**Application of Pneumatics**

Learning Objectives

The student who successfully completes this lab will be able to:

* Draw schematic symbols for pneumatic components
* Draw the schematic (piping and instrumentation diagram (PID)) of a simple pneumatic circuit
* Design a simple pneumatic circuit to perform a simulated manufacturing application
* Build a simple pneumatic circuit based from a PID
* Trouble shoot any faults that occur in the construction or operation of a pneumatic circuit

**Activity**

Circuit Design and Simulation

Students will design pneumatic circuits to perform certain operations based on a problem statement given. They will need to do force calculations and build a prototype of circuits that would simulate the operations. This is an open-ended experiment. With the components provided, students are encouraged to design their own system and prove to the lab instructor that their system works and meets all its requirements.

Problem Statement:

A manufacturing operation needs to clamp a work piece with a force of 15-20 lbs and move it from one place to another place, so that an operation can be done on the work piece. Once the operation is completed, the work piece is moved back to where it was when the cycle started and is released. The order of operations is:

1. The first pneumatic actuator extends and moves a gripper unit to position its extended jaws around the work piece.
2. The gripper is energized to clamp and hold the work piece for 1 second.
3. The first actuator retracts the gripper unit.
4. A third actuator (*simulated*, because we don’t have enough 5/2 valves to actually implement it) extends to do something to the work piece and retracts.
5. The first cylinder extends the gripper unit to move the work piece back to the position where it first gripped the work piece.
6. The gripper opens to release the work piece, and the first actuator retracts the gripper unit.
7. After a delay of one second, the sequence 1-6 repeats, and the sequence 1-7 repeats indefinitely.

Procedure

1. Design the pneumatic and electronic circuit needed to perform the manufacturing operation. Include the ANSI/ISO symbol schematic diagram for the pneumatic circuit and the microcontroller/electronics schematic in your report.
2. Develop the logic and pseudocode for the operations, and discuss with your group.
3. State what information is needed to perform the force calculation.
4. Build a prototype of the circuits to demonstrate the required operation. (For operation of the third actuator, turn the LED on the PSoC 4M Pioneer kit on or off to simulate actuation of the third actuator).
5. Show the lab instructor the prototype for verification.

Deliverables

Generate a lab report, which should include, but is not limited to (see the scoring rubric for the report in the Canvas Assignment):

* Title page
* Problem statement and background
* Experimental setup, including pneumatic and electronic circuit diagrams for the system constructed with formal ISO symbols
* List of inputs and outputs
* Step-by-step operations for pneumatic and electronic circuits
* Any logic functions used
* Calculation of pressure needed to meet force requirement
* Explanation of how the system works
* Tests conducted
* Discussion of results
* Conclusions
* Summary of contributions of group members
* Appendices (excerpts from data sheets of key elements, full program code, etc.)