

## 31343 Introduction to Programmable Logic Controllers

### Exercise 6: “ex6\_trafficlight”

#### Purpose

The purpose of this exercise is to introduce programming of logic operations using timers and counters.

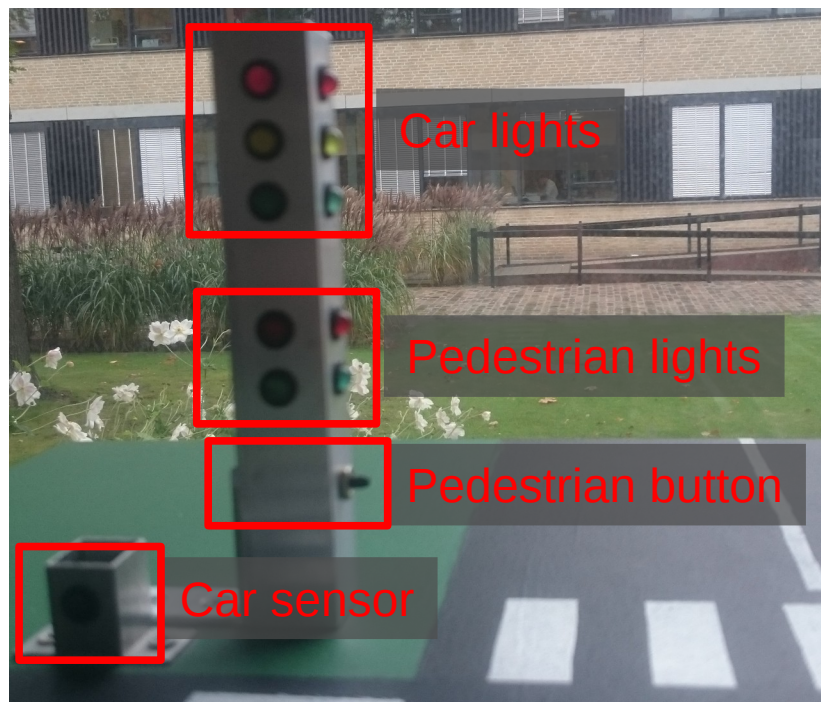
In this exercise we will use the traffic-light models placed in the cabinet in room 027 right next to the door. These are connected to the PLC's using a DB25 plug. A flat cable with the connecting plug is already mounted on the PLC's.

#### Part 1

Fetch a traffic light model in room 027 and connect it to the PLC system. Figure out which connections are used for each of the lights, pedestrian buttons and car sensors and configure the PLC to use appropriate variable names for these inputs and outputs. Create a table that states the relation between inputs and outputs on the PLC and the traffic light model and save this for your hand in.

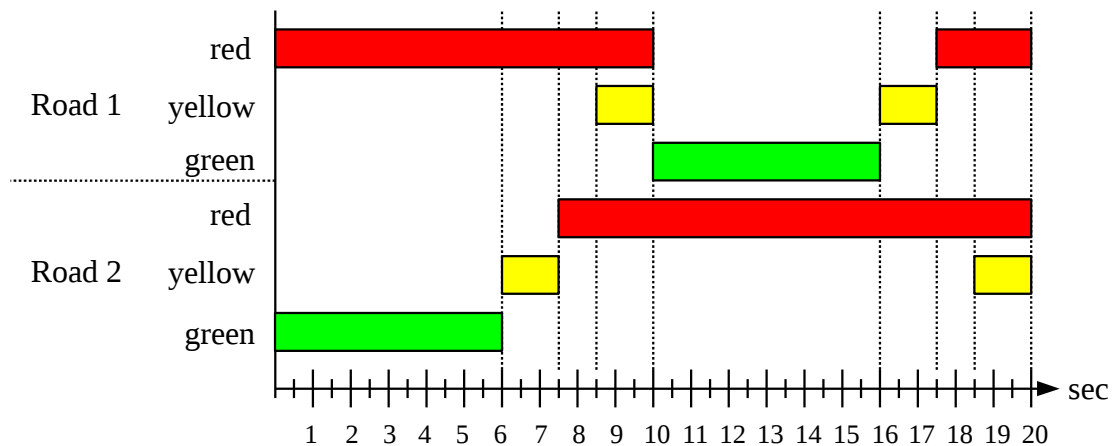
You should have 10 digital outputs (3 car lights for the main road, 3 car lights for the side road, 2 pedestrian lights for the main road and 2 pedestrian lights for the side road).

For the inputs you have 4 pedestrian buttons and 2 car sensors.



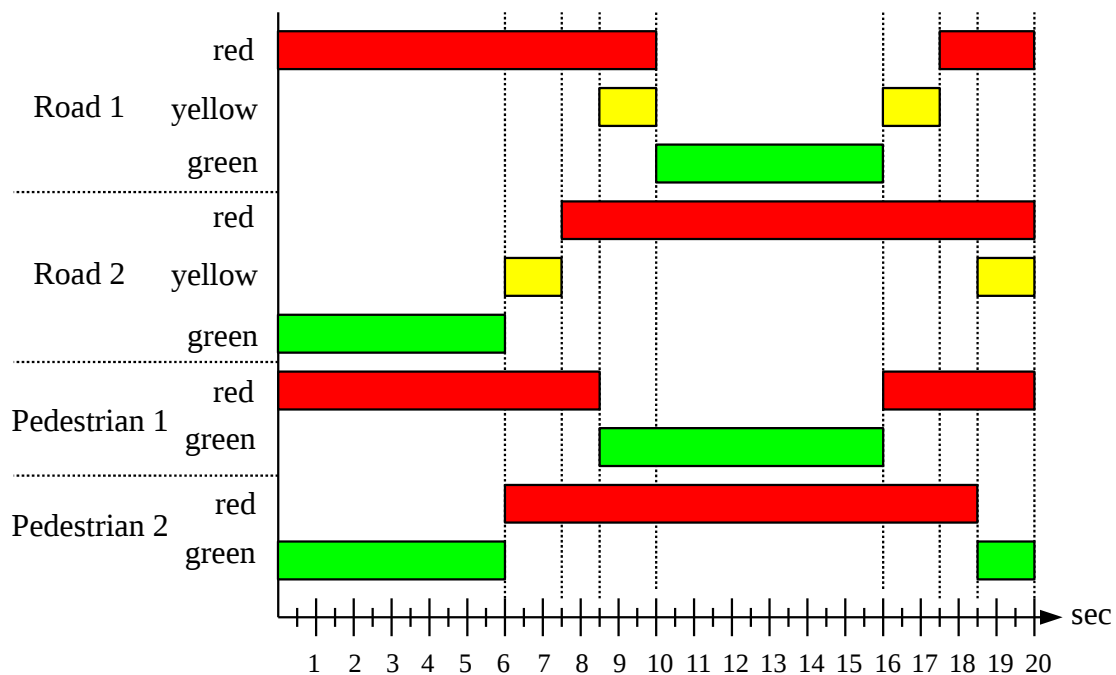
## Part 2

Create a PLC program that generates the following simple traffic control scheme. We do not use the pedestrian lights (lower red and green lights) in this part. Save the \*.pro file for your hand-in.



## Part 3

Add pedestrian signals to the cycle, such that the following cycle will be running on the traffic light.



## Part 4

Implement usage of the pedestrian buttons in the sequence. Green light on the pedestrian side road (pedestrian 2) should only be displayed if a button has been pushed during the current cycle, otherwise a constant red light should be shown on pedestrian 2. Think about how to avoid not activating two states at once and that the functionality should resemble a real traffic light and fx. not jump straight from red to green when a button is pushed.

### **Part 5**

Add to the program from part 4, functionality of the car sensors such that green on road 2 is only given if a car is present. Think about how to avoid that turning cars coming from the main road activates the sensor.

### **Part 6**

Implement a system that keeps track of the number of pedestrians activating the pedestrian buttons. Multiple presses of the buttons in one cycle should count as one. The counter should be reset by pressing the push button on the control box.

### **Part 7**

Sketch a solution that adaptively will change the system between the sequence based mode from part 2 and the sensor based mode in part 5. Describe the following things.

- What should the criterion to switch from sequence mode to sensor based mode be ?
- What should the criterion to switch from sensor based mode to sequence mode be ?
- Which additional signals could be measured on the traffic light to help this process ?
- How can this be implemented using the standard PLC function blocks ?

### **Journal**

As a minimum the journal should contain the table from Part 1, the CodeSys projects (\*.pro file) from part 2-6 and the description from part 7. In addition to these a small description of your solution to part 2-6 should be included.