Automation and Automatic Control
Lab
IE 0906544
Experiment 5

Introduction to Pneumatics

Simulation of Single Acting and Double acting Cylinders using Automation Studio

Introduction

In this experiment, you will study about the pneumatic circuits for the linear movement of an actuator. More precisely, we will study about the single-acting and double acting pneumatic cylinder.

Objectives

- To learn about pneumatic power characteristics, applications, advantages and disadvantages;
- To investigate a basic pneumatic circuit.

Components Required

Automation Studio software

Discussion

Fluid power systems convert mechanical energy into fluid energy, and then convert this fluid energy back into mechanical energy to do useful work. The fluid power devices that convert the energy of a pressurized fluid into mechanical energy to do work are called actuators. The two basic types of actuators are cylinders, which generate linear motion, and motors or rotary actuators, which generate rotary motion.

Most pneumatic circuits contain a source of compressed air, a pressure control device, conductors such as pipe or tubing, an actuator, and a directional control valve to control the operation of the actuator. The power source comes from a motor or engine, called a prime mover, that operates a compressor having its inlet port connected to the atmosphere. The mechanical energy is converted into fluid power when this air is compressed. In addition to a prime mover and a compressor, a pneumatic power source includes an air storage tank called a receiver. The receiver stores the compressed air until this energy is needed elsewhere in the system.

A pneumatic circuit is a fluid power circuit that uses gas to transmit power. Air is commonly used as a gas in pneumatics because it is readily available, inexpensive, and can be returned to the atmosphere after use.

Air is extremely compressible and elastic. It is capable of absorbing large amounts of potential energy. These properties of compressed air make possible smooth acceleration and deceleration and reversal of direction of mechanical motions, with relative freedom from shock.

As a power medium, compressed air has numerous distinct advantages such as:

- Easy to transport and store;
- Unlimited conductive geometry;
- Offers little risk of explosion or fire;
- Is a very fast working medium and enables high working speed to be obtained;
- Provides flexibility in the control of machines;
- Provides an efficient method of multiplying force; C no return lines necessary; C efficient and dependable.

The main disadvantages of compressed air are:

- Safety precautions are necessary in handling;
- Expensive compared to some mechanical, electrical or hydraulic means for a given application;
- Generally suitable for relatively low power requirements;
- Pressure limits;
- Leakages must be controlled to maintain usable pressures; C dirt and humidity must not be present.

Compressed air finds wide use in transportation and industry fields: air brakes, air cylinder, tools, die casting, etc. Figure 1-1 shows some typical applications.

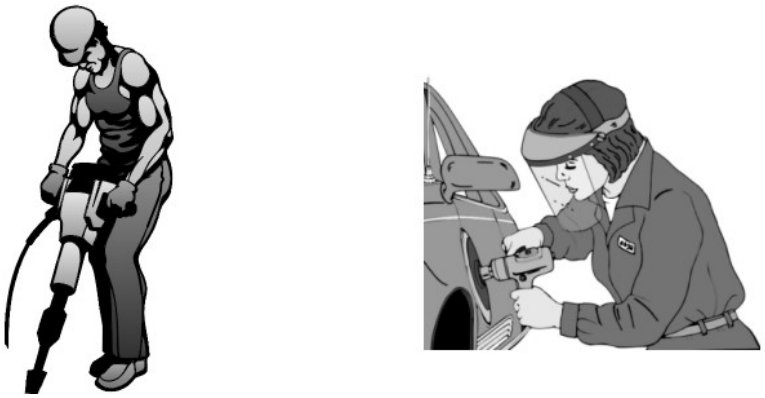

Figure 1-1. Compressed Air Applications.

Figure 1-2 illustrates the flow of air through a fundamental pneumatic circuit. Air is drawn from the atmosphere by the compressor and compressed in the receiver. When the directional control valve (DCV) is operated, air flows through the valve and to side A of the cylinder. This

causes the cylinder to extend and the air from side B is exhausted and returned to atmosphere.

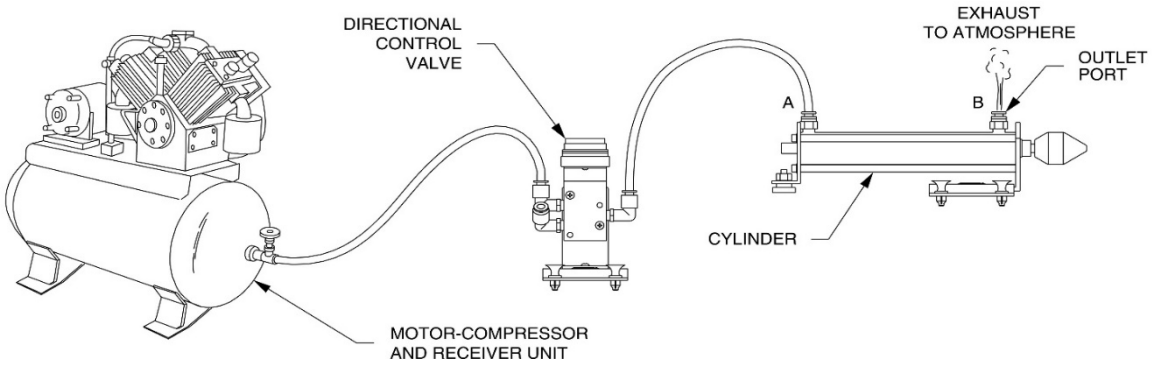

Figure 1-2. Fundamental Circuit Flow.

Procedure:

Part 1: Single –acting Cylinder

A. Simulation of single acting cylinder using direct method.

1. Draw the pneumatic circuit diagram for direct triggering of single acting cylinder in Figure 3 using Automation Studio Software.

2. Simulate the circuit using Automation Studio Software.

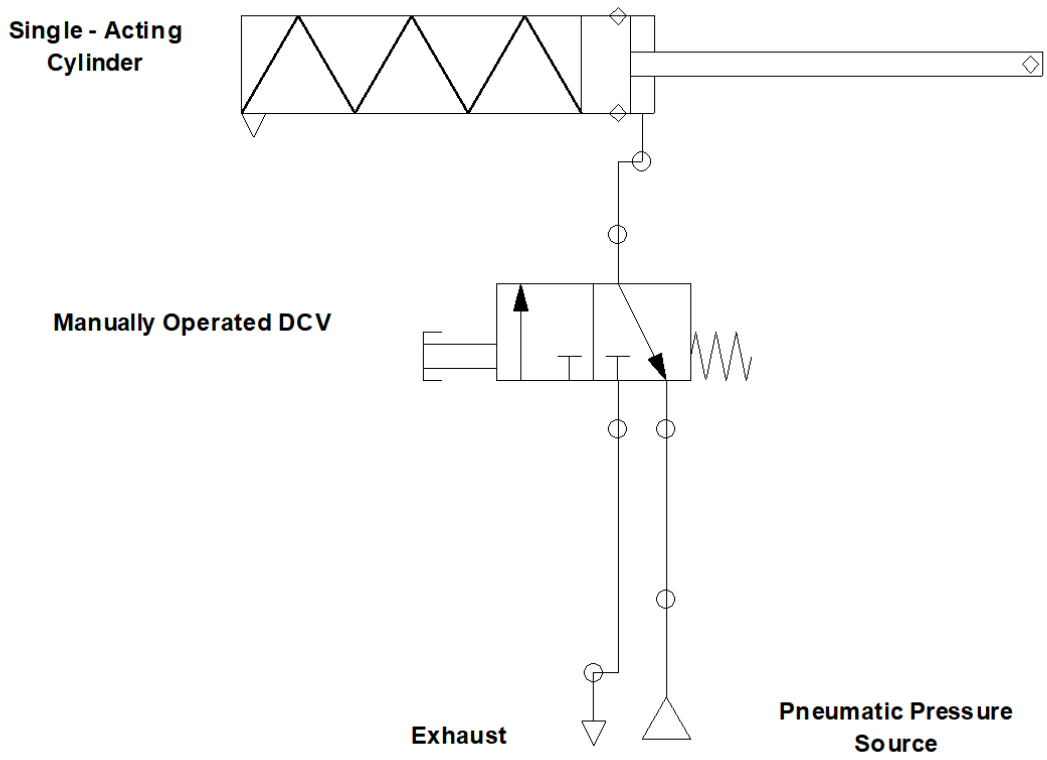

Figure 1- 3 Single acting Cylinder circuit using direct method.

B. Simulation of single acting cylinder using indirect method.

1. Draw the pneumatic circuit diagram for direct triggering of single acting cylinder in Figure 4 using Automation Studio Software.

2. Simulate the circuit using Automation Studio Software.

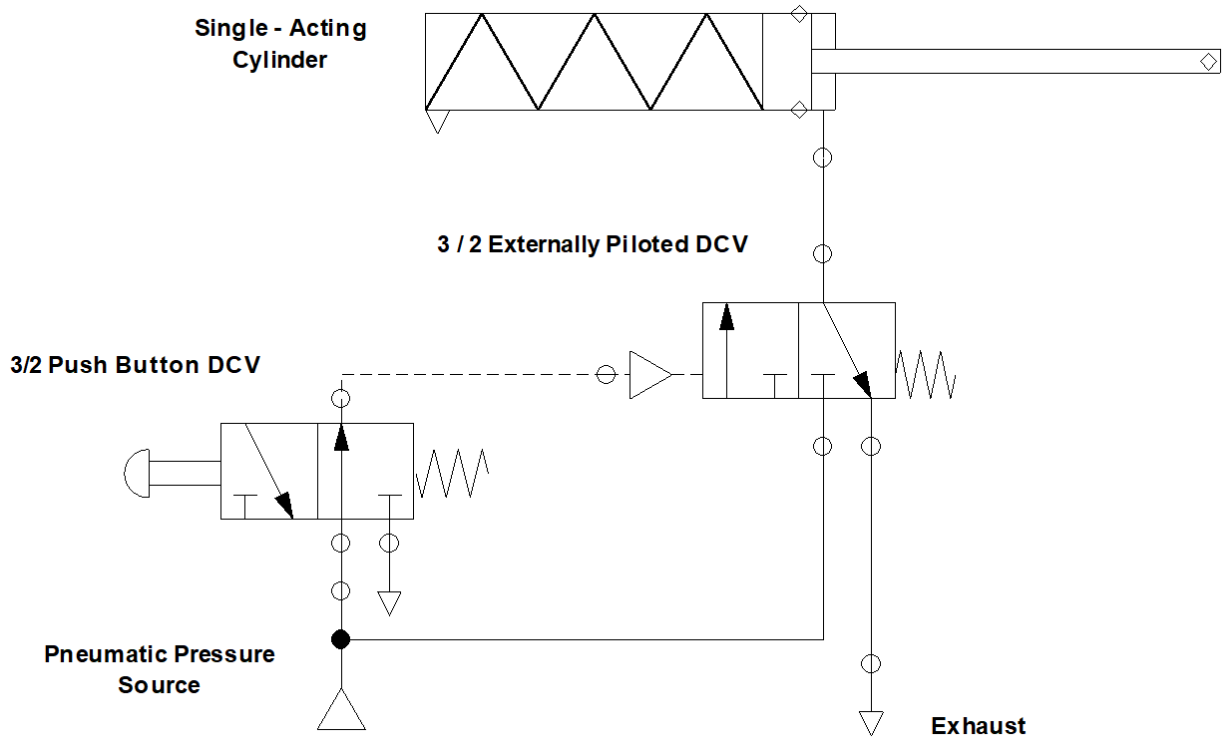

Figure 1- 4 Single acting Cylinder circuit using indirect method.

C. Simulation of single acting cylinder using two push Button switches.

1. Draw the pneumatic circuit diagram for direct triggering of single acting cylinder in Figure 5 using Automation Studio Software.

2. Simulate the circuit using Automation Studio Software.

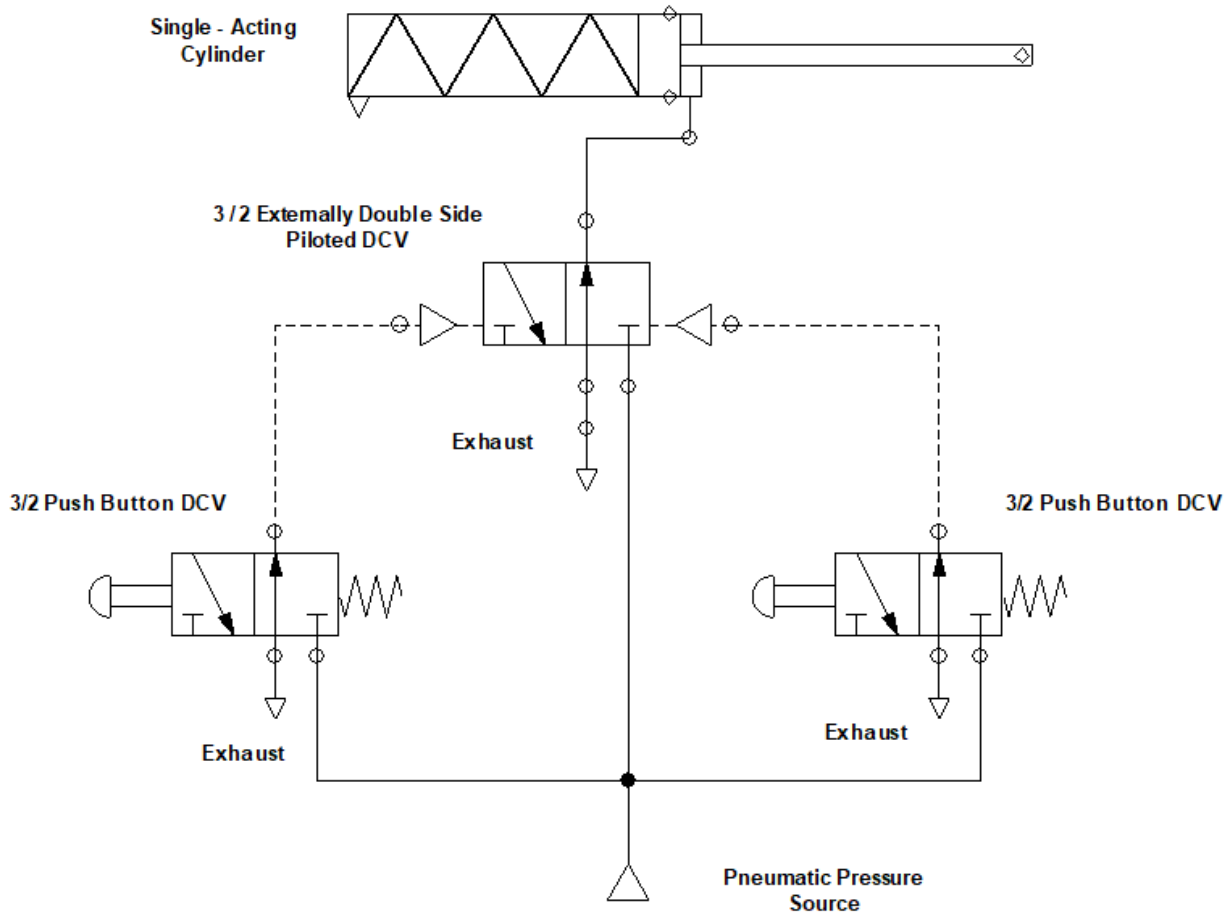

Figure 1- 5: Single acting Cylinder circuit using two push Button switches.

Part 2: Double –acting Cylinder

D. Simulation of double acting cylinder using direct method.

1. Draw the pneumatic circuit diagram for direct triggering of double acting cylinder in Figure 6 using Automation Studio Software.

2. Simulate the circuit using Automation Studio Software.

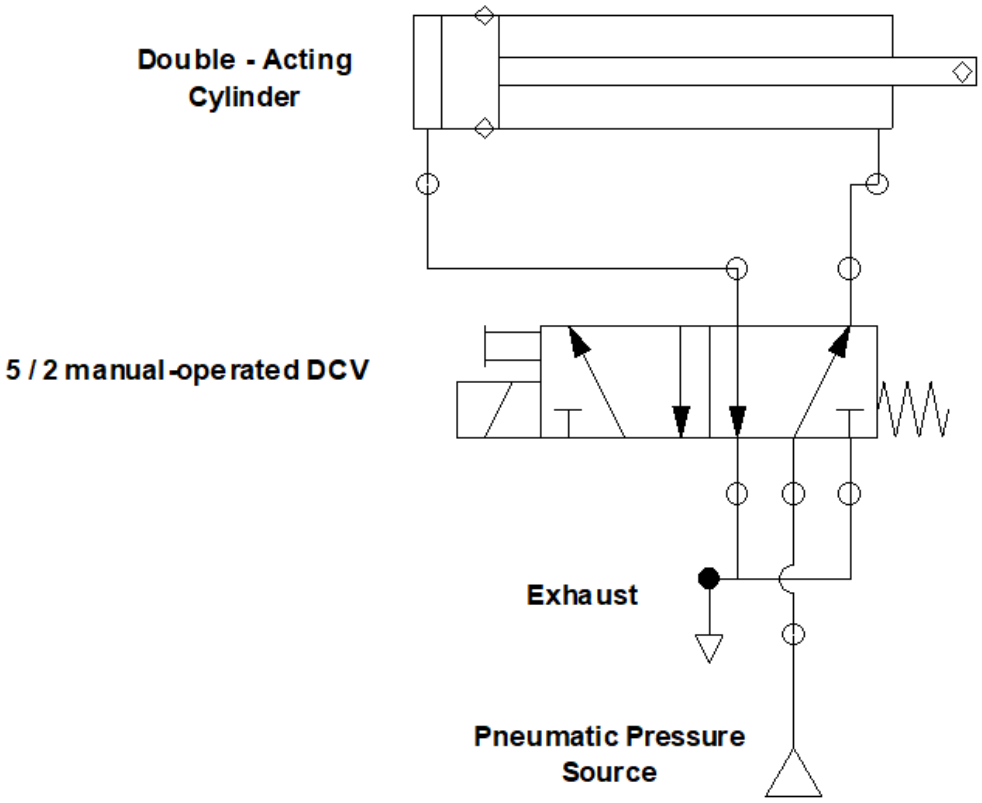

Figure 1-6: Double acting cylinder using direct method.

E. Simulation of double acting cylinder using two push button switches.

1. Draw the pneumatic circuit diagram for direct triggering of double acting cylinder in Figure 7 using Automation Studio Software.

2. Simulate the circuit using Automation Studio Software.

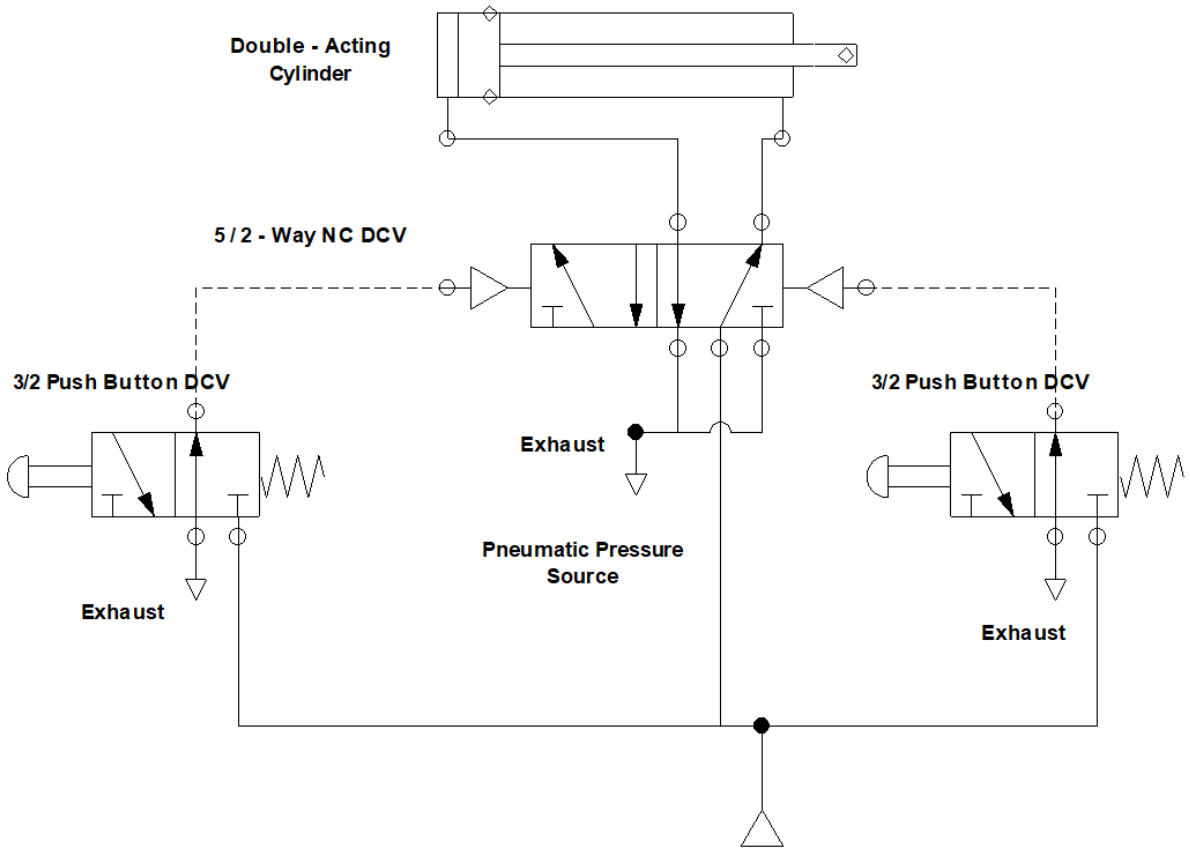

Figure 1- 7: Double acting Cylinder circuit using two push Button switches.