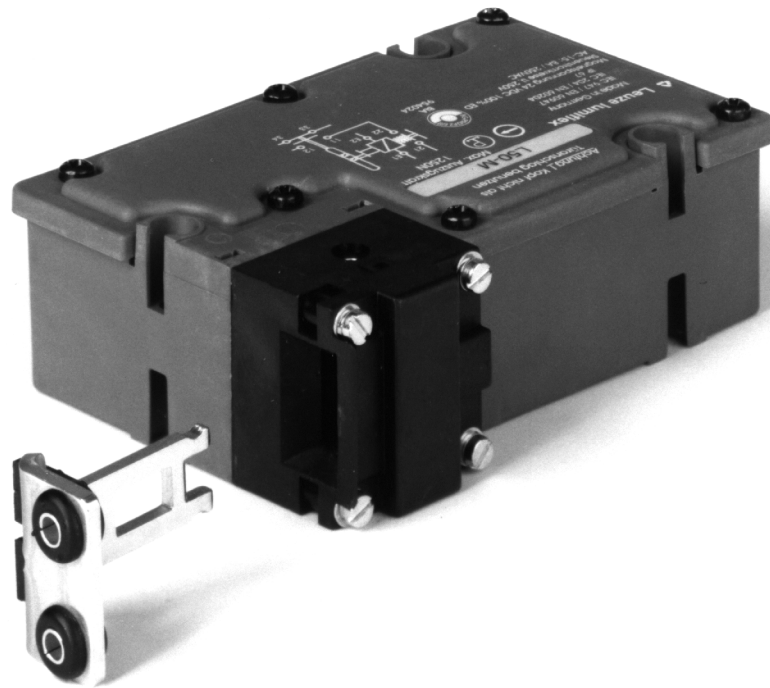




## L50

# Sicherheits-Türverriegelung / Safety Interlocking Device

Technische Beschreibung/Technical Description



### **About this technical description**

This description contains information regarding the proper and effective use of the safety interlocking devices L50.

Safety precautions and warnings are designated by the symbol.



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Leuze lumiflex GmbH + Co. KG  
Liebigstraße 4  
D-82256 Fürstenfeldbruck

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# 1 Safety Interlocking Device L50

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

Safety interlocking devices, Series L50, 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 monitor the position of protective devices and guard lock such 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.

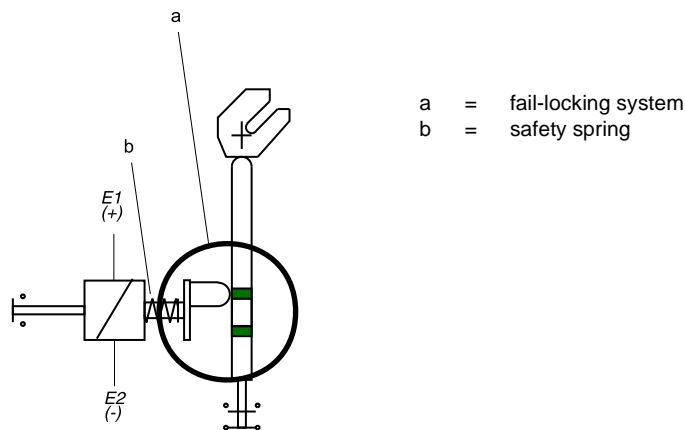


Fig. 1 Safety interlocking device with integrated fail-locking system



- 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 3.2.

- 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

- Spring-operated and power-operated versions (see 1.2.2).
- Funnel-shaped entry for the actuator.
- Ball lock in the actuating head for fixing the actuator.
- Actuating heads can be displaced 3 x 90°.
- Variable actuating radius possible with radius and telescope actuators (see 2.1 – Separate Actuators and 3.1 – Notes Regarding Minimum Radii).
- “Heavy duty” version for requirements that are more stringent than those of IP 67 (e.g. pressure-related effects of aggressive cooling agents and the like).
- “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 means of guard locking (i.e. the solenoid) is in (see Square Socket Key, Section 2.3).

### 1.2.1 Dimensions

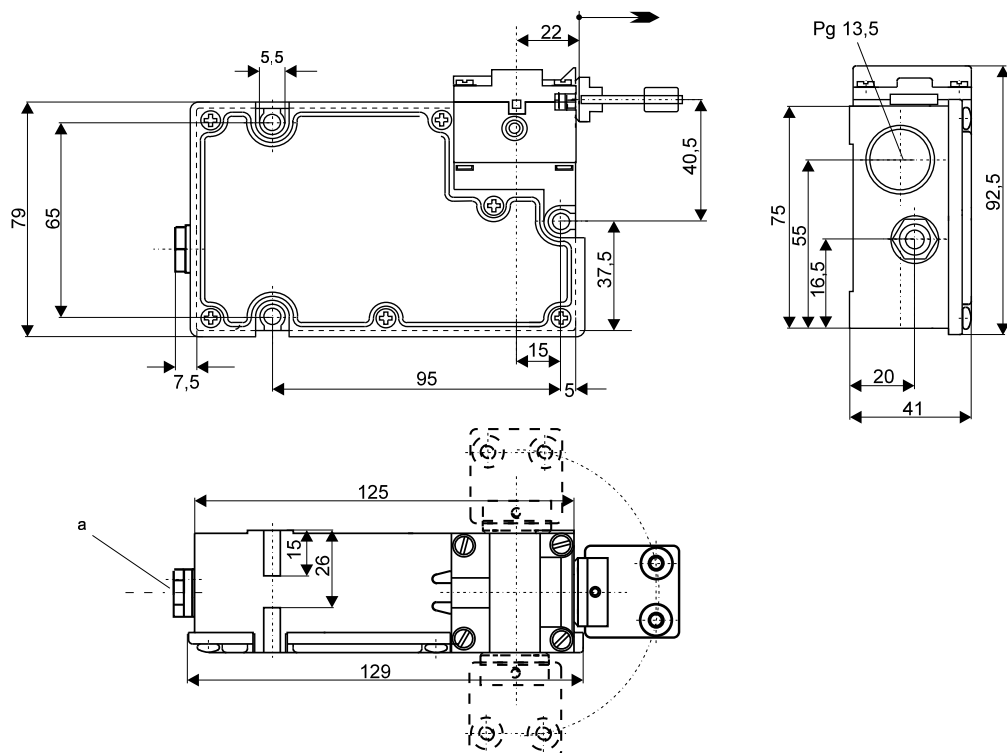


Fig. 2 Dimensions – safety interlocking device L50 with auxiliary release

## 1.2.2 Spring-Operated and Power-Operated Safety Interlocking Devices L50

### 1.2.2.1 L50-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 (available only for Type L50-F/CWS) allows the interlocking device to be opened even if no voltage is applied.
- The spring responsible for guard locking is equipped to function as a safety spring.

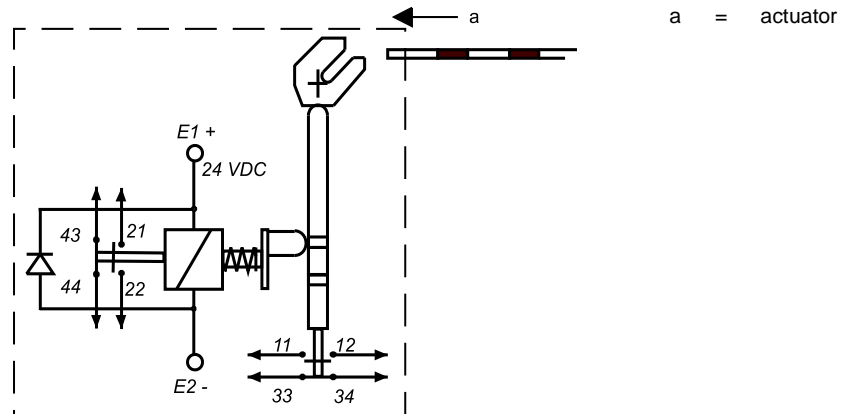


Fig. 3 Functional principle – L50-F

#### 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.

### 1.2.2.2 L50-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.

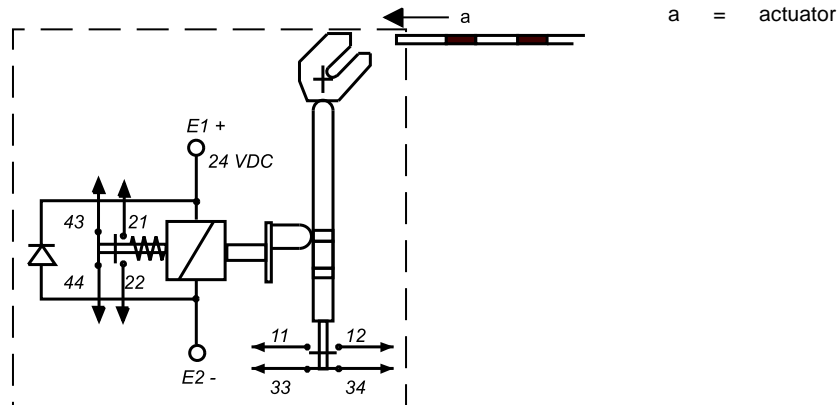


Fig. 4 Functional principle – L50-M

### 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.

### 1.2.2.3 Versions – Key for Identifying Device Types

L50-M	Power-operated interlocking device	„M“
L50-F	Spring-operated interlocking device	„F“
L50-_/C	Contact configuration: 2 normally closed contacts/ 2 normally open contacts	„C“
L50-/_/W	All contacts (normally open/normally closed) assembled separately	„W“
L50-/_/_S	Auxiliary release	„S“

### 1.2.3 Contact Layouts

#### 1.2.3.1 Assignment

All safety interlocking devices L50 are equipped with two independent safety contacts for signal processing:

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

Plus, each L50 has at least one feedback contact 33-34.



### 1.2.3.2 Versions L50-M

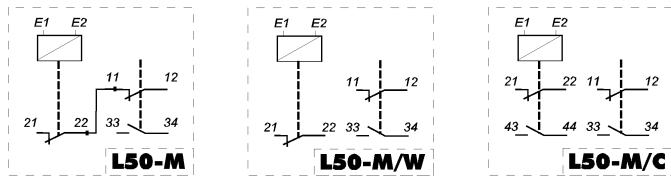


Fig. 5 Contact layout – L50-M

### 1.2.3.3 Versions L50-F

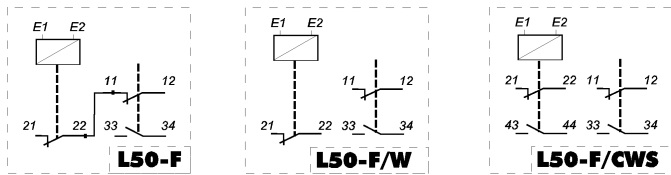



Fig. 6 Contact layout – L50-F

## 1.3 General Mounting Instructions for Series L50

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 L50 	<p><b>The devices may not be used as a dead stop for the door.</b></p> <p>Place the L50 at the closing edge of doors, hinged covers and sliding grids.</p> <p>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. 11 mm when in the locked state.</p> <p>The coded actuator must be precisely guided into the L50 switch opening.</p> <p>Do not fall below the minimum swivelling radius of doors and hinged covers as specified by the manufacturer.</p> <p>Positively attach the actuator to the protective device</p> <p>Secure the attachment elements of the L50 and the actuator so as to prevent self-loosening.</p> <p>Use sufficiently shielded wiring.</p>

Attachment – L50	Wall/floor mounting with screws 3 x M5 x 35 DIN 912 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 L50, 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. 7):

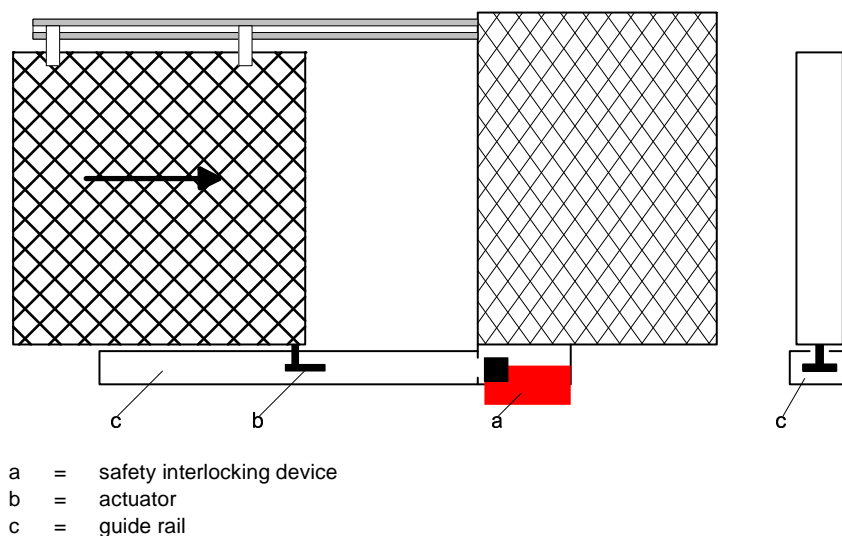


Fig. 7 Mounting example: „increased protection“

## 1.4 Delivery Overview

Type	Contact Components	Order No.
<b>Safety Interlocking Device with Guard Locking</b>		
L50-M	1 NC/1 NO - 1 NC	640030
L50-M/W	1 NC/1 NO - 1 NC	640031
L50-M/C	1 NC/1 NO - 1 NC/1 NO	640032
L50-F	1 NC/1 NO - 1 NC	640033
L50-F/W	1 NC/1 NO - 1 NC	640034
L50-F/CWS	1 NC/1 NO - 1 NC/1 NO	640035

Delivery does not include the actuators of the safety guard interlocks S10, L30 and L50.

### Accessories

Type	Feature	Order No.
<b>Actuator</b>		
CO-S10-L50	Actuator, standard	640049
COR-S10-L50	Radial actuator	640055
CW-S10-L50	Actuator, angled	640056
CWR-S10-L50	Radial actuator, angled	640057
COF/HIS.1-S10-L50	Telescope actuator, attached from behind	640058
COF/HIS.2-S10-L50	Telescope actuator, attached from above	640059
CK-S10-L50	Shortened actuator	640060
CWK-S10-L50	Shortened actuator, angled	640061
<b>Safety door belt</b>		
BL-L50	Safety door bolt with angle plate attachment	640041
BS-L50	Safety door bolt with angle plate attachment	640042
<b>Square socket key</b>		
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	„M“ version: -25° C ... +40° C „F“ version: -25° C ... +80° C
Housing material	Glass-fiber reinforced thermoplastic material, self-extinguishing, hardly flammable
Sealing	Perbunan, resistant to liquid fuels and oil
Cable entries	1 x PG 13,5
Connection types	Screw terminals, 0.5 mm <sup>2</sup> .. 2.5 mm <sup>2</sup> rigid or .. 1.5 mm <sup>2</sup> flexible
Connection designation	DIN EN 50 005/50 013
Installation position	Any chosen position <sup>1)</sup>
Mechanical serviceable life	min. 2 x 10 <sup>6</sup> switching cycles
Switching frequency	120 cycles/h
Actuating force	Insertion: 10 N, withdrawal: 20 N
Max. extraction force (guard locking force)	1500 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

<sup>1)</sup> 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
<b>Approvals</b>	BIA, UL, CSA

## 2 Accessories

### 2.1 Separate Actuators for Series S10 and L50

#### 2.1.1 Features

- Separate actuators for safety interlocking devices
- 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 11 mm of leeway when the safety interlocking devices are in the interlocked 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

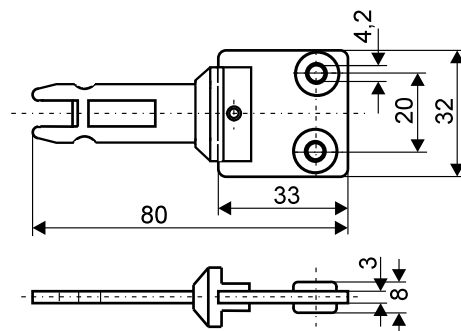


Fig. 8 Actuator: **CO-S10-L50\***

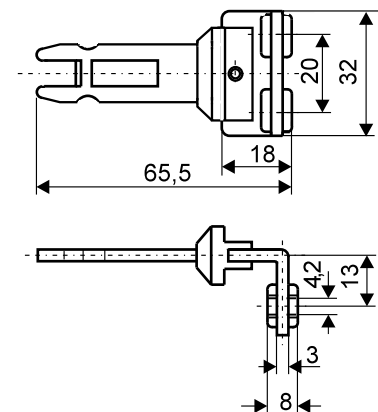
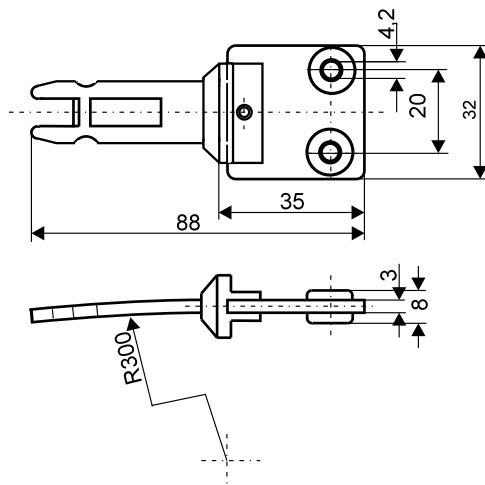
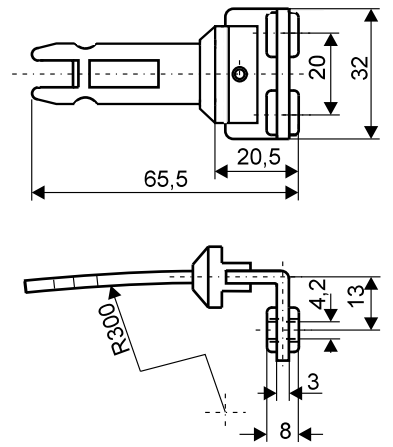


Fig. 9 Actuator, angled: **CW-S10-L50\***

\* Mounting notes regarding minimum radii for pivoting protective devices, section 3.1

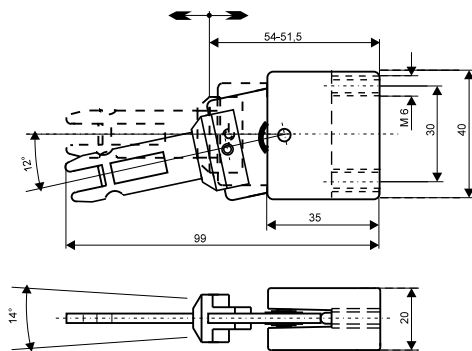


**Fig. 10** Radial actuator: **Fig. 11**  
**COR-S10-L50\***

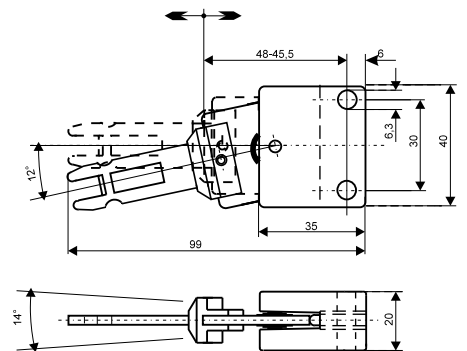


Radial actuator, angled:  
**CWR-S10-L50\***

\* Mounting notes regarding minimum radii for pivoting protective devices, section 3.1

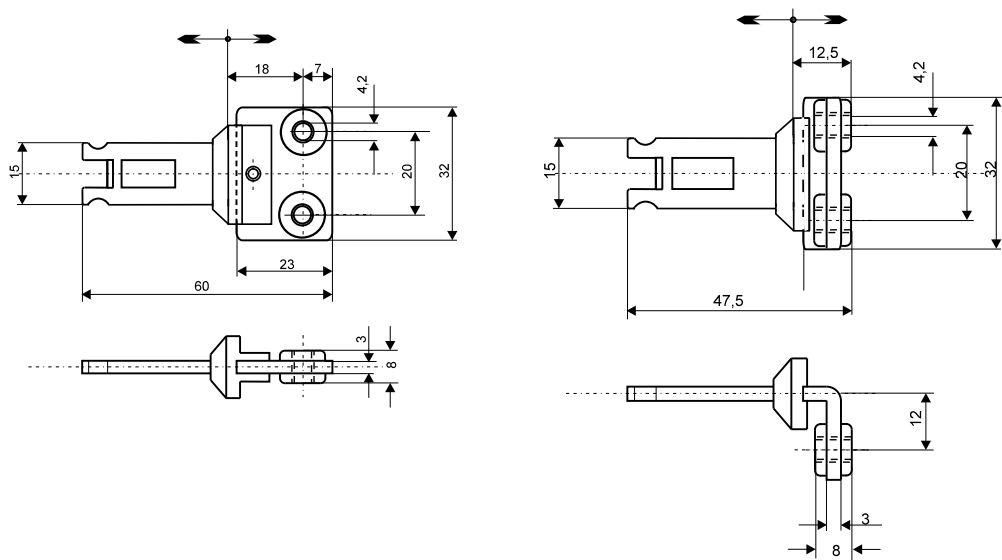


**Fig. 12** Telescope actuator **Fig. 13**  
**COF/HIS.1-S10-L50\***  
attached from behind



Telescope actuator:  
**COF/HIS.2-S10-L50\***  
attached from above

\* Mounting notes regarding minimum radii for pivoting protective devices, section 3.1



**Fig. 14** Shortened actuator: **Fig. 15** Shortened actuator, angled:  
**CK-S10-L50\*** **CWK-S10-L50\***

\* Mounting notes regarding minimum radii for pivoting protective devices, section 3.1

Shortened construction design results in:

- Actuator leeway reduced from 11 mm to 4 mm
- Reduced actuating radius possible (see Fig. 20, 22)
- Actuator tips no longer jut out from the back of the actuating head
- Increase in the maximum extraction forces due to the much shorter operating path for safety interlocking devices.

Legend: „Basic dimensions of actuator“

## 2.2 Safety Door Bolts for Series L50

### 2.2.1 Features

- Safety door bolts for attaching safety interlocking devices, Series L50
- Suitable for use with sliding and pivoting protective devices (e.g. safety doors).
- Suitable for use with right- and left-stopped safety doors.
- Can be mounted to commonly used aluminum profiles, square pipes and machine cover panels.
- Delivery includes door bolt along with actuator and mounting angle for Series L50
- Version BL-L50: Bent sheet-metal piece
- Version BS-L50: Solid flat-bar steel, 8 mm, with plastic guideway



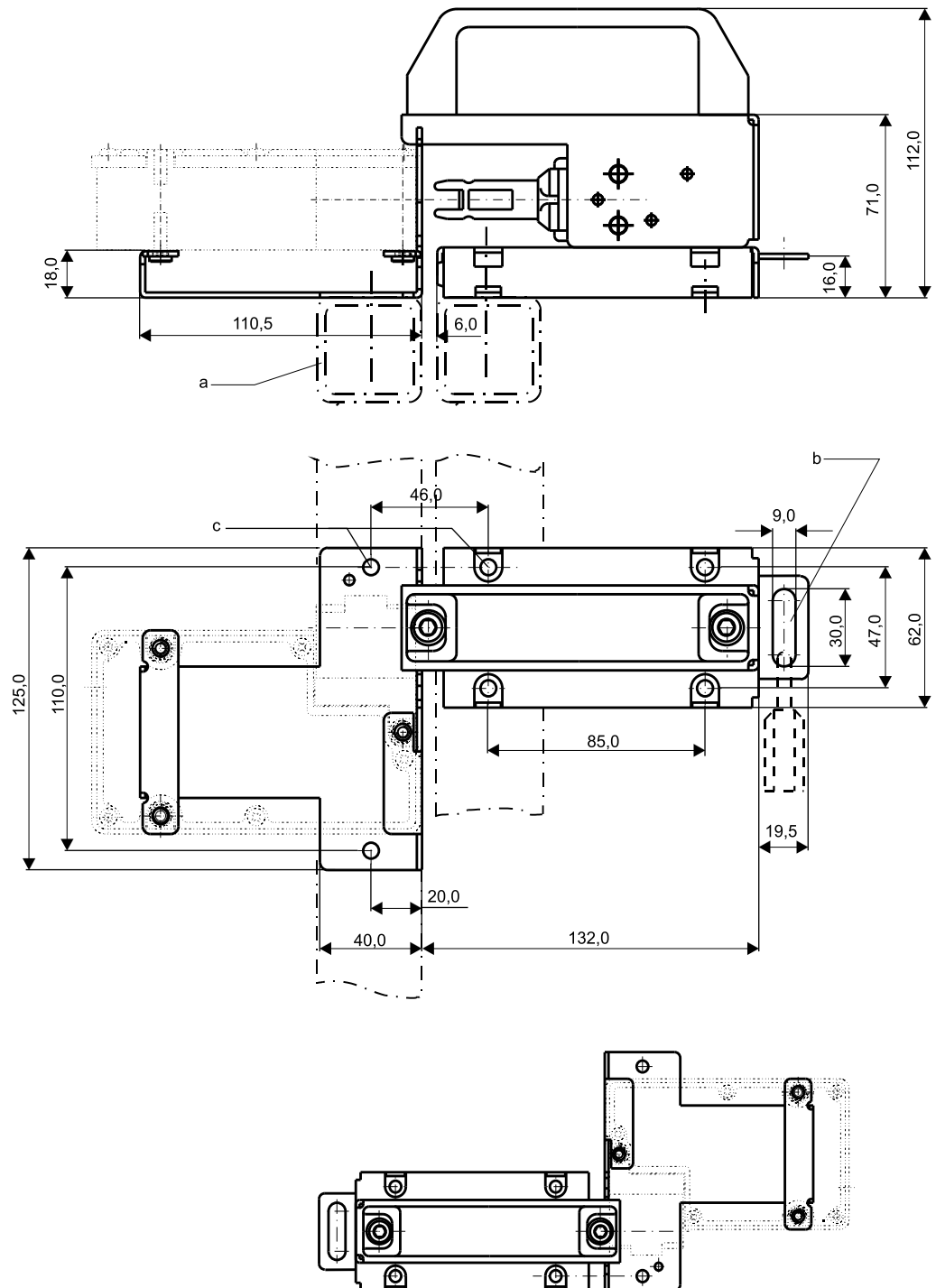
### **2.2.2 General Advantages**

- No need for the user to make mechanical adaptations (i.e. to adjust the actuator).
- No need for a mechanical end stop to protect interlocking devices L50 from damage.

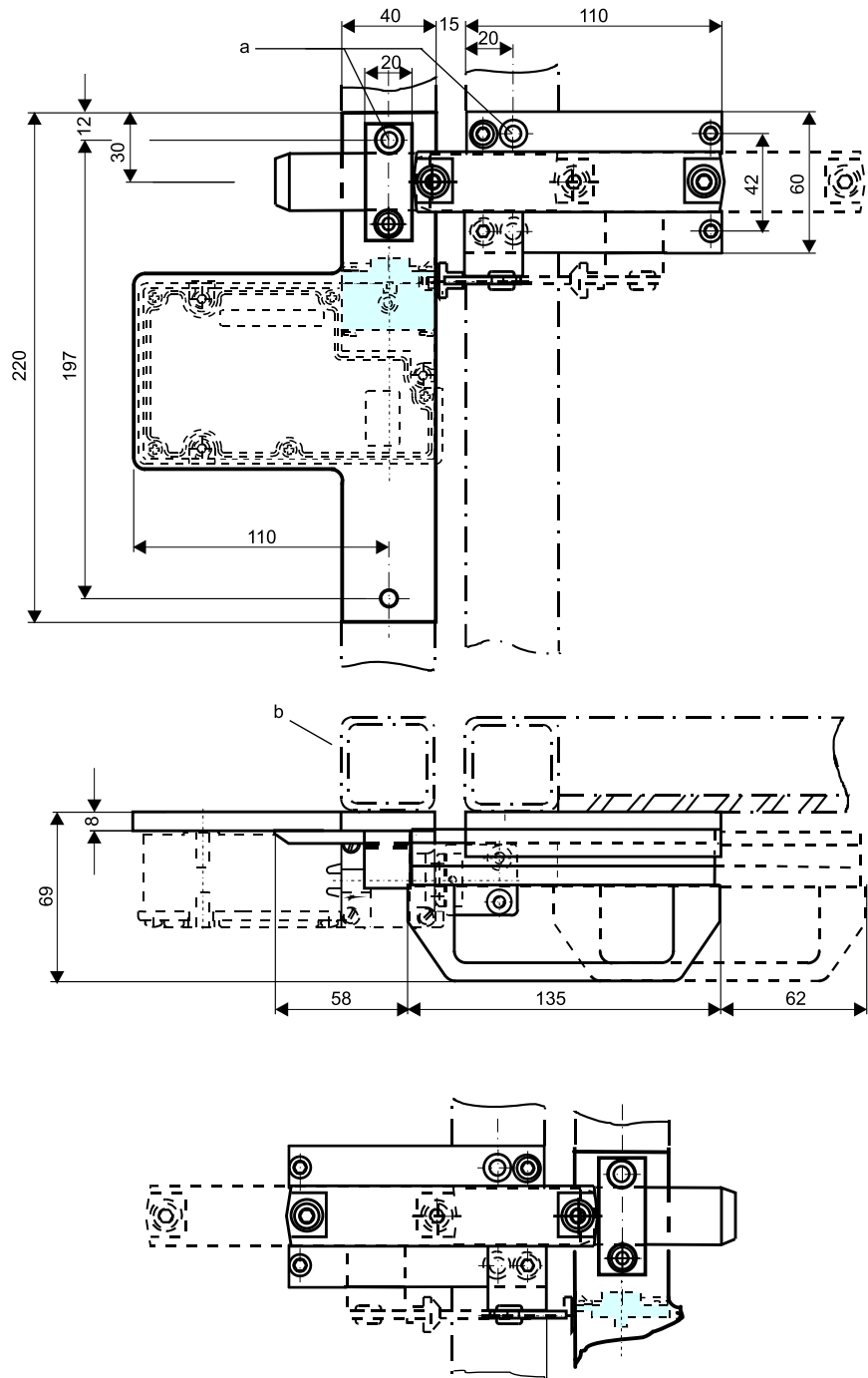
### **2.2.3 Safety Advantages**

- If a protective device closes accidentally, in particular a revolving door, electrical interlocking cannot be enabled unless the bolt with the actuator is inserted into the L50 interlocking device.
- Service personnel working in the hazardous area can protect themselves by making sure that the dangerous machinery cannot be set into motion inadvertently. To do so, the BL-L50 must be equipped with a slot where a shackle-type lock can be attached. It is not possible for unauthorized individuals to close the protective device unexpectedly when the shackle-type lock is in place.

## 2.2.4 Dimensions



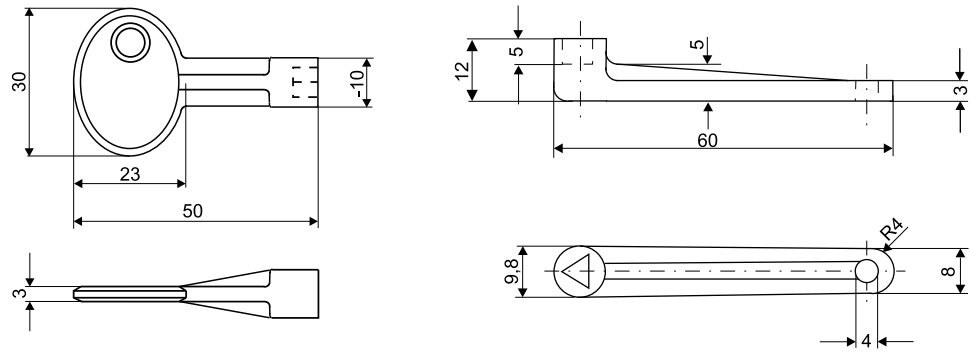
**Fig. 16** Safety Door Bolt **BL-L50**  
Mounting configuration for right-stopped and left-stopped doors



- a = for screws M6-DIN 912
- b = safety lattice frame, e.g. 40x40 mm

**Fig. 17** Safety Door Bolt **BS-L50**  
 Mounting configuration for right-stopped and left-stopped doors

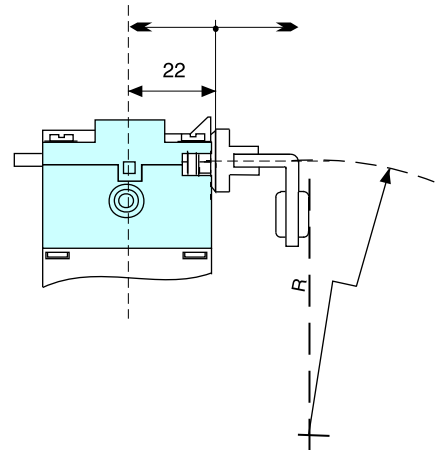
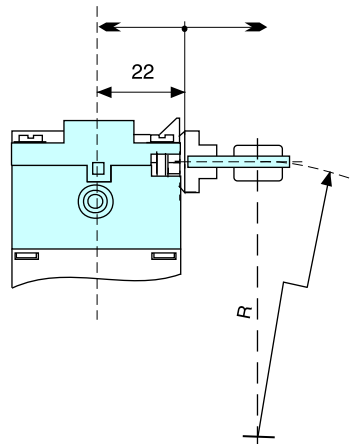
### 2.3 Square Socket Key for Auxiliary Release Function - L50



**Fig. 18** (included in delivery)**Fig. 19** K/75-L30-L50

### 3 Appendix

#### 3.1 Mounting Notes Regarding Minimum Radii for Pivoting Protective Devices



R = Radius

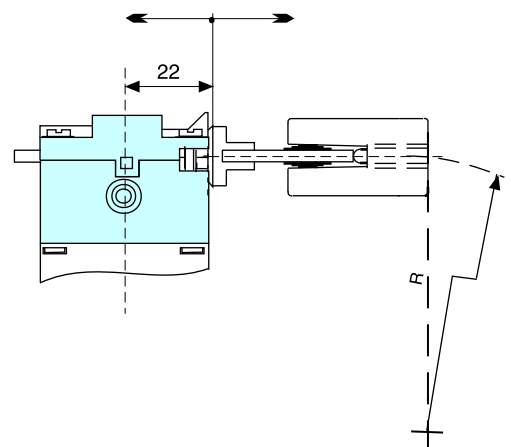
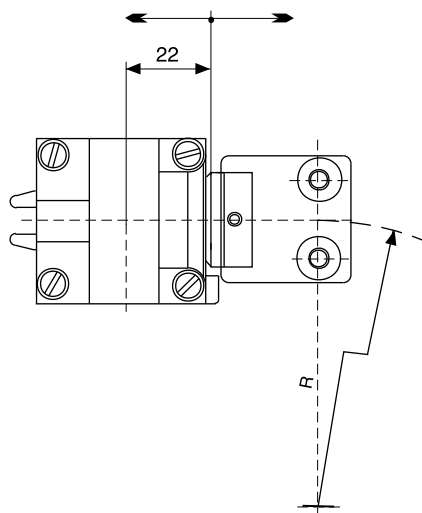
**Fig. 20**

**Fig. 21**

CO-S10-L50:R > 270 mm CW-S10-L50: R > 270 mm

COR-S10-L50:R > 200-300 mm CWR-S10-L50:R > 200-300 mm

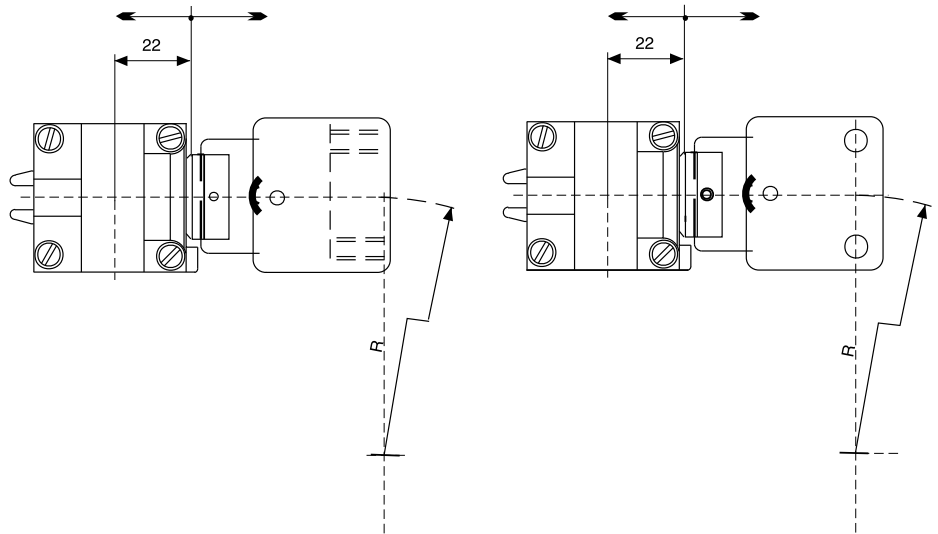
CK-S10-L50:R > 160 mm



R = Radius

**Fig. 22 Fig. 23**

CO-S10-L50:R > 330 mm COF/HIS.1-S10-L50:R > 350 mm



CW-S10-L50: R > 300 mm  
 COF/HIS.2-S10-L50: R > 350 mm  
 CK-S10-L50: R > 250 mm

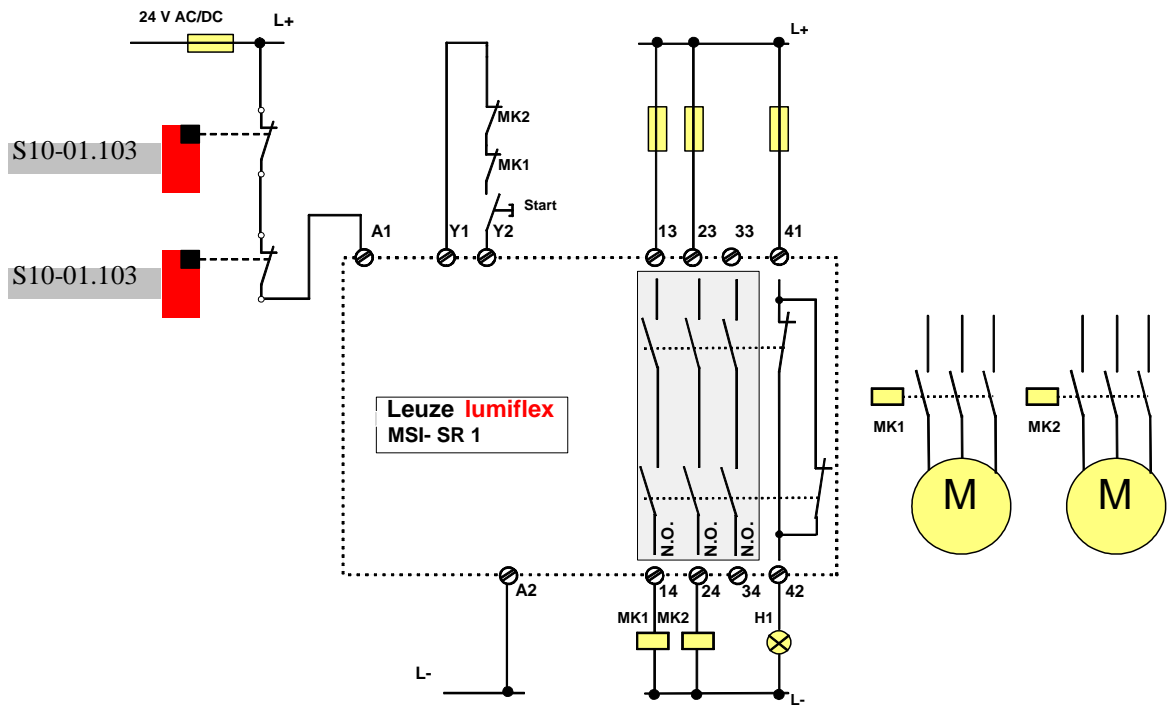
R = Radius

**Fig. 24**      **Fig. 25**  
 COF/HIS.1-S10-L50: R > 450 mm    COF/HIS.2-S10-L50: R > 400 mm

### 3.2 Connection Examples

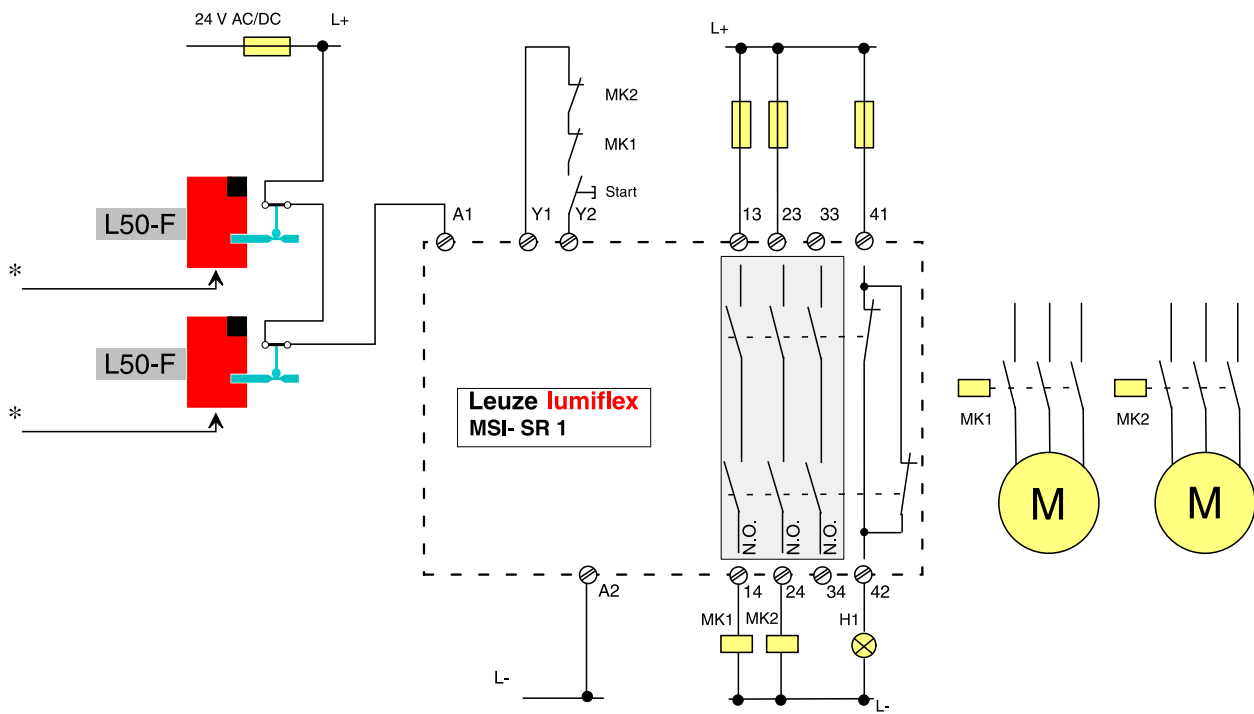
Corresponding to a risk assessment as specified in EN 954-1A, a safety category is determined for devices intended to protect humans at production systems. The contacts of the safety interlocking devices function as the interface to the safety relay modules in the machine controls. The circuit diagrams 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. 26** 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)

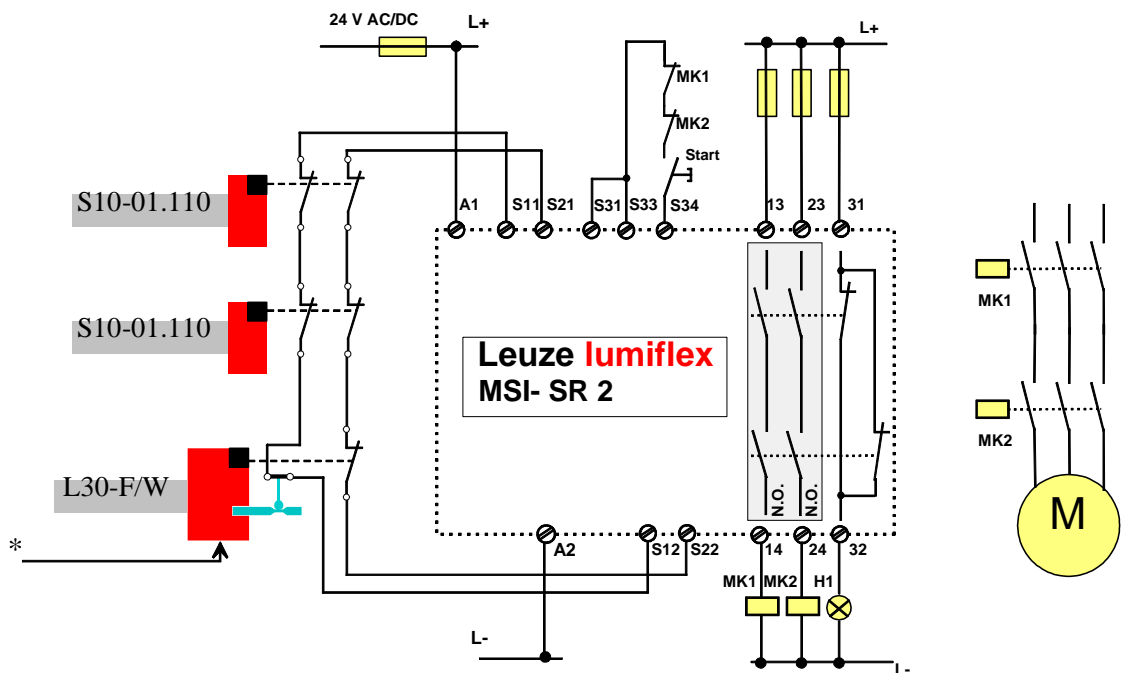


\* Separate magnet voltage supply (24V DC) serves as the guard locking signal by way of a time-delayed enabling circuit or stoppage control circuit – see Technical Description of safety interlocking device L50 (L30).

**Fig. 27** 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)

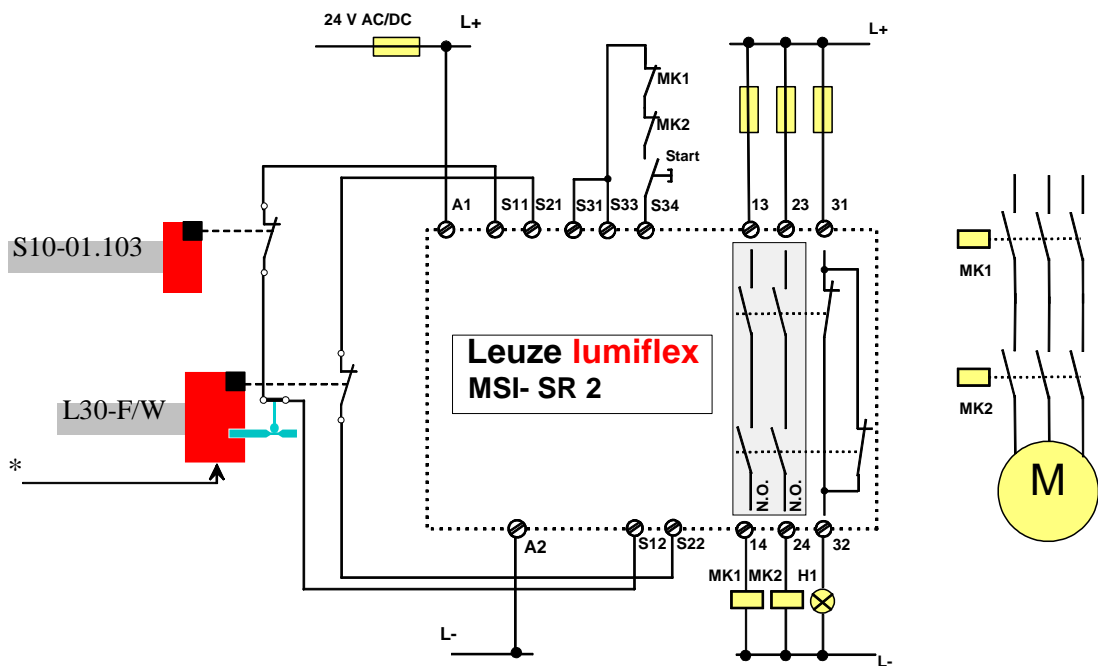




\* Separate magnet voltage supply (24V DC) serves as the guard locking signal by way of a time-delayed enabling circuit or stoppage control circuit – see Technical Description of safety interlocking device L50 (L30).

**Fig. 28** Safety door monitoring with/without guard locking, combined, in safety category 3 according to EN 954-1

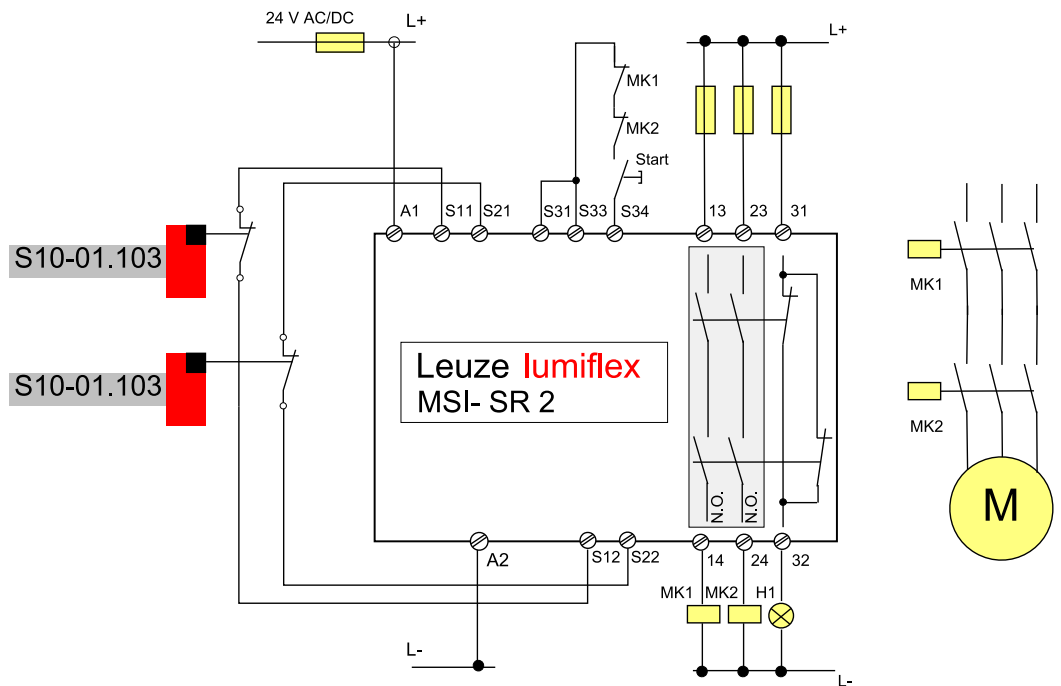
- MSI-SR2, dual-channel (with cross circuit monitoring - for safety category 4)
- Combination of several safety devices, each with 1 safety interlocking device with/without guard locking S10 (S40) and L30 (L50) combined



\* 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. 29** 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. 30** 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.