University of Jordan
School of Engineering
Department of Mechatronics Engineering
Automation and Process Control Lab (0908462)
Practical Lab 2+3

Objective

To be familiar with programming different PLC types.

Procedure:

This lab experiment is composed of four parts, each group need to finish two parts in the first week, then the rest two in the next week according to the schedule submitted during the previous lab.

Part 1

Use the following training panel, which is exist in the lab, to complete the Automatic Garage Door Experiment:

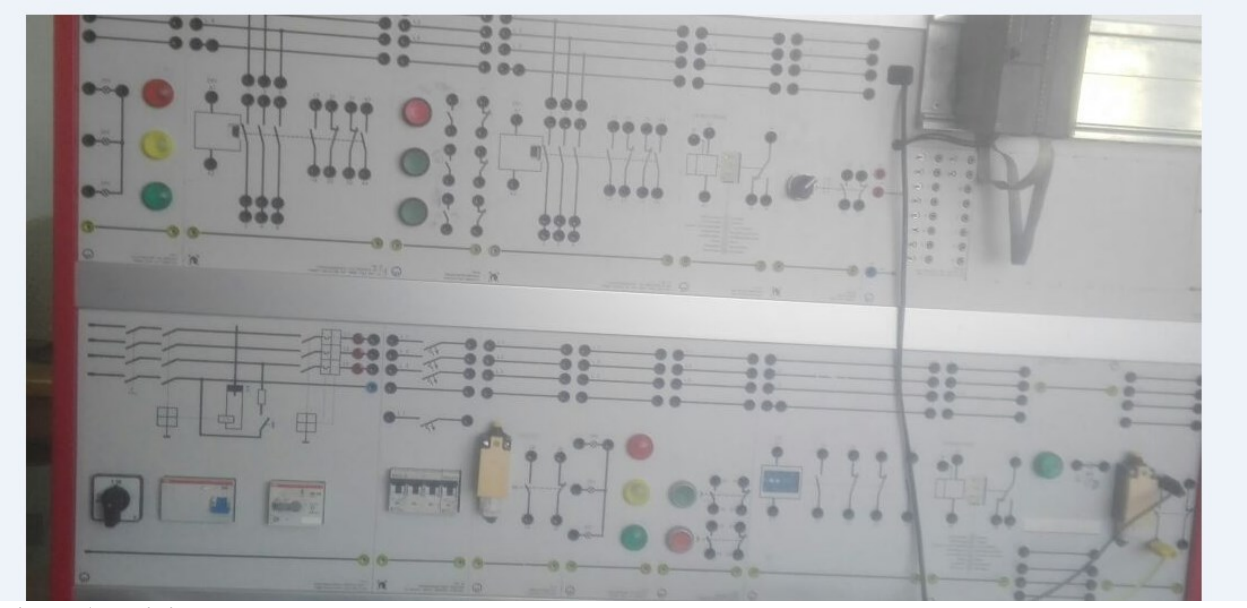

Figure 1 Training Board

Pre-lab Preparation:

- Review basic PLC instructions (Chapter 3, 4).
- Read Siemens datasheets

I/O Allocation list:

Input	Address	Output	Address
Start PB	I124.0	Motor CW	Q124.0
Stop PB	I124.1	Motor CCW	Q124.1
Sensor to indicate the car arrival (implemented by pb1).	I124.2	Stop Lamp	Q124.2
Sensor to indicate the car passed (implemented by pb2).	I124.3	Lamp for motor CW	Q124.3
Limit Switch1	I124.4	Lamp for motor CCW	Q124.4
Limit Switch2	I124.5		

Exercise 1:

Wire the input & output, which include the single phase motor representing the Garage Door, use S7-300 Siemens PLC as shown below.

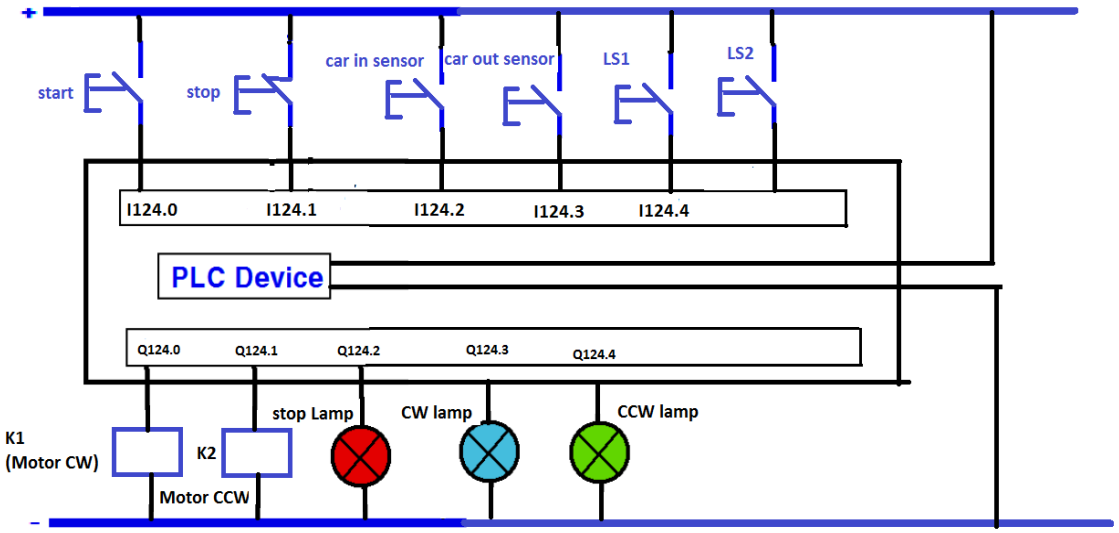

Figure 2 PLC Wiring Diagram

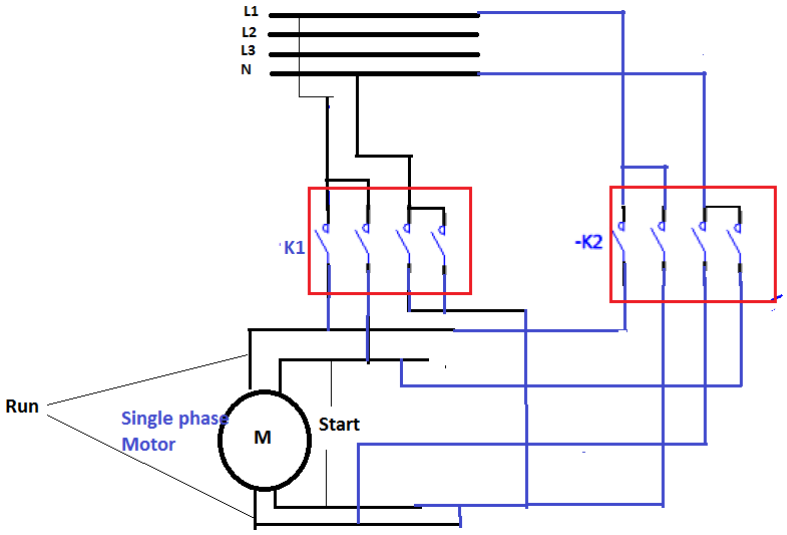

Figure 3 Power Wiring Diagram

Exercise 2:

Write a ladder logic program to satisfy the following:

1- When the sensor detect a car (implemented by reach PB on control panel), a single phase motor rotates in a clock wise direction and stop when press on a limit switch1 to indicate the door is fully opened.
2- When pass pushbutton is pressed which is indicate the car passed, the single phase motor rotate in the opposite direction a stop when press on limit switch 2 to indicate the door is fully closed.
3- Use indication lamps for the movement of the motor one for CW and other for CCW.
4- There is an emergency stop PB to stop the system any time & turned on an emergency lamp.

Part 2

Use the following Elevator Model, which is exist in the lab, to complete the following experiment:

Figure 4 Elevator Model

Pre-lab Preparation:

- Review basic PLC instructions (Chapter 3, 4).
- Read Zelio datasheets

I/O Allocation list:

Input	Address	Output	Address
External PB. For Gf	I1	Lamp for GF	Q1
External PB. For 1st floor	I2	Lamp for 1st Floor	Q2
External PB. For 2nd floor	I3	Lamp for 2nd Floor	Q3
External PB. For 3rd floor	I4	Lamp for 3rd Floor	Q4
Limit switch for Gf	I5	Motor Up	Q5
Limit switch. For 1st floor	I6	Motor Down	Q6
Limit switch. For 2nd floor	I7		
Limit switch. For 3rd floor	I8		
Internal PB. For Gf	I9		
Internal PB. For 1st floor	IA		
Internal PB. For 2nd floor	IB		
Internal PB. For 3rd floor	IC		

Exercise 1:

Write a ladder logic program to request any floor from Internal & external Pushbuttons, each lamp for each floor turned on when the elevator reach the corresponding floor.

Exercise 2:

Update your program to add priority for the nearest floor even if it was requested later.

Part 3

Use the following Traffic Light Model, which is exist in the lab, to complete the following experiment:

Figure 5 Traffic Light Model

Pre-lab Preparation:

- Review basic PLC instructions (Chapter 3, 4).
- Read Mitsubishi datasheets

I/O Allocation list:

Input	Address	Output	Address
Push button for pedestrian	X0	Red (Traffic)	Y0
		Yellow (Traffic)	Y1
		Green (Traffic)	Y2
		Red (pedestrian)	Y3
		Green (pedestrian)	Y4

Exercise 1:

Write a ladder logic diagram to run the Traffic in the following sequence:
Red: 15 sec.
Green: 10 sec.
Yellow: 5sec.
The pedestrian traffic always Red except the pushbutton of pedestrian pressed the pedestrian traffic became Green for 40 sec on condition the Car traffic is Red.

Exercise 2:

Update your Program to meet the following:
If there is 5 Pedestrian & the traffic light for cars green or yellow, the pedestrian traffic became green & the car traffic became red for 40 sec. to allow the pedestrian to cross the road, then return to its sequence

Part 3

Use the following Water Filling Machine, which is exist in the lab, to complete the following experiment:

Figure 6 Water Filling Machine

Pre-lab Preparation:

- Review basic PLC instructions (Chapter 3, 4).
- Read Omron datasheets
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I/O Allocation list:

Input	Address	Output	Address
Automatic/Manual	I0	Conveyor motor	Q0
Auto	I1	Pump	Q1
Conveyor	I2	Filling piston solenoid valve	Q2
Pump	I3	Capping piston solenoid valve	Q3
Filling Piston Sensor	I4	Stopper piston solenoid valve	Q4
Capping piston Sensor	I5	Automatic Start Lamp	Q5
Filling sensor	I6		
Capping sensor	I7		
Filling proximity sensor	I8		
Capping proximity sensor	I9		
Level controller	IA		
Stopper	IB		

Exercise 1:

Write a Program to control the machine manually using push buttons, as the following:

- Press on Conveyor PB to run the Conveyor motor.
- Press on Stopper PB to extend the Stopper piston solenoid valve.
- Press on Filling PB to extend the Filling piston solenoid valve.
- Press on Capping PB to extend the Capping piston solenoid valve.
- Press on Pump PB to run the Pump.
  When release your hand from any PB. The corresponding output turn off.

Exercise 2:

Now update your program to control the machine in automatic mode.

When the selector switch in in Auto position:

- Press on Auto PB to start the Conveyor movement.
- Stop the Conveyor when the Filling proximity sensor detects a bottle.
- Extend the Stopper pistons.
- Extend the Filling piston.
- Turn on the Pump for 20 sec.
- Retract the Filling piston.
- Retract the Stopper pistons.
- Start the Conveyor
- Stop the Conveyor when the Capping proximity sensor detects a bottle
- Extend the Stopper pistons.
- Extend the Capping piston for 10 sec.
- Retract the Capping piston.
- Retract the Stopper pistons.
- Then repeat...

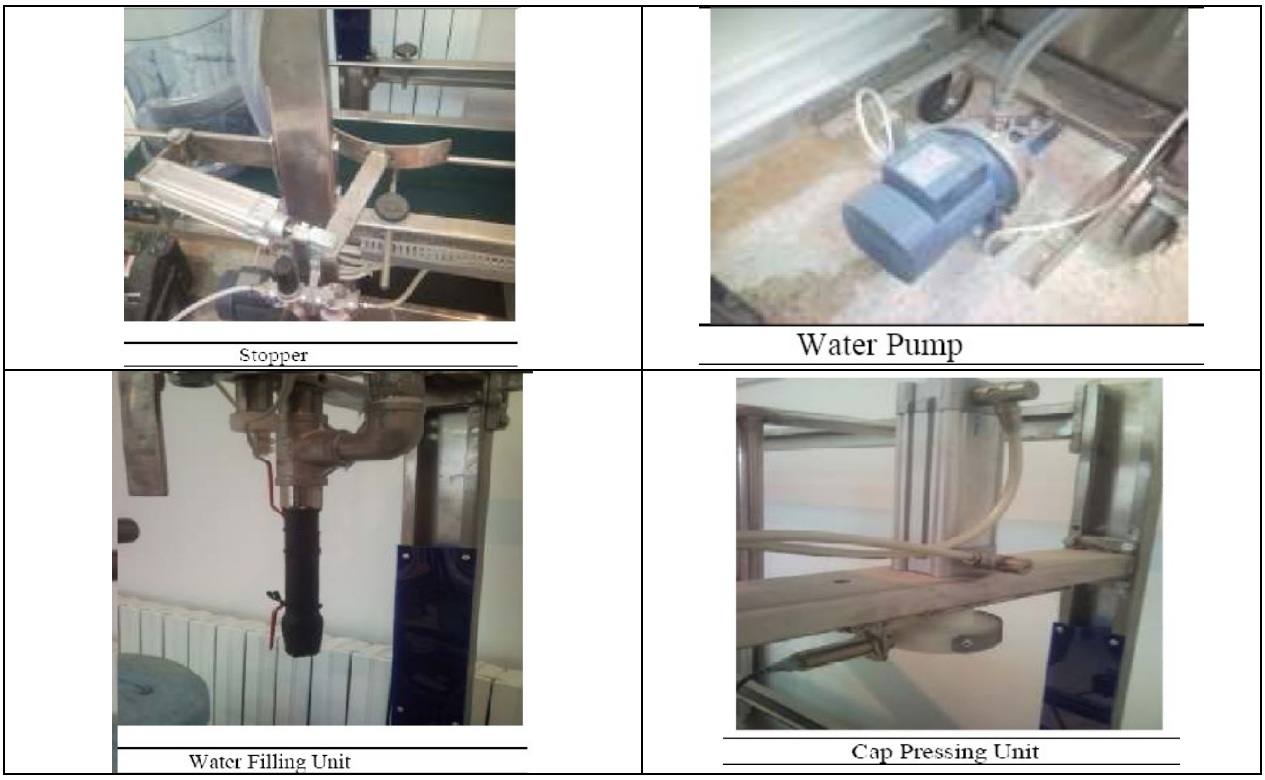

Figure 7 Different Filling Machine Parts