CNC DOOR / VICE CONTROLLER

USER MANUAL

Preface

Congratulations with your CNC door and Vice controller with robot interface.

Many CNC machine has a door there is operated manually. The door can be heavy and cumbersome to open and close many times through a working day. If a robot needs to take items in and out of the CNC machine, the door must be opened and closed automatically.

The SetupRobotics CNC door controller is an easy to implement solution using standard components and yet interfaces to the UR robot via MODBUS TCP/IP using only the network cable.

The conroller also interfaces to the SetupRobotics vice communication unit.

Features:

- Operates the CNC door via manual inputs also if robot is not present and doing other tasks.

- Operates the CNC door from UR robot.

- Interface to SetupRobotics Vice closer.

- Door states / vice status is showed on display for easy adjustment and troubleshooting.

- IP setup via display/buttons

- Extra I/O for solving special requirements. e.g. CNC cycle start.

- Industrial standard 24volt inputs configured as NPN or PNP. NPN or relay outputs for most electrical signals.

Installation

VICE CLOSER installation

Connect VICE CLOSE comunication unit and CNC door controller via M12 8 pole cable. If only using vise closer, skip to MODBUS setup.

When inputs from Vice closer changes status is showed on display.

Uppercase ST: request new item (start robot)
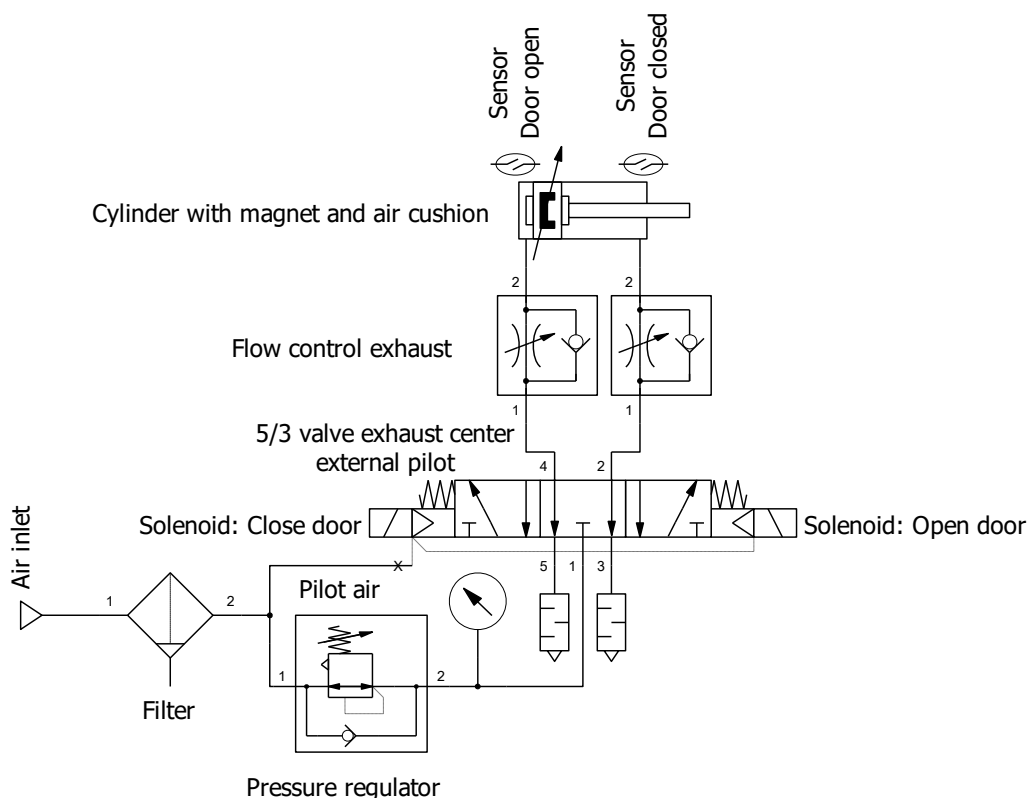
Uppercase OK: vice clamping OK

Uppercase ER: vice clamping error

Lowercase labels = not active.
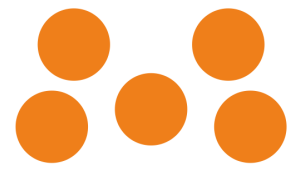
CNC door installation

Install the CNC door controller according to the following pneumatic diagram.

See list of optional festo components in the end of the manual.

Air inlet

Standard factory air supply. Typical 6bar dry and clean.

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Pressure regulator

On the pressure regulator the opening / closing force is adjusted.

Valve

The valve should be 5/3 exhaust center type 24V DC. Exhaust center is so the controller can abandon opening/closing in an error situation. e.g. if something is stuck in the door, the controller releases actuation forces after a period of time. External pilot is so the forces can be adjusted down to zero. (A typical standard valve can not operate below 2-3 bar)

Air cylinder

It is recommended dimension the cylinder so it operates around 2-3 bar and make final adjustments using the pressure regulator. Measure the forces needed to operate the door. Make sure the maximum forces is below the acceptable level for the risk assessment. It is recommended to use a cylinder with air cushion to decelerate the door at end of travel. It is also recommended to select a cylinder with magnet piston for easy detection of end positions.

Maximum speed

It is recommended to use exhaust type flow valves mounted directly on cylinder to limit the maximum speed. If the door for some reason is blocked halfway its travel and then released the maximum speed is better controlled using exhaust type flow valves. In some application a hydraulic damper is needed to control the maximum speed. This is specially the case for heavy doors.

Electrical connections

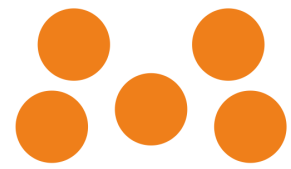| Connector	Function	Signal
Out6	Pneumatic valve coil: Open door	24V NPN (GND=*, #=OUT)
Out7	Pneumatic valve coil: Close door	24V NPN (GND=*, #=OUT)
In4	Manuel switch: Open door	24V NPN (default) or PNP
In5	Manuel switch: Close door	24V NPN (default) or PNP
In6	Air cylinder sensor: Door is open	24V NPN (default) or PNP
In7	Air cylinder sensor: Door is closed	24V NPN (default) or PNP

Input PNP/NPN is set via jumpers in two groups. I0..3 and I4..7

Open/close sequence

The door controller will normally be waiting in one of three states. Current state is showed on the display.

- Door is open: From this state a close door sequence can be isued. (via manual input or via MODBUS command)

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- Door is closed: From this state a open door sequence can be started.

- Door error/unknown: From this state a open door or close door sequence can be started.

When a open or close sequence is started the door must reach the end of travel within a period of time. This period can be configured via the display. If period expires the controller stops the door movement and enters he error state.

When the door reach the end of travel a settle period starts. This is so the door can make some jumps at end of travel (the end of travel sensor goes off and on) without triggering an error.

After the settle period the controller stops the movement and enter open or close/open state.

In this state the controller monitors the end of travel sensor and enters error state if door is moved away from its end position.

Power on

At power on the display runs through 3 messages.

- SetupRobotics welcome

- CNC door version

- Button navigation info
  - ← → cycles through menus.
  - + - alters a value.

After this the current door state is showed.

IO state

To see the current IO state press menu right. First is an explanation is showed then the actual status.

Upper case is activated, lower case is deactivated.

On sample picture right output 7 and input 5 is activated.

Configuration password

To protect setting against accidental configuration changes a password must be entered. Press and hold "-" to set password 9876. Now the configuration menus are accessible.
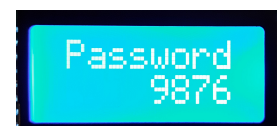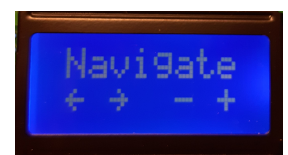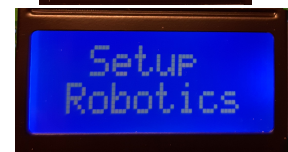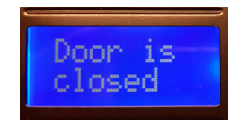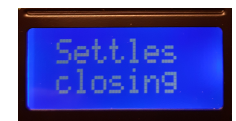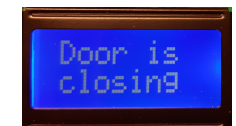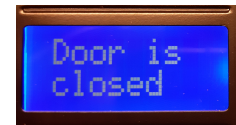
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Door time

Door time is the longest time it can take to open/close the door before controller enters error state.

```
DoorTime
[s]    5.0
```

Settle time

Settle time is the amount of time the controller keeps air cylinder activated after the door has closed.

```
Settle
[s]    1.0
```
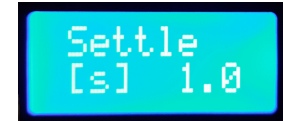
MODBUS

Below a list of available MODBUS addresses. The last 4 is used to control the door from UR polyscope or other system with MODBUS.

I/O	Coil (function)	Add.	Read function code	Write function code	data	Used by door control
O	Output 0	0	1	5	On / Off	No
O	Output 1	1	1	5	On / Off	No
O	Output 2	2	1	5	On / Off	No
O	Output 3	3	1	5	On / Off	No
O	Output 4	4	1	5	On / Off	No
O	Output 5	5	1	5	On / Off	No
O	Output 6 (valve coil: open door)	6	1	5	On / Off	Yes
O	Output 7 (valve coil: close door)	7	1	5	On / Off	Yes
I	Input 0	0	2		On / Off	No
I	Input 1	1	2		On / Off	No
I	Input 2	2	2		On / Off	No
I	Input 3	3	2		On / Off	No
I	Input 4 (manuel switch: Open door)	4	2		On / Off	Yes
I	Input 5 (manuel switch: Close door)	5	2		On / Off	Yes
I	Input 6 (cylinder sensor: Door is open)	6	2		On / Off	Yes
I	Input 7 (cylinder sensor: Door is closed)	7	2		On / Off	Yes
I	Input 8 (vice controller: Request new item)	8	2		On / Off	No
I	Input 9 (vice controller: VICE OK)	9	2		On / Off	No
I	Input 10 (vice controller: VICE ERROR)	10	2		On / Off	No
O	Polyscope open door	100	1	5	On / Off	Yes
O	Polyscope close door	101	1	5	On / Off	Yes
I	Polyscope door is open	100	2		On / Off	Yes
I	Polyscope door is closed	101	2		On / Off	Yes

Used I/O

Coils used by door control cant be used for other purposes.

Vacant I/O

Other coils can be used for other task e.g. CNC cycle start.

Operation via MODBUS

The operation via MODBUS is very similar to the manual operation.

To open door set **Open door** On and then Off. Wait for **Door open** to go ON

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To close door set **Close door** On and then Off. Wait for **Door closed** to go ON

Robot interface

To interface to the UR robot the IP address and IP mask must correspond then setting in the UR robot. The default values in the CNC door controller should correspond UR robot defaults and need normaly not to be adjusted.
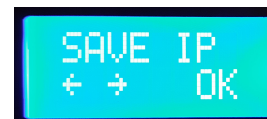
IP address
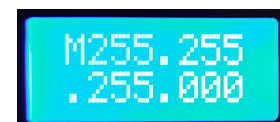
SET IP
ADDRESS

The IP address is set one field at the time.
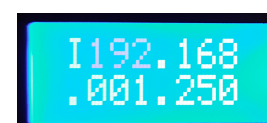
I192.168
.001.250

After the all four field are set press OK ("+" or "-") to save the value or menu key ← → to cancel.

SAVE IP
← →   OK

IP mask

SET IP
MASK

The IP mask is set one field at the time.

M255.255
.255.000

After the all four field are set press OK ("+" or "-") to save the value or menu key ← → to cancel.

SaveMASK
← →   OK

PING

It is possible to PING the controller when working with the network. When a PING is receaved "PING" is showed in upper right corner of display on top of any other menu. Use menu buttons to clear.

I192PING
.001.250
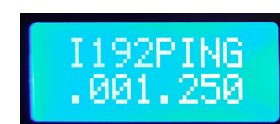
UR robot setup

Go to installation tab and then MODBUS.
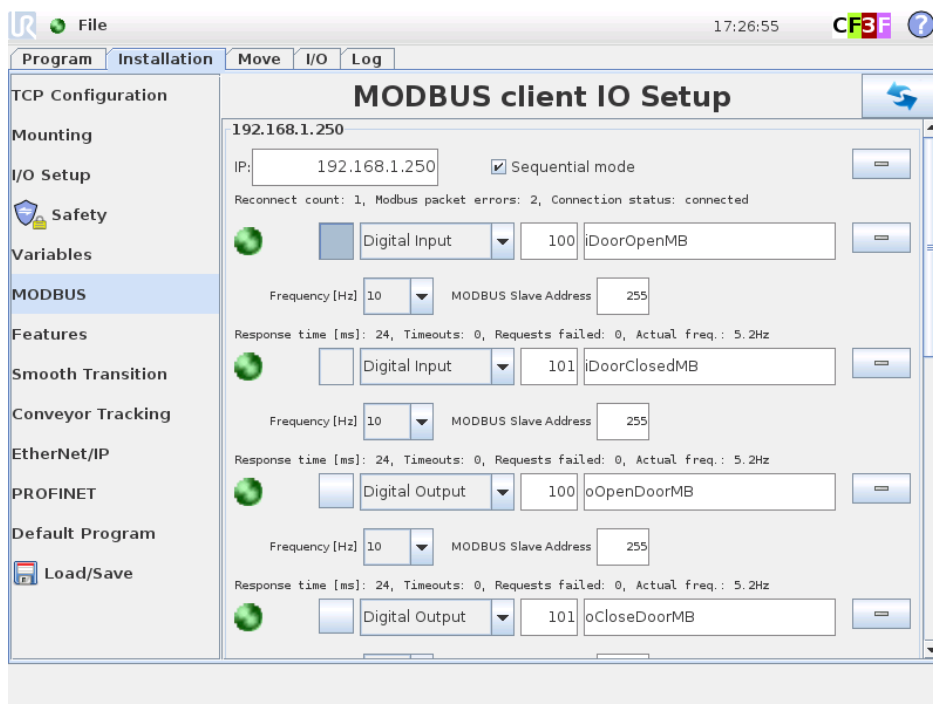
Enter as minimum the first 4 entries below, two digital inputs and two digital outputs. Also name the I/O so it is easy later to recall them in polyscope.
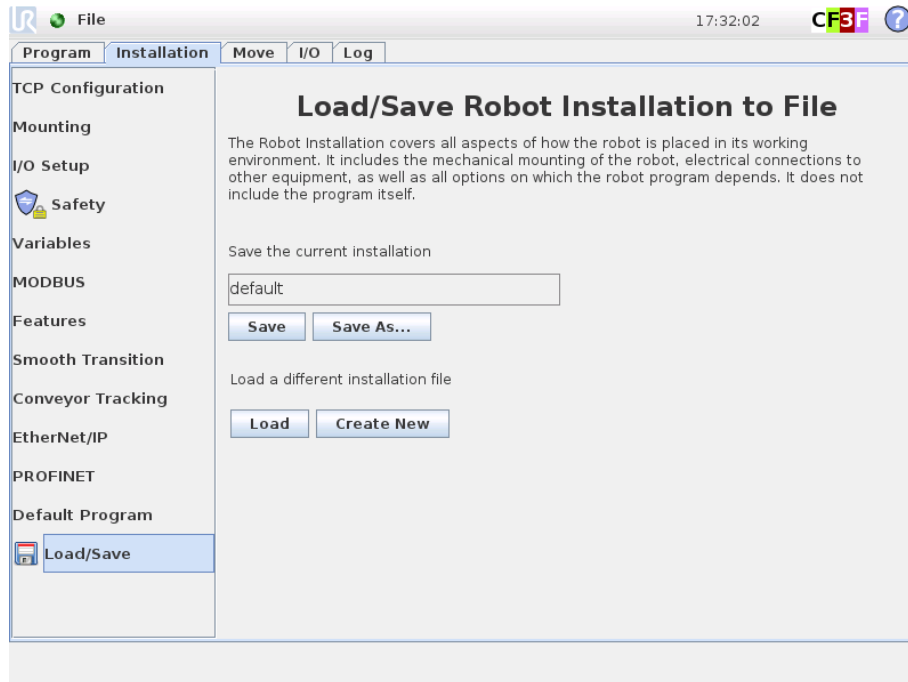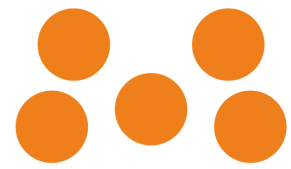
Below also 4 entries, one output for CNC cycle start and the 3 inputs are interface to the SetupRobotics ViceCloser.
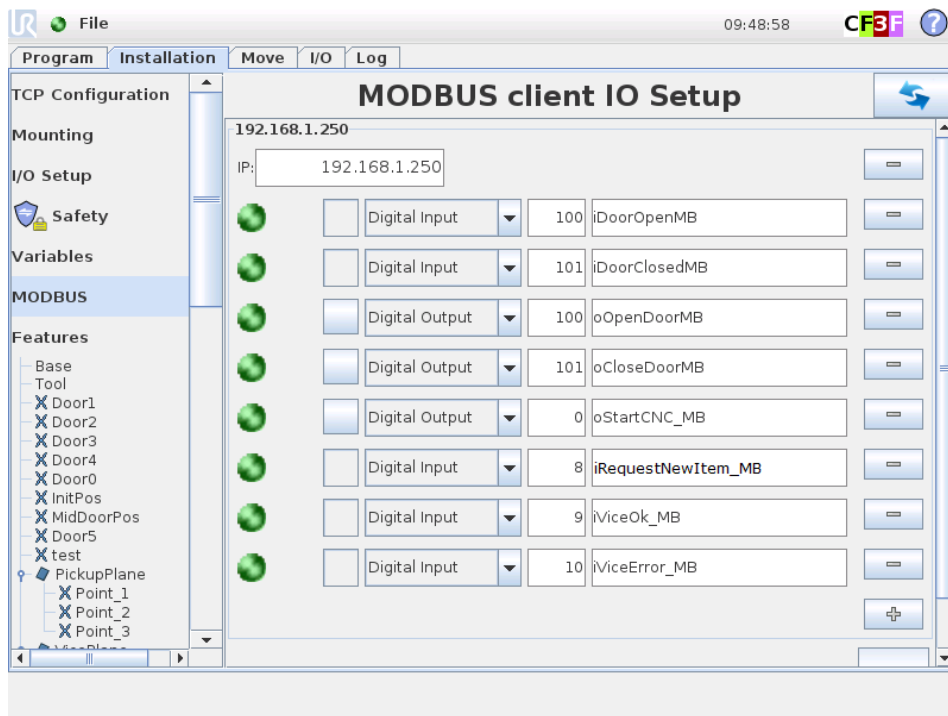
Click on advanced below entries and select "Sequential mode"

At last click Load/Save left and click Save

Load/Save Robot Installation to File

The Robot Installation covers all aspects of how the robot is placed in its working environment. It includes the mechanical mounting of the robot, electrical connections to other equipment, as well as all options on which the robot program depends. It does not include the program itself.

Save the current installation

default

[Save] [Save As...]

Load a different installation file

[Load] [Create New]

Installation tabs: TCP Configuration, Mounting, I/O Setup, Safety, Variables, MODBUS, Features, Smooth Transition, Conveyor Tracking, EtherNet/IP, PROFINET, Default Program, Load/Save

Important message.

The CNC door controller is part of a partly completed machinery. A risk assessment is required for each usage.

It is the responsibility of the integrator to make the risk assessment and that all safety requirements and local regulations are complied with.

Special precautions must be taken but not limited to:

- The CNC door controller must not circumvent security devices
- Closing and opening forces must be at a acceptable level specially make sure impact forces from a blocked door there is released is acceptable.

Never use a damaged controller or defect components.

The CNC door controller is intended to be used in a clean and dry industrial environment. It is not to be used in potentially explosive environments or in life support applications.

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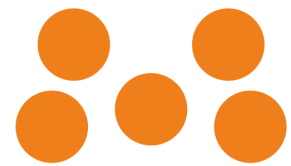
EC Declaration of conformity

Manufacturer: SetupRobotics ApS
                                                 Industrivaenget 6B, Melose
                                                 3320 Skaevinge
                                                 Denmark

Hereby is certified that the following product: CNC door controller
Description: CNC door controller
Type   ST-CNC-DOOR
Production year   2020
Serial No (from)   1

is partly completed machinery according to 2006/42/EC.

The complete machine must be in full compliance with all essential requirements of 2006/42/EC before the CNC door controller and its connected accessories are put into service. A comprehensive risk assessment must be carried out for each application as part of ensuring that all essential requirements are fulfilled. All essential requirements must be assessed. Instructions and guidance provided in the manual must be followed.

The product is in conformity with the following directives:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)
2014/35/EU — Low Voltage Directive (LVD)

Uffe Safeldt
COO, CTO
Hillerød 2020.01.01

Sample partlist for CNC door using Festo components.

Select one of the two cylinders. Adjust cylinder stroke to CNC door. Optinal mounting migth be used.
Cylinders are sugestions. Check they can be used current CNC project.

Part No.	Quantity	Article designation	x-Stroke	
		Cylinder and accessories Stroke < 500mm Ø32		
193992	1	DSNU-32-500 Round cylinder	500	Stroke must be adapted current door
175097	2	SMBR-8-32 Mounting kit		
543862	2	SME-8M-DS-24V-K-2,5-OE Prox. sensor		
193144	1	GRLA-1/8-QS-6-D 1-way contr.val		
195851	1	HBN-32X2 Foot mounting		Optinal mounting
189005	1	MSK-M10X1,25 Hex nut		Optinal mounting
9261	1	SGS-M10X1,25 Rod eye		Optinal mounting
195860	1	LBN-32 clevis foot		Optinal mounting
		Cylinder and accessories Stroke > 500mm Ø40		
1462834	1	DSBC-40-787-PPVA-N3 stand.based cyl	787	Stroke must be adapted current door
543862	2	SME-8M-DS-24V-K-2,5-OE Prox. sensor		
203968	1	DIN 439-B-M12X1,25-04 Hex nut		
193146	2	GRLA-1/4-QS-6-D 1-way contr.val		
174370	1	HNC-40 Foot mounting		Optinal mounting
32964	1	KSG-M12X1,25 Coupling piece		Optinal mounting
9262	1	SGS-M12X1,25 Rod eye		Optinal mounting
		Valve, 5/3 way, mid position exhausted, external pilot (works in complete pressure range), 24V DC M7 is because festo has lead time on M5 (2020.03.15)		
566485	1	VUVG-L10-P53E-ZT-M7-1P3 Solenoid valve		
573922	2	VAVE-L1-1R1-LR El.sub-base		
541342	2	NEBU-M8G4-K-2.5-LE4 connect. cable		
161418	2	UC-M7 Silencer		
133007	10	QSM-M7-6-I-R Push-in fitting		
133002	10	QSM-M3-4-I-R Push-in fitting		
		Filter reguator		
529148	1	MS4-LFR-1/4-D6-ERM-AS filt. regulator		
529555	1	MS4-FRM-1/4 Branch module		
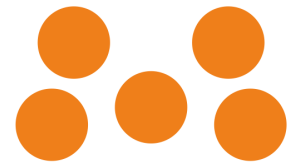
542966   2MS4-AEND Mounting plate
532184   1MS4-WP Mountng bracket
153003   10QS-1/4-6 Push-in fitting
153329   10QSM-6H-4 P/in connector

Tubing
558278   50PUN-H-4X0,75-SI Plastic tubing
558279   50PUN-H-6X1-SI Plastic tubing