Safedoor

User Manual

Assembly Instructions
English (original)
Version 2.1.0

Made 4 CNC

This user manual provides detailed instructions for the installation, configuration, and operation of the Safedoor system, designed for robotic tending of CNC machines. It is intended for use by system integrators and operators with a technical background.

System overview

The Safedoor system is an advanced automatic door solution specifically designed for CNC machines. The fully automated configuration and built-in force monitoring makes installation and operation simple and safe. The dual electrical interface allows simultaneous control from both a robot and the CNC machine. Seamless integration with external equipment and robots provide enhanced safety, ergonomics, reliability, and efficiency in automated operations. The Safedoor system includes the following main components:

- **Actuator(s)**: Robust and precise door actuators for smooth operation.
- **Controller**: The central unit that manages door movements and system configurations.
- **Operator Panel**: User interface for manual control and system status monitoring.

Features and Benefits

- Linear actuators ensure simple mounting and operation.
- Easy installation, configuration, programming and risk assessment.
- Built-in force monitoring and safety feature.
- Fully automated configuration ensuring optimal performance.
- Dual electrical control interfaces for easy electrical integration.
- Optimized for integration with robots in machine tending applications.
- Kits available for single- or double door machines.
- Flexible mounting brackets for hassle-free mounting.
- Software plugins for all major robot brands.

Content

Introduction

Welcome to the Safedoor System!

Congratulations on your purchase of the Safedoor automatic door system. Safedoor is designed to provide a reliable, safe, and efficient solution for the automation of CNC machine doors. This state-of-the-art system is specifically engineered to enhance the safety and ergonomics of your CNC machine operations.

About This Manual

This manual is your comprehensive guide to installing, configuring, and operating the Safedoor system. It contains important safety information, step-by-step installation instructions, detailed configuration procedures, and troubleshooting tips to ensure you get the most out of your Safedoor system.

Manual Overview

The manual is organized into the following sections:

System Overview: Detailed description of the Safedoor system components, features, and technical specifications.

Technical sheet: Overview of the technical specifications and operating conditions.

System components: Overview of items included in your Safedoor packages.

Installation Guide: Step-by-step mechanical and electrical installation procedures.

Configuration and Setup: Instructions for configuring and setting up your Safedoor system for the first time.

Integration with CNC Machines and Robots: Specific instructions for integrating Safedoor with CNC machines and various robot brands.

Certifications and Standards: List of standards the product complies with and declarations of incorporation.

Who Should Use This Manual?

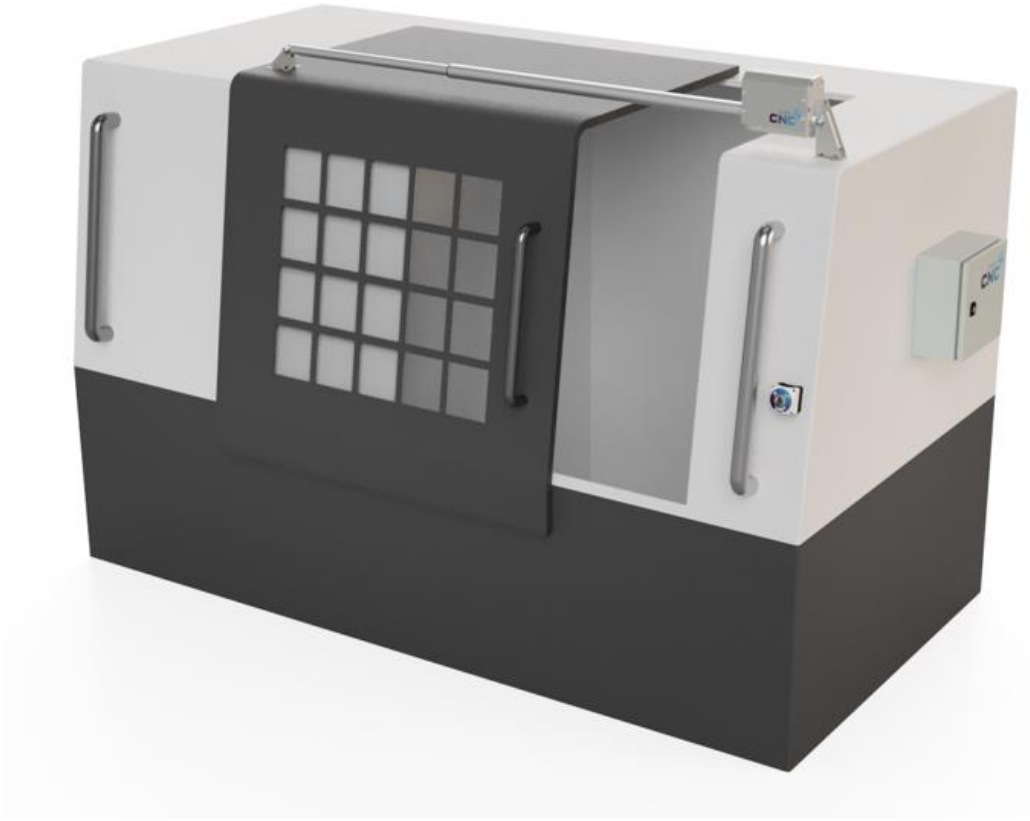
This manual is intended for system integrators, maintenance personnel, and operators who are responsible for the installation, configuration, and daily use of the Safedoor system. Prior knowledge of CNC machine operations and basic electrical installation practices is recommended.

Conventions Used in This Manual

Warnings and Cautions: Highlight critical information that ensures safe operation and prevents damage to the equipment.

Notes: Provide additional useful information to assist you in using the Safedoor system effectively.

Step-by-Step Instructions: Clearly numbered steps to guide you through specific tasks.



Contact Information

For further assistance or inquiries, please contact Safedoor Technical Support:

Phone: +45 28257281

Email: info@made4cnc.com

Website: www.made4cnc.com

Thank you for choosing Safedoor. We are committed to providing you with the highest quality products and support to ensure your complete satisfaction.

Technical Sheet

Safedoor is a unique automatic door system, especially designed for robotic tending of CNC machines. The Safedoor system is also an ideal solution for CNC tending without a robot, improving operator ergonomics.

The system contains actuator(s), and a controller which together enables safe, fast, and reliable operation of a CNC machine door.

With adjustable travel speed and built-in force monitoring it is capable of safe operation alongside human operators.

	Minimum	Typical	Maximum	Unit
Stroke, S	400 15.75	-	1600 62.99	mm in
Installation length	stroke + 225 stroke + 8.86	-	2 x stroke + 225 2 x stroke + 8.86	mm in
Adjustable Speed	250 9.84	375 14.76	500 19.68	mm/s in/s
Open/close time @ 750 mm		3.1*		s
Exerted force			150	N
Door weight		100	400	kg
		220	880	lb

*Traversal speed depends on settings and dynamic parameters. See Configuration and Settings on page 26.

Operating Conditions

	Min.	Typical	Max.	Unit
Input voltage	90	230/110	260	VAC
Input voltage frequency	47	50/60	63	Hz
External fuse	6	-	16	A
Operating temperature, ambient	0	-	50	°C
	32	-	122	°F
Relative humidity (non-condensing)	10	-	95	%
Calculated MTBF (5 min cycle)	33,000			hours

Specifications

	Specifications
IP rating, controller	IP66
IP rating, actuator	IP54
Digital interfaces	24V galvanically isolated I/Os
Robot Integrations	Universal Robots URCap (Polyscope ≥ 3.14 or 5.9) Omron Components, TM Robots (TMFLOW ≥ 1.76.3300) Fanuc Plugin, CRX robots (Version ≥ 9.40P/06) Doosan App, Series A, H and M Robots (Version ≥ V2.7.3) ABB Add-in, for GoFa, SWIFTI, YuMi, IRB 1100 and -1300 Kuka iiQKA.OS (Version ≥ 1.0) Kassow CBun
Dimensions, controller	300 x 300 x 155 mm 11.8 x 11.8 x 6.1 inch
Dimensions, actuator	Stroke+253 x 160 x 90 mm Stroke+10.0 x 6.3 x 3.5 in
Actuator cable	5 m 16.4 ft
Weight, controller	6.6 kg 14.5 lb
Weight, actuator	5 - 12 kg, depending on stroke 11 - 26 lb, depending on stroke

Typical applications

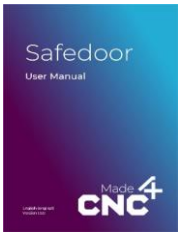
- CNC machine automation: Automates door operations to enable automation and robotic machine tending.
- Robotics: Integrates with collaborative robots for seamless automation of equipment door movements.
- Manufacturing: Suitable for automated door control in various manufacturing equipment, improving workflow efficiency and operator ergonomics.

System components

The system is composed of two packages: one with the controller and another package per actuator. Depending on the type of CNC machine, you will need a controller package and either one or two actuator packages.

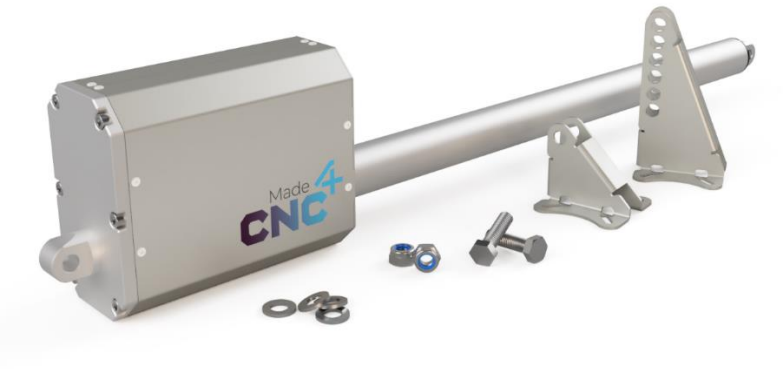
Controller package:

- Safedoor Controller
  - Safedoor controller board
  - Power supply (110/220VAC to 24VDC)
  - Printed instruction manual
  - 5m power cable (N+L+PE)
  - Cable entry plate with 9 PG11 knockouts
  - 9x PG11 for Ø5-10mm cables
- USB stick, containing:
  - Digital Instruction Manual
  - Digital Robot Instructions
  - URCap for Universal Robots (PolyScope v. 3.14 / 5.9 and above)
  - Components for Omron TM Robots (TMFLOW 1.76.3300 and above)
  - Plugin for Fanuc CRX Robots (Controller Software V9.40P/06 and above)
  - App for Doosan Series A, M and H Robots (Controller software V2.7.3 and above)
  - Add-in for ABB robots, Wizard blocks for GoFa, SWIFTI, single-arm YuMi, IRB 1100 and IRB 1300, KUKA KR C5 Micro
  - Kassow CBun
- Operator panel with 5m cable
  - Extra panel sticker for machine front mounting



Actuator package

- Safedoor actuator:
  - Stroke as designated on label,
  - 300 N (67.5 lbf)
  - 500 mm/s (19,7 in/s)
  - 5m cable
- Short mounting bracket
- Tall mounting bracket
- Mounting fasteners:
  - 2x M12x45 bolts
  - 2x M12 lock nuts
  - 4x M12 washers



Please check that all the parts are present and without defects before starting the installation.

Quick guide

DANGER
You must read, understand, and follow all safety information in this manual, as well as the manuals for robot, CNC machine and all other associated machinery before initializing door motion. Failure to comply with safety information could result in severe injury or death.

1. Actuator Installation

1. Unpack the content of the box (See full list of supplied equipment on page 10)
2. Mark the positions for the brackets on the door and machine frame. Observe the distances and positioning instructions in *Mounting the brackets* on page 15.
3. Secure the brackets to the machine and door using pop-nuts or similar fasteners.
4. Place the actuator between the brackets and secure it in place using the provided bolts, washers and nuts. Use the appropriate mounting holes in the tall bracket, to ensure the actuator is level.
5. Tighten the bolts and ensure that the actuator is firmly seated in the brackets.
6. When installing two actuators, repeat the process for the second actuator on the second door.
7. Verify that the door(s) can be moved freely and with even force throughout the travel.

See full description in the section *Mounting the* actuator on page 14.

INFO
The actuator must be able to fully reach the doors mechanical end stops in both directions. The minimum and maximum spacing between the brackets must be respected.

See *Mounting the brackets* on page 15.

2. Controller Installation

1. Mount the controller on a suitable location on the CNC machine.
2. Connect the *ENABLE* signal (J6 pin 1) to a source, such as the machine's interlock switch. See *J6: ENABLE* on page 21.
3. Connect J1 and/or J8 to the point(s) of control (e.g. machines door interface, a robot or the included operator panel). See *J1 & J8: DOOR CONTROL* on page 20.
4. Connect J3 and/or J7 to external machinery for the controller to provide them with feedback/status. See *J3 & J7: STATUS* on page 22.
5. If required, connect external emergency stop circuit and/or safety edge to J9. See *J9: E-STOP and REVERT* on page 22.
6. Connect the actuator(s) to J4 and/or J5. Observe the polarity according to *Mounting configuration* on page 14.
7. Connect the power supply to 110/230V AC. See *Mains connection* on page 25.

For full list and description of inputs and outputs, see *IO functional description* on page 20.

In addition, please refer to the following sections:

- *Interfacing with CNC machines* on page 36.
- *Interfacing with robots* on page 36.
- *Interfacing with an emergency stop circuit* on page 37.
- *Interfacing with a safety edge* on page 37.

INFO
Each input group is electrically isolated from each other and the rest of the board. External 24V and/or GND must be supplied at the COMMON terminals on each group.

3. System Configuration

1. Verify that the actuator and door can move freely and that the interlock will remain disengaged during the configuration.
2. Verify that that the ENABLE input is active.
3. Press and hold “CFG/CLR” on the Controller Board for 3 seconds to initiate the configuration cycle.
4. Observe the doors and ensure that both doors move all the way to the fully open and closed positions. The door will move back and forth multiple times, as the system configures.
5. Observe that the two green LEDs on the controller board light up, indicating that the configuration cycle was completed successfully.
6. If required, adjust the end-stop tolerance. See *Parameter programming menu* on page 28.
7. If required, adjust the OPEN DOOR delays on J1 and/or J8. See *Parameter programming menu* on page 28.

See full description and more options in the section *Configuration and Settings* on page 26.

DANGER
Safety features are not active during configuration. Stay clear of the door and observe it throughout the full cycle. Be prepared to remove power from the system, in case of an emergency.

For more guides and instruction videos, visit www.made4cnc.com

Mounting the actuator

It is important to plan the mounting process carefully before starting the work. This section guides you through the decisions in the process.

Mounting configuration

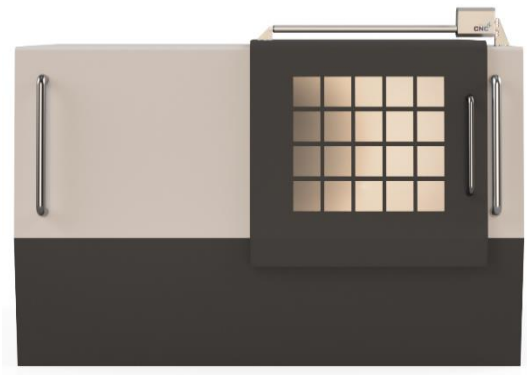
To accommodate various CNC machine designs, the Safedoor actuator and accompanying brackets offer a variety of different mounting options.

The two mounting brackets share similar mounting hole patterns and can both be used to fixate either end of the actuator.

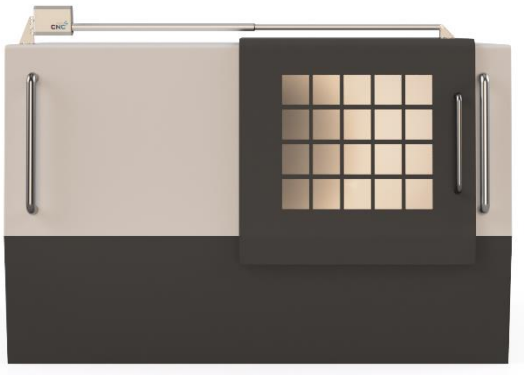
The low bracket is intended to be mounted on the highest of the two mounting points on the machine, and the tall bracket should be mounted on the lower mounting point. The tall bracket has multiple mounting positions for the actuator, allowing adjustment of the height to ensure the actuator is level with the door's direction of motion.

The end of the actuator with the motor-cabinet should always be mounted on the stationary side, i.e., on the CNC machine body. The rod end of the actuator should be mounted on the door of the CNC machine.

The actuator(s) can be mounted in either configuration: retracted when the door is closed and extended when the door is open, or vice versa. Keep in mind that the wires in the motor connector J4 and/or J5 mat need to be swapped depending on the configuration. See *J4 & J5: Actuator* outputs on page 24.

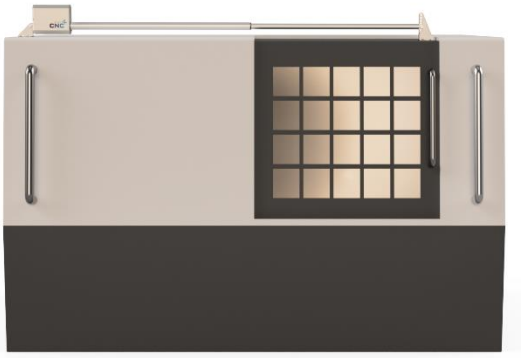


Retracted when closed



Extended when closed

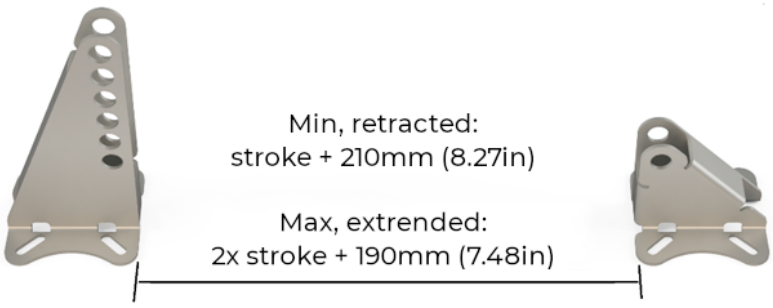
When the door is internal or the mounting point on the door, or for other reasons, is lower than the body of the CNC machine, the tall bracket should be mounted on the door, to allow the actuator to remain parallel with the door's line of motion.



Internal door mounting.

Mounting the brackets

When determining the position of the mounting brackets, it is important to ensure that they are lined up correctly and that the distance between them is correct. When the two mounting brackets are closest together, there must be stoke + 210mm between them to ensure proper operation of the actuator. The actuator will, when fully extended, push the brackets up to 2x stoke + 190mm apart.

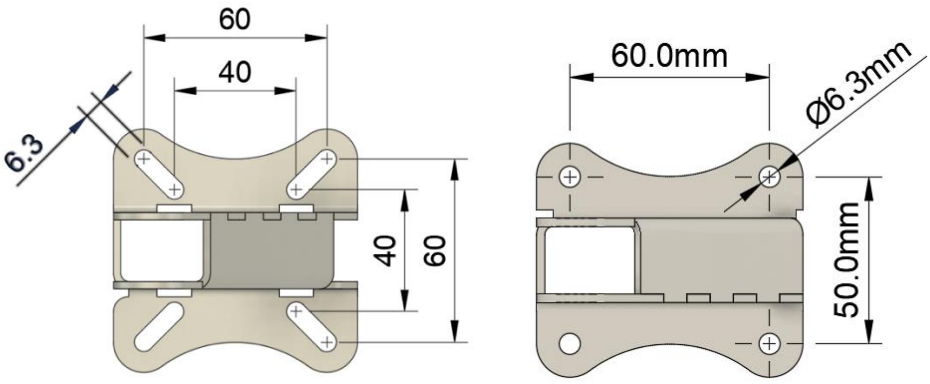


Maximum and minimum bracket distances over the travel length of the door.

The movement of the door must be mechanically limited so that the maximum and minimum distances are observed. If the mechanical stops provided by the CNC machine are not able to provide such stops, additional stops must be installed.

Once the positioning of the two mounting brackets has been determined, they can be mounted on the CNC machine body and door. The brackets should be mounted using

the four slotted mounting holes provided on each bracket. The slotted holes make it convenient to mount the brackets on various standard aluminum profiles and similar.



Bracket mounting dimensions in mm. Both the tall and the short brackets share the same mounting dimensions.

Mounting the actuator

The tall mounting bracket is made with several sets of mounting holes to allow height adjustment during the installation. Use the correct set of holes to adjust the actuator to a horizontally aligned position.

Each end of the actuator should be bolted into the brackets using the provided M12x45 bolts, M12 washers and M12 lock nuts. See the figure below. The bolts must be tightened firmly, and the actuator should not be able to jiggle when correctly mounted.

Safedoor actuators must only be installed to work with axial pushing and pulling forces. Lateral and radial loading is not permitted.

The actuators must be mounted in the supplied mounting brackets using the supplied bolts, tensioned to the specified torque, to ensure that neither of the actuator's ends are able to rotate in the mounting bracket. The minimum distance between the

mounting brackets must be respected, as the actuator cannot withstand retracting beyond this distance.

DANGER
Loose bolts can cause the actuator to fall from the CNC door. Always use the included safety nuts and make sure that they are firmly tightened.

Mechanical stops must be provided by the CNC machine or installed by separately the integrator, to ensure the minimum distance is kept. The Safedoor system uses the mechanical stops to automatically detect the width of the door and thereby scheduling proper acceleration and deacceleration of the door prior to closure of the door. This ensures that most of the kinetic energy of the door is removed before the door closes, further reducing the severity of pinching and crushing hazards.

Do not connect the actuator's power cables before verifying that it is mechanically secured and unable to rotate axially in either of the attachment points.

Maintenance and repair

All maintenance and repairs must be performed in compliance with this manual and latest service manual, which can be found on www.made4cnc.com/support.

Repairs must be performed by authorized system integrations or made4CNC. Original spare parts must be used.

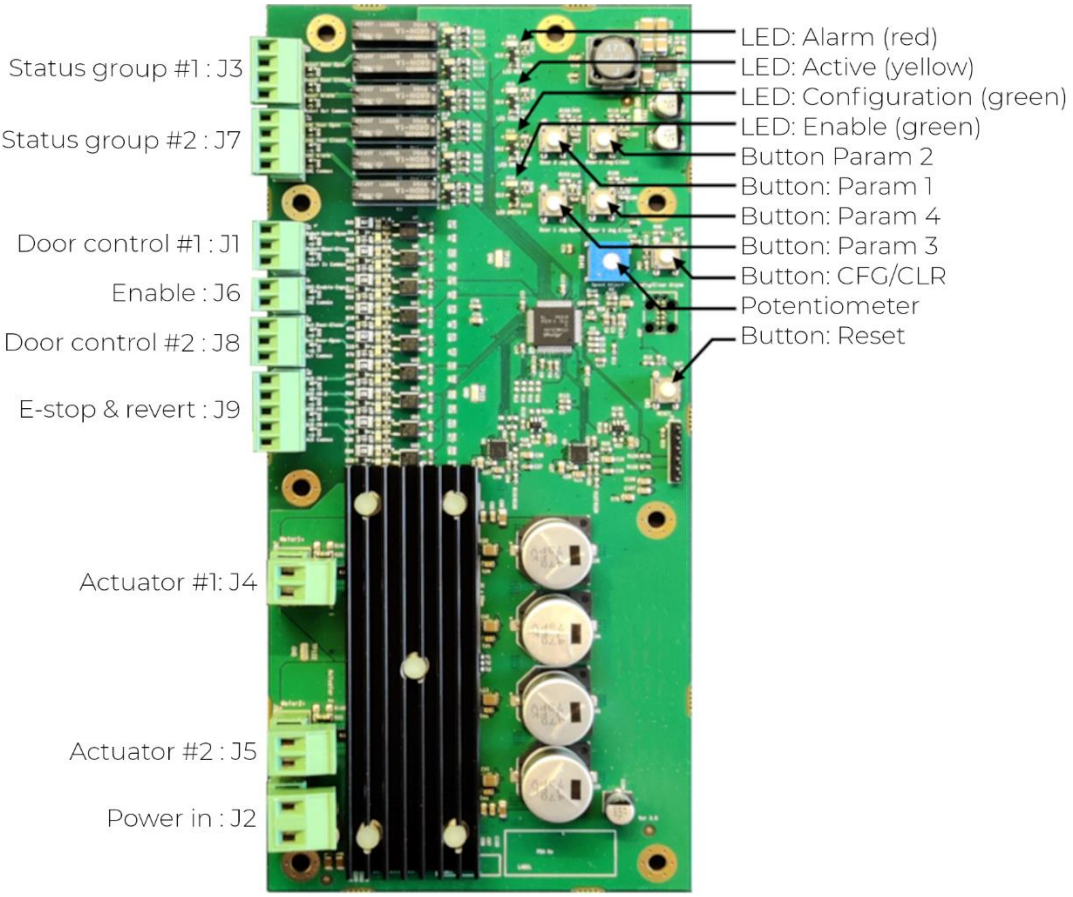
Actuators and controllers are marked with a product generation number. Only combine actuators and controllers with same generation number. Ask technical support for generation details.

WARNING
Combining actuators and controllers from different generations can change properties of the product significantly. Safety features might not be fully functional, which can result in injuries.

Use of non-original spare parts can change the safety features significantly. This can result in unacceptable impact forces and/or reduced product lifespan, which can result in injuries.

Electrical connections

Board overview



PCB status and controls

Name	Function(s)
LED: Alarm (red)	Indicates internal error.
LED: Active (yellow)	Indicates that the doors are moving.
LED: Config (green)	Solid on if the configuration is done.
LED: Enable (green)	Solid on when the ENABLE input is high. Flashes when emergency stopped.
Button: Param 1	Programs J1 OPEN DOOR delay in parameter menu.[1]
Button: Param 2	Programs end-stop tolerance in parameter menu.[1]
Button: Param 3	Programs J8 OPEN DOOR delay in parameter menu.[1]
Button: Param 4	-
Button: CFG/CLR	Hold for 3 seconds to initiate configuration cycle.[2] Hold during reset to enter parameters menu.[1]
Button: Reset	Press to perform a hardware reset of the controller PCB.
Potentiometer	Maximum speed configuration.[2] Programming value for parametes.[1]

[1]See Parameter programming menu on page 28.
[2]See Configuration and Settings on page 26.

IO Overview

Connection	Name	Signal type	Reference	Rating
J3 pin 1	DOOR OPENED #1	Digital output	J3 pin 4	$24V_{dc}$ / $1A_{dc}$
J3 pin 2	DOOR CLOSED #1	Digital output	J3 pin 4	$24V_{dc}$ / $1A_{dc}$
J3 pin 3	ALART #1	Digital output	J3 pin 4	$24V_{dc}$ / $1A_{dc}$
J3 pin 4	Group supply (24V)	Group common		
J7 pin 1	DOOR OPENED #2	Digital output	J7 pin 4	$24V_{dc}$ / $1A_{dc}$
J7 pin 2	DOOR CLOSED #2	Digital output	J7 pin 4	$24V_{dc}$ / $1A_{dc}$
J7 pin 3	ALARM #2	Digital output	J7 pin 4	$24V_{dc}$ / $1A_{dc}$
J7 pin 4	Group supply (24V)	Group common		
J1 pin 1	OPEN DOOR #1	Digital input	J1 pin 3	$24V_{dc}$
J1 pin 2	CLOSE DOOR #1	Digital input	J1 pin 3	$24V_{dc}$
J1 pin 3	Group GND (0V)	Group common	J1 pin 3	
J6 pin 1	ENABLE	Digital input	J6 pin 2	$24V_{dc}$
J6 pin 2	Group GND (0V)	Group common		
J8 pin 1	OPEN DOOR #2	Digital input	J8 pin 3	$24V_{dc}$
J8 pin 2	CLOSE DOOR #2	Digital input	J8 pin 3	$24V_{dc}$
J8 pin 3	Group GND (0V)	Group common		
J9 pin 1	EMERGENCY STOP 1	Digital input	J9 pin 5	$24V_{dc}$
J9 pin 2	EMERGENCY STOP 2	Digital input	J9 pin 5	$24V_{dc}$
J9 pin 3	(unused)	Digital input	J9 pin 5	$24V_{dc}$
J9 pin 4	REVERT MOTION	Digital input	J9 pin 5	$24V_{dc}$
J9 pin 5	Group GND (0V)	Group common		
J4 pin 1	ACTUATOR 1 +	24V power		$24V_{dc}$ / $12A_{dc}$
J4 pin 2	ACTUATOR 1 -	24V power		$24V_{dc}$ / $12A_{dc}$
J5 pin 1	ACTUATOR 2 +	24V power		$24V_{dc}$ / $12A_{dc}$
J5 pin 2	ACTUATOR 2 -	24V power		$24V_{dc}$ / $12A_{dc}$
J2 pin 1	24V SUPPLY	24V power		$24V_{dc}$ / $21A_{dc}$
J2 pin 2	GND	24V power		$24V_{dc}$ / $21A_{dc}$

Each connector group is galvanically isolated from the rest of the controller board and from each other and implemented in compliance with IEC-61131-2 Type 3.

All digital outputs are normally opened relays. When activated the output is electrically connected to the respective reference pin.

All digital inputs are optocoupled and activate when a voltage of 24V with respect to the group common ground is applied.

IO functional description

J1 & J8: DOOR CONTROL

The door control groups J1 and J8 are used to signal the door to open and close. The two groups are functionally identical but have separate configurations for hold-to-run/edge-triggered and opening delay.

Input signals should be 24V when activated and 0V when not activated, with reference to pin 3.

These inputs can be used to control the door from external equipment. E.g. the machine could set the OPEN DOOR signal at the end of its machining cycle and the robot could set the CLOSE DOOR signal when it is has inserted a blank into the machine and has moved out of the machine and is clear of the doors motion path.

Note that both CLOSE DOOR and OPEN DOOR commands are accepted when the door is moving. E.g. when an OPEN DOOR command is given while the door is closing, the door will simple change direction and start opening instead.

Pin	Description
Pin 1: OPEN DOOR	Request door close.
Pin 2: CLOSE DOOR	Request door open.
Pin 3: GND	Common GND for the J1 group.

Each of the door control groups can operate in either hold-to-run or edge-triggered mode. The mode defaults to edge-triggered but is set to hold-to-run if a positive edge on either CLOSE DOOR or OPEN DOOR is detected during the configuration cycle.

In **edge-triggered mode** (default), the door will start moving when a positive edge is detected on the input. Once the motion is initiated the signal can return to low without stopping the door.

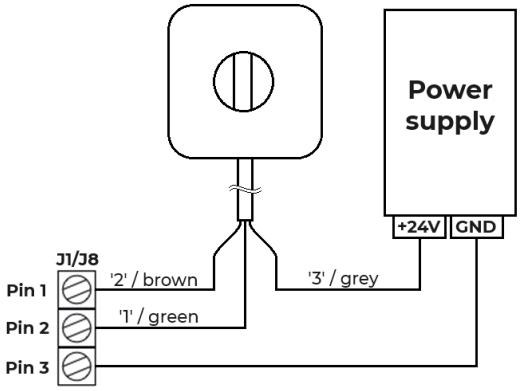
In **hold-to-run** the door will start moving when a positive edge is detected on the input. When/if a negative edge is detected on the same input the door will stop mid-travel.

The OPEN DOOR signals on both groups can be independently **delayed**, if required by the application. See *Opening delays* on page 2926.

INFO
Signals on the inputs of J1 and J8 are ignored if the ENABLE signal on J6 is low. After activation of ENABLE a positive edge on s required to initiate any motion.

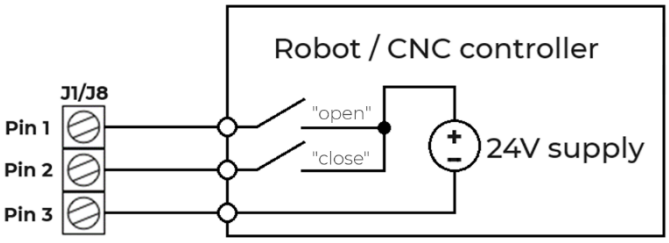
J1 and J8 can be connected to various external equipment to control the motion of the door. Below are a few connection examples.

The operator panel can be connected to either J1 or J8 as shown in the diagram below. The wires on the operator panel may be marked with either numbers or colors. The power supply in the Safedoor Controller can be used to power the button.



A robot or CNC controller can control the door by using their digital outputs as shown in the diagram below. Note that J1 and J8 are isolated and will each need to be connected to the external controller's GND on their respective pin 3.

See *Interfacing with CNC machines* on page 36 and *Interfacing with robots* on page 36.



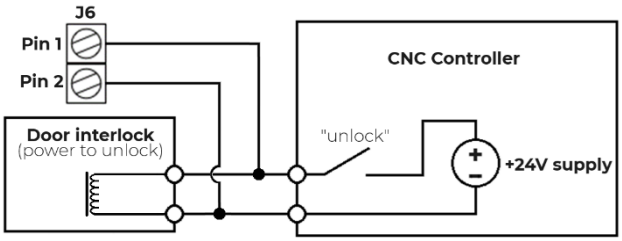
J6: ENABLE

The connectors in group J6 are used to signal the door that it can safely open, as the CNC machine is not active and has unlocked the door.

The signal should be connected to the supply line for the door interlock or a similar signal.

Pin	Description
Pin 1: ENABLE	When this signal is high commands on J1 and J8 are available and configuration cycles can be started. Commands to open/close or configure the system are ignored if this signal is low.

Pin 2: CNC GND	Common GND for the J6 group.



J3 & J7: STATUS

The connector groups J3 and J7 are identical and used to signal the state of the door to external equipment. They should be powered by connecting a 24V supply pin 4.

These signals can be used to signal external equipment about the state of the door and thus the operational cycle. E.g. the DOOR CLOSED can be used to activate the machine's cycle-start and the DOOR OPENED can be used to indicate to the robot that the machining cycle is completed, and it can safely enter the machine to exchange the finished part for a new blank.

The DOOR ALARM signal is set high when 3 consecutive attempts to close the door have failed due to an unexpected external force during the motion. The signal is kept high until reset by a new OPEN DOOR or CLOSE DOOR command via J1 or J8.

Pin	Description
Pin 1: DOOR OPENED	Relay contactor is closed when the door is fully opened.
Pin 2: DOOR CLOSED	Relay contactor is closed when the door is fully closed.
Pin 3: DOOR ALARM	Relay contactor is closed when the system is in an alarm state.
Pin 4: 24V	Common supply for the J3 group.

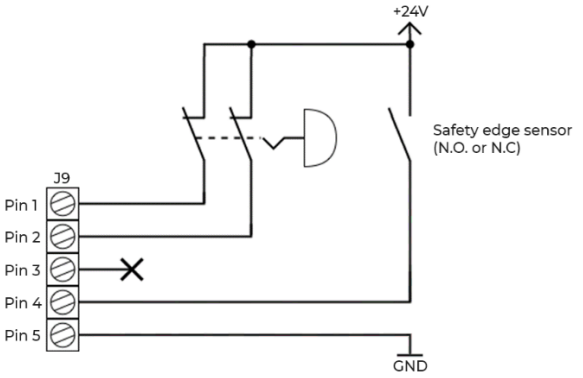
J9: E-STOP and REVERT

Emergency stop inputs are only supported for controllers produced after 1/1 2022. Safety edge input is only supported for controllers produced after 1/6 2024.

Pin	Description
Pin 1: E-STOP 1	Can be connected to an independent output on an Emergency stop circuit. When activated (24V is removed), the system will be set in an emergency stop mode, immediately stopping door motion.
Pin 2: E-STOP 2	Can be connected to an independent output on an Emergency stop circuit. When activated (24V is removed), the system will be set in an Emergency stop mode, immediately stopping door motion.

Pin 3: -	-
Pin 4: REVERT	Can be connected to a safety edge mounted on the leading edge of the door.
Pin 5: GND	Common GND for the J9 group.

Below is an example connection diagram for the emergency stop- and revert inputs.



Emergency Stop inputs (E-STOP 1 & E-STOP 2)

STOP 1 and STOP 2 comprise an emergency stop input which can be used to immediately stop door motion when CNC machine, robot and/or a separate button is put into emergency stop.

The emergency stop input is an optional feature as its use and requirements depend on the specific CNC application (See CNC manual, robot manual and risk assessment). The use of the emergency stop input feature is automatically detected during configuration. If unused, leave the terminals unconnected.

To restart motion after an emergency stop, first un-emergency stop (both STOP 1 and STOP 2 reestablished to 24V) and secondly provide an open or close command on either J1 or J8 (all edge changes on control inputs represents a reset from the emergency stop mode)

See additional functional description and considerations in the section *Interfacing with an emergency stop circuit* on page 37

Safety edge input (REVERT)

The REVERT (J9 pin 4) input can be used to trigger a motion reversal by external equipment. Connect this input to a safety edge mounted on the leading edge of the door, if required by the safety assessment.

If either a rising or falling edge is detected on this input during opening or closing motion, the door will retract back to the initial position and reattempt the motion.

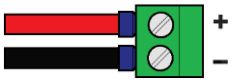
See additional functional description and considerations in section *Interfacing with a safety edge* on page 37.

J4 & J5: Actuator outputs

The two power outputs connect to the actuator to power it. Use either of the outputs in a single door installation and connect the two actuators to each of their own output in a double door installation.

The polarity of each output can be inverted to cause the actuator to travel in the opposite direction.

Retracted when closed.
Extended when opened.



Retracted when opened.
Extended when closed.

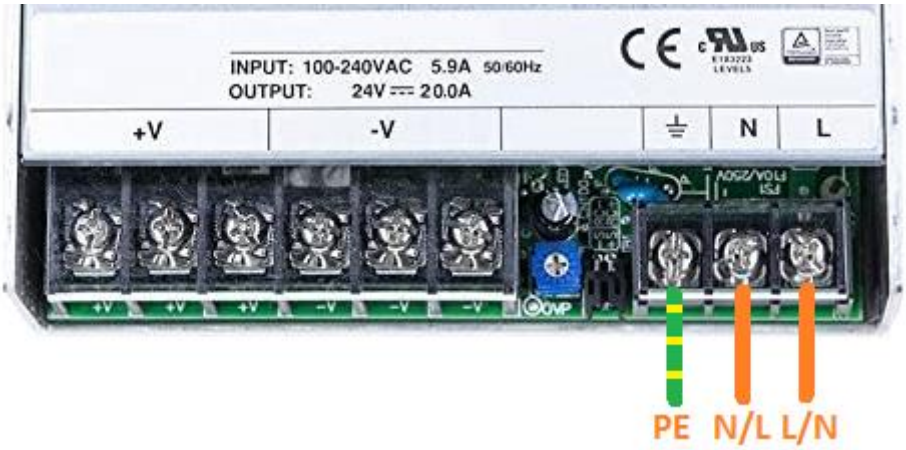
Pin	Description
Pin 1: ACTUATOR +	Connect to actuator red wire when retracted = closed Connect to actuator black wire when retracted = open
Pin 2: ACTUATOR -	Connect to actuator black wire when retracted = closed Connect to actuator red wire when retracted = open

J2: Power supply

Connector to power supply unit, providing power for the controller board and the attached actuators.

CAUTION
Pay attention to polarity when connecting signals and power to the controller board. Reversal of voltages may cause permanent damage to controller board, power-supply and any attached equipment.

Mains connection



230V / 110V is connected to the internal power supply as shown below.

The placement of L (line) and N (neutral) is not important and can be done as preferred by the integrator. Wires and cable must be rated to carry at least the current of the fuse group of the connected power source, and this fuse must be between 6A and 16A.

Connection of protective earth to the PE terminal is mandatory, and the power source must be fitted with a residual-current device.

Configuration and Settings

A configuration cycle must be performed on the system after it has been installed. The configuration cycle is started by pressing and holding the **CFG/CLR button for 3 seconds.** During the configuration the door will move back and for the multiple times and varying speeds. The cycle measures the width, resistance, weight, and other parameters on the door and stores it internally on the controller board. This data is later used to ensure proper speed ramping as well as high force detection, once the system is in service.

Maximum speed: Before the configuration is initiated the maximum allowed speed should be set via the potentiometer on the Controller board (see *Board overview* on page 18). The speed maximum speed can be set in three steps: 250, 375 and 500mm/s.

Speed setting	Description
	Fully clockwise: High speed: 500 mm/s
	Centered: Medium speed: 375 mm/s
	Fully counterclockwise: 250 mm/s

The maximum speed, determined during the configuration, will always be within the maximum speed indicated by the speed selector when the configuration is initiated.

Changing the position of the potentiometer after the configuration is completed has no effect on the speed.

Emergency stop input: At the beginning of the configuration, the system observes if either pin 1 or pin 2 in J9 is high. In this case, the system will configure to be used with emergency stop input enabled. See *Interfacing with an emergency stop circuit* on page *37*.

Trigger mode: If either OPEN DOOR or CLOSE DOOR in groups J1 and J8 are activated during configuration, the respective group will be configured in **hold-to-run** mode. In this mode, the door will start moving when the open/close signals are observed and stop when the signals are released, even if the door has not reached the opened/closed position.

The inputs default to **edge-triggerede** mode if no inputs are detected on OPEN DOOR or CLOSE DOOR during the configuration. In this mode an open/close signal will initiate the appropriate motion. The motion will complete, even if the open/close signal is released during the motion. The setting is done per-group.

During the configuration the system automatically configures these parameters:

Stroke: The distance between the opened and closed position. This allows the system to slow down the motion in due time before reaching the end of a travel.

Dynamic model: The mass, rolling resistance, drag and other dynamic parameters are determined to model the expected forces during travel and optimize the motion profile accordingly.

Maximum speed is determined, ensuring that the total energy of the moving mass is kept at or below **10 Joules**. This limit is calculated as $v_{max} = \sqrt{\frac{2 \cdot 10J}{m_d}}$, where m_d is the dynamic mass in kg. The maximum speed will always be within the maximum speed set by the speed selector.

Maximum acceleration is determined to ensure that the acceleration force is kept below **225 Newtons** and the total power is kept below **150 Watts**.

When configuring an emergency stop circuit, having high signals on J9 will activate the emergency stop feature. If no signals are high, the emergency stop feature will not be activated (See *Interfacing with an emergency stop circuit* on page 37).

Running the configuration

DANGER
Force monitoring is not active during all phases of the configuration. Take necessary precautions, observe- and stay clear of the door until the configuration is completed.

To perform a configuration, follow these steps carefully:

1. Ensure that the CNC door can move freely.
    a. Linear rails must be clean, free from chips/dust/debris and well lubricated.
2. Ensure that the actuator is mounted correctly on the CNC machine.
    a. The mounting brackets must be firmly mounted on the CNC machine.
    b. The actuator must be level with the machine and door.
    c. All bolts must be properly tensioned.
    d. All electrical connections must be firmly tightened.
3. Ensure that the CNC machine is not operating, and that the “CNC Not Active” signal is provided and high.
4. If required, ensure that the emergency stop circuit is properly connected.
    a. Ensure that emergency stop inputs receive a constant high signal.
5. Ensure that power and PE (protective earth) are connected.
    a. AC power (110V or 220V) source must be connected to the power supply in the controller cabinet.

b. The power supply and the controller cabinet must be connected to PE (protective earth).
c. 24V supply and GND cables must be mounted between the power supply and the controller board.

6. Press and hold “Config / Clear” for 3 seconds to initiate the configuration cycle.
   a. Observe the doors and ensure that both doors move all the way to both the fully opened and the fully closed position.
   b. Configure hold-to-run modes as needed, by activating an input in the relevant group. E.g., twist the button on the operator panel during configuration to configure it as a hold-to-run input.
   c. Observe that the two green LEDs on the controller board light up, indicating that the configuration cycle was completed successfully.
7. If an emergency stop circuit is connected, test to see if it stops the motion of the doors as intended.

Parameter programming menu

To access the programmable parameters, the controller must be reset into the parameter programming menu. This is done by pressing and holding the CFG/CLR button and then pressing and releasing the RESET button on the PCB.

The ACTIVE LED will flash to indicate that the parameter programming menu is active.

To program a setting, turn the potentiometer to the required value (see table below) and press and hold the corresponding parameter button until the CONFIG LED flashes rapidly.

After releasing the parameter button is released the procedure can be repeated for another parameter, if needed.

When all settings are properly adjusted, the menu can be exited by pressing the CFG/CLR button, causing the controller to store the settings and resume normal operation.

Setting	Fully CCW 	Fully CW 	Program button
J1 DOOR OPEN delay	0 seconds	3 seconds	Adj. 2
J8 DOOR OPEN delay	0 seconds	3 seconds	Adj. 4
End-stop tolerance	5mm	50mm	Adj. 1

See *Board overview* on page 18.

The setting values are proportional to the position of the potentiometer. E.g. programming the J1 DOOR OPEN delay with the potentiometer at the mid-point between fully counterclockwise (CCW) and fully clockwise (CW) will set it at 1.5 seconds. Similarly, programming the end-stop tolerance with the potentiometer a quarter turn away from fully counterclockwise will set it at 12.5mm.

Opening delays

When the door is opened with an M code from the CNC machine program at the end of a program, the reaction time of the Safedoor controller may be too fast for the CNC controller to finish the program and release the interlock.

Reaction delays can be programmed on the OPEN DOOR inputs of J1 and J8. The controller will delay reaction on the input between 0 and 3 seconds depending on this setting. The default activation delays are 0 seconds for both inputs.

End-stop adjustment

In some applications springiness of the mechanical assembly may result in the positional shift or low repeatability of the length of the door stroke. To accommodate these positional shifts, the tolerance of the end-stop position can be adjusted with this parameter. If the position of the detected stop is within the tolerance, the system sets the DOOR OPENED or DOOR CLOSED signals, whereas it reverts to re-attempt the motion if the end-stop was detected out of the tolerance area.

Trimming of the end-stop tolerance affects the width of objects that might be caught between the door and the frame of the machine – never trim this parameter wider than necessary and always verify that blocking objects of the required size are detected by the system.

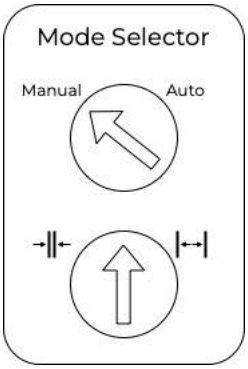
If tolerance cannot be trimmed with satisfactory results it is recommended to use an external safety edge. See *Interfacing with a safety edge* on page 37.

DANGER
Trimming of the end-stop position can potentially lead to pinching hazards. Always verify that the force-monitoring works as expected after trimming the position.

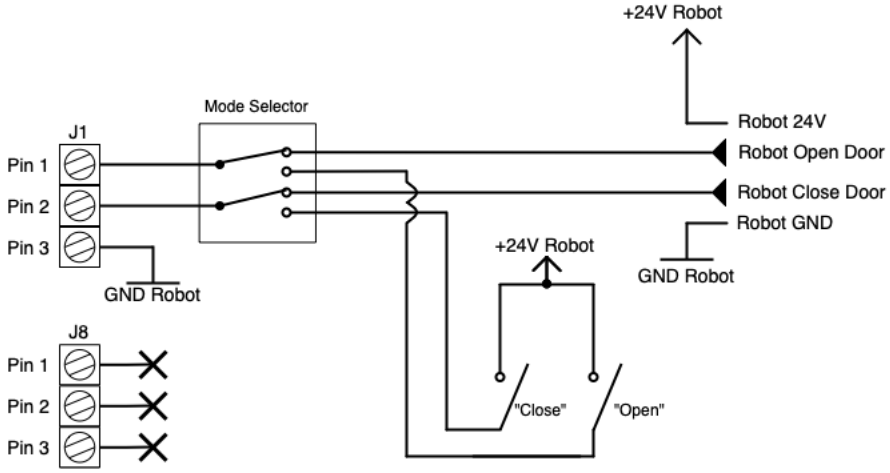
Mode Selector (Optional)

If desired in a specific installation, it is possible to add a switch to work as a mode selector to change between manual and automatic control. As default Safedoor accepts commands from both robot and operator buttons, and it completes a movement before accepting a new input. By adding a mode selector, inputs from the robot are disabled when manual mode (Manual) is enabled, allowing only the operator

buttons as input. When automatic mode (Auto) is enabled, only inputs from the robot can control the door.



When a mode selector is added the hold-to-run feature is disabled to make operation more convenient for the operator. The diagram below shows how to wire a mode selector button to the Safedoor Controller.



The integrator can choose any brand of industrial 24V capable DPDT / 2NO+2NC button for mode selection. For convenience the system has been tested with the components listed in the table below. Button to be built into a box; space efficient soler terminals:

Brand	Part Number	Description
IDEC	LBW7S-2T6	Turn button, 16mm, Solder Terminals
IDEC	LBW6K-2ST6A	Turn key, 16mm, Solder terminals

If solder connections are undesired, the Siemens button below is a good choice. Be aware that the body on the backside is fairly large, as the four screw terminal blocks stack in two layers:

Brand	Part Number	Description
Siemens	3SU1052-2BF60-0AA0	Turn button (Part 1 of 6)
Siemens	3SU1550-0AA10-0AA0	Turn button (Part 2 of 6)
Siemens	3SU1400-1AA10-1BA0	Contacts NO (x2) (Part 3&4 of 6)
Siemens	3SU1400-1AA10-1CA0	Contacts NC (x2) (Part 5&6 of 6)

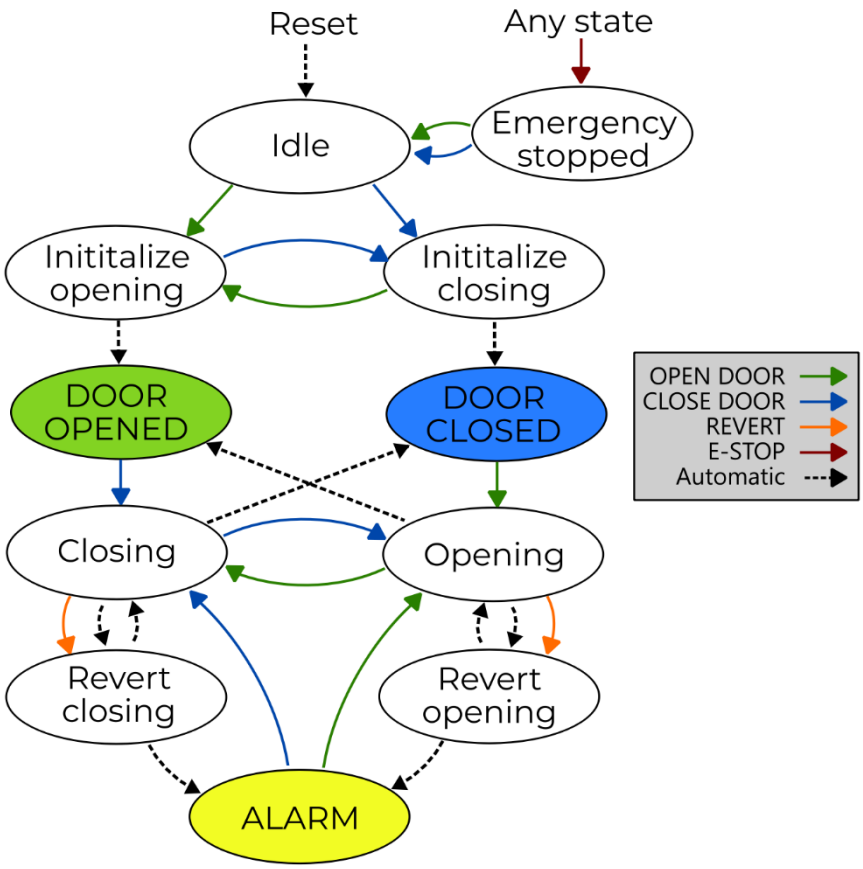
It is recommended to consider drilling holes in the CNC machine front to fit the two buttons because of their difference in dimensions

Software specification

Operating states

The software on the Controller Board performs motion control and force monitoring of the actuators and communicate with the CNC machine, robot, operator panel and other equipment through digital inputs and outputs.

During normal operation, the Safedoor Controller has four operating states; *Opening*, *DOOR OPENED*, *Closing* and *DOOR CLOSED*. In the state diagram below the capitalized and colored states represent the ones that have corresponding outputs.



Idle state

In the initial *Idle* state the actuators are unpowered and the system awaits a *OPEN DOOR* or *CLOSE DOOR* command on either J1 or J8 before it begins the initialization sequence. Once this is completed the system enters either the *DOOR OPENED* or *DOOR CLOSED* states, depending on which command it received. It is possible to change the direction of initialization by giving the system a new *OPEN DOOR* or *CLOSE DOOR* command while it is initializing.

Opening state

When in *Opening* state, the door is accelerated to the configured maximum speed. The speed is maintained until the door approaches the fully opened position. Then it is slowed down and reaches the fully opened position safely. Once the controller senses that the door is fully opened it transitions into *DOOR OPENED*. If a command to close the door is given during the motion, the door will enter the *Closing State* and reverse its motion.

If an excessive force or either a falling or rising edge on the *REVERT* signal is detected during motion the system will enter the *Revert opening* state and return to the opening position before reentering the *Opening* state and reattempt the opening motion.

In addition, the door will slow down to a stop mid travel, if the input initiating the Opening motion was configured as hold-to-run and is released during the motion. The motion can be resumed in either direction by a new *OPEN DOOR* or *CLOSE DOOR* command on J1 or J8.

DOOR OPENED

When the controller is in DOOR OPENED state the outputs *DOOR OPENED* on J3 and J7 are activated. In this state the Controller waits for an *OPEN DOOR* command on either J1 or J8 to be set while *ENABLE* is also set. The Controller then clears the *DOOR OPENED* outputs and transitions to the *Closing* state.

Closing state

When in *Closing* state, the door is accelerated to the configured maximum speed. The speed is maintained until the door approaches the fully closed position. Then it is slowed down and reaches the fully closed position safely. Once the controller senses that the door is fully closed it transitions into *DOOR CLOSED* and sets the *DOOR CLOSED* signals in J3 and J7. If a command to open the door is given during the motion, the door will enter the *Opening State* and reverse its motion.

If an excessive force or either a falling or rising edge on the *REVERT* signal is detected during motion the system will enter the *Revert closing* state and return to the opening position before reentering the *Closing* state and reattempt the closing motion.

In addition, the door will slow down to a stop mid travel, if the input initiating the closing motion was configured as hold-to-run and is released during the motion. The motion can be resumed in either direction by a new *OPEN DOOR* or *CLOSE DOOR* command on J1 or J8.

DOOR CLOSED

When the controller is in *Closed* state the outputs *DOOR CLOSED* on J3 and J7 are activated. In this state the Controller waits for an *CLOSE DOOR* command on either J1

or J8 to be set while *ENABLE* is also set. The controller then clears the *DOOR CLOSED* outputs and transitions to the *Opening* state.

Emergency stopped

When the controller is configured with emergency stop inputs enable (signals present during configuration), the controller will enter *Emergency stopped* when a falling edge on *E-STOP 1* or *E-STOP 2* is detected. In this state the motor power is removed and the doors can freely be moved by hand. Once voltage is re-applied to both *E-STOP 1* and *E-STOP 2* the system enters *Idle*.

ALARM

If three consecutive attempts to close or open door have been unsuccessful the system will stop its motion after reverting to the initial position from where the *OPEN DOOR* or *CLOSE DOOR* was given and enter the *ALARM* state. The *ALARM* outputs in J3 and J7 are activated and the system awaits a new *OPEN DOOR* or *CLOSE DOOR* command. When this command is given the *ALARM* signal will be cleared and the system will initiate the requested motion normally.

Robot plug-ins

Safedoor comes with software plug-ins for all the major brands of robots on the market. Please find them as well as the *Robot Instructions Manual* on the USB stick included in the controller package. Plug-ins and Robot Instructions are likewise available for download on our website:

www.made4cnc.com/support-download-section/

Below is a list of the available plug-ins.

Robots	Type	Functionality
Universal Robots Polyscope ≥ 3.14 Polyscope ≥ 5.9	URCap	• Written installation- and programming instructions • Installation node for configuring electrical connections between robot controller and Safedoor • OpenDoor node for opening the machine door. • CloseDoor node for closing the machine door. • Toolbar integration for operating the door from the teach pendent.
Omron TMFLOW ≥ 1.76.33	Component	• Written installation- and programming instructions • Config node for configuring electrical connections between the robot controller and Safedoor. • Open Door Node for opening the machine door. • Close Door Node for closing the machine door.
Fanuc CRX Version ≥ 9.40P/06	Fanuc Plugin	• Written installation- and programming instructions. • Configuration screen for configuring electrical connections between the robot controller and Safedoor. • Manual operation of the door from the Configuration screen • Open Instruction for opening the door from a program. • Close Instruction for closing the door from a program.

Doosan Series A, H & M Version ≥ 9.40P/06	Doosan App	• Written installation -and programming instructions. • WCI for configuring electrical connections between the robot controller and Safedoor. • Open Door skill for opening the machine door. • Close Door skill for closing the machine door.
ABB GoFa, SWIFTI YuMi IRB 1100 IRB 1300	Add-In WizardBlock	• Written installation -and programming instructions. • Configuration screen for setting up electrical connections between the robot and Safedoor. • Manual operation of the door form the Configuration screen. • Open Door Block for opening the machine door. • Close Door Block for closing the machine door. • RobotStudio smart component
KUKA KR C5 Micro iiQKA.OS ≥ 1.0		• Written installation -and programming instructions. • Connection examples • Setup guide • Programming guidelines and examples • Example program
Kassow Robots	CBun	• Written installation -and programming instructions. • Configuration screen for setting up electrical connections between the robot and Safedoor. • Open Action for opening the machine door. • Close Action for closing the machine door.

LEDs

The Controller Board has four LEDs, indicating the state of the Controller. Below is a description of each of the LED's; please refer to *Board overview* on page 18 for placement of the LEDs.

Alarm LED (red)

The Alarm LED is off during normal operation. If a problem, which requires the operator's intervention, is detected the Controller switches to the *Alarm State* and the *Alarm LED* will flash one of the patterns below, to indicate the cause. The *Alarm* state is retained until the cause of the alarm is removed and the *Reset / Config* button is pressed.

Blink pattern	Cause	Description
Solid on	Manual mode	Either of the Jog buttons was pressed and the Controller Board is in Manual Mode.
Single flash	Temperature Alarm	The motor driver's temperature exceeded 60C. Make sure the rails are clean and the door can move without excessive resistance.

Active LED (yellow)

The Active LED is on when the system is currently opening or closing the door. The LED is also on if a configuration cycle is being performed.

Configuration LED (green)

The configuration LED is ON when the system has been properly configured. If not, it will flash to indicate that configuration is required before the system can be used.

Enable LED (green)

The Enable LED is on, when the ENABLE input is high, and the system can move the door. When the system is in emergency stopped mode the Enable LED will flash.

Interfacing with CNC machines

When interfacing with the CNC machine, the system needs to be aware of the CNC's operating state, i.e. if the CNC is currently running a cycle and the doors need to remain closed, or if the cycle is completed and the door can be opened.

This information should be given by setting the ENABLE signal high when the CNC is not operating, and the door can be opened. When the machine starts a cycle, it should clear this signal and remain clear till the cycle is complete and the mechanical locks on the door have been unlocked.

The DOOR OPENED and DOOR CLOSED signals on either J3 or J7 can be used to signal the CNC to e.g. start a new cycle when the doors have been closed.

Likewise the OPEN DOOR and CLOSE DOOR signals on either J1 or J8 can be connected to the machine's door interface or an M-code output to allow the machine to operate the door.

When opening the door from an M-code at the end of the machining cycle it may be required to set an activation delay on the relevant OPEN DOOR signal, to allow the program to terminate and the door to unlock before the Safedoor attempts to initiate the opening motion. See *Opening delays* on page 29.

Interfacing with robots

Connecting a control group (J1 / J8) and a status group (J3 / J7) to the robot allows it to determine the current state of the CNC machine, as well as initiating door motion.

When the door opens DOOR OPENED is set on the status group and the robot can start its part replacement cycle.

Once done with its cycle, the robot can use the CLOSE DOOR signal the door to close.

When the door is fully closed, the DOOR CLOSED signal is set, which can be used to trigger Cycle Start on the CNC.

When using Safedoor with a robot it is recommended to use the software plug-in for the robot to ensure smooth and reliable integration. You will find the plug-ins as well as the Robot Instructions on the enclosed USB stick and on our website.

Interfacing with an emergency stop circuit

Optionally an emergency stop circuit can be connected to E-STOP 1 and E-STOP 2 (J9 pins 1 and 2). This can be used to immediately stop door motion when CNC machine, robot and/or a separate button is put into emergency stop. In the emergency stop mode the system will prevent any motion of the door.

The presence of an external emergency stop circuit is captured during the configuration cycle (See *Configuration and Settings* on page 26*)*. If either of the inputs E-STOP 1 or E-STOP 2 are high during the configuration, the system will register that an external emergency stop circuit is connected and will expect said circuit to be connected during operation. When neither of the signals are active (24V not present) during configuration, emergency stop mode is deactivated and the system will ignore the inputs during operation.

When configured with an external emergency stop circuit present, the system will monitor the emergency stop inputs during operation. Only when both signals are high will the system allow motion of the doors.

It is important to verify that the configuration captured the presence of an external emergency stop circuit, prior to placing the system into service. This can be done by activating the emergency stop while the door is in motion and verifying that it stops immediately.

Once the external emergency stop is deactivated and both inputs go high, the system exits emergency stop mode and proceeds to normal operation. Door motion will not start automatically when exiting emergency stop mode, even if a signal to move (robot/button open/close door) is high; a transition from low to high on one of these inputs are needed to reinitiate motion.

The functionality of the emergency stop circuit should be verified before the system is put into operation. It is likewise advised to test the functionality periodically.

Interfacing with a safety edge

Optionally a safety edge can be mounted to the leading edge of the door and its output connected to the REVERT MOTION input (J9 pin 4).

During opening and closing movements this input is observed and any rising or falling edges on it will immediately cause the system to reverse the direction of the motion back to the starting point, from where the motion is re-attempted.

The functionality of the safety edge should be verified before the system is put into operation. It is likewise advised to test the functionality periodically.

Safety

System integrator responsibilities

The system integrator is responsible for ensuring that the applicable safety laws and regulations in the country where the product is incorporated are followed and that all significant hazards in the complete automated system are eliminated. This includes, but is not limited to:

- Performing a risk assessment for the complete system, including CNC machine and/or robot.
- Interfacing other machinery and additional safety devices, if defined according to the risk assessment.
- Setting up the appropriate safety settings in the robot- and CNC software and other relevant safety controllers.
- Ensuring that the user will not modify any safety measures.
- Validating that the total system is working correctly and according to system requirements.
- Writing instructions for use (To be read by daily operators etc.)
- Marking the installation with the relevant signs and contact information system integrator.
- Collection all documentation in a technical file; including the risk assessment and this manual.

Intended use

The Safedoor system is intended to be installed on a CNC machine to automatically open and close one or two sliding doors of the CNC machine. The CNC machine must have mechanical stops at both ends of the door(s) linear travel and it must provide a safe locking mechanism, ensuring that the door cannot be opened while the CNC machine is operating.

The door can be opened to 1600mm and weight up to 400kg. Opening speed is maximum 500mm/s and will stop when meeting certain resistance. The Safedoor Actuators and Controller should only be used under conditions specified in the *Technical Sheet* on page 8.

The Safedoor Controller is installed with electrical 24V signals between controller and CNC machine and/or robot. The wiring must be carried out by qualified personnel, e.g. an electrician qualified to install wires in CNC machines and robots. When connecting to external machinery, such as CNC machines, robots and other industrial- and automation equipment, only signals intended for external communication. Note that some CNC machines have dedicated communication ports, specific digital I/Os, etc., designated for incorporation with an automated door function.

Any use of the Safedoor system deviating from the intended use is deemed to be impermissible misuse. This includes, but is not limited to:

- Use in potentially explosive atmospheres.
- Use in non-industrial environments.

- Use before conducting risk assessment.
- Use where the risk of clamping a human's head and/or neck is significant.
- Use outside permissible operational conditions and specifications.
- Use where the door(s) presents a cutting and/or impact risk.
- Use where safety features of the CNC machine door(s) are bypassed or compromised.
- Use as climbing or lifting aid.
- Use where the actuator is constantly soaked in oil or other liquids.
- All operators must be trained in the correct use of the equipment, including all relevant safety precautions.

Risk assessment

The system integrator must perform a risk assessment on the complete CNC machine and/or robot application. The Safedoor Controller and Actuators is only components in an automation application and the safe use of the Safedoor system rely on the integrators ability to design a safe application.

The Safedoor system is designed with these risk reduction features:

- Three different speed settings, allowing the integrator to reduce the travel speed if required by the risk assessment. The lower travel speed, the lower impact from the inertia (weight) of the door.
- Force limiting, reducing pinch and crushing hazards.
- Backdrivable gear, ensuring the door can be moved manually in case of emergency.

The safety of the overall automated system depends on the design and shape of individual CNC machine doors. The integrator of the Safedoor system must consider if the CNC machine doors are suitable for automatic operation, and if needed according to the integrators risk assessment edges of the door must be upgraded with soft padding or the edges must be smoothed to have suitable contact surfaces. All changes to the CNC machine itself must be done according to guidelines and requirements for such CNC machine.

The weight (inertia) of the CNC door and thereby potential impact with such door must be considered in the risk assessment. Light doors with large and flat closing surfaces pose less risk than heavy doors with thin/smaller closing surfaces. The integrator must also consider how the Safedoor Actuator is mounted and ensure that the mounting itself does not create any additional risks, e.g. risk of clamping.

In applications where the Safedoor system is used together with a robot, the integrator must consider if a potential collision between the door(s) and robot can create any additional hazards and mitigate any risk from such hazards as required by the risk assessment.

It is the responsibility of the integrator to conduct a risk assessment of the final installation, including the Safedoor system, the CNC machine and any other equipment used. All hazards as well as the severity of these must be identified and assessed before placing the installation into service.

Below is a list of the potential hazards that Made4CNC has identified as significant and that must be considered by the integrator:

- Collision between moving parts and human body parts (e.g. head and neck)
- Clamping between moving parts and robot or other equipment (e.g. head and neck)
- Consequences due to improper mounting and/or loosening of bolts/screws.
- Consequences due to lack of maintenance
- Contact between door(s) and robotics equipment and/or workpiece.

Maintenance and safety checks must be performed at appropriate and regular intervals, and at least once time per year. The integrator must define such appropriate intervals to the user and/or operator, e.g. in the information for use.

It is recommended that national standards and guidelines are observed in the design phase of the complete installation, and that the principles for risk assessment defined in ISO 12100 are followed.

When relevant, the max speed of the door can be determined by ISO 14120 stating a maximum force 150N and a kinetic energy of 10J for the Safedoor system combined with properties of the CNC door.

The table below shows examples of weight and speed settings that fits with ISO 14120. These numbers are guidelines only; please refer to ISO 14120 for application specific requirements.

Door Weight [kg]	Speed [m/s]
0-80	0,50
80-131.5	0,39
131.5-255	0,28

Shared signals and power off

It is recommended that installations as a whole are connected with shared emergency stop functionally, so that a push of any emergency stop button stops motion of all machines in reasonable proximity, as determined by the risk assessment.

It must be considered if a shared Lockout-Tagout function is required, where all mains power (230V/110V) to all parts of the installation can be disconnected at the same time (e.g. the CNC machine, the robot and the Safedoor system all together). It is recommended to follow ISO 14118.

Exerted force

The table below shows the typical actuator force at different levels of door openings. The data is based on tests carried out by third party test facility (Force Technology) and can be used as guidelines when performing risk assessment.

Opening [mm]	Force [N]
15	108
40	124
80	170
120	299
150	383

If it is found by risk assessment that the combination of physical properties of the CNC door and moving parts of Safedoor actuator and/or a robot result in risks that cannot be sufficiently reduced with safety features provided by Safedoor System and/or the robot, then additional risk reduction measures must be added. Such measures could include protective devices such as laser scanners or light curtains in combination with mechanical shielding.

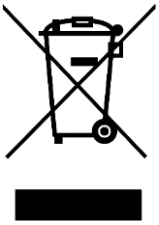
Environmental safety

The Safedoor system, including Actuators and Controllers, and any other Made4CNC product must be decommissioned and disposed of in accordance with applicable national laws, regulations and standards.

The product is manufactured with restricted use of hazardous substances to protect the environment and operators, as defined by the EU “RoHS” Directive 2001/65/EU. The restrictions include lead, cadmium, mercury, chromium VI, polybrominated biphenyls and polybrominated diphenyl ethers.

National requirements apply to importers according to EU “WEEE” Directive 2012/19/EU. Follow this link for more information.

https://www.ewrn.org/national-registers/national-registers



General safety instructions

Generally, all laws, regulations and legislations of the country of installation and use must be complied with. Observe all guidelines in this manual and the warnings below:

Warranties

Product warranty

Without prejudice to any claims the customer (user) may have in relation to the dealer or retailer, the customer shall be granted a manufacturer's warranty under the conditions set out below:

In the case of new devices and their components exhibiting defects resulting from manufacturing and/or material faults within 12 months of entering into services (maximum 15 month after shipment), Made4CNC shall provide the necessary spare parts, while the customer shall provide the working hours to replace the spare parts, either replace the failed part with another part in similar state of wear and tear or repair said failed part.

This warranty shall be invalid if the defect is attributable to improper treatment and/or failure to comply with information contained in the user guides. This warranty shall not apply to or extend to service performed by an authorized dealer or the customer themselves (including installation, software downloads and configuration). Purchase documentation, together with the date of purchase, shall be required as evidence for invoking the warranty. Claims under this warranty must be submitted within one month of the defect becoming evident. Ownership of products, devices, components and spare parts replaced by and returned to Made4CNC shall vest in Made4CNC. Any other claims resulting out of or in connection with the product shall be excluded from this warranty. Nothing in this warranty shall attempt to limit or exclude a customer's statutory rights nor the manufactures liability for death or personal injury resulting from its negligence. Insofar as no warranty default exists, Made4CNC reserves the right to charge the customer for the replacement or repair. The above provision does not imply change in the burden of proof to the detriment of the customers. In case of a device exhibiting defects, Made4CNC shall not be liable for any incidental, special, indirect or consequential damages, including but not limited to, loss of profit, loss of use, loss of production or damages to other equipment.

Disclaimer

Made4CNC continues to improve the reliability and performance of its products, and therefore reserve the right to upgrade the product without any prior notice. Made4CNC takes thorough care that the content of this manual is precise and correct but takes no responsibility of any erroneous or missing information.

DANGER

All wiring and connections must be performed by personal qualified to work with mains voltage (230V/110V). Electrical shock can result in death.

Do not touch any electrical components inside the controller besides the dedicated buttons.

Do not take the internal power supply apart. It operates with internal voltages up to 500V, and voltage can be present for up to 24 hours after disconnection.

Do not use the product if any electrical or mechanical components are damaged or modified. Made4CNC disclaims any and all liability if the product is modified in any way. Made4CNC cannot be held responsible for any damages caused to the product or any other equipment due to programming errors or malfunction of the Safedoor product.

Do not modify any safety features of the CNC door(s). The CNC machine must be prevented from operating when the door is open. CNC machine operation with open door(s) can result in death or serious injury.

Improper maintenance or installation can cause the product to separate unexpectedly. Schedule maintenance with a fixed and appropriate period of time not longer than one year.

Certifications

Declarations, certificates and standards are listed in this section.

Applied standards

Standards used under the development of the product is listed in this section. EU Directive numbers noted in square brackets indicates that the standard is harmonized under that directive.

ISO 12100:2010
EN ISO 12100:2010 (E) [2006/42/EC]
Safety of machinery – General principles of design – Risk assessment and risk reduction
The product is evaluated in accordance with the principles of these standards.

ISO 14120:2015
EN ISO 14120:2015 (E) [2006/42/EC]
Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards
The product is evaluated in accordance with the principles of these standards.

IEC 60529:2013
EN 60529/A2:2013

Degrees of protection provided by enclosures (IP Code)
This standard defines enclosure ratings regarding protection against dust and water. The actuator and the controller are designed with an IP classification according to this standard. See stickers on the controller cabinet and actuator.

IEC 61131-2:2017
EN 61131-2:2017 [Pending harmonization 2014/30/EU]

Programmable controllers
24 V I/O signals from/to the controller are designed for reliable communication with robots, CNC machines and PLCs conforming to this standard.

ISO 13732-1:2007
EN ISO 13732-1:2008 [2006/42/EC]

Ergonomics of the thermal environment. Methods for the assessment of human responses to contact with surfaces.
Part 1: Hot surfaces
The product is designed so that the surface temperature of the product is kept under the ergonomic limits defined by this standard.

IEC 61000-6-2:2016
IEC 61000-6-4:2018
EN 61000-6-2:2019 [Pending harmonization 2014/30/EU]
EN 61000-6-4:2019 [Pending harmonization 2014/30/EU]

Electromagnetic compatibility (EMC)
Part 6-2: Generic standards – Immunity for industrial environments
Part 6-4: Generic standards – Emission standard for industrial environments
The product is evaluated according to the limits and principles in these standards.

IEC 60068-2-1:2007
IEC 60068-2-2:2007
IEC 60068-2-27:2008
IEC 60068-2-64:2008
EN 60068-2-1:2007
EN 60068-2-2:2007
EN 60068-2-27:2009
EN 60068-2-64:2008

Environmental testing
Part 2-1: Tests – Test A: Cold
Part 2-2: Tests – Test B: Dry heat
Part 2-27: Tests – Test Ea and guidance: Shock
Part 2-64: tests -Test Fh: Vibration broadband random and guidance
The product is designed and prepared to pass tests defined in these standards.

IEC 60664-1:2020
EN 60664-1:2020 [2014/35/EU]

Insulation coordination for equipment within low-voltage supply systems
Part 1: Principles, requirements and tests
This standard is observed during development of the electrical circuits inside the product.

ISO 10218-2:2011
EN ISO 10218-2:2011 [2006/42/EC]
ANSI/RIA R15.06
CAN/CSA-Z434-14

Robots and robotic devices – Safety requirements for industrial robots
Part 2: Robot systems and integration
This standard is relevant for robotic applications and should be observed by integrators when integrating this product in conjunction with one or more robots.
The product evaluated and prepared for integrations according to these standards.

ISO/TS 15066:2016
RIA TR R15.606

Robots and robotic devices — Collaborative robots
This technical specification is relevant for collaborative robot applications and should be observed by integrators when integrating this product in conjunction with one or more cobots. The product evaluated and prepared for integrations according to the normative requirements in this technical specification.

CE/EU Declaration of incorporation

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

Made4CNC ApS
Helgavej 26
DK-5230 Odense M
DENMARK
www.made4cnc.com

declares that the product:

Model:	Safedoor
Type:	Controller with Actuator(s)
Generation:	2
Serial, controller:	SDC2-000000 to SDC2-999999
Serial, actuator:	SDA2-000000 to SDA2-999999

configured with one controller and one or two actuators fulfills the following essential health and safety requirements of the Machinery Directive 2006/42/EC:

1.1.2, 1.1.3, 1.1.5, 1.2.1, 1.2.6, 1.5.1, 1.5.2, 1.5.6, 1.5.8, 1.5.10, 1.6.3, 4.1.2.3

The product is partly completed machinery according to Machinery Directive 2006/42/EC and may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of 2006/42/EC and complies with national law.

Compliance with all essential requirements of 2006/42/EC requires a final risk assessment that also takes CNC machine, robot(s) and other equipment into account.

Technical documentation is prepared according to Directive 2006/42/EC annex VII part B and is available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufactures address and authorized to compile this documentation.

Additionally, the product declares in compliance with the following directives, according to which the product is CE marked:

- 2014/30/EU – Electromagnetic Compatibility Directive (EMC)
- 2011/65/EU – Restriction of the use of hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

- 2014/35/EU – Low Voltage Directive (LVD)
- 2012/19/EU – Waste of Electrical and Electronic Equipment (WEEE)

Odense, April 28th, 2023

Corporate management

Peter Nadolny Madsen
Chief Executive Officer

UK Declaration of incorporation

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

Made4CNC ApS
Helgavej 26
DK-5230 Odense M
DENMARK
www.made4cnc.com

declares that the product:

Model:	Safedoor
Types:	Controller with Actuator(s)
Generation:	2
Serial, controller:	SDC2-000000 to SDC2-999999
Serial, actuator:	SDA2-000000 to SDA2-999999

configured with one controller and one or two actuators fulfills the following essential health and safety requirements of the Supply of Machinery (Safety) Regulations 2008:

1.1.2, 1.1.3, 1.1.5, 1.2.1, 1.2.6, 1.5.1, 1.5.2, 1.5.6, 1.5.8, 1.5.10, 1.6.3, 4.1.2.3

The product is partly completed machinery and must not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Supply of Machinery (Safety) Regulations 2008.

Compliance with all essential requirements of Supply of Machinery (Safety) Regulations 2008 requires a final risk assessment that also takes CNC machine, robot(s) and other equipment into account.

The partly completed machinery must not be put into service until the final machinery into which it is to be incorporated has been declared to be in conformity with the provisions of the Supply of Machinery (Safety) Regulations 2008.

Furthermore, the partly completed machinery fulfils the Electromagnetic Compatibility Regulations 2016 (UK EMC Regulations), the Restriction of the Use of Certain Hazardous Substances in Electrical Equipment Regulations 2012 (UK RoHS) and all health and safety requirements in the Electrical Equipment (Safety) Regulations 2016 are met.

Odense, April 28th, 2023

Corporate management

Peter Nadolny Madsen
Chief Executive Officer

Safedoor is an innovative and safe solution designed to enable automated tending of existing CNC machines. Our specialized actuators facilitate fast and continuous operation of CNC machine doors, ensuring seamless integration with your robotic systems. The intelligent controller oversees every aspect of door motion, guaranteeing smooth and reliable performance.

Built-in safety features enable safe human-machine collaboration without the need for additional safety fencing, making the Safedoor system perfect for collaborative robot applications. With Safedoor, you can enhance efficiency, safety, and productivity in your CNC machine operations.