31343 Introduction to Programmable Logic Controllers
Exercise 5 : "ex5_sfc"

Purpose

The purpose of this exercise is to introduce programming of logic operations using Instruction Lists (IL), Sequential Function Charts (SFC) and Structured Text (ST).

In order to create a project using either of the three languages, in the CoDeSys development environment, choose the corresponding acronym in the POU configuration menu. You can also refer to ex3_plc_startup on how to configure the PLC.

Part 1 – IL XOR

Create an Instructions List program that implements an exclusive or (XOR) function and test it out using the control box (with three lights and three switches) connected to the PLC. Use only "NOT", "AND" and "OR" operators.

Part 2 – Logic expression in ST

In this part you should create your own function block that takes three inputs and three outputs. The function block should implement the following logic expression (from ex4_logics).

| 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

To create a new Function Block right click on the "POUs" folder in the left pane of the screen (see below).
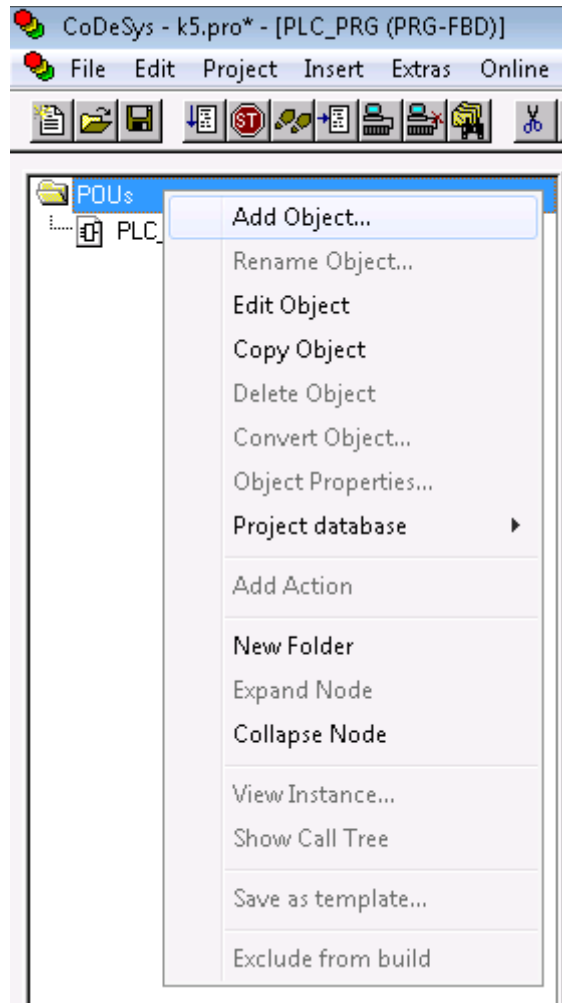
Choose "Add Object", and choose "Function Block" and "ST" from the "New POU" menu. Insert the new block in the "main" POU (PLC_PRG) and connect each of the inputs and outputs to the corresponding lights and switches according to the table above.

Part 3 – Water Tank Sequence

The following figure shows a water tank with two level switches "*LH*" and "*LL*" for indicating a high and low level in the tank..
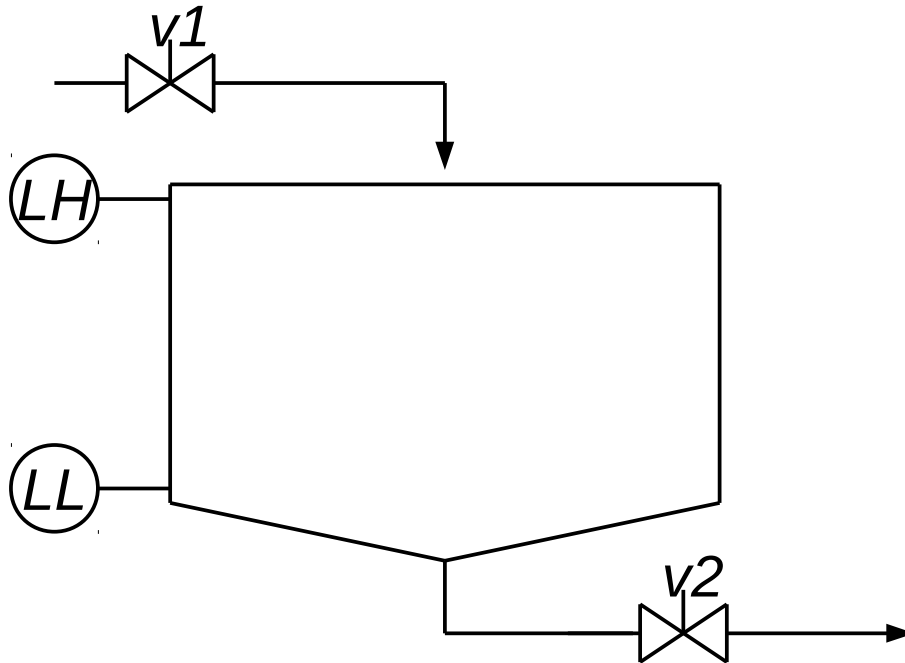
Two valves "*v1*" and "*v2*" controls the input and drainage of water in the tank respectively. The following describes a "flushing sequence" on the tank system:

1. The water tank starts from empty and both valves are closed.
2. When a "start button" is pressed "*v1*" is opened and the water will rise slowly in the tank. Level switch "*LL*" will go high, but that is ignored in this state.
3. When the water reaches "*LH*" valve "*v1*" is closed and "*v2*" is opened. The water level will now drop.
4. When the water comes below "*LL*" valve "*v2*" should be closed, and the system should be ready for a new sequence.

Implement the sequence on the ABB PLC's using SFC to control the sequence. You can use any languages to implement the actions needed during the states and transitions.

Use the two switches to simulate "*LL*" and "*LH*" respectively. Use the push button as the start button. Use the red light to indicate "*v1*" is open and the yellow light to indicate "*v2*". The green light should be on when the system is at rest and ready for start.

Make sure that pushing the start button does not have any influence on the system while it is running the sequence.

Extra:

Use timers to simulate the water level rising to "*LL*" and "*LH*" instead of switches.

Journal

As a minimum the journal should contain listing of text based programs for all parts and commented screen shots of your SFC diagrams. The journal should be uploaded to Campusnet in the usual way.