Course Code: 3112
Course Name: Advanced Mechatronics Engineering Lab

Experiment No: 03
Experiment Name: Controlling DC motor and counting rotation using PLC

Group No: 01
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Objectives:

- Controlling motor using PLC and count its rotation
- Understanding the ladder diagram
- Properly connecting all the modules to the PLC

Theory:

PLC:

PLC stands for “Programmable Logic Controller”. A PLC is a computer specially designed to operate reliably under harsh industrial environments – such as extreme temperatures, wet, dry, and/or dusty conditions. PLCs are used to automate industrial processes such as a manufacturing plant’s assembly line, an ore processing plant, or a wastewater treatment plant.

PLCs share many features of the personal computer you have at home. They both have a power supply, a CPU (Central Processing Unit), inputs and outputs (I/O), memory, and operating software (although it’s a different operating software).

The biggest differences are that a PLC can perform discrete and continuous functions that a PC cannot do, and a PLC is much better suited to rough industrial environments. A PLC can be thought of as a ‘ruggedized’ digital computer that manages the electromechanical processes of an industrial environment.

There is a wide range of PLC functions like timing, counting, calculating, comparing, and processing various analog signals.The main advantage of PLC over a “hard-wired” control system is that you can go back and change a PLC after you’ve programmed it, at little cost (*just the cost of the programmer’s time*). In a hard-wired control system, you’re essentially having to rip out wires and start from scratch (which is more expensive and takes longer).

The working of a programmable logic controller can be easily understood as a cyclic scanning method known as the scan cycle.

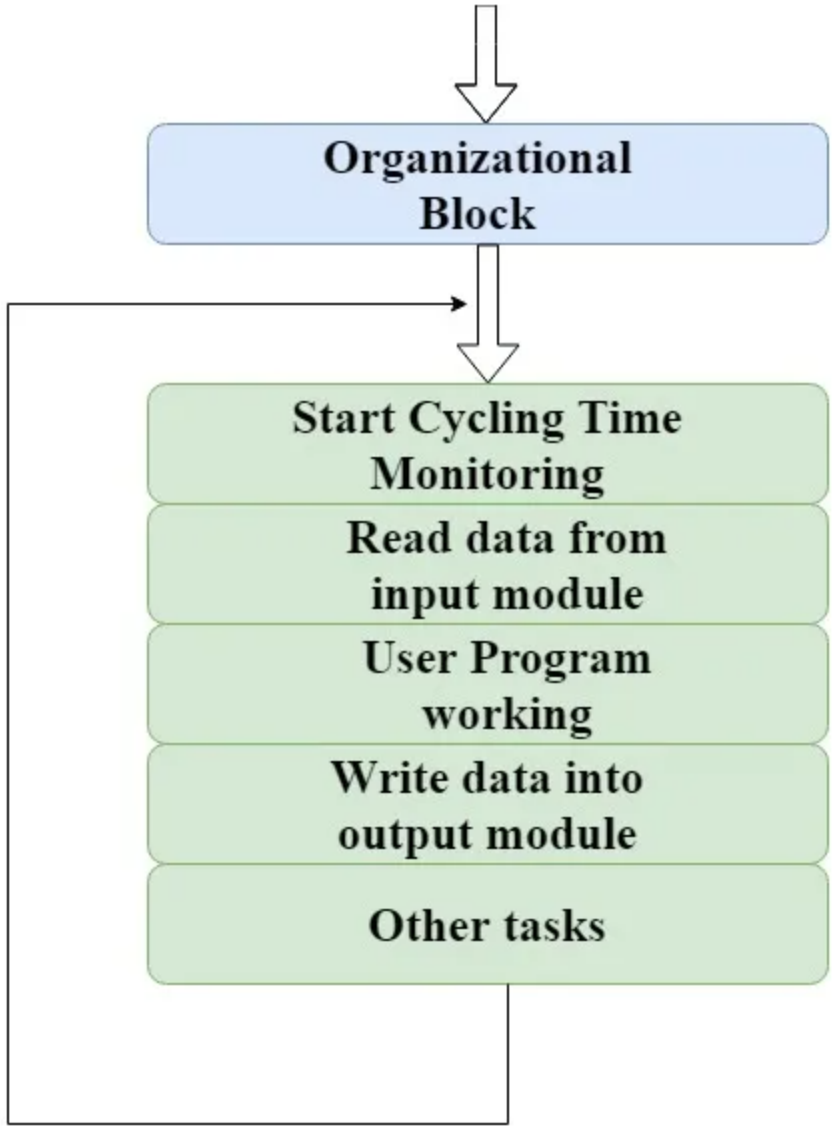


Figure:Working principle of PLC

A PLC Scan Process includes the following steps

- The operating system starts cycling and monitoring of time.
- The CPU starts reading the data from the input module and checks the status of all the inputs.
- The CPU starts executing the user or application program written in relay-ladder logic or any other PLC-programming language.

- Next, the CPU performs all the internal diagnosis and communication tasks.
- According to the program results, it writes the data into the output module so that all outputs are updated.
- This process continues as long as the PLC is in run mode.

Programmable Logic Controllers continuously monitor the input values from various input sensing devices (e.g. accelerometer, weight scale, hardwired signals, etc.) and produce corresponding output depending on the nature of production and industry. A typical block diagram of PLC consists of five parts namely:

- Rack or chassis
- Power Supply Module
- Central Processing Unit (CPU)
- Input & Output Module
- Communication Interface Module

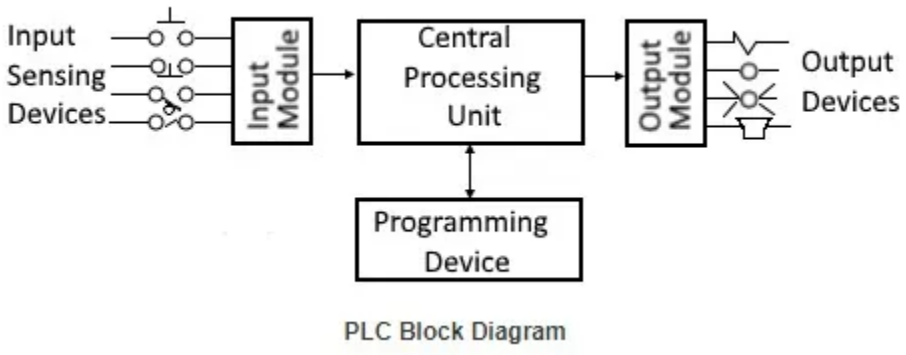
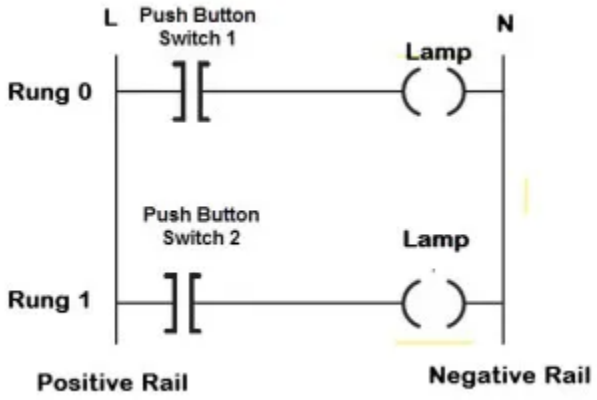


Figure: Block diagram of PLC

Ladder Logic:

Ladder logic is the simplest form of PLC programming. It is also known as “relay logic”. The relay contacts used in relay controlled systems are represented using ladder logic.

The below figure shows a simple example of a ladder diagram.



In the above-mentioned example, two pushbuttons are used to control the same lamp load. When any one of the switches is closed, the lamp will glow.

The two horizontal lines are called rungs and the two vertical lines are called rails. Every rung forms the electrical connectivity between Positive rail (P) and Negative rail (N). This allows the current to flow between input and output devices.

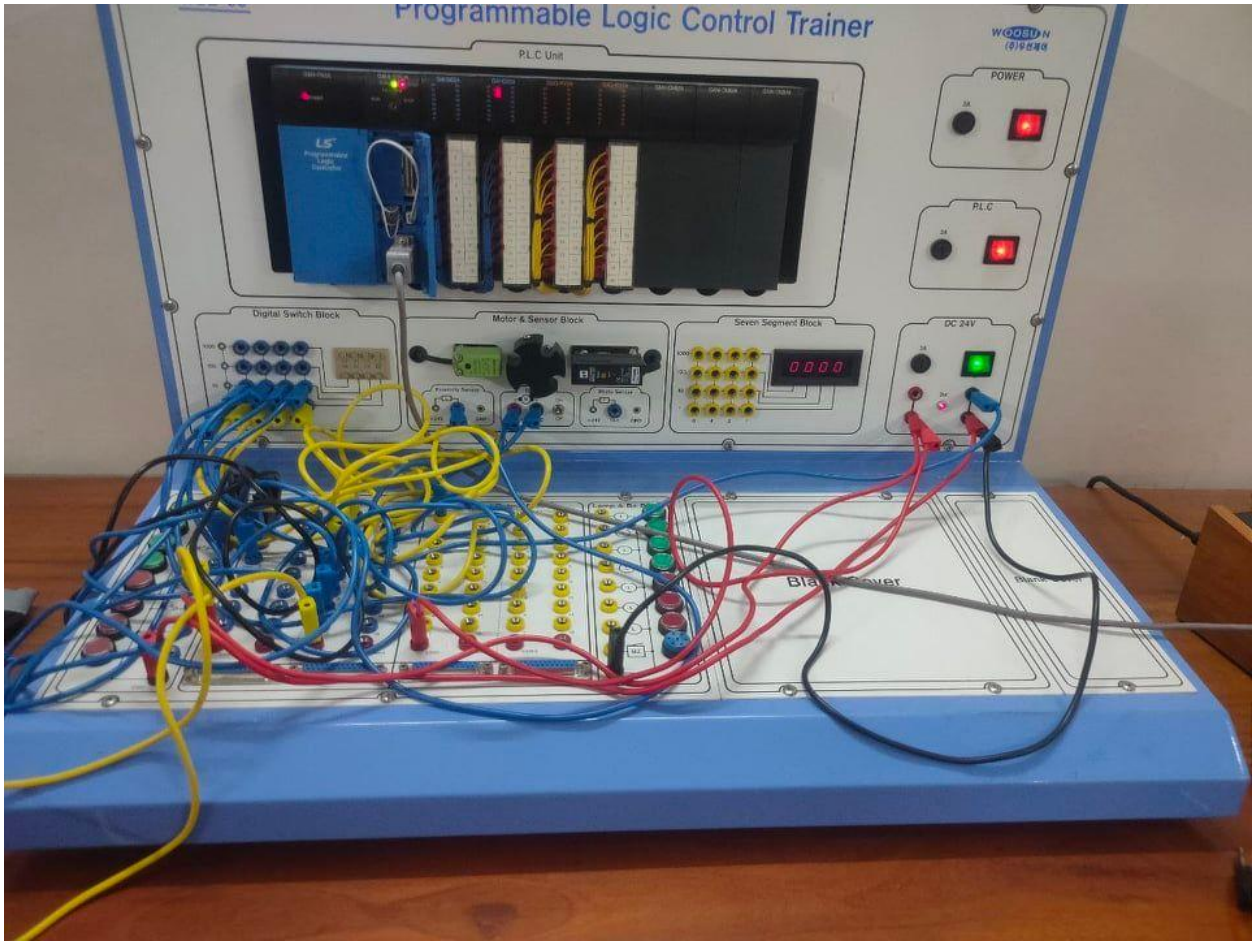
Ladder diagram is executed rung by rung in a sequence. Using the help of boolean logic and relay logic PLC can be programmed to do a task. It is easy to implement and edit. After uploading to a PLC it can control an industrial system.

Requirements:

- PLC
- Wires
- computer with ladder logic software

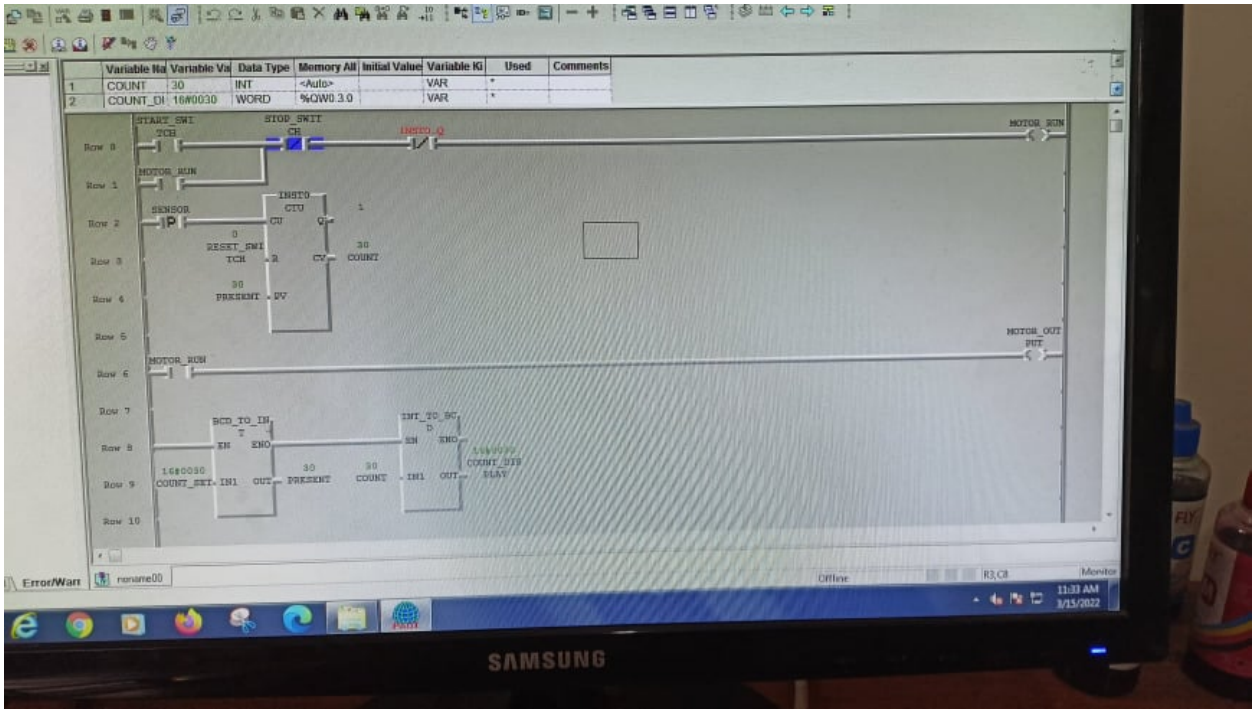
Working procedure:

We first had to give the connections to the IO modules properly seeing the diagram given below



The modules present here are digital switch block, seven segment block, motor block,switch block and the input and output blocks. First we make sure to connect the power lines to the blocks except the motor block and also ground teh blocks too. Then we connect the digital switch block to the input blocks along

with the start, stop and reset switch. Then we take the output block and give a connection to the motor. We have to connect the sensor reading to the input so that it can be used to control the motor. Also we can connect the count output to the seven segment block to display the current count of rotation of the motor. Then we have to upload the ladder logic to control the whole process.



This ladder logic is then compiled into hex code for the PLC to run. After uploading the start button starts the process and the stop button halts the process. The reset button resets all the registers to zero in hex value.

Results and Discussion:

Using the digital switch block we can take a number as input which takes how many times the motor will do a full rotation until it stops. After the number is set, pressing the start button starts the rotation of the motor and displays the number of times the motor rotates on the seven segment display. After the motor is done rotating the set number of times it stops. Pressing the stop button at any time stops the rotation of the motor. Reset button helps reset the counter to 0 for the process to start again. Here the whole process runs smoothly and we can add even more functions to this logic like adding a buzzer to make noise after the rotation is done. In the software we have to specify all the addresses of the ladder relay and blocks to match up with input and output connections so that the whole process runs smoothly.

Reference:

- https://www.electrical4u.com/programmable-logic-controllers/
- https://www.plcacademy.com/ladder-logic-tutorial/
- https://www.polycase.com/techtalk/electronics-tips/what-is-a-programmable-logic-controller.html
- http://www.inductiveautomation.com/resources/article/what-is-a-PLC

Name of the Experiment : Controlling DC motor and counting rotation using PLC.

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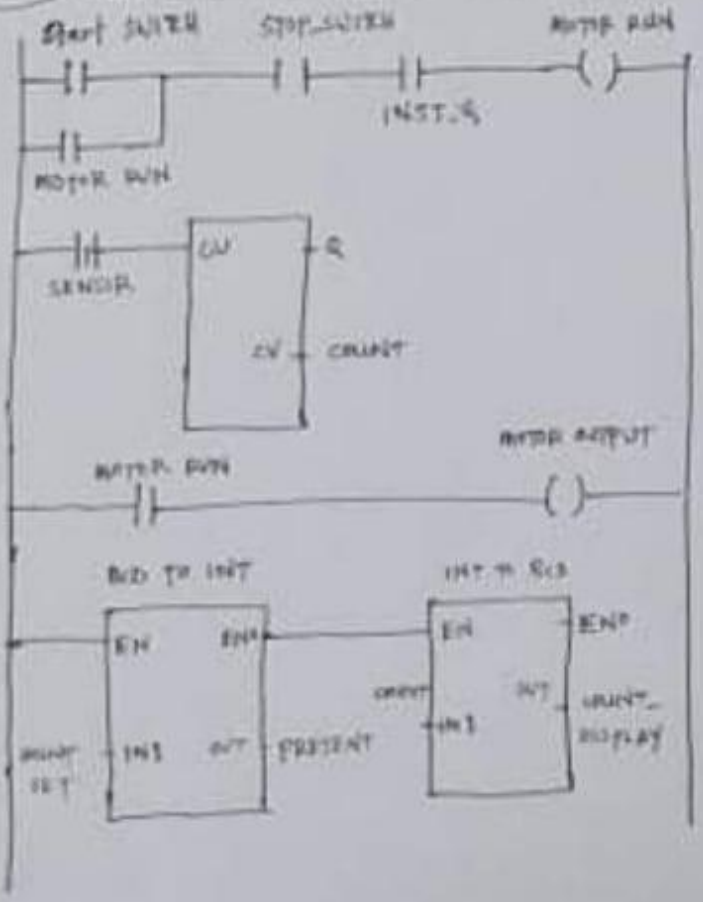

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