

## Lab 10 – PLC Programming

### Format

This lab will be conducted during your regularly scheduled lab time in a group format. I strongly recommend that you rotate roles during the lab - don't let one person do all of the programming at the computer. You may ask the lab monitor for assistance if needed, but successful completion of the lab is your responsibility. You must demonstrate the correct operation of each PLC exercise to your lab monitor.

### Report

A short report is due from each group for this lab at 8:00 AM on the Friday after you complete this lab. A written, rung-by-rung description of what the ladder logic program is doing is required for each exercise. Either use the Acrobat PDF print function or take a “screen shot” of the ladder logic for each of the programs and paste into PowerPoint for documenting your programs. A clean, computer-generated pneumatic system diagram and PLC wiring diagram is required for each of the exercises. See the ME 360 website for a PowerPoint file that can be used to help draw these diagrams.

### Procedures

#### 10.1 PLC Program #1

Develop a PLC program that will repeat the cycle below three times after a single push of a “start” button, C40.

1. Extend the vertical “tie rod” cylinder (activated by Y2), then
2. When X3 is activated (vertical “tie rod” cylinder extended) delay for 1.0 seconds, then
3. Extend the horizontal “tie rod” cylinder (activated by Y1), then
4. When X1 is activated (horizontal “tie rod” cylinder extended), wait 1.5 seconds, then
5. Retract both cylinders by deactivating Y2 and Y1.
6. Cycle starts the next repetition after both cylinders are fully retracted.

Download the program to the PLC. Execute the program several times. Does it work the way you expected?

Document the pneumatic system diagram, the PLC wiring diagram (connection of limit switches, pushbuttons, solenoids, etc. to the PLC), and the ladder logic diagram for your solution. Note that the schematic symbol for many of the components is given on the component itself. The schematic symbol for the 5-port solenoid valve and the flow controls used for all of the pneumatic cylinders is given in Figure 1. The layouts for the PLC inputs (pushbuttons and limit switches) and outputs (solenoid valves and fan) are given in Figures 2 and 3.

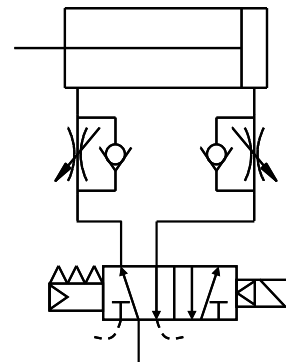


Figure 1. Pneumatic Valves

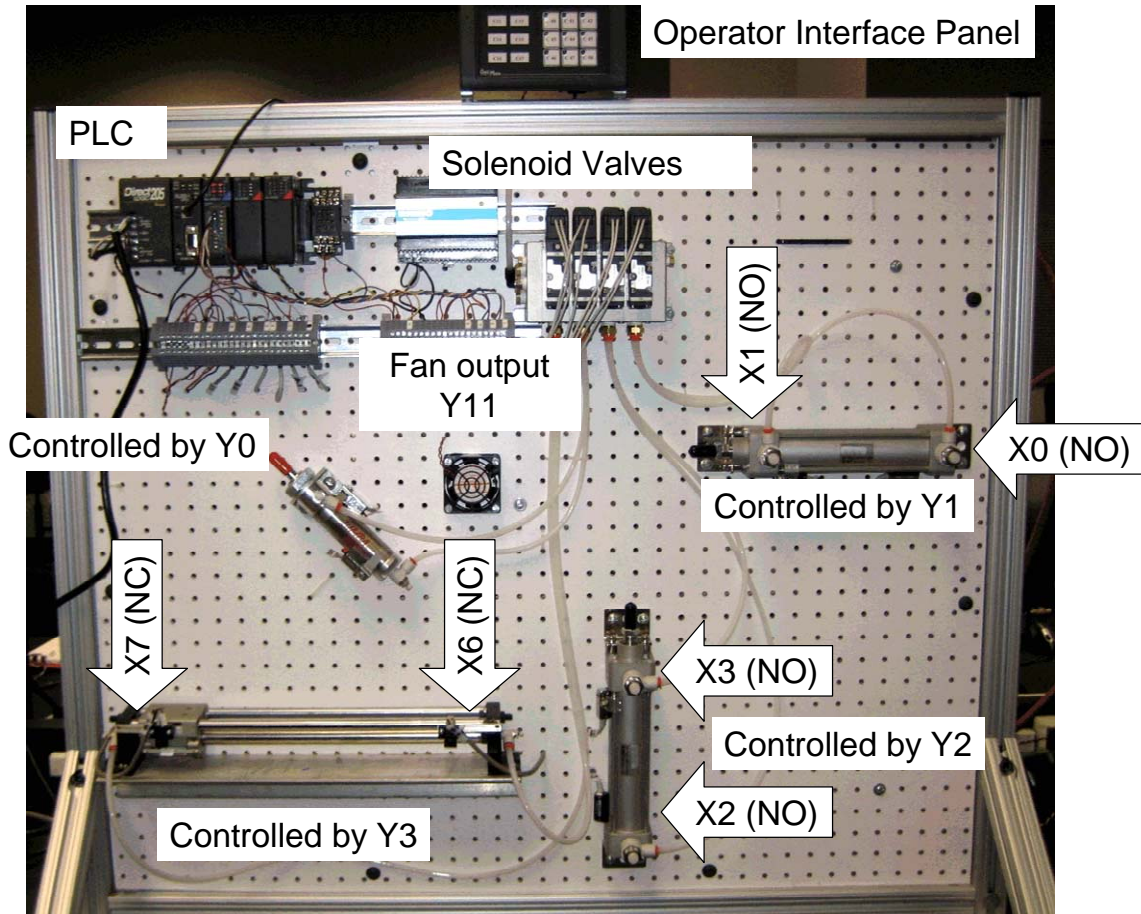


Figure 2. Solenoid and Limit Switch Assignments

Write to internal contacts C12 - C17 to turn on the "lamps"

|     |     |
|-----|-----|
| C12 | C13 |
| C14 | C15 |
| C16 | C17 |

Read from internal contacts C40 - C50 to read status of the pushbuttons

|     |     |     |
|-----|-----|-----|
| C40 | C41 | C42 |
| C43 | C44 | C45 |
| C46 | C47 | C50 |

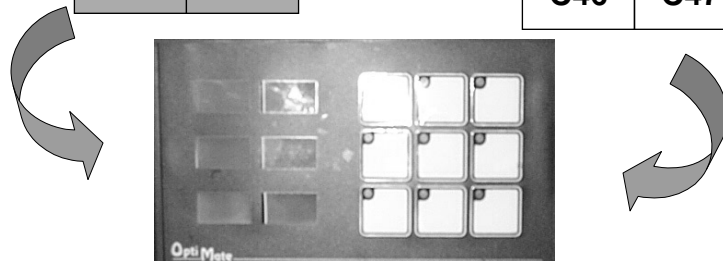


Figure 3. Operator Interface Panel Pushbutton and Indicator Light Assignments

### 10.2 PLC Program #2

Develop a PLC program that will “cycle” the vertical tie-rod cylinder (activated by Y2) from the retracted position (indicated by X2) to the extended position (indicated by X3),

1. One time after a single push of C41, or
2. Two times after a single push of C42, or
3. Three times after a single push of C43.
4. Use C44 as the “emergency” stop – a single push of this button will immediately retract the cylinder and reset all of the counters.

Download the program to the PLC and execute the program several times. Demonstrate the correct operation of the program and pneumatic system to one of the lab monitors.

Document the pneumatic system diagram, the PLC wiring diagram (connection of limit switches, pushbuttons, solenoids, etc. to the PLC), and the ladder logic diagram for your solution.

### 10.3 PLC Program #3

Develop a PLC program to perform this sequence of operations. Use the C44 pushbutton on the Operator Interface Panel to start the sequence.

1. Extend the Y3 “rodless” cylinder (clamp#2) fully to the right (indicated by limit switch X6 which is wired NC), then,
2. Delay 1.5 seconds, then
3. Extend the Y2 cylinder (clamp#1) fully extended
4. Delay 1.0 seconds, then
5. Cycle the horizontal Y1 cylinder from retracted to extended position 3 times, then
6. After the horizontal Y1 cylinder retracts to the X0 position the 3<sup>rd</sup> time, retract the Y2, cylinder fully (to the X2 position), then
7. Retract the Y3 cylinder fully to the left.

Download the program to the PLC and execute the program several times. Demonstrate the correct operation of the program and pneumatic system to one of the lab monitors.

Document the pneumatic system diagram, the PLC wiring diagram (connection of limit switches, pushbuttons, solenoids, etc. to the PLC), and the ladder logic diagram for your solution.