Lab 6: Sequencer Output Application

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Humber Polytechnics

Programmable Logic Controllers: MENG 3500 0NB

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PROGRAMMABLE LOGIC CONTROLLERS
MENG 3500

LABORATORY ASSIGNMENT SHEET

Lab Assignment	Description	Lab Attendance	Successful Run	Report Mark
1	Motor Control	✓	Jan 16, 2025	
2	Two-DC Motors Control With The Problem Detection	✓	Jan 23, 2025	
3	Timers and Counters	✓	Jan 30, 2025	
4	Computations and Comparison	✓	Feb 27, 2025	
5	Cascading Sequence	✓	Feb 27, 2025	
6	Sequencer Output Application	✓	March 27, 2025	
7	Stepper Motor Control	✓	April 03, 2025	
8	Programming with ST, FBD, SFC			
9	Temperature ON-OFF control			
10	Temperature PID control			

Lab Activities and Submission													
Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
Lab 1	Lab 2	Lab 3	Lab 4	Lab 5	Make up Lab	Make up Lab	Lab 6	Lab 7	Lab 8	Lab 9	Lab 10	Make up Lab	Make up Lab
	Report 1	Report 2	Report 3	Report 4	Report 5			Report 6	Report 7	Report 8	Report 9	Report 10	

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It is the student's responsibility to keep this sheet up to date as the proof of the course work.

Notes:

- The column titled Attendance will be checked at the end of the lab activity.
- The column titled Successful Runs, will be initialed when the assignment is seen to run and satisfy the requirements.
- The column titled Report / Mark will be initialed when the report has been handed in to the professor and marked.
- The minimum passing mark will be given to the signed assignments without written report. All the labs have to be handed in satisfying the rubric below.

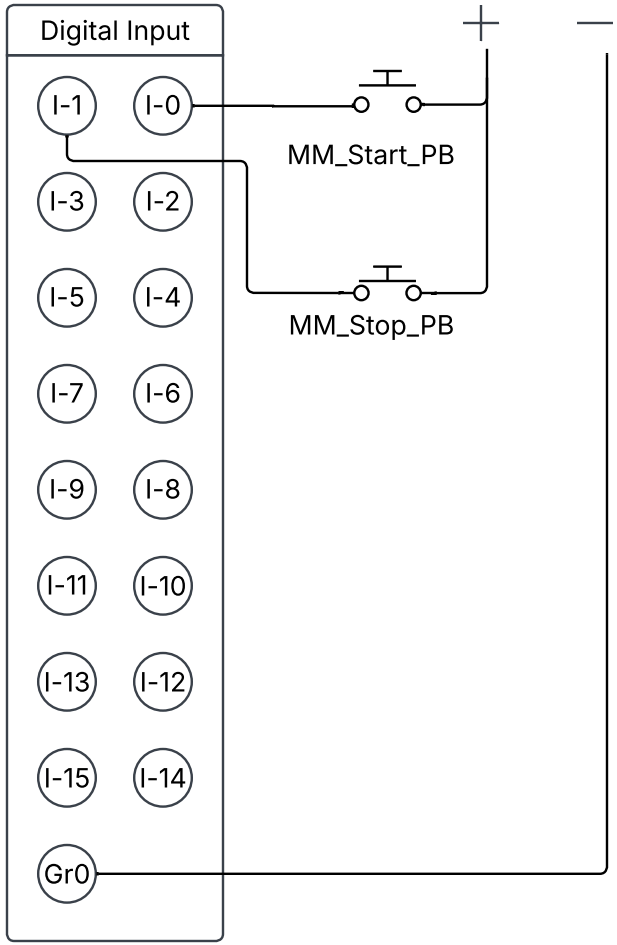
Objectives

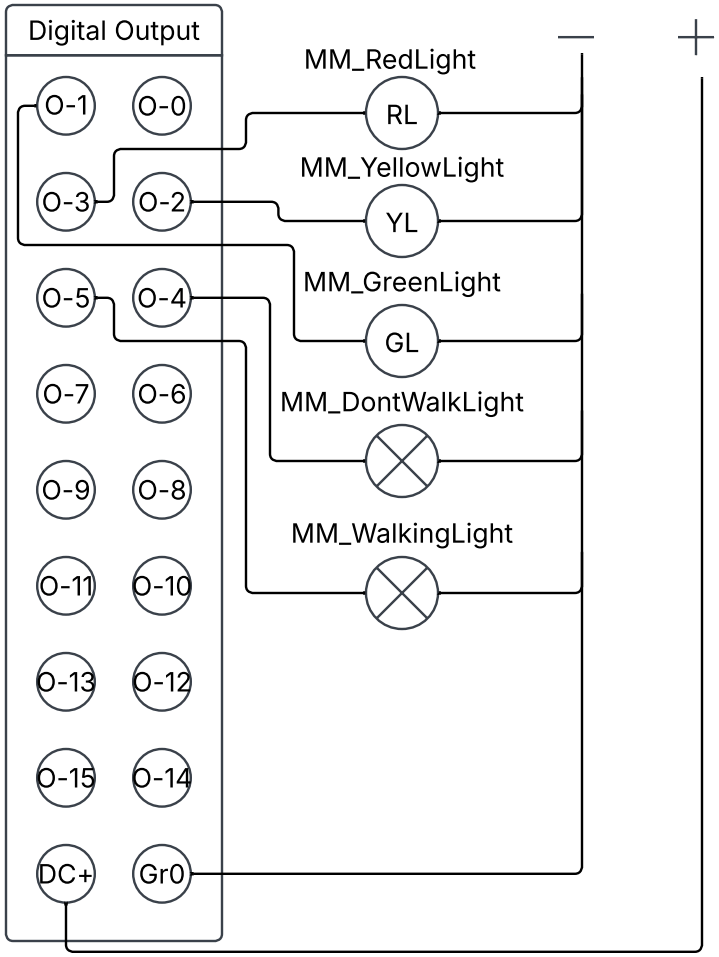
This Lab focuses on the implementation of a Sequence Output (SQO) to create & control traffic lights and pedestrian lights based on a set of requirements. The objectives are:

1. Establishing stable communication between the PLC and the Computer.
2. Implementing the Sequence Output (SQO) for Traffic Light sequencing.
3. Designing a Start-Stop Mechanism to control the process and pedestrian signals.
4. Creating a timed light sequence for traffic light and pedestrian walkway as specified in the set of requirements.
5. Wiring the Input Push Buttons and Output lights as per the requirements.
6. Running and Troubleshooting the program ensuring accurate timing and transition.

Description of Work Completed

- **PLC Communication Setup:** Communication between the PLC and computer was configured and verified.
- **Sequencer Output Logic Development:** Traffic Light sequence was programmed as follows:
    - **Red Light:** ON for 8 seconds.
    - **Green Light:** ON for 8 Seconds.
    - **Yellow Light:** ON for 4 Seconds.
- **Pedestrian Signal Logic:**
    - **DON'T WALK Light (Steady ON):** Active During the Last 2 seconds of Yellow Light phase
    - **WALK Light (Steady ON):** Active during the first 4 seconds of the Green phase.
    - **DON'T WALK Light (Flashing at 0.5s intervals):** Active during the last 4 seconds of the Green phase.
    - **DON'T Walk Light (Steady ON):** Remains steady ON during the last 2 seconds of the Yellow Light phase.
- **Troubleshooting & Debugging:**
    - The **flashing pedestrian light** was tested for correct 0.5-second intervals.
    - Edge cases, such as pressing STOP_PB mid-cycle, were verified to ensure the system reset correctly.
    - Delays and sequencing errors were corrected for smooth operation.


Digital Input
I-1
I-0
I-3
I-2
I-5
I-4
I-7
I-6
I-9
I-8
I-11
I-10
I-13
I-12
I-15
I-14
Gr0
MM_Start_PB
MM_Stop_PB


Digital Output
O-1
O-0
O-3
O-2
O-5
O-4
O-7
O-6
O-9
O-8
O-11
O-10
O-13
O-12
O-15
O-14
DC+
Gr0
MM_RedLight
RL
MM_YellowLight
YL
MM_GreenLight
GL
MM_DontWalkLight
MM_WalkingLight

This rung handles the start and stop control of the traffic light sequence.
When the MM_Start_PB (Normally Open) is pressed, it energizes MM_Run, enabling the sequence operation
Pressing MM_Stop_PB (Normally Closed) deactivates MM_Run, stopping the sequence and resetting outputs.

0

MM_Stop_PB <Local:1:I.Data.1>
MM_Start_PB <Local:1:I.Data.0>
MM_Run
MM_Run

This rung activates a TON (Timer On Delay) called MM_Step_Timer whenever MM_Run is active.

The timer has a preset value of 500 milliseconds, meaning it must be ON for that duration before completing

The DN (Done) bit of the timer is used in the next rung to trigger the sequencer instruction.

1

MM_Run
MM_Step_Timer.DN

TON	
Timer	MM_Step_Timer
Preset	500
Accum	52

EN
DN

The SQO instruction updates the traffic light outputs based on predefined sequence steps stored in MM_LightSequence.

The sequence progresses each time MM_Step_Timer.DN is set, ensuring a timed operation.

The MM_Mask ensures only relevant bits are modified, and MM_LightDestination holds the output state for each step.

2

MM_Step_Timer.DN

SQO	
Array	MM_LightSequence
Mask	MM_Mask
Dest	MM_LightDestination
Control	MM_SEQ_Control
Length	41
Position	1

EN
DN

If bit 0 in MM_LightDestination is set, MM_RedLight (Local:2:O.Data.3) turns ON.

This corresponds to the RED traffic signal being active for the specified sequence step.

3

MM_LightDestination.0
MM_RedLight <Local:2:O.Data.3>

When bit 1 of MM_LightDestination is set, the GREEN light (MM_GreenLight) turns ON.

This allows traffic to proceed during the GREEN phase of the sequence.

4

MM_LightDestination.1
MM_GreenLight <Local:2:O.Data.1>

If bit 2 in MM_LightDestination is activated, the YELLOW light (MM_YellowLight) turns ON
The yellow signal serves as a transition phase, warning vehicles that the light will soon change.

5

MM_LightDestination.2
MM_YellowLight <Local:2:O.Data.6>

This rung controls the MM_WalkingLight, which turns ON when bit 3 in MM_LightDestination is set.

It corresponds to the pedestrian "WALK" signal, which allows people to cross the street.

6

MM_LightDestination.3
MM_WalkingLight <Local:2:O.Data.5>

This rung manages the MM_DontWalkLight, which is activated when bit 4 in MM_LightDestination is set

The “DON’T WALK” light remains ON when the RED light is active and flashes during the last 4 seconds of GREEN.

MM_LightDestination.4 MM_DontWalkLight <Local:2:O.Data.4>

7

If MM_Stop_PB is pressed, the sequence position (MM_SEQ_Control.POS) is reset to 0 using a MOV instruction.

Additionally, all output values in MM_LightDestination are cleared, turning OFF all traffic lights

This ensures the system starts from the beginning when restarted, avoiding any inconsistent states.

MM_Stop_PB <Local:1:I.Data.1>

8

MOV
Source 0
Dest MM_SEQ_Control.POS 1

MOV
Source 0
Dest MM_LightDestination 17

(End)

Conclusion

The lab hasn’t been completed or shown, but the wiring diagram and the thought of the PLC programming has been completed. The SQO instruction provided handled the light sequencing, reducing the need for complex individual timers. The Pedestrian signals is timed and synchronized with the traffic light, ensuring safe pedestrian crossing. This Lab reinforces the idea of sequencing logic, real-time timing control, and emergency stop handling in the PLC Programming.