XPSMCWIN

Configuration Software for XPSMC Safety Controller

Original instructions

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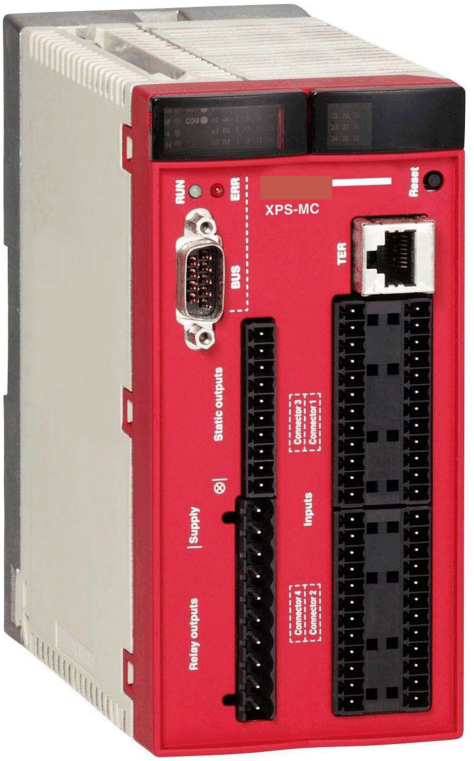

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Legal Information

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Safety Information

Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book

Document Scope

This manual contains the XPSMCWIN software description.

The XPSMCWIN software allows you to set up, configure, start, and perform diagnostics on the XPSMC Safety Controller using a PC.

The software is used for the installation, documentation and diagnostics of your application.

Validity Note

The technical characteristics of the devices described in the present document also appear online. To access the information online, go to the Schneider Electric home page www.se.com/ww/en/download/.

The characteristics that are described in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

Six versions of the XPSMC Safety Controller are available:

Type	Characteristics
XPSMC16Z	8 control outputs and 16 safety-related inputs 6 safety-related transistor outputs 2 x 2 safety-related relay outputs Modbus (RTU) communication and configuration port
XPSMC16ZP	8 control outputs and 16 safety-related inputs 6 safety-related transistor outputs 2 x 2 safety-related relay outputs Modbus (RTU) communication and configuration port Profibus DP communication port

Type	Characteristics
XPSMC16ZC	8 control outputs and 16 safety-related inputs 6 safety-related transistor outputs 2 x 2 safety-related relay outputs Modbus (RTU) communication and configuration port CANopen communication port
XPSMC32Z	8 control outputs and 32 safety-related inputs 6 safety-related transistor outputs 2 x 2 safety-related relay outputs Modbus (RTU) communication and configuration port
XPSMC32ZP	8 control outputs and 32 safety-related inputs 6 safety-related transistor outputs 2 x 2 safety-related relay outputs Modbus (RTU) communication and configuration port Profibus DP communication port
XPSMC32ZC	8 control outputs and 32 safety-related inputs 6 safety-related transistor outputs 2 x 2 safety-related relay outputs Modbus (RTU) communication and configuration port CANopen communication port

The types XPSMC16X and XPSMC32X are obsolete. Nevertheless they can be handled by the XPSMCWIN software described in this document.

This documentation is valid for XPSMCWIN under Microsoft Windows 2000 / XP / Vista / 7.

Related Documents

Title of Documentation	Reference Number
XPSMC Safety Controller - Hardware Manual	33003275

Safety Information on XPSMC Safety Controller

Safety-related Information

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- You must carry out a risk assessment in accordance with ISO 12100.
- Validate the entire system/machine in accordance with the required performance level and risk assessment.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Observe the required test cycles according to your application.

User Responsibilities

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user, machine builder, or system integrator to perform the appropriate and complete risk analysis, evaluation, and testing of the products with respect to the relevant specific application or use thereof.

Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found discrepancies in this publication, notify Schneider Electric. All pertinent safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

System Requirements and Software Installation

Overview

This chapter contains the system requirements for the software and hardware.

System Requirements

Hardware

The following is required to use the configuration software with the safety controller:

- an XPSMC Safety Controller
- a configuration cable
  - TCSMCNAM3M002P (for USB port) or
  - TSXCUSB485 + 490NTW00002 or equivalent straight (1:1) RJ45 cable cat. 5D or better (for USB port) or
  - TSXPCX1031 + XPSMCCPC (for Serial RS232 port)

  for connecting the XPSMC Safety Controller to the PC
- a PC with the following minimum capabilities:
  - Pentium® processor, or equivalent
  - mouse or an equivalent device
  - RS232 serial port with a 9-pin subD connector or USB-Port
  - at least 20 MB free hard disk space
- display: 1024 x 768, 256 colors

Connection between the PC and the XPSMC Safety Controller

To set up or perform diagnostics on the XPSMC Safety Controller with the XPSMCWIN software, you can connect:

- the USB port of the PC and the TER terminal of the controller by use of the TCSMCNAM3M002P cable
- the TSXCUSB485 cable to a USB port of your PC and to the TER connector of the XPSMC Safety Controller with a straight (1:1) RJ45 cable cat. 5D or better (e.g. 490NTW00002).
- a serial port of your PC to the TER connector of the XPSMC Safety Controller with the TSXPCX1031 serial interface cable and the XPSMCCPC adaptor

Software

The following are system requirements for the XPSMCWIN software:

- Operating system: Microsoft Windows 2000 / XP / Vista / 7

Installing the USB Driver for the Configuration Cable

For the USB configuration cables a driver is required. The USB drivers are included on the XPSMCWIN installation.

The following table describes steps to install them:

Step	Action
1	Change the directory to */Drivers for USB Cable*.
2	Run the file *Communication_Drivers_Pack_*.exe*. The asterisk (*) replaces a version indication.
3	Insert the cable.
4	In the **New Hardware** dialog box, select **Look for an adequate driver**.
5	Select **Other sources**.
6	Select the location of the driver on the hard disk. **Result:** The driver will be installed.
7	Verify at the **Windows Device Manager** which virtual COM port was assigned for the cable.

Installation

Installation Procedure

To install the XPSMCWIN software, proceed as follows:

Step	Action
1	Download XPSMCWIN software from www.se.com.
2	Double-click the Setup executable file to start the installation.
3	Follow the procedure on the screen.

XPSMCWIN User Interface

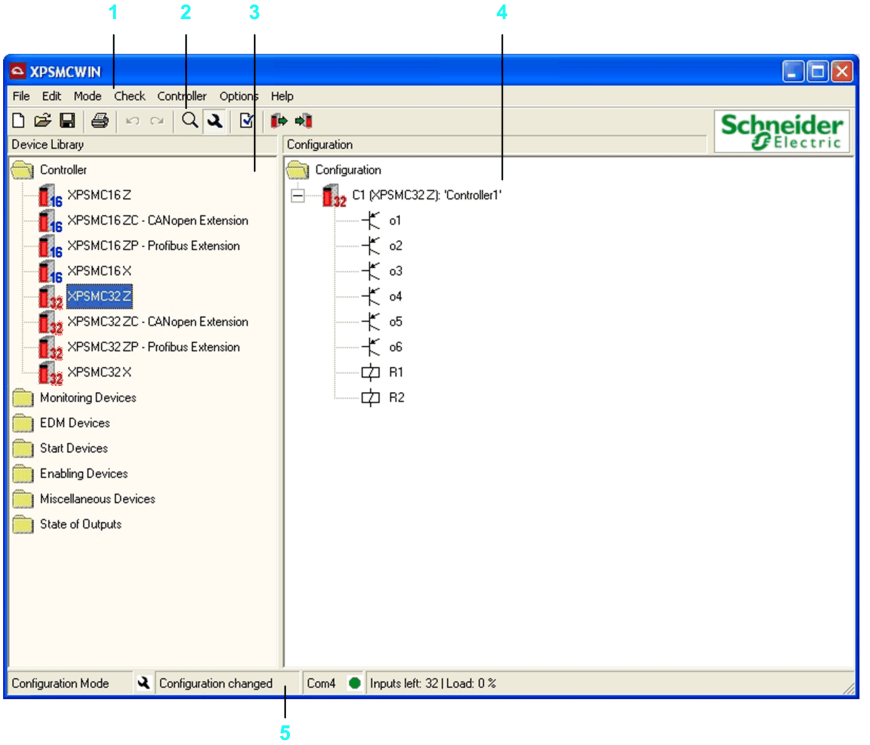
Overview

This chapter contains the description of the software user interface.

Window Types

Introduction

Typical XPSMCWIN user interface window



The items 1 to 5 have the following meanings:

Item	Meaning
1	Menu bar
2	Tool bar
3	Device library window
4	Configuration window
5	Status bar

Device Library Window

This window contains the eight possible types of controllers (XPSMC16Z, XPSMC16ZC, XPSMC16ZP, XPSMC16X, XPSMC32Z, XPSMC32ZC, XPSMC32ZP, and XPSMC32X) and the library of the available devices.

A device is copied from this library into the **Configuration** window by pressing and holding down the left mouse button and simultaneously dragging the mouse (drag-and-drop).

Configuration Window

The **Configuration** window is the working window in XPSMCWIN. The configuration is defined and modified in this window.

The devices are configured by the following procedure.

If a device is moved into the **Configuration** window, the specific property window of the device appears in which the parameters of this device can be set. For more information on these parameters, refer to Device Library, page 28.

In the menu **Options > Editor** you can select whether the **Properties** window appears automatically or not. In any case it is possible to access the window by double-clicking the device or by using the contextual menu (right-clicking the device and selecting **Properties**). Not all of the devices have editable properties.

The following commands can also be called by clicking the right mouse button on a device in the **Configuration** window:

Command	Description
Properties	Open the **Properties** window of the selected device.
Copy	Using this command, a device can be copied with the properties assigned to it and pasted elsewhere in the configuration tree.
Cut	Cut the selected device.

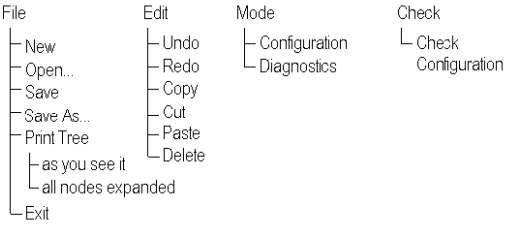
Command	Description
Paste	Paste a copied or cut device as a copy or as a new device into the selected location. (A copy of a device adopts the properties of the original. It is another instance of the same device. A new device is independent, with no properties set yet).
Delete	Delete the selected object.
Delete incl. copies	Delete the selected object and its copies.
Mark copies	Mark the copies of the selected device.
Unmark copies	Clear the markings.
Expand all	Expand the entire configuration tree.
Expand controller	Expand the selected controller tree (only visible when more than one controller are in the configuration).
Collapse all	Collapse the entire configuration tree. Only the controller will be shown.

Elements of a Window

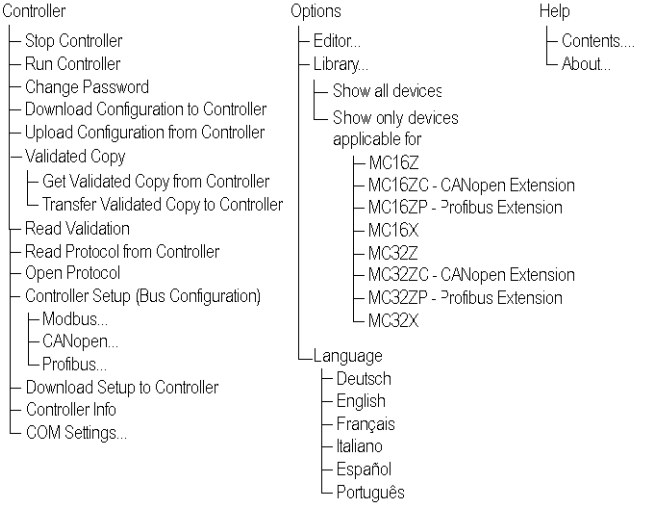
Menu Bar

The menu bar contains the commands of the XPSMCWIN software as shown in the structure overview below.

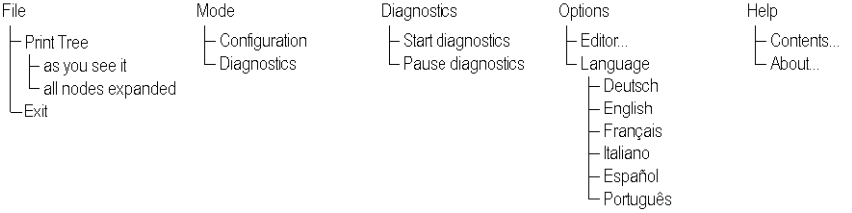
Menu bar for Configuration mode



Menu bar for Configuration mode (continued)



Menu bar for Diagnostics mode



Menu Commands

Overview

This chapter contains the description of the menu commands.

File

New

Click **New** to create a new configuration. When this command is called, a new window appears in which the name and the author of this configuration can be indicated. A message box appears for saving an existing configuration if a configuration is already opened.

To enable opening the **Properties** dialog box automatically, after you drag and drop a device onto the **Configuration** window, select option **automatically open properties dialog if a new device is dropped onto configuration** in **Editor** on the **Options** menu.

Open

Click **Open** to open a file selection popup menu. Here you can select an existing configuration. Additionally a backup file is created in the same directory with *.mcb* extension.

Save

Click **Save** to save the configuration.

Save As...

Click **Save As...** to save the configuration under a new name.

Print Tree

Click **Print Tree** to print the configuration, and choose one of the following options:

Option	Meaning
as you see it	The configuration tree will be printed as you see it in the configuration window.
all the nodes expanded	The configuration tree will be printed with the nodes expanded.

Exit

Click **Exit** to quit the XPSMCWIN software. If changes have been made to the configuration, you will be asked whether you want to save changes before quitting the program.

Edit

Undo

Click **Undo** to cancel the last action. You can repeat the step up to 10 times in a row.

Redo

Click **Redo** to restore a cancelled action. You can repeat the step up to 10 times in a row.

Copy

Click **Copy** to copy the selected item to the clipboard.

Cut

Click **Cut** to cut the selected device.

Paste

Click **Paste** to paste an item from the clipboard to the selected location, and choose one of the following options.

Option	Meaning
as a copy of the device	The device will be copied with the properties of the source device (e.g., the same input and output) if the same hardware is connected to different inputs and outputs of the XPSMC Safety Controller.
as a device	The device will be copied with its default properties. Alternatively, you can drag the device to the selected location.

Delete

Click **Delete** to delete the selected item.

Mode

Configuration

The **Configuration** mode is the software working mode. In the Configuration mode, a configuration is created, modified, and sent to or reloaded from XPSMC Safety Controller. When the program is started, this is the default mode of the software.

Diagnostics

The **Diagnostics** mode is used exclusively for performing diagnostics on the XPSMC Safety Controller connected to the PC. The configuration cannot be modified. In the Diagnostic mode, the software working windows are grey in color.

In this mode, the connected XPSMC Safety Controller operates without being affected.

Check

Check Configuration

Use this command to verify whether the configuration is correct, before you download it into the XPSMC Safety Controller.

NOTE: The configuration will be verified for consistency. This neither verifies the functional safety nor the suitability of the configuration for your application. You must ensure this and for compliance with all applicable codes and standards.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- You must carry out a risk assessment in accordance with ISO 12100.
- Validate the entire system/machine in accordance with the required performance level and risk assessment.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Controller

Stop Controller

Click **Stop Controller** to stop the XPSMC Safety Controller. Its safety-related outputs are de-activated in accordance with their stop category (either immediately or with a delay). The password must be entered.

Run Controller

Click **Run Controller** to change the XPSMC Safety Controller to RUN.

Change Password

Click **Change Password** to open a window in which you can change the password. Beforehand, if the controller is in RUN, you will receive a message requesting to put the controller in STOP.

Download Configuration to Controller

Click **Download Configuration to Controller** to send the configuration to the selected controller. Prior to it, if the controller is in RUN, you will receive a message requesting to put the controller in STOP. Thereafter, you must enter the password.

NOTE: When the configuration is downloaded, the outputs will be deactivated.

NOTE: Please bear in mind that when the configuration is downloaded, the outputs will be deactivated.

Upload Configuration from Controller

Click **Upload Configuration from Controller** to load the configuration to the PC and display the configuration of the connected XPSMC Safety Controller. The XPSMC Safety Controller is still running at the same time.

Create Validated Copy from Controller

Click **Create Validated Copy from Controller** to create a file as copy of a validated configuration.

Those validated copies can be transferred to a controller without the need to be validated again. This is intended to ease maintenance and configuration of a series of identical controllers.

Transfer Validated Copy to Controller

Click **Transfer Validated Copy to Controller** to transfer a validated configuration to a controller.

Read Validation

Click **Read Validation** to provide the date of validation and the name of the person who performed the validation of the connected XPSMC Safety Controller configuration.

Read Protocol from Controller

Click **Read Protocol from Controller** to upload the report of the configuration. This allows you to read, to save on PC, or to print the report. If the controller is in RUN, you will be asked to stop it.

NOTE: Since the controller is stopped while reading the report, the outputs are deactivated.

Open Protocol

Click **Open Protocol** to open a locally stored copy of the report file and to be able to print it. The file is read-only, and cannot be modified.

Controller Setup (Bus Configuration)

Click **Controller Setup (Bus Configuration)**, and choose one of the following options:

Option	Meaning
Modbus (RTU)	Opens a window for adjusting the settings required for the operation of all the XPSMC Safety Controllers (up to 8) of this configuration with a Modbus system. Operation with different Modbus systems is also possible. By clicking the **Download** button, the **Send the settings to the controller** command is executed. The settings are applicable to all controllers but need to be downloaded individually.
CANopen	If the controller supports CANopen communications, you can set the parameters, like address and transmission rate.
Profibus DP	If the controller supports Profibus communications, you can select the address.

Download Setup to Controller

Click **Download Setup to Controller** to send the parameters set (for all communication protocols, i.e., Modbus (RTU), CANopen, Profibus DP) to the selected controller of this

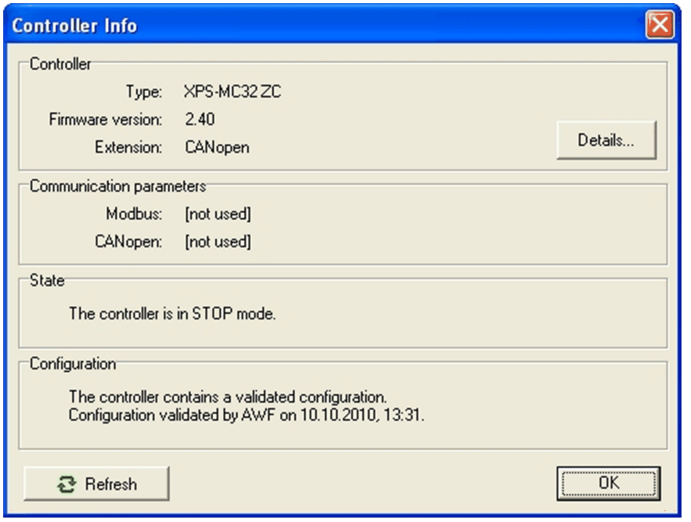
configuration. The XPSMC Safety Controller must be stopped. The password must be entered.

NOTE: This command causes only the bus communication parameters to be sent and not the configuration.

Controller Info

Click **Controller Info** to display the information about the type of controller, the firmware version, and the controller status.

The **Details** button available for some of the controllers provides access to more detailed information on firmware version and controller state for maintenance purposes.



COM Selection...

Choose **COM Selection...** to select the COM port (1...16) of the PC to which the XPSMC Safety Controller is connected. In case one of the USB adapters is used to connect to the PC, a virtual COM port is established by the USB driver. The number of this port is to be used then.

Options

Editor...

Click **Editor...** to open the **Editor Options** dialog box. The dialog box allows you to enable/disable the following options:

- The **Properties** dialog box automatically shows up immediately for each device that is dropped to the configuration tree by default.

  Alternatively, the **Properties** dialog box can be opened anytime by using the contextual menu of the device.
- The creation of validated copies of a configuration is allowed by default.

  Alternatively, you can select to create a validated copy during the validation of a configuration. Even if validated copies are allowed by choosing this option, the validated copy can be discarded during the validation.

Library

Click **Library**, and select one of the following options:

Option	Meaning
Show all devices	The available devices are shown.
Show only devices applicable for	Only the applicable devices of specific XPSMC Safety Controller reference are shown.

Language

Click **Language** to select the language to be used by the XPSMCWIN software. The available languages will be shown in the menu.

Help

Contents...

Click **Contents...** to view an overview of the online help.

About...

Click **About...** to view information about the version of the software.

Diagnostics

Start Diagnostics

The transmission of the diagnostics data from the XPSMC Safety Controller to the PC will be started.

Stop Diagnostics

The transmission of the diagnostics data from the XPSMC Safety Controller to the PC will be stopped.

Note

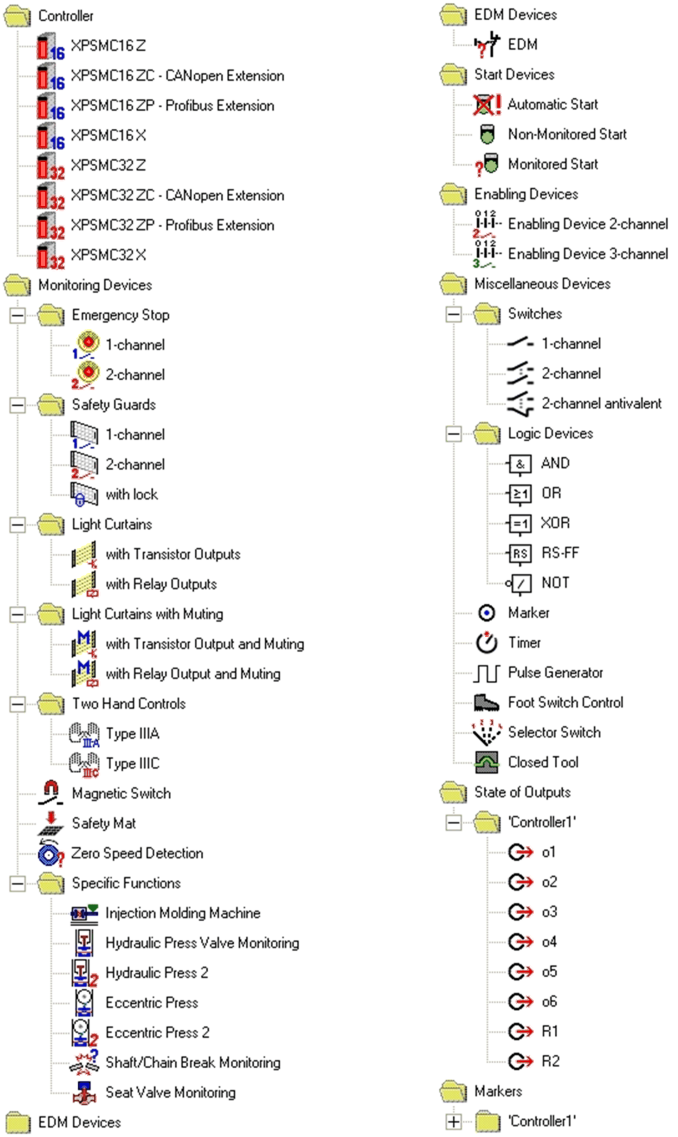
Switching into the **Diagnostics** mode, with menu command **Mode > Diagnostics**, the menu bar will be modified like described in the chapter Elements of a Window, page 17.

Device Library

Overview

This chapter contains the description of the functions and devices of the XPSMC Safety Controller. They are contained in the **Device Library** window in the configuration software.

The image below gives an overview of the devices in the library.



Controller

Overview

The folder *Controller* contains the 8 types of controllers: XPSMC16Z, XPSMC16ZC, XPSMC16ZP, XPSMC16X, XPSMC32Z, XPSMC32ZC, XPSMC32ZP and XPSMC32X.

Creating a Configuration

Introduction

To create a configuration, click **File > New**.

NOTE: The following examples are for 16 input controllers. The procedure for 32 input controllers is the same, unless stated otherwise.

Response Time

For the XPSMC16Z, XPSMC16ZC, XPSMC16ZP, XPSMC32Z, XPSMC32ZC, XPSMC32ZP the response time can be set to 20 ms or to 30 ms.

A longer response time allows more complex configurations.

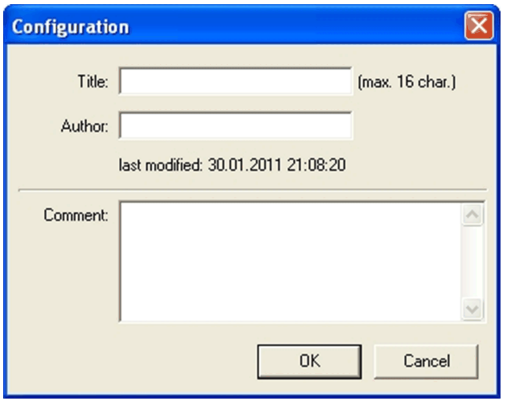
For controllers with 32 inputs the default response time is 30 ms.

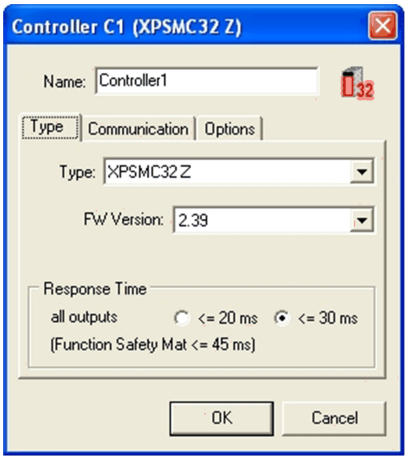
For controllers with 16 inputs the default response time is 20 ms.

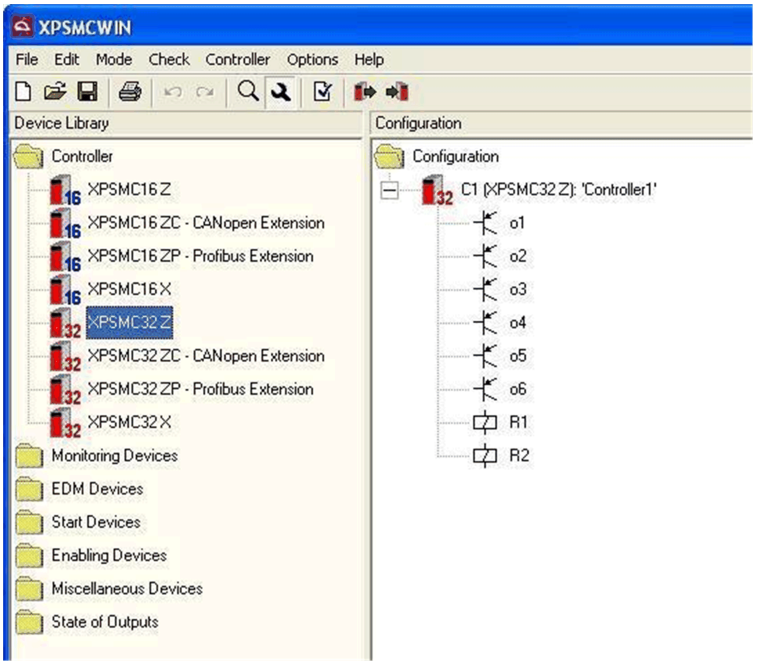
For the XPSMC16X and the XPSMC32X the response time is fixed to 20 ms.

Creating a Configuration

To create a configuration, proceed as follows.

Step	Action
1	To create a new configuration, click **File > New**. A configuration symbol appears in the **Configuration** window and a dialog box which contains the **Title** and the **Author** of this configuration opens. The following figure shows the **Configuration** dialog box.  **NOTE:** If this dialog box does not open automatically, this option is not active in the **Options > Editor...** menu. The dialog box can be accessed anytime by using the contextual menu of the **Configuration** symbol (right-click the symbol and select **Properties**).
2	The title of the configuration will be part of the configuration saved in the controller. The other content of the box is for information only. Fill in the fields and click **OK**.

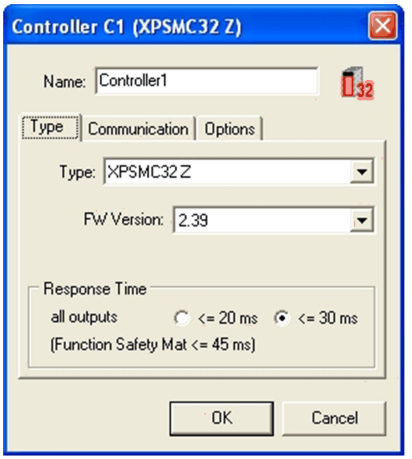
Step	Action
3	Choose the controller type you want to configure from the library and drag the related symbol into the **Configuration** window. The **Properties** dialog box of the controller appears:  **NOTE:** If this dialog box does not open automatically, right-click the symbol and select **Properties**. **NOTE:** The XPSMC16X and the XPSMC32X controllers support a limited set of devices. Hence when selected a window appears to ask if you want to hide the unsupported devices from the library.
4	The dialog box allows you to specify the controller type, the communication settings and to select some controller related options. A detailed description of the parameters is given in the following section *Setting Up the Controller*. Fill in the in the dialog box and click **OK**.

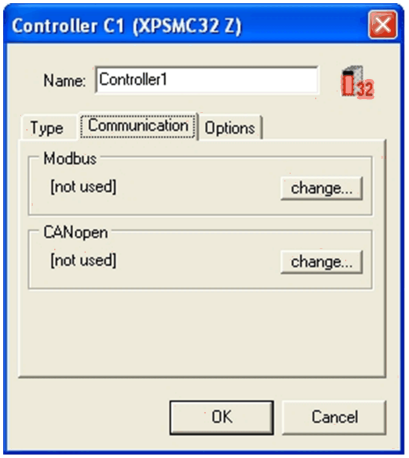
Step	Action
5	Symbols for the controller and the 8 available outputs are shown in the **Configuration** window. You can start to drag devices from the library onto the outputs you want to use to build your configuration. 

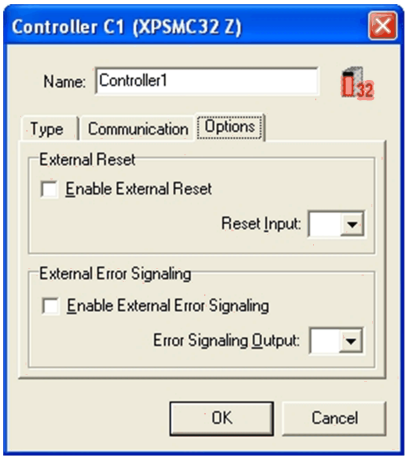
An alternative way to initialize a new configuration is to start with step 3. When you drag the desired controller symbol into the empty **Configuration** window both the configuration and the controller with the associated outputs appear as do the respective dialog boxes.

Setting Up the Controller

The **Controller** dialog box allows the following settings:

Option	Description
Name	A specific name can be assigned to the controller.
Type tab	In the **Type** tab you can change the type of controller, select the firmware version of your specific reference and set the desired response time.  Both the type of controller and the version of the firmware have to match the data on the type label of the specific device you want to configure. Some features may not be available for all versions. The **Response Time** can be set either to 20 ms or 30 ms (except for XPSMC16X and XPSMC32X fixed response time 20 ms). A longer response time allows the controller to process more complex configurations, i.e. more devices may be used. The relative load of the controller is shown in the status bar of the application window. A load of 100 % means no cycle time is left to process additional devices. Due to the way of processing the response time of Safety Mat devices is generally longer than for other devices. Depending on the setting it is 30 ms or 45 ms.

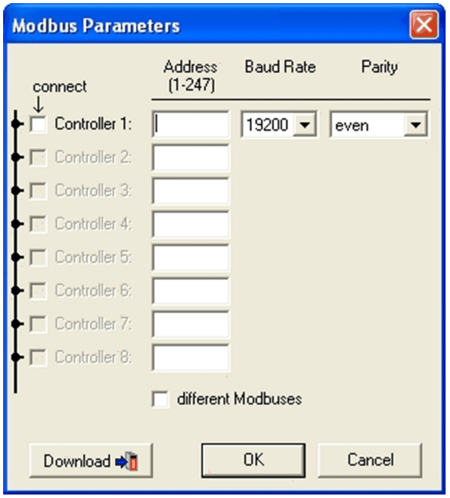
Option	Description
Communication tab	In the **Communication** tab the field bus settings of the controller are shown. Each controller is equipped with Modbus. As an option there may be CANopen or Profibus communication available.  There is a **change...** button for each bus available. Click this button to open a dialog box to change the bus parameters. A detailed description of those dialog boxes can be found in the following chapter *Configuring Communication*, page 37.

Option	Description
Options tab	Depending on the version of the controller there may be an **Options** tab (version 2.40 or greater). Here you can define an input for an **External Reset** and an output for **External Error Signaling**.  The **External Reset** input can be one of the inputs i01..i16 or i01..i32. With an external contact connected to this input the `External Error` status of the controller can be reset remotely. The contact behaves in the same way as the reset button at the front of the controller. Only exception is that if the contact is closed while power cycle the controller will not be reset to default values. So the configuration will stay valid. Refer to the *Hardware Manual* for more details. You can use one of the 8 outputs of the controller for **External Error Signaling**. This output will be active in case the controller is in `External Error` state. So the error can be indicated by a connected signaling device or by a non-safety-related controller. The state of this output is the same as of the `External Error` LED at the front of the controller.

Configuring Communication

Modbus

You can access the Modbus dialog box either by using the corresponding **change...** button in the **Communication** tab of the controller **Properties** dialog box (right-click the controller symbol and select **Properties**) or by using the menu **Controller > Controller Setup (Bus Configuration) > Modbus**.



The **Modbus Parameters** dialog box allows you for the up to 8 controllers in a configuration to select whether a controller is connected to the bus, to define the bus **Address** of the controller, the **Baud Rate** and the **Parity** of the bus.

If you want to use different Modbuses select the appropriate check box. In this case you can define different baud rates and parity settings for each controller.

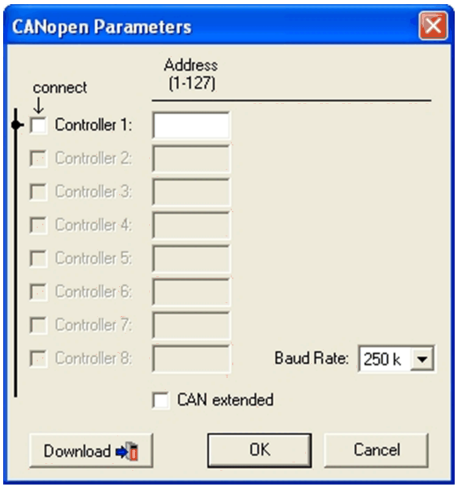
Pressing the **Download** button starts the transfer of the communication parameters (but not the configuration) to the connected controller.

The download has to be done for each controller separately.

The communication parameters are also transferred when the configuration is downloaded to a controller.

CANopen

If your controller is equipped with the CANopen option, you can access the CANopen dialog box either by using the corresponding **change...** button in the **Communication** tab of the controller **Properties** dialog box (right-click the controller symbol and select **Properties**) or by using the menu **Controller > Controller Setup (Bus Configuration) > CANopen**.



The **CANopen Parameters** dialog box allows you for up to 8 controllers in a configuration to select whether a controller is connected to the bus, to define the bus **Address** of the controller and the **Baud Rate** of the bus.

For controllers with a firmware version of 2.40 or greater you can also decide which set of PDOs to be used.

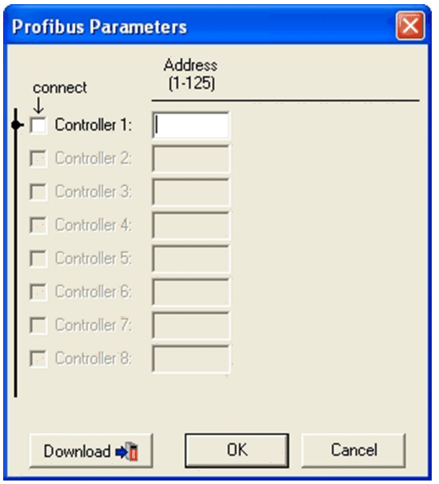
Pressing the **Download** button starts the transfer of the communication parameters (but not the configuration) to the connected controller.

The download has to be done for each controller separately.

The communication parameters are also transferred when the configuration is downloaded to a controller.

Profibus

If your controller is equipped with the Profibus option, you can access the Profibus dialog box either by using the corresponding **change...** button in the **Communication** tab of the controller **Properties** dialog box (right-click the controller symbol and select **Properties**) or by using the menu **Controller > Controller Setup (Bus Configuration) > Profibus**.



The **Profibus Parameters** dialog box allows you for up to 8 controllers in a configuration to select whether a controller is connected to the bus and to define the bus **Address** of the controller.

Pressing the **Download** button starts the transfer of the communication parameters (but not the configuration) to the connected controller.

The download has to be done for each controller separately.

The communication parameters are also transferred when the configuration is downloaded to a controller.

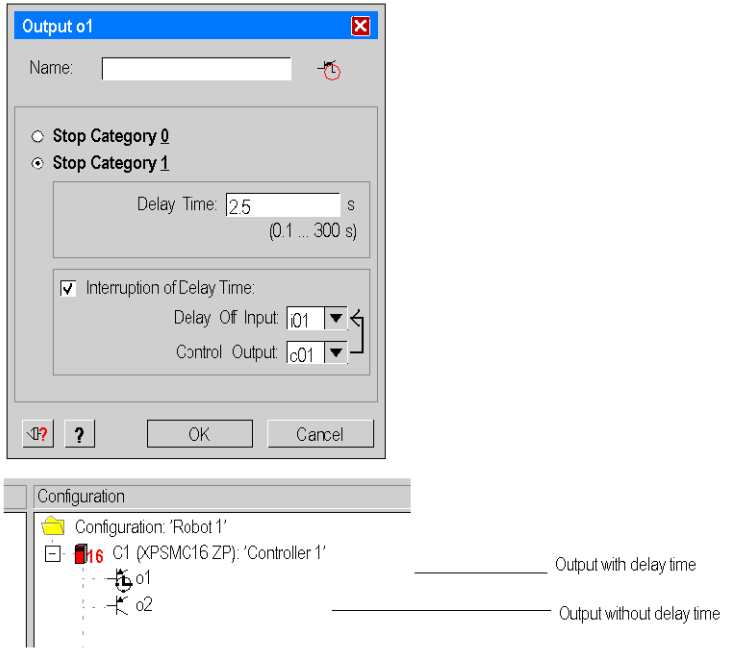
Setting the Safety-Related Outputs

Introduction

The following information shows you how to set up the safety-related outputs.

Procedure

Set up the safety-related outputs as follows:

Step	Action
1	Click the right mouse button, and select **Properties**. The following dialog box appears: 
2	Set the properties of the output.
3	Confirm your settings by clicking **OK**.

Dialog Box Settings

The parameter setting window provides the following setting possibilities:

Option	Description
Name	A specific **Name** can be assigned to the output.
Stop Category 0/1	A choice can be made between **Stop Category 0** (stop immediately) and **Stop Category 1** (stop delayed).

Option	Description
Delay Time	**Delay Time** is defined between 0.1 s and 300 s for the **Response Time** of 20 ms and between 0.15 s and 300 s for the **Response Time** of 30 ms for **Stop Category 1**
Interruption of Delay Time	An input can be defined for an interruption of the delay. If the connection between the assigned control output and the safety-related input is opened, the safety-related output is immediately deactivated.
Icon for Block Diagram	A window opens in which the block diagram of the concerned component is represented.
Icon for Help (**?**)	The instruction sheet will be opened at the corresponding chapter of the component from which help is required.

The last two functions are available for the devices where the block diagram and help icons appear.

Connecting a Device to a Safety-Related Output

Procedure

To assign a device to the desired safety-related outputs proceed as follows:

Step	Action
1	Open one of the device folders.
2	Click the symbol of the device you wish to connect, and drag it to the appropriate safety-related output symbol in the **Configuration** window. **Result:** When the mouse button is released, the device is connected to the safety-related output, as represented in a tree structure.

NOTE: When several devices are attached to a safety-related output they are treated like being connected by a logical **AND**. Start devices are an exception. They are assumed to be connected by an **OR**.

NOTE: This procedure is the same for the functions and devices of the XPSMC Safety Controller.

Use of Control Outputs

Introduction

The XPSMC Safety Controller provides 8 control outputs to drive the safety-related inputs.

Each of those control outputs delivers a different pulse signal.

By this the controller is able to determine if the correct signal is applied to a specific input. Hence a cross-circuit between those inputs can be detected.

If an input receives an incorrect signal, then the related output will be switched off.

For inputs connected to the same control outputs, no cross-circuit can be detected. Carefully analyze which control outputs can be used for which inputs in your application without compromising the safety integrity.

⚠WARNING

LOSS OF CROSS-CIRCUIT DETECTION

- Ensure that the required safety level of the application is not compromised by using the same control output for different devices.
- Carefully analyze and understand how the circuits which are sharing control outputs interact in your application.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

For some of the devices of the XPSMC Safety Controller the use of control outputs is optional.

You can connect the appropriate inputs alternatively to an external supply (nominally +24 VDC).

For inputs connected to an external supply instead of a control output there is no cross-circuit detection.

External means, such as separate cabling or shielding, may be necessary to help achieve the required safety level.

⚠WARNING
LOSS OF CROSS-CIRCUIT DETECTION • Ensure that the required safety level of the application is not compromised by connecting inputs to an external supply. • Carefully analyze and understand how loss of cross-circuit detection affects your application. • Verify whether alternative means are needed to achieve the required safety level. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Modifying the Properties

Introduction

By dropping a component onto an output, the **Properties** window of this component will be automatically opened. This function can be activated or deactivated in the menu **Options > Editor...**.

Procedure

For modifications of the properties proceed as follows:

Step	Action
1	Right-click at a device and select **Properties...** in the shortcut menu. In this window, the adjustable parameters of this function can be modified.
2	Indicate the parameters of the device, the control outputs and the safety-related inputs by which the physical device is connected to the XPSMC Safety Controller. **NOTE:** The same control output can be used only once per device. If a control output c1...c8 is already in use by an other device, a `*` follows the name, for example `c2*`. You must ensure that no hazardous situation can occur when this control output is used more than once, because a cross-circuit, for example, is no longer detected (refer to the hazard message hereafter). **NOTE:** If a safety-related input is already used, it does not appear in the list of available safety-related inputs. You cannot use the same safety-related input multiple times (except for the selector switch device). **NOTE:** Control output used in safety mats cannot be used elsewhere in the configuration.
3	Confirm the defined parameters with **OK**.

Cross-circuits between inputs driven by the same control outputs are not detected.

⚠WARNING

LOSS OF CROSS-CIRCUIT DETECTION

- Ensure that the required safety level of the application is not compromised by using the same control output for different devices.
- Carefully analyze and understand how the circuits which are sharing control outputs interact in your application.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Monitoring Devices

Overview

This section contains the description of the folder *Monitoring Devices*.

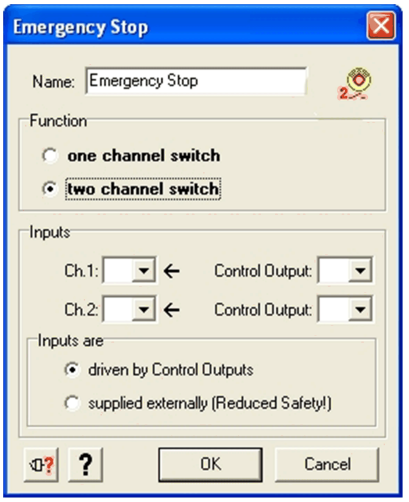
Emergency Stop

Introduction

The *Emergency Stop* folder contains the two device symbols for the one channel and two-channel emergency stop.

Dialog Box Settings

You can make the following settings in the **Emergency Stop** dialog box:



The table describes the setting possibilities:

Option	Description
Name	A specific **Name** can be assigned to this device.
Function	You can choose between a **one channel switch** and a **two channel switch**.
Inputs	The inputs to connect the emergency stop button to must be indicated here. You also need to choose the control outputs or alternatively external supply (nominally +24 VDC) to drive the inputs. **NOTE:** If the inputs are supplied externally, no cross-circuit detection is available. You may need to achieve the required safety level by other means. For further information refer to chapter *Use of Control Outputs*, page 42.

Safety Guards

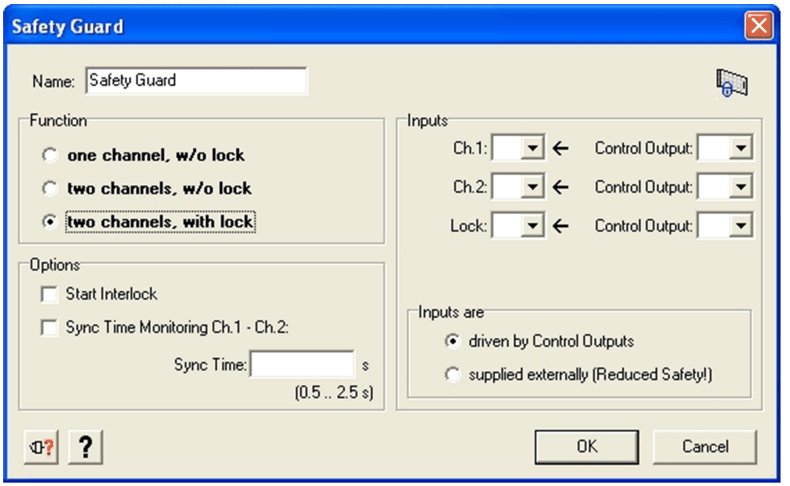
Introduction

NOTE: One of the 3 starting devices: automatic starting, non monitored starting or monitored starting must be assigned to each safety guard device. The corresponding safety-related output cannot be activated without this assignment.

The **Safety Guards** folder contains 3 device symbols: protection guard with **1-channel**, protection guard with **2-channels** and protection guard with **2-channels** and **lock** (3 channels).

Dialog Box Settings

The **Safety Guard** dialog box allows you to make the following settings:



The table describes the Parameters:

Option	Description
Name	A specific **Name** can be assigned to the device.
Function	A choice can be made between a protection guard with 1 limit switch **one channel, w/o lock**, 2 limit switches **two channels, w/o lock** or 2 limit switches with lock **two channels, with lock**.
Safety Guard with 1 channel, w/o lock	In the **Options** field, you can define whether a **Start Interlock** is to be carried out. During the **Start Interlock**, the protection guard must be opened once and then closed again before the machine can start, to verify if the connected contact is operative. In the **Inputs** group box, the input to connect channel 1 to must be indicated. You also need to choose the control output or alternatively external supply (nominally +24 VDC) to drive the input. **NOTE:** If the input is supplied externally, no cross-circuit detection is available. You may need to achieve the required safety level by other means. For further information refer to chapter *Use of Control Outputs*, page 42.

Option	Description
Safety Guard with 2 Channels, w/o Lock	In the **Options** field, you can define whether a start interlock is to be carried out. During the start interlock, the protection guard must be opened once and then closed again before the machine can start, to verify that the connected contacts are operative. A synchronization time, during which contacts channel 1 and channel 2 must operate, can be defined. If this time is exceeded, the assigned safety-related output will not be activated. For the response time of 20 ms, the range is 0.5...2.5 s; for the response time of 30 ms, the range is 0.45...2.4 s (synchronization time). In the **Inputs** group box, the inputs to connect channel 1 and channel 2 to must be indicated. You also need to choose the control outputs or alternatively external supply (nominally +24 VDC) to drive the inputs. **NOTE:** If the inputs are supplied externally, no cross-circuit detection is available. You may need to achieve the required safety level by other means. For further information refer to chapter *Use of Control Outputs*, page 42.
Safety Guard with 2 Channels, with Lock	In the **Options** field, you can define whether a start interlock is to be carried out. During the start interlock, the protection guard must be opened once and then closed again before the machine can start, to verify if the connected contacts channel 1, channel 2 and lock are operative. A synchronization time, during which contacts channel 1 and channel 2 must operate, can be defined. If this time is exceeded, the assigned safety-related output will not be activated. For the response time of 20 ms, the range is 0.5...2.5 s; for the response time of 30 ms, the range is 0.45...2.4 s (synchronization time). The inputs used must be indicated in the **Inputs** group box. You also need to choose the control outputs or alternatively external supply (nominally +24 VDC) to drive the inputs. **NOTE:** If the inputs are supplied externally, no cross-circuit detection is available. You may need to achieve the required safety level by other means. For further information refer to chapter *Use of Control Outputs*, page 42.

Light Curtains (Electro Sensitive Protective Equipment (ESPE)) of Category 4 without Muting

Introduction

The *Light Curtains* folder contains two device symbols:

Light curtain (ESPE = Electro Sensitive Protective Equipment) **with Transistor Outputs** and **with Relay Outputs** with and without muting.

NOTE: One of the three starting devices: automatic start, non-monitored start or monitored start must be assigned to each light curtain device. The corresponding safety-related output cannot be activated without this assignment.

For the light curtain with transistor outputs, the light curtain verifies its safety-related outputs (OSSD = Output Safety Switching Device) by a short interruption. The light curtain safety-related outputs must be connected to different XPSMC Safety Controller safety-related inputs.

This output test is not, however, possible for the output and is thus performed by the XPSMC Safety Controller. To provide cross-circuit monitoring, the light curtain safety-related outputs must be connected to different XPSMC Safety Controller safety-related inputs and control outputs.

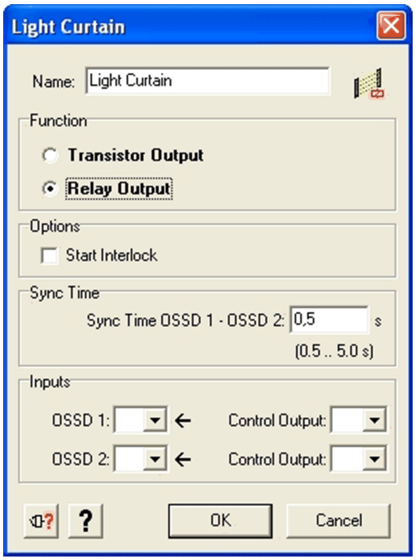
For the light curtain safety-related outputs the following synchronization time range is available:

Response Time	Synchronization Time
20 ms	0.5...5.0 s
30 ms	0.45...4.95 s

If the time difference between the tripping of the two safety-related outputs (OSSD) is outside this range, the safety-related output affected will not be activated.

Dialog Box Settings

The parameter setting window provides the following setting possibilities:



The table describes the following setting possibilities:

Option	Description
Name	A specific **Name** can be assigned to the device.
Function	A choice can be made between the light curtain with a **Transistor Output** and **Relay Output**.

Option	Description
Options and Sync Time	You can define whether a **Start Interlock** is to be carried out. During the start interlock, the light curtain protection field must be interrupted once and validated again, before activating the XPSMC Safety Controller safety-related outputs. A synchronization time during which contacts channel 1 and channel 2 must close can also be entered. If this time period is exceeded, the assigned safety-related outputs are not activated. The response time period of 20 ms can be defined in the range between 0.5 s and 5.0 s, and a response time of 30 ms - in the range of 0.45...4.95 s (synchronization time).
Inputs	The safety-related inputs to which the light curtain safety-related outputs (**OSSD 1** and **OSSD 2**) are connected need to be selected here. In case of light curtains with relay outputs, you also need to define the **Control Outputs**. **NOTE:** In order to drive the relay outputs by an external supply (not by control outputs), use the **Transistor Output** option. You may need to apply external means to compensate for the loss of cross-circuit detection. For further information refer to chapter *Use of Control Outputs*, page 42.

Light Curtain with Muting

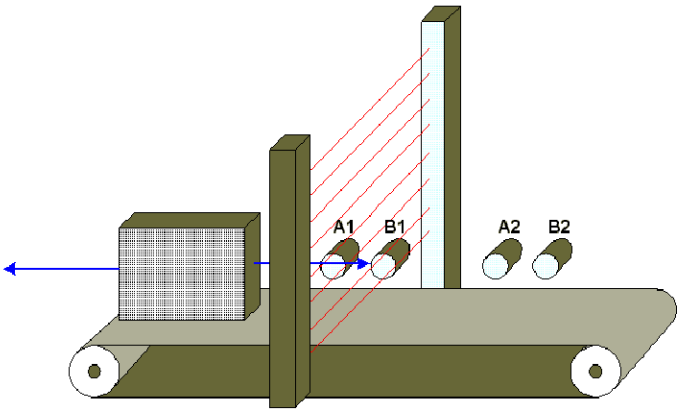
Introduction

The *Light Curtain with Muting* folder contains two device symbols:

Light curtain (ESPE = Electro Sensitive Protective Equipment) with transistor outputs or relay outputs, and with muting function.

The muting function can be used to bypass the protection field of a light curtain (ESPE) in order, for example, to bring a part to be worked into and/or out of the working area.

Show a muting example:



The muting function is controlled by four additional sensors belonging to two groups (A and B), and can only be activated when the safety-related outputs have already been activated (the protection field is then free). If not, the activation of the muting function produces an error message and the safety-related outputs remain deactivated. Muting operates according to a suitable order of the muting sensors in both directions of transport, and thus inside and outside the working area again.

The muting sensors of groups A and B must be activated during a variable synchronization time t_{syn} (0.5...3 s with the response time of 20 ms or 0.6...3 s with a response time of 30 ms or to infinity), in order to trigger the muting function. A muting time t_M can also be adjusted from 0.5...10 min or to infinity. During this time, the conveyed goods can pass through the activated protection field, without the XPSMC Safety Controller safety-related outputs switching off the machine. If this time is exceeded, an error message appears and the safety-related outputs are deactivated.

The override button is used to bypass the protection field manually. This is necessary, for example, when the muting function is activated and when conveyed goods have entered and blocked in the light curtain protection field (ESPE). Through this option, the goods can be withdrawn from the machine, in spite of the light curtain (ESPE). To help prevent inappropriate use, the override function can only be activated for up to 10 min. After this time, the override is canceled and the safety-related response is activated.

To create the muting signal, sensors with output, or mechanical limit switches are suitable for differentiating between individuals and goods. At the same time, all easily defeated safety-related means must be prevented.

On entering the working area, use a light signal to announce the muting status for muting operation; this signal must be connected between terminal H1 and the XPSMC Safety Controller supply voltage (terminal A1). If an error occurs at the level of this light signal (cross-circuit, interruption), the muting function is immediately de-activated and an error message appears. The safety-related outputs are then deactivated.

Sources of white light with an illumination surface of 1 cm^2 and a brightness of at least 200 lm/m are used as a light signal. The current of this light source could vary from 20...350 mA.

The light signal illuminates when the muting signals are generated and announces the bypassing of the light curtain protection function (ESPE):

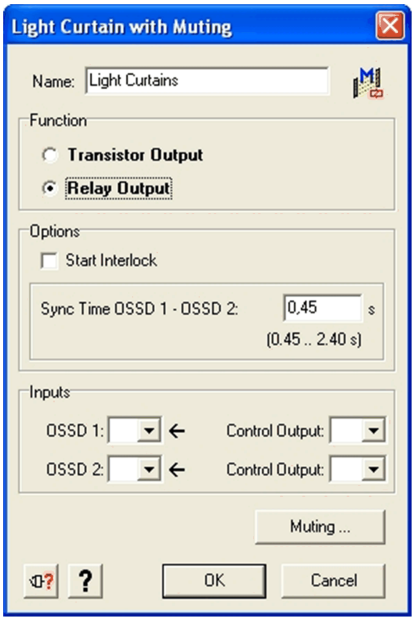
- A new cycle is only initiated with the starting control when no muting signal is required and when the protection field is free.
- During the time a muting signal is produced, no unauthorized personnel are allowed to enter the working area.

The muting function meets the requirements of PL e, category 4 according to ISO 13849-1. For monitoring of the muting lamp, a minimum duration of 500 ms for muting is necessary.

Photoelectric muting sensors must operate in dark switching mode, in order to produce the output signal when a light ray is interrupted.

Dialog Box Settings

The parameter setting window provides the following setting possibilities:

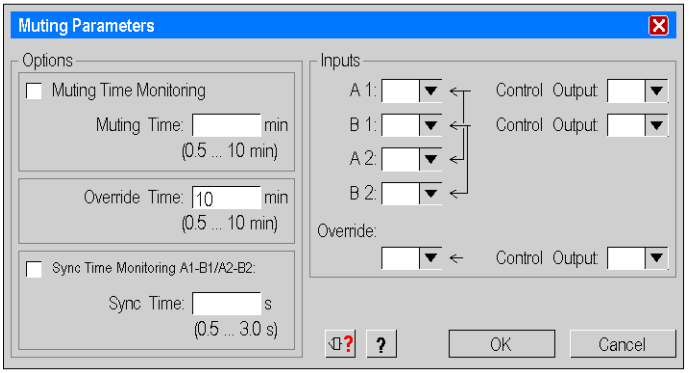


The table describes the following setting possibilities:

Option	Description
Name	A specific name can be assigned to this device.
Function	A choice can be made between the light curtain with a transistor or relay output. The device symbol is adapted to the choice made.
Options	You can define whether a start interlock is to be carried out. During the start interlock, the light curtain protection field must be interrupted once and validated again before activating the XPSMC Safety Controller safety-related outputs.
Inputs	The safety-related inputs to which the light curtain safety-related outputs (**OSSD 1** and **OSSD 2**) are connected need to be selected here. In case of light curtains with relay outputs, you also need to define the **Control Outputs**. **NOTE:** In order to drive the relay outputs by an external supply (not by control outputs), use the **Transistor Output** option. You may need to apply external means to compensate for the loss of cross-circuit detection. For further information refer to chapter *Use of Control Outputs*, page 42.

When pressing the **Muting** button, you get the following **Muting Parameters** window.

The **Muting Parameters** window offers the following options:



The following table describes the parameters of the dialog box:

Option	Description
Options	**Muting Time Monitoring:** The optional **Muting Time** indicates the maximum time the muting function is allowed to operate. Exceeding this time with the muting function still activated causes an error message. The **Muting Time** have the range of 0.5...10 min. **Override Time:** The **Override Time** indicates the maximum time during which the relieve time function can be activated. The default value set is 10 min. The **Override Time** has the range of 0.5...10 min. **Synchronization Time Monitoring:** The optional **Sync Time** is the time during which the muting sensors of groups A and B must be activated before muting is started. If this time is exceeded, the muting function is not activated. For a response time of 20 ms, the range is 0.5...2.5 s, and for a response time of 30 ms, the range is 0.45...2.4 s for the **Sync Time**.
Inputs	The override input, the 2 groups A and B of muting sensors and the control outputs to which the XPSMC Safety Controller are connected to the light curtain, must be indicated in the **Inputs** group box. The 2 groups A and B of muting sensors must be connected to different control outputs.

Magnetic Switch

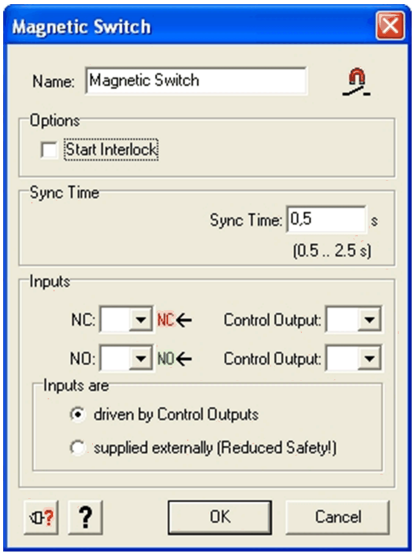
Introduction

The *Monitoring Devices* folder contains the *Magnetic Switch* control device symbol.

The Magnetic Switch consists of an opening contact and a closing contact, which must be actuated within the Synchronization Time, otherwise the safety-related outputs affected are not activated.

Dialog Box Settings

The parameter setting window offers the following settings:



The table describes the following setting possibilities:

Option	Description
Name	A specific **Name** can be assigned to this device.
Options and Sync Time	You can define whether a **Start Interlock** is to be carried out. During the **Start Interlock**, the magnetic switch must be actuated once before the machine is started and then de-activated again to verify whether the connected contacts are also operating. For the response time of 20 ms, the range is 0.5...2.5 s, and for the response time of 30 ms, the range is 0.45...2.4 s for the Synchronization Time.
Inputs	The inputs used must be indicated here. You also need to choose the control outputs or alternatively external supply (nominally +24 VDC) to drive the inputs. **NOTE:** If the inputs are supplied externally, no cross-circuit detection is available. You may need to achieve the required safety level by other means. For further information refer to chapter *Use of Control Outputs*, page 42.

NOTE: If you connect the magnetic switches in series, the maximum Category you can achieve is Category 3.

You can connect in series a maximum of

- 3 magnetic switches with LED
- 6 magnetic switches without LED

Two-Hand Control Type IIIA/IIIC

Introduction

The *Monitoring Devices* folder contains the *Two-Hand Controls* folder. In this folder you can find the device symbols for a Two-Hand Control **Type IIIA** and a Two-Hand Control **Type IIIC** according to ISO 13851.

The two buttons of a two-hand control have to have at least one normally open (NO) and one normally closed (NC) contact.

These buttons must be actuated within the synchronization time frame of 0.5 s to obtain switching of the safety-related output.

When this time is exceeded, the assigned safety-related output will not be activated.

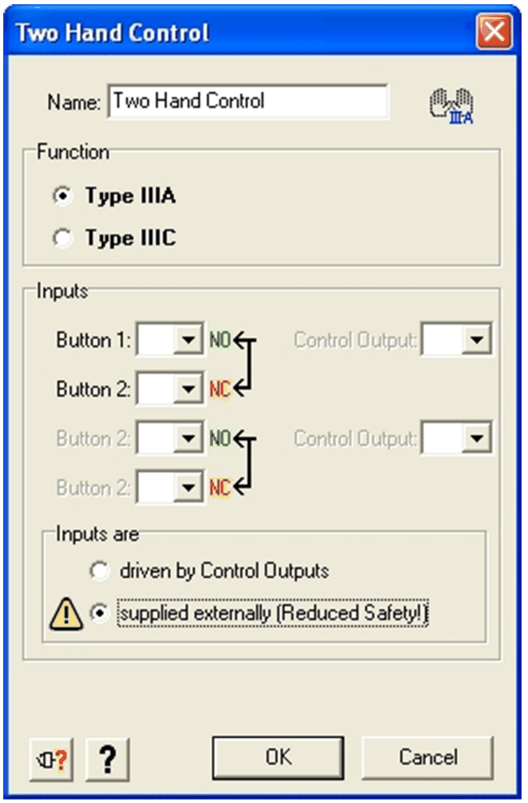
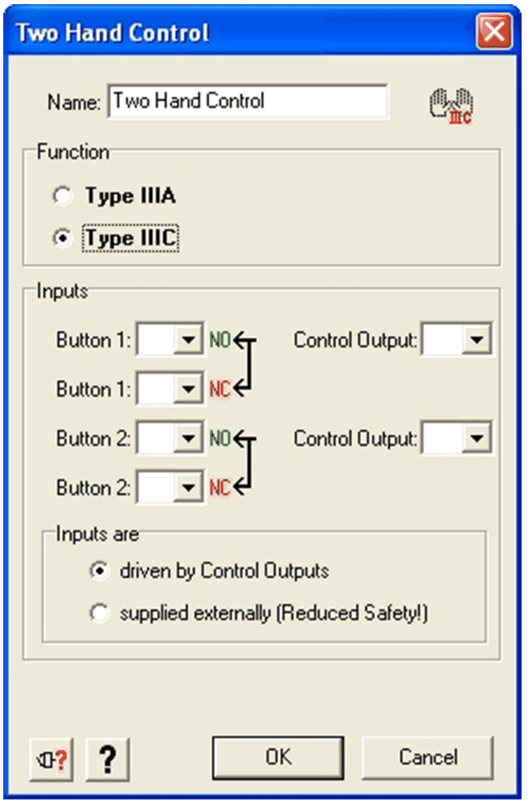
After releasing at least one of the buttons the output becomes inactive and cannot be activated again until both buttons were released.

For Two-Hand Controls of **Type IIIA** it is sufficient to have one button with an **NO** contact and another button with an **NC** contact.

For Two-Hand Controls of **Type IIIC** each button has to have a **NO** and a **NC** contact.

Dialog Box Settings

The Two-Hand Control provides the following settings:

Type IIIA	Type IIIC
	

Option	Description
Name	A specific name can be assigned to the device.
Function	You can select **Type IIIA** or **Type IIIC**.
Inputs	The control outputs and the safety-related inputs to which the two-hand control buttons are connected must be indicated in the Inputs field. For **Type IIIA** controls 2 inputs are to be used. For **Type IIIC** controls 4 inputs are to be used. The use of control outputs is optional. Alternatively the contacts can be driven by the external supply (nominally +24 VDC). **NOTE:** If the control outputs are not used, external means may need to be applied to achieve the required safety level. For further information refer to chapter *Use of Control Outputs*, page 42.

Safety Mat

Introduction

NOTE: 1 of the 3 starting devices: automatic starting, non monitored starting or monitored starting must be assigned to each switching mat function. The corresponding safety-related output cannot be activated without this assignment.

The *Monitoring Devices* folder contains the *Safety Mat* function symbol.

The switching mat consists of two pairs of metal leads that are cross-circuited when the mat is walked on. The XPSMC Safety Controller safety-related outputs are then immediately deactivated. To be able to detect this cross-circuit, the four connection leads must be connected to different safety-related inputs and control outputs.

Types: see Technical Specifications, Hardware Manual.

NOTE: The control outputs used for this device cannot be used for any other device.

⚠WARNING

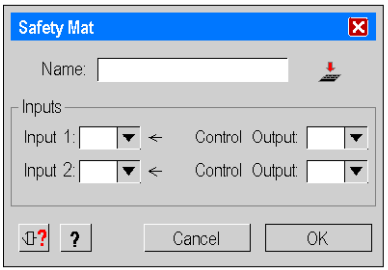
LOSS OF SAFETY INPUT-CROSS CONNECTION DETECTION

In Safety Mat applications, ensure that all four connection leads are connected to different safety-related inputs and control outputs.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Dialog Box Settings

The parameter setting window provides the following setting possibilities:



The table describes the following setting possibilities:

Option	Description
Name	A specific name can be assigned to this device.
Inputs	The control outputs and the safety-related inputs to which the safety switching mat is connected must be indicated in the **Inputs** group box.

Zero Speed Detection

Introduction

The *Monitoring Devices* folder contains the symbol *Zero Speed Detection* device symbol.

This device detects the zero speed of a motor or a shaft. To enter the motor rotational speed, an encoder wheel and two PNP sensors are required as indicated in figure Functional Diagram, page 180. These sensors can only be connected to XPSMC Safety Controller safety-related inputs i01 and i02. If these inputs are already used, the application generates an advisory message.

Operating Conditions

Comply with the following points for this device:

- The sensors must be arranged so that only 1 sensor is activated at any given time (= HIGH-Signal).
- If both sensors are in the LOW state, a cable break error message is indicated and the corresponding outputs are deactivated.
- If both sensors are in the HIGH state after power on of the XPSMC Safety Controller, a notification is available via Modbus RTU, or via the configuration terminal (PC), and the corresponding outputs are deactivated. After a zero speed detection followed by subsequent motion the notification is reset.
- If zero speed is already detected and both sensors are in HIGH state, a notification is available via Modbus RTU, or via the configuration terminal (PC), and the corresponding outputs are activated.
- If only 1 sensor produces a dynamic signal after a zero speed, an error message appears after 30 s and the corresponding outputs are deactivated.
- If, after the XPSMC Safety Controller has started, both sensors are in the LOW state, an error message is available via the Error LED on the XPSMC Safety Controller and Modbus RTU, or via the configuration terminal (PC).

NOTE: You can only use one Zero Speed Detection per XPSMC Safety Controller, because there are only two counter inputs (**i01** and **i02**) per controller. For the same reason you cannot use the Zero Speed Detection device simultaneously with the Shaft/ Chain Break Monitoring device on the same XPSMC Safety Controller.

NOTE: The output will be activated if the sensors detect no motion.

Sensor States and Behavior

Switch-on Sequence

State of Sensor 1	0	0 (*)	1
State of Sensor 2	0	1 (*)	1
Behavior	Error Message	Zero Speed	Notification (**)
Output	0	1	0

Operation

State of Sensor 1	0	0 (*)	1
State of Sensor 2	0	1 (*)	1
Behavior	Error Message	Zero Speed	Notification
Output	0	1	1

*	If the state of the sensors is inverse, the behavior is identical.
**	If the firmware version is earlier than 2.34 an error message (cross circuit between inputs) appears instead of a notification. This error message must be acknowledged with the reset button. **NOTE:** When XPSMC••Z•• with a firmware version earlier than 2.34 starts its function with both sensor inputs at HIGH, then the **Short circuit between inputs** stays ON.
Error Message	External error messages must be acknowledged with the reset button.
Notification	A notification, sent via Modbus, does not need to be acknowledged. As soon as the sensor states change, it will be acknowledged automatically.

Calculation

Both sensors give a frequency depending on the numbers of cogs and the revolution per minute:

$$f[Hz] = \frac{n[rpm]}{60} \times z$$

or

$$n[rpm] = \frac{f[Hz] \times 60]}{z}$$

where

f = Pulse frequency of the sensors in Hertz

n = Rotational speed of the encoder wheel in revolutions per minute

z = Encoder wheel number of cogs

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Do not use the XPSMC Safety Controller in applications where the pulse frequency requirement for detection of cogs on a rotary machine exceeds 450 Hz.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Examples

Example 1: Machine with 3000 rpm and an encoder wheel with 26 cogs:

$$f_{max} = \frac{3000}{60} \times 26 = 1300Hz$$

1300 Hz is not authorized, because it is greater than 450 Hz.

Example 2: The same machine (3000 rpm) and an encoder wheel with 8 cogs:

$$f_{max} = \frac{3000}{60} \times 8 = 400Hz$$

400 Hz is authorized, because it is smaller than 450 Hz.

Switching Frequency

The frequency limit, below which the zero speed is detected and the safety-related outputs activated, can be adjusted by the user within a range of 0.05...20 Hz.

Example: A 8-cog encoder wheel is located above a shaft. A zero speed is detected when the speed is less than 10 rpm.

$$f_{Switchingfrequency} = \frac{10[rpm]}{60} \times 8 = 1{,}33Hz$$

A switching frequency of 1.33 Hz must be indicated to detect a zero speed.

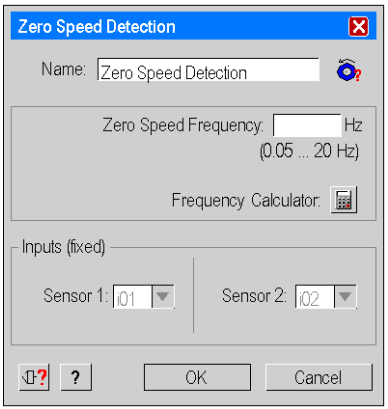
NOTE: A frequency calculator is included in the properties determination menu. Enter the number of cogs and the zero speed limit in rpm, and the frequency limit to be set is calculated automatically.

The switching from **Motor Operation** to **Zero Speed** (= activation of safety-related outputs) only occurs when

- one safety-related input contains a HIGH signal and
- the other input contains a LOW signal and
- the frequency on the two inputs is lower than the value entered.

Dialog Box Settings

The parameter setting window provides the following setting possibilities:

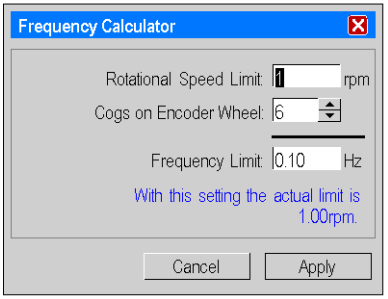


The table describes the following setting possibilities:

Option	Description
Name	A specific name can be assigned to this device.
Zero Speed Frequency	The frequency limit, below which the zero speed must be detected and the safety-related outputs activated, must be indicated in this field, as indicated above. For the response time of 20 ms, the range is 0.05...20 Hz, and for the response time of 30 ms, the range is 0.05...16.7 Hz for the Zero Speed Frequency.

Option	Description
Frequency Calculator	A dialog box opens when you click here.
Inputs (Fixed)	i01 and i02

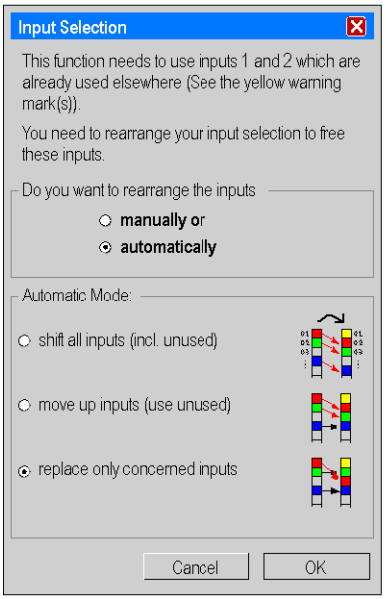
The parameter setting window provides the following setting possibilities:



The table describes the following setting possibilities:

Option	Description
Rotational Speed Limit	The desired rotational speed limit (in rpm) to detect a zero speed.
Cogs on Encoder Wheel	The number of cogs.
Frequency Limit	The frequency limit to be set is calculated automatically; it can be adjusted using the **Apply** button in the **Properties** menu.

Safety-related inputs i01 and i02 are already automatically indicated in the **Inputs** field. This device cannot operate with other inputs. If inputs i01 and/or i02 are already used, the following window appears to help resolve the conflict:



The table describes the following setting possibilities:

Option	Description
Manually or	As a user, you assign other safety-related inputs manually to the function using ii01 and/or i02. When **OK** is clicked, the **Properties** window of the concerned devices will be opened.
Automatically	The software automatically assigns other safety-related inputs to the function using i01 and/or i02 according to 1 of 3 options: 1. **shift all inputs** The safety-related inputs are shifted as a block. Inputs that are not used and are available may also be shifted. For example, i01 becomes i03, i02 becomes i04 and i04 becomes i06. 2. **move up inputs** The safety-related inputs are shifted as a block. Inputs that are not used and are available may also be shifted, and spaces thus filled. For example, i01 becomes i03, i02 becomes i04 and i04 becomes i05. 3. **replace only concerned inputs** Only the inputs that are used (i01 and/or i02) are shifted to the next free safety-related inputs. This is the default option.

Injection Molding Machine

Introduction

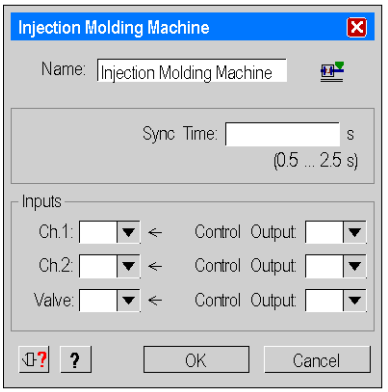
> **NOTE:** 1 of the 3 starting devices: automatic starting, non monitored starting or monitored starting must be assigned to each injection molding machine device. The corresponding safety-related output cannot be activated without this assignment.

The *Specific Functions* folder contains the *Injection Molding Machine* device symbol for monitoring an injection molding machine with a protection guard, as indicated in figure Wiring Diagram, page 186.

The 3 limit switches Channel 1, Channel 2 and Valve must then be connected to various control outputs and safety-related inputs, to provide cross-circuit monitoring. The injection molding machine is activated according to the switching states of limit switches Channel 1, Channel 2 and Valve, in accordance with the function diagram in figure Functional Diagram, page 183. A **Start Interlock** is, in this case, mandatory, i.e. the protection door must be opened once and then closed again, to make starting possible.

Dialog Box Settings

The parameter setting window provides the following setting possibilities:



The table describes the following setting possibilities:

Option	Description
Name	A specific name can be assigned to this device.
Sync Time	A synchronization time, during which contacts channel 1 and channel 2 must close, must be entered in this field. If this time is exceeded, the assigned safety-related outputs are not activated. For the response time of 20 ms, the range is 0.5...2.5 s, and for the response time of 30 ms, the range is 0.45...2.4 s for the Synchronization Time.
Inputs	The safety-related inputs and control outputs used must be indicated in this field.

Hydraulic Press Valve Monitoring

Introduction

The *Specific Functions* folder contains the *Hydraulic Press Valve Monitoring* device symbol for monitoring a hydraulic press valve, as indicated in figure Wiring Diagram, page 188.

Using this device, a hydraulic press with safety valves with three position switches or with PNP sensors Valve C to Valve C+O can be connected to the XPSMC Safety Controller, as shown in the figure Wiring Diagram, page 188. The press control delivers the press opening and closing signals. Each time the leading edge of one of the two press control signals, OPEN PRESS or CLOSE PRESS, goes positive, a configurable time window is generated, during which the XPSMC Safety Controller waits for a response from the appropriate valve position switch (Valve C and Valve C+O for press closing, Valve O for press opening). If this time window is exceeded, the corresponding safety-related outputs are deactivated.

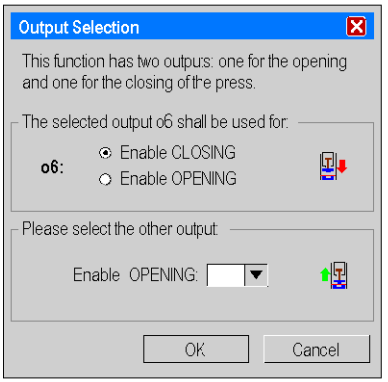
If signals Valve C to Valve C+O appear in an order other than the one shown in figure Functional Diagram, page 187, the affected safety-related outputs of this function are then deactivated and an error message appears.

This function thus delivers the CLOSING AUTHORIZATION signal to a safety-related output, if the CLOSE PRESS signal is active and if Valve C and Valve C+O are closed in the time window.

The OPENING AUTHORIZATION signal will also be activated on a safety-related output, if the OPEN PRESS signal is active and if Valve O is closed in the time window.

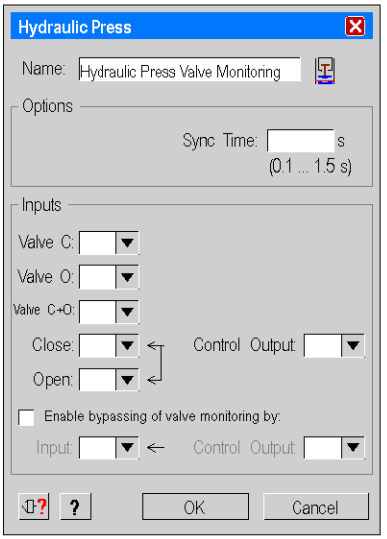
When this device is selected, it is necessary to assign the OPENING AUTHORIZATION function to a safety-related output and the CLOSING AUTHORIZATION function to another safety-related output.

This is to be done by the window that appears:



Dialog Box Settings

The parameter setting window provides the following setting possibilities:



The table describes the following setting possibilities:

Option	Description
Name	A specific name can be assigned to this device.
Options	A synchronization time, during which the respective contacts Valve C/Valve C+O and Valve O/Valve C+O must close, can be entered in this field. If this time is exceeded, the corresponding safety-related outputs are deactivated. For the response time of 20 ms, the range is 0.1...1.5 s, and for the response time of 30 ms, the range is 0.15...1.5 s for the Synchronization Time.
Inputs	The safety-related inputs and the control output used must be indicated here. Switches Valve C to Valve C+O must be connected directly to the +24 V supply voltage. The two contacts for OPEN PRESS and CLOSE PRESS can operate with the same control output. Optionally, an input to bypass the monitoring of the valves can be chosen. If the bypass is used, Valve C, Valve O and Valve C+O will not be monitored and have no influence on the position of the press. The safety-related outputs are only dependant on the situation of the OPEN and CLOSE contacts.

Hydraulic Press 2

Introduction

The *Specific Functions* folder contains the *Hydraulic Press 2 device* symbol for a hydraulic press with valve monitoring and optional overtravel monitoring, as indicated on the Wiring Diagram, page 188.

This device provides a mode selector switch function for the operation modes **Inching**, **Single Stroke** and **Automatic** of the hydraulic press.

The press safety valves and optionally a top dead center (**OT**) and a bottom dead center (**UT**) contact are monitored according to the selected mode.

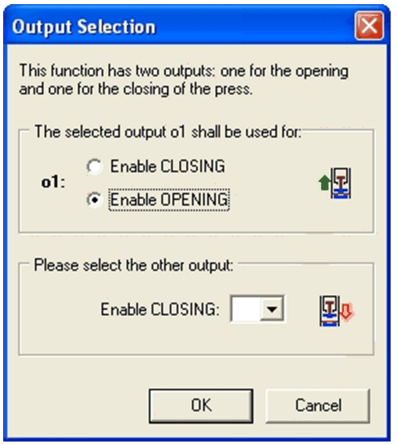
Optionally the overtravel of the press can be verified at start up.

The use of the **Open** and **Close** signals is mandatory when **Automatic** mode is selected. The use of the **Open** command is also necessary when mode **Inching** is selected.

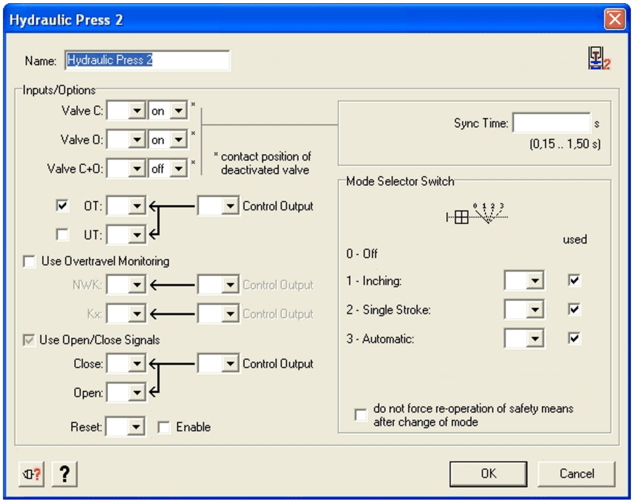
The Hydraulic Press 2 device can be attached to outputs only.

When you drop the Hydraulic Press 2 device onto an output, the window shown below appears.

Here you need to select if the output enables either the **OPENING** or the **CLOSING** movement of the press and which output to be used for the opposite movement. There are 2 outputs needed for a Hydraulic Press device.



Once the outputs are selected the **Hydraulic Press 2** dialog box appears as shown in the figure below.



Dialog Box Settings

The **Hydraulic Press 2** dialog box allows the following settings:

Option	Description
Name	A specific name can be assigned to the device.
Inputs/Options	Here you need to select the inputs to connect the press safety valves **C** (closing), **O** (opening), **C+O** (closing and opening) and to define a synchronization time (**Sync Time**), in which these valves must be actuated. For a response time of 20 ms, the range is 0.1...1.5 s; for a response time of 30 ms, the range is 0.15...1.5 s. If the time is exceeded before the valves react as expected, then the corresponding outputs are deactivated. If you chose to use the TDC (**OT**) and BDC (**UT**) contacts, you need to select the inputs to connect these contacts. If **Use Overtravel Monitoring** is selected, inputs for the overtravel contact (**NWK**) and the pressure contact of the hydraulic pump (**Kx**) must be defined. Also the use of a **Open** and a **Close** signal can be declared. Those signals may be generated by external contacts or by a non-safety-related controller. If mode **Automatic** is used then **Open** and **Close** signals are mandatory. Depending on the selected mode and chosen options the use of some of the inputs may become mandatory. Some inputs share common control outputs. An additional option available for controllers with firmware version 2.40 or greater is to store the last error generated by the press. If selected the press will stay in error state until the error is reset by activation of the **Reset** input. This is true also in case of a power cycle. Connect a key switch to the **Reset** input.

Option	Description
Mode Selector Switch	The following operation modes are available: • **Mode Off** If no input of the mode selector switch is active the press is assumed to be off. Both safety-related outputs are off and no movement is enabled. • **Mode Inching** In inching mode the position switches **OT** and **UT** as well as the switches of the valves **O**, **C** and **C+O** are not be monitored. The movement of the press is controlled by the status of the safety-related means (e.g. two-hand control) attached to the press device only. To enable an upstroke the **Open** input need to be active. • **Mode Single Stroke** If the safety-related means are valid and the press monitoring does not detect an error the press performs one stroke. If TDC is reached, i.e. the stroke ends, the movement stops even if all conditions are still valid. To start the next cycle the safety-related means need to be deactivated and activated again, e.g. a two-hand control has to be released and pressed again. If the safety-related means or monitoring result becomes invalid while downstroke the stroke will be interrupted. On upstroke the safety-related means are muted. • **Mode Automatic** The function of the automatic mode is equal to that of the single stroke mode with the difference that the press movement does not stop after the first cycle. The press keeps running until the safety-related means become invalid or an error is detected. The movement is controlled by the **Open** and **Close** signals. For controllers with a firmware version of 2.40 or later there is an option to prevent the need to re-operate the devices attached at the press after the operation mode was changed. The re-operation of only one device is sufficient to start a new cycle then; for example, in case not only a two-hand control but also safety guards are attached to the press which normally does not need to be tested cyclically.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Ensure that adequate safety-related measures are effective for each person working on the press.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Eccentric Press

Introduction

The *Specific Functions* folder contains the *Eccentric Press* symbol.

The eccentric press device is intended to monitor the operation of an eccentric press including stopping at the top dead center (**OTS**), the overtravel and optionally the press safety valve (**PSV**).

The press must be operated with a two-hand control device. A representation of the two-hand control has to be attached to the Eccentric Press symbol in the configuration tree.

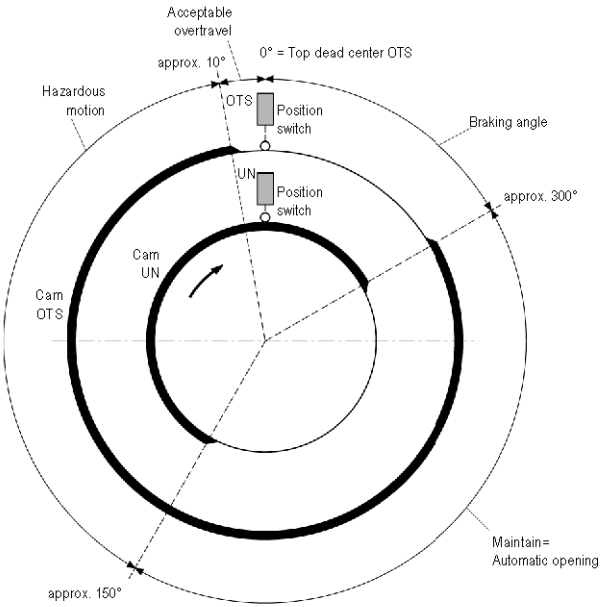
The XPSMC Safety Controller safety-related outputs are activated as long as the start signal is active at the beginning of the cycle and the position switches **OTS**, **UN**,**PSV1**, and **PSV2** deliver the signals throughout the cycle.

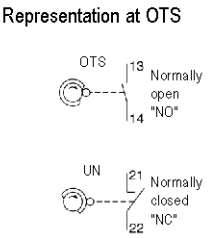
To enable cross-circuit detection, the position switches must be connected to different safety-related inputs and control outputs.

The function detailed operation differs according to the selected operating mode.

Position switches **OTS** and **UN** detect the press movement and in particular stopping at the top of the dead center **OTS**.

The control cams are shown on the following functional diagram:





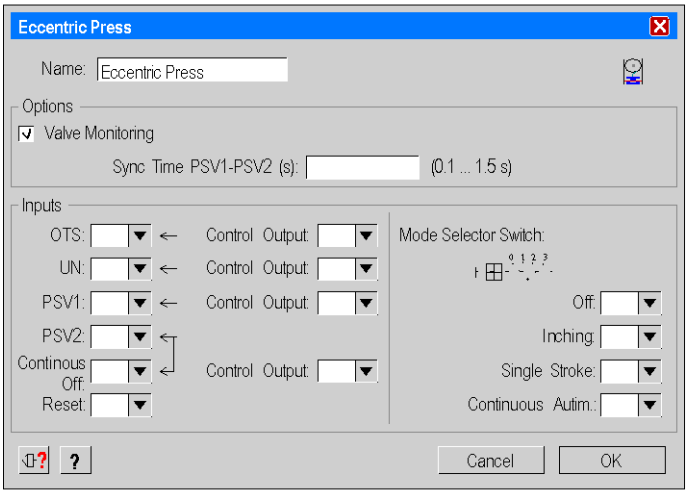
Position switches **PSV1** and **PSV2** monitor the status of the press safety valve. For the response time of 20 ms, the range is 0.1...1.5 s, and for the response time of 30 ms, the range is 0.15...1.5 s for the **Synchronization Time**. If this time is exceeded before both valve contacts were operated, an error message appears, and the corresponding safety-related outputs are deactivated.

Also if one of the other safety-related inputs delivers an incorrect signal, an error message appears, and the corresponding safety-related outputs are deactivated.

To reset an overtravel error, a valve error, or an error at the **UN** or **OTS** position switches, the **Reset** input must be actuated. These error states will not be cleared by switching off the controller.

Dialog Box Settings

The **Eccentric Press** dialog box provides the following setting possibilities:



Setting	Description
Name	A specific **Name** can be assigned to the device.
Options	The valve monitoring can be activated, and the **Synchronization Time** for the contacts at the valves **PSV1** and **PSV2** can be adjusted. For the response time of 20 ms, the range is 0.1...1.5 s, and for the response time of 30 ms, the range is 0.15...1.5 s

Setting	Description
Inputs	Relation between inputs and control outputs need to be selected. • At the **OTS** input the top dead center **(TDC)** contact is to be connected. • At the **UN** input the bottom dead center **(BDC)** contact need to be connected. • The **PSV1** and **PSV2** inputs are for the monitoring contacts of the 2 halves of the press safety valve **(PSV)**. • The **Continuous Off** input is used in **Continuous** and **Continuous Automatic** mode, see below. The input is low active. • The **Reset** input is used to reset the error state of the press. Connect a key switch.
Mode Selector Switch	The following operation modes are available: • Mode **Off** The press is deactivated and the related safety-related output is turned off. • Mode **Inching** Position switches **OTS** and **UN** as well as the switches of the valves **PSV1** and **PSV2** will not be monitored. The movement of the press is controlled by the status of the safety-related means (for example **Two-Hand Control**) attached to the press device only. • Mode **Single Stroke** The movement of the press starts when the two-hand control is activated, and the press is in **TDC**. As long as the two-hand control signal stays valid and there is no press error detected the cycle will be continued until **TDC** is reached again. In **TDC** the movement will stop even if the two-hand is still pressed. To restart the press the two-hand need to be released and pushed again. While upstroke the status of the two-hand is not monitored (muted). • Mode **Continuous** The behavior of monitoring correspond to that of the mode **Single Stroke**, however the press does not stop after one cycle. The movement is continued until the **Two-Hand Control** is released or the **Continuous Off** input is switched off. Dynamic monitoring of the valve and the monitoring of overtravel will only be performed one time in the continuous cycle. • Mode **Continuous Automatic** The behavior of monitoring corresponds to that of the mode **Single Stroke**, however the press does not stop after one cycle. The movement is continued until the **Continuous Off** input is switched off even if the **Two-Hand Control** was released before. The **Two-Hand Control** is required only to start the movement of the press. Dynamic monitoring of the valve and monitoring of overtravel will only be performed one time in the continuous cycle.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Ensure that adequate safety-related measures are effective for each person working on the press.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Eccentric Press 2

Introduction

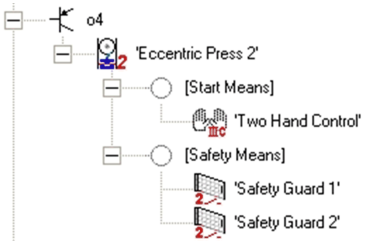
The *Specific Functions* folder contains the *Eccentric Press 2* device symbol.

The Eccentric Press 2 device is intended to monitor the operation of an eccentric press including stopping at the top dead center (**OTS**), the overtravel and optionally the press safety valve (**PSV**).

The Eccentric Press 2 device is more flexible than the device described in the Eccentric Press chapter. Also refer to the *Wiring diagram*, page 198.

In the configuration tree the Eccentric Press 2 device symbol provides 2 logical inputs to attach devices to. The dedication of those inputs is explained in the following table.

Devices, as for example two-hand controls, light curtains (w/o muting) and safety guards, can be attached to the inputs as start or safety-related means. Multiple assignments are possible.



By applying a Selector Switch device to the press the devices used as start or safety-related means may be changed during operation.

Input	Description
Firmware Versions < 2.40	
Safety Means and Start	The start means (e.g. two-hand control) and the safety-related means (for example safety guard) attached here have to be operated cyclically. The operation of the press can be started by any device attached here.
Safety Means for Continuous Automatic	The devices attached here are monitored in Continuous Automatic mode only. They do not need to be operated cyclically. To start the automatic mode the devices at the start input have to be activated.
Firmware Versions ≥ 2.40	

Input	Description
Start Means	The devices attached here need to be operated cyclically. Depending on the mode, they may become inactive when a cycle is started.
Safety Means	Devices attached here do not need to be operated cyclically. If they are not valid the operation of the press cannot be stated or has to be stopped (unless the safety-related means are muted).

Position switches **OTS** and **UN** detect the press movement and enable for stopping at the top dead center. For the functional diagram of the control cams refer to the *Eccentric Press chapter*, page 69.

With the valve contacts **PSV1** and **PSV2** the status of the press safety valve can be monitored optionally.

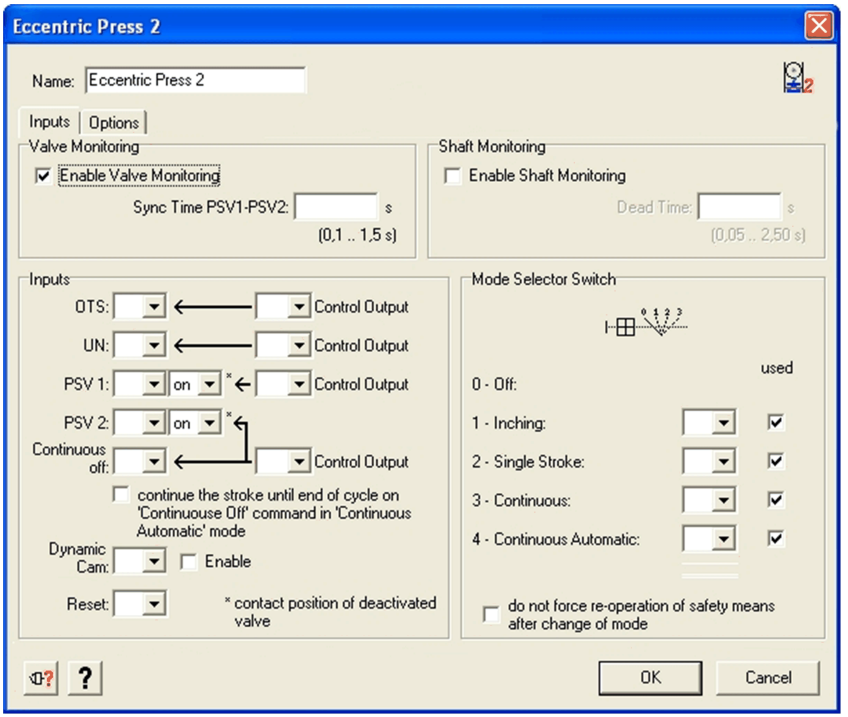
The range for the adjustable **Synchronization Time** is 0.1...1.5 s for a response time of 20 ms and 0.15...1.5 s for a response time of 30 ms. If this time is exceeded before both valve contacts were operated, an error will be indicated. The corresponding safety-related output becomes deactivated.

The reset input has to be actuated to reset an overtravel error or an error detected at the **UN** or **OTS** position switches. The error state of the press will not be cleared by resetting or switching off the controller.

The behavior of the output of the press depends on the operation mode selected. It is described in the operation Mode Selector Switch section below.

Dialog Box Settings

The **Eccentric Press 2** dialog box provides the following settings:



Option	Description
Name	A specific name can be assigned to the device.
Valve Monitoring	The optional valve monitoring can be activated and the allowable **Synchronization Time** for the safety-related valves contacts **PSV1** and **PSV2** can be adjusted. For the response time of 20 ms, the range is 0.1 to1.5 s and for the response time of 30 ms the range is 0.15 to 1.5 s.
Shaft Monitoring	The optional shaft monitoring can be activated and the allowable **Dead Time** can be adjusted. The dead time is the time before the shaft monitoring becomes active after start of the press movement. For a response time of 20 ms, the range is 0.05...0.50 s and for a response time of 30 ms the range is 0.06...0.48 s. If you activate the shaft monitoring option a Shaft/Chain Break Monitoring device will be attached to the press automatically. This device needs to be configured separately.

Option	Description
Inputs	The used inputs and the control output must be indicated. • At the **OTS** input the top dead center (**TDC**) contact is to be connected. • At the **UN** input the bottom dead center (**BDC**) contact need to be connected. • The **PSV1** and **PSV2** inputs are for the monitoring contacts of the 2 halves of the press safety valve (**PSV**). • The **Continuous Off** input is used in **Continuous** and **Continuous Automatic** mode, see below. The input is below threshold (logical 0). • The **Reset** input is used to reset the error state of the press. Connect a key switch. • For the **Mode Selector Switch** the inputs to activate the different modes need to be defined. One input only must be active at a time. • For controllers with firmware version 2.40 or later there is an input to connect a **Dynamic Cam** signal. The use of this input is optional. The Dynamic Cam option is described below. • The inputs that are not driven by a control output need to be connected to the external supply (nominal +24 V).
Mode Selector Switch	The following operation modes are available: • **Mode Off** If no mode selection input is activated, Off mode is assumed. The press is deactivated and the corresponding safety-related output is turned off. • **Mode Inching** Position switches **OTS** and **UN** as well as the switches of the valves **PSV1** and **PSV2** will not be monitored. The movement of the press is controlled by the status of the start condition only. • **Mode Single Stroke** The movement of the press starts when the safety-related means are valid, the start is activated and the press is in **TDC**. As long as the safety-related and start means stay valid and there is no press error detected the cycle will be continued until **TDC** is reached again. In **TDC** the movement will stop even if the conditions for movement are still valid. To restart the press the start means need to be released and activated again. While upstroke the status of the start and safety-related means is not monitored (muted). • **Mode Continuous** The behavior correspond to that of the **Mode Single Stroke**, however the press does not stop after one cycle. The movement will be continued until the start condition or the safety-related means are no longer valid or the Continuous Off signal is switched off. Dynamic valve monitoring and monitoring of overtravel will only be performed at the first cycle. • **Mode Continuous Automatic** The behavior correspond to that of the **Mode Single Stroke**, however the press does not stop after one cycle. The movement will be continued until the Continuous Off signal is switched off or the safety-related means become invalid. Dynamic valve monitoring and monitoring of overtravel will only be performed at the first cycle. For controllers with a firmware version of 2.40 or later there is an option to prevent the need to re-operate the devices attached at the press after the operation mode was changed. The re-operation of only one device is sufficient to start a new cycle then. If, for example, safety guards are also attached to the press which do not need to be cyclically tested with the two-hand control, the re-operation of only one device may be preferred..

Option	Description
Options tab	For controllers with firmware version 2.40 or later there is an **Options** tab. The following options are available: • By default the start conditions in **Continuous Automatic** mode can be released right after the press starts to move. When the **press start until BDC** option is active then the start conditions must be activated until bottom dead center to enter the continuous operation. • With the **stop stroke in TDC** option the press can be forced to stop in inching mode at **TDC** even if the start condition is still valid. When the press stops at **TDC**, the start conditions must be deactivated and reactivated to restart the press movement. • With the **do not use Continuous Off in Continuous Mode** option active the status of the Continuous Off signal has no meaning for **Continuous Mode**. The use of the signal stays mandatory in **Continuous Automatic** mode.

⚠WARNING

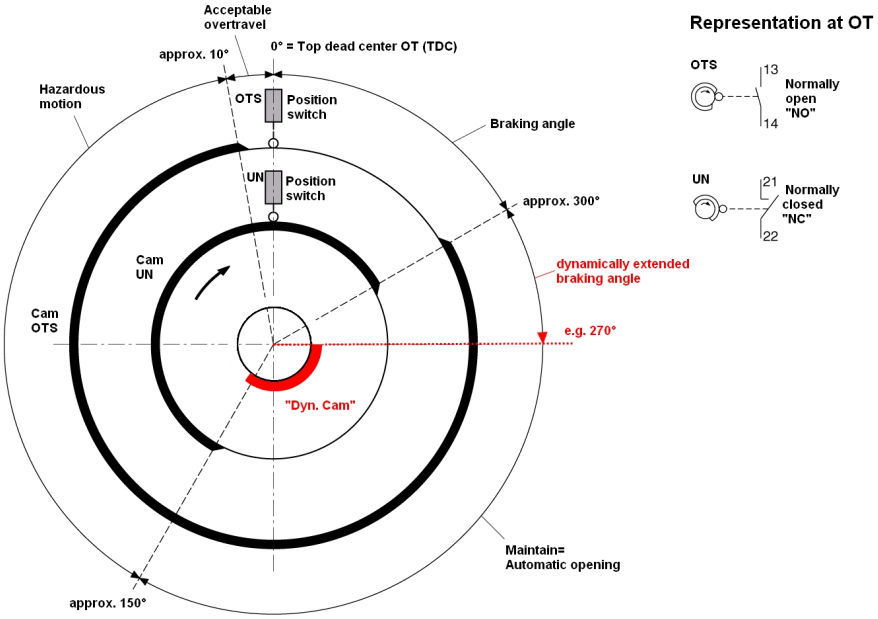
UNINTENDED EQUIPMENT OPERATION

Ensure that adequate safety-related measures are effective for each person working on the press.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Dynamic Cam Option

The dynamic cam option is shown in the following functional diagram:



When the speed of the press (cycles per minute) varies, then the start of braking also need to be variable in order to be able to stop the movement at the top dead center (**TDC**).

In the above example the braking should start at 270° instead of the invariable, fixed position of 300° indicated by the **UN** cam.

To achieve this, the XPSMC Safety Controller optionally allows to consider an external signal provided by a non-safety-related controller which calculates the variation of speed of the press and the appropriate braking point in relation to the **UN** signal. The Dynamic Cam signal overwrites the **UN** signal.

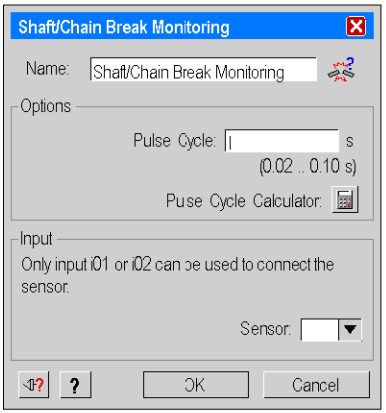
Shaft/Chain Break Monitoring

Introduction

The **Specific Functions** folder contains the **Shaft/Chain Break Monitoring** icon. The device is used to monitor the movement of a cam switch mechanism of an eccentric press, as shown in the Shaft/Chain-Break Monitoring, page 211. This device is directly linked to the OTS and UN position switches by a cogwheel sensor and can only be connected either to input i01 or i02. You can drag and drop the device from the library onto any output of the controller. For the **Eccentric Press 2** device, you can only enable the **Shaft Monitoring** device inside the **Properties** window.

Dialog Box Settings

The parameter setting window provides the following possibilities:



The table describes the following setting possibilities:

Option	Description
Name	A specific name can be assigned to this device.
Options	For the response time of 20 ms, the range is 0.02...0.10 s, and for the response time of 30 ms, the range is 0.03...0.9 s for the **Pulse** cycle.
Inputs	Only i01 or i02 are selectable.

NOTE: You can only use 2 different Shaft/Chain Break Monitoring devices in one XPSMC Safety Controller, because there are only 2 counter inputs (i01 and i02) available, see also Zero Speed Detection, page 57. If the Shaft/Chain Break Monitoring is used, no Zero Speed Detection can be used and vice versa.

Seat Valve Monitoring

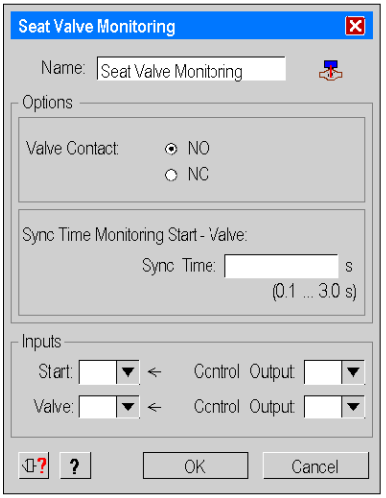
Introduction

The *Specific Functions* folder contains the device symbol for monitoring of a seat valve as shown in figure Wiring Diagram, page 214.

The device senses the start signal for operating the valve with the first input and the answer signal of the concerned valve contact with the second input.

Dialog Box Settings

The parameter setting window provides the following setting possibilities:



The table describes the following setting possibilities:

Option	Description
Name	A specific name can be assigned to this device.
Options	The function of the valve contact can be selected as either NO or NC. For the response time of 20 ms, the range is 0.1...3.0 s, and for the response time of 30 ms, the range is 0.15...3.0 s for the **Synchronization Time**.
Inputs	After the start signal is given and the valve contact is not operating, the output of the device is immediately activated and remains activated until the synchronization time is exceeded. The output only remains activated if the valve contact is operating during the synchronization time. After this, the valve contact may open and close without disrupting the output as long as the start signal is maintained. If the start command disappears, the output will be deactivated.

EDM Devices

Overview

This section contains the description of the *Eccentric Press* folder.

EDM Device (External Device Monitoring)

Introduction

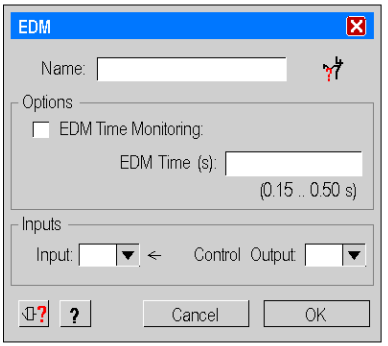
The *EDM Device* folder contains the device symbol for monitoring a feedback loop. This device is used to monitor external devices such as subsequent contactors or relays.

If, for example, external contactors K1 / K2 are activated, the EDM input to which opening contacts K1 and K2 are assigned must then be opened, by the end of the adjustable synchronization time at the latest. If this is not the case, an error message appears and the safety-related outputs concerning K1 and K2 are deactivated.

Before activating the safety-related output, ensure that the EDM input is activated. Otherwise, an error message appears, and the safety-related output gets deactivated.

Dialog Box Settings

The parameter setting window provides the following setting possibilities:



The table describes the following setting possibilities:

Option	Description
Name	A specific name can be assigned to this device.
Options	A synchronization time, during which the return circuit must open, can be entered in this field. If this time is exceeded, the corresponding safety-related output is deactivated. For the response time of 20 ms, the range is 0.1...0.5 s, and or the response time of 30 ms, the range is 0.15...0.5 s for the **Synchronization Time**. If the **Synchronization Time** monitoring is not activated, it is verified whether the EDM input is closed immediately before activating the safety-related outputs.
Inputs	The safety-related input and the control output must be indicated in this field.

Start Device

Overview

This section contains the description of the **Start Device** folder.

Start Device

Introduction

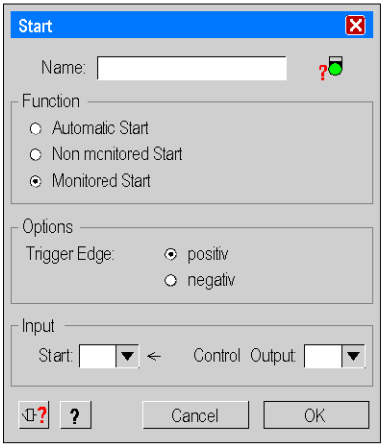
The *Start Devices* folder contains 3 device symbols for

- Automatic Start,
- Non-Monitored Start,
- Monitored Start.

The functional diagram for these devices is shown, as an example, in figure Functional Diagram, page 148.

Dialog Box Settings

The parameter setting window provides the following setting possibilities:



The table describes the following setting possibilities:

Option	Description
Name	A specific name can be assigned to this device.
Function	You can then select one of the starting devices again in this field. The device symbol in the configuration tree is adapted automatically. The following options are available: • **Automatic Start** The safety-related outputs are activated as soon as the starting conditions are fulfilled. A start button is not necessary. • **Non monitored Start** The safety-related outputs are activated as soon as the starting conditions are fulfilled and starting is initiated by the start button being pressed. The **Start** button does not need to be re-activated to launch the **Start** device, and the non monitored start then operates in the same way as the automatic start. • **Monitored Start** In this case, the safety-related outputs are only activated when the starting conditions are fulfilled and starting is initiated when the start button is pressed (start on a positive trigger edge) or when the start button is pressed and released (start on a negative trigger edge). It is possible to define whether starting should take place on the positive-going edge or negative-going edge of the starting signal. Unlike non monitored starting, the safety-related output cannot be activated when the start button is actuated by an XPSMC Safety Controller Power-Up or when the start button keeps being activated a certain time after the operation. In this case an error message will be generated.
Options	For monitored start, a selection can be made in this field to start on a positive trigger edge (= starting when the start button is pressed) or to start on a negative trigger edge (= starting when the start button is released).
Inputs	The safety-related input and the control output must be indicated here.

Enabling Devices

Overview

This section contains the description of the **Enabling Devices** folder.

Two-Channel or Three-Channel Enabling Device

Introduction

The *Enabling Devices* folder contains 2 device symbols for the enabling switch. This device can be used alone on a safety-related output, with a safety guard or together with a safety guard on the OR device.

NOTE: The enabling device can be dragged and dropped together with a safety guard onto the OR device. An external switch (usually a key switch) should be used to enable the input of the enabling device.

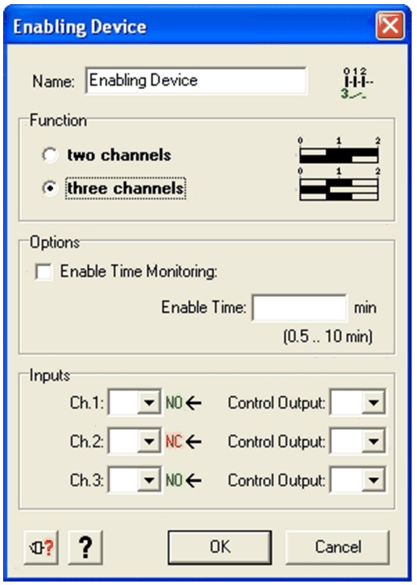
With an enabling switch, a safety guard can be bypassed and a hazardous movement can consequently be started, even with a protection door open, during the fitting out of a machine for example. The enabling switch does not activate the hazardous movement but enables the hazardous movement to be actuated.

This function works with a two or three channel enabling switch (Wiring Diagram, page 216 or figure Wiring Diagram, page 218). Category 4 is only achieved when using the 3 position enabling switch. For the types of enabling switches that can be used, see the *Technical Data* chapter of the Hardware instruction manual.

To generate the confirmation signal, the enabling switch must first be set to position 0 and then to position 1. The authorization is thus activated, as are the XPSMC Safety Controller safety-related outputs. If the enabling switch reaches position 2, the safety-related outputs are deactivated. No further enabling will be authorized before the switch has returned to position 0.

Dialog Box Settings

The parameter setting window provides the following setting possibilities:



The table describes the following setting possibilities:

Option	Description
Name	A specific name can be assigned to this device.
Function	You can select one of the enabling switches in this field. The switching diagram needed for the contact switch is schematically illustrated here.
Options	You can specify a maximum enable time. If the enabling switch is active longer than this time, the corresponding safety-related outputs will be deactivated and an error message will be given. The time is adjustable from 0.5...10 min.
Inputs	The safety-related inputs and control outputs used must be indicated in this field. To provide a cross-circuit detection, the contacts must be set into service on different control outputs.

Miscellaneous Devices

Overview

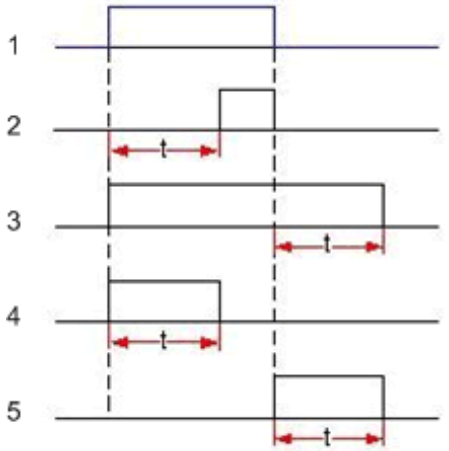
This section contains the description of the *Miscellaneous Devices* folder, which contains the logic devices.

Timer

Introduction

The *Miscellaneous Devices* folder contains the *Timer* device.

The Timer device facilitates 4 time-dependent behaviors as shown in the figure below. Time **t** is adjustable.



1 Input

2 Switch-ON delay

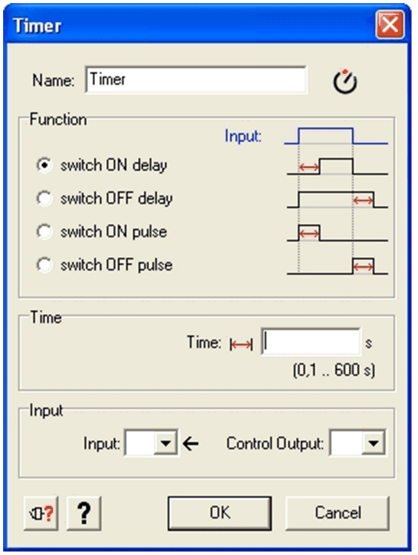
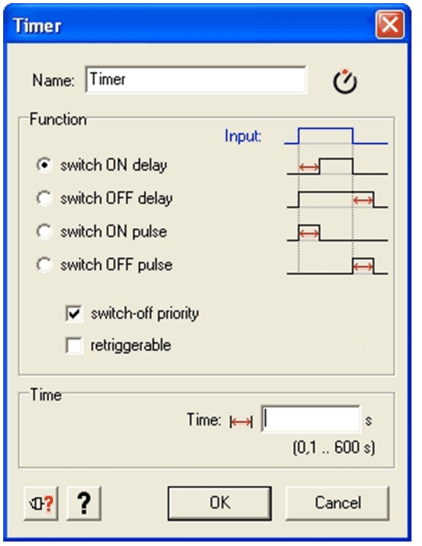
3 Switch-OFF delay

4 Switch-ON pulse

5 Switch-OFF pulse

Dialog Box Settings

The **Timer** dialog box provides the following setting:

Firmware version < 2.40	Firmware version ≥ 2.40
	

Option	Description
Name	A specific name can be assigned to this device.
Function	One of the 4 operating modes can be selected. • **Switch ON delay** If the input status becomes TRUE the adjustable time delay starts. If the delay has passed and the input is still TRUE then the result of the Timer becomes TRUE as long as the input status keeps staying TRUE. If the input status does not stay TRUE for the whole delay time, then the Timer status will not become TRUE. For controllers with firmware version 2.40 or greater, this behavior can be changed by deselecting the **switch-off priority** check box. In this case the Timer status can become TRUE even if the input signal was interrupted during delay time. • **Switch OFF delay** If the input signal becomes TRUE the timer status becomes TRUE too. If the input status changes to FALSE the adjustable delay starts and the timer status stays TRUE as long as the delay time is running. If the input status becomes TRUE again while the time delay is still running then the status of the Timer remains TRUE. • **Switch ON pulse** If the input status becomes TRUE the timer status becomes TRUE too and the adjustable pulse time starts. If the time has passed the timer status is set to FALSE again. The Timer status will also be FALSE when the input becomes FALSE during pulse time. Thus the pulse will be interrupted. For controllers with firmware version 2.40 or greater this behavior can be changed by deselecting the **switch-off priority** check box. In this case the Timer status will be TRUE for the whole pulse time even if the input status is not. • **Switch OFF pulse** If the input status was TRUE and changes to FALSE then the timer status is set to TRUE and the adjustable pulse time starts. The timer status stays TRUE until the pulse time passed. For controllers with firmware version 2.40 or greater, re-triggering can be allowed optionally by selecting the appropriate check box. When selected, the delay or pulse times will restart when trigger conditions repeat. The re-triggering and the switch-off priority options exclude each other.
Time	The adjustable delay time range is 0.1* to 600 seconds. (* 0.15 seconds if controller response time is set to 30 ms)
Input	If the controller firmware version is less than 2.40 and no other device was selected as an input then the safety-related input and the control output or external supply used for the input signal must be indicated here. For firmware versions of 2.40 or greater, a device has to be attached to the timer symbol to define the input signal. This may be a Switch device in case an external input shall be used.

For controllers with a firmware version 2.40 or greater, the Timer device needs an input device (e.g. Switch or Logic device). For firmware versions less than 2.40 the input device is optional. An external input can also be defined inside the **Properties** dialog box of the Timer.

Pulse Generator

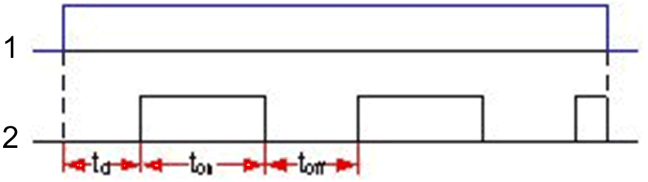
Introduction

In the *Miscellaneous Devices* folder contains a *Pulse Generator* device.

The Pulse Generator device provides a configurable pulse signal in dependence of an input signal.

As long as the input signal is TRUE the output signal will be generated.

When the input signal becomes FALSE, the pulse signal will be stopped and a current pulse will be interrupted (see image below). The input signal is the result of another device that need to be attached to the Pulse generator symbol.

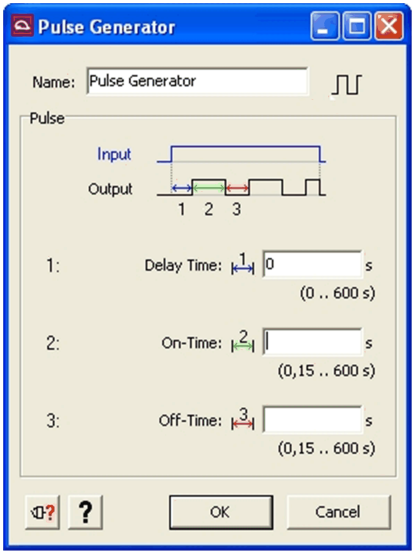


1 Input

2 Output

NOTE: The Pulse Generator device is available in firmware 2.40 or greater.

Dialog Box Settings



The **Pulse Generator** dialog box allows the following settings:

Option	Description
Name	A specific name can be assigned to the device.
Pulse	The pulse is described by 3 parameters: • **Delay Time t_d**: The time between a valid input signal (input becomes TRUE) and the first pulse (output becomes TRUE). Allowable range is from 0 to 600 seconds. The default value is 0. • **On-Time t_{on}**: The duration of a single pulse (output TRUE). Allowable range is from 0.1* to 600 seconds. • **Off-Time t_{off}**: The duration of a pulse pause (output FALSE). Allowable range is from 0.1* to 600 seconds. (* 0.15 seconds if controller response time is set to 30 ms)

The Pulse Generator device needs an input device (e.g. Switch or Logic device).

Logic Devices

Introduction

The *Miscellaneous Devices* folder contains a subfolder *Logic Devices*.

In this folder the following logic devices can be found:

- AND
- OR
- XOR
- NOT
- RS-Flip Flop

  NOTE: The Logic Devices are available in firmware 2.40 or greater.

Attachable to

Logic Devices can be attached to:

- Outputs
- Markers
- other Logic Devices
- Timers/Pulse Generators

Input Restrictions

Devices that cannot be attached to Logic Devices are:

- Emergency Stop (can be attached to outputs only)
- EDM (can be attached to outputs only)
- Hydraulic Press (can be attached to outputs only)
- Eccentric Press (can be attached to outputs only)
- Automatic Start (result is static)
- Closed Tool (result is static)

Input Restrictions for NOT Logic Devices

Specifically for NOT logic devices the possible inputs are restricted to:

- 1 state of another output
- 1 Marker
- other Logic Devices
- Switches

A maximum of 255 devices can be attached to logic devices. The NOT logic device accepts only 1 device attached.

AND

The result of an AND is TRUE as long as the result of **all** attached devices is TRUE.

This device has no editable properties.

NOTE: If there are more than 1 devices are attached to some device in the configuration tree, those connections are seen as AND connections in most of the cases even if there is no explicit AND device. Exceptions are connections to Logic Devices (connection depends on type of device) and connections of start devices (are taken for OR connections).

OR

The result of an OR is TRUE as long as the result of **at least 1** of the attached devices is TRUE.

This device has no editable properties.

NOTE: If more than 1 start devices are attached to some device in the configuration tree this connection is seen as an OR connection even if there is no OR device involved explicitly.

XOR

If there are 2 devices attached to the XOR device the result of an XOR is TRUE as long as the result of **exactly 1** of the 2 attached devices is TRUE.

More generally defined (valid for even more than 2 devices attached) the result is TRUE as long the count of the TRUE results of the attached devices is odd.

This device has no editable properties.

NOT

The NOT logic device performs an inversion (negation) of its input. The result is TRUE as long as the result of the attached device is FALSE and vice versa.

The NOT logic device accepts only 1 device attached.

⚠WARNING
UNINTENDED EQUIPMENT OPERATION • Ensure that the required safety level of the application is not compromised by using the NOT logic device. • Carefully analyze the inputs and outputs to be inverted and understand how the inversion (negation) affects the application, especially in terms of safety. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Inverted Outputs and inverted Markers are marked in the configuration tree by inversion (negation) of the original icons. In addition, an advisory message appears when NOT logic devices are used in a configuration.

This device has no editable properties.

RS-Flip Flop

The RS-Flip Flop device has 2 inputs, the Set (S) and the Reset (R) input.

If the result of the devices attached to the Set input is TRUE then the result of the RS-Flip Flop (Q) is TRUE.

If the result at the Reset input becomes TRUE the result of the RS-Flip Flop will be reset to FALSE.

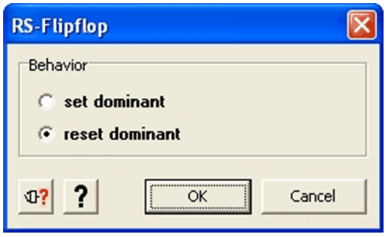
If both inputs are TRUE at the same time then the result of the RS-Flip Flop is determined by the dominant input.

Which of the inputs is the dominant one can be selected in the **Properties** window of the device. By default the Reset input is the dominant one.

The status of the RS-Flip Flop remains unchanged as long as both inputs receive a FALSE signal.

R	**S**	**Q** **Reset is dominant**	**Q** **Set is dominant**
FALSE	FALSE	Q	Q
FALSE	TRUE	TRUE	TRUE
TRUE	FALSE	FALSE	FALSE
TRUE	TRUE	FALSE	TRUE

In the RS-Flip Flop dialog box, you can select whether the Set or the Reset input is dominant.



Switches

Introduction

The *Miscellaneous Devices* folder contains a subfolder *Switches*.

In this folder the following basic switch devices can be found:

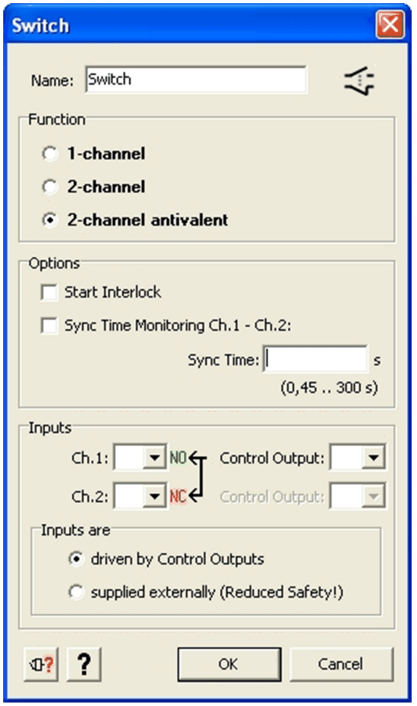
- 1-channel
- 2-channel
- 2-channel antivalent

Switches can be seen as representation of external contacts.

NOTE: The switches are available in firmware 2.40 or greater.

The 3 switches share the same dialog box.

Dialog Box Settings



The **Switch** dialog box allows the following settings:

Option	Description
Name	A specific name can be assigned to the device.
Function	One out of the 3 switch types can be selected.
1-channel	This device represents a single contact switch. The result of the device is TRUE as long as the external contact is closed (given the contact is connected to a control output or the external supply). For this device a start interlock can be defined. When the option is active the external contact has to be seen open before the result of the device can become TRUE after a power cycle or emergency stop.
2-channel	This device represents a 2-contact switch with similar type of contacts. The result of the device becomes TRUE when both external switch contacts are closed (given they are connected to a control output or the external supply). For this device a start interlock can be defined. When the option is active both contacts have to be seen open at the same time before the result of the device can become TRUE after a power cycle or emergency stop.

Option	Description
	Optionally a synchronization time monitoring can be configured. When the monitoring is active the result of the device will not become TRUE if the time between closing of the 2 contacts is longer than the chosen synchronization time
2-channel antivalent	This device represents a 2-contact switch with an NO contact and NC contact. The result of this device is TRUE if the NO contact of the switch is closed and the NC contact is open at the same time (given they are connected to a control output or the external supply). For this device a start interlock can be defined. When the option is active the NO contact has to be open and the NC contact to be closed at the same time before the result of the device can become TRUE after a power cycle or emergency stop. Optionally a synchronization time monitoring can be configured. When the monitoring is active the result of the device will not become TRUE if the time between opening of the NC contact and closing of the NO contact is longer than the chosen synchronization time.
Options	The **Start Interlock** can be activated. The synchronization time monitoring (**Sync Time Monitoring**) can be enabled (except for single channel switches). If the monitoring is enabled a synchronization time (**Sync Time**) need to be set. The range is from 0.5 to 300 seconds if the controller response time was set to 20 ms or from 0.45 to 300 seconds if the response time is 30 ms.
Inputs	The inputs to connect the external contacts need to be chosen. It can be defined whether the contacts are driven by control outputs or by the external supply. In the later case the control outputs need to be selected. **NOTE:** If no control outputs are used, there is no cross-circuit detection for the inputs. External means may be necessary to achieve the required safety level. For further information refer to chapter *Use of Control Outputs*, page 42.

Markers

Introduction

The *Miscellaneous Devices* folder contains a *Marker* device.

Markers can be used like Outputs but have no physical representation.

The result of a Marker can be used elsewhere in the configuration as an input signal (as far as the device specific rules allow).

To use Markers may be of benefit, for example, when provisional results are used at different parts of the configuration, or to group devices to make a configuration more structured.

Up to 255 devices can be attached to a Marker. The result of a Marker becomes TRUE when the results of all the attached devices are TRUE and the start signal is valid. If no start device is defined for a Marker. It will behave as if start is always valid (automatic start).

Up to 8 markers can be defined per controller.

NOTE: Markers are available in firmware 2.40 or greater.

Usage

To use a Marker, the marker symbol from the library (see item number 1 in figure below) needs to be dropped onto the configuration tree.

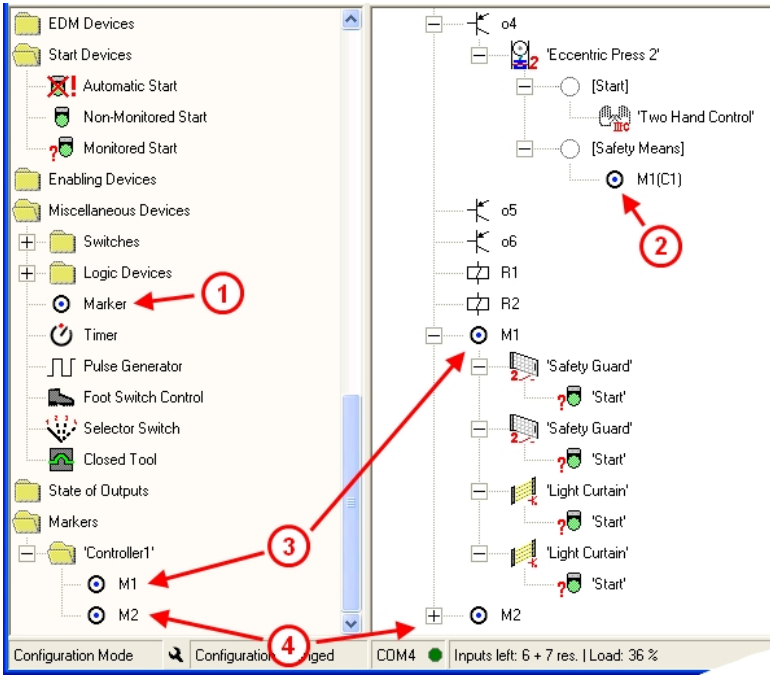
If it is dropped to the controller symbol, a Marker will be created at the output level.

If the marker symbol is dropped to a device other than a controller, a Marker will be created at the output level and a copy of this Marker at the device it is dropped onto (given the specific device accepts markers).

A Marker at the output level accepts the same device attachments as an output.

Copies of those output level Markers can be used elsewhere in the configuration as long as the specific rules of the target devices allow for it (see item number 2 in figure below).

Each Marker used in a configuration has a representation in the Markers folder of the library (see item number 3 and 4 in the figure below).



Copies of Markers

Copies of Markers can be brought into the configuration in 3 ways:

- By dragging-and-dropping the library representation of a Marker into the configuration,
- by dragging the symbol of an output level Marker and dropping it onto the device it should be used with,
- by copying a Marker at output level (using the **Edit** menu, the contextual menu or using Ctrl+C) and placing it at the target device.

The number of copies is not limited. Onto copied Markers no devices can be attached.

The copied Markers can be deleted separately. If an output level Marker is deleted the copies will be deleted, too.

Markers do not have a **Properties** dialog box.

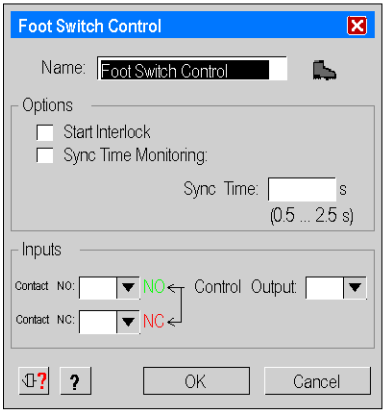
Foot Switch Control Device

Introduction

The *Miscellaneous Devices* folder contains the *Foot Switch Control* device symbol. The device monitors a NO and NC contact from one control output.

Dialog Box Settings

The parameter setting window provides the following setting possibilities:



The table describes the following setting possibilities:

Option	Description
Name	A specific **Name** can be assigned to this device.
Options	• **Start Interlock**: Foot switch must be released before starting the foot switch function. • **Sync Time Monitoring**: for the response time of 20 ms, the range is 0.5...2.5 s, and for the response time of 30 ms, the range is 0.45...2.4 s for the Synchronization Time, required for the 2 inputs, NO and NC.
Inputs	The inputs to connect the foot switch to must be indicated here. You also need to choose the control outputs or alternatively external supply (nominally +24 VDC) to drive the inputs. **NOTE:** If the inputs are supplied externally no cross-circuit detection is available. You may need to achieve the required safety level by other means. For further information refer to chapter *Use of Control Outputs*, page 42.

⚠ DANGER

UNPROTECTED MACHINE OPERATIONS

Do not use foot switches on machines without point-of-operation protection.

Failure to follow these instructions will result in death or serious injury.

NOTE: The use of the foot switch requires additional safety-related measures. The foot switch does not provide technical safety for a press control. Example: In order to control the continuous mode of a press with the foot switch, additional safety-related means are necessary (e.g., Safety Guard, Light Curtain).

Selector Switch

Introduction

The *Miscellaneous Devices* folder contains the *Selector Switch* device symbol.

You can use the Selector Switch device when different devices shall be selected as safety-related means or start means alternatively.

The Selector Switch device symbol can be dropped either onto the Eccentric Press 2, the Hydraulic Press 2 or directly onto an output.

A maximum of 16 devices can be attached to the Selector Switch and up to 6 switch positions (i.e. selections) are configurable.

For each switch position you can decide which of the attached devices shall be active. If multiple devices are selected for 1 position, then the result of the Selector Switch will become TRUE only if all the activated devices are TRUE.

Which switch position is activated is determined by physical inputs. For each switch positions used, an input has to be assigned.

Additionally, you can chose whether or not the attached devices need to be re-operated after the switch position was changed (controller firmware 2.40 or later required).

When the Selector Switch is assigned to a press device, then it can be linked to the operation mode selector switch of this press device. That means both switches share the same inputs for activation.

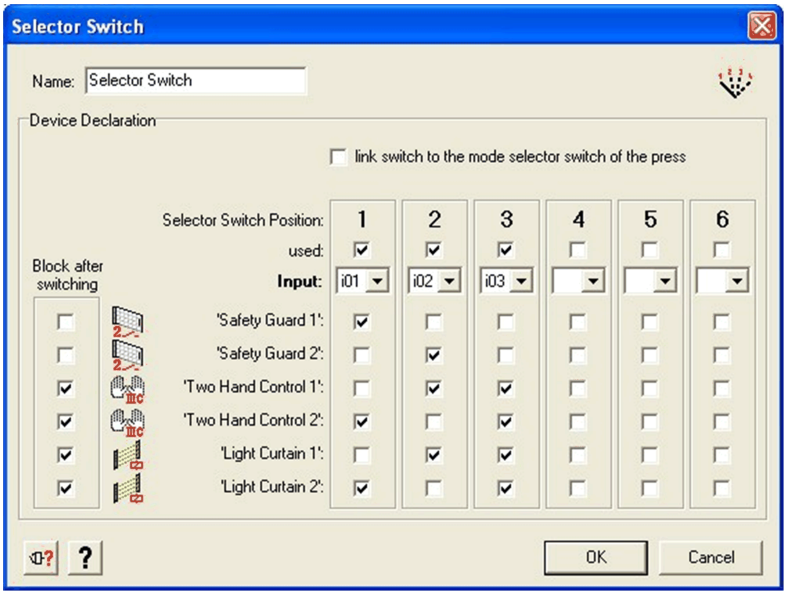
A physical representation would be a selector switch with 2 decks.

In case both switches shall be linked you need to make the input selection for the mode selector switch of the press before the configuration of the Selector Switch device.

No input selection is possible within the Selector Switch dialog box but the inputs are taken from the linked press device automatically.

Dialog Box Settings

The **Selector Switch** dialog box provides the following settings:



Option	Description
Name	A specific name can be assigned to the device.
Device Declaration	The **link switch to the mode selector switch of the press** check box is available only when the Selector Switch is attached to a press device. When selecting it, you force the Selector Switch to share the same inputs for activation as the mode selector switch of the press. The inputs of the mode selector switch of the press need to be defined before this option can be activated. When it is activated, then no inputs may be selected in the dialog box. Following the dialog box presents a table with the switch positions in the columns. With the **used** check boxes in the first row you can select the positions of the switch to be used. Alternatively they are set automatically when an input will be selected for a position. In the **Input** row you need to choose the inputs to be used to activate the positions. A position becomes activated when the related input is connected to the external supply. One position only must be active at a time. The following rows list the devices attached to the Selector Switch. You may choose for each position which of the devices shall be activated with that position. Multiple selections are possible. By default, all devices need to be re-operated when the switch position was changed. That means the switch cannot be activated until all attached devices are tested while the devices are off. Otherwise it is blocked. For controllers with firmware version 2.40 or greater, the **Block after switching** check boxes are available. You can use them to define for each device if it needs to be re-operated, i.e. tested, or not.

Closed Tool Device

Introduction

The *Miscellaneous Devices* folder contains the *Closed Tool* symbol. You can use this device with a *Selector Switch* and an additional start device (e.g., *Foot Switch Control*) on *Hydraulic Press 2* or *Eccentric Press 2*. You can also move it directly to the safety-related means for continuous automatic operation of the Eccentric Press 2.

When you configure the *Closed Tool* device directly to the *Safety Means* for continuous automatic operation of the *Eccentric Press 2*, you also need an external key switch to enable the continuous automatic operation as well as a signal lamp.

State of Outputs

Overview

This section contains the description of the **Output states** folder.

Applying Output States to Other Safety-Related Outputs

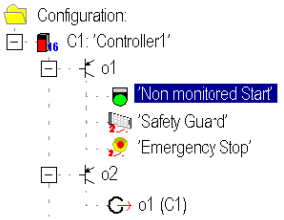
Introduction

The *Output states* folder contains the symbol of the safety-related outputs for each controller.

By moving the output X symbol on the output Y in the **Configuration** window, the safety-related output Y will have the same behavior as the safety-related output X. Other components can be additionally assigned to the output Y.

The same result will be achieved by moving the output X symbol with the left mouse button onto the output Y.

Example



In this example, safety-related output o1 is associated with **Non monitored Start**, **Safety Guard** and two-channel **Emergency Stop**. safety-related output **o2** represents the 2nd channel of this safety function and will behave exactly like **o1**.

Modifications can only be performed in the original safety function (in this case, safety-related output **o1**); they are taken into account automatically in the corresponding safety-related output.

Configuration

Overview

This chapter contains the description to create a configuration.

General Information

Overview

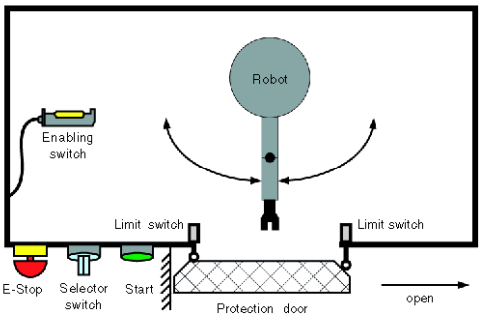
This section contains general information to the configuration.

Generals

Introduction

The configuration can be created while the PC is offline, that is without being connected with an XPSMC Safety Controller, and later sent to the XPSMC Safety Controller.

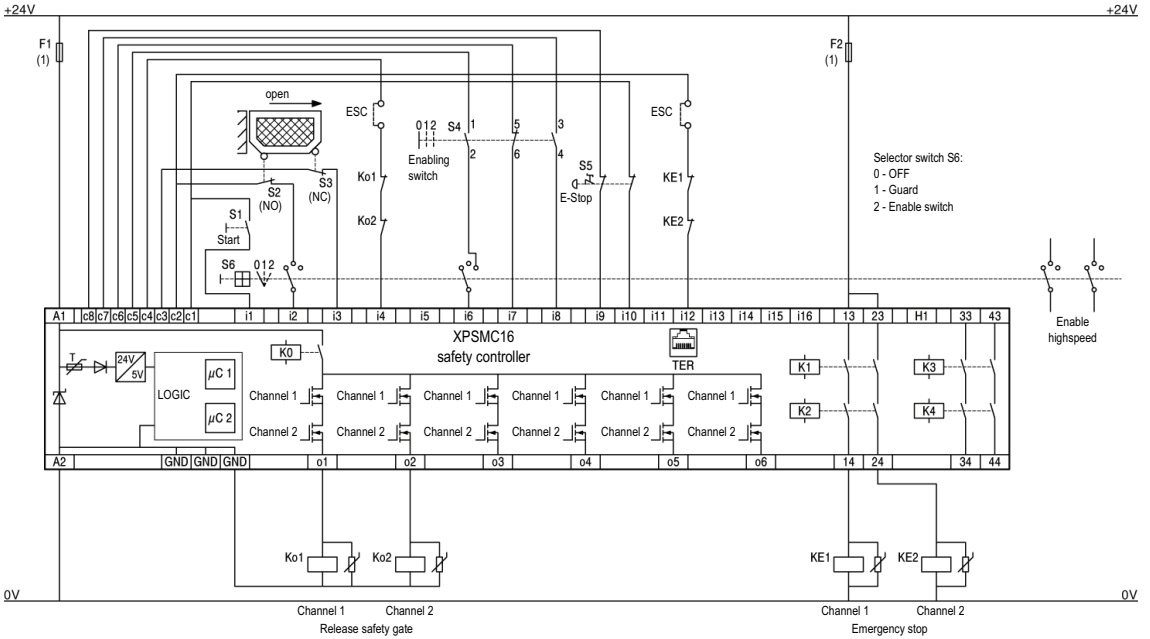
The creation of a configuration is explained by means of the following application:



The entry of personnel into the working area of the robot arm is prevented by the guard/ protection guard with 2 limit switches. For adjustment and maintenance purposes, the robot arm may also be controlled when the door is open by using an enabling switch. The choice of using the guard or enabling switch for functional safety is done by an external selector

switch mounted near the guard. The functional safety inside or around this cell is further enhanced with a two-channel emergency stop.

The corresponding wiring diagram could be as follows:

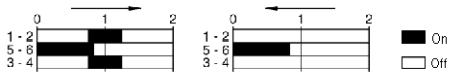


ESC External Start Conditions

(1) See Technical Data for maximum fuse size, Hardware manual

NOTE: XPSMC32 with 32 inputs i1...i32, otherwise identical

Enable switch contact:



An overview of the functions and their configurations is given in chapter Example Wiring and Functional Diagrams, page 140.

Maximum Response Time

You can select the response time for the XPSMC••Z versions. For the XPSMC••X versions, the response time is ≤ 20 ms. By selecting the response time, you can reduce the load of the

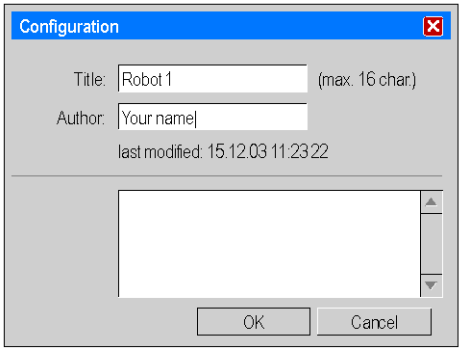
CPU. Note that when you change the response time in a configuration, configurable timers are set to zero and must be modified again. The limit ranges for the timers is also changed.

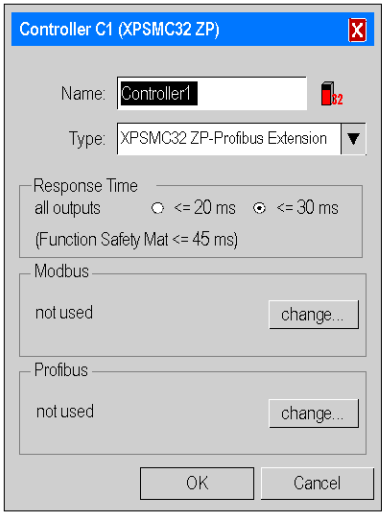
Creating an Application Configuration

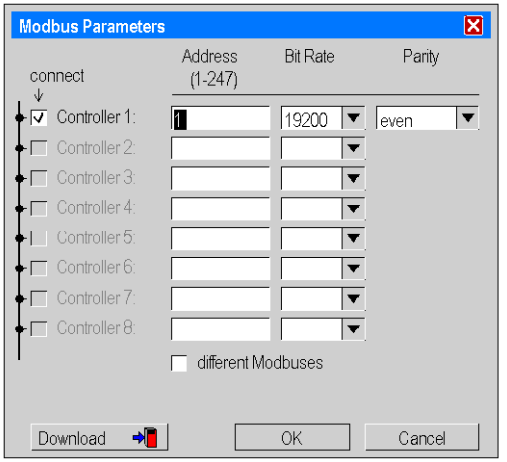
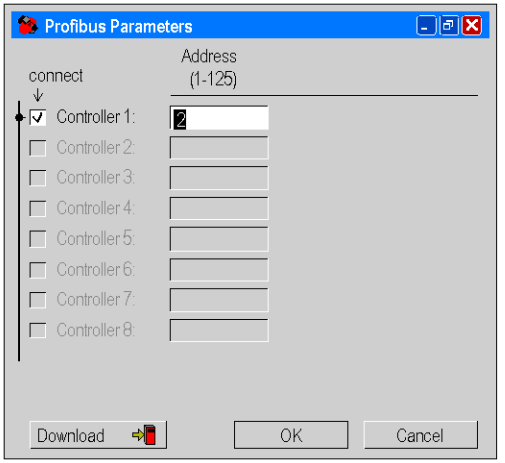
Selecting a Controller Type and Communication Settings

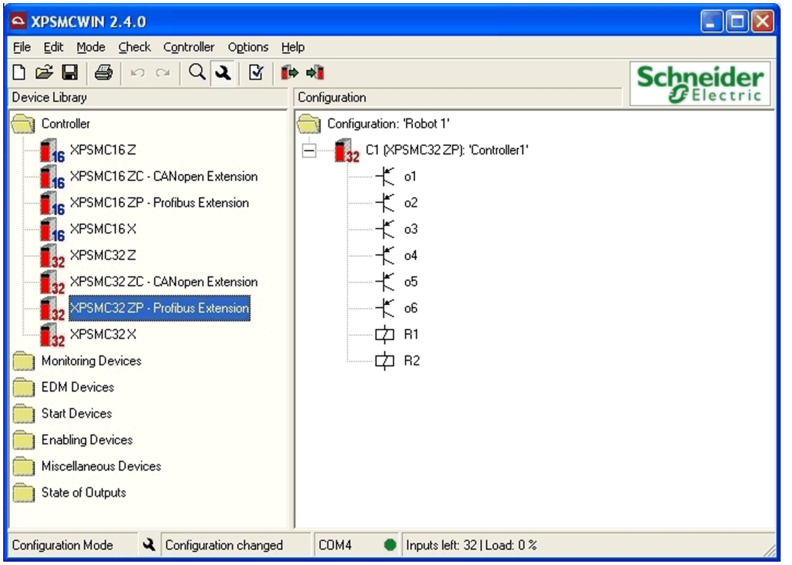
Procedure

Proceed as follows:

Step	Action
1	Start the XPSMCWIN configuration software.
2	Drag the symbol of the desired controller from the **Device Library** window into the **Configuration** window. When you release the left mouse button, a new configuration is automatically created.
3	The following **Configuration** dialog box appears:  **NOTE:** If the window does not open automatically, you are prompted to activate automatic opening in the **Options editor** menu option. Fill in the **Configuration** dialog box and click **OK**.

Step	Action
4	The following **Controller** dialog box appears:  Select the Response Time desired for the outputs. **NOTE:** You can select the response time for the XPSMC••Z versions. For the XPSMC••X versions, the response time is ≤ 20 ms.
5	Click on the relevant **change...** button to provide for adjustments for the Modbus and/or Profibus communication.

Step	Action
6	Fill in the window which has opened. The following figure shows the **Modbus Parameters** dialog box:  The following figure shows the **Profibus Parameters** dialog box:  If the PC is not connected to the XPSMC Safety Controller (Controller 1 in this example), the Modbus settings cannot be sent at this point. The settings would then need to be sent to the XPSMC Safety Controller once connected. You can download only the communication settings (not the entire Application configuration) for the Modbus and Profibus by clicking on the **Download** button when your PC is connected to the XPSMC Safety Controller.

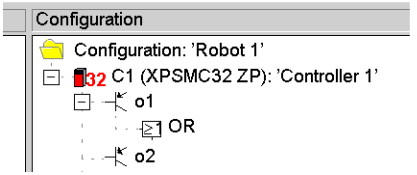
Step	Action
7	Click **OK**. **Result:** Your screen should now look like the one in this figure: 

Assigning the Selector Switch Position

Introduction

To continue with the configuration example, a selector switch needs to be configured, which determines if the machine will be started with the safety guard OR with the enabling switch (see the block diagram in the chapter Generals, page 104).

To configure this OR connection, the symbol of the OR device has to be first moved to the o1 output as follows:

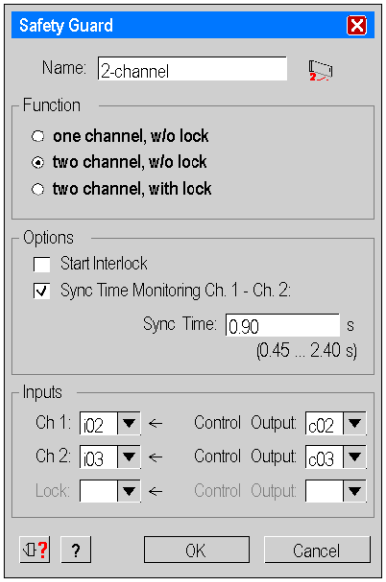
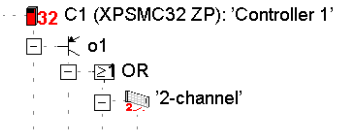


Later, you will program the OR function block and assign its inputs.

Assigning the Protective Guard Function

Procedure

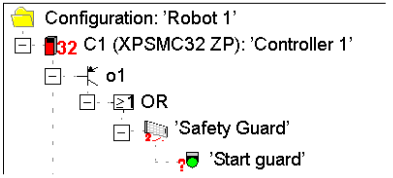
Proceed as follows:

Step	Action
1	In the *Safety Guard* folder (which is located in the *Monitoring Devices* folder), select the 2-channel protection door symbol, and drag it onto the symbol of the OR component. **Result:** A window opens, in which you have to define the function properties, for example: 
2	Confirm with **OK**. **Result:** The protection door device is then assigned with the OR component to safety-related output o1. 

Assigning the Starting Function

Procedure

Proceed as follows:

Step	Action
1	In the *Start Devices* folder, which is located in the *Monitoring Devices* folder, select the **Monitored Start** device symbol and drag-and-drop it to the **Safety Guard Device** in the configuration window. **Result:** A dialog box for the definition of the function properties opens. The following figure shows an example of the dialog box: 
2	Confirm with **OK**. **Result:** The **Monitored Start Device** is assigned to the Safety Guard device safety-related output o1. 

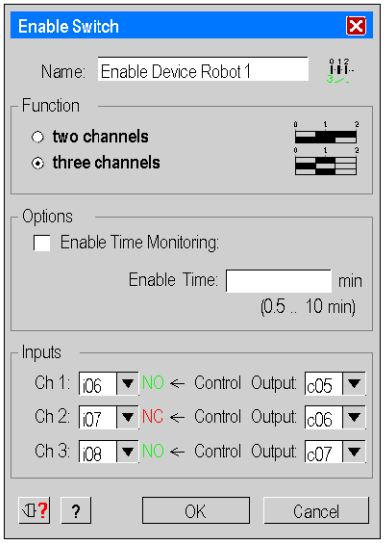
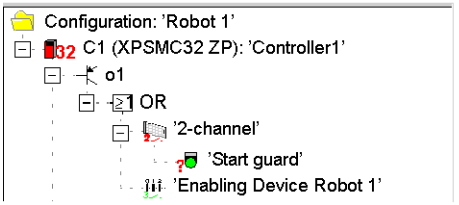
Assigning the Enabling Device

Introduction

According to this example application, the safety guard can be bypassed by the 3 channel enabling device. This gives the possibility for the Robot to run with the safety guard open when the 3 channel enabling device is used (when selector switch is in appropriate position).

Procedure

Proceed as follows:

Step	Action
1	Drag the 3-channel enabling device symbol from the *Enabling Devices* folder onto the **OR Device** symbol in the **Configuration** window and fill in the window. 
2	Confirm with **OK**. The following image shows the resulting configuration: 

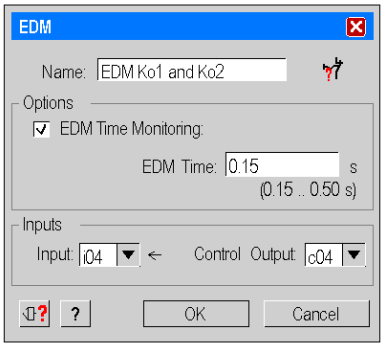
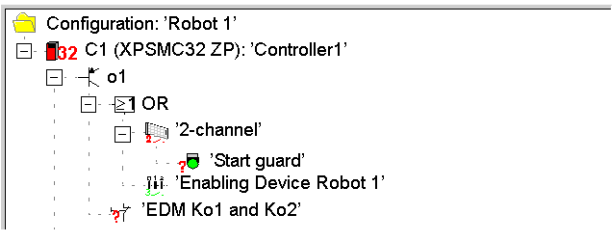
EDM Adjustment

Introduction

The opening contacts of switches Ko1 and Ko2 must be defined with a synchronization time of 0.2 s, i.e. within 0.2 s after the activation of safety-related outputs o1 and o2, and the return circuit must be open.

Procedure

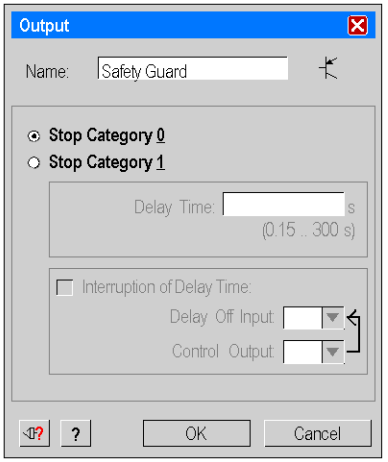
Proceed as follows:

Step	Action
1	Drag the EDM symbol from the *EDM Devices* folder onto symbol **o1** in the **Configuration** window. 
2	Confirm with **OK**. The following image shows the resulting configuration: 

Assign a Name and a Stop Category to a Safety-Related Output

Procedure

Proceed as follows:

Step	Action
1	Click the right mouse button on its function symbol in the **Configuration** window to assign a name and a stop category to safety-related output o1.
2	Select the **Properties** menu option. Indicate a name and the stop category. 
3	Confirm with **OK**. **Result:** This completes the configuration of safety-related output o1.

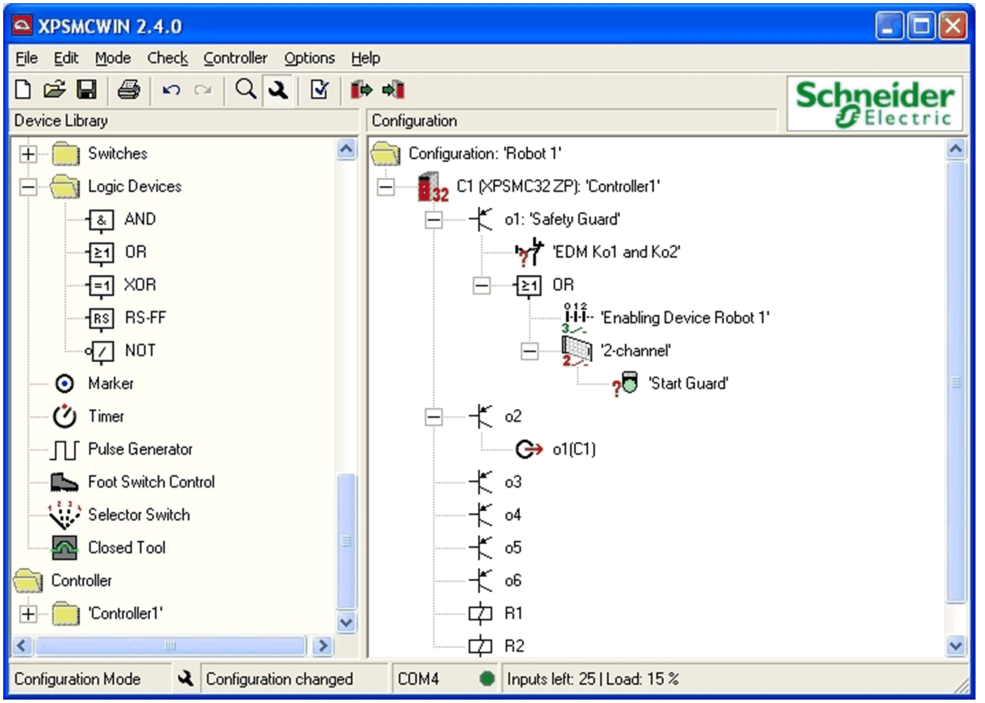
Copying the State of One Safety-Related Output onto another Safety-Related Output

Description

In our example, **o2** represents the 2nd channel of a safety-related control system, and must consequently behave exactly like **o1**. Left-click **o1** in the configuration window, then drag and drop it onto **o2**.

The global protection door function is then configured for safety-related outputs o1 and o2.

Your screen should look like the one below:



Configuring the Emergency Stop Function

Overview

This section contains the configuration description of the **Emergency Stop** function.

Emergency Stop

Description

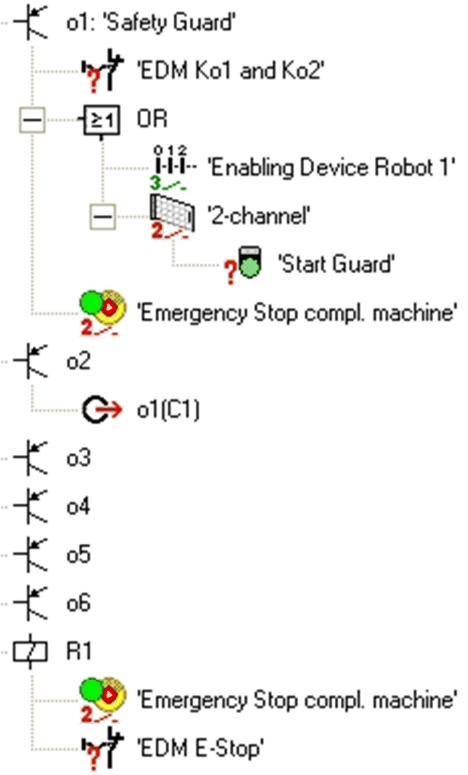
In our example, the global control system of the machine must be able to be stopped by means of Emergency Stop button S1 which activates free outputs 13 / 14 and 23 / 24 of

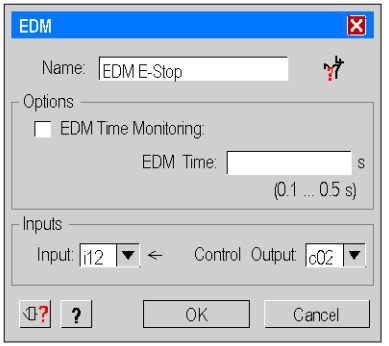
relay group R1. Their contactors KE1 and KE2 are assigned to provide that, when the machine is started, KE1 and KE2 are stopped in a statutory fashion.

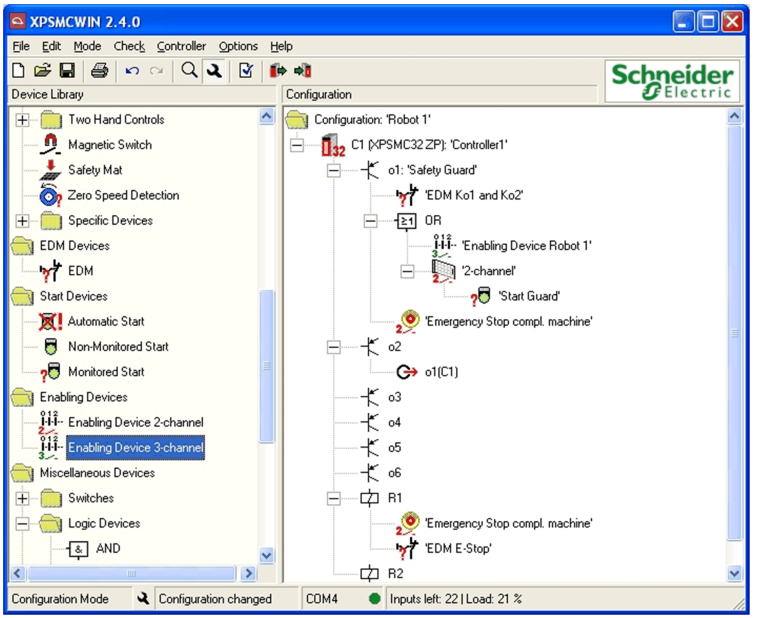
Procedure

Proceed as follows:

Step	Action
1	Drag the *Two-Channel Emergency Stop* symbol from the *Emergency Stop* folder (which is located in the *Monitoring Devices* folder) onto the output symbol of R1 in the **Configuration** window, and fill in the window. 
2	Confirm with **OK**. **Result:** Now the *E-Stop* device is assigned to the safety-related relays group R1.
3	To also assign the device to the solid state output o1, right-click on the *E-Stop* device in the **Configuration** window. Choose **Copy** from the selection. **Result:** The *E-Stop* device will then be copied with its properties.

Step	Action
4	Right-click on the symbol of the output o1. Select **Paste** and **as copy of device**. **Result:** The *E-Stop* device will now also act on the output o1, and as the output state o1 is linked with o2, it will also act on o2. **NOTE:** To view the copies of a device, right click on the device. Mark e.g. E-Stop and select the menu **Mark Copies**. On the copies a green bubble appears. To remove the bubbles click **Unmark Copies**. 

Step	Action
5	To adjust the return circuit, drag the EDM device symbol from the *EDM Devices* folder onto the symbol for R1 in the **Configuration** window, fill in the dialog box in accordance with the application. 

Step	Action
6	Confirm with **OK**. **Result:** This provides that the installation can only be started when KE1 and KE2 are closed and the external start conditions (ESC) are fulfilled. **NOTE:** If a control output c1...c8 has been used, a "*" follows the name, for example "c2*", appears when this output is selected. You must ensure that no hazardous situation can occur when this control output is used more than once, because a cross-circuit, for example, is no longer detected (refer to the hazard message hereafter). Your screen should now look like the one below: 
7	Complete the creation of the example configuration by saving and download it to the XPSMC Safety Controller.

⚠WARNING

LOSS OF CROSS-CIRCUIT DETECTION

- Ensure that the required safety level of the application is not compromised by using the same control output for different devices.
- Carefully analyze and understand how the circuits which are sharing control outputs interact in your application.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Master E-Stop Device

Description

An *E-Stop* device acts as a Master E-Stop on the other devices of the output. The other devices will be deactivated when the Master E-Stop is pressed. When this occurs, the start of this output is not possible until the start conditions of the other devices are met.

This is also available for the copies of the *E-Stop* devices.

NOTE: An Output State does not transfer a master E-Stop command on other devices.

Save the Configuration

Overview

This section contains the description to save the configuration.

Save

Description

The configuration can be saved by using the **File > Save** menu option (or by clicking on the floppy disk symbol button ) or by using the **File > Save As...** option and assigning a new path/name.

NOTE: When you close the configuration file and then open it again, a back-up copy is created in the same directory, with a *.mcb* extension. This way your last saved and closed configuration is stored as a back-up file.

Requesting/Changing the Password

Overview

This section contains the description of entering and changing the password.

Password

Enter Password

NOTE: Your PC must be connected to the XPSMC Safety Controller.

Each XPSMC Safety Controller command involving quitting the RUN mode (setting up the XPSMC Safety Controller for example) must be confirmed with a password. If such a command is performed, a dialog box opens in which the password must be entered.

Change Password

The default password is `safety`; it must be modified upon first use. The password must contain between 4 and 12 characters. Use a combination of letters and numbers.

The password can be modified with command **Controller > Change password**.

NOTE: The password is case sensitive.

Sending a Configuration from the PC to the XPSMC Safety Controller and Performing a Verification

Overview

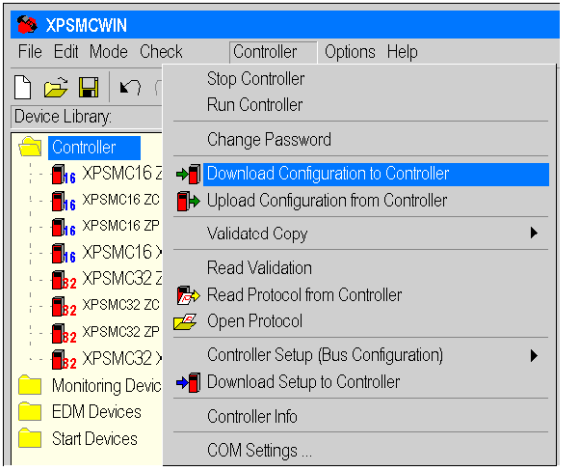
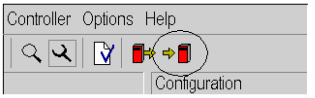
This section contains the description of sending a configuration.

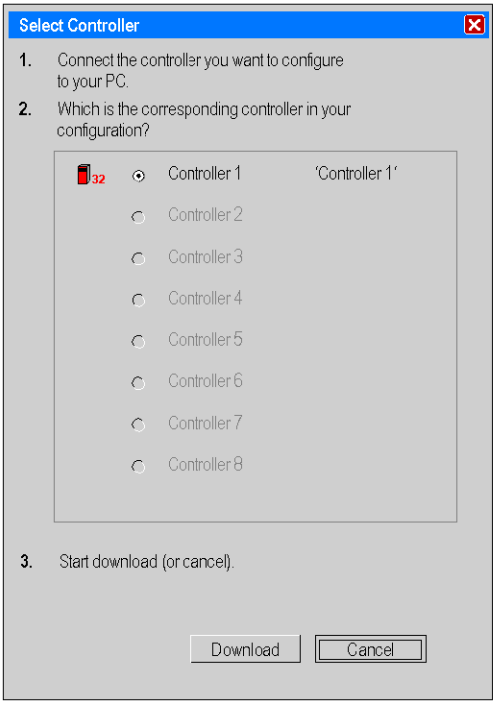
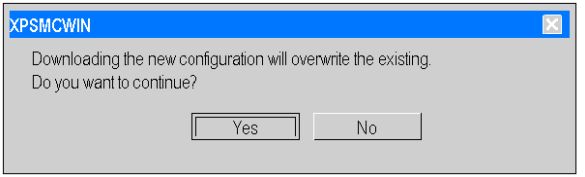
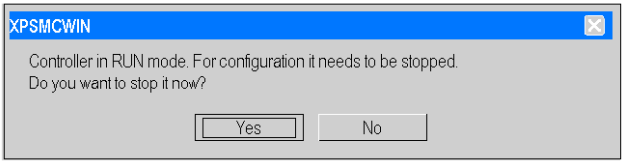
Sending a Configuration

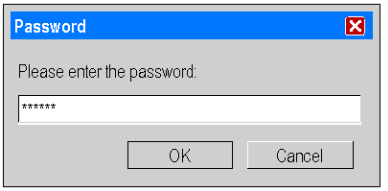
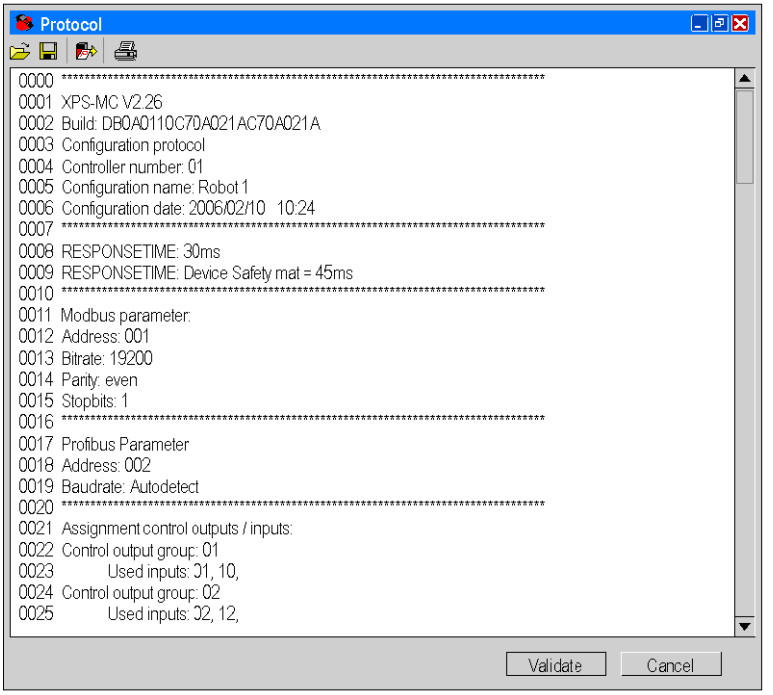
Procedure

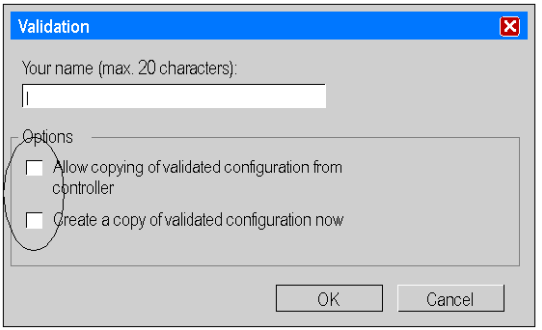
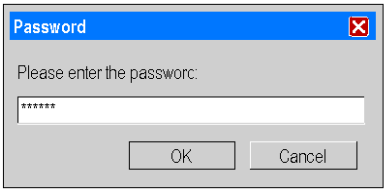
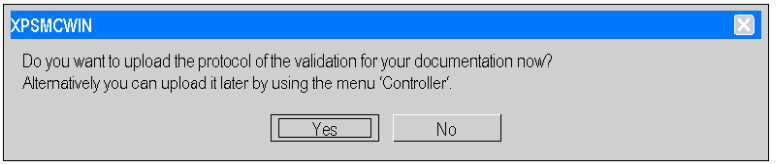
To send a completed configuration from the PC to the XPSMC Safety Controller, follow this procedure:

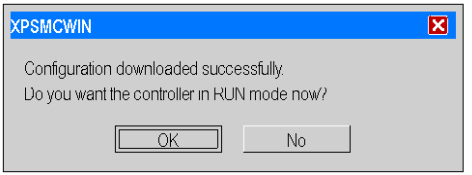
Step	Action
1	Select **Check > Check Configuration** to verify the configuration. You can click on the **Check Configuration** icon alternatively:  **Result:** If the configuration contains no errors, the following message box appears:  If the configuration contains errors, a yellow question mark will be seen, and a corresponding message box will appear. **NOTE:** The configuration will be verified for consistency. This neither verifies the functional safety nor the suitability of the configuration for your application. You are responsible to ensure this and to comply with all applicable codes and standards. **⚠WARNING** **UNINTENDED EQUIPMENT OPERATION** • You must carry out a risk assessment in accordance with ISO 12100. • Validate the entire system/machine in accordance with the required performance level and risk assessment. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Step	Action
2	Go to **Controller > Download Configuration to Controller** to download the configuration:  You can click on the **Configuration** icon alternatively: 

Step	Action
3	Click on the **Download** button.  **Result:** If the controller already has a configuration, the following message will appear: 
4	Click **Yes** to continue the procedure. **Result:** If the controller is in RUN, the following message will appear: 

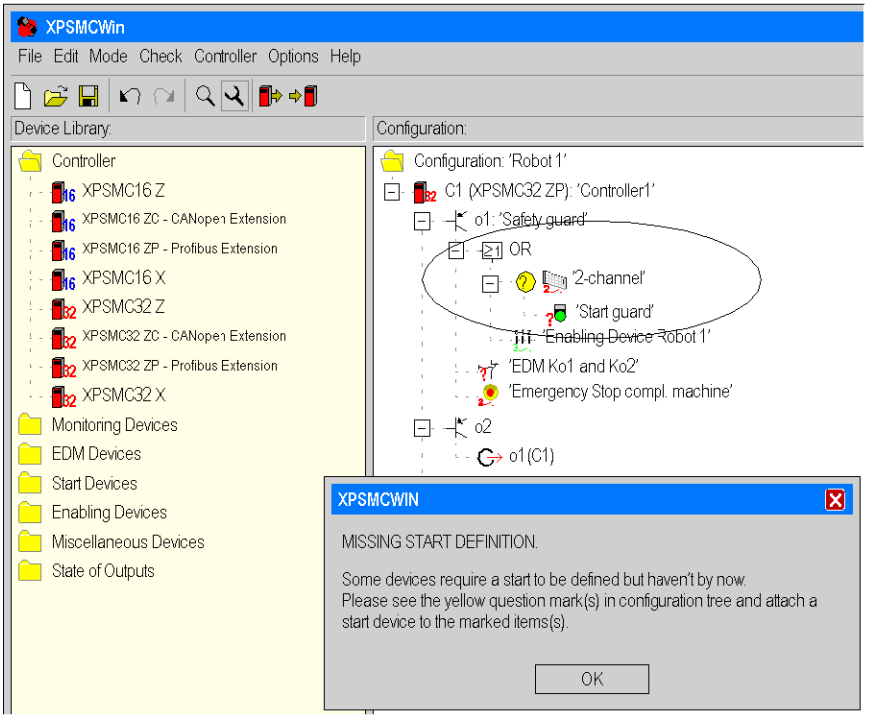
Step	Action
5	Click **Yes** to continue the procedure. **Result:** To stop the controller, enter your password. For more information, refer to Passwords, page 122. 
6	Click **OK** to continue. **Result:** The download procedure is starting. After the download, you will see the protocol:  **NOTE:** Read this protocol carefully and verify it with your hardware configuration. With **Validate** you confirm the correctness of the software configuration in the controller shown in the protocol.
7	Click on **Validate** button to validate the protocol.

Step	Action
8	Enter the name in the **Validation** dialog box: 
9	Click **OK** to continue. **Result:** The **Password** dialog box will be displayed: 
10	Enter your password and click **OK**.
11	Click **OK** to continue. **Result:** The following message will be displayed: 

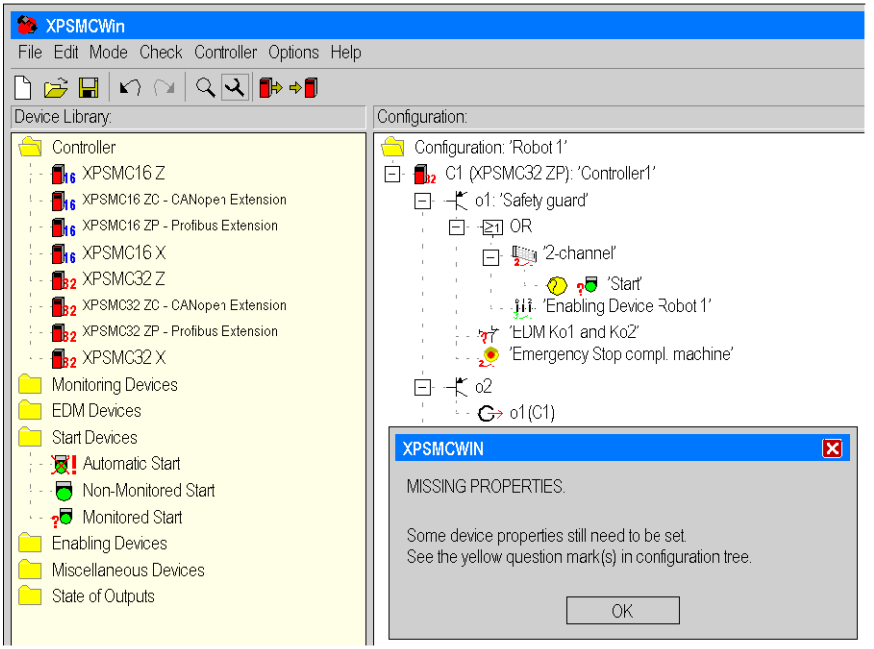
Step	Action
12	Click **Yes** to upload the protocol. **Result:** The following message will be displayed: 
13	Click **OK** to start the controller. **Result:** The following message will be displayed 
14	Click **OK** to finish the procedure.

Typical Configuration Errors

Configuration error 1: If no start device is assigned to the **Two-Channel Safety Guard**, the main window and the message box will look as follows:



Configuration error 2: If the inputs and outputs of the start device are not set, the main window and the message box will look as follows:



Loading a Configuration

Overview

This section contains the description of loading a configuration.

Loading

Description

The configuration of a controller can be uploaded without stopping the controller.

Procedure

Proceed as follows:

Step	Action
1	Connect your PC to the XPSMC Safety Controller.
2	Choose the command **Controller > Upload Configuration from Controller** or click on the button  in the toolbar. **Result:** The configuration is loaded from the XPSMC Safety Controller and then represented in the usual tree structure.

Creation/Transfer of a Validated Configuration Copy

Overview

This section contains the description of creation and transfer a validated configuration copy.

Copy/Saving of a Validated Configuration

Condition

As a condition to create a copy of a validated configuration, the **Enable copying of validated configuration from controller** option must be selected during the validation of the configuration, see also Sending a Configuration, page 122, step for the validation. Under this condition the user is able to make a copy of the validated configuration from the XPSMC Safety Controller into a binary file. In addition, the **Create a copy of the validated configuration now** option can be selected in order to create a copy during the validation.

Copy of a Validated Configuration

Included with the configuration itself, the following data of the original controller is taken:

- validation counter (VDC)
- password

- validation data (name, date)
- device parameters (Modbus parameters, controller number)

This file can be used as a copy to transfer the validated configuration to another controller without the need of a new validation.

Saving a Validated Configuration

Proceed as follows:

Step	Action
1	Connect the PC to the controller containing the validated configuration.
2	Choose the command **Controller > Create validated copy**. **Result:** The configuration will be read out of the controller.
3	Enter the save location and file name in the window which appears. **Result:** The copy will be saved as this file.

Transfer of a Validated Configuration Copy

Description

When a file with a copy of a validated configuration has been made (see chapter Copy/ Saving of a Validated Configuration, page 131) for a certain controller, you can transfer the configuration into another controller, especially for replacement of a XPSMC Safety Controller unit for service or for installation of controllers in identical machines.

Procedure 1 - New Controller

Proceed as follows:

Step	Action
1	Connect the PC to the controller in which the validated configuration is to be transferred. **Result:** The controller is not configured, the Power LED is on, and the CNF LED is flashing.
2	Choose the command **Controller > Validated copy > Transfer validated copy to controller**. **Result:** You get 2 messages: • Please connect the controller you want the configuration to transfer to and press 'OK' to start the transfer. • Transferring the copy will overwrite the existing configuration in the controller. Do you want to continue?
3	Indicate in the dialog box the name of the validated configuration file. **Result:** The validated configuration is transferred into the connected controller. A message box tells you to powercycle the controller to start the new configuration.

Procedure 2 -Configured Controller, Password Available

Proceed as follows:

Step	Action
1	Connect the PC to the controller in which the validated configuration is to be transferred.
2	Choose the command **Validated copy > Transfer validated copy to controller**. **NOTE:** If the controller is running, another message box reminds you that the controller has to be stopped. You will also be reminded to enter your password. If you do not have a password, you will have to reset the controller by powercycling it and simultaneously pressing the Reset button. See also Procedure 1 - New Controller, page 132 for downloading a validated copy.
3	Indicate in the dialog box the name of the file. **Result:** The validated configuration is transferred into the connected controller. A message box tells you that you have to powercycle the controller to start the new configuration and run the controller.

NOTE: To modify the configuration, you need the password of the validated configuration. The controller password has been overwritten.

Procedure 3 - Configured Controller, Password Unavailable

Reset the controller by pressing the Reset button and simultaneously performing a power cycle. Then follow Procedure 1 - New Controller, page 132.

Validated Configuration into another Controller

The new controller now has the validated configuration, including the validation counter (VDC), the password, the validation data (name, date) and the device parameters (Modbus parameters, controller number).

It can be used like the original controller from which the copy was made from, except that the running time (OPC) of the configuration is set to zero.

Read Protocol from Controller

Overview

This section contains how to read the protocol from the controller.

Read Protocol from Controller

Procedure

Proceed as follows:

Step	Action
1	Connect the PC to the XPSMC Safety Controller.
2	The controller has to be put in STOP with the menu **Controller > Stop Controller**.
3	A window appears, and you are asked to enter your password to stop the controller.
4	Choose the menu **Controller > Read Protocol from Controller**. **Result:** The protocol will be displayed in a separate window and can be printed. The only proof of the correctness of the configuration is the validated and signed protocol (See chapter Sending a Configuration, page 122).

Diagnostics

Overview

This chapter contains the diagnostics description.

XPSMC Safety Controller Diagnostics

Introduction

Various states of an XPSMC Safety Controller can be monitored by connecting it to a PC and using the diagnostics mode of the XPSMCWIN application.

NOTE: During the diagnostics, the XPSMC Safety Controller continues to operate without being influenced.

Procedure

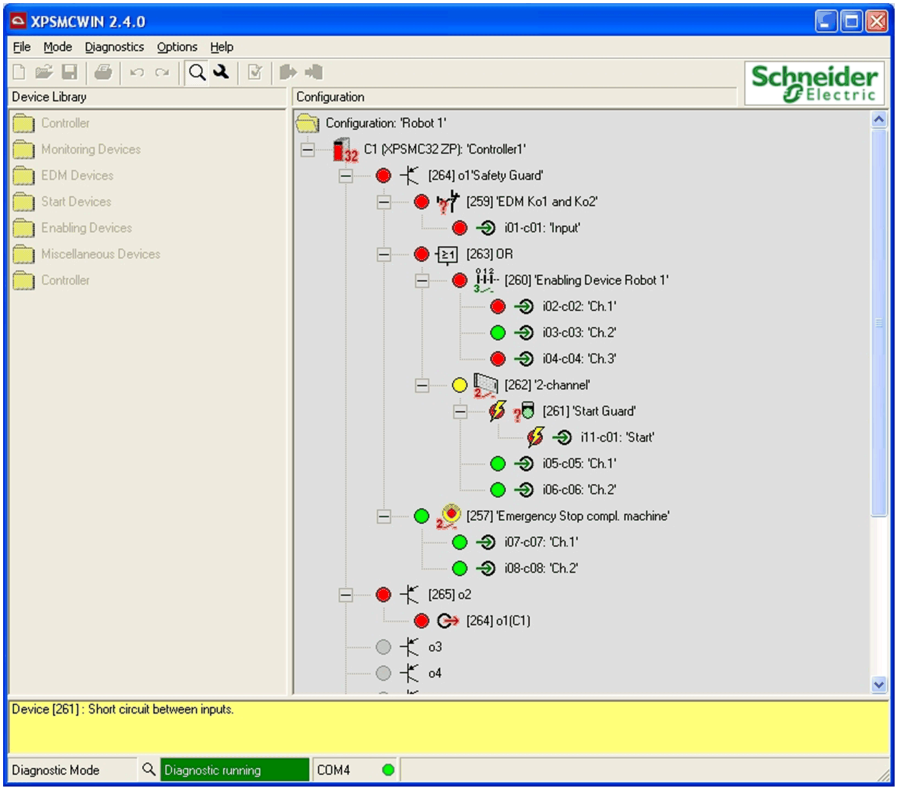
The Diagnostic mode is activated as follows:

Step	Action
1	Connect your PC to the XPSMC Safety Controller in operation.
2	Start the XPSMCWIN software.
3	Open a configuration from a file or upload the configuration from the controller. **NOTE:** The saved configuration must correspond to the one already in the controller. The controller configuration must have been validated. To use a saved configuration for diagnostics it has to be saved after download. Only in this case it contains the required information.
4	Choose the Diagnostic mode. To do this, choose the menu **Mode > Diagnostic** or click on the icon  for the Diagnostic mode. **Result:** The window will become grey, to show that no modifications can be made.

Color Definitions

In the **Configuration** window, a colored circle is placed next to each function symbol of the configuration tree.

The color indicates the status of the corresponding function:



Meaning of symbols

Symbols	Meaning
Red Dot	The safety-related output is deactivated or the device is not enabled (for example, protective guard is open or the concerned input is open).
Red Dot with a Yellow bolt	An error exists for this device (input/output). The error message is shown at the bottom of the configuration window.
Green Dot	The safety-related output is activated, or the device is enabled (for example, protective guard is closed or the concerned input is closed).

Symbols	Meaning
Green Dot with a Hourglass	This output has a category 1 stop. The enabling conditions are no longer fulfilled, but the time delay has not elapsed.
Yellow Dot	This device or this output is enabled (this means that the conditions to start are fulfilled), but not started.
Grey Dot	The related output or device is not used, or the PC has not received the diagnostics data from the XPSMC Safety Controller (the points are then disabled).

Diagnostics of Different Devices

Proceed as follows

Step	Action
1	Right-click the device to see the state of the inputs of the different devices
2	Right-click within the **Diagnostic** window. **Result:** A contextual menu will appear.
3	Select **Overview** from the menu. **Result:** A new window appears displaying the diagnostics of the inputs and outputs of the controller.
4	Click on **Pause diagnostic** in the menu **Diagnostics** to pause the diagnostics. **Result:** The **Diagnostic** window keeps the status.
5	Click on **Start diagnostic** in the menu **Diagnostics** to start the diagnostics. **Result:** The window will be continuously updated.

Appendices

What's in This Part

Example Wiring and Functional Diagrams..... 140

Overview

Additional information that is not necessarily required for an understanding of the documentation.

Example Wiring and Functional Diagrams

What's in This Chapter

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Eccentric Press 2 200
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Overview

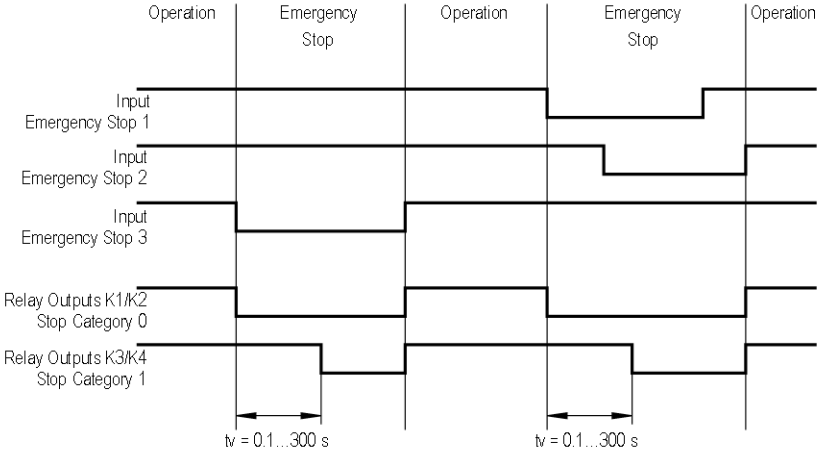
This chapter contains examples of wiring and functional diagrams.

NOTE: The data for safety categories in accordance with ISO 13849-1 refers to the maximum achievable categories. The machine control must be appropriately configured in order to achieve the desired category.

Three One-Channel Emergency Stops, with Automatic Start

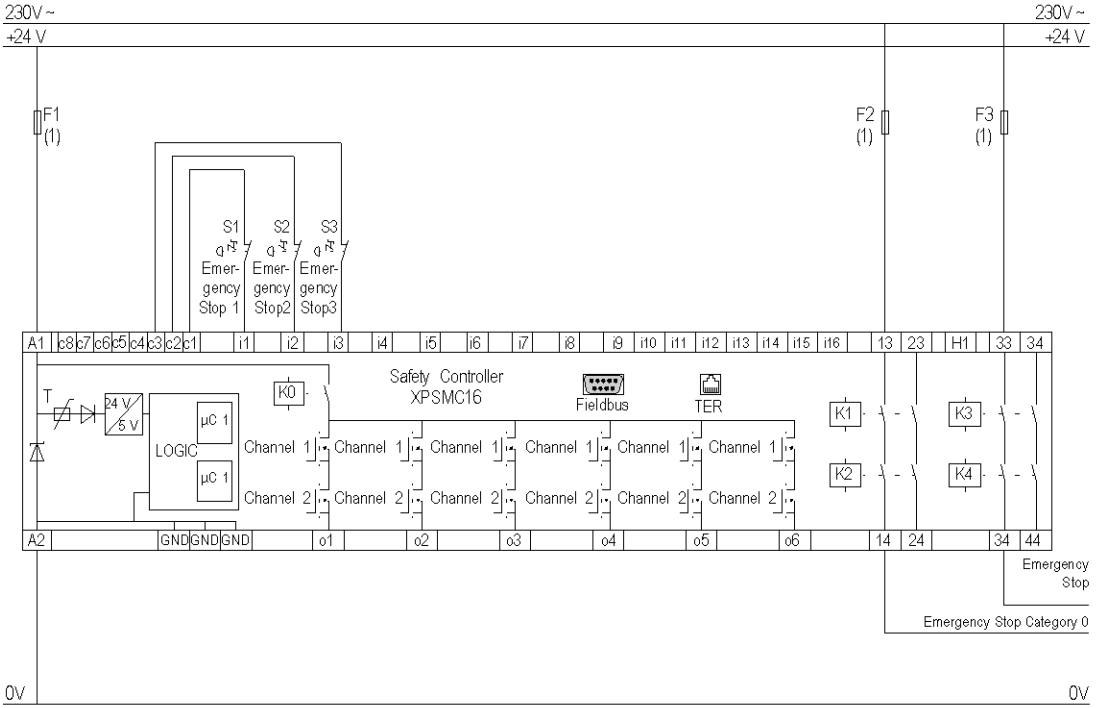
Functional Diagram

The following diagram shows three One-Channel Emergency Stops and the relevant control outputs for categories 0 and 1:



Wiring Diagram

The following image shows the wiring diagram of the One-Channel Emergency Stop:



(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse sizes.

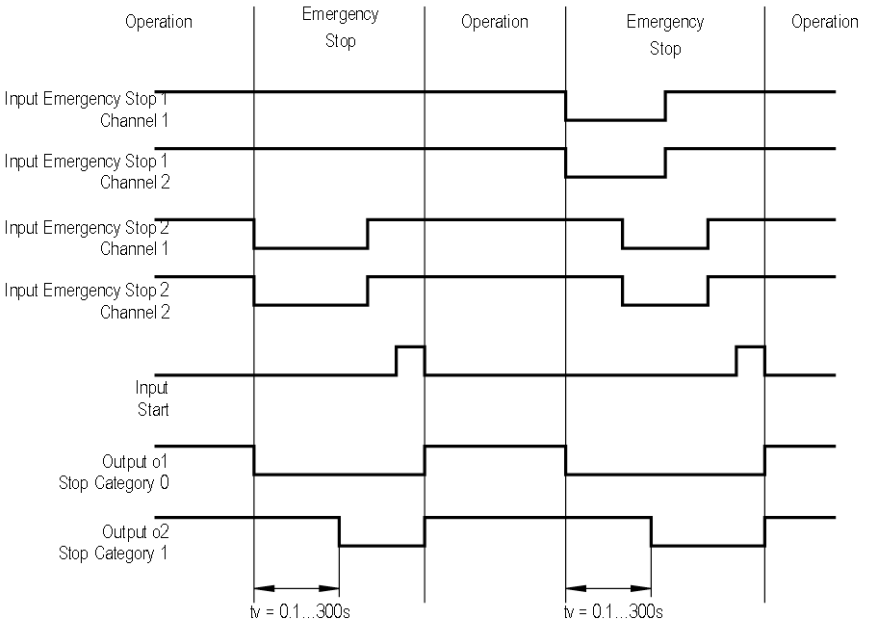
NOTE: A jumper between the 2 terminals of an Emergency Stop will not be detected. Cross-circuit between i1, i2, i3 will be detected.

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Two Two-Channel Emergency Stop, with Start Button

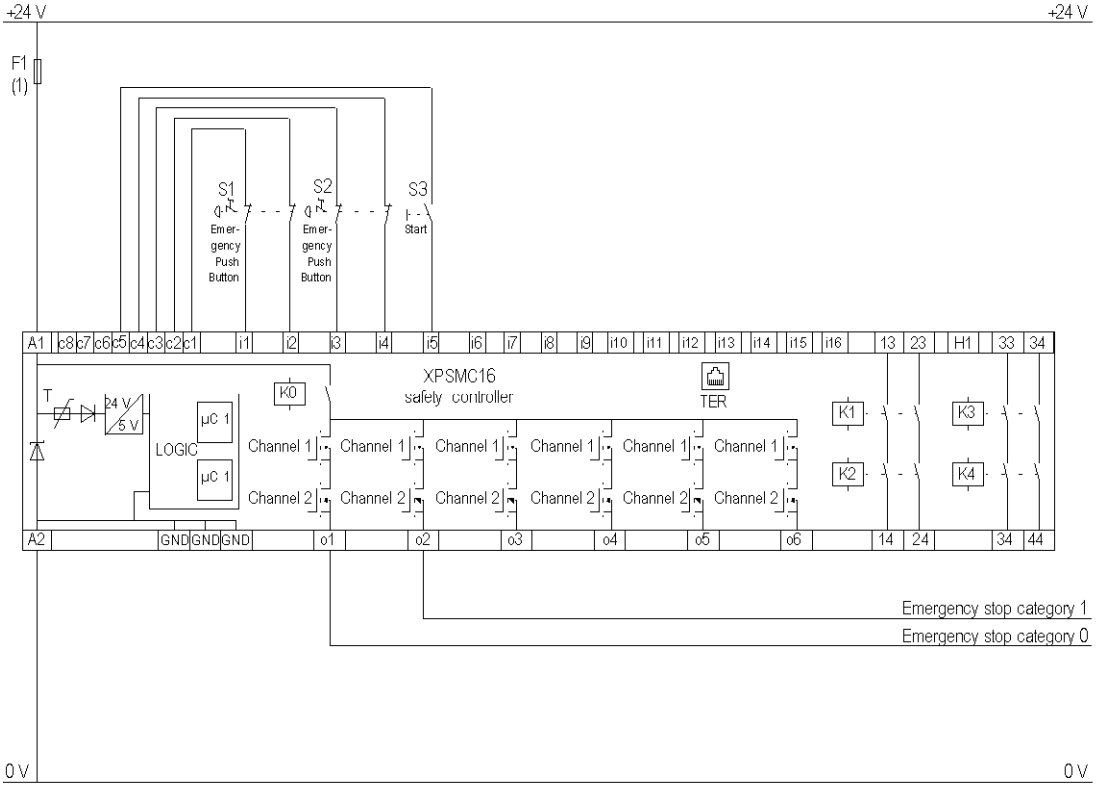
Functional Diagram

The following functional diagram shows two Two-Channel Emergency Stops and the relevant control outputs for Categories 0 and 1:



Wiring Diagram

The following wiring diagram shows two Two-Channel Emergency Stops and the relevant control outputs for the Categories 0 and 1:

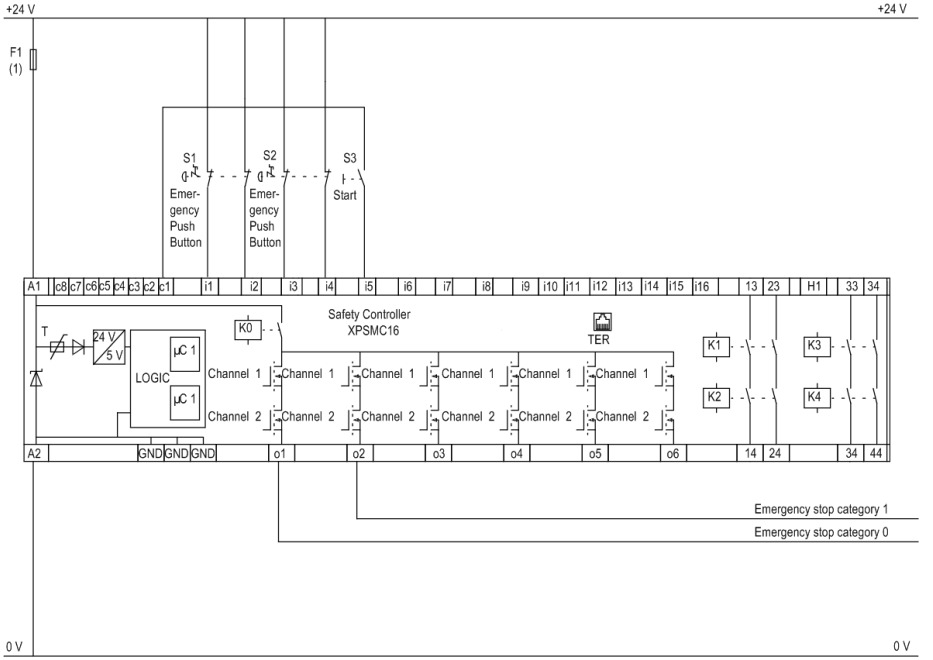


(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse sizes.

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Wiring Diagram with Externally Supplied 24 V Input

The following wiring diagram shows two Two-Channel Emergency Stops and the relevant control outputs for the Categories 0 and 1 with externally supplied 24 V input:

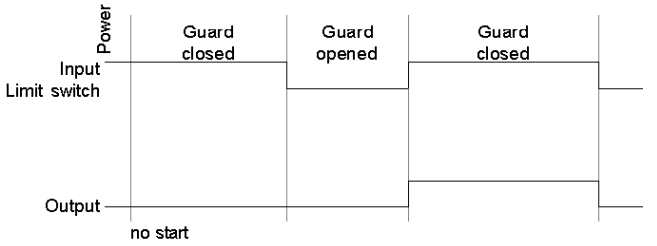
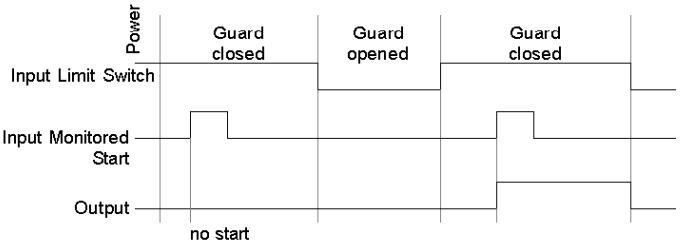
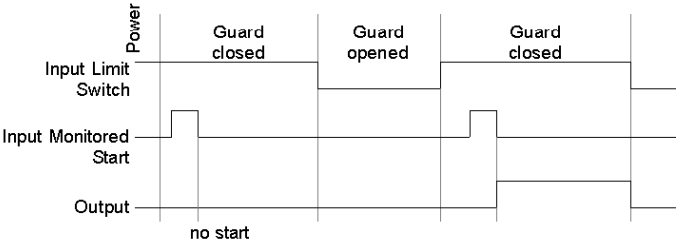


NOTE: For safety-related inputs not supplied by control outputs use external means to achieve up to SIL3 (IEC 62061) or PL e, Category 4 (ISO 13849-1), e.g. shielded cable.

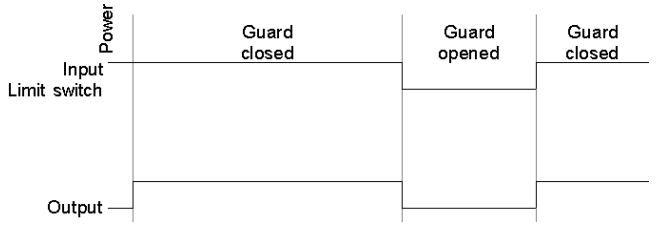
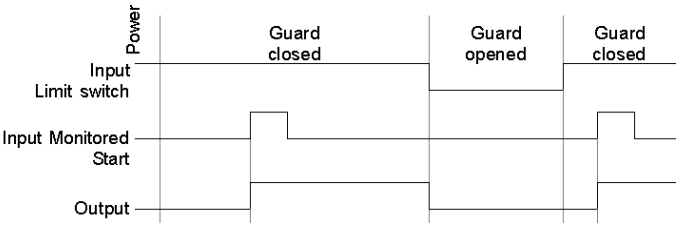
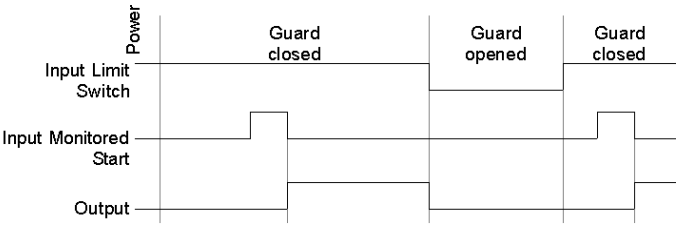
Safety Guard with One Channel

Functional Diagram

The following functional diagram shows the Safety Guard with One Channel with Start Interlock and different Start Functions:

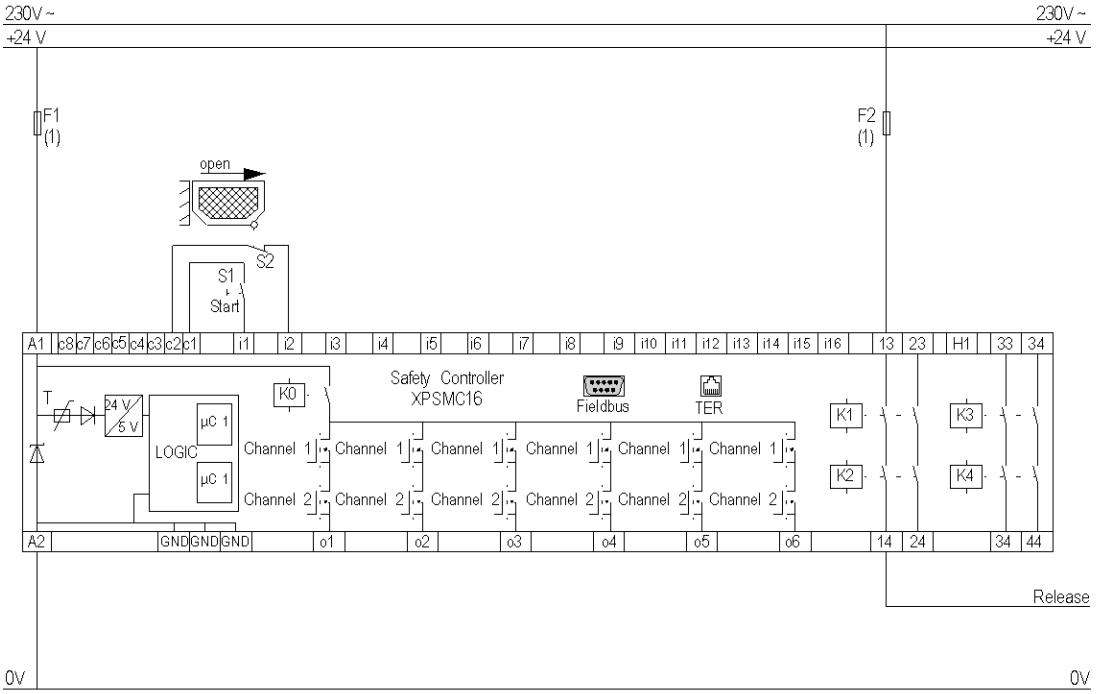
Start Function	Start Interlock = YES
Automatic Start	
Monitored Start Rising Edge	
Monitored Start Falling Edge	

The following functional diagram shows the Safety Guard with One Channel without Start Interlock and different Start Functions:

Start Function	Start Interlock = NO
Automatic Start	
Monitored Start Rising Edge	
Monitored Start Falling Edge	

Wiring Diagram

The following wiring diagram shows the Safety Guard with One Channel with and without Start Interlock and different Start Functions:



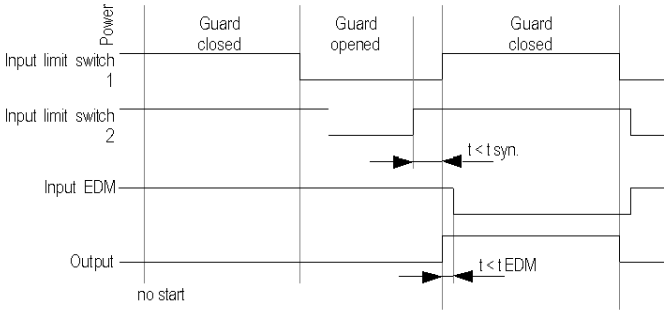
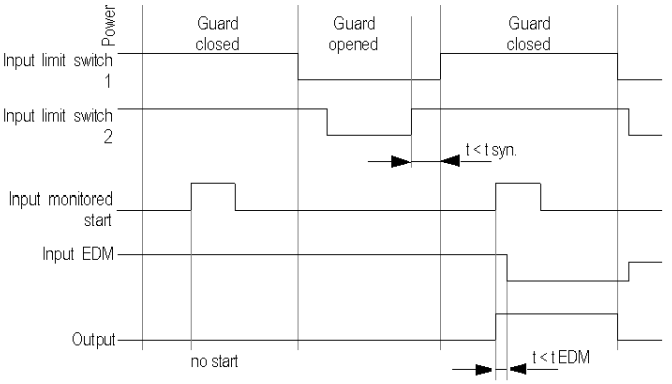
(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse sizes.

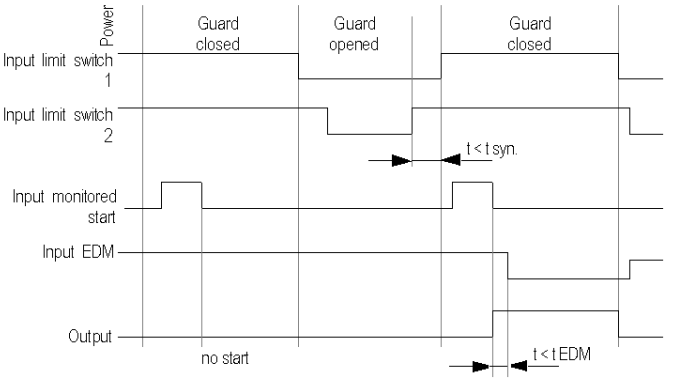
The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Two-Channel Safety Guard

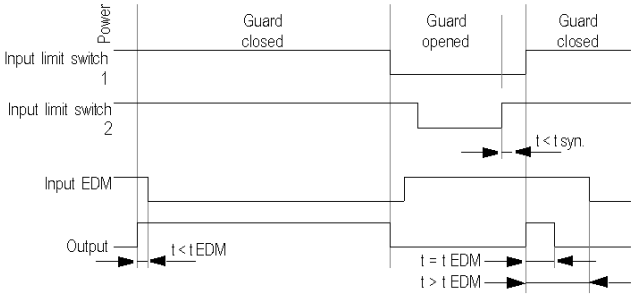
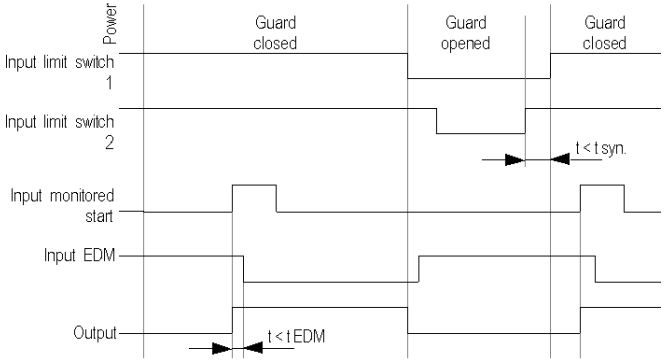
Functional Diagram

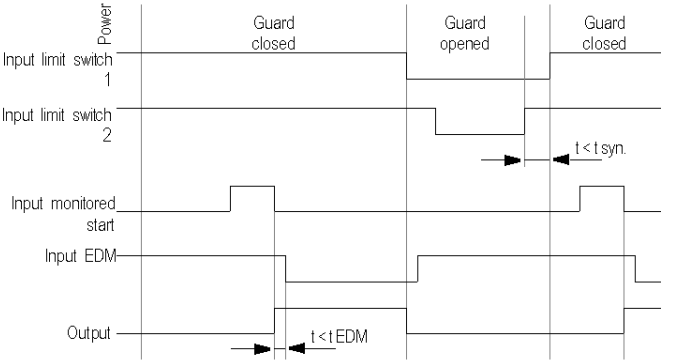
The following functional diagram shows the Two-Channel Safety Guard with Start Interlock and different Start Functions:

Start Function	Start Interlock = YES
Automatic Start	 EDM: External Device Monitoring
Monitored Start Rising Edge	 EDM: External Device Monitoring

Start Function	Start Interlock = YES
Monitored Start Falling Edge	 EDM: External Device Monitoring

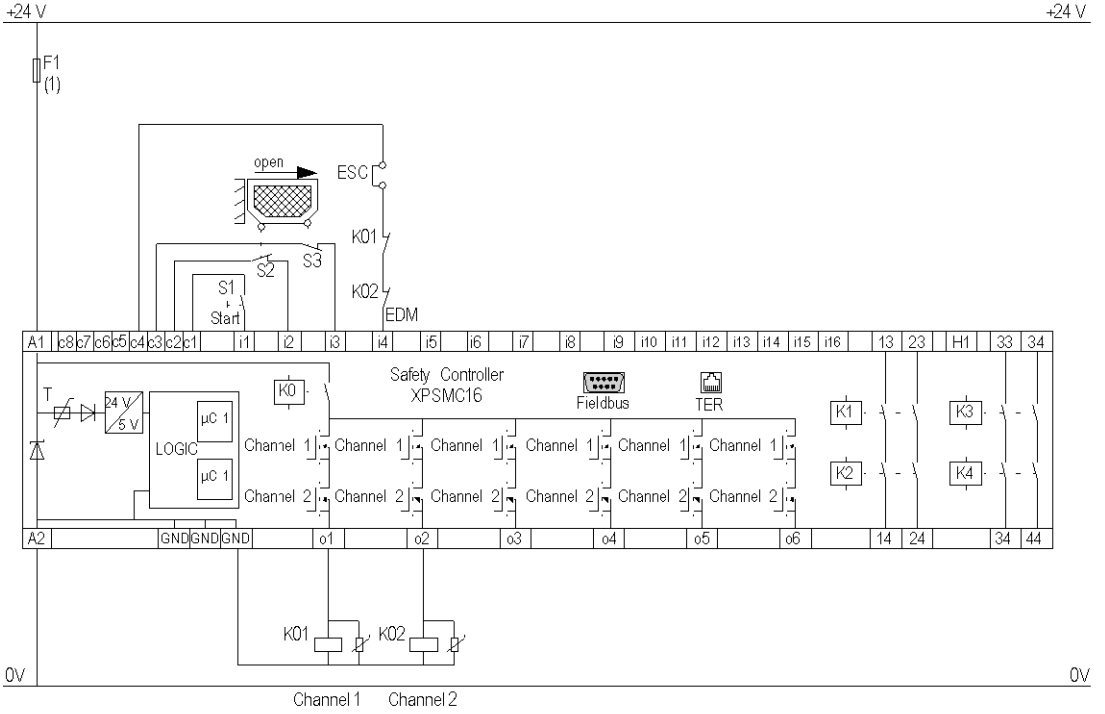
The following functional diagram shows the Two-Channel Safety Guard without Start Interlock and different Start Functions:

Start Function	Start Interlock = NO
Automatic Start	 EDM: External Device Monitoring
Monitored Start Rising Edge	 EDM: External Device Monitoring

Start Function	Start Interlock = NO
Monitored Start Falling Edge	 EDM: External Device Monitoring

Wiring Diagram

The following wiring diagram shows the Two-Channel Safety Guard with and without Start Interlock and different Start Functions:



ESC External Start Conditions

EDM External Device Monitoring

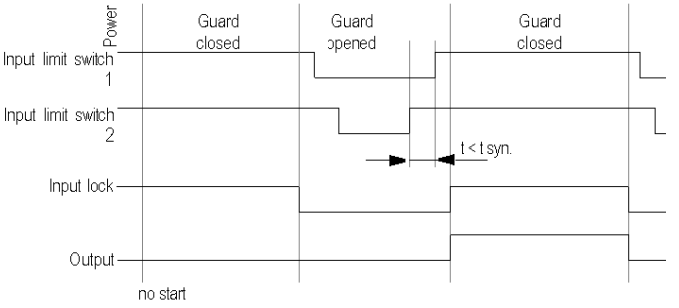
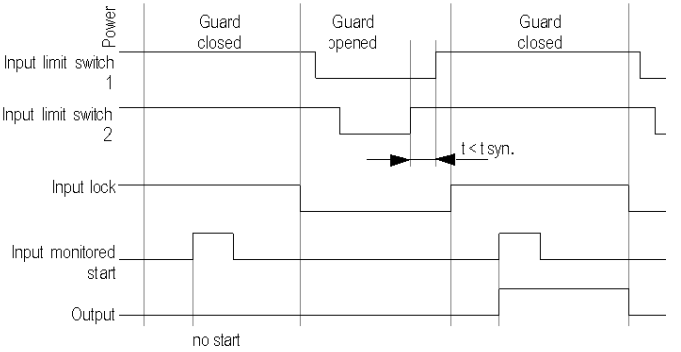
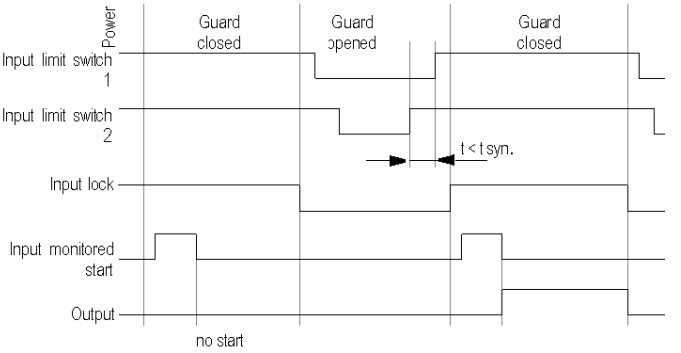
(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse size

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

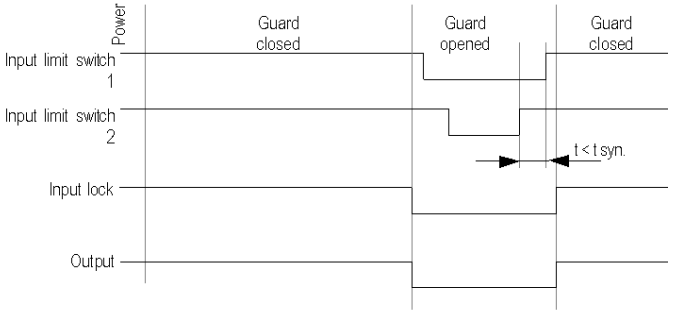
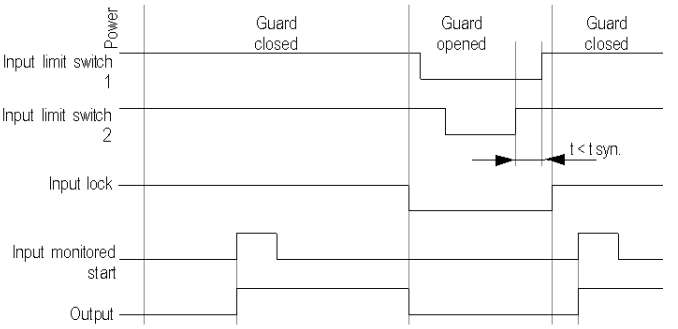
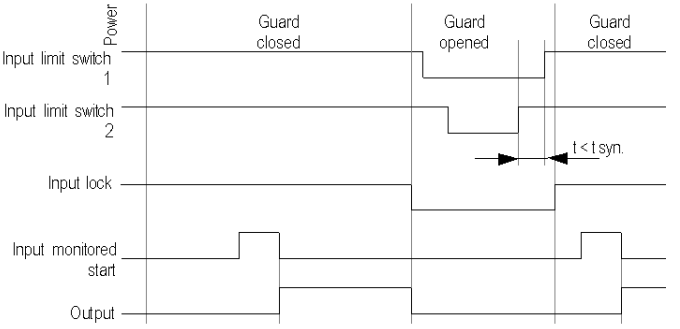
Two Channels Safety Guard with Lock

Functional Diagram

The following functional diagram shows the Two-Channel Safety Guard with Lock and with Start Interlock and different Start Functions:

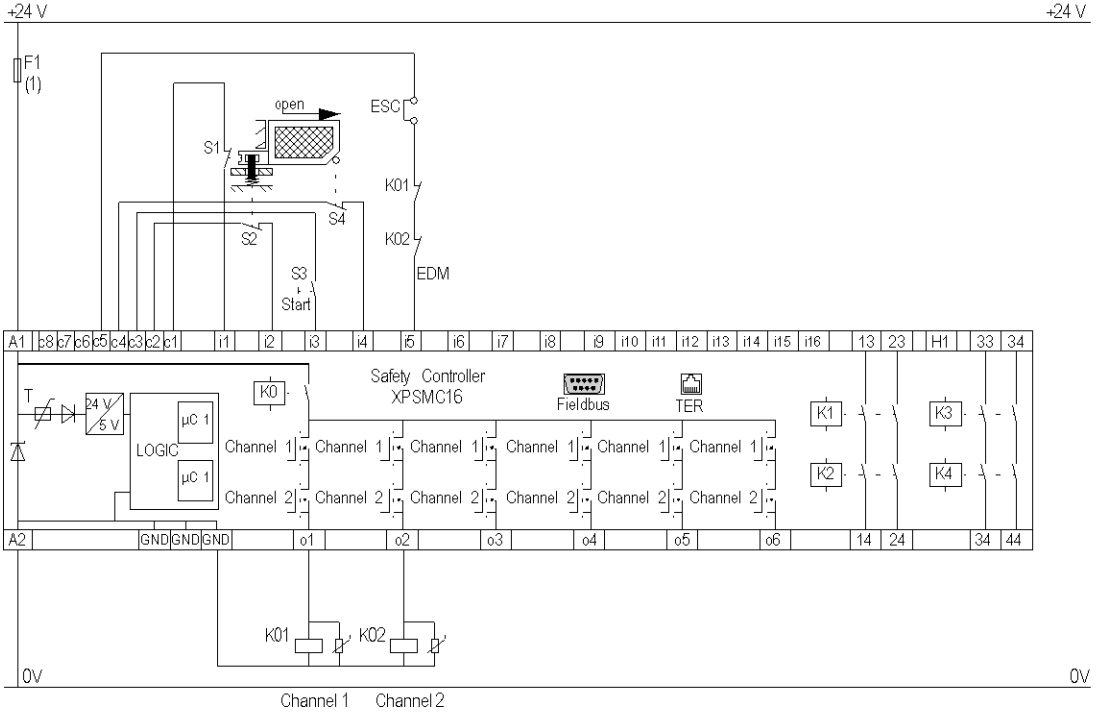
Start Function	Start Interlock = YES
Automatic Start	
Monitored Start Rising Edge	
Monitored Start Falling Edge	

The following functional diagram shows the Two-Channel Safety Guard with Lock and without Start Interlock and different Start Functions:

Start Function	Start Interlock = NO
Automatic Start	
Monitored Start Rising Edge	
Monitored Start Falling Edge	

Wiring Diagram

The following wiring diagram shows the Two-Channel Safety Guard with Lock and with and without Start Interlock and different Start Functions:



ESC External Start Conditions

EDM External Device Monitoring

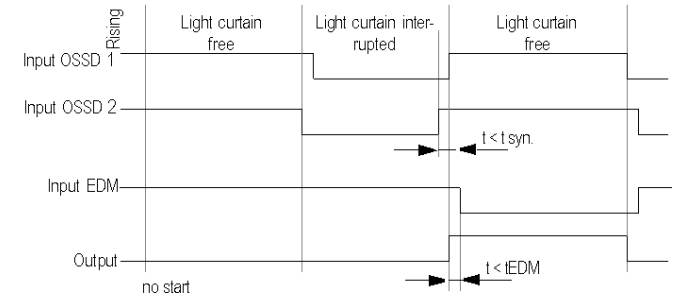
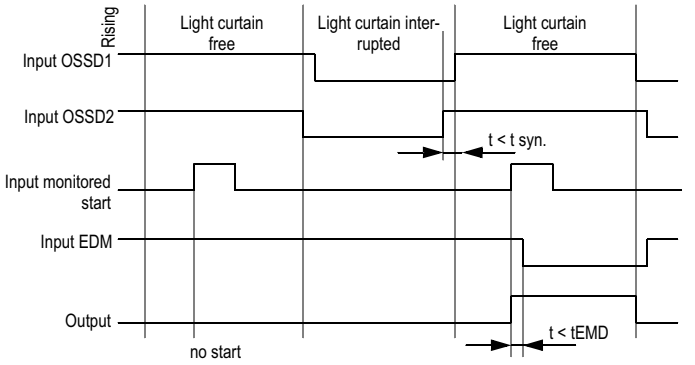
(1) See Technical Data in XPSMC Safety Controller Hardware manual form maximum fuse size

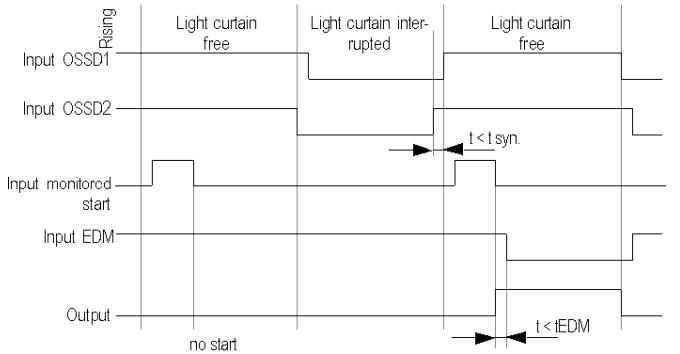
The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Light Curtain with Relay Outputs

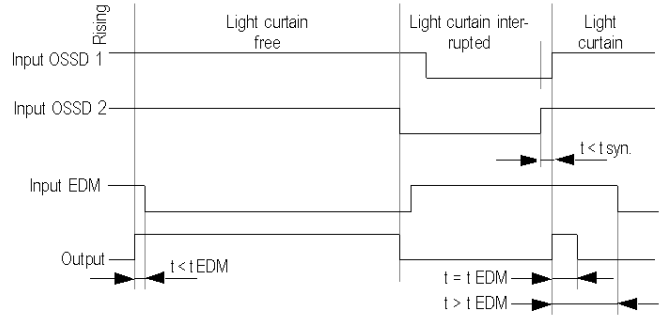
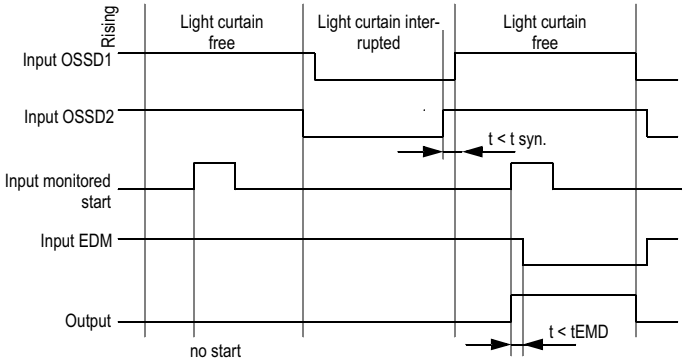
Functional Diagram

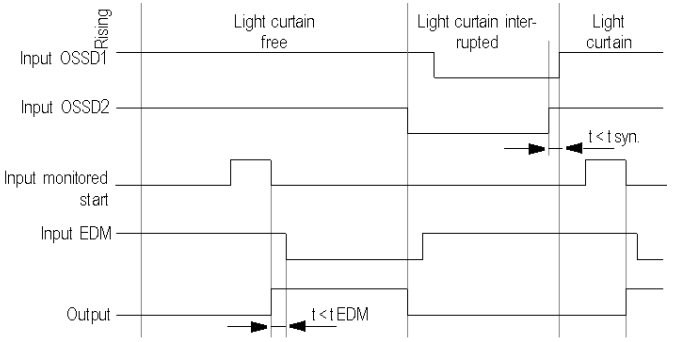
The following functional diagram shows the Light Curtain with Relay Outputs with Start Interlock and different Start Functions:

Start Function	Start Interlock = YES
Automatic Start	 OSSD: Output Safety Switching Device
Monitored Start Rising Edge	 OSSD: Output Safety Switching Device

Start Function	Start Interlock = YES
Monitored Start Falling Edge	 OSSD: Output Safety Switching Device

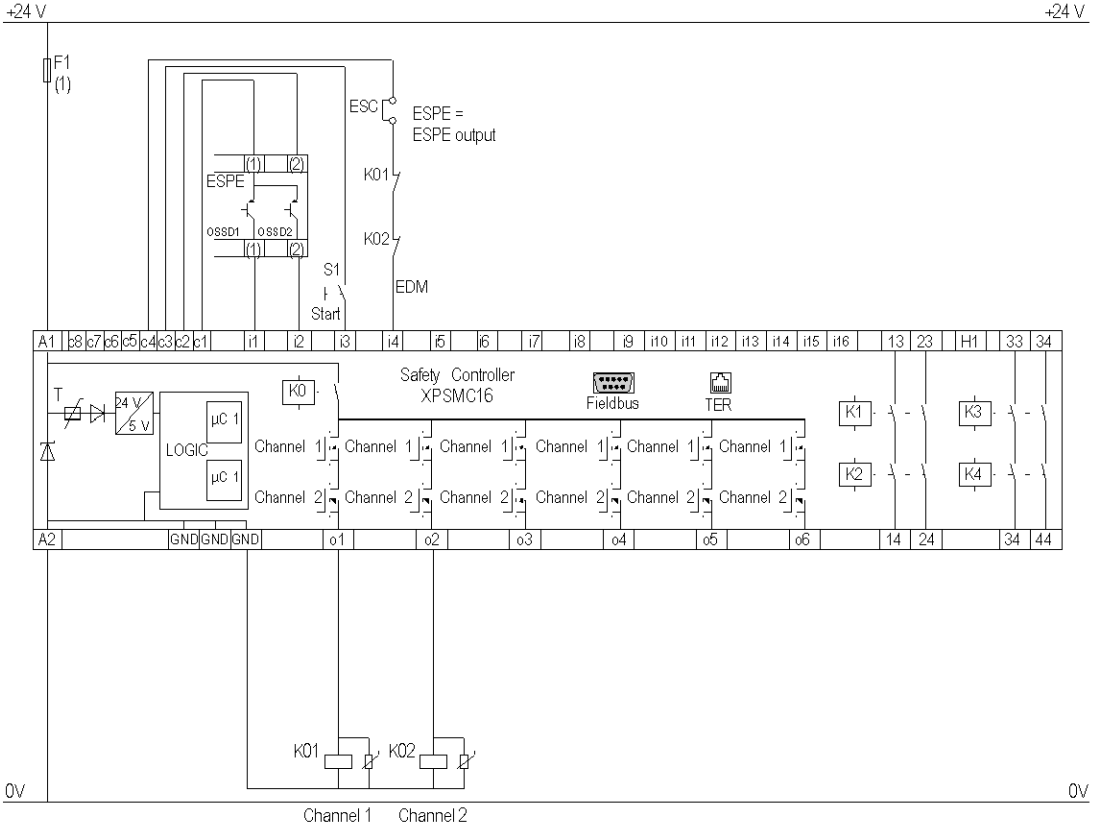
The following functional diagram shows the Light Curtain with Relay Outputs without Start Interlock and different Start Functions:

Start Function	Start Interlock = NO
Automatic Start	 OSSD: Output Safety Switching Device
Monitored Start Rising Edge	 OSSD: Output Safety Switching Device

Start Function	Start Interlock = NO
Monitored Start Falling Edge	 OSSD: Output Safety Switching Device

Wiring Diagram

The following wiring diagram shows the Light Curtain with Relay Outputs with and without Start Interlock and different Start Functions:



ESC External Start Conditions

EDM External Device Monitoring

ESPE Electro Sensitive Protective Equipment

OSSD Output Safety Switching Device

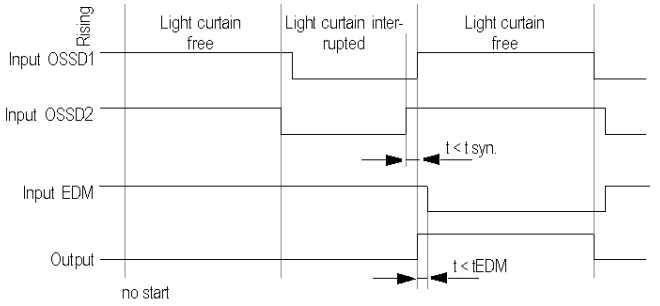
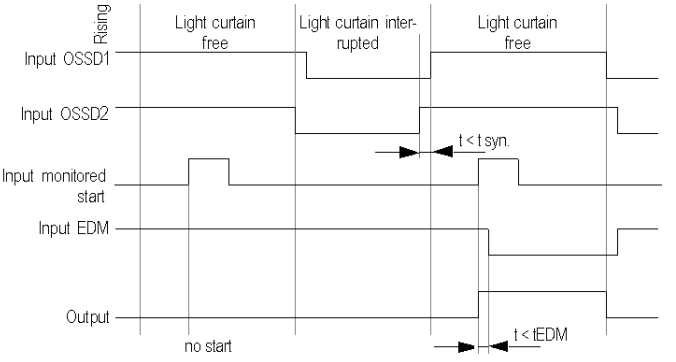
(1) See Technical Data in XPSMC Safety Controller Hardware manual form maximum fuse size

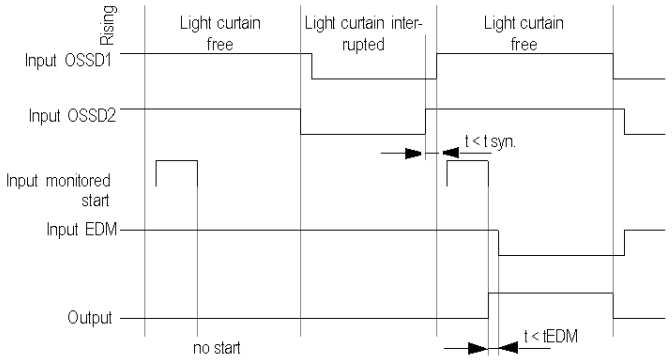
The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Light Curtain with Transistor Outputs

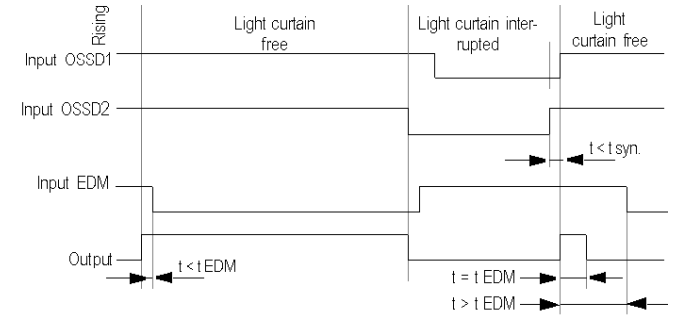
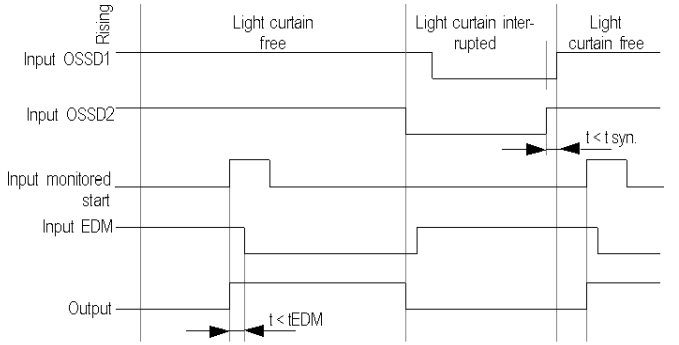
Functional Diagram

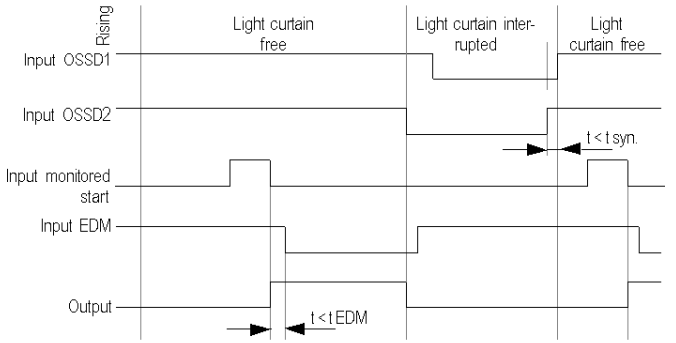
The following functional diagram shows the Light Curtain with Transistor Outputs with Start Interlock and different Start Functions:

Start Function	Start Interlock = YES
Automatic Start	 OSSD: Output Safety Switching Device
Monitored Start Rising Edge	 OSSD: Output Safety Switching Device

Start Function	Start Interlock = YES
Monitored Start Falling Edge	 OSSD: Output Safety Switching Device

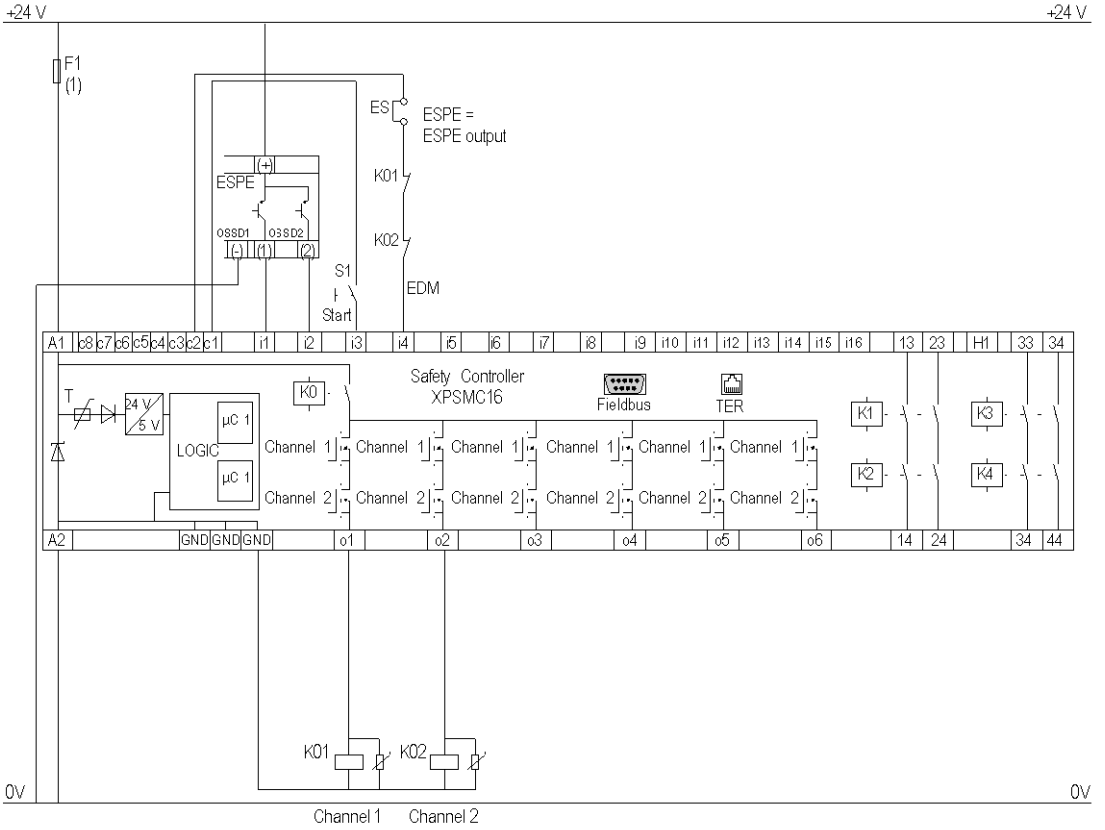
The following functional diagram shows the Light Curtain with Transistor Outputs without Start Interlock and different Start Functions:

Start Function	Start Interlock = NO
Automatic Start	 OSSD: Output Safety Switching Device
Monitored Start Rising Edge	 OSSD: Output Safety Switching Device

Start Function	Start Interlock = NO
Monitored Start Falling Edge	 OSSD: Output Safety Switching Device

Wiring Diagram

The following wiring diagram shows the Light Curtain with Transistor Outputs with and without Start Interlock and different Start Functions.



ESC External Start Conditions

EDM External Device Monitoring

ESPE Electro Sensitive Protective Equipment

OSSD Output Safety Switching Device

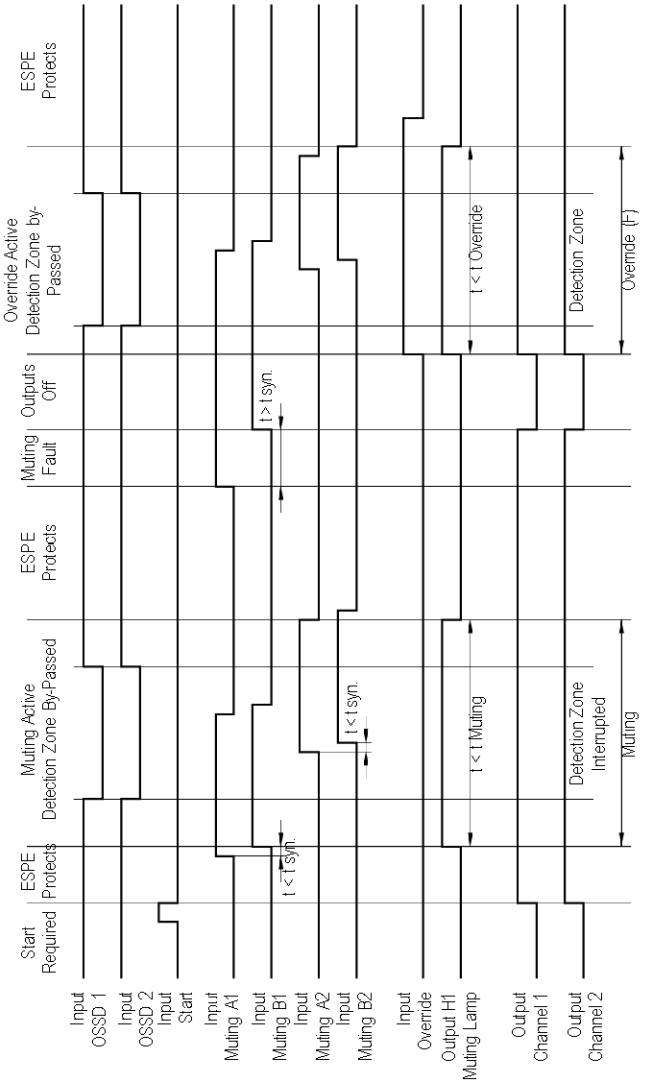
(1) See Technical Data in XPSMC Safety Controller Hardware manual form maximum fuse size

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Muting for Light Curtains Type 4

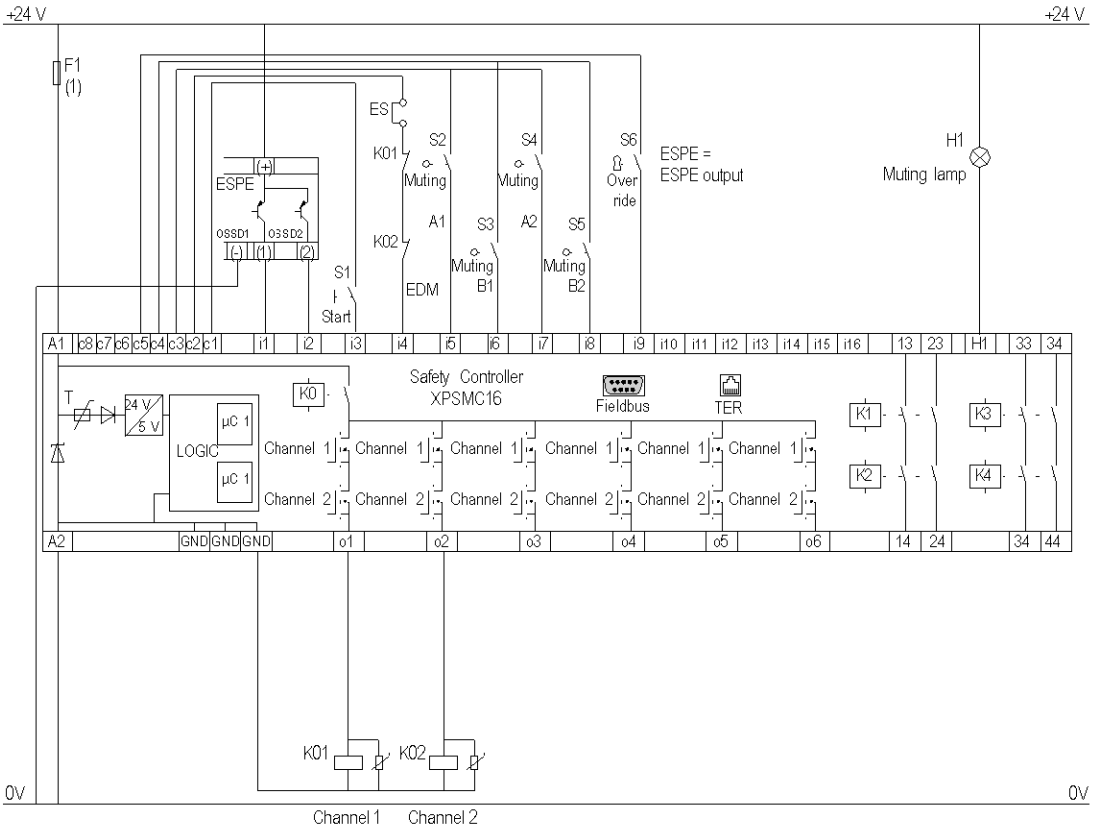
Functional Diagram

The following functional diagram shows the Muting for light curtains type 4:



Wiring Diagram

The following wiring diagram shows the Muting for light curtains type 4:



ESC External Start Conditions

EDM External Device Monitoring

ESPE Electro Sensitive Protective Equipment

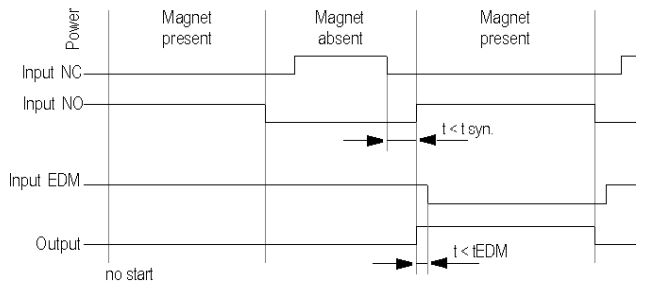
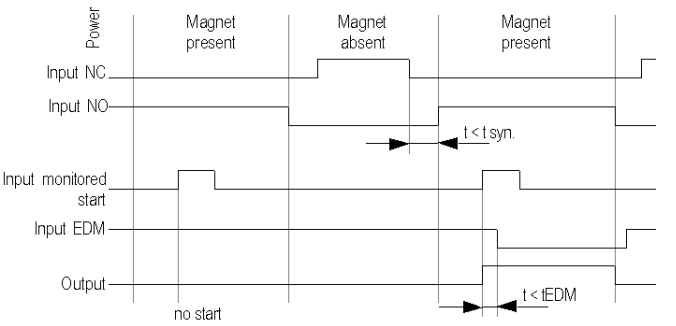
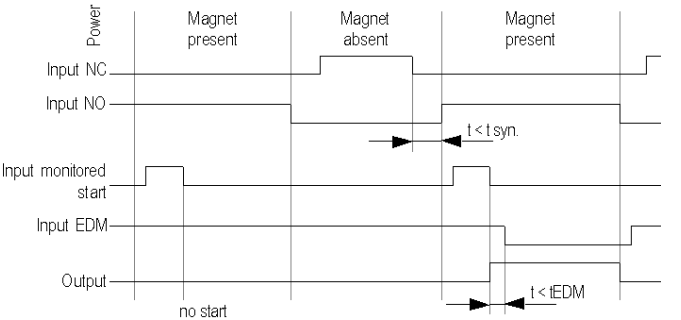
(1) See Technical Data in XPSMC Safety Controller Hardware manual form maximum fuse size

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

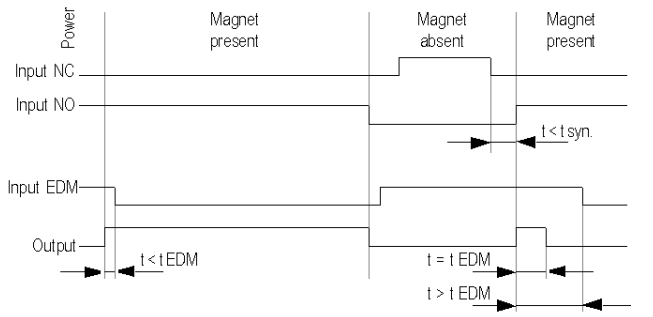
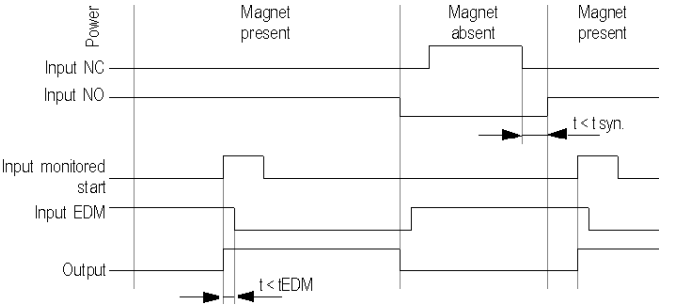
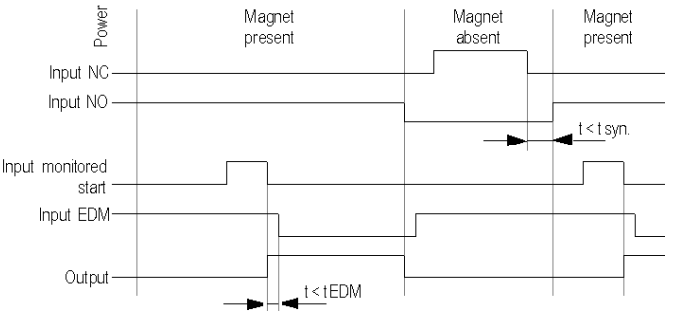
Magnetic Switch

Functional Diagram

The following functional diagram shows the Magnetic Switch with Interlock and different Start Functions:

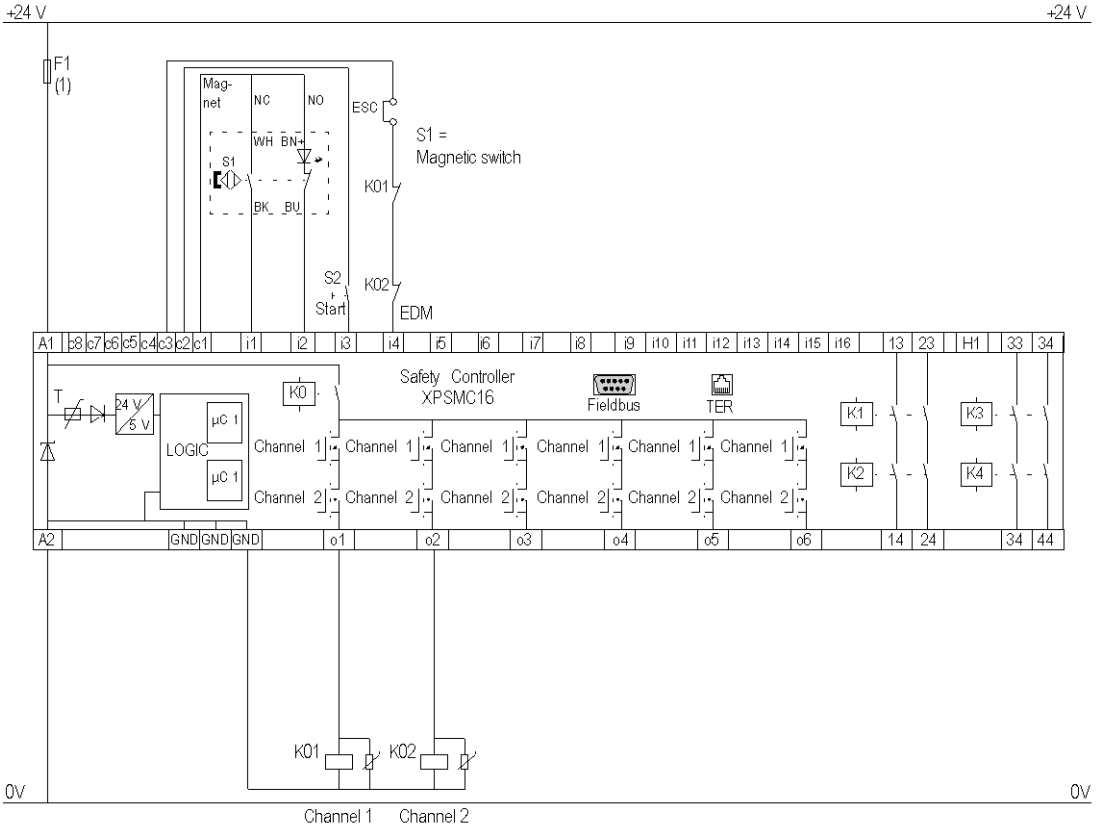
Start Function	Start Interlock = YES
Automatic Start	
Monitored Start Rising Edge	
Monitored Start Falling Edge	

The following functional diagram shows the Magnetic Switch without Interlock and different Start Functions:

Start Function	Start Interlock = NO
Automatic Start	
Monitored Start Rising Edge	
Monitored Start Falling Edge	

Wiring Diagram

The following wiring diagram shows the Magnetic Switch with and without Interlock and different Start Functions



ESC External Start Conditions

EDM External Device Monitoring

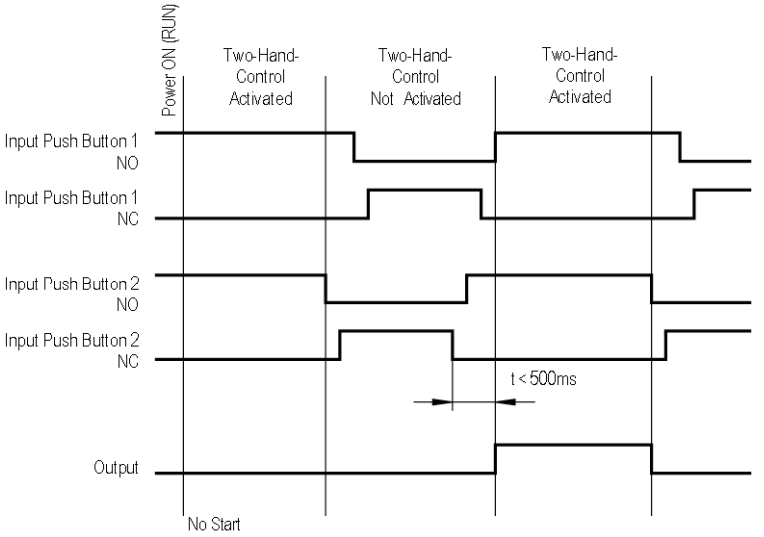
(1) See Technical Data in XPSMC Safety Controller Hardware manual form maximum fuse size

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Two-Hand Control

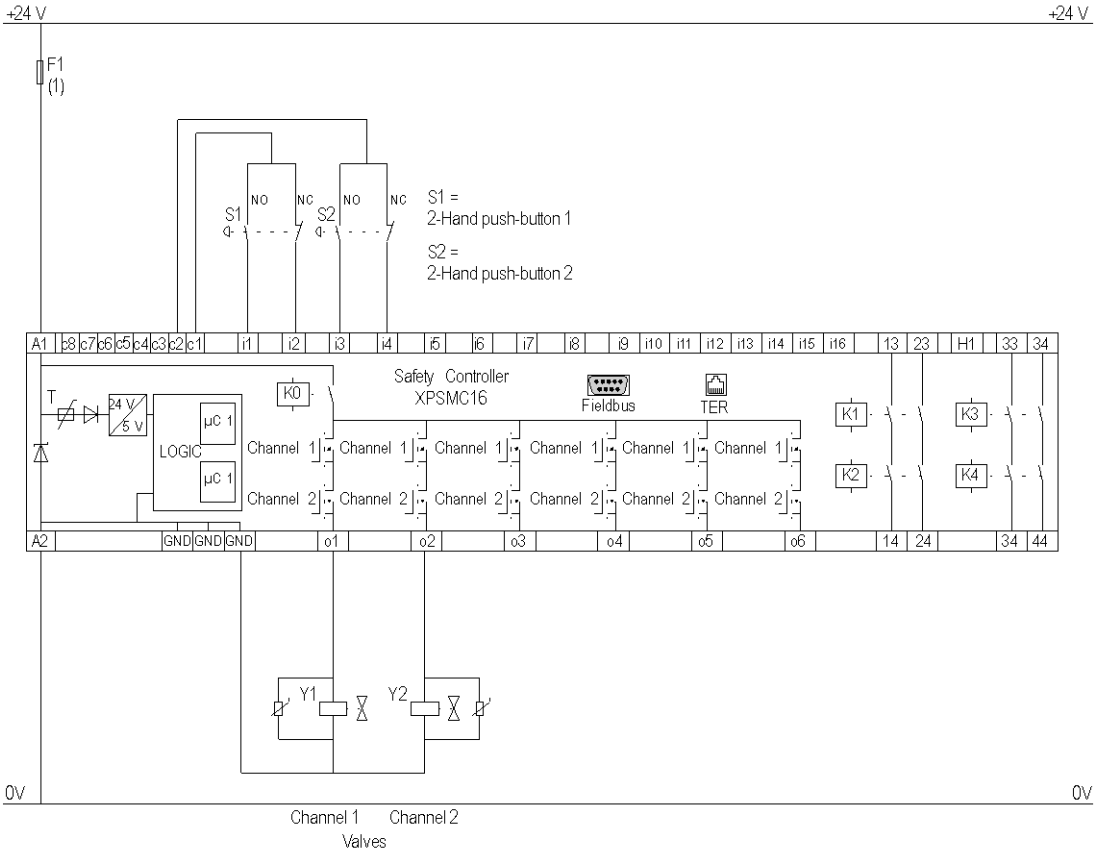
Functional Diagram

The following functional diagram shows the Two-Hand Control device:



Wiring Diagram

The following wiring diagram shows the Two-Hand Control device:



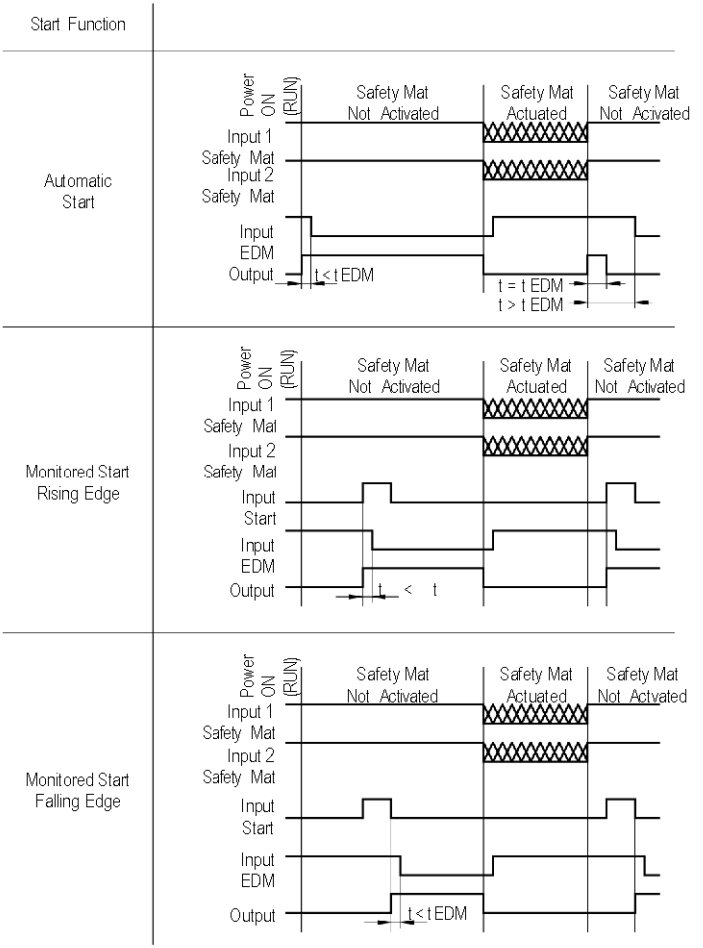
(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse sizes.

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Safety Mat

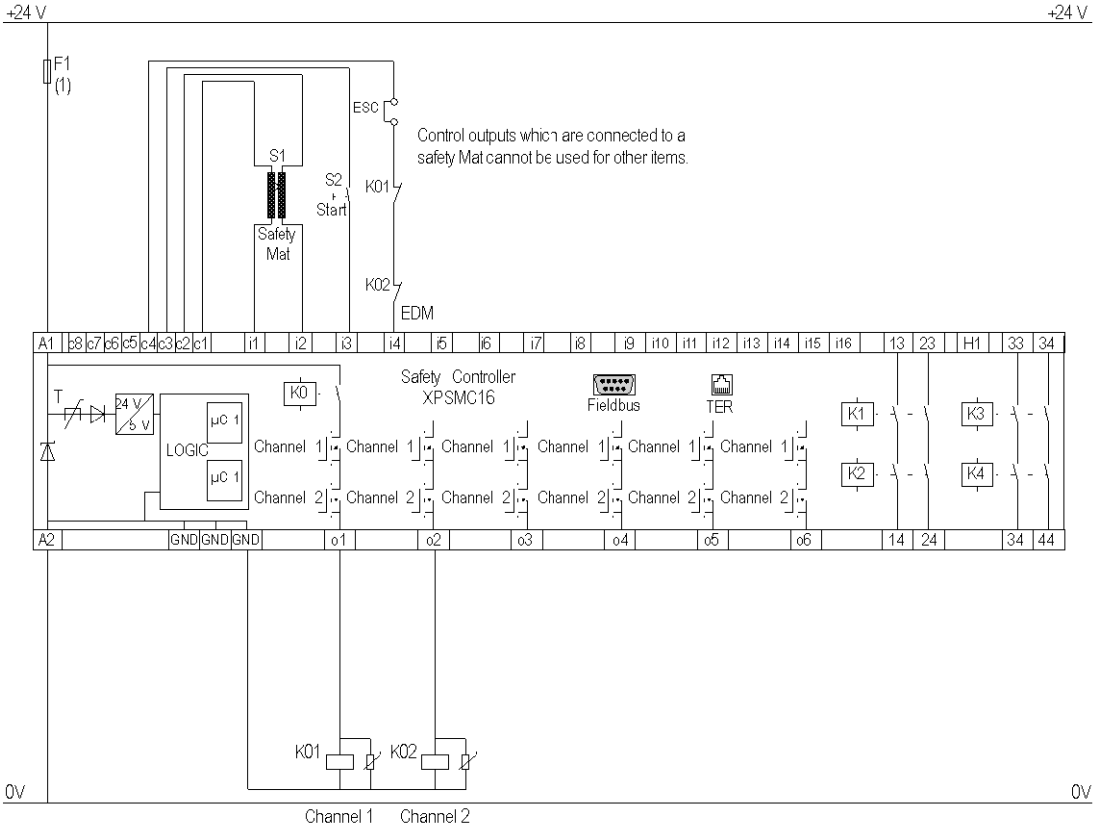
Functional Diagram

The following functional diagram shows the Safety Mat:



Wiring Diagram

The following wiring diagram shows the Safety Mat:



ESC External Start Conditions

EDM External Device Monitoring

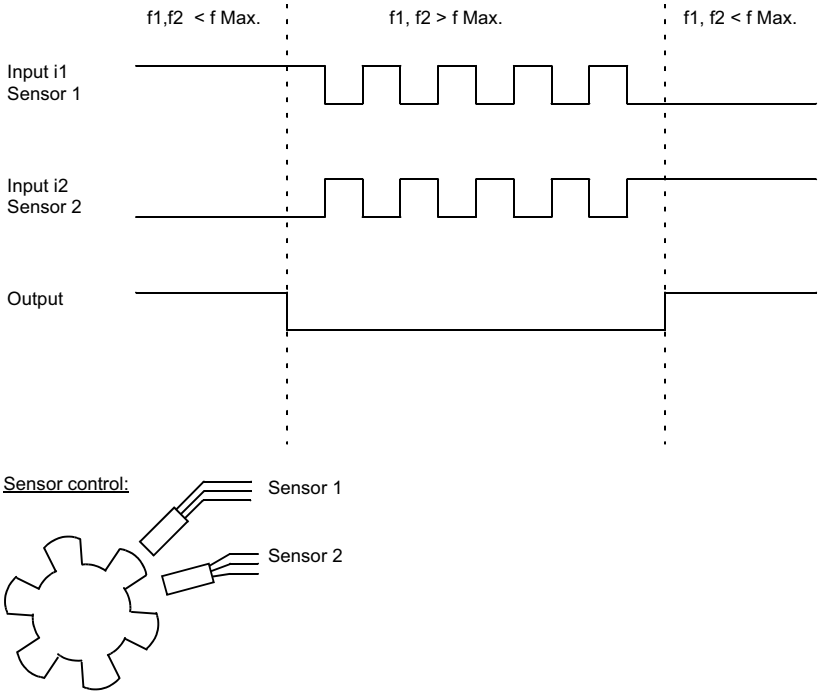
(1) See Technical Data in XPSMC Safety Controller Hardware manual form maximum fuse size

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Zero Speed Detection

Functional Diagram

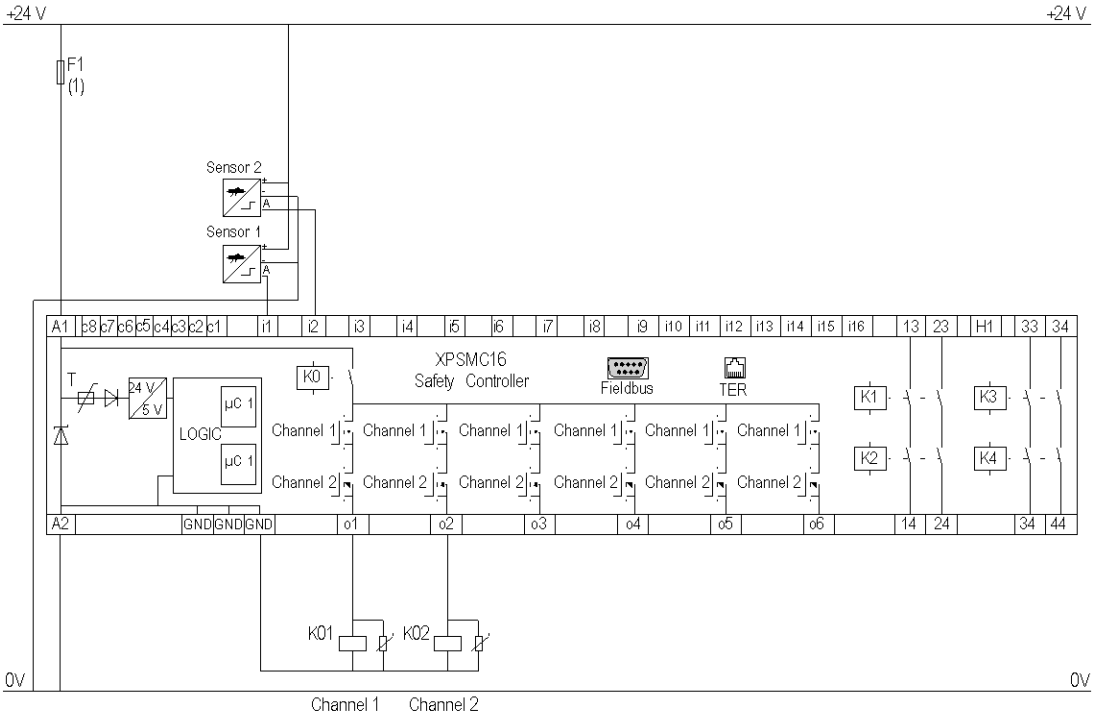
The following functional diagram shows the Zero Speed Detection:



NOTE: Use inputs i1 and i2 for zero speed detection. The two sensors must be arranged so that only one sensor is activated at any given time. If the inputs are in the low state, the zero speed signal will disappear after t=1/f and an open-circuit will be indicated. If the 2 inputs are in the high state, the zero speed signal will disappear after t=1/f and a cross-circuit will be indicated. If the 2 inputs are in the high or low state after starting, no enabling will take place.

Wiring Diagram

The following wiring diagram shows the Zero Speed Detection:



(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse sizes.

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Operating Conditions

Observe the following points for the operation of the zero speed detection:

- The sensors must be arranged so that only 1 sensor is activated at any given time (= HIGH-Signal).
- If both sensors are in the LOW state, a cable break error message is indicated and the corresponding outputs are deactivated.

- If both sensors are in the HIGH state after power on of the XPSMC Safety Controller, a notification is available via Modbus RTU, or via the configuration terminal (PC), and the corresponding outputs are deactivated. After a zero speed detection followed by subsequent motion the notification is reset.
- If zero speed is already detected and both sensors are in HIGH state, a notification is available via Modbus RTU, or via the configuration terminal (PC), and the corresponding outputs are activated.
- If only 1 sensor produces a dynamic signal after a zero speed, an error message appears after 30 s and the corresponding outputs are deactivated.
- If, after the XPSMC Safety Controller has started, both sensors are in the LOW state, an error message is available via the Error LED on the XPSMC Safety Controller and Modbus RTU, or via the configuration terminal (PC).

NOTE: You can only use one Zero Speed Detection per XPSMC Safety Controller, because there are only two counter inputs (**i1**and **i2**) per controller. For the same reason you cannot use the Zero Speed Detection device simultaneously with the Shaft/Chain Break Monitoring device on the same XPSMC Safety Controller.

NOTE: The output will be activated if the sensors detect no motion.

Sensor States and Behavior

Switch-on Sequence

State of Sensor 1	0	0 (*)	1
State of Sensor 2	0	1 (*)	1
Behavior	Error Message	Zero Speed	Notification (**)
Output	0	1	0

Operation

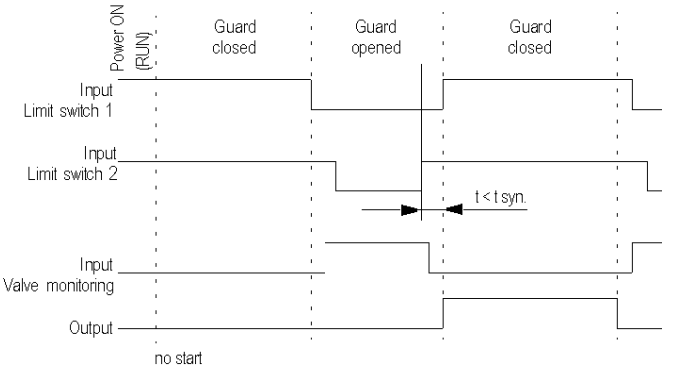
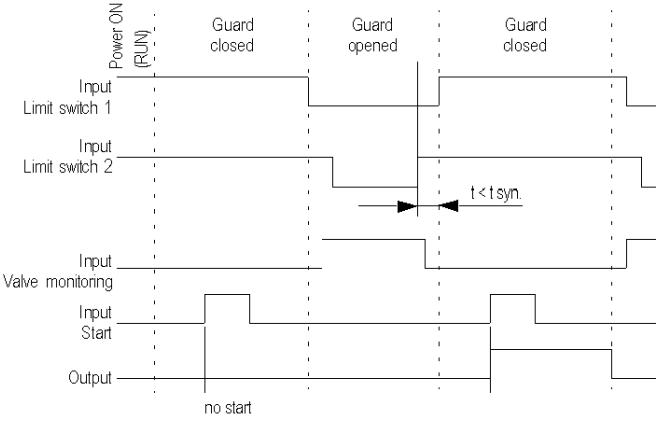
State of Sensor 1	0	0 (*)	1
State of Sensor 2	0	1 (*)	1
Behavior	Error Message	Zero Speed	Notification
Output	0	1	1

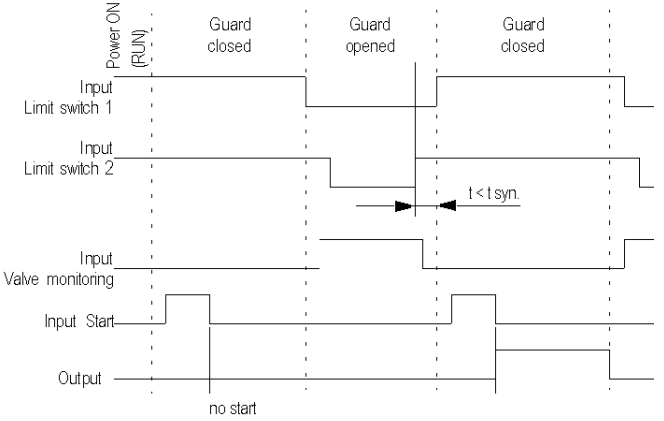
*	If the state of the sensors is inverse (0/1, 1/0), the behavior is identical.
**	If the firmware version is earlier than 2.34 an error message (cross circuit between inputs) appears instead of a notification. This error message must be acknowledged with the reset button. **NOTE:** When XPSMC••Z•• with firmware version earlier than 2.35 starts its function with both sensor inputs at HIGH, then the cross circuit between inputs stays ON.
Error Message	External error messages must be acknowledged with the reset button.
Notification	A notification, sent via Modbus, does not need to be acknowledged. As soon as the sensor states change, it will be acknowledged automatically.

Injection Molding Machines

Functional Diagram

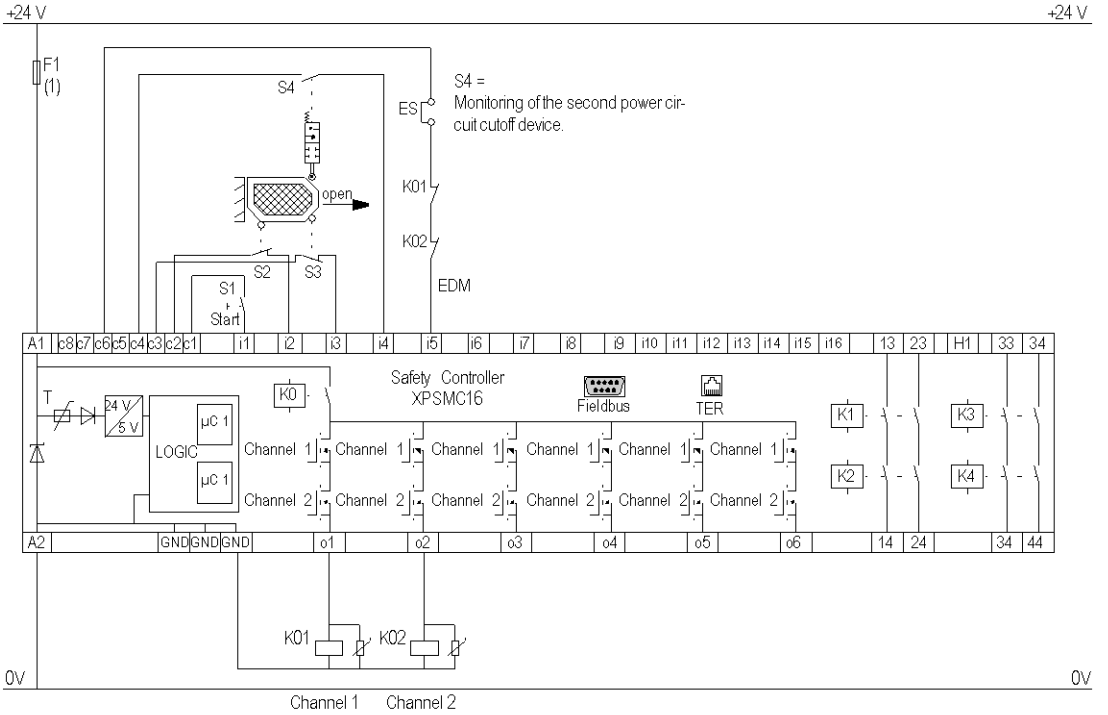
The following functional diagram shows the Safety Guard with One Channel with Start Interlock and different Start Functions:

Start Function	Start Interlock = NO
Automatic Start	
Monitored Start Rising Edge	

Start Function	Start Interlock = NO
Monitored Start Falling Edge	

Wiring Diagram

The following wiring diagram shows the Injection Molding with Start Functions:



EDM External Device Monitoring

ESC External Start Conditions

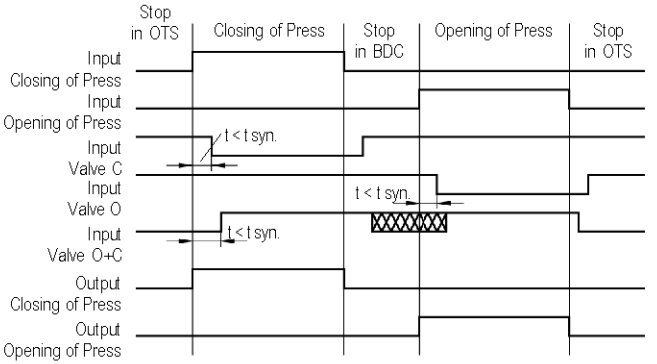
(1) See Technical Data in XPSMC Safety ControllerHardware manual for maximum fuse sizes.

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Hydraulic Press Valve Monitoring

Functional Diagram

The following functional diagram shows the Hydraulic Press Valve Monitoring:

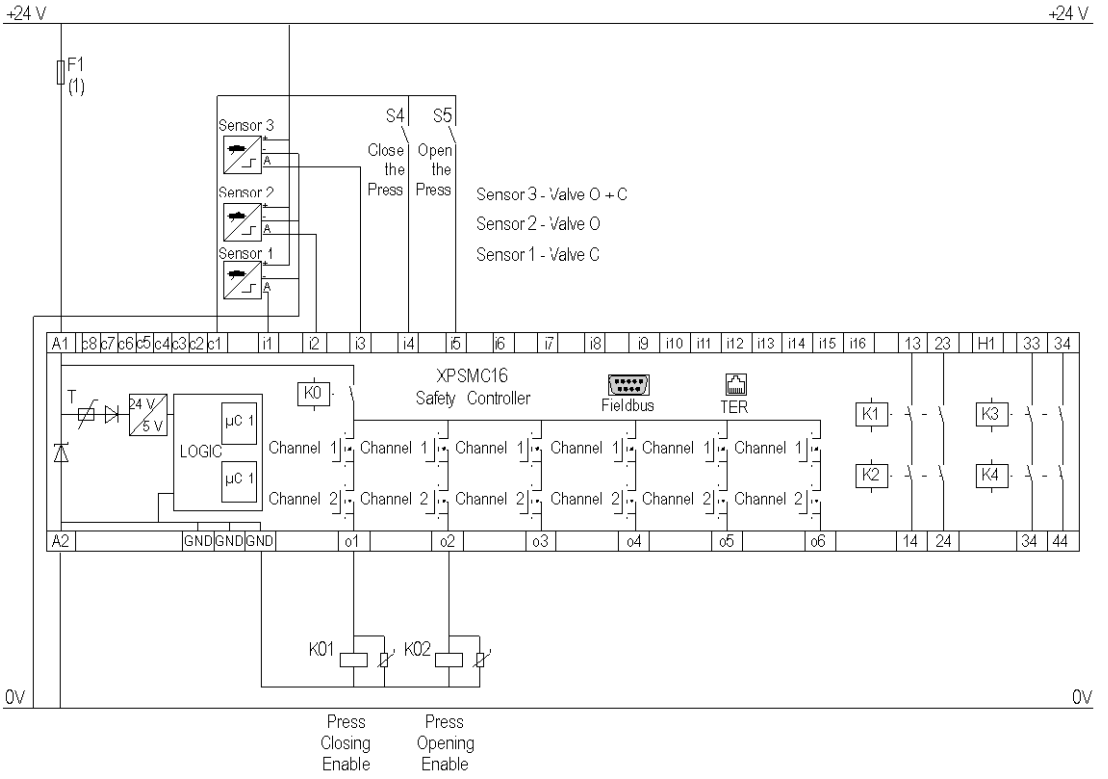


Sensor signals at valve level:

Valve	Sensor	Stop (Opened)	Pressing (Closing)	Stop (Closed)	Retraction (Opening)
Valve C	1				
Valve O	2				
Valve O + C	3				

Wiring Diagram

The following wiring diagram shows the Hydraulic Press Valve Monitoring:



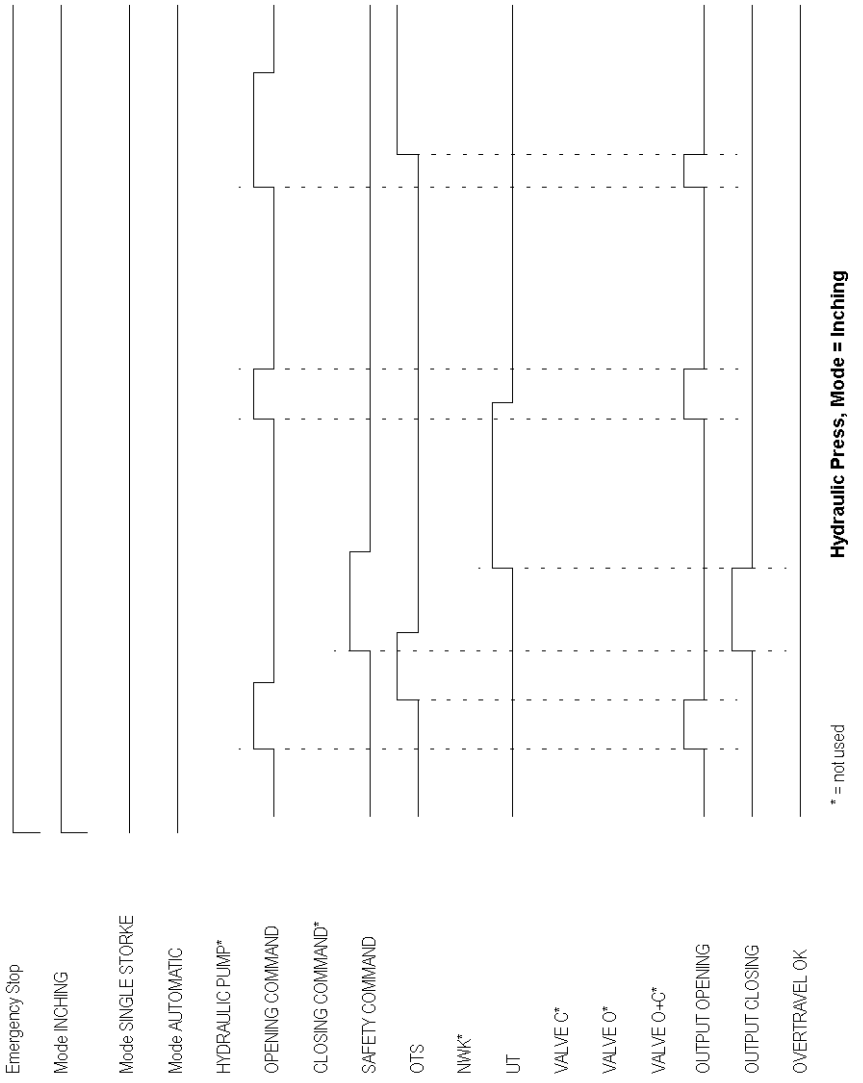
(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse sizes.

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

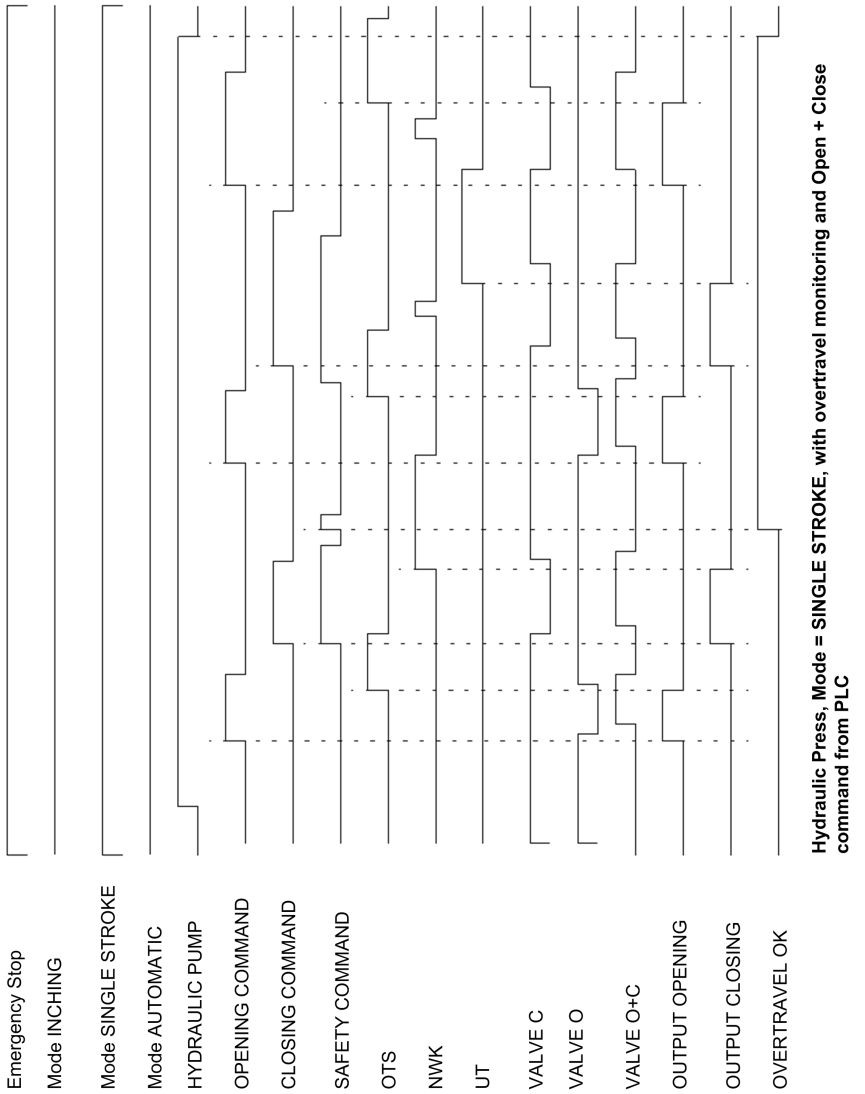
Hydraulic Press 2

Functional Diagrams

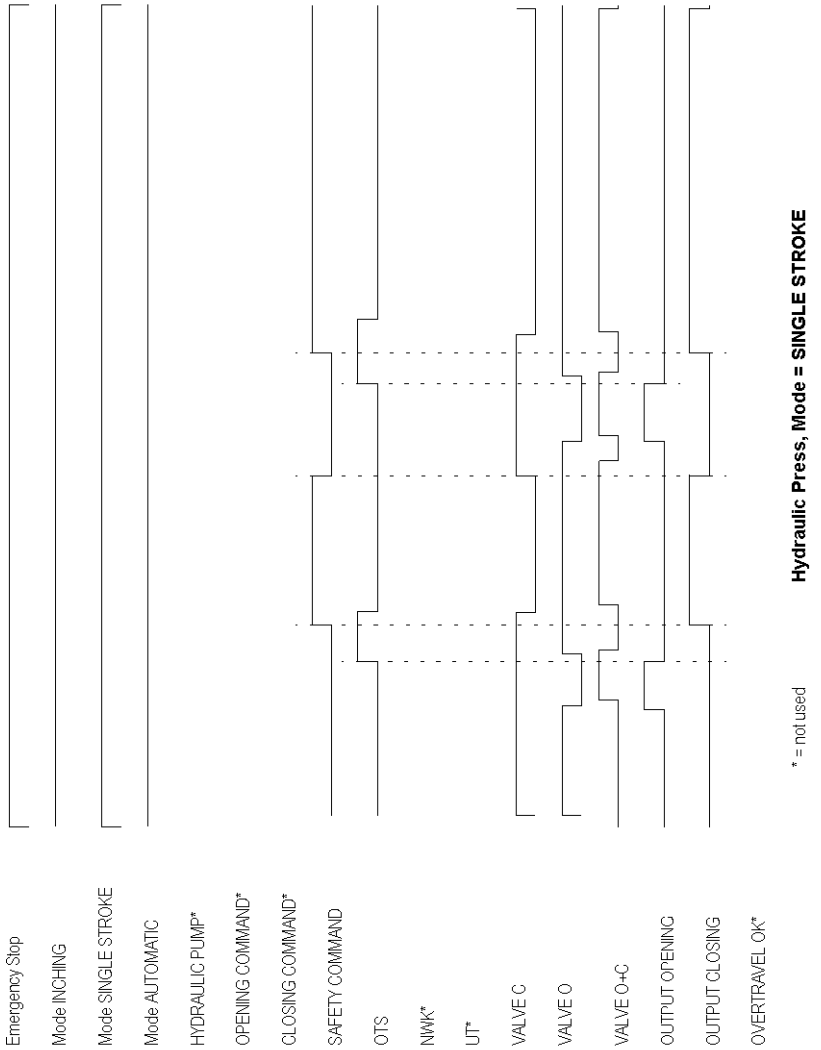
The following functional diagram shows the Hydraulic Press 2, Mode = INCHING



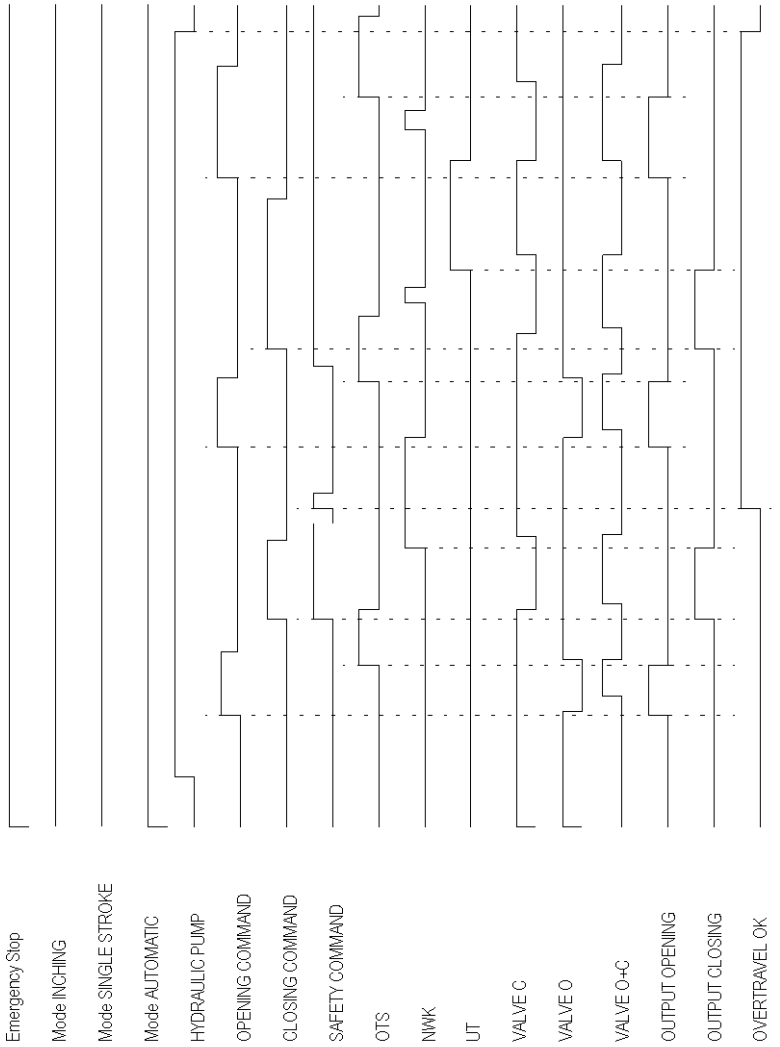
The following functional diagram shows the Hydraulic Press 2, Mode = SINGLE STROKE, with overtravel monitoring and `Open` + `Close` command from the non-safety-related controller:



The following functional diagram shows the Hydraulic Press 2, Mode = SINGLE STROKE:

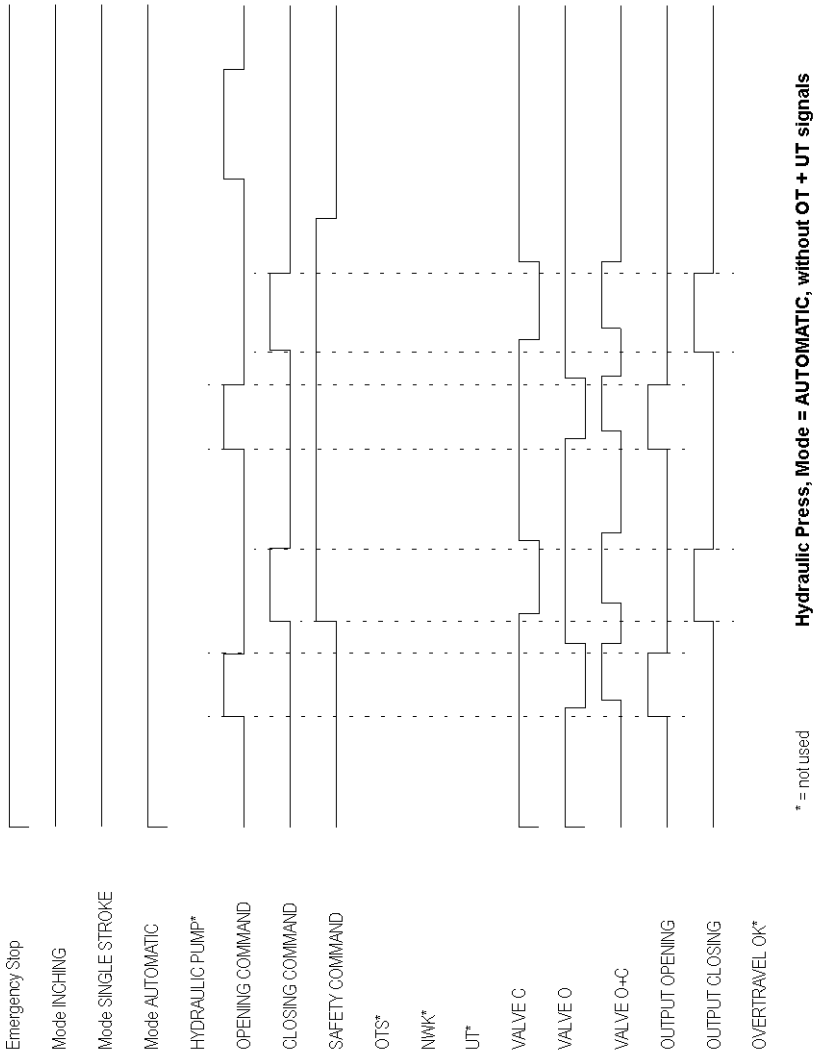


The following functional diagram shows the Hydraulic Press 2, Mode = Automatic, with overtravel monitoring and `Open` + `Close` command from the non-safety-related controller:



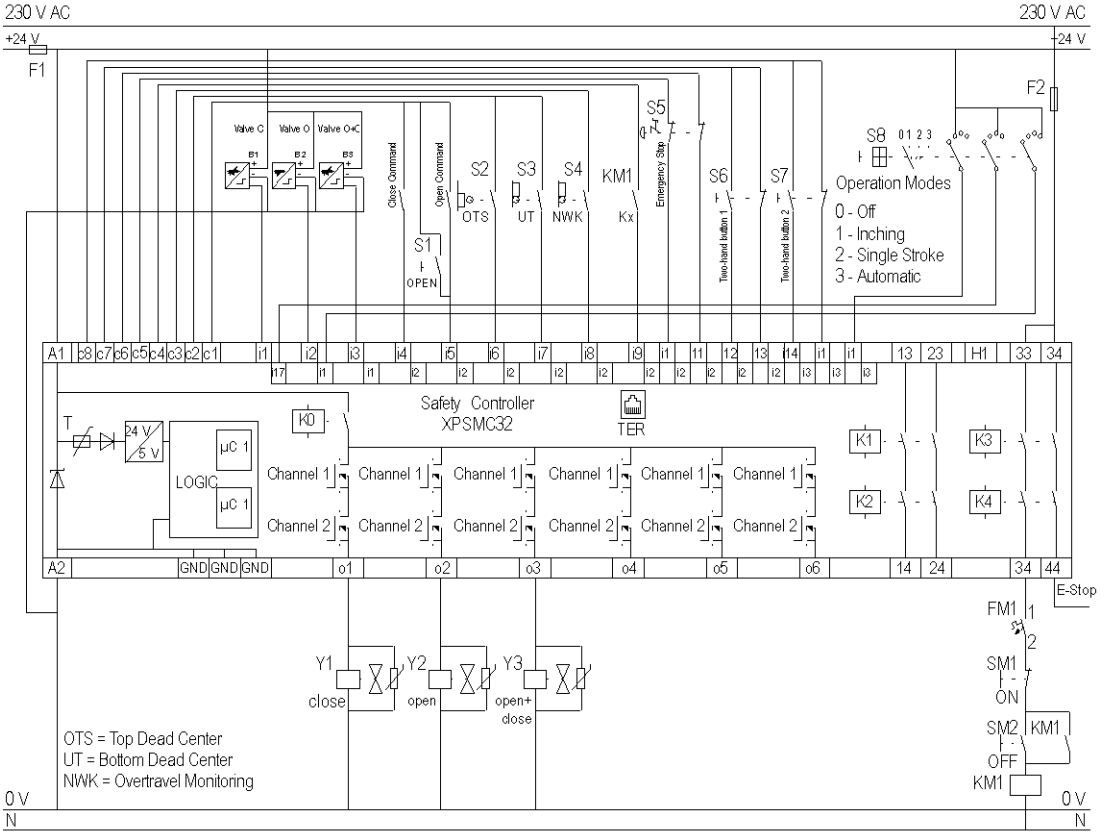
Hydraulic Press, Mode = AUTOMATIC, with overtravel monitoring and Open + Close command from PLC

The following functional diagram shows the Hydraulic Press 2, Mode = AUTOMATIC, without OT + UT signals:



Wiring Diagram

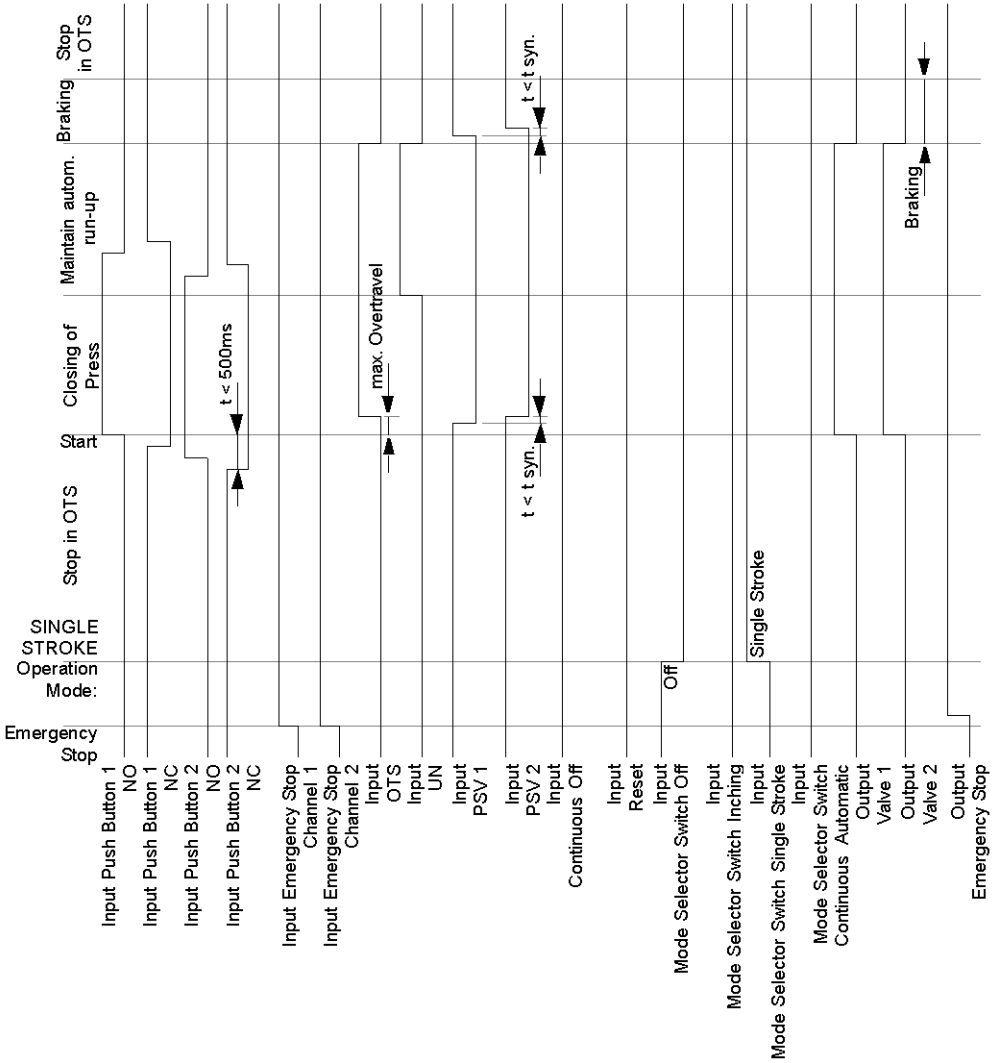
The following wiring diagram shows the Hydraulic Press 2:



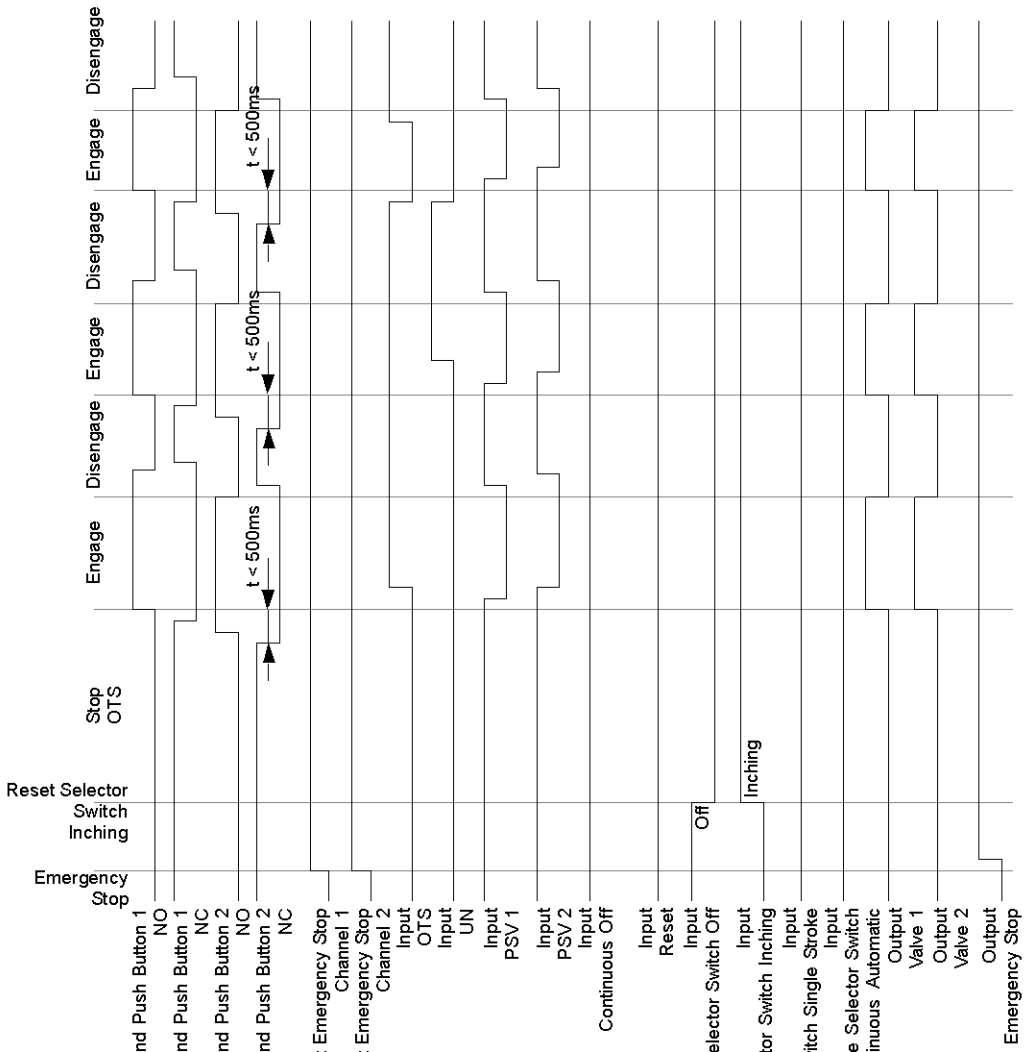
Eccentric Press

Functional Diagrams

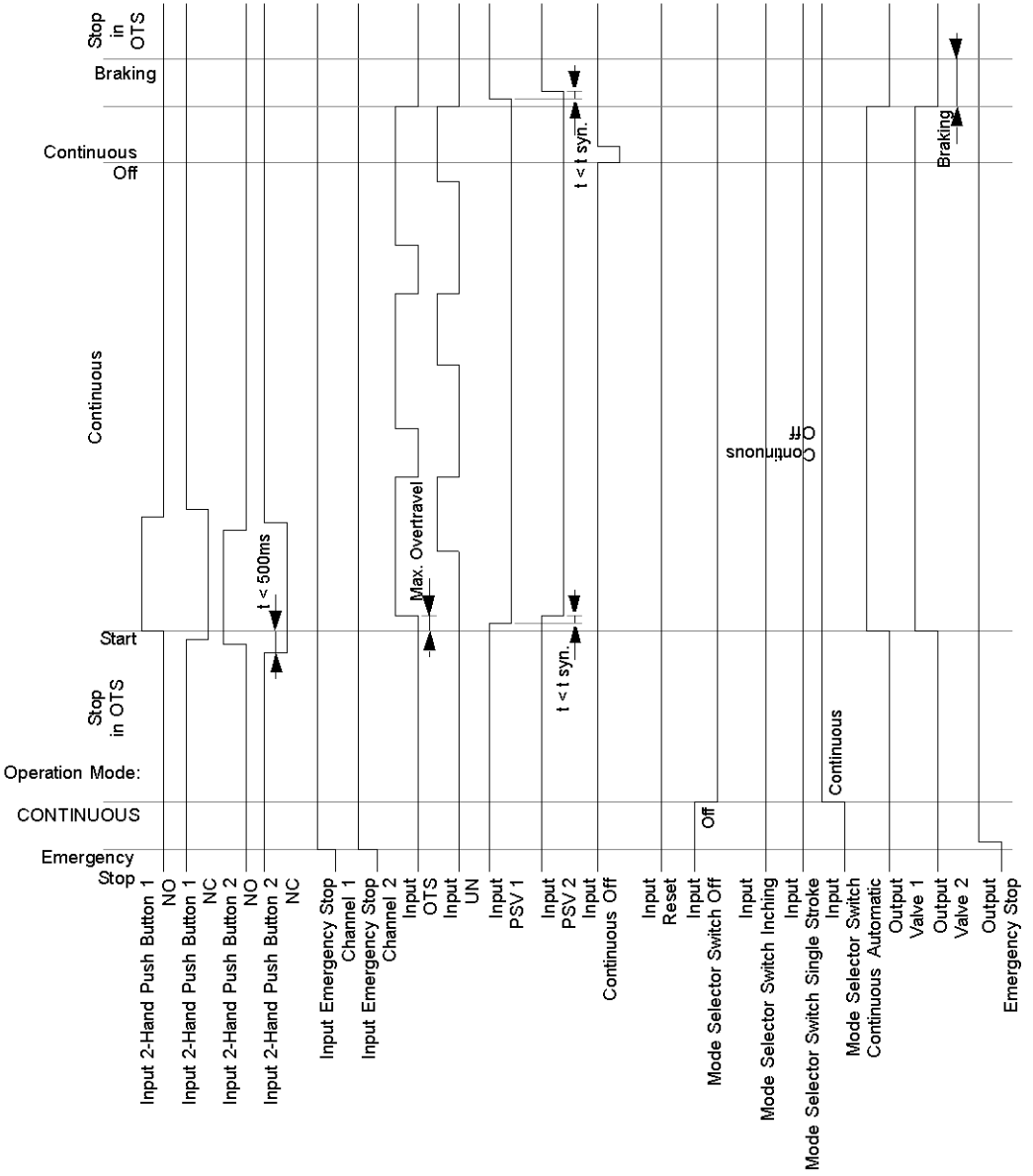
The following functional diagram shows the Eccentric Press, Mode = SINGLE STROKE



The following functional diagram shows the Eccentric Press, Mode = INCHING



The following functional diagram shows the Eccentric press, Mode = CONTINUOUS



Wiring Diagram

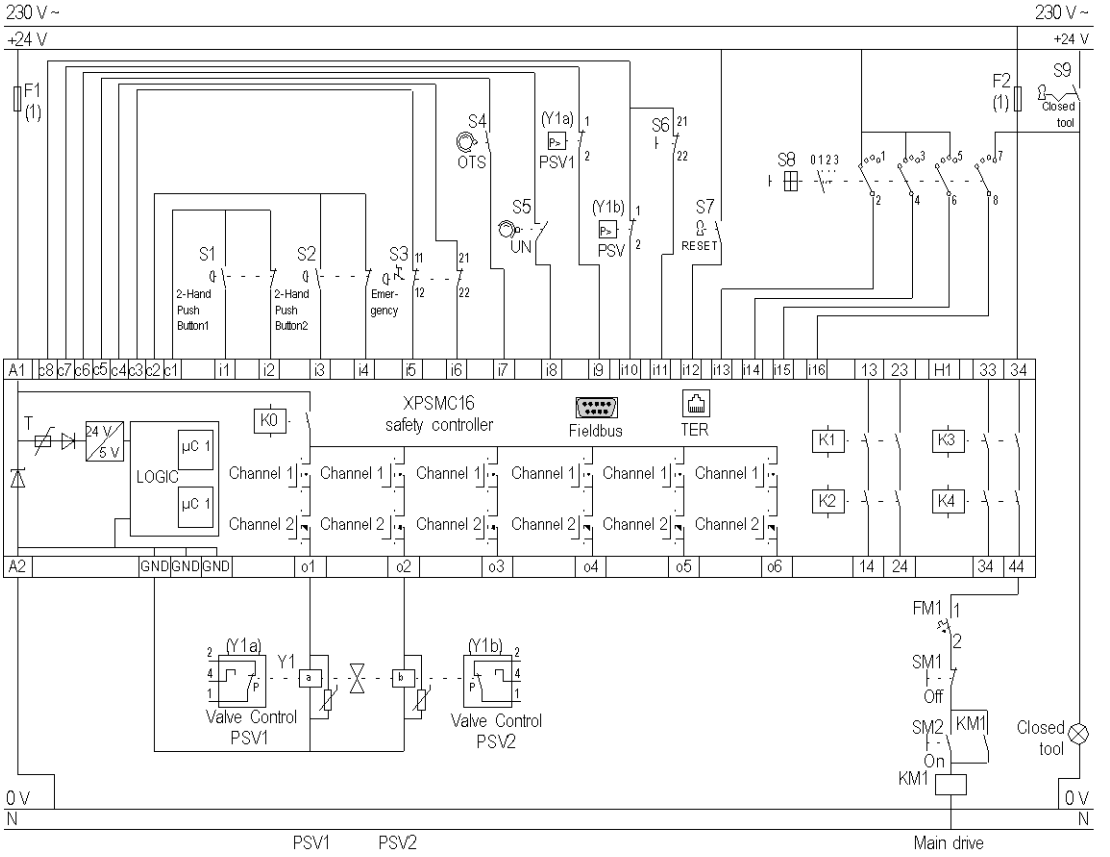
⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

The following wiring diagram shows the Eccentric Press:



OTS Top Dead Center

PSV Press Safety Valve

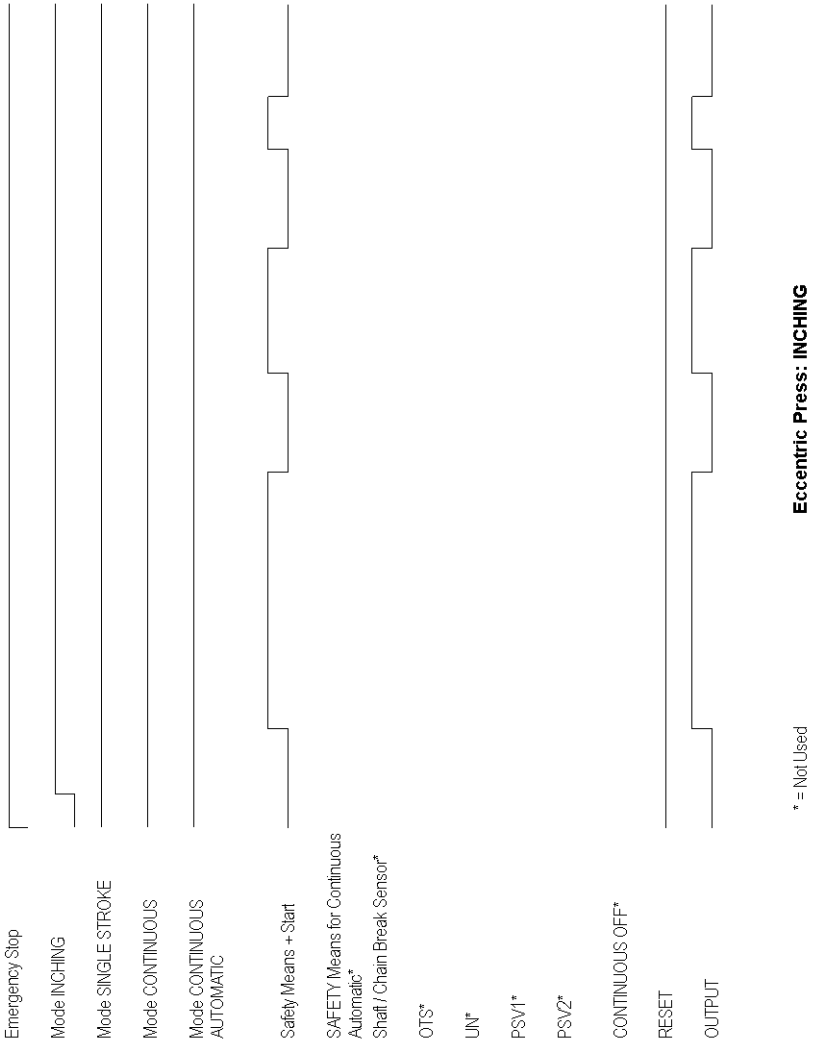
(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse sizes.

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

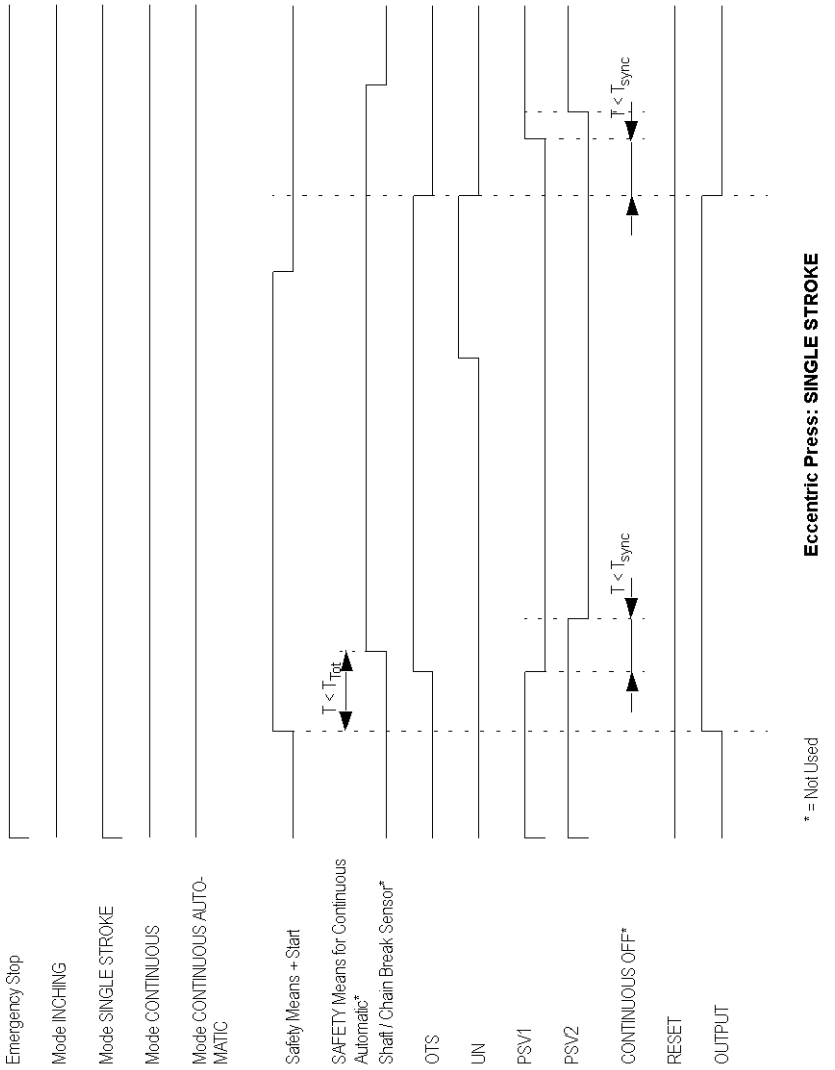
Eccentric Press 2

Functional Diagram

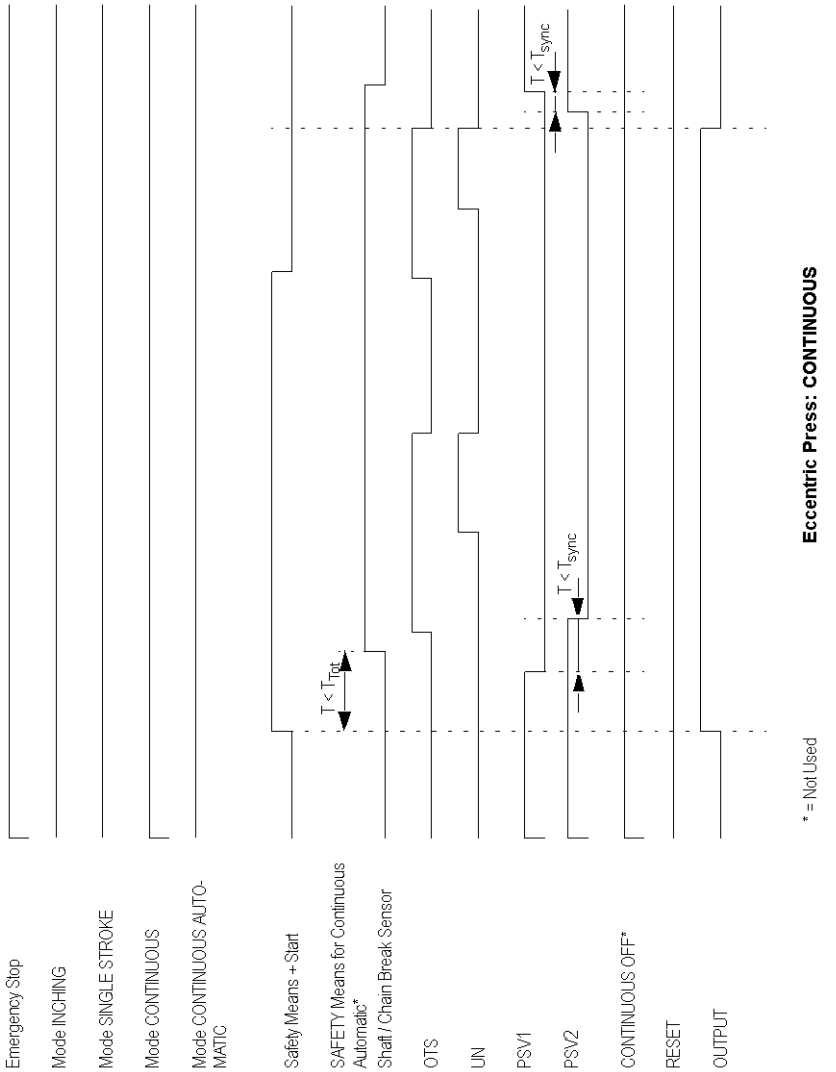
The following functional diagram shows the Eccentric Press 2, Mode = INCHING:



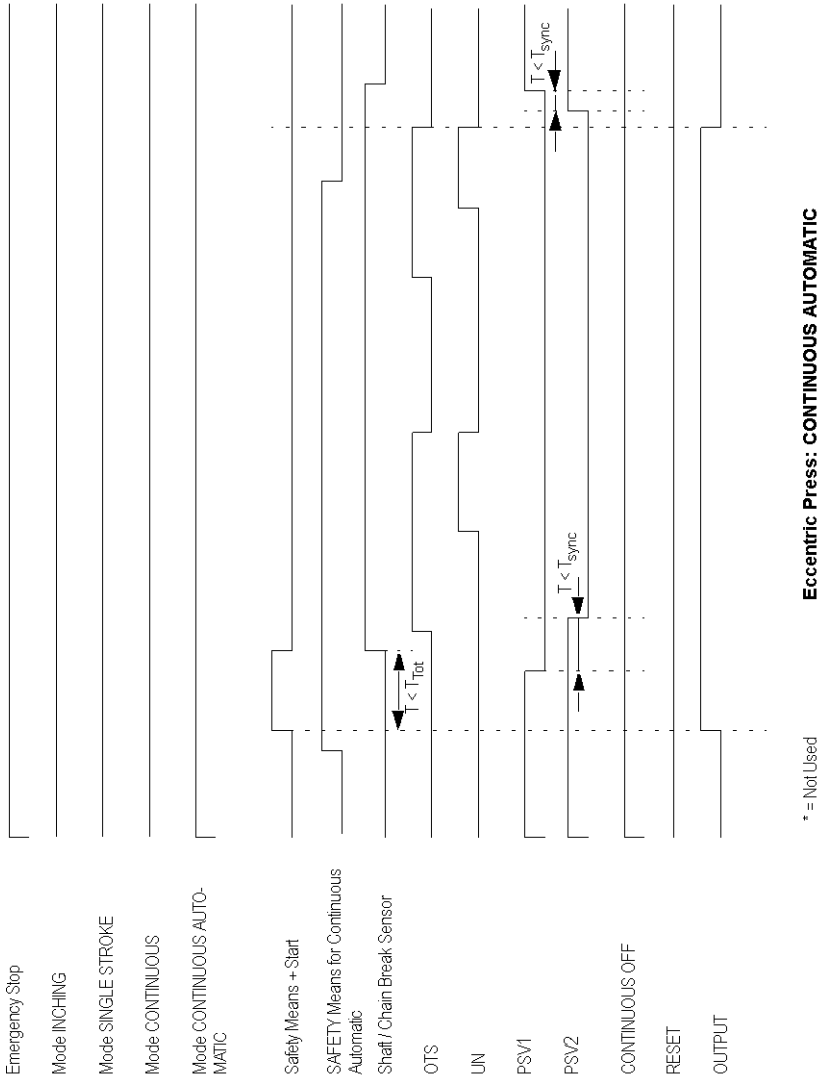
The following functional diagram shows the Eccentric Press 2, Mode = SINGLE STROKE:



The following functional diagram shows the Eccentric Press 2, Mode = CONTINUOUS:



The following functional diagram shows the Eccentric Press 2, Mode = CONTINUOUS AUTOMATIC:



Wiring Diagram

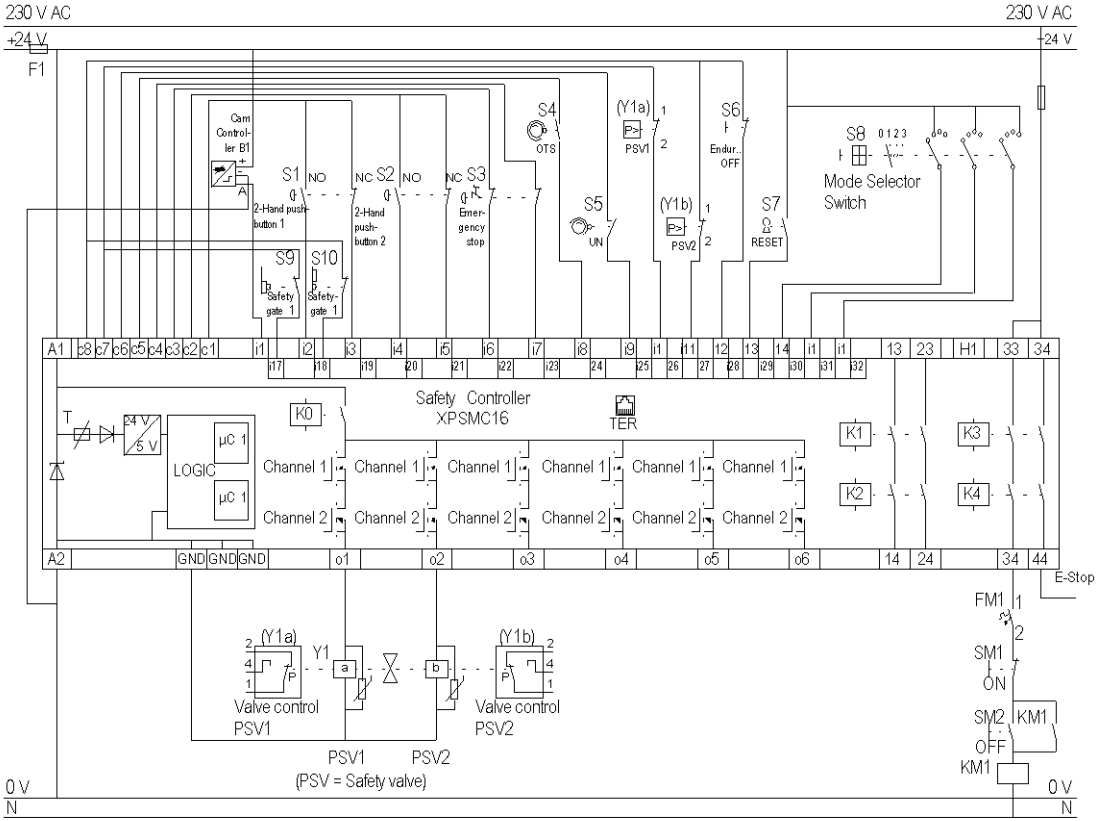
⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

The following image shows the wiring diagram of the Eccentric Press 2 device:



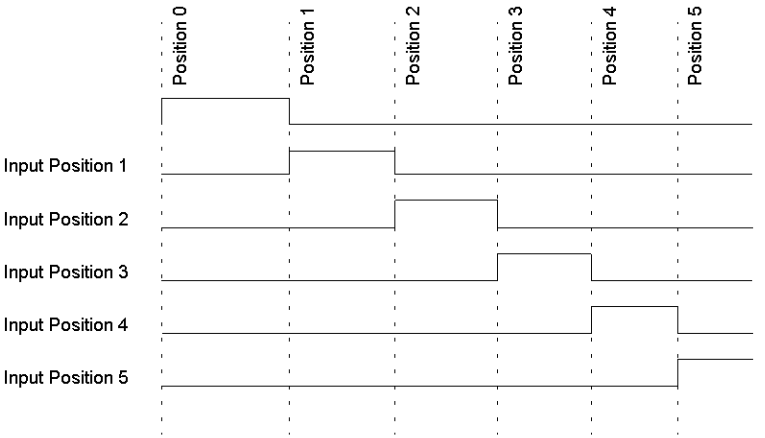
OTS Top Dead Center

PSV Press Safety Valve

Selector Switch

Functional Diagram

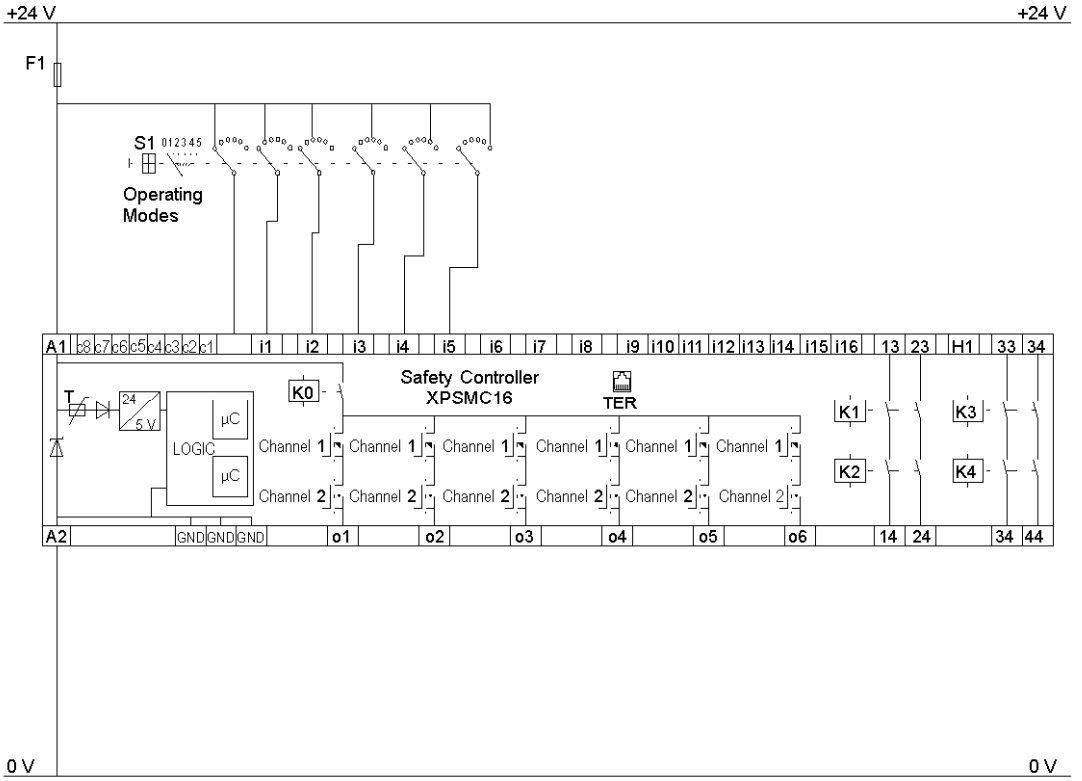
The following image represents the functional diagram of the Selector Switch device:



The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Wiring Diagram

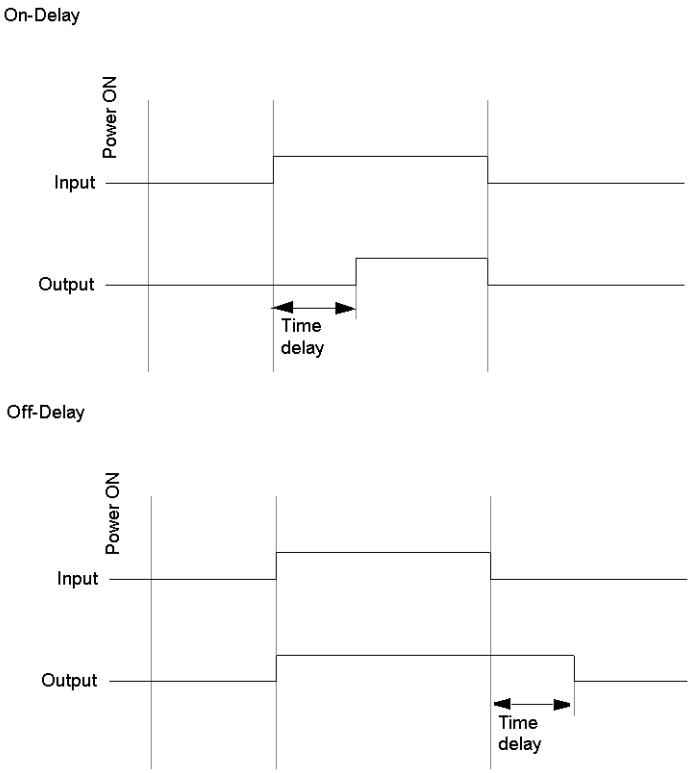
The following image represents the wiring diagram of the Selector Switch device:



Timer

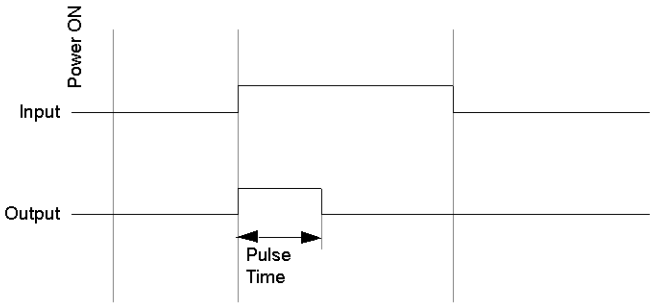
Functional Diagram

The following image represents the functional diagram of the Timer device for the On-/Off-Delay:

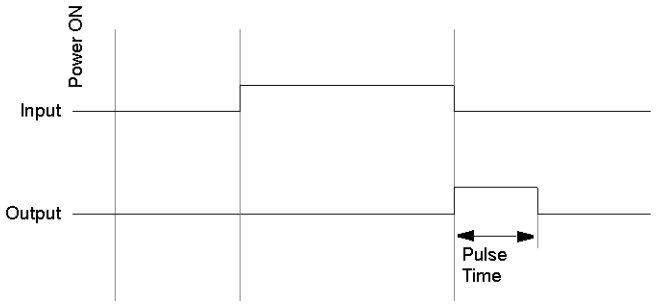


The following image represents the functional diagram of the Timer device for the On-/Off Pulse:

On Pulse

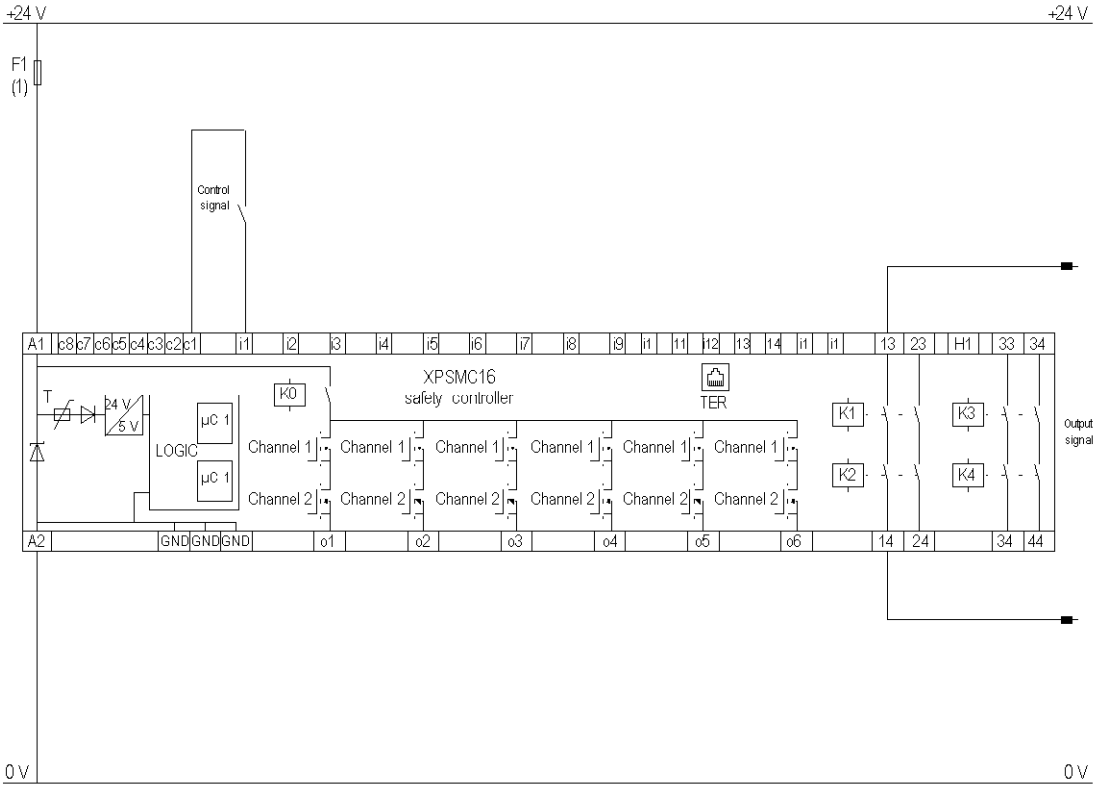


Off Pulse



Wiring Diagram

The following image represents the wiring diagram of the Timer device:



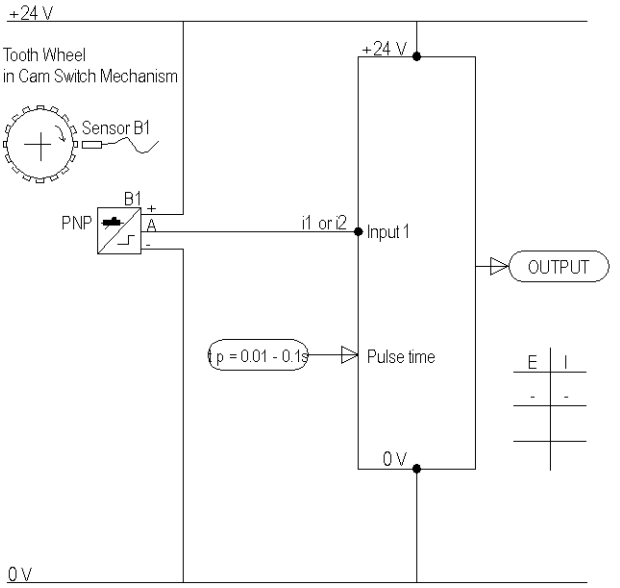
(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse sizes.

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Shaft/Chain-Break Monitoring

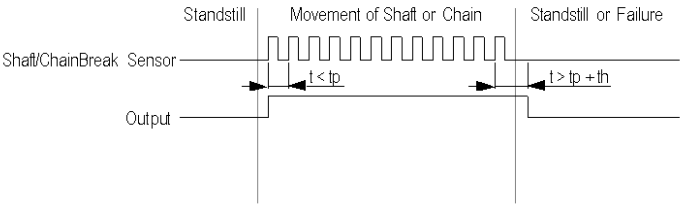
GBS Function Diagram

The following diagram shows the GBS function of the Shaft/Break-Chain Monitoring device:



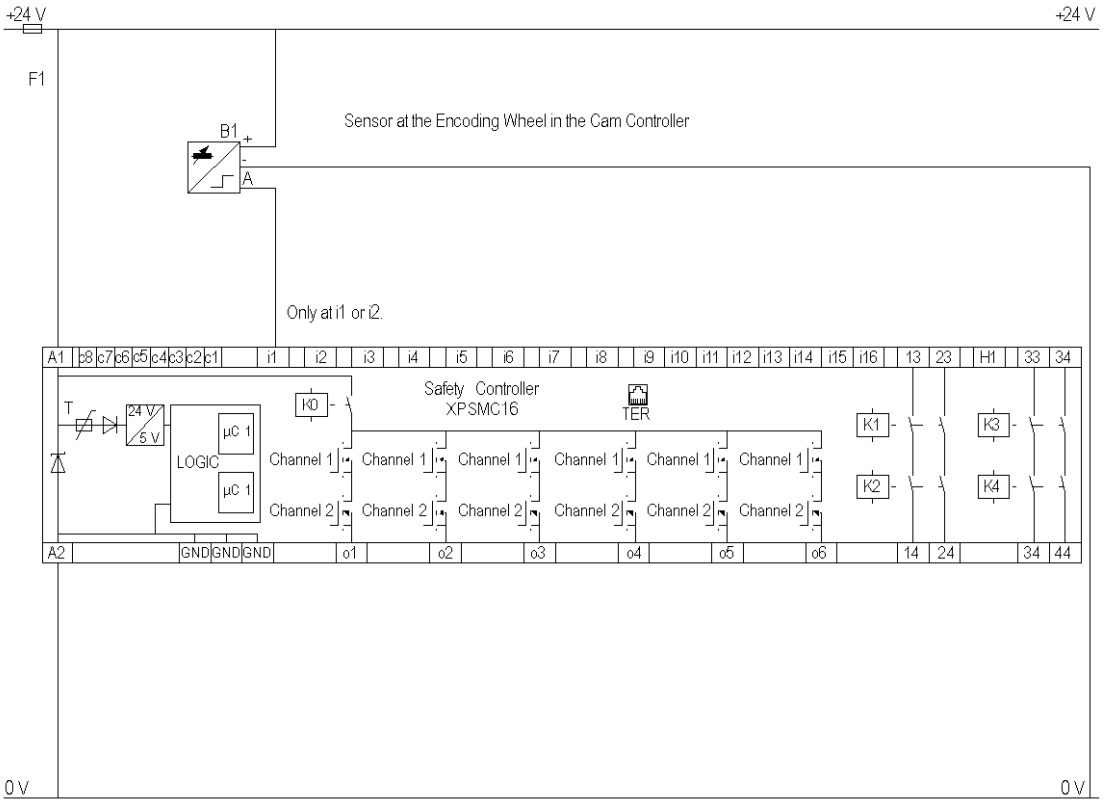
Sensor Position

The following diagram shows the Shaft/Chain-Break Monitoring function when the sensor is high or low at standstill:



Wiring Diagram

The following image is the Shaft/Chain-Break Monitoring wiring diagram:

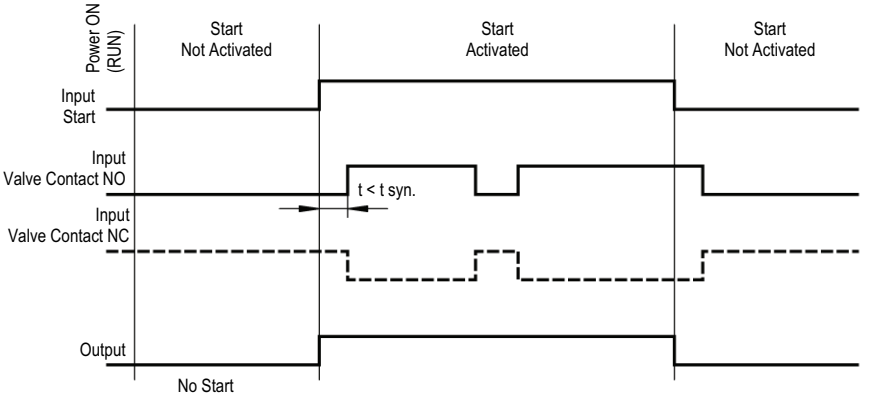


The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Seat Valve Monitoring

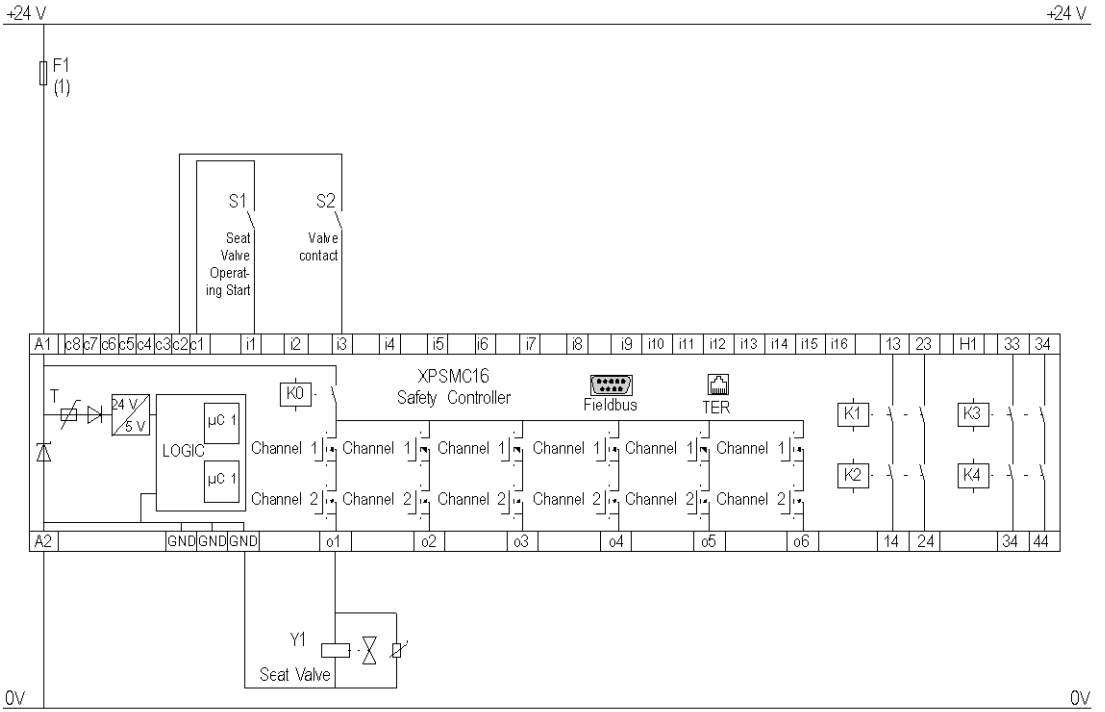
Functional Diagram

The following image represents the functional diagram of the Seat Valve Monitoring device:



Wiring Diagram

The following image represents the wiring diagram of the Seat Valve Monitoring device:



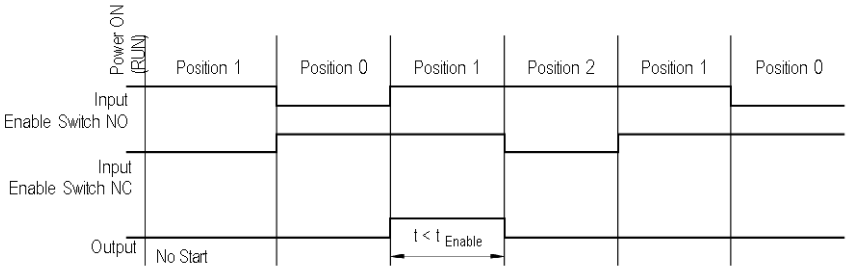
(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse sizes.

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

Enabling Device 2 Channel

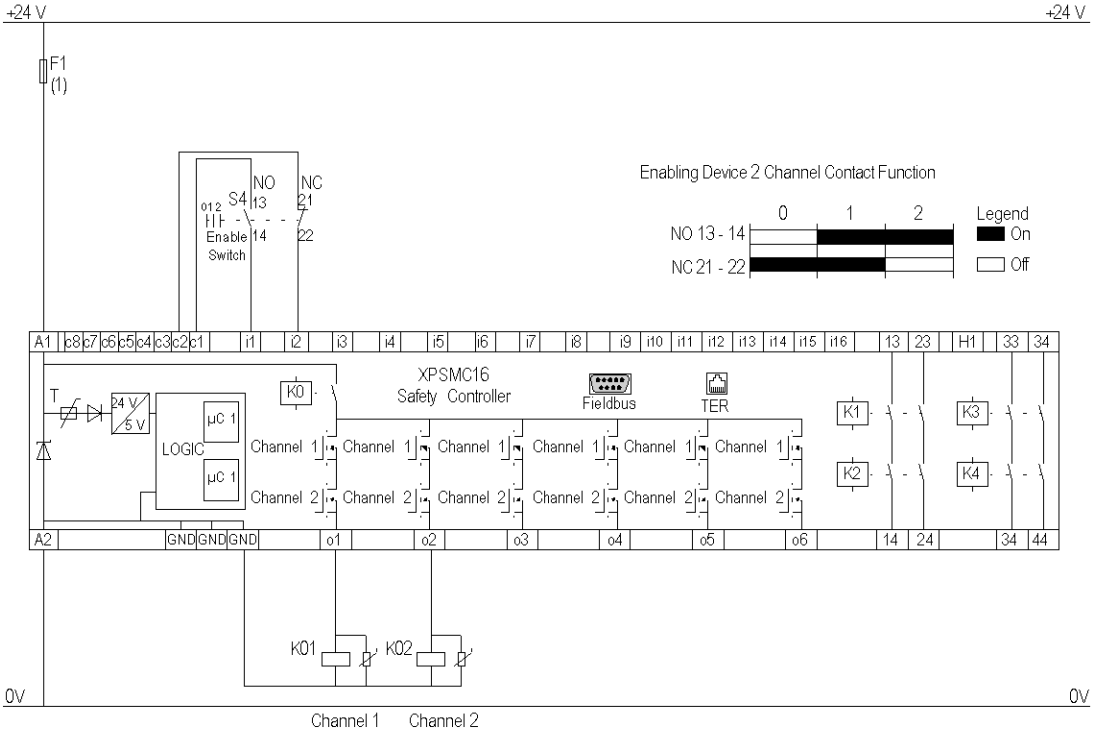
Functional Diagram

The following diagram represents the functional diagram of the Enabling Device 2 Channel:



Wiring Diagram

The following diagram represents the wiring diagram of the Enabling Device 2 Channel:



(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse sizes.

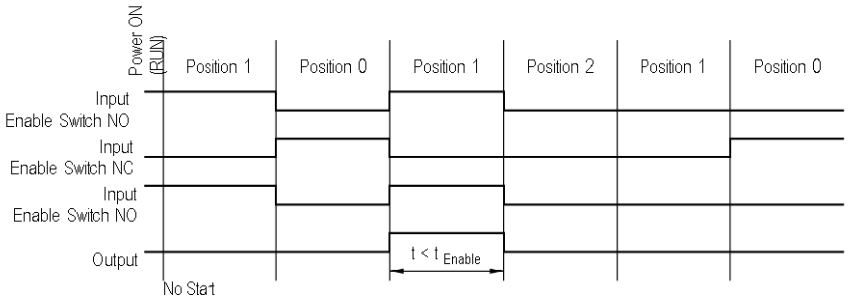
The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

NOTE: The XPSMC32 safety controller with 32 inputs is identical in function and wiring, but to inputs i1 to i32.

Enabling Device 3 Channel

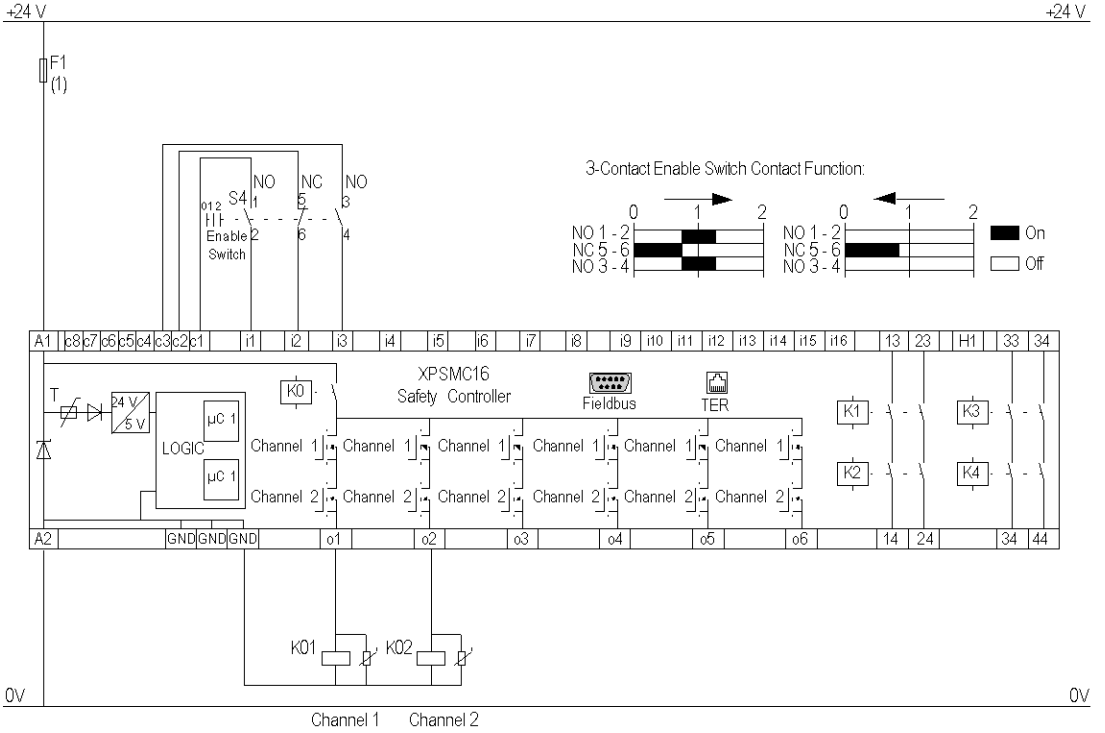
Functional Diagram

The following diagram represents the functional diagram of the 3-contact Enable Switch:



Wiring Diagram

The following diagram represents the wiring diaram of the 3-contact Enable Switch:



(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse sizes.

The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

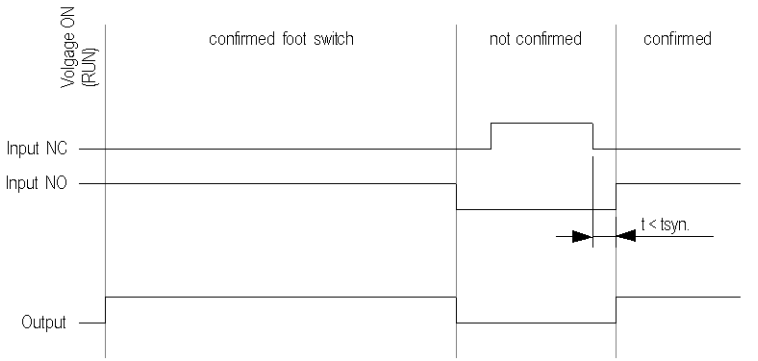
NOTE: The XPSMC32 safety controller with 32 inputs is identical in function and wiring, but to inputs i1 to i32.

Foot Switch

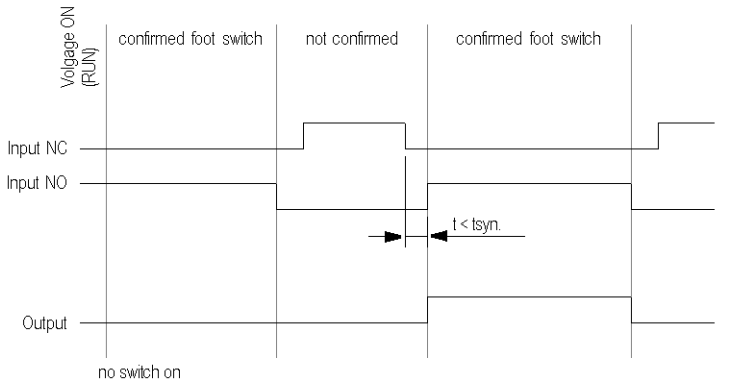
Functional Diagram

The following images represents the Foot Switch functional diagram:

Start interlock = NO



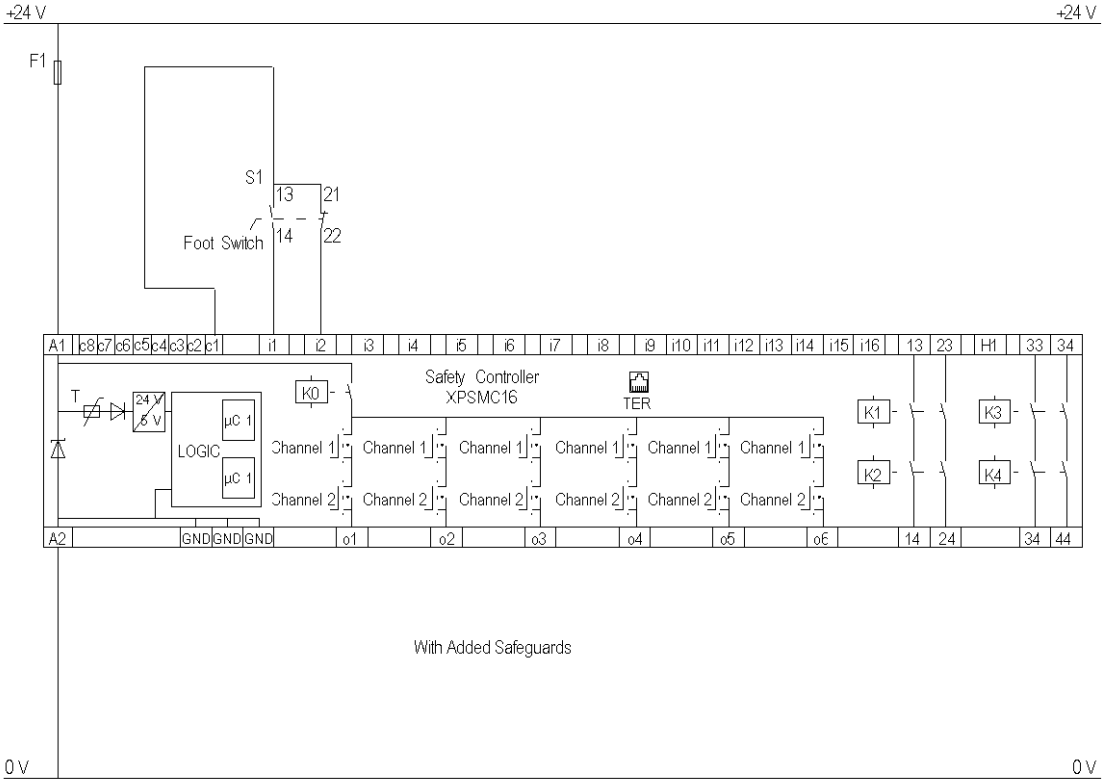
Start interlock = YES



The static outputs are rated PL e, category 4 according to ISO 13849-1, up to SIL 3 according to IEC 62061.

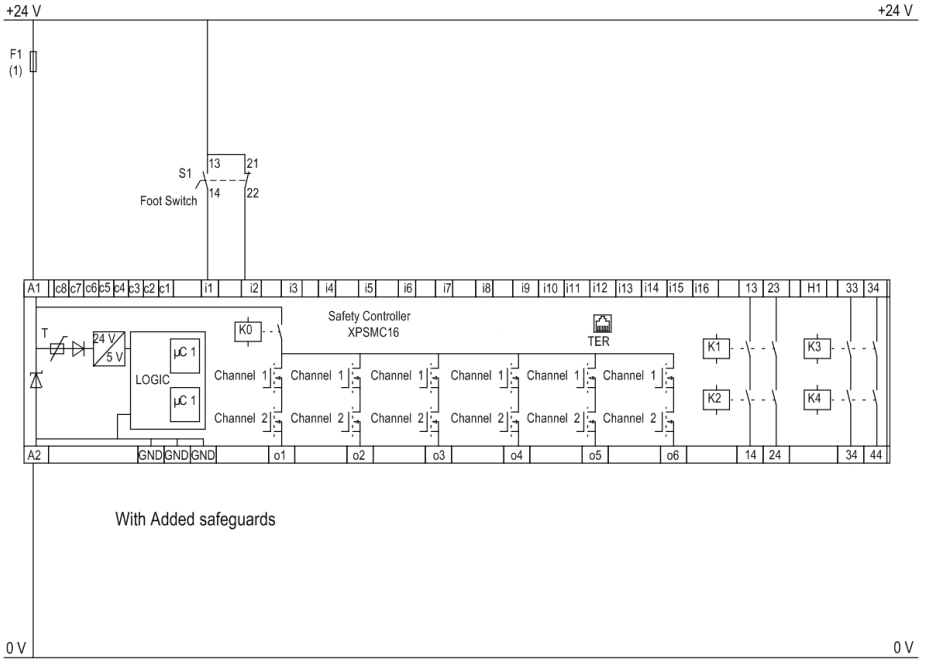
Wiring Diagram

The following image represents the Foot Switch wiring diagram:



Wiring Diagram with Externally Supplied 24 V Input

The following wiring diagram shows the Foot Switch with externally supplied 24 V input:



NOTE: For safety-related inputs not supplied by control outputs use external means to achieve up to SIL3 (IEC 62601) or PL e, Category 4 (ISO 13849-1), e.g. shielded cable.

Glossary

E

EDM:

external device monitoring

ESC:

external start conditions

ESPE:

electro sensible protective equipment

O

OSSD:

output safety switching device

OTS:

top dead center (Oberer Totpunktschalter)

P

PDO:

(*process data object*) An unconfirmed broadcast message or sent from a producer device to a consumer device in a CAN-based network. The transmit PDO from the producer device has a specific identifier that corresponds to the receive PDO of the consumer devices.

R

RUN Mode:

XPSMC Safety Controller functional status during which the connected circuit members are monitored and the safety outputs are switched.

S

Safety-Related Input:

Monitored input for connection of switching devices. By using various control outputs (c1... c8) to power the safety-related inputs, cross-connections, external voltage and ground connections can be detected on the safety-related inputs.

safety-related Outputs:

Relay or solid-state output activated by the XPSMC Safety Controller logic unit, which are able to cut off the subordinate control elements.

Synchronization Time:

maximum time difference allowed between the appearance of 2 input signals

T

TER (Connector for Terminal):

8 pin RJ45 connector for the connections of a PC for the configuration or diagnostic (bus system with Modbus protocol) or connections of another Modbus module (non-safety-related controller, terminals, etc...).

V

VDC:

validation counter

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As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

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