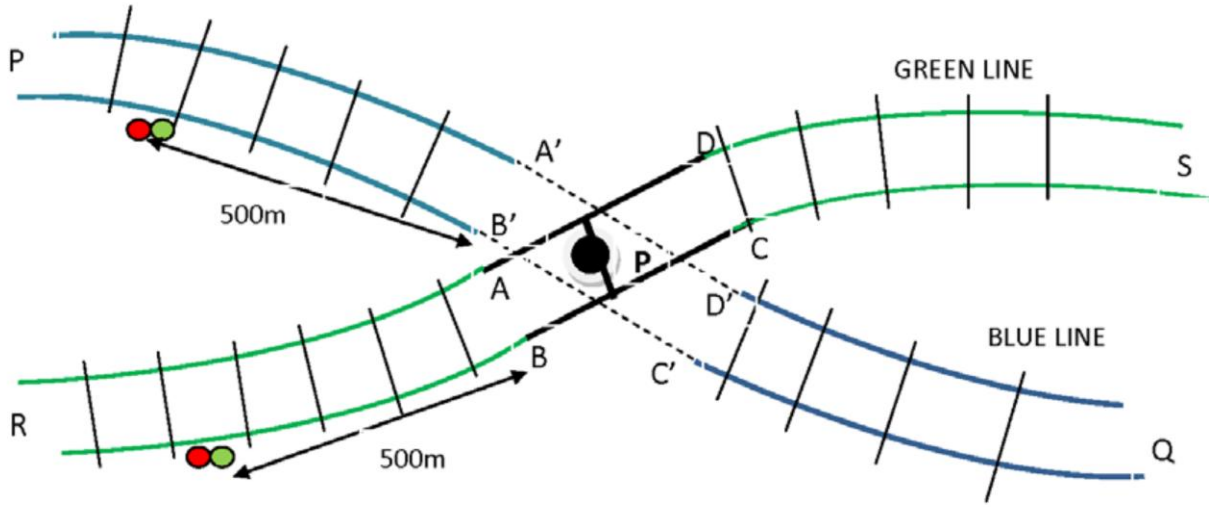
Exercise 1 - Railway Line Intersection

The following diagram shows two metropolitan railway line intersection. In GREEN LINE the trains travel towards RS direction and in BLUE LINE the trains travels towards PQ direction. The intersection point of two lines are indicated as AD BC, A'D' B'C'.



The rail segments AD,BC are relocated towards A'D' B'C' by using the actuator P, which is located at the middle of the intersection point. The actuator P can rotate and rail segment ABCD clockwise direction and comes to A'B'C'D' , in order to pass the train towards Q in the BLUE LINE.

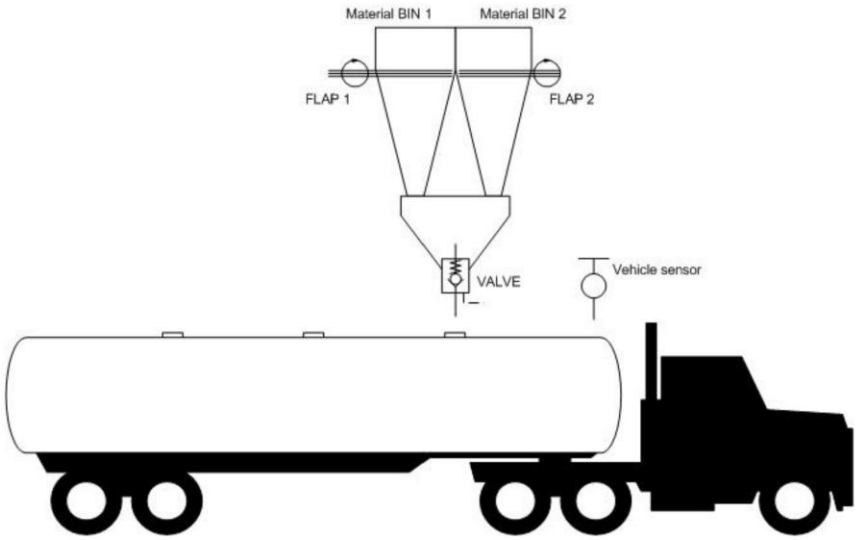
When a train is coming from GREEN LINE the rail segment A'B' C'D' rotates counter clock wise and comes to ABCB position, which enable the train to move towards S direction in the GREEN LINE.

Two colour lights are located in both lines, 500m before the intersection point and two sensors are located 600m before the intersection point to detect trains in GREEN and BLUE LINE.

When a train is detected on either line, the rail segment at the intersection point should be locate appropriately and light the GREEN lamp. If the rail segment at the intersection is not in order, the RED Lamp should light in order to stop the train.

- Construct a ladder logic diagram in order to implement the above system using a PLC. (Indicate your inputs and outputs clearly in the networks with comments)

Exercise 2 - Feeder

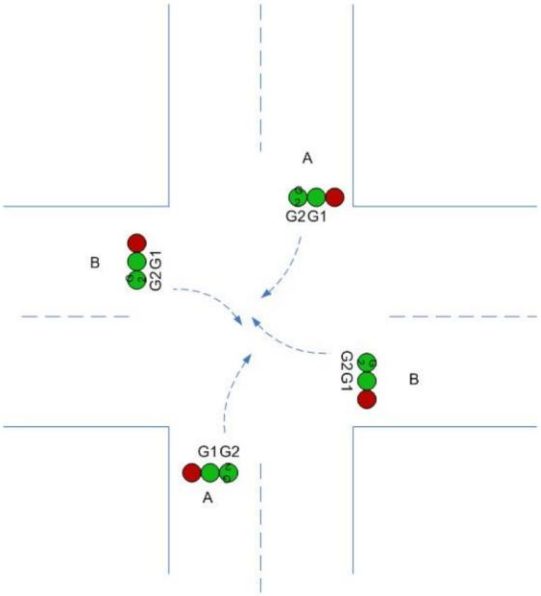


The above diagram shows a grain filling station. Two types of grain filled in two bins (Material BIN1 and Material BIN 2).

- When the vehicle comes into contact with the vehicle detection sensor the system gets activated.
- The FLAP1 and FLAP 2 are two large gates which are operated by motors. These gates are used to stop the flow of grains towards the bottom VALVE.
- When the vehicle detected the FLAP 1 opens for 500ms time. At the same time the bottom VALVE also open to flow the grain to the container.
- After 500ms time the FLAP1 closes and FLAP 2 opens to flow grains towards the bottom VALVE to fill into the container.
- The FLAP 2 keeps open for 500ms and closed.
- The bottom VALVE closes after 20ms when FLAP 2 closes.

Design the ladder diagram to automate the above process using a PLC

Exercise 3 - Color Light System



The above figure shows a color light system installed at a four way junction. The light system A and B function together.

- When G1 lamp ON vehicles allow to go straight ahead
- When G2 lamp ON vehicles allow left turns
- RED lamp (RB) ON for 10 s ¬ GA2 is ON only for 4 s and OFF
- As soon as GA2 OFF the GA1 ON for 6 s.
- After GA1 OFF the RA get ON for 10 s
- GB2 is ON only for 4 s and OFF
- As soon as GA2 OFF the GB1 ON for 6 s.
- After GB1 OFF RB ON for 10 s and same cycle begins.

To implement above traffic light system using a PLC, design a ladder diagram.

Exercise 2 - Feeder

A feeder drops material onto a conveyor, which then transfers the material to another conveyor for further processing. The feeder is equipped with a motor (motor 3) that activates to feed the material onto the conveyor belts. When the system starts, motor 3 turns on to begin dropping material. Load cells are installed beneath the conveyor belts to detect the presence of material. The conveyors must start automatically when material is dropped on them. Specifically, when

material is detected on conveyor belt 1, motor 1 should start. Similarly, motor 2 should remain on as long as material is detected on conveyor belt 2 by load cell 2. The system can be stopped at any time. Write a ladder diagram to implement the system.

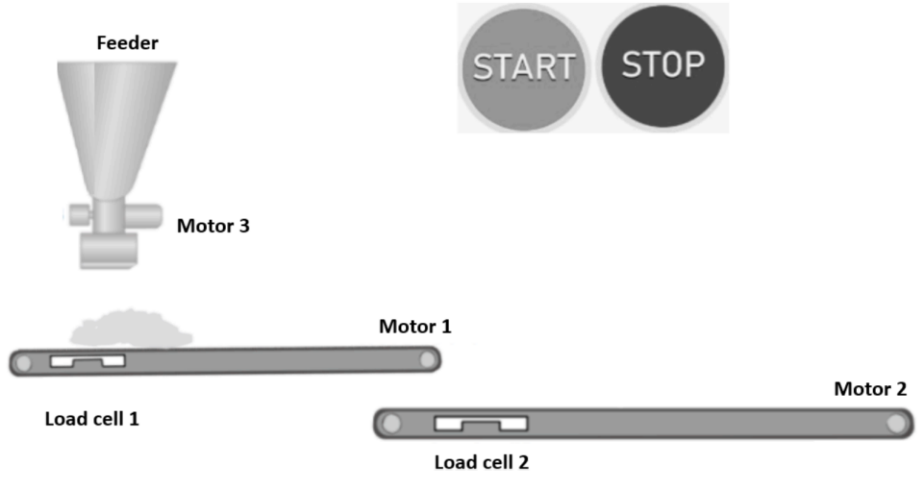


Figure 2

- Draw the hardware connection diagrams for all above exercises, showing how the sensors, motor, relay, indicators, and buttons are connected to the Fatek FBs-24MAT2-AC PLC (with Transistor SINK (NPN) output) PLC.