Modular Safety Controller
User Guide

04/2018

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

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

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

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

Table of Contents

Safety Information

Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, 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.

BEFORE YOU BEGIN

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

⚠ WARNING

UNGUARDED EQUIPMENT

- Do not use this software and related automation equipment on equipment which does not have point-of-operation protection.
- Do not reach into machinery during operation.

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

This automation equipment and related software is used to control a variety of industrial processes. The type or model of automation equipment suitable for each application will vary depending on factors such as the control function required, degree of protection required, production methods, unusual conditions, government regulations, etc. In some applications, more than one processor may be required, as when backup redundancy is needed.

Only you, the user, machine builder or system integrator can be aware of all the conditions and factors present during setup, operation, and maintenance of the machine and, therefore, can determine the automation equipment and the related safeties and interlocks which can be properly used. When selecting automation and control equipment and related software for a particular application, you should refer to the applicable local and national standards and regulations. The National Safety Council's Accident Prevention Manual (nationally recognized in the United States of America) also provides much useful information.

In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the operator's hands and other parts of the body are free to enter the pinch points or other hazardous areas and serious injury can occur. Software products alone cannot protect an operator from injury. For this reason the software cannot be substituted for or take the place of point-of-operation protection.

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

NOTE: Coordination of safeties and mechanical/electrical interlocks for point-of-operation protection is outside the scope of the Function Block Library, System User Guide, or other implementation referenced in this documentation.

START-UP AND TEST

Before using electrical control and automation equipment for regular operation after installation, the system should be given a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such a check be made and that enough time is allowed to perform complete and satisfactory testing.

⚠ WARNING

EQUIPMENT OPERATION HAZARD

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
- Remove tools, meters, and debris from equipment.

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

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and temporary grounds that are not installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove all temporary grounds from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

OPERATION AND ADJUSTMENTS

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

About the Book

At a Glance

Document Scope

This user manual describes how to use the XPSMCM• Modular Safety Controller system.

The XPSMCM• Modular Safety Controller system consists of a controller unit XPSMCMCP0802•, which can be configured using the SoSafe Configurable software. Expansion input and output modules can be connected to the XPSMCMCP0802• Modular Safety Controller.

Schneider Electric takes no responsibility for the solutions adopted by you or any customer concerning the circuits, the electrical diagrams, and the chosen configuration parameters of the application. The implemented circuits and electrical diagrams and the choice of the system configuration parameter values, including those of XPSMCMCP0802•, are fully under your control and responsibility.

Validity Note

The technical characteristics of the devices described in the present document also appear online. To access the information online:

Step	Action
1	Go to the Schneider Electric home page *www.schneider-electric.com*.
2	In the **Search** box type the reference of a product or the name of a product range. ● Do not include blank spaces in the reference or product range. ● To get information on grouping similar modules, use asterisks (*).
3	If you entered a reference, go to the **Product Datasheets** search results and click on the reference that interests you. If you entered the name of a product range, go to the **Product Ranges** search results and click on the product range that interests you.
4	If more than one reference appears in the **Products** search results, click on the reference that interests you.
5	Depending on the size of your screen, you may need to scroll down to see the data sheet.
6	To save or print a data sheet as a .pdf file, click **Download XXX product datasheet**.

The characteristics that are presented in the present manual 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 manual and online information, use the online information as your reference.

Product Related Information

The XPSMCM• is built to the following safety integrity levels: SIL 3 according to EN/IEC 61508, SILcl 3 according to EN/IEC 62061, PL e category 4 according to EN ISO 13849-1 in accordance with the applicable standards. However, the definitive SIL and PL of the application depends on the number of safety-related components, their parameters, and the connections that are made, as per the risk analysis.

The module must be configured in accordance with the application-specific risk analysis and all the applicable standards.

Pay particular attention in conforming to any safety information, different electrical requirements, and normative standards that would apply to your adaptation.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Perform an in-depth risk analysis to determine the appropriate safety integrity level for your specific application, based on all the applicable standards.

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

NOTE: Configuration of the module is the sole responsibility of the installer or user.

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, or that appear in or on the products themselves, are generally derived from the terms or definitions of international standards.

In the area of functional safety systems, drives and general automation, this may include, but is not limited to, terms such as *safety*, *safety function*, *safe state*, *fault*, *fault reset*, *malfunction*, *failure*, *error*, *error message*, *dangerous*, etc.

Among others, these standards include:

Standard	Description
EN 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2008	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2013	Safety of machinery: Electro-sensitive protective equipment. Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements

Standard	Description
EN 1088:2008 ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2006	Safety of machinery - Emergency stop - Principles for design
EN/IEC 62061:2005	Safety of machinery - Functional safety of safety-related electrical, electronic, and electronic programmable control systems
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements.
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784-3:2008	Digital data communication for measurement and control: Functional safety field buses.
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

In addition, terms used in the present document may tangentially be used as they are derived from other standards such as:

Standard	Description
IEC 60034 series	Rotating electrical machines
IEC 61800 series	Adjustable speed electrical power drive systems
IEC 61158 series	Digital data communications for measurement and control – Fieldbus for use in industrial control systems

Finally, the term *zone of operation* may be used in conjunction with the description of specific hazards, and is defined as it is for a *hazard zone* or *danger zone* in the *Machinery Directive* (*2006/42/EC*) and *ISO 12100:2010*.

NOTE: The aforementioned standards may or may not apply to the specific products cited in the present documentation. For more information concerning the individual standards applicable to the products described herein, see the characteristics tables for those product references.

Part I
Common Hardware Information

What Is in This Part?

This part contains the following chapters:

Chapter 1
General Information on the Modular Safety Controller

What Is in This Chapter?

This chapter contains the following topics:

Safety Information on XPSMCMx Modular Safety Controller

Safety-related Information

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Do not install, operate, or maintain this equipment unless you are a trained professional electrician and qualified to perform these activities.
- Install and use this equipment only in locations known to be non-hazardous.
- Do not use the equipment described herein to supply external drives or contactors.
- Use the same ground supply (0 Vdc) to supply all modules of the Modular Safety Controller family.
- Disconnect all power from all equipment including connected input devices, contactors, and drives prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- If connected drives or contactors contain stored energy, allow sufficient time after the removal of power for the stored energy to discharge in accordance with the instructions for those drives and contactors.
- Always use a properly rated voltage sensing equipment to confirm that the power is removed.
- Avoid contacting terminals with hand or tools until the power has been confirmed 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.
- Remove locks, tags, barriers, temporary ground straps, and replace and secure all covers, doors, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before reapplying power to the unit.
- Complete thorough hardware tests and system commissioning to verify that line voltages are not present on the control circuits before using your hardware operationally.
- 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

LOSS OF DESIGNATED SAFETY FUNCTION

- Install the XPSMCM• Modular Safety Controller system in an enclosure with a degree of protection of at least IP 54.
- Always use an isolated power supply (PELV) to help prevent the application of line voltages to control circuitry in the case of short-circuits.

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

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

⚠ DANGER

POTENTIAL FOR EXPLOSION OR UNINTENDED EQUIPMENT OPERATION

- Install and use the Modular Safety Controller in non-hazardous locations only.
- Do not use the Modular Safety Controller system for life support systems.

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, do not use 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 servicable components in the Modular Safety Controller and expansion modules. Inoperable products need to be replaced by a 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.
- Immediately return any product that you perceive to be damaged, malfunctioning or defective to your place of purchase.

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.

Qualified Personnel

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. A qualified person is one who has skills and knowledge related to the construction and operation of this electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Modular Safety Controller

Key safety values	Value	Standard
Probability of a dangerous failure per hour (PFHd)	Refer to module-specific characteristics.	IEC 61508
Safety Integrity Level (SIL)	3	
Hardware Fault Tolerance (HFT)	1 (type B)	
Defined “Safe state”[1]	All outputs off	
Safety Integrity Level claim limit (SILcl)	3	IEC 62061
Type	4	EN 61496-1

1 The Modular Safety Controller and expansion modules are in the defined safe state when their outputs are off. To exit the defined safe state condition, a combination of hardware inputs is required.

2 The EN ISO 13849-1 performance level (PL) and safety category (Cat) of the overall system depends on multiple factors, including the selected modules, wiring practices, the physical environment, and the application.

3 If expansion modules are added to the configuration, the MTTFd of the overall system is affected, refer to the SoSafe Configurable Project Report.

Key safety values	Value	Standard
Performance Level (PL)[2]	e	EN ISO 13849-1
Diagnostic Coverage$_{avg}$	High	
Mean Time to Dangerous Failure (MTTFd)	2500 years with Category 4 architecture, otherwise 100 years[3]	
Category[2]	4	
Maximum service life	20 years	

1 The Modular Safety Controller and expansion modules are in the defined safe state when their outputs are off. To exit the defined safe state condition, a combination of hardware inputs is required.

2 The EN ISO 13849-1 performance level (PL) and safety category (Cat) of the overall system depends on multiple factors, including the selected modules, wiring practices, the physical environment, and the application.

3 If expansion modules are added to the configuration, the MTTFd of the overall system is affected, refer to the SoSafe Configurable Project Report.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- You must carry out a risk assessment in accordance with EN ISO 14121-1.
- 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.

Regular proof test intervals as defined by IEC 61508 are required. Observe the required test cycles according to your application.

Modular Safety Controller System

Presentation

The XPSMCM• functional safety offer consists of a XPSMCMCP0802• Modular Safety Controller, which can be configured using the SoSafe Configurable software *(see page 189)*. The controller *(see page 50)* has eight safety-related inputs and two independent dual-channel solid-state safety-related outputs. Expansion input and output modules can be connected to the XPSMCMCP0802• controller via the backplane expansion bus *(see page 180)*. Together, these references form the structural basis of a functional safety system.

The system consists of a XPSMCMCP0802• controller, and may include a number of electronic expansions up to a maximum of 14, and not more than four I/O modules of the same reference. The number of external relay modules XPSMCMER0002• and XPSMCMER0004• which can be installed is limited by the number of OSSD outputs and status outputs of the system.

With 14 expansions, the system supports up to 128 inputs, 16 dual-channel safety-related outputs, and 32 status outputs. The controller and its expansion modules communicate via the 5-way backplane expansion bus physically arranged on the back of the controller and expansion modules. However, if the `Network` function block is used within the configuration, a maximum number of 9 expansion modules can be used with a controller.

In addition, 8 fieldbus inputs and 16 fieldbus probes can be used for non-safety related commands through the addition of fieldbus expansion modules.

The SoSafe Configurable software enables you to create simple to complex configurations with the mixture of safety-related functions and logic; such as the combination of muting function with timers or counters.

The configuration created on the PC is sent to the XPSMCMCP0802• controller via a USB (PC) to Mini B-USB (controller) cable. The file resides in the XPSMCMCP0802• controller and can also be saved on the optional memory card XPSMCMME0000 accessory *(see page 177)*. The configuration can therefore quickly be copied to another XPSMCMCP0802• controller unit.

The Modular Safety Controller is capable of monitoring the following safety-related sensors and command devices:

- Optoelectronic sensors (safety light curtains, scanners, safety photo cells)
- Mechanical switches
- Safety mats
- Emergency stops
- Two-hand controls
- Enabling devices
- Magnetic switches
- Proximity switches
- Encoders

Controller Modules

The following controller modules are available:

Controller module	Type	Description
XPSMCMCP0802•• *(see page 50)* XPSMCMCP0802••G *(see page 50)*	CP0802	• 8 safety-related inputs • 2 dual-channel solid-state safety-related outputs (Output Signal Switching Device, OSSD).

I/O Expansion Modules

The following input and output expansion modules are available:

Input and output expansion module	Type	Description
XPSMCMMX0802• *(see page 62)*	MX0802	• 8 safety-related inputs • 2 dual-channel solid-state safety-related output (Output Signal Switching Device, OSSD).
XPSMCMDI0800• Module *(see page 71)*	DI08	• 8 safety-related inputs • With this module, the number of inputs in the system can be increased to allow more external devices to be connected.
XPSMCMDI1600• Module *(see page 78)*	DI16	• 16 safety-related inputs • With this module, the number of inputs in the system can be increased to allow more external devices to be connected.
XPSMCMDI1200MT• Module *(see page 85)*	DI12M	• Specific module to connect safety mats. • Provides 8 test outputs for line control monitoring. • With this module, the number of inputs in the system can be increased to allow more external devices to be connected.
XPSMCMDO0002• Module *(see page 92)*	DO02	2 dual-channel solid-state safety-related output pairs for connection to contactors or drives.
XPSMCMDO0004• Module *(see page 100)*	DO04	4 dual-channel solid-state safety-related output pairs for connection to contactors or drives.
XPSMCMER0002• Module *(see page 110)*	ER02	• 2 forcibly guided contact safety-related relay output (2 NO +1 NC) module without backplane connection. • The XPSMCMER0002• module is not connected to the backplane expansion bus.
XPSMCMER0004• Module *(see page 118)*	ER04	• 4 forcibly guided contact safety-related relay output (2x 2 NO +1 NC) module without backplane connection. • The XPSMCMER0004• module is not connected to the backplane expansion bus.

Input and output expansion module	Type	Description
XPSMCMRO0004• Module *(see page 137)*	R04	• 4 forcibly guided contact safety-related relay output (4x 2 NO) module without backplane connection. • Expansion module with 4 independent safety-related relay outputs and the corresponding 4 inputs for the external feedback contacts (EDM). • The relay can be configured according to Category 1, 2 and 4 architectures.
XPSMCMRO0004DA • Module *(see page 146)*	R04DA	• 4 forcibly guided contact safety-related relay output (4x 2 NO) module without backplane connection. • Expansion module with 4 independent safety-related relay outputs and the corresponding 4 inputs for the external feedback contacts (EDM). • The relay can be configured according to Category 1, 2 and 4 architectures. • Contains 8 non-safety-related status outputs.

XPSMCMEN• Module *(see page 126)*	• PROX
	• E01HT
	• E01SC
	• E01TT
	• E02HT
	• E02SC
	• E02TT
		• Modules for monitoring speed by proximity sensors, and, depending on the reference, safety encoders with SinCos, HTL or TTL interface.
		• The XPSMCMEN• expansion units can be used to control the following (up to PLe):
		  ❍ Zero speed, maximum speed, speed range;
		  ❍ Direction of movement, rotation/translation
		• Up to 4 speed thresholds can be set for each logic output (axis).
		• Each unit incorporates two logic outputs that can be configured using the SoSafe Configurable software and is thus capable of controlling up to two independent axes.

Communication Modules

The following communication modules are available:

Communication module	Type	Description
XPSMCMCO0000S• Module *(see page 155)*	**SCOM1**, **SCOM2**	• The XPSMCMCO0000S1 and XPSMCMCO0000S2 units are used to build remote functional safety islands between controller and I/O expansion modules at distance (< 50 m / 164 ft) between islands and up to 6 islands. • Two XPSMCMCO0000S1 or XPSMCMCO0000S2 expansion modules can be connected using a RS-485 shielded cable *(see page 181)*.
XPSMCMCO0000•• Module *(see page 162)*	**USB**, **EIP**, **MTP**, **MBS**, **CAN**, **PDP**, **ECT**	The fieldbus expansion modules allow connection to the most common industrial fieldbus systems for diagnostics and data transmission.

Accessories

The following accessories are available:

Accessories	Type	Description
TCSXCNAMUM3P *(see page 176)*	USB/Mini B-USB configuration cable	Cable for configuring both the XPSMCMCP0802• controller and fieldbus communication modules
XPSMCMME0000 *(see page 177)*	Memory card	The memory card can be installed in the Modular Safety Controller and is used to save/restore the hardware/software configuration
XPSMCMCN0000SG *(see page 180)*	Backplane expansion connector	The connector allows you to add expansion input/output and communication modules to the XPSMCM• Modular Safety Controller. The Modular Safety Controller requires one XPSMCMCN0000SG connector; the expansion modules are delivered with the connector.
TSXSCMCN0•• *(see page 181)*	RS485 cables	RS485 serial interface shielded cables are used between the Bus expansion communications modules to create decentralized safety-related islands. The cable is available in 10 m (32.81 ft), 25 m (82.02 ft) and 50 m (164.04 ft) lengths.
TSXESPPM••• *(see page 182)* TSXESPP3••• *(see page 184)*	Encoder splitter cables	An encoder splitter cable is used to split the motor encoder feedback signal. One signal is then directed to the drive and one to the safety-related speed monitoring module. The cables is available in 1 m (3.28 ft), 3 m (9.84 ft), and 5 m (16.4 ft) lengths.

Scope of Delivery

Overview

Each controller is provided with:
- Multi-language instruction sheet
- Backplane connector XPSMCMCN0000SG (with XPSMCMCP0802*BC* only; controllers with a reference without “BC” are delivered without backplane connector for stand-alone use)
- Controllers whose reference number have a suffix “G” are delivered with spring terminal blocks, the other controllers with screw terminal blocks

Each expansion module including fieldbus and specific modules is provided with:
- Multi-language instruction sheet
- Backplane XPSMCMCN0000GS connector (except for XPSMCMER0002• and XPSMCMER0004• because they are not connected to the backplane expansion bus)
- Modules whose reference number have a suffix “G” are delivered with spring terminal blocks, the other modules with screw terminal blocks

NOTE: For each controller, you must order the following items separately:
- TCSXCNAMUM3P: USB/Mini B-USB configuration cable *(see page 176)*
- XPSMCMME0000: Memory card *(see page 177)*
- XPSMCMCN0000SG: Backplane expansion connector *(see page 180)* (except for controllers XPSMCMCP0802*BC*)

Declarations

EC Declaration of Conformity

CE

EC DECLARATION OF CONFORMITY
Copy of Document-no.: EAV9139101.00
Original Language

WE: **Schneider Electric Automation GmbH** / Schneiderplatz 1 / Marktheidenfeld 97828, Germany

hereby declare that the safety component

TRADEMARK: **SCHNEIDER ELECTRIC**

PRODUCT, TYPE: Modular Safety Controller

MODELS: XPSMCMCO0000S1•, XPSMCMCO0000S2•, XPSMCMCP0802•, XPSMCMDI0800•, XPSMCMDI1200MT•, XPSMCMDI1600•, XPSMCMDO0002•, XPSMCMDO0004•, XPSMCMEN0100HT•, XPSMCMEN0100SC•, XPSMCMEN0100TT•, XPSMCMEN0200HT•, XPSMCMEN0200SC•, XPSMCMEN0200TT•, XPSMCMER0002•, XPSMCMER0004•, XPSMCMMX0802•, XPSMCMRO0004DA•, XPSMCMRO0004•, XPSMCMEN0200•, XPSMCMME0000

SERIAL NUMBER: YYXXZZZZ (YY: 10…99, XX: 01…53, ZZZZ: 0001…9999)

DATE OF MANUFACTURING: refer to device nameplate

all the essential protection requirements that are described in the following directives are defined, corresponding. Furthermore, the conformity with the following harmonized European standards explained:

DIRECTIVE:	HARMONIZED STANDARD:
DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast)	EN 62061:2005 EN ISO 13849-1:2008 EN 61496-1:2013
DIRECTIVE 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL (EMC) of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC	EN 61131-2:2007
DIRECTIVE 2011/65/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL (RoHS) of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment	EN 50581:2012

It is important that the safety component is subject to correct installation, maintenance and use conforming to its intended purpose, to the applicable regulations and standards, to the supplier's instructions and to accepted rules of the art.

Name and address of the person authorised to compile the technical file:
Michael Schweizer / Schneider Electric Automation GmbH / Schneiderplatz 1 / Marktheidenfeld 97828, Germany

First year of affixing CE marking: 2014

Marktheidenfeld, Germany
December 1st, 2014

i.A. Michael Schweizer
Machine Solutions Certification Manager

The original EC Declaration of Conformity is available on our website: www.schneider-electric.com

CE

EC DECLARATION OF CONFORMITY

Copy of Document-no.: NHA3417601.00
Original Language

WE: **Schneider Electric Automation GmbH** / Schneiderplatz 1 / Marktheidenfeld 97828, Germany

hereby declare that the safety component

TRADEMARK: **SCHNEIDER ELECTRIC**

PRODUCT, TYPE: Modular Safety Controller – Communication Modules, Accessories

MODELS: XPSMCMCO0000CO•, XPSMCMCO0000DN•, XPSMCMCO0000EC•, XPSMCMCO0000EI•, XPSMCMCO0000EI2•, XPSMCMCO0000EM•, XPSMCMCO0000EP•, XPSMCMCO0000MB•, XPSMCMCO0000PB•, XPSMCMCO0000UB•, XPSMCMCN0000SG, TSXSCMCN•••, TSXESPPM•••, TSXESPP3•••

SERIAL NUMBER: YYXXZZZZ (YY: 10…99, XX: 01…53, ZZZZ: 0001…9999)

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DIRECTIVE 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL (EMC) of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC	EN 61131-2:2007
DIRECTIVE 2011/65/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL (RoHS) of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment	EN 50581:2012

It is important that the safety component is subject to correct installation, maintenance and use conforming to its intended purpose, to the applicable regulations and standards, to the supplier's instructions and to accepted rules of the art.

First year of affixing CE marking: 2014

Marktheidenfeld, Germany
December 1st, 2014

i.A. Michael Schweizer
Machine Solutions Certification Manager

The original EC Declaration of Conformity is available on our website: www.schneider-electric.com

China RoHS

Declaration on the Restriction of Hazardous Substances (RoHS)

The data shown in this spreadsheet are related to the following version of the China RoHS 2.0: Administrative Measures for the Restriction of Hazardous Substances in Electric Appliances and Electronic Products" released January 21st 2016.

部件名称 Part name	有害物质 - Hazardous Substances					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
金属部件 Metal parts	X	O	O	O	O	O
塑料部件 Plastic parts	O	O	O	O	O	O
电子件 Electronic	X	O	O	O	O	O
触点 Contacts	O	O	O	O	O	O
线缆和线缆附件 Cables & cabling accessories	O	O	O	O	O	O

本表格依据 SJ/T11364 的规定编制。

O: 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。

X: 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

This table is made according to SJ/T 11364.

O: indicates that the concentration of hazardous substance in all of the homogeneous materials for this part is below the limit as stipulated in GB/T 26572.

X: indicates that concentration of hazardous substance in at least one of the homogeneous materials used for this part is above the limit as stipulated in GB/T 26572

Table 1

Chapter 2
Technical Data

What Is in This Chapter?

This chapter contains the following topics:

General System Characteristics

General Characteristics

<table>
<tr><th colspan="4">General characteristics</th></tr>
<tr><td>Rated voltage</td><td colspan="3">24 Vdc ± 20 % (PELV supply)</td></tr>
<tr><td>Dissipated power</td><td colspan="3">3 W maximum</td></tr>
<tr><td>Overvoltage category</td><td colspan="3">II</td></tr>
<tr><td>Ambient operating temperature</td><td colspan="3">-10...+55 °C (14...131 °F)</td></tr>
<tr><td>Storage temperature</td><td colspan="3">-20...+85 °C (-4...185 °F)</td></tr>
<tr><td>Relative humidity</td><td colspan="3">10...95%</td></tr>
<tr><td>Maximum operation altitude</td><td colspan="3">2000 m (6562 ft)</td></tr>
<tr><td>Pollution degree</td><td colspan="3">2</td></tr>
<tr><td>Vibration resistance (IEC/EN 61496-1)</td><td colspan="3">+/- 3.5 mm (0.138 in) 5...8.4 Hz
1 g (8.4...150 Hz)</td></tr>
<tr><td>Shock resistance (IEC/EN 61496-1)</td><td colspan="3">15 g (11 ms half-sine)</td></tr>
<tr><td>EMC Category</td><td colspan="3">Zone B</td></tr>
<tr><td rowspan="15">Response time (ms)
The response time depends on the following parameters:
• Number of expansion modules installed
• Number of operators
• Number of OSSD outputs
• Status outputs

For the response time, refer to the one calculated by the SoSafe Configurable software (see project report).
$T_{\text{Input\_filter}}$ = filtering time set in the project for the inputs. For details, refer to the Input functions (see page 274).</td><td>Controller</td><td>10.6...12.6</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
<tr><td>Controller + 1 expansion module</td><td>11.8...26.5</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
<tr><td>Controller + 2 expansion modules</td><td>12.8...28.7</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
<tr><td>Controller + 3 expansion modules</td><td>13.9...30.8</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
<tr><td>Controller + 4 expansion modules</td><td>15...33</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
<tr><td>Controller + 5 expansion modules</td><td>16...35</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
<tr><td>Controller + 6 expansion modules</td><td>17...37.3</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
<tr><td>Controller + 7 expansion modules</td><td>18.2...39.5</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
<tr><td>Controller + 8 expansion modules</td><td>19.3...41.7</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
<tr><td>Controller + 9 expansion modules</td><td>20.4...43.8</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
<tr><td>Controller + 10 expansion modules</td><td>21.5...46</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
<tr><td>Controller + 11 expansion modules</td><td>22.5...48.1</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
<tr><td>Controller + 12 expansion modules</td><td>23.6...50.3</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
<tr><td>Controller + 13 expansion modules</td><td>24.7...52.5</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
<tr><td>Controller + 14 expansion modules</td><td>25.8...54.6</td><td>+ $T_{\text{Input\_filter}}$</td></tr>
</table>

NOTE: Specific characteristics for each reference can be found in Component-Specific Hardware Information *(see page 47)*.

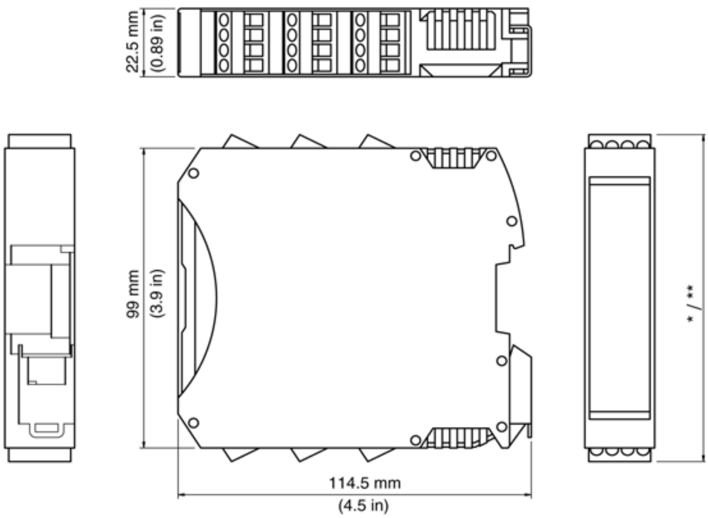
Housing Characteristics

Housing characteristics	
Housing material	Polyamide
Housing degree of protection	IP20
Terminal blocks degree of protection	IP2x
Mounting	35 mm DIN rail according to EN/IEC 60715
Mounting position	Any plane
Dimensions (h x l x d)	• with screw terminals: 108 x 22.5 x 114.5 mm (4.25 x 0.89 x 4.5 in) • with spring terminals: 118.5 x 22.5 x 114.5 mm (4.67 x 0.89 x 4.5 in)

Mechanical Dimensions

Dimensions

The graphics indicate the dimensions of the XPSMCM• references:



*	Screw terminals 108 mm (4.25 in)
**	Spring terminals 118 mm (4.67 in)

Mount the modules (Modular Safety Controller and any I/O expansion modules) in an electric cabinet with an IP54 degree of protection. The minimum clearance below and above the controller is 40 mm. Allow at least 100 mm distance between the cabinet door and the front face of the module(s). There are no clearances required on the left or right side of the module(s); however, other equipment in proximity may require larger distances and those clearances must also be taken into account.

Chapter 3
Electrical Requirements

What Is in This Chapter?

This chapter contains the following topics:

Wiring Best Practices

Overview

This section describes the wiring guidelines and associated best practices to be respected when using the XPSMCM• Modular Safety Controller system.

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.

Wiring Guidelines

The following rules must be applied when wiring a XPSMCM• Modular Safety Controller system:

- I/O and communication wiring must be kept separate from the power wiring. Route these two types of wiring in separate cable ducting.
- Verify that the operating conditions and environment are within the specification values found in the technical characteristics.
- Use proper wire sizes to meet voltage and current requirements.
- Use copper conductors (required).
- Use twisted pair, shielded cables for networks, and fieldbus.
- The maximum length of cables connected to inputs and of cables connecting controllers via the Network function block is 100 m (328 ft)

To help minimize the effects of electromagnetic interference, use shielded, properly grounded cables for all I/O susceptible to electrical noise and all communication connections. If you do not use shielded cable for these connections, electromagnetic interference can cause signal degradation. Degraded signals can cause the controller or attached modules and equipment to perform in an unintended manner.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Use shielded cables for communication signals and any I/O that may be susceptible to electromagnetic radiation.
- Ground cable shield at a single point[1].
- Route communication and I/O cables separately from power cables.

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

[1]Multipoint grounding is permissible if connections are made to an equipotential ground plane dimensioned to help avoid cable shield damage in the event of power system short-circuit currents.

The use of shielded cables requires compliance with the following wiring rules:

- For protective ground connections (PE), metal conduit or ducting can be used for part of the shielding length, provided there is no break in the continuity of the ground connections. For functional ground (FE), the shielding is intended to attenuate electromagnetic interference and the shielding must be continuous for the length of the cable. If the purpose is both functional and protective, as is often the case for communication cables, the cable must have continuous shielding.
- Wherever possible, keep cables carrying one type of signal separate from the cables carrying other types of signals or power.

Protective Ground (PE) on the Backplane

The protective ground (PE) should be connected to the conductive backplane by a heavy-duty wire, usually a braided copper cable with the maximum allowable cable section.

Shielded Cables Connections

Shielded I/O cables and fieldbus communication signals must be securely connected to ground. The I/O shields may be connected either to the functional ground (FE) or to the protective ground (PE) of your installation. The fieldbus communication cable shields must be connected to the protective ground (PE) with a connecting clamp secured to the conductive backplane of your installation.

The shielding of any Modbus cabling must be connected to the protective ground (PE).

DANGER

HAZARD OF ELECTRIC SHOCK

- The grounding terminal connection (PE) must be used to provide a protective ground at all times.
- Make sure that an appropriate, braided ground cable is attached to the PE/PG ground terminal before connecting or disconnecting the network cable to the equipment.

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

Cable Types and Wire Sizes

Cable types and wire sizes

for a 5.08 pitch removable **screw** terminal block

mm / *in.* 7 / *0.28*								
mm²	0.2...2.5	0.2...2.5	0.25...2.5	0.25...1.5	2 x 0.2...1	2 x 0.2...1.5	2 x 0.25...1	2 x 0.5...1.5
AWG	*24...14*	*24...14*	*23...14*	*23...16*	*2 x 24...18*	*2 x 24...16*	*2 x 23...18*	*2 x 20...16*

Ø 3,5 mm (*0.14 in.*)	C	N•m	0.5
		lb-in	*4.42*

for a 5.08 pitch removable **spring** terminal block (used by XPSMCM•••G).

mm / *in.* 10 / *0.39*					
mm²	0.2...2.5	0.2...2.5	0.25...2.5	0.25...2.5	2 x 0.5...1
AWG	*24...14*	*24...14*	*23...14*	*23...14*	*2 x 20...18*

The following instructions concerning connection cables must be observed:

- Use 60/75 °C copper (Cu) conductor only. Maximum cable length 100 m (328 ft).
- Cables used for connections of longer than 50 m (164 ft) must have a cross-section of at least 1 mm^2 (AWG 16).

NOTE: Spring cage clamp connectors have the added advantage of requiring no maintence in order to retain the tension on the wire. However, screw connectors do require tightening maintenance on a regular schedule.

DANGER

LOOSE WIRING CAUSES ELECTRIC SHOCK

Tighten connections in conformance with the torque specifications.

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

DANGER

FIRE HAZARD

- Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.
- For relay output (2 A) wiring, use conductors of at least 0.5 mm^2 (AWG 20) with a temperature rating of at least 80 °C (176 °F).
- For common conductors of relay output wiring (7 A), or relay output wiring greater than 2 A, use conductors of at least 1.0 mm^2 (AWG 16) with a temperature rating of at least 80 °C (176 °F).

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

The spring clamp connectors of the terminal block are designed for only one wire or one cable end. Two wires to the same connector must be installed with a double wire cable end to help prevent loosening.

DANGER

LOOSE WIRING CAUSES ELECTRIC SHOCK

Do not insert more than one wire per connector of the spring terminal blocks unless using a double wire cable end (ferrule).

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

Protecting Outputs from Inductive Load Damage

Depending on the load, a protection circuit may be needed for the outputs on the controllers and certain modules. Inductive loads using DC voltages may create voltage reflections resulting in overshoot that will damage or shorten the life of output devices.

⚠ CAUTION

OUTPUT CIRCUIT DAMAGE DUE TO INDUCTIVE LOADS

Use an appropriate external protective circuit or device to reduce the risk of inductive direct current load damage.

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

If your controller or module contains relay outputs, these types of outputs can support up to 240 Vac. Inductive damage to these types of outputs can result in welded contacts and loss of control. Each inductive load must include a protection device such as a peak limiter, RC circuit or flyback diode. Capacitive loads are not supported by these relays.

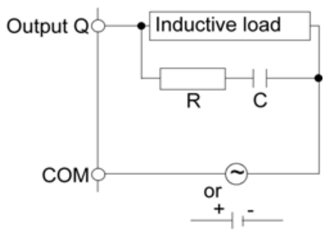
⚠ WARNING

RELAY OUTPUTS WELDED CLOSED

- Always protect relay outputs from inductive alternating current load damage using an appropriate external protective circuit or device.
- Do not connect relay outputs to capacitive loads.

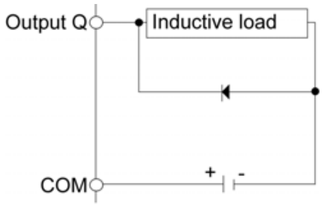
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Protective circuit A: this protection circuit can be used for both AC and DC load power circuits.



C Value from 0.1 to 1 μF
R Resistor of approximately the same resistance value as the load

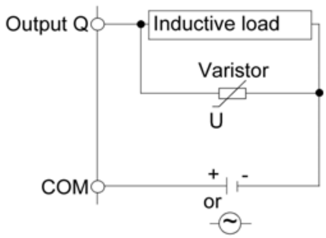
Protective circuit B: this protection circuit can be used for DC load power circuits.



Use a diode with the following ratings:

- Reverse withstand voltage: power voltage of the load circuit x 10.
- Forward current: more than the load current.

Protective circuit C: this protection circuit can be used for both AC and DC load power circuits.



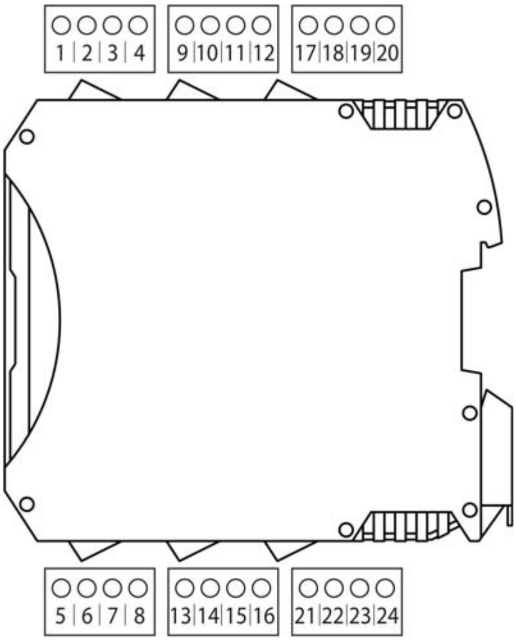
In applications where the inductive load is switched on and off frequently and/or rapidly, ensure that the continuous energy rating (J) of the varistor exceeds the peak load energy by 20 % or more.

Terminal Blocks

Presentation

The Modular Safety Controller references are provided with removable terminal blocks for the electrical connections. Each reference can have 8 (2 terminal blocks), 16 (4 terminal blocks) or 24 (6 terminal blocks) terminals.

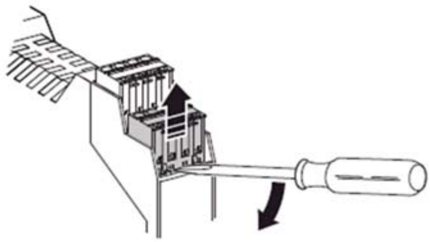
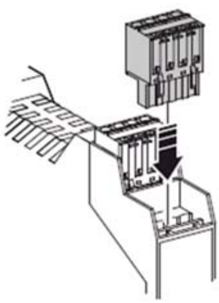
The following graphic shows an example with the maximum number of terminals:



The terminal blocks are either screw or spring cage clamp terminal blocks depending on the reference.

Removing the I/O Terminal Block

To remove a terminal block, use a flat, insulated or otherwise non-conductive screwdriver as described:

Step	Action
1	Slide the tip of the screwdriver into the slit located between the front of the terminal block and the module to lever the terminal block up.  **NOTE:** You can remove the terminal block to wire it.
2	To put a terminal block in the module, slide it in the proper location until you hear it click into place. 

Part II
Component-Specific Hardware Information

What Is in This Part?

This part contains the following chapters:

Chapter 4
Technical Features

What Is in This Chapter?

This chapter contains the following sections:

Section 4.1
XPSMCMCP0802x Modular Safety Controller

What Is in This Section?

This section contains the following topics:

Controller and Functional Description

Presentation

XPSMCMCP0802• is a Modular Safety Controller providing eight safety-related inputs and two safety-related outputs (four physical channels), which can be configured using SoSafe Configurable. In addition, the Modular Safety Controller can be combined with a number of expansion modules through the backplane expansion bus.

Configuration of the controller: The XPSMCMCP0802• Modular Safety Controller requires a USB (computer) to Mini B-USB (controller) configuration cable connected to a PC via a USB 2.0 port to configure the controller. The XPSMCMCP0802• requires SoSafe Configurable to configure the controller and system.

Optional memory card: An optional backup memory card can be installed in the XPSMCMCP0802• Modular Safety Controller and used to store the software configuration parameters.

Input MASTER_ENABLE

The XPSMCMCP0802• Modular Safety Controller contains two enabling EN inputs: MASTER_ENABLE1 and MASTER_ENABLE2. These signals must both be permanently set to logic level 1 (24 Vdc) for the controller to operate. To disable the controller, deactivate the supply voltage to the inputs, logic level 0 (0 Vdc).

Input RESTART (RST)

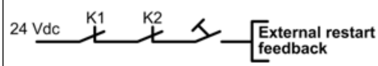
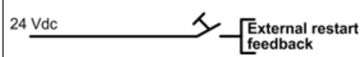
The RESTART (RST) signal input allows the XPSMCMCP0802• Modular Safety Controller to verify an EDM (External Device Monitoring) feedback signal (series of contacts) from external contactors, and to monitor manual or automatic operation.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- The RESTART command must be installed outside the zone of operation in a position where the zone of operation and the entire work area concerned are clearly visible.
- It must not be possible to operate the RESTART command from inside the zone of operation.

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

Operation mode	EDM	`Restart_fbk`
Automatic	With K1_K2 control	
	Without K1_K2 control	
Manual	With K1_K2 control	
	Without K1_K2 control	

Output STATUS

The STATUS outputs are configurable digital diagnostic outputs that indicate the diagnostic status of safety-related function inputs and/or outputs. The status outputs are non-safety-related outputs (not implicated in the prescribed safety-related function) and are intended to be connected only for diagnostic purposes. Two status outputs are available on the XPSMCMCP0802• Modular Safety Controller.

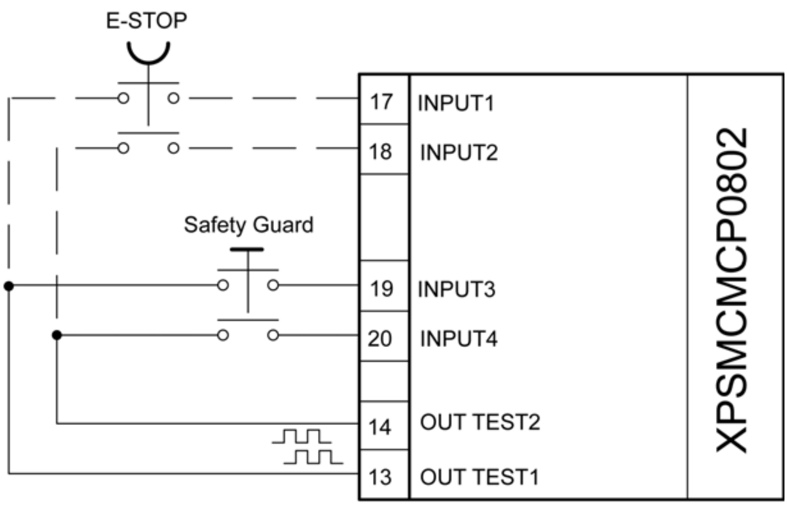
⚠ WARNING
UNINTENDED EQUIPMENT OPERATION Do not use STATUS outputs for safety-related functions. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Output TEST

The TEST outputs are used for line control monitoring and are connected through an input device (for example, emergency stop push-button) to the inputs on the Modular Safety Controller.

The TEST outputs must be used to monitor the presence of short-circuits or overloads on the inputs and reach performance level **e** in accordance with:
- EN/ISO 13849-1 Category 4 architecture, and
- SILcl 3 EN/IEC 62061.

The maximum number of inputs for each TEST output is:
- Two inputs (parallel connection) for XPSMCMCP0802•, XPSMCMMX0802•, XPSMCMDI0800•, XPSMCMDI1200MT•
- Four inputs (parallel connection) for XPSMCMDI1600•



Type C, class 3 according to "ZVEI Position Paper CB24I" with a maximum test pulse duration of 100 µs.

Solid-State Safety Output (OSSD)

The two outputs on the Modular Safety Controller OSSD (Output Signal Switching Device) are short-circuit protected. Physically two channels per output are required to reach a Category 4 architecture with the connected outputs.

The outputs are able to supply:
- In the ON condition: Uv-0.75 V ÷ Uv (where Uv is 24 V ± 20 %)
- In the OFF condition: 0 ÷ 2 V r.m.s.

The maximum load of 400 mA@24 V (each OSSD pair) corresponds to a minimum resistive load of 60 Ω.

The maximum capacitive load is 0.82 µF.

The maximum inductive load is 30 mH.

Type C, class 3 according to "ZVEI Position Paper CB24I" with a maximum test pulse duration of 100 µs.

The following table shows, how each OSSD output can be configured:

Automatic	The output is activated according to the configurations set by the SoSafe Configurable software, only if the corresponding RESTART input is connected to 24 Vdc.
Manual	The output is activated according to the configurations set by the SoSafe Configurable software, only if corresponding RESTART input follows a logic transition of 0-->1.
Monitored	The output is activated according to the configurations set by the SoSafe Configurable software, only if corresponding RESTART input follows a logic transition of 0-->1-->0.

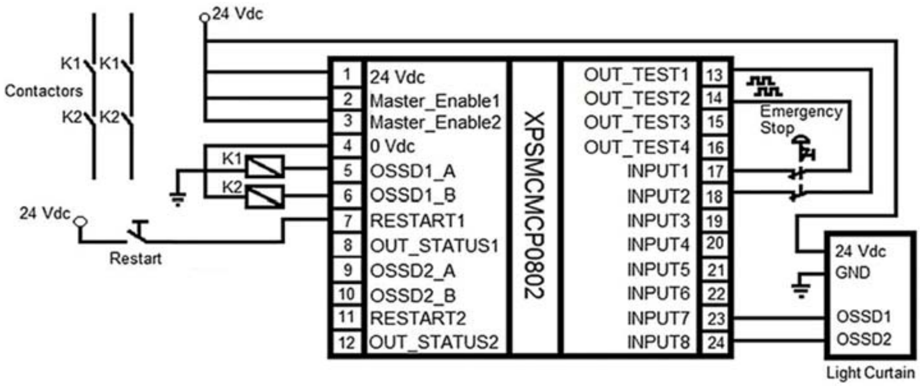
Connector Designations and Example Wiring Diagram

Modular Safety Controller Connector Designations

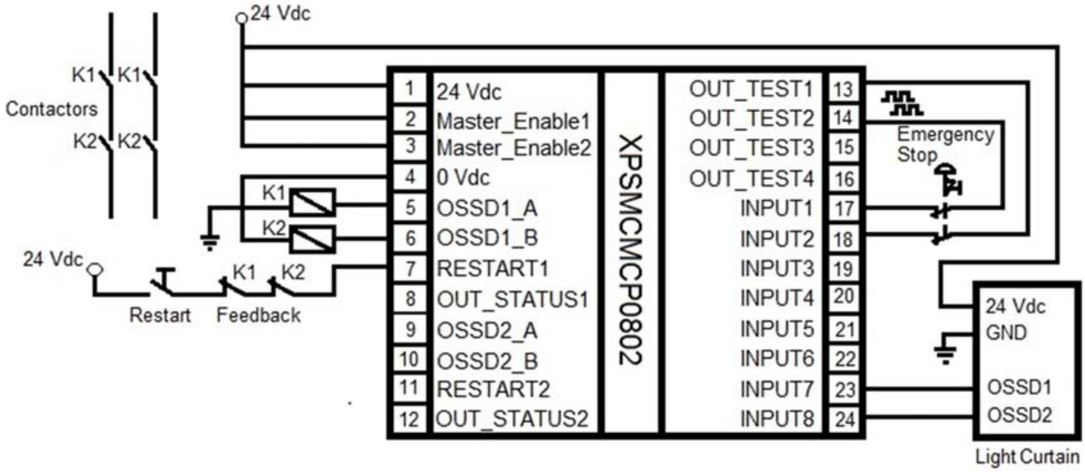
Terminal	Signal	LED	Type	Description	Operation
1	24 VDC	PWR	-	24 Vdc power supply	-
2	MASTER_ENABLE1	EN	Input	Master enable 1	Input type 3. Maximum applicable resistance 1.2 kΩ.
3	MASTER_ENABLE2	EN		Master enable 2	
4	0 VDC	PWR	-	0 Vdc power supply	-
5	OSSD1_A	OUT 1	Output	Static output 1	PNP (sourcing) active high
6	OSSD1_B	OUT 1			
7	RESTART1	RST 1	Input	Feedback/Restart 1	Input type 3. Maximum applicable resistance 1.2 kΩ.
8	OUT_STATUS 1	STATUS 1	Output	Configurable diagnostic output	PNP (sourcing) active high
9	OSSD2_A	OUT 2		Static output 2	
10	OSSD2_B	OUT 2			
11	RESTART2	RST 2	Input	Feedback/Restart 2	Input type 3. Maximum applicable resistance 1.2 kΩ.
12	OUT_STATUS 2	STATUS 2	Output	Configurable diagnostic output	PNP (sourcing) active high
13	OUT_TEST1	-		Short circuit detected output	
14	OUT_TEST2	-			
15	OUT_TEST3	-			
16	OUT_TEST4	-			
17	INPUT1	IN 1	Input	Digital input 1	Input type 3. Maximum applicable resistance 1.2 kΩ.
18	INPUT2	IN 2		Digital input 2	
19	INPUT3	IN 3		Digital input 3	
20	INPUT4	IN 4		Digital input 4	
21	INPUT5	IN 5		Digital input 5	
22	INPUT6	IN 6		Digital input 6	
23	INPUT7	IN 7		Digital input 7	
24	INPUT8	IN 8		Digital input 8	

Modular Safety Controller Example Wiring Diagram

Category 3 wiring for XPSMCMCP0802:



Category 4 wiring for XPSMCMCP0802:



LED Indicators

Front-Face View

Operation States

The following table describes the operation states of the XPSMCMCP0802• LED indicators, assuming the power (**PWR**) indicator is illuminated:

RUN green	E IN red	E EX red	COM orange	EN blue	IN 1-8 yellow	OUT 1/2 red/ green	RST 1/2 yellow	STATUS 1/2 yellow	Meaning
ON	ON	ON	ON	ON	ON	red	ON	ON	Power on - initial TEST
OFF	OFF	OFF	ON (max. 1 s)	ON (max. 1 s)	OFF	red	OFF	OFF	Memory card recognized
OFF	OFF	OFF	5 flashes	5 flashes	OFF	red	OFF	OFF	Writing/loading/ diagram to/from memory card
(1) MASTER_ENABLE1 and MASTER_ENABLE2 inputs are at state 1									

RUN green	E IN red	E EX red	COM orange	EN blue	IN 1-8 yellow	OUT 1/2 red/ green	RST 1/2 yellow	STATUS 1/2 yellow	Meaning
OFF	OFF	OFF	ON	OFF	OFF	red	OFF	OFF	Controller stopped
ON	OFF	OFF	ON = connected / OFF	ON (1)/ OFF	Input state	Output state: red = 0 green = 1	ON = waiting for reboot / Flashing = no feedback	Output diagnostics	Normal operation
(1) MASTER_ENABLE1 and MASTER_ENABLE2 inputs are at state 1									

Troubleshooting

The following table describes the error states of the LED indicators, assuming the power (**PWR**) indicator is illuminated:

Detected error	RUN green	E IN red	E EX red	COM orange	EN blue	IN 1-8 yellow	OUT 1/2 red/ green	RST 1/2 yellow	STATUS 1/2 yellow	Solution
Internal error detected	OFF	2 or 3 flashes	OFF	OFF	OFF	OFF	red	OFF	OFF	Product non serviceable[1].
Internal configuration not present	OFF	OFF	OFF	Slow flashes	OFF	OFF	red	OFF	OFF	Download the configuration to the controller[1].
Module or node number not correct	OFF	OFF	OFF	Rapid flashes	OFF	OFF	red	OFF	OFF	Verify the hardware configuration and the terminal 2 and 3 of each expansion module.
Module missing or not ready	Rapid flashes	OFF	OFF	Rapid flashes	OFF	OFF	red	OFF	OFF	Verify the hardware configuration and the state of each expansion module.
External wiring error detected	ON	OFF	ON	ON = connected / OFF	OFF	Flashing = input with error	OFF	OFF	OFF	Verify all I/O connections.
1 If the trouble persists, return the equipment to its place of purchase.										

Detected error	RUN green	E IN red	E EX red	COM orange	EN blue	IN 1-8 yellow	OUT 1 /2 red/ green	RST 1/ 2 yellow	STATU S 1/2 yellow	Solution
Internal error detected	OFF	2 or 3 flashe s	OFF	OFF	OFF	OFF	red	OFF	OFF	Product non serviceable[1].
Configuration error detected	OFF	5 flashe s	OFF	OFF	OFF	5 flashes				Download the configuration to the controller[1].
OSSD output error	OFF	4 flashe s	OFF	OFF	OFF	OFF	4 flashes	OFF	OFF	Verify solid-state safety output (OSSD)1/2 connections[1].
Error in communication with expansion module	OFF	5 flashe s	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Reboot the system.[1]
Expansion module unit error	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Reboot the system. Verify which expansion module is in error and consult its troubleshooting guide.
Memory card error detected.	OFF	6 flashe s	OFF	6 flashes	OFF	OFF	OFF	OFF	OFF	Replace the memory card *(see page 177)*.
1 If the trouble persists, return the equipment to its place of purchase.										

Controller Characteristics

Presentation

⚠ DANGER

FIRE HAZARD

Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Controller-specific characteristics	
Reference description	Electronic housing maximum 24-pole, with locking latch mounting
Maximum number of inputs	128
Maximum number of outputs	16
Maximum number of expansion modules (excluding XPSMCMER0002 - XPSMCMER0004)	14
Maximum number of expansion modules of the same reference (excluding XPSMCMER0002 - XPSMCMER0004)	4
Unit enable (No./description)	2 / Type 3. Maximum applicable resistance 1.2 kΩ.
Digital inputs (No./description)	8 / Type 3. Maximum applicable resistance 1.2 kΩ.
Input Restart (No./description)	2 / EDM (External Device Monitoring) type 3. Maximum applicable resistance 1.2 kΩ. / Possible automatic or manual operation with restart pushbutton
Test output (No./description)	4 / to test for short circuits - overloads, maximum current 100 mA / 24 Vdc
Controller to controller by Network function	Maximum 10 Modular Safety Controllers with distance of 100 m (328.08 ft) between each controller.

Controller-specific characteristics	
Solid-state safety-related output (OSSD) (No./description)	2 pairs / solid-state safety-related outputs PNP active high ● The outputs are able to supply: ❍ In the ON condition: Uv-0.75 V to Uv (where Uv is 24 V ± 20 %) ❍ In the OFF condition: 0 to 2 V rms (root mean square) ● The maximum load of 400 mA@24 V (each OSSD pair) corresponds to a minimum resistive load of 60 Ω. ❍ The maximum capacitive load is 0.82 μF. ❍ The maximum inductive load is 30 mH. ● To detect short circuit and line break on the outputs, a line monitoring is made by using an output pulse on each channel. The output pulse is generated every 5.5 ms with a pulse of 100 microseconds.
Status outputs	Maximum output current per channel: 100 mA / 24 Vdc
Probability of a dangerous failure per hour (PFHd)	6.06E-9
Mean Time to Dangerous Failure (MTTFd) in years	382
Connection to PC	USB 2.0 (High speed) - Maximum cable length: 3 m (9.84 ft)
Connection to expansion modules	5-way backplane expansion
Weight	0.12 kg (4.2 Oz)
Slot for memory card	Yes

NOTE: For the characteristics common to all modules, refer to General Characteristics *(see page 34)*.

Section 4.2
XPSMCMMX0802x Input/Output Expansion Module

What Is in This Section?

This section contains the following topics:

Module and Functional Description

Presentation

The XPSMCMMX0802• is an input/output expansion module for the XPSMCM• Modular Safety Controller. The XPSMCMMX0802• module can only be configured in conjunction with the XPSMCMCP0802• Modular Safety Controller. The XPSMCMMX0802• module provides eight safety-related inputs and two safety-related outputs (four physical channels).

The expansion module supports two inputs `NODE_ADDR0` and `NODE_ADDR1` which are used to attribute a physical address to the module:

	NODE_ADDR0 (Terminal 2)	NODE_ADDR1 (Terminal 3)
NODE 0	0 (or not connected)	0 (or not connected)
NODE 1	24 Vdc	0 (or not connected)
NODE 2	0 (or not connected)	24 Vdc
NODE 3	24 Vdc	24 Vdc

NOTE: Do not use the same physical address for two units of the same module reference.

NOTE: The LEDs **ADDR 1** and **ADDR 0** correspond to the NODE_ADDR1 and NODE_ADDR0 in this table respectively.

NOTE: The node address wiring must match the configuration settings.

Input **RESTART** (**RST**)

For more information refer to Input RESTART (RST) *(see page 51)*.

Output **STATUS**

For more information refer to Output STATUS *(see page 52)*.

Output **TEST**

For more information refer to Output TEST *(see page 53)*.

Solid-State Safety Output (**OSSD**)

For more information refer to Solid-State Safety Output (OSSD) *(see page 53)*.

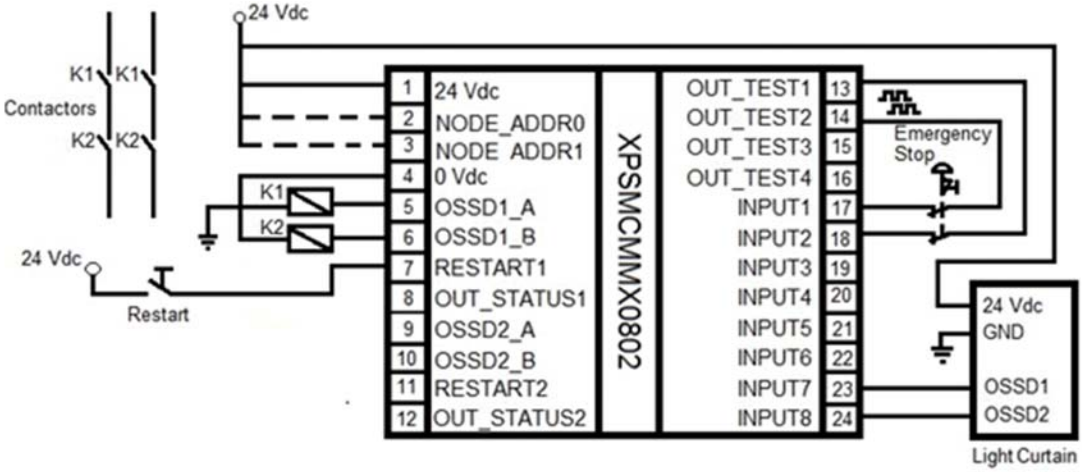
Connector Designations and Example Wiring Diagram

XPSMCMMX0802• Module Connector Designations

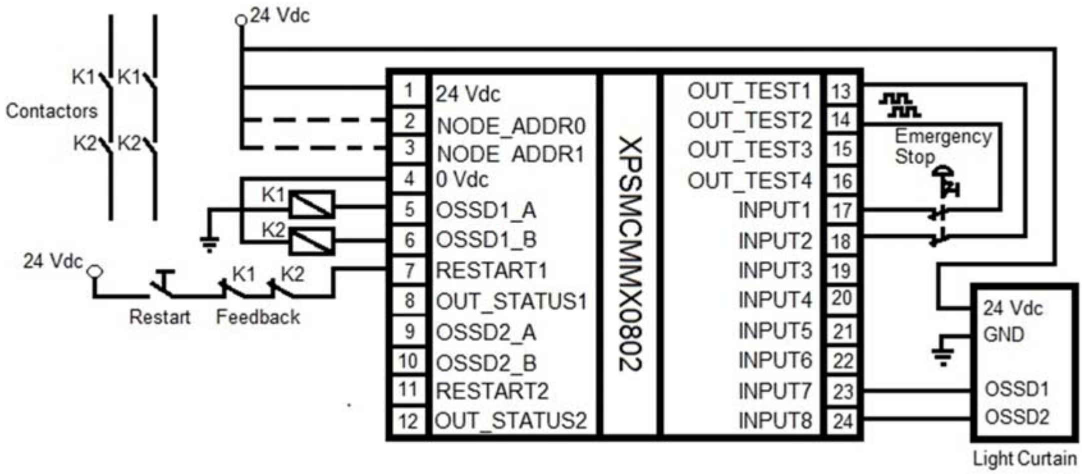
Terminal	Signal	LED	Type	Description	Operation
1	24 VDC	PWR	-	24 Vdc power supply	-
2	NODE_ADDR0	ADDR0	Input	Node selection	Input type 3. Maximum applicable resistance 1.2 kΩ.
3	NODE_ADDR1	ADDR1			
4	0 VDC	PWR	-	0 Vdc power supply	-
5	OSSD1_A	OUT 1	Output	Static output 1	PNP (sourcing) active high
6	OSSD1_B	OUT 1			
7	RESTART1	RST 1	Input	Feedback/Restart 1	Input type 3. Maximum applicable resistance 1.2 kΩ.
8	OUT_STATUS 1	STATUS 1	Output	Configurable diagnostic output	PNP (sourcing) active high
9	OSSD2_A	OUT 2		Static output 2	
10	OSSD2_B	OUT 2			
11	RESTART2	RST 2	Input	Feedback/Restart 2	Input type 3. Maximum applicable resistance 1.2 kΩ.
12	OUT_STATUS 2	STATUS 2	Output	Configurable diagnostic output	PNP (sourcing) active high
13	OUT_TEST1	-		Short circuit detected output	
14	OUT_TEST2	-			
15	OUT_TEST3	-			
16	OUT_TEST4	-			
17	INPUT1	IN 1	Input	Digital input 1	Input type 3. Maximum applicable resistance 1.2 kΩ.
18	INPUT2	IN 2		Digital input 2	
19	INPUT3	IN 3		Digital input 3	
20	INPUT4	IN 4		Digital input 4	
21	INPUT5	IN 5		Digital input 5	
22	INPUT6	IN 6		Digital input 6	
23	INPUT7	IN 7		Digital input 7	
24	INPUT8	IN 8		Digital input 8	

XPSMCMMX0802• Module Example Wiring Diagram

Category 3 wiring for XPSMCMMX0802•:

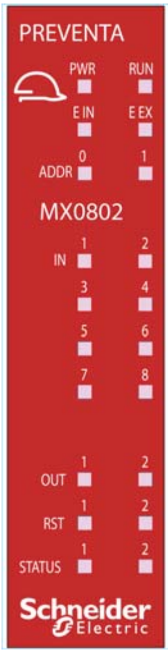


Category 4 wiring for XPSMCMMX0802•:



LED Indicators

Front-Face View



Operation States

The following table describes the operation states of the XPSMCMMX0802• LED indicators, assuming the power (**PWR**) indicator is illuminated):

RUN green	E IN red	E EX red	ADDR 0/1 orange	IN 1-8 yellow	OUT 1/2 red/ green	RST 1/2 yellow	STATUS 1/2 yellow	Meaning
ON	ON	ON	ON	ON	red	ON	ON	Power on - initial TEST

RUN green	E IN red	E EX red	ADDR 0/1 orange	IN 1-8 yellow	OUT 1/2 red/ green	RST 1/2 yellow	STATUS 1/2 yellow	Meaning
OFF = awaiting initialization	OFF	OFF	Encoded Node address *(see page 63)*	Input state	Output state: red = 0 green = 1	ON = waiting for restart	Output diagnostics	Normal operation
Flashing = no inputs or outputs configured		ON = Wiring error detected		Flashing = input with error		Flashing = no feedback		
ON = inputs or outputs configured								

Troubleshooting

The following table describes the error states of the LED indicators, assuming the power (**PWR**) indicator is illuminated:

Detected error	RUN green	E IN red	E EX red	IN 1-8 yellow	OUT 1/2 red/ green	RST 1/2 yellow	STATUS 1/2 yellow	Solution
Internal error detected.	OFF	2 or 3 flashes	OFF	OFF	red	OFF	OFF	Product non serviceable[1].
Compatibility error detected.	OFF	5 flashes	OFF	5 flashes				Firmware version not compatible with XPSMCMCP0802•[1].
OSSD output error detected.	OFF	4 flashes	OFF	OFF	4 flashes	OFF	OFF	Verify solid state safety output (OSSD)1/2 connections.
Error detected in the communication with controller.	OFF	5 flashes	OFF	OFF				Reboot the system[1].
Error detected on other expansion module or XPSMCMCP0802•.	OFF	ON	OFF	OFF				Reboot the system. Verify which module/controller is in error and consult its troubleshooting guide.

[1] If the trouble persists, return the equipment to its place of purchase.

NOTE: The **ADDR 0** and **ADDR 1** are not represented in this table as they can be found in the Operation States table.

Detected error	RUN green	E IN red	E EX red	IN 1-8 yellow	OUT 1/2 red/green	RST 1/2 yellow	STATUS 1/2 yellow	Solution
Two units of the same module reference detected with the same node address.	OFF	5 flashes	5 flashes	OFF				Modify the unit node address *(see page 63)* `NODE ADDR`.
[1] If the trouble persists, return the equipment to its place of purchase. **NOTE:** The **ADDR 0** and **ADDR 1** are not represented in this table as they can be found in the Operation States table.								

Module Characteristics

Presentation

⚠ DANGER

FIRE HAZARD

Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Module-specific characteristics	
Reference description	Electronic housing maximum 24-pole, with locking latch mounting
Unit enable (No./description)	2 / Type 3. Maximum applicable resistance 1.2 kΩ.
Digital inputs (No./description)	8 / Type 3. Maximum applicable resistance 1.2 kΩ.
Input Restart (No./description)	2 / EDM (External Device Monitoring) type 3. Maximum applicable resistance 1.2 kΩ. / Possible automatic or manual operation with restart pushbutton
Test output (No./description)	4 / to test for short circuits - overloads, maximum current 100 mA / 24 Vdc
Solid-state safety-related output (OSSD) (No./description)	2 pairs / solid-state safety-related outputs PNP active high ● The outputs are able to supply: ❍ In the ON condition: Uv-0.75 V to Uv (where Uv is 24 V ± 20 %) ❍ In the OFF condition: 0 to 2 V rms (root mean square) ● The maximum load of 400 mA@24 V (each OSSD pair) corresponds to a minimum resistive load of 60 Ω. ❍ The maximum capacitive load is 0.82 µF. ❍ The maximum inductive load is 30 mH. ● To detect short circuit and line break on the outputs, a line monitoring is made by using an output pulse on each channel. The output pulse is generated every 5.5 ms with a pulse of 100 microseconds.
Status outputs	Maximum output current per channel: 100 mA / 24 Vdc

Module-specific characteristics	
Probability of a dangerous failure per hour (PFHd)	5.72E-9
Mean Time to Dangerous Failure (MTTFd) in years	459
Connection to expansion modules	5-way backplane expansion
Weight	0.12 kg (4.2 Oz)

NOTE: For the characteristics common to all modules, refer to General Characteristics *(see page 34)*.

Section 4.3
XPSMCMDI0800x Input Expansion Module

What Is in This Section?

This section contains the following topics:

Module and Functional Description

Presentation

The XPSMCMDI0800• and XPSMCMDI1600• are input expansion modules for the XPSMCM• Modular Safety Controller. The XPSMCMDI0800• and XPSMCMDI1600• modules can only be configured in conjunction with the XPSMCMCP0802• Modular Safety Controller. The XPSMCMDI0800• module provides 8 safety-related inputs and the XPSMCMDI1600• module provides 16 safety-related inputs.

The expansion module supports two inputs `NODE_ADDR0` and `NODE_ADDR1` which are used to attribute a physical address to the module:

	NODE_ADDR0 (Terminal 2)	NODE_ADDR1 (Terminal 3)
NODE 0	0 (or not connected)	0 (or not connected)
NODE 1	24 Vdc	0 (or not connected)
NODE 2	0 (or not connected)	24 Vdc
NODE 3	24 Vdc	24 Vdc

NOTE: Do not use the same physical address for two units of the same module reference.

NOTE: The LEDs **ADDR 1** and **ADDR 0** correspond to the NODE_ADDR1 and NODE_ADDR0 in this table respectively.

NOTE: The node address wiring must match the configuration settings.

Output **TEST**

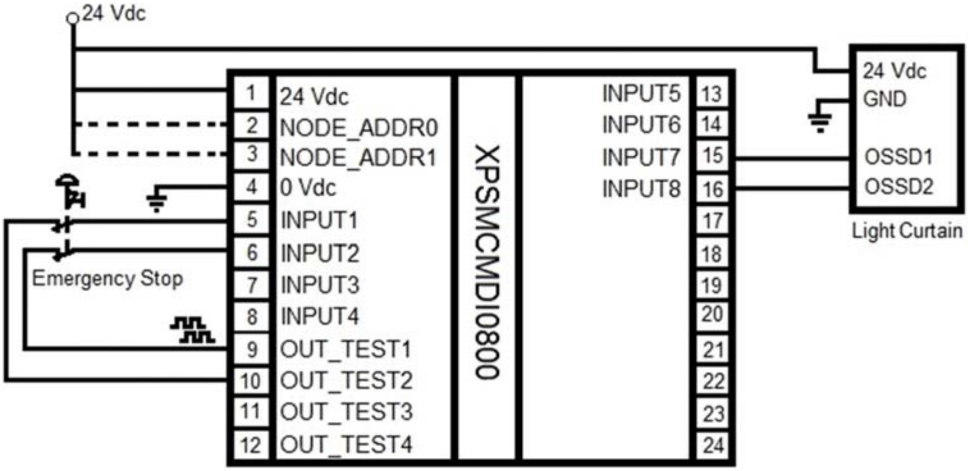
For more information refer to Output TEST *(see page 53)*.

Connector Designations and Example Wiring Diagram

XPSMCMDI0800• Module Connector Designations

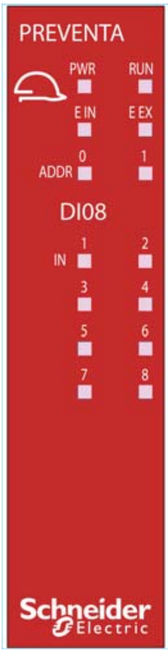
Terminal	Signal	LED	Type	Description	Operation
1	24 VDC	PWR	-	24 Vdc power supply	–
2	NODE_ADDR0	ADDR0	Input	Node selection	Input type 3. Maximum applicable resistance 1.2 kΩ.
3	NODE_ADDR1	ADDR1			
4	0 VDC	PWR	-	0 Vdc power supply	–
5	INPUT1	IN 1	Input	Digital input 1	Input type 3. Maximum applicable resistance 1.2 kΩ.
6	INPUT2	IN 2		Digital input 2	
7	INPUT3	IN 3		Digital input 3	
8	INPUT4	IN 4		Digital input 4	
9	OUT_TEST1	–	Output	Short circuit detected output	PNP (sourcing) active high
10	OUT_TEST2	–			
11	OUT_TEST3	–			
12	OUT_TEST4	–			
13	INPUT5	IN 5	Input	Digital input 5	Input type 3. Maximum applicable resistance 1.2 kΩ.
14	INPUT6	IN 6		Digital input 6	
15	INPUT7	IN 7		Digital input 7	
16	INPUT8	IN 8		Digital input 8	

XPSMCMDI0800• Module Example Wiring Diagram



LED Indicators

Front-Face View



Operation States

The following table describes the operation states of the XPSMCMDI0800• LED indicators, assuming the power (**PWR**) indicator is illuminated):

RUN green	E IN red	E EX red	ADDR 0/1 orange	IN 1 to 8 yellow	Meaning
ON	ON	ON	ON	ON	Power on - initial test
OFF = awaiting initialization	OFF	OFF / ON = Wiring error detected	Encoded Node address *(see page 72)*	Input state Flashing = input with error	Normal operation
Flashing = no inputs or outputs configured					
ON = inputs or outputs configured					

Troubleshooting

The following table describes the error states of the LED indicators, assuming the power (**PWR**) indicator is illuminated:

Detected error	RUN green	E IN red	E EX red	IN 1 to 8 yellow	Solution
Internal error detected.	OFF	2 or 3 flashes	OFF	OFF	Product non serviceable[1].
Compatibility error detected.	OFF	5 flashes	OFF	5 flashes	Firmware version not compatible with XPSMCMCP0802•[1].
Error detected in the communication with controller.	OFF	5 flashes	OFF	OFF	Reboot the system[1].
Error detected on other expansion module or XPSMCMCP0802•.	OFF	ON	OFF	OFF	Reboot the system. Verify which module /controller is in error and consult its troubleshooting guide.
Two units of the same module reference detected with the same node address.	OFF	5 flashes		OFF	Modify the unit node address *(see page 72)*.

1 If the trouble persists, return the equipment to its place of purchase.

NOTE: The **ADDR 0** and **ADDR 1** are not represented in this table as they can be found in the Operation States table.

Module Characteristics

Presentation

⚠ DANGER

FIRE HAZARD

Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Module-specific characteristics	XPSMCMDI0800•	XPSMCMDI1600•
Reference description	Electronic housing maximum 16-pole, with locking latch mounting	Electronic housing maximum 24-pole, with locking latch mounting
Node address (No./description)	2 / Type 3. Maximum applicable resistance 1.2 kΩ.	
Digital inputs (No./description)	8 / Type 3. Maximum applicable resistance 1.2 kΩ.	16 / Type 3. Maximum applicable resistance 1.2 kΩ.
Test output (No./description)	4 / to test for short circuits - overloads, maximum current 100 mA / 24 Vdc	
Probability of a dangerous failure per hour (PFHd)	5.75E-9	7.09E-9
Mean Time to Dangerous Failure (MTTFd) in years	474	402
Connection to expansion modules	5-way backplane expansion	
Weight	0.12 kg (4.2 Oz)	

NOTE: For the characteristics common to all modules, refer to General Characteristics *(see page 34)*.

Section 4.4
XPSMCMDI1600x Input Expansion Module

What Is in This Section?

This section contains the following topics:

Module and Functional Description

Presentation

The XPSMCMDI0800• and XPSMCMDI1600• are input expansion modules for the XPSMCM• Modular Safety Controller. The XPSMCMDI0800• and XPSMCMDI1600• modules can only be configured in conjunction with the XPSMCMCP0802• Modular Safety Controller. The XPSMCMDI0800• module provides 8 safety-related inputs and the XPSMCMDI1600• module provides 16 safety-related inputs.

The expansion module supports two inputs `NODE_ADDR0` and `NODE_ADDR1` which are used to attribute a physical address to the module:

	NODE_ADDR0 (Terminal 2)	NODE_ADDR1 (Terminal 3)
NODE 0	0 (or not connected)	0 (or not connected)
NODE 1	24 Vdc	0 (or not connected)
NODE 2	0 (or not connected)	24 Vdc
NODE 3	24 Vdc	24 Vdc
NOTE: Do not use the same physical address for two units of the same module reference. **NOTE:** The LEDs **ADDR 1** and **ADDR 0** correspond to the NODE_ADDR1 and NODE_ADDR0 in this table respectively. **NOTE:** The node address wiring must match the configuration settings.		

Output TEST

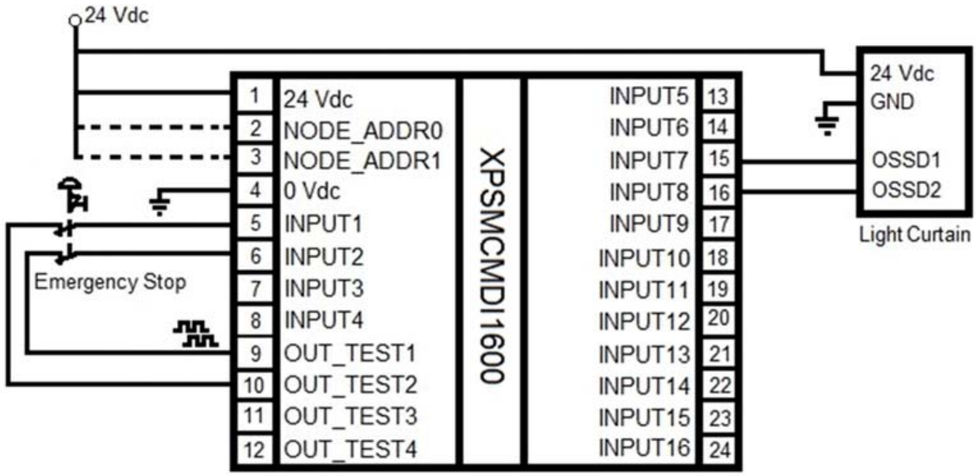
For more information refer to Output TEST *(see page 53)*.

Connector Designations and Example Wiring Diagram

XPSMCMDI1600• Module Connector Designations

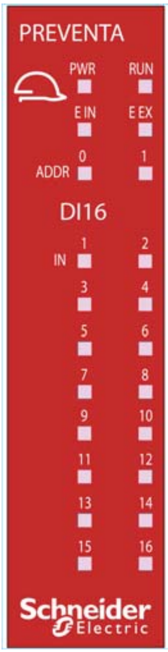
Terminal	Signal	LED	Type	Description	Operation
1	24 VDC	PWR	–	24 Vdc power supply	-
2	NODE_ADDR0	ADDR0	Input	Node selection	Input type 3. Maximum applicable resistance 1.2 kΩ.
3	NODE_ADDR1	ADDR1			
4	0 VDC	PWR	–	0 Vdc power supply	-
5	INPUT1	IN 1	Input	Digital input 1	Input type 3. Maximum applicable resistance 1.2 kΩ.
6	INPUT2	IN 2		Digital input 2	
7	INPUT3	IN 3		Digital input 3	
8	INPUT4	IN 4		Digital input 4	
9	OUT_TEST1	–	Output	Short circuit detected output	PNP (sourcing) active high
10	OUT_TEST2				
11	OUT_TEST3				
12	OUT_TEST4				
13	INPUT5	IN 5	Input	Digital input 5	Input type 3. Maximum applicable resistance 1.2 kΩ.
14	INPUT6	IN 6		Digital input 6	
15	INPUT7	IN 7		Digital input 7	
16	INPUT8	IN 8		Digital input 8	
17	INPUT9	IN 9		Digital input 9	
18	INPUT10	IN 10		Digital input 10	
19	INPUT11	IN 11		Digital input 11	
20	INPUT12	IN 12		Digital input 12	
21	INPUT13	IN 13		Digital input 13	
22	INPUT14	IN 14		Digital input 14	
23	INPUT15	IN 15		Digital input 15	
24	INPUT16	IN 16		Digital input 16	

XPSMCMDI1600• Module Example Wiring Diagram



LED Indicators

Front-Face View



Operation States

The following table describes the operation states of the XPSMCMDI1600• LED indicators, assuming the power (**PWR**) indicator is illuminated):

RUN green	E IN red	E EX red	ADDR 0/1 orange	IN 1 to 16 yellow	Meaning
ON	ON	ON	ON	ON	Power on - initial test
OFF = awaiting initialization	OFF	OFF ON = Wiring error detected	Encoded Node address *(see page 79)*	Input state Flashing = input with error	Normal operation
Flashing = no inputs or outputs configured					
ON = inputs or outputs configured					

Troubleshooting

The following table describes the error states of the LED indicators, assuming the power (**PWR**) indicator is illuminated:

Detected error	RUN green	E IN red	E EX red	IN 1 to 16 yellow	Solution
Internal error detected.	OFF	2 or 3 flashes	OFF	OFF	Product non serviceable[1].
Compatibility error detected.	OFF	5 flashes	OFF	5 flashes	Firmware version not compatible with XPSMCMCP0802•[1].
Error detected in the communication with controller.	OFF	5 flashes	OFF	OFF	Reboot the system[1].
Error detected on other expansion module or XPSMCMCP0802•.	OFF	ON	OFF	OFF	Reboot the system. Verify which module /controller is in error and consult its troubleshooting guide.
Two units of the same module reference detected with the same node address.	OFF	5 flashes		OFF	Modify the unit node address *(see page 79)*.

1 If the trouble persists, return the equipment to its place of purchase.

NOTE: The **ADDR 0** and **ADDR 1** are not represented in this table as they can be found in the Operation States table.

Module Characteristics

Presentation

⚠ DANGER

FIRE HAZARD

Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Module-specific characteristics	XPSMCMDI0800•	XPSMCMDI1600•
Reference description	Electronic housing maximum 16-pole, with locking latch mounting	Electronic housing maximum 24-pole, with locking latch mounting
Node address (No./description)	2 / Type 3. Maximum applicable resistance 1.2 kΩ.	
Digital inputs (No./description)	8 / Type 3. Maximum applicable resistance 1.2 kΩ.	16 / Type 3. Maximum applicable resistance 1.2 kΩ.
Test output (No./description)	4 / to test for short circuits - overloads, maximum current 100 mA / 24 Vdc	
Probability of a dangerous failure per hour (PFHd)	5.75E-9	7.09E-9
Mean Time to Dangerous Failure (MTTFd) in years	474	402
Connection to expansion modules	5-way backplane expansion	
Weight	0.12 kg (4.2 Oz)	

NOTE: For the characteristics common to all modules, refer to General Characteristics *(see page 34)*.

Section 4.5
XPSMCMDI1200MTx Input Expansion Module

What Is in This Section?

This section contains the following topics:

Module and Functional Description

Presentation

The XPSMCMDI1200MT• is an input expansion module for the XPSMCM• Modular Safety Controller. The XPSMCMDI1200MT• module can only be configured in conjunction with the XPSMCMCP0802• Modular Safety Controller. The XPSMCMDI1200MT• module provides 12 safety-related inputs.

The expansion module supports two inputs `NODE_ADDR0` and `NODE_ADDR1` which are used to attribute a physical address to the module:

	NODE_ADDR0 (Terminal 2)	NODE_ADDR1 (Terminal 3)
NODE 0	0 (or not connected)	0 (or not connected)
NODE 1	24 Vdc	0 (or not connected)
NODE 2	0 (or not connected)	24 Vdc
NODE 3	24 Vdc	24 Vdc

NOTE: Do not use the same physical address for two units of the same module reference.

NOTE: The LEDs **ADDR 1** and **ADDR 0** correspond to the NODE_ADDR1 and NODE_ADDR0 in this table respectively.

NOTE: The node address wiring must match the configuration settings.

Output TEST

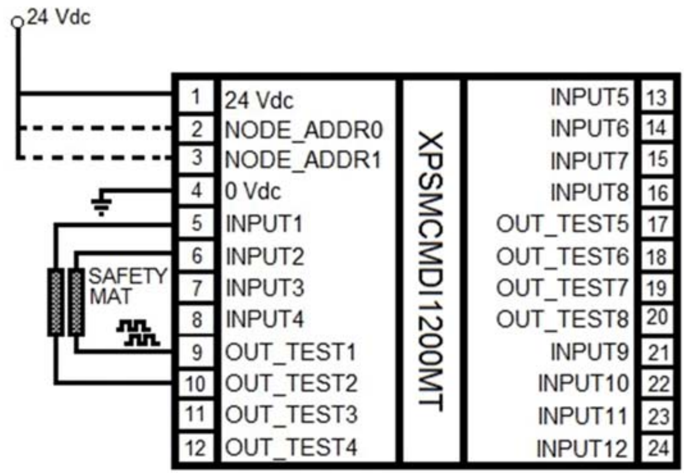
For more information refer to Output TEST *(see page 53)*.

Connector Designations and Example Wiring Diagram

XPSMCMDI1200MT• Module Connector Designations

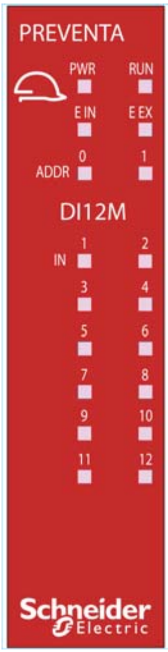
Terminal	Signal	LED	Type	Description	Operation
1	24 VDC	PWR	–	24 Vdc power supply	–
2	NODE_ADDR0	ADDR0	Input	Node selection	Input type 3. Maximum applicable resistance 1.2 kΩ.
3	NODE_ADDR1	ADDR1			
4	0 VDC	PWR	–	0 Vdc power supply	-
5	INPUT1	IN 1	Input	Digital input 1	Input type 3. Maximum applicable resistance 1.2 kΩ.
6	INPUT2	IN 2		Digital input 2	
7	INPUT3	IN 3		Digital input 3	
8	INPUT4	IN 4		Digital input 4	
9	OUT_TEST1	–	Output	Short circuit detected output	PNP (sourcing) active high
10	OUT_TEST2				
11	OUT_TEST3				
12	OUT_TEST4				
13	INPUT5	IN 5	Input	Digital input 5	Input type 3. Maximum applicable resistance 1.2 kΩ.
14	INPUT6	IN 6		Digital input 6	
15	INPUT7	IN 7		Digital input 7	
16	INPUT8	IN 8		Digital input 8	
17	OUT_TEST5	–	Output	Short circuit detected output	PNP (sourcing) active high
18	OUT_TEST6				
19	OUT_TEST7				
20	OUT_TEST8				
21	INPUT9	IN 9	Input	Digital input 9	Input type 3. Maximum applicable resistance 1.2 kΩ.
22	INPUT10	IN 10		Digital input 10	
23	INPUT11	IN 11		Digital input 11	
24	INPUT12	IN 12		Digital input 12	

XPSMCMDI1200MT• Module Example Wiring Diagram



LED Indicators

Front-Face View



Operation States

The following table describes the operation states of the XPSMCMDI1200MT• LED indicators, assuming the power (**PWR**) indicator is illuminated):

RUN green	E IN red	E EX red	ADDR 0/1 orange	IN 1 to 12 yellow	Meaning
ON	ON	ON	ON	ON	Power on - initial test
OFF = awaiting initialization	OFF	OFF ON = Wiring error detected	Encoded Node address *(see page 86)*	Input state Flashing = input with error	Normal operation
Flashing = no inputs or outputs configured					
ON = inputs or outputs configured					

Troubleshooting

The following table describes the error states of the LED indicators, assuming the power (**PWR**) indicator is illuminated:

Detected error	**RUN green**	**E IN red**	**E EX red**	**IN 1 to 12 yellow**	**Solution**
Internal error detected	OFF	2 or 3 flashes	OFF	OFF	Product non serviceable[1].
Compatibility error detected.	OFF	5 flashes	OFF	5 flashes	Firmware version not compatible with XPSMCMCP0802•[1].
Error detected in the communication with controller.	OFF	5 flashes	OFF	OFF	Reboot the system[1].
Error detected on other expansion module or XPSMCMCP0802•.	OFF	ON	OFF	OFF	Reboot the system. Verify which module /controller is in error and consult its troubleshooting guide.
Two units of the same module reference detected with the same node address.	OFF	5 flashes		OFF	Modify the unit node address *(see page 86)* `NODE ADDR`.

1 If the trouble persists, return the equipment to its place of purchase.

NOTE: The **ADDR 0** and **ADDR 1** are not represented in this table as they can be found in the Operation States table.

Module Characteristics

Presentation

⚠ DANGER

FIRE HAZARD

Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Module-specific characteristics	
Reference description	Electronic housing maximum 24-pole, with locking latch mounting
Node address (No./description)	2 / Type 3. Maximum applicable resistance 1.2 kΩ.
Digital inputs (No./description)	12 / Type 3. Maximum applicable resistance 1.2 kΩ.
Test output (No./description)	8 / to test for short circuits - overloads, maximum current 100 mA / 24 Vdc
Probability of a dangerous failure per hour (PFHd)	3.24E-9
Connection to expansion modules	5-way backplane expansion
Weight	0.12 kg (4.2 Oz)

NOTE: For the characteristics common to all modules, refer to General Characteristics *(see page 34)*.

Section 4.6
XPSMCMDO0002x Output Expansion Module

What Is in This Section?

This section contains the following topics:

Module and Functional Description

Presentation

The XPSMCMDO0002• and XPSMCMDO0004• are output expansion modules for the XPSMCM• Modular Safety Controller. The XPSMCMDO0002• and XPSMCMDO0004• modules can only be configured in conjunction with the XPSMCMCP0802• Modular Safety Controller. The XPSMCMDO0002• module provides two dual-channel safety-related outputs and two status outputs. The XPSMCMDO0004• module provides four dual-channel safety-related outputs and four status outputs.

The expansion module supports two inputs `NODE_ADDR0` and `NODE_ADDR1` which are used to attribute a physical address to the module:

	NODE_ADDR0 (Terminal 2)	NODE_ADDR1 (Terminal 3)
NODE 0	0 (or not connected)	0 (or not connected)
NODE 1	24 Vdc	0 (or not connected)
NODE 2	0 (or not connected)	24 Vdc
NODE 3	24 Vdc	24 Vdc

NOTE: Do not use the same physical address for two units of the same module reference.

NOTE: The LEDs **ADDR 1** and **ADDR 0** correspond to the NODE_ADDR1 and NODE_ADDR0 in this table respectively.

NOTE: The node address wiring must match the configuration settings.

Input RESTART (RST)

For more information refer to Input RESTART (RST) *(see page 51)*.

Output STATUS

For more information refer to Output STATUS *(see page 52)*.

Solid-State Safety Output (OSSD)

For more information refer to Solid-State Safety Output (OSSD) *(see page 53)*.

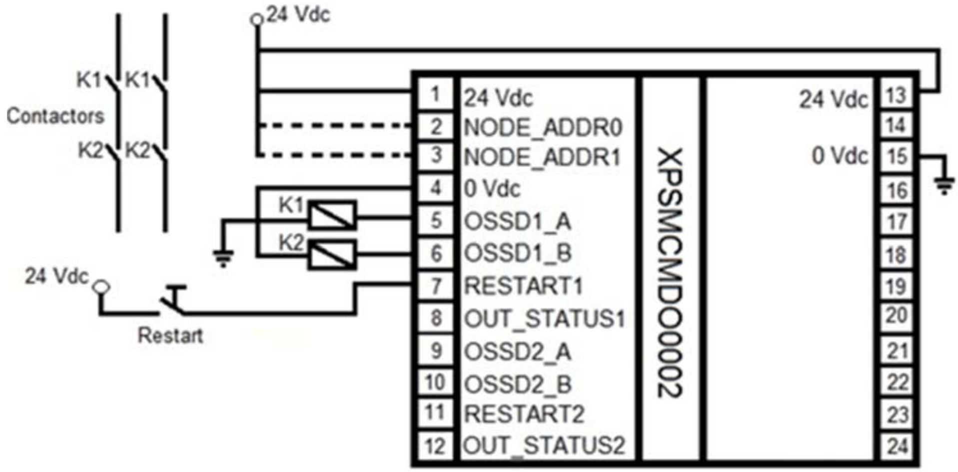
Connector Designations and Example Wiring Diagram

XPSMCMDO0002• Module Connector Designations

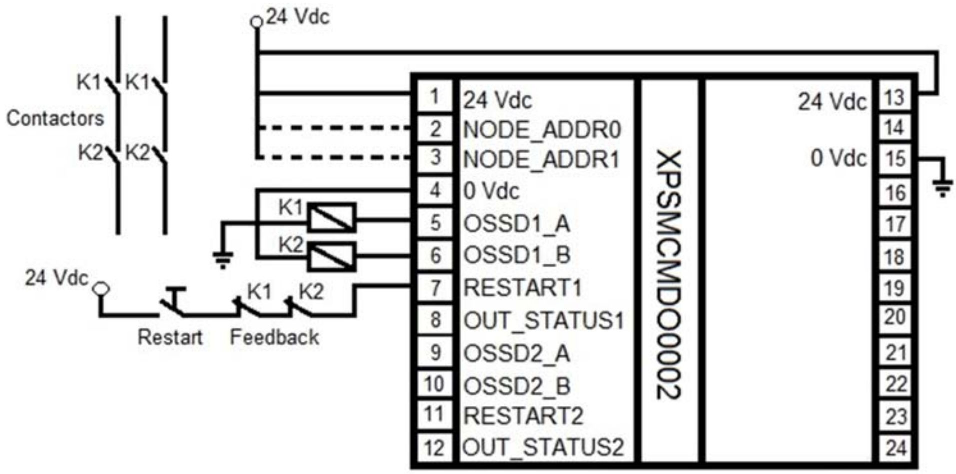
Terminal	Signal	LED	Type	Description	Operation
1	24 VDC	PWR	–	24 Vdc power supply	–
2	NODE_ADDR0	ADDR0	Input	Node selection	Input type 3. Maximum applicable resistance 1.2 kΩ.
3	NODE_ADDR1	ADDR1			
4	0 VDC	PWR	–	0 Vdc power supply	–
5	OSSD1_A	OUT 1	Output	Static output 1	PNP (sourcing) active high
6	OSSD1_B				
7	RESTART1	RST 1	Input	Feedback/Restart 1	Input type 3. Maximum applicable resistance 1.2 kΩ.
8	OUT_STATUS 1	STATUS 1	Output	Configurable diagnostic output	PNP (sourcing) active high
9	OSSD2_A	OUT 2	Output	Static output 2	PNP (sourcing) active high
10	OSSD2_B				
11	RESTART2	RST 2	Input	Feedback/Restart 2	Input type 3. Maximum applicable resistance 1.2 kΩ.
12	OUT_STATUS 2	STATUS 2	Output	Configurable diagnostic output	PNP (sourcing) active high
13	24 VDC	–	–	24 Vdc power supply	OSSD1/2 power supply
14	n.c.	–	–	-	–
15	0 VDC	–	–	0 Vdc power supply	–
16	n.c.	–	–	–	–

XPSMCMDO0002• Module Example Wiring Diagram

Category 3 wiring for XPSMCMDO0002•:



Category 4 wiring for XPSMCMDO0002•:



LED Indicators

Front-Face View

Operation States

The following table describes the operation states of the XPSMCMDO0002• LED indicators, assuming the power (**PWR**) indicator is illuminated):

RUN green	E IN red	E EX red	ADDR 1/2 orange	OUT 1/2 red/green	RST 1/ 2 yellow	STATUS 1/2 yellow	Meaning
ON	ON	ON	ON	RED	ON	ON	Power on - initial test
OFF = awaiting initialization	OFF	OFF ON = Wiring error detected	Encoded Node address *(see page 93)*	Output state: red = 0 green = 1	ON = waiting for restart Flashing = no feedback	Output diagnostics	Normal operation
Flashing = no inputs or outputs configured							
ON = inputs or outputs configured							

Troubleshooting

The following table describes the error states of the LED indicators, assuming the power (**PWR**) indicator is illuminated:

Detected error	RUN green	E IN red	E EX red	OUT 1/2 red/green	RST 1/ 2 yellow	STATUS 1/2 yellow	Solution
Internal error detected.	OFF	2 or 3 flashes	OFF	Red	OFF	OFF	Product non serviceable[1].
Compatibility error detected.	OFF	5 flashes	OFF	5 flashes			Firmware version not compatible with XPSMCMCP0802•[1].
OSSD output error detected.	OFF	4 flashes	OFF	4 flashes	OFF	OFF	Verify solid-state safety output (OSSD) 1/2 connections[1].
Error detected in the communication with controller.	OFF	5 flashes	OFF	OFF	OFF	OFF	Reboot the system[1].
Error detected on other expansion module or XPSMCMCP0802•.	OFF	ON	OFF	OFF	OFF	OFF	Reboot the system. Verify which module /controller is in error and consult its troubleshooting guide.
Two units of the same module reference detected with the same node address.	OFF	5 flashes		OFF	OFF	OFF	Modify the unit node address *(see page 93)*.
Power supply missing on OSSD 3,4 (MO4 only).	ON	OFF	ON	Red flashes	Flashes	Output condition	Connect 13 and 14 pin to power supply.
Error detected on node detection circuit.	OFF	3 flashes	OFF	OFF	OFF	OFF	Product non serviceable[1].

1 If the trouble persists, return the equipment to its place of purchase.

NOTE: The **ADDR 0** and **ADDR 1** are not represented in this table as they can be found in the Operation States table.

Module Characteristics

Presentation

⚠ DANGER

FIRE HAZARD

Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Module-specific characteristics	XPSMCMDO0002•	XPSMCMDO0004•
Reference description	Electronic housing maximum 16-pole, with locking latch mounting	Electronic housing maximum 24-pole, with locking latch mounting
Node address (No./description)	2 / Type 3. Maximum applicable resistance 1.2 kΩ.	
Input Restart (No./description)	2 / EDM (External Device Monitoring) type 3. Maximum applicable resistance 1.2 kΩ. / Possible automatic or manual operation with restart pushbutton	
Solid-state safety-related output (OSSD) (No./description)	2 pairs / solid-state safety-related outputs PNP active high	4 pairs / solid-state safety-related outputs PNP active high
	• The outputs are able to supply: ○ In the ON condition: Uv-0.75 V to Uv (where Uv is 24 V ± 20 %) ○ In the OFF condition: 0 to 2 V rms (root mean square) • The maximum load of 400 mA@24 V (each OSSD pair) corresponds to a minimum resistive load of 60 Ω. ○ The maximum capacitive load is 0.82 μF. ○ The maximum inductive load is 30 mH. • To detect short circuit and line break on the outputs, a line monitoring is made by using an output pulse on each channel. The output pulse is generated every 5.5 ms with a pulse of 100 microseconds.	
Status outputs	Maximum output current per channel: 100 mA / 24 Vdc	
Probability of a dangerous failure per hour (PFHd)	3.16E-9	3.44E-9

Module-specific characteristics	XPSMCMDO0002•	XPSMCMDO0004•
Mean Time to Dangerous Failure (MTTFd) in years	954	686
Connection to expansion modules	5-way backplane expansion	
Weight	0.12 kg (4.2 Oz)	

NOTE: For the characteristics common to all modules, refer to General Characteristics *(see page 34)*.

Section 4.7
XPSMCMDO0004x Output Expansion Module

What Is in This Section?

This section contains the following topics:

Module and Functional Description

Presentation

The XPSMCMDO0002• and XPSMCMDO0004• are output expansion modules for the XPSMCM• Modular Safety Controller. The XPSMCMDO0002• and XPSMCMDO0004• modules can only be configured in conjunction with the XPSMCMCP0802• Modular Safety Controller. The XPSMCMDO0002• module provides two dual-channel safety-related outputs and two status outputs. The XPSMCMDO0004• module provides four dual-channel safety-related outputs and four status outputs.

The expansion module supports two inputs `NODE_ADDR0` and `NODE_ADDR1` which are used to attribute a physical address to the module:

	NODE_ADDR0 (Terminal 2)	NODE_ADDR1 (Terminal 3)
NODE 0	0 (or not connected)	0 (or not connected)
NODE 1	24 Vdc	0 (or not connected)
NODE 2	0 (or not connected)	24 Vdc
NODE 3	24 Vdc	24 Vdc

NOTE: Do not use the same physical address for two units of the same module reference.

NOTE: The LEDs **ADDR 1** and **ADDR 0** correspond to the NODE_ADDR1 and NODE_ADDR0 in this table respectively.

NOTE: The node address wiring must match the configuration settings.

Input **RESTART (RST)**

For more information refer to Input RESTART (RST) *(see page 51)*.

Output **STATUS**

For more information refer to Output STATUS *(see page 52)*.

Solid-State Safety Output (**OSSD**)

For more information refer to Solid-State Safety Output (OSSD) *(see page 53)*.

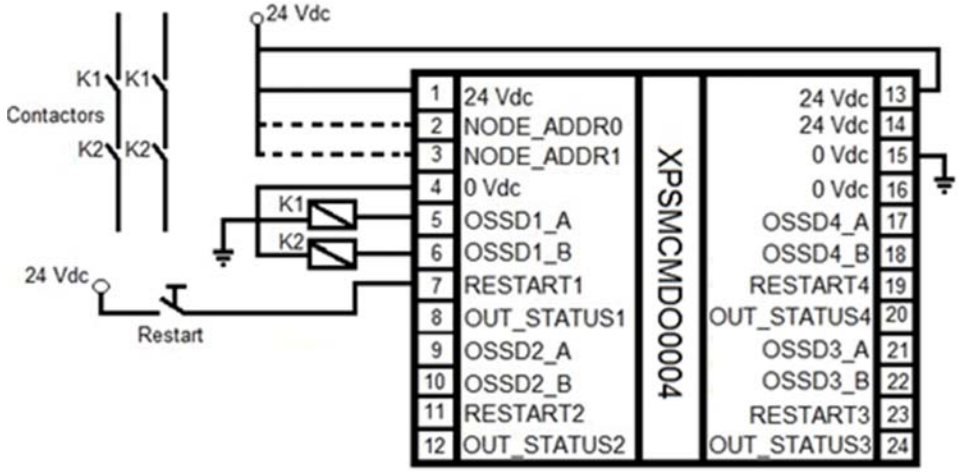
Connector Designations and Example Wiring Diagram

XPSMCMDO0004• Module Connector Designations

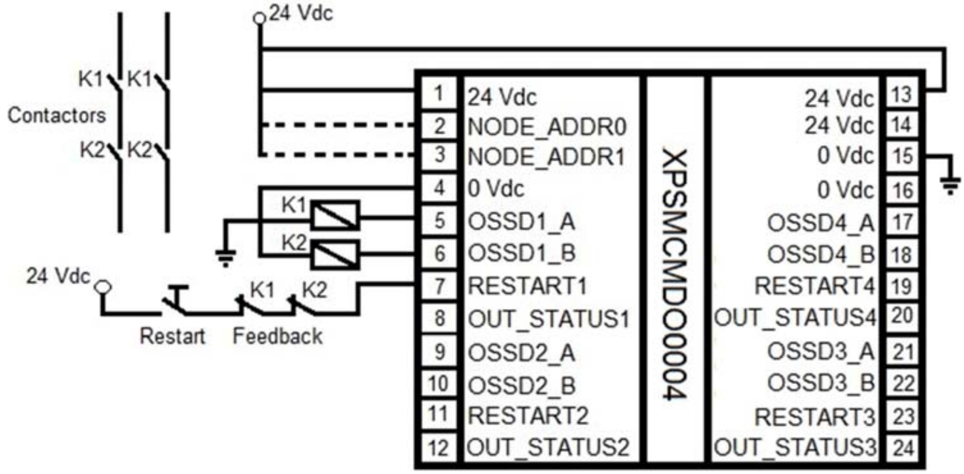
Terminal	Signal	LED	Type	Description	Operation
1	24 VDC	PWR	–	24 Vdc power supply	–
2	NODE_ADDR0	ADDR0	Input	Node selection	Input type 3. Maximum applicable resistance 1.2 kΩ.
3	NODE_ADDR1	ADDR1			
4	0 VDC	PWR	–	0 Vdc power supply	–
5	OSSD1_A	OUT 1	Output	Static output 1	PNP (sourcing) active high
6	OSSD1_B				
7	RESTART1	RST 1	Input	Feedback/Restart 1	Input type 3. Maximum applicable resistance 1.2 kΩ.
8	OUT_STATUS 1	STATUS 1	Output	Configurable diagnostic output	PNP (sourcing) active high
9	OSSD2_A	OUT 2	Output	Static output 2	PNP (sourcing) active high
10	OSSD2_B				
11	RESTART2	RST 2	Input	Feedback/Restart 2	Input type 3. Maximum applicable resistance 1.2 kΩ.
12	OUT_STATUS 2	STATUS 2	Output	Configurable diagnostic output	PNP (sourcing) active high
13	24 VDC	–	–	24 Vdc power supply	OSSD1/2 power supply
14	24 VDC	–	–	24 Vdc power supply	OSSD3/4 power supply
15	0 VDC	–	–	0 Vdc power supply	–
16					
17	OSSD4_A	OUT 4	Output	Static output 4	PNP (sourcing) active high
18	OSSD4_B				
19	RESTART4	RST 4	Input	Feedback/Restart 4	Input type 3. Maximum applicable resistance 1.2 kΩ.
20	OUT_STATUS4	STATUS 4	Output	Configurable diagnostic output	PNP (sourcing) active high
21	OSSD3_A	OUT 3	Output	Static output 3	PNP (sourcing) active high
22	OSSD3_B				
23	RESTART3	RST 3	Input	Feedback/Restart 3	Input type 3. Maximum applicable resistance 1.2 kΩ.
24	OUT_STATUS 3	STATUS 3	Output	Configurable diagnostic output	PNP (sourcing) active high

XPSMCMDO0004• Module Example Wiring Diagram

Category 3 wiring for XPSMCMDO0004•:



Category 4 wiring for XPSMCMDO0004•:


24 Vdc
K1 K1
Contactors
K2 K2
K1
K2
24 Vdc
K1 K2
Restart
Feedback
1 24 Vdc
2 NODE_ADDR0
3 NODE_ADDR1
4 0 Vdc
5 OSSD1_A
6 OSSD1_B
7 RESTART1
8 OUT_STATUS1
9 OSSD2_A
10 OSSD2_B
11 RESTART2
12 OUT_STATUS2
XPSMCMDO0004
24 Vdc 13
24 Vdc 14
0 Vdc 15
0 Vdc 16
OSSD4_A 17
OSSD4_B 18
RESTART4 19
OUT_STATUS4 20
OSSD3_A 21
OSSD3_B 22
RESTART3 23
OUT_STATUS3 24

LED Indicators

Front-Face View

Operation States

The following table describes the operation states of the XPSMCMDO0004• LED indicators, assuming the power (**PWR**) indicator is illuminated):

RUN green	E IN red	E EX red	ADDR 0/1 orange	OUT 1-4 red/ green	RST 1/ 4 yellow	STATUS 1-4 yellow	Meaning
ON	ON	ON	ON	Red	ON	ON	Power on - initial test

RUN green	E IN red	E EX red	ADDR 0/1 orange	OUT 1-4 red/ green	RST 1/ 4 yellow	STATUS 1-4 yellow	Meaning
OFF = awaiting initialization	OFF	OFF	Encoded Node address *(see page 101)*	Output state: red = 0 green = 1	ON = waiting for restart	Output diagnostics	Normal operation
Flashing = no inputs or outputs configured					Flashing = no feedback		
ON = inputs or outputs configured							

Troubleshooting

The following table describes the error states of the LED indicators, assuming the power (**PWR**) indicator is illuminated:

Detected error	RUN green	E IN red	E EX red	OUT 1/2 red/green	RST 1/ 2 yellow	STATUS 1/2 yellow	Solution
Internal error detected.	OFF	2 or 3 flashes	OFF	Red	OFF	OFF	Product non serviceable[1].
Compatibility error detected.	OFF	5 flashes	OFF	5 flashes			Firmware version not compatible with XPSMCMCP0802•[1].
OSSD output error detected.	OFF	4 flashes	OFF	4 flashes	OFF	OFF	Verify solid-state safety output (OSSD) 1/2 connections[1].
Error detected in the communication with controller.	OFF	5 flashes	OFF	OFF	OFF	OFF	Reboot the system[1].
Error detected on other expansion module or XPSMCMCP0802•.	OFF	ON	OFF	OFF	OFF	OFF	Reboot the system. Verify which module /controller is in error and consult its troubleshooting guide.
Two units of the same module reference detected with the same node address.	OFF	5 flashes		OFF	OFF	OFF	Modify the unit node address *(see page 101)*.
1 If the trouble persists, return the equipment to its place of purchase.							
NOTE: The **ADDR 0** and **ADDR 1** are not represented in this table as they can be found in the Operation States table.							

Detected error	RUN green	E IN red	E EX red	OUT 1/2 red/green	RST 1/ 2 yellow	STATUS 1/2 yellow	Solution
Power supply missing on 0SSD 3,4 (MO4 only).	ON	OFF	ON	Red flashes	Flashes	Output condition	Connect 13 and 14 pin to power supply.
Error detected on node detection circuit.	OFF	3 flashes	OFF	OFF	OFF	OFF	Product non serviceable[1].

[1] If the trouble persists, return the equipment to its place of purchase.

NOTE: The **ADDR 0** and **ADDR 1** are not represented in this table as they can be found in the Operation States table.

Module Characteristics

Presentation

⚠ DANGER

FIRE HAZARD

Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

<table>
<tr><th>Module-specific characteristics</th><th>XPSMCMDO0002•</th><th>XPSMCMDO0004•</th></tr>
<tr><td>Reference description</td><td>Electronic housing maximum 16-pole, with locking latch mounting</td><td>Electronic housing maximum 24-pole, with locking latch mounting</td></tr>
<tr><td>Node address (No./description)</td><td colspan="2">2 / Type 3. Maximum applicable resistance 1.2 kΩ.</td></tr>
<tr><td>Input Restart (No./description)</td><td colspan="2">2 / EDM (External Device Monitoring) type 3. Maximum applicable resistance 1.2 kΩ. / Possible automatic or manual operation with restart pushbutton</td></tr>
<tr><td rowspan="2">Solid-state safety-related output (OSSD) (No./description)</td><td>2 pairs / solid-state safety-related outputs PNP active high</td><td>4 pairs / solid-state safety-related outputs PNP active high</td></tr>
<tr><td colspan="2">● The outputs are able to supply:
❍ In the ON condition: Uv-0.75 V to Uv (where Uv is 24 V ± 20 %)
❍ In the OFF condition: 0 to 2 V rms (root mean square)
● The maximum load of 400 mA@24 V (each OSSD pair) corresponds to a minimum resistive load of 60 Ω.
❍ The maximum capacitive load is 0.82 µF.
❍ The maximum inductive load is 30 mH.
● To detect short circuit and line break on the outputs, a line monitoring is made by using an output pulse on each channel. The output pulse is generated every 5.5 ms with a pulse of 100 microseconds.</td></tr>
<tr><td>Status outputs</td><td colspan="2">Maximum output current per channel: 100 mA / 24 Vdc</td></tr>
<tr><td>Probability of a dangerous failure per hour (PFHd)</td><td>3.16E-9</td><td>3.44E-9</td></tr>
</table>

Module-specific characteristics	XPSMCMDO0002•	XPSMCMDO0004•
Mean Time to Dangerous Failure (MTTFd) in years	954	686
Connection to expansion modules	5-way backplane expansion	
Weight	0.12 kg (4.2 Oz)	

NOTE: For the characteristics common to all modules, refer to General Characteristics *(see page 34)*.

Section 4.8
XPSMCMER0002x Output Expansion Module

What Is in This Section?

This section contains the following topics:

Module and Functional Description

Presentation

The XPSMCMER0002• and XPSMCMER0004• are output expansion modules for the XPSMCM• Modular Safety Controller. The XPSMCMER0002• and XPSMCMER0004• modules can only be configured in conjunction with the XPSMCMCP0802• Modular Safety Controller.

The XPSMCMER0002• module provides one Category 4 safety-related relay output (2 NO contacts and 1 NC contact). The XPSMCMER0004• module provides two Category 4 safety-related relay outputs (2 x 2 NO contacts and 1 NC contact). Digital outputs from the XPSMCMCP0802• Modular Safety Controller or XPSMCMDO0002•, XPSMCMDO0004•, or XPSMCMMX0802• expansion modules are physically wired directly to the inputs of the XPSMCMER0002• and XPSMCMER0004• modules. The XPSMCMER0002• and XPSMCMER0004• modules are not connected to the backplane expansion.

Input **RESTART** (**RST**)

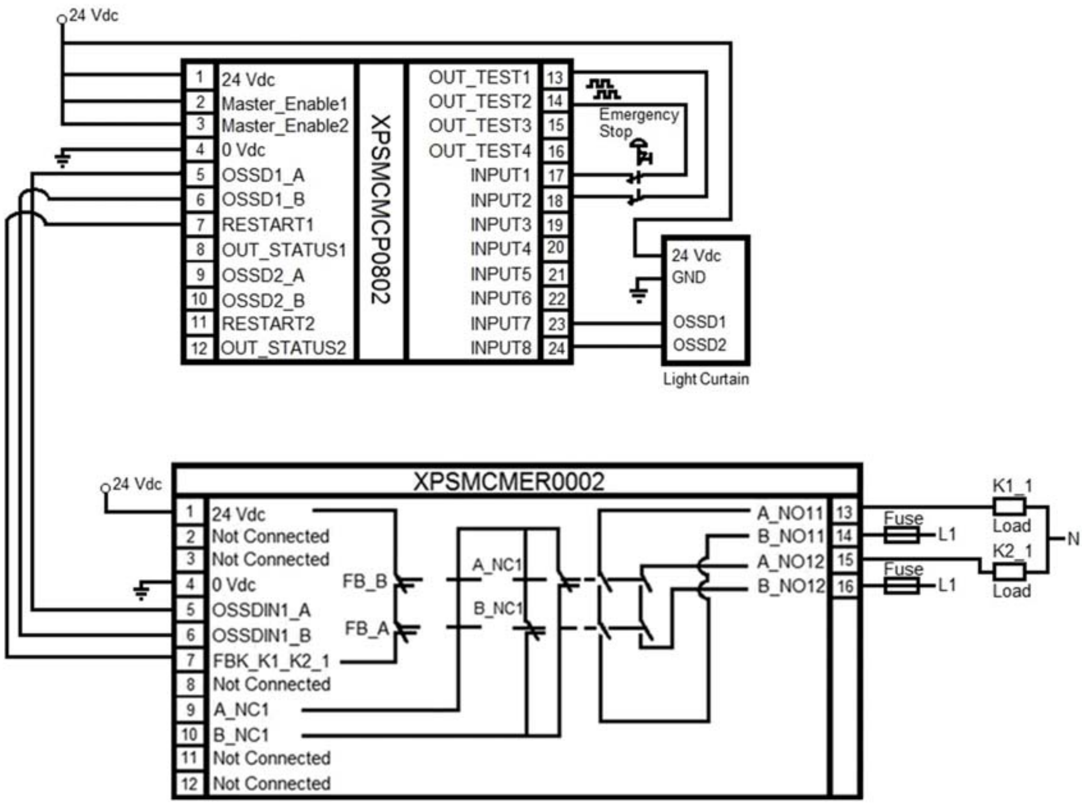
For more information refer to Input RESTART (RST) *(see page 51)*.

Connector Designations and Example Wiring Diagram

XPSMCMER0002• Module Connector Designations

Terminal	Signal	LED	Type	Description	Operation
1	24 VDC	PWR	–	24 Vdc power supply	–
4	0 VDC	PWR	–	0 Vdc power supply	
5	OSSDIN1_A	–	Input	Control circuit 1	Input type 3. Maximum applicable resistance 1.2 kΩ.
6	OSSDIN1_B				
7	FBK_K1_K2_1	–	Output	Feedback K1K2 ZONE 1	–
9	A_NC1	OUT 1		NC contact ZONE 1	
10	B_NC1				
13	A_NO11			NO1 contact ZONE 1	
14	B_NO11				
15	A_NO12			NO2 contact ZONE 1	
16	B_NO12				

XPSMCMER0002• Module Example Wiring Diagram



LED Indicators

Front-Face View

Operation State

The following table describes the operation state of the XPSMCMER0002• LED indicator:

OUT 1 green	Meaning
ON with output activated	Normal operation

Module Characteristics

Presentation

⚠ DANGER

FIRE HAZARD

- Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.
- For relay output (2 A) wiring, use conductors of at least 0.5 mm^2 (AWG 20) with a temperature rating of at least 80 °C (176 °F).
- For common conductors of relay output wiring (7 A), or relay output wiring greater than 2 A, use conductors of at least 1.0 mm^2 (AWG 16) with a temperature rating of at least 80 °C (176 °F).

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Module-specific characteristics	XPSMCMER0002•	XPSMCMER0004•
Reference description	Electronic housing maximum 16-pole, with locking latch mounting	Electronic housing maximum 24-pole, with locking latch mounting
Switching capacity according to EN 60947-5-1	AC-15, 240 V, 3 A or DC-13, 24 V, 2 A	
Switching current (resistive)	6 A maximum (minimum 17 V @ 10 mA)	
Relay contact type	2 NO + 1 NC	2 x 2 NO + 1 NC
FEEDBACK contacts	1	2
Response time	12 ms	
Mechanical life of contacts	> 20 x 10^6	
Connection to expansion modules	No backplane expansion available, connection to digital outputs by hardwiring	
Weight	0.12 kg (4.2 Oz)	

NOTE: For the characteristics common to all modules, refer to General Characteristics *(see page 34)*.

NOTE: To help ensure correct isolation and avoid the risk of premature aging of, or damage to, the relays, each output line must be protected using a delay 3.5 A fuse. The load characteristics must be consistent with those specified. For more important information on the protection of relay outputs, refer to Protecting Outputs from Inductive Load Damage *(see page 42)*.

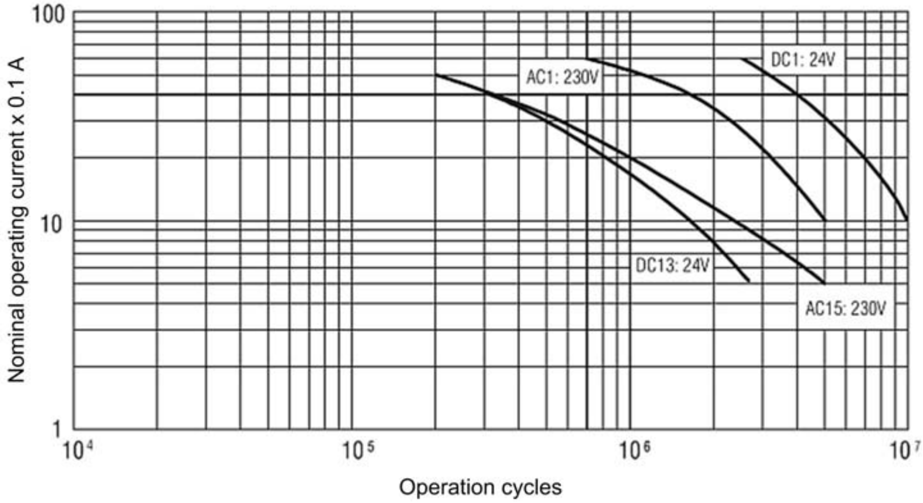
NOTE: If a relay module is connected, the response time of the OSSD linked must be increased by 12 ms.

Module Characteristics Concerning Safety

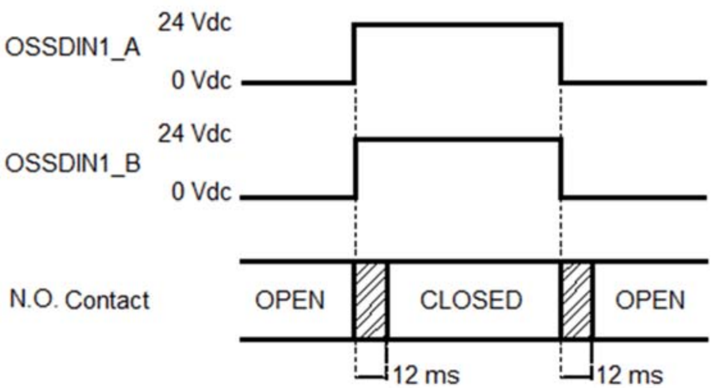
Module-specific characteristics concerning safety (XPSMCMER0002•/XPSMCMER0004•)									
-		Feedback contact used				Feedback contact not used			
-		PFHd	SFF (%)	MTTFd (years)	DCavg	PFHd	SFF (%)	MTTFd (years)	DCavg
DC-13 (2A)	t_{cycle1}	3.09E-10	99.6	2335.94	98.9	9.46E-10	0.60	2335.93	0
	t_{cycle2}	8.53E-11	99.7	24453.47	97.7	1.08E-10	0.87	24453.47	0
	t_{cycle3}	6.63E-11	99.8	126678.49	92.5	6.75E-11	0.97	126678.59	0
AC-15 (3A)	t_{cycle1}	8.23E-09	99.5	70.99	99.0	4.60E-07	0.50	70.99	0
	t_{cycle2}	7.42E-10	99.5	848.16	99.0	4.49E-09	0.54	848.15	0
	t_{cycle3}	1.07E-10	99.7	12653.85	98.4	1.61E-10	0.79	12653.85	0
AC-15 (1A)	t_{cycle1}	3.32E-09	99.5	177.38	99.0	7.75E-08	0.51	177.37	0
	t_{cycle2}	3.36E-10	99.6	2105.14	98.9	1.09E-09	0.60	2105.14	0
	t_{cycle3}	8.19E-11	99.7	28549.13	97.5	1.00E-10	0.88	28549.13	0
t_{cycle1} 300 s (1 commutation every 5 minutes) **t_{cycle2}** 3600s (1 commutation every hour) **t_{cycle3}** 1 commutation every day **PFHd** Probability of a dangerous failure per hour according IEC 61508 **MTTFd and DCavg** Mean Time to dangerous Failure and Diagnostic Coverage average according EN ISO 13849-1									

Electrical Life of the Output Contacts

The graphic shows the electrical life of the output contacts determined by EN 60947-51-1:



Switching Operation Timing Diagram



Section 4.9
XPSMCMER0004x Output Expansion Module

What Is in This Section?

This section contains the following topics:

Module and Functional Description

Presentation

The XPSMCMER0002• and XPSMCMER0004• are output expansion modules for the XPSMCM• Modular Safety Controller. The XPSMCMER0002• and XPSMCMER0004• modules can only be configured in conjunction with the XPSMCMCP0802• Modular Safety Controller.

The XPSMCMER0002• module provides one Category 4 safety-related relay output (2 NO contacts and 1 NC contact). The XPSMCMER0004• module provides two Category 4 safety-related relay outputs (2 x 2 NO contacts and 1 NC contact). Digital outputs from the XPSMCMCP0802• Modular Safety Controller or XPSMCMDO0002•, XPSMCMDO0004•, or XPSMCMMX0802• expansion modules are physically wired directly to the inputs of the XPSMCMER0002• and XPSMCMER0004• modules. The XPSMCMER0002• and XPSMCMER0004• modules are not connected to the backplane expansion.

Input **RESTART** (**RST**)

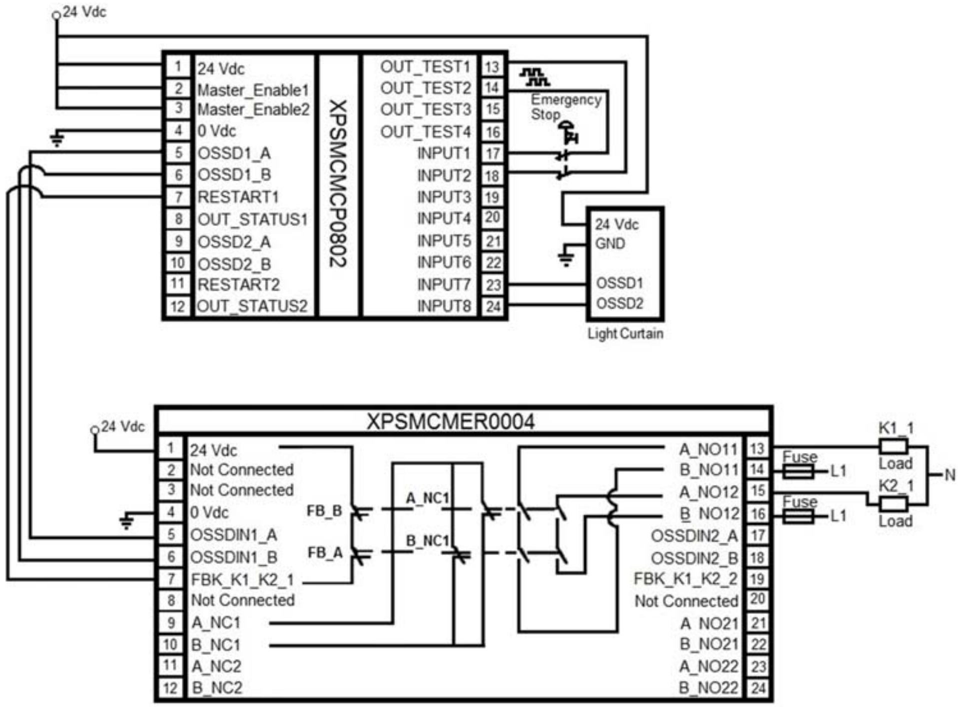
For more information refer to Input RESTART (RST) *(see page 51)*.

Connector Designations and Example Wiring Diagram

XPSMCMER0004• Module Connector Designations

Terminal	Signal	LED	Type	Description	Operation
1	24 VDC	PWR	–	24 Vdc power supply	–
4	0 VDC	PWR		0 Vdc power supply	–
5	OSSDIN1_A	–	Input	Control circuit 1	Input type 3. Maximum applicable resistance 1.2 kΩ.
6	OSSDIN1_B				
7	FBK_K1_K2_1	-	Output	Feedback K1 K2 ZONE 1	–
9	A_NC1	OUT 1	Output	NC contact ZONE 1	–
10	B_NC1				
11	A_NC2	OUT 2	Output	NC contact ZONE 2	–
12	B_NC2				
13	A_NO11	OUT 1	Output	NO1 contact ZONE 1	–
14	B_NO11				
15	A_NO12			NO2 contact ZONE 1	
16	B_NO12				
17	OSSDIN2_A	–	Input	Control circuit 2	Input type 3. Maximum applicable resistance 1.2 kΩ.
18	OSSDIN2_B				
19	FBK_K1_K2_2	–	Output	Feedback K1 K2 ZONE 2	–
21	A_NO21	OUT 2		NO1 contact ZONE 2	
22	B_NO21				
23	A_NO22			NO2 contact ZONE 2	
24	B_NO22				

XPSMCMER0004• Module Example Wiring Diagram



LED Indicators

Front-Face View

Operation State

The following table describes the operation state of the XPSMCMER0004• LED indicators:

OUT 1/2 green	Meaning
ON with output activated	Normal operation

Module Characteristics

Presentation

⚠ DANGER

FIRE HAZARD

- Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.
- For relay output (2 A) wiring, use conductors of at least 0.5 mm^2 (AWG 20) with a temperature rating of at least 80 °C (176 °F).
- For common conductors of relay output wiring (7 A), or relay output wiring greater than 2 A, use conductors of at least 1.0 mm^2 (AWG 16) with a temperature rating of at least 80 °C (176 °F).

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Module-specific characteristics	XPSMCMER0002•	XPSMCMER0004•
Reference description	Electronic housing maximum 16-pole, with locking latch mounting	Electronic housing maximum 24-pole, with locking latch mounting
Switching capacity according to EN 60947-5-1	AC-15, 240 V, 3 A or DC-13, 24 V, 2 A	
Switching current (resistive)	6 A maximum (minimum 17 V @ 10 mA)	
Relay contact type	2 NO + 1 NC	2 x 2 NO + 1 NC
FEEDBACK contacts	1	2
Response time	12 ms	
Mechanical life of contacts	> 20 x 10^6	
Connection to expansion modules	No backplane expansion available, connection to digital outputs by hardwiring	
Weight	0.12 kg (4.2 Oz)	

NOTE: For the characteristics common to all modules, refer to General Characteristics *(see page 34)*.

NOTE: To help ensure correct isolation and avoid the risk of premature aging of, or damage to, the relays, each output line must be protected using a delay 3.5 A fuse. The load characteristics must be consistent with those specified. For more important information on the protection of relay outputs, refer to Protecting Outputs from Inductive Load Damage *(see page 42)*.

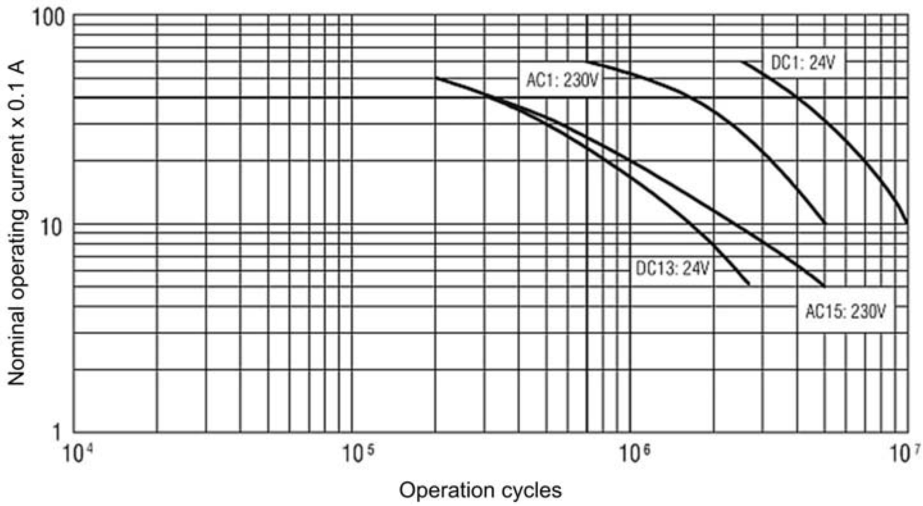
NOTE: If a relay module is connected, the response time of the OSSD linked must be increased by 12 ms.

Module Characteristics Concerning Safety

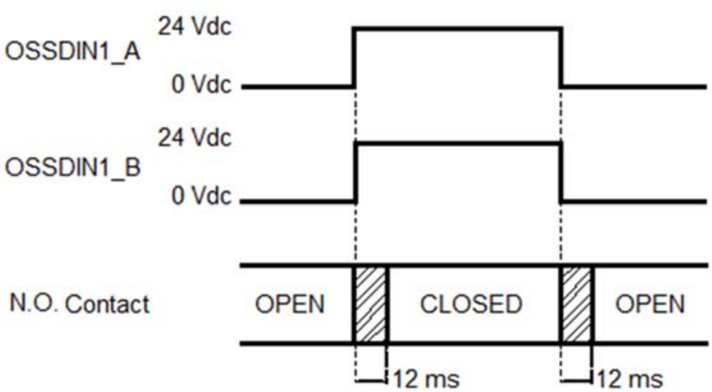
Module-specific characteristics concerning safety (XPSMCMER0002•/XPSMCMER0004•)									
-		Feedback contact used				Feedback contact not used			
-		PFHd	SFF (%)	MTTFd (years)	DCavg	PFHd	SFF (%)	MTTFd (years)	DCavg
DC-13 (2A)	t_{cycle1}	3.09E-10	99.6	2335.94	98.9	9.46E-10	0.60	2335.93	0
	t_{cycle2}	8.53E-11	99.7	24453.47	97.7	1.08E-10	0.87	24453.47	0
	t_{cycle3}	6.63E-11	99.8	126678.49	92.5	6.75E-11	0.97	126678.59	0
AC-15 (3A)	t_{cycle1}	8.23E-09	99.5	70.99	99.0	4.60E-07	0.50	70.99	0
	t_{cycle2}	7.42E-10	99.5	848.16	99.0	4.49E-09	0.54	848.15	0
	t_{cycle3}	1.07E-10	99.7	12653.85	98.4	1.61E-10	0.79	12653.85	0
AC-15 (1A)	t_{cycle1}	3.32E-09	99.5	177.38	99.0	7.75E-08	0.51	177.37	0
	t_{cycle2}	3.36E-10	99.6	2105.14	98.9	1.09E-09	0.60	2105.14	0
	t_{cycle3}	8.19E-11	99.7	28549.13	97.5	1.00E-10	0.88	28549.13	0
t_{cycle1} 300 s (1 commutation every 5 minutes) t_{cycle2} 3600s (1 commutation every hour) t_{cycle3} 1 commutation every day **PFHd** Probability of a dangerous failure per hour according IEC 61508 **MTTFd and DCavg** Mean Time to dangerous Failure and Diagnostic Coverage average according EN ISO 13849-1									

Electrical Life of the Output Contacts

The graphic shows the electrical life of the output contacts determined by EN 60947-51-1:



Switching Operation Timing Diagram



Section 4.10
XPSMCMENx Speed Monitoring Expansion Modules

What Is in This Section?

This section contains the following topics:

Modules and Functional Description

Presentation

The XPSMCMEN0200•, XPSMCMEN0100HT•, XPSMCMEN0200HT•, XPSMCMEN0100SC•, XPSMCMEN0200SC•, XPSMCMEN0100TT•, and XPSMCMEN0200TT• are speed monitoring expansion modules for zero speed, maximum speed, speed range and direction monitoring. In addition, you can configure up to four speed thresholds for each axis being monitored.

The XPSMCMEN0200•, XPSMCMEN0100HT•, XPSMCMEN0200HT•, XPSMCMEN0100SC•, XPSMCMEN0200SC•, XPSMCMEN0100TT•, and XPSMCMEN0200TT• modules can only be configured in conjunction with the XPSMCMCP0802• Modular Safety Controller.

The XPSMCMEN0200• module provides two safety-related inputs for proximity sensors. The XPSMCMEN0100HT• and XPSMCMEN0200HT• modules provide two proximity sensor inputs and one or two channels respectively for monitoring of safety-related HTL encoders. The XPSMCMEN0100SC• and XPSMCMEN0200SC• modules provide two proximity sensor inputs and one or two channels respectively for monitoring of safety-related Sin/Cos encoders. The XPSMCMEN0100TT• and XPSMCMEN0200TT• modules provides two proximity sensor inputs and one or two channels respectively for monitoring of safety-related TTL encoders.

NOTE: The encoders must be mounted according to EN 61800-5-2 to the shaft of the motor.

The modules are configured using SoSafe Configurable.

The expansion module supports two inputs `NODE_ADDR0` and `NODE_ADDR1` which are used to attribute a physical address to the module:

	NODE_ADDR0 (Terminal 2)	NODE_ADDR1 (Terminal 3)
NODE 0	0 (or not connected)	0 (or not connected)
NODE 1	24 Vdc	0 (or not connected)
NODE 2	0 (or not connected)	24 Vdc
NODE 3	24 Vdc	24 Vdc

NOTE: Do not use the same physical address for two units of the same module reference.

NOTE: The LEDs **ADDR 1** and **ADDR 0** correspond to the NODE_ADDR1 and NODE_ADDR0 in this table respectively.

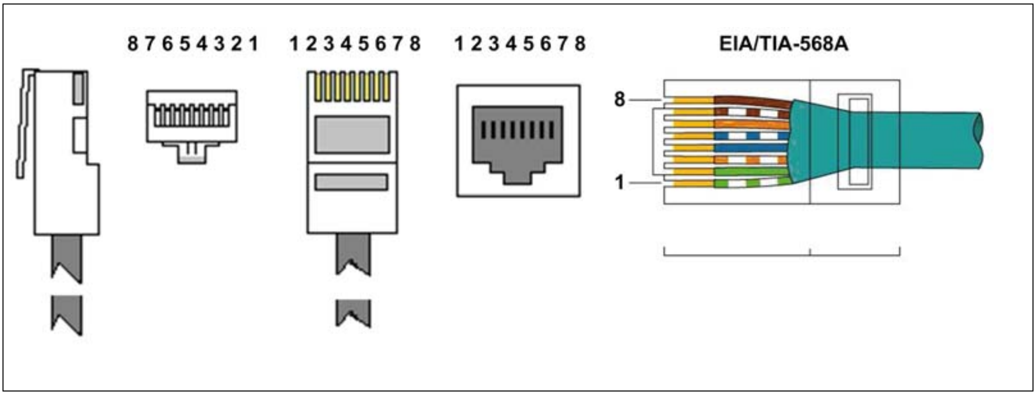
NOTE: The node address wiring must match the configuration settings.

Connector Designations

XPSMCMEN• Modules Connector Designations

Terminal	Signal	LED	Type	Description	Operation
1	24 VDC	PWR	–	24 Vdc power supply	–
2	NODE_ADDR0	ADDR0	Input	Node selection	Input type 3. Maximum applicable resistance 1.2 kΩ.
3	NODE_ADDR1	ADDR1			
4	0 VDC	PWR	–	0 Vdc power supply	–
5	PROXY1_24V	PROX1	Output	PROXIMITY 1 connections	Maximum current 100 mA
6	PROXY1_REF				Power supply 0 Vdc to PROXY1
7	PROXY1_IN1 (3-wire)		Input		PROXY1 Input_1 for NO or NC contact
8	PROXY1_IN2 (4-wire)				PROXY1 Input_2 for NO or NC contact
9	PROXY2_24V	PROX2	Output	PROXIMITY 2 connections	Maximum current 100 mA
10	PROXY2_REF				Power supply 0 Vdc to PROXY2
11	PROXY2_IN1 (3-wire)		Input		PROXY2 Input_1 for NO or NC contact
12	PROXY2_IN2 (4-wire)				PROXY2 Input_2 for NO or NC contact
13	not connected	–	–	not connected	–
14					
15					
16					

Encoder connections with RJ45 connector (modules XPSMCMEN0100HT•, XPSMCMEN0200HT•, XPSMCMEN0100SC•, XPSMCMEN0200SC•, XPSMCMEN0100TT•, and XPSMCMEN0200TT•):



Pin	Color	XPSMCMEN0•00TT	XPSMCMEN0•00HT	XPSMCMEN0•00SC
1	green - white	5 Vdc(1)	not connected	not connected
2	green	0 Vdc	0 Vdc	0 Vdc
3	orange - white	not connected	not connected	not connected
4	blue	A	A	A (Sin+)
5	blue-white	/A	/A	/A (Sin-)
6	orange	not connected	not connected	not connected
7	brown-white	B	B	B (Cos+)
8	brown	/B	/B	/B (Cos-)
(1) This pin is not the power supply of the TTL-encoder, which must be supplied separately. The pin needs to be connected for the speed monitoring module to detect the prescence of a TTL-encoder.				

For more information refer to the Encoder Splitter Cables *(see page 182)*.

LED Indicators

Front-Face View

Operation States

The following table describes the operation states of the XPSMCMEN• LED indicators, assuming the power (**PWR**) indicator is illuminated:

RUN green	E IN red	E EX red	ADDR 0/1 orange	ENC[1] yellow	PROX 1/2 yellow	SH 1/2 yellow	Meaning
ON	ON	ON	ON	ON	ON	ON	Power on - initial test
OFF = awaiting initialization	OFF	OFF	Encoded Node address *(see page 127)*	ON Encoder connected and operative	ON Proximity sensor connected and operative	OFF = Axis in normal speed range	Normal operation
Flashing = no inputs or outputs configured						Flashing = Axis in overspeed	
ON = inputs or outputs configured						ON = Axis in Standstill	

1 The **ENC** LED indicator is not present on XPSMCMEN0200 and XPSMCMEN0200G.

Troubleshooting

The following table describes the error states of the LED indicators, assuming the power (**PWR**) indicator is illuminated:

Detected error	RUN green	E IN red	E EX red	ADDR 0/1 orange	ENC[1] yellow	PROX 1/2 yellow	SH 1/2 yellow	Solution
Internal error detected.	OFF	2 or 3 flashes	OFF	Encoded Node address *(see page 127)*	OFF			Product non serviceable[2].
Compatibility error detected.	OFF	5 flashes	OFF		OFF			Firmware version not compatible with XPSMCMCP0802•[2].
Encoder configured but not connected.	OFF	ON	3 flashes		OFF			Connect encoder to the module. Verify input frequency is in range.
Proximity sensor inoperative.	OFF	OFF	ON		OFF	Flashes 2 sec.	OFF	Change the proximity sensor.
Proximity sensor configured but not connected.	OFF	OFF	3 flashes		OFF	Flashes 0.5 sec.	OFF	Connect proximity to the module. Verify input frequency is in range.
Two units of the same module reference detected with the same node address.	OFF	5 flashes			OFF			Modify the unit node address *(see page 127)*.
Error detected on node detection circuit.	OFF	OFF	OFF	3 flashes	OFF	OFF	Flashes	Product non serviceable[2].

1 The **ENC** LED indicator is not present on XPSMCMEN0200 and XPSMCMEN0200G.
2 If the trouble persists, return the equipment to its place of purchase.

Troubleshooting Speed Monitoring

The following table describes the speed monitoring error states of the LED indicators, assuming the power (**PWR**) indicator is illuminated:

Detected error	RUN green	E IN red	E EX red	ADDR 0/1 orange	ENC[1] yellow	PROX 1/2 yellow	SH 1/2 yellow	Solution
Encoder internal error detected.	OFF	3 flashes	OFF	–	3 flashes	OFF	OFF	Change the encoder[2].
Proximity internal error detected.	–	3 flashes	OFF	–	–	3 flashes	–	Change the proximity sensor [2].
Error detected on node detection circuit.	OFF	3 flashes	OFF	3 flashes	OFF	OFF	OFF	Product non serviceable[2].

1 The **ENC** LED indicator is not present on XPSMCMEN0200 and XPSMCMEN0200G.
2 If the trouble persists, return the equipment to its place of purchase.

Module Characteristics

Presentation

⚠ DANGER
FIRE HAZARD
Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.
Failure to follow these instructions will result in death or serious injury.

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

Module-specific characteristics	XPSMCMEN0200/ XPSMCMEN0200G	XPSMCMEN0100HT• XPSMCMEN0200HT•	XPSMCMEN0100SC• XPSMCMEN0200SC•	XPSMCMEN0100TT• XPSMCMEN0200TT•
Encoder interface	none	HTL	Sin/Cos	TTL
Encoder input signals electrically insulated in accordance with EN 61800-1	none	• Rated insulation voltage 250 V • Overvoltage category II • Rated impulse withstand voltage 4.00 kV		
Max. number of axis	2			
Zero speed / maximum speed frequency gap	> 10 Hz			
Minimum gap between thresholds (with threshold >1)	> 5 %			
Max. number of encoders	0	1 on XPSMCMEN0100TT•, XPSMCMEN0100HT•, XPSMCMEN0100SC• 2 on XPSMCMEN0200TT•, XPSMCMEN0200HT•, XPSMCMEN0200SC•		
Max. encoder frequency	-	300 kHz	500 kHz	500 kHz
Encoder adjustable threshold range	–	1 Hz to 450 kHz		

Module-specific characteristics	XPSMCMEN0200/ XPSMCMEN0200 G	XPSMCMEN0100HT• XPSMCMEN0200HT•	XPSMCMEN0100SC• XPSMCMEN0200SC•	XPSMCMEN0100TT• XPSMCMEN0200TT•
Encoder connections	-	RJ45		
Max. number of proximity sensors	2			
Max. proximity sensors frequency	5 kHz			
Maximum output current to proximity sensor	100 mA at 24 Vdc (terminals 5 and 9)			
Proximity adjustable threshold range	1 Hz to 4 kHz			
Zero speed/Maximum speed frequency gap	>10 Hz			
Minimum gap between thresholds (with threshold >1)	>5 %			
Proximity sensors connections	Terminal blocks			
Proximity sensors type	PNP/NPN - 3/4 wires			
PFHd XPSMCMEN01•	–	6.70-09	7.94E-09	7.08E-09
PFHd XPSMCMEN02•	5.98E-09	7.42-09	9.89E-09	8.18E-09
MeanTime to Dangerous Failure (MTTFd) in years XPSMCMEN0200	424			
MeanTime to Dangerous Failure (MTTFd) in years XPSMCMEN0100HT•, XPSMCMEN0100SC•, XPSMCMEN0100TT•	247			

Module-specific characteristics	XPSMCMEN0200/ XPSMCMEN0200G	XPSMCMEN0100HT• XPSMCMEN0200HT•	XPSMCMEN0100SC• XPSMCMEN0200SC•	XPSMCMEN0100TT• XPSMCMEN0200TT•
MeanTime to Dangerous Failure (MTTFd) in years XPSMCMEN0200HT•, XPSMCMEN0200SC•, XPSMCMEN0200TT•	180			
Weight	0.12 kg (4.2 Oz)			

NOTE: For the characteristics common to all modules, refer to General Characteristics *(see page 34)*.

The following table describes the behavior of the system based on the speed monitoring functions:

Speed monitoring function blocks	Maximum speed	Zero speed	Speed range
Defined safe state	If speed exceeds the maximum speed limit resulting in the deactivation of outputs associated with function.	If Zero speed not achieved resulting in outputs associated with function not being activated.	If speed exceeds the upper or lower speed limits resulting in the deactivation of outputs associated with function.

Section 4.11
XPSMCMRO0004x Output Expansion Module

What Is in This Section?

This section contains the following topics:

Module and Functional Description

Presentation

The XPSMCMRO0004• and XPSMCMRO0004DA• are output expansion modules for the XPSMCM• Modular Safety Controller. The XPSMCMRO0004• and XPSMCMRO0004DA• modules can only be configured in conjunction with the XPSMCMCP0802• Modular Safety Controller. The XPSMCMRO0004• module provides two Category 4, or four Category 1, or two single-channel relay outputs. The XPSMCMRO0004DA• module provides two Category 4, or four Category 1, or two single-channel safety-related relay outputs. XPSMCMRO0004DA• provides eight additional status outputs. The diagnostic status outputs can be configured using SoSafe Configurable.

The expansion module supports two inputs `NODE_ADDR0` and `NODE_ADDR1` which are used to attribute a physical address to the module:

	NODE_ADDR0 (Terminal 2)	NODE_ADDR1 (Terminal 3)
NODE 0	0 (or not connected)	0 (or not connected)
NODE 1	24 Vdc	0 (or not connected)
NODE 2	0 (or not connected)	24 Vdc
NODE 3	24 Vdc	24 Vdc

NOTE: Do not use the same physical address for two units of the same module reference.

NOTE: The LEDs **ADDR 1** and **ADDR 0** correspond to the NODE_ADDR1 and NODE_ADDR0 in this table respectively.

NOTE: The node address wiring must match the configuration settings.

Input RESTART (RST)

For more information refer to Input RESTART (RST) *(see page 51)*.

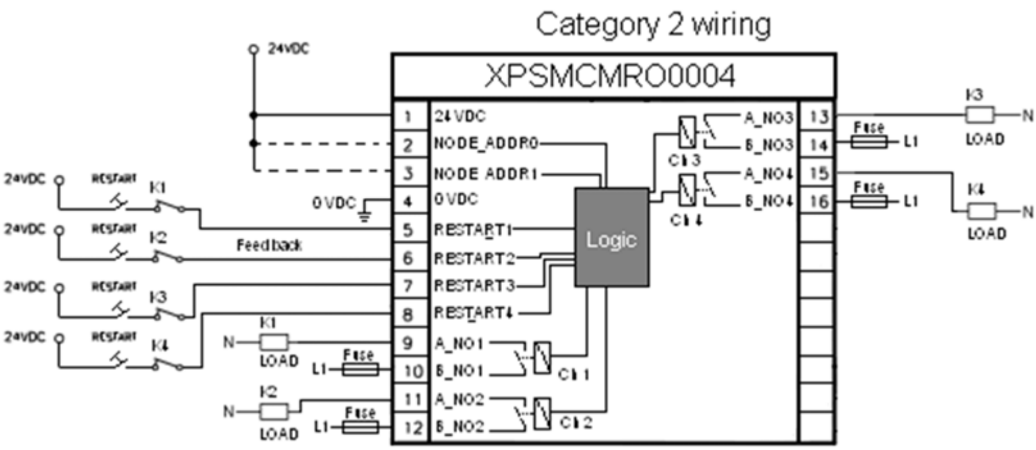
Connector Designations and Example Wiring Diagrams

XPSMCMRO0004• Module Connector Designations

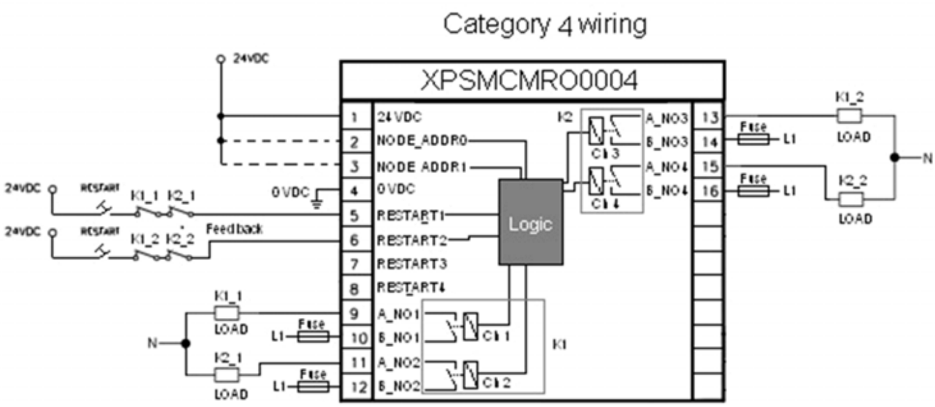
Terminal	Signal	LED	Type	Description	Operation
1	24 VDC	PWR	–	24 Vdc power supply	–
2	NODE_ADDR0	ADDR0	Input	Node selection	Input type 3. Maximum applicable resistance 1.2 kΩ.
3	NODE_ADDR1	ADDR1			
4	0 VDC	PWR	–	0 Vdc power supply	-
5	RESTART1	RST 1	Input	Feedback/Restart 1	Input type 3. Maximum applicable resistance 1.2 kΩ.
6	RESTART2	RST 2		Feedback/Restart 2	
7	RESTART3	RST 3		Feedback/Restart 3	
8	RESTART4	RST 4		Feedback/Restart 4	
9	A_NO1	-	Output	NO contact channel 1	-
10	B_NO1				
11	A_NO2			NO contact channel 2	
12	B_NO2				
13	A_NO3			NO contact channel 3	
14	B_NO3				
15	A_NO4			NO contact channel 4	
16	B_NO4				

XPSMCMRO0004• Module Example Wiring Diagrams

Category 2 wiring



Category 4 wiring



LED Indicators

Front-Face View

Operation States

The following table describes the operation states of the XPSMCMRO0004• LED indicators, assuming the power (**PWR**) indicator is illuminated):

RUN green	E IN red	E EX red	ADDR 0/1 orange	RELAY 1-4 red/green	RST 1-4 yellow	Meaning
ON	ON	ON	ON	Red	ON	Power on - initial test
OFF = awaiting initialization	OFF	OFF	Encoded Node address *(see page 138)*	Output state: red = 0 (contact opened) green = 1 (contact closed)	ON = waiting for restart	Normal operation
Flashing = no inputs or outputs configured					Flashing = no feedback	
ON = inputs or outputs configured						

Troubleshooting

The following table describes the error states of the LED indicators, assuming the power (**PWR**) indicator is illuminated:

<table>
<tr><th>Detected error</th><th>RUN green</th><th>E IN red</th><th>E EX red</th><th>ADDR 0/1 orange</th><th>RELAY 1-4 red/green</th><th>RST 1-4 yellow</th><th>Solution</th></tr>
<tr><td>Internal error detected.</td><td>OFF</td><td>2 or 3 flashes</td><td>OFF</td><td rowspan="7">Encoded Node address (see page 138)</td><td>Red</td><td>OFF</td><td>Product non serviceable[1].</td></tr>
<tr><td>Compatibility error detected.</td><td>OFF</td><td>5 flashes</td><td>OFF</td><td colspan="2">5 flashes</td><td>Firmware version not compatible with XPSMCMCP0802•[1].</td></tr>
<tr><td>Relay output error detected.</td><td>OFF</td><td>4 flashes</td><td>OFF</td><td>4 flashes [1]</td><td>OFF</td><td>Product non serviceable[1].</td></tr>
<tr><td>Error detected in the communication with controller.</td><td>OFF</td><td>5 flashes</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Reboot the system.</td></tr>
<tr><td>Error detected on other expansion module or XPSMCMCP0802•.</td><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Reboot the system[1]. Verify which module /controller is in error and consult its troubleshooting guide.</td></tr>
<tr><td>Two units of the same module reference detected with the same node address.</td><td>OFF</td><td colspan="2">5 flashes</td><td>OFF</td><td>OFF</td><td>Modify the unit node address (see page 138).</td></tr>
<tr><td>No external feedback category 4 relay.</td><td>ON</td><td>OFF</td><td>4 flashes</td><td>4 red flashes</td><td>OFF</td><td>Verify connection 5,6,7,8.</td></tr>
<tr><td>Error detected on node detection circuit.</td><td>OFF</td><td>3 flashes</td><td>OFF</td><td>3 flashes</td><td>OFF</td><td>OFF</td><td>Product non serviceable[1].</td></tr>
<tr><td colspan="8">1 If the trouble persists, return the equipment to its place of purchase.</td></tr>
</table>

Module Characteristics

Presentation

DANGER

FIRE HAZARD

- Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.
- For relay output (2 A) wiring, use conductors of at least 0.5 mm^2 (AWG 20) with a temperature rating of at least 80 °C (176 °F).
- For common conductors of relay output wiring (7 A), or relay output wiring greater than 2 A, use conductors of at least 1.0 mm^2 (AWG 16) with a temperature rating of at least 80 °C (176 °F).

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

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Module-specific characteristics	XPSMCMRO0004•	XPSMCMRO0004DA•
Reference description	Electronic housing maximum 16-pole, with locking latch mounting	Electronic housing maximum 24-pole, with locking latch mounting
Switching capacity according to EN 60947-5-1	AC-15, 240 V, 3 A or DC-13, 24 V, 2 A	
Switching current (resistive)	6 A maximum	
Excitation voltage	17...31 Vdc	
Minimum switching voltage	10 Vdc	
Minimum switching current	20 mA	
Maximum switching voltage (DC)	250 Vdc	
Maximum switching voltage (AC)	400 Vac	
Relay contact type	4	
FEEDBACK contacts	4 / EDM (External Device Monitoring) type 3. Maximum applicable resistance 1.2 kΩ. / Possible automatic or manual operation with restart pushbutton	
Status outputs	-	8 configurable diagnostic outputs PNP active high 100 mA @ 24 Vdc max

Module-specific characteristics	XPSMCMRO0004•	XPSMCMRO0004DA•
Response time	12 ms	
Mechanical life of contacts	> 20 x 10^6	
Connection to expansion modules	5-way backplane expansion	
Weight	0.12 kg (4.2 Oz)	

NOTE: For the characteristics common to all modules, refer to General Characteristics *(see page 34)*.

NOTE: To help ensure correct isolation and avoid the risk of premature aging of, or damage to, the relays, each output line must be protected using a delay 3.5 A fuse. The load characteristics must be consistent with those specified. For more important information on the protection of relay outputs, refer to Protecting Outputs from Inductive Load Damage *(see page 42)*.

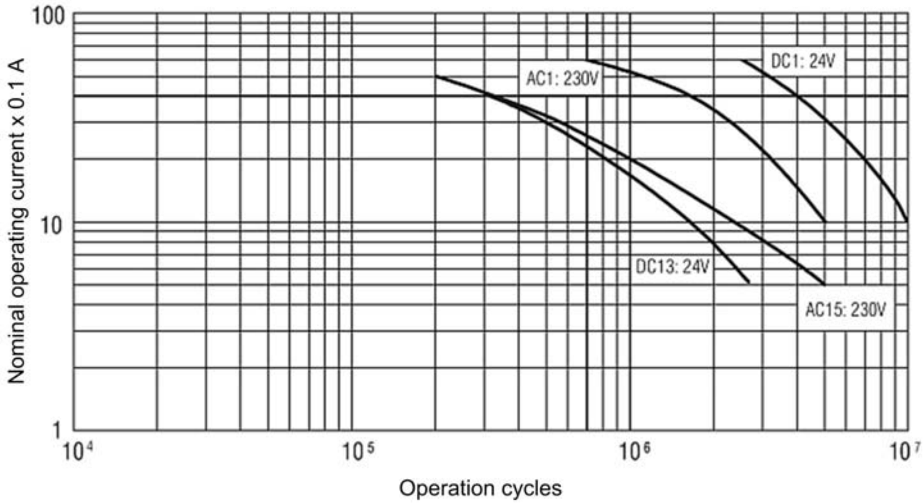
NOTE: If a relay module is connected, the response time of the OSSD linked must be increased by 12 ms.

Module Characteristics Concerning Safety

Module-specific characteristics concerning safety (XPSMCMRO0004•/XPSMCMRO0004DA•)									
-		Feedback contact used				Feedback contact not used			
-		PFHd	SFF (%)	MTTFd (years)	DCavg	PFHd	SFF (%)	MTTFd (years)	DCavg
DC-13 (2A)	t_{cycle1}	3.09E-10	99.6	2335.94	98.9	9.46E-10	0.60	2335.93	0
	t_{cycle2}	8.53E-11	99.7	24453.47	97.7	1.08E-10	0.87	24453.47	0
	t_{cycle3}	6.63E-11	99.8	126678.49	92.5	6.75E-11	0.97	126678.5	0
AC-15 (3A)	t_{cycle1}	8.23E-09	99.5	70.99	99.0	4.60E-07	0.50	70.99	0
	t_{cycle2}	7.42E-10	99.5	848.16	99.0	4.49E-09	0.54	848.15	0
	t_{cycle3}	1.07E-10	99.7	12653.85	98.4	1.61E-10	0.79	12653.85	0
AC-15 (1A)	t_{cycle1}	3.32E-09	99.5	177.38	99.0	7.75E-08	0.51	177.37	0
	t_{cycle2}	3.36E-10	99.6	2105.14	98.9	1.09E-09	0.60	2105.14	0
	t_{cycle3}	8.19E-11	99.7	28549.13	97.5	1.00E-10	0.88	28549.13	0
t_{cycle1} 300 s (1 commutation every 5 minutes) t_{cycle2} 3600s (1 commutation every hour) t_{cycle3} 1 commutation every day **PFHd** Probability of a dangerous failure per hour according IEC 61508 **MTTFd and DCavg** Mean Time to dangerous Failure and Diagnostic Coverage average according EN ISO 13849-1									

Electrical Life of the Output Contacts

The graphic shows the electrical life of the output contacts determined by EN 60947-51-1:



Section 4.12
XPSMCMRO0004DAx Output Expansion Module

What Is in This Section?

This section contains the following topics:

Module and Functional Description

Presentation

The XPSMCMRO0004• and XPSMCMRO0004DA• are output expansion modules for the XPSMCM• Modular Safety Controller. The XPSMCMRO0004• and XPSMCMRO0004DA• modules can only be configured in conjunction with the XPSMCMCP0802• Modular Safety Controller. The XPSMCMRO0004• module provides two Category 4, or four Category 1, or two single-channel relay outputs. The XPSMCMRO0004DA• module provides two Category 4, or four Category 1, or two single-channel safety-related relay outputs. XPSMCMRO0004DA• provides eight additional status outputs. The diagnostic status outputs can be configured using SoSafe Configurable.

The expansion module supports two inputs `NODE_ADDR0` and `NODE_ADDR1` which are used to attribute a physical address to the module:

	NODE_ADDR0 (Terminal 2)	NODE_ADDR1 (Terminal 3)
NODE 0	0 (or not connected)	0 (or not connected)
NODE 1	24 Vdc	0 (or not connected)
NODE 2	0 (or not connected)	24 Vdc
NODE 3	24 Vdc	24 Vdc

NOTE: Do not use the same physical address for two units of the same module reference.

NOTE: The LEDs **ADDR 1** and **ADDR 0** correspond to the NODE_ADDR1 and NODE_ADDR0 in this table respectively.

NOTE: The node address wiring must match the configuration settings.

Input **RESTART (RST)**

For more information refer to Input RESTART (RST) *(see page 51)*.

Output **STATUS**

For more information refer to Output STATUS *(see page 52)*.

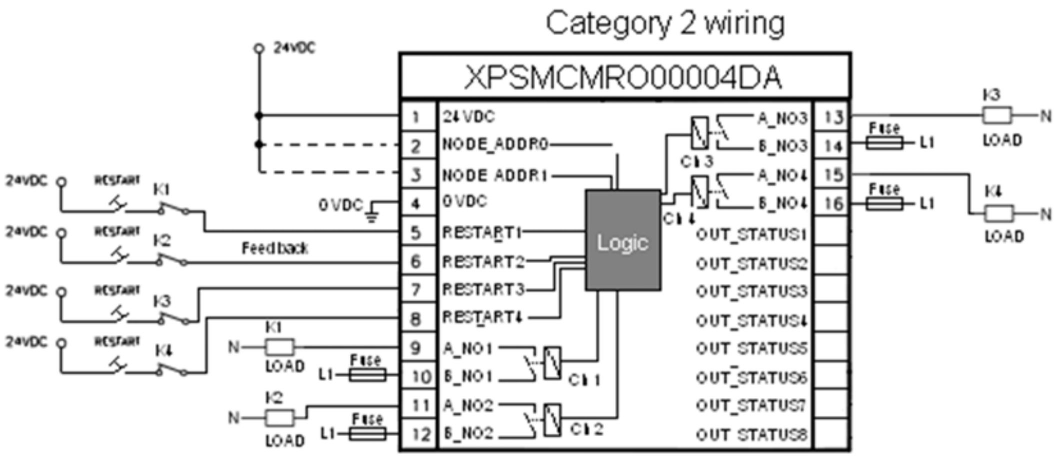
Connector Designations and Example Wiring Diagrams

XPSMCMRO0004DA• Module Connector Designations

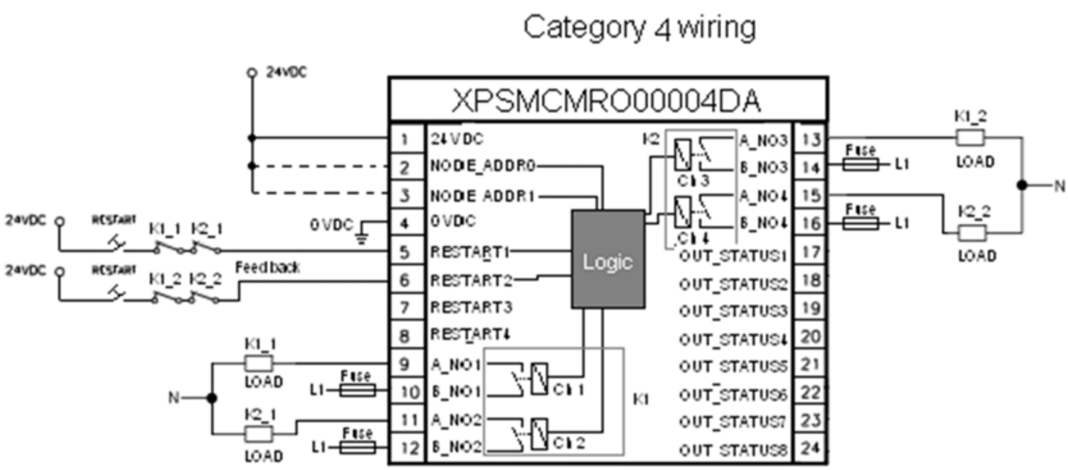
Terminal	Signal	LED	Type	Description	Operation
1	24 VDC	PWR	–	24 Vdc power supply	–
2	NODE_ADDR0	ADDR0	Input	Node selection	Input type 3. Maximum applicable resistance 1.2 kΩ.
3	NODE_ADDR1	ADDR1			
4	0 VDC	PWR	–	0 Vdc power supply	-
5	RESTART1	RST 1	Input	Feedback/Restart 1	Input type 3. Maximum applicable resistance 1.2 kΩ.
6	RESTART2	RST 2		Feedback/Restart 2	
7	RESTART3	RST 3		Feedback/Restart 3	
8	RESTART4	RST 4		Feedback/Restart 4	
9	A_NO1	-	Output	NO contact channel 1	-
10	B_NO1				
11	A_NO2			NO contact channel 2	
12	B_NO2				
13	A_NO3			NO contact channel 3	
14	B_NO3				
15	A_NO4			NO contact channel 4	
16	B_NO4				
17	OUT_STATUS 1	STATUS 1	Output	Configurable diagnostic output	PNP (sourcing) active high
18	OUT_STATUS 2	STATUS 2			
19	OUT_STATUS 3	STATUS 3			
20	OUT_STATUS 4	STATUS 4			
21	OUT_STATUS 5	STATUS 5			
22	OUT_STATUS 6	STATUS 6			
23	OUT_STATUS 7	STATUS 7			
24	OUT_STATUS 8	STATUS 8			

XPSMCMRO0004DA• Module Example Wiring Diagrams

Category 2 wiring

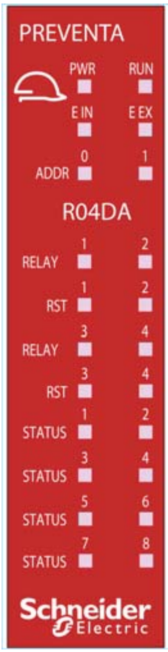


Category 4 wiring



LED Indicators

Front-Face View



Operation States

The following table describes the operation states of the XPSMCMRO0004DA• LED indicators, assuming the power (**PWR**) indicator is illuminated):

RUN green	E IN red	E EX red	ADDR 0/1 orange	RELAY 1-4 red/green	RST 1-4 yellow	STATUS 1-8 yellow	Meaning
ON	ON	ON	ON	Red	ON	ON	Power on - initial test

RUN green	E IN red	E EX red	ADDR 0/1 orange	RELAY 1-4 red/green	RST 1-4 yellow	STATUS 1-8 yellow	Meaning
OFF = awaiting initialization	OFF	OFF	Encoded Node address *(see page 147)*	Output state: red = 0 (contact opened) green = 1 (contact closed)	ON = waiting for restart	Output diagnostics	Normal operation
Flashing = no inputs or outputs configured					Flashing = no feedback		
ON = inputs or outputs configured							

Troubleshooting

The following table describes the error states of the LED indicators, assuming the power (**PWR**) indicator is illuminated:

Detected error	RUN green	E IN red	E EX red	ADDR 0/1 orange	RELAY 1-4 red/green	RST 1-4 yellow	Solution
Internal error detected.	OFF	2 or 3 flashes	OFF	Encoded Node address *(see page 147)*	Red	OFF	Product non serviceable[1].
Compatibility error detected.	OFF	5 flashes	OFF		5 flashes		Firmware version not compatible with XPSMCMCP0802•[1].
Relay output error detected.	OFF	4 flashes	OFF		4 flashes [1]	OFF	Product non serviceable[1].
Error detected in the communication with controller.	OFF	5 flashes	OFF		OFF	OFF	Reboot the system.
Error detected on other expansion module or XPSMCMCP0802•.	OFF	ON	OFF		OFF	OFF	Reboot the system[1]. Verify which module /controller is in error and consult its troubleshooting guide.
Two units of the same module reference detected with the same node address.	OFF	5 flashes			OFF	OFF	Modify the unit node address *(see page 147)*.
No external feedback category 4 relay.	ON	OFF	4 flashes		4 red flashes	OFF	Verify connection 5,6,7,8.
Error detected on node detection circuit.	OFF	3 flashes	OFF	3 flashes	OFF	OFF	Product non serviceable[1].
1 If the trouble persists, return the equipment to its place of purchase.							

Module Characteristics

Presentation

⚠ DANGER

FIRE HAZARD

- Use only the correct wire sizes for the current capacity of the I/O channels and power supplies.
- For relay output (2 A) wiring, use conductors of at least 0.5 mm^2 (AWG 20) with a temperature rating of at least 80 °C (176 °F).
- For common conductors of relay output wiring (7 A), or relay output wiring greater than 2 A, use conductors of at least 1.0 mm^2 (AWG 16) with a temperature rating of at least 80 °C (176 °F).

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Module-specific characteristics	XPSMCMRO0004•	XPSMCMRO0004DA•
Reference description	Electronic housing maximum 16-pole, with locking latch mounting	Electronic housing maximum 24-pole, with locking latch mounting
Switching capacity according to EN 60947-5-1	AC-15, 240 V, 3 A or DC-13, 24 V, 2 A	
Switching current (resistive)	6 A maximum	
Excitation voltage	17...31 Vdc	
Minimum switching voltage	10 Vdc	
Minimum switching current	20 mA	
Maximum switching voltage (DC)	250 Vdc	
Maximum switching voltage (AC)	400 Vac	
Relay contact type	4	
FEEDBACK contacts	4 / EDM (External Device Monitoring) type 3. Maximum applicable resistance 1.2 kΩ. / Possible automatic or manual operation with restart pushbutton	
Status outputs	-	8 configurable diagnostic outputs PNP active high 100 mA @ 24 Vdc max

Module-specific characteristics	XPSMCMRO0004•	XPSMCMRO0004DA•
Response time	12 ms	
Mechanical life of contacts	> 20 x 10^6	
Connection to expansion modules	5-way backplane expansion	
Weight	0.12 kg (4.2 Oz)	

NOTE: For the characteristics common to all modules, refer to General Characteristics *(see page 34)*.

NOTE: To help ensure correct isolation and avoid the risk of premature aging of, or damage to, the relays, each output line must be protected using a delay 3.5 A fuse. The load characteristics must be consistent with those specified. For more important information on the protection of relay outputs, refer to Protecting Outputs from Inductive Load Damage *(see page 42)*.

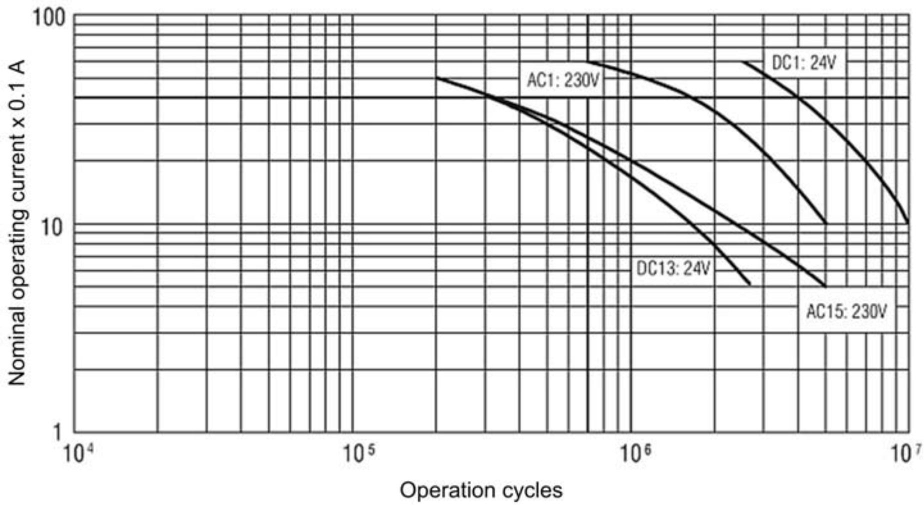
NOTE: If a relay module is connected, the response time of the OSSD linked must be increased by 12 ms.

Module Characteristics Concerning Safety

Module-specific characteristics concerning safety (XPSMCMRO0004•/XPSMCMRO0004DA•)									
-		Feedback contact used				Feedback contact not used			
-		PFHd	SFF (%)	MTTFd (years)	DCavg	PFHd	SFF (%)	MTTFd (years)	DCavg
DC-13 (2A)	t_{cycle1}	3.09E-10	99.6	2335.94	98.9	9.46E-10	0.60	2335.93	0
	t_{cycle2}	8.53E-11	99.7	24453.47	97.7	1.08E-10	0.87	24453.47	0
	t_{cycle3}	6.63E-11	99.8	126678.49	92.5	6.75E-11	0.97	126678.5	0
AC-15 (3A)	t_{cycle1}	8.23E-09	99.5	70.99	99.0	4.60E-07	0.50	70.99	0
	t_{cycle2}	7.42E-10	99.5	848.16	99.0	4.49E-09	0.54	848.15	0
	t_{cycle3}	1.07E-10	99.7	12653.85	98.4	1.61E-10	0.79	12653.85	0
AC-15 (1A)	t_{cycle1}	3.32E-09	99.5	177.38	99.0	7.75E-08	0.51	177.37	0
	t_{cycle2}	3.36E-10	99.6	2105.14	98.9	1.09E-09	0.60	2105.14	0
	t_{cycle3}	8.19E-11	99.7	28549.13	97.5	1.00E-10	0.88	28549.13	0
t_{cycle1} 300 s (1 commutation every 5 minutes) **t_{cycle2}** 3600s (1 commutation every hour) **t_{cycle3}** 1 commutation every day **PFHd** Probability of a dangerous failure per hour according IEC 61508 **MTTFd and DCavg** Mean Time to dangerous Failure and Diagnostic Coverage average according EN ISO 13849-1									

Electrical Life of the Output Contacts

The graphic shows the electrical life of the output contacts determined by EN 60947-51-1:



Section 4.13
XPSMCMCO0000Sx Communication Expansion Modules

What Is in This Section?

This section contains the following topics:

Communication Expansion Modules

Presentation

The XPSMCMCO0000S• are communication expansion modules (transmitter and receiver) which allow the connection of XPSMCMCP0802• Modular Safety Controller with expansion modules placed remotely (≤50 m/≤164 ft). Up to six islands can be created using the communication modules with a total length of 250 m (820.2 ft) and a maximum of 50 m (164 ft) between two communication modules. The system response time does not change with the use of the communication modules.

Using RS-485 shielded cable *(see page 181)*, two XPSMCMCO0000S• modules placed at the desired distance can be linked together thus joining the expansion modules to the controller. Each XPSMCMCO0000S2• module has two independent connection channels; the connection of two XPSMCMCO0000S2• modules can be accomplished by wiring either channel.

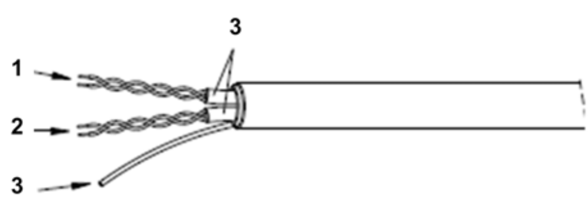
The XPSMCMCO0000S1• module has only one channel and must be connected as the first (remote) or last (local) module.

Connector Designations and Cable

XPSMCMCO0000S• Modules Connector Designations

<table>
<tr><th rowspan="2">Terminal</th><th colspan="2">Signal</th><th rowspan="2">Description</th><th rowspan="2">Cable connections</th></tr>
<tr><th>XPSMCMCO0000S1</th><th>XPSMCMCO0000S2</th></tr>
<tr><td>1</td><td colspan="2">24 VDC</td><td>24 Vdc power supply</td><td rowspan="8">–</td></tr>
<tr><td>2</td><td colspan="2">not connected</td><td>-</td></tr>
<tr><td>3</td><td colspan="2">Shielding CH1</td><td>-</td></tr>
<tr><td>4</td><td colspan="2">0 VDC</td><td>0 Vdc power supply</td></tr>
<tr><td>5</td><td rowspan="4">not connected</td><td rowspan="2">not connected</td><td>-</td></tr>
<tr><td>6</td><td>-</td></tr>
<tr><td>7</td><td>Shielding CH2</td><td>-</td></tr>
<tr><td>8</td><td>not connected</td><td>-</td></tr>
<tr><td>9</td><td colspan="2">CH1-A</td><td rowspan="8">Be sure to connect to the corresponding terminals of the remote XPSMCMCO0000S•:
● A <-> A
● B <-> B
● C <-> C
● D <-> D
● SHIELDING <-> SHIELDING
You can also connect CH1 with CH2 (XPSMCMCO0000S2).</td><td rowspan="2">First pair twisted conductors</td></tr>
<tr><td>10</td><td colspan="2">CH1-B</td></tr>
<tr><td>11</td><td colspan="2">CH1-C</td><td rowspan="2">Second pair twisted conductors</td></tr>
<tr><td>12</td><td colspan="2">CH1-D</td></tr>
<tr><td>13</td><td rowspan="4">not connected</td><td>CH2-A</td><td rowspan="2">First pair twisted conductors</td></tr>
<tr><td>14</td><td>CH2-B</td></tr>
<tr><td>15</td><td>CH2-C</td><td rowspan="2">Second pair twisted conductors</td></tr>
<tr><td>16</td><td>CH2-D</td></tr>
</table>

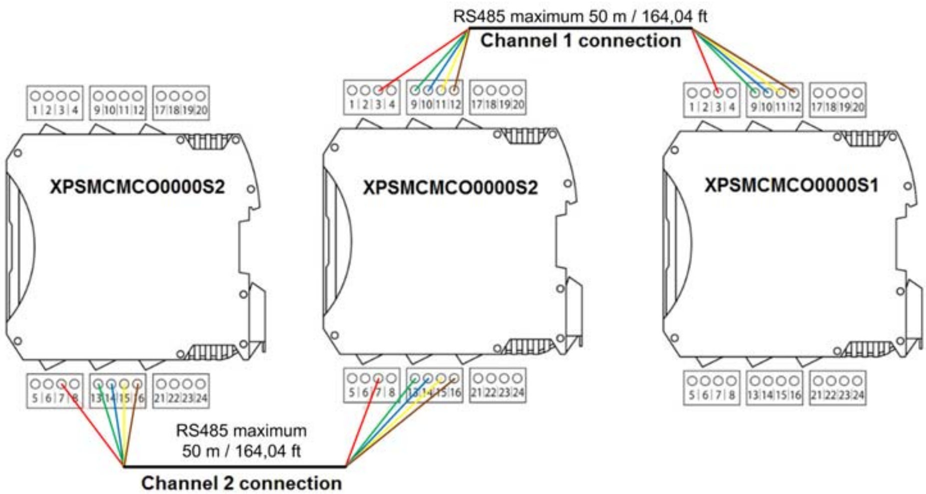
RS485 Cable Technical Data



1 First pair
2 Second pair
3 Shielding

Element	Description/Value
Conductors	2 pairs of twisted conductors with shielding
Nominal impedance	120 Ω
Nominal capacitance	<42 pF/m
Nominal resistance	<95 Ω/m

Wiring Example RS485 Island Expansion



LED Indicators

Front-Face View

Operation States

The following table describes the operation states of the XPSMCMCO0000S• LED indicators, assuming the power (**PWR**) indicator is illuminated:

RUN green	E IN red	E EX red	Meaning
ON	ON	ON	Power on - initial test
OFF = awaiting initialization	OFF	OFF	Normal operation
Flashing = no inputs or outputs configured			
ON = inputs or outputs configured			
[1] For more information, refer to Error Codes *(see page 412)*.			

Troubleshooting

The following table describes the error states of the LED indicators, assuming the power (**PWR**) indicator is illuminated:

Detected error	RUN green	E IN red	E EX red	Solution
Internal error detected	OFF	Flashing	OFF	Refer to Error Codes *(see page 412)*.
External wiring error detected	OFF	OFF	ON	Verify connections.

Module Characteristics

Presentation

Module-specific characteristics	XPSMCMCO0000S1	XPSMCMCO0000S2
Reference description	Electronic housing maximum 8-pole, with locking latch mounting	Electronic housing maximum 16-pole, with locking latch mounting
Connection channels	1	2
Maximum connections	6	
Maximum cable length between communication modules	<50 m (164 ft) per section	
Weight	0.12 kg (4.2 Oz)	
Probability of a dangerous failure per hour (PFHd)	1.13×10^{-8}	1.31×10^{-8}

NOTE: For the characteristics common to all modules, refer to General Characteristics *(see page 34)*.

Section 4.14
XPSMCMx Fieldbus Expansion Modules

What Is in This Section?

This section contains the following topics:

Modules and Functional Description

Presentation

The XPSMCMCO0000CO(G), XPSMCMCO0000EC(G), XPSMCMCO0000EI(G), XPSMCMCO0000EM(G), XPSMCMCO0000MB(G), XPSMCMCO0000PB(G), and XPSMCMCO0000UB(G) are fieldbus expansion modules for the XPSMCM• Modular Safety Controller offer. The fieldbus expansion modules can only be configured in conjunction with the XPSMCMCP0802• Modular Safety Controller.

The fieldbus expansion modules can be configured using the BUS Configurator software *(see page 242)*, part of the install package for SoSafe Configurable software.

One fieldbus expansion module can be added to your Modular Safety Controller system through the backplane expansion *(see page 180)*.

The following fieldbus expansion modules are available and contain the following interfaces:

Module reference	Interface	Type (short name in software and on product)
XPSMCMCO0000EI•	EtherNet/IP	**EIP**
XPSMCMCO0000MB•	Modbus Serial	**MBS**
XPSMCMCO0000CO•	CANopen	**CAN**
XPSMCMCO0000PB•	Profibus DP	**PDP**
XPSMCMCO0000EC•	EtherCAT	**ECT**
XPSMCMCO0000EM•	Modbus TCP/IP	**MTP**
XPSMCMCO0000UB•	Universal Serial Bus	**USB**

The fieldbus expansion module exports the system state and diagnostics of all I/Os configured on the Modular Safety Controller.

Green arrow I/O state
Red arrow I/O diagnostic
Blue arrow Input from fieldbus

The input map to the Modular Safety Controller is made up by a single byte representing the fieldbus inputs.

The output map from the Modular Safety Controller is 24 bytes in length:
- 1 byte represents the system status,
- 16 bytes represent the input status,
- 1 byte represents the mirror image of the fieldbus inputs,
- 2 bytes represent the fieldbus probe status,
- 2 bytes represent the OSSD outputs, and
- 2 bytes represent the diagnostic index and associated error code *(see page 250)*.

The system status is shown as one byte in which the bit 0 indicates whether the controller is online/offline and bit 1 indicates the presence of diagnostic elements. Each input and each output (OSSD) configured on the system is associated with two information elements: states and diagnostic.

Status is a binary value, 0 or 1, diagnostic is a code indicating the condition of the I/O.

Each module with inputs has a number of bits corresponding to the number of physical inputs that are present; thus modules XPSMCMCP0802•, XPSMCMDI0800•, XPSMCMMX0802• are associated with one byte (8 bit) and modules XPSMCMDI1600•, XPSMCMDI1200MT• with two bytes (16 bit) for the input status.

All safety-related outputs are summarized in one byte or two bytes. The input location varies according to the type of modules that are installed, in the following order:
1. XPSMCMCP0802•
2. XPSMCMMX0802•
3. XPSMCMDI1600•
4. XPSMCMDI0800•
5. XPSMCMDI1200MT•

If several modules of the same reference are installed, the order follows the node address. Diagnostic elements are in the form of two bytes which indicate the number of the I/O with the issue and the value of the diagnostic element. If there is more than one diagnostic element, the relative values alternate every 500 ms.

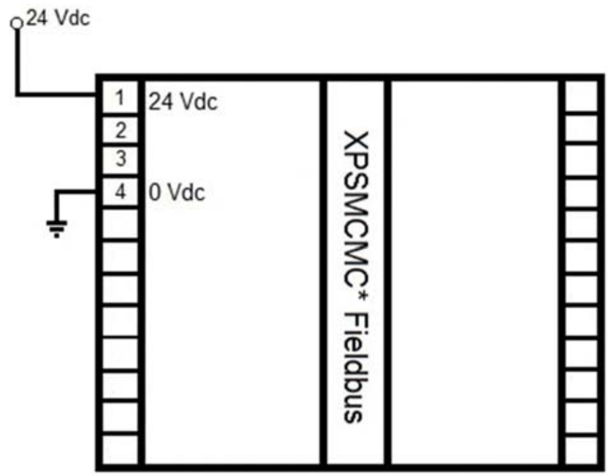
The project report indicates the association of bytes and bits to the modules.

Connector Designations and Example Wiring Diagram

Fieldbus Expansion Modules Connector Designations

Terminal	Signal	LED	Type	Description	Operation
1	24 VDC	PWR	–	24 Vdc power supply	–
2	–	–	–	Not connected	–
3					
4	0 VDC	PWR	–	0 Vdc power supply	–
5	–	–	–	Not connected	–
6					
7					
8					

Fieldbus Expansion Modules Example Wiring Diagram



LED Indicators

Front-Face View

Common LEDs for Operation

The following table describes the states of the common LED indicators of the fieldbus expansion modules:

PWR green	RUN green	E IN red	E EX red	First module-specific LED[1]	Second module-specific LED[1]	Meaning
ON	ON	ON	ON	ON	ON	Startup - Initial test
ON	Flashing	OFF	OFF	OFF	OFF	Waiting for configuration from the Modular Safety Controller
ON	ON	OFF	OFF	See the module-specific tables below[1]		Received configuration from the Modular Safety Controller

[1] Two LEDs indicate the communication protocol status. These LEDs are described in the following module-specific tables.

Common LED Indicators for Troubleshooting

The following table describes the states of the common LED indicators between the different communication expansion modules, assuming the power (**PWR**) indicator is illuminated:

<table>
<tr><th>Detected error</th><th>RUN green</th><th>E IN red</th><th>E EX red</th><th>First module-specific LED[1]</th><th>Second module-specific LED[1]</th><th>Solution</th></tr>
<tr><td>Internal microcontroller error detected.</td><td>OFF</td><td>2 flashes</td><td>OFF</td><td colspan="2" rowspan="6">See the module-specific tables below[1]</td><td rowspan="2">Replace the product if the condition persists</td></tr>
<tr><td>Internal board error detected.</td><td>OFF</td><td>3 flashes</td><td>OFF</td></tr>
<tr><td>Configuration error detected.</td><td>OFF</td><td>5 flashes</td><td>OFF</td><td>Verify correct configuration.</td></tr>
<tr><td>Bus communication error detected.</td><td>OFF</td><td>5 flashes</td><td>OFF</td><td>Verify the fieldbus connections.</td></tr>
<tr><td>Bus communication interruption detected.</td><td>OFF</td><td>ON</td><td>OFF</td><td>Verify wiring, connectors, and state of the fieldbus master.</td></tr>
<tr><td>Duplicate addresses detected on the fieldbus.</td><td>OFF</td><td>5 flashes</td><td>5 flashes</td><td>Set a correct fieldbus address</td></tr>
<tr><td colspan="7">[1] Two LEDs indicate the communication protocol status. These LEDs are described in the following module-specific tables.</td></tr>
</table>

NOTE: The LED frequency of flashing is: ON for 300 ms and OFF for 400 ms with an interval between flash sequences of 1 s.

XPSMCMCO0000CO• CANopen

The following table presents the LED indicator **CAN RUN**:

State	Indication
OFF	No power
Steady green	Online, connected
Flashes slow green	Operating state Pre-Operational
Periodic single green flash	Operating state Stopped
Flashes fast green	Baud rate detection in progress.
Steady red	Bus not operational.
Operating states mentioned in the table according to the CANopen state machine	

The following table presents the LED indicator **ERR**:

State	Indication
OFF	No error detected
Periodic single red flash	A bus error counter has reached an alert level.
Fast red flashing	Layer Setting Service (LSS) operational.
Periodic double red flash	Life guarding event: detected node guarding or heartbeat not detected.
Steady red	Bus not operational.

XPSMCMCO0000EC EtherCAT

The following table presents the LED indicator **RUN**:

State	Indication
OFF	Operating state Init or no power
Green	Operating state Operational
Flashes green	Operating state Pre-Operational
Flashes green once	Operating state Safe-Operational
Red	System locked
Operating states mentioned in the table according to the EtherCAT state machine	

The following table presents the LED indicator **ERR**:

State	Indication
OFF	No error or no power
Flashes red	Configuration not valid. Operating state transition requested by master not possible.
Flashes red twice	Timeout EtherCAT SynchManager watchdog.
Red	Error detected, fieldbus module not operational.

XPSMCMCO0000EI• EtherNet/IP Module

The following table presents the LED indicator **EIP NS**:

State	Indication
OFF	No power or no IP address.
Steady green	Online, connected. One or more connections established (CIP Class 1 or 3)
Green flashing	Online, not connected.
Steady red	Duplicate IP address.
Red flashing	Connection timeout, one or more connections timed out (CIP class 1 or 3)

The following table presents the LED indicator **MS**:

State	Indication
OFF	No power
Steady green	Operating state Operational
Green flashing	Not configured or Scanner is idle.
Steady red	One or more non-recoverable errors detected.
Red flashing	One or more recoverable errors detected.
Operating states mentioned in the table according to the EtherNet/IP state machine	

XPSMCMCO0000MB• Modbus Serial

The following table presents the LED indicator **MBS COM**:

State	Indication
OFF	No power or no data exchange
Yellow	Frame reception or transmission
Steady red	One or more non-recoverable errors detected.

The following table presents the LED indicator **STS**:

State	Indication
OFF	No power or initializing.
Steady green	Module initialized.
Steady red	One or more non-recoverable errors detected.
Periodic single red flash	Communication or configuration error detected.
Periodic double red flash	Application diagnostics available.

XPSMCMCO0000EM• Modbus TCP/IP

The following table presents the LED indicator **MTP NET**:

State	Indication
OFF	No power or no IP address
Steady green	Online, connected
Flashes green	Online, not connected
Steady red	Duplicate IP address
Flashes red	Connection timeout

The following table presents the LED indicator **STS**:

State	Indication
OFF	No power
Steady green	Running
Flashes green	Not configured
Steady red	One or more non-recoverable errors detected.
Flashes red	One or more recoverable errors detected.

XPSMCMCO0000PB• Profibus DP

The following table presents the LED indicator **PDP MODE**:

State	Indication
OFF	No power
Steady green	Online, connected
Green flashing	Online, clear
Periodic single red flash	Parameterization error detected.
Periodic double red flash	Profibus DP configuration error detected (configuration data in master or slave incorrect).

The following table presents the LED indicator **STS**:

State	Indication
OFF	Module not initialized
Green flashing	Diagnostics exchange active with master.
Steady green	Initialized
Red flashing (1 Hz)	One or more recoverable errors detected.
Steady red	Non-recoverable error detected.

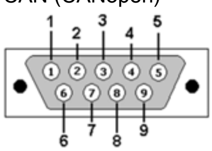
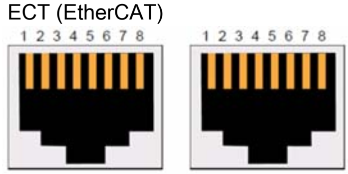
XPSMCMCO0000UB• USB

There are no specific LED indicators for this reference, refer to general tables for the operation states *(see page 166)* and the troubleshooting *(see page 167)*.

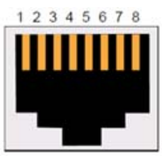
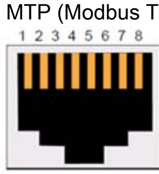
Module Characteristics

Presentation

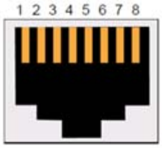
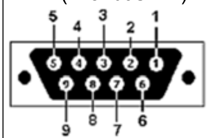
General characteristics	
Rated voltage	24 Vdc ± 20 % (PELV supply)
Dissipated power	3 W maximum
Overvoltage category	II
Ambient operating temperature	-10...+55 °C (14...131 °F)
Storage temperature	-20...+85 °C (-4...185 °F)
Relative humidity	10...95%
Maximum operation altitude	2000 m (6562 ft)
Pollution degree	2
Vibration resistance (IEC/EN 61496-1)	+/- 3.5 mm (0.138 in) 5...8.4 Hz 1 g (8.4...150 Hz)
Shock resistance (IEC/EN 61496-1)	15 g (11 ms half-sine)
EMC Category	Zone B

Module-specific characteristics	XPSMCMCO0000CO•	XPSMCMCO0000EC•
Reference description	**CAN:** CANopen non-safety-related communication device	**ECT:** EtherCAT non-safety-related communication device
Weight	0.12 kg (4.2 Oz)	
Output and PIN number	CAN (CANopen)  DB9 - male	ECT (EtherCAT)  RJ45 - female

Module-specific characteristics	XPSMCMCO0000CO•	XPSMCMCO0000EC•
Wiring	Pin/ Signal 1/ not connected 2/ CAN_L 3/ CAN_GND 4/ not connected 5/ CAN_SHLD 6/ not connected 7/ CAN_H 8/ not connected 9/ not connected Housing CAN_SHIELD	PIN/Signal 1/ Tx+ 2/Tx- 3/Rx+ 4/not connected 5/not connected 6/Rx- 7/not connected 8/not connected
Baud rate	from 10kbit/s to 1Mbit/s	100 Mbit/s (full duplex)
Mini B-USB	Use for configuration of the fieldbus module address and baud rates together with fieldbus configurator software	
Data sets	Input status, input diagnostics, fieldbus input status, fieldbus probe status, safety-related output status, safety-related output diagnostics	

Module-specific characteristics	XPSMCMCO0000EI•	XPSMCMCO0000EM•
Reference description	**EIP**: EtherNet/IP non-safety-related communication device	MTP (Modbus TCP/IP) standard communication device
Weight	0.12 kg (4.2 Oz)	
Output and PIN number	 RJ45- female	MTP (Modbus TCP)  RJ45- female
Wiring	PIN/ Signal 1/ Tx+ 2/ Tx- 3/ Rx+ 4/ not connected 5/ not connected 6/ Rx- 7/ not connected 8/ not connected	PIN/ Signal 1/ Tx+ 2/ Tx- 3/ Rx+ 4/ not connected 5/ not connected 6/ Rx- 7/ not connected 8/ not connected
Baud rate	10/100 Mbit, full/half duplex	
Mini B-USB	Use for configuration of the fieldbus module address and baud rate using the BUSConfigurator software	

Module-specific characteristics	XPSMCMCO0000EI•	XPSMCMCO0000EM•
Data sets	Input status, input diagnostics, fieldbus input status, fieldbus probe status, safety-related output status, safety-related output diagnostics	

Module-specific characteristics	XPSMCMCO0000MB•	XPSMCMCO0000PB•	XPSMCMCO0000UB•
Reference description	MBS (Modbus Serial) standard communication device	PDP (Profibus DP V1) standard communication device	USB (USB) communication device
Weight	0.12 kg (4.2 Oz)		
Output and PIN number	MBS (Modbus Serial)  RJ45 - female	PDP (Profibus DP)  DB9 – female	USB (USB)  Mini B-USB
Wiring	PIN/Signal/ Description 1/ not connected 2/ not connected 3/ not connected 4/ D1 5/ D0 6/ not connected 7/ VP (2) 8/ Common housing/cable shield	PIN/Signal/ Description 1 / not connected 2 / not connected 3 / B Line / + RxD/TxD, RS485 level 4 / RTS / Request to send 5 / GND Bus/ 0 Vdc (isolated)) 6 / 5 V / +5 V Bus Output / +5V termination power (isolated, short-circuit protected) 7 / not connected 8 / A Line / - RxD/TxD, RS485 level 9 / not connected housing/cable shield	PIN/Signal/Comment 1/ +5 V/ +5 V input 2/ USBDM/ USB communication signal 3/ USBDO/ USB communication signal 4/ GND/ Signal GND Housing/ Shield/ Cable shield
Slot for memory card	No (Modular Safety Controller only)		
Baud rate	up to 115200 bps	Auto Baud rate	up to 921.6 kbps
Mini B-USB	Use for configuration of the fieldbus module address and baud rates together with fieldbus configurator software		
Data sets	Input status, input diagnostics, fieldbus input status, fieldbus probe status, safety-related output status, safety-related output diagnostics		

The following table lists the Mean Time to Failure (MTTF) in years for the fieldbus modules:

Module reference	Fieldbus	Mean Time to Failure (MTTF) in years at an operating temperature of 30° C (86° F)
XPSMCMCO0000EI•	EtherNet/IP	212
XPSMCMCO0000MB•	Modbus Serial	245
XPSMCMCO0000CO•	CANopen	196
XPSMCMCO0000PB•	Profibus DP	247
XPSMCMCO0000EC•	EtherCAT	212
XPSMCMCO0000EM•	Modbus TCP/IP	212

NOTE: For the characteristics common to all modules, refer to General Characteristics *(see page 34)*.

Chapter 5
Accessories

What Is in This Chapter?

This chapter contains the following topics:

USB/Mini B-USB Configuration Cable

Presentation

The XPSMCMCP0802• Modular Safety Controller and Fieldbus communication modules have a dedicated USB 2.0 connection for connection to a PC and SoSafe Configurable software.

A USB/Mini B-USB configuration cable is available as an accessory under the reference **TCSXCNAMUM3P**.

Configuration Memory Card

XPSMCMME0000 Memory Card Presentation

The XPSMCMME0000 memory card can be installed in the Modular Safety Controller and is used to save/restore the hardware/software configuration.

The XPSMCMME0000 memory card is specific to the XPSMCMCP0802• controller, and therefore, only this reference can be used within the controller.

The memory card is only written to using SoSafe Configurable software during download of the configuration.

If the memory card is inserted without any configuration, the XPSMCMCP0802• controller continues to operate normally with the previously loaded configuration held in its non-volatile memory.

If a memory card is inserted with a configuration which does not match the one contained in the controller, the configuration on the memory card will overwrite that which is in the controller, erasing definitively the previous configuration therein. That is, all data (password included) previously contained in XPSMCMCP0802• controller will be overwritten.

NOTICE
LOSS OF DATA Ensure that the existing configuration in the controller is saved before inserting and enabling a memory card. **Failure to follow these instructions can result in equipment damage.**

Multiple load function: To perform the configuration of several XPSMCMCP0802• Modular Safety Controllers without using a PC and the USB connector, you can save the desired configuration on a single memory card and then use it to download data on the XPSMCMCP0802• Modular Safety Controllers.

Restore function: If the XPSMCMCP0802• controller is damaged, replace it with a new XPSMCMCP0802• Modular Safety Controller. When the memory card has been used, remove the memory card from the damaged controller, insert the memory card in the new XPSMCMCP0802• controller, and power the Modular Safety Controller. The configuration of the memory card is automatically loaded into the new controller.

XPSMCMME0000 Memory Card Insertion

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- First remove power from the Modular Safety Controller before attempting to insert or remove the memory card.
- Each time the memory card is used, carefully verify that the loaded configuration is the one that was intended for the particular system.
- Conduct a full functional test (see *Validation* in the *Modular Safety Controller User Guide*) of the system, composed of the Modular Safety Controller plus all input and output hardware connected to it, after using the memory card to overwrite your safety-related application.

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

The memory card can be inserted into the rear of the XPSMCMCP0802• Modular Safety Controller.

Step	Action
1	Remove all power from the controller before inserting or removing the memory card. **NOTE:** Before you insert the memory card for the first time, remove the protective label on the rear side of the controller. (See item 1 in graphic below).
2	Insert the memory card with the product label facing to the right. (See item 2 in graphic below). **NOTE:** If the memory card is oriented incorrectly, the memory card may be damaged or will not be identified.
3	Insert the card in the slot in the rear panel of the controller. 

XPSMCMME0000 Memory Card Characteristics

Memory card-specific characteristics	
Description	8-pole connector
Memory card size	250 MB
Ambient operating temperature	-10...+55 °C (14...131 °F)
Storage temperature	-20...+85 °C (-4...185 °F)
Relative humidity	10...95%
Maximum operation altitude	2000 m (6562 ft)
Dimensions	21.5 x 18 x 2 mm (0.85 x 0.7 x 0.079 in.)
Weight	0.12 kg (4.2 Oz)

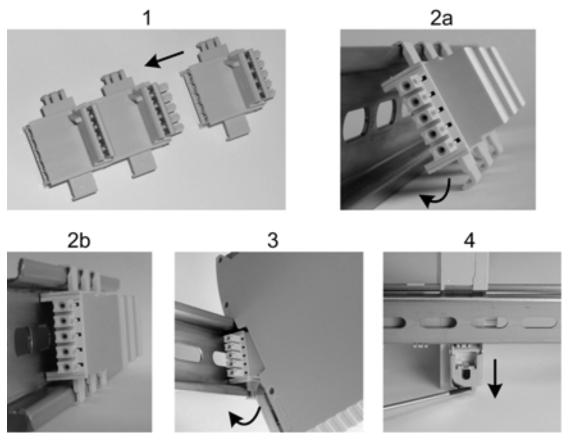
Backplane Expansion Connector

Overview

The XPSMCMCN0000SG backplane expansion connector allows you to add expansion input/output and communication modules to the XPSMCM• Modular Safety Controller. The expansion modules that require one XPSMCMCN0000SG connector are delivered with the connector. If, for the purposes of your system, you need to add expansion modules to the controller, you need to order an extra XPSMCMCN0000SG connector for the XPSMCM• controller.

To connect the Modular Safety Controller and expansion modules:

1. Connect the same number of backplane expansion connectors as the number of modules to be installed.
2. Fix the connectors to the DIN 35 mm (EN ISO 5022) rail, connecting them on to the rail at the top first).
3. Fasten the modules to the rail, arranging the contacts on the base of the module on the respective connector. Carefully press the module until it snaps into place.
4. To remove a module, use a screwdriver to pull down the locking latch on the back of the module; then lift the module upwards and pull.

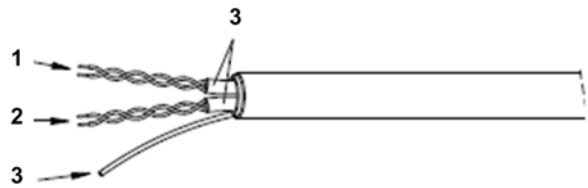


Backplane expansion connector-specific characteristics	
Connection to expansion modules	5-way backplane expansion
Ambient operating temperature	-10...+55 °C (14...131 °F)
Storage temperature	-20...+85 °C (-4...185 °F)
Relative humidity	10...95%
Maximum operation altitude	2000 m (6562 ft)
Dimensions	36.5 x 29.2 x 20.5 mm (1.44 x 1.15 x 0.8 in.)
Weight	5.2 g (0.18 Oz)

RS485 Cable

RS485 Cable Characteristics

RS485 serial interface shielded cables are used between the Bus expansion communications modules to create up to six decentralized safety-related islands with a maximum of 50 meters (164.04 ft) between each island.



1 First pair
2 Second pair
3 Shielding

Element	Description/Value
Conductors	2 pairs of twisted conductors with shielding
Nominal impedance	120 Ω
Nominal capacitance	<42 pF/m
Nominal resistance	<95 Ω/m

The following cables are compatible with the Modular Safety Controller system:

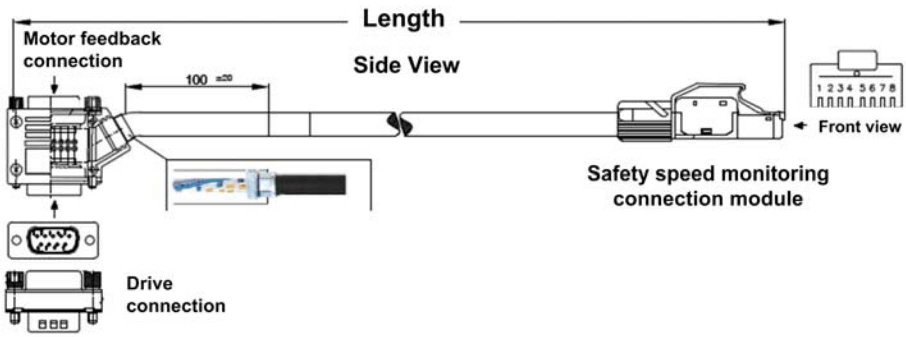
Reference	Length
TSXSCMCN010	10 m / 32.81 ft
TSXSCMCN025	25 m / 82.02 ft
TSXSCMCN050	50 m / 164.04 ft

Encoder Splitter Cables for PacDrive M

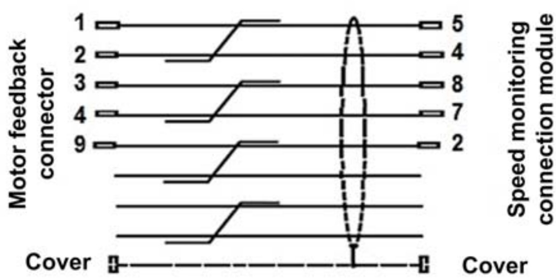
Description

An encoder splitter cable is used to split the motor encoder feedback signal. One signal is directed to the drive and one to the RJ45 connection of the safety-related speed monitoring module. The cables are unique to the specific drive system due to the wiring used. Encoder splitter cables are available in 1, 3 and 5 meters (3.28, 9.84 and 16.40 ft) lengths.

Enoder Splitter Cable



Encoder Splitter Terminal Designation



Motor feedback connector:

Pin	Wire color
1	Blue/White
2	Blue
3	Brown

Pin	Wire color
4	White/Brown
9	Green
Not connected	White/Green
Not connected	Orange
Not connected	White/Orange
Cover	Shield

Speed monitoring connection module:

Pin	Wire color	Function
5	Blue/White	/A (Sin-)
4	Blue	A (Sin+)
8	Brown	/B (Cos-)
7	White/Brown	B (Cos+)
2	Green	0 V
Not connected	White/Green	Not used
Not connected	Orange	Not used
Not connected	White/Orange	Not used
Cover	Shield	GND

Encoder Splitter Characteristics

Encoder splitter cable characteristics:

Parameter	Value
Ambient operating temperature	-10…+55 °C (14…131 °F)
Storage temperature	-20…+85 °C (-4….185 °F)
Relative humidity	10...95%
Maximum operation altitude	2000 m / 6562 ft

Encoder Splitter Cable References

Encoder splitter cable references:

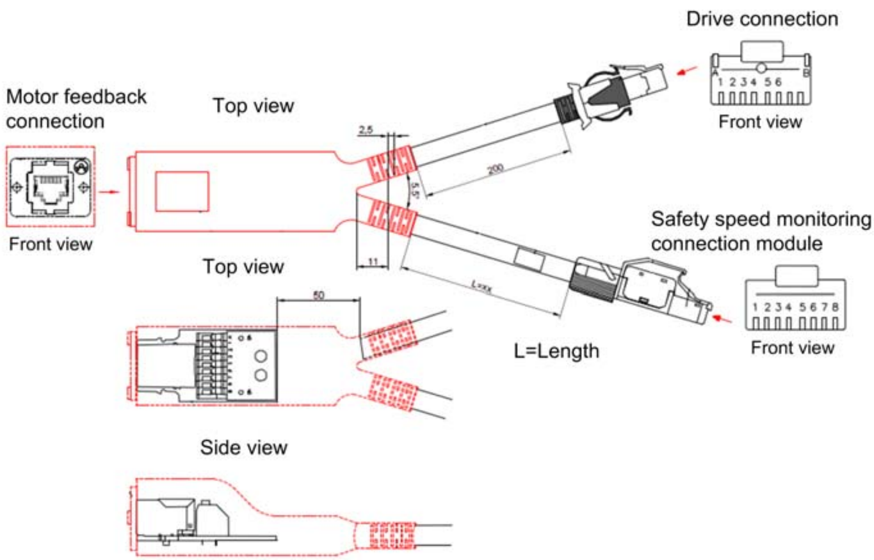
Reference	Length
TSXESPPM001	1 m / 3.28 ft
TSXESPPM003	3 m / 9.84 ft
TSXESPPM005	5 m / 16.40 ft

Encoder Splitter Cables for Lexium 32, Lexium 52 and Lexium 62

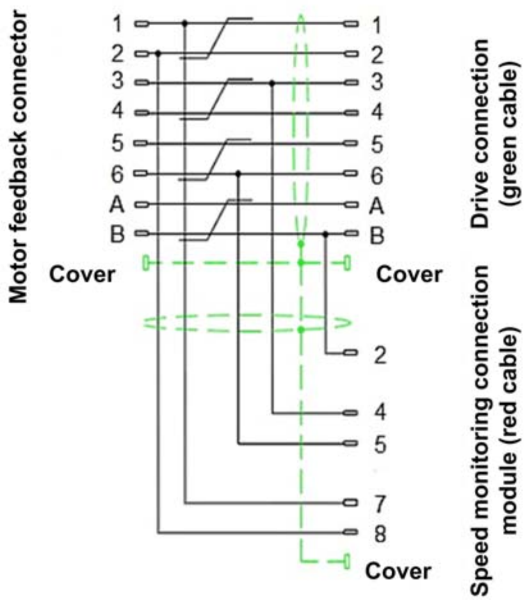
Description

An encoder splitter cable is used to split the motor encoder feedback signal. One signal is directed to the drive and one to the RJ45 connection of the safety-related speed monitoring module. The cables are unique to the specific drive system due to the wiring used. Encoder splitter cables are available in 1, 3 and 5 meters (3.28, 9.84 and 16.40 ft) lengths.

Encoder Splitter Cable



Encoder Splitter Cable - Terminal Designation



Motor feedback connector:

Pin	Wire color
1	Green
2	Yellow
3	White
4	Gray
5	Pink
6	Brown
A	Red
B	Blue
Cover	Shield

Drive connection (green cable):

Pin	Wire color	Function
1	Green	B (Cos+)
2	Yellow	/B (Cos-)
3	White	A (Sin+)
4	Gray	RS 485+
5	Pink	RS 485-
6	Brown	/A (Sin-)
A	Red	7-12 V
B	Blue	0 V
Cover	Shield	GND

Speed monitoring connection module (red cable):

Pin	Wire color	Function
1	Not connected	Not connected
2	Green	0 V
3	Not connected	Not connected
4	Blue	A (Sin+)
5	Blue/white	/A (Sin-)
6	Not connected	Not connected
7	White/brown	B (Cos+)
8	Brown	/B (Cos-)
Cover	Shield	GND

Lexium 32, Lexium 52 and Lexium 62 Splitter Cable Characteristics

Encoder splitter cable characteristics for Lexium 32, Lexium 52 and Lexium 62:

Parameter	Value
Ambient operating temperature	-10…+55 °C (14…131 °F)
Storage temperature	-20…+85 °C (-4….185 °F)
Relative humidity	10...95%
Maximum operation altitude	2000 m / 6562 ft

Lexium 32, Lexium 52 and Lexium 62 Splitter Cable References

Lexium 32, Lexium 52 and Lexium 62 splitter cable references:

Reference	Length
TSXESPP3001	1 m / 3.28 ft
TSXESPP3003	3 m / 9.84 ft
TSXESPP3005	5 m / 16.40 ft

Part III
SoSafe Configurable Software

What Is in This Part?

This part contains the following chapters:

Chapter 6
General Information

What Is in This Chapter?

This chapter contains the following topics:

SoSafe Configurable Software

Overview

The software used to operate this product is SoSafe Configurable and BUS Configurator.

The BUS Configurator software can be used for the configuration and communication of the system with a PC, and to display information on the input data map as well as the output data map (such as states of inputs and outputs, diagnostics information, etc.). For more information on the BUS Configurator software, see chapter BUS Configurator Software *(see page 241)*.

The SoSafe Configurable application software is used to configure a logic connection between the inputs and outputs of the XPSMCM• Modular Safety Controller system and the components of the application being developed. The Modular Safety Controller and its input or output modules form a functional safety system to monitor and control the connected safety components.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Only use software approved by Schneider Electric for use with this equipment.
- Update your application program every time you change the physical hardware configuration.

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

PC Hardware Requirements

- RAM: 256 MB
- Hard disk: ≥ 300 MB free space
- USB port: up to 3.0
- CD-ROM drive (recommended)

PC Software Requirements

- Windows 7, 32-bit or 64-bit
- Windows 8.1, 32-bit or 64-bit
- Windows 10, 32-bit or 64-bit
- Microsoft .NET Framework 3.5 (or higher) must be installed on the PC.

Installation of SoSafe Configurable Software

Installation

1. Download SoSafe Configurable software from *www.schneider-electric.com*.
2. Unzip the downloaded file and double -click on the Setup.exe file to start the installation.
3. Follow the procedure on the screen.
4. When the installation procedure is complete, close the setup program.

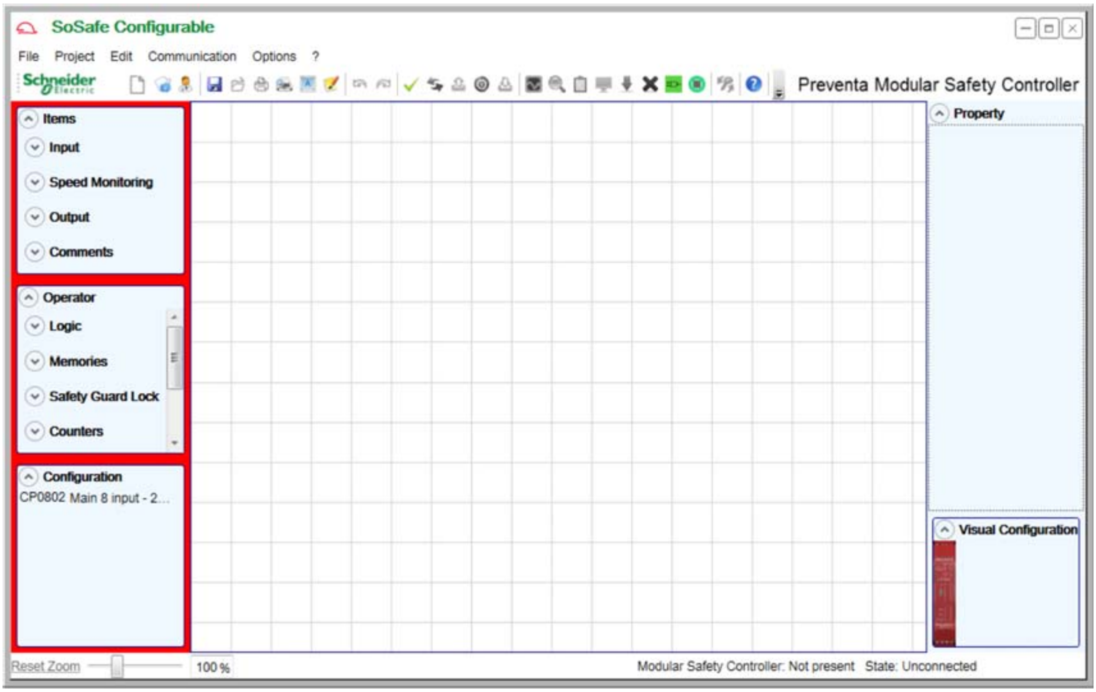
Presentation of SoSafe Configurable Software

Opening Screen

When the SoSafe Configurable software is correctly installed, an icon is created on the desktop.

To launch the program, double-click the icon .

The opening screen presented below is displayed:



Standard Toolbar

The following graphic shows the **Standard** toolbar:

Icon	Description
	Create a new project.
	Modify the hardware configuration
	Modify project information (for example name, company)
	Save the project
	Load an existing project from the PC
	Print the project schematic
	Print preview
	Display printing area
	Print the project report
	Undo (cancel the last command)
	Redo (restore the last cancelled command)

Icon	Description
	Validate the project
	Connect to Modular Safety Controller
	Download project to Modular Safety Controller
	Disconnect and Reboot the Modular Safety Controller
	Upload a project from Modular Safety Controller
	Graphical monitor (online I/O state - graphic)
	Monitor (online I/O state - textual)
	Upload log file
	Display system configuration
	Start interactive simulation
	Start automatic simulation
	Modify password

Icon	Description
	Online help

Menu bar

The commands accessible via the toolbar are also accessible via the menus (**File**, **Project**, **Edit**, **Communication**, and **Options**) on the menu bar.

Chapter 7
Creating a Project

What Is in This Chapter?

This chapter contains the following sections:

Section 7.1
Hardware Configuration

What Is in This Section?

This section contains the following topics:

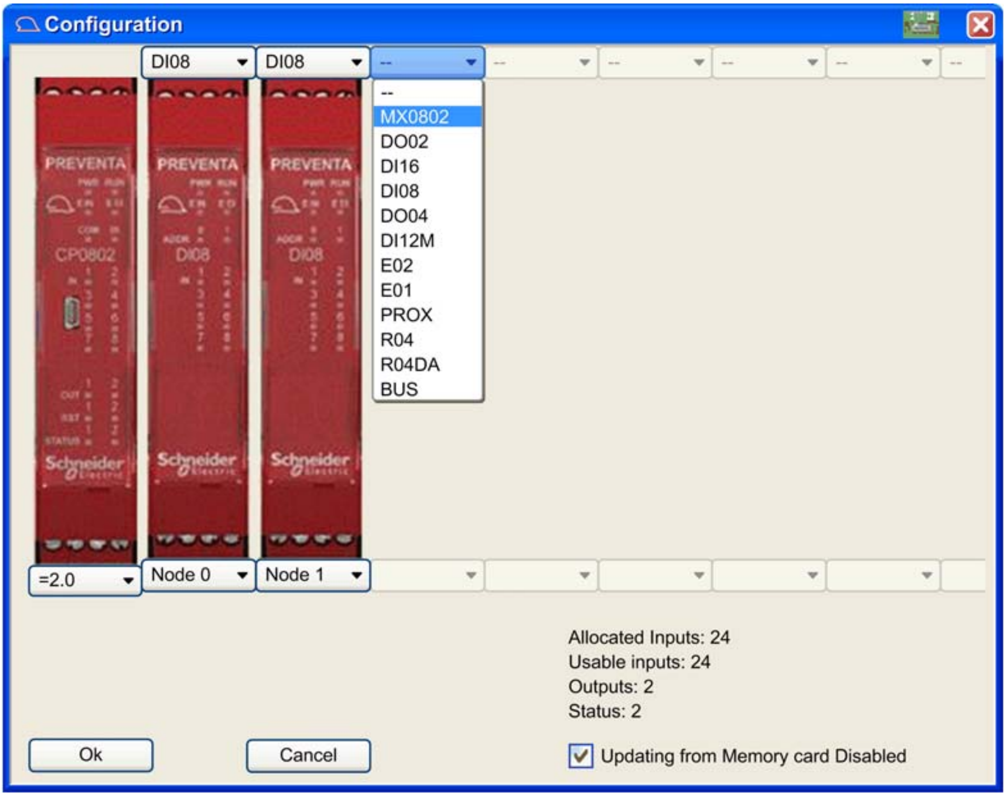
Create a New Project and Configure the Hardware

Create and Configure a Project

Step	Action	Result
1	Go to **Project** -> **New Project**, or select the  icon from the toolbar to start a new project.	The **Project information** window is displayed: 
2	Enter **Company** information, **User**, and **Project Name** and select **OK**.	The **Configuration**[1] window appears.
3	In the **Configuration**[1] window, select the required expansion modules using the drop-down menus above each module placeholder.	The selected module is represented with a default node address set to 0.
4	Select the node address (0 to 3) of the module below its representation[1]. Repeat the action for each expansion module. **NOTE:** If there are several units of the same reference, another node address must be selected.	The node addresses are set *(see page 63)*.
5	You can allow the update from the memory card to the controller *(see page 177)*. By default, the Modular Safety Controller cannot be updated from the memory card. To remove this protection, de-activate the checkbox **Updating from Memory card Disabled**[1].	The hardware/software configuration will now be loaded from the memory card to your Modular Safety Controller.
6	Click OK to confirm the hardware configuration.	The **Configuration** window closes.

[1] See **Configuration** window below.

The following graphic presents the **Configuration** window:



Modifying the Project Information

Procedure

To modify the project information, proceed as follows:

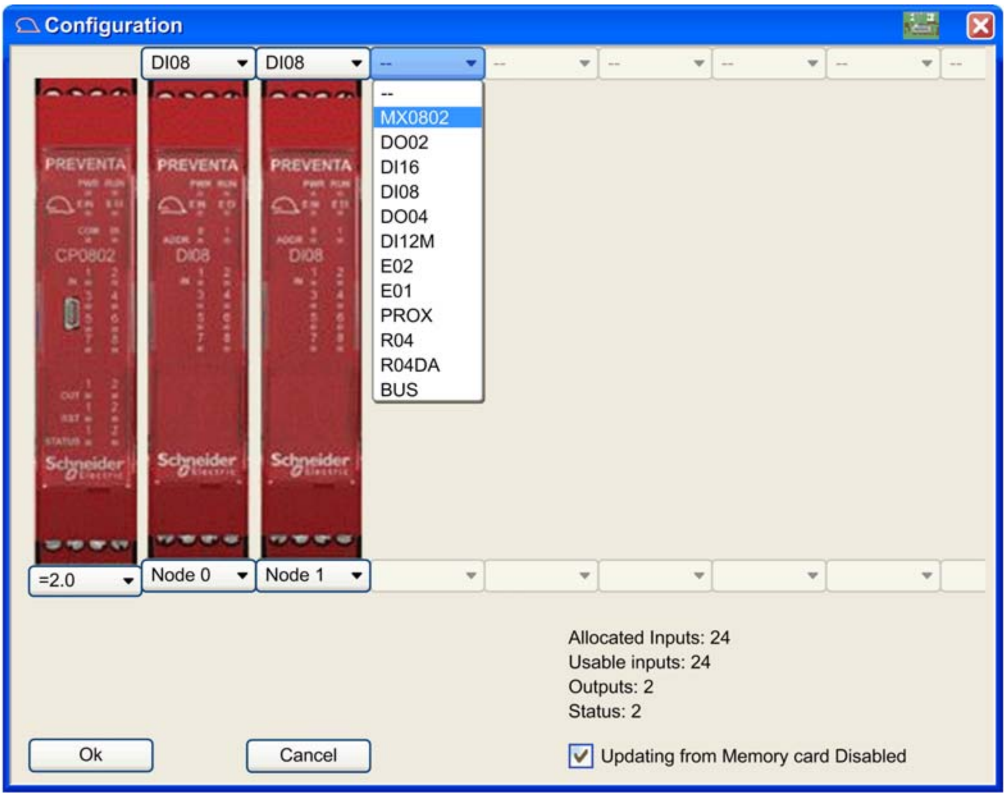
Step	Action	Result
1	Click the icon  or use the menu **Project** → **Change Project Info**.	The **Project information** window appears: 
2	Enter **Company** information, **User**, and **Project Name** and click **OK**.	The project information is updated.

Modifying the Hardware Configuration

Procedure

Use the icon  or menu option **Project → Change configuration** to modify the hardware configuration.

The following graphic presents the **Configuration** window:



NOTE: You cannot modify the hardware configuration for an expansion module if its inputs or outputs have been assigned in the software configuration. If the expansion module cannot be modified, deselect the relevant associated I/O from the **Property** window for the module in the software configuration *(see page 206)*.

Step	Action	Result
1	In the **Configuration** window, select the expansion module to modify or alternatively select a new module in the next available placeholder using the drop-down menu above.	The modification is represented.
2	If necessary, modify or select the node address (0 to 3) of the module below its representation. **NOTE:** If there are several units of the same reference, another node address must be selected.	The node address is set *(see page 63)*.
3	You can allow the update from the memory card to the controller *(see page 177)*. By default, the Modular Safety Controller cannot be updated from the memory card. To remove this protection, de-activate the checkbox **Updating from Memory card Disabled**.	The hardware/software configuration will now be loaded from the memory card to your Modular Safety Controller.
4	Click **OK** to confirm the hardware configuration.	The **Configuration** window closes.

Section 7.2
Software Configuration

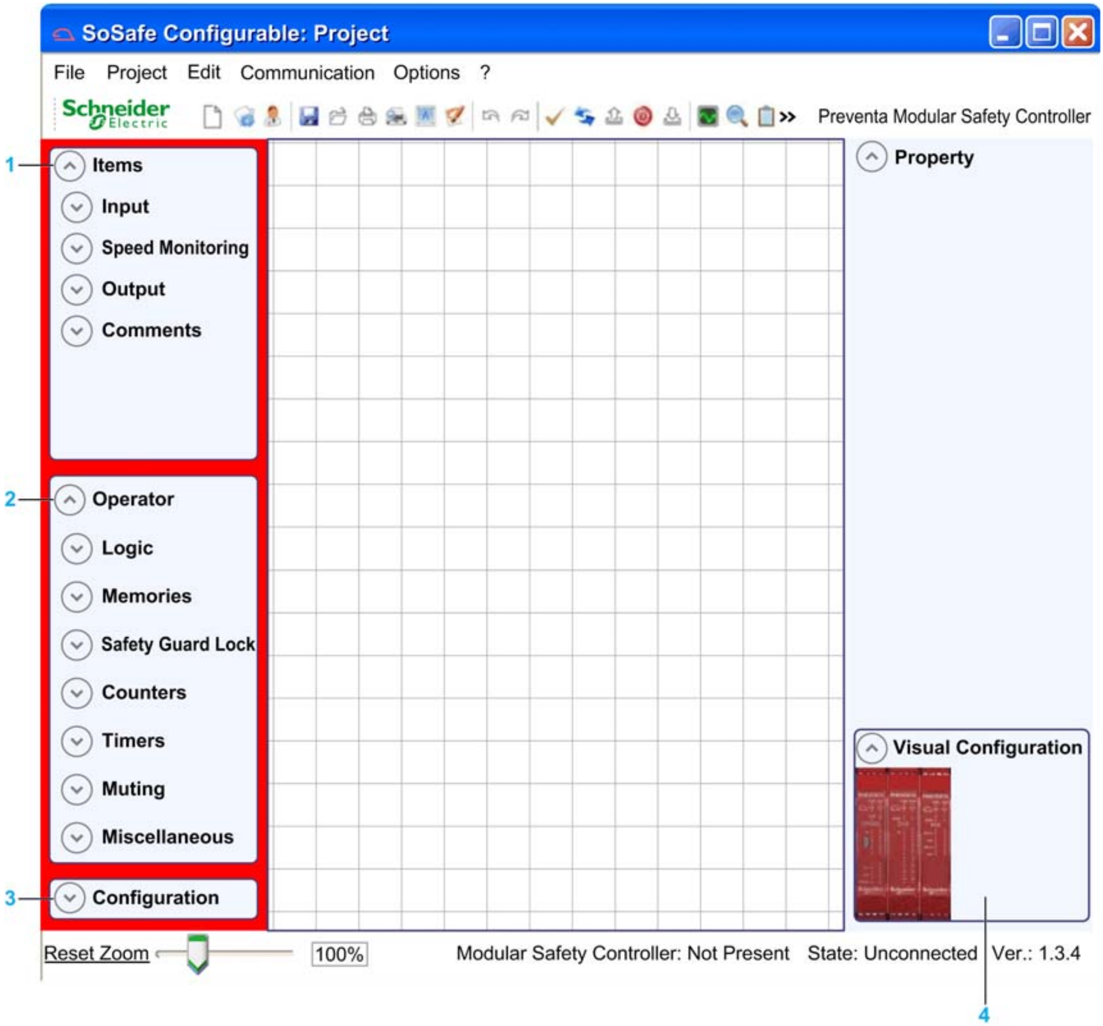
What Is in This Section?

This section contains the following topics:

Presentation of the Tool Windows

Description

Four tool windows are displayed to the left and right of the design area:

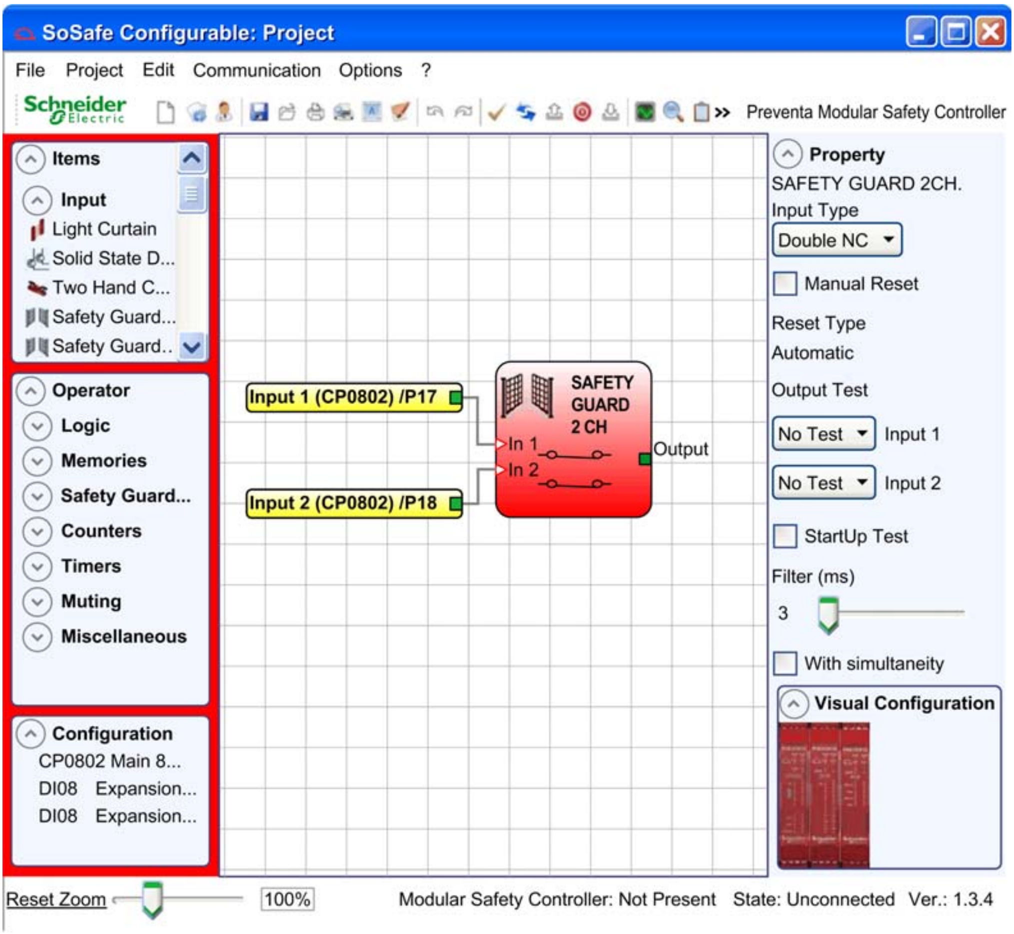


	Tool window	Description
1	**Items**	This window contains the function blocks *(see page 273)*, which are presented under four different types: ● **Input** ● **Speed Monitoring** ● **Output** ● **Comments**
2	**Operator**	This window contains operator function blocks *(see page 349)* used for connecting the functions, and are presented under seven different types: ● **Logic** ● **Memories** ● **Safety Guard Lock** ● **Counters** ● **Timers** ● **Muting** ● **Miscellaneous**
3	**Configuration**	This window contains the description of the hardware configuration.
4	**Visual configuration**	This window contains the graphic representation of the hardware configuration.

Creating the Configuration

Procedure

When the hardware configuration is defined, you can configure the software. Use drag & drop in the main screen:

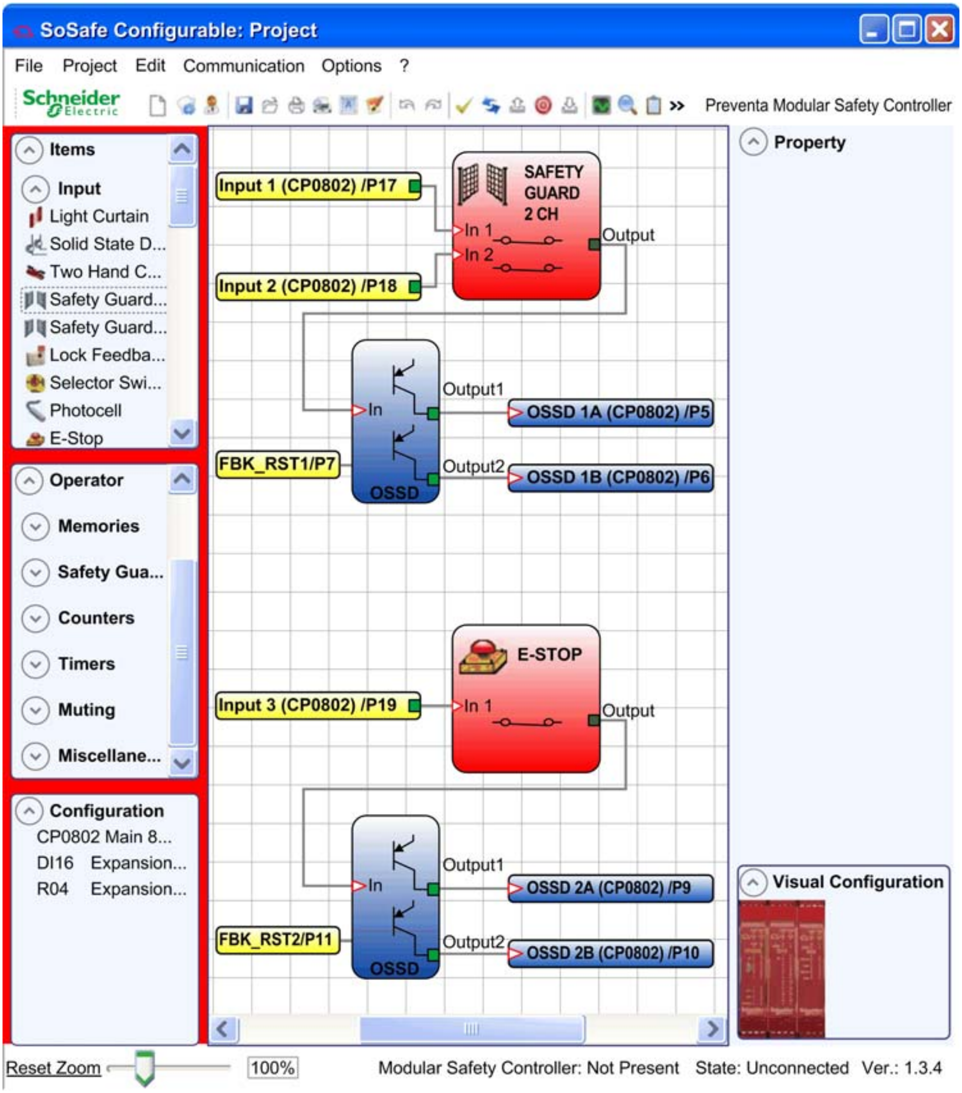


Step	Action
1	Drag the function block from the **Items** or **Operator** tool windows, and drop it into the design area. **NOTE:** For details about each function block, refer to Function Blocks *(see page 271)*.
2	Click the function block in the design area to display the **Property** side window and define specific attributes of the function block. **NOTE:** To set a specific numerical value with a slide (for example **Filter**), use the left and right arrows on the keyboard or click the sides of the slider to adjust the value.
3	Connect the objects by dragging the pin to connect and dropping it onto the pin to be connected.
4	To duplicate a function, you can select a function block and press **Ctrl+C** / **Ctrl+V**.
5	To delete a function or a link, select it and press **Del**.

Project Example

Presentation

The graphic below presents a project example in which a XPSMCMCP0802• controller is connected with two safety function blocks: `Safety Guard 2 Channels` and `E-STOP` (Emergency-Stop).



The XPSMCMCP0802• inputs (**Input 1**, **Input 2** and **Input 3**) for connecting the physical inputs from these function blocks are visualized in the design area.

The outputs (1 to 4) are activated according to the conditions defined by functions `Safety Guard 2 Channels` and `E-STOP`.

Step	Action
1	Click the function block in the design area to display the **Property** side window.
2	Configure the function block. Activation and parameters are described in the part Function Blocks *(see page 271)*.
3	Save the configuration using the icon from the toolbar or via the menu **File → Save/Save as...**.

Project Verification

Presentation

When the software configuration is complete, the project must be verified. Execute the verification command by clicking the icon ✓ on the **Standard** toolbar.

If the verification is successful, a sequential number is assigned to the input and output of the project. This number is listed in the report and in the monitor of SoSafe Configurable software. It is then possible to transfer the configuration to the XPSMCM• controller.

NOTE: The verification function verifies the consistency of the configuration with respect to the characteristics of the Modular Safety Controller system. It does not verify whether the device has been configured to meet all the safety requirements for the application. Each safety function and set of functions must be validated according to EN ISO 13849-2 to ensure correct operation *(see page 226)*.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Empirically validate each safety-related function of your functional safety system before placing your application into service.
- Practice the guidelines outlined by EN ISO 13849-2 to thoroughly validate the functionality of your safety-related system in the context of your application.

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

Project Report

Presentation

Click the icon on the toolbar to print out a project report of the hardware and software configurations (with properties for each block):

Preventa Modular Safety Controller

```
Project Report generated by SoSafe Configurable version 1.3.4

Project Name: Project
User: Name
Company: Company
Date: 01.10.2014 08:58:25
Schematic CRC: 0F80H

Modular Safety Controller: Configuration
Module CP0802 (Configured Firmware version: FW = 2.0)
Module DI16 Node 0 (Minimum Required Firmware version: 0.1)
Module R04 Node 0 (Minimum Required Firmware version: 0.0)
Updating from Memory card Disabled: True

Modular Safety Controller: Safety Information
PFHd (according to IEC 61508): 1.47E-008 (1/h)
MTTFd (according to EN ISO 13849-1): 172 years
DCavg (according to EN ISO 13849-1): 99.00 %

The PFHd value shown takes into account the failure rate of all the components with exclusion of internal relays. For each Relay output a new value must be added to the previous PFHd depending on the switching frequency and the load on the Relay output. Moreover, the PL obtained for Relay output changes according to the customer configuration. See each Relay report for further details.

Attention!
This definition of PL and of the other related parameters as set forth in EN ISO 13849-1 only refers to the functions implemented in the Modular Safety Controller system by the MSC configuration software, assuming configuration has been performed correctly. The actual PL of the entire application and the relative parameters must consider data for all the devices connected to the Modular Safety Controller system within the scope of the application. This task and any other aspect of system configuration are the exclusive responsibility of the user/installer.

The final MTTFd value, taking in account data for all the devices connected to the system, must always be saturated to 100 years if over.

Resources used

INPUT: 12% (3/24)
Function Blocks: 2

Total number blocks: 0% (0/64)

OSSD+Relay: 33% (2/6)
STATUS: 0% (0/2)

Electrical diagram

Safety Guard 2 Channel
Function Block 1
Filter (ms): 3
Double NC
Reset Type: Automatic
StartUp Test: False
Connections:
In1: CP0802 INPUT1/Terminal17
In2: CP0802 INPUT2/Terminal18

E-Stop
Function Block 2
Filter (ms): 3
Single
Reset Type: Automatic
StartUp Test: False
Connections:
In1: CP0802 INPUT3/Terminal19

OUTPUT1: OSSD
Reset Type: Automatic
Response time: 15,808 ms
Dependence on inputs:

Function Block 1
Connections:
CP0802 OSSD1A/Terminal5
CP0802 OSSD1B/Terminal6
CP0802 Fbk: Terminal7

OUTPUT2: OSSD
Reset Type: Automatic
Response time: 15,808 ms
Dependence on inputs:
Function Block 2
Connections:
CP0802 OSSD2A/Terminal9
CP0802 OSSD2B/Terminal10
CP0802 Fbk: Terminal11

Signature ____________________
```

NOTE:

- The details of performance level (PL) and of the other related parameters according to EN ISO 13849-1 only refers to the functions implemented in the Modular Safety Controller system by the SoSafe Configurable software. SoSafe Configurable does not calculate the overall safety chain (acquiring information, monitoring, and processing, stopping the machine devices) per function, this must be calculated using a calculation tool such as SISTEMA.
- The total performance level (PL) of the entire safety chain application (acquiring information, monitoring, and processing, stopping the machine devices) and the relative parameters must be considered as a whole for the devices connected to the Modular Safety Controller system.

Chapter 8
Transferring the Project

What Is in This Chapter?

This chapter contains the following topics:

Password Levels

Overview

SoSafe Configurable software requires a password to transfer (upload or download) the hardware/software configuration. Passwords are only required for operations while connected (Online) to the controller.

The password can be composed of upper and lower case alpha and numerical characters with a maximum length of eight characters.

The software contains two levels of passwords:
- **Level1 Password**: maintenance tasks
- **Level2 Password**: complete access to the configuration possibilities within the software.

Level 1 Password

Everyone using the XPSMCMCP0802• system must have a **Level1 Password**. This password allows access to view the log file, hardware configuration, online monitoring, and upload operations.

NOTE:
- When the system is initialized for the first time, use the password SAFEPASS (case sensitive).
- Before you can modify the **Level1 Password**, you must have entered the **Level2 Password**.

For reasons of security for your installation, modify the default password upon first use.

⚠ WARNING
UNAUTHORIZED DATA ACCESS ● Immediately change the default password to a new, secure password. ● Do not distribute the password to unauthorized or otherwise unqualified personnel. ● Disable any Internet access to your safety controller system to prevent any unwanted or unauthorized access to data in your application. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

NOTE: A secure password is one that has not been shared or distributed to any unauthorized personnel and does not contain any personal or otherwise obvious information. Further, a mix of upper and lower case letters and numbers offer the greatest security possible with the SoSafe Configurable software. You should choose a password length of at least seven characters.

Level2 Password

To enable download to the XPSMCMCP0802• controller, as well as all the features enabled by **Level1 Password**, the **Level2 Password** is required.

NOTE:

- When the system is initialized the first time, use the password SAFEPASS (case sensitive).
- Before you can modify the **Level2 Password**, you must have entered the existing **Level2 Password**.

For reasons of security for your installation, modify the default password upon first use.

⚠ WARNING

UNAUTHORIZED DATA ACCESS

- Immediately change the default password to a new, secure password.
- Do not distribute the password to unauthorized or otherwise unqualified personnel.
- Disable any Internet access to your safety controller system to prevent any unwanted or unauthorized access to data in your application.

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

NOTE: A secure password is one that has not been shared or distributed to any unauthorized personnel and does not contain any personal or otherwise obvious information. Further, a mix of upper and lower case letters and numbers offer the greatest security possible with the SoSafe Configurable software. You should choose a password length of at least seven characters.

Lost Password

In the condition either of the two passwords has been lost/forgotten, contact Schneider Electric technical support.

Modifying the Password

Procedure

The following table describes how to modify your password:

<table>
<tr><th>Step</th><th>Action</th><th>Result</th></tr>
<tr><td>1</td><td>Click the icon  or use the menu Communication → Change password.</td><td>A popup window appears requesting the password of the controller:


NOTE: You must enter the Level2 Password in order to modify either password level.</td></tr>
<tr><td>2</td><td>Enter the New Password and confirm it in Insert the New Password again.</td><td>A popup window requests the old Level2 Password.

</td></tr>
<tr><td>3</td><td>Click OK.</td><td>The new password is stored within the controller memory.</td></tr>
<tr><td colspan="3">NOTE: The password can be composed of upper and lower case alpha and numerical characters with a maximum length of eight characters.
NOTE: When a memory card (see page 177) is used within the controller the new password is automatically stored in the card and likewise to the controller memory.</td></tr>
</table>

Connecting to the Modular Safety Controller

Procedure

Step	Action	Result
1	Connect the XPSMCMCP0802• to the PC via USB/Mini B-USB configuration cable *(see page 176)*.	–
2	Click the icon  or use the menu **Communication → Connection** to log on to the controller.	A popup window appears requesting the password of the controller: 
3	Enter the password *(see page 218)* and click **OK**.	A connection is established to the Modular Safety Controller.

Transferring (Downloading/Uploading) the Configuration

Downloading the Configuration

To download the saved and verified hardware/software configuration from the PC to the controller, click the icon  or use the menu **Communication → Send configuration**. The XPSMCMCP0802• Modular Safety Controller saves the project in its internal memory and, if present and enabled, on the memory card *(see page 177)*.

The password level 2 is required for downloading the configuration.

NOTE: You can only download after a successful verification *(see page 213)*.

Uploading a Configuration

To upload the hardware/software configuration from the XPSMCMCP0802• controller to SoSafe Configurable software, click the icon  or use the menu **Communication → Schematic reading**.

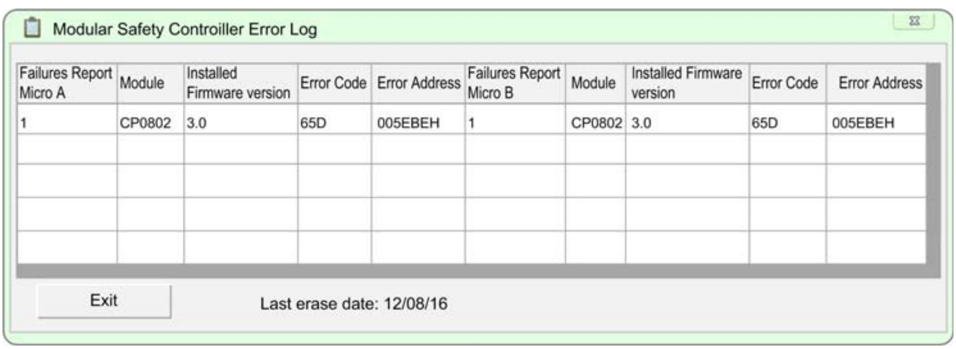
SoSafe Configurable software displays the project residing in XPSMCMCP0802• controller. The password level 1 is required for uploading the configuration.

Log File

The transfer date and CRC (4-digit hexadecimal identification) of a project that is stored in the XPSMCMCP0802• controller are included within the configuration.

This **Log File** can contain up to five consecutive events, after which, the oldest events are overwritten.

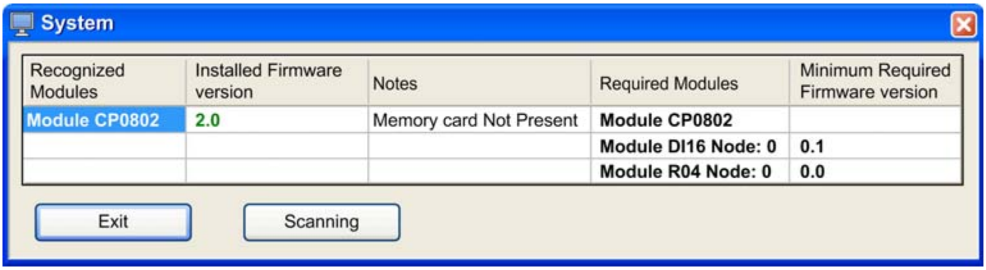
The **Log File** can be visualized using the icon  in the **Standard** toolbar or using the menu **Communication → Log file** (password level 1 required). The log file stores up to 5 entries:



Failures Report Micro A	Module	Installed Firmware version	Error Code	Error Address	Failures Report Micro B	Module	Installed Firmware version	Error Code	Error Address
1	CP0802	3.0	65D	005EBEH	1	CP0802	3.0	65D	005EBEH

Hardware Configuration

To view the online hardware configuration of the Modular Safety Controller system, use the icon  or use the menu **Communication** → **System** (password level 1 required) :



NOTE: If the modules connected are not matching the expected configuration, they are in red text. If the modules are not present in the system the **Recognized Modules** field will be empty. The example above indicates that the modules XPSMCMDI1600• and XPSMCMER0004• are not connected in the system and therefore not recognized.

A pop-up window appears with the following information:

- **Recognized Modules**: connected modules along with their **Installed Firmware Versions**
- **Notes**
- **Required Modules** with their node addresses when applicable: configured modules along with their **Minimum Required Firmware Versions**

Disconnecting and Rebooting the Controller

To disconnect the computer from XPSMCMCP0802• controller, use the icon  . When the controller is disconnected, it automatically reboots and restarts the last transferred configuration.

If the safety controller hardware or node addresses of any of the modules are not matching the expected configuration, the controller will not enter in to **Run** mode.

Chapter 9
Validating the Project

What Is in This Chapter?

This chapter contains the following topics:

Validation

Presentation

After verifying and downloading the project to the XPSMCMCP0802• controller and connecting all physical input and output automation equipment, a functional validation must be carried out to validate the operation.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Empirically validate each safety-related function of your functional safety system before placing your application into service.
- Practice the guidelines outlined by EN ISO 13849-2 to thoroughly validate the functionality of your safety-related system in the context of your application.

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

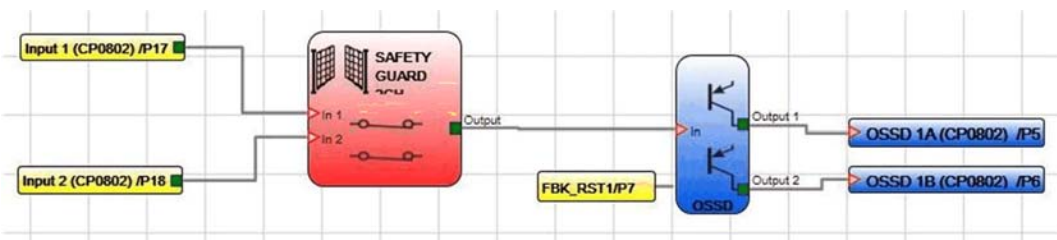
Software and Hardware Validation

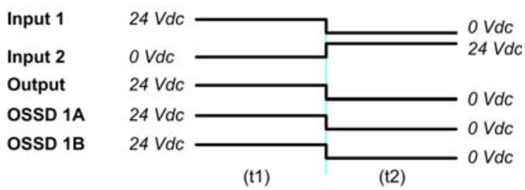
For software and hardware validation, the standard EN ISO 13849-2 provides a rational basis for thoroughly testing your application with your Modular Safety Controller system. A validation test plan must be created to minimize the risk and cross-verify that all requirements as part of the risk assessment are adequately covered such that any risks have been minimized to an acceptable level.

Functional Validation

For functional validation, each safety-related function must be tested before a machine is put into operation. The functional validation is managed by activating each input device and monitoring that the response of the system is what is expected. The validation must contain normal scenarios and must cover scenarios which combine multiple functions together to help ensure that the configuration has been done correctly.

The following is an example to help understand a typical test procedure.





(t1) In the normal operating condition a safety guard is closed. Input 1 is closed, Input 2 is open and the output of the safety guard function block is set to TRUE. In this mode, the safety-related outputs (`OSSD_1A`, `OSSD_1B`) are active and the power supply to the relative terminals is 24 Vdc.

(t2) When the safety guard is physically open, the inputs are set to FALSE which must set the outputs of `SAFETY GUARD 2CH` function block to FALSE. Therefore the physical output changes from 24 to 0 Vdc. If this change occurs, then the safety guard safety chain is functioning according to requirements.

NOTE:
- The installation of each external input sensor or actuator must be validated by referring to the device-specific installation manual.
- The validation must be performed for each safety-chain component in the project.

Checklist After Installation

Presentation

The following must be verified during a periodic verification:

Step	Action
1	Conduct a full functional test of the system, as described in the Validation *(see page 226)* section.
2	Verify that all the cables are correctly inserted and the terminal blocks are within correct torque for screw terminals.
3	Verify that all the LED indicators are correctly illuminating.
4	Verify the positioning and function of all input and output sensors and actuators used with the XPSMCM•.
5	Verify the correct mounting of XPSMCM• to the DIN rail.
6	Verify that all the external indicators (lamps/beacons/sirens) are functioning as you intended.

Chapter 10
Monitoring

Monitoring the I/O State

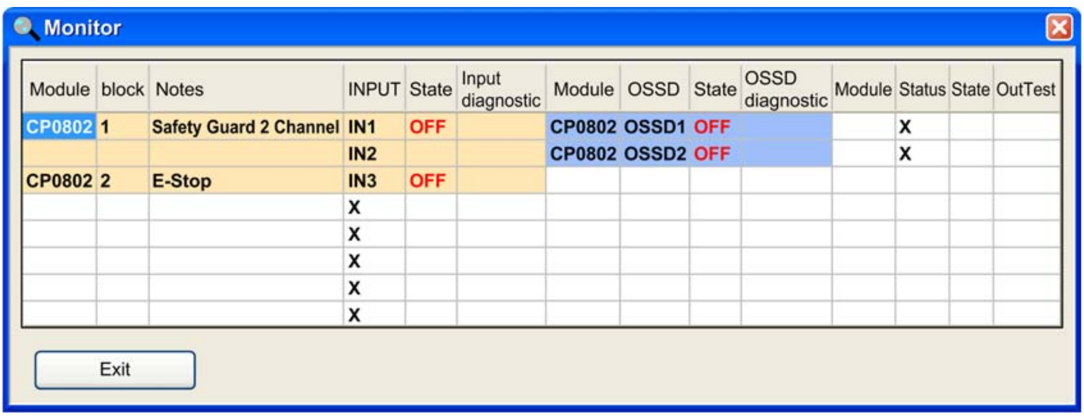
Online State Monitor

The online monitor presents the online I/O state (password level 1 required).

Click the icon  or use the menu **Communication** → **Monitor** to open the **Monitor** window providing the following information:

- Inputs (**State** and **Input diagnostic**)
- Solid-state safety-related output **OSSD State**
- Solid-state safety-related output **OSSD diagnostic**
- `Status` outputs
- Line monitoring test outputs (**OutTest**) diagnostics

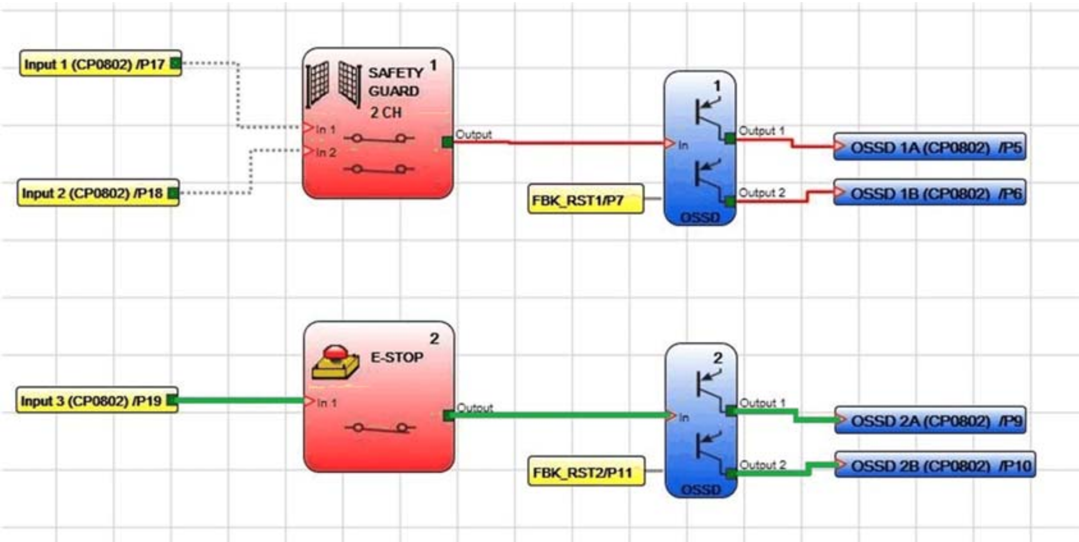
The following graphic presents the textual monitor:



Graphical Monitor

Click the icon  or use the menu **Communication → Graphical Monitor** to activate or deactivate the monitor (password level 1 required.)

The following graphic presents the graphical monitor:



The diagnostics are indicated by color coding the text:
- Red: OFF
- Green: ON
- Dashed orange: Connection error detected.
- Dashed red: Pending enable (for example restart).

Specific indications for function block `NETWORK`:
- Red: STOP
- Green: RUN
- Orange: START

Specific indications for function block `SERIAL OUTPUT`:
- Black: Data is being transmitted

Chapter 11
Simulation

Simulation

Overview

The Simulation function of SoSafe Configurable is intended to support you in developing your configuration by simulating the behavior of the function blocks. The Simulation function is not intended to substitute for, but to complement, the processes of risk assessment, risk evaluation, validation, and commissioning as well as any ancillary processes, tasks, and obligations according to the applicable regulations and standards such as ISO/EN 13849 and IEC 62061. The Simulation function only simulates the behavior of the function blocks in the configuration. It neither simulates nor tests the hardware in your application.

⚠ WARNING
INSUFFICIENT PERFORMANCE LEVEL/SAFETY INTEGRITY LEVEL Do not use the Simulation function as the sole means for risk assessment, risk evaluation, validation, and commissioning as well as any ancillary processes, tasks, and obligations according to the applicable regulations and standards such as, but not limited to, ISO/EN 13849 and IEC 62061. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Refer to Validating the Project *(see page 225)* for additional information on the validation of your project.

SoSafe Configurable provides two types of simulation: interactive simulation and automatic simulation.

Interactive simulation lets you, among other things, step through a simulation of a configuration or toggle the logical state of individual function blocks manually to observe the behavior of the function blocks in the configuration.

Automatic simulation can be used to automatically verify the behavior of a configuration over time. Automatic simulation is based on a user-configured triggers file. The result of automatic simulation is a list of selected signal traces that can be saved as a file.

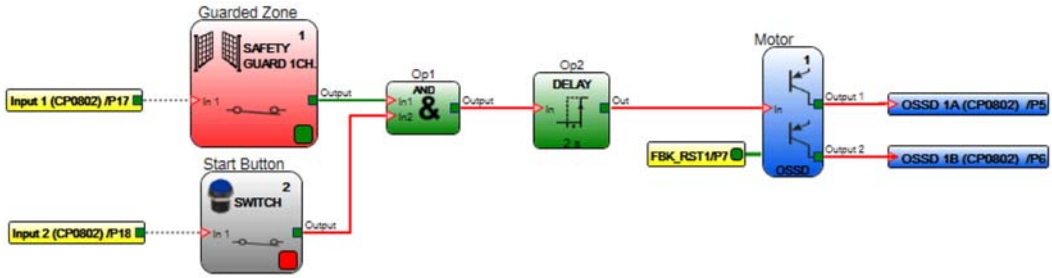
The simulation function requires firmware version 3.0 or greater on the XPSMCMCP0802• module. The simulation only runs if the Modular Safety Controller is offline.

Interactive Simulation

To start interactive simulation, click the  button on the toolbar. After you have clicked this button, the toolbar displays the following additional buttons and controls:

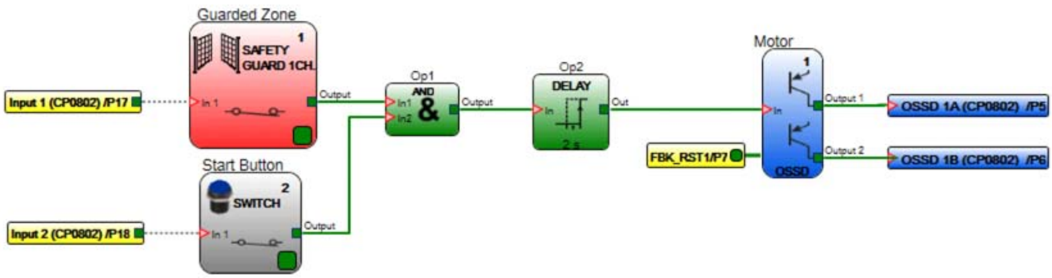
Button/control	Function
	Starts the simulation. The simulation runs with the time settings specified for the configuration.
	Stops the simulation.
	Goes through the simulation step by step.
	Stops the simulation and resets the time to 0 and the configuration to the initial condition.
Time 4900 ms	This field displays the time that has elapsed since the simulation has started. The time is displayed in the increments selected in the Step dropdown list.
x1	This dropdown list allows you to slow down or speed up the simulation by selecting a time factor.
Step: 100 ms	This dropdown list allows you to select the time increments for the simulation.

When you start the interactive simulation, the function blocks are displayed with additional colored tiles in the bottom right corner.



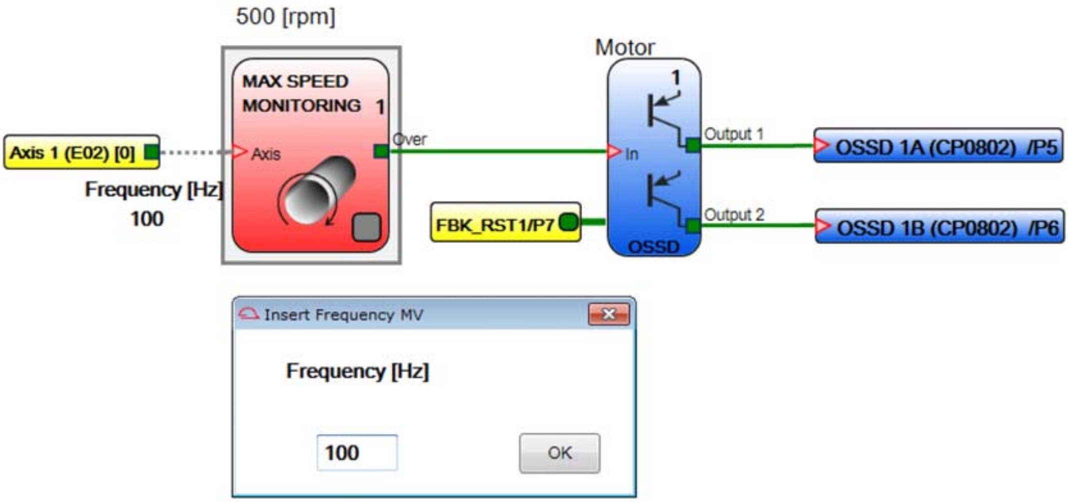
The color of a tile represents the logical state of the function block. If a tile is red, the logical state of the function block is FALSE (logical 0), if it is green, the logical state of the function block is TRUE (logical 1). This corresponds to the color of the connecting lines at the outputs of the function blocks.

By clicking a red or green tile of a function block, you can toggle the logical state of this function block. SoSafe Configurable then displays the response of the other function blocks in the configuration.



You can modify the logical state of a function block even if the simulation is not running (time displayed in the corresponding field is not elapsing) and observe the response of a configuration to a specific state transition in a targeted way.

Some function blocks are displayed with a gray tile. A gray tile indicates that you must enter a value manually. For example, the function block `MAX SPEED MONITORING` requires a velocity value in the form of a frequency. If you click a gray tile, SoSafe Configurable opens a dialog box and prompts you for a value.

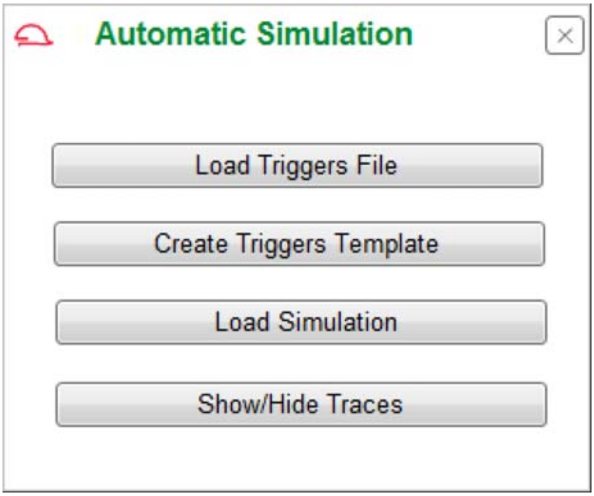


Enter a value and click OK to continue.

Automatic Simulation

As opposed to interactive simulation, automatic simulation runs through a full simulation of your SoSafe Configurable configuration without user interaction. Automatic simulation is based on a file with simulation trigger events. A trigger event is a transition of the logical state of a function block at a given point in time. The template for this triggers file is created by SoSafe Configurable and edited by the user. The resulting simulation triggers file is then used to perform the simulation.

To start automatic simulation, click the  button on the toolbar of SoSafe Configurable. After you have clicked this button, the following dialog box is displayed:



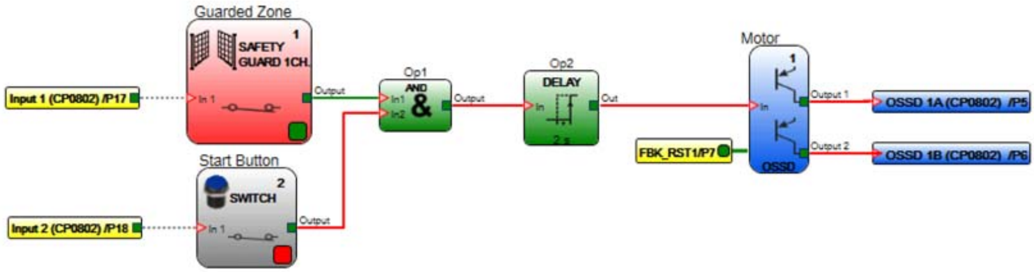
Button	Function
Load Triggers File	Lets you load a file containing simulation triggers. If the triggers are valid, automatic simulation starts immediately after you have loaded the triggers file. If the triggers are invalid, SoSafe Configurable displays an error message and you have to correct the simulation triggers. If you have not yet created a simulation triggers file, click the button Create Triggers Template to create a template file for the triggers and edit the triggers as required.
Create Triggers Template	If you have not yet created a simulation triggers file, click this button to create a template file for the triggers and edit the simulation triggers as required.
Load Simulation	Lets you load a simulation result previously saved and perform the simulation again.
Show/Hide Traces	Lets you select the signal traces to be displayed in the simulation result.

Performing automatic simulation requires a simulation triggers files. A simulation triggers file is created in two steps:

Step	Action
1	Create triggers template file.
2	Edit the simulation triggers in the template file to create the simulation triggers file.

Creating a Triggers Template for a Triggers File for an Automatic Simulation

The following descriptions use this sample configuration to explain the procedure:



To start the motor, the two input function blocks `SAFETY GUARD` and `SWITCH` must be TRUE (logic level 1). As soon as both input function blocks are TRUE, a `DELAY` function block (rising edge) adds a wait time until the outputs of the output function block `OSSD` are set to TRUE and the motor starts.

In the dialog box displayed after you have selected automatic simulation, click the button **Create Triggers Template**. SoSafe Configurable prompts you for a name and a location of the template to be saved (file extension *.STI).

The template is a text file. Open the template with a text editor such as Notepad. Content of the template:

```
// Simulation Triggers Template
//Sim 0:EndTime:Step (time unit ms)
Sim 0:10000:100
// Safety Guard 1 Channel
Input1
0:0
Time1:1
Time2:0
// Switch
Input2
0:0
Time1:1
Time2:0
// OSSD
Fbk_rst1
```

```
0:0
Time1:1
Time2:0
```

At the top, the template contains a section for the timing of the simulation (first section). The timing section is followed by one section for each input function block and output function block. These sections specify the simulation triggers.

Editing the Simulation Triggers in the Template File for an Automatic Simulation

In the text editor, edit the individual sections to suit your simulation requirements.

In the timing section at the top of the file, you can modify the end time of the simulation and the time increments. The unit is milliseconds for both time values.

Below the timing section, the template provides a section for each function block. Modify the values in these sections to adapt the behavior of the function blocks to your simulation requirement. Example of a section prior to editing:

```
// Safety Guard 1 Channel
Input1
0:0
Time1:1
Time2:0
```

`Input1` identifies the input. Do not modify this value.

`0:0` represents the logical state of the input at time 0 (start) of the simulation. If you want the simulation to start with the input at FALSE (logical 0), enter `0:0`. If you want the simulation to start with the input at TRUE (logical 1), enter `0:1`.

`Time1:1` represents the logical state of the input at a specified point in time. For example, if, after a period of 2000 ms, you want the input to switch from FALSE (0) to TRUE (1), enter `2000:1`.

`Time2:0` represents the next transition of the logical state. For example, if, after a period of 8000 ms, you want the input to switch back from TRUE (1) to FALSE (0), enter `8000:0`.

Example of section after editing for simulation triggers file:

```
// Safety Guard 1 Channel
Input1
0:0
2000:1
8000:0
```

You may enter additional `time:state` combinations if you want the simulation to include multiple state transitions at different times.

If function blocks require values other than the logical states TRUE (1) or FALSE (0) at a given point in time during the simulation, for example, minimum and maximum frequencies, these values are entered in the same way. For example, depending on your configuration, the triggers template file may contain the following section:

```
// Speed Control Speed
Input10:8 Hz
Time1:2500 Hz
Time2:300 Hz
```

Modify the time and frequency values to suit the requirements of your simulation.

You may enter additional `time:value` combinations if you want the simulation to include multiple transitions at different times.

It is possible to add comments to the simulation triggers file. Comments are not interpreted by the simulation function. A line starting with two slashes is a comment. Example:

```
// Switch
// This is the pushbutton the user has to press to start the motor
Input2
0:0
// Switch to TRUE after 3 seconds
3000:1
// Switch to FALSE after 9 seconds
9000:0
```

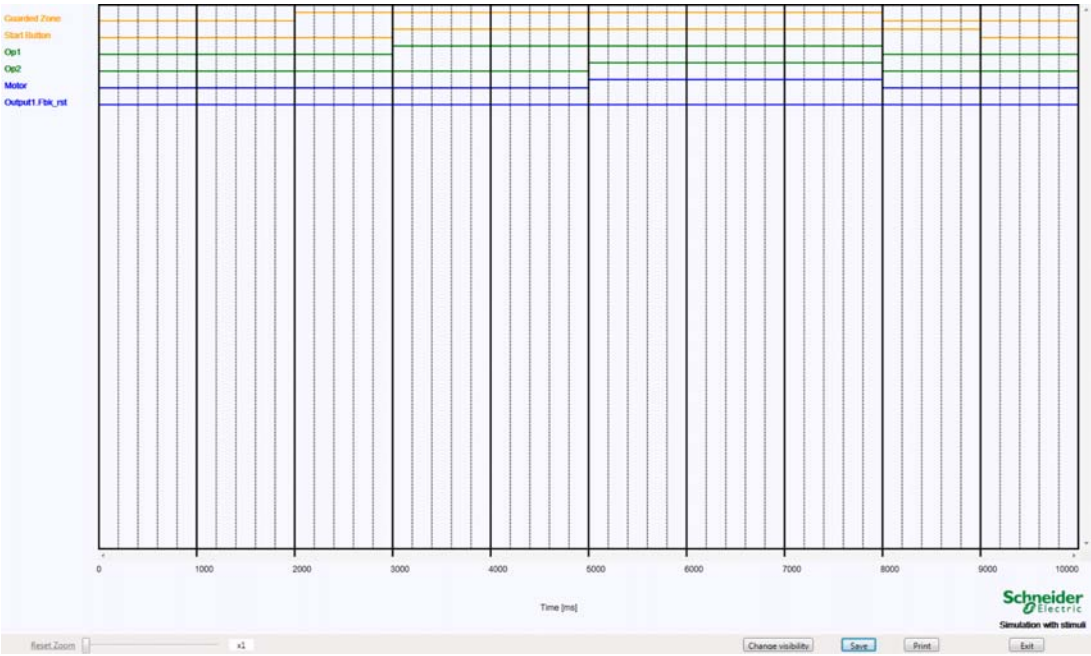
After you have modified the values in the triggers template file, save the file with the extension *.STI. This edited file is the simulation triggers file.

Running an Automatic Simulation

After you have created a simulation triggers file, you can start the automatic simulation.

In the dialog box displayed after you have selected automatic simulation, click the button **Load Triggers File**. SoSafe Configurable prompts you for the name and location of the simulation triggers file to be used for the simulation (file extension *.STI). After you have selected the file, the automatic simulation starts to run.

The simulation is displayed on screen. At the end of the simulation, SoSafe Configurable displays the results of the simulation in the form of a graphical representation of the traces (waveforms) of the function blocks.



The chart displays the signal traces over time. A trace is identified by the description you have assigned to the corresponding item in the diagram (for example, `GUARDED ZONE`). If you have not entered a description, the chart shows the name of the function block.

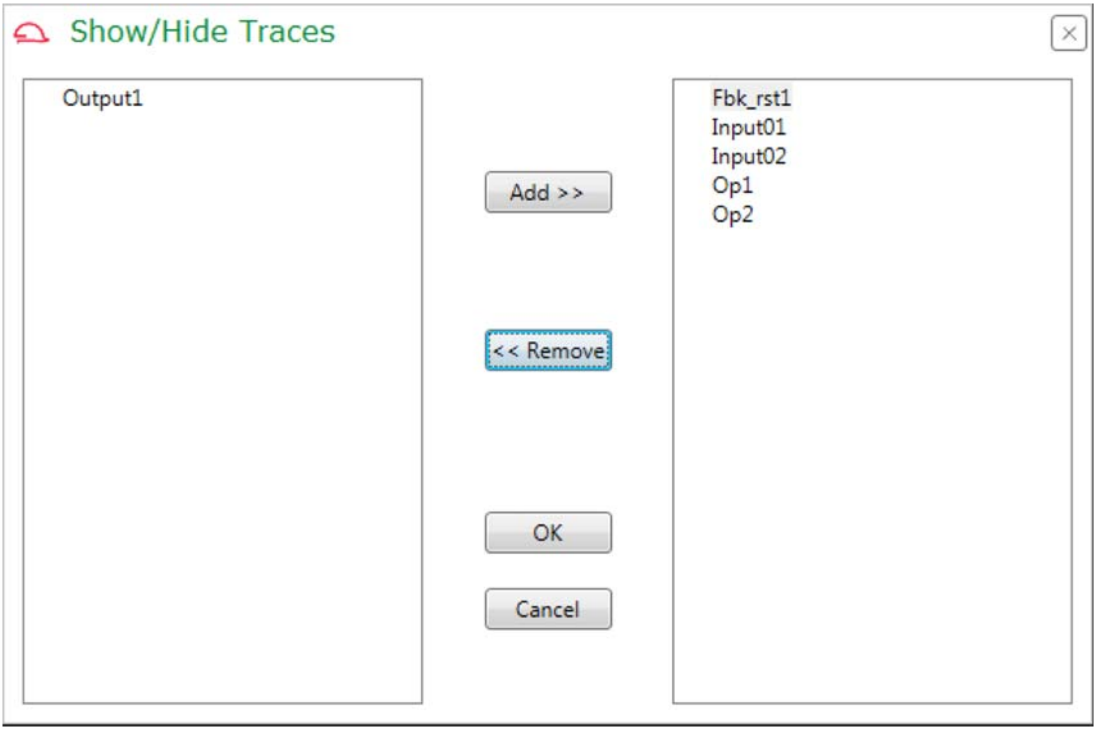
In the example, the logical state of the input function block `SAFETY GUARD` with the description Guarded Zone changes from FALSE (0) to TRUE (1) after 2000 ms. The logical state of the input function block `SWITCH` with the description Start Button changes from FALSE (0) to TRUE (1) after 3000 ms. This meets the condition defined by means of the operator function block `AND` (`Op1`). The time of 2 s defined by means of the timer function block `DELAY` (`Op2`) starts to run. After 5000 ms, the delay time has elapsed and output function block OSSD with the description Motor is set to TRUE (1).

After 8000 ms, the logical states of the function blocks with the exception of `SWITCH` (Start Button) change to FALSE. The logical state of the function block `SWITCH` (`Start Button`) changes to FALSE after 9000 ms.

You can print and save this file (file extension *.DAT) by means of the appropriate buttons in the chart window. The saved simulation can be loaded again in the dialog box displayed after you have selected **Automatic Simulation**.

Showing/Hiding Traces of an Automatic Simulation

In the dialog box displayed after you have selected **Automatic Simulation**, click the button **Show/Hide Traces**. SoSafe Configurable displays a dialog box that allows you to show or hide certain traces in the chart to be displayed at the end of the simulation:



The button **Show/Hide Traces** is also available directly in the chart with the simulation results.

Chapter 12
BUS Configurator Software

What Is in This Chapter?

This chapter contains the following topics:

Bus Configuration Overview

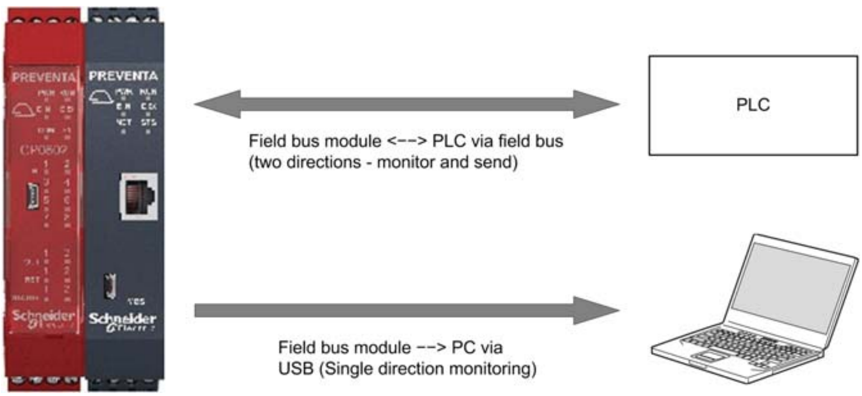
Overview

The bus module is configured using the USB/Mini B-USB interface on the front panel and the BUS Configurator software. The BUS Configurator software is installed along with the SoSafe Configurable software. Once the BUS Configurator software has been correctly installed, it creates a gray shortcut icon on the desktop 

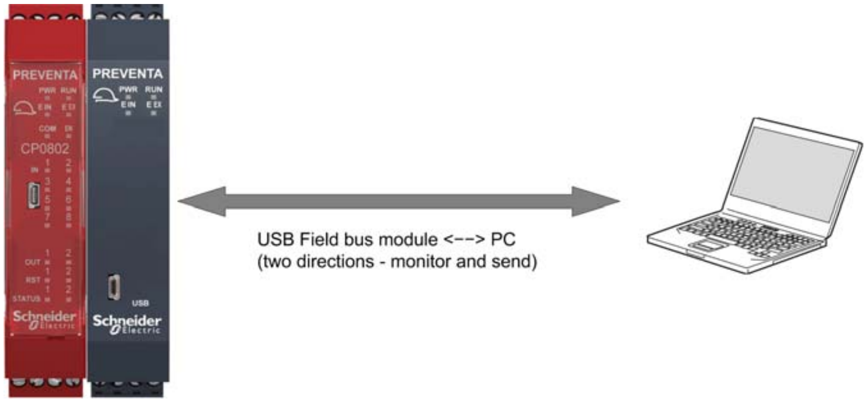
This software can be used for the configuration and communication of the system with a PC, and to display information on the input data map as well as the output data map (such as states of inputs and outputs, diagnostics information, etc.)

Examples of Connection

Example of a connection XPSMCMCP0802• to XPSMCMCO0000•• (bus):



Example of a connection XPSMCMCP0802• to XPSMCMCO0000UB•• (bus):



NOTE:
The BUS Configurator software functions differently depending on whether communication is with an XPSMCMCO0000•• module or an XPSMCMCO0000UB• module:
- XPSMCMCO0000•• module: the software only allows data transmitted via bus to be displayed.
- XPSMCMCO0000UB• module: The software allows two-way data transmission between the fieldbus and the PC. In this case, the programmer can set the fieldbus input directly via computer.

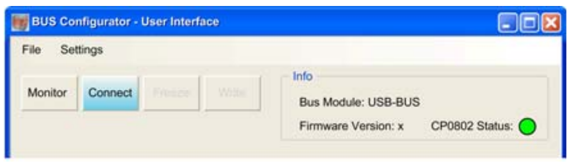
The following can be configured by means of BUS Configurator:
- Data to be transmitted to and from the Modular Safety Controller via the fieldbus (input data map, output data map)
- Modular I/Os
- Fieldbus address of the module
- Transmission rate

Connection, Configuration and Monitoring/Diagnostics

Connecting to the Modular Safety Controller

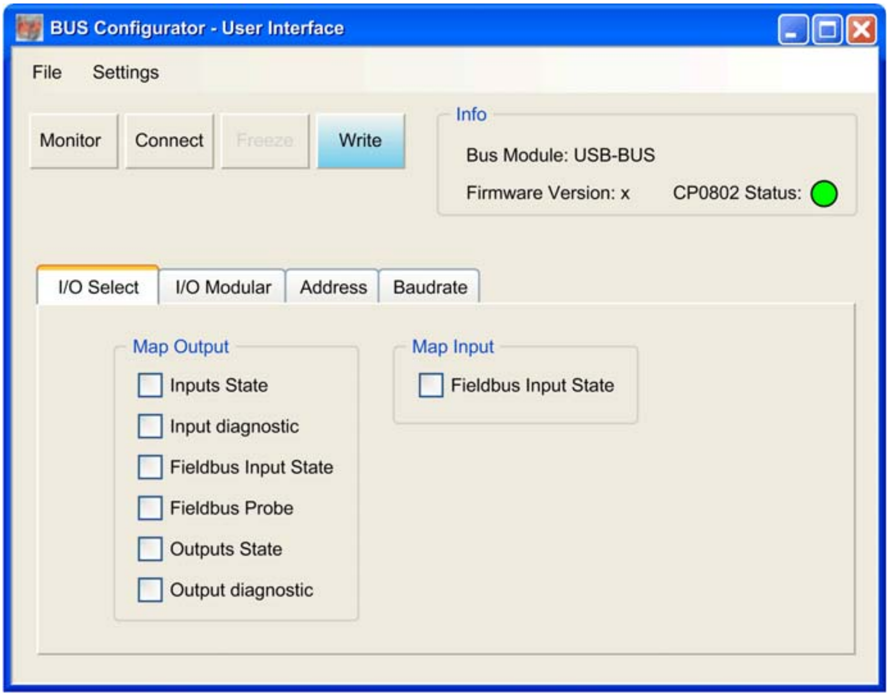
NOTE: Module configuration must be performed with power removed from the system (outputs OFF).

Connecting to the Modular Safety Controller :

Step	Action	Result
1	Connect the module to the 24 Vdc power supply via the terminal block.	–
2	Connect the USB cable to the PC and to the fieldbus module.	–
3	Open the **BUS Configurator - User Interface**.	–
4	Click **Connect**.	The program detects that a bus module is connected.  The fieldbus type, firmware version, and XPSMCMCP0802• states are displayed: ● Green=XPSMCMCP0802• active (RUN); ● Red=XPSMCMCP0802• not active (no communication with SoSafe Configurable software).

Configuring the Input Data Map and the Output Data Map

Data blocks for input data map and output data map:



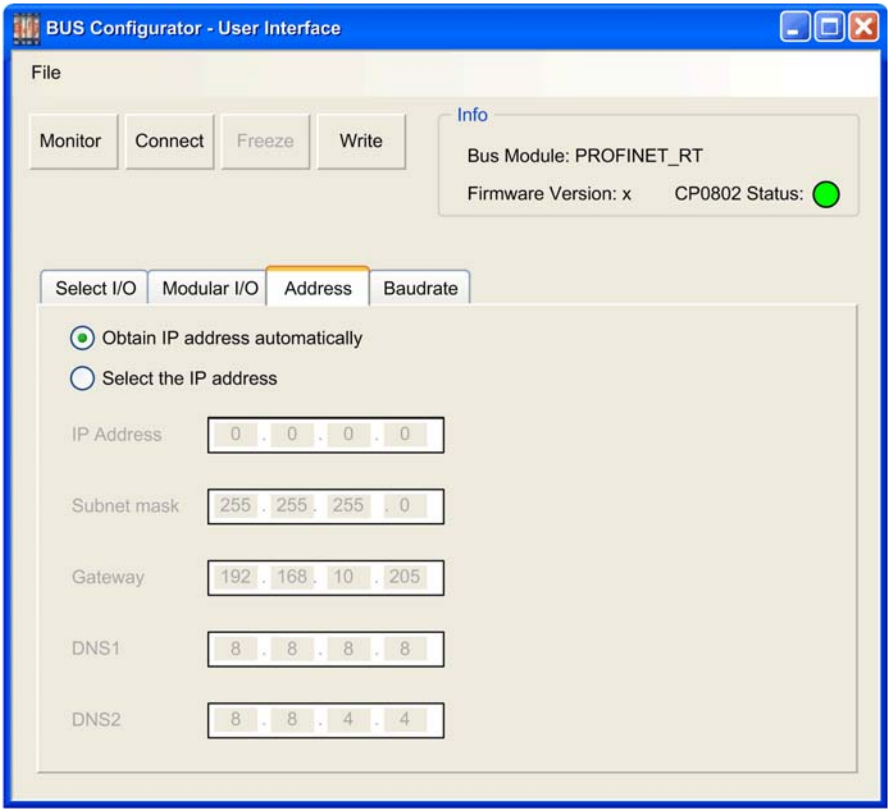
On this tab, you can select the data to be transferred from the Modular Safety Controller via the output data map *(see page 250)* and the data to be transferred to the Modular Safety Controller via the input data map *(see page 250)*.

By default, the data maps are transferred in their entirety. If you want to reduce the fieldbus load, i.e. the amount of data cyclically sent via the fieldbus, you can select individual data blocks of the data maps for transmission. For example, if you do not use probes in your project, there is no need to transfer the state of the probes in the output data map. In such a case, select the individual checkboxes for the data blocks you want to be included in the output data map.

Click **Write** to save the configuration to the Modular Safety Controller.

Configuring the Address

Address:



The options available for the address depend on the type of fieldbus detected.

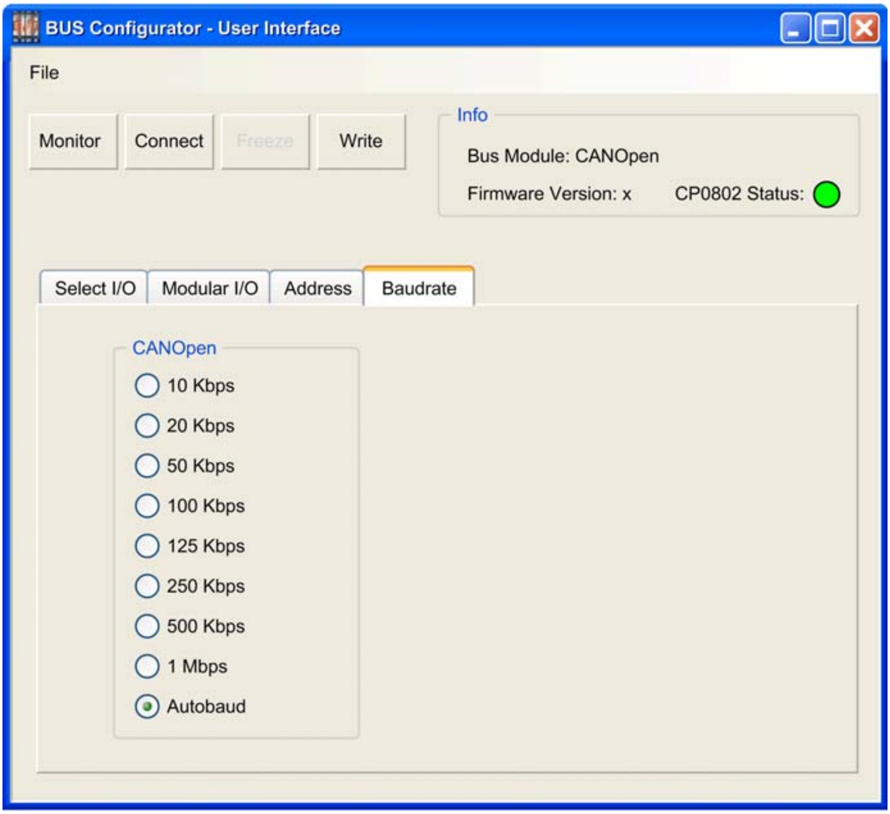
Default values:

Fieldbus	Address
Modbus Serial	64
Modbus TCP/IP	0.0.0.0
CANopen	127
Profibus DP	126
EtherCAT	0
Ethernet/IP 1 port	0.0.0.0

Click **Write** to save the configuration to the Modular Safety Controller.

Configuring the Baud Rate

Baud rate:



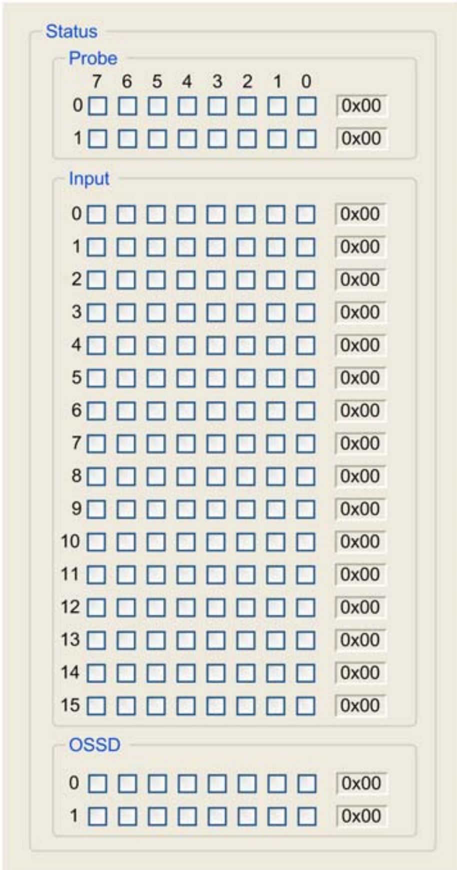
Default values:

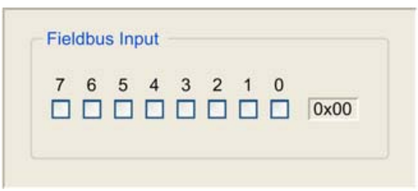
Fieldbus	Baud rate
Modbus Serial	AUTO
Modbus TCP/IP	AUTO
CANopen	AUTO
Profibus DP	N/A
EtherCAT	N/A
Ethernet/IP 1 port	AUTO

Click **Write** to save the configuration to the Modular Safety Controller.

Status and Diagnostic Screen

To display the Monitor screen of BUS Configurator, click **Monitor**.The information displayed in the **Monitor** window is refreshed at regular intervals if Modular Safety Controller is running

Representation	Description
	This section of the **Monitor** window shows the states of the probes, of the input function blocks, and of the output function blocks. For detailed information, refer to Input Data Map and Output Data Map for Fieldbus Operation *(see page 250)*.

Representation	Description
	This section of the **Monitor** window provides diagnostics information on the input function blocks and the output function blocks. For detailed information, refer to Input Data Map and Output Data Map for Fieldbus Operation *(see page 250)*.
	This section of the **Monitor** window shows the input data map. For detailed information, refer to Input Data Map and Output Data Map for Fieldbus Operation *(see page 250)*.

Input Data Map and Output Data Map for Fieldbus Operation

Introduction

If the Modular Safety Controller is operated on a fieldbus, it can receive input data from a logic controller or an HMI (input data map). The input data map is similar to a control word.

If the Modular Safety Controller is operated on a fieldbus, it provides output data via the fieldbus (output data map). The output data map is similar to a status word.

To display a graphical representation of the data of the input data map and the output data map in BUS Configurator, start BUS Configurator and click **Monitor**.

You can configure the information to be included in the input data map and the output data map on the I/O Select tab of BUS Configurator. For details, refer to Configuring the Input Data Map and the Output Data Map *(see page 245)*.

Input Data Map

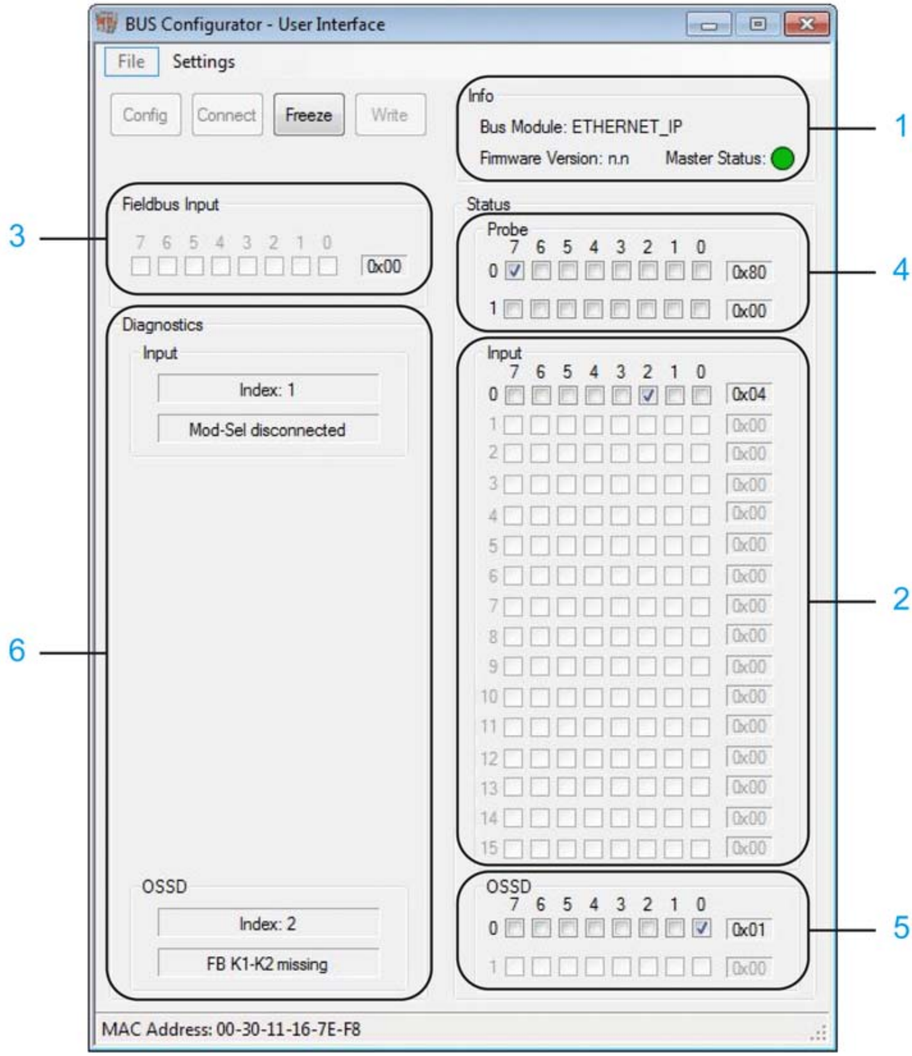
The input data map consists of one byte containing the data transmitted to the Modular Safety Controller via the fieldbus.

The input data map byte is shown in the Fieldbus Input section of the Monitor screen of BUS Configurator.

Output Data Map: Overview

By default, the output data map provided by the Modular Safety Controller consists of 24 bytes and comprises six data blocks. The description of the output data map assumes that you use these 24 bytes. If you have configured your output data map (refer to Configuring the Input Data Map and the Output data Map *(see page 245)*) to contain fewer bytes, you must adapt the references to the bytes (byte number) in the following description to match your output data map.

The output data map is represented on the Monitor screen of BUS Configurator by means of checkboxes. If a checkbox is checked, the value of the corresponding bit is 1. If a checkbox is not checked, the value of the corresponding bit is 0.



Data blocks of the output data map (data block number matches the number shown in the graphic above):

Data block number	Number of bytes in data block (default byte number in output data map)	Function
1	1 byte (byte 0)	System status *(see page 252)*
2	16 bytes (bytes 1 to 15)	State of inputs, bytes for modules *(see page 253)* and bits for input function blocks *(see page 254)*
3	1 byte (byte 16)	Data of the input data map, mirrored in output data map *(see page 257)*
4	2 bytes (bytes 17 to 18)	State of the probes *(see page 257)*
5	2 bytes (bytes 19 to 20)	State of the safety-related outputs (OSSD) *(see page 257)*
6	2 bytes (bytes 21 to 22)	Diagnostics information on the input function blocks and output function blocks *(see page 259)*

Output Data Map: Data Block System Status

The first data block of the output data map consists of one byte (byte 0) and provides information on the system status by means of two bits.

Meaning of the bits of byte 0 of the output data map, data block system status:

Bit	Value	Meaning
0	0	Modular Safety Controller not connected to fieldbus
0	1	Modular Safety Controller connected to fieldbus
1	0	No error detected
1	1	Error detected

As opposed to the bytes of other data blocks of the output data map, the system status in the Monitor screen of BUS Configurator is not represented by checkboxes, but by a symbolic light for bit 0 (bit 0 = 0: gray, bit 0 = 1: green). The Monitor window of BUS Configurator does not provide a visual representation of bit 1 of this byte. If bit 1 = 1, details on detected errors (identification of affected input function blocks and/or output function blocks and error message) are displayed in the diagnostics bytes and in the Diagnostics section of the Monitor window of BUS Configurator *(see page 259)*.

Output Data Map: Bytes for Modules in the Data Block for States of Inputs

The second data block of the output data map provides information on state of the connected inputs of the modules. The second data block consists of 16 bytes (bytes 1 to 15 of the output data map).

Each module with physical inputs is assigned the number of bits that corresponds to the number of physical inputs of the module. Depending on the number of physical inputs of a module, a module uses either one byte (modules with up to eight inputs) or two bytes (modules with more than eight inputs).

- Modules using one byte in the output data map:
  - XPSMCMCP0802•
  - XPSMCMDI0800•
  - XPSMCMMX0802•
  - XPSMCMEN•
- Modules using two bytes in the output data map:
  - XPSMCMDI1600•
  - XPSMCMDI1200MT

The bytes in the second data block of the output data map are assigned to the modules in the following order:
1. XPSMCMCP0802•
2. XPSMCMMX0802•
3. XPSMCMDI1600•
4. XPSMCMDI0800•
5. XPSMCMDI1200MT
6. XPSMCMEN0200SC• or XPSMCMEN0200HT• or XPSMCMEN0200TT•
7. XPSMCMEN0100SC• or XPSMCMEN0100HT• or XPSMCMEN0100TT•
8. XPSMCMEN0200•

The project report *(see page 214)* shows the connected modules, the assignment of bytes to the modules and the use of bits by function blocks.

Example:

Byte	Module	Explanation
Data block system status		
Byte 0	n.a.	Information on system status
Data block state of inputs		
Byte 1	XPSMCMCP0802•	This module has eight physical inputs, so it uses one byte. It is the first module in the order.

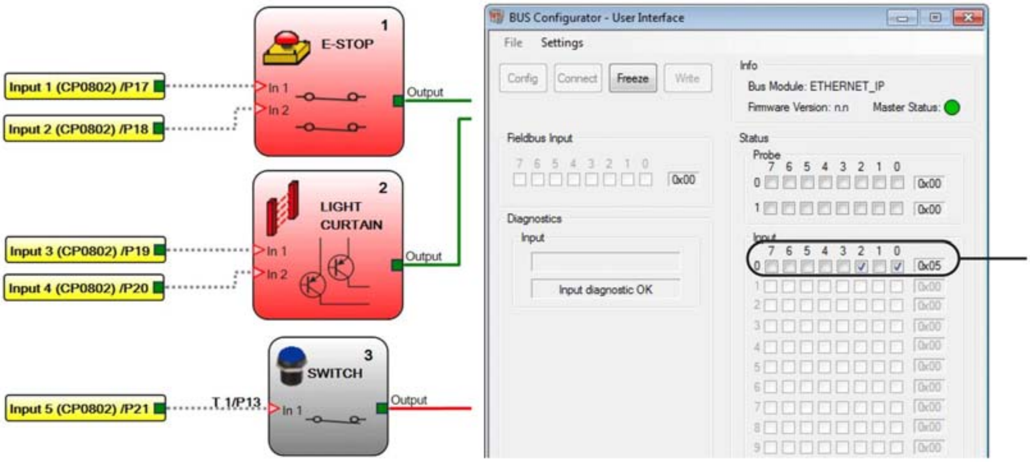
Byte	Module	Explanation
Byte 2	XPSMCMDI0800•	This module has eight physical inputs, so it uses one byte. It is the fourth module in the order. Since the second and the third module in the order are not installed, the next available byte (byte 2) of the output data map is assigned to this module.
Byte 3 Byte 4	XPSMCMDI1200MT	This module has 16 physical inputs, so it uses two bytes.
...	...	...

Output Data Map: Bits for the State of Input Function Blocks in the Data Block for States of Inputs

Input function blocks are assigned to the physical inputs of a module. The number of bits assigned to a function block depends on the number of logical inputs of the function block and the corresponding number of physical inputs of the module.

Example:

The function blocks `E-STOP`, `LIGHT CURTAIN` and `SWITCH` are used with module XPSMCMCP0802•. This module is the first module in the order of modules. Therefore, byte 1 of the output data map (the first byte of the data block for the state of inputs) is assigned to this module. The function block `E-STOP` has the lowest index value *(see page 259)* (1). It uses two physical inputs of the module. Therefore, the first two bits (0, 1) of byte 1 are assigned to the function block `E-STOP`. The function block `LIGHT CURTAIN` has the index value 2. It also uses two physical inputs. Therefore, the next two bits (2, 3) are assigned to the function block `LIGHT CURTAIN`. The function block `SWITCH` has the index value 3. It uses one physical input. Therefore, the next bit (4) is assigned to the function block `SWITCH`. In the example, no further function blocks are used with the module.



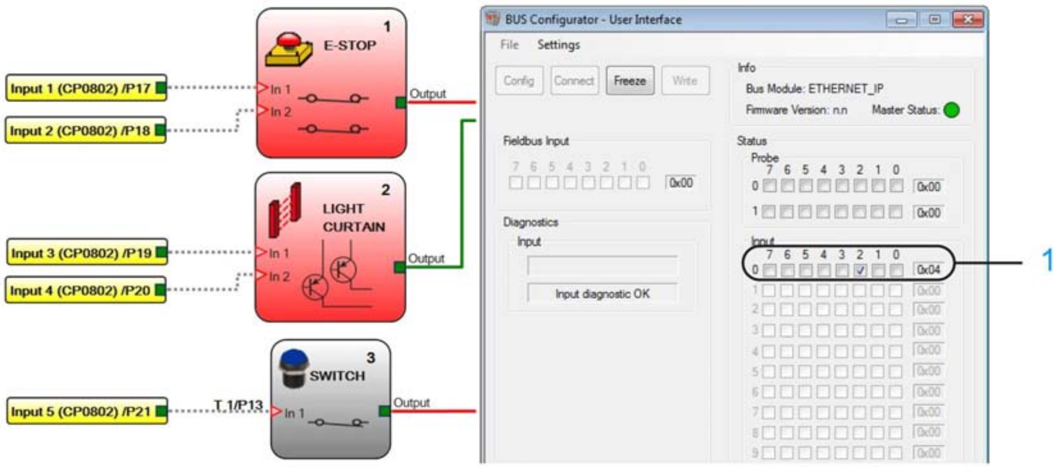
1 Graphical representation of byte 0 of data block states of inputs (byte 1 of output data map)

Byte 0 of data block states of inputs (byte 1 of output data map)							
Bit 7 = 0	Bit 6 = 0	Bit 5 = 0	Bit 4 = 0 or 1	Bit 3 = 0	Bit 2 = 0 or 1	Bit 1 = 0	Bit 0 = 0 or 1
Not used	Not used	Not used	Function block `SWITCH`	Function block `LIGHT CURTAIN`		Function block `E-STOP`	

Each input function block is assigned the number of bits that corresponds to the number of the inputs it uses. The first bit represents the state of the input function block (0 = FALSE, 1 = TRUE). The next bit or bits represent the number of inputs of the input function block. These bits remain zero.

If the first bit of an input function block is 1, the physical inputs of the module to which this function block is assigned are HIGH. If the first bit of an input function block is 0, at least one of the physical inputs of the module to which this function block is assigned is LOW.

Example:



1 Graphical representation of byte 0 of data block states of inputs (byte 1 of output data map)

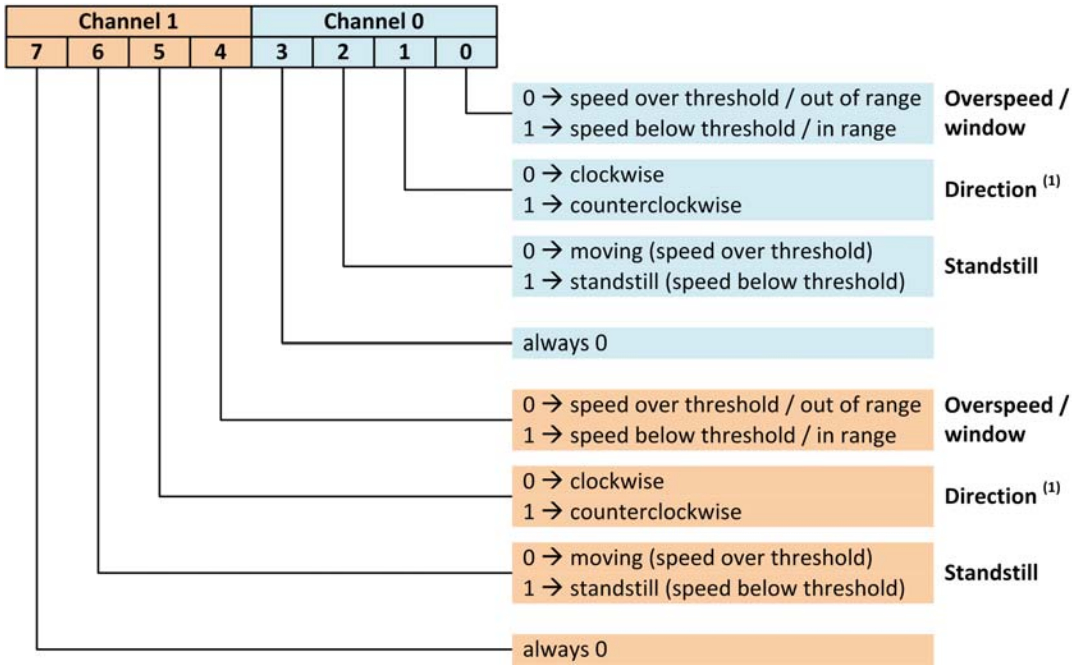
Byte 0 of data block states of inputs (byte 1 of output data map)							
Bit 7 = 0	Bit 6 = 0	Bit 5 = 0	Bit 4 = 0	Bit 3 = 0	Bit 2 = 1	Bit 1 = 0	Bit 0 = 0
Not used	Not used	Not used	State of input function block SWITCH is FALSE. The corresponding physical input of the module is LOW.	State of input function block LIGHT CURTAIN is TRUE. The corresponding physical inputs of the module are HIGH.		State of input function block E-STOP is FALSE. At least one of the corresponding physical inputs of the module is LOW.	

In addition to the information on the logical state of the input function block (TRUE or FALSE) and the state of the corresponding physical input (HIGH or LOW), diagnostics information on the input function blocks using these inputs is provided in the bytes of the Diagnostics data block of the output data map *(see page 259)*.

Special Case: Input Function Blocks used for Speed Monitoring Modules XPSMCMEN•

If XPSMCMEN• modules for speed monitoring are used, the corresponding bytes in the data block for the states of inputs contain additional information as opposed to the bytes for other modules.

Bits 0 to 3 of a byte represent the first channel, bits 4 to 7 of a byte the second channel. Depending on the type of monitoring (zero speed monitoring, speed range monitoring) and the type of hardware used (encoder and/or proximity sensor), the information in the following table is encoded in the bytes.



(1) Direction is only indicated if encoders are used. The value of the bit is of no relevance if only proximity sensors are used.

Output Data Map: Mirrored Data of the Input Data Map

The third data block of the output data map is a mirror of the input data map *(see page 250)*. It consists of one byte (byte 16). This data can be used to provide feedback to the logic controller.

Output Data Map: State of the Probes

The fourth data block of the output data map indicates the state of the configured probes *(see page 343)*. This data block consists of two bytes (bytes 17 to 18) which represent the up to 16 possible probes and the corresponding bits.

The probes allow you to obtain information on the state of function blocks which are not immediately connected to physical inputs as input function blocks, but which are located downstream in the diagram.

Output Data Map: State of the Safety-Related Outputs (OSSD)

The fifth data block of the output data map provides information on state of the connected safety-related outputs (OSSD) of the modules. It consists of two bytes (bytes 19 to 20).

Each module with safety-related physical outputs OSSD is assigned the number of bits that corresponds to the number of physical outputs.

The individual bits indicate the state of the corresponding logical output of the output function block (TRUE or FALSE) and the corresponding physical output (HIGH or LOW).

The bits are assigned in the following sequence of modules:
1. XPSMCMCP0802•
2. XPSMCMMX0802•
3. XPSMCMDO0002•
4. XPSMCMDO0004•
5. XPSMCMRO0004•
6. XPSMCMRO0004DA•

If multiple modules of the same type are used, the node addresses of these modules determine the byte or bytes used for the modules. The module with the lowest node address is assigned to the lowest bit, the module with the second lowest node address is assigned to next bit, and so on. Each output function block is assigned one bit, regardless of the number of its outputs.

Example:

Two output function blocks `OSSD` with two outputs each are used with module XPSMCMCP0802•. This module is the first module in the order of modules. Therefore, bit 0 of byte 19 of the output data map is assigned to the output function block `OSSD 1` because it has the lowest index value *(see page 259)* (1). The output function block `OSSD 2` uses bit 1.

Byte 0 data block states of OSSD (byte 19 of output data map)							
Bit 7 = 0	Bit 6 = 0	Bit 5 = 0	Bit 4 = 0	Bit 3 = 0	Bit 2 = 0	Bit 1 = 0 or 1	Bit 0 = 0 or 1
Not used	Not used	Not used	Not used	Not used	Not used	Function block `OSSD 2`	Function block `OSSD 1`

The bit assigned to an output function block represents the state of the output function block (0 = FALSE, 1 = TRUE). If the bit of an output function block is 1, the physical outputs of the module to which this function block is assigned are HIGH. If the bit of an output function block is 0, at least one of the physical outputs of the module to which this function block is assigned is LOW.

Example:

1 Graphical representation of byte 0 of data block states of OSSD (byte 19 of output data map)

Byte 0 of data block states of OSSD (byte 19 of output data map)							
Bit 7 = 0	Bit 6 = 0	Bit 5 = 0	Bit 4 = 0	Bit 3 = 0	Bit 2 = 0	Bit 1 = 0	Bit 0 = 1
Not used	Not used	Not used	Not used	Not used	Not used	State of output function block `OSSD 2` is FALSE. At least one of the corresponding physical outputs of the module is LOW.	State of output function block `OSSD 1` is TRUE. The corresponding physical outputs of the module are HIGH.

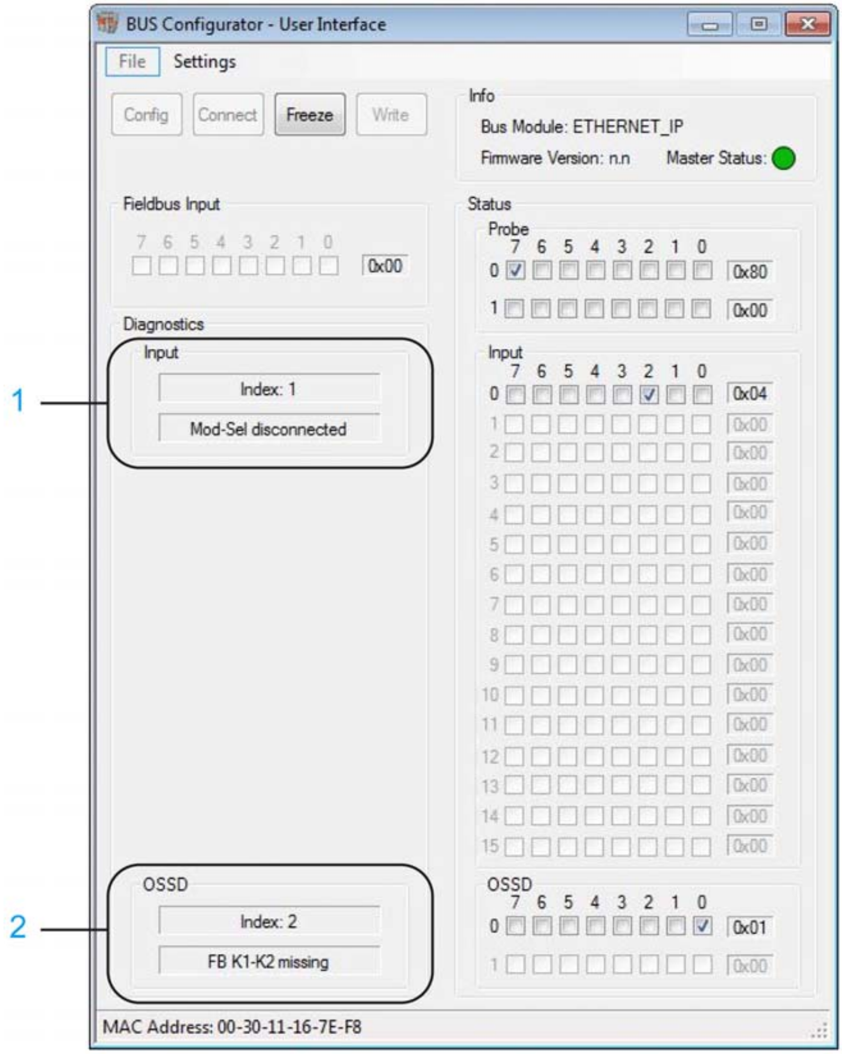
In addition to the information on the logical state of the output function block (TRUE or FALSE) and the state of the corresponding physical output (HIGH or LOW), diagnostics information on the output function blocks using these outputs is provided in the bytes of the Diagnostics data block of the output data map *(see page 259)*.

Output Data Map: Diagnostics Information on the Input and Output Function Blocks

The sixth data block of the output data map provides diagnostics information on the input function blocks and the output functions block used with the physical inputs and outputs. This data block consists of two bytes (bytes 21 to22).

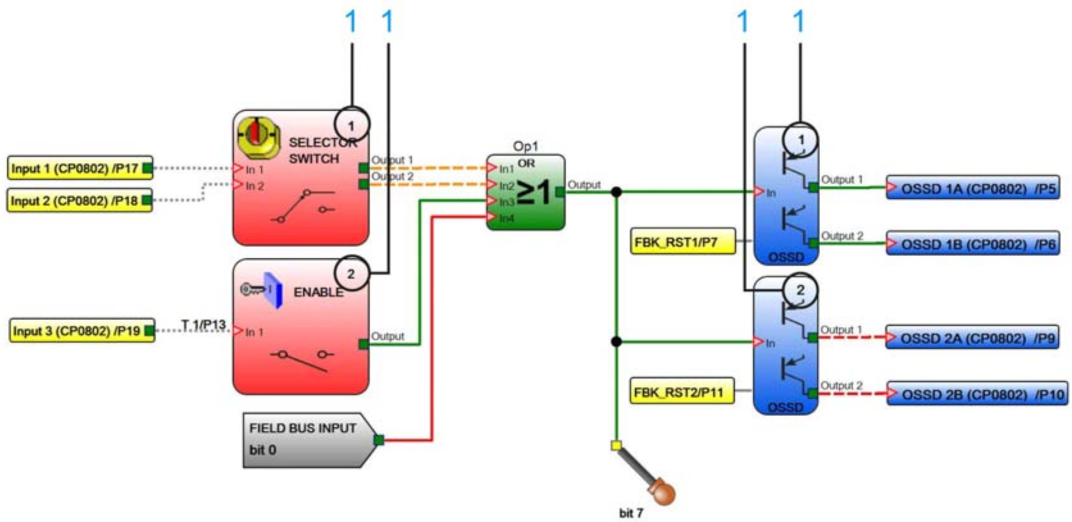
The first byte contains the index number of the function block to identify the function block. The second byte contains the diagnostic information for input function blocks *(see page 262)* or outputs function blocks *(see page 263)*.

The Monitor screen of BUS Configurator shows the information in separate sections for the inputs and the OSSD outputs. The first field in each of the sections contains the function block index number, the second field contains the corresponding error message.



1 Diagnostics information on input function blocks
2 Diagnostics information on output function blocks

The index number is also shown on the function blocks in SoSafe Configurable.



1 Index number shown in top right corner of graphical representation of function block in SoSafe Configurable

The index numbers of input function blocks range from 1 to 128. The index numbers of output function blocks range from 192 to 225.

Input function blocks and output function blocks may be displayed with the same numbers (1 to 128) in the Monitor screen of BUS BUS Configurator and in SoSafe Configurable since the types of function blocks are distinguished by separate fields and a different graphical representation. This means that the index numbers of the graphical representations of output function blocks are displayed with an offset of -191 in BUS Configurator and in SoSafe Configurable.

If diagnostics information is available on an output function block, the first byte of the data block with the diagnostics information (byte 21 of the output data map) contains the index number of the output function block without this offset. For example, the index number 2 of an output function block in SoSafe Configurablecorresponds to the number 93 in the output data map.

The diagnostics code for an input function block or an output function block is contained in byte 22 of the output data map. The corresponding error message is displayed in BUS Configurator.

If no error has been detected, no diagnostic information is available and the value of byte 22 is 128.

Diagnostics Codes for Input Function Blocks (Inputs)

The Diagnostics code field in the Input section of the Monitor screen of BUS Configurator and byte 23 of the output data map can contain the following values for inputs:

Diagnostics codes for input function blocks/inputs (decimal)		
Code	Error message	Explanation
128	No error detected.	–
1	No signal edge transition detected.	Both sets of contacts must first be reset before they can be evaluated by the function block.
2	Synchronization time exceeded.	Both switches have to change state within the defined synchronization time.
3	Synchronization time exceeded hand 1.	Incorrect operation on one side of a two-hands switch.
4	Synchronization time exceeded hand 2.	Incorrect operation on one side of a two-hands switch.
7	Selector switch inconsistent.	The selector should not have more than one input set.
8	Switch disconnected.	The selector should have at least one input set.
10	`OUT_TEST` error detected.	`OUT_TEST` diagnostic tests were unsuccessful.
11	Redundant input mismatch.	Redundancy verification unsuccessful on input.
12	Reserved	–
13	`OUT_TEST` diagnostics wiring error	Test output not connected to the correct input.
14	Output OK, but input connected to 24 Vdc.	Invalid test input connection.
15	Short circuit between photo cell test and photo cell input.	Photo cell response time error.
16	No response from photo cell.	The test signal on the photo cell emitter is not detected by the receiver.
17	Short circuit between photo cells.	The test signal is present on two different photo cells.
18	`Safety Mat` not connected.	Incorrect mat connection.
19	Output inconsistent with feedback.	The test signal on input is present on more than one `OUT_TEST`.
20	Connection incorrect.	The test signal is present on more than one input.
21	`OUT_TEST` error detected.	The test signal on the input is not present on the `OUT_TEST`.
22	Redundant `OUT_TEST` mismatch.	Redundancy verification unsuccessful on `OUT_TEST`.
NOTE: Codes not listed are reserved.		

Diagnostics codes for input function blocks/inputs (decimal)		
Code	**Error message**	**Explanation**
23	Speed monitoring module- proximity sensor not detected	Proximity sensor is not detected / Proximity sensor inoperable.
24	Speed monitoring module- encoder not detected	Verify whether the encoder is powered and wired correctly.
25	Speed monitoring module- encoder, Proximity not detected	Verify whether the proximity sensor of the encoder is powered and wired correctly.
26	Speed monitoring module- Proximity1, Proximity2 not detected	One of the two proximity sensors is not connected.
27	Speed monitoring module- encoder1, encoder2 not detected	One of the two encoders is not connected.
28	Speed monitoring module- error congruence frequencies	Redundancy verification error during measurement.
29	Speed monitoring module- encoder supply not detected	Encoder incorrectly powered.
133[1]	Detected TWO-HAND synchronization error.	Two-hand switches must change state within the defined synchronization time.
134[1]	Not started.	Start up test unsuccessful.
137[1]	Waiting for restart.	The input has manual reset and has not been restarted.
NOTE: Codes not listed are reserved.		

[1]Diagnostics code 133, 134 and 137 are not represented by the LEDs of XPSMCMCP0802•.

If diagnostics information is available on more than one input function block, the corresponding information in the Index field of BUS Configurator is updated every 500 ms.

Diagnostics Codes for Output Function Blocks/OSSD

The Diagnostics code field in the OSSD section of BUS Configurator and byte 23 of the output data map can contain the following values for outputs:

Diagnostics codes for output function blocks/**OSSD** (decimal)		
Code	**Error message**	**Explanation**
1	ENABLE NOT DETECTED	–
2	WAITING FOR RESTART OSSD	–
3	FEEDBACK K1/K2 NOT DETECTED	–
4	WAITING FOR INTERNAL SYNCRONIZATION	OSSD redundancy verification unsuccessful

Diagnostics codes for output function blocks/**OSSD** (decimal)		
Code	Error message	Explanation
5	No OSSD power supply detected	–
6	Exceeded maximum restart time	–
7	Feedback K1 K2 external not corresponding to CAT 2 wiring according to ISO 13849-1.	Applicable to XPSMCMRO0004 and XPSMCMRO0004DA modules configured in CAT 2 wiring according to ISO 13849-1.

If diagnostics information is available on more than one output function block, the corresponding information in the Index field of BUS Configurator is updated every 500 ms.

Fieldbus Mapping for Input Data Map and Output Data Map

Mapping information for CANopen and EtherCAT:

	Name	Index	Sub index	Bit length
RPDO 1	**Input data map**	**1400_{hex}**		
	Input data map byte 0	2100_{hex}	01_{hex}	8
TPDO 1	**Status and diagnostics**	**1800_{hex}**		
	System status	2000_{hex}	01_{hex}	8
	Diagnostics index	2001_{hex}	01_{hex}	8
	Diagnostic code	2001_{hex}	02_{hex}	8
	Mirror of input data map byte 0	2180_{hex}	01_{hex}	8
	State of probes byte 0	2202_{hex}	01_{hex}	8
	State of probes byte 1	2202_{hex}	02_{hex}	8
TPDO 2	**State of inputs 1**	**1801_{hex}**		
	State of inputs byte 0	2200_{hex}	01_{hex}	8
	State of inputs byte 1	2200_{hex}	02_{hex}	8
	State of inputs byte 2	2200_{hex}	03_{hex}	8
	State of inputs byte 3	2200_{hex}	04_{hex}	8
	State of inputs byte 4	2200_{hex}	05_{hex}	8
	State of inputs byte 5	2200_{hex}	06_{hex}	8
	State of inputs byte 6	2200_{hex}	07_{hex}	8
	State of inputs byte 7	2200_{hex}	08_{hex}	8

	Name	Index	Sub index	Bit length
TPDO 3	**State of inputs 2**	**1802_{hex}**		
	State of inputs byte 8	2200_{hex}	09_{hex}	8
	State of inputs byte 9	2200_{hex}	$0A_{hex}$	8
	State of inputs byte 10	2200_{hex}	$0B_{hex}$	8
	State of inputs byte 11	2200_{hex}	$0C_{hex}$	8
	State of inputs byte 12	2200_{hex}	$0D_{hex}$	8
	State of inputs byte 13	2200_{hex}	$0E_{hex}$	8
	State of inputs byte 14	2200_{hex}	$0F_{hex}$	8
	State of inputs byte 15	2200_{hex}	10_{hex}	8
TPDO 4	**State of outputs**	**1803_{hex}**		
	State of OSSD byte 0	2201_{hex}	01_{hex}	8
	State of OSSD byte 1	2201_{hex}	02_{hex}	8

NOTE: For PROFIBUS DP, an external configuration tool available with the master device is used for mapping. The input data block consisting of one byte is mapped before the output data map consisting of 24 bytes (system status, state of inputs, state of probes, state of OSSD, diagnostics index and code). The bytes must be configured as "1 byte" type.

Input data map:

Data	Modbus Serial (RTU) Register address	Modbus TCP/IP Register address	EtherNet/IP Assembly object Instance/attribute
Input data map byte	40001	40001	$96_{hex}/1_{hex}$

Input data map:

Data	CANopen Object index/ subindex	EtherCAT Object index/ subindex
Input data map byte	$2181_{hex}/1_{hex}$	$2101_{hex}/1_{hex}$

Output data map:

Data	Modbus Serial (RTU) Register address	Modbus TCP/IP Register address	EtherNet/IP Assembly object Instance/attribute
System status	30001	30001	$64_{hex}/1_{hex}$
NOTE: Only the low byte of the 16 bit registers is used.			

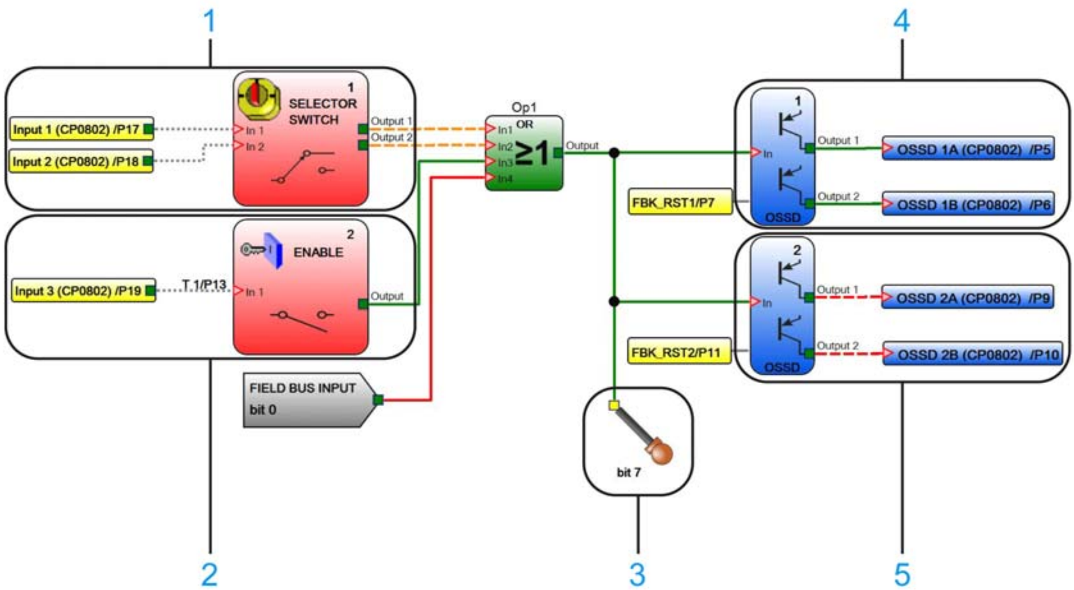
Data	Modbus Serial (RTU) Register address	Modbus TCP/IP Register address	EtherNet/IP Assembly object Instance/attribute
State of inputs	30002-30017	30002-30017	$64_{hex}/2_{hex}$ - $64_{hex}/11_{hex}$
Mirror of input data map	30018	30018	$64_{hex}/12_{hex}$
State of probes	30019-30020	30019-30020	$64_{hex}/13_{hex}$ - $64_{hex}/14_{hex}$
State of OSSD	30021-30022	30021-30022	$64_{hex}/15_{hex}$ - $64_{hex}/16_{hex}$
Diagnostics index and code	30023-30024	30023-30024	$64_{hex}/17_{hex}$ - $64_{hex}/18_{hex}$
NOTE: Only the low byte of the 16 bit registers is used.			

Data	CANopen Object index/ subindex	EtherCAT Object index/ subindex
System status	$2001_{hex}/1_{hex}$	$2001_{hex}/1_{hex}$
State of inputs	$2201_{hex}/01_{hex}$ - $2201_{hex}/10_{hex}$	$2201_{hex}/01_{hex}$ - $2201_{hex}/10_{hex}$
Mirror of input data map	$2181_{hex}/01_{hex}$	$2181_{hex}/01_{hex}$
State of probes	$2203_{hex}/01_{hex}$ - $2203_{hex}/02_{hex}$	$2203_{hex}/01_{hex}$ - $2203_{hex}/02_{hex}$
State of OSSD	$2202_{hex}/01_{hex}$ - $2202_{hex}/02_{hex}$	$2202_{hex}/01_{hex}$ - $2202_{hex}/02_{hex}$
Diagnostics index and code	$2002_{hex}/01_{hex}$ - $2002_{hex}/02_{hex}$	$2002_{hex}/01_{hex}$ - $2002_{hex}/02_{hex}$

Configuration Example in SoSafe Configurable and Representation in BUS Configurator

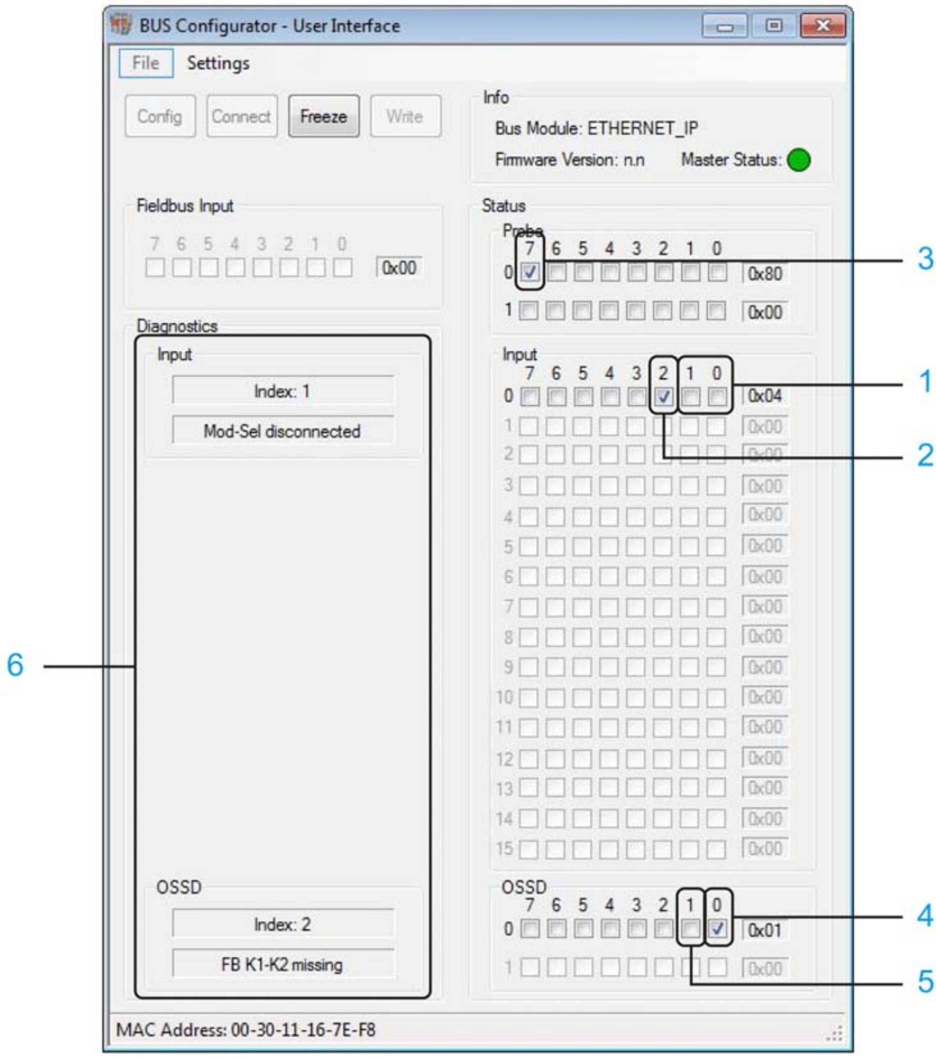
Configuration Example in SoSafe Configurable

The table below *(see page 268)* the following two screenshots provides detailed descriptions of the numbered items in the screenshot and allows you to correlate these items with the same items as represented in SoSafe Configurable *(see page 267)*.



Representation of Configuration Example in BUS Configurator

The table below *(see page 268)* the following screenshot provides detailed descriptions of the numbered items in the screenshot and allows you to correlate these items with the same items as represented in BUS Configurator *(see page 267)*.



Explanation of Configuration Example in SoSafe Configurable and Representation in BUS Configurator

The following table provides detailed descriptions of the numbered items in the configuration example in SoSafe Configurable *(see page 267)* and the corresponding representation in BUS Configurator *(see page 267)*.

Number	Description
1	The input function block `SELECTOR SWITCH` with index 1 is connected to physical inputs 1 and 2 of XPSMCMCP0802•. Since the input function block has two inputs, bits 0 and 1 of byte 1 of the output data map are assigned to the function block. The logical state of the input function block `SELECTOR SWITCH` is FALSE. In BUS Configurator, this is indicated by the fact that none of the checkboxes representing the bits (0 and 1) are checked. In SoSafe Configurable, this is indicated by the dashed orange line (incorrect connection). At least one of the corresponding physical inputs of XPSMCMCP0802• is LOW.
2	The input function block `ENABLE` with index 2 is connected to physical input 3 of XPSMCMCP0802•. Since the input function block has one input, bit 2 of byte 1 of the output data map is assigned to the function block. The logical state of the input function block `ENABLE` is TRUE. In BUS Configurator, this is indicated by the fact that the checkbox representing the bit is checked. In SoSafe Configurable, this is indicated by the green line (connected). The corresponding physical input of XPSMCMCP0802• is HIGH.
3	The logical state of the probe assigned to bit 7 is TRUE. In BUS Configurator, this is indicated by the fact that the checkbox representing the bit is checked. In SoSafe Configurable, this is indicated by the green line.
4	The output function block `OSSD 1` with index 1 is connected to physical outputs 1A and 1B of XPSMCMCP0802•. Bit 0 of byte 19 of the output data map is assigned to this function block. The logical state of the output function block `OSSD 1` is TRUE. In BUS Configurator, this is indicated by the fact that the checkbox representing the bit is checked. In SoSafe Configurable, this is indicated by the green line (connected). The corresponding physical outputs 1A and 1B of XPSMCMCP0802• are HIGH.
5	The output function block `OSSD 2` with index 2 is connected to physical outputs 2A and 2B of XPSMCMCP0802•. Bit 1 of byte 19 of the output data map is assigned to this function block. The logical state of the output function block `OSSD 2` is FALSE. In BUS Configurator, this is indicated by the fact that the checkbox representing the bit is not checked. In SoSafe Configurable, this is indicated by the dashed red line (incorrect signal). The corresponding physical outputs 2A and 2B of XPSMCMCP0802• are LOW.
6	BUS Configurator provides diagnostics information. The fields of the Input section display the index number of the input function block (1) and the corresponding diagnostics message. The fields of the OSSD section display the index number of the output function block (2) and the corresponding diagnostics message. In SoSafe Configurable, diagnostics information is graphically represented on the Monitor screen *(see page 229)*, not on this screen.

Part IV
Function Blocks

What Is in This Part?

This part contains the following chapters:

Chapter 13
Input, Speed Monitoring, Output and Comment Function Blocks

What Is in This Chapter?

This chapter contains the following sections:

Section 13.1
Input Function Blocks

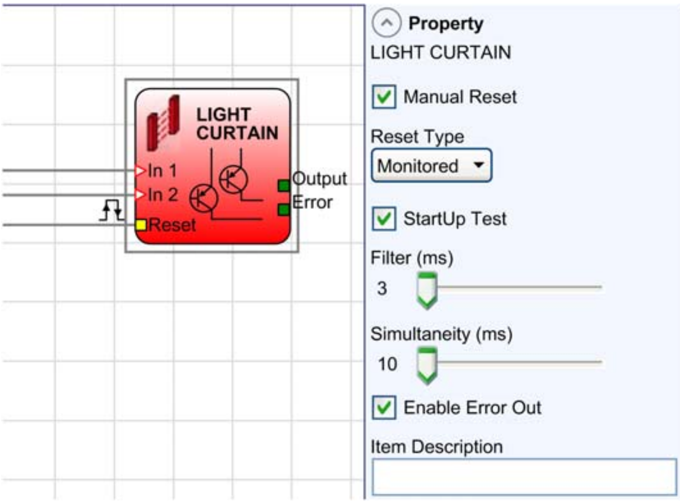
What Is in This Section?

This section contains the following topics:

`LIGHT CURTAIN` Function Block

Presentation

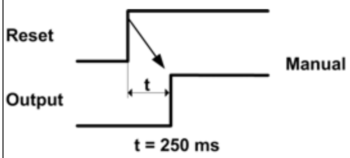
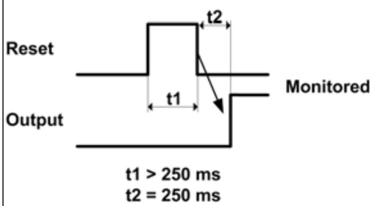
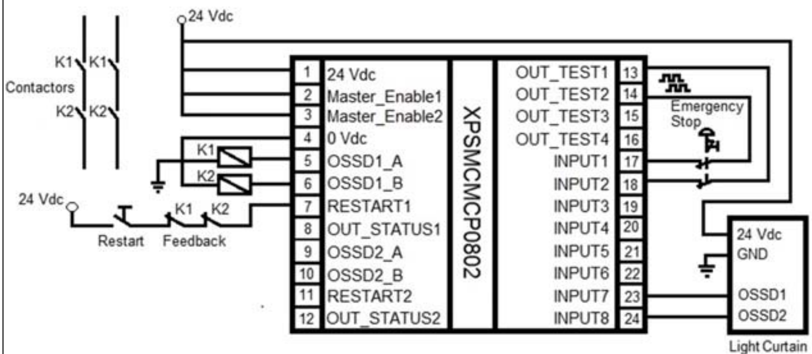
The light curtain function block `LIGHT CURTAIN` monitors an optoelectronic safety light curtain (or laser scanner) state (Electro-Sensitive Protective Equipment, `ESPE`). When the optoelectronic device detects an object, the outputs are set to FALSE. If there is no object detected by the optoelectronic device, the output is set to TRUE.



Parameters

The following table describes the parameters displayed in the **Property** pane:

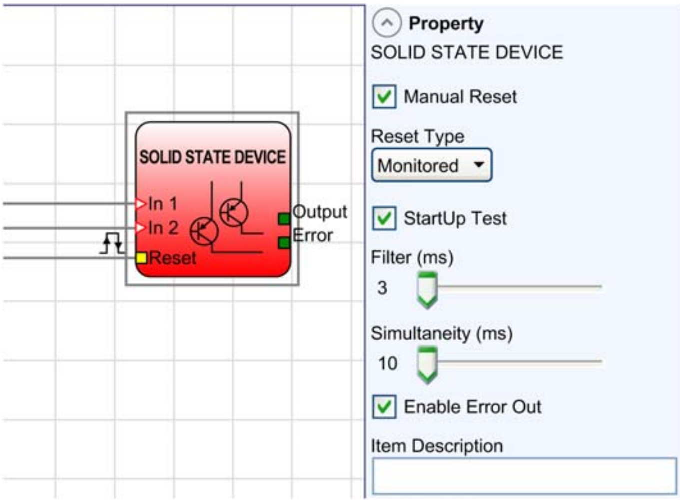
Parameter	Description
Manual Reset	When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.

Parameter	Description
Reset Type	When **Manual** is selected, the function verifies the reset signal transition from 0 to 1. When **Monitored** is selected, the function verifies the reset signal transition from 0 to 1 to 0.   Connection example: 
StartUp Test	If selected the function requires on power-up of machine the light curtain to be activated. This test is performed by opening and activating the light curtain.
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
With Simultaneity	Is only available when 2-channel inputs are used. When selected, the function monitors the 2 channels switching if the synchronization is not below the synchronization (simultaneity) time, the function remains at FALSE. The maximum time (ms) between the switching of 2 channels can be configured between 10 to 7000 ms.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

SOLID STATE DEVICE Function Block

Presentation

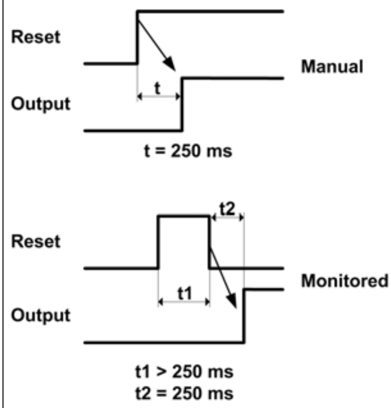
The SOLID STATE DEVICE function block monitors the inputs of a solid state device. If the inputs are set to TRUE, the output is set to TRUE. If the inputs are set to FALSE, the output is set to FALSE.



Parameters

The following table describes the parameters displayed in the **Property** pane:

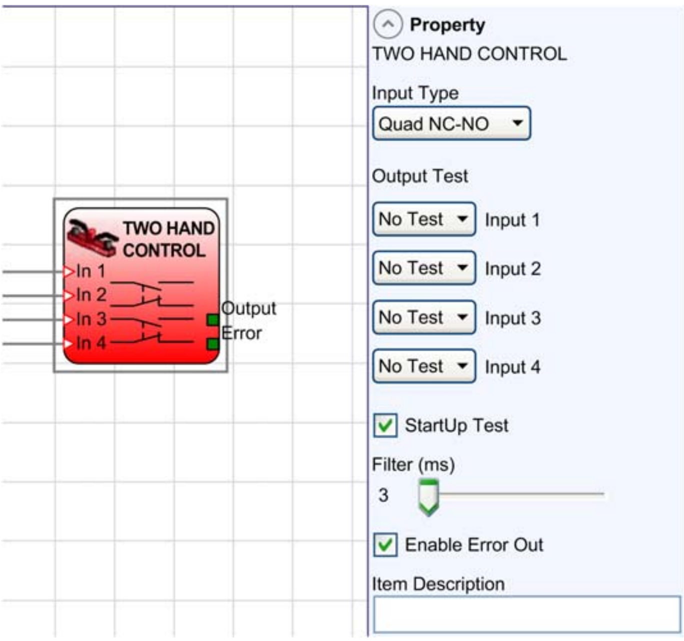
Parameter	Description
Manual Reset	When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.

Parameter	Description
Reset Type	When **Manual** is selected, the function verifies the reset signal transition from 0 to 1. When **Monitored** is selected, the function verifies the reset signal transition from 0 to 1 to 0. 
StartUp Test	If selected, the function requires on power-up of machine the safety switch to be activated. This test is performed by activating and deactivating the safety switch.
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
With Simultaneity	Is always active. The function monitors the two channels switching if the synchronization is not below the synchronization (simultaneity) time, the function remains at FALSE. The maximum time (ms) between the switching of two channels can be configured between 10 to 7000 ms.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

TWO HAND CONTROL Function Block

Presentation

The `TWO HAND CONTROL` function block monitors the two-hand control switch. Both of the push-button switches must be activated within 500 ms to enable the output to TRUE. If the pushbutton switches are not activated simultaneously, then the output is set to FALSE.



Parameters

The following table describes the parameters displayed in the **Property** pane:

Parameter	Description
Input Type	• **Double NO** (Double channel NO): allows connection of Two Hand control switch with one normally open NO contact on each button (EN 574 III A) • **Quadruple NC-NO** : allows connection of Two Hand control switch with a normally open and normally closed NO/NC set of contacts for each button (EN 574 III C).

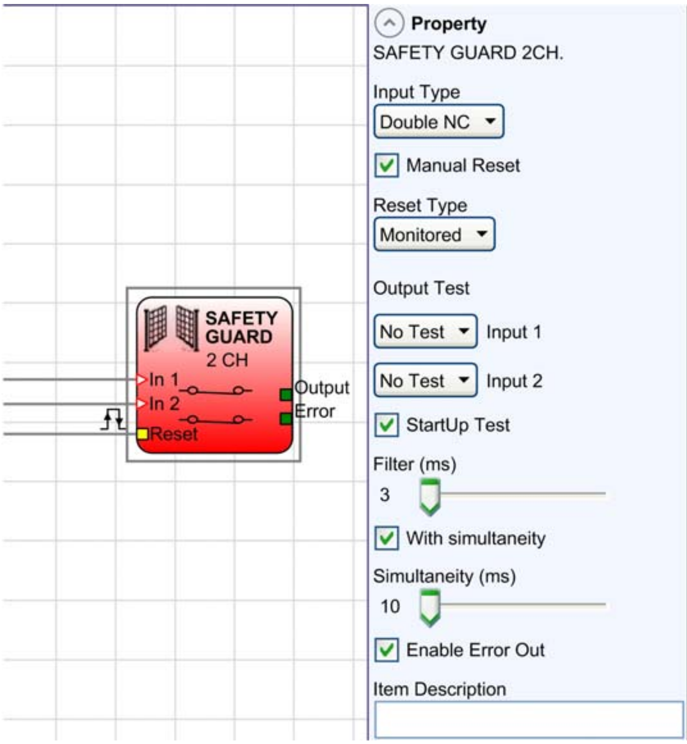
Parameter	Description
Output Test	The output tests are line monitoring detection for short circuit. The outputs provide a 24 Vdc supply with a specific periodic pulse (100 µs pulse every 5.5 ms) for each test output. When assigned to the various input channels, the inputs expect the specific periodic pulse from the specified test output. If the pulse is not received or a different pulse is received, the outputs of the function are set to FALSE. Once physical hardware inputs have been selected for the function, it is then possible to assign the appropriate test outputs which are fed into the associated inputs.
StartUp Test	If selected the function requires on power-up of machine the Two Hand control function to be activated. This test is performed by pressing simultaneously within 500 ms and releasing the Two Hand control switches.
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

SAFETY GUARD Function Block

Presentation

The SAFETY GUARD 1- or 2-channel function blocks monitor a mobile guard or safety guard state.

When the guard is closed, the inputs to the function are set to TRUE and the output is set to TRUE. When the guard is open, inputs to the function are set to FALSE and the output is set to FALSE.

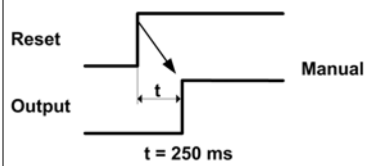


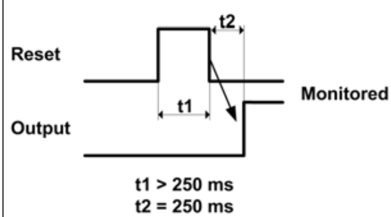
Parameters

The following table describes the parameters displayed in **Property** pane:

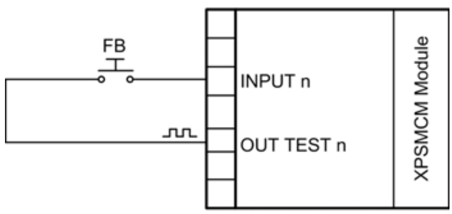
Parameter	Description
Input Type	● Single channel (NC): allows connection of 1-channel normally closed contact guards. ● Double channel (NC); allows connection of 2-channel normally closed contacts guards. ● Double NC/NO - Allows connection of 2-channel guards with 1 normally open and 1 normally closed contacts

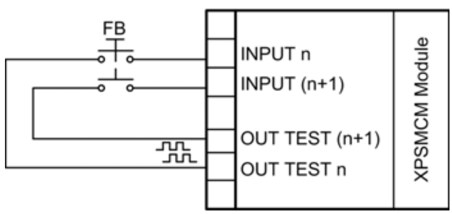
<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Manual Reset</td><td>When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.</td></tr>
<tr><td>Reset Type</td><td>When Manual is selected, the function verifies the reset signal transition from 0 to 1. When Monitored is selected, the function verifies the reset signal transition from 0 to 1 to 0.





Connection examples with one / two contacts:





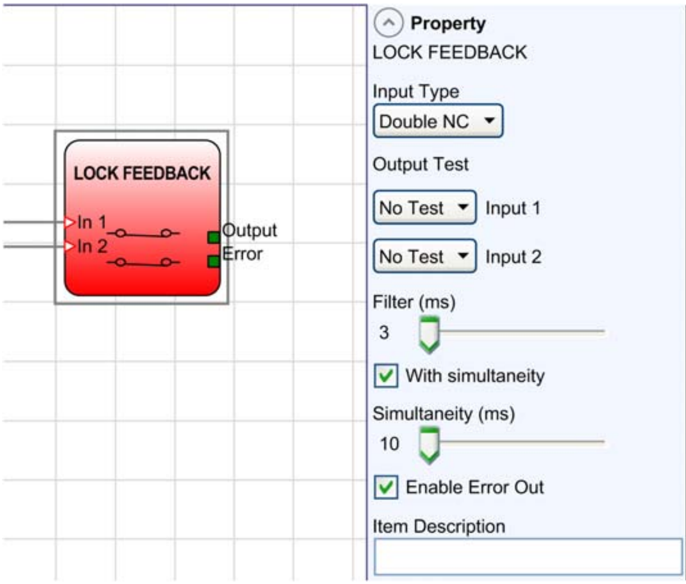
</td></tr>
</table>

Parameter	Description
Output Test	The output tests are line monitoring detection for short circuit. The outputs provide a 24 Vdc supply with a specific periodic pulse (100 μs pulse every 5.5 ms) for each test output. When assigned to the various input channels, the inputs expect the specific periodic pulse from the specified test output. If the pulse is not received or a different pulse is received, the outputs of the function are set to FALSE. Once physical hardware inputs have been selected for the function, it is then possible to assign the appropriate test outputs which are fed into the associated inputs.
StartUp Test	If selected the function requires on power-up of machine the guard to be activated. This test is performed by opening and closing the guard.
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
With Simultaneity	Is only available when 2-channel inputs are used. When selected, the function monitors the 2 channels switching if the synchronization is not below the synchronization (simultaneity) time, the function remains at FALSE. The maximum time (ms) between the switching of 2 channels can be configured between 10 to 7000 ms.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

LOCK FEEDBACK Function Block

Presentation

The `LOCK FEEDBACK` function block monitors the inputs of a guard lock device for a mobile guard or safety gate. In the case where the inputs indicate that the lock is locked, the output is set to TRUE, otherwise, the output is set to FALSE.



Parameters

The following table describes the parameters displayed in the **Property** pane:

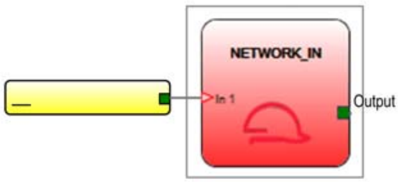
Parameter	Description
Input Type	• **Single NC**: allows connection of components with one normally closed contact. • **Double NC**: allows connection of components with two normally closed contacts. • **Double NC/NO**: allows connection of components with one normally open and one normally closed contacts.

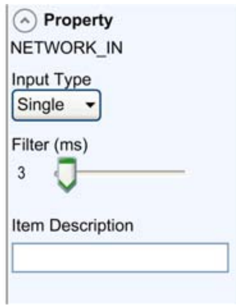
Parameter	Description
Output Test	The output tests are line monitoring detection for short circuit. The outputs provide a 24 Vdc supply with a specific periodic pulse (100 μs pulse every 5.5 ms) for each test output. When assigned to the various input channels, the inputs expect the specific periodic pulse from the specified test output. If the pulse is not received or a different pulse is received, the outputs of the function are set to FALSE. Once physical hardware inputs have been selected for the function, it is then possible to assign the appropriate test outputs which are fed into the associated inputs.
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
With Simultaneity	Is only available when 2-channel inputs are used. When selected, the function monitors the 2 channels switching if the synchronization is not below the synchronization (simultaneity) time, the function remains at FALSE. The maximum time (ms) between the switching of 2 channels can be configured between 10 to 7000 ms.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

NETWORK_IN Function

Presentation

The NETWORK_IN function block is used to connect the network inputs to the NETWORK function block. When the inputs are set to TRUE, the associated output is set to TRUE.





Parameters

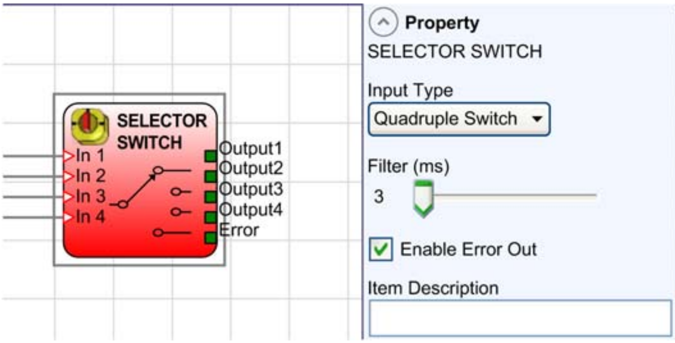
Parameter	Description
Input Type	• **Single**: enables the connection of signaling outputs of another Modular Safety Controller. • **Double**: enables the connection of OSSD outputs of another Modular Safety Controller.
Filter (ms)	• If selected, enables the filtering of signals from another Modular Safety Controller. • The filter can be configured to 3...250 ms. • The length of the filter affects the calculation of the total response time of the Modular Safety Controller.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

NOTE: The input can only be allocated on the Modular Safety Controller. It must be used together with the NETWORK operator *(see page 401)*.

`SELECTOR SWITCH` Function Block

Presentation

The selector switch function block `SELECTOR SWITCH` monitors the inputs from a two-channel to four-channel selector switch. When only one input is set to TRUE, the corresponding output is also set to TRUE. In other conditions, where all inputs are set to FALSE or more than one input is set to TRUE, the outputs are set to FALSE.



Parameters

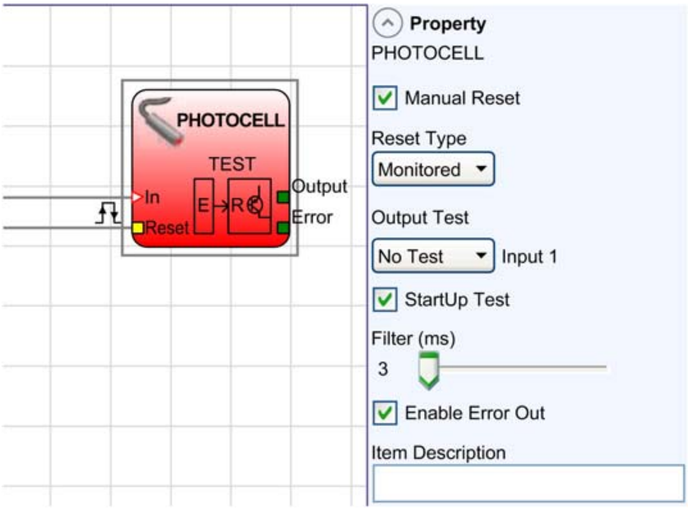
The following table describes the parameters displayed in **Property** pane:

Parameter	Description
Input Type	● **Double switch**: allows connection of a two-way selector switch. ● **Triple switch**: allows connection of a three- way selector switch. ● **Quadruple switch**: allows connection of a four-way selector switch.
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

PHOTOCELL Function Block

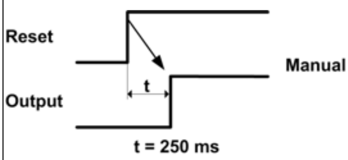
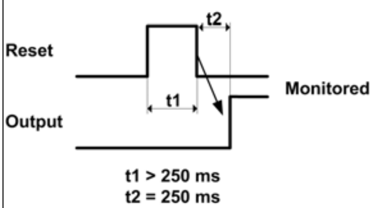
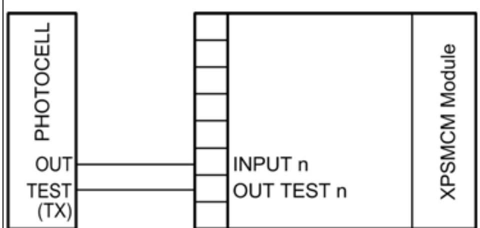
Presentation

The PHOTOCELL function block monitors the inputs of an optoelectronic safety photo cell. If the beam of the photo cell is clear, the output is set to TRUE. If the beam of the photo cell is occupied, the output is set to FALSE.



Parameters

The following table describes the parameters displayed in the **Property** pane:

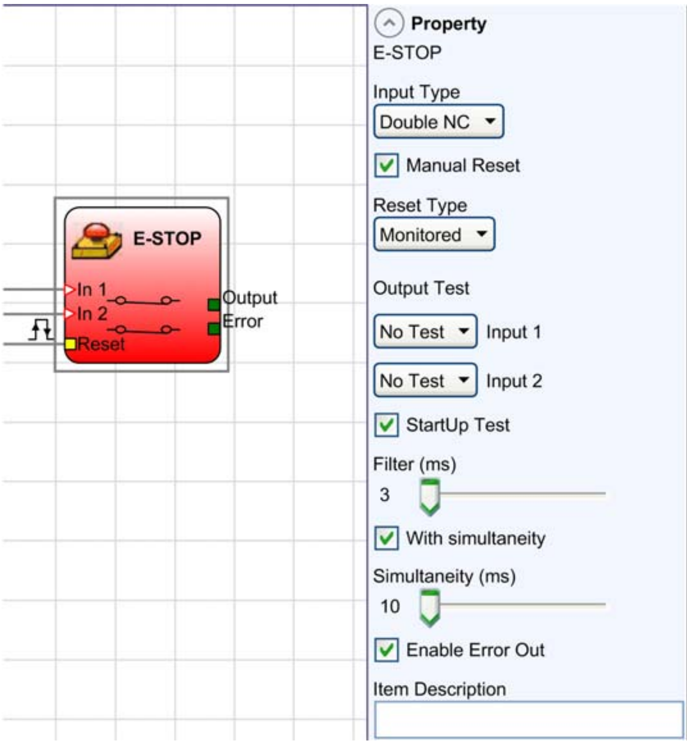
Parameter	Description
Manual Reset	When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.
Reset Type	When **Manual** is selected, the function verifies the reset signal transition from 0 to 1. When **Monitored** is selected, the function verifies the reset signal transition from 0 to 1 to 0.   
Output Test	The output tests are line monitoring detection for short circuit. The outputs provide a 24 Vdc supply with a specific periodic pulse (100 µs pulse every 5.5 ms) for each test output. When assigned to the various input channels, the inputs expect the specific periodic pulse from the specified test output. If the pulse is not received or a different pulse is received, the outputs of the function are set to FALSE. Once physical hardware inputs have been selected for the function, it is then possible to assign the appropriate test outputs which are fed into the associated inputs.
StartUp Test	If selected, the function requires on power-up of machine the photo cell to be activated. This test is performed by a rising and falling edge on the photocell.

Parameter	Description
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

E-STOP Function Block

Presentation

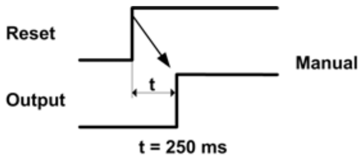
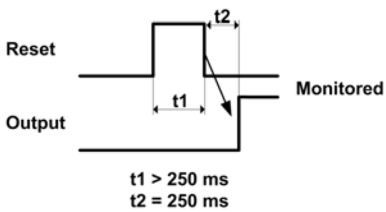
The E-STOP function block (emergency stop) monitors an emergency stop push-button state. The outputs of the E-STOP function block are only TRUE when the inputs are set to TRUE.



Parameters

The following table describes the parameters displayed in the **Property** pane:

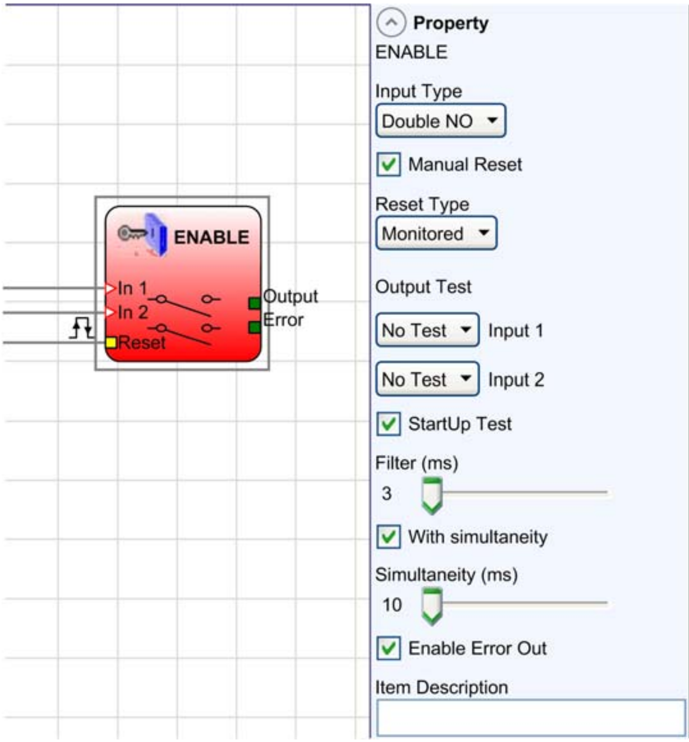
Parameter	Description
Input Type	● Single channel (NC): allows connection of 1-channel emergency stop push-button. ● Double channel (NC): allows connection of 2-channel emergency stop push-button.
Manual Reset	When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.

Parameter	Description
Reset Type	When **Manual** is selected, the function verifies the reset signal transition from 0 to 1. When **Monitored** is selected, the function verifies the reset signal transition from 0 to 1 to 0.  
Output Test	The output tests are line monitoring detection for short circuit. The outputs provide a 24 Vdc supply with a specific periodic pulse (100 μs pulse every 5.5 ms) for each test output. When assigned to the various input channels, the inputs expect the specific periodic pulse from the specified test output. If the pulse is not received or a different pulse is received, the outputs of the function are set to FALSE. Once physical hardware inputs have been selected for the function, it is then possible to assign the appropriate test outputs which are fed into the associated inputs.
StartUp Test	If selected, the function requires on power-up of machine the emergency stop to be activated. This test is performed by pressing and releasing the push-button.
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
With Simultaneity	Is only available when 2-channel inputs are used. When selected, the function monitors the 2 channels switching if the synchronization is not below the synchronization (simultaneity) time, the function remains at FALSE. The maximum time (ms) between the switching of 2 channels can be configured between 10 to 7000 ms.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

ENABLE Function Block

Presentation

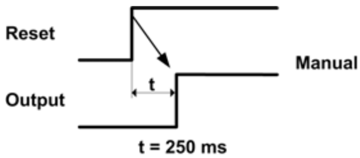
The ENABLE function block or ENABLE key function monitors a manual key device. When the key is inserted and turned in the closed position, the output is set to TRUE. When the key is not inserted or not turned to the closed position, the output is set to FALSE.

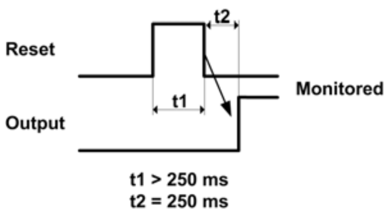


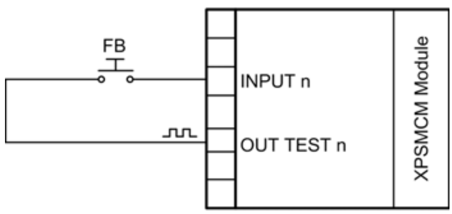
Parameters

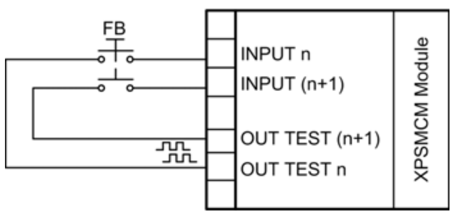
The following table describes the parameters displayed in the **Property** pane:

Parameter	Description
Input Type	● **Single NO**: allows connection of 1-channel normally open contact. ● **Double NO**: allows connection of 2-channel normally open contacts
Manual Reset	When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Reset Type</td><td>When Manual is selected, the function verifies the reset signal transition from 0 to 1. When Monitored is selected, the function verifies the reset signal transition from 0 to 1 to 0.




Connection examples with one/ two contacts:


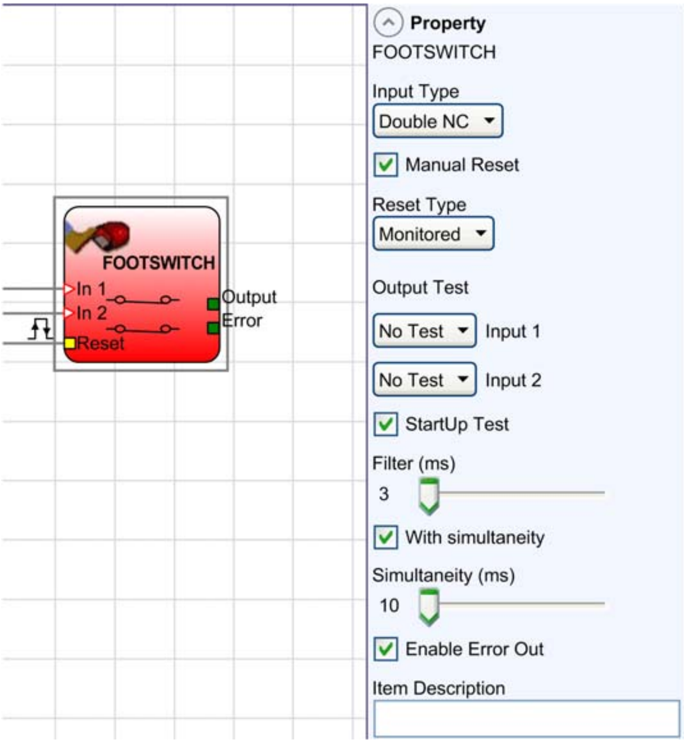

</td></tr>
</table>

Parameter	Description
Output Test	The output tests are line monitoring detection for short circuit. The outputs provide a 24 Vdc supply with a specific periodic pulse (100 µs pulse every 5.5 ms) for each test output. When assigned to the various input channels, the inputs expect the specific periodic pulse from the specified test output. If the pulse is not received or a different pulse is received, the outputs of the function are set to FALSE. Once physical hardware inputs have been selected for the function, it is then possible to assign the appropriate test outputs which are fed into the associated inputs.
StartUp Test	If selected, the function requires on power-up of machine the enable switch to be activated. This test is performed by opening and activating the enable key.
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
With Simultaneity	Is only available when 2-channel inputs are used. When selected, the function monitors the 2 channels switching if the synchronization is not below the synchronization (simultaneity) time, the function remains at FALSE. The maximum time (ms) between the switching of 2 channels can be configured between 10 to 7000 ms.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

FOOTSWITCH Function Block

Presentation

The `FOOTSWITCH` function block monitors the safety footswitch. If the footswitch is pressed, the output is set to TRUE. When not pressed, the output is set to FALSE.

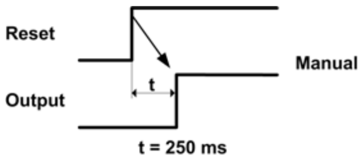


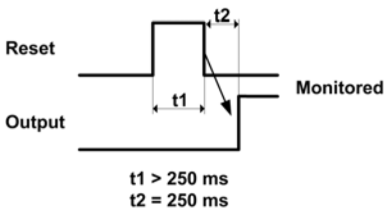
Parameters

The following table describes the parameters displayed in the **Property** pane:

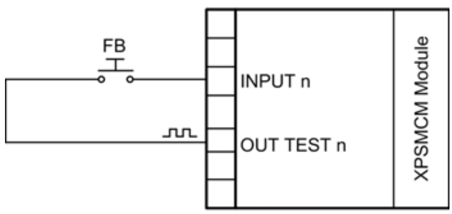
Parameter	Description
Input Type	• Single channel (NC): allows connection of 1-channel normally closed footswitch contact. • Single channel (NO): allows connection of 1-channel normally open footswitch contact. • Double channel (NC): allows connection of 2-channel normally closed footswitch contacts. • Double NC/NO: allows connection of two channel footswitches with one normally open and one normally closed contacts.
Manual Reset	When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.

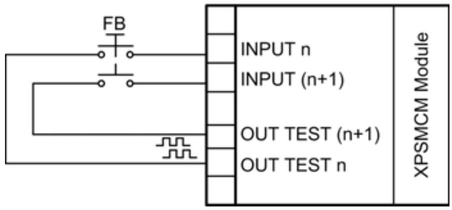
<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Reset Type</td><td>When Manual is selected, the function verifies the reset signal transition from 0 to 1. When Monitored is selected, the function verifies the reset signal transition from 0 to 1 to 0.





Connection example with one / two contacts:





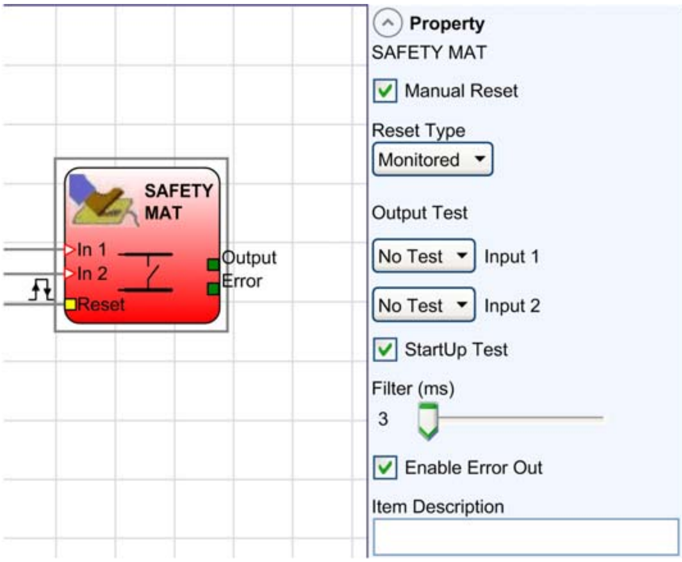
</td></tr>
</table>

Parameter	Description
Output Test	The output tests are line monitoring detection for short circuit. The outputs provide a 24 Vdc supply with a specific periodic pulse (100 µs pulse every 5.5 ms) for each test output. When assigned to the various input channels, the inputs expect the specific periodic pulse from the specified test output. If the pulse is not received or a different pulse is received, the outputs of the function are set to FALSE. Once physical hardware inputs have been selected for the function, it is then possible to assign the appropriate test outputs which are fed into the associated inputs.
StartUp Test	If selected the function requires on power-up of machine the footswitch to be activated. This test is performed by pressing and releasing the footswitch.
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
With Simultaneity	Is only available when 2-channel inputs are used. When selected, the function monitors the 2 channels switching if the synchronization is not below the synchronization (simultaneity) time, the function remains at FALSE. The maximum time (ms) between the switching of 2 channels can be configured between 10 to 7000 ms.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

SAFETY MAT Function Block

Presentation

The SAFETY MAT function monitors the safety mat. If the safety mat is not activated, the output is set to TRUE. If the safety mat is activated, the output is set to FALSE.

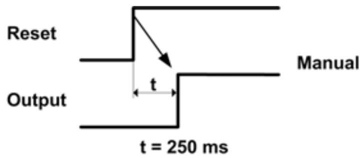


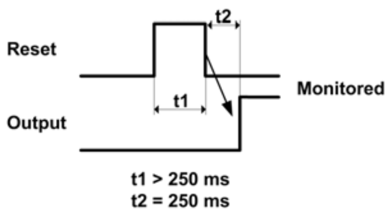
Parameters

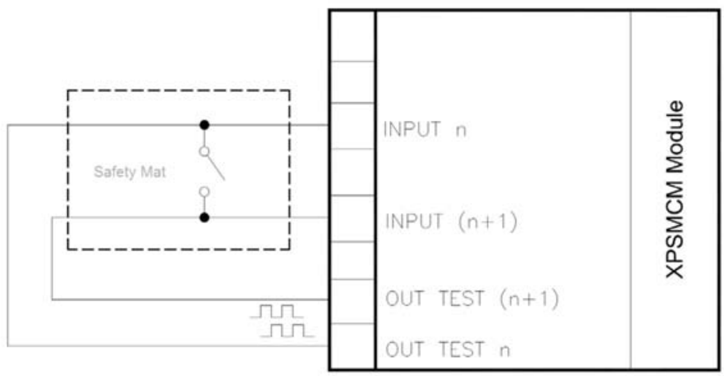
The following table describes the parameters displayed in the **Property** pane:

Parameter	Description
Manual Reset	When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Reset Type</td><td>When Manual is selected, the function verifies the reset signal transition from 0 to 1. When Monitored is selected, the function verifies the reset signal transition from 0 to 1 to 0.







NOTE:
Each output test can be connected to only one input safety mat (it is not allowed parallel connection of 2 inputs).
The function block <code>SAFETY MAT</code> cannot be used with 2-wire components and termination resistance.</td></tr>
</table>

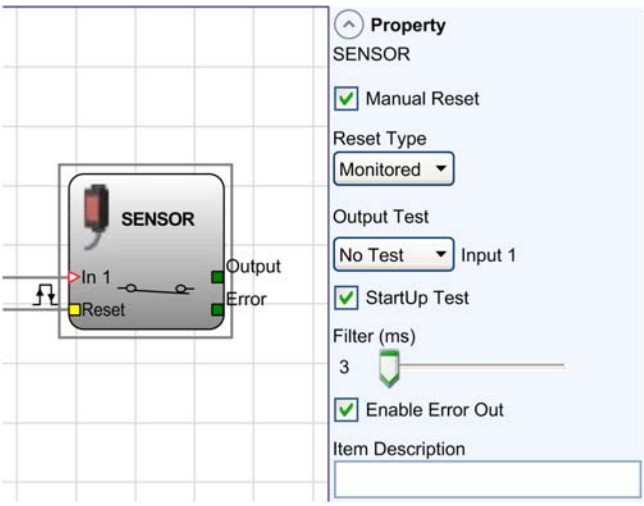
Parameter	Description
Output Test	The output tests are line monitoring detection for short circuit. The outputs provide a 24 Vdc supply with a specific periodic pulse (100 μs pulse every 5.5 ms) for each test output. When assigned to the various input channels, the inputs expect the specific periodic pulse from the specified test output. If the pulse is not received or a different pulse is received, the outputs of the function are set to FALSE. Once physical hardware inputs have been selected for the function, it is then possible to assign the appropriate test outputs which are fed into the associated inputs.
Start-up Test	If selected, the function requires on power-up of machine the safety mat to be activated. This test is performed by opening and activating the safety mat.
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

SENSOR Function Block

Presentation

The SENSOR function monitors the input of a non safety-related sensor. If the beam of the sensor is clear, the output is set to TRUE. If the beam of the sensor is interrupted, the output is set to FALSE.

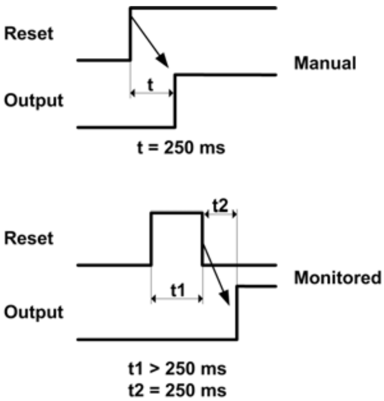
⚠ WARNING
UNINTENDED EQUIPMENT OPERATION Do not use the SENSOR function as a safety-related input. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**



Parameters

The following table describes the parameters displayed in the **Property** pane:

Parameter	Description
Manual Reset	When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.

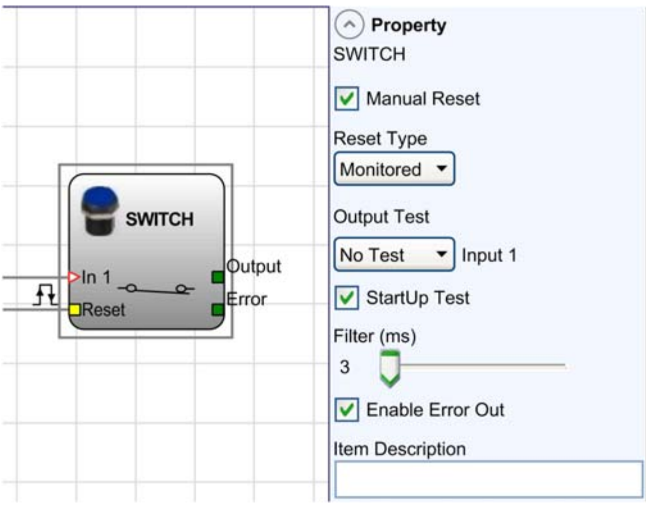
Parameter	Description
Reset Type	When **Manual** is selected, the function verifies the reset signal transition from 0 to 1. When **Monitored** is selected, the function verifies the reset signal transition from 0 to 1 to 0. 
Output Test	The output tests are line monitoring detection for short circuit. The outputs provide a 24 Vdc supply with a specific periodic pulse (100 μs pulse every 5.5 ms) for each test output. When assigned to the various input channels, the inputs expect the specific periodic pulse from the specified test output. If the pulse is not received or a different pulse is received, the outputs of the function are set to FALSE. Once physical hardware inputs have been selected for the function, it is then possible to assign the appropriate test outputs which are fed into the associated inputs.
StartUp Test	If selected the function requires on power-up of machine the sensor to be activated. This test is performed by activating and deactivating the sensor area.
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

SWITCH Function Block

Presentation

The SWITCH function block monitors the input of a non safety-related push button or switch. When the push button is pressed, the output is set to TRUE; otherwise, the output is set to FALSE.

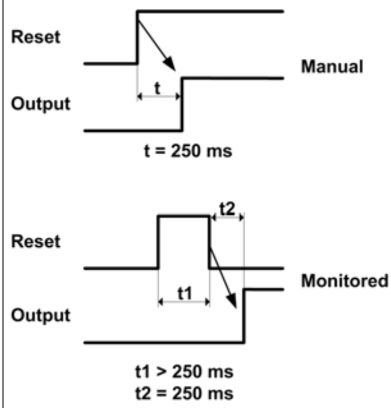
⚠ WARNING
UNINTENDED EQUIPMENT OPERATION Do not use the SWITCH function as a safety-related input. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**



Parameters

The following table describes the parameters displayed in **Property** pane:

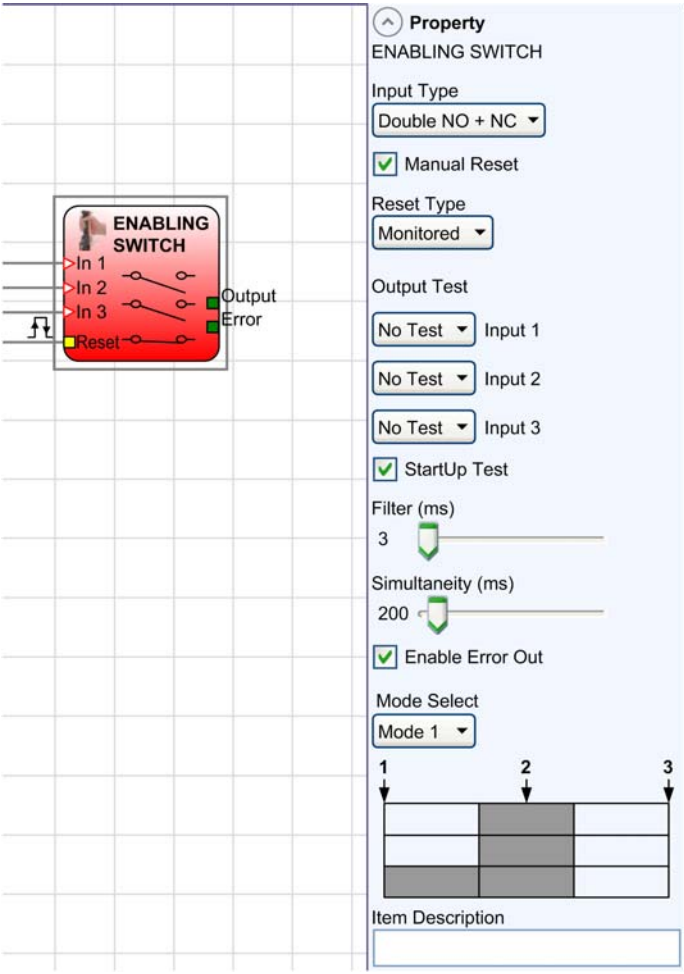
Parameter	Description
Manual Reset	When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.

Parameter	Description
Reset Type	When **Manual** is selected, the function verifies the reset signal transition from 0 to 1. When **Monitored** is selected, the function verifies the reset signal transition from 0 to 1 to 0. 
Output Test	The output tests are line monitoring detection for short circuit. The outputs provide a 24 Vdc supply with a specific periodic pulse (100 µs pulse every 5.5 ms) for each test output. When assigned to the various input channels, the inputs expect the specific periodic pulse from the specified test output. If the pulse is not received or a different pulse is received, the outputs of the function are set to FALSE. Once physical hardware inputs have been selected for the function, it is then possible to assign the appropriate test outputs which are fed into the associated inputs.
StartUp Test	If selected the function requires on power-up of machine the switch to be activated. This test is performed by activating and deactivating the switch.
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

`ENABLING SWITCH` Function Block

Presentation

The `ENABLING SWITCH` function block monitors the inputs of an enabling switch. When the enable switch is in the middle position (position 2), the output is set to TRUE. If the enable switch is not pressed (position 1) or if it is pressed completely (position 3), the output is set to FALSE.

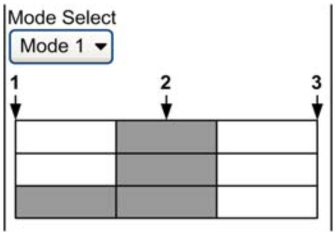


Parameters

The following table describes the parameters displayed in the **Property** pane:

Parameter	Description
Input Type	• **Double NO**: allows connection of an enabling switch with 2 normally open contacts. • **Double NO + NC**: allows connection of an enabling switch with 2 normally open and 1 normally closed contacts.
Manual Reset	When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.
Reset Type	When **Manual** is selected, the function verifies the reset signal transition from 0 to 1. When **Monitored** is selected, the function verifies the reset signal transition from 0 to 1 to 0.
Output Test	The output tests are line monitoring detection for short circuit. The outputs provide a 24 Vdc supply with a specific periodic pulse (100 µs pulse every 5.5 ms) for each test output. When assigned to the various input channels, the inputs expect the specific periodic pulse from the specified test output. If the pulse is not received or a different pulse is received, the outputs of the function are set to FALSE. Once physical hardware inputs have been selected for the function, it is then possible to assign the appropriate test outputs which are fed into the associated inputs.
StartUp Test	If selected the function requires on power-up of machine the enable switch to be activated. This test is performed by activating by pressing and deactivating by releasing the enable switch.
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
With Simultaneity	Is always active. The function monitors the two channels switching if the synchronization is not below the synchronization (simultaneity) time, the function remains at FALSE. The maximum time (ms) between the switching of two channels can be configured between 10 to 7000 ms.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Mode Select	Mode 1 and mode 2 are described hereafter.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

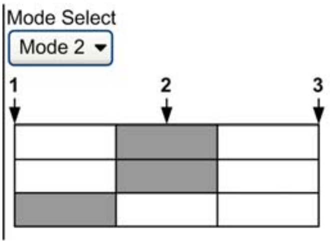
Table Mode 1 (2NO + 1 NC)



Position 1: enable switch fully released
Position 2: enable switch pressed to middle position
Position 3: enable switch fully pressed

	Position		
Input	1	2	3
IN1	0	1	0
IN2	0	1	0
IN3[1]	1	1	0
OUT	0	1	0
[1]only with 2NO + 1NC			

Table Mode 2 (2NO + 1 NC)



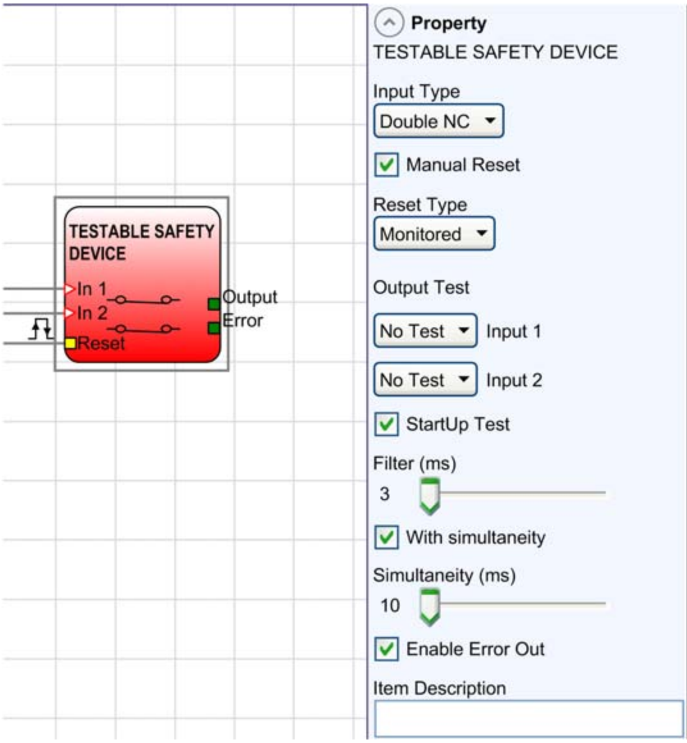
Position 1: enable switch fully released
Position 2: enable switch pressed to middle position
Position 3: enable switch fully pressed

	Position		
Input	1	2	3
IN1	0	1	0
IN2	0	1	0
IN3[1]	1	0	0
OUT	0	1	0
[1]only with 1NO + 1NC			

TESTABLE SAFETY DEVICE Function Block

Presentation

The TESTABLE SAFETY DEVICE function block monitors the inputs of a single or double channel safety sensor.



Parameters

The following table describes the parameters displayed in the **Property** pane:

Parameter	Description
Input Type	• **Single channel (NC)**: allows connection of single normally closed contacts. • **Single channel (NO)**: allows connection of single normally open contacts. • **Double channel NC**: allows connection of 2-channel normally closed contacts. • **Double channel NO + NC**: allows connection of two channels with one normally open and one normally closed contacts
Manual Reset	When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.
Reset Type	When **Manual** is selected, the function verifies the reset signal transition from 0 to 1. When **Monitored** is selected, the function verifies the reset signal transition from 0 to 1 to 0.
Output Test	The output tests are line monitoring detection for short circuit. The outputs provide a 24 Vdc supply with a specific periodic pulse (100 μs pulse every 5.5 ms) for each test output. When assigned to the various input channels, the inputs expect the specific periodic pulse from the specified test output. If the pulse is not received or a different pulse is received, the outputs of the function are set to FALSE. Once physical hardware inputs have been selected for the function, it is then possible to assign the appropriate test outputs which are fed into the associated inputs.
StartUp Test	If selected the function requires on power-up of machine the safety switch to be activated. This test is performed by activating and deactivating the safety switch.
Filter (ms)	Used to filter the input signals from the function block. The filter can be configured to 3...250 ms and is used to help eliminate bouncing on the contacts. The length of the filter affects the calculation of the unit total response time.
With Simultaneity	Is only available when 2-channel inputs are used. When selected, the function monitors the 2 channels switching if the synchronization is not below the synchronization (simultaneity) time, the function remains at FALSE. The maximum time (ms) between the switching of 2 channels can be configured between 10 to 7000 ms.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

Single NC and Single NO

Single NC

IN1	OUT
0	0
1	1

Double NC and double NO

Double NC

IN1	IN2	OUT	Synchronization error detected
0	0	0	–
0	1	0	X
1	0	0	X
1	1	1	–

Double NC / NO

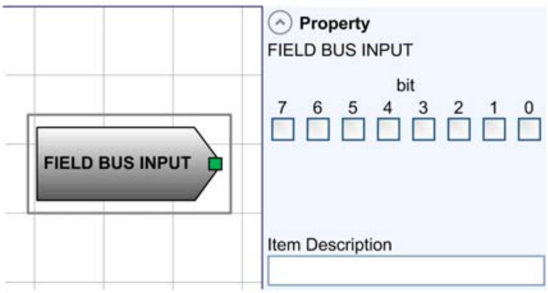
IN1	IN2	OUT	Synchronization error detected
0	0	0	X
0	1	0	–
1	0	1	–
1	1	0	X

FIELDBUS INPUT Function Block

Presentation

The FIELDBUS INPUT function permits an insertion of a non safety-related input from the fieldbus. Up to 8 fieldbus inputs can be used within a configuration. Each input must be configured defining the exact bit used within the properties window.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
Do not use the FIELDBUS INPUT as a safety-related input.
Failure to follow these instructions can result in death, serious injury, or equipment damage.



Parameters

The following table describes the parameters displayed in the **Property** pane:

Parameter	Description
bit selection	For each Fieldbus Input an individual bit must be selected (0-7) to set the address of the associated input.
Item Description	A-14 character text description of component function or name can be entered. The text is displayed above the function block.

`LL0` and `LL1` Functions

Presentation

The `LL0` 

and `LL1` 

functions allow a predefined logical level (binary constants) to be entered on a function block input.

- `LL0`: logical level 0 (FALSE)
- `LL1`: logical level 1 (TRUE)

Section 13.2
Speed Monitoring Function Blocks

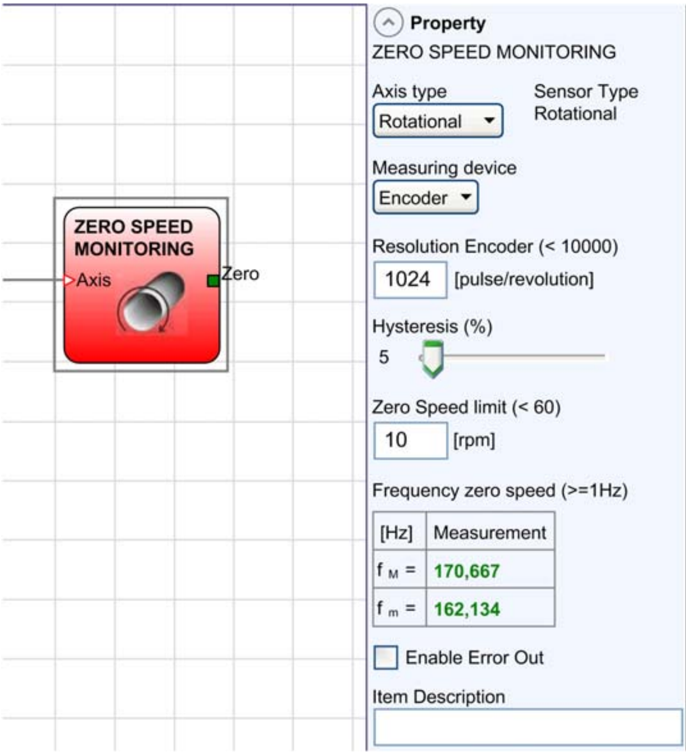
What Is in This Section?

This section contains the following topics:

ZERO SPEED MONITORING Function Block

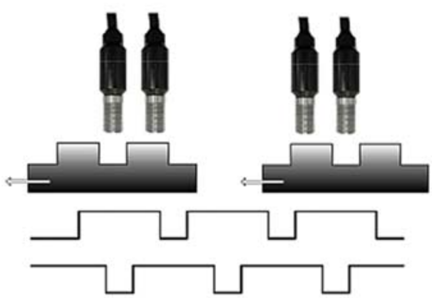
Presentation

The ZERO SPEED MONITORING function block monitors the speed of a device, generating an output set to TRUE when the speed is lower than a selected value.



Parameters

Parameter	Description
Axis type	Defines the type of axis monitored by the motor. ● **Linear**: must be selected for translation. ● **Rotational**: must be selected for rotation.
Sensor Type	If the **Axis type** parameter is **Linear**, the **Sensor Type** defines the type of sensor connected to the module inputs. The **Sensor Type** can be, for example, a shaft encoder for a **Rotational Axis type** or an optical array for a **Linear Axis type**.

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Measuring device</td><td>It defines the type of sensor used. You can select:
Encoder
Proximity
Encoder + Proximity
Proximity1 + Proximity2
Encoder1 + Encoder2</td></tr>
<tr><td>Pitch</td><td>If the Axis type selected is Linear with a Rotational Sensor Type, this field allows you to enter the sensor pitch to obtain a conversion between sensor revolutions and distance traveled.</td></tr>
<tr><td>Proximity choice</td><td>This parameter is active if Proximity is selected as Measuring device.
The type of proximity sensor can be selected from PNP, NPN, Normally Open (NO) and Normally Closed (NC), with 3 or 4 wires.
No Proxy:
PNP 3 - wire NC
PNP 3 - wire NO
NPN 3 - wire NO
NPN 3 - wire NC
PNP 4 - wire NC/NO
NPN 4 - wire NC/NO
PNP/NPN 4 - wire NC/NC
PNP/NPN 4 - wire NO/NO</td></tr>
<tr><td>Proximity interleaved</td><td>This option is available if a single axis is monitored by 2 proximity sensors (Proximity1 + Proximity2).
If this option is used, an input condition with both sensors signals LOW at the same time is detected as an input error, for example, no sensor signal. Conditions for using this option:
The proximity sensors must be mounted in such a way that the HIGH signals overlap.
The proximity sensors must be mounted in such a way that at least one of the two signals is HIGH at any given point in time.
You must use PNP proximity sensors.
The proximity sensors must be of type NO (normally open).
</td></tr>
</table>

Parameter	Description
Resolution	Enter in this field the number of pulses/revolution (in the case of rotary sensor) or µm/pulse (linear sensor) relating to the sensor used.
Verification	This parameter is active if there are two sensors on the selected axis. Enter in this field the number of pulses/revolution (in the case of rotary sensor) or µm/pulse (linear sensor) relating to the second sensor used.
Gear Ratio	This parameter is active if there are two sensors on the selected axis. This parameter allows you to enter the ratio between the two sensors. If both sensors are on the same moving parts, the ratio is 1; otherwise the number corresponding to the ratio must be entered. Example: there is an encoder and a proximity switch, and the latter is on a moving part that (due to a gear reduction ratio) rotates at twice the speed of the encoder. Therefore, this value must be set at 2.
Hysteresis (%)	It represents the percentage hysteresis value below which the speed change is filtered. Enter a value other than 1 to avoid continuous switching as the input changes.
Zero speed limit	Enter in this field the maximum speed value above which output of the function block `Zero` is set to FALSE. If the measured speed is less than the set value, the output `Zero` of the function block is set to TRUE.
Frequency zero speed	It shows the maximum calculated frequency values fM and fm (decreased by the hysteresis set). If the displayed value is green, the calculation of frequency gave a positive result. If the displayed value is red, it is necessary to change the parameters given in the following formulas. Rotary axis, rotary sensor. The frequency obtained is: $f[Hz] = \frac{rpm\,[rev/min]}{60} \times Resolution\,[pulses/rev]$ Linear axis, rotary sensor. The frequency obtained is: $f[Hz] = \frac{speed\,[m/min] \times 1000}{60 \times pitch\,[mm/rev]} \times Resolution\,[pulses/rev]$ Linear axis, linear sensor. The frequency obtained is: $f[Hz] = \frac{speed\,[mm/s] \times 1000}{Resolution\,[\mu m/pulse]}$ **f** frequency **Rpm** rotational speed **Resolution** measurement **Speed** linear speed **Pitch** sensor pitch **NOTE:** The hysteresis must be changed only if: f_M=green; f_m=red.

⚠ WARNING

LOSS OF DESIGNATED SAFETY FUNCTION

Ensure that the response of the system matches your machine requirements when using `Speed Monitoring` function blocks.

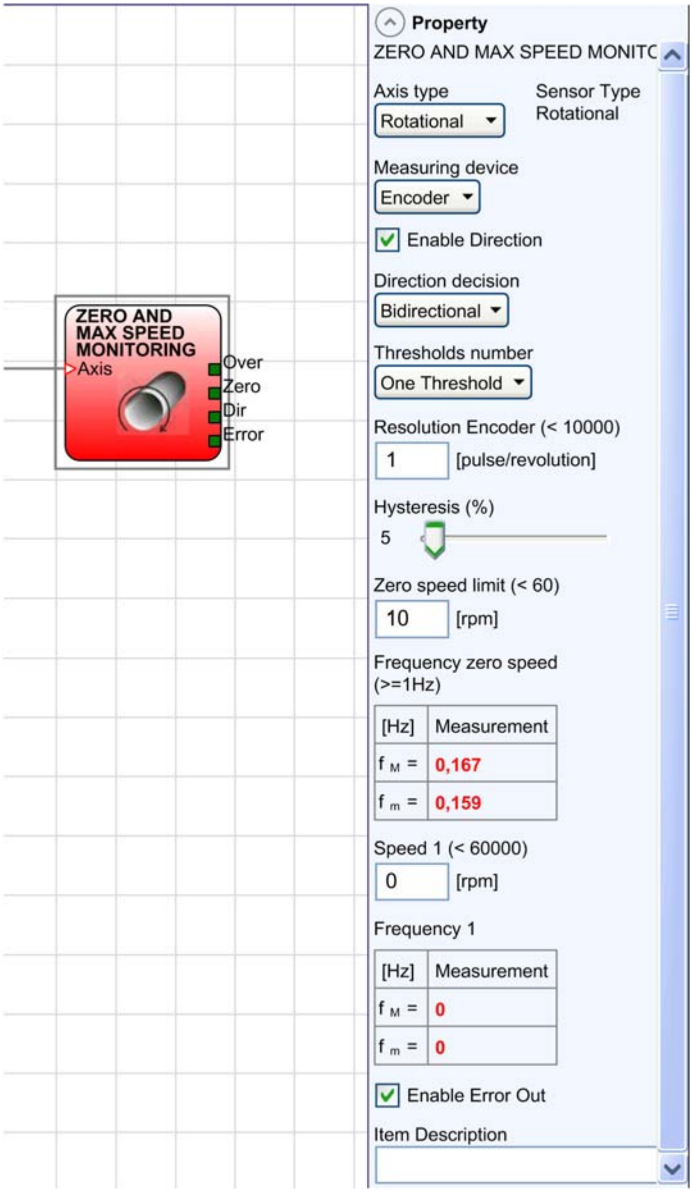
Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTE: The Modular Safety Controller response time can exceed 300 ms. You must make functional, empirical tests to verify the response time.

ZERO AND MAX SPEED MONITORING Function Block

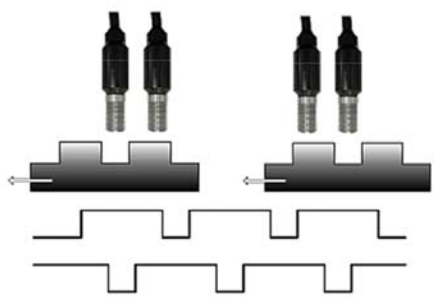
Presentation

The ZERO AND MAX SPEED MONITORING function block monitors the speed of a device, generating the output ZERO set to TRUE when the speed is lower than a selected value. In addition, it generates the output OVER set to FALSE if the measured speed exceeds a predetermined threshold.


ZERO AND MAX SPEED MONITORING
Axis
Over
Zero
Dir
Error
Property
ZERO AND MAX SPEED MONITC
Axis type
Rotational
Sensor Type
Rotational
Measuring device
Encoder
Enable Direction
Direction decision
Bidirectional
Thresholds number
One Threshold
Resolution Encoder (< 10000)
1
[pulse/revolution]
Hysteresis (%)
5
Zero speed limit (< 60)
10
[rpm]
Frequency zero speed (>=1Hz)
[Hz] Measurement
f M = 0,167
f m = 0,159
Speed 1 (< 60000)
0
[rpm]
Frequency 1
[Hz] Measurement
f M = 0
f m = 0
Enable Error Out
Item Description

Parameters

Parameter	Description
Axis type	Defines the type of axis monitored by the device. • **Linear**: must be selected for translation. • **Rotational**: must be selected for rotation.
Sensor Type	If the **Axis type** parameter is **Linear**, the **Sensor Type** defines the type of sensor connected to the module inputs. The **Sensor Type** can be, for example, a shaft encoder for a **Rotational Axis type** or an optical array for a **Linear Axis type**.
Measuring device	Defines the type of sensor used. You can select: • **Encoder** • **Proximity** • **Encoder + Proximity** • **Proximity1 + Proximity2** • **Encoder1 + Encoder2**
Enable direction	Enabling this parameter, the `DIR` output is enabled on the function block. This output is set to TRUE when the axis rotates counterclockwise and is set to FALSE when the axis rotates clockwise.
Direction decision	Defines the direction of rotation for which the set thresholds are made active: • **Bidirectional** • **Clockwise** • **Counterclockwise** If **Bidirectional** is selected, the excess of the set threshold is detected whether the axis rotates clockwise or counterclockwise. **Clockwise** or **Counterclockwise** is only detected when the axis rotates in the selected direction.
Thresholds number	It allows you to enter the number of thresholds for the maximum value of speed. Changing this value increases/decreases the number of thresholds that can be entered from a minimum of 1 to a maximum of 4. In the case of more than 1 threshold, the input pins for the selection of the specific threshold appear in the lower part of the function block. Refer to Threshold Settings *(see page 331)*.
Pitch	If the **Axis type** selected is **Linear** with a **Rotational Sensor Type**, this field allows to enter the sensor pitch to obtain a conversion between sensor revolutions and distance traveled.

Parameter	Description
Proximity choice	This parameter is active if **Proximity** is selected as **Measuring device**. The type of proximity sensor can be selected from PNP, NPN, Normally Open (NO), and Normally Closed (NC), with 3 or 4 wires: **No Proxy**: ● PNP 3 - wire NC ● PNP 3 - wire NO ● NPN 3 - wire NO ● NPN 3 - wire NC ● PNP 4 - wire NC/NO ● NPN 4 - wire NC/NO ● PNP/NPN 4 - wire NC/NC ● PNP/NPN 4 - wire NO/NO
Proximity interleaved	This option is available if a single axis is monitored by 2 proximity sensors (Proximity1 + Proximity2). If this option is used, an input condition with both sensors signals LOW at the same time is detected as an input error, for example, no sensor signal. Conditions for using this option: ● The proximity sensors must be mounted in such a way that the HIGH signals overlap. ● The proximity sensors must be mounted in such a way that at least one of the two signals is HIGH at any given point in time. ● You must use PNP proximity sensors. ● The proximity sensors must be of type NO (normally open). 
Resolution	Enter in this field the number of pulses/revolution (in the case of rotary sensor) or µm/pulse (linear sensor) relating to the sensor used.
Verification	This parameter is active if there are two sensors on the selected axis. Enter in this field the number of pulses/revolution (in the case of rotary sensor) or µm/pulse (linear sensor) relating to the second sensor used.

Parameter	Description
Gear Ratio	This parameter is active if there are two sensors on the selected axis. This parameter allows you to enter the ratio between the two sensors. If both sensors are on the same moving parts, the ratio is 1; otherwise the number corresponding to the ratio must be entered. Example: there is an encoder and a proximity switch, and the latter is on a moving part that (due to a gear reduction ratio) rotates at twice the speed of the encoder. Therefore, this value must be set at 2.
Hysteresis (%)	It represents the percentage hysteresis value below which the speed change is filtered. Enter a value other than 1 to avoid continuous switching as the input changes.
Zero speed limit	Enter in this field the maximum speed value above which the output of the function block `Zero` is set to FALSE. If the measured speed is less than the set value, the output `Zero` of the function block is set to TRUE.
Speed 1, 2, 3, 4	Enter in this field the maximum speed value above which the function block output `Over` is set to FALSE. If the measured speed is less than the set value, the function block output `Over` is set to TRUE.
Frequency zero speed / Frequency1 / Frequency2	Shows the maximum calculated frequency values f_M and f_m (decreased by the hysteresis set). If the displayed value is green, the calculation of frequency gave a positive result. If the displayed value is red, it is necessary to change the parameters given in the following formulas: Rotary axis, rotary sensor. The frequency obtained is: $f[Hz] = \frac{rpm\ [rev / min]}{60} \times Resolution\ [pulses / rev]$ Linear axis, rotary sensor. The frequency obtained is: $f[Hz] = \frac{speed\ [m / min] \times 1000}{60 \times pitch\ [mm / rev]} \times Resolution\ [pulses / rev]$ Linear axis, linear sensor. The frequency obtained is: $f[Hz] = \frac{speed\ [mm / s] \times 1000}{Resolution\ [\mu m / pulse]}$ **f** frequency **Rpm** rotational speed **Resolution** measurement **Speed** linear speed **Pitch** sensor pitch **NOTE:** The hysteresis must be changed only if: f_M=green; f_m=red.

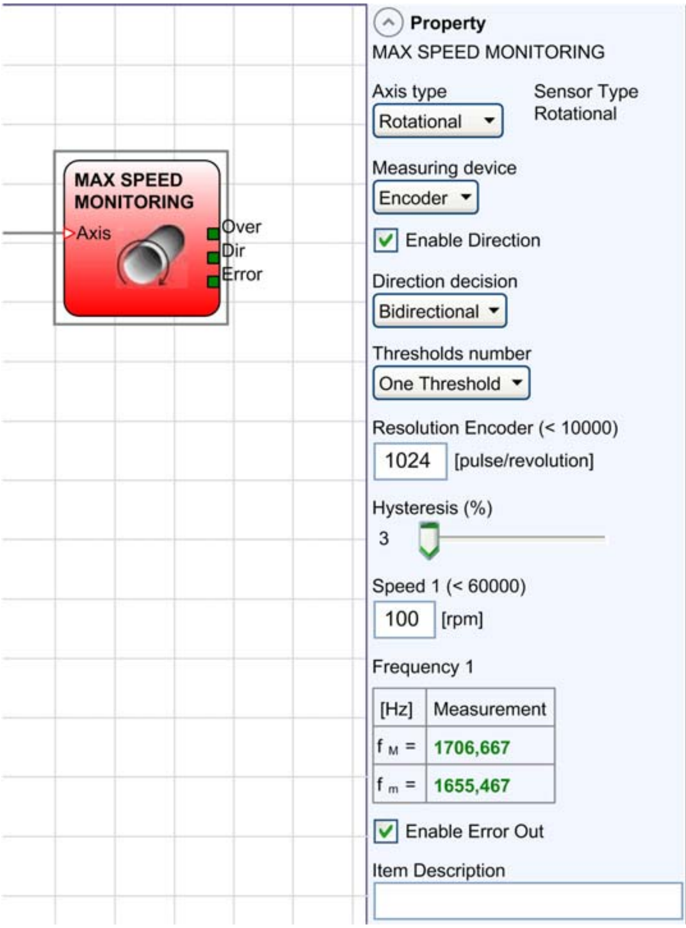
⚠ WARNING
LOSS OF DESIGNATED SAFETY FUNCTION Ensure that the response of the system matches your machine requirements when using `Speed Monitoring` function blocks. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

NOTE: The Modular Safety Controller response time can exceed 300 ms. You must make functional, empirical tests to verify the response time.

`MAX SPEED MONITORING` Function Block

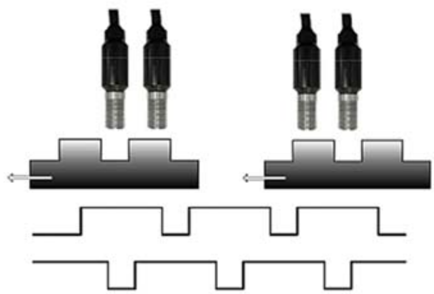
Presentation

The `MAX SPEED MONITORING` function block monitors the speed of a motor generating an output set to FALSE when the measured speed exceeds a predetermined threshold. If the speed is below the predetermined threshold, the output is set to TRUE.



Parameters

Parameter	Description
Axis type	Defines the type of axis monitored by the motor. ● **Linear**: must be selected for translation. ● **Rotational**: must be selected for rotation.
Sensor Type	If the **Axis type** parameter is **Linear**, the **Sensor Type** defines the type of sensor connected to the module inputs. The **Sensor Type** can be, for example, a shaft encoder for a **Rotational Axis type** or an optical array for a **Linear Axis type**.
Measuring device	Defines the type of sensor used. The possible choices are: ● **Encoder** ● **Proximity** ● **Encoder + Proximity** ● **Proximity1 + Proximity2** ● **Encoder1 + Encoder2**
Enable direction	This parameter is active if **Encoder** is selected as **Measuring device**. Enabling this parameter, the `DIR` output is enabled on the function block. This output is set to TRUE when the axis rotates counterclockwise, and it is set to FALSE when the axis rotates clockwise.
Direction decision	Defines the direction of rotation for which the set thresholds are made active. The possible choices are: ● **Bidirectional** ● **Clockwise** ● **Counterclockwise** If **Bidirectional** is selected, the excess of the set threshold is detected whether the axis rotates clockwise or counterclockwise. **Clockwise** or **Counterclockwise** is only detected when the axis rotates in the selected direction.
Thresholds number	Allows the number of thresholds to be entered for the maximum value of speed *(see page 331)*. Changing this value increases/decreases the number of thresholds that can be entered from a minimum of 1 to a maximum of 4 (see below). In the case of more than one threshold, the input pins for the selection of the specific threshold appears in the lower part of the function block.
Pitch	If the **Axis type** selected is **Linear** with a **Rotational Sensor Type**, this field allows you to enter the sensor pitch to obtain a conversion between sensor revolutions and distance traveled.

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Proximity choice</td><td>This parameter is active if Proximity is selected as Measuring device.
The type of proximity sensor can be selected from PNP, NPN, Normally Open (NO), and Normally Closed (NC), with 3 or 4 wires.
No Proxy:
PNP 3 - wire NC
PNP 3 - wire NO
NPN 3 - wire NO
NPN 3 - wire NC
PNP 4 - wire NC/NO
NPN 4 - wire NC/NO
PNP/NPN 4 - wire NC/NC
PNP/NPN 4 - wire NO/NO</td></tr>
<tr><td>Proximity interleaved</td><td>This option is available if a single axis is monitored by 2 proximity sensors (Proximity1 + Proximity2).
If this option is used, an input condition with both sensors signals LOW at the same time is detected as an input error, for example, no sensor signal. Conditions for using this option:
The proximity sensors must be mounted in such a way that the HIGH signals overlap.
The proximity sensors must be mounted in such a way that at least one of the two signals is HIGH at any given point in time.
You must use PNP proximity sensors.
The proximity sensors must be of type NO (normally open).
</td></tr>
<tr><td>Resolution</td><td>Enter in this field the number of pulses/revolution (in the case of rotary sensor) or µm/pulse (linear sensor) relating to the sensor used.</td></tr>
<tr><td>Verification</td><td>This parameter is active if there are two sensors on the selected axis. Enter in this field the number of pulses/revolution (in the case of rotary sensor) or µm/pulse (linear sensor) relating to the second sensor used.</td></tr>
</table>

Parameter	Description
Gear Ratio	This parameter is active if there are two sensors on the selected axis. This parameter allows you to enter the ratio between the two sensors. If both sensors are on the same moving parts, the ratio is 1; otherwise the number corresponding to the ratio must be entered. Example: there is an encoder and a proximity switch, and the latter is on a moving part that (due to a gear reduction ratio) rotates at twice the speed of the encoder. Therefore, this value must be set at 2.
Hysteresis (%)	It represents the percentage hysteresis value below which the speed change is filtered. Enter a value other than 1 to avoid continuous switching as the input changes.
Speed 1, 2, 3, 4	Enter in this field the maximum speed value above which the function block output `Over` is set to FALSE. If the measured speed is less than the set value, the function block output `Over` is set to TRUE.
Frequency	It shows the maximum calculated frequency values f_M and f_m (decreased by the hysteresis set). If the displayed value is green, the calculation of frequency is a positive value. If the displayed value is red, it is necessary to change the parameters given in the following formulas: Rotary axis, rotary sensor. The frequency obtained is: $f[Hz] = \frac{rpm\,[rev/min]}{60} \times Resolution\,[pulses/rev]$ Linear axis, rotary sensor. The frequency obtained is: $f[Hz] = \frac{speed\,[m/min] \times 1000}{60 \times pitch\,[mm/rev]} \times Resolution\,[pulses/rev]$ Linear axis, linear sensor. The frequency obtained is: $f[Hz] = \frac{speed\,[mm/s] \times 1000}{Resolution\,[\mu m/pulse]}$ **f** frequency **Rpm** rotational speed **Resolution** measurement **Speed** linear speed **Pitch** sensor pitch **NOTE:** The hysteresis must be changed only if: f_M=green; f_m=red.

Threshold number

2 threshold settings:

IN1	Threshold number
0	Speed 1
1	Speed 2

4 threshold settings:

IN2	IN1	Threshold number
0	0	Speed 1
0	1	Speed 2
1	0	Speed 3
1	1	Speed 4

WARNING

LOSS OF DESIGNATED SAFETY FUNCTION

Ensure that the response of the system matches your machine requirements when using `Speed Monitoring` function blocks.

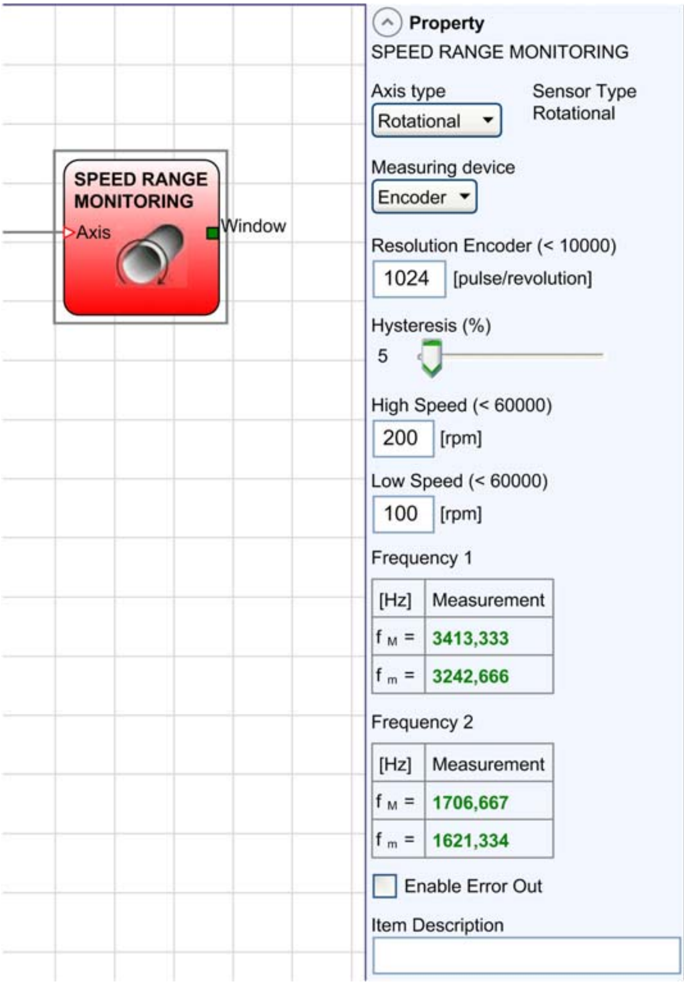
Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTE: The Modular Safety Controller response time can exceed 300 ms. You must make functional, empirical tests to verify the response time.

`SPEED RANGE MONITORING` Function Block

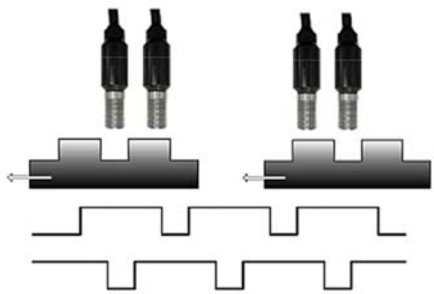
Presentation

The `SPEED RANGE MONITORING` function block monitors the speed of a device, generating an output set to TRUE when the speed is within a prefixed range.



Parameters

Parameter	Description
Axis type	Defines the type of axis monitored by the motor: ● **Linear**: must be selected for translation. ● **Rotational**: must be selected for rotation.
Sensor Type	If the **Axis type** parameter is **Linear**, the **Sensor Type** defines the type of sensor connected to the module inputs. The **Sensor Type** can be, for example, a shaft encoder for a **Rotational Axis type** or an optical array for a **Linear Axis type**.
Measuring device	Defines the type of sensor used. You can select: ● **Encoder** ● **Proximity** ● **Encoder + Proximity** ● **Proximity1 + Proximity2** ● **Encoder1 + Encoder2**
Pitch	If the **Axis type** selected is **Linear** with a **Rotational Sensor Type**, this field allows to enter the sensor pitch to obtain a conversion between sensor revolutions and distance traveled.
Proximity choice	This parameter is active if **Proximity** is selected as **Measuring device**. The type of proximity sensor can be selected from PNP, NPN, Normally Open (NO), and Normally Closed (NC), with 3 or 4 wires. **No Proxy**: ● PNP 3 - wire NC ● PNP 3 - wire NO ● NPN 3 - wire NO ● NPN 3 - wire NC ● PNP 4 - wire NC/NO ● NPN 4 - wire NC/NO ● PNP/NPN 4 - wire NC/NC ● PNP/NPN 4 - wire NO/NO

Parameter	Description
Proximity interleaved	This option is available if a single axis is monitored by 2 proximity sensors (Proximity1 + Proximity2). If this option is used, an input condition with both sensors signals LOW at the same time is detected as an input error, for example, no sensor signal. Conditions for using this option: ● The proximity sensors must be mounted in such a way that the HIGH signals overlap. ● The proximity sensors must be mounted in such a way that at least one of the two signals is HIGH at any given point in time. ● You must use PNP proximity sensors. ● The proximity sensors must be of type NO (normally open). 
Resolution	Enter in this field the number of pulses/revolution (in the case of rotary sensor) or µm/pulse (linear sensor) relating to the sensor used.
Verification	This parameter is active if there are two sensors on the selected axis. Enter in this field the number of pulses/revolution (in the case of rotary sensor) or µm/pulse (linear sensor) relating to the second sensor used.
Gear Ratio	This parameter is active if there are two sensors on the selected axis. This parameter allows you to enter the ratio between the two sensors. If both sensors are on the same moving parts, the ratio is 1; otherwise the number corresponding to the ratio must be entered. Example: there is an encoder and a proximity switch, and the latter is on a moving part that (due to a gear reduction ratio) rotates at twice the speed of the encoder. Therefore, this value must be set at 2.
Hysteresis (%)	It represents the percentage hysteresis value below which the speed change is filtered. Enter a value other than 1 to avoid continuous switching as the input changes.
High Speed	Enter in this field the maximum speed value above which the `Window` output of the function block is set to FALSE. If the measured speed is less than the set value, the `Window` output of the function block is set to TRUE.

Parameter	Description
Low Speed	Enter in this field the minimum speed value below which the `Window` output of the function block is set to FALSE. If the measured speed is more than the set value, the `Window` output of the function block is set to FALSE. Rotary axis, rotary sensor. The frequency obtained is: $f[Hz] = \frac{rpm\,[rev / min]}{60} \times Resolution\,[pulses / rev]$ Linear axis, rotary sensor. The frequency obtained is: $f[Hz] = \frac{speed\,[m / min] \times 1000}{60 \times pitch\,[mm / rev]} \times Resolution\,[pulses / rev]$ Linear axis, linear sensor. The frequency obtained is: $f[Hz] = \frac{speed\,[mm / s] \times 1000}{Resolution\,[\mu m / pulse]}$ **f** frequency **Rpm** rotational speed **Resolution** measurement **Speed** linear speed **Pitch** sensor pitch **NOTE:** The hysteresis must be changed only if: f_M=green; f_m=red.

⚠ WARNING

LOSS OF DESIGNATED SAFETY FUNCTION

Ensure that the response of the system matches your machine requirements when using `Speed Monitoring` function blocks.

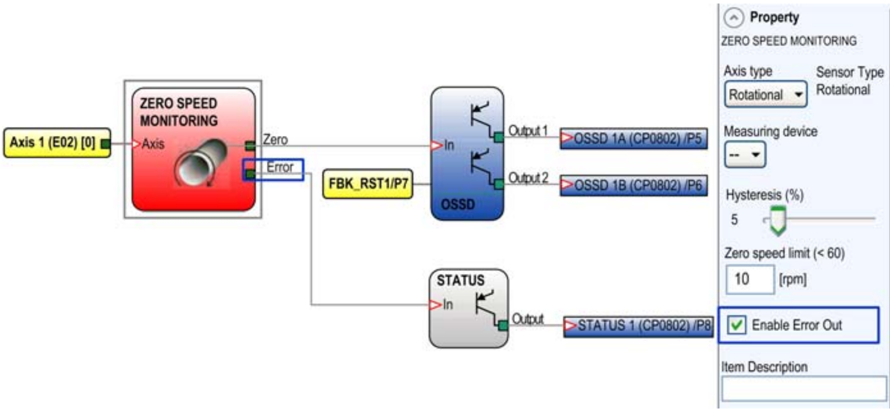
Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTE: The Modular Safety Controller response time can exceed 300 ms. You must make functional, empirical tests to verify the response time.

Detection of Encoder and Proximity Sensor Errors

Presentation

An external error deriving from an encoder, proximity sensor, or wiring does not necessarily involve a change of status of the output `Zero` on the function block.



The detected errors of an encoder, proximity sensor, or wiring are recognized by the speed monitoring module managed and specified by the `Error Out` diagnostic bit on every function block. To enable the `Error Out`, select the **Enable Error Out** option within the **Property** menu from the `Speed Monitoring` function block.

⚠ WARNING
LOSS OF DESIGNATED SAFETY FUNCTION
Use the diagnostic bit `Error Out` in the configuration program to deactivate the outputs if an error is detected while the axis is working using speed monitoring.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

In absence of errors detected on an encoder or proximity sensor, the `Error Out` is equal to 0 (FALSE).

In the presence of an encoder or proximity sensor errors, the `Error Out` is equal to 1 (TRUE) in the following conditions:
- Non-detection of encoder or proximity sensor.
- Non-detection of one or more wirings from encoder or proximity sensor.
- Non-detection of encoder power supply (only with TTL speed monitoring module).
- Error of congruence frequencies detected between signals from encoder or proximity sensor.
- Phase error detected between signals from the encoder or duty cycle error of a single phase.

Section 13.3
Output Function Blocks

What Is in This Section?

This section contains the following topics:

Solid-State Safety Output (OSSD)

Presentation

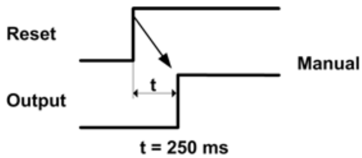
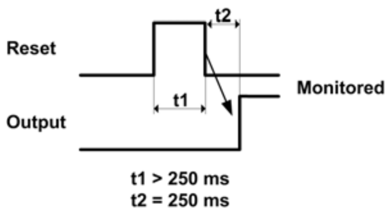
The OSSD (Output Signal Switching Device) semiconductor safety-related outputs require no maintenance, Output1 and Output2 supply 24 Vdc if the input is set to TRUE, whereas they supply 0 Vdc if the input is set to FALSE.

NOTE: Each pair of solid-state safety-related output (OSSD) has a RESTART input. This input must be connected as described in paragraph RESTART *(see page 51)*.

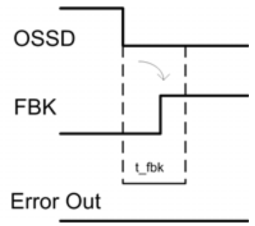
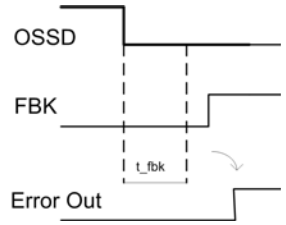
Parameters

The following table describes the parameters displayed in **Property** pane:

Parameter	Description
Manual Reset	When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.

Parameter	Description
Reset Type	• **Manual**:if selected, the system only verifies the signal transition from 0 to 1. • **Monitored**: If selected, the system verifies the double transition from 0 to 1 and then back to 0.  
Enable Status	If selected, enables the function block Status output indicating the state of the `OSSD` outputs.
External K time monitoring	If selected, enables the setting of the time window within which the external feedback signal is monitored. • When the Outputs transition to TRUE, feedback signal (`FBK_RST`) must transition from FALSE to TRUE within the specified time. • Otherwise, Outputs are set to FALSE and the error is indicated on the Modular Safety Controller by flashing the CLEAR LED corresponding to the OSSD.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block. **NOTE:** The Error Out signal is reset in the following cases: • Power cycle of the system. • Activation of the RESET function.
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

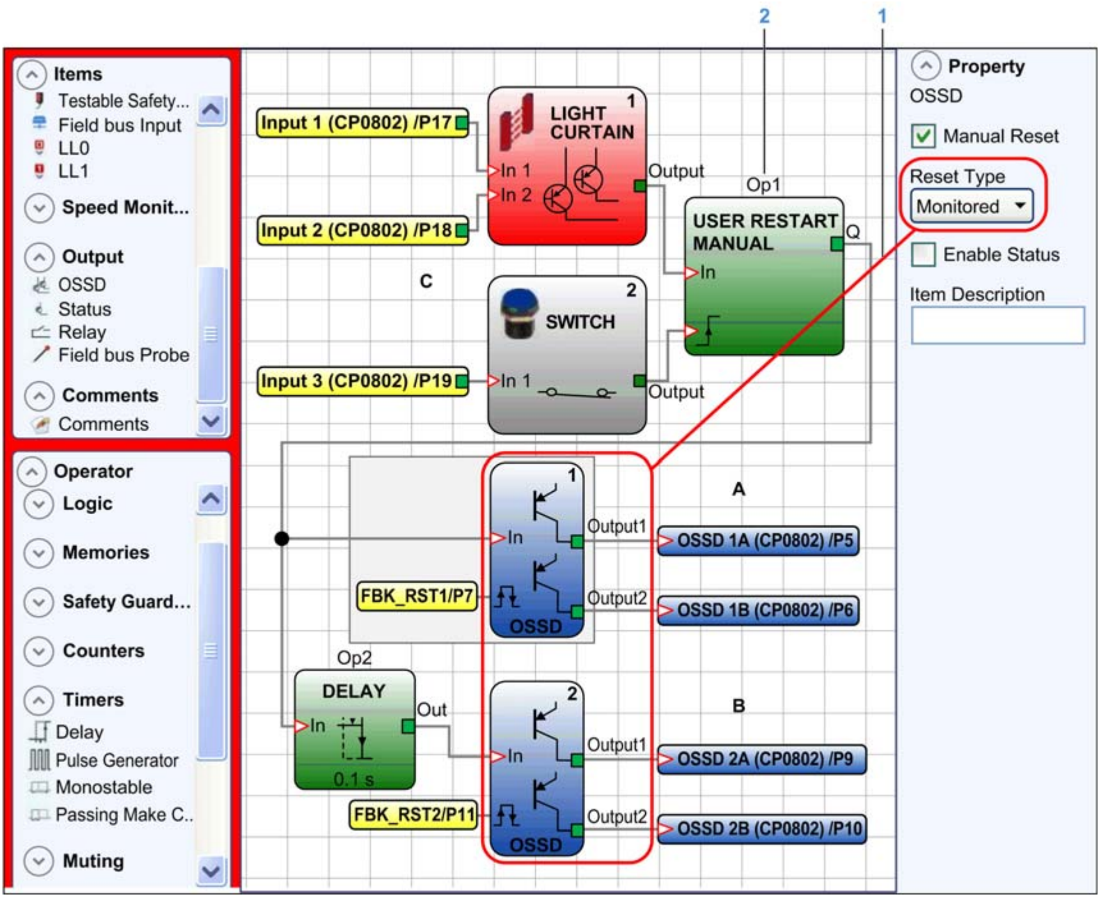
Example of Output Timing

Example of OSSD with correct feedback signal.	`Error Out` set to FALSE: 
Example of OSSD with incorrect feedback signal (K external time exceeded).	`Error Out` set to TRUE: 

Example for Output Delay with `USER RESTART MANUAL`

Presentation

To configure two solid-state safety-related (`OSSD`) outputs with one of them delayed (`USER RESTART MANUAL`), use the following configuration:



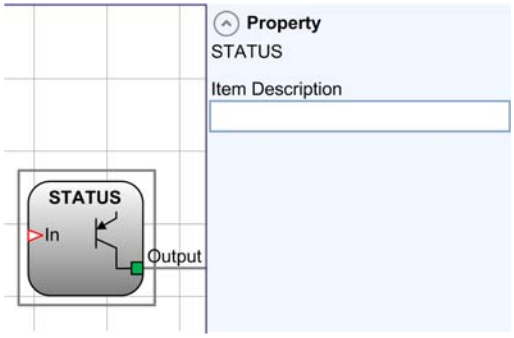
1 If you use the operating logic `DELAY` the two outputs have to be programmed with reset type **Monitored**.
2 The function `USER RESTART MANUAL` must be used.

NOTE: A physically connected restart push button must be connected to the inputs `RESTART1/2` of the solid-state safety-related output `OSSD A` and `OSSD B` used and to the `INPUT3 (C)`.

STATUS Function Block

Presentation

The STATUS output function block is a non-safety-related diagnostic output (not implicated in the prescribed safety-related function) and is intended to be connected only for diagnostic purposes. The function block can be used to monitor any point within the configuration by connecting it to the input of the STATUS function block. The output returns 24 Vdc if the input is set to TRUE, or 0 Vdc if the input is set to FALSE.



⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
Do not use the STATUS function block as a safety-related output.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Parameters

The following table describes the parameters displayed in the **Property** pane:

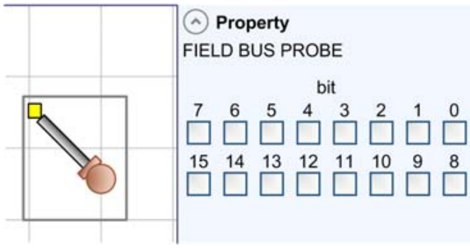
Parameter	Description
Item Description	A 14-character text description of component function or name can be entered. The text is displayed above.

`FIELD BUS PROBE` Element

Presentation

The `FIELD BUS PROBE` is an element that allows to display the state of any point of the wiring diagram on the fieldbus.

Up to 16 fieldbus probes can be inserted and the bit on which state is represented must be entered for each. The fieldbus probe states are represented with 2 bytes on the fieldbus.



⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
Do not use the `FIELDBUS PROBE` as a safety-related element.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Parameters

The following table describes the parameters displayed in the **Property** pane:

Parameter	Description
bit selection	For each Fieldbus probe an individual bit must be selected (0-15) to set the address of the associated probe

RELAY Function Block

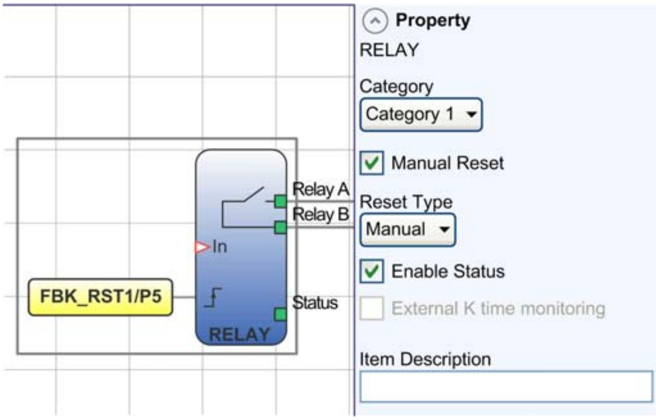
Presentation

The RELAY function is a normally open relay output. Relay outputs are closed when the input In is set to TRUE, otherwise the outputs are set to FALSE.

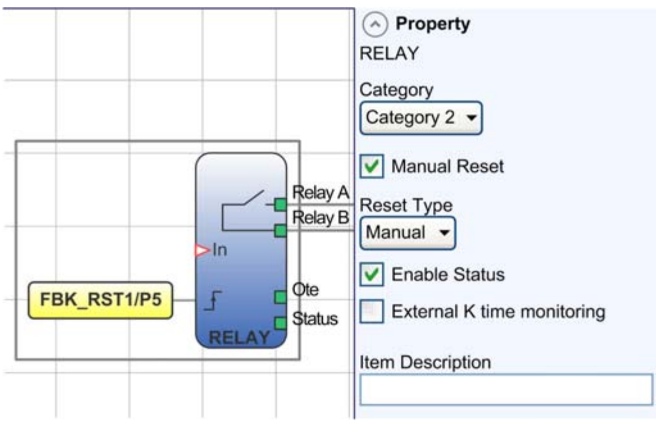
The RELAY output is only used with the modules XPSMCMRO0004• and XPSMCMRO0004DA•.

When using either of the modules XPSMCMRO0004• or XPSMCMRO0004DA•, it is possible to set the category of architecture used to 1, 2 and 4.

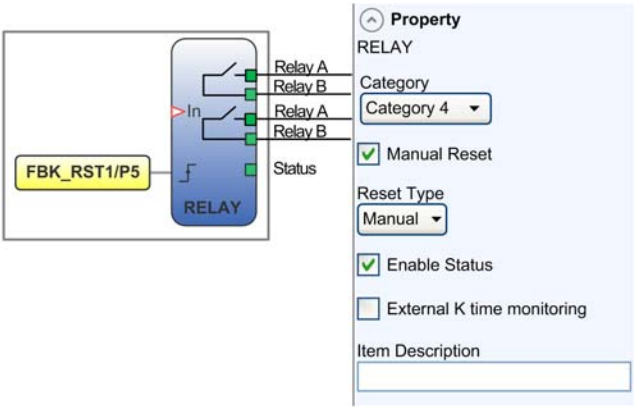
The following graphic displays **Category 1**:



The following graphic displays **Category 2**:



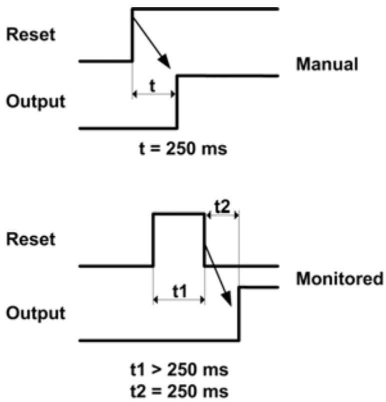
The following graphic displays **Category 4**:



Parameters

The following table describes the parameters displayed in **Property** pane:

Parameter	Description
Category 1	Outputs with single category 1 relay. Each unit may have up to 4 of these outputs. Internal relays are monitored. External device monitoring feedback is not used as it is not required for **Category 1**, and each output can be set as **Auto** or **Manual** Restart.
Category 2	Outputs with single category 2 relay with OTE (Output Test Equipment) outputs. Each unit can have up to 4 of these outputs. The OTE output is normally 1 (TRUE), except in the case of an internal error or an error associated with feedback from the external contactors (FALSE). Internal relays are monitored. External device monitoring feedback is required for **Category 2**, and each output can be set as **Auto** or **Manual** Restart. **NOTE:** The external device monitoring feedback cannot be activated with the manual restart. To monitor the external device feedback the automatic reset must be selected. OTE: ● OTE is activated as it is necessary to comply with category 2 wiring architectures to increase diagnostic coverage (DC) in accordance to ISO 13849-1. ● OTE output is normally 1 (TRUE). In the case of an internal error or external device monitoring error, the OTE output changes to 0 (FALSE).

Parameter	Description
Category 4	Outputs with two category 4 relays. Each unit can have up to 2 of these outputs. With this output, the relays are controlled in pairs. Double internal relays are always monitored and each output can be set as **Auto** or **Manual** Restart.
Manual Reset	When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.
Reset Type	When **Manual** is selected, the function verifies the reset signal transition from 0 to 1. When **Monitored** is selected, the function verifies the reset signal transition from 0 to 1 to 0. 
Enable Status	If selected, this enables the connection of the state of the relay outputs to a STATUS function block.
External K time monitoring	When this is selected, it enables reading and verification of external contactor switching times: ● With category 1, control of external contactors cannot be enabled. ● With category 4, control of external contactors is mandatory (always enabled).
Item Description	14-character text description of component function or name can be entered. The text is displayed above the function block.

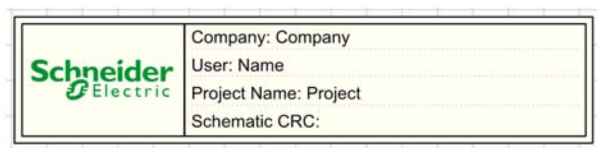
Section 13.4
Comment Function Blocks

`COMMENTS` and `TITLE` Function Blocks

Comments and Titles for Configurations

The objects `COMMENTS` `TITLE` (which are not function blocks in the strict sense of the term) allow you to create titles for configurations and annotate them with comments.

The following table describes the objects that can be used to provide additional information on a configuration:

Object	Description
Comments	This object can be used to add comments anywhere in a configuration diagram. 
Title	This object can be used to add title information to a configuration diagram. 

Chapter 14
Operator Function Blocks

What Is in This Chapter?

This chapter contains the following sections:

Section 14.1
Logical Operators

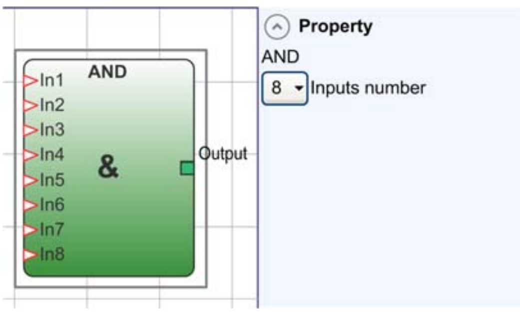
The total number of operator function blocks which can be used within an application is 64.

What Is in This Section?

This section contains the following topics:

AND

Presentation



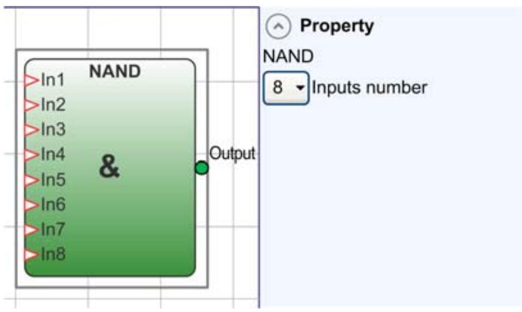
Logical AND returns an output of 1 (TRUE) if all the inputs are 1 (TRUE).

In_1	In_2	In_x	Out
0	0	0	0
1	0	0	0
0	1	0	0
1	1	0	0
0	0	1	0
1	0	1	0
0	1	1	0
1	1	1	1

The **Inputs number** can be set from 2 to 8.

NAND

Presentation



Logical NAND returns an output of 0 (FALSE) if all the inputs are 1 (TRUE).

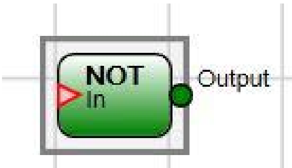
In_1	In_2	In_x	Out
0	0	0	1
1	0	0	1
0	1	0	1
1	1	0	1
0	0	1	1
1	0	1	1
0	1	1	1

In_1	In_2	In_x	Out
1	1	1	0

The **Inputs number** can be set from 2 to 8.

NOT

Presentation

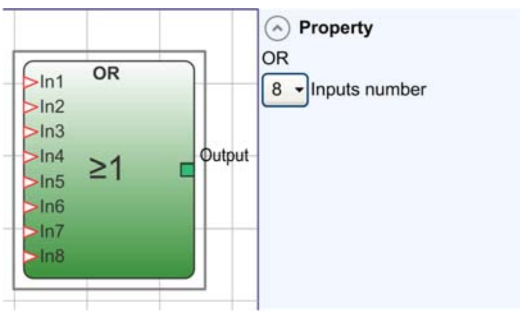


Logical NOT inverts the logical state of the input.

In	Out
0	1
1	0

OR

Presentation



Logical OR returns an output of 1 (TRUE) if at least one of the inputs is 1 (TRUE).

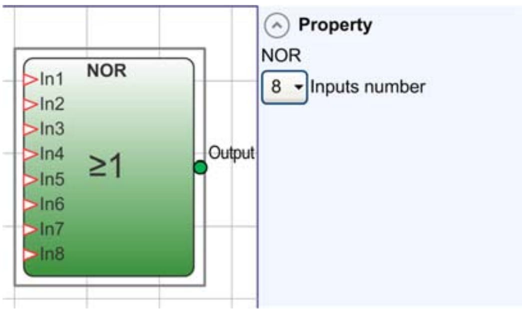
In_1	In_2	In_x	Out
0	0	0	0

In_1	In_2	In_x	Out
1	0	0	1
0	1	0	1
1	1	0	1
0	0	1	1
1	0	1	1
0	1	1	1
1	1	1	1

The **Inputs number** can be set from 2 to 8.

NOR

Presentation



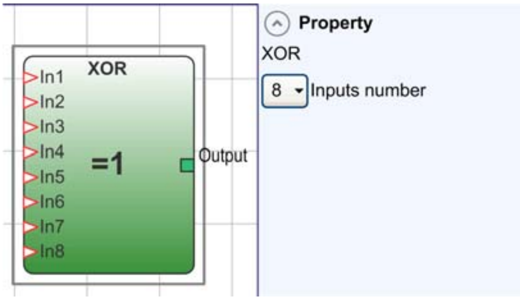
Logical `NOR` returns an output of 0 (FALSE) if at least one of the inputs is 1 (TRUE).

In_1	In_2	In_x	Out
0	0	0	1
1	0	0	0
0	1	0	0
1	1	0	0
0	0	1	0
1	0	1	0
0	1	1	0
1	1	1	0

The **Inputs number** can be set from 2 to 8.

XOR

Presentation



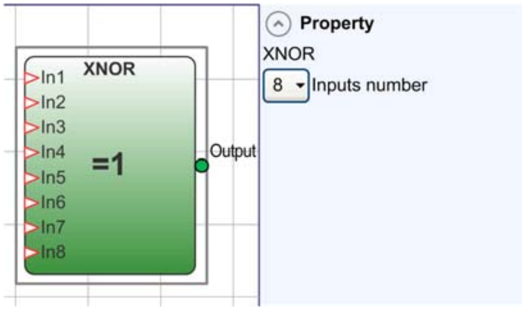
Logical XOR returns an output 0 (FALSE) if the number of inputs is at 1 (TRUE) is even or the inputs are all 0 (FALSE).

In_1	In_2	In_x	Out
0	0	0	0
1	0	0	1
0	1	0	1
1	1	0	0
0	0	1	1
1	0	1	0
0	1	1	0
1	1	1	1

The **Inputs number** can be set from 2 to 8.

XNOR

Presentation



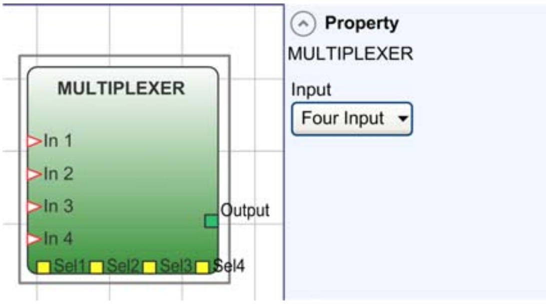
Logical XNOR returns an output 1 (TRUE) if the number of inputs is at 1 (TRUE) is even or the inputs are all 0 (FALSE).

In_1	In_2	In_x	Out
0	0	0	1
1	0	0	0
0	1	0	0
1	1	0	1
0	0	1	0
1	0	1	1
0	1	1	1
1	1	1	0

The **Inputs number** can be set from 2 to 8.

MULTIPLEXER

Presentation



Logical MULTIPLEXER forwards the signal of the inputs to the output according to the Sel selection. If the SEL1 to SEL4 have only 1 bit set, the selected In n is connected to the output. If the SEL inputs are:

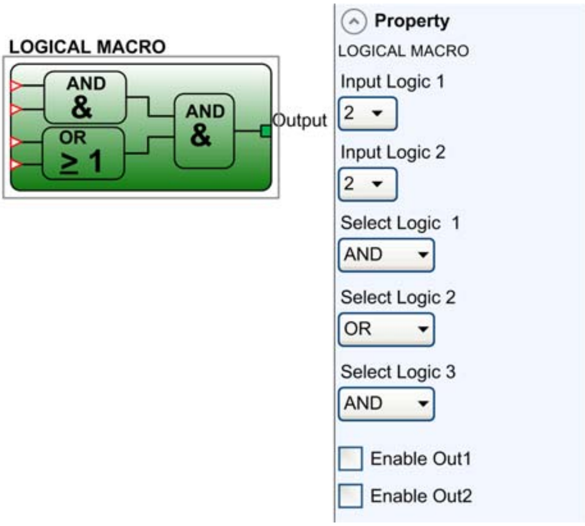
- More than one = 1 (TRUE)
- None = 1 (TRUE)

The output is set to 0 (FALSE) independently from the In n values.

The **Inputs number** can be set from 2 to 4.

LOGICAL MACRO

Presentation



The `LOGICAL MACRO` operator enables the grouping of two or three logic gates. A maximum of eight inputs are available. The result of the first two logic gates converges into a third logic gate. The result of the third logic gate is provided at the `Output`.

Parameters

Parameters	Description
Input Logic1 Input Logic2	Select the number of logic inputs (1...7) for each of the input logic gates. If 1 is selected from the drop down list, it results in removing the logic gate, and the output of this logic gate is directly connected to the third (end) logic.
Select Logic1 Select Logic2 Select Logic3	Select the operator type: • AND • NAND • OR • NOR • XOR • XNOR
Enable Out1 Enable Out2	If selected, activates an output with the result of the logic gate 1 and/or 2.

Section 14.2
Memory Operators

Memory operators can be used to save data from other project components. State changes are performed according to the truth tables shown for each memory operator.

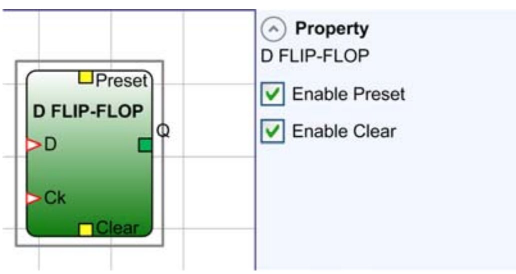
What Is in This Section?

This section contains the following topics:

D FLIP-FLOP

Presentation

You can configure up to 16 FLIP-FLOP operators.



The `D FLIP-FLOP` operator saves the previously set state on output `Q` according to the following truth table:

Preset	Clear	Ck	D	Q
1	0	0/1	0/1	1
0	1	0/1	0/1	0
1	1	0/1	0/1	0
0	0	0	0/1	Retain output value
0	0	Rising edge	1	1
0	0	Rising edge	0	0

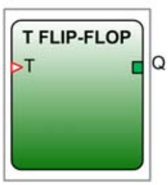
Parameters

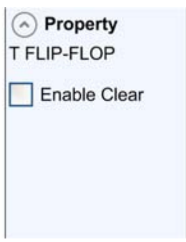
Parameters	Description
Enable Preset	If selected, enables output `Q` to be set to 1 (TRUE).
Enable Clear	If selected, enables the saving process to be reset.

`T FLIP-FLOP`

Presentation

You can configure up to 16 `FLIP-FLOP` operators.





The `T FLIP-FLOP` operator switches the `Q` output at each rising edge of the `T` input (toggle).

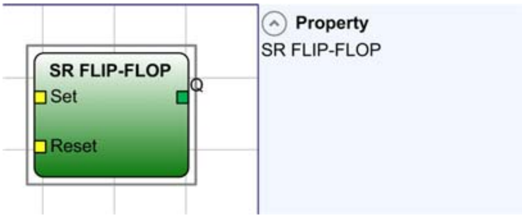
Parameters

Parameter	Description
Enable Clear	If selected, enables the saving process to be reset.

SR FLIP-FLOP

Presentation

You can configure up to 16 FLIP-FLOP operators.



The SR FLIP-FLOP operator brings output Q at 1 with Set, 0 with Reset:

Set	Reset	Q
0	0	Retain output value
0	1	0
1	0	1
1	1	0

USER RESTART MANUAL

Presentation

You can configure up to 16 RESTART operators.

The USER RESTART MANUAL operator saves the restart signal according to the following truth table:

Clear	Restart	In	Q
1	0/1	0/1	0
0/1	0/1	0	0

Clear	Restart	In	Q
0	0	1	Retain output value
0	Rising edge	1	1
0	Falling edge	1	Retain output value

Parameters

Parameter	Description
Enable Clear	If selected, enables the saving process to be reset.

USER RESTART MONITORED

Presentation

You can configure up to 16 RESTART operators.

The USER RESTART MONITORED operator is used to save the restart signal according to the following truth table:

Clear	Restart	In	Q
1	0/1	0/1	0
0/1	0/1	0	0
0	0	1	Retain output value
0	Rising edge	1	Retain output value
0		1	1

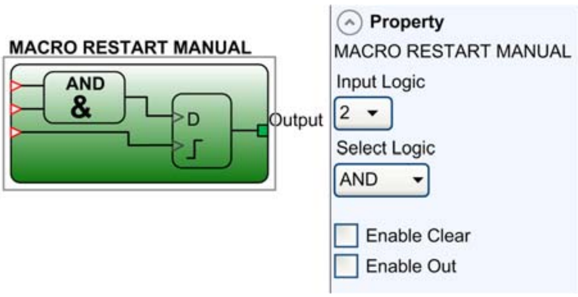
Parameters

Parameter	Description
Enable Clear	If selected, enables the saving process to be reset.

MACRO RESTART MANUAL

Presentation

You can configure up to 16 `RESTART` operators.



The `MACRO RESTART MANUAL` operator is used to combine a logic gate of your choice with the `USER RESTART MANUAL` function block according to the following truth table:

Clear	Restart	In	Q
1	0/1	0/1	0
0/1	0/1	0	0
0	0	1	Retain output value
0	Rising edge	1	1
0	Falling edge	1	Retain output value

Parameters

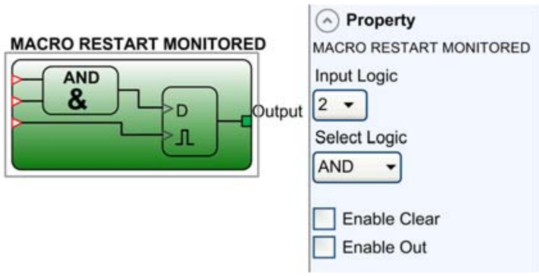
Parameters	Description
Input Logic	Select the number of logic inputs (**1**...**7**).

Parameters	Description
Select Logic	Select the operator type: ● AND ● NAND ● OR ● NOR ● XOR ● XNOR
Enable Clear	If selected, enables the saving process to be reset.
Enable Out	If selected, activates an output with the result of the calculation performed by the logic.

MACRO RESTART MONITORED

Presentation

You can configure up to 16 `RESTART` operators.



The `MACRO RESTART MONITORED` operator is used to combine a logic gate of your choice with the `USER RESTART MONOTORED` function block according to the following truth table:

Clear	Restart	In	Q
1	0/1	0/1	0
0/1	0/1	0	0
0	0	1	Retain output value
0	Rising edge	1	Retain output value
0		1	1

Parameters

Parameters	Description
Input Logic	Select the number of logic inputs (**1**...**7**).
Select Logic	Select the operator type: • **AND** • **NAND** • **OR** • **NOR** • **XOR** • **XNOR**
Enable Clear	If selected, enables the saving process to be reset.
Enable Out	If selected, activates an output with the result of the calculation performed by the logic.

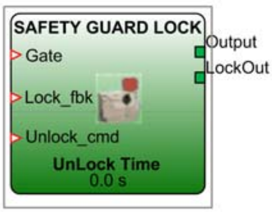
Section 14.3
Guard Lock Operators

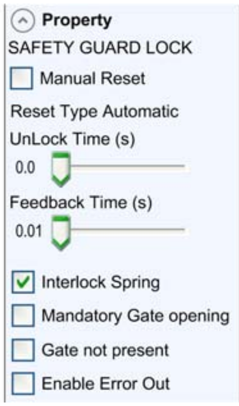
SAFETY GUARD LOCK

Presentation

The SAFETY GUARD LOCK operator monitors locking/unlocking of an electromechanical guard lock that analyzes the consistency between the lock command and the state of a SAFETY GUARD 1 CH or SAFETY GUARD 2 CH function block and FEEDBACK. The main output is set to TRUE when the guard lock is closed and locked.

You can configure up to 4 SAFETY GUARD LOCK operators.





Operating Principles

The SAFETY GUARD LOCK operator supports the following operating principles:

A The function block is used to monitor a lock and a guard. An interlock guard switch is not available (parameter **Gate not present** is selected). For more details, refer to Operating Principle A *(see page 366)*.

B The function block is used to monitor a lock and a guard. An interlock guard switch is available. The status of the guard is provided by the SAFETY GUARD 1 CH or SAFETY GUARD 2 CH function block to the Gate input. For more details, refer to Operating Principle B *(see page 366)*.

C The function block is used to monitor a lock and a guard with a guard test. An interlock guard switch is available (parameter **Mandatory Gate opening** is selected). The status of the guard is provided by the `SAFETY GUARD 1 CH` or `SAFETY GUARD 2 CH` function block to the `Gate` input on the function block (feedback of the guard). For more details, refer to Operating Principle C *(see page 366)*.

Operating Principle A: Interlock Guard Switch Is Not Available

To operate the function without an interlock guard switch, select the parameter **Gate not present**.

1. The `Lock_fbk` input must be connected to a `LOCK FEEDBACK` (feedback coil lock) input element.
2. The `UnLock_cmd` input can be connected freely in the diagram and determines the request to unlock at a rising edge.
3. The `Output` signal of this element is set to 1 (TRUE) if the guard is closed and locked. When an unlock command is applied to the `UnLock_cmd` input, the `Output` signal is set to 0 and the lock is released. The `Output` is set to 0 (FALSE) even if an error has been detected (for example, open guard with lock locked, maximum **Feedback Time** was exceeded).
4. The `LockOut` signal monitors the locking/unlocking of the guard.

Operating Principle B: Interlock Guard Switch Is Available

The function block is used to monitor a lock and a guard.

1. The `Gate` input must be connected to a `SAFETY GUARD 1 CH` or `SAFETY GUARD 2 CH` function block to the `Gate` input on the function block (guard feedback).
2. The `Lock_fbk` input must be connected to a `LOCK FEEDBACK` (feedback coil lock) input element.
3. The `UnLock_cmd` input can be connected freely in the diagram and determines the request to unlock at a rising edge.
4. The `Output` signal of this element is set to 1 (TRUE) if the guard is closed and locked. When an unlock command is applied to the `UnLock_cmd` input, the `Output` signal is set to 0 and the lock is released. The `Output` is set to 0 (FALSE) even if an error has been detected (for example, open guard with lock locked, maximum **Feedback Time** was exceeded).
5. The `LockOut` signal monitors the locking/unlocking of the guard.

Operating Principle C: Interlock Guard Switch Is Available, Parameter Mandatory Gate opening Is Selected

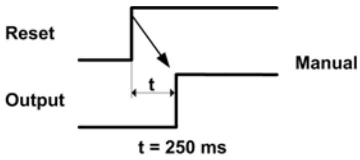
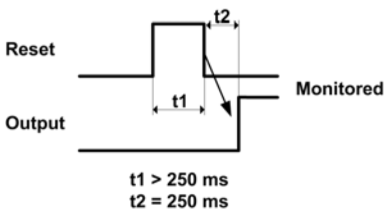
To operate the function as a guard safety lock taking into account the feedback of the guard, select the parameter **Mandatory Gate opening**.

1. The `Gate` input must be connected to a `SAFETY GUARD 1 CH` or `SAFETY GUARD 2 CH` function block to the `Gate` input on the function block (feedback of the guard). In this mode, the `Gate` input must confirm the opening of the guard.
2. The `Lock_fbk` input must be connected to a `LOCK FEEDBACK` (feedback coil lock) input element.

3. The UnLock_cmd input can be connected freely in the diagram and determines the request to unlock at a rising edge.
4. The Output signal of this element is set to 1 (TRUE) if the guard is closed and locked. When an unlock command is applied to the UnLock_cmd input, the Output signal is set to 0 and the lock is released. The Output is set to 0 (FALSE) even if an error has been detected (for example, open guard with lock locked, maximum **Feedback Time** was exceeded).
5. The LockOut signal monitors the locking/unlocking of the guard.

Parameters

Parameter	Description
Unlock Time (s)	Delay time after a rising edge on the UnLock_cmd input while the guard unlock output is set to TRUE (Lockout output). ● 0 ms to 1 s increments of 100 ms ● 1.5 s to 10 s increments of 0.5 s ● 15...25 s increments of 5 s
Feedback Time (s)	Maximum delay time accepted between LockOut output and Lock_fbk input. ● 10 ms to 100 s increments of 10 ms ● 150 ms to 1 s increments of 50 ms ● 1.5 s to 3 s increments of 0.5 s
Mandatory gate opening	If selected, the guard must be tested by opening and closing the guard before the function is enabled.
Gate not present	If selected, allows function block to be used for only a lock feedback without the Guard function block.
Interlock Spring	The guard is locked passively and released actively, that is, the mechanical force of the spring keeps it locked. The guard thus continues to be locked even when the power supply is disconnected.
Manual Reset	When selected, the function requires a reset each time the function block is activated. When not selected, the enabling of the output of the function directly follows the input conditions.

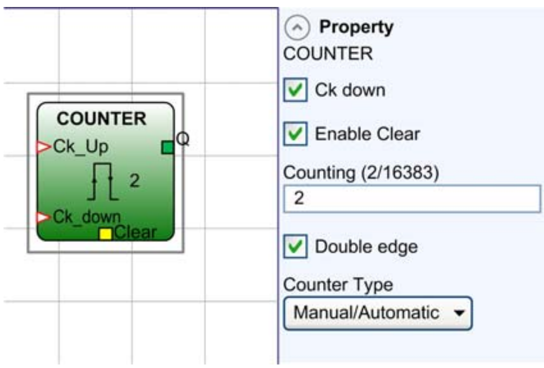
Parameter	Description
Reset Type	When **Manual** is selected, the function verifies the reset signal transition from 0 to 1. When **Monitored** is selected, the function verifies the reset signal transition from 0 to 1 to 0.   **NOTE:** For **Manual** reset, use the input immediately after those used by the function block: For example, if inputs 1 and 2 are used for the function block, use input 3 for `Reset`.
Enable Error Out	If selected, provides an output to indicate that an error has been detected by the function block. When `Error Out` = 1 (TRUE) there is an error detected.

Section 14.4
Counter Operators

COUNTER

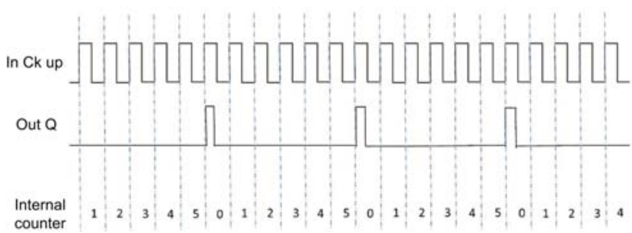
Presentation

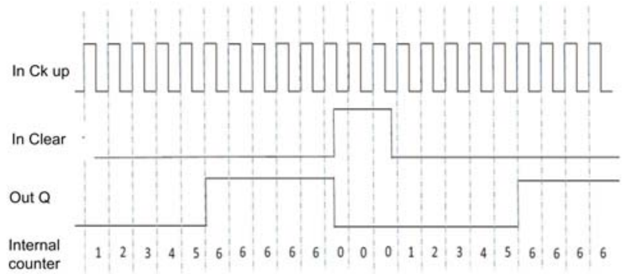
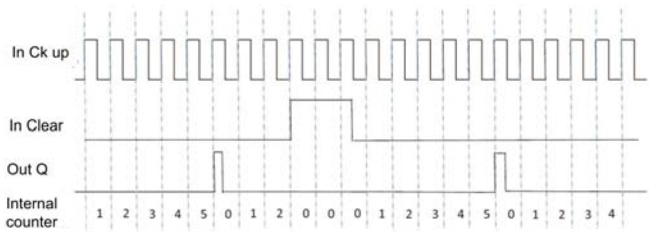
The `COUNTER` operator is a pulse counter that sets the output `Q` to 1 (TRUE), as soon as the desired count is reached.



You can configure up to 16 `COUNTER` operators.

The table describes the counter types:

Counter Type	Description
Automatic Counter	Only available if **Enable Clear** is NOT selected. The counter generates a pulse with a duration of twice the cycle time (2 x `Tcycle`) as soon as the set count is reached.  Pulses at the Ck_Down input decrease the internal counter.

Counter Type	Description
Manual Counter	Only available if **Enable Clear** is selected.The counter output is set to 1 (TRUE) as soon as the set count is reached. The output `Q` changes to 0 (FALSE) when the input value to `Clear` is set to 1 (TRUE).  Pulses at the Ck_Down input decrease the internal counter.
Manual/Automatic	Only available if **Enable Clear** is selected. The counter generates a pulse with a equal to the system response time as soon as the set count is reached. When the input value `Clear` is set to 1 (TRUE), the counter is reset to 0.  Pulses at the Ck_Down input decrease the internal counter.

Parameters

Parameter	Description
Ck down	If selected, enables counting down.
Enable Clear	If selected, this enables the request to clear in order to restart the counter setting output `Q` to 0 (FALSE). It also offers the possibility of enabling or not enabling (automatic enable) automatic operation with manual reset. If this is not selected, the counter type is automatic. Once the set count is reached output `Q` is set to 1(TRUE) and stays in this condition for two internal cycles after which it is reset.

Parameter	Description
Counting	When the counter reaches this value, it triggers the output to be set to 1 (TRUE). The value range is from 2 to 16383.
Double edge	If selected, it enables counting on both rising and falling edges.

Section 14.5
Timer Operators

What Is in This Section?

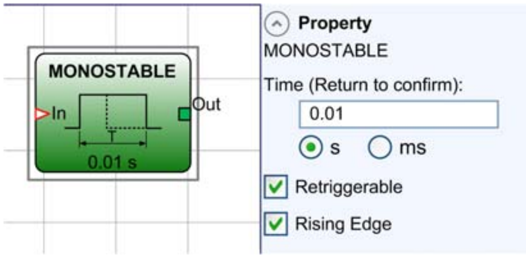
This section contains the following topics:

MONOSTABLE

Presentation

TIMER operators generate a signal (TRUE or FALSE) for a user-definable period.

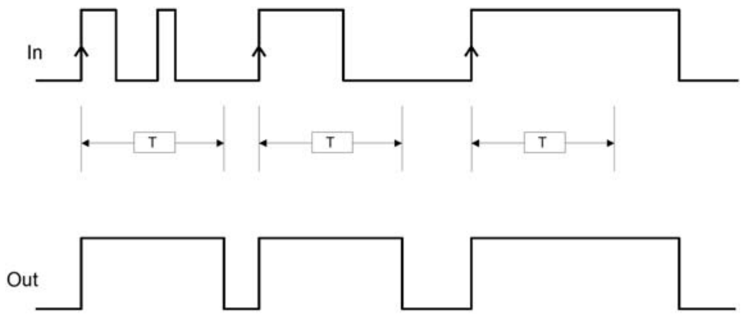
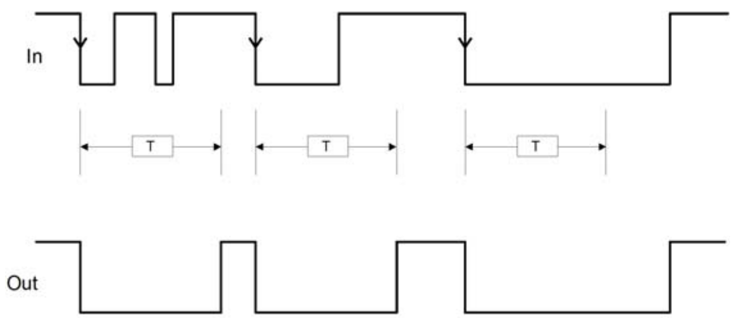
The MONOSTABLE operator generates a 1 (TRUE) output activated by the rising edge of the input and remains in this condition for the set time.



You can configure up to 32 MONOSTABLE operators.

Parameters

Parameter	Description
Time	The period can be set to between 10 ms and 1098.3 s. **NOTE:** When entering the value into the field, press the Return key on the keyboard to confirm the value.
Retriggerable	If selected, the period configured in **Time** is reset each time the input state changes.

Parameter	Description
Rising Edge	If selected, the output is set to 1 (TRUE) on the input signal rising edge where it remains for the set time, which can be extended for as long as the input stays at 1 (TRUE).  If not selected, the logic is inverted, the output is set to 0 (FALSE) on the input signal falling edge, where it remains for the set time, which can be extended for as long as the input stays at 0 (FALSE). 

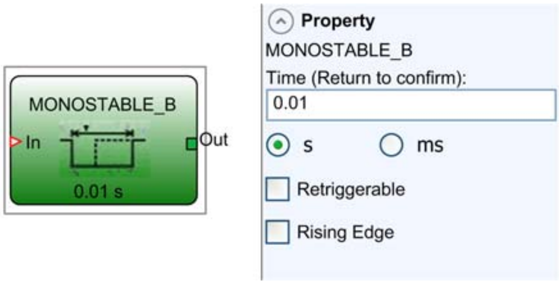
NOTE: A HIGH signal at an input does not generate a rising edge after a power cycle. The input needs to be re-operated to trigger the timer function.

MONOSTABLE_B

Presentation

TIMER operators generate a signal (TRUE or FALSE) for a user-definable period.

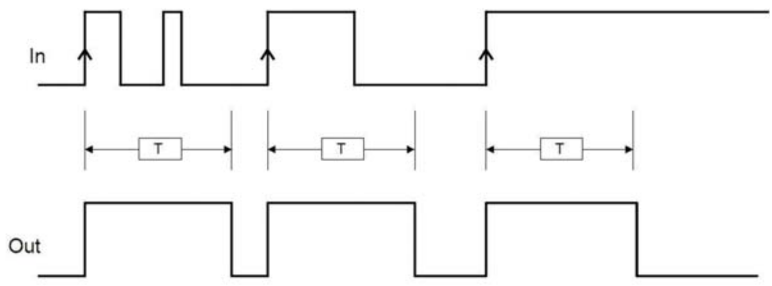
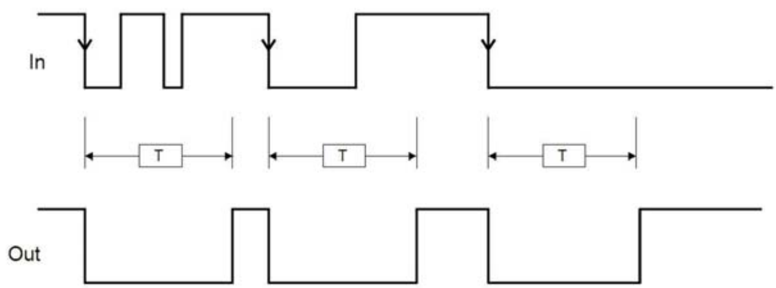
The MONOSTABLE_B operator generates a 1 (TRUE) output activated by the rising/falling edge of the input and remains in this condition for the set time.



You can configure up to 32 MONOSTABLE_B operators.

Parameters

Parameter	Description
Time	The period can be set to between 10 ms and 1098.3 s. **NOTE:** When entering the value into the field, press the Return key on the keyboard to confirm the value.
Retriggerable	If selected, enables the repetition of commands even before the end of the set time.

Parameter	Description
Rising Edge	If selected, the `Out` output is set to 1 (TRUE) if a rising edge is detected at the `In` input.  If not selected, the logic is inverted. The `Out` output is set to 0 (FALSE) on the `In` input signal's falling edge, where it remains for the set time. 

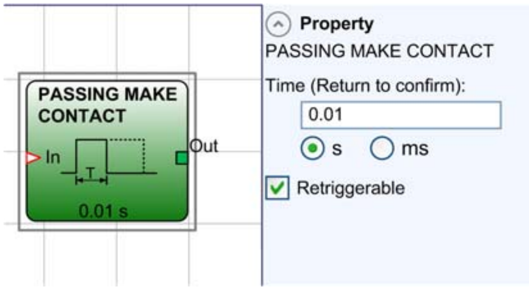
NOTE: In contrast to the `MONOSTABLE` operator, the `Out` output of the `MONOSTABLE_B` operator does not maintain a level 1 (TRUE) for a time which exceeds the set period.

NOTE: A HIGH signal at an input does not generate a rising edge after a power cycle. The input needs to be re-operated to trigger the timer function.

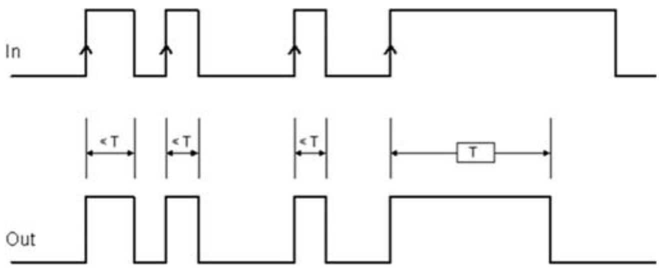
PASSING MAKE CONTACT

Presentation

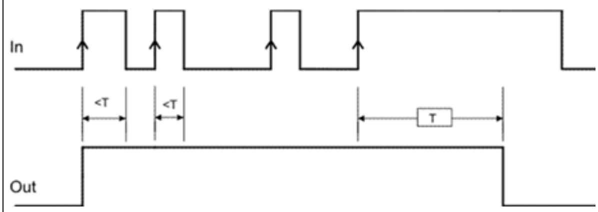
In the `PASSING MAKE CONTACT` operator, the output follows the signal on the input. If the input is at TRUE for longer than the set time the output changes to 0 (FALSE). When there is an input falling edge, the timer is cleared.



You can configure up to 32 `PASSING MAKE CONTACT` operators.



Parameter	Description
Time	The period can be set to between 10 ms and 1098.3 s. **NOTE:** When entering the value into the field, press the Return key on the keyboard to confirm the value.

Parameter	Description
Retriggerable	If selected, the time is not reset when there is an input falling edge. The output stays at 1 (TRUE) for the selected time. When there is a new input rising edge, the timer restarts again. 

DELAY

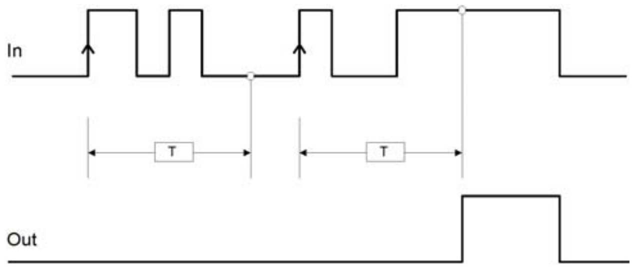
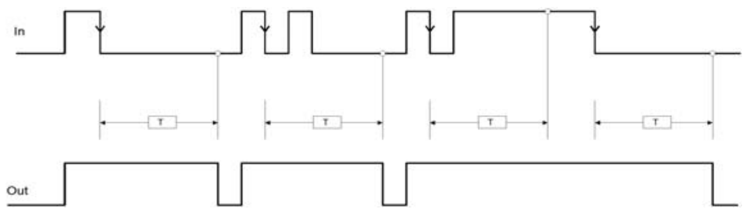
Presentation

The DELAY operator applies a delay to a signal by setting the output to 1 (TRUE) after the set time, against a change in the level of the input signal.

You can configure up to 32 DELAY operators.

Parameters

Parameter	Description
Time	The period can be set to between 10 ms and 1098.3 s. **NOTE:** When entering the value into the field, press the Return key on the keyboard to confirm the value.
Retriggerable	If selected, the period is reset each time the input state changes.

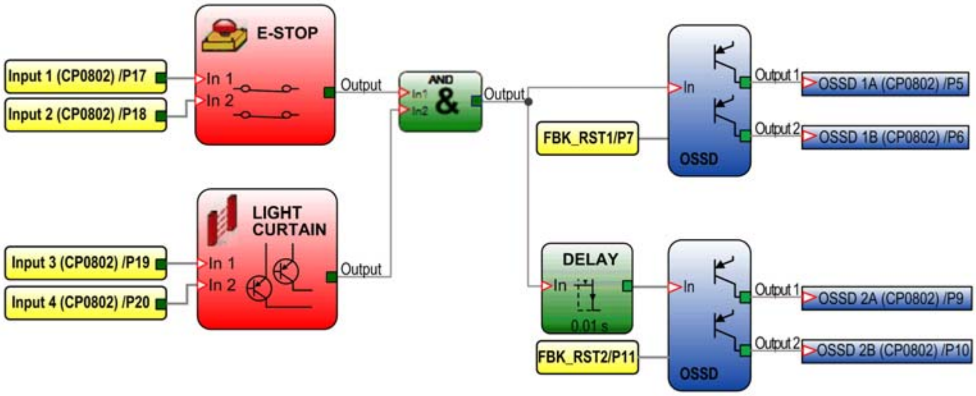
Parameter	Description
Rising Edge	If selected, the delay starts on the input signal rising edge. If the input signal is at 1 (TRUE) when the delay time has finished, the output transitions to 1 (TRUE) and remains at 1 (TRUE) until the input signal is set to 0 (FALSE). If the input is no longer 1 (TRUE) when the delay time has finished, the output remains at 0 (FALSE). The next rising edge re-triggers the delay timer.  If **Rising Edge** is not selected, the logic is inverted, the output is set to 1 (TRUE) on the rising edge of the input.The delay begins on the falling edge of the input. The delay starts on the input signal falling edge. At the end of the delay time the output transitions to 0 (FALSE) only in the case that the input is also at 0 (FALSE), otherwise it remains at 1 (TRUE). 

NOTE: A HIGH signal at an input does not generate a rising edge after a power cycle. The input needs to be re-operated to trigger the timer function.

Example of Configuration with DELAY

In the configuration, there are 2 safety-related functions `E-STOP` (emergency stop) and `LIGHT CURTAIN`.

Both safety-related functions outputs must be set to TRUE to enable the outputs. Two outputs are connected in the configuration where one is instantaneous and a second has delay off timer.

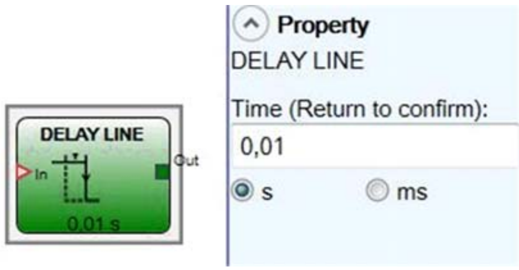


DELAY LINE

Presentation

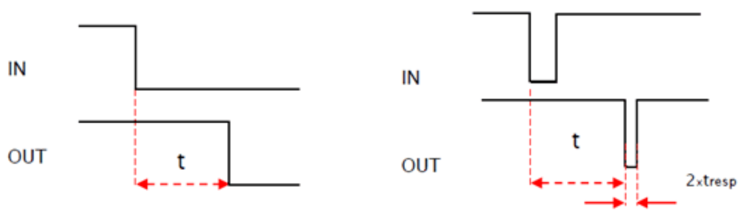
The `DELAY LINE` operator applies a delay to a signal by setting the output to 0 (FALSE). After the set time, the delay is set at a falling edge of the input signal.

If the input signal returns to 1 before the end of the set time, the output still generates an `LL0` impulse *(see page 315)*. This `LL0` impulse lasts approximately twice as long as the response time and is delayed by the set time.



You can configure up to 32 `DELAY LINE` operators.

Parameters

Parameter	Description
Time	The period can be set to between 10 ms and 1098.3 s.  **NOTE:** When entering the value into the field, press the Return key on the keyboard to confirm the value.

NOTE: In contrast to the `DELAY` operator, the `DELAY LINE` operator does not filter any interruptions in the input which are shorter than the set time.

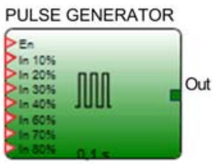
Use the `DELAY LINE` operator when you use delayed OSSD *(see page 338)* (the `OSSD` is programmed with `USER RESTART MANUAL` function *(see page 360)*).

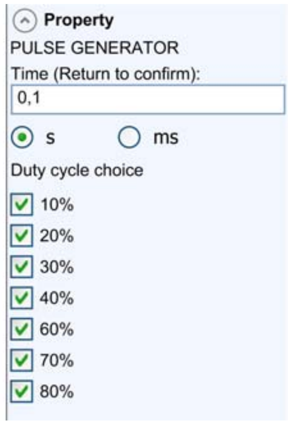
PULSE GENERATOR

Presentation

The `PULSE GENERATOR` operator generates a clock signal output with the set period if the input `In` is set to 1 (TRUE) while the `Enable` is also set to TRUE.

The `PULSE GENERATOR` operator has up to 7 inputs to control the output duty cycle.





You can configure up to 32 `PULSE GENERATOR` operators.

Parameters

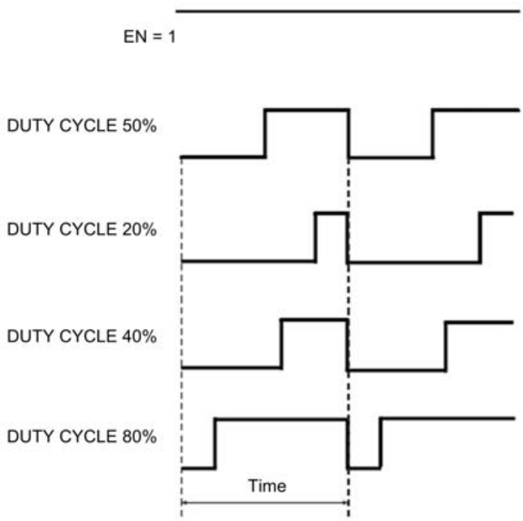
Parameter	Description
Time	The period can be set to between 10 ms and 1098.3 s. **NOTE:** When entering the value into the field, press the Return key on the keyboard to confirm the value.
Duty cycle choice	Up to seven inputs can be selected for seven different output signal duty cycles. Depending on the active input, the `Out` clock signal has its corresponding duty cycle. The `EN` input must always be set to TRUE.

EN (`Enable`)	10%	20%	30%	40%	60%	70%	80%	OUT
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	50%
1	1	0	0	0	0	0	0	10%
1	0	1	0	0	0	0	0	20%

EN (Enable)	10%	20%	30%	40%	60%	70%	80%	OUT
1	0	0	1	0	0	0	0	30%
1	0	0	0	1	0	0	0	40%
1	0	0	0	0	1	0	0	60%
1	0	0	0	0	0	1	0	70%
1	0	0	0	0	0	0	1	80%
1	1	0	0	0	0	0	1	90%

NOTE: Exactly one of the duty cycle selection inputs (other than the Enable input EN) must be 1 (TRUE) to generate an output signal of the appropriate duty cycle. The exception is the pair 10 % and 80 % which generates a duty cycle of 90 %.

A 1 (TRUE) signal at the Enable input EN without a 1 (TRUE) signal at any of the duty cycle selection inputs or with multiple 1 (TRUE) signals at the selection inputs generates an output signal with a duty cycle of 50 %.



Section 14.6
Muting Operators

What Is in This Section?

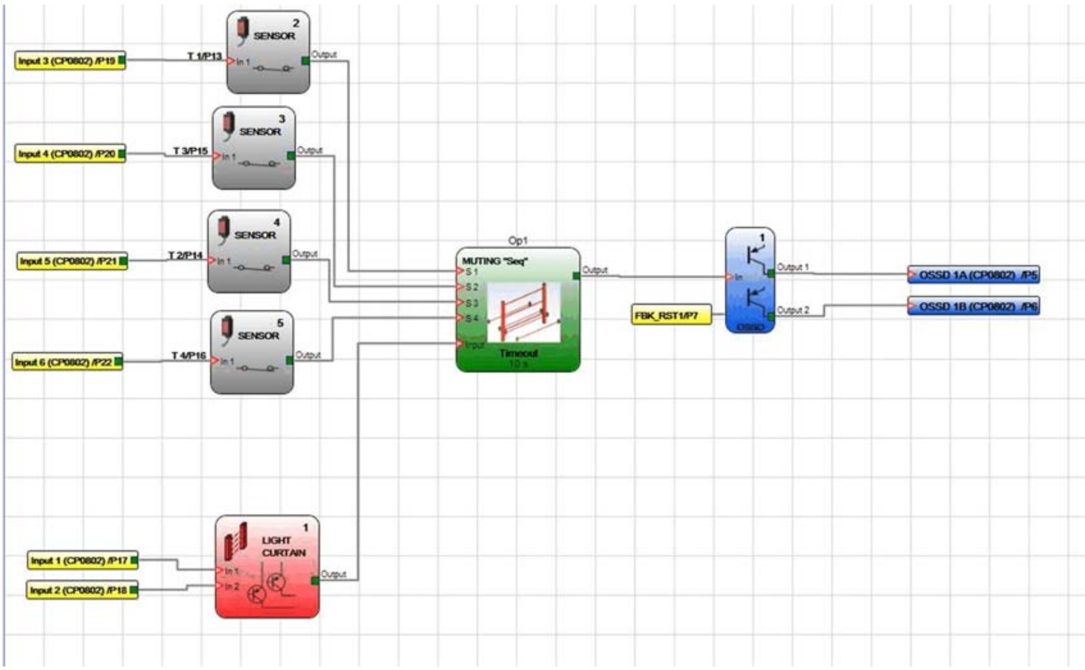
This section contains the following topics:

`LIGHT CURTAIN` with `MUTING` Function

Presentation

The `MUTING` function block can be used to bypass the protection field of a light curtain (`ESPE`) in order, for example, to bring a part to be worked into and/or leave the zone of operation.

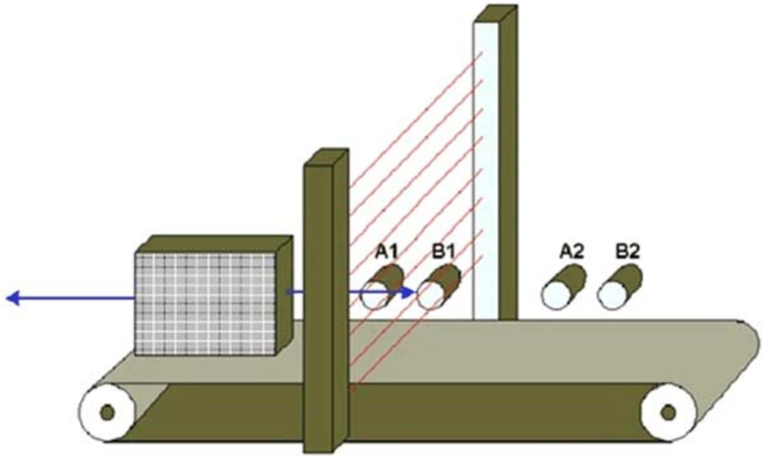
The maximum number of `MUTING` function blocks in a configuration is 4.



The muting function is controlled by either two or four sensors either as concurrent or sequential for the four sensors or L logic or T logic two-sensor muting and can only be activated when the safety-related outputs have already been activated (the zone of operation is clear). If not, the activation of the muting function produces an error message and the safety-related outputs remain deactivated. Muting operates according to a suitable order of the muting sensors in both directions of transport, and thus inside and outside the zone of operation again.

The `MUTING` function block must be used with the `LIGHT CURTAIN` function block.

The following graphic shows an example for sequential muting with the four sensors A1, A2, B1 and B2:

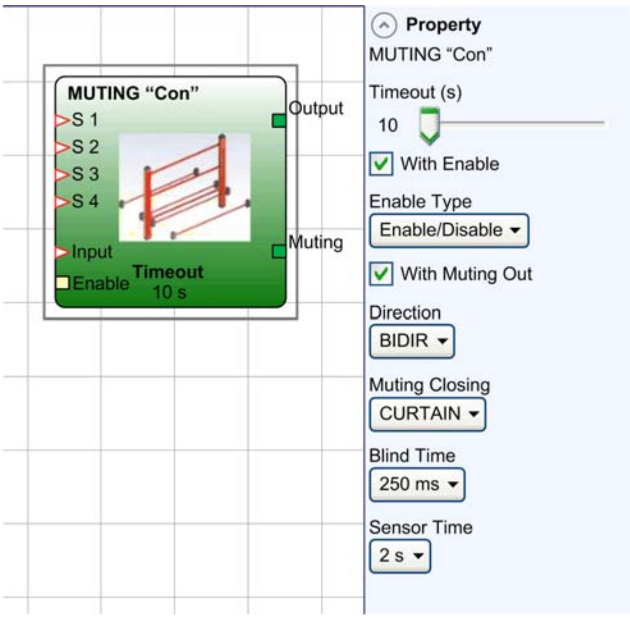


Concurrent MUTING

Presentation

The MUTING operator with concurrent logic performs muting of the input signal through sensor inputs S1, S2, S3 and S4. Within this type of muting, 4 sensors must be used and the activation of each sensor is monitored.

NOTE: Preliminary condition: The muting cycle can only start if the sensors are 0 (FALSE) and the inputs are 1 (TRUE).



Parameter	Description
Timeout (s)	Sets the time, between 10 secs and infinity, within which the muting cycle must end. If the cycle is not complete at the end of this time, muting is immediately discontinued.
With Enable	This option provides an Enable input for the muting function. Without an Enable input, the muting function is always enabled. Two Enable types are available: ● **Enable/Disable**: If **Enable/Disable** is selected, the muting cycle is started with a rising edge at the Enable input. A falling edge at the Enable input disables muting regardless of the condition of the muting sensors. ● **Enable Only**: If **Enable Only** is selected, the muting cycle must also be started with a rising edge at the Enable input, but it is not disabled with a falling edge. The Enable input must be set to 0 (FALSE) before a new rising edge can start the next muting cycle.

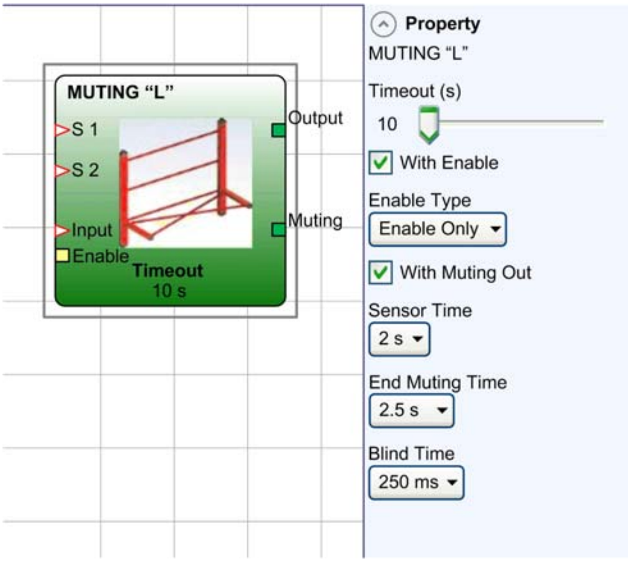
<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>With Muting Out</td><td>When enabled, provides an output Muting on the function block which can be used to connect to a muting lamp to indicate that Muting is active.</td></tr>
<tr><td>Direction</td><td>The order in which the sensors are activated.
If set to BIDIR they can be occupied in both directions:
From S1 and S2 to S3 and S4
From S3 and S4 to S1 and S2
If set to UP, they can be occupied from S1 and S2 to S3 and S4.
If set to DOWN, they can be occupied from S3 and S4 to S1 and S2.</td></tr>
<tr><td>Muting Closing</td><td>There are 2 types:
CURTAIN: If you select CURTAIN, muting terminates when the input signal rises.
SENSOR: If you select SENSOR, it terminates when the third sensor has been cleared.
Select CURTAIN:
<table>
<tr><th>S1</th><th>S2</th><th>Input</th><th>S3</th><th>S4</th><th>Muting</th></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>X</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>X</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
</table>
Select SENSOR:
<table>
<tr><th>S1</th><th>S2</th><th>Input</th><th>S3</th><th>S4</th><th>Muting</th></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>X</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>X</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
</table></td></tr>
<tr><td>Blind Time</td><td>Only with Muting Closing set to CURTAIN, blind time is enabled after the complete transition of the pallet (muting cycle close) some protruding objects could still occupy the light curtain and send the input to 0 (FALSE).
During blind time, the input remains 1 (TRUE). Blind Time can range from 250 ms to 1 second.</td></tr>
<tr><td>Sensor Time</td><td>The maximum time between 2 to 5 seconds between activating the two muting sensors.</td></tr>
</table>

`MUTING` with L - Logic

Presentation

The `MUTING` operator with L - logic performs muting of the input signal through sensor inputs `S1` and `S2`. With the L-type muting, the sensors `S1` and `S2` are cross beam muting sensors with monitoring the timing between activation of sensor `S1` and `S2`.

NOTE: Preliminary condition: The muting cycle can only start if `S1` and `S2` are 0 (FALSE) and the inputs are 1 (TRUE).



Parameters

Parameters	Description
Timeout (s)	Sets the time, between 10 secs and infinity, within which the muting cycle must end. If the cycle is not complete at the end of this time, muting is immediately discontinued.
With Muting Out	When enabled, provides an output `Muting` on the function block which can be used to connect to a muting lamp to indicate that Muting is active.

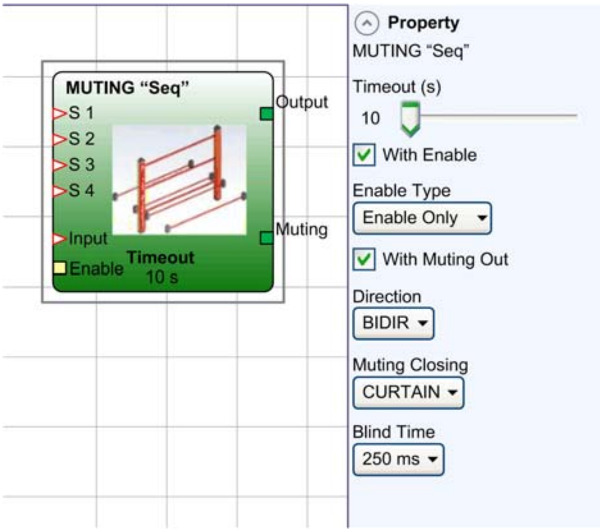
Parameters	Description
With Enable	This option provides an Enable input for the muting function. Without an Enable input, the muting function is always enabled. Two Enable types are available: ● **Enable/Disable**: If **Enable/Disable** is selected, the muting cycle is started with a rising edge at the Enable input. A falling edge at the Enable input disables muting regardless of the condition of the muting sensors. ● **Enable Only**: If **Enable Only** is selected, the muting cycle must also be started with a rising edge at the Enable input, but it is not disabled with a falling edge. The Enable input must be set to 0 (FALSE) before a new rising edge can start the next muting cycle.
Sensor Time	The maximum time between 2 to 5 seconds between activating the two muting sensors.
End Muting Time	Sets the muting termination delay time, from 2.5 to 6 seconds, after the first sensor has been cleared.
Blind Time	Enabled after the complete transition of the pallet (muting cycle close) some protruding objects could still occupy the light curtain and send the input to 0 (FALSE). During blind time, the input remains 1 (TRUE). **Blind Time** can range from 250 ms to 1 second.

Sequential MUTING "Seq"

Presentation

The MUTING operator with sequential logic performs muting of the input signal through sensor inputs S1, S2, S3 and S4. For sequential muting, the function requires the activation of each sensor in the correct sequence to allow muting to occur.

NOTE: Preliminary condition: The muting cycle can only start if all the sensors are 0 (FALSE) and the inputs are 1 (TRUE).



Parameter	Description
Timeout (s)	Sets the time, between 10 secs and infinity, within which the muting cycle must end. If the cycle is not complete at the end of this time, muting is immediately discontinued.
With Enable	This option provides an Enable input for the muting function. Without an Enable input, the muting function is always enabled. Two Enable types are available: ● **Enable/Disable**: If **Enable/Disable** is selected, the muting cycle is started with a rising edge at the Enable input. A falling edge at the Enable input disables muting regardless of the condition of the muting sensors. ● **Enable Only**: If **Enable Only** is selected, the muting cycle must also be started with a rising edge at the Enable input, but it is not disabled with a falling edge. The Enable input must be set to 0 (FALSE) before a new rising edge can start the next muting cycle.
With Muting Out	When enabled, provides an output `Muting` on the function block which can be used to connect to a muting lamp to indicate that Muting is active.
Direction	The order in which the sensors are activated. ● If set to **BIDIR** they can be occupied in both directions: ❍ From `S1` to `S4` ❍ From `S4` to `S1` ● If set to **UP**, they can be occupied from `S1` to `S4`. ● If set to **DOWN**, they can be occupied from `S4` to `S1`.

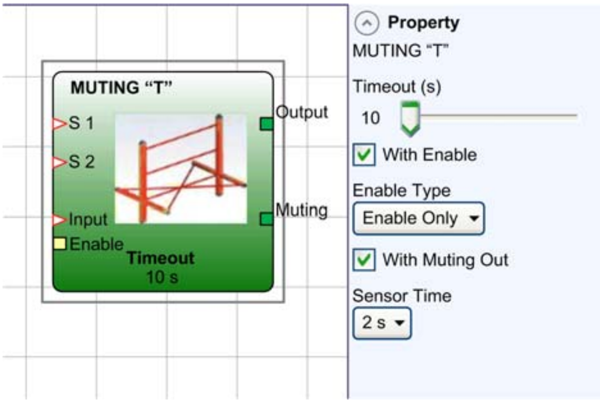
<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Muting Closing</td><td>There are 2 types:
● CURTAIN: If you select CURTAIN, muting terminates with a rising edge of the input signal.
● SENSOR: If you select SENSOR, muting terminates when the third sensor has been cleared.
Select CURTAIN:
<table>
<tr><th>S1</th><th>S2</th><th>Input</th><th>S3</th><th>S4</th><th>Muting</th></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>X</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>X</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>X</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>X</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
</table>
Select SENSOR:
<table>
<tr><th>S1</th><th>S2</th><th>Input</th><th>S3</th><th>S4</th><th>Muting</th></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>X</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>X</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>X</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>X</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>Blind Time</td><td>Only with Muting Closing set to CURTAIN, blind time is enabled after the complete transition of the pallet (muting cycle close) some protruding objects could still occupy the light curtain and send the input to 0 (FALSE).
During blind time, the input remains 1 (TRUE). Blind Time can range from 250 ms to 1 second.</td></tr>
</table>

`MUTING` with T-Logic

Presentation

The `MUTING` operator with T - logic performs muting of the input signal through sensor inputs `S1` and `S2`. With the T-type muting, the sensors `S1` and `S2` are cross beam muting sensors with monitoring the timing between activation of sensor `S1` and `S2`.

NOTE: Preliminary condition: The muting cycle can only start if `S1` and `S2` are 0 (FALSE) and the inputs are 1 (TRUE).



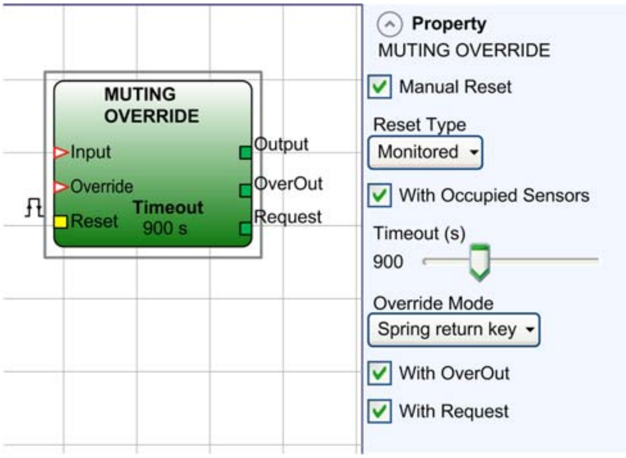
Parameter	Description
Timeout (s)	Sets the time, between 10 secs and infinity, within which the muting cycle must end. If the cycle is not complete at the end of this time, muting is immediately discontinued.
With Enable	This option provides an Enable input for the muting function. Without an Enable input, the muting function is always enabled. Two Enable types are available: ● **Enable/Disable**: If **Enable/Disable** is selected, the muting cycle is started with a rising edge at the Enable input. A falling edge at the Enable input disables muting regardless of the condition of the muting sensors. ● **Enable Only**: If **Enable Only** is selected, the muting cycle must also be started with a rising edge at the Enable input, but it is not disabled with a falling edge. The Enable input must be set to 0 (FALSE) before a new rising edge can start the next muting cycle.
With Muting Out	When enabled, provides an output `Muting` on the function block which can be used to connect to a muting lamp to indicate that Muting is active.
Sensor Time	The maximum time between 2 to 5 seconds between activating the two muting sensors.

MUTING OVERRIDE

Presentation

The maximum number of MUTING OVERRIDE functions used in a configuration is 4.

The operator permits override of the directly connected muting input. Override can be activated only if muting is not active (INPUT=0) and at least one muting sensor is occupied (or the light curtain is occupied). Override ends when the light curtain and sensors are cleared and the output switches to logical 0 (FALSE).



Override can be set to pulsed or maintained action mode:

Mode	Description
Override with pulsed action	This function is enabled activating the override command (override=1). Override ends when the light curtain and sensors are cleared (gap free) or on expiry of the timeout. The function can be restarted only if the override command is reactivated (override=1).
Override with maintained action monitor	This function must be activated maintaining the override command active (override=1) during all subsequent operations. However, a new override can be activated, de-activating and reactivating the command. When the light curtain and sensors are cleared (gap free) or on expiry of the timeout, override ends without the need for further commands.

Parameters

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>With Occupied Sensors</td><td>Must be selected with "T" sequential, simultaneous muting; with "L" muting it is not necessary to select this option.
NOTE: Otherwise, an advisory is displayed in the compilation phase and in the report.
Conditions to be verified for activation of override:
<table>
<tr><th>With sensors occupied</th><th>Sensor occupied</th><th>Light curtain occupied</th><th>Input</th><th>Override request</th><th>Override output</th></tr>
<tr><td>X</td><td>X</td><td>-</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td rowspan="3">-</td><td>-</td><td>X</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>X</td><td>-</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>X</td><td>X</td><td>0</td><td>1</td><td>1</td></tr>
</table>
</td></tr>
<tr><td>Timeout (s)</td><td>Used to set the time, between 10 sec and infinity, by which the override function must end.</td></tr>
<tr><td>Override Mode</td><td>Used to configure the type of override (pulsed or maintained action).</td></tr>
<tr><td>With OverOut</td><td>Used to activate an override active signaling output (active when TRUE).</td></tr>
<tr><td>With Request</td><td>Used to activate a signaling output (active when TRUE) indicating that the override function can be activated.</td></tr>
</table>

Section 14.7
Miscellaneous Functions

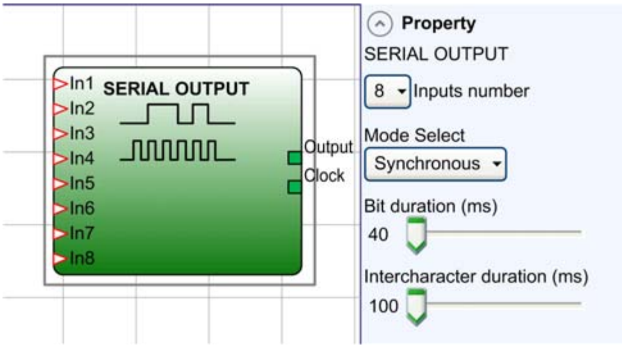
What Is in This Section?

This section contains the following topics:

`SERIAL OUTPUT` Function

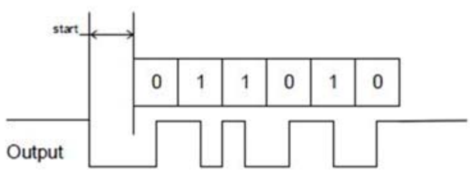
Presentation

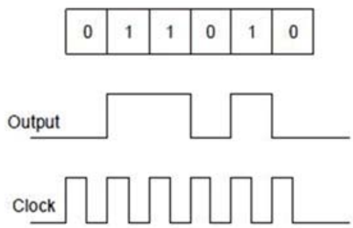
The `SERIAL OUTPUT` function provides the output state of up to 8 inputs, serializing the information.



Operating Principles

This operator outputs the state of the connected inputs in 2 different ways:

Mode Select	Description
Asynchronous	1. The state of the line in the idle condition is 1 (TRUE); 2. The start data transmission signal is 1 bit = (FALSE); 3. Transmission of n bits with the state of the connected inputs encoded using the Manchester coding: ❍ State 0: rising edge of the signal at the center of the bit ❍ State 1: falling edge of the signal at the center of the bit 4. Inter-character interval is set to 1 (TRUE) to allow synchronization of an external device.  With the asynchronous method, the clock output is not present.

<table>
<tr><th>Mode Select</th><th>Description</th></tr>
<tr><td>Synchronous</td><td>1. The output and the clock in the idle condition are 0 (FALSE).
2. Transmission of n bits with the input state using <code>Output</code> as data, <code>Clock</code> as the timing base.
3. Inter-character interval is 0 (FALSE) to allow synchronization of an external device.

</td></tr>
</table>

Parameters

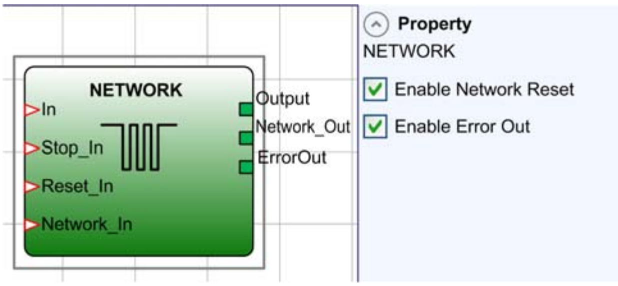
Parameter	Description
Inputs number	Defines the number of inputs of the function block, which may be 2 to 8 (asynchronous) or 3 to 8 (synchronous).
Bit duration (ms)	Enter the value corresponding to the length of each single bit (input n) in the pulse train that makes up the transmission. ● 40 to 200 ms (increments of 10 ms) ● 250 ms to 0.95 s (increments of 50 ms)
Intercharacter duration (ms)	Enter the time that must pass between the transmission of one pulse train and the next. ● 100 ms to 2.5 s (increments of 100 ms) ● 3 to 6 s (increments of 500 ms)

NOTE: Performance of the `SERIAL OUTPUT` function is variable depending on cycle times, configuration, and other factors that may impact performance. Thoroughly validate that the timing is adequate for your application.

NETWORK Function Block

Presentation

The NETWORK function block is used to distribute Stop and Reset commands via a hardwired network. Use Network_in and Network_out to exchange emergency stop and reset signals between the different nodes.



Operating Principles

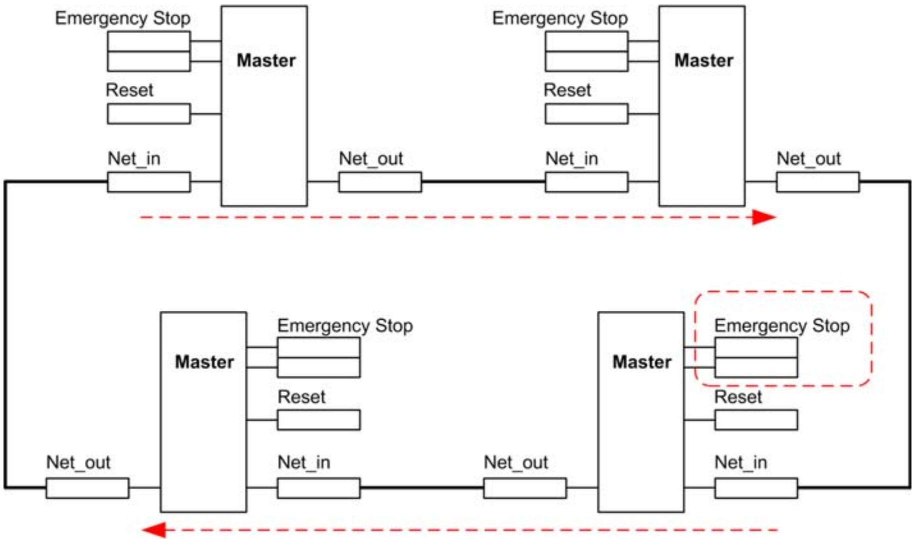
This function block allows Stop and Reset commands to be distributed in a local hardwired controller network.

The Network function block requires the following:

- The Network_In input connected to a single or double input must be connected to the Network_Out output of the preceding unit in the local network.
- The Network_Out output is logically connected to a STATUS output function block or OSSD output function block and must be connected to the Network_In input of the next unit in the local network.
- The Stop_In and Reset_In inputs must be connected to input devices that act as Stop (for example, E-STOP) and Reset (for example, SWITCH), respectively.
- The In input can be connected freely in the diagram (for example, input function blocks or results of logical combinations).
- The Output can be connected freely in the diagram. Output is set to 1 (TRUE) when the In input is set to 1 (TRUE) and the function block has been restarted.

Parameter	Description
Enable Network Reset	When selected, this allows the distribution network to reset the function block. If not enabled, the function block can only be reset via the local Reset_In input.
Enable Error Out	If selected, this enables the presence of the ErrorOut signal.

Example of Application



NOTE: The maximum cable length between masters is 100 m (328 ft).

Care must be taken when networking controllers to avoid long response times.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
Do not connect more than 10 master Modular Safety Controllers to the network configuration.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

In the example of application above, the following applies at power-on:

1. The `Output` of the various nodes are in the 0 (FALSE) condition.
2. The STOP signal is sent via the `Network_Out` (`Net_out`) line.
3. When the Reset command is pressed on one of the nodes, all the nodes that are present are started when the START signal is sent.
4. As the end result, the `Output` of all the connected nodes is in condition 1 (TRUE) if the various `In` inputs are in condition 1 (TRUE).
5. The RUN signal is sent via the network of the 4 nodes present.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- The RESET command must be installed outside the zone of operation in a position where the zone of operation and the entire work area concerned are clearly visible.
- It must not be possible to operate the RESET command from inside the zone of operation.

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

In the example of application above, the following applies when the emergency stop is pressed on one of the four nodes

1. The output moves to condition 0 (FALSE).
2. The STOP signal is sent via the `Network_Out` (`Net_out`) line.
3. The next node receives the stop command and deactivates the output.
4. The stop command generates the stop command for all `Network_In` (`Net_in`) and `Network_Out` (`Net_out`) lines.
5. As the end result, the output of all the connected nodes is in condition 0 (FALSE).
6. When the emergency stop is restored to the normal position, all the nodes can be restarted by sending the START signal with a single reset. The latter condition does not occur when **Enable Network Reset** is not enabled. In that case, the local reset method must be used.

Response Time

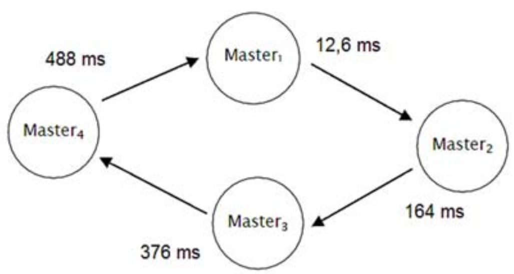
The response time of the network starting from emergency stop is given by the formula:

t_{rTot}= [(212 ms x number of controllers) – 260 ms]

A maximum of 10 XPSMCMCP0802• controllers can be connected together.

Example of 4 nodes network:

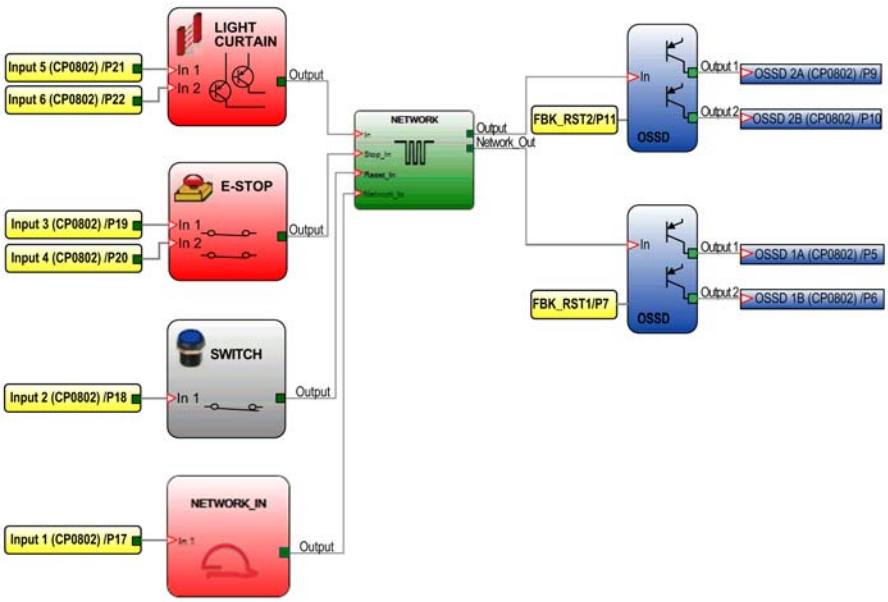
Master	Master 1	Master 2	Master 3
12.6 ms	164 ms	376 ms	488 ms



The graphic below shows the `In` input of the `NETWORK` function block of one of the 4 nodes moves to condition 0 (FALSE):

1. The local output moves to condition 0 (FALSE).
2. The RUN signal continues to be sent via the `Network_Out` (`Net_out`) lines.
3. The states of the remaining nodes remain unchanged.
4. In that case, local reset must be used.
   The `Reset_in` LED flashes to indicate this condition. All the nodes can be restarted by sending the START signal with a single reset.
   This condition does not occur when **Enable Network Reset** is not enabled. In that case, the local reset method must be used.
   The `Reset_in` and `Network_In` (`Net_in`) inputs and the `Network_Out` (`Net_out`) output can only be mapped to the I/O pins of the master.

The following graphic shows a configuration example using the `NETWORK` function block:



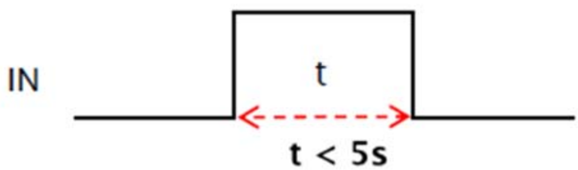
Network Function Block Signals

		Network_In		Network_Out (OSSD)	Network_Out (Status)	Reset_In
	LED	E EX	IN	OUT	STATUS	RST
STATUS	STOP	OFF	OFF	red	OFF	OFF
	CLEAR	OFF	flashing	red/green (flashing)	flashing	flashing
	RUN	OFF	ON	green	ON	ON
	Error	ON	flashing	–	–	–

RESET Function

Presentation

The RESET function initiates a system reset when there is a OFF-ON-OFF transition on the corresponding input which lasts less than 5 s.



NOTE: The RESET function is not initiated when the OFF-ON-OFF transition on the corresponding input lasts more than 5 s.

You can use the RESET function to reset detected errors without disconnecting system power providing that the cause of the error has been removed.

`Interpage In` and `Interpage Out` Function

`Interpage In`

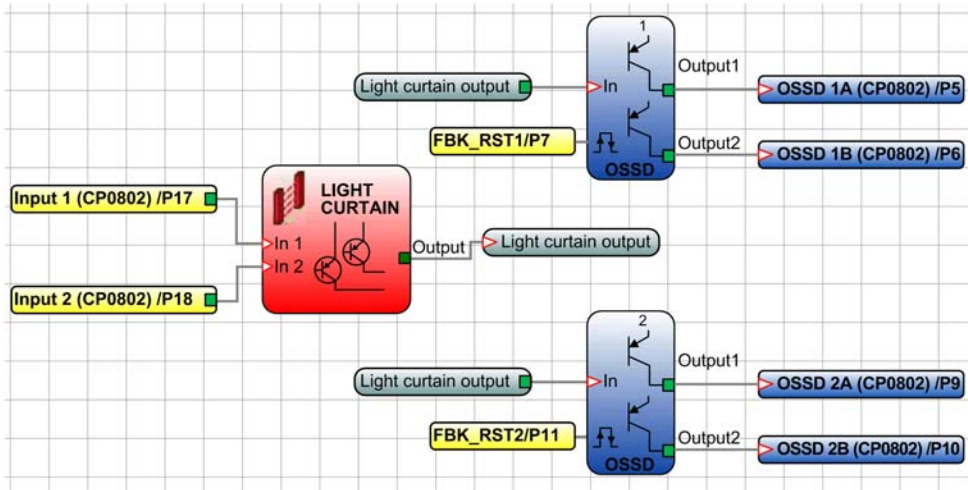
The `Interpage In` operator enables the reuse of an output of a function block. The operator simplifies the working area by using this function every time the same output is required in multiple places.

The operator is connected to the input of the function block, for example: `OSSD`. The operator must be given the same unique name as used on the `Interpage Out` operator function block.

`Interpage Out`

The `Interpage Out` operator enables the reuse of an output of a function block. The operator is connected to the output of a function block, for example `LIGHT CURTAIN`. The operator must be given a unique name, and then the value can be reused multiple times by initializing the `Interpage In` operator with the same unique name.

In the following example the output of the `LIGHT CURTAIN` function block is connected to the `Interpage Out` operator. The `Interpage In` operator is used to connect to two `OSSD` outputs in the configuration.



Appendices

Appendix A
Diagnostic Information

What Is in This Chapter?

This chapter contains the following topics:

Error Codes

Overview

If an error is detected, the controller system provides a corresponding error code to SoSafe Configurable.

To read the code, proceed as follows:

- Connect the XPSMCMCP0802• controller (indicating **E IN** or **E EX** by LED) to the computer using the USB/Mini B-USB configuration cable.
- Open SoSafe Configurable. A popup window appears with the associated code.

The following table lists the error codes and their solution:

Code	Description	Solution
19D 20D	The XPSMCMCP0802• controller and expansion modules do not have the same hardware or software configuration.	Verify that the connectors of the XPSMCMCP0802• and expansion modules are properly connected together.
66D	Two or more units of the same module reference detected with the same node address.	Verify the terminal connectors terminal 2 and 3 for the expansion modules to find node address duplication.
68D	Maximum number of expansion modules has been exceeded.	Remove the excess expansion modules. The limitation is 14 expansion modules per controller (excluding relay modules and communication modules).
70D	One or more expansion modules have detected a change in the node address number.	Verify the terminal connectors terminal 2 and 3 for the expansion modules.
73D	An expansion module has detected an external wiring issue.	Verify the module LED indicators and/or the diagnostic code in the software.
96D to 101D	Memory card not functioning.	Replace the memory card *(see page 177)*.
137D	XPSMCMRO0004 or XPSMCMRO0004DA - detected external device monitoring (EDM) error on the relay 1 and 2 when used in category 4.	Verify the connection to the external feedback contactors.
147D	XPSMCMRO0004 or XPSMCMRO0004DA - detected external device monitoring (EDM) error on the relay 2 and 3 when used in category 4.	
157D	XPSMCMRO0004 or XPSMCMRO0004DA - detected external device monitoring (EDM) error on the relay 3 and 4 when used in category 4.	
131D	XPSMCMEN• hardware - a disconnection of proximity sensor 1 or 2 has been detected.	Verify the connection of the proximity sensors.

Code	Description	Solution
132D	XPSMCMEN0200••• hardware - a disconnection of encoder 1 or 2 has been detected.	Verify the connection of the encoder.
133D (Proxy 1) 140D (Proxy 2)	XPSMCMEN• module: Over frequency detected on proximity input.	The input frequency must be ≤ 500 KHz.
136D (Encoder 1) 143D (Encoder 2)	XPSMCMEN• module: Encoder input signals are not as expected (duty cycle, phase displacement).	The duty cycle must be 50 ± 33% of the period (HTL, TTL). The phase displacement must be 90° ± 45° (HTL, TTL); not applicable for SinCos.
138D (Encoder 1) 145D (Encoder 2)	XPSMCMEN• module: Over frequency detected on encoder input.	The input frequency must be ≤500 KHz (TTL, SinCos) and ≤ 300 kHz (HTL).
142D	XPSMCMEN0100••• hardware - a disconnection of encoder 1 has been detected.	Verify the connection of the encoder 1.
144D	XPSMCMEN• hardware - a disconnection of proximity sensor 1 has been detected.	Verify the connection of the proximity sensor 1.
152D	XPSMCMEN0200••• hardware - a disconnection of encoder 2 has been detected.	Verify the connection of the encoder 2.
154D	XPSMCMEN• hardware - a disconnection of proximity sensor 2 has been detected.	Verify the connection of the proximity sensor 2.
194D 197D 198D 199D 201D 202D 203D 205D	Solid-state output 1 on the XPSMCMCP0802• or expansion module **E EX** LED.	Verify the digital output (`OSSD1`) connection relative the module containing **E EX** LED.
208D 211D 212D 213D 215D 216D 217D 219D	Solid-state output 2 on the XPSMCMCP0802• or expansion module **E EX** LED.	Verify the digital output (`OSSD2`) connection relative the module containing **E EX** LED.
222D 225D 226D 227D 229D 230D 232D 233D	Solid-state output 3 on the XPSMCMCP0802• or expansion module **E EX** LED.	Verify the digital output (`OSSD3`) connection relative the module containing **E EX** LED.

Code	Description	Solution
236D 239D 240D 241D 243D 244D 245D 247D	Solid-state output 4 on the XPSMCMCP0802• or expansion module **E EX** LED.	Verify the digital output (OSSD4) connection relative the module containing **E EX** LED.

Other codes are related to internal errors. If such a detected error persists after a system restart, replace the affected product.

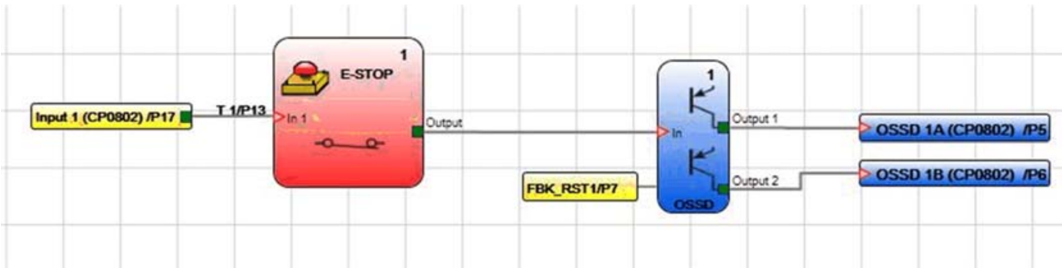
Code	Description	Solution
1D to 31D	Microcontroller error detected.	Try to restart the system. If the detected error persists, replace the affected product.
32D to 63D	Mainboard error detected.	
64D to 95D	Communication error between units detected.	
96D to 127D	Memory card error detected.	Replace the memory card
128D to 138D	XPSMCMRO0004• module Relay 1 error detected.	Try to restart the system. If the detected error persists, replace the affected product.
139D to 148D	XPSMCMRO0004• module Relay 2 error detected.	
149D to 158D	XPSMCMRO0004• module Relay 3 error detected.	
159D to 168D	XPSMCMRO0004• module Relay 4 error detected.	
128D to 191D	Error units XPSMCMRO0004• or XPSMCMEN•	
192D to 205D	OSSD1 error detected.	
206D to 219D	OSSD2 error detected.	
220D to 233D	OSSD3 error detected.	
234D to 247D	OSSD4 error detected.	

Examples of Diagnostics

Example 1

In this example, `Input1` (connected to module XPSMCMCP0802•), is tested with the `T1` test signal. During wiring, the 24 Vdc is connected to `Input 1` instead of the `T1` test signal.

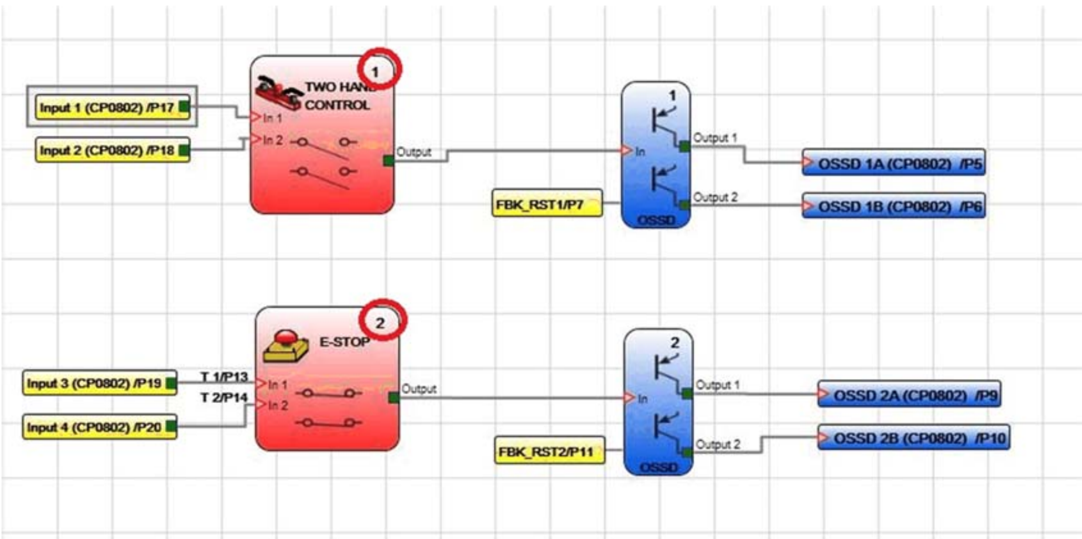
The I/O index and diagnostic code fields assume the values 1 - 20 to indicate the diagnostics on `Input 1` of the XPSMCMCP0802• module (detected connection error).



Example 2

In this example, the I/O index corresponds to the logical block and not to the physical terminal on the XPSMCMCP0802• module.

The `Two Hand Control` element connected to the `Input 1` and `Input 2` physical terminals corresponds to I/O index number 1, and the emergency stop (`E-STOP`) connected to the `Input 3` and `Input 4` terminals corresponds to I/O index number 2.

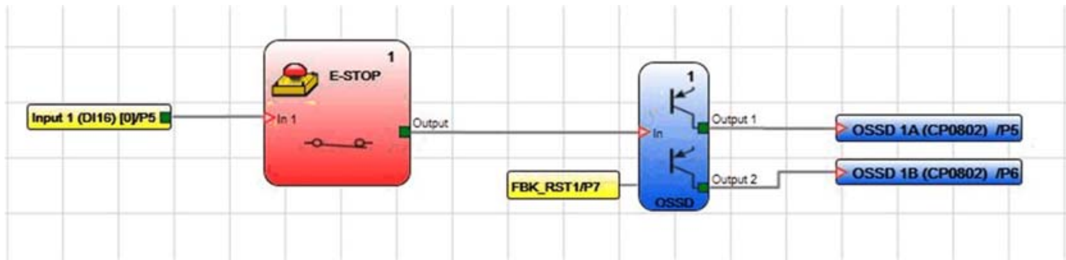


Example 3

In this example, `Input 1` is connected to module XPSMCMDI1600• and is tested with the `T1` test signal.

During wiring, the 24 Vdc is connected to `Input 1` instead of the `T1` test signal.

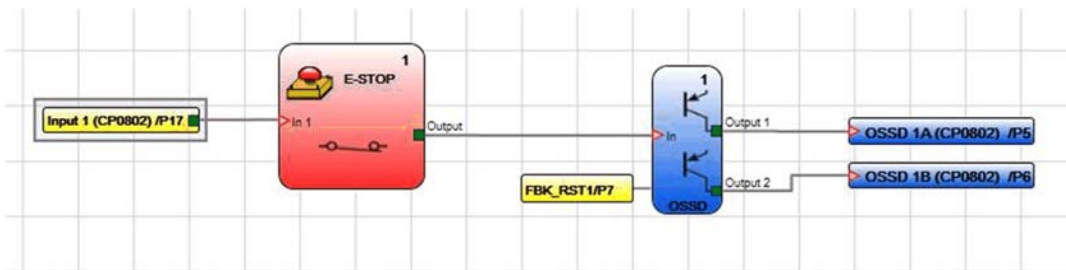
`Input 1` has diagnostic code 10 (`OUT_TEST` error) and `OUT_TEST T1` has diagnostic code 8 (detected connection error).



Example 4

In this example, the manual reset function is enabled on `OSSD 1`. The push-button connected to `Input 1` is pressed without sending a reset command.

- The I/O index and diagnostics code fields assume the values 192 - 2.
- Indication of the diagnostics on `OSSD 1A` and `OSSD 1B` (192 = first output).
- Indication of the diagnostic code: 2 = waiting for `OSSD` to restart.



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