Course:	HD in Artificial Intelligence and Robotics
Course code:	EG114728
Module:	Industrial Automation
Module code:	MBS4521

Official Use

Lab 1:
Fluid Power System and Pneumatic Circuits

Student Name:	Cheung Tsz Chun Noddy
Student number:	22017174
Names of other members:	1. Lai Ho 2. Lai Ka Ming 3. Lui Shing Tak
Date:	5/2
Signature:	Cheung Tsz Chun Noddy

Notes to Students:

1. Maximum of 4 members per group
2. Submit this lab sheet in pen writing
3. Individual submission required
4. Use spaces given for each part
5. Glue print out in specified spaces
6. Due date will be given in lab session
7. A maximum of 5% will be deducted for untidiness
8. Late submission will normally not be accepted

Objective

After completion of this lab, students should be able to perform simple calculations regarding fluid power related problems, understand how pneumatic system works, draw symbolic representation of simple components, and design, build and test simple pneumatic circuits utilizing pneumatic design and simulation software and a pneumatic training board and pneumatic components.

Introduction

Pneumatic equipment is being used for automation in certain manufacturing industry and testing and quality control laboratories. Due to the variety of applications, there is a large range of pneumatic components available. The design of a pneumatic circuit by conventional means can be a long process with no means of testing the circuit until it is assembled. However, with the help of computer simulation software, pneumatic circuits can be simulated before actually

building it to test for suitability of function.

In this laboratory session, students are required to work as a group of 4 members (maximum). Each group is required to build their own circuit and run the computer simulation. Each member is required to print out the result and paste it onto his/her own lab sheet. Every student should hand in his/her own lab sheet one week after the lab session.

Apparatus

1. Pneumatic design and simulation software (Automation Studio)
2. Personal computers
2. Pneumatic components and accessories
3. Pneumatic training board

Procedures

Part A – Pneumatic System Basic (40 %) P32

What is the function of the lubricator in pneumatic system?

1. Pressure drop directly proportional to the flow rate
2. Oil is lifed from the container into air steam
3. Oil is broken up into miniscule particles, atomized and mixed homogeneously with air

水分

Why do we need to remove moisture in pneumatic system using a device like the one shown below?

Moisture dilutes the oil required for the head and rod of an air cylinder, corrodes the walls and slows response.

6×10^5 N/m²

A single acting cylinder as shown below is supplied with 6 bar of air. The cylinder has a bore diameter of 150 mm and a stroke of 500 mm. Neglect the force in spring.

(i) Determine the extension force of the cylinder, in [N].

Area $= \frac{\pi D^2}{4}$

$= \frac{\pi \times (150/1000)^2}{4}$

$= 0.0177\ m^2$

6 bar $= 6 \times 10^5$ Pa

$= 6 \times 10^5$ N/m²

Force = pressure × Area

$= 6 \times 10^5$ N/m² × 0.0177 m²

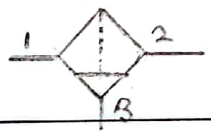
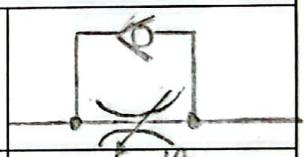
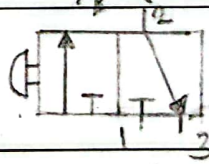
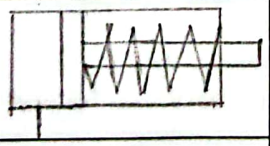
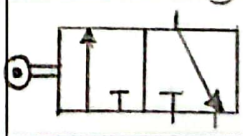
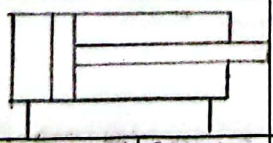
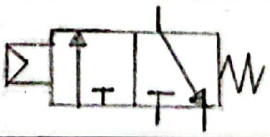
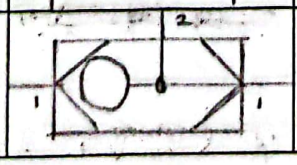
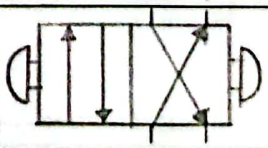
$= 10602.9$ N

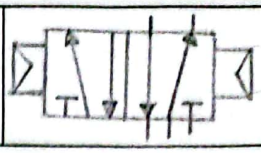
(ii) If the pneumatic system is replaced by hydraulic system, and the supply pressure is 100 bar, determine the extension force of the cylinder, in [N].

Force = pressure × Area

$= 100 \times 10^5$ N/m² $\times \frac{\pi (150/1000)^2}{4}$ m²

$= 176714.6$ N

Sketch the ISO symbol of the following components:			
Filter with manual drain		Restriction check valve	
Lubricator		3/2 (NC) Pushbutton	
Single acting cylinder (spring return type)		3/2 (NC) roller actuated control valve	
Double acting cylinder		3/2 (NC) pilot actuated valve with spring return	
Shuttle valve		4/2 double pushbutton valve	

Check valve		5/2 double pilot directional control valve	

Part B – Pneumatic Circuit Practice (10%)

A double acting cylinder is used in an equipment to control a press such that, after pressing PB1 momentarily, the press will ***extend*** to its designed position. When the designed position is reached, the press will retract to the starting position.

The complete circuit is shown in Fig.1.

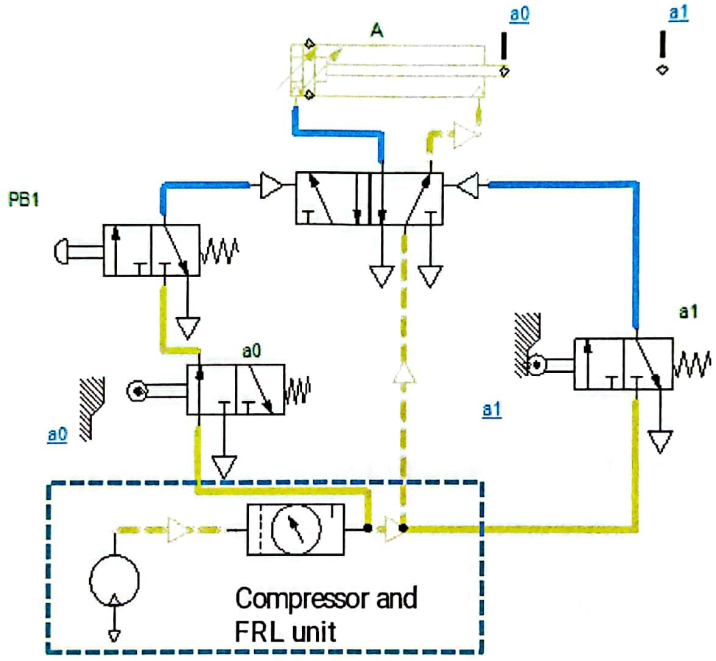


Fig. 1 Oscillatory circuit for a double acting cylinder

B1 Use the pneumatic training board to construct the above circuit.

Official use:

Satisfactory / Minor assistance required / Major assistance required / Incomplete

Date and Time: _____

Part C – Software Simulation and Circuit design and building (30%)

Sequential Control of Two Double Acting Cylinders by Intuitive Method

An automatic conveyor system, as shown in Fig.2, is designed for packaging transferring which consists of two pneumatic double acting cylinders, namely **A** and **B**. Only pneumatic components will be used for this control circuit.

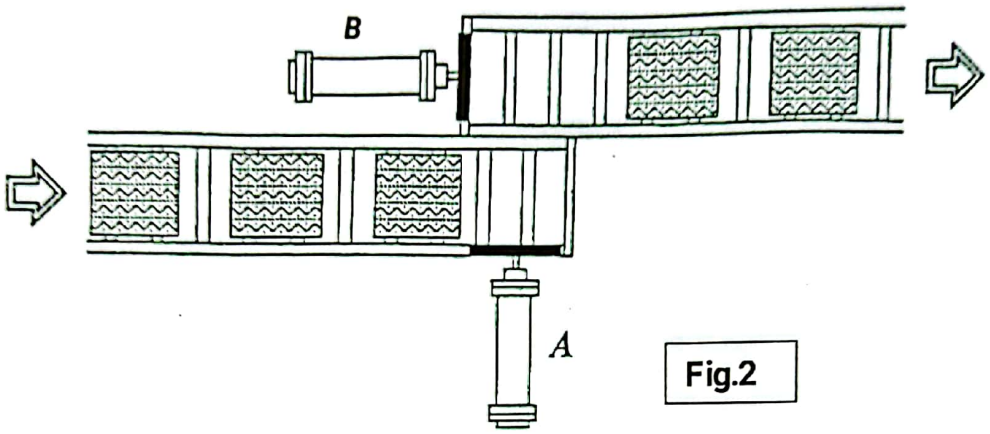


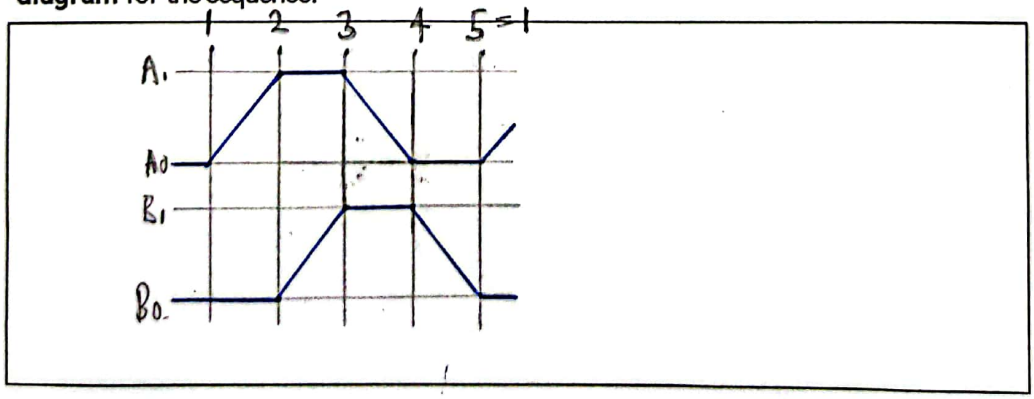
Fig.2

The required operation sequences are:

a) The package is placed in position by the lower conveyor belt,
b) Press the START button once;
c) One package will be *slowly* pushed by **Cylinder A** from the lower conveyor belt to the upper conveyor belt;
d) **Cylinder B** *slowly* extends to push the package out onto the upper conveyor belt;
e) **Cylinder A** then retracts to pick up another package,
f) **Cylinder B** fully retracts and the next cycle will begin when button is pressed again.

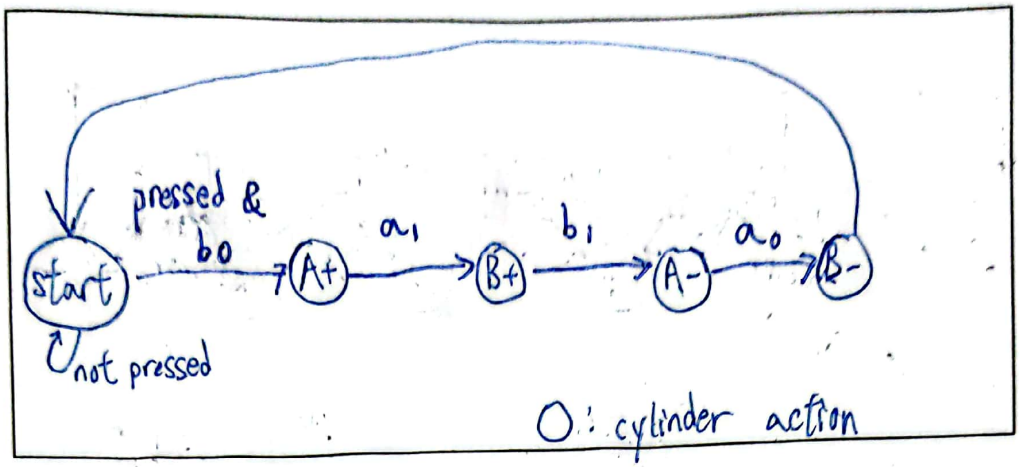
P64

C1 Write down the **operation sequence** for the system and draw the **displacement-time diagram** for the sequence.



P69.

C2 Draw the **block diagram** (flowchart) of the above sequence with the correct actuating signals.



C3 Design your circuit using the **simulation software** and simulate your solution.
Print the complete circuit diagram from the software and paste it below.

Graph is in the last page

C4 Use the pneumatic training board to construct the circuit.

Official use:
Satisfactory / Minor assistance required / Major assistance required / Incomplete
Date and Time: _____

Part D – Discussion (20 %)

D1 Compare software simulation and building actual pneumatic circuits.

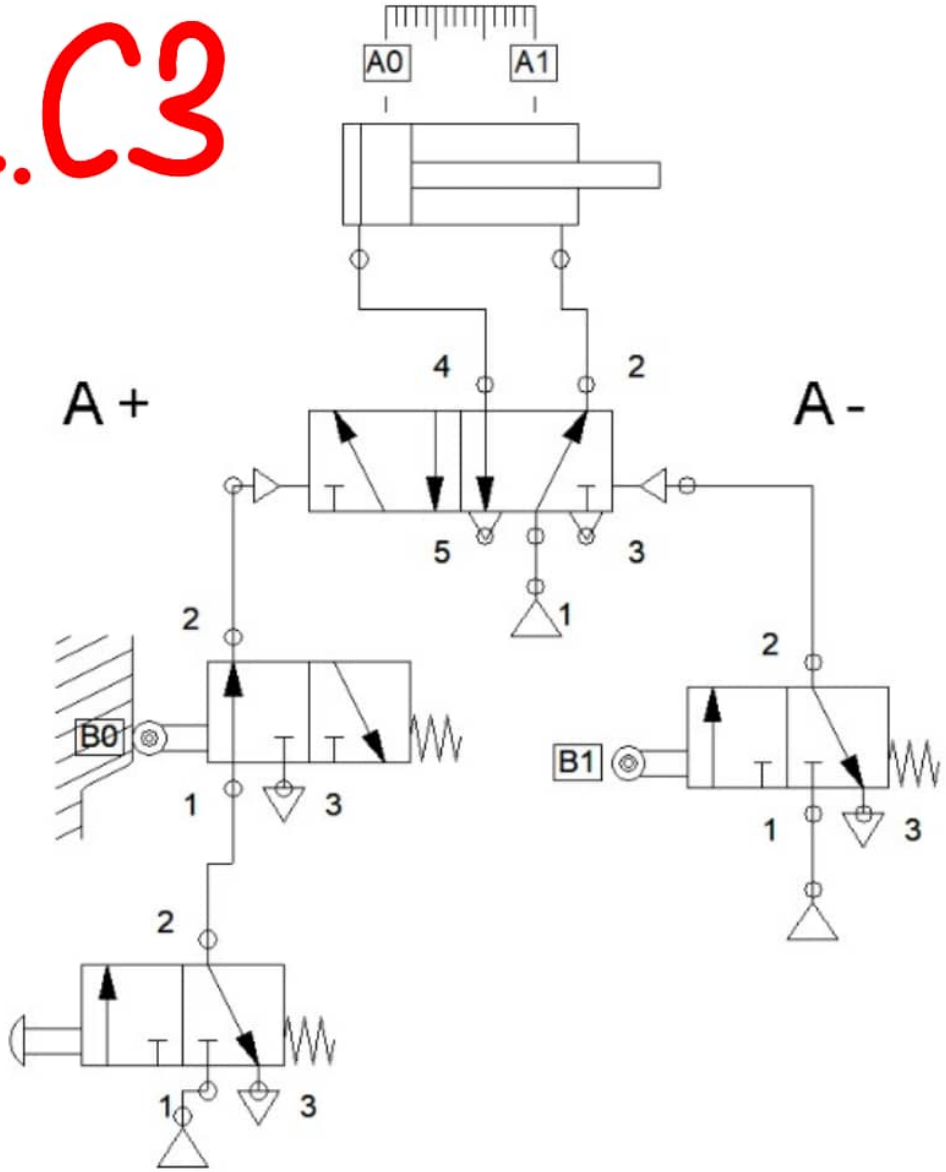
Sofeware is safer than hardware, we can use the simulation at home or where ever you want. Compare to hardware, you can save the process of making circuit in sofeware without rebuilding your actual circuit every time.
Hardware is less costly than sofeware. It is also more easy to build compare to sofeware, sofeware is way more difficult to use because you need to watch Youtube tutorials. Besides, Hardware creates more impressive experience to the students.

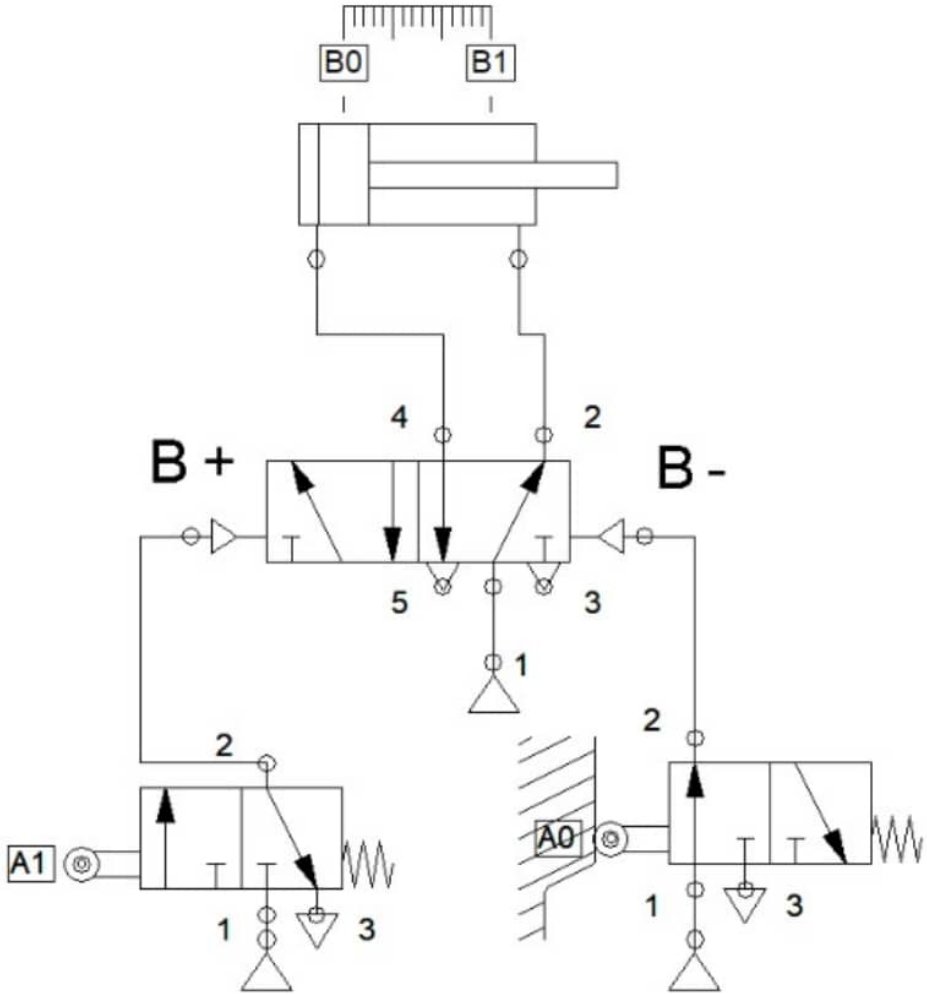
D2 Suggest how to improve the design of the pneumatic system described in Part C.

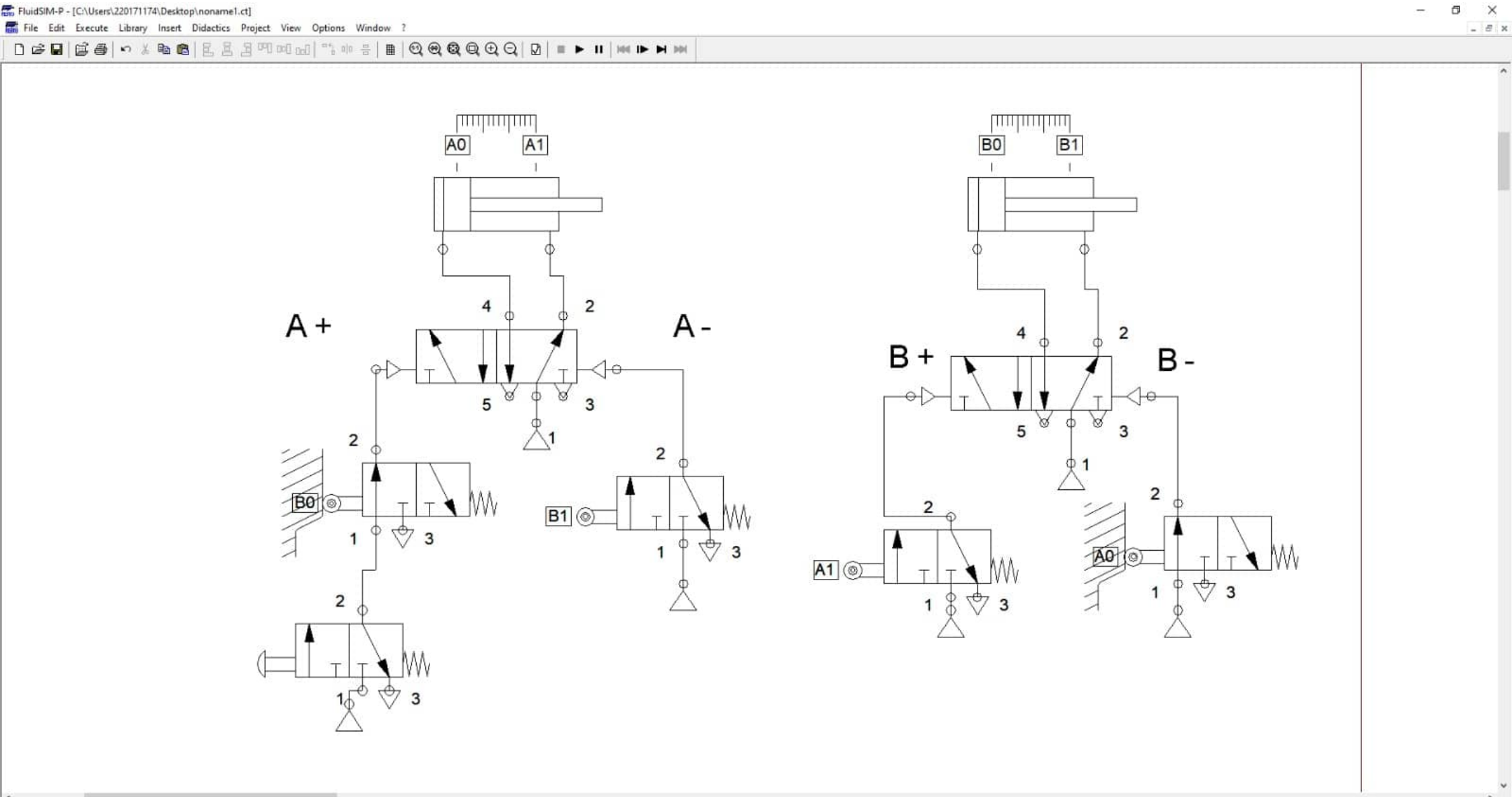
I suggest to add lubricating oil to make the circuit smoother. It can excute the orders faster and increase industrial production.
I also suggest to add on/off switch for safety propose to prevent accident happens.
3/2 ways Pushbutton is one of a good opinion for On/off switch.

- End -

Q.C3



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