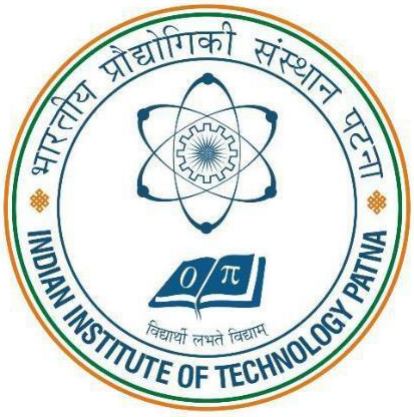
Indian Institute of Technology Patna



Mechatronics, Instrumentation And Controls Laboratory

Lab 9 Report

Topic:

Hydraulics Circuit

Submitted by: Aditya Shah**(**2011mt02**)**
(MTech-Mechatronics)

1. Aim of the Experiments.

1. Design a hydraulic circuit to control speed and direction of hydraulic motor. The circuit may be operated using one pushbutton or retention switch.
2. Implement a Quick Return Mechanism for a double acting hydraulic cylinder, where forward stroke velocity is slow and controllable (Like in Shaper), and return stroke should be faster than forward stroke.
3. Design a hydraulic circuit to actuate hydraulic motor after complete expansion of double acting cylinder. (Such kinds of combination of motions is required for carrying out tasks in industry. For e.g. drilling a hole on work piece after securing it on fixture). (Hint: after complete expansion, pressure builds up in piston side, use a 3-way pressure regulator to direct the flow after the pressure reaches a certain limit. You may decide the limit)
4. Electro-hydraulics problem

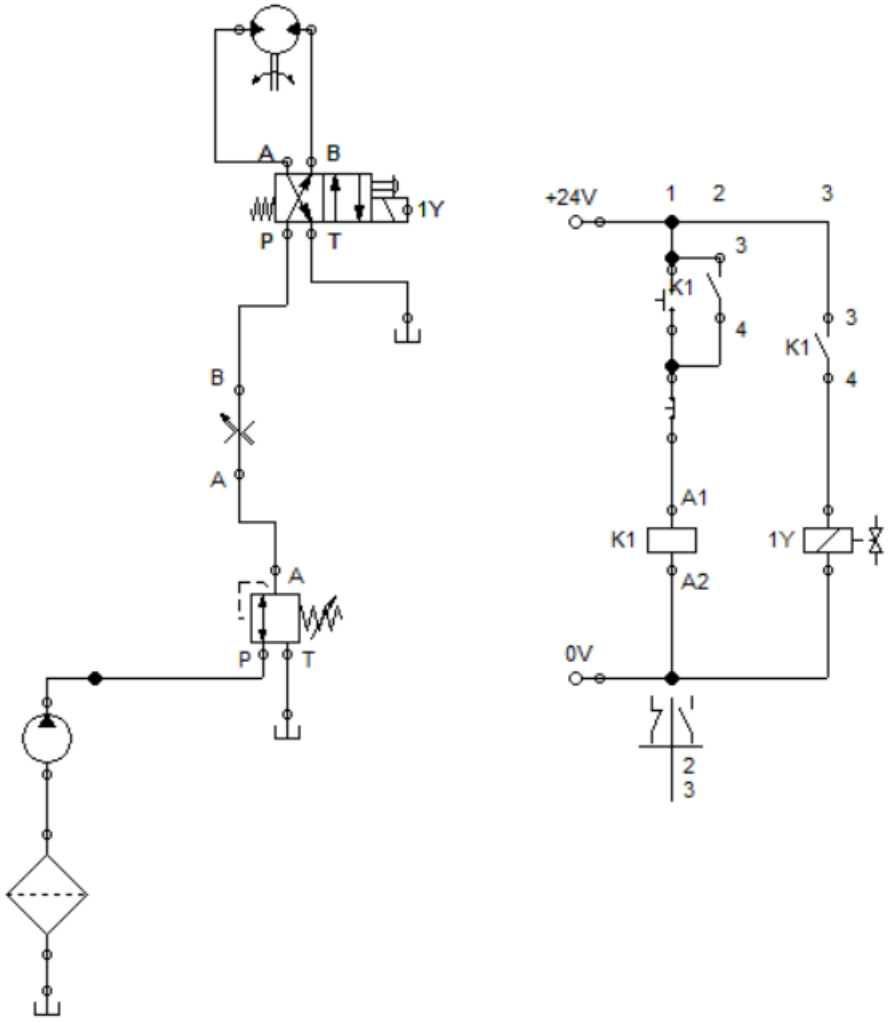
2. Pre-Requisites/Components Required

Software Used:-

- FESTO
  FluidSIM®4
  Version 4.2p/1.67 Hydraulics

3. Circuit Diagram

1.1



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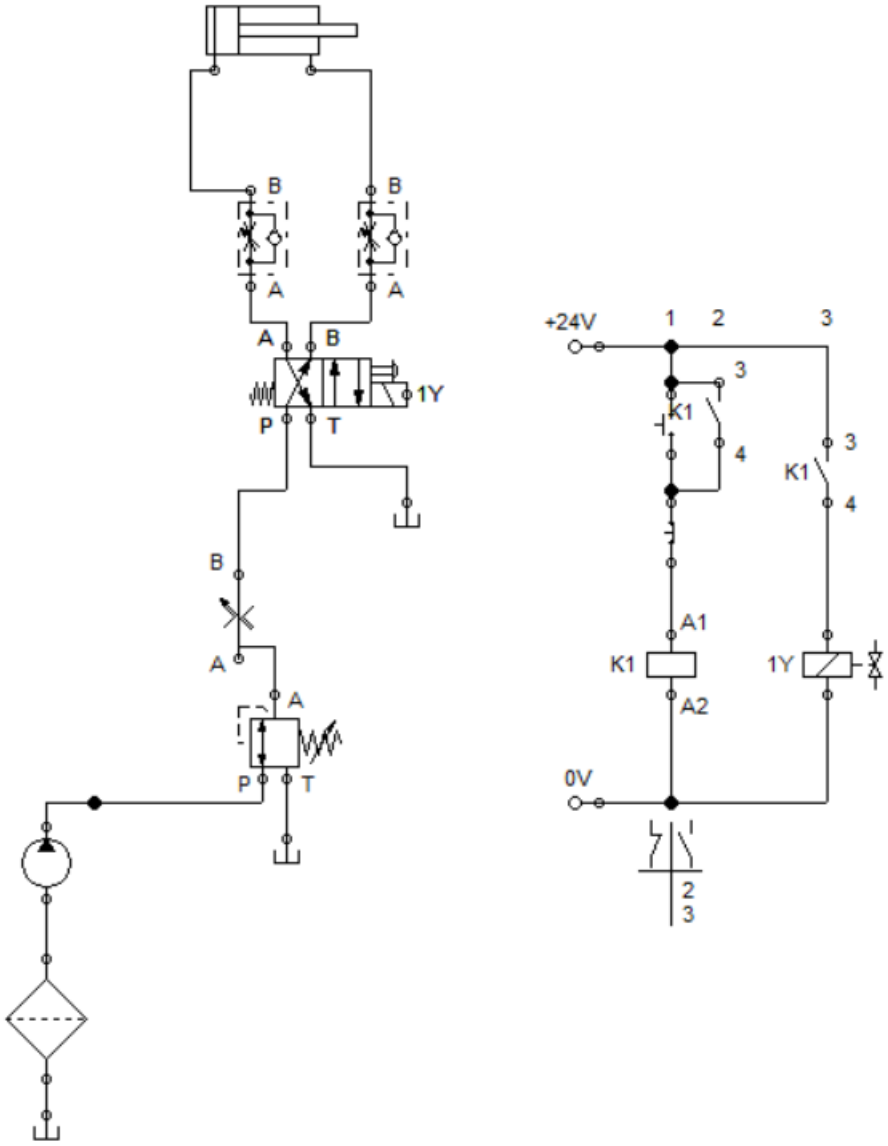
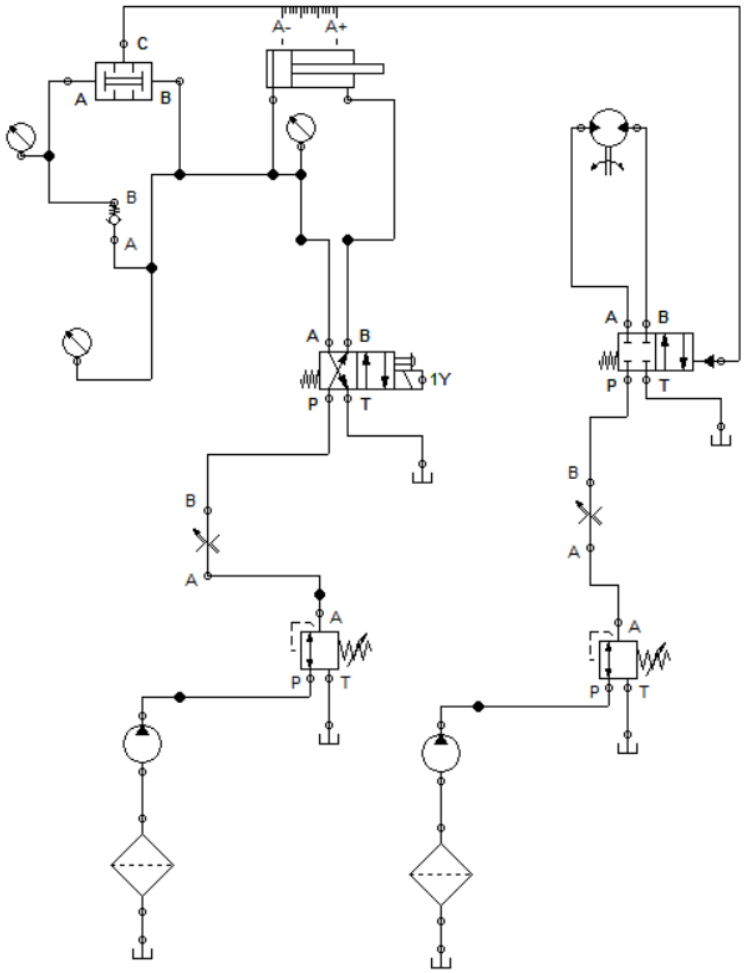
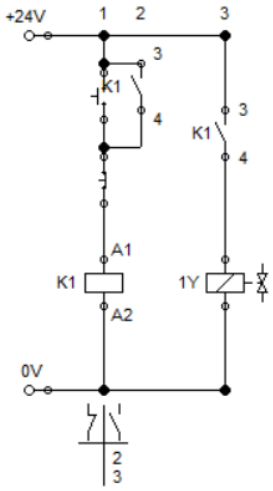
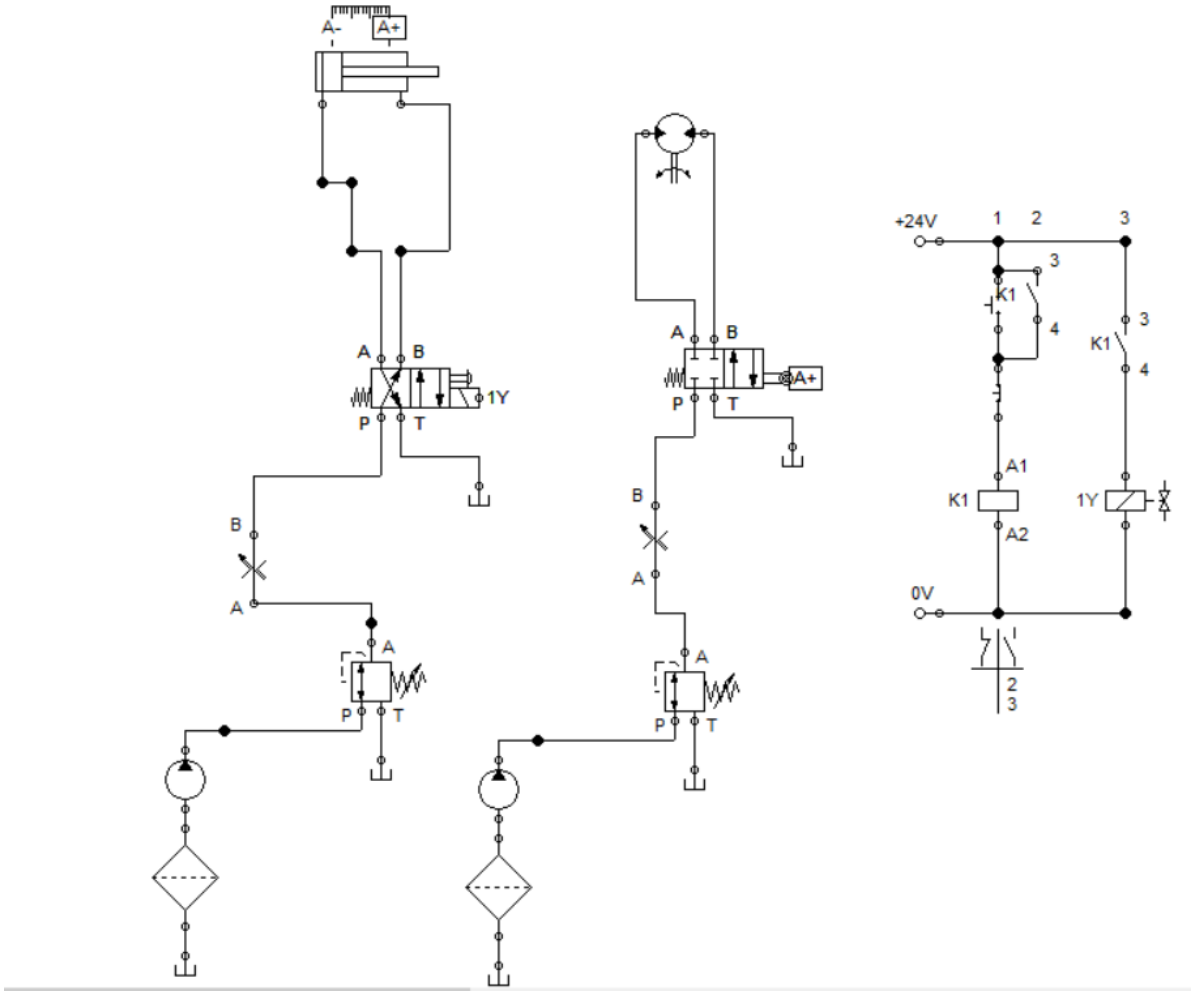


1.3-First Method: -

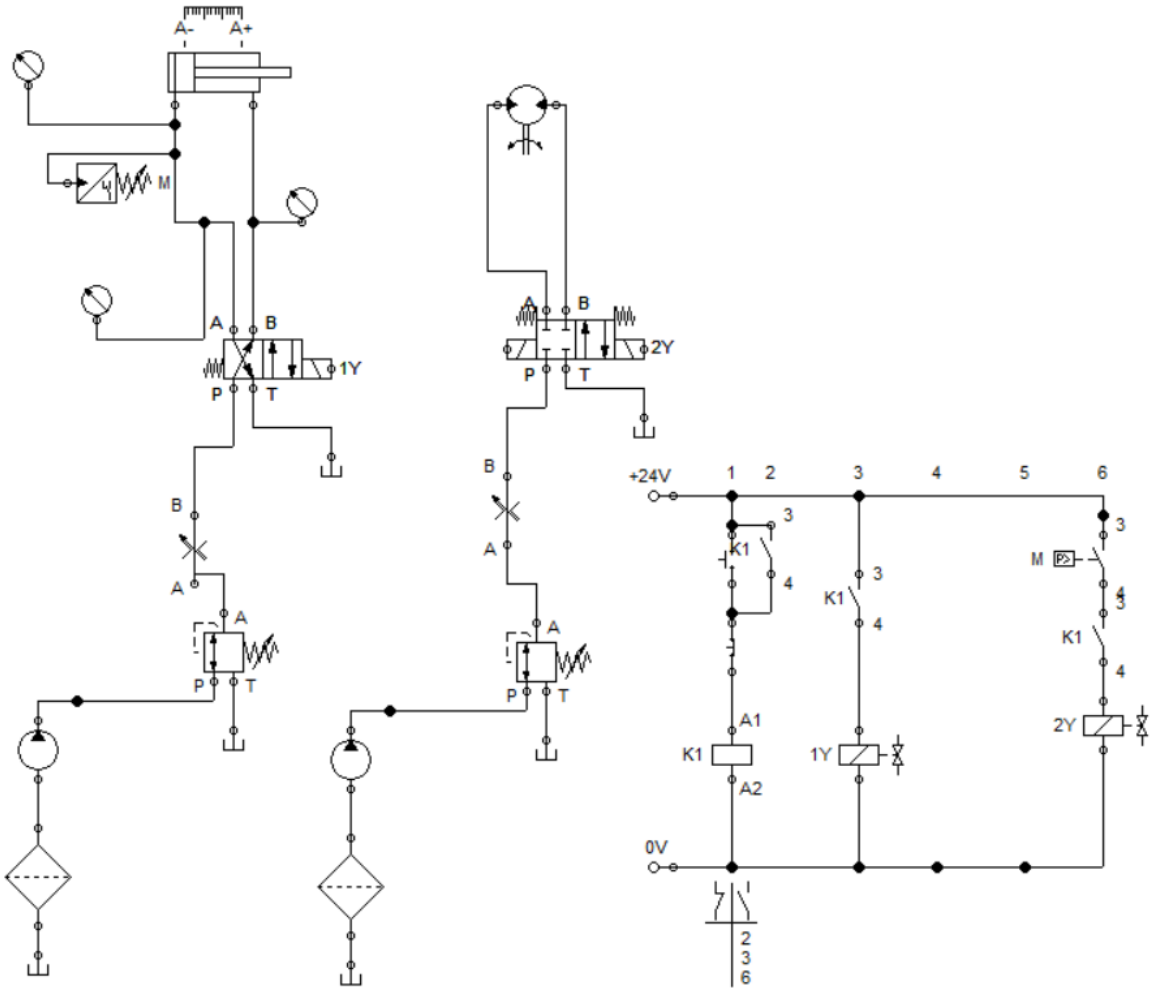


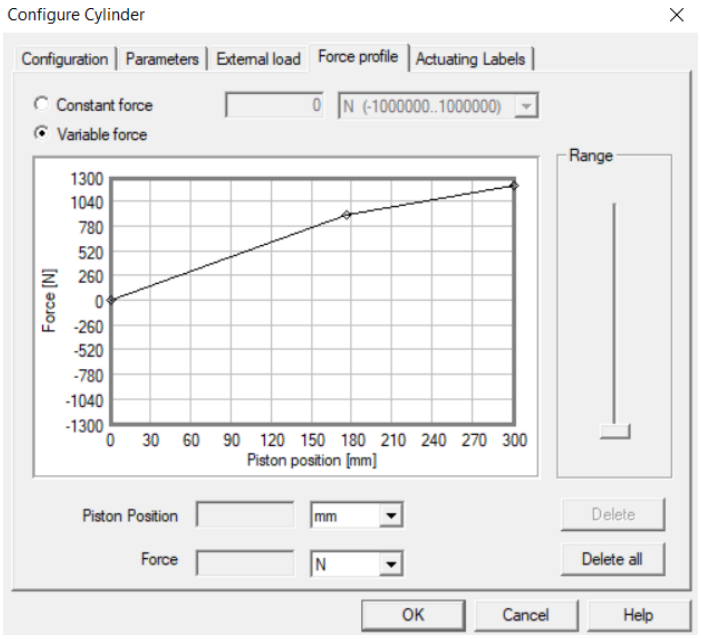


Second Method: -



1.4





Force Profile

Name: Aditya Shah Roll: 2011mt02

Question: -

1. What is the use of spring in DCVs? What if there is no string in a DCV? How does the spring help in maintaining the initial position of a DCV?
2. How is a hydraulic circuit different from a pneumatic circuit? What is the use of tank in the hydraulic circuit? In pneumatic circuits, what is analogous to tank of a hydraulic circuit?

Answer: -

1. Springs are used in most directional valves to hold the flow-directing element in a neutral position. Thus, used to recover the position of valve.
   For ex: -
   - In 2-position valves, , springs hold the non-actuated valve in one position until an actuating force great enough than the spring force, shifts the valve. When the actuating force is removed, the spring returns the valve to its original position.
   - In 3-position valves, two springs hold the non-actuated valve in its center position until an actuating force shifts it. When the actuating force is removed, the springs re-center the valve, leading to the common identification, spring-centered valve.

   If there is no spring in DCV, then that position is retained by the valve(currently in), even if the actuation signal corresponding to this position is not applied. This happens till another actuation signal is given to change the valve position.

   Spring helps in maintaining the initial position of a DCV. It does so by applying a spring force, to retain its original configuration, which was disturbed by the actuation force. Thus, if there is no actuation signal applied, it will return to initial valve position, by the help of restoring spring force.

2. Both pneumatics and hydraulics are applications of fluid power. They each use a pump as an actuator, are controlled by valves, and use fluids to transmit mechanical energy.
   The biggest difference between the two types of systems is the medium used and applications.
   - Pneumatics use an easily compressible gas such as air or other sorts of suitable pure gas.
   - While hydraulics uses relatively incompressible liquid media such as hydraulic or mineral oil, ethylene glycol, water, or high temperature fire-resistant fluids.

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In a nutshell, their differences are as follows:

Pneumatics	Hydraulics
➢ Confined pressurized systems that use moving air or other gases.	➢ Confined pressurized systems that use moving liquids.
➢ Because gases can be compressed, there is a delay in the movement, the force	➢ Liquids are not very compressible, thus there is nil/no delay in the movement.
➢ Produces Less Power	➢ Produces more power
➢ Pressure limited up to 10 bar	➢ Pressure produces from 100 bar up to 700 bar or even more
➢ Working fluid available in cheap rate.	➢ Working fluid is costly comparatively
➢ The process is clean	➢ Process is not clean
➢ The discharge port is open to atmosphere, because there is no harm to environment. No reservoir needed for storage.	➢ The discharge port is not open to atmosphere, thus need a tank for discharge (High risk of contamination.). Thus, it needs a reservoir to hold the fluid which will flow through the system.
➢ Easy to operate	➢ System with high pressure is difficult to operate.
➢ Maintenance is easier.	➢ Maintenance is not easier.
➢ Low initial and operating cost	➢ Higher initial and operating cost.
➢ Examples: ▪ Precision drills used by dentists - pneumatic brakes (air brakes) used by buses, trucks, trains ▪ Tampers used to pack down dirt and gravel ▪ Lungs ▪ Nail gun ▪ Dentist chair	➢ Examples: ▪ Dump truck lift ▪ Hydraulic Lift to lift cars ▪ Jaws of lift ▪ Blood in body ▪ Used in cars

Hydraulic systems, need a finite amount of liquid fluid that must be stored and reused continually as the circuit works. Therefore, part of any hydraulic circuit is a storage reservoir or tank. This tank may be part of the machine framework or a separate stand-alone unit. In either case, reservoir design and implementation is very important. The efficiency of a well-designed hydraulic circuit can be greatly reduced by poor tank design.
A hydraulic reservoir does much more than just provide a place to put fluid. A well-designed reservoir also dissipates heat, allows time for contamination to drop out of the fluid, and allows air bubbles to come to the surface and dissipate. It may give a positive pressure to the pump inlet and makes a convenient mounting place for the pump and its motor, and valves.

In a nutshell,

- Beyond its most rudimentary role of providing fluid storage,
- Other main functions of the hydraulic tank are to dissipate heat and allow contaminants to settle out of the fluid.

In pneumatic circuits, the atmosphere is analogous to tank of a hydraulic circuit.

To view the Zip file of all experiment and demonstration video, click on the following Link: -

- Zip File & Demonstration Video