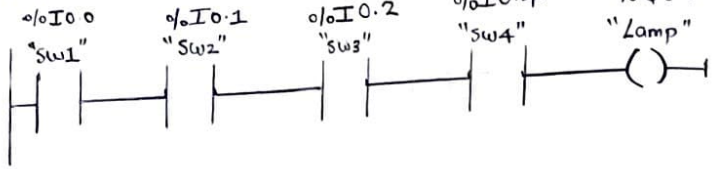
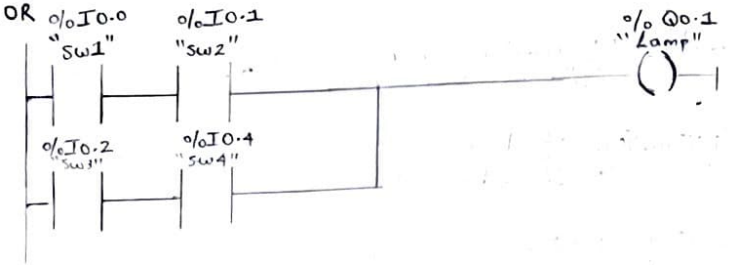
Network 1: AND

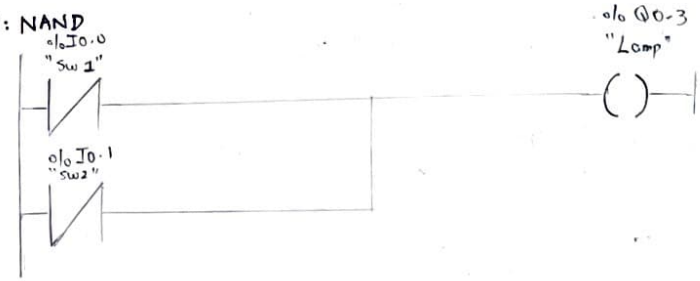


Network 2: OR

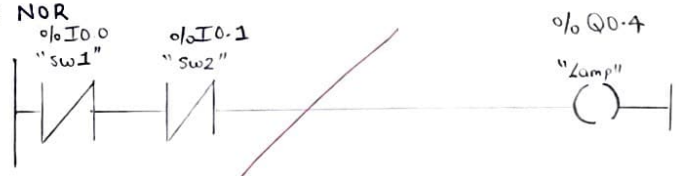


Network 3: NOT

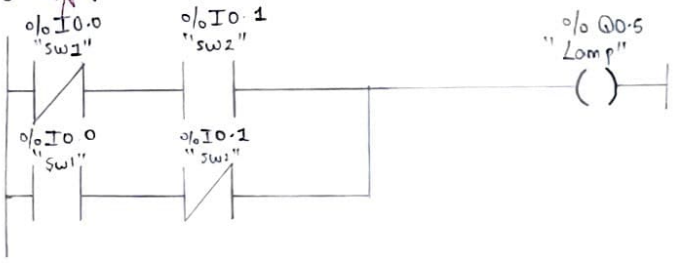
Network 4: NAND



Network 5: NOR



Network 6: EOR



PRACTICAL NO: 1

Date: 6/1/25

TITLE: Ladder Programming for basic logical operations

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

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

PLC Hardware (Simulator (Siemens)), PLC programming software (TIA portal), PC/Laptop, output device (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
   Select PLC and configure the hardware
2) Create a new PLC program
3) Implement Logic Gates in Main OB1
4) Assign input and output tags
5) Compile the program and check for errors
6) Download the program to PLC and switch to Online Mode
7) Test the logic gates by pressing the input buttons and observing output status in real time.

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 precise and reliable logical operations.

CONCLUSION :

This experiment successfully demonstrates 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) : 2hrs

3. List other Parameters & Outcomes :

Sr. No.	Parameter	Outcome (Achieved / Not Acheived)
(1)	To program and simulate different logical gates in a PLC environment.	
(2)	To understand practical application of logical gates with various input configuration	
(3)	To familiarize with basic Logical operations using PLC	

Remarks : Find. Give Ladder for. clamp

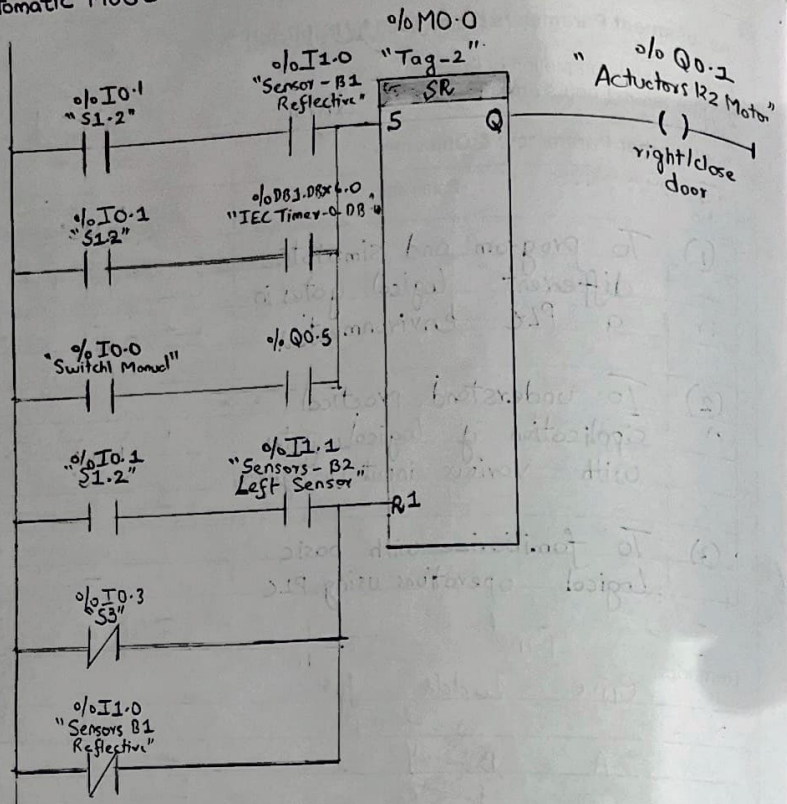
A	B	Y
0	1	0
1	0	0
1	1	1
0	0	0

Total marks 10 out of 10.

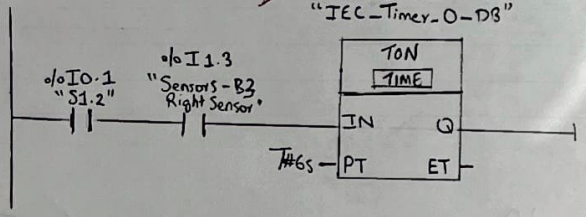
Sign of Instructor

Date : 10.2.24.

Network 1: Automatic Mode



Network 2: Automatic Mode



PRACTICAL NO: 2

Date : 20/1/25

TITLE : Automation of door control in automatic and manual mode

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

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

PLC Hardware, PLC programming Software (TIA portal)
Switches, Indicators, Sensors and Actuators.
Power supply
Connecting cable
Wiring setup

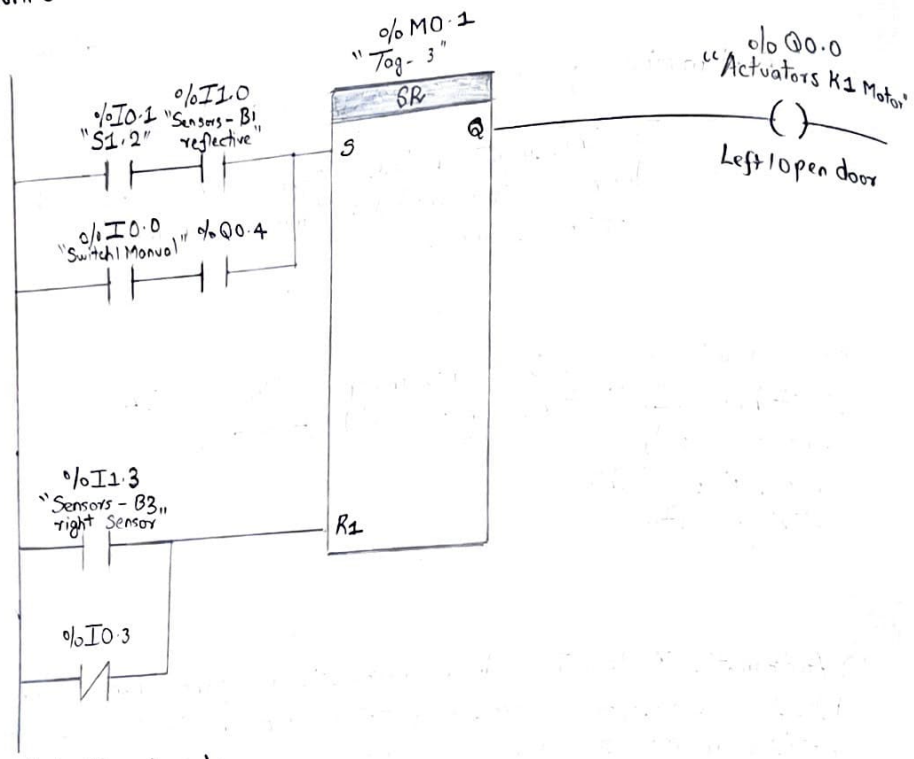
CONCEPT / THEORY OF EXPERIMENT:

(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.

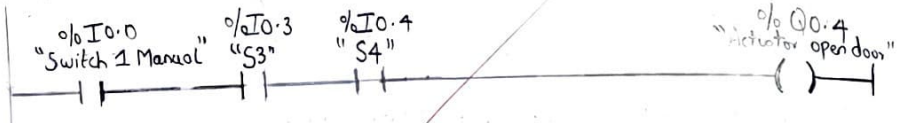
PROCEDURE :

(1) Create New Project in TIA V14, configure the PLC
(2) Define input and outputs
(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.

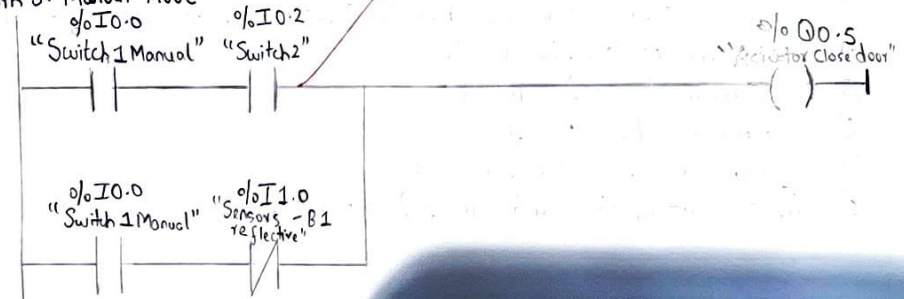
Network 3: Automatic Mode



Network 4: Manual mode



Network 5: Manual Mode



OBSERVATIONS : PLC TAGS

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 Switch	%I0.4
"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) : 4hrs

3. List other Parameters & Outcomes :

Sr. No.	Parameter	Outcome (Achieved / Not Acheived)
(1)	Understood PLC programming	
(2)	Learnt Sensor and Actuator Integeration: Understood working of motion sensors, switches and motors in an automated system.	
(3)	Practical Application of Industrial Automation : developed skills applicable to real world industrial door automation.	

Remarks :

Total marks 10 out of 10.

Sign of Instructor
Date : 10-2-25

PRACTICAL NO: 3

Date : 10/2/25

TITLE : Sorting operation on conveyers belt programming as per standards.

AIM / OBJECTIVE: To implement sorting operation on conveyers belt programming on PLC 300

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

PLC Hardware, PLC programming software, Connecting cables, Wiring setup.

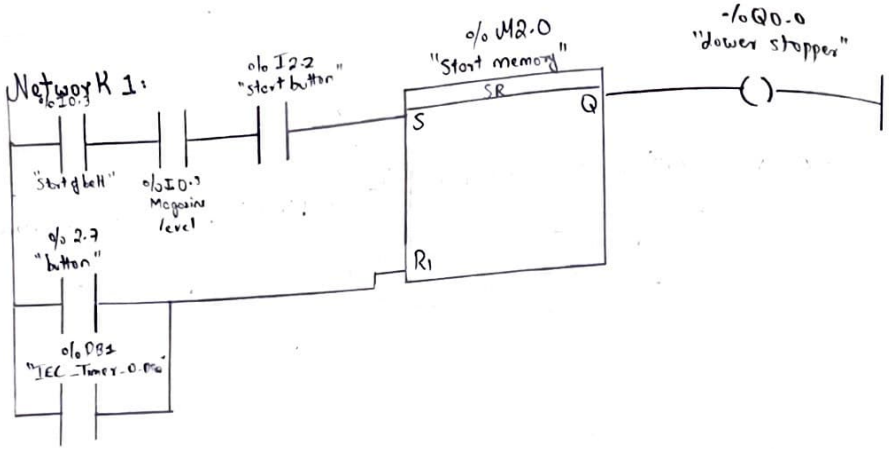
CONCEPT / THEORY OF EXPERIMENT:

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

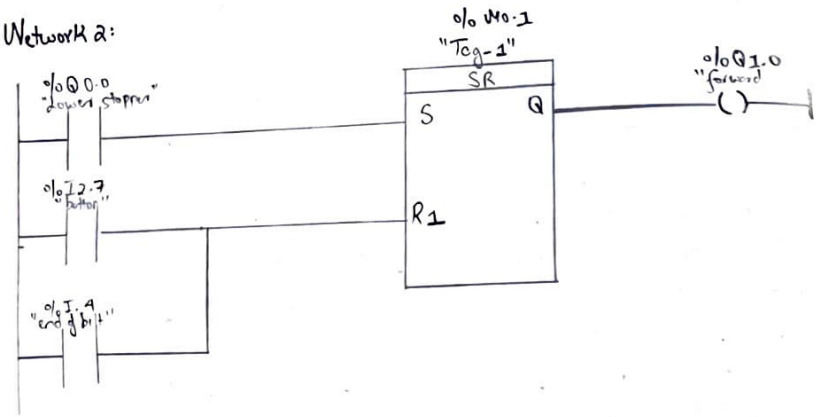
PROCEDURE :

(1) Open TIA V14 and create a project.
(2) Define Inputs and Outputs.
(3) Code for sorting operations.
(4) Code and compile the program
(5) Open TIMS virtual and open sorting operation.
(6) Open TIMS virtual and open sorting operation.
(7) Now, click start simulation and then download the program. Put virtual PLC to run mode.
(8) Test sorting operation on the virtual window.

Network 1:

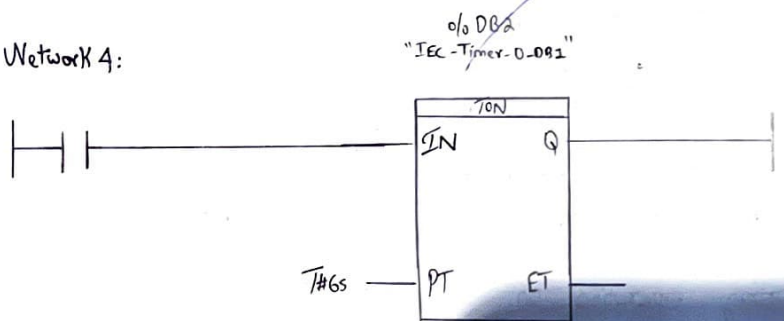


Network 2:

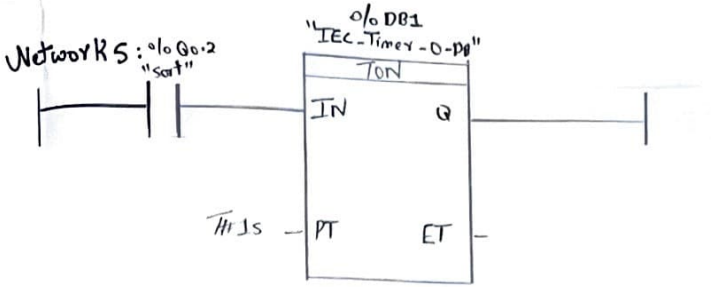


Network 3:

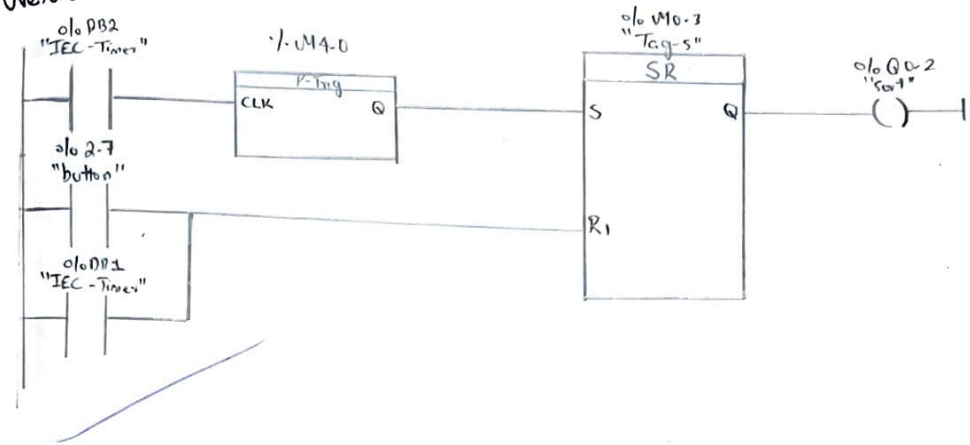
Network 4:



Network 5:

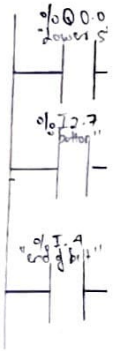


Network 6:



Network 1:

Network 2



Network 3:

Network 4:

OBSERVATIONS

PLC Tags

Name	Instruction	Address
"Start g belt"	NO	%I1.3
"End g belt"	NO	%I1.4
"Magazine Level"	NO	%I0.3
"Start button"	NO	%I2.2
"Start Menu"	SR flipflop	%M2.0
"Lower Stopper"	Output	%Q0.0
"IEC_Timer_0-DB"	TON	%DB1
"Tag-1"	SR flipflop	%M0.1
"Forward"	Output	%Q1.0
"Teaching 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 pice"	NO	%Q0.2

CALCULATIONS :

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 successfully demonstrates the implementation of sorting operation on conveyor belt.

Assessment Parameters (To be filled by Instructor)

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

3. List other Parameters & Outcomes :

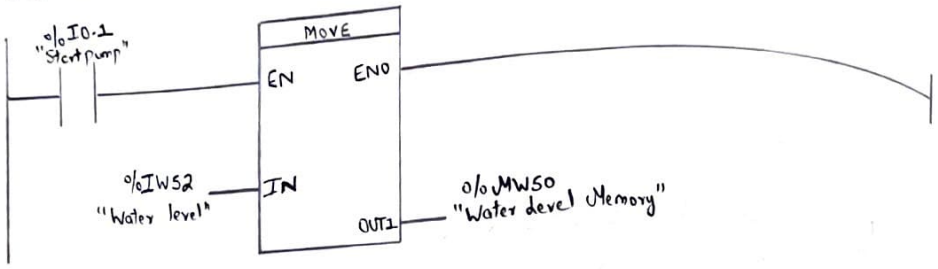
Sr. No.	Parameter	Outcome (Achieved / Not Acheived)
(1)	Understood PLC programming.	
(2)	Learnt sorting operation on conveyor belt programming.	
(3)	Able to run the program and observe the sorting operation.	
(4)	Rectify the code for any errors.	

Remarks :

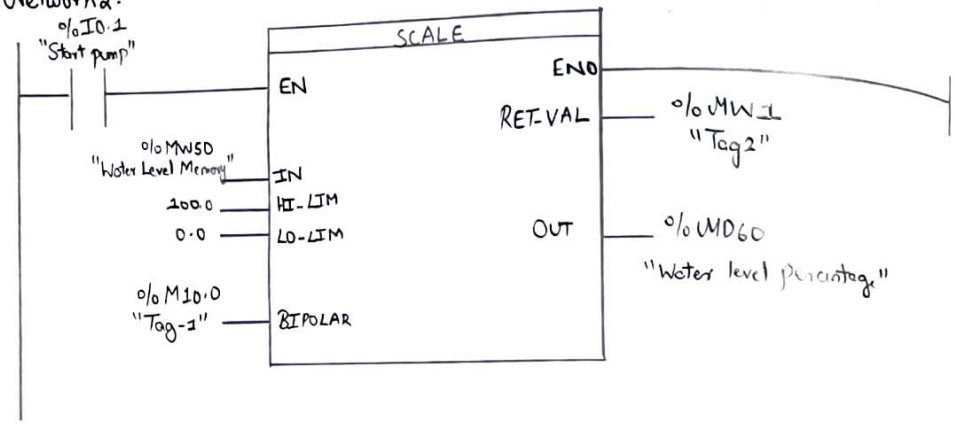
Total marks 10 out of 10.

Sign of Instructor
Date : 11.3.25

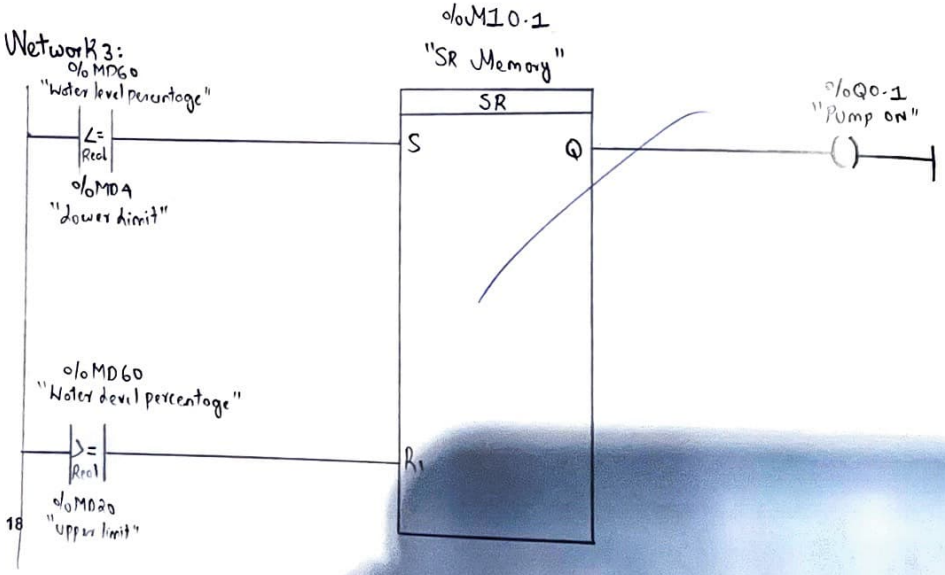
Network 1:



Network 2:



Network 3:



PRACTICAL NO: 4

Date : 10/2/25

TITLE : PLC programming for Analog data.

AIM / OBJECTIVE: To implement and 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 and 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.

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	%IW52
Water Level Memory	Int	%MW50
Start Pump	Bool	%I0.1
Tag-1	Bool	%M10.0
Tag-2	Word	%MW1
Water level percentage	Real	%MD60
SR Memory	Bool	%M10.1
Upper limit	Real	%MD20
Lower limit	Real	%MD4
Reset	Bool	%I0.2

HMI Tags

Name	Tagtable	Data Type	PLC Tag	Address
HMI Lower limit	Default Tag Table	Real	"Lower Limit"	%MD4
HMI-Start		Bool	START	%MI0.2
HMI-Upperlimit		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 and 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 sensor inputs, ensuring automatic operation at defined lower and upper limits.

Assessment Parameters (To be filled by Instructor)

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

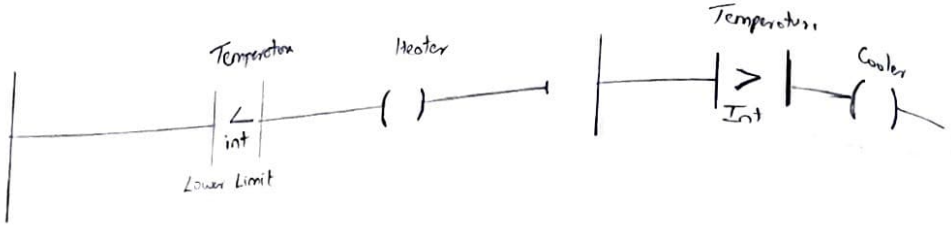
3. List other Parameters & Outcomes :

Sr. No.	Parameter	Outcome (Achieved / Not Acheived)
(1)	Understood 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 and turns off when water level reaches higher limit.	

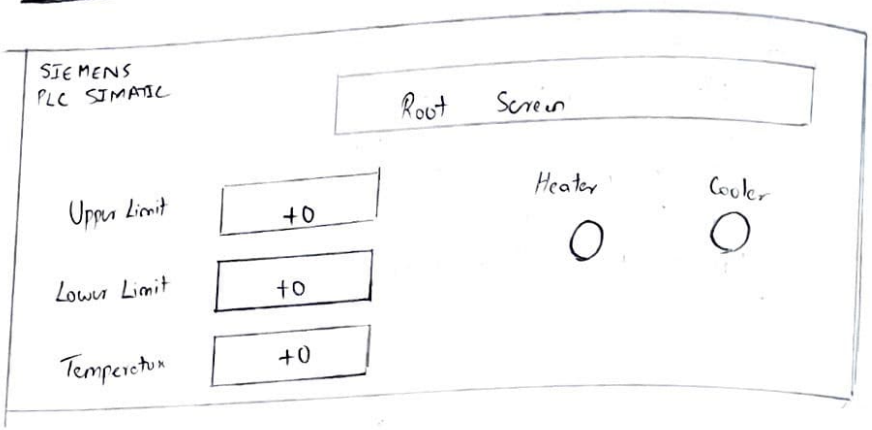
Remarks :

Total marks 10 out of 10.

Sign of Instructor
Date : 11.3.25



HMI Interface



PRACTICAL NO: 5

Date : 17/3/21

TITLE : PLC programming for analog data (Heater cooler with HMI Simulation)

AIM / OBJECTIVE:
(1) To simulate HMI in TIA portal
(2) To create a ladder logic program with analog data processing

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

Tia Portal v14, PLC Sim, PC

CONCEPT / THEORY OF EXPERIMENT:

For HMI integration with PLC, first we create the PLC tags. Creat a ladder logic program. Check the ladder logic for the intended function. Add HMI Interface the HMI tags and link with PLC tags create the HMI interface and set the attribute values. Lastly download the interfaceon to HMI.

PROCEDURE :

(1) Create the PLC Tag Table in Tia Portal v14.
(2) Creat the ladder logic program in Tia portal
(3) Check if the program is appropriate by via PLC sim (optional)
(4) Add HMI to the file
(5) Creat HMI Tags as read
(6) Link HMI tags and PLC Tags appropriate.
(7) Creat HMI Interface by the attributes
(8) Download HMI Interface and simulate
(9) Check for output and verify

OBSERVATIONS

PLC Tag Table

Name	Data Types	Address
Start	Bool	%M0.0
Heater	Bool	%Q0.0
Cooler	Bool	%Q0.1
Temperature	Int	%MW1
Upper Limit	Int	%MW3
Lower Limit	Int	%MW5

HMI Tag Table

Name	Datatype	Connection	PLC name	PLC Tag	Address	Acquisition cycle
Start_HMI	Bool	HMI_Connection	PLC_1	Start	%M0.0	100ms
HMI Heater	Bool	HMI_connection	PLC_1	Heater	%Q0.0	100ms
HMI Cooler	Bool	HMI_Connection	PLC_1	Cooler	%Q0.1	100ms
HMI Temp	Int	HMI_connection	PLC_1	Temperature	%MW1	100ms
HMI Upperlimit	Int	HMI_connection	PLC_1	Upper Limit	%MW3	100ms
HMI Lower Limit	Int	HMI_Connection	PLC_1	Lower Limit	%MW5	100ms

PRACTICAL NO: 6

Date : 24/2/25

TITLE : Implement the logic for crane application on HMI

AIM / OBJECTIVE: To design and implement the control logic for a crane system using Human Machine Interface & PLC for real time monitors & operation.

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

HMI panel (siemens), PLC, crane simulation setup & model, TIA portal, communication cable, power supply, push buttons

CONCEPT / THEORY OF EXPERIMENT:

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

PROCEDURE :

① Connect the PLC to the HMI via the appropriate communication protocol

② Analyze the existing HMI crane simulation. Identify the i/p and o/p tags or addresses used for commands and status indicators.

③ Open the programming software and project. define I/O variables matching the HMI simulation Tags.

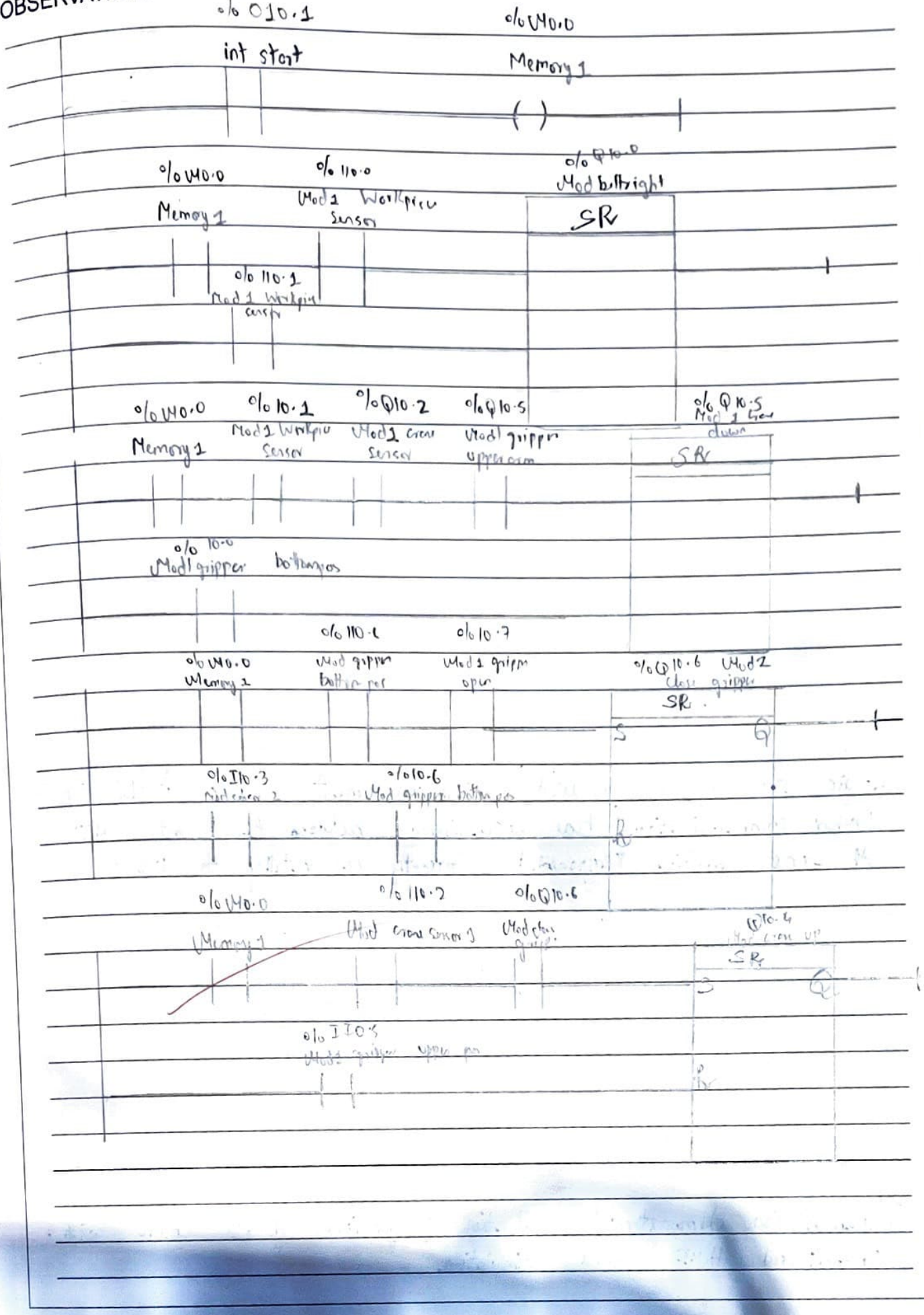
④ Write the control logic according to simulation or problem statement given on LN.

⑤ Download the PLC program

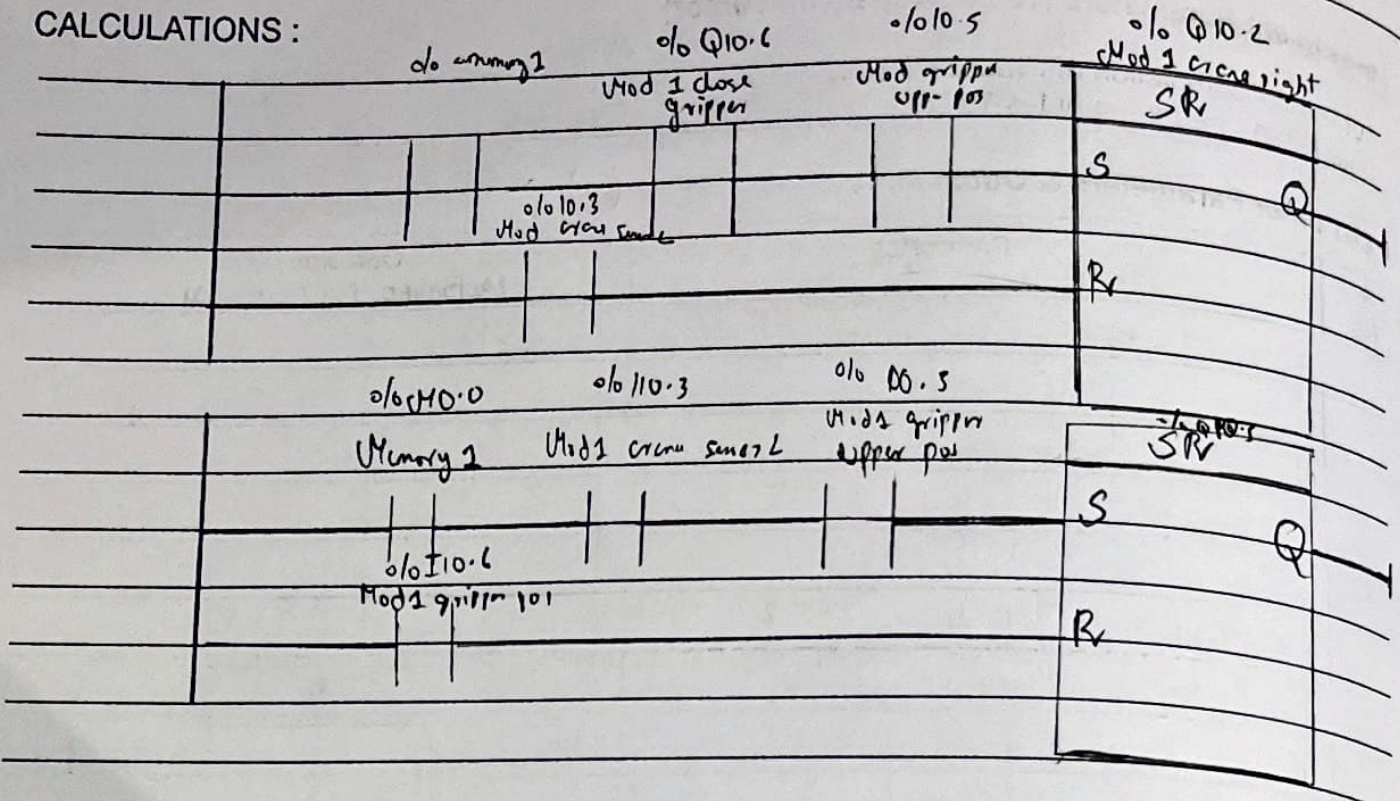
⑥ Start the crane simulation on the HMI

⑦ Operate the crane using HMI controls and observe response.

OBSERVATIONS



CALCULATIONS :

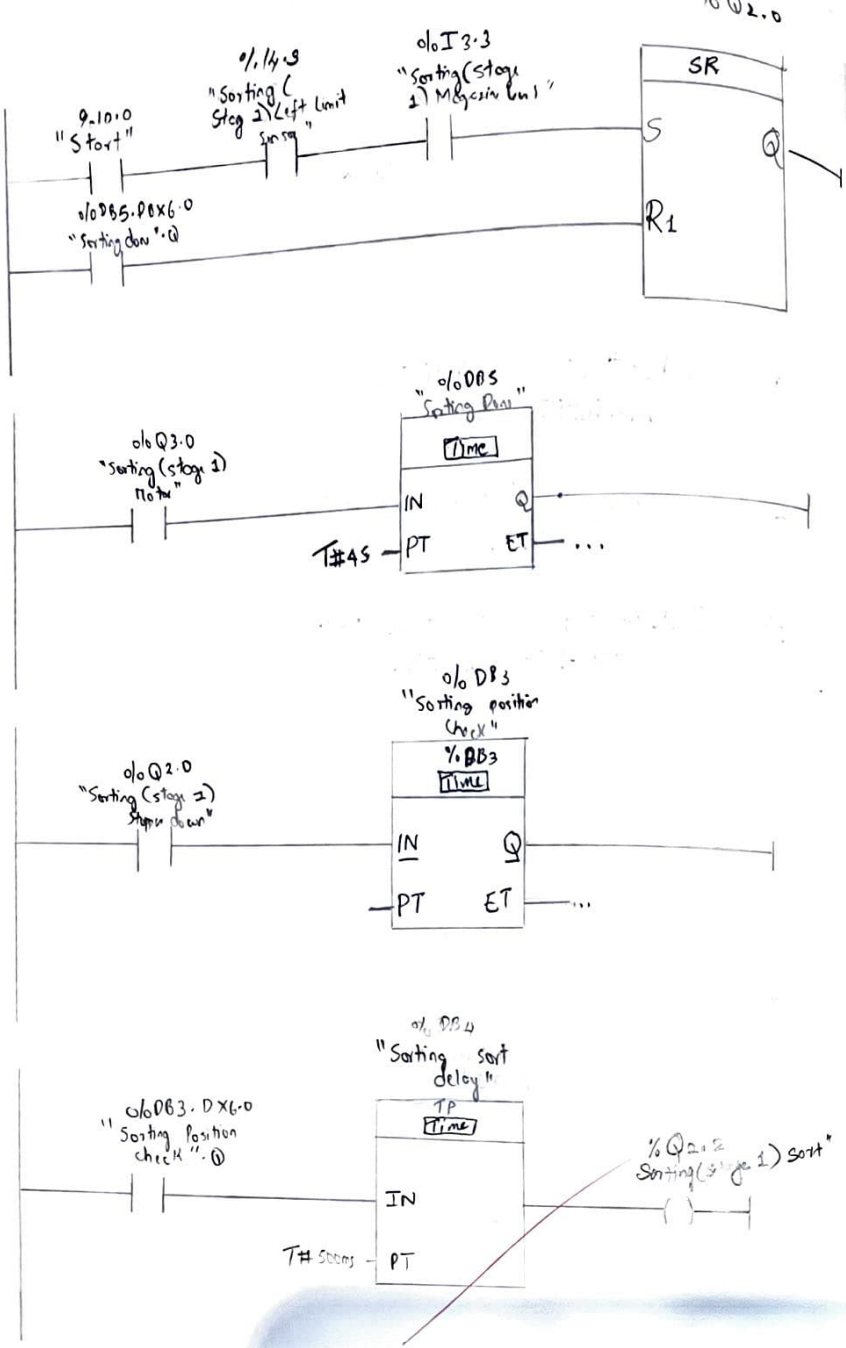


RESULTS :

Logic successfully executed crane movement as per HMI i/p proper communication has established between PLC and HMI all crane motion responded correctly/accurately to user

CONCLUSION :

Implementation demonstrated effectin integration of PLC Logic with



PRACTICAL NO: 7

Date : 28/3/25

TITLE : Working on Assembly Line Operation

AIM / OBJECTIVE: To design implement and simulate an automated assembly line using PLC programming

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

Siemens PLC, TIA portal, assembly line conveyor, system, i/p, o/p modules for interfacing sensors and actuators.

CONCEPT / THEORY OF EXPERIMENT:

An automated assembly line simulates industrial process using PLC logic to control flow of objects through multiple stages. Each stages sorting, assembly and processing includes: sensors to detect position and level actuators to control movement timers (TON and TP) for controlled delay and sequencing set reset (SR) latches for conditional control logic, the process begin at sorting stage, where objects are sorted. stage 2 is assembly components are positioned, verified and paced for processing. stage 3 is processing.

PROCEDURE :

(1) Stage 1 - Sorting:

Start the system using start signal

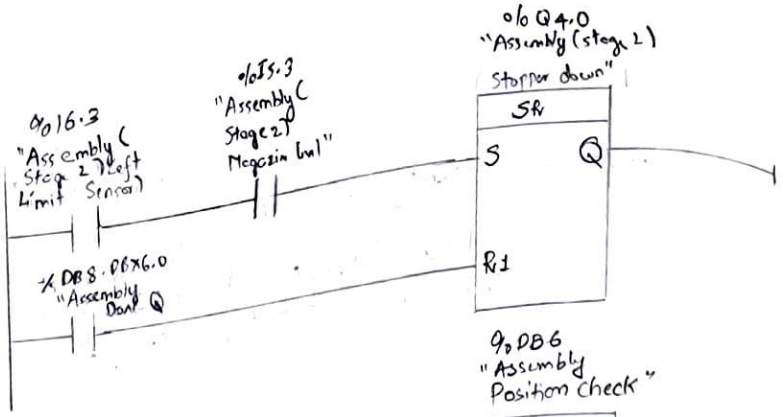
eMonitor the left limit sensor and magazine level

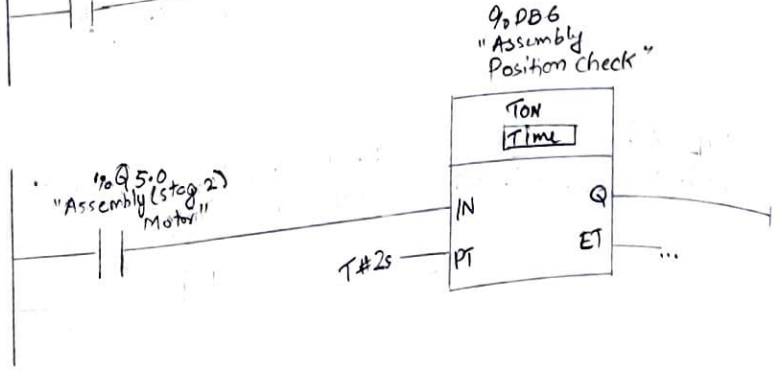
eActivate stopper and check object position using timers.

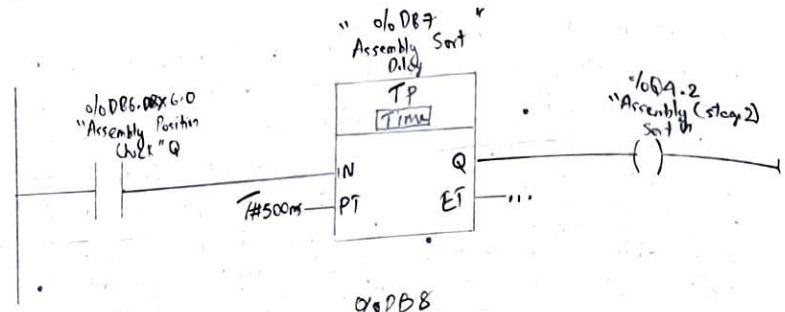
(2) Step 2 : Assembly:

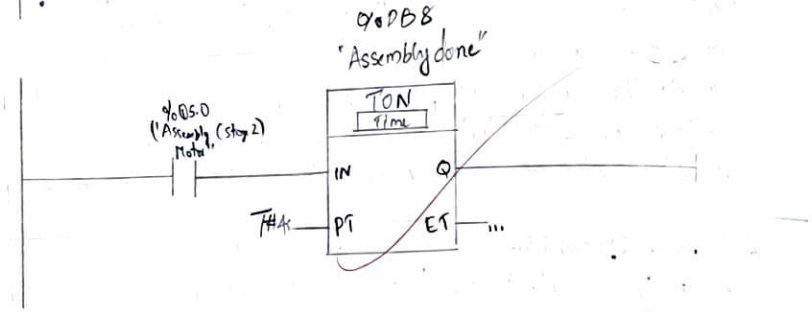
Detect the object via left in limit sensor

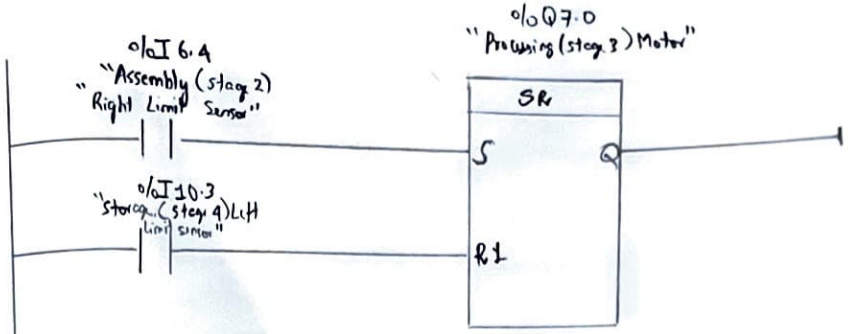
Check if the magazine has components

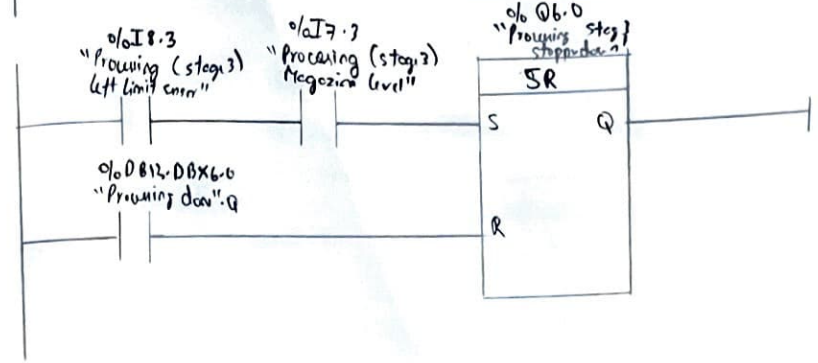

%I6.3
"Assembly (Stage 2) Left Limit Sensor"
%I5.3
"Assembly (Stage 2) Magazin Full"
%DB8.DBX6.0
"Assembly Done".Q
%Q4.0
"Assembly (stage 2) stopper down"
SR
S
Q
R1

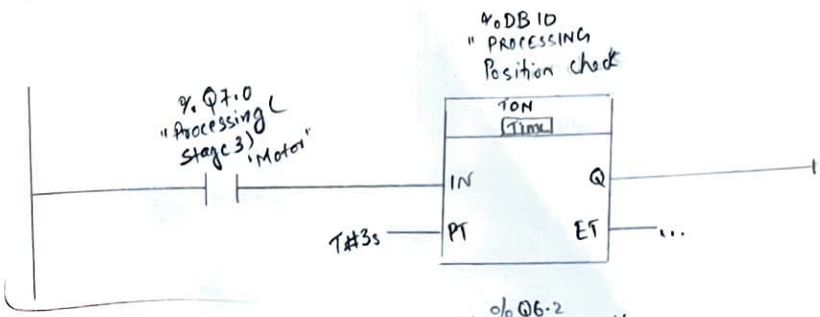

%DB6
"Assembly Position Check"
%Q5.0
"Assembly (stage 2) Motor"
TON
Time
IN
Q
T#2s
PT
ET

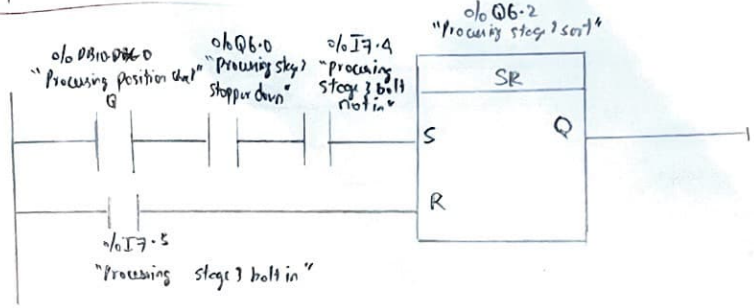

"%DB7 Assembly Data"
%DB6.DBX6.0
"Assembly Position Check".Q
TP
Time
IN
Q
T#500ms
PT
ET
%Q4.2
"Assembly (stage 2) Sort"


%DB8
"Assembly done"
%Q5.0
"Assembly (stage 2) Motor"
TON
Time
IN
Q
T#4s
PT
ET


%I6.4
"Assembly (stage 2) Right Limit Sensor"
%I10.3
"Storage (stage 4) Left Limit sensor"
%Q7.0
"Processing (stage 3) Motor"
SR
S
Q
R1


%I8.3
"Processing (stage 3) Left Limit enter"
%I7.3
"Processing (stage 3) Magazine Level"
%DB12.DBX6.0
"Processing done".Q
%Q6.0
"Processing stage 3 stopper down"
SR
S
Q
R


%DB10
"PROCESSING Position check"
%Q7.0
"Processing (stage 3) Motor"
TON
Time
IN
Q
T#3s
PT
ET


%DB10.DBX6.0
"Processing Position check" Q
%Q6.0
"Processing stage 3 stopper down"
%I7.4
"Processing stage 3 bolt not in"
%Q6.2
"Processing stage 3 sort"
SR
S
Q
R
%I7.5
"Processing stage 3 bolt in"

OBSERVATIONS

Stage 3: Processing

Use limit sensors to detect incoming parts
Activate magazine release and stopper functionality
Engage motor and detect whether bolt is present or not
Sort based on bolt presence complete process with a timed
motor drive.

Tag Table Sorting

eName	Data type	Address
Sorting (Stage 1) Magazine Level	Bool	%I3.3
Sorting (Stage 1) Left Limit Sensor	Bool	%I4.3
Sorting (Stage 1) Right Limit Sensor	Bool	%I4.4
Sorting (Stage 1) stopper down	Bool	%Q2.0
Sorting (Stage 1) sort	Bool	%Q2.2
Sorting (Stage 1) Motor	Bool	%Q3.0
Sorting (Stage 1) Memory start	Bool	%M0.0
	Bool	%I0.0

CALCULATIONS :

Tag Table Processing

Name	Data type	Address
Processing (stg 3) bolt In	bool	%I 7.5
Processing (stg 3) Bolt Not in	bool	%I 7.4
Processing (stg 3) Left Limit Sensor	bool	%I 8.3
Processing (stg 3) Magazine Low	bool	%I 7.3
Processing (stg 3) Magnet	bool	%M 0.2
Processing (stg 3) Motor	bool	%Q 7.0
Processing (stg 3) Right Limit Sensor	bool	%I 8.4
Processing (stg 3) sort	bool	%Q 6.2
Processing (stg 3) Stopper down	bool	%Q 6.0

RESULTS :

CONCLUSION :

Hence, we have successfully programmed assembly line.