

# Safety Relays

## ESM



**EUCHNER**

More than safety.

# EUCHNER

More than safety.



Headquarters in Leinfelden-Echterdingen



Logistics center in Leinfelden-Echterdingen



Production location in Unterböhringen

## Internationally successful – the EUCHNER company

EUCHNER GmbH + Co. KG is a world-leading company in the area of industrial safety technology. EUCHNER has been developing and producing high-quality switching systems for mechanical and systems engineering for more than 70 years.

The medium-sized family-operated company based in Leinfelden, Germany, employs around 900 people around the world.

20 subsidiaries and other sales partners in Germany and abroad work for our international success on the market.

## Quality and innovation – the EUCHNER products

A look into the past shows EUCHNER to be a company with a great inventive spirit. We take the technological and ecological challenges of the future as an incentive for extraordinary product developments.

EUCHNER safety switches monitor safety doors on machines and installations, help to minimize dangers and risks and thereby reliably protect people and processes. Today, our products range from electromechanical and electronic components to intelligent integrated safety solutions. Safety for people, machines and products is one of our dominant themes.

We define future safety technology with the highest quality standards and reliable technology. Extraordinary solutions ensure the great satisfaction of our customers.

The product ranges are subdivided as follows:

- ▶ Transponder-coded Safety Switches
- ▶ Transponder-coded Safety Switches with guard locking
- ▶ Multifunctional Gate Box MGB
- ▶ Access management systems (Electronic-Key-System EKS)
- ▶ Electromechanical Safety Switches
- ▶ Magnetically coded Safety Switches
- ▶ Enabling Switches
- ▶ Safety Relays
- ▶ Emergency Stop Devices
- ▶ Hand-Held Pendant Stations and Handwheels
- ▶ Safety Switches with AS-Interface
- ▶ Joystick Switches
- ▶ Position Switches

 **made  
in  
Germany**

## Safety Relays ESM

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## General information

For machines and installations that can produce a risk for people when in operation, the EU Machinery Directive defines minimum requirements that are intended to reduce to a minimum the specific hazards and the related risks of accident.

If all sources of danger cannot be eliminated by design measures, appropriate protective measures must be taken. Using guards, such as fences or similar, it is intended to prevent personnel from entering the danger area. If users need to have access to the danger area during operation, movable guards such as safety doors, flaps, etc., are used. This is the case, for example, for loading or unloading, troubleshooting, machine setup or cleaning work.

To safeguard this access area, safety switches with various principles of operation are used. These switches are designed to monitor the position of the guard and, when the guard is opened, to generate a signal that will safely interrupt the supply of power to the potentially hazardous parts of the installation or that will ensure that the safety circuits are safely interrupted. The EUCHNER safety relays series ESM ensure that the safety circuits are interrupted. For one thing, they safely evaluate components connected such as

- ▶ mechanical safety switches with and without guard locking,
- ▶ non-contact safety switches,
- ▶ emergency stop controls,
- ▶ electro-sensitive protective equipment, etc.,

for another, they safely shut down dangerous machine functions.

The safety relays impress with their compact mounting rail housing and their suitability for applications up to category 4/PLe according to EN ISO 13849-1.

## The ESM modular principle

The majority of modules in the safety relay series ESM are installed in a housing that is only 22.5 mm wide. Various safety relays are available to which contact expansions can be added on the output side. The contact expansions can be non-time-delayed or time-delayed. The advantage of this modular principle is that only a few devices are required to be able to realize a large number of different safety evaluations.

The safety relays can be operated with various types of starting. The devices can be started manually or automatically using suitable wiring. The manual start can also monitor the start button.

Using suitable wiring, it is also possible to integrate a feedback loop such that safety-related parts of a downstream machine or installation can also be monitored.




In the ESM series, the majority of the devices are available with a variety of input voltage ranges.

## Approvals

To demonstrate conformity, the Machinery Directive also includes the possibility of type examination. Although all relevant standards are taken into account during development, we have all our switchgear subjected to additional type examinations by a notified body.





Furthermore, numerous items of switchgear are listed by Underwriters Laboratories (UL). These items of switchgear can be used in countries in which this listing is required. The approval symbols on the individual pages of the catalog indicate which body tested the switchgear.

With the aid of the approval symbols listed below, you can quickly see which approvals are available for the related switchgear:




	Switches with this symbol are approved by Underwriters Laboratories (UL)
	Switches with this symbol are approved by TÜV Rheinland
	Switches with this symbol comply with the guidelines of the Eurasian Economic Union (EEU).

## Explanation of symbols

### Connection options

	Suitable for the connection of emergency stop
	Suitable for the connection of safety switches according to EN ISO 14119
	Suitable for the connection of electro-sensitive protective equipment, e.g. light grids
	Suitable for the connection of 2-hand circuits

### Fault detection

	Short circuit is detected
	Ground fault is detected
	Earth fault is detected

## Time-delay



Safety contacts switch time-delayed

## Safety category

**Cat.  
3**

Suitable up to category 3 according to EN ISO 13849-1

**Cat.  
4**

Suitable up to category 4 according to EN ISO 13849-1

## Stop category

**STOP  
0**

Immediate shutdown  
Stop category 0 according to EN 60204-1

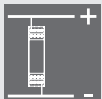
**STOP  
1**

Time-delayed shutdown  
Stop category 1 according to EN 60204-1

## Technical Data



Mechanical data

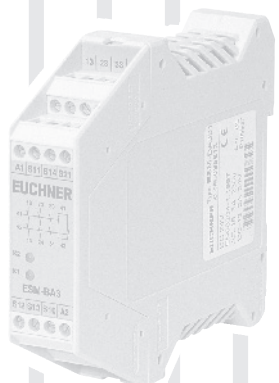


Electrical data



## Selection table for safety relays ESM

Safety relays																
BA		Non-time-delayed category 4														
BT		Time-delayed category 3/non-time-delayed category 4														
2H		2-hand requirement level III C according to EN 574, category 4														
Contact expansion																
ES		Non-time-delayed category 4														
TE		Time-delayed category 4														
Category according to EN ISO 13849-1																
K		Category according to EN ISO 13849-1														
Enable path																
SU		Safety contacts non-time-delayed														
SV		Safety contacts time-delayed														
M		Monitored start button														
Relay start																
A		Automatic start														
M		Start button														
U		Monitored start button														
Monitoring																
R		Feedback loop														
Q		Short circuit monitoring														
E		Earth fault monitoring														
M		Ground fault monitoring														

Devices					K	Outputs			Start			Monitoring				Page
BA	BT	2H	ES	TE		SU	SV	M	A	M	U	R	Q	E	M	
●					4	2			●	●	●	●	●	●	●	8
●					4	3		1	●	●	●	●	●	●	●	9
●					4	7		4	●	●	●	●	●	●	●	10
	●				4/3	2	2		●	●		●	●	●	●	11
	●				4/3	3	1		●	●		●	●	●	●	11
		●			4	2					●	●	●	●	●	12
			●		4	3		1						●	●	13
				●	3		3	1						●	●	14

## Safety relay ESM-BA..

- ▶ ESM-BA.. Use up to category 4 according to EN ISO 13849-1
- ▶ LED status indicators
- ▶ 1-channel or 2-channel control
- ▶ Up to 7 redundant safety contacts
- ▶ Auxiliary contact (monitoring contact) optional
- ▶ Short circuit and earth fault/ground fault monitoring optional



### Relay outputs

The outputs are electrically decoupled and of redundant design.

### Connection options

By using suitable wiring, the following functions can be selected:

- ▶ Relay start with automatic start or a start button
- ▶ Monitoring of downstream relays or contactors.

By using suitable wiring, the following functions can additionally be selected:

- ▶ Simultaneity monitoring to monitor safety components over time
- ▶ Short circuit monitoring to detect short circuits between the connecting cables and to shut down the outputs or prevent relay starting if necessary
- ▶ Earth fault/ground fault monitoring to detect short circuits between the connecting cables and earth or ground and to shut down the outputs or prevent relay starting if necessary.

### Auxiliary contacts

Relays in the series ESM-BA3.. and ESM-BA7... are available with electrically separate normally closed contacts.

### Connection terminals

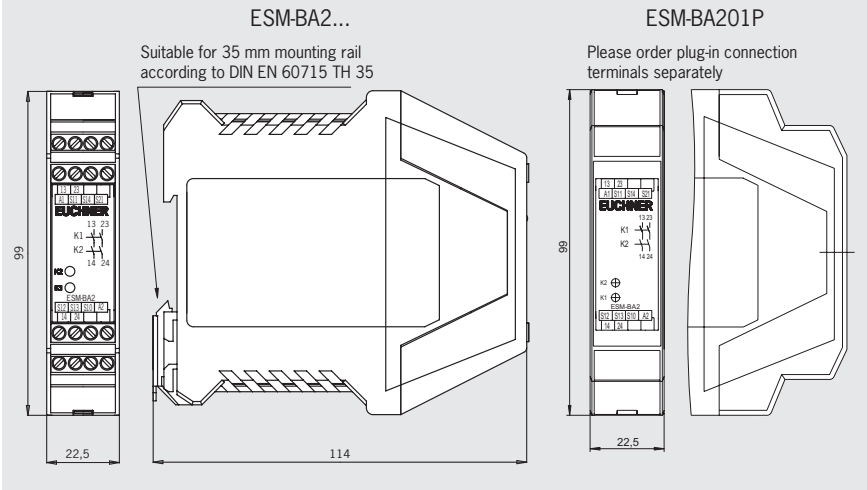
Optionally, the ESM-BA... devices are also available as versions with plug-in connection terminals.

## Safety relay ESM- BA2..

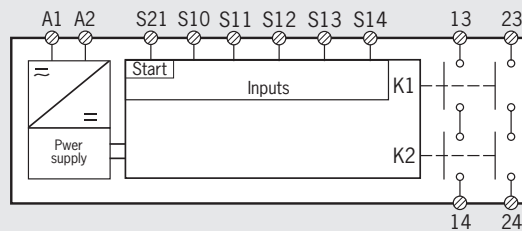


Cat. 4 STOP 0

### Dimension drawing



### Block diagram



### Technical data for outputs

Parameter	Value		
Min. switching current at DC 24 V	20 mA		
Switching voltage, max.	DC 24 V / AC 250 V		
Utilization category * according to EN 60947-5-1	$U_e$	$I_e$	$\Sigma I_e$
	AC-12	250 V	6 A
	AC-15	250 V	3 A
	DC-12	24 V	6 A
DC-13	24 V	3 A	12 A

$U_e$  = switching voltage

$I_e$  = max. switching current per contact

$\Sigma I_e$  = max. switching current of all safety contacts (cumulative current)

\* Information about the utilization category is on page 25

### Ordering table

Series	Version	Outputs	Version	AC/DC 24 V	AC 115 V	AC 230 V
ESM	BA Safety relay	2 2 S	Screw terminals	085610 ESM-BA201	085611 ESM-BA202	085612 ESM-BA203
			Plug-in connection terminals <sup>1)</sup>	097226 ESM-BA201P	-	-

<sup>1)</sup> Please order plug-in connection terminals separately (see page 16)





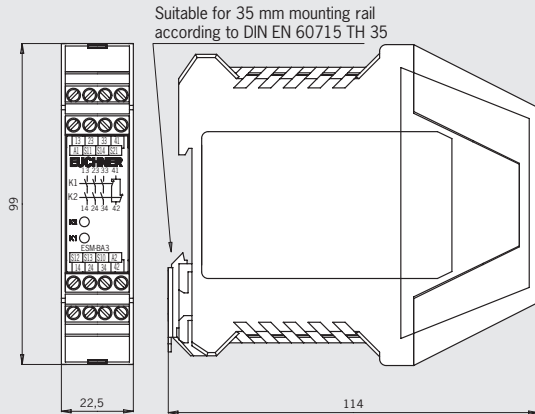
## Safety relay ESM-BA3..



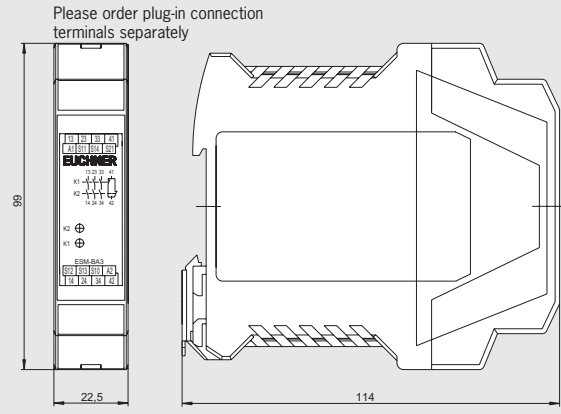
Cat. 4 STOP 0

### Dimension drawing

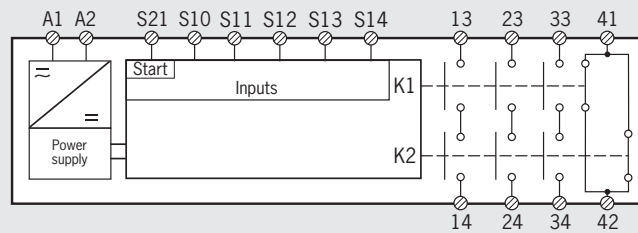
ESM-BA3...



ESM-BA301P



### Block diagram



### Technical data for outputs

Parameter	Value		
Min. switching current at DC 24 V	5 mA		
Switching voltage, max.	DC 24 V / AC 250 V		
Utilization category * according to EN 60947-5-1	<b>U<sub>e</sub></b>	<b>I<sub>e</sub></b>	<b>Σ I<sub>e</sub></b>
	AC-12	250 V	8 A
	AC-15	250 V	3 A
	DC-12	40 V	8 A
	DC-13	24 V	3 A

1) If several ESM-BA3.. are closely spaced under load, the max. cumulative current at an ambient temperature of 20 °C = 9 A; at 30 °C = 3 A; at 40 °C = 1 A. If these currents are exceeded, a spacing of 5 mm between the devices must be observed.

U<sub>e</sub> = switching voltage

I<sub>e</sub> = max. switching current per contact

Σ I<sub>e</sub> = max. switching current of all safety contacts (cumulative current)

\* Information about the utilization category is on page 25

### Ordering table

Series	Version	Outputs	Version	AC/DC 24 V		AC 115 V	AC 230 V
				085613 ESM-BA301	163689 ESM-BA301/V50 PU = 50 pcs.	087412 ESM-BA302	087413 ESM-BA303
ESM	BA Safety relay	3 3 NO + 1 NC	Screw terminals	097230 ESM-BA301P	-	-	-
			Plug-in connection terminals <sup>1)</sup>				

1) Please order plug-in connection terminals separately (see page 16)

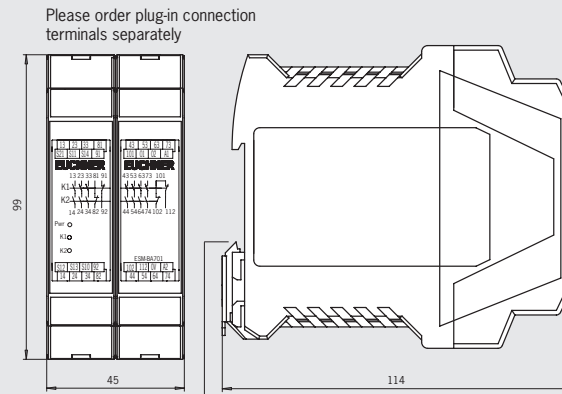


## Safety relay ESM-BA7..



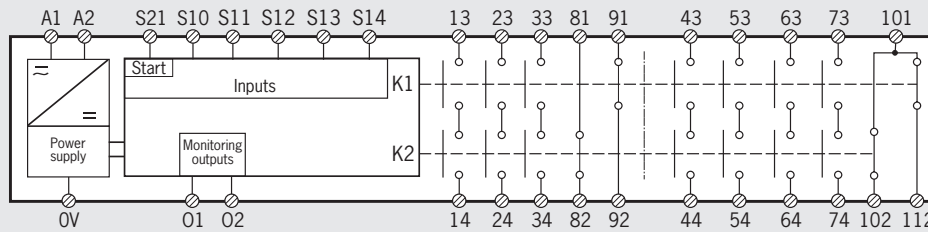
Cat. 4 STOP 0

### Dimension drawing



Suitable for 35 mm mounting rail according to DIN EN 60715 TH 35

### Block diagram



### Technical data for outputs

Parameter	Value			
Min. switching current at DC 24 V	5 mA			
Switching voltage, max.	DC 24 V / AC 250 V			
Utilization category * according to EN 60947-5-1		<b>U<sub>e</sub></b>	<b>I<sub>e</sub></b>	<b>Σ I<sub>e</sub></b>
	AC-12	250 V	8 A	
	AC-15	250 V	3 A	
	DC-12	40 V	8 A	
	DC-13	24 V	3 A	35 A <sup>1)</sup>

1) With a housing distance of 10 mm. 20 A closely spaced at 40 °C

U<sub>e</sub> = switching voltage

I<sub>e</sub> = max. switching current per contact

Σ I<sub>e</sub> = max. switching current of all safety contacts (cumulative current)

\* Information about the utilization category is on page 25

### Ordering table

Series	Version	Outputs	Version	AC/DC 24 V
ESM	BA Safety relay	7 7 NO + 4 NC	Screw terminals	<b>097224</b> ESM-BA701
			Plug-in connection terminals <sup>1)</sup>	<b>097225</b> ESM-BA701P

1) Please order plug-in connection terminals separately (see page 16). Two connection kits are required for devices from series ESM-BA701P.

## Safety relays time-delayed ESM-BT..



- ▶ Use up to category 4 according to EN ISO 13849-1
- ▶ LED status indicators
- ▶ 1-channel or 2-channel control
- ▶ 4 redundant safety contacts of which 1, 2 or 3 contacts time-delayed
- ▶ Delay time range 1 s–30 s
- ▶ Fixed time delay of 2 s or 5 s optional
- ▶ Short circuit and earth fault/ground fault monitoring



### Relay outputs

The outputs are electrically decoupled and of redundant design.

### Connection options

By using suitable wiring, the following functions can be selected:

- ▶ Relay start with automatic start, a start button or a monitored start button
- ▶ Monitoring of downstream relays or contactors
- ▶ Simultaneity monitoring to monitor safety components over time
- ▶ Short circuit monitoring to detect short circuits between the connecting cables and to shut down the outputs or prevent relay starting if necessary
- ▶ Earth fault/ground fault monitoring to detect short circuits between the connecting cables and earth or ground and to shut down the outputs or prevent relay starting if necessary.

### Time-delayed shutdown

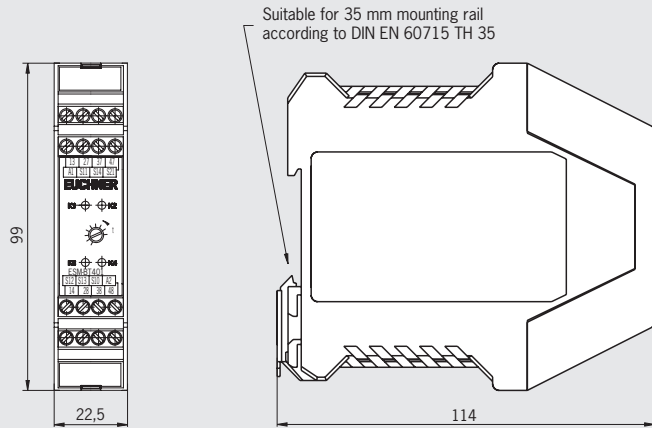
The release time for the time-delay contacts can be set as required using a potentiometer on the safety relay.

The time delay is fixed for ESM-BT411-20S and ESM-BT421-50S. The potentiometer is omitted.

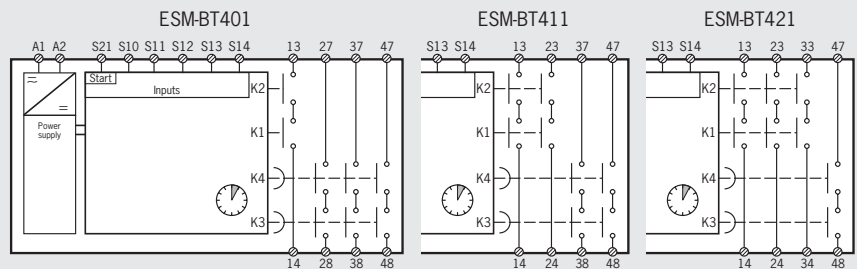
### Safety relay ESM-BT..



### Dimension drawing



### Block diagram



### Technical data for outputs

Parameter	Value		
Min. switching current at DC 24 V	5 mA		
Switching voltage, max.	DC 40 V / AC 250 V		
Utilization category * according to EN 60947-5-1	$U_e$	$I_e$	$\Sigma I_e$
	AC-12	250 V	8 A
	AC-15	250 V	3 A
	DC-12	40 V	8 A
	DC-13	24 V	3 A

$U_e$  = switching voltage

$I_e$  = max. switching current per contact

$\Sigma I_e$  = max. switching current of all safety contacts (cumulative current)

\* Information about the utilization category is on page 25

### Ordering table

Series	Version	Outputs	Time delay	AC/DC 24 V
ESM	BT Safety relay	401 1 NO non-time-delayed 3 NO time-delayed	adjustable 1 s ... 30 s	090818 ESM-BT401
			adjustable 1 s ... 30 s	090819 ESM-BT411
		411 2 NO non-time-delayed 2 NO time-delayed	Fixed 2 s	090077 ESM-BT411-20S
			adjustable 1 s ... 30 s	090820 ESM-BT421
		421 3 NO non-time-delayed 1 NO time-delayed	Fixed 5 s	090094 ESM-BT421-50S

## Safety relays 2-hand ESM-2H..



- ▶ Use up to category 4 according to EN ISO 13849-1
- ▶ Type III C acc. to EN ISO 13851
- ▶ LED status indicators
- ▶ Operation by 2-hand control
- ▶ 2 redundant safety contacts
- ▶ Short circuit and earth fault/ground fault monitoring can be selected

### Safety relay ESM-2H..



Cat. 4 STOP 0



### Relay outputs

The outputs are electrically decoupled and of redundant design.

### Connection

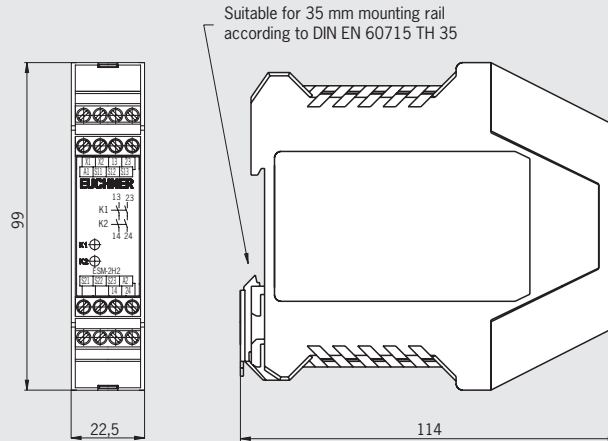
- ▶ Two buttons each with one normally closed contact and one normally open contact that are monitored for simultaneity according to EN ISO 13851. In this way a high level of protection against tampering is provided.
- ▶ Short circuit monitoring to detect short circuits between the connecting cables and to shut down the outputs or prevent relay starting if necessary.
- ▶ Earth fault/ground fault monitoring to detect short circuits between the connecting cables and earth or ground and to shut down the outputs or prevent relay starting if necessary.

### Connection option

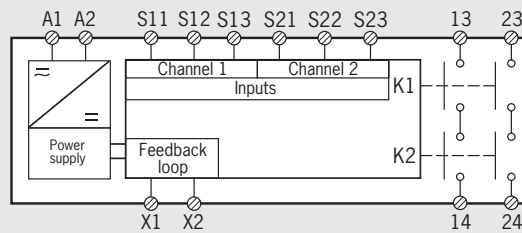
By using suitable wiring, the following function can be selected:

- ▶ Monitoring of downstream relays or contactors.

### Dimension drawing



### Block diagram



### Technical data for outputs

Parameter	Value		
Min. switching current at DC 24 V	20 mA		
Switching voltage, max.	DC 24 V / AC 250 V		
Utilization category * according to EN 60947-5-1	<b>U<sub>e</sub></b>	<b>I<sub>e</sub></b>	<b>Σ I<sub>e</sub></b>
	AC-12	250 V	6 A
	AC-15	250 V	3 A
	DC-12	24 V	6 A
	DC-13	24 V	3 A

U<sub>e</sub> = switching voltage

I<sub>e</sub> = max. switching current per contact

Σ I<sub>e</sub> = max. switching current of all safety contacts (cumulative current)

\* Information about the utilization category is on page 25

### Ordering table

Series	Version	Outputs	AC/DC 24 V	AC 230 V
ESM	2H Safety relay	2 2 S	085620 ESM-2H201	-

## Contact expansion ESM-ES..

- ▶ Use up to category 4 according to EN ISO 13849-1
- ▶ LED status indicators
- ▶ Control using safety relays
- ▶ 3 redundant safety contacts
- ▶ 1 monitoring contact
- ▶ Earth fault/ground fault monitoring can be selected



### Relay outputs

The outputs are electrically decoupled and of redundant design.

### Connection option

By using suitable wiring, the following function can be selected:

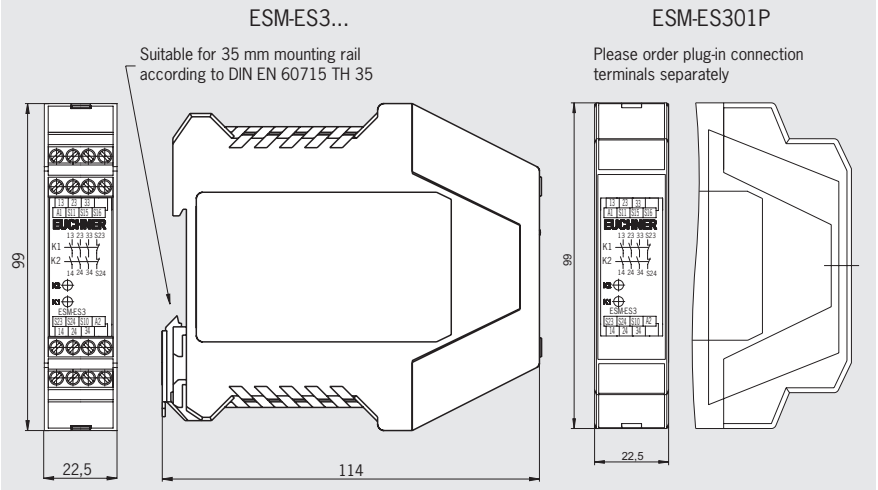
- ▶ Earth fault/ground fault monitoring to detect short circuits between the connecting cables and earth or ground and to shut down the outputs or prevent relay starting if necessary.

## Contact expansion ESM-ES..

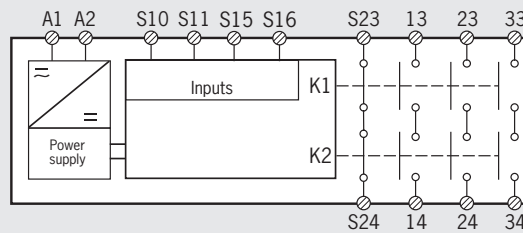


Cat. 4 STOP 0

### Dimension drawing



### Block diagram



### Technical data for outputs

Parameter	Value			
Min. switching current at DC 24 V	5 mA			
Switching voltage, max.	DC 24 V / AC 250 V			
Utilization category * according to EN 60947-5-1	<b>U<sub>e</sub></b>	<b>I<sub>e</sub></b>	<b>Σ I<sub>e</sub></b>	
	AC-12	230 V	6 A	10.5 A
	AC-15	230 V	4 A	
	DC-12	24 V	1.25 A	
DC-13	24 V	2 A		

U<sub>e</sub> = switching voltage

I<sub>e</sub> = max. switching current per contact

Σ I<sub>e</sub> = max. switching current of all safety contacts (cumulative current)

\* Information about the utilization category is on page 25

### Ordering table

Series	Version	Outputs	Version	AC/DC 24 V	AC 115 V	AC 230 V
ESM	ES Contact expansion	3 3 NO + 1 NC	Screw terminals	<b>085614</b> ESM-ES301	<b>085615</b> ESM-ES302	<b>085616</b> ESM-ES303
			Plug-in connection terminals <sup>1)</sup>	<b>090057</b> ESM-ES301P	-	-

1) Please order plug-in connection terminals separately (see page 16)

## Contact expansion time-delayed ESM-TE..



- ▶ Use up to category 3 according to EN ISO 13849-1
- ▶ LED status indicators
- ▶ Control using safety relays
- ▶ 3 redundant time-delayed safety contacts
- ▶ Delay time range 1 s–30 s
- ▶ Fixed time delay of 0.5 s optional
- ▶ 1 auxiliary contact
- ▶ Earth fault/ground fault monitoring can be selected



### Relay outputs

The outputs are electrically decoupled and of redundant design.

### Connection option

By using suitable wiring, the following function can be selected:

- ▶ Earth fault/ground fault monitoring to detect short circuits between the connecting cables and earth or ground and to shut down the outputs or prevent relay starting if necessary.

### Time-delayed shutdown

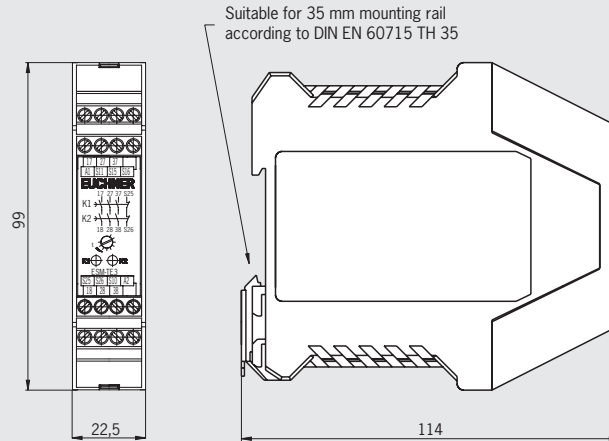
The release time for the time-delay contacts can be set as required using a potentiometer on the safety relay.

### Contact expansion ESM-TE..

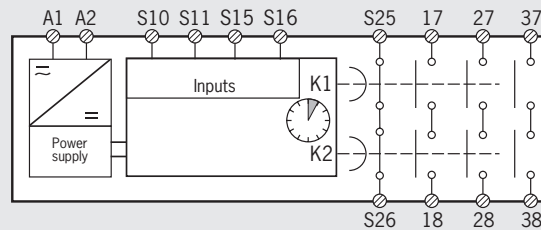


Cat. 3 STOP 1

### Dimension drawing



### Block diagram



### Technical data for outputs

Parameter	Value			
Min. switching current at DC 24 V	5 mA			
Switching voltage, max.	DC 24 V / AC 250 V			
Utilization category * according to EN 60947-5-1	<b>U<sub>e</sub></b>	<b>I<sub>e</sub></b>	<b>Σ I<sub>e</sub></b>	
	AC-12	230 V	6 A	10.5 A
	AC-15	230 V	4 A	
	DC-12	24 V	1.25 A	
DC-13	24 V	2 A		

U<sub>e</sub> = switching voltage

I<sub>e</sub> = max. switching current per contact

Σ I<sub>e</sub> = max. switching current of all safety contacts (cumulative current)

\* Information about the utilization category is on page 25

### Ordering table

Series	Version	Outputs	Time-delay	AC/DC 24 V	AC 230 V
ESM	TE Contact expansion	3 NO + 1 NC time-delayed	adjustable 1 s ... 30 s	<b>085617</b> ESM-TE301	<b>085619</b> ESM-TE303
			Fixed 0.5 s	<b>097223</b> ESM-TE301-05S	-



## Accessories for safety system ESM

- ▶ Connection kit ESM...P with screw terminals or spring terminals

**Important:** One connection kit is required, depending on the device (see information on the corresponding product page). Two connection kits are required for devices from series ESM-BA701P.

### Ordering table

Designation	Description	Order no.
Connection kit ESM...P with screw terminals	Comprising: 4 plug-in screw terminals (can be coded) 2 jumpers Coding pins	<b>097194</b> ESM-F-AK4
Connection kit ESM...P with spring terminals	Comprising: 4 plug-in spring terminals (can be coded) 2 jumpers Coding pins	<b>097195</b> ESM-F-KK4



## Overview of safety relays ESM

### Safety relays ESM


<b>BA</b>	Non-time-delayed category 4
<b>BT</b>	Time-delayed category 3/non-time-delayed category 4
<b>2H</b>	2-hand requirement level III C according to EN ISO 13851, category 4


### Contact expansion ESM

<b>ES</b>	Non-time-delayed category 4
<b>TE</b>	Time-delayed category 4

Safety Relays ESM					Page
BA	BT	2H	ES	TE	
●					18
	●				21
		●			22
			●		23
				●	24



Housing						
Parameter	Value					Unit
Housing material	Polyamide PA6.6					
Dimensions	114 x 99 x 22.5 (ESM-BA7... 114 x 99 x 45)					mm
Weight	Approx. 0.25 (ESM-BA7... approx. 0.35)					kg
Connection	Connection terminals					
Connection terminals	0.14 ... 2.5					mm <sup>2</sup>
Ambient temperature	<b>Safety relay</b>	<b>ESM-BA..</b>	<b>ESM-BA3..</b>	<b>ESM-BA7..</b>	<b>ESM-BT4..</b>	<b>ESM-2H2..</b>
		-15 ... +60	-15 ... +40	-15 ... +40	-15 ... +40	-15 ... +60
	<b>Contact expansion</b>	<b>ESM-ES3.. ESM-TE3...</b>				
		-15 ... +60				°C
Degree of protection acc. to EN 60529	IP20					
Degree of contamination	2					
Mounting	Mounting rail 35 mm acc. to DIN EN 60715 TH 35					
Mechanical life	<b>Safety relay</b>	<b>ESM-BA2..</b>	<b>ESM-BA3..</b>	<b>ESM-BA7..</b>	<b>ESM-BT4..</b>	<b>ESM-2H2..</b>
	mechanical	1 x 10 <sup>7</sup>		1 x 10 <sup>6</sup>	1 x 10 <sup>6</sup>	1 x 10 <sup>7</sup>
	<b>Contact expansion</b>	<b>ESM-ES3.. ESM-TE3...</b>				
	mechanical	1 x 10 <sup>7</sup>				operating cycles

Connection ESM-BA2..				
Parameter	Value			Unit
Operating voltage	ESM-BA201	24 ± 10% <sup>1)</sup>		V AC/DC
	ESM-BA202	115 ± 10%		V AC
	ESM-BA203	230 ± 10%		V AC
Reverse polarity protection	on ESM-BA201			
Rated supply frequency	50 ... 60			Hz
Power consumption	Approx. 3.7 VA (at 230 V AC)/ approx. 1.5 W (at 24 V DC)			
Control voltage at S11	18.6 ... 26			V DC
Control cable length (cross-section 0.75 mm <sup>2</sup> )	Max. 1,000			m
Control current S11 ... S14	Approx. 40			mA
External contact fuse (safety circuit) acc. to EN IEC 60269-1	10 A gG (T4A / F6A)			
Test voltage (control voltage/contacts)	2.5			kV
Rated impulse withstand voltage, leakage path and air gaps acc. to DIN VDE 0110-1	4			kV
Rated insulation voltage	250			V
Overvoltage category acc. to DIN VDE 0110-1	3			
<b>Safety contacts</b>	<b>2 NO contacts (redundant)</b>			
Switching current, min., at DC 24 V	20			mA
Switching voltage, max.	24			V DC
	250			V AC
Breaking capacity acc. to $\mathcal{U}$	6 A 250 V AC 2 A 24 V DC			
Utilization category <sup>2)</sup> according to EN 60947-5-1		<b>U<sub>e</sub></b>	<b>I<sub>e</sub></b>	<b>Σ I<sub>e</sub></b>
	AC-12	250 V	6 A	12 A
	AC-15	250 V	3 A	
	DC-12	24 V	6 A	
	DC-13	24 V	3 A	
LED displays	2, status display for relays K1 and K2			
<b>Reliability values acc. to EN ISO 13849-1</b>				
Category	4			
Performance Level PL	e			

1) All the electrical connections must either be isolated from the mains supply by a safety transformer according to EN 61558-2-6 with limited output voltage in the event of a fault, or by other equivalent isolation measures.

2) Information about the utilization category is on page 25.

U<sub>e</sub> = switching voltage

I<sub>e</sub> = max. switching current per contact

Σ I<sub>e</sub> = max. switching current of all safety contacts (cumulative current)

## Connection ESM-BA3..



Parameter		Value	Unit	
Operating voltage	ESM-BA301	24 ± 10% <sup>1)</sup>	V AC/DC	
	ESM-BA302	115 ± 10%	V AC	
	ESM-BA303	230 ± 10%	V AC	
Reverse polarity protection		on ESM-BA301		
Rated supply frequency		50 ... 60	Hz	
Power consumption		Approx. 7 VA (at 230 V AC)/approx. 4.5 VA (at 24 V DC)	VA	
Control voltage at S11		18.6 ... 26	V DC	
Control cable length (cross-section 0.75 mm <sup>2</sup> )		Max. 1,000	m	
Control current S11 ... S14		Approx. 60	mA	
External contact fuse (safety circuit) acc. to EN IEC 60269-1		10 A gG (T6A / F8A)		
Test voltage (control voltage/contacts)		2.5	kV	
Rated impulse withstand voltage, leakage path and air gaps acc. to DIN VDE 0110-1		4	kV	
Rated insulation voltage		250	V	
Overvoltage category acc. to DIN VDE 0110-1		3		
<b>Safety contacts</b>		<b>3 NO contacts (redundant)</b>		
Cumulative current of all contacts acc. to $\mathcal{U}$		Max. 15	A	
Switching current, min., at DC 24 V		5	mA	
Switching voltage, max.		24	V DC	
		250	V AC	
Breaking capacity acc. to $\mathcal{U}$	ESM-BA301	8 A 250 V AC / 3 A 24 V DC		
	ESM-BA302			
	ESM-BA303	8 A 250 V AC / 3 A 24 V DC		
Utilization category <sup>2)</sup> according to EN 60947-5-1		<b>U<sub>e</sub></b>	<b>I<sub>e</sub></b>	
		AC-12	250 V	8 A <sup>4)</sup>
		AC-15	250 V	3 A
		DC-12	24 V	8 A <sup>4)</sup>
		DC-13	24 V	3 A
			$\Sigma I_e$	
			15 A <sup>3)</sup>	
LED displays		2, status display for relays K1 and K2		
<b>Monitoring contact</b>		<b>1 NC contact</b>		
Switching voltage, max.		24	V DC	
		250	V AC	
Breaking capacity acc. to $\mathcal{U}$	ESM-BA301	2 A 250 V AC / 1.5 A 24 V DC		
	ESM-BA302			
	ESM-BA303	2 A 250 V AC / 2 A 24 V DC		
Utilization category <sup>2)</sup> according to EN 60947-5-1		<b>U<sub>e</sub></b>	<b>I<sub>e</sub></b>	
		AC-12	250 V	2 A
		DC-12	40 V	2 A
<b>Reliability values acc. to EN ISO 13849-1</b>				
Category		4		
Performance Level PL		e		

1) All the electrical connections must either be isolated from the mains supply by a safety transformer according to EN 61558-2-6 with limited output voltage in the event of a fault, or by other equivalent isolation measures.

2) Information about the utilization category is on page 25.

3) If several ESM-BA3.. are closely spaced under load, the max. cumulative current at an ambient temperature of 20 °C = 9 A; at 30 °C = 3 A; at 40 °C = 1 A. If these currents are exceeded, a spacing of 5 mm between the devices must be observed.

4) With ohm resistive load.

U<sub>e</sub> = switching voltage

I<sub>e</sub> = max. switching current per contact

$\Sigma I_e$  = max. switching current of all safety contacts (cumulative current)

## Connection ESM-BA7..



Parameter	Value	Unit	
Operating voltage	24 ± 10% <sup>1)</sup>	V AC/DC	
Reverse polarity protection	Yes		
Rated supply frequency	50 ... 60	Hz	
Power consumption	Approx. 8.5 VA (at 230 V AC)/approx. 4.5 VA (at 24 V DC)	VA	
Control voltage at S11	18.6 ... 26	V DC	
Control cable length (cross-section 0.75 mm <sup>2</sup> )	Max. 1,000	m	
Control current S11 ... S 14	Approx. 250	mA	
External contact fuse (safety circuit) acc. to EN IEC 60269-1	10 A gG (T6A / F8A)		
Test voltage (control voltage/contacts)	2.5	kV	
Rated impulse withstand voltage, leakage path and air gaps acc. to DIN VDE 0110-1	4	kV	
Rated insulation voltage	250	V	
Overvoltage category acc. to DIN VDE 0110-1	3		
<b>Safety contacts</b>	<b>7 NO contacts (redundant)</b>		
Switching current, min., at DC 24 V	5	mA	
Switching voltage, max.	24	V DC	
	250	V AC	
Breaking capacity acc. to $\mathcal{U}$ (per contact)	8 A 250 V AC		
	2 A 24 V DC		
Utilization category <sup>2)</sup> according to EN 60947-5-1	<b>U<sub>e</sub></b>	<b>I<sub>e</sub></b>	
	AC-12 250 V	8 A	Σ I <sub>e</sub> 35 A <sup>3)</sup>
	AC-15 250 V	3 A	
	DC-12 40 V	8 A	
DC-13 24 V	3 A		
LED displays	2, status display for relays K1 and K2		
<b>Monitoring contacts</b>	<b>4 NC contact</b>		
Switching voltage, max.	24	V DC	
	250	V AC	
Breaking capacity acc. to $\mathcal{U}$	2 A 250 V AC		
	1.5 A 24 V DC		
Utilization category <sup>2)</sup> according to EN 60947-5-1	<b>U<sub>e</sub></b>	<b>I<sub>e</sub></b>	
	AC-12 250 V	8 A	
	DC-12 40 V	8 A	
<b>Monitoring outputs</b>	<b>2 semiconductor outputs</b>		
Semiconductor output current	Max. 30	mA	
Semiconductor output voltage	24	V DC	
<b>Reliability values acc. to EN ISO 13849-1</b>			
Category	4		
Performance Level PL	e		

1) All the electrical connections must either be isolated from the mains supply by a safety transformer according to EN 61558-2-6 with limited output voltage in the event of a fault, or by other equivalent isolation measures.

2) Information about the utilization category is on page 25.

3) With a housing distance of 10 mm. 20 A closely spaced at 40 °C.

U<sub>e</sub> = switching voltage

I<sub>e</sub> = max. switching current per contact

Σ I<sub>e</sub> = max. switching current of all safety contacts (cumulative current)



## Connection ESM-BT4..



Parameter	Value	Unit		
Operating voltage	24 ± 10% <sup>1)</sup>	V AC/DC		
Reverse polarity protection	Yes			
Rated supply frequency	50 ... 60	Hz		
Power consumption	Approx. 5.3 VA (at 24 V AC)/approx. 4.7 W (at 24 V DC)	W		
Delay time range	1 ... 30	s		
Control voltage at S11	18.6 ... 26	V DC		
Control cable length (cross-section 0.75 mm <sup>2</sup> )	Max. 1,000	m		
Control current S11 ... S 14	Approx. 190	mA		
External contact fuse (safety circuit) acc. to EN IEC 60269-1	10 A gG (T6A / F8A)			
Test voltage (control voltage/contacts)	2.5	kV		
Rated impulse withstand voltage, leakage path and air gaps acc. to DIN VDE 0110-1	4	kV		
Rated insulation voltage	250	V		
Overtoltage category acc. to DIN VDE 0110-1	3			
<b>Safety contacts</b>	<b>4 NO contacts (redundant)</b>			
Cumulative current of all contacts acc. to $I_{\Sigma}$	Max. 15	A		
Switching current, min., at DC 24 V	5	mA		
Switching voltage, max.	40	V DC		
	250	V AC		
Breaking capacity acc. to $I_{\Sigma}$ (per contact)	6 A 250 V AC			
	2 A 24 V DC			
Utilization category <sup>2)</sup> according to EN 60947-5-1	<b>U<sub>e</sub></b>	<b>I<sub>e</sub></b>	<b>Σ I<sub>e</sub></b>	
	AC-12	250 V		8 A <sup>4)</sup>
	AC-15	250 V		3 A
	DC-12	40 V		8 A <sup>4)</sup>
	DC-13	24 V	3 A	15 A <sup>3)</sup>
LED displays	4, status display for relays K1 to K4			
<b>Reliability values acc. to EN ISO 13849-1</b>				
Category	4 (non-time-delayed) / 3 (time-delayed)			
Performance Level PL	e			

1) All the electrical connections must either be isolated from the mains supply by a safety transformer according to EN 61558-2-6 with limited output voltage in the event of a fault, or by other equivalent isolation measures.

2) Information about the utilization category is on page 25.

3) With a housing distance of 5 mm. 9 A closely spaced at 40 °C.

4) With ohm resistive load.

U<sub>e</sub> = switching voltage

I<sub>e</sub> = max. switching current per contact

Σ I<sub>e</sub> = max. switching current of all safety contacts (cumulative current)

## Connection ESM-2H2..



Parameter	Value	Unit		
Operating voltage	24 ± 10% <sup>1)</sup>	V AC/DC		
Reverse polarity protection	Yes			
Rated supply frequency	50 ... 60	Hz		
Power consumption	Approx. 3.7 VA (at 230 V AC)/approx. 1.5 W (at 24 V DC)	VA		
Control voltage on start buttons S12 - S13 and S22 - S23	24	V DC		
Control cable length (cross-section 0.75 mm <sup>2</sup> )	Max. 1,000	m		
Control current for both buttons	Each 40	mA		
External contact fuse (safety circuit) acc. to EN IEC 60269-1	10 A gG (T4A / F6A)			
Test voltage (control voltage/contacts)	2.5	kV		
Rated impulse withstand voltage, leakage path and air gaps acc. to DIN VDE 0110-1	4	kV		
Rated insulation voltage	250	V		
Overvoltage category acc. to DIN VDE 0110-1	3			
<b>Safety contacts</b>	<b>2 NO contacts (redundant)</b>			
Synchronization time	Max. 0.5	s		
Release time for the safety relay (response time)	Max. 20	ms		
Switching current, min., at DC 24 V	20	mA		
Switching voltage, max.	24	V DC		
	250	V AC		
Breaking capacity acc. to $\mathcal{U}$	6 A 250 V AC 2 A 24 V DC			
Utilization category <sup>2)</sup> according to EN 60947-5-1	<b>U<sub>e</sub></b>	<b>I<sub>e</sub></b>	<b>Σ I<sub>e</sub></b>	
	AC-12	250 V	6 A <sup>3)</sup>	8.4 A
	AC-15	250 V	3 A	
	DC-12	24 V	6 A <sup>3)</sup>	
DC-13	24 V	3 A		
LED displays	2, status display for relays K1 and K2			
<b>Reliability values acc. to EN ISO 13849-1</b>				
Category	4			
Performance Level PL	e			

1) All the electrical connections must either be isolated from the mains supply by a safety transformer according to EN 61558-2-6 with limited output voltage in the event of a fault, or by other equivalent isolation measures.

2) Information about the utilization category is on page 25.

3) With ohm resistive load.

U<sub>e</sub> = switching voltage

I<sub>e</sub> = max. switching current per contact

Σ I<sub>e</sub> = max. switching current of all safety contacts (cumulative current)

Connection ESM-ES3..			
Parameter		Value	Unit
Operating voltage	ESM-301	24 ± 10% <sup>1)</sup>	V AC/DC
	ESM-302	115 ± 10%	V AC
	ESM-303	230 ± 10%	V AC
Reverse polarity protection		on ESM-ES301	
Rated supply frequency		50 ... 60	Hz
Power consumption		Approx. 3.5 VA (at 230 V AC)/approx. 1.2 W (at 24 V DC)	
Control voltage at S11		24	V DC
Control cable length (cross-section 0.75 mm <sup>2</sup> )		Max. 1,000	m
Control current S11 ... S14		Approx. 40	mA
External contact fuse (safety circuit) acc. to EN IEC 60269-1		10 A gG (T4A / F6A)	
Test voltage (control voltage/contacts)		2.5	kV
Rated impulse withstand voltage, leakage path and air gaps acc. to DIN VDE 0110-1		4	kV
Rated insulation voltage		250	V
Overvoltage category acc. to DIN VDE 0110-1		3	
Cumulative current of all contacts acc. to $\mathcal{U}$		Max. 10.5	A
<b>Safety contacts</b>			
<b>3 NO contacts (redundant)</b>			
Switching current, min., at DC 24 V		20	mA
Switching voltage, max.		24	V DC
		250	V AC
Breaking capacity acc. to $\mathcal{U}$ (per contact)		6 A 250 V AC	
		2 A 24 V DC	
Utilization category <sup>2)</sup> according to EN 60947-5-1		<b>U<sub>e</sub></b>	<b>I<sub>e</sub></b>
	AC-12	230 V	6 A <sup>3)</sup>
	AC-15	230 V	4 A
	DC-12	24 V	1.25 A <sup>3)</sup>
	DC-13	24 V	2 A
LED displays		2, status display for relays K1 and K2	
<b>Auxiliary contact</b>			
<b>1 NC contact</b>			
Continuous current, max.		500 <sup>4)</sup>	mA
Switching voltage, max.		24	V AC/DC
<b>Reliability values acc. to EN ISO 13849-1</b>			
Category		4	
Performance Level PL		e	

1) All the electrical connections must either be isolated from the mains supply by a safety transformer according to EN 61558-2-6 with limited output voltage in the event of a fault, or by other equivalent isolation measures.

2) On ESM-TE301-05S the potentiometer is not required.

3) Information about the utilization category is on page 25.

4) With ohm resistive load.

5) As monitoring contact for safety relay.

U<sub>e</sub> = switching voltage

I<sub>e</sub> = max. switching current per contact

Σ I<sub>e</sub> = max. switching current of all safety contacts (cumulative current)

## Connection ESM-TE3..



Parameter	Value	Unit																	
Operating voltage	24 ± 10% <sup>1)</sup>	V AC/DC																	
Reverse polarity protection	Yes																		
Rated supply frequency	50 ... 60	Hz																	
Power consumption	Approx. 4 VA (at 230 V AC)/approx. 1.5 W (at 24 V DC)	VA																	
Delay time range	1 ... 30	s																	
Fixed time delay ESM-TE301-05S	0.5 <sup>2)</sup>	s																	
Control voltage at S11	24	V DC																	
Control cable length (cross-section 0.75 mm <sup>2</sup> )	Max. 1,000	m																	
Control current S11 ... S14	Approx. 40	mA																	
External contact fuse (safety circuit) acc. to EN IEC 60269-1	10 A gG (T4A / F6A)																		
Test voltage (control voltage/contacts)	2.5	kV																	
Rated impulse withstand voltage, leakage path and air gaps acc. to DIN VDE 0110-1	4	kV																	
Rated insulation voltage	250	V																	
Overtoltage category acc. to DIN VDE 0110-1	3																		
Cumulative current of all contacts acc. to $\text{Ⓜ}$	Max. 10.5	A																	
<b>Safety contacts</b>	<b>3 NO contacts (redundant)</b>																		
Switching current, min., at DC 24 V	20	mA																	
Switching voltage, max.	24	V DC																	
	250	V AC																	
Breaking capacity acc. to $\text{Ⓜ}$ (per contact)	6 A 250 V AC 2 A 24 V DC																		
Utilization category <sup>3)</sup> according to EN 60947-5-1	<table border="1"> <thead> <tr> <th></th> <th><math>U_e</math></th> <th><math>I_e</math></th> <th><math>\Sigma I_e</math></th> </tr> </thead> <tbody> <tr> <td>AC-12</td> <td>230 V</td> <td>6 A <sup>4)</sup></td> <td rowspan="4">10.5 A</td> </tr> <tr> <td>AC-15</td> <td>230 V</td> <td>4 A</td> </tr> <tr> <td>DC-12</td> <td>24 V</td> <td>1.25 A <sup>4)</sup></td> </tr> <tr> <td>DC-13</td> <td>24 V</td> <td>2 A</td> </tr> </tbody> </table>		$U_e$	$I_e$	$\Sigma I_e$	AC-12	230 V	6 A <sup>4)</sup>	10.5 A	AC-15	230 V	4 A	DC-12	24 V	1.25 A <sup>4)</sup>	DC-13	24 V	2 A	
	$U_e$	$I_e$	$\Sigma I_e$																
AC-12	230 V	6 A <sup>4)</sup>	10.5 A																
AC-15	230 V	4 A																	
DC-12	24 V	1.25 A <sup>4)</sup>																	
DC-13	24 V	2 A																	
LED displays	2, status display for relays K1 and K2																		
<b>Auxiliary contact</b>	<b>1 NC contact</b>																		
Continuous current, max.	500 <sup>5)</sup>	mA																	
Switching voltage, max.	24	V DC																	
<b>Reliability values acc. to EN ISO 13849-1</b>																			
Category	3																		
Performance Level PL	d																		

1) All the electrical connections must either be isolated from the mains supply by a safety transformer according to EN 61558-2-6 with limited output voltage in the event of a fault, or by other equivalent isolation measures.

2) On ESM-TE301-05S the potentiometer is not required.

3) Information about the utilization category is on page 25.

4) With ohm resistive load.

5) As monitoring contact for safety relay.

$U_e$  = switching voltage       $I_e$  = max. switching current per contact       $\Sigma I_e$  = max. switching current of all safety contacts (cumulative current)



## Glossary

### Feedback loop

Components connected downstream of the safety relay can be monitored for correct function. For this purpose, normally closed contacts on these components are integrated into the feedback loop on the relay.

### Relay start

After a relay has switched off due to a request from a safety component connected, the relay must be re-started. On this topic please pay attention to section 5.2.2 of EN ISO 13849-1:2023.

#### ▶ Automatic start

The relay switches on automatically as soon as the safety component connected changes back to the safe state.

#### ▶ Manual start

The relay is started by actuating a button. First, the safe state of the safety components connected must be re-established.

#### ▶ Monitored manual start

The relay is started by actuating a button. The button is monitored for jamming or possible tampering. Before the relay is started, the safe state of the safety components connected must be re-established.

### Single-channel safety circuit

A single positively driven contact in the safety component is connected to the relay. This connection is suitable for category 1 or 2 according to EN ISO 13849-1.

### Dual-channel safety circuit

Two contacts, of which at least one is a positively driven contact, are connected to the relay. This connection is suitable for category 3 or 4 according to EN ISO 13849-1.

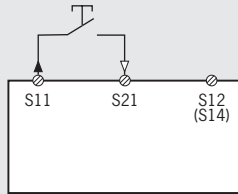
### Utilization category according to EN 60947-5-1 (extract)

Voltage type	Utilization category	Typical applications
AC	AC-12	Controlling ohm resistive load and semiconductor load in input circuits of optocouplers
	AC-15	Controlling electromagnetic load (> 72 VA)
DC	DC-12	Controlling ohm resistive load and semiconductor load in input circuits of optocouplers
	DC-13	Controlling electromagnetic loads with economy resistors in the circuit

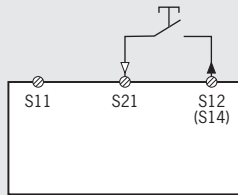
## Connection examples for safety relays ESM

Safety relays ESM-BA../ESM-BT..

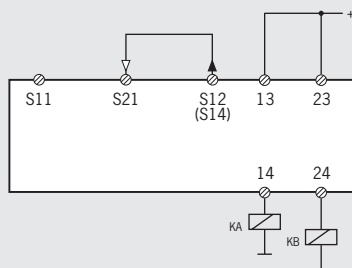
Monitored manual start without integration of the feedback loop



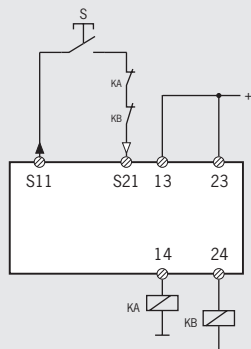
Un-monitored manual start without integration of the feedback loop (for ESM-BT)



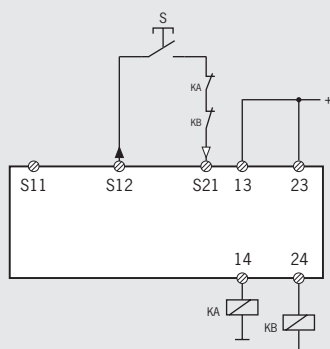
Automatic start without integration of the feedback loop



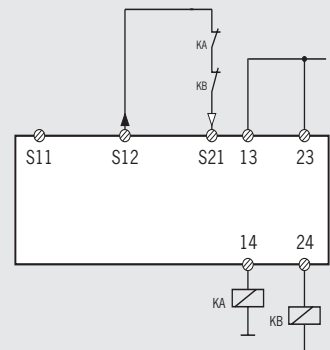
Monitored manual start with integration of the feedback loop



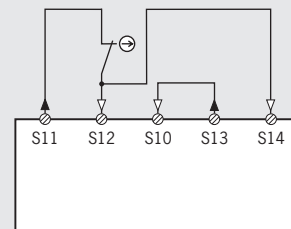
Un-monitored manual start with integration of the feedback loop (for ESM-BT)



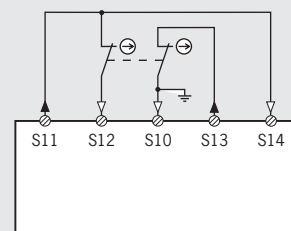
Automatic start with integration of the feedback loop



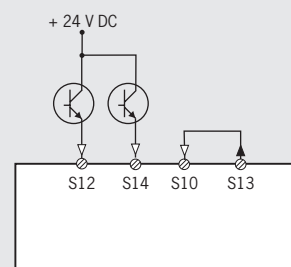
1-channel emergency stop/safety circuit



2-channel emergency stop/safety circuit with ground fault/short circuit detection

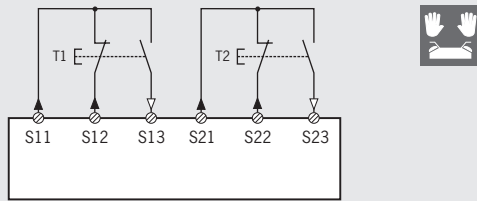


2-channel emergency stop/safety circuit with connection for safety devices with pnp semiconductor outputs/OSSD outputs with integrated short circuit detection

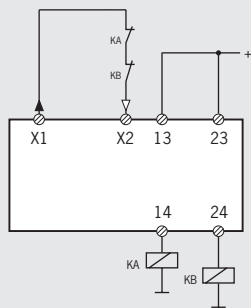


## Safety relay ESM-2H2..

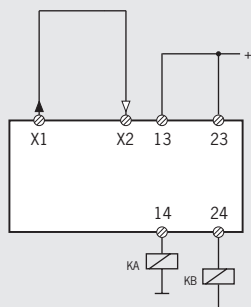
Monitoring a 2-hand control



With integration of the feedback loop

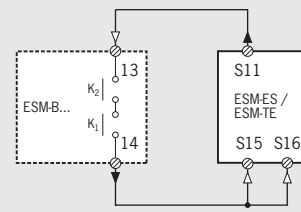


Without integration of the feedback loop

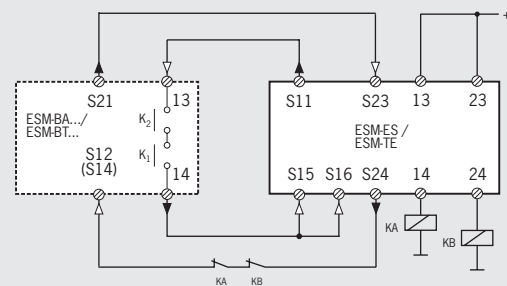


## Safety contact expansion ESM-ES../ESM-TE..

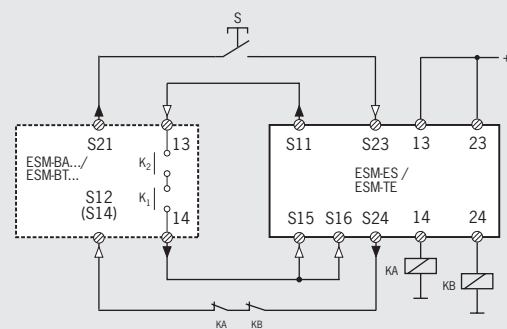
Connection of the contact expansion



Connection of the contact expansion with automatic start and with integration of the feedback loop



Connection of the contact expansion with manual start and with integration of the feedback loop



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A series of 30 horizontal grey bars, evenly spaced, intended for writing notes. The bars span the width of the page, leaving a small margin on the left and right.

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