

LAB MANUAL

FUNDAMENTALS OF AUTOMATION TECHNOLOGY LAB (20EE43)

IV SEM ELECTRICAL AND ELECTRONICS ENGINEERING



Prepared by

**K.MURUGAN**

FORMER HOD

DEPT OF EEE

DSIT, BENGALURU-111

NAME OF STUDENT:

REGISTER NUMBER:

ROLL NUMBER :

DAYANANDA SAGAR INSTITUTE OF TECHNOLOGY (POLYTECHNIC)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SHAVIGE MALLESHWARA HILLS, KUMARASWAMY LAYOUT, BENGALURU-560111

Academic year 2022-2023

1. Video demonstration on Automation technology

<https://www.youtube.com/watch?v=fleoiLhe1XA>

<https://www.youtube.com/watch?v=JdXzMI1PXcs>

**EXPERIMENT 2a. Test a Linear Actuator Solenoid**    Date;

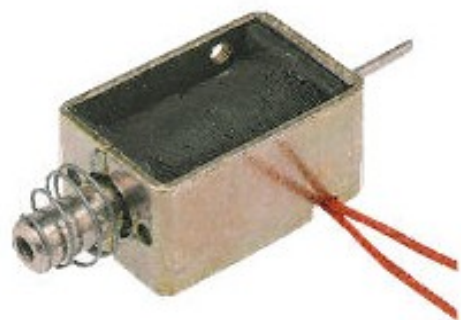
Aim

To test a Linear Actuator Solenoid

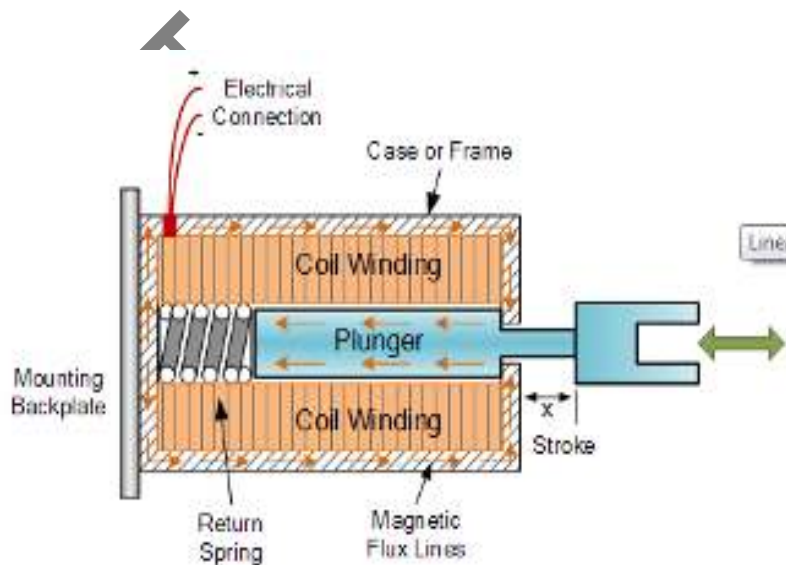
Apparatus required

1. solenoid coil
2. actuating rod
3. DC power supply unit
4. connecting wires

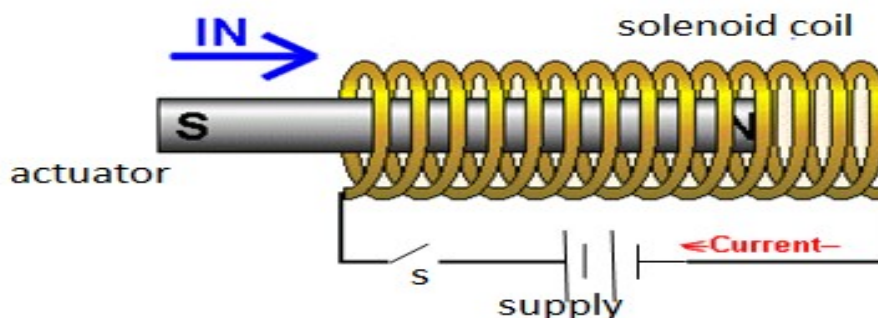
Circuit diagram (cross sectional view)



Linear Solenoid



Connection diagram



Procedure

1. connections are made as per the circuit diagram
2. Switch on the DC power supply.
3. close the switch 'S'
4. First the solenoid coil is energized due to which rod is actuated.
5. Thus linear solenoid actuator is observed.
6. Switch off the power supply and disconnect the circuit.

Result

Thus linear solenoid actuator is observed experimentally

**Signature of Staff**

**EXPERIMENT-2b. Install, wire and test digital time delay relay      Date:**

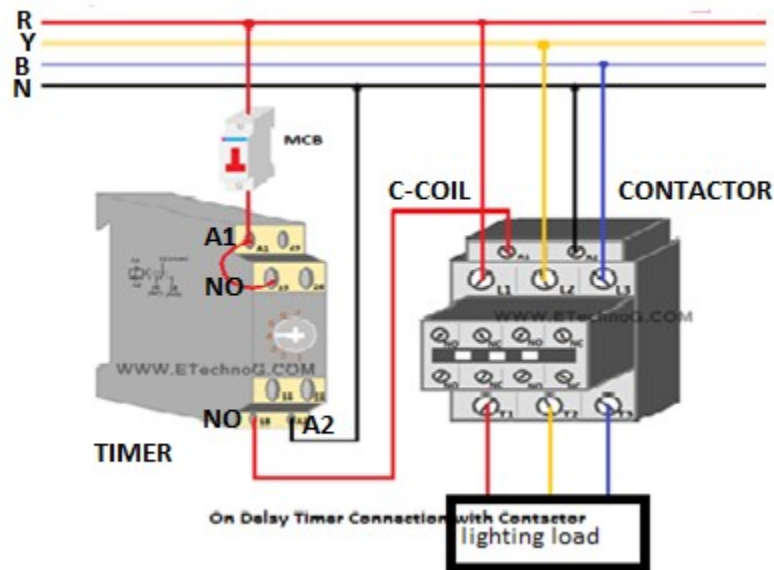
Aim:

To install, wire and test digital time delay relay.

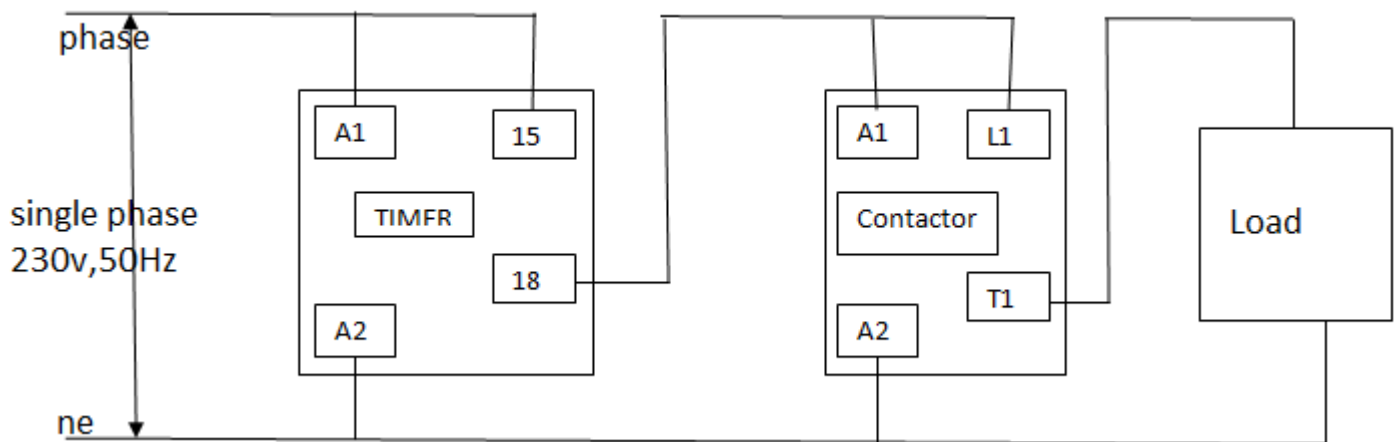
Apparatus Required:

1. Digital Time Delay Relay
2. 230V contactor
3. Lighting Load
4. Connecting wires

Wiring diagram



Circuit Diagram:



Procedure:

1. connections are made as per the circuit diagram
2. Switch on the power supply and adjust the timer knob to set the value.
3. first the timer coil is energized
4. then contact of timer coil is closed after reaching the preset value
5. then 230v contactor is energised as a output
6. Output of the lighting load is observed.
7. Switch off the power supply and disconnect the circuit.

Tabular column

Sl no	Preset time in seconds	output
1		
2		

## Result

Hence the test digital time delay relay is installed, wired, tested and conducted and verified experimentally.

Signature of Staff

## EXPERIMENT- 3a (Identify and test different sensors.) Date:

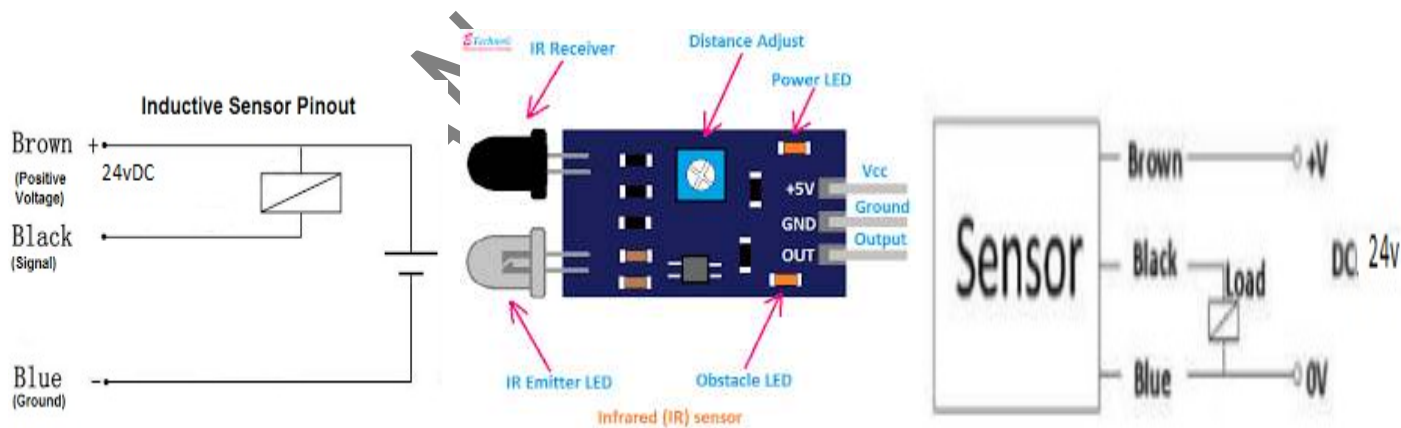
### Aim:

To identify and test different sensors by using respective object.

### Apparatus required

1. inductive proximity sensor
2. infra red sensor
3. capacitive proximity sensor

### Connection diagram



### Procedure

1. connections are made as per the circuit diagram
2. switch on the power supply
3. keep the metal object near by the sensor called inductive proximity sensor
4. keep the non metallic object nearby sensor called capacitive proximity sensor

5. Keep both metallic and non metallic object with distance more than the above two sensor called infra red sensor

Tabular column

Sl no	sensor	Type of object	output
1	Infrared sensor		
2	Inductive proximity sensor		
3	Capacitive proximity sensor		

Result

Thus different sensors are identified and tested experimentally by using respective object.

**Signature of Staff**

## EXPERIMENT- 3b.

Select a suitable proximity sensor for a given application and wire up the same. Date:

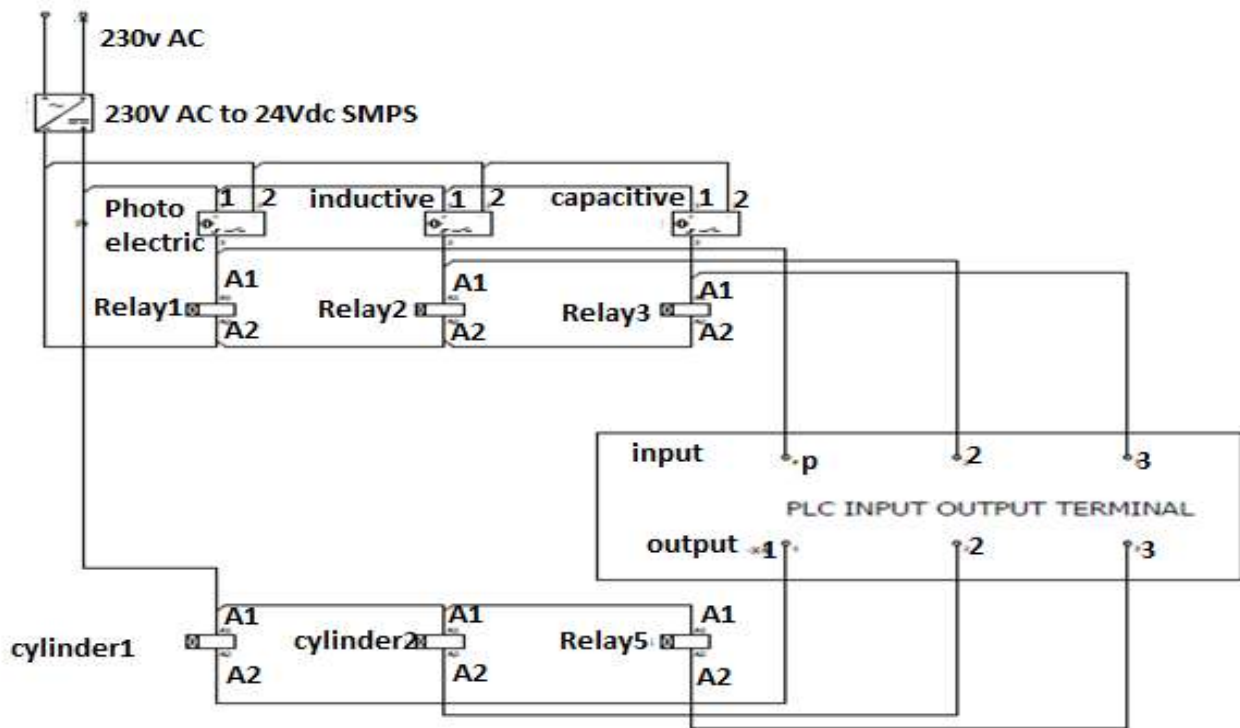
Aim

To operate single acting cylinder and double acting cylinder with the application of given sensors

Apparatus required

1. PLC Automation software
2. Computer
3. USB downloading Cable
4. Infra red sensor
5. Inductive proximity sensor
6. Air compressor unit
7. Single acting cylinder with valve and control circuit
8. Double acting cylinder with valve and control circuit

Circuit diagram



#### Procedure

1. Click the icon of Auto shop software
2. Click the file and open project.
3. Then select the required circuit using the library tool bar.
4. Then pick the required cylinder and valves.
5. Then drag it and place it from the file.
6. Then make the connections as given in the circuit.
7. Then save the circuit and then download the program into PLC.
8. Use object near the sensor then it will work automatically as per the program

#### Result:

Thus the operation of a single acting cylinder and double acting cylinder is done with the application of different sensor

Signature of Staff

EXPERIMENT 3c

Date:

Develop relay-based motor control automation such that the motor reverses its direction when the limit switches are activated.

#### Aim

To execute PLC program for a relay based motor control automation to reverse its direction using limit switches.

#### Apparatus Required

1. PLC.
2. PC with inovance Software.
3. 3. USB cable.
4. Power supply.

5. Conveyor system setup.
6. Single-phase motor
7. Geared train

## Procedure

1. Switch ON the power supply to PC and PLC.
2. Patch the power chords. (24v Positive to inputs and 24v Positive to outputs)
3. Connect the USB cable between computer and PLC.
4. Click File >Click Open>relay based motor control Program.
5. Download and Run the program.
6. Enable the Start input; motor starts to move in forward direction if Direction input is not enabled in the motor control setup.
7. When the specified count is reached from detection of metal piece by sensor, the motor will come to stop.
8. If direction input is enabled, then motor will start to run in reverse direction.
9. If stop input is enabled, motor comes to stop.



Tabular column

Sl no	sensor	Sensor position	output
1	Sensor 1	enabled	
2	Sensor2	enabled	

Result

Thus PLC program for relay based motor control automation system is executed



**EXPERIMENT -4**

Date:

**4. Controlling of single acting cylinder by 3/2 pushbutton valve/ solenoid valve and Controlling of double acting cylinder by 5/2 pushbutton valve/Solenoid valve**

**Aim:**

To control the single acting cylinder by 3/2 pushbutton /solenoid valve and control the double acting cylinder by 5/2 pushbuttons / solenoid valve.

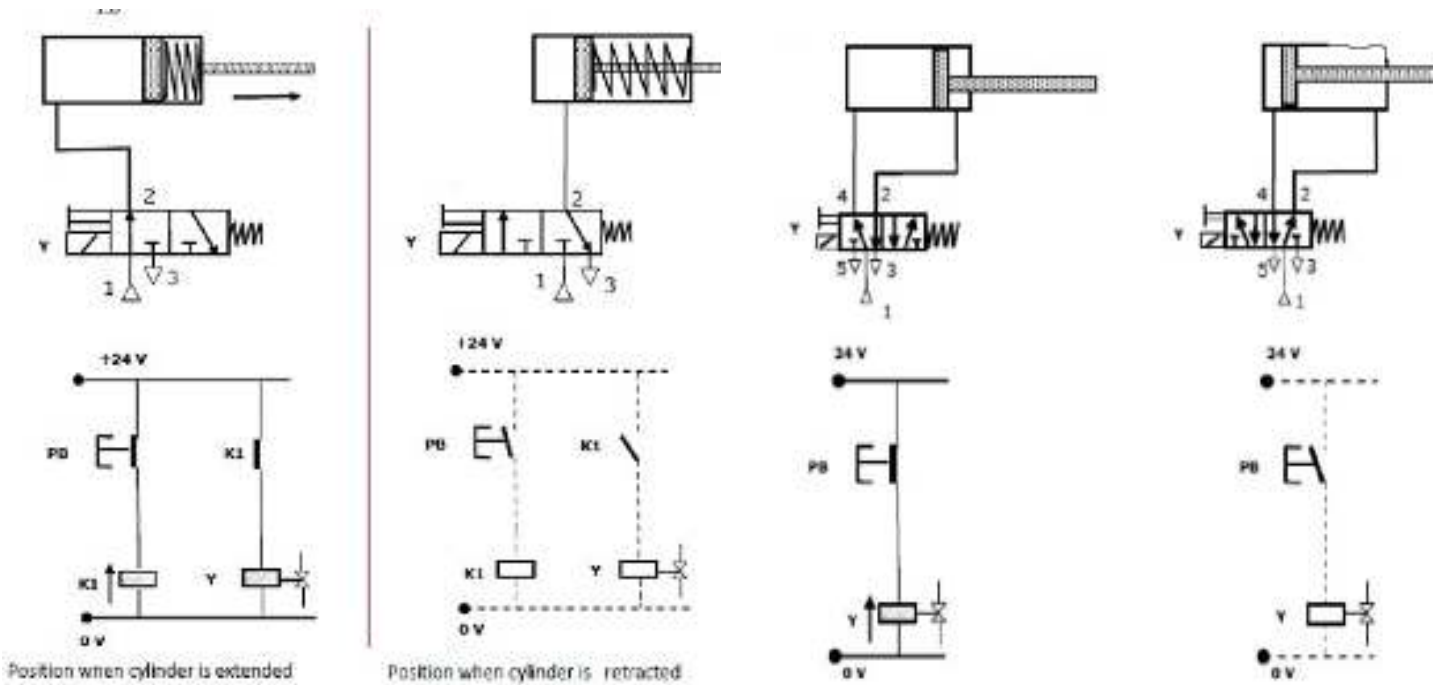
**Apparatus Required:**

1. Air compressor Unit
2. 24v SMPS
3. 24V Solenoid coil
4. Flow Control valve
5. 5/3 solenoid operated directional control Valve
6. 3/2 solenoid directional control Valve
7. Single Acting Pneumatic Cylinder
8. Double Acting Pneumatic Cylinder
9. Polyurethane Tubes and Electrical wires

**Procedure:**

1. Connect the air compressor unit, Control valves, directional control valves and cylinders as shown in the circuit.
2. Draw the functional block diagram for single acting cylinder and double acting cylinder.
3. Adjust the air flow controller and set the pressure.
4. Switch on the electric supply.
5. Observe the operation of single acting cylinder and double acting cylinder.

**Actuated Position**



**Single Acting cylinder**  
Tabular column

**Double Acting cylinder**

Sl no	pushbutton	Cylinder position	output
1	PB 1	enabled	
2	PB2	enabled	

Result:

Thus the Controlling of single acting cylinder by 3/2 pushbutton valve/ solenoid valve and Controlling of double acting cylinder by 5/2 pushbutton valve/Solenoid valve is operated

Signature of Staff

**EXPERIMENT – 5**      Date:

**5. Speed control of single acting cylinders by flow control valve and control of double acting cylinders by flow control valve**

Aim

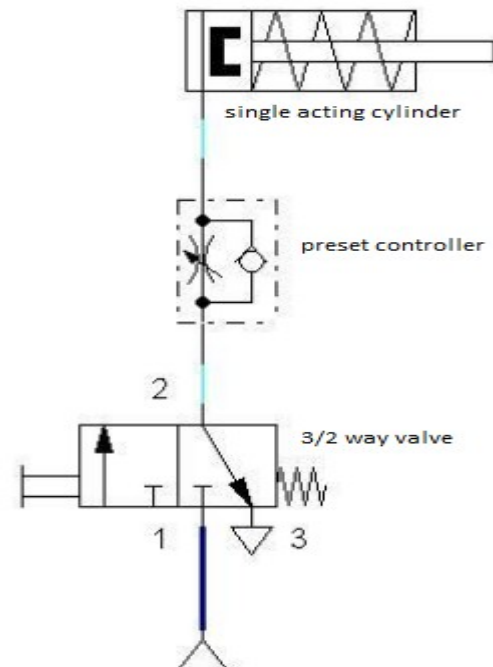
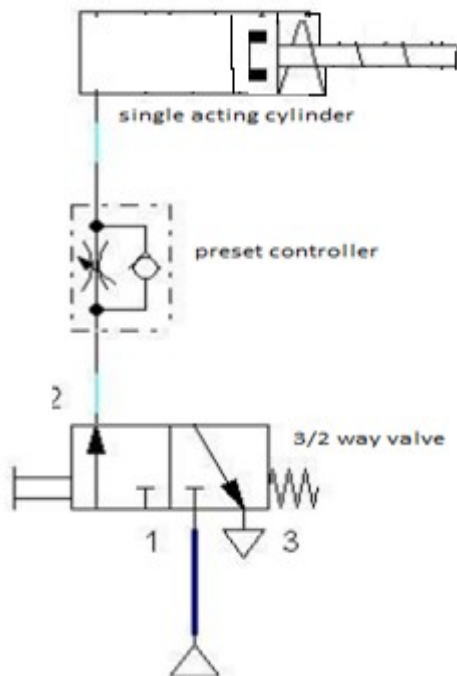
To control the speed of single acting cylinder and control of double acting cylinder by flow control valve.

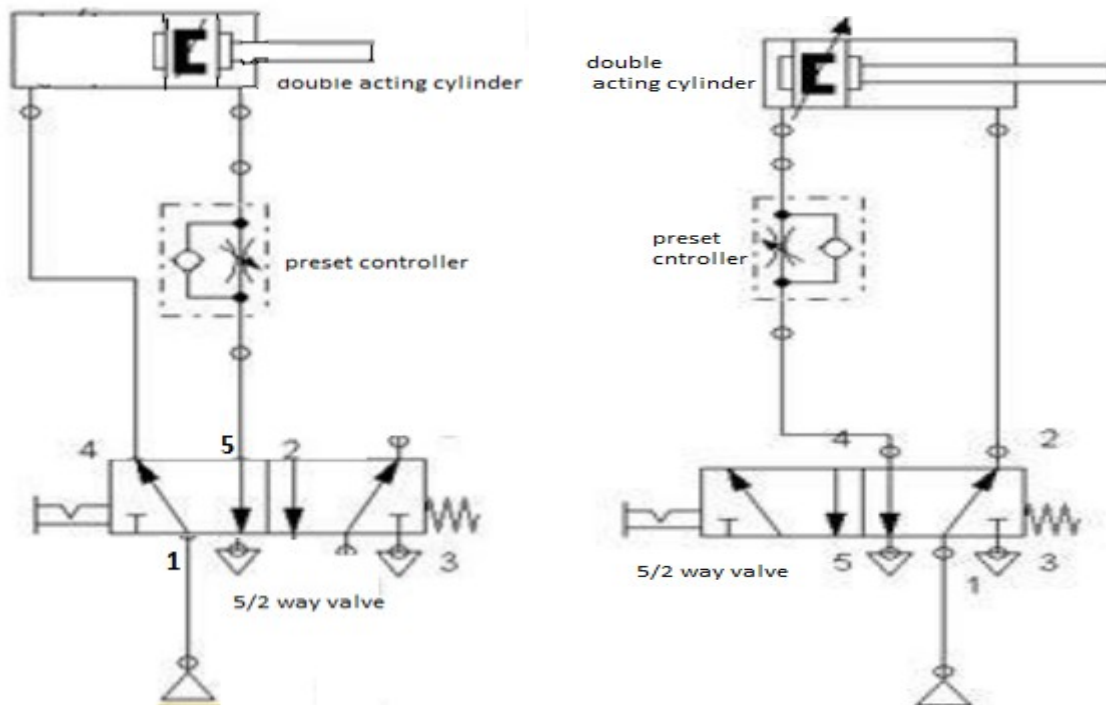
Apparatus Required

1. Air compressor Unit
2. 24v SMPS
3. 24V Solenoid coils
4. Flow Control valve
5. 5/3 solenoid operated directional control Valve
6. 3/2 solenoid directional control Valve
7. Single Acting Pneumatic Cylinder
8. Double Acting Pneumatic Cylinder
9. Polyurethane Tubes and Electrical wires

## Procedures:

1. Prepare the components according to the components list.
2. Mount all components according to the Pneumatic circuit.
3. Connect pneumatic tubes according to the pneumatic circuit.
4. Check all parts are connected properly with each other.
5. Switch on the air compressor unit.
6. Turn the control knob and set the pressure at air flow controller.
7. Start the circuit, check the operation and observe the speed of pneumatic cylinder.





Tabular column

Sl no	pushbutton	Cylinder name	Flow control valve	speed
1	PB 1	Single acting cylinder		
2	PB2	Double acting cylinder		

Result: The Speed control of single acting cylinder and double acting cylinders by flow control valve are observed

Signature of Staff

### EXPERIMENT – 6

Date:

6. Activate the DC motor using 2 relays to run the motor forward and backward direction.

Aim

To execute PLC program for a relay based DC motor control automation to reverse its direction using Sensors.

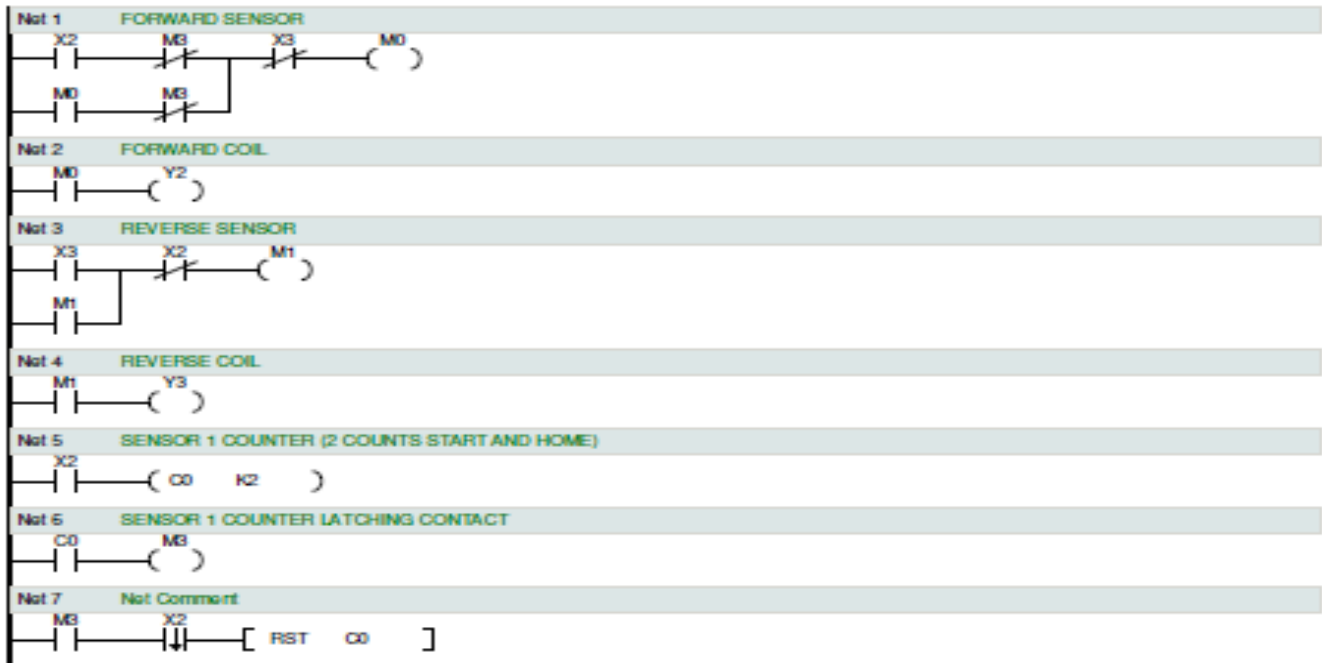
Apparatus Required

1. PLC.
2. PC with inovance Software.
3. USB cable.
4. Power supply.
5. Conveyor system setup.
6. DC motor
7. geared train

Procedure

1. Switch ON the power supply to PC and PLC.
2. Patch the power chords. (24v Positive to inputs and 24v Positive to outputs)
3. Connect the USB cable between computer and PLC.
4. Click File >Click Open>relay based motor control Program.
5. Download and Run the program.
6. Enable the Start input; motor starts to move in forward direction if Direction input is not enabled in the motor control setup.
7. When the specified count is reached from detection of metal piece by sensor, the motor will come to stop.
8. If direction input is enabled, then motor will start to run in reverse direction.
9. If stop input is enabled, motor comes to stop.

**Ladder Diagram**



Tabular column

Sl no	sensor	Sensor position	output
1	Sensor 1		
2	Sensor 2		

Result:

Thus PLC program for relay based motor control automation system is executed

**Signature of Staff**

**EXPERIMENT -7**

Date:

**7. Install and control speed of 3-ph motor using VFD.**

**Aim**

To install and control the speed of three phase induction motor using variable frequency drive (VFD)

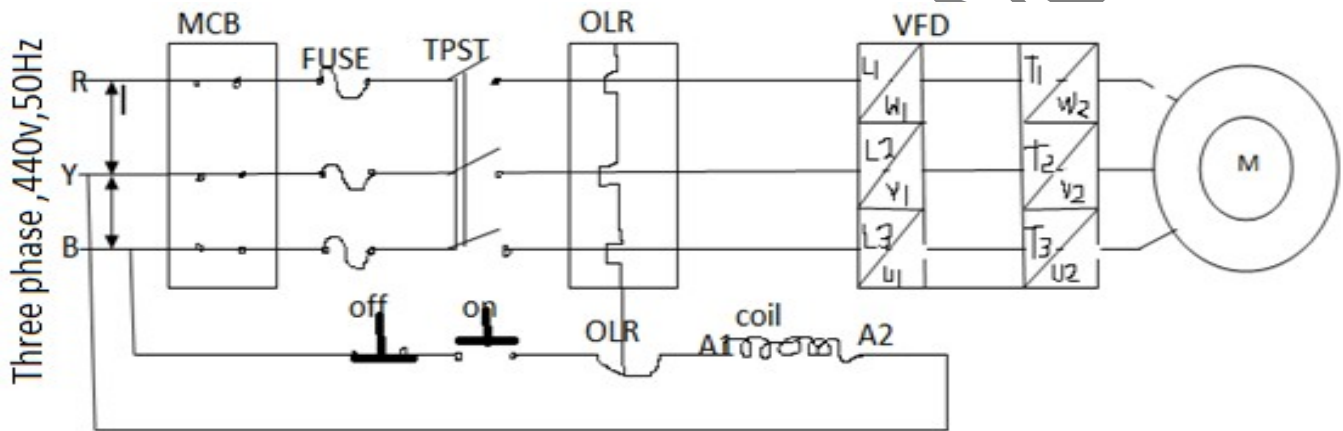
Apparatus Required

1. TPST- 1no
2. Fuse carrier set-3set
3. VFD
4. Three Phase induction motor-1no
5. Connecting wires

Procedure

1. Connections are made as per the circuit diagram
2. Switch on the three phase power supply
3. Close the TPST switch
4. Observe the indication of variable frequency drive which is ready for the operation
5. Turn the knob placed on VFD to vary the speed of induction motor
6. Motor runs at variable speed

Circuit Diagram



Tabular column

Sl no	Frequency	speed
1		
2		
3		

Result

The speed of three phase induction motor is controlled using variable frequency drive (VFD).

Signature of Staff

# PLC PART

## EXPERIMENT-8a

Date:

8a. Demonstrate open loop and closed systems observed in everyday life.

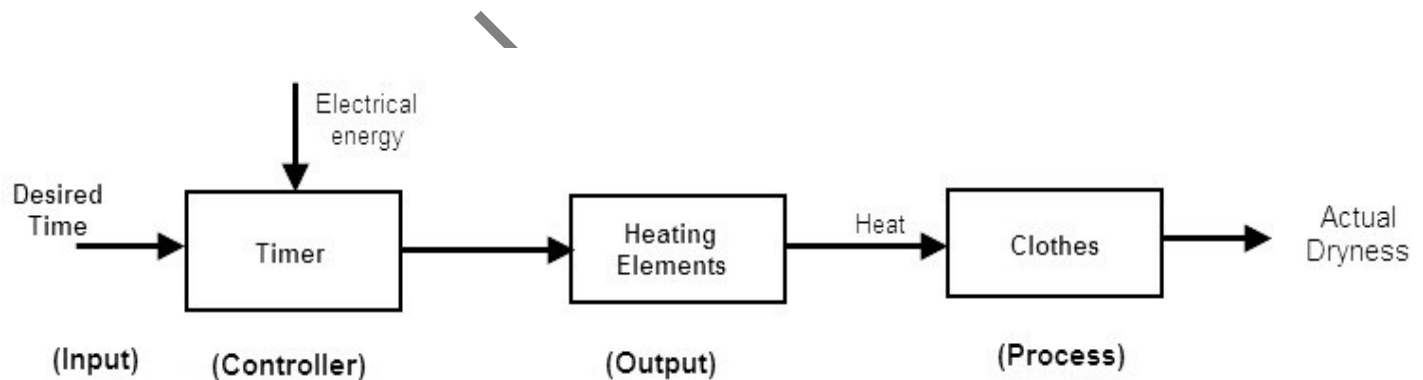
### Definition of the Open-Loop Control System

The control system in which the output of the system does not have any effect on its input is known as the open-loop control system. This means that the system does not have any feedback structure.

### Electrical Clothes Drier

We operate the clothes drier depending upon the amount of clothes to make dry. We set a timer in the system to do this operation, let's say 20 mins. As it is an automatic open loop system, the machine stops working automatically after 20 mins, irrespective of the nature of the clothes, whether they are dry or damp.

The clothes drier is an open loop system, because it doesn't consider the condition of clothes before it stops working. The user can adjust the operating duration of the system by setting the timer controls as per his / her requirement. Observe the below block diagram for the open loop control system, electric drier.



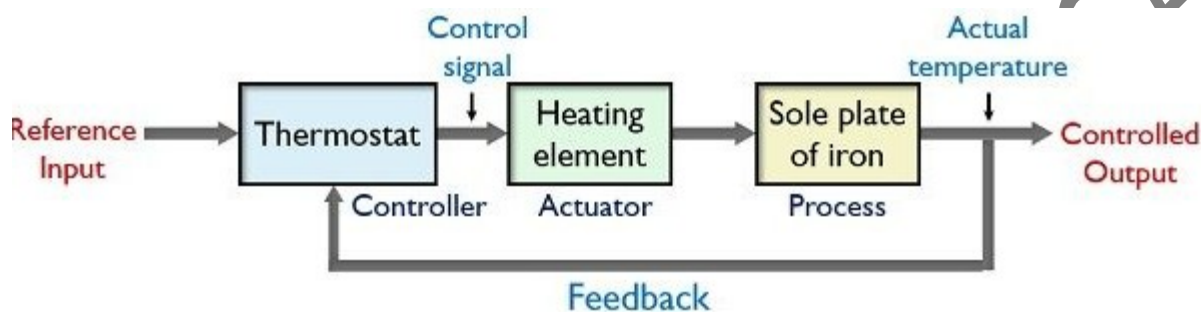
Here, the electric drier system has three blocks, timer, heating elements and clothes. Primarily, the user sets the time for drying the clothes in the timer. And the timer control works in combination with the heating element, to produce heat and dry the clothes. As there is no feedback about clothes, humidity, the system stops working after the preset time and it doesn't consider the state of clothes. Even if the clothes are dry, the system will switch off after the allotted time. As the system has no feedback, this is also known as “non-feedback system”, in which the output of the system depends only on the input signal and no control action of the input signal based on the output is provided.

## Closed loop control system

A closed loop control system is an electronic device that automatically regulates a system to maintain a desired state or set point without human interaction. It uses a feedback system or sensor. Closed loop control is contrasted with open loop control, where there is no self-regulating mechanism and human interaction is typically required.

### 1. Automatic Electric Iron

Consider an example of automatic electric iron which acts as a closed-loop system.



An automatic electric iron consists of a thermostat that acts as a controller of the system, a resistive heating element is present that generates heat. The sole-plate of the iron instrument acts as a process of the overall system.

The basic working performed by an automatic electric iron is such that when the temperature of the sole-plate attains a predefined value then the heating action gets stopped automatically. And when the temperature falls below a certain specified value then again heating starts inside it.

So, it is clear that in this type of system the controlling depends on the output of the system. Initially, in electric iron, the thermostat is provided with a certain specific value which acts as a reference input for the system.

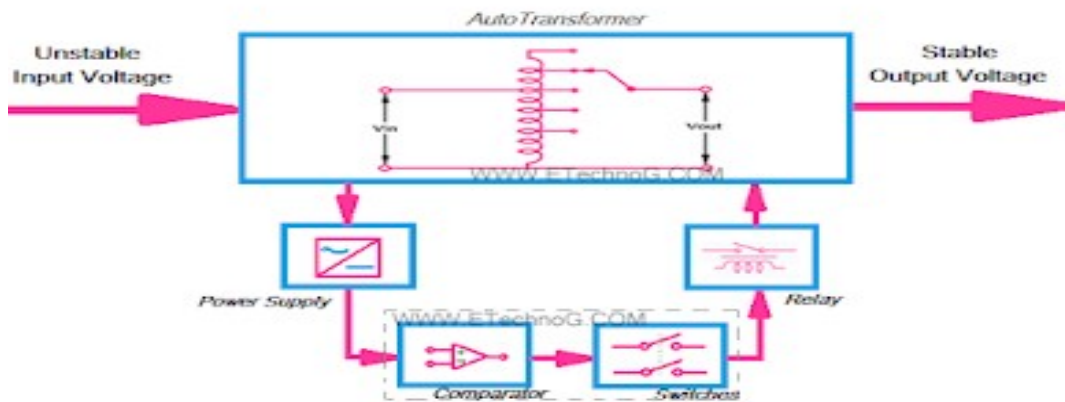
When the input is provided to the system, then the resistive heating element generates heat inside the system. This leads to rising up the temperature of the iron sole. Through a feedback element, this output temperature is compared with the reference input of the thermostat.

If the achieved output shows lesser value than the reference input, then the difference temperature actuates the thermostat and this switches on the heating element. This resultantly causes an increase in the temperature of the iron sole.

Once the temperature exceeds the reference value then the heating element automatically turns off. And after a certain point of time, the temperature starts to decrease. However, the comparison still goes on and as the temperature falls below the specific value, the heating element again begins to raise the temperature of the sole.



## 2. Voltage Stabilizer



Voltage Stabilizer is an example of Closed Loop Control System. Here, you can see the block diagram of the voltage stabilizer. a feedback control system available. It continuously monitors the output voltage. So when the output voltage increase or decreases from a certain level, the feedback system sends a signal to the input circuit, so it can increase or decrease the voltage level to maintain a constant output voltage level.

EXPERIMENT-8b

Date:

### 8b.Demonstrate Industrial applications of PLC

#### 1. Industrial Applications of PLC

In industrial automation, PLC performs a wide variety of manufacturing production, monitoring machine tool or equipment, building the system, and process control functions. Here are some of the examples where PLC has been used. PLCs are used in,

1. Transportation System likes Conveyor Belt System.
2. Packing and Labelling System in Food & Beverage.
3. Automatic Bottle or Liquid Filling System.
4. Packaging and Labelling System in Pharmacy Industries.
5. Transportation System like Escalator and Elevator.
6. Industrial Crane Control System for Operation of Overhead Travelling Crane.
7. Glass Industries for glass production and recording data.
8. Paper Industries for the production of Pages, Books or Newspapers, etc.
9. Cement Industries for manufacturing or mixing the right quality and quantities of raw materials, and accuracy of data regarding.
10. Automatic Drainage Water Pump Monitoring and Controlling System.
11. Time and Count-based Control System for an Industrial Machine.
12. Temperature Controller or Humidity by using the Sensors Input to the PLC system.
13. Fault Detection and Protection of Industrial Machines like an Induction Motor.
14. Wind Turbine System for Maximum Efficiency, Recording Data, and Safety Purposes.
15. Conveyor Belt System controls the Sequence of Conveyors and Interlocking procedure.
16. Energy Management System like Boiler, Ball Milling, Coal Kiln, Shaft Kiln, etc.
17. Oil and Gas Industries for controlling the Purging Procedure.

## EXPERIMENT-9a

### 9a. Identify Components of PLC

The PLC consists of five parts namely:

1. Rack or chassis
2. Power Supply Module
3. Central Processing Unit (CPU)
4. Input & Output Module
5. Communication Interface Module

**Rack or Chassis:** In all PLC systems, the PLC rack or chassis forms the most important module and acts as a backbone to the system. PLCs are available in different shapes and sizes. . All I/O modules will be residing inside this rack/chassis.

**Power Supply Module:** This module is used to provide the required power to the whole PLC system. It converts the available AC power to DC power which is required by the CPU and I/O module. PLC generally works on a 24V DC supply. Few PLC uses an isolated power supply.

**CPU Module and Memory:** CPU module has a central processor, ROM & RAM memory. ROM memory includes an operating system, drivers, and application programs. RAM memory is used to store programs and data. CPU is the brain of PLC with an octal or hexagonal microprocessor.

Being a microprocessor-based CPU, it replaces timers, relays, and counters. Two types of processors as a single bit or word processor can be incorporated with a PLC. One bit processor is used to perform logic functions. Whereas word processors are used for processing text, numerical data, controlling, and recording data. CPU reads the input data from sensors, processes it, and finally sends the command to controlling devices. CPU also contains other electrical parts to connect cables used by other units.

**Input and Output Module:** PLC has an exclusive module for interfacing inputs and output, which is called an input & output module. Input devices can be start and stop pushbuttons, switches, etc and output devices can be an electric heater, valves, relays, etc. I/O module helps to interface input and output devices with a microprocessor.

## EXPERIMENT-9b

### 9b. Identify different types of PLC

#### 1. Based on Size

**Small [PLC]:** A small [PLC] computer can control smaller machines such as conveyors and motors. It has less functionality than the other two classes of PLCs and contains enough memory to store ladder logic programs for monitoring local I/O devices.

**Medium [PLC]:** A medium [PLC] is a computer that can control larger machines such as assembly lines and motors. It has more functionality than the other two classes of PLCs due to its large memory size, expanded communication ports, higher processing speeds, and additional input/output devices.

Examples of medium programmable controllers are digital-to-analog converters (DACs), These machines have PLC programming languages that allow many different logic structures to be implemented for monitoring devices and controlling machines.

**Large [PLC] :** A large PLC is a computer that can control very large machines such as whole building blocks or power-producing turbines. It has more functionality than the other two classes of PLCs due to its high memory size, expanded communication ports, high processing speeds, and additional input/output devices.

Some examples of large programmable controllers are analog output modules digital-to-analog converters (DACs), These machines have programming languages that allow many different logic structures to be implemented for monitoring devices and controlling machinery.

## 2. Based on Hardware Setup (The two main types of PLC are fixed / compact PLC and modular PLC.)

**Compact PLC:** Within a single case, there would be many modules. It has a fixed number of I/O modules and external I/O cards. So, it does not have the capability to expand the modules. Every input and output would be decided by the manufacturer.

**Modular PLC:** This type of PLC permits multiple expansions through “modules”, hence referred to as Modular PLC. I/O components can be increased. It is easier to use because each component is independent of each other.

**A Modular Type PLC** is divided into three types based on output namely Relay output, Transistor output, and Triac Output PLC. The relay output type is best suited for both AC and DC output devices. Transistor output type PLC uses switching operations and used inside microprocessors.

## 3. Based on Power

PLCs can be divided into two main types depending on their power supply: those with a built-in power supply and those that require an external power supply. These types of PLC do not have a built-in power supply, must be connected to



Supply

divided into two main types depending on their power supply: those with a built-in power supply and those that require an external power supply. These types of PLC do not have a built-in power supply, must be connected to

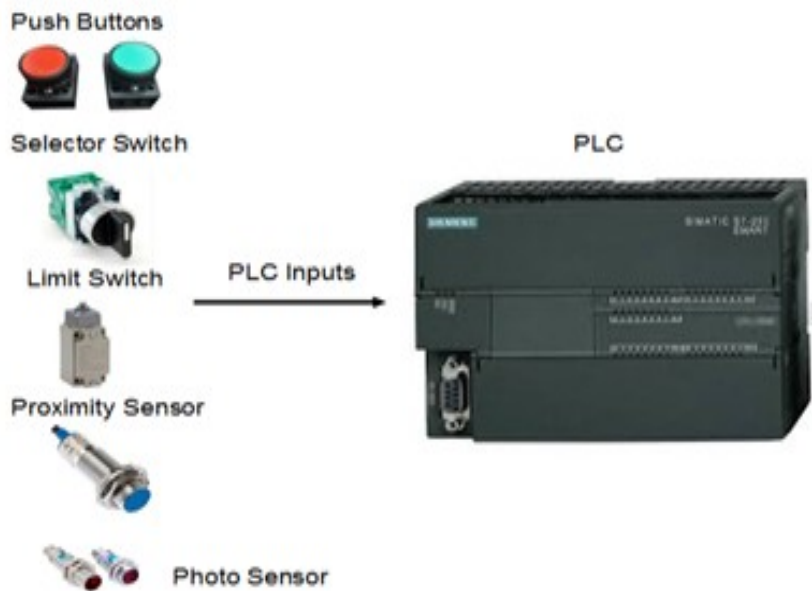
power source such as batteries. PLC with the built-in power supply: This type does have a built-in DC voltage DC24V or DC48V for the circuit inside the machine, so it will never need a separate battery or transformer.

## EXPERIMENT-9c

9c. Identify different input and output devices of PLC

Some examples of input devices include:

- Switches and push buttons.
- Sensing devices.
- Limit switches.
- Proximity sensors.
- Photoelectric Sensors.
- Condition sensors.
- Vacuum switches.
- Temperature switches



Output Devices

- Valves.
- Motor starters.
- Horns and alarms.
- Stack lights.
- Control relays.
- Pumps.
- Printers.
- Fans.



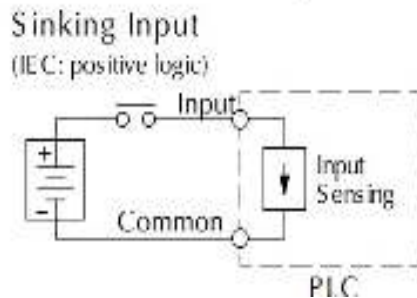
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EXPERIMENT-9d

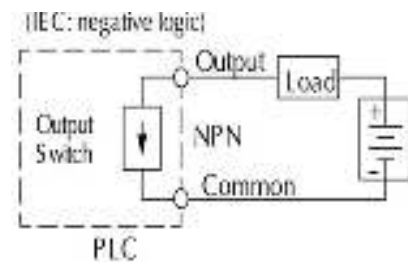
9d. Identify the wiring mode of PLC- sourcing and sinking modes

The Sinking and Sourcing are the input/output module cards used in PLCs. Conventional Relay cards are simple and very easy to the interface but limited lifespan. These problems can almost overcome by using

sinking and sourcing digital chords. A sinking digital I/O (input/output) provides a grounded connection to the load. The switching element used in sinking card is NPN, so they are also known as NPN cards **Sinking input:** A sinking input or output circuit provides a path to ground for the electric load. A sinking input or output circuit provides the necessary ground for the circuit.



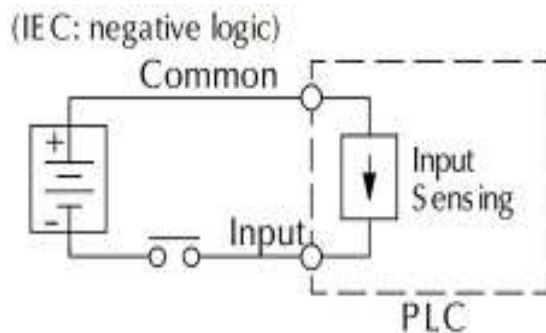
**Sinking input**



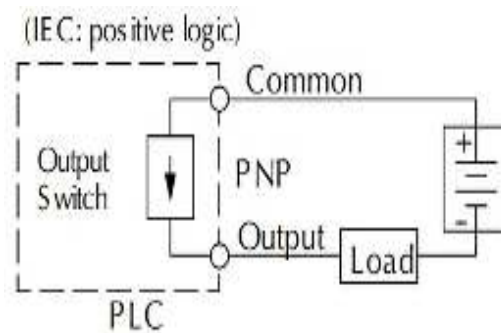
**sinking output**

**Advantages of sinking:** Ability to switch voltage higher than the card supply voltage, but two power supplies are required for proper interfacing

**Sourcing input:** The switching element used here is PNP and so they are known as PNP chords. Sourcing digital I/O provides a voltage source to the load. A sourcing input or output circuit provides the necessary voltage for the circuit.



**Sourcing output**



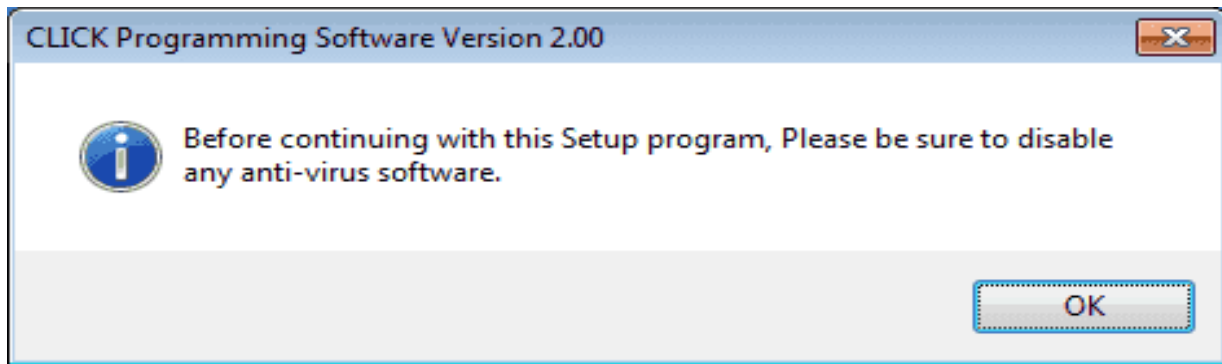
**sourcing output**

**Advantages of sourcing:**

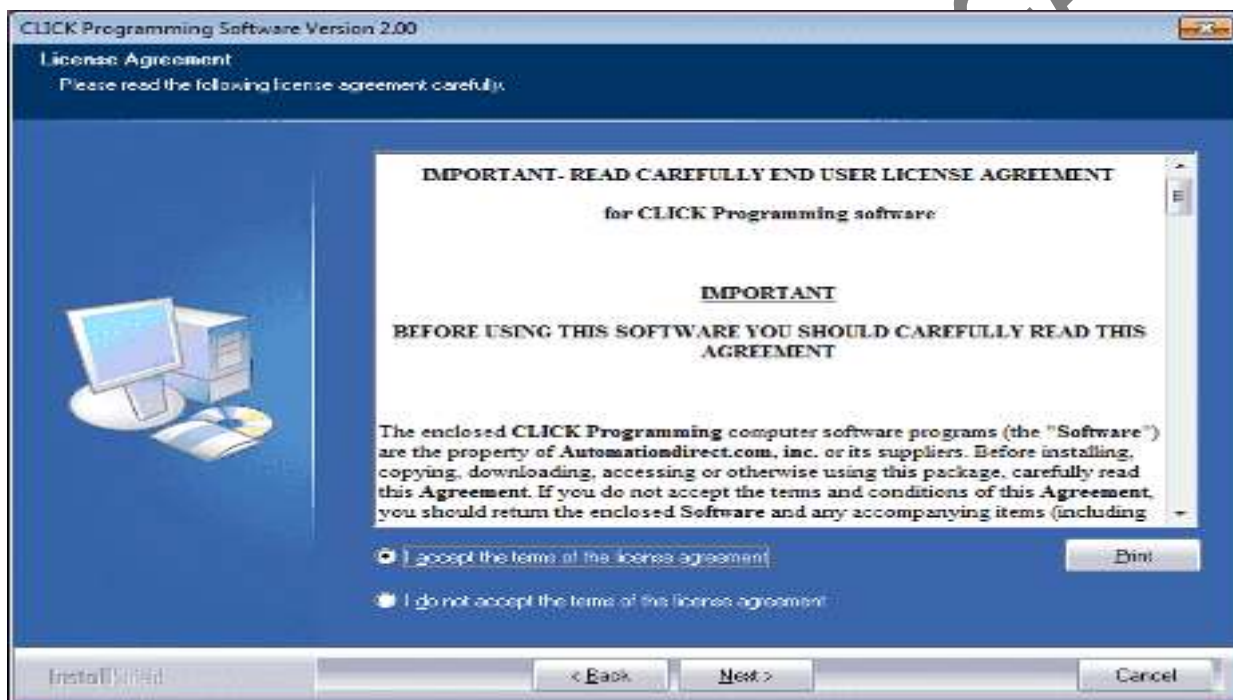
- Easier interfacing since only one power supply needed.
- The voltage load is limited to card supply voltage

## EXPERIMENT-9e

### 9e. Identify and Install Programming Software and communication driver



step1: The License Agreement will now be displayed. You must accept the terms of the license agreement before the software can be installed. Then Select (Click) 'Next'.



step2: Enter your name and company. Then Select (Click) 'Next'.

step3: You will be able to now choose the destination location. This is the location that the software will be installed. I leave this as the default. Select (Click) 'Next'.

step4: A notice will now appear that everything is ready to install the program. Select (Click) 'Install'.

step5: Files will now be installed on your computer. You will be able to cancel at any time by selecting the cancel button.

step6: Once everything is installed it will ask if you wish to create a desktop icon. I usually allow the icon to be created. Select (Click) 'Next'.

step7: The installation is now complete. Select (Click) 'Finish'.

step8: You will notice that an icon is now on your desktop. This is the shortcut to the Click PLC Software.

## **installation of PLC Communication driver**

PLC has three different ways to communicate to the unit. Serial RS232, Serial RS485, and Ethernet. As mentioned last time, RS232 is the most common method of communicating.

## DB9 Computer to RS232 PLC

If you have a DB9 connector on your computer then use the D2-DSCBL cable or make your own using the following pin out information in the Direct LOGIC PLC Programming Cable guide.

<http://www.automationdirect.com/static/specs/directsoftcables.pdf>

You can install this software from the Click Programming Software or from the separate file from the Automation Direct website mentioned above. (PL2302\_Koyo\_All\_in\_One.exe) Start the installation:

step1: The licensing agreement must be accepted. Then click 'Next'.

step2: The software has now been installed. Click 'Finish'.

step3: You can now plug in the DB9 Computer to RS232 PLC. The following window will be displayed on the computer.

step4: We have already installed the necessary drivers for the device. The window will change to the following.

### EXPERIMENT-10

Date: \_\_\_\_\_

10. Develop and test the ladder programs for the following motor controls:

a) Starting from two different locations (OR Function)

#### Aim

To Develop and test the ladder programs for OR, NOR, AND, NAND, EX-OR, EX-NOR, NOT Function using **PLC simulation software**

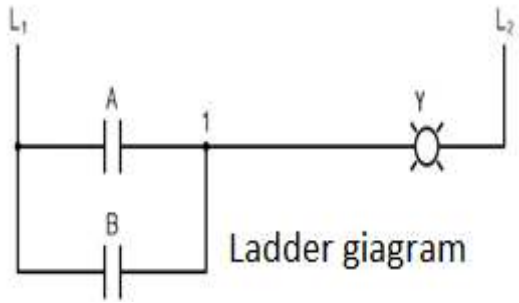
Apparatus required

1. AC31 GRAF Software
2. ABB PLC Trainer Kit
3. RS232 Downloading cable
4. Power cable
5. Connecting wires

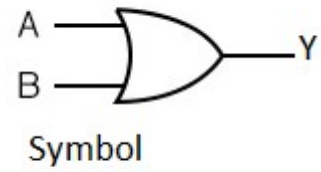
Procedure

1. Double click on AC31GRAF software icon
2. create a new project →new → create project name
3. draw the ladder logic diagram in the ladder program editor window
4. verify the programming symbol of the currently entered ladder program
5. click on build button which generates the code for the entire ladder program
6. click on the PLC communication and download the program to PLC module
7. verify the truth table or output for different conditions by selecting the input conductor

OR GATE



A	B	Output y
0	0	0
0	1	1
1	0	1
1	1	1



**ADDRESS AND VARIABLES**

**INPUT**

A= %i62.00

B = %i62.01

**OUTPUT**

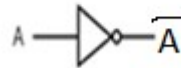
Y= %O62.00

BENGALURU

**B) STOPPING FROM ONE POSITION (NOT FUNCTION)**



A	Output
0	1
1	0



**ADDRESS AND VARIABLES**

**INPUT**

A= %i62.00

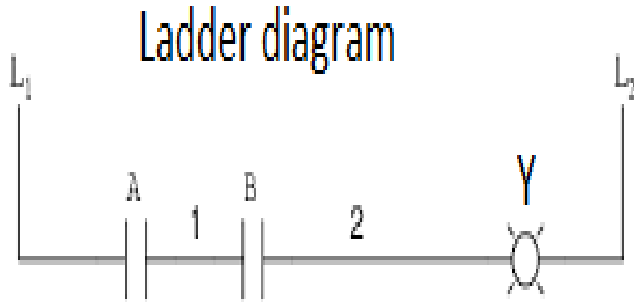
**OUTPUT**

$\bar{A}$  = %O62.00

**C) TWO HAND OPERATION (AND FUNCTION)**

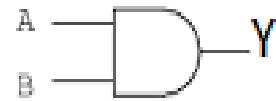
K. MURUGAN





A	B	Output
0	0	0
0	1	0
1	0	0
1	1	1

Truth table



Symbol

**ADDRESS AND VARIABLES**

**INPUT**

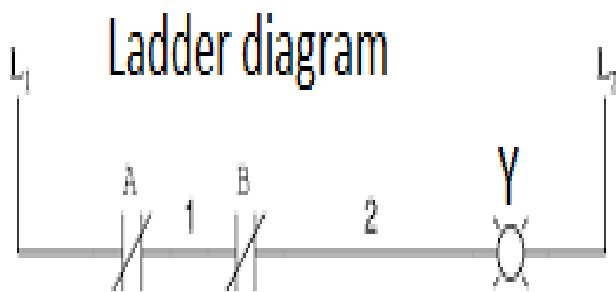
A= %i62.00

B = %i62.01

**OUTPUT**

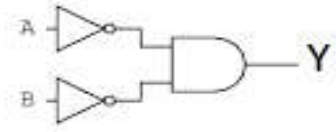
Y= %O62.00

**D) STOPPING FROM TWO DIFFERENT LOCATIONS (NOT+OR OR NOR FUNCTIONS)**



A	B	Output
0	0	1
0	1	0
1	0	0
1	1	0

Truth table



or



Symbol

**ADDRESS AND VARIABLES**

**INPUT**

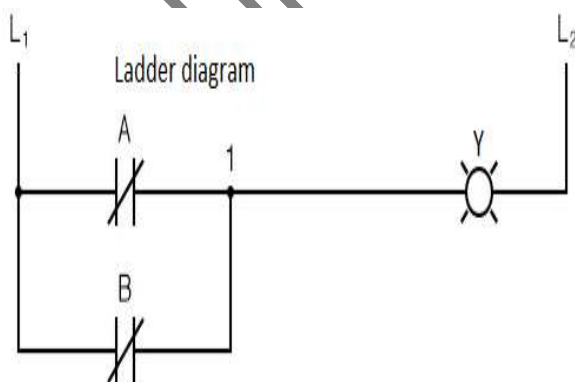
A= %i62.00

B = %i62.01

**OUTPUT**

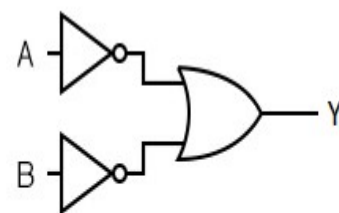
Y= %O62.00

**E) STOPPING IF BOTH SIGNALS ARE GIVEN (NOT+AND OR NAND FUNCTIONS)**

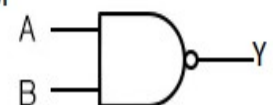


A	B	Output Y
0	0	1
0	1	1
1	0	1
1	1	0

Truth table



Symbol



**ADDRESS AND VARIABLES**

**INPUT**

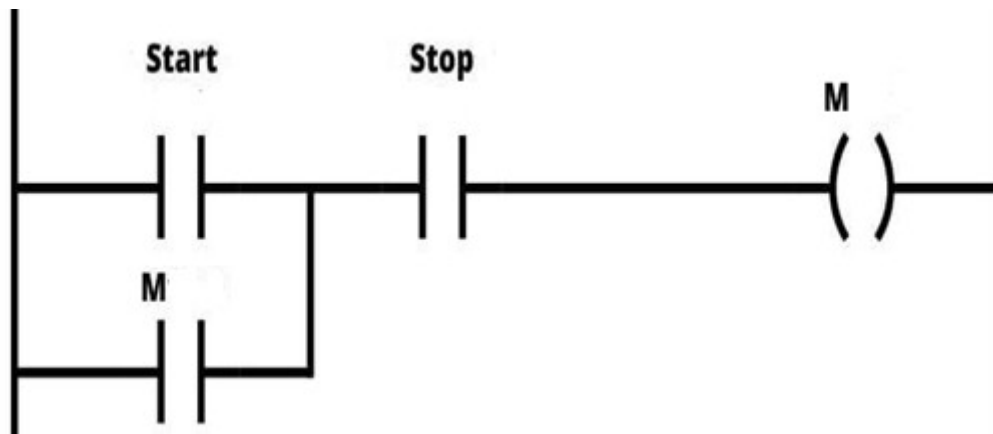
A= %i62.00

B = %i62.01

**OUTPUT**

Y= %O62.00

**F) MEMORY FUNCTION (SIGNAL IS MAINTAINED OR HOLDING)**



**ADDRESS AND VARIABLES**

**INPUT**

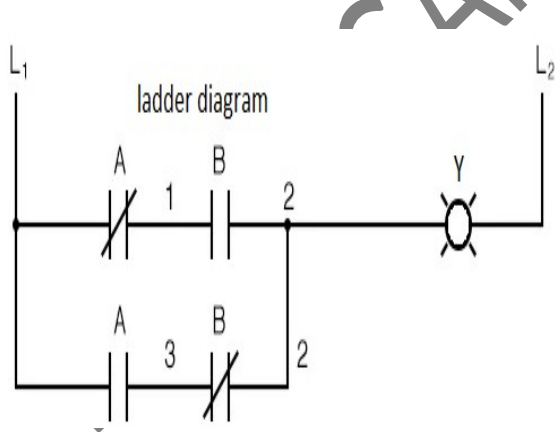
Start= %i62.00

Stop = %i62.01

**OUTPUT**

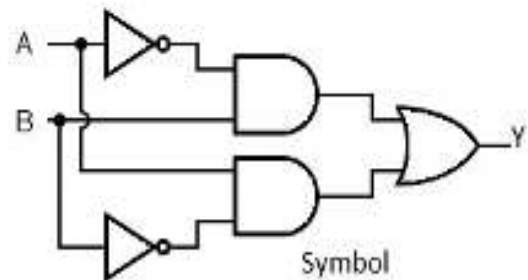
M= %O62.00

**G) INTERLOCKING PROTECTION (XNOR/XOR) XNOR GATE EX-OR GATE**

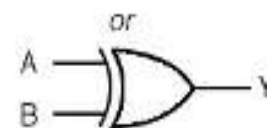


A	B	Output Y
0	0	0
0	1	1
1	0	1
1	1	0

Truth table



Symbol



**ADDRESS AND VARIABLES**

**INPUT**

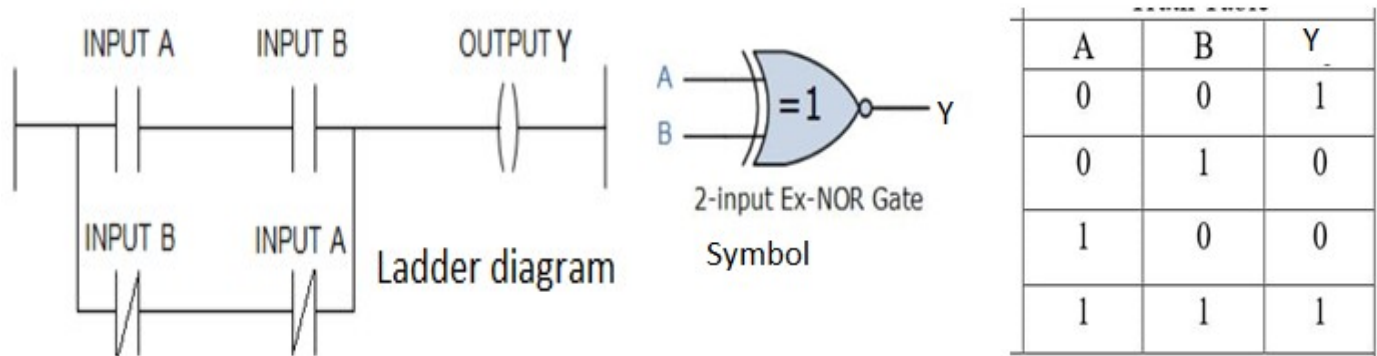
A= %i62.00

B = %i62.01

**OUTPUT**

Y= %O62.00

**EX-NOR GATE**



**ADDRESS AND VARIABLES**

**INPUT**

A= %i62.00

B = %i62.01

**OUTPUT**

Y= %O62.00

RESULT: All logic gates are verified using PLC kit

Signature of Staff

**PROGRAM- 10b**

Date:

**10b. Develop and test the ladder program for interlocking two motors, using PLC simulation software**

**Aim**

To Develop and test the ladder program for interlocking two motors, using **PLC simulation software**

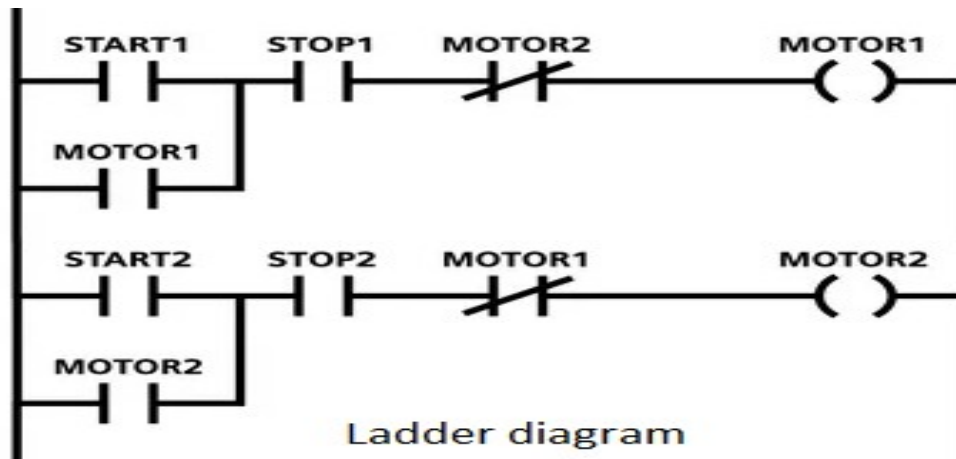
**Apparatus required**

1. AC31 GRAF Software
2. ABB PLC Trainer Kit
3. RS232 Downloading cable
4. Power cable
5. Connecting wires

**Procedure**

1. Double click on AC31GRAF software icon
2. create a new project →new → create project name
3. draw the ladder logic diagram in the ladder program editor window
4. verify the programming symbol of the currently entered ladder program
5. click on build button which generates the code for the entire ladder program
6. click on the PLC communication and download the program to PLC module
7. verify the truth table or output for different conditions by selecting g the input conductor

**Ladder Diagram**



**ADDRESS AND VARIABLES**

**INPUT**

START1= %i62.00  
 STOP1 = %i62.01  
 START2 =%i62.02  
 STOP2 = %i62.03

**OUTPUT**

MOTOR1= %O62.00  
 MOTOR2 = %O62.01

Result

The ladder program for interlocking two motors were developed and tested using **PLC simulation software**

**Signature of Staff**

**PROGRAM-11**

Date:

**11. Develop and test ladder program for switching ON motor 1, motor 2 and motor 3 in sequence with some time delay, using PLC simulation software.**

**Aim**

To Develop and test ladder program for switching ON motor 1, motor 2 and motor 3 in sequence with some time delay , using **PLC simulation software**

Apparatus required

1. AC31 GRAF Software
2. ABB PLC Trainer Kit
3. RS232 Downloading cable
4. Power cable
5. Connecting wires

Procedures

1. Double click on AC31GRAF software icon
2. create a new project →new → create project name

3. draw the ladder logic diagram in the ladder program editor window
4. verify the programming symbol of the currently entered ladder program
5. click on build button which generates the code for the entire ladder program
6. click on the PLC communication and download the program to PLC module
7. verify the truth table or output for different conditions by selecting g the input conductor

## ADDRESS AND VARIABLES

### INPUT

START= %i62.00

STOP = %i62.01

### OUTPUT

ONDELAY=%O62.00

STAR=%62.01

MAIN=%O62.02

DELTA=%O62.03

MOTOR1= %O62.05

MOTOR2 = %O62.06

MOTOR1= %O62.07

FREQUENCY\_1Hz =%M255.01

START1=MW000.00

M1=MW0000.01

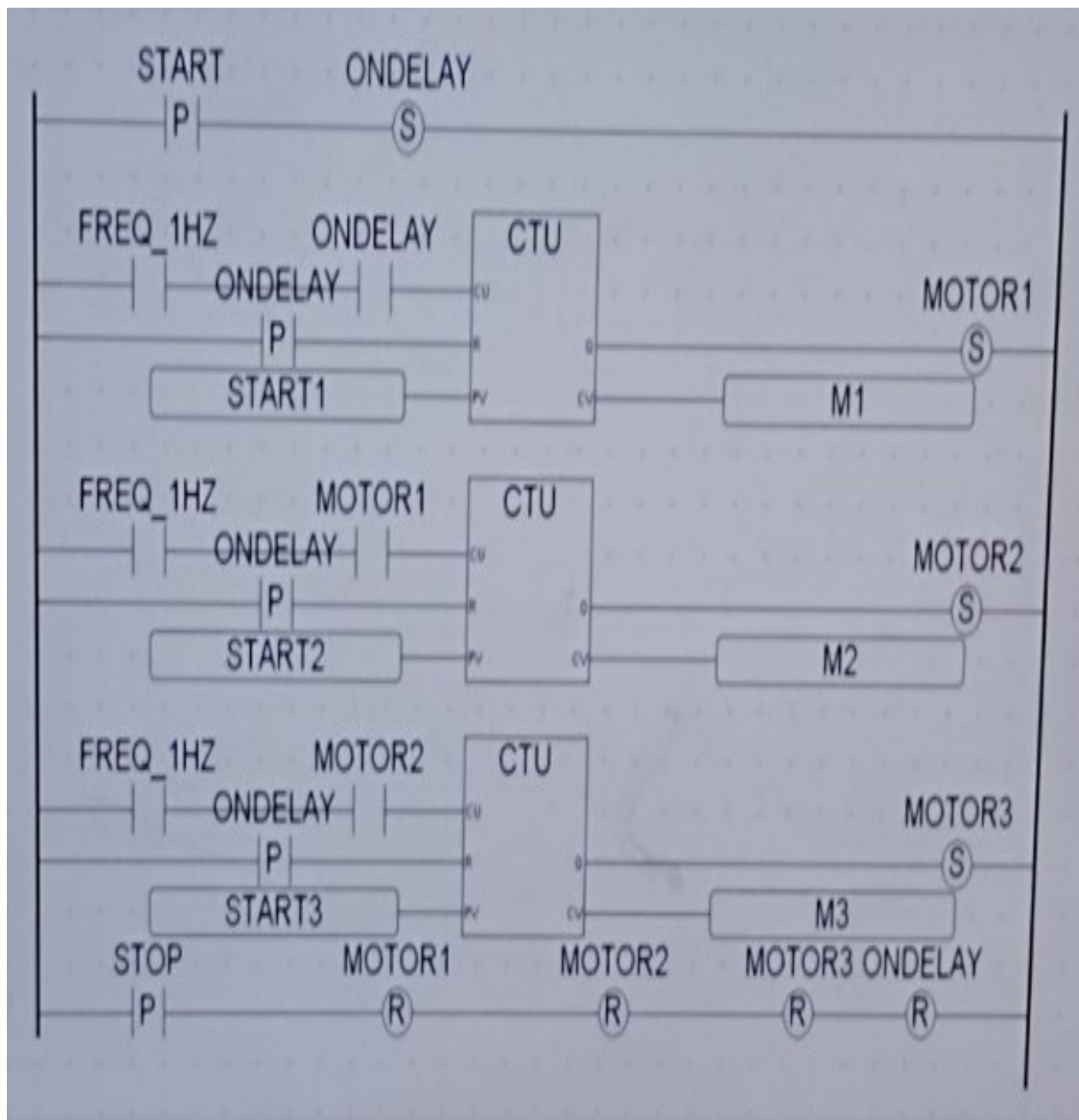
START2=MW000.02

M2=MW0000.03

START3=MW000.04

M3=MW0000.05

Ladder diagram



Sl no	Time in seconds motor1	Time in seconds Motor2	Time in seconds Motor3
1			
2			

Result

The ladder program for switching ON motor 1, motor 2 and motor 3 in sequence with some time delay are developed and tested using **PLC simulation software**

**PROGRAM-11b**

**Signature of Staff**  
**Date:**

11b. Develop and test the ladder program of the Alarm system for the following conditions: If one input is ON nothing happens, if any two inputs are ON- a red light turns ON, if any three inputs are ON- a Hooter/Alarm turns ON, using PLC simulation software.

## Aim

To Develop and test the ladder program of the Alarm system for the following conditions: If one input is ON nothing happens, if any two inputs are ON- a red light turns ON, If any three inputs are ON- a Hooter/Alarm turns ON, using **PLC simulation software**

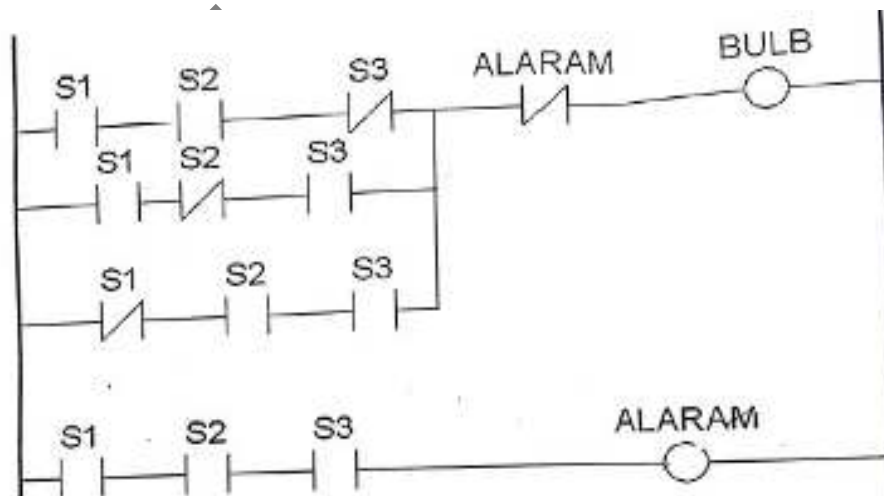
## Apparatus required

1. AC31 GRAF Software
2. ABB PLC Trainer Kit
3. computer
4. RS232 Downloading cable
5. Power cable
6. Connecting wires

## Procedure

1. Double click on AC31GRAF software icon
2. create a new project →new→create project name
3. draw the ladder logic diagram in the ladder program editor window
4. verify the programming symbol of the currently entered ladder program
5. click on build button which generates the code for the entire ladder program
6. click on the PLC communication and download the program to PLC module
7. verify the truth table or output for different conditions by selecting g the input conductor

## Ladder Diagram



### INPUT

S1= %i62.00  
S2 = %i62.01  
S3=%i62.02

### OUTPUT

BULB=%O62.00

ALARM=%62.01

## Result

The ladder program of Alarm system for the following conditions: If one input is ON nothing happens, if any two inputs are ON- a red light turns ON, if any three inputs are ON- a Hooter/Alarm turns ON were developed and tested using **PLC simulation software**

Signature of Staff

PROGRAM-11

Date:

## 12. Develop and test ladder Program for fully Automatic Star-Delta starter, using PLC simulation software.

### Aim

To Develop and test ladder Program for fully Automatic Star-Delta starter, using **PLC simulation software**

### Apparatus required

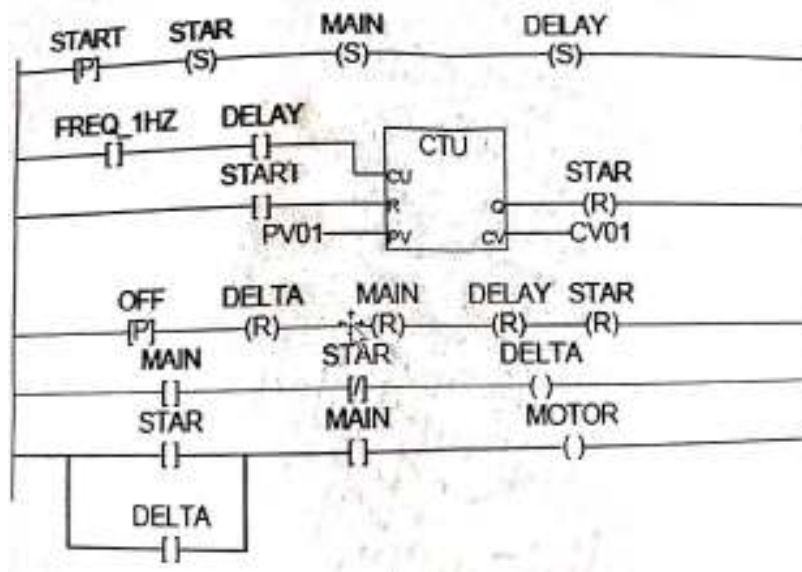
1. AC31 GRAF Software
2. ABB PLC Trainer Kit
3. computer
4. RS232 Downloading cable
5. Power cable
6. Connecting wires

### Procedure

1. Double click on AC31GRAF software icon
2. create a new project →new→create project name
3. draw the ladder logic diagram in the ladder program editor window
4. verify the programming symbol of the currently entered ladder program
5. click on build button which generates the code for the entire ladder program
6. click on the PLC communication and download the program to PLC module
7. verify the truth table or output for different conditions by selecting g the input conductor

### Ladder Diagram





Result

The ladder program for fully Automatic Star-Delta starter were developed and tested using **PLC simulation software**

Signature of Staff

### 13. Demonstrate application of SCADA/HMI/DCS

SOME APPLICATIONS OF SCADA

**1. Water/Wastewater systems:** SCADA systems monitor and control the water being pumped at wells and treated at water treatment plants. They are used to control flow rate sensors, contaminant sensors, etc., fill overhead storage tanks and control booster pumps to regulate the pressure of water being supplied to users, and many other tasks.

**2. Food/Pharma production:** This is a major SCADA application. SCADA is used to monitor and control all phases of production, control the exact mix of ingredients, monitor the time and temperature required to process/manufacture food & beverages or pharmaceutical products. SCADA also helps to document data that proves the production process meets industry standards and governmental regulations.

**3. Manufacturing plants:** SCADA precisely controls all plant operations, ensuring all systems run smoothly and productivity targets are met. It tracks how many units

are produced, measures values like temperature, pressure, humidity, etc. at different production stages, control assembly-line robots, monitor parts usage so just-in-time inventory control is implemented.

**4. Oil & Gas systems:** SCADA systems are used to monitor wells and pumping sites, pumping pressure, pipeline flow and compressor stations. It detects anomalies and prevents catastrophic events from occurring – thus enhancing safety.

**5. Electricity Generation, Transmission and Distribution Systems:** SCADA is used to monitor every phase of generating electricity from fuel input to electrical output. SCADA also monitors and controls electrical substations and distribution lines. SCADA is utilized to monitor and control the amount of electrical power being transmitted over long distances, and to respond instantaneously to fluctuations in demand.

### Applications for Human Machine Interfaces

#### Automotive Dashboards

Several of the world's leading automakers are now adding HMIs into their vehicles. A typical in-car HMI may consist of a touchscreen-enabled interface through which the driver or passenger can control systems like the heating, air conditioning, turn-by-turn navigation, radio/stereo, and more. And this isn't a trend that will go away anytime soon, as industry experts predict that more automakers will jump on board with HMI technology in the years to come.

#### Equipment/Machinery Monitoring

Another common application for HMI involves the monitoring of equipment and/or machinery. This is particularly common in factories and other industrial settings, as workers rely on HMIs to ensure their equipment is running properly. The HMI is connected to the respective equipment and/or machinery, sending it valuable data about its processes. If the equipment begins to fail, workers will notice the change in the HMI.

#### Electronic Displays

HMIs can also be used for electronic displays. An HMI, in its most basic form, is nothing more than an interface through which a human operator controls a machine. So, an HMI could essentially be a touchscreen interface that is used to display e-ink text. You'll frequently find HMI electronic displays such as this being used in offices and similar commercial workplaces.

#### Building Automation

Home and building automation has become a hot topic as of late. It involves connecting multiple indoor systems together so they can be controlled from a single interface. Some of the systems connected in building automation may include heating and air, humidity, lights, and security systems. HMIs are frequently used in building automation, as it streamlines the process while providing the owner with a convenient control interface.

#### Audio/Video Production

One of the lesser-known applications for HMIs is audio/video production. A/V companies may use HMIs to control their microphones and video cameras.

## Applications of Distributed Control System

The processors where the DCS is employed are

1. Nuclear power plants, chemical, and petrochemical, metallurgical plants
2. Automobile engineering
3. Food processing industries
4. Pharmaceutical industry
5. Water handling and sewage plants
6. Environmental management systems
  
7. Chemical plants
8. Organic compound (oil) and refineries
9. Pulp and Paper Mills
10. Boiler controls and power station systems
11. Atomic power plants
12. Environmental management systems
13. Water management systems
14. Water treatment plants
15. Sewerage treatment plants
16. Food and food process
17. Biochemical and fertilizer
18. Metal and mines
19. Automobile producing
20. Metallurgic method plants
21. Pharmaceutical producing
22. Sugar purification plants
23. Agriculture Applications

**CIE-4 Skill Test Scheme of Evaluation**

SL. No.	Particulars/Dimension	CO	Marks
1	Portfolio evaluation of Practice Sessions (week1-week6)		10
2	1. Identify different pneumatic components 2. Identify various sensors	1 & 2	10
3	Select and test suitable sensor for a given application	05+15	20
4	Test a given Linear Actuator Solenoid OR Install, wire and test digital time delay relay	2	15
5	Demonstrate & control the Pneumatic actuators using pneumatic valves. i. Draw the circuit diagram using right symbols 05 ii. Build the circuit as per the circuit diagram 10 iii. Demonstrate the operation of a Pneumatic actuators 20	3	35
6	Viva voce		10
<b>Total Marks</b>			<b>100</b>

**CIE-5 Skill Test Scheme of Evaluation**

SL. No.	Particulars/Dimension	CO	Marks
1	Portfolio evaluation of Practice Sessions (week7- week12)		10
2	i. Identify different input and output devices of PLC ii. Identify various indicators on PLC Modules.	3	10
3	Explain Scope of IEC standard for PLC: IEC 61131	3	10
4	Demonstrate the implementation of given application using PLC i. Draw the ladder diagram and PLC wiring diagram using right symbols 10 ii. Simulate the ladder diagram using PLC simulator and check the automation logic by activating the respective inputs 20 iii. Upload the Ladder program into PLC and execute 10 iv. Demonstrate desired output from PLC. 20	3	60
5	Viva voce		10
<b>Total Marks</b>			<b>100</b>

SEE Scheme of Evaluation

SL. No.	Particulars/Dimension	CO	Marks	
1	Portfolio evaluation of Practice Sessions		10	
2	i. For a given automation application select suitable pneumatic components and sensors.	1, 2	10	
3	Demonstrate & control the Pneumatic actuators using pneumatic valves.	1 / 3	40	
	i. Draw the circuit diagram using right symbols			10
	ii. Build the circuit as per the circuit diagram			20
	iii. Demonstrate the operation of a Pneumatic actuators			10
	<b>OR</b>			
Demonstrate the implementation of given application using PLC				
i. Draw the ladder diagram using right symbols	10			
ii. Simulate the ladder diagram using PLC simulator and check the automation logic by activating the respective inputs	15			
iii. Upload the Ladder program into PLC and execute	05			
iv. Demonstrate desired output from PLC.	10			
4	Demonstrate simple application of SCADA using SCADA software.	4	20	
5	Viva voce		20	
<b>Total Marks</b>			<b>100</b>	

THANK YOU