XPSMC Safety Controller

Hardware Manual

Original instructions

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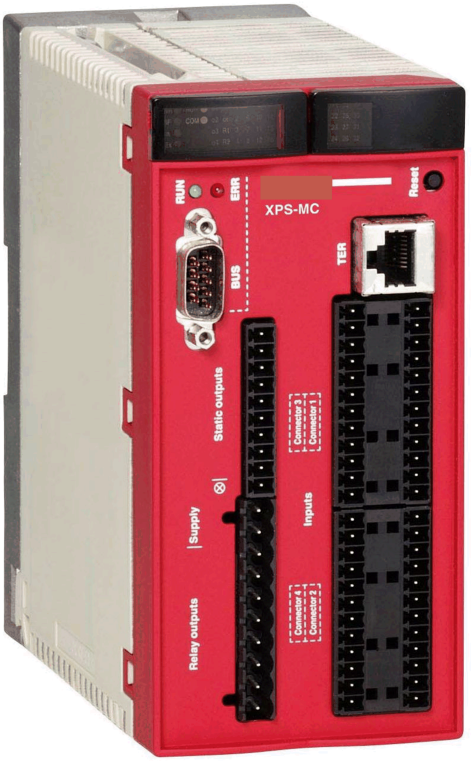

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Legal Information

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Safety Information

Important Information

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

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

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

Please Note

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

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

About the Book

Document Scope

This manual provides a detailed description of the XPSMC Safety Controller range.

Details of each of the references are outlined below.

The hardware aspects of the safety controller range are outlined in this manual.

The following descriptions are included:

- the dimensions and installation of the XPSMC Safety Controller
- the application and function
- description of the XPSMC Safety Controller
- a brief description of the functional devices
- examples of applications
- the technical characteristics of the XPSMC Safety Controllers

There are 6 versions of the XPSMC Safety Controller:

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

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

Validity Note

The corresponding configuration software is XPSMCWIN under Microsoft Windows 2000/XP/Vista/7.

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

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

Related Documents

Title of Documentation	Reference Number
Configuration Software for XPSMC Safety Controller	33003281

Product Related Information

The English version of this Hardware Manual is the original document. Publications in any other language are translations of this original English document.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.[1]
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

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

[1] For additional information, refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and to NEMA ICS 7.1 (latest edition), "Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems" or their equivalent governing your particular location.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Before starting up your machine/plant for the first time, verify the safety functions according to valid regulations, and observe the specified test cycles for safety-related equipment.

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

Overview: XPSMC16Z/ZC/ZP, XPSMC32Z/ZC/ZP

Overview

This chapter contains an overview of the XPSMC Safety Controllers XPSMC16Z, XPSMC16ZC, XPSMC16ZP, XPSMC32Z, XPSMC32ZC, and XPSMC32ZP.

Safety Information XPSMC Safety Controller

Safety-related Information

⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Do not use the equipment described herein to supply other, external equipment.
- Avoid contacting terminals with hand or tools until the power has been confirmed to be removed.
- Follow all electrical safety regulations and standards (for example, lockout/tag-out, phase grounding, barriers) to reduce the possibility of contact with hazardous voltages in the work area.
- Complete thorough hardware tests and system commissioning to verify that line voltages are not present on the control circuits before using your hardware operationally.

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

⚠ DANGER

LOSS OF DESIGNATED SAFETY FUNCTION

- Install the XPSMC Safety Controller system in an enclosure with a degree of protection of at least IP 54.
- Use a Protective Extra Low Voltage (PELV) power supply to isolate the equipment from line voltage.
- Do not directly connect the equipment to line voltage.

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

NOTE: The safety-related function can be compromised if this equipment is not used for the intended purpose and in accordance with the instructions in the present document. This equipment must only be used as safety-related equipment on machines intended to protect persons, material, and installations.

⚠ DANGER

POTENTIAL FOR EXPLOSION

Install and use this equipment in non-hazardous locations only.

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

NOTE: The observation of operating limits and duty cycles is of particular importance for equipment designed to perform a safety-related function. If this module has been subjected to electrical, mechanical, or environmental stresses in excess of its stated limits, replace it.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not exceed any of the rated operating limits for the equipment specified in the present document.
- Immediately cease using and replace any equipment that has or might have been subjected to conditions in excess of its rated operating limits.

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

There are no user serviceable components in the XPSMC Safety Controller. Inoperable products need to be replaced by new products of the same references.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Do not open the housing or otherwise attempt to service the safety-related products in any way.

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

User Responsibilities

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

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

XPSMC Safety Controller

Safety-related characteristics	Value	Standard
for relay outputs		
Probability of a dangerous failure per hour (PFH_D)	1,4 x 10^{-8} 1/h	IEC 62061
Safety integrity level claim limit (SILcl)	3	
Maximum performance level / Category (1)	PL e / Cat. 4	ISO 13849-1
Mean time to dangerous failure ($MTTF_D$) (2)	71 years	
Diagnostic coverage (DC)	> 99%	
Maximum service life	20 years	
for safety-related transistor outputs		
Probability of a dangerous failure per hour (PFH_D)	1,29 x 10^{-8} 1/h	IEC 62061
Safety integrity level claim limit (SILcl)	3	
Maximum performance level / Category (1)	PL e / Cat. 4	ISO 13849-1
Mean time to dangerous failure ($MTTF_D$) (2)	76,6 years	
Diagnostic coverage (DC)	> 99%	
Maximum service life	20 years	

(1) The performance level (PL) and the safety category (Cat.) according to ISO 13849-1 of an overall system depend on multiple factors, including the selected input and output devices, the wiring practice, the physical environment, and the application.

(2) As the XPSMC Safety Controller contains electromechanical relays, the actual $MTTF_D$ values will vary depending on the applications load and duty cycle. The estimated $MTTF_D$ values in years mentioned above are based on the following assumptions:

- B10D of 400.000 for maximum load, average switching quantity NOP (Number Of Operations) = 6.300 cycles/year
- B10D of 20.000.000 for low load, average switching quantity NOP = 361.800 cycles/year (see ISO 13849-1, C 2.4 and Tab. K.1)

You must ensure that the loads and switching cycles experienced by the XPSMC Safety Controller are appropriate for the calculated performance level. Use the Electrical Life of the Output Contacts diagrams, page 92 to determine the maximum acceptable load values. Make frequent observations of the operating conditions and replace the XPSMC Safety Controller before these limits are exceeded. The specified performance level can only be valid for the number of switching cycles calculated using this method. Do not exceed a service life of 20 years.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Observe the required test cycles according to your application.

XPSMC Safety Controller References

XPSMC Safety Controllers

XPSMC is a generic term that describes the entire family of different XPSMC Safety Controllers. The following references are available: XPSMC16Z, XPSMC16ZC, XPSMC16ZP, XPSMC32Z, XPSMC32ZC, and XPSMC32ZP.

Differences Between XPSMC Safety Controller References

XPSMC Safety Controllers

Reference	Modbus RTU Serial	CANopen	Profibus DP	Number of Inputs and Outputs
XPSMC16Z	x	–	–	16 safety-related inputs, 8 independent safety-related outputs and 8 control outputs
XPSMC16ZC	x	x	–	16 safety-related inputs, 8 independent safety-related outputs and 8 control outputs
XPSMC16ZP	x	–	x	16 safety-related inputs, 8 independent safety-related outputs and 8 control outputs
XPSMC32Z	x	–	–	32 safety-related inputs, 8 independent safety-related outputs and 8 control outputs

Reference	Modbus RTU Serial	CANopen	Profibus DP	Number of Inputs and Outputs
XPSMC32ZC	x	x	–	32 safety-related inputs, 8 independent safety-related outputs and 8 control outputs
XPSMC32ZP	x	–	x	32 safety-related inputs, 8 independent safety-related outputs and 8 control outputs
Details about the XPSMC Safety Controller functionality can be found within the Device Set chapter, page 76.				

XPSMC Safety Controller Package Content

The XPSMC Safety Controller Package consists of the following items:

Hardware	XPSMC Safety Controller
Manuals	Printed English Manual
Documentation CD	Hardware Manuals (PDF) in: English, German, French, Spanish, Portuguese

To configure and commission the XPSMC Safety Controller you also require the following items:

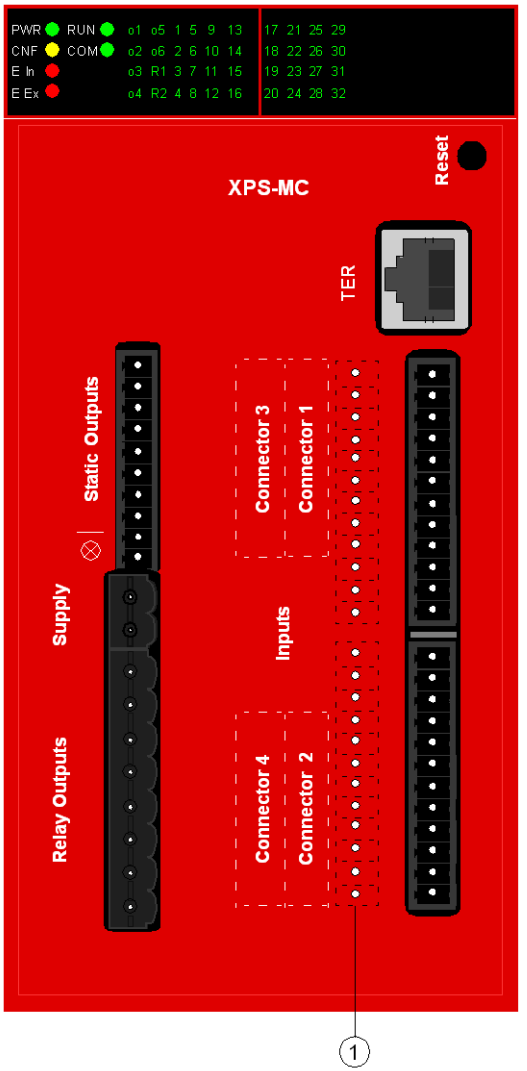
Item		References
Configuration software	XPSMCWIN configuration software	XPSMCWIN
Configuration cable	USB/RJ45 PC adaptor cable or	TCSMCNAM3M002P
	USB PC adaptor and Ethernet connection cable (2 references)	TSXCUSB485 + 490NTW00002
IO terminals	Screw terminals pack available for 16 or 32 Digital Input versions of the XPSMC Safety Controller (Terminals provided for the complete XPSMC Safety Controller) For XPSMC Safety Controller: 1. References 16 Digital Input: XPSMC16Z, XPSMC16ZC, XPSMC16ZP 2. References 32 Digital Input: XPSMC32Z, XPSMC32ZC, XPSMC32ZP	You require 1 of the following references: 1. XPSMCTS16 2. XPSMCTS32

Item		References
	Cage Clamp terminals pack available for 16 or 32 Digital Input versions of the XPSMC Safety Controller (Terminals provided for the complete XPSMC Safety Controller) For XPSMC Safety Controller: 1. References 16 Digital Input: XPSMC16Z, XPSMC16ZC, XPSMC16ZP 2. References 32 Digital Input: XPSMC32Z, XPSMC32ZC, XPSMC32ZP	1. XPSMCTC16 2. XPSMCTC32
Power Supply	IEC 60950 or IEC 60204-1 rated powers supply with protective separation (PELV)	Size power supplies appropriate to your needs.

Representation

Front View XPSMC16Z / 32Z

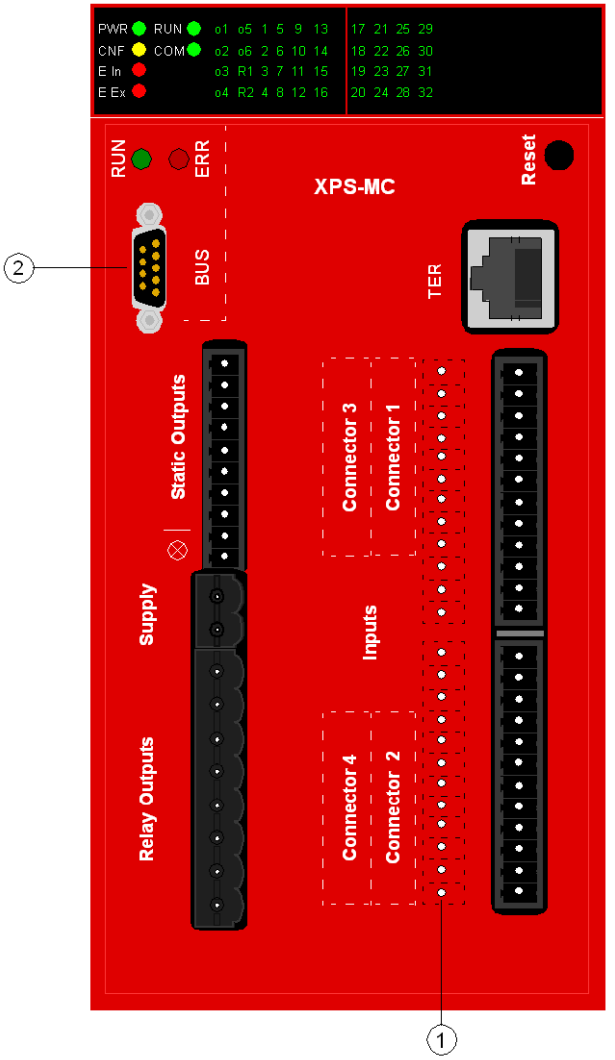
The following image shows the front view of the XPSMC16Z and XPSMC32Z:



1 16 additional safety-related inputs of XPSMC32Z

Front View XPSMC16ZP / 16ZC/ 32ZP / 32ZC

The following image shows the front view of the XPSMC16ZP , XPSMC16ZC, XPSMC32ZP and XPSMC32ZC:



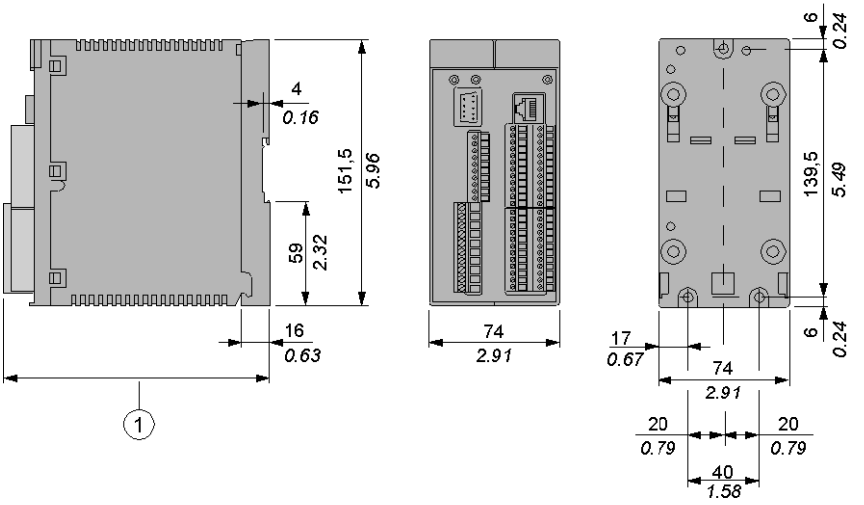
1 16 additional safety-related inputs of XPSMC32ZP and XPSMC32ZC

2 Profibus DP female connector (XPSMC••ZP) or CANopen male connector (XPSMC••ZC)

Dimensions

Dimensions of the XPSMC Safety Controller

The following figures show the dimensions of the XPSMC Safety Controller (mm/in):



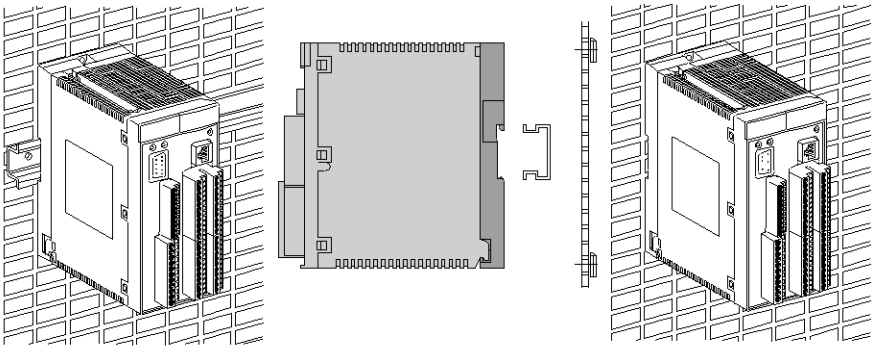
1 When using XPSMCTS• connectors this dimension is 153 mm (6.02 in)

When using XPSMCTC• connectors this dimension is 151,5 mm (5.96 in)

Installation

Assembly on a 35 mm DIN Rail

35 mm (1.37 in) DIN rail and wall installation



This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

⚠DANGER

POTENTIAL FOR EXPLOSION

Install and use this equipment in non-hazardous locations only.

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

⚠WARNING

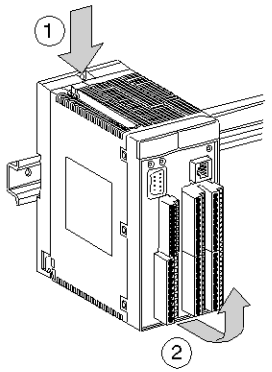
UNINTENDED EQUIPMENT OPERATION

- Place devices dissipating the most heat at the top of the cabinet and ensure adequate ventilation.
- Avoid placing this equipment next to or above devices that might cause overheating.
- Install the equipment in a location providing the minimum clearances from all adjacent structures and equipment as directed in this document.
- Install all equipment according to the drawings specified in the related documentation.

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

⚠WARNING
UNINTENDED EQUIPMENT OPERATION Do not exceed any of the rated values specified in the environmental and electrical characteristics tables. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Disassembling from 35 mm (1.37 in.) DIN rail



NOTE: The XPSMC Safety Controller is grounded through an attachment plate or a DIN rail.

Requirements

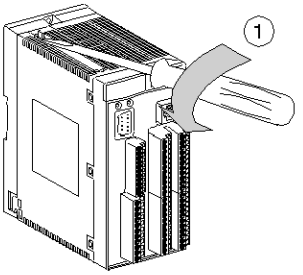
The XPSMC Safety Controller should be air-cooled by natural convection. Install the controller vertically with the ventilation louvers on the bottom and on the top.

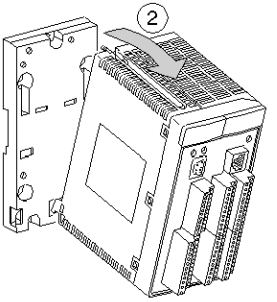
Observe the following installation rules:

- Leave a free space of at least 150 mm (5.90 in.) for the ducts, wiring, and air circulation above and below the controller.
- Install heat-generating devices (transformers, supply modules, power switches, etc.) above the controllers.

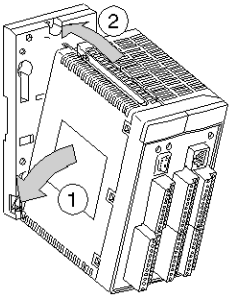
Disassembly of the Upper Housing

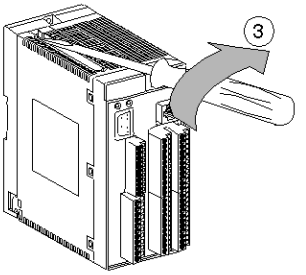
Removal of the upper housing section from the mounting plate (torque value = 1.1 Nm (9.7 lb-in)).





Assembly of the upper housing section on to the mounting plate (torque value = 1.1 Nm (9.7 lb-in)).





Application and Function

Overview

This chapter described the application and function of XPSMC16Z, XPSMC16ZC, XPSMC16ZP, XPSMC32Z, XPSMC32ZC, and XPSMC32ZP Safety Controllers.

Application

Description

The XPSMC Safety Controller is an electronic controller for the monitoring of safety functions up to safety category 4, PL e, according to ISO 13849-1 and SILCL 3 according to IEC 62061 respectively SIL 3 according to IEC 61508 in the section for machine safety.

The XPSMC Safety Controller has 6 safety-related solid state transistor outputs and in addition 2 safety-related relay outputs, and depending on version either 16 or 32 digital inputs.

The XPSMC Safety Controller contains a configuration interface (TER).

The TER interface is a Modbus RTU serial communications port which can also be used for diagnostic purposes as it can be connected to a non-safety-related controller or a graphical user interface.

Additional references of the XPSMC Safety Controller contain either CANopen or Profibus DP interfaces.

NOTE: Every connected sensor and actuator to the XPSMC Safety Controller must be tested by changing its status at least once a year. This must be done, as the Safety Integrity Level calculation for each safety function is based upon a complete input/output test once a year.

NOTE: The XPSMC Safety Controller contains no components which require maintenance by the user. For safety-related circuits to comply with IEC 60204, ISO 13850, only the output circuits between terminals 13-14, 23-24, 33-34, 43-44 and semiconductor safety-related outputs o1 to o6 can be used.

Function

Description

The device includes 6 independent semiconductor safety-related outputs and 2 independent groups of dual channel positively driven potential-free contact safety-related relay outputs. Each of the 4 channels has 2 contacts in series.

The equipment described in the present document is not intended for use in domestic, residential environments and may not provide adequate protection to radio reception in such environments.

⚠WARNING

INSUFFICIENT ELECTROMAGNETIC COMPATIBILITY

- Verify compliance with all EMC regulations and requirements applicable in the country in which the device is to be operated and with all EMC regulations and requirements applicable at the installation site.
- Do not install and operate the devices described in the present document in residential environments.
- Implement all required radio interference suppression measures and verify their effectiveness.

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

Electromagnetic radiation may interfere with control communications and/or input/output signals to the control system.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not wire I/O and communication lines in proximity to power cables, radio devices, or other equipment that may cause electromagnetic interference.
- If wiring of I/O lines near power lines or radio equipment is unavoidable, use shielded cables that are properly grounded to an equipotential ground plane.

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

Functions of XPSMC Safety Controller

The XPSMC Safety Controller has 8 control outputs, c1 to c8 and 16 (32) safety-related inputs, i1 to i16 (i1 to i32).

The safety-related inputs are monitored for cross connections and short circuits by supplying the circuit members with different control outputs, c1 to c8.

The XPSMC Safety Controller uses the control outputs to continuously test the connected inputs including their power connections.

If an error is detected on the input circuit, the control logic deactivates the safety-related outputs associated with the relevant safety function. The safety-related outputs associated with other safety functions continue to operate.

XPSMC Safety Controllers are equipped with a Modbus RTU serial interface (TER).

In addition a CANopen communication port is available on

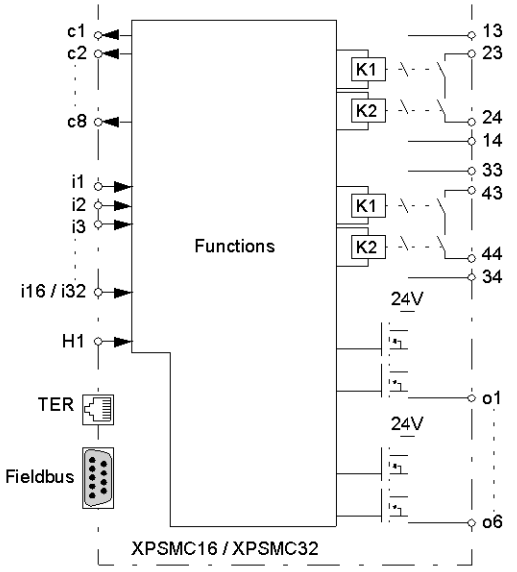
- XPSMC16ZC
- XPSMC32ZC

and a Profibus DP interface is available on

- XPSMC16ZP
- XPSMC32ZP

The communication ports are to provide diagnostic information regarding the status of the controller. The communication is non-safety related. The XPSMC Safety Controller is a slave for all communication possibilities.

XPSMC Safety Controller



⚠DANGER

UNINTENDED EQUIPMENT OPERATION OR ELECTRIC SHOCK

Be sure to connect the terminal blocks to their designated location.

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

⚠WARNING

IMPROPER CIRCUIT DESIGN, TESTING AND SERVICING HAZARD

- You must strictly comply with testing and servicing intervals for your machine.
- You must strictly comply with the relevant safety instructions concerning machine operation, adjustment and service.

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

For more information, refer to ISO 12100.

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

⚠WARNING

LOSS OF CROSS-CONNECTION DETECTION

Carefully analyze and understand how the circuits which are sharing control outputs interact in your application.

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

Configuration of XPSMC Safety Controller

The XPSMC Safety Controller is configured using a PC (computer) and the XPSMCWIN configuration software.

The connection between the XPSMC Safety Controller and PC (computer) can be made in 2 ways, page 35:

- using the serial communication port from the PC (computer)
- using the USB communication port from the PC (computer)

Initial Operation

Auto-test (factory settings)

The XPSMC Safety Controller is delivered in a non-configured state. On first power up it performs an internal test which lasts approximately 2 seconds. To connect the power to the XPSMC Safety Controller connect +24 VDC to terminal A1 and 0 VDC to terminal A2.

Stage	Description
1	The LEDs located on the housing light up.
2	After 2 seconds • PWR LED is on • CNF LED is flashing • remaining LEDs are off

Auto-test (hardware test)

You can reset the configuration of an XPSMC Safety Controller as follows: Disconnect the XPSMC Safety Controller from power supply, press and hold the **Reset** button while you reconnect the XPSMC Safety Controller to the power supply. The configuration will no longer be valid however, it is possible to read the configuration from the controller on the computer and revalidate the configuration.

Stage	Description
1	The LEDs located on the housing light up.
2	After 2 seconds, the LEDs switch off for a short time and then on again, since the **Reset** button is pressed.
3	Release the **Reset** button. • PWR LED is on • CNF LED is flashing • remaining LEDs are off

Auto-test (with a valid configuration)

Power cycle the XPSMC Safety Controller with a valid configuration.

Stage	Description
1	The LEDs located on the housing light up.
2	After 2 seconds • PWR LED is on • RUN LED is on when the controller was in RUN before power cycle • RUN LED is off when the controller was in STOP before power cycle If the controller has fieldbus interfaces then: • CANopen/Profibus DP LEDs (RUN and ERR) behavior depends on the connection (see Elements of the Display and System Diagnostics, page 39).

Downloading a New Configuration

The XPSMC Safety Controller is delivered in a non-configured state, and the device must be configured to be operational. The configuration is performed using software XPSMCWIN.

NOTE: The XPSMCWIN software manual contains a detailed description of the safety functions available from the XPSMC Safety Controller.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Test your safety-related application before putting it into regular operation in the XPSMC Safety Controller with the XPSMCWIN software.

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

Once the XPSMC Safety Controller has been successfully configured and validated, it can be set into RUN mode with the XPSMCWIN software.

Stage	Description
1	After downloading a valid configuration • CNF LED is off
2	After setting the XPSMC Safety Controller into RUN mode: • RUN LED is on • LEDs corresponding to the inputs and outputs light up as a function of their status If the XPSMC Safety Controller has fieldbus interfaces then: • CANopen/Profibus LEDs - behavior depends on the connection (see Elements of the Display and System Diagnostics, page 39) The XPSMC Safety Controller is operational.

XPSMC Safety Controller Description

Overview

This chapter contains the description of the XPSMC Safety Controllers XPSMC16Z, XPSMC16ZC, XPSMC16ZP, XPSMC32Z, XPSMC32ZC, and XPSMC32ZP.

General Description of the XPSMC Safety Controller

Introduction

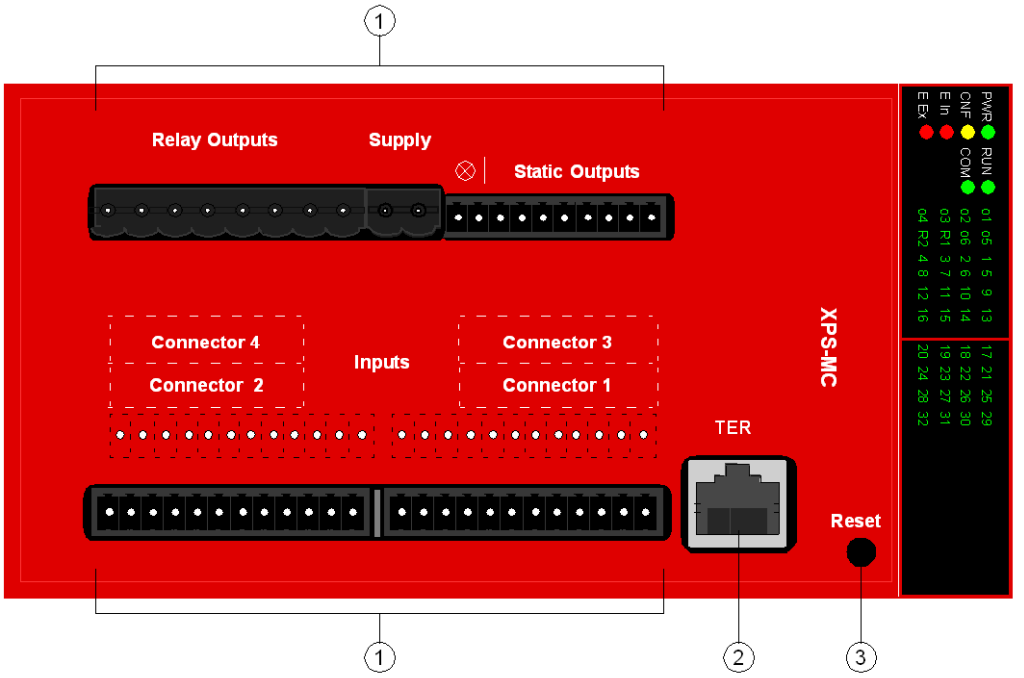
This section provides an overview of the general functions and properties of the XPSMC Safety Controller.

Front View of XPSMC Safety Controller

Overview

The following images represent the XPSMC Safety Controller references with screw terminals (ref: XPSMCTS) or cage clamp terminals (ref: XPSMCTC).

Front View XPSMC••Z

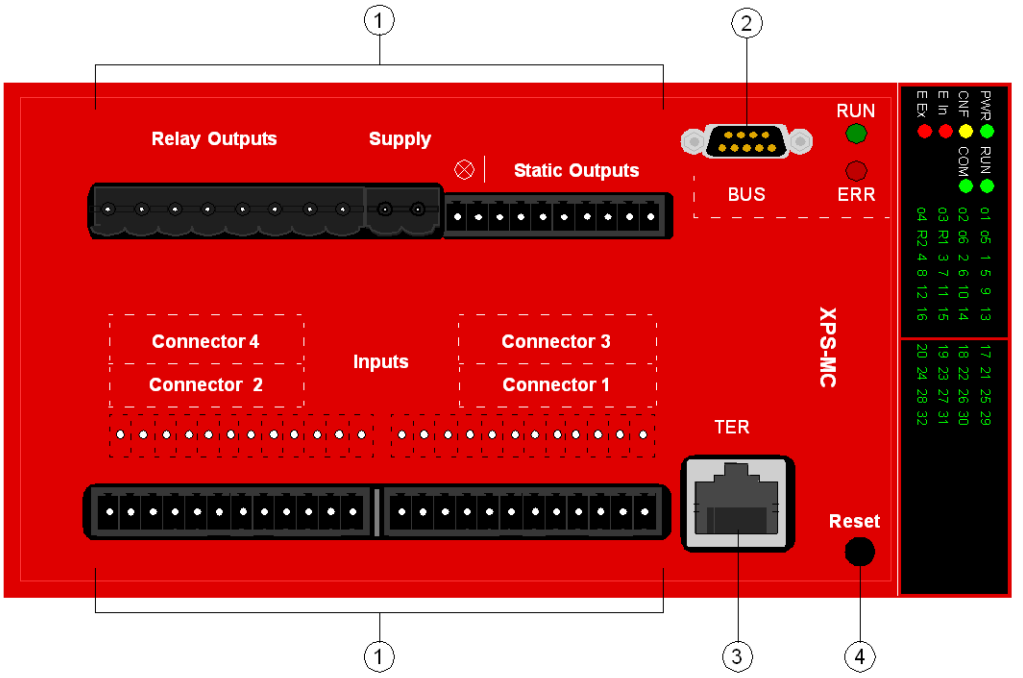


1 Terminals

2 TER connection

3 Reset button

Front View XPSMC••ZP and XPSMC••ZC



1 Terminals

2 Fieldbus connection (Profibus DP(female connector) or CANopen (male connector))

3 TER connection

4 Reset button

Keying of the Terminal Connectors Connector 1...4

The terminal connectors *Connector 1...4* can be keyed by inserting the code profiles into the slots of the controller connectors and breaking off the appropriate tabs of the cable connector.

Display

The LED indicators reflect the current operating status of the device (see chapter Elements of the Display and System Diagnostics, page 39).

Terminals

The terminal layout is as follows:

Terminal Layout	Meaning
A1-A2	24 Vdc power supply; A1 is the + pole (+24 VDC), A2 is the - pole (0 VDC, GND)
GND	It is identical to the 0 VDC potential on A2 for loads on the o1-o6 semiconductor safety-related outputs.
o1-o6	semiconductor safety-related outputs
13-44	potential-free safety-related relay outputs equipped with contacts
c1-c8	control outputs for safety-related input power supply The control outputs provide a signal that enables detection of short circuit and detection of voltage intrusion for the connected control components.
i1-i16 or i1-i32	safety-related inputs
H1	connection for muting lamp The supply voltage must be taken from the same source which supplies the XPSMC Safety Controller.

Connection

An 8 pin RJ45 connector is 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 a HMI operating terminal, or a non-safety-related controller.

Fieldbus Connection

Dependant on version:

- Profibus DP: 9 pin D-Sub female connector
- CANopen: 9 pin D-Sub male connector

Reset Button

When an external error was detected and fixed, this has to be acknowledged by pressing the **Reset** button. If the error is no longer detected, the XPSMC Safety Controller will be able to enter the RUN mode again.

Pressing the **Reset** button during a power cycle will reset the XPSMC Safety Controller to default values. As a result the password is set to 'safety', and the configuration is invalid but not deleted. That means the controller cannot be set to RUN mode anymore but the configuration and protocol can still be read from the controller. To set the controller operational again, the controller needs to be reconfigured (download and validate a configuration).

CANopen/Profibus DP LEDs

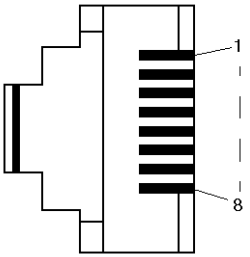
Two LEDs for CANopen/Profibus DP connection: RUN (green) and ERR (red).

Refer to Profibus DP LEDs, page 55 for Profibus DP and to CANopen LEDs, page 60 for CANopen LED description.

Communication Connections TER

Connection

8 pole RJ45-Socket pin-outs

8 Pole RJ45-Socket, with Protection	Pin	Signal	Description
Representation: 	1	–	–
	2	–	–
	3	DPT	TER Port Mode Control
	4	D1 (B)	RS485 Signal
	5	D0 (A)	RS485 Signal
	6	/DE	Negative Data Transmit Enable
	7	5V	5 Vdc power
	8	0V	0 Vdc

Connection to a PC for Configuration

There are 2 ways to connect the XPSMC Safety Controller to the PC (computer):

- using the serial communications interface from the PC
- using the USB communications interface from the PC

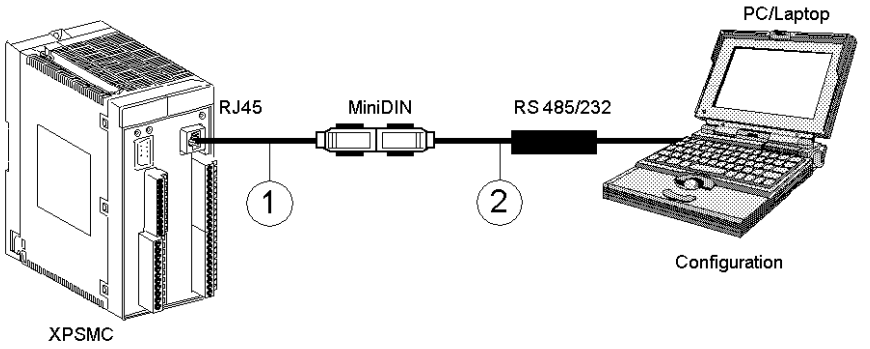
Serial Connection

The following 2 cabling components are required to set up the serial connection:

- XPSMCCPC adaptor
- TSXPCX1031 serial adaptor

NOTE: These accessories need to be ordered separately.

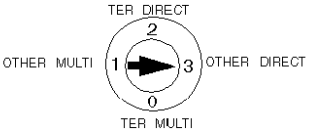
The following figure shows the physical serial connection from the PC to the XPSMC Safety Controller.



1 XPSMCCPC

2 TSXPCX1031

Setting of the interface cable TSXPCX1031.

Representation	Switch Position
	The switch must be in position 3 OTHER DIRECT

USB Connection

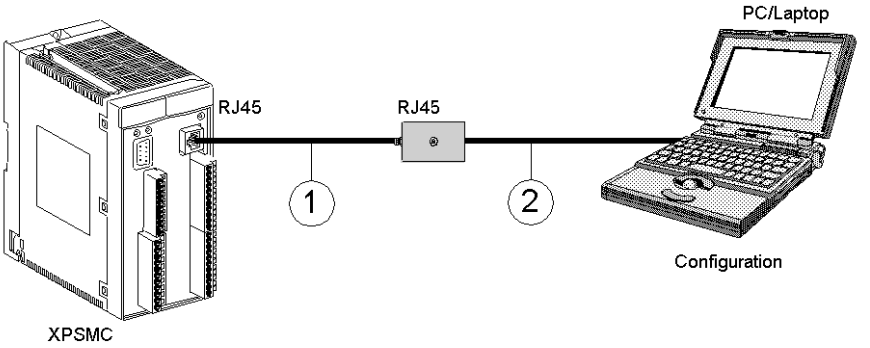
Use the USB/RJ45 PC adaptor cable TCSMCNAM3M002P or the following 2 cabling components to set up the USB connection:

- Standard (1:1) RJ45/RJ45 twisted pair Category 5D Ethernet cable Ref: 490NTW00002
- TSXCUSB485 USB adaptor

In addition you will require the USB driver pack available on the Safety Suite V2 (XPSMCWIN) software CD or on www.se.com.

The driver pack installation instructions are available within the *XPSMCWIN Configuration Software for XPSMC*.

The following figure shows the physical USB connection from the PC to the XPSMC Safety Controller.



1 RJ45-RJ45 twisted pair category 5D or better (1:1) Ethernet cable (e.g. 490NTW00002)

2 USB Adaptor TSXCUSB485

or

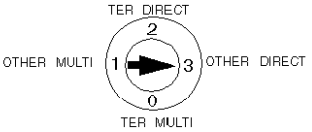
USB/RJ45 PC adaptor cable TCSMCNAM3M002P

The following cabling components are required to set up the connection:

1. Serial connection from PC to the XPSMC Safety Controller:
   - XPSMCCPC adaptor
   - TSXPCX1031 serial adaptor
2. USB connection from the PC to communications interface from the PC
   - USB/RJ45 PC adaptor cable TCSMCNAM3M002P or
   - Standard (1:1) RJ45/RJ45 twisted pair Category 5D Ethernet cable. Ref. 490NTW00002 with TSXCUSB485 USB adaptor

   NOTE: For connection to other devices, refer to Modbus RTU Communication Example, page 116.

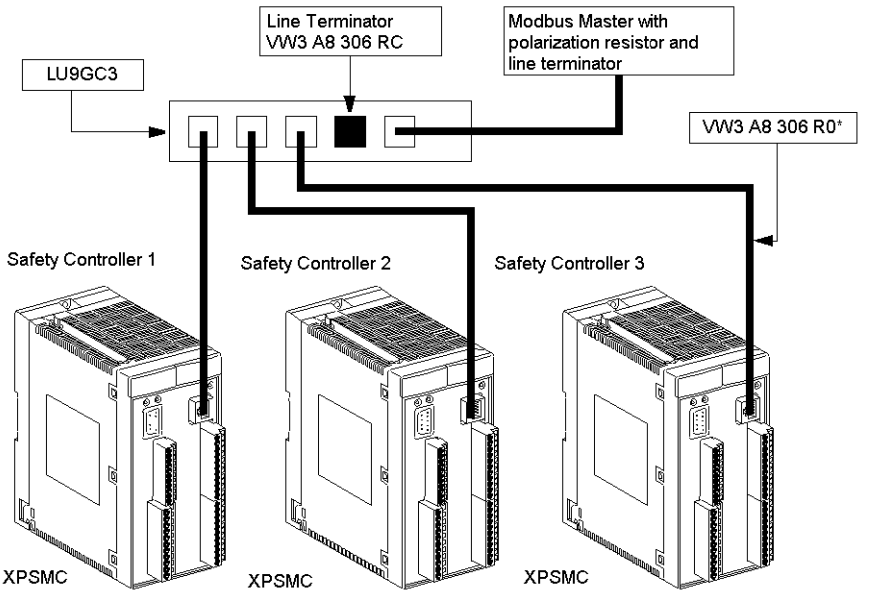
Setting of the interface cable TSXCUSB485

Representation	Switch Position
	The switch must be in position 3 OTHER DIRECT

Connection of One or More XPSMC Safety Controllers to a Modbus RTU System

NOTE: It is not possible to program the controller via the LU9GC3 system. The connection of more than one controller on the network is for use with HMI-Magelis, and the non-safety-related controllers.

The following figure shows the connection of one or more XPSMC Safety Controllers to a Modbus RTU system:



Configuration Rules

Every XPSMC Safety Controller must be separately addressed and configured if it is to be used on the same bus.

If the controller is operated within a Modbus network under strong EMC influence the resulting disturbances may lead to unsuccessful bus traffic. To avoid this situation from occurring, use a snap on ferrite filter on the bus connection.

Follow these instructions for the Modbus network wiring:

- Use a shielded twisted pair cable.
- Connect the reference potentials (ground) to one another.
- Ensure that the maximum cable length does not exceed 1000 m (3280.8 ft).
- Ensure that the maximum drop length does not exceed 20 m (65.6 ft).
- Keep at least 30 cm (1 ft) between the bus cable and the power cable.
- Any crossing of the bus cable and power cables should be made at right angles (90°).
- Ground the cable shielding on each unit.
- Adapt the line at both ends using a line terminator.

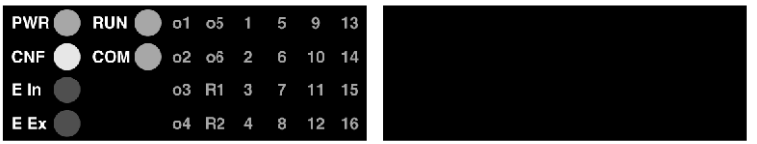
NOTICE
LOSS OF NETWORK Make sure that devices on a Modbus system have unique network addresses. **Failure to follow these instructions can result in equipment damage.**

Elements of the Display and System Diagnostics

LED Display Fields

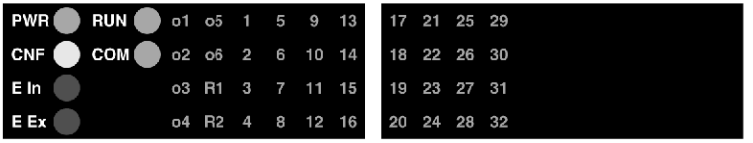
XPSMC16Z• Display

The following LEDs are used to display the status of the XPSMC16Z•:



XPSMC32Z• Display

The following LEDs are used to display the status of the XPSMC32Z•.



LED Description

LED	Color	Significance
PWR	green	**Power** Illuminates when operational voltage is applied to A1/A2.
CNF	yellow	**Config** Illuminates in the configuration mode. Flashes when the XPSMC Safety Controller is not configured, for example during the initial operation. The XPSMC Safety Controller must be configured before operation.
E In	red	**Internal Error** Illuminates if an internal error is detected. The safety-related outputs are immediately deactivated. If the indication is persistent after power cycle and reset then the XPSMC Safety Controller must be replaced.
E Ex	red	**External Error** Illuminates when an external error is detected, for example in the wiring. Only the safety-related outputs of the affected inputs are deactivated. When the detected error has been corrected, and the RESET button has been pressed, the corresponding safety-related outputs become operational again.
RUN	green	**Run** Illuminates in the RUN mode. Flashes during the transition from RUN mode to the STOP mode as long as defined delay times are running.
COM	green	**Communication** Illuminates during communication via the TER.

LED	Color	Significance
o1...o6	green	**Output 1...6** Illuminates when the corresponding semiconductor safety-related output is activated. Flashes, when a short circuit, an internal or an external error is detected on this output. In addition the LED **E Ex** illuminates. An error message can be caused by a false signal (e.g. cross circuit connection, external voltage) or when a transistor is non-operational. Disconnect the wire of the concerned output and press the RESET button. If the error message disappears, then the error that was detected is in the wiring. Otherwise, an output transistor is non-operational. In this case, this output can no longer be used.
R1, R2	green	**Relay group 1/2** Illuminates when relay group R1 (safety-related relay outputs 13/14 and 23/24) and/or relay group R2 (safety-related relay outputs 33/34 and 43/44) are activated. The LED(s) flashes, when an error is detected on this output. In addition the LED **E In** illuminates. This output must no longer be used.
1...16 1...32	green green	**Input i1...i16** **Input i1...i32** Illuminates if on the corresponding i1...i16/i32 input circuit is closed. Flashes when an error is detected on this input.

Connection Diagram

Introduction

The following information is provided to help you to connect and wire your XPSMC Safety Controller.

Electrical Diagram for XPSMC Safety Controllers

⚠ DANGER

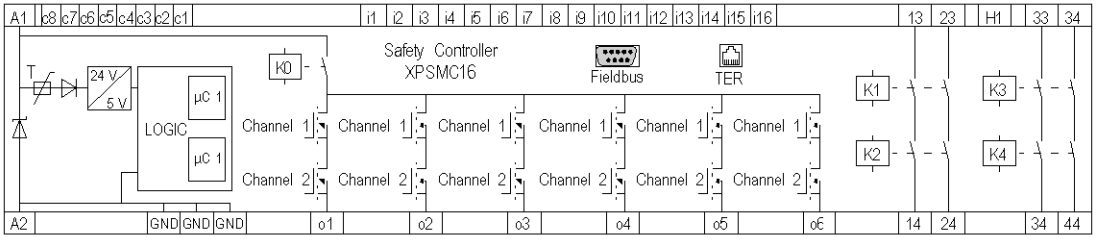
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

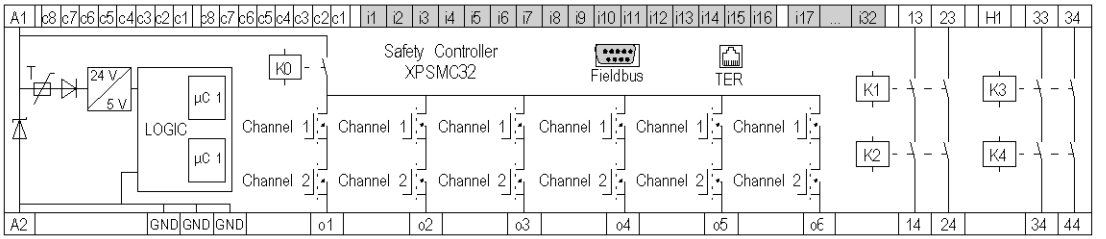
Failure to follow these instructions will result in death or serious injury.

The following diagram shows the XPSMC Safety Controllers connection:

XPSMC16



XPSMC32



Description of terminals:

Terminal Layout	Meaning
A1-A2	24 Vdc power supply; A1 is the + pole (+24 V), A2 is the - pole (0 V, GND)
GND	It is identical to the 0 V potential on A2 for loads on the o1...o6 semiconductor safety-related outputs.
c1-c8	control outputs (for the XPSMC32Z•: there are two sets of 8 control outputs available)
i1-i16 or i1-i32	safety-related inputs
H1	connection for muting lamp
o1-o6	semiconductor safety-related outputs
13/14, 23/24, 33/34, 43/44	safety-related relay outputs, potential free
TER	8 pin RJ45 connector for configuration and/or diagnostics. The communication via the TER terminal is Modbus RTU protocol and can also be used to connect to a HMI magelis operating terminal, or a non-safety-related controller.
Fieldbus	Dependant on version: • Profibus DP: 9 pin D-Sub female connector. • CANopen: 9 pin D-Sub male connector.

Technical Characteristics

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the following tables.

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

XPSMC Safety Controller, Terminals A1, A2, 13, 14, 23, 24, 33, 34, 43, 44

Single lead connection

Connection Diameters, Single Lead Connection	XPSMCTS / XPSMCTC
Without lead end sleeves	solid 0.2 - 2.5 mm^2 stranded 0.2 - 2.5 mm^2 (24 - 12 AWG)
Stranded with lead end sleeves (without plastic sleeves)	0.25 - 2.5 mm^2 (22 - 14 AWG)
Stranded with lead end sleeves (with plastic sleeves)	0.25 - 2.5 mm^2 (22 - 14 AWG)

Multiple lead connections

Connection Diameters, Multiple Lead Connections (2 leads maximum same diameters)	XPSMCTS	XPSMCTC
Without lead end sleeves	solid 0.2 - 1.5 mm^2 (24 - 16 AWG) stranded 0.2 - 1.5 mm^2 (24 - 16 AWG)	- -
Stranded with lead end sleeves (without plastic sleeves)	0.20 - 1.5 mm^2 (22 - 18 AWG)	-
Stranded with twin lead end sleeves (with plastic sleeves)	0.5 - 1.5 mm^2 (20 - 16 AWG)	0.5 - 1 mm^2 (20 - 18 AWG)

Miscellaneous

Stripping length	10 mm (0.39 in)	
Tightening torque	0.5 - 0.6 Nm (4.2 - 5.3 lb-in)	-

NOTE: AWG indication according to IEC 60947-1 / table 5.

XPSMC Safety Controller, Other Terminals

Single lead connection

Connection Diameters, Single Lead Connection	XPSMCTS• / XPSMCTC•
Without lead end sleeves	solid 0.14 - 1.5 mm^2 stranded 0.14 - 1.5 mm^2 (28 - 16 AWG)
Stranded with lead end sleeves (without plastic sleeves)	0.25 - 1.5 mm^2 (22 - 16 AWG)
Stranded with lead end sleeves (with plastic sleeves)	0.25 - 0.5 mm^2 (22 - 20 AWG)

Multiple lead connections

Connection Diameters, Multiple Lead Connections (2 leads maximum same diameters)	XPSMCTS•	XPSMCTC•
Without lead end sleeves	solid 0.14 - 0.5 mm^2 (28 - 20 AWG) stranded 0.14 - 0.75 mm^2 (28 - 18 AWG)	- -
Stranded with lead end sleeves (without plastic sleeves)	0.25 - 0.34 mm^2 (22 AWG)	-
Stranded with twin lead end sleeves (with plastic sleeves)	0.5 mm^2 (20 AWG)	-

Miscellaneous

Stripping length	9 mm (0.35 in)	
Tightening torque	0.5 - 0.6 Nm (1.9 - 2.2 lb-in)	-

NOTE: AWG indication according to IEC 60947-1 / table 5.

Mechanical Structure

Enclosure Mounting	Metal adapter for mounting on 35 mm (1.37 in.) standard DIN rails as per IEC 60715 and screw mounting. • Use a DIN rail with a thickness of 1.5 mm (0.06 in.) up to 2 g (0.07 oz) vibration requirements. • Use the fixed mounting directly on a metal plate above 2 g (0.07 oz) vibration requirements.
Protection, as per IEC 60529, Terminals Protection, as per IEC 60529, Housings	IP 20 IP 20
Weight XPSMCT•16 Weight XPSMCT•32 Weight XPSMC16Z Weight XPSMC32Z Weight XPSMC16Z• Weight XPSMC32Z•	0.08 kg (0.18 lb) 0.11 kg (0.24 lb) 0.82 kg (1.81 lb) 0.84 kg (1.83 lb) 0.83 kg (1.85 lb) 0.85 kg (1.87 lb)
Assembly Position	Ventilation louver on the top and on the bottom, see chapter Installation, page 21.
Ambient Operational Temperature	-10 °C / +55 °C (+14 °F / +131 °F)
Storage Temperature	-25 °C / +85 °C (-13 °F / +185 °F)
Shock Resistance	150 m/s^2 duration 11 ms forms half sine
Vibration Resistance	0.5 mm^2 from 10 to 55 Hz

External Power Supply Requirements

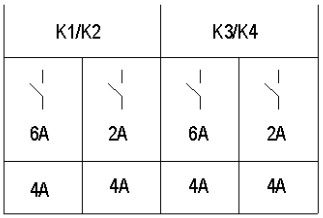
Excess voltage category III (4 kV) pollution category 2 / Isolation voltage 300 V as per IEC 60664-1

Supply as per IEC 60038	24 Vdc (+/- 20%) including ripple
Cross-Circuit Protection, maximum Fuse Element Type gL	16 A

Consumption	≤ 12 W
Maximum Current Consumption, including Peripherals	8 A

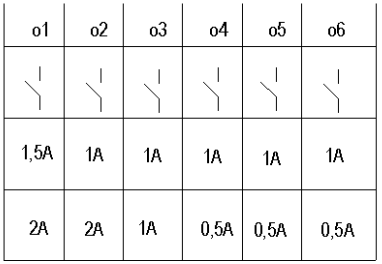
Safety-Related Relay Outputs

The following table provides technical data on safety-related relay outputs:

Maximum Current per Relay Output	6 A
Safety-Related Relay Outputs, Potential Free	13...14, 23...24, 33...34, 43...44
Maximum Switching Capacity of Potential-Free Safety-Related Relay Outputs	AC15 - C300 Ue = 230 Vac / Ie = 0.75 A DC13 Ue = 24 Vdc / Ie = 1.5 A
Cumulative Current Limit for Concurrent use of several Relay Output Circuits:	∑ Ith ≤ 16 A Load examples: 
Cross-Circuit Protection, maximum Fuse Element for Potential-Free Safety-Related Output Circuits	4 A (gL) or 6 A fastblow

The following table provides technical data on safety-related static outputs:

Semiconductor Safety-Related Outputs, NO	o1, o2, o3, o4, o5, o6
Maximum Current per Semiconductor Safety-Related Outputs	2 A
Voltage Drop of the Semiconductor Safety-Related Outputs	0.25 V (typical)
Minimum Operating Current of the Semiconductor Safety-Related Outputs	0.8 mA
Leakage Current of Semiconductor Safety-Related Outputs	10µA

Breaking Capacity of the Semiconductor Safety-Related Outputs	DC-13 SQ 24 V (SQ is defined in IEC 60947-5-1 table A3)
Conditional cross circuit current of the Semiconductor Safety Outputs	100 A
Cumulative Current Limit for Concurrent use of several Semiconductor Outputs	∑ Ith ≤ 6.5 A Examples: 
Cross-Circuit Protection, maximum Fuse Element for Semiconductor Output Circuits	none required, the semiconductor outputs are internally cross-circuit-protected

You have the possibility to select between 20 ms and 30 ms for the response times. Selecting the 30 ms response time enables you to configure more functions within the configuration.

Response time <= 20 ms

Response Time of the Safety-Related Outputs	<= 20 ms
Response Time of the Safety Mat	<= 30 ms
Increments of Configurable Times	-10 ms, -15%

Response time <= 30 ms

Response Time of the Safety-Related Outputs	<= 30 ms
Response Time of the Safety Mat	<= 45 ms
Increments of Configurable Times	-15 ms, -15%

The potential-free safety-related outputs are also suitable for small loads (minimum 17 V / 10 mA). This is, however, only possible if high loads have not already been switched via the contacts.

Input Circuits

Number of Inputs	16 or 32
Maximum Category / Maximum Performance Level as per ISO 13849	4 / PL e
Maximum Safety Level as per IEC 62061	SILCL 3
Maximum Voltage/Current in Input Circuits	28.8 V / 13 mA
Maximum Wire Resistance in Input Circuits	100 Ω
Maximum Line Capacitance in Input Circuits	220 nF
Maximum Wire Length in Input Circuits	2000 m (6500 ft)

Miscellaneous

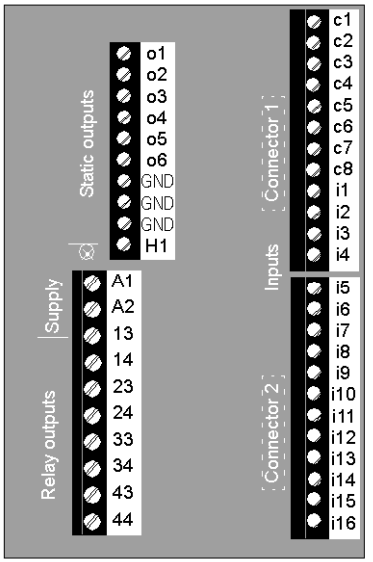
Lamp Muting (source of white light, with a luminosity of minimum 200 cd/m^2 and an illuminated surface of minimum 1 cm^2)	Light bulb (24 V / minimum 0.5 W to maximum 7.0 W, for example: references DL1-BEB) or LED (24 Vdc / minimum 0.5 W to maximum 7.0 W, for example: references DL1-BDB1
Magnet Switch	For example, XCS-DM•
Safety Mats	For example, XY2-TP•
Enabling Device	For example, XY2AU•

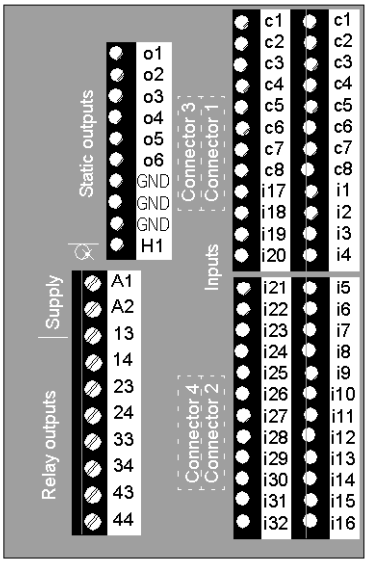
Connectors

Screw Terminals for XPSMC16•• (includes Keying Device)	XPSMCTS16
Screw Terminals for XPSMC32•• (includes Keying Device)	XPSMCTS32
Cage Clamp Terminals for XPSMC16•• (includes Keying Device)	XPSMCTC16
Cage Clamp Terminals for XPSMC32•• (includes Keying Device)	XPSMCTC32

Terminals

The following table shows the terminals of XPSMC Safety Controllers:





The following table explains the layout of the terminals:

Terminal Layout	Meaning
A1-A2	24 Vdc power supply; A1 is the + pole (+24 VDC), A2 is the - pole (0 VDC, GND)
GND	It is identical to the 0 VDC potential on A2 for loads on the o1-o6 semiconductor safety-related outputs.
o1-o6	semiconductor safety-related outputs
13-44	potential-free safety-related relay outputs equipped with contacts
c1-c8	control outputs for safety-related input power supply The control outputs provide a signal that enables detection of cross circuit and detection of voltage intrusion for the connected control components.
i1-i16 or i1 to i32	safety-related inputs
H1	connection for muting lamp The supply voltage must be taken from the same source which also supplies the XPSMC Safety Controller.

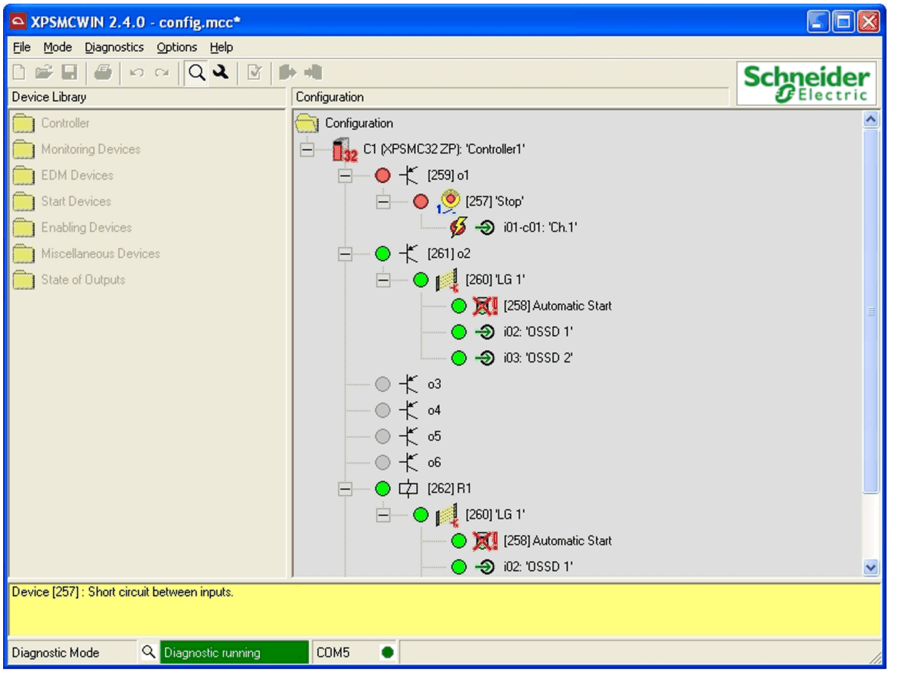
Error Codes

Error Code Dialog Box

The diagnostic window is available within the XPSMCWIN software. Debugging a configuration is possible using this tool.

Diagnostics are indicated with the error information along with the device index number(s).

The following image is an example of the diagnostics view mode:



NOTE: The device number/index in brackets [] identifies the devices in the configuration. The indexes for the devices can be found in the configuration tree itself and in the protocol of the configuration.

Error codes and explanations of the XPSMC Safety Controller:

Code	Explanation	Status
1	short-circuit between inputs	error
2	potential hardware problem detected	
3	muting error detected	
4	override timeout	
5	timeout error detected	
6	overtravel exceeded	
7	short-circuit	
8	muting lamp non-operational	
9	cam switch mechanism non-operational	
10	press safety valve non-operational	
11	external voltage detected	
12	output will not switch ON	
13	potential shaft / chain problem detected	
16	reset button blocked	indication
17	timeout	
18	incomplete opening	
19	start interlock active	
20	open circuit	
21	delay time running	
22	check locking device	
23	check valve	
24	unexpected muting signal	
25	sensor activated permanently	
26	restart interlock active	
27	incomplete closing	
28	no mode selection	
29	reoperate safety means	
30	open and close command active	
31	Emergency Stop pressed	

NOTE: The diagnostic explanations are shown in the XPSMCWIN diagnostics. In fieldbus communications only the error codes are transmitted but not the explanations.

Description of Profibus DP Parameter and Settings

Introduction

This section provides an overview of the Profibus DP parameter and settings.

To configure the Profibus DP Master you require a network configuration tool such as Sycon 2.9 or greater. Other Profibus DP network configuration tools may be used. The GSD files for the XPSMC Safety Controller are available either from the Safety Suite CD or from www.se.com. In addition, refer to Connection of the XPSMC Safety Controller with Profibus and Sycon 2.9, page 112.

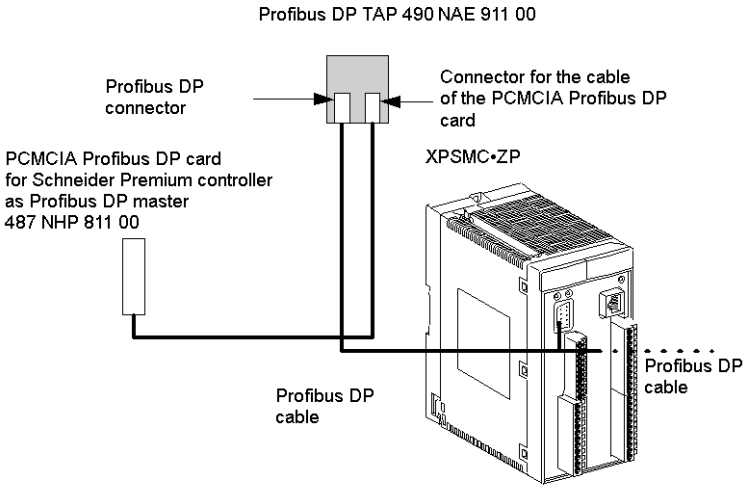
Profibus DP Communication Port

Introduction

The following information gives you an overview of the Profibus DP communication port and a wiring example.

Wiring Example

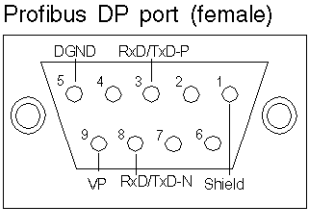
The following figure shows the connection of an XPSMC Safety Controller to a Profibus DP system:



NOTE: Connect the shield of the fieldbus cable with the functional ground near the product.

Profibus DP Pin Assignment

The following figure shows the pin assignment of the Profibus DP connectors:



(For details, see tables below)

The following table shows the Profibus DP pin assignment:

Pin No.	Signal	Description
1	Shield	Shield/functional ground
2	-	Reserved
3	RxD/TxD-P	Receive/transmit data plus (B wire)
4	-	Reserved
5	DGND	Data ground (reference potential for VP)
6	-	Reserved
7	-	Reserved
8	RxD/TxD-N	Receive/transmit data minus (A wire)
9	VP	Supply voltage plus (+5 VDC)

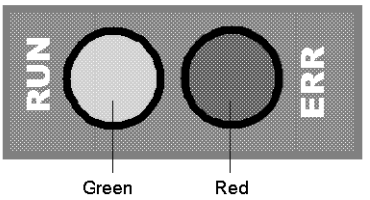
Profibus DP LEDs

Introduction

The following information helps you to understand the status of the Profibus DP communication. The status is displayed by LEDs.

Profibus DP LEDs

The following image shows the LEDs of the XPSMC••ZP:



Profibus DP States

The following table shows the possible states of the Profibus DP LEDs:

RUN LED	ERR LED	Description
on	on	Profibus DP hardware is OK.
on	off	The status is normal, communication is OK.
off	off	Profibus DP hardware is not OK.
off	on	Communication is not possible, because the configuration is missing or the hardware is non-operational.

Data Exchange

Introduction

The following information helps you to setup your Profibus DP data exchange.

Profibus DP Input Data Exchange

The following table shows the Profibus DP input data exchange for the hardware and configuration:

Profibus DP Word	High Byte	Low Byte	Details
1	Mode	Status	Mode bit **0** reset button pressed **1** XPSMC alive **4** 1 = XPSMC16 0 = XPSMC32 **5** 1 = after POWER UP or START command and until self test has finished **6** config. valid **7** received STOP command Status bit **0** RUN **1** CONF **3** INT Error **4** EXT Error **5** STOP **6** STATUS_R_S
2	Reserved	Reserved	Reserved

The following table shows the Profibus DP input data exchange for the I/O Data:

Profibus DP Word	High Byte	Low Byte	Details
3	input data (input 1 -8)	input data (input 9 -16)	Bit: 1 = corresponding input / output on
4	input data (input 17 - 24)	Input data (input 25 -32)	
5	unused (0)	output data (output 1-8)	

The following table shows the Profibus DP input data exchange for the detected I/O Errors:

Profibus DP Word	High Byte	Low Byte	Details
6	input error (input 1 - 8)	input error (input 9 - 16)	Bit: 1 = error detected at corresponding input / output
7	input error (input 17 - 24)	input error (input 25 - 32)	
8	unused (0)	Output data (output 1-8)	

The following table shows the Profibus DP input data exchange for the diagnostic explanations (DH):

Profibus DP Word	High Byte	Low Byte	Details
9	(DH 1) index high	(DH 1) index low	Index: software device number Message: diagnostic explanation (see chapter Error Codes, page 51)
10	unused (0)	(DH 1) message	
11	(DH 2) index high	(DH 2) index low	
12	unused (0)	(DH 2) message	
13	(DH 3) index high	(DH 3) index low	
14	unused (0)	(DH 3) message	

Profibus DP Parameters

An interface is provided to exchange data between the XPSMC Safety Controller and the Profibus DP port. Below is a description of the Profibus DP parameter. Through the XPSMCWIN configuration software the Profibus DP node address can be set in the range between 1–125.

Description of CANopen Parameter and Settings

Introduction

This section provides an overview of the CANopen parameter and settings.

To configure the CANopen master you require a network configuration tool such as Sycon 2.9 or greater. Other CANopen network configuration tools may be used. The EDS files for the XPSMC Safety Controller are available either from the Safety Suite CD or from www.se.

com. Refer to Connection of the XPSMC Safety Controller with CANopen and Sycon 2.9, page 101.

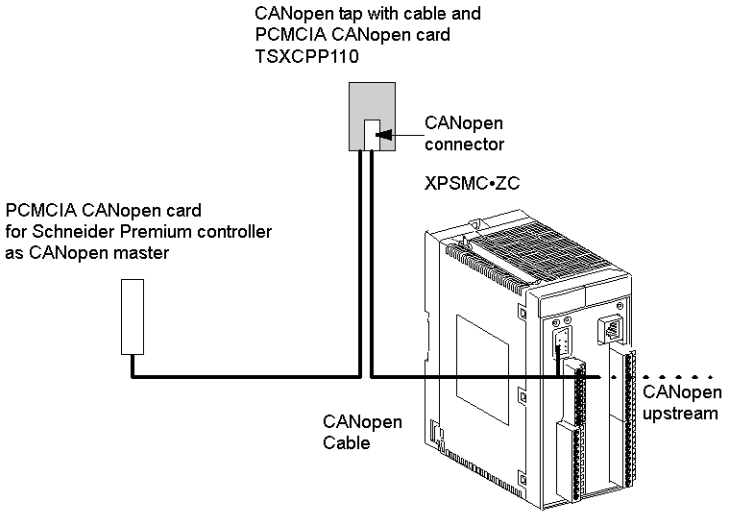
CANopen Communication Port

Introduction

The following information gives you an overview of the CANopen communication port and a wiring example.

Wiring Example

The following figure shows the connection of an XPSMC Safety Controller to a CANopen system:

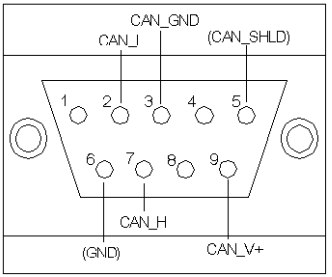


NOTE: Connect the shield of the fieldbus cable with the functional ground near the product.

CANopen Pin Assignment

The following figure shows the pin assignment of the CANopen connectors:

CANopen port (male)



(For details, see tables below)

The following table shows the CANopen pin assignment:

Pin No.	Signal	Description
1	-	Reserved
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_GND	CAN Ground
4	-	Reserved
5	(CAN-SHLD)	Optional CAN shield
6	(GND)	Optional CAN Ground
7	CAN_H	CAN_H bus line (dominant high)
8	-	Reserved (error line)
9	(CAN_V+)	Optional CAN external positive supply

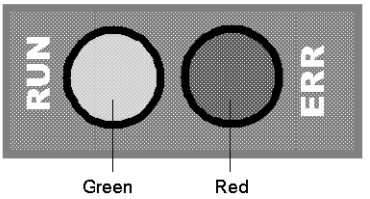
CANopen LEDs

Introduction

The following information helps you to understand the status of the CANopen communication. The status is displayed by LEDs.

CANopen LEDs

The following image shows the LEDs of the XPSMC••ZC:



CANopen States

The following table shows the possible states of the CANopen LEDs:

RUN LED	ERR LED	Description
on	off	CANopen hardware is OK. The status is normal, communication is possible.
off	off	CANopen hardware is not OK.
Flashing 3 times then Error LED flashes 1 time, repeats		Configured and waiting for communication.
off	on	Communication is not possible.
off	single flash (one short flash followed by a pause)	At least one of the error counters of the CANopen controllers has reached or exceeded the alert level (too many errors detected).
off	double flash (two short flashes with a pause)	A guard event or a heartbeat event has occurred.

CANopen Network Length and Stub Length

Network Length and Bit Rate

The length is restricted by the bit rate due to the bit arbitration process.

Bit rate	Maximum Length
1 Mbit/s	20 m/65 ft
800 kbit/s	40 m/131 ft
500 kbit/s	100 m/328 ft
250 kbit/s	250 m/820 ft
125 kbit/s	500 m/1640 ft
50 kbit/s	1000 m/3280 ft
20 kbit/s	2500 m/8202 ft
10 kbit/s	5000 m/16404 ft

In documents about CANopen, you will find often 40 m/131 ft as a maximum length at 1 Mbit/s.

This length is calculated without electrical isolation as used in the Schneider Electric CANopen devices.

With the electrical isolation, the maximum network length calculated is 4 m/13 ft at 1 Mbit/s.

However, the experience shows that 20 m/65 ft are the practical length that could be shorten by stubs or other influences.

Length Limitations Concerning Stubs

Length limitations concerning stubs have to be taken into account and are fixed by the following parameters.

Bit Rate (kbits/s)	L_{max} [m/ft] (1)	ΣL_{max} [m/ft] Local Star (2)	Interval $_{min}$ [m/ft] 0.6 x ΣL_{Local} (3)	ΣL_{max} [m/ft] On All Bus (4)
1000	0.3 m/0.9 ft	0.6 m/1.9 ft	-	1.5 m/4.9 ft
800	3 m/9.8 ft	6 m/19.7 ft	3.6 m/11.8 ft	15 m/49 ft
500	5 m/16.5 ft	10 m/32 ft	6 m/19.7 ft	30 m/98 ft
250	5 m/16.5 ft	10 m/32 ft	6 m/19.7 ft	60 m/196.8 ft
125	5 m/16.5 ft	10 m/32 ft	6 m/19.7 ft	120 m/393 ft
50	60 m/196.8 ft	120 m/393 ft	72 m/236 ft	300 m/984 ft
20	150 m/492 ft	300 m/984 ft	180 m/590,5 ft	750 m/2460.5 ft
10	300 m/984 ft	600 m/1968 ft	360 m/1181 ft	1500 m/4921 ft

(1)	L_{max}: Maximum length for 1 stub.
(2)	ΣL_{max} Local Star: Maximum cumulative length of stubs in the same point when using a multi-port TAP creating a local star.
(3)	Interval $_{min}$: Minimum distance between 2 TAP. Value for a maximum length of derivation in the same point. Could be computed case by case for each derivation. Interval $_{min}$ between 2 derivation is 60 % of the cumulative length of derivations at the same point.
(4)	ΣL_{max} On All Bus: Maximum cumulative length of stubs on the bus.

Use of Repeaters

A repeater should be used when more then 64 devices are used.

As repeaters add a propagation delay in the bus, this delay reduces the maximum network length of the bus.

A propagation delay of 5 ns is equal to a length reduction of 1 m/3.2 ft.

A repeater with e.g. 150 ns delay reduces the bus length therefore by 30 m/98 ft.

CANopen Data Exchange

Introduction

The following information helps you to run your CANopen data exchange.

CANopen Parameters

An interface is provided to exchange data between the XPSMC Safety Controller and the CANopen part. Below is a description of CANopen parameters.

The CANopen parameters can be set by the XPSMCWIN configuration software.

CANopen parameters are as follows:

1. bit rate,
   - 20 kBit/s
   - 50 kBit/s
   - 125 kBit/s
   - 250 kBit/s
   - 500 kBit/s
   - 800 kBit/s
   - 1 Mbit/s
2. node address
   - 1 - 127

Default bit rate is 250 kBit/s.

These parameters can be adjusted with the XPSMCWIN Software. The .eds file describes the object directory.

The PDOs are statically mapped. There are 4 PDOs used for the parameters of the XPSMC Safety Controller.

Firmware versions earlier than 2.40: PDOs 5 to 8 are used.

Firmware version 2.40 or greater: Depending on the setting in the XPSMCWIN software the PDOs 1 to 4 or the PDOs 5 to 8 are used.

The following table shows the PDO mapping:

PDO*	**Byte**	**Object Index, Subindex**	**Details**
PDO 1 or PDO 5	1.Byte	2000	status
PDO 1 or PDO 5	2.Byte	2001	mode
PDO 1 or PDO 5	3.Byte	2002	reserved
PDO 1 or PDO 5	4.Byte	2003	reserved
PDO 1 or PDO 5	5.Byte	2004	input data state 9-16
PDO 1 or PDO 5	6.Byte	2005	input data state 1-8
PDO 1 or PDO 5	7.Byte	2006	input data state 25-32
PDO 1 or PDO 5	8.Byte	2007	input data state 17-24
PDO 2 or PDO 6	1.Byte	2008	output data state 1-8
PDO 2 or PDO 6	2.Byte	2009	unused
PDO 2 or PDO 6	3.Byte	200A	input error 9-16

PDO*	Byte	Object Index, Subindex	Details
PDO 2 or PDO 6	4.Byte	200B	input error 1-8
PDO 2 or PDO 6	5.Byte	200C	input error 25-32
PDO 2 or PDO 6	6.Byte	200D	input error 17-24
PDO 2 or PDO 6	7.Byte	200E	output error 1-8
PDO 2 or PDO 6	8.Byte	200F	unused
PDO 3 or PDO 7	1.Byte	2010	diagnostic information index 1 low
PDO 3 or PDO 7	2.Byte	2011	diagnostic information index 1 high
PDO 3 or PDO 7	3.Byte	2012	diagnostic information message 1
PDO 3 or PDO 7	4.Byte	2013	unused
PDO 3 or PDO 7	5.Byte	2014	diagnostic information index 2 low
PDO 3 or PDO 7	6.Byte	2015	diagnostic information index 2 high
PDO 3 or PDO 7	7.Byte	2016	diagnostic information message 2
PDO 3 or PDO 7	8.Byte	2017	unused
PDO 4 or PDO 8	1.Byte	2018	diagnostic information index 3 low
PDO 4 or PDO 8	2.Byte	2019	diagnostic information index 3 high
PDO 4 or PDO 8	3.Byte	201A	diagnostic information message 3
PDO 4 or PDO 8	4.Byte	201B	unused
* depending on firmware version and software setting			

NOTE: For detailed diagnostic information see also Error Code Dialog Box, page 51 (table of error messages and indications).

Object Dictionary of the XPSMC••ZC Safety Controller

The **Object type** column of the table contains the object name according to the table below and is used to denote what kind of object is at that particular index within the Object Dictionary.

The following table explains the definitions used in the Object Dictionary:

Object code	Meaning
VAR	single value, such as unsigned8, boolean, float, integer16, visible string, etc.
ARR (ARRAY)	Multiple data field object where each data field is a simple variable of the same basic data type, e. g., ARRAY of unsigned16 etc. The Subindex 0 is of unsigned8 and thus is not part of the ARRAY data. The Subindex 0 sets the numbers of the elements in the ARRAY.
REC (RECORD)	Multiple data field object where the data fields may be any combination of simple variables. The Subindex 0 is of unsigned8 and thus is not part of the RECORD data. The Subindex 0 sets the numbers of the elements in the RECORD.

A data type determines a relation between values and encoding for data of that type. Names are assigned to data types in their type definitions.

The following table describes the various data types:

Acronym	Data Type	Range of Value	Data Length
BOOL	boolean	0=false, 1=true	1 byte
INT8	8 bit integer	-128 ... +127	1 byte
INT16	16 bit integer	-32768 ... +32767	2 byte
INT32	32 bit integer	-2147483648 ... +2147483647	4 byte
UINT8	8 bit of unsigned integer	0 ... 255	1 byte
UINT16	16 bit of unsigned integer	0 ... 65535	2 byte
UINT32	32 bit of unsigned integer	0 ... 4294967295	4 byte
STRING8	8 byte visible string	ASCII character	8 byte
STRING16	16 byte visible string	ASCII character	16 byte

The following table provides an overview of the Object Dictionary entries defined by the communication profile of the XPSMC••ZC. This is a snapshot of the Object Dictionary. Some Default Values, for instance Software version, may shown other values in the actual Object Dictionary of the XPSMC Safety Controller.

Index, Subindex	Name	Data Type	Object Type	Access Type	Default Value	Description
1000	device type	UINT32	VAR	ro	0x00010191	device type and profile
1001	error register	UINT8	VAR	ro	0x0000	error register
1003	pre-defined error field	UINT32	ARR	-	-	error history
1003, 0	number of errors	UINT8	VAR	rw	0x0	number of detected errors

Index, Subindex	Name	Data Type	Object Type	Access Type	Default Value	Description
1003, 1	Standard error field 1	UINT32	VAR	ro	0x0	error number of detected error 1
1003, 2	Standard error field 2	UINT32	VAR	ro	0x0	error number of detected error 2
1003, 3	Standard error field 3	UINT32	VAR	ro	0x0	error number of detected error 3
1003, 4	Standard error field 4	UINT32	VAR	ro	0x0	error number of detected error 4
1003, 5	Standard error field 5	UINT32	VAR	ro	0x0	error number of detected error 5
1005	COB-ID SYNC message	UINT32	VAR	rw	0x80	identifier of the SYNC object
1008	Manufacturer device name	STRING16	VAR	ro	XPSMCxxZC	device name
1009	Manufacturer hardware version	STRING16	VAR	ro	2.10	hardware version
100A	Manufacturer software version	STRING16	VAR	ro	1.08	software version
100C	Guard time	UINT16	VAR	rw	0x0	time period of node guarding (ms)
100D	Life time factor	UINT16	VAR	rw	0x00	factor of the node guarding protocol
1014	COB-ID EMCY message	UINT32	VAR	rw	0x80 + Node ID	identifier of the EMCY object
1016	Consumer heartbeat time	UINT32	ARR	-	-	consumer heartbeat object
1016, 0	Number of entries	UINT8	VAR	ro	0x1	number of nodes to be controlled
1016, 1	Consumer heartbeat time of node	UINT32	VAR	rw	0x0	time period and node ID of the controlled node
1017	Produce heartbeat time	UINT16	VAR	rw	0x0	time period of the heartbeat object
1018	Identity object	Identity	REC	-	-	identity object
1018, 0	Number of entries	UINT8	VAR	ro	4	number of objects
1018, 1	Vendor ID	UINT32	VAR	ro	0x0700005A	vendor ID
1018, 2	Product code	UINT32	VAR	ro	0x90102	product code
1018, 3	Revision number	UINT32	VAR	ro	0x00010008	revision number

Index, Subindex	Name	Data Type	Object Type	Access Type	Default Value	Description
1018, 4	Serial number	UINT32	VAR	ro	0x2800564	serial number
1029	Error behavior	UINT8	ARR	-	-	behavior in case of a detected error
1029, 0	Number of entries	UINT8	VAR	ro	0x1	number of entries
1029, 1	Communication error	UINT8	VAR	rw	0x0	behavior in case of a detected communication error
1200	Server SDO parameter	SDO parameter	REC	-	0x0	server SDO settings
1200, 0	Number of entries	UINT8	VAR	ro	0x2	number of attributes
1200, 1	COB-ID rx	UINT32	VAR	ro	0x600 + node ID	identifier client → server
1200, 2	COB-ID tx	UINT32	VAR	ro	0x580 + node ID	identifier client → client
1201	Server SDO parameter	SDO parameter	REC	-	0x0	server SDO settings
1201, 0	Number of entries	UINT8	VAR	ro	0x3	number of attributes
1201, 1	COB-ID rx	UINT32	VAR	ro	-	identifier client → server
1201, 2	COB-ID tx	UINT32	VAR	ro	-	identifier server → client
1201, 3	Node ID of SDO client	UINT8	VAR	rw	-	node ID of the SDO client
1804	TxPDO5 communication parameter	PDO CommPar	REC	-	-	first transmit PDO settings
1804, 0	Number of entries	UINT8	VAR	ro	0x3	number of settings
1804, 1	COB-ID	UINT32	VAR	rw	0x80000680	identifier of the PDO
1804, 2	Transmission mode	UINT8	VAR	rw	0xFF	transmission type
1804, 3	Inhibit time	UINT16	VAR	rw	0x0	minimum interval between two PDOs (100 s)
1804, 5	Event timer	UINT16	VAR	rw	0x0	time period of the event release (ms)
1805	TxPDO6 communication parameter	PDO CommPar	REC	-	-	second transmit PDO settings
1805, 0	Number of entries	UINT8	VAR	ro	0x3	number of settings
1805, 1	COB-ID	UINT32	VAR	rw	0x80000681	identifier of the PDO
1805, 2	Transmission mode	UINT8	VAR	rw	0xFF	transmission type

Index, Subindex	Name	Data Type	Object Type	Access Type	Default Value	Description
1805, 3	Inhibit time	UINT16	VAR	rw	0x0	minimum interval between two PDOs (100 µA)
1805, 5	Event timer	UINT16	VAR	rw	0x0	time period of the event release (ms)
1806	TxPDO7 communication parameter	PDO CommPar	REC	-	-	third transmit parameter
1806, 0	Number of entries	UINT8	VAR	ro	0x3	number of settings
1806, 1	COB-ID	UINT32	VAR	rw	0x80000682	identifier of the PDO
1806, 2	Transmission mode	UINT8	VAR	rw	0xFF	transmission type
1806, 3	Inhibit time	UINT16	VAR	rw	0x0	minimum intervals between two PDOs (100 µA)
1806, 5	Event timer	UINT16	VAR	rw	0x0	time period of the event release (ms)
1807	TxPDO8 communication parameter	PDO	REC	-	-	fourth transmit PDO settings
1807, 0	Number of entries	UINT8	VAR	ro	0x3	number of settings
1807, 1	COB-ID	UINT32	VAR	rw	0x80000683	identifier of the PDO
1807, 2	Transmission mode	UINT8	VAR	rw	0xFF	transmission type
1807, 3	Inhibit time	UINT16	VAR	rw	0x0	minimum interval between two PDOs (100 µA)
1807, 5	Event timer	UINT16	VAR	rw	0x0	time period of the event release (ms)
1A04	TxPDO5 mapping parameters	PDO mapping	REC	-	-	PDO mapping for TxPDO5
1A04, 0	Number of mapped objects	UINT8	VAR	ro	0x8	number of mapped objects
1A04, 1	Mapped mode byte	UINT32	VAR	ro	0x20000008	first mapped object
1A04, 2	mapped status byte	UINT32	VAR	ro	0x20010008	second mapped object
1A04, 3	reserved	UINT32	VAR	ro	0x20020008	third mapped object
1A04, 4	reserved	UINT32	VAR	ro	0x20030008	fourth mapped object

Index, Subindex	Name	Data Type	Object Type	Access Type	Default Value	Description
1A04, 5	Mapped input data state 1-8	UINT32	VAR	ro	0x20040008	fifth mapped object
1A04, 6	Mapped input data state 9-16	UINT32	VAR	ro	0x20050008	sixth mapped object
1A04, 7	Mapped input data state 17-24	UINT32	VAR	ro	0x20060008	seventh mapped object
1A04, 8	Mapped input data state 25-32	UINT32	VAR	ro	0x20070008	eighth mapped object
1A05	TxPDO6 mapping parameters	PDO mapping	REC	-	-	PDO mapping for TxPDO6
1A05, 0	Number of mapped objects	UINT8	VAR	ro	8	number of mapped objects
1A05, 1	unused	UINT32	VAR	ro	0x20080008	first mapped object
1A05, 2	Mapped output data state 1-8	UINT32	VAR	ro	0x20090008	second mapped object
1A05, 3	Mapped input error 1-8	UINT32	VAR	ro	0x200A0008	third mapped object
1A05, 4	Mapped input error 9-16	UINT32	VAR	ro	0x200B0008	fourth mapped object
1A05, 5	Mapped input error 17-24	UINT32	VAR	ro	0x200C0008	fifth mapped object
1A05, 6	Mapped input error 25-32	UINT32	VAR	ro	0x200D0008	sixth mapped object
1A05, 7	unused	UINT32	VAR	ro	0x200E0008	seventh mapped object
1A05, 8	Mapped output error 1-8	UINT32	VAR	ro	0x200F0008	eighth mapped object
1A06	TxPDO7 mapping parameters	PDO mapping	REC	-	-	PDO mapping for TxPDO7
1A06, 0	Number of mapped objects	UINT8	VAR	ro	8	number of mapped objects
1A06, 1	Mapped diagnostic information index 1 high	UINT32	VAR	ro	0x20100008	first mapped object
1A06, 2	Mapped diagnostic information index 1 low	UINT32	VAR	ro	0x20110008	second mapped object
1A06, 3	Mapped unused	UINT32	VAR	ro	0x20120008	third mapped object
1A06, 4	Mapped diagnostic information message 1 high	UINT32	VAR	ro	0x20130008	fourth mapped object

Index, Subindex	Name	Data Type	Object Type	Access Type	Default Value	Description
1A06, 5	Mapped diagnostic information message 1 low	UINT32	VAR	ro	0x20140008	fifth mapped object
1A06, 6	Mapped diagnostic information message 1	UINT32	VAR	ro	0x20150008	sixth mapped object
1A06, 7	Mapped unused	UINT32	VAR	ro	0x20160008	seventh mapped object
1A06, 8	Mapped diagnostic information message 2	UINT32	VAR	ro	0x20170008	eighth mapped object
1A07	TxPDO8 mapping parameters	PDO	REC	-	-	PDO mapping for TxPDO8
1A07, 0	Number of mapped objects	UINT8	VAR	ro	8	number of mapped objects
1A07, 1	Mapped diagnostic information message 3 high	UINT32	VAR	ro	0x20180008	first mapped object
1A07, 2	Mapped diagnostic information message 3 low	UINT32	VAR	ro	0x20190008	second mapped object
1A07, 3	Mapped unused	UINT32	VAR	ro	0x201A0008	third mapped object
1A07, 4	Mapped diagnostic information message 3	UINT32	VAR	ro	0x201B0008	fourth mapped object
2000	Status byte	UINT8	VAR	ro	-	Status bit **0** RUN **1** CONF **3** INT Error **4** EXT Error **5** STOP **6** STATUS_R_S

Index, Subindex	Name	Data Type	Object Type	Access Type	Default Value	Description
2001	Mode byte	UINT8	VAR	ro	-	Mode bit **0** reset button pressed **1** XPSMC alive **4** 1 = XPSMC16 0 = XPSMC32 **5** 1 = after POWER UP or START command and until self test has finished **6** config. valid **7** received STOP command
2002	Reserved	UINT8	VAR	ro	-	reserved
2003	Reserved	UINT8	VAR	ro	-	reserved
2004	Input data state 9-16	UINT8	VAR	ro	-	input data (input 9-16)
2005	Input data state 1-8	UINT8	VAR	ro	-	input data (input 1-8)
2006	Input data state 25-32	UINT8	VAR	ro	-	input data (input 25-32)
2007	Input data state 17-24	UINT8	VAR	ro	-	input data (input 17-24)
2008	Output data state 1-8	UINT8	VAR	ro	-	output error (output 1-8)
2009	Unused	UINT8	VAR	ro	-	unused
200A	Input error 9-16	UINT8	VAR	ro	-	input error (input 9-16)
200B	Input error 1-8	UINT8	VAR	ro	-	input error (input 1-8)
200C	Input error 25-32	UINT8	VAR	ro	-	input error (input 25-32)
200D	Input error 17-24	UINT8	VAR	ro	-	input error (input 17-24)
200E	Output error 1-8	UINT8	VAR	ro	-	output error (output 1-8)
200F	Unused	UINT8	VAR	ro	-	unused
2010	Diagnostic information 1 low	UINT8	VAR	ro	-	device number (low)
2011	Diagnostic information index 1 high	UINT8	VAR	ro	-	device number (high)
2012	Diagnostic information message 1	UINT8	VAR	ro	-	diagnostic explanation
2013	Unused	UINT8	VAR	ro	-	unused
2014	Diagnostic information index 2 low	UINT8	VAR	ro	-	device number (low)

Index, Subindex	Name	Data Type	Object Type	Access Type	Default Value	Description
2015	Diagnostic information index 2 high	UINT8	VAR	ro	-	device number (high)
2016	Diagnostic message 2	UINT8	VAR	ro	-	diagnostic explanation
2017	Unused	UINT8	VAR	ro	-	unused
2018	Diagnostic information message low	UINT8	VAR	ro	-	device number (low)
2019	Diagnostic information message 3 high	UINT8	VAR	ro	-	device number (high)
201A	Diagnostic information message 3	UINT8	VAR	ro	-	diagnostic explanation
201B	Unused	UINT8	VAR	ro	-	unused
5FFF	SE Data Object	SE-information	REC	-	-	Schneider Electric object
5FFF, 0	Number of entries	UINT8	VAR	ro	3	number of entries
5FFF, 1	Brand Name	STRING 16	VAR	ro	Telemecanique	brand name
5FFF, 2	Conformance Class	STRING 16	VAR	ro	S20	intern conformance class
5FFF, 3	Bus off counter	UINT8	VAR	rw	0x0	bus off counter

NOTE: For detailed information about the device number and the diagnostic explanations see also Error Code Dialog Box, page 51 (table of error messages and indications).

The following table provides information about transmission types:

Transmission type	PDO transmission				
	cyclic	acyclic	synchronous	asynchronous	RTR only
0	-	x	x	-	-
1 - 240	x	-	x	-	-
253	-	-	-	x	x
254	-	-	-	x	-
255	-	-	-	x	-

0: Node transmits the PDO synchronously with the SYNC object, but its transmission is event driven.

1-240: Node transmits the PDO once every 1-240 receptions of a SYNC object.

253: Node transmits PDO after a Remote Transmit Request

254: Mode of transmission is fully manufacturer specific.

255: Mode of transmission is defined in the device profile.

Appendices

What's in This Part

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Electrical Life of the Output Contacts 92
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Overview

Additional information that is not necessarily required to understand the documentation.

Brief Description of the Functional Devices

What's in This Chapter

Device Set....76
Monitoring Devices....78
EDM Device....81
Start Devices....81
Enabling Devices....82
Miscellaneous Devices....82
Output Functional Elements....84

Overview

This chapter contains brief descriptions of the functional devices.

NOTE: Time ranges given in the following devices have the basis of 20 ms response time. When using a basis of 30 ms the ranges are changing slightly.

Device Set

Overview

The XPSMC Safety Controller feature the following devices / functions.

Details of each function are provided in the XPSMCWIN Software manual.

Device Type	Devices
monitoring devices	• emergency stop 1-channel, 2-channels • safety guard 1-channel, 2-channels, 2-channels with lock • light curtain with transistor output, with relay output, with and without muting and monitoring of muting lamp • magnetic switch • two-hand control type IIIA*, type IIIC in accordance with EN 574 • safety mat, forming short circuit • zero speed detection
specific monitoring devices	• injection molding machine monitoring • basic hydraulic press valve monitoring • enhanced hydraulic press monitoring** • basic eccentric press monitoring • enhanced eccentric press monitoring** • seat valve monitoring • shaft / chain break monitoring
EDM devices	external device monitoring
start devices	automatic, non-monitored, monitored start
enabling devices	enabling devices with 2-channels, 3-channels
miscellaneous devices	• timer** • logical function: OR, AND*, XOR*, negation*, RS-flip-flop* • marker* • basic contact functions* • foot switch control • selector switch** • closed tool

An output of the controller can be configured to indicate an error state*. A safety-related input can optionally be used for a remote reset of the controller*.

NOTE: Devices marked by a star [*] are available with firmware version 2.40 or greater.

Functionality of devices marked by 2 stars [**] was enhanced with firmware version 2.40.

Monitoring Devices

Brief Descriptions of the Monitoring Devices

Monitoring Devices	Brief Description
Emergency Stop 1 Channel	• Monitors a single emergency stop contact. • Up to category 4, PL e, in accordance with ISO 13849 with the necessary fault exclusion for the input cabling. • The Emergency Stop devices need to be tested within the framework of the machine maintenance.
Emergency Stop 2 Channel	• Monitors 2 emergency stop contacts. • For a restart both contacts of the Emergency Stop must have been opened before. • Up to category 4, PL e, in accordance with ISO 13849. • The Emergency Stop devices need to be tested within the framework of the machine maintenance.
Safety Guard 1 Channel	• Monitors a single contact of a safety guard. • The device can be configured with or without a Start interlock. • Up to category 1, in accordance with ISO 13849.
Safety Guard 2 Channel	• Monitors 2 contacts of a safety guard. • The device can be configured with or without a Start interlock. • Synchronization time can be configured. • Up to category 4, PL e, in accordance with ISO 13849.
Safety Guard with Lock	• Monitors 2 contacts of a safety guard and an additional lock contact. • The device can be configured with or without a Start interlock. • Synchronization time can be configured. • Up to category 4, PL e, in accordance with ISO 13849.
Light Curtains with Transistor Output	• Monitors a light curtain unit with PNP outputs. • The XPSMC Safety Controller does not monitor the wiring to the OSSDs. • The device can be configured with or without a Start interlock. • Synchronization time for the inputs can be configured. • Up to category 4, PL e, in accordance with ISO 13849.
Light Curtains with Relay Output	• Monitors a light curtain unit with relay outputs. • The XPSMC Safety Controller monitors the cross-connections at the input wiring. • The device can be configured with or without a Start interlock. • Synchronization time for the inputs can be configured. • Up to category 4, PL e, in accordance with ISO 13849.

Monitoring Devices	Brief Description
Light Curtains with Muting and Monitoring of Muting Lamp, with Transistor Outputs	• Same characteristics as light curtains without muting and transistor outputs. • Additionally the device connects 4 muting sensors and a muting lamp in accordance with IEC 61496-1. • The muting lamp is monitored for short circuit or open circuit. For the lamp characteristics, refer to the technical data. • Synchronization time can be configured to create the muting signal in a group. • The maximum muting duration can be configured. • An override function with adjustable time is available. • Up to category 4, PL e, in accordance with ISO 13849.
Light Curtains with Muting and Monitoring of Muting Lamp, with Relay Outputs	• Same characteristics as light curtains without muting and transistor outputs. • Additionally the device connects 4 muting sensors and a muting lamp in accordance with IEC 61496-1. • The muting lamp is monitored for short circuit or open circuit. For the lamp characteristics, refer to the technical data. • Synchronization time can be configured to create the muting signal in a group. • The maximum muting duration can be configured. • An override function with adjustable time is available. • Up to category 4, PL e, in accordance with ISO 13849.
Magnetic Switch	• Monitors the (non-forcibly guided) contacts (NC + NO) of a magnetic switch. • The device can be configured with or without start interlock. • Synchronization time can be configured. • Up to category 4, PL e, in accordance with ISO 13849.
Two-Hand Control Type IIIA* in accordance with EN 574 / ISO 13851	• Monitors 2 inputs for 2 push buttons connected to build a two-hand control type IIIA. • The synchronization time is fixed at ≤500 ms. • Up to category 1, PL b, in accordance with ISO 13849.
Two-Hand Control Type IIIC in accordance with EN 574 / ISO 13851	• Monitors 4 inputs to connect 2 push buttons with an NO and NC contact, each to build a two-hand control type IIIC. • The synchronization time is fixed at ≤500 ms. • Up to category 4, PL e, in accordance with ISO 13849.
Safety Mat	• Monitors a safety mat that forms a short circuit. • The maximum input capacitance of the mat must not exceed 120 nF. • Up to category 3, PL d, in accordance with ISO 13849.

Monitoring Devices	Brief Description
Zero Speed Detection	• For zero speed detection 2 proximity sensors need to be connected to safety-related inputs i01 and i02. • The sensors detect the movement by monitoring the teeth on a cog which is connected to a rotating shaft. The output will not be enabled unless a frequency below the threshold frequency set by the user is detected. • The threshold value can be configured for a frequency of 0.05 to 20 Hz (tolerance up to 15%). • A frequency calculator within the configuration software XPSMCWIN provides a mean to calculate frequency from RPM and number of cogs concerning tolerance, increments and so on. • The maximum transmitter frequency is 450 Hz. • The device cannot be used together with a shaft / chain break monitoring device in the same configuration. • Up to category 4, PL e, in accordance with ISO 13849.
Injection Molding Machine	• The device monitors the safety guard for the tool area (2 position switches) and a third position switch for main stop-valve monitoring. • Synchronization time can be configured. • Up to category 4, PL e, in accordance with ISO 13849.
Hydraulic Press Valve Monitoring	• The device performs monitoring of safety valves of hydraulic presses using limit switches or proximity switches. • Synchronization time (reaction time) of the valve switches can be configured. • Up to category 4, PL e, in accordance with ISO 13849.
Hydraulic Press Extended (2)	• The device performs monitoring of hydraulic presses with valve control and optional over-travel monitoring. • Several optional settings are possible. • Up to category 4, PL e, in accordance with ISO 13849.
Eccentric Press	• The device performs monitoring of eccentric press cycles. • Safety valves can be monitored optionally. • Synchronization time of the valves can be configured. • Up to category 4, PL e, in accordance with ISO 13849.
Eccentric Press Extended (2)	• The device performs monitoring of eccentric press cycles. • Start and safety means can be assigned separately. • The behavior of the monitoring device is widely configurable by options. • Up to category 4, PL e, in accordance with ISO 13849.
Shaft / Chain Break Monitoring	• The device monitors the movement of a shaft or chain by detecting impulses with the help of a proximity switch. • The switch needs to be connected to input i01 or i02. Hence the device cannot be used with zero speed detection in the same configuration. • The shaft / chain break monitoring can be used in conjunction with the eccentric press 2 device to monitor the transmission from the eccentric shaft to the cam.

Monitoring Devices	Brief Description
Seat Valve Monitoring	• Monitors the operation of a valve. • There is an input for the start signal for the valve movement and an input for the valve contact providing the position of the valve. • The valve contact can be chosen between NO and NC. • The synchronization time between start and result signal can be monitored.
NOTE: Features marked by a star [*] are available in firmware version 2.40 or greater.	

EDM Device

Brief Description of the EDM Device

EDM Device	Brief Description
EDM (External Device Monitoring)	• The device is intended to monitor NC contacts of external relays to get a feedback of their switching status. • The allowable reaction time of the external contacts can be configured. • Up to category 4, PL e, in accordance with ISO 13849.

Start Devices

Brief Descriptions of the Start Devices

Start Devices	Brief Description
Automatic Start	There is no start input. Starting occurs immediately, once the relevant input conditions have been met.
Non-Monitored Start	The start condition is valid when the input is closed.
Monitored Start	• The start condition is valid only when a transition of the signal was detected. • The type of transition, negative edge or positive edge, can be chosen.

Enabling Devices

Brief Descriptions of the Enabling Devices

Enabling Devices	Brief Description
Enabling Device 2 Channel	• A three-stage enabling switch with 2 contacts is monitored. • A maximum enabling time can be defined. • Up to category 1, PL b, in accordance with ISO 13849.
Enabling Device 3 Channel	• A three-stage enabling switch with 3 contacts is monitored. • A maximum enabling time can be defined. • Up to category 4, PL e, in accordance with ISO 13849.

Miscellaneous Devices

Brief Description of Miscellaneous Devices

Miscellaneous Devices	Brief Description
Timer	The timer function provides • switch on delay • switch off delay • switch on pulse • switch off pulse • pulse generator*
Marker*	• A marker can be used like an output but without physical representation. • Up to 8 markers are available.
Basic Switches*	• The following basic switches are provided: ◦ single contact ◦ double contact ◦ double contact antivalent (NC / NO) • A start interlock is optionally available for the switches. • For the 2-channel switches the synchronization time of the contacts can be monitored. • The contacts can be driven by control outputs or by the supply. • Up to category 4, PL e, in accordance with ISO 13849.

Miscellaneous Devices	Brief Description
Logic Functions	• Logic functions provided are ◦ AND* ◦ OR ◦ XOR* ◦ NOT (negation)* ◦ RS-flip-flop*, optionally set or reset dominant • Refer to the hazard message hereafter. • The logic functions can have up to 255 inputs (the actual maximum device count per controller may limit this value).
NOTE: Features marked by a star [*] are available with firmware version 2.40 or greater.	

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Ensure that the required safety level of the application is not compromised by using the NOT logic device.
- Carefully analyze the inputs and outputs to be inverted and understand how the inversion affects the application, especially in terms of functional safety.

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

Miscellaneous Devices	Brief Description
Selector Switch	• The function is used to select a set of other devices (1 out of up to 6). • The selector reads the status of a hardware selector switch. • The switch has a maximum of 6 positions. • It can be selected if attached devices need to be re-operated after changing positions*.
Foot Switch Control	• The device monitors an NO and an NC contact, both driven by the same control output as it is usual for foot switches. • Up to category 4, PL e, according to ISO 13849.
Closed Tool	• The closed tool device provides a steady active signal. • It is to be used only in conjunction with a selector switch on press devices. By selecting the switch position with the closed tool it is indicated that no safety means are needed due to the use of a “safe” tool (see ISO16092).
NOTE: Features marked by a star [*] are available with firmware version 2.40 or greater.	

⚠DANGER

UNPROTECTED MACHINE OPERATIONS

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

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

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

Output Functional Elements

Brief Descriptions of the Output Functional Elements

Output Functional Elements	Brief Description
Stop Category 0 (IEC 60204)	• Safety outputs are switched off without delay at the end of the release condition. • The 2 double relay outputs and the 6 semiconductor outputs can be operated in stop category 0.
Stop Category 1 (IEC 60204)	• Safety outputs are switched off after a certain time delay (which can be configured from 0.1 to 300 s) from the end of the release condition. • The 2 double relay outputs and the 6 semiconductor outputs can be operated in stop category 1.

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

Examples of Applications

What's in This Chapter

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Application Example - Safety Guard with Enabling Device 88
Application Example for Several Functions - Emergency Stop, Two-Hand Control, Safety Mat 90

Overview

This chapter contains application examples.

Application Example - Light Curtain With Muting

Introduction

The following connection example shows an ESPE with muting. The following devices are connected:

- light curtain with muting
- a monitored muting indicator
- a start button
- relay output (230 VAC)

Light Curtain With Muting Example

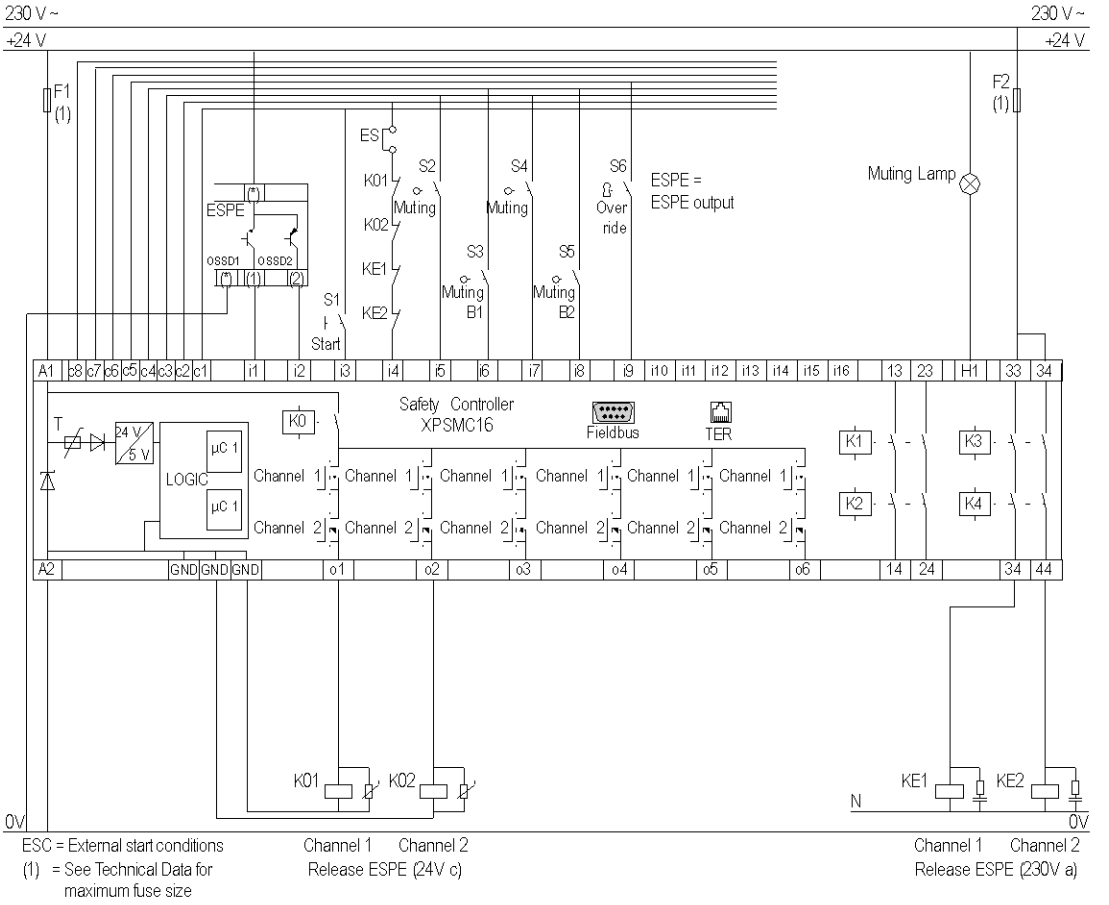
⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

The following diagram shows the wiring of an ESPE with muting:



NOTE: The wiring for the 32 input version is identical for the additional inputs available for configuration.

Application Example - Safety Guard with Enabling Device

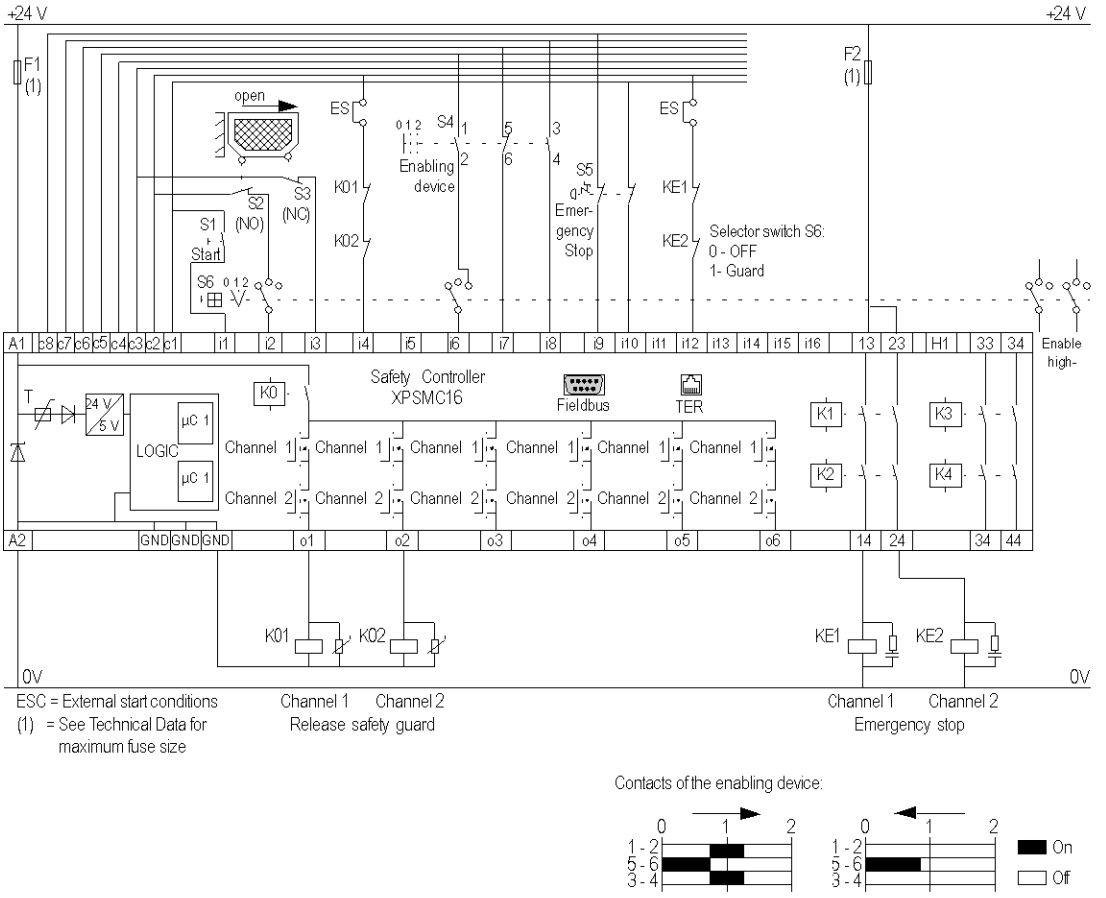
Introduction

The following connection example shows a Safety Guard with enabling device. The following devices are connected:

- Emergency Stop
- Enabling Switch
- Selector Switch

Safety Guard with Enabling Device Example

The following diagram shows the wiring of a Safety Guard with enabling device



NOTE: The wiring for the 32 input version is identical for the additional inputs available for configuration.

Application Example for Several Functions - Emergency Stop, Two-Hand Control, Safety Mat

Introduction

The following connection example shows the wiring of several functions. The following devices are connected:

- Two-Hand Control
- Safety Mat
- Emergency Stop
- Relay outputs (24 VDC and 230 VAC)

Application Example

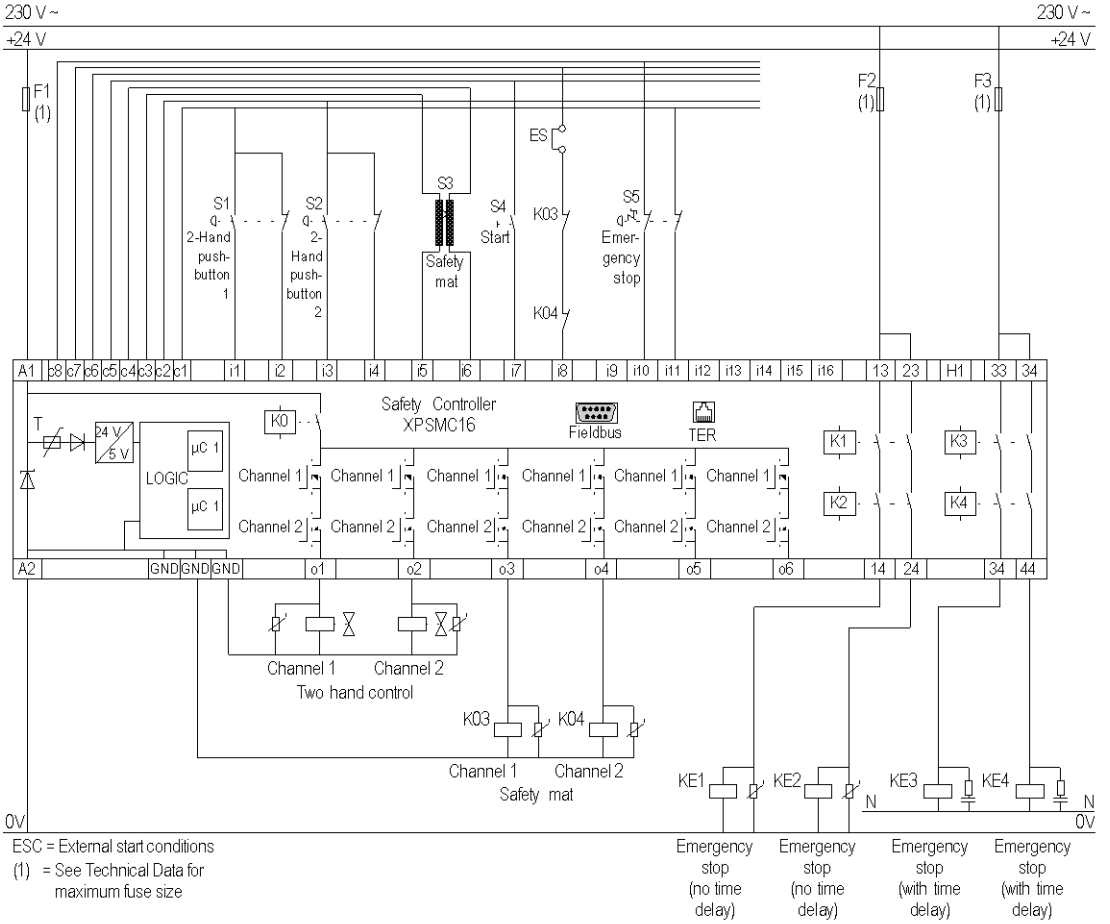
⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

The following diagram shows the wiring of several device (see list above):



NOTE: The wiring for the 32 input version is identical for the additional inputs available for configuration.

Electrical Life of the Output Contacts

What's in This Chapter

Diagram of the Electrical Life 92

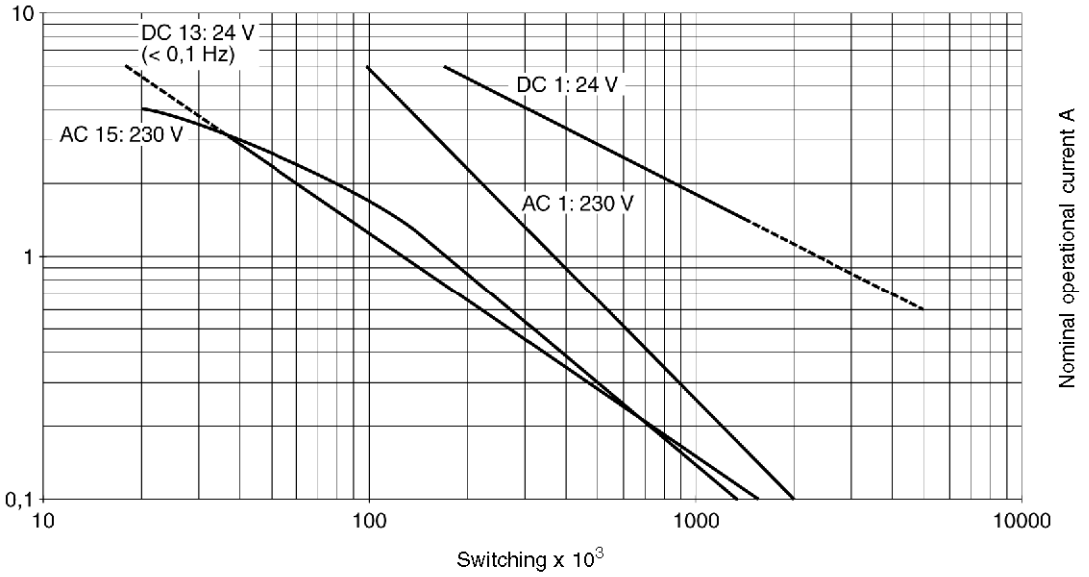
Overview

This chapter contains a diagram of the electrical life of the output contacts determined by IEC 60947-5-1 / Annex C.3.

Diagram of the Electrical Life

Diagram

Electrical life of the output contacts determined by IEC 60947-5-1 / Annex C.3



Examples for Bus Configuration

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Connection of the XPSMC Safety Controller with CANopen and Sycon 2.8 93
Connection of the XPSMC Safety Controller with CANopen and Sycon 2.9 101
Configuration of Unity Pro for CANopen 110
Connection of the XPSMC Safety Controller with Profibus and Sycon 2.9 112

Overview

This chapter contains a description of the bus configuration for Profibus and CANopen.

Connection of the XPSMC Safety Controller with CANopen and Sycon 2.8

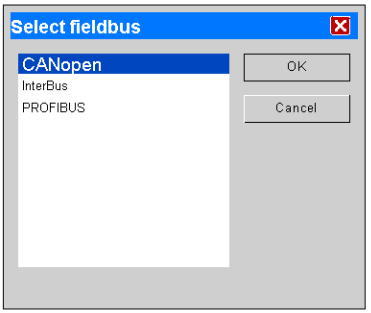
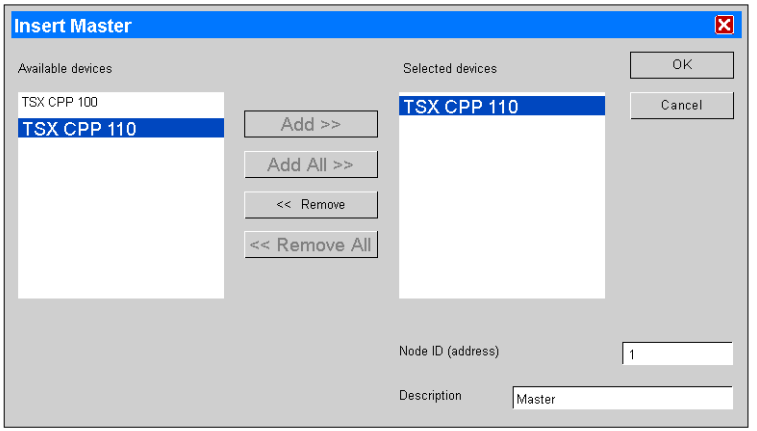
Introduction

In this example, the XPSMC Safety Controller is connected via CANopen to the CANopen master (e.g. Premium TSX with a TSX CPP110 CANopen interface from Schneider Electric). The fieldbus is configured using Sycon 2.8 from Schneider Electric and the controller is configured using Unity Pro from Schneider Electric.

NOTE: The cables, the connectors and the resistors for CANopen must be in accordance with the CiA DRP 303-1 standard.

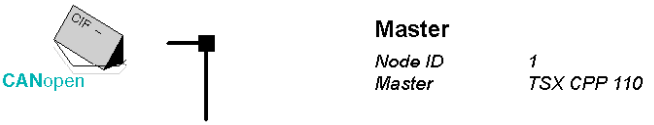
Configuration Using Sycon 2.8

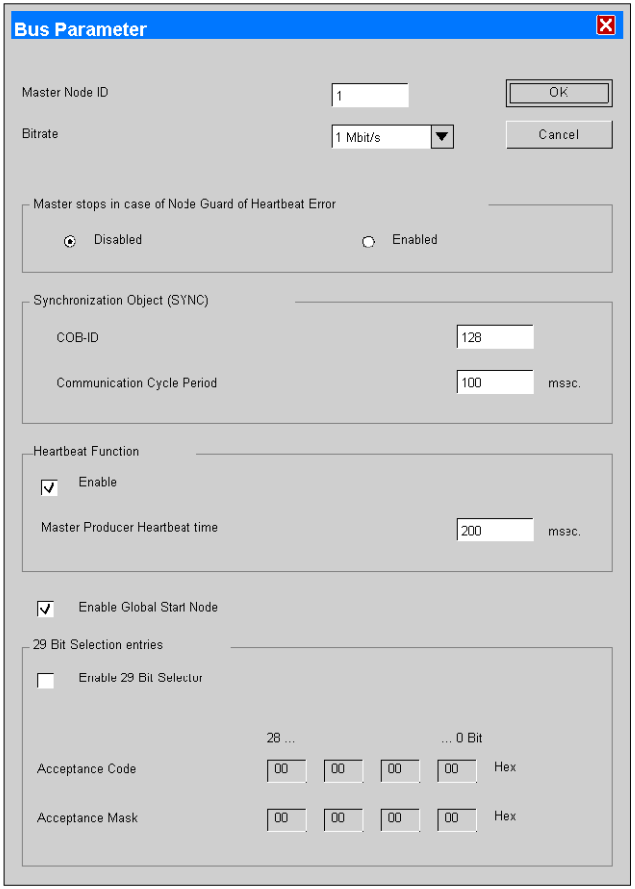
The following table shows how to configure CANopen bus using Sycon 2.8:

Step	Action
1	Copy the EDS file **.eds* into the CANopen EDS directory. The standard installation directory is: *c:\programs\Schneider\SyCon\Fieldbus\CANopen\EDS* Copy the 3 CANopen pictures (**.dib*) into the designated directory, e.g. *c:\programs\Schneider\SyCON\Fieldbus\CANopen\BMP*. You will find this EDS file and the pictures on the supplied CD or you can download it from the Schneider Electric homepage www.se.com.
2	Start the Sycon **System Configurator**.
3	Select the CANopen as fieldbus. 
4	Choose the CANopen master for the configuration. You will get the dialog box by using **Insert > Master**. 

Step	Action

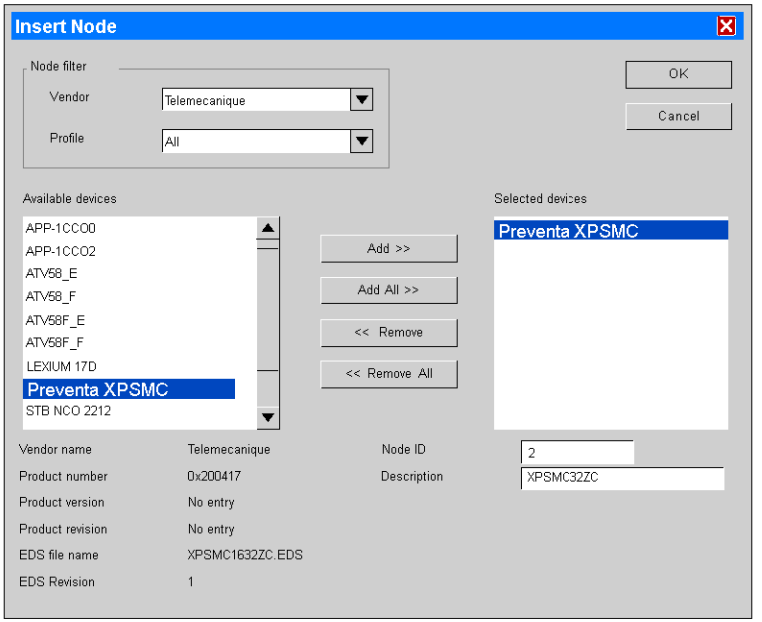
5	Select the TSX CPP 110 CANopen module and press **Add** to adopt it to your configuration. Declare the node address and description. The description is limited to 32 characters.
	• Node ID (address)
	`1`
	• Description
	`Master`

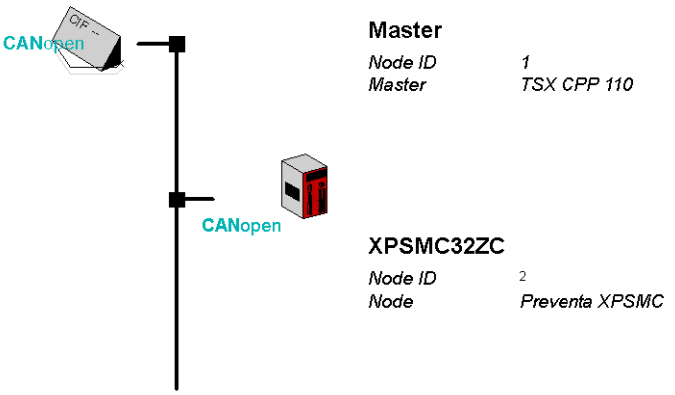
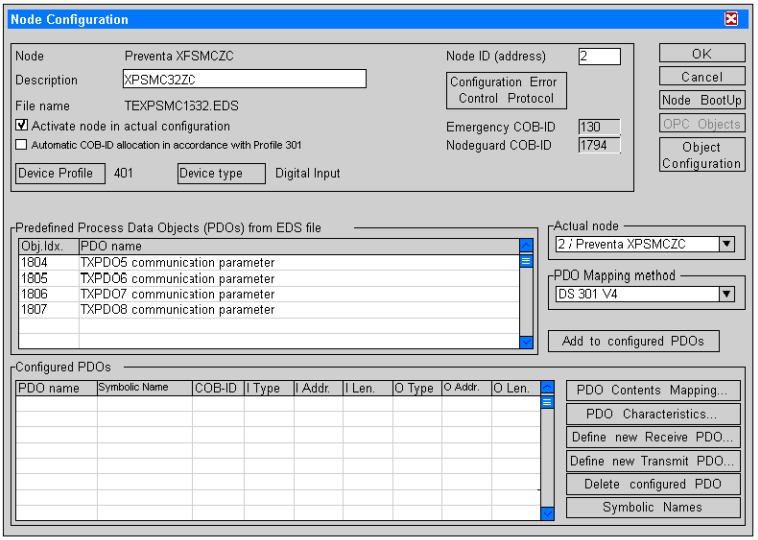
6	The following figure will be displayed. 

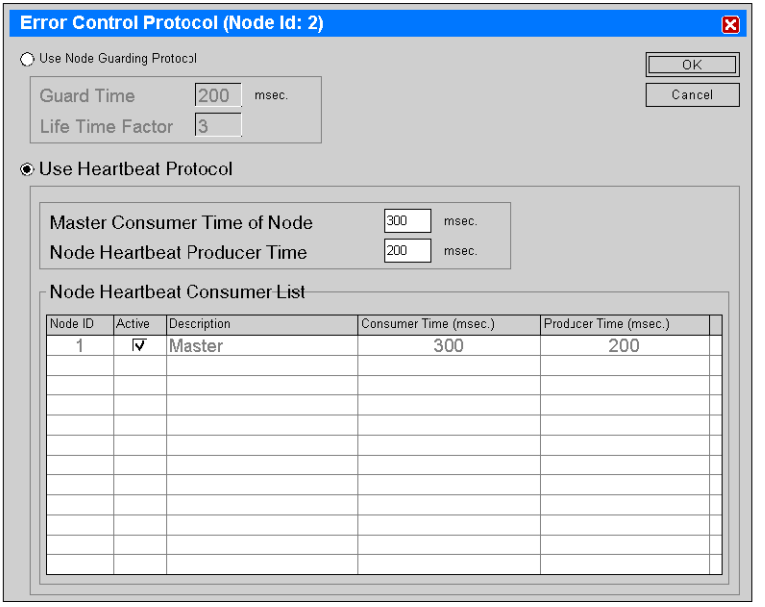
Step	Action
7	Open the bus parameter settings under **Settings > Bus Parameter**. The following dialog will be displayed: 

Step	Action

8	Configure the following parameters:
	• **Master Node ID**
	`1`
	• **Bitrate**
	`1 Mbit/s`
	• **Master stops in case of Node Guard or Heartbeat Error**
	◦ **Disabled**
	• **Synchronization Object (SYNC)**
	◦ **COB-ID**
	`128`
	◦ **Communication Cycle Period**
	`100` msec.
	• **Heartbeat Function**
	◦ **Enable**
	◦ **Master Producer Heartbeat Time**
	`200` msec.
	• **Enable Global Start Node**
	• **29 Bit Selection entries**
	nothing
	Press **OK** to confirm the settings.

Step	Action
9	After the selection of the CANopen master, insert the CANopen node. Insert the node by using **Insert > Node**. The following dialog will be displayed: 
10	Select the Preventa XPSMC Safety Controller from the vendor Telemecanique (older) or Schneider Electric (newer). After the selection press **Add >>** to adopt it.
11	Configure the following parameters: • **Node ID** 2 • **Description** XPSMC32ZC **NOTE:** The parameters are examples and can be changed. The maximum length of the description is 32 characters.

Step	Action
12	Press **OK** to confirm the settings. The following figure will be displayed: 
13	Select **Settings > Node Configuration** to configure the node settings. The following dialog will be displayed:  **NOTE:** Here you can change the **Node-ID** and **Description** if necessary.

Step	Action
14	Select a PDO, which transfer the data of the XPSMC Safety Controller and press **Add** to configured PDOs. Of each PDO the properties must be confirmed. The PDOs contain the following properties: • **TXPDO5** Mode and Status-Byte, the Input data 1-32 COB-ID e.g. `1668` • **TXPDO6** Output data 1-8, Input and Output Error COB-ID e.g. `1669` • **TXPDO7** Diagnostic explanation 1 and 2 COB-ID e.g. `1670` • **TXPDO8** Diagnostic explanation 3 COB-ID e.g. `1671` Press **Configuration Error Control Protocol** to open the **Error Control Protocol** dialog.
15	The following dialog will be displayed: 
16	Select the **Error Control Protocol Node Guarding Protocol** or **Heartbeat Protocol**.

Step	Action
17	Select the following parameter: For **Node Guarding Protocol** • **Guard Time** 200 msec • **Life Time Factor** 2 For **Heartbeat Protocol** • **Master Consumer Time of Node** 220 msec • **Node Heartbeat Producer Time** 200 msec • **Node Heartbeat Consumer List** Activate the specific master.
18	Press **OK** to confirm the **Error Control Protocol** settings.
19	Press **OK** to confirm the **Node Configuration** settings.

Connection of the XPSMC Safety Controller with CANopen and Sycon 2.9

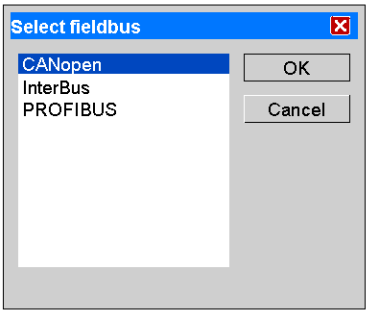
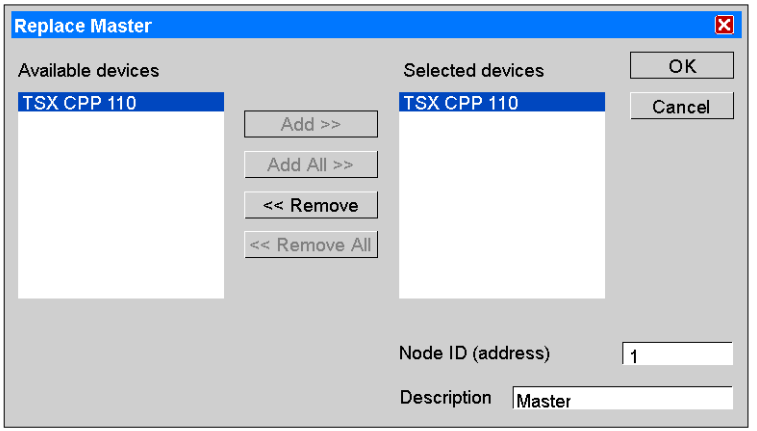
Introduction

In this example, the XPSMC Safety Controller is connected via CANopen to the CANopen master (e.g. Premium TSX with a TSX CPP110 CANopen interface from Schneider Electric). The fieldbus is configured using Sycon 2.9 from Schneider Electric and the controller is configured using Unity Pro from Schneider Electric.

NOTE: The cables, the connectors and the resistors for CANopen must be in accordance with the CiA DRP 303-1 standard.

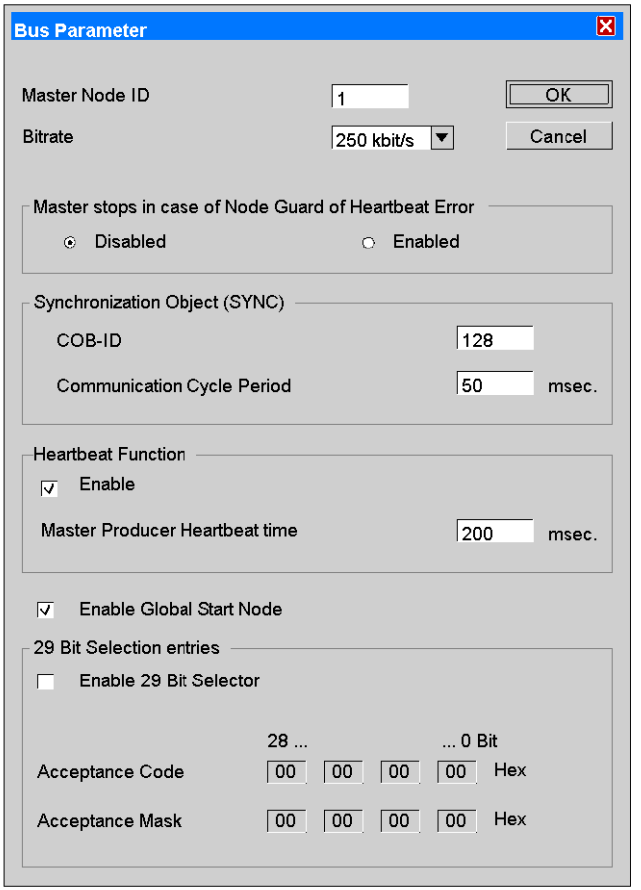
Configuration Using Sycon 2.9

The following table shows how to configure CANopen bus using Sycon 2.9:

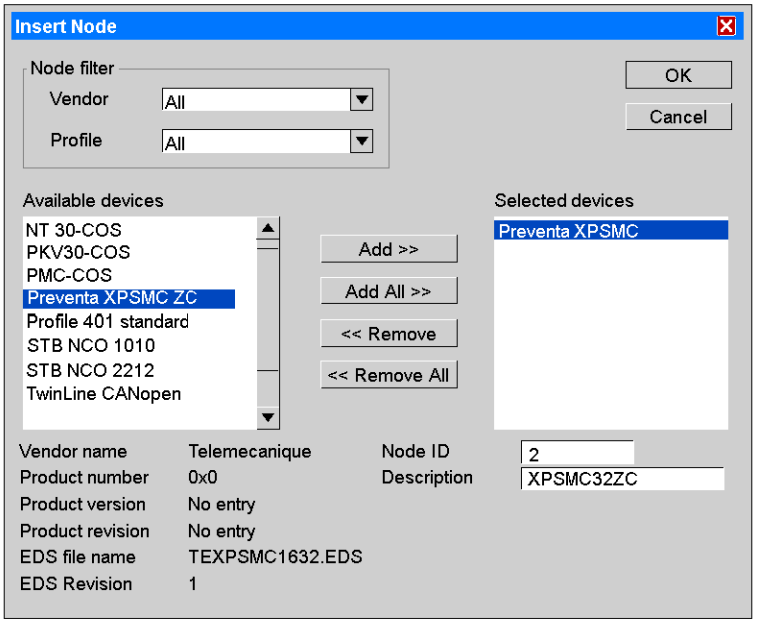
Step	Action
1	Copy the EDS file **.eds* into the CANopen EDS directory. The standard installation directory is: *c:\programs\Schneider\SyCon\Fieldbus\CANopen\EDS* Copy the 3 CANopen pictures (**.dib*) into the designated directory, e.g. *c:\programs\Schneider\SyCON\Fieldbus\CANopen\BMP*. You will find this EDS file and the pictures on the supplied CD or you can download it from the Schneider Electric homepage www.se.com.
2	Start the Sycon **System Configurator**.
3	Select the CANopen as fieldbus. 
4	Choose the CANopen master for the configuration. You will get the dialog box by using **Insert > Master**. 

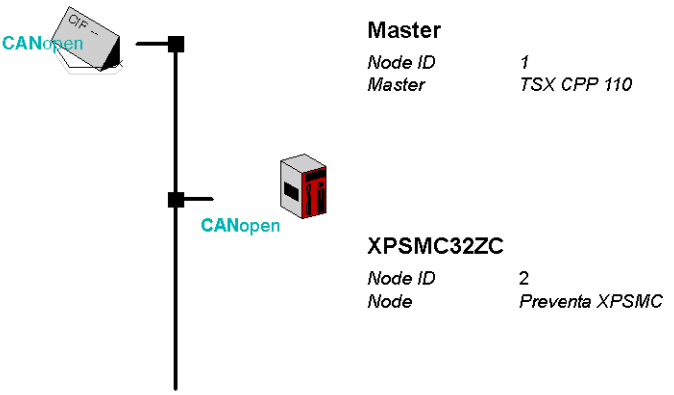
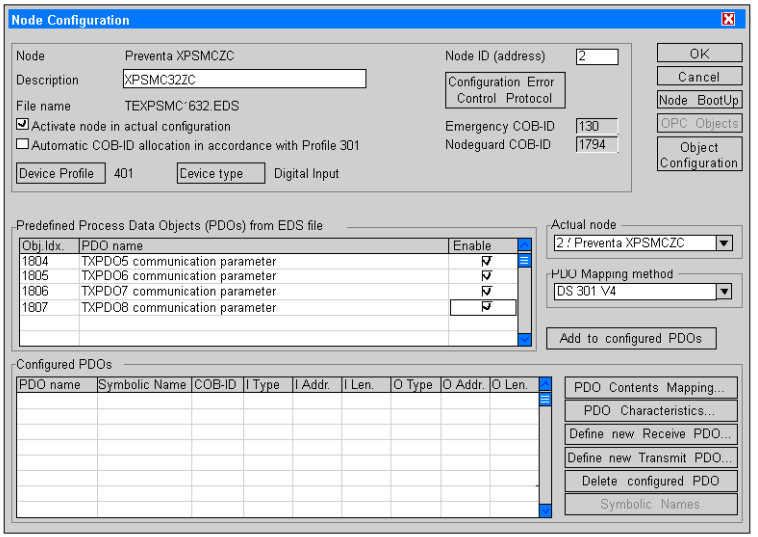
Step	Action

5	Select the TSX CPP 110 CANopen module and press **Add** to adopt it to your configuration. Declare the node address and description. The description is limited to 32 characters.
	• **Node ID (address)**
	`1`
	• **Description**
	`Master`

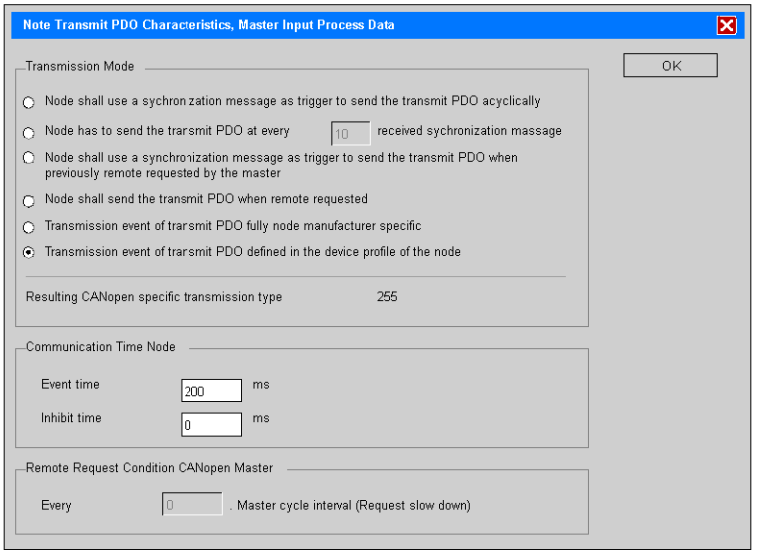
6	Open the bus parameter settings under **Settings > Bus Parameter**. The following dialog will be displayed: 

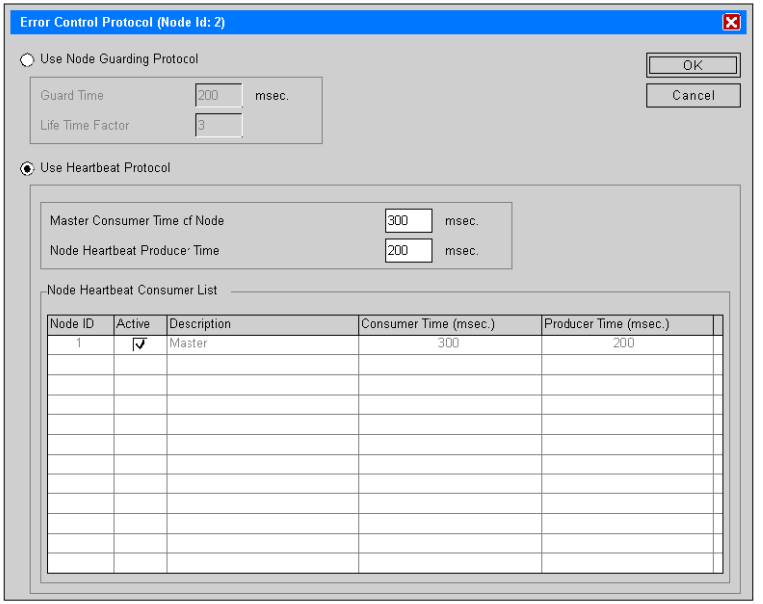
Step	Action
7	Configure the following parameters: • **Master Node ID** 1 • **Bitrate** 250 kbit/s • **Master stops in case of Node Guard or Heartbeat Error** ◦ **Disabled** • **Synchronization Object (SYNC)** ◦ **COB-ID** 128 ◦ **Communication Cycle Period** 50 msec. • **Heartbeat Function** ◦ **Enable** ◦ **Master Producer Heartbeat Time** 200 msec. • **Enable Global Start Node** • **29 Bit Selection entries** nothing Press **OK** to confirm the settings.

Step	Action
8	After the selection of the CANopen master, insert the CANopen node. Insert the node by using **Insert > Node**. The following dialog will be displayed: 
9	Select the **Preventa XPSMC ZC** Safety Controller. After the selection press **Add >>** to adopt it.
10	Configure the following parameters: • **Node ID** 2 • **Description** XPSMC32ZC **NOTE:** The parameters are examples and can be changed. The maximum length of the description is 32 characters.

Step	Action
11	Press **OK** to confirm the settings. The following figure will be displayed: 
12	Select **Settings > Node Configuration** to configure the node settings. The following dialog will be displayed:  **NOTE:** Here you can change the **Node-ID** and **Description** if necessary.

Step	Action
13	Select a PDO, which transfer the data of the XPSMC Safety Controller and press **Add to configured PDOs**. Of each PDO the properties must be confirmed. The PDOs contain the following properties: • **TXPDO5** Mode and Status-Byte, the Input data 1-32 COB-ID e.g. `1668` • **TXPDO6** Output data 1-8, Input and Output Error COB-ID e.g. `1669` • **TXPDO7** Diagnostic explanation 1 and 2 COB-ID e.g. `1670` • **TXPDO8** Diagnostic explanation 3 COB-ID e.g. `1671`
14	Press **PDO Characteristics** to open the dialog.

Step	Action
15	The following dialog will be displayed:  Set the **Event Timer** to `200` ms for each PDO. **NOTE:** If the **Event Timer** is up to `0` and the **Transmission Mode** is `255` (default settings), the PDO will transmit once at the start up, and when a changing of the data (inputs, outputs, detected errors or diagnostic) occurred, with the exception of `Remote Transfer Request`. If the **Event Timer** is up to `0`, the cycle data traffic is disabled.
16	Press **OK** to confirm the settings.
17	Press **Configuration Error Control Protocol** to open the **Error Control Protocol** dialog.

Step	Action
18	The following dialog will be displayed: 
19	Select the **Error Control Protocol Node Guarding Protocol** or **Heartbeat Protocol**.
20	Select the following parameter: For **Node Guarding Protocol** • **Guard Time** 200 msec • **Life Time Factor** 2 For **Heartbeat Protocol** • **Master Consumer Time of Node** 300 msec • **Node Heartbeat Producer Time** 200 msec • **Node Heartbeat Consumer List** Activate the specific master.
21	Press **OK** to confirm the **Error Control Protocol** settings.
22	Press **OK** to confirm the **Node Configuration** settings.

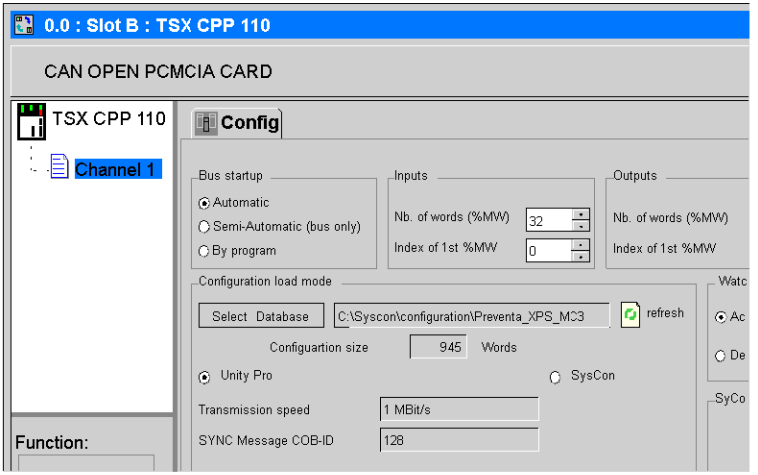
Configuration of Unity Pro for CANopen

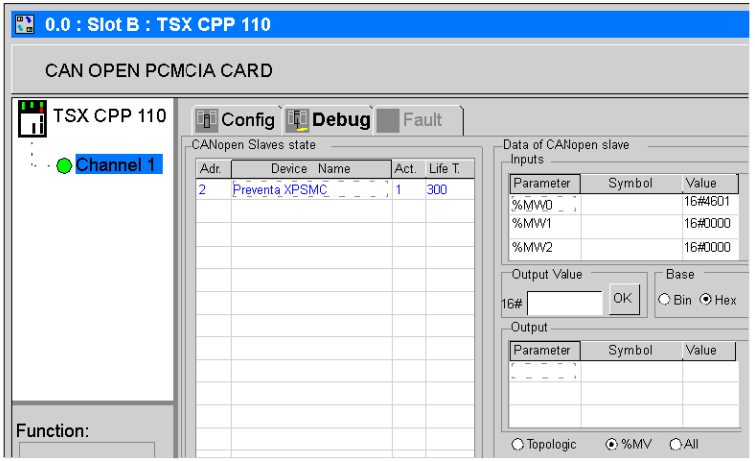
Introduction

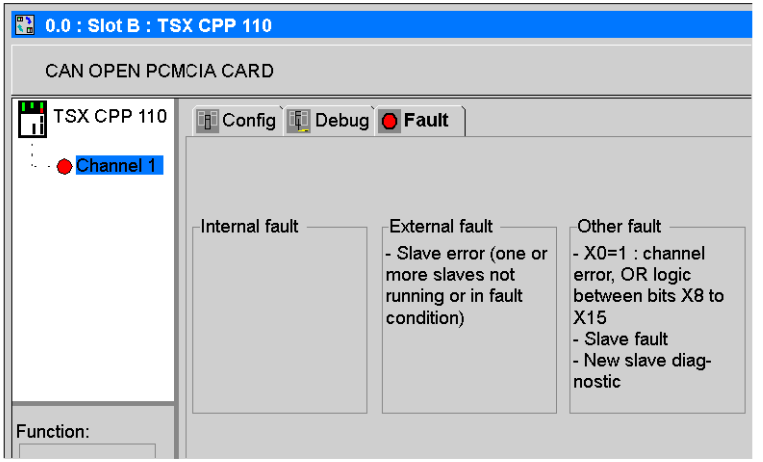
This example shows you how to configure Unity Pro with a Premium TSX and a TSX CPP110 CANopen interface.

Configure Unity Pro

The following table shows how to configure CANopen bus using SYCON 2.9 and Unity Pro.

Step	Action
1	Start the Unity Pro.
2	Define the controller configuration within Unity Pro.
3	Choose the CANopen master TSX CPP110 and double click it. You will get the following dialog box (extract): 
4	Press **Select Database** and choose the configuration you have made before with the SYCON tool. See also chapter *Connection of the XPSMC Safety Controller with CANopen and Sycon 2.8*, page 93 or chapter *Connection of the XPSMC Safety Controller with CANopen and Sycon 2.9*, page 101.
5	Press **OK** to confirm the settings.
6	Create your entire Unity Pro controller program.

Step	Action
7	Generate the program.
8	Transfer the program and configuration into the controller.
9	Run the controller.
10	Open the CANopen master by double clicking the module. See also step 3. The following figure will be displayed (extract): 
11	Debug the program and configuration by using the **Debug** register within the TSX CPP 110 dialog box. The **CANopen Slaves state** shows you the state of the modules. The following colors will be used. • blue When a detected error was corrected. It will turn into black when you move the cursor above the text. • red When a Slave is not working. • black In other cases. The **Data of CANopen slave** dialog shows the values, which will be received from the CANopen master.
12	In case an error is detected on the bus, the **Fault** register will be active.

Step	Action
13	Press **OK** to confirm the settings.
14	Press **Configuration Error Control Protocol** to open the **Error Control Protocol** dialog. The following figure (extract) shows that a slave is not running or an error is detected (abstract). In that case the slave is disconnected: 

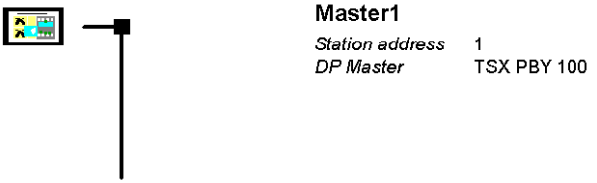
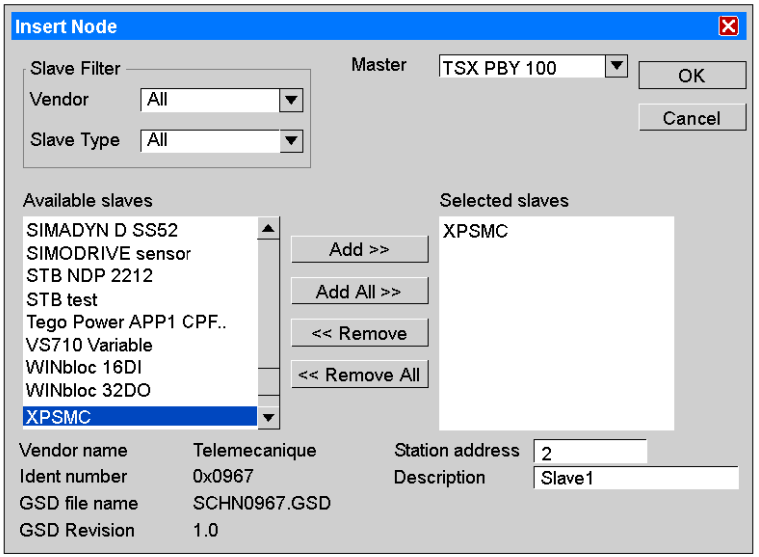
Connection of the XPSMC Safety Controller with Profibus and Sycon 2.9

Introduction

In this example, the XPSMC Safety Controller is connected via Profibus to the Profibus master (e.g. Premium TSX with a TSX PBY100 Profibus master interface from Schneider Electric). The fieldbus is configured using Sycon 2.9 from Schneider Electric and the controller is configured using Unity Pro by Schneider Electric.

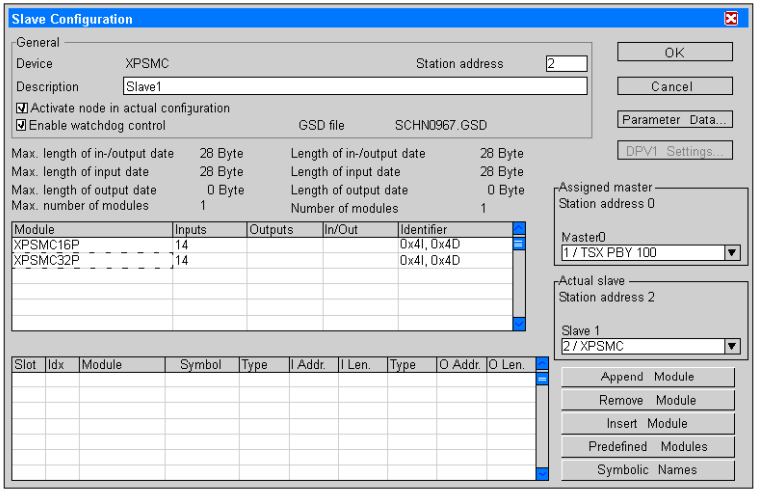
Configuration Using Sycon 2.9

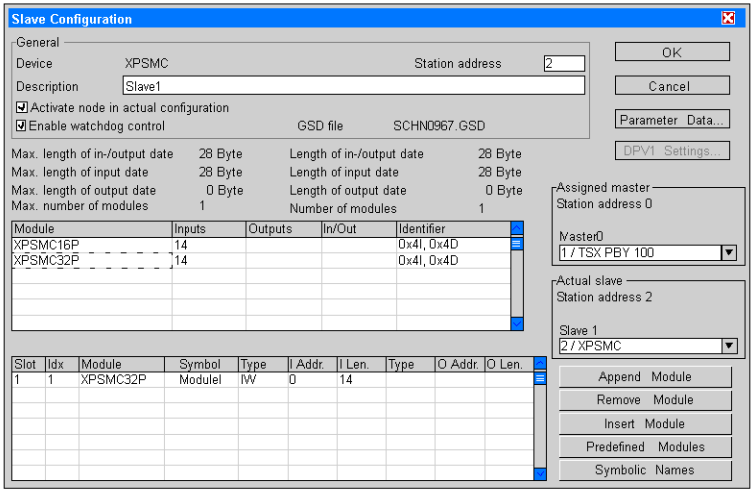
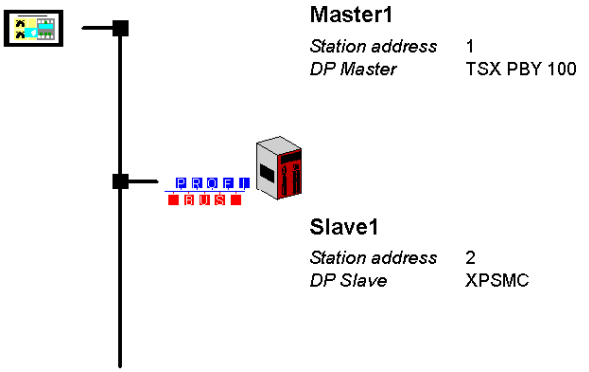
The following table shows how to configure Profibus using Sycon 2.9 and Unity Pro.

Step	Action
1	Copy the available *GSD* file into the directory *..\SyCon\Fieldbus\Profibus\GSD*.
2	Copy the available *DIB* file into the directory *..\SyCon\Fieldbus\Profibus\BMP*.
3	Start the Sycon System Configurator.
4	Create a new Profibus configuration **File > New**
5	Insert a Profibus master module under **Insert > Master** and select the Profibus as fieldbus. The following figure will be displayed (abstract): 
6	Insert a Profibus slave module under **Insert > Slave**. The following dialog will be displayed: 

Step	Action

7	Select **XPSMC** and press **Add >>** to adopt it to your configuration. Declare the node address and description. The description is limited to 32 characters.
	• Node ID (address)
	`2`
	• Description
	`Slave1`

8	Open the slave configuration with a double click on the module. The following dialog will be displayed: 

Step	Action
9	Select the XPSMC16ZP or XPSMC32ZP. The following figure shows the available dialog: 
10	Press **OK** to confirm.
11	Save your configuration under **File > Save as...**. The following figure will be displayed after the saving: 
12	Export your configuration under **File > Export > ASCII**.
13	Import the configuration into your Profibus master software, e. g. Unity Pro.

Legacy Communication Information

What's in This Chapter

Modbus RTU Communication Example 116

Overview

This chapter contains a description of the bus configuration for Modbus.

Modbus RTU Communication Example

General

This section describes how to connect your XPSMC hardware for Modbus RTU. It lists the cables required for connection to either HMI Magelis terminals or Premium PLCs, provides a configuration example to a Premium PLC and lists the respective function codes.

Cables to Connect the XPSMC Hardware

Introduction

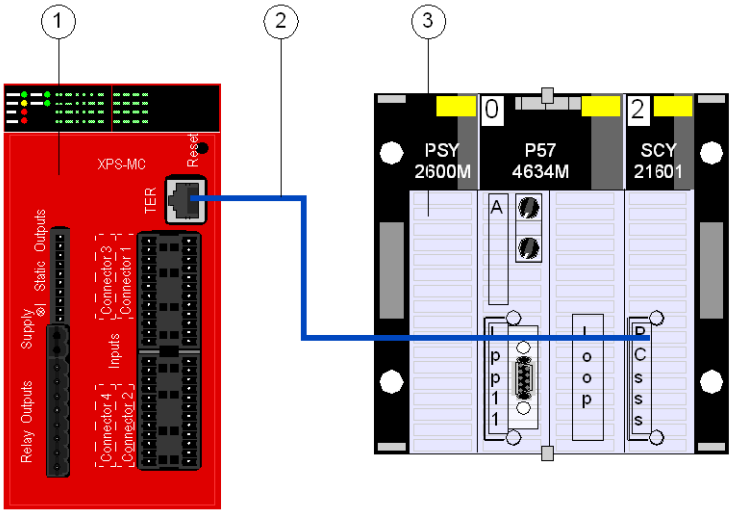
The following information helps you to select the cable to connect your XPSMC hardware for Modbus RTU to either an HMI Magelis or a Premium PLC.

Cable

Connection of an HMI Magelis terminal	cable XBT-Z938 or adapter XPSMCCPC + cable XBT-Z968
Connection to a Premium PLC (Modbus RTU serial card TSXSCY21601 or TSXSCY11601)	XPSMCSCY cable

Connecting XPSMC Safety Controller to a Premium PLC

The figure below illustrates the connection between an XPSMC••Z• and a Premium PLC:



1 XPSMC••Z•

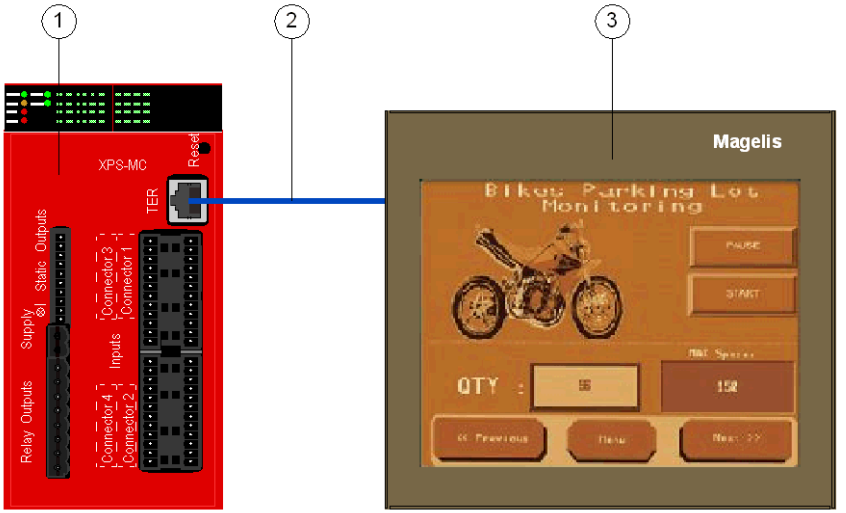
2 XPSMCSCY cable

3 Premium PLC with TSXSCY11601 Modbus RTU serial interface

Modbus RTU communication set up is the same for the XPSMC references.

Connecting XPSMC Safety Controller to an HMI Magelis Terminal

The figure below illustrates the connection between an XPSMC••Z• and a Magelis XBTG• HMI terminal:



1 XPSMC••Z•

2 XBT-Z938 cable or XPSMCCPC + XBT-Z968 cables

3 Magelis XBTG•, XBTGT, or XBTGK HMI Terminal

Modbus RTU communication set up is the same for the XPSMC references.

Connecting XPSMC Safety Controller to Premium PLC Modbus Communication Cards

Types of Premium PLC Modbus Communication Cards

The following cards are available for the Premium PLC for Modbus RTU communication:

- TSX SCY 11601
- TSX SCY 21601

TSX SCY 11601

The TSX SCY 11601 communication module allows communication via a Modbus link.

It consists of a communication channel, channel 0, mono-protocol, RS485 isolated asynchronous serial link supporting the Modbus protocol.

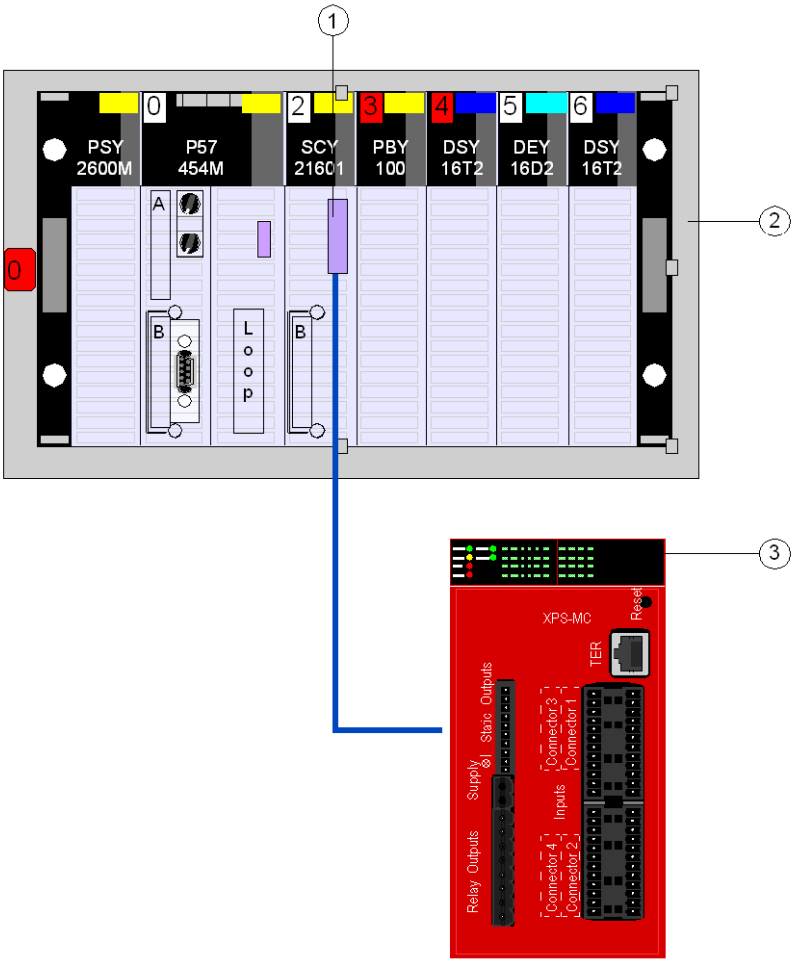
TSX SCY 21601

The TSX SCY 21601 module has two communication ports, PCMCIA and RS485:

RS485	PCMCIA
Multi-protocol built-in channel (channel 0) RS485 isolated asynchronous serial link, supporting Uni-Telway, Modbus or Character Mode protocols.	PCMCIA host channel (channel 1) which supports the following protocols: • Uni-Telway, Modbus and Character Mode on an RS232-D • Current Loop, or RS485 link, corresponding to cards TSX SCP 111, 112 and 114 • Fipway cell network corresponding to the TSX FPP 20 card

Wiring Diagram TSX SCY 21601

The figure below shows a TSX SCY 21601 configuration:



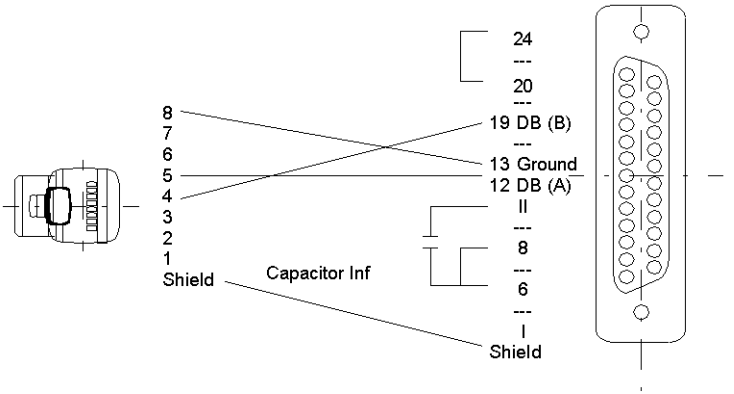
1 D-Sub 25 connector of the Unity Premium PLC SCY 21601

2 Master

3 Slave

XPSMCSCY Cable

The figure below shows the specifications of the XPSMCSCY connection cable:



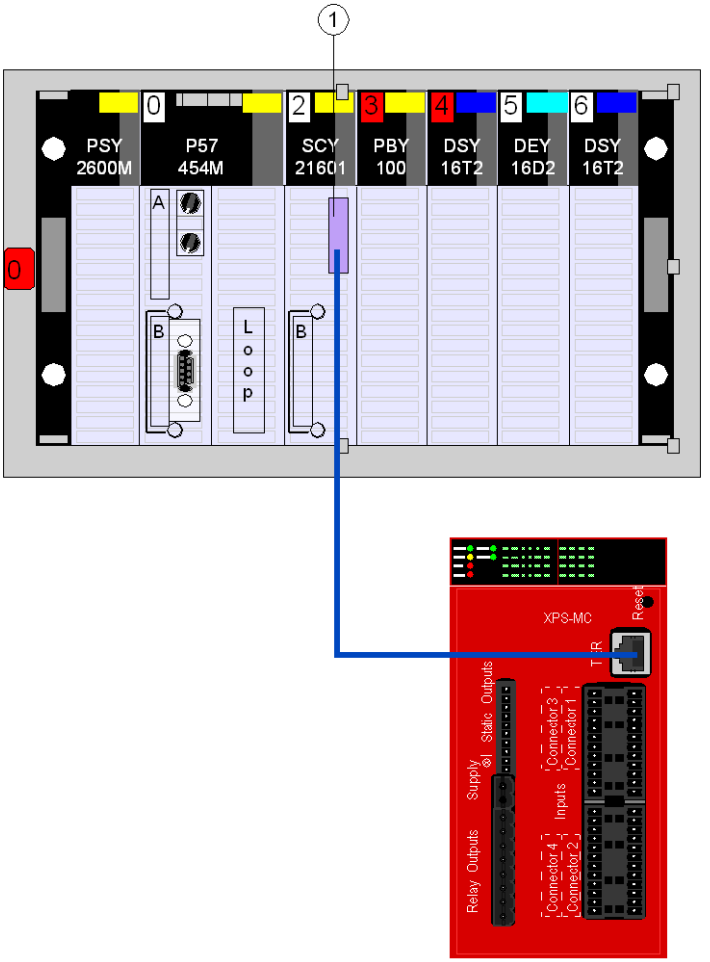
Configuring a Premium PLC with Unity for Modbus RTU Communication

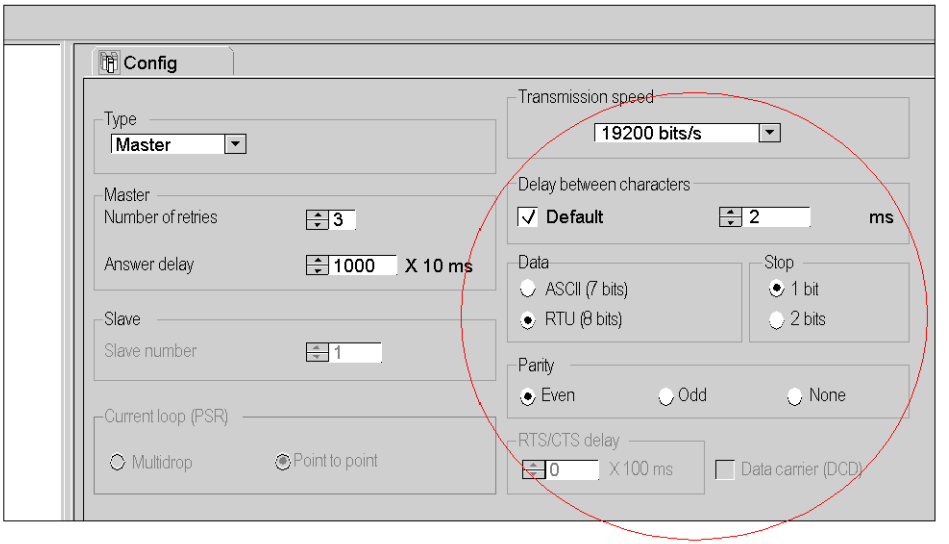
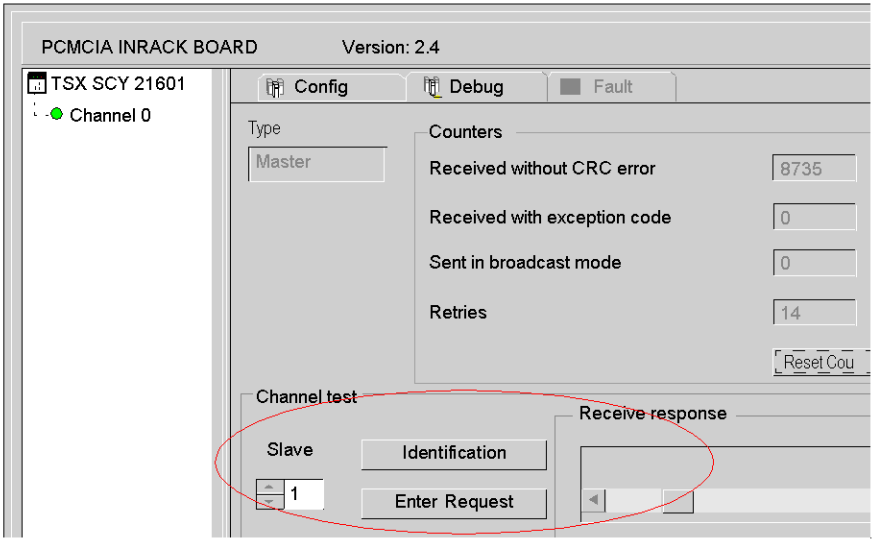
General

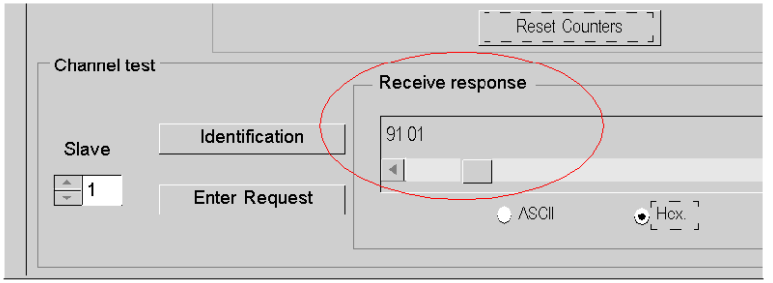
In this example, the XPSMC Safety Controller is connected via Modbus RTU to the Modbus master (Premium TSX with a TSX SCY 21601 Modbus RTU interface from Schneider Electric). The Modbus RTU is configured by Unity Pro.

Configuring a Premium PLC with Unity

To configure a Premium PLC for Modbus RTU communication proceed as follows:

Step	Action
1	Connect the XPSMC Safety Controller to the Premium PLC as shown in the figure below:  **1** D-Sub 25 connector of the Unity Premium TSX SCY 21601
2	Start Unity Pro and create a new project. Define your controller configuration.

Step	Action
3	Open the TSX SCY 21601 configuration dialog box and set the parameters as shown below to communicate with XPSMC••: 
4	To test the communication enter the slave address of your XPSMC•• and click on the **Identification** button. 

Step	Action
	Result: If the communication configuration is correct and the communication is OK the number will be displayed in the **Receive response** box as shown below. 

Inputs and Outputs

Description of the inputs and outputs (for address 1 => Slave 01)

Input / Output	Name	Type	Description
Input	Address	`ANY_ARRAY_INT`	ADDR('m.n.p.x') is the hardware address of the Modbus card (first three numbers) m: rack n: module p: channel x: Modbus slave address
Input / Output	Management	`ARRAY[1..3] OF INT`	management parameters of the Modbus
Output	Outputs	`ARRAY[1..8] OF BOOL`	8 outputs (6 transistor and 2 relay outputs)
Output	Output_Error	`ARRAY[1..8] OF BOOL`	error bit for the 8 outputs
Output	Inputs	`ARRAY[1..32] OF BOOL`	32 bits for input (MC32), 16 bits for input (MC16)
Output	Input_Error	`ARRAY[1..32] OF BOOL`	error bit for 16 / 32 inputs
Output	Messages	`ARRAY[1..3] OF STRING`	text of the messages (max. 16 characters)

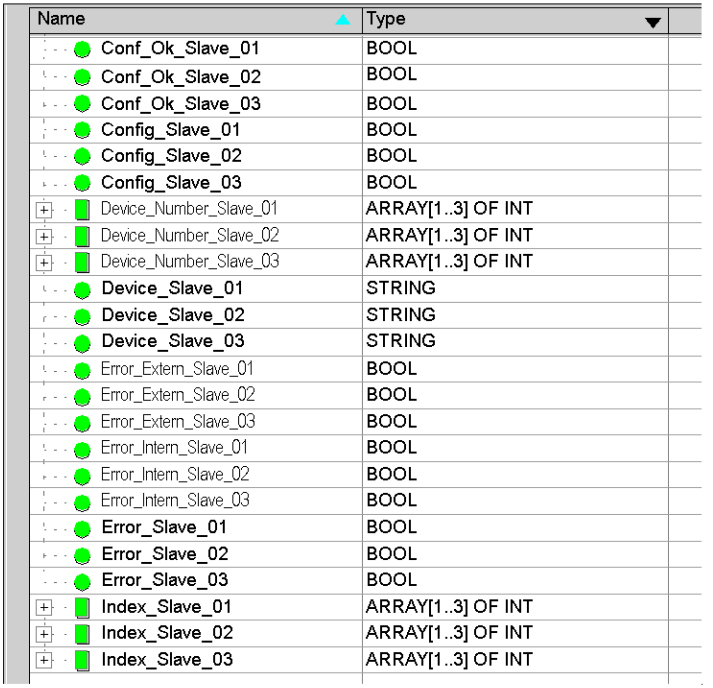
Input / Output	Name	Type	Description
Output	Device_Number	ARRAY[1..3] OF INT	device number of the module for the messages (max. 3)
Output	Stop	BOOL	XPSMC is in STOP
Output	Run	BOOL	XPSMC is in RUN
Output	Config	BOOL	XPSMC is in configuration
Output	Error_Intern	BOOL	XPSMC has detected an internal error
Output	Error_Extern	BOOL	XPSMC has detected an external error
Output	Device	STRING	XPSMC16 or XPSMC32
Output	Conf_OK	BOOL	configuration is OK
Output	Error_1001	ARRAY[1..16] OF BOOL	error word 1001 (for internal use)
Output	Error_100E	ARRAY[1..16] OF BOOL	error word 100E (for internal use)
Output	Modbus_Counter	DINT	Modbus request counter
Output	Modbus_Counter_OK	DINT	Modbus request OK counter
Output	Modbus_Counter_Error	DINT	Modbus request error counter
Output	Modbus_Error_Kind	INT	type of the detected Modbus error
Output	Modbus_Cycle	DINT	Modbus request / cycle time
Output	Modbus_Words	ARRAY[0..14] OF INT	array of Modbus words (0-14)
Output	Fieldbus_Card_Ok	BOOL	fieldbus card (Profibus or CANopen) OK no verification of the communication

Inputs and Outputs from the DFB

When you insert the DFB *Section_DFB_XPS_MC.XBD* that is available on our website www.se.com, the input and output variables are already available.

Inserting a Second DFB

To insert a second DFB file proceed as follows:

Step	Action
1	When you insert a second DFB (XPS_MC-DFB), replace "Slave_01" with the Slave's Modbus Address as shown in the example in the next step.
2	If the Modbus address is 32, then enter `Slave_32` and create a new variable list. Example for 3 slaves with Modbus slave addresses 1,2,3. 

Name	Type
Conf_Ok_Slave_01	BOOL
Conf_Ok_Slave_02	BOOL
Conf_Ok_Slave_03	BOOL
Config_Slave_01	BOOL
Config_Slave_02	BOOL
Config_Slave_03	BOOL
Device_Number_Slave_01	ARRAY[1..3] OF INT
Device_Number_Slave_02	ARRAY[1..3] OF INT
Device_Number_Slave_03	ARRAY[1..3] OF INT
Device_Slave_01	STRING
Device_Slave_02	STRING
Device_Slave_03	STRING
Error_Extern_Slave_01	BOOL
Error_Extern_Slave_02	BOOL
Error_Extern_Slave_03	BOOL
Error_Intern_Slave_01	BOOL
Error_Intern_Slave_02	BOOL
Error_Intern_Slave_03	BOOL
Error_Slave_01	BOOL
Error_Slave_02	BOOL
Error_Slave_03	BOOL
Index_Slave_01	ARRAY[1..3] OF INT
Index_Slave_02	ARRAY[1..3] OF INT
Index_Slave_03	ARRAY[1..3] OF INT

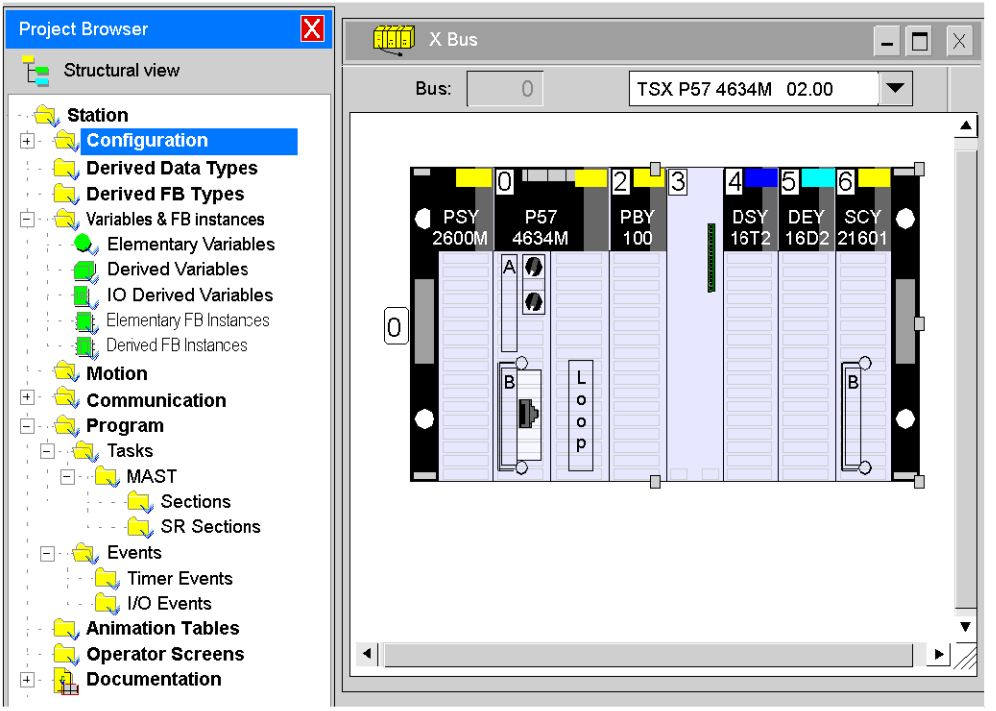
Importing a Section Including the DFB

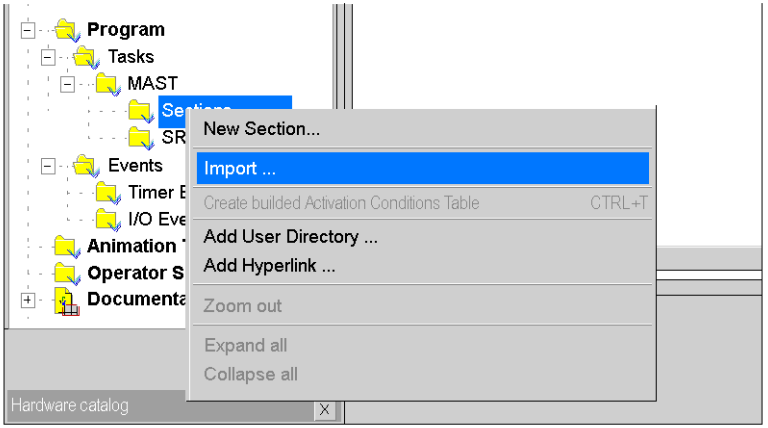
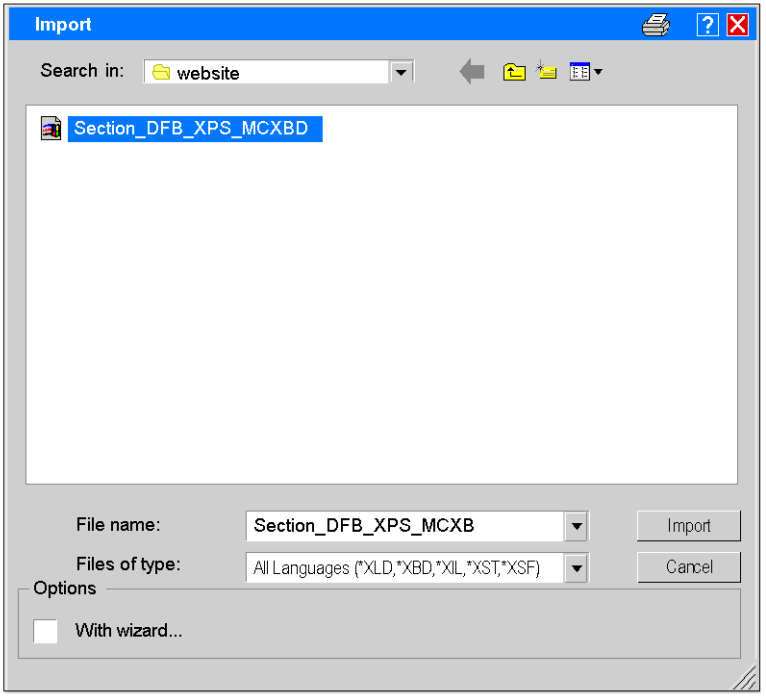
Overview

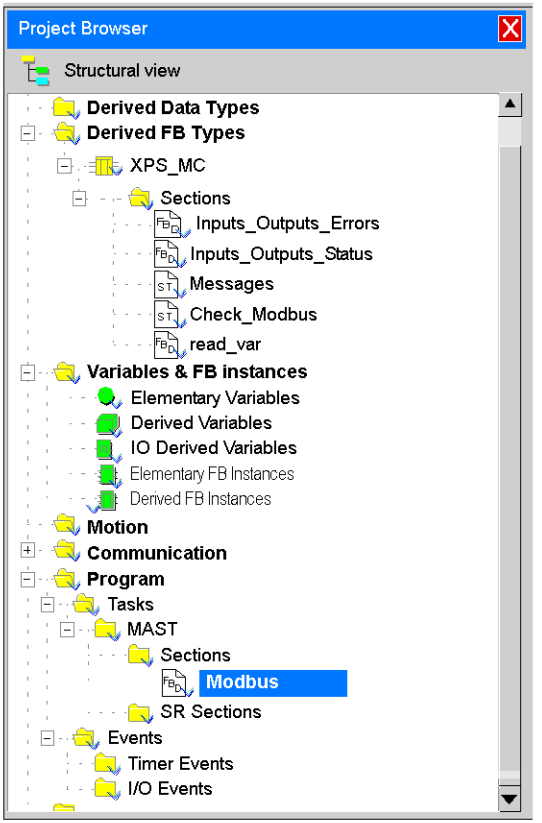
If you import a section including the DFB in Unity, you have to adapt its contents to your configuration. You can perform the import and adaptation in 2 different ways:

- Importing and adapting the section with DFB file in Unity.
- Adapting the file with an ASCII editor and importing it in Unity.

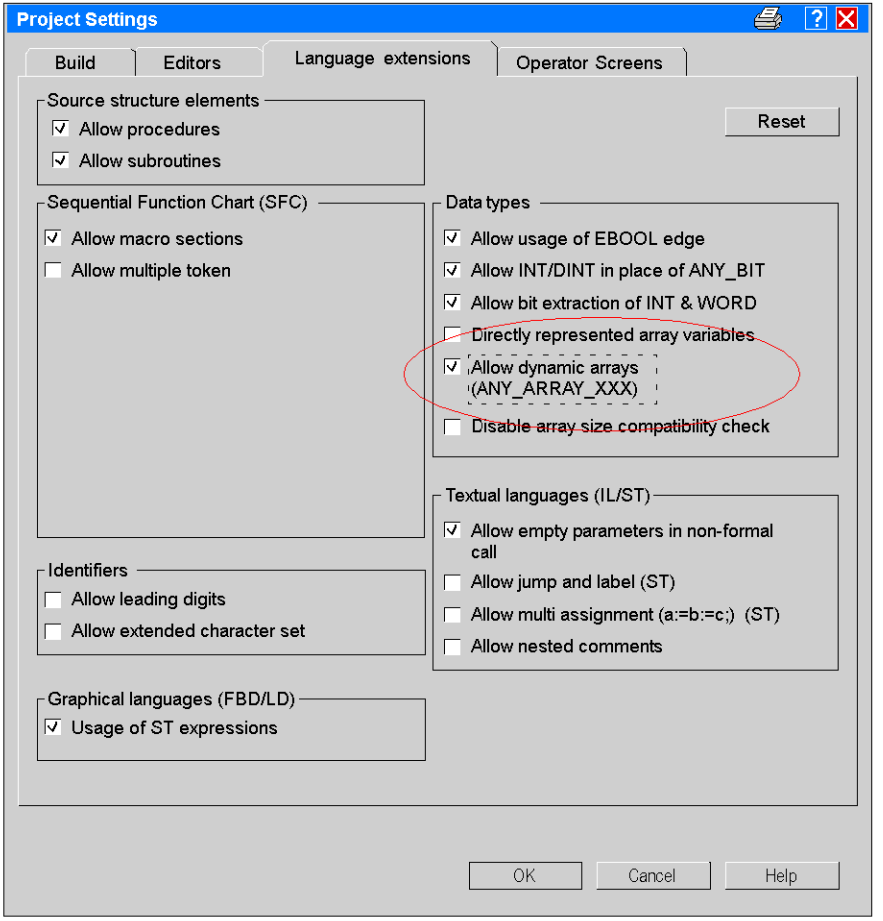
Import the Section with the DFB in Unity

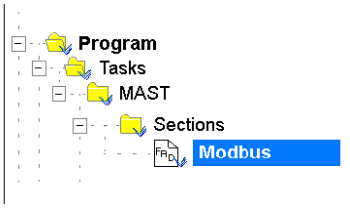
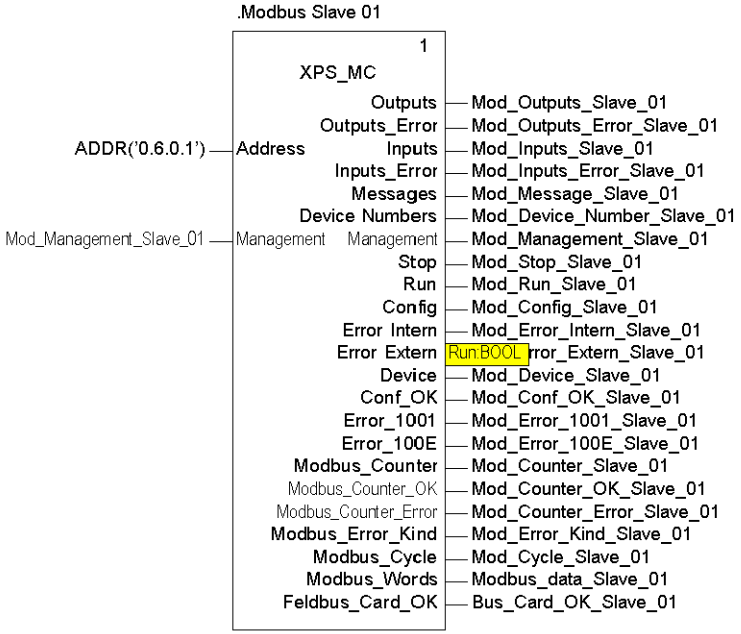
Step	Action
1	Open a new configuration in Unity 
2	In the **Project Browser** right-click the **Section** folder and select the **Import...** command from the contextual menu.

Step	Action
	
3	Browse to the folder where you have stored the section with DFB file, select it and click **Import**. 

Step	Action
4	After the file has been imported the **Project Browser** looks as shown below: 

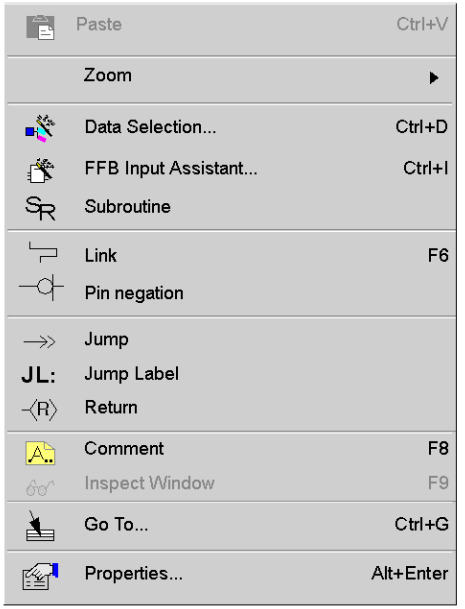
Errors Importing the Section with the DFB in Unity

Step	Action
1	If errors like these are displayed in Unity during the import of the file, {read_var <DFB> : [XPS_MC]} : (r: 9, c: 19) E1208 usage of dynamic arrays is disabled {read_var <DFB> : [XPS_MC]} : (r: 9, c: 19) E1208 usage of dynamic arrays is disabled {read_var <DFB> : [XPS_MC]} : 2 error(s),0 warning(s) then open the **Project Settings** dialog box via **Tools > Project Settings... > Language extensions** and enable the option **Allow dynamic arrays (ANY_ARRAY_XXX)**. 
2	Rebuild the project via the **Build** menu.

Step	Action
3	Open the **Modbus Section** located within the **Program** folder of the Unity project by double-clicking the **Modbus** FBD name.  Within the FBD the following function will be shown:  **Note:** To monitor more than one XPSMC Safety Controller insert additional Modbus DFBs as required.

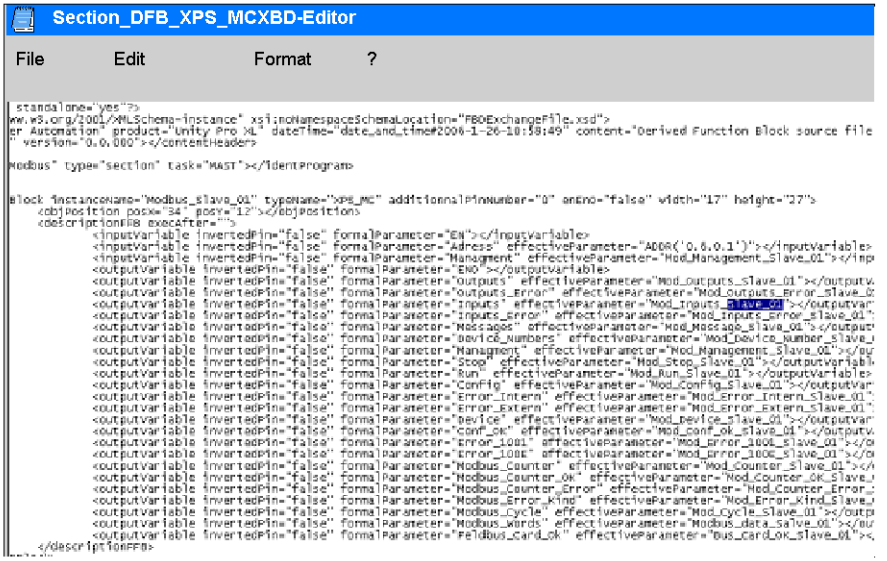
Inserting Additional Modbus DFBs

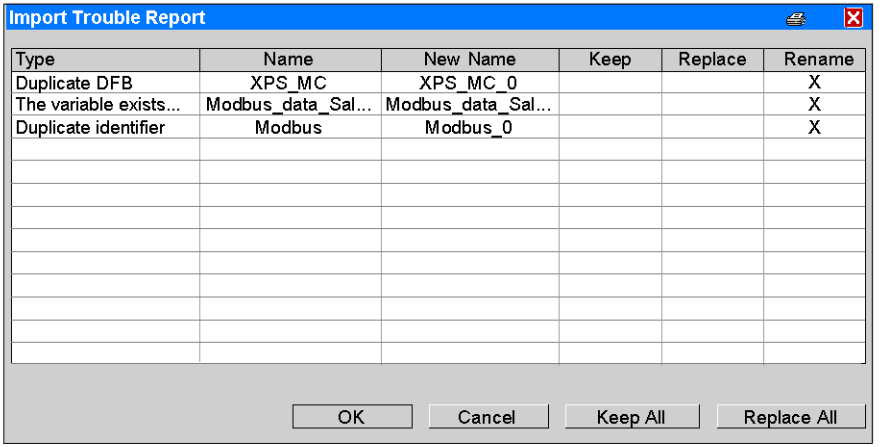
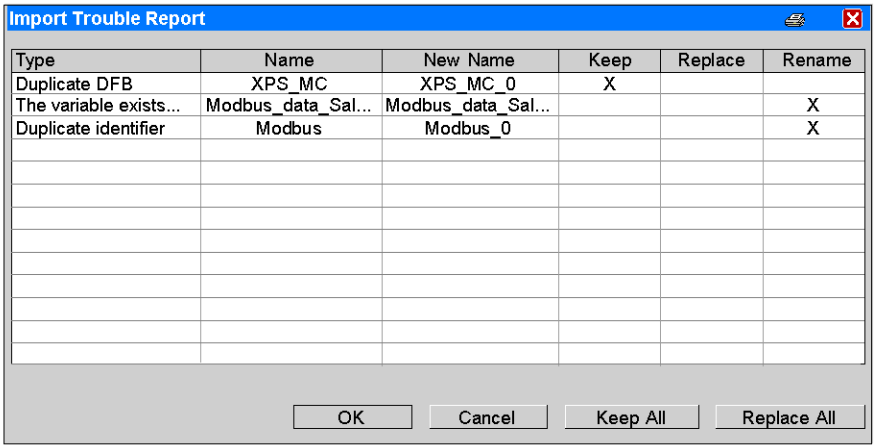
To insert additional Modbus DFBs proceed as follows.

Step	Action
1	Right-click on an empty place within the open DFB function block. **Result**: The following contextual menu will be displayed: 
2	Select the command **Data Selection...**.
3	Place the new DFB within the Modbus area as required
4	Fill out the inputs and outputs with the necessary variables. **NOTE:** You can use the same variables as the above one, but replace **Slave_01** by **Slave_02** etc.

Adapting the File with an ASCII Editor

Since the section with DFB files are normal XML files you can edit them with a conventional ASCII editor prior to importing them in Unity.

Step	Action
1	Open the DFB_XPS_MC.XBD with an ascii editor: 
2	Replace the **Slave_01** names according to the new slave address by e.g. Slave_02 if the address is 2. Save the file under a new name.
3	Import the saved file in Unity.

Step	Action
4	An **Import Trouble Report** (due to an existing DFB) will be displayed. 
5	For the **Duplicate DFB**s select the option **Keep**. For the **The variable exists...** and **Duplicate identifier** select the option **Rename**.  **Result**: After the import is complete a new section will appear within the Program area of Unity with the name **Modbus_0**, and in addition the variables are automatically generated by Unity.

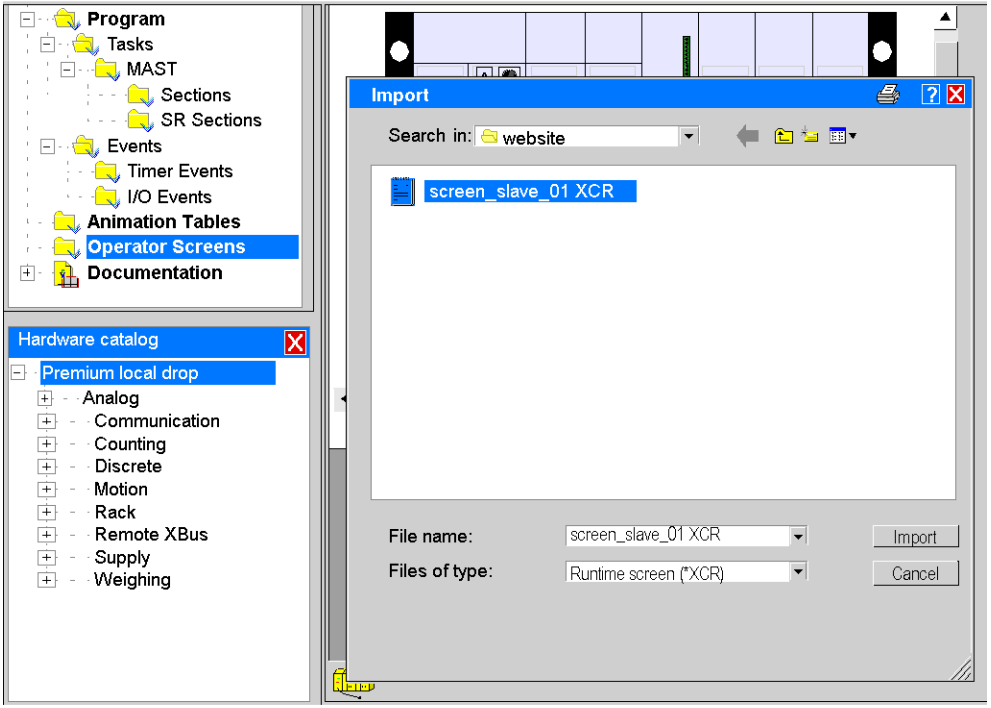
Viewing Modbus Communications

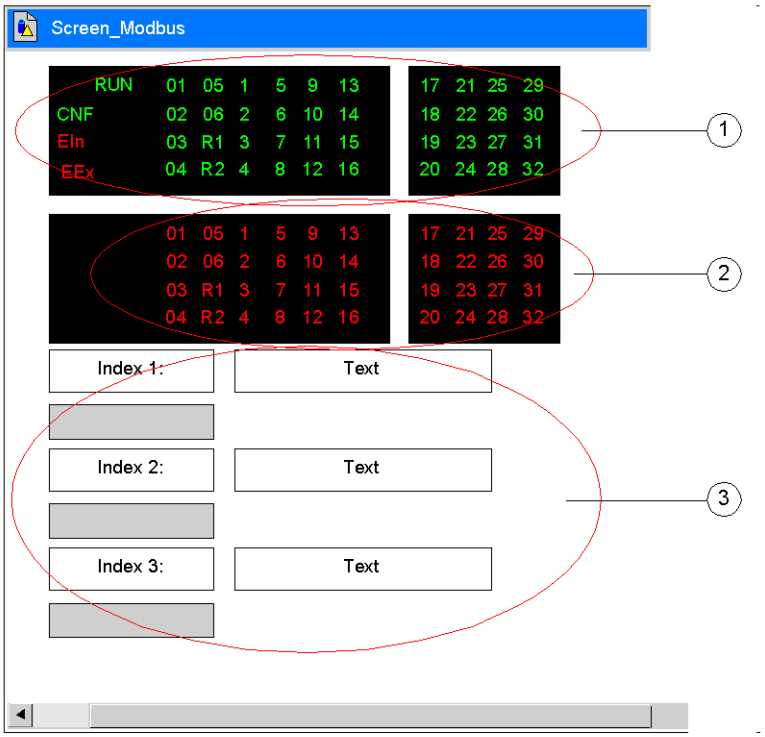
Operator Screen File

To view the Modbus communications use the following operator screen file provided on either the Safety Suite V2 CD or on www.se.com.

Operator Screen Installation

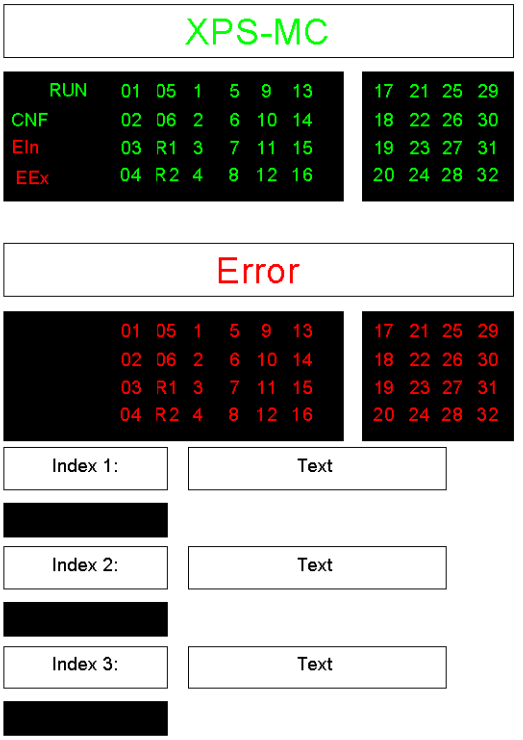
To install the operator screen proceed as follows.

Step	Action
1	In the **Project Browser** right-click the folder **Operator Screens** and select the file *screen_slave_01.XCR* from either the Safety Suite CD or from www.se.com. 
2	Double-click the new subfolder in the folder **Operator Screens**. **Result**: The following operator screen will be displayed.

Step	Action
	 **1** Status of the inputs and outputs, internal error detected, external error detected, RUN and CNF. **2** Lights red when an error of the inputs or outputs was detected. **3** Messages and the device number. Use this screen to view and test the communication between the Premium PLC and the XPSMC Safety Controller.

Monitoring XPSMC•• Data

Use the operator screen for monitoring the data from the XPSMC••.



If you have more than 1 XPSMC Safety Controller change the names using the ASCII editor by replacing `SLAVE_01` with your extension (see section Adapting the File with an ASCII Editor, page 132).

Function Codes and Parameters

Function Codes

The XPSMC Safety Controller supports the Modbus RTU functions 01, 02 and 03 and is a Modbus RTU slave.

Details regarding the Modbus protocol can be found within the documentation of the respective Modbus masters.

The table describes data which can be read, the respective addresses and the Modbus RTU function codes.

Addresses (hex)	Addresses (dec)	Size of Data	Supported Modbus Function	Results for Usage
0100-0127	256-295	40 bit	01 (0x01) 02 (0x02)	8 bit output data / 32 bit input data (0 = OFF, 1 = ON)
0200-0227	512-551	40 bit	01 (0x01) 02 (0x02)	32 bit input data / 8 bit output data (0 = OFF, 1 = ON)
1000-100D	4096-4109	14 words	03 (0x03)	Information and errors signification, see next table.
-	-	-	43 (0x2B) MEI Type 14 (0x0E)	Read device identification

The following table provides data which can be read, to provide details of hardware and configuration status.

Word Addresses (hex)	Word Addresses (dec)	High Byte	Low Byte	Details
1000	4096	Status		**Bit:** **0** RUN (device is running) **1** CONF (configuration mode) **2** reserved **3** INTERR (internal error detected) **4** EXTERR (external error detected) **5** STOP (device is not running) **6** STATUS_R_S (changeover from RUN to STOP) **7** reserved
		Mode		**Bit:** Meaning: **8** reset button pressed **9** CPU2 OK (visible only on Modbus) **10** fieldbus OK **11** 1=interrupt in progress, 0=internal CPU test running **12** 0=XPSMC32, 1=XPSMC16 **13** 1=after power-up or START until self test finished, then 0 **14** configuration valid **15** received STOP command
1001	4097			reserved

The following table provides data on physical input output channels which can be read to view the status.

Word Addresses (hex)	Word Addresses (dec)	High Byte	Low Byte	Details
1002	4098	input data (input 1-8)	input data (input 9-16)	**Bit:** 1 = corresponding in/output on

Word Addresses (hex)	Word Addresses (dec)	High Byte	Low Byte	Details
1003	4099	input data (input 17-24)	input data (input 25-32)	
1004	4100	not used (0)	output data (output 1-8)	

The following table provides data on physical input / output error states:

Word Addresses (hex)	Word Addresses (dec)	High Byte	Low Byte	Details
1005	4101	input error (input 1-8)	input error (input 9-16)	**Bit:** 1 = corresponding in/output error
1006	4102	input error (input 17-24)	input error (input 25-32)	
1007	4103	not used (0)	output error (output 1-8)	

The following table provides data regarding the diagnostic explanations (DH):

Word Addresses (hex)	Word Addresses (dec)	High Byte	Low Byte	Details
1008	4104	(DH 1) index high	(DH 1) index low	**Index** software device number
1009	4105	not used (0)	(DH 1) message	**Message** Diagnostic explanation (see chapter Error Codes, page 51.)
100A	4106	(DH 2) index high	(DH 2) index low	
100B	4107	not used (0)	(DH 2) message	
100C	4108	(DH 3) index high	(DH 3) index low	

Word Addresses (hex)	Word Addresses (dec)	High Byte	Low Byte	Details
100D	4109	not used (0)	(DH 3) message	
100E	4110	reserved		

Modbus Parameter

The following table shows the XPSMC••Z• Modbus RTU possible parameters.

Address	1 to 247
Baud Rate	• 1200 bit/s • 2400 bit/s • 4800 bit/s • 9600 bit/s • 19200 bit/s
Parity	• even • odd • none
Fixed Parameter	• RTU Mode (**R**emote **T**erminal **U**nit Mode) • 1 start bit • 8 data bits • 1 stop bit with parity **Even** or **Odd** • 2 stop bits with parity **None**

Glossary

C

CAN:

Stands for controller area network.

The CAN protocol (ISO 11898) for serial bus networks is designed for the interconnection of smart devices (from multiple manufacturers) in smart systems for real-time industrial applications. CAN multi-master systems help to ensure high data integrity through the implementation of broadcast messaging and advanced error handling mechanisms. Originally developed for use in automobiles, CAN is now used in a variety of industrial automation control environments.

CANopen Protocol:

An open industry standard protocol used on the internal communication bus. The protocol allows the connection of any standard CANopen device to the island bus.

Configuration Mode:

Functional status of the XPSMC in which no valid configuration is available in the controller and in which a configuration can be transferred.

Control Output:

An output providing a test signal, which serves exclusively to power the safety inputs of the XPSMC. As each control output operates with another test signal, cross-connections between safety inputs connected to different control outputs can be detected. External voltage or ground connections can also be detected.

E

EDM:

external device monitoring

ESPE:

Stands for electro sensible protective equipment.

O

OSSD:

output signal switching device

P

PDO:

Stands for process data object.

In CAN-based networks, PDOs are transmitted as unconfirmed broadcast messages or sent from a producer device to a consumer device. The transmit PDO from the producer device has a specific identifier that corresponds to the receive PDO of the consumer devices.

Profibus DP:

Stands for Profibus decentralized peripheral.

It is an open bus system that uses an electrical network based on a shielded two-wire line or an optical network based on a fiber-optic cable. DP transmission allows for high-speed, cyclic exchange of data between the controller CPU and the distributed I/O devices.

R

Release Circuit:

Switches the control voltage for the part of the machine which generates the potentially hazardous movement.

RUN Mode:

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

S

Safety-Related Input:

Cross circuits between inputs and cross-circuits of inputs to ground or to external supply can be detected when the control outputs (c1...c8) are used to drive the safety-related inputs.

Safety-Related Output:

Relay or solid-state output activated and monitored by the XPSMC logic unit, which can be used to release safety-related circuits.

Start Inhibition:

Following power-up, operation is inhibited until the existing input signals are switched off and then re-energized (for example, the safety guard is opened and closed again).

Synchronization Time:

Maximum time difference allowed between the appearance of two 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 (controller, terminals, etc....).

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

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