Operating instructions
Basic module ESM-BA3..

EUCHNER

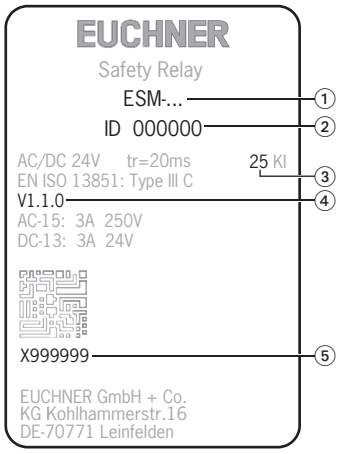
Scope

These operating instructions apply to all emergency stop safety switching devices ESM-BA3...V1.1.X. These operating instructions, the document *Safety information* and any available data sheet form the complete user information for your device.

Important!

Make sure to use the operating instructions valid for your product version. The version numbers can be found on the type label of your product. Please contact the EUCHNER service team if you have any questions.

Type label



① Item designation
② Item number
③ Year of manufacture
④ Version
⑤ Serial number

Supplementary documents

The overall documentation for this device consists of the following documents:

Document title (document number)	Contents	
Safety information (2525460)	Basic safety information	
Operating instructions (2090073)	(this document)	
Declaration of conformity	Declaration of conformity	
Any additions to the operating instructions	Take any associated additions to the operating instructions or data sheets into account.	

Important!

Always read all documents to gain a complete overview of safe installation, setup and use of the device. The documents can be downloaded from www.euchner.com. For this purpose, enter the doc. no. or the order number for the device in the search box.

Notes about the EU Data Act

During operation, this product produces data that are available to the user in accordance with EU Data Act 2023/2854. The corresponding chapters in these operating instructions explain what these data are and how you can access and use them.

Correct use

The ESM-BA3.. is a universal emergency stop safety switching device with three safe relay outputs that can quickly and safely stop the moving parts of a machine or system in case of danger.

Applications for the ESM-BA3.. include single- or dual-channel emergency stop circuits and guard monitoring on machines and installations.

Before the device is used, a risk assessment must be performed on the machine, e.g. in accordance with the following standards:

- EN ISO 13849-1
- EN ISO 12100
- EN IEC 62061.

Correct use includes observing the relevant requirements for installation and operation, particularly based on the following standards:

- EN ISO 13849-1
- EN IEC 60204-1
- EN IEC 62061.

Important!

- The user is responsible for the integration of the device in a safe overall system. For this purpose, the overall system must be validated, e.g. in accordance with EN ISO 13849-1.
- The device user must assess and document remaining risks.
- If a data sheet is included with the product, the information on the data sheet applies.

Safety precautions

⚠ WARNING

- Installation and setup of the device must be performed only by authorized personnel.
- Observe the country-specific regulations when installing the device.
- The electrical connection of the device is only allowed to be made with the device isolated.

- The wiring of the device must comply with the instructions in these operating instructions, otherwise there is a risk that the safety function will be lost.
- It is not allowed to open the device, tamper with the device or bypass the safety devices.
- All relevant safety regulations and standards are to be observed.
- The overall concept of the control system in which the device is incorporated must be validated by the user.
- Failure to observe the safety regulations can result in death, severe injuries and serious damage.
- Note down the version of the device (see type label *Vx.x.x*) and check it each time prior to setup. If the version changes, the use of the device in the overall application must be validated again.

Features

- 3 safe, redundant relay outputs
  1 auxiliary contact (monitoring contact)
- Connection of:
  - Emergency stop buttons
  - Safety switches
  - Non-contact safety switches
  - Safety components with OSSD outputs
- Single- and dual-channel operation possible
- Additional, non-safe function: feedback loop for monitoring downstream contactors or expansion modules
- Cyclical monitoring of the output contacts
- Indication of the switching state via LED
- 2 starting behaviors possible:
  - Monitored manual start
  - Automatic start
- Short circuit and ground fault monitoring
- Use up to PL e, SILCL 3, category 4

Function

The emergency stop safety switching device ESM-BA3.. is designed for the safe isolation of safety circuits according to EN IEC 60204-1 and can be used up to safety category 4, PL e according to EN ISO 13849-1.

If the emergency stop circuit (e.g. safety door or emergency stop pushbutton) is closed, the machine is enabled via the emergency stop safety switching device.

The safety contacts in the device are opened immediately if there is demand for the safety function from the emergency stop circuit (e.g. safety door opened). Due to the redundant use of positively driven relays, it is ensured that a single fault in the device does not lead to the loss of the safety function and the loss of the safety function is detected by cyclical self-monitoring with the next demand for the safety function.

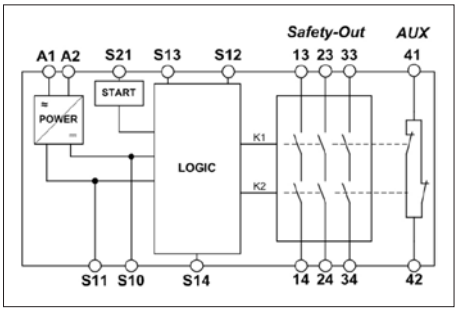


Fig. 1: Block diagram for ESM-BA3..

Mounting

As per EN IEC 60204-1, the device is intended for installation in control cabinets with a minimum degree of protection of IP54. It is mounted on a 35 mm mounting rail according to EN IEC 60715 TH35.

Important!

- Sufficient heat dissipation is to be ensured in the control cabinet.
- For the AC 115 V/230 V variant, maintain a distance of min. 10 mm to neighboring devices.

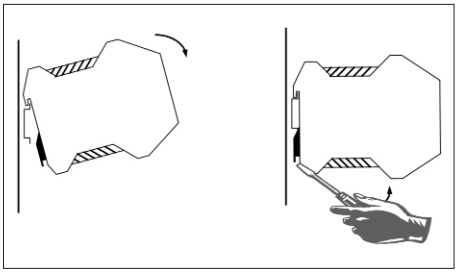
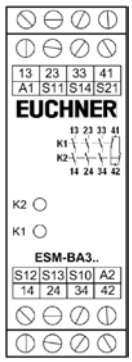


Fig. 2: Mounting/removing

Electrical connection

- When the 24 V version is used, a safety transformer according to EN IEC 61558-2-6 or a power supply unit with electrical isolation from the mains must be connected.
- External fusing of the safety contacts must be provided.
- A maximum length of the control lines of 1,000 m with a conductor cross-section of 0.75 mm² must not be exceeded.
- The conductor cross-section must not exceed 2.5 mm².
- If the device does not function after setup, it must be returned to the manufacturer unopened. Opening the device will void the warranty.
- A suppressor circuit suitable for inductive loads (e.g. free-wheeling diode) is to be provided.



A1	Power supply
A2	Power supply
S11	DC 24 V control voltage
S10	Control line
S21	Start control line
S13	Control line
S14	Control line
S12	Control line
13-14	Safety contact 1
23-24	Safety contact 2
33-34	Safety contact 3
41-42	Monitoring contact

Fig. 3: Connections

Setup procedure

Notice

The items listed under *Electrical connection* must be observed during setup.

1. Wiring emergency stop circuit:

Wire the emergency stop circuit according to the required Performance Level determined (see Fig. 5 to Fig. 9).

2. Wiring start circuit:

Wire the start circuit as shown in the examples in Fig. 11 or Fig. 12 to set the starting behavior.

Attention: If *Automatic start* is set, bear in mind that the safety contacts will switch immediately after the power supply is connected. If *Monitored manual start* is set, the start button must be opened after wiring.

3. Wiring feedback loop:

If your application provides for external contactors or expansion modules, connect them as shown in the examples in Fig. 13 or Fig. 14.

4. Wiring power supply:

Connect the power supply to terminals *A1* and *A2* (see Fig. 15).

Attention: Wiring only in de-energized state.

5. Starting the device:

Switch the operating voltage on.

Attention: If the *Automatic start* behavior is set, the safety contacts will close immediately.

If the *Monitored manual start* behavior is set, close the start button to close the safety contacts.

LEDs *K1* and *K2* illuminate.

6. Activating safety function:

Open the emergency stop circuit by actuating the connected safety switch. The safety contacts open immediately.

7. Reactivating:

Close the emergency stop circuit. If *Automatic start* is selected, the safety contacts will close immediately.

If the *Monitored manual start* behavior is set, close the start button to close the safety contacts.

What to do in case of a fault?

Device does not switch on:

- Check the wiring by comparing it to the wiring diagrams.
- Check the safety switch used for correct function and adjustment.
- Check whether the emergency stop circuit is closed.
- Check whether the start button (with manual start) is closed.
- Check the operating voltage at *A1* and *A2*.
- Is the feedback loop closed?

Device cannot be switched on again after an emergency stop:

- Check whether the emergency stop circuit was closed again.
- Was the start button opened before closing of the emergency stop circuit (with manual start)?
- Is the feedback loop closed?

If the fault persists, perform the steps listed under *Setup procedure*.

If these steps do not remedy the fault either, return the device to the manufacturer for examination.

Opening the device is impermissible and will void the warranty.

Maintenance

The device must be checked once per month for proper function and for signs of tampering and bypassing of the safety function. The device is otherwise maintenance-free, provided that it was installed properly.

Disposal

Pay attention to the applicable national regulations and laws during disposal.

Notes about UL requirements

This device is intended to be used with a Class 2 power source in accordance with UL1310. Connecting cables for safety switches installed at the place of use must be separated from all moving and permanently installed cables and un-insulated active elements of other parts of the system that operate at a voltage of over 150 V. A constant clearance of 50.8 mm must be maintained. This does not apply if the moving cables are equipped with suitable insulation materials that possess an identical or higher dielectric strength compared to the other relevant parts of the system.

Declaration of conformity

The product complies with the requirements according to

- Machinery Directive 2006/42/EC (until January 19, 2027)
- Machinery Regulation (EU) 2023/1230 (from January 20, 2027)

The EU declaration of conformity can be found at www.euchner.com. Enter the order number of your device in the search box. The document is available under *Downloads*.

Service

If servicing is required, please contact:

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Technical data

Parameter	Value		
Version	**ESM-BA301**	**ESM-BA302**	**ESM-BA303**
Operating voltage	AC/DC 24 V	AC 115 V	AC 230 V
Rated supply frequency	50 - 60 Hz		
Permissible deviation	± 10%		
Power consumption	AC 24 V Approx. 4.5 VA	AC 230 V Approx. 6.9 VA	
Control voltage at S11	DC 24 V		
Control current S11 … S14	Approx. 60 mA		
Safety contacts	3 NO contacts		
Monitoring contacts	1 NC contact		
Max. switching voltage	AC 250 V		
Safety contact breaking capacity (13-14, 23-24, 33-34)	AC: 250 V, 2,000 VA, 8 A for ohm resistive load (6 operating cycles/minute) 250V, 3A for AC-15		
	DC: 40 V, 320 W, 8 A for ohm resistive load (6 operating cycles/minute) 24V, 3A, for DC-13		
Max. cumulative current	15 A (13-14, 23-24, 33-34) [1]		
Monitoring contact breaking capacity (41-42)	AC: 250 V, 500 VA, 2 A for AC-12		
	DC: 40 V, 80 W, 2 A for ohm resistive load		
Minimum contact load	5 V, 10 mA		
Contact fuses	10 A gG		
Conductor cross-section	0.14 - 2.5 mm²		
Tightening torque (min./max.)	0.5 Nm/0.6 Nm		
Typ. switch-on delay/switch-off delay for the normally open contacts upon demand from the safety circuit	< 30 ms/< 20 ms		
Max. length of control line	1,000 m with 0.75 mm²		
Contact material	$AgSnO_2$		
Mech. contact life	Approx. 1×10^7		
Test voltage	2.5 kV (control voltage/contacts)		
Rated impulse withstand voltage, leakage paths/air gaps	4 kV (DIN VDE 0110-1)		
Rated insulation voltage	250 V		
Degree of protection	IP20		
Temperature range	-15 °C to +40 °C [1]		
Installation altitude	≤ 2000 m (above sea level)		
Degree of contamination	2 (DIN VDE 0110-1)		
Overvoltage category	3 (DIN VDE 0110-1)		
Weight	Approx. 230 g		
Mounting	Mounting rail acc. to EN IEC 60715 TH35		
Characteristics according to EN ISO 13849-1 for all variants of the series ESM-BA3 [2]			
Load (DC-13; 24 V)	**≤ 0.1 A**	**≤ 1 A**	**≤ 2 A**
n_{op}	≤ 500,000 cycles	≤ 350,000 cycles	≤ 100,000 cycles
T_{10D}	20 years		
Category	4		
PL	e		
PFH	1.2×10^{-8} 1/h		

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

2) Additional data can be requested from the manufacturer for applications that deviate from these conditions.

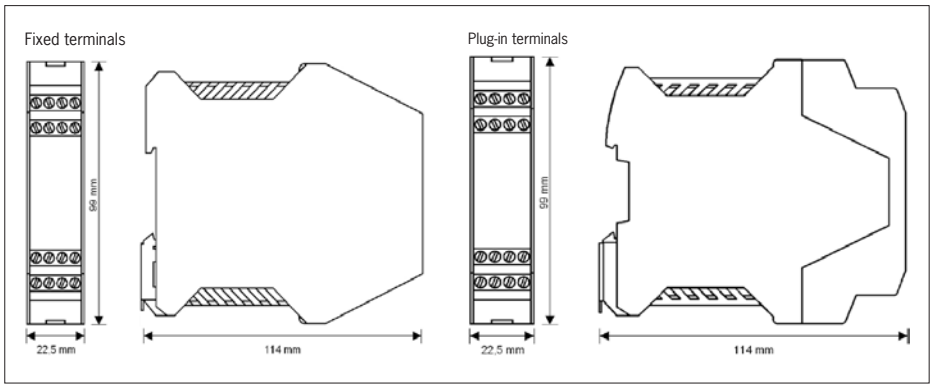

Fig. 4: Dimension drawing for ESM-BA3..

Applications

Depending on the application or the result of the risk assessment according to EN ISO 13849-1, the device must be wired as shown in Fig. 5 to Fig. 16.

Emergency stop circuit

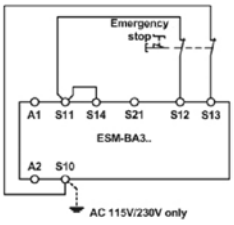

Fig. 5: Dual-channel emergency stop circuit with short circuit and ground fault monitoring (category 4, up to PL e).

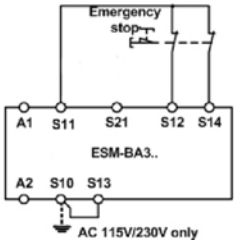

Fig. 6: Dual-channel emergency stop circuit with ground fault monitoring (category 3, up to PL d).

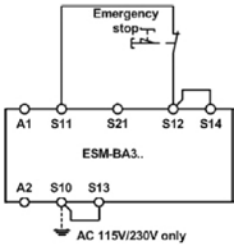

Fig. 7: Single-channel emergency stop circuit with ground fault monitoring (category 1, up to PL c).

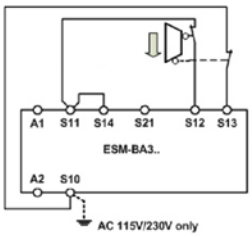

Fig. 8: Dual-channel sliding guard monitoring with short circuit and ground fault monitoring (category 4, up to PL e).

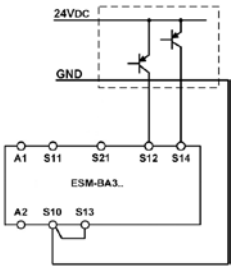

Fig. 9: Dual-channel emergency stop circuit with pnp semiconductor outputs/OSSD outputs with short circuit detection (category 4, up to PL e).

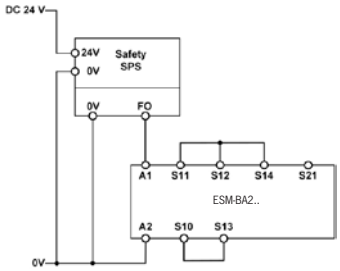

Fig. 10: Connection to fail-safe control system (cat. 4, up to PL e)

Prerequisite: fault exclusion for short circuits (e.g. according to EN ISO 13849-2; Table D4 - wiring in protected wiring space) and control system also meets requirements for cat. 4, PL e.

Starting behavior

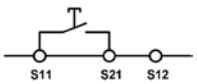

Fig. 11: Monitored manual start. It is monitored that the start button was opened before the emergency stop buttons close (pre-requisite: operating voltage must not be interrupted).

Fig. 12: Automatic start. Max perm. delay during closing of the safety switches on S12 and S13:
S12 before S13: 300 ms
S13 before S12: any

Feedback loop

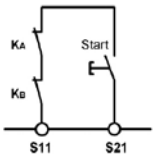

Fig. 13: Feedback loop with monitored manual start. Monitoring of externally connected contactors or expansion modules.

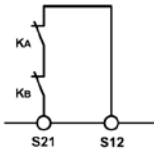

Fig. 14: Feedback loop with automatic start. Monitoring of externally connected contactors or expansion modules.

Power supply and safety contacts

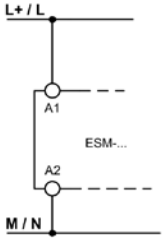

Fig. 15: Connection of the power supply to terminals A1 and A2 (power supply according to the technical data).

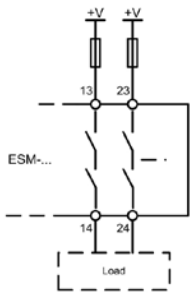

Fig. 16: Connection to switching loads on safety contacts (example contact configuration. Differing according to device type. Switching voltages +V corresponding to technical data).

Notice:

- In order to activate ground fault monitoring, S10 must be connected to PE (protective earth) on the AC115/230 V devices.
- On AC/DC 24 V devices, the power supply unit used must be grounded on the secondary side for ground fault monitoring.
- For applications according to Fig. 9 and Fig. 10, the following must be observed:
  - The reference potential for the signaling device/ the control system and the safety relay must be the same.
  - It is to be ensured that any switch-on pulses emitted by the signaling device (light test) do not cause the safety relay to respond briefly and should therefore in principle be deactivated.