

INTRODUCTION

In modern waste management systems, efficient handling of wastewater is crucial. This lab focuses on designing a waste water pumping system to automate and monitor the operation of pumps using a Programmable Logic Controller (PLC). By simulating real-world scenarios, this project aims to ensure proper water level management, enhance safety, and minimize manual intervention.



OBJECTIVES:

The primary objective of this task is to:

- To develop a function for a waste water pumping system.
- To simulate and download the program in a PLC and check the results in real time.

SYSTEM DESCRIPTION:

The waste water pumping system is designed to handle wastewater in a collecting basin using two pumps. The system operates based on manual inputs and automatic water level detection through float switches.

OPERATION:

System Activation:

The system starts when the ENABLE E0 is pressed.

Pump 1:

- **Start:** The pump starts manually by pressing the momentary contact push button S2 or automatically when float switch B1 is triggered by high water levels.
- **Stop:** The pump stops automatically when the water level falls below float switch B0 or manually by pressing push button S1 or triggering the thermal overcurrent release F1.

Pump 2:

- **Start:** The pump starts manually by pressing push button S4 or automatically when float switch B4 is triggered by high water levels.
- **Stop:** The pump stops automatically when the water level falls below float switch B3 or manually by pressing push button S3 or triggering the thermal overcurrent release F2.

Alarm System:

When the water level exceeds float switch B2, a hooter (alarm) sounds to notify the user of high water levels.

METHODOLOGY

PLC Programming Logic

The ladder logic for the waste water pumping system was developed in the PLC programming software. The logic incorporates the following features:

- Manual start and stop controls for both pumps.
- Automatic start based on water level detection using float switches (B1 and B4).
- Automatic stop based on low water level detection using float switches (B0 and B3).
- Thermal overcurrent protection to ensure safety.
- An alarm system to alert users of high water levels.

Simulation and Testing

The developed logic was simulated in the PLC software to verify the following:

- Proper starting and stopping of pumps in both manual and automatic modes.
- Activation of the alarm system when the water level exceeded float switch B2.
- Correct behavior of thermal overcurrent release mechanisms (F1 and F2).

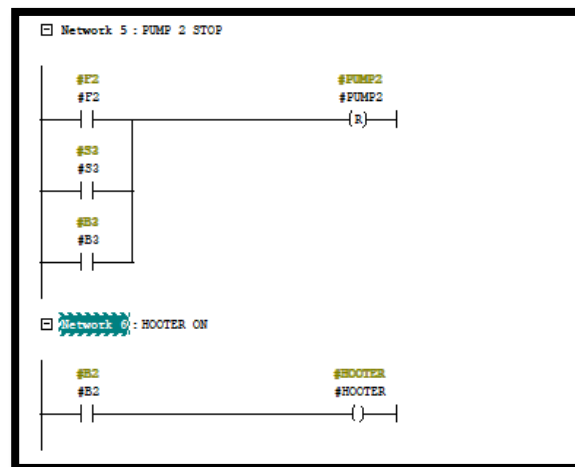
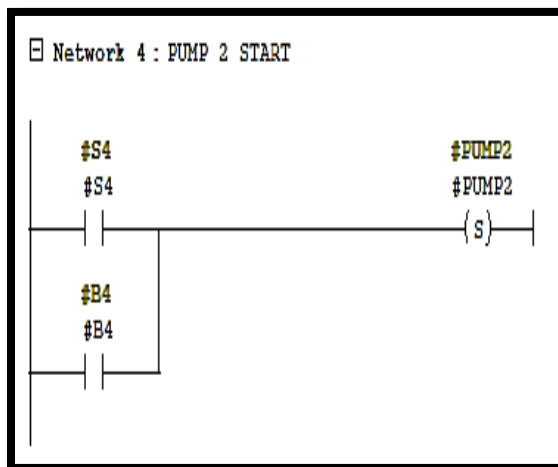
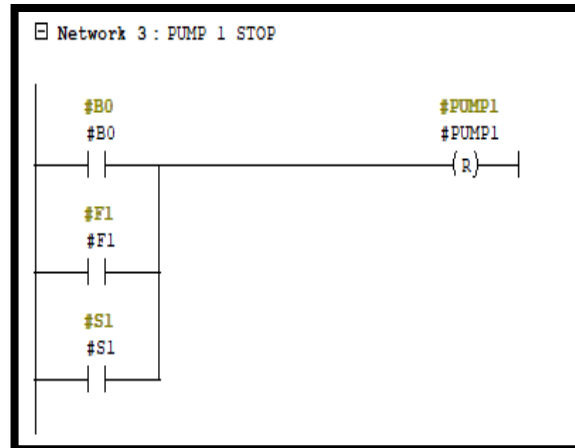
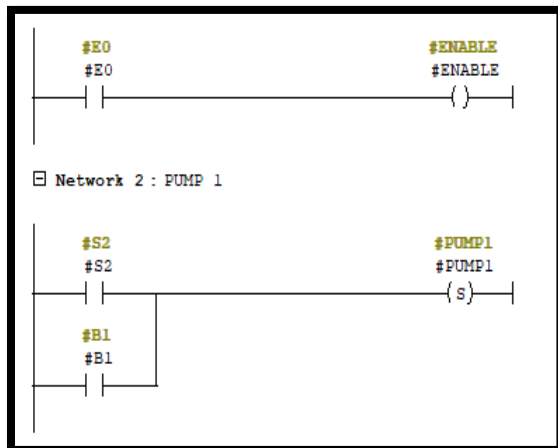
SIMULATED SCENARIOS:

Test Scenario	Expected Outcome	Observed Outcome
Float switch B1 activated	Pump 1 starts automatically	Pump 1 started automatically
Float switch B0 deactivated	Pump 1 stops automatically	Pump 1 stopped automatically
Float switch B2 activated	Alarm (hooter) sounds	Alarm sounded
S4 pressed	Pump 2 starts manually	Pump 2 started manually
Thermal overcurrent F1 triggered	Pump 1 stops	Pump 1 stopped

ATTACHMENTS:

- **Figure 1:** PLC Ladder Logic Screenshot.
- **Figure 2:** Real-Time Process Monitoring Results.

NETWORKS:



RESULTS AND ANALYSIS:

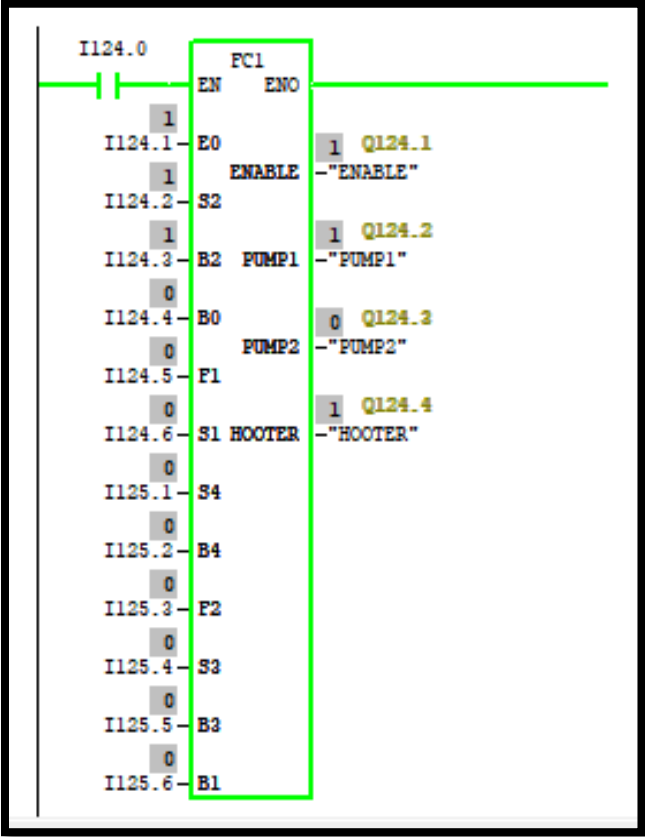
Both pumps operated as expected based on the conditions outlined in the description:

- Manual and automatic modes were successfully implemented and tested.
- Pumps stopped immediately when water levels fell below the designated thresholds.

The alarm system activated accurately when the water level exceeded float switch B2.

Thermal overcurrent release mechanisms (F1 and F2) were successfully triggered to stop pumps when required.

FUNCTION FC1:



OUTPUT:

Output status window showing the status of various outputs. The window displays the status of outputs Q124.1 (ENABLE), Q124.2 (PUMP1), Q124.3 (PUMP2), and Q124.4 (HOOTER). The outputs are labeled with their addresses and values: Q124.1 (1), Q124.2 (0), Q124.3 (0), and Q124.4 (1).

Address	Label	Value
I 124.6	"S1"	BOOL false
I 125.1	"S4"	BOOL false
I 125.2	"B4"	BOOL false
I 125.3	"F2"	BOOL false
I 125.4	"S3"	BOOL false
Q 124.1	"ENABLE"	BOOL true
Q 124.2	"PUMP1"	BOOL true
Q 124.3	"PUMP2"	BOOL false
Q 124.4	"HOOTER"	BOOL true
I 125.5	"B3"	BOOL false
I 125.6	"B1"	BOOL false

CONCLUSION:

The waste water pumping system was successfully designed, programmed, and tested using PLC. The system effectively automated the operation of pumps based on water level conditions, ensuring reliable wastewater management. Manual and automatic controls functioned seamlessly, while the alarm system provided a robust safety mechanism for high water levels. This project demonstrates the potential of PLC-based solutions in enhancing efficiency, reducing manual workload, and improving safety in wastewater management systems.