

XPSMCWIN

Configuration Software for XPSMC Original Version

01/2012



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All pertinent state, regional, and local 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.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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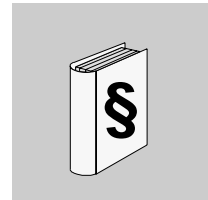
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Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, 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 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 an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.



WARNING

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

CAUTION
--

CAUTION indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.
--

<i>NOTICE</i>

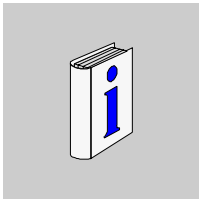
<i>NOTICE</i> is used to address practices not related to physical injury.

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



At a Glance

Document Scope

This manual contains the XPSMCWIN software description.

The XPSMCWIN application allows you to set up, configure, start, and diagnose the XPSMC safety controller using a PC.

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

Validity Note

Six versions of the safety controller are available:

Type	Characteristics
XPSMC16Z	8 control outputs and 16 safety inputs 6 safety transistor outputs 2 x 2 safety relay outputs add-in functions Modbus (RTU) communication and configuration port
XPSMC16ZP	8 control outputs and 16 safety inputs 6 safety transistor outputs 2 x 2 safety relay outputs add-in functions Profibus DP communication port Modbus (RTU) communication and configuration port
XPSMC16ZC	8 control outputs and 16 safety inputs 6 safety transistor outputs 2 x 2 safety relay outputs add-in functions CANopen communication port Modbus (RTU) communication and configuration port

Type	Characteristics
XPSMC32Z	8 control outputs and 32 safety inputs 6 safety transistor outputs 2 x 2 safety relay outputs add-in functions Modbus (RTU) communication and configuration port
XPSMC32ZP	8 control outputs and 32 safety inputs 6 safety transistor outputs 2 x 2 safety relay outputs add-in functions Profibus DP communication port Modbus (RTU) communication and configuration port
XPSMC32ZC	8 control outputs and 32 safety inputs 6 safety transistor outputs 2 x 2 safety relay outputs add-in functions CANopen communication port Modbus (RTU) communication and configuration 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 - Hardware Manual	33003275

You can download these technical publications and other technical information from our website at www.schneider-electric.com.

User Comments

We welcome your comments about this document. You can reach us by e-mail at techcomm@schneider-electric.com.

Functional Safety Information

1

What's in this Chapter?

This chapter contains the following topics:

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IEC 61508 and Safety Integrity Level (SIL)

Introduction

The XPSMC safety controllers are a Safety-Related System certified according to IEC 61508 by TÜV NORD CERT GmbH.

IEC 61508 Description

The IEC 61508 is a technical standard concerning the Functional Safety of electrical, electronic or programmable electronic Safety-Related Systems.

A Safety-Related System is a system that is required to perform 1 or more specific functions to ensure risks are kept at or below an acceptable level. Such functions are defined as Safety Functions.

A system is defined functionally Safe if random, systematic, and common cause failures do not lead to malfunctioning of the system and do not result in injury or death of humans, spills to the environment, and loss of equipment and production.

Description of the Safety Integrity Level (SIL)

Safety Functions are executed to achieve and maintain the Safe state of a system. The IEC 61508 specifies 4 levels of Safety performance for a Safety Function. These are called Safety Integrity Levels (SIL), ranging from 1 (the lowest) to 4 (the highest). The XPSMC controllers are certified for use in SIL 3 applications in which the de-energized state is the Safe state, for example in an emergency shutdown (ESD) system.

Functional Safety Certification

Introduction

The XPSMC controllers are certified

- by TÜV NORD CERT GmbH
- for use in applications up to and including SIL 3 according to IEC 61508 and IEC 62061.

This certification verifies that the XPSMC is compliant with the following standards and directives:

- 2006/42/EC
- EN 60204-1:2006
- EN ISO 13849-1:2008, PL e
- EN / IEC 61508:2001, SIL 3
- EN 62061:2005, SILCL 3
- EN 60947-5-1:2004 chapter 4.4 Categories for switching elements
- EN 61496-1:2004+A1:2008 annex A.7 Muting
- EN 574:1996+A1:2008, Typ IIIa, Typ IIIc
- EN 692:2005+A1:2009, chapter 5.4.1
- EN 693:2001+A1:2009, chapter 5.4.1

NOTE: Please visit our website www.schneider-electric.com for a copy of the most recent version of the certificate. Also refer to Declaration of Conformity.

NOTE: Using a XPSMC safety controller is a necessary but not sufficient precondition for the certification of a SIL 3 application. A SIL 3 application must also fulfill the requirements of the IEC 61508, and other application standards.

Functional Safety Parameters

Values for safety relay outputs

- according to EN ISO / ISO 13849-1
 - PL e / Category 4
 - $MTTF_d = 71$ Years
 - DC > 99%
- according to EN / IEC 62061
 - $PFH_d = 1,4 \times 10^{-8}$ 1/h
 - SILCL 3

Values for safety transistor outputs

- according to EN ISO / ISO 13849-1
 - PL e / Category 4
 - $MTTF_d = 76,6$ Years
 - DC > 99%

- according to EN / IEC 62061
 - $\text{PFH}_d = 1,29 \times 10^{-8} \text{ 1/h}$
 - SILCL 3

NOTE:

- The performance level and safety category in accordance with EN ISO / ISO 13849-1 depends on the external wiring, the application case, the choice of control station and how this is physically arranged on the machine.
- The user must carry out a risk assessment in accordance with EN ISO / ISO 12100.
- The entire system/machine must undergo validation in accordance with the applicable standards.
- The module contains electro-mechanical relays. This is why actual MTTF_d values will vary depending on the application load and duty cycle. The estimated MTTF_d values in years mentioned above are based on the following assumptions:
 - B_{10d} value for maximum load of 400,000
 - average switching quantity $n_{op}=6,300 \text{ cycles/year}$
 - B_{10d} value for low load of 20,000,000
 - average switching quantity $n_{op}=361,800 \text{ cycles/year}$
(see EN ISO / ISO 13849-1, C.2.4 and Tab K.1)
- You must ensure that the loads and switching cycles experienced by the safety relay are appropriate for the calculated performance level. Use the *Electrical Life of the Output Contacts diagrams* to calculate the maximum acceptable values. Make frequent observations of the operating conditions and replace the module before these limits are exceeded. The specified performance level can only be assured for the number of switching cycles calculated using this method. In no case should you exceed a service life of 20 years.
- Operating the device not within the specifications may lead to unintended behavior or the destruction of the device.
- Please consult the installation notes.

NOTE: There are no user serviceable components in the module.

 CAUTION**RESIDUAL RISK (EN ISO / ISO 12100-1)**

These controllers must be used for safety-related functions in conjunction with the connected safety equipment and devices that meet applicable standard requirements.

A residual risk will remain if:

- it is necessary to modify this recommended circuit and if the added/ modified components are not properly integrated in the control circuit.
- the user does not follow the required standards applicable to the operation of the machine, or if the adjustments to and maintenance of the machine are not properly made. It is essential to strictly follow the prescribed machine maintenance schedule.
- the devices connected to the safety outputs do not have mechanically-linked contacts.

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

Training

Introduction

As stated in the IEC 61508, Part 1, App. B, all persons involved in a Safety Lifecycle activity must have the appropriate training, technical knowledge, experience, and qualifications relevant to the specific duties they have to perform. This should be assessed in relation to each particular application.

NOTE: Make sure you possess all information and skills required to install, run, and maintain Safety-Related Systems correctly.

Qualification of Personnel

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 the installation, and has received safety training to recognize and avoid the hazards involved.

The specialists must be able to detect possible hazards that may arise from parameterization, changing parameter values and generally from mechanical, electrical or electronic equipment. The specialists must be familiar with the standards, provisions and regulations for the prevention of industrial accidents, which they must observe when working on the drive system.

Training Contents

In addition to the usual training courses concerning the use of the company's products, Schneider Electric offers you training courses covering the topics of its IEC 61508 compliant Safety-Related System.

System Requirements and Software Installation



Overview

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

What’s in this Chapter?

This chapter contains the following topics:

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System Requirements

Hardware

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

- an XPSMC safety controller
- a configuration cable
 - TCSMCNAM3M002P (preferred, 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 safety controller to the PC

- an IBM compatible PC with the following minimum capabilities:
 - Pentium® processor, or equivalent
 - CD-ROM drive for the installation
 - mouse or an equivalent device
 - free RS232 serial port with a 9-pin subD connector or USB-Port
 - at least 20 MB free hard disk space
- display: 800 x 600, 256 colors (1024 x 768 recommended)

Connection between the PC and the XPSMC Safety Controller

To set up or diagnose the XPSMC 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 universal 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 standard 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

NOTE: Do not use other than the cabling options mentioned above.

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 CD-ROM.

The following table describes steps to install them:

Step	Action
1	On the installation CD-ROM change the directory to <i>/Drivers for USB Cable</i> .
2	Run the file <i>Communication_Drivers_Pack_*.exe</i> . The asterisk (*) replaces a version indication.
3	Plug in the cable.
4	In the New Hardware dialog 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	Check at the Windows Device Manager which virtual COM port was assigned for the cable.

Installation

Installation Procedure

To install the XPSMCWIN software, you need the installation CD-ROM. Proceed as follows:

Step	Action
1	Insert the CD with the current version of the XPSMCWIN software into the drive. Follow the installation wizard instructions to install the software.
2	In case installation does not start automatically, run the <i>setup.exe</i> file in the CD-ROM default directory, for example: <i>D:\setup.exe</i> (if <i>D:</i> is the letter corresponding to your CD-ROM drive).
3	The program is ready to be started for the first time

XPSMCWIN User Interface



Overview

This chapter contains the description of the software user interface.

What’s in this Chapter?

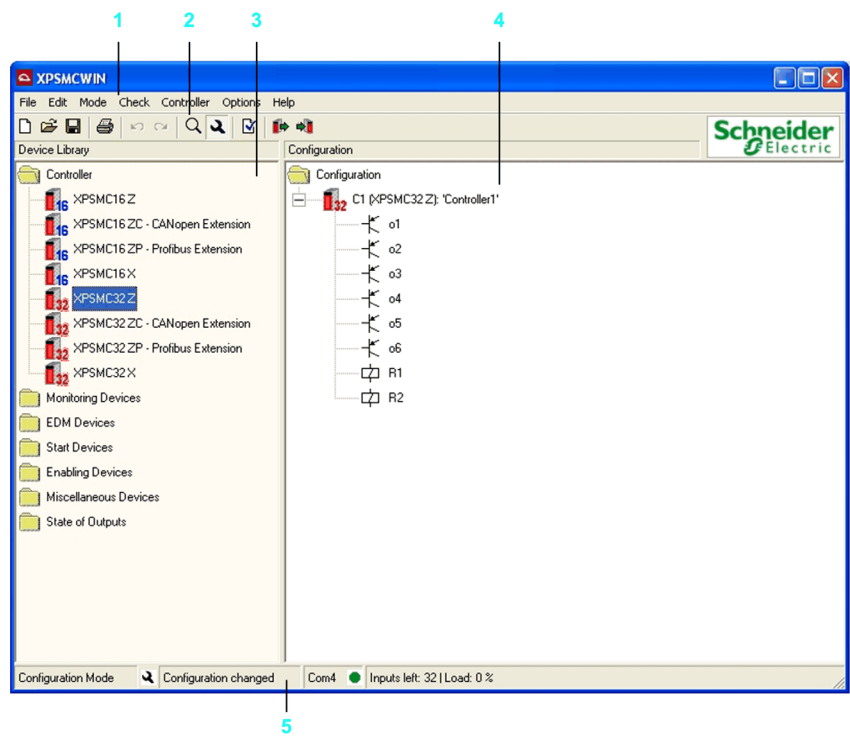
This chapter contains the following topics:

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Elements of a Window	24

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

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

The devices are configured by the following similar 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. On the subject of these parameters, refer to chapter *Device Library*, page 37.

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 context menu (right-clicking the device and selecting **Properties** command). 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:

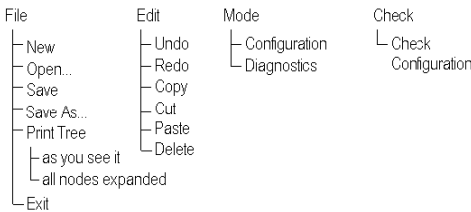
Command	Description
Properties	Open the Properties window of the selected device.
Copy	Using this command, a device can be copied with the properties assigned to it and pasted elsewhere in the configuration tree.
Cut	Cut the selected device.
Paste	Paste a copied or cut device as a copy or as a new device 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 current configuration).
Collapse all	Collapse the entire configuration tree. Only controller will be shown.

Elements of a Window

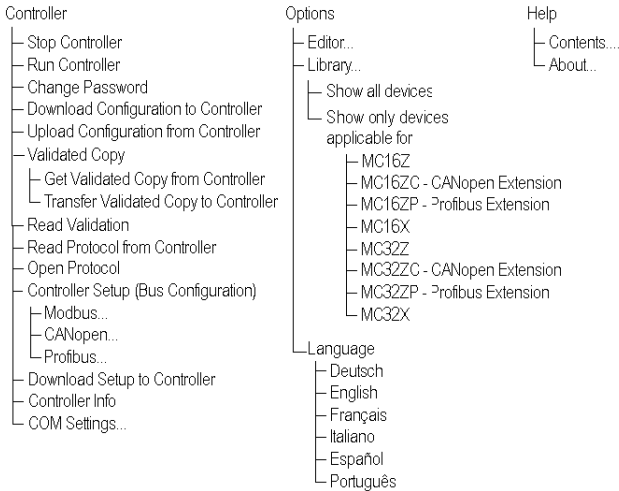
Menu Bar

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

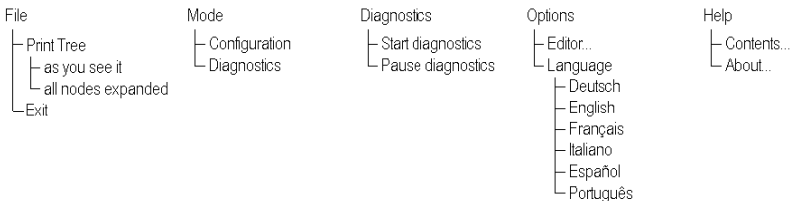
Menu bar for Configuration mode



Menu bar for Configuration mode (continued)



Menu bar for Diagnostics mode



Menu Commands



Overview

This chapter contains the description of the menu commands.

What’s in this Chapter?

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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 window 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 current configuration under the current name.

Save As...

Click **Save As...** to save the current 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 internal clipboard.

Cut

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

Paste

Click **Paste** to paste an item from the internal 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.
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's working mode. Most of the commands can be executed in this mode. In the Configuration mode, a configuration is created, modified, and sent to or reloaded from XPSMC. When the program is started, this is the default mode of the software.

Diagnostics

The **Diagnostics** mode is used exclusively for diagnosing the XPSMC 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 continues to operate without being affected.

Check

Check Configuration

Use this command to check if the configuration is correct, before you download it into the XPSMC.

NOTE: The configuration will be checked for consistency. This check neither verifies the safety nor the suitability of the configuration for your application. You are responsible for ensuring this and for compliance with all applicable codes and standards.

Controller

Stop Controller

Click **Stop Controller** to stop the XPSMC. Its safety 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 to Run mode.

Change Password

Click **Change Password** to open a window in which you can change the password. Beforehand, you will receive a message saying the controller has been stopped

Download Configuration to Controller

Click **Download Configuration to Controller** to send the current configuration to the selected controller. Prior to it, you will receive a message that the controller has been stopped. The password must be entered.

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 current configuration of the connected XPSMC. The XPSMC 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 the configuration of a series of identical controllers.

Transfer Validated Copy to Controller

Click **Transfer Validated Copy to Controller** to transfers 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 configuration.

Read Protocol from Controller

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

NOTE: Since the Controller is stopped while reading the protocol, the outputs are deactivated.

Open Protocol

Click **Open Protocol** to open a locally stored copy of the protocol 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 XPSMCs (up to 6) 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, here.
Profibus DP	If the controller supports Profibus communications, you can select the address here.

Download Setup to Controller

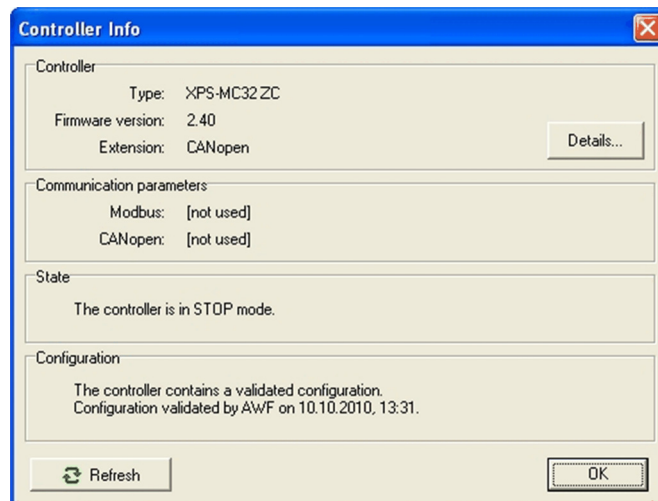
Click **Download Setup to Controller** to send the parameters set (for all communication protocols, i.e. Modbus (RTU), CANopen, Profibus DP) to the selected controller of this configuration. The XPSMC must also be stopped. The password must be entered.

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 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. The dialog allows you to enable/disable the following options:

- The properties dialog automatically shows up immediately for each device that is dropped to the configuration tree.
Alternatively the properties dialog can be opened anytime by using the context menu of the device.
- The creation of validated copies of a configuration is allowed by default.
Alternatively a selection can be made while validation of a configuration. Even if validated copies are allowed by choosing this option the allowance can be discarded while 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 model 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 present version of the software.

Diagnostics

Start Diagnostics

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

Stop Diagnostics

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

Note

Switching into the diagnostic mode, with menu command **Mode** → **Diagnostics**, the menu bar will be modified like described in the chapter *Elements of a Window*, page 24.

Device Library

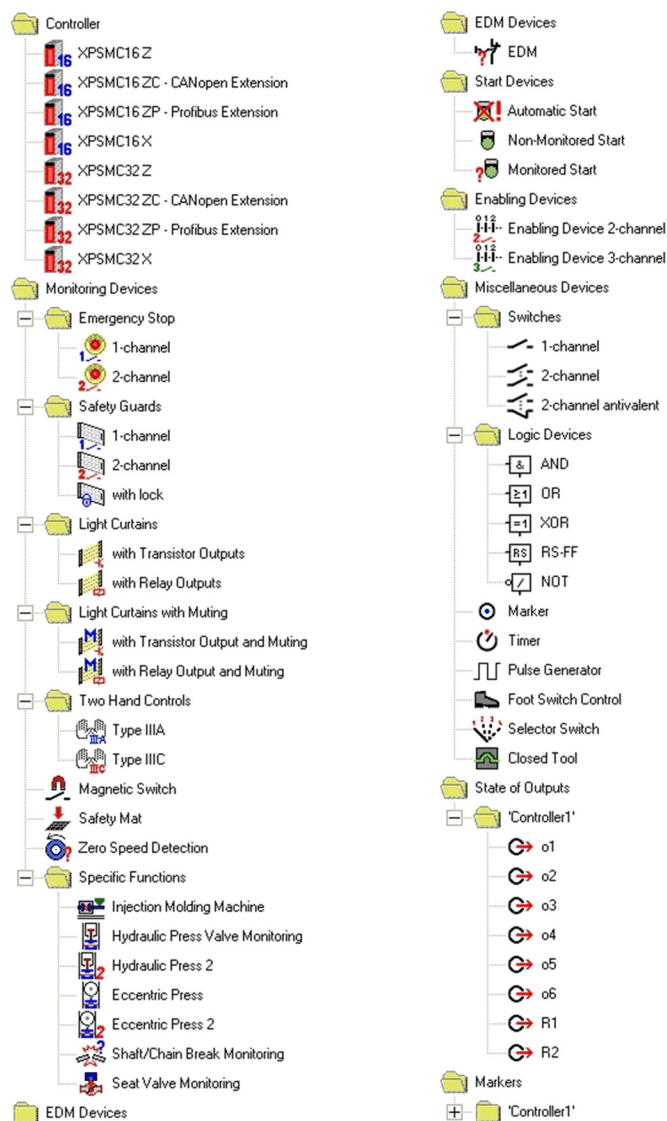


5

Overview

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

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



What's in this Chapter?

This chapter contains the following sections:

Section	Topic	Page
5.1	Controller	40
5.2	Monitoring Devices	56
5.3	EDM Devices	96
5.4	Start Device	97
5.5	Enabling Devices	99
5.6	Miscellaneous Devices	101
5.7	State of Outputs	120

5.1 Controller

Overview

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

What's in this Section?

This section contains the following topics:

Topic	Page
Creating a Configuration	41
Configuring Communication	47
Setting the Safety Outputs	50
Connecting a Device to a Safety Output	52
Use of Control Outputs	53
Modifying the Properties	55

Creating a Configuration

Introduction

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

NOTE: The following examples are for 16 input controllers only. The procedure for 32 input controllers is the same, if it is not otherwise stated.

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.

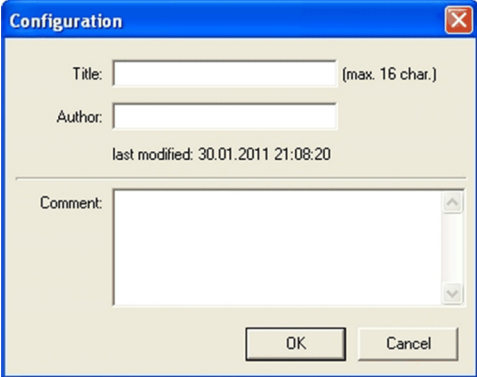
For controllers with 32 inputs the default response time is 30 ms.

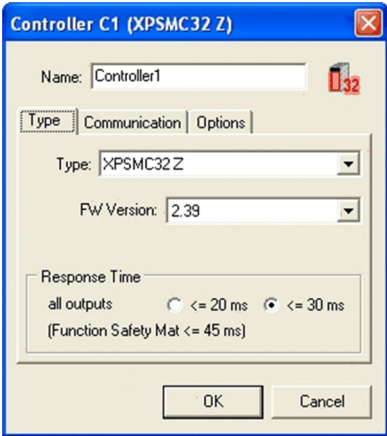
For controllers with 16 inputs the default response time is 20 ms.

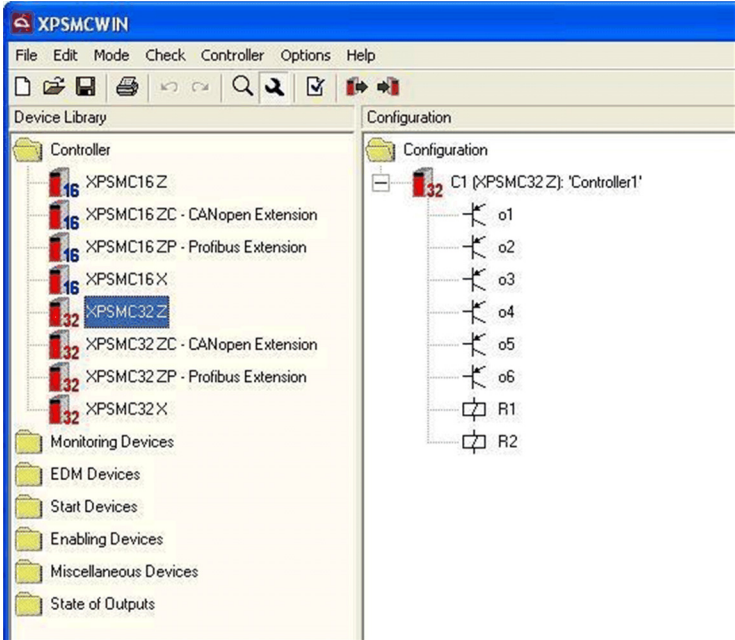
For the XPSMC16X and the XPSMC32X the response time is fixed to 20 ms.

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 which contains the Title and the Author of this configuration opens. The following figure shows the Configuration dialog:  NOTE: If this dialog does not open automatically, this option is not active in the Options → Editor... menu. The dialog can be accessed anytime by using the context menu of the Configuration symbol (right-click the symbol and select Properties).

Step	Action
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 optionally and click OK.
3	Choose the controller type you want to configure from the library and drag the related symbol into the Configuration window. The properties dialog of the controller appears:  NOTE: If this dialog does not open automatically, this option is not active in the Options → Editor... menu. The dialog can be accessed anytime by using the context menu of the Configuration symbol (right-click the symbol and select Properties). NOTE: XPSMC*X 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. It is recommended to hide them.
4	The dialog 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 <i>Setting Up the Controller</i>. Fill in the in the dialog and click OK.

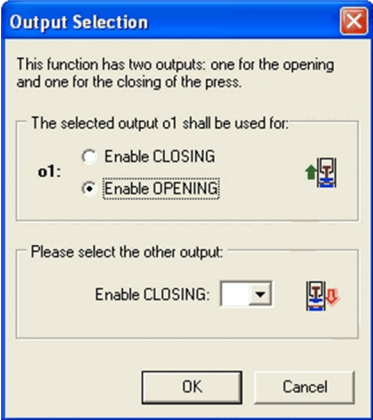
Step	Action
5	Symbols for the controller and the 8 available outputs are shown beside the dialog in the Configuration window. You can start to drag devices from the library onto the outputs you want to use to build your configuration. 

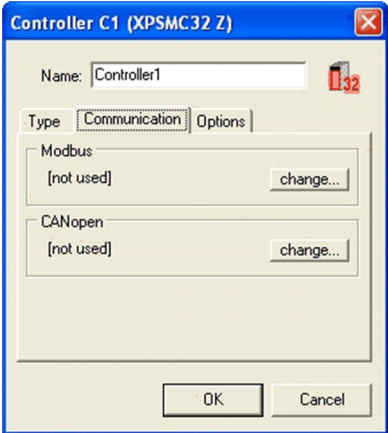
An alternative way to initialize a new configuration is to start with step 3.

When you drag the desired controller symbol into the empty **Configuration** window both the configuration and the controller with the associated outputs appear as the accordant dialogs do.

Setting Up the Controller

The **Controller** dialog 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 model and set the desired response time.  Both the type of controller and the version of the firmware shall 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. A longer response time allows the controller to process more complex configurations, i.e. more devices may be used. The current 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.

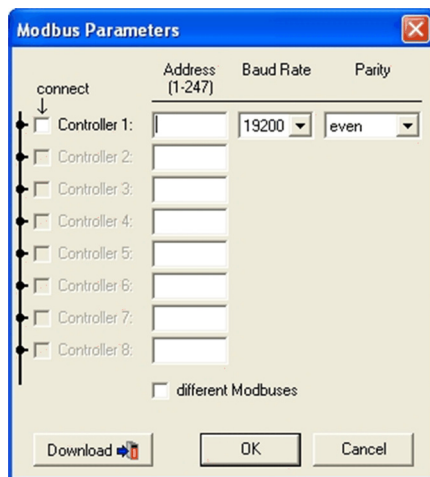
Option	Description
Communication tab	In the Communication tab the field bus settings of the controller are shown. Each controller is equipped with a Modbus. As an option there may be CANopen or Profibus communication available.  There is a change... button for each bus available. Click this button to open a dialog to change the bus parameters. A detailed description of those dialogs can be found in the following chapter <i>Configuring Communication</i> (see page 47).

Option	Description
Options tab	Depending on the version of the controller there may be an Options tab (version 2.40 and later). Here you can define an input for an External Reset and an output for External Error Signaling. Controller C1 (XPSMC32 Z) Name: Controller1 Type Communication Options External Reset ☐ Enable External Reset Reset Input: External Error Signaling ☐ Enable External Error Signaling Error Signaling Output: OK Cancel The External Reset input can be one of the inputs i01..i16 or i01..i32. With an external contact connected to this input the <code>External Error</code> 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 <i>Hardware Manual</i> 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 <code>External Error</code> state. So the error can be indicated by a connected signaling device or to a PLC. The state of this output is the same as of the <code>External Error</code> LED at the front of the controller.

Configuring Communication

Modbus

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



The **Modbus Parameters** dialog 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 and **Baud Rate** and **Parity** of the bus.

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

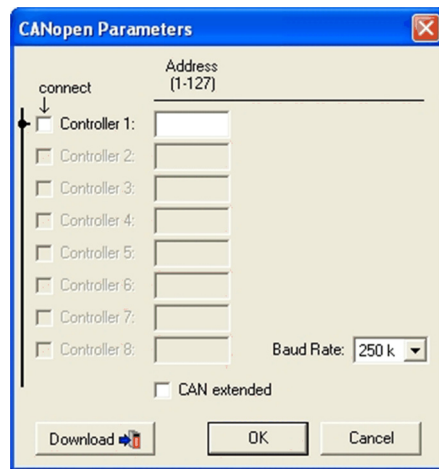
Pressing the **Download** button starts the transfer of the communication parameters (but not the configuration) to the connected controller.

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

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



The **CANopen Parameters** dialog 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 and the **Baud Rate** of the bus.

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

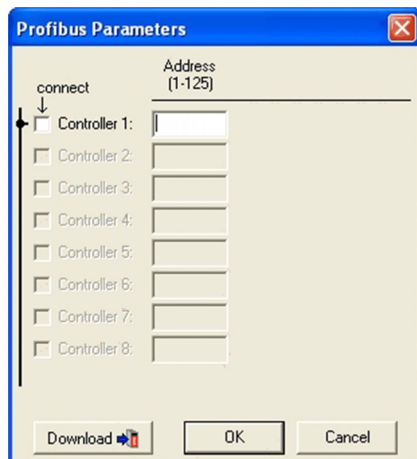
Pressing the **Download** button starts the transfer of the communication parameters (but not the configuration) to the connected controller.

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

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



The **Profibus Parameters** dialog allows you for the 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.

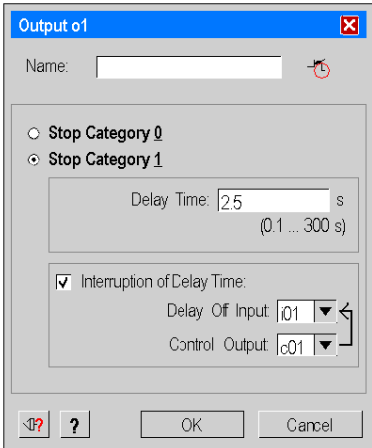
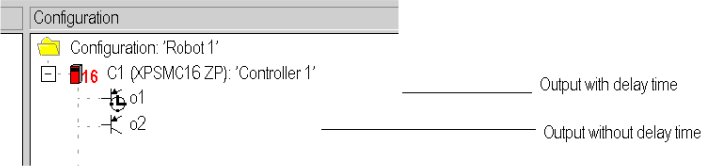
Setting the Safety Outputs

Introduction

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

Procedure

Set up the safety 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 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).
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 Delays Time	An input can be defined for an interruption of the delay. If the connection between the assigned control output and the safety input is opened, the safety 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 Output

Procedure

To assign a device to the desired safety 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 output symbol in the Configuration window. Result: When the mouse button is released, the device is connected to the safety output, as represented in a tree structure.

NOTE: When several devices are attached to a safety 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.

Use of Control Outputs

Introduction

The safety controller XPSMC provides 8 control output to drive the safety inputs.

Each of those control outputs delivers a different pulse signal.

By this the controller is able to tell if the right signal is applied to a specific input. Hence a short-circuit between those inputs can be detected.

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

For inputs connected to the same control outputs no short-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 SHORT-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. Short-circuits between inputs driven by the same control outputs are not detected. You have to ensure that no hazardous situation can occur.

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

For some of the devices of the safety controller XPSMC 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 short-circuit detection.

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

WARNING

LOSS OF SHORT-CIRCUIT DETECTION

Ensure that the required safety level of the application is not compromised by connecting inputs to external supply.

Short-circuits between inputs connected to external supply are not detected.

Carefully analyze and understand how loss of short-circuit detection affects your application.

Check if alternative means are needed to ensure the required safety level. You have to ensure that no hazardous situation can occur.

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. Result: 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 inputs by which the physical device is connected to the XPSMC. Note: The same control output can be used once only 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 then once, as a hazardous short-circuit, for example, is no longer detected. Note: If a safety input is already used, it no longer appear in the list of safety inputs currently available. A multiple use of safety inputs is not intended (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 .

WARNING

LOSS OF SHORT-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. Short-circuits between inputs driven by the same control outputs are not detected. You have to ensure that no hazardous situation can occur.

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

5.2 Monitoring Devices

Overview

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

What's in this Section?

This section contains the following topics:

Topic	Page
Emergency Stop	57
Safety Guards	58
Light Curtains (Electro Sensitive Protective Equipment (ESPE)) of Category 4 without Muting	60
Light Curtain with Muting	62
Magnetic Switch	67
Two-Hand Control Type IIIA/IIIC	69
Safety Mat	71
Zero Speed Detection	72
Injection Molding Machine	78
Hydraulic Press Valve Monitoring	79
Hydraulic Press 2	81
Eccentric Press	84
Eccentric Press 2	87
Shaft/Chain Break Monitoring	94
Seat Valve Monitoring	95

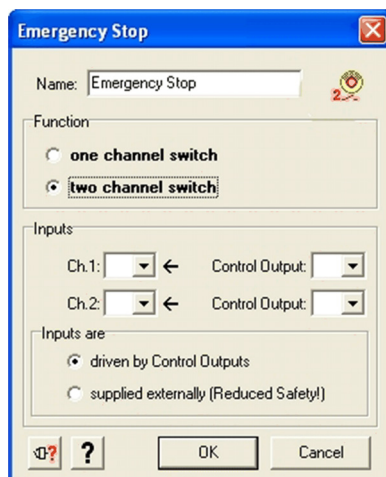
Emergency Stop

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 short-circuit detection is available. You may need to ensure the required safety level by other means. For further information refer to chapter <i>Use of Control Outputs</i> (see page 53).

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 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 **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 channel, w/o lock or 2 limit switches with lock two channel, with lock .

Option	Description
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 ch.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 short-circuit detection is available. You may need to ensure the required safety level by other means. For further information refer to chapter <i>Use of Control Outputs</i> (see page 53).
Safety Guard with 2 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 that the connected contacts are operative. A synchronization time, during which contacts ch.1 and ch.2 must operate, can be defined. If this time is exceeded, the assigned safety 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 ch.1 and ch.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 short-circuit detection is available. You may need to ensure the required safety level by other means. For further information refer to chapter <i>Use of Control Outputs</i> (see page 53).
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 ch.1, ch.2 and lock are operative. A synchronization time, during which contacts ch.1 and ch.2 must operate, can be defined. If this time is exceeded, the assigned safety 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 short-circuit detection is available. You may need to ensure the required safety level by other means. For further information refer to chapter <i>Use of Control Outputs</i> (see page 53).

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 output cannot be activated without this assignment.

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

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

For the light curtain safety 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 outputs (OSSD) is outside this range, the safety 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 .
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 outputs. A synchronization time during which contacts ch.1 and ch.2 must close can also be entered. If this time period is exceeded, the assigned safety 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 (for the synchronization time).
Inputs	The safety inputs to which the light curtain safety 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), please use the Transistor Output option. You may need to apply external safety means to compensate for the loss of short-circuit detection. For further information refer to chapter <i>Use of Control Outputs</i> (see page 53).

Light Curtain with Muting

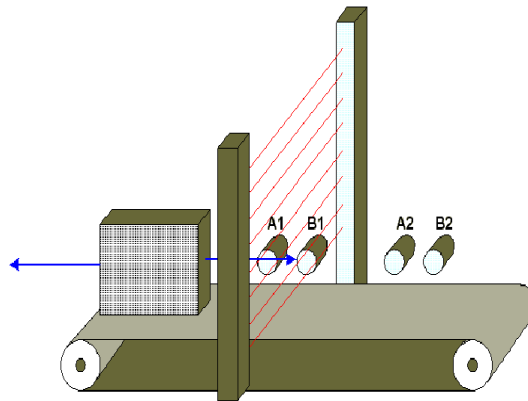
Introduction

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 leave the hazardous 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 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 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 hazardous 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 outputs switching off the machine. If this time is exceeded, an error message appears and the safety 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 stuck 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 prevent inappropriate use, the override function can only be activated for up to 10 min.

DANGER

IMPROPER ACCESS TO A PROTECTED AREA

Ensure opening sizes are as small as possible and comply with EN60294.

Ensure photo-sensors are clean and free from obstructions.

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

WARNING

DETECTOR INTERFERENCE HAZARD WITH THRU-BEAM SENSORS

Reciprocal mount transmitters and receivers.

Mount adjacent receivers at distance greater than minimum separation distance.

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

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 easy defeating must be prevented (stickers or photoelectric sensors for example).

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

Sources of white light with an illumination surface of 1 cm² 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 comes on when the muting signals are generated correctly 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 correctly, no one must be allowed to enter the hazardous area.
- A guide less means of transport must create the muting signal before it enters the protection field, and may only leave this field when it no longer interrupts the light curtains beams of the protection field.

The muting function meets the requirements of PL e, category 4 according to EN ISO / ISO 13849-1. For correct 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:

Light Curtain with Muting

Name: 

Function

☐ Transistor Output

☒ Relay Output

Options

☐ Start Interlock

Sync Time OSSD 1 - OSSD 2: s
(0.45 .. 2.40 s)

Inputs

OSSD 1: ← Control Output:

OSSD 2: ← Control Output:

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 outputs.
Inputs	The safety inputs to which the light curtain safety 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), please use the Transistor Output option. You may need to apply external safety means to compensate for the loss of short-circuit detection. For further information refer to chapter <i>Use of Control Outputs</i> (see page 53).

Press the **Muting** button you get the following **Muting Parameters** window.

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

Muting Parameters

Options:

☐ Muting Time Monitoring
Muting Time: min
(0.5 ... 10 min)

☒ Override Time: min
(0.5 ... 10 min)

☐ Sync Time Monitoring A1-B1/A2-B2:
Sync Time: s
(0.5 ... 3.0 s)

Inputs:

A 1: ← Control Output:

B 1: ← Control Output:

A 2: ←

B 2: ←

Override: ← Control Output:

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 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 necessarily 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 Outputs affected are not activated.

Dialog Box Settings

The parameter setting window offers the following settings:

Magnetic Switch

Name:

Options

☐ Start Interlock

Sync Time

Sync Time: s
(0,5 .. 2,5 s)

Inputs

NC: ← Control Output:

NO: ← Control Output:

Inputs are

☒ driven by Control Outputs

☐ supplied externally (Reduced Safety!)

? OK Cancel

The table describes the following setting possibilities:

Option	Description
Name	A specific Name can be assigned to this device.
Options	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 check if the connected contacts are also operating. For the response time of 20 ms, the range is 0.5...2.5 ms, 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 short-circuit detection is available. You may need to ensure the required safety level by other means. For further information refer to chapter <i>Use of Control Outputs</i> (see page 53).

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 EN 574.

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 output.

When this time is exceeded, the assigned safety 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. The error detection possibilities are limited.

For Two-Hand Controls of **Type IIIC** each buttons has to have a **NO** and a **NC** contact. Hence more diagnostic is possible.

NOTE: Two-Hand Controls of **Type IIIC** provide a higher level of safety than **Type IIIA** controls.

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 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 ensure the required safety level. For further information refer to chapter <i>Use of Control Outputs</i> (see page 53).

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 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 short-circuited when the mat is walked on. The XPSMC safety outputs are then immediately deactivated. To be able to detect this short-circuit, the four connection leads must be connected to different safety 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

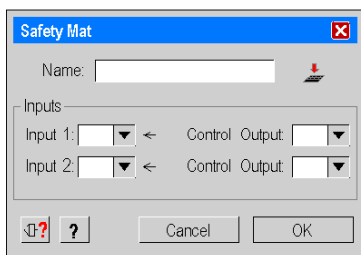
LOSS OF SAFETY INPUT-CROSS CONNECTION DETECTION

In Safety Mat applications, ensure that all four connection leads are connected to different safety 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 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 201*. These sensors can only be connected to XPSMC safety inputs i1 and i2. If these inputs are already used, the application generates a warning message.

Points to be Complied

The following points should be complied with 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, a notification is send via Modbus and the corresponding outputs are deactivated. After a zero speed detection and a subsequent motion the notification is reset.
- If zero speed is already detected and both sensors are in HIGH state, a notification is send via Modbus 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 has started, both sensors are in the LOW state, an error message appears.

NOTE: You can only use one Zero Speed Detection per XPSMC, 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 (short 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

IMPROPER OPERATION

Do not use the XPSMC 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 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.

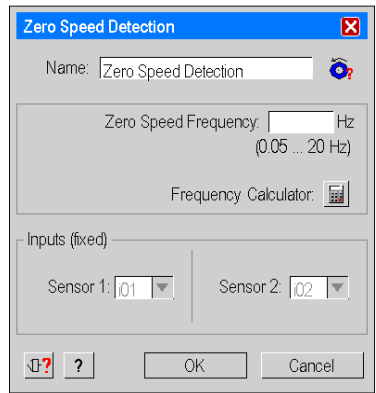
NOTE: A frequency calculator is included in the properties determination menu. Enter the number of cogs and the zero speed limit in rpm, and the frequency limit to be set is calculated automatically.

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

1. 1 safety input contains a HIGH signal and
2. the other input contains a LOW signal and
3. the frequency on the two inputs is lower than the value entered.

Dialog Box Settings

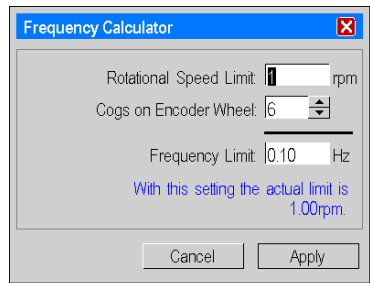
The parameter setting window provides the following setting possibilities:



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 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.
Frequency Calculator	A dialogue field opens when you click here.
Inputs (Fixed)	i1 and i2

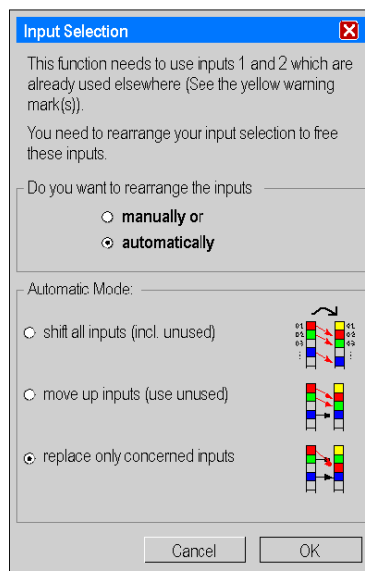
The parameter setting window provides the following setting possibilities:



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 inputs i1 and i2 are already automatically indicated in the **Inputs** field. This device cannot operate with other inputs. If inputs i1 and/or i2 are already used, the following window appears to resolve the conflict:



The table describes the following setting possibilities:

Option	Description
Manually or	As a user, you assign other safety inputs manually to the function using i1 and/or i2. When OK is clicked, the Properties window of the concerned devices will be opened.
Automatically	The software automatically assigns other safety inputs to the function using i1 and/or i2 according to 1 of 3 options: 1. shift all inputs The safety inputs are shifted as a block. Inputs that are not used and are available may also be shifted. For example, i1 becomes i3, i2 becomes i4 and i4 becomes i6. 2. move up inputs The safety inputs are shifted as a block. Inputs that are not used and are available may also be shifted, and spaces thus filled. For example, i1 becomes i3, i2 becomes i4 and i4 becomes i5. 3. replace only concerned inputs Only the inputs that are used (i1 and/or i2) are shifted to the next free safety inputs. This is the default option.

Injection Molding Machine

Introduction

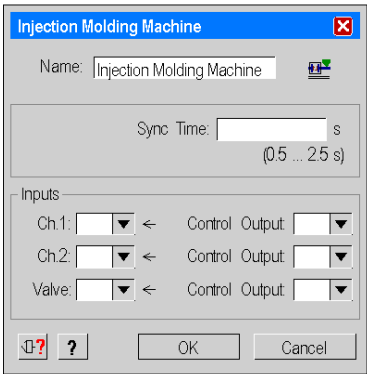
NOTE: 1 of the 3 starting devices: automatic starting, non monitored starting or monitored starting must be assigned to each injection molding machine device. The corresponding safety output cannot be activated without this assignment.

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 206.

The 3 limit switches Ch.1, Ch.2 and Valve must then be connected to various control outputs and safety inputs, to provide short-circuit monitoring. The injection molding machine is activated according to the switching states of limit switches Ch.1, Ch.2 and Valve, in accordance with the function diagram in figure *Functional Diagram*, page 204. 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 ch.1 and ch.2 must close, must be entered in this field. If this time is exceeded, the assigned safety 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 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 208.

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, as shown in the figure *Wiring Diagram*, page 208. 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 internal time window is generated, during which the XPSMC 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 outputs are deactivated.

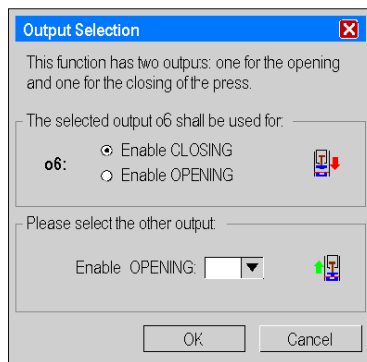
If signals Valve C to Valve C+O appear in an order other than the one shown in figure *Functional Diagram*, page 207, the affected safety outputs of this function are then deactivated and an error message appears.

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

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

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

This is to be done by the window that appears:



Dialog Box Settings

The parameter setting window provides the following setting possibilities:

Hydraulic Press

Name: Hydraulic Press Valve Monitoring

Options

Sync Time: s
(0.1 ... 1.5 s)

Inputs

Valve C:Valve O:Valve C+O:Close:Open:Control Output:Control Output:

☐ Enable bypassing of valve monitoring by:
Input:Control Output:

OKCancel

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 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 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. Optional, 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 outputs are dependant only 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 (see page 208).

This device provides an internal 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.

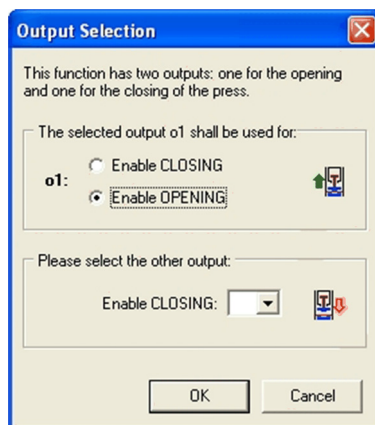
Optionally the overtravel of the press can be verified at start up.

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.

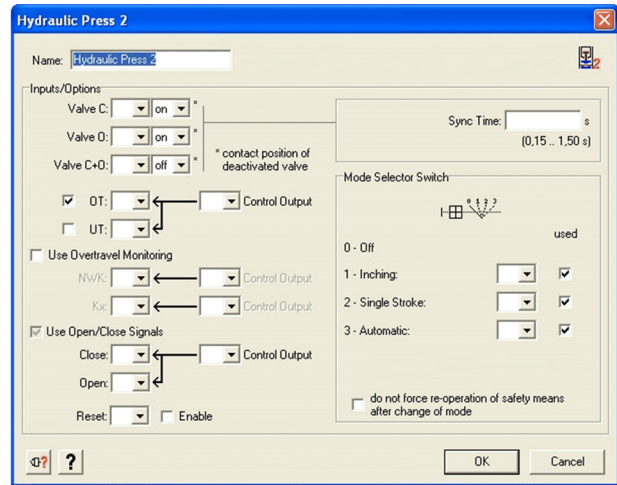
The Hydraulic Press 2 device can be attached to outputs only.

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

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



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



Dialog Box Settings

The **Hydraulic Press 2** dialog 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 (opening and closing) 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 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 be external contacts or by a PLC. 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 and later 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. It is recommended to 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 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 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 means are valid and the result of the press monitoring is okay 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 means need to be deactivated and activated again, e.g. a two hand control has to be released and pressed again. If the safety means or monitoring result becomes invalid while downstroke the stroke will be interrupted. On upstroke the safety 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 did not stop after the first cycle. The press keeps running until the safety 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 all 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. This may be preferable if for example not only a two hand control but also safety guards are attached to the press which normally not need to be tested cyclically.

Eccentric Press

Introduction

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

The eccentric press device is intended to monitor the safe operation of an eccentric press including safe 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.

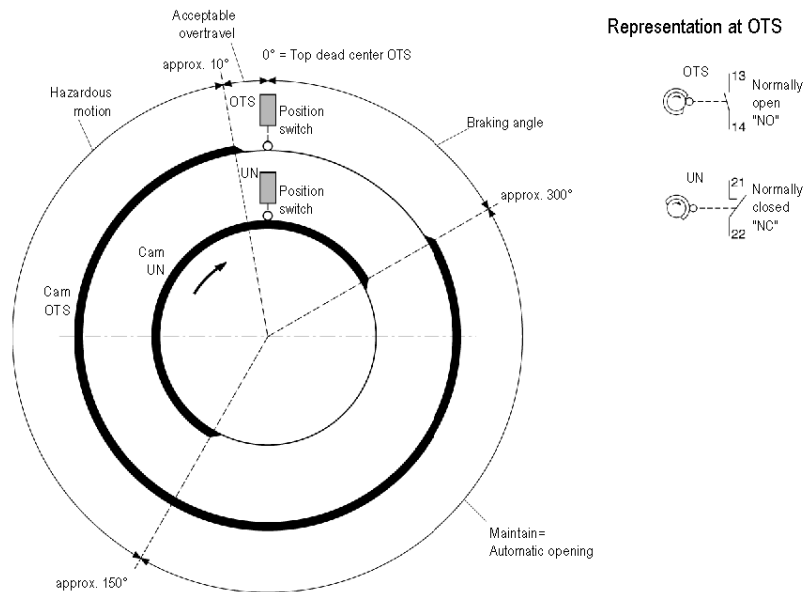
The XPSMC safety outputs are activated as long as the start signal is active at the beginning of the cycle and the position switches **OTS**, **UN**, **PSV1**, and **PSV2** deliver the correct signals throughout the cycle.

To enable short-circuit detection, the position switches must be connected to different safety 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 safety 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 outputs are deactivated.

Also if one of the other safety inputs delivers an incorrect signal, an error message appears, and the corresponding safety 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 provides the following setting possibilities:

Eccentric Press

Name:

Options

☒ Valve Monitoring

Sync Time PSV1-PSV2 (s): (0.1 ... 1.5 s)

Inputs

OTS:

UN:

PSV1:

PSV2:

Continuous Off:

Reset:

Control Output:

Control Output:

Control Output:

Control Output:

Control Output:

Control Output:

Mode Selector Switch:

0123

Off:

Inching:

Single Stroke:

Continuous Autim.:

?

?

Cancel

OK

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 safety 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. It is recommended to connect a key switch.
Mode Selector Switch	The following operation modes are available: Mode Off The press is deactivated and the related safety 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 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 release 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.

Eccentric Press 2

Introduction

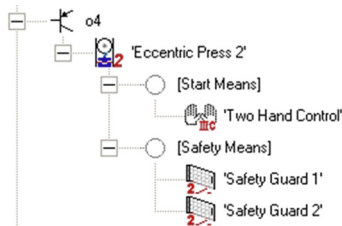
The *Specific Functions* folder contains the *Eccentric Press 2* device symbol.

The Eccentric Press 2 device is intended to monitor the safe operation of an eccentric press including safe 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. Please also refer to the *Wiring diagram* (see page 218).

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 means. Multiple assignments are possible.



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

Input	Description
Firmware Versions < 2.40	
Safety Means and Start	The start means (e.g. two-hand control) and the safety means (for example safety guard) attached here have to be operated cyclically. There 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	
Start Means	The devices attached here need to be operated cyclically. Depending on mode they may become inactive once a cycle was started.

Input	Description
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 means are muted).

Position switches **OTS** and **UN** detect the press movement and enable safe stopping at the top dead center. For the functional diagram of the control cams please refer to the *Eccentric Press chapter (see page 84)*.

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 output becomes deactivated.

To reset this error, an overtravel error or an error detected at the **UN** or **OTS** position switches, the reset input has to be actuated. 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 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 valves contacts PSV1 and PSV2 can be adjusted. For the response time of 20 ms, the range is 0.1 to 1.5 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.

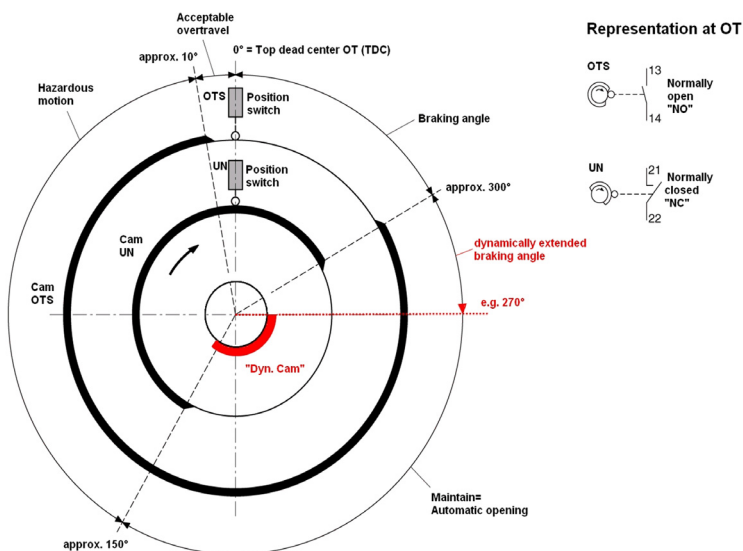
Option	Description
Inputs	The used inputs and the control output must be indicated. ● At the OTS input the top dead center (TDC) contact is to be connected. ● At the UN input the bottom dead center (BDC) contact need to be connected. ● The PSV1 and PSV2 inputs are for the monitoring contacts of the 2 halves of the press safety valve (PSV). ● The Continuous Off input is used in Continuous and Continuous Automatic mode, see below. The input is low active. ● The Reset input is used to reset the error state of the press. It is recommended to 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).

Option	Description
Mode Selector Switch	The following operation modes are available: ● Mode Off If no mode selection input is activated Off mode is supposed. The press is deactivated and the related safety 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 means are valid, the start is activated and the press is in TDC. As long as the safety 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 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 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 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 all 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. This may be preferable for example if not only a two-hand control but also safety guards are attached to the press which not need to be tested cyclically.

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 upstroke is considered to be safe. Hence the safety means are muted by the UN signal. By activation of the disable muting option the safety means will be monitored while upstroke also. ● 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.

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 at 300° invariable indicated by the **UN** cam.

To achieve this, the XPSMC optionally allows to consider an external signal provided by an external PLC 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.

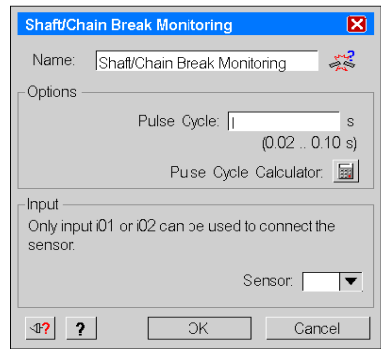
Shaft/Chain Break Monitoring

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 229. This device is directly linked to the OTS and UN position switches by a cogwheel sensor and can only be connected either to input i1 or i2. 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, because there are only 2 counter inputs (i1 and i2) available, see also *Zero Speed Detection*, page 72. If the Shaft/Chain Break Monitoring is used, no Zero Speed Detection can be used and vice versa.

Seat Valve Monitoring

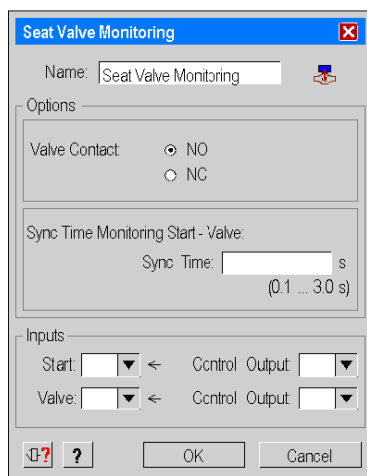
Introduction

The *Specific Functions* folder contains the device symbol for monitoring of a seat valve as shown in figure *Wiring Diagram*, page 232.

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.

5.3 EDM Devices

EDM Device (External Device Monitoring)

Introduction

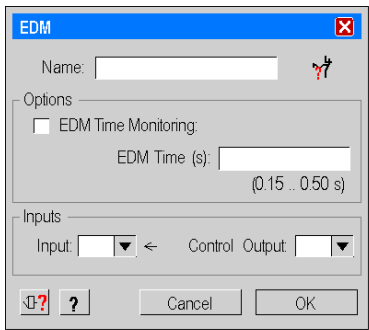
The *EDM Device* folder contains the device symbol for monitoring a feedback loop. This device is used to monitor external devices such as subsequent contactors or relays.

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 outputs concerning K1 and K2 are deactivated.

Before activating the safety output, ensure that the EDM input is activated. If it is not, an error message appears, and the safety 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 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 checked only whether the EDM input is closed immediately before activating the safety outputs.
Inputs	The safety input and the control output must be indicated in this field.

5.4 Start Device

Start Device

Introduction

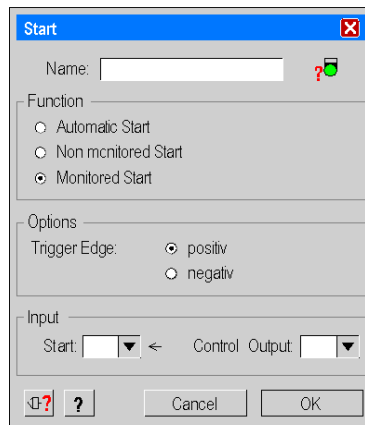
The *Start Devices* folder contains 3 device symbols for

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

The functional diagram for these devices is shown, as an example, in figure *Functional Diagram, page 175*.

Dialog Box Settings

The parameter setting window provides the following setting possibilities:



The image shows a dialog box titled "Start". It contains the following fields and controls:

- Name:** A text input field with a red question mark icon and a green checkmark icon to its right.
- Function:** A group box containing three radio buttons:
 - ☐ Automatic Start
 - ☐ Non monitored Start
 - ☒ Monitored Start
- Options:** A group box containing a label "Trigger Edge:" followed by two radio buttons:
 - ☒ positiv
 - ☐ negativ
- Input:** A group box containing two dropdown menus. The first is labeled "Start:" and the second is labeled "Control Output:". There is a left-pointing arrow between the two dropdowns.
- Buttons:** At the bottom, there are four buttons: a red question mark icon, a green question mark icon, a "Cancel" button, and an "OK" button.

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 outputs are activated as soon as the starting conditions are fulfilled. A start button is not necessary. ● Non monitored Start The safety 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 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 output cannot be activated when the start button is actuated by an XPSMC 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 input and the control output must be indicated here.

5.5 Enabling Devices

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 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 (preferably a key switch) should be used to enable the input of the enabling device.

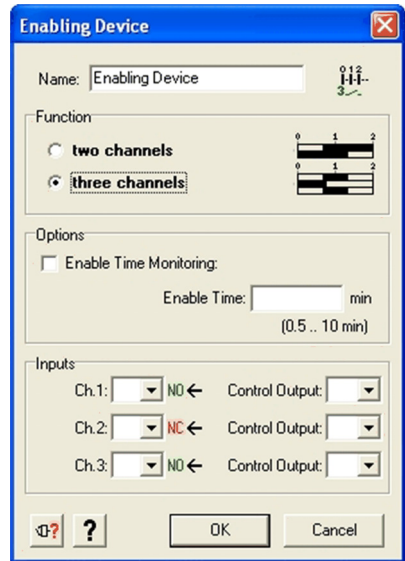
With an enabling switch, a safety guard can be bypassed and a hazardous movement can consequently be started, even with a protection door open, during the fitting out of a machine for example. The enabling switch does not activate the dangerous movement but gives a validation for the dangerous movement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

This function works with a two or three channel enabling switch (*Wiring Diagram, page 234* or figure *Wiring Diagram, page 236*). 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 outputs. If the enabling switch reaches position 2, the safety 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 outputs will be deactivated and a fault message will be given. The time is adjustable from 0.5...10 min.
Inputs	The safety inputs and control outputs used must be indicated in this field. To provide reliable short-circuit detection, all the contacts must be set into service on different control outputs.

5.6 Miscellaneous Devices

Overview

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

What's in this Section?

This section contains the following topics:

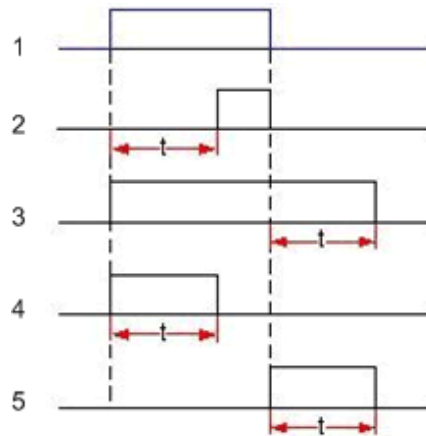
Topic	Page
Timer	102
Pulse Generator	105
Logic Devices	107
Switches	111
Markers	113
Foot Switch Control Device	115
Selector Switch	117
Closed Tool Device	119

Timer

Introduction

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

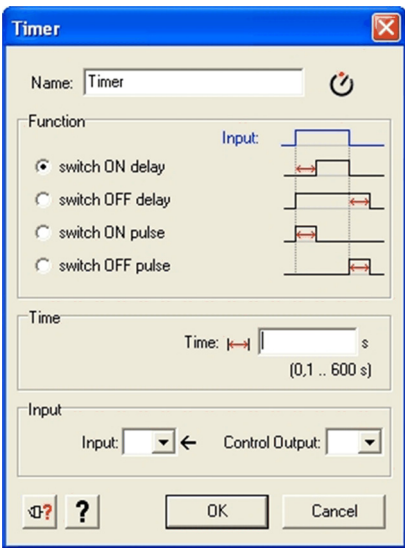
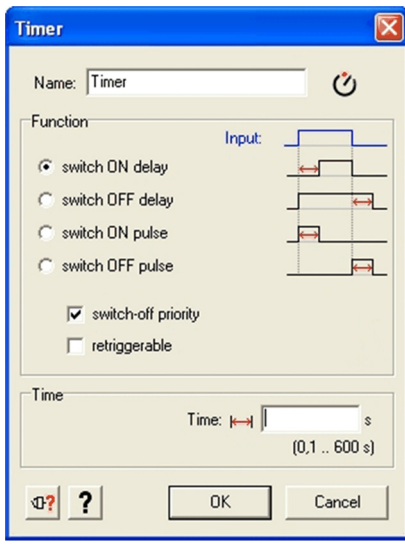
The Timer device facilitates 4 time dependent behaviors as shown in the figure below. Time t is adjustable.



- 1 Input
- 2 Switch-ON delay
- 3 Switch-OFF delay
- 4 Switch-ON pulse
- 5 Switch-OFF pulse

Dialog Box Settings

The **Timer** dialog 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 and later 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 result becomes TRUE, too. If the input status changes to FALSE the adjustable delay starts and the timer result 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 result becomes TRUE, too and the adjustable pulse time starts. If the time has passed the Timer result 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 and later 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 result of the Timer 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 and later re-triggering can be allowed optionally by checking 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 below 2.40 and no other device was selected as an input then the safety input and the control output or external supply used for the input signal must be indicated here. For firmware versions of 2.40 and later 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 and later the Timer device needs an input device (e.g. Switch or Logic device). For firmware versions earlier than 2.40 the input device is optional. An external input can also be defined inside the properties dialog 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.

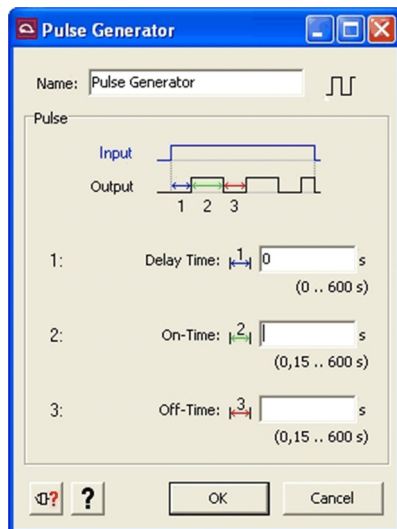
When the input signal becomes FALSE, the pulse signal will be stopped and a current pulse will be interrupted (see image below). The input signal is the result of another device that need to be attached to the Pulse generator symbol.



- 1 Input
- 2 Output

NOTE: The Pulse Generator device is available in firmware 2.40 and later.

Dialog Box Settings



The **Pulse Generator** dialog 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 and later.

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 Devices

Specifically for NOT 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 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 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 device accepts only 1 device attached.

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

Ensure that the required safety level of the application is not compromised by using the NOT device.

Carefully analyze the inputs and outputs to be inverted and understand how the inversion (negation) affects the application, especially in terms of safety. Keep in mind 'safe' could be converted into 'NOT safe'.

Only personnel who are thoroughly knowledgeable of the machine, the application, and the effects on the application should consider using the NOT device.

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

Inverted Outputs and inverted Markers are marked in the configuration tree by inversion (negation) of the original icons. In addition a warning message appears when NOT 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 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:

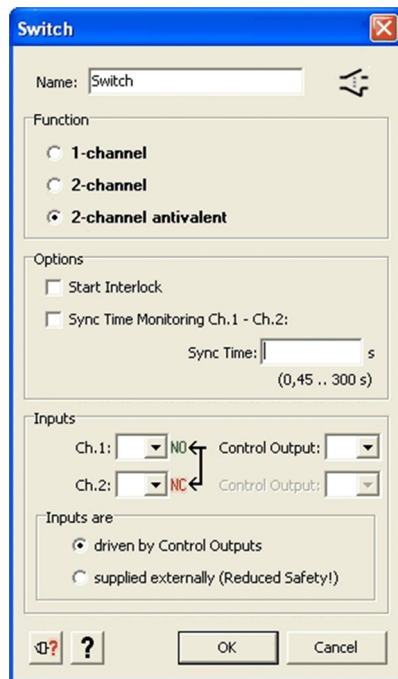
- 1-channel
- 2-channel
- 2-channel antivalent

Switches can be seen as representation of external contacts.

NOTE: The switches are available in firmware 2.40 and later.

The 3 switches share the same dialog.

Dialog Box Settings



The image shows a 'Switch' dialog box with the following sections:

- Name:** A text field containing 'Switch'.
- Function:** Three radio buttons: '1-channel', '2-channel', and '2-channel antivalent' (which is selected).
- Options:** Two checkboxes: 'Start Interlock' and 'Sync Time Monitoring Ch.1 - Ch.2:'. Below the second checkbox is a 'Sync Time:' text field with a unit 's' and a range '(0,45 .. 300 s)'.
- Inputs:** Two rows for channel configuration. Each row has a dropdown for 'Ch.1:', a dropdown for 'Ch.2:', and a 'Control Output:' dropdown. The first row shows 'NO' and 'NC' with arrows pointing to the 'Control Output' dropdown. The second row shows 'NC' and 'NO' with arrows pointing to the 'Control Output' dropdown.
- Inputs are:** Two radio buttons: 'driven by Control Outputs' (selected) and 'supplied externally (Reduced Safety!)'.
- Buttons:** At the bottom are 'OK' and 'Cancel' buttons, along with a help icon (?) and a question mark icon (?) on the left.

The **Switch** dialog 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. 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 then 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 then 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 to 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 short-circuit detection for the inputs. External means may be necessary to achieve the required safety level. For further information refer to chapter <i>Use of Control Outputs</i> (see page 53).

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 anywhere 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 shall be 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 like start is always valid (automatic start).

Up to 8 markers can be defined per controller.

NOTE: Markers are available in firmware 2.40 and later.

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 anywhere in the configuration as long as the specific rules of the target devices allow for (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

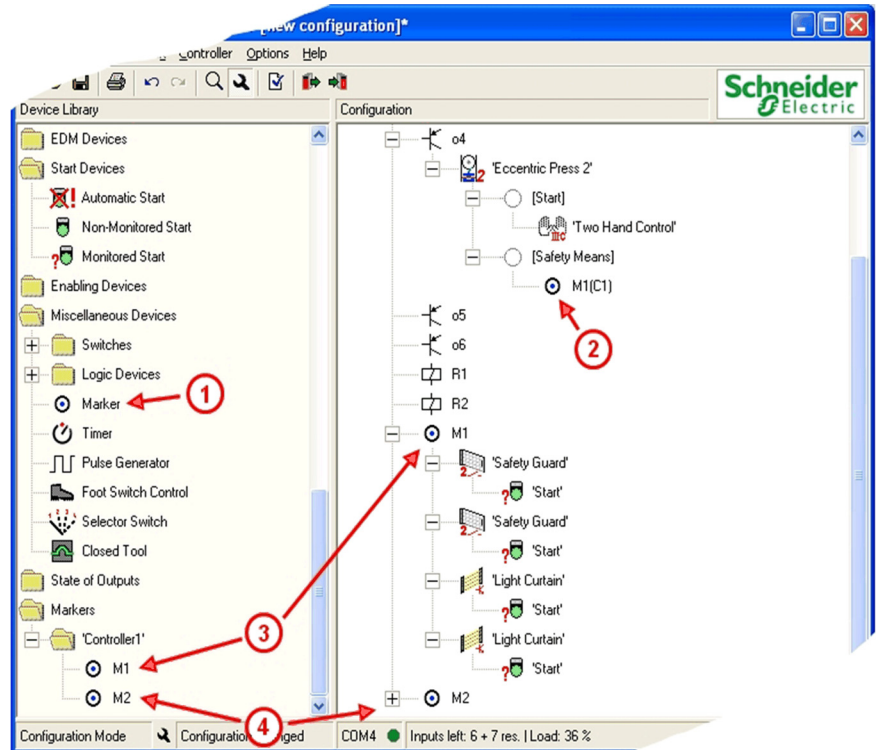
Copies of Markers can be brought into the configuration in 3 ways:

- 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 context 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.



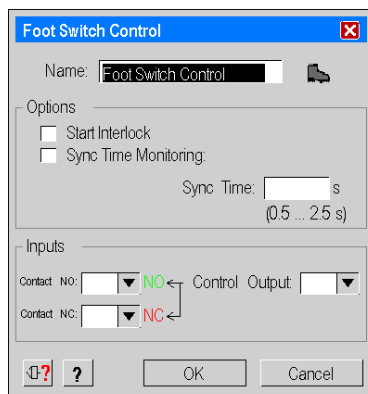
Foot Switch Control Device

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 short-circuit detection is available. You may need to ensure the required safety level by other means. For further information refer to chapter <i>Use of Control Outputs</i> (see page 53).

DANGER

HAZARDOUS APPLICATIONS

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 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 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 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 need 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 the 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 but the inputs are taken from the linked press device automatically.

Dialog Box Settings

The **Selector Switch** dialog 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. By checking 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. Following the dialog 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 devices attached were recognized off once to test them. Otherwise it is blocked. For controllers with firmware version 2.40 and later 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 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.

5.7 State of Outputs

Applying Output States to Other Safety Outputs

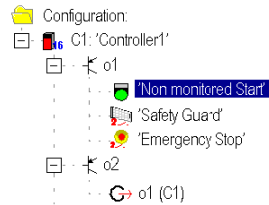
Introduction

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

By moving the output x symbol on the output y in the **Configuration** window, the safety output y will have the same behavior as the safety 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 output o1 is associated with **Non monitored Start**, **Safety Guard** and two channel **Emergency Stop**. Safety 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 output **o1**); they are taken into account automatically in the corresponding safety output.

Configuration

6

Overview

This chapter contains the description to create a configuration.

What's in this Chapter?

This chapter contains the following sections:

Section	Topic	Page
6.1	General Information	122
6.2	Application Scheme Configuration	124
6.3	Configuring the Emergency Stop Function	136
6.4	Save the Configuration	142
6.5	Requesting/Changing the Password	143
6.6	Sending a Configuration from the PC to the XPSMC and Performing a Check	144
6.7	Loading a Configuration	151
6.8	Creation/Transfer of a Validated Configuration Copy	152
6.9	Read Protocol from Controller	156

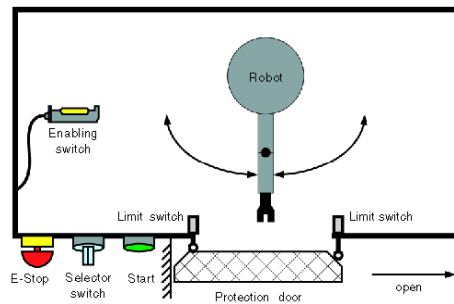
6.1 General Information

Generals

Introduction

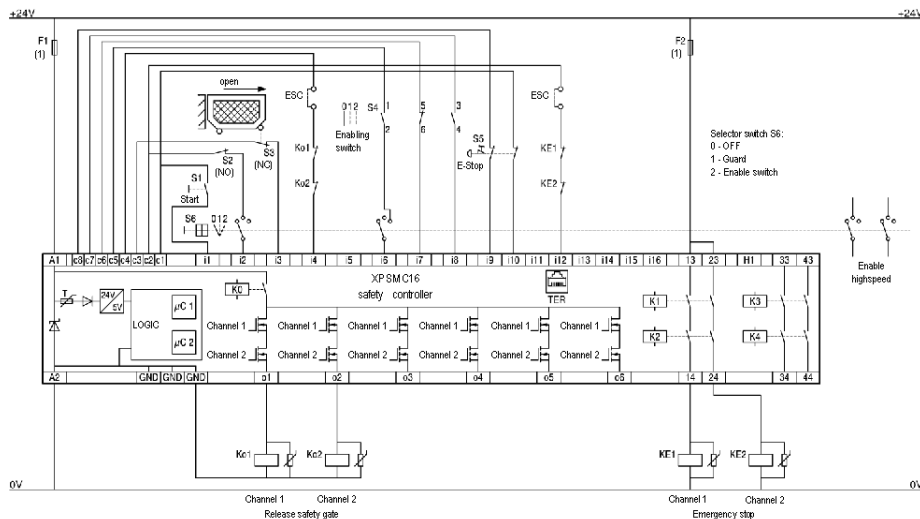
NOTE: The configuration can be created while the PC is offline, that is without being connected with an XPSMC, and later sent to the XPSMC.

By way of example, the creation of a configuration is explained by means of the following application:



The entry of personnel into the hazardous zone 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 personnel safety is done by an external selector switch mounted near the guard. The safety of any personnel 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 163.

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 current configuration, configurable timers are set to zero and must be modified again. The limit ranges for the timers is also changed.

6.2 Application Scheme Configuration

Overview

This section contains the application scheme of configuration.

What's in this Section?

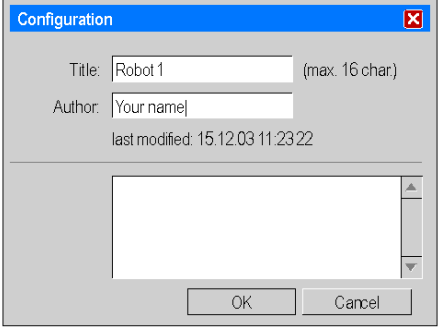
This section contains the following topics:

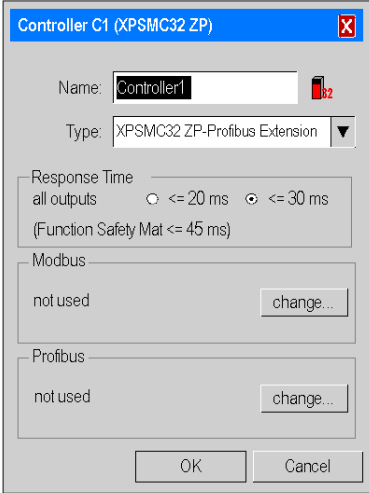
Topic	Page
Creating a New Configuration / Selecting a Controller Type	125
Assigning the Switch Position	129
Assigning the Protective Guard Function	130
Assigning the Starting Function	131
Assigning the Enabling Device	132
EDM Adjustment	133
Assign a Name and a Stop Category to a Safety Output	134
Copying the State of One Safety Output onto another Safety Output	135

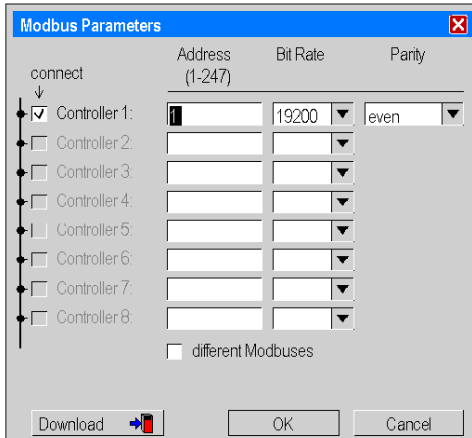
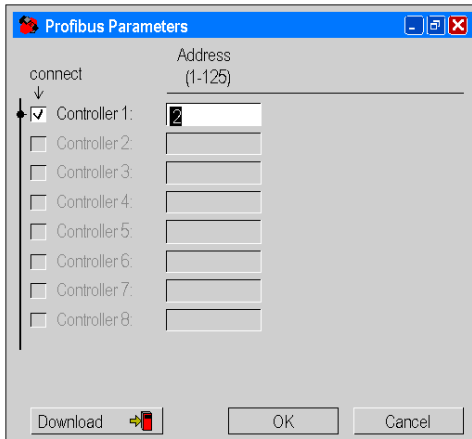
Creating a New Configuration / Selecting a Controller Type

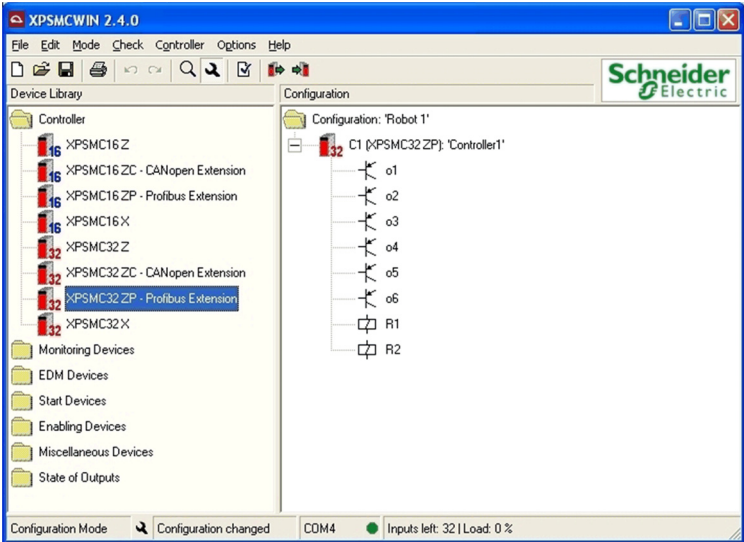
Procedure

Proceed as follows:

Step	Action
1	Start the XPSMCWIN configuration software. Result: The program user interface appears.
2	Drag the symbol of the desired controller from the Device Library window into the yet empty Configuration window.
3	Release the left mouse button and a new configuration is automatically created. Result: Fill in the window which has opened. Note: If the window does not open automatically, you are prompted to activate automatic opening in the Options editor menu option. The following figure shows the Configuration dialog box: 

Step	Action
4	Click on the relevant change... button to provide for adjustments for the future Modbus and Profibus communication. The following figure shows the Controller dialog box: 
5	Click on the change... button of Modbus or Profibus.

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:  As the PC is not yet connected to controller 1, the Modbus settings cannot yet be sent at this level to controller 1. You can download only the parameters (no configuration) for the Modbus and Profibus by clicking on the Download button when your PC is connected to the safety controller.

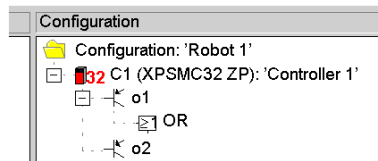
Step	Action
7	Click OK. Result: Your screen should now look like the one in this figure: 

Assigning the Switch Position

Introduction

For safety reasons, a position switch is necessary, 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 122).

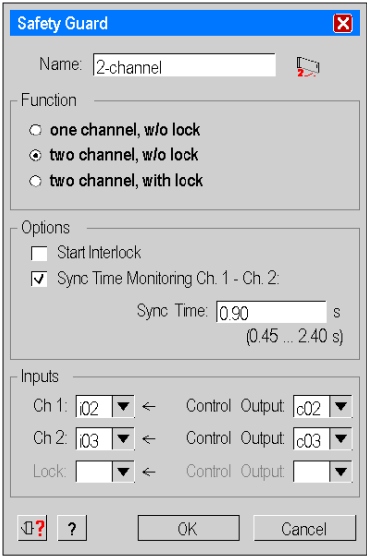
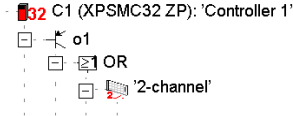
To configure this OR connection, the symbol of the OR device has to be moved to the o1 output as follows:



Assigning the Protective Guard Function

Procedure

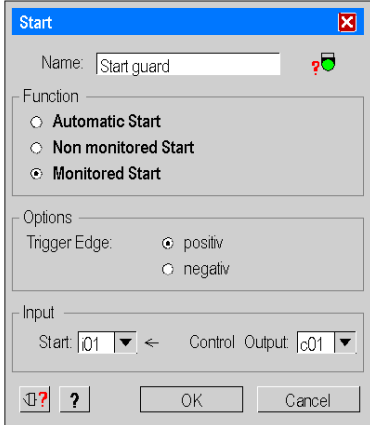
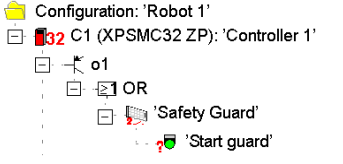
Proceed as follows:

Step	Action
1	In the <i>Safety Guard</i> folder (which is located in the <i>Monitoring Devices</i> 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 output o1. 

Assigning the Starting Function

Procedure

Proceed as follows:

Step	Action
1	In the <i>Start Devices</i> folder, which is located in the <i>Monitoring Devices</i> 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 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 <i>Enabling Devices</i> 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:

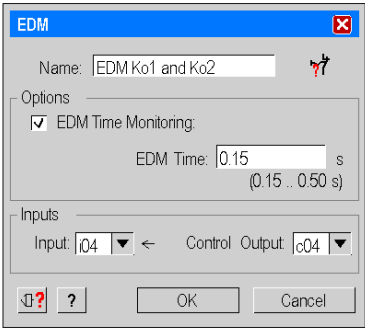
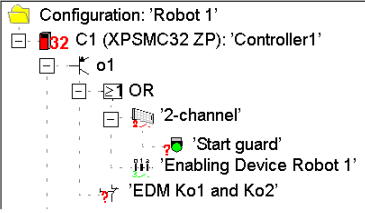
EDM Adjustment

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 outputs o1 and o2, and the return circuit must be open.

Procedure

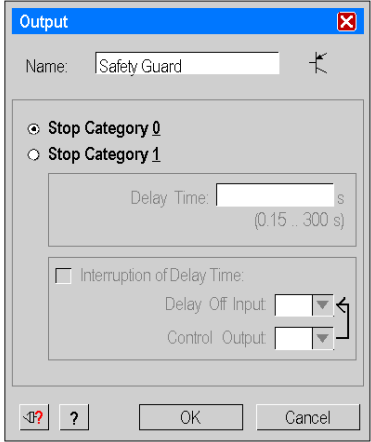
Proceed as follows:

Step	Action
1	Drag the EDM symbol from the <i>EDM Devices</i> 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 Output

Procedure

Proceed as follows:

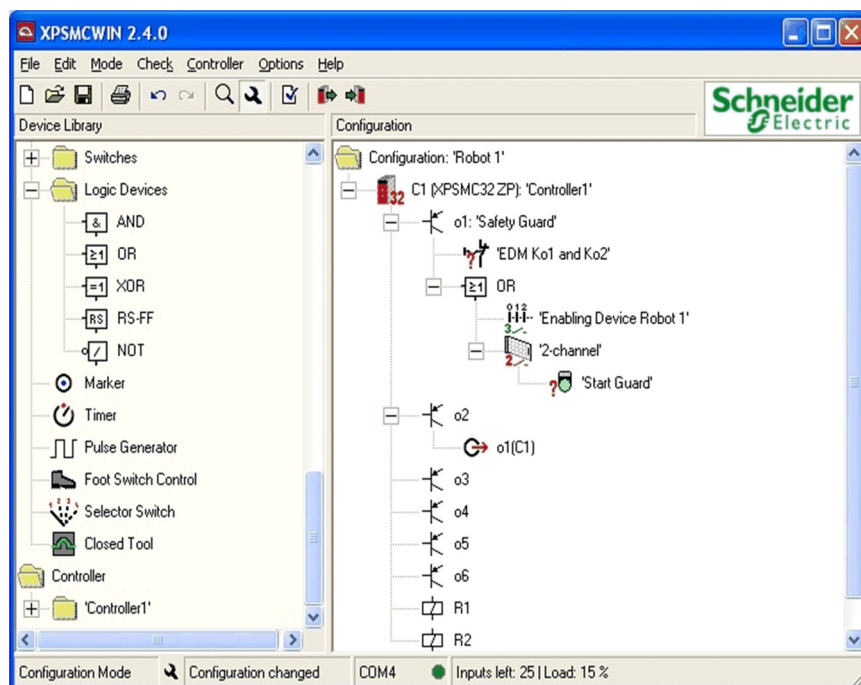
Step	Action
1	Click the right mouse button on its function symbol in the Configuration window to assign a name and a stop category to safety output o1.
2	Select the Properties menu option. Indicate a name and the stop category.  Note: Any safety output not modified has a default stop category of 0.
3	Confirm with OK. Result: This completes the configuration of safety output o1.

Copying the State of One Safety Output onto another Safety Output

Description

In our example, **o2** represents the 2nd channel of a safety 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 outputs o1 and o2. Your screen should look like the one below:



6.3 Configuring the Emergency Stop Function

Overview

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

What's in this Section?

This section contains the following topics:

Topic	Page
Emergency Stop	137
Master E-Stop Device	141

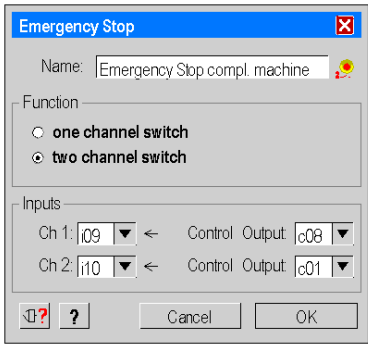
Emergency Stop

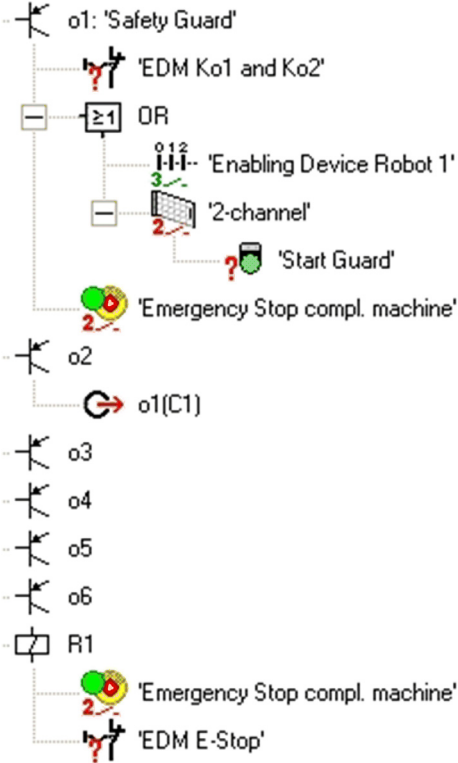
Description

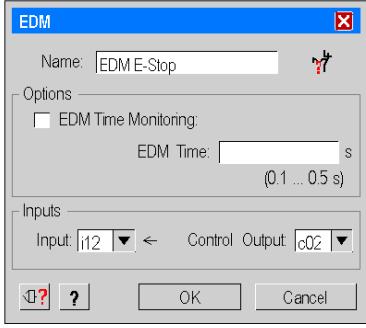
Depending on the application, the machine's global control system must be able to be stopped by means of Emergency Stop button S1 which activates free outputs 13 / 14 and 23 / 24 of relay group R1. Their contactors KE1 and KE2 are assigned to provide that, when the machine is started, KE1 and KE2 are stopped in a statutory fashion.

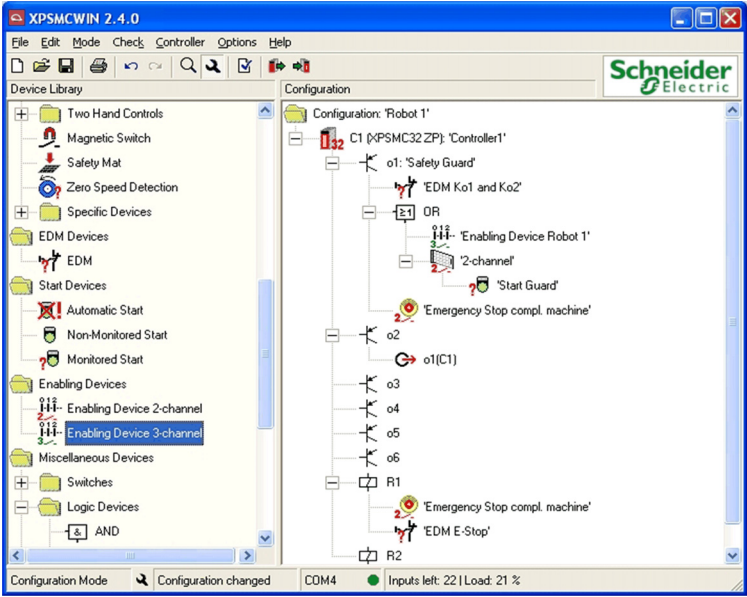
Procedure

Proceed as follows:

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

Step	Action
6	Select Paste and as copy of device. Result: The <i>E-Stop</i> 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 the mouse 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
7	To adjust the return circuit, drag the EDM device symbol from the <i>EDM Devices</i> folder onto the symbol for R1 in the Configuration window, fill in the dialog box in accordance with the application. 

Step	Action
8	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. The user must guarantee that no dangerous fault can occur when this control output is used more then once, as a dangerous short-circuit, for example, is no longer detected. Your screen should now look like the one below:
	
9	Complete the creation of the example configuration by saving and download it to the XPSMC.

WARNING

LOSS OF SAFETY INPUT CROSS-CONNECTION DETECTION

Ensure that no more than one critical safety input is connected to each of the control outputs.

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

Master E-Stop Device

Description

A *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. Only the status itself is transferred.

6.4 Save the Configuration

Save

Description

The configuration can be saved by opening the **File** → **Save** menu option (or by clicking on the floppy disk symbol button ) under the current name or by opening 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.

6.5 Requesting/Changing the Password

Password

Enter Password

NOTE: Your PC must be connected to the XPSMC safety controller.

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

Change Password

The default password is `safety`; as a safety measure, it must be changed to an individual password. The password must contain between 4 and 12 characters. Any combination of letters and numbers may be used.

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

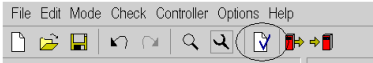
NOTE: The password is case sensitive. *Security* and *security* are thus two different passwords.

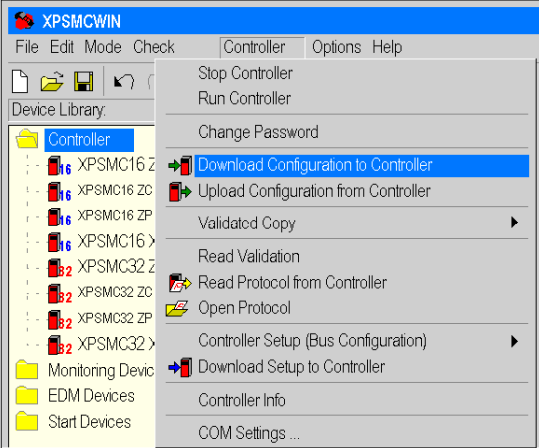
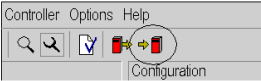
6.6 Sending a Configuration from the PC to the XPSMC and Performing a Check

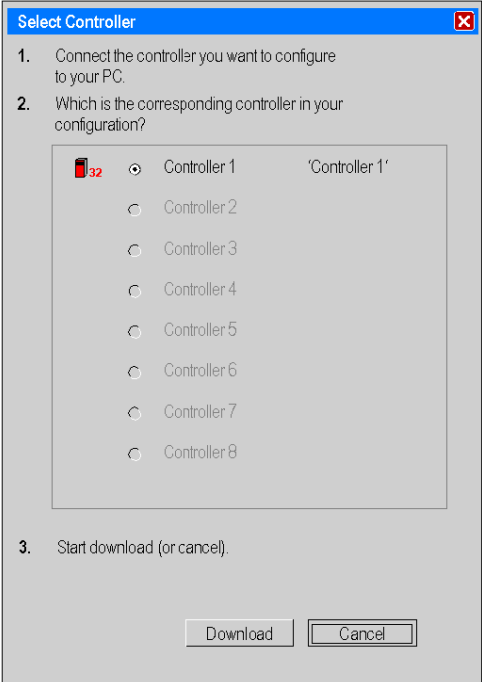
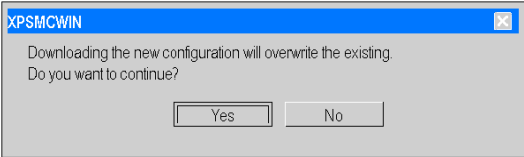
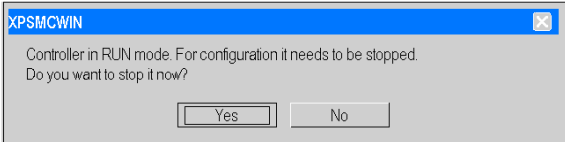
Sending a Configuration

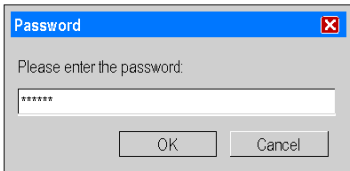
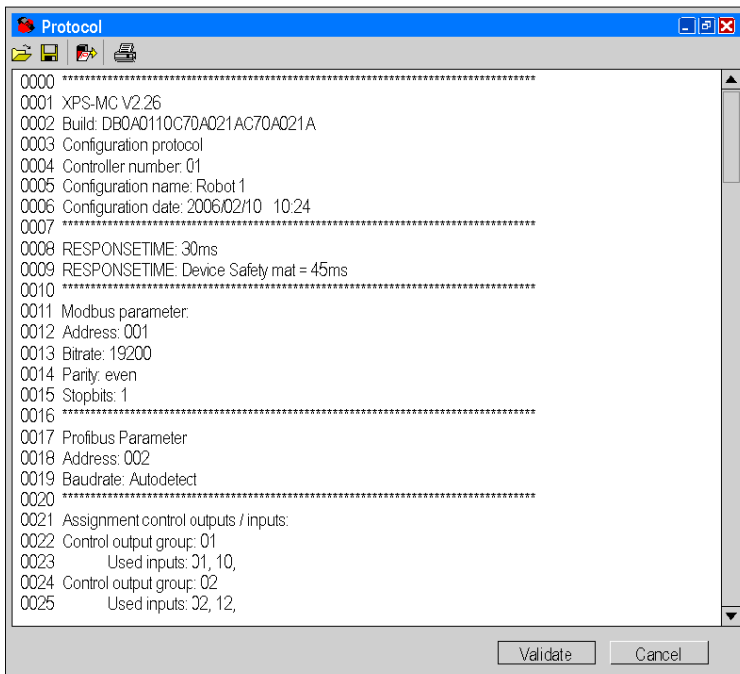
Procedure

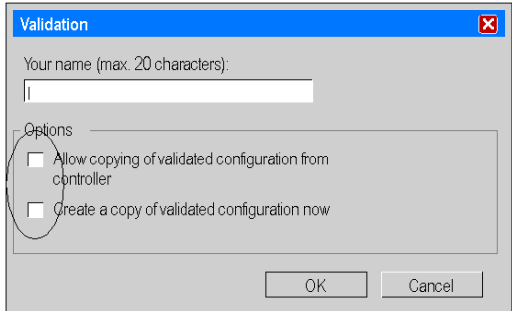
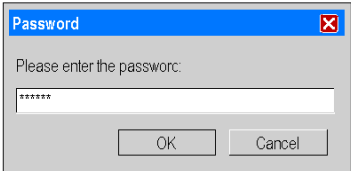
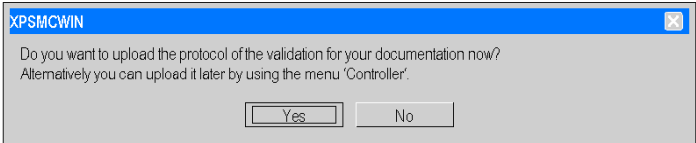
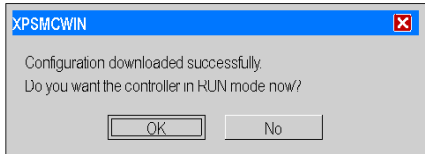
To send a completed configuration from the PC to the safety controller, follow this procedure:

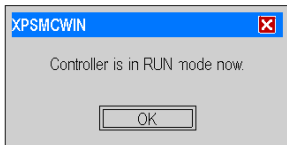
Step	Action
1	Select Check → Check Configuration to check the configuration. You can click on the Check Configuration icon alternatively:  Result: If the configuration contains no errors, the following message box appears:  If the configuration contains errors, a yellow question mark will be seen, and a corresponding message box will appear. Note: The configuration will be checked for consistency. This check neither verifies the 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.

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 mode, the following message will appear: 

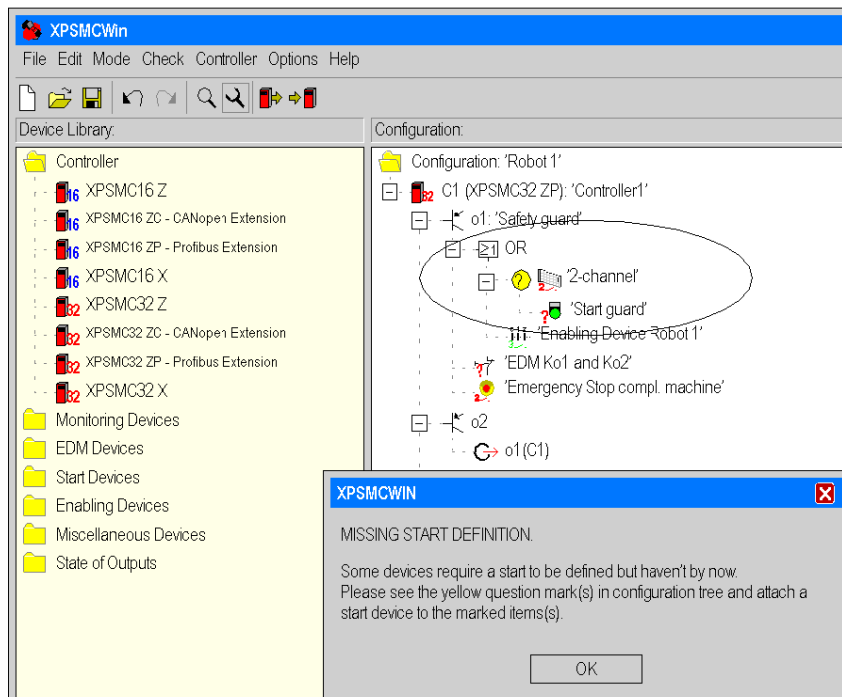
Step	Action
5	Click Yes to continue the procedure. Result: To stop the controller, enter your password (default password is <i>safety</i> in lower case)  The image shows a 'Password' dialog box with a title bar containing a red 'X' icon. The text inside says 'Please enter the password:' followed by a text input field containing seven asterisks. At the bottom are 'OK' and 'Cancel' buttons.
6	Click OK to continue. Result: The download procedure is starting. After the download, you will see the protocol:  The image shows a 'Protocol' dialog box with a title bar containing a red 'X' icon. The text inside lists configuration parameters in a list format, separated by asterisks. At the bottom are 'Validate' and 'Cancel' buttons. <pre> 0000 ***** 0001 XPS-MC v2.26 0002 Build: DB0A0110C70A021AC70A021A 0003 Configuration protocol 0004 Controller number: 01 0005 Configuration name: Robot 1 0006 Configuration date: 2006/02/10 10:24 0007 ***** 0008 RESPONSETIME: 30ms 0009 RESPONSETIME: Device Safety mat = 45ms 0010 ***** 0011 Modbus parameter: 0012 Address: 001 0013 Btrate: 19200 0014 Parity: even 0015 Stopbits: 1 0016 ***** 0017 Profibus Parameter 0018 Address: 002 0019 Baudrate: Autodetect 0020 ***** 0021 Assignment control outputs / inputs: 0022 Control output group: 01 0023 Used inputs: 01, 10, 0024 Control output group: 02 0025 Used inputs: 02, 12, </pre> Note: Read this protocol carefully and check 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 your name in the Validation dialog box:  The Validation dialog box has a title bar 'Validation' with a close button. It contains a text input field labeled 'Your name (max. 20 characters):'. Below it is an 'Options' section with two checkboxes: 'Allow copying of validated configuration from controller' and 'Create a copy of validated configuration now'. Both checkboxes are circled in red. At the bottom are 'OK' and 'Cancel' buttons.
9	Click OK to continue. Result: The Password dialog box will be displayed:  The Password dialog box has a title bar 'Password' with a close button. It contains a text input field labeled 'Please enter the password:' with masked characters '*****'. At the bottom are 'OK' and 'Cancel' buttons.
10	Enter your password and click OK.
11	Click OK to continue. Result: The following message will be displayed:  The XPSMCWIN dialog box has a title bar 'XPSMCWIN' with a close button. It contains the text: 'Do you want to upload the protocol of the validation for your documentation now? Alternatively you can upload it later by using the menu 'Controller''. At the bottom are 'Yes' and 'No' buttons.
12	Click Yes to upload the protocol. Result: The following message will be displayed:  The XPSMCWIN dialog box has a title bar 'XPSMCWIN' with a close button. It contains the text: 'Configuration downloaded successfully. Do you want the controller in RUN mode now?'. At the bottom are 'OK' and 'No' buttons.

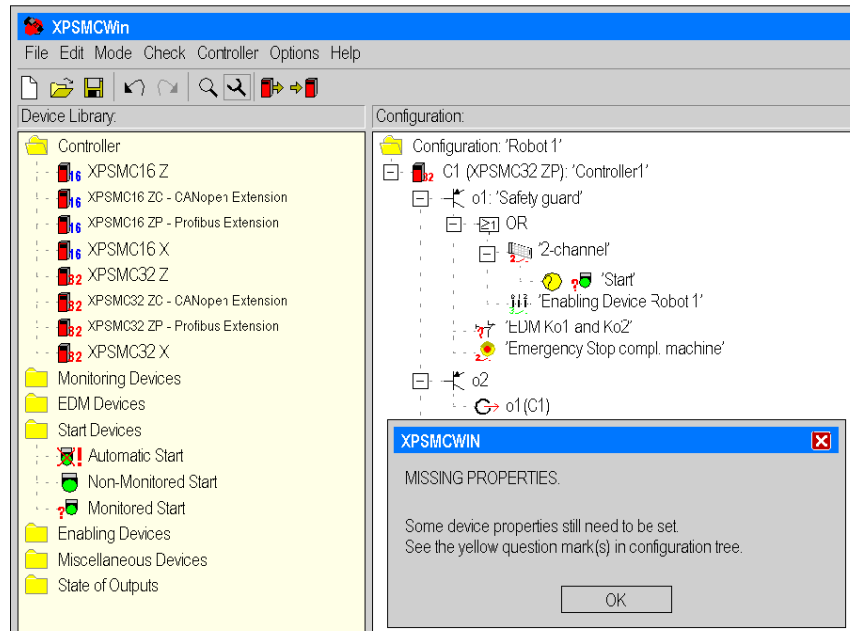
Step	Action
13	Click OK to start the controller. Result: The following message will be displayed
	
14	Click OK to finish the procedure.

Typical Configuration Errors

Configuration error 1: If you forgot to assign a start device to the **Two-Channel Safety Guard**, the main window and the message box will look as follows:



Configuration error 2: If you forgot to set the inputs and outputs of the start device, the main window and the message box will look as follows:



6.7 Loading a Configuration

Loading

Description

The configuration of a controller can be uploaded at any time 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. Reaction: The configuration is loaded from the XPSMC and then represented in the usual tree structure.

6.8 **Creation/Transfer of a Validated Configuration Copy**

Overview

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

What's in this Section?

This section contains the following topics:

Topic	Page
Copy/Saving of a Validated Configuration	153
Transfer of a Validated Configuration Copy	154

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 144*, step for the validation. Under this condition the user is able to make a copy of the validated configuration from the XPSMC into a binary file at any time. In addition, the **Create a copy of the validated configuration now** option can be selected in order to immediately create such 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 safety 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 which is free for copy.
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 153*) for a certain controller, it is easy to transfer the configuration into another controller, especially for replacement of a XPSMC 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 blinking.
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 appearing window 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 <i>Procedure 1 - New Controller, page 154</i> for downloading a validated copy.

Step	Action
3	Indicate in the appearing window the name of the file. Result: The validated configuration is picked out from the file and 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 154*.

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.

6.9 Read Protocol from 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 mode 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. Note: This print is just a work tool. The only proof of the correctness of the configuration is the validated and signed protocol. (See chapter <i>Sending a Configuration</i> , page 144)

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 fault diagnostics, the XPSMC continues to operate without being influenced.

Procedure

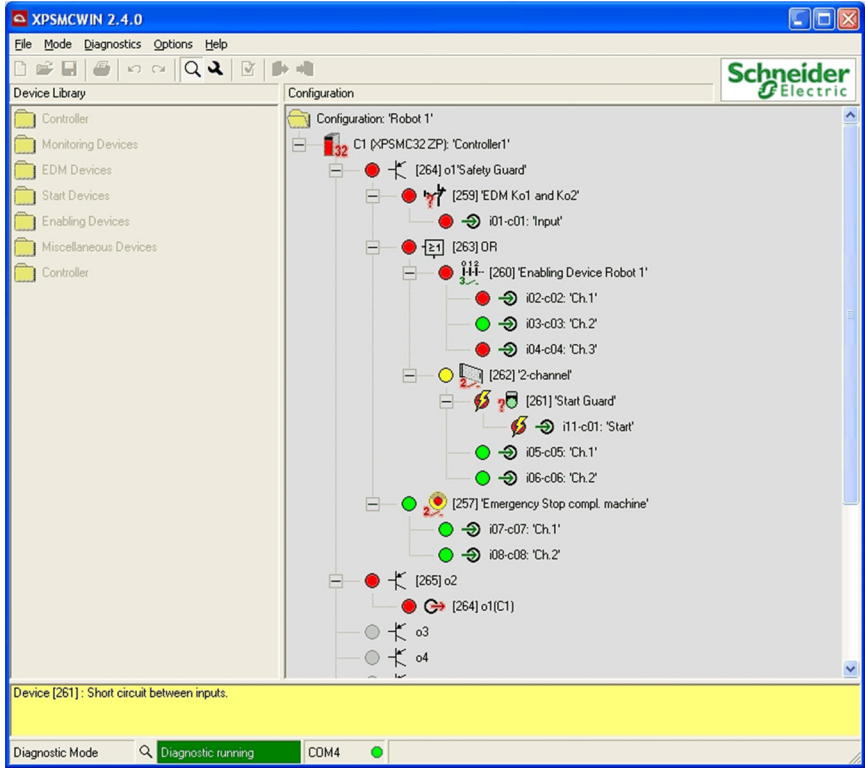
The fault Diagnostic mode is activated as follows:

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 current status of the corresponding function:



Meaning of symbols

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

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

Fault Diagnostics of Different Devices

Proceed as follows

Step	Action
1	Click on the symbol of the device to see the state of the inputs of the different devices
2	Click the right mouse button within the Diagnostic window. Result: A special 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



Example Wiring and Functional Diagrams



Overview

This chapter contains examples of wiring and functional diagrams.

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

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Electrical Diagram for the XPSMC	165
Three One-Channel Emergency Stops, with Automatic Start	167
Two Two-Channel Emergency Stop, with Start Button	169
Safety Guard with One Channel	172
Two Channel Safety Guard	175
Two Channels Safety Guard with Lock	179
Light Curtain with Relay Outputs	183
Light Curtain with Transistor Outputs	187
Muting for Light Curtains Type 4	191
Magnetic Switch	193
Two-Hand Control	197
Safety Mat	199
Zero Speed Detection	201
Injection Molding Machines	204
Hydraulic Press Valve Monitoring	207
Hydraulic Press 2	209
Eccentric Press	215
Eccentric Press 2	219

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Selector Switch	224
Timer	226
Shaft/Chain-Break Monitoring	229
Seat Valve Monitoring	231
Enabling Device 2 Channel	233
Enabling Device 3 Channel	235
Foot Switch	237

Electrical Diagram for the XPSMC

Response Time

When not other mentioned the following drawings show a XPSMC16 with a response time of 20 ms.

Wiring Diagram

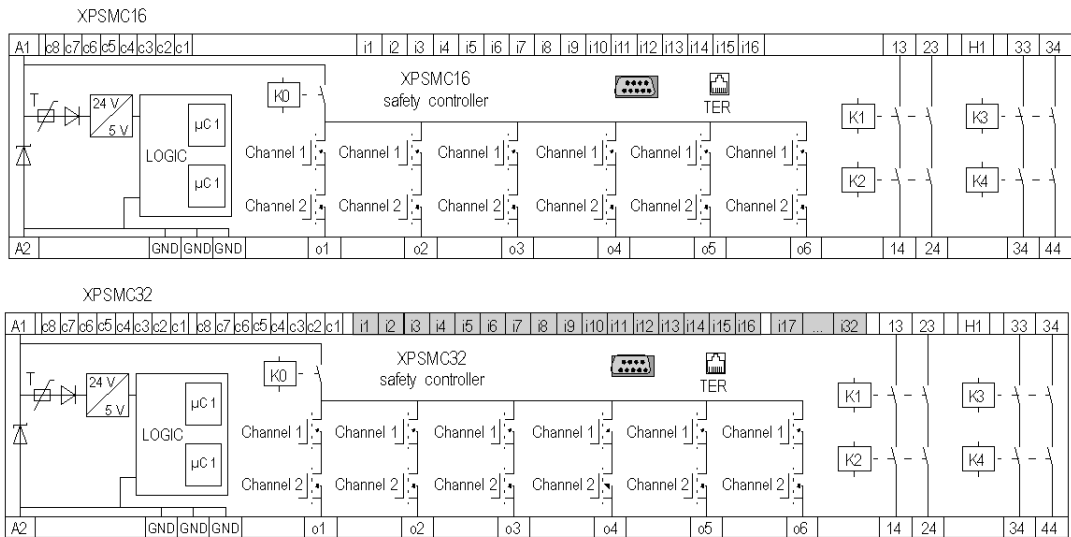
⚠ DANGER

HAZARDOUS VOLTAGE

Disconnect all power before servicing equipment.

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

XPSMC16 / XPSMC32



The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

Technical Data

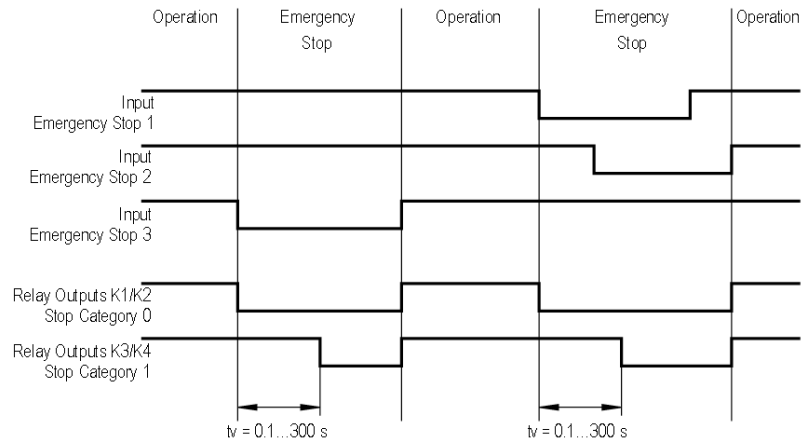
Description of terminals

Terminal Layout	Meaning
A1-A2	24V  power supply; A1 is the positive pole (+24 VDC), A2 is the negative pole (0 VDC, GND)
GND	It is identical to the 0 V potential on A2 for loads on the o1...o6 semiconductor safety outputs.
c1-c8	control outputs for safety input power supply The control outputs contain a signal which enables short circuit detection monitoring, voltage intrusion and open circuit detection for the connected control components.
i1-i16 or i1-i32	safety inputs
H1	connection for muting lamp
o1-o6	semiconductor safety outputs
13/14, 23/24, 33/34, 43/44	safety outputs, potential free
TER	8 pin RJ45 connector used to connect the XPSMC safety controller to a PC for configuration and/or diagnostics. The communication via the TER terminal is Modbus RTU protocol and can also be used to connect to an HMI Magelis operating terminal, or a standard PLC.
Fieldbus	connector for a fieldbus dependant on version: ● Profibus DP: 9 pin D-SUB female connector ● CANopen: 9 pin D-SUB male connector.

Three One-Channel Emergency Stops, with Automatic Start

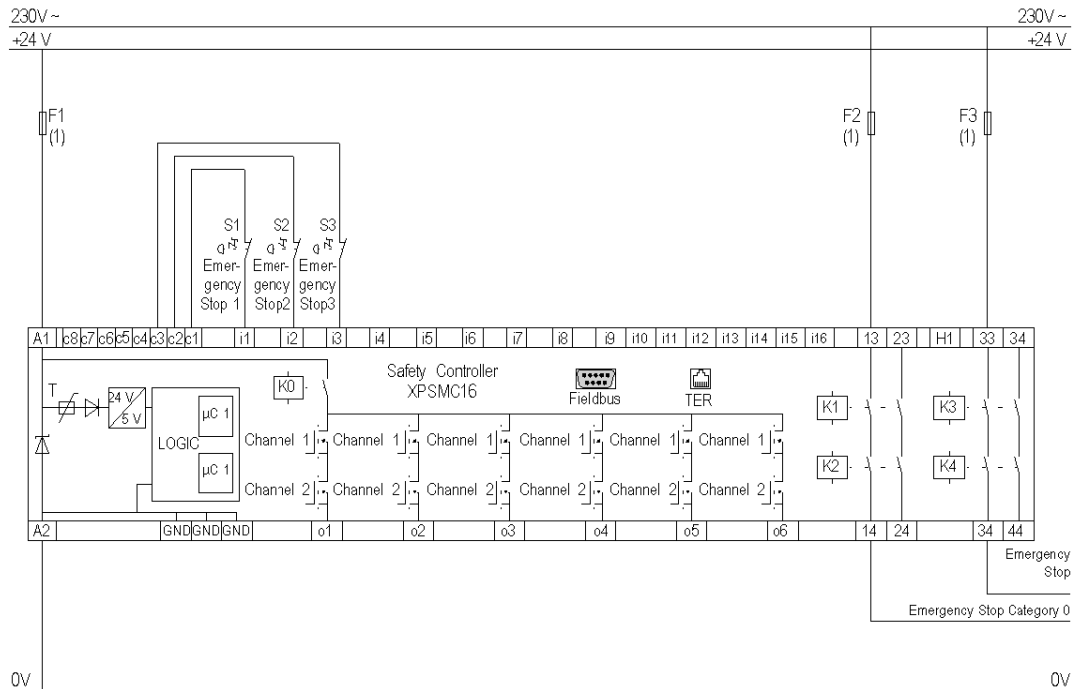
Functional Diagram

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.

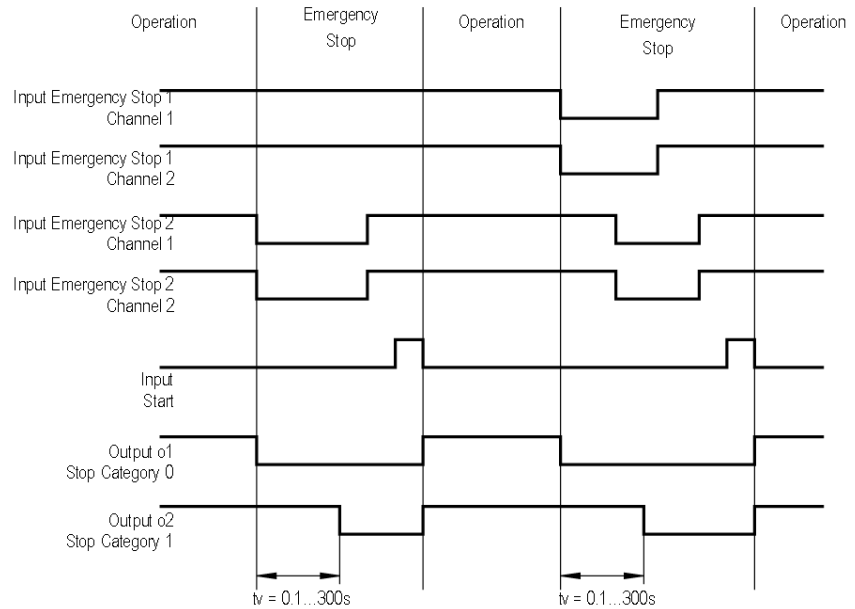
NOTE: A jumper between the 2 terminals of an Emergency Stop will not be recognized. Short-circuit between i1, i2, i3 will be recognized.

The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

Two Two-Channel Emergency Stop, with Start Button

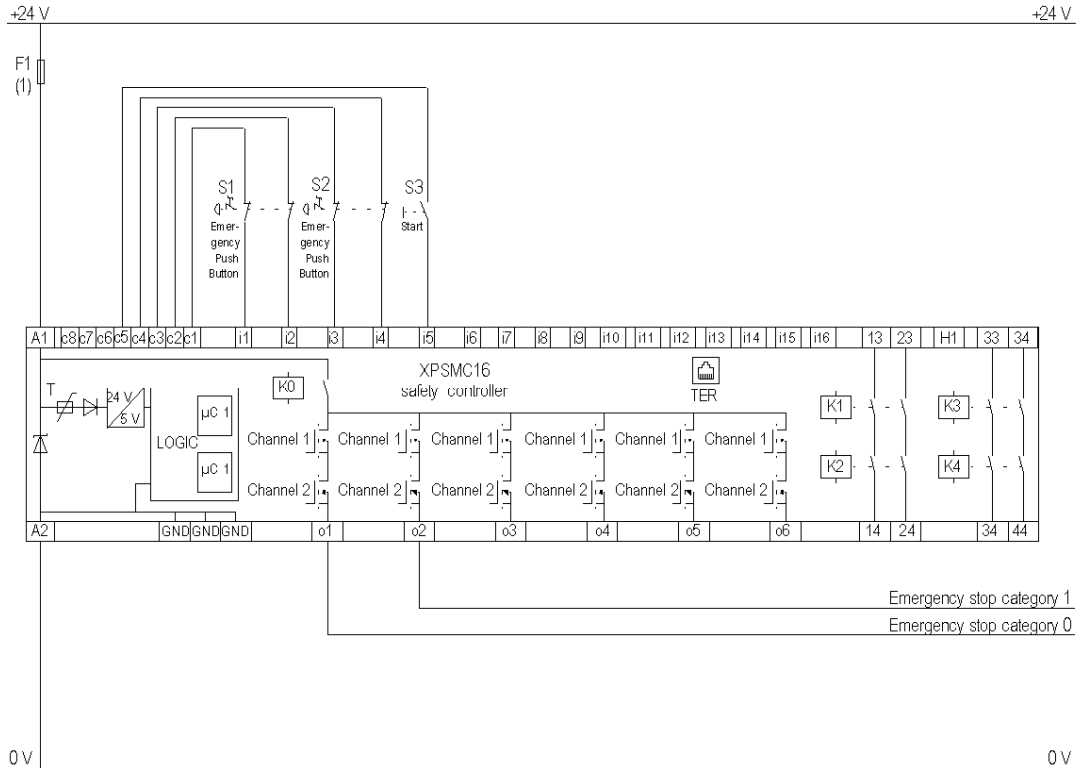
Functional Diagram

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:

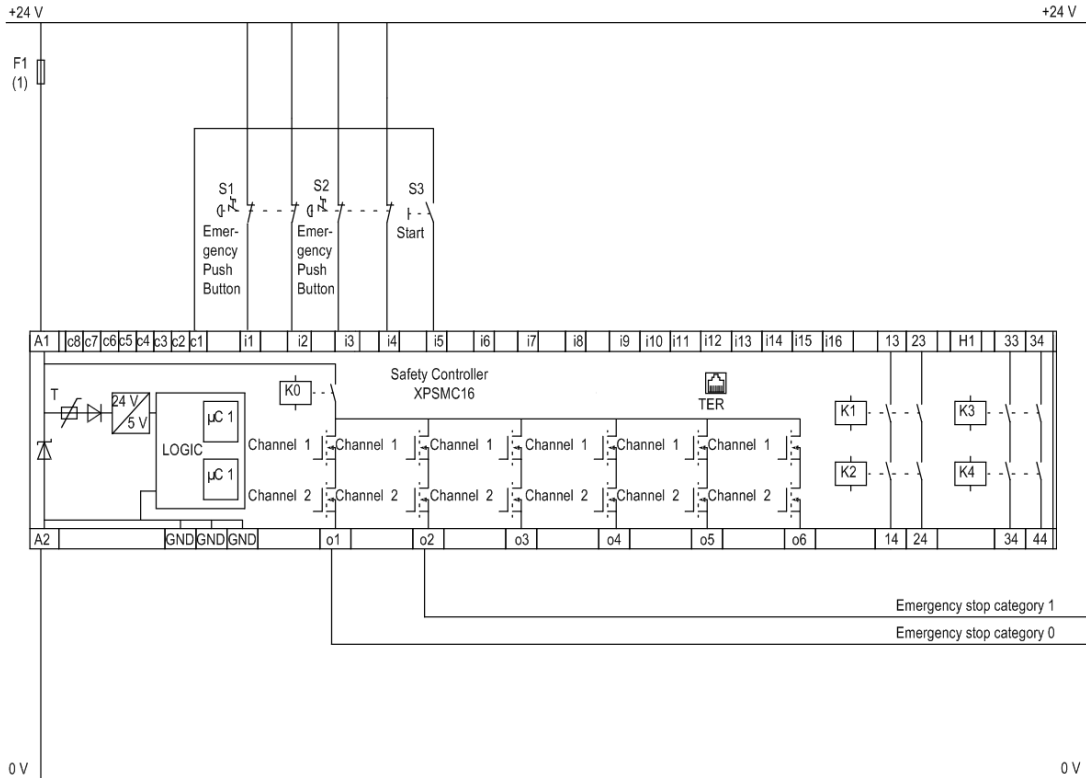


(1) See Technical Data in XPSMC safety controller Hardware manual for maximum fuse sizes.

The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

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:

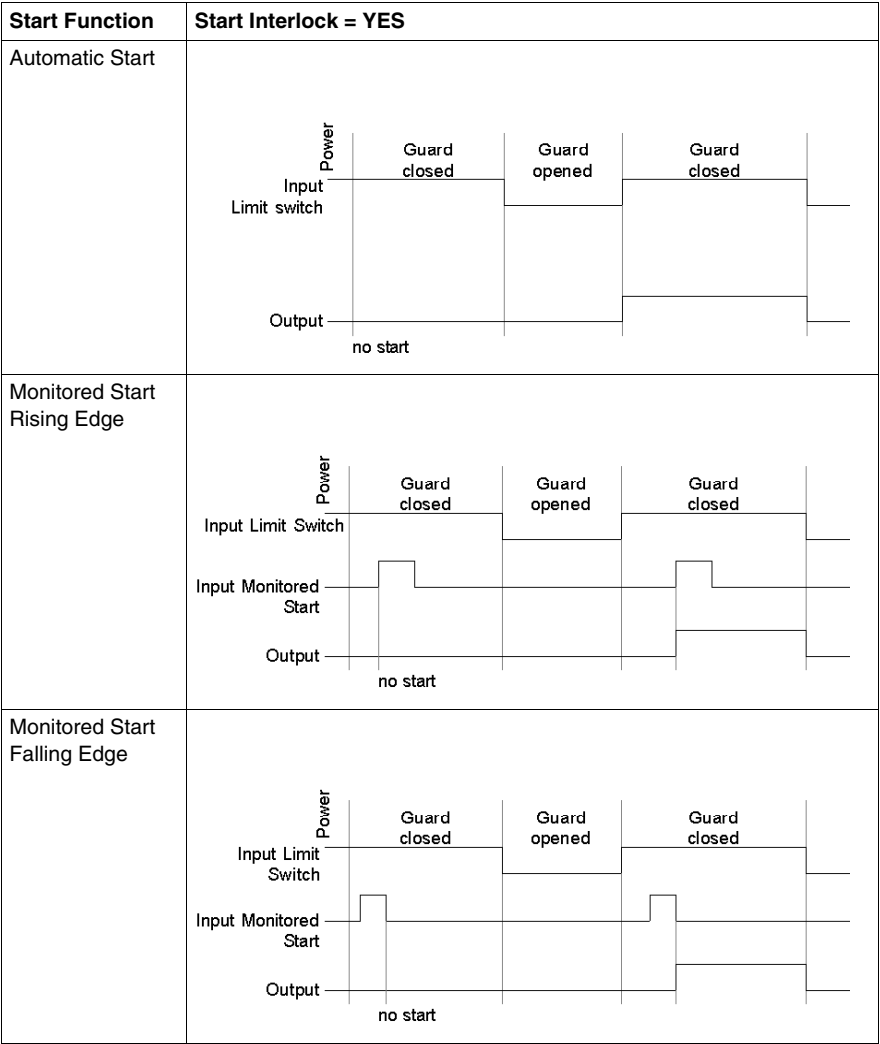


NOTE: For safety inputs not supplied by control outputs use external means to achieve up to SIL3 (EN / IEC 61508) or PL e, Category 4 (EN ISO / ISO 13849-1), e.g. shielded cable.

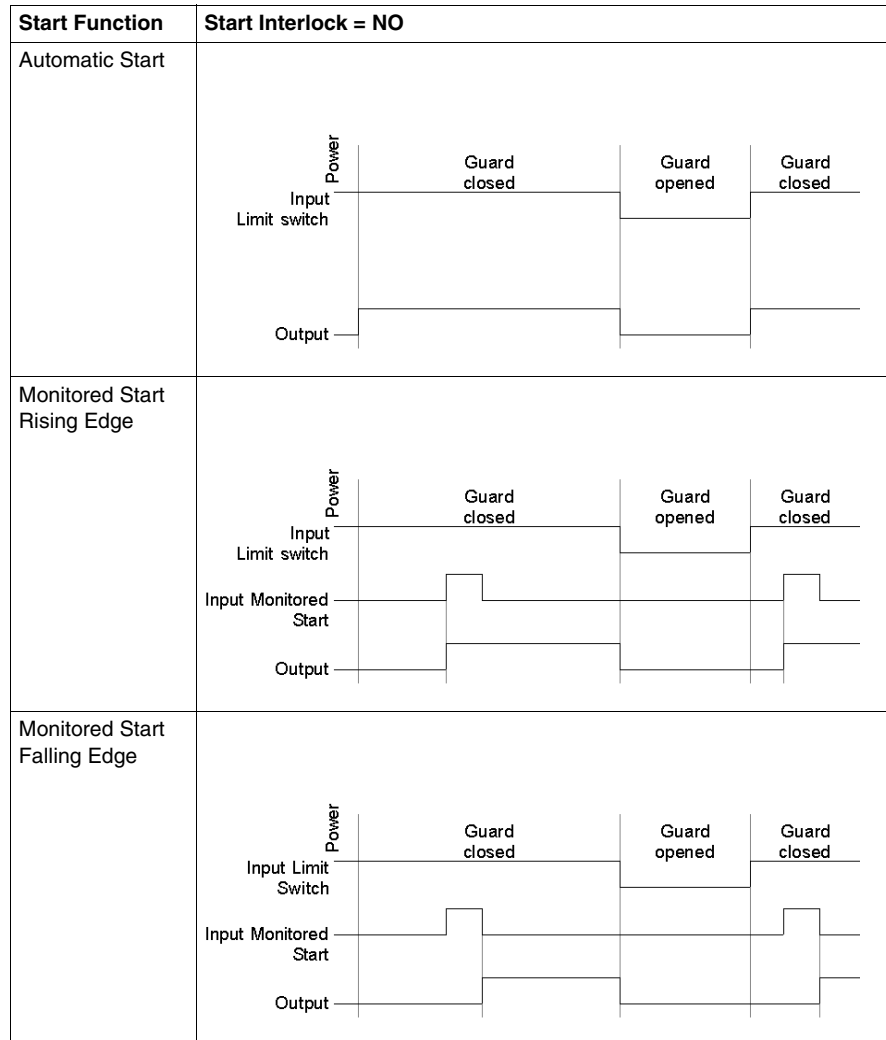
Safety Guard with One Channel

Functional Diagram

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

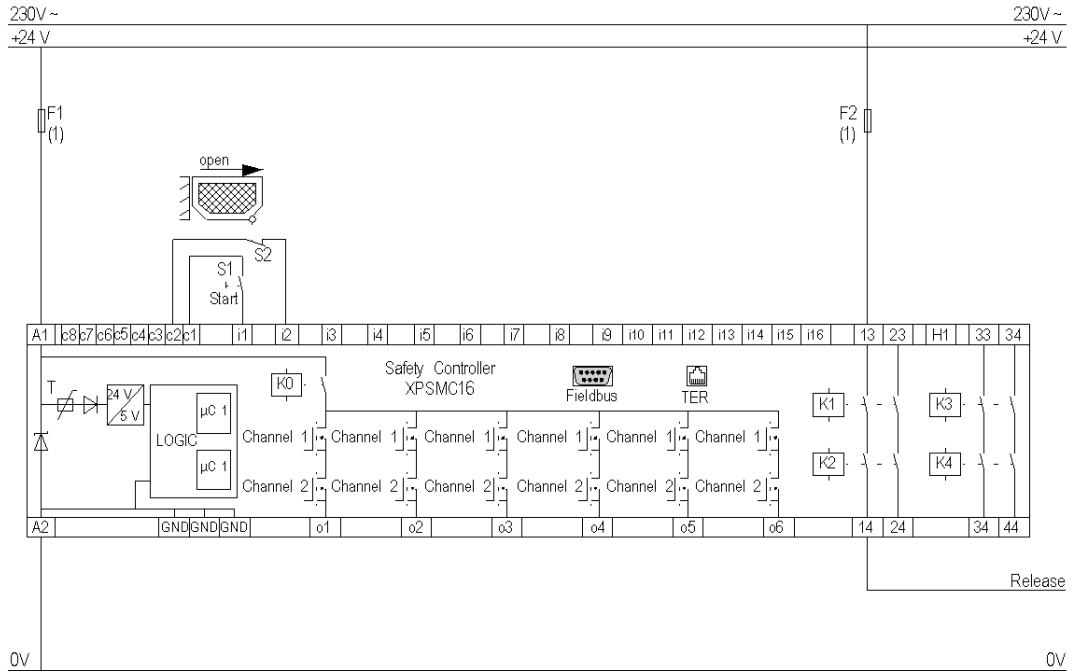


The following functional diagram shows the Safety Guard with One Channel without Start Interlock and different Start Functions:



Wiring Diagram

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



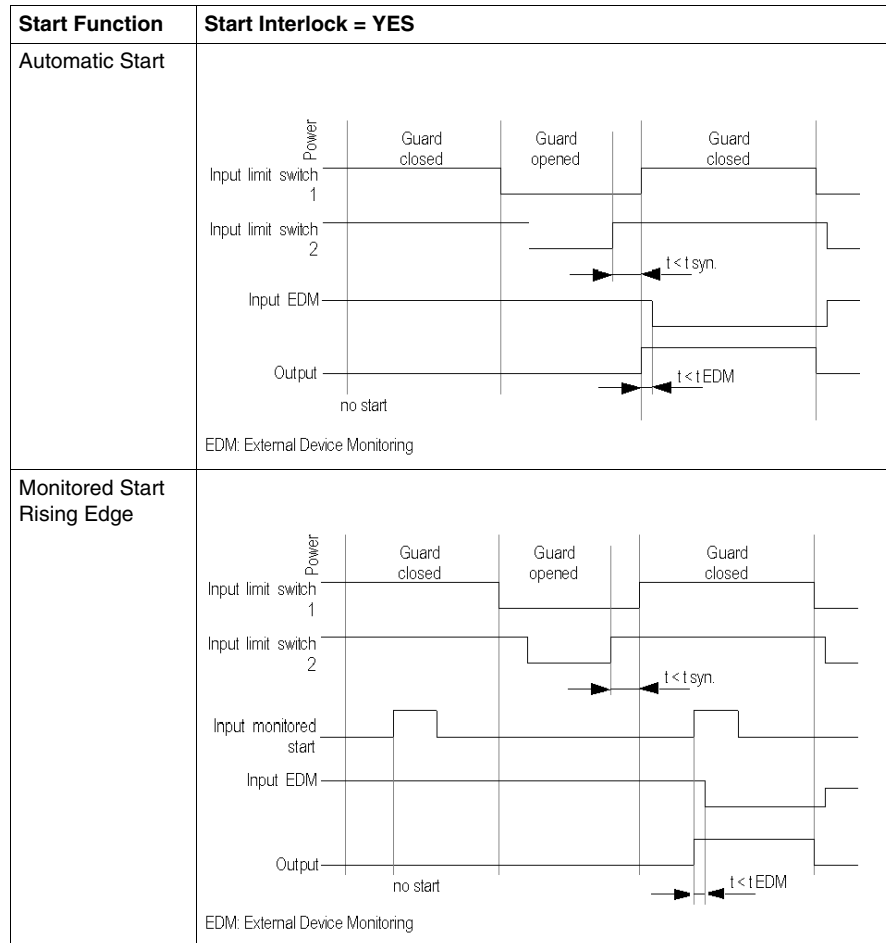
(1) See Technical Data in XPSMC safety controller Hardware manual for maximum fuse sizes.

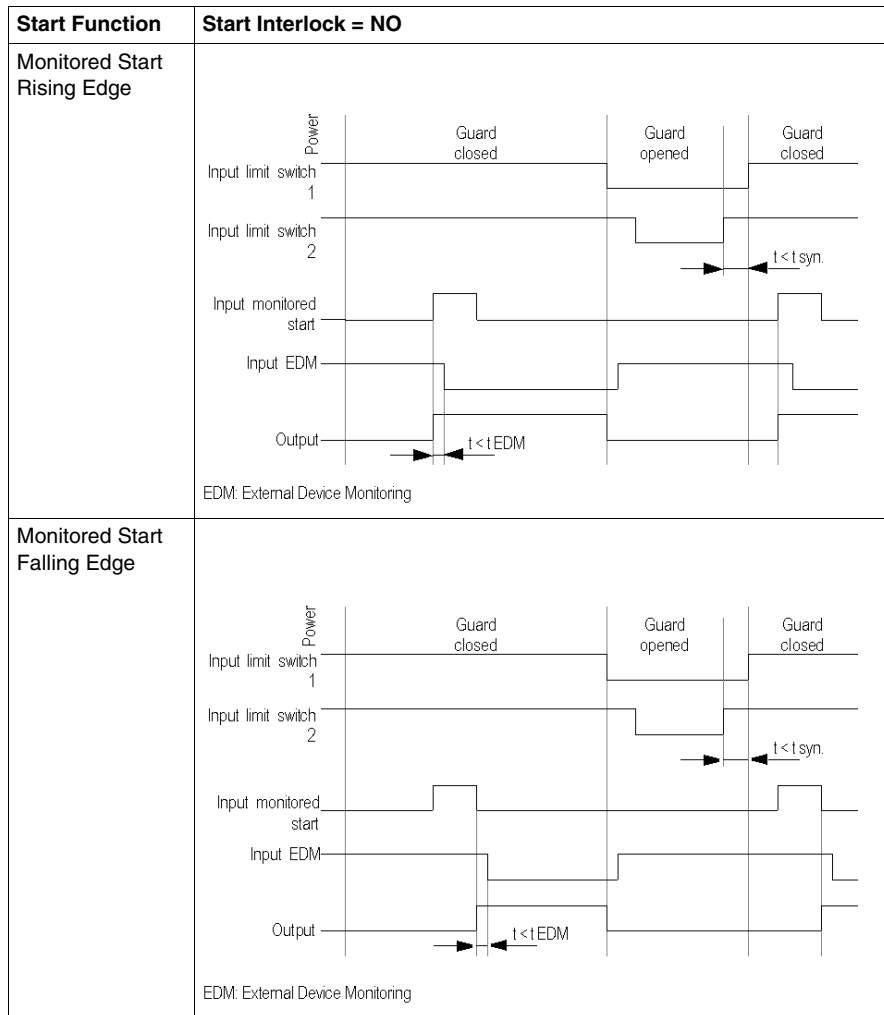
The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

Two Channel Safety Guard

Functional Diagram

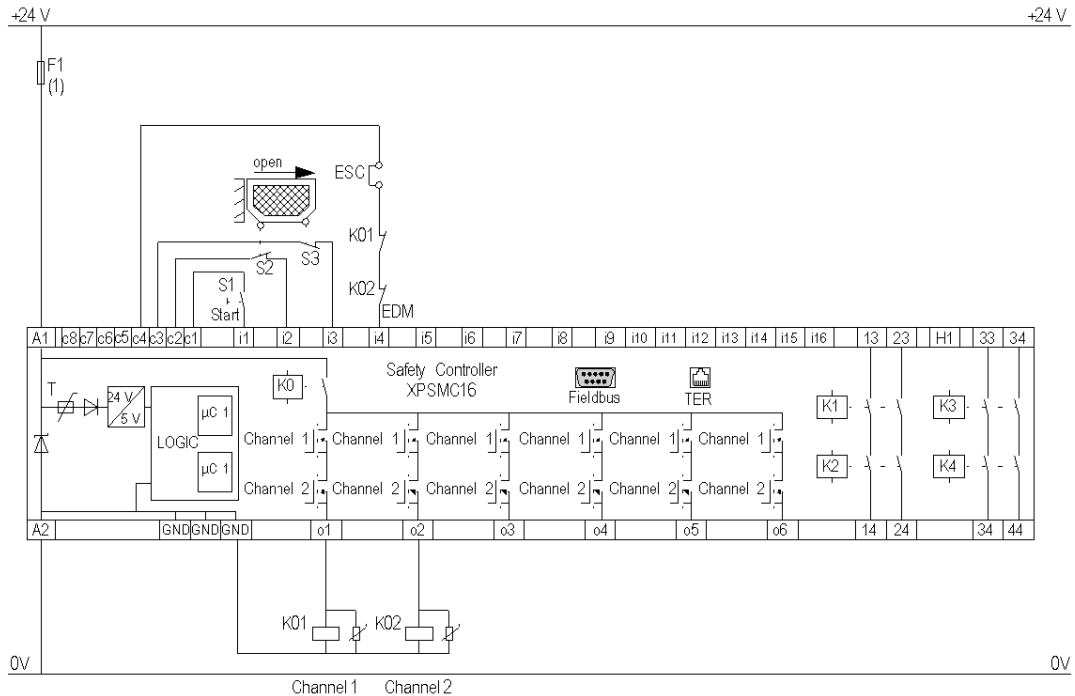
The following functional diagram shows the Two-Channel Safety Guard with Start Interlock and different Start Functions:





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

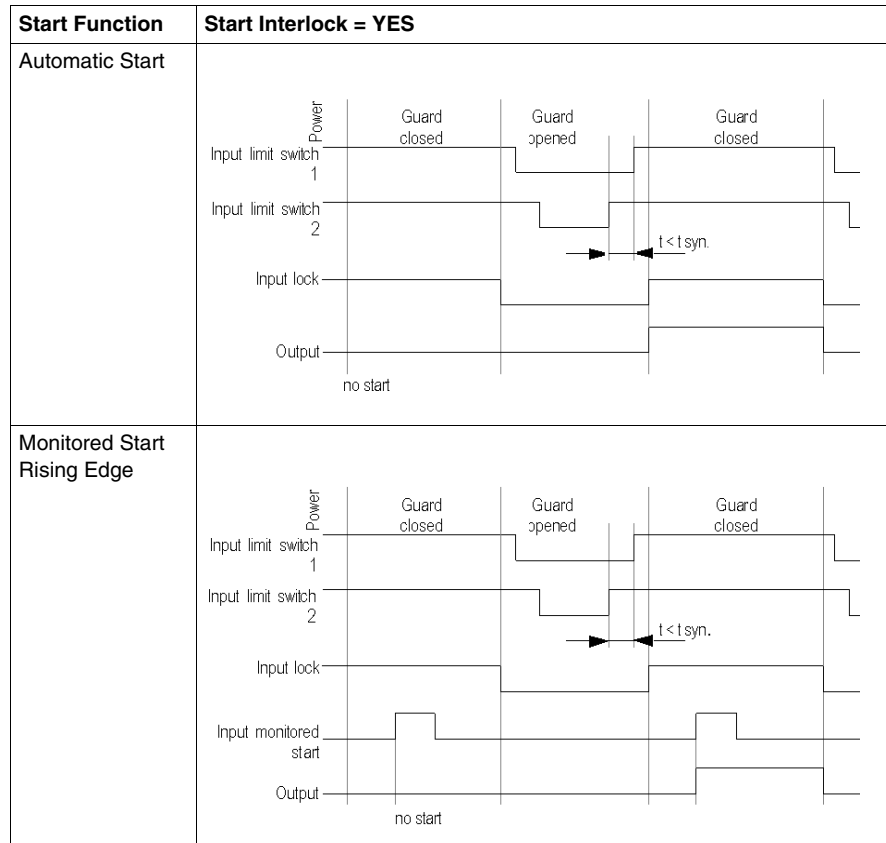
(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse size

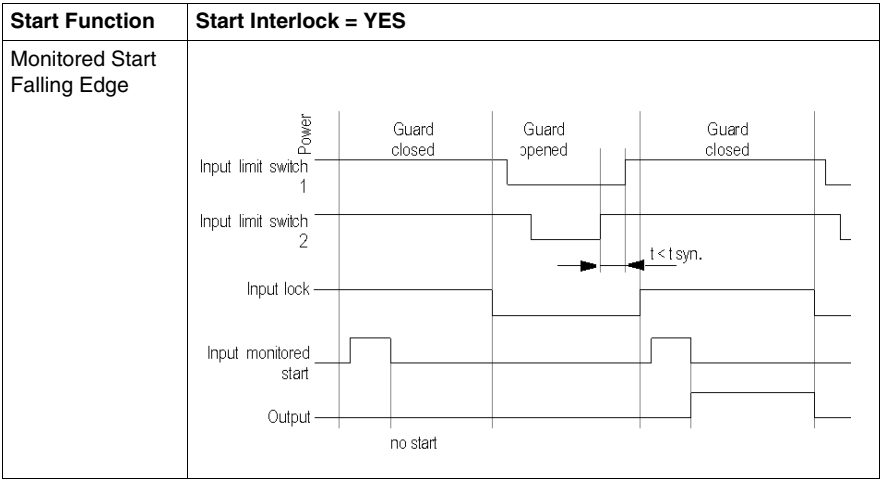
The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

Two Channels Safety Guard with Lock

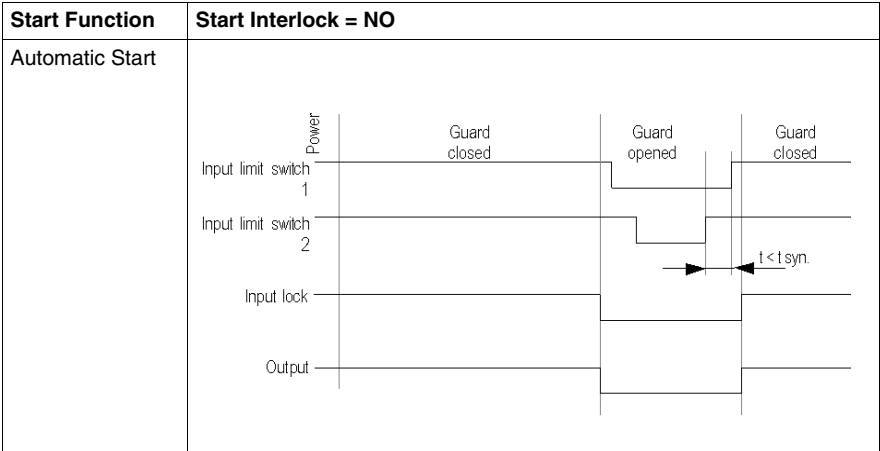
Functional Diagram

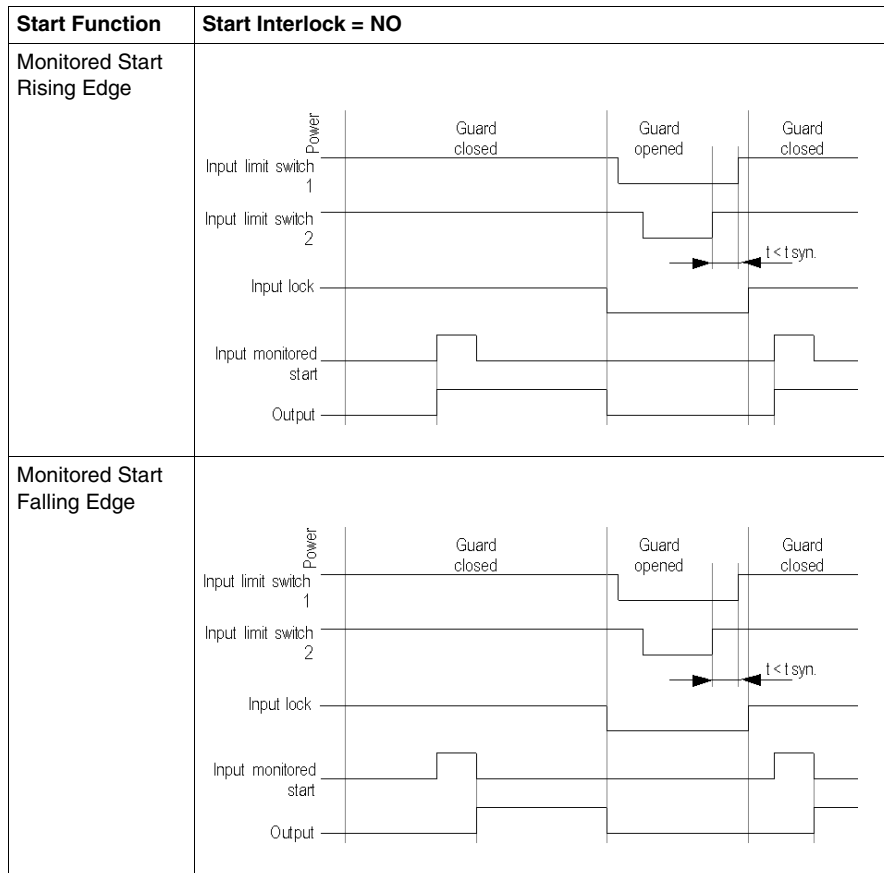
The following functional diagram shows the Two-Channel Safety Guard with Lock and with Start Interlock and different Start Functions:





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

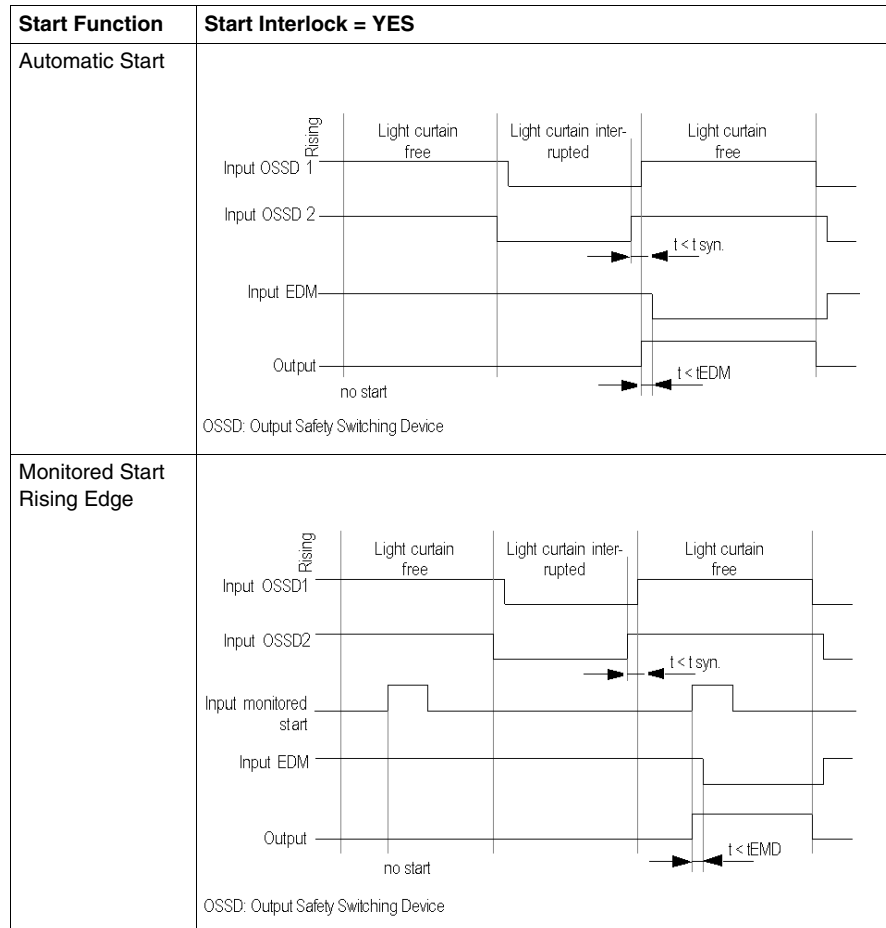


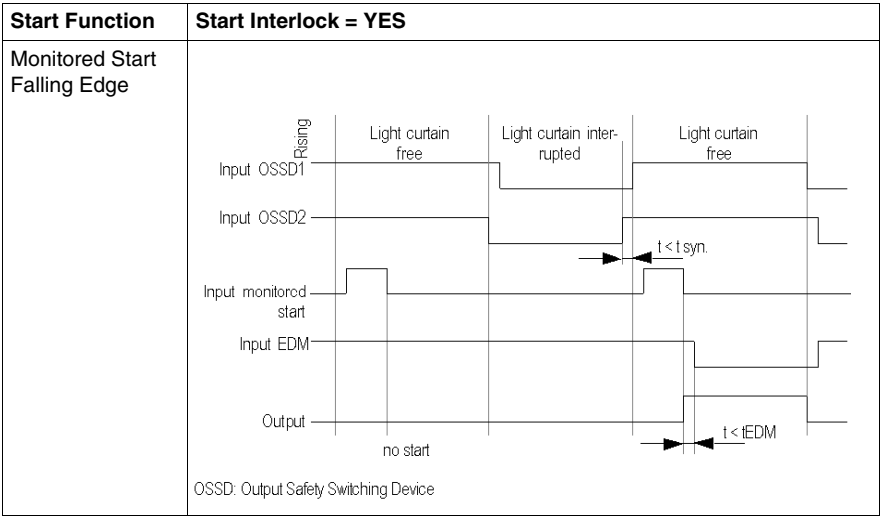


Light Curtain with Relay Outputs

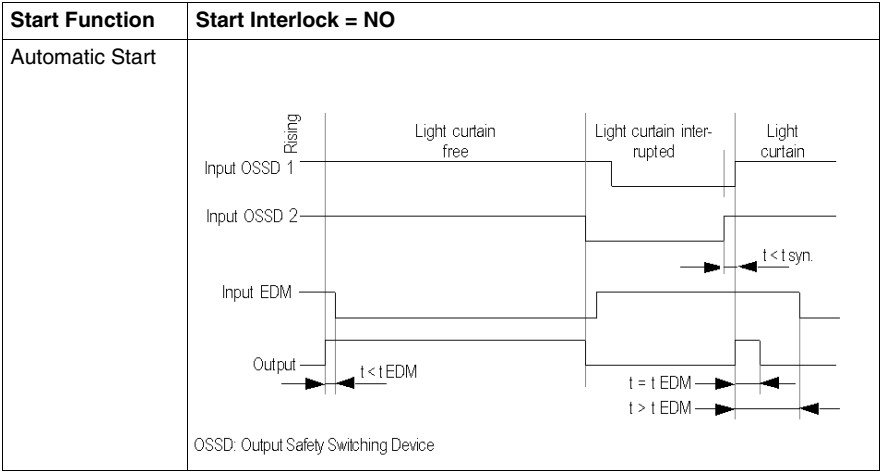
Functional Diagram

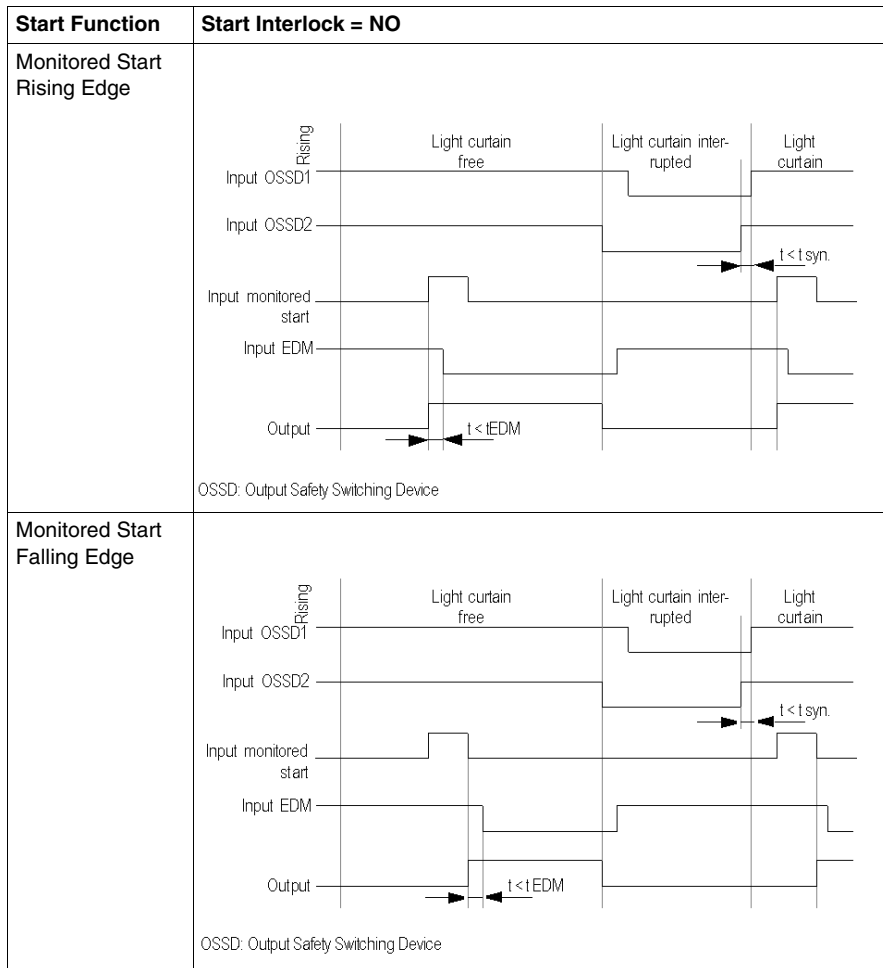
The following functional diagram shows the Light Curtain with Relay Outputs with Start Interlock and different Start Functions:





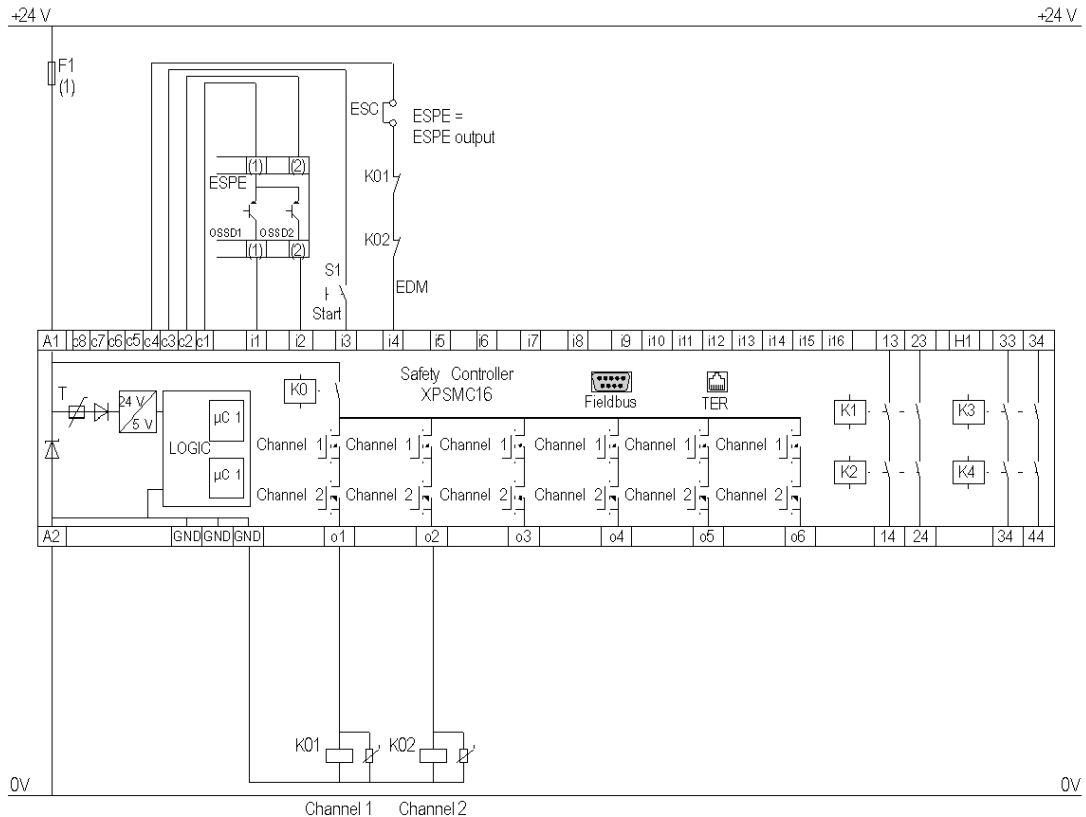
The following functional diagram shows the Light Curtain with Relay Outputs without Start Interlock and different Start Functions:





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

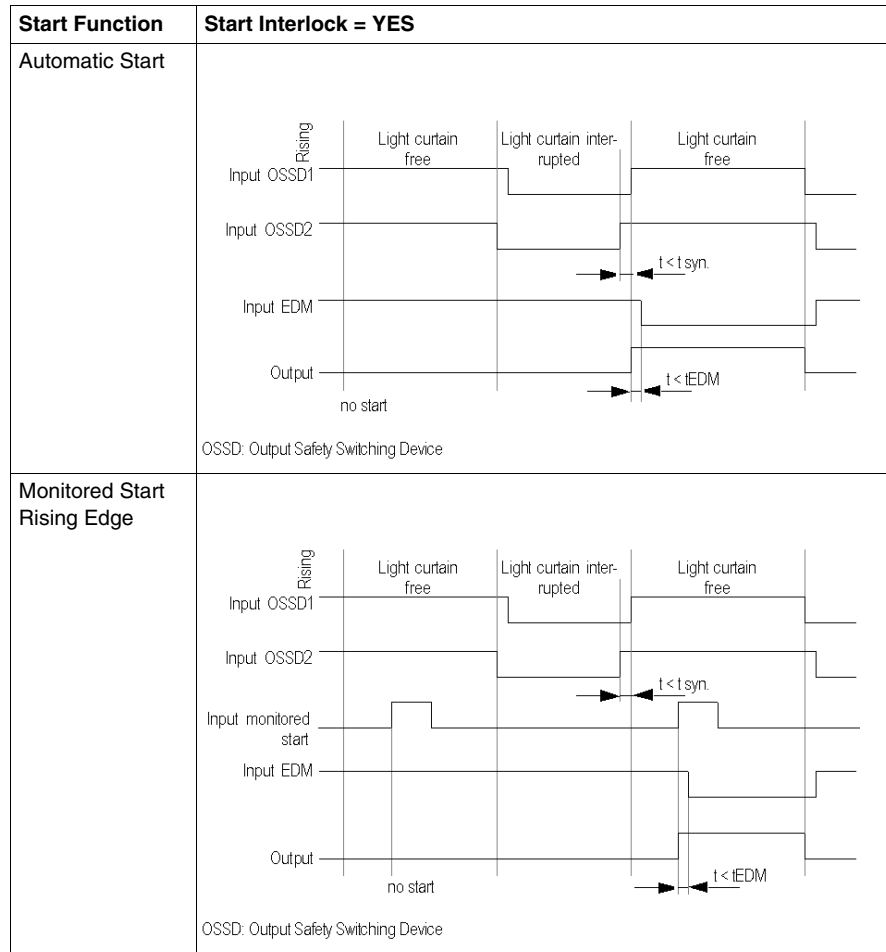
(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse size

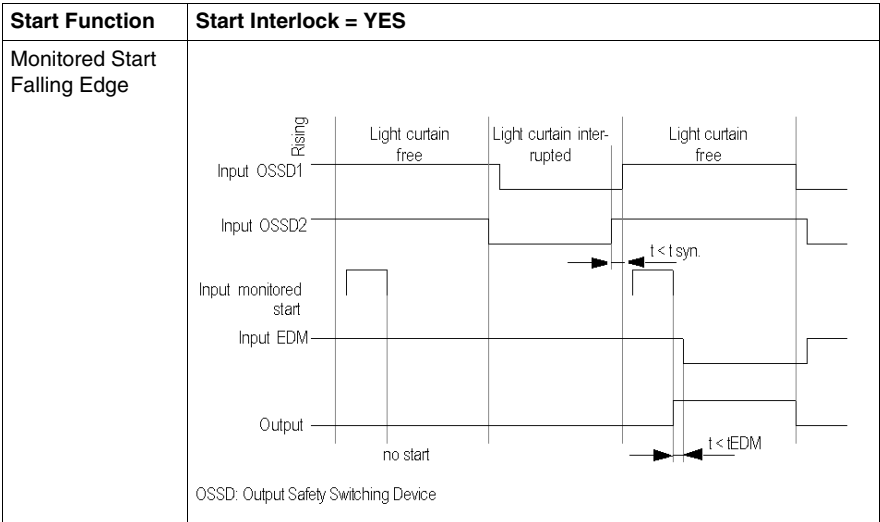
The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

Light Curtain with Transistor Outputs

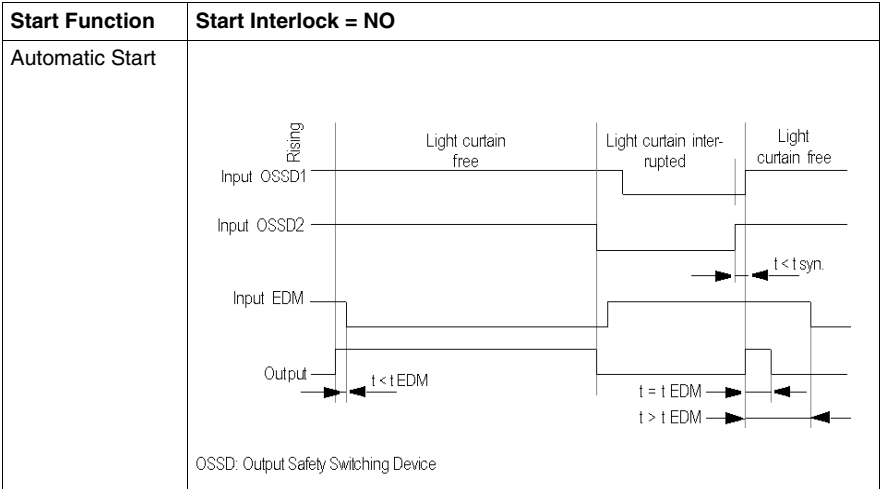
Functional Diagram

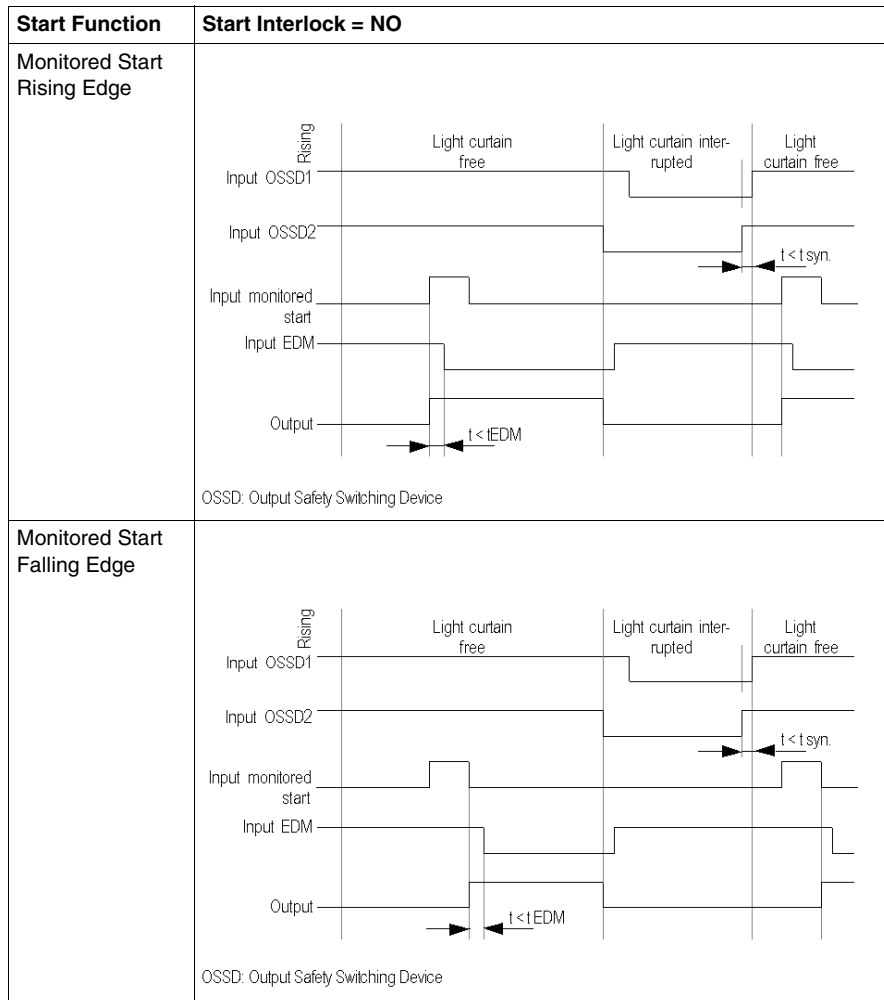
The following functional diagram shows the Light Curtain with Transistor Outputs with Start Interlock and different Start Functions:





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

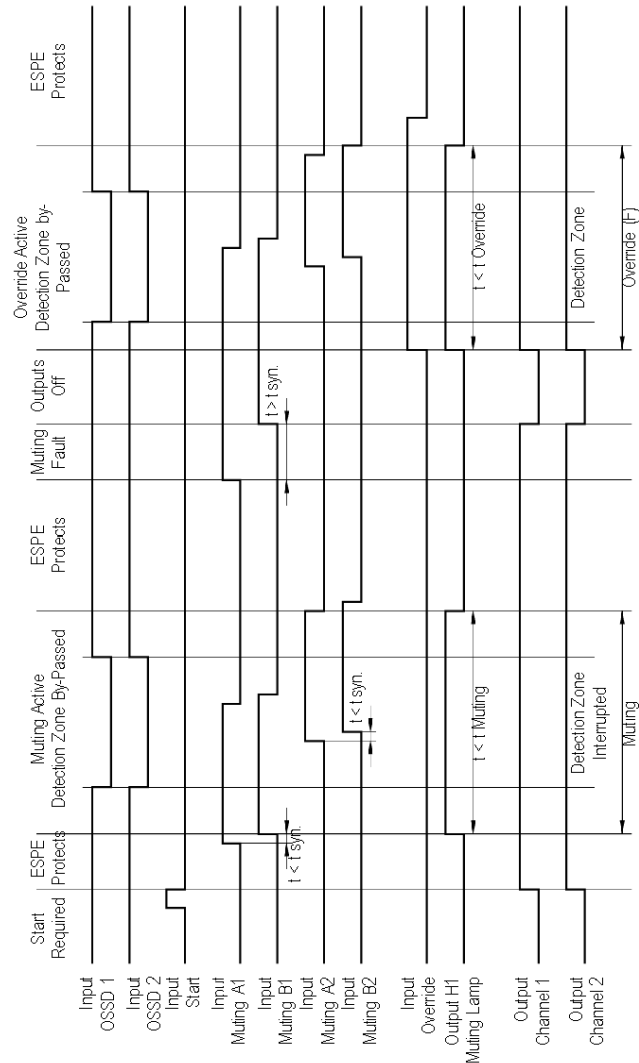




Muting for Light Curtains Type 4

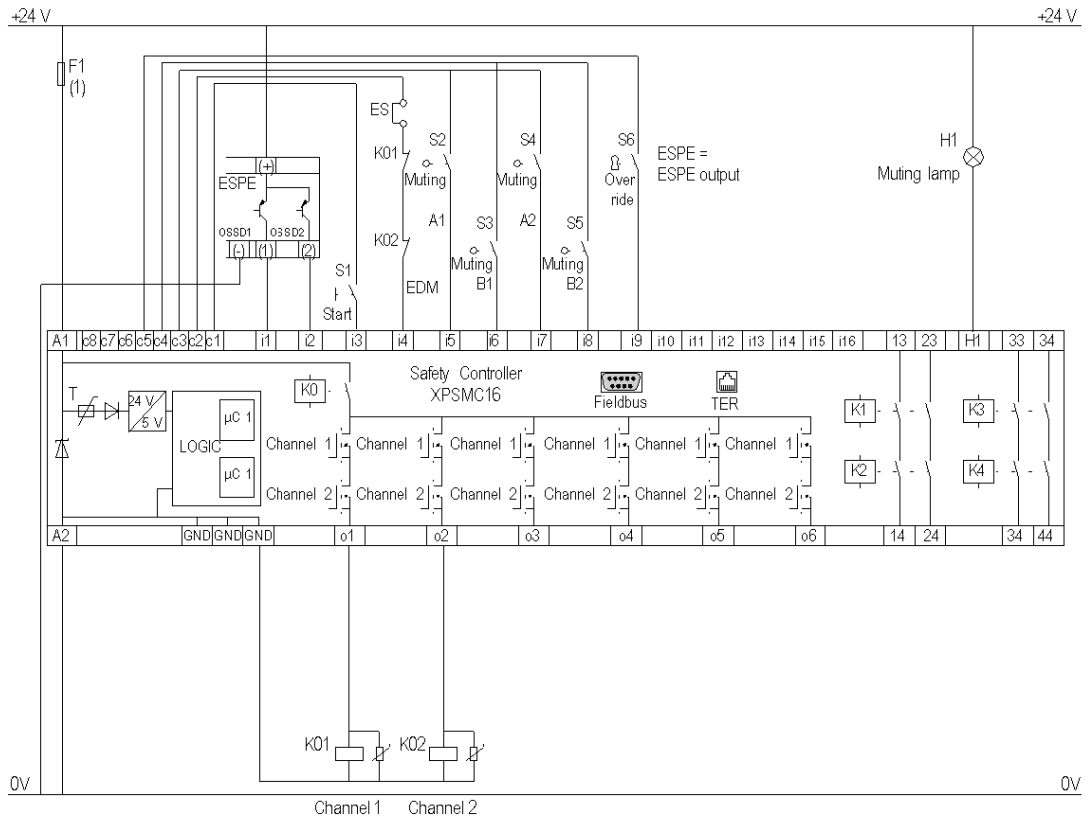
Functional Diagram

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

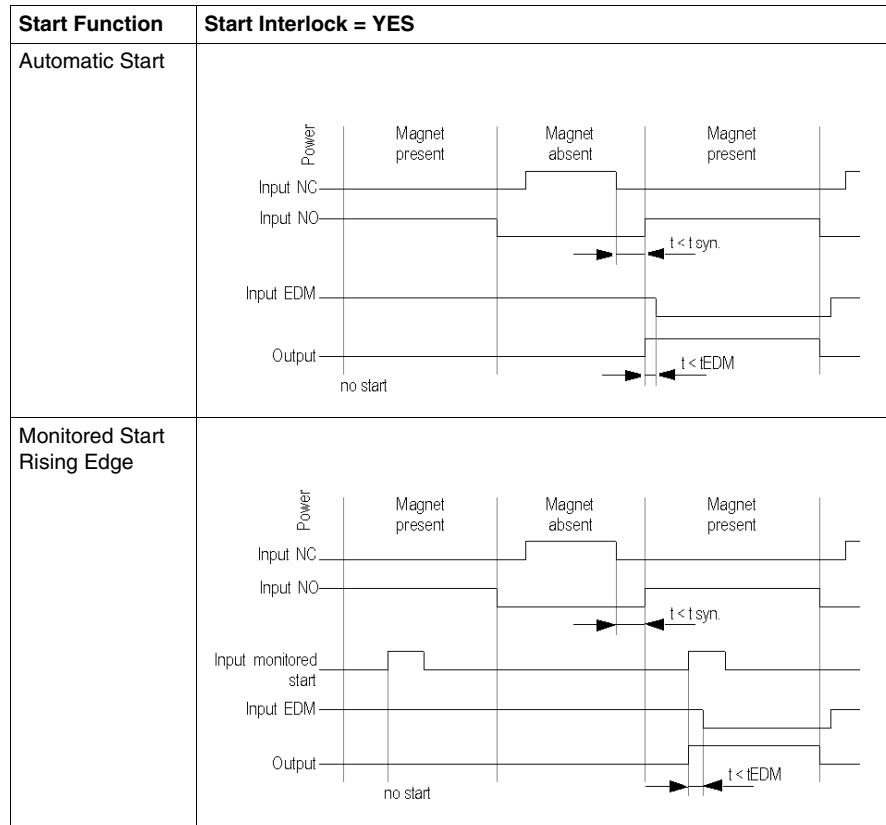
(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse size

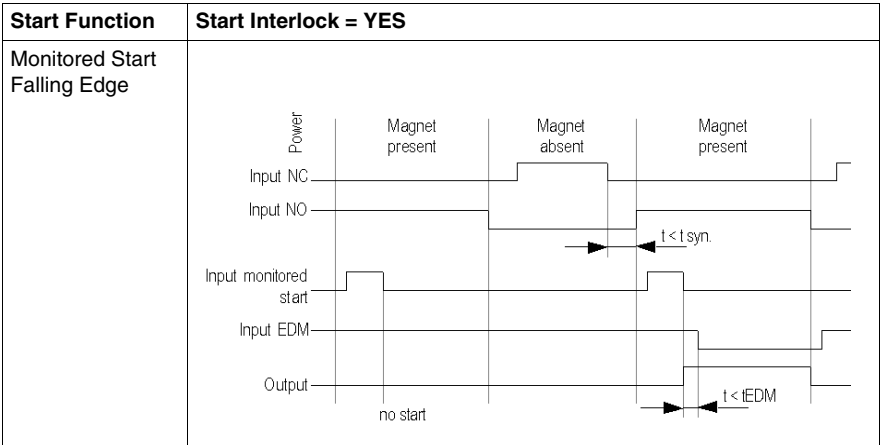
The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

Magnetic Switch

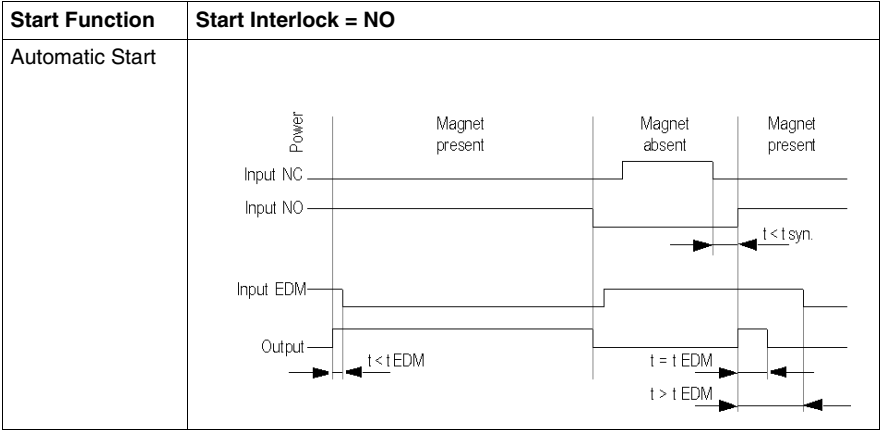
Functional Diagram

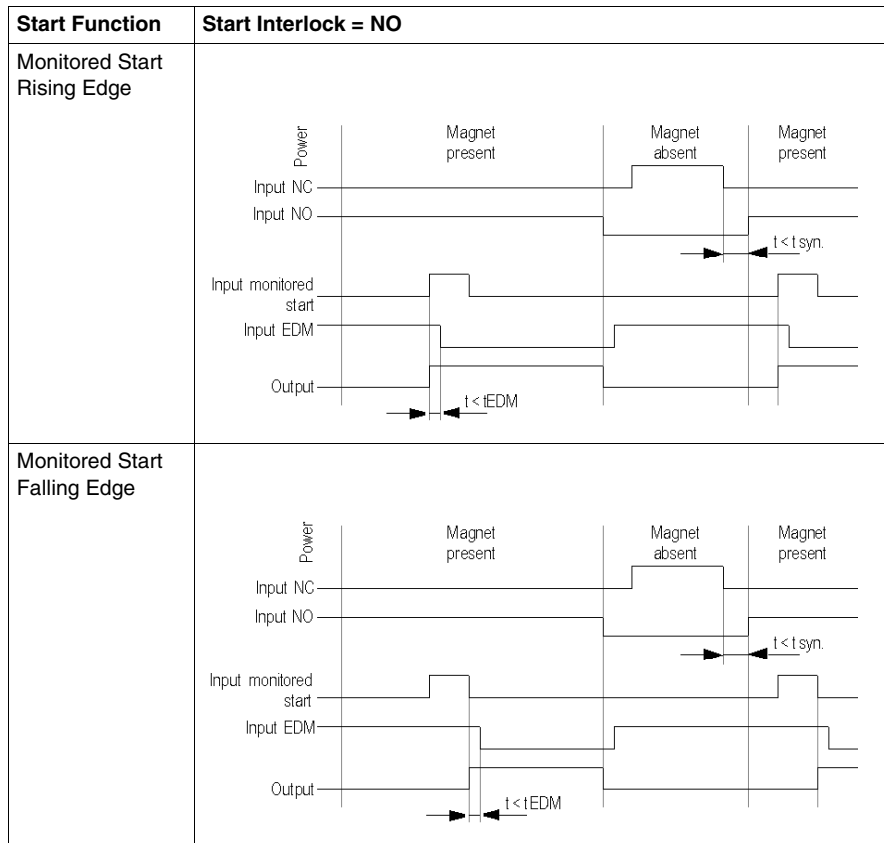
The following functional diagram shows the Magnetic Switch with Interlock and different Start Functions:





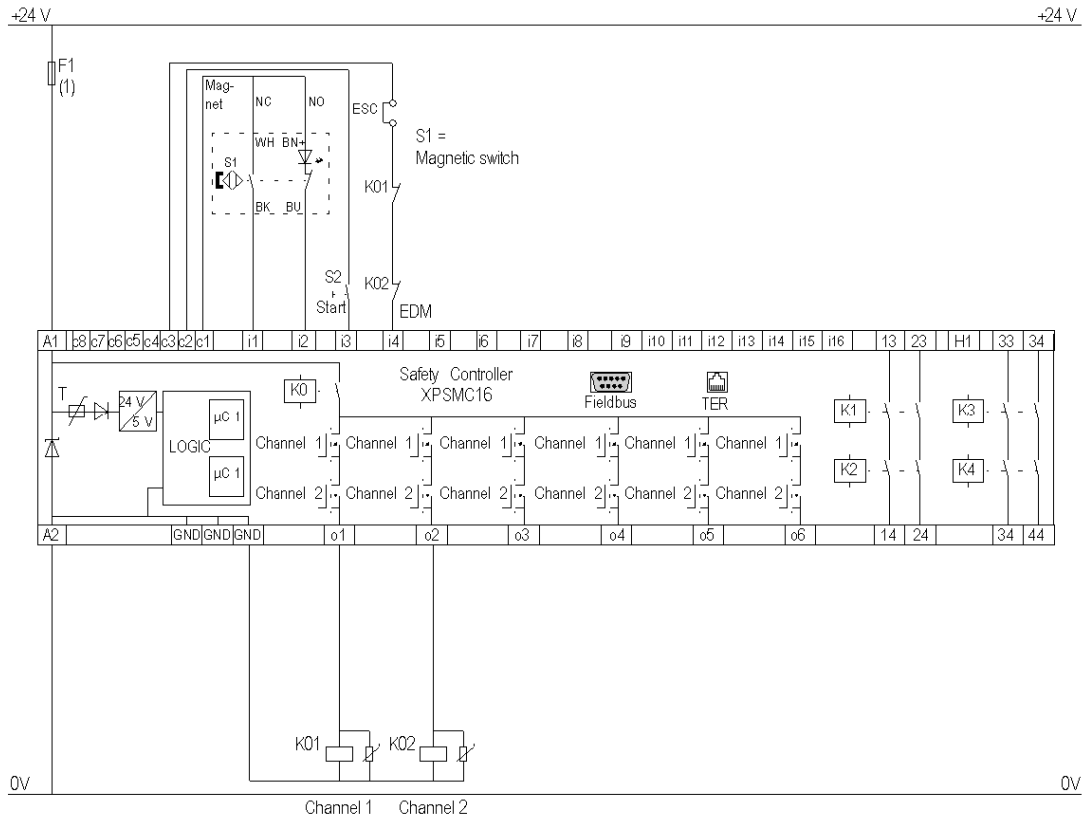
The following functional diagram shows the Magnetic Switch without Interlock and different Start Functions:





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

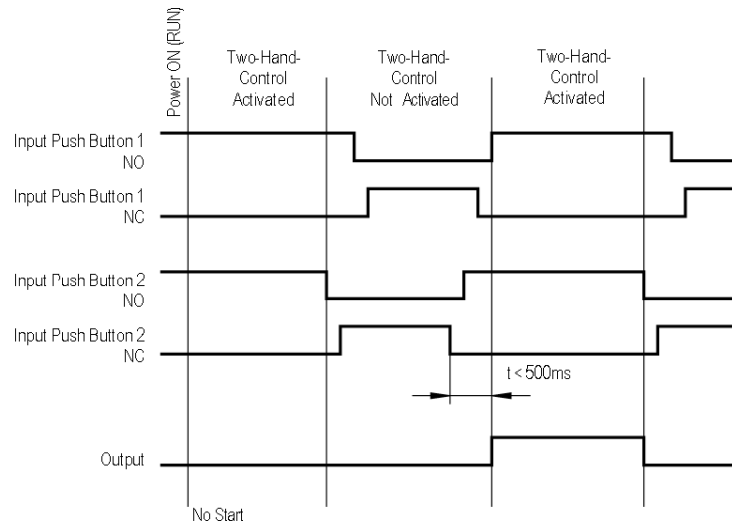
(1) See Technical Data in XPSMC Safety Controller Hardware manual for maximum fuse size

The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

Two-Hand Control

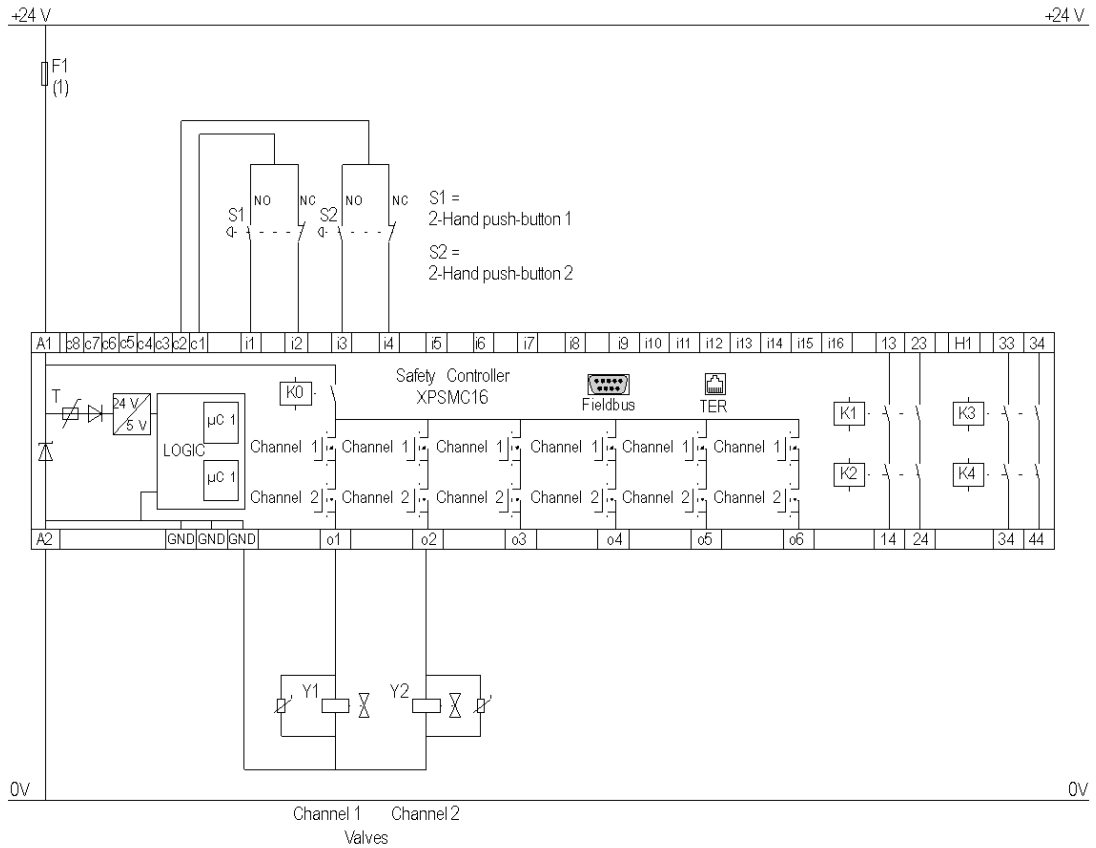
Functional Diagram

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



Wiring Diagram

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

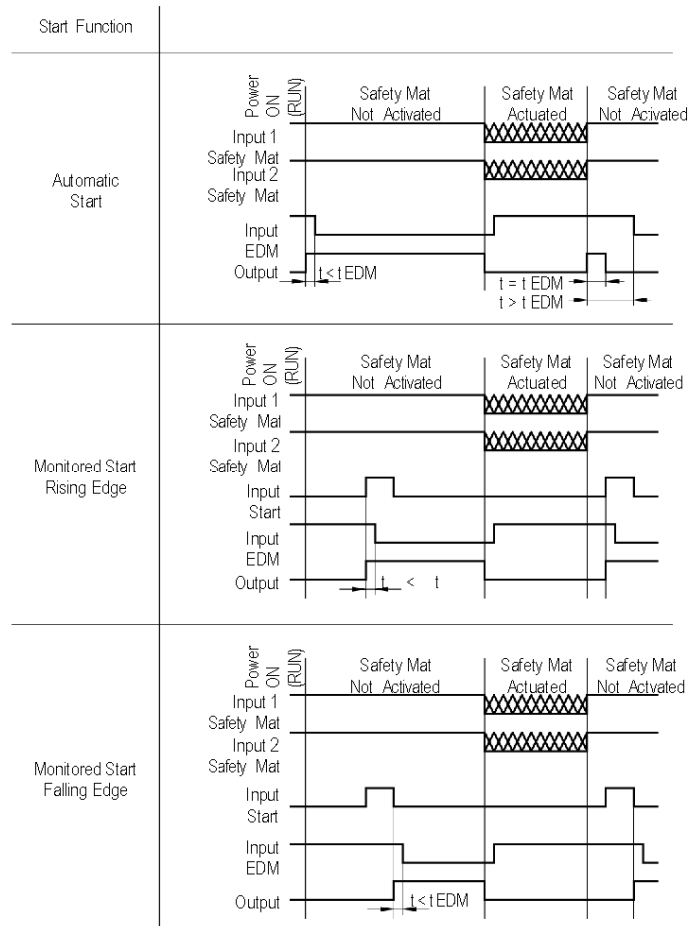


(1) See Technical Data in XPSMC safety controller Hardware manual for maximum fuse sizes. The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

Safety Mat

Functional Diagram

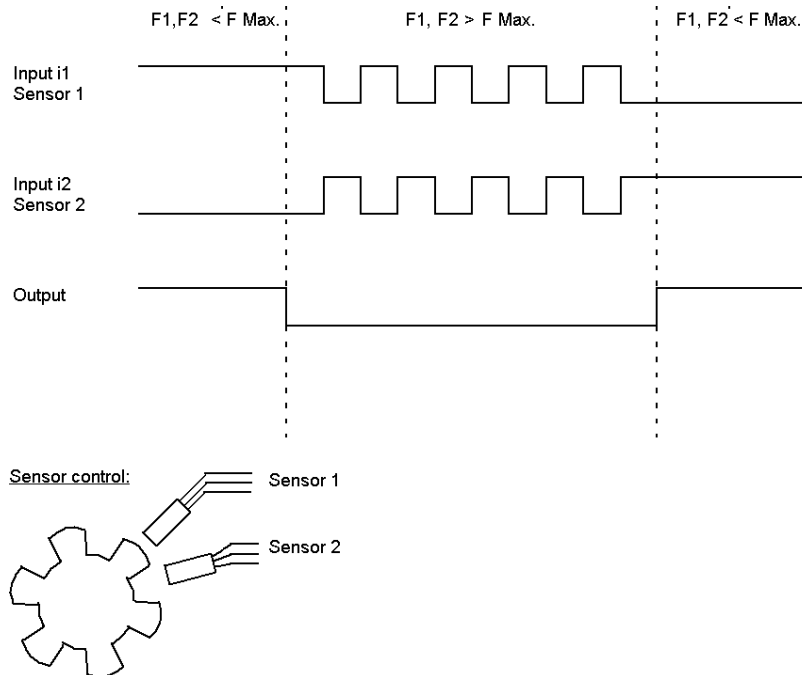
The following functional diagram shows the Safety Mat:



Zero Speed Detection

Functional Diagram

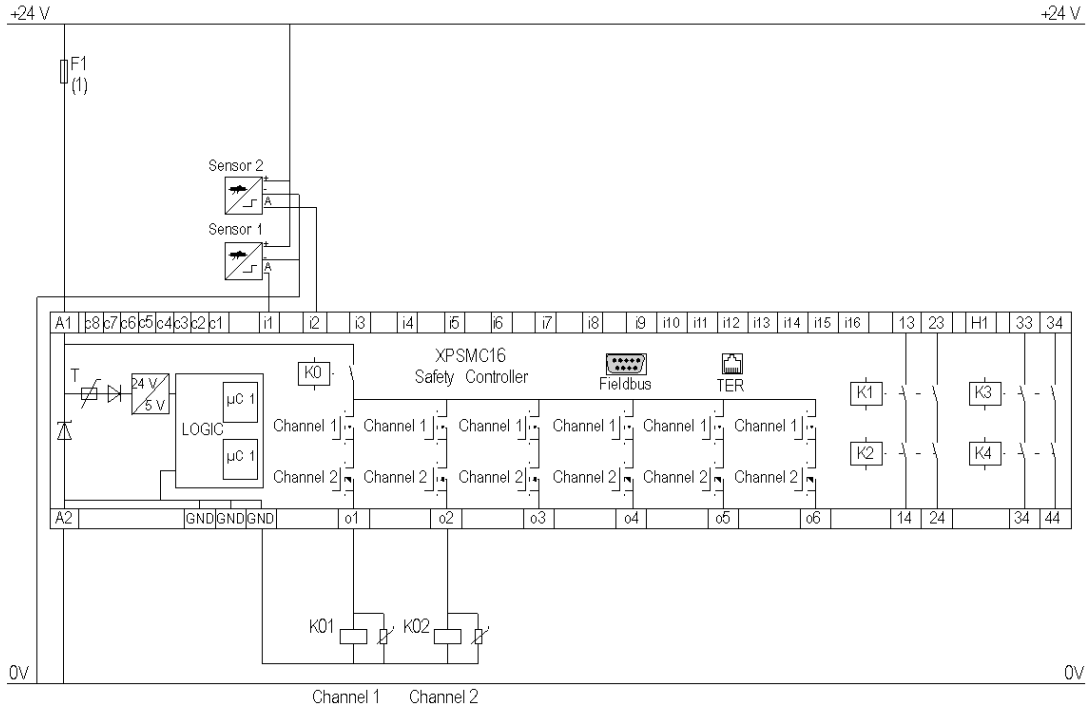
The following functional diagram shows the Zero Speed Detection:



NOTE: It is vital to 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 $t=1/f$ seconds and an open-circuit will be indicated. If the 2 inputs are in the high state, the zero speed signal will disappear after $t=1/f$ seconds and a short-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 EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

Important Key Points to Observe

The following points should be observed for the correct 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, a notification is available via Modbus RTU, or via the configuration terminal (PC), and the corresponding outputs are deactivated. After a zero speed detection and a 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 has started, both sensors are in the LOW state, an error message is available via the Error LED on the XPSMC and Modbus RTU, or via the configuration terminal (PC).

NOTE: You cannot use the Zero Speed Detection device simultaneously with the Shift/Chain Break Monitoring device on the XPSMC safety controller, because there are only two counter inputs (**i1** and **i2**) per 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 (short 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 short circuit between inputs stays ON.

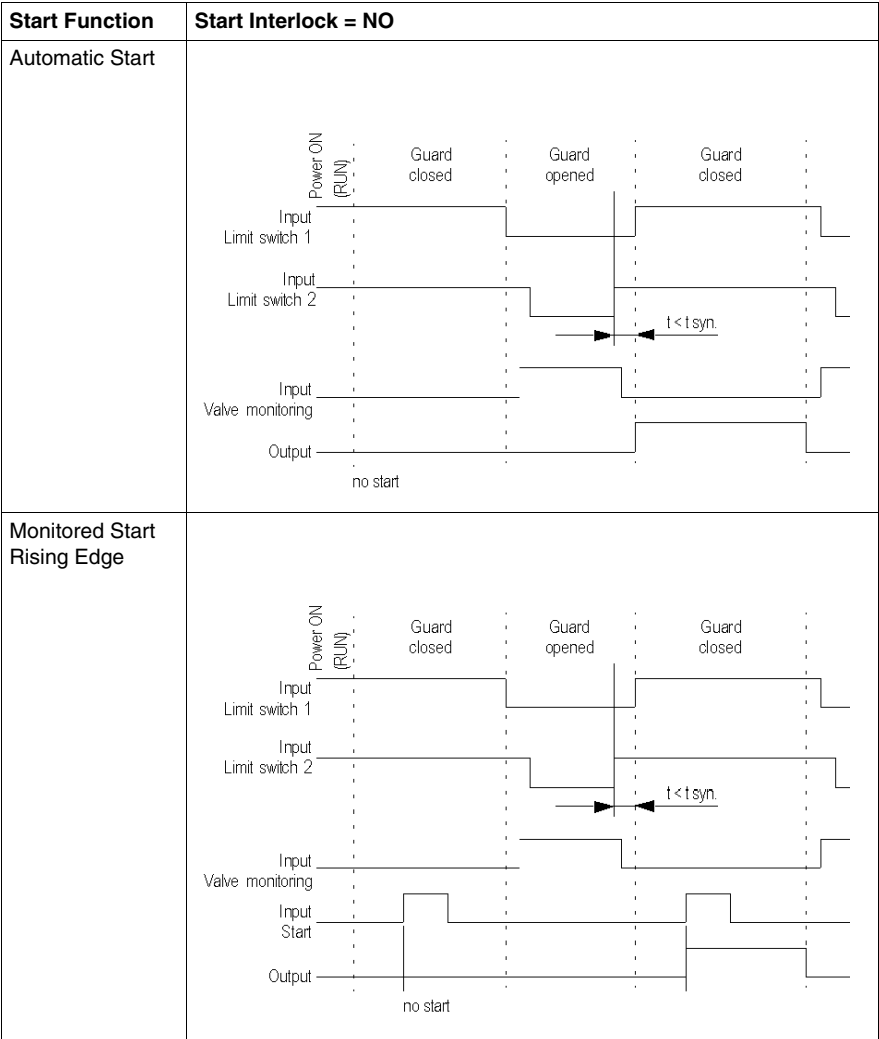
Error Message External error messages must be acknowledged with the reset button.

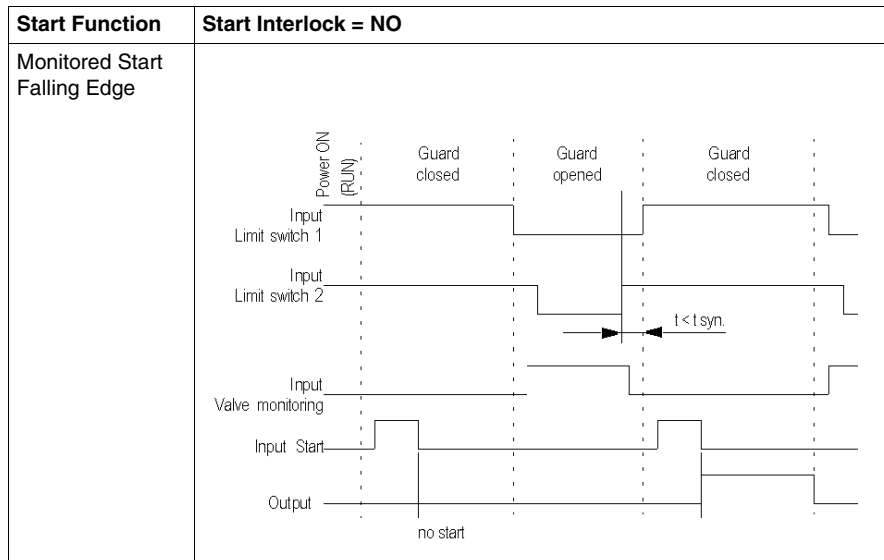
Notification A notification, sent via Modbus, does not need to be acknowledged. As soon as the sensor states change, it will be acknowledged automatically.

Injection Molding Machines

Functional Diagram

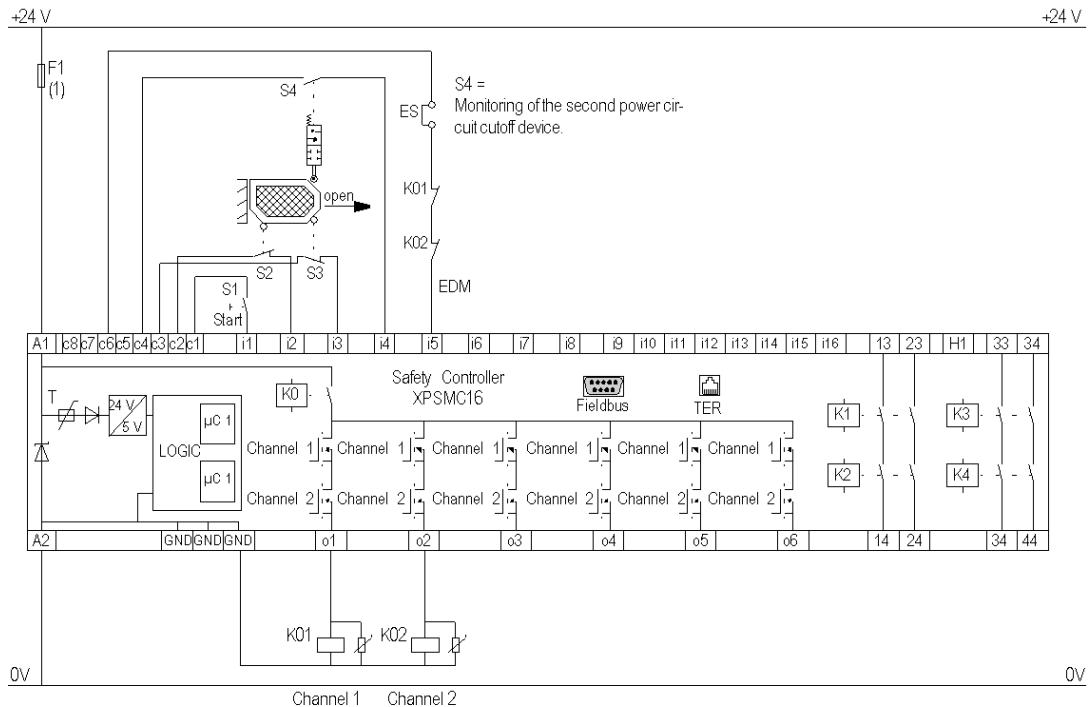
The following functional diagram shows the Safety Guard with One Channel with Start Interlock and different Start Functions:





Wiring Diagram

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



EDM External Device Monitoring

ESC External Start Conditions

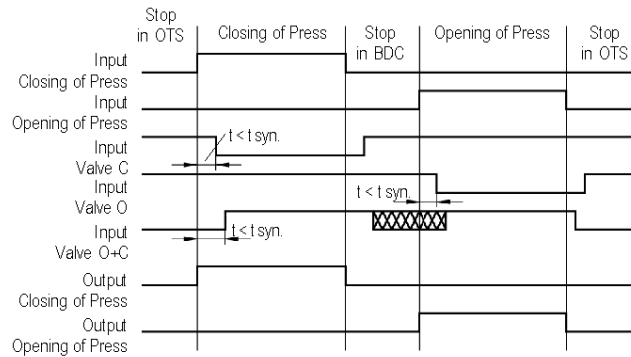
(1) See Technical Data in XPSMC safety controller Hardware manual for maximum fuse sizes.

The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

Hydraulic Press Valve Monitoring

Functional Diagram

The following functional diagram shows the Hydraulic Press Valve Monitoring:

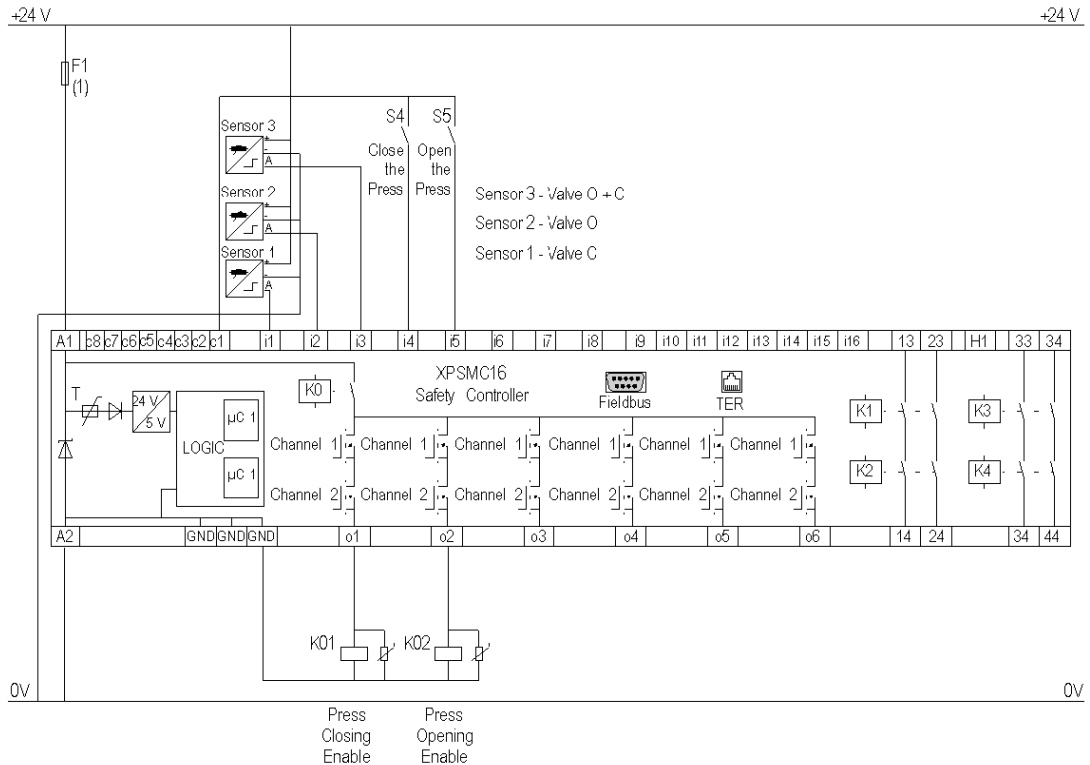


Sensor signals at valve level:

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

Wiring Diagram

The following wiring diagram shows the Hydraulic Press Valve Monitoring:



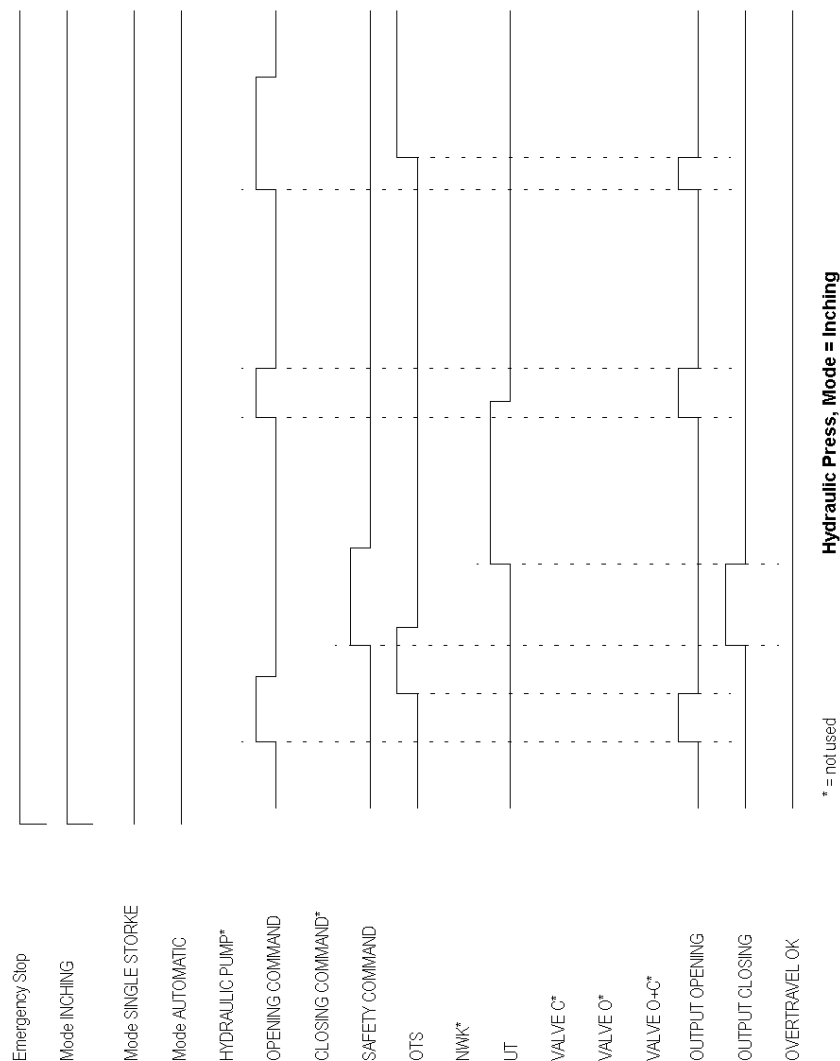
(1) See Technical Data in XPSMC safety controller Hardware manual for maximum fuse sizes.

The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

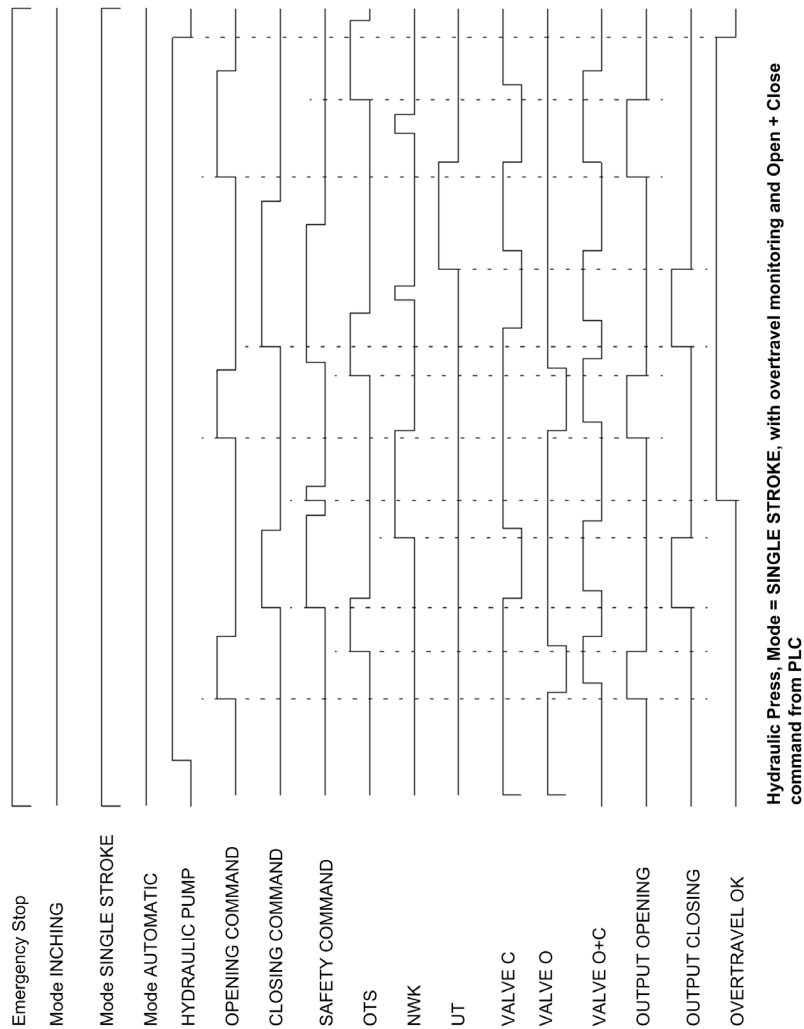
Hydraulic Press 2

Functional Diagrams

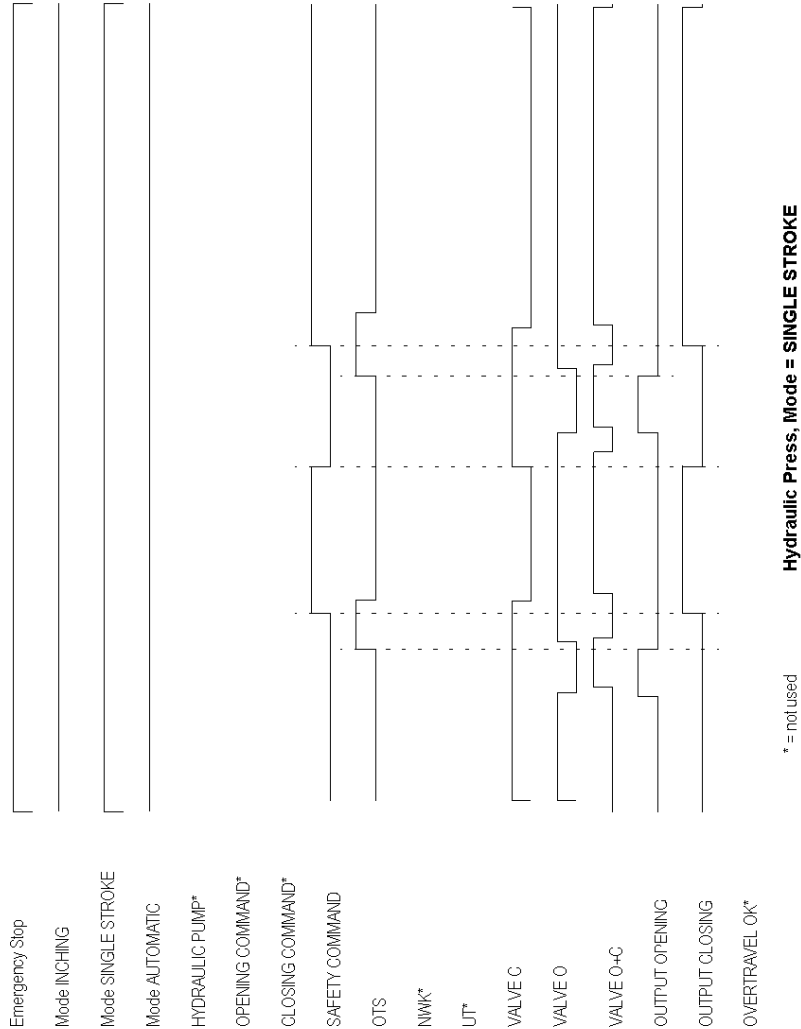
The following functional diagram shows the Hydraulic Press 2, Mode = INCHING



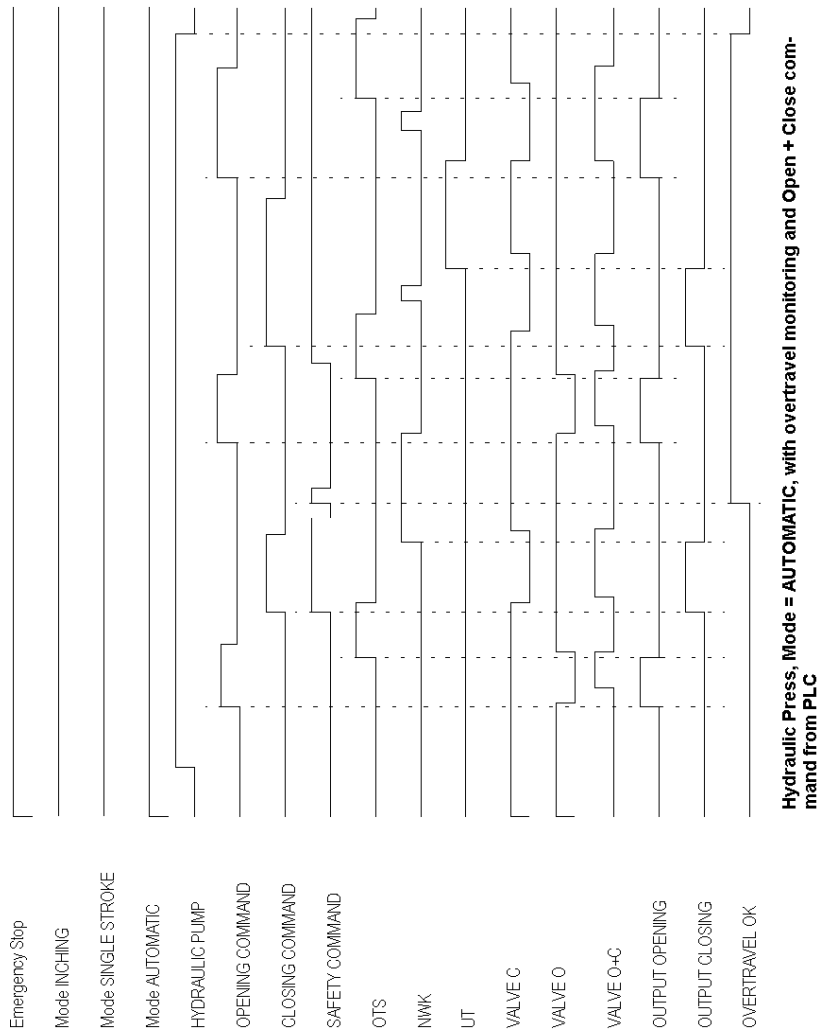
The following functional diagram shows the Hydraulic Press 2, Mode = SINGLE STROKE, with overtravel monitoring and *Open + Close* command from the PLC:



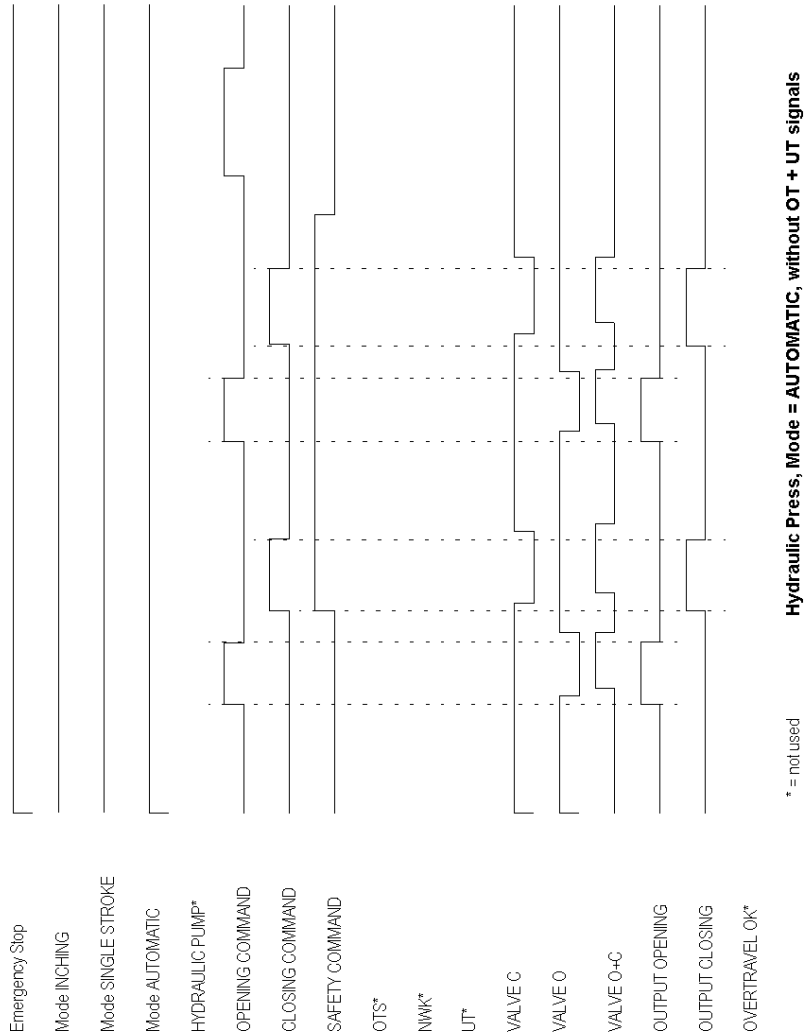
The following functional diagram shows the Hydraulic Press 2, Mode = SINGLE STROKE:



The following functional diagram shows the Hydraulic Press 2, Mode = Automatic, with overtravel monitoring and Open + Close command from the PLC:



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

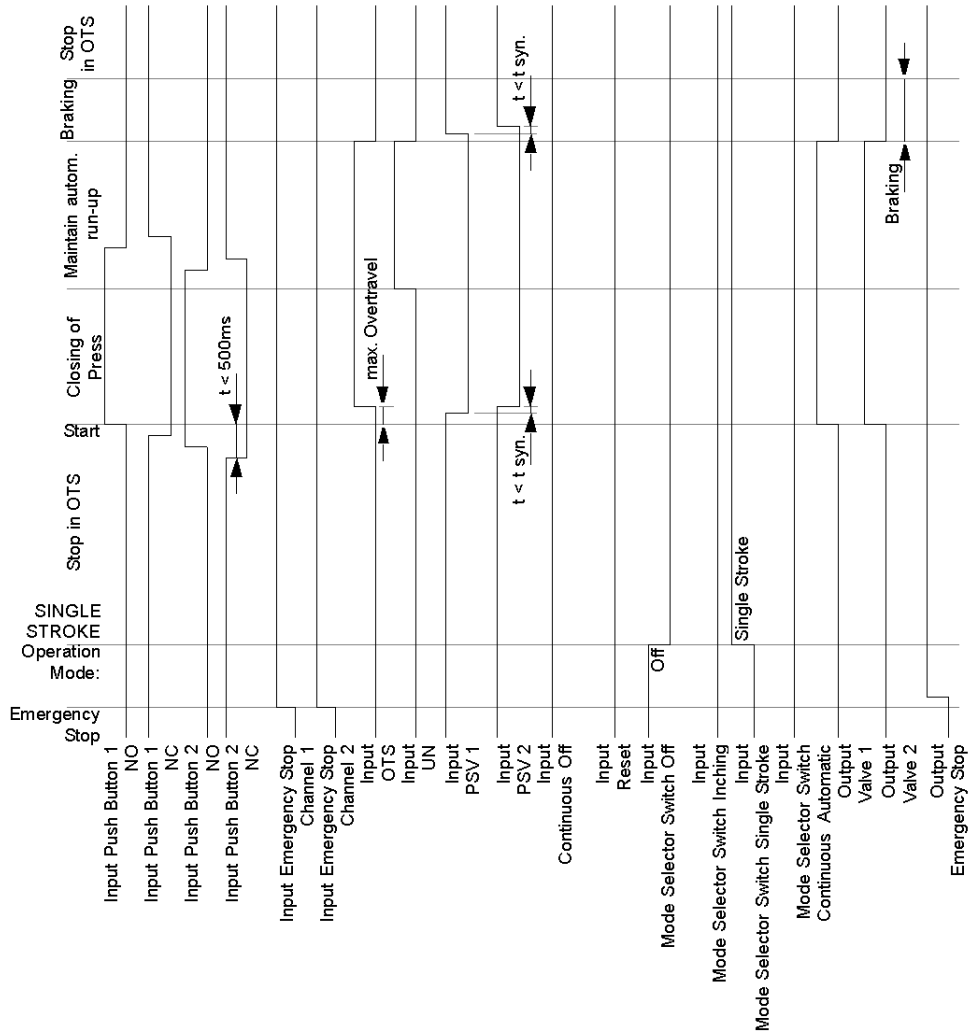


* = not used

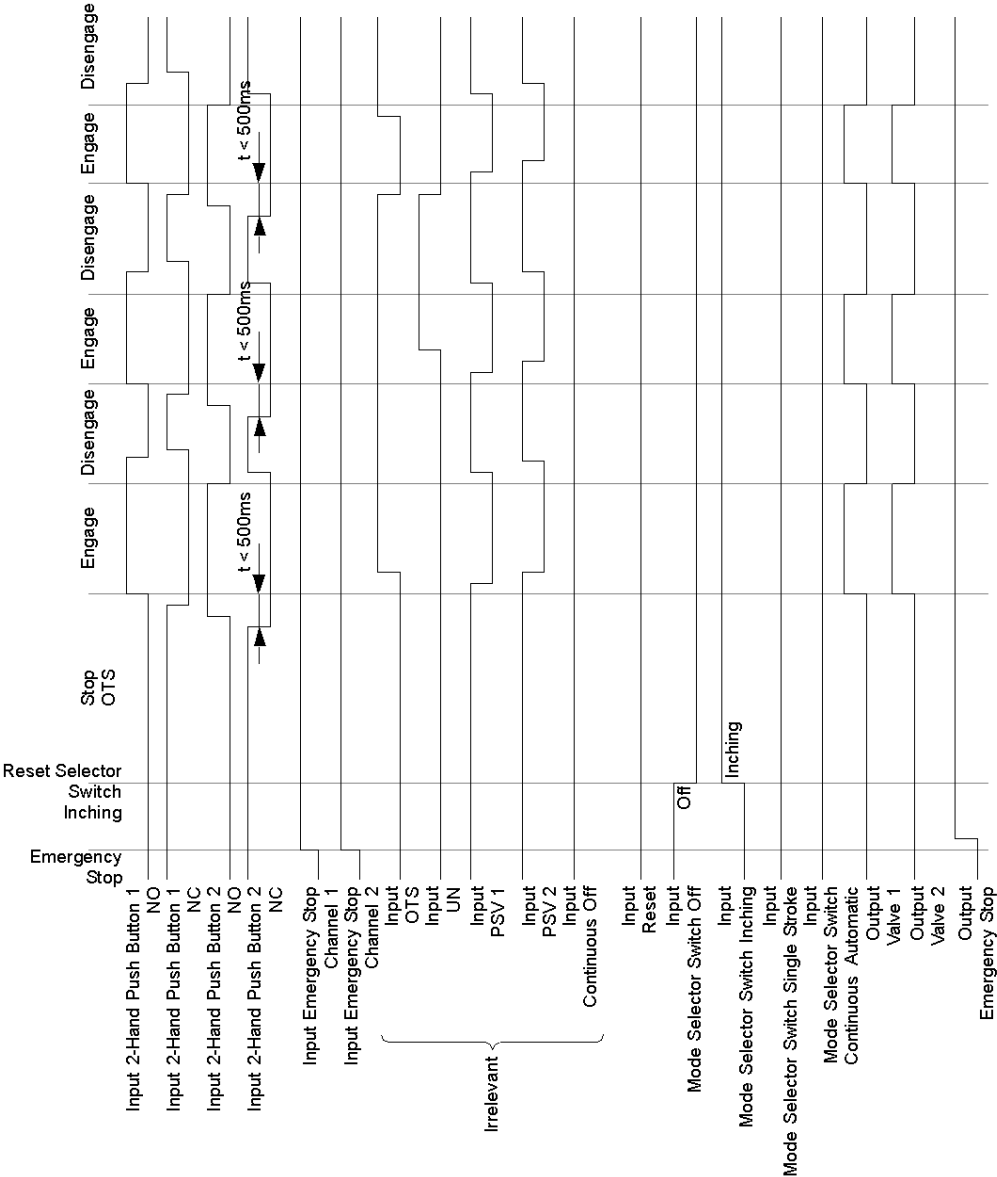
Eccentric Press

Functional Diagrams

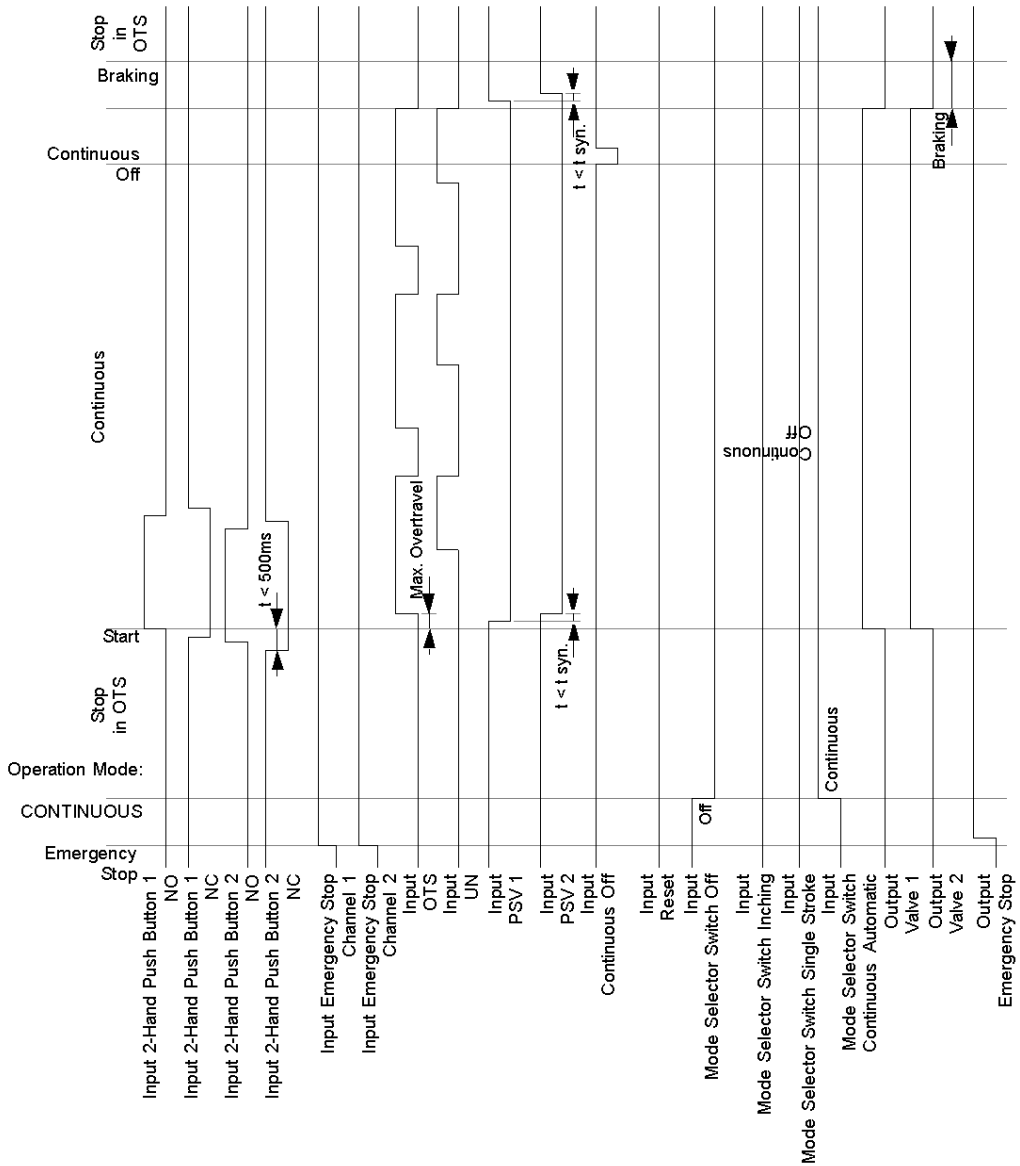
The following functional diagram shows the Eccentric Press, Mode = SINGLE STROKE



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



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



Wiring Diagram

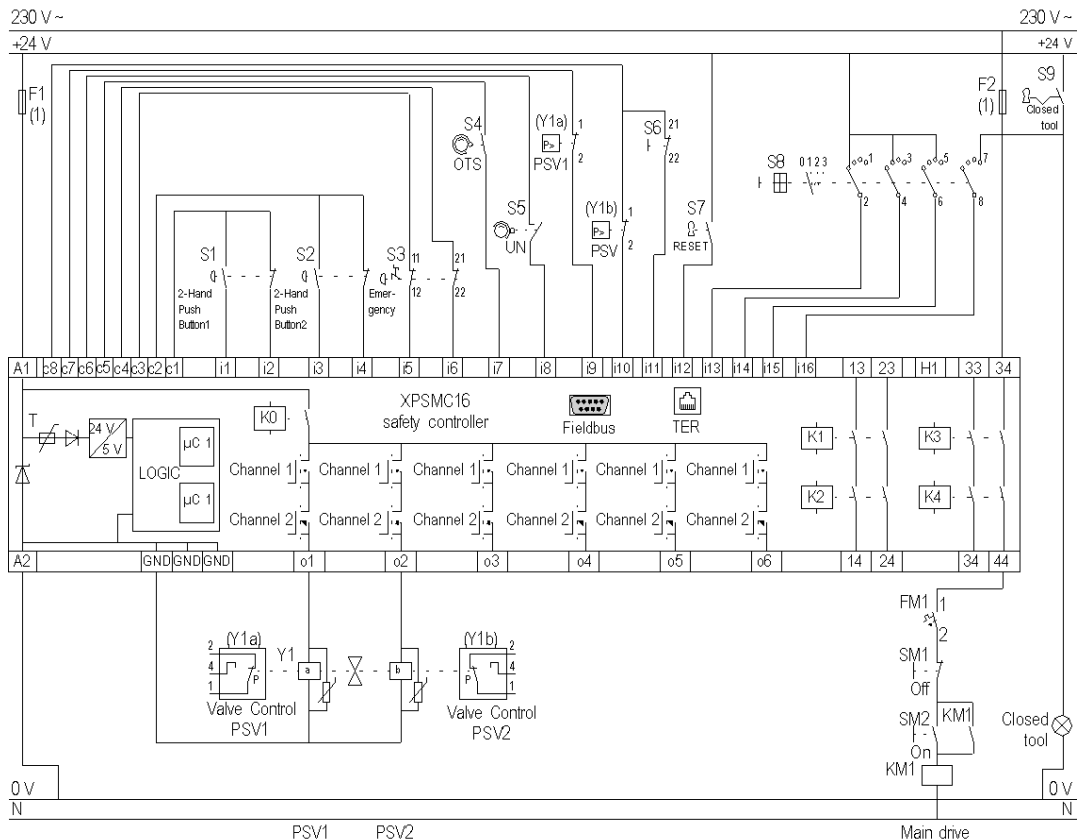
⚠ DANGER

HAZARDOUS VOLTAGE

Disconnect all power before servicing equipment.

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 Safety Valve

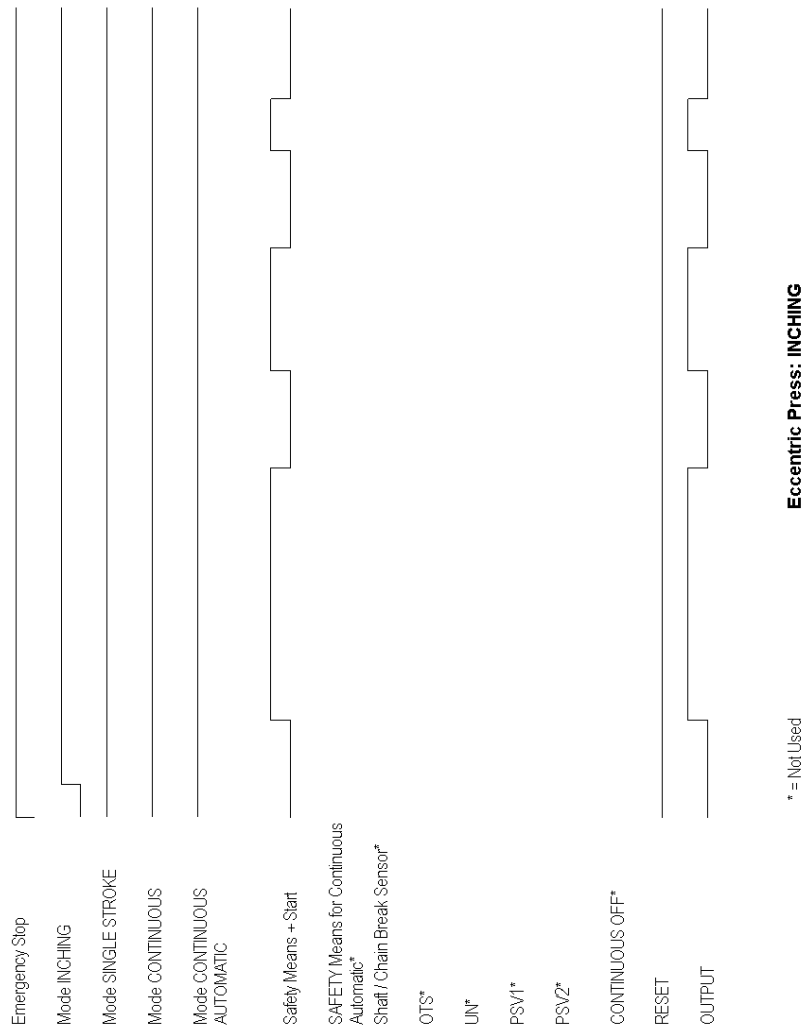
(1) See Technical Data in XPSMC safety controller Hardware manual for maximum fuse sizes.

The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

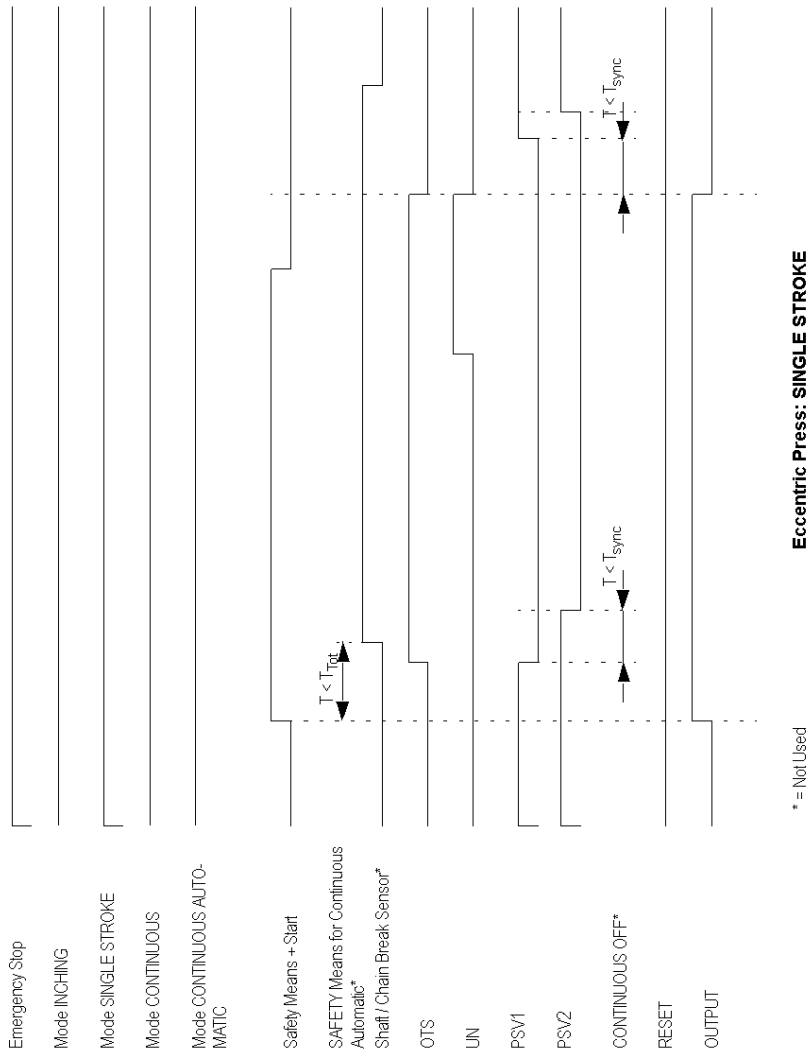
Eccentric Press 2

Functional Diagram

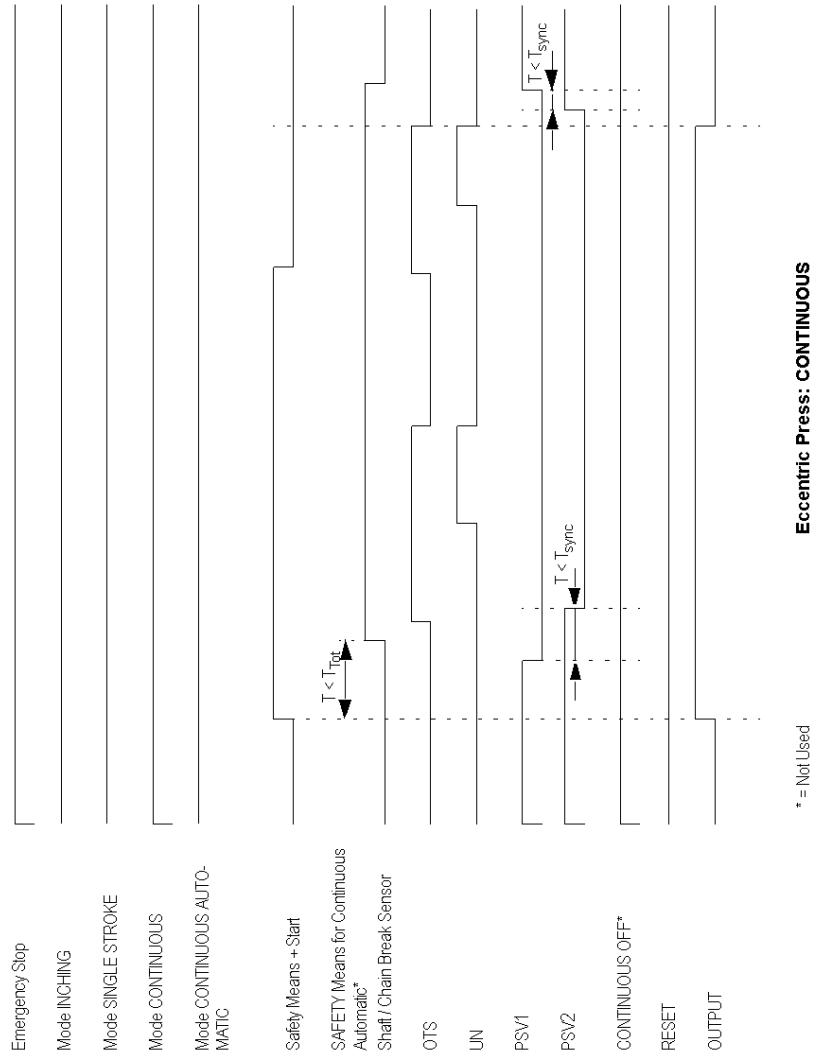
The following functional diagram shows the Eccentric Press 2, Mode = INCHING:



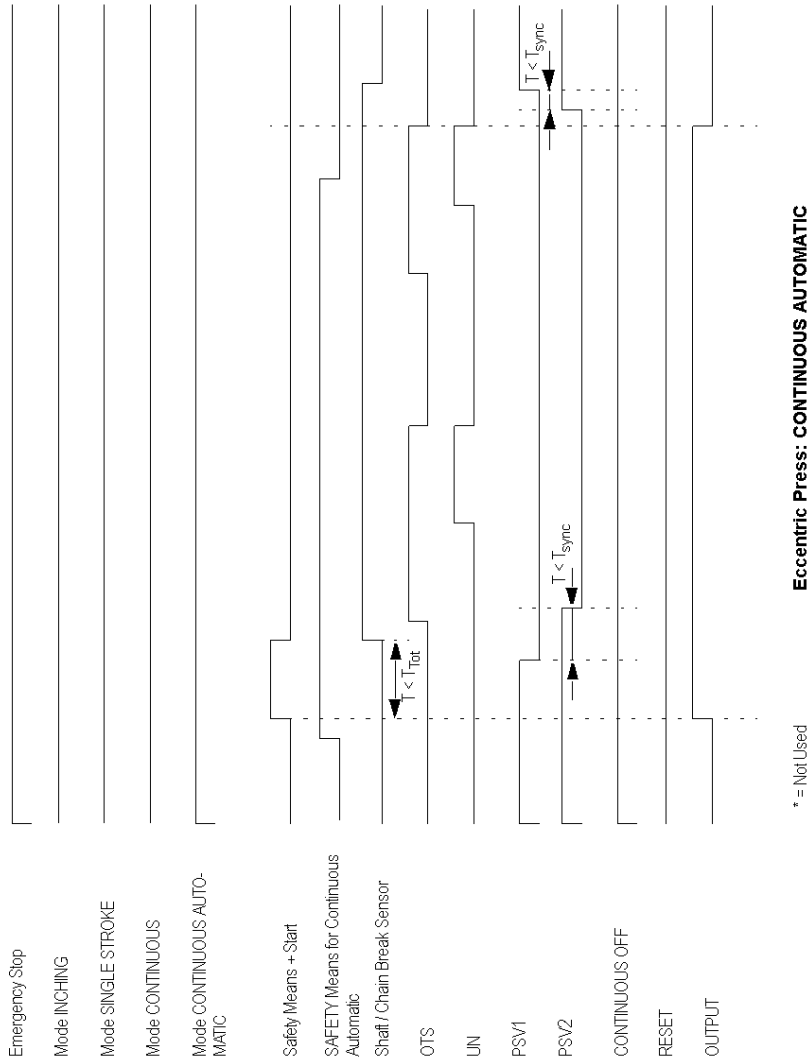
The following functional diagram shows the Eccentric Press 2, Mode = SINGLE STROKE:



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



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



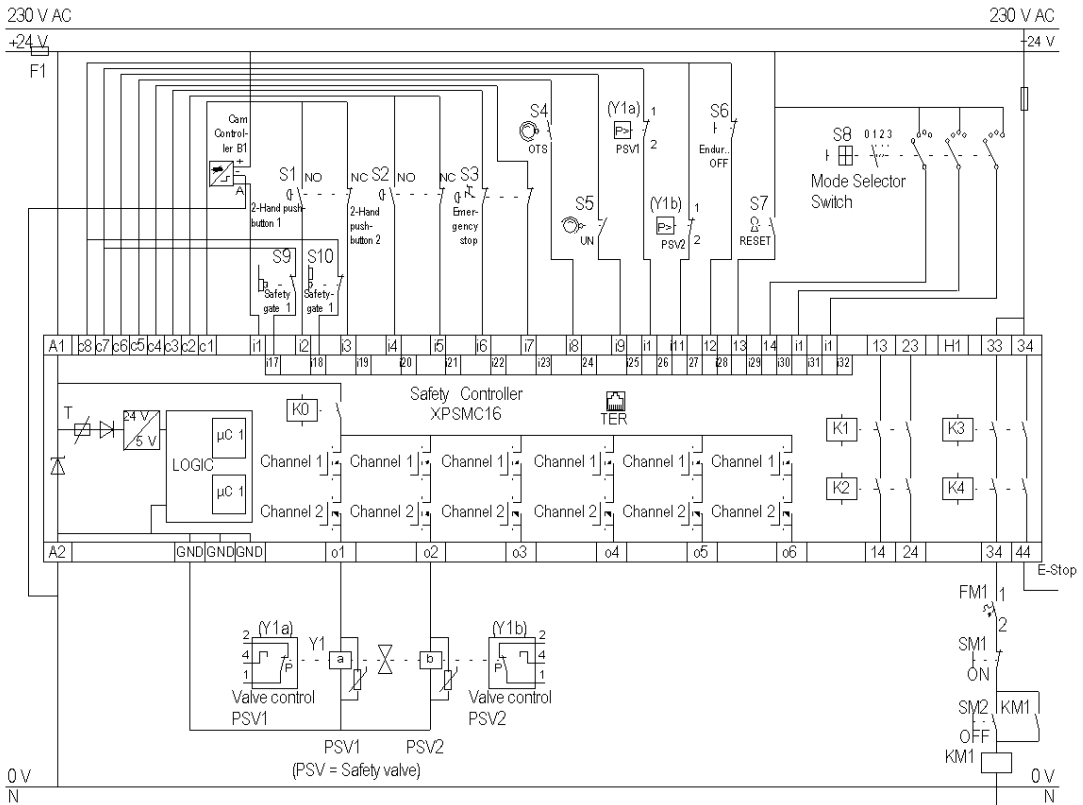
Wiring Diagram

⚠ DANGER**HAZARDOUS VOLTAGE**

Disconnect all power before servicing equipment.

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

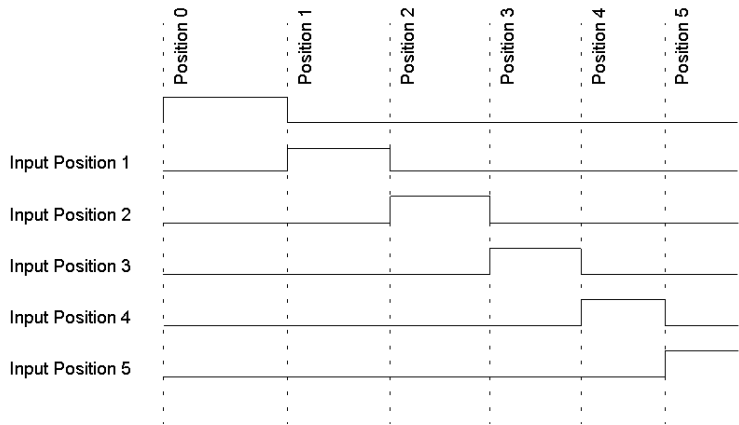
The following image shows the wiring diagram of the Eccentric Press 2 device:



Selector Switch

Functional Diagram

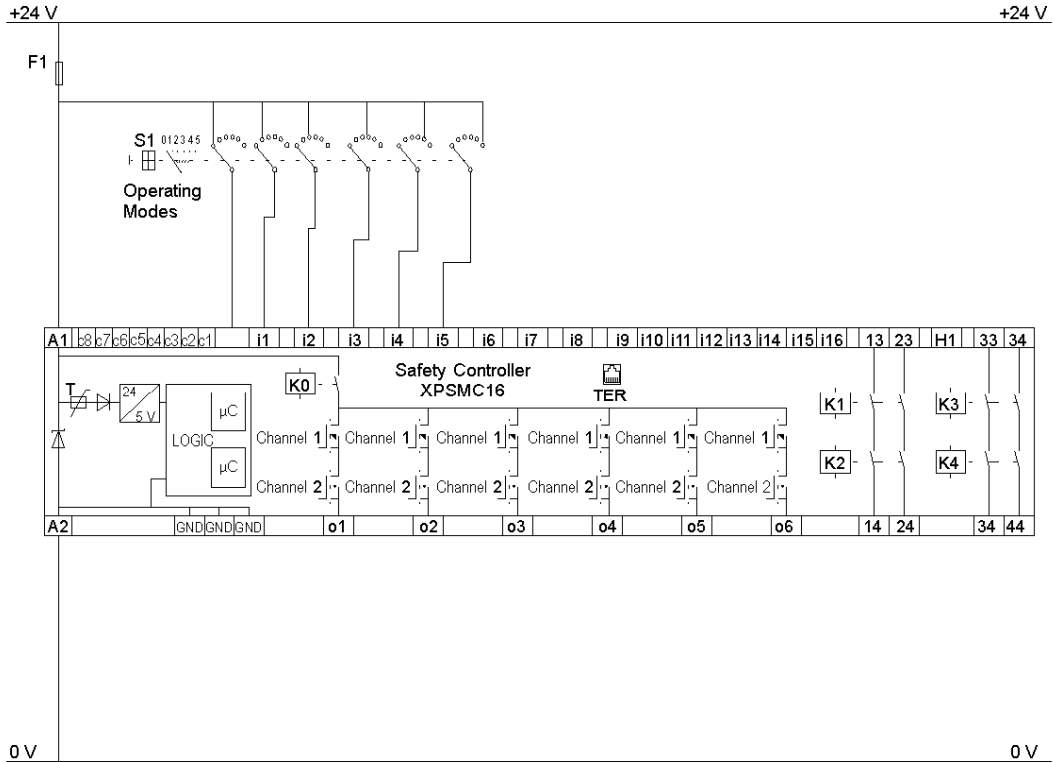
The following image represents the functional diagram of the Selector Switch device:



The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

Wiring Diagram

The following two images represent the wiring diagrams of the Selector Switch device:

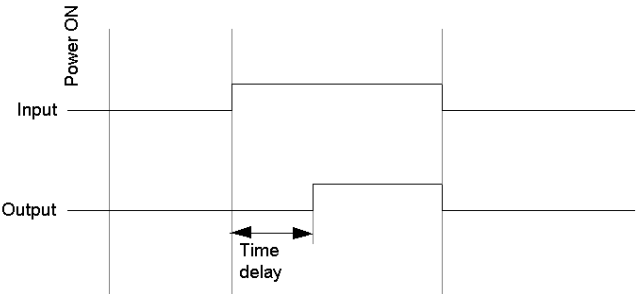


Timer

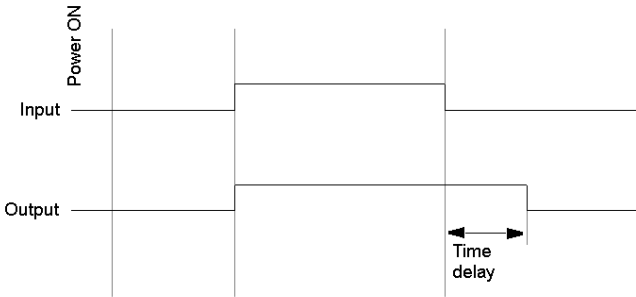
Functional Diagram

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

On-Delay

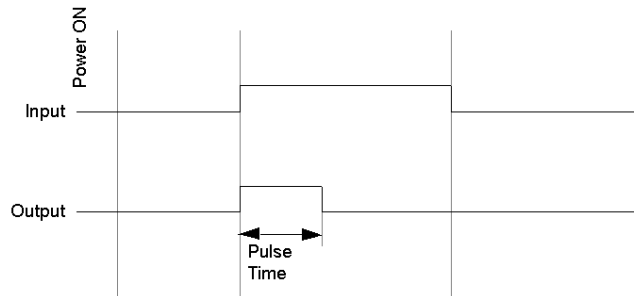


Off-Delay

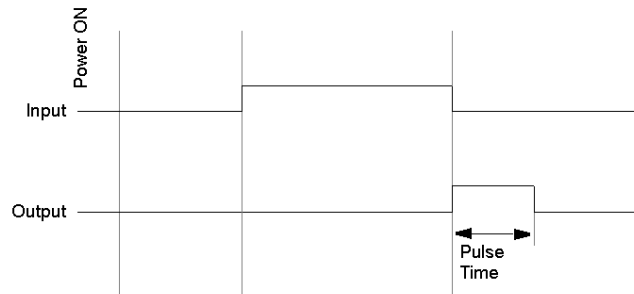


The following image represents the functional diagram of the Timer device for the On-/Off Pulse:

On Pulse

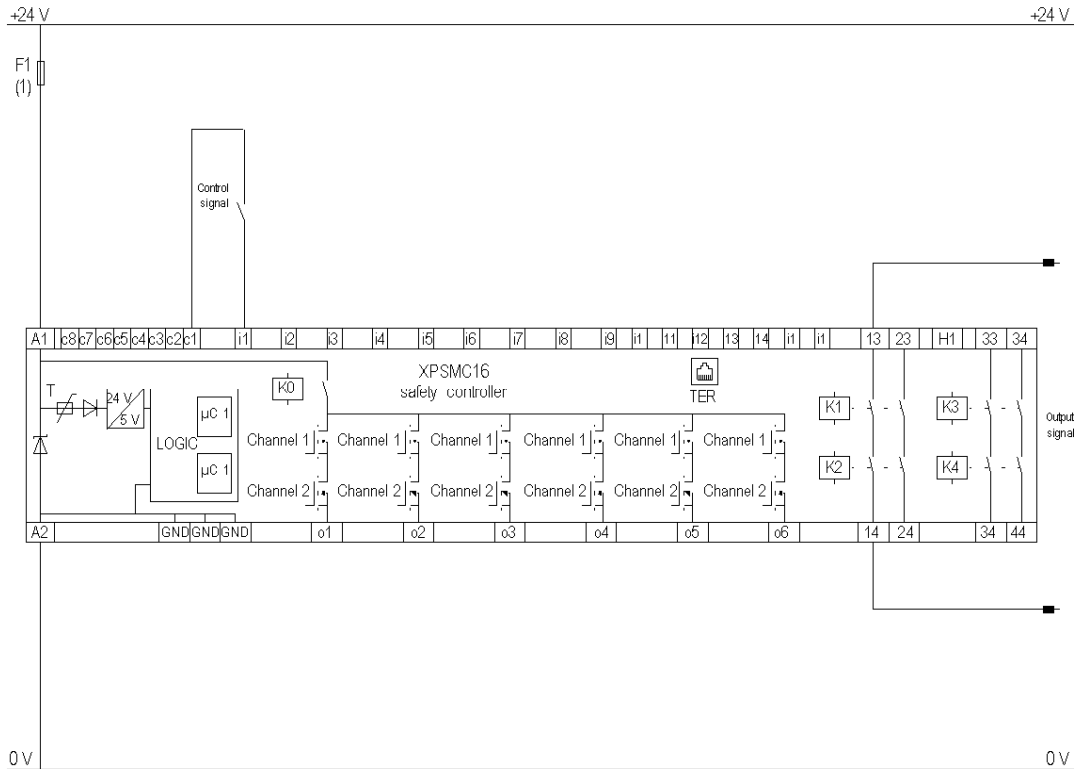


Off Pulse



Wiring Diagram

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



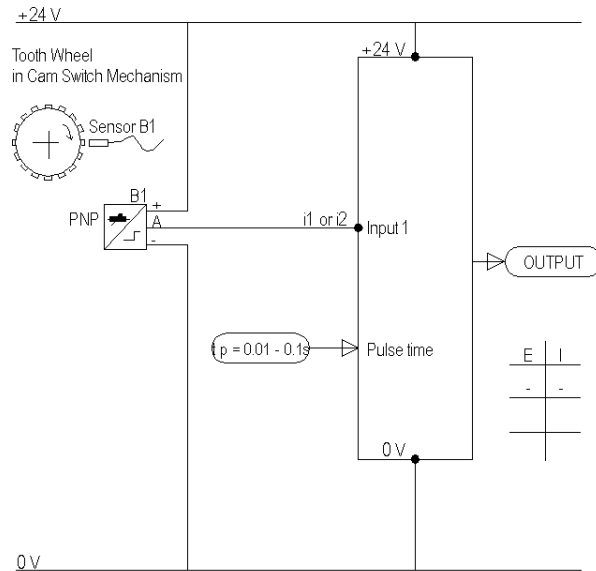
(1) See Technical Data in XPSMC safety controller Hardware manual for maximum fuse sizes.

The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

Shaft/Chain-Break Monitoring

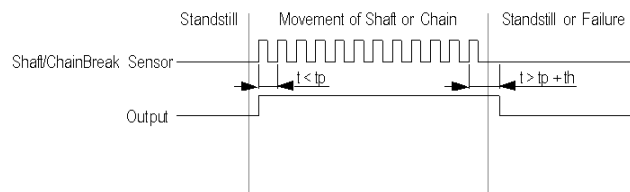
GBS Function Diagram

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



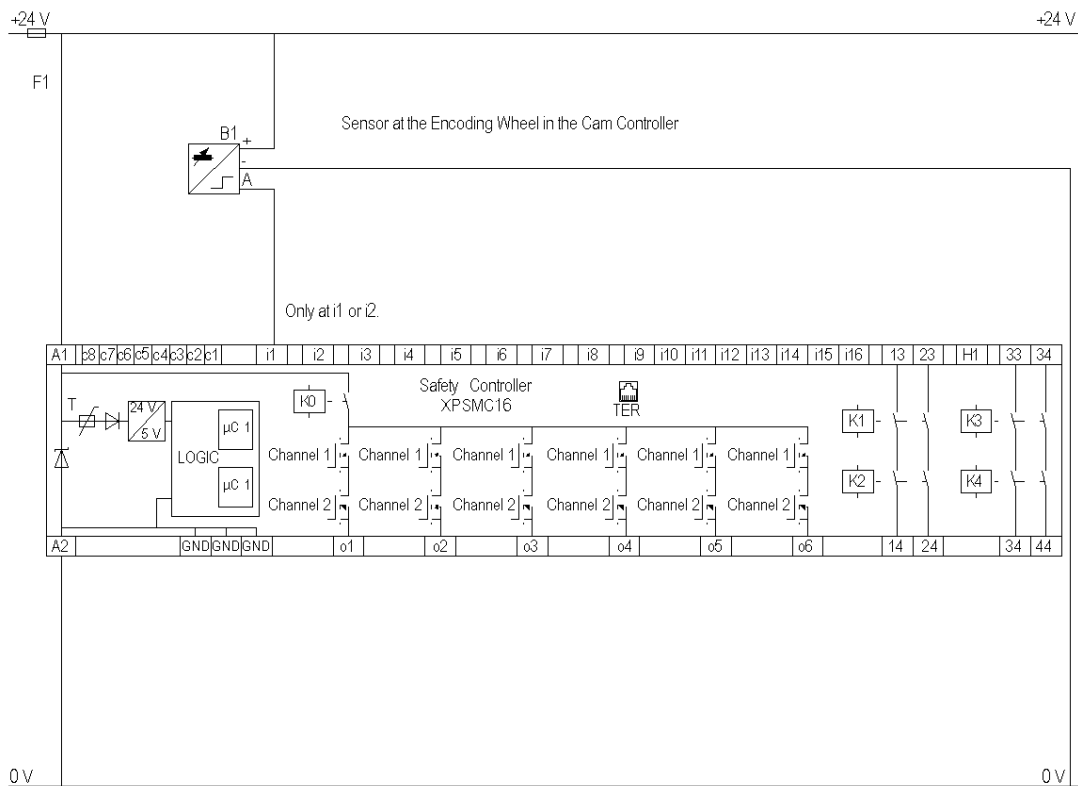
Sensor Position

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:

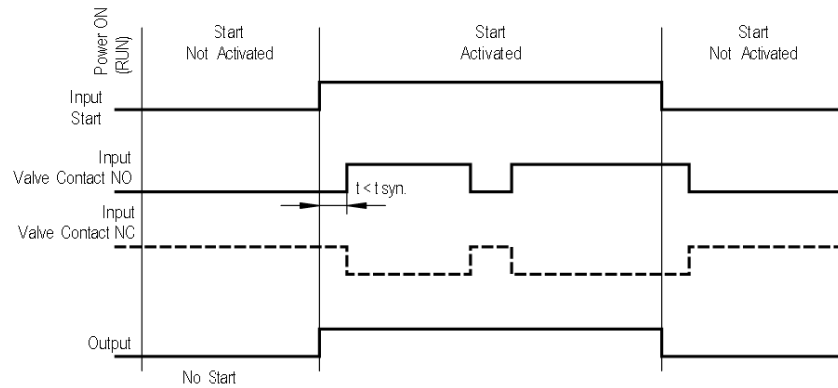


The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

Seat Valve Monitoring

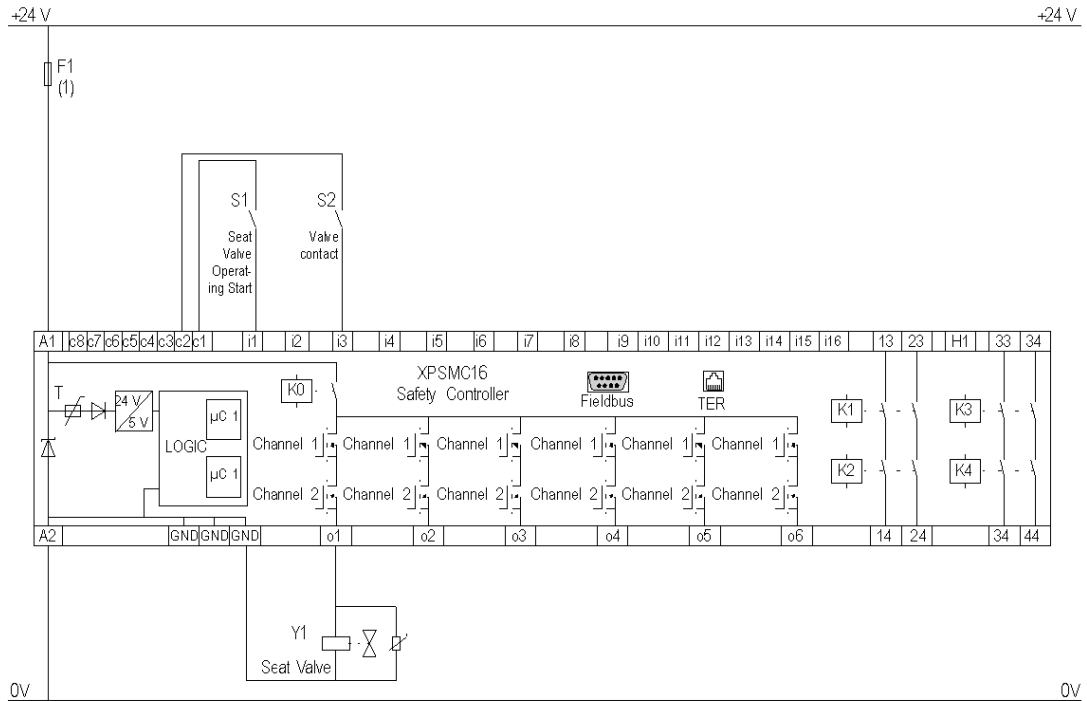
Functional Diagram

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:

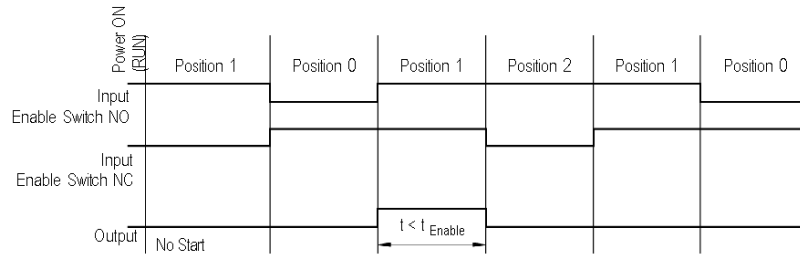


(1) See Technical Data in XPSMC safety controller Hardware manual for maximum fuse sizes. The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

Enabling Device 2 Channel

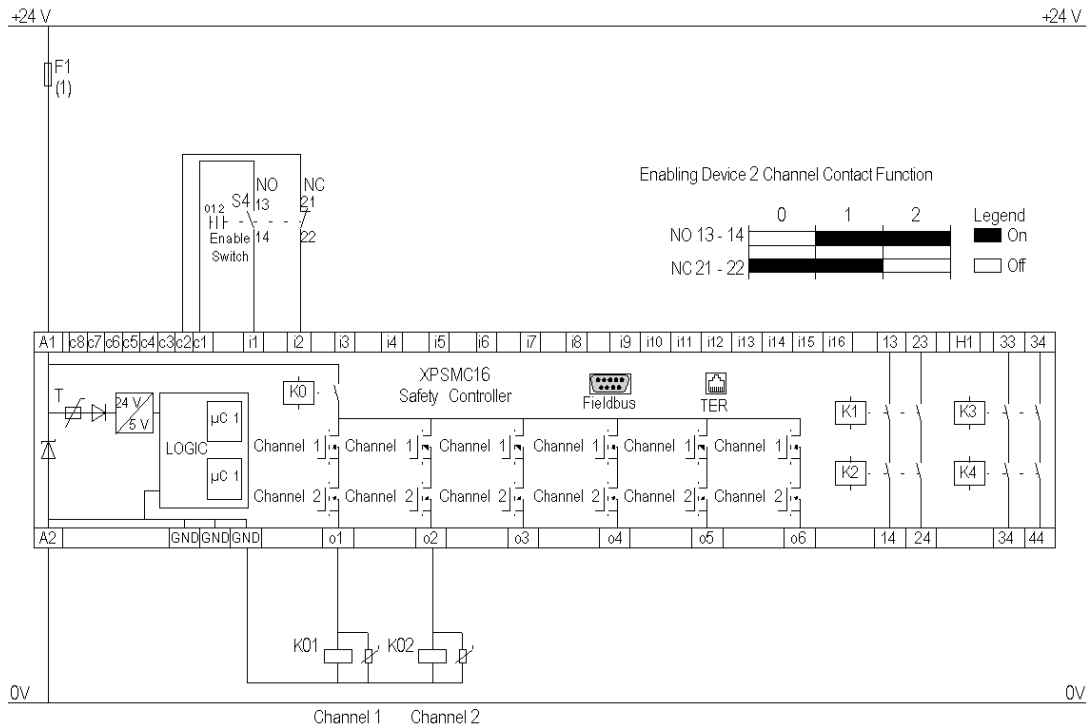
Functional Diagram

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.

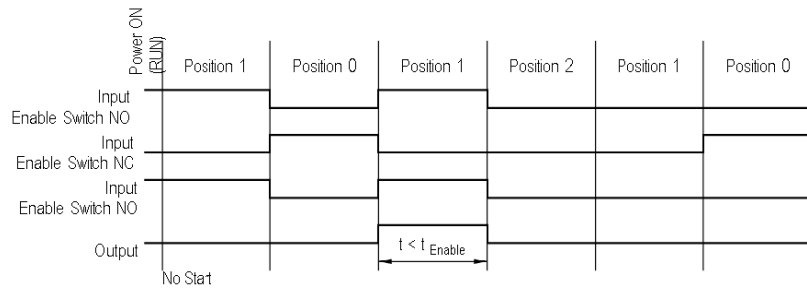
The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

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

Enabling Device 3 Channel

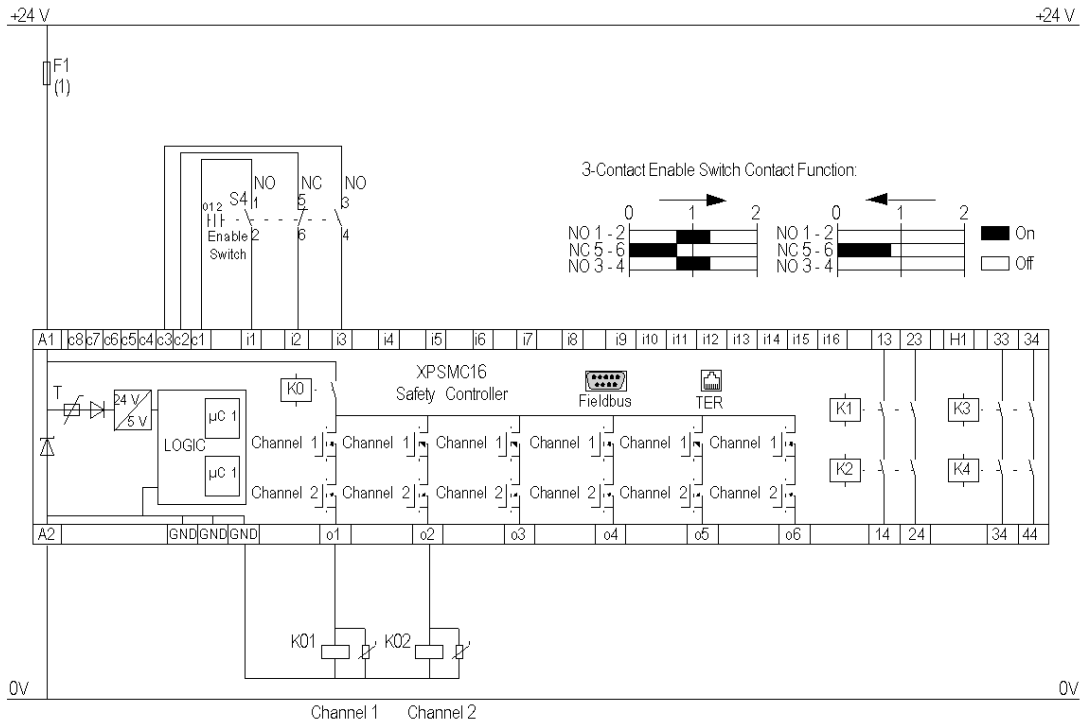
Functional Diagram

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



Wiring Diagram

The following diagram represents the wiring diagram 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 EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

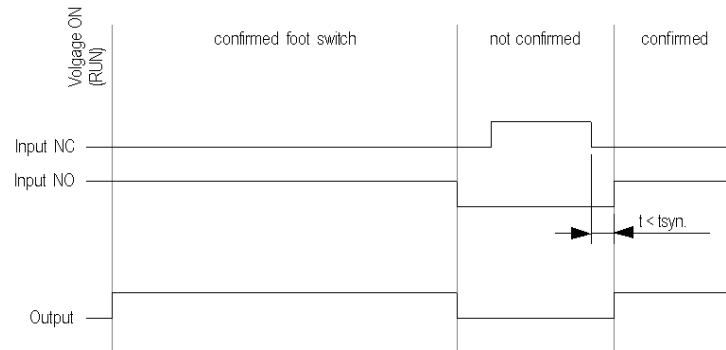
NOTE: XPSMC32 with 32 inputs i1...i32, otherwise identical.

Foot Switch

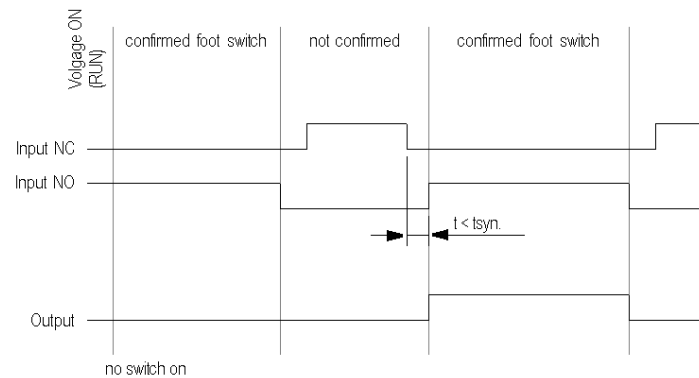
Functional Diagram

The following images represents the Foot Switch functional diagram:

Start interlock = NO



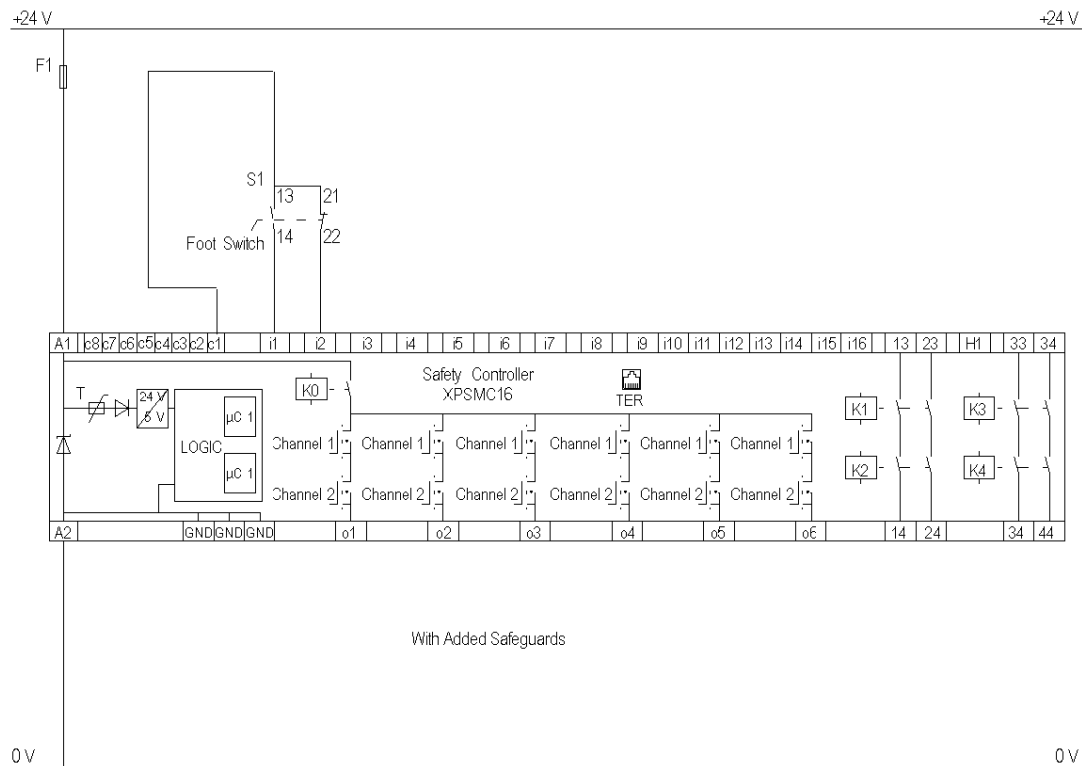
Start interlock = YES



The static outputs are rated PL e, category 4 according to EN ISO / ISO 13849-1, up to SIL 3 according to EN / IEC 61508.

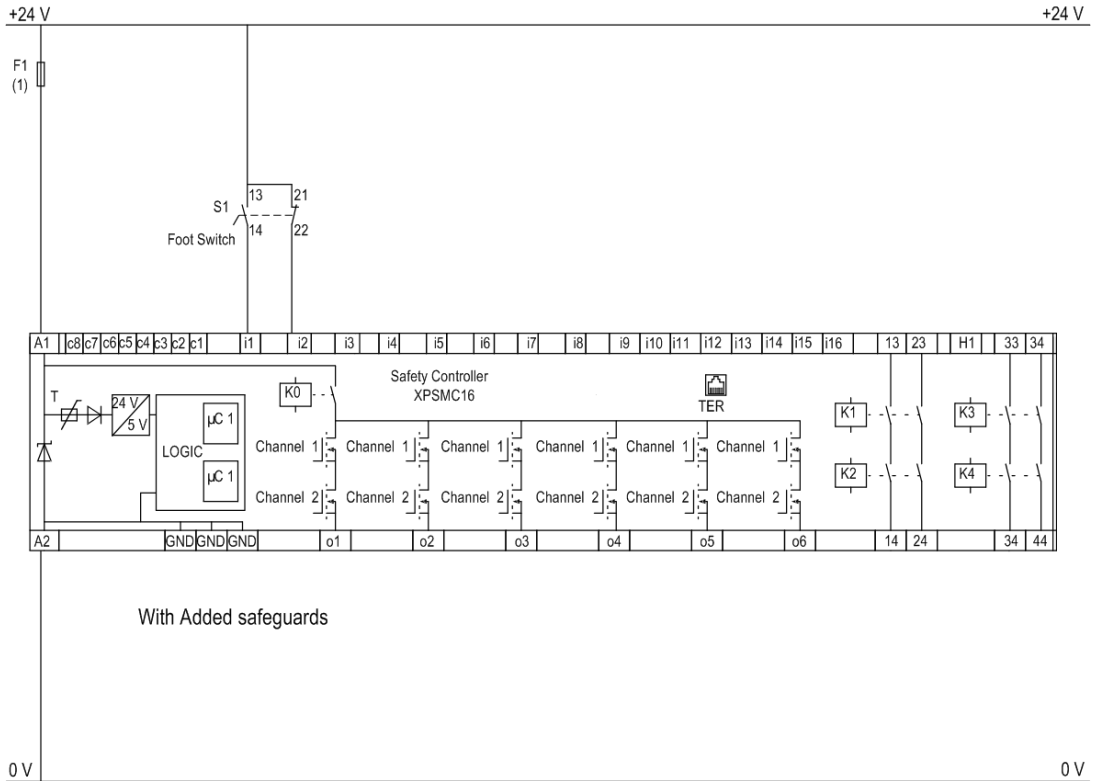
Wiring Diagram

The following image represents the Foot Switch wiring diagram:



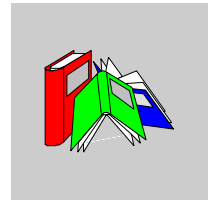
Wiring Diagram with Externally Supplied 24 V Input

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



NOTE: For safety inputs not supplied by control outputs use external means to achieve up to SIL3 (EN / IEC 61508) or PL e, Category 4 (EN ISO / 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)

R

RUN Mode

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

S

Safety Input

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

Safety Outputs

Relay or solid-state output activated by the XPSMC 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)

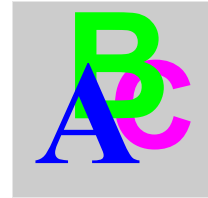
8 pin RJ45 connector for the connections of a PC for the configuration or diagnostic (bus system with Modbus protocol) or connections of another Modbus module (PLC, terminals, etc...).

V

VDC

validation counter

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