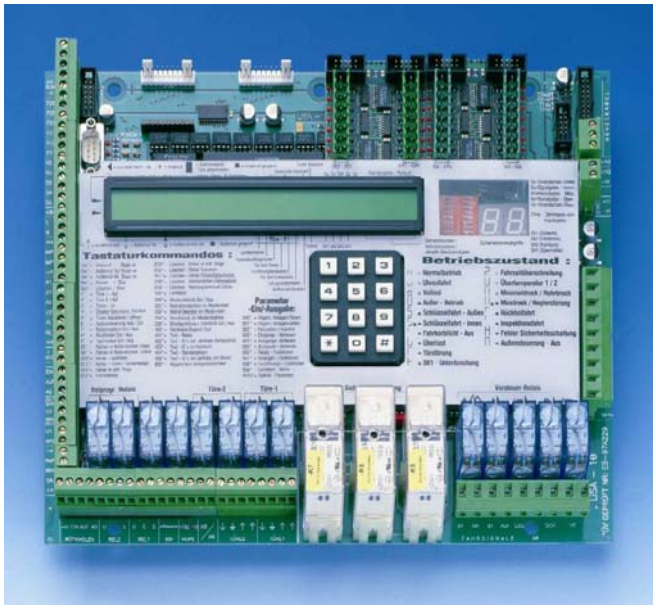
LiSA User Manual

Safety circuit and safety circuit taps (part C)



Schneider Steuerungstechnik GmbH

Gewerbestrasse 5-7
D-83558 Maitenbeth

Phone: +49 (0)8076 / 91 87 – 0
Phone: +49 (0)8076 / 91 87 – 117

http://www.lisa-lift.de

E-mail: info@lisa-lift.de

Contents

Sicherheitsschaltung und Sicherheitskreisabgriffe (Teil C)

1. Operating instructions for the safety circuit

1.1. General information

Lifts which are supposed to approach with early opening doors or relevel with open doors require additional components.

Therefore check whether the LiSA controller

- is equipped with 3 safety relays K5, K6, K7 (on the LiSA10 board) and the relay La (= K13),
- has a selector block with 3 inductor switches (in the case of shaft selection with switches) or
- one additional magnetic switch (in the case of lifts with absolute encoders) and
- whether the jumper branch for the door contacts (see wiring diagram "safety circuit") is wired accordingly.

Purpose and function of the safety circuit

According to EN81 part 1 / 2, no. 14.2.1.2. the gates which allow for the motion of the lift car with open shaft and car doors in the release zone by overriding the door contacts must either be safety switches or realised in such a way that they meet the requirements for safety circuits according to 14.1.2.3.

LiSA controllers use a safety circuit for this purpose.

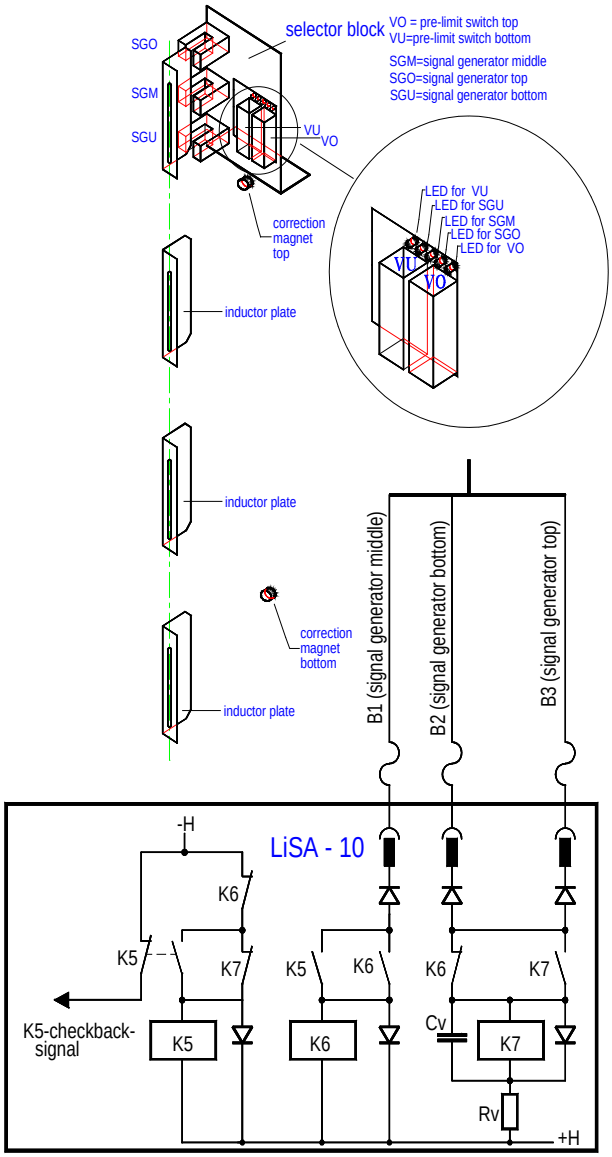
1.2. Structure

1.2.1. Structure with selector block and rails

In the flush range of each landing, there is a rail with a length of 20 - 40 cm. The size of the zone in which approaching and relevelling with open doors is possible is determined in this way.

The selector block is installed on the lift car, it consists of the following components:

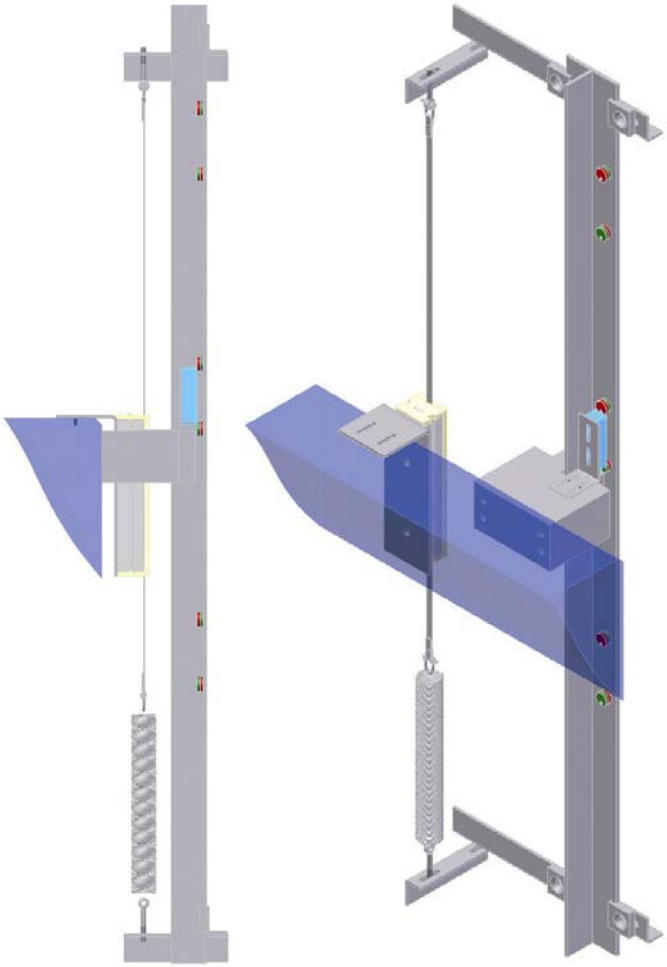
- Inductor switch B1 = centrical inductor switch (SGM), an inductive slot switch or photoelectric barrier
- Inductor switch B2 = top inductor switch (SGO), a slot switch or photoelectric barrier
- Inductor switch B3 = bottom inductor switch (SGU), a slot switch or photoelectric barrier
- Inductor switch B4 = top slow-down switch (VO), a bistable magnetic switch
- Inductor switch B5 = bottom slow-down switch (VU), a bistable magnetic switch



1.2.2. Structure with absolute encoder

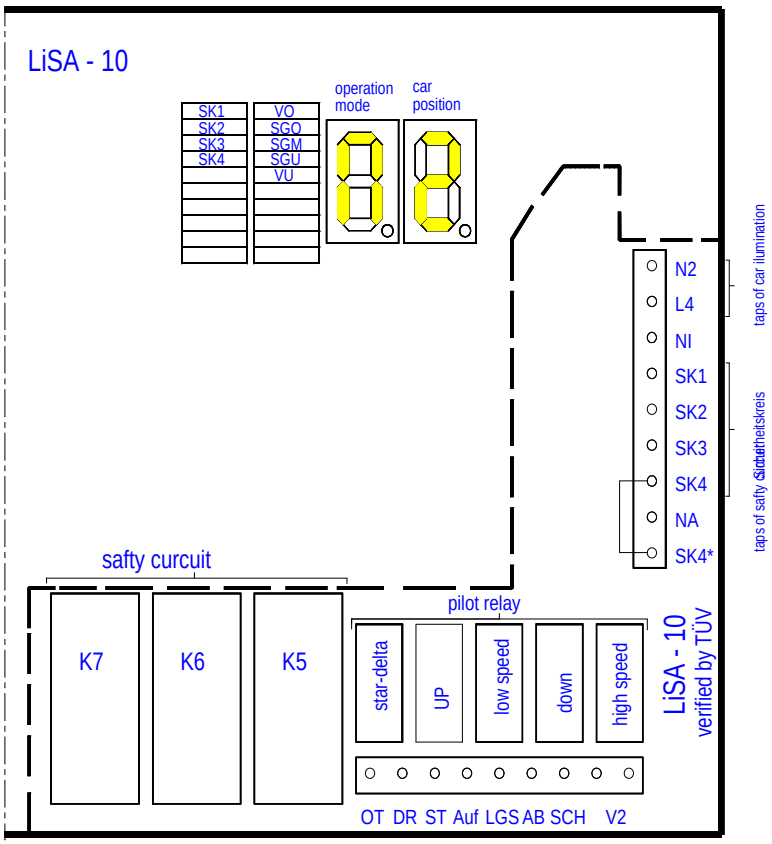
system and zone switches

A magnetic tape is stretched in the shaft, which is fed through a reading head installed on the car. The reading head transmits data to the absolute encoder adapter via an RS422 interface, the adapter emulates the discrete signals Sm (zone signal 1, Z1), pulse, bottom slow-down switch (VU) and top slow-down switch (VO). Furthermore one magnetic switch and two magnets generate the zone signal 2 (Z2) in each landing.

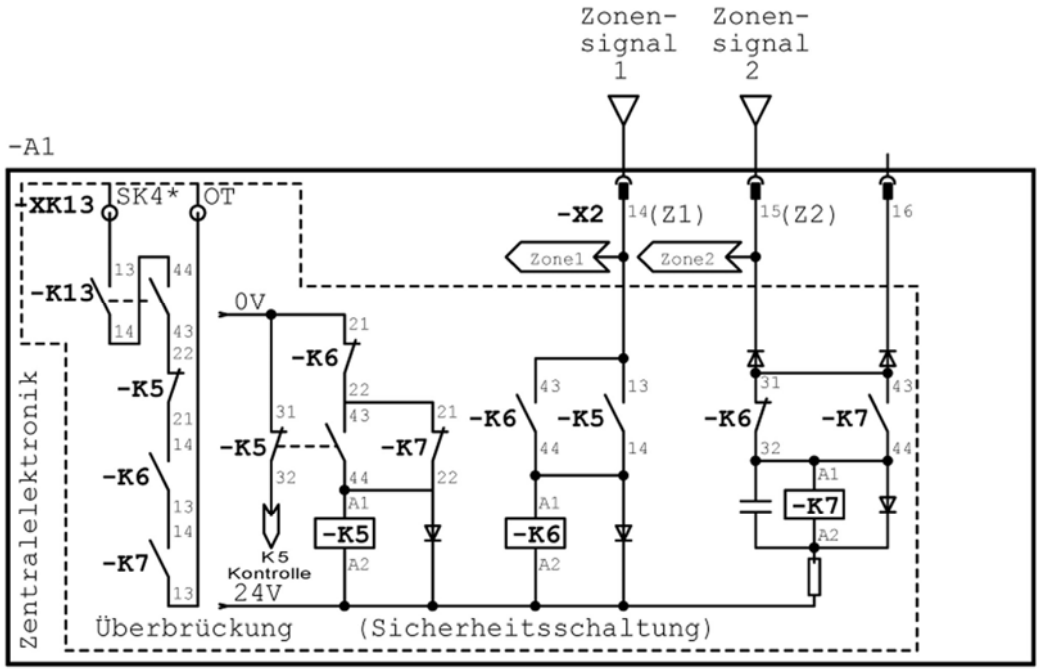


1.2.3. Safety circuit on the LiSA10 board consisting of:

- Safety relay K5 = positively driven relay to override the safety circuit in the zone and to monitor the operation of the safety circuit
- Safety relay K6 = positively driven relay to override the safety circuit in the zone
- Safety relay K7 = positively driven relay to override the safety circuit in the zone
- Pull-in delay for K7 consisting of resistor/capacitor combination Rv, Cv



1.3. Function



Wiring diagram of safety circuit

After applying the supply voltage, K5 pulls in first. This is only possible if K6 and K7 have deenergised. In this way, all 3 gates in the jumper branch between terminal OT and K5:21 on the LiSA10 board (A1) are opened.

Approaching the zone

K5 is pulled in beyond the zone, K6 and K7 are deenergised.

When one of the outer zone signals (B3 when travelling upwards, B2 when travelling downwards or Z2 in the case of absolute encoder) is present, K7 is energised. As K6 is deenergised, K7 pulls in.

As soon as the centrical zone signal (B1 or Z1) is present, K6 is energised and pulls in, too. Then K5 is deenergised and the override for the door contacts is closed, if the following criteria are also met:

- low-speed relay pulled in (K13),
- high-speed contactor not pulled in (N/C contact of K1 in the jumper branch).

The approaching speed is determined by means of the pulse inputs Imp+/Imp-. In the case of frequency-controlled lifts (voltage control or closed-loop frequency inverter) you can alternatively apply the signal for the travelling speed < 0.3 m/sec (contact of the approach monitoring) is applied at the programmed electronics input on the LiSA10 board. Only when this signal is recognised by the controller, the doors are opened.

Leaving the zone:

When the centrical inductor switch (B1, Z1) leaves the zone, K6 is deenergised. K7 remains pulled in until the outer zone signals (B2 or B3, Z2) are no longer present, too. Then K5 can pull in again.

1.4. Ambient conditions and operating conditions

1.4.1. Place of installation

The LiSA10 board is to be installed in a housing or a control cabinet with a degree of protection corresponding to the respective place of installation so that it is protected against harmful influences like condensation, ingress of water or residues of conductible dusts.

1.4.2. Ambient temperature

The ambient temperature for the LiSA10 board must be within the range of –10 to +50 degrees Celsius. A range of –20 to +50 degrees Celsius is permissible for the inductor switches.

1.4.3. Use in explosion-hazardous areas

A precondition for the use in explosion-hazardous areas is the housing of the LiSA10 board in control cabinet approved for the respective explosion-hazardous area. The inductor switches used must also be approved for the respective explosion-hazardous area.

1.5 Installation and connection

The components required for the operation of the safety circuit and their installation and connection is described under section 1.2.

In particular this refers to the following procedures:

1.5.1. Installation and connection of selector block and rails

- Installation of the rails and slow-down switch magnets in the shaft.
- Installation of the selector block on top of the lift car.
- Connection of the selector block via a 10-pin plug on the APO-x connection board in the inspection box. The connector for the travelling cable is located on this board, too.
- Plug the connector at the other end of the travelling cable onto the LiSA10 board in the control cabinet.
- Installation of the safety relays (K5, K6, K7) on the LiSA10 board. Depending on the order, these might already be pre-installed.

1.5.2. Installation and connection of the absolute encoder system and zone switch:

- Installation of the magnetic tape and zone magnets in the shaft.
- Installation of the reading head and the zone switch on top of the lift car.
- Connection of the reading head via the made-up plug on the APO-x inspection board (terminal XK13) in the inspection box. Connection of the zone switch to the APO-x (terminal XK4.5 (-H) / XK4.6 (Sm)). The connector for the travelling cable is located on this board, too.
- Plug the connector at the other end of the travelling cable to the absolute encoder adapter in the control cabinet.
- Installation of the safety relays (K5, K6, K7) on the LiSA10 board. Depending on the order, these might already be pre-installed.

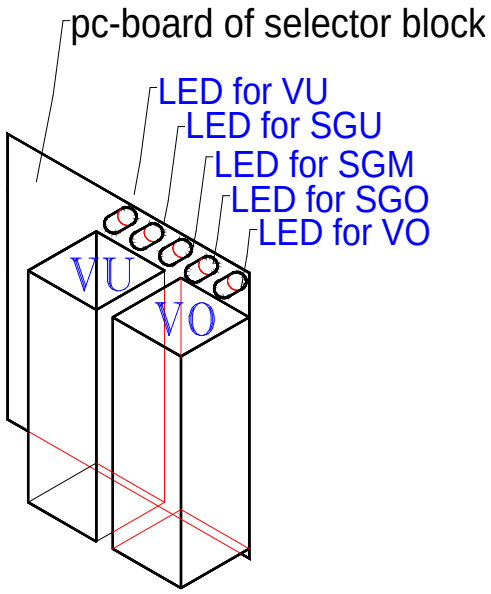
1.6 Adjustment / check

The adjustment required for the correct operation of the safety circuit are limited to the instructions for the installation of the shaft rails and the selector block or the absolute encoder system and the magnetic switch and the associated magnets, as explained under item 3.1.

However, by all means effect the following checks after the connection:
Check of the inductor switch function:

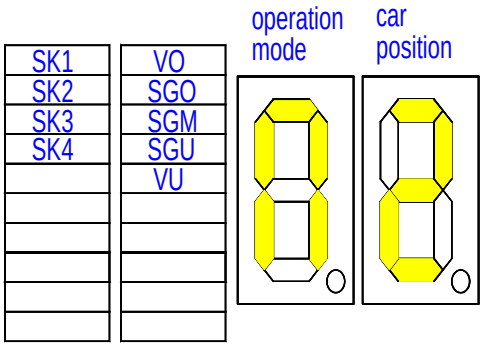
1.6.1. Visual check of the selector block

Each inductor switch (B1 - B5) is represented by an LED on the selector block which must be on if the inductor switch is activated.



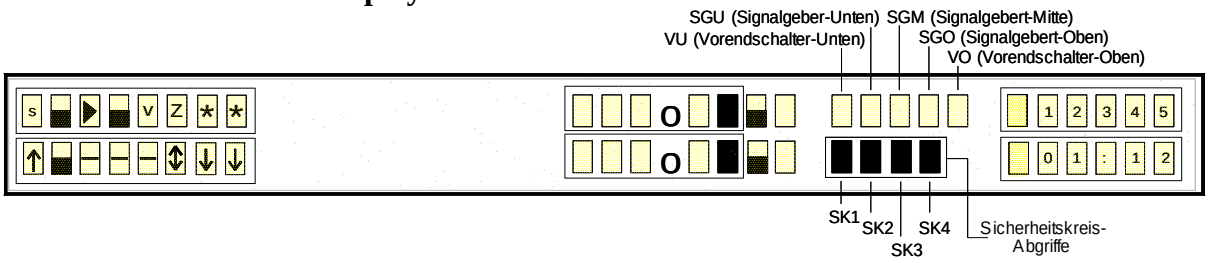
1.6.2. Visual check of the LiSA10 board

If the shaft selection is connected correctly to the LiSA10 board and if the signals of the inductor switches (B1 - B5) are present at the input opto-couplers, the corresponding LEDs of the light bar display on the LiSA10 board must be on if the inductor switches are activated.



A final check whether the inductor switches are correctly processed by the controller software is possible via the LCD display on the LiSA10 board (LiSA display). The inductor switch statuses are displayed in the upper right area as they are "read" by the controller software.

Indication on the LiSA display



1.6.3. Check of the safety circuit

A hole in the relay cap of relays K5 / K6 / K7 serves to simulate that the pallet does not deenergise. If a relay is held in this way from the beginning to the end of a travel, the lift will adopt the operating mode "safety circuit faulty" at the next stop ("H" is displayed on the left seven-segment display of the LiSA10 board).

K5 being operated in standstill has the effect that the operating mode "safety circuit error" is adopted immediately (without previous travel).

In the case of lifts with absolute encoders, the length of zone 1 (Z1) is also monitored by the LiSA10 board. If the zone length Z1 is larger than Z2, the lift will also adopt the out-of-operation state. This is indicated by the symbol "H" in the seven-segment display as well as the error message "ZoErr" on the display of the LiSA10 board.

- Then the lift remains out of operation.
- In the case of hydraulic lifts, the recall feature to the lowest landing is activated before.

1.7 Maintenance and troubleshooting

If an error occurs in the safety circuit, the lift is put out of operation. Usually the result is that a technician must be called whose task is not only to put the lift back into operation by means of a reset, but also to immediately effect all checks which would be required in the context of a regular maintenance of the lift with regard to the function of the safety circuit!

- Check whether the error memory for errors in chronological order contains any "error in safety circuit". If one or several errors of this type are contained and are inexplicable, i.e. did not occur during the check of the safety circuit, all connections (travelling cable, cable to the selector block or absolute encoder system), inductor switches, absolute encoder system and safety relays must be checked accurately.
  If the same error occurs again, the LiSA10 board must be replaced unless the error memory for errors in chronological order contains any counter errors. In this case we recommend to replace the centrical inductor switch (SGM) first.
  If this does neither lead to success and if you are sure that the connection of the inductor switches to the LiSA10 board is correct, the safety relays should be replaced as last measure. At this point of time you should consult Schneider or Klinkhammer.
- Check of the safety circuit as described under 4.1.2.2. Check of the safety circuit.
- If the relevelling function is activated (compulsory for hydraulic lifts), you must check whether the lift relevels with open doors, too.
  - Avoid that the LiSA closes the door (turn off the landing control by entering 6* on the LiSA keyboard).
  - Stop the lift in an unflush position so that one of the outer inductor switches is beyond the zone (simply by activating the lowering valve or lifting the brake).

- If the function "approaching with open doors" is activated, you must check whether the lifts stops when B1 (SGM) approaches the destination and the jumper branch at the terminal OT of the LiSA10 board is

interrupted before.
➔ Approximately 15 seconds after the stop, the system must adopt the operating mode "error in safety circuit" followed by the responses described under item 5. (see also risk analysis for the safety circuit).

2. Operating manual for query circuits at the safety circuit

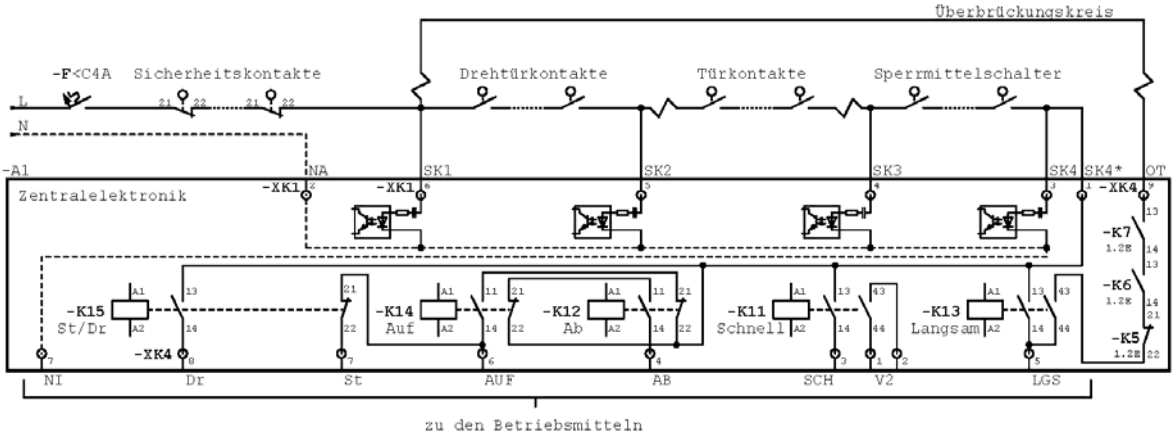
2.1. General information

Purpose and function of the query circuits for the evaluation of 4 statuses at the safety circuit of LiSA controllers.

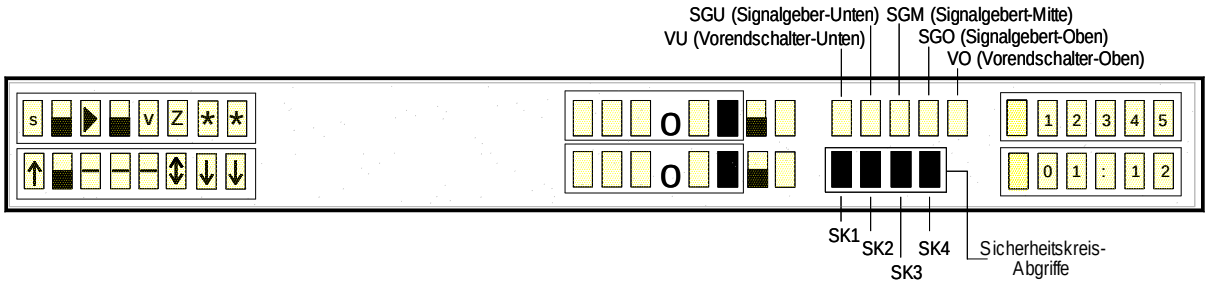
The terminal XK13 is located at the right edge of the LiSA10 board. 4 connections of the safety circuit (SK1, SK2, SK3 and SK4) are connected to it, which are evaluated via electronic query circuits. Each connection is laid to an individual query circuit consisting of a resistor-capacitor combination and an opto-coupler. The voltage drop at the RC combination has the effect that a voltage of only approx. 6.8 V is present between the opto-coupler input and the neutral conductor.

The neutral conductor is fed at terminal Ni which in turn is connected to the neutral conductor of the travel contactors. The terminal Ni is connected to the terminal Na (= neutral conductor output) on the LiSA10 board, to which the neutral conductor of the feed-in is connected.

This neutral conductor layout serves to ensure that in the case of an interruption of the neutral conductor to the opto-couplers (opto-couplers override the safety circuit) the neutral conductor to the contactors is interrupted, too, and in this way prevents that the contactors pull in.



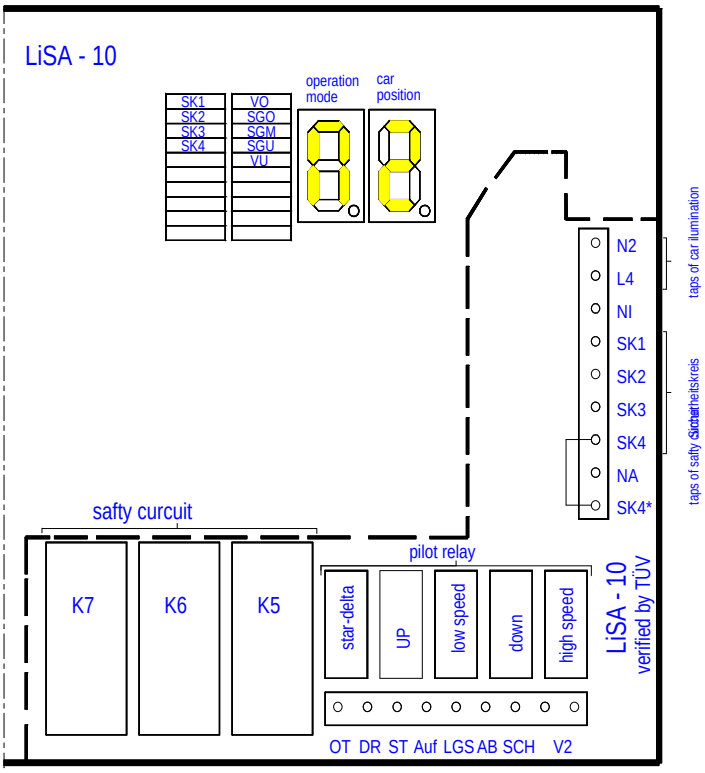
Wiring diagram of safety circuit taps



If a voltage of > 80 V DC is present at one tap, the query circuit recognises that the safety circuit is closed up to this point. This is indicated by the lights bars of the LED displays on the LiSA10 board and on the LiSA display.

2.2 Installation and connection

The safety circuit taps are connected to the terminals Sk1 - Sk4. The neutral conductor must be connected as described under item 2.1.



2.3 Adjustment and check

Without the properly operating query circuits, the software of the lift is not able to make the required logic operations.

The failure of one query circuit (defective opto-coupler, interrupted resistor or capacitor at the input) will inevitably result in the fact that the lift is put out of operation.

2.4 Maintenance

During the regular maintenance of the lift, the state of the query circuits must be checked, too.

This concerns mainly their possible impairment by a change of the degree of protection.

- Is the board soiled?
- Is there any condensed water at times?
- Is the housing sufficiently tight for a moist environment?

3. Risk analyses

3.1 Risk analysis for the safety circuit

Preliminary remark:

For the LiSA safety circuit and query circuits for the safety circuit there is already a component test certificate issued by the TÜV Rheinland with the reference number EB-97A229.

Two cases are distinguished for the following risk analysis according to ISO178 (draft) and EN1050, one with regard to the K5 control signal and one without.

The relay K5 must principally carry out one switching cycle during each travel, i.e. the relay must pull in when leaving the zone and deenergise when entering the zone. This process is monitored by means of a permanent evaluation of the **K5 control signal** (N/C contact 21-22) by the processor on the LiSA10 board.

3.1.1 Risk analysis with regard to the K5 control signal

	Risk characteristics	**Cause**	**Effect**	**Current estimation**		**Measures** *(corrective action)*
				Severity	*Frequency*	
1.	Car in zone (B1 in zone), but K5 not deenergised	• Contact of K5 welded together • K5 blocked mechanically • K6 and K7 do no longer pull in • B1 defective	• No change recognised for the K5 control signal **->** Software prevents the early opening of doors **->** Lift is put out of operation with an error in the safety circuit	insignificant	rare	• Check the safety circuit • If required, replace K5 / K6 / K7 / B1
2.	K5 did not pull in during the entire travel	• Contact of K5 welded together • K5 blocked mechanically • K6 or K7 does no longer deenergise • B1 defective	• see under 1.	insignificant	rare	• see under 1.
3.	K5 control signal not recognised due to defective electronics input	• Hardware error on the LiSA10 board	• see under 1.	insignificant	rare	• Replace the LiSA10 board
4.	K5 control signal not recognised due to software error	• Error in the programme logic	• see under 1.	insignificant	rare	• Eliminate the programme error

3.1.2 Risk analysis without evaluation of the K5 control signal

The previous risk analysis (see 4.3.1.1.) reveals that the K5 control signal helps to surely recognise a not properly working safety circuit.As this, however, is a software function, the correct operation of which depends on the correctness of the software, the following additional risk analysis without evaluation of the K5 control signal is carried out.

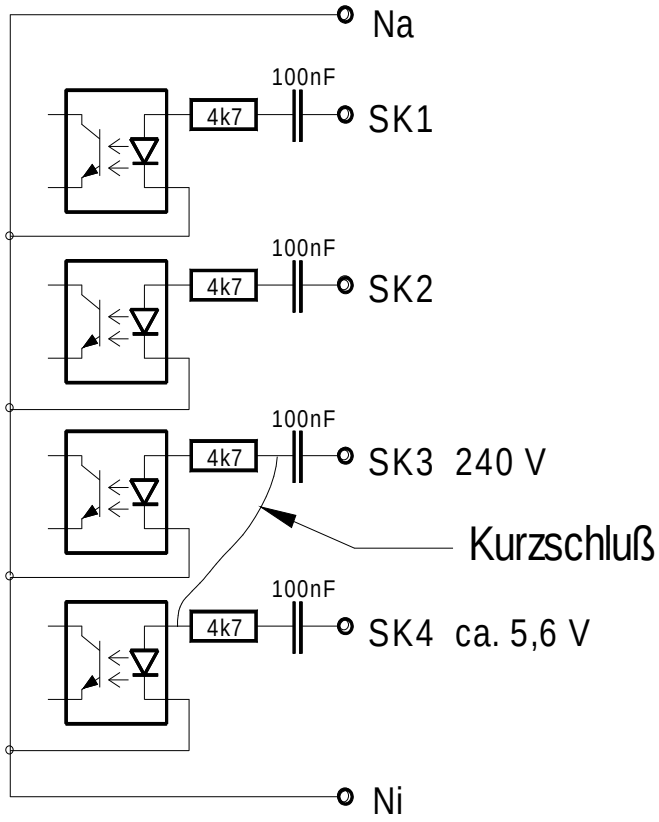
	Risk characteristics	**Cause**	**Result**	**Current estimation**		**Measures** *(corrective action)*
				Severity	*Frequency*	
1.	K5 does no longer deenergise	• Contact of K5 welded together • K5 blocked mechanically • K6 and K7 do no longer pull in • B1 defective	• Jumper branch not closed when entering the zone **->** Lift stops with a step and is put out of operation after 15 seconds with an error in the safety circuit • In the case of hydraulic lifts, previously lowering to the lowest landing	minor	rare	• Check • the safety circuit • If required, replace K5 / K6 / K7 / B1
2.	K5 does not longer pull in	• K6 does no longer deenergise • K7 does no longer deenergise • K5 blocked mechanically	• see under 1.	minor	rare	• see under 1.
3	K6 does no longer deenergise	• Contact of K6 welded together • K6 blocked mechanically	• see under 1.	minor	rare	• see under 1.
4.	K7 does no longer deenergise	• Contact of K7 welded together • K7 blocked mechanically	• see under 1.	minor	rare	• see under 1.
5.	Simultaneous earth fault at the outputs of the inductor switches B2 / B3	• Travelling cable defective • Selector block cable defective	• Jumper branch remains open even if the lift is beyond the zone because K/ pulls in belatedly due to Cv and Rv • K7 remains pulled in when the car is beyond the zone • see under 1.	minor	rare	• Replace the travelling cable • Replace the selector block cable
6.	Earth fault at the output of inductor switch B1	• Travelling cable defective • Selector block cable defective	• Lift slowly moves to the emergency stop switch	minor	rare	• see under 5.
7.	Short circuit at the outputs of the inductor switches B2 / B3	• Travelling cable defective • Selector block cable defective	• Jumper branch remains open because K/ pulls in belatedly due to Cv and Rv	minor	rare	• see under 5.

8.	After voltage failure simultaneous application of the supply voltage at K5, K6 and K7	• Switch-on of the supply voltage after switching off the lift	• Jumper branch remains open because K/ pulls in belatedly due to Cv and Rv	minor	often	• none

3.2. Risk analysis for query circuits at the safety circuit

	Risk characteristics	Cause	Result	Current estimation		Measures *(corrective action)*
				Severity	*Frequency*	
1.	Short circuit between the safety circuit taps	• Water ingress • Collection of conductible dusts • Condensation	Overriding of safety measures (door contacts, interlock contacts, etc.)	inacceptable	unlikely	• Check the degree of protection (at least IP2X) • Control the temperature in the control cabinet
2.	Short circuit on the LiSA10 board (see also enclosed computational proof)	• Water ingress • Collection of conductible dusts • Condensation	Overriding of safety measures (door contacts, interlock contacts, etc.)	minor	rare	• Check the degree of protection (at least IP2X) • Control the temperature in the control cabinet
3.	Interruption of the neutral conductor at Ni on the LiSA10 board	• Wire break • Loose terminal	Override of safety measures via RC combination and optocouplers	minor	rare	• Connect the wire

Computational proof for item 2



Assumptions:

- Short circuit between input capacitor at SK3 and opto-coupler input of SK4.
- Contactor voltage = 240 V; contactor current = 150 mA -> $R_{contactor}$ = 1.5 kOhms

$$U_{contactor} = 240\ V \frac{R_{contactor}}{R_{contactor} + R_2 + Z_{11} + Z_{12}}\ ;\ \text{with } Z_{11} = Z_{12} = \frac{1}{j\,\omega\,C}\ ;\ \text{with } C = C11 = C12 = 100\ nF;$$

$$U_{contactor} = 240\ V \frac{R_{contactor}}{R_{contactor} + R_2 + 2\,(-j\ 1/\omega\,C)}\ ;$$

$$U_{contactor} = 240\ V \frac{R_{contactor}}{R_{contactor} + R_2 + 2\,(-j\ 1/2\,\pi\,f)} \sim \frac{1.5\ kOhms}{1.5\ kOhms + 4.7\ kOhms - j\ 2/2\,\pi\,50 * 10^{-7}}\ ;$$

$$U_{contactor} \sim 240\ V \frac{1.5\ kOhms}{6.2\ kOhms - j\ 2/2\,\pi\,50 * 10^{-7}} \sim 240\ V \frac{1.5\ kOhms}{64{,}000\ V/A} \sim 5{,}6\ V\ ;$$

As a consequence

Even in the unlikely event of a short circuit between the mentioned points, the travel contactors cannot pull in as the activation voltage available for the contactor coil is only 5.6 V.

TÜV CERT

EG-Baumusterprüfbescheinigung

nach Anhang V (A) der Richtlinie 95/16/EG

Zertifikat-Nr. 09 208 92613/5

Die TÜV CERT-Zertifizierungsstelle für Aufzüge und Sicherheitsbauteile
der TÜV Anlagentechnik GmbH,
benannte Stelle der Europäischen Gemeinschaft, Kenn-Nr. 0671,
bescheinigt dem Unternehmen

Schneider Steuerungstechnik GmbH
Gewerbestraße 5
D-83527 Winden

Neue Adresse ab 08/99:
Gewerbestraße 7
83558 Maitenbeth
Tel. 08076-91870
Fax 08076-9187117

die Übereinstimmung des Sicherheitsbauteiles

Sicherheitsschaltung mit elektronischen Bauelementen

Typ: **LiSA 10**

Verwendung: **Sicherheitsschaltung zum Einfahren und Nachstellen bei offenen Türen sowie Abgriffe vom Sicherheitsstromkreis gem.:**

- **EN 81-1/2:1998, Nr. 14.2.1.2 und Nr. 14.1.2.1.3, Absatz 2**
- **Betriebsanleitung „Handbuch für LiSA-Steuerungen" -**

mit den Anforderungen der Richtlinie 95/16/EG.

Der Nachweis wurde durch eine EG-Baumusterprüfung
Bericht-Nr. **947/S 99/138**
erbracht.

Köln, den 01.07.1999

TÜV CERT-Zertifizierungsstelle
für Aufzüge und
Sicherheitsbauteile

TÜV Rheinland /
Berlin-Brandenburg

TÜV

TÜV
CERT

EC type examination certificate

according to Appendix V (A) of the Directive 95/16/EC

Certificate no. 09 208 92613/5

The TÜV CERT certification authority for lifts and safety components
of TÜV Anlagentechnik GmbH (= TÜV Systems Engineering),
nominated authority of the European Community, identification no. 0671,
certifies for the company

Schneider Steuerungstechnik GmbH
Gewerbestrasse 5
D-83517 Winden

new address from 08/99:
Gewerbestrasse
783558 Maitenbeth
Phone 08076-91870
Fax 08076-9187117

the conformity of the safety component

Safety circuit with electronic components

Type: **LiSA 10**
Use: **Safety circuit for approaching and relevelling with open doors as well as safety circuit taps according to:**
- EN 81-1/2:1998, no. 14.2.1.2 and no. 14.1.2.1.3, sec. 2
- Operating manual "Manual for LiSA controller"

with the requirements of the Directive 95/16/EC.
The evidence was provided by means of a EC type examination,
report no. 947/s 99/138.

Cologne, 01 July 1999

signature
TÜV CERT certification authority
for lifts and safety components

TÜV Rhineland/
Berlin-Brandenburg

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD Industrie Service

EG - Baumusterprüfbescheinigung

Bescheinigungs-Nr.:	AEB 007
Benannte Stelle:	TÜV SÜD Industrie Service GmbH Zertifizierungsstelle für Aufzüge und Sicherheitsbauteile Westendstraße 199 80686 München - Deutschland
Antragsteller/ Bescheinigungsinhaber:	Schneider Steuerungstechnik GmbH Gewerbestr. 7 83558 Maitenbeth - Deutschland
Antragsdatum:	31. Oktober 2007
Hersteller:	Schneider Steuerungstechnik GmbH Gewerbestr. 7 83558 Maitenbeth - Deutschland
Produkt, Typ:	Sicherheitsschaltung mit elektronischer Bauelementen auf der Steuerungsplatine Typ LiSA10 – x, die Sicherheitsschaltung hat die EG-Baumusterprüfnummer AEB 007
Prüflaboratorium:	TÜV SÜD Industrie Service GmbH Abteilung Aufzüge und Sicherheitsbauteile Westendstrasse 199 80686 München - Deutschland
Datum und Nummer des Prüfberichtes:	26. November 2007 AEB 007
EU-Richtlinie:	95 / 16 / EG
Ergebnis:	Die Sicherheitsschaltung erfüllt als Sicherheitsbauteil die grundlegenden Sicherheitsanforderungen der EU- Richtlinie im Anwendungsbereich, der im Anhang zu dieser EG-Baumusterprüfbescheinigung angegeben ist.
Ausstellungsdatum:	26. November 2007

Zertifizierungsstelle für Aufzüge und Sicherheitsbauteile
EU-Kennnummer: 0036

D. Roas

Dieter Roas

TÜV SÜD Industrie Service GmbH 00 36 Benannte Stelle

TÜV SÜD Industrie Service GmbH · Westendstrasse 199 · 80686 München · Germany

TÜV®

TÜV
Industrial Service

EC type examination certificate

Certificate no.:	AEB 007
Nominated authority:	TÜV SOUTH Industrial Service Certification authority for lifts and safety components Westendstrasse 199 80686 Munich – Germany
Applicant/ **Owner of certificate:**	Schneider Steuerungstechnik GmbH Gewerbestrasse 7 83558 Maitenbeth – Germany
Date of application:	31 October 2007
Manufacturer:	Schneider Steuerungstechnik GmbH Gewerbestrasse 7 83558 Maitenbeth – Germany
Product, type:	Safety circuit with electronic components on the controller board type LiSA10 – x, the safety circuit has the EC type examination certificate no. AEB 007
Examination laboratory:	TÜV SOUTH Industrial Service Department for lifts and safety components Westendstrasse 199 80686 Munich – Germany
Date and number of the examination report:	26 November 2007 AEB 007
EU Directive:	95 / 16 / EC
Result:	The safety circuit as safety component meets the basic requirements of the EU Directive in the field of application mentioned in the Appendix of this EC type examination certifice.
Date of issue:	26 November 2007

(seal)

Certification authority for lifts and safety components
EU identification no.: 0036
signature
Dieter Ross