PRACTICAL NO: 1

Date : 6/01/25

TITLE : Ladder Programming for basic logical Operations.

AIM / OBJECTIVE: To design & implement logical gates (OR, AND, NOT, NOR, NAND, EOR) using programmable logic controllers (PLC) to understand their working and protocol applications in automation system.

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

PLC Hardware (Simulator (siemens)), PLC programming software, (TIA portal), PC/Laptop, output devices (eg. LED).

CONCEPT / THEORY OF EXPERIMENT:

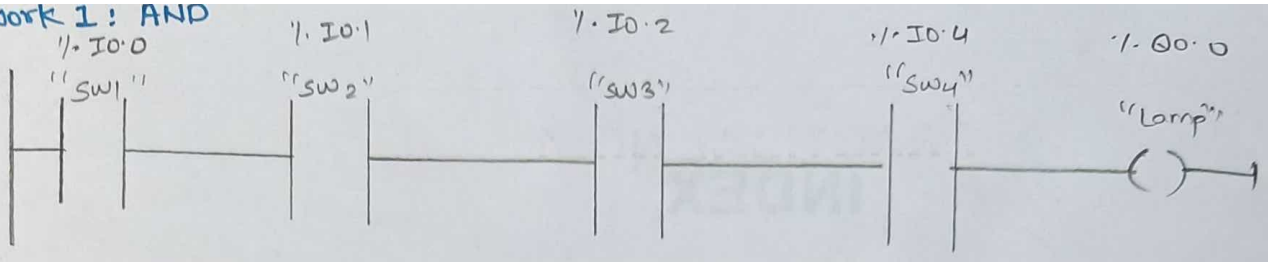
PLC (Programmable Logic Controller):- is an industrial digital computer used for automation. PLC's are widely used in industries for logic based operations.

Logic Gates: are fundamental building blocks in digital circuits that perform logical operations based on Boolean algebra. Implementing logic gates in PLC involves using ladder Logic.

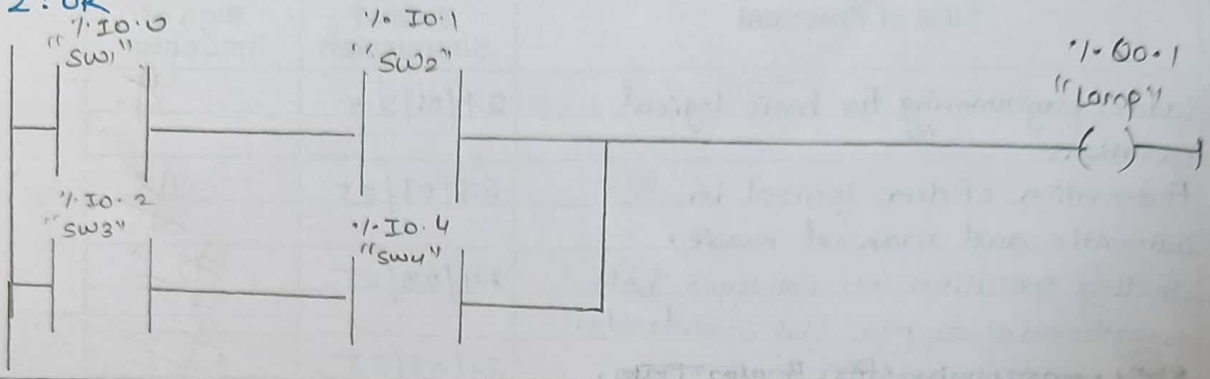
PROCEDURE :

1) Open TIA Portal V14.
2) Select PLC & configure the hardware.
3) Create a new PLC program.
4) Implement Logic gates in Main OB1.
5) Assign input and output tags.
6) Compile the program and check for errors.
7) Download the program to PLC & switch to Online Mode.
8) Test the logic gates by pressing the input buttons and observing output status in real time.

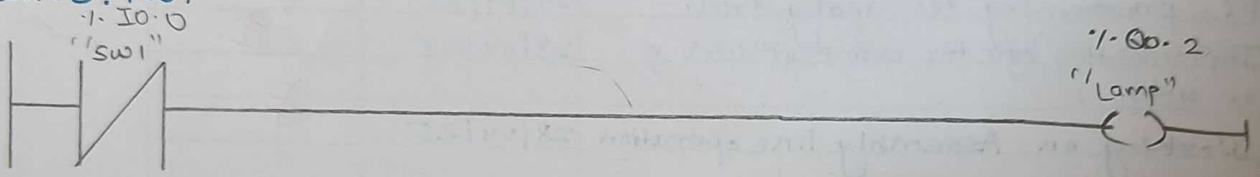
Network 1 : AND



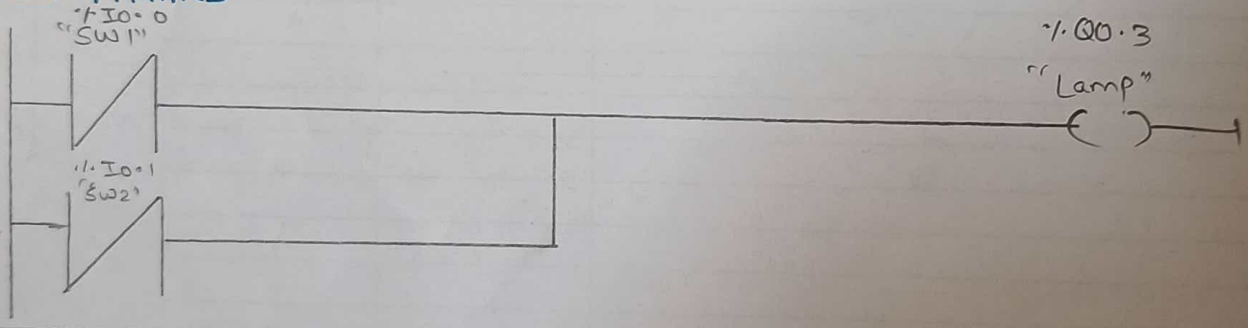
Network 2 : OR



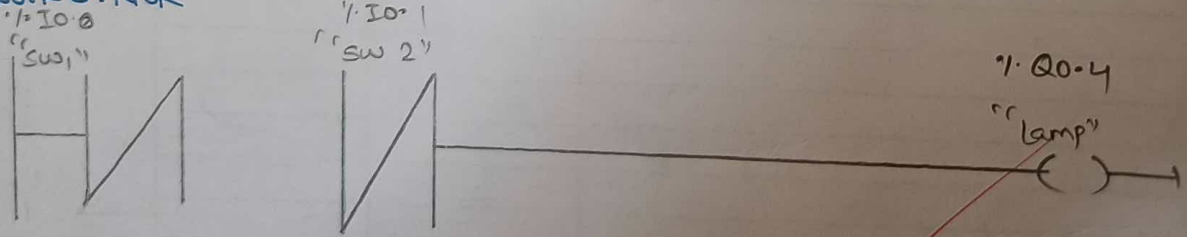
Network 3 : NOT



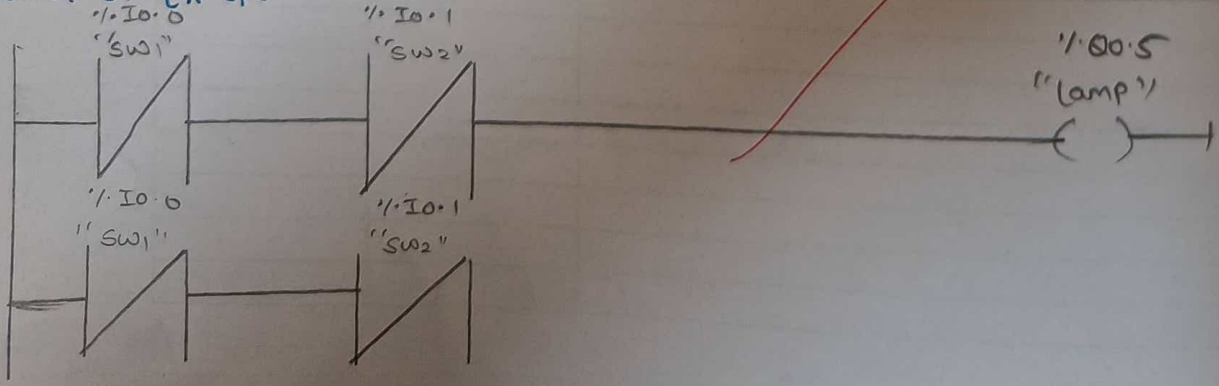
Network 4 : NAND



Network 5 : NOR



Network 6 :- Ex-OR



- PLC tags [CPU 314C-2PN/DP]

Name	Data Type	Address
SW1	Bool	%I0.0
SW2	Bool	%I0.1
SW3	Bool	%I0.2
SW4	Bool	%I0.4
Lamp	Bool	%Q0.0
Lamp(1)	Bool	%Q0.1
Lamp(2)	Bool	%Q0.2
Lamp(3)	Bool	%Q0.3
Lamp(4)	Bool	%Q0.4
Lamp(5)	Bool	%Q0.5

OBSERVATIONS

TRUTH TABLE :-

1) AND GATE

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

2) OR GATE

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

3) NOR GATE

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

4) NAND GATE

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

5) EX-OR GATE

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

6) NOT GATE

A	Output
0	1
1	0

CALCULATIONS :

RESULTS :

1) The logical gates were successfully implemented in the PLC.

2) The output for each gate matches the expected truth table.

3) PLC demonstrates and reliable logical operations.

CONCLUSION :

This experiment successfully demonstrate implementation of AND, OR, NOT, NAND, NOR, EOR gates using PLC.

Assessment Parameters (To be filled by Instructor)

1. Successful completion of Practical (Y/N)
2. Time taken (hours / minutes) : 2 Hrs.

3. List other Parameters & Outcomes :

Sr. No.	Parameter	(Achieve
1)	To program & simulate different logical gates in a PLC environment.	
2)	To understand practical application of logical gates with various input configuration.	Y
3)	To familiarize with basic logical operations using PLC.	

Remarks :

PRACTICAL NO: 2

Date : 20/01/25

TITLE : Automation of door control in automatic and manual mode.

AIM / OBJECTIVE: To implement a PLC program for operations of door in two modes: Manual (Hand mode) and Automatic mode.

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

PLC Hardware, PLC programming software (TIA portal)
switches, Indicator, sensors and Actuators.
Power supply
Connecting cable
Wiring setup

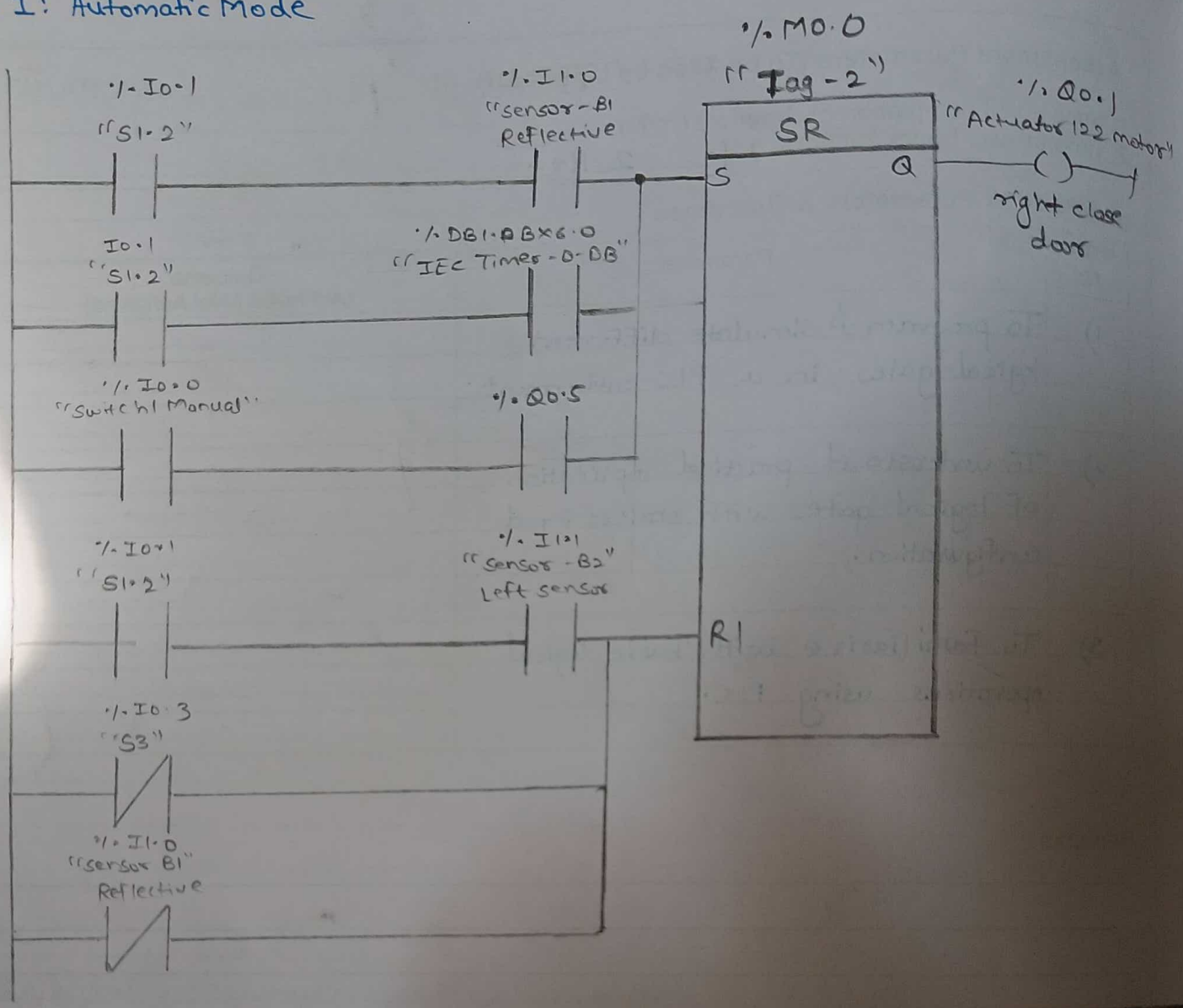
CONCEPT / THEORY OF EXPERIMENT:

1) Automatic Mode:- The door automatically opens when sensor detects a person approaching, triggered by a signal to PLC, which activates motor to open the door
2) Manual Mode :- The user manually operates the door using switches, allowing opening and closing without sensor intervention.

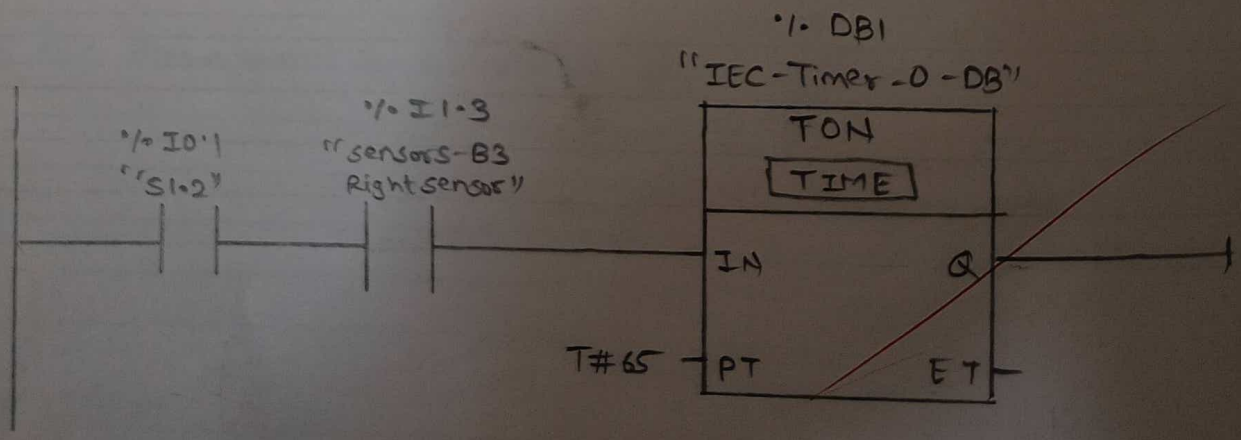
PROCEDURE :

1) Create New project in TIA V14, configure the PLC.
2) Define input & output.
3) Create tags for switches, indicators, sensors and actuators.
4) Program Automatic mode.
5) Program manual mode.
6) Compile the program.
7) Download the program to PLC.
8) Test automatic and manual operations.

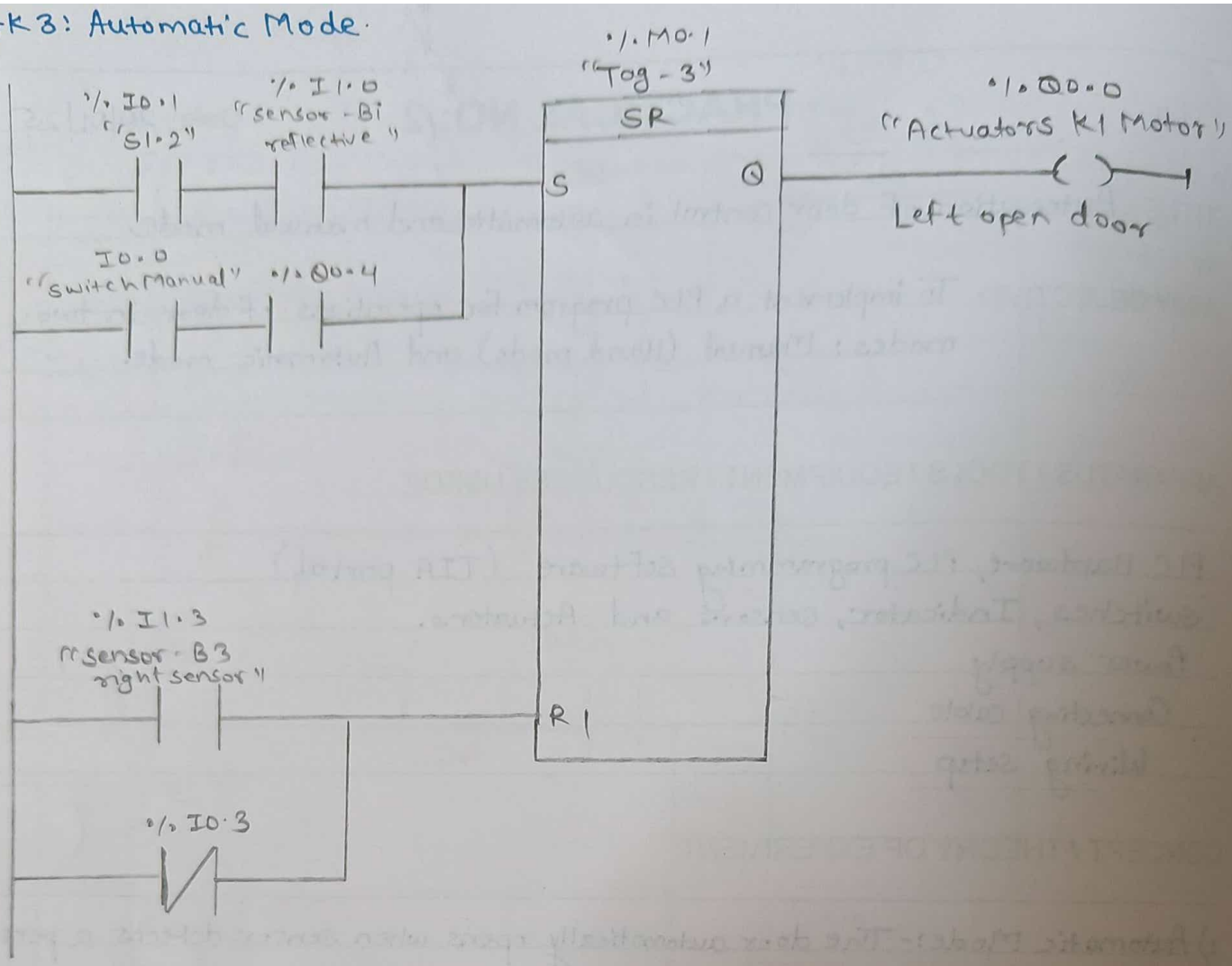
• Network 1: Automatic Mode



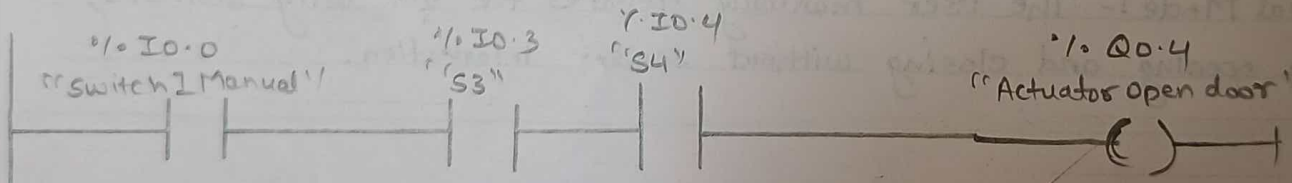
Network 2: Automatic Mode

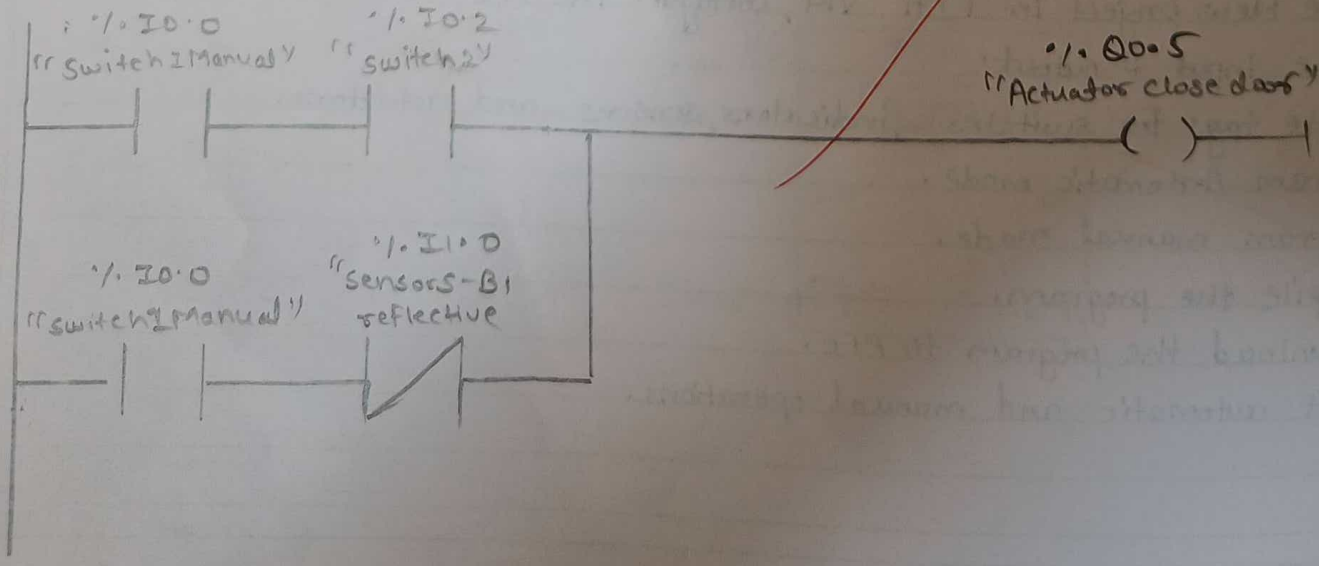


Network 3: Automatic Mode



Network 4: Manual Mode





OBSERVATIONS

Name	Address
"S1.2" Auto switch	%I0.1
"Switch 1 Manual"	%I0.0
"Switch 2" - Left motor	%I0.2
"S3" - Emergency stop	%I0.3
"S4" - Right motor	%I0.4
Switch	
"Sensor - B1 reflective"	%I1.0
"Sensor - B2 left sensor"	%I1.1
"Sensor - B3 right sensor"	%I1.3
"Actuator K1 motor"	%Q0.0
"Actuator K2 motor"	%Q0.1
"Actuator open door"	%Q0.4
"Actuator close door"	%Q0.5
"IEC - Timer - 0 - DB"	%DB1

CALCULATIONS :

RESULTS :

1) The door successfully operates in both manual and automatic modes.

2) In Automatic mode, the door opened and closed based on sensor detection, ensuring hands free operation.

3) In manual mode, the door responded to open and close switches.

CONCLUSION :

This experiment successfully demonstrates the implementation of dual mode door control system using PLC.

Assessment Parameters (To be filled by Instructor)

1. Successful completion of Practical (Y/N)
2. Time taken (hours / minutes) : 2 Hr.

3. List other Parameters & Outcomes :

Sr. No.	Parameter
1)	Understood PLC programming.
2)	Learnt sensor and Actuator Integeration: Understood working of motion sensor, switches and motors in an automated system.
3)	Practical application of Industrial Automation: developed skills applicable to real world industrial door automation.

Remarks :

PRACTICAL NO: 3

Date : _____

TITLE : Sorting Operation on conveyers belt programming as per the standards.

AIM / OBJECTIVE: To implement a PLC program for operation of setting operation on conveyers belt programming.

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

PLC Hardware, PLC programming software (TIA V14), IMS virtual, TIA simulation, Power supply, connecting cable.

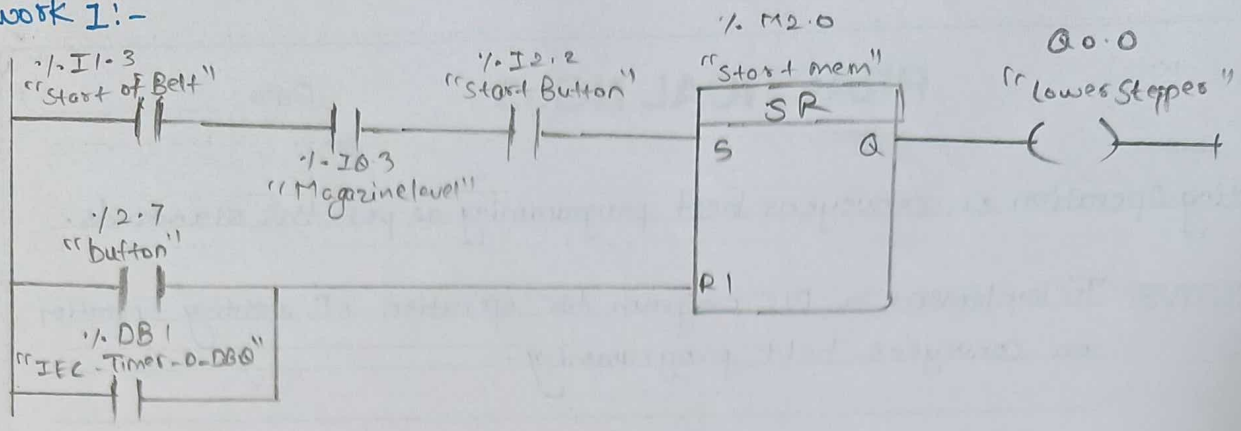
CONCEPT / THEORY OF EXPERIMENT:

Sorting Operation on conveyer bets involve classifying objects based on predefined criteria such as size, weight, cloour, shape. These operations are widely used in industries like logistics, manufacturing and packging. The sorting process is typically automated using sensors and programmable logic controllers to ensure accuracy and efficiency.

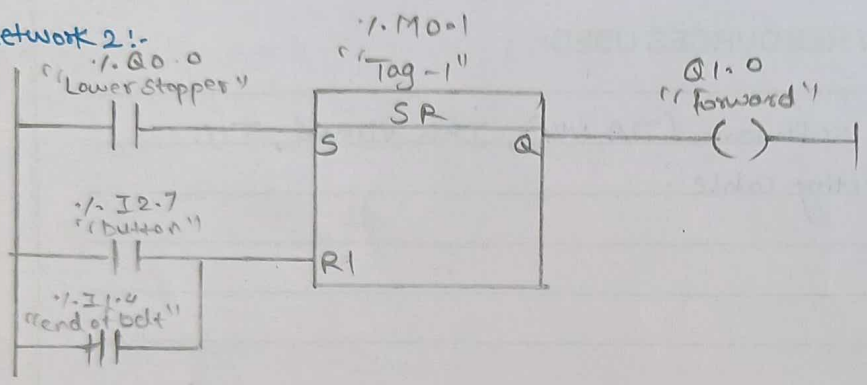
PROCEDURE :

1) Open TIA V14 and create a project.
2) Define Inputs & outputs.
3) Create Required Tags.
4) Code for sorting operations.
5) Compile the program.
6) Open IMS virtual and open sorting operation IMS.
7) Now, click Start Simulation & then download the program. Put the virtual PLC to RUN Mode.
8) Test the sorting operation on the virtual window.

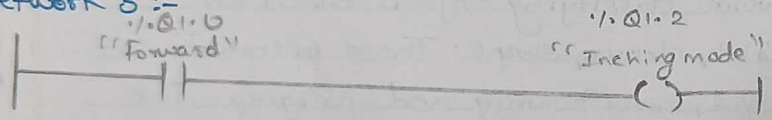
Network 1:-



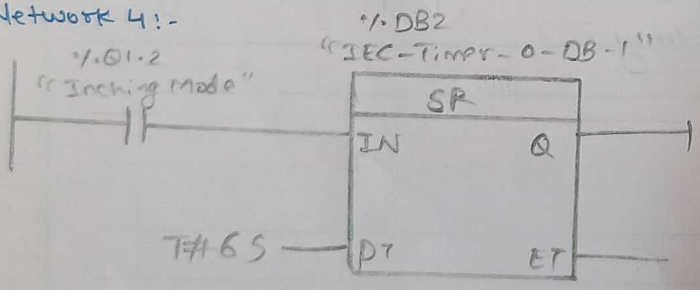
Network 2:-



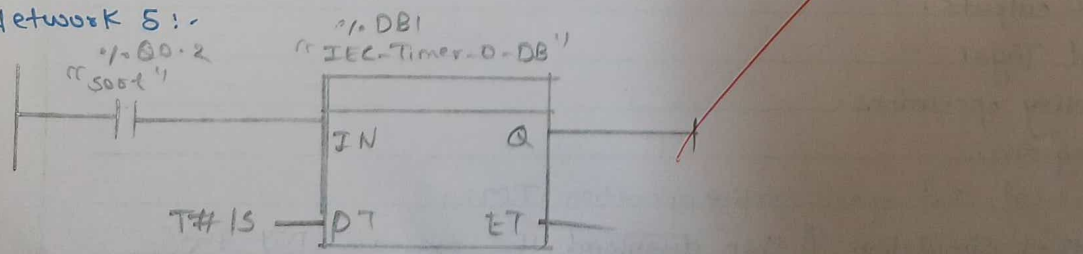
Network 3:-



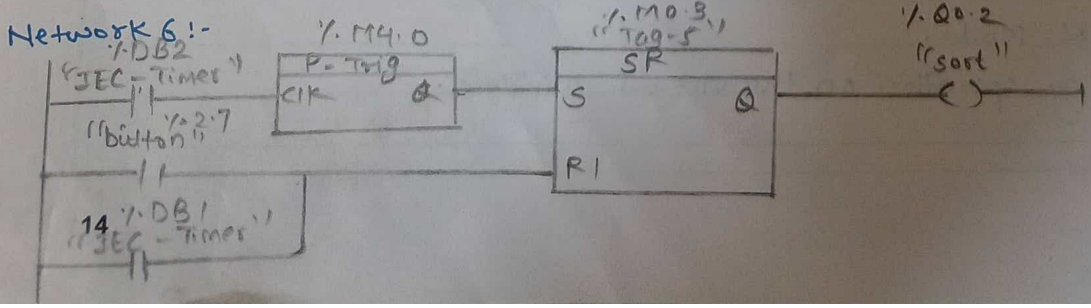
Network 4:-



Network 5:-



Network 6:-



OBSERVATIONS

PLC Tags :-

Name	Instruction	Address
"Start of Belt"	NO	%I1.3
"end of belt"	NO	%I1.4
"Magazine level"	NO	%I0.3
"Start Button"	NO	%I2.2
"start Mem"	SR flipflop	%M2.0
"lower stopper"	Output	%Q0.0
"IEC_Timer_0_DB"	TON	%DB1
"Tag_1"	SR Flipflog	%M0.1
"Forward"	Output	%Q1.0
"Inching Mode"	NO	%Q1.2
"IEC_Timer_0_DB1"	TON	%DB2
"Tag_8"	P_Trig	%M4.0
"Tag_5"	SR_flipflop	%M0.3
"Sort (select one piece)"	NO	%Q0.2

RESULTS :

1) The conveyer starts when Button is pressed.
2) The object is piece gets sorted.
3) PLC executed logic with minimal delay.
4) Object gets detected.

CONCLUSION :

The experiment succcasfully demonstrates the implementation of sorting operation on conveyer belt.

Assessment Parameters (To be filled by Instructor)

1. Successful completion of Practical (Y/N)
2. Time taken (hours / minutes) : 2 Hr.

3. List other Parameters & Outcomes :

Sr. No.	Parameter
1)	Understood PLC programming.
2)	Learnt Sorting Operation on conveyer belt programming.
3)	Able to run the program and observe the sorting operation.
4)	Rectify the code for any errors.

Remarks :

PRACTICAL NO: 5

Date : 10/03/25

TITLE : Water level ON-OFF Controller.

AIM / OBJECTIVE: To implement & design a water level monitoring system using siemens PLC (TIA Portal) that automatically controls pump based on predefined water level limits.

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

1) Siemens PLC.
2) TIA Portal.
3) Power Supply.
4) Water pump.
5) HMI Module & water level sensor.

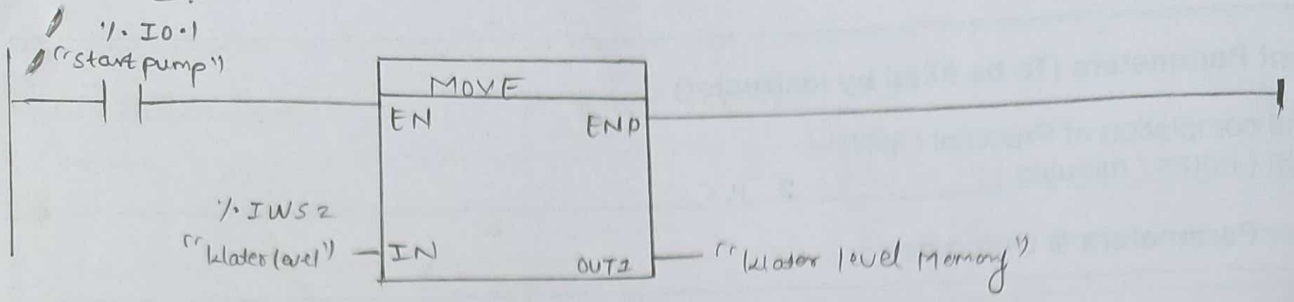
CONCEPT / THEORY OF EXPERIMENT:

In this practical, Siemens PLC (S7-1200) and TIA portal are used to implement a water level monitoring system that controls a pump based on sensor inputs. The system automatically turns ON the pump when the water level reaches lower limit and turns off when it reaches upper limit to prevent overflow.

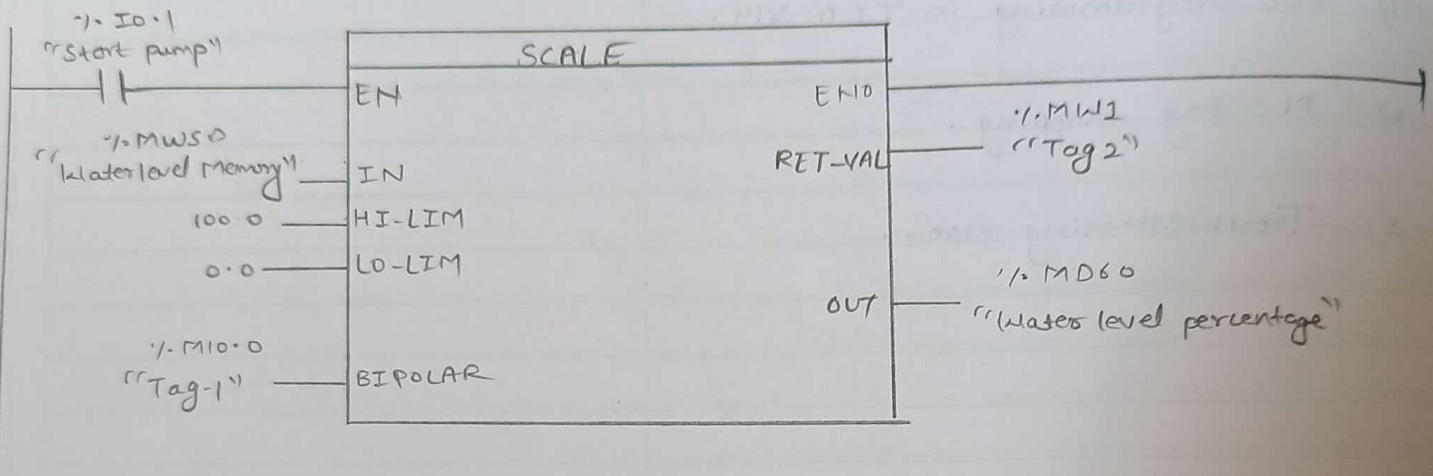
PROCEDURE :

1) Open TIA V14 and create a project.
2) Define input % I0.1 to start pump and connect pump/ relay to PLC output Q0.1.
3) Provide 24V power supply.
4) Write a ladder program where the pump turns ON when low level sensor is active and turns off when high-level sensor is active.
5) Code and compile the program.
6) Upload program to PLC, monitor real-time values and use an HMI for visual representation and manual control.

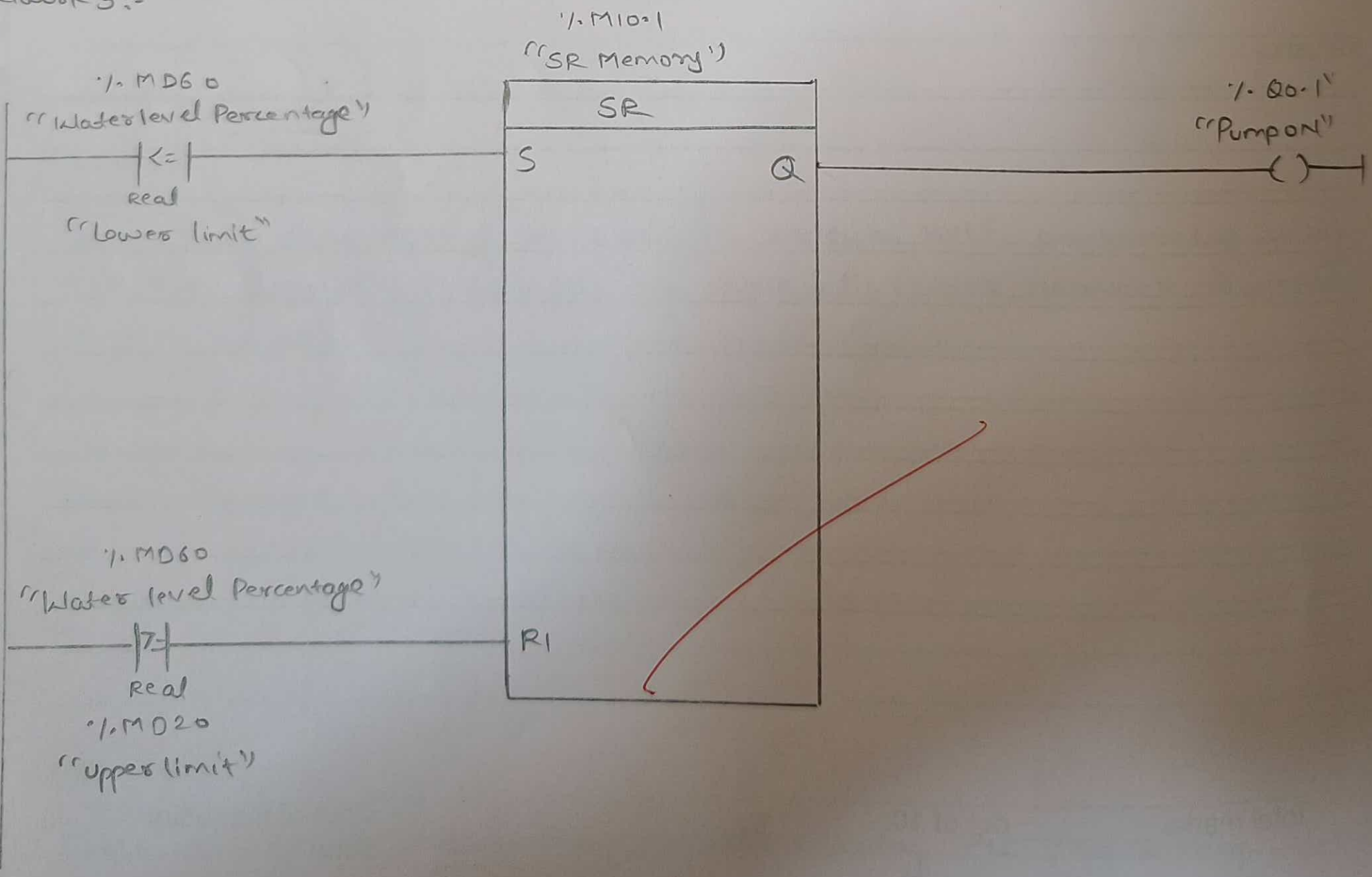
Network 1 :-



Network 2 :-



Network 3 :-



OBSERVATIONS

PLC Tags [PLC-1 [CPU 314C-2PN/DP]

Name	Data Type	Address
START	BOOL	%.M10.2
Pump ON	BOOL	%.Q0.1
Water level	Int	%.IWS2
Water level	Int	%.MWS0
Memory		
Start pump	BOOL	%.I0.1
Tag-1	BOOL	%.M10.0
Tag-2	Word	%.MW1
Water level	Real	%.MD60
Percentage		
SR Memory	BOOL	%.M10.1
Upper limit	Real	%.MD20
Lower limit	Real	%.MD4
Reset	BOOL	%.I0.2

HMI Tags

Name	Tag Table	Data Type	PLC Tag	Address
HMI lower limit		Real	"Lower limit"	%.MD4
HMI_Start	Default Tag	BOOL	START	%.MI0.2
HMI_Upper limit	Table	Real	"Upper limit"	%.MD20
HMI Water %		Real	"Water level%"	%.MD60

CALCULATIONS :

RESULTS :

1) Sensors detect water level in tank and send signals to PLC.

2) When water level drops below low-level, PLC activates the pump (Q0.1) to turn ON.

3) Once water reaches high level, PLC turns off the pump to stop further filling.

4) PLC continously monitors water level & restarts pump only when low level sensor detects an empty tank.

5) Automation and safety: This system ensures automatic water management, prevents overflow, dry running and enhances pump lifespan.

CONCLUSION :

The water level monitoring system using siemens PLC successfully controlled water pump based on sensors inputs, ensuring automatic operation at defined lower & upper limits.

Assessment Parameters (To be filled by Instructor)

1. Successful completion of Practical (Y/N)
2. Time taken (hours / minutes) : 2 Hr

3. List other Parameters & Outcomes :

Sr. No.	Parameter	(Ac
1)	Understand PLC programming.	
2)	learnt how PLC can be used to implement a water level monitoring system that turns on pump when water level reaches lower limit & turns off when water level reaches higher limit.	

Remarks :

PRACTICAL NO: 6

Date : 25/04/25

TITLE : PLC programming for analog data.

AIM / OBJECTIVE: To program a PLC for analog data processing in Industrial Automation.

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

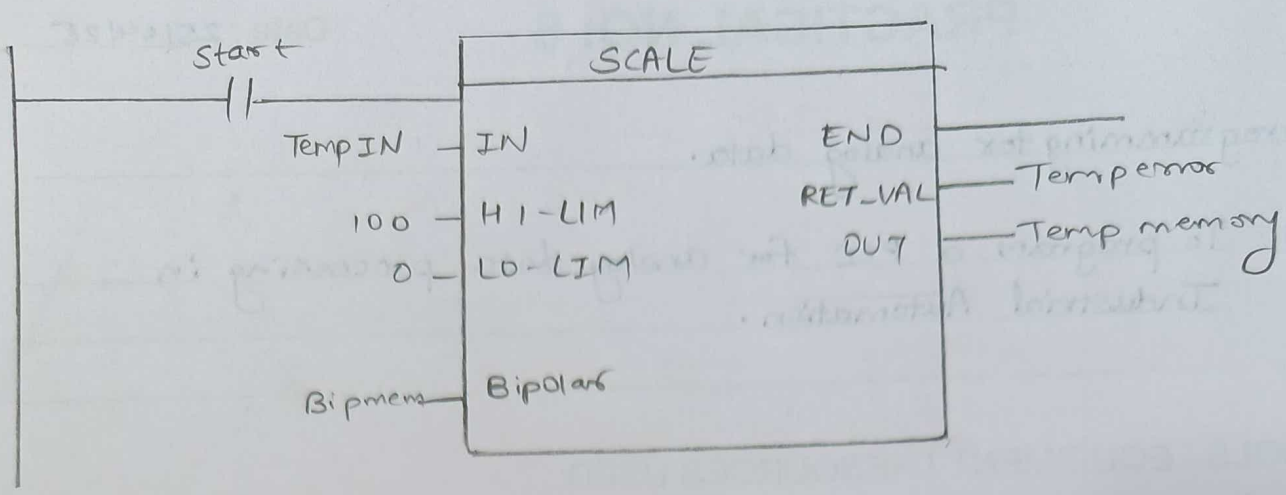
Computer
PLC
TIA V14 software.

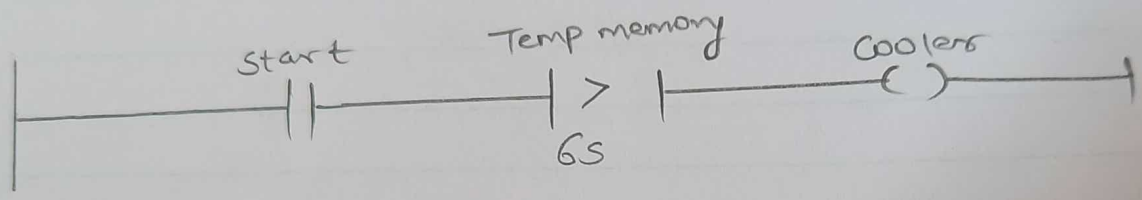
CONCEPT / THEORY OF EXPERIMENT:

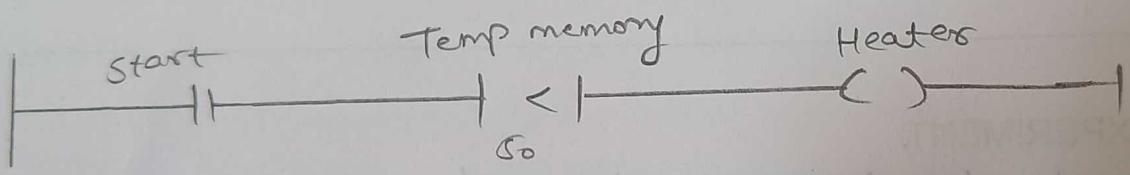
PLC programming for analog data involves reading and processing continuous signals (eg. temperature, pressure, speed) from analog sensors. The PLC converts these signals using ADC ; scales the values and controls actuators based on set parameters. This enables precise monitoring and automation in industrial processes.

PROCEDURE :

1) Open Tia portal V14.
2) Configure Hardware.
3) Set analog Input parameters.
4) Create Ladder logic program.
5) Implement Central logic.
6) Integrate HMI (optional).
7) Compile & Download.
8) Simulate & Test.
9) Debug & optimize.


Start
SCALE
Temp IN
IN
END
Temp error
RET_VAL
100
HI-LIM
Temp memory
OUT
0
LO-LIM
Bipmem
Bipolar


Start
Temp memory
Coolers
>
65


Start
Temp memory
Heaters
<
60

OBSERVATIONS

Scale Instruction -- use of the 'scale' instruction is done to convert the integers at the IN parameter into a floating point numbers which can be souted in physical units between low & high limit.

Parameters	Decleration	Data	PLC mory	Description.
EN	INPUT	Bool	P, Q, M, D, L	Enable
ENO	OUTPUT	BOOL	P, Q M, D, L	Enable
IN	INPUT	INT	P, Q, M, D, 2, Porc	Input
HI - LIM	INPUT	REAL	I, Q, M, D, 2, Porc	High limit
LO - LIM	INPUT	REAL	P, Q, M, D, L, Porc	low limit
BIPOLAR	INPUT	BOOL	P, Q, M, D, L, Porc	Unipolar

* Tag Table *

Name	Data Type	Address
Bipolar arm	BOOL	%M10.0
Start	BOOL	%I5.5
Temp Error	WORD	%MW8
Temp Input	INT	%IWD
Temp memory	REAL	%MD4
Heater	BOOL	%Q10.1
Cooler	BOOL	%Q10.2

CALCULATIONS :

RESULTS :

The PLC successfully read, processed and controlled analog signals from sensor ensuring accurate automation.

CONCLUSION :

This activity enhanced analog signal handling and automation control using PLC programming.

Assessment Parameters (To be filled by Instructor)

1. Successful completion of Practical (Y/N)
2. Time taken (hours / minutes) : 2Hr.

3. List other Parameters & Outcomes :

Sr. No.	Parameter
1)	PLC model.
2)	Analog Input Type.
3)	Sensor used.
4)	Scaling Range.
5)	Control logic.
6)	Response time.
7)	HMI Integration
8)	Simulation mode.

Remarks :

PRACTICAL NO: 7

Date : 25/05/25

TITLE : Implementing the logic for crane application on HMI.

AIM / OBJECTIVE: To design of implement the control logic for a crane system using HMI and PLC for real time monitor and operation.

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

HMI panel (siemens), PLC, Crane, simulation setup or model, TIA model, communication cable, power supply, push buttons.

CONCEPT / THEORY OF EXPERIMENT:

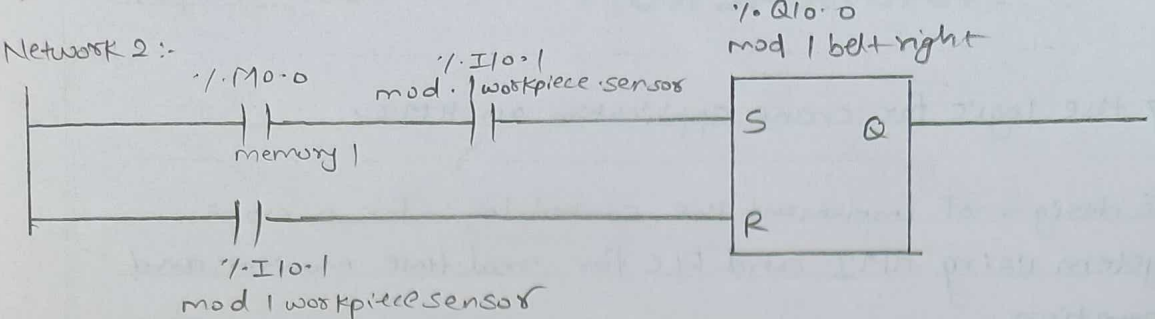
A HMI allows operations to interact with & monitor a PLC controlled crane system. This system typically includes functions to close open gripper like moving the crane left/right; up/down & stop/start. The logic ensures safety through limit switches & smooth control via start/stop commands the PLC processes sensor inputs & executes control outputs, while the HMI displays start uses & allows operators interaction.

PROCEDURE :

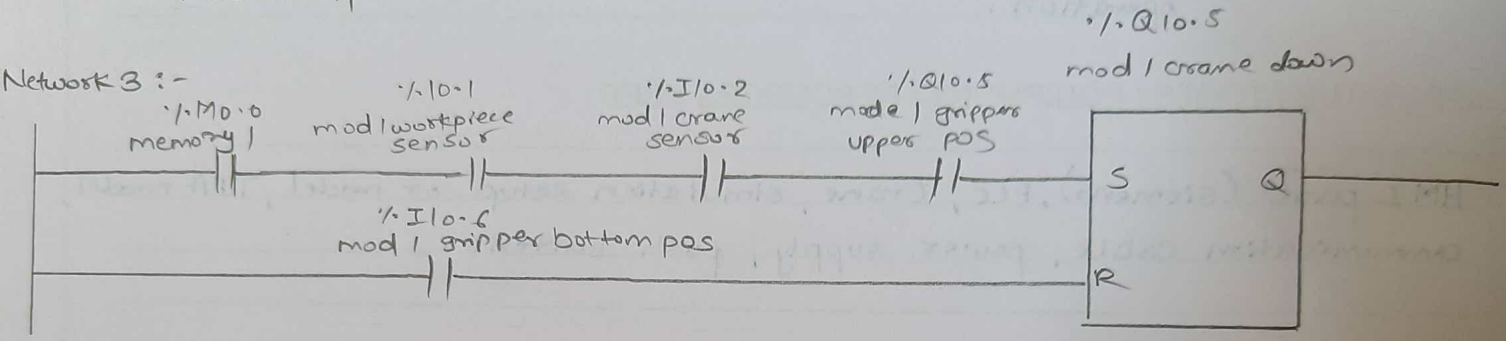
1) Connect the PLC to HMI via the appropriate communication protocol.
2) Analyze the existing HMI crane simulation, Identify the IP/OP tags or addresses used for commands & status indicators.
3) Open the programming software & create a new project define I/O variaty matching the HMI simulation tags.
4) Write the control I logic according to the simulation or problem statement given on LxL.
5) Download the PLC program.
6) Start the crane simulation on HMI.
7) Operate the crane using HMI controls & observe response.

Network 1:-

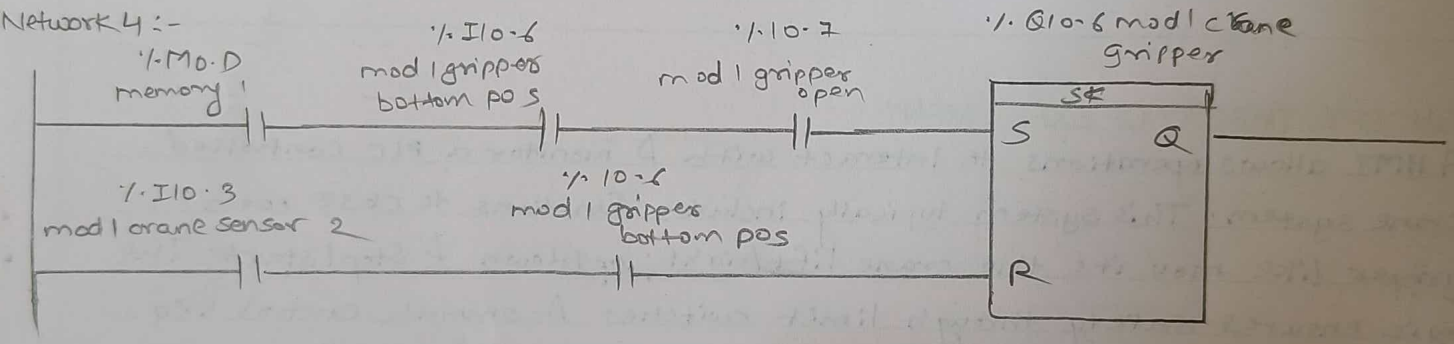
Network 2:-



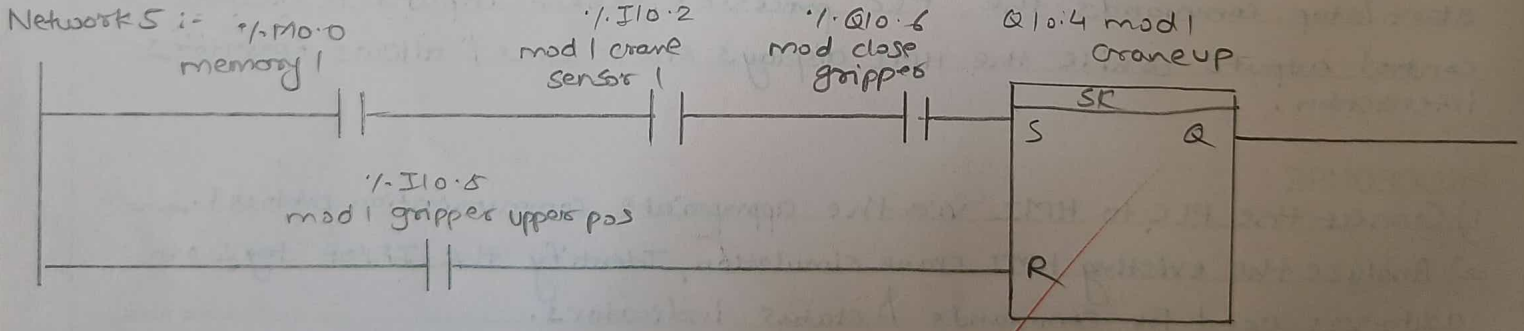
Network 3:-



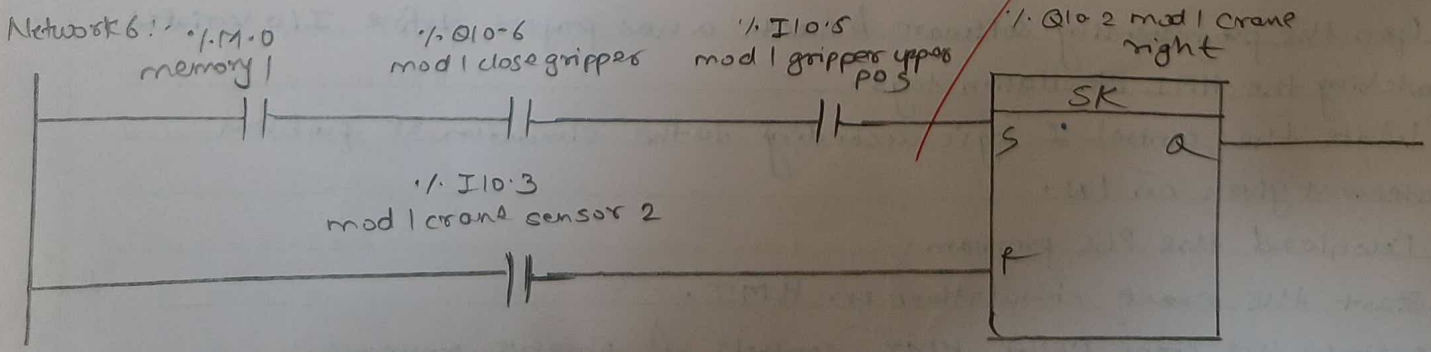
Network 4:-



Network 5:-



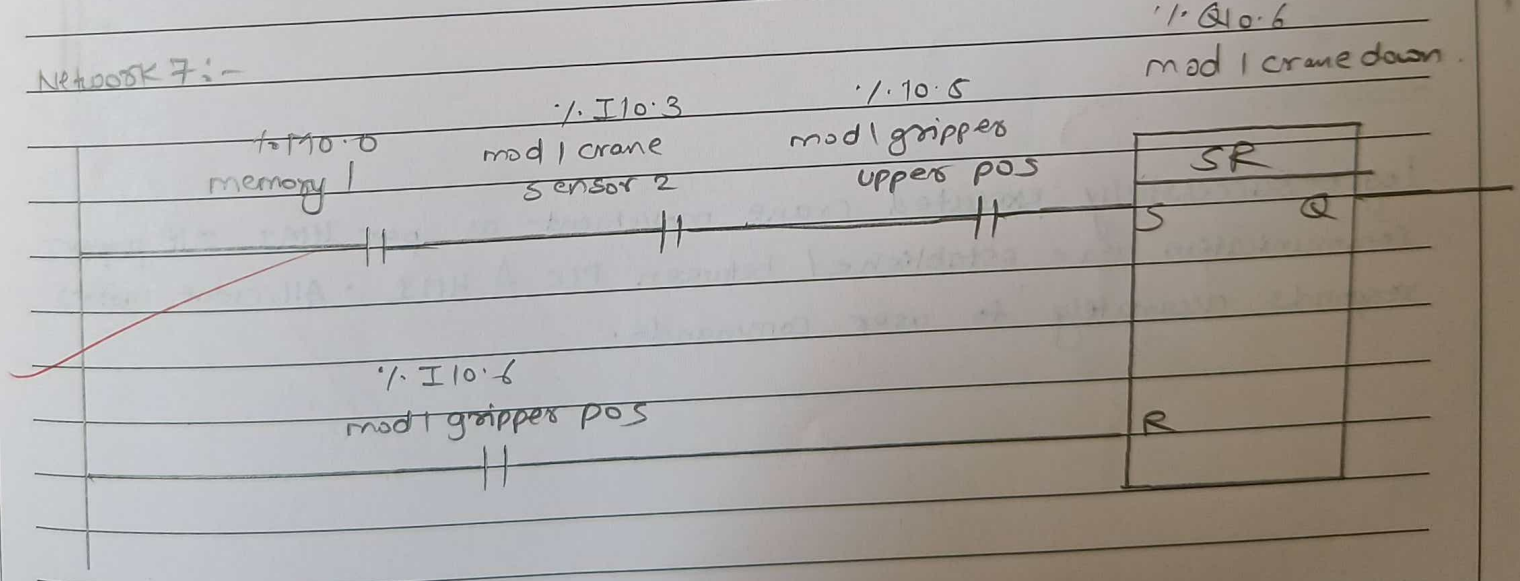
Network 6:-



OBSERVATIONS

Name	Data	Address
Start	BOOL	%I0.1
Memory 1	BOOL	%M0.0
mod 1 work piece sensor 1	BOOL	%I10.0
mod 1 work piece sensor 2	BOOL	%I10.1
mod 1 belt right	BOOL	%Q10.0
mod 1 crane sensor 1	BOOL	%I10.2
mod 1 gripper upper pos	BOOL	%I0.5
mod 1 gripper bottom pos	BOOL	%I0.6
mod 1 gripper open	BOOL	%I0.7
mod 1 close gripper	BOOL	%Q10.6
mod 1 crane sensor 2	BOOL	%I10.3
mod 1 crane up	BOOL	%Q10.4
mod 1 crane right.	BOOL	%Q10.2

Network 7:-



CALCULATIONS :

RESULTS :

Logic successfully executed crane movement as per HMI I/P proper communication was established between PLC & HMI . All crane motors responds accurately to user commands.

CONCLUSION :

The Implementation demonstrated effective integration of PLC logic with a pre-configured HMI crane simulation.

Assessment Parameters (To be filled by Instructor)

1. Successful completion of Practical (Y/N)
2. Time taken (hours / minutes) : 2 Hr.

3. List other Parameters & Outcomes :

Sr. No.	Parameter
1)	Understanding of HMI-PLC communication.
2)	Designing and implementing control logic.
3)	Interfacing logic with pre-built simulation.
4)	Trouble shooting & debugging real time automation.

Remarks :

PRACTICAL NO: 8

Date : 28/04/25

TITLE : Working on Assembly line Operation.

AIM / OBJECTIVE: To design implement & simulate an automated assembly line using PLC programming in CAD.

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

Siemens PLC, TIA portal, assembly line conveyor between system I/P, O/P modules for interfacing sensors & actuators.

CONCEPT / THEORY OF EXPERIMENT:

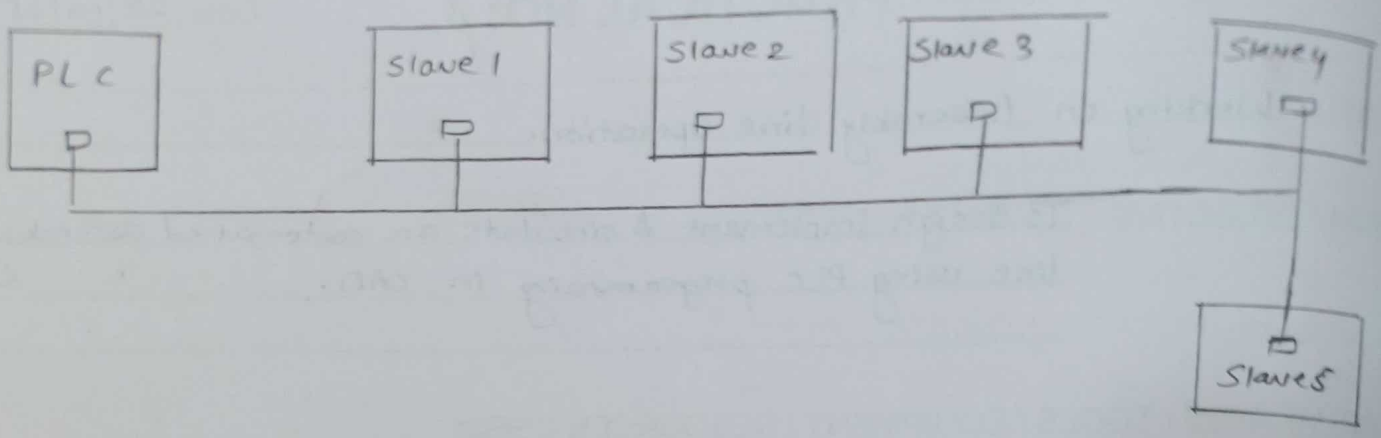
An automated assembly line simulates industrial process using PLC logic to control the flow of objects through multiple stages each stage sorting assembly & processing includes:- Sensors to detect position & level & sequencing, set, Reset latch & for conditional control logic. the process begins at starting (stage 1) where objects are detected, sorted & passed forward.

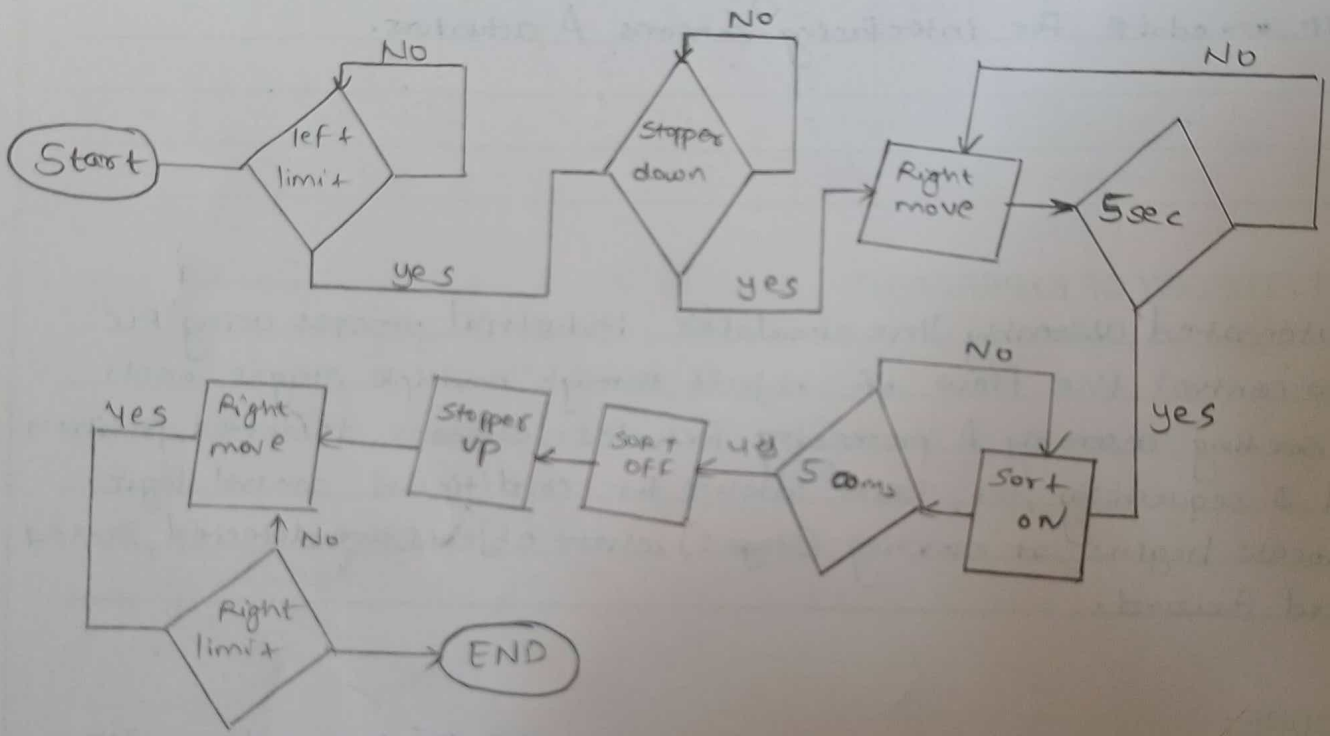
PROCEDURE :

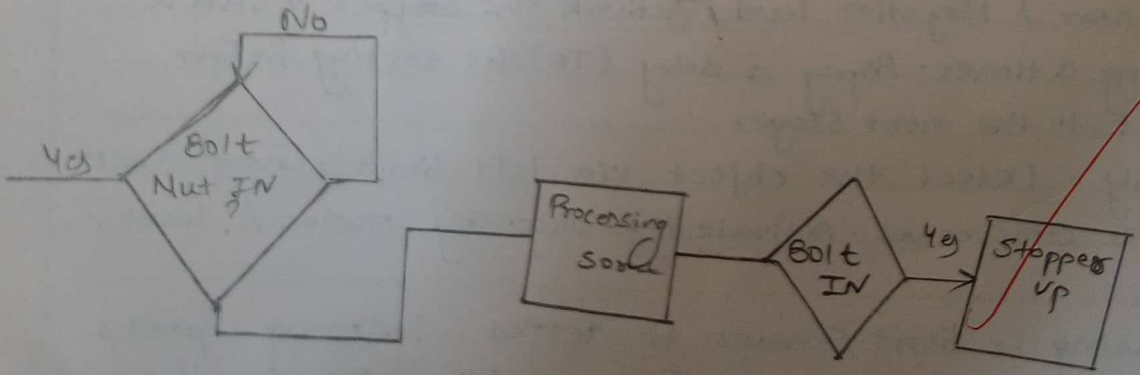
1) Stage 1:- Sorting - Stat the system using the start signal monitor the left limit sensor & Negative level. Activate the stopper & checks object position using a timer. Apply a delay (TP) for sorting before releasing the object to the next stage.

2) Stage 2: Assembly - Detect the object via left limit sensor check if the magzine has components. Activate the assembly motor & lower the stopper.

3) Stage 3:- processing ← limit Sensors to detect incoming parts. Ensure magzine readiness & stopper functionality. Engage the motor & detect whether a bolt is present or not. sort based with a timed motor drive.


PLC
Slave 1
Slave 2
Slave 3
Slave 4
Slave 5


Start
left limit
No
yes
Stopper down
No
yes
Right move
5sec
No
yes
No
Sort ON
5 00ms
Sort OFF
Stopper UP
Right move
Yes
No
Right limit
END


No
Bolt Nut IN
Yes
Processing
Bolt IN
Yes
Stoppers UP

OBSERVATIONS

* Flowchart changes for assembly station:-

Instead of sort ON & sort OFF. Assembly sort ON & Assembly sort OFF respectively.

* Flowchart changes for processing station:-

from sort ON to sort OFF.

Code:

CALCULATIONS :

RESULTS :

CONCLUSION :

Hence, we have successfully programmed the assembly line.

Assessment Parameters (To be filled by Instructor)

1. Successful completion of Practical (Y/N)
2. Time taken (hours / minutes) : 2 Hrs

3. List other Parameters & Outcomes :

Sr. No.	Parameter	(Achiev
1)	Able to write an appropriate & efficient ladder logic diagram.	

Remarks :