



EKS2 – Selection of Safe Operating Mode with Touch Panel

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1. About this document

1.1. Version

Version	Date	Change/addition	Chapter
01-05/25	05/2025	Prepared	All

1.2. Scope

The purpose of this document is to aid the integration and programming of selection of safe operating mode via an HMI (human-machine interface) and the EKS2 with PROFINET interface. Safe evaluation of the outputs is not part of this application.

1.3. Target group





Design engineers and installation planners for safety devices on machines as well as setup and servicing staff possessing the following expertise:


- specialist knowledge in handling safety components
- expertise in the installation, setup, programming and diagnostics of programmable logic controllers (PLCs) and bus systems
- knowledge about the applicable EMC regulations
- knowledge about the applicable regulations on operational safety and accident prevention

	NOTICE! The programming principles required in EN ISO 13849-1:2023 section 7 are to be followed.
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1.4. Supplementary documents

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

Document title (document number)	Contents	
Safety information (2525460)	Basic safety information	
Operating instructions (MAN20001715)	Transponder-coded Electronic-Key-System EKS2	
Possibly available data sheets	Item-specific information about deviations or additions	 

	NOTICE! This document is based on the EKS2 operating instructions. 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
EKS2 evaluation unit/read unit	170904 / EKS2-E-PN-MH1-170904
	170915 / EKS2-R1A1-B1-170915
EKS2 Electronic-Key	168433 / EKS2-K-K-B-D2-BK-168433
	168434 / EKS2-K-K-B-D2-BU-168434
	168435 / EKS2-K-K-B-D2-GN-168435
	168438 / EKS2-K-K-B-D2-OG-168438
	168432 / EKS2-K-K-B-D2-RD-168432
	168437 / EKS2-K-K-B-D2-WH-168437
	168436 / EKS2-K-K-B-D2-YE-168436



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.

2.2. Others

Description	Order number / item
SIMATIC ET200SP, CPU 1512SP F-1 PN	6ES7 512-1SK01-0AB0
SIMATIC F-DI 8x24VDC HF	6ES7 136-6BA00-0CA0
SIMATIC HMI MTP1200 Unified Comfort	6AV2 128-3MB06-0AX1

2.3. Software

Description	Version
Totally Integrated Automation Portal	Version V19 Update 3
STEP 7 Professional	Version V19 Update 3
STEP 7 Safety	Version V19 Update 3
WinCC Unified	Version V19 Update 3

3. Functional description

3.1. General

In this application, selection of safe operating mode is to be implemented on a machine using the EKS2 as the access system and as part of the selection system. The operating mode is selected using an HMI. Operation is therefore possible via the standard user interface; a key-operated rotary switch does not have to be used.


The Electronic-Key-System EKS2-... has the following safety function:

Safe switching and monitoring of the selected operating mode
(subsystem of the safety function *selection of safe operating mode* according to EN ISO 13849-1)

Refer to the operating instructions for more information about the safety function, the safety characteristics and selection of safe operating mode.

With the aid of the EKS2, six access rights for selection of safe operating mode can be defined. Which operating modes the owner of the related Electronic-Key can select depends on the access rights.

This application describes the program-related implementation of the HMI using a SIMATIC HMI Unified Comfort MTP1200 as the example. Operating modes MO0 to MO5 are possible. Selection of an operating mode is shown using an example.

	<p>NOTICE!</p> <p>The visual display can be implemented in various ways. This is an example.</p>
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3.2. Definition of the data structure for the operating mode level

The data structure of selection of safe operating mode is hierarchically structured for the individual access rights, and it changes values accordingly in the individual polling levels.

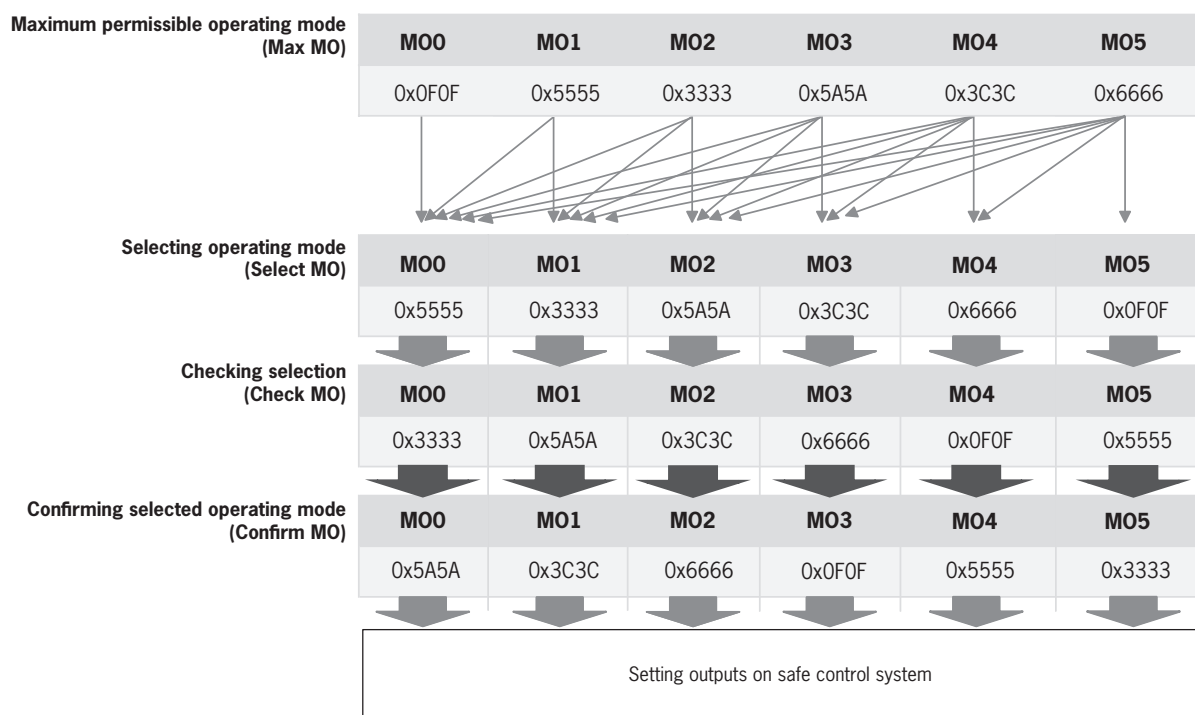


Fig. 1: Data structure of selection of safe operating mode



NOTICE!

The values represent a hierarchical order – MO0 and MO1 are contained in MO2, for example.



Important!

These values **must** be used and cannot be changed.

4. Variable linking

4.1. Creation of UDTs

The control system forwards the data from the EKS2 to the HMI and from the HMI to the EKS2.

The use of one or more UDTs is suitable for structuring the data and rendering them readable. Two UDTs are created in this example.

1. Input data

- Max MO
- Check MO
- Current MO




typeInputMoVariables			
		Name	Data type
1		I_Max_Mo	Word
2		I_Check_Mo	Word
3		I_Current_Mo	Word

Fig. 2: UDT input variables

2. Output data

- Select MO
- Confirm MO



typeOutputMoVariables			
		Name	
1		Q_Select_Mo	
2		Q_Confirm_Mo	

Fig. 3: UDT output variables

4.2. Creating variable table

To create the variables, you require the input and output addresses of the read/write module: *Read/Write: EKS2 MO Module* from the device overview.


Device overview								
	...	Module	Rack	Slot	I address	Q address	Type	Article no.
		▼ EUCHNER-EKS2	0	0			EKS2-E-PN-MH1-1...	170904
		▶ Interface	0	0 X1			EUCHNER-EKS2	
		EKS2 Diagnose Extended_1	0	1	8...11	5	EKS2 Diagnose Ext...	
		Read: Transponder UID with 8...	0	2	12...19		Read: Transponder ...	
		▼ Read: EU001 Base module_1	0	3			Read: EU001 Base ...	
		Read: EU001 Base module	0	3 1			Read: EU001 Base ...	
			0	3 2				
		Read: EU001 User data wi...	0	3 3	20...109		Read: EU001 User ...	
		Read/Write: EKS2 MO Module_1	0	4	110...115	6...9	Read/Write: EKS2 M...	
			0	5				

Fig. 4: Device overview input and output addresses

The variables to be created of the previously created UDTs are linked with the input and output addresses in a variable table.

Mo_Selection_EKS2_Variable_Table_PLC							
	Name	Data type	Address	Retain	Acces...	Writa...	Visibl...
1	▼ I_InputMoVariables	*typeInputMoVariables*	%I110.0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	I_Max_Mo	Word	%IW110		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	I_Check_Mo	Word	%IW112		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	I_Current_Mo	Word	%IW114		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
5	▼ Q_OutputMoVariables	*typeOutputMoVariables*	%Q6.0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
6	Q_Select_Mo	Word	%QW6		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
7	Q_Confirm_Mo	Word	%QW8		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Fig. 5: Variable table

5. HMI visualization

For selection of safe operating mode on the HMI, it is vital that the operating mode to be selected (Select MO) is not located in the same place on the HMI as the operating mode to be confirmed (Confirm MO). The following figure shows one option for visualizing the user interface:

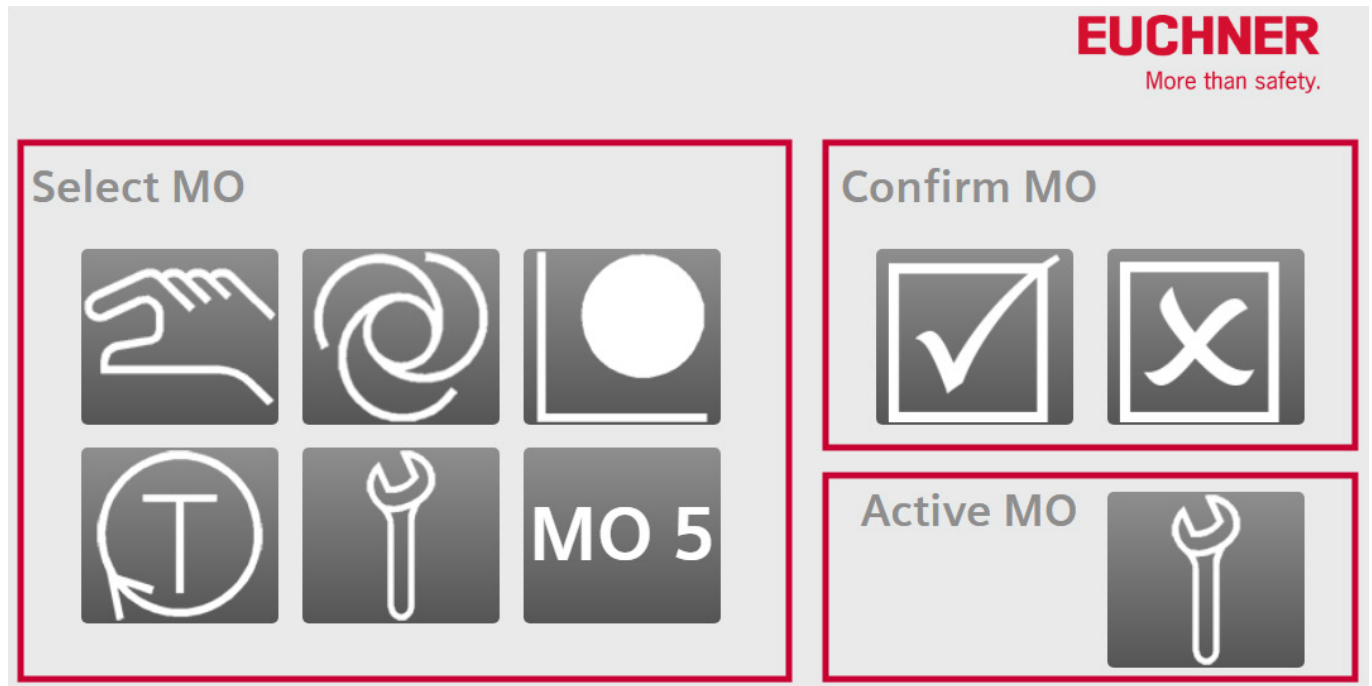


Fig. 6: Example of the user interface

This application explains switchover of the operating mode based on an example. Switchover from operating mode MO0 to MO4 is shown:

MO0 → MO4

The following values are required from Fig. 1 for this purpose:

Max MO for MO4: 0x3C3C

Select MO for MO4: 0x6666

Check MO for MO4: 0x0F0F

Confirm MO for MO4: 0x5555

5.1. Select MO

5.1.1. Visibility

Create the Select buttons for the operating modes you require. In accordance with the maximum operating mode, these buttons can be visible or not visible on the Electronic-Key. In this example, the buttons MO0 to MO4 are to be visible for a maximum MO4. The buttons are not displayed if no Electronic-Key is placed.

Max MO for MO4: $0x3C3C = 15420$

Open the properties of the button and click the *Expressions* tab. Add the *Visibility* property here. You can add the corresponding condition by double-clicking *Add new*. The following conditions will be created in our example:

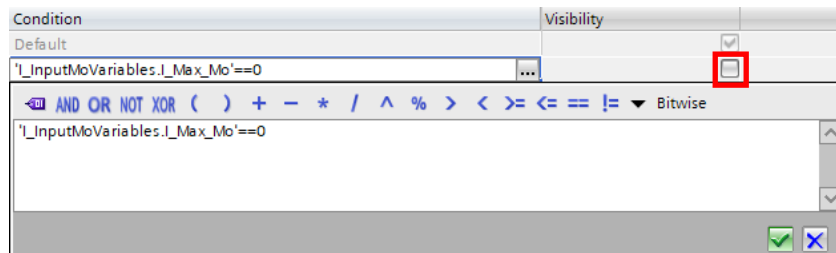


Fig. 7: Not visible if value for Max MO equals 0 (e.g. no Electronic-Key placed)

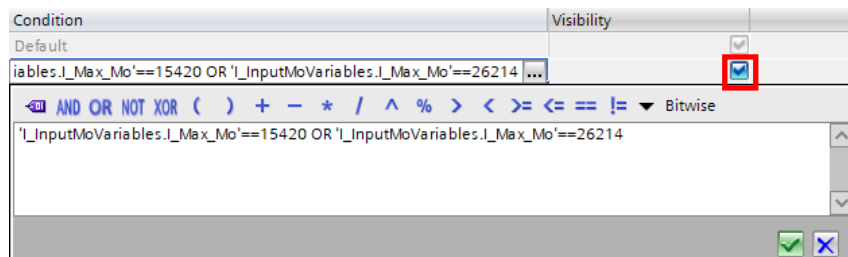


Fig. 8: Visible if Max MO equals MO4 or MO5 (greater than or equal to MO4)

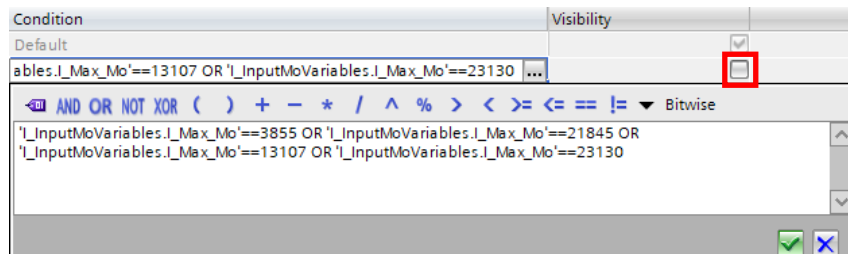


Fig. 9: Not visible if Max MO equals MO0, MO1, MO2 or MO3 (less than or equal to MO4)

5.1.2. Event when MO4 Select button is released

In this example, the *Release* (button release) event triggers transmission of the value for selection of operating mode MO4 to the EKS2. For this purpose, go to the properties of the Select button for MO4 and open the *Events* tab.

Select *Release* in the listed events. In the adjacent table, select *SetTagValue* under *Name*. Use your HMI variable for the corresponding output area in the EKS2 as the tag.

Select MO for MO4: 0x6666 = 26214

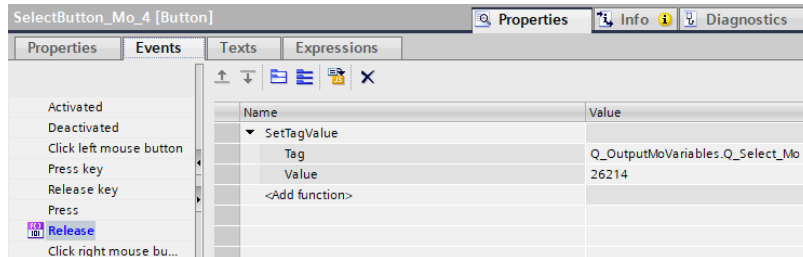


Fig. 10: Select button event

5.2. Check MO

EKS2 checks the Select MO value. If the check was successful, the EKS2 provides the Check MO value in the PLC's input area. This value is then used for the visibility of the Confirm button or Cancel button. The following explanation about the visibility of the buttons is based on an example and must be transferred to the other button.

5.2.1. Visibility of Confirm button by Check MO

For the Confirm button: Open the properties of the button and click the *Expressions* tab. Add the *Visibility* property here. You can add the corresponding condition by double-clicking *Add new*. The following conditions will be created in our example:

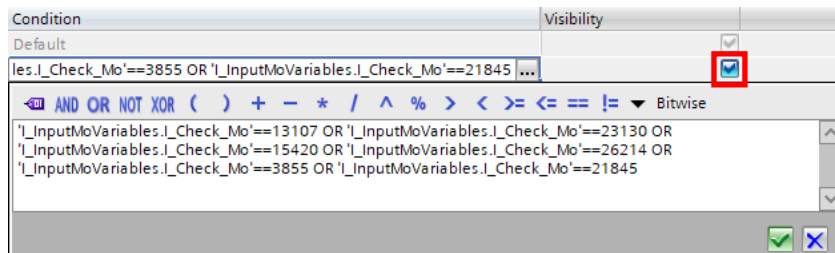


Fig. 11: Visible with valid Check MO

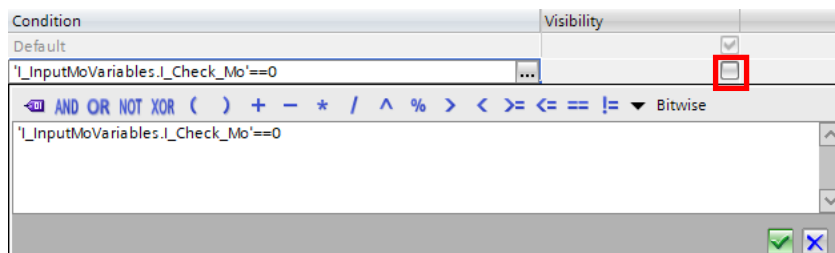


Fig. 12: Not visible if value for Check MO equals 0 (e.g. no Electronic-Key placed)

5.3. Confirm MO



Important!

Confirmation of the selected operating mode must take place somewhere else on the HMI than selection of the required operating mode.

5.3.1. Confirmation of operating mode

In this example, the *Release* (button release) event triggers transmission of the value for confirmation of operating mode MO4 to the EKS2. For this purpose, go to the properties of the Confirm button for MO4 and open the *Events* tab.

Select *Release* in the listed events. In order to avoid having to stack several Confirm buttons for each operating mode to be confirmed, a script is used for the Confirm MO value. Click the button to change from table view to script view. A different Confirm MO value is transmitted to the EKS2 for each previously selected operating mode (value for Check MO).

Confirm MO for MO4: 0x5555 = 21845

Properties	Events	Texts	Expressions
Activated			
Deactivated			
Click left mouse button			
Press key			
Release key			
Press			
Release			
Click right mouse button			

```

1  export function ConfirmButton_Mo_OK_OnUp(item, x, y, modifiers, trigger) {
2  let confirmMo = 0;
3  switch (Tags("I_InputMoVariables.I_Check_Mc").Read()) {
4  //Confirm MO 0
5      case 13107: //Check MO0
6          confirmMo = 23130;
7          break;
8  //Confirm MO 1
9      case 23130: //Check MO1
10         confirmMo = 15420;
11         break;
12 //Confirm MO 2
13     case 15420: //Check MO2
14         confirmMo = 26214;
15         break;
16 //Confirm MO 3
17     case 26214: //Check MO3
18         confirmMo = 3855;
19         break;
20 //Confirm MO 4
21     case 3855: //Check MO4
22         confirmMo = 21845;
23         break;
24 //Confirm MO 5
25     case 21845: //Check MO5
26         confirmMo = 13107;
27         break;
28     default:
29 //This is not part of the application.
30         break;
31 }
32 Tags("Q_OutputMoVariables.Q_Confirm_Mc").Write(confirmMo);
33 }
    
```

Fig. 13: Script for confirmation of operating mode

If the Check MO value does not correspond to any of the expected values, the *default* condition is carried out. This must be defined by the customer.

5.3.2. Cancellation of confirmation of operating mode

In case of incorrect selection of the operating mode, it must be possible to cancel confirmation of the selected operating mode. The following event is stored for the Cancel button for this purpose:

Cancel Select MO: 0x0000 = 0

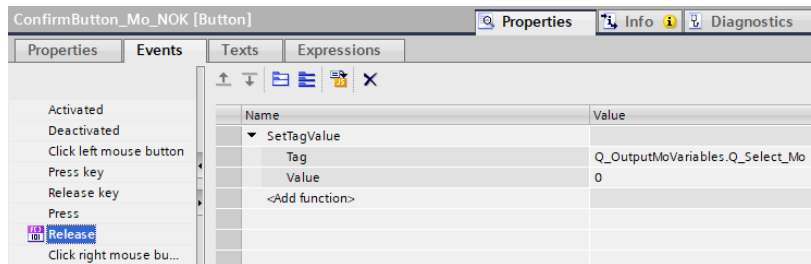


Fig. 14: Cancel button event

5.4. Evaluation of the safety outputs

To fulfill the safety function of the overall selection of safe operating mode system, a suitable activation system must be connected to the safe outputs of the evaluation unit. A suitable activation system is a safe control system that can process 1-of-n signals, for example. Additionally, the safe function is ensured only if two adjacent safe outputs (e.g. F01A and F01B) are connected and evaluated.

1-of-n evaluation of the EKS2 outputs is not part of this application.

6. Important notice – 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 engineering 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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