



Original operating instructions
Safety rope emergency stop switches

GB

**ZB0050
ZB0051
ZB0070
ZB0071
ZB0074
ZB0075**

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1 Preliminary note

Instructions , technical data, approvals, accessories and further information at www.ifm.com.

2 Symbols used

- ✓ Requirement
- Instructions
- ▷ Reaction, result
- [...] Designation of keys, buttons or indications
- Cross-reference
-  Important note
Non-compliance may result in malfunction or interference.
-  Information
Supplementary note

3 Warnings

Warnings indicate the possibility of personal injury and damage to property. This enables safe product handling. Warnings are graded as follows:

**WARNING**

Warning of serious personal injury

▷ If the warning is not observed, fatal and serious injuries are possible.

**CAUTION**

Warning of minor to moderate personal injury

▷ If the warning is not observed, minor to moderate injuries are possible.

ATTENTION

Warning of damage to property

▷ If the warning is not observed, damage to property is possible.

4 Safety instructions

- The unit described is a subcomponent for integration into a system.
 - The system architect is responsible for the safety of the system.
 - The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Intended use).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.
- Replace damaged units, otherwise the technical data and safety will be impaired.
- Observe applicable documents.
- Observe the national valid regulations for e-stop devices.

5 Intended use

The safety rope emergency stop switch is used to detect safety-related switching states.

The safety rope emergency stop switch is used

- to secure vast hazardous areas.
- in places where housings or covers are not possible.

Typical application areas:

- conveyors
- rotating machines
- vast hazardous areas

Application area ZB0074

- Adhere to the remarks for safe use in hazardous areas in the enclosed ATEX operating instructions.

5.1 Safety-related requirements

It must be ensured that the safety requirements of the respective application correspond to the requirements stated in these instructions.

Observe the following requirements:

- ▶ Adhere to the specified operating conditions (→ Technical data).
- ▶ In case of faults within the device which result in the defined safe state:
Take measures to maintain the safe state when the complete control system continues to be operated.

With appropriate operation, the safety rope emergency stop switch can be used in applications up to performance level e according to ISO 13849-1, depending on the system architecture.

Installation must be in accordance with EN 13850.

If an AS-i network is controlling a machine with potentially dangerous movements and EN 60204-1 applies, a special insulation monitoring device must also be installed.

The device meets the requirements of EN ISO 13850, IEC / EN 60947-5-1 and IEC / EN 60947-5-5.



The wiring influences the achievable control category.

The requirements for external wiring and the selection of the connected switching contacts refer to the functionality to be accomplished and to the required control category (DIN EN ISO 13849-1 or EN 62061).

The control category is either determined by means of a risk analysis (e.g. to DIN EN ISO 12100) or taken from a C standard.

The control category or SIL level of the safe evaluation unit must at least correspond to the control category or SIL level necessary for the application.



Depending on the safety components used the complete safety system can also be classified for a lower control category.

- ▶ Characteristic safety values of other components, especially of the safe evaluation unit, can be found in the corresponding documentation.

5.2 IT safety

By default, the device is not intended for direct connection to IT systems. If this application is required, the users have to implement it (e.g. by using their own additional components).

6 Items supplied

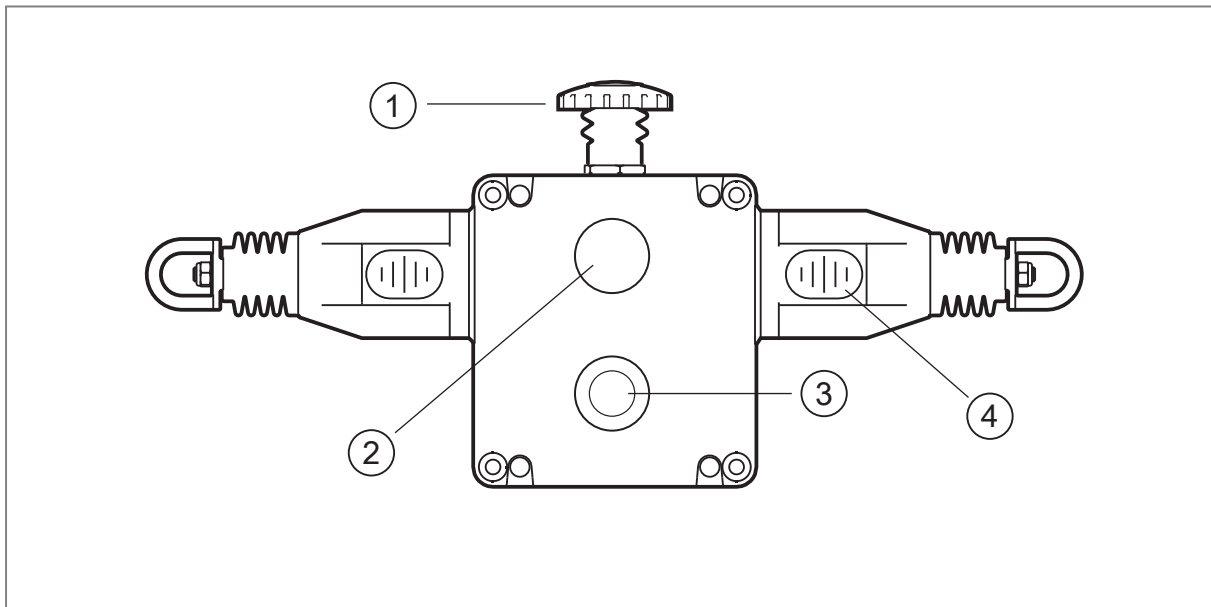
1 Safety rope emergency stop switch and 1 original operating instructions.

ZB0074:

additionally 1 ATEX operating instructions, 1 original EU declaration of conformity

If one of the above-mentioned components is missing or damaged, please contact one of the ifm branch offices.

7 Operating and display elements



1: E-STOP (red)

3: Dual LED

(ZB0051, ZB0070, ZB0071, ZB0075)

2: Reset button (blue)

4: Rope status indication

Rope status indication

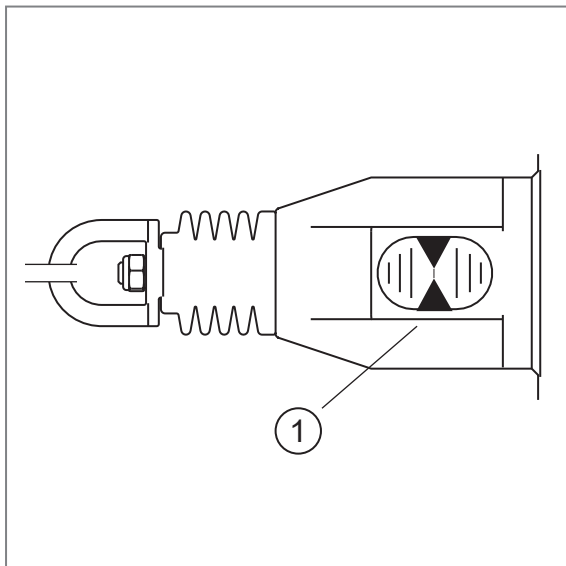


Fig. 1: Indication with properly set steel rope

8 Function description

Pulling the tensioned rope, rope breakage or impact on the E-STOP cause activation of the switching function of the safety rope emergency stop switch.

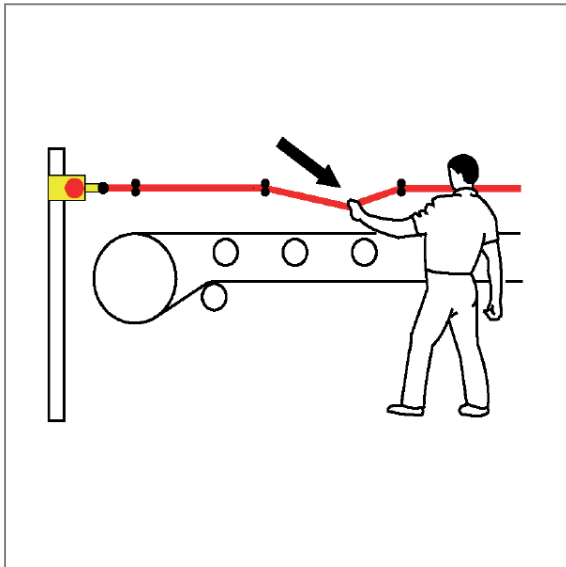
A window on the device (rope status indication) shows the correct rope tension and facilitates adjustment, troubleshooting and maintenance.

After activation of the E-STOP function a clip mechanism maintains the E-STOP command until it is unlocked manually by pressing the blue reset button.

► Before resetting the E-STOP signal the cause of the activation has to be determined.

Reset is only possible with correct rope tension (position indication in middle position).

The max. rope length also depends on the change of the ambient temperature.



Maintenance requirement

Monthly:

Check the proper functioning of the system at various points along the rope length.
Check the setting of the nominal rope tension and retighten the rope if necessary.

Every six months:

Disconnect the device from the voltage supply and remove the cover. Check that the screw terminals are tight and tighten them if necessary.
Check the device for moisture penetration.



► Replace damaged or faulty devices. Repair is not permissible.

9 Installation

The device is mounted using four M5 screws. Any installation position is possible.

To ensure protection rating IP67, the following tightening torques must be observed:

- fixing screws 4 Nm
- cover screws (Lid T20 Torx M4) 1.5 Nm

► Only use seals of the correct size for the cable entry and the external diameter of the cable.

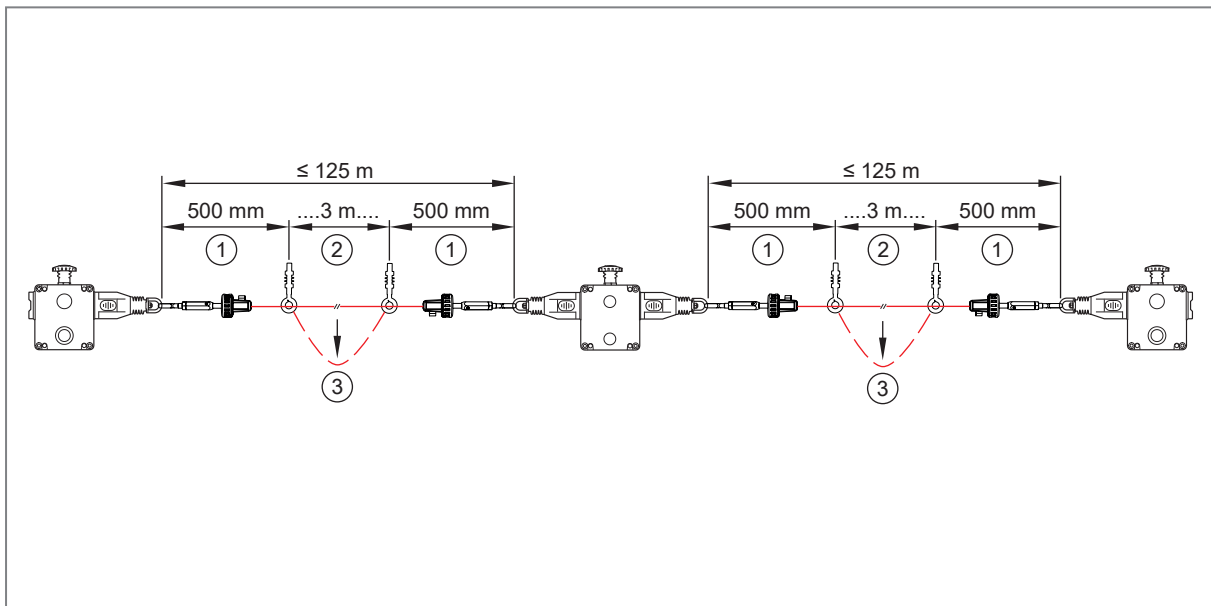
The maximum vertical pull force on the rope pull is 130 N until activation, the max. travel 300 mm.

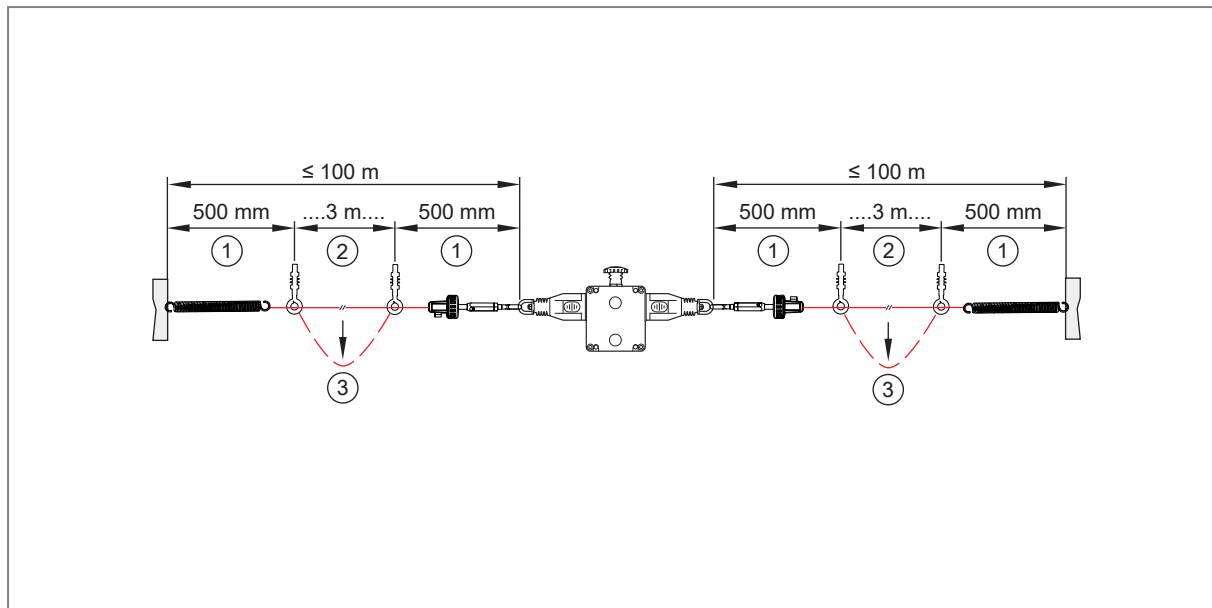
- Enough space has to be provided so that the required actuation travel can be reached.
- Eye bolts have to be installed between the switches across the whole length of the rope at a distance of min. 2.5 m to max. 3 m.
- The first eye bolt must be mounted at a distance of max. 500 mm of the switch eye bolt or the tension spring (if it is used).

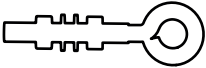
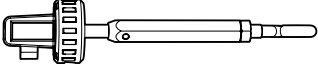


- Do not use the first 500 mm as part of the active protected area (E-STOP triggering).

Installation of components





1:	Inactive zone 500 mm
2:	Active protected area
3:	Trigger e-stop → pull rope
	Eye bolt
	Clamping system
	Tension spring

The tension of the rope is obtained by rope tensioner systems.

- After installation, set the tension to the middle position.
- ▷ The tension is indicated by the green arrows in the window of the individual switches.
- Check the function of all switches and the control circuits.
- To do so, pull on the rope at various points in the active protected area.
- Then reset the individual switches by pressing the blue reset button.
- Ensure that the switches lock into place.
- Reset the switches manually by pressing the blue button.
- If necessary, increase the rope tension until the tests along the active length of the area are satisfactory.

The switches are equipped with a red, mushroom-shaped E-STOP button.

- Check and reset the individual E-STOP switches to ensure proper operation of the control circuits.

The typical operating conditions for a successful operation of the safety rope emergency stop system are:

- max. 75 N pull force
- and max. 150 mm bending of the rope between the eye bolts for rope support



Rope pull systems with single direction safety rope emergency stop switches are influenced by fluctuations of the ambient temperature.

- ▷ To ensure proper function of the rope pull system it is mandatory to take into account the dependence on the temperature when fixing the rope length and distance of the eye bolts (every 3 m).

+ 25°C							
+ 22°C							
+ 20°C							
+ 15°C							
+ 10°C							
+ 7,5°C							
+ 5°C							
+ 3°C							
T [°C]							
-3 °C							
-5 °C							
-7,5°C							
-10°C							
-15°C							
-20°C							
-22°C							
-25°C							
L [m]	15 m	30 m	50 m	60 m	75 m	100 m	126 m

Installation temperature $T [^{\circ}\text{C}] \pm X [^{\circ}\text{C}] = \text{maximum permissible rope length } L [\text{m}]$

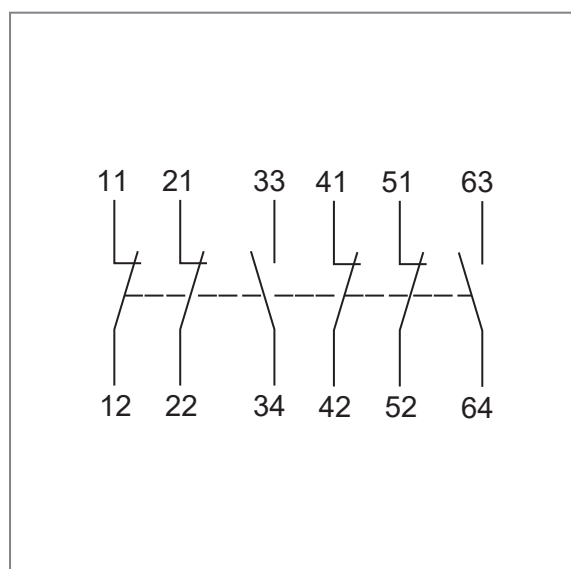
10 Electrical connection



The unit must be connected by a qualified electrician.

- Observe the national and international regulations for the installation of electrical equipment.
- Wiring is only possible if the device is disconnected from power.

10.1 Contact arrangement

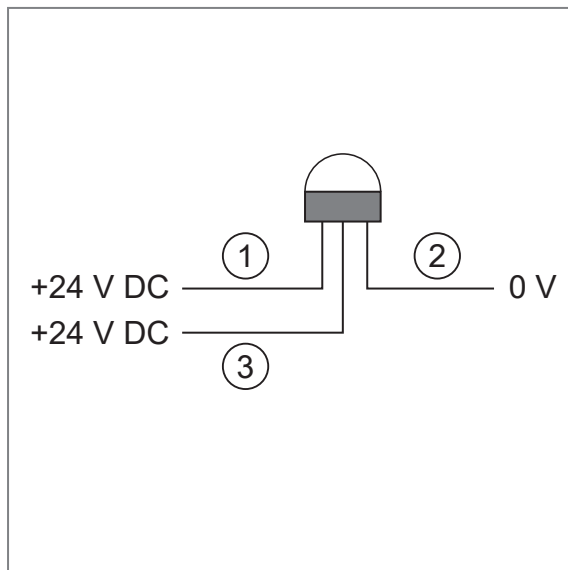


Shifting travels safety rope emergency stop switch

0 mm	4 mm	15 mm	17 mm
4 NC + 2 NO	Rope sagging	Tension range	Rope tensioned
11/12			
21/22			
33/34			
41/42			
51/52			
63/64			
Contact closed 		Contact open 	

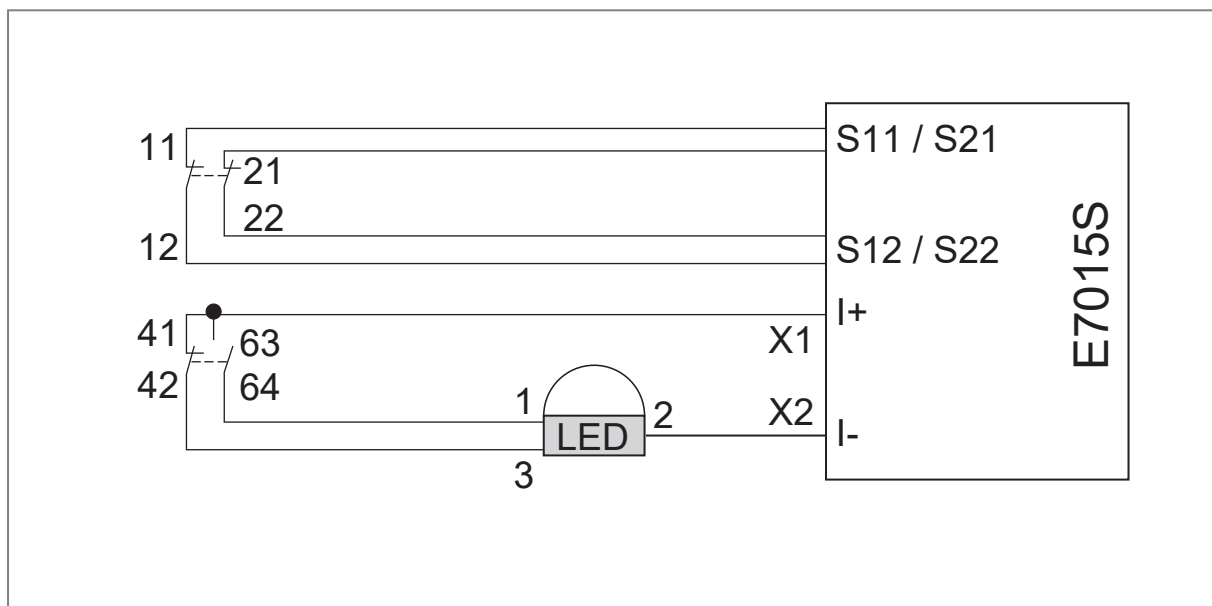
10.2 24 V DC LED

ZB0051 / ZB0075



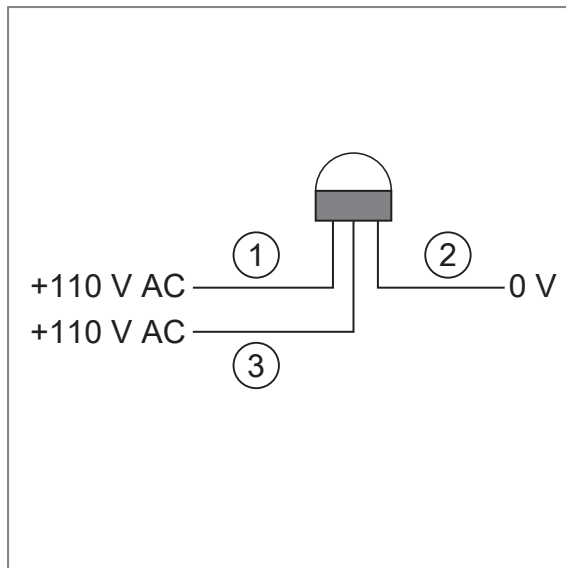
- 1: +24 V DC at connection 1 → LED red flashes
 2: 0 V
 3: +24 V DC at connection 3 → LED green is on

10.2.1 Wiring example



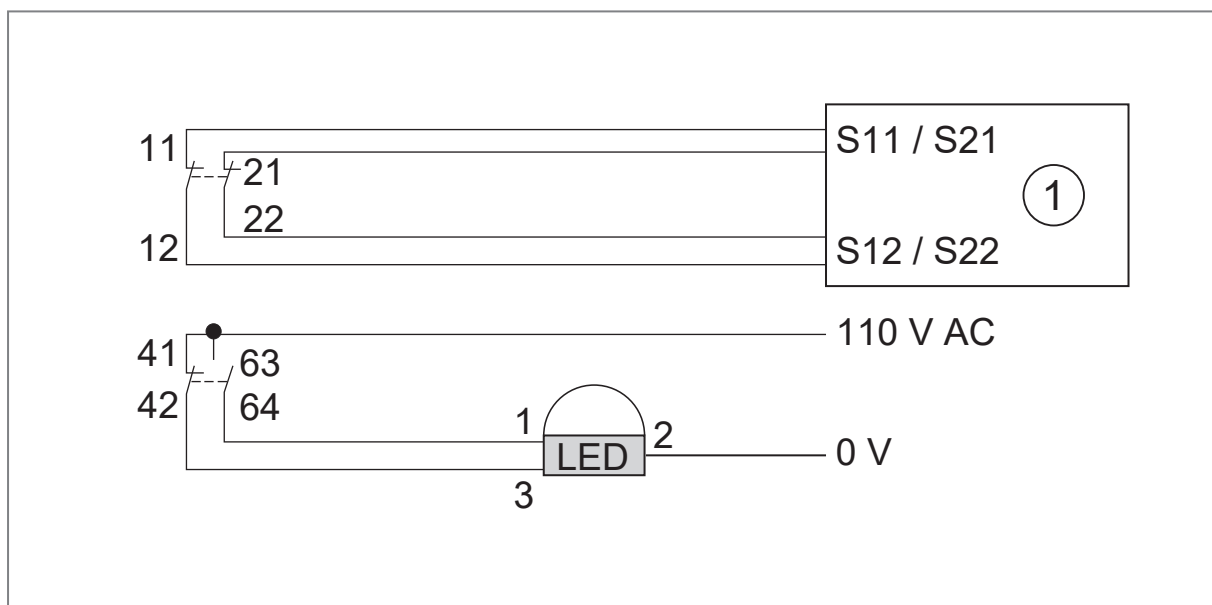
10.3 110 V AC LED

ZB0070 / ZB0071



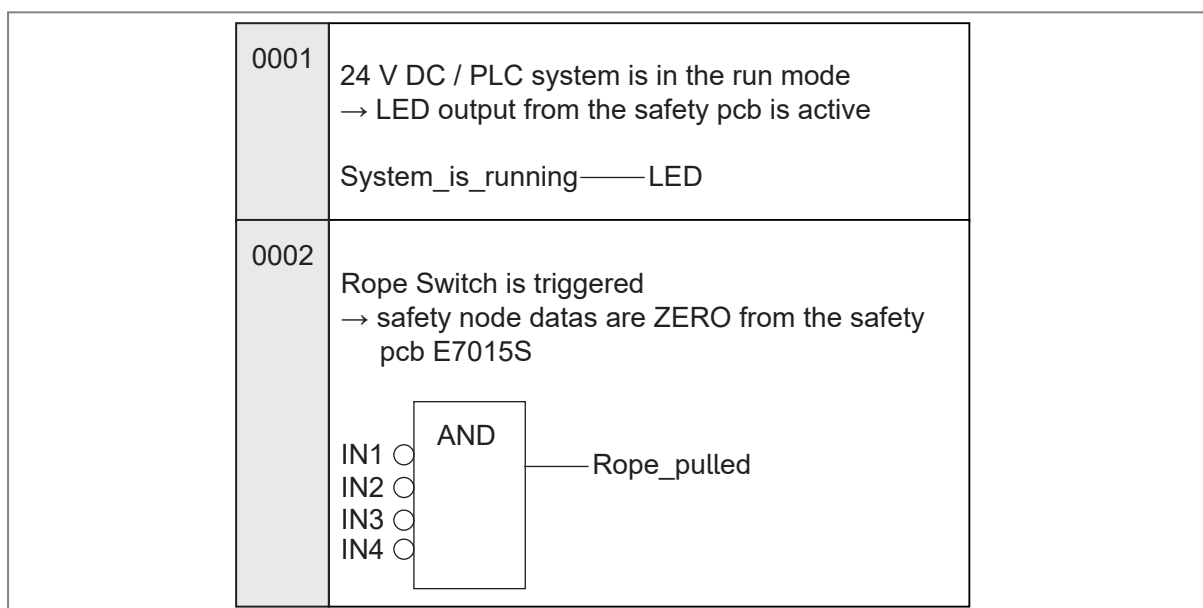
- 1: 110 V AC at connection 1 → LED red flashes
 2: 0 V at connection 2 (black)
 3: 110 V AC at connection 3 → LED green is on

10.3.1 Wiring example



1: Safe evaluation unit

10.4 Programming example



10.5 Data bits

Data bit	D3	D2	D1	D0
In / Out	SI-2	SI-2	SI-1	SI-1/O-1

Activated input channel	Bit sequence D3-D0
SI-1	XX00
SI-2	00XX
SI-1 and SI-2	0000
None	XXXX
Activated alarm output	Bit sequence D3-D0
O-1	XXX1
X = random	

11 Technical data

ZB0050 / ZB0051 / ZB0071	
Electrical design	
Safety contacts	4 NC
Auxiliary contacts	2 NO
Type of contact	Snap-action contacts
Contact material	Silver
Switching capacity	AC: 240 V/3 A, 120 V/6 A, inductive DC: 24 V/2.5 A, inductive
Max. switching voltage/switching capacity	240 V/720 VA
Minimum load	5 V, 5 mA DC
Thermal current	10 A
Rated insulation voltage	500 V
Short-circuit / overload protection	External fuse 10 A (FF)
Connection	Terminal up to 2.5 mm ²
Mechanical design	
Fixing elements	4 x M5 screws
Mounting position	any
Cable entry	4 x M20
Max. rope length	125 m each side
Actuating force (rope)	< 125 N
Tension force for operating position (axial)	130 N (between the switches)
Switching contacts	to IEC / EN 60947-5-1
Mechanical life	> 1,000,000 activations
Function display	
Operation	LED green
Error	LED red flashing
Current rating LED	15 mA
Ambient temperature	-25...80 °C
Protection rating	IP 67
Vibration resistance	10...500 Hz
Shock resistance	15g 11ms
Housing material	Die-cast aluminium
Housing colour	Yellow

ZB0070 / ZB0075	
Electrical design	
Safety contacts	4 NC
Auxiliary contacts	2 NO
Type of contact	Snap-action contacts
Contact material	Silver
Switching capacity	AC: 240 V/3 A, 120 V/6 A, inductive DC: 24 V/2.5 A, inductive
Max. switching voltage/switching capacity	240 V/720 VA

Minimum load	5 V, 5 mA DC
Thermal current	10 A
Rated insulation voltage	500 V
Short-circuit / overload protection	External fuse 10 A (FF)
Connection	Terminal up to 2.5 mm ²
Mechanical design	
Fixing elements	4 x M5 screws
Mounting position	any
Cable entry	4 x M20
Max. rope length	125 m each side
Actuating force (rope)	< 125 N
Tension force for operating position (axial)	130 N (between the switches)
Switching contacts	to IEC / EN 60947-5-1
Mechanical life	> 1,000,000 activations
Function display	
Operation	LED green
Error	LED red flashing
Current rating LED	15 mA
Ambient temperature	-25...80 °C
Protection rating	IP 67 / IP69K
Vibration resistance	10...500 Hz
Shock resistance	15g 11ms
Housing material	Stainless steel 316
Housing colour	Silver

ZB0074	
Electrical design	
Safety contacts	2 NC
Auxiliary contacts	2 NO
Type of contact	Snap-action contacts
Contact block explosion-protected	LS-EX
Nominal voltage	250 V AC / DC
Nominal current	8 poles 2.5 A
Thermal current	10 A
Rated insulation voltage	500 V
Short-circuit / overload protection	External fuse 10 A (FF)
Length connection cable	3 m
Mechanical design	
Fixing elements	4 x M5 screws
Mounting position	any
Connection	Prewired with a 3 m cable through a stainless steel cable gland
Max. rope length	125 m each side
Actuating force (rope)	< 125 N

Tension force for operating position (axial)	130 N (between the switches)
Switching contacts	to IEC / EN 60947-5-1
Mechanical life	> 1,000,000 activations
Ambient temperature	-20...60 °C
Protection rating	IP 67 / gas and dust (zone 21 + 22) IP69K / food
Vibration resistance	10...55 Hz (IEC62-2-6)
Shock resistance	15g 11ms
Housing material	Stainless steel 316
Housing colour	Silver

11.1 Safety characteristics

Characteristics	Value
B10 _d	1.5 x 10 ⁻⁶ cycles at 100 mA load
ISO 13849-1	up to PLe depending on the system architecture
EN 62061	up to SIL3 depending on the system architecture
Annual application	8 cycles per hour/24 hours per day/365 days
MTTF _d	214 years

The safety rope pull switch can be used as part of the safety-related control system to perform the E-STOP function according to EN 13850.

The PFD/PFH values or MTTF_d values of the other components (e.g. evaluation units) can be found in the respective documentation.

Explanation of the abbreviations

PL	Performance level	Capability of safety-related parts to perform a safety function under predictable conditions to fulfil the expected risk reduction.
SIL	Safety Integrity Level	Safety Integrity Level SIL 1-4 to EN 62061. The higher the SIL, the lower the probability that a safety function will fail.
B10 _d		Number of cycles at which 10 % of the components have failed and caused danger.
MTTF _d	Mean Time To Dangerous Failure	Mean time to dangerous failure.

11.2 ATEX characteristics (Ex-approved switch type LS-Ex)

The device is fitted with an Ex-approved switch, type LS-Ex, from the company IDEM.

The switch comes with

- an IECEx certificate IECEx BAS11.0133X
- an ATEX type examination certificate Baseefa11ATEX0267X

Marking

- Ex d IIC T6 (-20 °C Ta +60 °C) Gb
- Ex tb IIIC T85 °C (-20 °C Ta +60 °C) Db IP65

12 Approvals / standards

Information on UL 508:

Type 1 housing.

Use copper wires 16 - 12 AWG with a nominal temperature of at least 90 °C.

Use the same polarity for a multiple connection line.

Electrical data:

- 240V AC / 3A (6000 cycles) A300
- 120V / 60A switching element 6A
- Shutdown PF > 0.38 (100,000 cycles)
- 240V / 10A carry only

Wire cross section: 16AWG - 12AWG copper; tightening torque 0.8 Nm (7lb/in).

Operate LED only with LVLC or Class 2.

If necessary, there is a connection terminal for grounding in the housing.

Notes for AS4024.3610 conveyor belts

Information with regard to AS4024.1-2014:

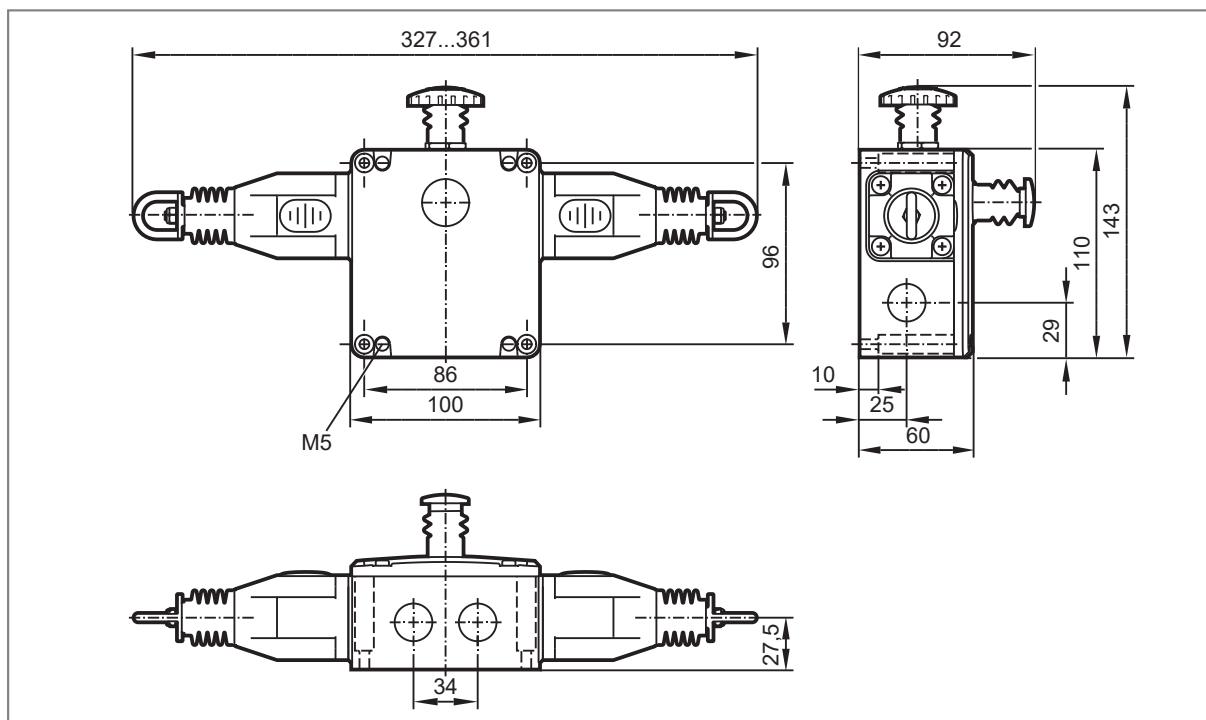
- 1) Vertical forces to operate the switches midway between the eyebolts → support: check <70N; rope deflection <300 mm
- 2) Axial forces - directly along the rope axis: <230 N (typically 125 N).

Typical parameters for successful operation of a system is less than 70 N pull force with less than 150 mm deflection of rope between the eyebolt supports.

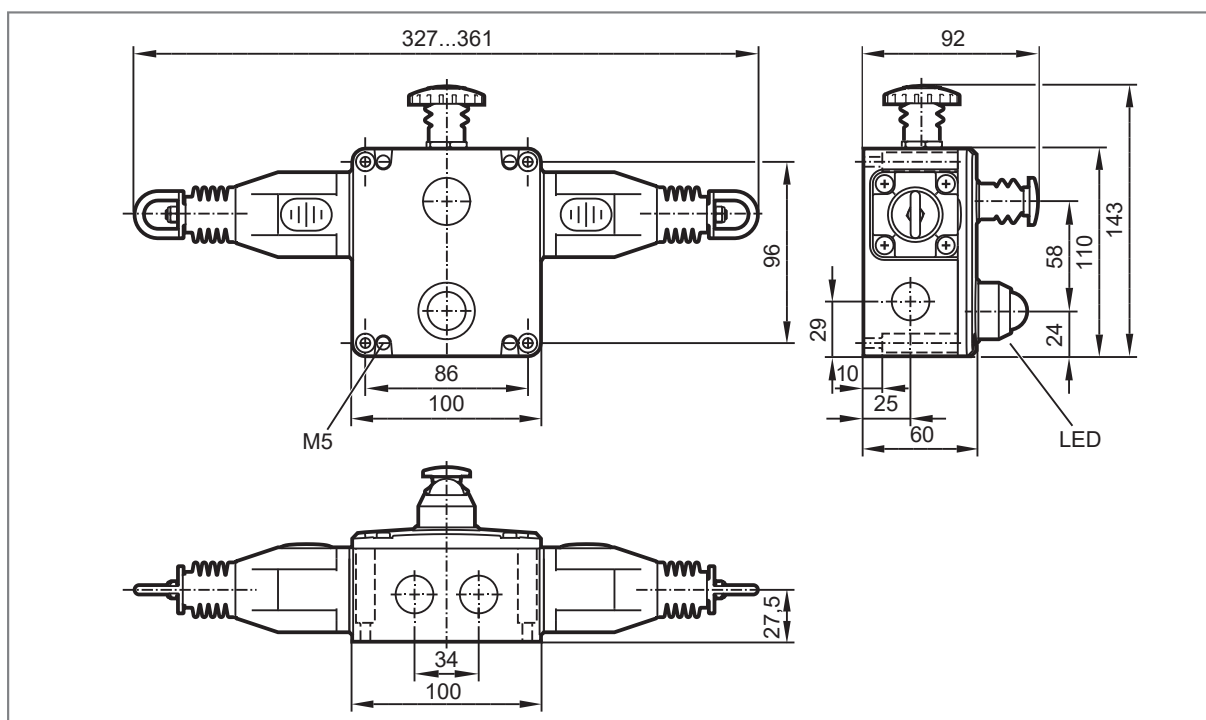
This can normally be achieved with switches set to the central position between the green arrows in the viewing window.

If required, depending on the necessary checks along the active rope length, the tension can be increased further beyond the central position to ensure a tripping pull force of less than 70N.

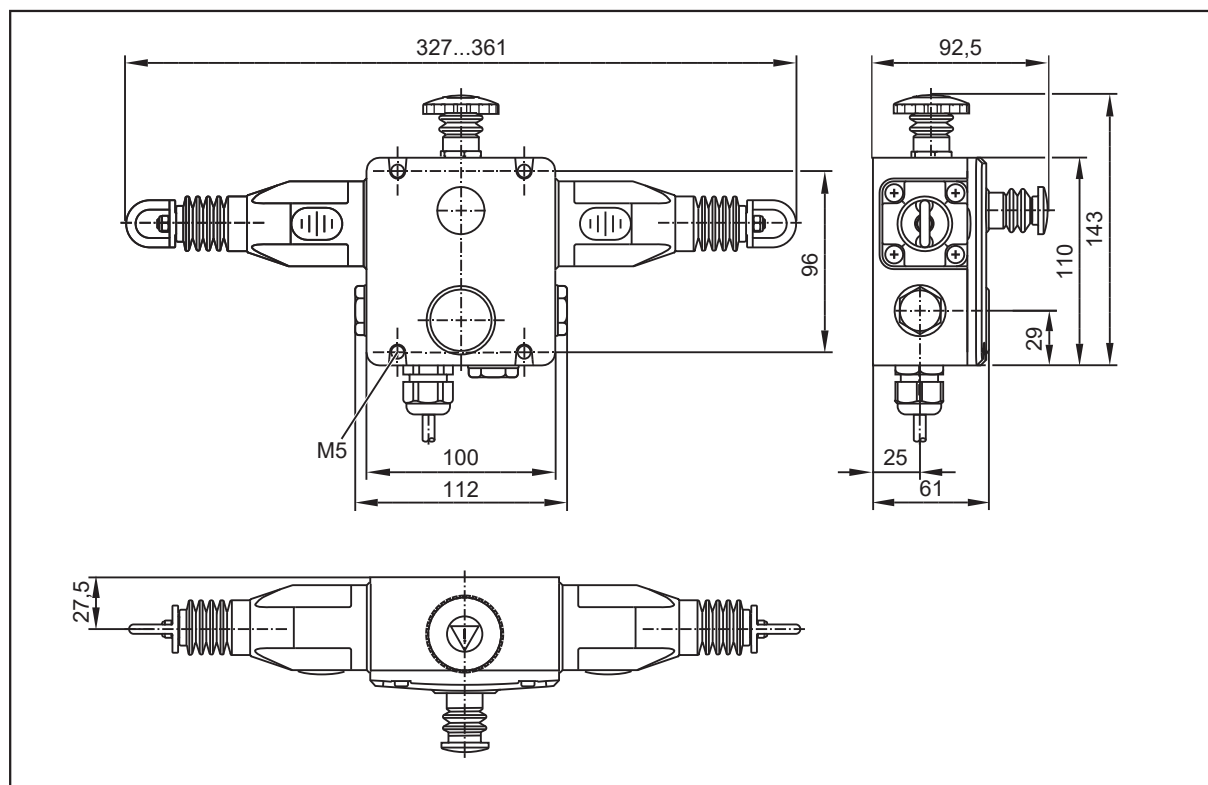
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ZB0074



14 Maintenance, repair and disposal

Maintenance requirement for testing the safety function → chapter 8 (functional description).

Only the manufacturer is allowed to repair the unit.



► After repair/replacement, carry out a test by requesting the safety function.

► After use, dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.

Cleaning the unit:

► Disconnect the unit from the voltage supply.

► Clean the unit from dirt using a soft, chemically untreated and dry micro-fibre cloth.