31343 Introduction to Programmable Logic Controllers
Exercise 4 : “ex4_logics”

Purpose
The purpose of this exercise is to introduce programming of logic operations using Ladder Diagrams (LD). Ladder Diagrams is the most common way of implementing logic networks in PLC’s. In this exercise you will use the ABB PLC’s to get familiar with the different interfaces.

In order to create a new project using LD open the CoDeSys environment and create a new project. In the POU configuration menu choose “LD” as language of the POU. Refer to ex3_plc_startup on how to configure the PLC.

Note also it is possible to switch between programming languages. This is done by right-clicking the POU in the left part of the screen (usually called “PLC_PRG (PRG)”). The choose “convert object” from the menu. Usually the program is converted correctly, but with advanced functions the conversion might yield some strange results.

Part 1 – Logic Functions

Implement a LD solution that acts as described by the following truth table. Use the switches and lights on the control box as verification.

Switch 1	Switch 2	Switch 3	Red light	Yellow light	Green light
0	0	0	1	0	1
0	0	1	0	1	1
0	1	0	0	1	0
0	1	1	1	1	0
1	0	0	0	1	0
1	0	1	1	0	1
1	1	0	0	1	1
1	1	1	1	0	0

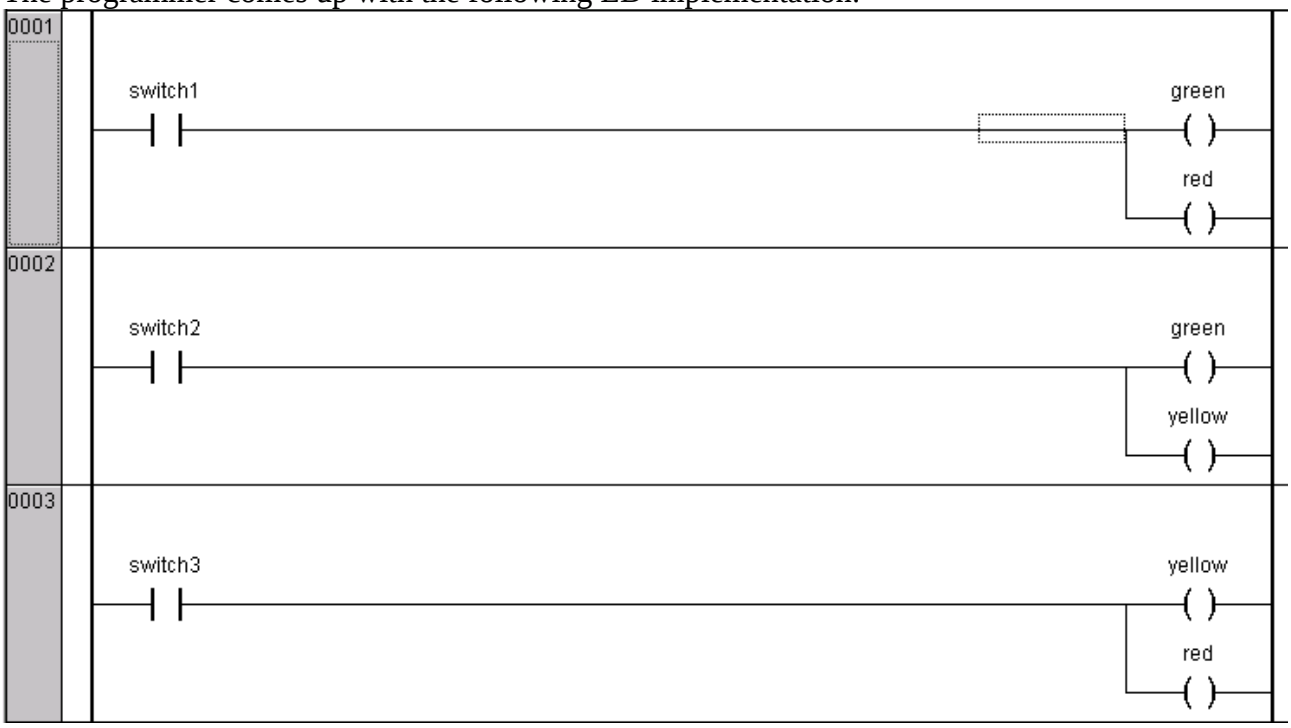
Try converting the solution to Function Block Diagrams (FBD) using the conversion functionality described in the introduction. Is the FBD solution correct ?

Part 2 – Priority of networks

A PLC programmer is tasked with implementing the following functionality:

- Switch 1 turns on the red and green light
- Switch 2 turns on the green and yellow light
- Switch 3 turns on the yellow and red light

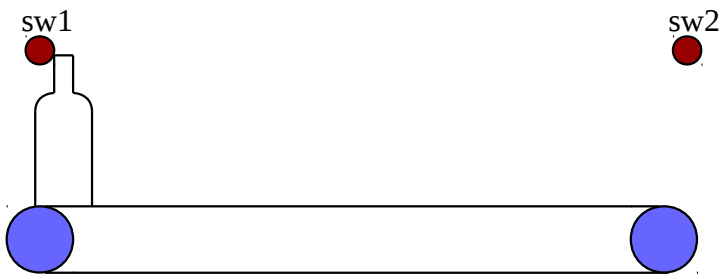
The programmer comes up with the following LD implementation:



Try implementing the solution and test if it works as intended using the control box. Describe potential problems with the given solution, and come up with a better solution to solve the problem.

Part 3 – Retentive Coils

We wish to implement a control logic for the following conveyor systems which moves a bottle back and forth between two positions:



When sw1 is triggered the conveyor belt should start to move in the right direction (simulated by the red light). This should continue until sw2 is triggered where the direction of travel should be reversed (simulated by the green light) until sw1 is triggered and the direction is reversed again. An emergency stop (sw3) is also present, and if this is pushed everything should stop immediately.

Create two solutions for controlling this and simulate then using the control box on the PLC. One solution should only use normal coils and one solution should use retentive coils (set/reset coils).

Can the functionality be achieved using only one input switch (apart from the emergency stop) ? (Explain your answer).

Journal

As a minimum the journal should contain answers to the questions, commented screen shots of your solutions for all parts. The journal should be uploaded to Campusnet in the usual way.