Use of a Cylinder with Two Piston Rods

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Abstract: *This paper presents aspects related to the use of cylinders with two piston rods. Beside the cylinder with two piston rods, there is also a pneumatic actuator. This actuator is a cylindrical metal machine, which guides with two piston rods in a straight-line, a reciprocating movement in a cylinder. In this article, four circuits for cylinders with two piston rods, both pneumatic and electro-pneumatic circuits are presented. The first pneumatic circuit is a simple one and has only one cylinder with two piston rods. The second pneumatic circuit has two cylinders with two piston rods. Furthermore, the first electro-pneumatic scheme is endowed with logical modules. The second electro-pneumatic scheme is equipped with Grafcet PLC. It should be noted that all circuits have various pneumatic devices: air supply, lamps in cold, strong wind or storm fishing conditions. The design and simulation of the pneumatic circuits in this manuscript is done using FluidSim software from Festo.*

Keywords*: Piston, rod, pneumatic, electrical, scheme, circuit*

1. Introduction

In practice, a cylinder with two piston rods can be used twofold: it can replace other types of pneumatic cylinders and also can be used in various industrial machinery and pneumatic tools.
Moreover, because the advantage it has, having the same construction height, the cylinder with two piston rods transmits at least twice the force compared to standard cylinders, [1].
Construction of this pneumatic actuator is compact, Fig. 1.

Fig. 1. Cylinder with two piston rods

In pneumatic and electro-pneumatic schemes, the cylinders with two rods is represented by a specific symbol, Fig. 2.

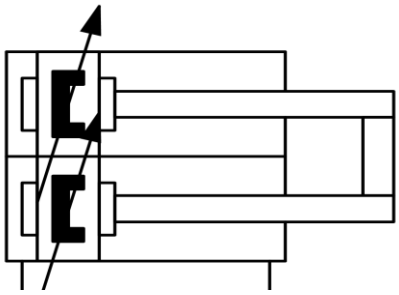

Fig. 2. Symbol of cylinder with two piston rods

This cylinder has two piston rods that move in parallel and that are coupled by a double trestle, [1].

The main characteristics of the cylinder with two piston rods are: low noise emission, dust emission, compact units, corrosion-resistant, easy and ready-to-install, etc.
The actuator guarantees small torsion when positioning and moving assemblies and tools.
Therefore, coming along in the same construction height, the cylinder with two piston rod conveys a double force as compared to standard cylinders.

2. The cylinder with two piston rods in the pneumatic circuits

A pneumatic installation is an interconnected set of devices that converts compressed air into mechanical work, [2].
In the table below there are given the component devices used in the first pneumatic scheme.

Table 1: The devices of the first pneumatic scheme

Description	Number of components
Compressed air supply	1
5/2 way valve	1
Air filter	1
Throttle valve	2
Cylinder with two piston rods	1

The first pneumatic circuit studied by authors has one cylinder with two piston rods, Fig. 3.

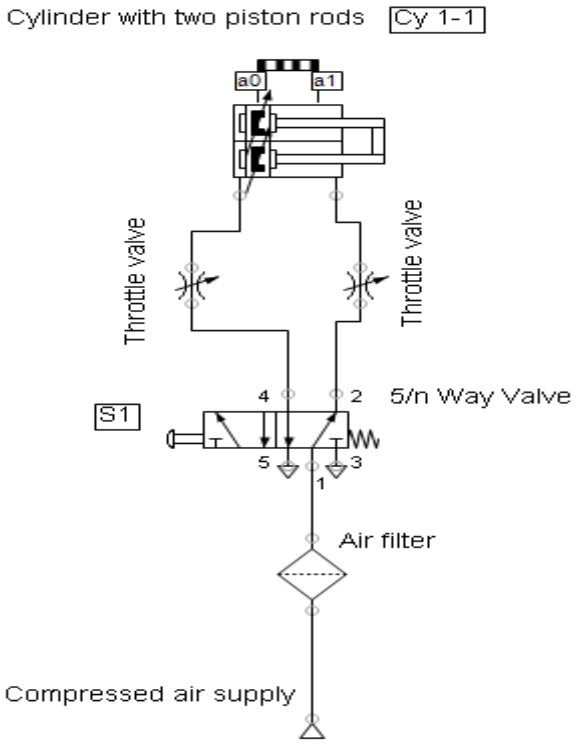

Fig. 3. First pneumatic circuit using one actuator

The first pneumatic circuit operates only if operator presses S1 button. This button belongs to the 5/2 way valve with spring. Then, two piston rods move from point a0 to point a1. After that, those two piston rods return from point a1 to point a0, because the 5/2 way valve has a spring, Fig.4.

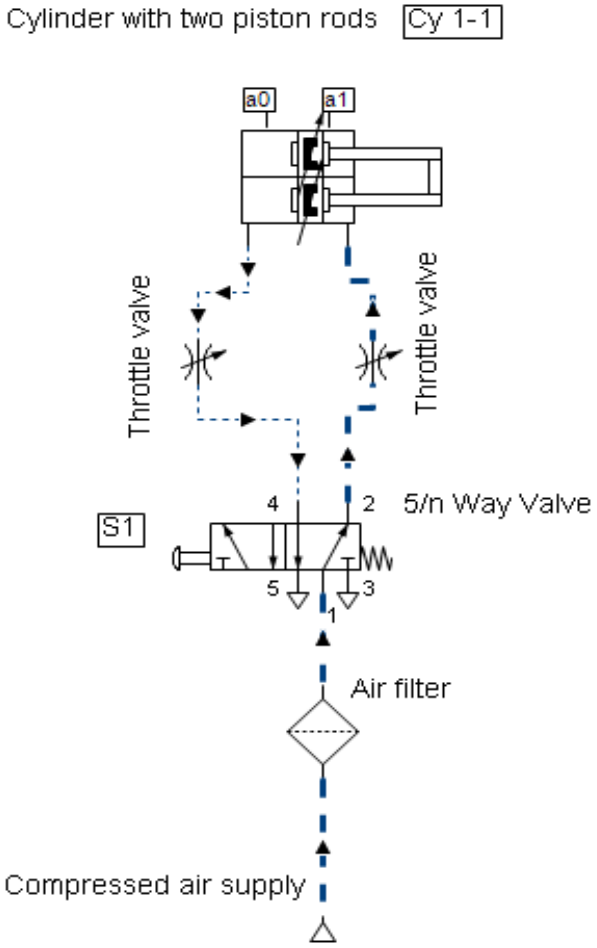

Fig. 4. First pneumatic scheme with one actuator

The diagrams below show variation of the position and velocity. These functional parameters belong to a cylinder with two piston rods (Cy 1-1), Fig. 5.

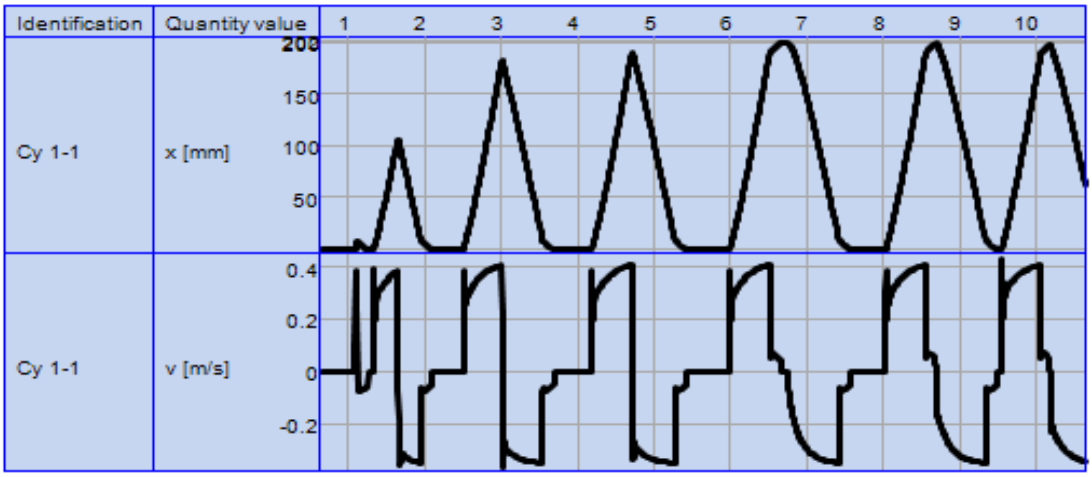

Fig. 5. Diagrams of parameters variations from the Cy 1-1

The data in Table 2 shows the component devices used in the second pneumatic circuit.

Table 2: The devices of the second pneumatic scheme

Description	Number of components
Compressed air supply	1
5/2 way valve	1
Air service unit	1
Throttle valve	4
Cylinder with two piston rods	2

The second pneumatic scheme studied uses two actuators (Cy 2-1 and Cy 2-2), Fig. 6.

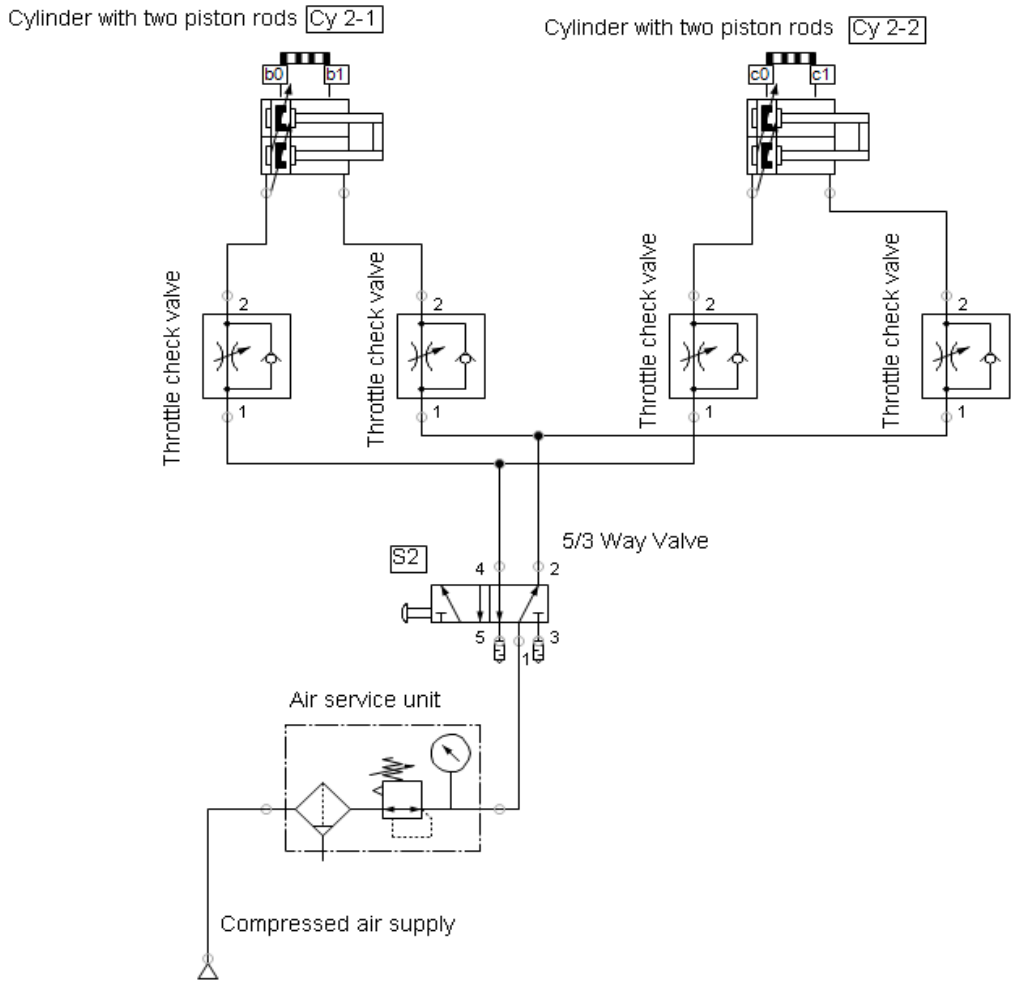

Fig. 6. Second pneumatic scheme with two actuators

When operator presses S2 button, the cylinders with two rods open together. Thereby, the piston rods which belongs to the cylinder (Cy 2-1) move from point b0 to point b1 and the piston rods which belong to the cylinder (Cy 2-2) move from point c0 to c1, [3].

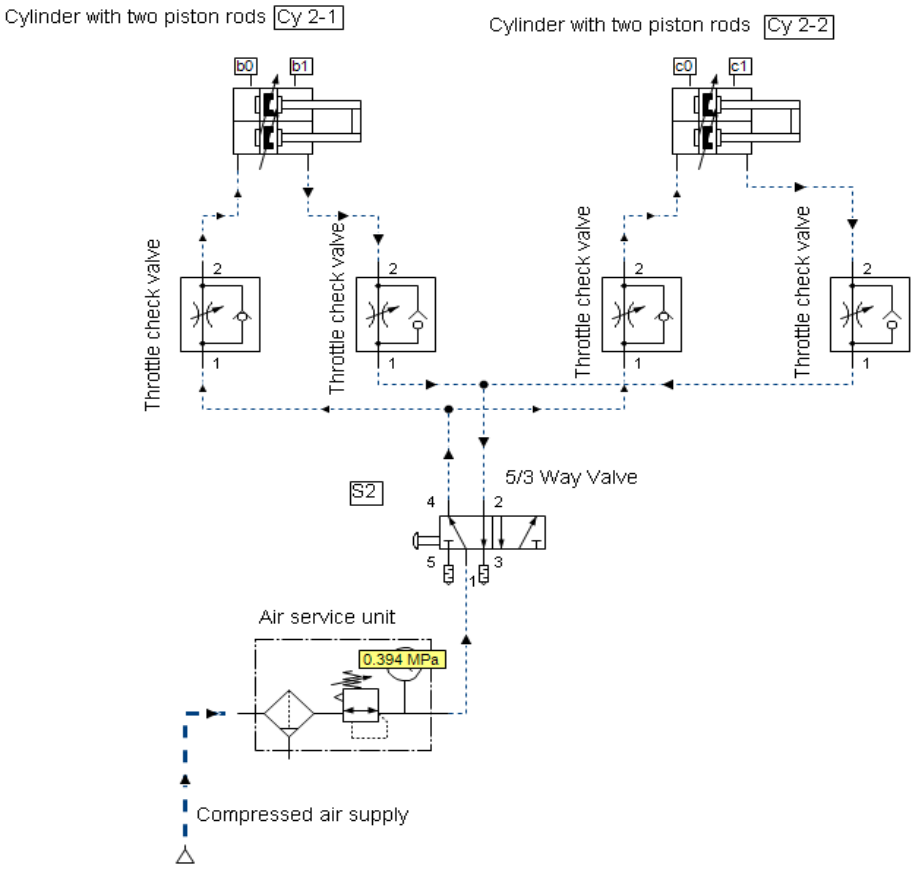

Fig. 7. Second pneumatic scheme - Simulation

To close the pneumatic circuit, the operator has to press the S2 button again. In this case, both pistons return to their starting points, Fig. 7.

3. The cylinder with two piston rods in the electro-pneumatic circuits

An electro-pneumatic scheme consists of an electrical or electronic part controlling the pneumatic power part of the circuit, [4].
Table 3 shows the components used in the pneumatic circuit.

Table 3: The devices of the first electro-pneumatic scheme

Description	Number of components
Compressed air supply	1
5/2 way solenoid valve	1
Air filter	1
Throttle valve	2
Cylinder with two piston rods	1
Relay	2
Lamp	2
Valve solenoid	2

The first electro-pneumatic scheme analyzed has one cylinder with two piston rods, Fig. 8.

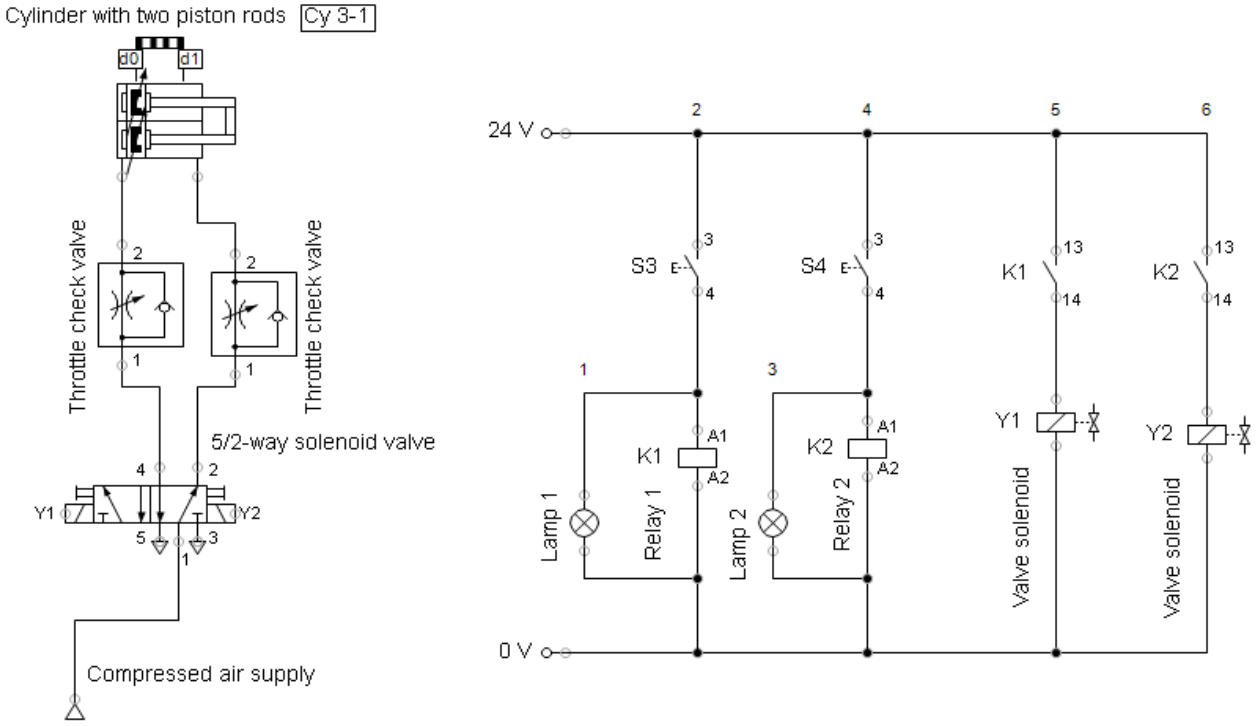

Fig. 8. First electro-pneumatic scheme

This first electro-pneumatic circuit operates only if operator presses S3 button. This button belongs to the 5/2 way solenoid valve. Then, the two piston rods move from point d0 to point d1. In this case, lamp 1 shows a pink signal, Fig. 9.

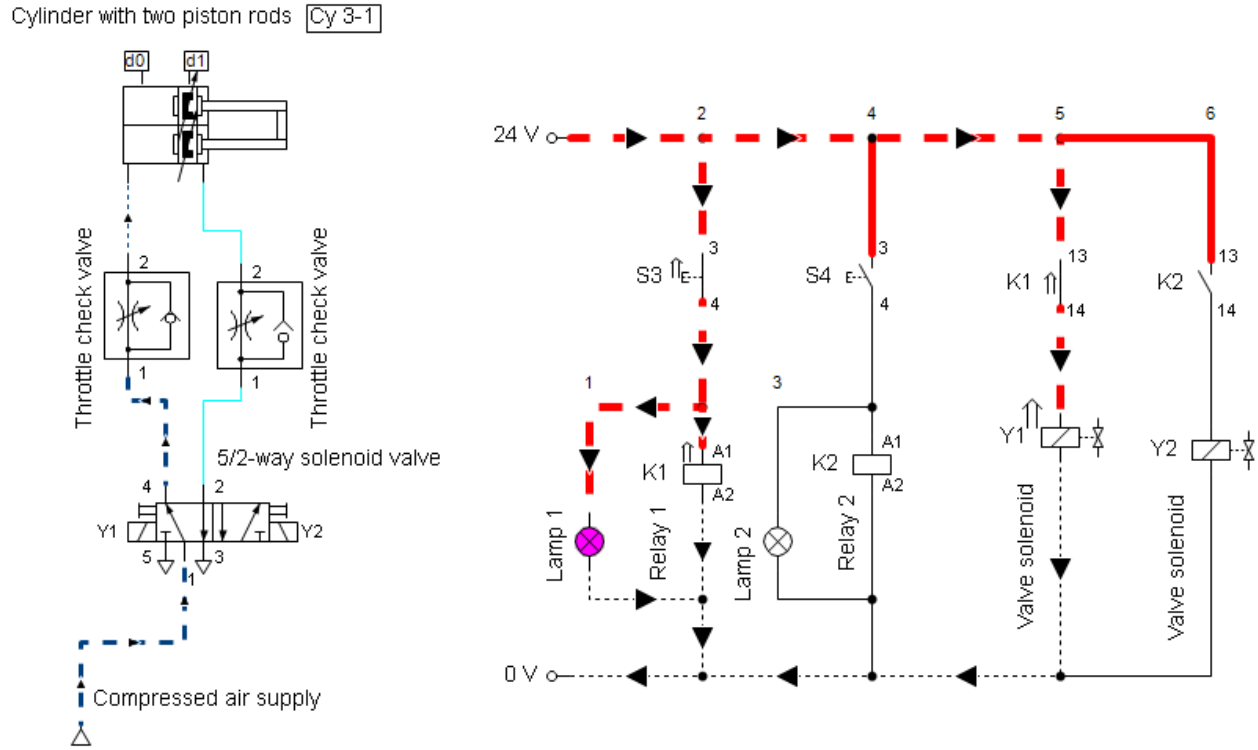

Fig. 9. First electro-pneumatic scheme – Simulation I

After that, the two piston rods return from point d1 to point d0 and lamp 2 shows a blue signal in electro-pneumatic circuit, Fig. 10.

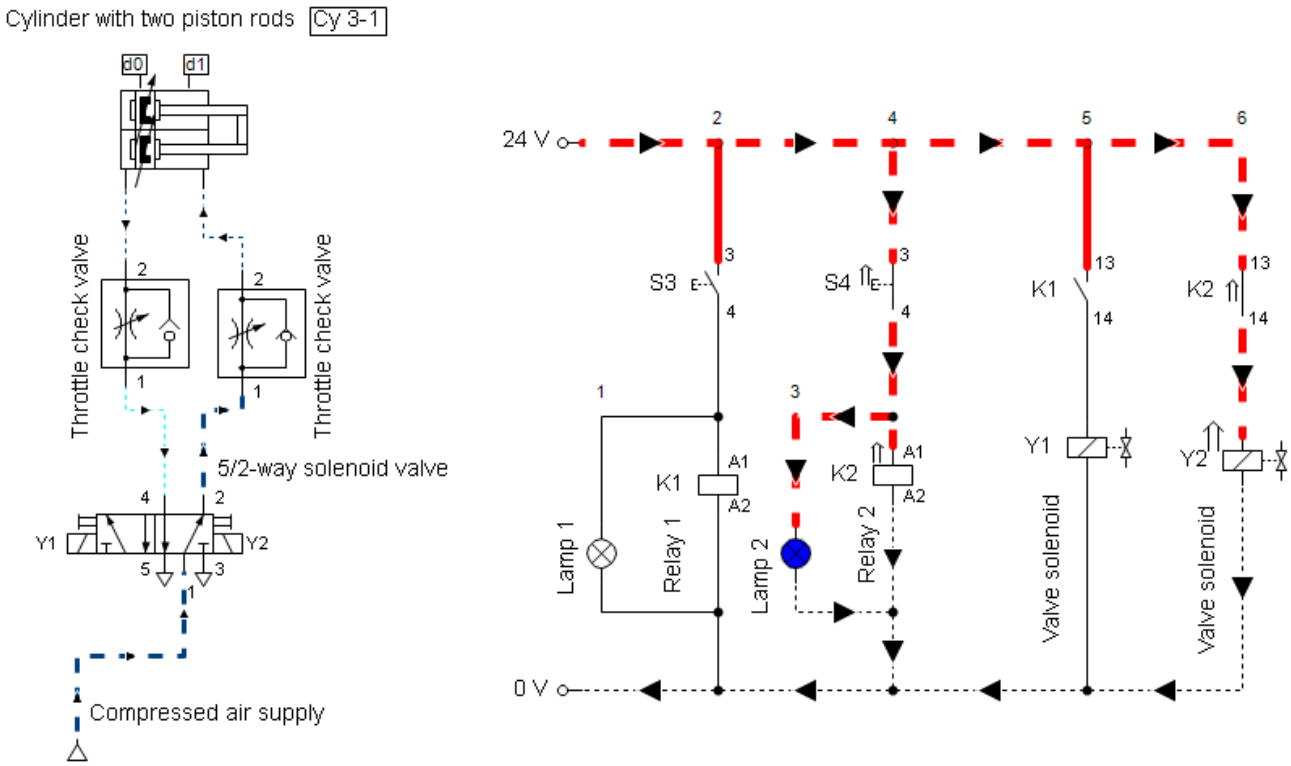

Fig. 10. First electro-pneumatic scheme – Simulation II

Table 4 shows the components used in the second electro-pneumatic circuit, [5].

Table 4: The devices of the second electro-pneumatic scheme

Description	Number of components
Compressed air supply	1
5/2 way solenoid valve	1
Cylinder with two piston rods	1
Logic module	1
Valve solenoid	2

A development of a second electro-pneumatic scheme consists in further improvement with logic module, Fig. 11.

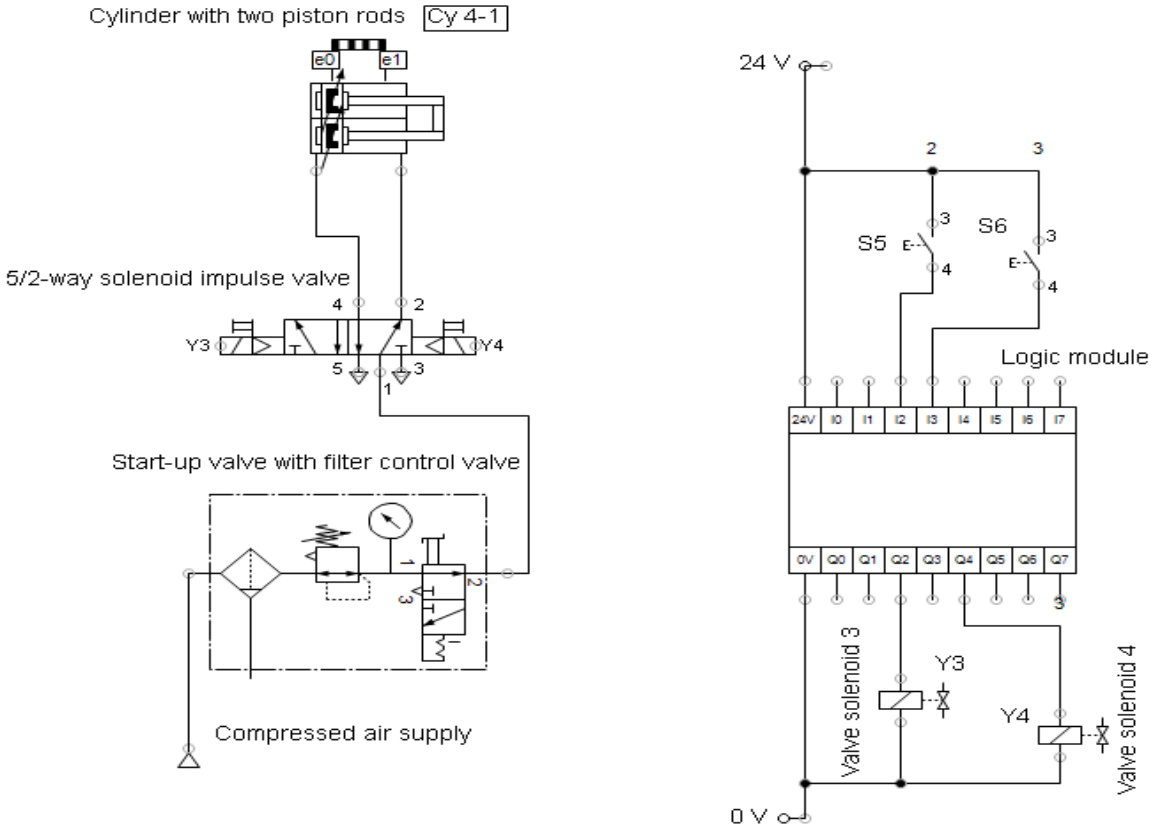

Fig. 11. Second electro-pneumatic scheme

The operator has to press the S 5 button to open the second electro-pneumatic scheme. In this case, the cylinder with two piston rods (4-1) moves from point e0 to point e1, Fig. 12.

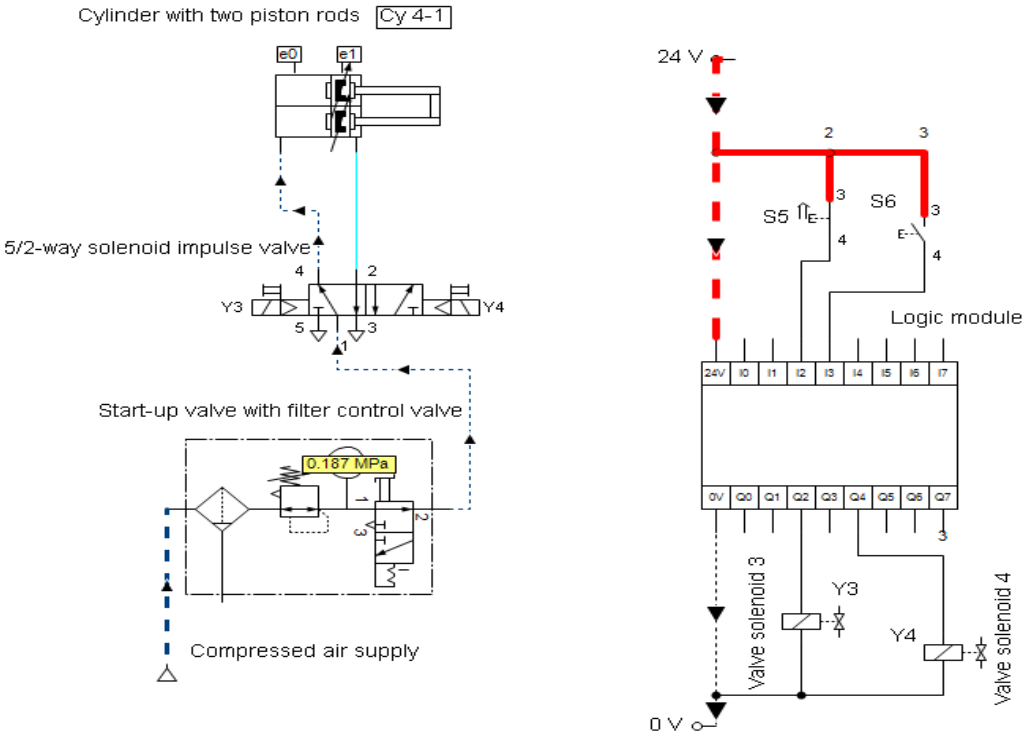

Fig. 12. Second electro-pneumatic scheme – Simulation I

Afterwards, the operator presses S6 button, [6].
This causes the cylinder with two piston rods (4-1) to move from point e1 to point e2, Fig. 13.

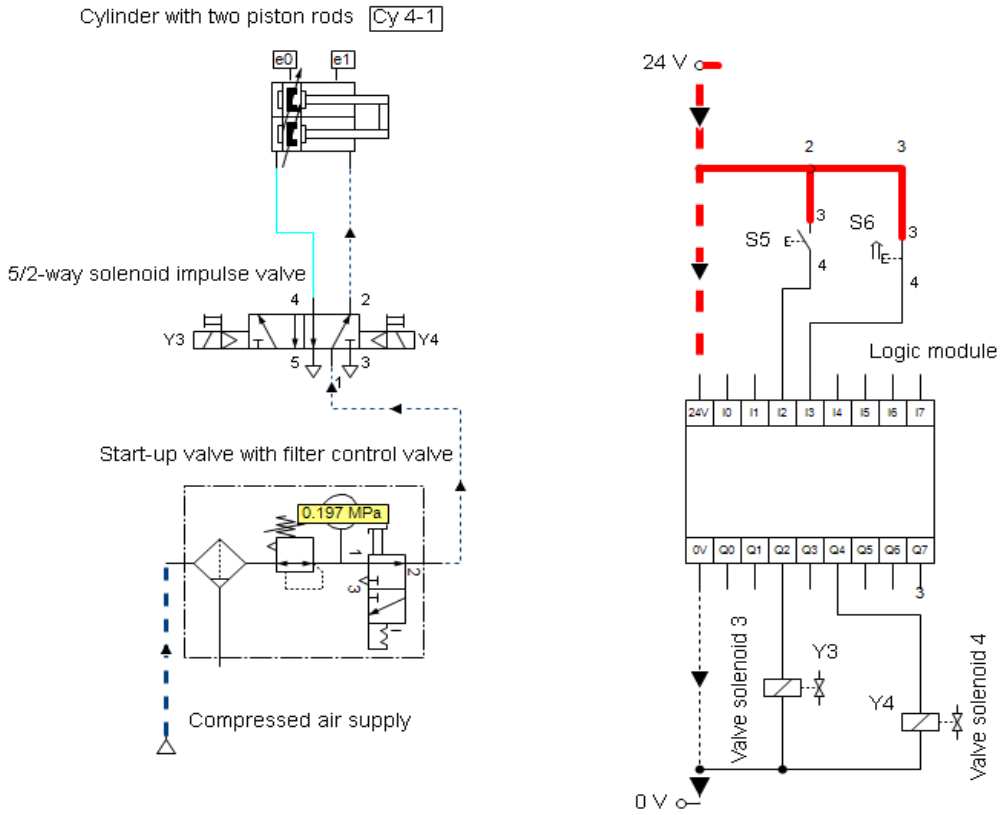

Fig. 13. Second electro-pneumatic scheme – Simulation II

4. Conclusions

The circuits shown in this paper allow the experimental verification of cylinder with two piston rods used in pneumatic installations based on these above presented circuits. Moreover, these installations can be used for practical training at any level (students, operators, workers, etc.) of persons who specialize and/or improve in the field of pneumatic components.
Cylinders with two piston rods, logic module and electrical equipment used for automatic system design have a high degree of performance and accessibility.
For a better choice of investment in such devices using the presented pneumatic installations, it is recommended that similar simulation methods should also be used beforehand.

References

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