

G.PULLA REDDY ENGINEERING COLLEGE (AUTONOMOUS): KURNOOL
ELECTRICAL & ELECTRONICS ENGINEERING DEPARTMENT
V Semester B.Tech. - E.E.E. (Scheme-2020)
PROGRAMMABLE LOGIC CONTROLLER LABORATORY

TITLE: Verification of Logic Gates, Timer and Counter using PLC

GPREC/EEED/EXPT-SCEE-1
Date: 27-07-2022

1. Verification of Logic Gates, Timer and Counter using PLC

AIM: To verify the AND gate, OR gate, Timer and Counter operation using PLC

APPARATUS: VPLCT – 01, Patch chords, RS232 Cable

THEORY:

Programmable logic controllers (PLC) were originally designed to replace relay based logic systems and solid state hard wired logic control panels. Their advantages over conventional logic systems are that they are easy to program, highly flexible, relatively inexpensive and able to communicate with other plant computers.

A PLC examines the status of inputs, and in response, controls some process or machines through outputs. Combinations of input and output data are referred to as logic. Several logic combinations are usually required to carry out a control plan or program. This control plan is stored in memory using a programming device to input the program into the system. The control plan in memory is periodically scanned by the processor, usually a microprocessor, in a predetermined sequential order.

VPLCT-01 PLC's has the 6 inputs, 4 outputs and also having high speed counter. Pulse width modulation operations. Two versions are available. Both operates on +24V DC nominal input power accept inputs from 6 positive or negative logic inputs 2 Amps relay provides the outputs that can be control 5 to 30 V DC or 5 to 250V AC outputs devices. Then 4 positive logic 24V DC transistor outputs that can be also be used for PWM or pulse train applications

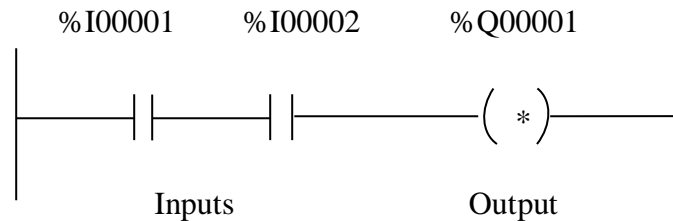
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LADDER DIAGRAM:

AND GATE



OR GATE

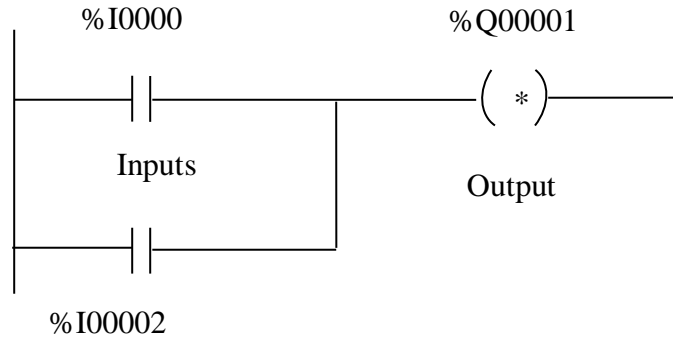


Figure. 1 AND and OR GATE ladder diagram.

PROCEDURE:

1. Connect the PLC to PC with the help of RS 232 cable
2. Open VERSA PRO in desktop of PC
3. Create new folder and select required location in PC and click on NEXT option
4. Choose empty folder (default) and select FINISH option
5. Construct the ladder program as per the diagram shown in figure.1
6. After construction go to PLC Option, select connect button.
7. Go to PLC option select CLEAR ALL to delete previous any loaded program in PLC hardware kit
8. Again go to PLC option select STORE option to store logic Program in PLC.
9. Again go to PLC option select LOAD option to load Logic Program in PLC hardware kit and select RUN option button.
10. On PLC hardware kit turns ON supply and operates the switches S1 and S2 and verify the AND/OR logic truth tables.

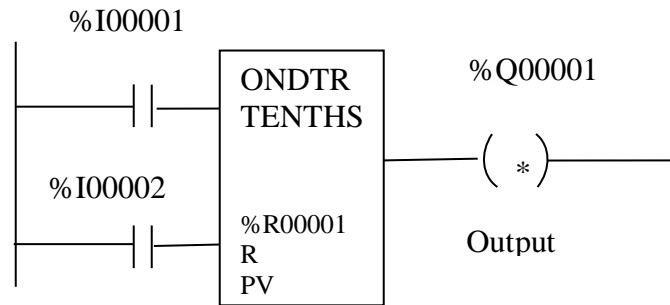
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LADDER DIAGRAM:

TIME FUNCTION



COUNTER FUNCTION

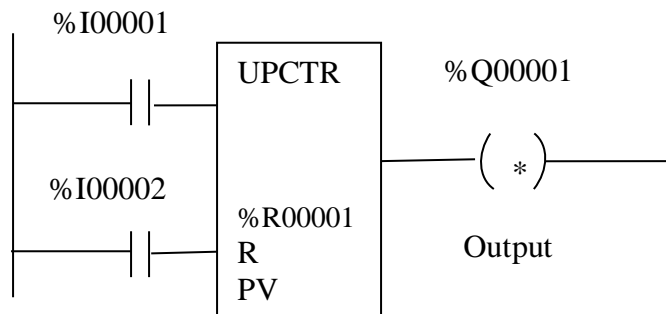


Figure. 2 TIMER and COUNTER ladder diagram.

PROCEDURE:

1. Connect the PLC to PC with the help of RS 232 cable.
2. Open VERSA PRO in desktop of PC
3. Create new folder and select required location in PC and click on NEXT option
4. Choose empty folder (default) and select FINISH option.
5. In VIEW widow select EXTENDED tools in function tool box option.

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6. Construct the ladder program as per the diagram shown in figure.2
7. Go to PLC option select CLEAR ALL to delete previous any loaded program in PLC hardware kit
8. Again go to PLC option select STORE option to store logic program in PLC.
9. Again go to PLC option select LOAD option to load logic program in PLC hardware kit and select RUN option button.
10. On PLC hardware kit turn ON supply and operates the switches S1 and S2 and verifies the TIMER and COUNTER Functions.

RESULT:

REMARKS IF ANY:

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Approved by:
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PROGRAMMABLE LOGIC CONTROLLER LABORATORY

TITLE: Traffic Light Control using PLC

GPRECD/EEE/EXPT- SCEE - 2

Date: 27-07-2022

2. Traffic Light Control using PLC

AIM: To analyse the traffic light control by using PLC.

APPARATUS:

1. 24V-Lamps
 - a. Red Lamp
 - b. Orange Lamp
 - c. Green Lamp
2. Patch Card
3. PLC Kit
4. Ladder program/STL

THEORY:

Programmable logic controllers (PLC) were originally designed to replace relay based logic systems and solid state hard wired logic control panels. Their advantages over conventional logic systems are that they are easy to program, highly flexible, relatively inexpensive and able to communicate with other plant computers

The laboratory owns Siemens PLCs. A small traffic control system was built based on the PLCs, which contains three LED signal heads and a button for pedestrian crossing as well. Each PLC is responsible for the control of one signal head; furthermore the equipment receives the pedestrian requests for a green sign. The PLC checks the operation. The described devices simulate a fixed time signal program with a green request opportunity for pedestrians.

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PROGRAMMABLE LOGIC CONTROLLER LABORATORY

TITLE: Traffic Light Control using PLC

GPRECD/EEE/EXPT- SCEE - 2

Date: 27-07-2022

PROCEDURE:

- 1 Open TIA Portal V-13 in desktop of PC
- 2 Select the option to create new project and give project name and path in the window
- 3 Select “Write PLC Program” under start tree window
- 4 Under Organization Block (OB) select MAIN option.
- 5 Construct the PLC Program as per the diagram shown in figure.1 and save it.
- 6 Go to ONLINE option in the main window select “Download to device”
- 7 Select the start search option in window.
- 8 Select the compatible target subnet and click on “Load” option.
- 9 In load result window, select “Start all” and then click on “Finish” option.
- 10 Go to Online option in main widow and select “Monitor” option and green tick marks should be appear in Project Tree Window.
- 11 Again go to online option and select “Start” option in main window
- 12 Switch ON the supply to PLC hardware kit and connect the banana probes at output(Q0.0,Q0.1,Q0.2) terminals
- 13 Set the time delay input at “PT of IEC TIMER” in ladder program.
- 14 Observe the RED/GREEN/ORANGE light blinking with given time delay in “IEC TIMER”

TITLE: Traffic Light Control using PLC

GPRECD/EEE/EXPT- SCEE - 2

Date: 27-07-2022

LADDER DIAGRAM:

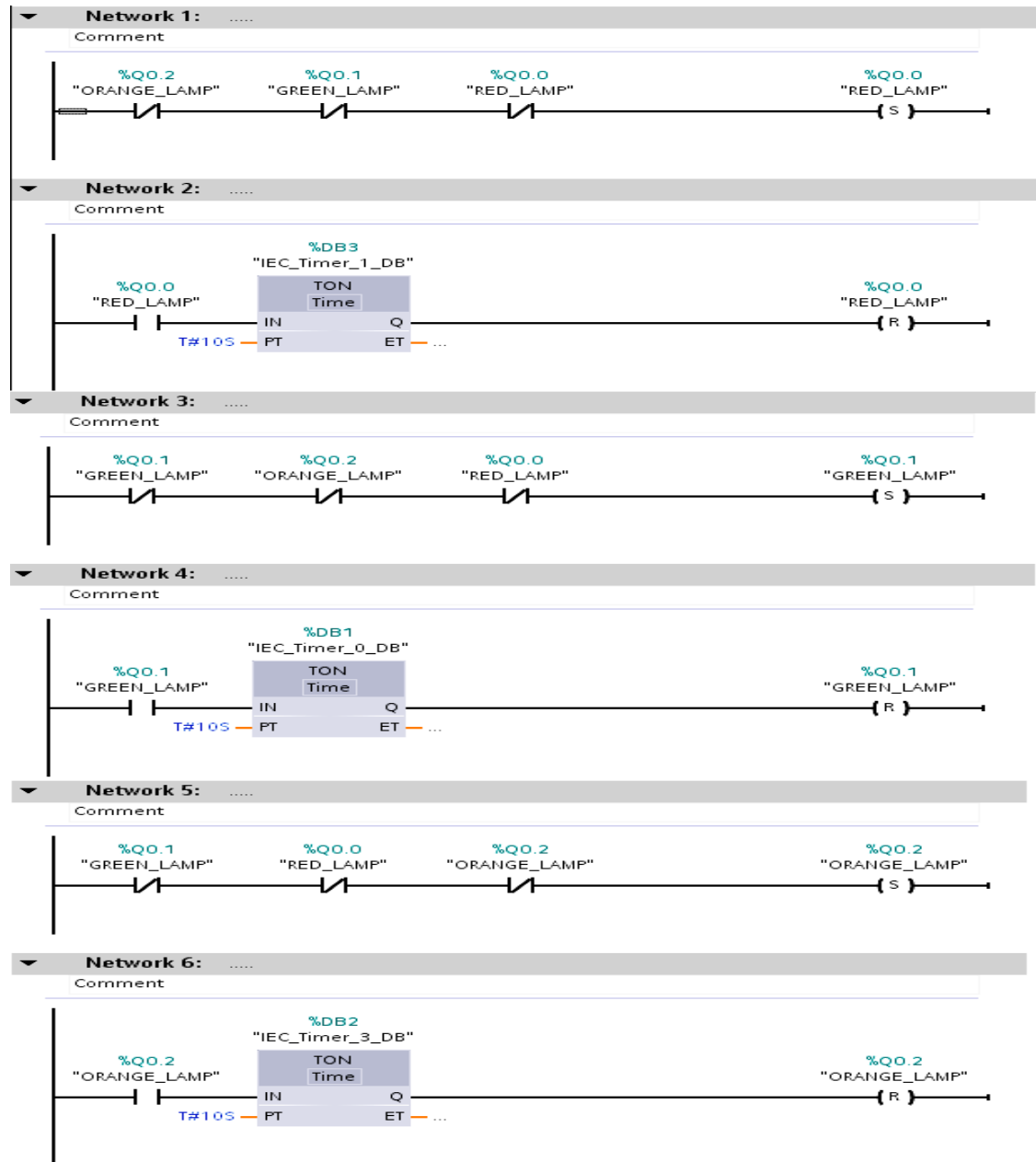


Figure.1 Traffic Light Control ladder diagram

RESULT:

REMARKS IF ANY:

3. Automatic water level control system using PLC

AIM: To design automatic water level control using PLC.

APPARATUS:

1. Level Sensors
2. Drive Kit
3. PLC Kit
4. Banana Plugs
5. Ladder Program/STL
6. Drive Parameter Software

THEORY:

A Programmable Logic Controller (PLC) is a digital computer used for automation of electromechanical processes. Unlike general-purpose computers, the PLC is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Three sensors are used to implement the system. These sensors detect the presence of water. The readings of the sensors are used by the PLC to take the required decision. The PLC communicates the present status of the system through the IM port to the computer. The ladder logic was implemented in SIMANTIC manager.

PROCEDURE:

- 1 Open TIA Portal V-13 in desktop of PC
- 2 Select the option to Create New Project and give project name and path in the window
- 3 Select "Write PLC Program" under start tree window
- 4 Under organization block (OB) select MAIN option.
- 5 Construct the PLC Program as per the diagram shown in figure.1 and save it.
- 6 Go to ONLINE option in the main window select "down load to device"
- 7 Select the start search option in window.
- 8 Select the compatible target subnet and click on "Load" option.
- 9 In load result window, select "Start all" and then click on "Finish" option.
- 10 Go to online option in main window and select "MONITOR" option and green tick marks should be appear in project tree window.
- 11 Again go to online option and select "START" option in main window
- 12 Switch ON the supply to PLC hardware kit and connect the banana probes at Inputs (I0.0,0.1,0.2,0.3,0.4) and Output (Q0.0,Q0.2) terminals
- 13 Press the "Green Button" at power source of motor board supply.
- 14 After reaching the HIGH/MEDIUM/LOW level of water in the tank, the sensor will sense it and send the signal to the drive and then power supply is cut off to the motor.

PROGRAMMABLE LOGIC CONTROLLER LABORATORY

TITLE: Automatic water level control system using PLC GPRECD/EEE/EXPT-SCEE - 3
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CIRCUIT DIAGRAM:

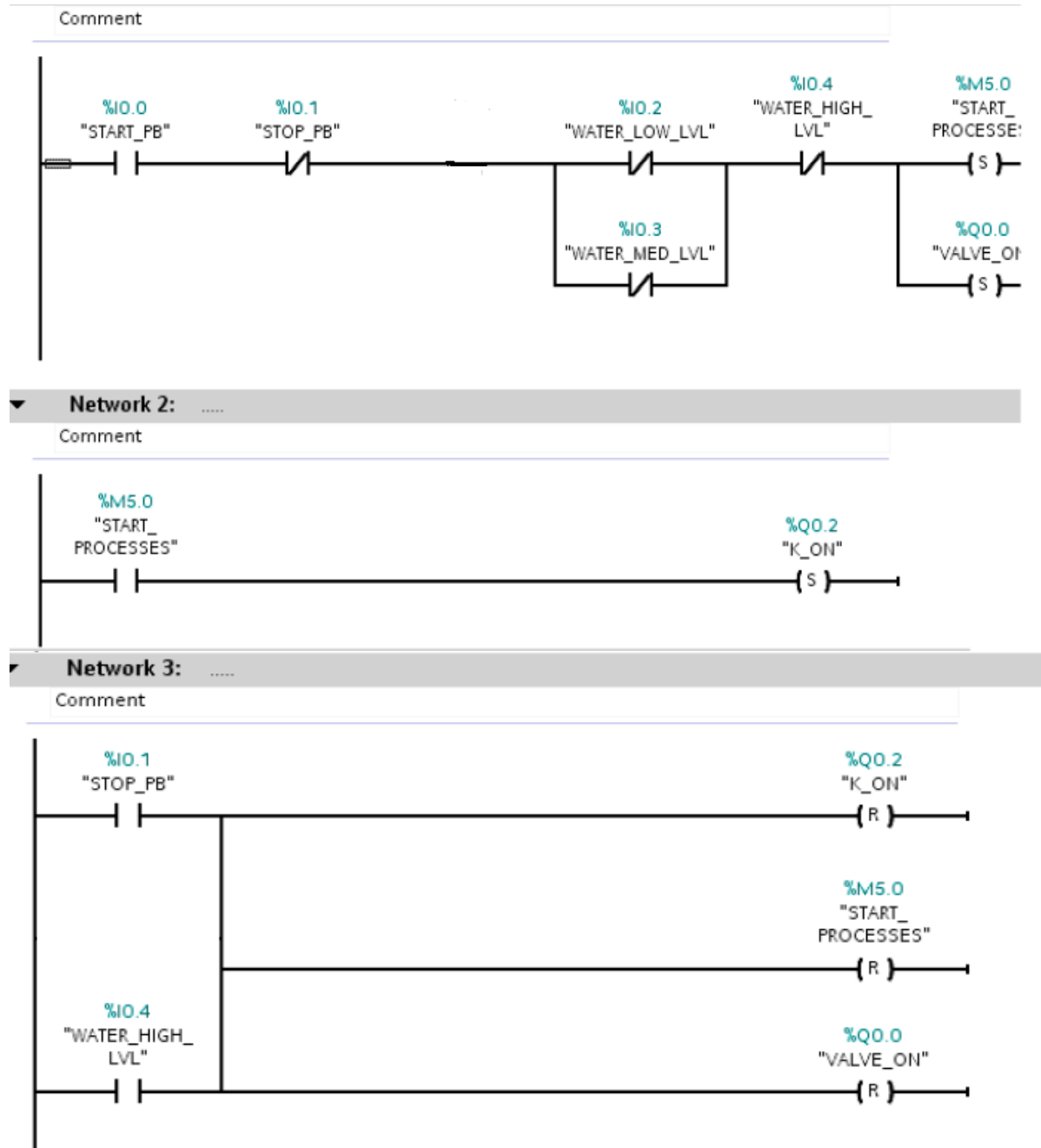


Figure.1 Automatic water level control system ladder diagram

RESULT:

REMARKS IF ANY:

4. Direct On line (DOL) Starting of Induction Motor with/without latching

AIM: To start the 3- Φ Induction Motor using DOL starter with/without Latching

APPARATUS:

1. PLC Trainer Kit : 3-Pole MCB, MPCB, Contactor, Push Buttons and 3- Φ Induction Motor
2. Banana Plugs

THEORY:

A Programmable Logic Controller (PLC) is a digital computer used for automation of electromechanical processes. Unlike general-purpose computers, the PLC is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. The direct-on-line (DOL) motor start is the easiest method for starting up three-phase asynchronous motors. The stator windings are directly connected to the mains supply in a single switching process. Large starting currents result by applying the full mains voltage, which in turn cause trouble some voltage changes on the mains supply. For small size motor (less than 2 HP) where starting torque is about twice the full-load torque and starting period only a few seconds, then this type starter is used. The Direct on Line motor starter (DOL) consists of an MCB, contactor, and an overload relay (NC) for protection. To control the contactor use ON (NO) push button and OFF (NC) pushbutton. Provide an auxiliary contact (NO) from the contactor across the ON pushbutton, as to hold in the contact i.e. the contactor is electrically latched closed while the motor is operating.

PROCEDURE:

1. Without Latching

- 1 Make sure that Motor Protection Circuit Breaker(MPCB) in OFF position (Red button in lower position and Black button in upper position)
- 2 Connections are made as per the circuit diagram shown in Figure.1 (a) and 1(b).
- 3 Turn ON the supply to the kit by using Miniature circuit breaker (MCB)
- 4 When the ON push button is pressed and hold, the contactor C1 turns ON and motor starts running.
- 5 Whenever the ON push button is released, the supply to the contactor C1 will be cut-off and motor stops running.

2. With Latching

1. Make sure that Motor Protection Circuit Breaker (MPCB) in OFF position (Red button in lower position and black button in upper position)
2. Connections are made as per the circuit diagram shown in Figure.2 (a) and 1(b).
3. Turn ON the supply to the kit by using Miniature circuit breaker (MCB)
4. When the ON push button is pressed, the contactor C1 turns ON and motor starts running and continues even if ON push button is released.
5. Whenever the OFF push button is pressed, the supply to the contactor C1 will be Cut-off and motor stops running.

CIRCUIT DIAGRAM:

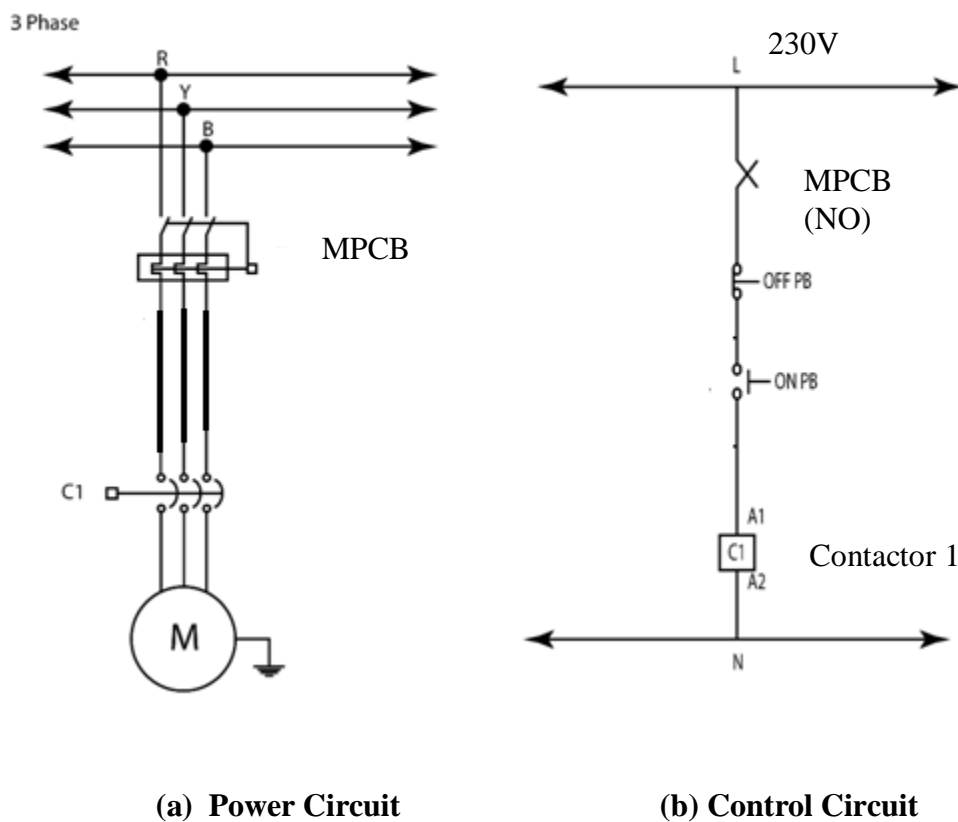


Fig.1 DOL Starter Circuit without Latching

TITLE: Direct On line (DOL) Starting of Induction Motor with/without latching
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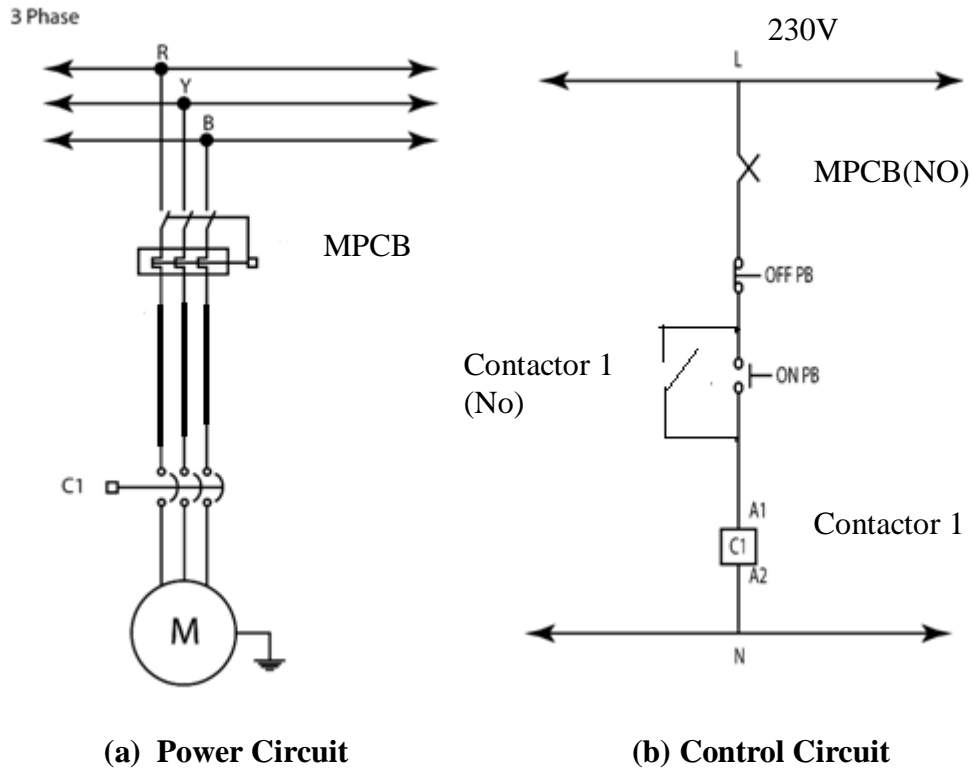


Fig.2 DOL Starter Circuit with Latching

RESULT:

REMARKS IF ANY:

5. Speed Control of DC Motor using Potentiometer

AIM: To Control the speed of the DC Motor by varying Potentiometer (POT)

APPARATUS:

1. PLC Kit : 2-Pole MCB, Contactor, PLC and D.C. Motor Controller Kit and DC Motor
2. Banana Plugs

THEORY:

A Programmable Logic Controller (PLC) is a digital computer used for automation of electromechanical processes. Unlike general-purpose computers, the PLC is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. The PLC installed in the kit is SIEMENS S7 1200 CPU 1214C. This PLC has fourteen digital I/O ports, two analog I/O ports. The PLC is of transistor output type an external relay board is connected to the PLC which can be used to switch outputs of different voltage levels like 24V output or 230V output as per the requirements.

The purpose of this kit is to understand the fundamentals of automation. This kit is helpful in learning all the basic principles of methods of starting an DC motor. the kit is interfaced with basic sensors, push buttons, VFD,HMI and PLC. All the basic automation experiments can be tested practically. The contact terminals of all the components are connected to the banana connectors so that various connections can tried out and tested as required. Since all the components are available on the kit.

PROCEDURE:

1. Turn ON the supply to DC Motor trainer kit using MCB
2. Connect PLC to PC using Ethernet cable.
3. Connect three terminals of the POT (Potentiometer) to 7, 8 and 9 of DC motor controller kit.
4. Connect the HMI analog inputs (A11+ and A11-) to feedback terminals of armature Output (blue colored terminals)
5. Give the connections start and stop adjacent to POT terminals as shown Figure.1 in the panel diagram
6. Keep the POT at minimum position (clock wise position)
7. Turn ON the supply to both PLC and DC motor trainer kit and see that HMI device and PLC are turned ON
8. Slowly vary the POT in anti- clockwise direction and observe the feedback of armature voltage in HMI display.
9. Tabulate the Armature voltage and speed of DC motor

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PROGRAMMABLE LOGIC CONTROLLER LABORATORY

TITLE: Speed Control of DC Motor using POT

GPRED/EEE/EXPT- SC EE - 5
 Date: 27-07-2022

CIRCUIT DIAGRAM:

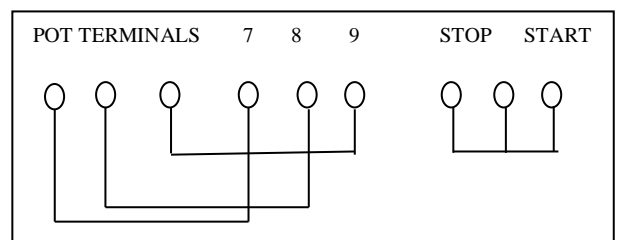
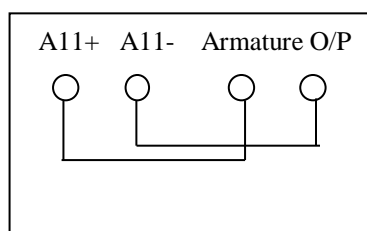
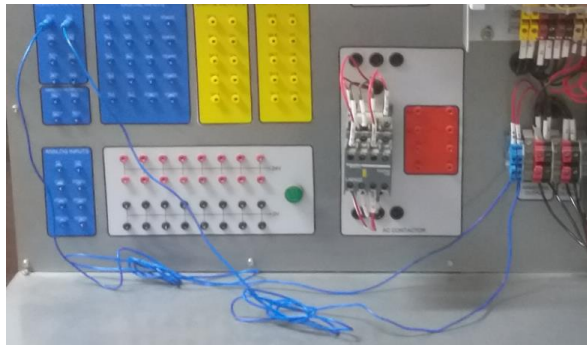


Figure 1. Connections in DC Motor Trainer Kit

RESULT:

REMARKS IF ANY:

6. Servo motor control using PLC

AIM: To operate the servomotor using PLC

APPARATUS:

1. PLC Kit : 2-Pole MCB, PLC, HMI, Illuminated selector switch, Push Buttons, connectors for 230V line and Neutral (A.C.), connectors for 24V line and OV (D.C.), Connectors for I/O of PLC
2. Servo Drive Kit: 2-Pole MCB, Servo Drive, Servo Motor, Solid state Relay
3. Banana Plugs

THEORY:

A Programmable Logic Controller (PLC) is a digital computer used for automation of electromechanical processes. Unlike general-purpose computers, the PLC is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. The PLC installed in the kit is SIEMENS S7 1200 CPU 1214C. This PLC has fourteen digital I/O ports, two analog I/O ports. The PLC is of transistor output type an external relay board is connected to the PLC which can be used to switch outputs of different voltage levels like 24V output or 230V output as per the requirements.

The purpose of this kit is to understand the fundamentals of automation. This kit is helpful in learning all the basic principles of servo drive. The kit is interfaced with ball screw experiments can be tested practically. The contact terminals of all the components are connected to the banana connectors so that various connections can be tried out and tested as required. Since all the components are available on the kit, it is practically a better approach in learning about automation.

Sinamics V90 servo converter is suitable for operation on single and three phase networks, and with four frame sizes. Power range from 0.1 kW to 2.0 kW and a voltage range of between 200 V and 240 V. The system can be easily integrated by means of PTI, PROFINET, USS and Modbus RTU.

The SIMOTICS S-1FL6 LI servo motor is suitable for simple and highly dynamic applications in conjunction with the SINAMICS V90 servo converter. The servo motor with a high dynamic response and a low moment of inertia (low-inertia motor) is available in four shaft heights and a braking.

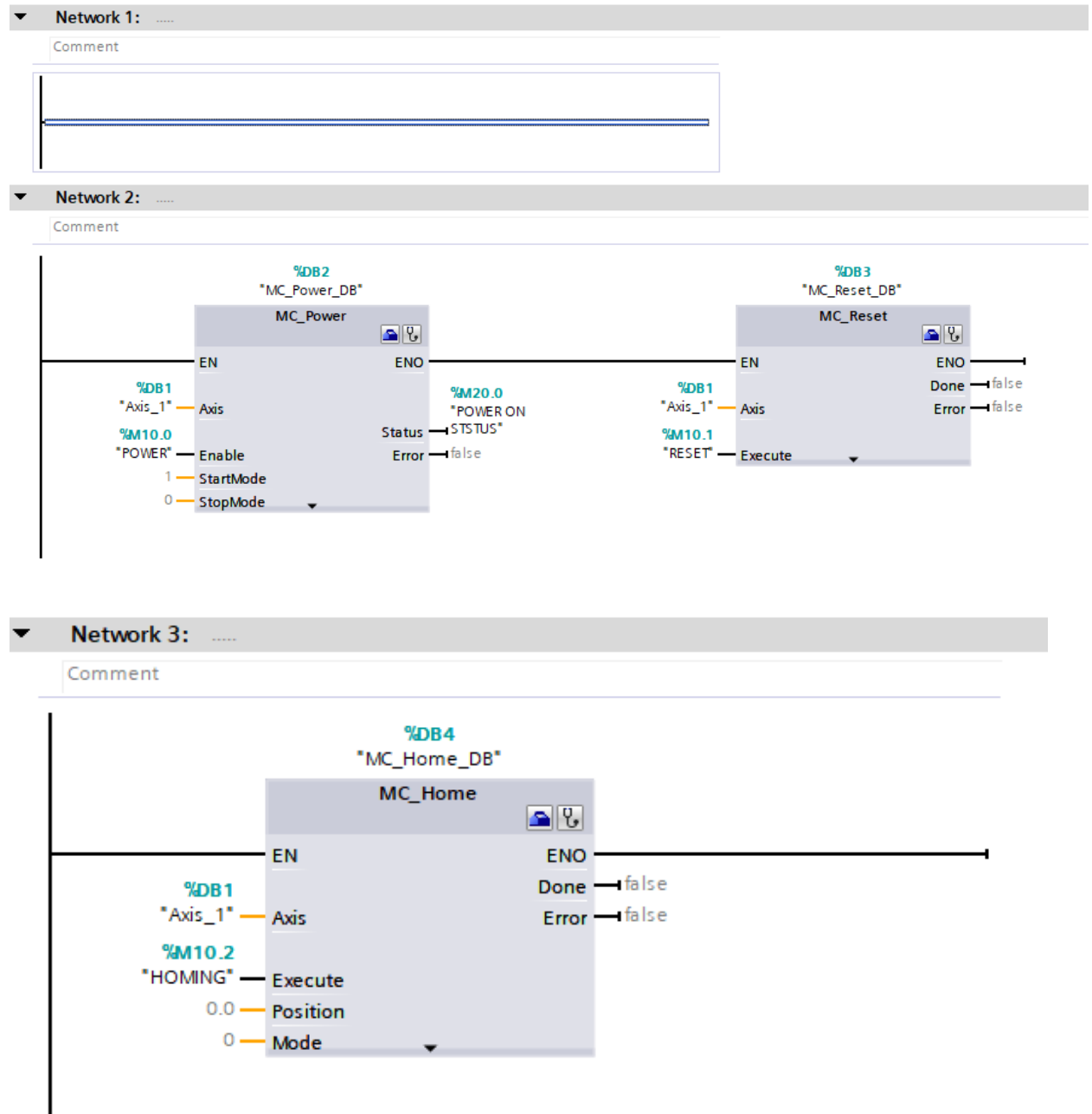
PROGRAMMABLE LOGIC CONTROLLER LABORATORY

TITLE: Servo motor control using PLC

GPRED/EEE/EXPT- SC EE - 6

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LADDER DIAGRAM:

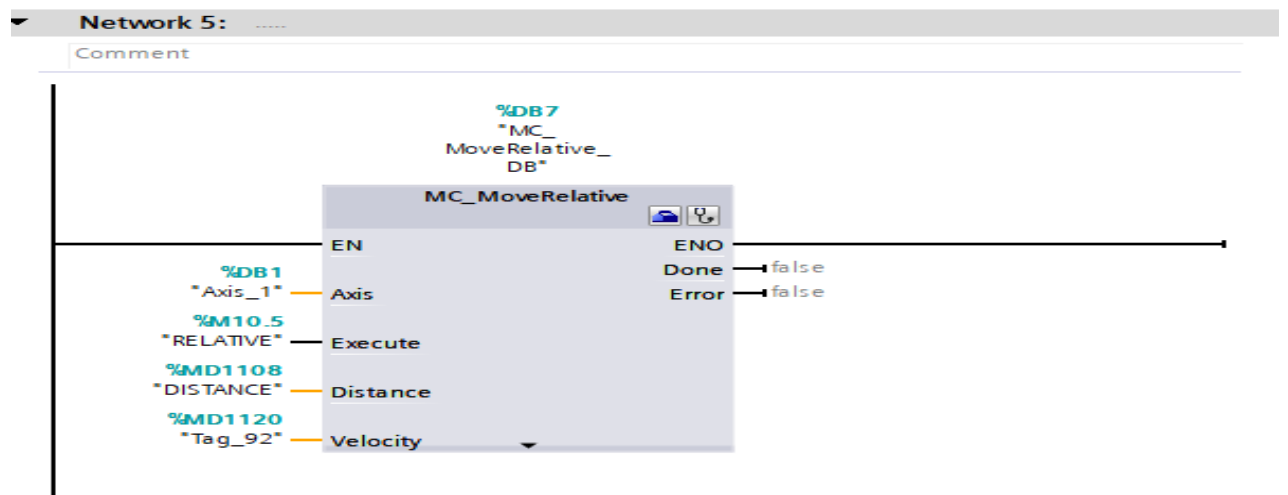
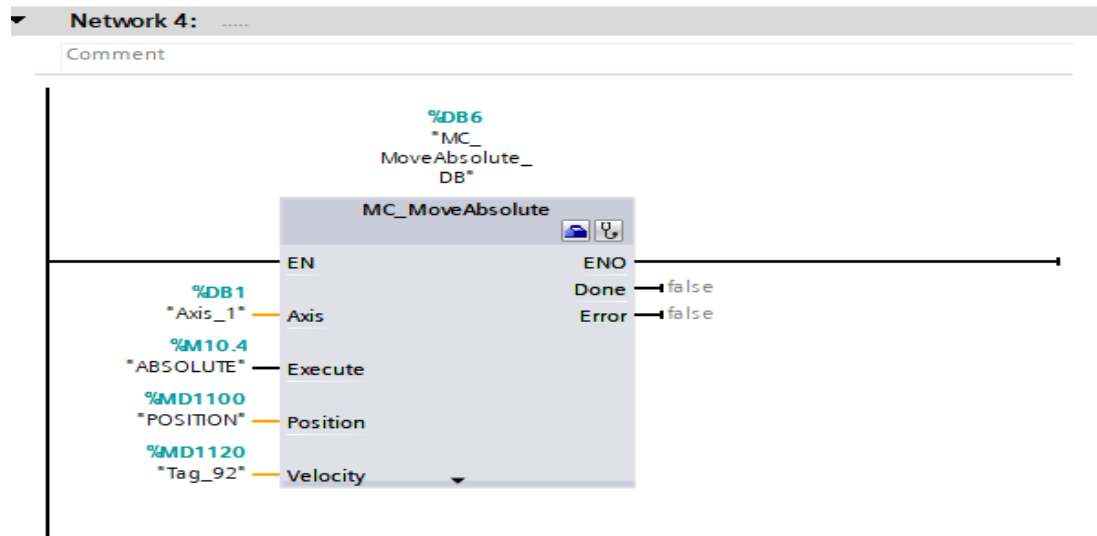


PROGRAMMABLE LOGIC CONTROLLER LABORATORY

TITLE: Servo motor control using PLC

GPRED/EEE/EXPT- SC EE - 6

Date: 27-07-2022



PROGRAMMABLE LOGIC CONTROLLER LABORATORY

TITLE: Servo motor control using PLC

GPRED/EEE/EXPT- SC EE - 6

Date: 27-07-2022

PROCEDURE:

1. Connect the PLC to the Computer using an Ether net cable /PROFINET cable via Ethernet Ports and Establish a connection using the software provided.
2. Connect the PLC to the Servo Drive using an Ether net cable /PROFINET cable via Ethernet Ports and Establish a connection using the software provided.
3. Turn ON the supply to both PLC and Servo Kits and see that HMI device and PLC are turned ON
4. Ones the HMI turned ON, select SERVO MOTOR option, press the “POWER ON” and enter the some velocity/position/distance values, press the respective “RUN” button.
5. Then press the forward and backward button on HMF and observe the movements of servomotor lever.

RESULT:

REMARKS IF ANY: