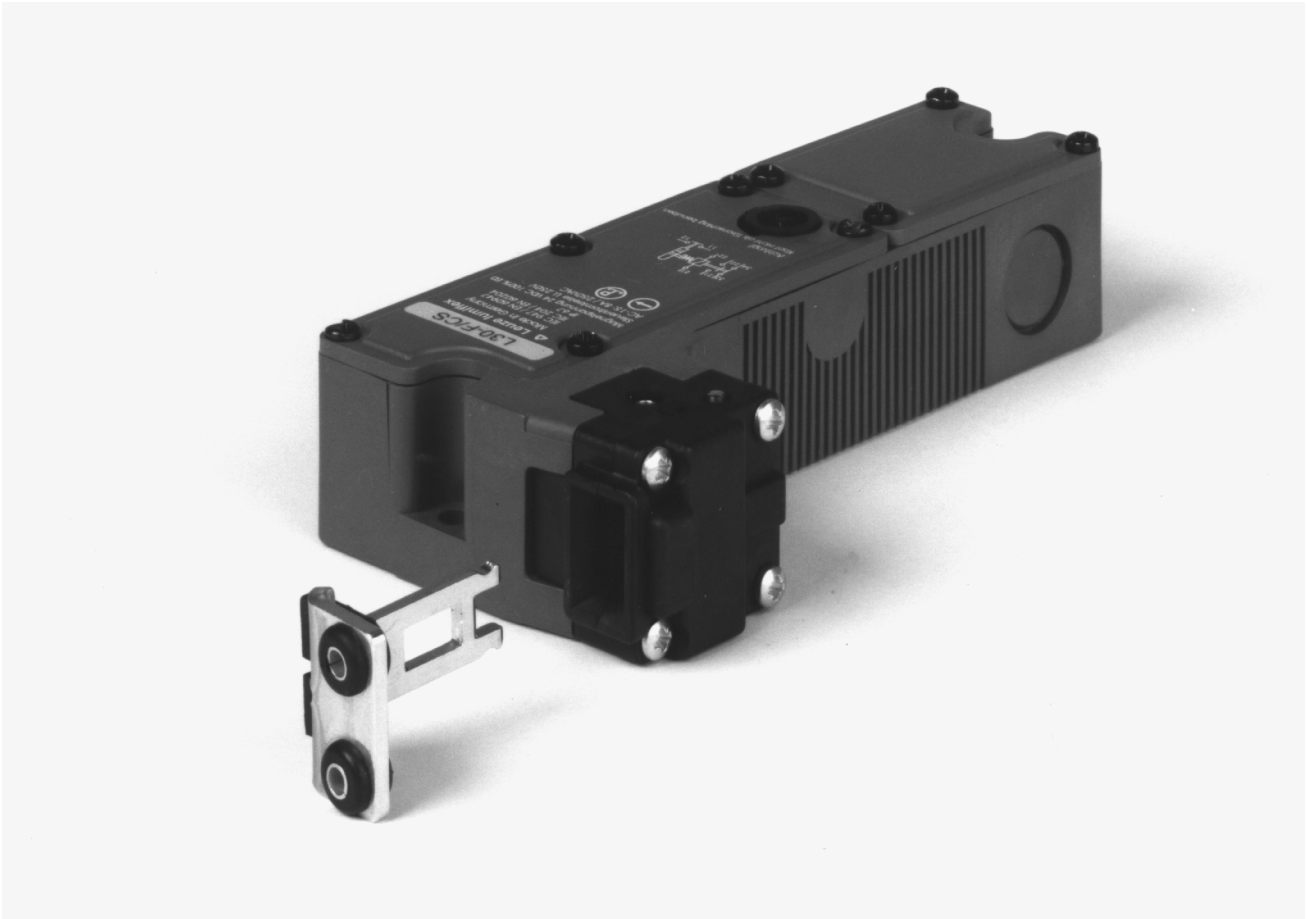
L30
Safety Interlocking Device
Technical Description



603945-12/99 subject to change without prior notice

About this technical description

This description contains information regarding the proper and effective use of the safety interlocking devices L30.

Safety precautions and warnings are designated by the symbol. 

Leuze lumiflex GmbH + Co is not liable for damages resulting from improper use of its equipment. Familiarity with this description constitutes part of the knowledge required for proper use.

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TABLE OF CONTENTS

1 Safety Interlocking Device L30

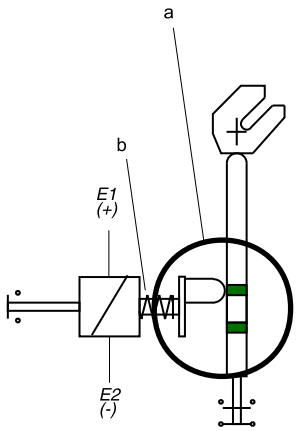
“Interlocking device with guard locking” (European Standard EN 1088)

Safety interlocking devices, Series L30, are necessary if:

- The stopping time of a dangerous movement is longer than the period of time it takes for a person to reach the hazardous area. As a rule, an access time of 1.6 m/s is taken as a basis for this calculation.
- Safety doors are automatically monitored, without a change in state of the interlocking device, thus causing an increased risk that an undetected error could occur between the control cycles (EN 1088, Clause 7.5.2).
- An undefined interruption of the production process should be avoided for reasons of machine safety and protection of the production material (in accordance with EN 60 204-1, Clause 9.4.1).

1.1 Safety Features

- Protects humans from dangerous movements in the operating range of industrial machinery and systems.
- Safety interlocking devices with guard locking for the position monitoring and guard locking of protective devices until the machine movement that is hazardous to humans has come to a standstill (“double position detection“)
- The constructive feature of the *fail-locking system* ensures that the interlocking device can go into effect only when the safety door is closed. It is thus impossible for interlocking to take place when the protective device is open.



a = fail-locking system
b = safety spring

Fig. 1 Safety interlocking device with integrated fail-locking device

- Protective device monitors (according to EN 954-1): Safety interlocking devices are not assigned to a safety category (SC). They can merely fulfill the requirement set by particular categories for integration into safety circuits. Connection examples for SC 1 to 4 are given in the Appendix, Section 3.1.
- The interlocking device and the actuator are not constructively connected to each other. Due to the operating procedure using a separate actuator, the following applies:
  - The separating protective device is guard locked until no risk of injury is posed by a machine function that is hazardous to humans.

- The machine is unable to perform a dangerous movement when the protective devices are open.

1.2 Functional and Constructive Features

1.2.1 Advantages of Series L30

- The slim L-shaped design is particularly well-suited for rotating protective devices whose assembly is based on profile systems.
- The actuating head can be displaced 4 x 90°.
- The funnel-shaped entry openings for the actuating heads have a self-centering effect when the movable protective device is closed. The actuator has a minimal amount of leeway to move within certain tolerances when it is in the locked position. This helps to prevent false signals that could be caused by the effects of possible shocks or vibrations. An additional ball lock in the actuating head extends this advantage even further.
- A transverse sliding adapter plate makes it possible to implement the L30, in particular, at revolving doors with a profile-system assembly. Using the adapter plate results in an even surface for attaching the devices to the Series L30 actuators (see Fig. 15).
- A dust-proof flap in the approach range of the actuator (integrated in the actuating head) prevents dirt and dust particles from entering when the protective device is open (see Fig. 2).

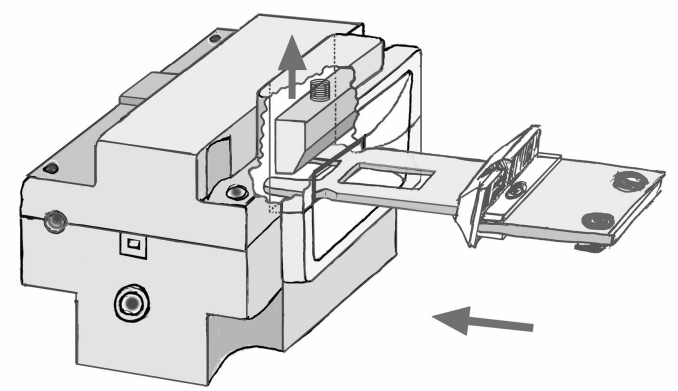
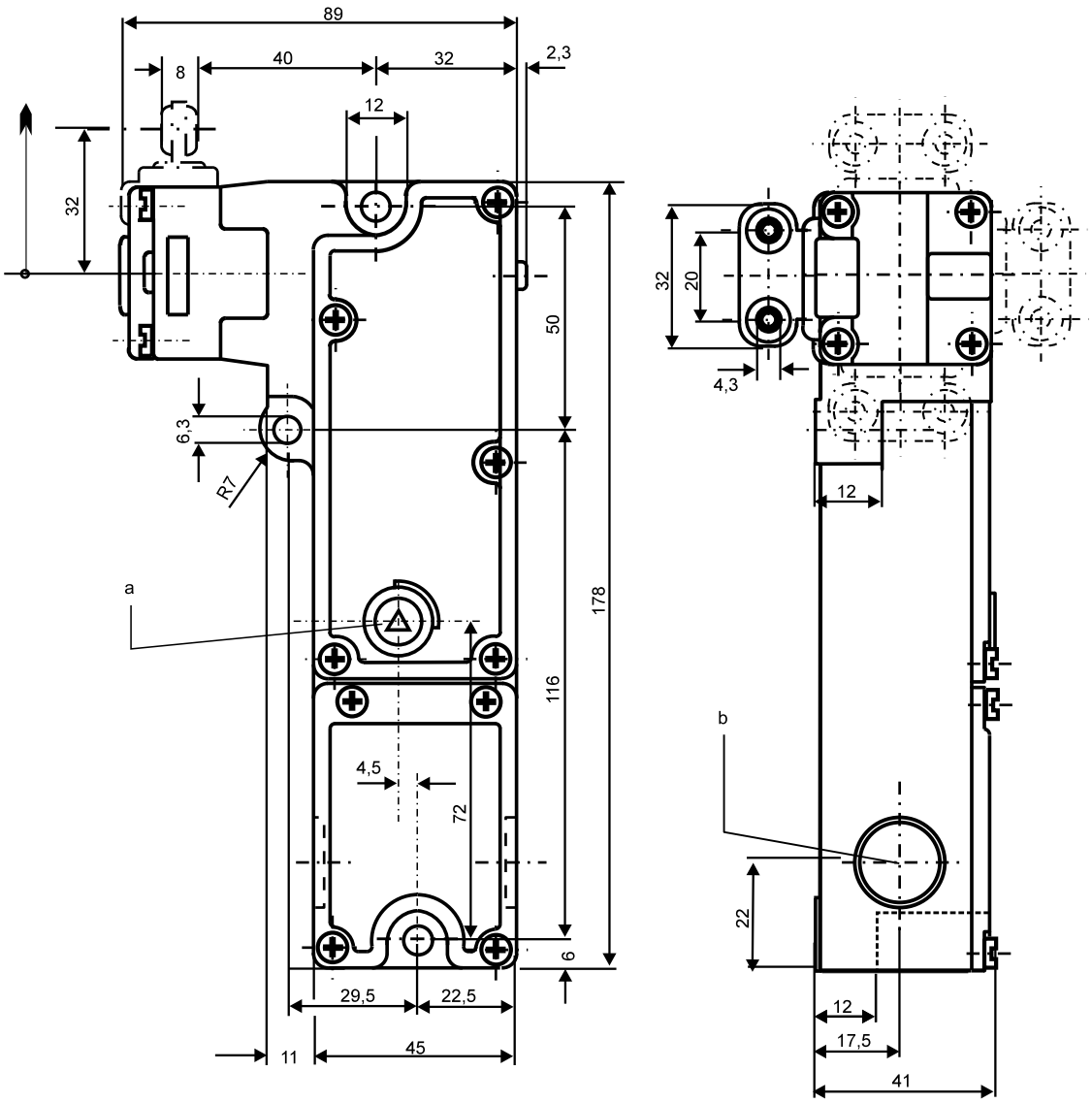


Fig. 2 Automatic locking mechanism in the actuating head, Series L30

- “Auxiliary release” – In case of a fault, it is possible to release the guard locking with a square socket key, no matter what state the guard locking mechanism (i.e. the solenoid) is in (see Fig. 13).

1.2.2 Dimensions



a = auxiliary release with esp. square socket key
b = punched out hole PG 13.5

Fig. 3 Dimensions – Safety interlocking device L30 with auxiliary release

Legend: „Basic dimensions of actuator“

1.2.3 Spring-Operated and Power-Operated Safety Interlocking Devices L30

1.2.3.1 L30-F – Spring-Operated

Features

- Held in the locked state by means of spring tension and actively released when the solenoid is actuated.
- Works on the closed-circuit current principle.
- If the supply voltage to the interlocking device is interrupted, the protective device can still fulfill its safety function.
- An auxiliary release allows the interlocking device to be opened even if no voltage is applied.
- The spring responsible for guard locking is equipped as a safety spring.

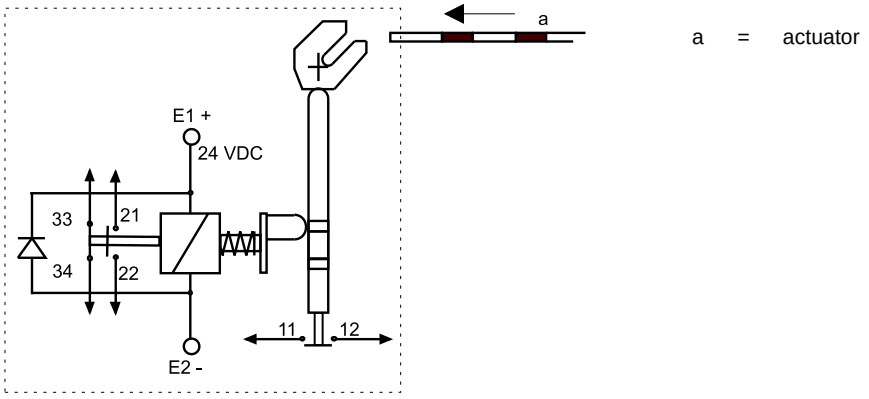


Fig. 4 Functional principle – **L30-F**

Applications

- According to EN 1088, spring-operated safety interlocking devices are to be implemented for tasks with a human protection function.
- At all types of machine tools, industrial robots, packaging machines, printing presses, paper processing machines, etc.

1.2.3.2 L30-M – Power-Operated

Features

- Actively held in the locked state by solenoids and released by means of spring tension.
- Works on the open-circuit current principle.
- The protective device can be opened immediately if the supply voltage is interrupted.

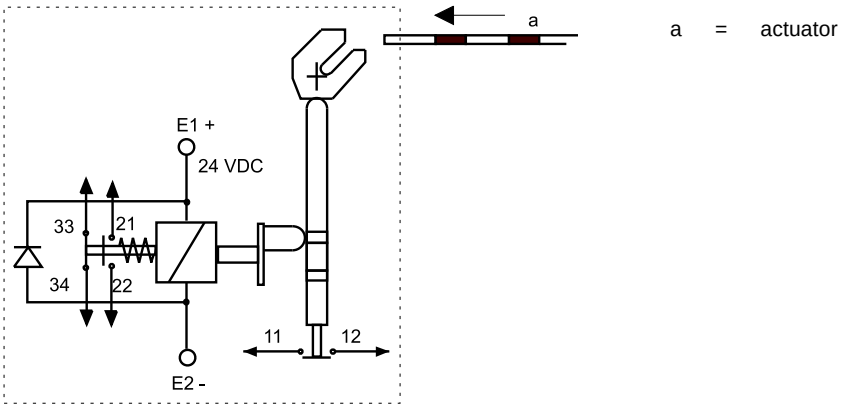


Fig. 5 Functional principle – **L30-M**

Applications

- According to EN 1088, power-operated safety interlocking devices can be implemented for tasks of machine safety and of protecting the production material (e.g. preventing the undefined interruption of a production process).
- At all types of machine tools, industrial robots, packaging machines, printing presses, paper processing machines, etc.

1.2.3.3 Versions – Key for Identifying Device Types

TE	Door position monitoring (open/closed)	
ME	Solenoid position monitoring (guard locked/opened)	
L30-M	Power-operated interlocking device	„M“
L30-F	Spring-operated interlocking device	„F“
L30-_/C	Contact configuration: 1 normally closed contact (TE) – 1 normally closed contact/1 normally open contact (ME)	„C“
L30-_/E	Contact configuration: 1 normally open contact (TE) – 2 normally closed contacts	„E“
L30-_/G	Contact configuration: 1 normally open contact (TE) – 1 normally closed contact/1 normally open contact (ME)	„G“
L30-_/_ _ S	Auxiliary release	„S“

1.2.4 Connection/Contact Layouts

- Eight self-lifting screw terminals M 3.5 form the connections to the contacts and the solenoid supply voltage. These are located in a separate connection chamber away from the rest of the device’s functional mechanism.
- The standard device wiring is fed through two lateral cable entries Pg 13.5

(punched-out holes). Alternatively, the cable entry can be located at the front with respect to the connection chamber. For this purpose, a specially constructed cover with an integrated cable entry Pg 13.5 (see Fig. 16) is available as an optional accessory.

1.2.4.1 Assignment

- *Normally closed contact* 11-12 for monitoring the position of the movable protective device (“Door position monitoring“)
- *Normally closed contact* 21-22 (31-32) for detecting the guard locking position (“Solenoid position monitoring”)

Plus, each L30 has at least one feedback contact 33-34.

1.2.4.2 Versions L30-M

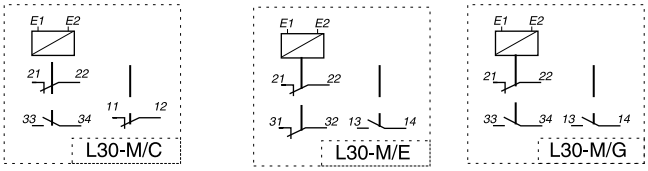


Fig. 6 Contact layout – L30-M

1.2.4.3 Versions L30-F

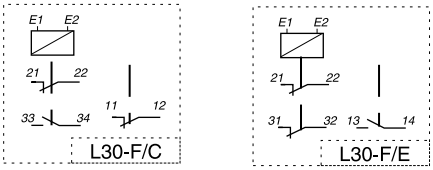


Fig. 7 Contact layout – L30-F

1.3 General Mounting Instructions for Series L30

Installation position	Any chosen position. The actuating head should, however, be positioned so that it is protected from direct exposure to flying chips, cooling and cutting oils, etc.
Attachment – actuator	2 x one-way screws M4 with washers (enclosed) or corresponding rivet. It must be impossible to dismantle the actuator key using simple means.

Setup and position L30 	**The devices may not be used as a dead stop for the door.** Place the L30 at the closing edge of doors, hinged covers and sliding grids. The ball lock in the actuating head allows the door to be positioned. The door's end position should be adjusted onto the ball lock. The door can be moved axially approx. 5 mm when in the locked state. The coded actuator must be precisely guided into the L30 switch opening. Do not fall below the minimum swivelling radius of doors and hinged covers as specified by the manufacturer. Positively attach the actuator to the protective device Secure the attachment elements of the L30 and the actuator so as to prevent self-loosening. Use sufficiently shielded wiring.
Attachment – L30	Wall/floor mounting with 3 screws DIN 912 M6 x 20 and special spring washers (included in delivery).
Attachment – actuating head 	The enclosed one-way screws can be used instead of the standard screws provided in the actuating head. This prevents the actuating head from being manipulated after installation has been completed. The advantages of being able to displace the heads, depending on the conditions for installing the devices, and of the simplified bearing support can be fully maintained. For spring-operated safety interlocking devices, Series L30, the separate actuator must be inserted when the actuating head is turned.

1.3.1 Measures Against Defeating Safety Interlocking Devices (according to EN1088)

In order to prevent simple manipulation (with screwdrivers, bent wires and the like), the actuators are given multiple codes and the actuating heads of the devices, among others, are equipped with locking discs.

In case of elevated risk (if used for SC 3 (4)), additional measures against defeat are advisable:

- If the one-way screws (included in delivery) are used, the actuators create an indissoluble connection to the separating safety door.
- A concealed installation can hinder the insertion of "substitute actuators" and at the same time provide *increased protection* against damage (see Fig. 8).

a = safety interlocking device
b = actuator
c = guide rail

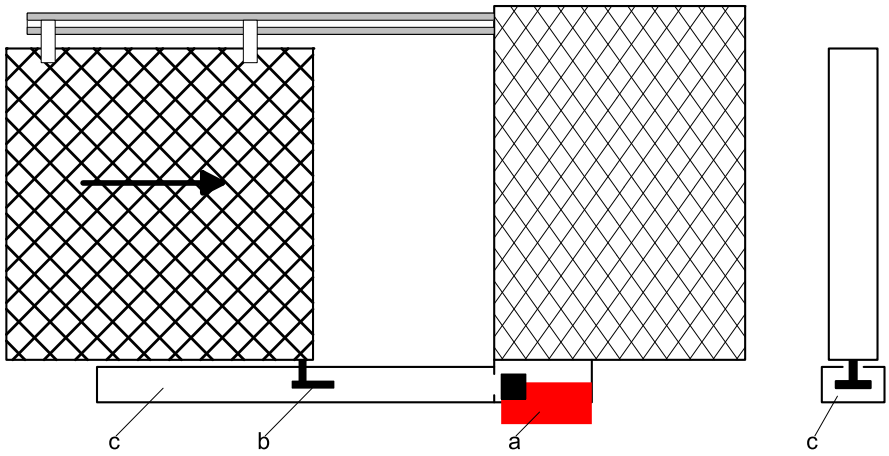


Fig. 8 Mounting example: „increased protection“

1.4 Delivery Overview

Type	**Contact Components**	**Order No.**
Safety Interlocking Device with Guard Locking		
L30-M/C	1 NC - 1 NC/1 NO	640020
L30-M/E	1 NO - 2 NC	640021
L30-M/G	1 NO - 1 NC/1 NO	640022
L30-F/CS	1 NC - 1 NC/1 NO	640023
L30-F/ES	1 NO - 2 NC	640024

Delivery does not include the actuators of the safety guard interlocks S 10, L 30 and L 50.

Zubehör

Type	**Feature**	**Order No.**
Actuator		
CO-L30	Actuator, standard	640050
CW-L30	Actuator, standard, angled	640051
COF-L30	Actuator +/- 15 °	640052
CORF/15°-L30	Actuator with prestressed spring	640053
CORF/7,5°-L30	Actuator with prestressed spring	640054
Others		
APL-L30	Adapter plate	640062
PG-L30	PG cover attachment	640064
K/75-L30-L50	Square socket key	640063

1.5 Technical Data

Standards/Specifications

Industrial switch gear, positively opening	In accordance with IEC 947; EN 60947; DIN VDE 0660
Interlocking device with guard locking	In accordance with EN 1088

Mechanical Data

Enclosure rating	IP 67
Ambient temperature range	0 °C ... 50 °C
Housing material	Glass-fiber reinforced thermoplastic material, self-extinguishing, hardly flammable
Sealing	Perbunan, resistant to liquid fuels and oil
Cable entries	2 x PG 13,5
Connection types	Screw terminals, 0.5 mm^2 .. 2.5 mm^2 rigid or .. 1.5 mm^2 flexible
Connection designat-ion	DIN EN 50 005/50 013
Installation position	Any chosen position [1)]
Mechanical service-able life	min. 2 x 10^6 switching cycles
Switching frequency	120 cycles/h
Actuating force	Insertion: 10 N, withdrawal: 20 N
Max. extraction force (guard locking force)	approx. 1750 N, max. admissible door weight 40 kg
Shock resistance	> 30 g/11 ms
Vibration resistance	> 20 g/10 ... 55 Hz
Climatic resistance	Conforms to DIN EN 60 068 part 2-30

1) The entry openings for the actuator should, however, be positioned in such a way that they are protected from coarse dirt and moisture.

Electrical Data

Utilization category in accordance with DIN VDE 0660/part 200	AC-15/ 250 V AC/ 8 A DC-13/ 24 V DC/ 5 A
Contact material	Fk-Ag, silver-plated, passivated
Switching of small loads	24 V/10 mA
Rated isolated voltage U_{ri}	440 V, test voltage 2,500 V
Thermal rated performance	max. 10 A
Clearance and creepage distance in accordance with DIN VDE 0110	Pollution degree 3 over-voltage category III
Proof of positive opening	2.5 kV impulse voltage
Positive opening path	Door monitoring: approx. 2 x 3.5 mm Solenoid monitoring: approx. 2 x 3 mm
Short circuit protection	gG 10 A

Solenoid

Solenoid voltage	24 V DC, voltage tolerance: +5 % / -10 %
C.d.f.	100 %
Power consumption	24 V DC: 300 mA cold, 250 mA warm
Rated frequency	50/60 Hz
Approvals	BIA, UL, CSA

2 Accessories

2.1 Separate Actuators for Safety Interlocking Devices, Series L30

2.1.1 Features

- Rubber buffers with integrated spacer sleeves compensate for tolerances between the guideway of the movable protective device and the entry opening for the actuating heads.
- Actuator key has 5 mm of leeway when the safety interlocking devices are in the locked state.
- Integrated auxiliary stop at the end of the actuator shaft prevents possible damage

2.1.2 Technical Data

Actuator	Galvanized steel
Auxiliary stop	Glass-fiber reinforced, thermoplastic material, self-extinguishing
Rubber buffers	Perbunan, resistant to liquid fuels and oil

2.1.3 Dimensions

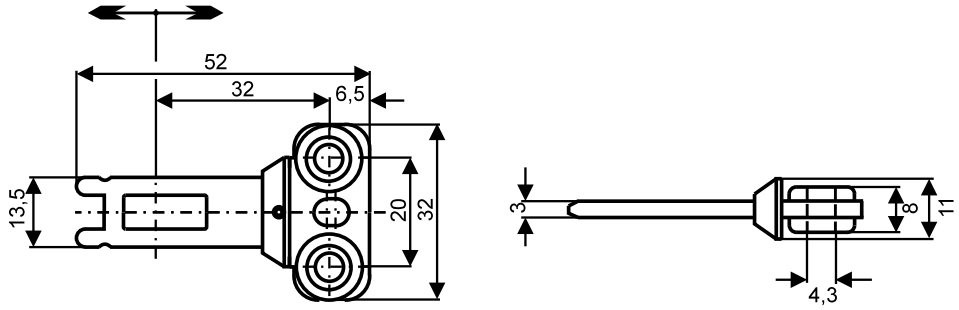


Fig. 9 Actuator: ***CO-L30***

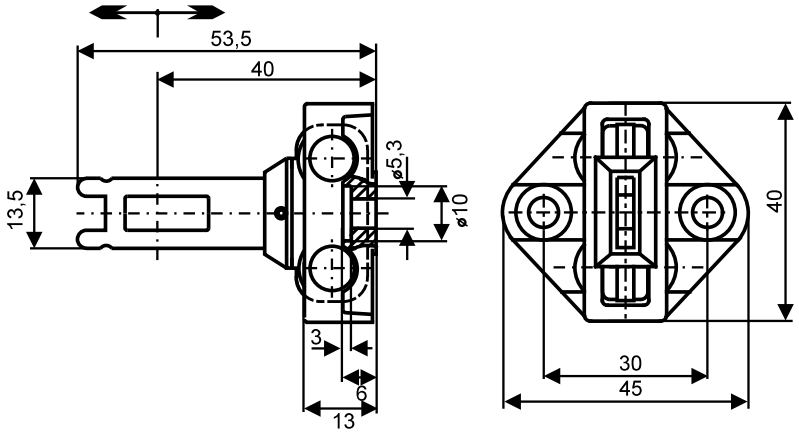


Fig. 10 Actuator, angled: ***CW-L30***

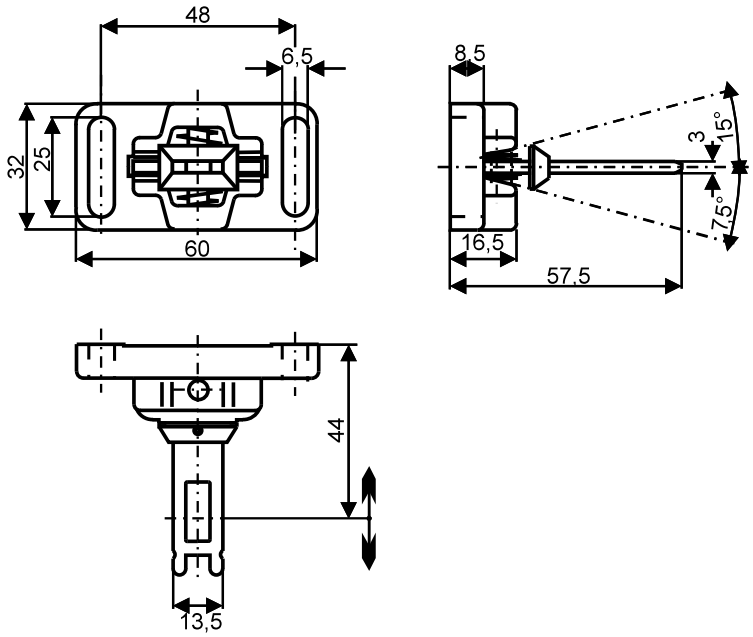


Fig. 11 Telescope actuator +/-15 °: ***COF-L30***

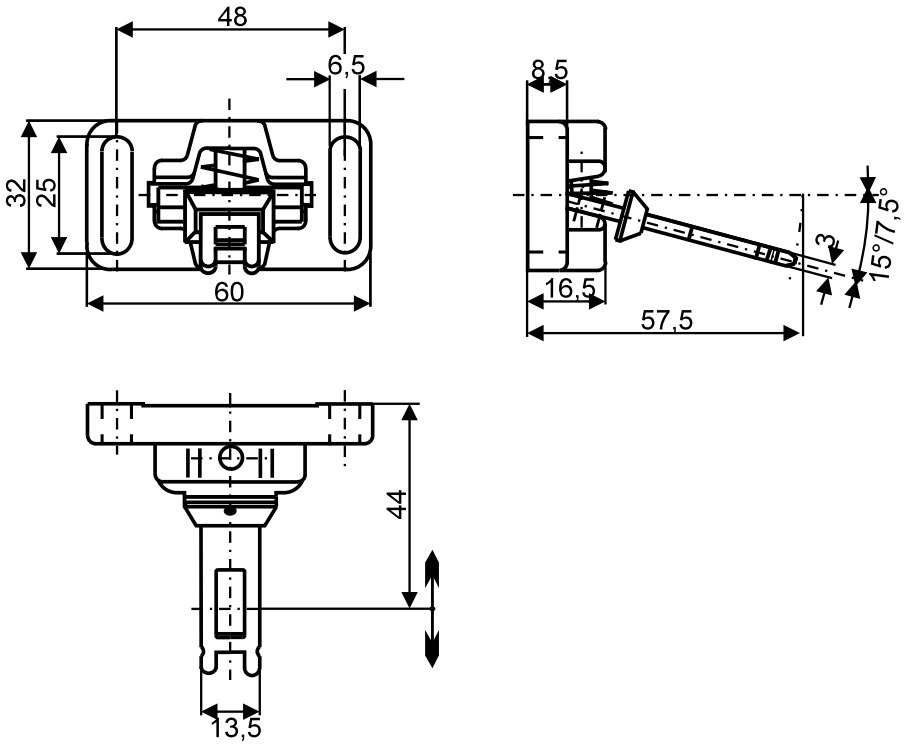
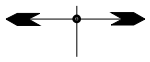


Fig. 12 Actuator with prestressed spring: ***CORF/15°(7,5°)-L30***

Legend: „Basic dimensions of actuator“ 

2.2 Square Socket Key for Auxiliary Release Function - L30

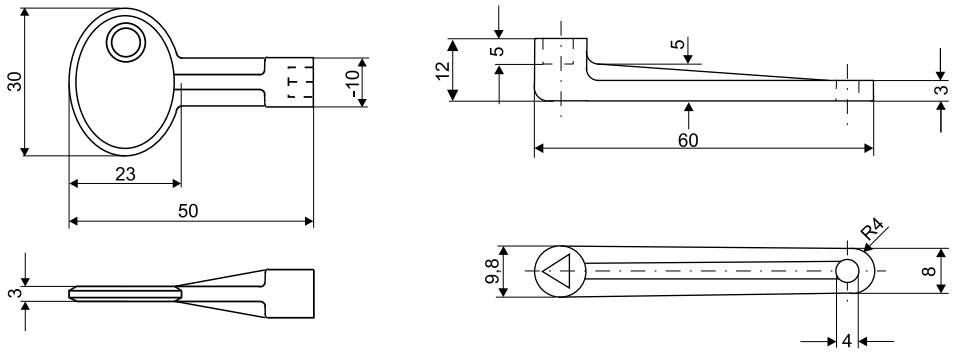


Fig. 13 (included in delivery)**Fig. 14** K/75-L30-L50

2.3 Adapter Plate

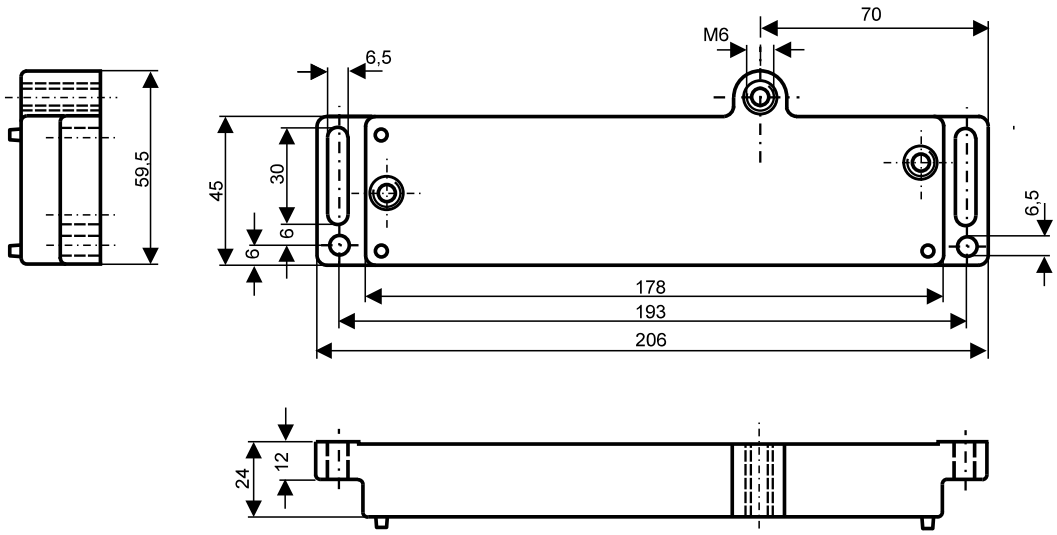


Fig. 15 APL-L30

2.4 Additional Cover with PG Cable Entry at the Front

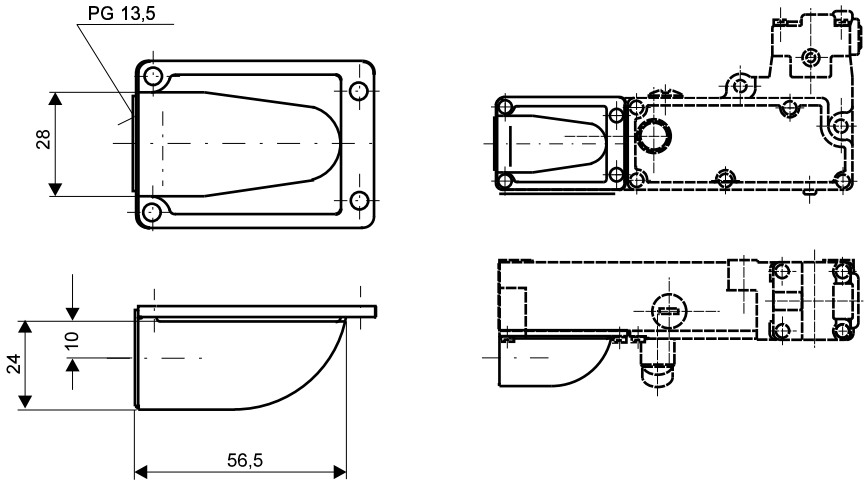


Fig. 16 PG-L30

3 Appendix

3.1 Connection Examples

Corresponding to a risk assessment as specified in EN 954-1A, a safety category is determined for devices intended to protect humans at production systems. The contacts of the safety interlocking devices function as the interface to the safety relay modules in the machine controls. The circuit diagrams below show wiring examples for connecting safety interlocking devices with MSI safety relay modules, classified by safety category (1 – 4).

(For the configurations and technical data related to the MSI safety relay modules, refer to the Connection and Operating Instructions for MSI-SR1 and MSI-SR2)

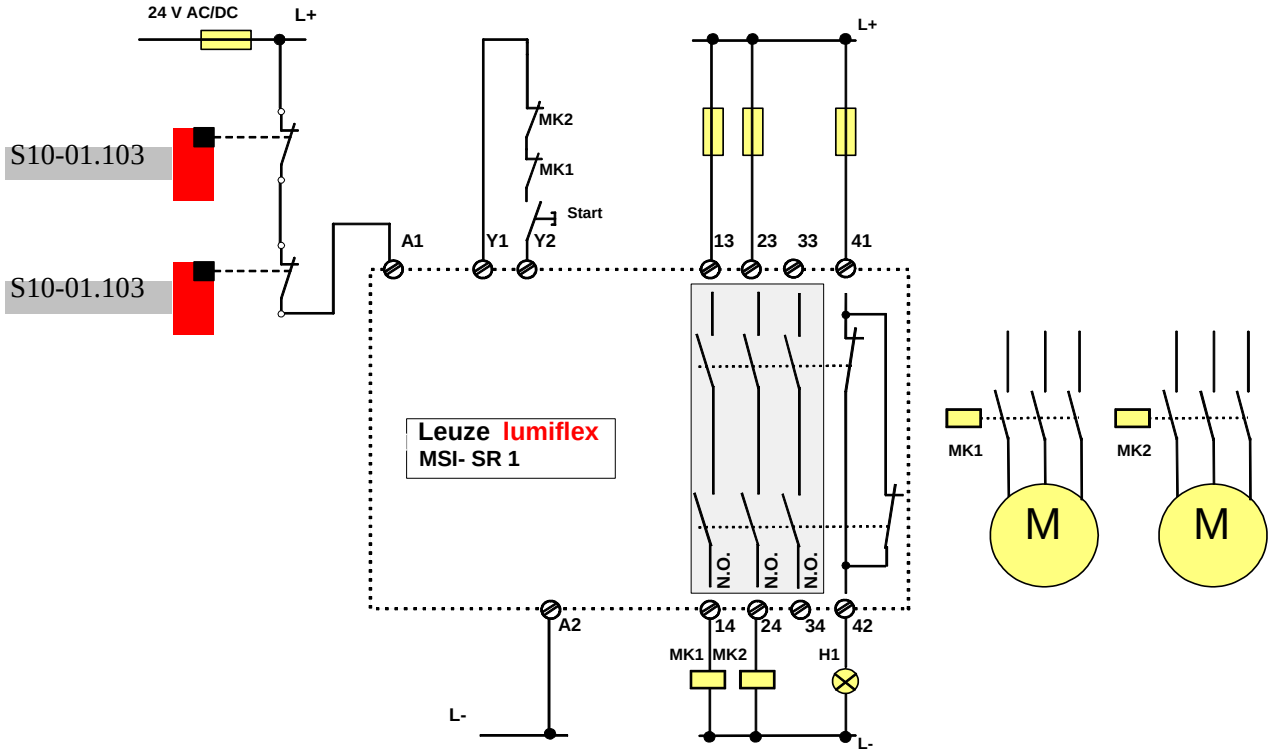
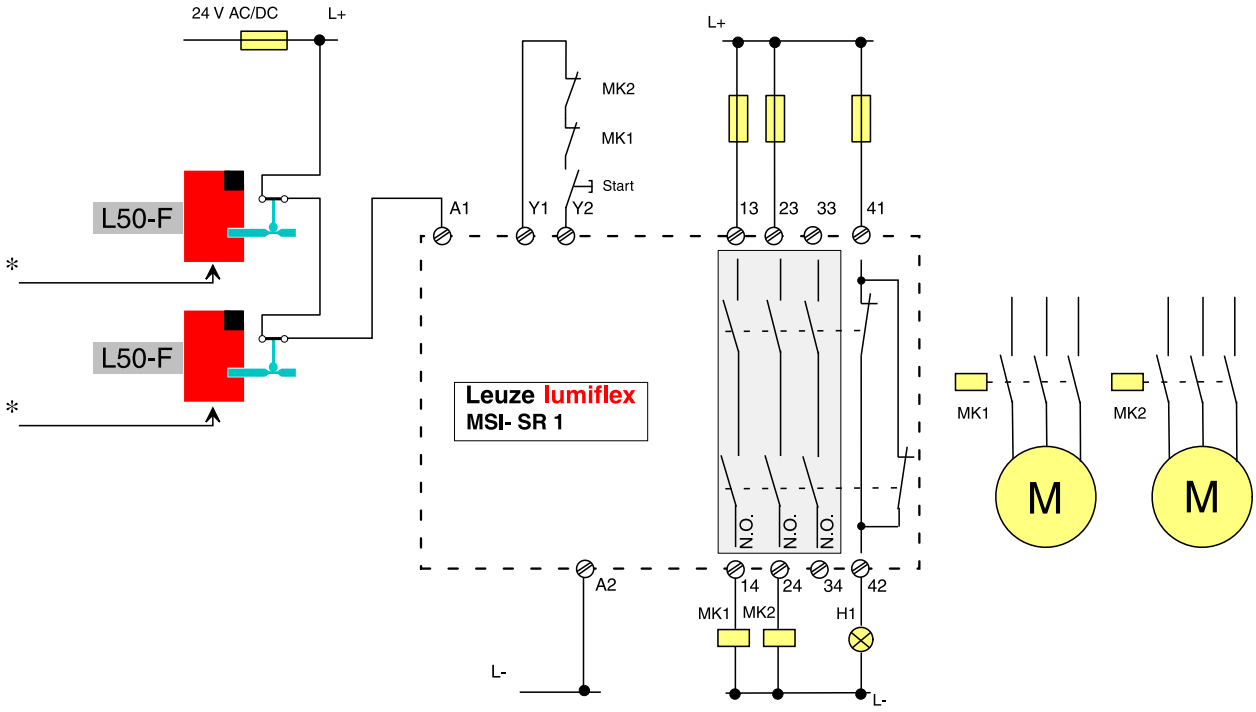


Fig. 17 Safety door monitoring in safety category 2 (1) according to EN 954-1

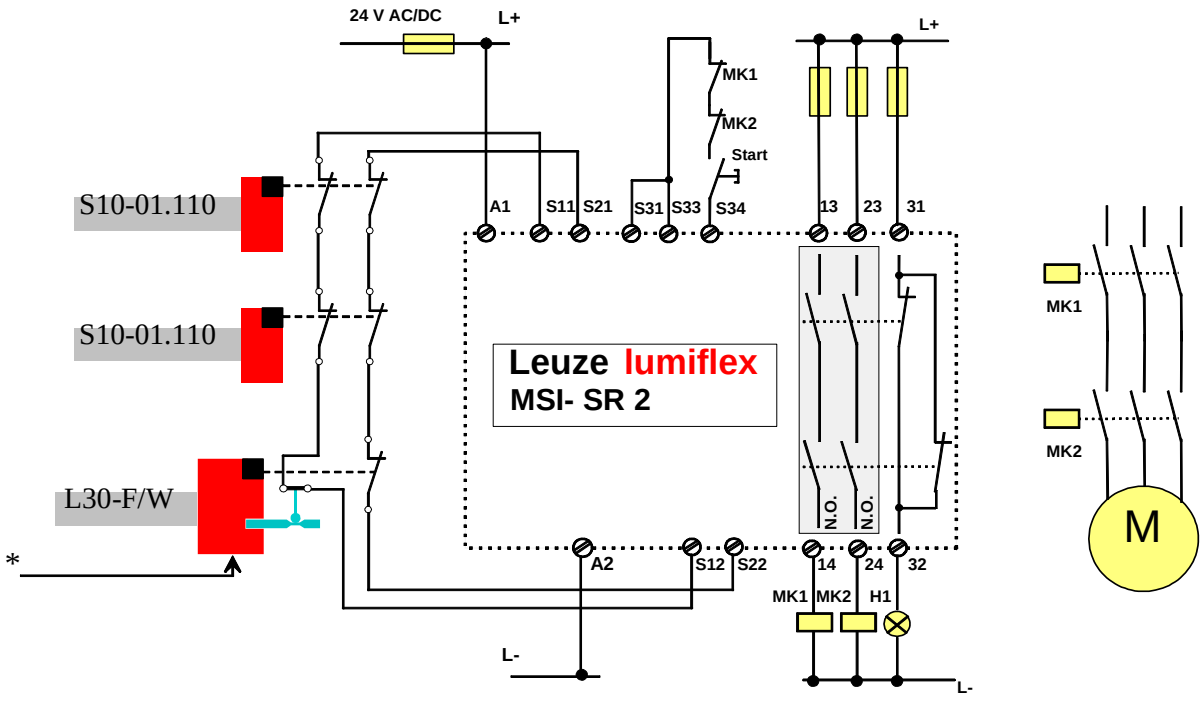
- MSI-SR1, single-channel
- Combination of several safety doors, each with 1 safety interlocking device S10 (S40)



* Separate magnet voltage supply (24V DC) serves as the guard locking signal by way of a time-delayed enabling circuit or stoppage control circuit – see Technical Description of safety interlocking device L50 (L30).

Fig. 18 Safety door monitoring with guard locking in safety category 2 (1) according to EN 954-1

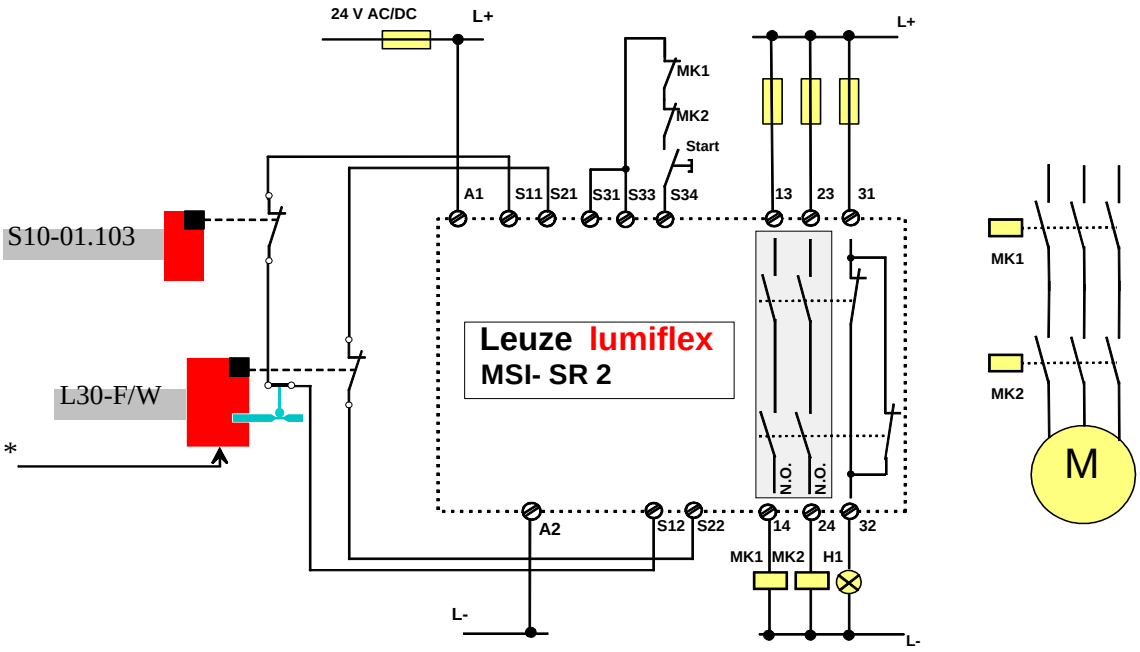
- MSI-SR1, single-channel
- Combination of several safety doors, each with 1 safety interlocking device with guard locking L50 (L30)



* Separate magnet voltage supply (24V DC) serves as the guard locking signal by way of a time-delayed enabling circuit or stoppage control circuit – see Technical Description of safety interlocking device L50 (L30).

Fig. 19 Safety door monitoring with/without guard locking, combined, in safety category 3 according to EN 954-1

- MSI-SR2, dual-channel (with cross circuit monitoring - for safety category 4)
- Combination of several safety devices, each with 1 safety interlocking device with/without guard locking S10 (S40) and L30 (L50) combined



* Separate magnet voltage supply (24V DC) serves as the guard locking signal by way of a time-delayed enabling circuit or stoppage control circuit – see Technical Description of safety interlocking device L50 (L30).

Fig. 20 Safety door monitoring with guard locking in safety category 4 according to EN 954-1

- MSI-SR2, dual-channel with cross circuit monitoring
- 1 safety interlocking device with guard locking L30 (L50) and 1 safety interlocking device S10 (S40) per safety door

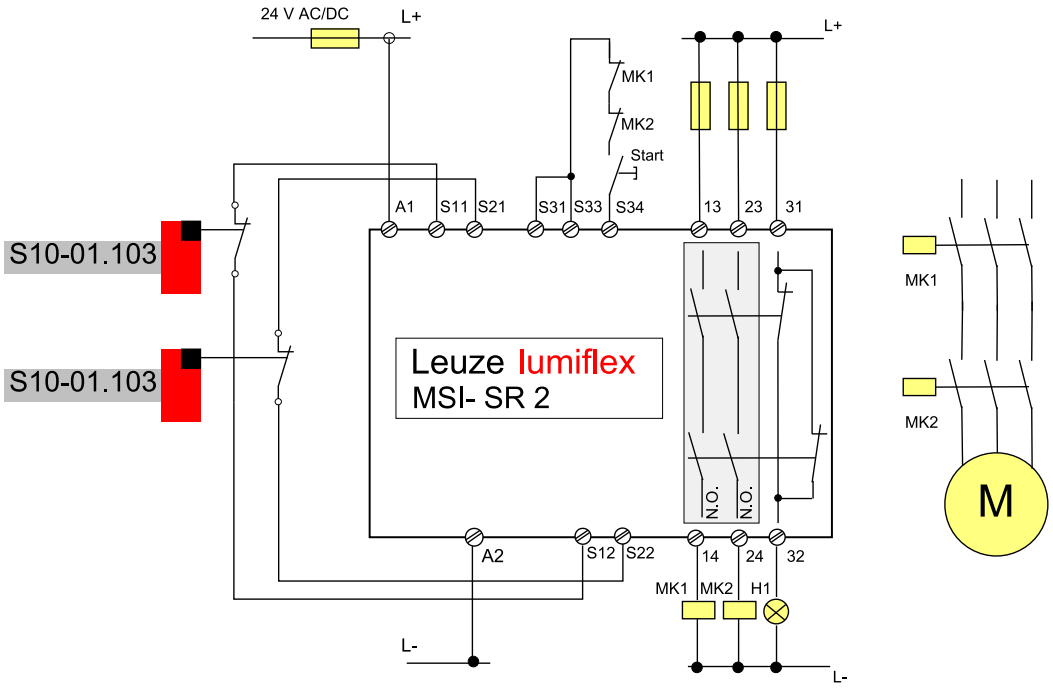


Fig. 21 Safety door monitoring in safety category 4 according to EN 954-1

- MSI-SR2, dual-channel with cross circuit monitoring
- 2 safety interlocking devices S10 (S40) per safety door with only 1 NC-contact per S10 (S40)

To ensure trouble-free operation, the cables used for connecting the safety interlocking devices to the MSI safety relay modules may not exceed specific lengths. For more information, refer to the admissible input cable resistance values in the Technical Data section of the connection and operating instructions for MSI-SR1 and MSI-SR2.