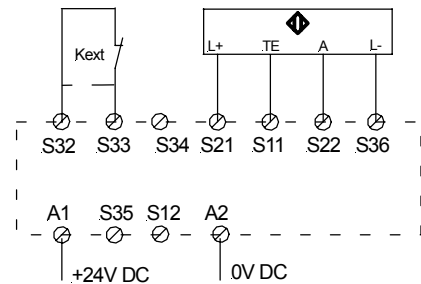
The power supply of the clocked switch is provided by the SAFE FLEX (positive pole to S21, negative pole to S36, $I_{max} = 50mA$).

General information:

For this operation mode the terminals S35/S36 must not be bridged. A bridge or feedback control loop (S32/S33) switches the device into the automatic start mode.

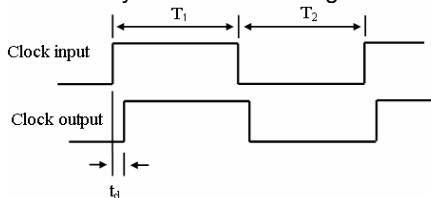
While turning on the power supply there must not be a signal at the output of the clocked safety switch. As long as no signal is detected at the clock input the device stays in a wait state.

Category 4, PLe, SIL 3 reachable



Monitoring of a clocked safety switch with monitored start and supply of the clocked safety switch by the SAFE FLEX.

The SAFE FLEX provides a clock at terminal S11. Connect S11 to the clock input TE of the safety switch. The timing of the clock for the safety switch is as



followed:

T_1 and T_2 are approximately 60ms. By enabling the clock output S11 the clock is delayed at the clock output of the safety switch and is read in at terminal S22. The delay from clock output (S11) to clock input (S22) should be between 1ms and 20ms. Is the delayed signal, read in, identical to the signal at the clock output the outputs of the SAFE FLEX are activated after closing and re-opening the start button, connected to S32 and S33. In this moment S33 has to be linked to S34 by a bridge or a feedback control loop. Is the detected signal not identical the outputs fall off into the initial state. The contacts 13-14 and 23-24 are opened. The auxiliary output S31 is inactive.

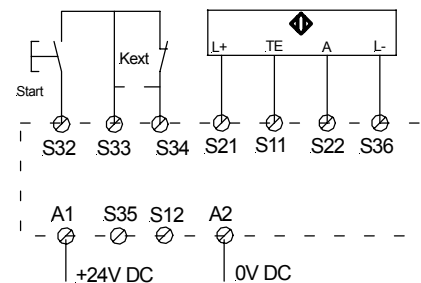
The power supply of the clocked switch is provided by the SAFE FLEX (positive pole to S21, negative pole to S36, $I_{max} = 50mA$)

General information:

For this operation mode the terminals S35/S36 must not be bridged.

While turning on the power supply there must not be a signal at the output of the clocked safety switch. As long as no signal is detected at the clock input the device stays in a wait state.

Category 4, PLe, SIL 3 reachable

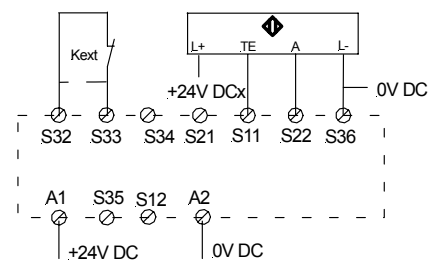


Monitoring of a clocked safety switch with automatic start and supply of the clocked safety switch by an external power supply.

The clocked safety switch is supplied by an external power supply. The negative pole of the clocked safety switch is connected additionally to terminal S36.

Function same as in application 9

Category 4, PLe, SIL 3 reachable

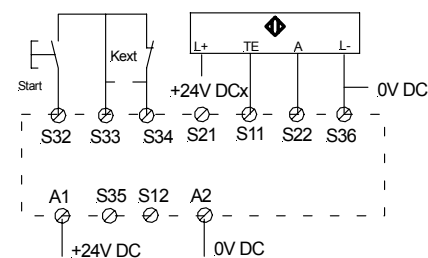


Monitoring of a clocked safety switch with monitored start and supply of the clocked safety switch by an external power supply.

The clocked safety switch is supplied by an external power supply. The negative pole of the clocked safety switch is connected additionally to terminal S36.

Function same as in application 10

Category 4, PLe, SIL 3 reachable

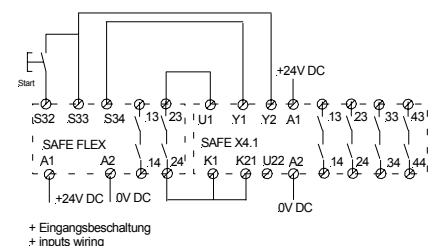


Contact expansion with SAFE X4.1 in applications with monitored start

For monitoring the contacts of the expansion are linked into the feedback control loop S33/S34 of the SAFE FLEX.

In the case of protected laying of the wires and exclusion of parasitic voltage between U1 and K1/K21 the expansion is qualified up to safety category 4

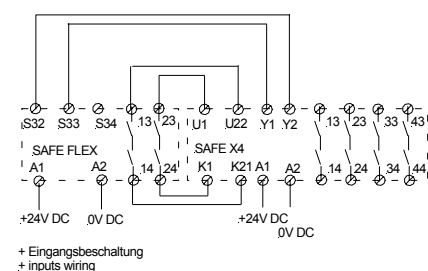
Category 4, PLe, SIL 3 reachable



Contact expansion with SAFE X4 in applications with automatic start

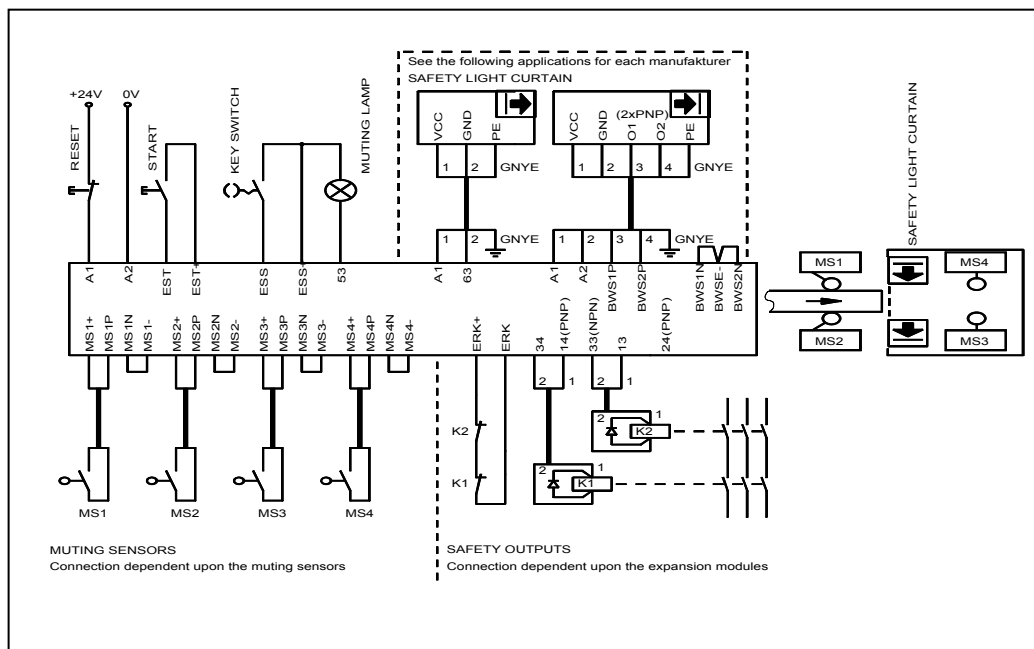
For monitoring the N/C contacts of the expansion are linked into the feedback control loop of the SAFE FLEX.

Category 4, PLe, SIL 3 reachable

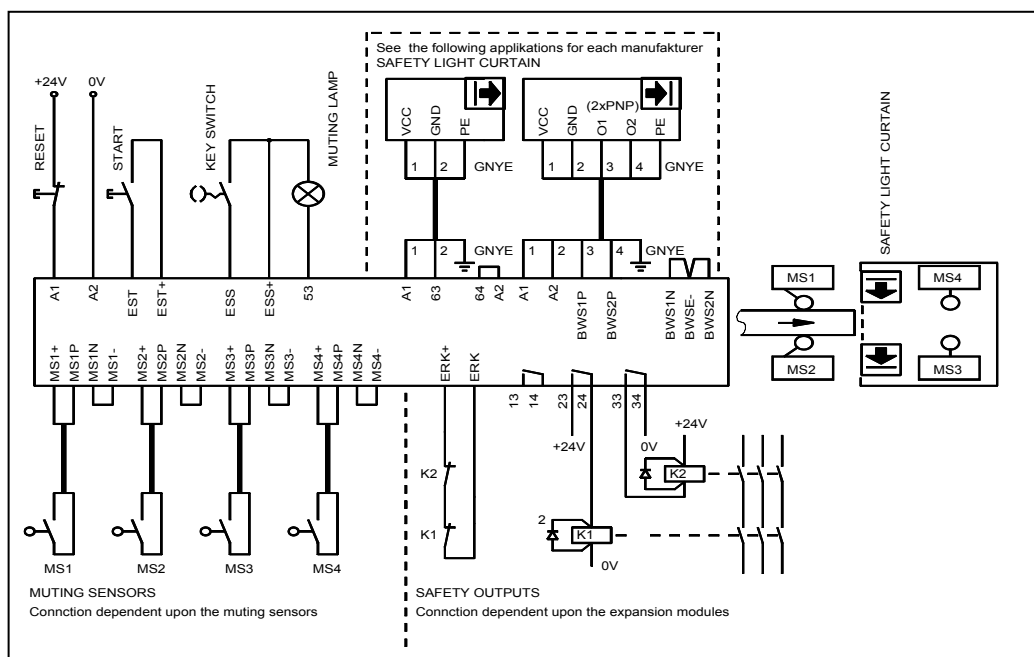


7 Application examples for muting

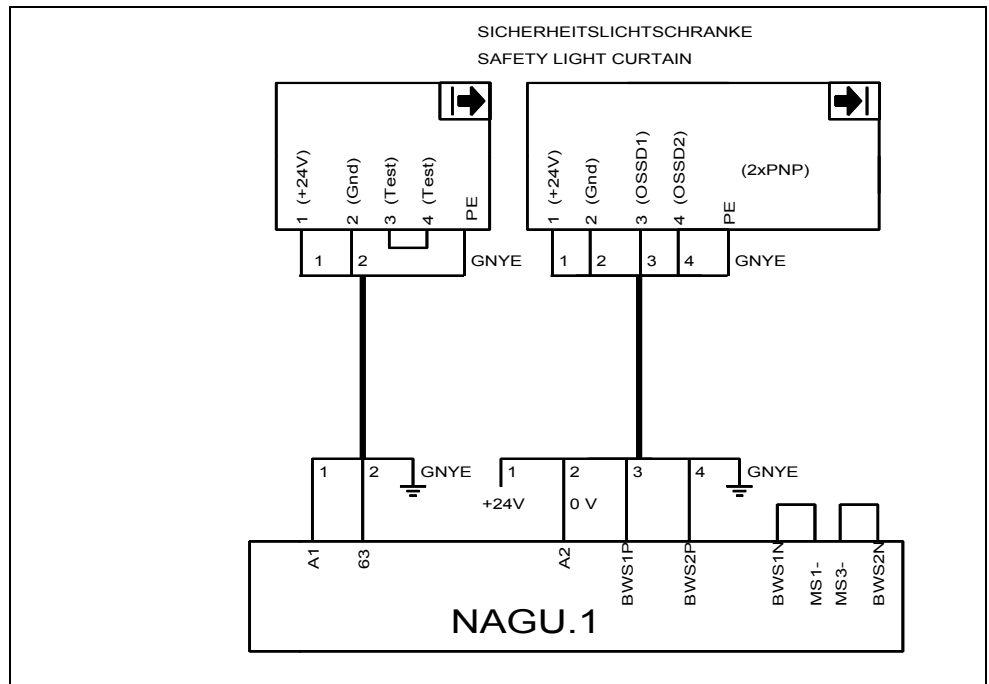
a) Basic wiring of a muting controller NAGU.1 / NAGU.1b



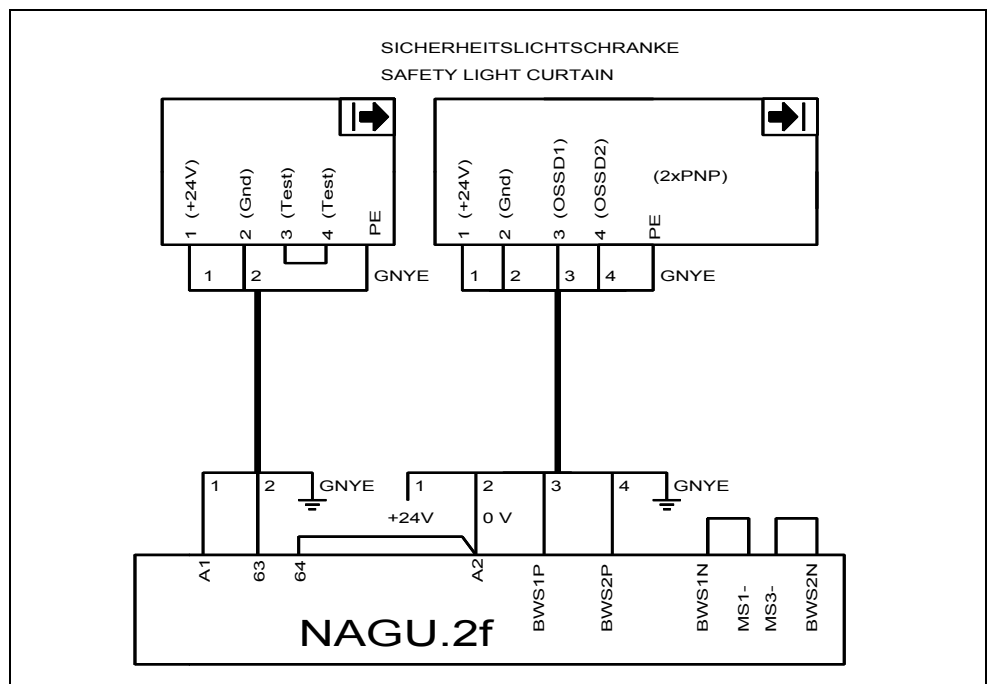
b) Basic wiring of a muting controller NAGU.2f



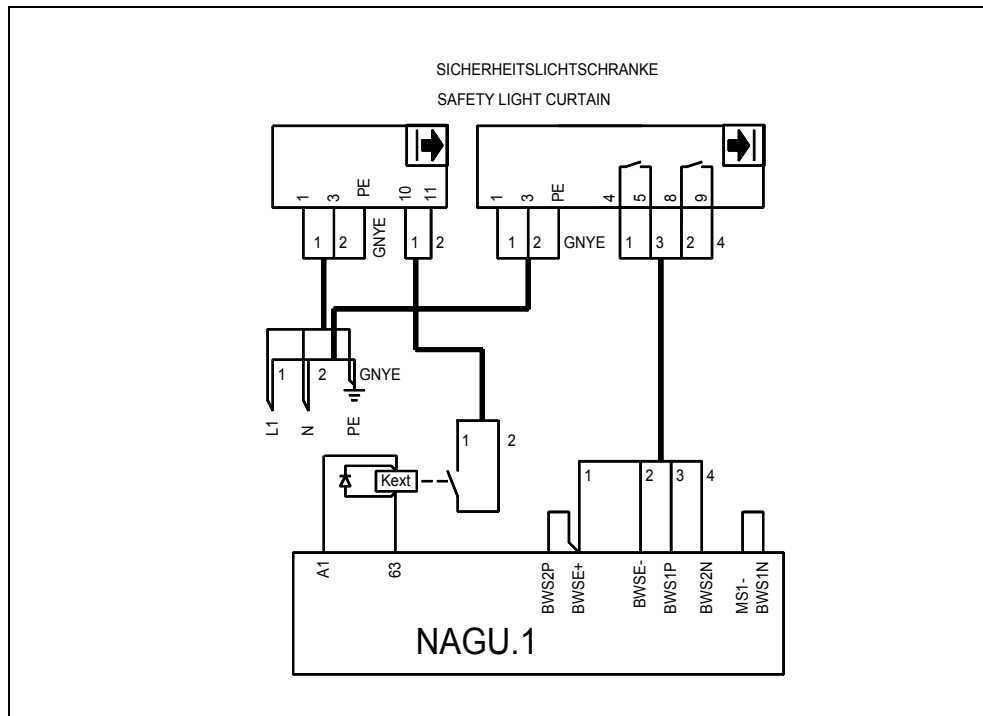
Sick - FGS with muting controller RS-NAGU / RS-NAGU.1 (semiconductor outputs)
Tested: September 1999



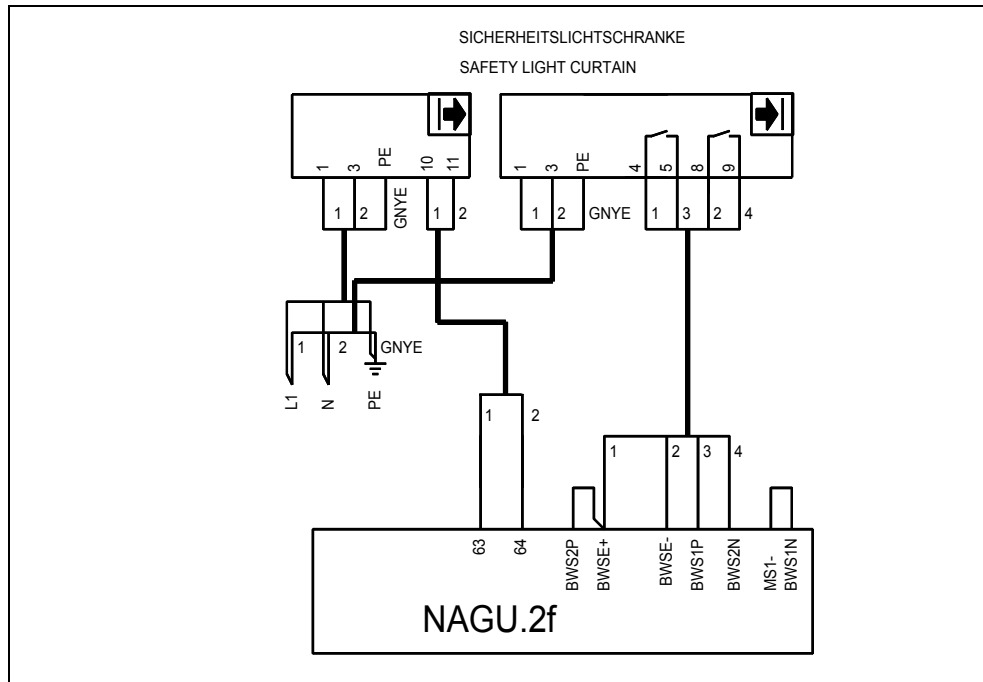
Sick - FGS with muting controller RS-NAGU.2f (relay outputs)
Tested: September 1999



Sick - WSU-WEU with muting controller RS-NAGU / RS-NAGU.1
 (semiconductor outputs)
 Tested: September 1999

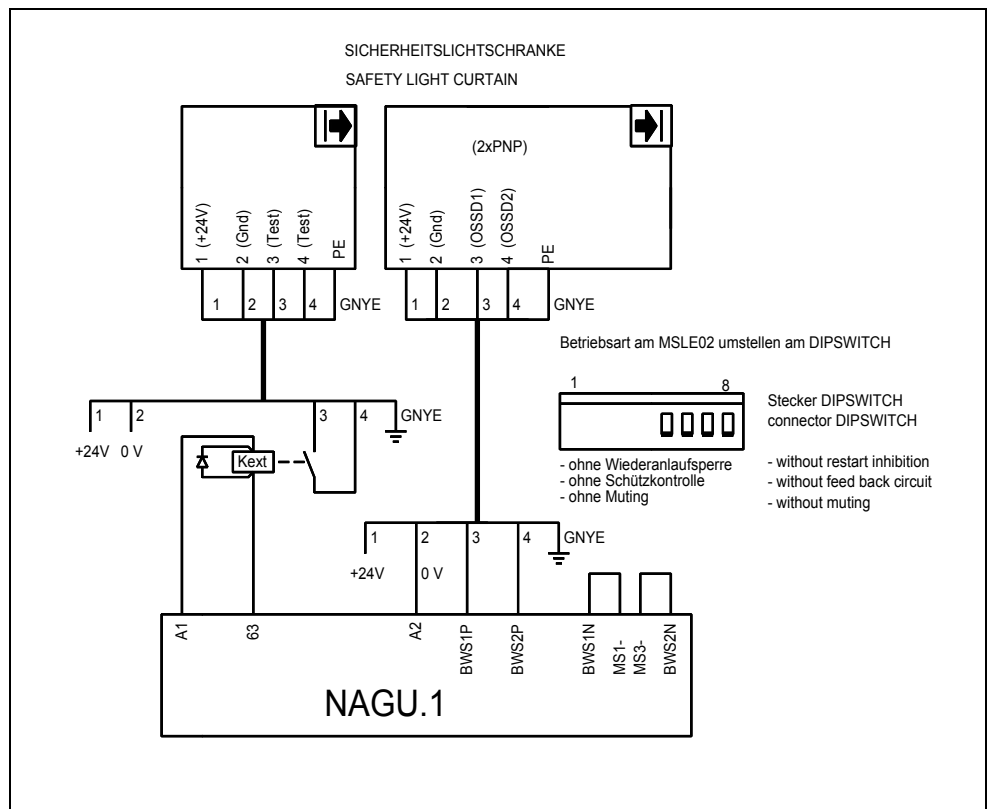


Sick - WSU-WEU with muting controller RS-NAGU.2f (relay outputs)
 Tested: September 1999



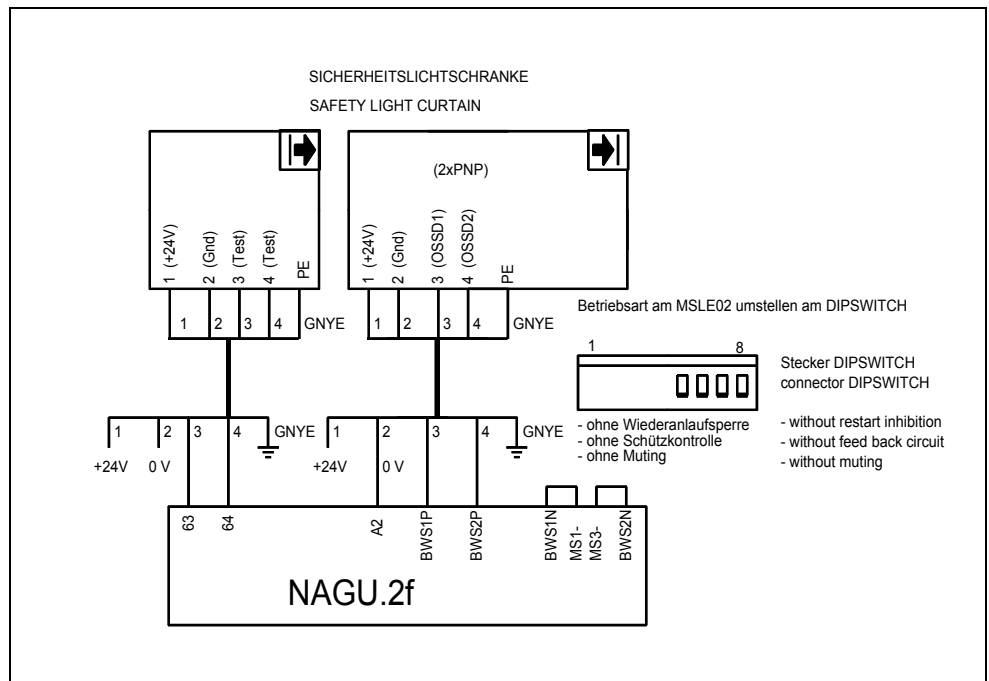
Sick - MSL with muting controller RS-NAGU / RS-NAGU.1 (semiconductor outputs)

Tested: September 1999

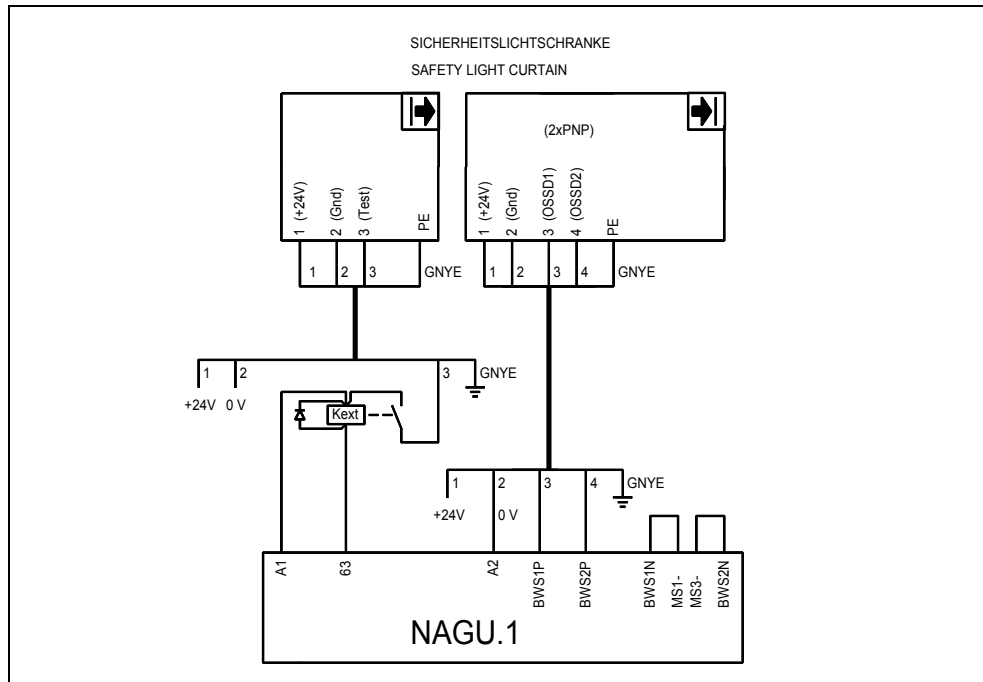


Sick - MSL with muting controller RS-NAGU.2f (relay outputs)

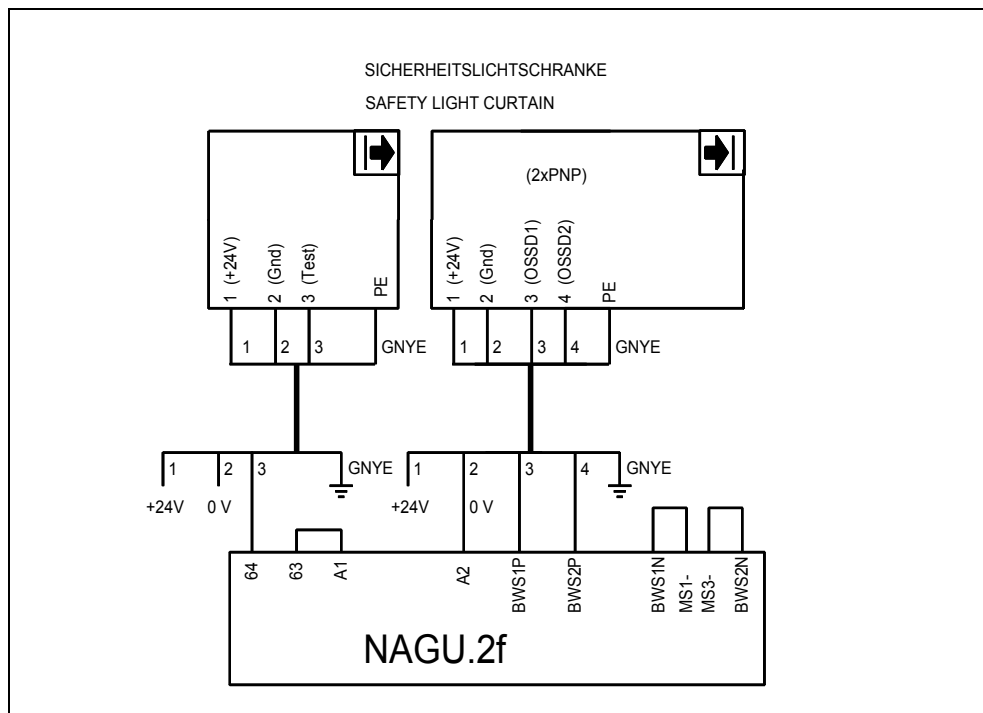
Tested: September 1999



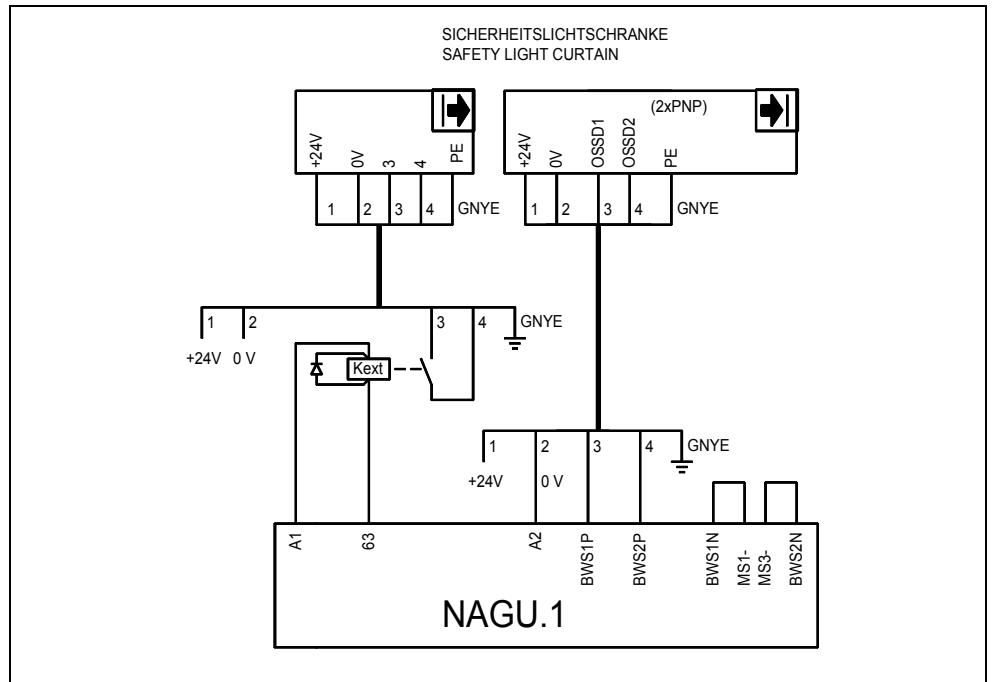
Sick - M2000 with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: September 1999



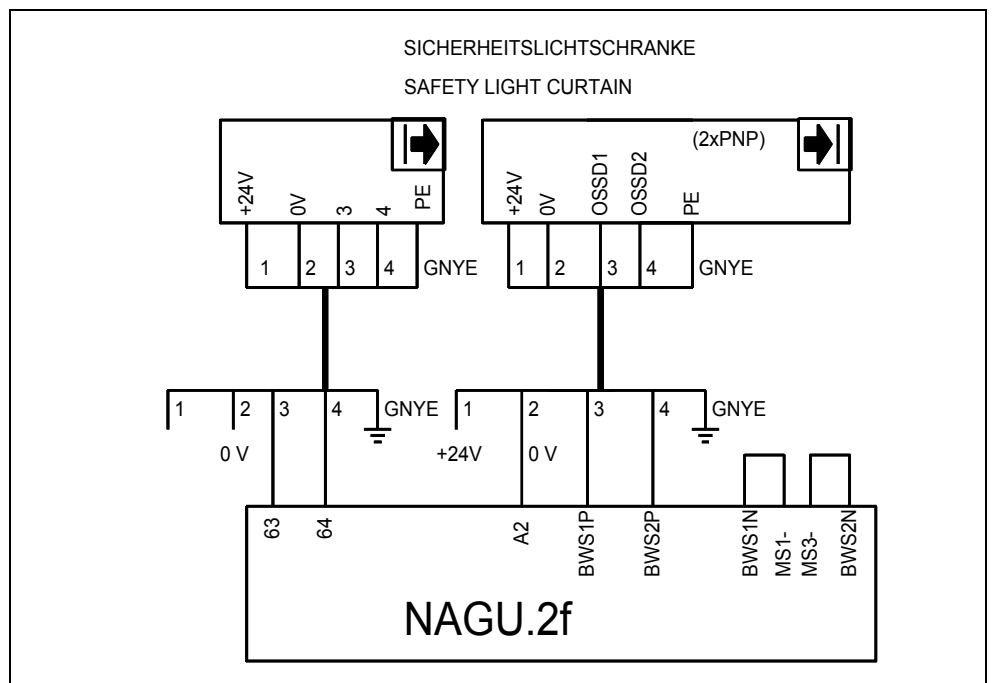
Sick - M2000 with muting controller RS-NAGU.2f (relay outputs)
Tested: September 1999



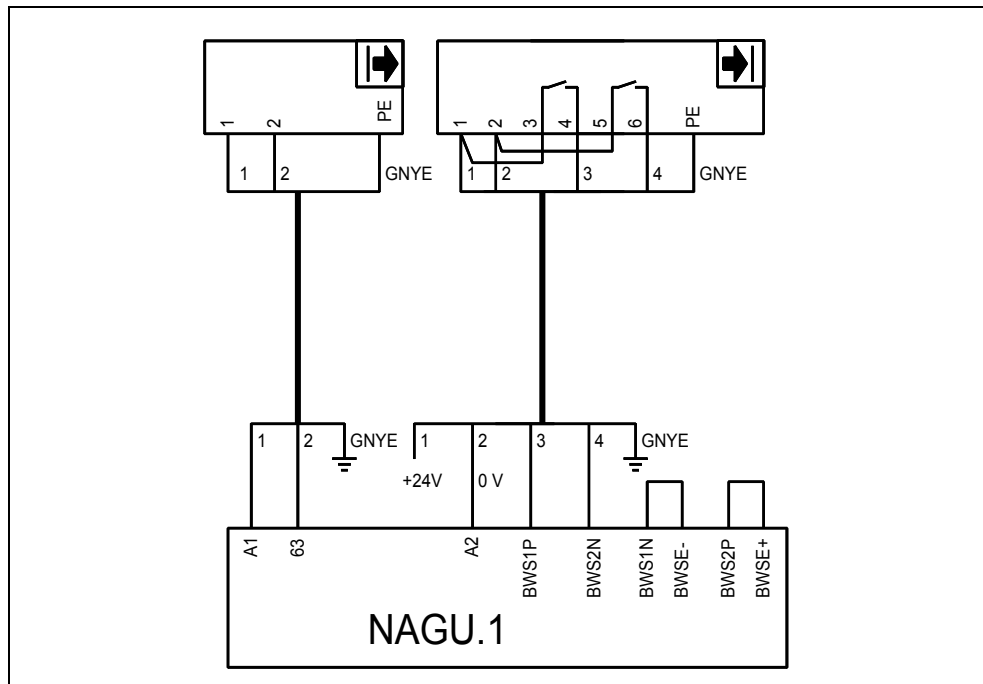
Leuze Compact with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: November 1999



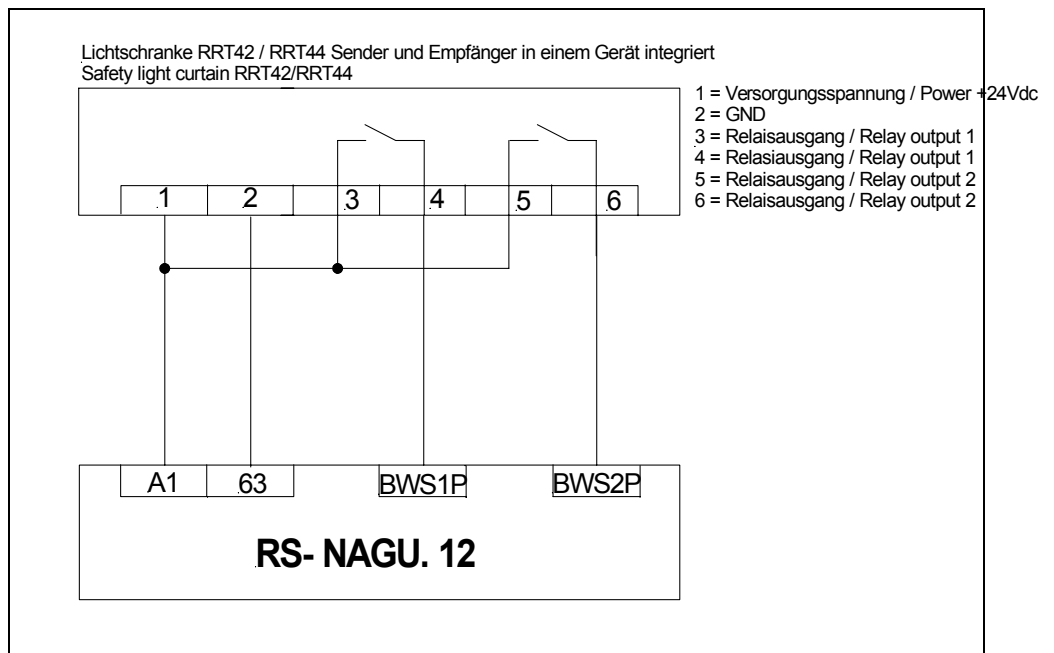
Leuze Compact with muting controller RS-NAGU.2f (relay outputs)
Tested: November 1999



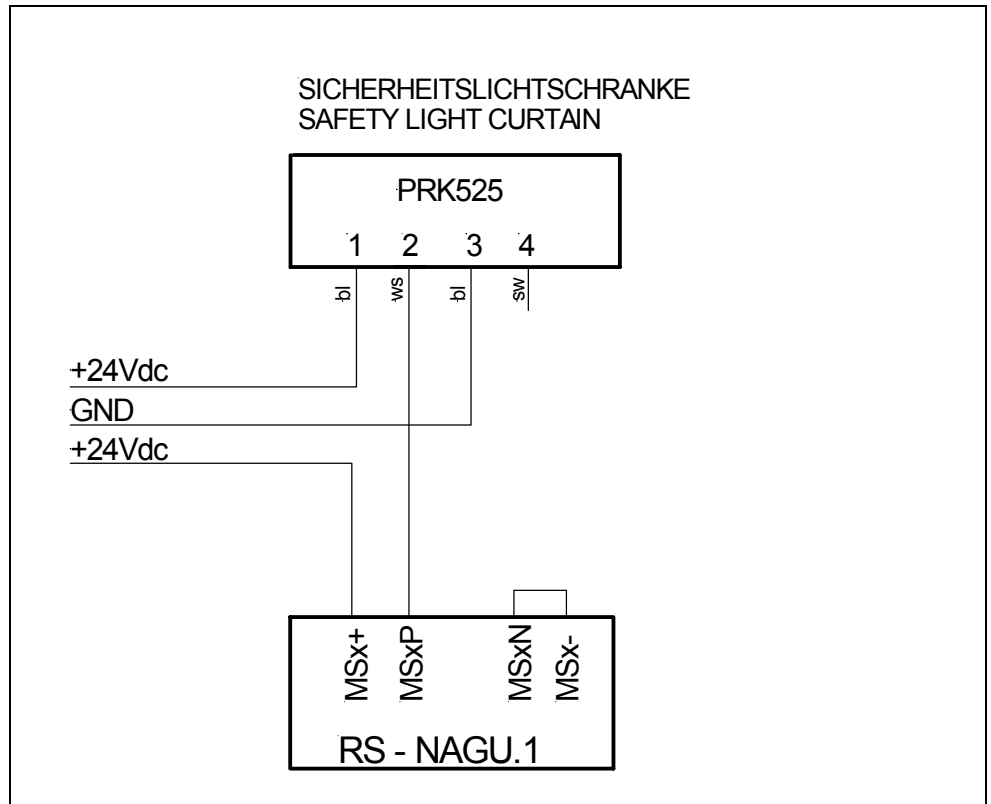
Leuze Robust 43 with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: August 1997



Leuze Robust RRT42/44 with muting controller RS-NAGU.12 (semiconductor outputs)
Tested: November 2002

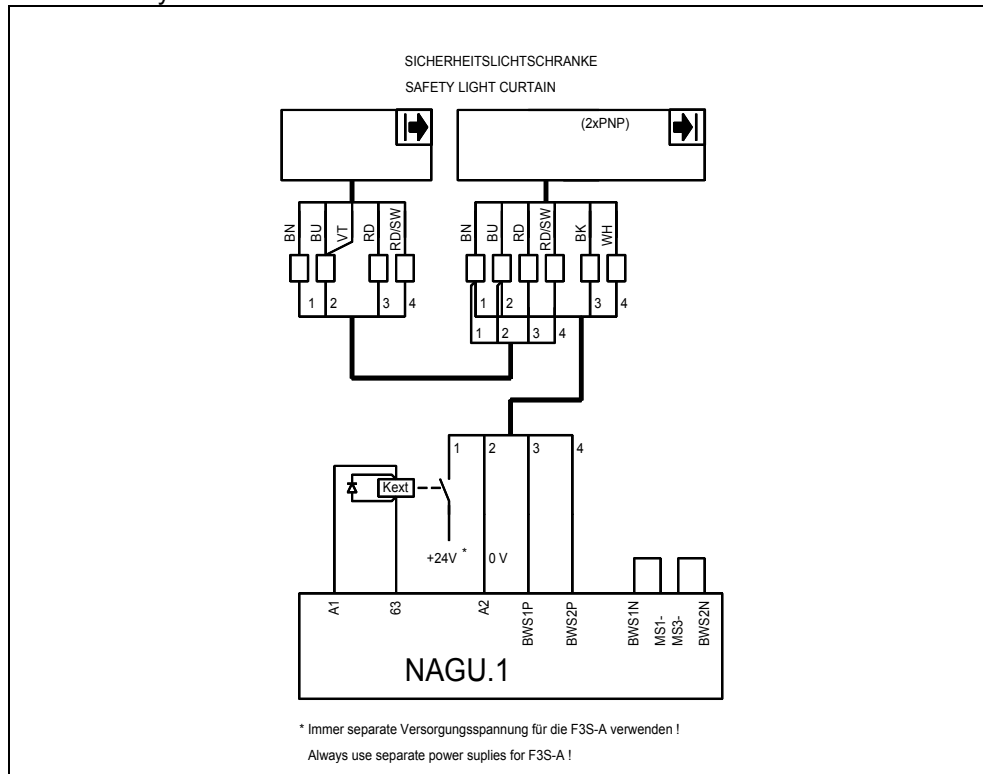


Leuze PRK525 with muting controller RS-NAGU.1
Tested: January 2004



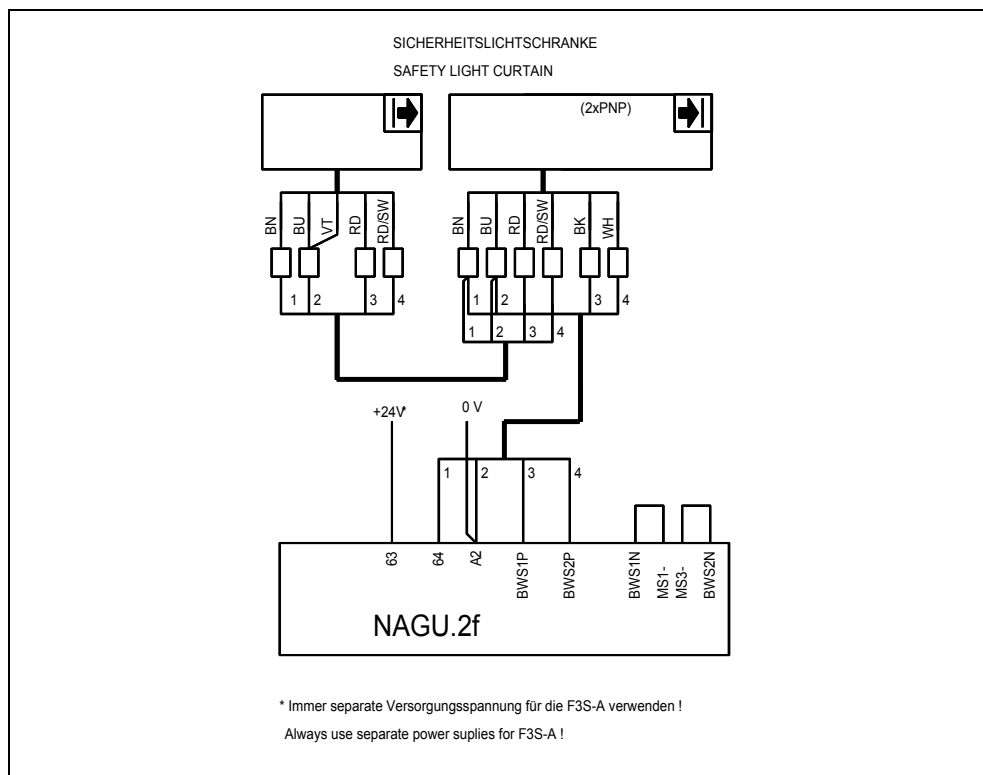
Omron F3S-A with muting controller RS-NAGU / RS-NAGU.1 (semiconductor outputs)

Tested: May 1999



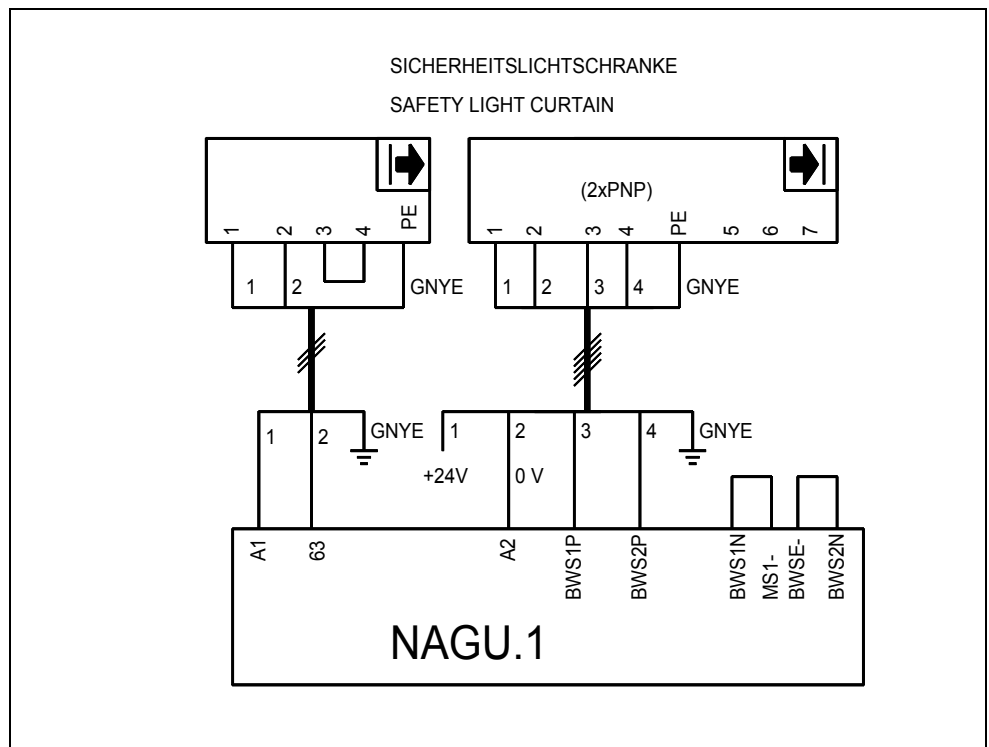
Omron F3S-A with muting controller RS-NAGU.2f (relay outputs)

Tested: May 1999



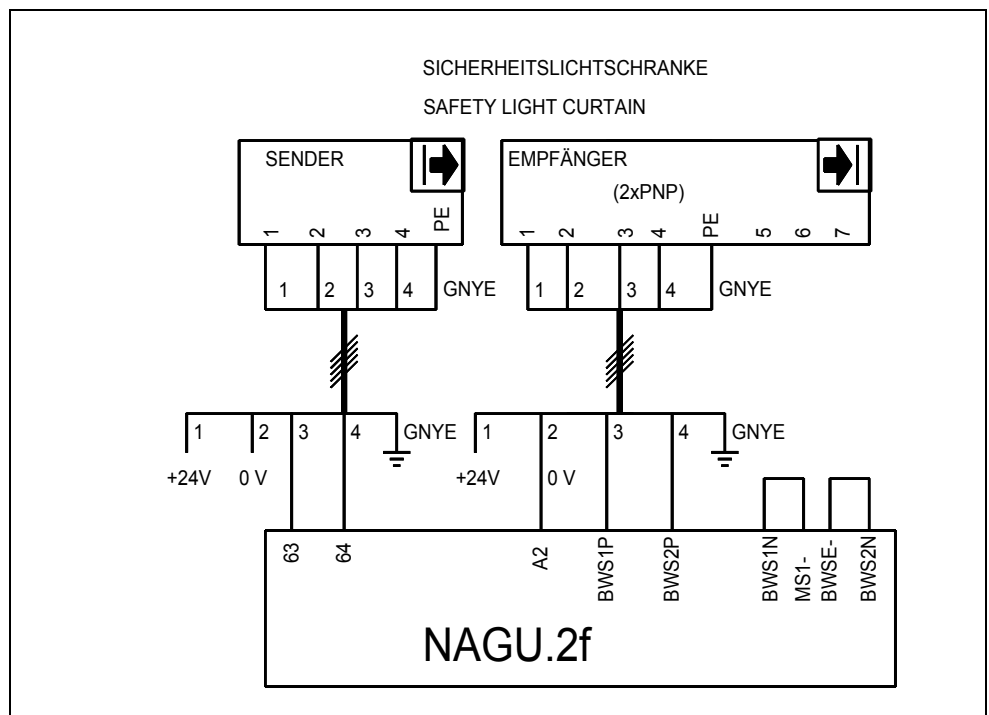
Cedes Safe 4 with muting controller RS-NAGU / RS-NAGU.1 (semiconductor outputs)

Tested: November 1999

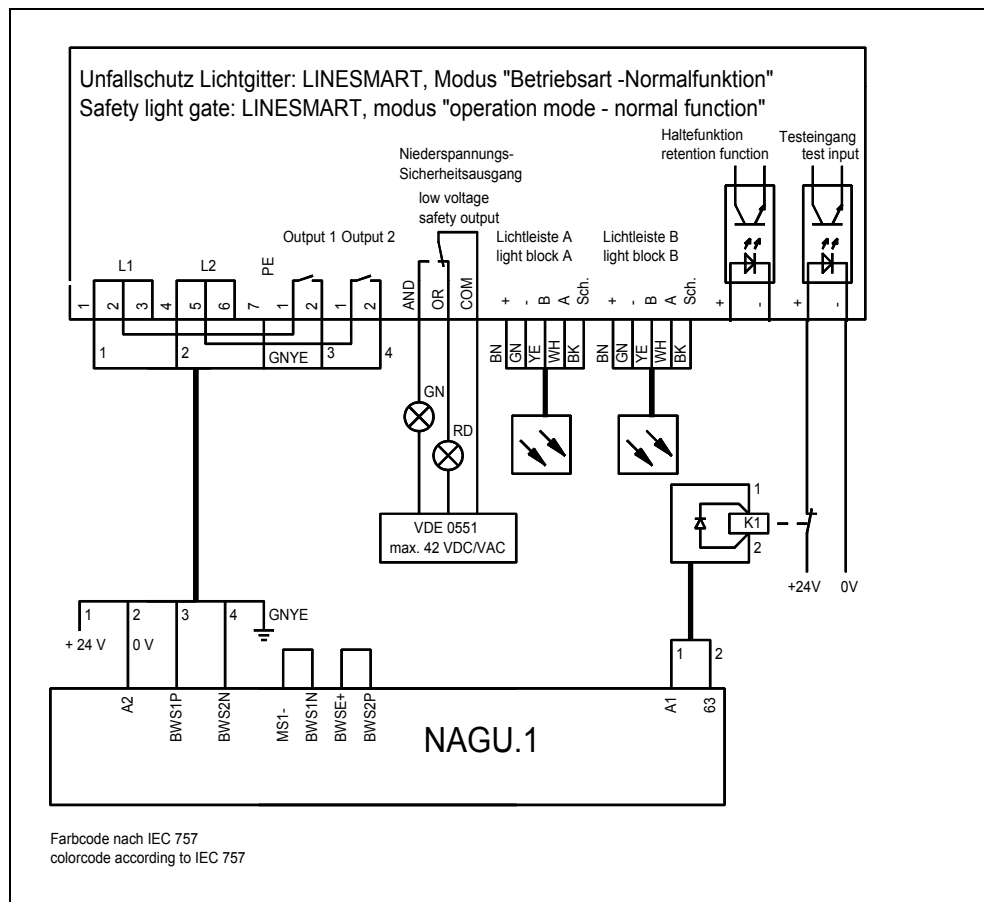


Cedes Safe 4 with muting controller RS-NAGU.2f (relay outputs)

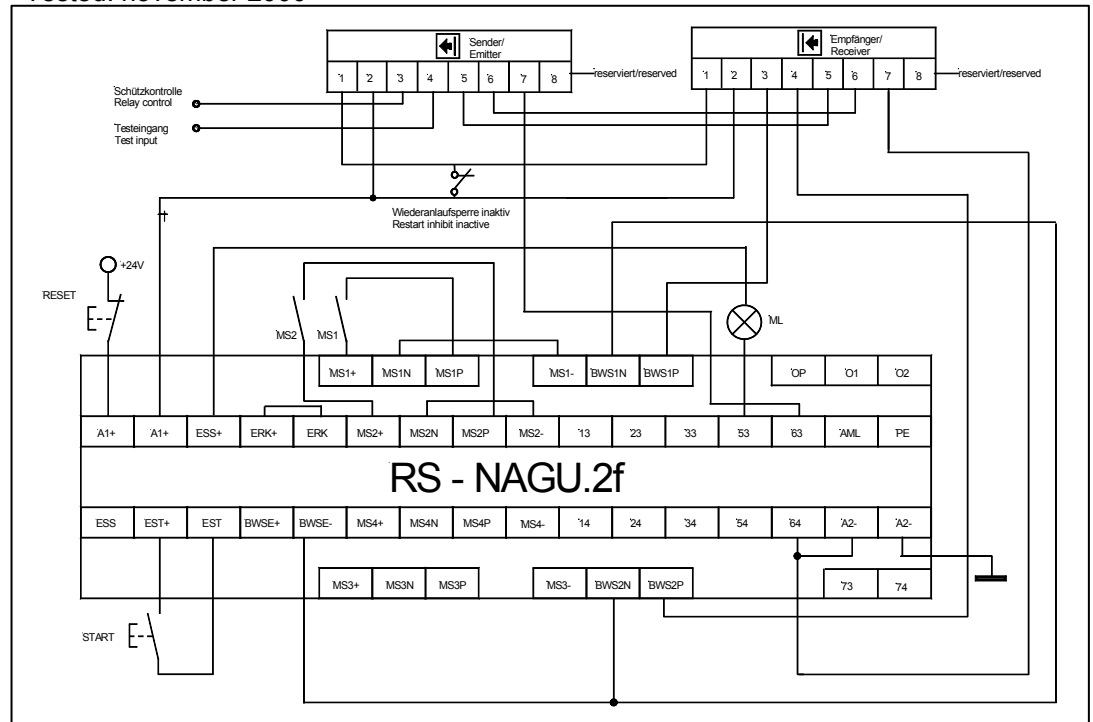
Tested: November 1999



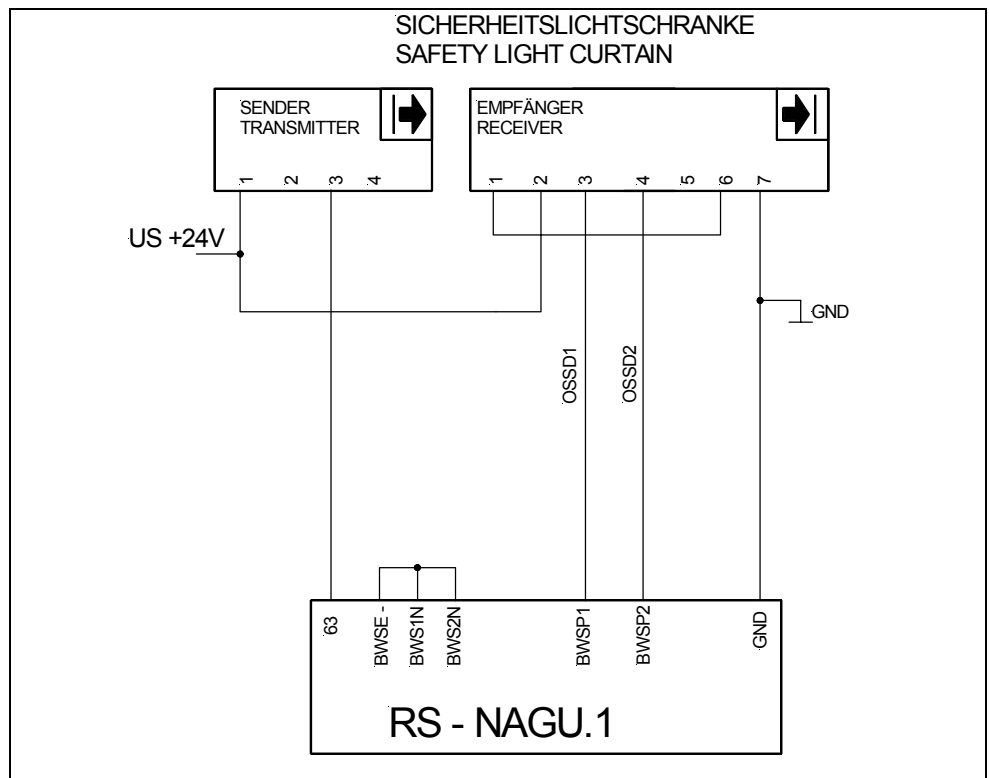
Ines Linesmart light gate with muting controller RS-NAGU / RS-NAGU.1
 (semiconductor outputs)
 Tested: July 1997



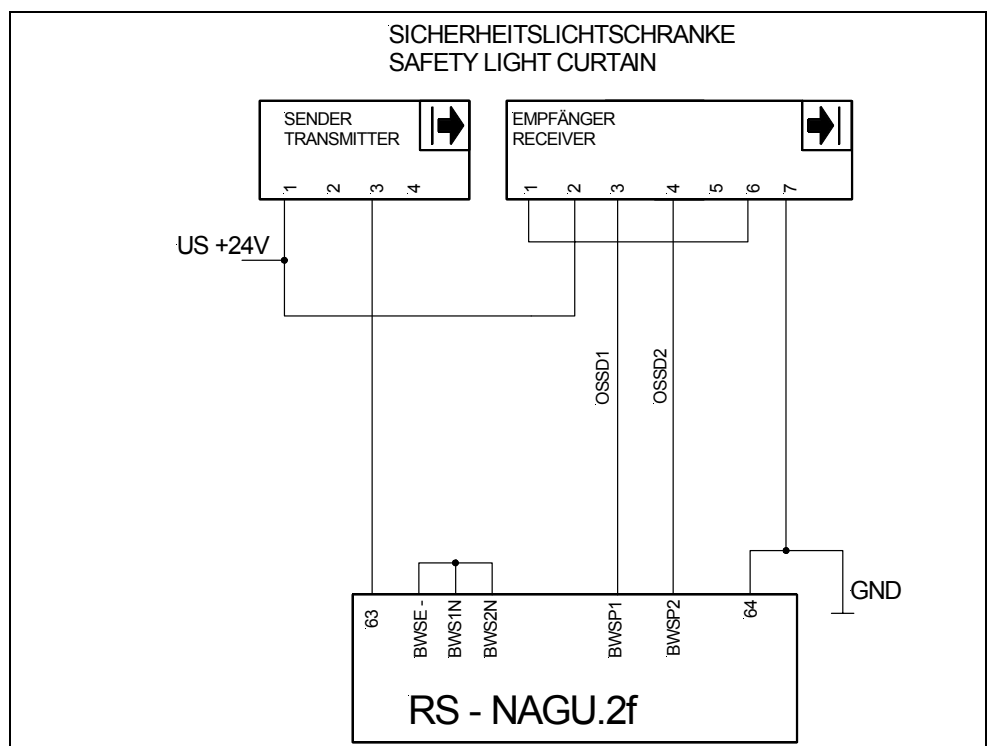
Ines Alfa II with muting controller RS-NAGU2f (relay outputs)
 Tested: november 2000



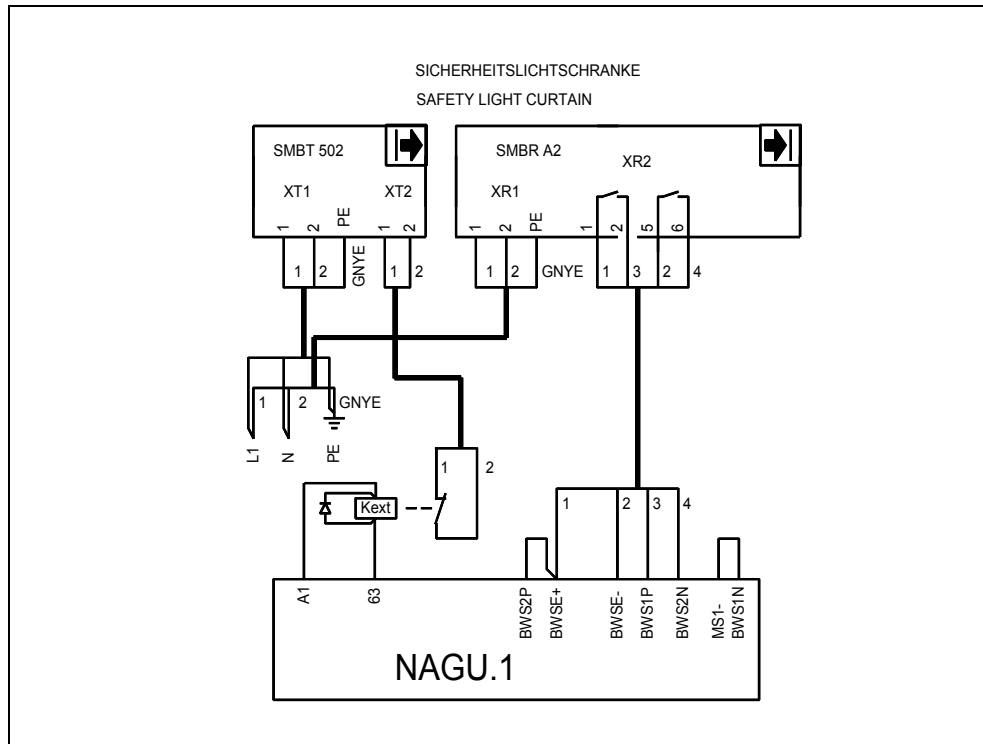
Ines Alfa 4 safety light curtain with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: October 2003



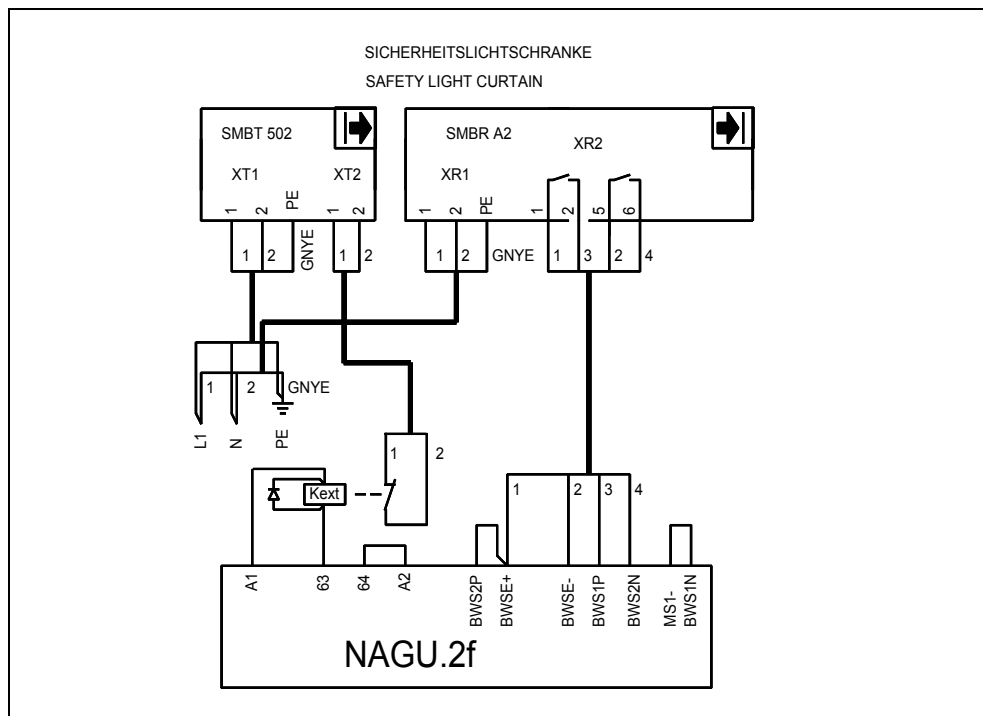
Ines Alfa 4 safety light curtain with muting controller RS-NAGU2f (relay outputs)
Tested: october 2003



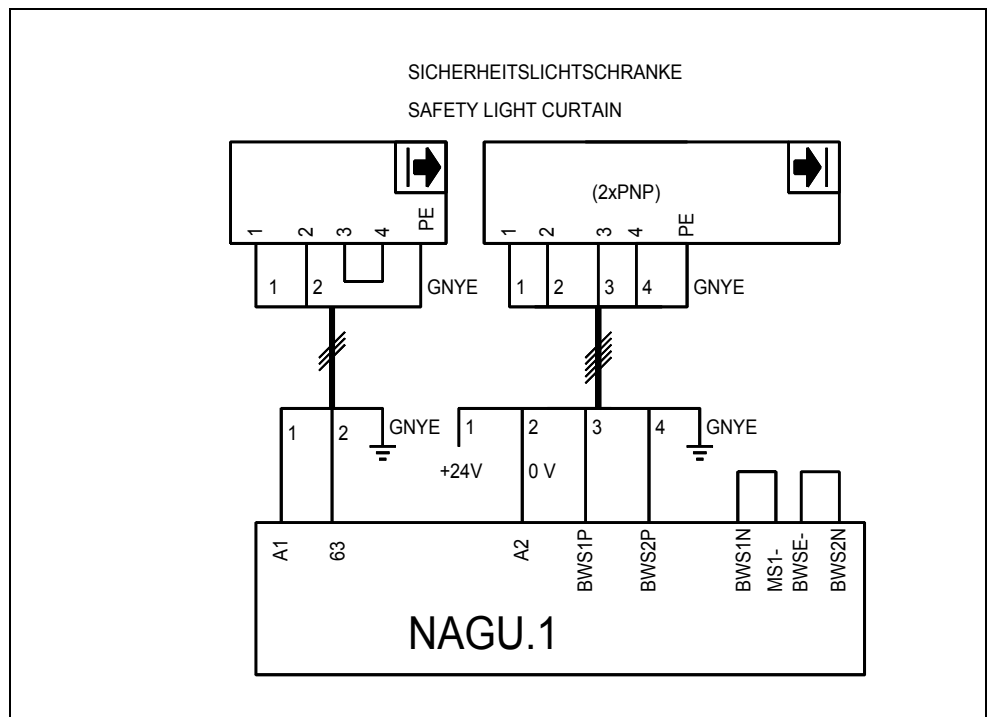
Jay SMBT/SMBR with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: February 1998



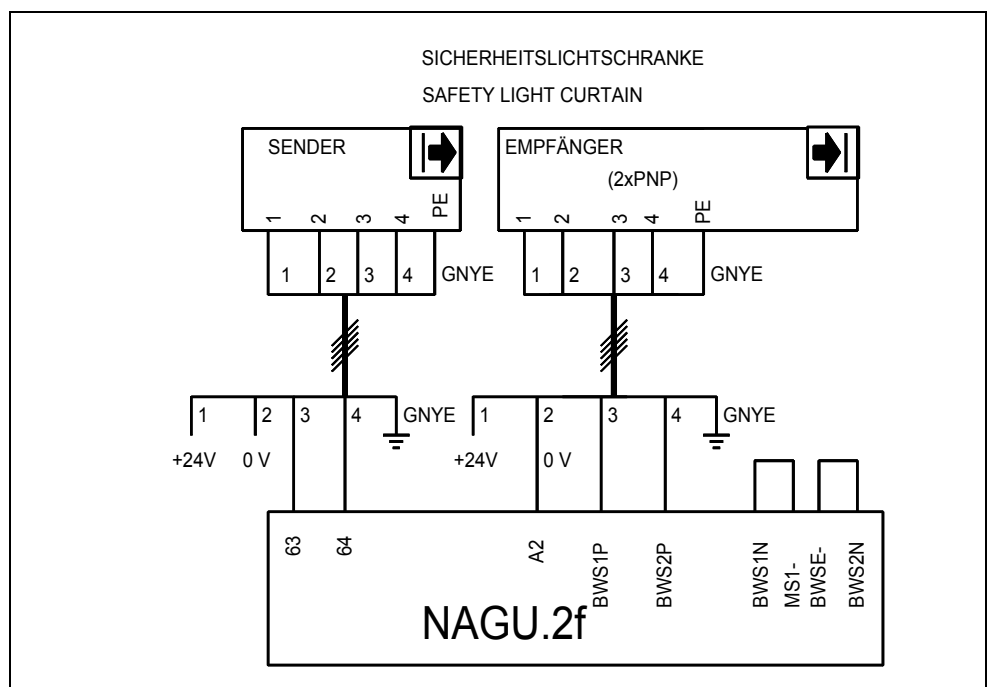
Jay SMBT/SMBR with muting controller RS-NAGU.2f (relay outputs)
Tested: February 1998



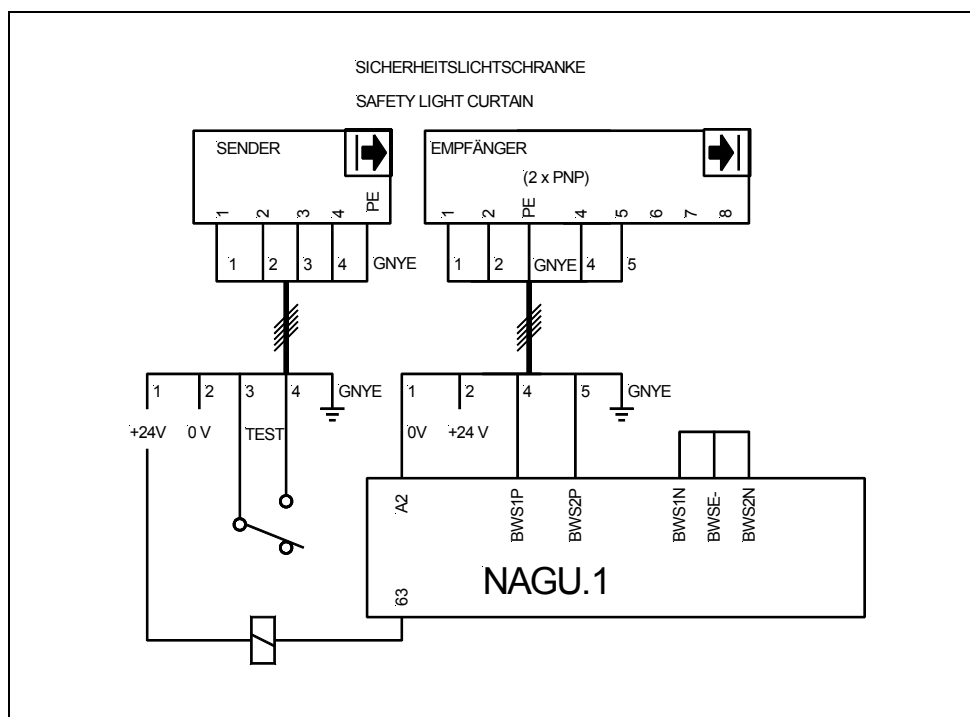
Guardscan B0214 with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: November 1999



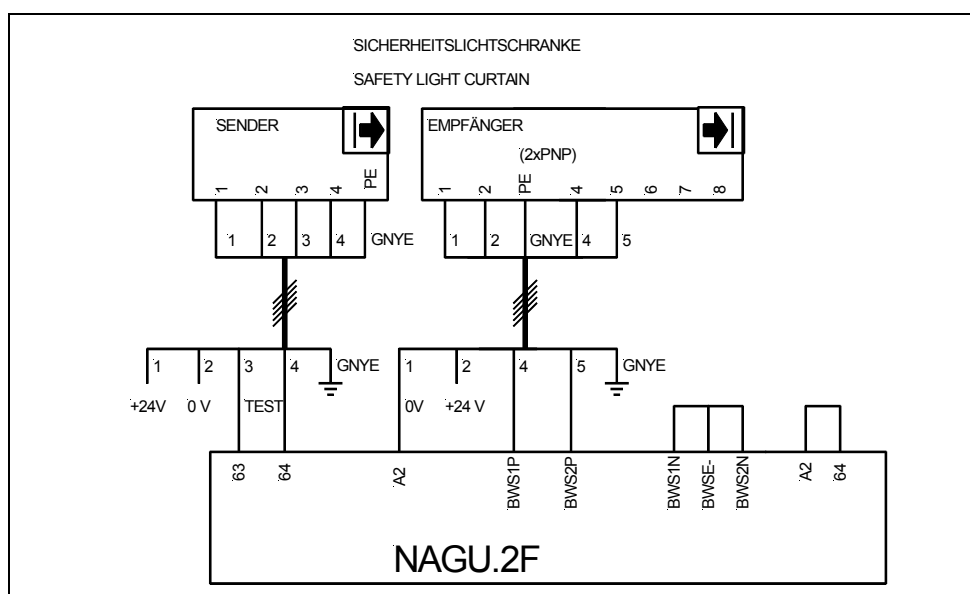
Guardscan B0214 with muting controller RS-NAGU.2f (relay outputs)
Tested: November 1999



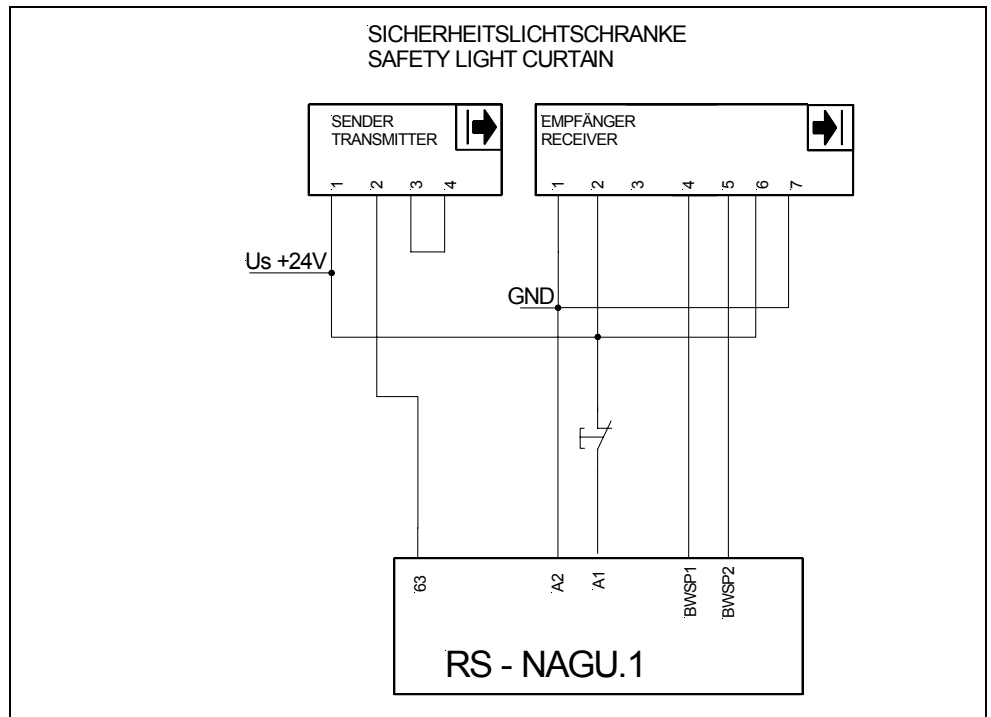
Guardscan – T Series with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: Juni 2001



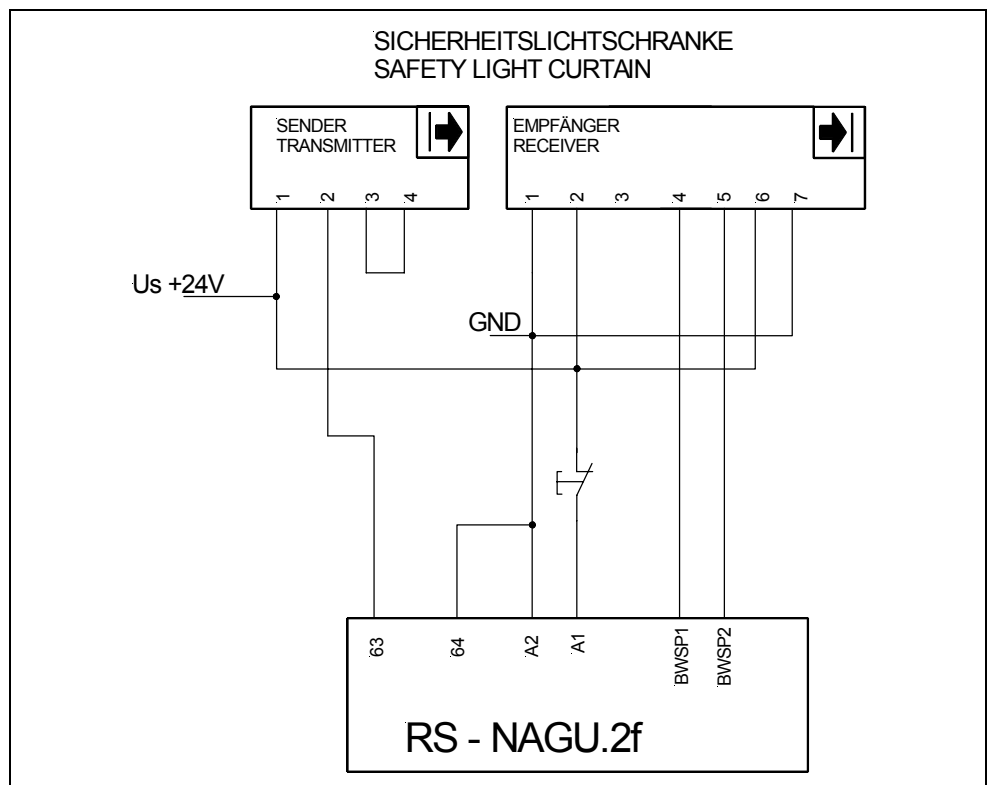
Guardscan – T Series with muting controller RS-NAGU.2f (relay outputs)
Tested: Juni 2001



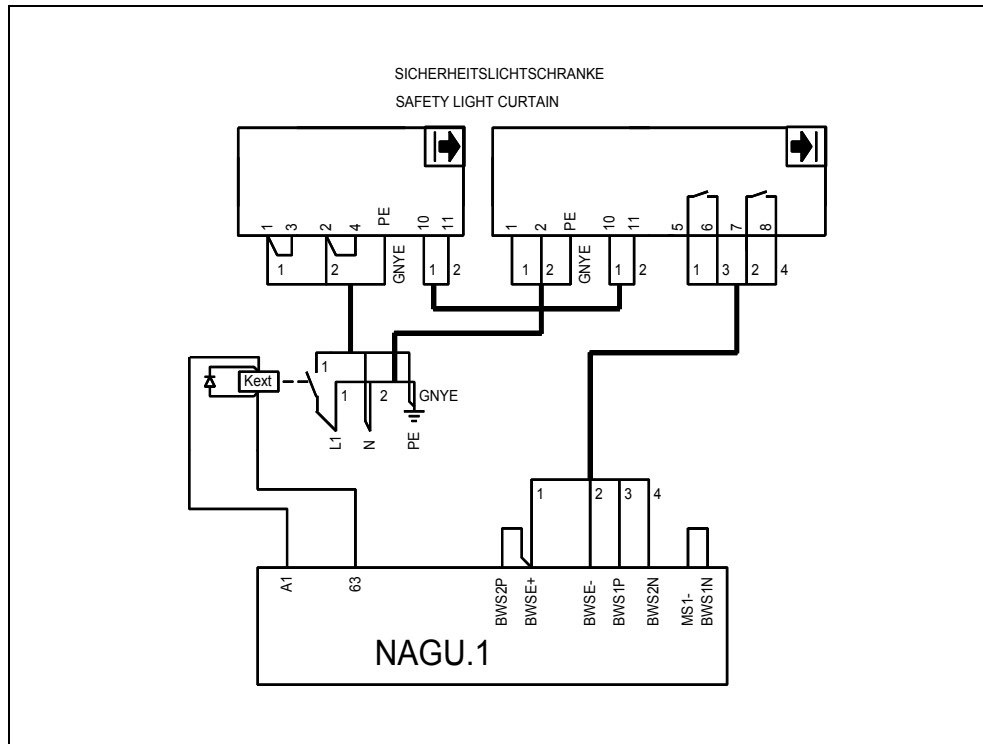
Guardscan GS120 with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: October 2003



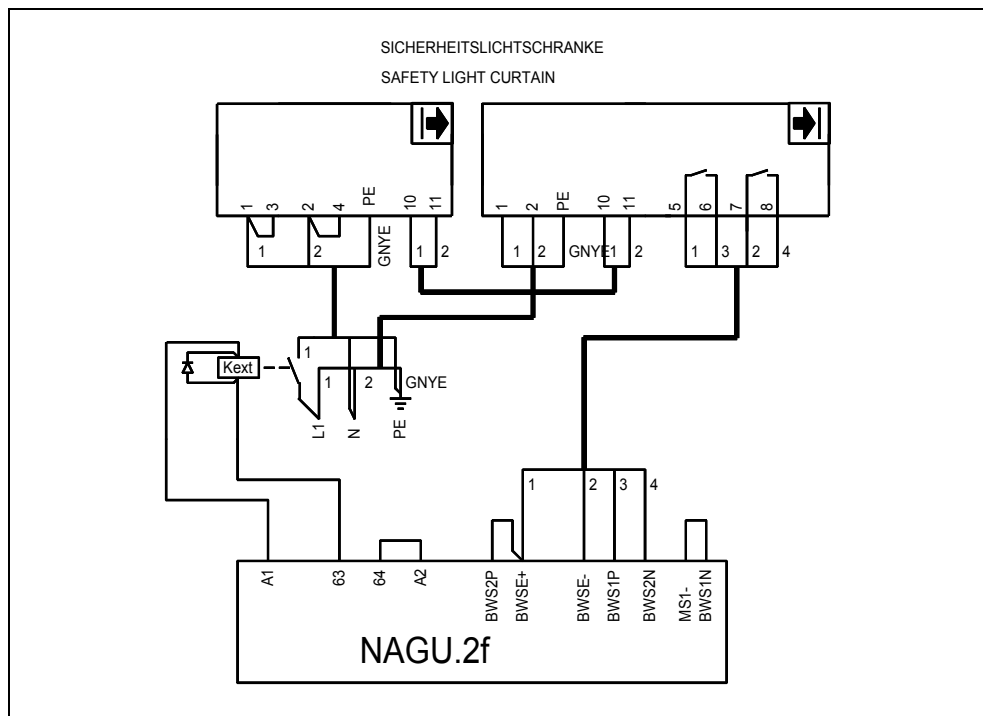
Guardscan GS120 with muting controller RS-NAGU.2f (relay outputs)
Tested: October 2003



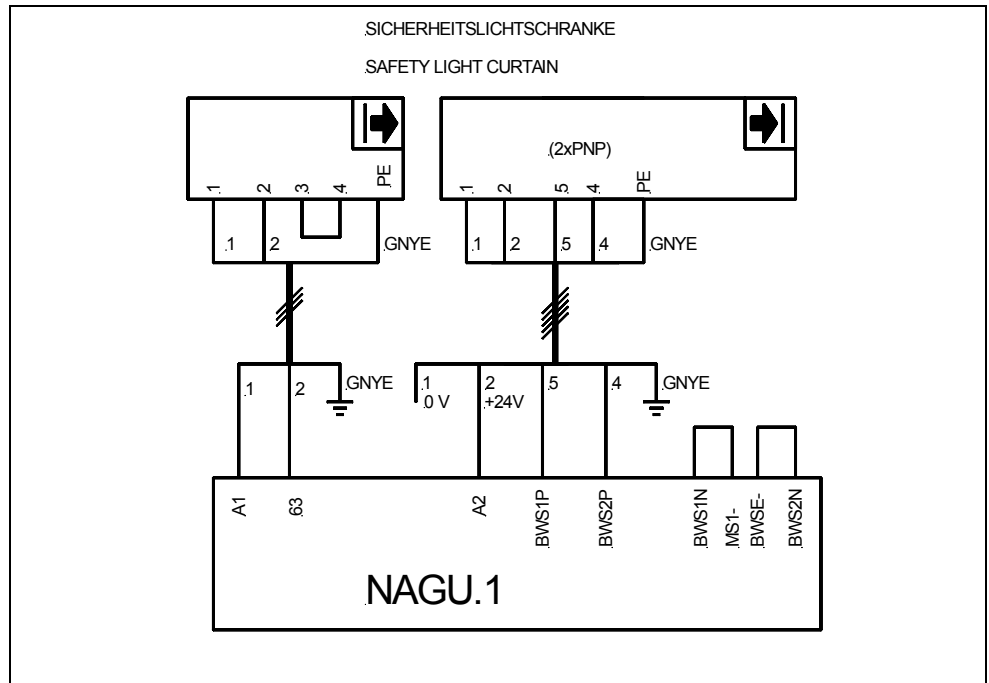
Pauly PP2126/2 with muting controller RS-NAGU / RS-NAGU.1
 (semiconductor outputs)
 Tested: March 1998



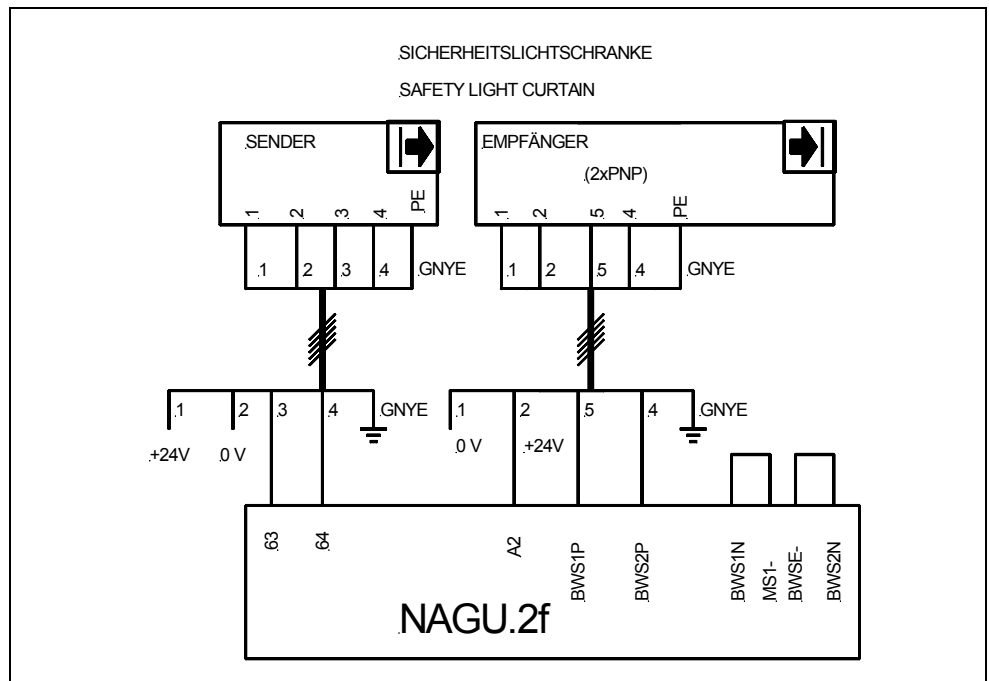
Pauly PP2126/2 with muting controller RS-NAGU.2f (relay outputs)
 Tested: March 1998



Siemens 3RG7812 with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: November 1999

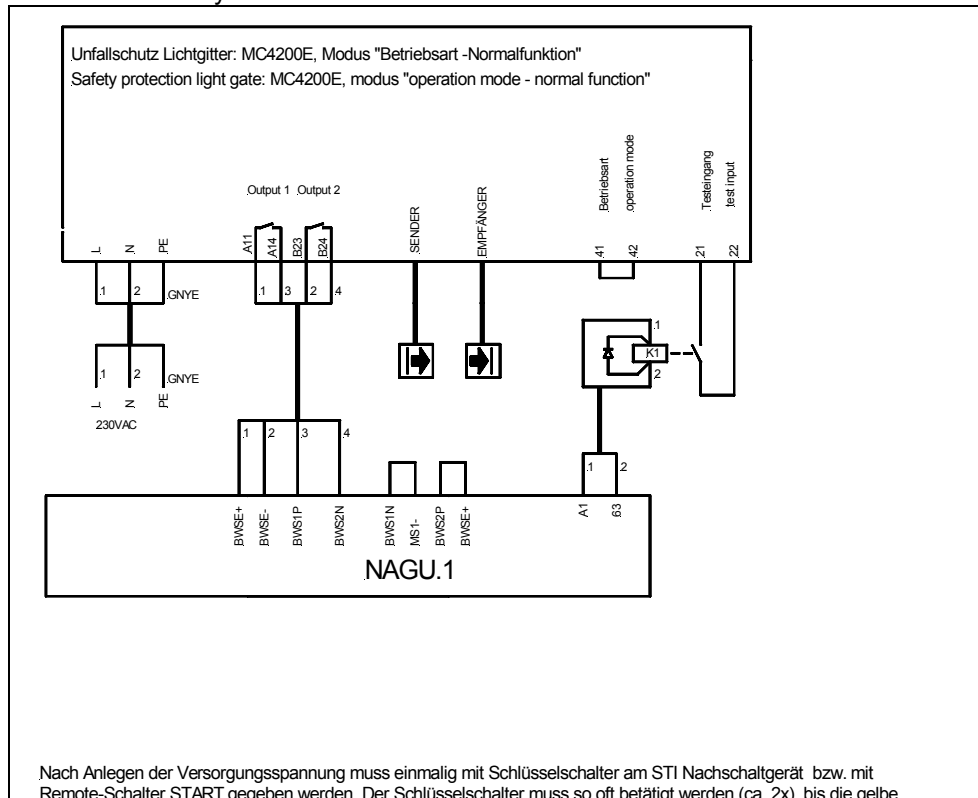


Siemens 3RG7812 with muting controller RS-NAGU.2f (relay outputs)
Tested: November 1999



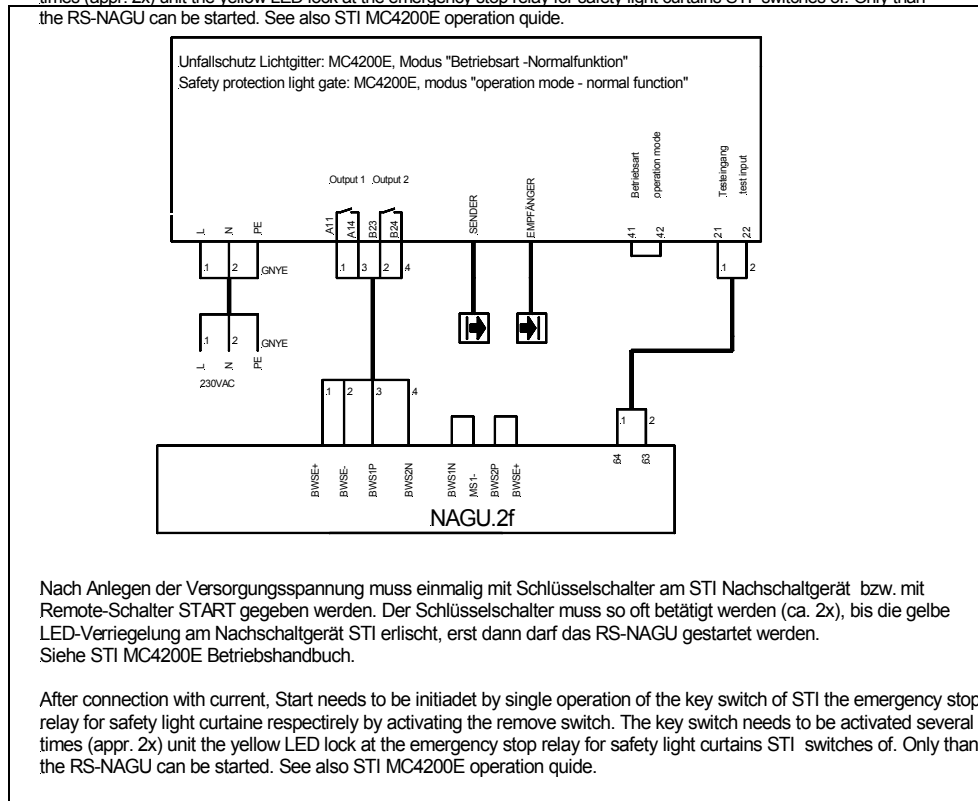
STI MC4200E with muting controller RS-NAGU / RS-NAGU.1 (semiconductor outputs)

Tested: February 1998

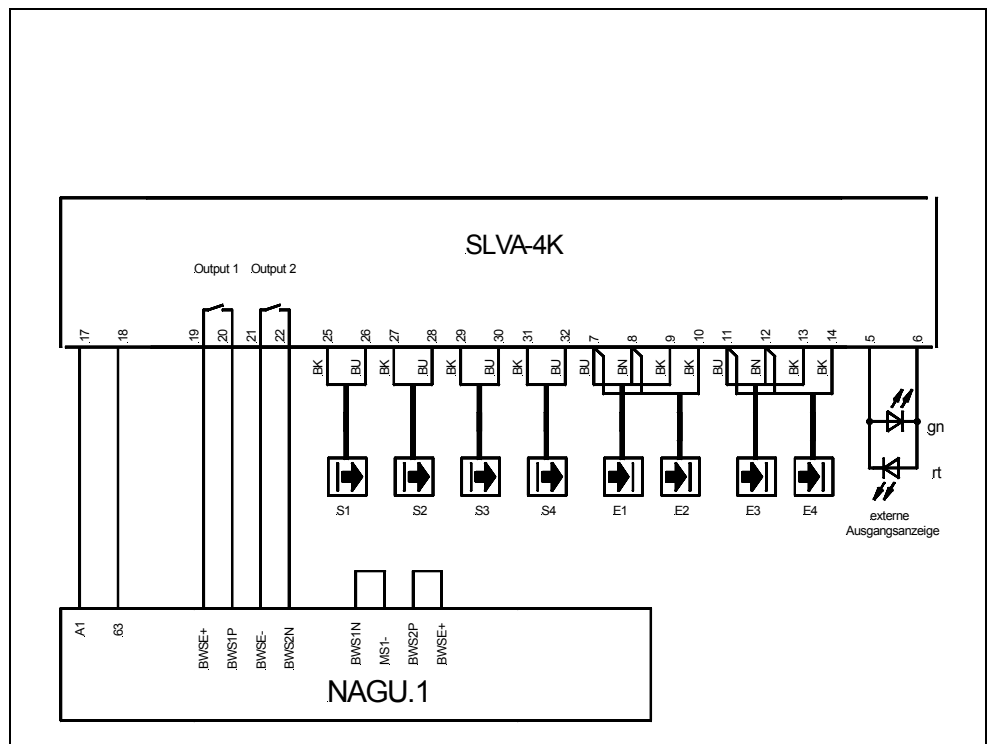


STI MC4200E with muting controller RS-NAGU.2f (relay outputs)

Tested: February 1998
After connection with current, Start needs to be initiated by single operation of the key switch of STI the emergency stop relay for safety light curtains respectively by activating the remove switch. The key switch needs to be activated several times (appr. 2x) until the yellow LED lock at the emergency stop relay for safety light curtains STI switches of. Only then the RS-NAGU can be started. See also STI MC4200E operation guide.

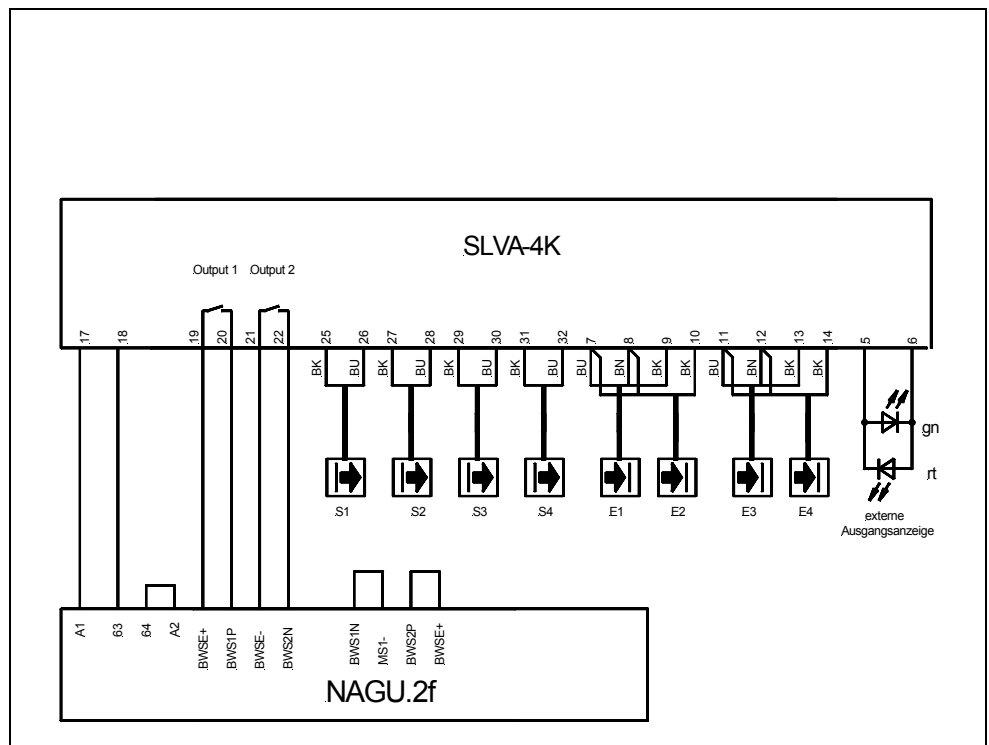


Visolux SLVA-4K with muting controller RS-NAGU.1
 (semiconductor outputs)
 Tested: November 1997



nicht benutzte Sensoreingänge müssen gebrückt werden; z.B.: / unused sensor inlets need to be bridged:
 E4: 31-14 or E3: 29-13 or E2: 27-10 or E1: 25-9

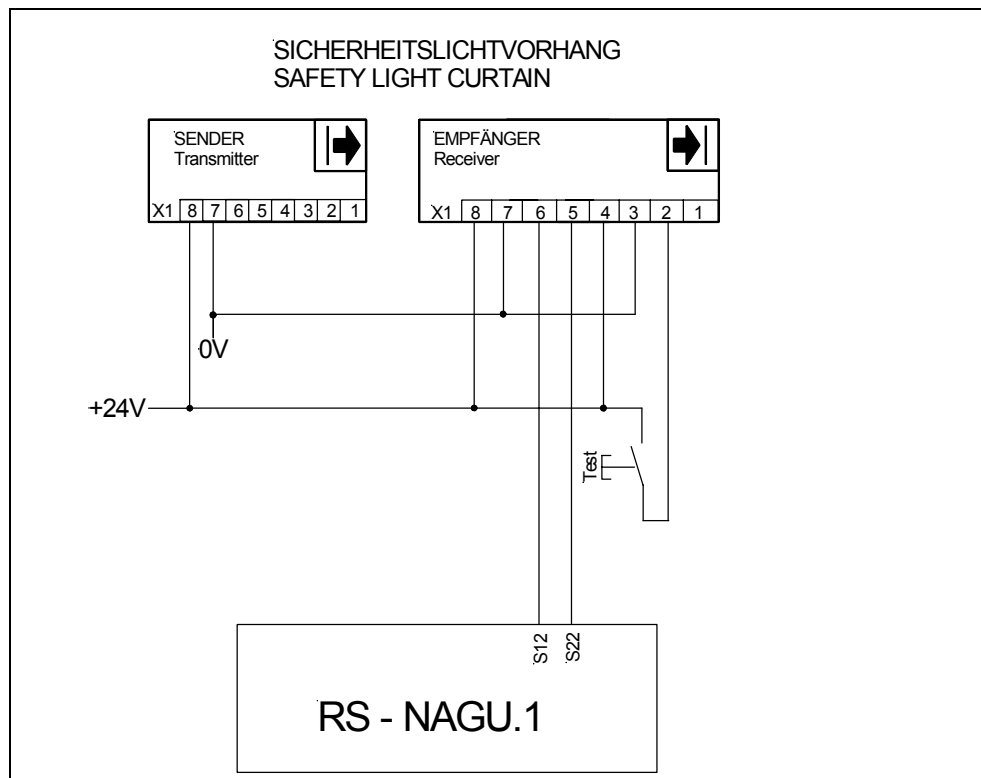
Visolux SLVA-4K with muting controller RS-NAGU.2f (relay outputs)
 Tested: November 1997
 Betriebsart: ohne Anlauf-/Wiederanlaufssperre / operations mode: without start / restart lock
 Keine Funktion Schützkontrolle / No funktion connector control.



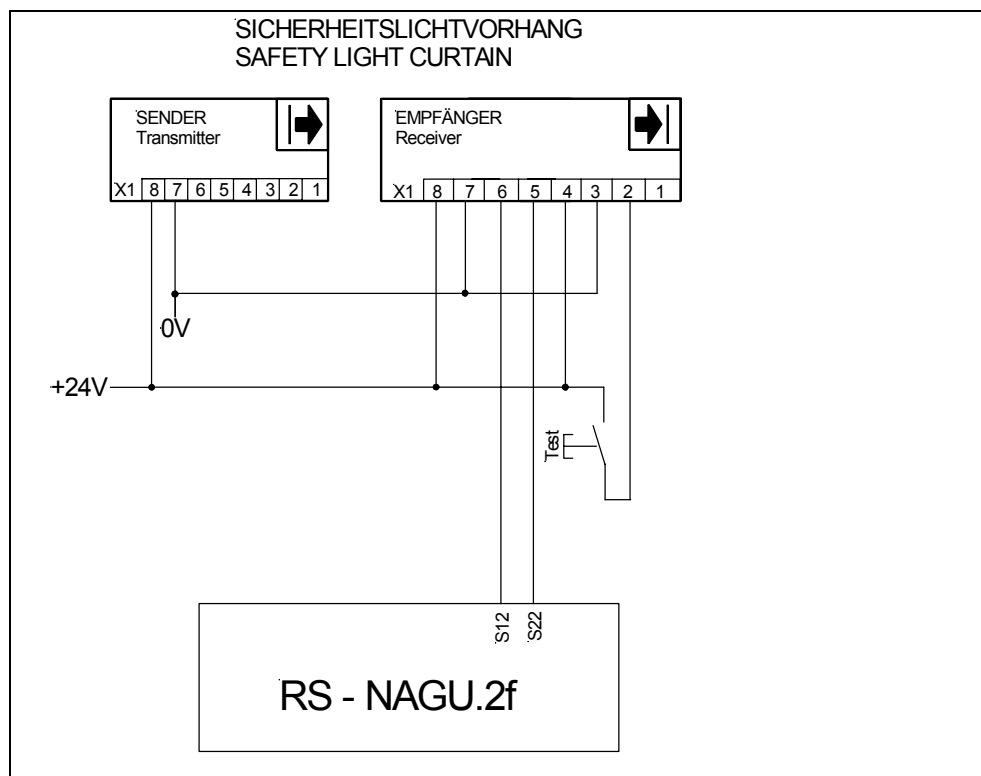
nicht benutzte Sensoreingänge müssen gebrückt werden; z.B.: / unused sensor inlets need to be bridged:
 E4: 31-14 or E3: 29-13 or E2: 27-10 or E1: 25-9

alle DIP-Schalter intern auf Null stellen / set all DIP switches to "0"
 Betriebsart: ohne Anlauf-/Wiederanlaufssperre / operations mode: without start / restart lock
 Keine Funktion Schützkontrolle / No funktion connector control.

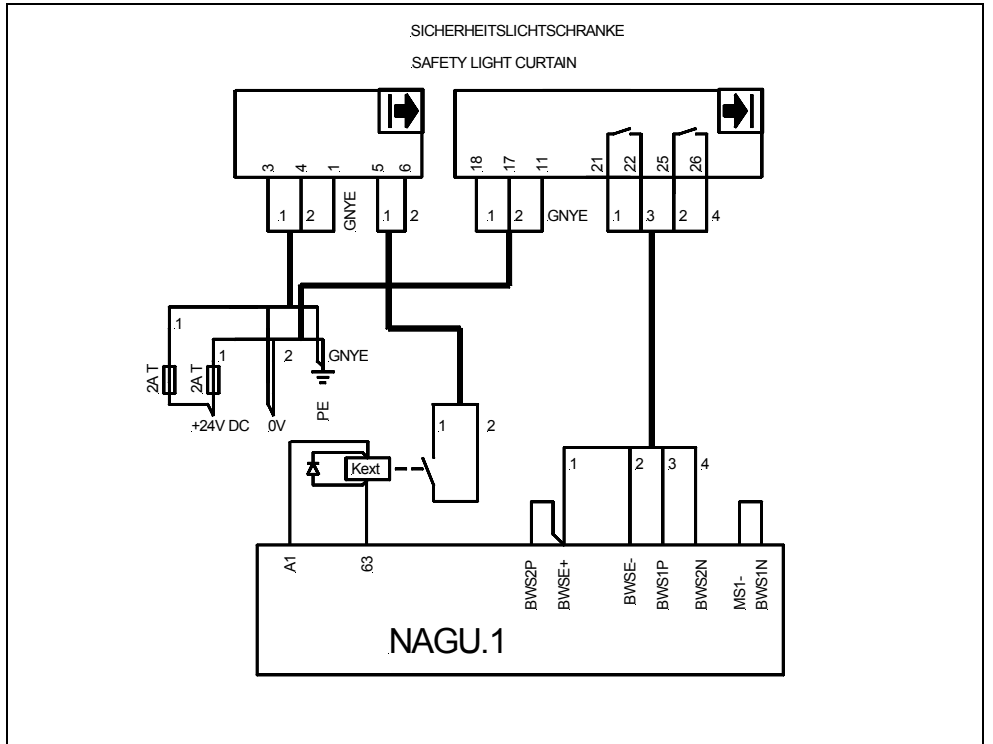
Visolux SCL 14-150 with muting controller RS-NAGU.1
(semiconductor outputs)
Tested: May 2004



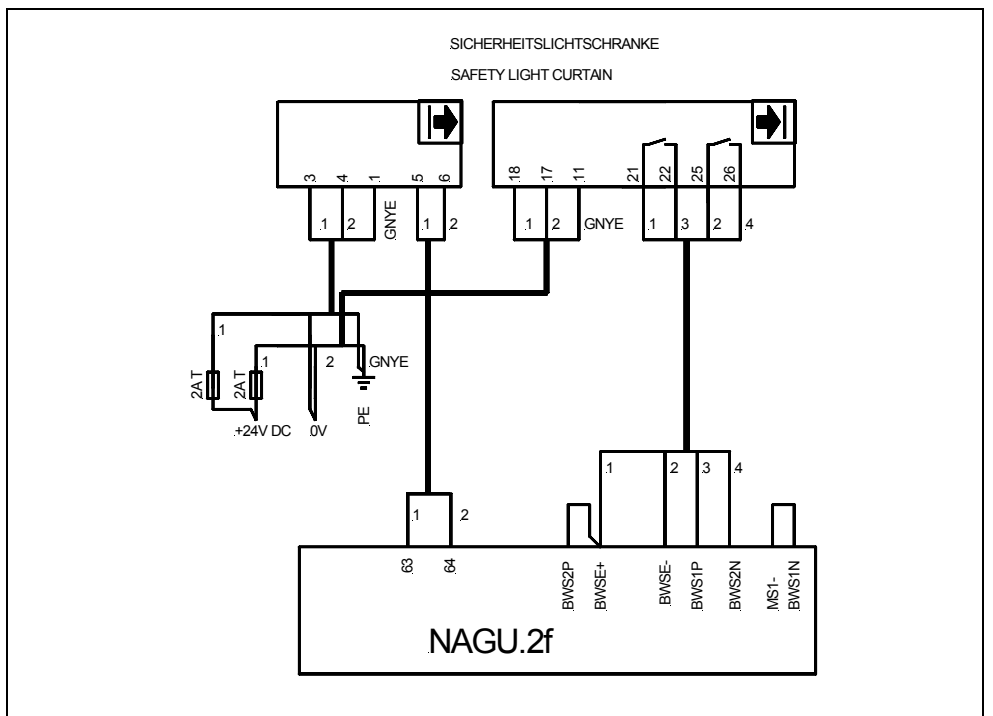
Visolux SCL 14-150 with muting controller RS-NAGU.2f (relay outputs)
Tested: May 2004



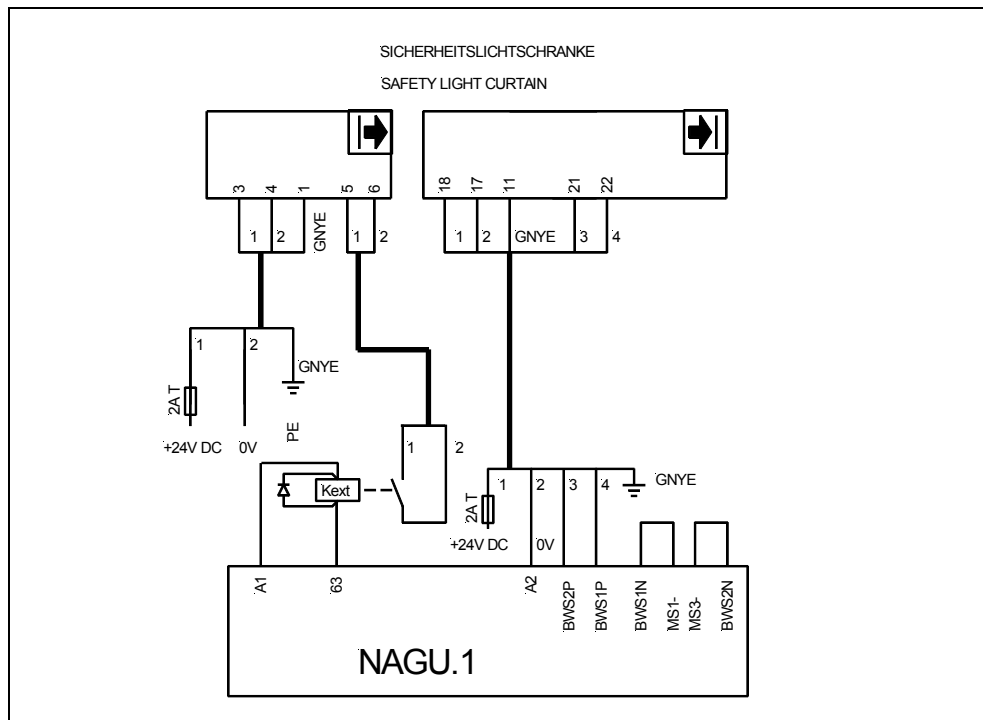
Schneider XUSLA with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: November 1999



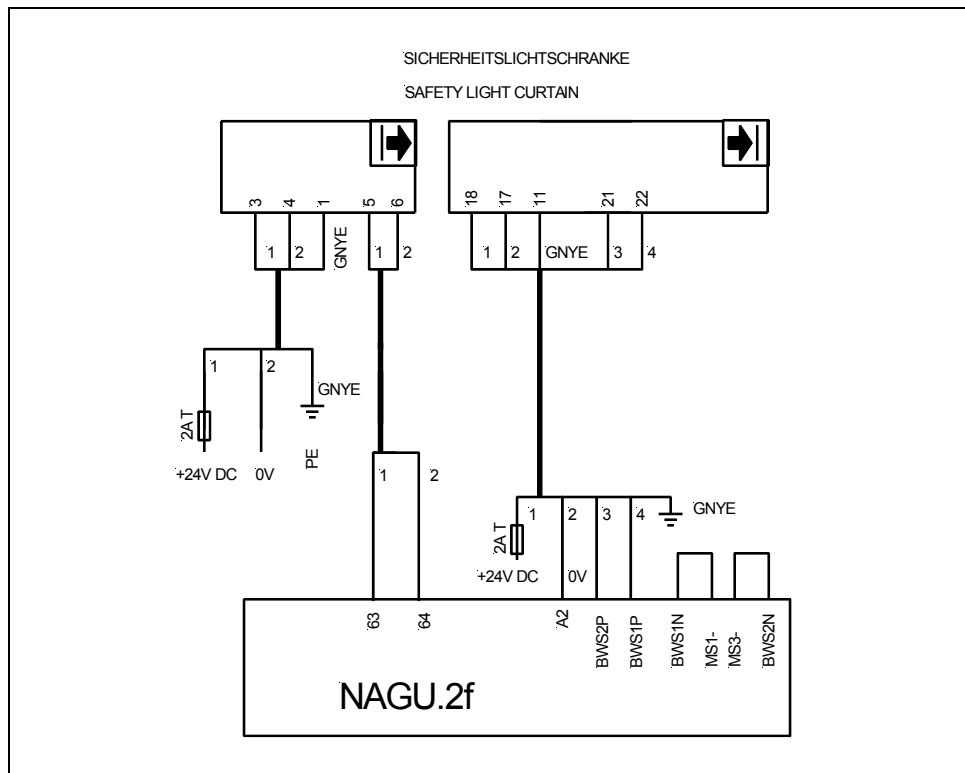
Schneider XUSLA with muting controller RS-NAGU.2f (relay outputs)
Tested: November 1999



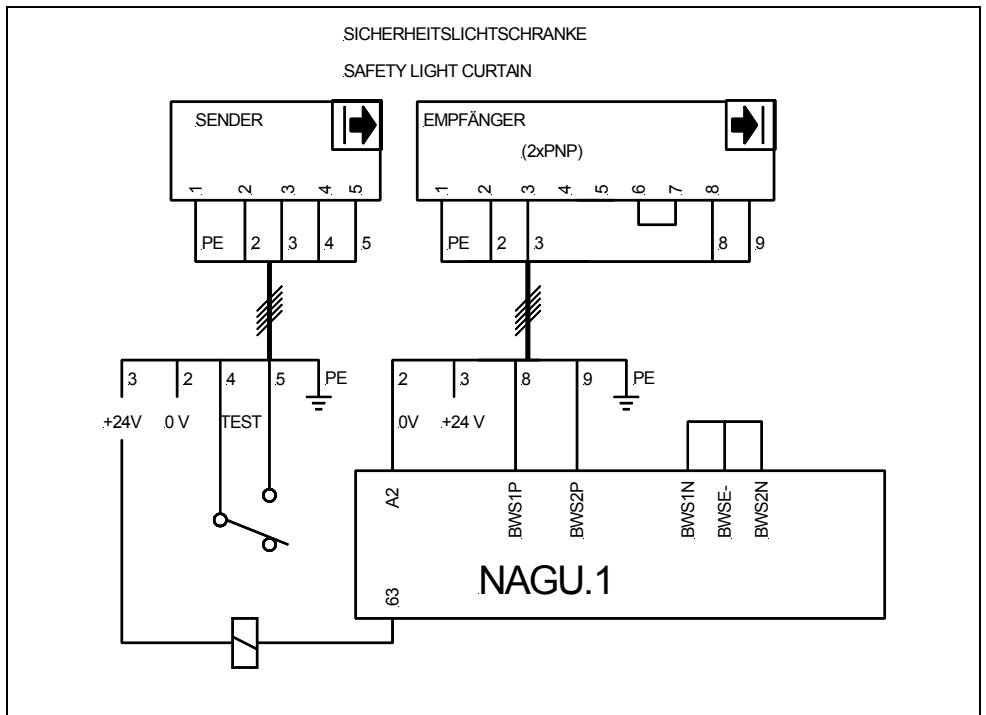
Schneider XUSLC Serie with muting controller RS-NAGU.1
(semiconductor outputs)
Tested: October 2001



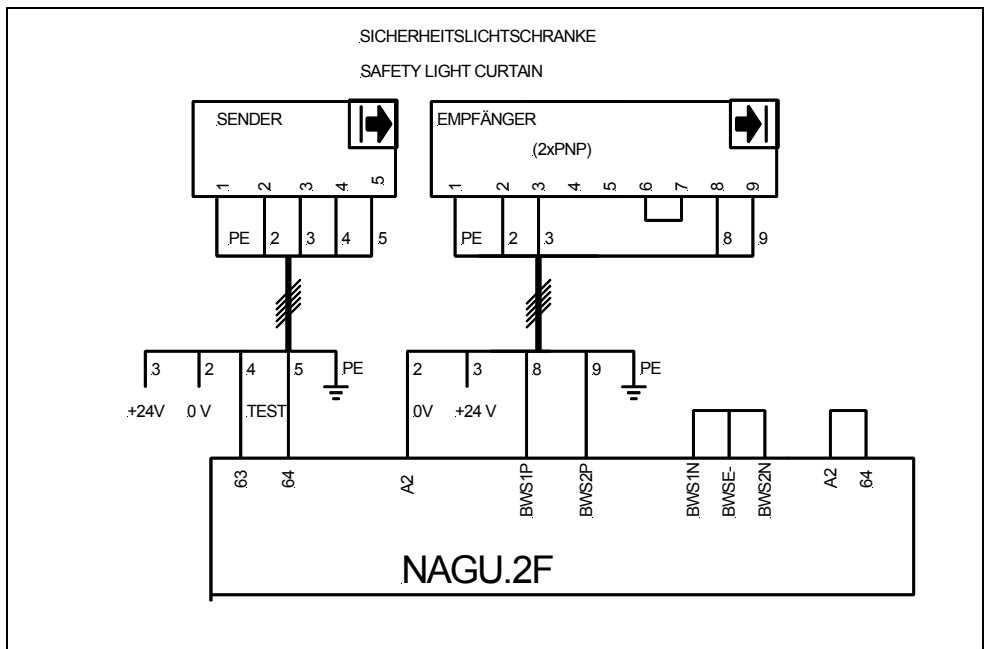
Schneider XUSLC Serie with muting controller RS-NAGU.2f (relay outputs)
Tested: Oktober 2001



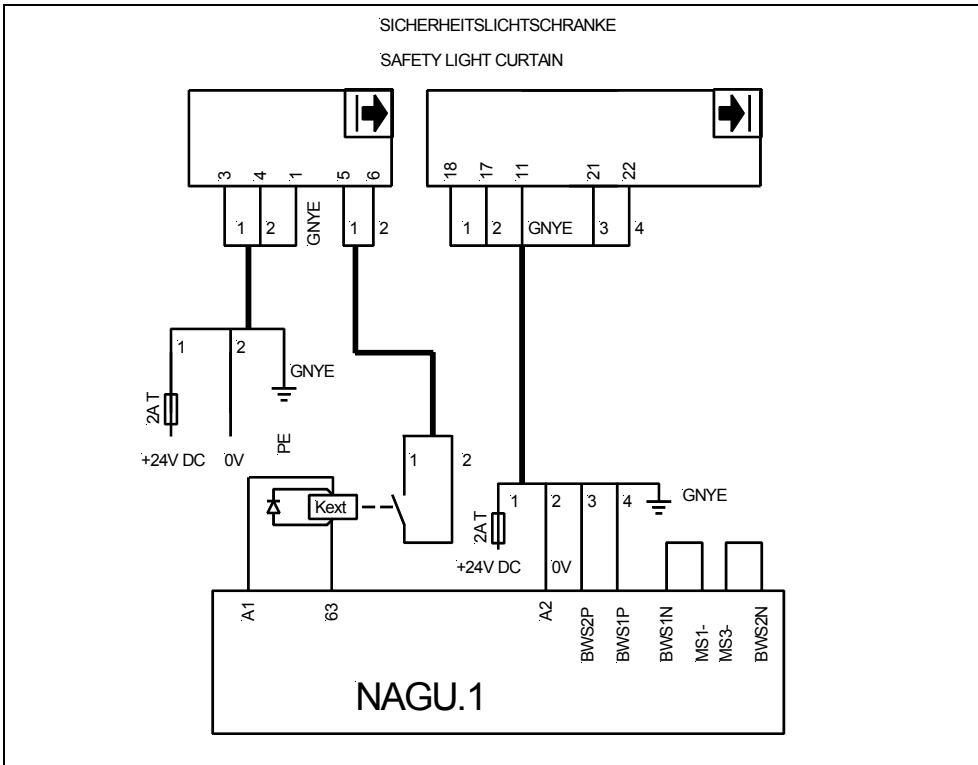
Banner SGP3 Serie with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: Oktober 2001



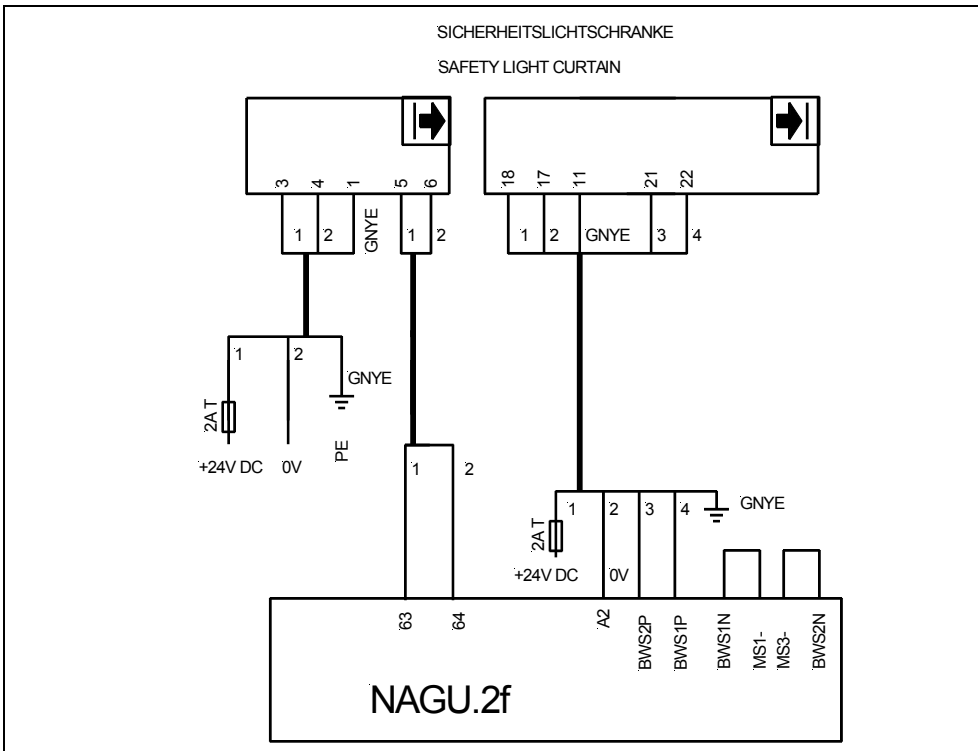
Banner SGP3 Serie with muting controller RS-NAGU.2f (relay outputs)
Tested: Oktober 2001



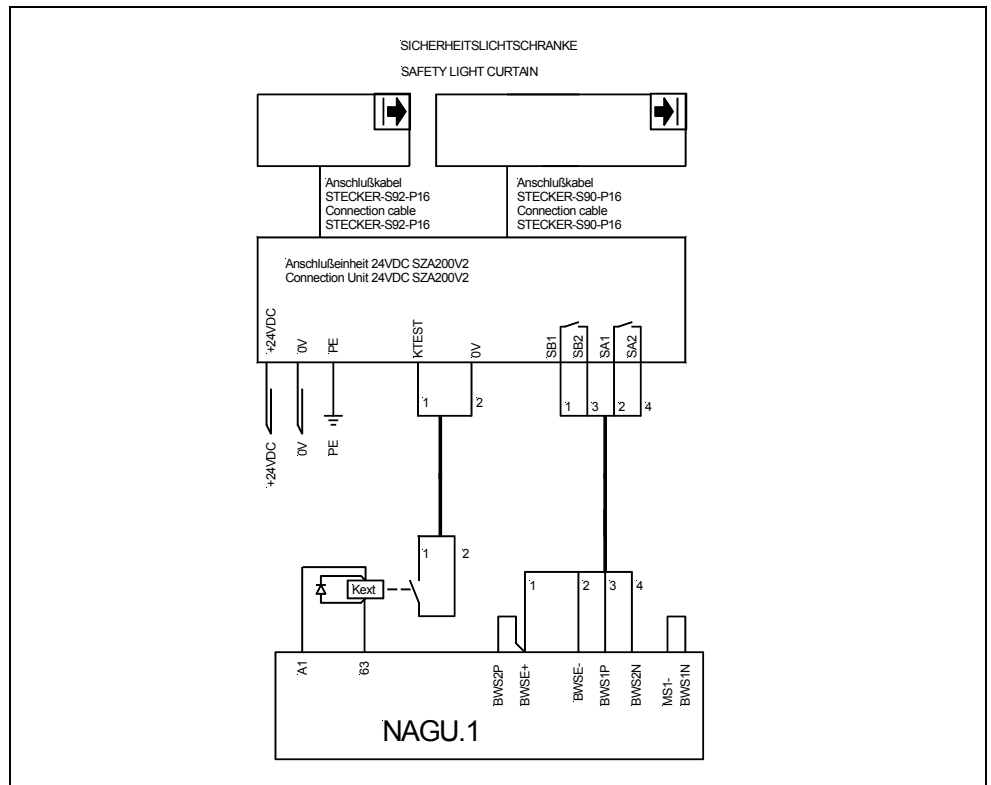
Tested: Oktober 2000



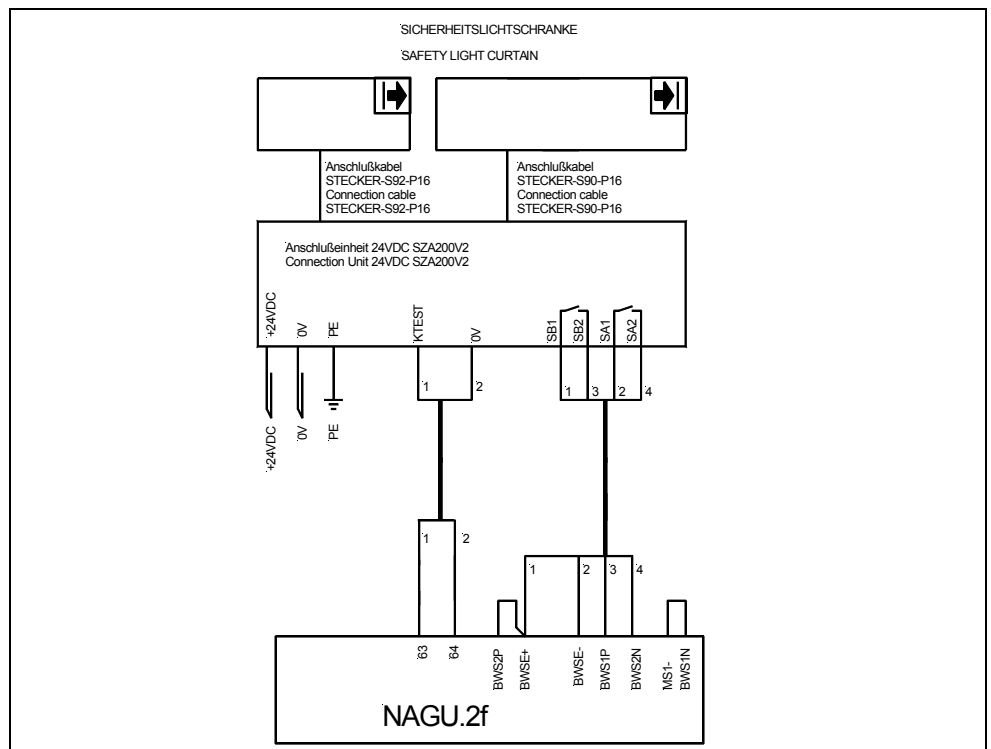
Tested: Oktober 2000



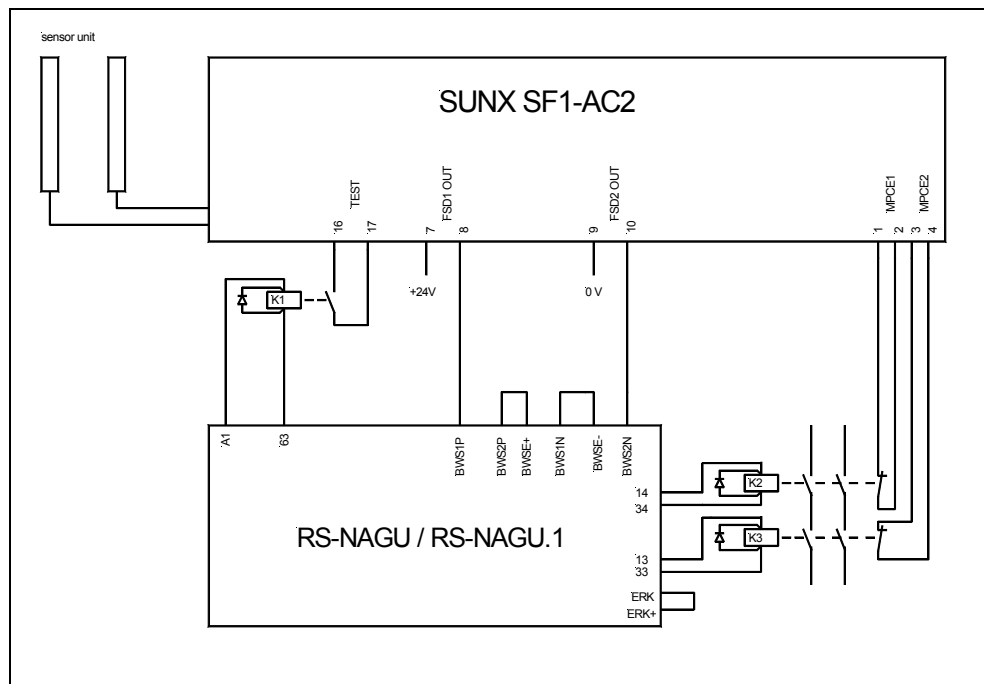
Wenglor SSG/SEG280V2 with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: August 2000



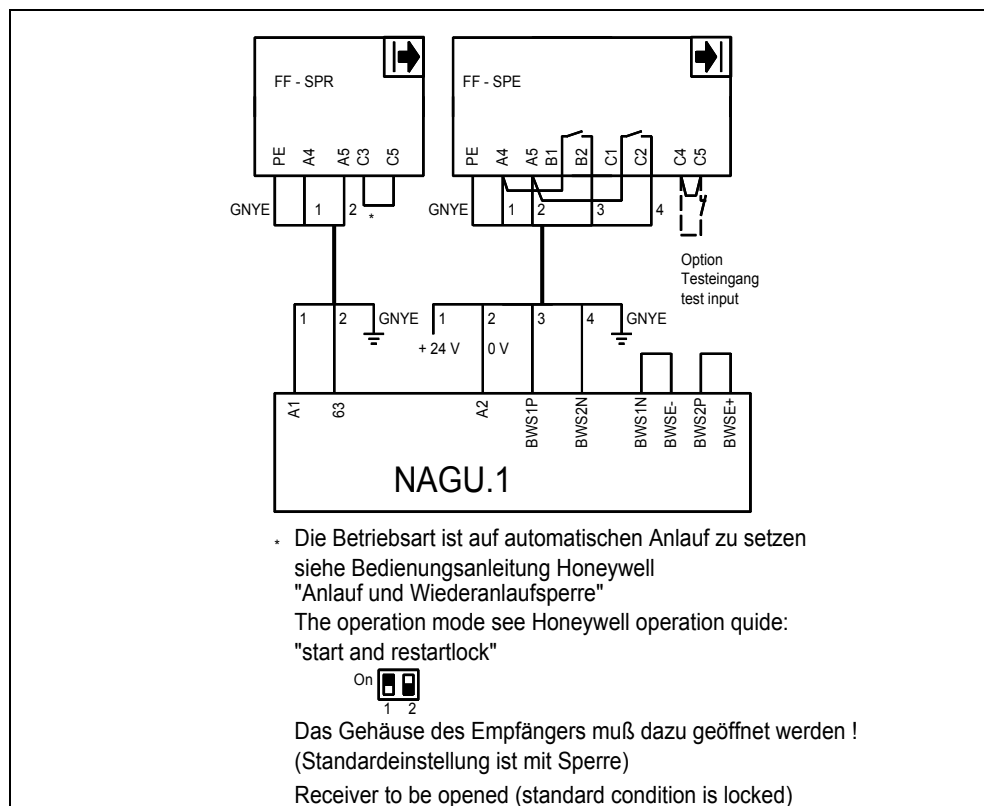
Wenglor SSG/SEG280V2 with muting controller RS-NAGU.2f (relay outputs)
Tested: August 2000



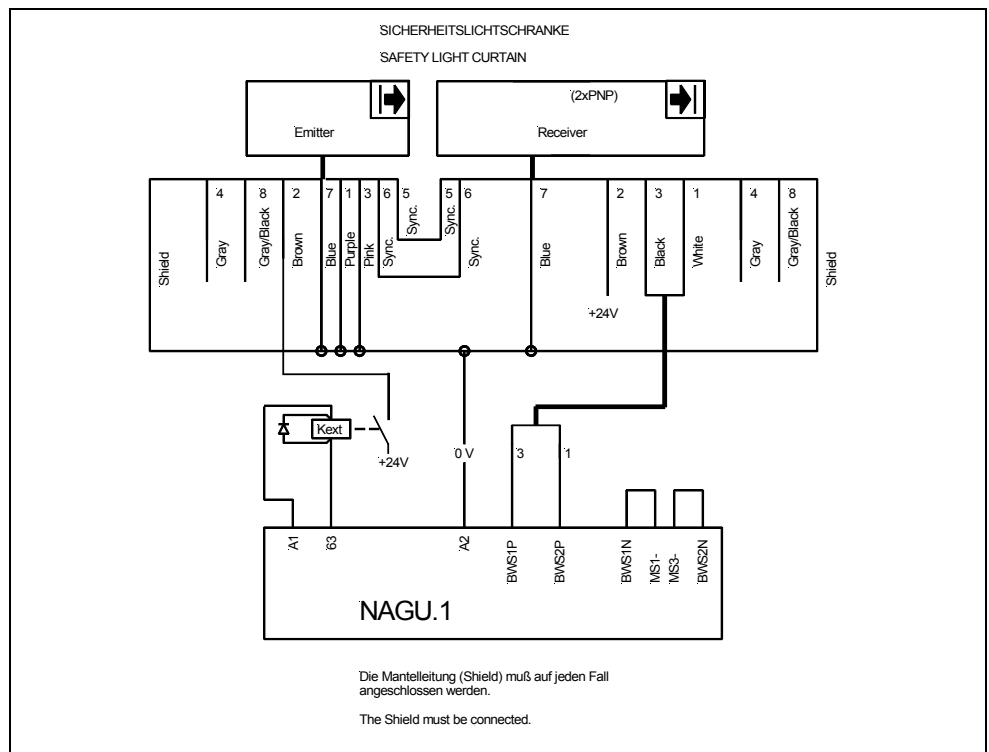
SUNX SF1-AC2 with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: November 1999



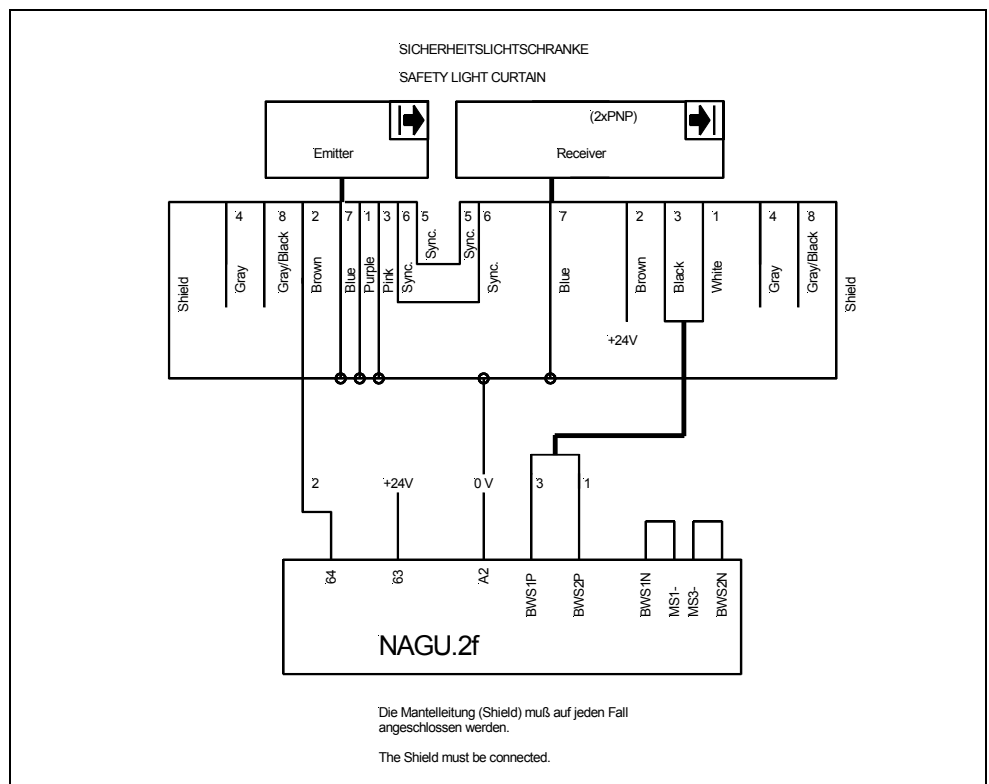
Honeywell FF-SPR / FF- with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: October 1997



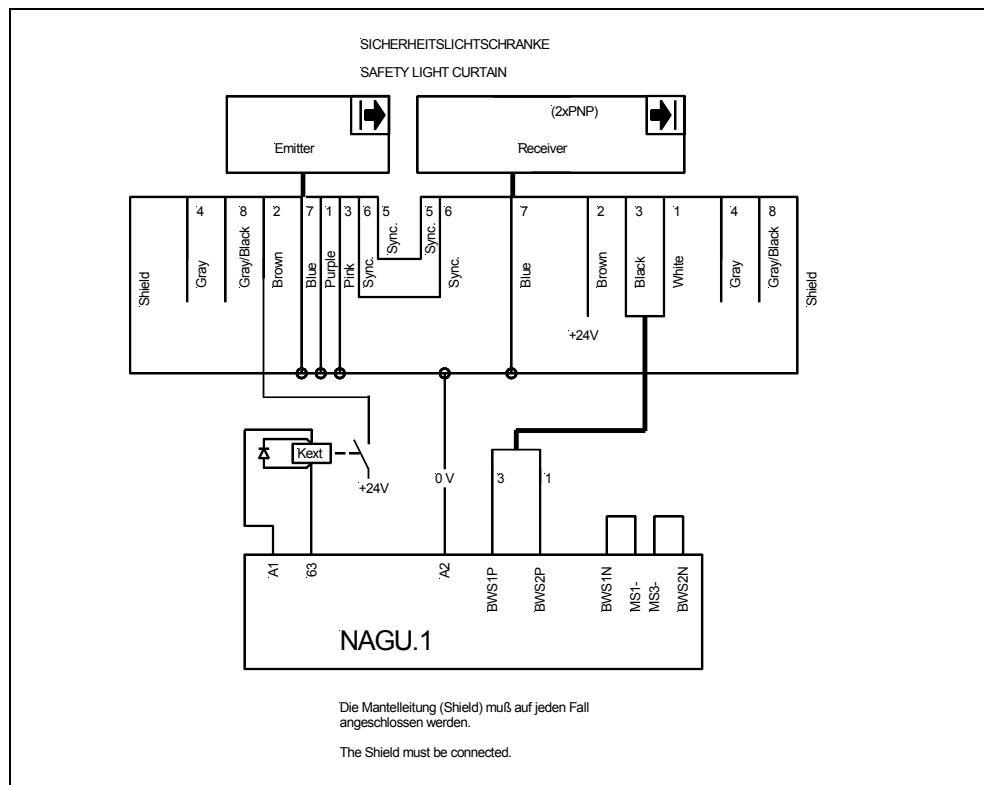
SUNX SF2-EH12P with muting controller RS-NAGU / RS-NAGU.1
 (semiconductor outputs)
 Tested: Mai 2000



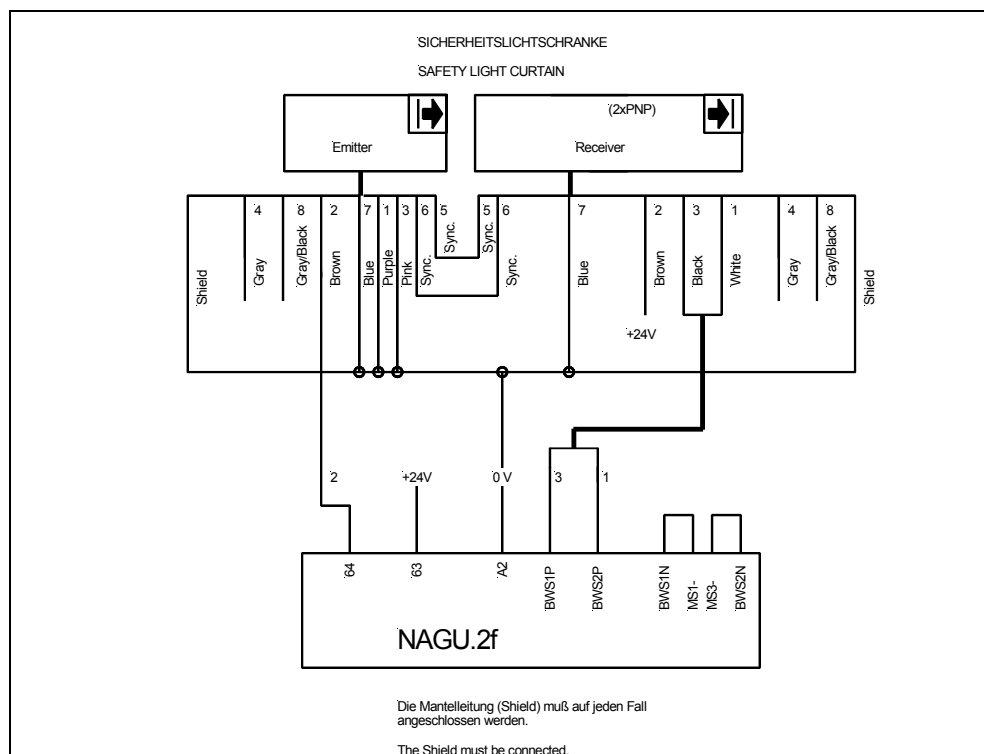
SUNX SF2-EH12P with muting controller RS-NAGU.2f (relay outputs)
 Tested: Mai 2000



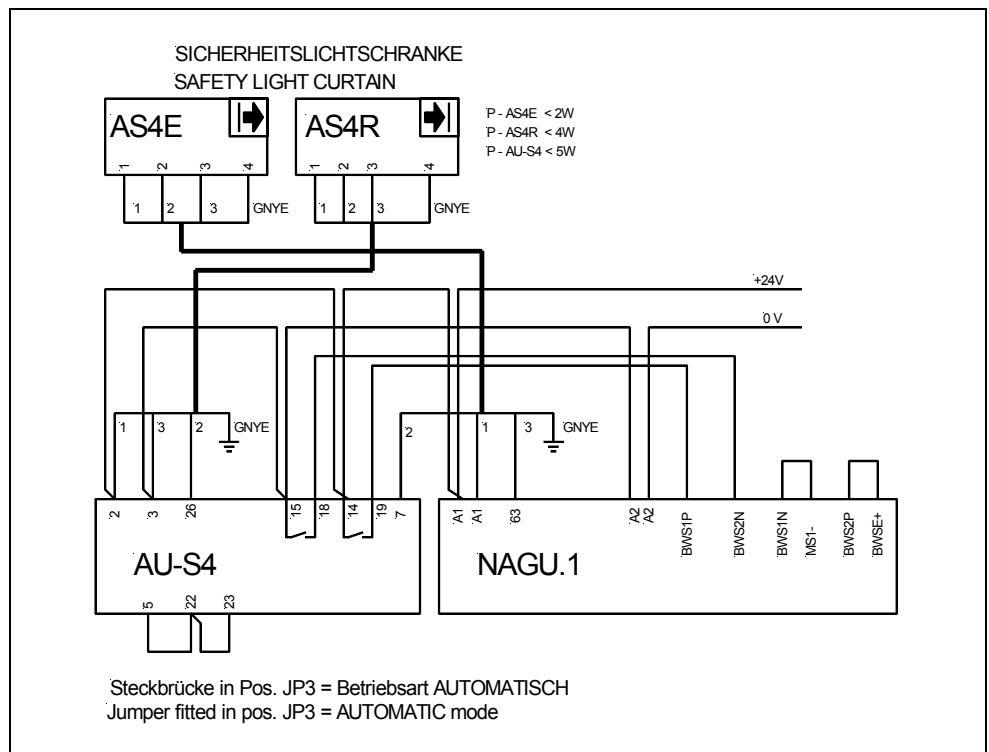
NAIS UZKA2 with muting controller RS-NAGU / RS-NAGU.1 (semiconductor outputs)
 Tested: Juni 2001



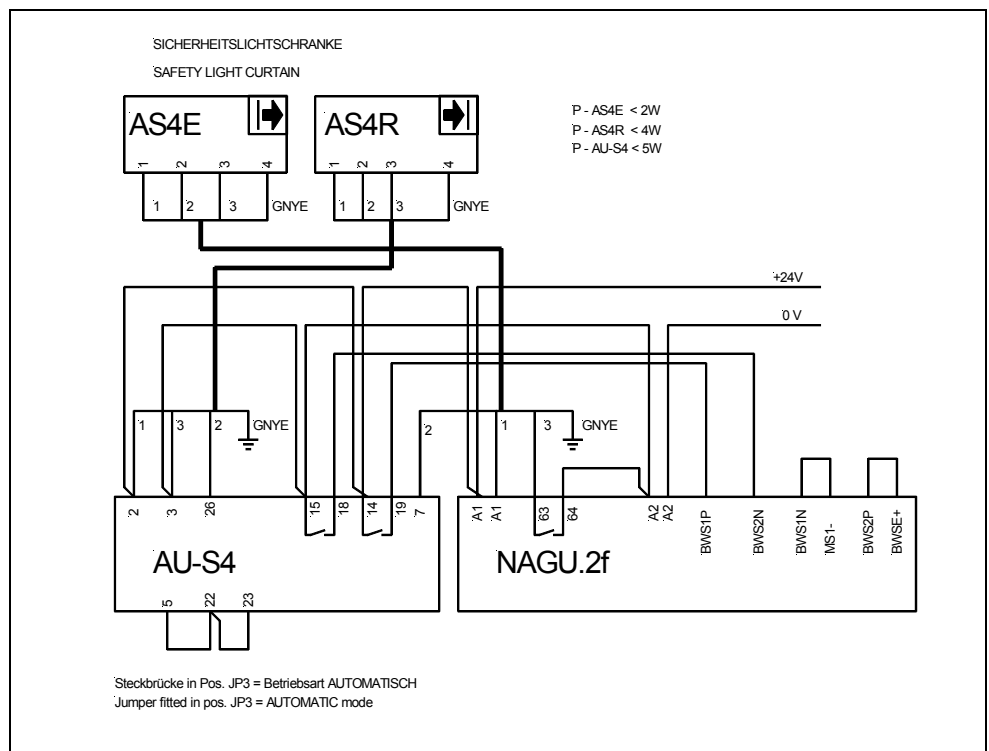
NAIS UZKA2 with muting controller RS-NAGU.2f (relay outputs)
 Tested: Juni 2001



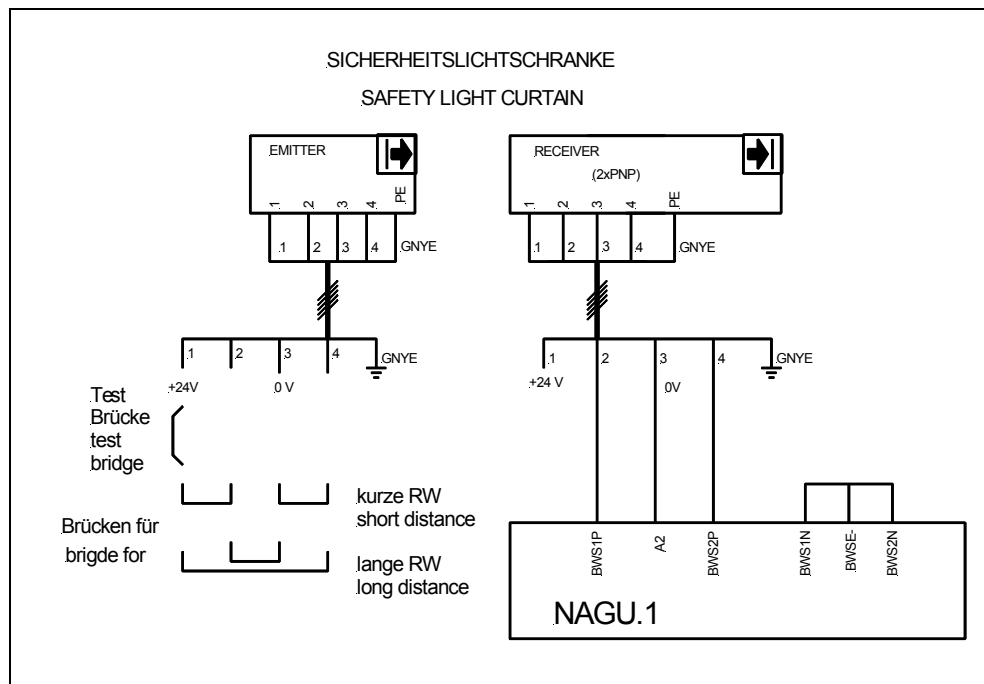
REER –Argolux AS4 with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: November 2001



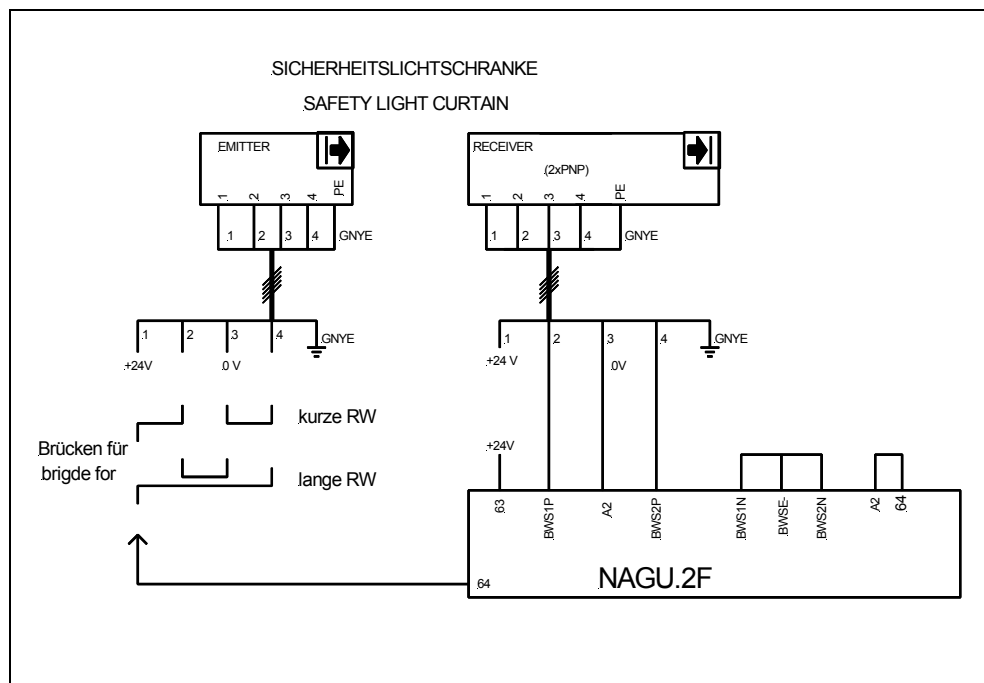
REER –Argolux AS4 with muting controller RS-NAGU.2f (relay outputs)
Tested: November 2001



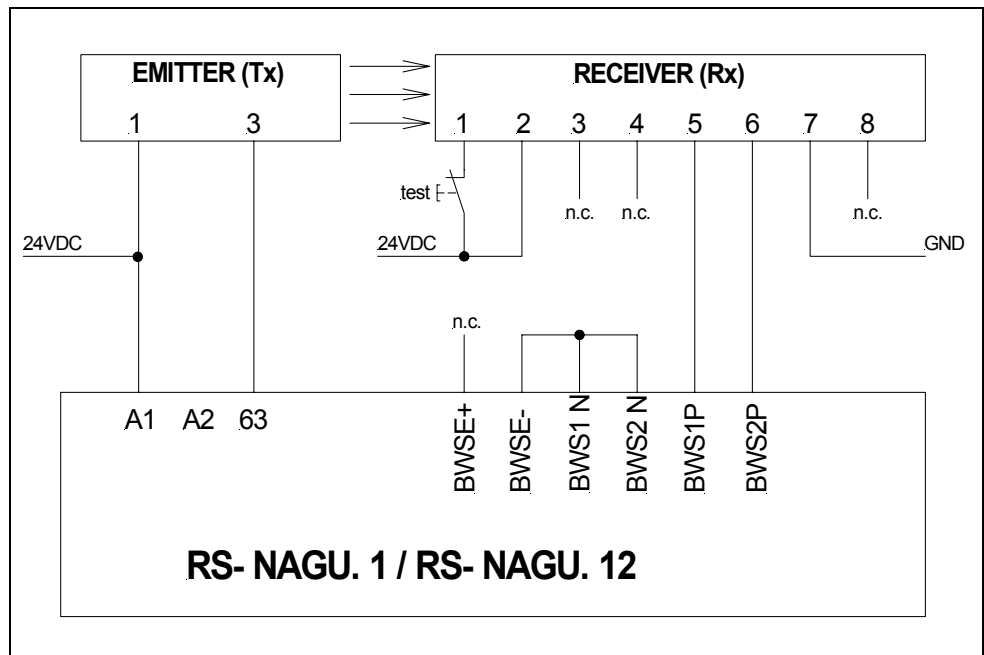
REER –Admiral with muting controller RS-NAGU / RS-NAGU.1
(semiconductor outputs)
Tested: Juli 1999



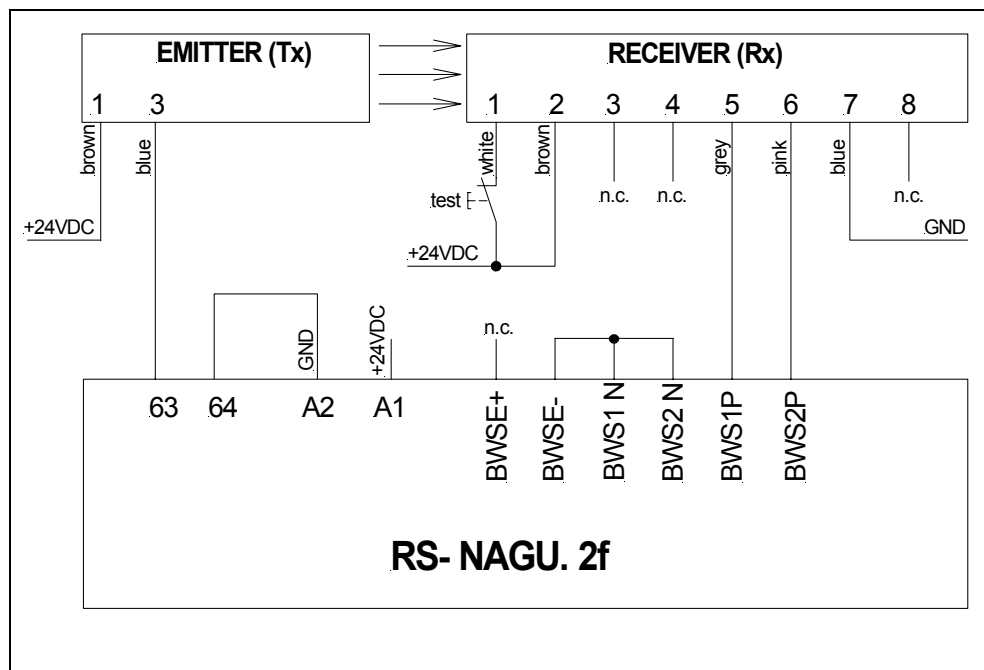
REER –Admiral with muting controller RS-NAGU.2f (relay outputs)
Tested: Juli 1999



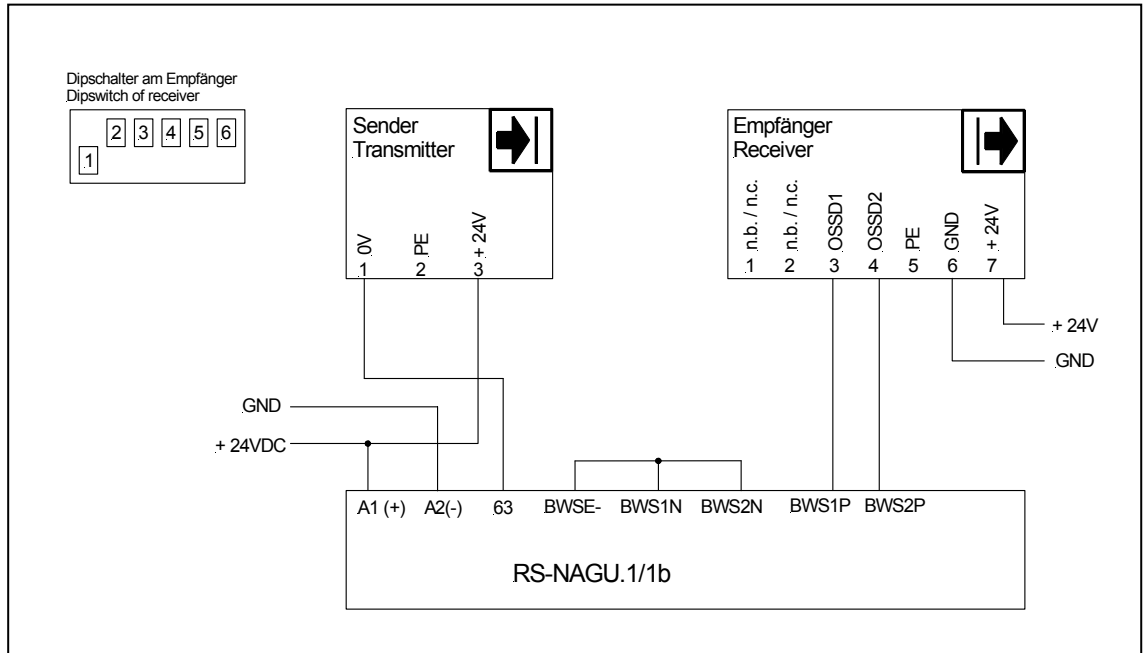
Datasensor SE4 with muting controller RS-NAGU / RS-NAGU.1 / RS-NAGU.12
(semiconductor outputs)
Tested: September 2002



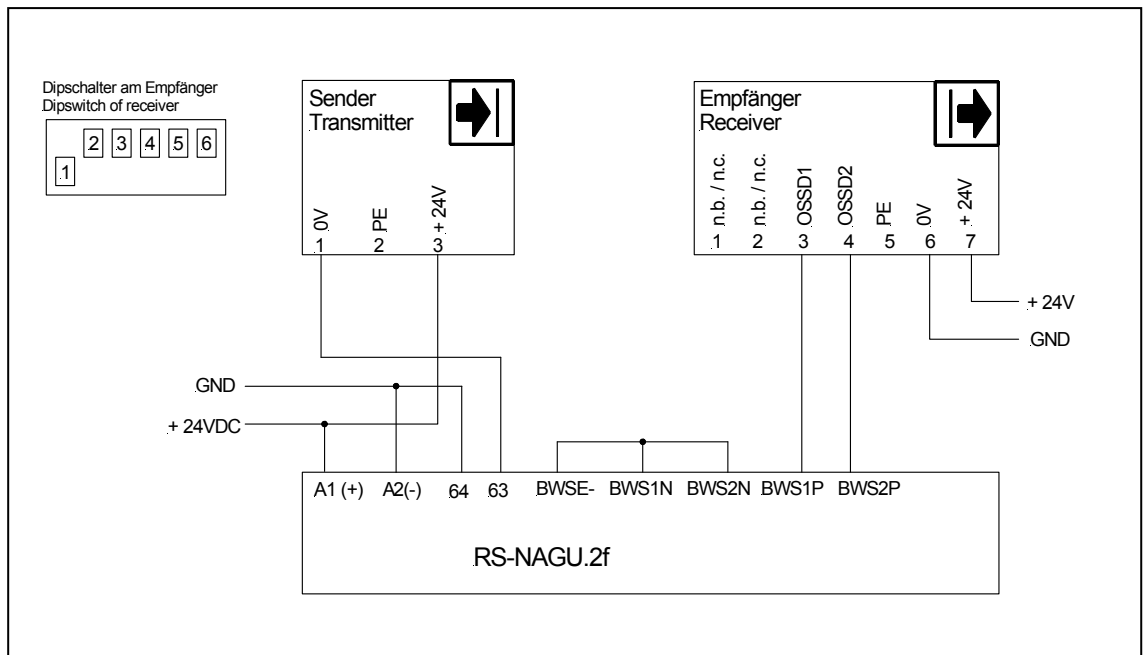
Datasensor SE4 with muting controller RS-NAGU.2f (relay outputs)
Tested: September 2002



Fiessler ULTV with muting controller RS-NAGU.1 / RS-NAGU.1b
(semiconductor outputs)
Tested: April 2003

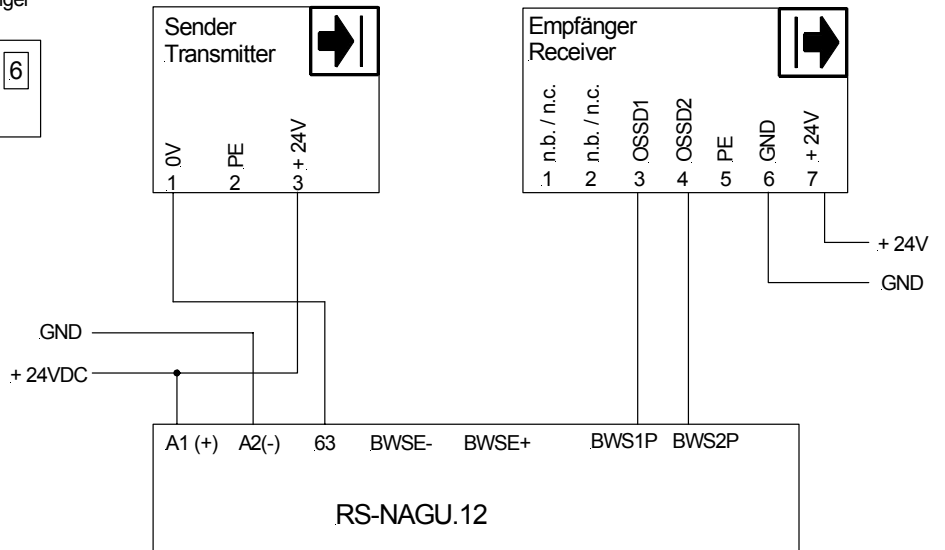
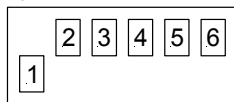


Fiessler ULTV with muting controller RS-NAGU.2f (relay outputs)
Tested: April 2003



Fiessler ULTV with muting controller RS-NAGU.12
 (semiconductor outputs)
 Tested: April 2003

Dipschalter am Empfänger
 Dipswitch of receiver



Terminal point of reflection light barrier PRK 525 k/P used as muting sensor on the RS-NAGU.1

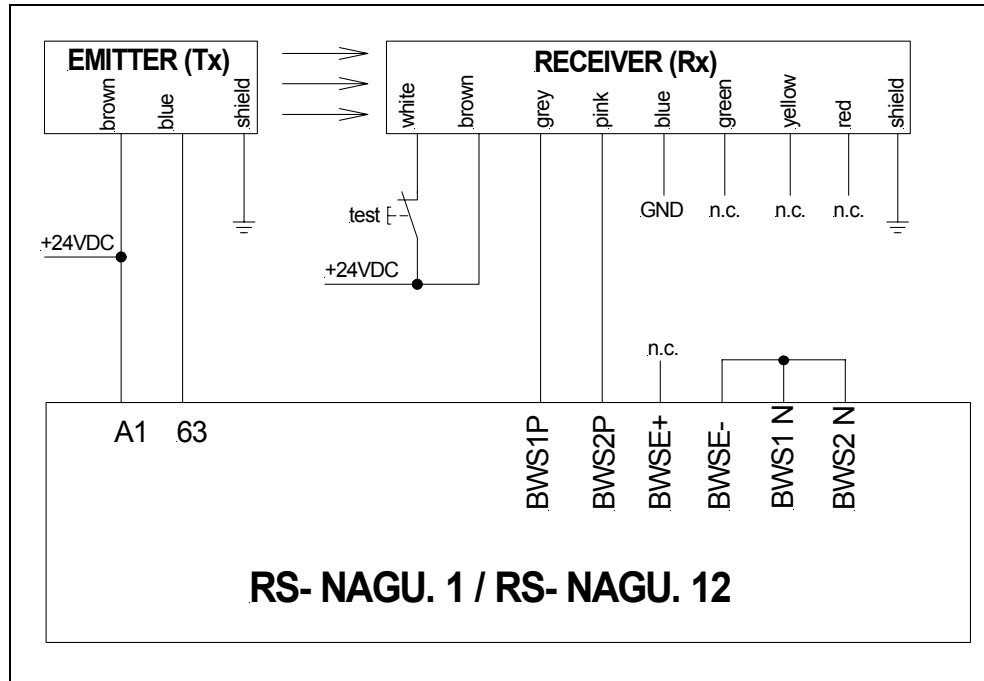
Wire the RS-NAGU.1 as discribed in the applicaton manual. If necessary watch the application drawing of riese.

Terminal 2 (ws) = dark switching output

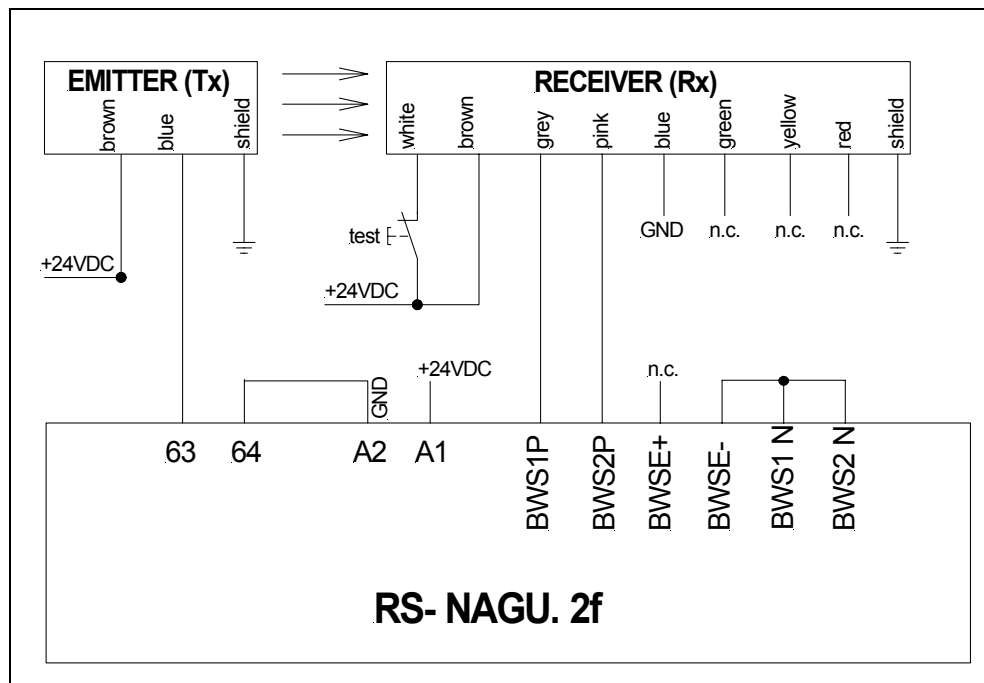
Terminal 4 (sw) = light switching output

For using the muting sensor, the dark switching output of the light barrier must be used.

Technogr SB2 und SB4 with muting controller RS-NAGU / RS-NAGU.1 / RS-NAGU.12 (semiconductor outputs)
 Tested: September 2002



Technogr SB2 und SB4 with muting controller RS-NAGU.2f (relay outputs)
 Tested: September 2002



c) RS-NAGU.1b muting controller with fieldbus

Function:

The function of RS-NAGU.1b is the same like RS-NAGU.1 (see page 76)
There is one main difference between RS-NAGU.1b and RS-NAGU.1. RS-NAGU.1b could be connected to fieldbus-system like AS-i Bus or INTERBUS.

All application from RS-NAGU.1 could be used for RS-NAGU.1b

Interface of the RS-NAGU.1b

Failure detection

To get a failure message from the RS-NAGU.1b the FA1 or FI1 connects a high signal (TTL) on the data inputs. In this way the controllers in the RS-NAGU.1b knows that he must connect the actual failure code to his outputs.
This signals were then send to the main control unit.

Detection of the Control-Bits

In a period way all inputs were read and all outputs were written with information.
The numbers of slaves is responsible for the time of one period. It could be between 200µs and 5ms.

In the first step the controllers say if an error had happened. The controller does not send the failure information in this step.

In the next step the slave sets his data output on a high signal.

When the data output of the slave (FA1 or FI1) are set the RS-NAGU.1b is able to send the failure code.

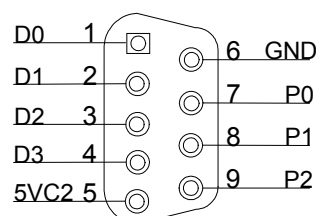
The main control system could now detect this. The time of this two steps are the period time. The delay time which is the result of the this two steps lies between 20ms and 50ms.

That means only after 50ms a new detection of the status is possible. This is the time which is need to make the transfer of information to the PC.

RS-NAGU.1b has four outputs and three inputs. This ports were leaded outside the device by a SUB-D9 connector.

SUB-D9 Pining

Pining



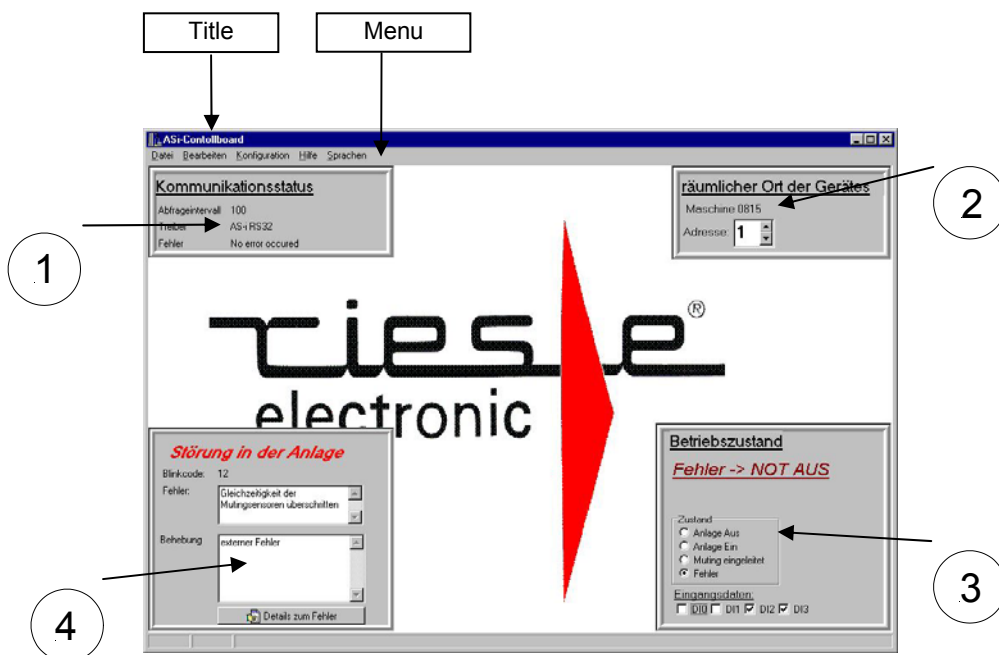
D0 ... D4 data outputs
P0 ... P2 data inputs

Visualisation software ASi-win

With the visualisation software ASi-win from riese electronic the status of the RS-NAGU.1b could be shown on the PC.

Main window of the ASi win program

After starting the ASi Win program the main window will be opened.

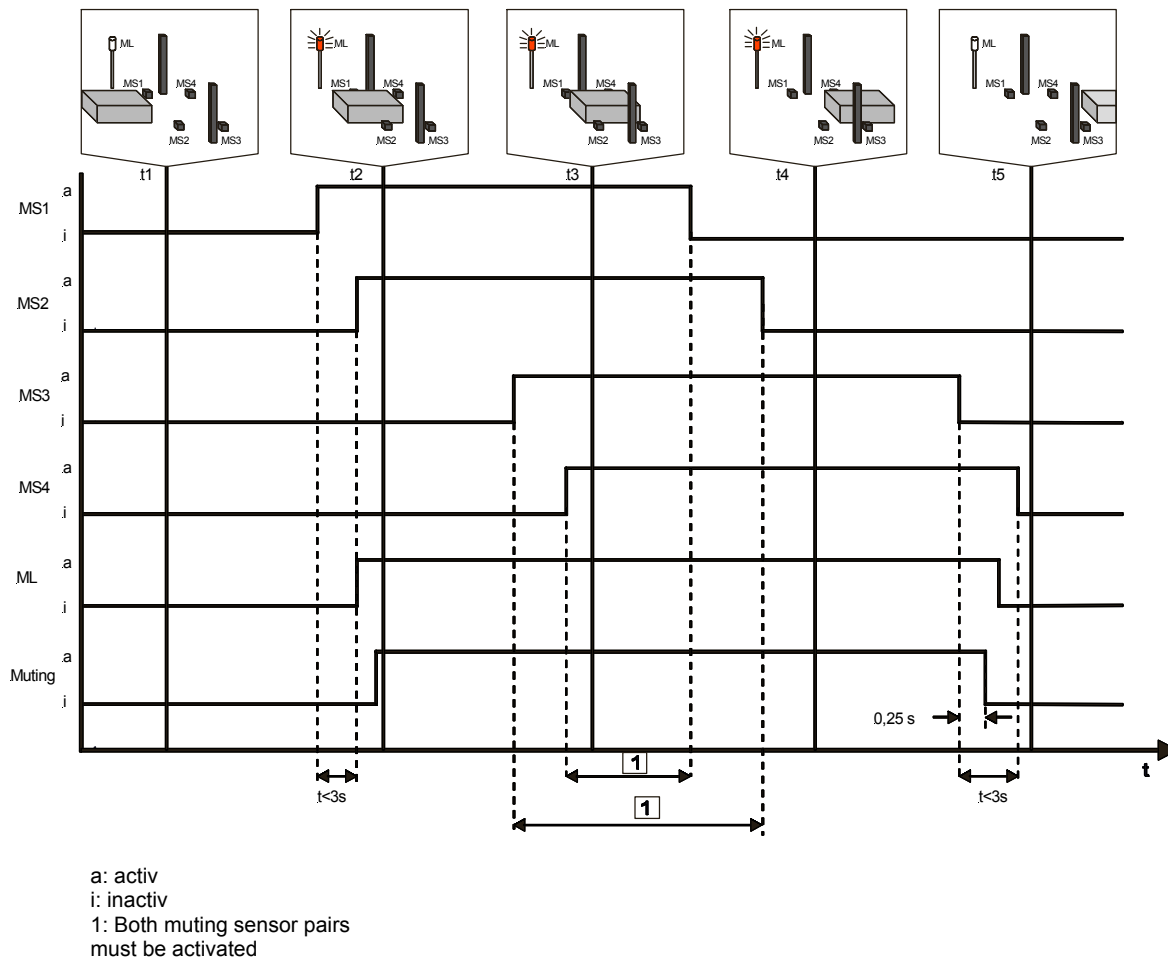


The main window is divided in four submenus where the status of the program and the muting controller is shown

1. **Communication status** informs the user how often the bus transfer takes place and if an error had happened.
2. **Place of the bus interface** says the user which bus-slave (interface) would be checked. The user can define, for example that bus-slave no. 1 is on the automation plant 4. He has to do this only one time. If he want to change it later he could always make this.
3. **Status** gives the user all information's what in his plant happens. For example if muting is active or if the RS-NAGU.1b works.
4. **Error** where shown here. It would be show which error had happened. What must be done, who should do this...

Sequence of a muting cycle

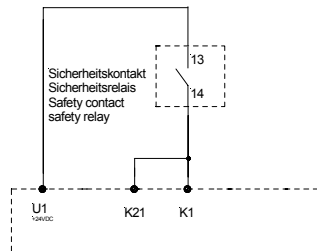
If the muting sensors MS1 and MS2 are activated within a 3-second period, the muting cycle is initiated. The muting lamp is switched on and interruption of the safety light barrier does not cause the device to switch off. If three of the four muting sensors are inactive, the muting cycle is terminated after a delay period of 0.25 seconds.



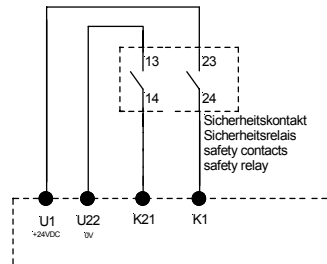
8 Connection of the expansion modules

a) SAFE X4/X4.1

Wiring of expansion modules with opposite polarity between channels /
without opposite polarity between channels



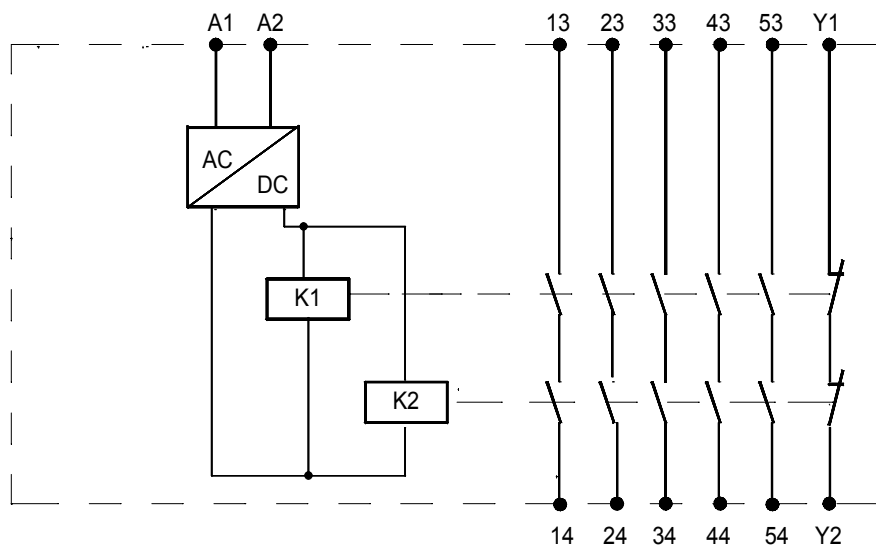
SAFE X4.1
Single-channel contact expansion without
opposite polarity between the channels.



SAFE X4
Dual-channel contact expansion with
opposite polarity between the channels.

b) RS-NAGX 5

Wiring of expansion modules with RS-NAGX 5

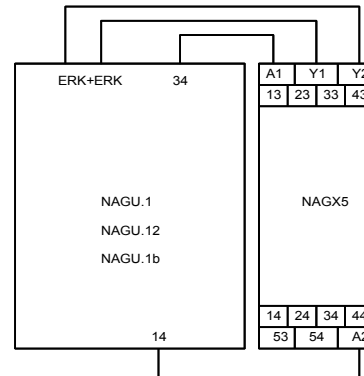


Examples for applications

RS-NAGX5

Single-channel contact expansion for base units with pnp safety solid state outputs examples NAGU.1, NAGU.12, NAGU.1b

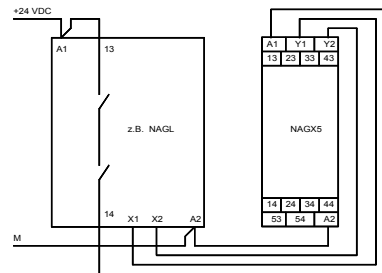
In case of protected wiring (short current circuit exclusion) and regularly tests for example with maintenance, up to category 4, PLe, SIL 3 reachable.



Single-channel contact

Input circuit A1 is to be connected with one of the redundant safety outputs (13-14). Errors of the expansion unit will be announced over the feedback control loop (Y1-Y2) and the next activation will be disabled.

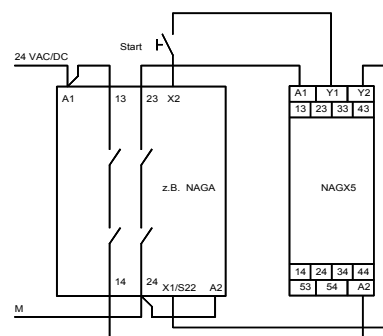
In case of protected wiring (short current circuit exclusion) and regularly tests, for example during maintenance, up to category 4, PLe, SIL 3 reachable.



Dual-channel contact expansion

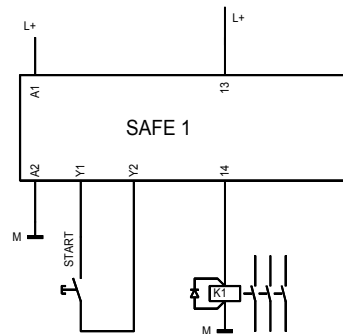
Input circuits A1 and A2 will be connected with separately safety outputs (13-14, 23-24). Errors of the expansion unit will be announced over the feedback control loop (Y1-Y2) and the next activation will be disabled.

In case of regularly tests, for example during maintenance, up to category 4, PLe, SIL 3 reachable.

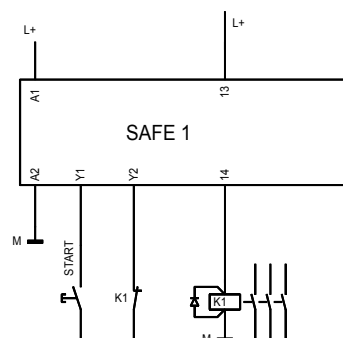


For extension of the contacts, also the **protectors with positive guided** contacts are allowed.
According to category, the according conditions have to be considered. .

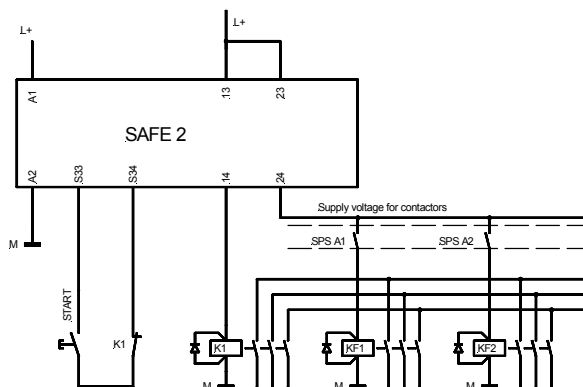
**example for
category 1 :**



**example for
category 2:**

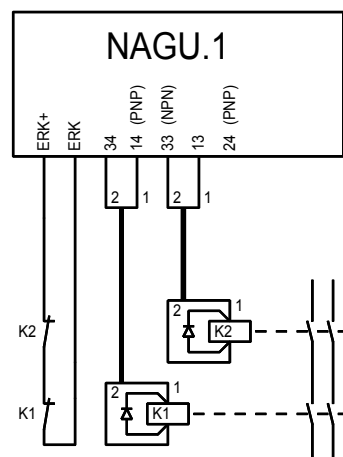


**example for
category 3:**



**example for
category 4:**

**Look at basic-wiring
on page 76**



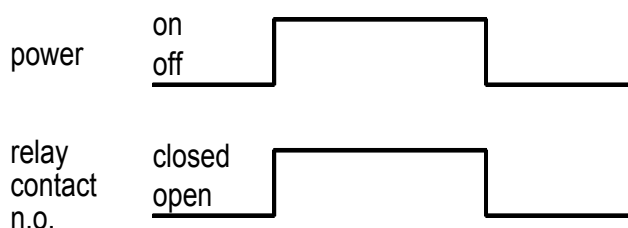
9 Application examples for - industrial relay

a) SAFE IRZ.2

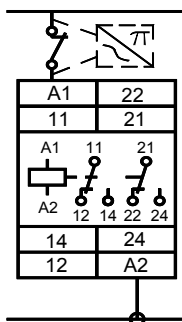
function / output contact

Industrial relay with **positive guided** contacts.
2 changer

principal operation



schematic



LED

1 LED

voltage

24V AC/DC *

additional product properties

* without galvanic separation
initialising input : yes (controllable over contact or two-wire reed switch
with cut-off-current < 4mA)

Description

The device is an industrial relay for high switching cycles. The delay on and delay off times are less than 25 ms. After connecting the power supply on terminals A1 and A2 the relay activates immediately. If the power supply on terminals A1 and A2 is removed, the relay drops into the initial state.

category

In combination with another safety relay, the SAFE IRZ.2, could be category 1 to 4.

More information's

- * you can use SAFE IRZ.2 if you need relay outputs.
- * you can use SAFE IRZ.2 as an alternative for an contactor.

10 Application examples for - Inline System

INLINE system offers a high flexibility with the realization of decentralized industrial control. By the comprehensive product range at safety devices for INLINE from the company riese, decentralized safety and functional units can be developed and extend easily. Lot of safety sensors can be integrated into a bus system. The largest advantage of INLINE is the integrated housing and function concept, which reduce the wiring up to 80% and reduce costs of the installation and start-up substantially. The modules have to be installed simply on the DIN rail. All modules are supplied by the integrated INLINE housing concept automatically with the operating voltage and are coupled to the BUS. The safety devices of the company riese support a broad pallet of safety requirements and applications:

- SAFE IL1 – safety device for emergency-stop applications, door-monitoring, safety mats and edges
- SAFE ILL – safety device for ESPE with PNP and relay contacts
- SAFE ILZ – safety device for two-hand applications
- SAFE IL2 – expansion module for switching of high-current and highe-voltage inductive, capacitive and resistive loads

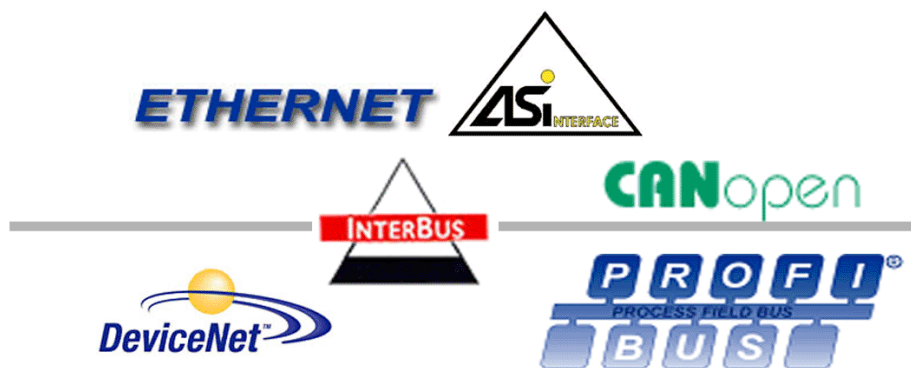
The status of the internal safety circuits can be easily supervised and evaluated if necessary. The connection to a certain bus system is not necessary with INLINE-system. INLINE function units can be integrated by suitable bus modules into different standardized bus systems without any wiring.

With a ethernet bus-converter e.g. a enterprise-far integration can be realized, which it constitutes possible from each conventional computer to supervise the status of the function islands logs and statistic evaluations to accomplish.

Larger distances are bridged by fiber-optic cables and connect functional units over the large distances.

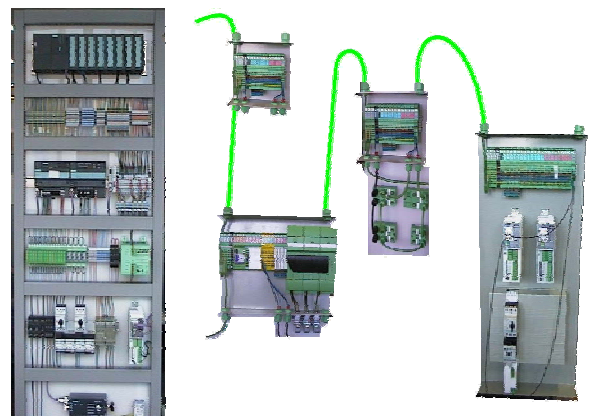
INLINE advantages on a view:

- Integrated system of housing and functions
- Bus integration of all safety mats, light barrier and edges to all standard industrial bus systems



- Interbus, AS-interface, CANopen, DeviceNET, Ethernet, Profibus etc.

- Removable terminals
- System-wide integrated power supply for inline devices (no wiring necessary))
- Very efficient assembly, extension and combination of INLINE modules
- Structured design of safety units
- Small maintenance and operating cost
- Expandable!

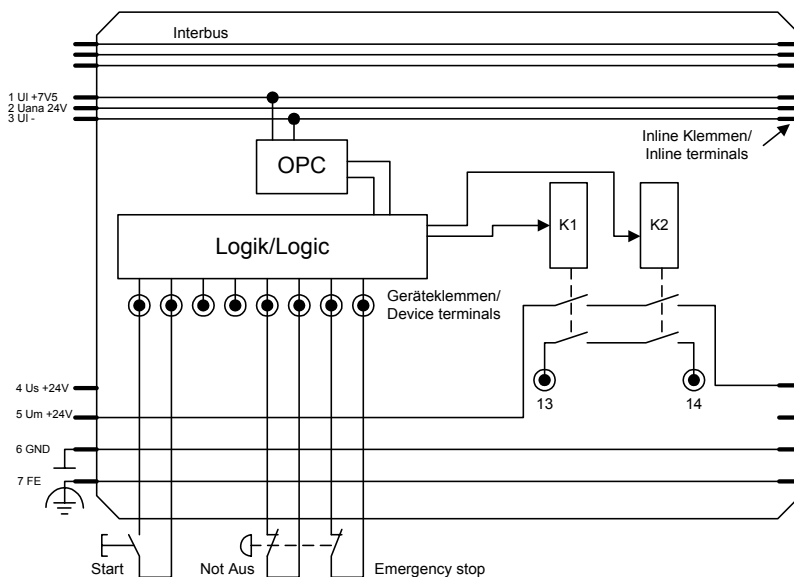


a) SAFE IL1

The emergency stop relay SAFE IL1 can be used for:

- Single and dual-channel protection door monitoring
- Safety electric circuits according to EN60204 part 1
- Safety mats

Assembly and function



S11,S12,S21,S22,S33,S34,S41,S42 S51,S52 Activation- and release contacts
UM-US, 13-14 Safety current circuit (normally open contact)

The activation and input contacts have to be wired according to the intended purpose (s. of " sample applications " and " assembly and line-up "). For the operation of the device the device must be connected with the Inline system. Over the Inline bus terminal or a power terminal the voltage supply of 24V/DC is taken over. It lights up the LED "UM".

For the start the terminal S33 with S34 must be bridged with a start button.

Afterwards the contact 13-14 is closed and the segment circuit is switched on. The LED's 1,2 and US lights up.

If the input set is opened, the safety contacts 13-14 are open and the LED's 1, 2 and US goes out. The following segment circuit of the Inline system is safety-reality switched off

The device is again activated, if the input sets close and the start button is pressed. The LED's 1 and 2 and US lights up again.

Over the interface to the Interbus Inline local bus can be transferred the device status.

The main circuit is interrupted in the device SAFE IL1.

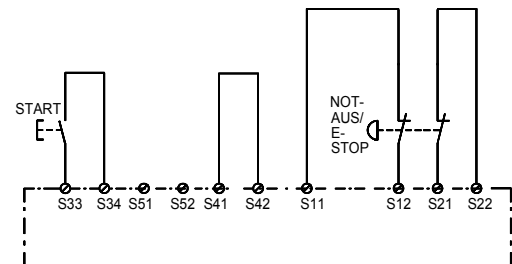
Product Application for

- emergency stop relay
- safety gate monitoring relay
- safety mats

**Dual-channel emergency stop
(with opposite between channels)**

By pressing the start button, the safety contacts 13-14 and the segment will close. Pressing the emergency stop switch will reset the safety contacts and interrupt the segment circuit.

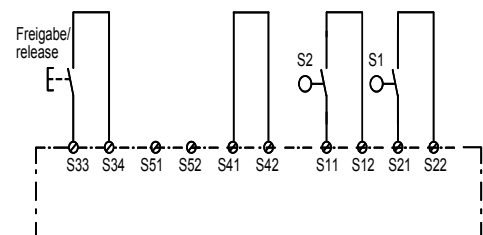
Suitable up to category 4, PLe, SIL 3 reachable



**Dual-channel protection door monitoring
with opposite polarity between channels.**

If the safety gate switches are closed, the output contacts remain unchanged. After the release of the unit, the contact 13-14 closes. After opening the protection door switches the contacts return to their normal position without delay.

Suitable up to category 4, PLe, SIL 3 reachable

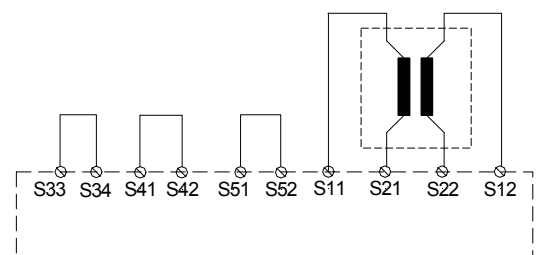


**Dual-channel application for four-wire-safety-mats
(with opposite polarity between channels)**

Example 7 and 8 are possible only with mats, which operate according to the contact principle. I.e. the mat must switch when loading immediately to 0 Ohms.

The activation works automatically, since the terminals S33 -S34 and S51-S52 are bridged. Contact 13-14 closes after power is on or after steps off the safety mat. The turn on time amounts to after 10s loading of the mat approx. 1s.

Suitable up to category 1,PLc, SIL1 reachable

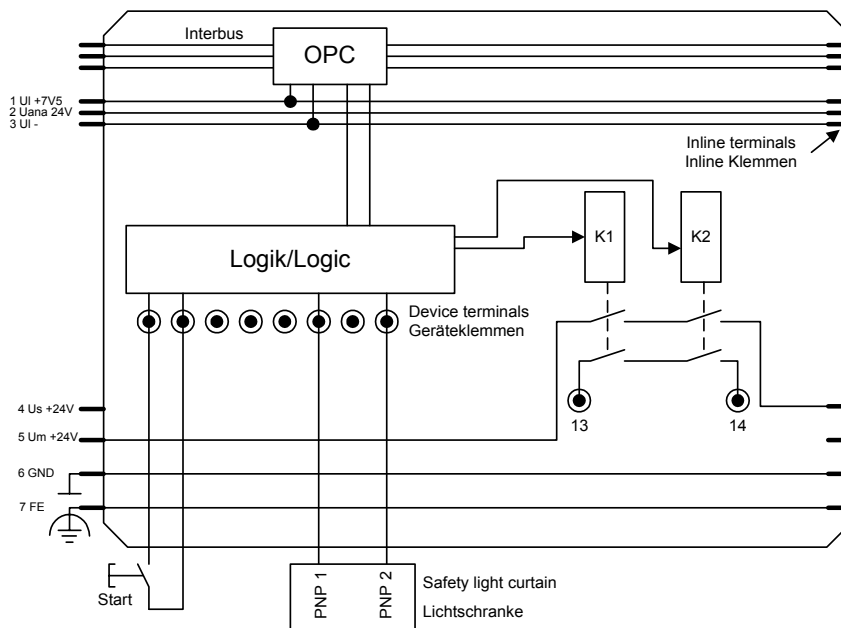


b) SAFE ILL

The emergency stop relay SAFE ILL can be used for:

- Single or dual channel capability for presence sensing safeguarding devices (light curtains and light barriers).

Assembly and function



S11,S12,S21,S22,S33,S34,S41,S42 S51,S52
UM-US, 13-14

Activation- and release contacts
Safety current circuit (normally open contact)

The activation and input contacts have to be wired according to the intended purpose (s. of " sample applications " and " assembly and line-up "). For the operation of the device, it must be connected with the Inline system. Over the Inline bus terminal or a power terminal the voltage supply of 24V/DC is taken over. It lights up the LED "UM".

For the start the terminals S33 and S34 must be bridged with a start button. Afterwards the contact 13-14 is closed and the segment circuit is switched on. The LEDs 1, 2 and US light up.

If the input set is opened, the safety contacts 13-14 are open and the LEDs 1, 2 and US turn off. The following segment circuit of the Inline system is safety-related switched off.

The device is activated again, if the input sets close and the start button is pressed. The LEDs 1, 2 and US light up again. Over the interface to the Interbus Inline local bus the device status can be transferred.

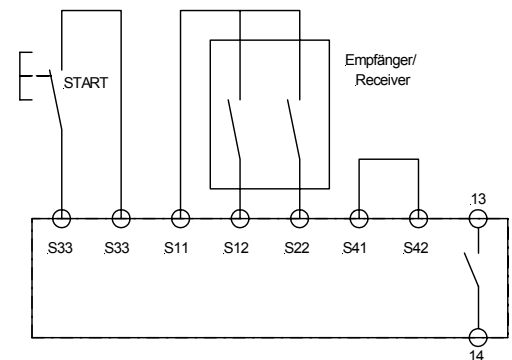
The main circuit is interrupted in the device SAFE ILL.

Product Application for SAFE ILL

Dual-channel monitoring of light barrier or light curtain (with relay outputs).

After pressing the START-button, the device is active. The security contact 13-14 will close. An interruption of the light beam will reset the contacts.

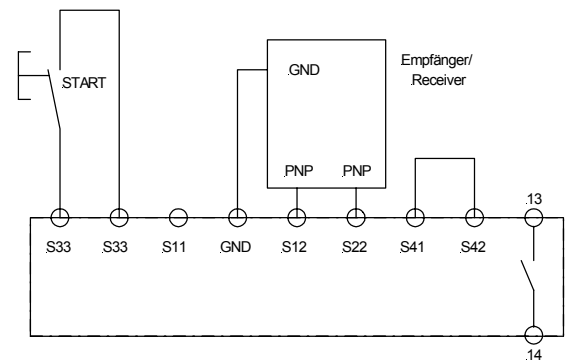
Suitable up to category 1, PLc, SIL 1 reachable



Dual-channel monitoring of light barrier or light curtain (with semiconductor outputs and short circuit monitoring).

After pressing the START-button, the device is active. The security contact 13-14 will close. An interruption of the light beam will reset the contacts.

Suitable up to category 4, PLe, SIL 3 reachable



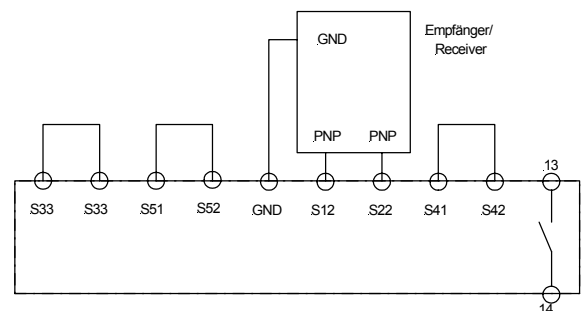
Dual-channel monitoring of light barrier or light curtain (with semiconductor outputs and short circuit monitoring) and automatical start.

Bridge the terminals S33-S34. The device will now start automatically.

The security contact 13-14 will close. An interruption of the light beam will reset the contacts.

After the end of interruption, the device start automatically and close the security contact.

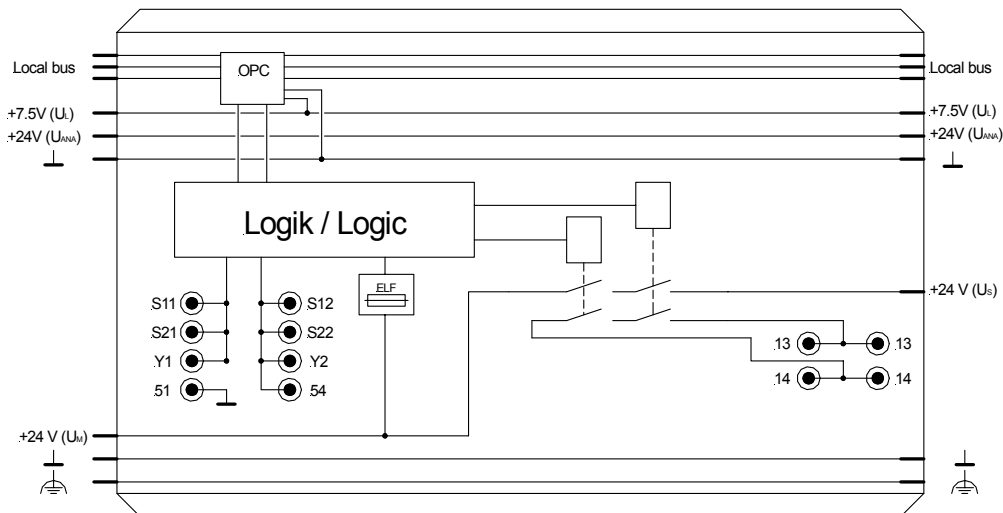
Suitable up to category 4, PLe, SIL 3 reachable



c) SAFE ILZ

Two-hand control relay for Interbus Inline System

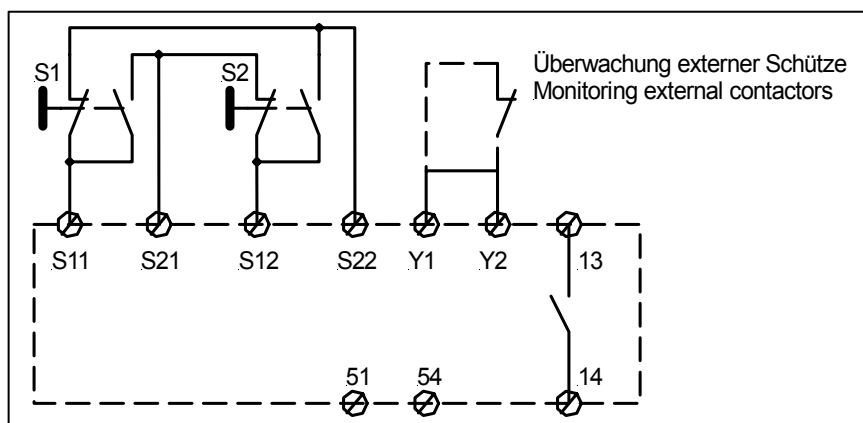
Assembly and function



S11, S12, S21, S22, Y1, Y2	Activation- and release contacts
51, 54	Auxiliary contacts
UM-US, 13-14	Safety current circuit (normally open)

The activation and input contacts have to be wired according to the intended purpose (s. of " assembly and line-up "). For the operation of the device, it must be connected with the Inline system. Over the Inline bus terminal or a inline power terminal the voltage supply of 24V/DC is taken over. It lights up the LED "UM".

For the start the terminals Y1 and Y2 have to be bridged (Feedback loop circuit control). The safety device SAFE ILZ activates the safety current circuits only if the loop back circuit (Y1-Y2) is closed.

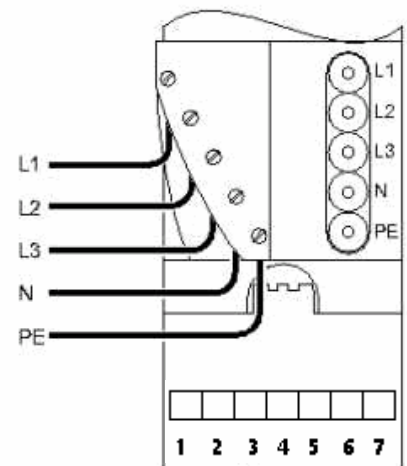
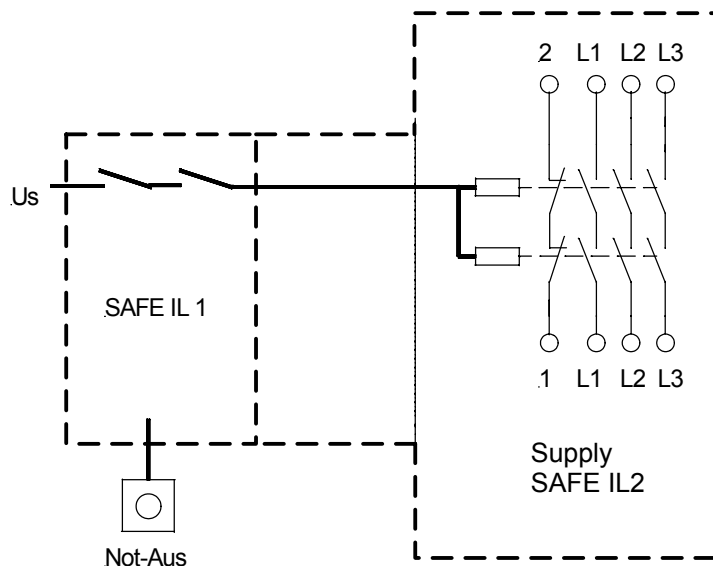


d) SAFE IL2

Load interrupt switch for main current circuits (e.g. three phase motor)

The emergency stop relay SAFE IL2 can be used as contact expansion module in combination with SAFE ILL.

Suitable up to category 4, PLe, SIL 3 reachable



L1, L2, L3 main current circuits
1, 2 feedback circuit

Function:

For the operation of the device must be connected with the Inline system. The Interbus-Inline Station provides the SAFE IL2 with power. The LED „Us (Segment-voltage)“ lights. After activation of the SAFE IL1 the normally open contact contact the segment voltage US and the SAFE IL2 starts to work.

To guarantee that the SAFE IL2 can not be restarted, when the contacts of the conductor are welded, the auxiliary closed contact of the SAFE IL2 has to be wired in series with the start bottom of the SAFE IL1.

SAFE IL 2 can be used together with the motor-switch MLR or ELR from Phoenix Contact.

Safety-category

With SAFE IL2 applications up to category 4.

11 Application examples for – bus module

a) AS-Interface

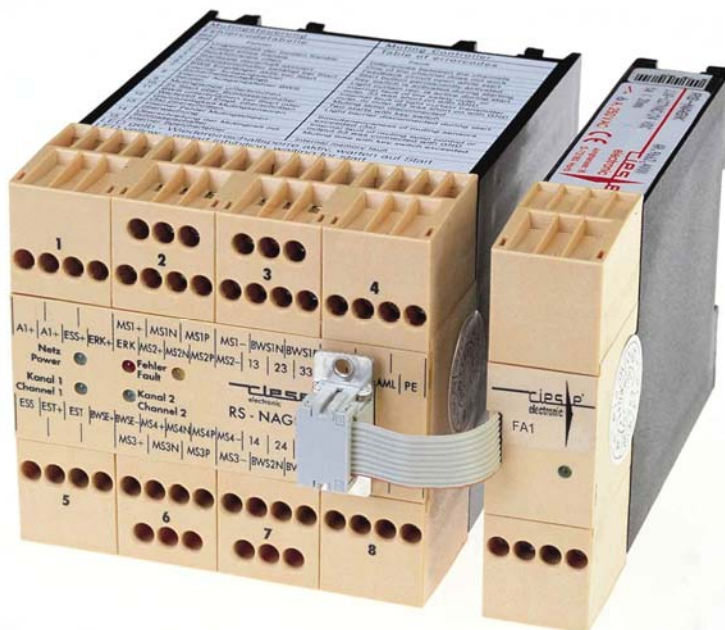
Simple bus-system or fieldbus-applications.
Most times it would be used for sensors.

Characteristic:

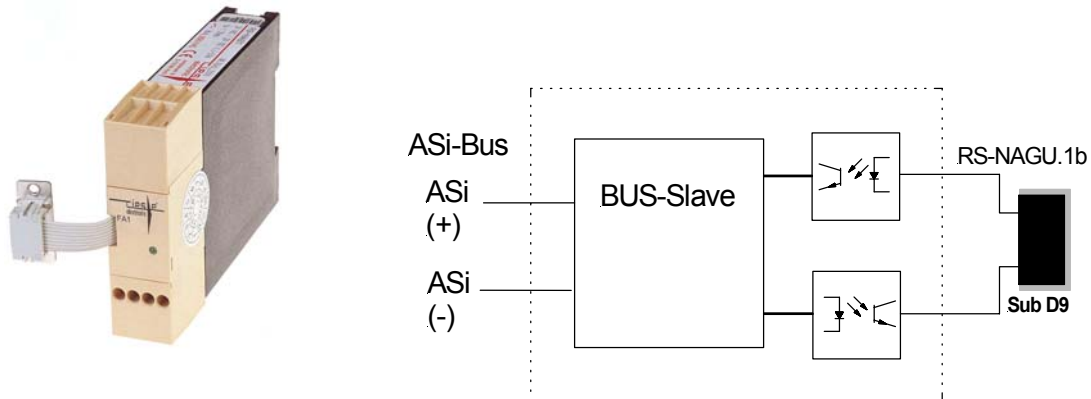
- Master-Slave system
- Power supply and signal transfer on the same two wires (yellow ASi wire)
- Very safety and less sensible bus transfer
- Up to 62 bus slaves on only one master are possible
- Each kind of bus structure is possible → tree structure
- Maximal length of the ASi wire 100m and 300m with repeaters
- Different dealer for busmaster (stand alone devices or PC-Interfaces) offer their products
- By using form Interface modules the connection to a higher bus system is possible.

FA1 ASI bus interface

The FA1 could be used for industrial ASi-Networks in connection with RS-NAGU.1b.

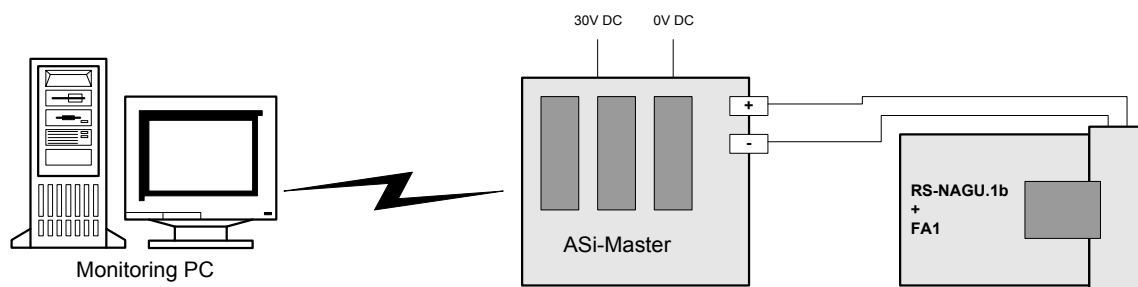


Assembly and function



For the operation of the device ASI+ and ASI the ASI signal line (yellow) must be attached at the clamps. The Sub-D9 plug must be connected with a RS-NAGU.1b or a RS-NAGU.2b. Further links are not necessary.

Connection



b) Interbus

The FI1 could be used for example for industrial plants, as control unit in different production lines, in machines and different equipment for the industry.

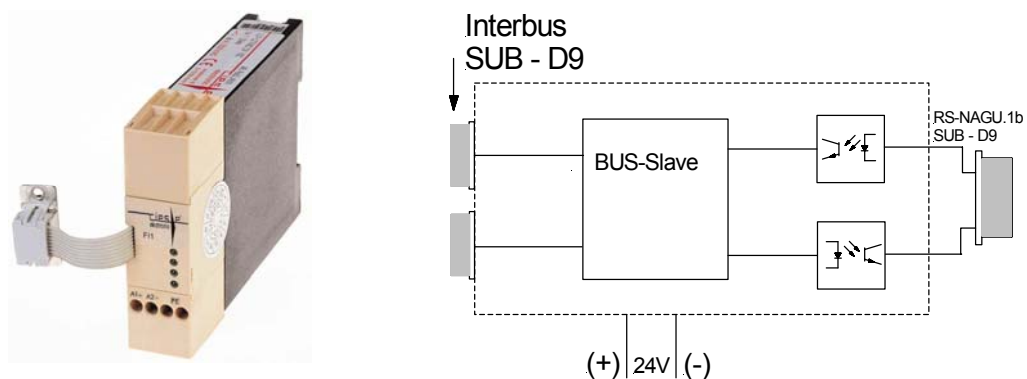
Characteristic:

- Master-Slave System,
- Point-to-Point-Structure
- Fix telegram-length
- Transfer speed : 500 kBit/s 2MBit/s
- max. 4096 E/A-Points
- Buslength: 400m (between two bus fieldbus user)
- Complete length: max. 13 km

FI1 INTERBUS Interface

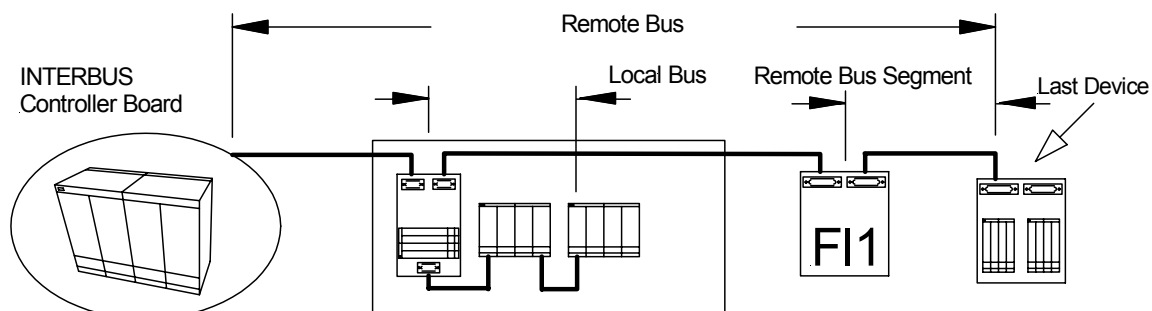
The FI1 could be used for industrial Interbus-Networks in connection with RS-NAGU.1b.

Assembly and function



For the operation of the device the RS-NAGU Sub-D9 plug must be connected with a RS-NAGU.1b . The Interbus SUB-D9 plugs must be connected with Interbus. Further links are not necessary.

Connection



E Others

1 Safety Integrity Software Tool for the Evaluation of Machines (SISTEMA)

Abstract

Safety related parts of machine controls were constructed and evaluated according to DIN 954-1. To take more account of new technologies like electronic and software, this standard has been revised and is now available in the revision DIN EN ISO 13849:1:2007. This standard combines established deterministic features with the new requirements for the probability of default.

A BGIA (institute for occupational safety of the German statutory accident insurance) developed technological aid is the software tool SISTEMA. This tool simplifies and speeds up the calculation of the probability of failure, including the achieved performance level for planned or already implemented controls. The different procedures of the standard are included in the software. The user needs only to enter their data into the input masks. The result is calculated automatically and continuously. Comfort features such as the results forecast, an excellent support, as well as the labor-saving way to create libraries or to include them.

Include the riese library in SISTEMA

You can download the SISTEMA software (freeware) or the riese SISTEMA library at the following addresses:

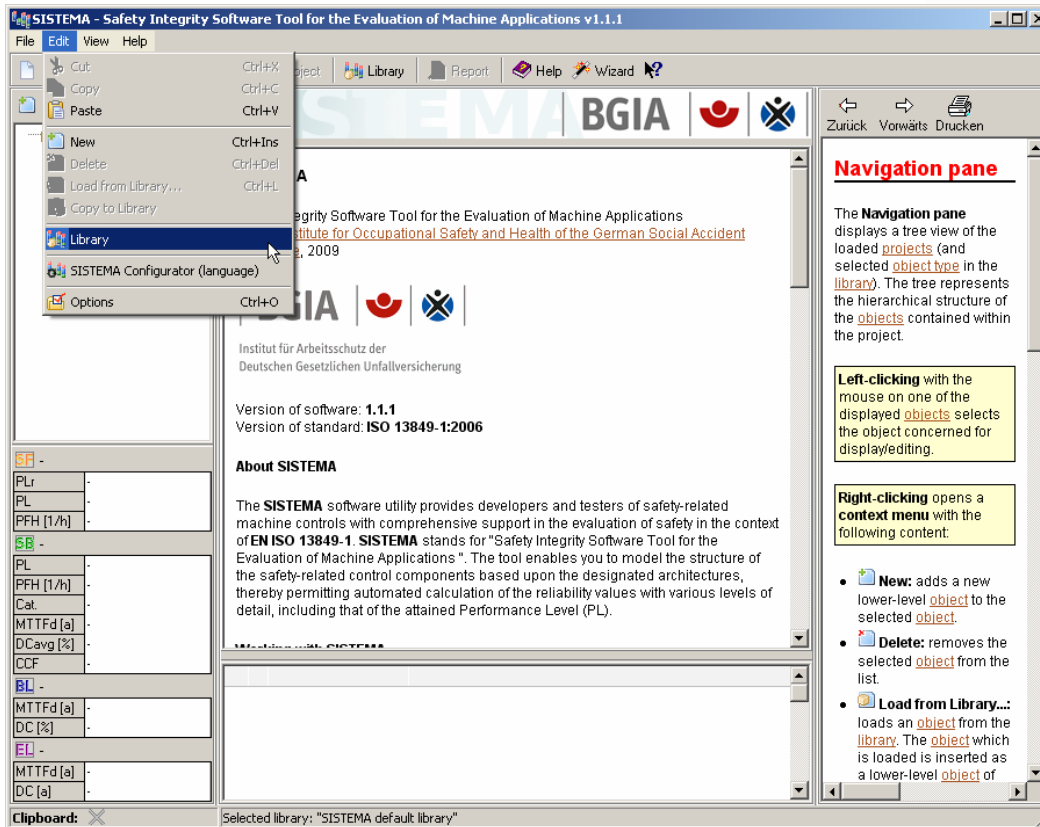
- SISTEMA: <http://www.dguv.de> webcode d11223
- riese SISTEMA Bibliothek: <http://www.dguv.de> webcode d92599

oder

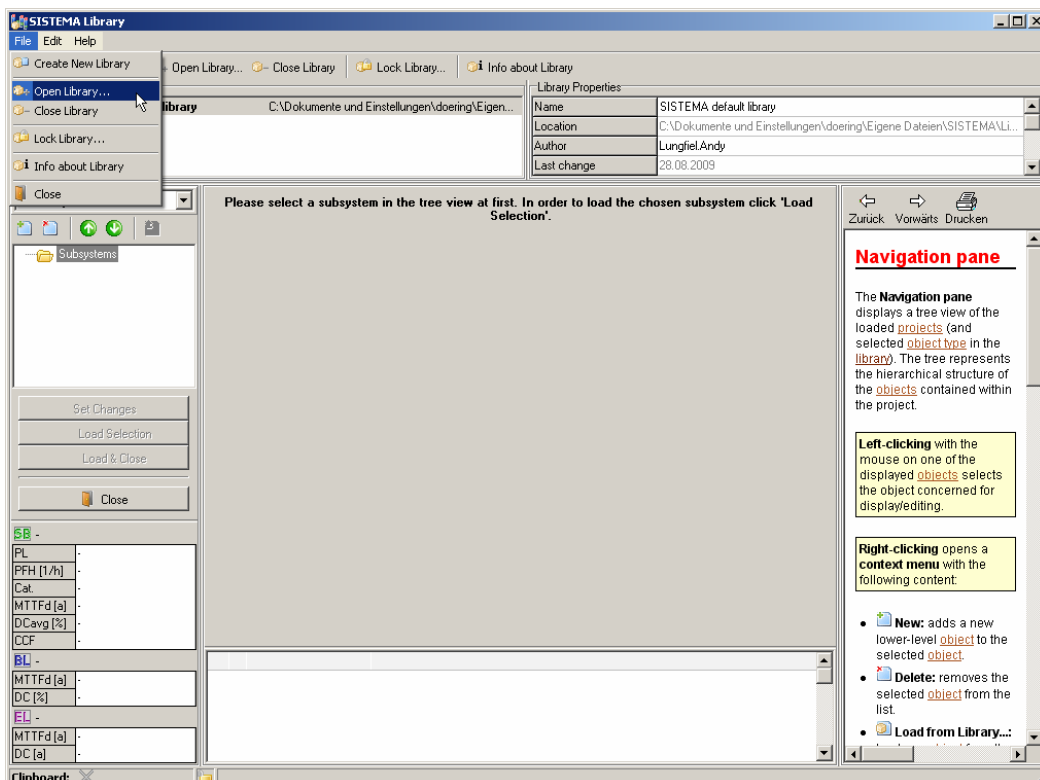
<http://www.automation-safety.com>

The following describes how to include the free riese SISTEMA library into your own project.

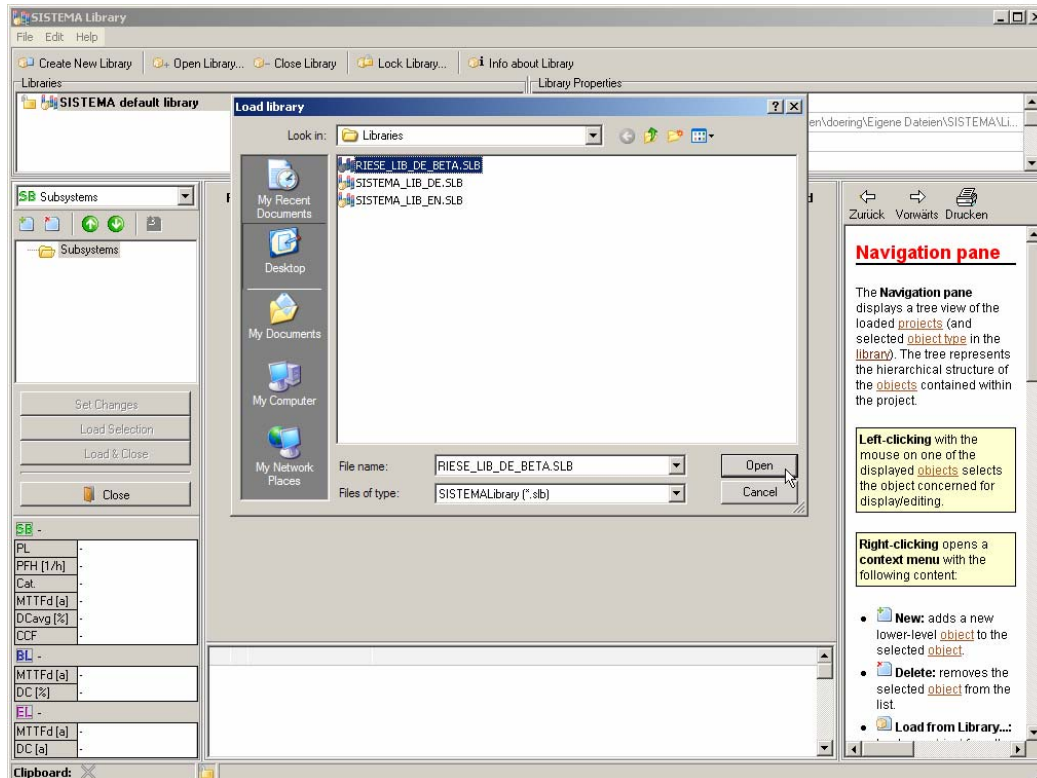
- After starting the software, select *Edit* and then the subitem *Library*. Confirm this with a mouse click.



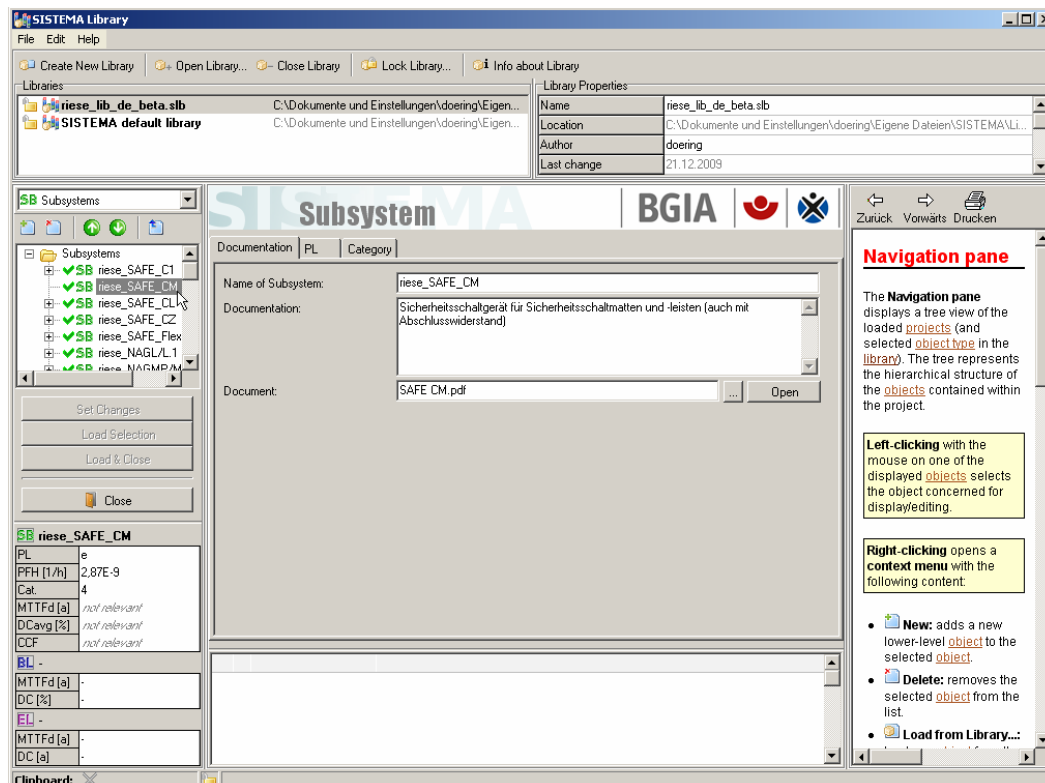
- This will open the library manager. With an click on *Open Library...* in submenu *File ...*



- ... you can select and load the riese SISTEMA library



- All riese safety relays are now available for your project.



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SAFE L.1	25	two hand control relays	75
SAFE L.2	26, 81	Two hand controls	22
SAFE L.2	25	Visolux	86
SAFE M	33, 65	Wenglor	86
SAFE S.10	48	Zwangsgeführte Kontakte	6
SAFE S.6	48	β 6	
SAFE T	69	λ 7	
SAFE T ON	70	λ avg	7
SAFE X4	35	λ DU	7
SAFE X4 / SAFE X4.1	132	λ SD	7
SAFE Z	23, 77	λ SU	7
SAFE Z.2	23, 24, 76		

5 Time relay

(request information material upon need)



Time-delay relays from riese

Applications	Relay designations (all with CE)	Column	EN 954 safety class
On-delay	RS-VR1, RS-VR2, RS-ZR1, RS-ZR2, RS-ER1, RS-ER2, RS-ERF, RS-EB, RS-LR1, RS-LR2, RS-LZ1, RS-LZ2, RS-LZF	1, 2, 3 4, 5, 6 7, 8	all 1
Off-delay	RS-AR1, RS-AR2, RS-AZ1, RS-AZ2, RS-LA1, RS-LA2, RS-AZS	9, 10 11, 12	all 1
Flashing	RS-BR1, RS-BR2, RS-BRS1, RS-BRS2	13, 14	1
Clock-pulsed	RS-TG1, RS-TG2, RS-TG11, RS-TG12	15, 16	1
Multifunction	RS-MF	17	1
Interval time-delay	RS-EI1, RS-EI2, RS-EIF, RS-WAR, RS-WAR2	18, 19 20	all 1
Star-delta	RS-SD	21, 22	1

Features:

- 100% computer tested
- many 12V relays
- relays for railway applications
- many customer specific relays

6 measuring relay

(request information material upon need)



Measuring relays from riese

Applications	Relay designations (all with CE)	Column	EN 954 safety class
PTC-resistor release relays	RS-TMSA, RS-TMSA-2 RS-TMKA, RS-TMKA-2 RS-TMSW, RS-TMSW-2 RS-TMKV, RS-TMKV-2 RS-TMSV, RS-TMSV-2 RS-TMKV, RS-TMKV-2 PTC-resistor release relay in 22.5 mm housing RS-TMWV	1 2 3 4 5 6 7	all 1
Level relays	RS-NR4, RS-NRU-4 RS-NR2	9, 10 11	all 1
Current relays	RS-185-4, RS-186-4 RS-187-4, RS-188-4	12, 13 14, 15	all 1
Voltage relays	RS-190-4, RS-191-4 RS-192-4, RS-193-4	16, 17 18, 19	all 1
Phase relay	RS-PH1-4	20	1
Industrial relay (High frequency switching)	RS-IR2	21	1

Features:

- 100% computer tested
- many level-relais
- some relays are listed by VW
- many customer specific relays