

Dan Otieno

CPE 459/559 – 01.

Traffic Light Assignment.

Due Date: 02/26/2024.

## **REPORT QUESTIONS.**

A. (60 points) Upload a video of your project running. Show the following in your video (All videos uploaded as separate files in Canvas):

1. ) Breadboard Function.

(a) (15 points) Show that red, yellow, lights function correctly. The lights should adhere to the timing requirements from the project description.

2. HMI Function.

(a) (15 points) Show that the north-south and east-west light stacks in the HMI exhibit the correct timing.

(b) (15 points) Show that the north-south and east-west light stacks in the HMI follow safety rules described in the project description.

(c) (15 points) show that each LED has a correct countdown timer in the HMI.

B. (10 points) What is the correct Modbus address for %QX100.5? Specify the address and the data type (coil, input status, holding register, input register).

**Response:**

- 100.0 ---> 800, 100.1 ---> 801, 100.2 ---> 802, 100.3 ---> 803, 100.4 ---> 804, 100.5 ---> 805.
- $m = (805/8) = 100$ ;  $l = (805 \bmod 8) = 5$ , therefore, 100.5
- Correct Modbus address = 805.
- According to <https://autonomylogic.com/docs/2-5-modbus-addressing/>, address =  $m.l$ , therefore for QX100.5,  $m = 100$  and  $l = 5$ .
- $100 = 805/8$  and  $5 = 805 \bmod 8$ , thus we can verify that the address is 805.
- This is a discrete output coil, and the datatype is binary.

C. (10 points) What is the correct Modbus address for %MW103? Specify the address and the data type (coil, input status, holding register, input register).

**Response:** Correct Modbus address = 1127. This is a whole number, so no Modulo operation. And holding registers increase by 1, so by adding 103 to 1024, we can determine the correct Modbus address of %MW103.

This is a holding register, and the datatype is a 2-byte signed integer.

D. (20 points) For the OpenPLC would it be correct to state that Modbus Coil address 0 and Modbus Holding register address 0 both point to the same location in the PLC memory? What kind of memory map model does OpenPLC follow? Explain your answer.

**Response:** Yes, it is correct to state that both the Modbus coil address 0 and Modbus Holding Register address 0 point to the same location in the PLC memory. Modbus memory mapping is vendor/application specific, and OpenPLC uses a model where each Modbus datatype has an address space ranging from 0 – 65535. Data types are arranged in blocks that occupy memory address spaces, specified by function codes. For example, it is possible that address 0 in the coils block is the same as address 0 in the holding register block. However, the function code instructs the slave device which memory block to access, depending on what action needs to be completed.