Lab 3: Tracking the UV Lamp Irradiation Time

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Humber Polytechnics

Programmable Logic Controllers: MENG 3500 0NB

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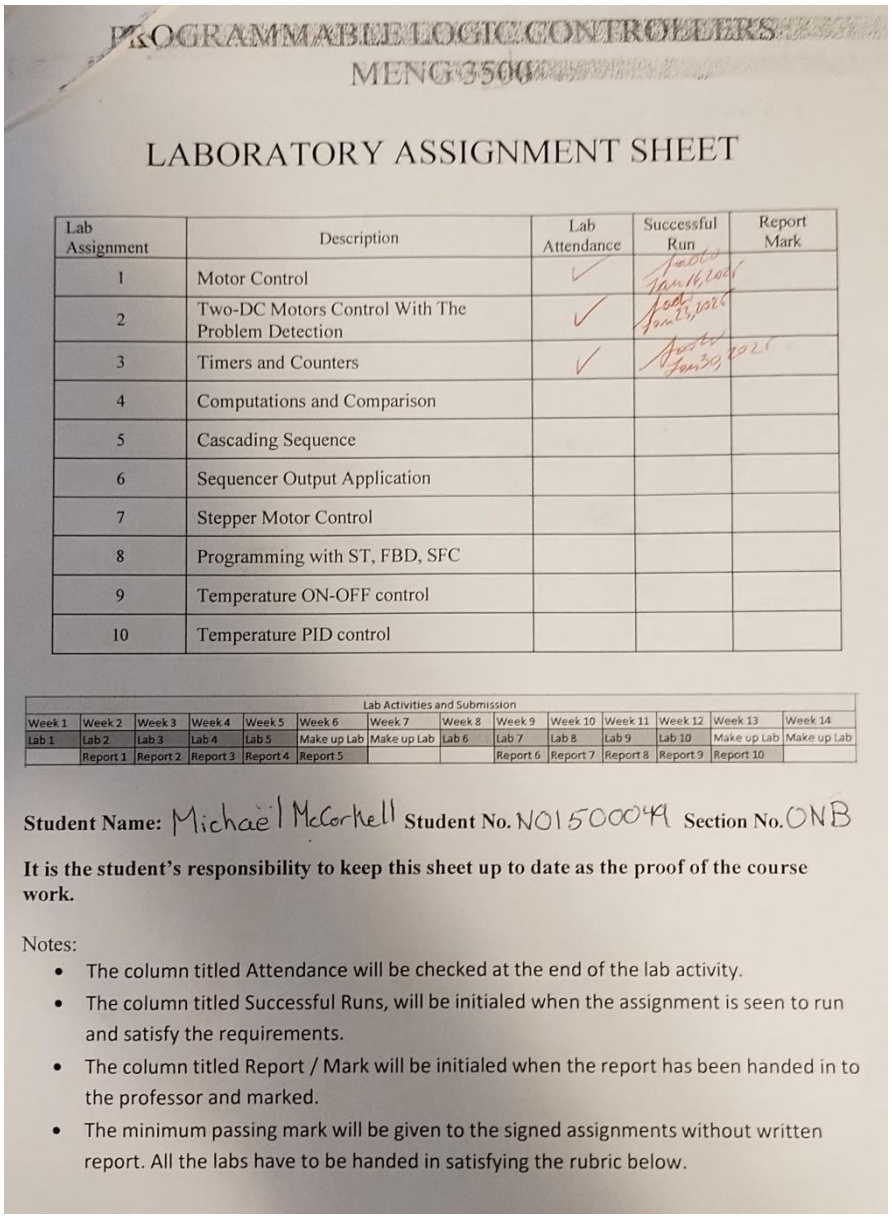
February 4, 2025



PROGRAMMABLE LOGIC CONTROLLERS
MENG 3500

LABORATORY ASSIGNMENT SHEET

Lab Assignment	Description	Lab Attendance	Successful Run	Report Mark
1	Motor Control	✓	Jaadu Jan 16, 2025	
2	Two-DC Motors Control With The Problem Detection	✓	Jaadu Jan 23, 2025	
3	Timers and Counters	✓	Jaadu Jan 30, 2025	
4	Computations and Comparison			
5	Cascading Sequence			
6	Sequencer Output Application			
7	Stepper Motor Control			
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 designing a PLC program to track and control the operation time of a UV irradiation lamp. The primary goals include:

1. Establishing a stable communication link between the PLC and the computer.
2. Implementing timers to measure and track the lamp's operational time.
3. Using counters to accumulate time measurements up to a predefined limit.
4. Developing a PLC program to manage lamp operation and replacement indication.
5. Wiring field devices, including pushbuttons, the lamp, and an alert signal light.
6. Downloading and verifying the program on the PLC.
7. Running the system and troubleshooting any errors in logic or hardware.

Description of Work Completed

- **PLC Communication & Initial Setup:** The PLC was connected to the computer, and communication was tested to ensure stability.
- **Timer & Counter Integration:**
    - The program included a **1000-hour clock interlock** using timers and counters to track the lamp's runtime in hours, minutes, and seconds.
    - A reset function was implemented to allow the runtime counter to be cleared.
- **Control Logic Development:**
    - The lamp was programmed to turn **ON and OFF** using a Normally Open (N.O.) START pushbutton and a Normally Closed (N.C.) STOP pushbutton.
    - A **safety interlock** prevented the lamp from exceeding 1000 hours of operation.
    - The lamp could not be restarted unless the RESET button was held for **3 seconds.**
    - A flashing **RED signal light (0.5s ON, 0.5s OFF)** was programmed to indicate that the lamp required replacement after reaching 1000 hours.
- **Field Device Wiring:**
    - Pushbuttons, the UV lamp, and the RED signal light were wired according to the provided schematic.
- **Program Execution & Testing:**
    - The program was downloaded and executed on the PLC, and runtime tracking was validated.
    - A **manual reset mechanism** was tested to ensure that the system cleared time tracking correctly.
    - Fault scenarios, such as exceeding 1000 hours and incorrect button presses, were tested to ensure proper response.

When this rung is energized, it will activate the output Run activating Rung 1 (Turning on the Lamp) and Rung 2 Starting the Timer for 1 second.

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

1
MM_Run
MM_Lamp <Local:2:O.Data.1>

Timer has a preset of 1000 because its running in miliseconds, now its for 1 Second.

2
MM_Run
MM_Seconds.DN

TON		
Timer	MM_Seconds	EN
Preset	1000	DN
Accum	0	

The Values for MM_Hours & MM_Minutes & MM_Lifespan are smaller values to respect the time of the testing but when testing is finished and accepted, values should go to 60, 60, 1000.

3
MM_Seconds.DN
MM_Minutes.DN

CTU		
Counter	MM_Minutes	CU
Preset	2	DN
Accum	0	

4
MM_Minutes.DN
MM_Hours.DN

CTU		
Counter	MM_Hours	CU
Preset	2	DN
Accum	0	

5
MM_Minutes.DN
MM_Minutes (RES)

6
MM_Hours.DN
MM_Lifespan.DN

CTU		
Counter	MM_Lifespan	CU
Preset	2	DN
Accum	0	

7
MM_Hours.DN
MM_Hours (RES)

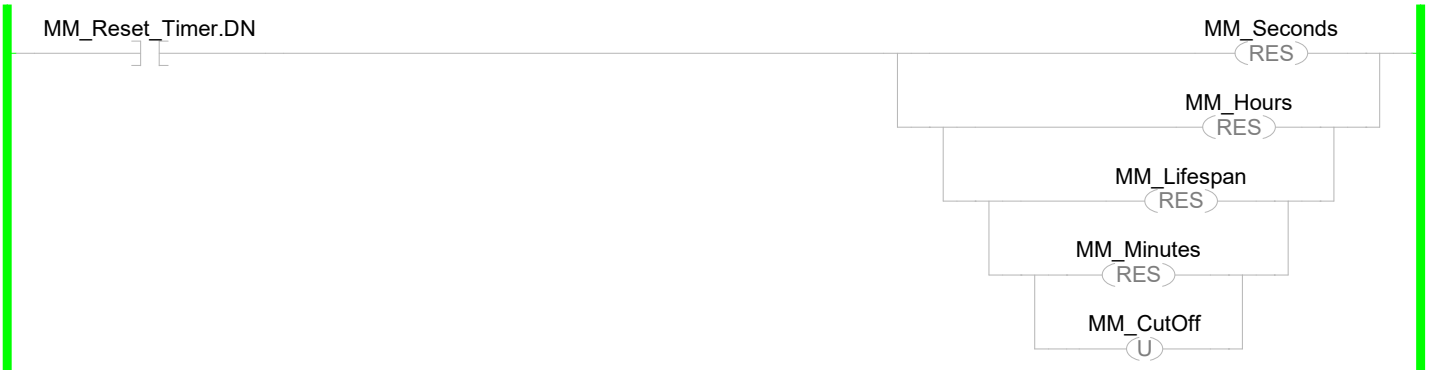
8
MM_Lifespan.DN
MM_CutOff

The Pushbutton Reset is only energized when it is needed by the operator when the timers and counters need to be reset on Rung 10.

9
MM_Reset_PB <Local:1:I.Data.2>

TON		
Timer	MM_Reset_Timer	EN
Preset	3000	DN
Accum	0	

10

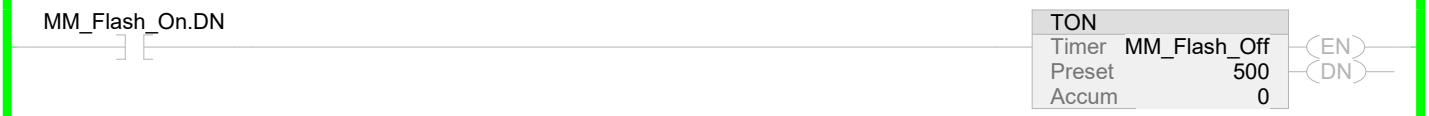


When the MM_Reset_Timer reaches the 3 seconds it'll trigger the Flashlight protocal where a 0.5s interval for on light and a 0.5s interval light off.

11

12

13



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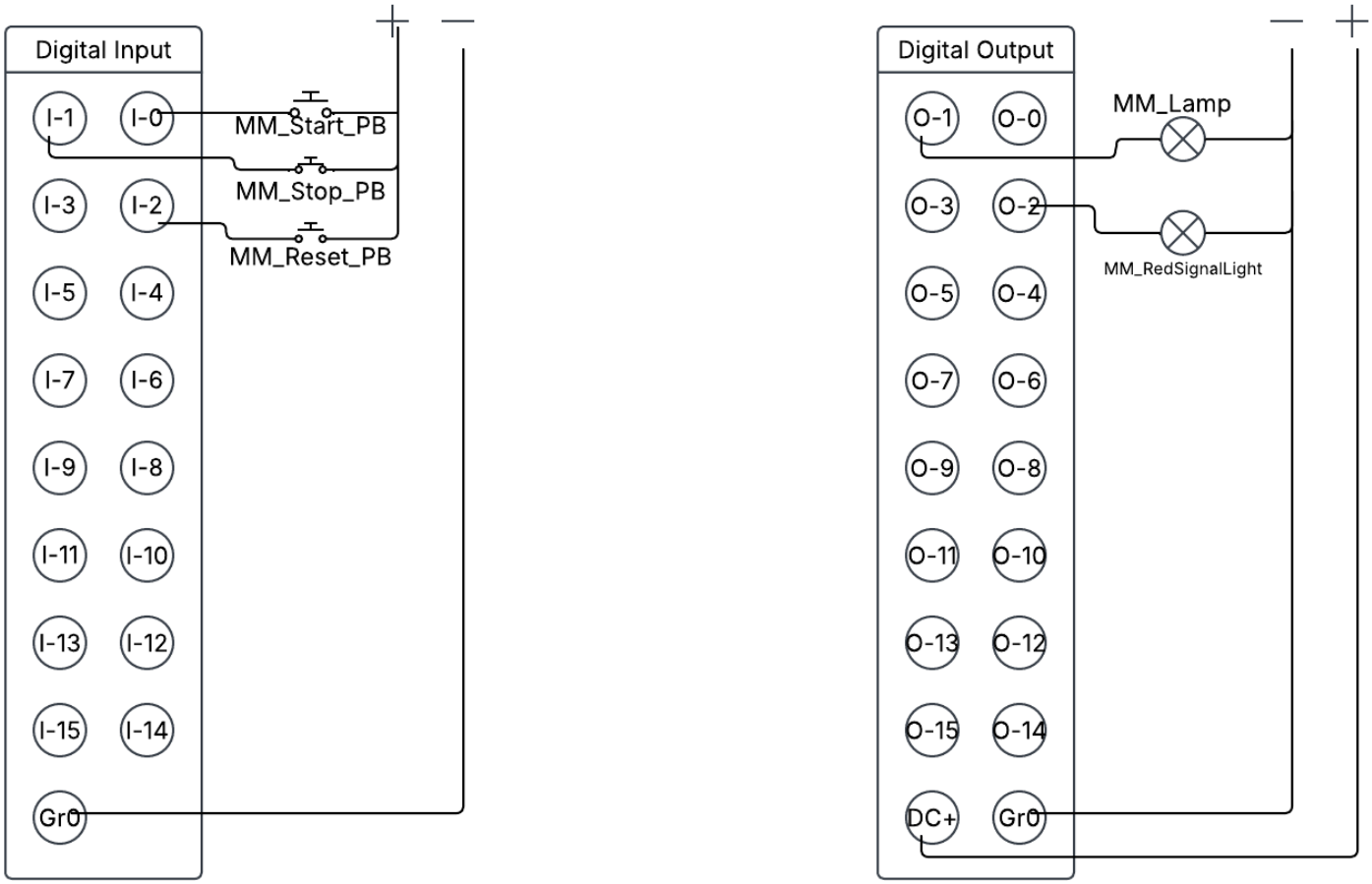
(End)

Wiring Diagram



Conclusions

The lab was successfully completed, and the PLC system functioned as expected. The combination of **timers, counters, and interlocks** ensured precise control over the UV lamp's runtime. The flashing RED signal effectively indicated when a lamp replacement was needed, and the reset mechanism allowed proper system recovery. This lab reinforced key concepts in **event tracking, safety interlocks, and real-time monitoring** using PLC programming.