

Automation Studio PLC Simulation (AB CompactLogix) Lab 1

Upon completion of this lab, the student should be able to:

1. Explain the addressing of the CompactLogix Functional Block in A.S.
2. Explain the operation of the pneumatic, PLC and PLC Program documents
3. Explain the CompactLogix I/O indicators
4. Explain what turns on the input & output status lights
5. Explain what turns on a discrete output device connected to a PLC
6. Explain the operation of the pneumatic circuit in this simulation

Log into the student Virtual Machine. The Virtual Machine has the Automation Studio application loaded. On the desktop, the user will find a folder named “Automation Studio Files”. Double click on the **AS PLC CompactLogix Pneumatic 1.prx** simulation file.

Video to show students how the sections of the simulation work together :

Operation of AS PLC pneumatic Simulation 1 091621

https://youtu.be/cw5rt_cHQhc

Explanation of the PLC Pneumatic Circuits 092421

<https://youtu.be/TV5Xit3mgjI>

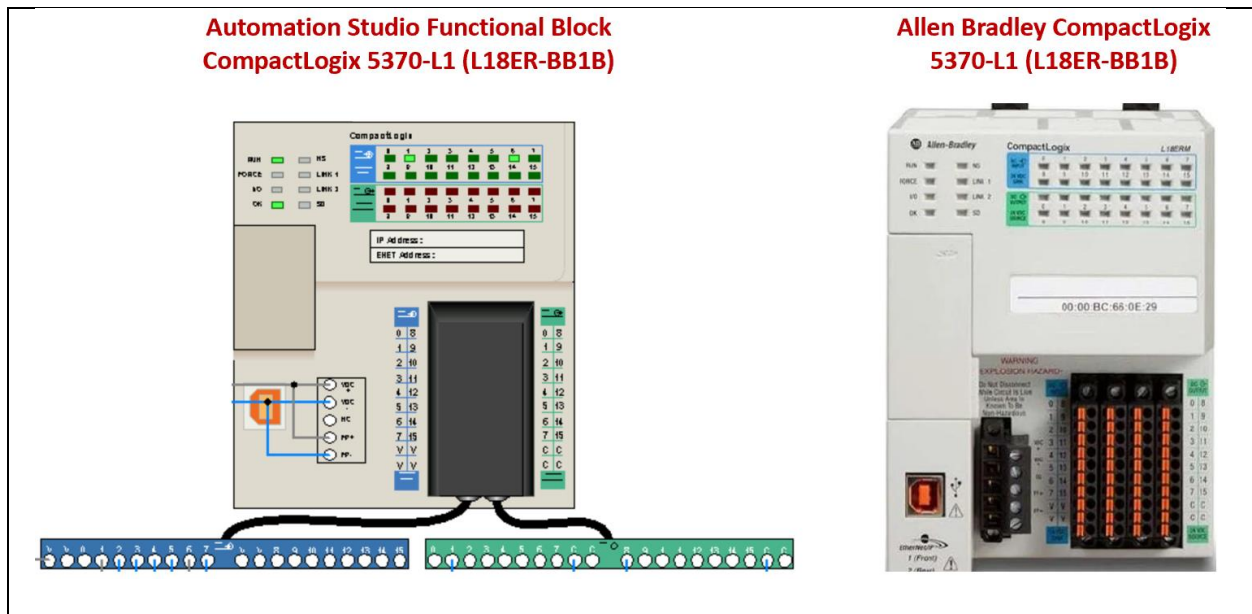


Figure 1. Functional Block to simulate an AB CompactLogix.

Figure 1 shows an Allen Bradley CompactLogix 5370-L1 Programmable Automation Controller (graphic on the right) that is used in many industrial applications. The leftmost graphic in Figure 1 shows a Functional Block that was designed by Famic (company who created Automation Studio) to simulate a CompactLogix controller. The most important function of the

ControlLogix Functional Block is that the I/O status lights works with the corresponding signals on the I/O terminal strips.

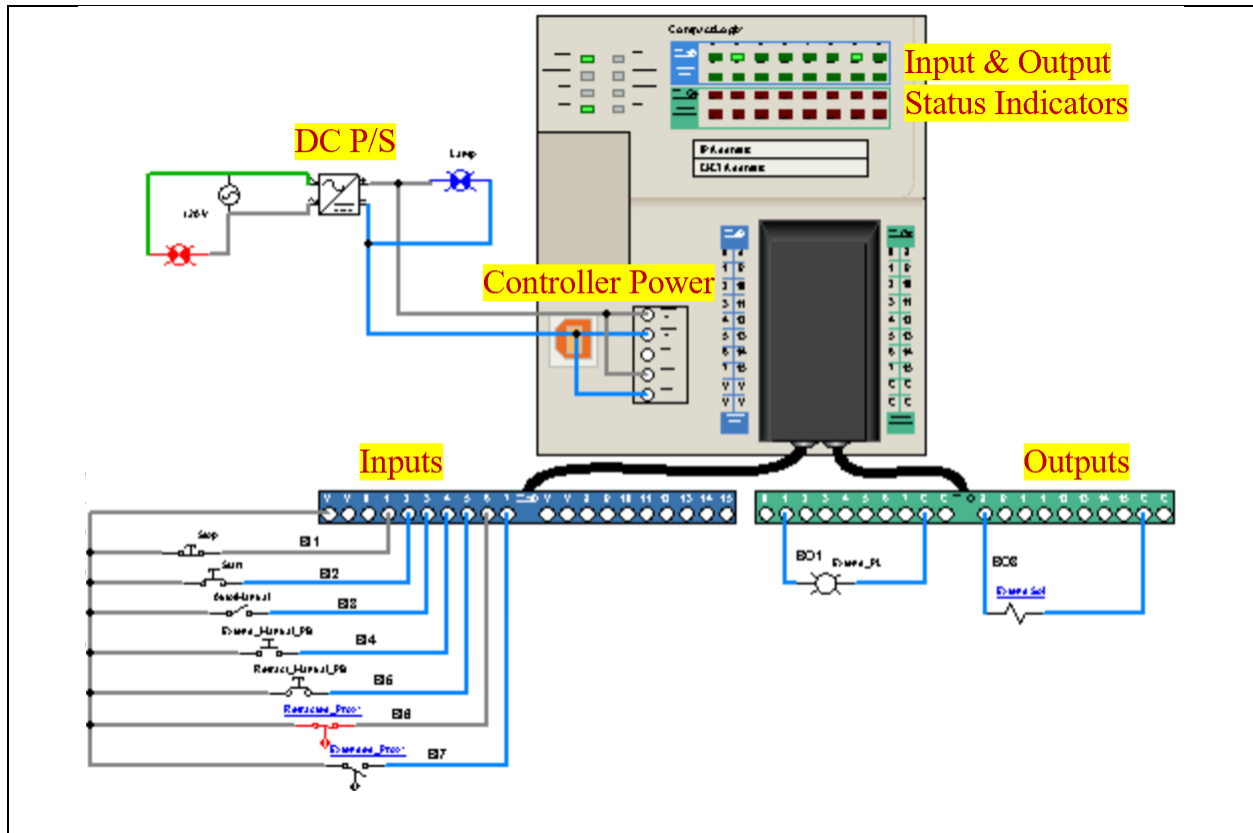


Figure 2. The CompactLogix Functional Block connections diagram.

Figure 2 shows the PLC portion of the simulation. An image of the CompactLogix unit, as well as the power feed for the system. In the upper left portion, a 120VAC power source (red indicator light) is feeding a DC power supply. The output of the power supply (24 VDC) powers the CompactLogix unit, and also parallels into the terminals that will connect the DC power to the I/O terminal strip. The terminals marked with a “V” (found on the Inputs terminal strip) will be +24VDC, and the terminals marked with a “C” (found on the Outputs terminal strip) will be the common side of the DC power supply. In this simulation, discrete I/O devices are connected to the input and output terminal strips.

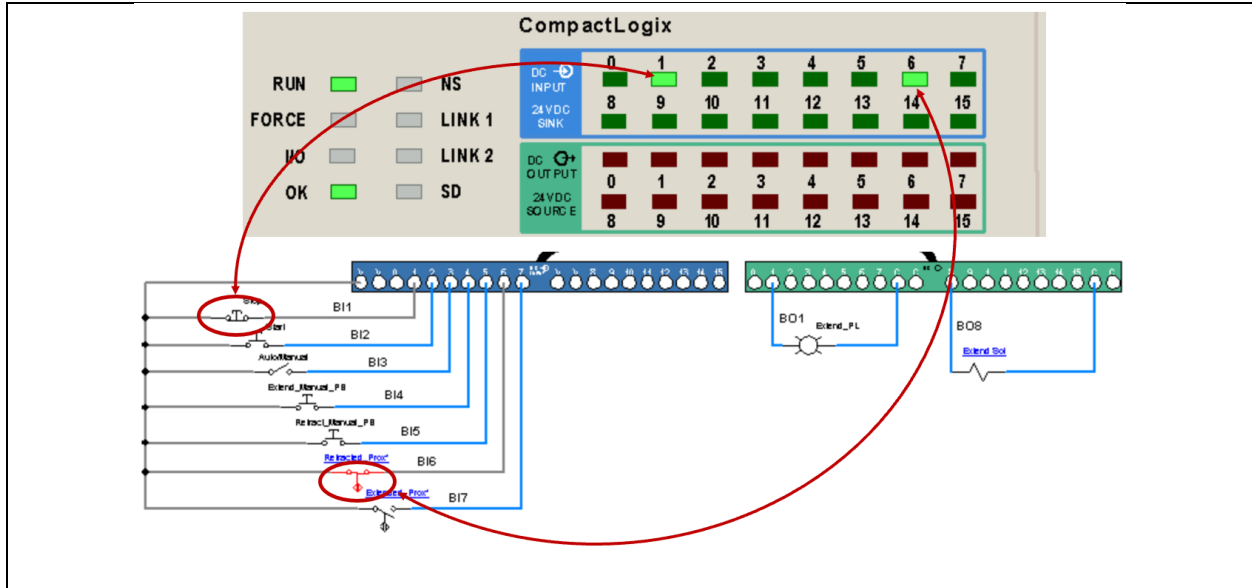


Figure 3. Input & Output devices connected to the CompactLogix.

Figure 3 shows the input and output connections between the discrete input devices and the terminal strip for the inputs, as well as the connections between the output devices and the terminal strip for the outputs. Notice that the input addresses use the designation of BI1 (Binary Input, terminal 1) to BI7 (Binary Input, terminal 7). Also notice that the Extend Solenoid is connected to output terminal 8, thus the address is: BO8, and the Extend Pilot Light is connected to output terminal 1, thus the address is: BO1.

Also notice in Figure 3 the correlation to the input indicator lights. A normally-closed pushbutton is connected to terminal “1”, thus the input indicator light for terminal “1” is on, indicating that there is voltage at the terminal. Also notice that a normally-open proximity switch is connected to input terminal “6”. Since the proximity switch is actuated (due to the pneumatic cylinder being fully retracted), the input indicator light for terminal “6” is on.

When the designers at Famic developed the CompactLogix Functional Block, they did not use standard CompactLogix I/O addressing, they instead created a simplified I/O addressing structure of BI0-BI15 (Binary Input, terminal number) for inputs, and BO0-BO15 (Binary Output, terminal number) for outputs. On an actual CompactLogix unit, the I/O addressing would be Local:1:I.Data.0-Local:1:I.Data.15 (Local I/O, slot 1, Input, terminal number) for inputs, and Local:1:O.Data.0-Local:1:O.Data.15) for outputs.

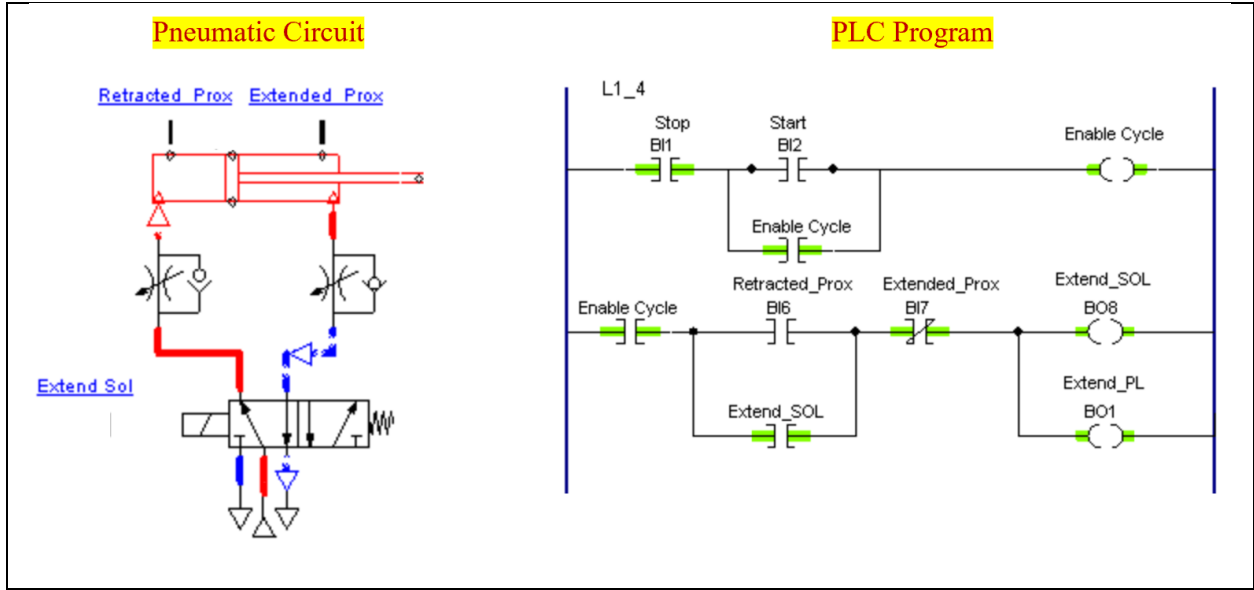


Figure 4. Pneumatic Circuit and the PLC Program.

Figure 4 shows the Pneumatic circuit on the left, and the PLC program on the right. Automation Studio has a PLC program scanning process in their software that function like a PLC processor. The PLC program in Figure 4 would be similar to going online to a CompactLogix with Studio5000 software and viewing the logic with the PLC. Notice the instructional also show highlight (logic continuity).

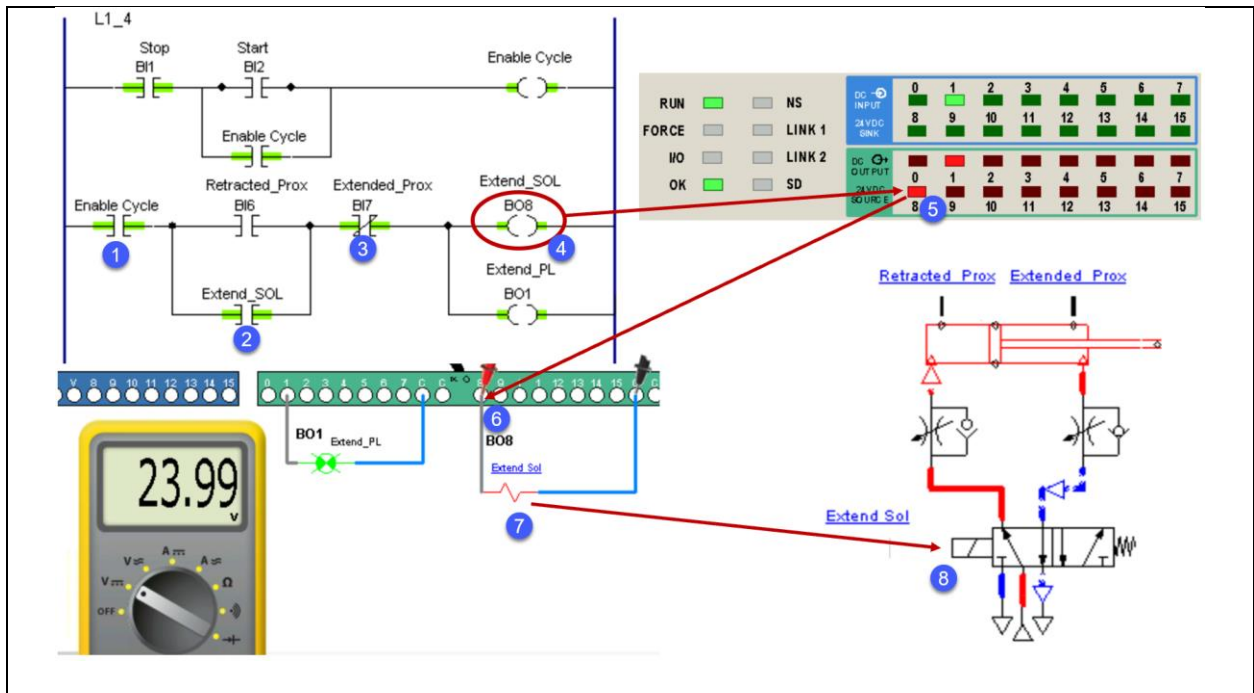


Figure 5. How the signals flow with the simulation.

Figure 5 shows the logic and signal flow in the simulation. The program in the PLC turns on the output instruction for the Extend Solenoid (BO8), which in turn, turns on the PLC output indicator light for output terminal “8”. Notice that the three instructions marked as 1, 2, & 3 in the second rung of the PLC program, all have a green highlight. This is what turns on BO8 output.

Since the output indicator light “8” is on, 24Vdc will be measured at terminal “8”. Since the Extend Solenoid is connected to output terminal “8”, the solenoid is energized, which shifts the directional control valve of the pneumatic circuit which extends the cylinder. When the extend solenoid shuts off, the pneumatic cylinder retracts.

***Output Status Indicators (lights):** Are typically turned on by the output coil in the PLC program that has the same address as the indicator. This is shown in Figure 6. Notice that the output coil that is addressed as BO8 is highlighted (which means it is on), thus the output light “8” is on, and the voltage at output terminal “8” is approximately 24Vdc.*

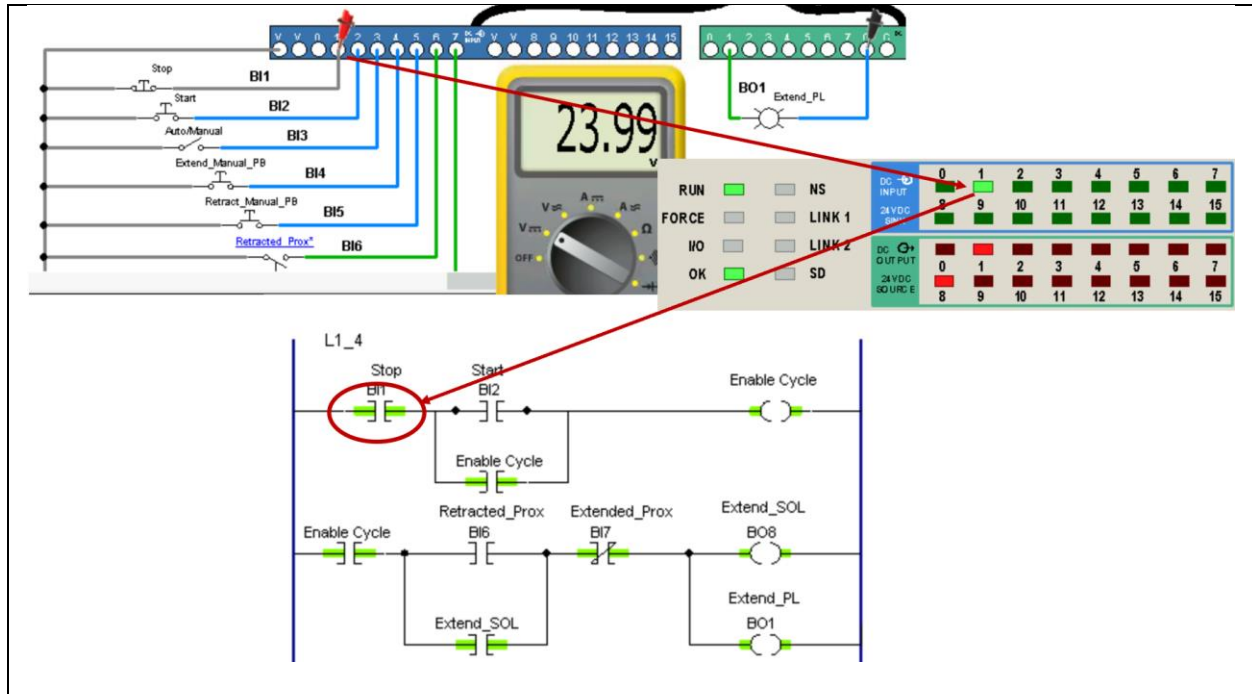


Figure 6. Signal flow from an input signal.

Figure 6 shows the signal flow of an input signal coming into the PLC. The Stop pushbutton is a normally-closed pushbutton, which sends 24Vdc to input terminal “1”, which is addressed BI1



(Binary Input, terminal “1”). Notice that the digital multi-meter is measure the voltage at input terminal “1” as 24Vdc, thus the input is turned on. This will then turn on the corresponding input indicator light for terminal “1”. If the input is on, then BI1 is “on” or a “1”.

In the PLC program, the normally-open instruction has a green highlight on it, which indicates logic continuity. This is very important to understand. If BI1 input indicator is on, then all of the normally-open instructions in the PLC program addressed as BI1 will have logic continuity, and all of the normally-closed instructions in the PLC program addressed as BI1 will not have logic continuity (no green highlight).

Input Status Indicators (lights): Are turned on due to voltage present at the corresponding input terminal as shown in Figure 7. In this example, the Stop pushbutton is normally-closed, thus 24 Vdc is measured at input terminal “1”, the corresponding input light comes on, and this will control the operation of the PLC program.



Questions from this Lab:

After completing this lab, the students should be able to answer the following questions. These questions will also help the students to prepare for the online assessment in LMS.

1. What is the input address within the PLC for the Extended Proximity switch?
2. What is the output address within the PLC for the Extend Pilot Light?
3. What turns on an output status indicator on the CompactLogix unit?
4. What turns on an input status indicator on the CompactLogix unit?
5. What is the input address for the Start pushbutton?
6. What part of the PLC system will determine when an output device, connected to the PLC, will energize?
7. What input address will be “on” when the piston is fully retracted?
8. What type of discrete input device is connected to BI6?