**MODULAR SAFETY INTEGRATED CONTROLLER**

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosaic Configuration Memory (MCM)</td>
<td>Is a proprietary removable memory card that can be used to save Mosaic configuration data for subsequent transfer to a new device without using a PC and for backup.</td>
</tr>
<tr>
<td>MV units</td>
<td>Expansion units for safety speed monitoring.</td>
</tr>
<tr>
<td>MOR4, MOR4S8 units</td>
<td>Safety relay expansion units with configurable outputs.</td>
</tr>
<tr>
<td>MI, MO units</td>
<td>Input/Output units. Up to 128 inputs and 16 OSSD pairs.</td>
</tr>
<tr>
<td>MR2, MR4 units</td>
<td>Safety relays units.</td>
</tr>
<tr>
<td>MB Units</td>
<td>Expansion unit for connection to the most common industrial Fieldbus systems for diagnostics and data communication.</td>
</tr>
<tr>
<td>USB Connection</td>
<td>USB 2.0 serial bus for the connection to Mosaic Safety Designer (MSD) software.</td>
</tr>
<tr>
<td>MO4LHCS8 unit</td>
<td>High current output unit.</td>
</tr>
<tr>
<td>M1 Master unit</td>
<td>Master unit, also usable as a stand-alone device, able to control any other expansion unit.</td>
</tr>
<tr>
<td>Mosaic Safety Communication (MSC)</td>
<td>Mosaic MSC allows communication between the various units through a proprietary high-speed safety bus.</td>
</tr>
</tbody>
</table>

**Notes:**
- Mosaic Configuration Memory (MCM) is a proprietary removable memory card that can be used to save Mosaic configuration data for subsequent transfer to a new device without using a PC and for backup.
- MV units are expansion units for safety speed monitoring.
- MOR4, MOR4S8 units are safety relay expansion units with configurable outputs.
- MI, MO units are input/output units with up to 128 inputs and 16 OSSD pairs.
- MR2, MR4 units are safety relays units.
- MB Units are expansion units for connection to the most common industrial Fieldbus systems for diagnostics and data communication.
- USB Connection is a USB 2.0 serial bus for the connection to Mosaic Safety Designer (MSD) software.
- MO4LHCS8 unit is a high current output unit.
- M1 Master unit is a master unit, also usable as a stand-alone device, able to control any other expansion unit.
- Mosaic Safety Communication (MSC) allows communication between the various units through a proprietary high-speed safety bus.
KEY FEATURES

- Mosaic is a safety hub able to manage all safety functions of a machinery. **Configurable and scalable**, allows **cost reductions** and **minimal wiring**.

- Mosaic can manage safety sensors and signals such as:
  - Light curtains
  - Photocells
  - Laser scanners
  - Emergency stops
  - Electromechanical switches
  - Guard-lock safety door switches
  - Magnetic switches
  - Safety mats and edges
  - Two-hands controls
  - Hand grip switches
  - Encoders and proximities for safety speed control

ADVANTAGES

Compared to "traditional" electromechanical safety-relays-based safety circuitries, Mosaic has many remarkable advantages, including:

- **Reducing the number of devices** and wiring used and, therefore, the overall size of the project

- **Speeding-up control panel construction**

- Providing **logic configuration** via a quick and **easy-to-use software**. Machine designers are always able to change configuration logic

- Simply adding or removing safety function blocks at any stage of machine design

- Is able to check the logic configuration of the application during the designing phase through the **validation function** and **Simulation** as well as to test it during the installation through the **monitor function**

- Allows **tamper-proof system** configurations as:
  - detection of any attempts of by-passing the safety devices, always possible with traditional safety relays, through specific tests (i.e. mandatory test of the safety device at the machine start-up)
  - protection against unauthorized changes to the project through a **2-level password**

- All logic is configured through a **graphic interface**. No more laborious wiring is needed as with traditional solutions

- A lower number of electromechanical components also means a **better Performance Level** and, therefore, a **higher Safety Level**

- The project report provides the actual values of PFH, DCavg and MTTFd according to EN 13849-1 and EN 62061

- Master unit M1 configurable via the MSD (Mosaic Safety Designer) graphic interface (provided with each Master unit at no extra cost)
MODULAR SAFETY INTEGRATED CONTROLLER

Connect up to 14 expansion

**MB**
Field-bus units
- Profibus DP
- DeviceNET
- CANopen
- Ethernet/IP
- EtherCAT
- Profinet
- Modbus RTU
- Modbus TCP/IP
- USB

**MCT**
Interface connection units
Interface module allowing the connection of remote expansions via proprietary MSC bus
- M1: 1 connection interface
- MCT2: 2 connection interface

**MV0/MV1/MV2**
Speed monitoring units
- Safety speed monitoring (up to PL e) for: Zero speed control, Maximum speed control, Speed range control, Direction
- MV0: Input for 2 proximity switches
- MV1: Input for 1 incremental encoder and 2 proximity switches
- MV2: Input for 2 incremental encoders and 2 proximity switches

**MOR4/MOR4S8**
Safety relay output units
- MOR4: 4 safety relays with guided contacts
  4 NO contacts (250 VAC 6 A)
  It is possible to select two different configurations via MSD:
  - 4 independent single channel outputs
  - 2 dual channel outputs
  4 input for Start/Restart, interlock and EDM
  Single channel LED signaling
- MOR4S8: As MOR4, with 8 status outputs (PNP 100 mA)

**MR2/MR4**
Safety relay output units
- MR2: 2 safety relays with guided contacts
  2 NO + 1 NC contacts (230 VAC 6 A)
  1 NC contacts for EDM feedback
- MR4: 4 safety relays with guided contacts
  4 NO + 2 NC contacts (240 VAC 6 A)
  2 NC contacts for EDM feedback

**M1**
Master unit
- 8 digital inputs
- 2 input for Start/Restart, interlock and EDM
- 2 pairs OSSD Cat. 4 safety outputs (PNP 400 mA)
- 2 status outputs (PNP 100 mA)
- 4 test outputs (for short-circuits monitoring)
**MODULAR SAFETY INTEGRATED CONTROLLER**

### M1 Master unit

<table>
<thead>
<tr>
<th>Additional inputs</th>
<th>Additional outputs</th>
<th>Additional inputs/outputs</th>
<th>Additional No safety outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MI8/MI16</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input units</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI8</td>
<td>8 digital inputs</td>
<td>2 input for Start/Restart, interlock and EDM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 test outputs</td>
<td>2 status outputs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(for short-circuits monitoring)</td>
<td>(PNP 100mA)</td>
<td></td>
</tr>
<tr>
<td><strong>MI12T8</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input unit with test output</td>
<td>12 digital inputs</td>
<td>2 input for Start/Restart, interlock and EDM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8 test outputs (for short-circuits monitoring)</td>
<td>2 status outputs (PNP 100mA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Can manage up to 4 independent safety mats/edge</td>
<td>8 status outputs (PNP 100mA)</td>
<td></td>
</tr>
<tr>
<td><strong>MO2/MO4</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output units</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MO2</td>
<td>2 pairs OSSD Cat. 4 safety outputs (PNP 400mA)</td>
<td>4 input for Start/Restart, interlock and EDM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 input for Start/Restart, interlock and EDM</td>
<td>2 status outputs (PNP 100mA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 status outputs (PNP 100mA)</td>
<td>4 test outputs (for short-circuits monitoring)</td>
<td></td>
</tr>
<tr>
<td><strong>MO4</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High current output unit</td>
<td>4 single channels or 4 pairs OSSD Cat. 4 safety outputs (PNP 2,0 A)</td>
<td>4 input for Start/Restart, interlock and EDM</td>
<td></td>
</tr>
<tr>
<td><strong>MO4LHCS8</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input/Output unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MO4LHCS8</td>
<td>8 digital inputs</td>
<td>2 input for Start/Restart, interlock and EDM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 pairs OSSD Cat. 4 safety outputs (PNP 400mA)</td>
<td>2 status outputs (PNP 100mA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 input for Start/Restart, interlock and EDM</td>
<td>4 test outputs (for short-circuits monitoring)</td>
<td></td>
</tr>
<tr>
<td><strong>MO8O2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-safety output units</td>
<td>8 digital inputs</td>
<td>2 input for Start/Restart, interlock and EDM</td>
<td></td>
</tr>
<tr>
<td>MOS8</td>
<td>8 status outputs</td>
<td>2 pairs OSSD Cat. 4 safety outputs (PNP 400mA)</td>
<td></td>
</tr>
<tr>
<td><strong>MOS8/MOS16</strong></td>
<td>8 status outputs</td>
<td>2 status outputs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(PNP 100mA)</td>
<td>(PNP 100mA)</td>
<td></td>
</tr>
</tbody>
</table>

New units to the M1 Master unit
MASTER UNIT

Master unit, also usable as a stand-alone device, able to control any other expansion unit. With 8 digital input and 2 safety output pairs.

APPLICATION EXAMPLE

Standalone: To provide protection for a smaller machine connecting for example 1 safety light curtain, 1 e-stop, 1 magnetic sensor and 1 two-hand switch.

As Master unit: To control a more complex system providing protection for bigger machineries.

TECHNICAL FEATURES

- Digital Inputs: 8 digital inputs
- Safety Outputs: 2 OSSD pairs - PNP 400 mA output current
- EDM: 2 inputs for Start/Restart interlock and external device monitoring (EDM)
- Signal Outputs: 2 programmable digital signal outputs - PNP 100 mA output current
- Test Outputs: 4 test outputs for sensor monitoring
- LED Signalling: Input/output status and fault diagnostics
- Configuration: With PC via USB interface using MSD (Mosaic Safety Designer) software
- MSC bus connection: With optional MSC connector
- MCM: Mosaic Configuration Memory optional

ACCESSORIES

MSC Rear Bus connector: necessary to connect the M1 Master unit to any expansion module. As the M1 Master unit can be used as standalone, the bus connector must be ordered separately.

MCM Card (Mosaic Configuration Memory): memory card designed to store the M1 Master unit configuration as a back-up. Can be used to restore the saved configuration onto a new M1 Master unit or to duplicate the current configuration to other M1 Master units.

PART NUMBERS

- 1100000: M1 Master unit
- 1100060: MCM - Memory card
- 1100061: MCS - Rear bus connector
- 1100062: USB cable A–mini B, length 1.8 m
- 1100079: CPM - Polarizing keys for Mosaic connectors
**MI8O2**

**INPUT/OUTPUT EXPANSION UNIT**

Input/output expansion unit. With 8 digital input and 2 safety output pairs it doubles the capabilities of an M1 Master unit.

**APPLICATION EXAMPLE**

To provide more inputs and outputs for a smaller machinery connecting for example extra safety sensors and/or e-stops buttons and to control 2 extra actuators.

- **DIGITAL INPUTS**: 8
- **SAFETY OUTPUTS**: 2
- **EDM/RESTART**: 2
- **TEST OUTPUTS**: 4
- **STATUS OUTPUTS**: 2

**TECHNICAL FEATURES**

- Digital inputs: 8 digital inputs
- Safety outputs: 2 OSSD pairs - PNP 400 mA output current
- EDM: 2 inputs for Start/Restart interlock and external device monitoring (EDM)
- Signal outputs: 2 programmable digital signal outputs - PNP 100 mA output current
- Test outputs: 4 test outputs for sensor monitoring
- LED signalling: Input/output status and fault diagnostics
- Connection to M1: Via MSC connector (included)

**PART NUMBERS**

- 1100010 MI8O2 Expansion unit
- 1100079 CPM - Polarizing keys for Mosaic connectors

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**MI8 - MI16**

**INPUT EXPANSION UNITS**

Input expansion units with 8 or 16 digital inputs increase the number of inputs of an M1 Master unit.

**APPLICATION EXAMPLE**

To provide more inputs for a smaller machinery connecting for example extra safety sensors and/or e-stops buttons.

- **DIGITAL INPUTS**: 8 (MI8) 16 (MI16)
- **TEST OUTPUTS**: 4

**TECHNICAL FEATURES**

- Digital inputs: 8 digital inputs
- Test outputs: 4 test outputs for sensor monitoring
- LED signalling: Input/output status and fault diagnostics
- Connection to M1: Via MSC connector (included)

**PART NUMBERS**

- 1100020 MI8 Expansion unit
- 1100021 MI16 Expansion unit
- 1100079 CPM - Polarizing keys for Mosaic connectors
MI 12T8

INPUT EXPANSION UNIT

Input expansion unit for safety mats and edges. With 12 digital input and 8 test outputs for sensor monitoring.

APPLICATION EXAMPLE

With 8 test outputs can manage up to 4 independent safety mats or edges. Test output signals are used to monitor overloads and short circuits on input lines.

DIGITAL INPUTS
12

TEST OUTPUTS
8

TECHNICAL FEATURES

Digital inputs  12 digital inputs
Test outputs  8 test outputs for sensor monitoring
LED signalling  Input/output status and fault diagnostics
Connection to M1  Via MSC connector (included)

PART NUMBERS

1100022  MI12T8 Expansion unit
1100079  CPM - Polarizing keys for Mosaic connectors

MO2 - MO4

OUTPUT EXPANSION UNITS

Output expansion units with 2 or 4 safety outputs pairs increase the number of safety outputs of an M1 Master unit.

APPLICATION EXAMPLE

To provide more safety outputs in machine where different actuators need to be controlled. For example automatic packaging machines, etc.

SAFETY OUTPUTS
2 (MO2)
4 (MO4)

EDM/RESTART
2 (MO2)
4 (MO4)

STATUS OUTPUTS
2 (MO2)
4 (MO4)

TECHNICAL FEATURES

Safety outputs  MO2 - 2 OSSD pairs - PNP 400mA output current
MO4 - 4 OSSD pairs - PNP 400mA output current
EDM  MO2 - 2 inputs for Start/Restart interlock and external device monitoring (EDM)
MO4 - 4 inputs for Start/Restart interlock and external device monitoring (EDM)
Signal outputs  MO2 - 2 programmable digital signal outputs - PNP 100 mA output current
MO4 - 4 programmable digital signal outputs - PNP 100 mA output current
LED signalling  Input/output status and fault diagnostics
Connection to M1  Via MSC connector (included)

PART NUMBERS

1100030  MO2 Expansion unit
1100031  MO4 Expansion unit
1100079  CPM - Polarizing keys for Mosaic connectors
MR2 - MR4
SAFETY RELAY UNITS
Output expansion units provide 2 (MR2) or 4 (MR4) safety relays outputs with guided contacts connectable to 2 or 4 independent OSSD pairs. These units can also be used separately from the Mosaic system.

APPLICATION EXAMPLE
To provide 2 or 4 guided contact safety relay in applications where there is the need to cut the actuators power supply. Each NO contact is interrupted twice by the integrated safety relays.

TECHNICAL FEATURES
- Safety relays
  - MR2: 2 safety relays with 6 A 250 VAC guided contacts: 2 NO + 1 NC for EDM feedback
  - MR4: 4 safety relays with 6 A 250 VAC guided contacts: 4 NO + 2 NC for EDM feedback
- LED signalling: OSSD output status
- Connection to M1: Via MSC connector (included)

PART NUMBERS
- 1100040 MR2 Expansion unit
- 1100041 MR4 Expansion unit
- 1100079 CPM - Polarizing keys for Mosaic connectors

MOR4
SAFETY RELAY WITH CONFIGURABLE OUTPUTS UNITS
Output expansion units provide 4 configurable safety relays with guided contacts. These units are connected to M1 via MSC bus avoiding to occupy the OSSD to drive the relay.

APPLICATION EXAMPLE
To provide 4 configurable guided contact safety relay. It allows to select the safety category via MSD:
- Safety Cat. 1: 4 independent single channel outputs
- Safety Cat. 2: 4 independent single channel outputs with OTE (Output Test Equipment)
- Safety Cat. 4: 2 independent double channels outputs

TECHNICAL FEATURES
- Safety relays: 4 safety relays with 6 A 250 VAC guided contacts
- EDM: 4 inputs for Start/Restart interlock and external device monitoring (EDM)
- LED signalling: Output status and fault diagnostics LED signalling
- Connection to M1: Via MSC connector (included)

PART NUMBERS
- 1100042 MOR4 Expansion unit
- 1100079 CPM - Polarizing keys for Mosaic connectors
MOR4S8
SAFETY RELAY WITH CONFIGURABLE OUTPUTS UNITS AND 8 SIGNAL OUTPUTS

Output expansion units provide 4 configurable safety relays with guided contacts. These units are connected to M1 via MSC bus avoiding to occupy the OSSD to drive the relay.

APPLICATION EXAMPLE
To provide 4 configurable guided contact safety relay. It allows to select the safety category via MSD:
- Safety Cat. 1: 4 independent single channel outputs
- Safety Cat. 2: 4 independent single channel outputs with OTE (Output Test Equipment)
- Safety Cat. 4: 2 independent double channels outputs

TECHNICAL FEATURES
- Safety relays: 4 relays with 6 A 250 VAC guided contacts
- EDM: 4 inputs for Start/Restart interlock and external device monitoring (EDM)
- LED signalling: Output status and fault diagnostics LED signalling
- Connection to M1: Via MSC connector (included)

PART NUMBERS
- 1100043 MOR4S8 Expansion unit
- 1100079 CPM - Polarizing keys for Mosaic connectors

MO4LHCS8
HIGH CURRENT OUTPUT EXPANSION UNIT

Output expansion unit with 4 high current safety outputs and 4 relative inputs for external feedback contacts (EDM).

APPLICATION EXAMPLE
To provide 2 different high current output configurations (configurable with MSD configuration software)
- Two double independent channels (2 safety outputs per channel with 2 feedback inputs)
- Four single independent channels (1 safety output per channel with 4 feedback inputs)

The module provide 8 programmable signal outputs.

TECHNICAL FEATURES
- Safety outputs: 4 single channels (or 2 double channels) Solid state safety outputs PNP active high
- EDM: 4 inputs for Start/Restart interlock and external device monitoring (EDM)
- Output current: 2A max per channel
- Signal outputs: PNP 100 mA output current
- LED signalling: Output status and fault diagnostics LED signalling
- Connection to M1: Via MSC connector (included)

PART NUMBERS
- 1100032 MO4LHCS8 Expansion unit
- 1100079 CPM - Polarizing keys for Mosaic connectors
MODULAR SAFETY INTEGRATED CONTROLLER

MV0 - MV1 - MV2
SAFETY SPEED MONITORING UNITS
Safety speed monitoring (up to PL e) for: zero speed control, max. speed, speed range and direction.

APPLICATION EXAMPLE
Any applications requiring speed monitoring for a hazardous tool. See the application example on page 34. Maintenance speed control in rail dependent storage and retrieval equipment applications.

TECHNICAL FEATURES
Digital inputs
- MV0 - Input for 2 PNP/NPN proximity switches
- MV1 - Input for 1 incremental encoder (TTL, HTL or SIN/COS) and 1 or 2 PNP/NPN proximity switches
- MV2 - Input for 1 or 2 incremental encoder (TTL, HTL or SIN/COS) and 1 or 2 PNP/NPN proximity switches

Speed thresholds
- Up to 4 logically selectable speed thresholds (freely configurable via MSD) for each logical output (axis)

LED signalling
- Input/output status and fault diagnostics

Connection to M1
- Via MSC connector (included)

ACCESSORIES
SAFECODER - Safety Sin/Cos incremental encoder. See page 14

PART NUMBERS
- 1100077 MV0 - Proximities switch expansion module
- 1100070 MV1T - 1 TTL incremental encoder + 1 or 2 PNP/NPN proximity switches expansion module
- 1100086 MV1TB - 1 TTL incremental encoder (24 VDC) + 1 or 2 PNP/NPN proximity switches expansion module
- 1100071 MV1H - 1 HTL incremental encoder + 1 or 2 PNP/NPN proximity switches expansion module
- 1100072 MV1S - 1 SIN/COS incremental encoder + 1 or 2 PNP/NPN proximity switches expansion module
- 1100073 MV2T - 1 or 2 TTL incremental encoders + 1 or 2 PNP/NPN proximity switches expansion module
- 1100087 MV2TB - 1 or 2 TTL incremental encoders (24 VDC) + 1 or 2 PNP/NPN proximity switches expansion module
- 1100074 MV2H - 1 or 2 HTL incremental encoders + 1 or 2 PNP/NPN proximity switches expansion module
- 1100076 MV2S - 1 or 2 SIN/COS incremental encoders + 1 or 2 PNP/NPN proximity switches expansion module
- 1100079 CPM - Polarizing keys for Mosaic controller connectors

The MV2 module includes two configurable logical outputs and is therefore able to control up to two independent axis (configuration via MSD).

RJ-45 (1 for MV1, 2 for MV2) connectors for encoders and terminal blocks for proximity switches.

Max. input frequency for encoders: up to 500 KHz (300 KHz for HTL encoder).

Max. input frequency for proximity switches: up to 5 KHz.

Any applications requiring speed monitoring for a hazardous tool. See the application example on page 34. Maintenance speed control in rail dependent storage and retrieval equipment applications.
**MCT1 - MCT2**

**REMOTE INTERFACE UNITS**

Interface module allowing the connection of remote expansions units via the MSC bus.

**APPLICATION EXAMPLE**

Ideal solution for the interconnection of the safety functions of more machines on a single production line. MCT1 and MCT2 are not shown in MSD configuration software as do not count as expansions.

**TECHNICAL FEATURES**

| Connection | MCT1 - 1 connection: 1 input or 1 output to be placed at the beginning or at the end of the network  
MCT2 - 2 connections: 1 input and 1 output |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable</td>
<td>Shielded RS 485 serial interface compatible cable (4 wires + shield) via the connector block. We recommend the use of ReeR’s cables for a correct operation of the system</td>
</tr>
<tr>
<td>Total distance</td>
<td>Up to 50 m for each connection (total distance up to 250 m). Max. 5 MCT expansions units</td>
</tr>
<tr>
<td>LED signalling</td>
<td>Module status and fault diagnostics</td>
</tr>
<tr>
<td>Connection to M1</td>
<td>Via MSC connector (included)</td>
</tr>
</tbody>
</table>

**PART NUMBERS**

- 1100058: MCT1 Expansion unit  
- 1100057: MCT2 Expansion unit  
- 1100063: MCT25 - Serial cable for MSC bus transfer 25 m  
- 1100064: MCT50 - Serial cable for MSC bus transfer 50 m  
- 1100065: MCT100 - Serial cable for MSC bus transfer 100 m

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**HM1**

**DISPLAY UNIT**

Alphanumeric display. It displays the messages programmed using the HSD software.

**APPLICATION EXAMPLE**

Used in control panels to display status messages as diagnostic or operation functions of the safety system. Can be also used to display other functioning messages of the machine or the plant.

**TECHNICAL FEATURES**

<table>
<thead>
<tr>
<th>Display</th>
<th>Green display LCD 2x16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ports</td>
<td>2 configurable RS 485 serial ports USB port for messages on display programming</td>
</tr>
<tr>
<td>Inputs</td>
<td>4 inputs for the connection with Mosaic: 2 synchronous serial ports (clock + data) or 4 asynchronous serial ports (data)</td>
</tr>
</tbody>
</table>
| Connection to M1 | HM1 can be connected to Mosaic 3 ways:  
Wired to a status output connected to the serial operator, asynchronous serial connection Max 32 status displayed.  
Wired to 2 status outputs connected to the serial operator, synchronous serial connection Max 16 status displayed.  
Wired to the serial MBx module via RS 485 serial port, All I/O statuses and diagnostic displayed. |

**PART NUMBERS**

- 1100090: HM1 Expansion unit  
- 1100062: USB cable A–mini B, length 1,8 m
MBs
FIELD-BUS EXPANSION UNITS
Expansion unit for connection to the most common industrial Field-bus systems for diagnostics and data communication.

APPLICATION EXAMPLE
In all applications where it is required to communicate between the machine’s safety system and the PLC control.

MBP - Profibus DP
MBD - DeviceNET
MBC - CANopen
MBEC - EtherCAT
MBEI - Ethernet-IP
MBEP - PROFINET
MBU - Universal Serial Bus
MBMR - ModBus RTU
MBEM - ModBus TCP/IP

TECHNICAL FEATURES
Ports
RS 485 serial ports for I/O Bus expansion
USB port for configuration
Connection to M1
Via MSC connector (included)

PART NUMBERS
1100050 MBP Profibus DP expansion module
1100051 MBD DeviceNet expansion module
1100052 MBC CANopen expansion module
1100053 MBEC EtherCAT expansion module
1100054 MBEI Ethernet-IP expansion module
1100085 MBEI2B Ethernet-IP expansion module (with two connectors)
1100055 MBEP PROFINET expansion module
1100056 MBU Universal Serial Bus expansion module
1100082 MBMR ModBus RTU expansion module
1100083 MBEM ModBus TCP/IP expansion module

MOS8 - MOS16
AUTOMATION OUTPUT EXPANSION UNITS
Non-safety output expansion units.

APPLICATION EXAMPLE
Modules for automation where non-safety outputs are required. In this way the Mosaic controller can also be used as a PLC for automation.

STATUS OUTPUTS
8 (MOS8)
16 (MOS16)

TECHNICAL FEATURES
Signal outputs
MOS8 - 8 programmable digital signal outputs - PNP 100 mA output current
MOS16 - 16 programmable digital signal outputs - PNP 100 mA output current
LED signalling
Output status and fault diagnostics
Connection to M1
Via MSC connector (included)

PART NUMBERS
1100091 MOS8 Expansion unit
1100092 MOS16 Expansion unit
### TECHNICAL FEATURES SUMMARY

<table>
<thead>
<tr>
<th>Module</th>
<th>M1</th>
<th>M1B02</th>
<th>M18</th>
<th>M16</th>
<th>M12T8</th>
<th>MO2</th>
<th>MO4</th>
<th>MR2</th>
<th>MR4</th>
<th>MCT1</th>
<th>MCT2</th>
<th>MOR4</th>
<th>S8</th>
<th>MO4SL</th>
<th>MOS8</th>
<th>MO516</th>
<th>MBx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Master unit</td>
<td>Input/Output unit</td>
<td>Input units</td>
<td>Input unit</td>
<td>Output units</td>
<td>Guided contact relay output units</td>
<td>Bus Transfer units</td>
<td>Safety relay configurable output units</td>
<td>High Current Safety Outputs units</td>
<td>Safety speed monitoring units</td>
<td>Safety monitoring units</td>
<td>Automation units</td>
<td>Field bus units</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>USB</td>
<td>yes</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housing for MCM</td>
<td>yes</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection with MSC bus</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>-</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSC connector provided</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>-</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety level</td>
<td>SIL 3 – SILCL 3 according to IEC 61508 - IEC 62061 / PL e – Cat. 4 according to ISO 13849-1</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety inputs</td>
<td>8</td>
<td>8</td>
<td>8-16</td>
<td>12</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety outputs (OSSD)</td>
<td>2 pairs PNP 400 mA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2 - 4 pairs PNP-400 mA</td>
<td>1 - 2 pairs</td>
<td>-</td>
<td>-</td>
<td>4 or 2 PNP 2A max</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programmable status outputs</td>
<td>2 PNP 100 mA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2 - 4 PNP 100 mA</td>
<td>-</td>
<td>-</td>
<td>MOR4 S8 8 PNP 100 mA</td>
<td>-</td>
<td>-</td>
<td>8 - 16 PNP 100 mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test outputs</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Safety relay outputs</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2 NO + 1 NC</td>
<td>4 NO + 2 NC</td>
<td>6 A 250 VAC</td>
<td>4 NO single 6 A 250 VAC or 2 NO pairs 6 A 250 VAC</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start/Restart inputs and External Device Monitoring</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2 - 4</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Led signalling</td>
<td>Input/output status and fault diagnostics</td>
<td>Output status</td>
<td>Input status and fault diag</td>
<td>Output status and fault diag</td>
<td>Fault diag</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply (VDC)</td>
<td>24 ± 20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connections</td>
<td>Removable terminal blocks, screw contacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-10 to 55 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-20 to 85 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection rating</td>
<td>IP 20 for housing / IP 2X for terminal block</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fastening</td>
<td>Rail fastening according to EN 50022-35 standard</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimension (HxWxD)</td>
<td>99 mm x 22.5 mm x 114 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

- Compact design: single module dimensions 22.5 x 99 x 114.5 mm
- Removable terminal blocks, screw contacts
- Input/Output connectors: 24 x 22.5 mm, 6 removable terminal blocks, screw contact
- Possible connection with ReeR MSC rear bus for connection with other expansion modules (not included)
SAFECODER

Safety Sin/Cos incremental encoder, together with Mosaic, comprise a SIL 3 certified safety function for speed monitoring. Available in two models: Shaft or Hollow shaft versions.

APPLICATION EXAMPLE

Any applications requiring speed monitoring of a rotating axis. See the application example on page 32.

Features a robust and reliable interface and the ability to handle high mechanical loads.

TECHNICAL FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft type</td>
<td>Hollow shaft version Ø 12 mm</td>
</tr>
<tr>
<td></td>
<td>Shaft version Ø 10 mm with flat</td>
</tr>
<tr>
<td>Fastening</td>
<td>Safety-Lock™ Allow high rotational speed and high shaft load capacity</td>
</tr>
<tr>
<td>Protection rate</td>
<td>Housing and flange side IP67, shaft IP65 (optional IP67)</td>
</tr>
<tr>
<td>Immunity to interference</td>
<td>Shock and vibration resistant</td>
</tr>
<tr>
<td></td>
<td>Insensitive to strong magnetic fields</td>
</tr>
<tr>
<td>Resolution</td>
<td>2048 pulse rate</td>
</tr>
<tr>
<td>Power supply</td>
<td>SC3 24D2048R - 24 VDC</td>
</tr>
<tr>
<td></td>
<td>SC3 05D2048R - 5 VDC</td>
</tr>
<tr>
<td></td>
<td>SC3 24B2048R - 24 V VD</td>
</tr>
<tr>
<td></td>
<td>SC3 05B2048R - 5 V VD</td>
</tr>
<tr>
<td>Connector</td>
<td>Radial M12</td>
</tr>
</tbody>
</table>

PART NUMBERS

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1100102</td>
<td>SC3 24D2048R - 24 V Hollow Shaft version Ø 12 mm</td>
</tr>
<tr>
<td>1100103</td>
<td>SC3 05D2048R - 5 V Hollow Shaft version Ø 12 mm</td>
</tr>
<tr>
<td>1100104</td>
<td>SC3 24B2048R - 24 V Shaft version Ø 10 mm with flat</td>
</tr>
<tr>
<td>1100105</td>
<td>SC3 05B2048R - 5 V Shaft version Ø 10 mm with flat</td>
</tr>
<tr>
<td>1330930</td>
<td>CBD5 SH - M12 straight connector, 8 poles, pre-wired shielded cable 5 m</td>
</tr>
<tr>
<td>1330931</td>
<td>CBD10 SH - M12 straight connector, 8 poles, pre-wired shielded cable 10 m</td>
</tr>
<tr>
<td>1330932</td>
<td>CBD15 SH - M12 straight connector, 8 poles, pre-wired shielded cable 15 m</td>
</tr>
<tr>
<td>1330933</td>
<td>CBD95 SH - M12 90° angled connector, 8 poles, pre-wired shielded cable 5 m</td>
</tr>
<tr>
<td>1330934</td>
<td>CBD910 SH - M12 90° angled connector, 8 poles, pre-wired shielded cable 10 m</td>
</tr>
<tr>
<td>1330935</td>
<td>CBD915 SH - M12 90° angled connector, 8 poles, pre-wired shielded cable 15 m</td>
</tr>
</tbody>
</table>

NOTE: Cable supplied with M12 8-poles connector at one end only. The other side must be cut off at correct length and crimped with RJ45 connector (not included).
MCM
MOSAIC CONFIGURATION MEMORY

<table>
<thead>
<tr>
<th>Model</th>
<th>Ordering code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCM</td>
<td>1100060</td>
<td>Mosaic Configuration Memory - Memory Card</td>
</tr>
</tbody>
</table>

MSC
MOSAIC SAFETY COMMUNICATION

<table>
<thead>
<tr>
<th>Model</th>
<th>Ordering code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSC</td>
<td>1100061</td>
<td>Mosaic Safety Communication - Connector</td>
</tr>
</tbody>
</table>

CSU
USB A CABLE

<table>
<thead>
<tr>
<th>Model</th>
<th>Ordering code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSU</td>
<td>1100062</td>
<td>USB A cable – mini B, length 1,8 m</td>
</tr>
</tbody>
</table>

CPM
POLARIZING KEYS

<table>
<thead>
<tr>
<th>Model</th>
<th>Ordering code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPM</td>
<td>1100079</td>
<td>Polarizing keys for Mosaic controller connectors</td>
</tr>
</tbody>
</table>

MCT
SERIAL CABLE FOR MSC BUS TRANSFER

<table>
<thead>
<tr>
<th>Model</th>
<th>Ordering codes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC25</td>
<td>1100063</td>
<td>MCT serial cable for MSC bus transfer 25 m</td>
</tr>
<tr>
<td>MC50</td>
<td>1100064</td>
<td>MCT serial cable for MSC bus transfer 50 m</td>
</tr>
<tr>
<td>MC100</td>
<td>1100065</td>
<td>MCT serial cable for MSC bus transfer 100 m</td>
</tr>
</tbody>
</table>

MPD
PULL-DOWN ADAPTER

<table>
<thead>
<tr>
<th>Model</th>
<th>Ordering code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPD</td>
<td>1350150</td>
<td>Pull-down resistor</td>
</tr>
</tbody>
</table>

Each kit MPD contains 2 adapters
CONFIGURATION SOFTWARE

Mosaic M1 is equipped with a 2.0 USB mini interface for connection to a Personal Computer where MSD software is installed.

Drag&Drop configuration of all safety functions.

Functional validation of design.

Real-time I/O monitoring.

Project report with the following information:
- Project name
- Mosaic: Configuration
- Mosaic: Safety Information (PFHd, MTTFd, DCavg)
- Resources used

2-level passwords management for the prevention of unauthorised accesses and therefore of incidental modifications or tampering of the system configuration.

Log File with project date of creation and related checksum (CRC 4-digit hexadecimal identification) is stored in the M1 module.

The image here below illustrate the main screen of the MSD software.
# MAIN FUNCTIONAL BLOCKS

## Input objects

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Configurable for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-stop (emergency stop)</td>
<td></td>
<td>1 NC or 2 NC inputs</td>
</tr>
<tr>
<td>Photocell (Type 2 safety photocell)</td>
<td></td>
<td>Input for photocells that need external controller. Specific output test is required</td>
</tr>
<tr>
<td>Single E-gate (safety gate device)</td>
<td></td>
<td>2 NC or 1 NC + 1 NO inputs</td>
</tr>
<tr>
<td>Mod-sel (safety selector)</td>
<td></td>
<td>2, 3 or 4 position selectors inputs. Specific output test is not required</td>
</tr>
<tr>
<td>Testable safety device</td>
<td></td>
<td>1 NC, 1 NO, 2 NC or 1 NC + 1 NO inputs</td>
</tr>
<tr>
<td>Two-hand (bi-manual control)</td>
<td></td>
<td>2 NO (EN 574 III A) or 2 NO + 2 NC (EN 574 III C) inputs</td>
</tr>
<tr>
<td>Footswitch (safety pedal)</td>
<td></td>
<td>1 NC, 1 NO, 2 NC or 1 NO + 1 NO inputs</td>
</tr>
<tr>
<td>S-mat (safety mat or safety edge)</td>
<td></td>
<td>4 wires technology. 2 inputs Specific output test is required on 2 wires</td>
</tr>
<tr>
<td>Enable (enable key)</td>
<td></td>
<td>1 NO or 2 NO inputs</td>
</tr>
<tr>
<td>Enable grip switch</td>
<td></td>
<td>2 NC or 2 NO + 1 NC inputs</td>
</tr>
<tr>
<td>ESPE (optoelectronic safety light curtain / laser scanner)</td>
<td>Safety optoelectronics sensors with static OSSD, self-controlled output Dual channel inputs</td>
<td>More info: Automatic or Manual Reset on page 23</td>
</tr>
<tr>
<td>Lock feedback</td>
<td>It verifies the lock status of the guard lock device for mobile guard or safety gate. More info: Safety guard lock operator on page 21</td>
<td>In the case where the inputs indicate that the guard is locked the Output will be 1 (TRUE). Otherwise the output is 0 (FALSE)</td>
</tr>
<tr>
<td>Solid state device</td>
<td>Generic safety sensors with static OSSD self-controlled outputs Dual channel inputs</td>
<td></td>
</tr>
<tr>
<td>Network_In</td>
<td>This input must be used in case of connection between Mosaic OSSD output and the input of another Mosaic to realize a network. More info: Network_In on page 23</td>
<td></td>
</tr>
</tbody>
</table>
Input objects

Switch
Input for non safety switches or non safety signals. E.g.: restart button, position switch, enable signals etc.

Sensor
Input for non safety sensors or non safety signals. E.g.: muting sensors, enable signals etc.

Fieldbus input
Allows to receive signals (up to 8 bits) from the machine control unit via the field-bus module. The signal is connected directly into the diagrams without using any input block. Warning: FIELDBUS inputs are not a safety signals

Fixed input
Input fixed to logic level 0 (Low) Input fixed to logic level 1 (High)

Speed monitoring objects

Stand still
Check that the speed is zero or not greater than the values set

Stand still and speed control
Check that the speed does not exceed the values set for both the max. speed and zero speed

Speed control
Check that the speed is not greater than the values set

Window speed control
Check that the speed is not lower or higher than the values set

Output objects

OSSD (category 4 safety outputs)
PNP safety static outputs (dual channel, 400 mA). The 2 outputs cannot operate independently

Relay
The Output relay is a NO relay output. Relay outputs are closed when the input is equal to 1 (TRUE), otherwise they are open (FALSE)

Status (signal output)
PNP static outputs (single channel, 100 mA). Can be connected to any point in the project

Fieldbus probe output
Allows to send signals (up to 16 bits) to the machine control unit via the field-bus module. The signal is connected directly into the diagrams without using any output block

Serial Output
It makes possible the transmission of information status to a PLC or HM1 without the need to use fieldbus modules. The Serial Output operator outputs the status of up to 8 inputs, serializing the information. Max. number of operators: 4 - total 32 information status

- The serial line can be:
  - Synchronous (1 clock + 1 data output)
  - Asynchronous (1 Manchester coding data output). For a typical application sample, see HM1 on page 12
### Logical operators - Up to 64 logical operator can be used

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AND</strong></td>
<td>Logical AND returns an output of 1 (TRUE) if all the inputs are 1 (TRUE)</td>
</tr>
<tr>
<td><strong>NAND</strong></td>
<td>Logical NAND returns an output of 0 (FALSE) if all the inputs are 1 (TRUE)</td>
</tr>
<tr>
<td><strong>NOT</strong></td>
<td>Logical NOT inverts the logical status of the input</td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td>Logical OR returns an output of 1 (TRUE) if at least one of the inputs is 1 (TRUE)</td>
</tr>
<tr>
<td><strong>NOR</strong></td>
<td>Logical NOR returns an output of 0 (FALSE) if at least one of the inputs is 1 (TRUE)</td>
</tr>
<tr>
<td><strong>XOR</strong></td>
<td>Logical XOR returns an output 0 (FALSE) if the input's number at 1 (TRUE) is even or the inputs are all 0 (FALSE)</td>
</tr>
<tr>
<td><strong>XNOR</strong></td>
<td>Logical XNOR returns an output 1 (TRUE) if the input's number at 1 (TRUE) is even or the inputs are all 0 (FALSE)</td>
</tr>
</tbody>
</table>

#### 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 input 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 input values

#### Logical macro

Groupings can be created with a maximum of three operators of different types for a total of max. 8 inputs.

This allows to increase the maximum number of operators used.

#### Memory operators

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D FLIP-FLOP</strong></td>
<td>The D FLIP-FLOP operator saves the previously set status on output Q</td>
</tr>
<tr>
<td><strong>SR FLIP-FLOP</strong></td>
<td>SR FLIP-FLOP operator brings output Q at 1 with Set, 0 with Reset</td>
</tr>
<tr>
<td><strong>USER RESTART MANUAL</strong></td>
<td>The USER RESTART MANUAL operator saves the restart signal according to the Inputs: In, Rising edge input and Clear</td>
</tr>
</tbody>
</table>
### Memory operators

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T FLIP-FLOP</td>
<td>This operator switches the Q output at each rising edge of the T input (Toggle)</td>
</tr>
<tr>
<td>USER RESTART MONITORED</td>
<td>The USER RESTART MONITORED operator is used to save the restart signal according to the inputs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macro restart manual</td>
<td>Used to combine a logic gate chosen by the user with the Restart Manual functional block USER RESTART MANUAL</td>
</tr>
<tr>
<td>Macro restart monitored</td>
<td>Used to combine a logic gate chosen by the user with the Restart Manual functional block USER RESTART MONITORED</td>
</tr>
</tbody>
</table>

### Timer operators

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monostable operator</td>
<td>The MONOSTABLE operator generates a level 1 (TRUE) output activated by the rising edge of the input and remains in this condition for the set time</td>
</tr>
<tr>
<td>Monostable B operator</td>
<td>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</td>
</tr>
<tr>
<td>Passing make contact</td>
<td>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</td>
</tr>
<tr>
<td>Delay</td>
<td>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</td>
</tr>
<tr>
<td>Clocking operator</td>
<td>This operator has up to 7 inputs to control the output Duty Cycle. Related to the selected input, this operator will generate a clock with different duty cycle. It can be used, for example, to pass or receive the status information to or from a PLC. More info: Clocking Operator on page 24</td>
</tr>
</tbody>
</table>

### Safety guard lock operator

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guard lock</td>
<td>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 More info: Guard lock operator on page 26</td>
</tr>
</tbody>
</table>

### Network operator

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network</td>
<td>Is a serial connection (Loop) of several Mosaic M1 Master unit (with possible expansions). This operator allows stop and reset commands to be distributed in a simply Mosaic network More info: Network operator on page 26</td>
</tr>
</tbody>
</table>

### Counter operator

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counter operator</td>
<td>COUNTER operator is a pulse counter that sets output Q to 1 (TRUE) as soon as the desired count is reached. There are 3 operating modes: Automatic, Manual, Automatic + Manual</td>
</tr>
</tbody>
</table>
### Interpage operator

**Interpage**
The operator INTERPAGE is used to connect parts of the diagram without trace physically the linking. Simply assign the same link identifier operators to Interpage In and Interpage Out.

Operators Interpage that allow connection of parts of the diagram only by assigning a name to the connection identifier. More info: Interpage operators on page 27

### Reset operator

**Reset M1 operator**
This operator resets the MOSAIC system in presence of errors on the inputs or outputs.

This operator generates a reset of the system when the corresponding input is a double transition OFF-ON-OFF of less than 5s. More info: Reset M1 operator on page 24

### Muting operator objects

<table>
<thead>
<tr>
<th>Muting object</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L Muting</strong></td>
<td>With 2 Muting sensors for one-way openings (exit only) Suitable solution for any applications of pallet exit</td>
</tr>
<tr>
<td><strong>T Muting</strong></td>
<td>With 2 Muting sensors for two-way openings (entry/exit) Suitable solution for the most common pallet infeed/outfeed applications</td>
</tr>
<tr>
<td><strong>T Muting “Sequential”</strong></td>
<td>With 4 Muting sensors for two-way openings (entry/exit), Suitable solution for transparent material and application with presence of a pallet with reduced width or not centred with respect to the conveyor. More info: T Muting «Sequential» on page 24</td>
</tr>
<tr>
<td><strong>T Muting “Concurrent”</strong></td>
<td>With 4 Muting sensors for two-way openings (entry/exit), Suitable solution for transparent material and application with presence of a pallet with reduced width or not centred with respect to the conveyor. More info: T Muting «Concurrent» on page 25</td>
</tr>
<tr>
<td><strong>Muting override</strong></td>
<td>Are available two selectable functional mode: Override with hold to run action Override with one pulse action More info: Muting override on page 25</td>
</tr>
</tbody>
</table>
INSIGHTS

A DETAILED LOOK INTO THE MOST INTERESTING FEATURES OF MOSAIC

Property window

The property window of each function block allows configuring each block parameters in a simple and easy way.

This allows achieving an important level of customisation for each project tailoring Mosaic behaviour to each particular application.

E-gate configuration example

Network_In

This function block creates a network input interface connection, generating on the OUT output a logical level high (1) when the line is high, 0 otherwise.

This input can only be allocated to M1.

Network_IN Object

They must be physically connected terminals related to an output OSSD or the first Mosaic system status to Network_in inputs of the second Mosaic system.

Automatic or Manual Reset

Manual Reset: if selected this enables the input request to reset each time the area protected by the safety light curtain is occupied. Otherwise (Automatic Reset), enabling of the output directly follows the input conditions.

ESPE configuration example

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 and monitored reset
**Reset M1 operator**

This operator resets the Mosaic system in presence of errors on the inputs or outputs.

**Connection of Reset operator**

This operator generates a reset of the system when the corresponding input is a double transition OFF-ON-OFF of less than 5s.

**Clocking Operator**

This operator has up to 7 inputs to control the output Duty Cycle.

Related to the selected input, this operator will generate a clock with different duty cycle.

**Example of Sequential Muting parameters configuration**

Enable only button: It is possible to enable/disable the Muting function depending on the sequence of the machine. This increase the safety.
T Muting «Concurrent»

The activation of the Muting function occurs following interruption of the sensors S1 and S2 beams and then of the sensor S3 and S4: the two sensor must be interrupted within a configurable safety timeout (sensor time) the maximum duration of the Muting status is limited by a timeout.

S1 --X sec. --> S2 ---t---S3 --X sec. --> S4

Where t is a value that depends on the “timeout”, X is the “sensor time”.

If available the “Minimum sensors time option” that allows you to stop the Muting function if the passage in front of the sensors 1-2 and 3-4 takes place with a time less than 150 ms. In this way it is possible to detect the transit of a person much faster than a pallet.

Muting override

This function allows you to locally restore the safety function of the light curtain after an engaged of the light curtain not related to a normal Muting sequence.

There are also the following signalling outputs:
- Request = need to override
- OverOut = override active

Example of Sequential Muting parameters configuration

Muting closing button: It is possible to use the light curtain as sensor and anticipate the Muting closure the moment the light curtain is free instead waiting the third Muting sensor.
Guard lock operator

The Gate input is connected to the functional block e-Gate. This is an example of Guard lock configuration.

Sample of Guard lock operator connection
1. The Lock_fbk input is connected to the functional block Lock_fbk (feedback from the lock)
2. The UnLock_cmd input (unlocks command) is connected to an input switch
3. The signal output will be 1 if the door is closed and the guard lock is locked
4. When an unlock command is applied to the input (UnLock_cmd), the output signal will be set to “0” and after a programmable time Time_Lock (2 sec. in the example) the guard lock is unlocked through the LockOut output

Network operator

It allows loop connection (Loop) of several Mosaic M1 Master unit (with possible expansions). This operator allows stop and reset commands to be distributed in the Mosaic network.
**Speed monitoring object configuration example**

Example of speed monitoring of one axis. Monitoring of stand still and speed control with selectable 2 thresholds.

**Interpage operators**

Interpage operators is a label assigning a name to a certain logical interconnection.

Considerable simplification and readability of the diagram.

To simplify the names assignment a drop-down menu, that lets you choose the name of the “Interpage out” among those assigned to the operators “interpage in”

**Interpage operator advantages**
REAL TIME MONITOR

The I/O MONITOR allows the real-time monitoring of all the I/Os of a Mosaic system and the diagnostic information about a working system.

/ VISUALIZATION 

Graphic visualization

Text visualization

Real time Monitor
The Simulator allows to verify the functionality and correct operations of a project created with MSD before the assembly of the machinery.

It allows activate the inputs of the system manually or in a programmed way in order to ensure the outputs gained are correct.

Note: The simulation feature is available with MSD version 1.5 and M1 firmware version 3.0 or higher.

SCHEMATIC SIMULATION

The schematic simulation allows to "start" the project via a dedicated menu and to operate directly on any of the inputs to verify the logic of the system.

Simulation can start, stop or restart via dedicated menu

Timings setting
When timer operators are included in the actual configuration.

Clicking on the button on the lower right of each input block it is possible to toggle its output status.

Likewise in the monitor function, also in this case the color of the line indicates the signal status: green means the signal is at LL1, red means the signal is at LL0.
MANAGING GRAPHIC SIMULATION

The graphic simulation allows to load a number of programmed inputs status change and to verify the logic of the system as a graphical output diagram. This methodology allows to create templates replicating the exact functionality of a machinery and apply them on different projects.

Template Stimuli
Based on the schematic loaded, it creates a template file to fill with the desired values. The user can modify the status of the input signals in a certain time.

Parameter Editor
The user must save the file with the required name and open it again with a text editor to modify the parameters.

Simulation with Stimuli
Load the template file saved and starts the simulation.

Load simulation
With this feature is it possible to load a previous completed simulation.

Traces visibility
With this option the user could select the traces (waveform signal) to be displayed in the graph or not.

Ad the end of the simulation a graph with all the resulting signals is showed.
HSD SOFTWARE
MESSAGES EDITOR FOR HM1 DISPLAY

HSD is the editor software that allows programming of the device HM1

HM1 can be connected to Mosaic system in 3 ways:

1. Wired to a status output connected to the serial operator, asynchronous serial connection. Max 32 status displayed. See picture 1
2. Wired to 2 status outputs connected to the serial operator, synchronous serial connection. Max 16 status displayed. See picture 2
3. Wired to the serial MBx module via RS 485 serial port, All I/O statuses and diagnostic displayed

The digital signals from the output status or serial can be converted to display messages on the display HM1 through this HSD editor software.
SAFETY MANAGEMENT OF A PALLETIZING SYSTEM WITH TWO ROBOTIC CELLS

The system comprises a conveyor that transports boxes to two robotic palletization cells.

The machine is completely protected by a fence with three access gates (one for each robotic cell and one for the conveyor area) equipped with a safety switch. When the gate of the robotic cell is open, the corresponding robot stops. When the conveyor area gate is open, the entire plant stops.

The completed pallets are collected by a forklift truck through the access gate which is protected by a safety light curtain. The access of the forklift truck for collecting the pallet, when the robot is stopped in the rest position, by reason of the safety light curtains, prevents the robot to start.

In all other phases of processing, occupation of each light curtain causes the related robot to stop. The related manual restart control is located close to each light curtain. The system is equipped with four emergency push buttons (e-stop).

Total safety devices: 2 safety light curtains, 2 restart buttons for the safety light curtains, 3 safety gate switches, 4 emergency push buttons.

Using conventional components – safety relay modules – to build up the safety circuit, it would be necessary to use at least six safety modules, wired to each other in order to perform the required functions: 2 safety relays for the light curtains, 3 safety relays for the gate switches, 1 safety relay for the emergency stop chain.

Solution with Mosaic

Using Mosaic to build up the safety circuit, it is sufficient to use:
- 1 M1 Master unit
- 1 MI8O2 expansion unit

Note 1: The Reset buttons are not displayed on the diagram because they are directly connected to the feedback of the OSSD safety outputs (inputs FBK_RST1, FBK_RST2). The 4 E-STOP are connected in series and in the diagram they are represented with a single block.

Note 2: 3 operators Interpage (2 In and 1 Out) were included in the diagram. These allow you to link the inputs and outputs of the logic gates “&” without having to draw the line.

16 inputs - 4 OSSD pairs - 8 test outputs - 4 signal outputs
SAFETY MANAGEMENT OF A MACHINING CENTRE WITH ALTERNATE LOAD / UNLOAD

The operator is required to load and unload the workpiece. The machine is protected by two horizontal safety light curtains. In this case, each light curtain must be equipped with the Muting function so as to permit access to the hazardous area by personnel during the non-hazardous part of the machine cycle.

Depending on the position of the tool, which is the hazardous element, one of the two light curtains (the one facing the tool working area) is active, while the other is muted so that the operator can load/unload the workpiece.

The Muting condition of the two safety light curtains will then be inverted when the tool is required to operate on the opposite side of the machine.

The machine is completely protected by a fence with an access gate equipped with a safety switch. When the gate is opened, the machine stops. The related manual restart control is located close to each safety light curtain. The system is equipped with three emergency push buttons which, if activated, stop the machine.

Total safety components: 2 safety light curtains, 2 restart buttons for the safety light curtains, 1 safety gate switch, 3 emergency push buttons.

Using conventional components – safety relay modules – to build up the safety circuit, four safety modules would be necessary: 2 safety modules for the safety light curtains with Muting function, 1 safety module for the gate switch, 1 safety module for the emergency stop.

Solution with Mosaic

Using Mosaic to build up the safety circuit, it is sufficient to use:
- 1 M1 Master unit
- 1 MI8 expansion unit

Which provide a total of:

Note: The Reset buttons are not displayed on the diagram because they are directly connected to the feedback of the OSSD safety outputs (inputs FBK_RST1, FBK_RST2).

The 3 E-STOP are connected in series and are represented in the diagram with a single block.

The diagram also shows 2 status outputs used to drive the indication lights of the active Muting.

16 inputs - 2 OSSD pairs - 8 test outputs - 2 signal outputs
SPEED MONITORING FOR A HAZARDOUS TOOL

In this example, to place or remove tooling or to perform maintenance activity where is necessary for the operator to enter the dangerous area.

As long as the tool is working at the normal speed the GUARD LOCK is locked and the access to the hazardous area is not allowed.

Access to the hazardous area is allowed either when the working cycle is over or when the operator switches the MOD SEL to “Access Request”. When the tool stops the lock is unlocked and allows the opening of the door. In this case the speed controller verifies that the tool is stopped (zero speed).

For maintenance, it is necessary that the system operates at reduced speed. The operator will have to act on the selector (MOD-SEL) and bring it in the “Maintenance” position. When the tool stops the lock is unlocked and allows the door opening. If the tool has to be kept moving for maintenance reasons as the operator is inside the hazardous area, this is possible through the Grip Switch. The speed monitoring device detects whether the speed of the tool is under a defined threshold set through the MSD. If the threshold is exceeded or the Grip Switch is released the machine is immediately stopped.

On the operator panel are available the emergency stop (e-stop) button and reset button to restore the normal operating conditions of the safety lock after the operator intervention.

Using Mosaic to build up the safety circuit, it is sufficient to use:
- 1 M1 Master unit
- 1 MI6 expansion unit
- 1 MV0 expansion unit for safety speed monitoring

Comments

Using Mosaic, all the safety logic circuitry is implemented using the graphic interface and not by hard-wiring the outputs of the relay modules to each other. Correct functioning of the logic circuitry is checked during the design phase by the validation function and can be tested with the simulation and monitor function during installation. During the design phase, safety functions can be easily added or removed, for example adding other sensors or zones. Start up tests can be inserted in order to detect any attempt of by-passing the safety system, which is always a possibility with traditional relay modules.
TYPICAL APPLICATIONS

Pallets production machines

Wood-working machinery

Painting machines for wood-working industry

Handling machines for wood-working plants

Wood-working machines squaring edgebanders

Robot

Plastic film production machines

AGV (Automatic Guided Vehicle)

Pad printing machines

Bending machines
APPLICATION EXAMPLES

Palletising systems

Palletising and bottling plants

Crate packer/unpacker and palletising systems

Beam drilling and sawing machines

Panel sizing saws

Vertical lift storage system

Rail dependent storage and retrieval equipment

Industrial boilers

Industrial thermal processes
More than 50 years of quality and innovation

Founded in Turin (Italy) in 1959, ReeR distinguished itself for its strong commitment to innovation and technology.

A steady growth throughout the years allowed ReeR to become a point of reference in the safety automation industry at a worldwide level.

The Safety Division is in fact today a world leader in the development and manufacturing of safety optoelectronic sensors and controllers.

ReeR is ISO 9001, ISO 14001 and BS OHSAS 18001 certified.