

REMOTE WORKSHOP FOR PROGRAMING Electrical Automation Systems



Practice 2 - Programmed Control Maneuver for Reversing the Rotation of a Three-Phase Motor.

V1.20250901

Student Name:

Delivery Date:

OBJECTIVE

The objective is for students to become familiar with industrial equipment used for PLC-based programmed control. To achieve this, the guided exercise involves implementing a programmed control for reversing the rotation of a three-phase squirrel-cage motor.

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1. PREVIOUS KNOWLEDGE.

For this exercise, the student should be able to:

- Demonstrate basic proficiency in TIAPORTAL STEP7 software.
- Understand the communication process between the PLC and TIAPORTAL STEP7.
- Read and interpret the panel's electrical diagram.
- Identify components and their functions on the panel.
- Recognize the PLC's input and output signals.
- Analyze the electrical characteristics of the motor, PLC, and control elements.
- Be familiar with Ladder (KOP) programming language and the operation of TIA PORTAL.

2. THEORETICAL RESOURCES.

- Didactic guide
- Workshop manual.
- Annexes.

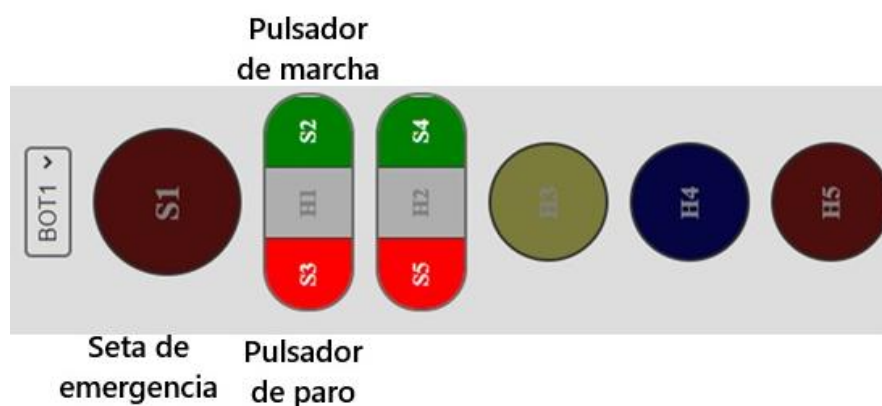
3. DESCRIPTION OF THE PRACTICE.

1. The task is to program a PLC system to:
 - When pressing one of the start pushbuttons, the motor (belt) will rotate to the right until it reaches the right cycle end sensor.
 - When pressing one of the start pushbuttons, the motor (belt) will rotate to the left until it reaches the left cycle end sensor.
 - Include a stop pushbutton and an emergency stop mushroom button.
2. The system will include the following control elements:
 - Motor protection switch for the motor.
 - Emergency stop mushroom button with NC contact.
 - Stop pushbutton (NC).



- Start pushbuttons (NO) for left or right rotation.
 - Two PNP inductive sensors with normally open contacts as cycle end detectors: B1 for left and B2 for right.
3. The motor must be powered from the 400V AC three-phase supply (star connection). The KE contactor must be activated.
 4. Ensure that KIZQ and KDCHA are not activated simultaneously.

In our case it is a PLC of the SIEMENS brand that is programmed with TIAPORTAL. This software allows determining the data of the PLC that we want to program and will be the starting point from which we can continue with the following proposed practices.



4. SAFE USE OF THE EQUIPMENT IN THE LABORATORIOS.

The activities proposed in this workshop do not require physical or online monitoring by a teacher.

5. STEP BY STEP Example

Once the remote desktop connection to the panel is established, you will have access to the computer. You must log in using:

- Username: Alumnos
- Password: Xabec2025

After logging into Windows, you will have access, on the same desktop, to the following resources:

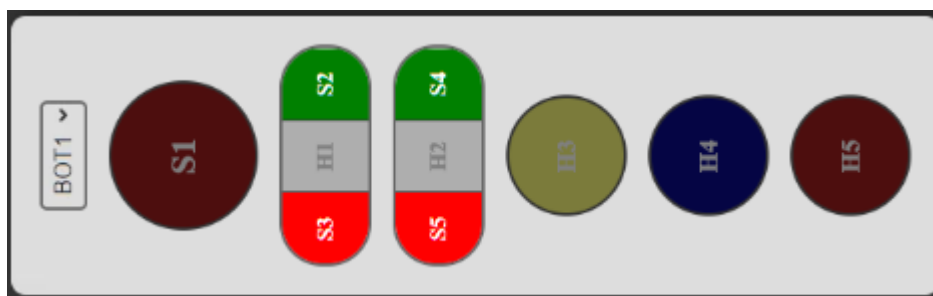
TIAPORTAL V17 programming software for PLC programming.	
VLC video software for remote monitoring of the panel's operation.	
HTML access to the virtual pushbutton panel.	

Before starting with TIAPORTAL programming

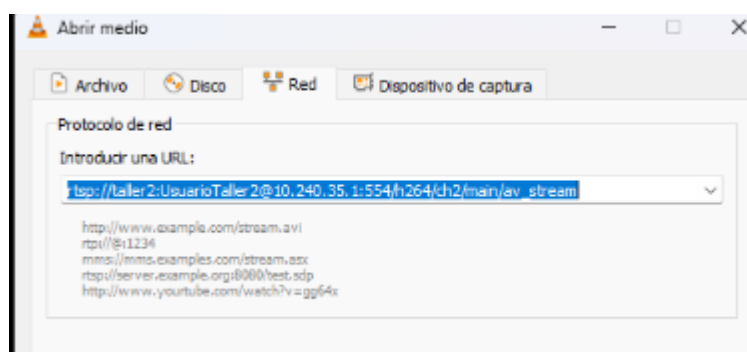
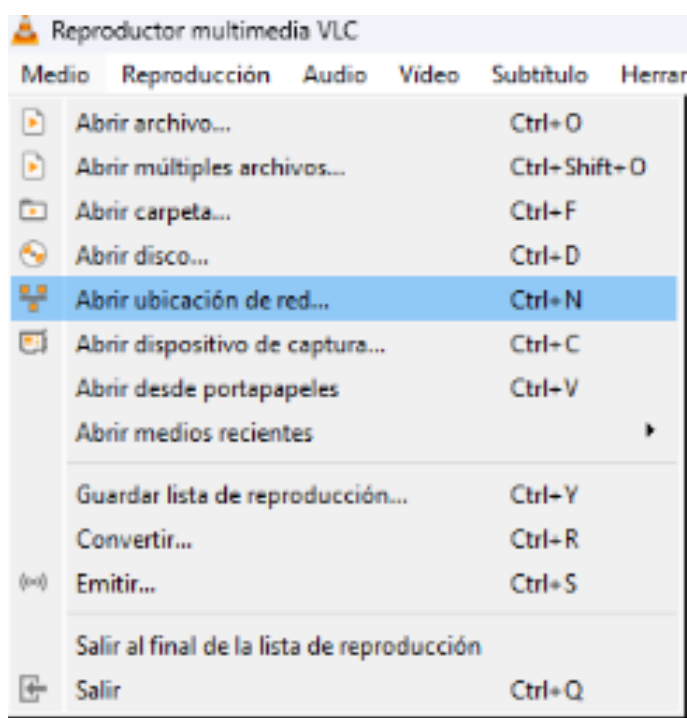
1. Launch the virtual pushbutton panel by double-clicking the icon on the desktop.

The browser should open, displaying the following image of the virtual pushbutton panel.

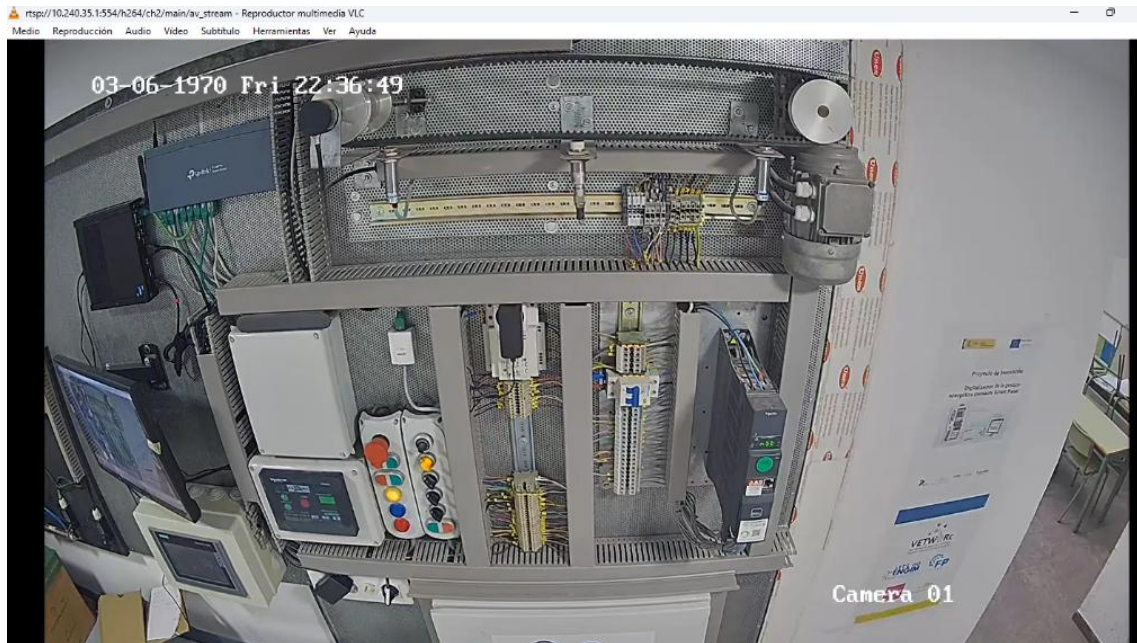




2. **Start the panel visualization using VLC software** In the middle menu, open the **stored network location**.



And we will then have access to the **panel monitoring**.

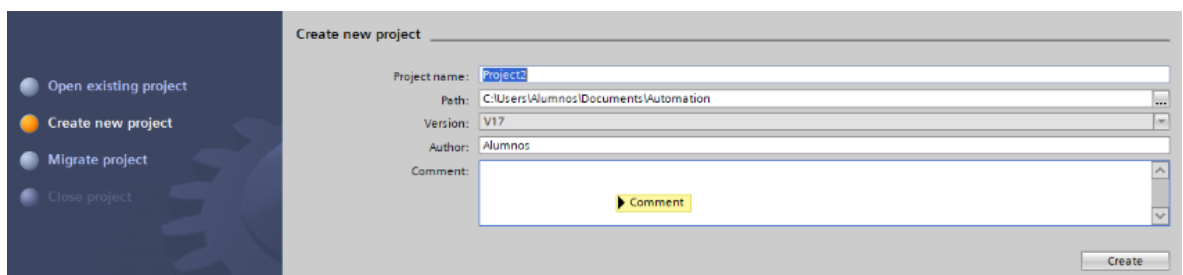


We continue with SIEMENS PLC Programming

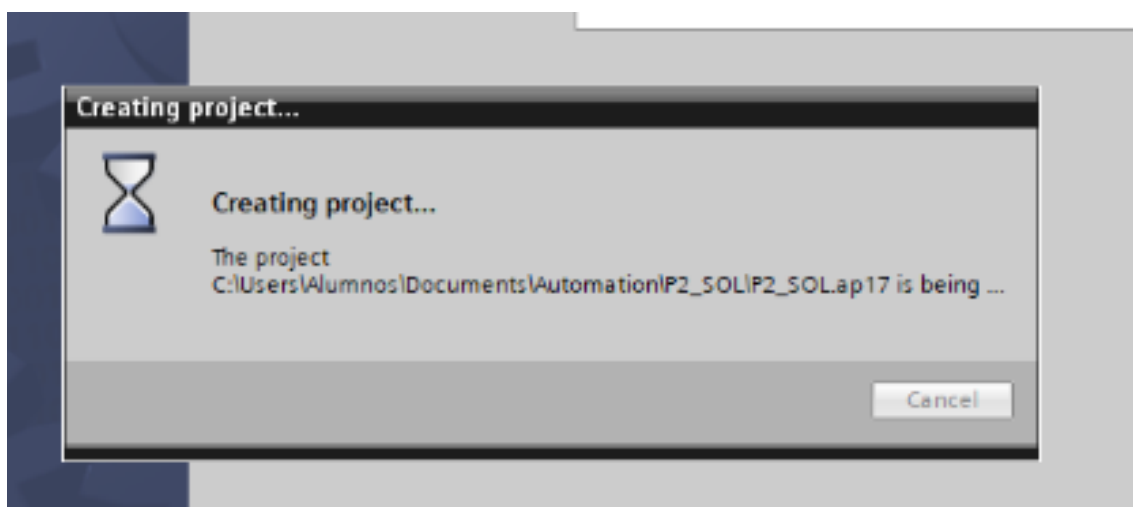
1. Launch TIAPORTAL



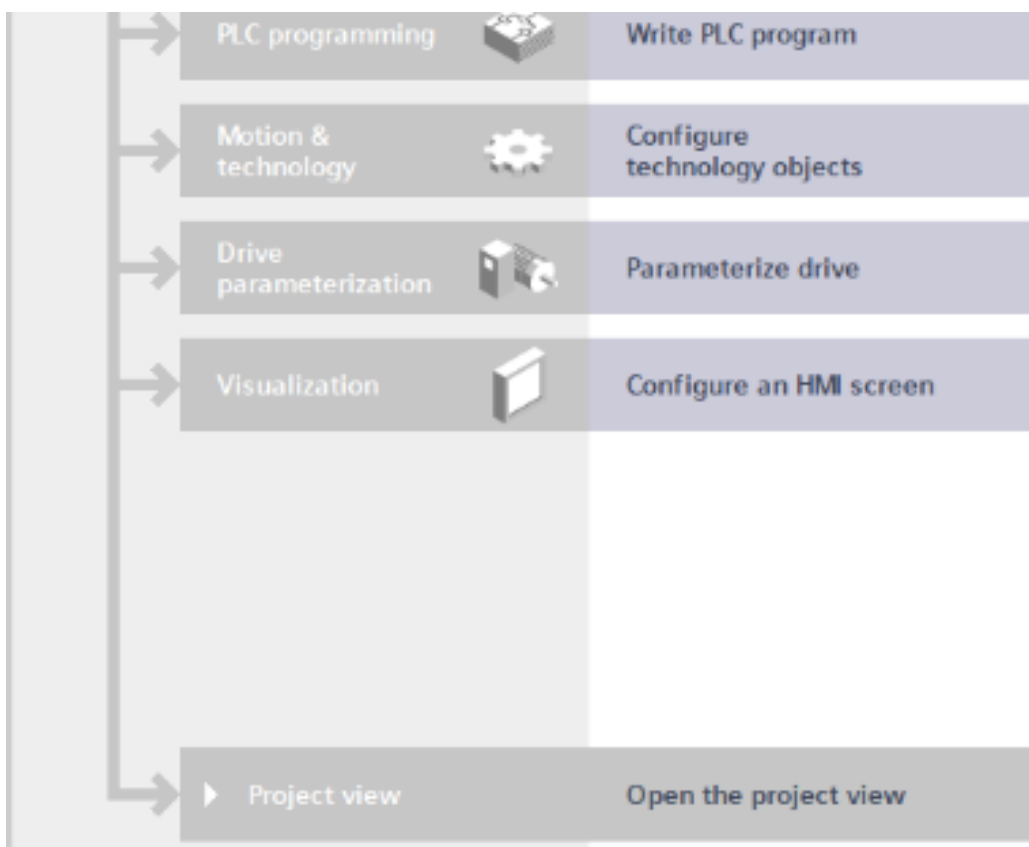
2. Create a new project and give it a name



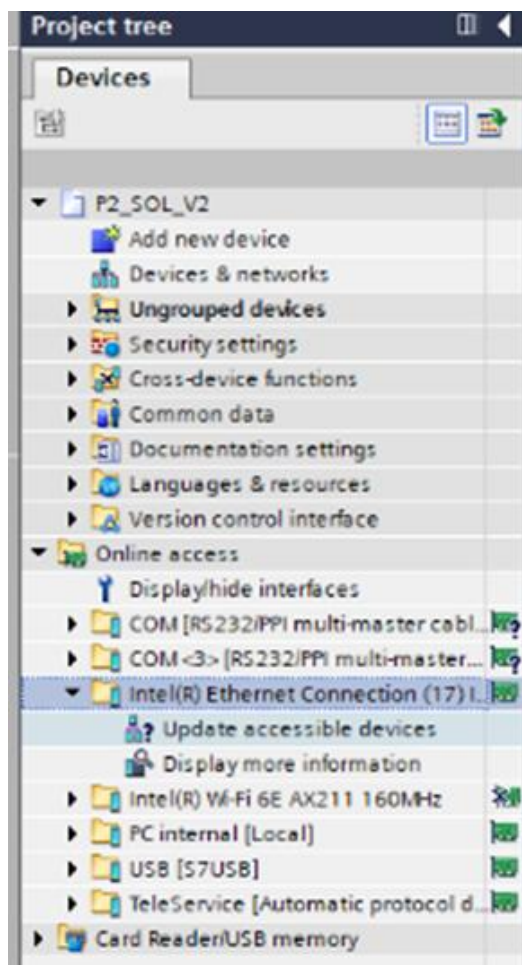
3. The project creation process is started:



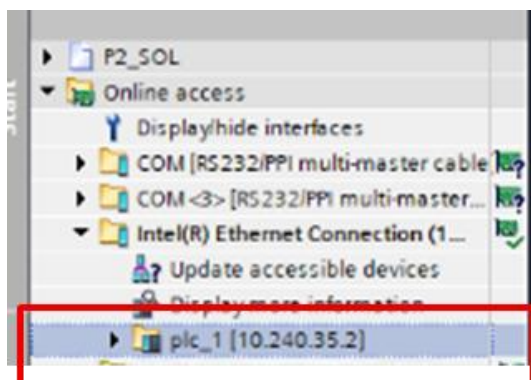
4. Access the Open Project Preview



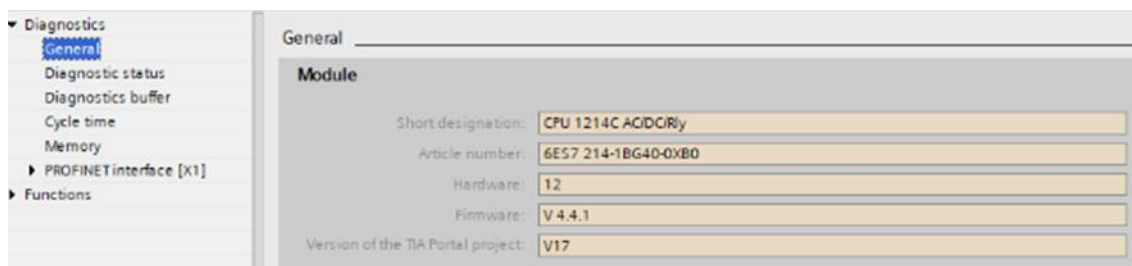
5. Search for accessible devices.



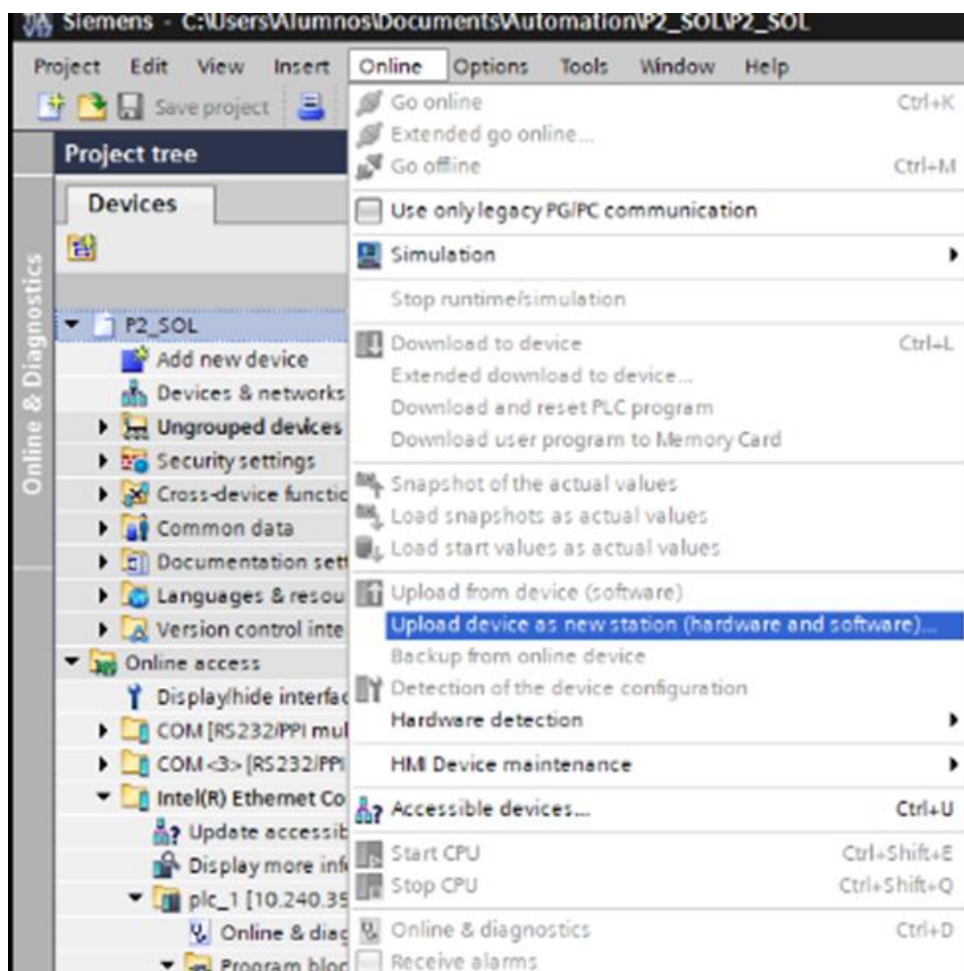
6. The following device should appear with its IP address, which must be verified for correctness by comparing it with the one shown in the image.



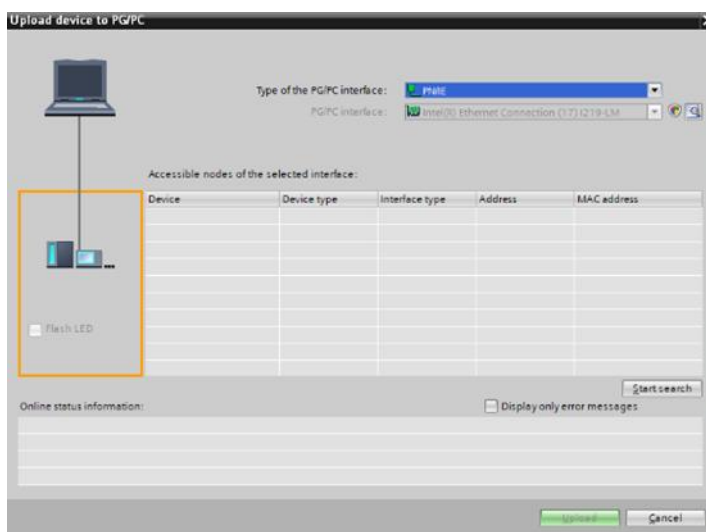
7. Expand the menu and click on Online & Diagnostics to verify that the PLC firmware version matches the one shown in the image.



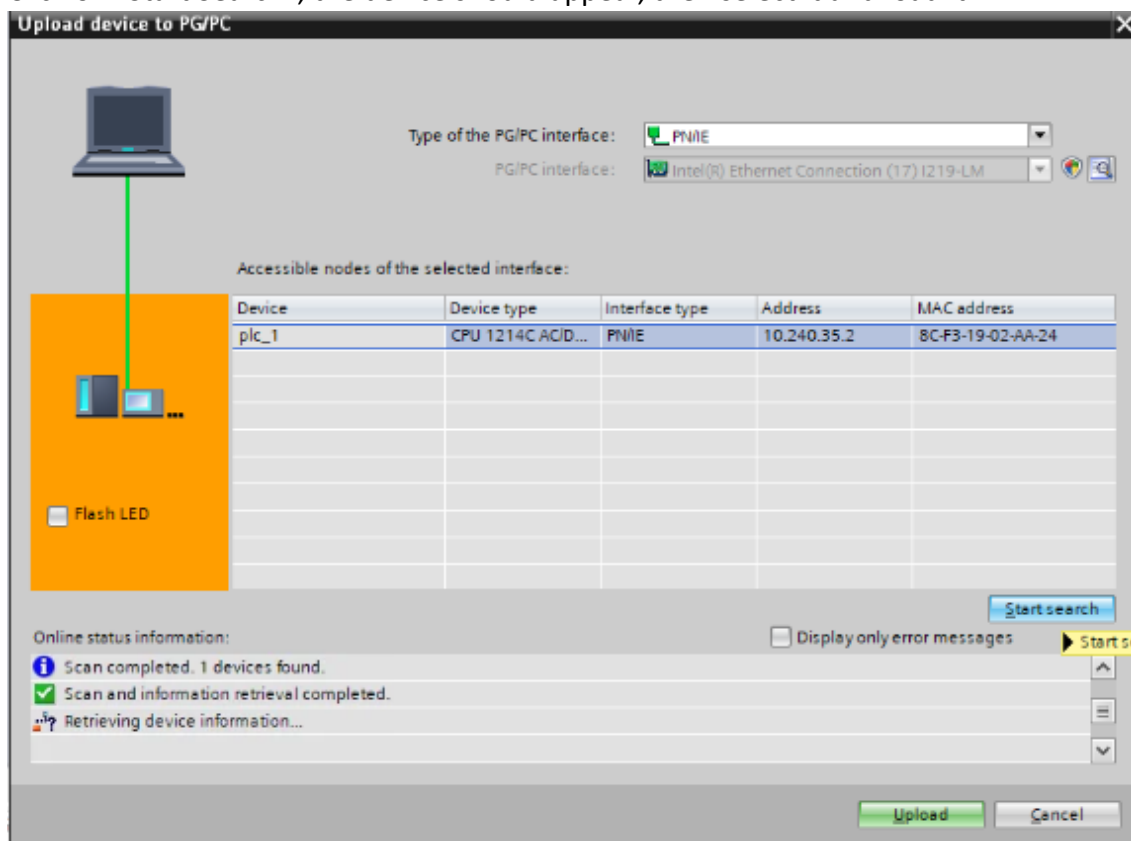
8. Load the PLC configuration as the new station.



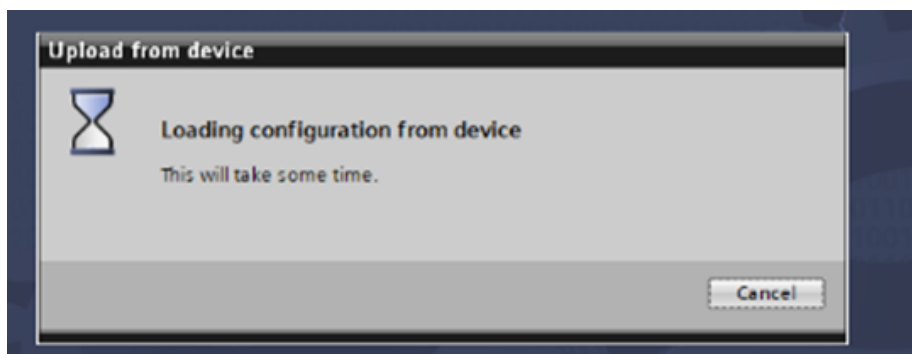
The following window will appear:



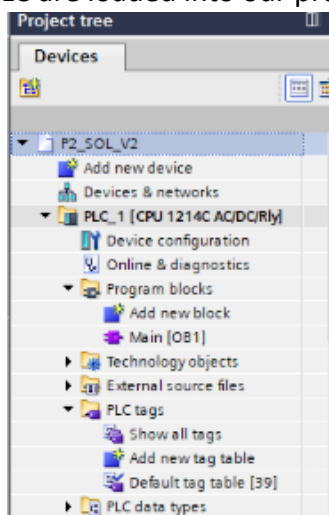
- Click on "Start Search"; the device should appear, then select it and load it.



The device characteristics will start loading:



Now the characteristics of our PLC are loaded into our project:

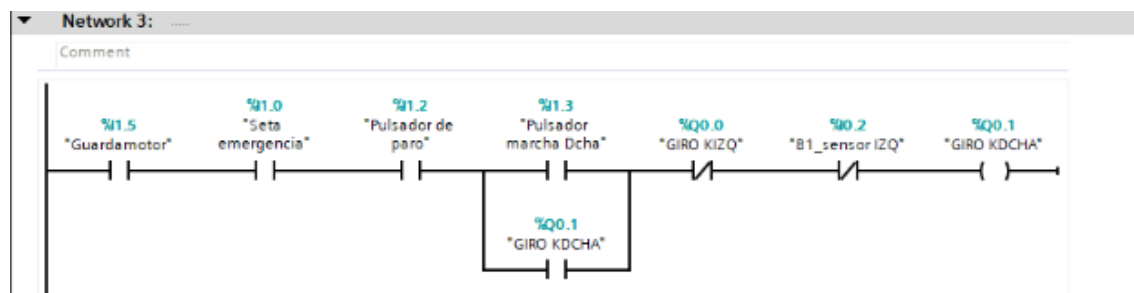
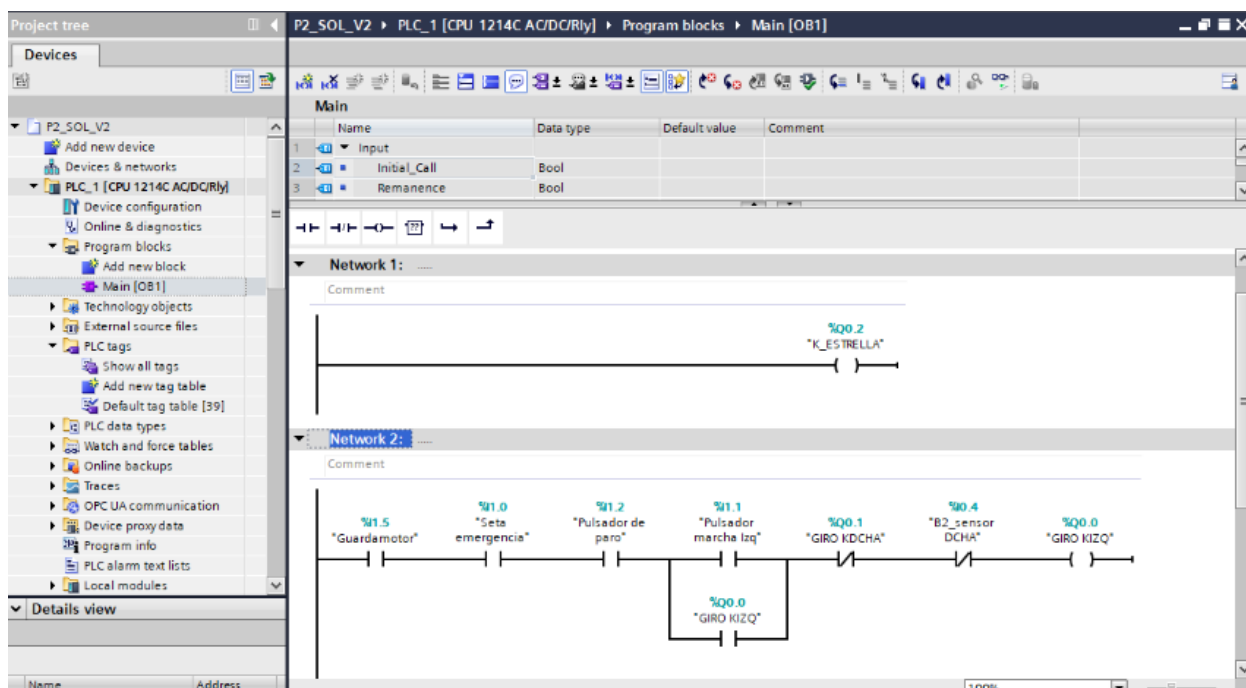


10. Verify that the following address table has been loaded

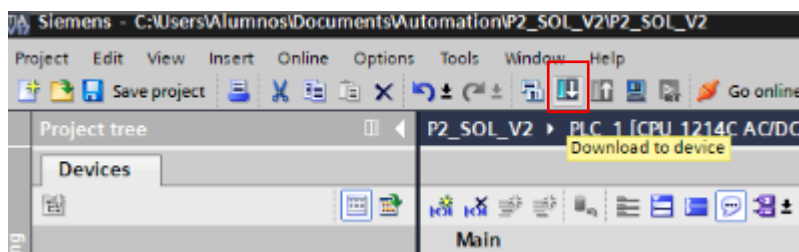
Default tag table										
	Name	Data type	Address	Retain	Acces...	Writa...	Visibl...	Commen		
1	Pulsador marcha DCHA	Bool	%I.1	☐	☒	☒	☒			
2	Pulsador marcha IZQ	Bool	%I.3	☐	☒	☒	☒			
3	Guardamotor	Bool	%I.5	☐	☒	☒	☒			
4	Seta emergencia	Bool	%I.0	☐	☒	☒	☒			
5	Pulsador de paro	Bool	%I.2	☐	☒	☒	☒			
6	B2_sensor DCHA	Bool	%I.4	☐	☒	☒	☒			
7	B1_sensor IZQ	Bool	%I.2	☐	☒	☒	☒			
8	GIRO KIZQ	Bool	%Q0.1	☐	☒	☒	☒			
9	GIRO KDCHA	Bool	%Q0.0	☐	☒	☒	☒			
10	K_ESTRELLA	Bool	%Q0.2	☐	☒	☒	☒			
11	<Add new>			☐	☒	☒	☒			

11. Using the tools, we proceed to create the reverse rotation investment program. **IMPORTANT!!!** In the first segment, activate output Q0.2 (K_STAR) to configure the motor connection in star.

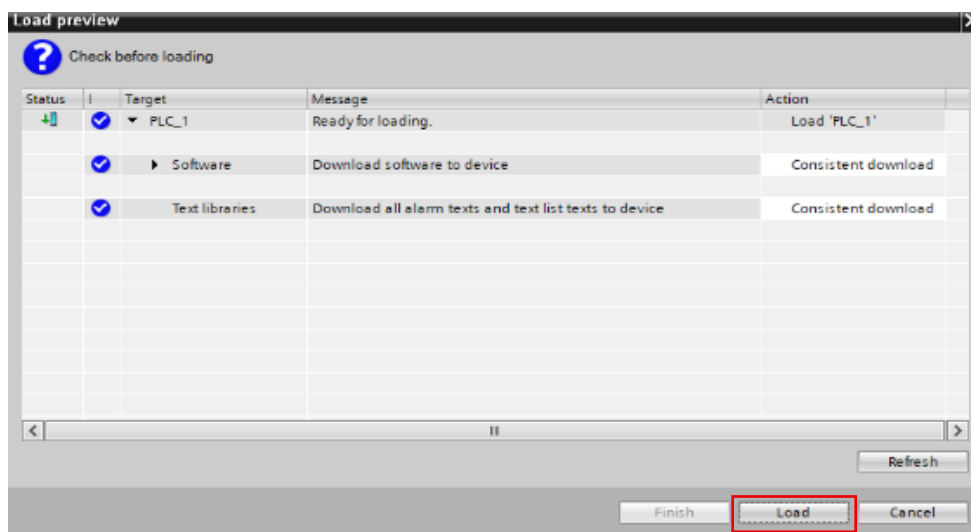
You can copy this code or create it according to your own criteria, as long as it meets the specifications of the instructions.



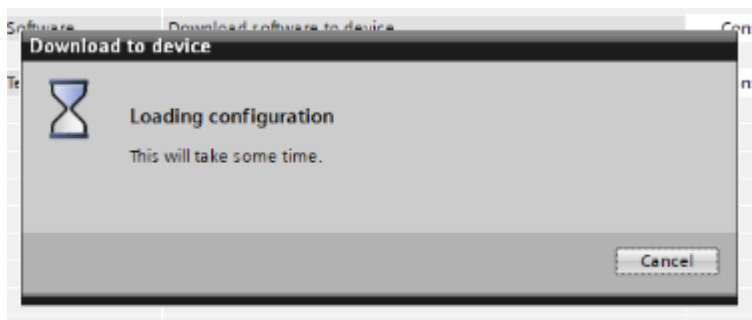
12. Once the program has been created, we proceed to load it into the PLC.



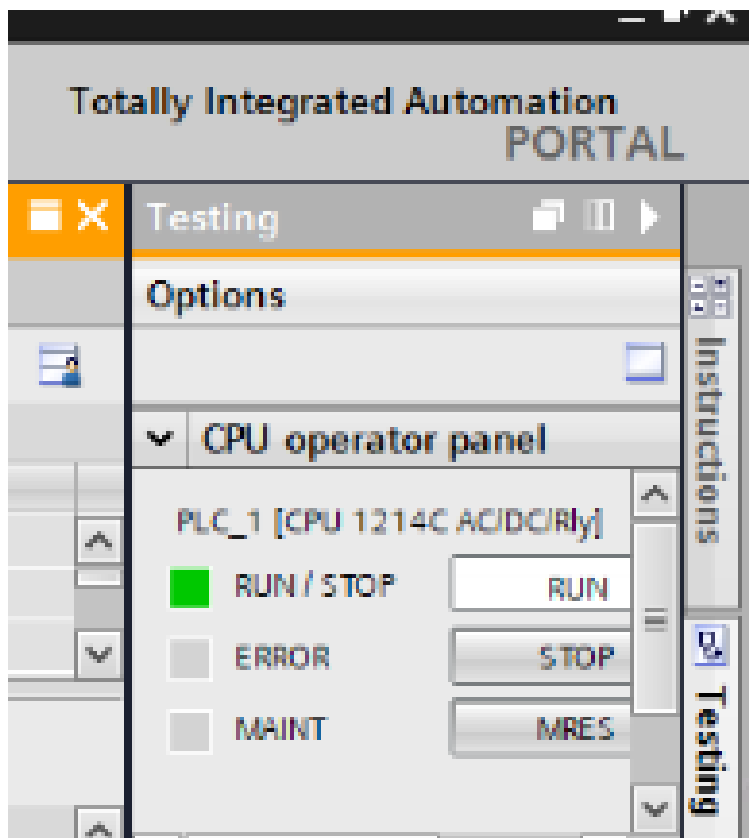
The compilation process will begin, checking for any errors in the program. If everything is correct, a confirmation window will appear, and we click “Load” to proceed.



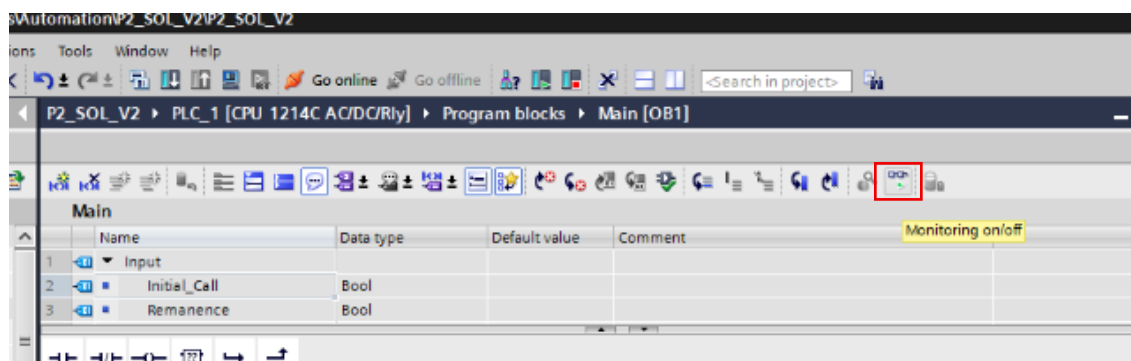
And then Loading will start



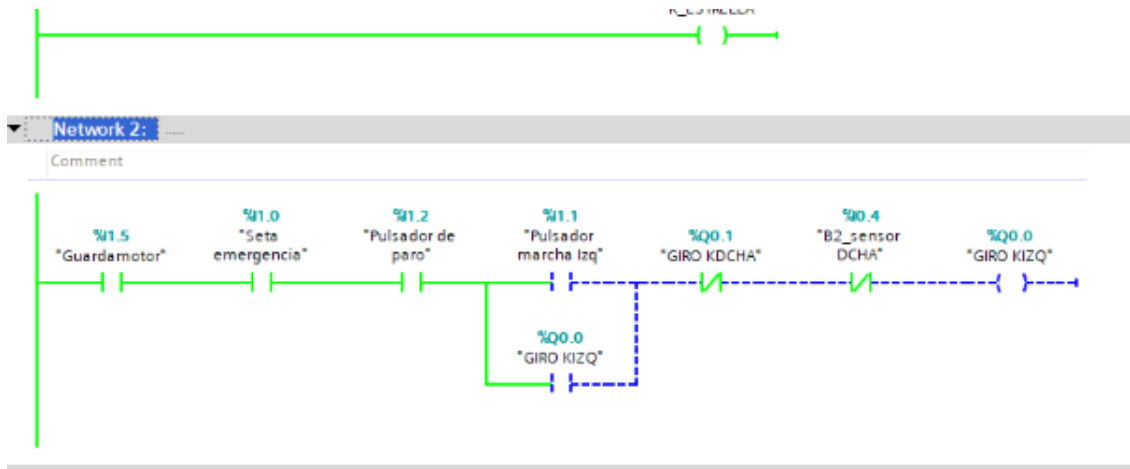
13. We check that the PLC is in RUN mode; if it isn't, we set it to RUN.



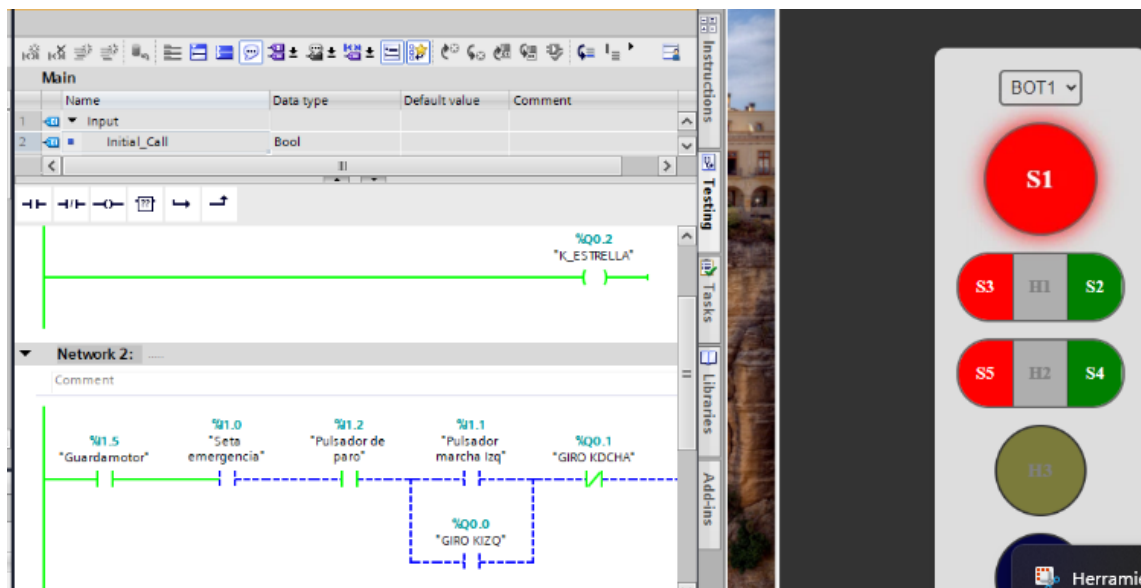
14. We switch to observation mode to analyze its operation.



And now we have an image of the status of the signals in our program.



15. If we press the emergency stop button on the virtual control panel, we will see that the associated contact is deactivated.
To deactivate the emergency stop, it must be pressed again.



16. Now, we only need to verify that our system rotates left or right depending on the direction selected with the start buttons, stopping at sensors B1 (LEFT) or B2 (RIGHT), in addition to checking the functionality of the stop button and the emergency stop.

6. ACTIVITIES

Activity 1: Configuration of the training panel and addressing table

1. Complete the addressing table required to achieve the proposed objective.

Element Identification	Memory Address (I, Q, M)	Description

Activity 2: KPO Programming

Create in TIA PORTAL or attach the KOP program you propose as a solution to the exercise.

Activity 3 Online Mode Verification

Attach an image showing the motor variable activated while rotating to the left.

Activity 4 : Program Download and Verification

1. Download the program to the PLC and observe its operation via the IP camera connection.
2. Record a video showing a complete cycle: right and left.

Activity 5: Power and Control Diagrams

Create the necessary power and control diagrams using the identifiers provided in the documentation.

7. Learning Outcomes.

- a. Establishes remote desktop communication via VPN.
- b. Interprets electrical diagrams with programmed control, determining the addressing of elements connected to the PLC.
- c. Uses PLC programming software to implement control programs for basic maneuvers on three-phase motors.
- d. Uses PLC programming software to establish communication between the computer and the PLC, and downloads the program to the PLC.
- e. Verifies the operation of the maneuvers programmed on the PLC.

8. Evaluation Criteria

- a. The properties of the VPN connection are recognized.
- b. The characteristics of the IP connection are understood, establishing communication between the software and the PLC.
- c. The PLC physical addresses have been identified to perform the appropriate maneuvers.
- d. The control program has been implemented on the PLC, meeting the given specifications.

9. Evaluation tools.

- a. Time connected to the remote workshop
- b. Verification of the programming diagram
- c. Video capture of the maneuver in operation