# MOSAIC

## MODULAR SAFETY INTEGRATED CONTROLLER

## Installation and use

**⌂ReeR**

32 via Carcano
10153 Torino Italia
www.reer.it

# MODULAR SAFETY INTEGRATED CONTROLLER

## CONTENTS

**English**

*English*

**English**

# INTRODUCTION

## Contents of this handbook

This handbook describes how to use the MOSAIC programmable safety module and its expansion units ("SLAVES");

it includes:

- a description of the system
- method of installation
- connections
- signals
- troubleshooting
- use of the configuration SW

## Important safety instructions

> ⚡ This safety alert symbol indicates a potential **personal safety hazard.** Failure to comply with instructions bearing this symbol could pose a very serious risk to personnel.

> ➔ This symbol indicates an important instruction.

> ⚡ The MOSAIC is built to the following safety levels: SIL 3, SILCL 3, PL e, Cat. 4, Type 4 in accordance with the applicable standards. However, the definitive SIL and PL of the application will depend on the number of safety components, their parameters and the connections that are made, as per the risk analysis.
>
> ⚡ Read the "Applicable Standards" section carefully.
>
> ⚡ Perform an in-depth risk analysis to determine the appropriate safety level for your specific application, on the basis of all the applicable standards.
>
> ⚡ Programming/configuration of the Mosaic is the sole responsibility of the installer or user.
>
> ⚡ The device must be programmed/configured in accordance with the application-specific risk analysis and all the applicable standards.
>
> ⚡ Once you have programmed/configured and installed the Mosaic and all the relative devices, run a complete application safety test (see "TESTING the system", page 75).
>
> ⚡ Always test the complete system whenever new safety components are added (see the "TESTING the system" section, page 75).
>
> ⚡ ReeR is not responsible for these operations or any risks in connection therewith.
>
> ⚡ Reference should be made to the handbooks and the relative product and/or application standards to ensure correct use of devices connected to the Mosaic within the specific application.
>
> ⚡ The ambient temperature in the place where the system is installed must be compatible with the operating temperature parameters stated on the product label and in the specifications.
>
> ⚡ For all matters concerning safety, if necessary, contact your country's competent safety authorities or the competent trade association.

**English**

# Abbreviations and symbols

**MCM =** MOSAIC Configuration Memory: *memory chip for MOSAIC M1 (accessory)*
**MSC =** MOSAIC Safety Communication: *proprietary bus for expansion units*
**MSD =** MOSAIC Safety Designer: *MOSAIC configuration SW running in Windows*
**OSSD =** Output Signal Switching Device: *solid state safety output*
**MTTFd =** Mean Time to Dangerous Failure
**PL =** Performance Level
**PFHd =** Probability of a dangerous failure per Hour
**SIL =** Safety Integrity Level
**SILCL =** Safety Integrity Level Claim Limit
**SW =** Software

# Applicable standards

MOSAIC complies with the following European Directives:
- **2006/42/EC** "Machinery Directive"
- **2004/108/EC** "Electromagnetic Compatibility Directive"
- **2006/95/EC** "Low Voltage Directive"

and is built to the following standards:

| | |
|---|---|
| **CEI EN 61131-2** | Programmable controllers, part 2: Equipment requirements and tests |
| **ISO 13489-1** | Safety of machinery: Safety related parts of control systems. General principles for design |
| **EN 61496-1** | Safety of machinery: Electro-sensitive protective equipment. Part 1: General requirements and tests. |
| **IEC 61508-1** | Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements. |
| **IEC 61508-2** | Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems. |
| **IEC 61508-3** | Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements. |
| **IEC 61784-3** | Digital data communication for measurement and control: Functional safety fieldbuses. |
| **IEC 62061** | Safety of machinery. Functional safety of safety-related electrical, electronic and programmable electronic control systems |

*Table 1*

**English**

## OVERVIEW

MOSAIC is a modular safety controller. It consists of a master unit **(M1)**, which can be configured using the MSD graphic interface, and a number of expansion units connected to the M1 via the proprietary MSC bus.

The M1 can also be used as a stand-alone device. It has 8 safety inputs and 2 independent programmable dual channel outputs.

➜  The following expansions are available: I/O expansions **(MI8O2)**, input only expansions **(MI8, MI12T8, MI16, MV0, MV1 and MV2)**, output only expansions **(MO2 and MO4)**, signaling only expansions **(MOS8 and MOS16)**, guided contact safety relay output modules **(MR2, MR4, MOR4 and MOR4S8)** and diagnostic connections to the main fieldbuses: **MBP** (PROFIBUS), **MBC** (CanOpen)**, MBD** (DeviceNet), **MBEI** (ETHERNET/IP), **MBEI2B** (ETHERNET/IP-2PORT), **MBEP** (Profinet), **MBEC** (ETHERCAT), **MBMR** (Modbus RTU), **MBEM** (Modbus/TCP)**.**

MOSAIC is capable of monitoring the following safety sensors and commands:

optoelectronic sensors (safety light curtains, scanners, safety photocells), mechanical switches, safety mats, emergency stops, two-hand controls, all managed by a single flexible and expandable device.

The system must consist of just one Master M1 and a number of electronic expansions that can range from 0 to a maximum of 14, not more than 4 of which of the same type. There is no limit to the number of relay modules that can be installed.

With 14 expansions, the system can have up to 128 inputs, 16 dual channel safety outputs and 16 status outputs. The MASTER and its SLAVE units communicate via the 5-way MSC bus (ReeR proprietary bus), physically arranged on the rear panel of each unit.

Furthermore 8 inputs and 16 outputs probe controllable (by Fieldbus) are available.

With the **MI8, MI16** and **MI12T8** Mosaic expansion units, the number of inputs in the system can be increased to allow more external devices to be connected. The **MI12T8** also provides 8 OUT_TEST outputs.

The **MO2** and **MO4** Mosaic expansion units provide the system, respectively, with 2 and 4 OSSD (Output Signal Switching Device) pairs for controlling devices connected downstream of the **MOSAIC**.

The **MI8O2** has 8 inputs and 2 OSSD outputs.

The **MR2** and **MR4** Mosaic expansion units provide the system with 2 and 4 N.O. guided contact safety relay outputs, respectively, with the related external relay feedback (N.C. contact).

The expansion units in the **MB** series permit connection to the most commonly used industrial fieldbus systems for diagnostics and data transmission.

The **MBEI**, **MBEI2B**, **MBEP, MBEM** and **MBEC** also have an ethernet connection. The **MBU** permits connection to devices with a USB port.

The **MCT1** and **MCT2 Mosaic** units are used to connect the M1 to other slave units installed at a distance (< 50 m). Two MCT units installed at the required distance can be connected using a shielded cable (ReeR MC25, MC50 or other cable with the characteristics set out in the cable data sheet).

The **MV0**, **MV1** and **MV2** Mosaic expansion units can be used to control the following (up to PLe):
- Zero speed, Max. 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 MSD software and is thus capable of controlling up to two independent axes.

The **MOR4** and **MOR4S8** are safety units provided with 4 independent safety relay outputs and the corresponding 4 inputs for the external feedback contacts (EDM).

There are two possible output settings (configured using the MSD configuration software).

- Two pairs of connection contacts (2 N.O. contacts per output with 2 corresponding feedback inputs).

- Four independent single connection contacts (1 N.O. contact per output with 1 corresponding feedback input).

Only the MOR4S8 unit has 8 programmable signal outputs.

The **MOS8** and **MOS16** have 8 and 16 programmable signal outputs.

The MSD software is capable of creating complex logics, using logical operators and safety functions such as muting, timer, counters, etc.

All this is performed through an easy and intuitive graphic interface.

The configuration performed on the PC is sent to the M1 via USB connection; the file resides in the M1 and can also be saved on the proprietary MCM memory chip (accessory). The configuration can therefore quickly be copied to another M1 unit.

> ➡  The MOSAIC system is certified to the maximum safety level envisaged by the applicable industrial safety standards (SIL 3, SILCL 3, PL e, Cat. 4).

**English**

# PRODUCT COMPOSITION

The MOSAIC M1 is supplied with:
- CD-ROM containing the free MSD SW, this PDF multi-language handbook and other product literature.
- Multi-language installation sheet.

➜ NB: the rear panel MSC connector and MCM memory can be ordered separately as accessories.

The expansion units are supplied with:
- Multilingual Installation sheet.
- Rear panel MSC connector (not present in the MR2 and MR4 which are connected via terminal blocks only).

➜ NB: to install an expansion unit (excluding relays) you will need the MSC connector supplied with the unit plus another MSC for the connection to the M1. This can be ordered separately as an accessory.

*English*

# INSTALLATION

## Mechanical fastening

Fix the MOSAIC system units to a 35mm DIN rail as follows:

1. Connect the same number of "MSC" 5-pole rear panel connectors as the number of units to be installed.
2. Fix the train of connectors thus obtained to the Omega DIN 35mm (EN 5022) rail (hooking them at the top first).
3. Fasten the units to the rail, arranging the contacts on the base of the unit on the respective connector. Press the unit gently until you feel it snap into place.
4. To remove a unit, use a screwdriver to pull down the locking latch on the back of the unit; then lift the unit upwards and pull.



*Figure 1*

*English*
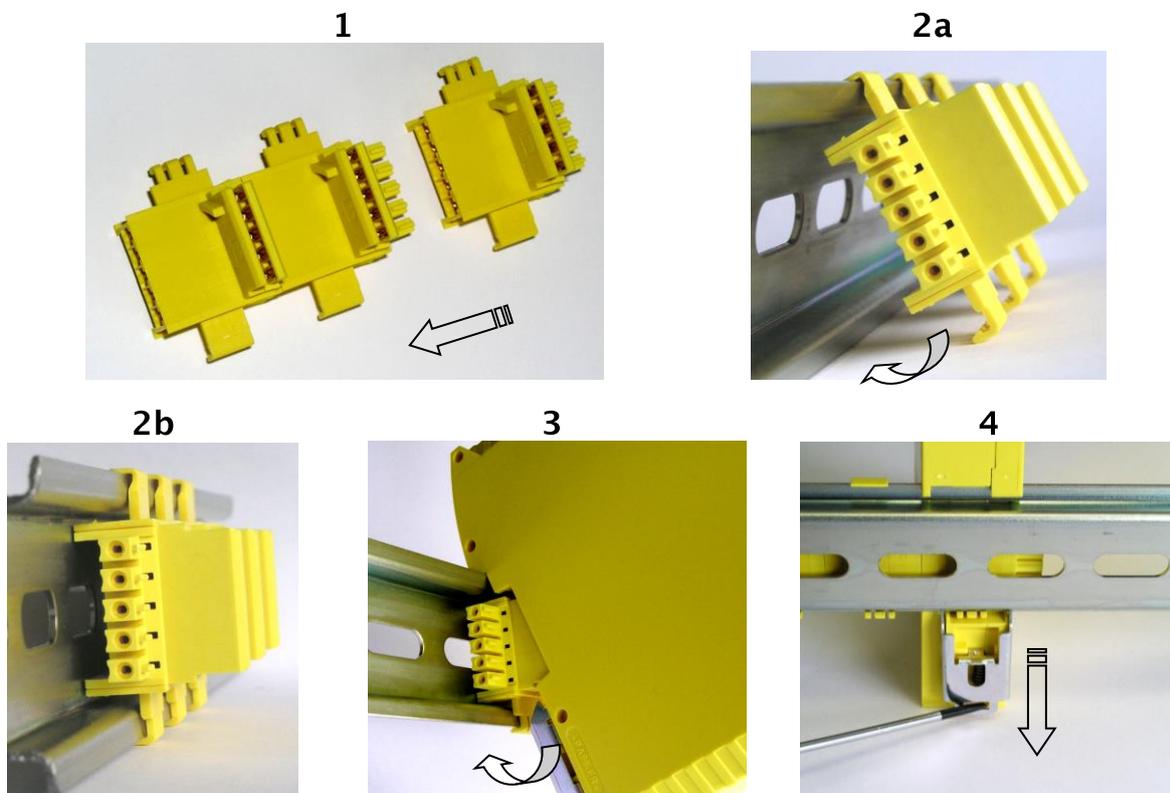
## Calculation of safety distance of an ESPE connected to MOSAIC

Any Electro-sensitive Protective Equipment device connected to MOSAIC, must be positioned at a distance equal to or greater than the minimum safety distance **S** so that the dangerous point can be reached only after stopping the dangerous movement of the machine.

> ⚡ The european standard:
> - ISO 13855:2010- (EN 999:2008) Safety of machinery - *Positioning of safeguards with respect to the approach speeds of parts of the human body.*[1]
> provides the elements to calculate the proper safety distance.
>
> ⚡ Carefully read the installation manual of each device for specific information on the correct positioning.
>
> ⚡ Remember that the total response time depends on:
> MOSAIC response time + ESPE response time + response time of the machine (i.e. the time taken by the machine to stop the dangerous movement from the moment in which the stop signal is transmitted).

## Electrical connections
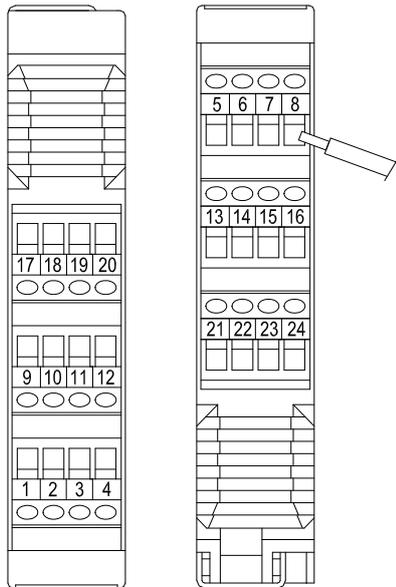


The MOSAIC system units are provided with terminal blocks for the electrical connections. Each unit can have 8, 16 or 24 terminals.
Each unit also has a rear panel plug-in connector (for communication with the master and with the other expansion units).

The MR2 and MR4 are connected via terminal blocks only.

> ➜ Terminal tightening torque: 5÷7lb-in (0,6÷0,7 Nm).

> ⚡ Install safety units in an enclosure with a protection class of at least IP54.
>
> ⚡ Connect the module when it is not powered.
>
> ⚡ The supply voltage to the units must be 24Vdc ±20% (PELV, in compliance with the standard EN 60204-1 (Chapter 6.4)).
>
> ⚡ Do not use the MOSAIC to supply external devices.
>
> ⚡ The same ground connection (0VDC) must be used for all system components.

---

[1] "Describe the methods that designers can use to calculate the minimum safety distance from a specific dangerous point for the safety devices, particularly Electro-sensitive devices (eg. light curtains), safety-mats or pressure sensitive floors and bimanual control. It contains a rule to determine the placement of safety devices based on approach speed and the stopping time of the machine, which can reasonably be extrapolated so that it also includes the interlocking guards without guard locking."

## Instructions concerning connection cables.

➜ Wire size range: AWG 12÷30, (solid/stranded) (UL).

➜ Use 60/75°C copper (Cu) conductor only.

➜ We recommend the use of separate power supplies for the safety module and for other electrical power equipment (electric motors, inverters, frequency converters) or other sources of disturbance.

➜ Cables used for connections of longer than 50m must have a cross-section of at least 1mm2 (AWG16).

Connections of each single MOSAIC system unit are listed in the table below:

| Master M1 | | | | |
|---|---|---|---|---|
| TERMINAL | SIGNAL | TYPE | DESCRIPTION | OPERATION |
| 1 | 24VDC | - | 24VDC power supply | - |
| 2 | MASTER_ENABLE1 | Input | Master Enable 1 | Input (*"type B"* according to EN 61131-2 ) |
| 3 | MASTER_ENABLE2 | Input | Master Enable 2 | Input (*"type B"* according to EN 61131-2 ) |
| 4 | 0VDC | - | 0VDC power supply | - |
| 5 | OSSD1_A | Output | Static output 1 | PNP active high |
| 6 | OSSD1_B | Output | | PNP active high |
| 7 | RESTART_FBK1 | Input | Feedback/Restart 1 | Input according to EN 61131-2 |
| 8 | OUT_STATUS1 | Output | Programmable signal output | PNP active high |
| 9 | OSSD2_A | Output | Static output 2 | PNP active high |
| 10 | OSSD2_B | Output | | PNP active high |
| 11 | RESTART_FBK2 | Input | Feedback/Restart 2 | Input according to EN 61131-2 |
| 12 | OUT_STATUS2 | Output | Programmable signal output | PNP active high |
| 13 | OUT_TEST1 | Output | Short circuit detected output | PNP active high |
| 14 | OUT_TEST2 | Output | Short circuit detected output | PNP active high |
| 15 | OUT_TEST3 | Output | Short circuit detected output | PNP active high |
| 16 | OUT_TEST4 | Output | Short circuit detected output | PNP active high |
| 17 | INPUT1 | Input | Digital input 1 | Input according to EN 61131-2 |
| 18 | INPUT2 | Input | Digital input 2 | Input according to EN 61131-2 |
| 19 | INPUT3 | Input | Digital input 3 | Input according to EN 61131-2 |
| 20 | INPUT4 | Input | Digital input 4 | Input according to EN 61131-2 |
| 21 | INPUT5 | Input | Digital input 5 | Input according to EN 61131-2 |
| 22 | INPUT6 | Input | Digital input 6 | Input according to EN 61131-2 |
| 23 | INPUT7 | Input | Digital input 7 | Input according to EN 61131-2 |
| 24 | INPUT8 | Input | Digital input 8 | Input according to EN 61131-2 |

**English**

## USB input

The MOSAIC master M1 includes a USB 2.0 connector for connection to a Personal Computer where the **MSD** (MOSAIC Safety Designer) configuration SW resides.

A USB cable of the correct size is available as an accessory (**CSU**).



*Figure 2 - USB 2.0 front panel connector*

**TECHNICAL DATA LABEL**

**MCM LABEL**
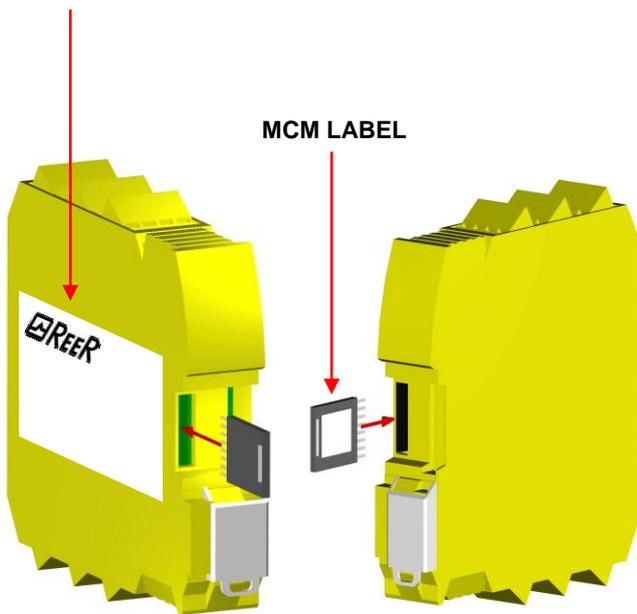


*Figure 3 - MCM*

## MOSAIC Configuration Memory (MCM)

A backup memory, called **MCM** (optional) can be installed in the MOSAIC master M1 and used to save the SW configuration parameters.

The MCM is written **each time** a new project is sent from the PC to the M1.

➔ Always switch the M1 off before logging on to/logging off from the MCM.

Insert the card in the **slot in the rear panel of the M1** (in the direction shown in Figure 3 - MCM)**.**

### MULTIPLE LOAD function

To perform the configuration of several M1 modules without using a PC and the USB connector, you can save the desired configuration on a single MCM and then use it to download data on the modules M1 to be configured.

If the file contained in the MCM is not identical to the one contained in M1, an overwrite operation that will permanently delete the configuration data contained in M1 will be performed.
**WARNING: ALL DATA PREVIOUSLY CONTAINED IN M1 WILL BE LOST.**

## RESTORE function

If the M1 unit is damaged, you can replace it with a new one; having already saved all the configurations on the MCM, all you need to do is insert the MCM in the new M1 and

*English*

switch on the MOSAIC system, that will immediately load the backup configuration. In this way, the work interruptions will be minimized.

➔ The LOAD and RESTORE functions can be disabled via SW. (see Figure 40)

➔ In order to be used, the expansion units must be addressed at the time of installation (see the NODE SEL section).

⚡ Each time MCM is used, carefully check that the chosen configuration is the one that was planned for that particular system. Try again a fully functional test of the system composed of Mosaic plus all devices connected to it (see the TESTING the system section).

| MI8O2 | | | | |
|---|---|---|---|---|
| **TERMINAL** | **SIGNAL** | **TYPE** | **DESCRIPTION** | **OPERATION** |
| 1 | 24VDC | - | 24VDC power supply | - |
| 2 | NODE_SEL0 | Input | Node selection | Input (*"type B"* according to EN 61131-2 ) |
| 3 | NODE_SEL1 | Input | | Input (*"type B"* according to EN 61131-2 ) |
| 4 | 0VDC | - | 0VDC power supply | - |
| 5 | OSSD1_A | Output | Static output 1 | PNP active high |
| 6 | OSSD1_B | Output | | PNP active high |
| 7 | RESTART_FBK1 | Input | Feedback/Restart 1 | Input according to EN 61131-2 |
| 8 | OUT_STATUS1 | Output | Programmable signal output | PNP active high |
| 9 | OSSD2_A | Output | Static output 2 | PNP active high |
| 10 | OSSD2_B | Output | | PNP active high |
| 11 | RESTART_FBK2 | Input | Feedback/Restart 2 | Input according to EN 61131-2 |
| 12 | OUT_STATUS2 | Output | Programmable signal output | PNP active high |
| 13 | OUT_TEST1 | Output | Short circuit detected output | PNP active high |
| 14 | OUT_TEST2 | Output | Short circuit detected output | PNP active high |
| 15 | OUT_TEST3 | Output | Short circuit detected output | PNP active high |
| 16 | OUT_TEST4 | Output | Short circuit detected output | PNP active high |
| 17 | INPUT1 | Input | Digital input 1 | Input according to EN 61131-2 |
| 18 | INPUT2 | Input | Digital input 2 | Input according to EN 61131-2 |
| 19 | INPUT3 | Input | Digital input 3 | Input according to EN 61131-2 |
| 20 | INPUT4 | Input | Digital input 4 | Input according to EN 61131-2 |
| 21 | INPUT5 | Input | Digital input 5 | Input according to EN 61131-2 |
| 22 | INPUT6 | Input | Digital input 6 | Input according to EN 61131-2 |
| 23 | INPUT7 | Input | Digital input 7 | Input according to EN 61131-2 |
| 24 | INPUT8 | Input | Digital input 8 | Input according to EN 61131-2 |

*Table 2*

*English*

| MI8 | | | | |
|---|---|---|---|---|
| **TERMINAL** | **SIGNAL** | **TYPE** | **DESCRIPTION** | **OPERATION** |
| 1 | 24VDC | - | 24VDC power supply | - |
| 2 | NODE_SEL0 | Input | Node selection | Input (*"type B"* according to EN 61131-2 ) |
| 3 | NODE_SEL1 | Input | | Input (*"type B"* according to EN 61131-2 ) |
| 4 | 0VDC | - | 0VDC power supply | - |
| 5 | INPUT1 | Input | Digital input 1 | Input according to  EN 61131-2 |
| 6 | INPUT2 | Input | Digital input 2 | Input according to  EN 61131-2 |
| 7 | INPUT3 | Input | Digital input 3 | Input according to  EN 61131-2 |
| 8 | INPUT4 | Input | Digital input 4 | Input according to  EN 61131-2 |
| 9 | OUT_TEST1 | Output | Short circuit detected output | PNP active high |
| 10 | OUT_TEST2 | Output | Short circuit detected output | PNP active high |
| 11 | OUT_TEST3 | Output | Short circuit detected output | PNP active high |
| 12 | OUT_TEST4 | Output | Short circuit detected output | PNP active high |
| 13 | INPUT5 | Input | Digital input 5 | Input according to  EN 61131-2 |
| 14 | INPUT6 | Input | Digital input 6 | Input according to  EN 61131-2 |
| 15 | INPUT7 | Input | Digital input 7 | Input according to  EN 61131-2 |
| 16 | INPUT8 | Input | Digital input 8 | Input according to  EN 61131-2 |

*Table 3*

| MI12T8 | | | | |
|---|---|---|---|---|
| **TERMINAL** | **SIGNAL** | **TYPE** | **DESCRIPTION** | **OPERATION** |
| 1 | 24VDC | - | 24VDC power supply | - |
| 2 | NODE_SEL0 | Input | Node selection | Input (*"type B"* according to EN 61131-2 ) |
| 3 | NODE_SEL1 | Input | | Input (*"type B"* according to EN 61131-2 ) |
| 4 | 0VDC | - | 0VDC power supply | - |
| 5 | INPUT1 | Input | Digital input 1 | Input according to  EN 61131-2 |
| 6 | INPUT2 | Input | Digital input 2 | Input according to  EN 61131-2 |
| 7 | INPUT3 | Input | Digital input 3 | Input according to  EN 61131-2 |
| 8 | INPUT4 | Input | Digital input 4 | Input according to  EN 61131-2 |
| 9 | OUT_TEST1 | Output | Short circuit detected output | PNP active high |
| 10 | OUT_TEST2 | Output | Short circuit detected output | PNP active high |
| 11 | OUT_TEST3 | Output | Short circuit detected output | PNP active high |
| 12 | OUT_TEST4 | Output | Short circuit detected output | PNP active high |
| 13 | INPUT5 | Input | Digital input 5 | Input according to  EN 61131-2 |
| 14 | INPUT6 | Input | Digital input 6 | Input according to  EN 61131-2 |
| 15 | INPUT7 | Input | Digital input 7 | Input according to  EN 61131-2 |
| 16 | INPUT8 | Input | Digital input 8 | Input according to  EN 61131-2 |
| 17 | OUT_TEST5 | Output | Short circuit detected output | PNP active high |
| 18 | OUT_TEST6 | Output | Short circuit detected output | PNP active high |
| 19 | OUT_TEST7 | Output | Short circuit detected output | PNP active high |
| 20 | OUT_TEST8 | Output | Short circuit detected output | PNP active high |
| 21 | INPUT9 | Input | Digital input 9 | Input according to  EN 61131-2 |
| 22 | INPUT10 | Input | Digital input 10 | Input according to  EN 61131-2 |
| 23 | INPUT11 | Input | Digital input 11 | Input according to  EN 61131-2 |
| 24 | INPUT12 | Input | Digital input 12 | Input according to  EN 61131-2 |

*Table 4*

**English**

| MI16 | | | | |
|---|---|---|---|---|
| **TERMINAL** | **SIGNAL** | **TYPE** | **DESCRIPTION** | **OPERATION** |
| 1 | 24VDC | - | 24VDC power supply | - |
| 2 | NODE_SEL0 | Input | Node selection | Input (*"type B"* according to EN 61131-2 ) |
| 3 | NODE_SEL1 | Input | | Input (*"type B"* according to EN 61131-2 ) |
| 4 | 0VDC | - | 0VDC power supply | - |
| 5 | INPUT1 | Input | Digital input 1 | Input according to  EN 61131-2 |
| 6 | INPUT2 | Input | Digital input 2 | Input according to  EN 61131-2 |
| 7 | INPUT3 | Input | Digital input 3 | Input according to  EN 61131-2 |
| 8 | INPUT4 | Input | Digital input 4 | Input according to  EN 61131-2 |
| 9 | OUT_TEST1 | Output | Short circuit detected output | PNP active high |
| 10 | OUT_TEST2 | Output | Short circuit detected output | PNP active high |
| 11 | OUT_TEST3 | Output | Short circuit detected output | PNP active high |
| 12 | OUT_TEST4 | Output | Short circuit detected output | PNP active high |
| 13 | INPUT5 | Input | Digital input 5 | Input according to  EN 61131-2 |
| 14 | INPUT6 | Input | Digital input 6 | Input according to  EN 61131-2 |
| 15 | INPUT7 | Input | Digital input 7 | Input according to  EN 61131-2 |
| 16 | INPUT8 | Input | Digital input 8 | Input according to  EN 61131-2 |
| 17 | INPUT9 | Input | Digital input 9 | Input according to  EN 61131-2 |
| 18 | INPUT10 | Input | Digital input 10 | Input according to  EN 61131-2 |
| 19 | INPUT11 | Input | Digital input 11 | Input according to  EN 61131-2 |
| 20 | INPUT12 | Input | Digital input 12 | Input according to  EN 61131-2 |
| 21 | INPUT13 | Input | Digital input 13 | Input according to  EN 61131-2 |
| 22 | INPUT14 | Input | Digital input 14 | Input according to  EN 61131-2 |
| 23 | INPUT15 | Input | Digital input 15 | Input according to  EN 61131-2 |
| 24 | INPUT16 | Input | Digital input 16 | Input according to  EN 61131-2 |

*Table 5*

| MO4 | | | | |
|---|---|---|---|---|
| **TERMINAL** | **SIGNAL** | **TYPE** | **DESCRIPTION** | **OPERATION** |
| 1 | 24VDC | - | 24VDC power supply | - |
| 2 | NODE_SEL0 | Input | Node selection | Input (*"type B"* according to EN 61131-2 ) |
| 3 | NODE_SEL1 | Input | | Input (*"type B"* according to EN 61131-2 ) |
| 4 | 0VDC | - | 0VDC power supply | - |
| 5 | OSSD1_A | Output | Static output 1 | PNP active high |
| 6 | OSSD1_B | Output | | PNP active high |
| 7 | RESTART_FBK1 | Input | Feedback/Restart 1 | Input according to  EN 61131-2 |
| 8 | OUT_STATUS1 | Output | Programmable signal output | PNP active high |
| 9 | OSSD2_A | Output | Static output 2 | PNP active high |
| 10 | OSSD2_B | Output | | PNP active high |
| 11 | RESTART_FBK2 | Input | Feedback/Restart 2 | Input according to  EN 61131-2 |
| 12 | OUT_STATUS2 | Output | Programmable signal output | PNP active high |
| 13 | 24VDC | - | 24VDC power supply | 24VDC outputs power supply * |
| 14 | 24VDC | - | 24VDC power supply | - |
| 15 | 0VDC | - | 0VDC power supply | 0VDC outputs * |
| 16 | 0VDC | - | 0VDC power supply | - |
| 17 | OSSD4_A | Output | Static output 4 | PNP active high |
| 18 | OSSD4_B | Output | | PNP active high |
| 19 | RESTART_FBK4 | Input | Feedback/Restart 4 | Input according to  EN 61131-2 |
| 20 | OUT_STATUS4 | Output | Programmable signal output | PNP active high |
| 21 | OSSD3_A | Output | Static output 3 | PNP active high |
| 22 | OSSD3_B | Output | | PNP active high |
| 23 | RESTART_FBK3 | Input | Feedback/Restart 3 | Input according to  EN 61131-2 |
| 24 | OUT_STATUS3 | Output | Programmable signal output | PNP active high |

*Table 6*

**English**

| MO2 | | | | |
|---|---|---|---|---|
| TERMINAL | SIGNAL | TYPE | DESCRIPTION | OPERATION |
| 1 | 24VDC | - | 24VDC power supply | - |
| 2 | NODE_SEL0 | Input | Node selection | Input (*"type B"* according to EN 61131-2 ) |
| 3 | NODE_SEL1 | Input | | Input (*"type B"* according to EN 61131-2 ) |
| 4 | 0VDC | - | 0VDC power supply | - |
| 5 | OSSD1_A | Output | Static output 1 | PNP active high |
| 6 | OSSD1_B | Output | | PNP active high |
| 7 | RESTART_FBK1 | Input | Feedback/Restart 1 | Input according to EN 61131-2 |
| 8 | OUT_STATUS1 | Output | Programmable signal output | PNP active high |
| 9 | OSSD2_A | Output | Static output 2 | PNP active high |
| 10 | OSSD2_B | Output | | PNP active high |
| 11 | RESTART_FBK2 | Input | Feedback/Restart 2 | Input according to EN 61131-2 |
| 12 | OUT_STATUS2 | Output | Programmable signal output | PNP active high |
| 13 | 24VDC | - | 24VDC power supply | 24VDC output power supply * |
| 14 | n.c. | - | - | - |
| 15 | 0VDC | - | 0VDC power supply | 0VDC output * |
| 16 | n.c. | - | - | - |

*Table 7*

* This terminal must be connected to the power supply for the unit to work properly.

| MR4 | | | | |
|---|---|---|---|---|
| TERMINAL | SIGNAL | TYPE | DESCRIPTION | OPERATION |
| 1 | 24VDC | - | 24VDC power supply | - |
| 4 | 0VDC | - | 0VDC power supply | - |
| 5 | OSSD1_A | Input | Control **ZONE 1** | PNP active high |
| 6 | OSSD1_B | Input | | |
| 7 | FBK_K1_K2_1 | Output | Feedback K1K2 **ZONE 1** | |
| 9 | A_NC1 | Output | NC contact **ZONE 1** | |
| 10 | B_NC1 | Output | | |
| 13 | A_NO11 | Output | NO1 contact **ZONE 1** | |
| 14 | B_NO11 | Output | | |
| 15 | A_NO12 | Output | NO2 contact **ZONE 1** | |
| 16 | B_NO12 | Output | | |
| 11 | A_NC2 | Output | NC contact **ZONE 2** | |
| 12 | B_NC2 | Output | | |
| 17 | OSSD2_A | Input | Control **ZONE 2** | PNP active high |
| 18 | OSSD2_B | Input | | |
| 19 | FBK_K1_K2_2 | Output | Feedback K1K2 **ZONE 2** | |
| 21 | A_NO21 | Output | NO1 contact **ZONE 2** | |
| 22 | B_NO21 | Output | | |
| 23 | A_NO22 | Output | NO2 contact **ZONE 2** | |
| 24 | B_NO22 | Output | | |

*Table 8*

**English**

| MR2 | | | | |
|---|---|---|---|---|
| TERMINAL | SIGNAL | TYPE | DESCRIPTION | OPERATION |
| 1 | 24VDC | - | 24VDC power supply | - |
| 4 | 0VDC | - | 0VDC power supply | - |
| 5 | OSSD1_A | Input | Control **ZONE 1** | PNP active high |
| 6 | OSSD1_B | Input | | |
| 7 | FBK_K1_K2_1 | Output | Feedback K1K2  **ZONE 1** | |
| 9 | A_NC1 | Output | NC contact **ZONE 1** | |
| 10 | B_NC1 | Output | | |
| 13 | A_NO11 | Output | NO1 contact **ZONE** 1 | |
| 14 | B_NO11 | Output | | |
| 15 | A_NO12 | Output | NO2 contact **ZONE 1** | |
| 16 | B_NO12 | Output | | |

*Table 9*

| MV0 –  MV1 – MV2 | | | | |
|---|---|---|---|---|
| TERMINAL | SIGNAL | TYPE | DESCRIPTION | OPERATION |
| 1 | 24VDC | - | 24VDC power supply | - |
| 2 | NODE_SEL0 | Input | Node selection | Input (**"type B"** according to EN 61131-2) |
| 3 | NODE_SEL1 | Input | | Input (**"type B"** according to EN 61131-2) |
| 4 | 0VDC | - | 0VDC power supply | - |
| 5 | PROXI1_24V | Output | PROXIMITY 1 connections (ref. "PROXIMITY INPUT FOR SPEED CONTROLLER MV2" -> 26) | Power supply 24VDC to PROXI1 |
| 6 | PROXI1_REF | Output | | Power supply 0VDC to PROXI1 |
| 7 | PROXI1 IN1 (3 WIRES) | Input | | PROXI1 NO input |
| 8 | PROXI1 IN2 (4 WIRES) | Input | | PROXI1 NC input |
| 9 | PROXI2_24V | Output | PROXIMITY 2 connections (ref. "PROXIMITY INPUT FOR SPEED CONTROLLER MV2" -> 26) | Power supply 24VDC to PROXI2 |
| 10 | PROXI2_REF | Output | | Power supply 0VDC to PROXI2 |
| 11 | PROXI2 IN1 (3 WIRES) | Input | | PROXI2 NO input |
| 12 | PROXI2 IN2 (4 WIRES) | Input | | PROXI2 NC input |
| 13 | N.C. | - | Not connected | - |
| 14 | N.C. | - | | - |
| 15 | N.C. | - | | - |
| 16 | N.C. | - | | - |

*Table 10*

**English**

# ENCODER CONNECTIONS WITH RJ45 CONNECTOR (MV1, MV2)



EIA/TIA-568A
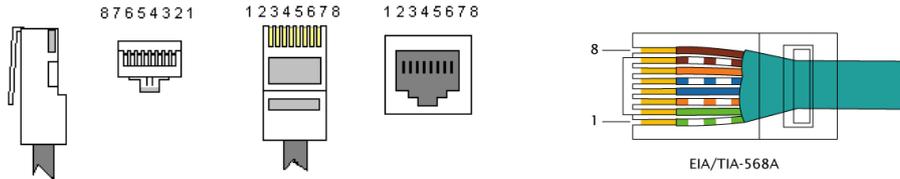
| | PIN | | MVT | MVTB | MVH | MVS |
|---|---|---|---|---|---|---|
| **TWISTED *** | 1 | | 5VDC | N.C. | N.C. | N.C. |
| | 2 | | EXT_0V | EXT_0V | EXT_0V | EXT_0V |
| | 3 | | N.C. | N.C. | N.C. | N.C. |
| **TWISTED *** | 4 | **INPUT** | A | A | A | A |
| | 5 | | $\overline{A}$ | $\overline{A}$ | $\overline{A}$ | $\overline{A}$ |
| | 6 | | N.C. | N.C. | N.C. | N.C. |
| **TWISTED *** | 7 | | B | B | B | B |
| | 8 | | $\overline{B}$ | $\overline{B}$ | $\overline{B}$ | $\overline{B}$ |

## * IN CASE OF UTILIZATION OF TWISTED CABLE



ENCODER TTL



ENCODER TTLB



ENCODER HTL



ENCODER SIN/COS

| MOR4 | | | | |
|---|---|---|---|---|
| **TERMINAL** | **SIGNAL** | **TYPE** | **DESCRIPTION** | **OPERATION** |
| 1 | 24VDC | - | 24VDC power supply | - |
| 2 | NODE_SEL0 | Input | Node selection | Input (*"type B"* according to EN 61131-2) |
| 3 | NODE_SEL1 | Input | | Input (*"type B"* according to EN 61131-2) |
| 4 | 0VDC | - | 0VDC power supply | - |
| 5 | REST_FBK1 | Input | Feedback/Restart 1 | Input (secondo EN 61131-2) |
| 6 | REST_FBK2 | Input | Feedback/Restart 2 | Input (secondo EN 61131-2) |
| 7 | REST_FBK3 | Input | Feedback/Restart 3 | Input (secondo EN 61131-2) |
| 8 | REST_FBK4 | Input | Feedback/Restart 4 | Input (secondo EN 61131-2) |
| 9 | A_NO1 | Output | N.O. contact Channel 1 | |
| 10 | B_NO1 | Output | | |
| 11 | A_NO2 | Output | N.O. contact Channel 2 | |
| 12 | B_NO2 | Output | | |
| 13 | A_NO3 | Output | N.O. contact Channel 3 | |
| 14 | B_NO3 | Output | | |
| 15 | A_NO4 | Output | N.O. contact Channel 4 | |
| 16 | B_NO4 | Output | | |

*Table 11*

| MOR4S8 | | | | |
|---|---|---|---|---|
| **TERMINAL** | **SIGNAL** | **TYPE** | **DESCRIPTION** | **OPERATION** |
| 1 | 24VDC | - | 24VDC power supply | - |
| 2 | NODE_SEL0 | Input | Node selection | Input (*"type B"* according to EN 61131-2) |
| 3 | NODE_SEL1 | Input | | Input (*"type B"* according to EN 61131-2) |
| 4 | 0VDC | - | 0VDC power supply | - |
| 5 | REST_FBK1 | Input | Feedback/Restart 1 | Input (secondo EN 61131-2) |
| 6 | REST_FBK2 | Input | Feedback/Restart 2 | Input (secondo EN 61131-2) |
| 7 | REST_FBK3 | Input | Feedback/Restart 3 | Input (secondo EN 61131-2) |
| 8 | REST_FBK4 | Input | Feedback/Restart 4 | Input (secondo EN 61131-2) |
| 9 | A_NO1 | Output | N.O. contact Channel 1 | |
| 10 | B_NO1 | Output | | |
| 11 | A_NO2 | Output | N.O. contact Channel 2 | |
| 12 | B_NO2 | Output | | |
| 13 | A_NO3 | Output | N.O. contact Channel 3 | |
| 14 | B_NO3 | Output | | |
| 15 | A_NO4 | Output | N.O. contact Channel 4 | |
| 16 | B_NO4 | Output | | |
| 17 | OUT_STATUS1 | Output | Programmable signal output 1 | PNP active high |
| 18 | OUT_STATUS2 | Output | Programmable signal output 2 | PNP active high |
| 19 | OUT_STATUS3 | Output | Programmable signal output 3 | PNP active high |
| 20 | OUT_STATUS4 | Output | Programmable signal output 4 | PNP active high |
| 21 | OUT_STATUS5 | Output | Programmable signal output 5 | PNP active high |
| 22 | OUT_STATUS6 | Output | Programmable signal output 6 | PNP active high |
| 23 | OUT_STATUS7 | Output | Programmable signal output 7 | PNP active high |
| 24 | OUT_STATUS8 | Output | Programmable signal output 8 | PNP active high |

*Table 12*

**English**

| MOS8 | | | | |
|---|---|---|---|---|
| **PIN** | **SIGNAL** | **TYPE** | **DESCRIPTION** | **OPERATION** |
| **1** | 24VDC | - | 24VDC power supply | - |
| **2** | NODE_SEL0 | Input | Node selection | Input ("*type B*" according to EN 61131-2) |
| **3** | NODE_SEL1 | Input | | Input ("*type B*" according to EN 61131-2) |
| **4** | 0VDC | - | 0VDC power supply | - |
| **5** | 24VDC STATUS 1–8 | - | 24VDC power supply OUTPUT STATUS 1-8 | - |
| **6** | – | - | - | - |
| **7** | – | - | - | - |
| **8** | – | - | - | - |
| **9** | OUT_STATUS1 | Output | Programmable signal output 1 | PNP active high |
| **10** | OUT_STATUS2 | Output | Programmable signal output 2 | PNP active high |
| **11** | OUT_STATUS3 | Output | Programmable signal output 3 | PNP active high |
| **12** | OUT_STATUS4 | Output | Programmable signal output 4 | PNP active high |
| **13** | OUT_STATUS5 | Output | Programmable signal output 5 | PNP active high |
| **14** | OUT_STATUS6 | Output | Programmable signal output 6 | PNP active high |
| **15** | OUT_STATUS7 | Output | Programmable signal output 7 | PNP active high |
| **16** | OUT_STATUS8 | Output | Programmable signal output 8 | PNP active high |

*Table 13*

| MOS16 | | | | |
|---|---|---|---|---|
| **PIN** | **SIGNAL** | **TYPE** | **DESCRIPTION** | **OPERATION** |
| **1** | 24VDC | - | 24VDC power supply | - |
| **2** | NODE_SEL0 | Input | Node selection | Input ("type B" according to EN 61131-2 ) |
| **3** | NODE_SEL1 | Input | | Input ("type B" according to EN 61131-2 ) |
| **4** | 0VDC | - | 0VDC power supply | - |
| **5** | 24VDC STATUS 1–8 | - | 24VDC power supply OUTPUT STATUS 1-8 | - |
| **6** | 24VDC STATUS 9–16 | - | 24VDC power supply OUTPUT STATUS 9-16 | - |
| **7** | – | - | - | - |
| **8** | – | - | - | - |
| **9** | OUT_STATUS1 | Output | Programmable signal output 1 | PNP active high |
| **10** | OUT_STATUS2 | Output | Programmable signal output 2 | PNP active high |
| **11** | OUT_STATUS3 | Output | Programmable signal output 3 | PNP active high |
| **12** | OUT_STATUS4 | Output | Programmable signal output 4 | PNP active high |
| **13** | OUT_STATUS5 | Output | Programmable signal output 5 | PNP active high |
| **14** | OUT_STATUS6 | Output | Programmable signal output 6 | PNP active high |
| **15** | OUT_STATUS7 | Output | Programmable signal output 7 | PNP active high |
| **16** | OUT_STATUS8 | Output | Programmable signal output 8 | PNP active high |
| **17** | OUT_STATUS9 | Output | Programmable signal output 9 | PNP active high |
| **18** | OUT_STATUS10 | Output | Programmable signal output 10 | PNP active high |
| **19** | OUT_STATUS11 | Output | Programmable signal output 11 | PNP active high |
| **20** | OUT_STATUS12 | Output | Programmable signal output 12 | PNP active high |
| **21** | OUT_STATUS13 | Output | Programmable signal output 13 | PNP active high |
| **22** | OUT_STATUS14 | Output | Programmable signal output 14 | PNP active high |
| **23** | OUT_STATUS15 | Output | Programmable signal output 15 | PNP active high |
| **24** | OUT_STATUS16 | Output | Programmable signal output 16 | PNP active high |

*Table 14*

**English**

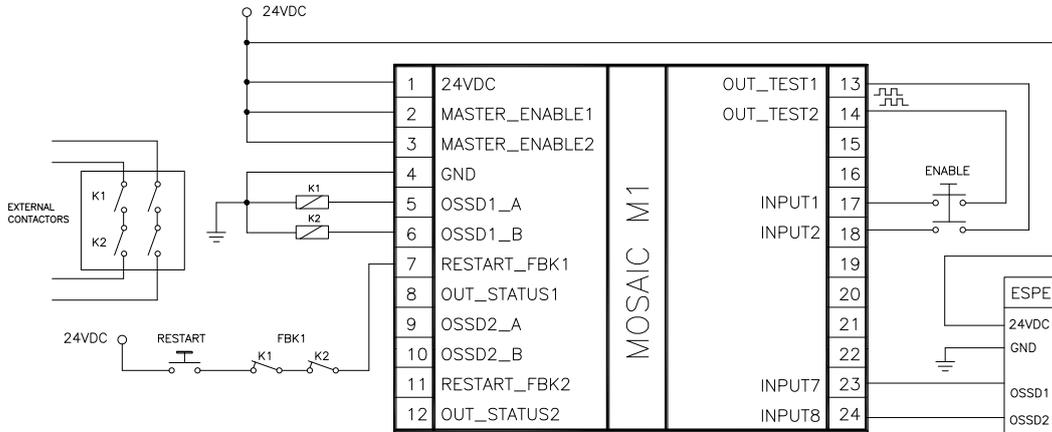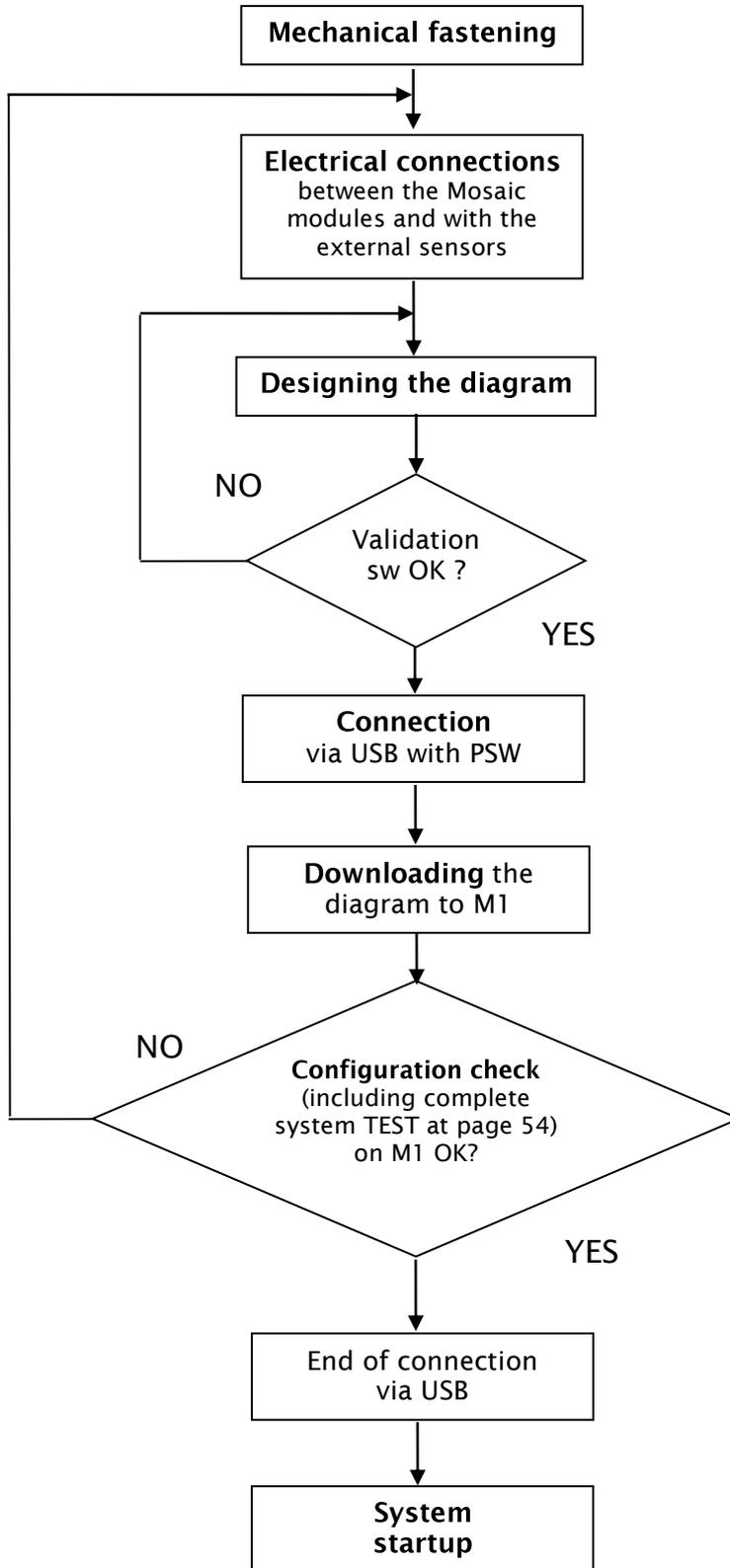## Example of connection of Mosaic to the machine control system



*Figure 4*

# CHECKLIST AFTER INSTALLATION

The MOSAIC system is able to detect the faults that occurs in each own module.
Anyway to have the system perfect operation perform the following checks at start up and at least every one year:

1. *Operate a complete system TEST (see "TESTING the system")*
2. *Verify that all the cables are correctly inserted and the terminal blocks well screwed.*
3. *Verify that all the leds (indicators) light on correctly.*
4. *Verify the positioning of all the sensors connected to MOSAIC.*
5. *Verify the correct fixing of MOSAIC to the Omega rail.*
6. *Verify that all the external indicators (lamps) work properly.*

➔  After installation, maintenance and after any eventual configuration change perform a System TEST as described in the paragraph *"TESTING the system"* at page 75.

*English*

# OPERATING DIAGRAM

```
              ┌─────────────────────────┐
              │   Mechanical fastening   │
              └─────────────────────────┘
                           │
                           ▼
              ┌─────────────────────────┐
              │  Electrical connections  │
              │      between the Mosaic   │
              │    modules and with the   │
              │      external sensors     │
              └─────────────────────────┘
                           │
                           ▼
              ┌─────────────────────────┐
              │   Designing the diagram   │
              └─────────────────────────┘
                           │
                           ▼
     NO                ╱Validation╲
  ◄──────────         ╱   sw OK ?   ╲
                      ╲             ╱
                       ╲           ╱
                           │  YES
                           ▼
              ┌─────────────────────────┐
              │        Connection         │
              │       via USB with PSW    │
              └─────────────────────────┘
                           │
                           ▼
              ┌─────────────────────────┐
              │    Downloading the        │
              │       diagram to M1       │
              └─────────────────────────┘
                           │
                           ▼
     NO            ╱  Configuration check ╲
  ◄──────        ╱  (including complete     ╲
                ╲  system TEST at page 54)  ╱
                 ╲      on M1 OK?          ╱
                      │  YES
                      ▼
              ┌─────────────────────────┐
              │    End of connection      │
              │        via USB            │
              └─────────────────────────┘
                           │
                           ▼
              ┌─────────────────────────┐
              │        System             │
              │        startup            │
              └─────────────────────────┘
```

# SIGNALS

## INPUTS

### MASTER ENABLE

The MOSAIC M1 master has two inputs: MASTER_ENABLE1 and MASTER_ENABLE2.

➜ These signals must <u>both be permanently set</u> to logic level 1 (24VDC) for the MOSAIC to operate. If the user needs to disable the MOSAIC simply lower these inputs to logic level 0 (0VDC).

### NODE SEL

The NODE_SEL0 and NODE_SEL1 inputs (on the SLAVE units) are used to attribute a physical address to the slave units with the connections shown in Table 15:

|  | NODE_SEL1 (Terminal 3) | NODE_SEL0 (Terminal 2) |
|---|---|---|
| NODE 0 | 0 (or not connected) | 0 (or not connected) |
| NODE 1 | 0 (or not connected) | 24VDC |
| NODE 2 | 24VDC | 0 (or not connected) |
| NODE 3 | 24VDC | 24VDC |

*Table 15*

➜ It is not allowed to use the same physical address on two units of the same type.

*English*

## PROXIMITY INPUT FOR SPEED CONTROLLER MV

### Configuration With Interleaved Proximity (Figure 5)

When an axis of the MV modules is configured for a measurement with two proximity switches, these can be configured in interleaved mode. Under the conditions listed below the system reaches a Performance Level = PLe:

- Proximity switches must be fitted such that the recorded signals overlap.
- Proximity switches must be fitted such that at least one is always activated.
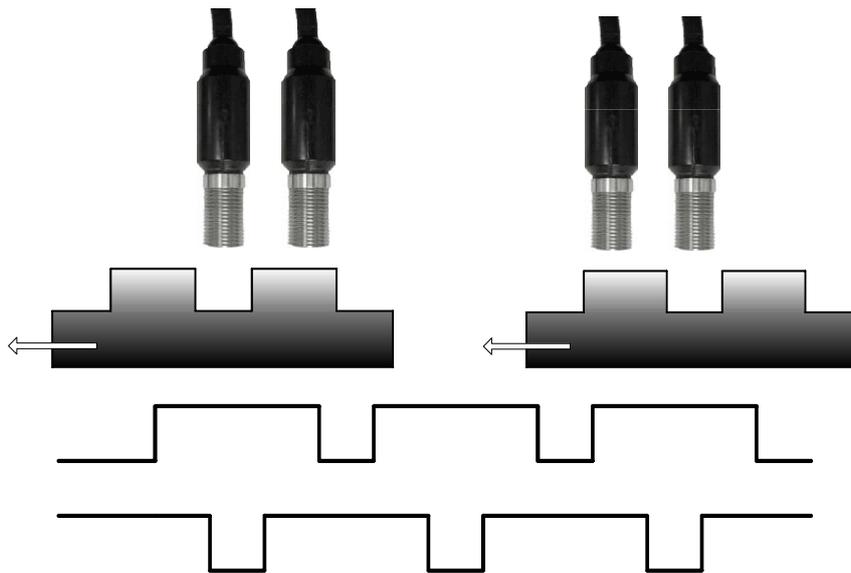


*Figure 5*

In addition:
- The proximity switches must be PNP type.
- The proximity switches must be NO type (Output ON when detecting metal).
- With the above conditions fulfilled, the DC value is equal to 90%.
- The two proximity switches must be of the same model, with MTTF > 70 years.

*English*

RESTART_FBK

The RESTART_FBK signal input allows the MOSAIC to verify an EDM (External Device Monitoring) feedback  signal (series of contacts) from the external contactors, and to monitor Manual/Automatic operation (See the list of possible connections in Table 16).

---

☢ If the application requires it, the response time of the external contactors must be verified by an additional device.

☢ The RESTART command must be installed outside the danger area in a position where the danger area and the entire work area concerned are clearly visible.

☢ It must not be possible to reach the control from inside the danger area.

---

| MODE OF OPERATION | EDM | RESTART_FBK |
|---|---|---|
| AUTOMATIC | With K1_K2 control | 24V —K1— K2— ext_Restart_fbk |
| AUTOMATIC | Without K1_K2 control | 24V ——————— ext_Restart_fbk |
| MANUAL | With K1_K2 control | 24V —K1— K2— —o�µo— ext_Restart_fbk |
| MANUAL | Without K1_K2 control | 24V ——— —o�µo— ext_Restart_fbk |

*Table 16*

**English**

# OUTPUTS

## OUT STATUS

The OUT STATUS signal is a Programmable signal output that can indicate the status of:
- An input.
- An output.
- A node of the logic diagram designed using the MSD.

## OUT TEST

The OUT TEST signals must be used to monitor the presence of short-circuits or overloads on the inputs (Figure 6).
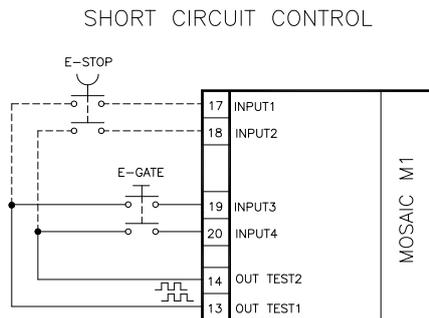


➔ The maximum number of controllable inputs for each output OUT TEST is:
- 2 INPUT (parallel connection) **(M1, MI802, MI8, MI12T8)**
- 4 INPUT (parallel connection) **(MI16)**

➔ The maximum allowed length for OUT TEST signal connections is = 100m.

*Figure 6*

## OSSD (M1, MI8O2)

The OSSD *(static semiconductor safety outputs)* are short circuit protected, cross circuit monitored and supply:
- In the ON condition: **Uv–0,75V ÷ Uv** *(where Uv is 24V ± 20%)*
- In the OFF condition: **0V ÷ 2V r.m.s.**

The maximum load of 400mA@24V corresponds to a minimum resistive load of 60Ω.

The maximum capacitive load is 0.82μF. The maximum inductive load is 2 mH.

## OSSD (MO2, MO4)

The OSSD *(static semiconductor safety outputs)* are short circuit protected, cross circuit monitored and supply:
- In the ON condition: **Uv–0,75V ÷ Uv** *(where Uv is 24V ± 20%)*
- In the OFF condition: **0V ÷ 2V r.m.s.**

The maximum load of 400mA@24V corresponds to a minimum resistive load of 60Ω.

The maximum capacitive load is 0.82μF. The maximum inductive load is 2 mH.

➔ It is not allowed the connection of external devices to the outputs, except as expected in the configuration performed with the MSD software.

Each OSSD output can be configured as shown in Table 17:

| | |
|---|---|
| **Automatic** | The output is activated according to le configurations set by the MSD SW only if the corresponding RESTART_FBK input is conected to 24VDC. |
| **Manual** | The output is activated according to le configurations set by the MSD SW only if corresponding RESTART_FBK input FOLLOWS A LOGIC TRANSITION OF **0-->1.** |
| **Monitored** | The output is activated according to le configurations set by the MSD SW only if the corresponding RESTART_FBK input FOLLOWS A LOGIC TRANSITION OF **0-->1-->0.** |

*Table 17*

*English*

MANUAL

RESTART_FBK

OUT

t = 250ms

MONITORED

RESTART_FBK

OUT

250ms < t1< 5s
t2 = 250ms
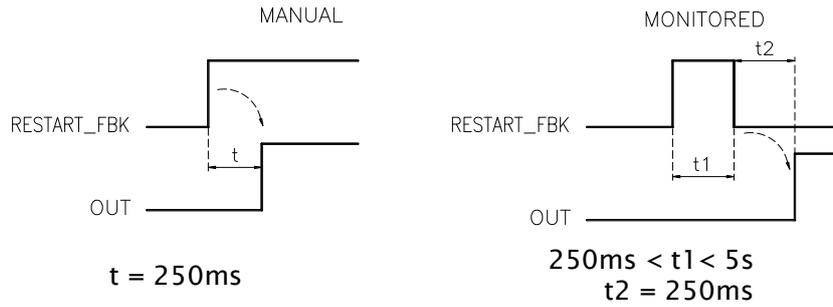
## SAFETY RELAYS (MR2, MR4, MOR4, MOR4S8)

## Characteristics of the output circuit.

The MR2/MR4 units use guided contact safety relays, each of which provides **two N.O. contacts and one N.C contact in addition to the N.C. feedback contact**.
The MR2 unit uses two safety relays and the MR4 uses four.
The MOR4/MOR4S8 units use four guided-contact safety relays. Each relay provides one NO contact monitored by the module logic through internal FBK contact.

➔ Refer to the "RELAY" section to check the possible MOR4/MOR4S8 operation modes configurable with MSD software.

| | |
|---|---|
| Excitation voltage | **17...31 VDC** |
| Minimum switchable voltage | **10 VDC** |
| Minimum switchable current | **20 mA** |
| Maximum switchable voltage (DC) | **250VDC** |
| Maximum switchable voltage (AC) | **400VAC** |
| Maximum switchable current | **6A** |
| Response time | **12ms** |
| Mechanical life of contacts | **> 20 x 10^6** |

*Table 18*

➔ To guarantee correct isolation and avoid the risk of premature ageing of or damage to the relays, each output line must be protected using a fast acting 4A fuse and the load characteristics must be consistent with those specified in Table 12.

➔ See the "MR2/MR4" section (for further details on these relays).

## MR2/MR4 internal contacts diagram
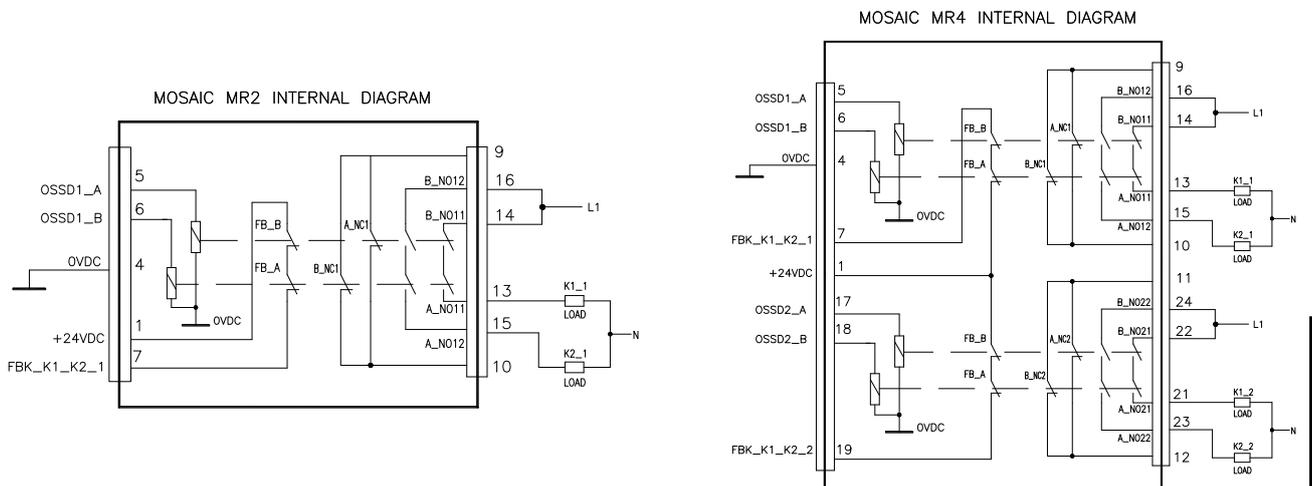


*Figure 7*

## Example of MR2 module connection with static OSSD outputs of a module M1[2]
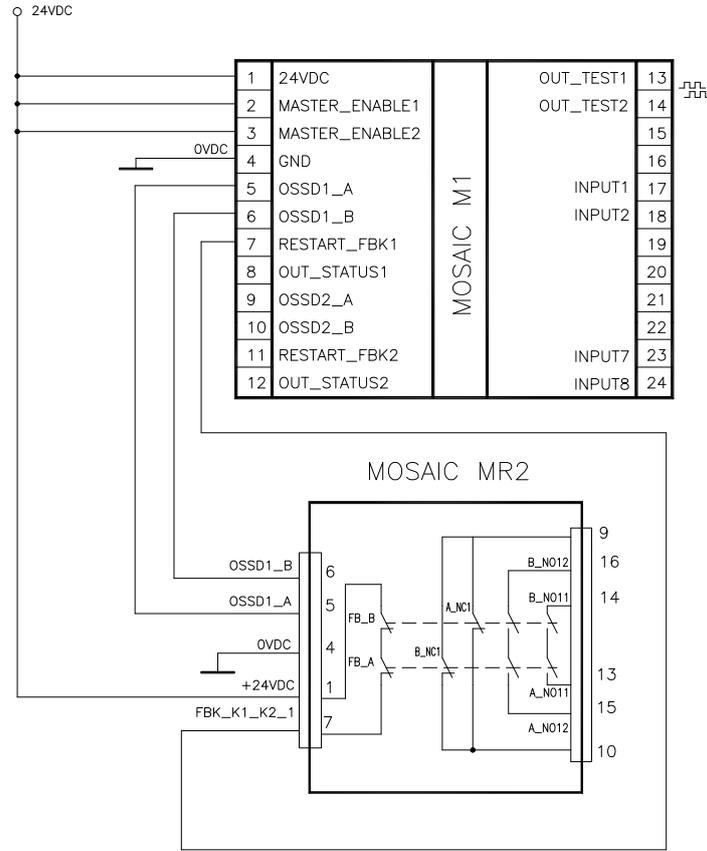


*Figure 8*

## Switching operation timing diagram.



*Figure 9*

---
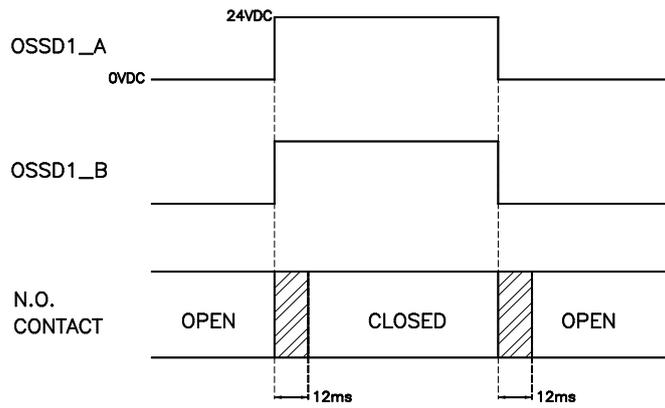
[2] If a relay module is connected, the response time of the OSSD linked, must be increased of 12ms.

# TECHNICAL FEATURES

## GENERAL SYSTEM CHARACTERISTICS

### Safety level parameters

| Parameter | Value | Standard |
|---|---|---|
| $PFH_d$ | See the technical data tables for each module | IEC 61508:2010 |
| SIL | 3 | |
| SFF | 99,8% | |
| HFT | 1 | |
| Safety standard | Type B | |
| SILCL | 3 | IEC 62061:2005 |
| Type | 4 | EN 61496-1:2013 |
| PL | e | EN ISO 13849-1:2008<br>EN 62061:2005 |
| $Dc_{avg}$ | High | |
| MTTFd (years) | 30 ÷ 100 | |
| Category | 4 | |
| Device lifetime | 20 years | |
| Pollution degree | 2 | |

### General data

| | |
|---|---|
| **Max number of inputs** | 128 |
| **Max number of outputs** | 16 |
| **Max number of slave units<br>(excluding MR2–MR4)** | 14 |
| **Max number of slave units of the same type<br>(excluding MR2–MR4)** | 4 |
| **Rated voltage** | 24VDC ± 20% / Supply from class II (LVLE) |
| **Over voltage category** | II |
| **Digital INPUTS** | PNP active high (EN 61131-2) – Max. applicable resistance 1,2kΩ |
| **OSSD (M1, MI8O2, MO2, MO4)** | PNP active high - 400mA@24VDC max (each OSSD) |
| **Signaling OUTPUTS<br>(M1, MI8O2, MO2, MO4, MOS8, MOS16)** | PNP active high - 100mA@24VDC max |

| **Response time (ms)**<br><br>*This response times depends on the following parameters:*<br>*1) Number of Slave modules installed*<br>*2) Number of Operators*<br>*3) Number of OSSD outputs*<br><br>*For the right response time refer to the one calculated by the DSD software (see Project report)*<br><br>**Failure Response time (ms)**<br><br>*This parameter corresponds to the response time, with the exception of MV modules with Encoder/Proximity interface where is 2s* | | |
|---|---|---|
| | Master | $10,6 \div 12,6 + T_{Input\_filter}$ |
| | M1 + 1 Slave | $11,8 \div 26,5 + T_{Input\_filter}$ |
| | M1 + 2 Slaves | $12,8 \div 28,7 + T_{Input\_filter}$ |
| | M1 + 3 Slaves | $13,9 \div 30,8 + T_{Input\_filter}$ |
| | M1 + 4 Slaves | $15 \div 33 + T_{Input\_filter}$ |
| | M1 + 5 Slaves | $16 \div 35 + T_{Input\_filter}$ |
| | M1 + 6 Slaves | $17 \div 37,3 + T_{Input\_filter}$ |
| | M1 + 7 Slaves | $18,2 \div 39,5 + T_{Input\_filter}$ |
| | M1 + 8 Slaves | $19,3 \div 41,7 + T_{Input\_filter}$ |
| | M1 + 9 Slaves | $20,4 \div 43,8 + T_{Input\_filter}$ |
| | M1 + 10 Slaves | $21,5 \div 46 + T_{Input\_filter}$ |
| | M1 + 11 Slaves | $22,5 \div 48,1 + T_{Input\_filter}$ |
| | M1 + 12 Slaves | $23,6 \div 50,3 + T_{Input\_filter}$ |
| | M1 + 13 Slaves | $24,7 \div 52,5 + T_{Input\_filter}$ |
| | M1 + 14 Slaves | $25,8 \div 54,6 + T_{Input\_filter}$ |

| | |
|---|---|
| **M1> module connection** | ReeR proprietary 5-pole bus (MSC) |
| **Connection cable cross-section** | 0,5 ÷ 2,5 mm² / AWG 12÷30 (solid/stranded) |
| **Max length of connections** | 100m |
| **Operating temperature** | -10 ÷ 55°C |
| **Max surrounding air temperature** | 55°C (UL) |
| **Storage temperature** | -20 ÷ 85°C |
| **Relative humidity** | 10% ÷ 95% |
| **Max. altitude (above sea level)** | 2000 m |

**English**

➡ $T_{Input\_filter}$ = max filtering time from among those set on project inputs (see "INPUTS" section").

## Enclosure

| | |
|---|---|
| **Description** | Electronic housing max 24 pole, with locking latch mounting |
| **Enclosure material** | Polyamide |
| **Enclosure protection class** | IP 20 |
| **Terminal blocks protection class** | IP 2X |
| **Fastening** | Quick coupling to rail according to EN 60715 |
| **Dimensions (h x l x d)** | 108 x 22.5 x 114.5 |

## M1 module

| | |
|---|---|
| **PFH$_d$ (IEC 61508:2010)** | 6.86E-9 |
| **Rated voltage** | 24VDC ± 20% |
| **Dissipated power** | 3W max |
| **Unit enable (No./description)** | 2 / PNP active high "*type B*" according to EN 61131-2 |
| **Digital INPUTS (No./description)** | 8 / PNP active high according to EN 61131-2 |
| **INPUT FBK/RESTART (No./description)** | 2 / EDM control / possible Automatic or Manual operation with RESTART button |
| **Test OUTPUT (No./description)** | 4 / to check for short-circuits - overloads |
| **Signaling OUTPUTS (No./description)** | 2 / programmable - PNP active high |
| **OSSD (No./description)** | 2 pairs / solid state safety outputs PNP active high 400mA@24VDC max |
| **SLOT for MCM card** | Available |
| **Connection to PC** | USB 2.0 (Hi Speed) - Max cable length: 3m |
| **Connection to slave units** | via MSC 5-way ReeR proprietary bus |

## MI8O2 module

| | |
|---|---|
| **PFH$_d$ (IEC 61508:2010)** | 5.68E-9 |
| **Rated voltage** | 24VDC ± 20% |
| **Dissipated power** | 3W max |
| **Digital INPUTS (No./description)** | 8 / PNP active high according to EN 61131-2 |
| **Test OUTPUT (No./description)** | 8 / to check for short-circuits - overloads |
| **Signaling OUTPUTS (No./description)** | 2 / programmable - PNP active high |
| **OSSD (No./description)** | 2 pairs / solid state safety outputs: PNP active high – 400mA@24VDC max |
| **Connection to M1** | via MSC 5-way ReeR proprietary bus |

**English**

## MI8 – MI16 modules

| Model | MI8 | MI16 |
|---|---|---|
| PFH$_d$ (IEC 61508:2010) | 4.45E-9 | 4.94E-9 |
| Rated voltage | 24VDC ± 20% | |
| Dissipated power | 3W max | |
| Digital INPUTS (No./description) | 8 | 16 |
| | PNP active high according to EN 61131-2 | |
| Test OUTPUT (No./description) | 4 / to check for short-circuits - overloads | |
| Connection to M1 | via MSC 5-way ReeR proprietary bus | |

## MI12T8 module

| | |
|---|---|
| PFH$_d$ (IEC 61508:2010) | 5.56E-9 |
| Rated voltage | 24VDC ± 20% |
| Dissipated power | 3W max |
| Digital INPUTS (No./description) | 12 |
| | PNP active high according to EN 61131-2 |
| Test OUTPUT (No./description) | 8 / to check for short-circuits - overloads |
| Connection to M1 | via MSC 5-way ReeR proprietary bus |

## MO2 – MO4 modules

| Model | MO2 | MO4 |
|---|---|---|
| PFHd (IEC 61508:2010) | 4.09E-9 | 5.84E-9 |
| Rated voltage | 24VDC ± 20% | |
| Dissipated power | 3W max | |
| Signaling OUTPUTS (No./description) | 2 | 4 |
| | programmable  - PNP active high | |
| OSSD  (No./description) | 2 | 4 |
| | Solid state safety outputs: PNP active high 400mA@24VDC max | |
| Connection to M1 | via MSC 5-way ReeR proprietary bus | |

## MOS8 – MOS16 modules

| Model | MOS8 | MOS16 |
|---|---|---|
| Rated voltage | 24VDC ± 20% | |
| Dissipated power | 3W max | |
| Signaling OUTPUT (No./description) | 8 | 16 |
| | programmable  - PNP active high | |
| Connection to M1 | through 5-way MSC proprietary bus | |

**English**

## MR2 – MR4 modules

| Model | MR2 | MR4 |
|---|---|---|
| **Rated voltage** | 24VDC ± 20% | |
| **Dissipated power** | 3W max | |
| **Switching voltage** | 240 VAC | |
| **Switching current** | 6A max | |
| N.O. contacts | 2 N.O. + 1 N.C. | 4 N.O. + 2 N.C. |
| FEEDBACK contacts | 1 | 2 |
| **Response time** | 12ms | |
| **Mechanical life of contacts** | > 20 x 10$^6$ | |
| **Connection to output module** | Via front-panel terminal strip (no connection via MSC bus) | |

| MR2 – MR4: TECHNICAL DATA CONCERNING SAFETY | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FEEDBACK CONTACT PRESENT | | | | | | FEEDBACK CONTACT MISSING | | | | | |
| PFHd | SFF | MTTFd | DCavg | | | PFHd | SFF | MTTFd | DCavg | | |
| 3,09E-10 | 99,6% | 2335,94 | 98,9% | tcycle1 | | 9,46E-10 | 60% | 2335,93 | 0 | tcycle1 | |
| 8,53E-11 | 99,7% | 24453,47 | 97,7% | tcycle2 | DC13 (2A) | 1,08E-10 | 87% | 24453,47 | 0 | tcycle2 | DC13 (2A) |
| 6,63E-11 | 99,8% | 126678,49 | 92,5% | tcycle3 | | 6,75E-11 | 97% | 126678,5 | 0 | tcycle3 | |
| 8,23E-09 | 99,5% | 70,99 | 99,0% | tcycle1 | | 4,60E-07 | 50% | 70,99 | 0 | tcycle1 | |
| 7,42E-10 | 99,5% | 848,16 | 99,0% | tcycle2 | AC15 (3A) | 4,49E-09 | 54% | 848,15 | 0 | tcycle2 | AC15 (3A) |
| 1,07E-10 | 99,7% | 12653,85 | 98,4% | tcycle3 | | 1,61E-10 | 79% | 12653,85 | 0 | tcycle3 | |
| 3,32E-09 | 99,5% | 177,38 | 99,0% | tcycle1 | | 7,75E-08 | 51% | 177,37 | 0 | tcycle1 | |
| 3,36E-10 | 99,6% | 2105,14 | 98,9% | tcycle2 | AC15 (1A) | 1,09E-09 | 60% | 2105,14 | 0 | tcycle2 | AC15 (1A) |
| 8,19E-11 | 99,7% | 28549,13 | 97,5% | tcycle3 | | 1,00E-10 | 88% | 28549,13 | 0 | tcycle3 | |

t$_{cycle1}$: 300s (1 commutation every 5 minutes)

t$_{cycle2}$: 3600s (1 commutation every hour)

t$_{cycle3}$: 1 commutation every day

(PFHd according IEC61508, MTTFd and DCavg according ISO13849-1)

## MOR4 – MOR4S8 module

| Model | MOR4 | MOR4S8 |
|---|---|---|
| **PFH$_d$ (IEC 61508:2010)** | 2,9E-9 | 2,94E-9 |
| **Rated voltage** | 24VDC ± 20% | |
| **Dissipated power max** | 3W max | |
| **Switching voltage** | 240 VAC | |
| **Switching current** | 6A max | |
| N.O. contacts | 4 | |
| **INPUT FBK/RESTART (No./description)** | 4 / EDM control / possible Automatic or Manual operation with RESTART button | |
| **Digital OUTPUT (No./description)** | - | 8 / Programmable output PNP active high |
| **Response time** | 12ms | |
| **Mechanical life of contacts** | > 40 x 10$^6$ | |
| **Connessione per utilizzatore** | Terminal blocks | |
| **Connection to M1** | via MSC 5-way ReeR proprietary bus | |

*English*

## MV0 – MV1 – MV2 modules

| Condition<br>(–> SPEED CONTROL TYPE FUNCTION BLOCKS) | Overspeed | Stand still | Window speed |
|---|---|---|---|
| Safe state | Overspeed | NO Stand still | Out of Window speed |

| Model | MV0 | MV1 | MV2 |
|---|---|---|---|
| PFH$_d$ | 5,98E-09 | - | - |
| PFH$_d$ (TTL) | - | 7,08E-09 (MV1T) | 8,18E-09 (MV2T) |
| PFH$_d$ (sin/cos) | - | 7,94E-09 (MV1S) | 9,89E-09 (MV2S) |
| PFH$_d$ (HTL24) | - | 6,70E-09 (MV1H) | 7,42E-09 (MV2H) |
| PFH$_d$ (TTL internal power supply) | - | 7,82E-09 (MV1TB) | 9,66E-09 (MV2TB) |
| Rated Voltage | 24VDC ± 20% | | |
| Dissipated power　　　max | 3W | | |
| Encoder Interface | - | TTL (MV1T – MV1TB / MV2T – MV2TB models)<br>HTL (MV1H - MV2H models)<br>sin/cos (MV1S - MV2S models) | |
| Encoder connections | - | RJ45 connector | |
| Encoder input signals electrically insulated  in accordance with EN 61800–5 | - | Rated insulation voltage 250V<br>Overvoltage category II<br>Rated impulse withstand voltage 4.00 kV | |
| Max number of encoders | - | 1 | 2 |
| Max encoder frequency | - | 500KHz (HTL: 300KHz) | |
| Encoder adjustable threshold range | - | 1Hz ÷ 450KHz | |
| Proximity type | PNP/NPN  - 3/4 wires | | |
| Proximity connections | Terminal blocks | | |
| Proximity adjustable threshold range | 1Hz ÷ 4KHz | | |
| Max number of proximity | 2 | | |
| Max proximity frequency | 5KHz | | |
| Max number of axes | 2 | | |
| Stand–still/overspeed frequency gap | >10Hz | | |
| Min. gap between tresholds (with tresholds >1) | > 5% | | |
| M1 connections | via MSC 5-way ReeR proprietary bus | | |

**English**

# MECHANICAL DIMENSIONS
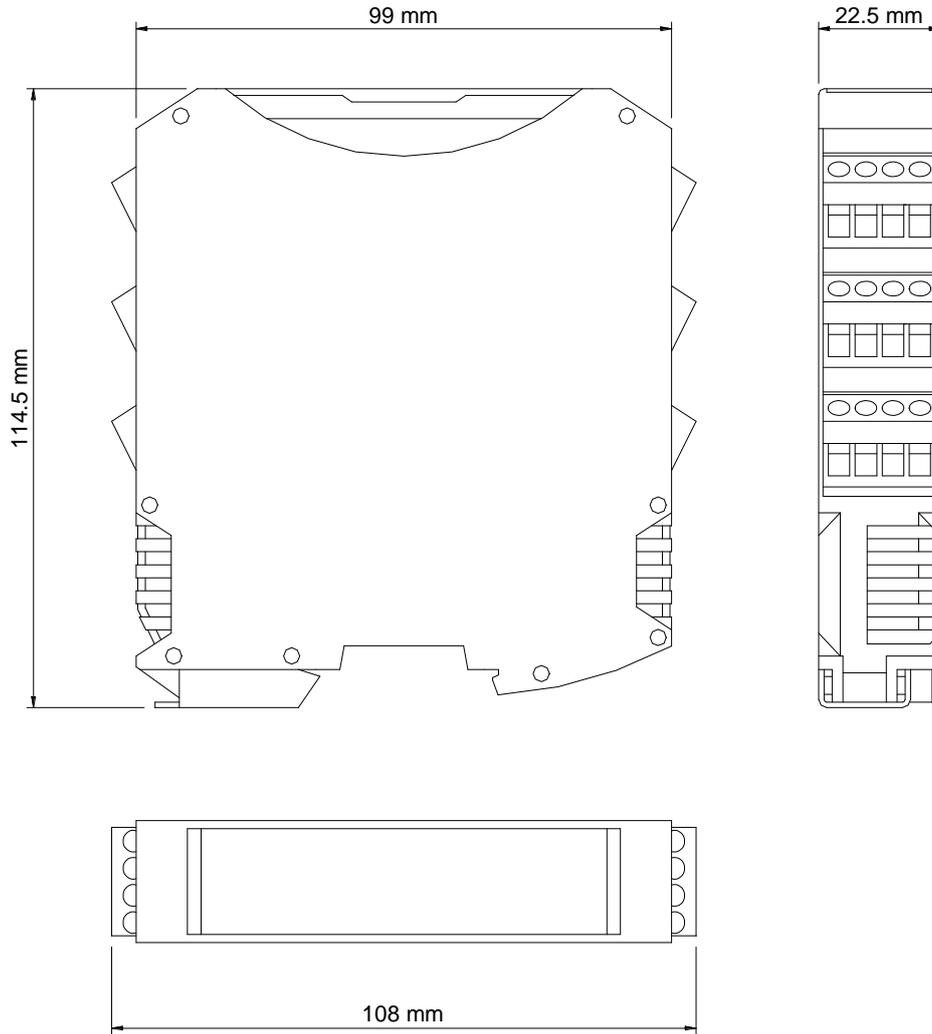


*Figure 10*

# SIGNALS

## Master M1 (Figure 11)
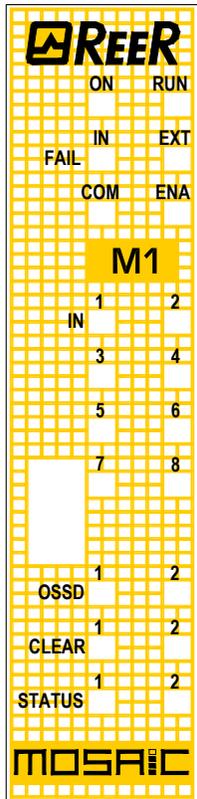


*Figure 11 - M1*

| MEANING | LED | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | RUN GREEN | IN FAIL RED | EXT FAIL RED | COM ORANGE | ENA BLUE | IN1÷8 YELLOW | OSSD1/2 RED/GREEN | CLEAR1/2 YELLOW | STATUS1/2 YELLOW |
| Power on – initial TEST | ON | ON | ON | ON | ON | ON | Red | ON | ON |
| MCM recognised | OFF | OFF | OFF | ON (max 1s) | ON (max 1s) | OFF | Red | OFF | OFF |
| Writing/loading/ diagram to/from MCM card | OFF | OFF | OFF | 5 flashes | 5 flashes | OFF | Red | OFF | OFF |
| MSD requesting connection: internal configuration not present | OFF | OFF | OFF | Flashes slowly | OFF | OFF | Red | OFF | OFF |
| MSD requesting connection: (slave module or node number not correct) (ref. System composition) | OFF | OFF | OFF | Flashes quickly | OFF | OFF | Red | OFF | OFF |
| MSD requesting connection: (slave module missing or not ready) (ref. System composition) | Flashes quickly | OFF | OFF | Flashes quickly | OFF | OFF | Red | OFF | OFF |
| MSD connected M1 stopped | OFF | OFF | OFF | ON | OFF | OFF | Red | OFF | OFF |

*Table 19 - Opening Screen*

| MEANING | LED | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | RUN GREEN | IN FAIL RED | EXT FAIL RED | COM ORANGE | IN1÷8 YELLOW | ENA BLUE | OSSD1/2 RED/GREEN | CLEAR1/2 YELLOW | STATUS1/2 YELLOW |
| NORMAL OPERATION | ON | OFF | OFF op. OK | ON = M1 connected to PC OFF=otherwise | INPUT condition | ON MASTER_ENABLE1 and MASTER_ENABLE2 active OFF otherwise | RED with output OFF GREEN with output ON | ON waiting for RESTART Flashing NO feedback | OUTPUT condition |
| EXTERNAL FAULT DETECTED | ON | OFF | ON incorrect external connection detected | ON = M1 connected to PC OFF=otherwise | only the number of the INPUT with the incorrect connection flashes | | | | |

*Table 20 - Dynamic Screen*

**English**

## MI8O2 (Figure 12)
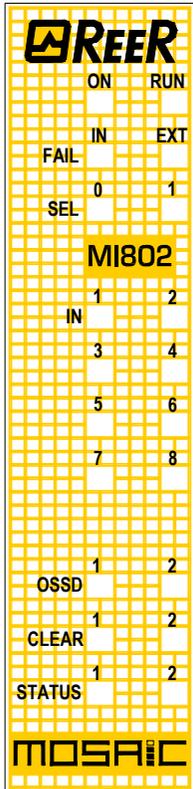
| MEANING | LED | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | RUN<br>GREEN | IN FAIL<br>RED | EXT FAIL<br>RED | SEL<br>ORANGE | IN1÷8<br>YELLOW | OSSD1/2<br>RED/GREEN | CLEAR1/2<br>YELLOW | STATUS1/2<br>YELLOW |
| Power on – initial TEST | ON | ON | ON | ON | ON | Red | ON | ON |

*Table 21 - Opening Screen*

| MEANING | LED | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | RUN<br>GREEN | IN FAIL<br>RED | EXT FAIL<br>RED | IN1÷8<br>YELLOW | SEL<br>ORANGE | OSSD1/2<br>RED/GREEN | CLEAR1/2<br>YELLOW | STATUS1/2<br>YELLOW |
| NORMAL OPERATION | **OFF**<br>if the unit is waiting for the first communication from the MASTER<br><br>**FLASHES**<br>if no INPUT or OUTPUT requested by the configuration<br><br>**ON**<br>if INPUT or OUTPUT requested by the configuration | OFF | **OFF**<br><br>**ON**<br>incorrect external connection detected | INPUT condition<br><br>only the number of the INPUT with the incorrect connection **flashes** | Shows the NODE_SEL0/1 signal table | **RED**<br>with output OFF<br><br>**GREEN**<br>with output ON | **ON**<br>waiting for RESTART<br><br>**Flashes**<br>NO feedback | OUTPUT condition |

*Table 22 - Dynamic Screen*

*Figure 12 - MI8O2*

## MI8 (Figure 13)



Figure 13 - MI8
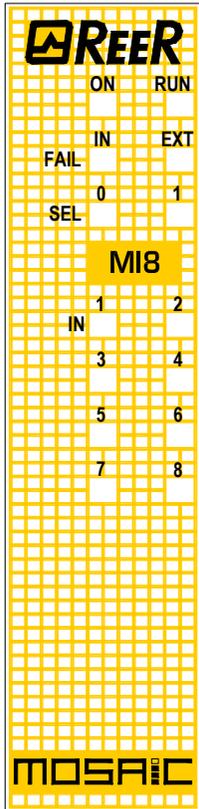
| MEANING | LED | | | | |
|---|---|---|---|---|---|
| | RUN GREEN | IN FAIL RED | EXT FAIL RED | SEL ORANGE | IN1÷8 YELLOW |
| Power on – initial TEST | ON | ON | ON | ON | ON |

*Table 23 - Opening Screen*

| MEANING | LED | | | | |
|---|---|---|---|---|---|
| | RUN GREEN | IN FAIL RED | EXT FAIL RED | SEL ORANGE | IN1÷8 YELLOW |
| NORMAL OPERATION | **OFF** if the unit is waiting for the first communication from the MASTER<br>**FLASHES** if no INPUT or OUTPUT requested by the configuration<br>**ON** if INPUT or OUTPUT requested by the configuration | OFF | **OFF**<br><br>**ON** incorrect external connection detected | Shows the NODE_SEL0/1 signal table | INPUT condition<br><br>only the number of the INPUT with the incorrect connection **flashes** |

*Table 24 - Dynamic Screen*

English

## MI12T8 (Figure 15)



*Figure 14*
*MI12T8*

| MEANING | LED | | | | |
|---------|-----|---|---|---|---|
| | RUN<br>GREEN | IN FAIL<br>RED | EXT FAIL<br>RED | SEL<br>ORANGE | IN1÷12<br>YELLOW |
| Power on – initial TEST | ON | ON | ON | ON | ON |

*Table 25 - Opening Screen*

| MEANING | LED | | | | |
|---------|-----|---|---|---|---|
| | RUN<br>GREEN | IN FAIL<br>RED | EXT FAIL<br>RED | SEL<br>ORANGE | IN1÷12<br>YELLOW |
| NORMAL OPERATION | **OFF**<br>if the unit is waiting for the first communication from the MASTER<br>**FLASHES**<br>if no INPUT or OUTPUT requested by the configuration<br>**ON**<br>if INPUT or OUTPUT requested by the configuration | OFF | OFF | Shows the NODE_SEL0/1 signal table | INPUT condition |
| | | | **ON**<br>incorrect external connection detected | | only the number of the INPUT with the incorrect connection **flashes** |

*Table 26 - Dynamic Screen*

English

## MI16 (Figure 15)



Figure 15 - MI16

| MEANING | LED | | | | |
|---|---|---|---|---|---|
| | RUN GREEN | IN FAIL RED | EXT FAIL RED | SEL ORANGE | IN1÷16 YELLOW |
| Power on – initial TEST | ON | ON | ON | ON | ON |

*Table 27 - Opening Screen*

| MEANING | LED | | | | |
|---|---|---|---|---|---|
| | RUN GREEN | IN FAIL RED | EXT FAIL RED | SEL ORANGE | IN1÷16 YELLOW |
| NORMAL OPERATION | **OFF** if the unit is waiting for the first communication from the MASTER<br>**FLASHES** if no INPUT or OUTPUT requested by the configuration<br>**ON** if INPUT or OUTPUT requested by the configuration | OFF | OFF | Shows the NODE_SEL0/1 signal table | INPUT condition |
| | | | **ON** incorrect external connection detected | | only the number of the INPUT with the incorrect connection **flashes** |

*Table 28 - Dynamic Screen*

**English**

## MO2 (Figure 16)



Figure 16 - MO2
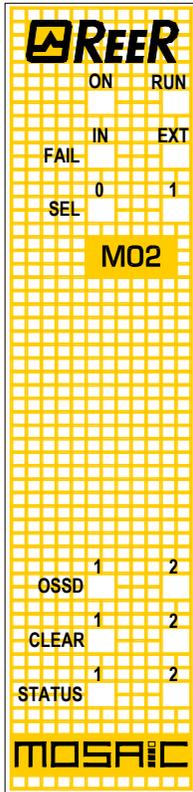
| MEANING | LED | | | | | | |
|---|---|---|---|---|---|---|---|
| | RUN GREEN | IN FAIL RED | EXT FAIL RED | SEL ORANGE | OSDD1/2 RED/GREEN | CLEAR1/2 YELLOW | STATUS1/2 YELLOW |
| Power on – initial TEST | ON | ON | ON | ON | Red | ON | ON |

*Table 29 - Opening screen*

| MEANING | LED | | | | | | |
|---|---|---|---|---|---|---|---|
| | RUN GREEN | IN FAIL RED | EXT FAIL RED | SEL ORANGE | OSSD1/2 RED/GREEN | CLEAR1/2 YELLOW | STATUS1/2 YELLOW |
| NORMAL OPERATION | **OFF** if the unit is waiting for the first communication from the MASTER **FLASHES** if no INPUT or OUTPUT requested by the configuration **ON** if INPUT or OUTPUT requested by the configuration | **OFF** op. OK | **OFF** op. OK | Shows the NODE_SEL0/1 signal table | **RED** with output OFF / **GREEN** with output ON | **ON** waiting for RESTART / **Flashes** NO feedback | OUTPUT condition |

*Table 30 - Dynamic screen*

English

## MO4 (Figure 17)



Figure 17 - MO4

| MEANING | LED | | | | | | |
|---|---|---|---|---|---|---|---|
| | RUN<br>GREEN | IN FAIL<br>RED | EXT FAIL<br>RED | SEL<br>ORANGE | OSDD1/4<br>RED/GREEN | CLEAR1/4<br>YELLOW | STATUS1/4<br>YELLOW |
| Power on – initial TEST | ON | ON | ON | ON | Red | ON | ON |

*Table 31 - Opening screen*

| MEANING | LED | | | | | | |
|---|---|---|---|---|---|---|---|
| | RUN<br>GREEN | IN FAIL<br>RED | EXT FAIL<br>RED | SEL<br>ORANGE | OSDD1/4<br>RED/GREEN | CLEAR1/4<br>YELLOW | STATUS1/4<br>YELLOW |
| NORMAL OPERATION | **OFF**<br>if the unit is waiting for the first communication from the MASTER<br>**FLASHES**<br>if no INPUT or OUTPUT requested by the configuration<br>**ON**<br>if INPUT or OUTPUT requested by the configuration | **OFF**<br>op. OK | **OFF**<br>op. OK | Shows the NODE_SEL0/1 signal table | **RED**<br>with output OFF<br><br>**GREEN**<br>with output ON | **ON**<br>waiting for RESTART<br><br>**Flashes**<br>NO feedback | OUTPUT condition |

*Table 32 - Dynamic screen*

English
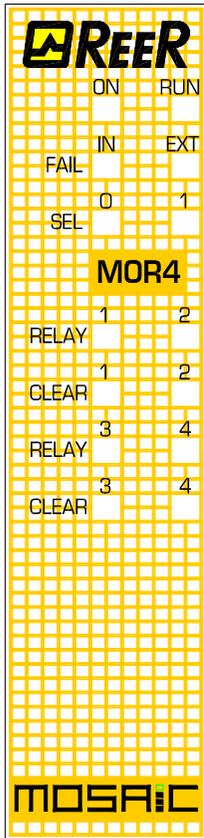
## MOR4 (Figure 18)

Figure 18 - MOR4

| MEANING | LED | | | | | |
|---|---|---|---|---|---|---|
| | RUN | IN FAIL | EXT FAIL | SEL 0/1 | RELAY 1/4 | CLEAR1/4 |
| | GREEN | RED | RED | ORANGE | RED / GREEN | YELLOW |
| Power on – initial TEST | ON | ON | ON | ON | Red | ON |

*Table 33 - Opening screen*

| MEANING | LED | | | | | |
|---|---|---|---|---|---|---|
| | RUN | IN FAIL | EXT FAIL | SEL 0/1 | RELAY 1/4 | CLEAR1/4 |
| | GREEN | RED | RED | ORANGE | RED / GREEN | YELLOW |
| NORMAL OPERATION | **OFF** if the unit is waiting for the first communication from the MASTER<br><br>**FLASHES** if no INPUT or OUTPUT requested by the configuration<br><br>**ON** if INPUT or OUTPUT requested by the configuration | **OFF** operation OK | **OFF** operation OK | Shows the NODE_SEL0/1 signal table | **RED** with contact opened<br><br>**GREEN** with contact closed | **ON** waiting for RESTART<br><br>**FLASHES** External contactors feedback error |

*Table 34 - Dynamic screen*

## MOR4S8 (Figure 19)
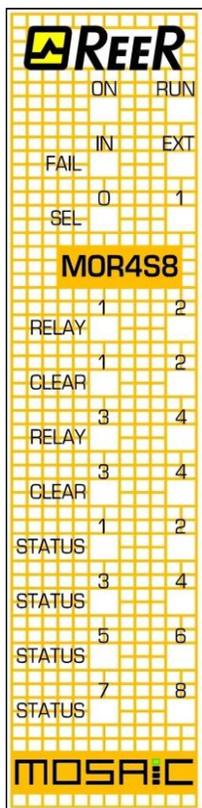


*Figure 19 - MOR4S8*

| MEANING | LED | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | RUN | IN FAIL | EXT FAIL | SEL 0/1 | RELAY 1/4 | | CLEAR1/4 | STATUS1/8 |
| | GREEN | RED | RED | ORANGE | RED | GREEN | YELLOW | YELLOW |
| **Power on – initial TEST** | ON | ON | ON | ON | Red | | ON | ON |

*Table 35 - Opening screen*

| MEANING | LED | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | RUN | IN FAIL | EXT FAIL | SEL 0/1 | RELAY 1/4 | | CLEAR1/4 | STATUS1/8 |
| | GREEN | RED | RED | ORANGE | RED | GREEN | YELLOW | YELLOW |
| **NORMAL OPERATION** | **OFF** if the unit is waiting for the first communication from the MASTER<br><br>**FLASHES** if no INPUT or OUTPUT requested by the configuration<br><br>**ON** if INPUT or OUTPUT requested by the configuration | **OFF** operation OK | **OFF** operation OK | Shows the NODE_SEL0/1 signal table | **RED** with contact opened<br><br>**GREEN** with contact closed | | **ON** waiting for RESTART<br><br>**FLASHES** wrong feedback external contactors | OUTPUT condition |

*Table 36 - Dynamic screen*

*English*
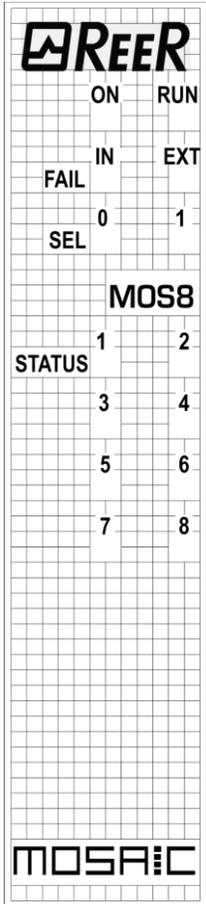
## MOS8 (Figure 20)



Figure 20 - MOS8

| LED | | | | | |
|---|---|---|---|---|---|
| **MEANING** | **RUN** | **IN FAIL** | **EXT FAIL** | **SEL 0/1** | **STATUS1/8** |
| | **GREEN** | **RED** | **RED** | **ORANGE** | **YELLOW** |
| **Power on – initial TEST** | ON | ON | ON | ON | ON |

*Table 37 - Opening screen*

| LED | | | | | |
|---|---|---|---|---|---|
| **MEANING** | **RUN** | **IN FAIL** | **EXT FAIL** | **SEL 0/1** | **STATUS1/8** |
| | **GREEN** | **RED** | **RED** | **ORANGE** | **YELLOW** |
| **NORMAL OPERATION** | **OFF** if the unit is waiting for the first communication from the MASTER <br><br> **FLASHES** if no INPUT or OUTPUT requested by the configuration <br><br> **ON** if INPUT or OUTPUT requested by the configuration | **OFF** operation OK | **OFF** operation OK | Shows the NODE_SEL0/1 signal table | OUTPUT condition |

*Table 38 - Dynamic screen*

**English**
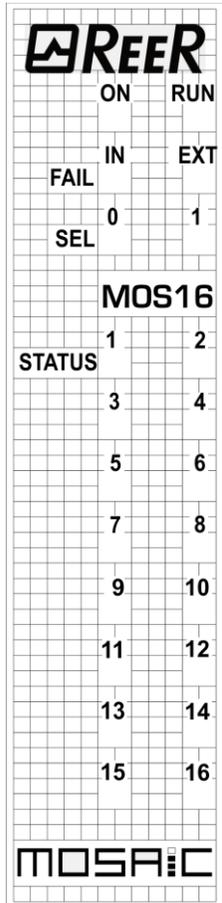
## MOS16 (Figure 21)

Figure 21 – MOS16

| LED | | | | | |
|-----|-----|-----|-----|-----|-----|
| **MEANING** | **RUN** | **IN FAIL** | **EXT FAIL** | **SEL 0/1** | **STATUS1/16** |
| | **GREEN** | **RED** | **RED** | **ORANGE** | **YELLOW** |
| **Power on – initial TEST** | ON | ON | ON | ON | ON |

*Table 39 - Opening screen*

| LED | | | | | |
|-----|-----|-----|-----|-----|-----|
| **MEANING** | **RUN** | **IN FAIL** | **EXT FAIL** | **SEL 0/1** | **STATUS1/16** |
| | **GREEN** | **RED** | **RED** | **ORANGE** | **YELLOW** |
| **NORMAL OPERATION** | **OFF** if the unit is waiting for the first communication from the MASTER<br><br>**FLASHES** if no INPUT or OUTPUT requested by the configuration<br><br>**ON** if INPUT or OUTPUT requested by the configuration | **OFF** operation OK | **OFF** operation OK | Shows the NODE_SEL0/1 signal table | OUTPUT condition |

*Table 40 - Dynamic screen*

**English**
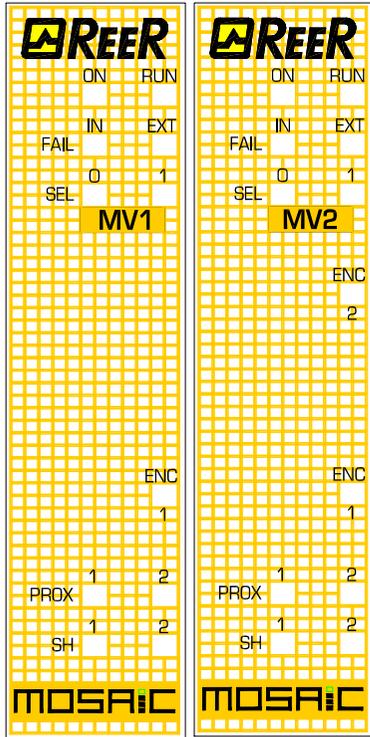
## MV1, MV2 (Figure 22)



*Figure 22 - MV1, MV2*

| MEANING | LED | | | | | | |
|---|---|---|---|---|---|---|---|
| | **RUN** | **IN FAIL** | **EXT FAIL** | **SEL** | **ENC*** | **PROX** | **SH** |
| | **GREEN** | **RED** | **RED** | **ORANGE** | **YELLOW** | **YELLOW** | **YELLOW** |
| **Power on – initial TEST** | ON | ON | ON | ON | ON | ON | ON |

*Table 41 - Opening screen*

| MEANING | LED | | | | | | |
|---|---|---|---|---|---|---|---|
| | **RUN** | **IN FAIL** | **EXT FAIL** | **SEL** | **ENC*** | **PROX** | **SH** |
| | **GREEN** | **RED** | **RED** | **ORANGE** | **YELLOW** | **YELLOW** | **YELLOW** |
| **NORMAL OPERATION** | **OFF** if the unit is waiting for the first communication from the MASTER<br><br>**FLASHES** if no INPUT or OUTPUT requested by the configuration<br><br>**ON** if INPUT or OUTPUT requested by the configuration | **OFF** operation OK | **OFF** operation OK | Shows the NODE_SEL0/1 signal table | **ON** Encoder connected and operative | **ON** Proximity connected and operative | **OFF** Axis in normal speed range<br><br>**ON** Axis in stand still<br><br>**BLINKING** Axis in overspeed |

*Table 42 - Dynamic screen*

\* NOT PRESENT ON MV0 MODULE

**English**

## MR2 (Figure 23) / MR4 (Figure 24)



Figure 23 - MR2    Figure 24 - MR4
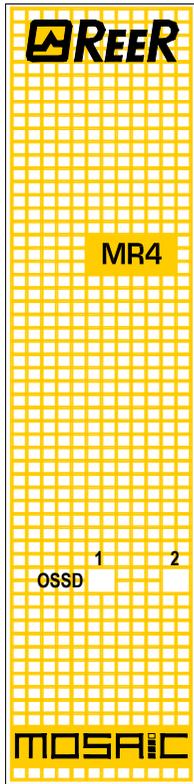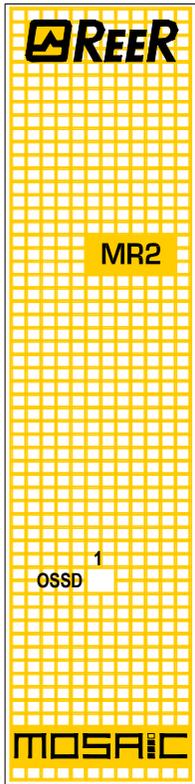
| MEANING | LED |
|---|---|
| | OSSD1 GREEN |
| NORMAL OPERATION | ON with output activated |

*Table 43 - MR2 - Dynamic screen*

| MEANING | LED | |
|---|---|---|
| | OSSD1 GREEN | OSSD2 GREEN |
| NORMAL OPERATION | ON with output activated | |

*Table 44 - MR4 - Dynamic screen*

English

# TROUBLESHOOTING

## Master M1 (Figure 25)



Figure 25 - M1

| MEANING | LED | | | | | | | | | REMEDY |
|---|---|---|---|---|---|---|---|---|---|---|
| | RUN<br>GREEN | IN FAIL<br>RED | EXT FAIL<br>RED | COM<br>ORANGE | IN1÷8<br>YELLOW | ENA<br>BLUE | OSSD1/2<br>RED/GREEN | CLEAR1/2<br>YELLOW | STATUS1/2<br>YELLOW | |
| Internal fault | OFF | 2 or 3 flashes | OFF | OFF | OFF | OFF | Red | OFF | OFF | Return the unit to ReeR to be repaired |
| OSSD output error | OFF | 4 flashes | OFF | OFF | OFF | OFF | 4 flashes (only the LED corresponding to the output in FAIL mode) | OFF | OFF | • Check the OSSD1/2 connections<br>• If the problem persists return the M1 to ReeR to be repaired |
| Error in communication with slave | OFF | 5 flashes | OFF | OFF | OFF | OFF | OFF | OFF | OFF | • Restart the system.<br>• If the problem persists return the M1 to ReeR to be repaired |
| Slave unit error | OFF | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | • Restart the system<br>• Check which unit is in FAIL mode |
| MCM error | OFF | 6 flashes | OFF | 6 flashes | OFF | OFF | OFF | OFF | OFF | Replace the MCM |

*Table 45 - Troubleshooting M1*

## MI8O2 (Figure 26)



| MEANING | LED | | | | | | | | REMEDY |
|---|---|---|---|---|---|---|---|---|---|
| | RUN | IN FAIL | EXT FAIL | SEL | IN1÷8 | OSSD1/2 | CLEAR1/2 | STATUS1/2 | |
| | GREEN | RED | RED | ORANGE | YELLOW | RED/GREEN | YELLOW | YELLOW | |
| Internal fault | OFF | 2 or 3 flashes | OFF | Shows the physical address of the unit | OFF | Red | OFF | OFF | • Return the unit to ReeR to be repaired |
| Compatibility error | OFF | 5 flashes | OFF | | 5 flashes | 5 flashes | 5 flashes | 5 flashes | • Firmware version not compatible with M1, return to ReeR for FW upgrade. |
| OSSD output error | OFF | 4 flashes | OFF | | OFF | 4 flashes (only the LED corresponding to the output in FAIL mode) | OFF | OFF | • Check OSSD1/2 connections • If the problem persists, return the MI8O2 to ReeR to be repaired |
| Error in communication with master | OFF | 5 flashes | OFF | | OFF | OFF | OFF | OFF | • Restart the system • If the problem persists, return the MI8O2 to ReeR to be repaired |
| Error on other slave or M1 | OFF | ON | OFF | | OFF | OFF | OFF | OFF | • Restart the system • Check which unit is in FAIL mode |
| Same type of slave with same address detected | OFF | 5 flashes | 5 flashes | | OFF | OFF | OFF | OFF | • Change the unit's address (see NODE SEL) |
| Node detection circuit error | OFF | 3 flashes | OFF | 3 flashes | OFF | OFF | OFF | OFF | • Return the unit to ReeR to be repaired |

*Figure 26 - MI8O2*

*Table 46 - Troubleshooting MI8O2*

**English**

## MI8 (Figure 27)



*Figure 27 - MI8*

| MEANING | LED | | | | | REMEDY |
|---------|-----|-----|-----|-----|-----|--------|
| | RUN | IN FAIL | EXT FAIL | SEL | IN1÷8 | |
| | GREEN | RED | RED | ORANGE | YELLOW | |
| Internal fault | OFF | 2 or 3 flashes | OFF | Shows the physical address of the unit | OFF | • Return the unit to ReeR to be repaired |
| Compatibility error | OFF | 5 flashes | OFF | | 5 flashes | • Firmware version not compatible with M1, return to ReeR for FW upgrade. |
| Error in communication with master | OFF | 5 flashes | OFF | | OFF | • Restart the system<br>• If the problem persists, return the MI8 to ReeR to be repaired |
| Error on other slave or M1 | OFF | ON | OFF | | OFF | • Restart the system<br>• Check which unit is in FAIL mode |
| Same type of slave with same address detected | OFF | 5 flashes | 5 flashes | | OFF | • Change the unit's address (see **NODE SEL**) |
| Node detection circuit error | OFF | 3 flashes | OFF | 3 flashes | OFF | • Return the unit to ReeR to be repaired |

*Table 47 - Troubleshooting MI8*

## MI12T8 (Figure 28)



Figure 28 - MI12T8

| LED | | | | | | |
|---|---|---|---|---|---|---|
| **MEANING** | **RUN** | **IN FAIL** | **EXT FAIL** | **SEL** | **IN1÷12** | **REMEDY** |
| | **GREEN** | **RED** | **RED** | **ORANGE** | **YELLOW** | |
| **Internal fault** | OFF | 2 or 3 flashes | OFF | Shows the physical address of the unit | OFF | Return the unit to ReeR to be repaired |
| **Compatibility error** | OFF | 5 flashes | OFF | | 5 flashes | • Firmware version not compatible with M1, return to ReeR for FW upgrade. |
| **Error in communication with master** | OFF | 5 flashes | OFF | | OFF | • Restart the system<br>• If the problem persists, return the MI12T8 to ReeR to be repaired |
| **Error on other slave or M1** | OFF | ON | OFF | | OFF | • Restart the system<br>• Check which unit is in FAIL mode |
| **Same type of slave with same address detected** | OFF | 5 flashes | 5 flashes | | OFF | • Change the unit's address (see **NODE SEL**) |
| **Node detection circuit error** | OFF | 3 flashes | OFF | 3 flashes | OFF | • Return the unit to ReeR to be repaired |

*Table 48 - Troubleshooting MI12T8*

**English**
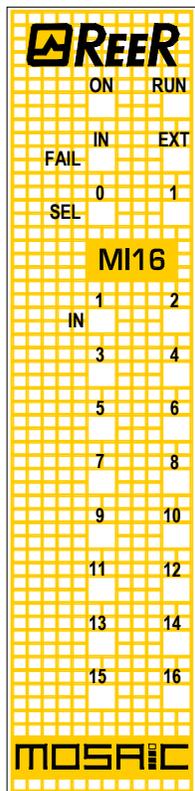
## MI16 (Figure 29 - MI16)



*Figure 29 - MI16*

| MEANING | LED | | | | | REMEDY |
|---|---|---|---|---|---|---|
| | **RUN** | **IN FAIL** | **EXT FAIL** | **SEL** | **IN1÷16** | |
| | **GREEN** | **RED** | **RED** | **ORANGE** | **YELLOW** | |
| **Internal fault** | OFF | 2 or 3 flashes | OFF | Shows the physical address of the unit | OFF | • Return the unit to ReeR to be repaired |
| **Compatibility error** | OFF | 5 flashes | OFF | | 5 flashes | • Firmware version not compatible with M1, return to ReeR for FW upgrade. |
| **Error in communication with master** | OFF | 5 flashes | OFF | | OFF | • Restart the system<br>• If the problem persists, return the MI16 to ReeR to be repaired |
| **Error on other slave or M1** | OFF | ON | OFF | | OFF | • Restart the system<br>• Check which unit is in FAIL mode |
| **Same type of slave with same address detected** | OFF | 5 flashes | 5 flashes | | OFF | • Change the unit's address (see **NODE SEL**) |
| **Node detection circuit error** | OFF | 3 flashes | OFF | 3 flashes | OFF | • Return the unit to ReeR to be repaired |

*Table 49 - Troubleshooting MI16*

## MO2 / MO4 (Figure 30)
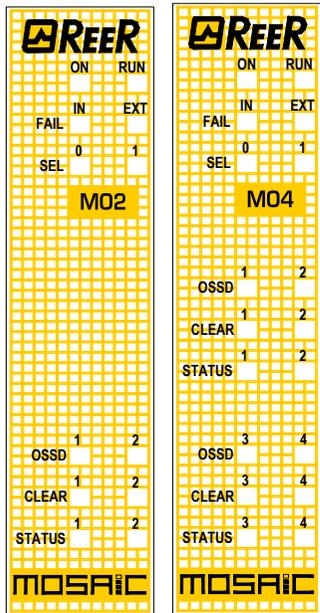


*Figure 30 - MO2 / MO4*

| MEANING | LED | | | | | | | REMEDY |
|---|---|---|---|---|---|---|---|---|
| | RUN | IN FAIL | EXT FAIL | SEL | OSSD1/4 | CLEAR1/4 | STATUS1/4 | |
| | GREEN | RED | RED | ORANGE | RED/GREEN | YELLOW | YELLOW | |
| Internal fault | OFF | 2 or 3 flashes | OFF | Shows the physical address of the unit | Red | OFF | OFF | Return the unit to ReeR to be repaired |
| Compatibility error | OFF | 5 flashes | OFF | | 5 flashes | 5 flashes | 5 flashes | • Firmware version not compatible with M1, return to ReeR for FW upgrade. |
| OSSD output error | OFF | 4 flashes | OFF | | 4 flashes (only the LED corresponding to the output in FAIL mode) | OFF | OFF | • Check OSSD1/2 connections • If the problem persists, return the MO2/4 to ReeR to be repaired |
| Error in communication with master | OFF | 5 flashes | OFF | | OFF | OFF | OFF | • Restart the system • If the problem persists, return the MO2/4 to ReeR to be repaired |
| Error on other slave or M1 | OFF | ON | OFF | | OFF | OFF | OFF | • Restart the system • Check which unit is in FAIL mode |
| Same type of slave with same address detected | OFF | 5 flashes | 5 flashes | | OFF | OFF | OFF | • Change the unit's address (see NODE SEL) |
| 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 |
| Status output overload or short circuit | OFF | OFF | ON | | OUTPUT condition | CLEAR condition | flashes | • Check STATUS connections |
| Error on node detection circuit | OFF | 3 flashes | OFF | 3 flashes | OFF | OFF | OFF | • Return the MO2/4 to ReeR to be repaired |

*Table 50 - Troubleshooting MO2/MO4*

## MOR4 (Figure 31)



Figure 31 - MOR4

| MEANING | LED | | | | | | | REMEDY |
|---|---|---|---|---|---|---|---|---|
| | RUN | IN FAIL | EXT FAIL | SEL 0/1 | RELAY 1/4 | | CLEAR1/4 | |
| | GREEN | RED | RED | ORANGE | RED | GREEN | YELLOW | |
| Internal fault | OFF | 2 / 3 flashes | OFF | Shows the physical address of the unit | Rosso | | OFF | • Return the unit to ReeR to be repaired |
| Compatibility error | OFF | 5 flashes | OFF | | 5 flashes | | 5 flashes | • Firmware version not compatible with M1, return to ReeR for FW upgrade. |
| Relais output error | OFF | 4 flashes | OFF | | 4 flashes (only the LED corresponding to the output in FAIL mode) | | OFF | • If the problem persists, return the module to ReeR to be repaired |
| Error in communication with master | OFF | 5 flashes | OFF | | OFF | | OFF | • Restart the system • If the problem persists, return the module to ReeR to be repaired |
| Error on other slave or M1 | OFF | ON | OFF | | OFF | | OFF | • Restart the system • Check which unit is in FAIL mode |
| Same type of slave with same address detected | OFF | 5 flashes | 5 flashes | | OFF | | OFF | • Change the unit's address (see NODE SEL) |
| External contactors feedback error on Category 4 relay | ON | OFF | 4 flashes | | 4 flashes (only the LEDs corresponding to the outputs in FAIL mode) | | | • Verify connections 5,6,7,8. |
| Error on node detection circuit | OFF | 3 flashes | OFF | 3 flashes | OFF | | OFF | • Return the module to ReeR to be repaired |

Table 51 - Troubleshooting MOR4

English
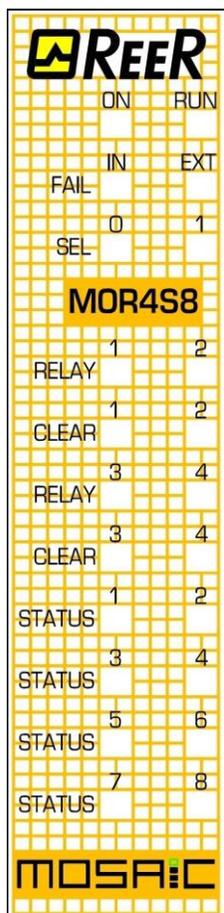
## MOR4S8 (Figure 32)



*Figure 32 - MOR4S8*

| MEANING | LED | | | | | | | | REMEDY |
|---|---|---|---|---|---|---|---|---|---|
| | RUN | IN FAIL | EXT FAIL | SEL 0/1 | RELAY 1/4 | | CLEAR1/4 | STATUS1/8 | |
| | GREEN | RED | RED | ORANGE | RED | GREEN | YELLOW | YELLOW | |
| Internal fault | OFF | 2 / 3 flashes | OFF | Shows the physical address of the unit | Rosso | | OFF | | • Return the unit to ReeR to be repaired |
| Compatibility error | OFF | 5 flashes | OFF | | 5 flashes | | 5 flashes | 5 flashes | • Firmware version not compatible with M1, return to ReeR for FW upgrade. |
| Relais output error | OFF | 4 flashes | OFF | | 4 flashes (only the LED corresponding to the output in FAIL mode) | | OFF | OFF | • If the problem persists, return the module to ReeR to be repaired |
| Error in communication with master | OFF | 5 flashes | OFF | | OFF | | OFF | OFF | • Restart the system<br>• If the problem persists, return the module to ReeR to be repaired |
| Error on other slave or M1 | OFF | ON | OFF | | OFF | | OFF | OFF | • Restart the system<br>• Check which unit is in FAIL mode |
| Same type of slave with same address detected | OFF | 5 flashes | 5 flashes | | OFF | | OFF | OFF | • Change the unit's address (see **NODE SEL**) |
| External contactors feedback error on Category 4 relay | ON | OFF | 4 flashes | | 4 flashes (only the LEDs corresponding to the outputs in FAIL mode) | | | OFF | • Verify connections 5,6,7,8. |
| Error on node detection circuit | OFF | 3 flashes | OFF | 3 flashes | OFF | | OFF | OFF | • Return the module to ReeR to be repaired |
| Short circuit or overload detected on status output | OFF | OFF | ON | OFF | OUTPUT condition | | CLEAR condition | flash | • Verify output status connections |

*Table 52 - Troubleshooting MOR4S8*

**English**

## MOS8 (Figure 33)

| MEANING | LED | | | | | REMEDY |
|---|---|---|---|---|---|---|
| | RUN | IN FAIL | EXT FAIL | SEL 0/1 | STATUS1/8 | |
| | GREEN | RED | RED | ORANGE | YELLOW | |
| Internal fault | OFF | 2 / 3 flashes | OFF | Shows the physical address of the unit | OFF | • Return the unit to ReeR to be repaired |
| Compatibility error | OFF | 5 flashes | OFF | | 5 flashes | • Firmware version not compatible with M1, return to ReeR for FW upgrade. |
| Error in communication with master | OFF | 5 flashes | OFF | | OFF | • Restart the system<br>• If the problem persists, return the module to ReeR to be repaired |
| Error on other slave or M1 | OFF | ON | OFF | | OFF | • Restart the system<br>• Check which unit is in FAIL mode |
| Same type of slave with same address detected | OFF | 5 flashes | 5 flashes | | OFF | • Change the unit's address (see **NODE SEL**) |
| Error on node detection circuit | OFF | 3 flashes | OFF | 3 flashes | OFF | • Return the module to ReeR to be repaired |
| Short circuit or overload detected on status 1–8 output | OFF | OFF | ON | OFF | flash | • Verify output status 1-8 connections |
| Power supply missing on status 1–8 output | OFF | OFF | ON | OFF | flash alternatively | • Connect 5 pin to power supply |

*Table 53 - Troubleshooting MOS8*

*Figure 33 – MOS8*

## MOS16 (Figure 34)
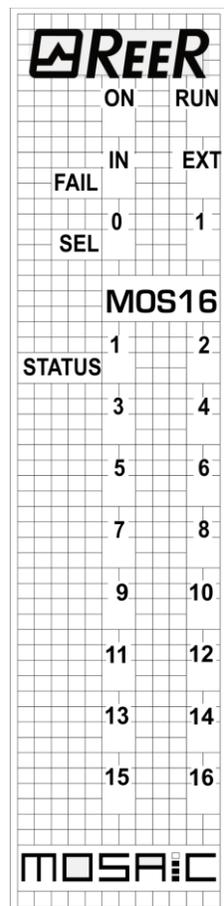


Figure 34 – MOS16

| MEANING | LED | | | | | | REMEDY |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | RUN | IN FAIL | EXT FAIL | SEL 0/1 | STATUS1/8 | STATUS9/16 | |
| | GREEN | RED | RED | ORANGE | YELLOW | YELLOW | |
| Internal fault | OFF | 2 / 3 flashes | OFF | Shows the physical address of the unit | OFF | OFF | • Return the unit to ReeR to be repaired |
| Compatibility error | OFF | 5 flashes | OFF | | 5 flashes | 5 flashes | • Firmware version not compatible with M1, return to ReeR for FW upgrade. |
| Error in communication with master | OFF | 5 flashes | OFF | | OFF | OFF | • Restart the system<br>• If the problem persists, return the module to ReeR to be repaired |
| Error on other slave or M1 | OFF | ON | OFF | | OFF | OFF | • Restart the system<br>• Check which unit is in FAIL mode |
| Same type of slave with same address detected | OFF | 5 flashes | 5 flashes | | OFF | OFF | • Change the unit's address (see NODE SEL) |
| Error on node detection circuit | OFF | 3 flashes | OFF | 3 flashes | OFF | OFF | • Return the module to ReeR to be repaired |
| Short circuit or overload detected on status 1–8 output | OFF | OFF | ON | OFF | flash | OFF | • Verify output status 1-8 connections |
| Short circuit or overload detected on status 9–16 output | OFF | OFF | ON | OFF | OFF | flash | • Verify output status 9-16 connections |
| Power supply missing on status 1–8 output | OFF | OFF | ON | OFF | flash alternatively | OFF | • Connect 5 pin to power supply |
| Power supply missing on status 9–16 output | OFF | OFF | ON | OFF | OFF | flash alternatively | • Connect 6 pin to power supply |

*Table 54 - Troubleshooting MOS16*

English

## MV0, MV1, MV2 (Figure 32)
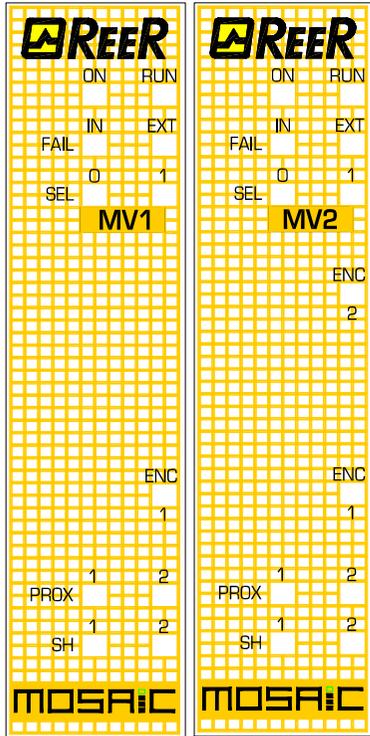


*Figure 35 - MV1, MV2*

| MEANING | LED | | | | | | | REMEDY |
|---|---|---|---|---|---|---|---|---|
| | RUN | IN FAIL | EXT FAIL | SEL | ENC* | PROX | SH | |
| | GREEN | RED | RED | ORANGE | YELLOW | YELLOW | YELLOW | |
| Internal fault | OFF | 2 or 3 flashes | OFF | Shows the physical address of the unit | OFF | OFF | OFF | • Return the unit to ReeR to be repaired |
| Compatibility error | OFF | 5 flashes | OFF | | 5 flashes | 5 flashes | 5 flashes | • Firmware version not compatible with M1, return to ReeR for FW upgrade. |
| Encoder INTERNAL error | OFF | 3 flashes | OFF | | 3 flashes | OFF | OFF | • Change the encoder • Return the unit to ReeR to be repaired |
| Proximity INTERNAL error | | 3 flashes | OFF | | | 3 flashes | | • Change the proximity • Return the unit to ReeR to be repaired |
| Error on node detection circuit | OFF | 3 flashes | OFF | 3 flashes | OFF | OFF | OFF | • Return the unit to ReeR to be repaired |
| Same type of slave with same address detected | OFF | 5 flashes | 5 flashes | | OFF | OFF | OFF | • Change the unit's address (see **NODE SEL**) |
| Encoder not connected but requested from the configuration | OFF | OFF | 3 flashes ** | | 3 flashes ** | OFF | OFF | • Verify encoder connection and power supply • Verify input frequency (in range) |
| Proximity not connected but requested from the configuration | OFF | OFF | 3 flashes ** | | OFF | 3 flashes ** | OFF | • Verify proximity connection • Verify input frequency (in range) |

*Table 55 - Troubleshooting MV1/MV2*

\*    NOT PRESENT ON MV0 MODULE

\*\* WITH FAULT OF A SINGLE CHANNEL, THE SIGNAL IS PRESENTED IN TWO TEMPORAL WINDOWS:
IN THE FIRST IS SHOWED TE FAULT, IN THE SECOND IS SHOWED THE CORRECT CHANNEL.

# MOSAIC SAFETY DESIGNER SOFTWARE

The *"MOSAIC SAFETY DESIGNER"* application software can be used to configure a logic diagram of the connections between the MOSAIC (Master + expansions) and the components of the system being developed.

The MOSAIC and its SLAVE units will thus monitor and control the connected safety components.

The MSD uses a versatile graphic interface to establish the connections between the various components, as described below:

## Installing the software

### PC HARDWARE requirements

- RAM: 256 MB
  (adequate to run *Windows XP SP3 + Framework 4.0*)
- Hard disk: $\geq$ 500Mbyte of free space
- USB connector: 1.1, 2.0 or 3.0
- CD-ROM drive

### PC SOFTWARE requirements

- Windows XP with Service Pack 3 installed (or higher OS).

➜　Microsoft Framework 4.0 (or higher) must be installed on the PC

### How to install MSD

- Insert the installation CD;
- Wait for the auto-run installer to request the SW setup program;

Alternatively follow the path D:/;
- Double-click on the **SetupDesigner.exe** file;

When the installation procedure is complete a window is displayed asking you to close the setup program.

*English*

## Fundamentals

Once the MSD has been correctly installed it creates an icon on the desktop. To launch the program: double-click on this icon. =>

The opening screen shown below is displayed:
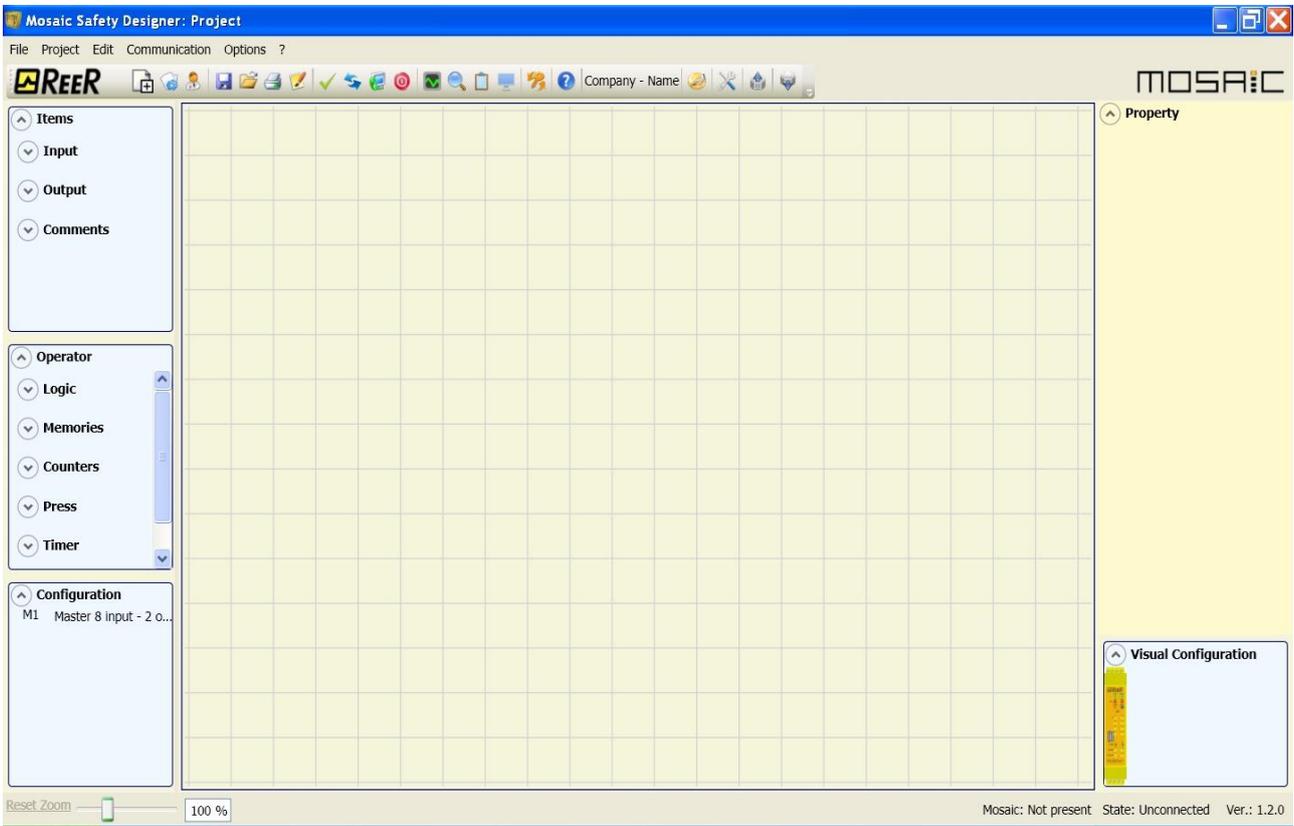


*Figure 36*

You are now ready to create your project.

english

## Standard tool bar

The standard tool bar is shown in Figure 37. The meanings of the icons are listed below:



*Figure 37*

1 -> **CREATE A NEW PROJECT**

2 -> **CHANGE CONFIGURATION** (composition of different modules)

3 -> **CHANGE USER PARAMETERS** (name, company, etc)

4 -> **SAVE THE ACTUAL PROJECT**

5 -> **LOAD AN EXISTING PROJECT (FROM THE PC)**

6 -> **PRINT THE PROJECT SCHEMATIC**

7 -> **PRINT PREVIEW**

8 -> **PRINTING AREA**

9 -> **PRINT THE PROJECT REPORT**

10 -> **UNDO (CANCEL THE LAST COMMAND)**

11 -> **REDO (RESTORE THE LAST CANCELLATION)**

12 -> **VALIDATE THE PROJECT**

13 -> **CONNECT TO MOSAIC**

14 -> **SEND PROJECT TO MOSAIC**

15 -> **DISCONNECT FROM MOSAIC**

16 -> **DOWNLOAD AN EXISTING PROJECT (FROM MOSAIC)**

17 -> **MONITOR** (Real time I/O status - **graphic**)

18 -> **MONITOR** (Real time I/O status - **textual**)

19 -> **DOWNLOAD LOG FILE**

20 -> **SHOW SYSTEM CONFIGURATION**

21 -> **CHANGE PASSWORD**

22 -> **HELP ON-LINE**

23 -> **PASSWORD RECOVERY**

*English*

## Textual tool bar

Optionally the textual tool bar shown below is also available (drop down).



*Figure 38*

## Create a new project (configure the MOSAIC system)

Select icon CREATE (Figure 37) from the standard tool bar to start a new project. The user authentication window is displayed (Figure 39).
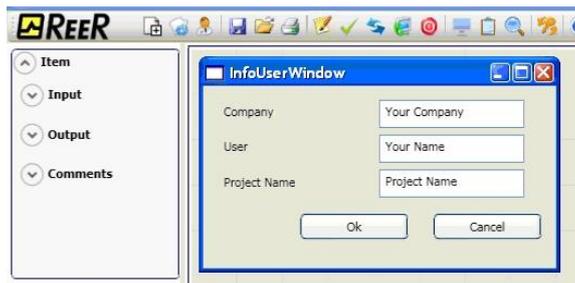


*Figure 39*

Next the MSD displays a window showing the M1 only.
You may add the various units needed to create your system, using the pull-down menus at the top of the screen (select slave) and at the bottom to select the relative node (0÷3).

**SELECT SLAVE** (to add to your configuration)
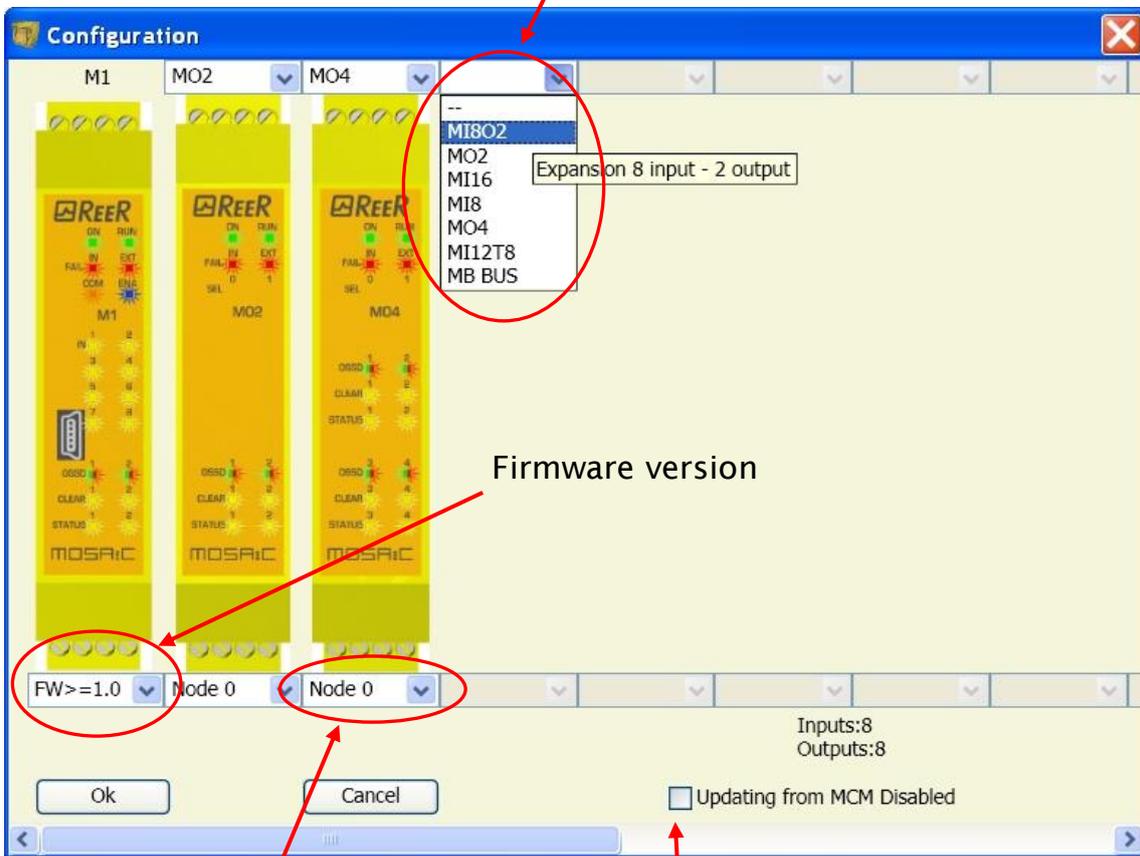


*Figure 40*

**SELECT NODE** (from 0 to 3)          Select to disable MCM operations

*english*

## EDIT CONFIGURATION (composition of the various modules)

**The change of the system composition is obtained with the icon** .
The configuration window is showed again (Figure 37).

## Change user parameters

**The change of user parameters is obtained with the icon** .
The dialog user identification request appears (Figure 41). To accomplish this operation is not necessary to Log out from Mosaic. Generally it serves when a new user must create a new project (even using a previously created).



*Figure 41*

*English*

## OBJECTS - OPERATOR - CONFIGURATION tool bars

Four large tool windows are displayed to the left and right of the main window (shown in Figure 42):
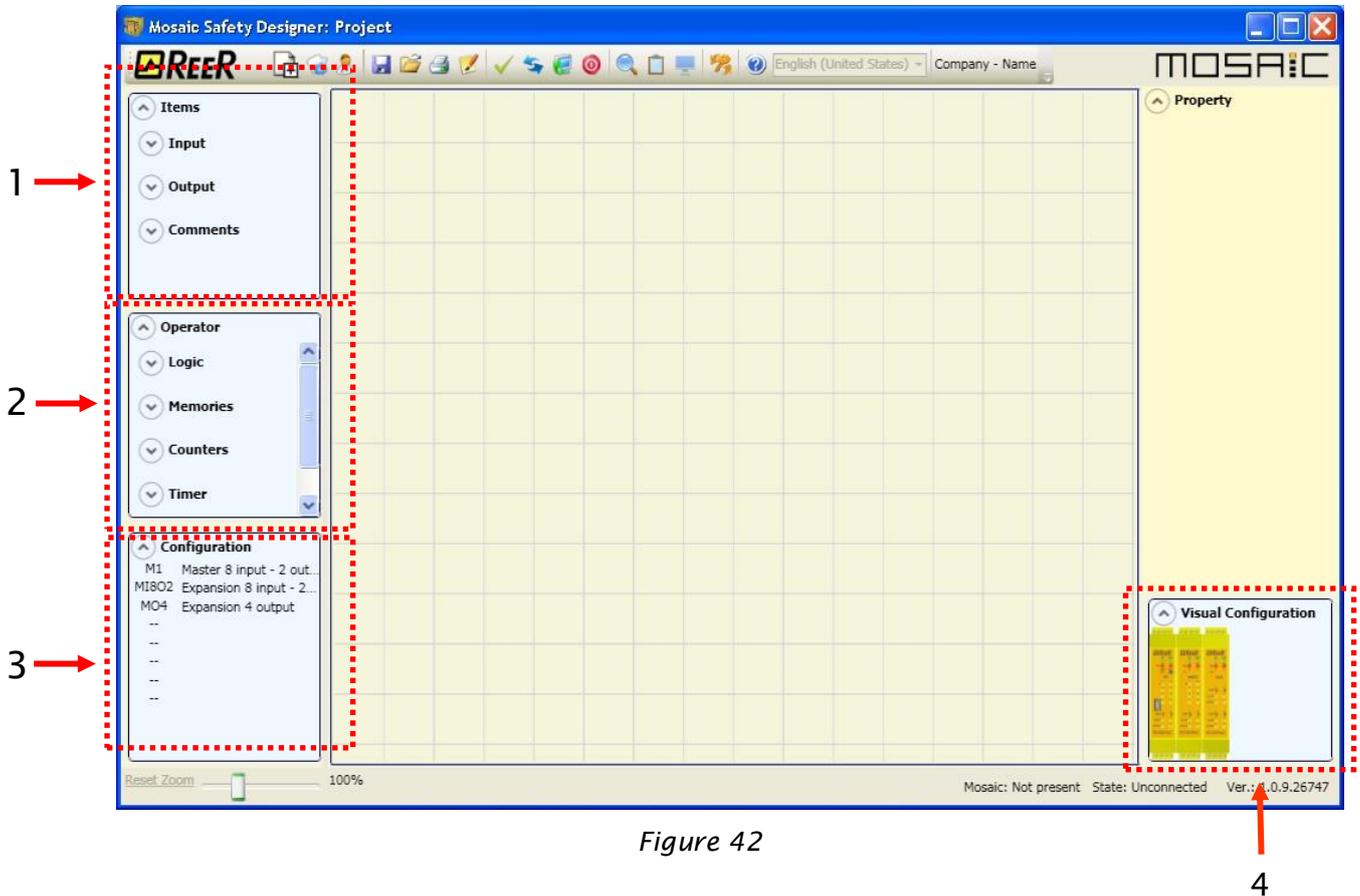


*Figure 42*

**1 > OBJECT TOOL WINDOW**
   This contains the various function blocks that will make up your project; these blocks are divided into 3 different types:
   – physical
   – inputs
   – outputs
   – comments

**2 > OPERATOR TOOL WINDOW**
   This contains the various function blocks for connecting the objects in point 1; these blocks are divided into 6 different types:
   – logical
   – muting
   – memories
   – counters
   – timers

**3 > CONFIGURATION TOOL WINDOW**
   This contains the description of your project composition.

**4 > CONFIGURATION TOOL WINDOW (view)**
   This contains the graphic representation of your project composition.

## Creating the diagram

Once you have selected your system composition, you are ready to configure the project.

The logic diagram is created using a **DRAG&DROP** function:

- Select the objects as required from the windows described previously (each single object is described in detail in the following sections) and drag it into the design area.
- Now when you select the object the **PROPERTIES** window is enabled, where you must fill in the fields as required.
- When you need to set a specific numerical value with a slide (eg filter) use the left and right arrows on your keyboard or click the sides of the slider of the slide.
- Connect the objects by moving the mouse over the required pin and then dragging it onto the pin to be connected.
- If the scheme requires the PAN function (moving working area in the window), select the object to move and use the arrow keys on your keyboard.
- If the scheme is very complicated and requires a connection between two elements very far, use the "Interpage" component. The element "*Interpage out*" must have a name which, invoked by the corresponding "*Interpage in*", allows the desired link.
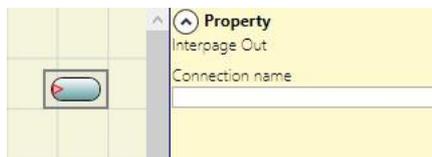
**(scheme side SX)**  **(scheme side SX)** 
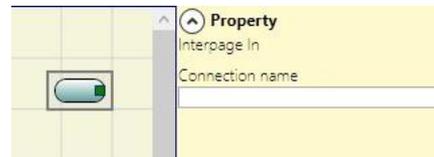
- When you need to duplicate an object, select it and press CTRL+C / CTRL+V keys on your keyboard.
- When you need to delete an object or a link, select it and press DEL key on your keyboard.

**Use of mouse right button**

*ON BLOCK INPUT / OUTPUT*

- Copy / Paste
- Delete
- Delete all the assigned pins
- Alignment with other functional blocks (multiple selection)
- On-line Help
- Monitor Mode: Show / Hide Properties window
- The block Status: pin input enable / disable logical negation

*ON BLOCK OPERATORS*

- Copy / Paste
- Delete
- Alignment with other functional blocks (multiple selection)
- On-line Help
- On input pin: activate / deactivate logical negation
- Monitor Mode: Show / Hide Properties window

*ON TERMINALS*

- Alignment with other blocks

## ON CONNECTION (WIRES)

- Delete
- Display full path of the connection (network)
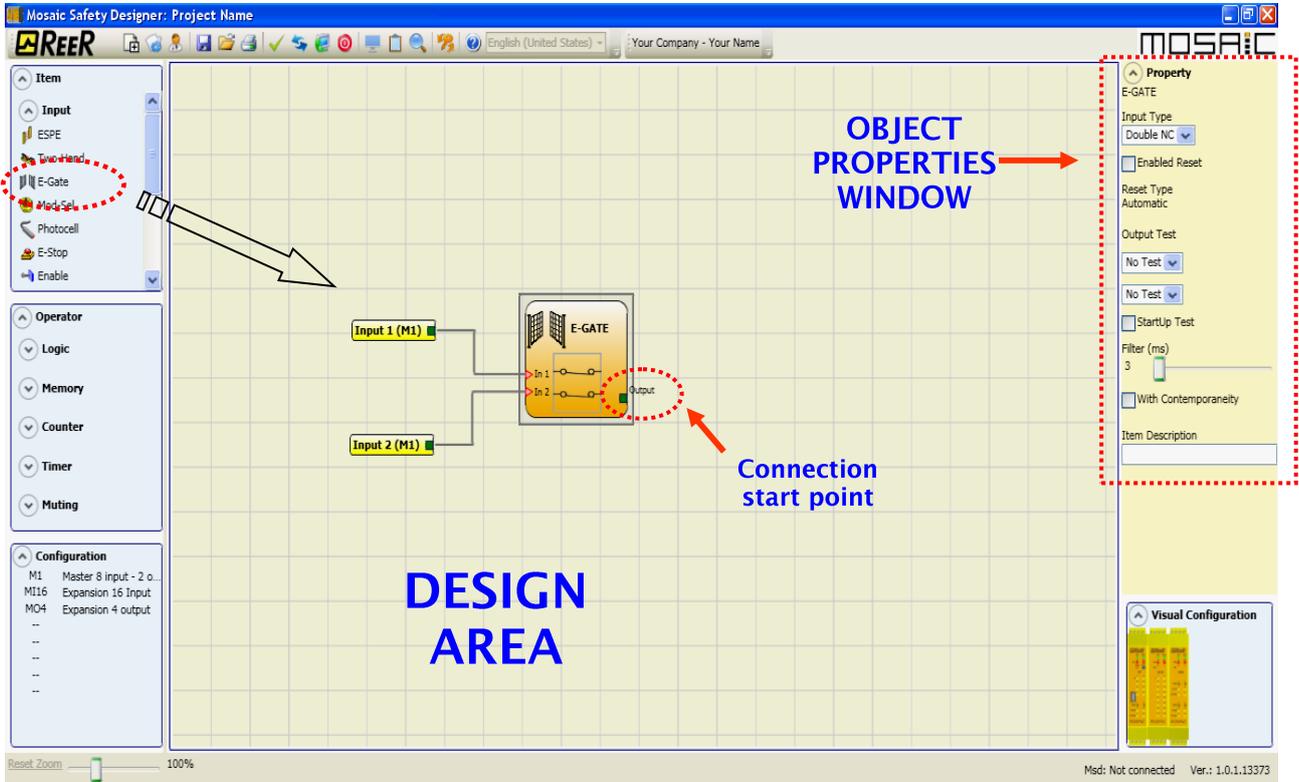


*Figure 43*

## Example of a project

Figure 44 shows an example of a project in which the M1 unit only is connected to two safety blocks (E-GATE and E-STOP).

The M1 inputs (1,2,3) for connecting the contacts of the safety components are shown on the left, in yellow. The MOSAIC outputs (from 1 to 4) are activated according to the conditions defined in E-GATE and E-STOP (see the *E-GATE* - *E-STOP* sections).

By clicking on a block to select it, you enable the PROPERTIES WINDOW on the right, which you can use to configure the block activation and test parameters (see the *E-GATE* - *E-STOP* sections).
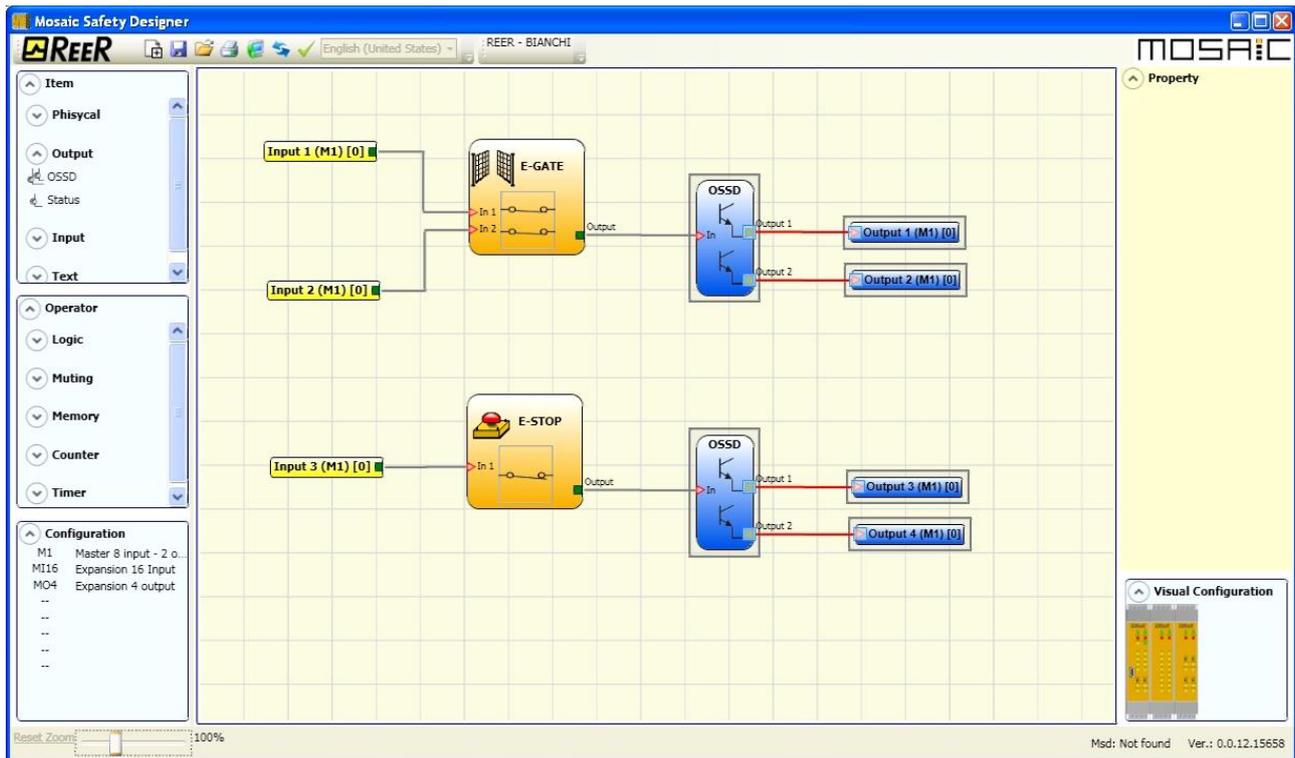


*Figure 44*

At the end of the project design stage (or at intermediate steps) you can save the current configuration using the icon **SAVE** on the standard tool bar.

### Project validation

➜ Now the finished project must be verified. Execute the VALIDATE command (Icon ✓ on the standard toolbar).

If the validation is successful, a sequential number is assigned to the input and output of the project. Then, this number is also listed in the REPORT and in the MONITOR of MSD.

Only if the validation is successful we will proceed to send the configuration.

The validation function only verifies the consistency of programming with respect to the characteristics of the MOSAIC system. It does not guarantee that the device has been programmed to meet all the safety requirements for the application.

**English**

## Project report

Print of the System composition with properties of each block. (Icon ![icon] on the standard toolbar).



MOSAIC
MOdular SAfety Integrated Controller

Via Carcano, 32
10153 Torino Italia
http://www.reer.it

Project Report generated by Mosaic Safety Designer version 1.2.0

Project Name: Sch24 SOLID STATE DEVICE
User: Greco
Company: Reer
Date: 07/11/2011 14.28.48
Schematic CRC: 3A4BH

Mosaic: Configuration
Module M1 (Configured Firmware version: >= 1.0)
Module MI8O2 Node 0
Module MI8O2 Node 1
Module MO4 Node 0
Module MI12T8 Node 0

Mosaic: Safety Information's
PFHd (according to IEC 61508): 2,42E-008 (1/h)
MTTFd (according to EN ISO 13849-1): 85 years
DCavg (according to EN ISO 13849-1): 98.04 %

Resources used

INPUT: 22% (8/36)
Functional Blocks: 3

Timing: 6% (1/16)
Total number blocks: 5% (3/64)

OSSD: 50% (5/10)
STATUS: 20% (2/10)

Electrical diagram

SSD
Functional Block 1
Filter (ms): 3
Contemporaneity (ms): 10
Reset Type: Automatic
StartUp Test: True
Connections:
M1 INPUT1/Terminal17
M1 INPUT2/Terminal18

SSD
Functional Block 2
Filter (ms): 100
Contemporaneity (ms): 500
Reset Type: Manual
StartUp Test: False
Connections:
MI8O2 - 0 INPUT1/Terminal17
MI8O2 - 0 INPUT2/Terminal18
MI8O2 - 0 INPUT3/Terminal19

SSD
Functional Block 3
Filter (ms): 250
Contemporaneity (ms): 1000
Reset Type: Monitored
StartUp Test: False

---

| | |
|---|---|
| ⚡ | This definition of PL and of the other related parameters as set forth in ISO 13849-1 only refers to the functions implemented in the Mosaic system by the MSD 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 Mosaic system within the scope of the application. |
| ⚡ | This must only be performed by the user/installer. |

## Connect to Mosaic

After connecting M1 to the PC via CSU cable (USB) use the icon [icon] for the connection.

A window appears to request the password. Enter the password (see "Password protection").



*Figure 45*

## Sending the configuration to the MOSAIC

To send the saved configuration from a PC to M1 use the icon [icon] on the standard toolbar and wait the execution. M1 will save the project in its internal memory and (if present) in MCM memory. (Password Required: level 2).

➜   This function is possible only after project validation with OK result.

## Download a configuration file (project) from Mosaic M1

To download a project from MOSAIC M1 to MSD use the icon [icon] on the Standard toolbar. MSD will display the project residing in M1. (Sufficient Password level 1).

➜   If the project must be used on other modules M1 verify the components effectively connected (ref. **"System composition"** on page 72).

➜   Then perform a **"Project Validation"** (page 69) and  a **"System Test"** (page 75).

## Configuration LOG

➜   Within the configuration file (project), are included the **creation date** and **CRC (4-digit hexadecimal identification)** of a project that are stored in M1.

➜   This logbook can record up to 5 consecutive events, after which these are overwritten, starting from the least recent event.

The log file can be visualized using the icon [icon] in the standard tool bar.
(Password Required: level 1).
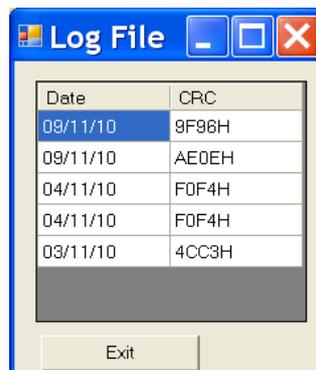


*Figure 46*

## System composition

The check of the actual composition of the MOSAIC system is obtained using the icon

. (Password Required: level 1). A pop-up window will appear with:
- Connected modules;
- Firmware version of each module;
- Node number (physical address) of each module.
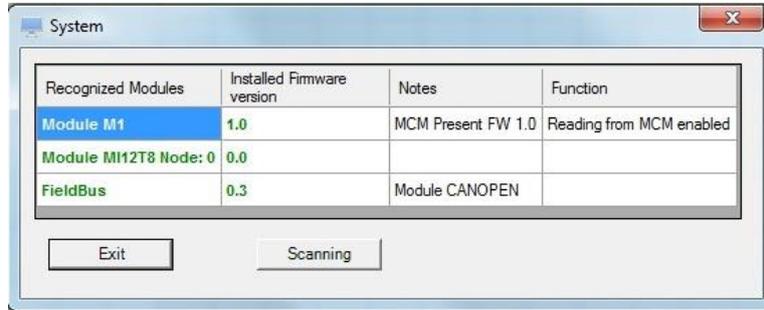


*Figure 47*

If the modules found are not correct the following window will appear;
e.g. MI12T8 node number not correct (displayed in red color text).
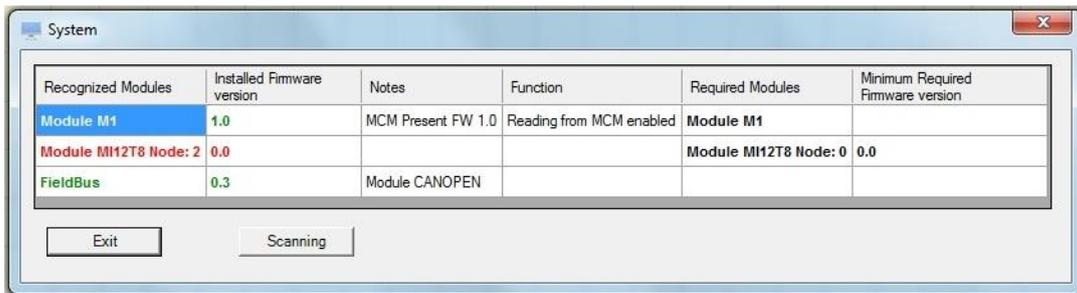


*Figure 48*

## Disconnecting System

To disconnect the PC from M1 use the icon  ; when the system is disconnected it is resetted and it starts with the sent project.

➔    If the system is not composed of all modules provided by the configuration, after the disconnection,  M1 indicates the incongruity and does not starts. (See SIGNALS).

## MONITOR (I/O status in real time – textual)

To activate the monitor use the icon . (Password Required: level 1).
A pop-up window will appear **(in real time)** with:

- Status of the inputs (when the object has two or more input connections to Mosaic, the MONITOR will show as active only the first), see the example in figure;
- Inputs Diagnostics;
- OSSD State;
- OSSD Diagnostics;
- Status of Signaling OUTPUTS;
- OUT TEST diagnostics.

*Figure 49 - textual monitor*

## MONITOR (I/O status in real time – textual – graphic)

To activate/deactivate the monitor use the icon . (Password Required: level 1).
The color of links (Figure 33) allows you to view the diagnostics **(in real time)** with:
**RED** = OFF
**GREEN** = ON
**DASHED ORANGE** = Connection Error
**DASHED RED** = Pending enable (for example  RESTART)
Placing the mouse pointer over the link, you can display the diagnostics.
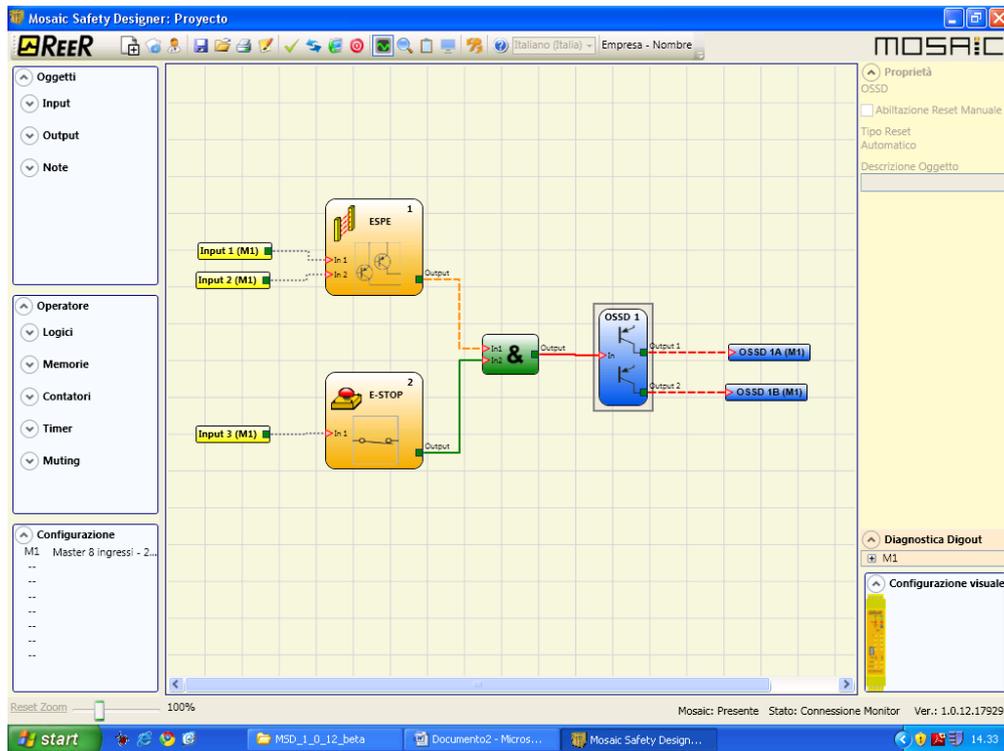


*Figure 50 - graphic monitor*

English

## Password protection

The MSD requests a password in order to upload and save the project.

> ➔ The password entered as default must be modified to avoid manipulation (level 2 password) or so that the configuration loaded on Mosaic (level 1 password) is not visible.

### Level 1 password

All operators using the M1 system must have a Level 1 PASSWORD.

This password allows only to view the LOG file, composition of the system and MONITOR in real time and upload operations.

The first time the system is initialised the operator must use the password "" (ENTER key).

Designers who know the level 2 password can enter a new level 1 password (alphanumerical, max 8 characters).

> ➔ Operators who know this password **are enabled** to upload (from M1 to PC), modify or save the project.

### Level 2 password

Designers authorised to work on the creation of the project must know a Level 2 PASSWORD. The first time the system is initialised the operator must use the password **"SAFEPASS"** (all capital letters)**.**

Designers who know the level 2 password can enter a new level 2 password (alphanumerical, max 8 characters).

> ➔ This password **enables** the project to be uploaded (from PC to M1), modified and saved. In other words, it allows total control of the PC => MOSAIC system.
>
> ➔ When a new project is UPLOADED the level 2 password could be changed.
>
> ➔ Should you forget either of these passwords, please contact ReeR which will provide an unlock file (when the unlock file is saved in the right directory the icon 🪄 will appear on the toolbar). When the icon is activated, the password level 1 and level 2 are restored to their original values. This password is only given to the designer and can only be used once.

### Password Change

To activate the PASSWORD Change use icon 🔧, after connecting with Level 2 Password.

A window appears (Figure 51) allowing the choice of the new password; insert the old and new passwords in the appropriate fields (max 8 characters). Click OK.

At the end of the operation disconnect to restart the system.

If MCM is present the new password is also saved in it.



*Figure 51*

## TESTING the system

> 🗲 After validating and uploading the project to the M1 and connecting all the safety devices, you must test the system to verify its correct operation.

This is done by forcing a change of status for each safety device connected to the MOSAIC to check that the status of the outputs actually changes.
The following example is helpful for understanding the TEST procedure.



*Figure 52*

(t1)   In the normal operating condition (E-GATE closed) Input1 is closed, Input2 is open and the output of the E-GATE block is set to high logic level; in this mode the safety outputs (OSSD1/2) are active and the power supply to the relative terminals is 24VDC.

(t2)   When the E-GATE is **physically** opened, the condition of the inputs and thus of the outputs of the E-GATE block will change: (OUT= 0VDC--->24VDC); **the condition of the OSSD1–OSSD2 safety outputs will change from 24VDC to 0VDC.** If this change is detected the mobile E-GATE is connected correctly.



> 🗲 For the correct installation of each external sensor/component refer to their installation manual.
> 🗲 This test must be performed for each safety component in the project.

*English*

# OBJECT FUNCTION BLOCKS

## OUTPUT OBJECTS

### OSSD (safety outputs)

OSSD safety outputs which use semiconductor technology do not require maintenance, Output1 and Output2 supply 24Vdc if the In is 1 (TRUE) and vice versa 0Vdc if the In is 0 (FALSE).

➡ Each pair of OSSD outputs has a relative RESTART_FBK input. This input must always be connected as indicated in the RESTART_FBK paragraph.
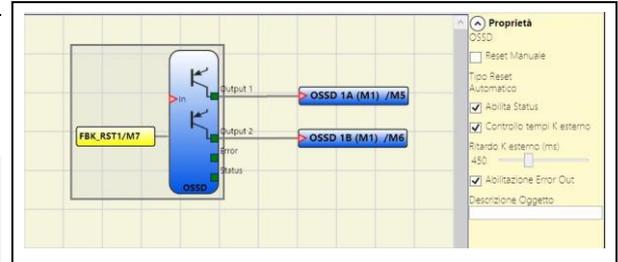


### *Parameters*

*Manual Reset:* If selected this enables the request to reset each time the input signal falls. Otherwise, output enabling directly follows In input conditions.



MANUAL

t = 250ms



MONITORED

5s > t1 > 250ms
t2 = 250ms
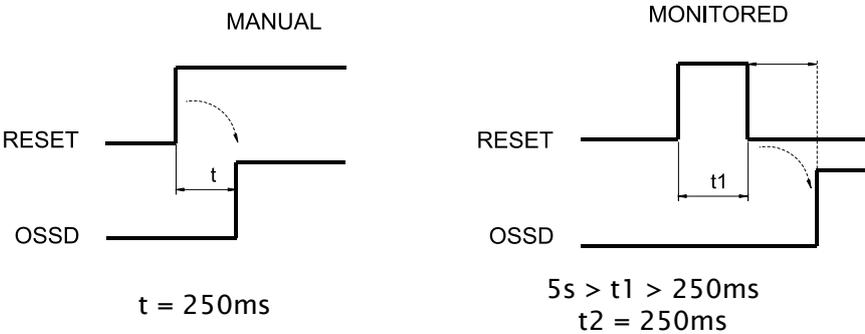
There are two types of reset: Manual and Monitored. In selecting the Manual option only signal transition from 0 to 1 is verified. If the Monitored option is selected, the double transition from 0 to 1 and back to 0 is verified.

*Enable Status:* If selected, enables the connection of the current OSSD state to any point on the screen.

*K external time check:* If selected, enables the setting of the time window within which the external feedback signal is to be monitored (according to output conditions).
With high level (TRUE) OUTPUT, the FBK signal must be at low level (FALSE) and vice versa, within the set time.
Otherwise, OUTPUT is set to low level (FALSE) and the error is indicated on the master M1 by the flashing CLEAR LED corresponding to the OSSD in error.

*Enable Error Out* If selected, enables the ERROR OUT output. This output is set to high level (TRUE) when an external FBK error is detected.

The **Error Out** signal is reset in case of one of the following events:

1. Switching on and switching off of system.
2. Activation of the RESET M1 operator.
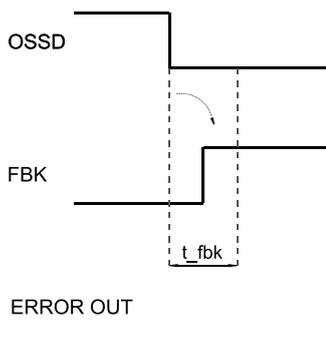




**Example of OSSD with correct Feedback signal: In this case ERROR OUT=FALSE**
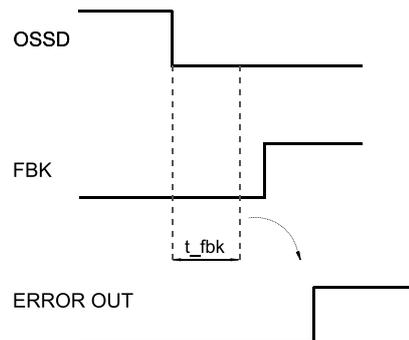
**Example of OSSD with incorrect Feedback signal (k external time exceeded): In this case ERROR OUT=TRUE**

**english**

## STATUS (signal output)

STATUS output (NOT SAFETY OUTPUT) makes it possible to monitor any point on the diagram by connecting it to the input. The output returns 24Vdc if the input is 1 (TRUE), or 0Vdc if the input is 0 (FALSE).
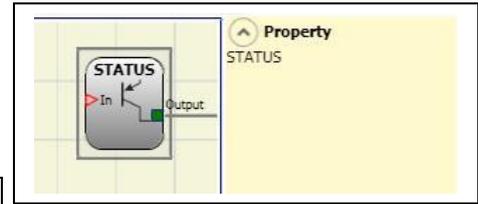
> ⚡ WARNING: The STATUS output is NOT a safety output.

## FIELDBUS PROBE

Element that permits display of the status of any point of the scheme on the fieldbus.

Up to 16 probes can be inserted and the bit on which status is represented must be entered for each.

States are represented with 2 bytes on the fieldbus.

*(For more detailed information, consult the fieldbus manual on the MSD CD-ROM).*
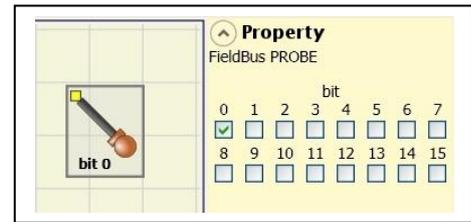
> ⚡ WARNING: the PROBE output is NOT a safety output

## RELAY

The Output relay is a N.O. relay output. Relay outputs are closed when the input *IN* is equal to 1 (TRUE), otherwise they are open (FALSE).

*Parameters*

*Category* There is a choice of 3 different relay output categories:

**Category 1.** Outputs with single Category 1 relay. Each MOR4/S8 unit may have up to 4 of these outputs.

Features:
* Internal relays are monitored.
* EDM feedback (check of FBK 1-4) not used (not requested for Category 1).
* Each output can be set as AUTO or MANUAL RESTART.
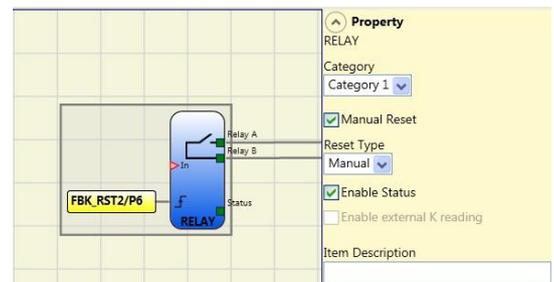
**Example with external relay**
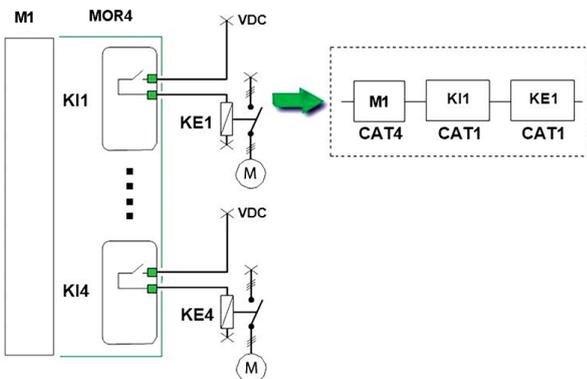


**Example with the internal relay only**
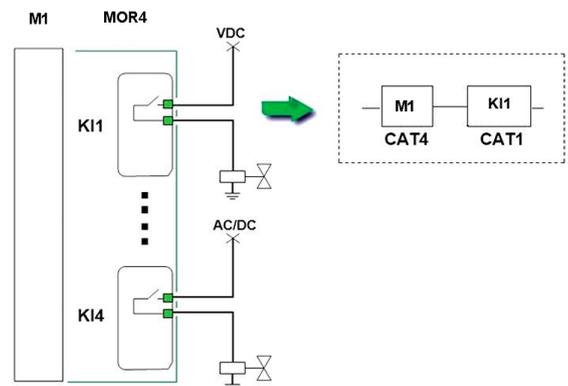
**Category 2.** Outputs with single Category 2 relay with OTE outputs. Each MOR4/S8 unit can have up to 4 of these outputs.

Features:
- Internal relays are always monitored.
- Monitored EDM feedback.
- The output can be configured to Manual or Automatic restart. The EDM feedback monitor cannot be activated with the manual restart. To monitor the EDM feedback must be confi- gured automatic restart. In this case, if you want to use the manual restart shall be provided a dedicated logic. Refer to the following note.
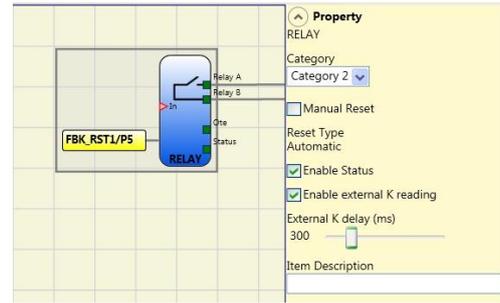
## (Output Test Equipment)

OTE (Output Test Equipment) is activated; this is necessary with configurations of category 2 for the reporting of hazardous failures in accordance with EN 13849-1: 2006 / DAM1 (under development).OTE output: normally ON. In case of fault of internal feedback or EDM => OFF.
This permits to inform the machine logic, with the aim of stopping the dangerous movement or at least signaling the fault to the user.
*OTE:* The OTE (Output Test Equipment) output is normally 1 (TRUE) exept in the case of an internal error or a fault associated with feedback from the external contactors (FALSE).

## Use with RESTART: Automatic (A) or Manual (B) (Category 2)
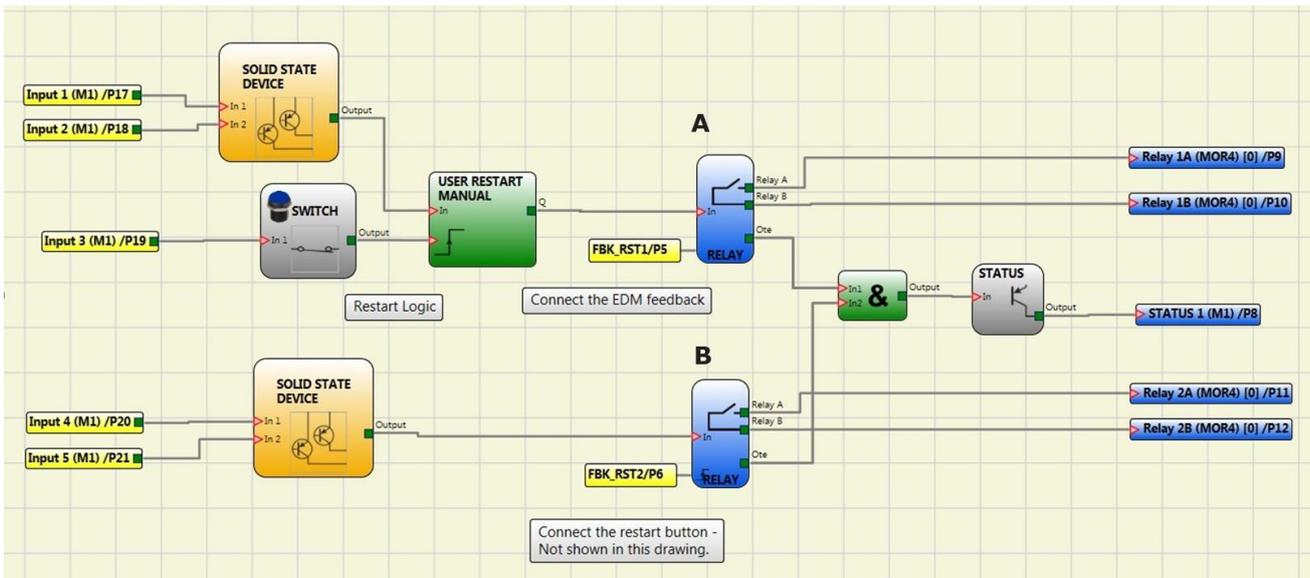


*Figure 53*

**Category 4.** Outputs with two Category 4 relays. Each MOR4/S8 unit can have up to 2 of these outputs.
With this output the relays are controlled in pairs.

Features:
- 2 double channel outputs.
- Double internal relays are monitored.
- Each output can be set as AUTO or MANUAL RESTART.
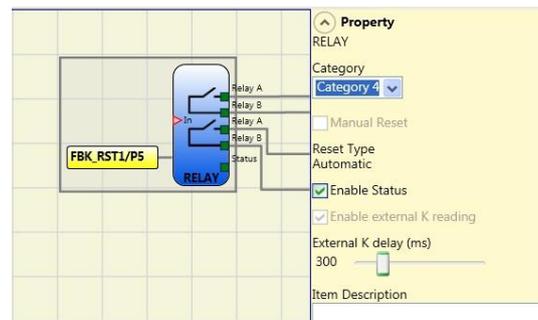
➔ In order to not affect the outcome of the calculation of the PL, the inputs (sensors or safety devices) must be of a category equal to or higher than the other devices in the chain.

**Example of use with only the internal relay and monitored solenoid valves.**
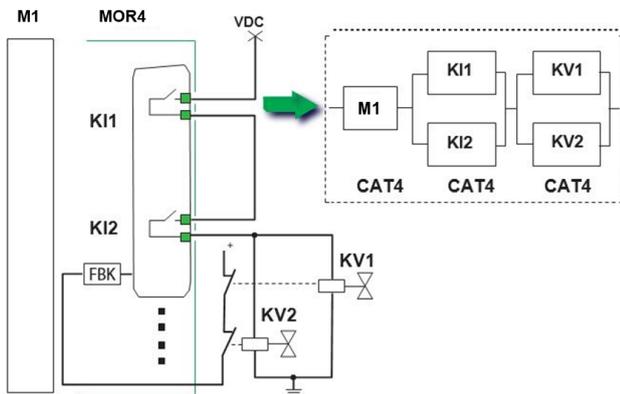
**Example of use with external contactors with feedback.**
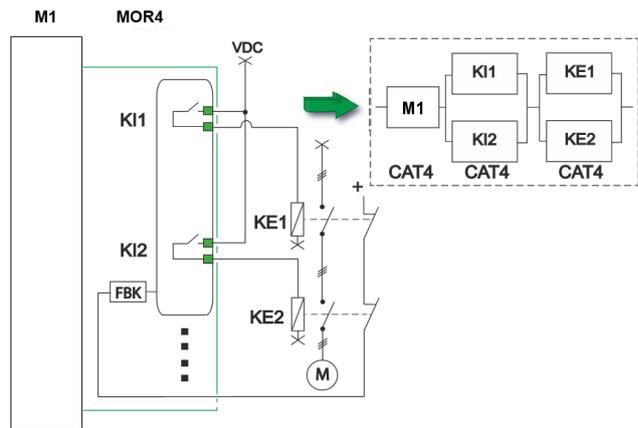


*External K delay (ms):* Select the Maximum delay the external contactors are allowed to introduce. This value can be used to check the maximum delay between switching of the internal relays and switching of the external contactors (during both activation and deactivation).

*Manual Reset:* If selected this enables the request to reset each time the IN input signal falls. Otherwise, the output is enabled directly according to the condition of the IN input.

There are two types of reset: Manual and Monitored. When Manual is selected the system only verifies the signal's transition from 0 to 1. If Monitored is selected, the double transition from 0 to 1 and then back to 0 is verified.

*Enable status:* If selected this enables the connection of the current status of the relay outputs to a STATUS.

*Enable reading of external K:* 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).

**English**

## INPUT OBJECTS

### E–STOP (emergency stop)

E-STOP function block verifies an emergency stop device inputs status. If the emergency stop button has been pressed the output is 0 (FALSE). If not the output is 1 (TRUE).

*Parameters*



*Input type*:
- Single NC – allows connection of one-way emergency stops
- Double NC – allows connection of two-way emergency stops .

*Manual reset:* If selected this enables the request to reset each time the emergency stop is activated. Otherwise, enabling of the output directly follows the input conditions.

There are two types of reset: Manual and Monitored. When Manual is selected the system only verifies the signal's transition from 0 to 1. If Monitored is selected the double transition from 0 to 1 and then back to 0 is verified.



MANUAL

RESET

OUTPUT

t = 250ms

MONITORED

RESET

OUTPUT

t1 > 250ms
t2 = 250ms

CONNECTION EXAMPLE (ONE CONTACT)

CONNECTION EXAMPLE (TWO CONTACTS)
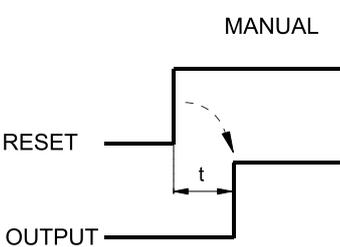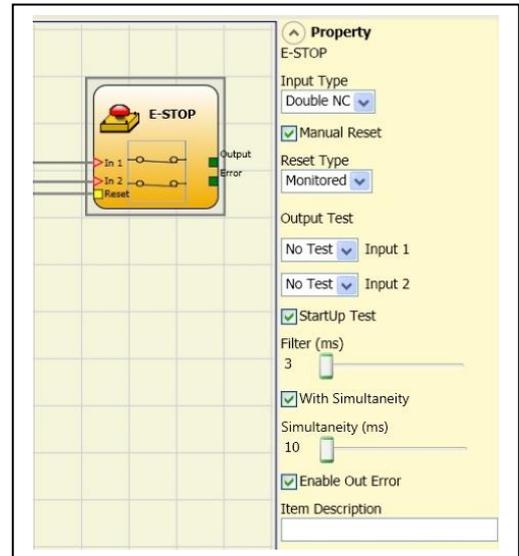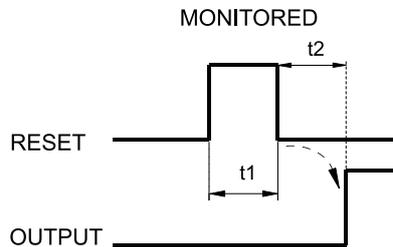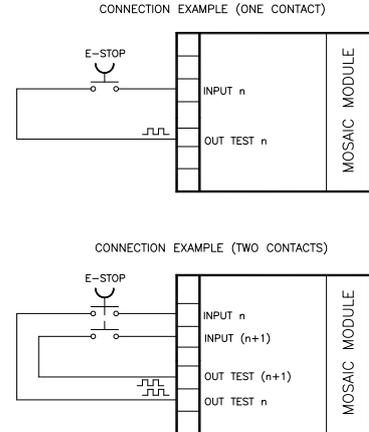
> ➜ WARNING: If the Manual Reset is active, a consecutive Input have to be used. Example : Input 1 and Input 2 are used for the fuctional block, then Input 3 have to be used for the Reset Input.

*Output test*: This is used to select which test output signals are to be sent to the emergency stop (mushroom pushbutton). This additional test makes it possible to detect and manage any short-circuits between the lines. This additional control permits detection and management of any short-circuits between the lines. To enable this control, the test output signals must be configured (amongst those available).

*Test at start-up*: If selected this enables the test at start-up of the external component (emergency stop). This test is performed by pressing and releasing the pushbutton to run a complete function test and enable the output. This test is only requested at machine start-up (when the unit is switched on).

*english*

*Filter (ms)*: This is used to filter the signals coming from the emergency stop. The filter can be configured to between 3 and 250 ms and eliminates any bouncing on the contacts. The length of the filter affects the calculation of the unit's total response time.

*With Simultaneity:* If selected this activates the test to verify concurrent switching of the signals coming from the emergency stop.

*Simultaneity (ms):* This is only active if the previous parameter is enabled. It defines the maximum time (in msecs) between the switching of two different signals from the emergency stop.

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* This allows a description of the component's function to be entered. The text is displayed in the top part of the symbol.

## E-GATE (safety gate device)

E-GATE function block verifies a mobile guard or safety gate device input status. If the mobile guard or safety gate is open, the output is 0 (FALSE). Otherwise the output is 1 (TRUE).

*Parameters*

*Input type*:
- Double NC – Allows connection of components with two NC contacts
- Double NC/NO – Allows connection of components with one NO contact and one NC.

➜ With inactive input (block with Output FALSE), connect:
  - Contact NO to terminal corresponding to IN1.
  - Contact NC to terminal corresponding to IN2.



*Enable reset*: If selected this enables the request to reset each time the mobile guard/safety gate is activated. Otherwise, enabling of the output directly follows the input conditions.
There are two types of reset: Manual and Monitored. When Manual is selected the system only verifies the signal's transition from 0 to 1. If Monitored is selected the double transition from 0 to 1 and then back to 0 is verified.



MANUAL

t = 250ms

MONITORED

t1 > 250ms
t2 = 250ms

CONNECTION EXAMPLE (TWO CONTACTS)

**English**

➜ WARNING: If the Manual Reset is active, a consecutive Input have to be used. Example : Input 1 and Input 2 are used for the fuctional block, then Input 3 have to be used for the Reset Input.

*Output test*: This is used to select which test output signals are to be sent to the component contacts. This additional control permits detection and management of any short-circuits between the lines. To enable this control, the test output signals must be configured (amongst those available).

*Test at start-up*: If selected this enables the test at start-up of the external component. This test is performed by opening the mobile guard or safety gate to run a complete function test and enable the output. This test is only requested at machine start-up (when the unit is switched on).

*Filter (ms)*: This is used to filter the signals coming from the external contacts. The filter can be configured to between 3 and 250 ms and eliminates any bouncing on the contacts. The length of the filter affects the calculation of the unit's total response time.

*With Simultaneity:* If selected this activates the test to verify concurrent switching of the signals coming from the external contacts.

*Simultaneity (ms):* This is only active if the previous parameter is enabled. It defines the maximum time (in msecs) between the switching of two different signals from the external contacts.

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* This allows a description of the component's function to be entered. The text is displayed in the top part of the symbol.


## SINGLE E-GATE (safety gate device)

SINGLE E-GATE function block verifies a mobile guard or safety gate device input status. If the mobile guard or safety gate is open, the output is 0 (FALSE). Otherwise the output is 1 (TRUE).
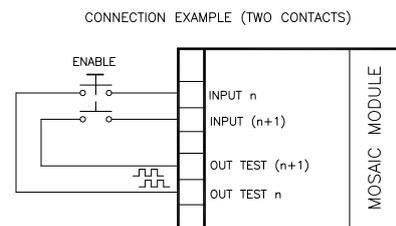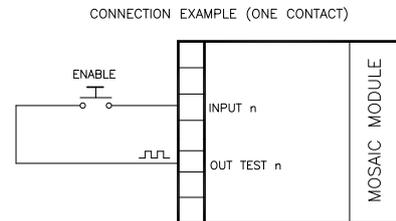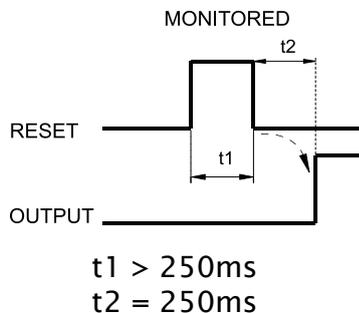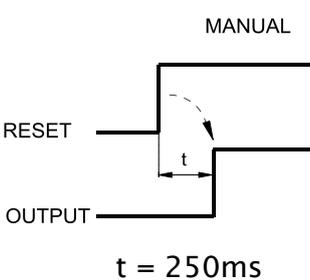
*Parameters*

*Enable reset*: If selected this enables the request to reset each time the mobile guard/safety gate is activated. Otherwise, enabling of the output directly follows the input conditions.
There are two types of reset: Manual and Monitored. When Manual is selected the system only verifies the signal's transition from 0 to 1. If Monitored is selected the double transition from 0 to 1 and then back to 0 is verified.



MANUAL



t = 250ms

MONITORED



t1 > 250ms
t2 = 250ms

➜ WARNING: If the Manual Reset is active, a consecutive Input have to be used. Example : Input 1 and Input 2 are used for the fuctional block, then Input 3 have to be used for the Reset Input.

*Output test*: This is used to select which test output signals are to be sent to the component contacts. This additional control permits detection and management of any short-circuits between the lines. To enable this control, the test output signals must be configured (amongst those available).

*Test at start-up*: If selected this enables the test at start-up of the external component. This test is performed by opening the mobile guard or safety gate to run a complete function test and enable the output. This test is only requested at machine start-up (when the unit is switched on).

*Filter (ms)*: This is used to filter the signals coming from the external contacts. The filter can be configured to between 3 and 250 ms and eliminates any bouncing on the contacts. The length of the filter affects the calculation of the unit's total response time.

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* This allows a description of the component's function to be entered. The text is displayed in the top part of the symbol.

## LOCK FEEDBACK

The function block LOCK FEEDBACK verifies the lock status of the guard lock device for mobile guard or safety gate. In the case where the inputs indicate that the guard is locked the Output will be 1 (TRUE). Otherwise the output is 0 (FALSE).

*Parameters*

*Input type*
- Single NC – Allows connection of components with one NC contact;
- Double NC – Allows connection of components with two NC contacts.
- Double NC/NO – Allows connection of components with one NO contact and one NC.
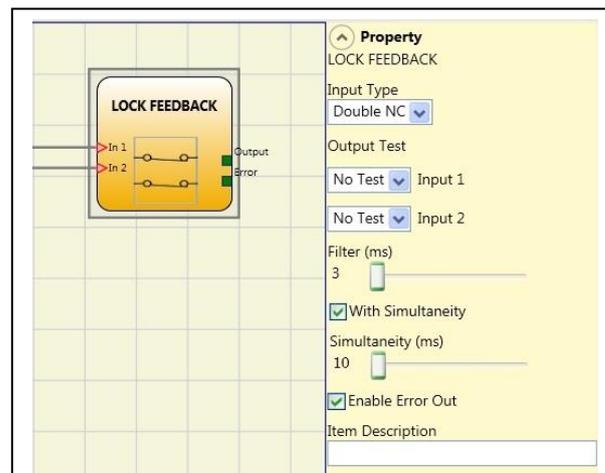


➜ With inactive input (guard unlocked), connect:
  - Contact NO to terminal corresponding to IN1
  - Contact NC to terminal corresponding to IN2.

*Output test*: This is used to select which test output signals are to be sent to the component contacts. This additional control permits detection and management of any short-circuits between the lines. To enable this control, the test output signals must be configured (amongst those available).

*Filter (ms)*: This is used to filter the signals coming from the external contacts. The filter can be configured to between 3 and 250 ms and eliminates any bouncing on the contacts. The length of the filter affects the calculation of the unit's total response time.

*English*

*With Simultaneity:* If selected this activates the test to verify concurrent switching of the signals coming from the external contacts.

*Simultaneity (ms):* This is only active if the previous parameter is enabled. It defines the maximum time (in msecs) between the switching of two different signals from the external contacts.

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* This allows a description of the component's function to be entered. The text is displayed in the top part of the symbol.

## ENABLE (enable key)

ENABLE function block verifies a manual key device Input status. If the key is not turned the output is 0 (FALSE). Otherwise the output is 1 (TRUE).

*Parameters*

*Input type*
- Single NO – Allows connection of components with one NO contact;
- Double NO – Allows connection of components with two NO contacts.

*Enable reset*: If selected this enables the request to reset each time the command is activated. Otherwise, enabling of the output directly follows the input conditions.
There are two types of reset: Manual and Monitored. When Manual is selected the system only verifies the signal's transition from 0 to 1.
If Monitored is selected the double transition from 0 to 1 and then back to 0 is verified.

➔ WARNING: If the Manual Reset is active, a consecutive Input have to be used. Example : Input 1 and Input 2 are used for the fuctional block, then Input 3 have to be used for the Reset Input.

MANUAL

t = 250ms

MONITORED

t1 > 250ms
t2 = 250ms

CONNECTION EXAMPLE (ONE CONTACT)

CONNECTION EXAMPLE (TWO CONTACTS)

**english**

*Output test*: This is used to select which test output signals are to be sent to the component contacts. This additional control permits detection and management of any short-circuits between the lines. To enable this control, the test output signals must be configured (amongst those available).

*Test at start-up*: If selected this enables the test at start-up of the external component. This test is performed by opening and activating the enable key to run a complete function test and enable the output. This test is only requested at machine start-up (when the unit is switched on).

*Filter (ms)*: This is used to filter the signals coming from the external contacts. The filter can be configured to between 3 and 250 ms and eliminates any bouncing on the contacts. The length of the filter affects the calculation of the unit's total response time.

*With Simultaneity:* If selected this activates the test to verify concurrent switching of the signals coming from the external contacts.

*Simultaneity (ms):* This is only active if the previous parameter is enabled. It defines the maximum time (in msecs) between the switching of two different signals from the external contacts.

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* This allows a description of the component's function to be entered. The text is displayed in the top part of the symbol.

## ESPE (optoelectronic safety light curtain / laser scanner)

ESPE function block verifies an optoelectronic safety light curtain (or laser scanner) inputs state. If the area protected by the light curtain is occupied, (light curtain outputs FALSE) the output is 0 (FALSE). Otherwise, with the area clear and outputs to 1 (TRUE) the output is 1 (TRUE).
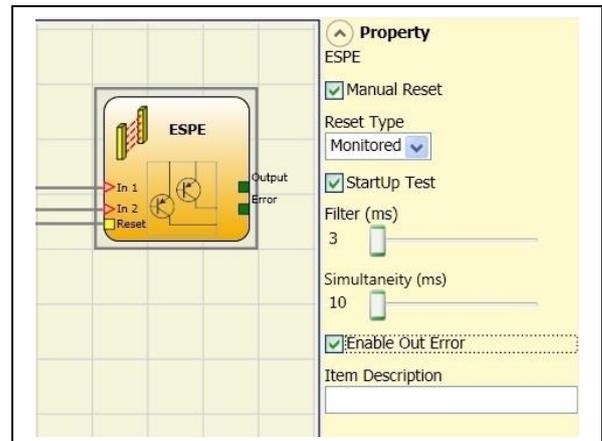


*Parameters*

*Enable reset*: If selected this enables the request to reset each time the area protected by the safety light curtain is occupied. Otherwise, enabling of the output directly follows the input conditions.

There are two types of reset: Manual and Monitored. When Manual is selected the system only verifies the signal's transition from 0 to 1. If Monitored is selected the double transition from 0 to 1 and then back to 0 is verified.
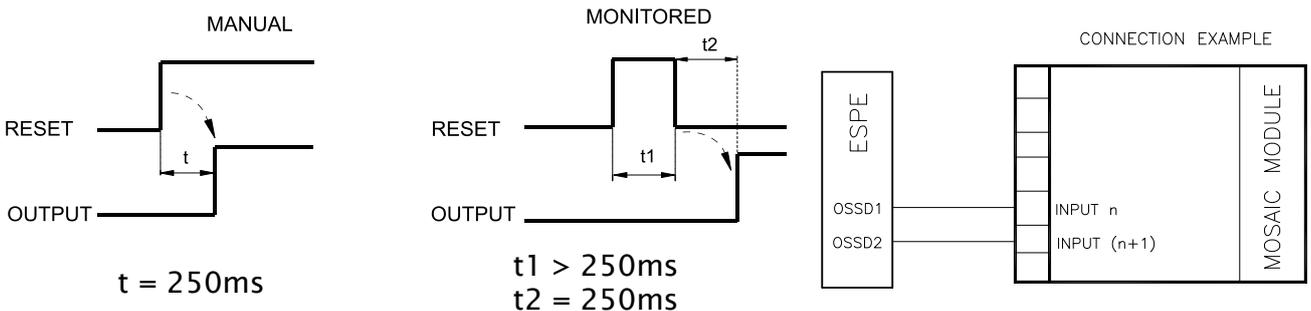
> ➔ WARNING: If the Manual Reset is active, a consecutive Input have to be used. Example : Input 1 and Input 2 are used for the fuctional block, then Input 3 have to be used for the Reset Input.

OUT TEST signals cannot be used in case of safety static output ESPE because the control is carried out from the ESPE.

*Test at start-up*: If selected this enables the test at start-up of the safety light curtain. This test is performed by occupying and clearing the area protected by the safety light curtain to run a complete function test and enable the output. This test is only requested at machine start-up (when the unit is switched on).

*Filter (ms)*: This is used to filter the signals coming from the safety light curtain. The filter can be configured to between 3 and 250 ms and eliminates any bouncing on the contacts. The length of the filter affects the calculation of the unit's total response time.

*Simultaneity (ms)*: always active. Determines that maximum permissible time (msec) between switching of the various signals from the external contacts of the device.

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* This allows a description of the component's function to be entered. The text is displayed in the top part of the symbol.

## FOOTSWITCH (safety pedal)

The FOOTSWITCH function block verifies the status of the inputs of a safety pedal device. If the pedal is not pressed the output is 0 (FALSE). Otherwise the output is 1 (TRUE).

*Parameters*

*Input type*:
- Single NC – Allows connection of pedals with one NC contact
- Single NO – Allows connection of pedals with one NO contact.
- Double NC – Allows connection of pedals with two NC contacts
- Double NC/NO – Allows connection of pedals with one NO contact and one NC.
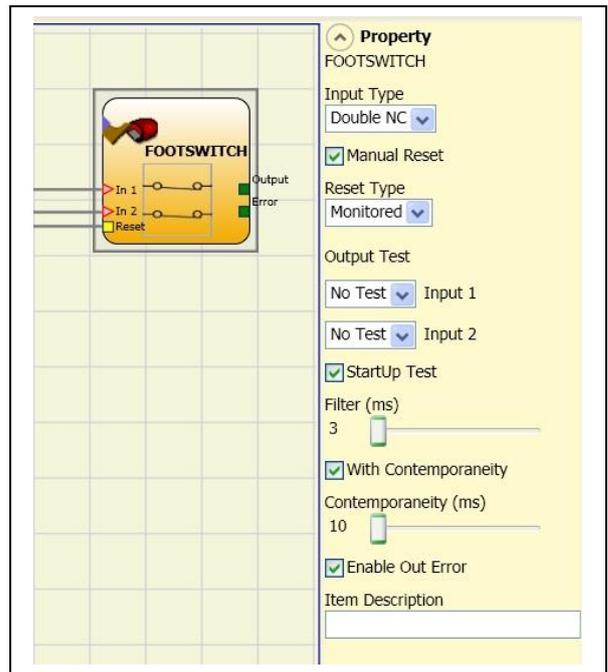


> ➔ With inactive input (block with Output FALSE), connect:
> - Contact NO to terminal corresponding to IN1
> - Contact NC to terminal corresponding to IN2.

*Manual reset:* If selected this enables the request to reset each time the safety pedal is activated. Otherwise, enabling of the output directly follows the input conditions.

There are two types of reset: Manual and Monitored. When Manual is selected the system only verifies the signal's transition from 0 to 1. If Monitored is selected the double transition from 0 to 1 and then back to 0 is verified.



MANUAL

t = 250ms

MONITORED

t1 > 250ms
t2 = 250ms

CONNECTION EXAMPLE (ONE CONTACT)

CONNECTION EXAMPLE (TWO CONTACTS)

→ WARNING: If the Manual Reset is active, a consecutive Input have to be used. Example : Input 1 and Input 2 are used for the fuctional block, then Input 3 have to be used for the Reset Input.

*Output test*: This is used to select which test output signals are to be sent to the component contacts. This additional control permits detection and management of any short-circuits between the lines. To enable this control, the test output signals must be configured (amongst those available).

*Test at start-up*: If selected this enables the test at start-up of the external component. This test is performed by pressing and releasing the footswitch to run a complete function test and enable the output. This test is only requested at machine start-up (when the unit is switched on).

*Filter (ms)*: This is used to filter the signals coming from the external contacts. The filter can be configured to between 3 and 250 ms and eliminates any bouncing on the contacts. The length of the filter affects the calculation of the unit's total response time.

*With Simultaneity:* If selected this activates the test to verify concurrent switching of the signals coming from the external contacts.

*Simultaneity (ms):* This is only active if the previous parameter is enabled. It defines the maximum time (in msecs) between the switching of two different signals from the external contacts.

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* This allows a description of the component's function to be entered. The text is displayed in the top part of the symbol.

English

## MOD–SEL (safety selector)

The MOD-SEL function block verifies the status of the inputs from a mode selector (up to 4 inputs): If only one input is 1 (TRUE) the corresponding output is also 1 (TRUE). In all other cases, and thus when all inputs are 0 (FALSE) or more than one input is 1 (TRUE) all the outputs are 0 (FALSE).

*Parameters*

*Input type*:
- Double selector – Allows connection of two-way mode selectors.
- Triple selector – Allows connection of three-way mode selectors.
- Quadruple selector - Allows connection of four-way mode selectors.

*Filter (ms)*: This is used to filter the signals coming from the mode selector. The filter can be configured to between 3 and 250 ms and eliminates any bouncing on the contacts. The length of the filter affects the calculation of the unit's total response time.

*Simultaneity (ms)*: always active. Determines that maximum permissible time (msec) between switching of the various signals from the external contacts of the device.

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* This allows a description of the component's function to be entered. The text is displayed in the top part of the symbol.
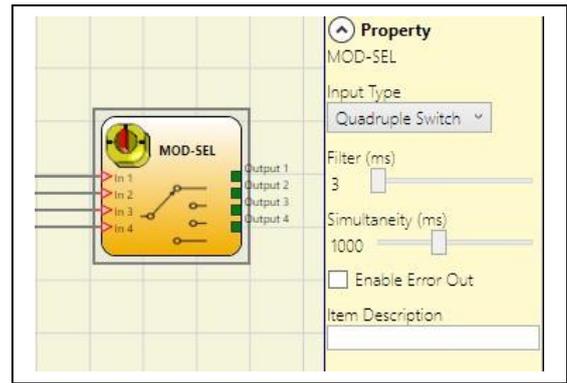
## PHOTOCELL (safety photocell)

The PHOTOCELL function block verifies the status of the inputs of an optoelectronic safety photocell. If the beam of the photocell is occupied (photocell output FALSE) the output is 0 (FALSE). Otherwise with the beam clear and an output of 1 (TRUE) the output is 1 (TRUE).

*Parameters*

*Manual reset:* If selected this enables the request to reset each time safety photocell is activated. Otherwise, enabling of the output directly follows the input conditions.
There are two types of reset: Manual and Monitored. When Manual is selected the system only verifies the signal's transition from 0 to 1. If Monitored is selected the double transition from 0 to 1 and then back to 0 is verified.

MANUAL t = 250ms
MONITORED t1 > 250ms t2 = 250ms
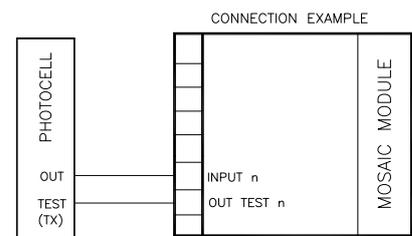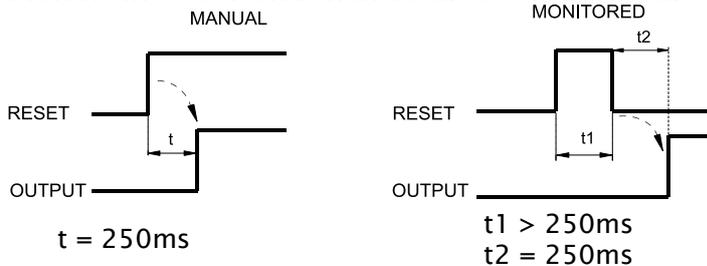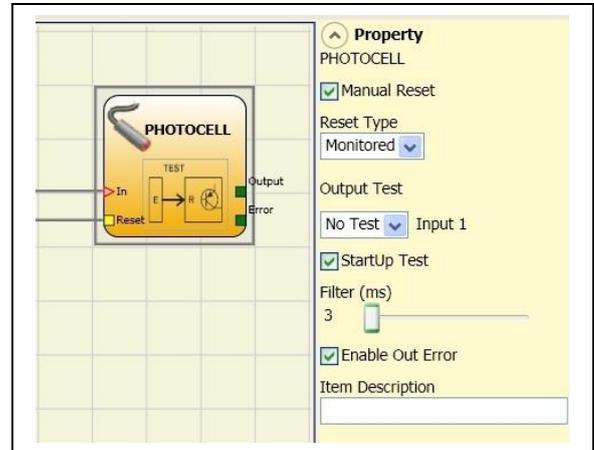
➔ An output test signal is mandatory and can be selected from the 4 possible Test Output 1 ÷ 4.

➔ If the Manual Reset is active, a consecutive Input have to be used. Example: Input 1 is used for the functional block, then Input 2 have to be used for the Reset Input.

> ➔ The response time of the photocell must be >2ms and <20ms.

*Output test*: This is used to select which test output are to be sent to the photocell test input. This additional control permits detection and management of any short-circuits between the lines. To enable this control, the test output signals must be configured (amongst those available).

*Test at start-up*: If selected this enables the test at start-up of the external component. This test is performed by occupying and clearing the photocell to run a complete function test and enable the output. This test is only requested at machine start-up (when the unit is switched on).

*Filter (ms)*: This is used to filter the signals coming from the external contacts. The filter can be configured to between 3 and 250 ms and eliminates any bouncing on the contacts. The length of the filter affects the calculation of the unit's total response time.

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* This allows a description of the component's function to be entered. The text is displayed in the top part of the symbol.

## TWO–HAND (bimanual control)

The TWO HAND function block verifies the status of the inputs of a two hand control switch. Only if both the press-buttons are pressed within 500 msec the output is 1 (TRUE). Otherwise the output is 0 (FALSE).

*Input type*:
- Double NO – Allows connection of two-hand switch with one NO contact for each button (EN 574 III A).
- Quadruple NC-NO - Allows connection of two-hand switch with a double NO/NC contact for each button (EN 574 III C).
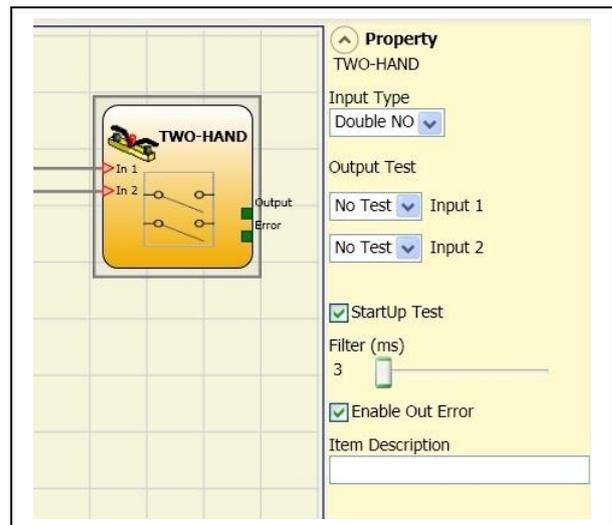


> ➔ With inactive input (block with Output FALSE), connect:
> - Contact NO to terminal corresponding to IN1
> - Contact NC to terminal corresponding to IN2.

*Output test*: This is used to select which test output signals are to be sent to the component contacts. This additional control permits detection and management of any short-circuits between the lines. To enable this control, the test output signals must be configured (amongst those available).

*Test at start-up*: If selected this enables the test at start-up of the external component. This test is performed by pressing the two buttons (within 500 msec) and releasing them to run a complete function test and enable the output. This test is only requested at machine start-up (when the unit is switched on).

*Filter (ms)*: This is used to filter the signals coming from the mode selector. The filter can be configured to between 3 and 250 ms and eliminates any bouncing on the contacts. The length of the filter affects the calculation of the unit's total response time.

*English*

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description*: This allows a description of the component's function to be entered. The text is displayed in the top part of the symbol.
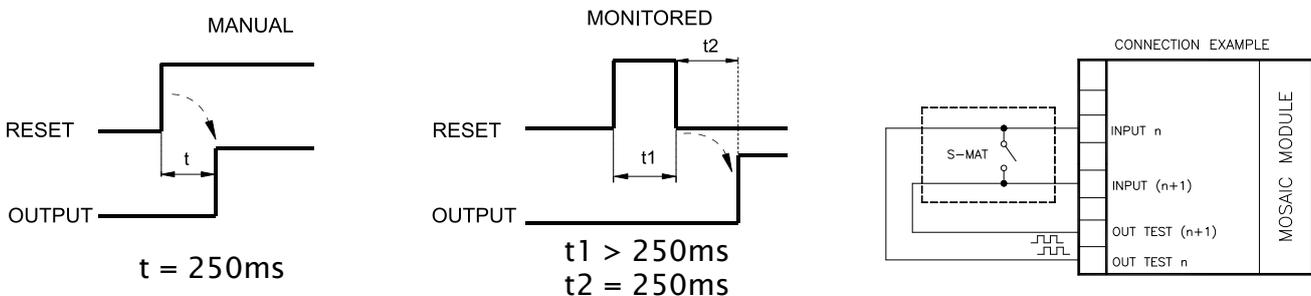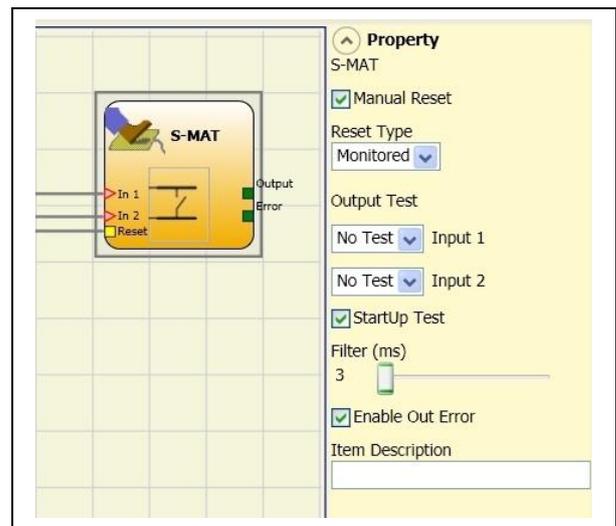
## NETWORK_IN

This functional block implements a Network connection input interface; it generates an LL1 in the OUT output when the line is high, otherwise an LL0.
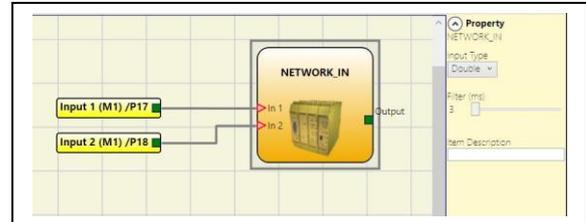


*Parameters*

*Type of input:*
- Single - enables the connection of Signaling outputs of an additional M1 unit.
- Double - enables the connection of OSSD outputs of an additional M1 unit.

*Filter (ms):* Enables the filtering of signals from an additional M1 unit.
This filter can be set to between 3 and 250 ms. The length of the filter affects the calculation of the unit's total response time.

➔ This input can only be allocated on M1.

➔ This input must be used when Mosaic OSSD outputs are connected to the inputs of a second downstream Mosaic or together with the NETWORK operator.

## SENSOR

The SENSOR function block verifies the status of the input of a sensor (not a safety sensor). If the beam of the sensor is occupied (sensor output FALSE) the output is 0 (FALSE). Otherwise, with the beam clear and an output of 1 (TRUE) then the output is 1 (TRUE).
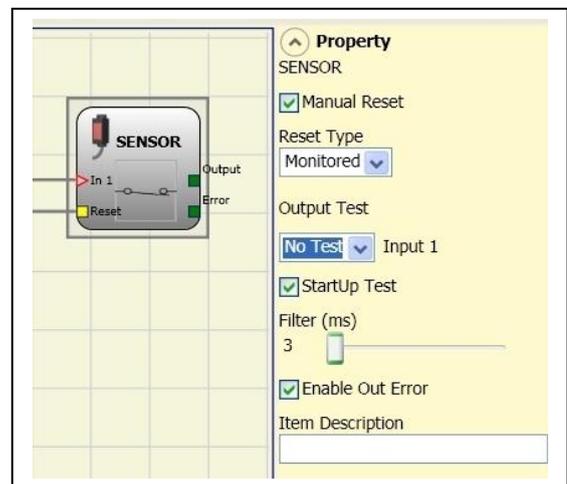


*Parameters*

*Manual reset:* If selected this enables the request to reset each time the area protected by the sensor is occupied. Otherwise, enabling of the output directly follows the input conditions.
There are two types of reset: Manual and Monitored. When Manual is selected the system only verifies the signal's transition from 0 to 1. If Monitored is selected the double transition from 0 to 1 and then back to 0 is verified.



MANUAL

t = 250ms

MONITORED

t1 > 250ms
t2 = 250ms
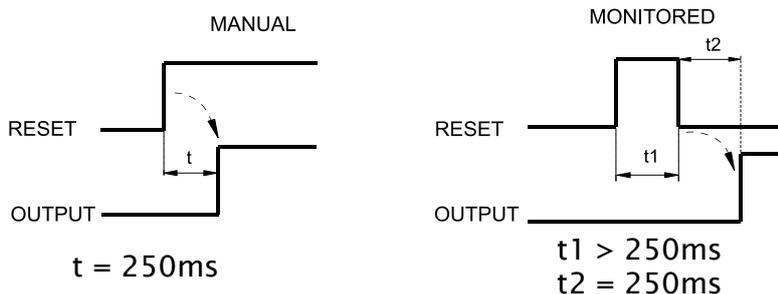
*english*

> ➔ WARNING: If the Manual Reset is active, a consecutive Input have to be used. Example : Input 1 is used for the fuctional block, then Input 2 have to be used for the Reset Input.

*Output test*: This is used to select which test output signals are to be sent to the sensor. This additional control permits detection and management of any short-circuits between the lines. To enable this control, the test output signals must be configured (amongst those available).

*Test at start-up*: If selected this enables the test at start-up of the sensor. This test is performed by occupying and clearing the area protected by the sensor to run a complete function test and enable the output. This test is only requested at machine start-up (when the unit is switched on).

*Filter (ms)*: This is used to filter the signals coming from the sensor. The filter can be configured to between 3 and 250 ms and eliminates any bouncing on the contacts. The length of the filter affects the calculation of the unit's total response time.

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* This allows a description of the component's function to be entered. The text is displayed in the top part of the symbol.
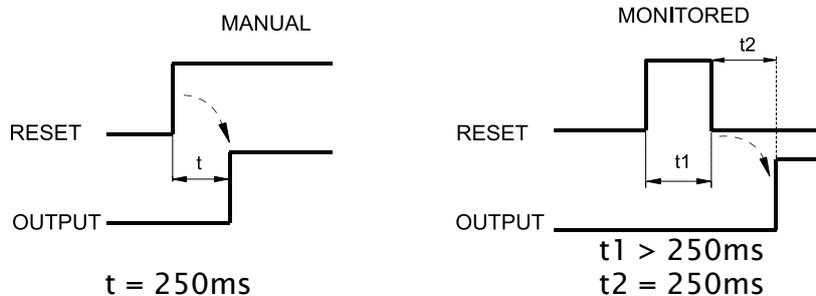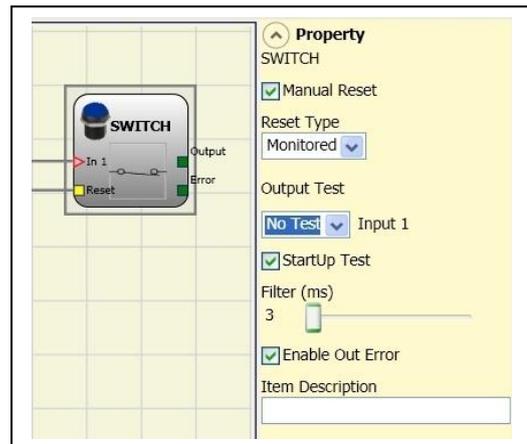
### S-MAT (safety mat)

The S-MAT function block verifies the status of the inputs of a safety mat. If a person stands on the mat the output is 0 (FALSE). Otherwise, with the mat clear, the output is 1 (TRUE).

*Parameters*

*Manual reset:* If selected this enables the request to reset each time the mobile guard/safety gate is activated. Otherwise, enabling of the output directly follows the input conditions.
There are two types of reset: Manual and Monitored. When Manual is selected the system only verifies the signal's transition from 0 to 1. If Monitored is selected the double transition from 0 to 1 and then back to 0 is verified.





MANUAL

t = 250ms

MONITORED

t1 > 250ms
t2 = 250ms

CONNECTION EXAMPLE

> ➔ If the Manual Reset is active, a consecutive Input have to be used. Example: Input 1 and Input 2 are used for the fuctional block, then Input 3 have to be used for the Reset Input.

**English**

➔ Two output test signals are mandatory. Each output OUT TEST can be connected to only one input S-MAT (it is not allowed parallel connection of 2 inputs).

➔ The function block S-MAT can not be used with 2-wire components and termination resistance.

*Output test*: This is used to select which test output signals are to be sent to the s-mat contact. This additional control permits detection and management of any short-circuits between the lines. To enable this control, the test output signals must be configured (amongst those available). Test signals are mandatory.

*Test at start-up*: If selected this enables the test at start-up of the external component. This test is performed by pressing and releasing the safety mat to run a complete function test and enable the output. This test is only requested at machine start-up (when the unit is switched on).

*Filter (ms)*: This is used to filter the signals coming from the external contacts. The filter can be configured to between 3 and 250 ms and eliminates any bouncing on the contacts. The length of the filter affects the calculation of the unit's total response time.

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* This allows a description of the component's function to be entered. The text is displayed in the top part of the symbol.

## SWITCH

SWITCH function block verifies the input status of a pushbutton or switch (NOT SAFETY SWITCHES). If the pushbutton is pressed the output is 1 (TRUE). Otherwise, the output is 0 (FALSE).

*Parameters*

*Manual reset:* If selected this enables the request to reset each time the device is activated. Otherwise, enabling of the output directly follows the input conditions.

There are two types of reset: Manual and Monitored. When Manual is selected the system only verifies the signal's transition from 0 to 1.

If Monitored is selected the double transition from 0 to 1 and then back to 0 is verified.

MANUAL

t = 250ms

MONITORED

t1 > 250ms
t2 = 250ms

➔ WARNING: If the Manual Reset is active, a consecutive Input have to be used. Example : Input 1 is used for the fuctional block, then Input 2 have to be used for the Reset Input.

*english*

*Output test*: This is used to select which test output signals are to be sent to the switch.
This additional control permits detection and management of any short-circuits between the lines. To enable this control, the test output signals must be configured (amongst those available).

*Test at start-up*: If selected this enables the test at start-up of the switch. This test is performed by opening and closing the switch contact to run a complete function test and enable the output. This test is only requested at machine start-up (when the unit is switched on).

*Filter (ms)*: This is used to filter the signals coming from the switch. The filter can be configured to between 3 and 250ms and eliminates any bouncing on the contacts. The length of the filter affects the calculation of the unit's total response time.

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* This allows a description of the component's function to be entered. The text is displayed in the top part of the symbol.

## ENABLING GRIP SWITCH

The ENABLING GRIP functional block checks the status of the $In_x$ inputs of an enabling grip. If this is not gripped (position 1) or is gripped completely (position 3), the OUTPUT will be 0 (FALSE). If it is gripped to middle position (position 2), the OUTPUT will be 1 (TRUE).
Refer to truth tables at the bottom of the page.
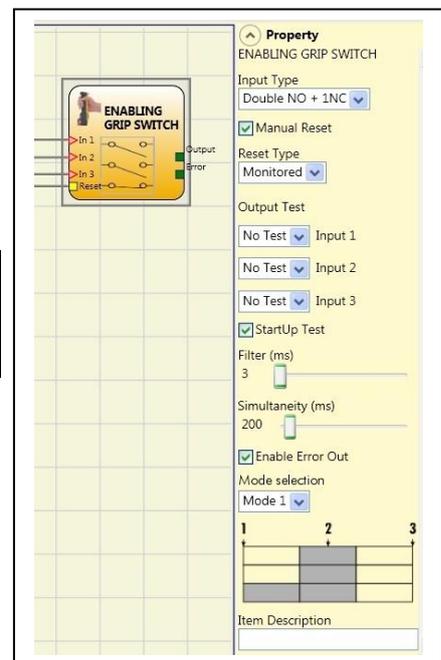


➜  The ENABLING GRIP functional block requires that the assigned module has a minimum Firmware version as Table below:

| M1 | MI8O2 | MI8 | MI16 | MI12 |
|-----|-------|------|-------|-------|
| 1.0 | 0.4 | 0.4 | 0.4 | 0.0 |

*Parameters*

*Type of inputs*:
- Double NO – Permits connection of an enabling grip with 2 NO contacts.
- Double NO+1NC – Permits connection of an enabling grip switch with 2 NO contacts + 1 NC contact.

*Test outputs*: Permits selection of the test output signals to be sent to the enabling grip.
This additional control permits detection and management of any short-circuits between the lines. To enable this control, the test output signals must be configured (amongst those available).

*Power-on test*: If selected, enables the power-on test of the external component (Enabling Grip). To run the test, the device must be gripped and released to carry out a complete functional check and enable the Output terminal. This control is required only at machine start-up (power-on of the module).

*Simultaneity (ms)*: always active. Determines that maximum permissible time (msec) between switching of the various signals from the external contacts of the device.

*Filter (ms)*: Permits filtering of signals from the device control. This filter can be set to between 3 and 250 ms and eliminates any rebounds on the contacts. The duration of the filter affects calculation of module total response time.

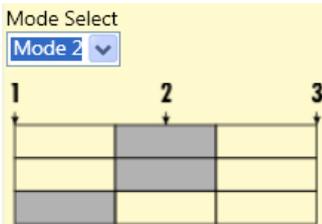**English**

## Table mode 1 (device 2NO + 1NC)
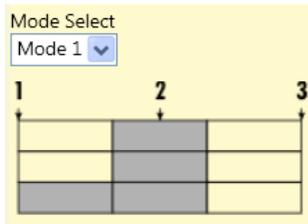
POSITION 1: enabling grip fully released
POSITION 2: enabling grip pressed to middle position
POSITION 3: enabling grip fully pressed

(only with 2NO+1NC)

| Input | Position | | |
|-------|---|---|---|
|       | 1 | 2 | 3 |
| IN1   | 0 | 1 | 0 |
| IN2   | 0 | 1 | 0 |
| IN3   | 1 | 1 | 0 |
| OUT   | 0 | 1 | 0 |

## Table mode 1 (device 2NO + 1NC)

POSITION 1: enabling grip fully released
POSITION 2: enabling grip pressed to middle position
POSITION 3: enabling grip fully pressed

(only with 1NO+1NC)

| Input | Position | | |
|-------|---|-------|---|
|       | 1 | Input | 1 |
| IN1   | 0 | 1 | 0 |
| IN2   | 0 | 1 | 0 |
| IN3   | 1 | 0 | 0 |
| OUT   | 0 | 1 | 0 |

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* Permits insertion of a descriptive text of the function of the component. This text will be displayed in the top part of the symbol.

## TESTABLE SAFETY DEVICE

The TESTABLE SAFETY DEVICE functional block checks the status of the Inx inputs of a single or double safety sensor, both NO and NC. Refer to the tables below to check type of sensor and behaviour.
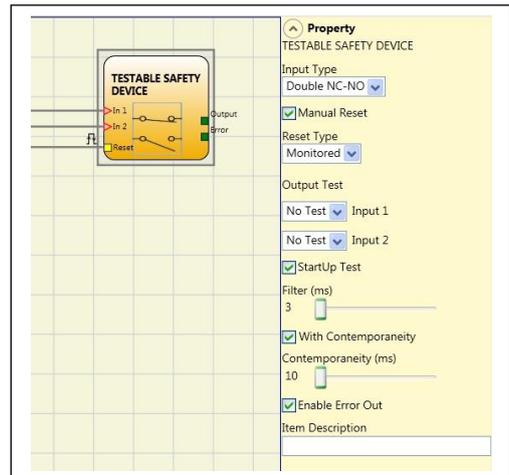
### (single NC)          (single NO)
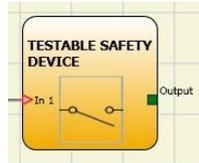
| IN1 | OUT |
|-----|-----|
| 0 | 0 |
| 1 | 1 |

| IN1 | OUT |
|-----|-----|
| 0 | 0 |
| 1 | 1 |

### (double NC)
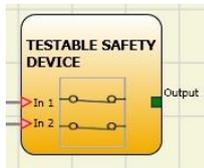
| IN1 | IN2 | OUT | Simultaneity error * |
|-----|-----|-----|----------------------|
| 0 | 0 | **0** | – |
| 0 | 1 | **0** | X |
| 1 | 0 | **0** | X |
| 1 | 1 | **1** | – |

### (double NC-NO)
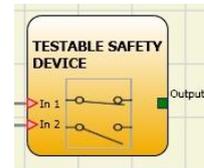
| IN1 | IN2 | OUT | Simultaneity error * |
|-----|-----|-----|----------------------|
| 0 | 0 | **0** | X |
| 0 | 1 | **0** | - |
| 1 | 0 | **1** | - |
| 1 | 1 | **0** | X |

***Simultaneity error** = the maximum time between switching of the single contacts has been exceeded.*

### Parameters

*Manual Reset:* If selected, enables the reset request after each activation of the device. Otherwise, enabling of the output follows directly the conditions of the inputs. Reset may be of two types: Manual and Monitored. Selecting the Manual option, only transition of the signal from 0 to 1 is checked. If Monitored is selected, double transition from 0 to 1 and return to 0 is checked.

MANUAL

t = 250ms

MONITORED

t1 > 250ms
t2 = 250ms

➡ WARNING: if Reset is enabled, the input consecutive to those used by the functional block must be used. For example: If inputs 1 and 2 are used for the functional block, input 3 must be used for Reset.

REER | MODULAR SAFETY INTEGRATED CONTROLLER MOSAIC
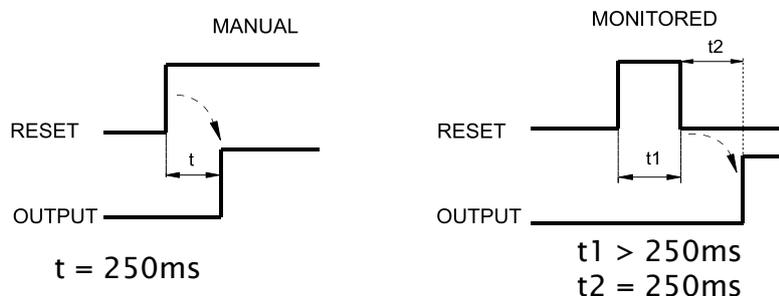
*Power-on test*: If selected, enables the power-on test of the device. This test requires activation and de-activation of the device in order to run a complete functional check and enable the Output terminal. This test is required only at machine start-up (power-on of the module).

*Filter (ms):* Permits filtering of signals from the device. This filter can be set to between 3 and 250 ms and eliminates any rebounds on the contacts. The duration of the filter affects calculation of module total response time.

*With simultaneity:* If selected, activates control of simultaneity between switching of signals from the device.

*Simultaneity (ms)*: Is active only if the previous parameter is enabled. Determines the maximum permissible time (msec) between switching of two different signals from the sensor.

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* Permits insertion of a descriptive text of the function of the component. This text will be displayed in the top part of the symbol.

## SOLID STATE DEVICE

The SOLID STATE DEVICE functional block checks the status of the Inx inputs. If the inputs are at 24VDC, the Output will be 1 (TRUE), otherwise the OUTPUT will be 0 (FALSE).

*Parameters*

*Manual Reset:* If selected, enables the reset request after each safety function activaction. Otherwise, enabling of the output follows directly the conditions of the inputs. Reset may be of two types: Manual and Monitored. Selecting the Manual option, only transition of the signal from 0 to 1 is checked. If Monitored is selected, double transition from 0 to 1 and return to 0 is checked.



MANUAL

RESET

OUTPUT

t = 250ms

MONITORED

t2

RESET

OUTPUT

t1 > 250ms
t2 = 250ms
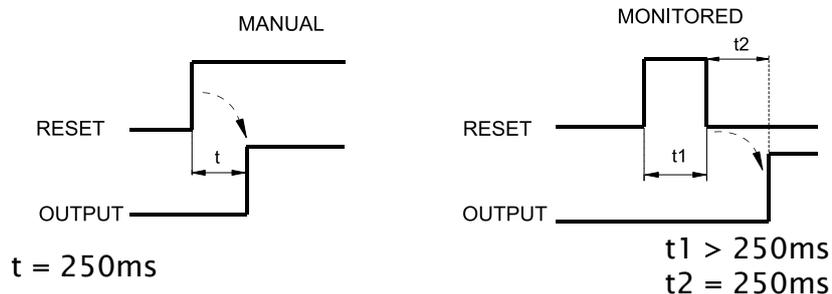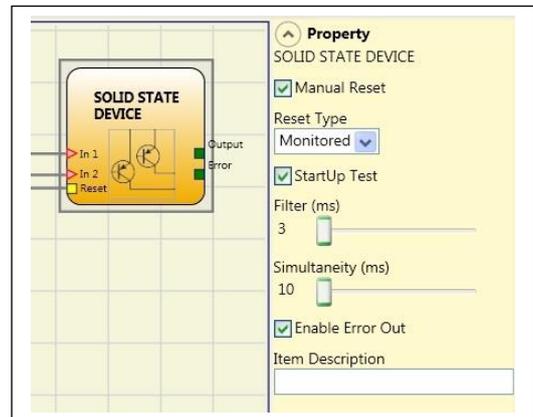
⚡ WARNING: if Reset is enabled, the input consecutive to those used by the functional block must be used. For example: if inputs 1 and 2 are used for the functional block, input 3 must be used for Reset.

*Power-on test:* If selected, enables the power-on test of the safety device. This test requires activation and de-activation of the device in order to run a complete functional check and enable the Output terminal. This test is required only at machine start-up (power-on of the module)

English

96                                          8540780 · 30/03/2016 · Rev.26

*Filter (ms):* Permits filtering of signals from the safety device. This filter can be set to between 3 and 250 ms and eliminates any rebounds on the contacts. The duration of the filter affects calculation of module total response time.

*Simultaneity (ms)*: always active. Determines that maximum permissible time (msec) between switching of the various signals from the external contacts of the device.

*Enable Error Out:* If selected reports a fault detected by the function block.

*Item description:* Permits insertion of a descriptive text of the function of the component. This text will be displayed in the top part of the symbol.

## FIELDBUS INPUT

Element that permits insertion of a non-safety input whose status is modified via the fieldbus.
Up to 8 virtual inputs can be inserted and the bit on which status is to be modified must be selected for each.
They are represented with one byte on the fieldbus.
*(For more detailed information, consult the fieldbus manual on the MSD CD-ROM).*
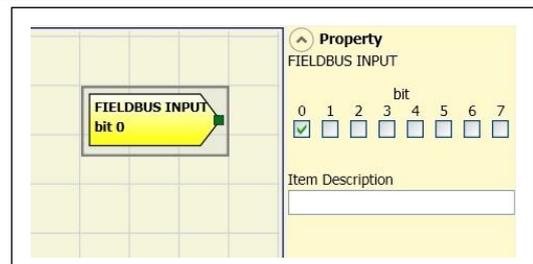
WARNING: the FIELDBUS INPUT is NOT a safety input.

## LL0-LL1

These allow a predefined logical level to be entered on a component's input.

**LL0** -> logical level 0
**LL1** -> logical level 1
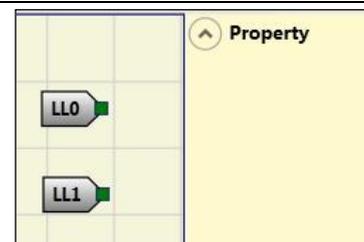
IMPORTANT: LL0 and LL1 cannot be used to disable the logical ports in the diagram.

## COMMENTS

This allows a description to be entered and placed in any point of the diagram.
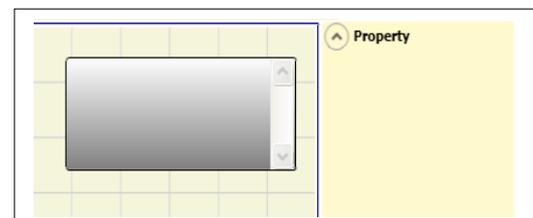
## TITLE

Automatically adds the name of the manufacturer, the designer, the project name and the CRC.
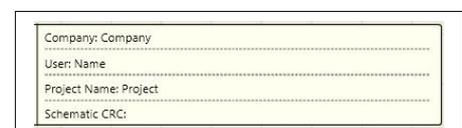
# SPEED CONTROL TYPE FUNCTION BLOCKS

## Warning concerning safety

---

⚡ An external error or malfunction deriving from encoder/proximity or its wiring, does not necessarily involve a change of safety status of the normal output **(i.e. "Zero")** of the function block. Failures or malfunctions of encoder/proximity switch or its wiring are then recognized by the module, managed and specified via the diagnostic bit on every function block **("Enable Error Out").**

⚡ To ensure the safety features the diagnostic bit has to be used in the configuration program created by the user to cause a possible deactivation of the outputs if the axis is working. In absence of encoder/proximity external anomalies, **Error** bit will be equal to 0 (zero).

⚡ In presence of encoder/proximity external anomalies, error_out bit will be equal to 1 (one):
- Absence of encoder or proximity.
- Absence of one or more wiring from encoder/proximity.
- Absence of encoder power supply (only model with TTL external power supply).
- Error of congruence frequencies between signals from encoder/proximity.
- Phase error between signals from the encoder or duty cycle error of a single phase.

---
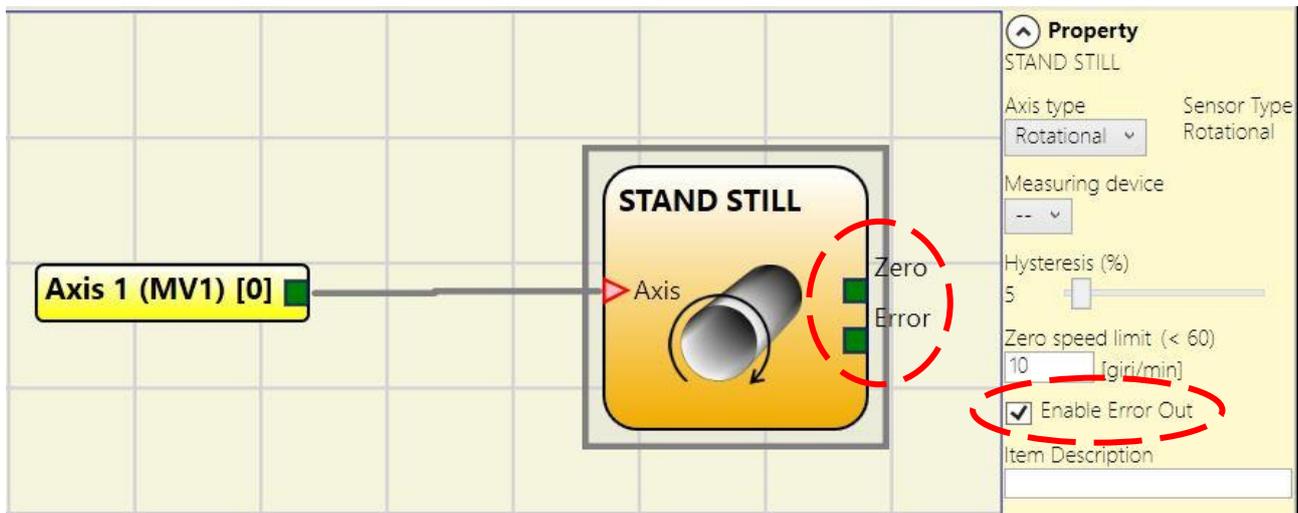


*Figure 54 – Example of speed control functional block with Error Out enabled*

## SPEED CONTROL

The **Speed Control** function block monitors the speed of a device generating an output 0 (FALSE) when the measured speed exceeds a predetermined threshold. In the case in which the speed is below the predetermined threshold the output will be 1 (TRUE).

*Parameters*

***Axis type:*** It defines the type of axis controlled by the device. It will be Linear in the case of a translation and will be Rotary in the case of motion around an axis.

***Sensor Type:*** In the event that the previous parameter is Linear, the Sensor Type defines the type of sensor connected to the module inputs. It can be Rotary (e.g. shaft encoder) or Linear (e.g. optical array). This choice allows to define the following parameters.

***Measuring device:*** It defines the type of sensor(s) used. The possible choices are:
- Encoder
- Proximity
- Encoder+Proximity
- Proximity1+ Proximity2
- Encoder1+ Encoder2

***Enable direction:*** Enabling this parameter, the DIR output is enabled on the function block. This output will be 1 (TRUE) when the axis rotates Counterclockwise and will be 0 (FALSE) when the axis rotates Clockwise

***Direction decision:*** It 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. Selecting Clockwise or Counterclockwise, this is detected only when the axis rotates in the selected direction.

***Threshold number:*** It allows you to enter the number of thresholds for the maximum value of speed. Changing this value will increase/decrease the number of thresholds that can be entered from a minimum of 1 to a maximum of 4. In the case of thresholds greater than 1, the input pins for the selection of the specific threshold will appear in the lower part of the function block.

***Pitch:*** If the Axis Type chosen was linear, this field allows you to enter the sensor pitch to obtain a conversion between sensor revolutions and distance travelled.

Example of CLOCKWISE axis rotation

2 threshold settings

| In1 | Threshold no. |
|-----|---------------|
| 0   | Speed 1       |
| 1   | Speed 2       |

4 threshold settings

| In2 | In1 | Threshold no. |
|-----|-----|---------------|
| 0   | 0   | Speed 1       |
| 0   | 1   | Speed 2       |
| 1   | 0   | Speed 3       |
| 1   | 1   | Speed 4       |

***Proximity choice:*** It allows you to choose the type of proximity sensor from PNP, NPN, Normally Open (NA) and Normally Closed (NC), with 3 or 4 wires.

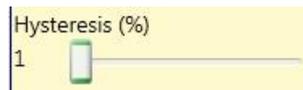*(In order to ensure a Performance Level = PLe use a proximity switch type PNP NO: ref. "Interleaved proximity -> page 26).*

| 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 |

***Measurement:*** 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:*** 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 will be 1 otherwise the number corresponding to the report must be entered. E.g. there are 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) will be 0 (FALSE). If the measured speed is less than the set value, the function block output (OVER) will be 1 (TRUE).

***Frequency:*** 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.

1. Rotary axis, rotary sensor. The frequency obtained is:

$$f[Hz] = \frac{rpm[rev/min]}{60} * Resolution[pulses/rev]$$

2. Linear axis, rotary sensor. The frequency obtained is:

$$f[Hz] = \frac{speed[m/min] * 1000}{60 * pitch[mm/rev]} * Re\,solution[pulses/rev]$$

3. Linear axis, linear sensor. The frequency obtained is:

$$f[Hz] = \frac{speed[mm/s] * 1000}{Resolution[\mu m/pulse]}$$

**KEY:**

*f = frequency*
*Rpm = rotational speed*
*Resolution = measurement*
*Speed = linear speed*
*Pitch = sensor pitch*

4. Hysteresis. To be changed only if: fM=green; fm=red

**English**

## WINDOW SPEED CONTROL

The **Window Speed Control** function block monitors the speed of a device, generating the Zero to 1 (TRUE) output when the speed is within a prefixed range.

*Parameters*

*Axis type:* It defines the type of axis controlled by the device. It will be Linear in the case of a translation and will be Rotary in the case of motion around an axis.

*Sensor Type:* In the event that the previous parameter is Linear, the Sensor Type defines the type of sensor connected to the module inputs. It can be Rotary (e.g. shaft encoder) or Linear (e.g. optical array). This choice allows to define the following parameters.

*Measuring device:* It defines the type of sensor(s) used. The possible choices are:
- Encoder
- Proximity
- Encoder+Proximity
- Proximity1+ Proximity2
- Encoder1+ Encoder2

*Pitch:* If the Axis Type chosen was linear, this field allows you to enter the sensor pitch to obtain a conversion between sensor revolutions and distance travelled.

*Proximity choice:* It allows you to choose the type of proximity sensor from PNP, NPN, Normally Open (NA) and Normally Closed (NC), with 3 or 4 wires.

*(In order to ensure a Performance Level = PLe use a proximity switch type PNP NO: ref. "Interleaved proximity -> page 26).*

Proximity choice

*Measurement:* 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:* 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.

*English*

*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 will be 1 otherwise the number corresponding to the report must be entered. E.g. there are 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 output of the function block (WINDOW) will be 0 (FALSE). If the measured speed is less than the set value, the output (WINDOW) of the function block will be 1 (TRUE).

*Low speed:*
Enter in this field the minimum speed value below which the output of the function block (WINDOW) will be 0 (FALSE). If the measured speed is more than the set value, the output (WINDOW) of the function block will be 1 (TRUE).

*Frequency:* 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.

1. Rotary axis, rotary sensor. The frequency obtained is:

$$f[Hz] = \frac{rpm[rev/min]}{60} * Resolution[pulses/rev]$$

2. Linear axis, rotary sensor. The frequency obtained is:

$$f[Hz] = \frac{speed[m/min] * 1000}{60 * pitch[mm/rev]} * Re\,solution[pulses/rev]$$

3. Linear axis, linear sensor. The frequency obtained is:

$$f[Hz] = \frac{speed[mm/s] * 1000}{Resolution[\mu m/pulse]}$$

4. Hysteresis. To be changed only if: fM=green; fm=red

**KEY:**

*f = frequency*
*Rpm = rotational speed*
*Resolution = measurement*
*Speed = linear speed*
*Pitch = sensor pitch*

## STAND STILL

The **StandStill** function block monitors the speed of a device, generating the Zero to 1 (TRUE) output when the speed is lower than a selected value.

### Parameters

**Axis type:** It defines the type of axis controlled by the device. It will be Linear in the case of a translation and will be Rotary in the case of motion around an axis.

**Sensor Type:** In the event that the previous parameter is Linear, the Sensor Type defines the type of sensor connected to the module inputs. It can be Rotary (e.g. shaft encoder) or Linear (e.g. optical array). This choice allows to define the following parameters.

**Measuring device:** It defines the type of sensor(s) used. The possible choices are:
- Encoder
- Proximity
- Encoder+Proximity
- Proximity1+ Proximity2
- Encoder1+ Encoder2

**Pitch:** If the Axis Type chosen was linear, this field allows you to enter the sensor pitch to obtain a conversion between sensor revolutions and distance travelled.

**Proximity choice:** It allows you to choose the type of proximity sensor from PNP, NPN, Normally Open (NA) and Normally Closed (NC), with 3 or 4 wires.

*(In order to ensure a Performance Level = PLe use a proximity switch type PNP NO: ref. "Interleaved proximity -> page 25).*

Proximity choice

**Measurement:** 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
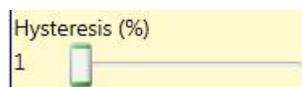
**Verification:** Enter in this field the number of pulses/revolution (in the case of rotary sensor) or µm/pulse (linear sensor) relating to the second sensor used.

**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 will be 1 otherwise the number corresponding to the report must be entered. E.g. there are 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) will be 0 (FALSE). If the measured speed is less than the set value, the output (ZERO) of the function block will be 1 (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.

1. Rotary axis, rotary sensor. The frequency obtained is:

$$f[Hz] = \frac{rpm[rev/min]}{60} * Resolution[pulses/rev]$$

2. Linear axis, rotary sensor. The frequency obtained is:

$$f[Hz] = \frac{speed[m/min]*1000}{60*pitch[mm/rev]} * Resolution[pulses/rev]$$

3. Linear axis, linear sensor. The frequency obtained is:

$$f[Hz] = \frac{speed[mm/s]*1000}{Resolution[\mu m/pulse]}$$

4. Hysteresis. To be changed only if: fM=green; fm=red

**KEY:**

*f = frequency*
*Rpm = rotational speed*
*Resolution = measurement*
*Speed = linear speed*
*Pitch = sensor pitch*

## STAND STILL AND SPEED CONTROL

The **StandStill and Speed Control** function block monitors the speed of a device, generating the Zero to 1 (TRUE) output when the speed is lower than a selected value. In addition, it generates the Over = 0 (FALSE) output if the measured speed exceeds a predetermined threshold.

### Parameters

*Axis type:* It defines the type of axis controlled by the device. It will be Linear in the case of a translation and will be Rotary in the case of motion around an axis.

*Sensor Type:* In the event that the previous parameter is Linear, the Sensor Type defines the type of sensor connected to the module inputs. It can be Rotary (e.g. shaft encoder) or Linear (e.g. optical array). This choice allows to define the following parameters.

*Measuring device:* It defines the type of sensor(s) used. The possible choices are:
- Encoder
- Proximity
- Encoder+Proximity
- Proximity1+ Proximity2
- Encoder1+ Encoder2

*Enable direction:* Enabling this parameter, the DIR output is enabled on the function block. This output will be 1 (TRUE) when the axis rotates Counterclockwise and will be 0 (FALSE) when the axis rotates Clockwise.

*Direction decision:* It 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. Selecting Clockwise or Counterclockwise, this is detected only when the axis rotates in the selected direction.

*Threshold number:* It allows you to enter the number of thresholds for the maximum value of speed. Changing this value will increase/decrease the number of thresholds that can be entered from a minimum of 1 to a maximum of 4. In the case of thresholds greater than 1, the input pins for the selection of the specific threshold will appear in the lower part of the function block.

*Pitch:* If the Axis Type chosen was linear, this field allows you to enter the sensor pitch to obtain a conversion between sensor revolutions and distance travelled.

Example of CLOCKWISE axis rotation

2 threshold settings

| In1 | Threshold no. |
|-----|---------------|
| 0 | Speed 1 |
| 1 | Speed 2 |

4 threshold settings

| In2 | In1 | Threshold no. |
|-----|-----|---------------|
| 0 | 0 | Speed 1 |
| 0 | 1 | Speed 2 |
| 1 | 0 | Speed 3 |
| 1 | 1 | Speed 4 |

**English**

*Proximity choice:* It allows you to choose the type of proximity sensor from PNP, NPN, Normally Open (NA) and Normally Closed (NC), with 3 or 4 wires.

*(In order to ensure a Performance Level = PLe use a proximity switch type PNP NO: ref. "Interleaved proximity -> page 26).*

```
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
```
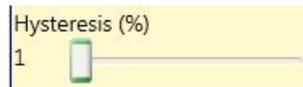
Proximity choice:

*Measurement:* 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:* 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 will be 1 otherwise the number corresponding to the report must be entered. E.g. there are 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.

```
Hysteresis (%)
1  [====]
```

*Zero speed limit:*
Enter in this field the maximum speed value above which the output of the function block (ZERO) will be 0 (FALSE). If the measured speed is less than the set value, the output (ZERO) of the function block will be 1 (TRUE).

*Speed 1, 2, 3, 4:* Enter in this field the maximum speed value above which the function block output (OVER) will be 0 (FALSE). If the measured speed is less than the set value, the function block output (OVER) will be 1 (TRUE).

*Frequency zero speed/Frequency1/ Frequency2:* 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.

**KEY:**

*f = frequency*
*Rpm = rotational speed*
*Resolution = measurement*
*Speed = linear speed*
*Pitch = sensor pitch*

1. Rotary axis, rotary sensor. The frequency obtained is:

$$f[Hz] = \frac{rpm[rev/min]}{60} * Resolution[pulses/rev]$$

2. Linear axis, rotary sensor. The frequency obtained is:

$$f[Hz] = \frac{speed[m/min] *1000}{60 * pitch[mm/rev]} * Re\,solution[pulses/rev]$$

3. Linear axis, linear sensor. The frequency obtained is:

$$f[Hz] = \frac{speed[mm/s]*1000}{Resolution[\mu m/pulse]}$$

4. Hysteresis. To be changed only if: fM=green; fm=red

English

# OPERATOR FUNCTION BLOCKS

All the input of these operators could be inverted (logical NOT). It could be done clicking with the right mouse key on the input to be inverted. A little circle will be showed on the inverted input. To cancel the inversion, simply click another time on the same input pin.
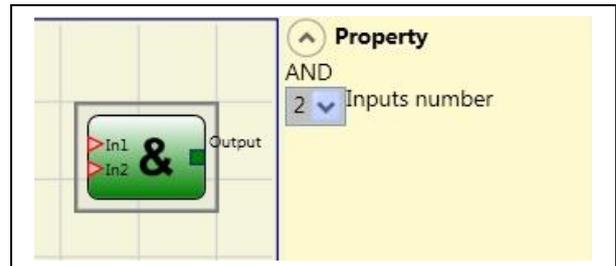
➜ The maximum number of user blocks is 64.

## LOGICAL OPERATORS

### AND

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 |



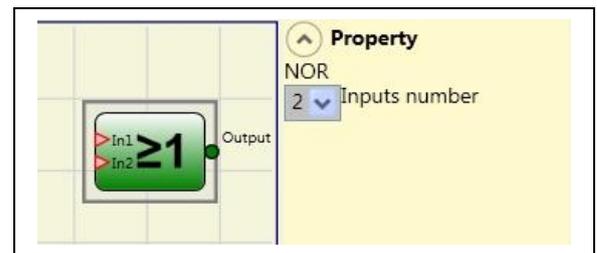*Parameters*

*Number of inputs*: this is used to set between 2 and 8 inputs.

### NAND

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 |
| 1 | 1 | 1 | 0 |
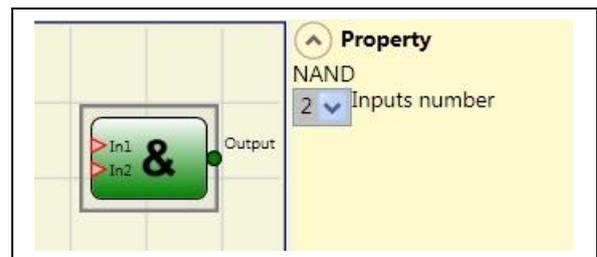


*Parameters*

*Number of inputs*: this is used to set between 2 and 8 inputs.

## NOT

Logical NOT inverts the logical status of the input.

| In | Out |
|----|-----|
| 0  | 1   |
| 1  | 0   |
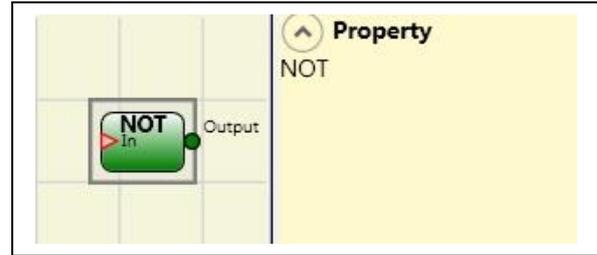
## OR

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 |
| 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 |
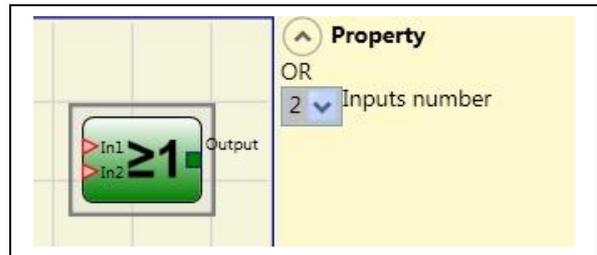
*Parameters*

*Number of inputs*: this is used to set between 2 and 8 inputs.

## NOR

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 |

*Parameters*

*Number of inputs*: this is used to set between 2 and 8 inputs.

## XOR

Logical XOR returns an output 0 (FALSE) if the input's number at 1 (TRUE) is even or the inputs are all 0 (FALSE).

| In$_1$ | In$_2$ | Inx | 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 |

*Parameters*

*Number of inputs*: this is used to set between 2 and 8 inputs.

## XNOR

Logical XNOR returns an output 1 (TRUE) if the input's number 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 |

*Parameters*

*Number of inputs*: this is used to set between 2 and 8 inputs.

*English*
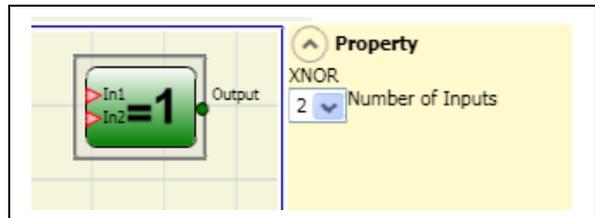
## LOGICAL MACRO

This operator enables the grouping together of two or three logic gates.
A maximum of 8 inputs is foreseen.
The result of the first two operators converges into a third operator, the result of which is the OUTPUT.

*Parameters*

*Logic inputs 1, 2:* enables the selection of the number of logic inputs (from 1 to 7).
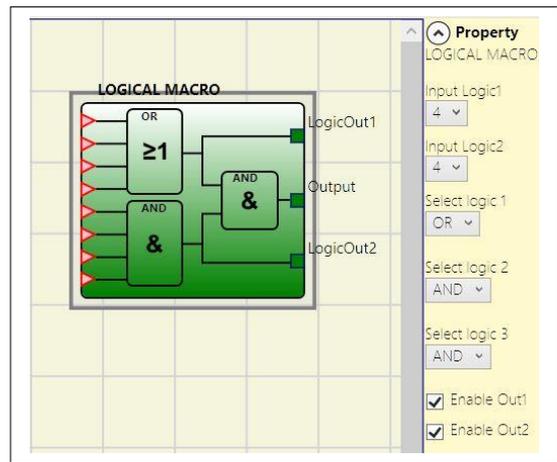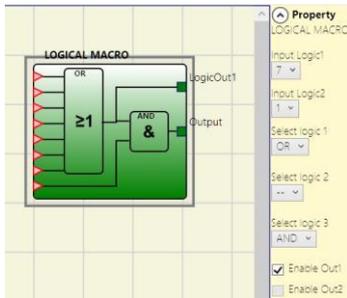
If one of the Logic Inputs equals "1", the corresponding logic is disabled and the input is directly connected to the end logic (refer to diagram opposite for example).

*Select Logic 1, 2, 3:* enables the selection of one of the following types of operator: AND, NAND, OR, NOR, XOR, XNOR.

*Enable (OUT1, OUT2)* If selected, activates an output with the result of the first two operators.

## MULTIPLEXER

Logical MULTIPLEXER forwards the signal of the inputs to the output according to the Sel selection. If the SEL1÷SEL4 have only one 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.

*Parameters*

*Number of inputs*: this is used to set between 2 and 4 inputs.
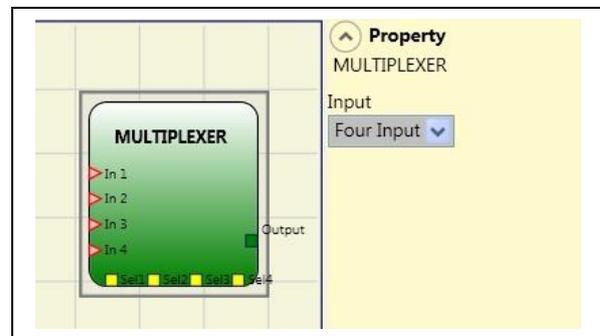
## MEMORY OPERATORS

MEMORY operators can be used if you decide to save any data (TRUE or FALSE) from other project components.

Status changes are performed according to the truth tables shown for each operator.

### D FLIP FLOP (max number = 16)

The D FLIP FLOP operator saves the previously set status on output Q according to the following truth table.

| Preset | Clear | Ck | D | Q |
|---|---|---|---|---|
| 1 | 0 | X | X | 1 |
| 0 | 1 | X | X | 0 |
| 1 | 1 | X | X | 0 |
| 0 | 0 | L | X | Keep memory |
| 0 | 0 | Rising edge | 1 | 1 |
| 0 | 0 | Rising edge | 0 | 0 |



*Parameters*

*Preset*: If selected enables output Q to be set to 1 (TRUE).

*Clear*: If selected enables the saving process to be reset.

### T FLIP FLOP (max number = 16)

This operator switches the Q output at each rising edge of the T input (Toggle).

*Parameters*

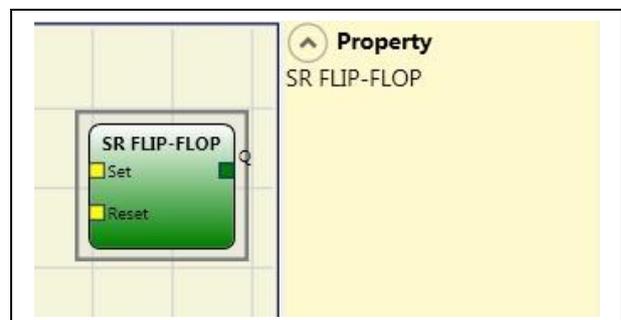*Enable Clear:* If selected enables the saving process to be reset.
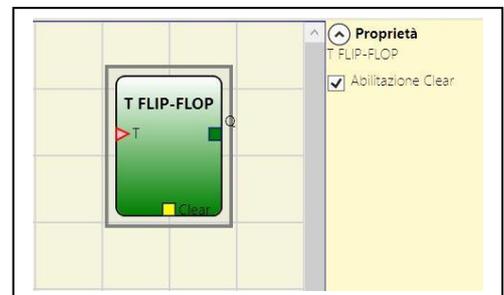


### SR FLIP FLOP (max number = 16)

SR FLIP FLOP operator brings output Q at 1 with Set, 0 with Reset.
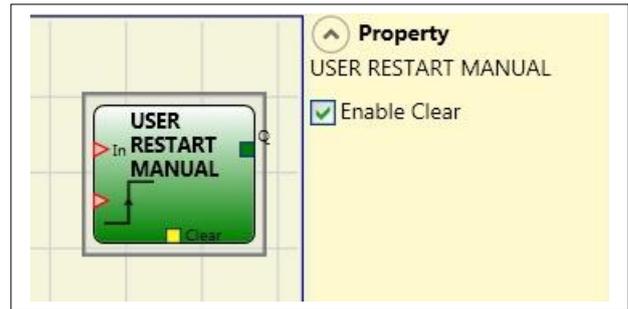See the following truth table.

| SET | RESET | Q |
|---|---|---|
| 0 | 0 | Keep memory |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

**English**

## USER RESTART MANUAL (max number = 16 with other RESTART operators)

The USER RESTART MANUAL operator saves the restart signal according to the following truth table.



| Clear | Restart | In | Q |
|---|---|---|---|
| 1 | X | X | 0 |
| X | X | 0 | 0 |
| 0 | L | 1 | Keep memory |
| 0 | Rising edge | 1 | 1 |
| 0 | Falling edge | 1 | Keep memory |

*Parameters*

*Clear enable*: If selected enables the saving process to be reset.

## USER RESTART MONITORED  (max number = 16 with other 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 | X | X | 0 |
| X | X | 0 | 0 |
| 0 | L | 1 | Keep memory |
| 0 | Rising edge | 1 | Keep memory |
| 0 | ⊓ | 1 | 1 |

*Parameters*

*Clear enable*: If selected enables the saving process to be reset.

## MACRO RESTART MANUAL (max number = 16 with other RESTART operators)

The MACRO RESTART MANUAL operator is used to combine a logic gate chosen by the user with the Restart Manual functional block ("USER RESTART MANUAL") in accordance with the following truth table.



| Clear | Restart | D | Q |
|---|---|---|---|
| 1 | X | X | 0 |
| X | X | 0 | 0 |
| 0 | L | 1 | Keep memory |
| 0 | Rising edge | 1 | 1 |
| 0 | Falling edge | 1 | Keep memory |

*English*
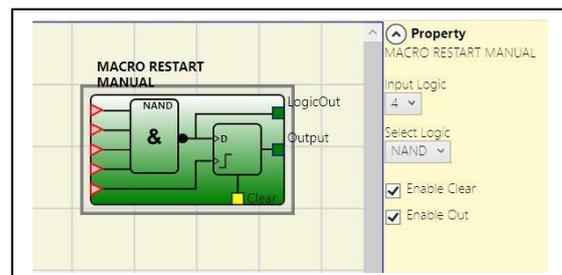
*Parameters*

*Logic Inputs*: enables the selection of the number of logic inputs (from 1 to 7).

*Select Logic:* enables the selection of one of the following types of operator:
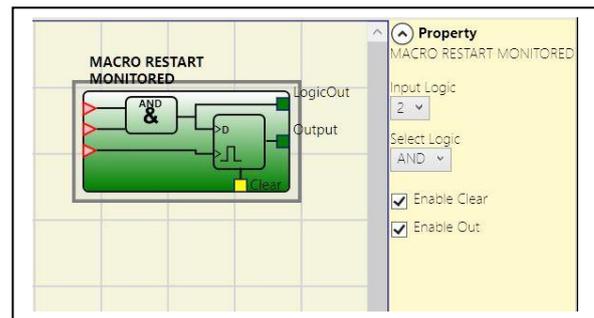AND, NAND, OR, NOR, XOR, XNOR.

*Enable Clear:* If selected enables the saving process to be reset.

*Enable Out:* If selected activates an output with the result of the calculation done by the logic.

## MACRO RESTART MONITORED (max number = 16 with other RESTART operators)

The MACRO RESTART MONITORED operator is used to combine a logic gate chosen by the user with the Restart Manual functional block ("USER RESTART MONITORED") in accordance with the following truth table.



| Clear | Restart | D | Q |
|---|---|---|---|
| 1 | X | X | 0 |
| X | X | 0 | 0 |
| 0 | L | 1 | Keep memory |
| 0 | Rising edge | 1 | Keep memory |
| 0 | ⊓⊔ | 1 | 1 |

*Parameters*

*Logic Inputs*: enables the selection of the number of logic inputs (from 1 to 7).

*Select Logic:* enables the selection of one of the following types of operator:
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 done by the logic.

**English**

## GUARD LOCK OPERATORS (max number = 4)

### GUARD LOCK

The GUARD LOCK operator controls locking/unlocking of an **ELECTROMECHANICAL GUARD LOCK** by analysing consistency between the Lock command and the status of an E-GATE and a FEEDBACK. The main ouput is 1 (TRUE) when the guard lock is <u>closed and locked</u>.

### Operating modes

#### A) *"GATE not present"* selected

1) The **Lock_fbk** input must always 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 (when in LL1 state).
3) The **OUTPUT** signal of this element is 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 guard is unlocked (**LockOut** output) after a time **UnLock_Time** configurable as parameter. This output goes to 0 (FALSE) even when error conditions are present (eg. open door with lock locked, **Feedback Time** that exceeds the maximum allowed, ...).
4) **Lockout** signal controls the locking/unlocking of the guard.

#### B) GATE present

1) The **GATE** input must always be connected to an **E_GATE** lock input (guard feedback).
2) The **Lock_fbk** input must always 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 (when in LL1 state).
4) The **OUTPUT** signal of this element is 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 guard is unlocked (**LockOut** output) after a time **UnLock_Time** configurable as parameter. This output goes to 0 (FALSE) even when error conditions are present (eg. open door with lock locked, **Feedback Time** that exceeds the maximum allowed, ...).
5) **Lockout** signal controls the locking/unlocking of the guard.

#### C) *"MANDATORY gate opening"* selected

1) The GATE Input must always be connected to a E_GATE block input (feedback of the door). **IN THIS MODE "GATE" INPUT MUST CONFIRM THE OPENING OF THE DOOR.**
2) The **Lock_fbk** input must always 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 (when in LL1 state).
4) The **OUTPUT** signal of this element is 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 guard is unlocked (**LockOut** output) after a time **UnLock_Time** configurable as parameter. This output goes to 0 (FALSE) even when error conditions are present (eg. open door with lock locked, **Feedback Time** that exceeds the maximum allowed, ...).
5) **Lockout** signal controls the locking/unlocking of the guard.

### Manual Reset:

There are two types of reset: Manual and Monitored. When Manual is selected the system only verifies the signal's transition from 0 to 1. If Monitored is selected the double transition from 0 to 1 and then back to 0 is verified.



MANUAL

RESET

OUTPUT

t = 250 ms

MONITORED

$t2$

RESET

$t1$

OUTPUT

$t1 > 250$ ms
$t2 = 250$ ms

---
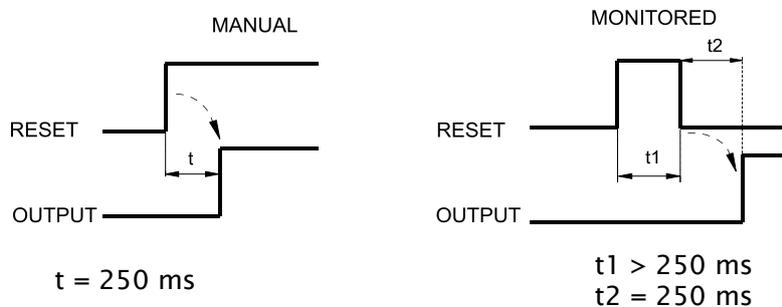
Important: for Manual reset always use the input immediately after those used by the function block. E.g.: if inputs 1 and 2 are used for the function block, use input 3 for Reset.

---

### Unlock Time (s):

The time that must pass between the **UnLock_cmd** input reaching and the real guard unlock (**Lockout output**).

- 0 ms ÷ 1 s Step 100 ms

- 1.5 s ÷ 10 s Step 0.5 s

- 15 s ÷ 25 s Step 5 s

### Feedback Time (s):

Maximum delay accepted between **LockOut** output and **Lock_fbk** input (must be the one shown on the lock data sheet with appropriate gap decided by the operator).

- 10 ms ÷ 100 s Step 10 ms

- 150 ms ÷ 1 s Step 50 ms

- 1.5 s ÷ 3 s Step 0.5 s

### Mandatory gate opening:  Only with door opening and subsequent confirmation of input GATE, the cycle proceeds.

### Gate not present: If selected, enables configuration without Gate but only with LOCK FEEDBACK (feedback coil lock).

### Interlock Spring: The guard is locked passively and released actively, i.e. the mechanical force of the spring keeps it locked. *The guard thus continues to be locked even when the power supply is disconnected.*

### Enable error out: This can be selected to enable a signal (Error Out) to indicate a lock malfunction. When Error Out = 1 (TRUE) there is a fault in the lock.
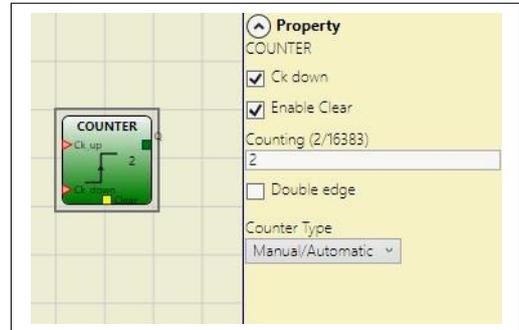
**English**

---

## COUNTER OPERATORS

COUNTER operator is a pulse counter that sets output Q to 1 (TRUE) as soon as the desired count is reached.
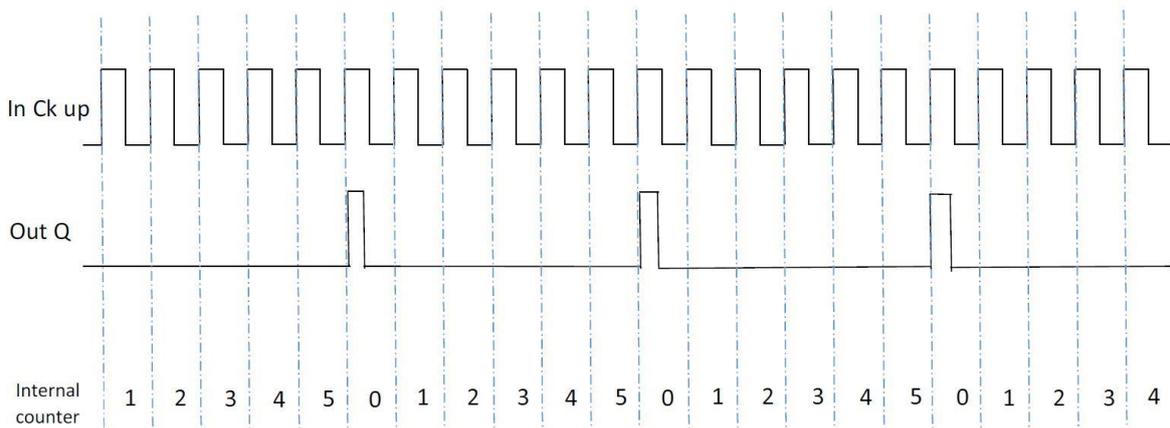
### COUNTER (max number = 16)

The operator COUNTER is a pulse counter.
There are 3 operationg modes:

1) AUTOMATIC
2) MANUAL
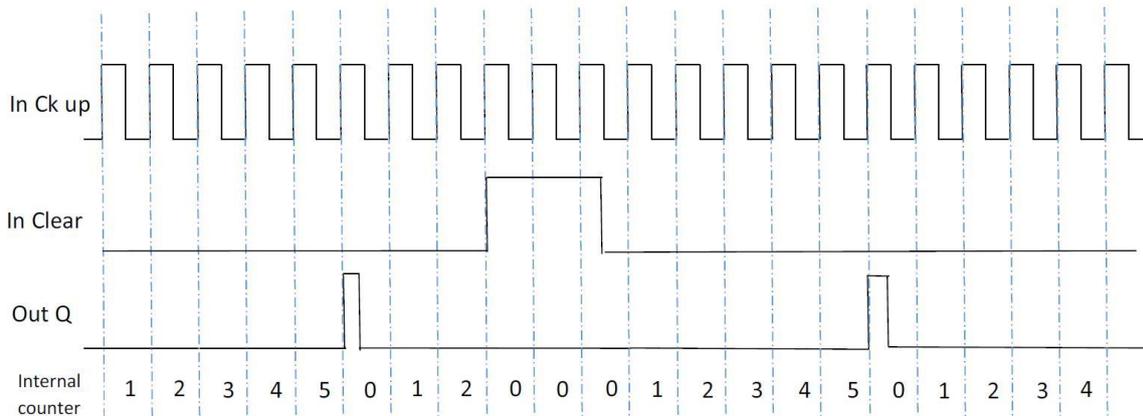3) AUTOMATIC + MANUAL



Counter value is 6 for all examples:

1) The counter generates a pulse duration equal to 2 x Tcycle (indicated in the REPORT) as soon as the set count is reached. If the CLEAR pin is not enabled this is the default mode.



2) The counter leads to 1 (TRUE) the output Q as soon as it reaches the set count. The output Q goes to 0 (FALSE) when the signal CLEAR is activated.
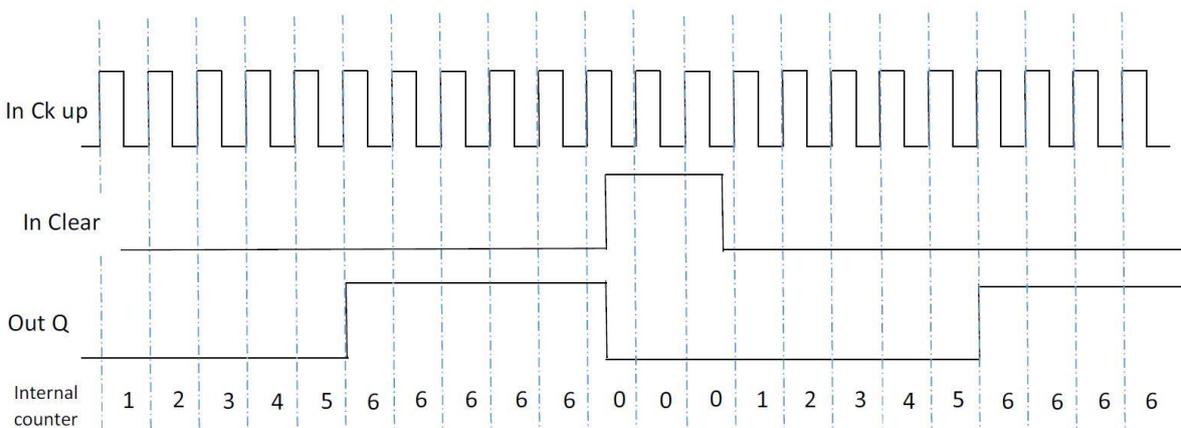
3) The counter generates a pulse duration equal to the system response time as soon as the set count is reached. If the CLEAR signal is activated, the internal count goes back to 0.



*Parameters*

*Clear Enable*: 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 operation 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 resetted.

*Ck down*: Enables counting down.
*Two-way*: If selected it enables counting on both the rising and falling edges.

*English*

## TIMER OPERATORS (max number = 32)

TIMER operators allow you to generate a signal (TRUE or FALSE) for a user-definable period.

### CLOCKING

The CLOCKING operator generates a clock signal output with the set period if the IN input is 1 (TRUE). Clocking has up to 7 inputs to control output Duty Cycle.
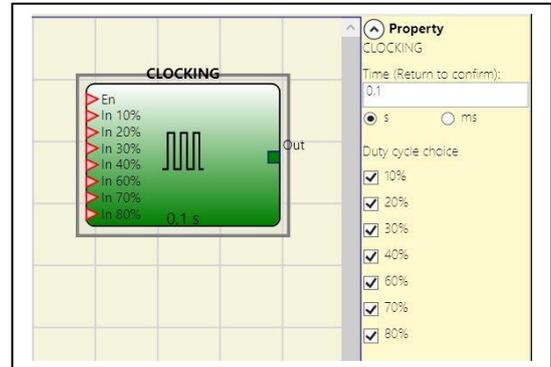
*Parameters*

*Time:* The period can be set to between 10 ms and 1098.3 s.

*Duty cycle selection:* Up to 7 inputs can be selected for 7 different output signal duty cycles.

Depending on the active input, the OUT clock signal has its corresponding duty cycle.

EN input must always be high level (TRUE).

Refer to the table below to check operator functioning.



| EN | 10% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | OUT |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50% |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10% |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 20% |
| 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 | 50% |
| 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 60% |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 70% |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 80% |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 90% |

➔ The circuit upstream of the CLOCKING operator must guarantee the presence of a single input signal other than the EN enable (apart from the pair 10% 80%).

➔ The presence of the EN input together with > 1 high level (TRUE) inputs, generates an output signal with a duty cycle = 50%.
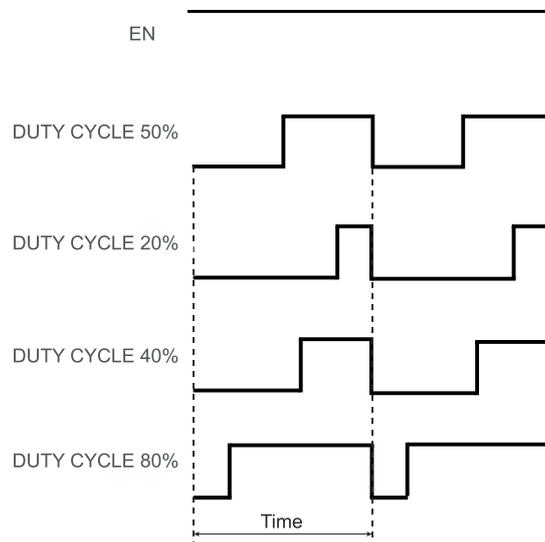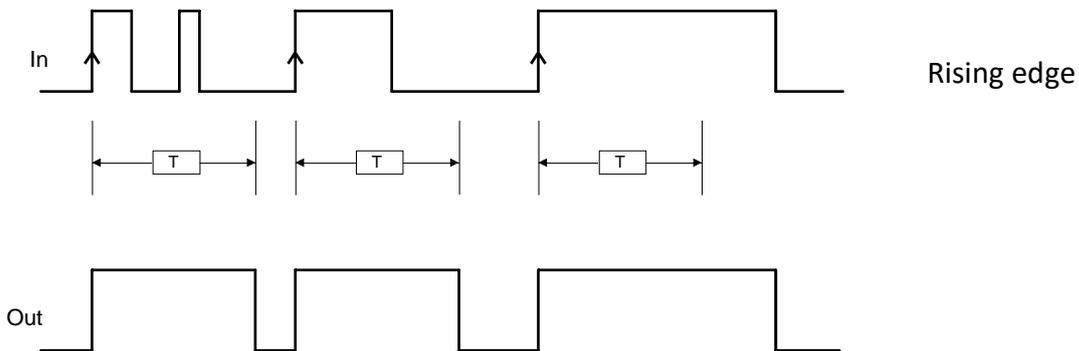
## MONOSTABLE

The MONOSTABILE operator generates a level 1 (TRUE) output activated by the rising edge of the input and remains in this condition for the set time.
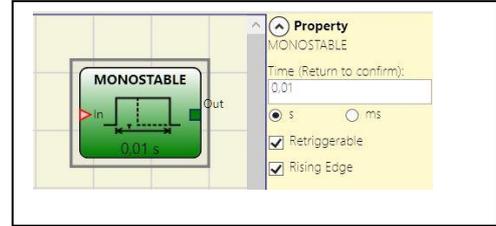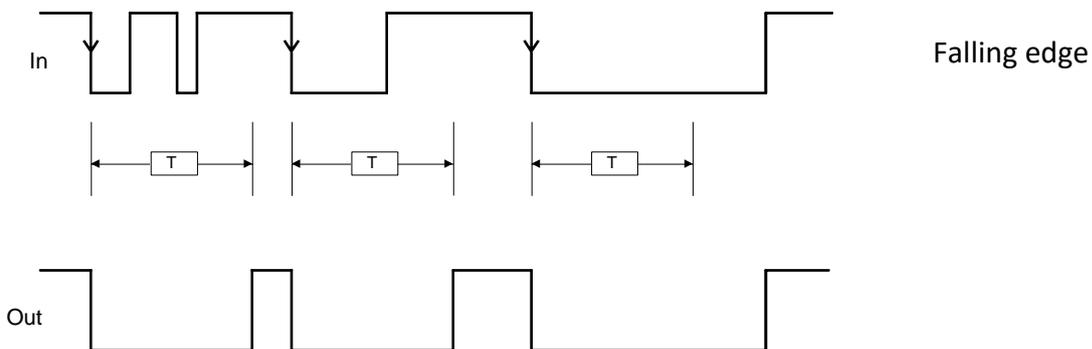
*Parameters*

*Time*: The delay can be set to between 10 ms and 1098.3 s.

*Rising edge*: If selected, the output is set to 1 (TRUE) on the input signal's rising edge where it remains for the set time, which can be extended for as long as the input stays at 1 (TRUE).

Rising edge

If not selected the logic is inverted, the output is set to 0 (FALSE) on the input signal's falling edge, where it remains for the set time, which can be extended for as long as the input stays at 0 (FALSE).
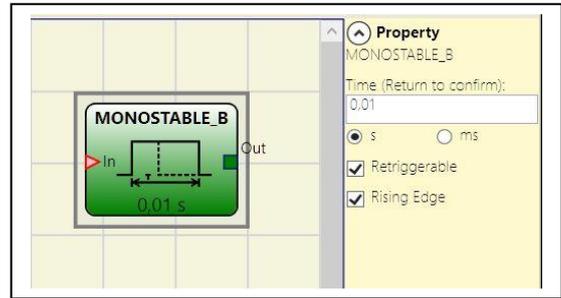
Falling edge

*Retriggerable*: If selected the time is reset each time the input status changes.

*English*

## MONOSTABLE_B

This operator generates a level 1 (TRUE) output activated by the rising/falling edge of the input and remains in this condition for the set time *t*.

*Parameters*

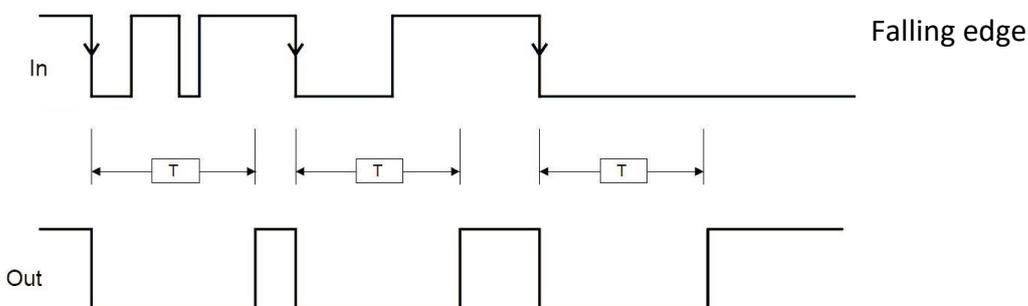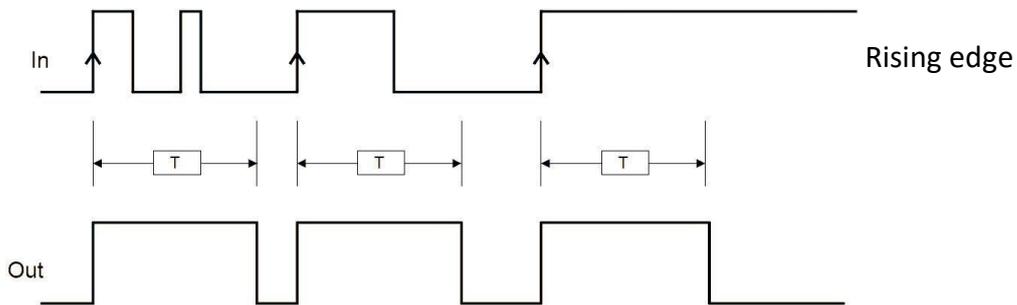*Time:* The delay can be set to between 10 ms and 1098.3 s.



*Retriggerable*: If selected enables the repetition of commands even before the end of the set time *t*.
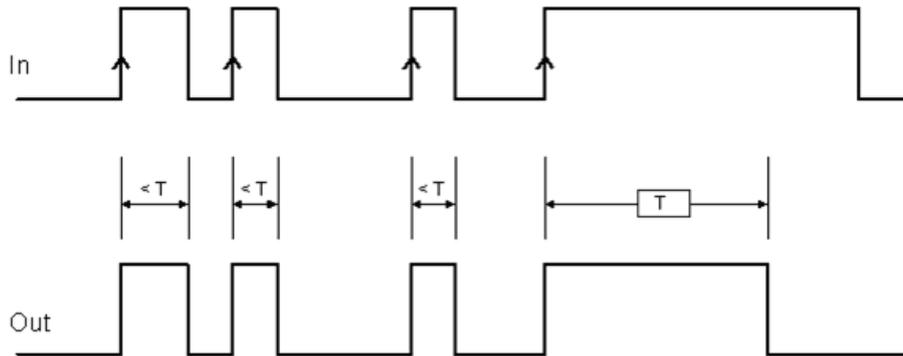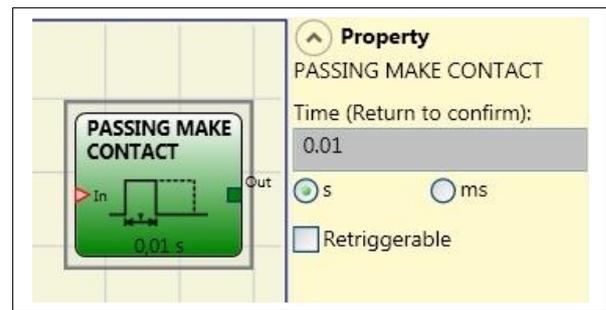
*Rising edge:*

- If selected provides a level 1 (TRUE) in the OUT output if a **rising edge** is detected on the IN input.

- If not selected the logic is inverted, the OUT output is set to 0 (FALSE) on the IN signal's falling edge, where it remains for the set time.

➔ Unlike the MONOSTABLE operator, the Out output of MONOSTABLE_B does not maintain a level 1 (TRUE) for a time which exceeds the set period *t*.



Rising edge



Falling edge

## PASSING MAKE CONTACT

In the PASSING MAKE CONTACT operator the output follows the signal on the input. However, if this is 1 (TRUE) for longer than the set time, the output changes to 0 (FALSE). When there is an input falling edge, the timer is cleared.





*Parameters*

*Time*: The delay can be set to between **10 ms and 1098.3 s**.

*Retriggerable*: If selected the time is not reset when there is an input falling edge. The output stays 1 (TRUE) for all the selected time. When there is a new input rising edge, the timer restart again.
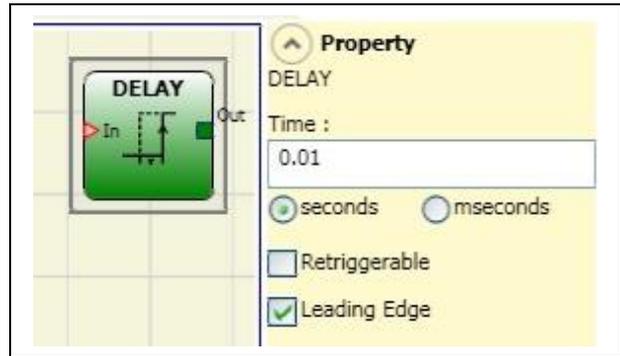
**English**
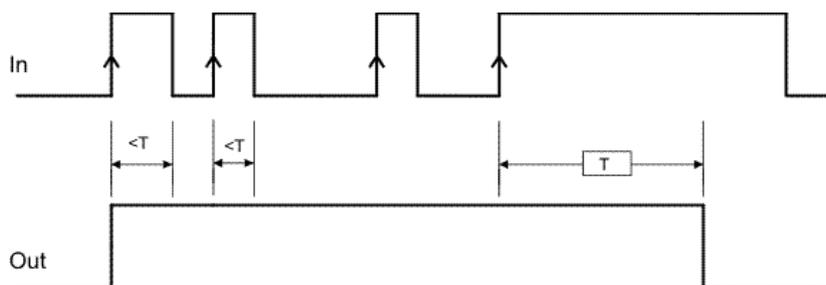
## DELAY

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.

*Parameters*

*Time*: The delay can be set to between **10 ms and 1098.3 s.**



*Rising edge*: If selected, the delay starts on the input signal's rising edge at the end of which the output changes to 1 (TRUE) if the input is 1 (TRUE) where it remains for as long as the input stays at 1 (TRUE).
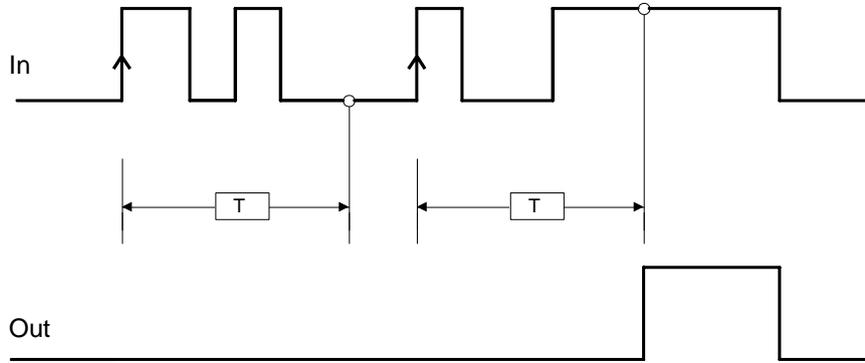


If not selected the logic is inverted, the output is set to 1 (TRUE) on the input signal's rising edge, the delay starts on the input signal's falling edge, at the end of the set time the output changes to 0 (FALSE) if the input is 0 (FALSE) otherwise it remains 1 TRUE.
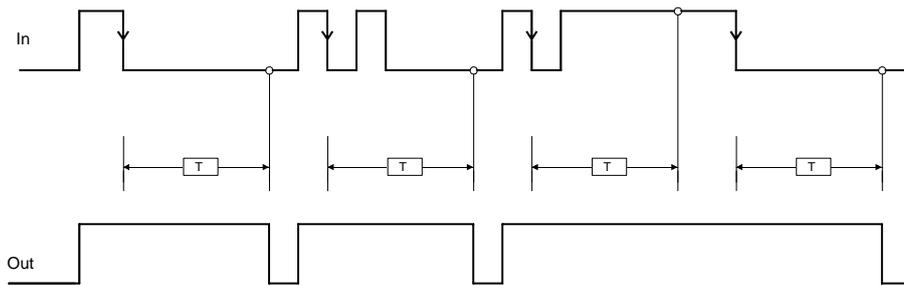


*Retriggerable*: If selected the time is reset each time the input status changes.

*English*

## DELAY LINE

This operator applies a delay to a signal by setting the OUT output to 0 after the set time, set at a falling edge of the IN signal.
If IN returns to 1 before the end of the set time, the OUT output still generates an LL0 impulse lasting approximately twice the response time and delayed by the set time.
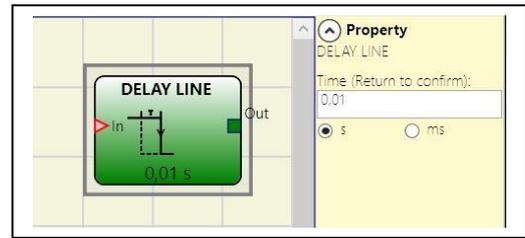
*Parameters*

*Time:* Enables the insertion of the desired delay time by selecting the preferred unit of measurement. The delay can be set to between 10 ms and 1098.3 s.
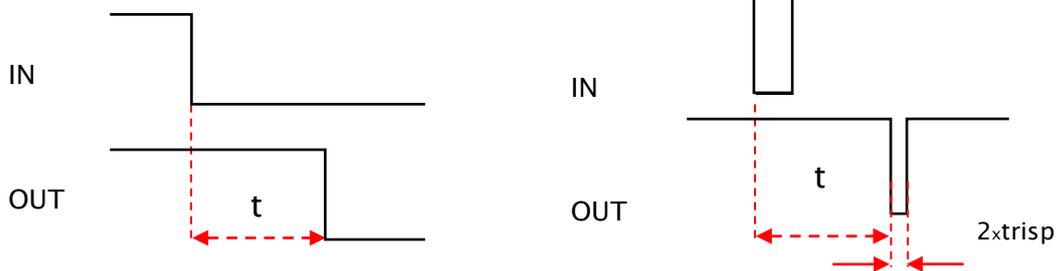
➔ Unlike the DELAY operator, the DELAY LINE operator does not filter any interruptions in the IN input which are shorter than the set time.

➔ This operator is recommended when using delayed OSSD (the OSSD must be programmed with RESTART MANUAL).

*English*

## MUTING FUNCTION

*The Muting function generates a temporary, automatic interruption of safety device operation in order to permit normal transit of material through the guarded opening.*
*In other words, when the system recognizes the material and distinguishes between this and any operator (in a potentially dangerous situation), it is enabled to bypass the safety device temporarily, allowing the material to pass through the guarded opening.*

## MUTING OPERATORS (max number = 4)
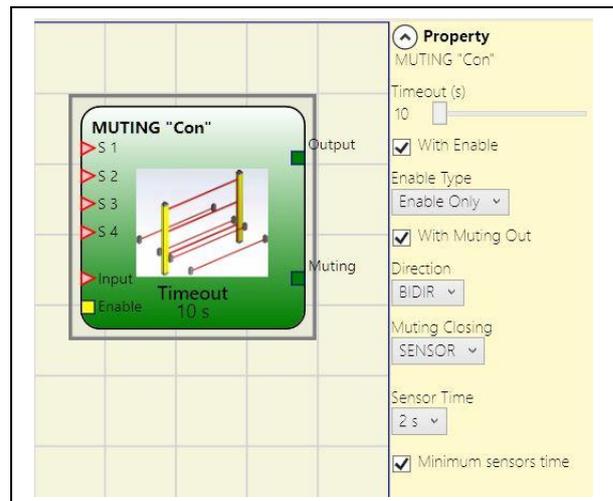
### "Concurrent" MUTING

*The activation of the Muting function occurs following interruption of the sensors S1 and S2 beam (the order does not matter) within a time range from 2s and 5s decided by the operator (or S3 and S4 with material that is moving in the direction opposite).*



The MUTING operator with "Concurrent" logic performs muting of the input signal through sensor inputs S1, S2, S3 and S4.

➜  Preliminary condition: The Muting cycle can only start if all the sensors are 0 (FALSE) and inputs are 1 (TRUE) (barrier free).

*Parameters*

*Timeout (sec)*: Sets the time, between 10 secs and unlimited, within which the Muting cycle must end. If the cycle is not complete at the end of this time, Muting is immediately discontinued.

*Enable*: If selected it enables the possibility of enabling or not enabling the Muting function. Otherwise the Muting function is always enabled.
There are two Enable modes: Enable/Disable and Enable Only. If Enable/Disable is selected the Muting cycle cannot start if Enable is fixed at 1 (TRUE) or 0 (FALSE) but is only activated with a rising edge. To disable muting, set Enable to 0 (FALSE). In this mode the falling edge disables Muting regardless of the condition. If Enable Only is selected Muting cannot be disabled but Enable must be set to 0 (FALSE) in order to enable a new rising edge for the next Muting cycle.

*Direction*: The order in which the sensors are occupied can be set. If set to BIDIR they can be occupied in both directions, from S1&S2 to S3&S4 and from S3&S4 to S1&S2, if set to UP they can be occupied from S1&S2 to S3&S4 and if set to DOWN from S3&S4 to S1&S2.

*Muting Close*: There are two types, CURTAIN and SENSOR. If you select CURTAIN muting closes when the input signal rises, if you select SENSOR it closes when the third sensor has been cleared.

**English**

**Select CURTAIN**

| S1 | S2 | Input | S3 | S4 | Muting | |
|----|----|-------|----|----|--------|---|
| 0 | 0 | 1 | 0 | 0 | 0 | |
| 1 | 0 | 1 | 0 | 0 | 0 | |
| 1 | 1 | 1 | 0 | 0 | 1 | |
| 1 | 1 | X | 0 | 0 | 1 | Muting active |
| 1 | 1 | X | 1 | 1 | 1 | |
| 0 | 0 | 0 | 1 | 1 | 1 | |
| 0 | 0 | 1 | 1 | 1 | 0 | |
| 0 | 0 | 1 | 0 | 0 | 0 | |

**Select SENSOR**

| S1 | S2 | Input | S3 | S4 | Muting | |
|----|----|-------|----|----|--------|---|
| 0 | 0 | 1 | 0 | 0 | 0 | |
| 1 | 0 | 1 | 0 | 0 | 0 | |
| 1 | 1 | 1 | 0 | 0 | 1 | |
| 1 | 1 | X | 0 | 0 | 1 | Muting active |
| 1 | 1 | X | 1 | 1 | 1 | |
| 0 | 0 | 0 | 1 | 1 | 1 | |
| 0 | 0 | 1 | 1 | 1 | 1 | |
| 0 | 0 | 1 | 0 | 1 | 0 | |
| 0 | 0 | 1 | 0 | 0 | 0 | |

*Blind Time*: <u>**Only with Muting Close=Curtain**</u>, *blind time* is enabled if you know that 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 msecs to 1 second.

*Sensors Time:* Sets the ***maximum time*** (between 2 and 5 seconds) between activating two muting sensors.

*Minimum sensors time:* If selected, allows the activation of Muting cycle only if a time $\geq$150ms elaps between the activation of the sensor 1 and sensor 2 (or sensor 4 and 3).

## MUTING "L"

*The activation of the Muting function occurs following interruption of the sensors S1 and S2 beam (the order does not matter) within a time range from 2s and 5s decided by the operator.*
*The state of the Muting ends after the liberation of the guarded opening.*



The MUTING operator with "L" logic performs muting of the input signal through sensor inputs S1 and S2.

➜ Preliminary condition: The Muting cycle can only start if S1 and S2 are 0 (FALSE) and the inputs are 1 (TRUE) (barrier free).

*Parameters*

*Timeout (sec)*: Sets the time, between 10 secs and unlimited, within which the Muting cycle must end. If the cycle is not complete at the end of this time, Muting is immediately discontinued.

*Enable*: If selected it enables the possibility of enabling or not enabling the Muting function. Otherwise the Muting function is always enabled.

There are two Enable modes: Enable/Disable and Enable Only. If Enable/Disable is selected the Muting cycle cannot start if Enable is fixed at 1 (TRUE) or 0 (FALSE) but is only activated with a rising edge. To disable muting, set Enable to 0 (FALSE). In this mode the falling edge disables Muting regardless of the condition. If Enable Only is selected Muting cannot be disabled but Enable must be set to 0 (FALSE) in order to enable a new rising edge for the next Muting cycle.

*Sensors Time:* Sets the **maximum time** (between 2 and 5 seconds) between activating two muting sensors.

*End of Muting time*: sets the maximum time (from 2.5 to 6 seconds) that must elapse between the release of the first sensor and the release of guarded opening. The end of this time determines the end of the Muting function.
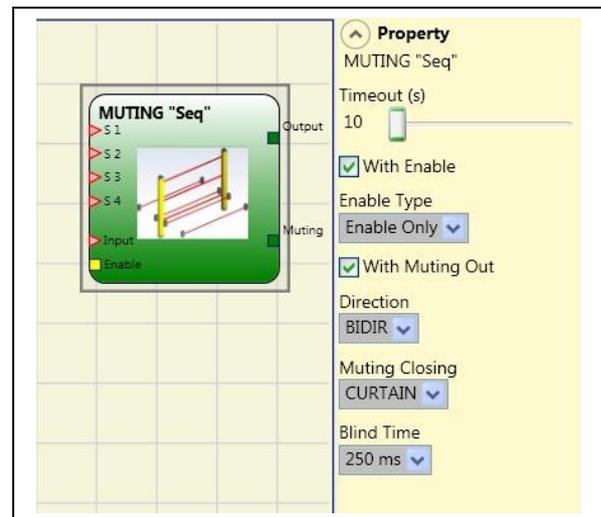
*Blind Time*: enabled if you know that after the complete transition of the pallet (muting cycle close) some protruding objects could still occupy the light curtain and send the input to 0 (FALSE). During blind time the input remains 1 (TRUE). Blind Time can range from 250 msecs to 1 second.

## "Sequential" MUTING

*The activation of the Muting function occurs following sequential interruption of the sensors S1 and S2, subsequently S3 and S4 sensors (without time limit). If the pallet proceeds in the opposite direction the correct sequence is: S4, S3, S2, S1.*

The MUTING operator with "Sequential" logic performs muting of the input signal through sensor inputs S1, S2, S3 and S4.

➜   Preliminary condition: The Muting cycle can only start if all the sensors are 0 (FALSE) and the inputs are 1 (TRUE) (barrier free).



*Parameters*

*Timeout (sec)*: Sets the time, between 10 secs and unlimited, within which the Muting cycle must end. If the cycle is not complete at the end of this time, Muting is immediately discontinued.

*Enable*: If selected it enables the possibility of enabling or not enabling the Muting function. Otherwise the Muting function is always enabled.
There are two Enable modes: Enable/Disable and Enable Only. If Enable/Disable is selected the Muting cycle cannot start if Enable is fixed at 1 (TRUE) or 0 (FALSE) but is only activated with a rising edge. To disable muting, set Enable to 0 (FALSE). In this mode the falling edge disables Muting regardless of the condition. If Enable Only is selected Muting cannot be disabled but Enable must be set to 0 (FALSE) in order to enable a new rising edge for the next Muting cycle.

*Direction*: The order in which the sensors are occupied can be set. If set to BIDIR they can be occupied in both directions, from S1 to S4 and from S4 to S1, if set to UP they can be occupied from S1 to S4 and if set to DOWN from S4 to S1.

*Muting Close*: There are two types, CURTAIN and SENSOR. If you select CURTAIN muting closes when the input signal rises, if you select SENSOR it closes when the third sensor has been cleared.

### Select CURTAIN

| S1 | S2 | Input | S3 | S4 | Muting | |
|----|----|-------|----|----|--------|--|
| 0 | 0 | 1 | 0 | 0 | 0 | |
| 1 | 0 | 1 | 0 | 0 | 0 | |
| 1 | 1 | 1 | 0 | 0 | 1 | |
| 1 | 1 | X | 0 | 0 | 1 | |
| 1 | 1 | X | 1 | 0 | 1 | Muting active |
| 1 | 1 | X | 1 | 1 | 1 | |
| 0 | 1 | X | 1 | 1 | 1 | |
| 0 | 0 | 0 | 1 | 1 | 1 | |
| 0 | 0 | 1 | 1 | 1 | 0 | |
| 0 | 0 | 1 | 0 | 1 | 0 | |
| 0 | 0 | 1 | 0 | 0 | 0 | |

### Select SENSOR

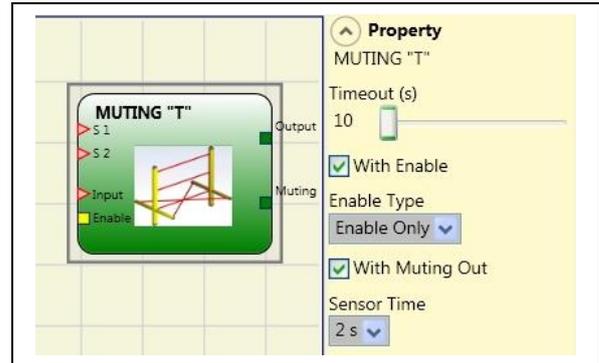| S1 | S2 | Input | S3 | S4 | Muting | |
|----|----|-------|----|----|--------|--|
| 0 | 0 | 1 | 0 | 0 | 0 | |
| 1 | 0 | 1 | 0 | 0 | 0 | |
| 1 | 1 | 1 | 0 | 0 | 1 | |
| 1 | 1 | X | 0 | 0 | 1 | |
| 1 | 1 | X | 1 | 0 | 1 | Muting active |
| 1 | 1 | X | 1 | 1 | 1 | |
| 0 | 1 | X | 1 | 1 | 1 | |
| 0 | 0 | 0 | 1 | 1 | 1 | |
| 0 | 0 | 1 | 1 | 1 | 1 | |
| 0 | 0 | 1 | 0 | 1 | 0 | |
| 0 | 0 | 1 | 0 | 0 | 0 | |

*Blind Time*: **_Only with Muting Close=Curtain_**, *blind time* is enabled if you know that 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 msecs to 1 second.

**English**

## MUTING "T"

| |
|---|
| *The activation of the Muting function occurs following interruption of the sensors S1 and S2 beam (the order does not matter) within a time range from 2s and 5s decided by the operator.* *The state of the Muting ends after the liberation of at least one of the two sensors.* |

The MUTING operator with "T" logic performs muting of the input signal through sensor inputs  S1 and S2.

➜ Preliminary condition: The Muting cycle can only start if S1 and S2 are 0 (FALSE) and the inputs are 1 (TRUE) (barrier free).

*Parameters*

*Timeout (sec)*: Sets the time, between 10 secs and unlimited, within which the Muting cycle must end. If the cycle is not complete at the end of this time, Muting is immediately discontinued.

*Enable*: If selected it enables the possibility of enabling or not enabling the Muting function. Otherwise the Muting function is always enabled.
There are two Enable modes: Enable/Disable and Enable Only. If Enable/Disable is selected the Muting cycle cannot start if Enable is fixed at 1 (TRUE) or 0 (FALSE) but is only activated with a rising edge. To disable muting, set Enable to 0 (FALSE). In this mode the falling edge disables Muting regardless of the condition. If Enable Only is selected Muting cannot be disabled but Enable must be set to 0 (FALSE) in order to enable a new rising edge for the next Muting cycle.

*Sensors Time:* Sets the ***maximum time*** (between 2 and 5 seconds) between activating two muting sensors.

## MUTING OVERRIDE (max number = 4)

*The OVERRIDE function must be used when the machine stops due to incorrect Muting activation sequences with the material obstructing the guarded opening.*
*This function activates the OSSD outputs making it possible to remove the material that is obstructing the guarded opening.*
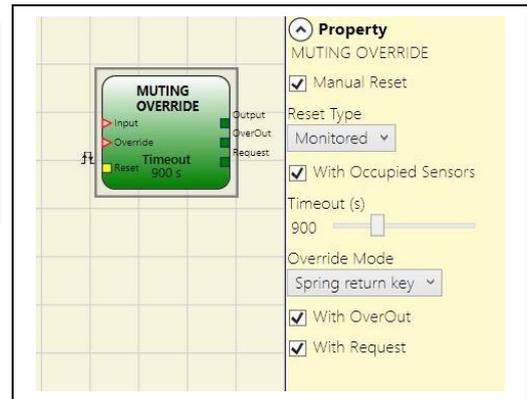
The operator must be connected after the Muting operator (Muting OUTPUT directly to the Override INPUT).

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 OverOut switches to logical "0" (FALSE).

Override can be set to pulsed or maintained action mode.

### Override with maintained action control.

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 ad re-activating 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.

### 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 re-activated (OVERRIDE=1).

### Parameters

*With sensors occupied:* Must be selected with "T" sequential, simultaneous muting; with "L" muting, must not be selected.

> ➔ Otherwise, a Warning is displayed in the compilation phase and in the report.
> ➔ The user must adopt additional safety measures during the Override phase.

*Conditions to be checked for activation of Override*

| "With sensors occupied " selected | sensor occupied | light curtain occupied | Input | Override request | Override output |
|---|---|---|---|---|---|
| X | X | - | 0 | 1 | 1 |
| - | - | X | 0 | 1 | 1 |
| | X | - | 0 | 1 | 1 |
| | X | X | 0 | 1 | 1 |

*Timeout (sec):* Used to set the time, between 10 sec and infinity, by which the Override function must end.

*Override mode:* Used to configure the type of Override (pulsed or maintained action).

*With OverOut:* Used to activate an Override active Signaling output (active when high).

*With Request:* Used to activate a Signaling output (active when high) indicating that the Override function can be activated.

*Manual Reset:*
- Should the INPUT be active (TRUE), the reset enables the output of the function block.
- Should the INPUT be not active (FALSE), the output of the function block follows the OVERRIDE request.

There are two types of reset: Manual and Monitored. When Manual is selected the system only verifies the signal's transition from 0 to 1. If Monitored is selected the double transition from 0 to 1 and then back to 0 is verified.
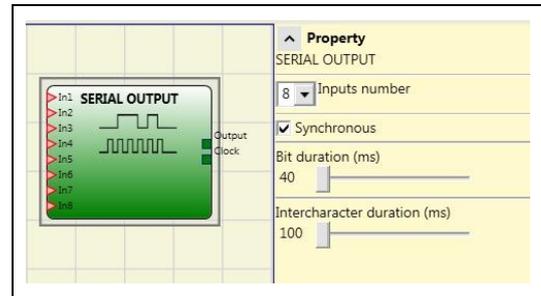
# MISCELLANEOUS FUNCTION BLOCKS

## SERIAL OUTPUT

The **Serial Output** operator outputs the status of up to 8 inputs, serialising the information.

**Operating principles.**
This operator outputs the status of all the connected inputs in two different ways:



**Asynchronous serialisation:**
1) The status of the line in the idle condition is 1 (TRUE);
2) The start data transmission signal is 1 bit = (FASLE);
3) Transmission of *n* bits with the status of the connected inputs encoded using the *Manchester* method:
- Status 0: rising edge of the signal at the centre of the bit
- Status 1: falling edge of the signal at the centre of the bit
4) Intercharacter interval is 1 (TRUE) to allow synchronisation of an external device.
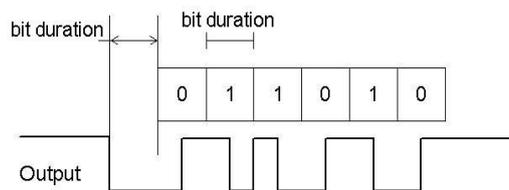


Therefore, with the Asynchronous method the *Clock* output is not present.

**Synchronous serialisation:**
1) The output and the clock in the idle condition are 0 (FASLE);
2) Transmission of *n* bits with the input status using OUTPUT as data, CLOCK as the timing base;
3) Intercharacter interval is 0 (FALSE) to allow synchronisation of an external device.
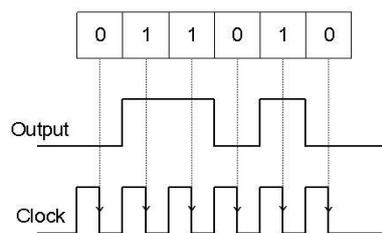


*Parameters*

**Number of inputs:** Defines the number of inputs of the function block, which may be 2÷8 (*asynchronous*) or 3÷8 (*synchronous*).

**Bit length (ms):** Enter the value corresponding to the length of each single bit (input n) in the pulse train that makes up the transmission.
- 40 ms ÷ 200 ms        (Step 10 ms)
- 250 ms ÷ 0.95 s        (Step 50 ms)

**Intercharacter interval (ms):** Enter the time that must pass between the transmission of one pulse train and the next.
- 100 ms ÷ 2.5 s (Step 100 ms)
- 3 s ÷ 6 s        (Step 500 ms)

**English**

## NETWORK

The **Network** operator is used to distribute Stop and Reset commands via a simple local network. Use **Network_in** and **Network_out** to exchange *START*, *STOP* and *RUN* signals between the different nodes.
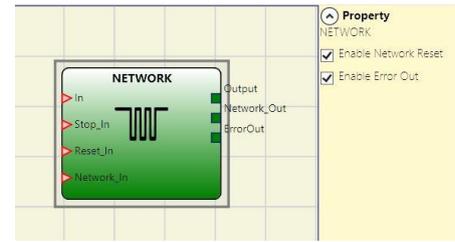
### Operating principles.
This operator allows stop and reset commands to be distributed simply in a local Mosaic network.

The Network operator requires the following:
1) 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.
2) the **Network_Out** output connected to a STATUS signal or OSSD output, must be connected to the **Network_in** input of the next unit in the local network.
3) the **Stop_In** and **Reset_In** inputs must be connected to input devices that act as Stop (e.g. E-STOP) and Reset (e.g. SWITCH), respectively.
4) the **In** input can be connected freely in the diagram (e.g. input function blocks or results of logical combinations).
5) **Output** can be connected freely in the diagram. **Output** is 1 (TRUE) when the IN input is 1 (TRUE) and the function block has been restarted.

### *Parameters*

***Enable Reset Network:*** 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 **Error_Out** status signal.

---

⚡ The RESET commands must be installed outside all the danger areas of the network in positions where the danger areas and the entire work areas are clearly visible.

---

➡ The maximum number of MASTER modules that can be connected in network configuration is equal to 10.

➡ Each Master module can have a maximum of 9 expansion modules connected.

---

### *Condition 1:*
*With reference to the Figure 57 and Figure 58, at power-on:*

1. *The Net_out of the various nodes are in the 0 (FALSE) condition;*
2. *The STOP signal is sent via the 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 Net_out of all the connected nodes is in condition 1 (TRUE) if the various Net_in inputs are in condition 1 (TRUE);*
5. *The RUN signal is sent via the network of the 4 nodes present.*

### *Condition 2:*
*With reference to the Figure 57 and Figure 58, when the emergency stop is pressed in one of the four nodes:*
1. *The Net_out moves to condition 0 (FALSE);*
2. *The STOP signal is sent via the Net_out line;*
3. *The next node receives the stop code and deactivates the output;*
4. *The stop command generates the stop code for all Net_in and Net_out lines;*
5. *As the end result, the Net_out 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 RESET NETWORK is not enabled. In that case, the local reset method must be used. The system will employ about 4s to restore all the outputs of the blocks that make up the network.*
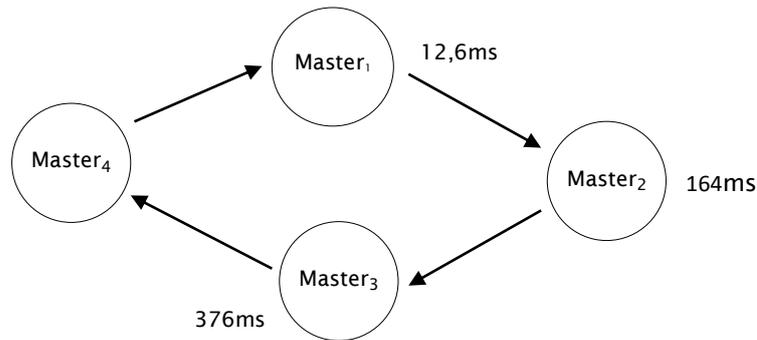
*Response Time*
*The max response time of the network starting from emergency stop is given by the formula:*

$$t_r = [(212 \text{ ms} \times n°Master)-260ms]$$

⚡ The max number of connected Master must be 10.

| Emergency Stop Pressing | MASTER n°1 $t_{rMASTER1}$ 12,6ms | MASTER n°2 $t_{rMASTER2}$ 164ms | MASTER n°3 $t_{rMASTER3}$ 376ms | MASTER n°4 $t_{rMASTER4}$ 488ms |
|---|---|---|---|---|



## Condition 3:

*With reference to the Figure 55 and Figure 56, when 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 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. This condition is signaled by the corresponding LED flashing Reset_In entrance.*
   *The affected node will be restarted with its own reset.*

The **Reset_in** and **Network_in** inputs and the **Network_out** output can only be mapped to the I/O pins of the MASTER.

## *Master M1 signals with Network operative*

| | | NETWORK FUNCTIONAL BLOCK SIGNALS | | | | |
|---|---|---|---|---|---|---|
| | | Network in | | Network out (OSSD) | Network out (STATUS) | Reset in |
| | LED | FAIL EXT | IN (1) | OSSD (2) | STATUS | IN (3) |
| STATUS | STOP | OFF | OFF | RED | OFF | OFF |
| | CLEAR | OFF | BLINKING | RED/GREEN (BLINKING) | BLINKING | BLINKING |
| | RUN | OFF | ON | GREEN | ON | ON |
| | FAIL | ON | BLINKING | – | – | – |

(1) Corresponding to the input where is wired Network IN
(2) Corresponding to the input where is wired Network OUT
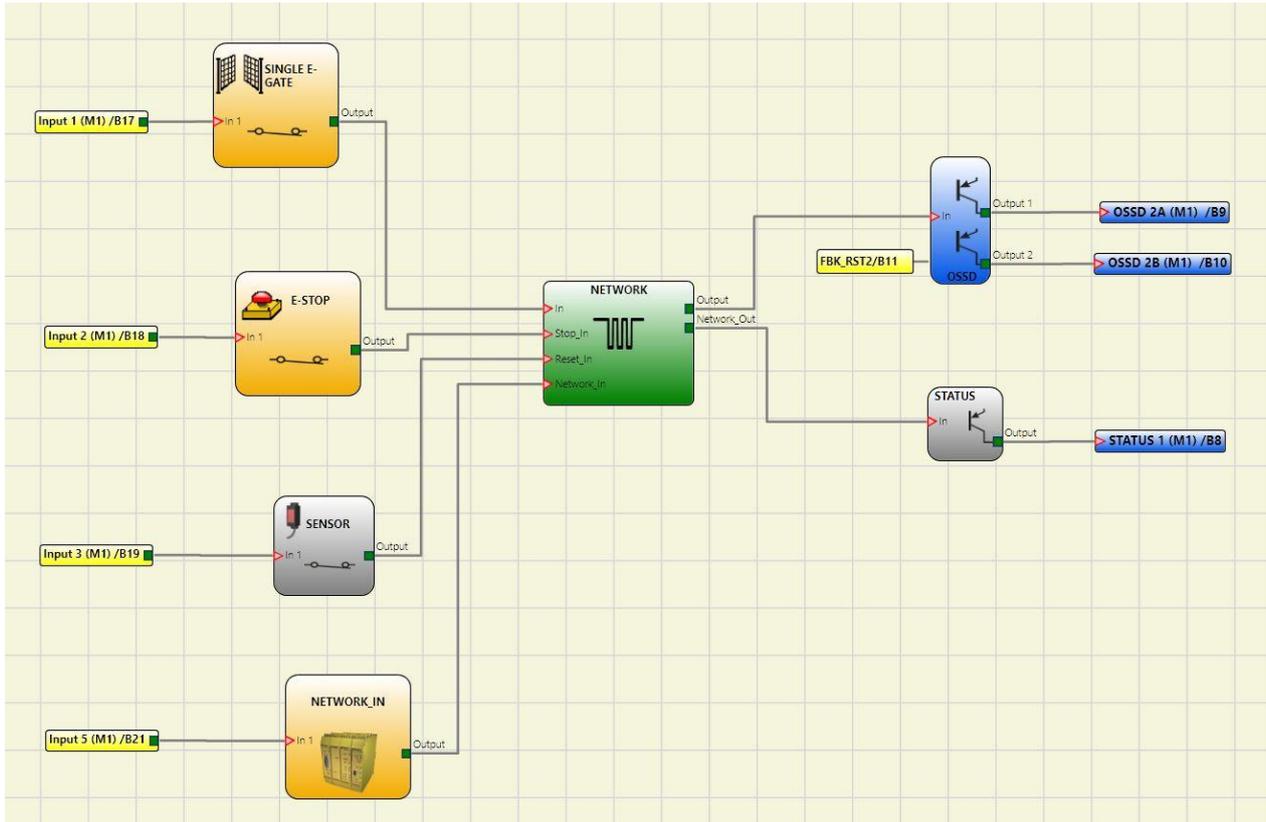(3) Corresponding to the input where is wired Reset IN

English

*Figure 55 - NETWORK function block scheme example (Category 2)*



*Figure 56 - NETWORK function block scheme example (Category 4)*
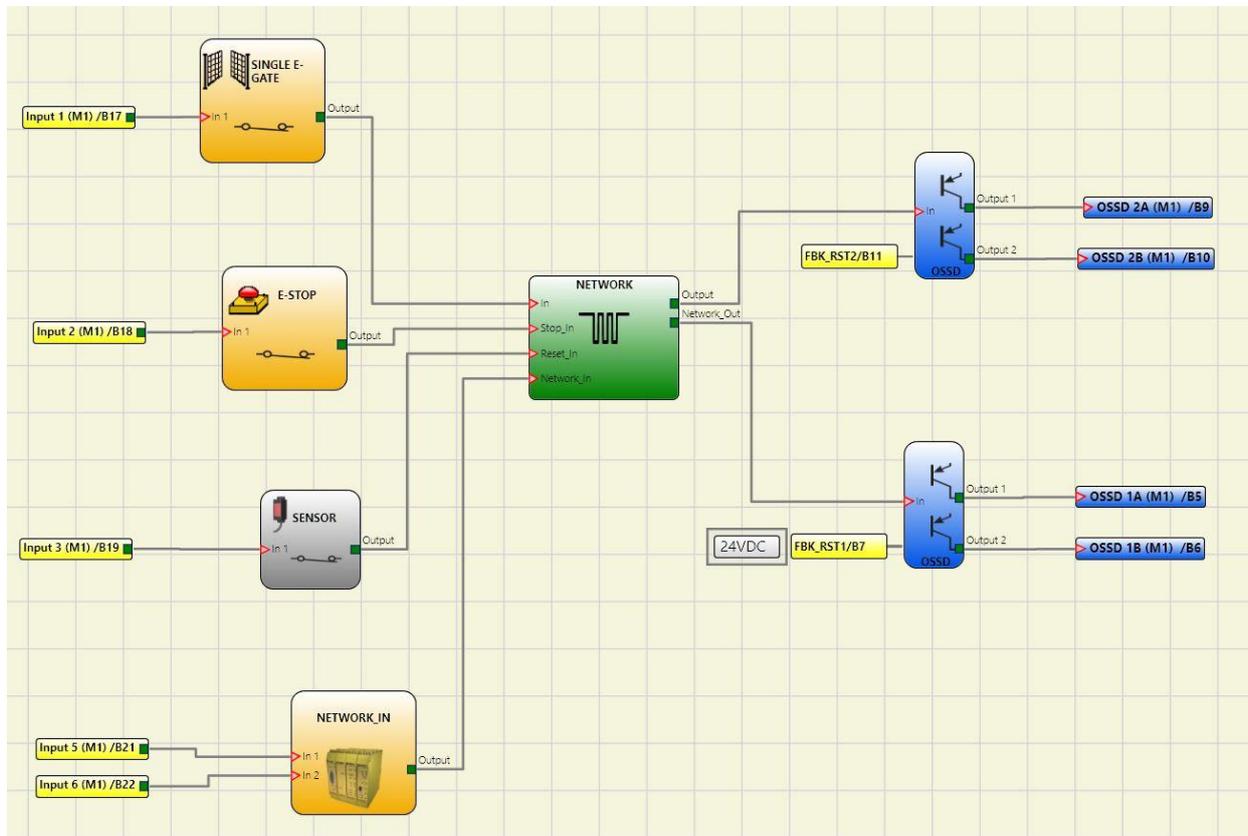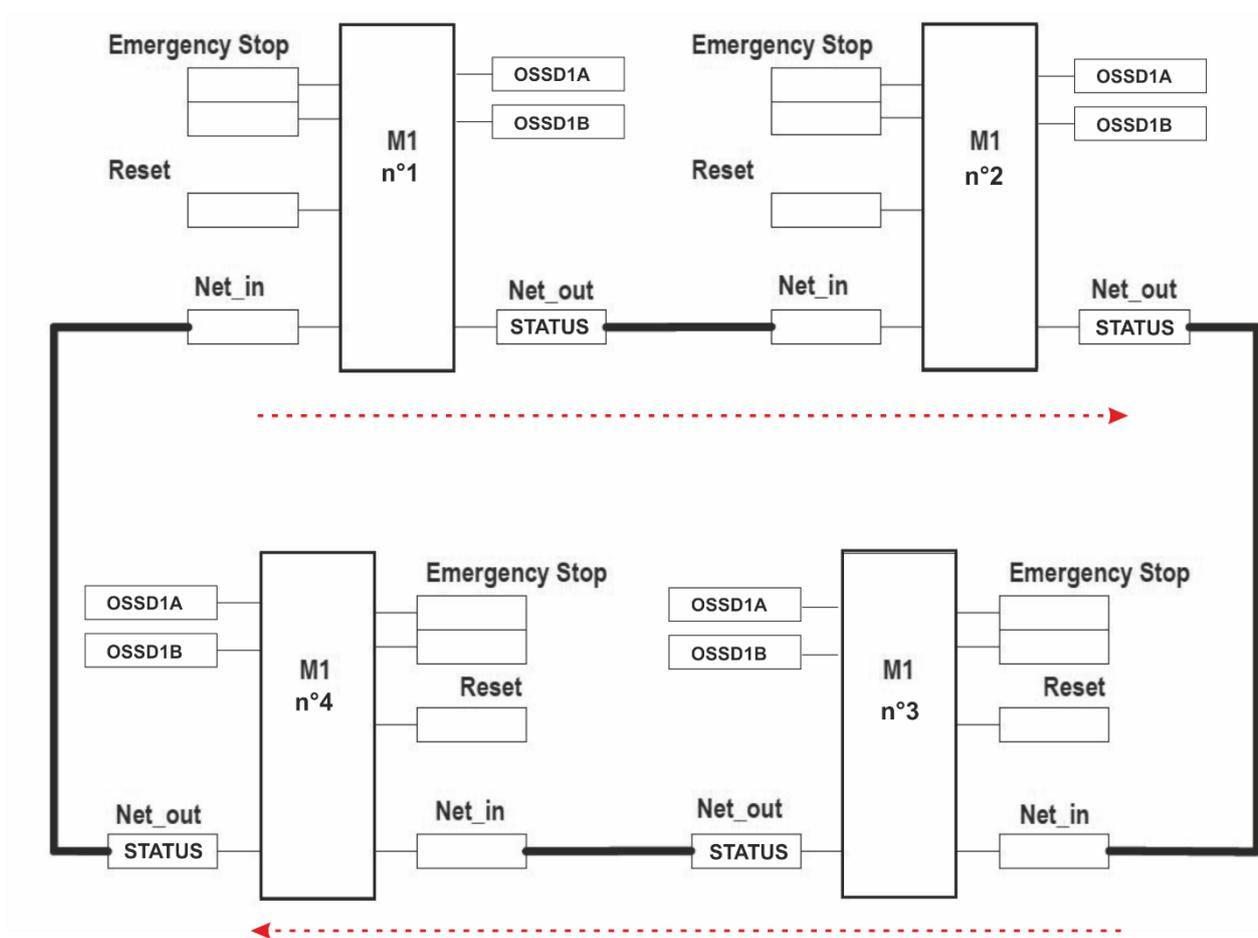
## Example of application in Category 2 according to ISO 13849-1:



Network data flow

*Figure 57*

## Network parameters for the PL calculation

| Architecture: | Cat.2 |
|---|---|
| Diagnostic coverage: | DC = 90% |
| Reliability of Module M1: | MTTF$_d$ = 437 *(years)* |

## Logical block diagram of a safety function using the network



LOGIC (NETWORK)

English
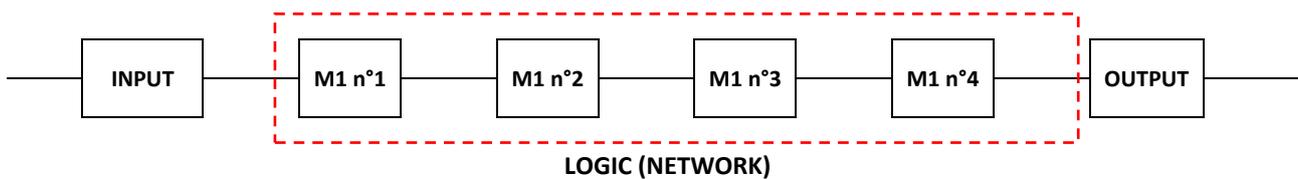
## Example of application in Category 4 according to ISO 13849-1:
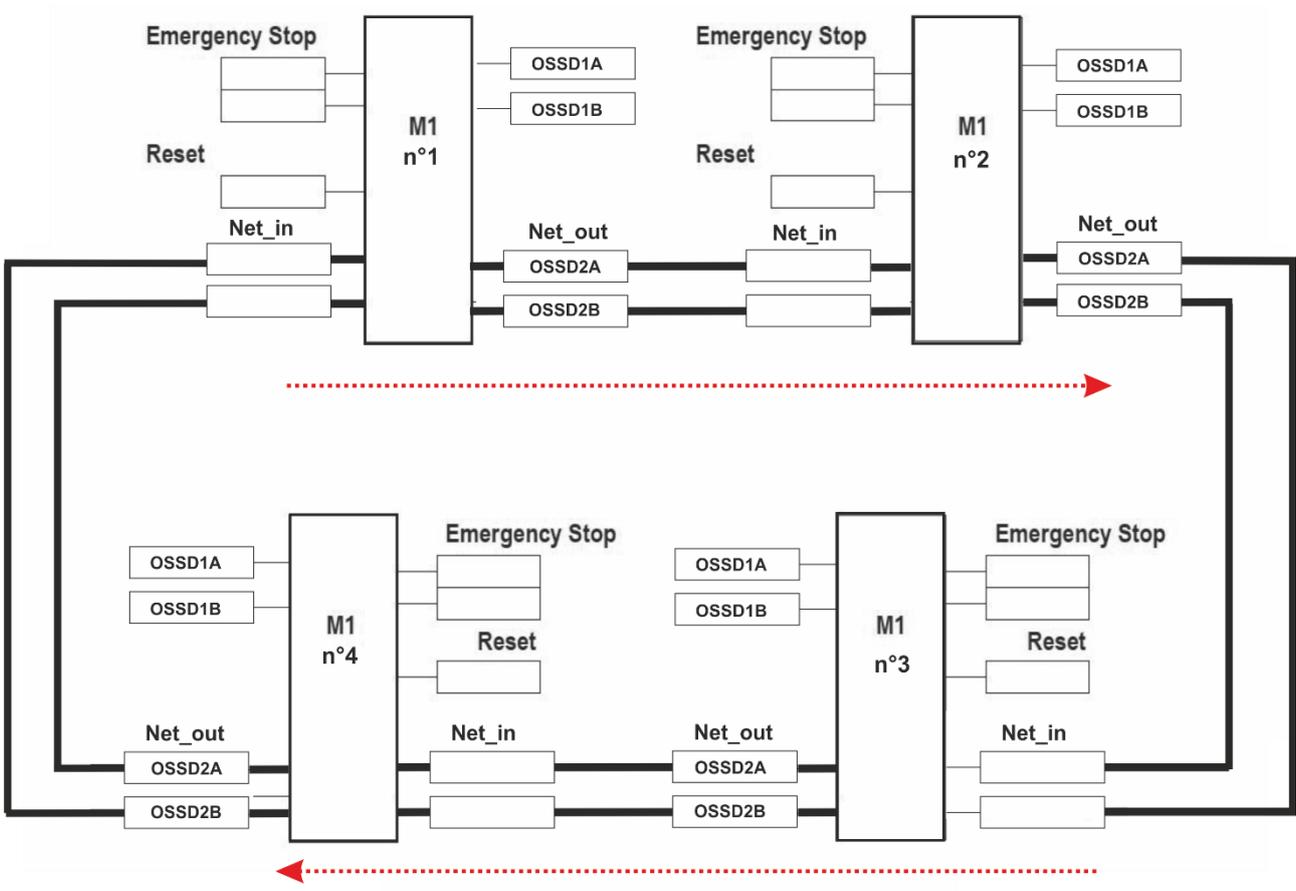


Network data flow

*Figure 58*

### Network parameters for the PL calculation

| Architecture: | Cat.4 |
|---|---|
| Diagnostic coverage: | DC = 99% |
| PFH Module M1: | PFHd = 6,86E-09 *(hour$^{-1}$)* |

## Logical block diagram of a safety function using the network



LOGIC (NETWORK)
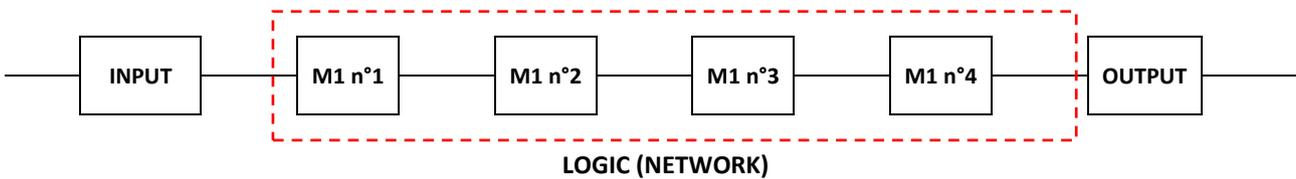
## RESET M1

This operator generates a system Reset when there is a double OFF-ON-OFF transition on the corresponding input which lasts less than 5 s.

IN

t

t < 5s
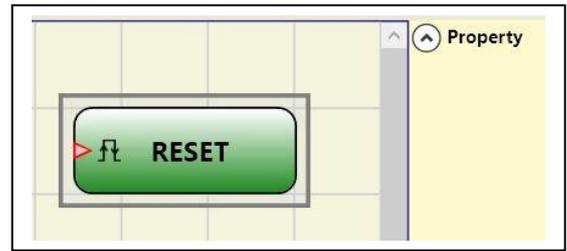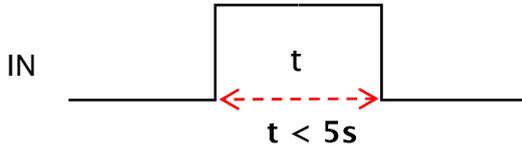
➡ If > 5s, RESET is not generated.

➡ It can be used to reset faults without disconnecting system power.

## INTERPAGE IN/OUT

If the scheme is very complicated and requires a connection between two elements very far, use the "Interpage" component.

| INTERPAGE OUT | INTERPAGE IN |
|---|---|
| **(scheme side SX)** | **(scheme side SX)** |

The element "*Interpage out*" must have a name which, invoked by the corresponding "*Interpage in*", allows the desired link.

*English*

## SPECIAL APPLICATIONS

### Output delay with manual

If you need to have two OSSD output with one of them delayed (in MANUAL mode) use the following scheme:



*Figure 59 - Two outputs with one delayed (in MANUAL mode)*

# MOSAIC FAIL CODES

In case of malfunction the Mosaic system transmits to the MSD software a code corresponding to the error detected by the master M1.

To read the code, proceed as follows:
- connect the Master M1 (indicating FAIL by led) to the PC using the USB cable;
- launch the software MSD;
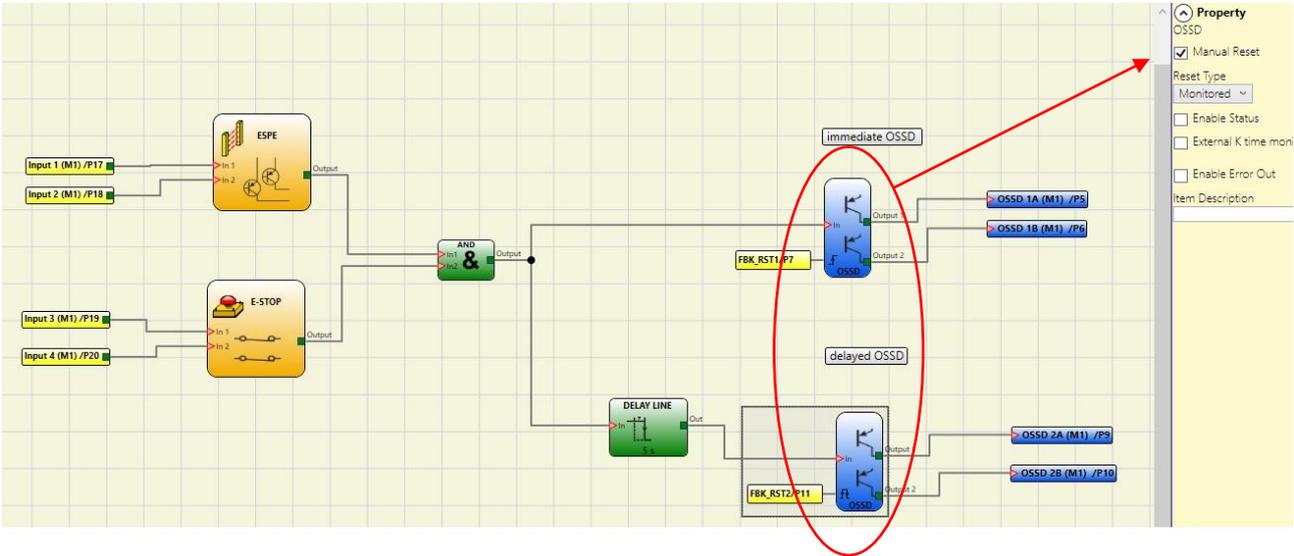- use the icon    for the connection; a window appears to request the password; enter the password; a window appears with the error code occurred.

The following table lists all possible errors detected and their solution.

| CODE | FAIL | RESOLUTION |
|---|---|---|
| 19D, 20D | *The two M1 microcontrollers do not see the same hw/sw configuration* | CHECK CORRECT INSERTION OF M1 AND EXPANSION MODULES CONNECTORS MSC. POSSIBLY REPLACE THE CONNECTORS. IF MCT IS PRESENT, CHECK CONNECTION |
| 66D | *2 or more same expansion modules with the same node number* | CHECK THE CONNECTIONS PIN 2, 3 EXPANSION MODULES |
| 68D | *Exceeded max expansion modules number* | DISCONNECT THE MODULES IN EXCESS (MAX14) |
| 70D | *One or more modules have detected a change in the node number* | CHECK THE CONNECTIONS OF PIN 2, 3 EXPANSION MODULES |
| 73D | *A slave module has detected an external error* | CHECK THE ERROR CODE ON MODULE FOR MORE INFORMATION |
| 96D ÷ 101D | *Errors related to memory MCM* | REPLACE MCM MEMORY |
| 137D | *from a MOR4 MOR4S8 - EDM error on the couple RELAY1 and 2 used in Category 4* | CHECK THE CONNECTION OF THE EXTERNAL FEEDBACK CONTACTORS |
| 147D | *from MOR4 MOR4S8 - EDM error on the Relay 2 and 3 used in Category 4* | CHECK THE CONNECTION OF THE EXTERNAL FEEDBACK CONTACTORS |
| 157D | *from a form or MOR4 MOR4S8 - EDM error on the Relay 3 and 4 used in Category 4* | CHECK THE CONNECTION OF THE EXTERNAL FEEDBACK CONTACTORS |
| 133D (Proxi1) 140D (Proxi2) | *From a module MV2, MV1 or MV0: over-frequency detected on Proximity input* | THE INPUT FREQUENCY MUST BE $\leq$ 5KHz |
| 136D (Encoder1) 143D (Encoder2) | *From a module MV2, MV1 or MV0: encoder input signals not Standard (duty cycle, phase displacement)* | THE DUTY CYCLE MUST BE: 50%$\pm$33% OF THE PERIOD (HTL, TTL). THE PHASE DISPLACEMENT MUST BE: 90˚$\pm$33% (HTL, TTL) (not applicable to SIN / COS) |
| 138D (Encoder1) 145D (Encoder2) | *From a module MV2, MV1 or MV0: over-frequency detected on Encoder input* | THE INPUT FREQUENCY MUST BE: $\leq$ 500KHz (TTL, SIN/COS); $\leq$ 300KHz (HTL). |
| 194D 197D 198D 199D 201D 202D 203D 205D | *Errors solid state output OSSD1* | CHECK THE OSSD1 CONNECTIONS RELATIVE TO THE MODULE IN ERROR |
| 208D 211D 212D 213D 215D 216D 217D 219D | *Errors solid state output OSSD2* | CHECK THE OSSD2 CONNECTIONS RELATIVE TO THE MODULE IN ERROR |
| 222D 225D 226D 227D 229D 230D 232D 233D | *Errors solid state output OSSD3* | CHECK THE OSSD3 CONNECTIONS RELATIVE TO THE MODULE IN ERROR |
| 236D 239D 240D 241D 243D 244D 245D 247D | *Errors solid state output OSSD3* | CHECK THE OSSD3 CONNECTIONS RELATIVE TO THE MODULE IN ERROR |

**All other codes are related to errors or an internal malfunction. Please replace the module that gave the error or return to ReeR for repair and/or debugging and inform REER at the time of shipment.**

| CODE | FAIL | SOLUTION |
|---|---|---|
| 1D ÷ 31D | *Microcontroller Error* | TRY TO RESTART SYSTEM. IF ERROR PERSISTS, SEND UNIT TO REER LABORATORY FOR REPAIR. |
| 32D ÷ 63D | *Mainboard error* | |
| 64D ÷ 95D | *Communication error between units* | |
| 96D ÷ 127D | *MCM memory card error* | REPLACE MCM MEMORY CARD |
| 128D ÷ 138D | *Error module MOR4 relay 1* | TRY TO RESTART SYSTEM. IF ERROR PERSISTS, SEND UNIT TO REER LABORATORY FOR REPAIR. |
| 139D ÷ 148D | *Error module MOR4 relay 2* | |
| 149D ÷ 158D | *Error module MOR4 relay 3* | |
| 159D ÷ 168D | *Error module MOR4 relay 4* | |
| 128D ÷ 191D | *Error units MV encoder interface* | TRY TO RESTART SYSTEM. IF ERROR PERSISTS, SEND UNIT TO REER LABORATORY FOR REPAIR. |
| 192D ÷ 205D | *OSSD1 Error* | |
| 206D ÷ 219D | *OSSD2 Error* | |
| 220D ÷ 233D | *OSSD3 Error* | |
| 234D ÷ 247D | *OSSD4 Error* | |

**English**

# ACCESSORIES AND SPARE PARTS

| MODEL | DESCRIPTION | CODE |
|---|---|---|
| M1 | MOSAIC main unit  (8 inputs / 2 double OSSD ) | 1100000 |
| MI8O2 | MOSAIC I/O expansion unit  (8 inputs / 2 double OSSD) | 1100010 |
| MI8 | MOSAIC input expansion unit (8 inputs) | 1100020 |
| MI16 | MOSAIC input expansion unit (16 inputs) | 1100021 |
| MI12T8 | MOSAIC input expansion unit (12 input, 8 test output) | 1100022 |
| MO2 | MOSAIC output expansion unit (2 double OSSD) | 1100030 |
| MO4 | MOSAIC output expansion unit (4 double OSSD) | 1100031 |
| MR2 | MOSAIC safety relay unit (2 relays) | 1100040 |
| MR4 | MOSAIC safety relay unit (4 relays) | 1100041 |
| MOR4 | MOSAIC safety relay expansion unit (4 relays) | 1100042 |
| MOR4S8 | MOSAIC safety relay expansion unit (4 relays, 8 test outputs) | 1100043 |
| MOS8 | MOSAIC output expansion unit (8 test outputs) | 1100091 |
| MOS16 | MOSAIC output expansion unit (16 test outputs) | 1100092 |
| MBP | MOSAIC PROFIBUS DP interface unit | 1100050 |
| MBD | MOSAIC DeviceNet interface unit | 1100051 |
| MBC | MOSAIC CANopen interface unit | 1100052 |
| MBEC | MOSAIC ETHERCAT interface unit | 1100053 |
| MBEI | MOSAIC ETHERNET/IP interface unit | 1100054 |
| MBEP | MOSAIC PROFINET interface unit | 1100055 |
| MBMR | MOSAIC MODBUS RTU interface unit | 1100082 |
| MBEM | MOSAIC MODBUS TCP interface unit | 1100083 |
| MBEI2B | MOSAIC ETHERNET/IP 2 PORT interface unit | 1100085 |
| MCT2 | MOSAIC BUS TRANSFER interface unit (2 channels) | 1100058 |
| MCT1 | MOSAIC BUS TRANSFER interface unit (1 channel) | 1100057 |
| MCM | MOSAIC external configuration memory | 1100060 |
| MSC | MOSAIC connector for 5-way communication | 1100061 |
| CSU | MOSAIC USB cable for connection to PC | 1100062 |
| MV1T | MOSAIC TTL expansion unit | 1100070 |
| MV1TB | MOSAIC TTL expansion unit | 1100086 |
| MV1H | MOSAIC HTL expansion unit | 1100071 |
| MV1S | MOSAIC SIN/COS expansion unit | 1100072 |
| MV2T | MOSAIC TTL expansion unit (2 encoders) | 1100073 |
| MV2TB | MOSAIC TTL expansion unit (2 encoders) | 1100087 |
| MV2H | MOSAIC HTL expansion unit (2 encoders) | 1100074 |
| MV2S | MOSAIC SIN/COS expansion Unit (2 encoders) | 1100076 |
| MV0 | MOSAIC proximity expansion unit | 1100077 |

*English*

# WARRANTY

ReeR warrants that all of its MOSAIC units shall be free from defects in material or workmanship for a period of 12 (twelve) months from the date of shipment. This warranty applies to the products under normal conditions of use.
If the product proves to be defective during the warranty period, ReeR will repair or replace any faulty parts without any charge for material or labour.
ReeR S.p.A. may, at its discretion, replace the defective equipment with the same type of equipment or with equipment having the same characteristics, rather than repair it.

This warranty is subject to the conditions listed below:
The customer must inform ReeR of the fault within twelve months from the date of delivery of the product.
The equipment and all components must be in the condition as they were at the time of delivery by ReeR.
The fault or defect must not been caused either directly or indirectly by:

- Improper use;

- Failure to comply with the instructions for use;

- Carelessness, misuse, incorrect maintenance;

- Repairs, modifications, adaptations not performed by ReeR, tampering, etc.;

- Accidents or collisions (also during transportation and as a result of force majeure);

- Other causes for which ReeR cannot be held liable.

The defective equipment must be delivered or shipped to ReeR's works to be repaired: the warranty does not cover costs of transport or the risk of damage to or loss of the equipment during shipment, which shall be borne by the customer.
All products and components that are replaced become the property of ReeR.
ReeR shall not be held liable under any other warranties or rights except for those expressly indicated above. ReeR shall not therefore accept claims to pay damages for expenses, interruption of work or other factors or circumstances in any way related to failure of the product or any parts thereof.

*Please, visit the website www.reer.it  for the list of the authorised representative of each Country.*

---

⚠ Precise, complete compliance with all standards, instructions and warnings in this handbook is essential for the correct operation of the device. ReeR therefore declines any responsibility for all and anything resulting from failure to comply with all or some of the aforesaid instructions.

*Characteristics are subject to change without prior notice. No part of this document may be reproduced unless authorised by ReeR.*

**English**

**⧉REER**

# CE

## Dichiarazione CE di conformità
*EC declaration of conformity*

Torino, 14/03/2016

REER SpA
via Carcano 32
10153 – Torino
Italy

**dichiara che il controllore integrato MOSAIC costituisce un dispositivo di sicurezza realizzato in conformità alle seguenti Direttive Europee:**
*declares that the integrated controller MOSAIC is a safety device complying with the following European Directives:*

| | |
|---|---|
| **2006/42/EC** | "Direttiva Macchine" |
| | *"Machine Directive"* |
| **2014/30/EU** | "Direttiva Compatibilità Elettromagnetica" |
| | *"Electromagnetic Compatibility Directive"* |
| **2014/35/EU** | "Direttiva Bassa Tensione" |
| | *"Low Voltage Directive"* |

**ed è conforme alle seguenti norme:**
*and complies with the following standards:*

| | |
|---|---|
| **EN 61131-2** (2007) | Controllori programmabili - Parte 2: Specifiche e prove delle apparecchiature. |
| | *Programmable controllers - Part 2. Equipment requirements and tests.* |
| **EN ISO 13849-1** (2008) | Sicurezza del macchinario: Parti dei sistemi di comando legate alla sicurezza. Parte 1: Principi generali per la progettazione. |
| | *Safety of machinery:- Safety-related parts of control systems - Part 1: General principles for design.* |
| **EN 61496-1** (2013) | Sicurezza del macchinario: Dispositivi Elettrosensibili di protezione, Parte 1: Requisiti generali e tests. |
| | *Safety of machinery : Electro sensitive protective equipment, Part 1: General requirements and tests.* |
| **EN 61508-1** (2010) | Sicurezza funzionale di impianti elettrici/elettronici/programmabili legati alla sicurezza: Requisiti generali. |
| | *Functional safety of electrical/electronic programmable electronic safety related systems: General requirements.* |
| **EN 61508-2** (2010) | Sicurezza funzionale di impianti elettrici/elettronici/programmabili legati alla sicurezza: Requisiti per impianti elettrici/elettronici/programmabili legati alla sicurezza. |
| | *Functional safety of electrical/electronic/programmable electronic safety related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.* |
| **EN 61508-3** (2010) | Sicurezza funzionale di impianti elettrici/elettronici/programmabili legati alla sicurezza: Requisiti Software. |
| | *Functional safety of electrical/electronic programmable electronic safety related systems: Software requirements.* |
| **EN 61508-4** (2010) | Sicurezza funzionale di impianti elettrici/elettronici/programmabili legati alla sicurezza: Definizioni e abbreviazioni. |
| | *Functional safety of electrical/electronic programmable electronic safety related systems: Definitions and abbreviations.* |
| **IEC 61784-3** (2008) | Reti di comunicazione industriali - Profili - Parte 3: Sicurezza funzionale dei bus di campo - Norme generali e profilo definizioni. |
| | *Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions.* |
| **EN 62061** (2005) | Sicurezza del macchinario. Sicurezza funzionale dei sistemi di comando e controllo elettrici, elettronici e programmabili correlati alla sicurezza. |
| | *Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems.* |

**raggiungendo il livello di sicurezza pari a: SIL 3 / SILCL 3 / PL e/ Cat. 4 / Tipo 4 (v. standard corrispondenti)**
*reaching a safety level corresponding to: SIL 3 / SILCL 3 / PL e / Cat. 4 / Type 4 (see related standards)*

**ed è identico all'esemplare esaminato ed approvato con esame di tipo CE da:**
*and is identical to the specimen examined and approved with a CE - type approval by:*
TÜV SÜD Rail GmbH – Ridlerstrasse 65 – D-80339 – Muenchen – Germany

<table>
<tr><td><strong>Carlo Pautasso</strong><br>Direttore Tecnico<br><em>Technical Director</em></td><td><strong>Simone Scaravelli</strong><br>Amministratore Delegato<br><em>Managing director</em></td></tr>
</table>

**⊞REER**

**NORSTAT INC.**

**300 Roundhill Drive Rockaway, NJ 07866**
**Tel: 973-586-2500**
**www.norstat.com**

*English*