Access Request Module Datasheet

Contents

Overview

The Access Request Module, CE-SA-017-0001 is intended to interface up to 4 guard-locks and a MachineMotionV2. The minimum configuration is 1 guardlock and 1 MachineMotionV2.

Features

- Compatible with MachineMotion V2
- Configuration-free: plug & play
- Modules can be daisy-chained
- On-board LED for power, fuse, and communication status indication, located on the bottom of the module
- LED indicator displaying power status, fault alerts, safety status, and activation of an emergency stop triggered by the module

- The access request module can be connected to up to 4 guardlock devices but only one of high duty (1 opening per hour).

Included cables

- 1x Safety Extension cable (5m) - CE-CA-102-5001__2
- 1x Dry Contact Jumper - CE-JP-000-0002
- 2x Safety Jumper - CE-SA-102-0001
- 2x Guard Lock T-Splitter - CE-SA-124-0001

Important Notes

Safety

The Access Request Module performs 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 Module shall not be put into operation only after the safety functions have been tested during the commissioning.
- The use of the Safety Module does not prevent the automatic reset of devices connected to the Safety OUT port.
- The use of the Safety Module does not prevent the automatic start of the devices connected to the Safety OUT ports. 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 Smart Access Request Module may only be connected to the equipment listed in this manual;
The Smart Access Request Module does not monitor the input redundant signals at the End Effector IN and Position IN ports. If the connected device at the Position IN port does not have monitoring of its output signals, the performance level of the safety function can be reduced;
If the a jumper is used for the Position IN port but a limit switch is connected to the End effector IN port, the performance level of the safety function can be reduced;
If devices with OSSD signals are connected to the both Position IN and End Effector IN ports, the device connected in the End Effector IN port shall accept OSSD inputs and be placed in cascade using the pins 1 and 3 as OSSD inputs;
As per ISO/TR 24119:2015, only 1 guardlock shall be high duty (opening the guardlock at a frequency greater than 1 per hour);
A maximum of 4 guardlock should be connected to maintain the performance level of the module;
Bypassing the guardlock with the Manual override may expose the operator to residual risk (heavy boxes in grippers, robot in wrong position);
The Smart Access Request 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.

Important Information

Shorting or overloading the guardlock port could trip the E-FUSE. To reset the fuse, a power cycle is needed.
As per ISO/TR 24119:2015, only 1 guardlock shall be high duty (opening the guardlock at a frequency greater than 1 per hour).
Bypassing the guardlock with the Manual override may expose the operator to residual risk (heavy boxes in grippers, robot in wrong position)

Technical specs

General Specifications

Item	Specification
Part Number	CE-SA-017-0001

Item	Specification
Weight	0.8kg
Dimensions	19.0 x 15.0 x 9.0mm
Material	• 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	• With light curtains (TX and RX) and muting sensors: 8.4 W • With laser scanner and muting sensors: 8.4 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: 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	Processing

Functionality

The Access Request Module enables guard lock devices to be interfaced with a MachineMotion safety chain. A guard lock is a device that prevents a user to open a door or gate based on a Safety or Programming condition. The Safety conditions to be met is the “Cell safe” input and the “end effector” input. Those conditions are optional meaning that if there is no residual risk involving an end effector in a cell, the end effector input can be jumped with the jumper CE-JP-000-0002. For the “Cell safe” input, it can be connected to a safe robot output or a fail safe inductive sensor CE-SN-010-0001.
Once everything is connected, software on the MachineMotion must be running in order to send the lock/unlock request. This was done to be flexible on

the functionality. Pressing the buttons of the access request module sends a message to the MachineMotion. The MachineMotion can then send a request to lock/unlock the door. An alternate condition might be that an unlock request parks the robot in a safe location before unlocking the door.
In order for an access request to be successful, the cell must be in a safe state. Therefore, Access request Modules must be integrated into your application. See below for MachineLogic and MachineLogic Python examples.

Making a Lock or Unlock Request

The Access Request Module will accept requests to unlock under the following conditions:

- Interlocks are detected on the guardlock port connectors
- The guardlock is closed and locked
- The Position IN port is triggered & End Effector IN port is untriggered

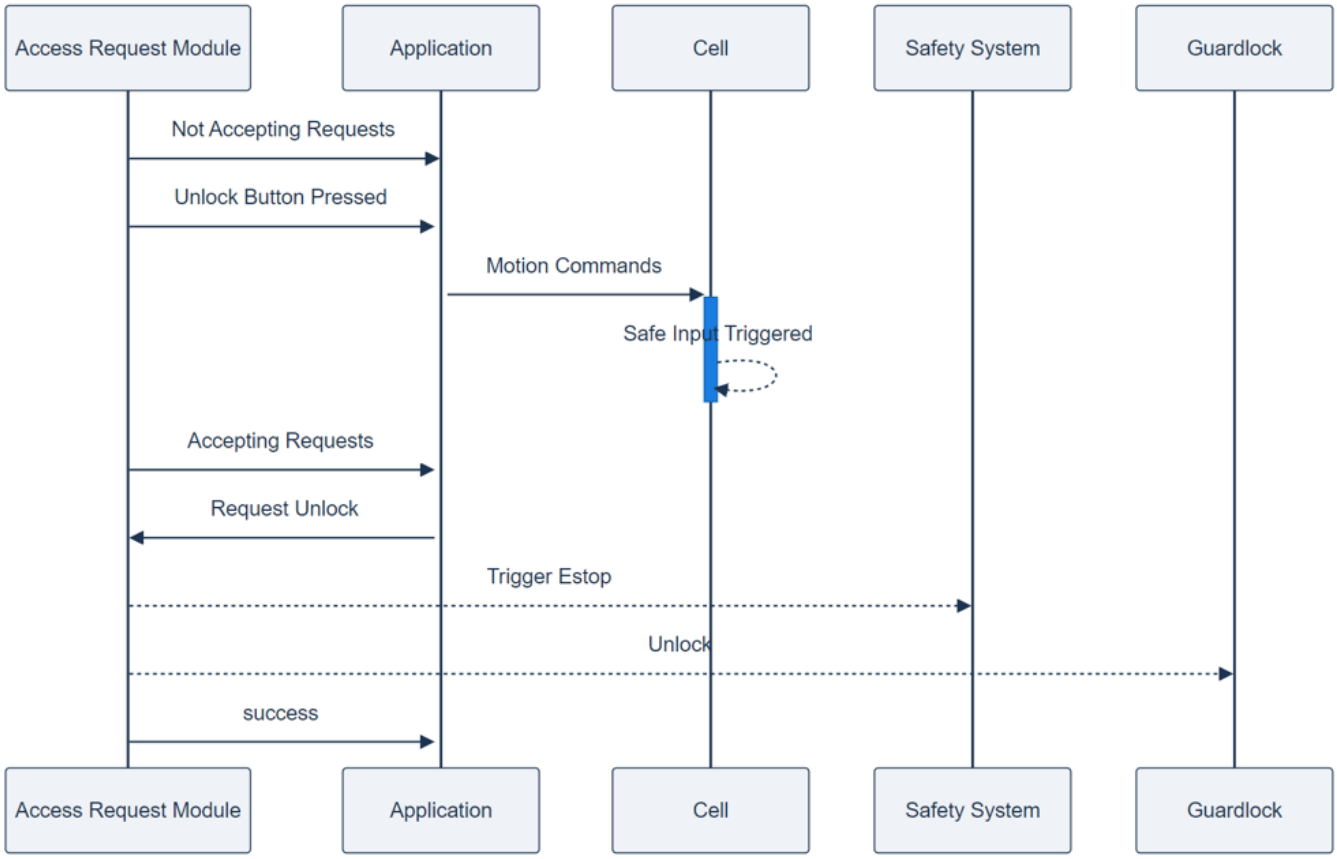


Figure 2: Successful unlock sequence

The Access Request Module will accept requests to lock under the following conditions:

- Interlocks are detected on the guardlock port connectors
- The guardlock is closed and unlocked
- The Position IN port is triggered & End Effector IN port is untriggered

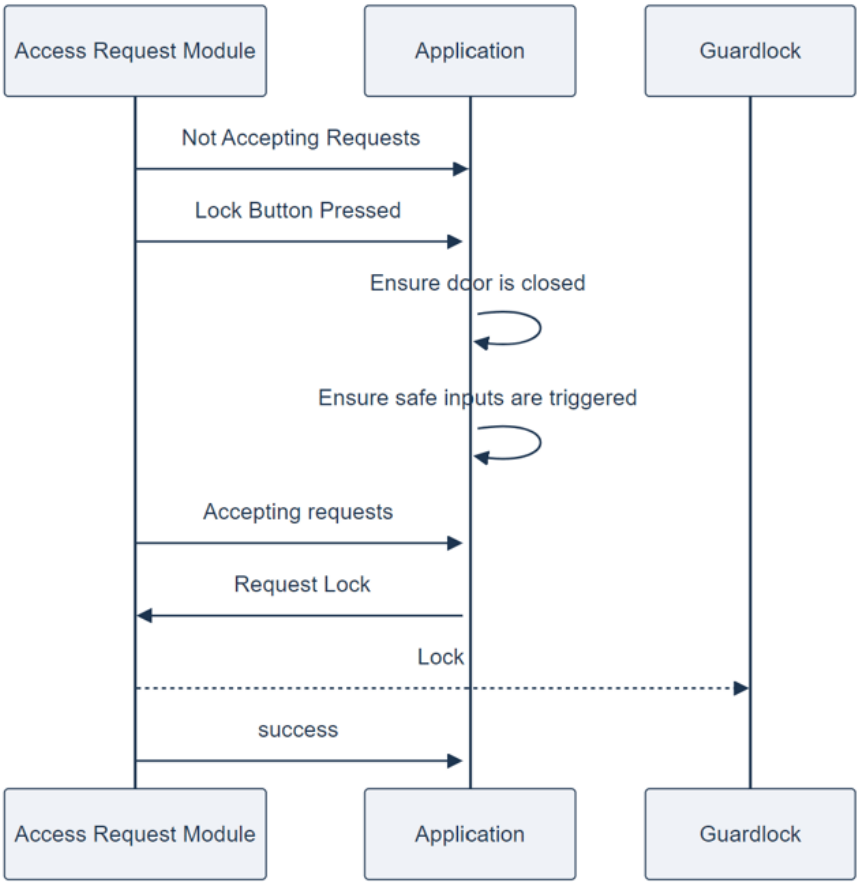


Figure 3: Successful lock sequence

Port definitions

Figure 4: Access Request 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 MachineMotion V2.

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 - (INPUT)
Pin 9	ETHERNET TX+ (auto-MDIX)
Pin 10	ETHERNET TX- (auto-MDIX)
Pin 11	ETHERNET RX+ (auto-MDIX)
Pin 12	ETHERNET RX- (auto-MDIX)

Door 1 & 2 - Pin-out - M12, female, 12-pin, A-Keyed

Pin	Function
Pin 1	Lock signal A1 (24V fused)
Pin 2	0V A2
Pin 3	Guard lock contact 1&2 11

Pin	Function
Pin 4	Guard lock contact 1&2 12
Pin 5	Guard lock contact 1&2 21
Pin 6	Guard lock contact 1&2 22
Pin 7	Gate Feedback 43 (24V)
Pin 8	Gate Feedback 44 (input)
Pin 9	NC
Pin 10	NC
Pin 11	NC
Pin 12	NC

Door 3 & 4 - Pin-out - M12, female, 12-pin, A-Keyed

Pin	Function
Pin 1	Lock signal A1 (24V fused)
Pin 2	0V A2
Pin 3	Guard lock contact 3&4 11
Pin 4	Guard lock contact 3&4 12
Pin 5	Guard lock contact 3&4 21
Pin 6	Guard lock contact 3&4 22
Pin 7	Gate Feedback 43 (24V)
Pin 8	Gate Feedback 44 (input)
Pin 9	NC
Pin 10	NC
Pin 11	NC
Pin 12	NC

Position IN - Pin-out - M12, female, 4-pin, A-Keyed

Pin	Function
Pin 1	24V fused
Pin 2	OSSD input 1

Pin	Function
Pin 3	0V
Pin 4	OSSD input 2

End Effector IN - Pin-out - M12, female, 4-pin, A-Keyed

Pin	Function
Pin 1	11
Pin 2	12
Pin 3	21
Pin 4	22

Status OUT - Pin-out - M12, male, 4-pin, A-Keyed

Pin	Function
Pin 1	NC
Pin 2	OSSD output 1
Pin 3	0V
Pin 4	OSSD output 2

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.

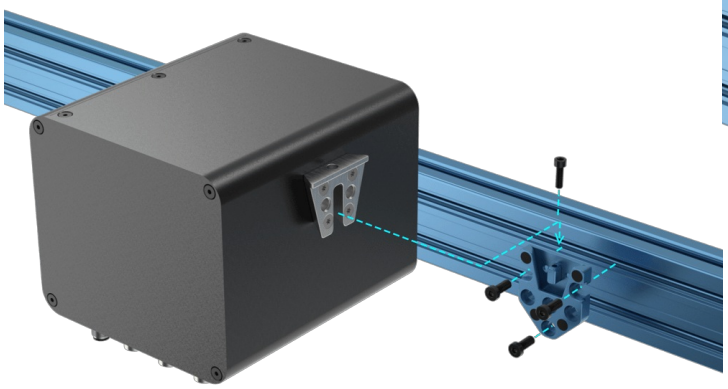


Figure 5: Module Mounting

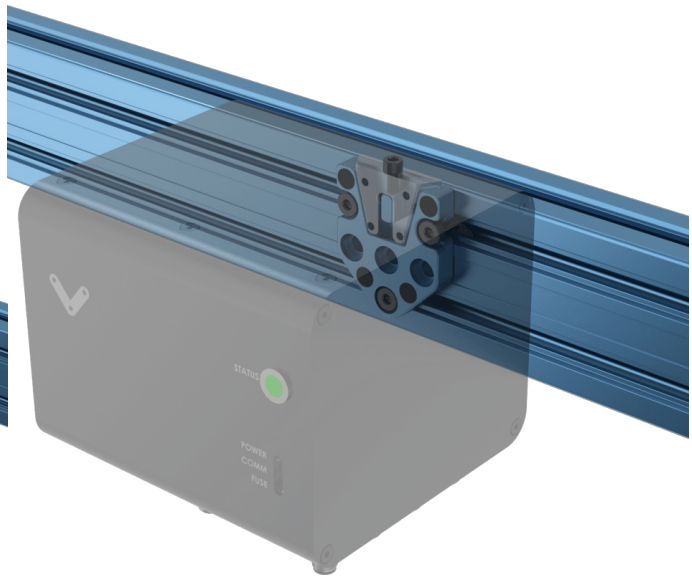
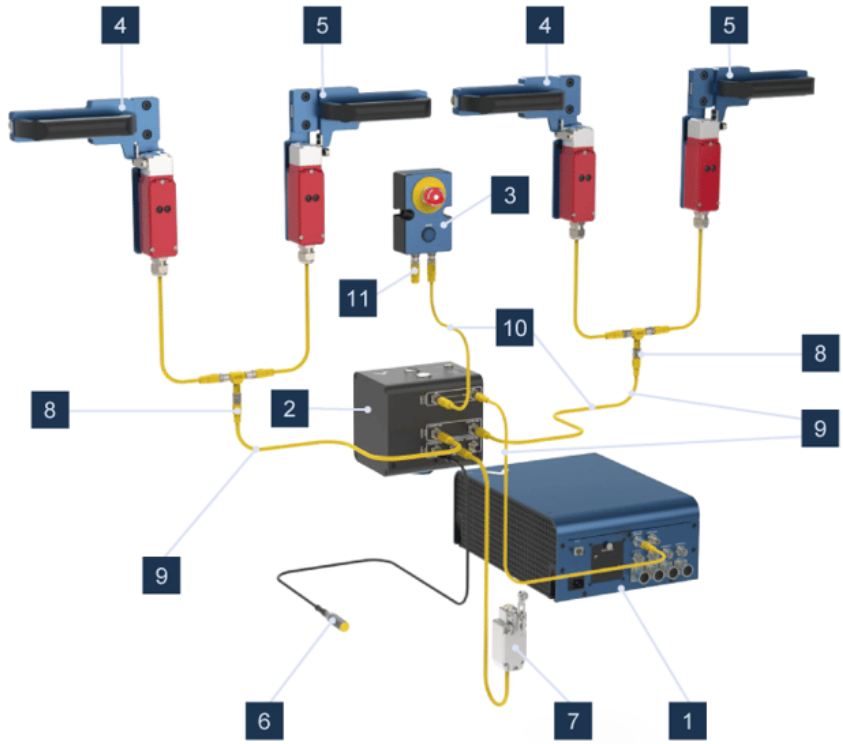


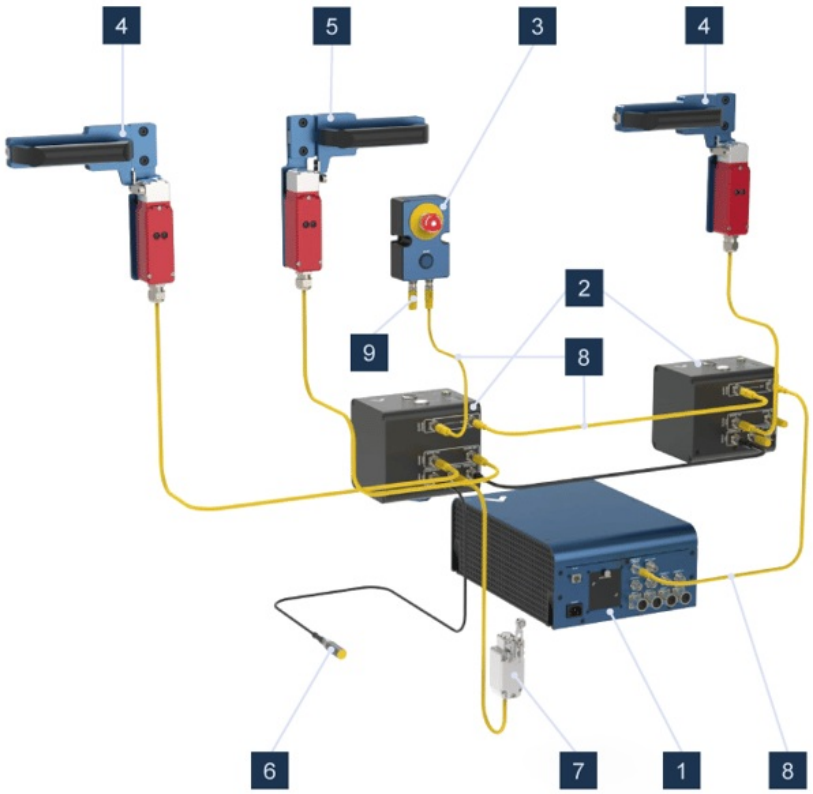
Figure 3: Module Mounting

Wiring Diagrams



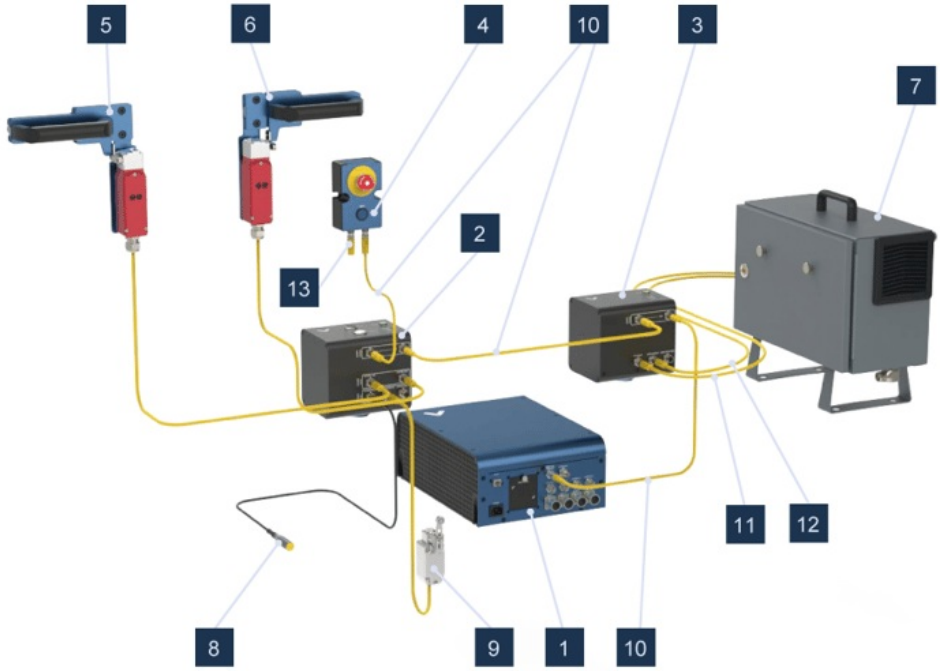
1. MachineMotion - CE-CL-010-0004
2. Access Request Module - CE-SA-017-0001
3. E-Stop Module - CE-SA-007-0000
4. Right Gate Bolt with Lockable Interlock - ST-SE-006-2001
5. Left Gate Bolt with Lockable Interlock - ST-SE-006-2002
6. Fail-safe Inductive Sensor - CE-SN-010-0001
7. Safety Limit Switch for Grippers - CE-SN-011-0001
8. Guardlock Lock T-Splitter - CE-SA-124-0001
9. Safety Extension Cable - CE-SA-102-5001__2
10. Safety Extension Cable - CE-SA-102-5001__2
11. Safety Jumper - CE-SA-102-0001

Figure 6: Access Request Module with 4 guardlocks



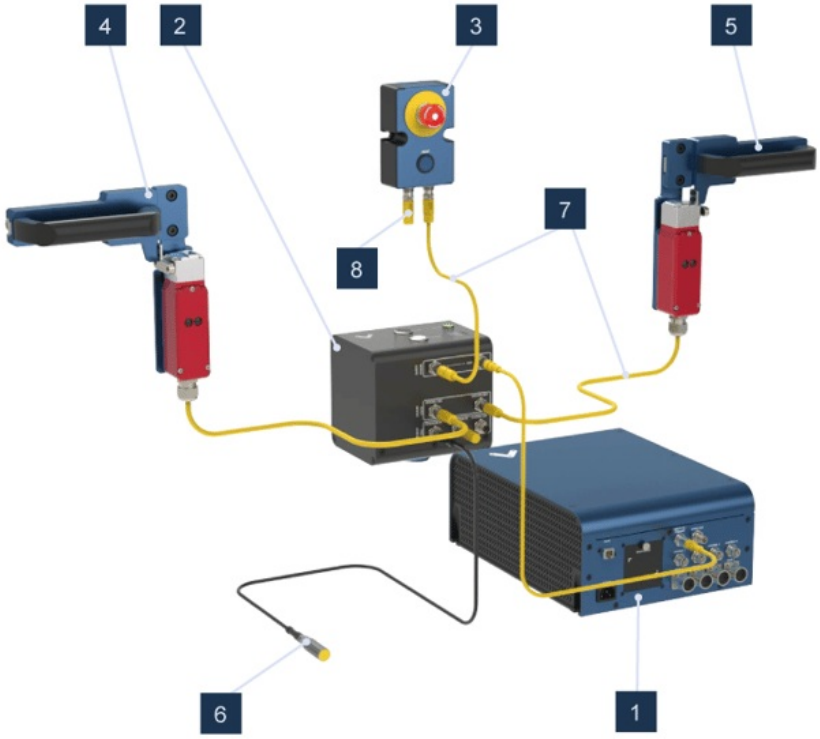
1. MachineMotion - CE-CL-010-0004
2. Access Request Module - CE-SA-017-0001
3. E-Stop Module - CE-SA-007-0000
4. Right Gate Bolt with Lockable Interlock - ST-SE-006-2001
5. Left Gate Bolt with Lockable Interlock - ST-SE-006-2002
6. Fail-safe Inductive Sensor - CE-SN-010-0001
7. Safety Limit Switch for Grippers - CE-SN-011-0001
8. Safety Extension Cable - CE-SA-102-5001__2
9. Safety Jumper - CE-SA-102-0001

Figure 7: Daisy-chaining Access Request Modules



1. MachineMotion - CE-CL-010-0004
2. Access Request Module - CE-SA-017-0001
3. Robot Safety Module - CE-SA-016-0001
4. E-Stop Module - CE-SA-007-0000
5. Right Gate Bolt with Lockable Interlock - ST-SE-006-2001
6. Left Gate Bolt with Lockable Interlock - ST-SE-006-2002
7. Robot Controller
8. Fail-safe Inductive Sensor - CE-SN-010-0001
9. Safety Limit Switch for Grippers - CE-SN-011-0001
10. Safety Extension Cable - CE-SA-102-5001__2
11. Robot Safety Module "TO ROBOT" Cable - CE-SA-111-0001
12. Safety IN Pigtail Cable - CE-CA-105-2000
13. Safety Jumper - CE-SA-102-0001

Figure 8: Access Request Module with Robot Safety Module



1. MachineMotion - CE-CL-010-0004
2. Access Request Module - CE-SA-017-0001
3. E-Stop Module - CE-SA-007-0000
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5. Left Gate Bolt with Lockable Interlock - ST-SE-006-2002
6. Fail-safe Inductive Sensor - CE-SN-010-0001
7. Safety Extension Cable - CE-SA-102-5001__2
8. Safety Jumper - CE-SA-102-0001

Figure 9: Access Request Module with 2 guardlocks

HTTP commands

The Access Request module can receive commands from HTTP to lock or unlock the doors. This enables a user to lock/unlock doors on events, like a push button press.

Route	Data Type	Format	Description
http://localhost:4446/access-request	json	{"serial-number": INT, "command": "lock" | "unlock"}	Will try to lock the doors on the target device

HTTP /access-request return codes :

Code	Full json payload
0	{“code”:0,”msg”:”Success”}
1	{“code”:1,”msg”:”Post must be of JSON type with format {“serial-number”: INT, “command”: “lock” “unlock”}
2	{“code”:2,”msg”:”Smart Module not found.”,”errors”:[]}
3	{“code”:3,”msg”:”Smart Module not connected.”,”errors”:[]}
4	{“code”:4,”msg”:”Smart Module is not an Access-Request Module.”,”errors”:[]}
5	{“code”:5,”msg”:”Access-Request Module is not accepting requests. Topic not initialized.”,”errors”:[]}

Code	Full json payload
6	{“code”:6,”msg”:”Access-Request Module is not accepting requests. Cell is not safe”,”errors”:[]}
7	{“code”:7,”msg”:”Access-Request Module is not accepting requests. Door is Open.”,”errors”:[]}
8	{“code”:8,”msg”:”door is already locked.”,”errors”:[]}
9	{“code”:9,”msg”:”door is already unlocked.”,”errors”:[]}
10	{“code”:10,”msg”:”Access-Request Module was unable to lock”,”errors”:[]}
11	{“code”:11,”msg”:”Access-Request Module was unable to unlock”,”errors”:[]}
99	{“code”:99,”msg”:”error”}

MQTT topics

Device Type `access-request`

Topic	Data Type	Description
`/available`	int (0 or 1)	0 = disconnected, 1 = connected
/errors	string array	Array of string which indicates all current errors
`/thermistor`	int	Temperature of the device in celcius
/safety-in	int (0 or 1)	Status of the input voltage on safety-in port. ‹/br›0 = 0V (Estop) , 1 = 24V (Good)
/safety-out	int (0 or 1)	Status of the output voltage on safety-out port. ‹/br›0 = 0V (Estop), 1 = 24V (Good)
/door-open	int (0 or 1)	Indicates if a door is opened ‹/br›0 = closed, 1 = open
/door-locked	int (0 or 1)	Indicates if doors are locked ‹/br›0 = unlocked, 1 = locked
/accepting-requests	int (0 or 1)	Indicates if the module accepts lock/unlock requests ‹/br›0 = not accepting, 1 = accepting
`/cell-safe`	int (0 or 1)	Status of the input of the IN and END port. Status out port. ‹/br›0 = not safe, 1 = safe
/user-unlock-request	int (0 or 1)	Status of the user request‹/br› 0 = lock request, 1= unlock request
`/active-request`	int (0 or 1)	Status of the request ‹/br› 0 = locked, 1= unlocking or unlocked
/transitioning	int (0 or 1)	Indicates if there’s a transition between lock and unlocked/unlocked and locked ‹/br› 0 = nothing, 1= transitioning
`/lock-signal`	int (0 or 1)	0 = locked, 1= unlocked

Error codes

Code	Errors	Description
1	Error on safety output. Shortcircuit or crossfault.	shortcircuit, cross fault, or wrong feedback
2	Error on safety input	shortcircuit, cross fault, wrong feedback, feedback not simultaneous
9	Error on state of locking door.	Door has a problem. Error in door signals / miswiring
10	Error on lock output. Shortcircuit or crossfault.	shortcircuit, cross fault
11	Error with wiring or timing of safe state	Signals not simultaneous
12	Error in door operation: Failure of operation or manual override	shortcircuit, cross fault, or wrong feedback

MachineLogic Sequence Examples

How to send a Unlock request

Sequence example to handle an unlock request from the Access Request Module (CE-SA-017-0001).

Topic for Output **Generate Event** to send the Unlock request to the module:

- **Topic**: safety-module-hub/access-request/{Serial Number}/unlock
  Note: Serial Number must be inputted manually and must match the serial on the label on the back of the Access Request Module
  Ex: safety-module-hub/access-request/1234567/unlock
- **Message**: “UnlockRequest”

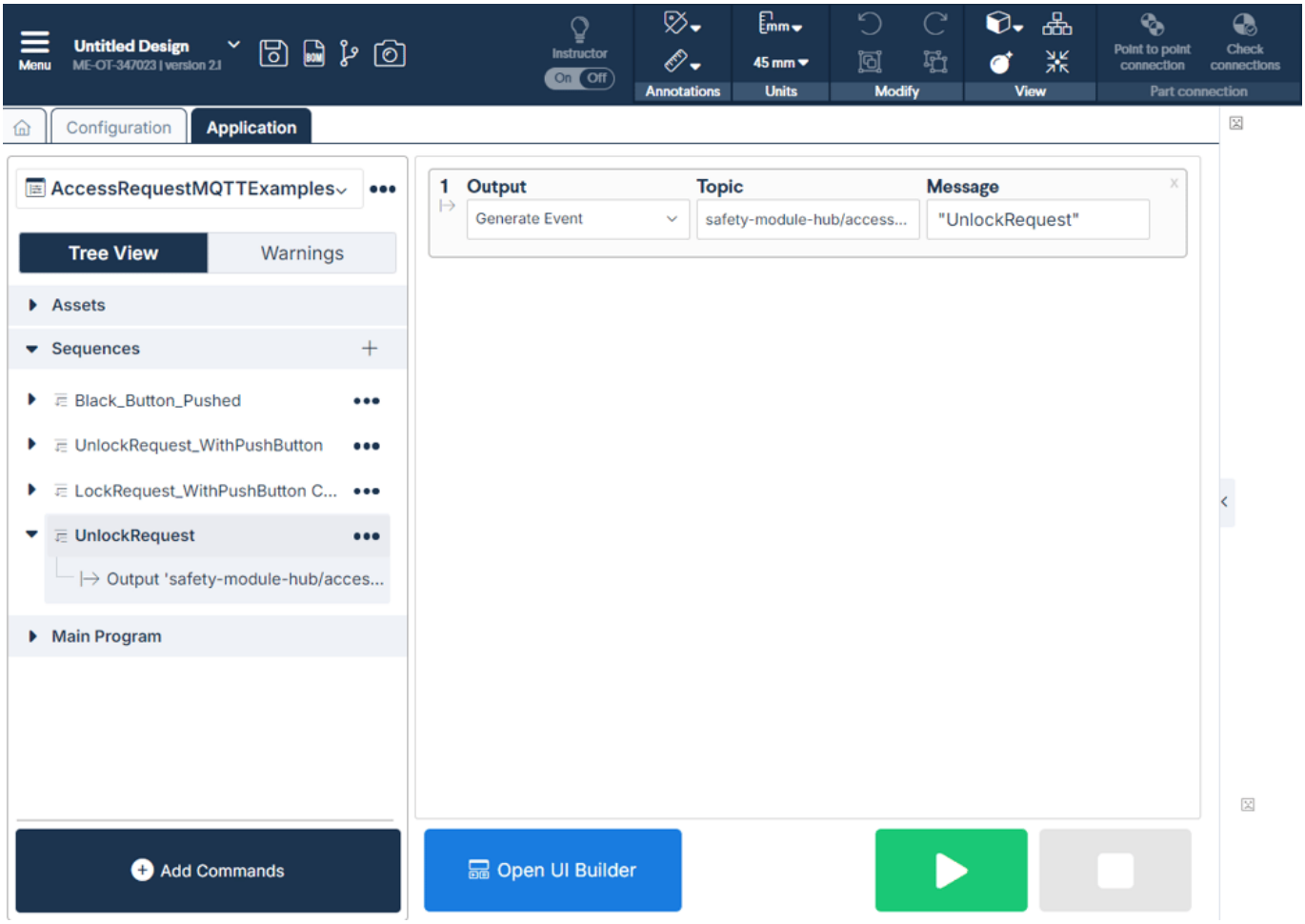

Figure 10: MachineLogic example to handle an unlock request from the Access Request Module

How to send a Lock request

Sequence example to handle an lock request from the Access Request Module (CE-SA-017-0001).

Topic for Output **Generate Event** to send the Lock request to the module:

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- **Message**: “LockRequest”

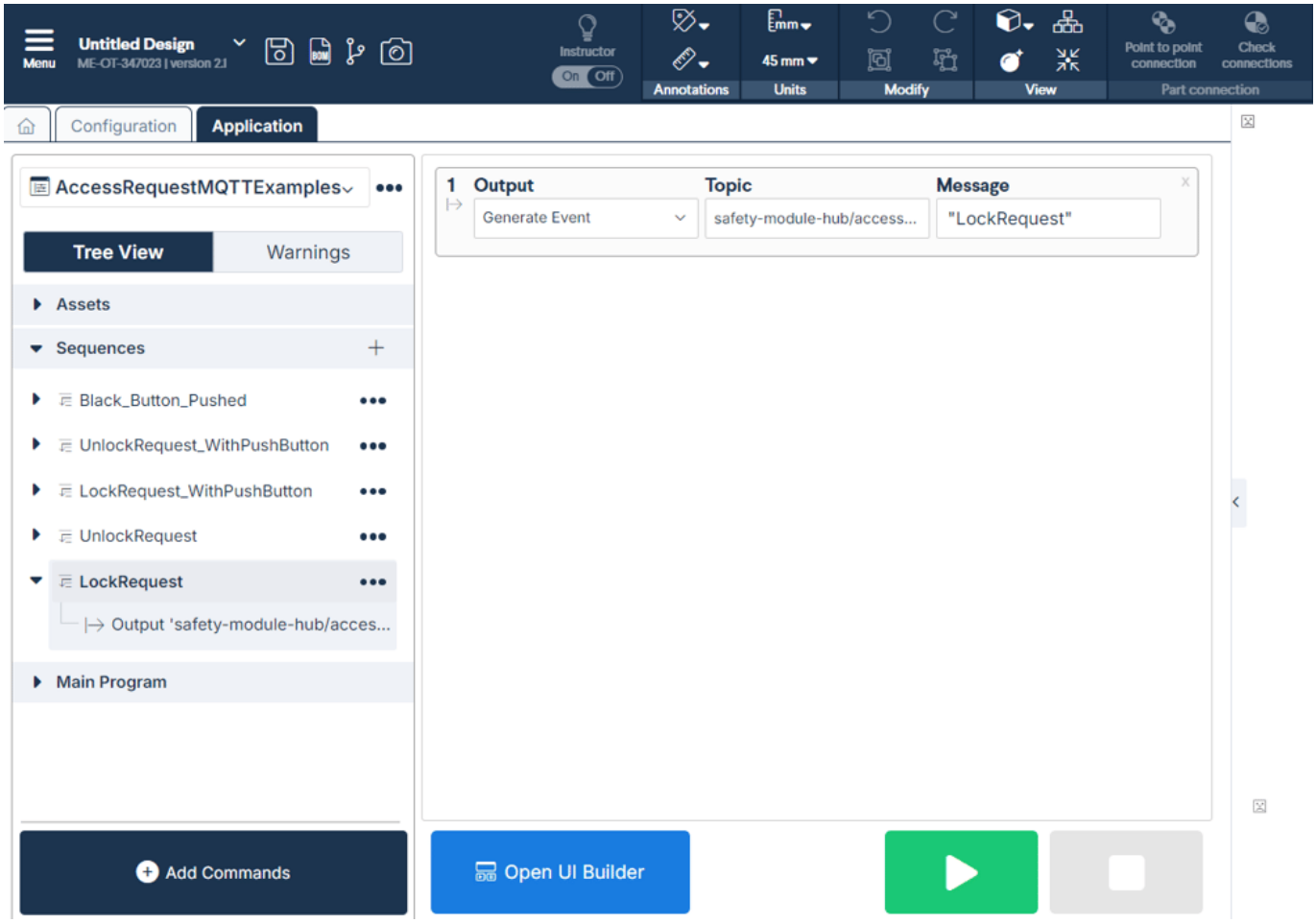


Figure 11: MachineLogic example to handle an lock request from the Access Request Module

How to send a Unlock request with a Pushbutton and Access Request Module

Sequence example to handle a button being pushed to trigger the unlock request and send that command to the Access Request Module (CE-SA-017-0001). It will also change the LED color of the device to Blue.

Topic for Wait For **Event**:
Depending on the users choice, you can associate the unlock request with the button of your choice between the black and white button.
Topic:

- If Black Button: devices/push-button-v2/+/digital-input/0
- If White Button: devices/push-button-v2/+/digital-input/1

Message: 1

Topic for Output **Generate Event** to change the LED color:

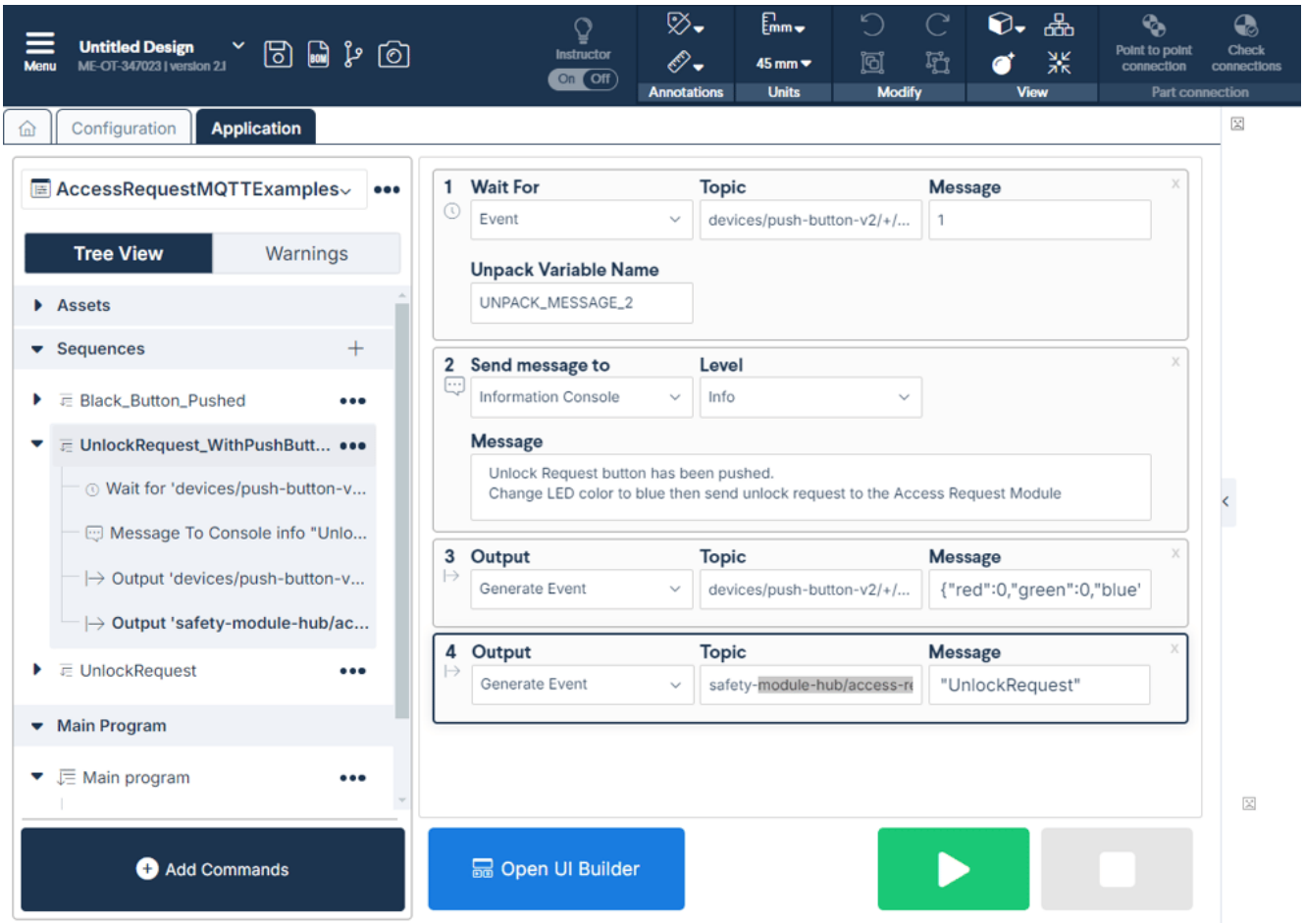
- **Topic:** devices/push-button-v2/+/set-led
- **Message**: {“red”:0,”green”:0,”blue”:1}

Topic for Output **Generate Event** to send the Unlock request to the module:

- **Topic:** safety-module-hub/access-request/{Serial Number}/unlock

**Note: Serial Number must be inputted manually and must match the serial on the label on the back of the Access Request Module*
Ex: safety-module-hub/access-request/1234567/unlock

- **Message**: “UnlockRequest”
  **



How to send a Lock request with a Pushbutton and Access Request Module

Sequence example to handle a button being pushed to trigger the lock request and send that command to the Access Request Module (CE-SA-017-0001). It will also change the LED color of the device to Blue.

Topic for Wait For **Event**:
Depending on the users choice, you can associate the unlock request with the button of your choice between the black and white button.
Topic:

- If Black Button: devices/push-button-v2/+/digital-input/0
- If White Button: devices/push-button-v2/+/digital-input/1

Message: 1

Topic for Output **Generate Event** to change the LED color:

- **Topic:** devices/push-button-v2/+/set-led
- **Message**: {“red”:0,”green”:0,”blue”:1}

Topic for Output **Generate Event** to send the Lock request to the module:

- **Topic:** safety-module-hub/access-request/{Serial Number}/lock

**Note: Serial Number must be inputted manually and must match the serial on the label on the back of the Access Request Module*
Ex: safety-module-hub/access-request/1234567/unlock

- **Message**: “UnlockRequest”

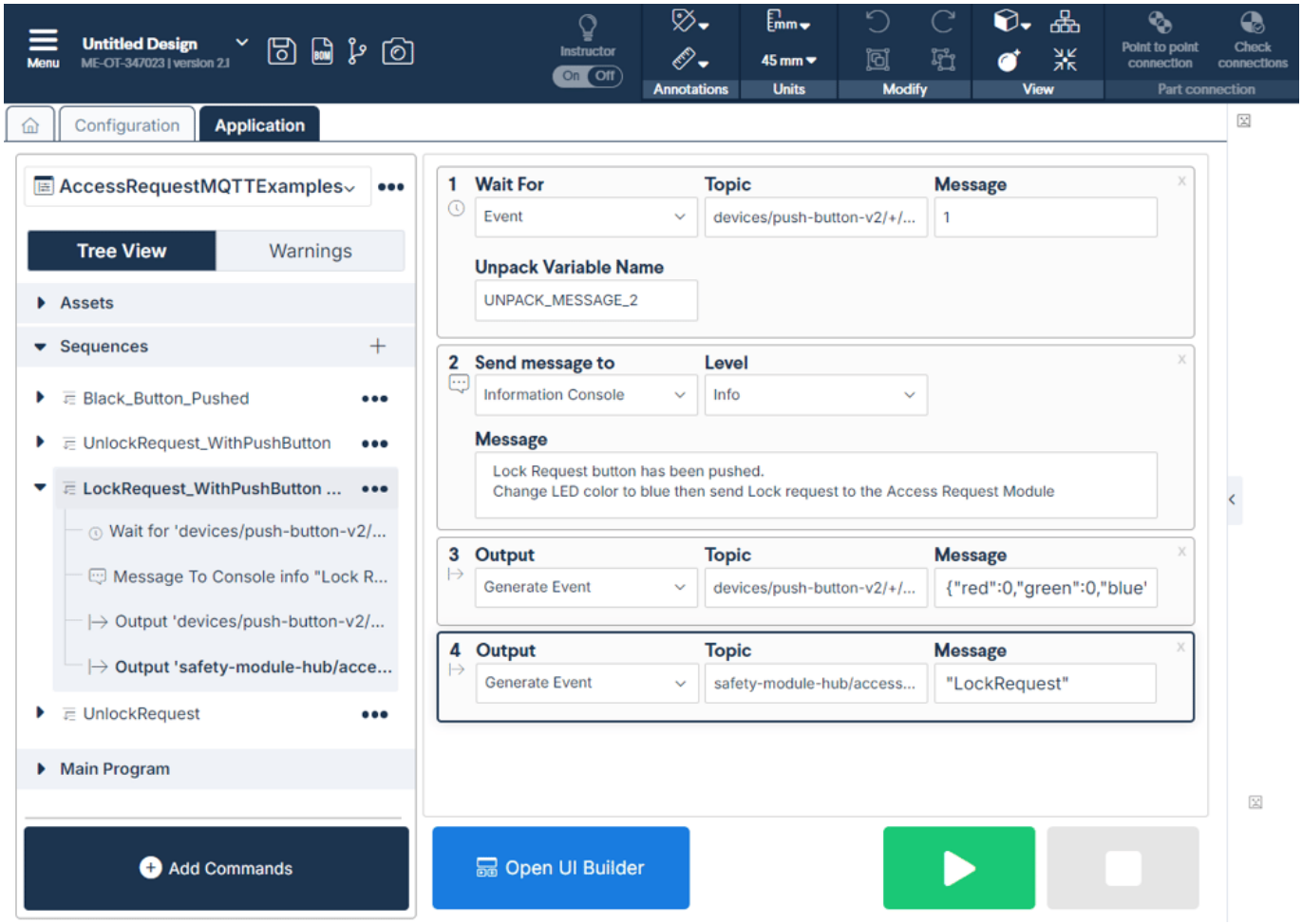


Figure 13: MachineLogic example to handle a button being pushed to trigger the lock request and send that command to the Access Request Module

MachineLogic Python Unlock Sequence Example

```
from machinelogic import Machine, ActuatorGroup
from machinelogic import MachineException, MachineMotionException, ActuatorGroupException, ActuatorException, RobotException

### Configuration ###

# The following code has been automatically generated from the configuration.
# If the configuration changes, please update the code below, and ensure that the names match.

machine = Machine()

### Program ###

# Start coding here!
# Documentation can be found at vention.io/resources/guides/machinelogic-python-programming-514
import requests
from time import sleep

def request_access(machine_ip,module_serial_number, unlock = True):
    unlock_string = "unlock" if unlock else "lock"
    payload = {
      "serial-number": module_serial_number,
      "command": unlock_string
    }
    try:
        r = requests.post(
          "http://localhost:4446/access-request",
          json = payload
        )
    finally:
        return ( r.status_code == 200, r.text)

if __name__ == "__main__":

    m = Machine()
    ip = '192.168.7.2'
    serial_number = 1110003 # serial number can be found on device label

    def handle_module_status(topic, payload):
        print(topic, payload) # display incoming module statuses

    def handle_access_request(topic, payload): # callback for module button press
        print("handling request", topic, payload)
        if not payload: # button is released, do nothing
          return

        is_unlock_request = topic.split('/')[3] == "button-unlock"
        success, info = request_access(ip,serial_number,is_unlock_request)
        print(info)

    machine.on_mqtt_event(
      f'safety-module-hub/access-request/{serial_number}/button-lock',
      handle_access_request
    )

    machine.on_mqtt_event(
      f'safety-module-hub/access-request/{serial_number}/button-unlock',
      handle_access_request
    )

    machine.on_mqtt_event(
      f'safety-module-hub/access-request/#',
      handle_module_status
    )

    while True:
        sleep(1)
```

Safety Data

The Smart Access Request Module realizes the following safety functions:

- System emergency stop output at the Safety OUT connector from the Safety IN port (E-stop_SafetyOUT);
- Guardlock safety function without safe position input (GuardLock);
- Guardlock safety function with safe position input (GuardLock_PositionIN).

For each of these functions, safety data can be found in the following tables. Due to potential fault masking, the safety data is dependent on the number of doors and their frequency of use.

The table below refers to the safety data with only one door or no door frequently used and up to 4 not frequently used doors:

Safety Function	PL	Cat.	$MTTF_d$	DC_{avg}	PFH_d	
E-stop_SafetyOUT	e	3	64	99%	8.84E-08	
GuardLock	e	3	64	99%	8.84E-08	
GuardLock_PositionIN		e	3	64	99%	8.84E-08

The table below refers to the safety data with no door frequently used and up to 30 doors not frequently used doors or 1 frequently used doors and up to 4 not frequently used doors:

Safety Function	PL	Cat.	$MTTF_d$	DC_{avg}	PFH_d	
E-stop_SafetyOUT	e	3	64	99%	8.84E-08	
GuardLock	d	3	64	91.3%	2.13E-07	
GuardLock_PositionIN		d	3	64	91.3%	2.13E-07

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

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