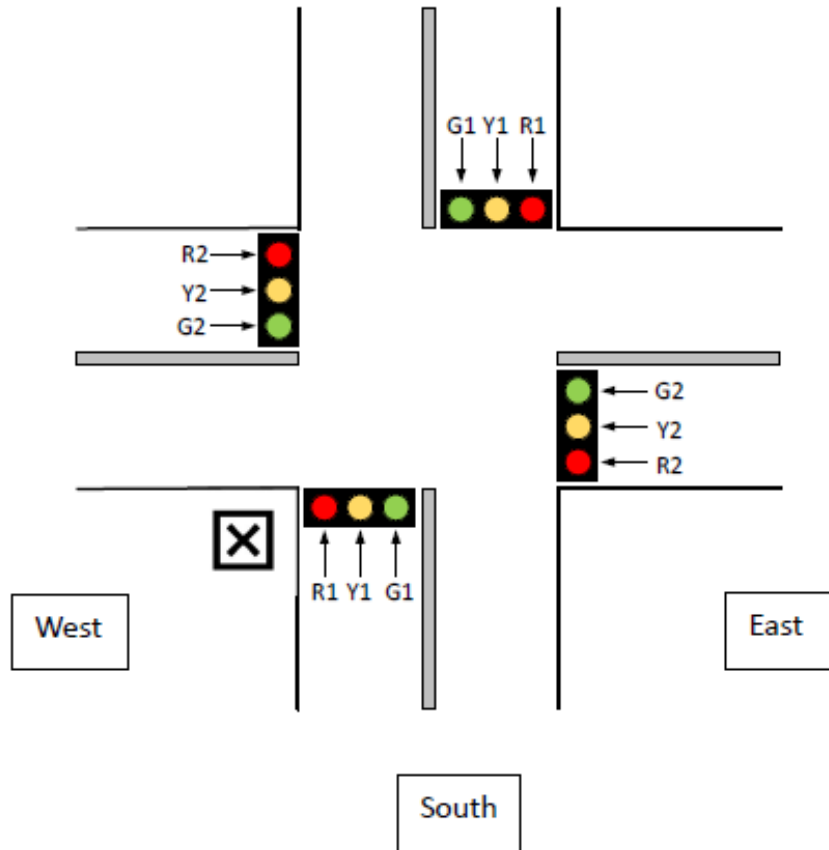


# Traffic Light Sequence Control



## Objectives:

1. Build a PLC ladder program for controlling traffic light sequence of a 4-way intersection.
2. Green lights will be ON for 80 seconds and yellow lights for 10 seconds.
3. Implement a system where, if the traffic is low in one lane, the other lane's green lights will be ON before 90 seconds.
4. On the west side there is an extra button (X) to help crossing the street from west to east. When a pedestrian presses "X" it forces the green light to change into yellow after 20 seconds.
5. Provide a reset button for the whole system.
6. Modify the system for a left turn signal from east to south only.

**Software Used:** XG5000

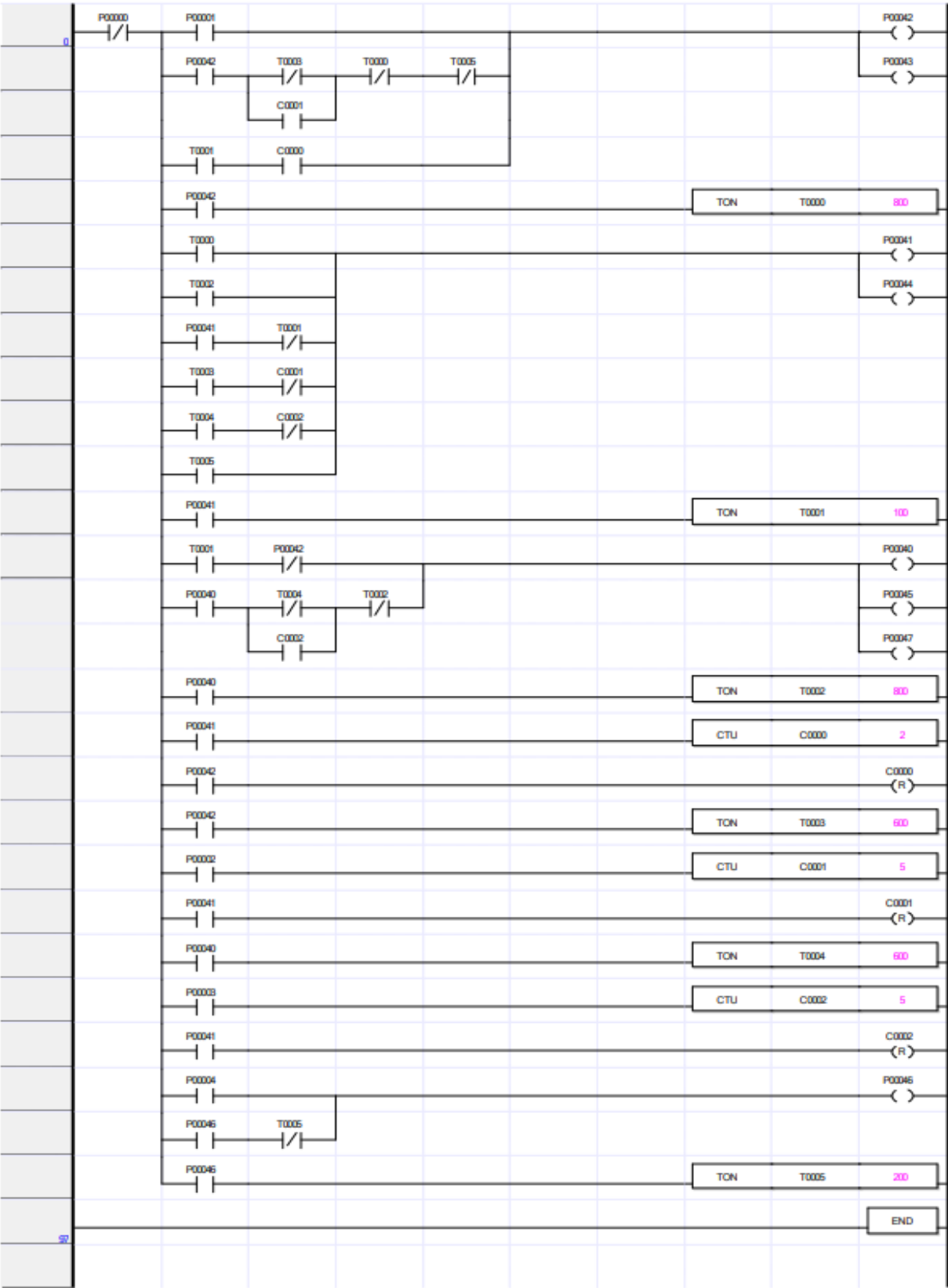
**Input Switches and Sensors:**

P00	Stop/Reset Switch
P01	Start Switch
P02	Sensor for counting cars in the North-South lane
P03	Sensor for counting cars in the East-West lane
P04	'X' button

**Output Signals:**

P40	R1 (Red signal in the North-South lane)
P41	Y1 (Yellow signal in the North-South lane)
P42	G1 (Green signal in the North-South lane)
P43	R2 (Red signal in the East-West lane)
P44	Y2 (Yellow signal in the East-West lane)
P45	G2 (Green signal in the East-West lane)
P46	Green signal for crossing the road
P47	Left turn signal from East to South

PLC Ladder Logic Diagram:



## **Traffic Condition Scenarios:**

1. Moderate Traffic in north-south lane:  
When the traffic is normal the Green signal(G1) is ON for 80 seconds in the North-South lane and the Red signal(R2) is ON in the East-West lane for the same time.
2. After 80 seconds G1 and R2 turn OFF and the Yellow signals Y1 and Y2 in both the lanes turn ON for 10 seconds.
3. Moderate Traffic in east-west lane:  
After 10 seconds the Yellow signals (Y1 and Y2) turn OFF. The Green signal(G2) of East-West lane and Red signal(R1) of North-South lane turns ON for 80 seconds.
4. After 80 seconds G2 and R1 turn OFF and the Yellow signals Y1 and Y2 in both the lanes turn ON again for 10 seconds.
5. Less Traffic in north-south lane:  
If in between 60 seconds of Green signal, the number of cars crossing the traffic signals in the north-south lane is less than 5 (for simplicity), it is considered as less traffic and the Green signal(G1) turns OFF at 60 seconds (before 80 seconds). After 60 seconds the Yellow signals turn ON for 10 seconds and after this the Green signal of the east-west lane (G2) turns ON before 90 seconds.
6. Less Traffic in east-west lane:  
If in between 60 seconds of Green signal, the number of cars crossing the traffic signals in the east-west lane is less than 5 (for simplicity), it is considered as less traffic and the Green signal(G2) turns OFF at 60 seconds (before 80 seconds). After 60 seconds the Yellow signals turn ON for 10 seconds and after this the Green signal of the north-south lane (G1) turns ON before 90 seconds.
7. 'X' button is pressed:  
When a pedestrian presses the 'X' button in the west side, it forces the Green signal to change to Yellow after 20 seconds and eventually the Red signal is ON in the north-south lane so that the cars stop and the pedestrians can cross the road from west to east. This Red signal is ON for 80 seconds. There's an additional signal showing Green signal for pedestrians to cross the road during this period.
8. A left indicating signal:  
There's an additional signal in the East side showing left turn signal from east to south only during the period when the Green signal (G2) is ON in the east-west lane.

## **Sequential Mechanism in Different Traffic Condition Scenarios:**

- 1) Moderate Traffic in north-south lane:  
G1(P42) & R2(P43) turn ON for 80s as traffic is normal there. G1(P42) energizes both timer T00 & T03. Though T03 triggers after 60s, it doesn't turn OFF G1 & R2 as C01 gets high which nullifies the T03's action. C01 turns ON when 5 vehicles went from north-south before 60s as we assumed 5 vehicles moving indicates normal traffic. P02 is a photosensor which triggers counter C01 by plus 1 every time when a car passes. G1 & R2 turn OFF after 80s as T00 triggers while Y1(P41) & Y2(P44) turn ON.

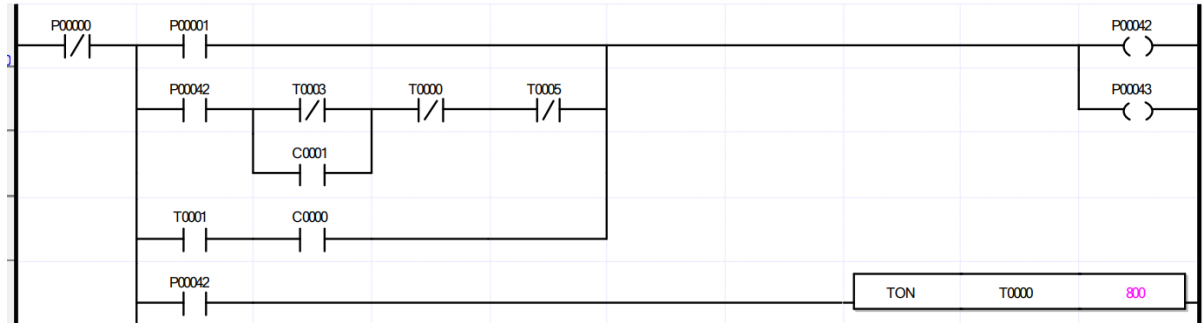


Fig: G1 R2 turned off as triggered by T00

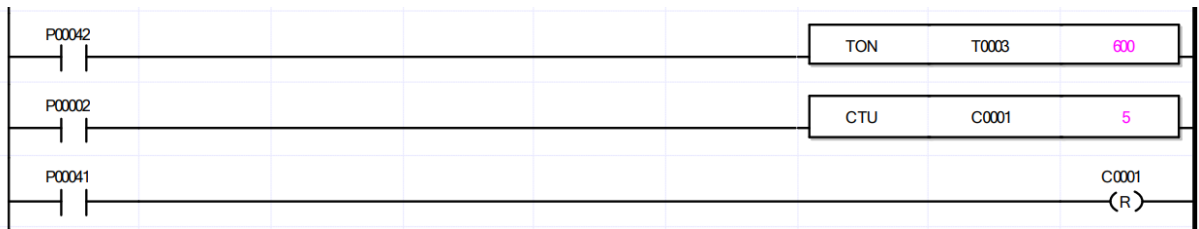


Fig: C01 nullifies T03's action

## 2) Moderate Traffic in east-west lane:

G2(P45) & R1(P40) turn ON for 80s as traffic is normal there. R1(P40) energizes both timer T02 & T04. Though T04 triggers after 60s, it doesn't turn OFF G2 & R1 as C02 gets high which nullifies the T04's action. C02 turns ON when 5 vehicles went from east-west before 60s as we assumed 5 vehicles moving indicates normal traffic. P03 is a photosensor which triggers counter C01 by plus 1 every time when a car passes. G2 & R1 turns OFF after 80s as T02 triggers while Y1(P41) & Y2(P44) turns ON.

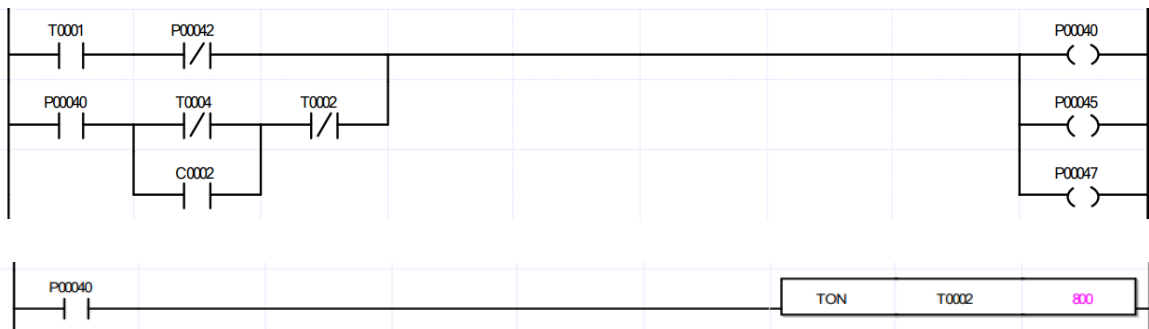


Fig: G2 R1 turned off as triggered by T02

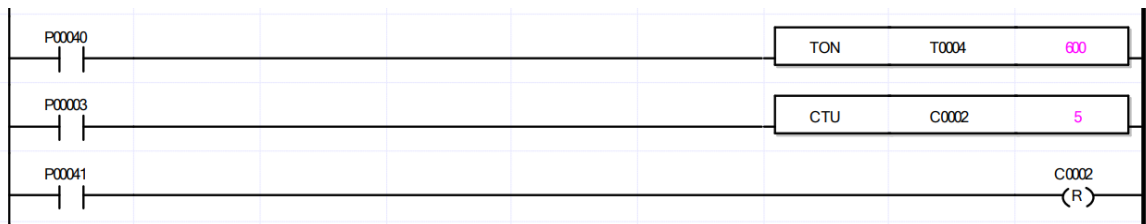


Fig: C02 nullifies T04's action

3) Less Traffic in north-south lane:

G1 & R2 stay ON for 60s instead of 80s, as we assumed G1 to be ON 20s less during less traffic conditions. G1(P42) energizes both timer T00 & T03. But T03 triggers first after 60s; G1& R2 turn OFF while Y1 & Y2 turn ON.

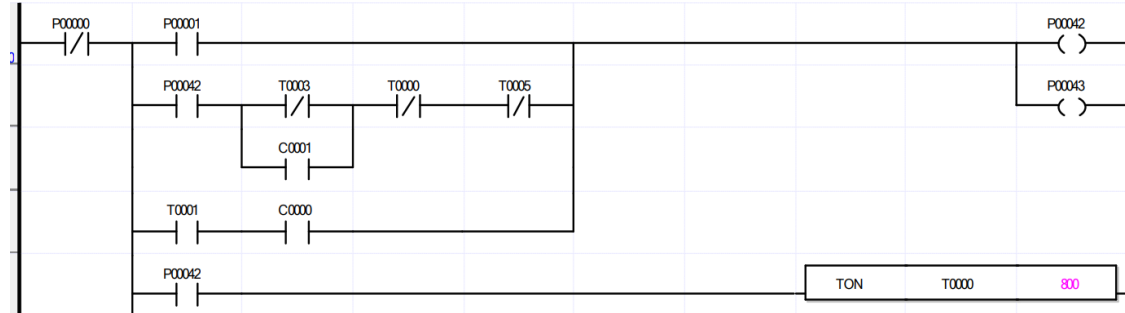


Fig: G1 & R2 with latches



Fig: T03 triggers before T00

4) Less Traffic in east-west lane:

G2 & R1 stay ON for 60s instead of 80s, as we assumed G2 to be ON 20s less during less traffic conditions. R1(P40) energizes both timer T02 & T04. But T04 triggers first after 60s; G2 & R1 turn OFF while Y1 & Y2 turn OFF.

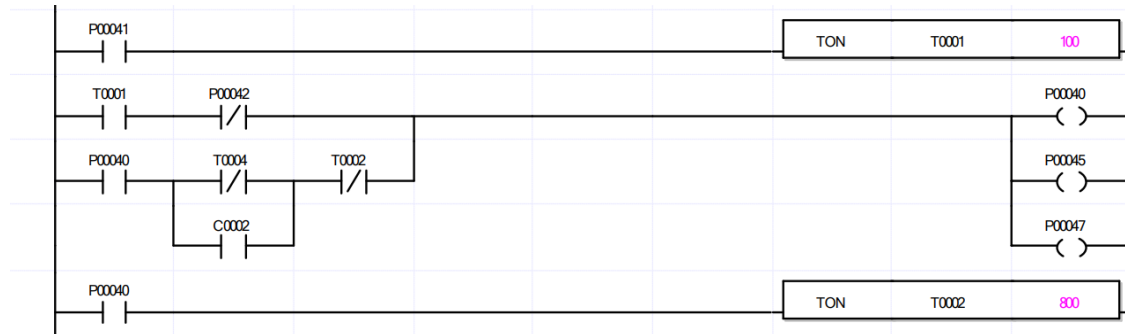


Fig: G2 & R1 with latches

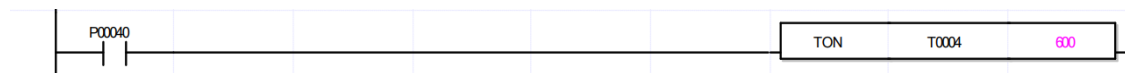


Fig: T04 triggers before T02

- 5) When 'X' button is pressed for pedestrians to cross west to east with above conditions:  
 When a pedestrian hits the 'X' button (P04), a road crossing signal (P46) is initiated which turns ON a timer T05. T05 after 20s, gets triggered which eventually triggers the yellow signals (Y1 & Y2) to forcefully turn ON allowing the pedestrian to walk.

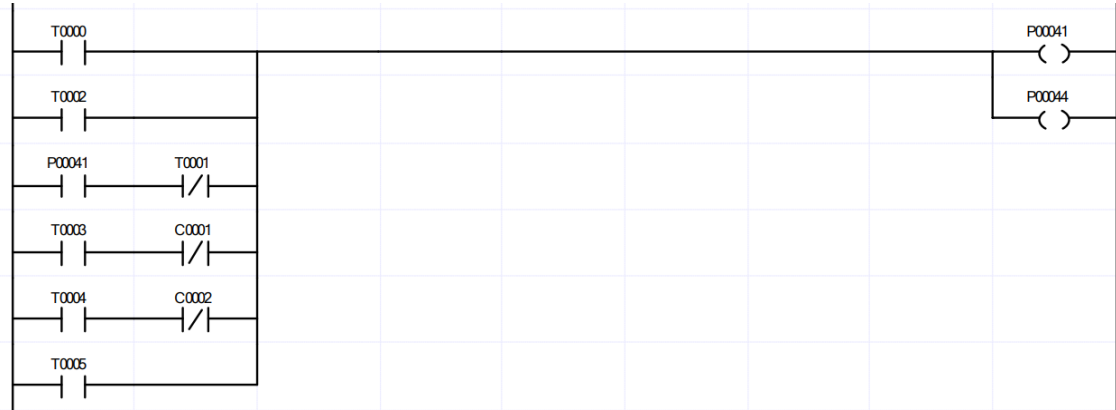


Fig: Y1 & Y2 with latches

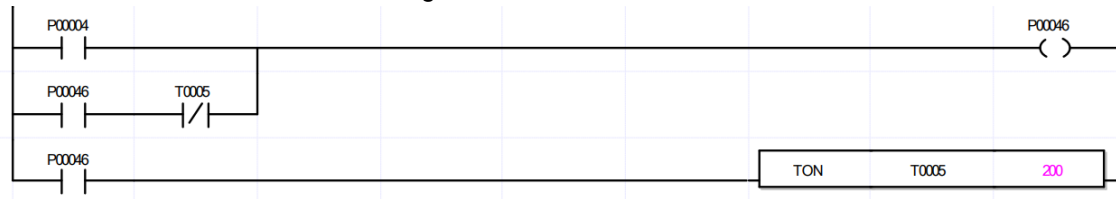


Fig: 'X' button triggers T05 which triggers Y1 & Y2

- 6) Left turn signal from east to south only with all above conditions:  
 When G2 is turned ON, indicating that cars can go from east-west, at the same time a light (P47) which is placed in the south lane also turns ON, indicating that cars from east can turn left to the south lane freely.

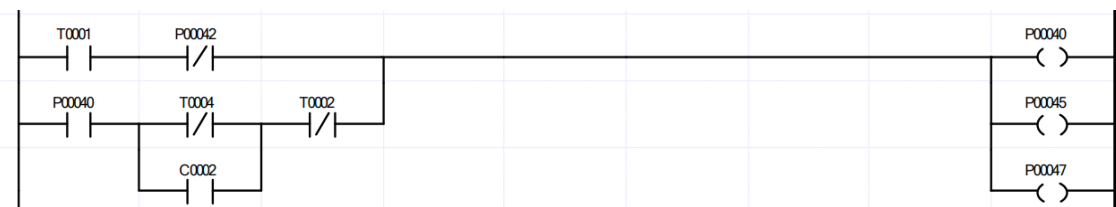


Fig: Left turn signal gets on when G2 energizes

- 7) Reset the system and turning back ON:  
 Pressing P00 will reset the whole system. It also works as an OFF switch. Pressing P01 will start the system again.

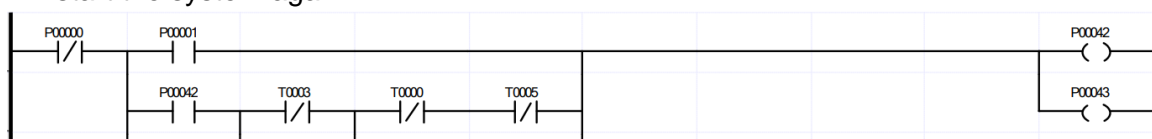


Fig: P00 resets and P01 initializes the system

**Issues faced during designing the system:**

We did not face any issues while designing the system. It seemed complex at the beginning. So, we advanced step by step completing one objective and moving on to the next one. This made the problem easier and thus we fulfilled all the objectives.

**Conclusion:**

This project successfully achieved its objectives of designing a PLC ladder logic diagram for traffic control at a 4-way intersection. The implemented system effectively controls the traffic light sequence, considering various factors such as green light duration, yellow light duration, and the presence of low traffic in one lane. A smart feature has been incorporated where, if the traffic is low in one lane, the green lights in the other lane will be activated before the standard 90-second interval.

To enhance pedestrian safety, a specific scenario was considered on the west side of the intersection. A pedestrian crossing button ("X") was implemented, enabling pedestrians to trigger a change in the green light to yellow after 20 seconds, allowing them to safely cross the street from west to east.

Furthermore, a reset button was provided to reset the entire system, ensuring smooth operation and eliminating any potential issues or glitches.

Lastly, the system was modified to accommodate a left turn signal exclusively for traffic traveling from the east to the south. This modification enhances traffic flow and improves safety by providing a dedicated signal for this specific movement.

Overall, this project successfully designed a PLC ladder logic diagram for traffic control, incorporating various features and functionalities to optimize traffic flow, prioritize pedestrian safety, and allow for specific traffic movements.