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Industrial liquid level system

1.0. INTRODUCTION

In modern industrial automation, ensuring precise control over liquid levels in tanks is vital across various sectors, from manufacturing to chemical processing. Leveraging advanced technologies like Factory I/O, Siemens' TIA Portal, and PLCSIM, we can construct a robust and efficient level tank control system.

- Factory I/O: Factory I/O is a realistic industrial automation simulation software that allows us to create virtual environments mimicking real-world manufacturing scenarios. With its intuitive interface, it enables us to design and test control systems in a simulated environment before actual implementation, saving time and resources.
- TIA Portal: Siemens' Totally Integrated Automation (TIA) Portal is a powerful engineering framework that integrates various automation tasks, including PLC programming, HMI design, and commissioning. TIA Portal provides a unified platform for developing control systems, offering seamless integration and efficient engineering workflows.
- PLCSIM: PLCSIM is a simulation tool within TIA Portal that emulates Siemens' PLC hardware, allowing users to test and validate control programs without the need for physical hardware. PLCSIM enables thorough testing of PLC logic and functionality in a virtual environment, facilitating software debugging and optimization.

2.0. OBJECTIVE

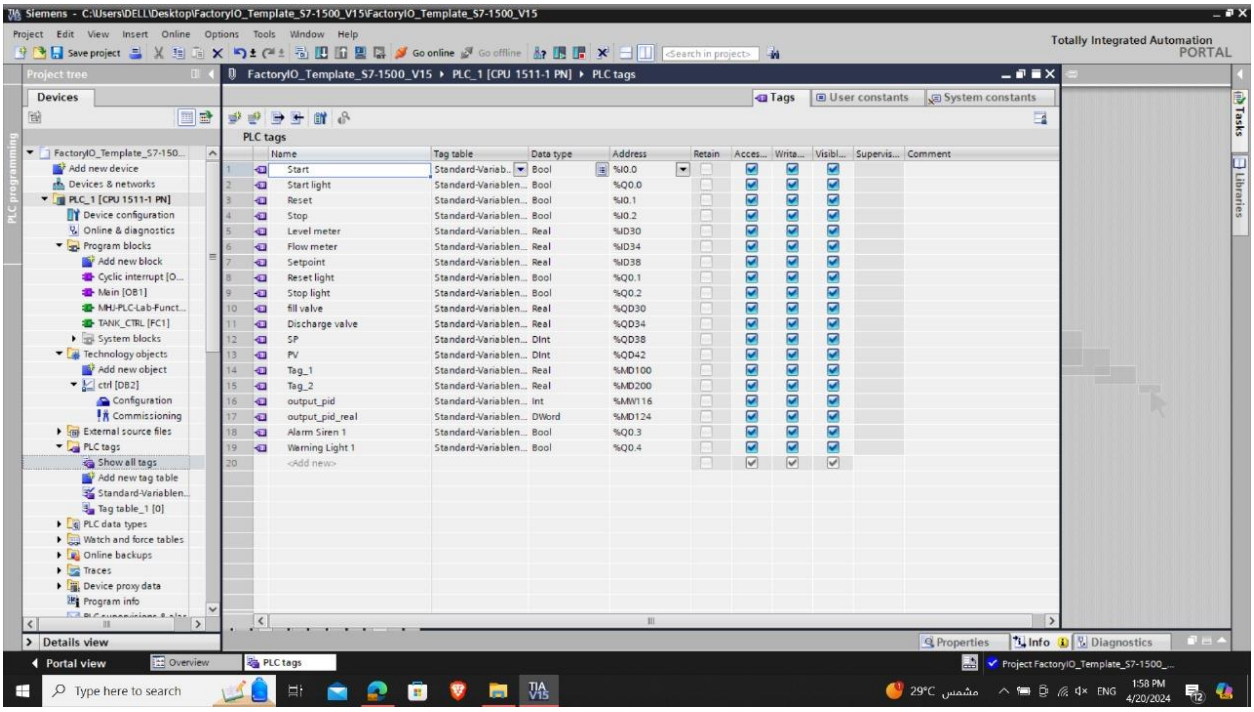
In groups of 3 students each, you are required to:

(a) Use SIMATIC S7-1200 PLC or PLCSIM to control one of the following industrial systems:
   a. An Industrial liquid-level system

(b) Design and tune the controllers using the PID_Compact block in TIA Portal
(c) You may use Factory IO/MATLAB Simulink for simulating the plants and SIL/HIL simulation.
(d) A suitable HMI interface on TIA portal to monitor and visualize the systems' states readings as well as the desired set-points and system faults
(e) Utilize field-related alarms for the detection of hardware and sequence faults.

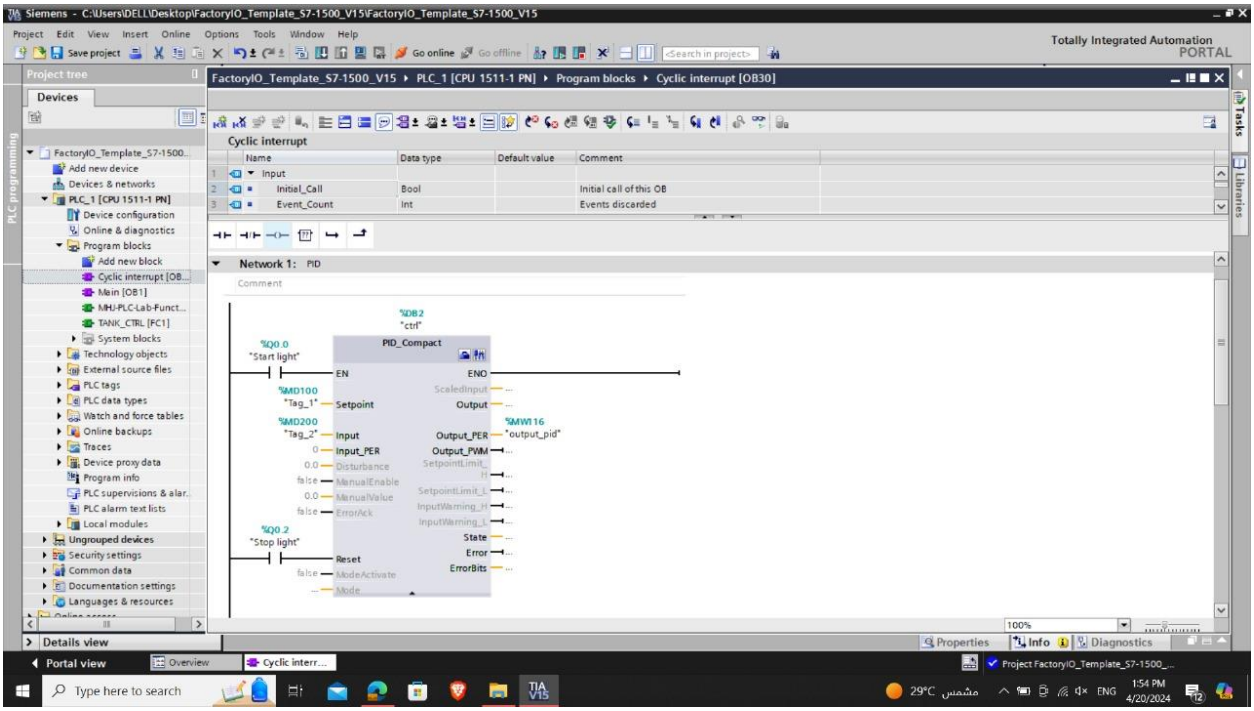
3.0. TIA PORTAL

- All tags we used in TIA portal

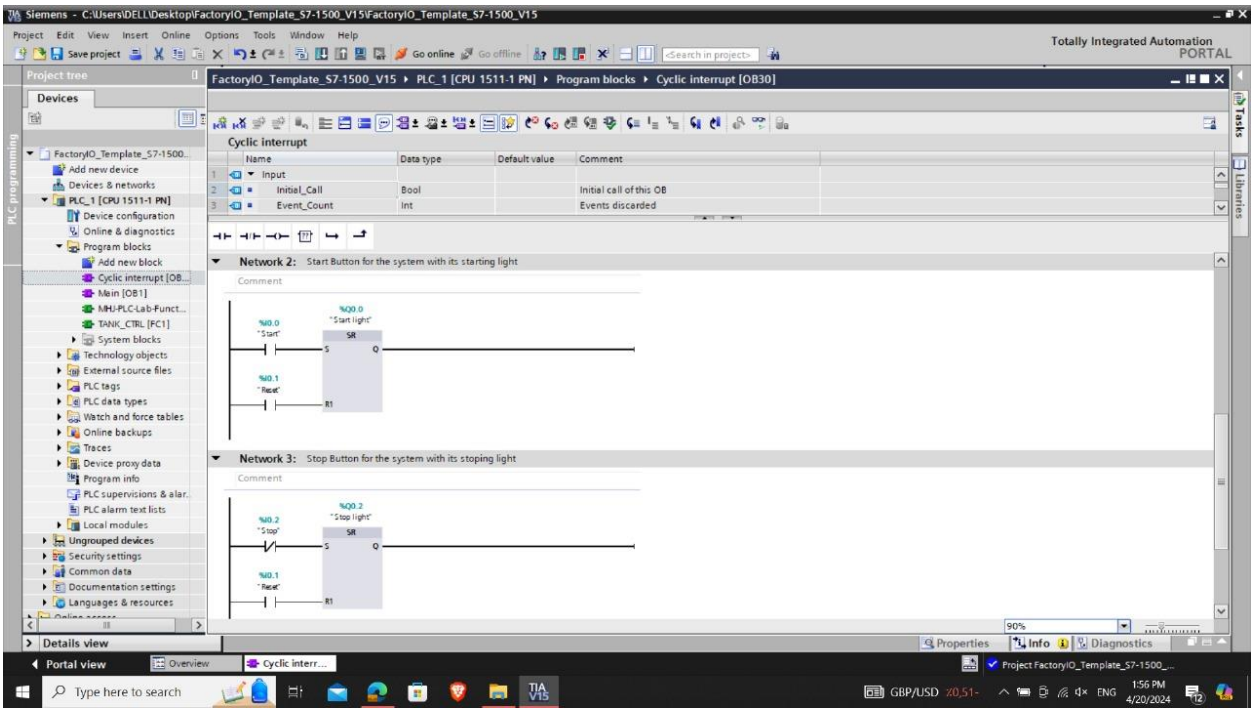


3.1. PID Control

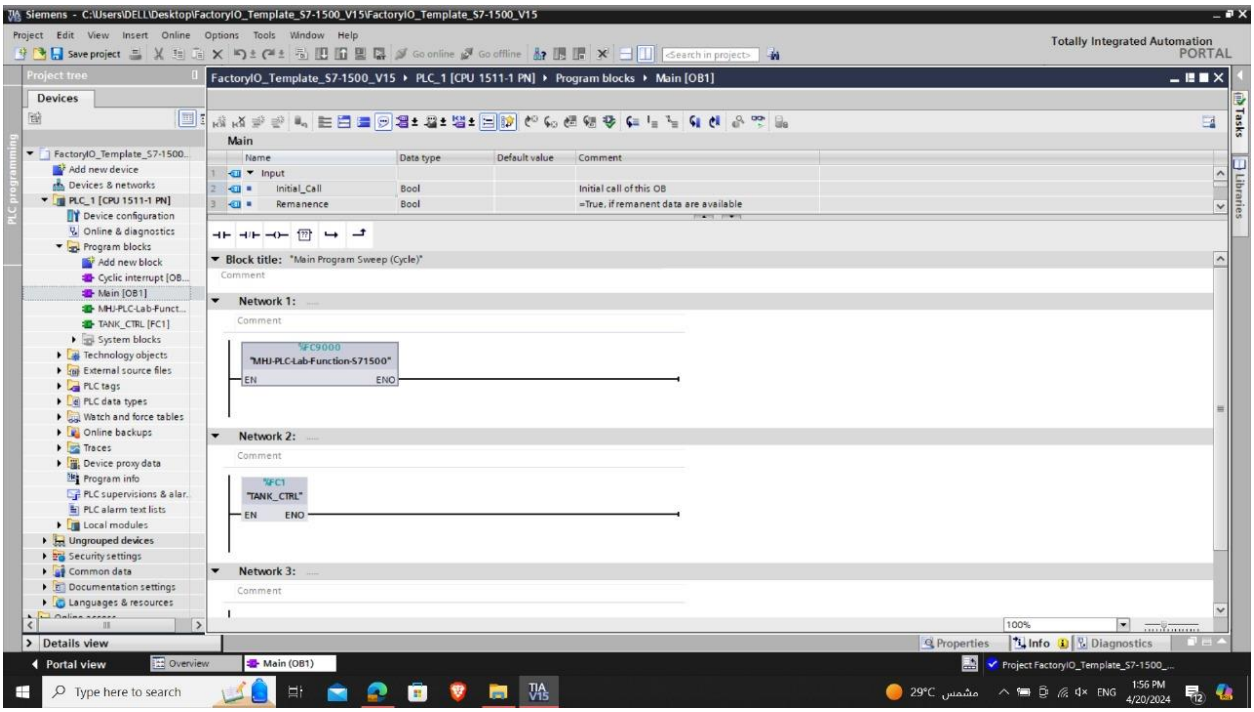
- We used PID_compact block to control the overshoot of tank level by using cyclic interrupt for more accurate tuning and results



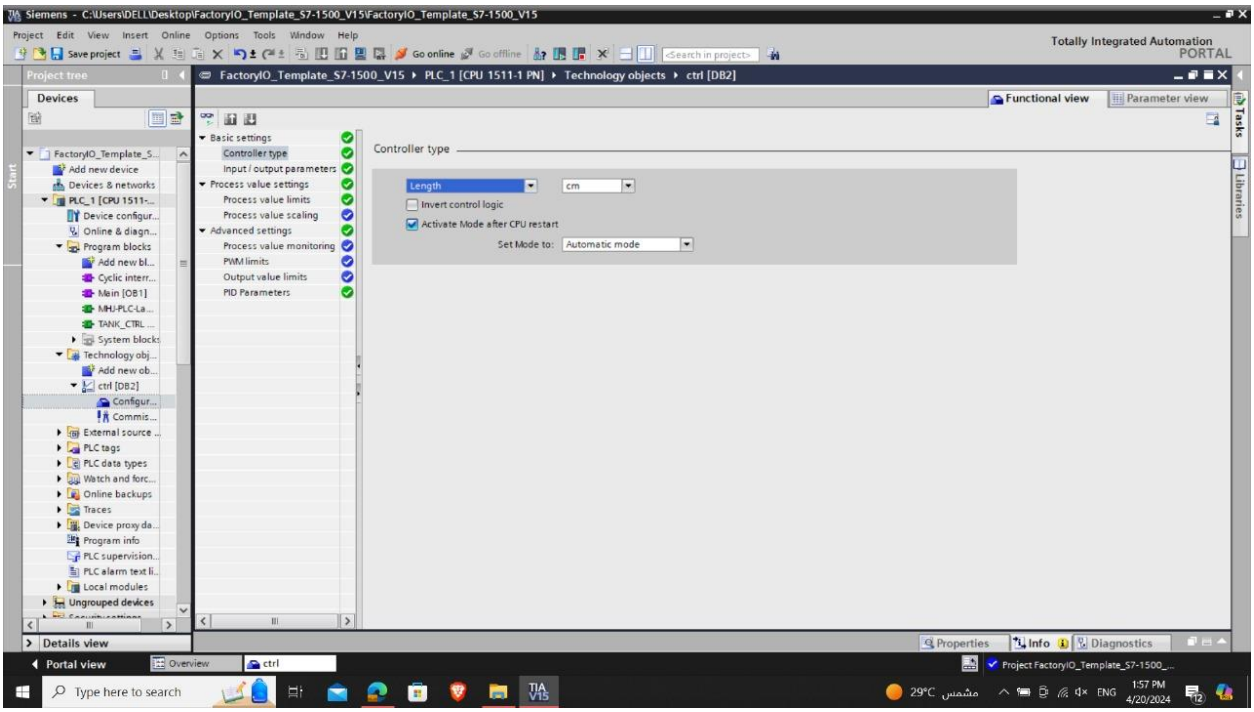
- Start andd stop blocks for tank control

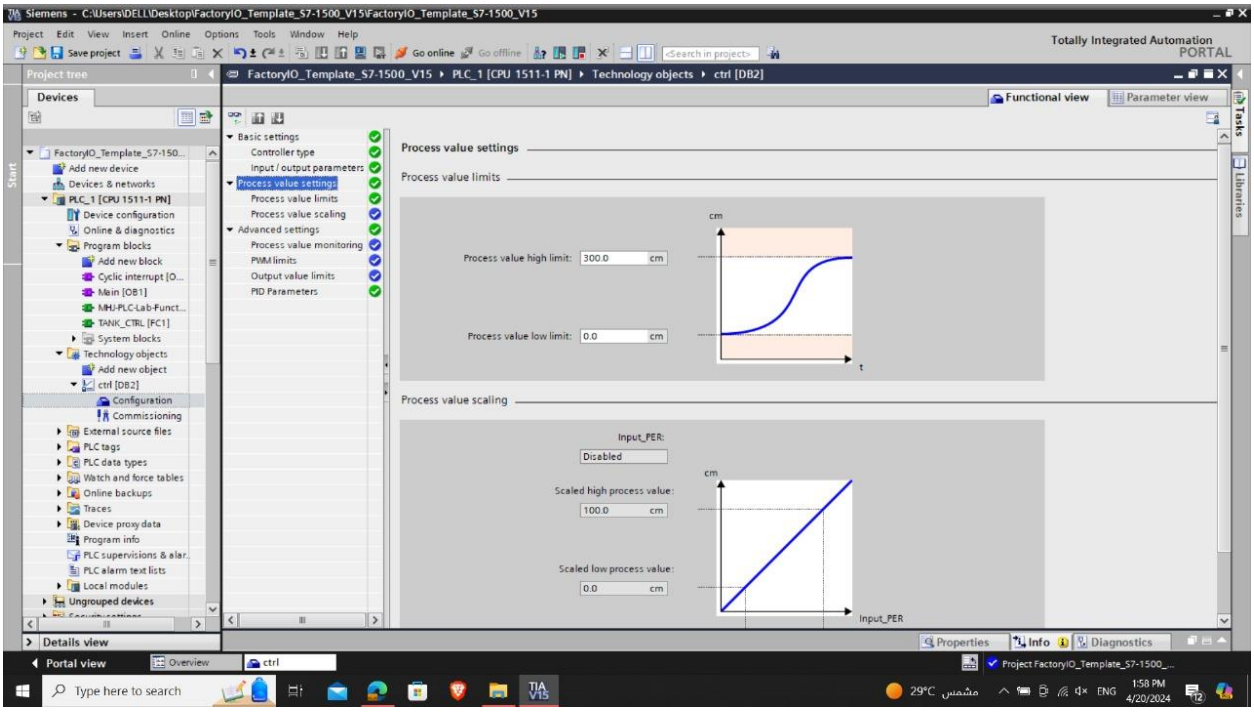


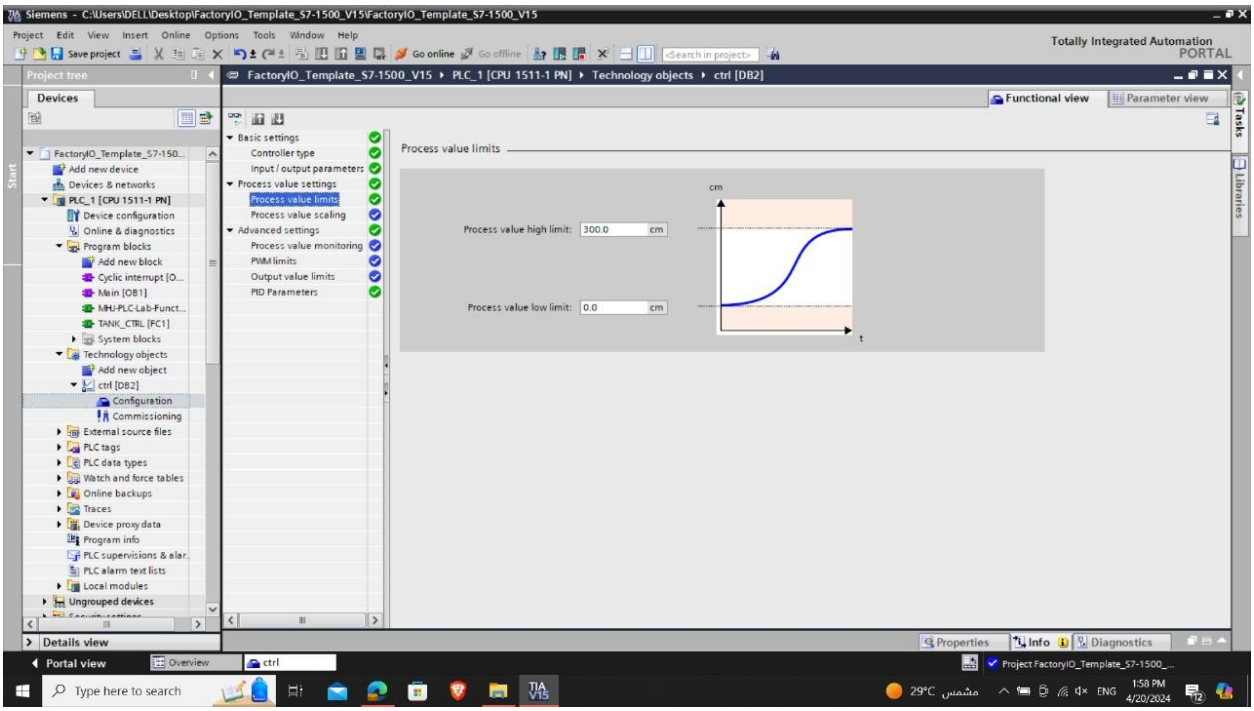
- Main Block Networks



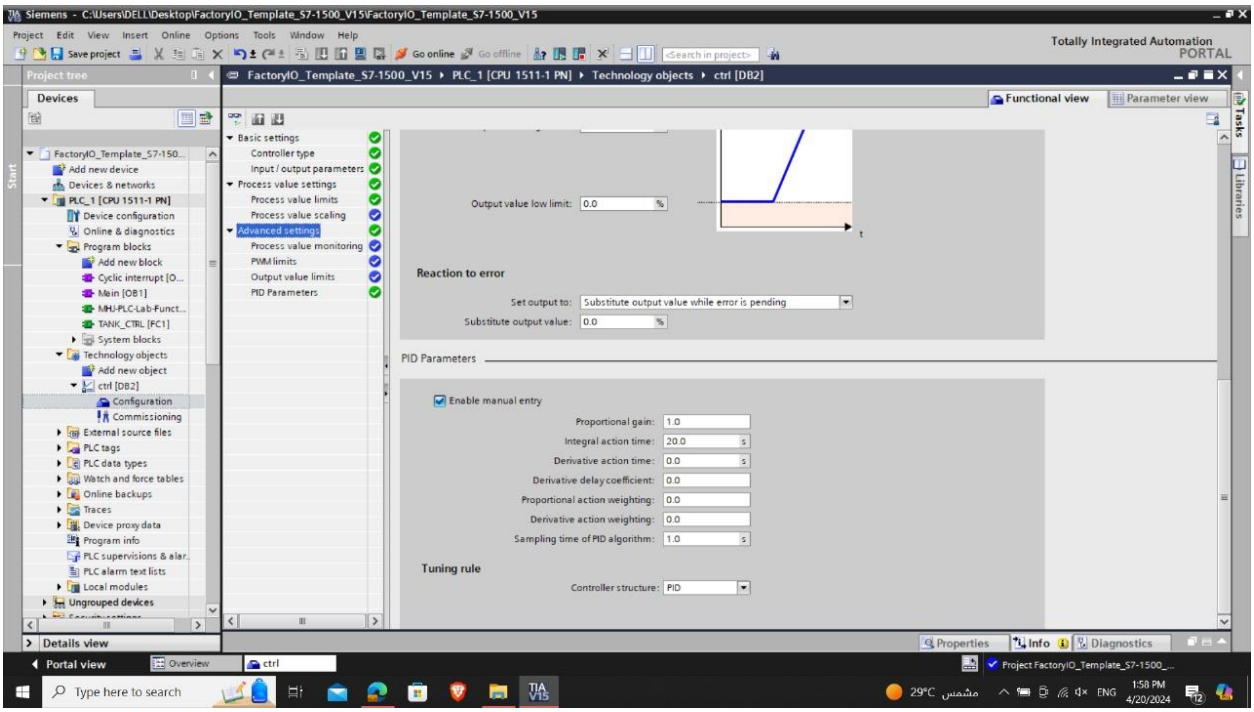
- configuration of PID Compact





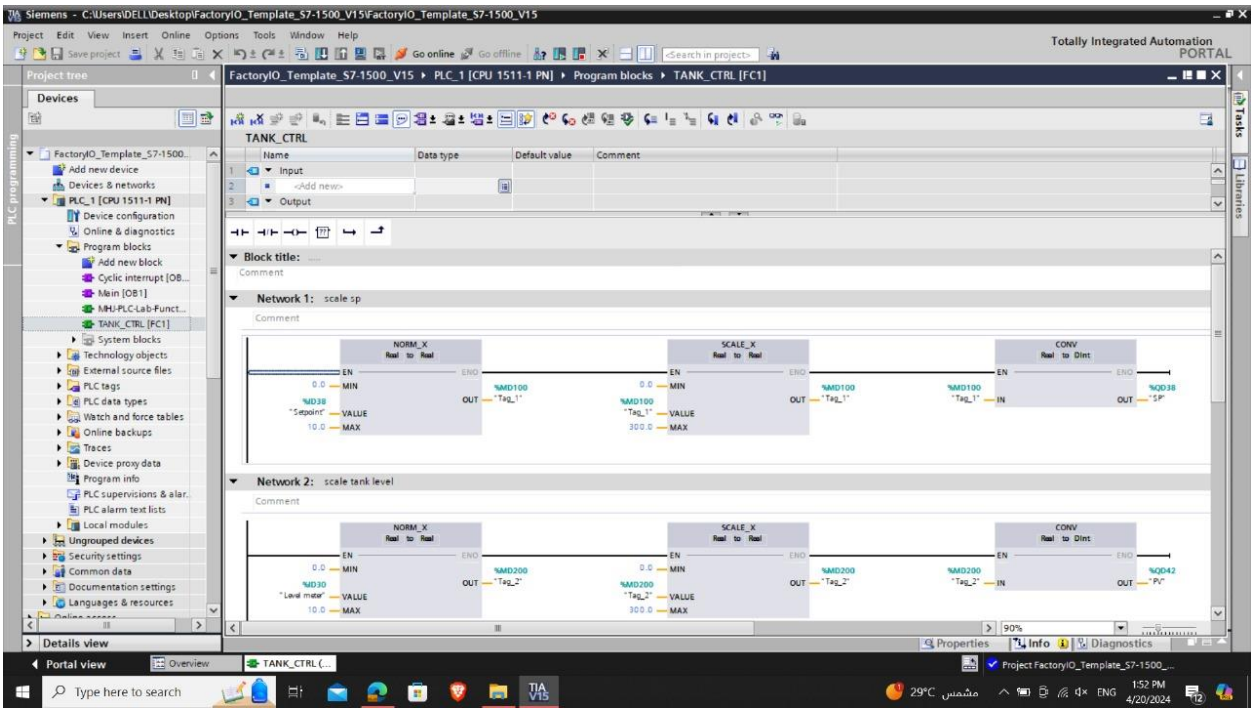


- PID parameters used

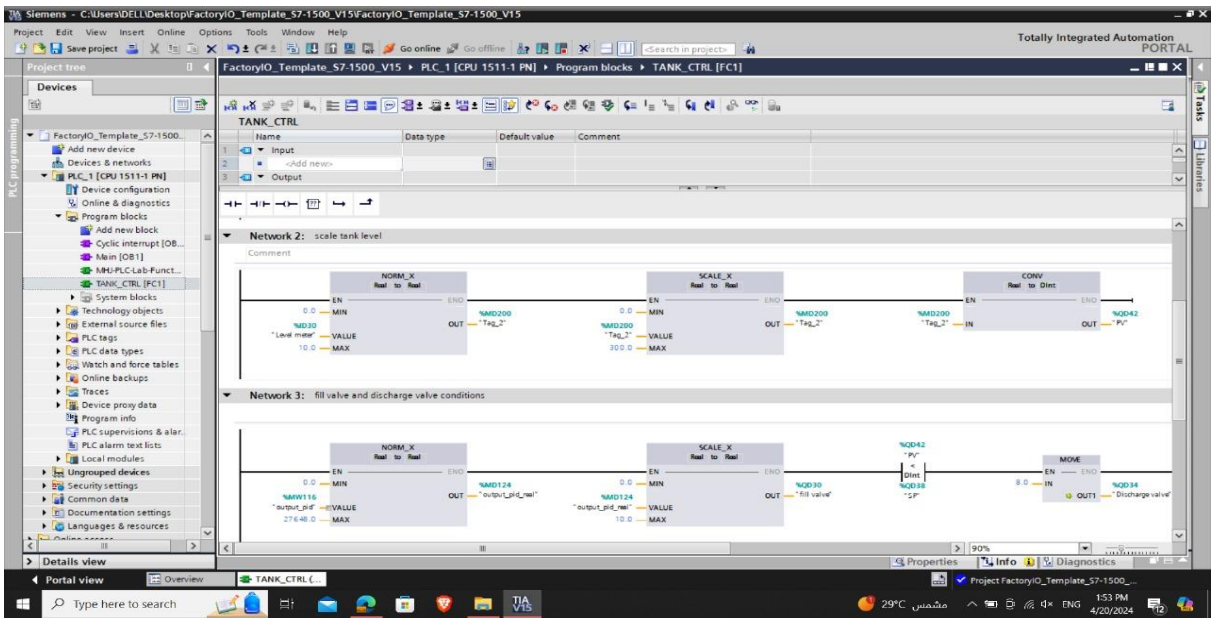


3.2. Tank Control

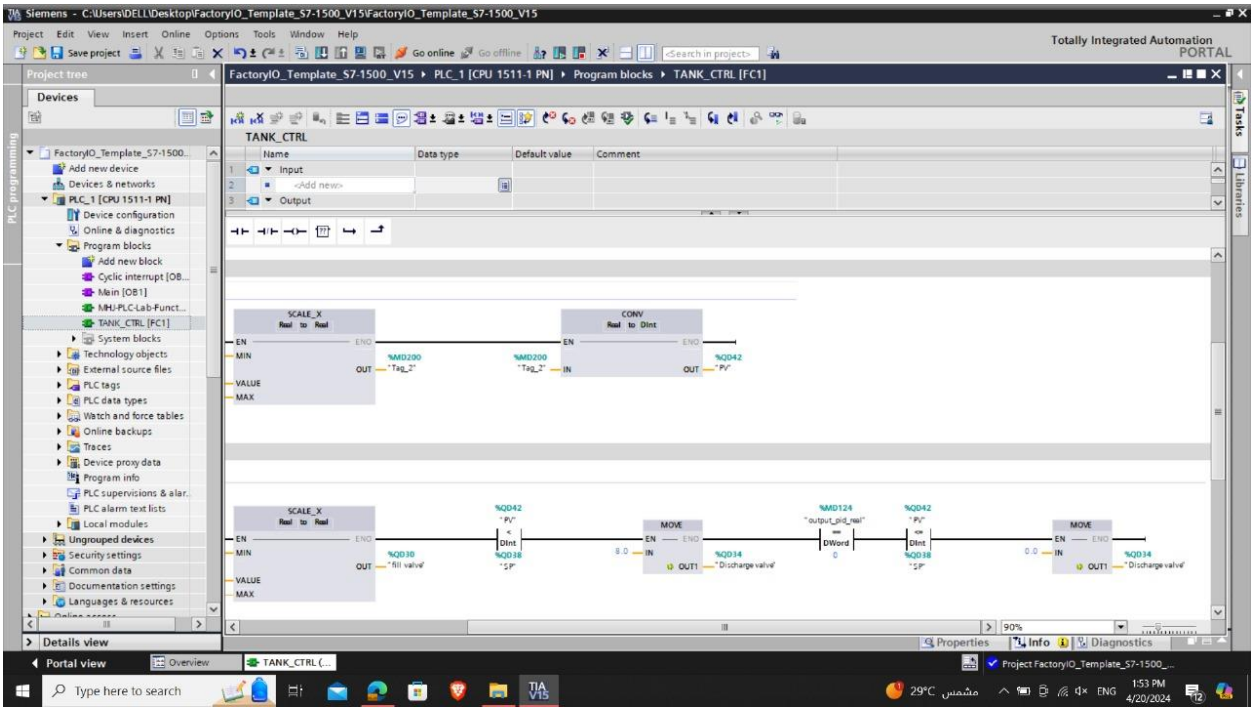
- At Network 1 , we add a norm block to scale the potentiometer voltage from 0 to 10 then sav the output in memory tag_1 and then we scale that output from 0 to 300 which is related to the maximum tank level and then we convert the scaled Tag_1 to SP Which is the potentiometer reading in the control panel



- At Network 2 , we add norm block with the level meter scaling from zero to 10 and then saving the output in memory Tag_2 and then scaling this Tag_2 from 0 to 300 and then converting the value to PV which is current liquid level in tank

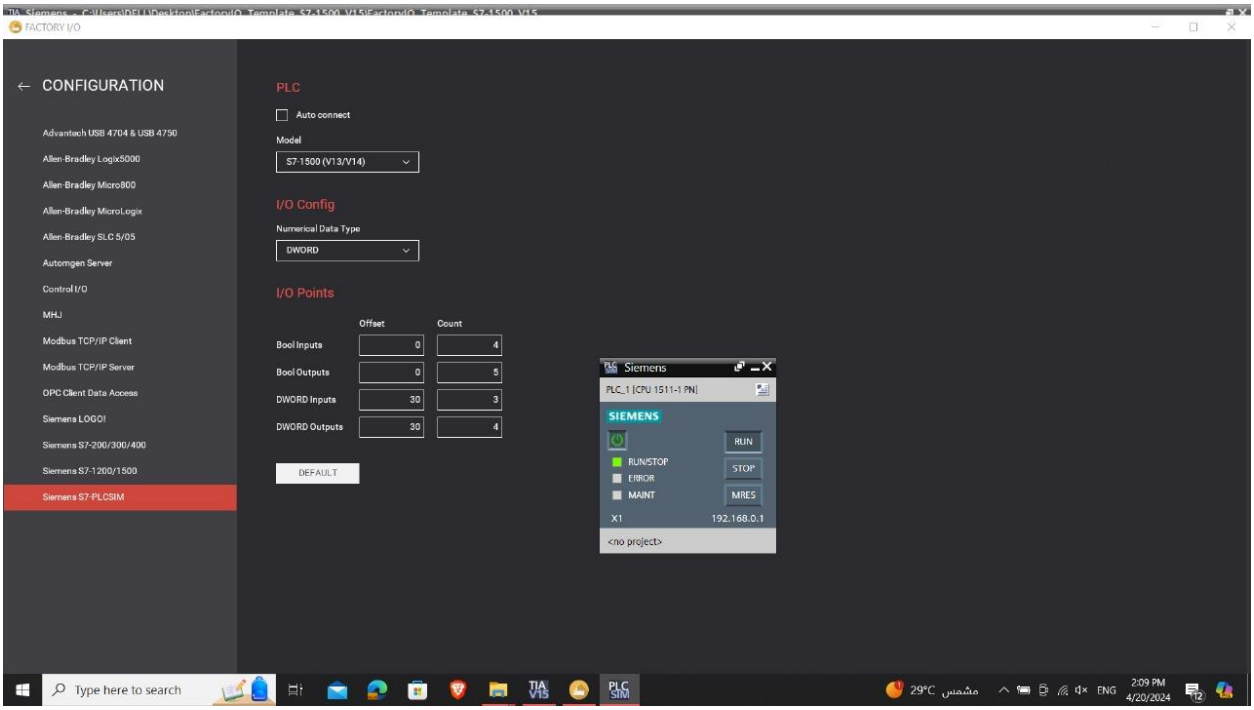


- At Network 3, we add a norm block with output of pid from 0 to 10 and saving the output to output _pid_real and then we add a condtion that if PV< SP make the discharge valve valve value is 8 which is opened by value of 8 until and then I add an comparator to compare the output_pid_real if its equal to zero so the stop button is pressed and then I added another comparator if pv <= sp so the discharge valve still open by 8 until pv<=sp then it closes with value 0 to make the whole system stops with the current level without discharging at the stopping button

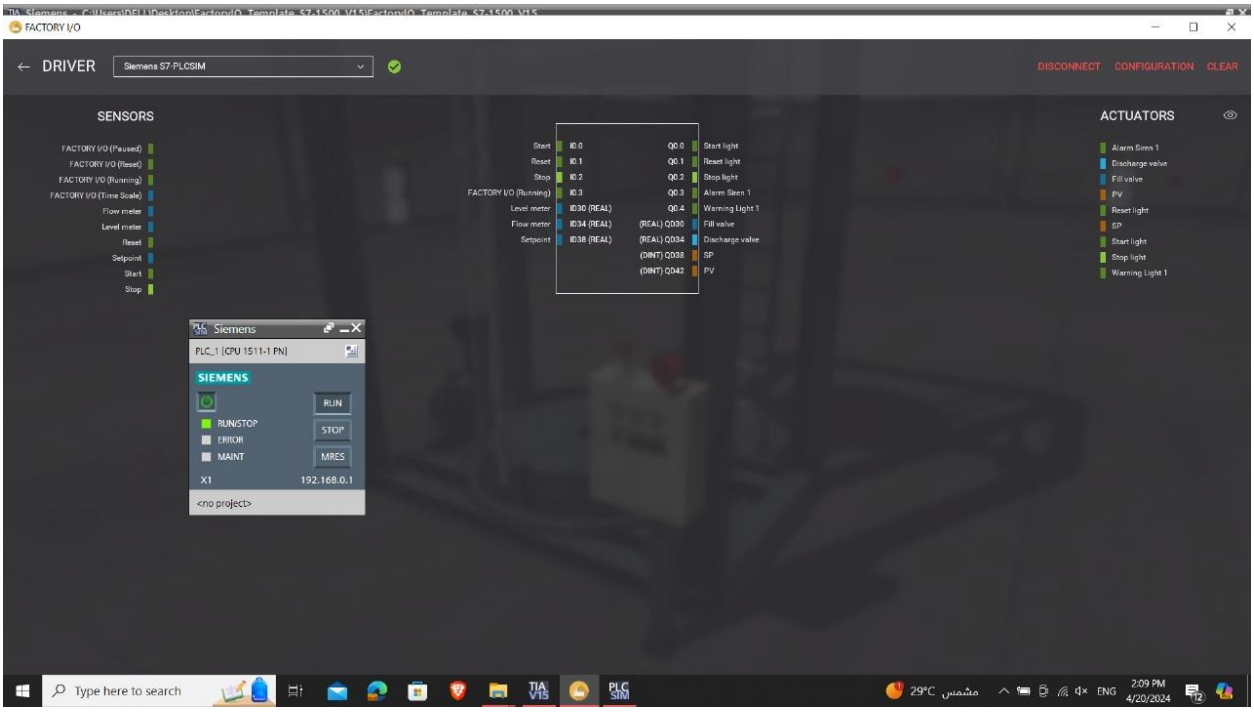


4.0. FACTORY I/O

- driver configuration

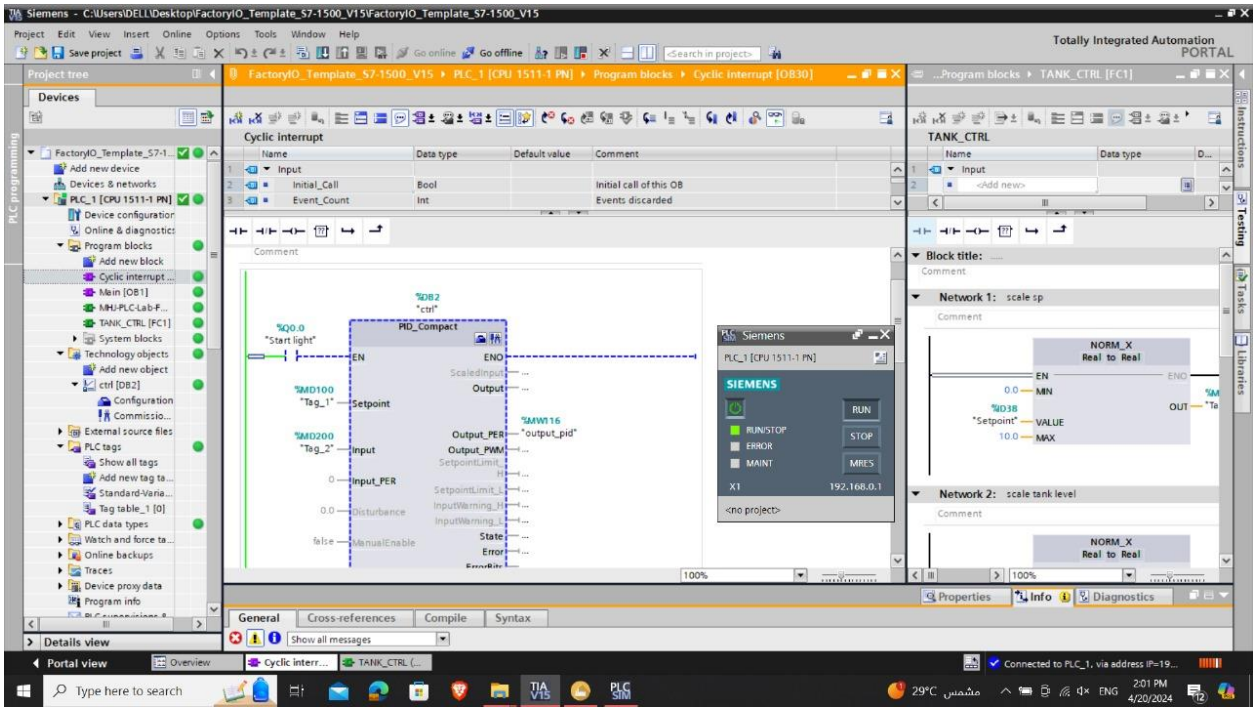


- driver

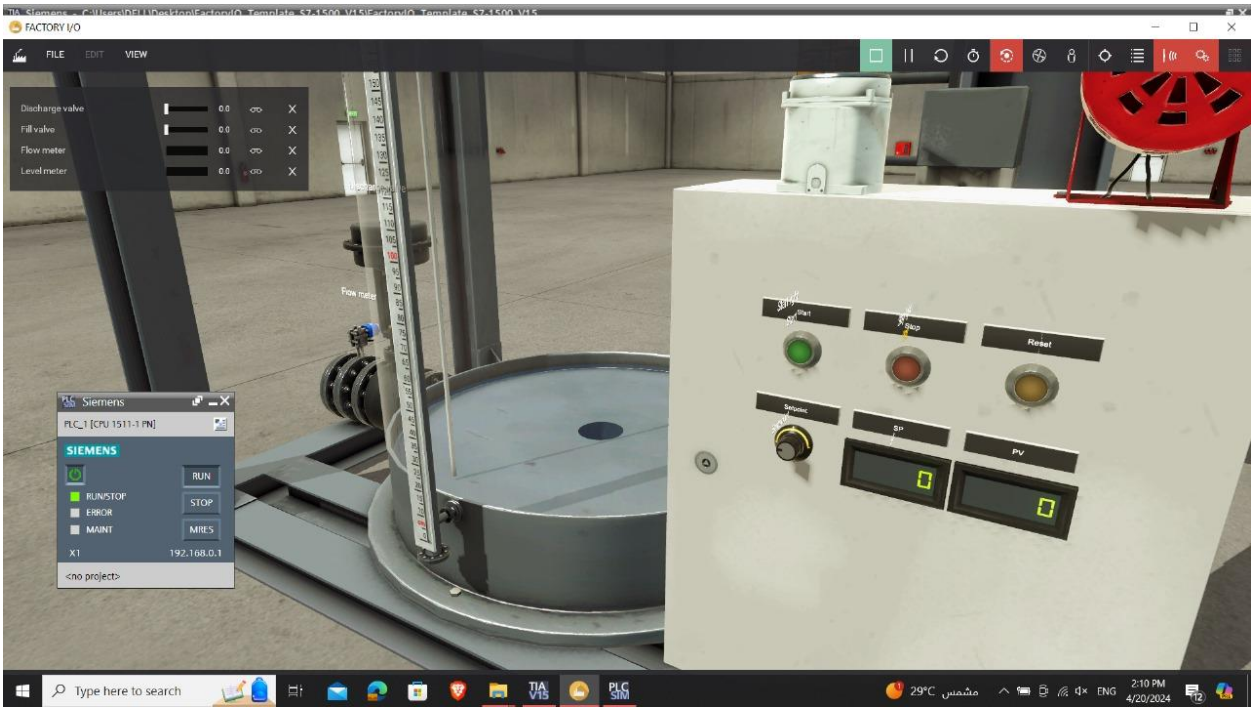


5.0. SIMULATION

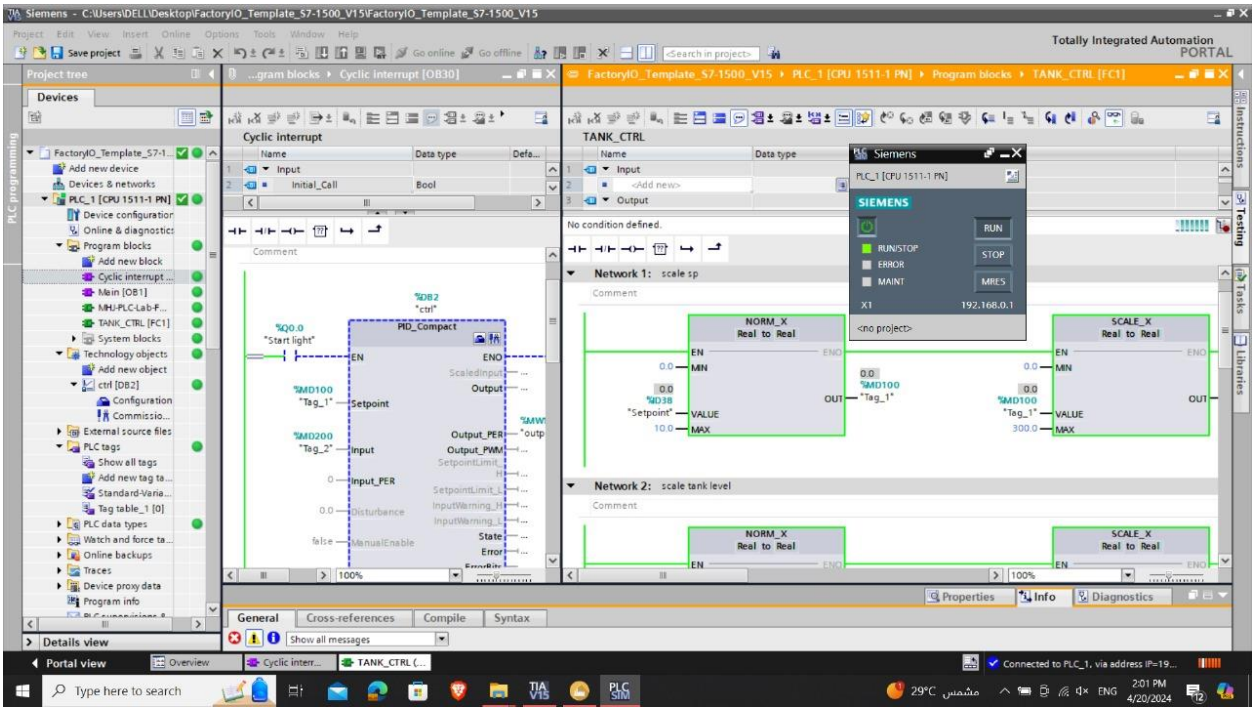
- start simulation and go online



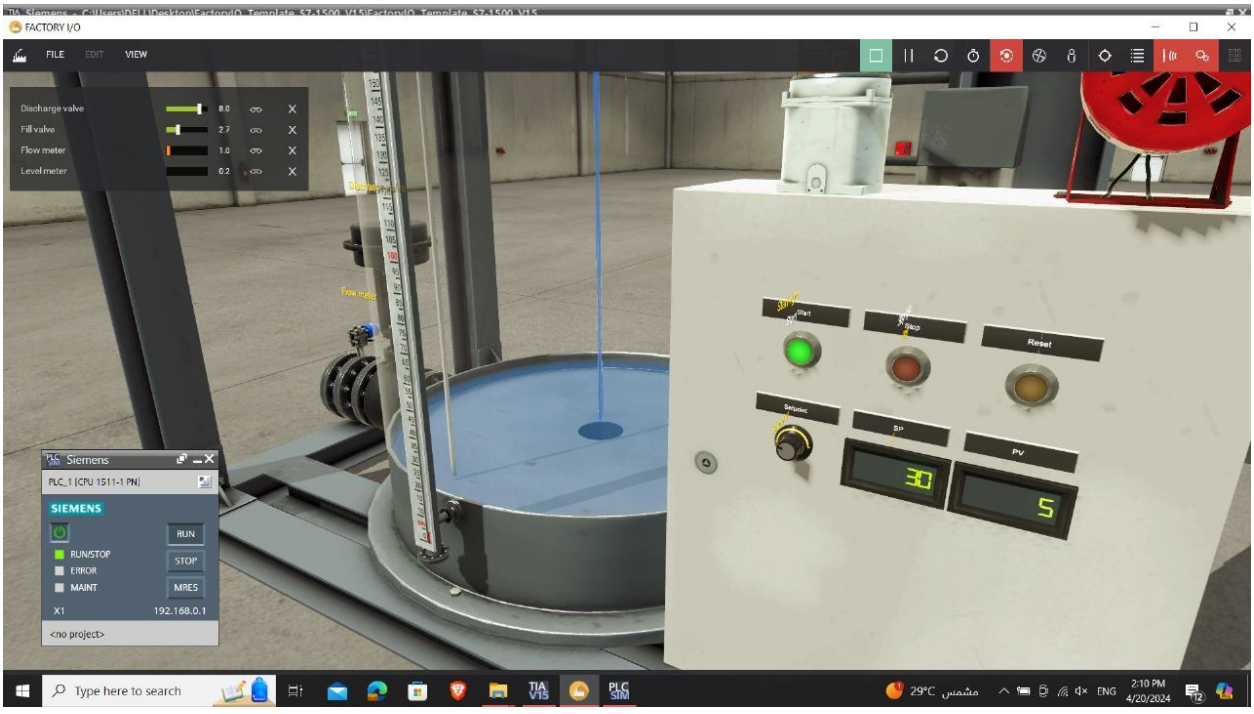
- Start simulation in factory IO



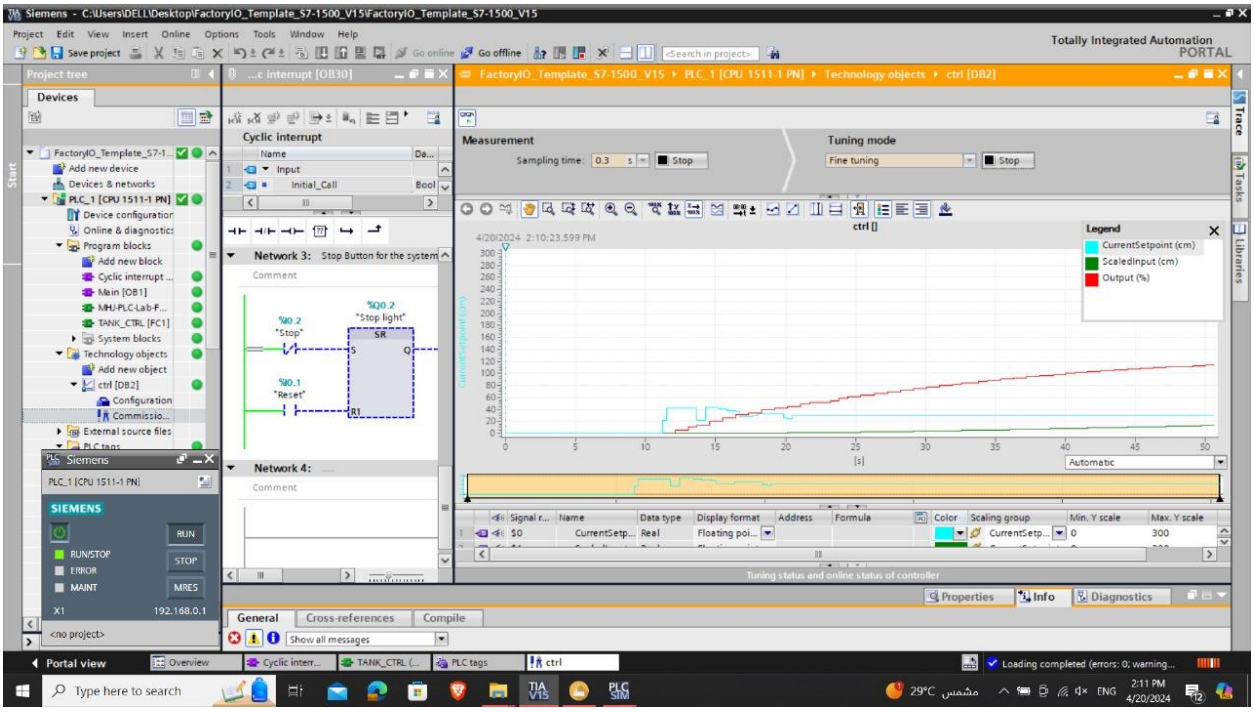
- Simulation is ready



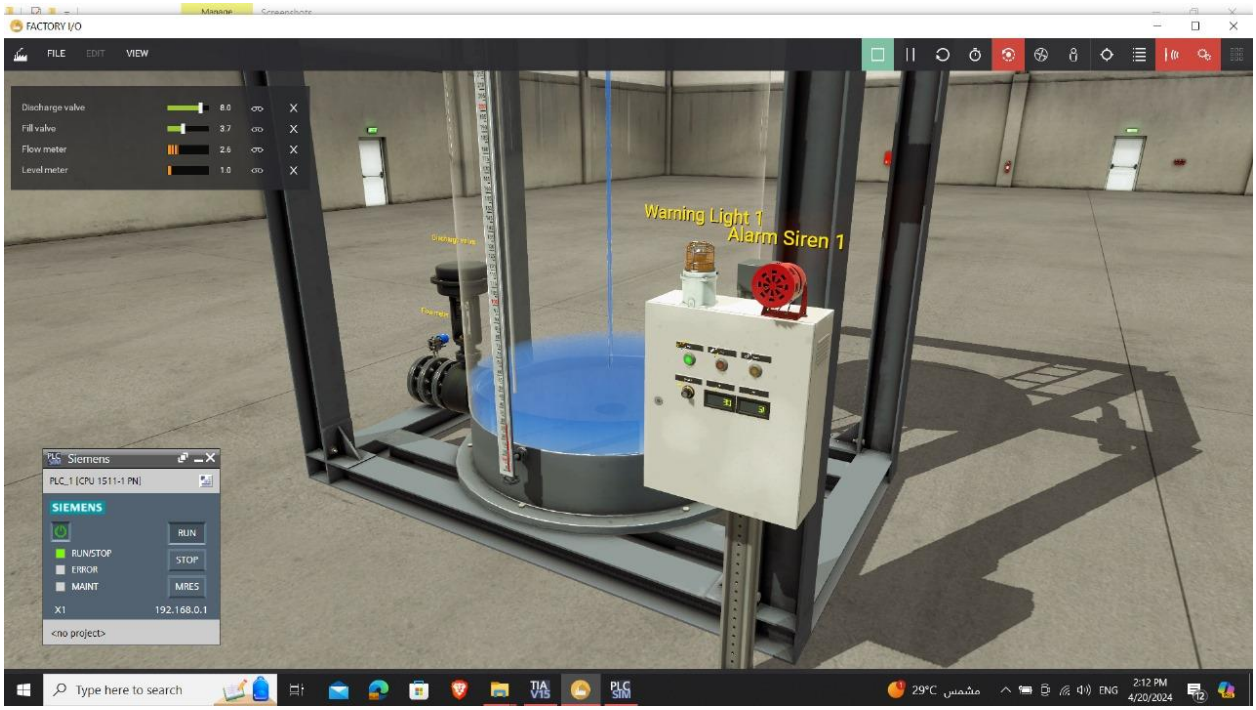
- Setting the potentiometer to 30cm , fill valve open and start to fill the tank



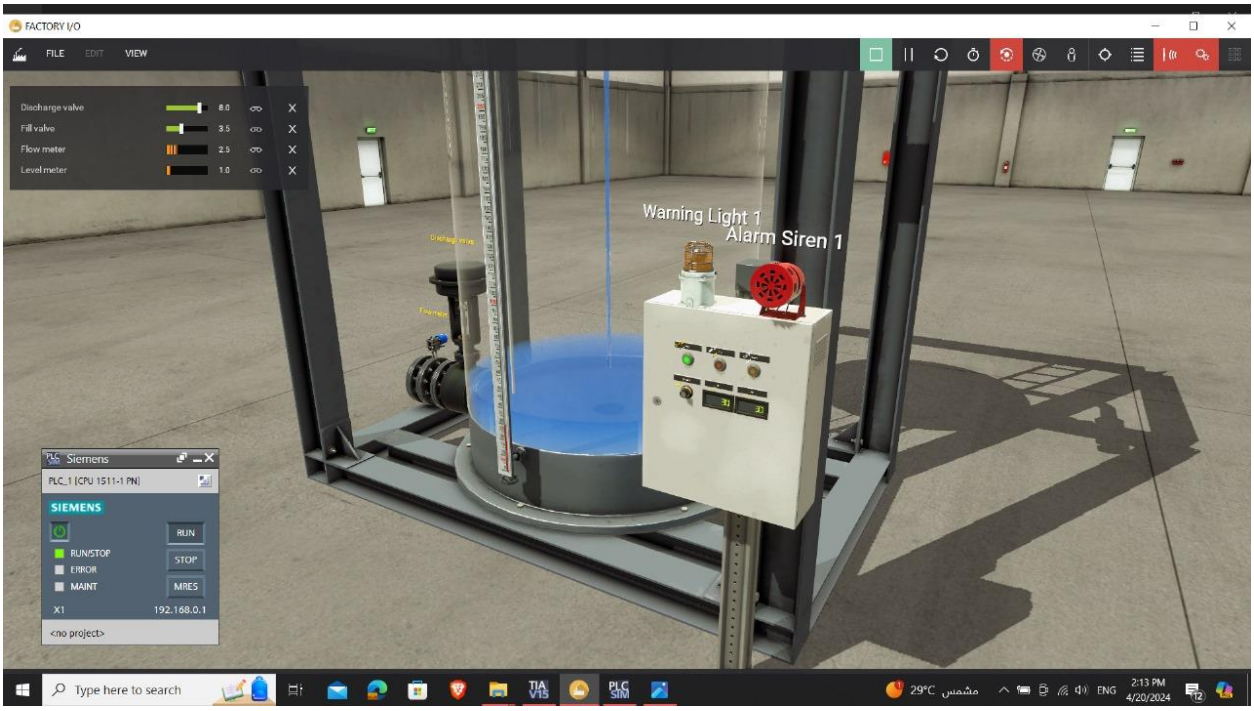
- PID graph



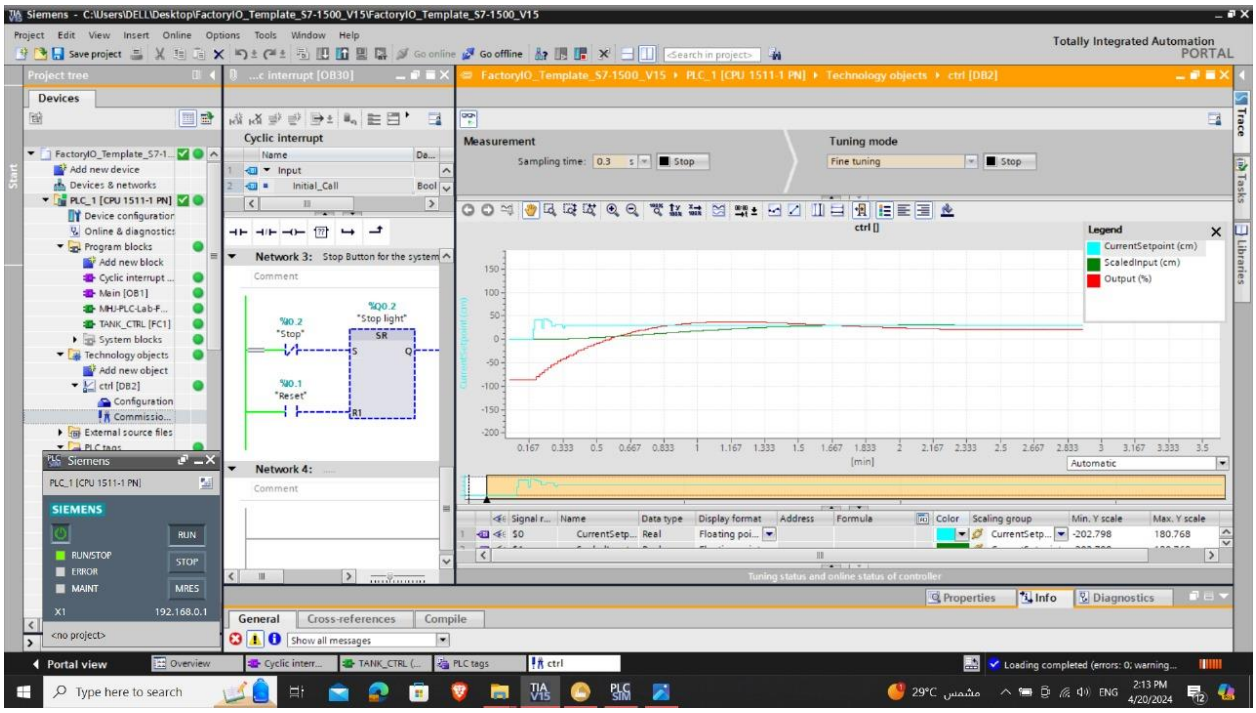
- Pv reading is 31 , we have overshoot +1 so warning light and alarm siren is ON



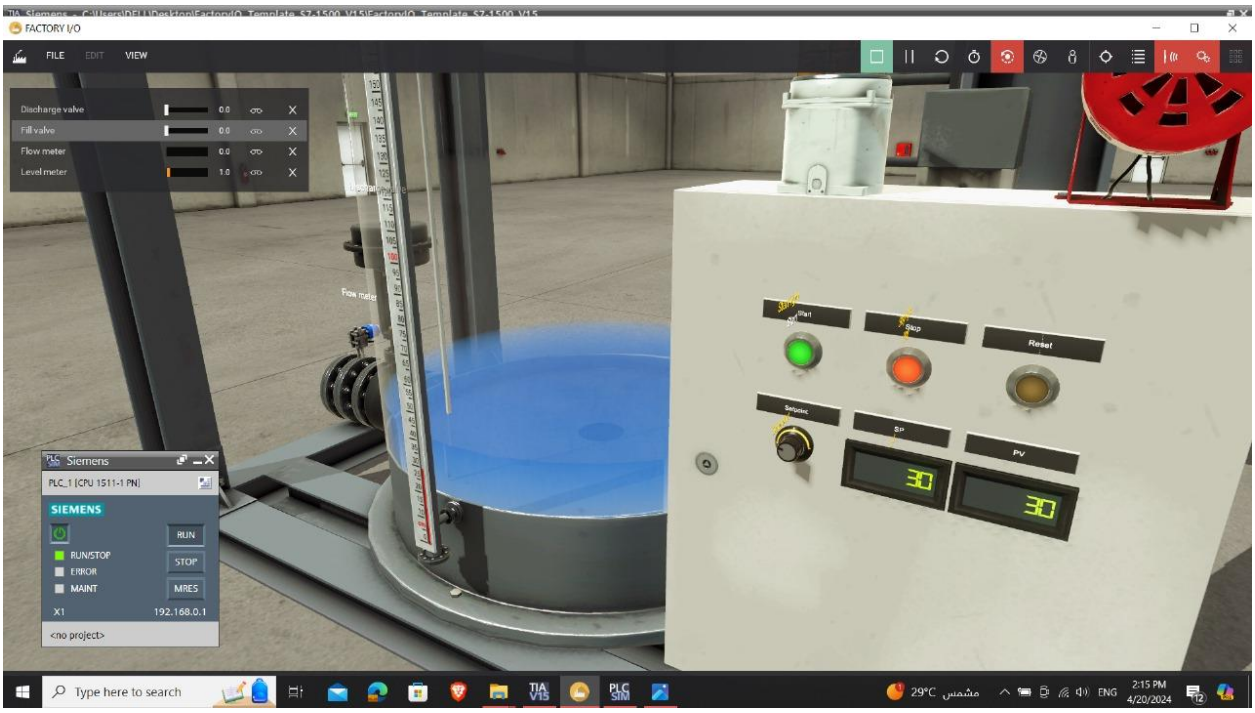
- Tank level reach the setpoint value



- PID Graph



- Stop button pressed and the fill and discharge stops completely with values zero



6.0. DRIVE LINK

https://drive.google.com/drive/folders/1sitQrSa1rtfIVeYHHvGqFQ9XMLrEQeaJ?usp=drive_link

- this link include:
- TIA portal file
- factory i/o file
- simulation video