

Mode Switching Safety Module Datasheet

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Overview

The Mode Switching Safety Module (CE-SA-018-0001), is intended to interface up to 4 safety devices with the MachineMotion V2. It can interface with area scanners, light curtains and other safety devices to perform safety functions. The minimum configuration is 2 safety devices and a MachineMotionV2, the two unused ports have to be populated with device jumpers. A safety function is a function which reduces risk, if a safety function was to be removed, the users would be subject to increased risk. Every safety equipment deployment should be paired with a safety assessment.

Features

- Configuration-free, plug-and-play
- Compatible with MachineMotion V2
- Daisy-chainable
- Compatible with Datalogic SG4 & Keyence GL-R light curtains
- Compatible with Datalogic & Keyence laser scanners
- Inputs for 2 pairs of muting sensors (CE-AP-002-0000 compatible)
- On-board LED to indicate power, fuse and communication
- RGB LED for any other status (software programmable)
- Reports safety states to the MachineMotion
- Mode switching in applications without full body entry

Included cables

- 1x Safety Extension cable (5m) - CE-CA-102-5001__2
- 2x Safety Device Jumper - CE-SA-125-0001
- 1x Safety Jumper - CE-SA-102-0001

Safety



Vention's safety modules perform safety functions as a part of a whole installation or machine. A complete safety system normally includes sensors or input units, logic units and contactors or output units. The manufacturer of the installation or machine is responsible for ensuring proper functioning of the whole system. The total concept of the control system into which the safety module is integrated must be validated by the user. Vention cannot guarantee all specifications of an installation or a machine without being responsible for the risk assessment and the design of the safety system. Vention takes over no liability for recommendations which are given or implied in the following description.

The following items must be taken into consideration during the design, risk assessment & installation of the safety system :

- The Safety Modules shall be put into operation only after the safety functions have been tested during the commissioning.
- According to EN IEC 60204-1:2018 and EN ISO 10218-1:2011 it is not allowed to restart automatically after emergency stop. Therefore the control systems of the connected devices have to disable the automatic start after emergency stop.
- Opening the Safety Module or implementing unauthorized changes voids any warranty.



Functional error! Danger to life, risk of serious injuries or property damage

- The Mode Switching Safety Module may only be connected to the equipment listed in this manual.
- The Mode Switching Safety Module does not monitor the input redundant signals at the safety device ports. If the connected devices do not have monitoring of its output signals, the performance level of the safety function can be reduced.
- Mode switching is not designed for full body entry. As there is no latch on the monitoring of the safety device ports 1A and 2A, it is not acceptable to allow full body entry.
- When using the mode switching function, it shall be ensured that the safety device ports 1B and 2B represent the safe state of the application. As there is no latch on the monitoring of the safety device ports 1B and 2B, these safety inputs shall always be low if the machinery is in an unsafe state or location.
- The risk assessment shall demonstrate that when triggering the safety devices connected to the Device ports, the state of the machine and the safety distance are acceptable;
- The Smart Safety Module is designed to operate in indoor environments without dust or high humidity. Dust and dampness may lead to malfunction. Do not install or operate the Safety Module outdoors.
- The machine shall be designed in such a way that it is not possible to press the reset button from inside a safeguarded area without triggering one of the devices connected to the Device ports.

Technical specs

General Specifications

| Item | Specification |
|----------------|--|
| Part Number | CE-SA-018-0001 |
| Weight | 0.8kg |
| Dimensions | 19.0 x 15.0 x 9.0mm |
| Material | <ul style="list-style-type: none">• Bottom enclosure: Aluminum• Top enclosure: Aluminum |
| Operating Temp | 0 to 40°C |

Electrical Specifications

| Item | Specification |
|-----------------------------|---|
| Nominal input voltage | 24 VDC (Class 2 or SELV power supply)** |
| Input voltage range | 19.2 ~ 26.4 VDC |
| Operating power consumption | <ul style="list-style-type: none"> • With light curtains (TX and RX): 8.4 W • With laser scanner: 8.4 W |
| Peak power consumption | <ul style="list-style-type: none"> • With light curtains (TX and RX): 18.6 W • With laser scanner: 42 W |
| Short circuit protection | Internal E-FUSE IC* |
| Max current allowed | 2 A |
| Post-short current | 250 mA |
| Release delay at 24 V | < 40 ms |

*Note: Due to the inrush of safety devices, the E-FUSE might trip if you power the unit while 4 or more Safety devices are plugged into it. To fix this issue, you can remove power from the MachineMotion and start it again.

** Note: In North America the Safety Module shall be supplied by a certified class 2 power supply. In Europe, the Safety Module must be supplied by an SELV circuit. When powered by the MachineMotion those requirements are met.

Physical Interface



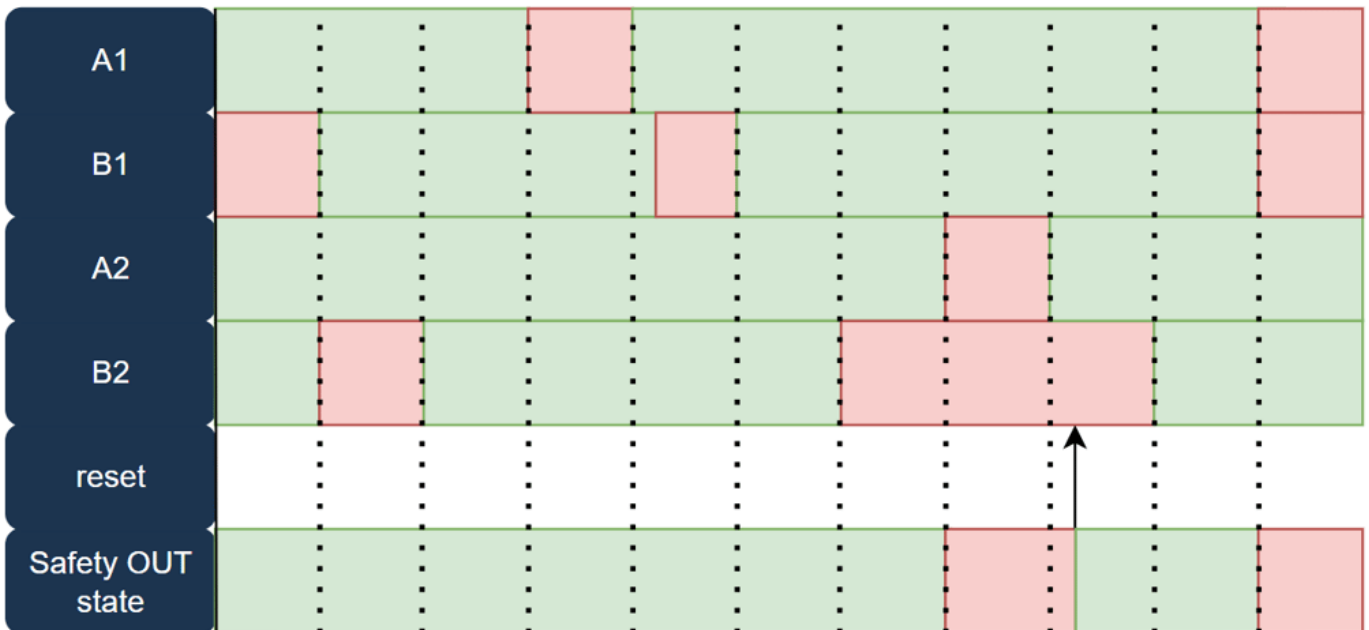
Figure 1: Physical Interface

LED Indicators

| Name | LED Color | Indicated (when ON) |
|--------|---------------|-----------------------------------|
| POWER | White | 24 VDC supplied to module |
| COMM | White | EtherNet communication functional |
| FUSE | Red | Module internal fuse tripped |
| STATUS | Off | Disconnected |
| STATUS | Green | Connected |
| STATUS | White | Communication issue |
| STATUS | Orange | Error |
| STATUS | Red | E-Stop |
| STATUS | Blinking Red | User triggered E-Stop |
| STATUS | Blinking Blue | Mode Switching |

Functionality

If device A and device B are triggered, a Safety OUT state will be triggered. The Safety OUT state is latched until a manual reset is engaged. There are two groups of mode switching (Zone 1 and Zone 2).



Port Definitions



Figure 3: Mode Switching Safety module ports

Safety OUT - Pin-out - M12, male, 12-pin, A-Keyed

The Safety OUT port connects to the SAFETY IN port of another Safety Module (if daisy-chaining multiple safety modules) or to a MachineMotionV2.

| Pin | Function |
|-------|---------------|
| Pin 1 | 24 VDC |
| Pin 2 | 0V |
| Pin 3 | SAFETY OUT 11 |
| Pin 4 | SAFETY OUT 12 |
| Pin 5 | SAFETY OUT 21 |
| Pin 6 | SAFETY OUT 22 |

| Pin | Function |
|--------|--------------------------|
| Pin 7 | RESET +(24V) |
| Pin 8 | RESET - (OUTPUT) |
| Pin 9 | ETHERNET TX+ (auto-MDIX) |
| Pin 10 | ETHERNET TX- (auto-MDIX) |
| Pin 11 | ETHERNET RX+ (auto-MDIX) |
| Pin 12 | ETHERNET RX- (auto-MDIX) |

Safety IN - Pin-out - M12, female, 12-pin, A-Keyed

The Safety IN port connects to the SAFETY OUT port of another Safety Module (if daisy-chaining multiple safety modules) or to an E-Stop and Reset Module (CE-SA-007-0000). IMPORTANT: If the SAFETY IN port is not used, insert the included yellow jumper.

| Pin | Function |
|--------|--------------------------|
| Pin 1 | 24 VDC |
| Pin 2 | 0V |
| Pin 3 | SAFETY IN11 |
| Pin 4 | SAFETY IN 12 |
| Pin 5 | SAFETY IN 21 |
| Pin 6 | SAFETY IN 22 |
| Pin 7 | RESET +(24V) |
| Pin 8 | RESET - (OUTPUT) |
| Pin 9 | ETHERNET TX+ (auto-MDIX) |
| Pin 10 | ETHERNET TX- (auto-MDIX) |
| Pin 11 | ETHERNET RX+ (auto-MDIX) |
| Pin 12 | ETHERNET RX- (auto-MDIX) |

Device 1A/B & 2A/B - Pin-out - M12, female, 12-pin, A-Keyed

| Pin | Function |
|-------|-----------|
| Pin 1 | 24V fused |
| Pin 2 | 0V |
| Pin 3 | NC |

| Pin | Function |
|--------|--------------|
| Pin 4 | NC |
| Pin 5 | OSSD input 1 |
| Pin 6 | NC |
| Pin 7 | NC |
| Pin 8 | OSSD input 2 |
| Pin 9 | NC |
| Pin 10 | NC |
| Pin 11 | NC |
| Pin 12 | NC |

Mounting

Install the module mounting bracket (CE-HW-005-1002) to the extrusion with the screws provided (HW-FN-003-0018). Install the module onto the mounting bracket as illustrated below.

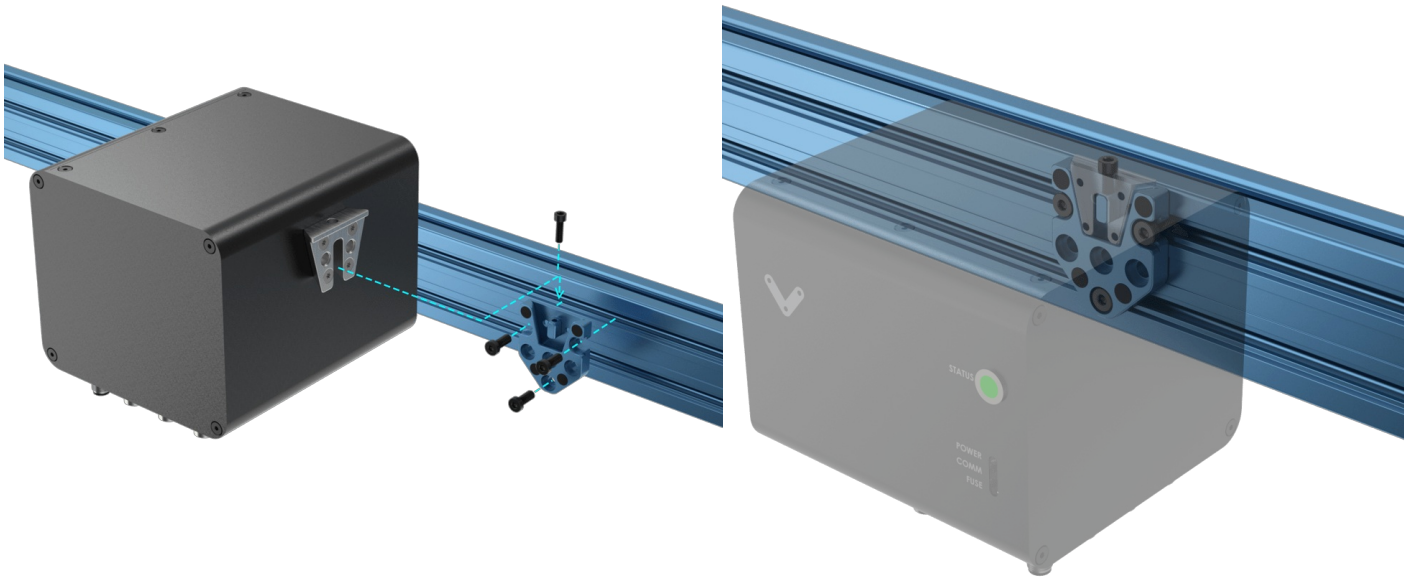
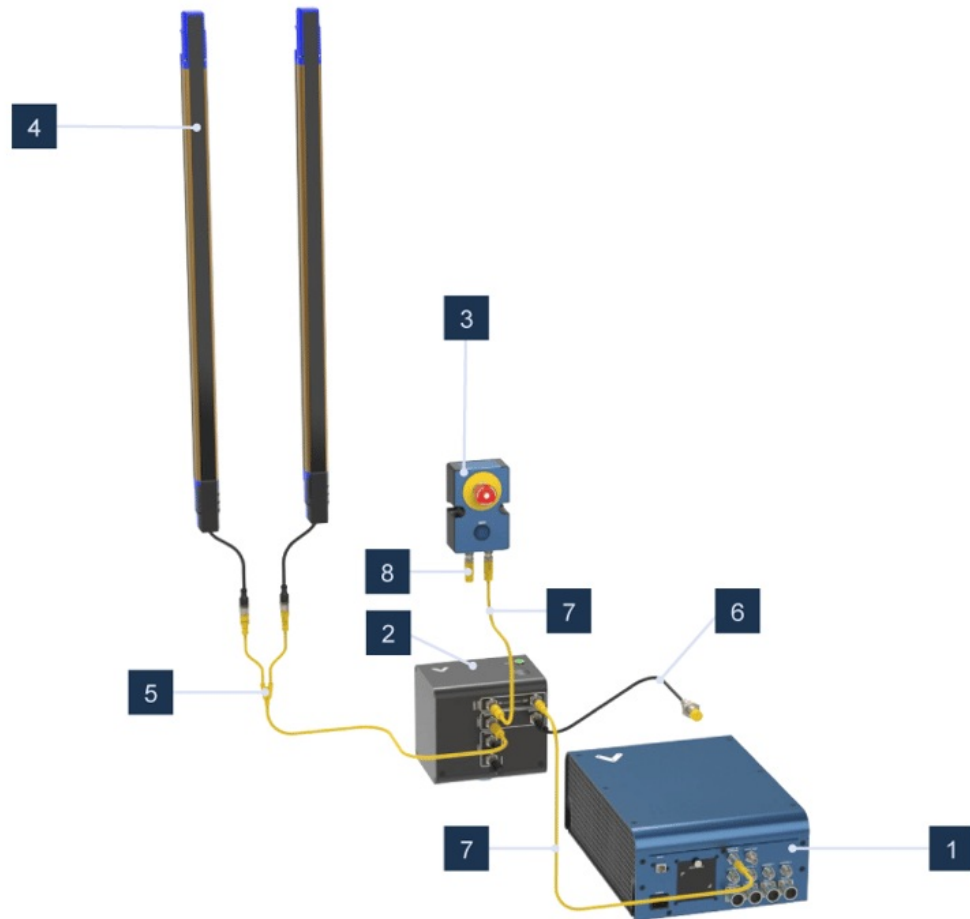


Figure 4: Module Mounting

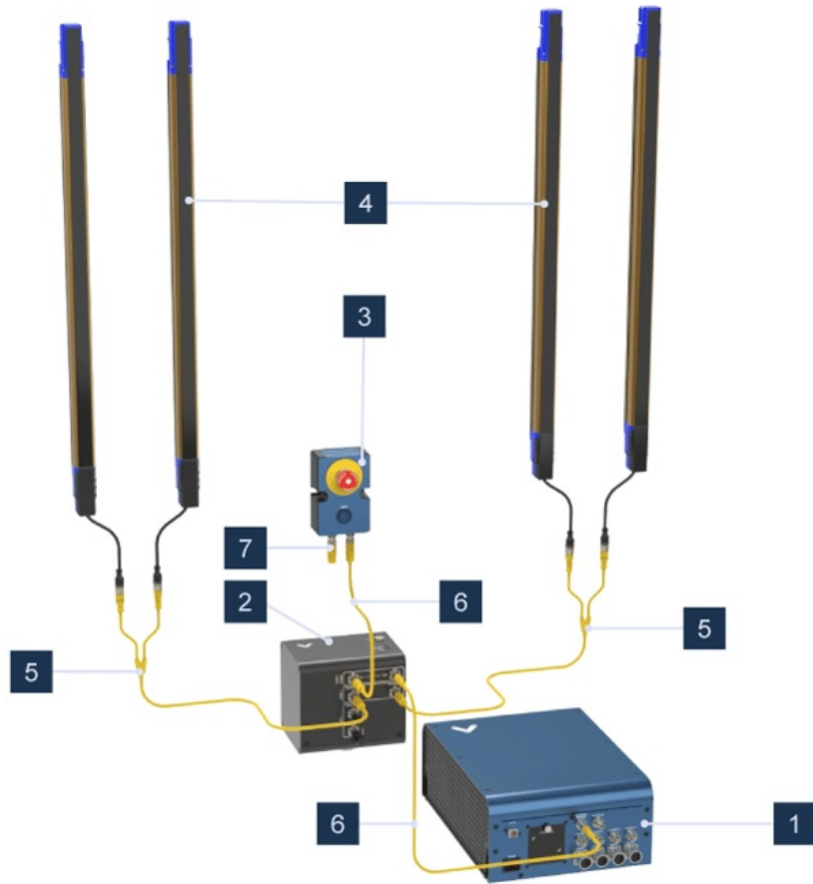
Figure 4: Module Mounting

Wiring Diagram



- | | |
|--|--|
| 1. MachineMotion - CE-CL-010-0004 | 5. Light Curtain Cable - CE-SA-106-0001 |
| 2. Mode-Switching Safety Module - CE-SA-018-0001 | 6. Fail-Safe Induction Sensor - CE-SA-010-0001 |
| 3. E-Stop Module - CE-SA-007-0000 | 7. Safety Extension Cable - CE-SA-102-5001__2 |
| 4. Datalogic Light Curtains | 8. Safety Jumper - CE-SA-102-0001 |

Figure 5: Mode Switching Safety Module wiring diagram



- | | |
|--|---|
| 1. MachineMotion - CE-CL-010-0004 | 5. Light Curtain Cable - CE-SA-106-0001 |
| 2. Mode-Switching Safety Module - CE-SA-018-0001 | 6. Safety Extension Cable - CE-SA-102-5001__2 |
| 3. E-Stop Module - CE-SA-007-0000 | 7. Safety Jumper - CE-SA-102-0001 |
| 4. Datalogic Light Curtains | |

Figure 6: Mode Switching Safety Module wiring diagram with 2x Light Curtains

Safety Data

The Vention's Safety Modules realize the following safety functions :

- System emergency stop output at the Safety OUT connector from the Safety IN port (E-stop_SafetyIN-to-SafetyOUT);
 - The Device port (light-curtain or area scanner) to the Safety OUT port System emergency stop output at the Safety OUT connector from a Safety Device port (E-stop_Device-to-SafetyOUT); and
 - System reset propagation from the Safety IN port to the Safety OUT port (Reset_SafetyOUT).
- For each of these functions, safety data can be found in the following table.

For each of these functions performed by the Robot Safety Module, safety data can be found in the following table:

| Safety Function | PL | Cat. | MTTF _d | DC _{avg} | PFH _d |
|------------------------------|----|------|-------------------|-------------------|------------------|
| E-stop_SafetyIN-to-SafetyOUT | e | 3 | 186 | 99% | 4.29E-08 |
| E-stop_Device-to-SafetyOUT | e | 3 | 186 | 99% | 4.29E-08 |
| Reset_SafetyOUT | c | 1 | >100 | N/A | 1.14E-06 |

The above information have been calculated based on the following operation conditions:

| Data | Value | Unit |
|------|-------|------|
|------|-------|------|

| Data | Value | Unit |
|-------------|-------|------------|
| d_{op} | 365 | days/years |
| h_{op} | 24 | hours/days |
| t_{cycle} | 8640 | s/cycle |