LAB 11
INTRODUCTION TO LADDER LOGIC PROGRAMMING

This lab consists of four parts:
I. INTRODUCTION TO THE LAB EQUIPMENT:
   - Modicon Series Programmable Logic Controllers.
   - Taylor software for RLL (Relay Ladder Logic) programming.

II. IMPLEMENTATION OF TWO SIMPLE EXAMPLES:
   (The oscillating lamp, the real-time clock)

III. IMPLEMENTATION OF ALTERNATING (FLASHING) LIGHTS

IV. IMPLEMENTATION OF A TRAFFIC SIGNAL

Example 1: The oscillating lamp

![Ladder logic diagram for the oscillator](image)

**NOTE:** No external inputs are required to initiate the oscillator as shown. However, one can add a “START” switch to initiate the loop or stop it. The program as shown is selfstarting.

The only physical output is Y1 (connected to a lamp). The control relay C1 is an internal coil in the PLC.

**Features:**
- Timers in RLL.
- Discrete outputs (relay coils and contacts).
- Internal coils (used only for intermediate logic).
Example 2: The real-time clock

![Ladder logic diagram for the real-time clock](image)

**Figure 2:** Ladder logic diagram for the real-time clock

**Note:**
- The current time on the real time clock is indicated by the output indicators Y6 (hours): Y5 (minutes): Y4 (seconds), and Y1 (days).
- To speed up the simulation of the real-time clock during the lab, we’ll reduce the preset values of the counters. This will allow us to see the same I/O effects faster.

**Features:**
- Counters, Timers, Relay coils and contacts.

**ALTERNATING (FLASHING) LIGHTS**

A controller is needed to simulate an intersection where both sides are flashing red lights (the equivalent of a four-way stop). The timing diagram is as shown below.
TRAFFIC SIGNAL

A controller is needed to control the traffic lights of an intersection of two streets. Street number 1 (Washington Avenue) is a main street whereas street number 2 (Union Street) is a side street (or secondary street). The timing diagram is shown below.

Figure 3. Flashing lights: timing diagram

Figure 4: Traffic signal timing diagram
SEQUENCE OF EVENTS

Step 1: Turn Green 1 on for 35 seconds and Red 2 on for 40 seconds.
Step 2: Turn Green 1 off and turn Yellow 1 on for 5 seconds.
Step 3: Turn Yellow 1 off, Red 2 off, Green 2 on for 15 seconds and Red 1 on for 20 seconds.
Step 4: Turn Green 2 off and Yellow 2 on for 5 seconds.
Step 5: Turn Red 1 and Yellow 2 off.
Step 6: Repeat steps 1 through 6.

DESCRIPTION OF THE I/O POINTS

Y1: The green light of street 1.
Y2: The yellow light of street 1.
Y3: The red light of street 1.
Y4: The green light of street 2.
Y5: The yellow light of street 2.
Y6: The red light of street 2.

NOTE: Use an external input to initiate the cycle or stop it at any time. When the cycle is started, all timers must be enabled simultaneously or sequentially. When the cycle is tipped, all timers must be reset similarly. In addition, you can use as many internal coils (and contacts) as you need.

PRELAB # 11

It is important that you show up on time for the lab tour and all of the demos. Following the demonstrations, the whole group will be asked to implement a controller for alternating flashing lights using timers (Figure 3). This situation can been seen at street intersections where both sides display red blinking lights (a stop sign equivalent). There are two outputs, Y3 (red light on street 1) and Y6 (red light on street 2). Y3 and Y6 should alternate on and off at two-second intervals as shown in the timing diagram of Figure 3. The program will run indefinitely until it is halted. How can we do this externally while the program is running?

The group will then be asked to implement a controller for the traffic signal shown in Figure 4. The program will run indefinitely until it is halted.

Prelab requirements:
• Create a ladder logic diagram for the alternating flashing lights described in Figure 3.
• Create a ladder logic diagram for the streetlights described in Figure 4.
Prelabs are very important (they will account for a majority of the grade of Lab 9) and will be checked by your TA at the beginning of the lab. A hard copy of your work completed prior to the lab is required for prelab credit. Taylor software will be provided at the ME 308 computer labs, and students are encouraged (but NOT required) to save their work on a 3 ½” floppy disk before coming to lab.

**COMMENTS**
Implement your controllers using Taylor software. Have the TA initial your final draft of the program (printout from Taylor software) before you leave the lab. Keep this for later reference.

**Reports:**
During the lab, your TA will hand out detailed specifications of your lab write-up.