EUCHNER

## Application


# Connection of CTP/CTA-L.-B.-.. to Safety Relays ESM-BA..1

EN

**from V1.0.0**

# Contents

# 1. About this document

## 1.1. Version

| Version | Date | Change/addition | Chapter |
|---|---|---|---|
| 01-02/21 | 2/24/2021 | Prepared | All |
| | | | |
| | | | |

## 1.2. Scope

This document describes the connection of the CTP/CTA-L.-B.-.. to the safety relays in the series ESM-BA..1.

## 1.3. Target group

Design engineers and installation planners for safety devices on machines, as well as setup and servicing staff possessing special expertise in handling safety components.

## 1.4. Supplementary documents

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

| Document title (document number) | Contents | |
|---|---|---|
| Operating instructions (2537376) | Operating instructions transponder-coded safety switch with guard locking CTP/CTA-L1/2-BR unicode/multicode | www |
| Operating instructions (2537377) | Operating instructions transponder-coded safety switch with guard locking CTP/CTA-L1/2-BP unicode/multicode | www |
| Operating instructions (2090071) | Operating instructions safety relay ESM-BA2.. | www |
| Operating instructions (2090073) | Operating instructions safety relay ESM-BA3.. | www |
| Operating instructions (2090093) | Operating instructions safety relay ESM-BA7.. | www |
| Safety information (2525460) | Information sheet with important safety information | |
| Possibly enclosed data sheets | Item-specific information about deviations or additions | |

## 1.5. Notice

This application is based on the operating instructions for the CTP/CTA-L.-B.-.. and the operating instructions for the safety relays ESM-BA..1. Please refer to the operating instructions for technical details and other information.

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# 2. Components/modules used

## 2.1. EUCHNER

| Description | Order number / item number |
|---|---|
| Safety switch with guard locking and guard lock monitoring with transponder technology, BR output family, plug connectors 2x M12 (8-pin/5-pin) | 166653 / CTA-L1-BR-U-HA-AP-SAB-166653 |
| | 166701 / CTA-L2-BR-U-HA-AP-SAB-166701 |
| | 166751 / CTP-L1-BR-U-HA-AZ-SAB-166751 |
| Safety switch with guard locking and guard lock monitoring with transponder technology, BR output family, plug connector 1x M23 (19-pin) | 166257 / CTA-L1-BR-U-HA-AP-SH-166257 |
| Safety switch with guard locking and guard lock monitoring with transponder technology, BR output family, plug connector 1x M12 (8-pin) | 165455 / CTP-L1-BR-U-HA-AE-SA-165455 |
| Safety switch with guard locking and guard lock monitoring with transponder technology, BP output family, plug connector 1x M12 (8-pin) | 166702 / CTA-L1-BP-U-HA-AP-SA-166702 |
| | 166752 / CTP-L1-BP-U-HA-AZ-SA-166752 |
| Safety switch with guard locking and guard lock monitoring with transponder technology, BP output family, plug connectors 2x M12 (5-pin/5-pin) | 165454 / CTA-L1-BP-U-HA-AP-SII-165454 |
| Safety relay | 085610 / ESM-BA201 |
| | 097226 / ESM-BA201P |
| | 085613 / ESM-BA301 |
| | 097230 / ESM-BA301P |
| | 097224 / ESM-BA701 |
| | 097225 / ESM-BA701P |

Tip: More information and downloads about the aforementioned EUCHNER products can be found at www.euchner.com. Simply enter the order number in the search box.

# 3. Functional description

## 3.1. CTP/CTA-L1-B.-..

The CTP/CTA-L1-B.–.. is an interlocking device with guard locking in accordance with EN ISO 14119 according to the closed-circuit current principle. The safety outputs are switched off when guard locking is released (monitoring of the locking element).

| **Guard locking according to EN ISO 14119 actuated by spring force – released by power-ON (closed-circuit current principle)** | |
|---|---|
| Safety function | Guard locking for personnel protection according to EN ISO 14119 |
| Reliability values according to EN ISO 13849 | Category 4, PL e |

In this example, the two safe outputs (FO1A and FO1B) of the CTP/CTA-L1-B.–.. are connected to a safety relay ESM-BA..1.

## 3.2. CTP/CTA-L2-B.-..

The CTP/CTA-L2-B.–.. is an interlocking device with guard locking in accordance with EN ISO 14119 according to the open-circuit current principle. The safety outputs are switched off when guard locking is released (monitoring of the locking element).

| **Guard locking according to EN ISO 14119 actuated by power-ON – released by spring force (open-circuit current principle)** | |
|---|---|
| Safety function | Guard locking for process protection with locking according to EN ISO 14119 |
| Reliability values according to EN ISO 13849 | Category 4, PL e |

In this example, the two safe outputs (FO1A and FO1B) of the CTP/CTA-L2-B.–.. are connected to a safety relay ESM-BA..1.

# 4. Safety assessment

The CTP/CTA-L.-B.–.. features complete monitoring for faults in the safety-relevant parts and in the connected cables (short circuit monitoring by means of pulsed signals on the outputs FO1A and FO1B).

The example achieves PL e in accordance with EN ISO 13849-1 for position monitoring of the locking element of the guard locking device.

A safety assessment for control of guard locking is not part of this example and must be supplemented for the respective machine by the design engineer in accordance with the risk assessment.

| | |
|---|---|
|  | **Important!**<br><br>Shutdown of the energy and any necessary monitoring of the shutdown of the energy (feedback loop) causing the hazard are not part of this document and must be added in accordance with the risk assessment for the machine. In this example, the safety evaluation unit without feedback loop and without start button is used. Please refer to the operating instructions of the safety evaluation unit used for more information. |

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# 5. Overview of the connections

## 5.1. Output family BR

### 5.1.1. Plug connector SA

| Pin | Designation | Function | Use in this example |
|---|---|---|---|
| 1 | FI1B | Enable input, channel B | Connection to power supply 24 V DC |
| 2 | UB | Electronics operating voltage, 24 V DC | Connection to power supply 24 V DC |
| 3 | FO1A | Safety output, channel A | Switching off this safety output will result in the direct shutdown of the enable paths (13 – 14, 23 – 24, ...) of the safety relay ESM-BA..1. Important: The actual shutdown of the energy causing a hazard in a machine is not shown in the example and must be added. |
| 4 | FO1B | Safety output, channel B | |
| 5 | OD/C | Door position monitoring output/communication | Function is not used |
| 6 | FI1A | Enable input, channel A | Connection to power supply 24 V DC |
| 7 | 0 V | Electronics and solenoid operating voltage, 0 V DC | Connection to power supply 0 V DC |
| 8 | IMP | Solenoid operating voltage, 24 V DC | Deactivation of the guard locking by switch S1. Important: According to EN ISO 14119, it must be ensured that the hazard posed by a machine is no longer present before the guard locking can be opened. |

Table 1: Terminal assignment and contact description, plug connector SA

### 5.1.2. Plug connector SH

| Pin | Designation | Function | Use in this example |
|---|---|---|---|
| 1 | IMP | Solenoid operating voltage, 24 V DC | Deactivation of the guard locking by switch S1. Important: According to EN ISO 14119, it must be ensured that the hazard posed by a machine is no longer present before the guard locking can be opened. |
| 2 | FI1A | Enable input, channel A | Connection to power supply 24 V DC |
| 3 | FI1B | Enable input, channel B | Connection to power supply 24 V DC |
| 4 | FO1A | Safety output, channel A | Switching off this safety output will result in the direct shutdown of the enable paths (13 – 14, 23 – 24, ...) of the safety relay ESM-BA..1. Important: The actual shutdown of the energy causing a hazard in a machine is not shown in the example and must be added. |
| 5 | FO1B | Safety output, channel B | |
| 6 | UB | Electronics and solenoid operating voltage, 24 V DC | Connection to power supply 24 V DC |
| 7 | RST | Reset input | Connection via switch S2 to 0 V DC; actuate S2 to activate. |
| 8 | OD/C | Door position monitoring output/communication | Function is not used |
| 9 | OI | Diagnostic monitoring output | Function is not used |
| 10 | OL | Guard lock monitoring output | Function is not used |
| 11 | — | n.c. | — |
| 12 | FE | Functional earth | This must be connected to meet the EMC requirements; connection to ⏚ |
| 13 | — | n.c. | — |
| 14 | — | n.c. | — |
| 15 | — | n.c. | — |
| 16 | — | n.c. | — |
| 17 | — | n.c. | — |
| 18 | IMM | Solenoid operating voltage, 0 V | Connection to power supply 0 V DC |
| 19 | 0 V UB | Electronics operating voltage, 0 V DC | Connection to power supply 0 V DC |

Table 2: Terminal assignment and contact description, plug connector SH

### 5.1.3. Plug connector SAB

| Pin | Designation | Function | Use in this example |
|---|---|---|---|
| X1.1 | FI1B | Enable input, channel B | Connection to power supply 24 V DC |
| X1.2 | UB | Electronics operating voltage, 24 V DC | Connection to power supply 24 V DC |
| X1.3 | FO1A | Safety output, channel A ⊡ | Switching off this safety output will result in the direct shutdown of the enable paths (13 – 14, 23 – 24, ...) of the safety relay ESM-BA..1.<br>Important: The actual shutdown of the energy causing a hazard in a machine is not shown in the example and must be added. |
| X1.4 | FO1B | Safety output, channel B ⊡ | |
| X1.5 | OL/C | Guard lock monitoring output/communication | Function is not used |
| X1.6 | FI1A | Enable input, channel A | Connection to power supply 24 V DC |
| X1.7 | 0 V UB | Electronics operating voltage, 0 V DC | Connection to power supply 0 V DC |
| X1.8 | RST | Reset input | Connection via switch S2 to 0 V DC; actuate S2 to activate. |
| | | | |
| X2.1 | IMM | Solenoid operating voltage, 0 V | Connection to power supply 0 V DC |
| X2.2 | OD | Door position monitoring output | Function is not used |
| X2.3 | OI | Diagnostic monitoring output | Function is not used |
| X2.4 | IMP | Solenoid operating voltage, 24 V DC | Deactivation of guard locking by switch S1 (on CTA/CTP-L1-B.-..)<br>Deactivation of guard locking by switch S1 (on CTA/CTP-L2-B.-..)<br>Important: According to EN ISO 14119, it must be ensured that the hazard posed by a machine is no longer present before the guard locking can be opened. |
| X2.5 | — | n.c. | — |

Table 3: Terminal assignment and contact description, plug connector SAB

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## 5.2. Output family BP

### 5.2.1. Plug connector SA

| Pin | Designation | Function | Use in this example |
|---|---|---|---|
| 1 | IMP | Solenoid operating voltage, 24 V DC | Deactivation of the guard locking by switch S1.<br>Important: According to EN ISO 14119, it must be ensured that the hazard posed by a machine is no longer present before the guard locking can be opened. |
| 2 | UB | Electronics operating voltage, 24 V DC | Connection to power supply 24 V DC |
| 3 | FO1A | Safety output, channel A | Switching off this safety output will result in the direct shutdown of the enable paths (13 – 14, 23 – 24, ...) of the safety relay ESM-BA..1.<br>Important: The actual shutdown of the energy causing a hazard in a machine is not shown in the example and must be added. |
| 4 | FO1B | Safety output, channel B | |
| 5 | OI/C | Diagnostic monitoring output/communication | Function is not used |
| 6 | OD | Door position monitoring output | Function is not used |
| 7 | 0 V UB | Electronics operating voltage, 0 V DC | Connection to power supply 0 V DC |
| 8 | IMM | Solenoid operating voltage, 0 V | Connection to power supply 0 V DC |

Table 4: Terminal assignment and contact description, plug connector SA

### 5.2.2. Plug connector SII

| Pin | Designation | Function | Use in this example |
|---|---|---|---|
| X1.1 | UB | Electronics operating voltage, 24 V DC | Connection to power supply 24 V DC |
| X1.2 | FO1A | Safety output, channel A | Switching off this safety output will result in the direct shutdown of the enable paths (13 – 14, 23 – 24, ...) of the safety relay ESM-BA..1.<br>Important: The actual shutdown of the energy causing a hazard in a machine is not shown in the example and must be added. |
| X1.3 | 0 V UB | Electronics operating voltage, 0 V DC | Connection to power supply 0 V DC |
| X1.4 | FO1B | Safety output, channel B | Switching off this safety output will result in the direct shutdown of the enable paths (13 – 14, 23 – 24, ...) of the safety relay ESM-BA..1.<br>Important: The actual shutdown of the energy causing a hazard in a machine is not shown in the example and must be added. |
| X1.5 | — | n.c. | — |
| | | | |
| X2.1 | — | n.c. | — |
| X2.2 | OD/C | Door position monitoring output/communication | Function is not used |
| X2.3 | IMM | Solenoid operating voltage, 0 V | Connection to power supply 0 V DC |
| X2.4 | IMP | | Deactivation of the guard locking by switch S1.<br>Important: According to EN ISO 14119, it must be ensured that the hazard posed by a machine is no longer present before the guard locking can be opened. |
| X2.5 | — | n.c. | — |

Table 5: Terminal assignment and contact description, plug connector SII

# 6. Basic circuit diagrams – output family BR

## 6.1. Plug connector SA

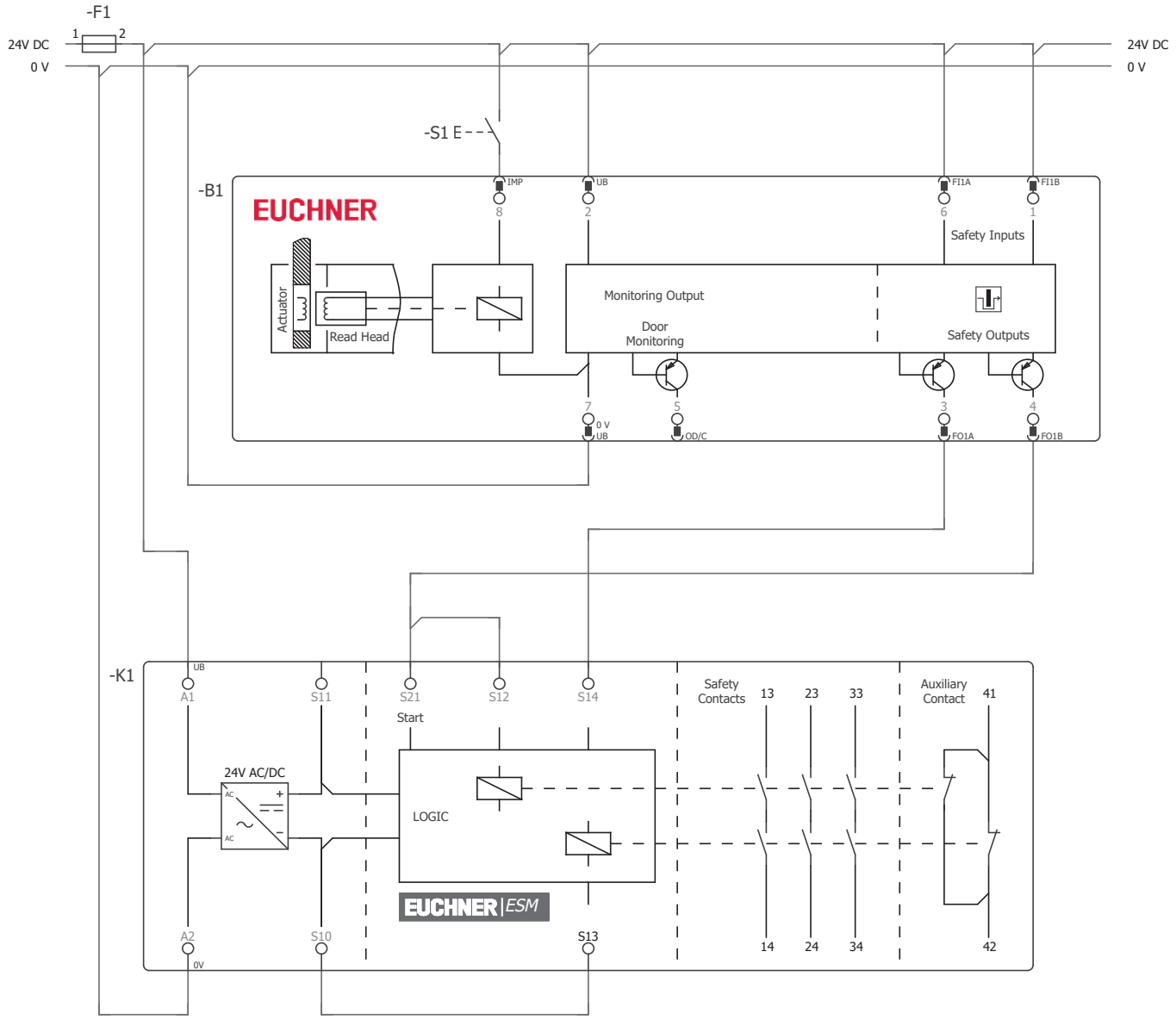


Fig. 1: Basic circuit diagram (shown with the ESM-BA301)

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## 6.2. Plug connector SH

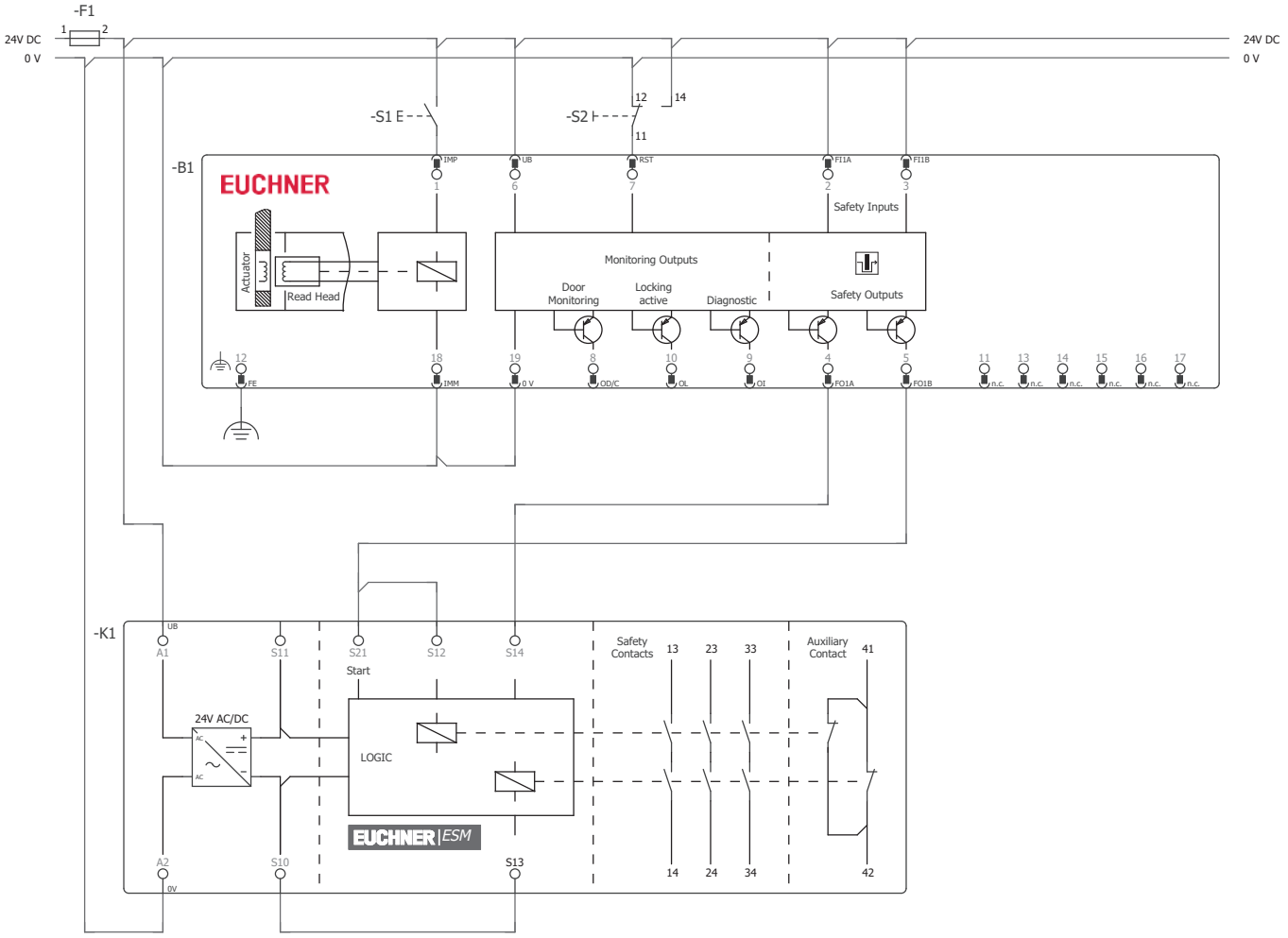


Fig. 2: Basic circuit diagram (shown with the ESM-BA301)

## 6.3. Plug connector SAB

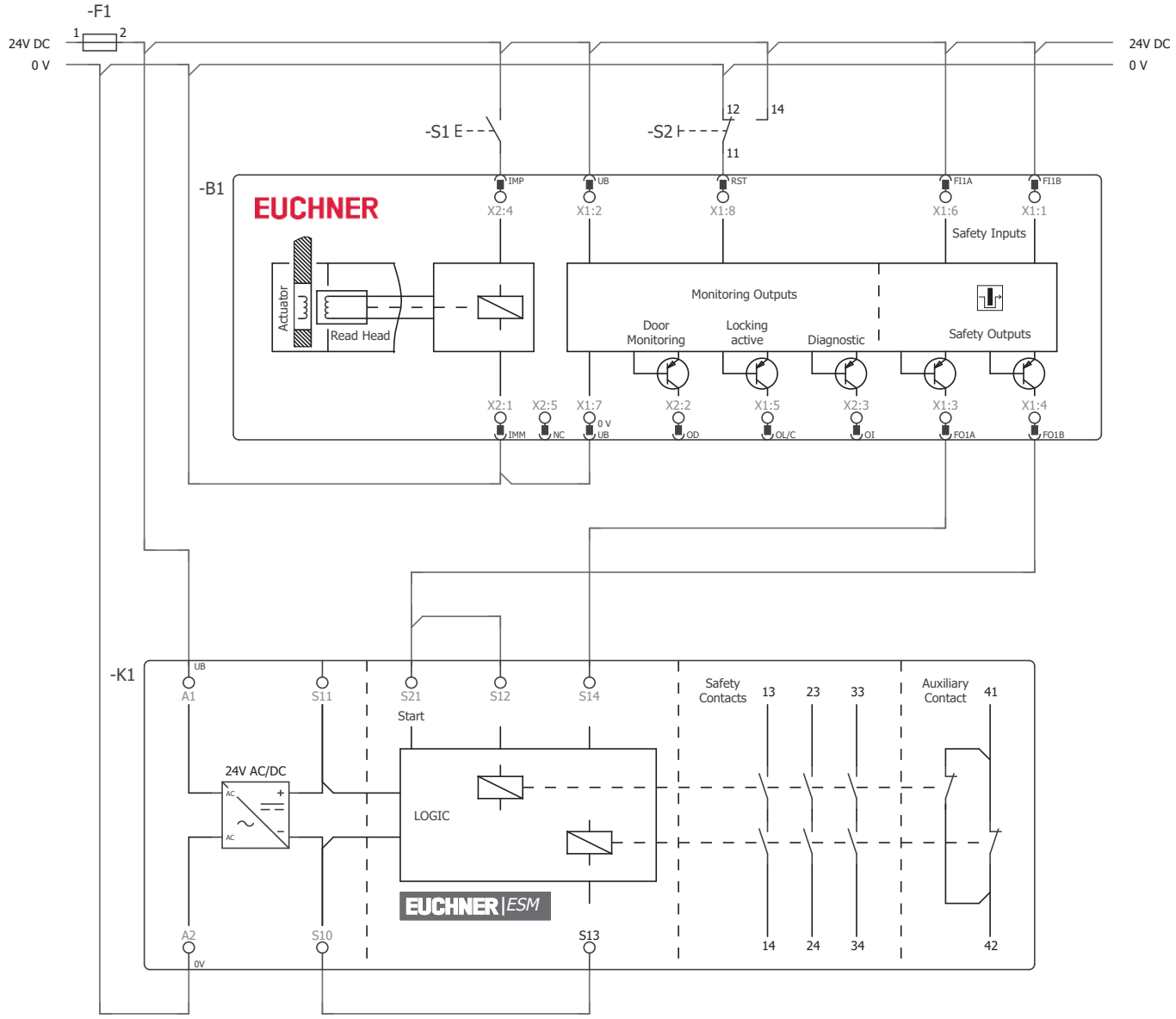


Fig. 3: Basic circuit diagram (shown with the ESM-BA301)

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# 7. Basic circuit diagrams – output family BP

## 7.1. Plug connector SA

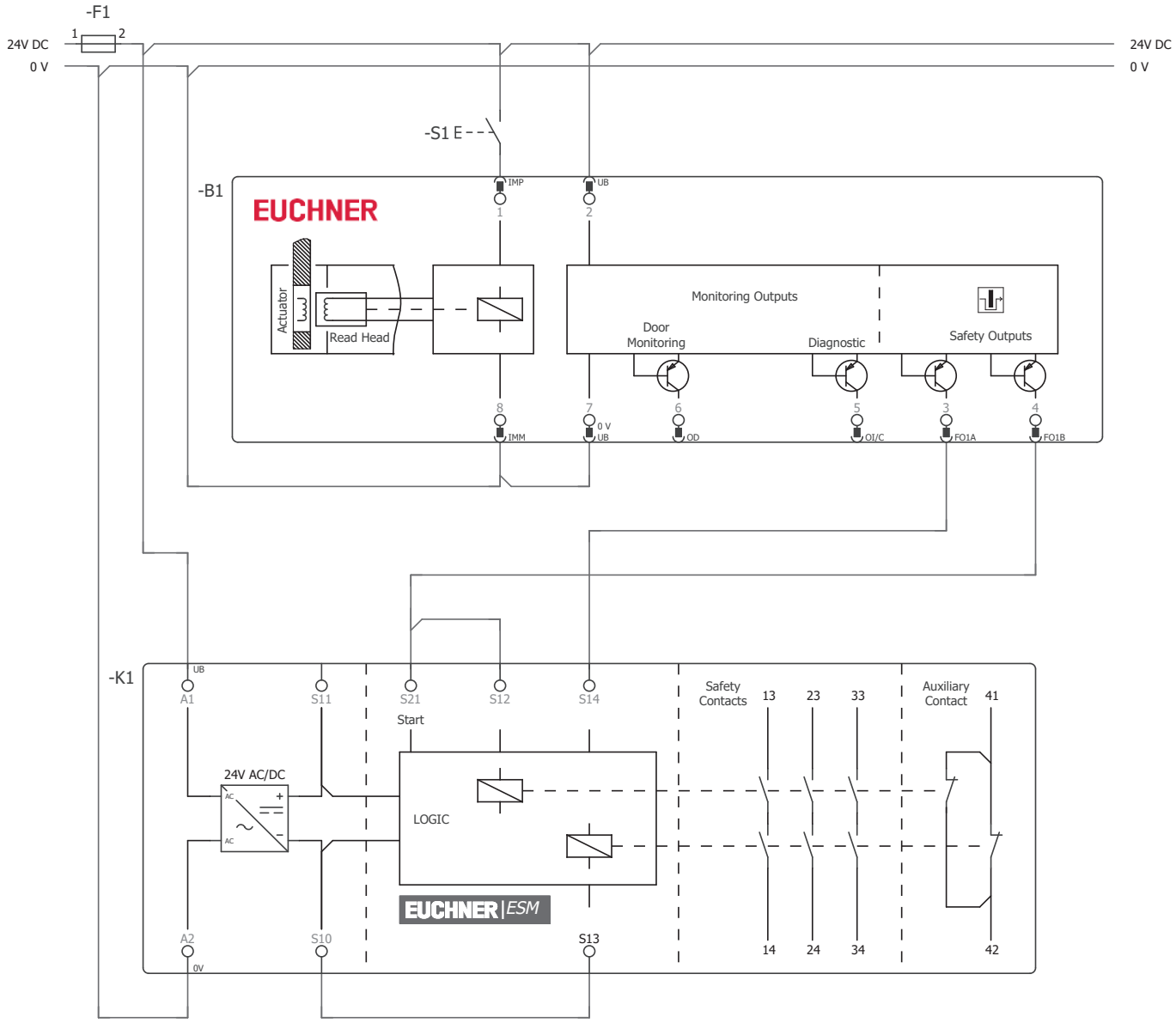


Fig. 4: Basic circuit diagram (shown with the ESM-BA301)

## 7.2. Plug connector SII

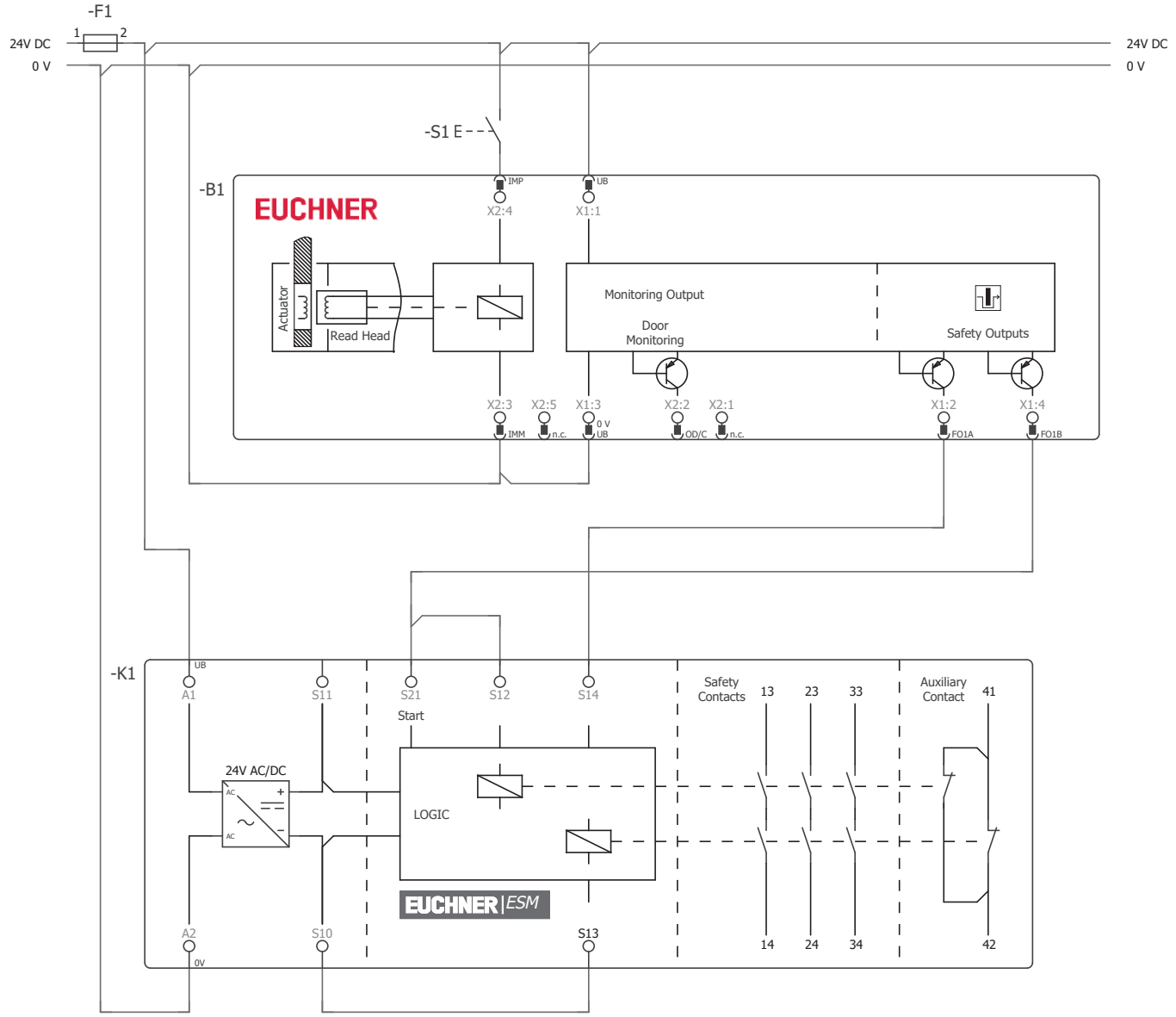


Fig. 5: Basic circuit diagram (shown with the ESM-BA301)

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## 8. Wiring of the starting behavior on the ESM-BA..1

With the following settings, the safety relay ESM-BA..1 operates correctly in combination with the CTM-LBI-BP-..

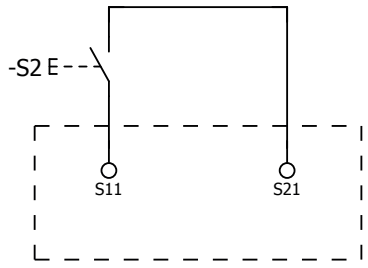


Fig. 6: Manual start

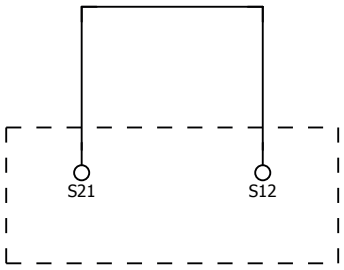


Fig. 7: Automatic start

# 9. Important note – please observe carefully!

This document is intended for a design engineer who possesses the requisite knowledge in safety engineering and knows the applicable standards, e.g. through training for qualification as a safety engineer. Only with the appropriate qualification is it possible to integrate the example provided into a complete safety chain.

The example represents only part of a complete safety chain and does not fulfill any safety function on its own. In order to fulfill a safety function, the energy switch-off function for the danger zone and the software must also be considered in the safety evaluation, for example.

The applications provided are only examples for solving certain safety tasks for protecting safety doors. The examples cannot be comprehensive due to the application-dependent and individual protection goals within a machine/installation.

**If questions concerning this example remain open, please contact us directly.**

According to the Machinery Directive 2006/42/EC, the design engineer of a machine or installation has the obligation to perform a risk assessment and take measures to reduce the risk. While doing this, the engineer must comply with the applicable national and international safety standards. Standards generally represent the current state-of-the-art. Therefore, the design engineer should continuously inform himself about changes in the standards and adapt his considerations to them. Relevant standards for functional safety include EN ISO 13849 and EN 62061. This application must be regarded only as assistance for the considerations about safety measures.

The design engineer of a machine/installation has the obligation to assess the safety technology himself. The examples must not be used for an assessment, because only a small excerpt of a complete safety function was considered in terms of safety engineering here.

In order to be able to use the safety switch applications correctly on safety doors, it is indispensable to observe the standards EN ISO 13849-1, EN ISO 14119 and all relevant C-standards for the respective machine type. Under no circumstances does this document replace the engineer's own risk assessment, and it cannot serve as the basis for a fault assessment.

In particular in relation to a fault exclusion, it must be noted that a fault can be excluded only by the machine's or installation's design engineer and this action requires justification. A general fault exclusion is not possible. More information about fault exclusion can be found in EN ISO 13849-2.

Changes to products or within assemblies from third-party suppliers used in this example can lead to the function no longer being ensured or the safety assessment having to be adapted. In any event, the information in the operating instructions on the part of EUCHNER, as well as on the part of third-party suppliers, must be used as the basis before this application is integrated into an overall safety function. If contradictions should arise between the operating instructions and this document, please contact us directly.

**Use of brand names and company names**

All brand names and company names stated are the property of the related manufacturer. They are used only for the clear identification of compatible peripheral devices and operating environments in relation to our products.

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