# Exercise 1 - Mixing System

Design a ladder logic diagram to automate a mixing system with the following sequence:

- When the Start Push Button is pressed, the sequence begins.
- **Valve and Motor Operation Sequence:**
    - **Inlet Valve 1 opens for 10 seconds**, then closes.
    - **Inlet Valve 2 opens for 10 seconds**, then closes.
    - **Steam Valve opens for 10 seconds**, then closes.
    - **Both Inlet Valve 1 and Inlet Valve 2 open simultaneously for 20 seconds**.
    - **10 seconds after both valves open, the Motor starts** and remains ON until the valves close.
- Once all steps are completed, the system resets and is ready for the next cycle when Start Push Button is pressed again.
- The **Emergency Stop** should be implemented to halt the process at any time(all valves and the motor should be turned off immediately). The system should remain in a safe state until the Start Push Button is pressed again.
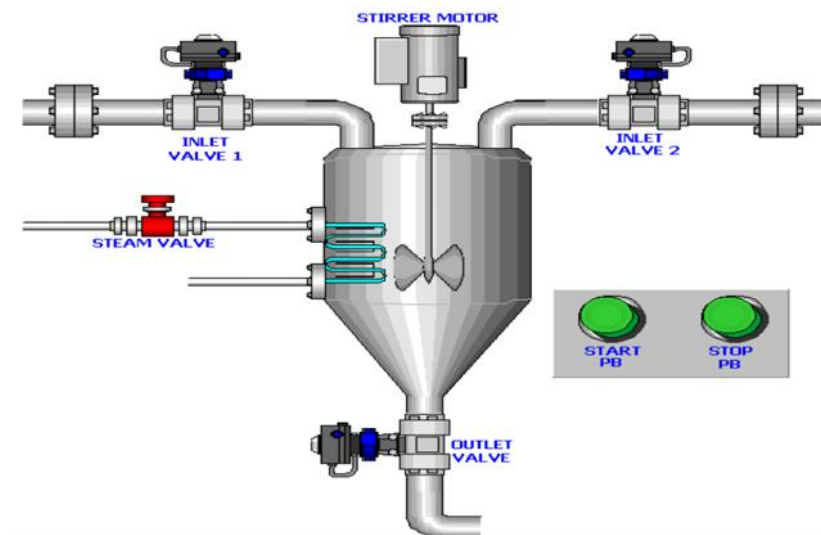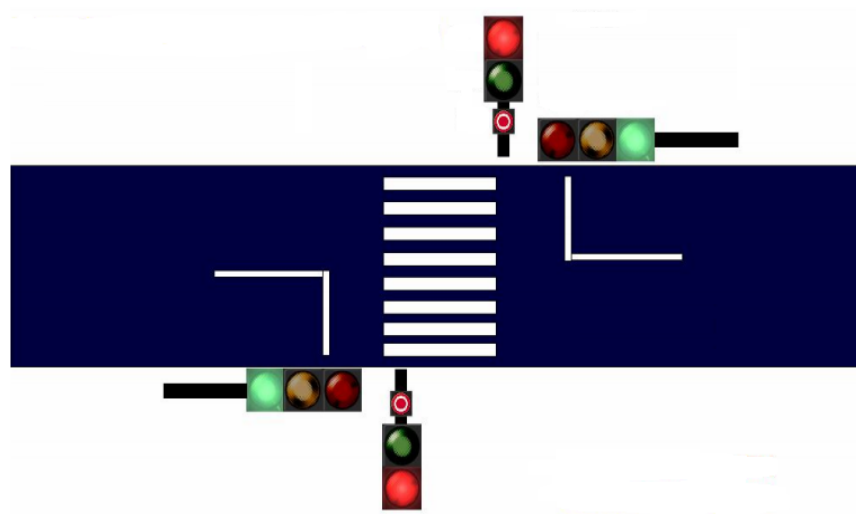

- **Identify Inputs & Outputs**

Device	Type	Address

Control Logic Overview

Exercise 2 - Pedestrian Traffic Light System

Write a PLC ladder program to control the pedestrian traffic light system. The system should meet the following criteria:

- The traffic light starts with Green for vehicles and Red for pedestrians by default.
- When the Pedestrian Push Button (PB) is pressed, the system waits for 5 seconds before changing the traffic light sequence.
- After 5 seconds, the vehicle Green light turns OFF, the vehicle Yellow light turns ON for 3 seconds, and then the vehicle Red light turns ON.
- Once the vehicle Red light is ON, the pedestrian Green light turns ON for 10 seconds, allowing pedestrians to cross.
- After 10 seconds, the pedestrian Green light turns OFF, and the pedestrian Red light turns ON.
- Then, the traffic light returns to the initial state, with Green for vehicles and Red for pedestrians, and the cycle repeats.

- **Identify Inputs & Outputs**

Device	Type	Address

Control Logic Overview

Exercise 3 - Automatic Garage Door Control

Design a PLC ladder logic program to control an automatic garage door system with the following requirements:

1. Start button used to provide power to the system

2. The Open push button opens the garage door.

3. The Close push button closes the garage door.

4. The door should **stop automatically** when it reaches the **fully open** or **fully closed** position using Open limit switch) and Close limit switch.

5. A **Green Light** should turn ON when the door is **fully open**.

6. A **Red Light** should turn ON when the door is **fully closed**.

7. If the "Auto" switch (slide switch) is enabled, then if door remains **fully open for 30 seconds**, it should **automatically start closing**.

8. If the **Stop Push Button** is pressed, **all operations must stop immediately**.

- **Identify Inputs & Outputs**

Device	Type	Address

Control Logic Overview

Exercise 4

Design and implement a PLC-based automatic filling machine control system with multiple selection modes and safety features:

Initial Conditions

- **Job_in Sensor** → ON (Indicates product arrival)

- **Job_out Sensor** → OFF (Product not yet exited)

- **Yellow Tank High-Level Sensor (YTHL)** → ON (Tank is sufficiently filled)

- **Blue Tank High-Level Sensor (BTHL)** → ON (Tank is sufficiently filled)

Main Operation Modes (Based on Selector Switch)

- **Condition 1 – Yellow Tank Filling**

If the Selector Switch is set to Yellow:

- When Start_PB is pressed, the conveyor starts moving until Filling_Sensor_1 is activated.

- After 2 seconds, Valve_Yellow opens and remains open for 20 seconds.

- After 2 more seconds, the conveyor resumes moving until the Job_out Sensor is triggered (indicating product exit).

- **Condition 2 – Blue Tank Filling**

If the Selector Switch is set to Blue:

- When Start_PB is pressed, the conveyor starts moving until Filling_Sensor_2 is activated.

- After 2 seconds, Valve_Blue opens and remains open for 20 seconds.

- After 2 more seconds, the conveyor resumes moving until the Job_out Sensor is triggered.

- **Condition 3 – Both Tanks Filling**

If the Selector Switch is set to Both:

- When Start_PB is pressed, the conveyor moves until Filling_Sensor_1 is activated.

- After 1 second, Valve_Yellow opens and remains open for 10 seconds.

- After 2 seconds, the conveyor moves until Filling_Sensor_2 is activated.

- After 1 second, Valve_Blue opens and remains open for 10 seconds.

- After 2 seconds, the conveyor moves until the Job_out Sensor is triggered.

Additional Features

- If Yellow Tank Low Level Sensor (YLLL) or Blue Tank Low Level Sensor (BLLL) is ON, the system should stop the operation and display an error indicator.

- Emergency stop feature as usual.
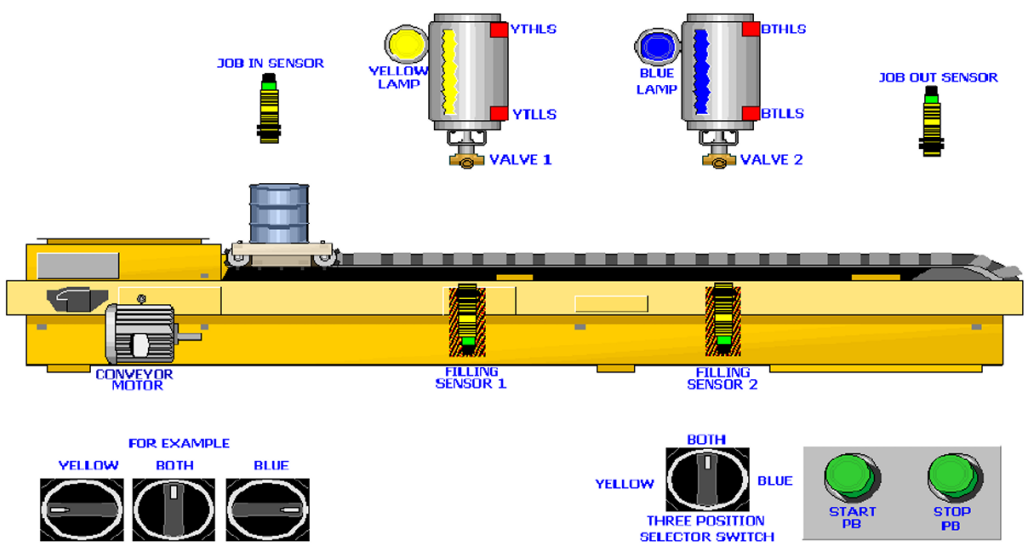
- **Identify Inputs & Outputs**

Device	Type	Address

Control Logic Overview

Exercise 4

Make Conveyor forward reverse circuit continuous. First conveyor goes to forward and after activating fwd limit switch, conveyor should be reversed. And after activating reverse limit switch conveyor should be forward. This cycle is continuing running until we press stop push button.
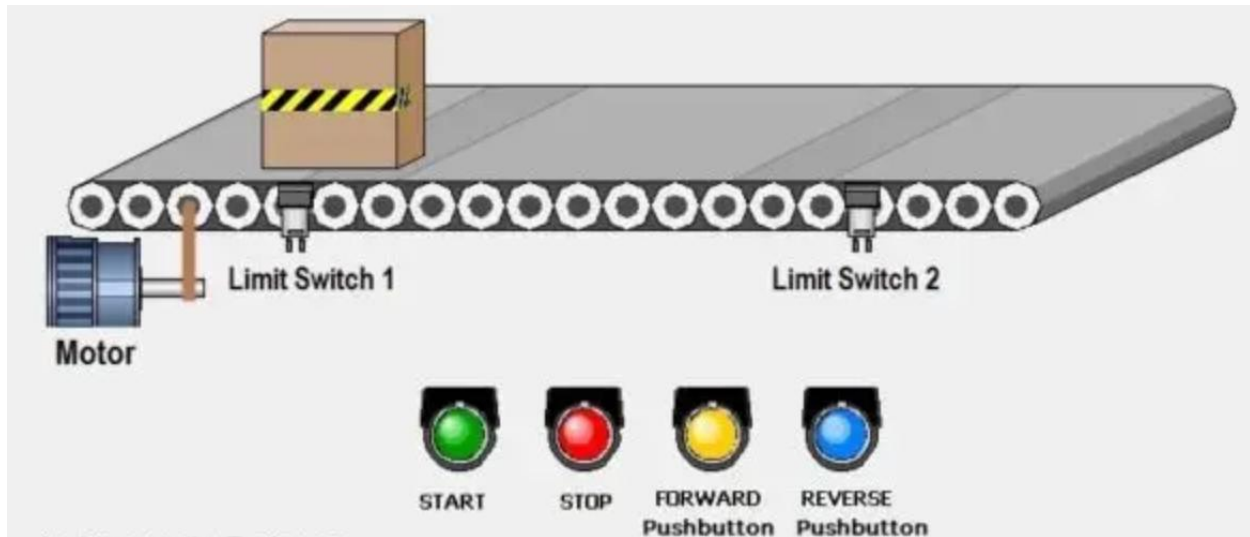
Exercise 5

The product packaging working as follows:

- When started, the motor of a conveyor for boxes is activated.

- The conveyor takes a box up to the limit switch, and the motor stops then.

- The condition for starting the conveyor with apples is actually a limit switch for a box.

- When a box is detected, the conveyor with apples and starts moving.

- The presence of the box allows the counter to count 10 apples through a sensor used for apples and to generate a counter flag which is a condition for new activation of the conveyor with boxes.

- When the conveyor with boxes has been activated, the limit switch resets the counter which is again ready to count 10 apples.

Operations repeat until STOP key is pressed.