Data Science and Automation

Lesson 22 – Laboratory

B&R Automation Studio

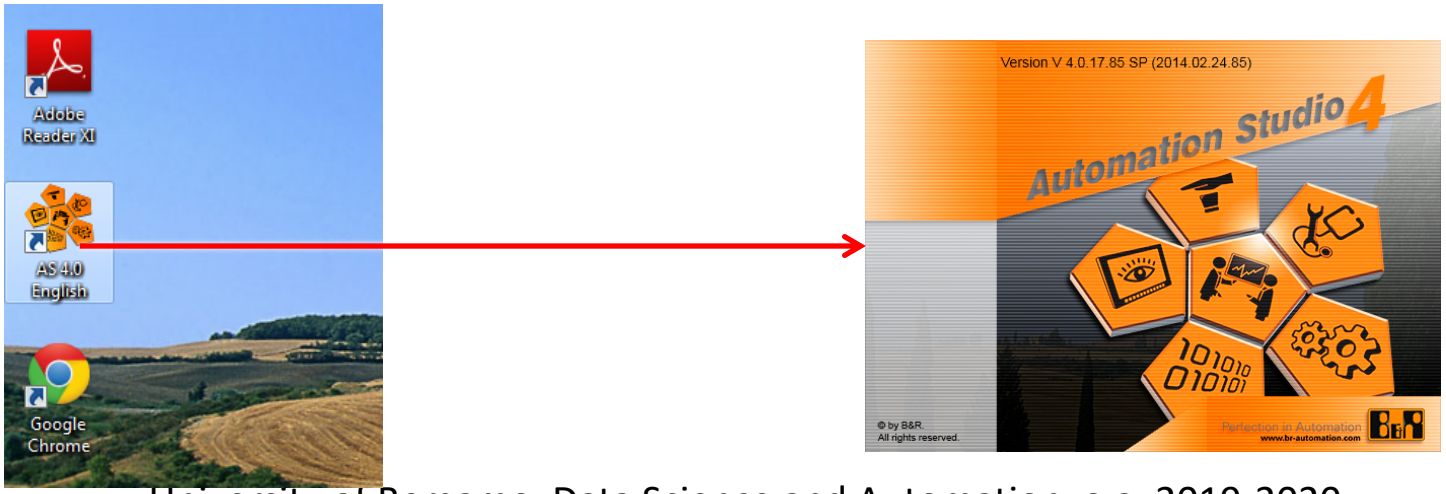
Tool-chain

As we said before during this morning introduction, this afternoon we are going to see how the software B&R Automation Studio 4.1 works.

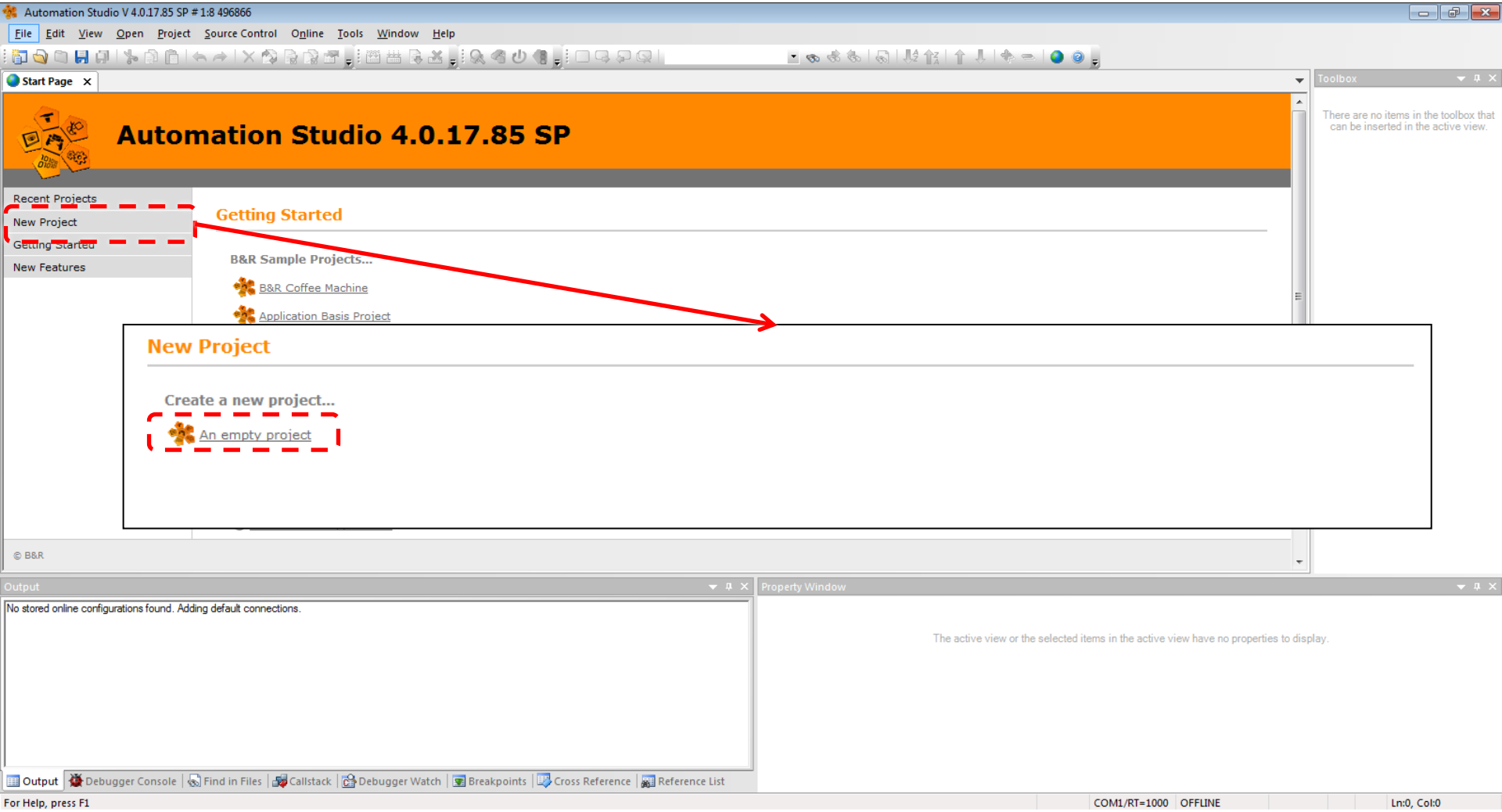
Automation Studio

You can download Automation Studio 4.1 (trial version) from the following link:

https://www.br-automation.com/index.php?eID=dumpFile&t=f&f=2%3A%2FBRP4440000000000000515253&token=084d860a13ed034f6604600d2c4d81d8a1f1cae0



Automation Studio



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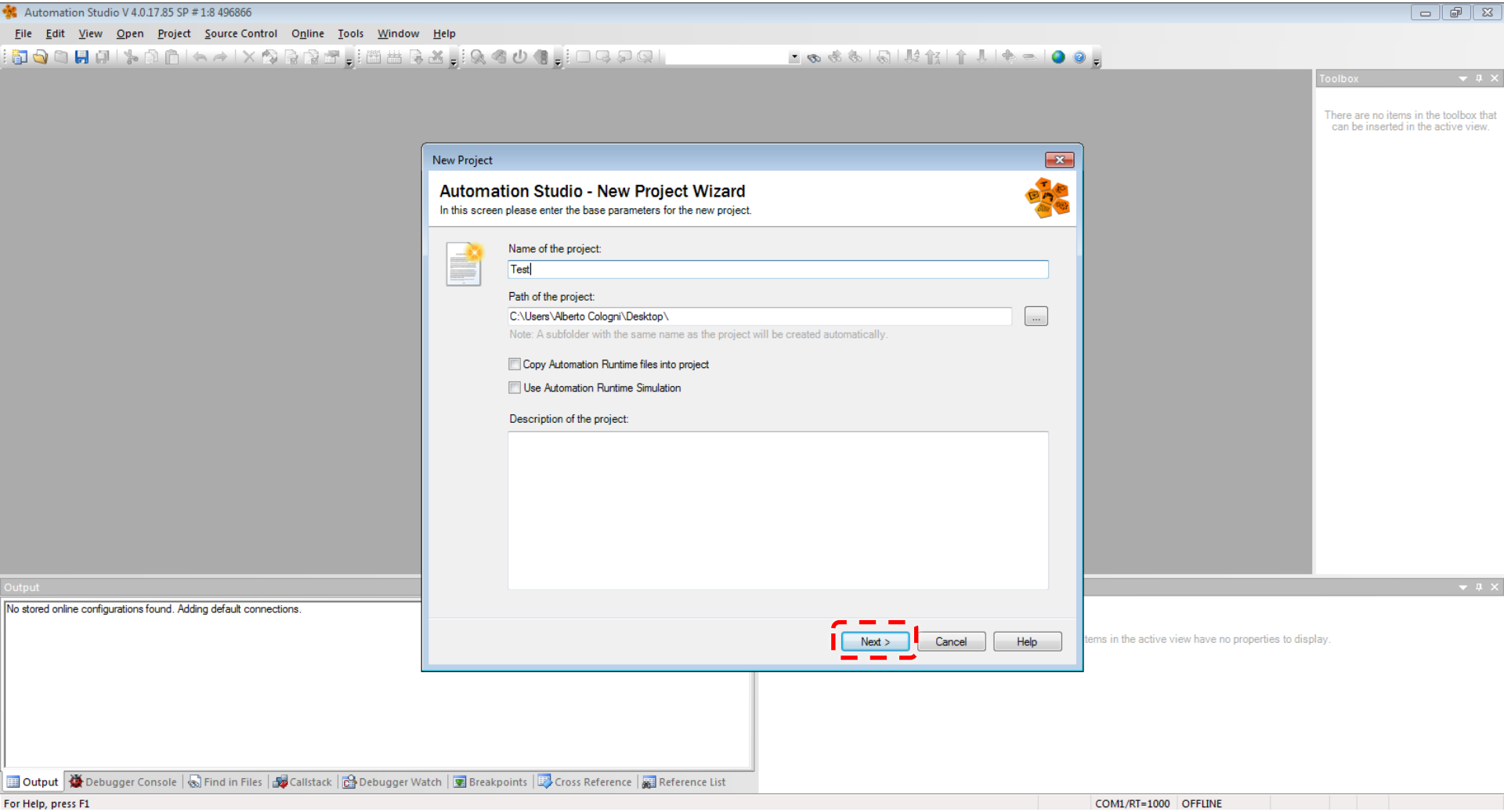

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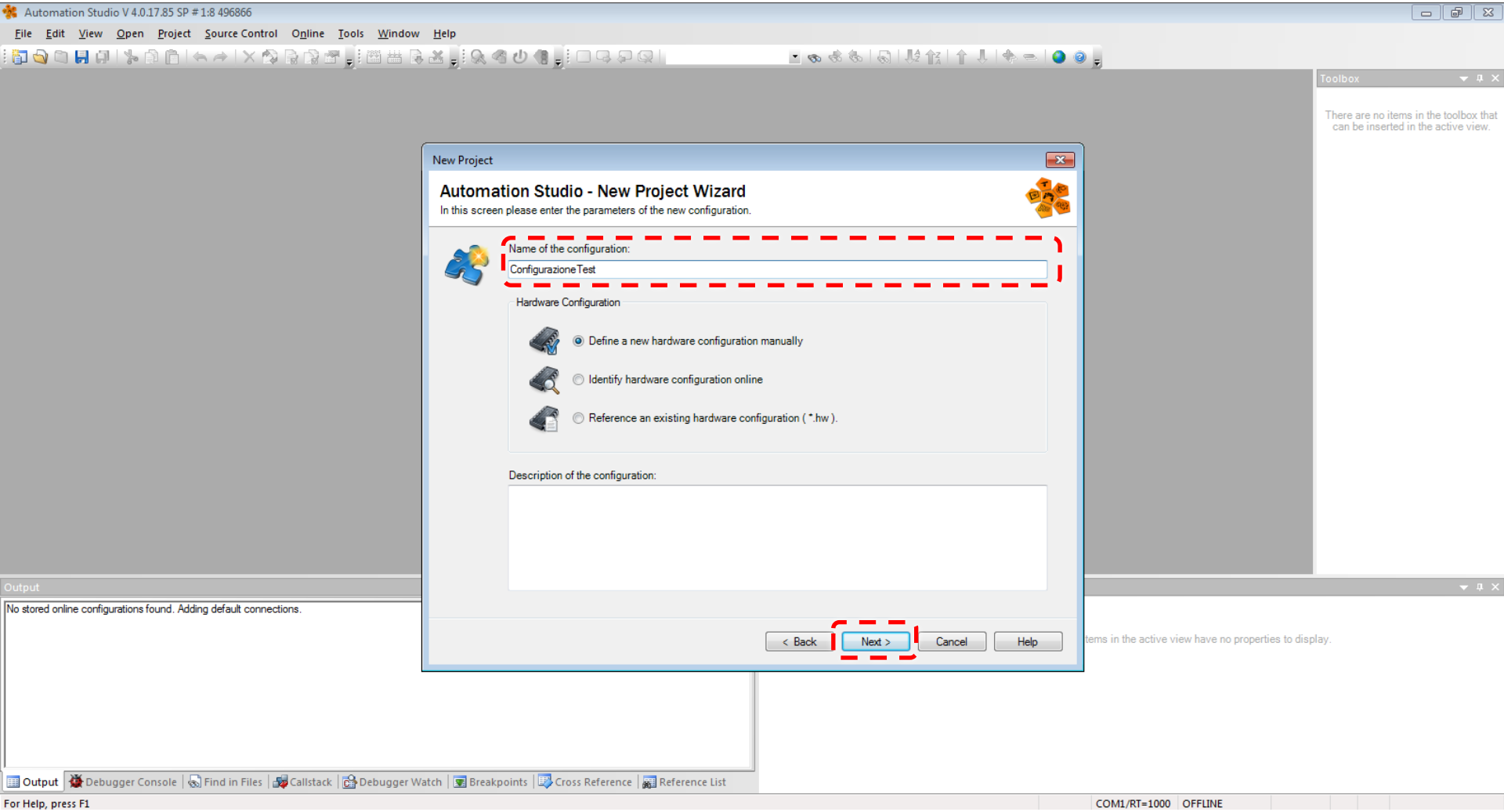

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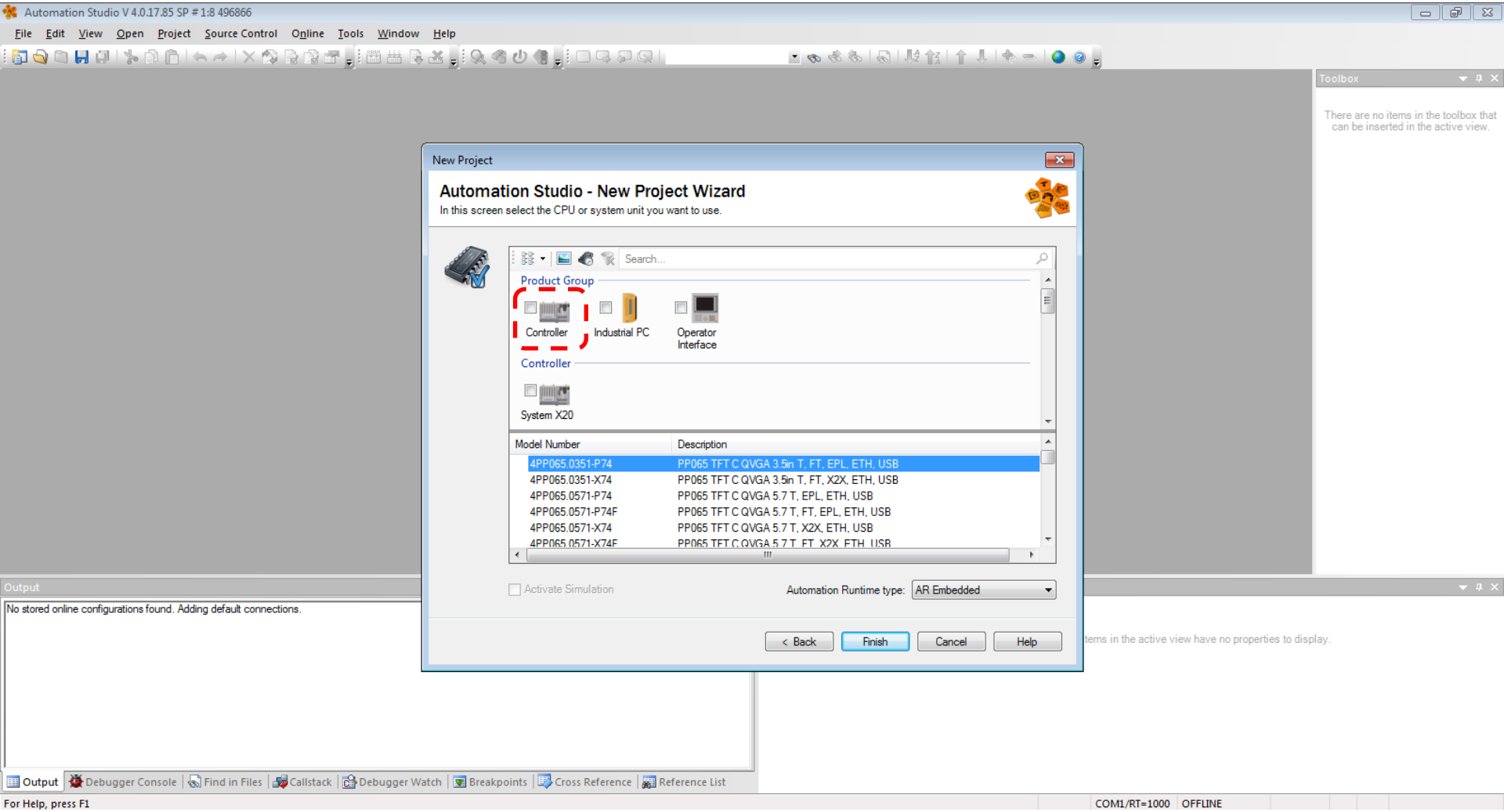

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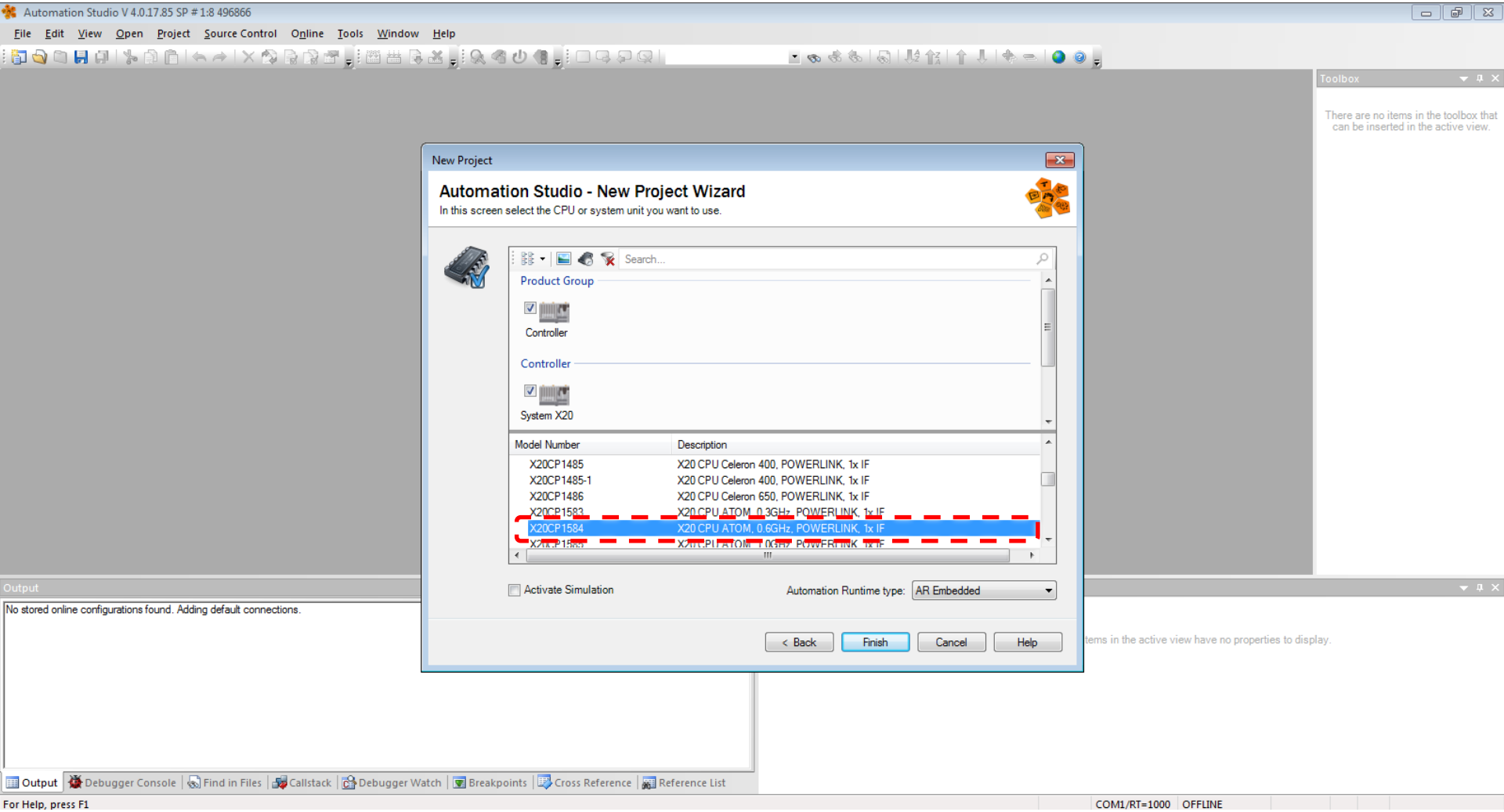

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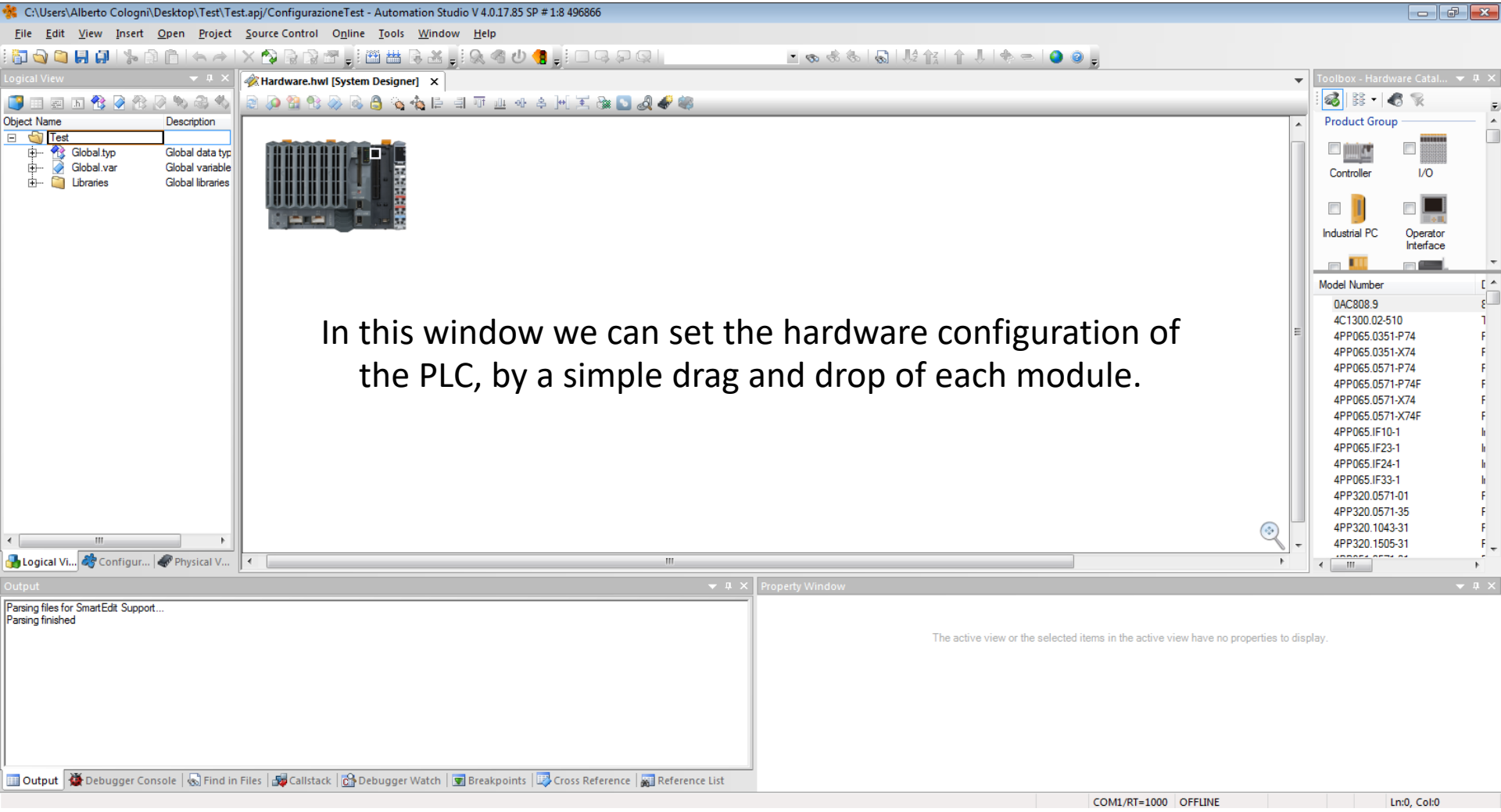

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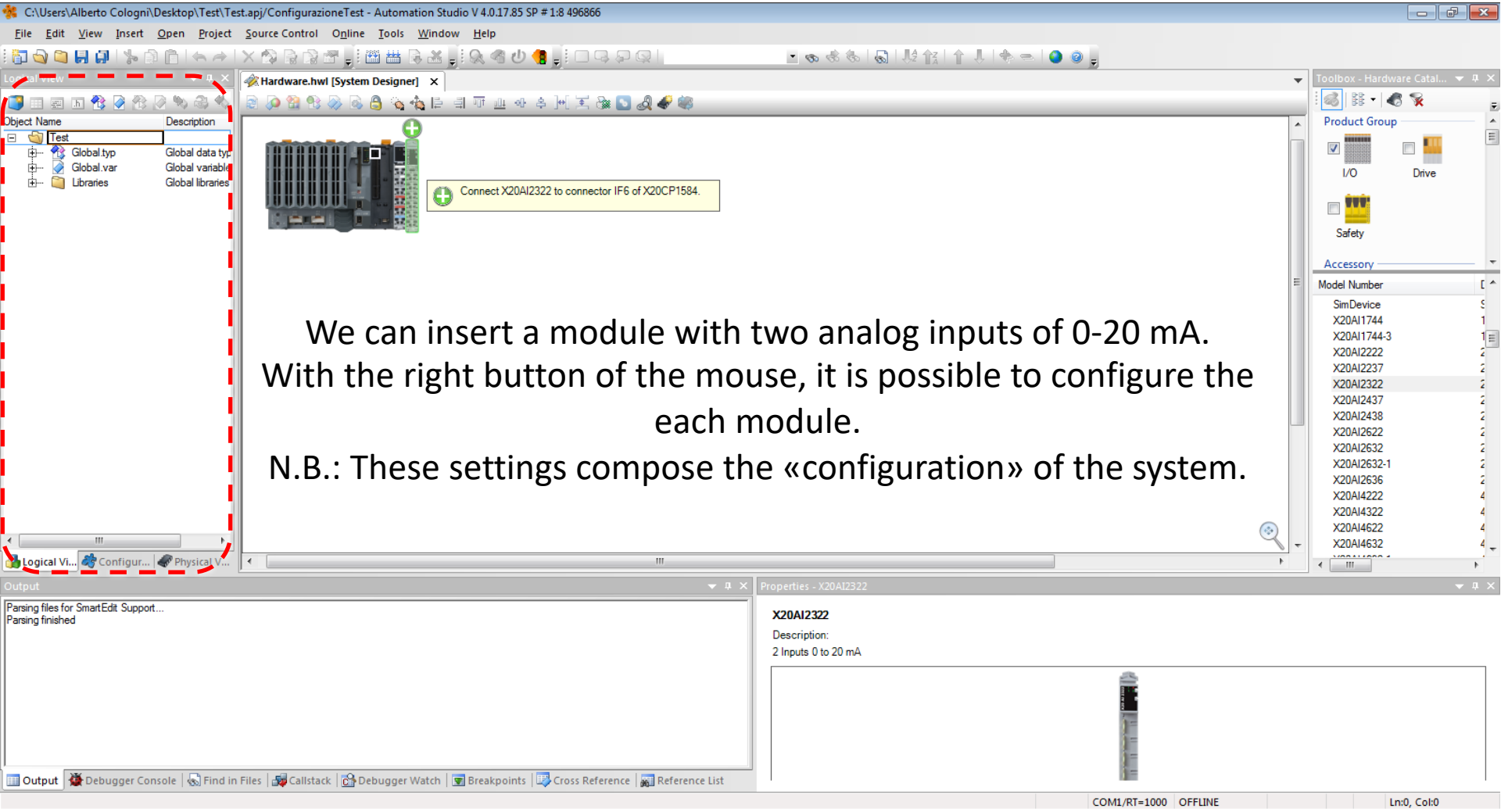
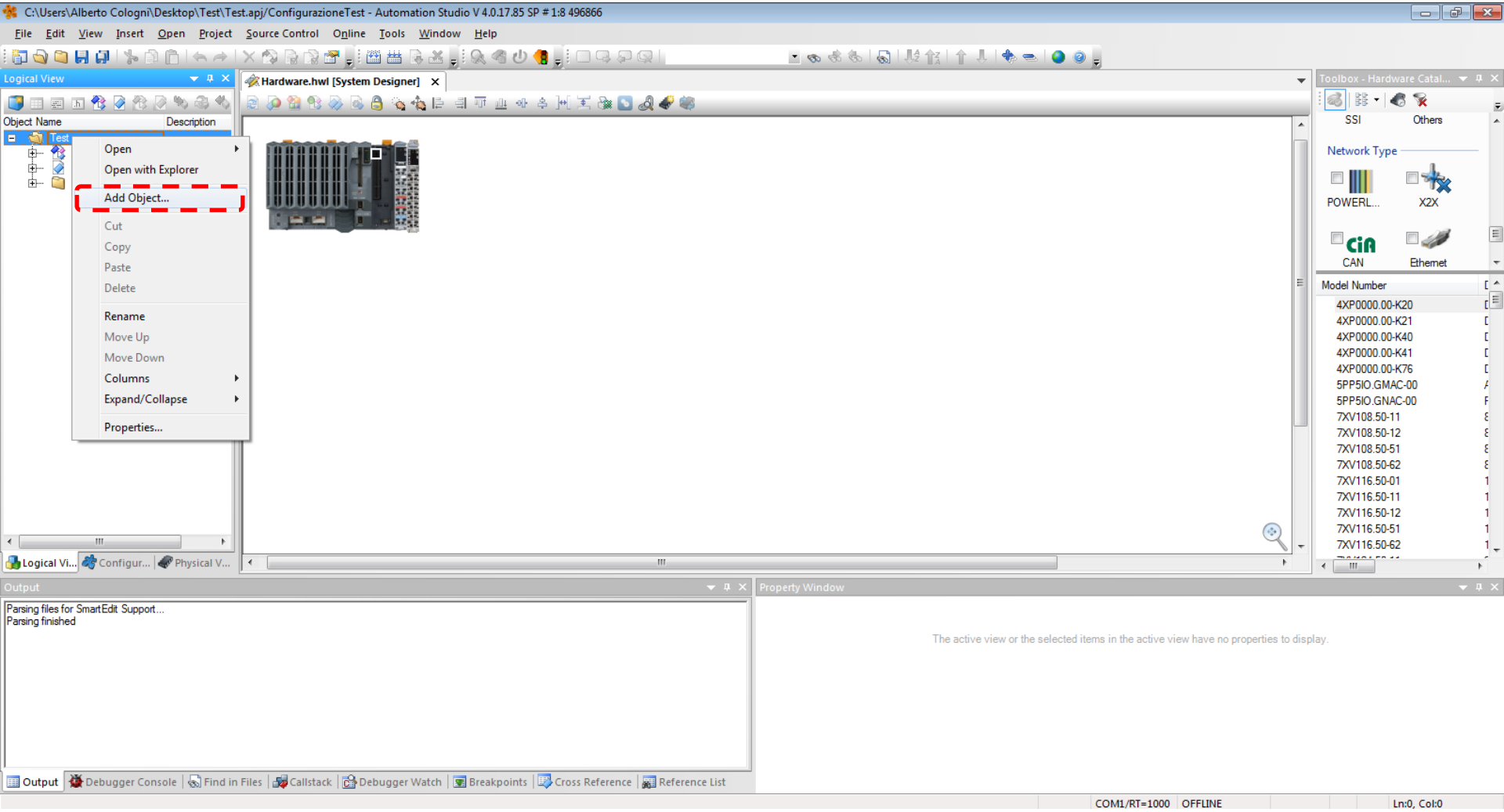


We can insert a module with two analog inputs of 0-20 mA.
With the right button of the mouse, it is possible to configure the each module.

N.B.: These settings compose the «configuration» of the system.

Automation Studio



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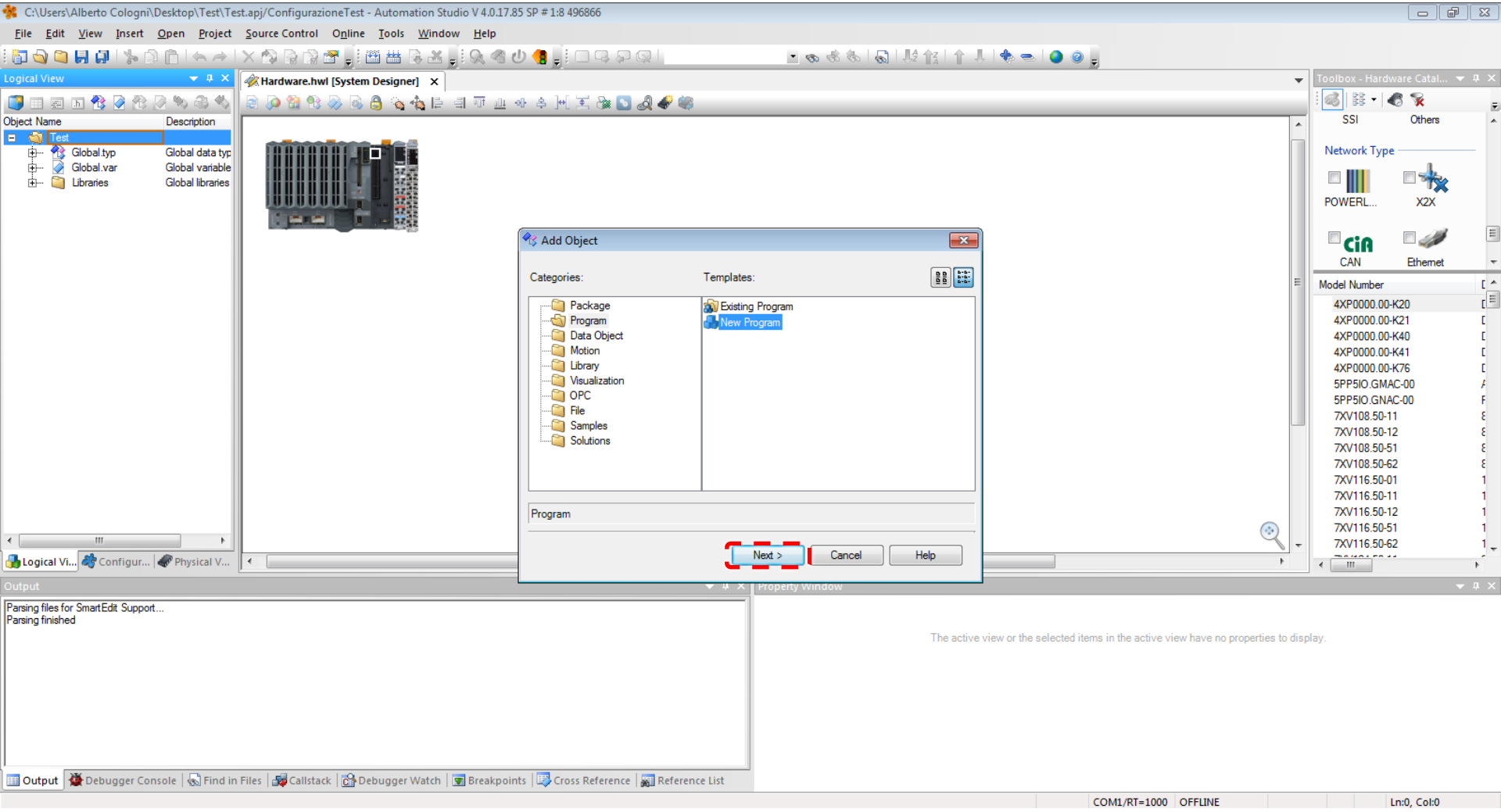

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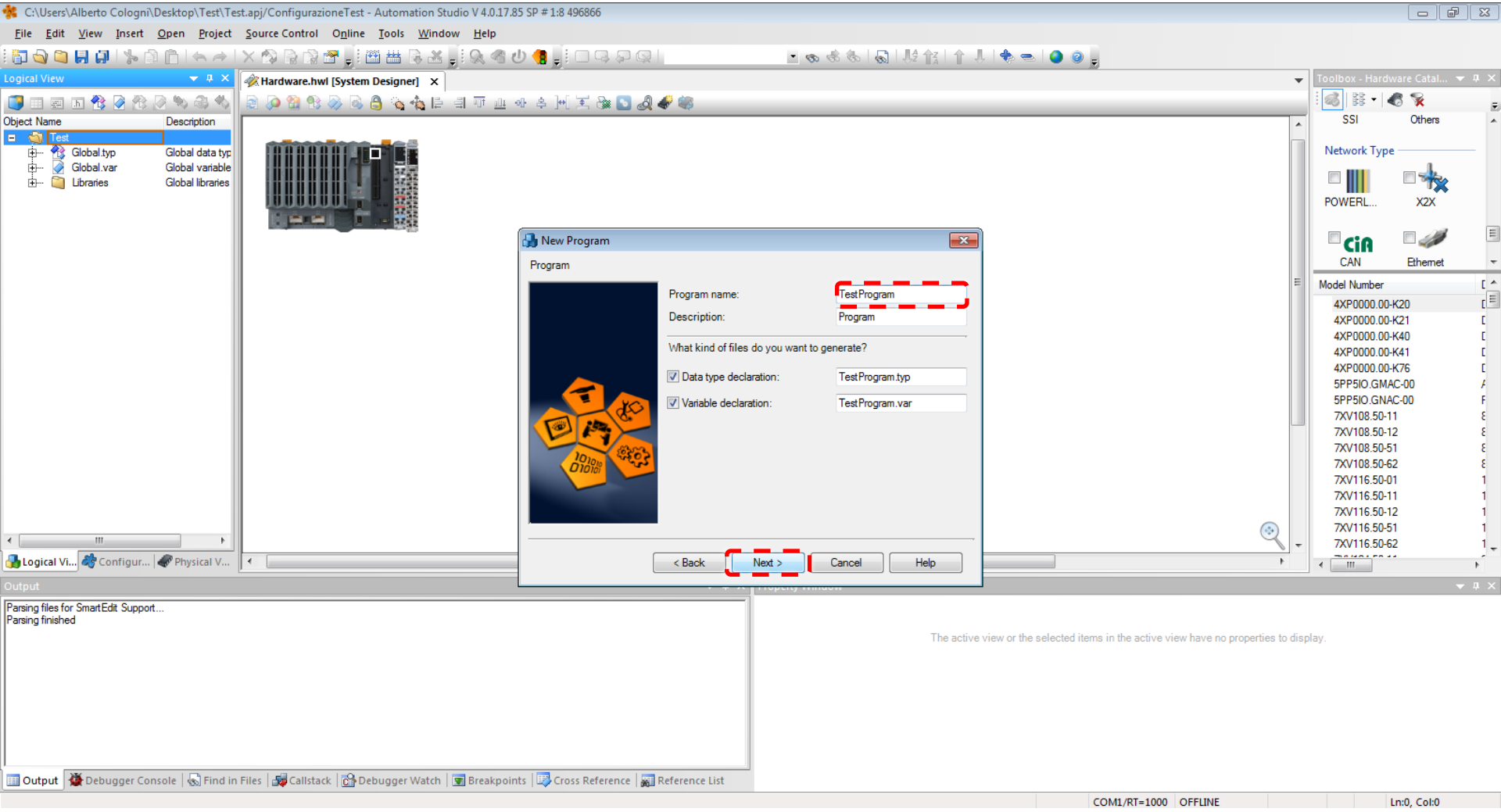

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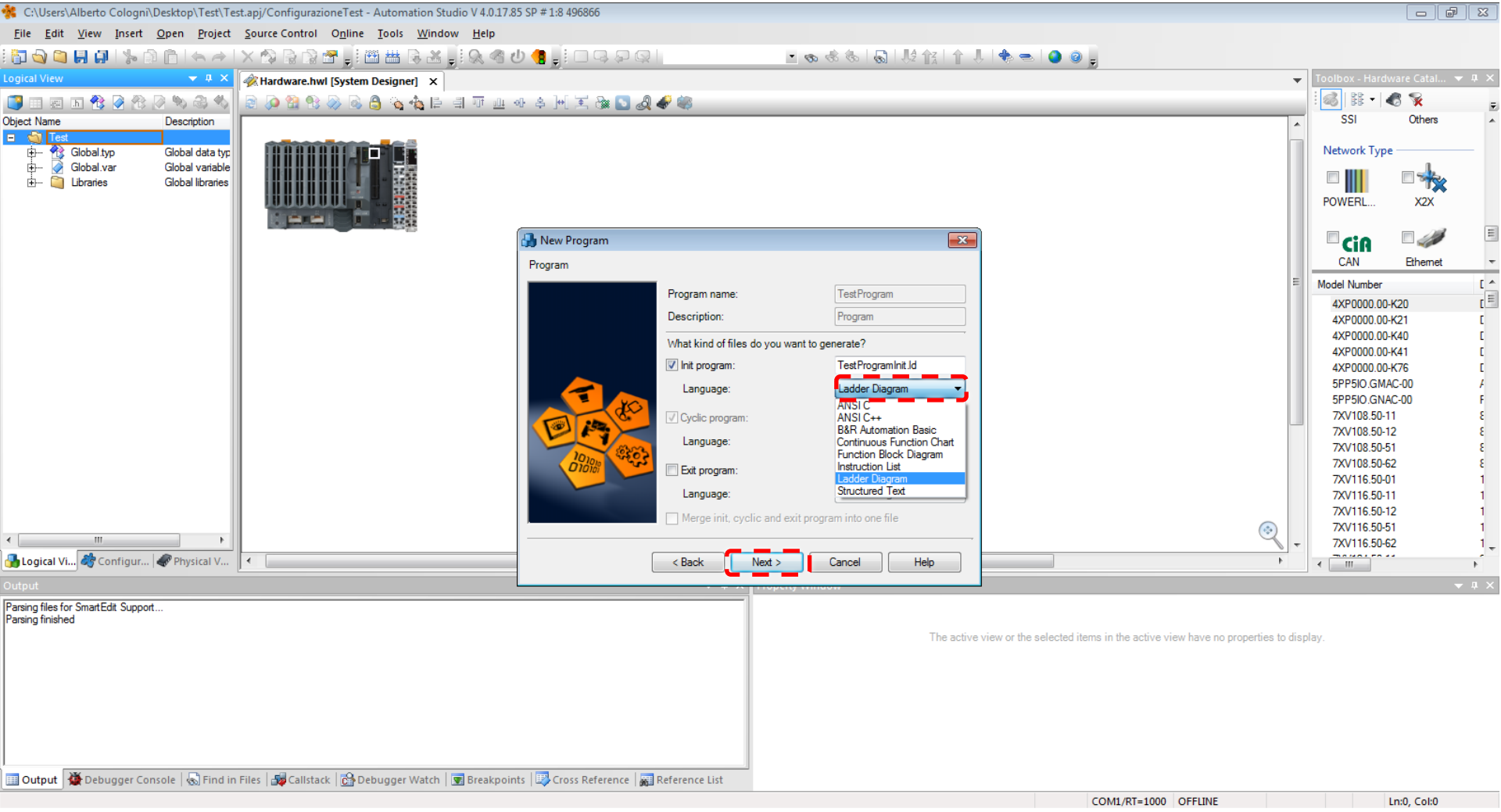

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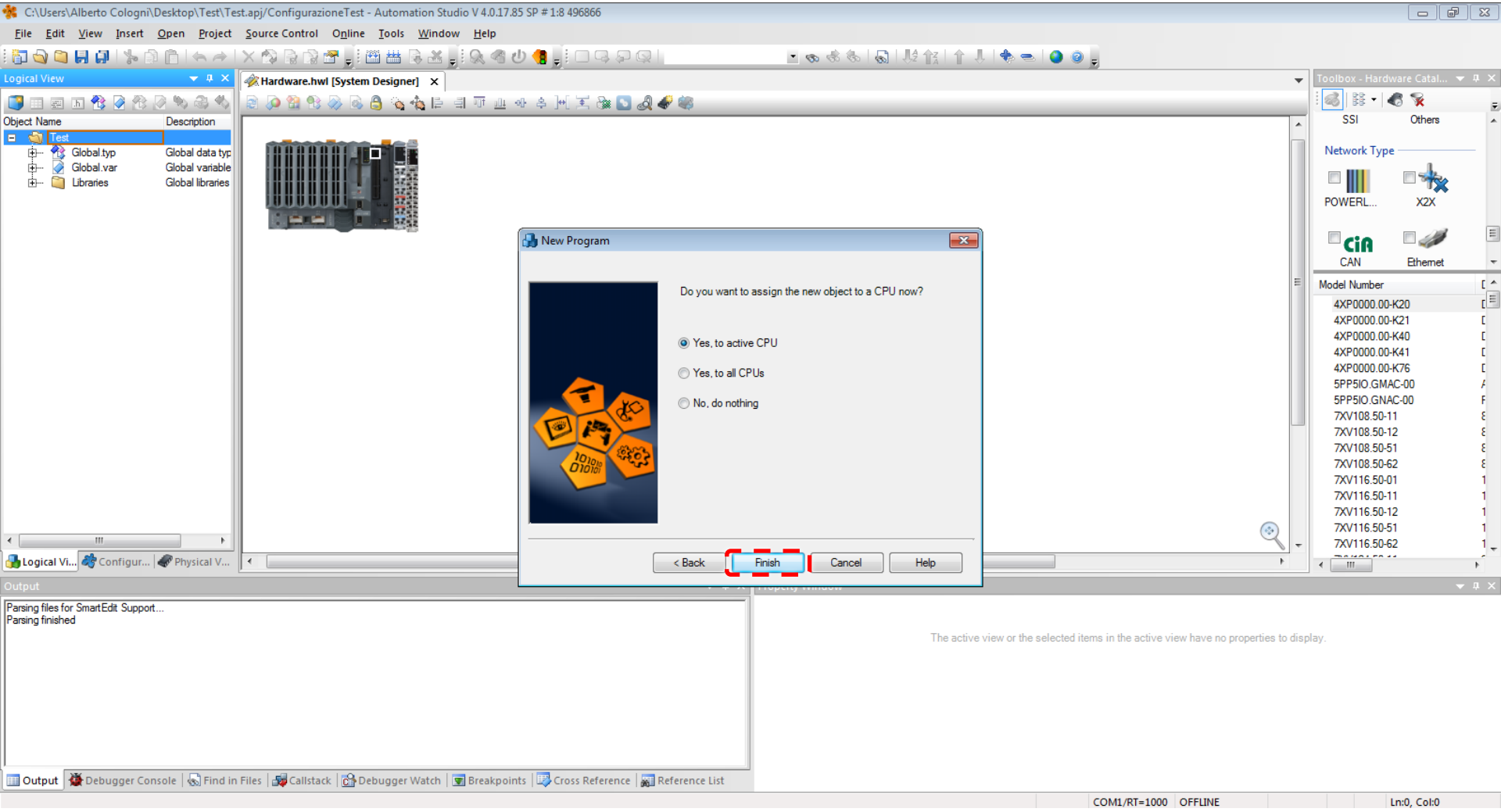

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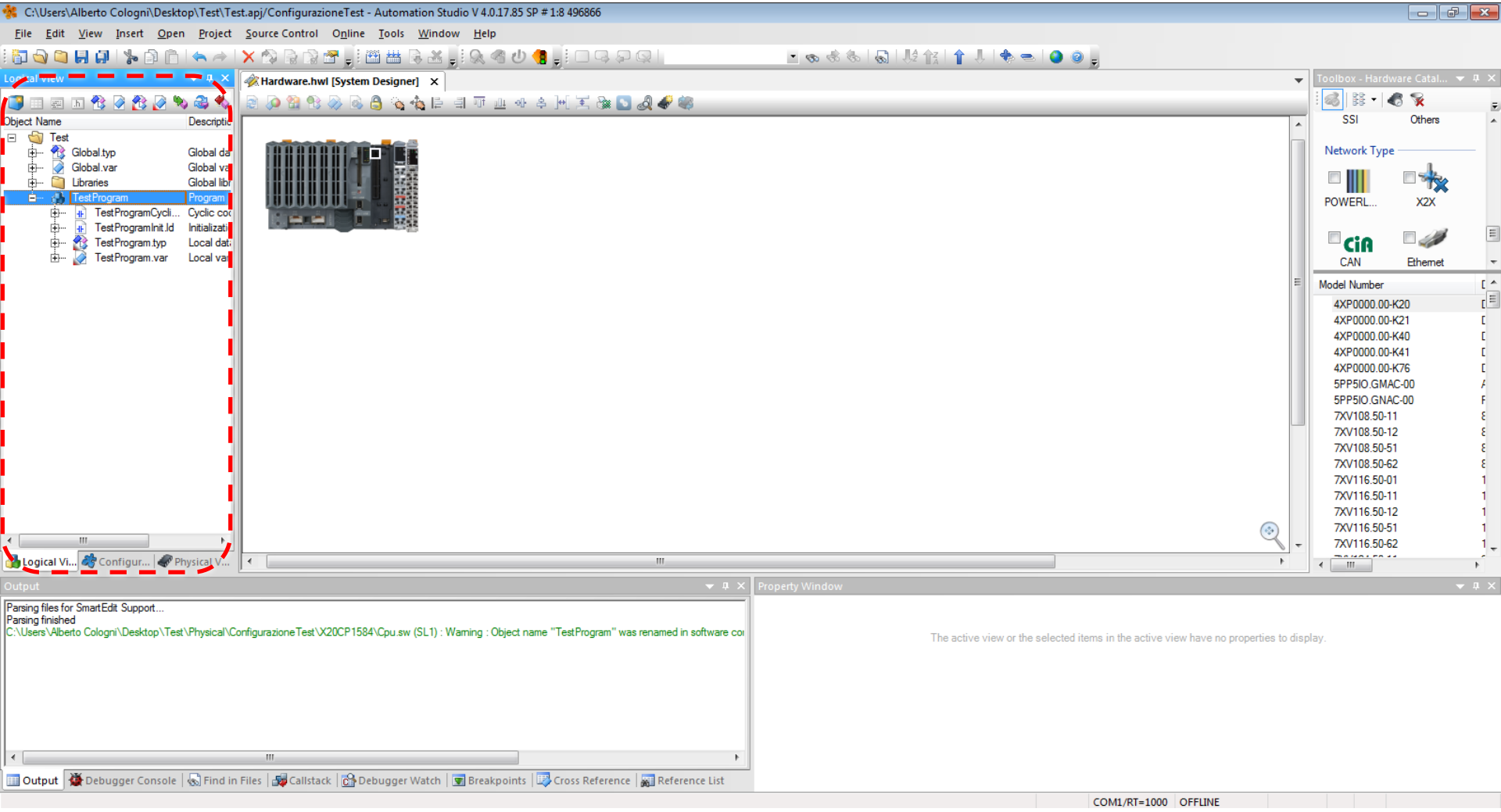

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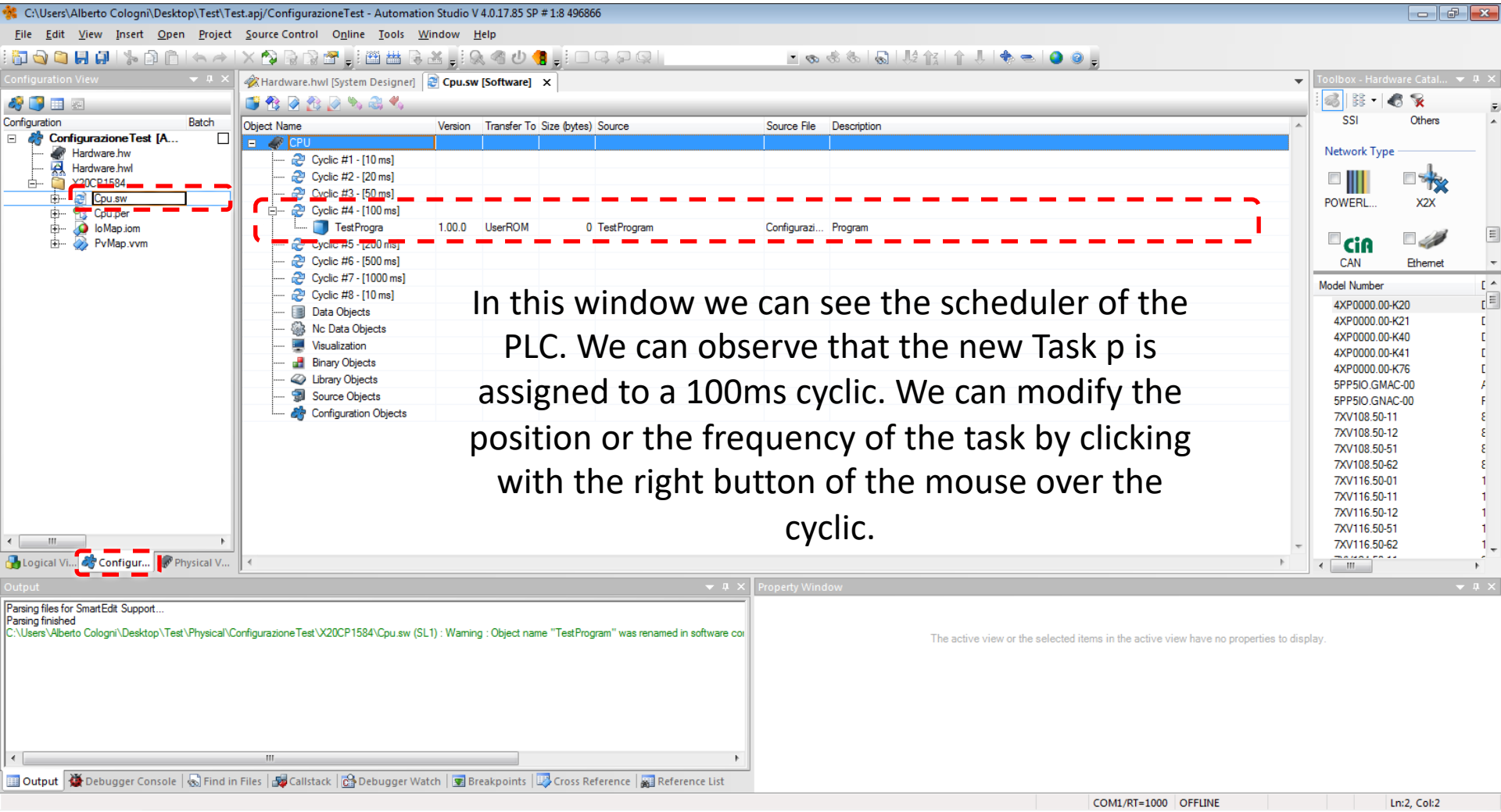


In this window we can see the scheduler of the PLC. We can observe that the new Task p is assigned to a 100ms cyclic. We can modify the position or the frequency of the task by clicking with the right button of the mouse over the cyclic.

Ladder exercises

Exercise 1

Develop a Ladder software that allows the control of an industrial oven with the following operating mode.

When the operator press the start button (START=1), the PLC starts the warming cycle of the material (OP=1) for 30 seconds. After that interval, the OP command must be reset by the PLC (OP=0). The completion of the process have to be signaled by the powering on of a green light (GREEN=1) for 10 seconds.

After this interval, the green light must be powered off (GREEN=0).

Exercise 1

The only input of the system is:

- START: Button that starts the oven

The outputs are:

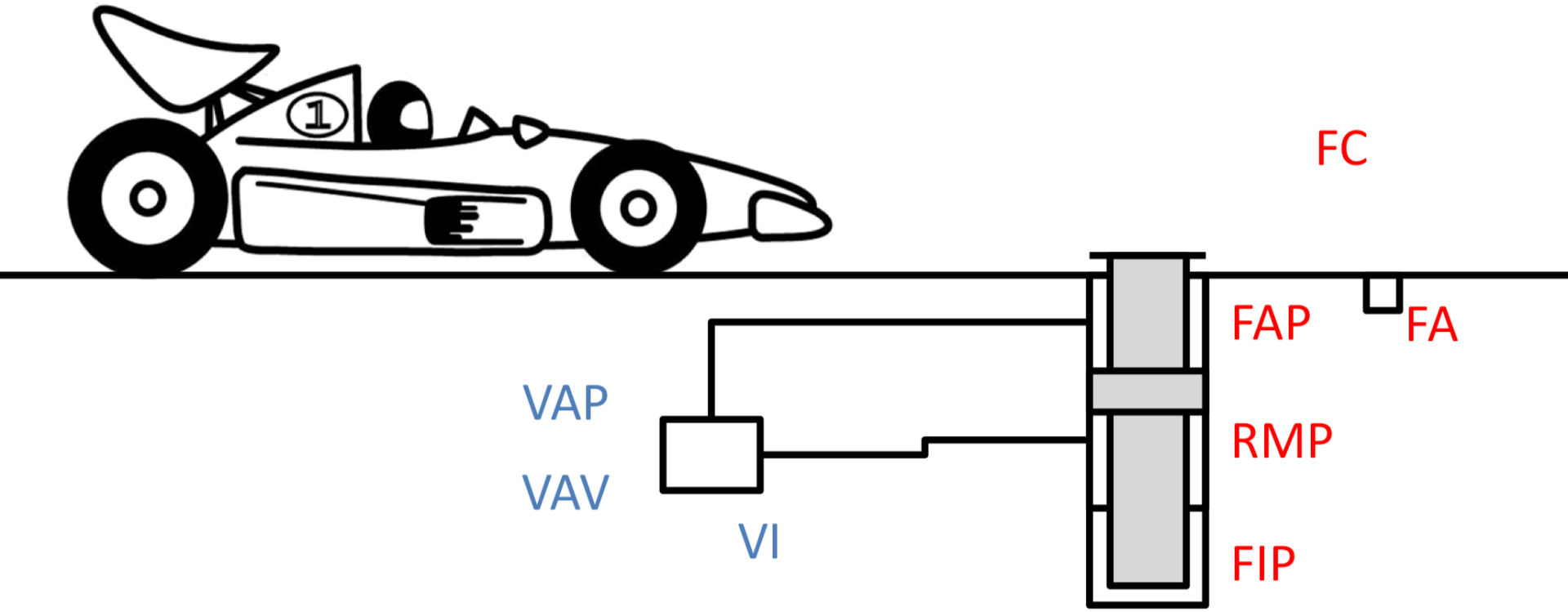
- OP: Oven enabling
- GREEN: Led that indicates the end of the oven functioning.

Exercise 2

Develop a Ladder software that allows the control of an hydraulic car-lifter for the tyres change with the following operating mode:

- The car arrives in proximity of the lifter and it is detected by a photocell.
- The piston starts the lifting of the car in slow forward mode (suppose that the piston starts from the FIP point) until the reaching of the RMP point.
- The piston lift the car until the reaching of the FAP point, in rapid forward mode.
- The piston stays in its position until the tyres change has finished (for our simulation purposes, we can suppose that FC=0 instantly when the piston reach the FAP point)
- The piston put down the car until the reaching of the FIP point with the VI command.

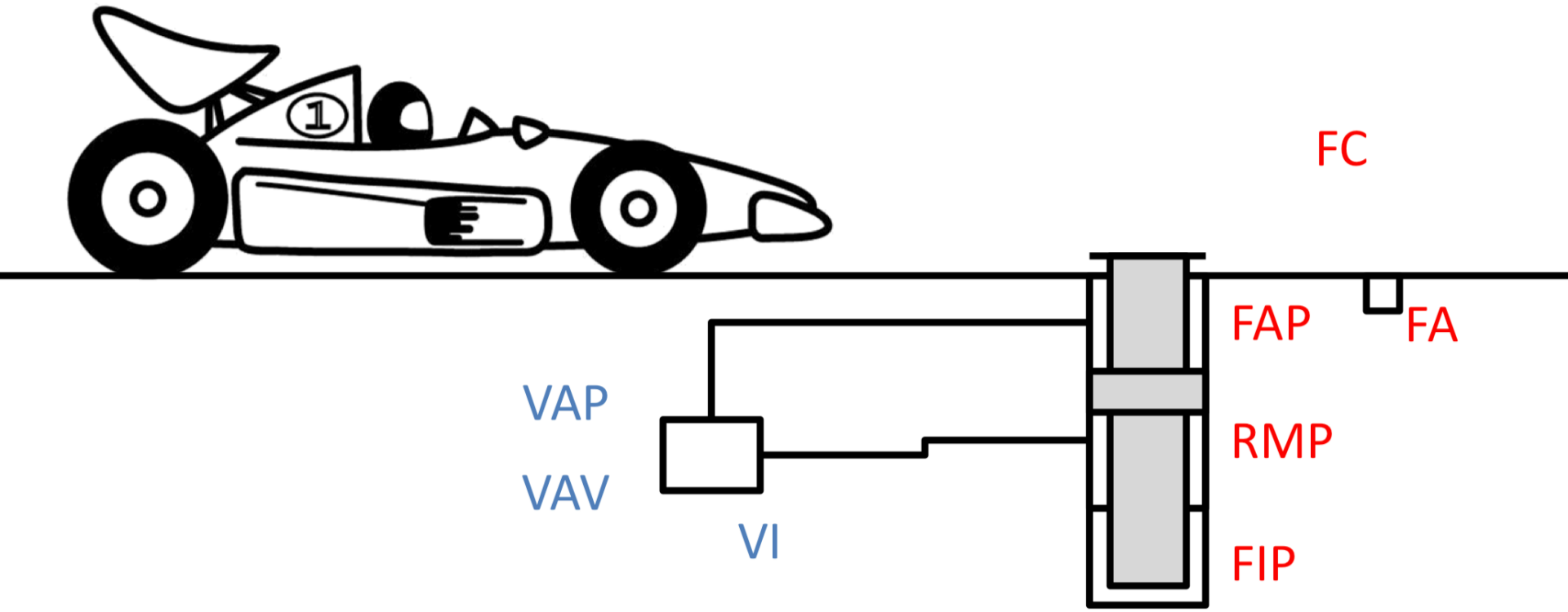
Exercise 2



OUTPUTS:

- VAP: Command to send the piston forward in slow mode(0 – deactivated – 1 activated)
- VAV: Command to send the piston forward in rapid mode(0 – deactivated – 1 activated)
- VI: Command to send the piston backwards (0 – deactivated – 1 activated)

Exercise 2



INPUTS:

- FC: End of the tyres change (0 change occurring– 1 change not occurring)
- FAP: Forward limit of the piston (0 not active – 1 active)
- FA: Car photocell (0 car not present – 1 car present)
- RMP: Reaching of the half turn of the piston (0 piston extended for less than half turn – 1 piston extended for more than half turn)
- FIP: Backward limit of the piston (0 not active – 1 active)

Exercise 2

Notes:

- FA=0 only after the complete moving of the car away from the lifter, that can happen also many cycles after the lowering of the piston to the FIP point.
- We have to create a program that assure the lowering of the piston in any time if FA=0 (independently on the condition in which the piston is).

Exercise 3

Develop a Ladder software that allows the control of an industrial drill with the following operating mode.

When the operator press the START button (START=1), the PLC must turn on the drill's motor (MOTOR=1), but only if the security protection is activated (PROTECTION=1).

Otherwise, the PLC have to signal to the operator with an alarm (ALARM=1) that the protection has to be activated.

When the operator activate the protection, the PLC must turn off the alarm (ALARM=0) and the operator can press again the START button (START=1) to make the motor turn on (MOTOR=1).

To stop the drill, the operator can press the STOP button (STOP=1). If the operator doesn't press the stop button, the drill stops itself automatically after 10 seconds.

Exercise 3

The inputs of the system are:

- START: Button that starts the drill's motor (0 button not pressed – 1 button pressed)
- STOP: Button that stops the drill's motor (0 button not pressed – 1 button pressed)
- PROTECTION: Sensor on the security protection (0 deactivated – 1 activated)

The outputs are:

- MOTOR: Command that enable the drill's motor (0 deactivated – 1 activated)
- ALARM: Alarm that signal the need of activation of the security protection (0 deactivated – 1 activated)

SFC exercises

Exercise 1

Develop a SFC software that allows the control of an industrial oven with the following operating mode.

When the operator press the start button (START=1), the PLC starts the warming cycle of the material (OP=1) for 30 seconds. After that interval, the OP command must be reset by the PLC (OP=0). The completion of the process have to be signaled by the powering on of a green light (GREEN=1) for 10 seconds.

After this interval, the green light must be powered off (GREEN=0).

Exercise 1

The only input of the system is:

- START: Button that starts the oven

The outputs are:

- OP: Oven enabling
- GREEN: Led that indicates the end of the oven functioning.

Exercise 2

Develop a SFC software that allows the control of an hydraulic car-lifter for the tyres change with the following operating mode:

- The car arrives in proximity of the lifter and it is detected by a photocell.
- The piston starts the lifting of the car in slow forward mode (suppose that the piston starts from the FIP point) until the reaching of the RMP point.
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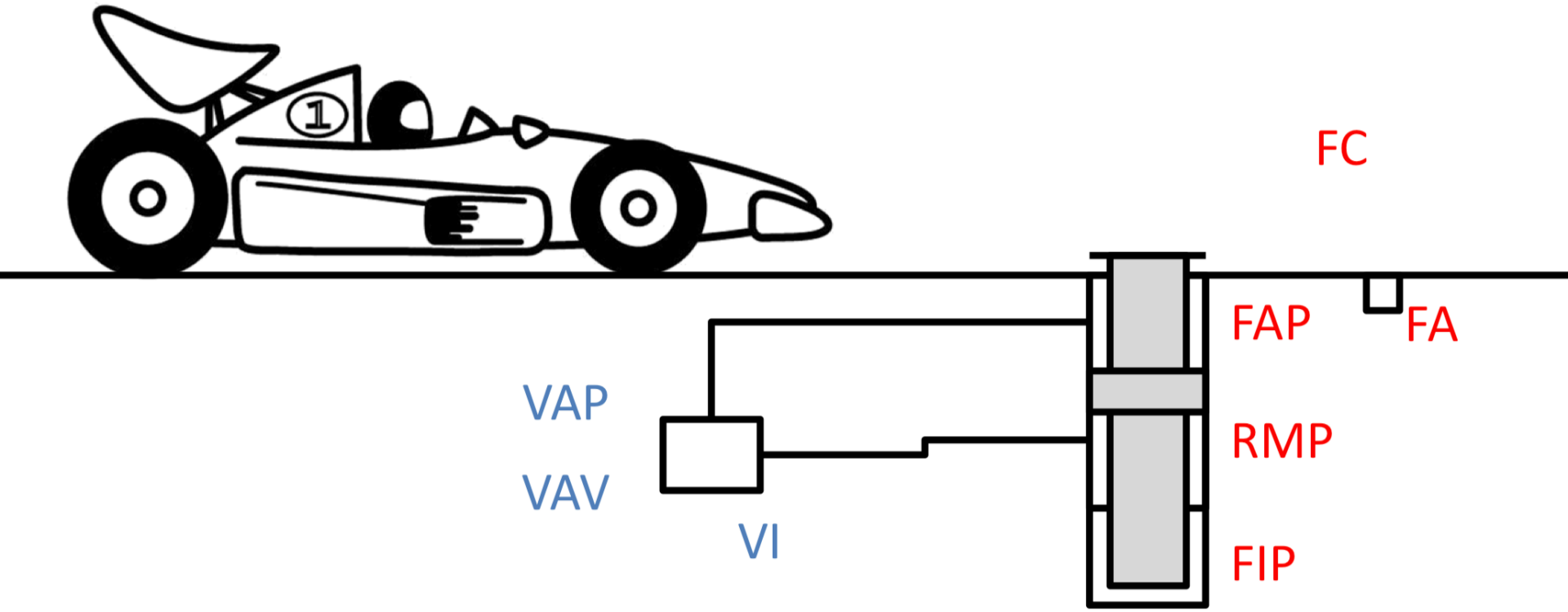
Exercise 2



OUTPUTS:

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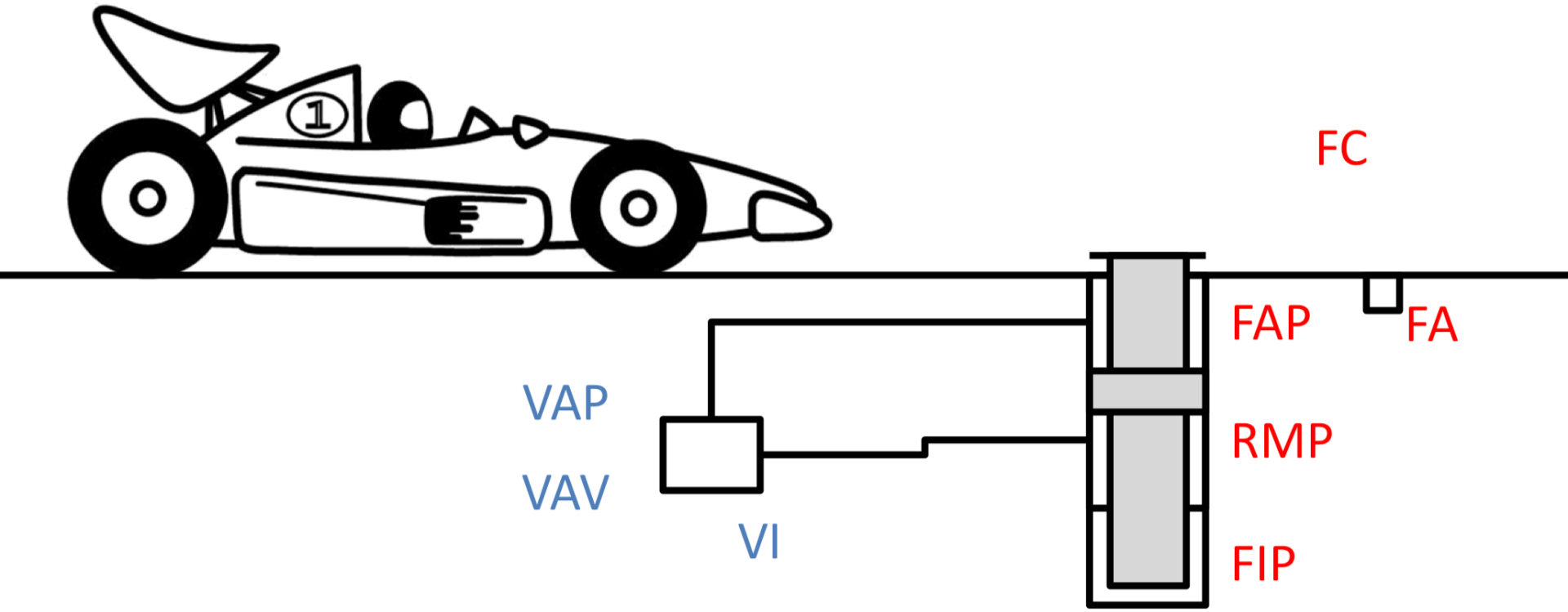

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Structured Text exercises

Exercise 1

Develop a Structured Text software that allows the control of an industrial oven with the following operating mode.

When the operator press the start button (START=1), the PLC starts the warming cycle of the material (OP=1) for 30 seconds. After that interval, the OP command must be reset by the PLC (OP=0). The completion of the process have to be signaled by the powering on of a green light (GREEN=1) for 10 seconds.

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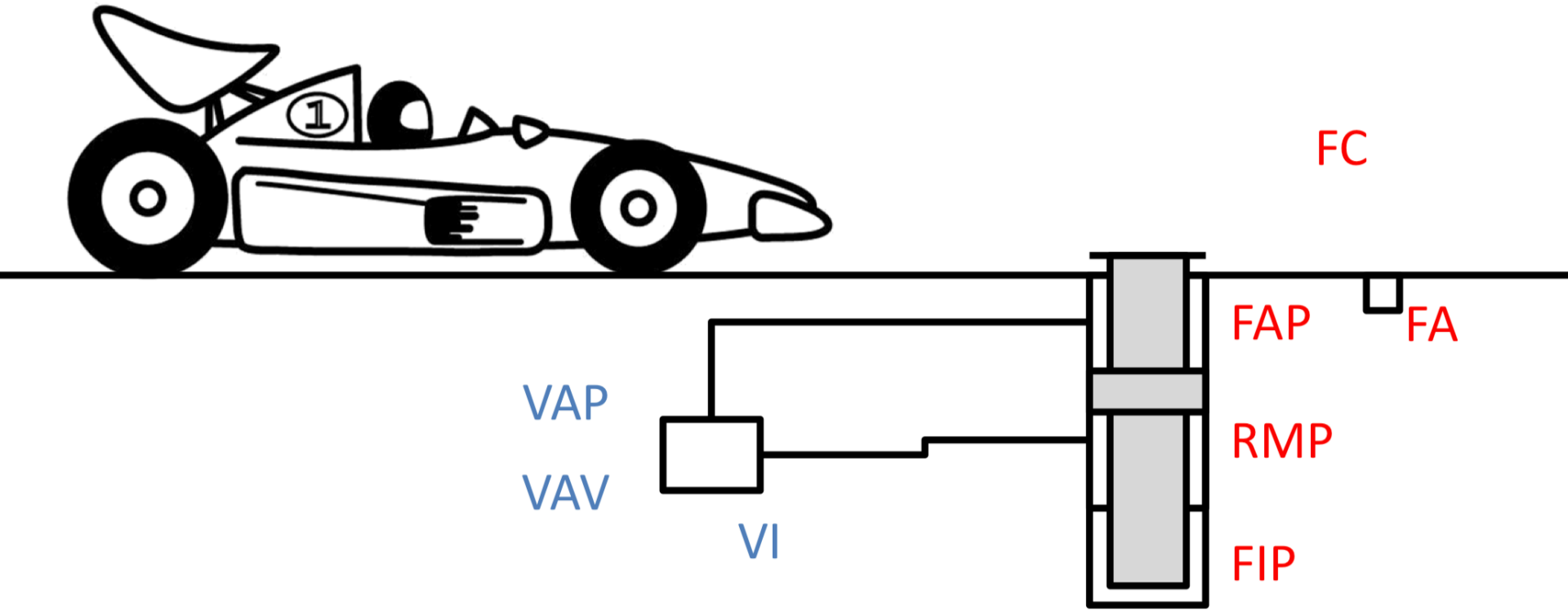

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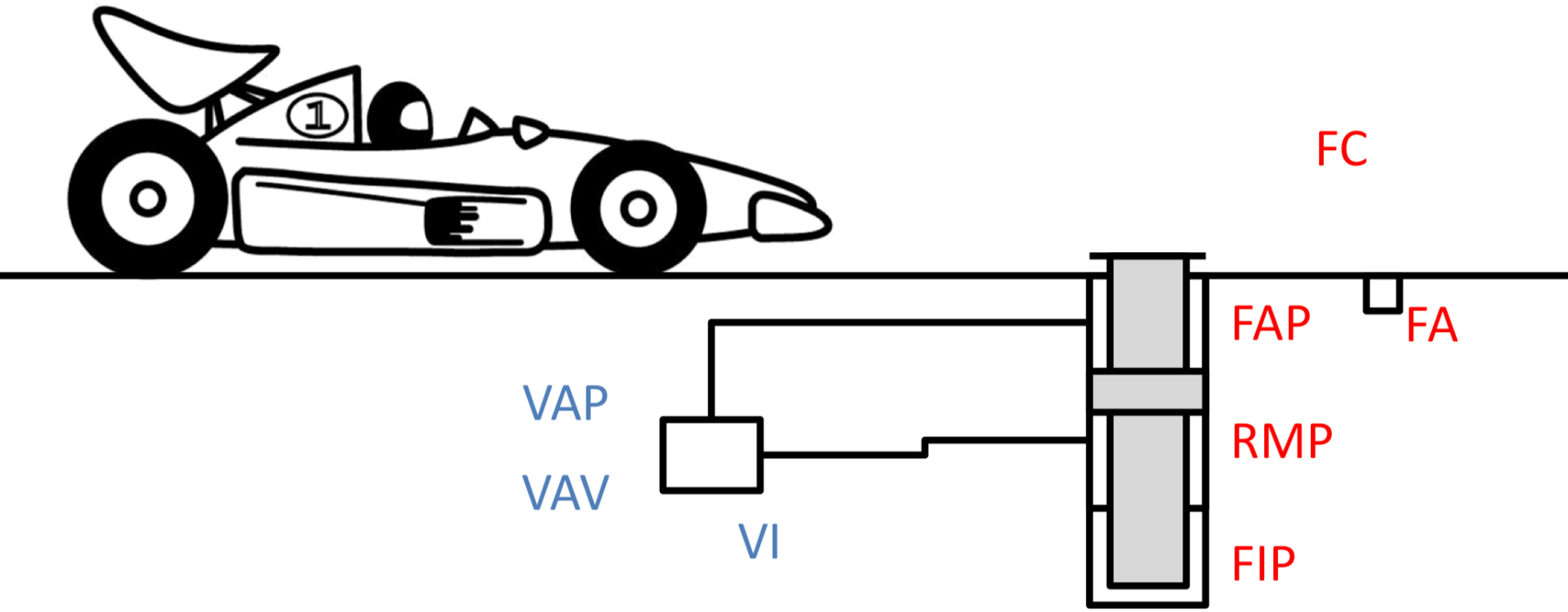

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