

## **Semestral Task**

### **Project A**

Programmable Controller Applications

2022

Kaung Htet Zaw

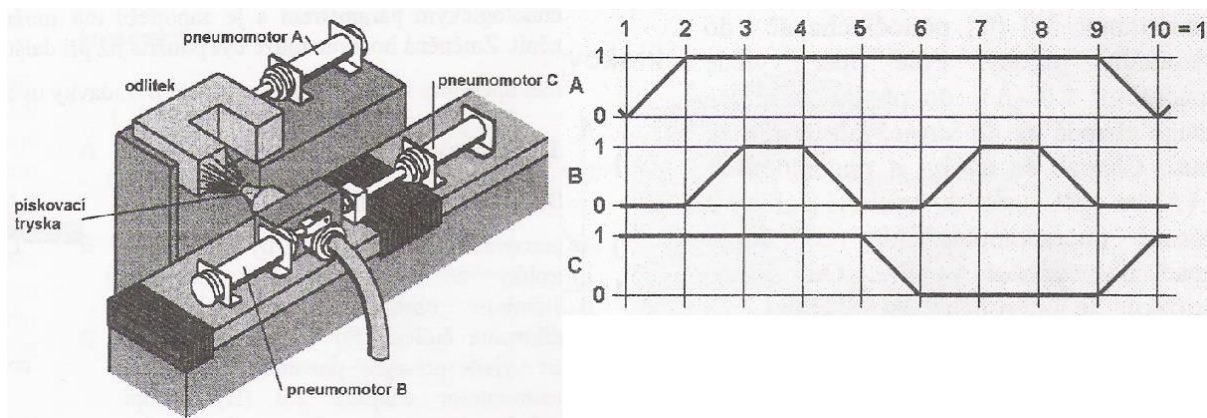
Hasindu Nimantha Weerasinghe

## Task A – Sanding Facility

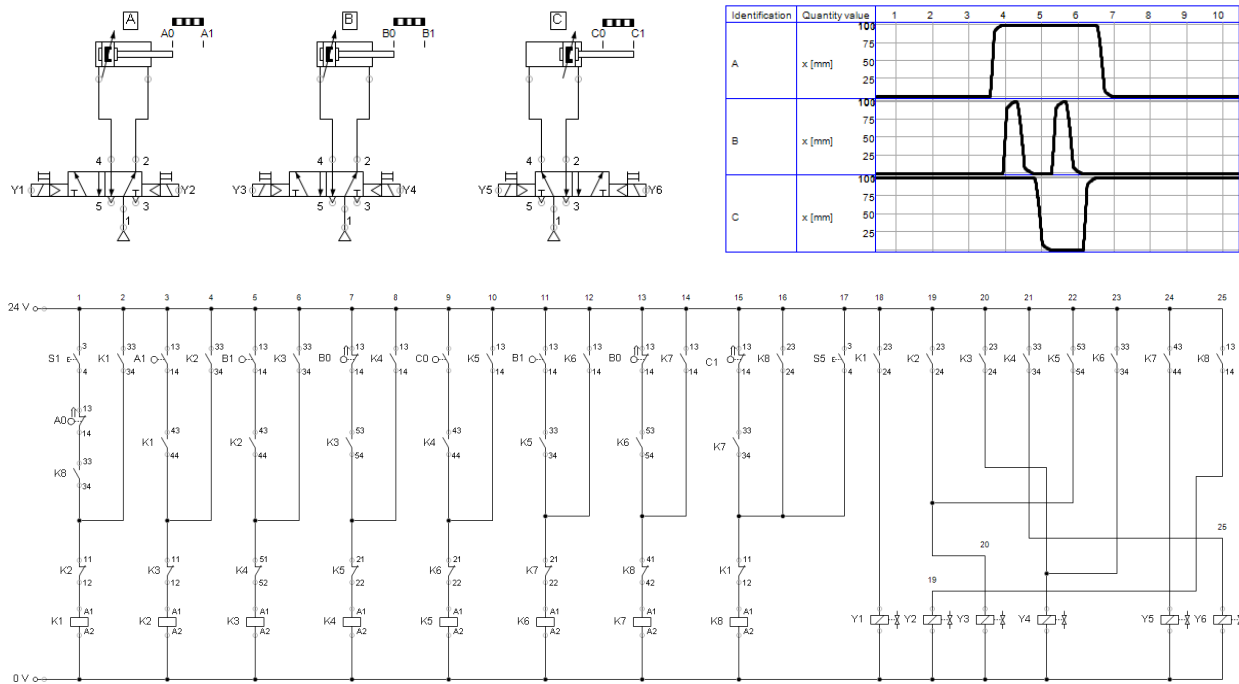
### Functionality desired:

There is a need to sand (cleanse) two arms of a U-shaped casting. The casting is put manually into the clamping facility. Then, via a START button, the command to begin the operation is relayed to the PLC. The casting is then clamped by the pneumatic motor A. Then, the pneumatic B opens the valve of the sanding nozzle and let it sand for the interval  $T_a$ . This interval of sanding is a parameter and it is possible to change it for each particular piece of casting from HMI facility (textual operator panel or PC with visualisation application). After completion of sanding of one arm of the casting, the pneumatic motor C moves the bed with the nozzle to second arm of the casting. The operation of sanding then repeats with the same interval. After completion of the second arm, the pneumatic motor C returns the bed of the sanding nozzle to the initial position. Then, the casting is released by the pneumatic motor A and it can be removed manually from the clamping bed.

Situation and step diagram:



## Circuit created in FluidSIM:



## List of inputs of PLC program

S1	Start press button	To start running the program and initiate the sequences
S5	Set/reset press button	To reset the sequences or set them to be in standby mode
A0	End sensor A0	A0 = 1 indicates that motor A is in retracted position
A1	End sensor A1	A1 = 1 indicates that motor A is in extended position
B0	End sensor B0	B0 = 1 indicates that motor B is in retracted position
B1	End sensor B1	B1 = 1 indicates that motor B is in extended position
C0	End sensor C0	C0 = 1 indicates that motor C is in retracted position
C1	End sensor C1	C1 = 1 indicates that motor C is in extended position

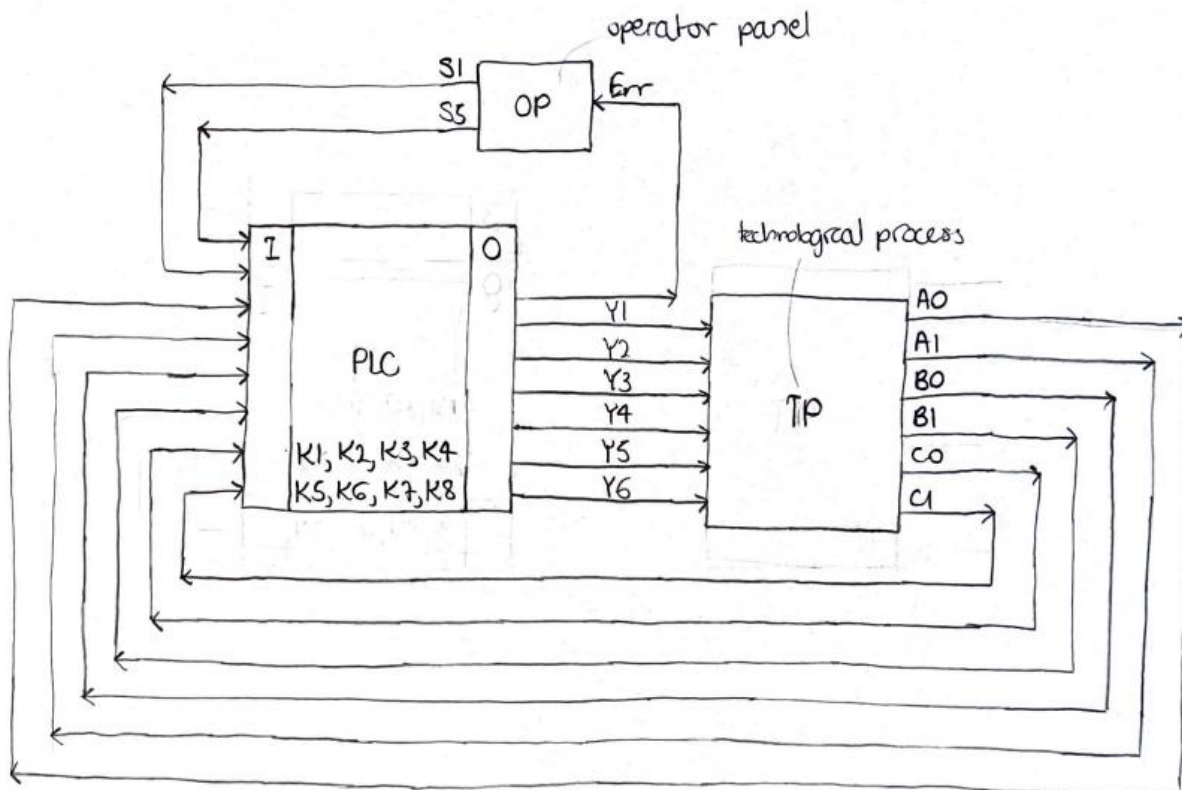
## List of outputs of PLC program

Y1	Electric connector Y1	Y1 = 1 actuates the motor A to extend
Y2	Electric connector Y2	Y2 = 1 actuates the motor A to retract
Y3	Electric connector Y3	Y3 = 1 actuates the motor B to extend
Y4	Electric connector Y4	Y4 = 1 actuates the motor B to retract
Y5	Electric connector Y5	Y5 = 1 actuates the motor C to extend
Y6	Electric connector Y6	Y6 = 1 actuates the motor C to retract

## List of internal variables of PLC program























K1	Memory block 1	K1 = 1 indicates that the first step of the sequence is taking place and resets the signal from previous step, also sets Y1 = 1
K2	Memory block 2	K2 = 1 indicates that the second step of the sequence is taking place and resets the signal from previous step, also sets Y3 = 1
K3	Memory block 3	K3 = 1 indicates that the third step of the sequence is taking place and resets the signal from previous step, also sets Y4 = 1
K4	Memory block 4	K4 = 1 indicates that the fourth step of the sequence is taking place and resets the signal from previous step, also sets Y6 = 1
K5	Memory block 5	K5 = 1 indicates that the fifth step of the sequence is taking place and resets the signal from previous step, also sets Y3 = 1
K6	Memory block 6	K6 = 1 indicates that the sixth step of the sequence is taking place and resets the signal from previous step, also sets Y4 = 1
K7	Memory block 7	K7 = 1 indicates that the seventh step of the sequence is taking place and resets the signal from previous step, also sets Y5 = 1
K8	Memory block 8	K8 = 1 indicates that the eighth step of the sequence is taking place and resets the signal from previous step, also sets Y2 = 1

## Block diagram



# Program in TIA Portal

## PLC tags

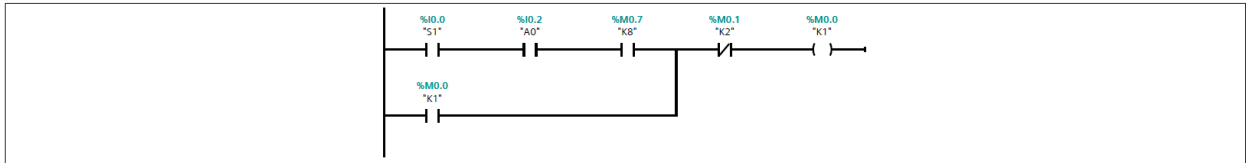
	Name	Data type	Address	Retain	Accessi-ble from HMI/OPC UA	Writab-le from HMI/OPC UA	Visible in HMI engi-neering	Supervision	Comment
	S1	Bool	%I0.0	False	True	True	True		
	S5	Bool	%I0.1	False	True	True	True		
	A0	Bool	%I0.2	False	True	True	True		
	A1	Bool	%I0.3	False	True	True	True		
	B0	Bool	%I0.4	False	True	True	True		
	B1	Bool	%I0.5	False	True	True	True		
	C0	Bool	%I0.6	False	True	True	True		
	C1	Bool	%I0.7	False	True	True	True		
	Y1	Bool	%Q0.0	False	True	True	True		
	Y2	Bool	%Q0.1	False	True	True	True		
	Y3	Bool	%Q0.2	False	True	True	True		
	Y4	Bool	%Q0.3	False	True	True	True		
	Y5	Bool	%Q0.4	False	True	True	True		
	Y6	Bool	%Q0.5	False	True	True	True		
	K1	Bool	%M0.0	False	True	True	True		
	K2	Bool	%M0.1	False	True	True	True		
	K3	Bool	%M0.2	False	True	True	True		
	K4	Bool	%M0.3	False	True	True	True		
	K5	Bool	%M0.4	False	True	True	True		
	K6	Bool	%M0.5	False	True	True	True		
	K7	Bool	%M0.6	False	True	True	True		
	K8	Bool	%M0.7	False	True	True	True		

Project\_A\_Zaw\_Hasindu / plc-12137-109-s7-1200-01 [CPU 1215C DC/DC/DC] / Program blocks

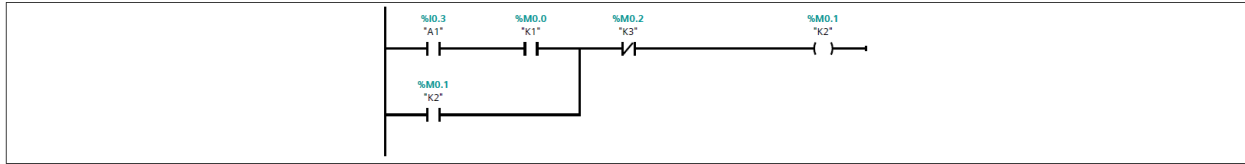
## Main [OB1]

Main Properties							
General							
Name	Main	Number	1	Type	OB	Language	LAD
Numbering	Automatic						
Information							
Title	"Main Program Sweep (Cycle)"	Author		Comment		Family	
Version	0.1	User-defined ID					
Main							
Name		Data type	Default value		Comment		
▼ Input							
Initial_Call		Bool			Initial call of this OB		
Remanence		Bool			=True, if remanent data are available		
▼ Temp							
di2not		Bool					
Constant							

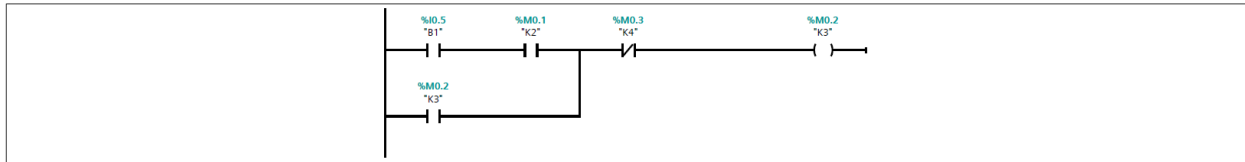
## Network 1: K1



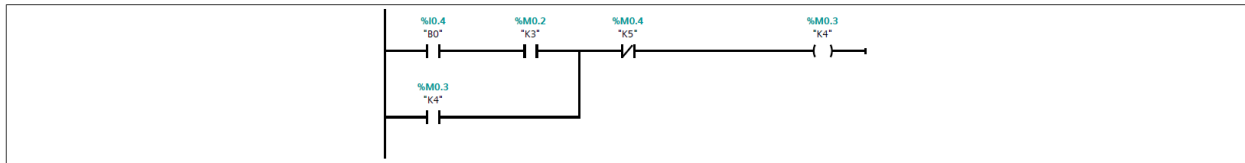
Network 2: K2



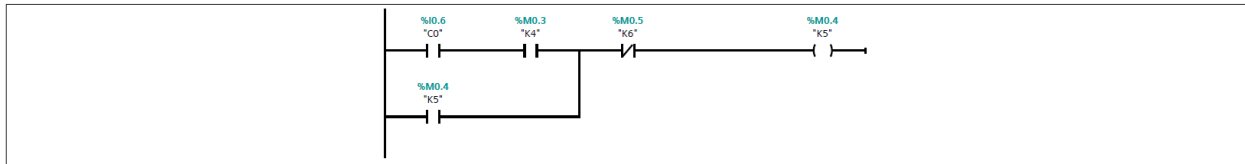
Network 3: K3



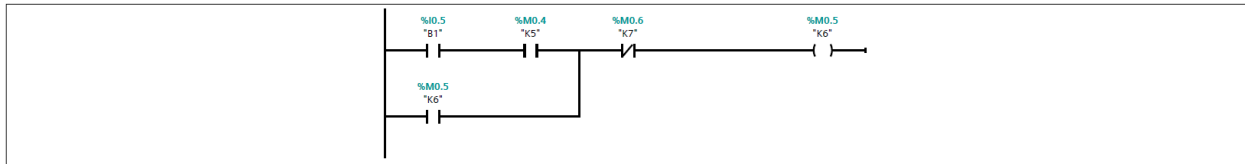
Network 4: K4



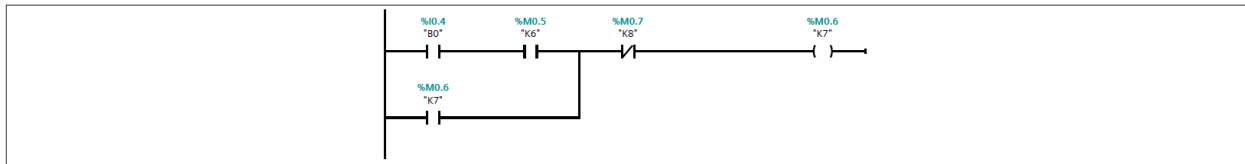
Network 5: K5



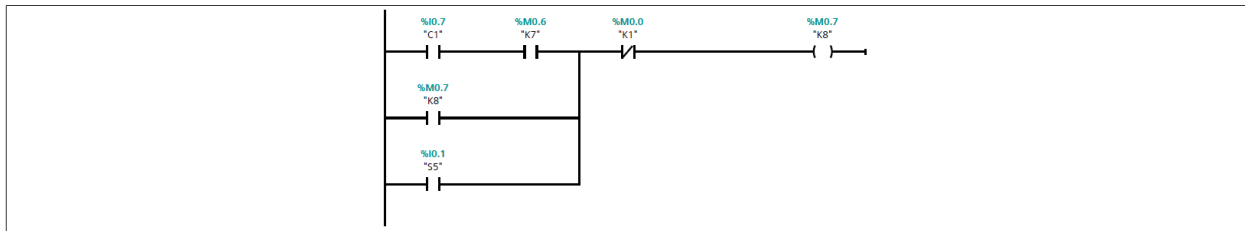
Network 6: K6



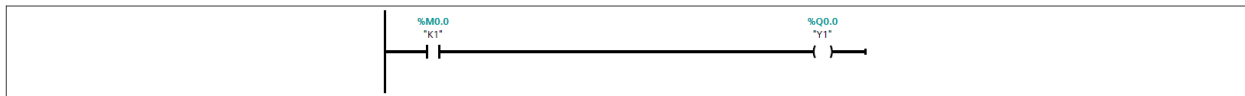
Network 7: K7



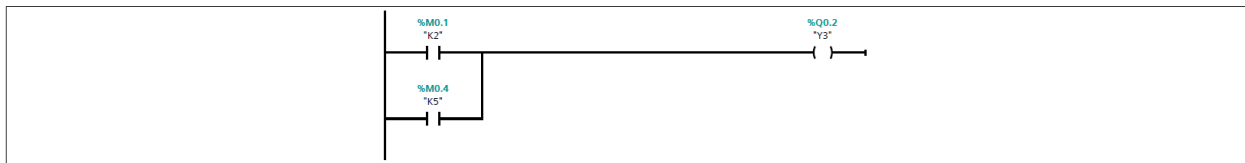
Network 8: K8



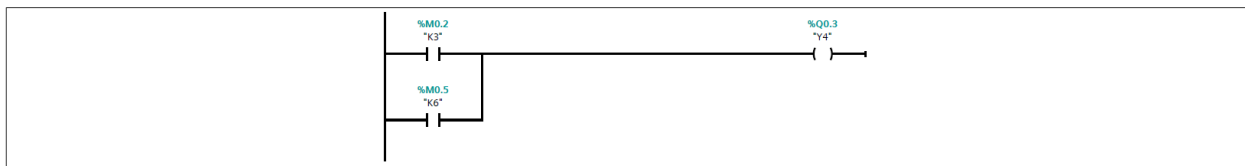
Network 9: Y1



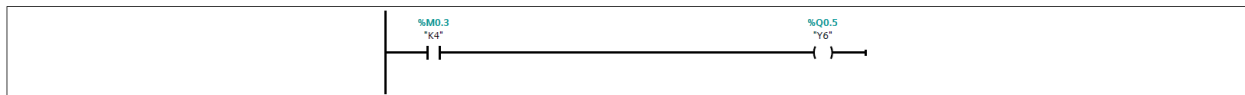
Network 10: Y2



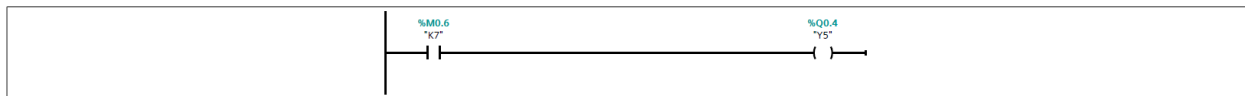
Network 11: Y3



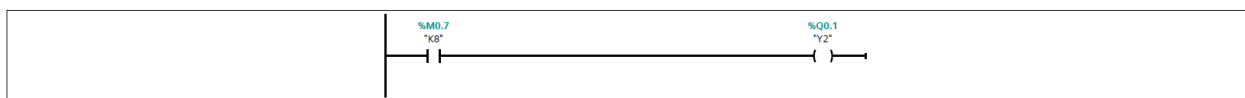
Network 12: Y4



Network 13: Y5



Network 14: Y6



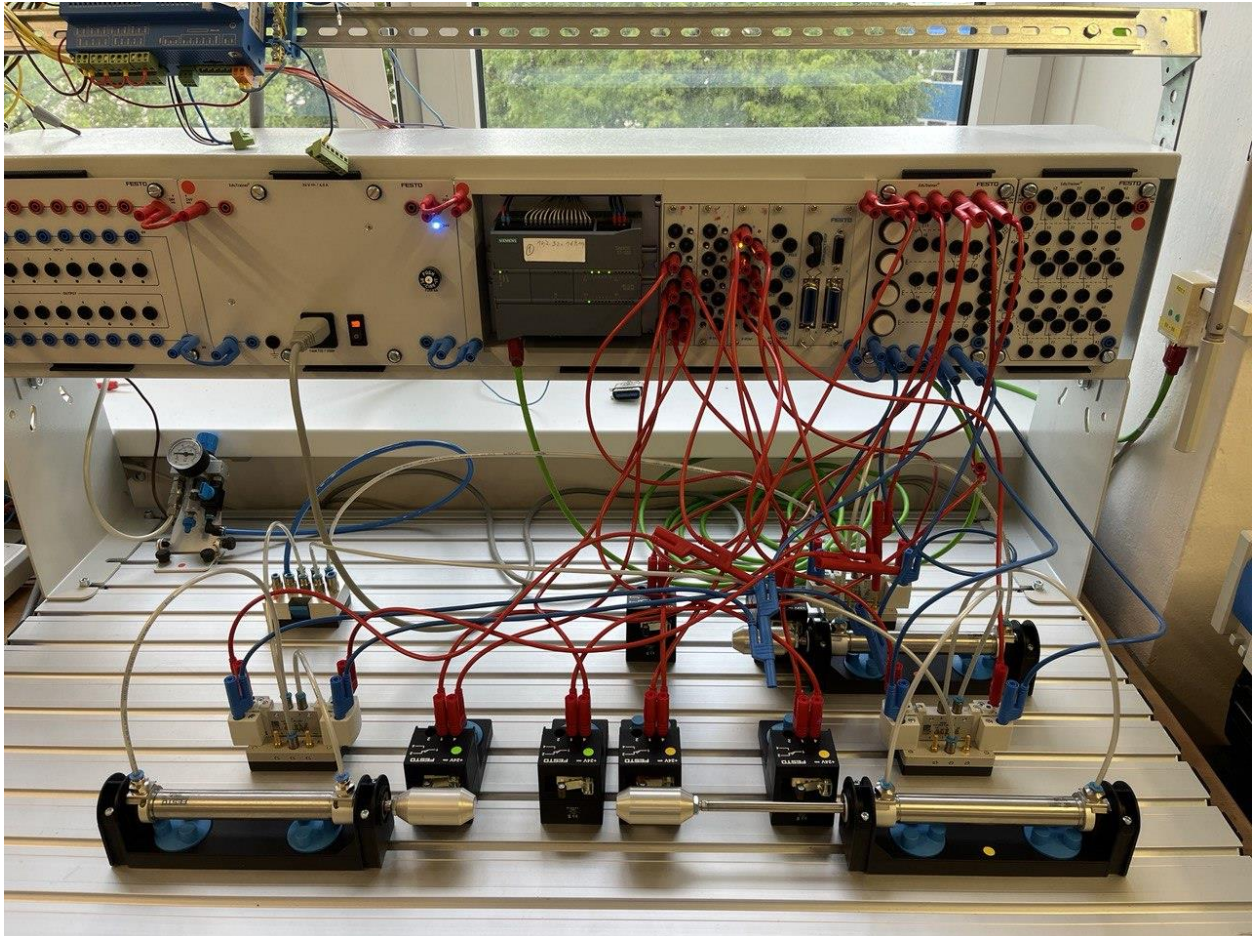
## PLC used: Siemens SIMATIC S7-1200

### Technical specifications

General technical specifications	
Degree of protection	IP20 acc. to IEC 529
Ambient temperature	
<ul style="list-style-type: none"> <li>Operation (95% humidity)</li> </ul>	
- Horizontal installation	-20 ... +60 °C
- Vertical installation	-20 ... +50 °C
<ul style="list-style-type: none"> <li>Transportation and storage</li> </ul>	-40 ... +70 °C
- With 95% humidity	25 ... 55 °C
Insulation	
<ul style="list-style-type: none"> <li>5/24 V DC circuits</li> </ul>	500 V AC test voltage
<ul style="list-style-type: none"> <li>115/230 V AC circuits to ground</li> </ul>	1500 V AC test voltage
<ul style="list-style-type: none"> <li>115/230 V AC circuits to 115/230 V AC circuits</li> </ul>	1500 V AC test voltage
<ul style="list-style-type: none"> <li>230 V AC circuits to 5/24 V DC circuits</li> </ul>	1500 V AC test voltage
<ul style="list-style-type: none"> <li>115 V AC circuits to 5/24 V DC circuits</li> </ul>	1500 V AC test voltage
Electromagnetic compatibility	Requirements of the EMC directive
<ul style="list-style-type: none"> <li>Noise immunity acc. to EN 50082-2</li> </ul>	Test acc. to: IEC 801-2, IEC 801-3, IEC 801-4, EN 50141, EN 50204, IEC 801-5, VDE 0160
<ul style="list-style-type: none"> <li>Emitted interference acc. to EN 50081-1 and EN 50081-2</li> </ul>	Test according to EN 55011, Class A, Group 1
Mechanical strength	
<ul style="list-style-type: none"> <li>Vibrations, test acc. to / tested with</li> </ul>	IEC 68, Part 2-6: 10 ... 57 Hz; constant amplitude 0.3 mm; 58 ... 150 Hz; constant acceleration 1 g (mounted on DIN rail) or 2 g (mounted in switchboard); mode of vibration: frequency sweeps with a sweep rate of 1 octave/minute; duration of vibration: 10 frequency sweeps per axis in each direction of the three mutually perpendicular axes
<ul style="list-style-type: none"> <li>Shocks, test acc. to / tested with</li> </ul>	IEC 68, Part 2-27/half-sine: magnitude of shock 15 g (peak value), duration 11 ms, 6 shocks in each of the three mutually perpendicular axes



## Physical connection



In this picture, we can see the Siemens SIMATIC S7-1200 PLC in the centre of the picture and 3 pneumatic motors, where the one at the bottom left is Motor B, the one on the right of it is Motor C and the one next to Motor C is Motor A. All arranged according to the picture shown in the desired functionality part.

## Conclusion

All 3 pneumatic motors operate as they should according to the sequence given in the project description. However, I did not put a program to set the timer for the Motor B as requested in the project description. Apart from that, everything works well.