

Labo 1: Ladder diagrams

Corrigé

Preparation work Spend some time to browse (and read) the “Basic usage of CoDeSys 3.5” supplied as pdf. This will help you out figuring out how to use the software. Start with project set-up, Ladder specification, IO specification and simulation.

Exercice 1. Consider the reservoir system shown on Figure 1. We have water level indicators marked: I0.0 and I0.1. The sensors indicate 1 when they are fully immersed in the water. We want to maintain the level in the reservoir in such a way that the tank is refilled up to I0.0 as soon as the level get below I0.1 (Figure 1c). The level is maintained using a water pump controlled by the variable Q0.0. Establish the Ladder diagram of the problem and show the correct operation sequence.

Réponse :

The screenshot displays the CODESYS environment with two main windows: the 'PROGRAM PLC_PRG' window on the left and the 'Visualization' window on the right.

PROGRAM PLC_PRG Window:

- Scope:** Lists three variables: `VAR setPump` (Data type: BOOL), `VAR resetPump` (Data type: BOOL), and `VAR` (Data type: BOOL).

Scope	Name	Address	Data type	Initialization	Comment	Attributes
1	setPump		BOOL			
2	resetPump		BOOL			
3	VAR		BOOL			

- Ladder Logic:** The program consists of three rungs:
 - Rung 1:** A normally open contact labeled `GV1.a` is connected to a coil labeled `setPump`.
 - Rung 2:** A normally open contact labeled `GV1.a` is connected to a coil labeled `resetPump`.
 - Rung 3:** Two parallel normally open contacts, labeled `setPump` and `GV1.pump`, are connected to a coil labeled `GV1.pump`.

Visualization Window:

- Shows a 3D graphical representation of the system, including two cylindrical components and a central circular component.
- Scope:** Lists three variables: `VAR GLOBAL a` (Data type: BOOL), `VAR GLOBAL b` (Data type: BOOL), and `VAR GLOBAL pump` (Data type: BOOL).

Scope	Name	Address	Data type	Initialization	Comment	Attributes
1	VAR GLOBAL a		BOOL			
2	VAR GLOBAL b		BOOL			
3	VAR GLOBAL pump		BOOL			

- Status Bar:** Displays 'Last build: 0 0 0', 'Precompile: ✓', and 'Current user: (nobody)'.

Exercise 2. We will consider rail crossing problem illustrated on Figure 2 (there is only one railway track that can be occupied by only one train at a time). Three detectors labeled a, b and c are placed on the rails and are used to control the opening/closing of the barrier. When the train passes through a or c, the barrier should close. When the train leaves the crossing, *i.e.* when b is released, the barrier should open. The train can come from any of the two directions and we will suppose that any maneuver inside the sensor zone is forbidden (train will not do reverse). Distances between different sensors are arbitrary. Trains could be of different lengths, in all 4 combinations are possible. If l is the train length, your control should consider the following lengths: $l < ab$, $bc > l > ab$, $ac > l > bc > ab$, $l > ac$. Build the model of the control logic required to command the opening/closing of the barrier using LD diagrams. Perform simulations for all train length combinations and show proper command.

Réponse :

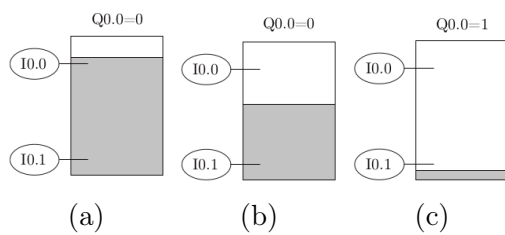


Figure 1

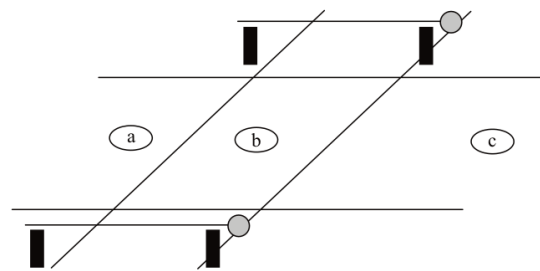


Figure 2

The screenshot displays the CODESYS environment for a PLC program. The main window is titled "train-project - CODESYS" and contains several panes:

- Menu Bar:** File, Edit, View, Project, Declarations, Build, Online, Debug, Tools, Window, Help.
- Toolbar:** Standard CAD and development tools.
- Project Tree (Left):** Shows the project structure with "PLC_PRG" and "PROGRAM PLC_PRG" selected.
- Variable Declaration Table:**

Scope	Name	Address	Data type	Initialization	Comment	Attributes
VAR	trainInside		BOOL	FALSE		
- Variable Attributes Table:**

Scope	Name	Address	Data type	Initialization	Comment	Attributes
VAR_GLOBAL	a		BOOL		Input	
VAR_GLOBAL	b		BOOL			
VAR_GLOBAL	c		BOOL			
VAR_GLOBAL	gate		BOOL		Output	
- Ladder Logic Editor:** Contains three rungs:
 - Rung 1:** A normally open contact labeled "trainInside" is connected to a coil for "GVL.a" (address 5).
 - Rung 2:** A normally open contact labeled "trainInside" is connected to a coil for "GVL.b" (address 6).
 - Rung 3:** A normally open contact labeled "trainInside" is connected to a coil for "GVL.gate" (address 8). This coil is also connected to a parallel combination of two normally open contacts: "GVL.a" (address 5) and "GVL.c" (address 7).
- Visualization Window (Right):** Shows a 3D model of the gate mechanism, including a gate, a train car, and a control panel with buttons.
- Status Bar (Bottom):** Displays "Cross Reference List", "Messages - Total 0 error(s), 0 warning(s), 0 message(s)", "Last build: 0 0 0", "Precompile: ✓", and "Current user: (nobody)".