Technical University of Denmark

31342 Introduction to Programmable Logic Controllers

Exercise 5

Sequential Function Charts (SFC)

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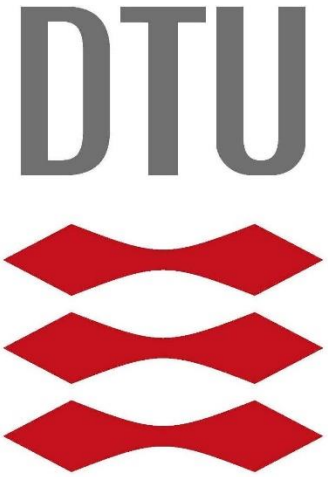

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Task 1: Instruction List XOR:

In order to implement the XOR gate with only AND, OR, and NOT gates, the expression Sw1'Sw2+Sw1Sw2' is used. And the output is assigned to the red light.

Task 2: Logic Expressions in Structural Text:

The corresponding logic expressions for the lights are obtain from the previous exercise:

Re= S1S3 + S2S3 + S1' S2' S3' Ye= S1'S2 + S1'S3 + S1 S3' Gr= S1'S2' + S2'S3 + S1 S2 S3'

The corresponding function block using structural text and the main POU:

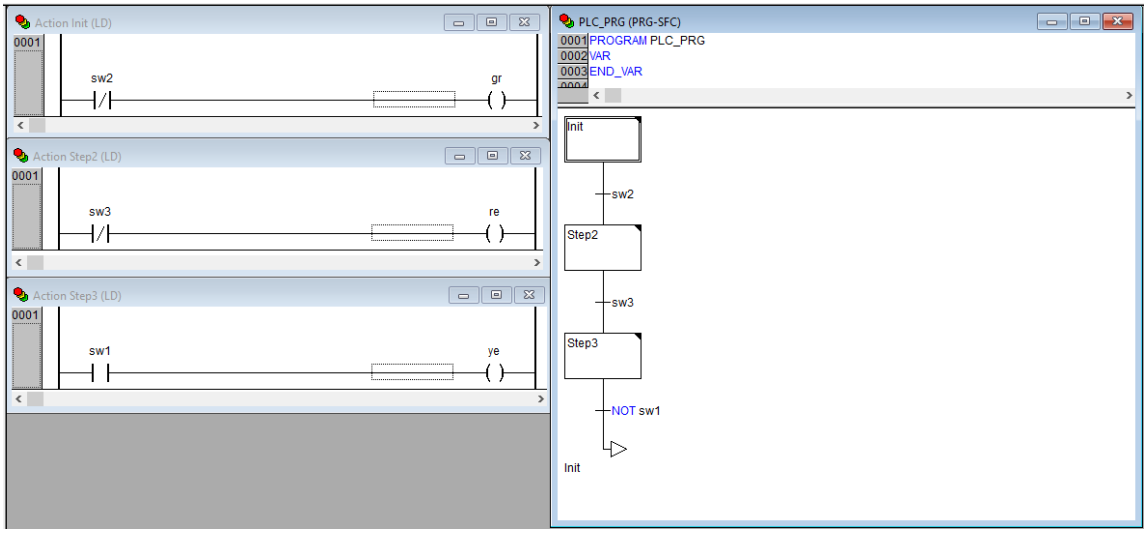
Task 3: Water Tank Sequence:

The implementation of the water tank sequence is done by using SFC and LD is used for the implementation of actions during states and transitions.

There are 3 steps in the sequence:

- Init: The rest and ready for the start state. In this state, the green light is on. To start the sequence, the start bottom (sw2) should be pressed.
- Step2: The filling the tank state. In this state, v1 (the red light) is open. And as the level of water increases, firstly, the level switch LL (sw1) goes high and then the level switch LH (sw3) goes high. When LH (sw3) does high, v1 (the red light) is close and the sequence proceeds to the next step.

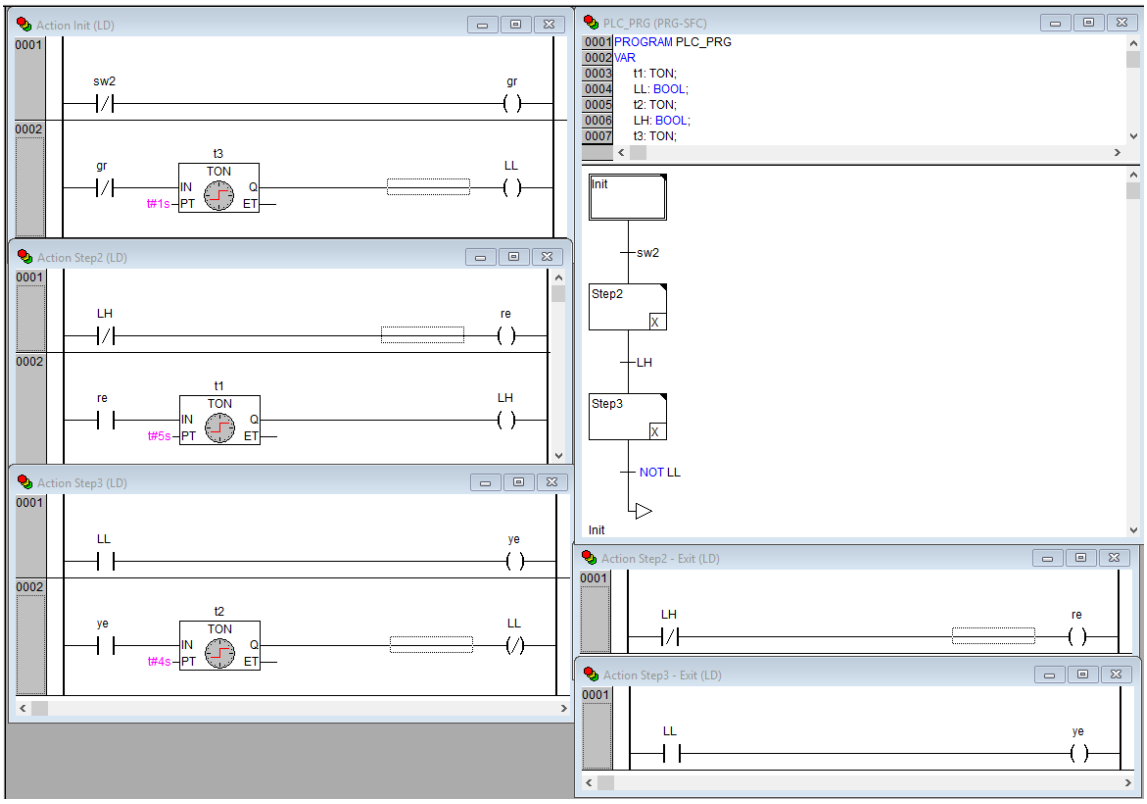
- Step3: The draining the tank state. In this state, v2 (the yellow light) is open. And as the water level decreases, firstly, the level switch LH (sw3) goes low and then the level switch LL (sw1) goes low. When LL (sw1) goes low, v2 (the yellow light) is close and the sequence proceeds to the Init state; namely, the rest and ready for the start state.



Extra: If the implementation of the level switches is done by the timers instead of sw1 and sw3, the time that passes during each state should be assigned. In this implementation, the time to reach LL from the empty level is assigned as 1s, to reach LH from LL is assigned as 4s.

- Init: Green light is on and LL goes high after 1s when the light turns off.
- Step1: v1 (red light) is on and LH goes high after 5s when v1 (red light) turns on.
- Step2: v2 (yellow light) is on and LL goes low after 4s when v2 (yellow light) turns on.

The exit actions are added to make sure that corresponding valves (lights) turn off in the end of the states. Transition conditions are changed as sw1 to LL and sw3 to LH.



The video of the implementations of the sequence is attached in the DTU-inside with the name Task3.1 for 1st one and Task3.2 for the 2nd one.