How to connect Factory I/O with TIA Portal

This guide shows you how to connect Factory I/O with TIA Portal using S7-PLCSIM. You download the Siemens template project from the Factory I/O tutorials, open and migrate it in TIA Portal, and review the communication code. You then build a simple sensor and conveyor program, load it into the PLC simulator, configure the Factory I/O driver, and test the logic.

Prerequisites

Before you start, make sure you have the following:

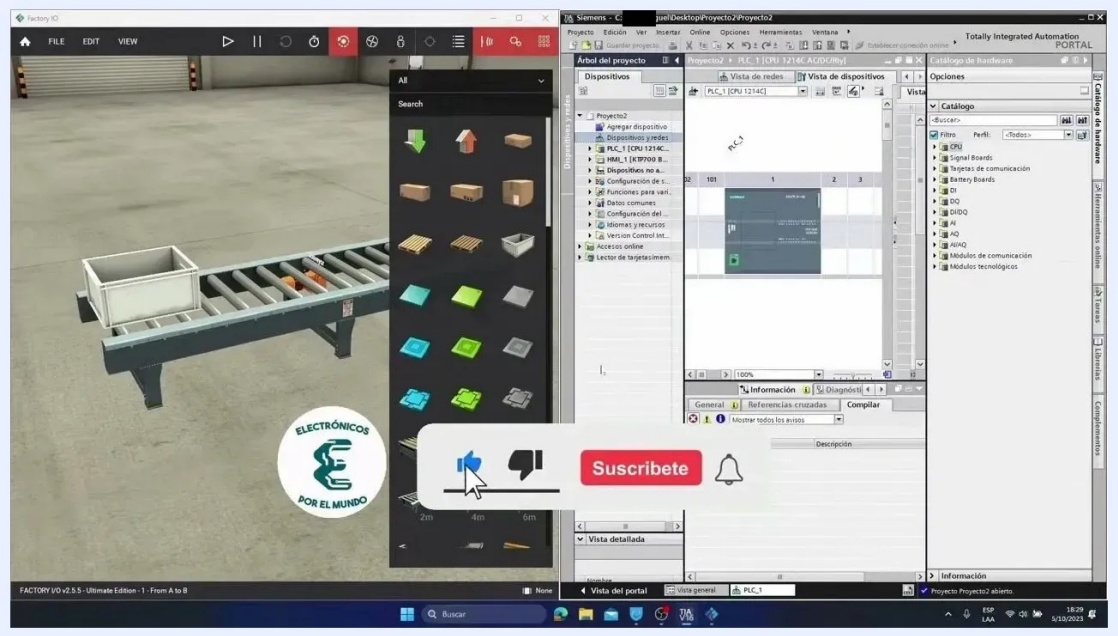
- Factory I/O installed on your computer.
- Siemens TIA Portal installed, with a project open. The examples in this guide use TIA Portal V16 and a PLC_1 (CPU 1214C) device.
- S7-PLCSIM, which you use to simulate the PLC.
- A web browser to open the Siemens Tutorials & Samples page.
- An extraction tool such as WinRAR to unpack the template archive (ZIP or RAR).

Open Factory I/O and TIA Portal

Step 1. Open both applications

Launch Factory I/O and open Siemens TIA Portal. Arrange both applications side by side so you can switch between them easily.

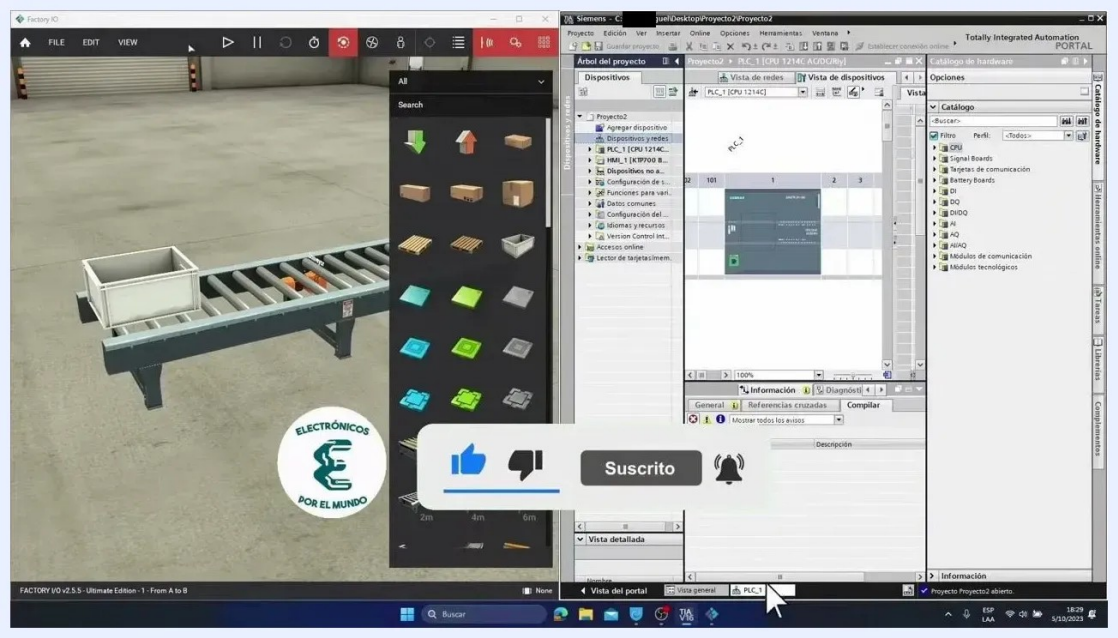
In Factory I/O, you see a 3D simulation environment with a conveyor and an object selection panel. In TIA Portal, make sure your project is open and the hardware configuration is visible.



Factory I/O and TIA Portal open side by side, with the Factory I/O conveyor simulation and object panel next to the TIA Portal project tree and hardware configuration for PLC_1 (CPU 1214C)

Step 2. Maximize Factory I/O

Click the maximize button on the Factory I/O window to enlarge it for better visibility.



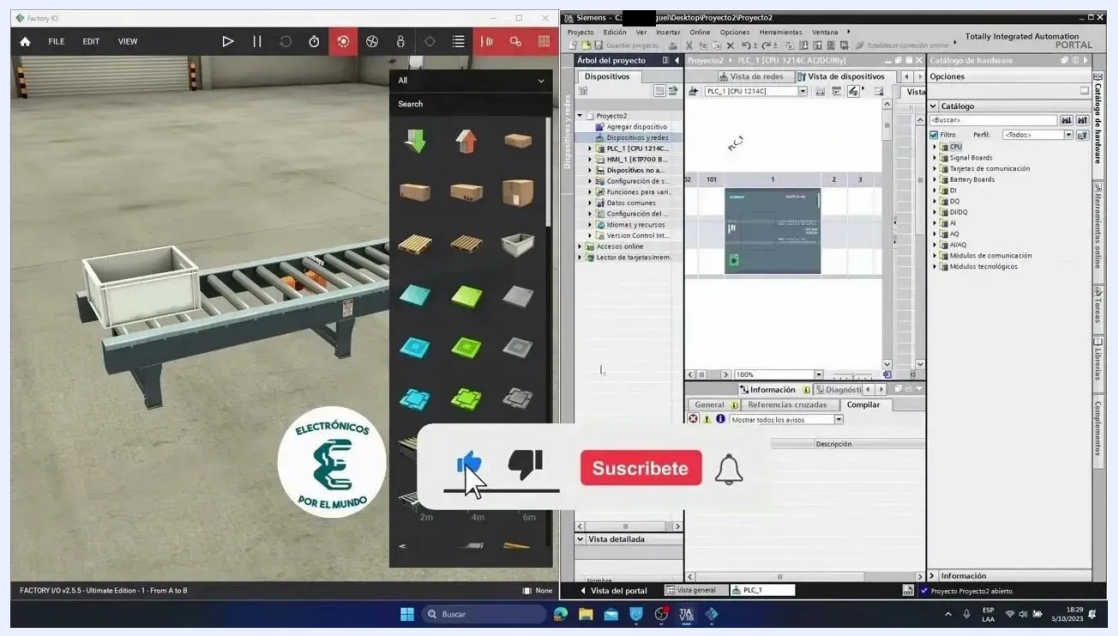
Factory I/O window being maximized, showing the simulation and object selection panel, with TIA Portal still open on the right

Find the Siemens setup instructions

Step 3. Go to the Factory I/O home page

In Factory I/O, go to the home page. On the left sidebar, select **Documentation and Tutorials**.

The main area shows these sections: Getting Started, Manual, Parts, Scenes, What's New, and Tutorials for Allen-Bradley, Schneider, Siemens, and CODESYS.

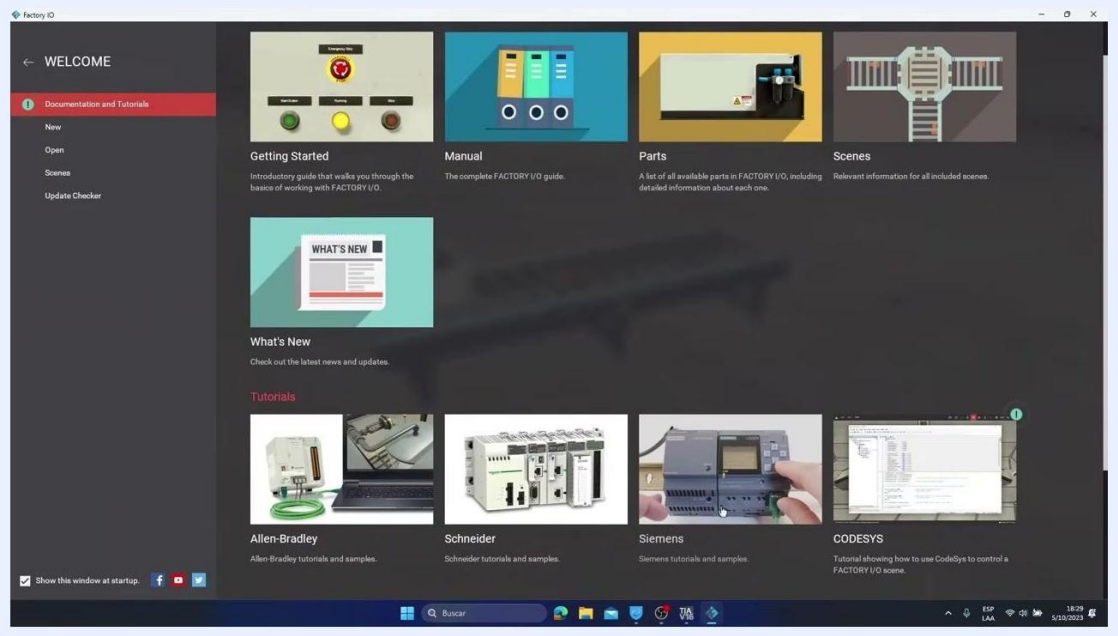


Factory I/O home page with Documentation and Tutorials selected and the Getting Started, Manual, Parts, Scenes, What's New, and Tutorials sections in the main area

Step 4. Open the Siemens tutorial

Scroll down to the **Tutorials** section. Click the **Siemens** tutorial card, which shows a Siemens PLC and a hand connecting a cable.

The Siemens Tutorials & Samples page opens in your web browser.



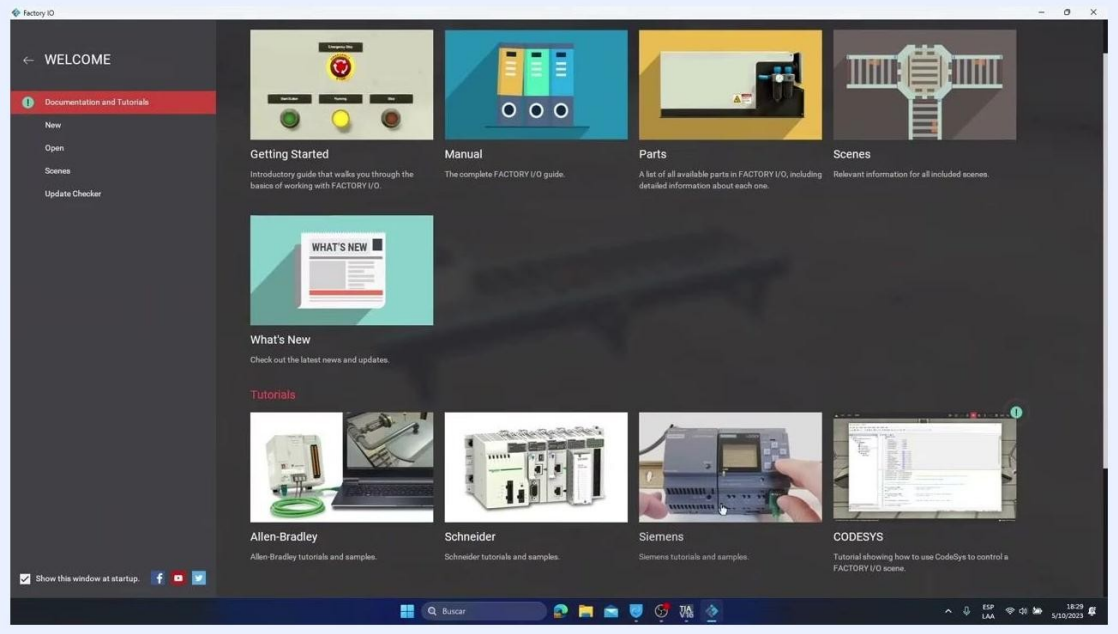
Factory I/O home page with the Siemens tutorial card highlighted in the Tutorials section

Step 5. Review the Siemens Tutorials & Samples page

In your browser, the Siemens Tutorials & Samples page shows three main options:

- **S7-1200/1500**
- **S7-PLCSIM**
- **S7-200**

Each option provides links for setting up and for sample projects.

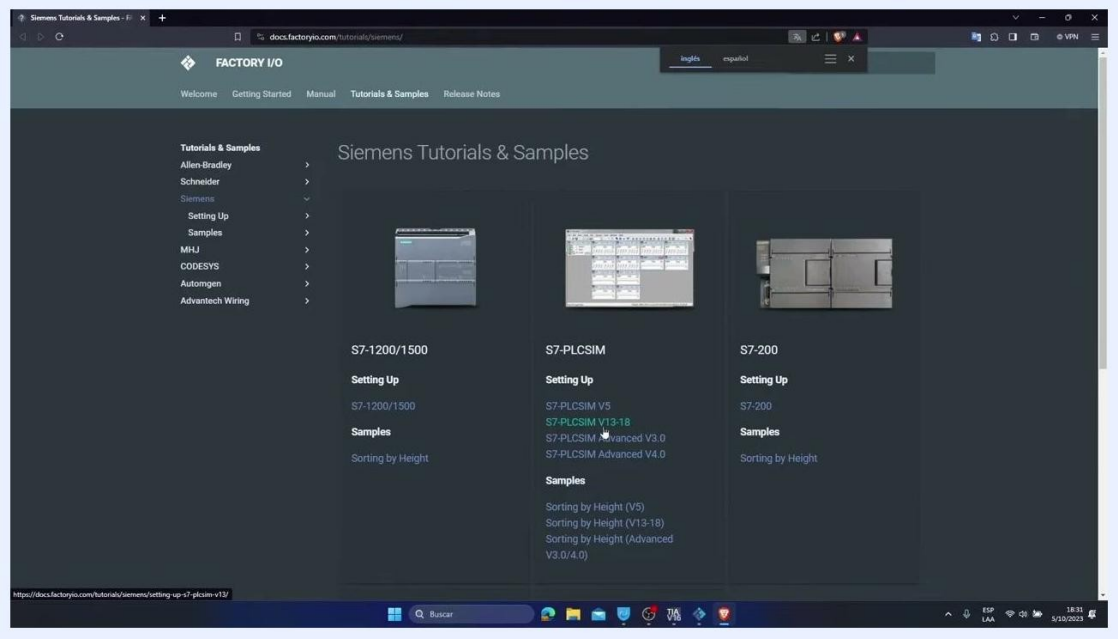


Siemens Tutorials & Samples page in the browser, showing the S7-1200/1500, S7-PLCSIM, and S7-200 options with setup and sample links

Step 6. Select S7-PLCSIM for your TIA Portal version

Under the **S7-PLCSIM** section, locate the "Setting Up" links. Identify the link for your TIA Portal version. For TIA Portal version 16, select **S7-PLCSIM V13-18**.

Click **S7-PLCSIM V13-18** to access the setup instructions and download the required program and code. Follow the instructions on that page for setup and code integration steps specific to your TIA Portal version.

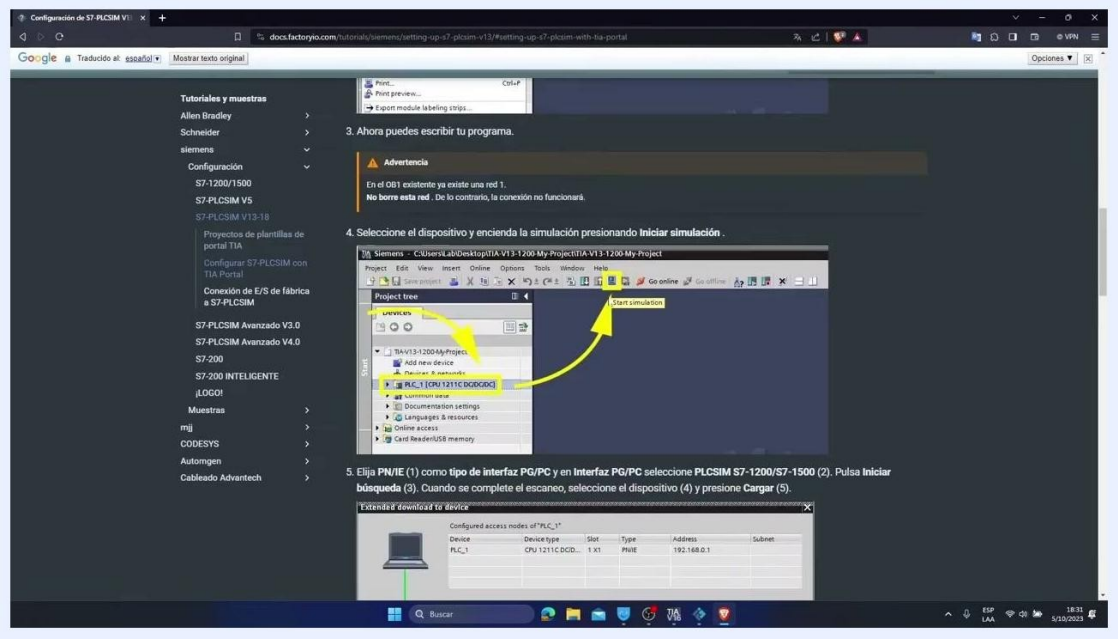


S7-PLCSIM section with the S7-PLCSIM V13-18 link highlighted for TIA Portal version 16

Step 7. Review and translate the online instructions (optional)

Open the Siemens S7-PLCSIM V13-18 setup page in your browser. If the instructions are not in your preferred language, use your browser's translation feature, such as Google Translate, to translate the page.

Review the step-by-step instructions for communicating Factory I/O with TIA Portal. The requirements and sample project sections are visible on this page.



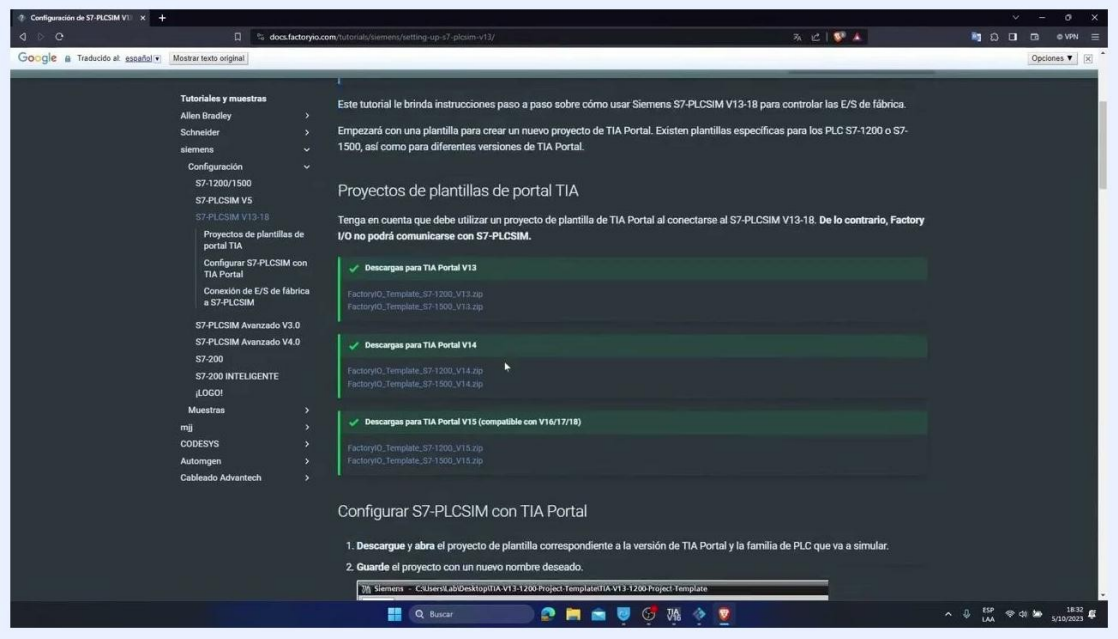
Browser showing the Factory I/O documentation page for setting up S7-PLCSIM V13-18, with the Google Translate bar at the top and the requirements and sample project sections visible

Download and extract the TIA Portal template

Step 8. Download the template file

Scroll to the section labeled "Proyectos de plantillas de portal TIA" (TIA Portal Template Projects). Find the download links for your TIA Portal version.

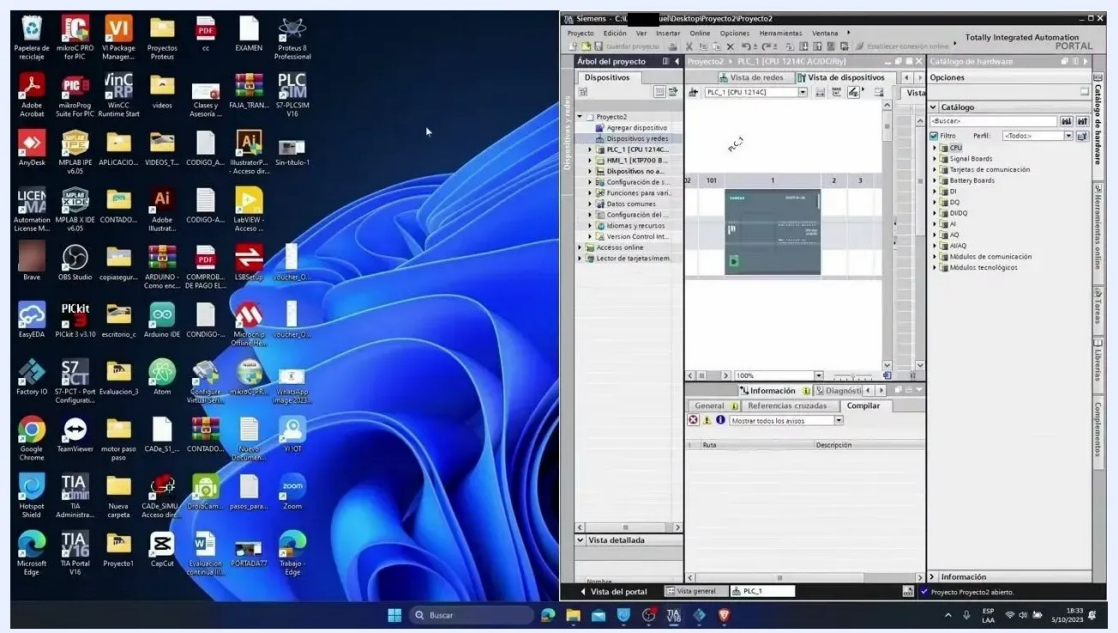
For TIA Portal V16, use the templates listed under "Descargas para TIA Portal V15 (compatible con V16/17/18)". Download the appropriate template file, for example FactoryIO_Template_S7-1200_V15.zip.



Section of the Factory I/O documentation page showing the download links for TIA Portal templates compatible with V13, V14, and V15 (V16/17/18)

Step 9. Choose the closest template version if needed

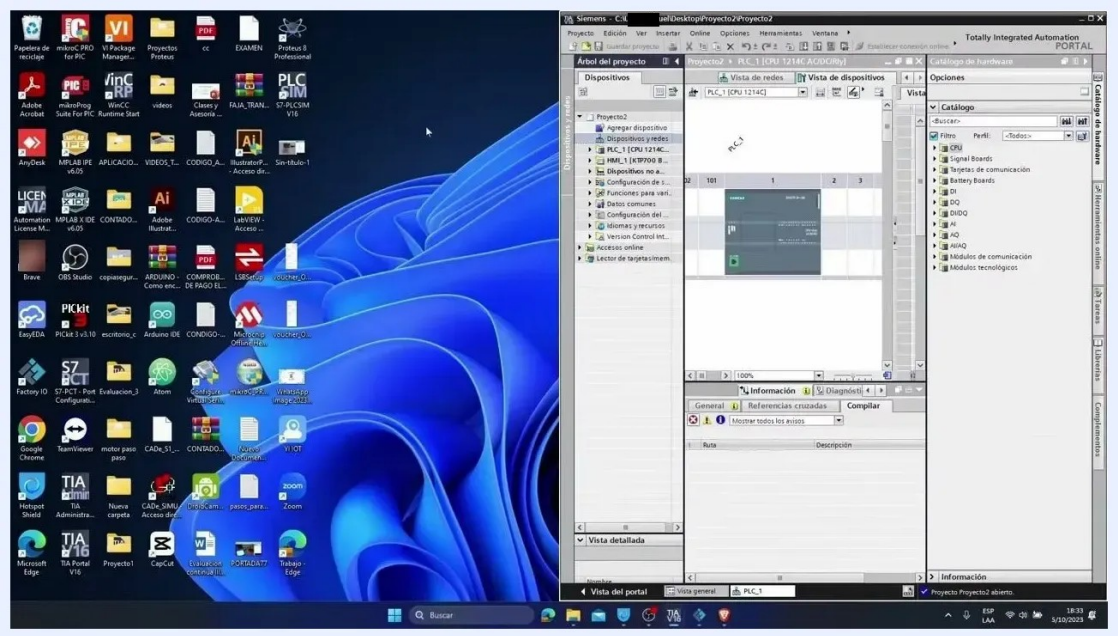
If your exact TIA Portal version is not listed, select the closest available version, for example V15 for V16. After the download, you migrate the project to your installed TIA Portal version (see Step 15).



Download link for FactoryIO_Template_S7-1200_V15.zip highlighted as the selection for TIA Portal V16 compatibility

Step 10. Locate the downloaded file

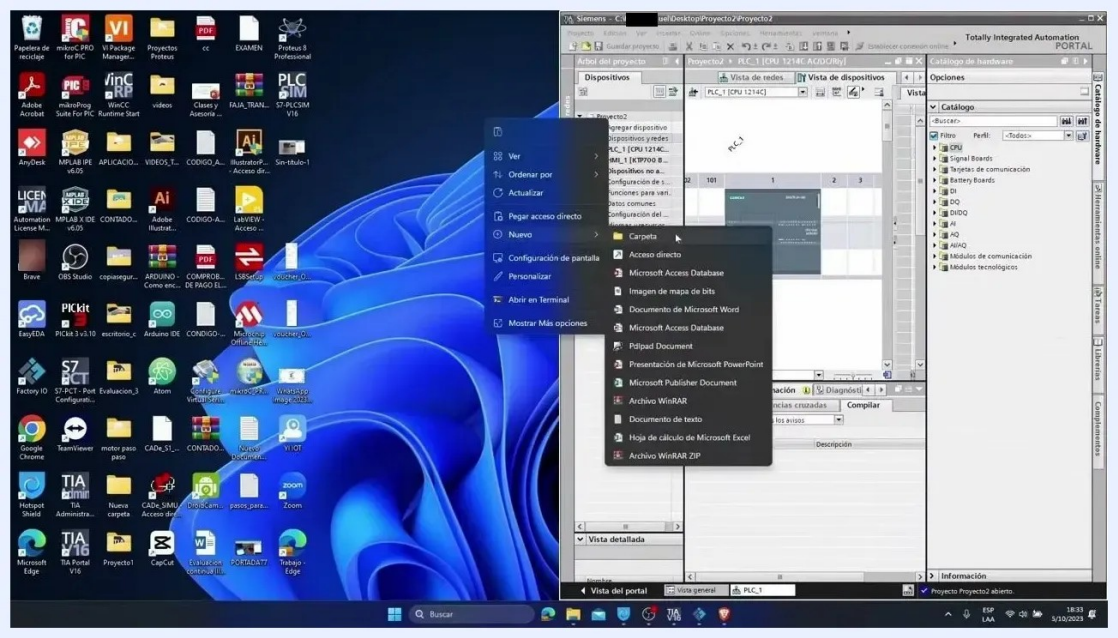
Open your Downloads folder and find the downloaded template file, for example FactoryIO_Template_S7-1200_V15 (1).zip. The file is a compressed archive (ZIP or RAR).



Windows Downloads folder showing the downloaded FactoryIO_Template_S7-1200_V15 (1).zip file

Step 11. Create a folder for the project

On your desktop or in another location you prefer, right-click and select **New** > **Folder**. Name the folder factory, or choose another descriptive name.



Windows desktop with the right-click context menu open and the option to create a new folder, with TIA Portal open on the right

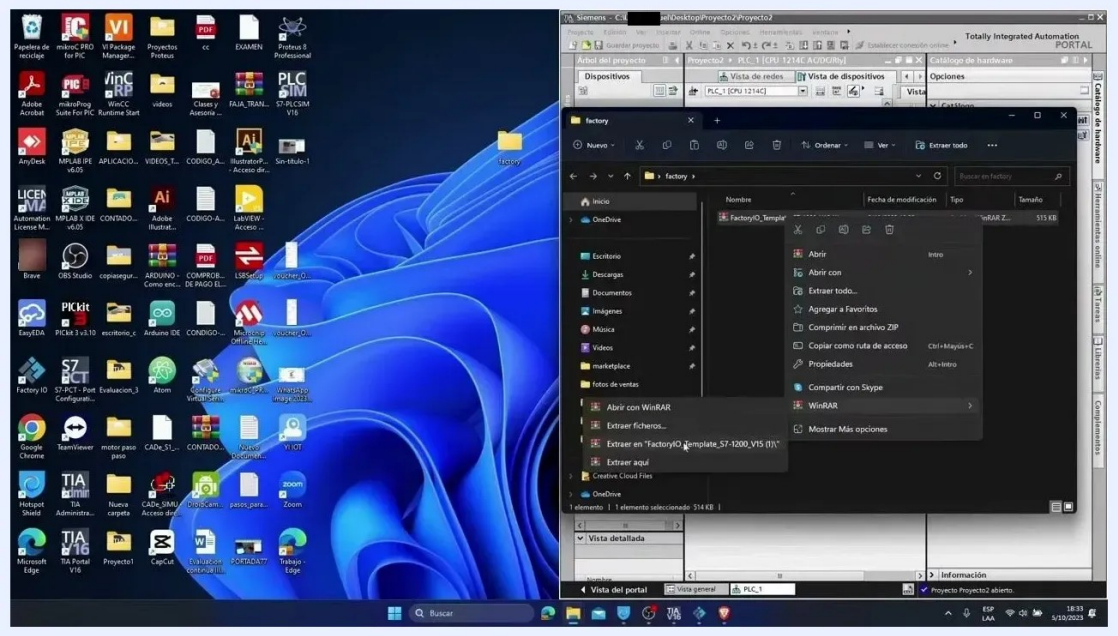
Step 12. Move the template file into the folder

Copy or move the downloaded template file into the new factory folder.

Step 13. Extract the template file

Open the factory folder and right-click the template file, for example FactoryIO_Template_S7-1200_V15.zip. Select **Extract here** from the context menu, using WinRAR or your preferred extraction tool.

Wait for the extraction to complete. The extracted folder contains the TIA Portal project files.



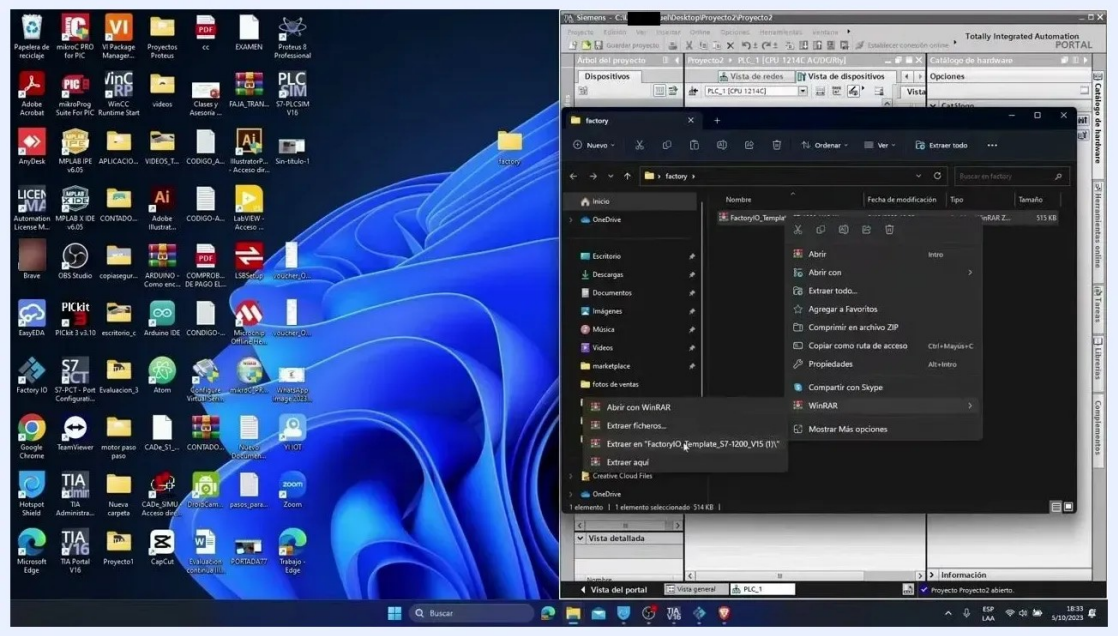
Windows desktop with the factory folder open and the right-click context menu on the template file, with Extract here highlighted and TIA Portal open in the background

Open and migrate the project in TIA Portal

Step 14. Open the existing project in TIA Portal

If TIA Portal is not already open, launch it. Switch to the **Portal view** if you are not already there. This is the main starting interface for project management.

In the TIA Portal start menu, select **Open existing project** from the left sidebar. Then click the **Examine** button to browse for your project file.

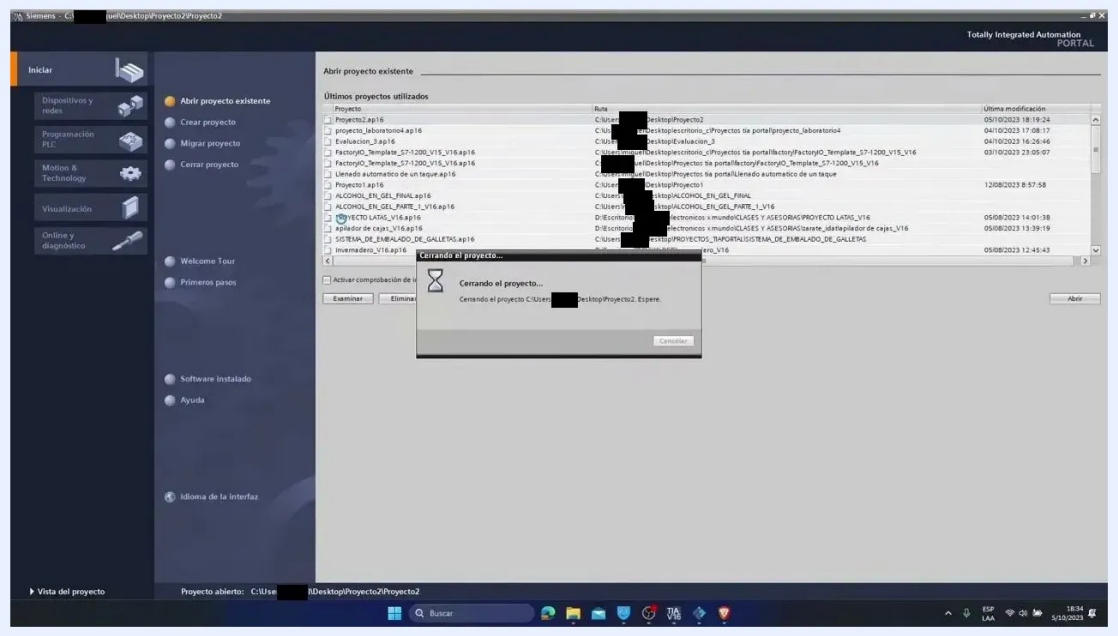


TIA Portal start menu with Open existing project selected, showing a list of recent projects and the Examine button

Step 15. Select the extracted template project

In the file browser, go to the factory folder you created. Select the extracted project file, for example FactoryIO_Template_S7-1200_V15.ap15, and click **Open**.

If another project is open, TIA Portal prompts you to close it before opening the new one. Confirm to close the current project.

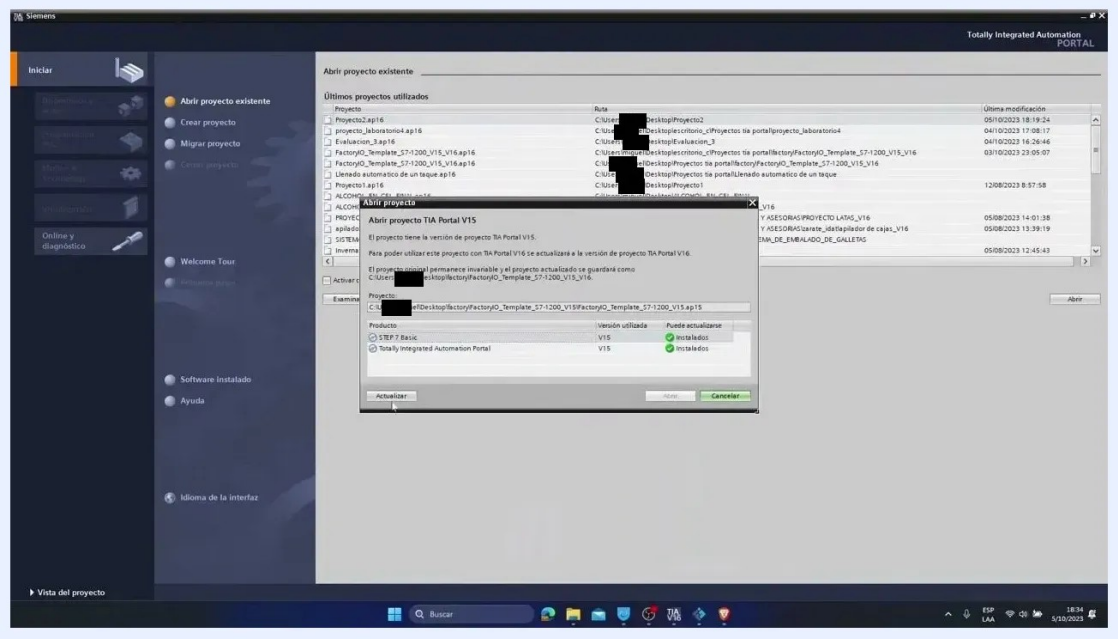


TIA Portal Open existing project dialog showing the project list and a prompt to close the current project

Step 16. Migrate the project to your TIA Portal version

If the template project is older than your installed TIA Portal version, a migration dialog appears. For example, this happens when the template is V15 and your TIA Portal is V16.

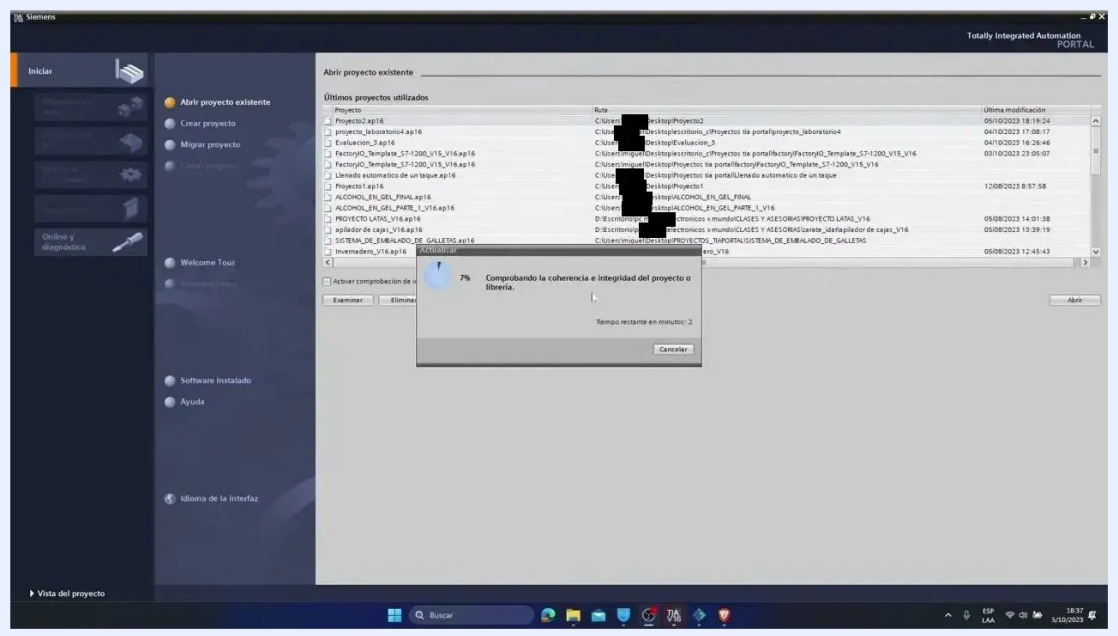
Click the **Update** button (shown as "Actualizar" in a Spanish interface) to migrate the project to your current version. The dialog shows the original project path and the new version it will be saved as.



TIA Portal migration dialog showing the project version details with the Actualizar (Update) button highlighted

Step 17. Wait for the integrity check

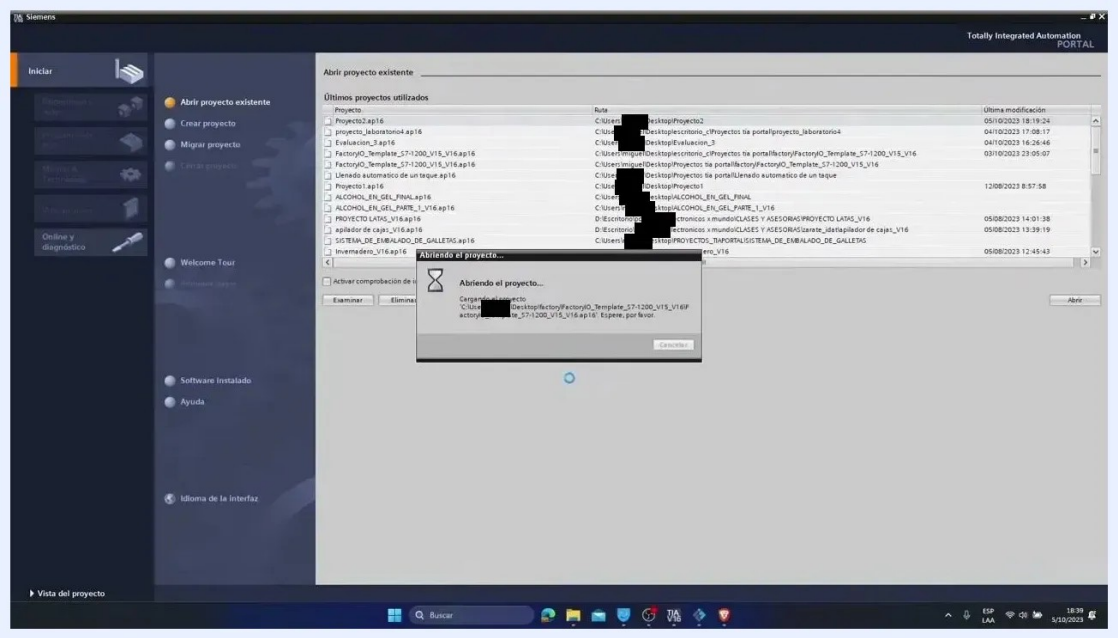
During migration, TIA Portal performs a project integrity and consistency check. Wait for the progress bar to reach 100%. This can take several minutes, depending on your system and project size.



TIA Portal progress dialog at 7%, showing the message "Comprobando la coherencia e integridad del proyecto o librería" (Checking project or library consistency and integrity)

Step 18. Wait for the project to finish loading

When the integrity check is complete, TIA Portal finishes opening the migrated project. A loading dialog stays on screen until the project is fully open.



TIA Portal dialog "Abriendo el proyecto..." (Opening the project...), showing the project path and a loading indicator

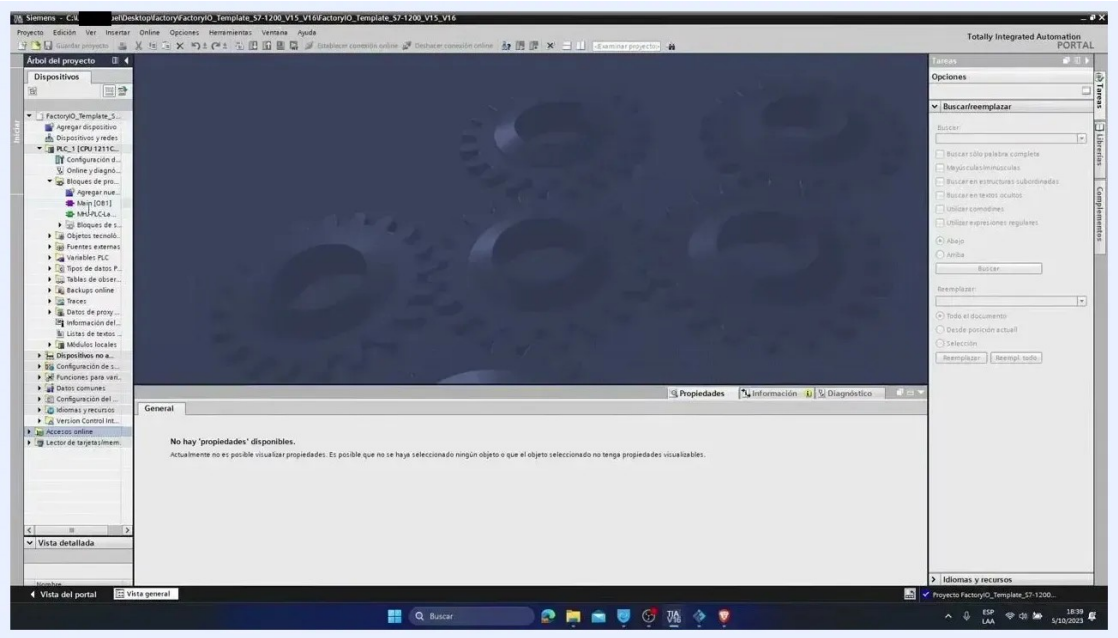
Review the program blocks

Step 19. Find the main program block

In TIA Portal, make sure you are in the project view with the project tree visible on the left. Locate the expanded PLC device, for example PLC_1 [CPU 1214C].

Under "Program blocks," identify the main logic block, for example Main [OB1] or a custom-named block such as MnPLC_.... This block contains the code responsible for Factory I/O communication.

Until you open a block for editing, the workspace shows a background with gear icons. The "General" properties panel at the bottom states "No hay 'propiedades' disponibles" (No properties available) because no block is selected. The right sidebar contains the "Buscar/reemplazar" (Search/Replace) panel for searching within the project.

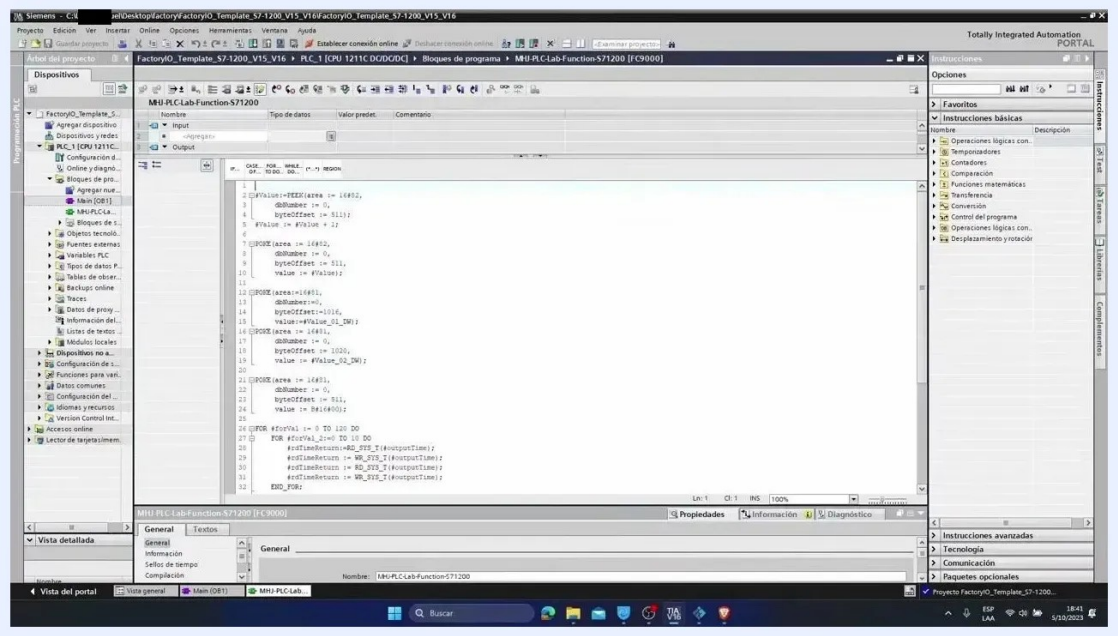


TIA Portal project view with the project tree expanded to show PLC_1 and Program blocks, the workspace with no block selected, and the properties panel stating that no properties are available

Step 20. Review the SCL communication code

Open the communication function block to review its code. The function block is named MHJ-PLC-Lab-Function-S71200 (FC9000), and its language is set to SCL.

The code is already written and does not require modification. Leave it as is.



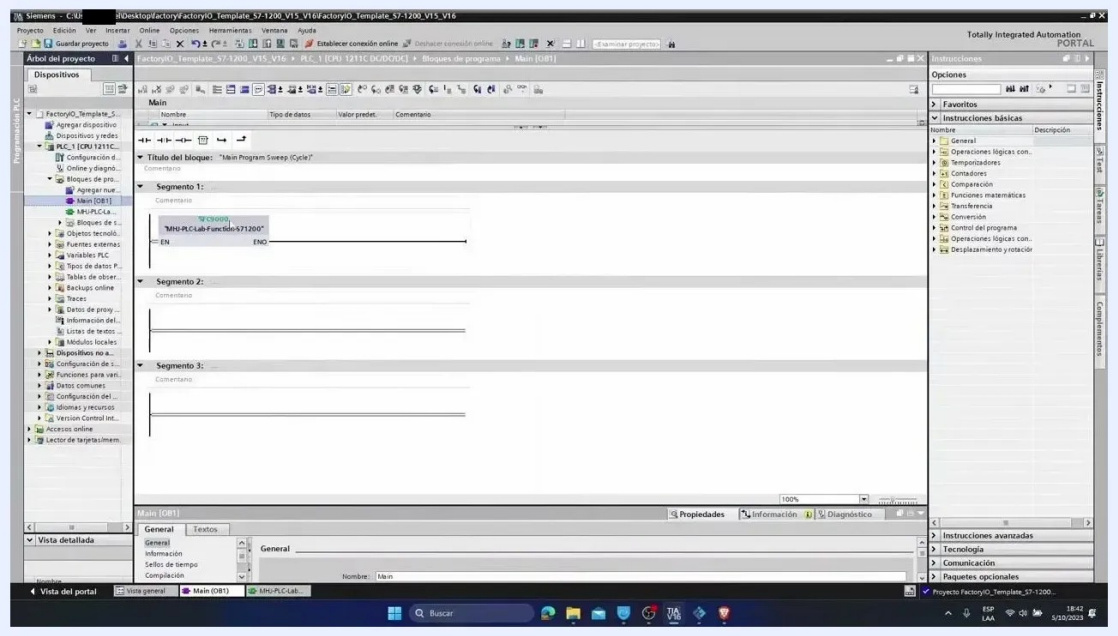
TIA Portal showing the SCL code for the communication function block, which requires no modifications

Step 21. Change the language of the main block

The main block (Main [OB1]) may be set to FUP (Function Block Diagram). To change it, right-click the block and select **Properties**.

In the properties dialog, open the "Language" dropdown and select **KOP** (Ladder Diagram). Click **Aceptar** (Accept) to apply the new setting.

The main program block is now set to Ladder Diagram (KOP), and the workspace updates to show the ladder logic editor.

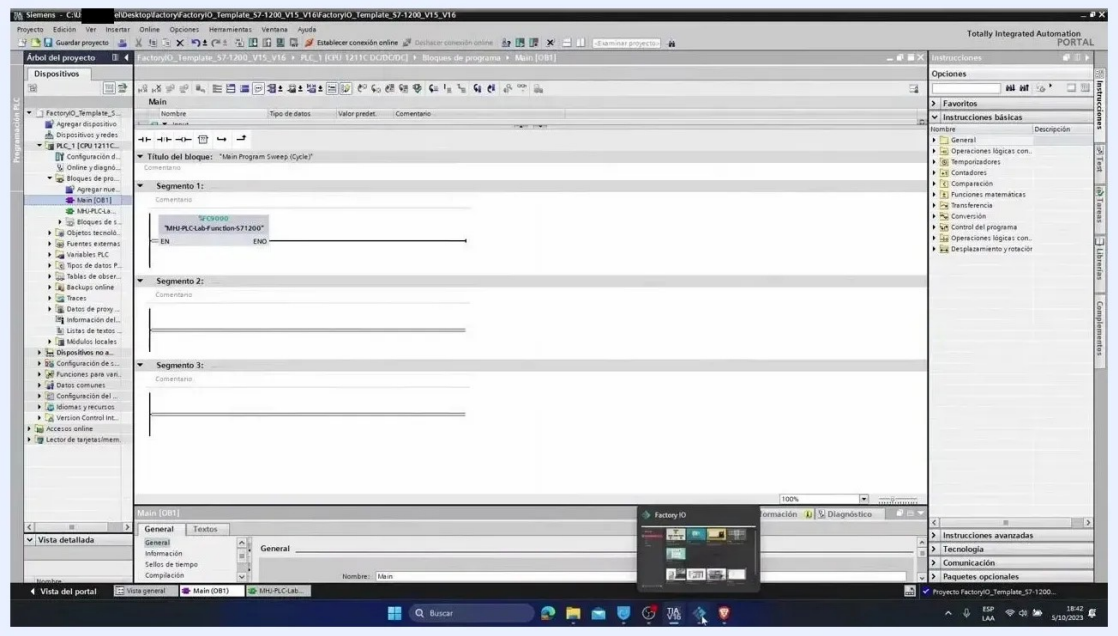


Main program block in TIA Portal displayed in the ladder logic editor, showing the FC9000 function call

Step 22. Check the function block call

Make sure the function block MHJ-PLC-Lab-Function-S71200 is called in the first segment of the main program cycle. The ladder diagram shows the function block call in Segment 1.

Segments 2 and 3 are empty and available for additional logic.

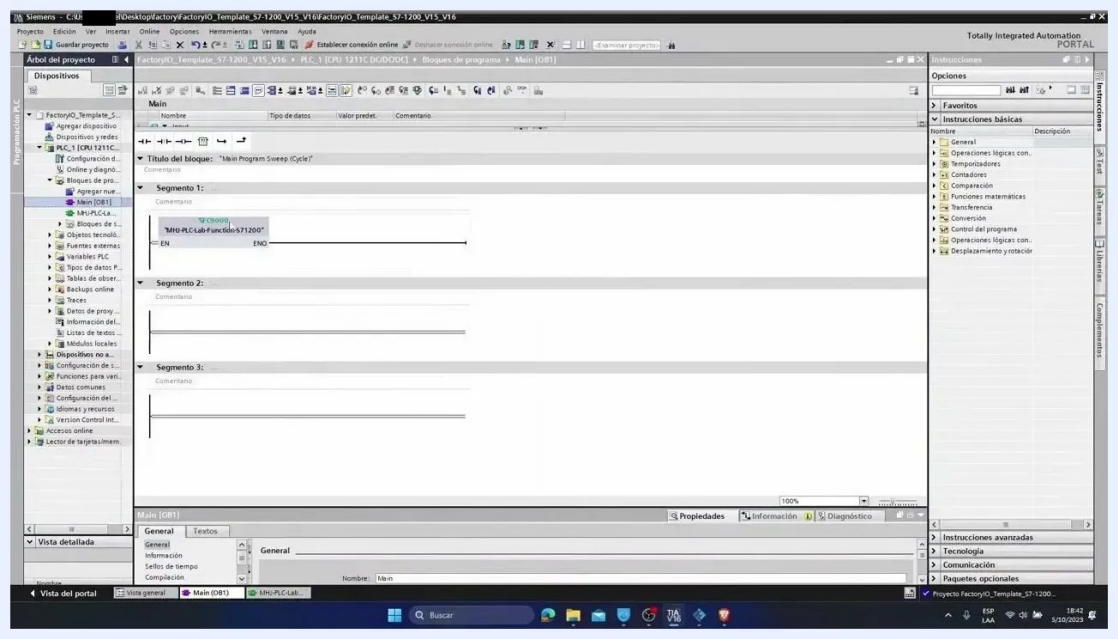


Ladder diagram in TIA Portal with the function block call in Segment 1 and Segments 2 and 3 empty

Prepare a simulation scene in Factory I/O

Step 23. Open a simulation scene

Switch to the Factory I/O application. In the **Open Scene** window, select a pre-built scene for testing communication. Example scenes include "1 - From A to B," "Buffer Station," and "Production Line."

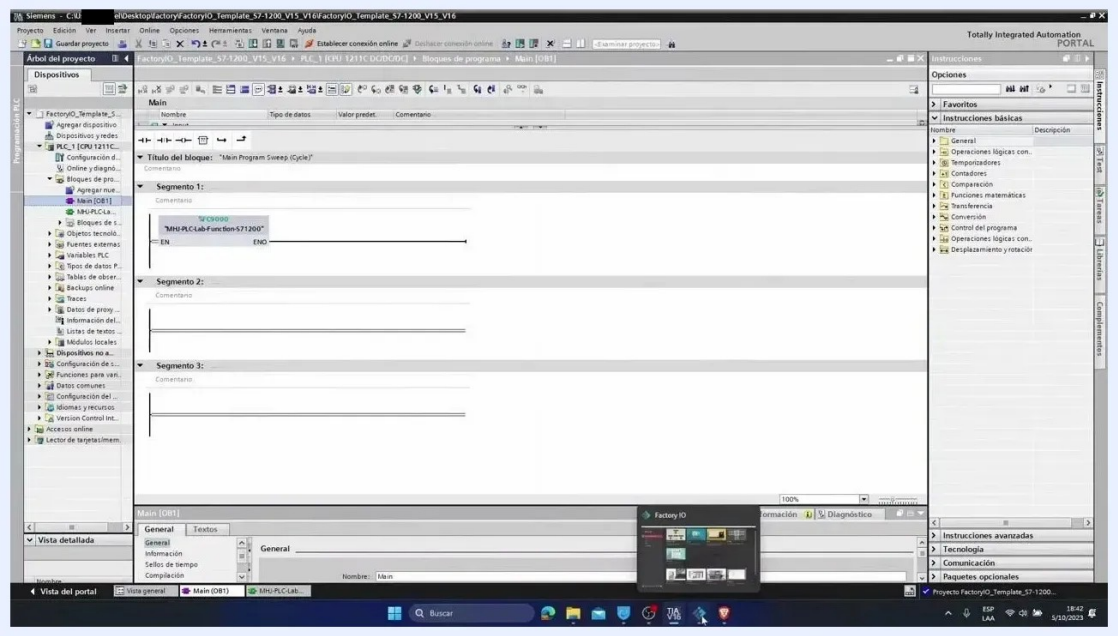


Factory I/O Open Scene window listing industrial simulation scenes with thumbnails and descriptions

Step 24. Load the scene

Select the scene you want. For example, select "1 - From A to B" to simulate a conveyor transporting a box to a sensor.

The scene loads and displays a conveyor, a box, and a sensor. The right panel shows the available objects for editing the scene.

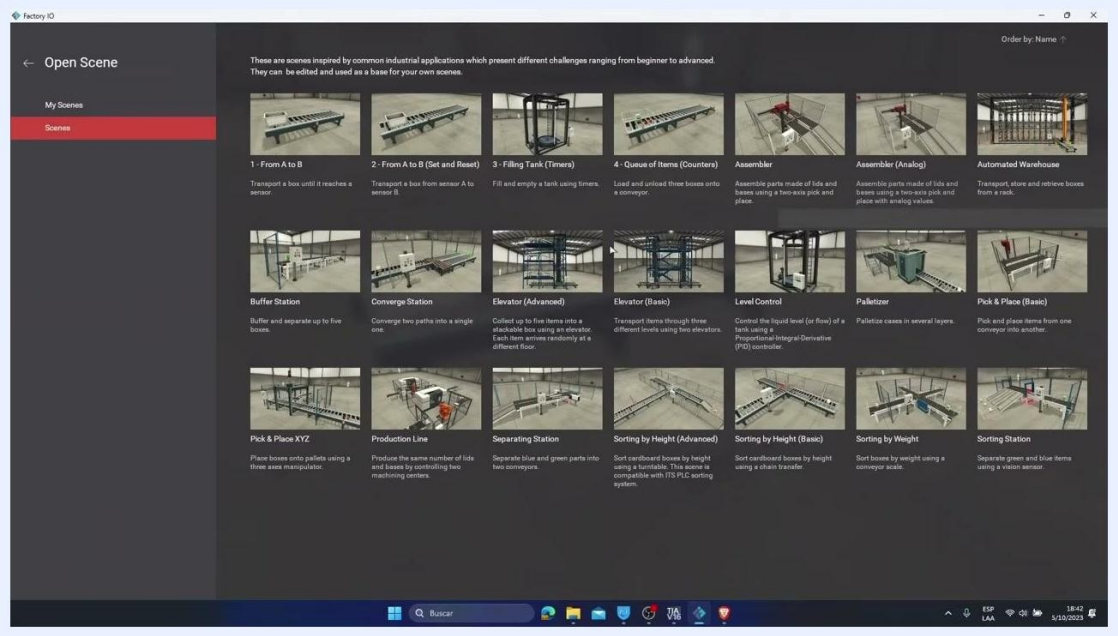


Factory I/O simulation scene loaded, showing a conveyor, a box, a sensor, and the object palette

Step 25. Show the sensor and actuator tags

If the sensor or actuator tags are not visible, click **VIEW** in the top menu. In the dropdown, check **Sensors Tags** and **Actuators Tags** to display these labels in the scene.

The tags help you identify and map the correct I/O points for communication with the PLC.



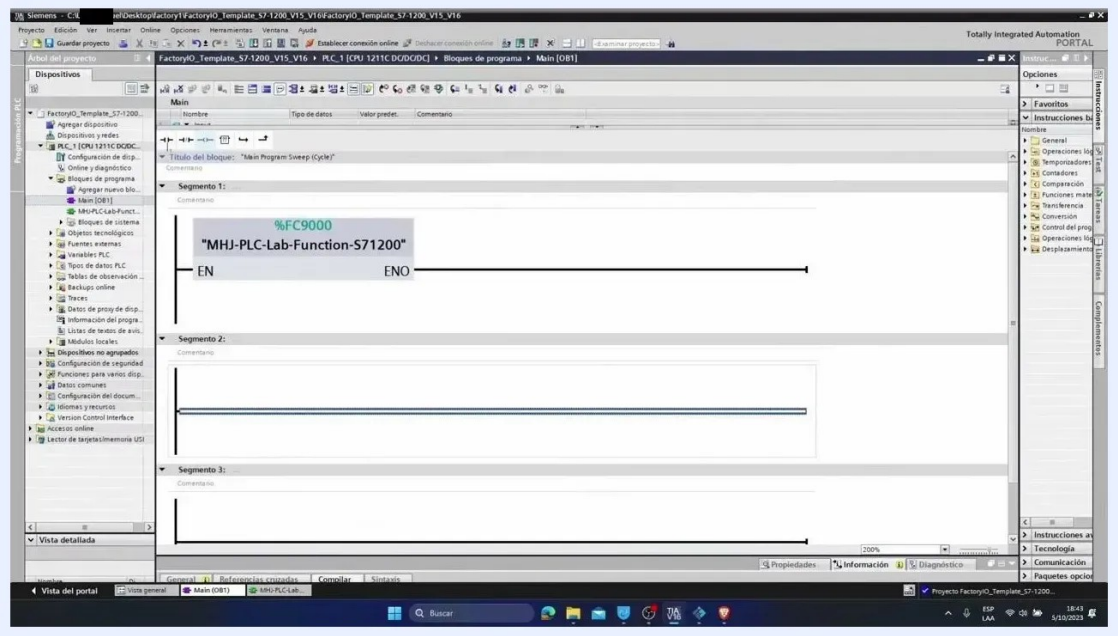
Factory I/O scene with the VIEW menu open, Sensors Tags and Actuators Tags checked, and the tags visible in the scene

Build the control logic in TIA Portal

Step 26. Plan the control logic

You create a simple PLC program: the conveyor runs until the sensor detects an object, at which point the conveyor stops. The logic uses a normally open contact for the sensor and an output coil for the conveyor.

The scene shows status indicators for both devices at the top left.



Factory I/O scene showing the conveyor and sensor, with status indicators for both devices at the top left and the object palette on the right

Step 27. Add a normally open contact

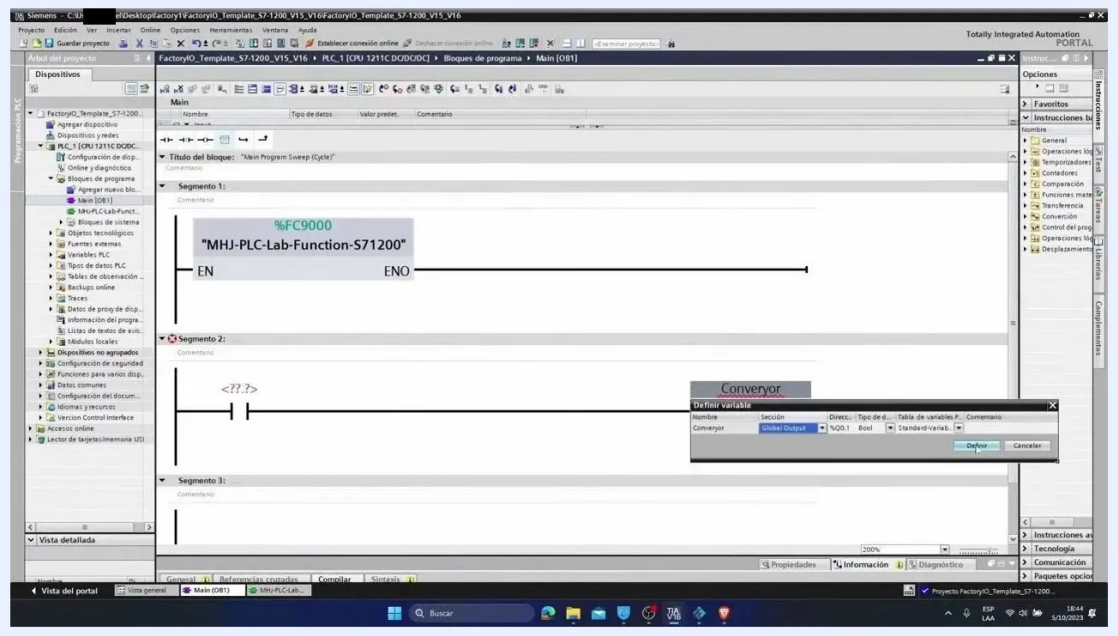
Switch to TIA Portal and open the main program block (OB1). In Segment 2, add a normally open contact on the left side of the rung. You assign a variable to this contact in Step 29.

Step 28. Add and assign the conveyor output coil

In the same rung, add an output coil on the right side. Assign the coil to the conveyor by defining a new variable with these values:

- Name: Conveyor
- Section: Global Output
- Address: %Q0.1
- Type: Bool

Click **Definir** (Define) to confirm the variable assignment.



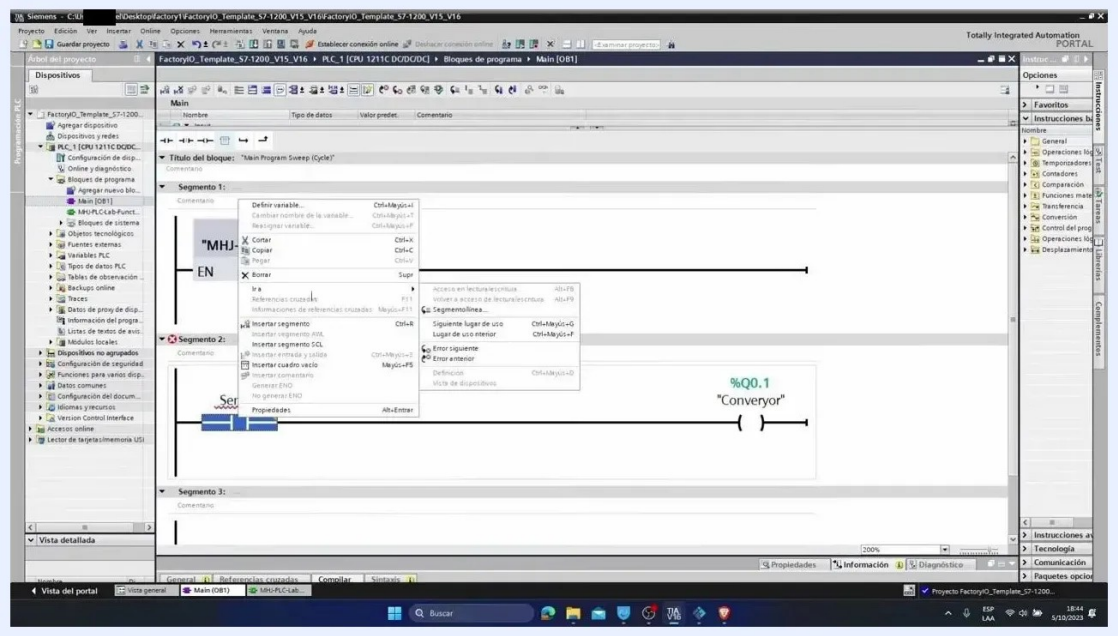
TIA Portal ladder logic editor with a rung being configured, showing a contact and an output coil labeled Conveyor, and the variable definition dialog open

Step 29. Define the sensor as an input

In Segment 2, right-click the contact labeled "Sensor" and select **Definir variable** (Define variable) from the context menu. In the variable definition dialog, set these values:

- Name: Sensor
- Section: Global Input
- Data Type: Bool

Click **Definir** (Define) to confirm. This maps the sensor to a physical PLC input for simulation.

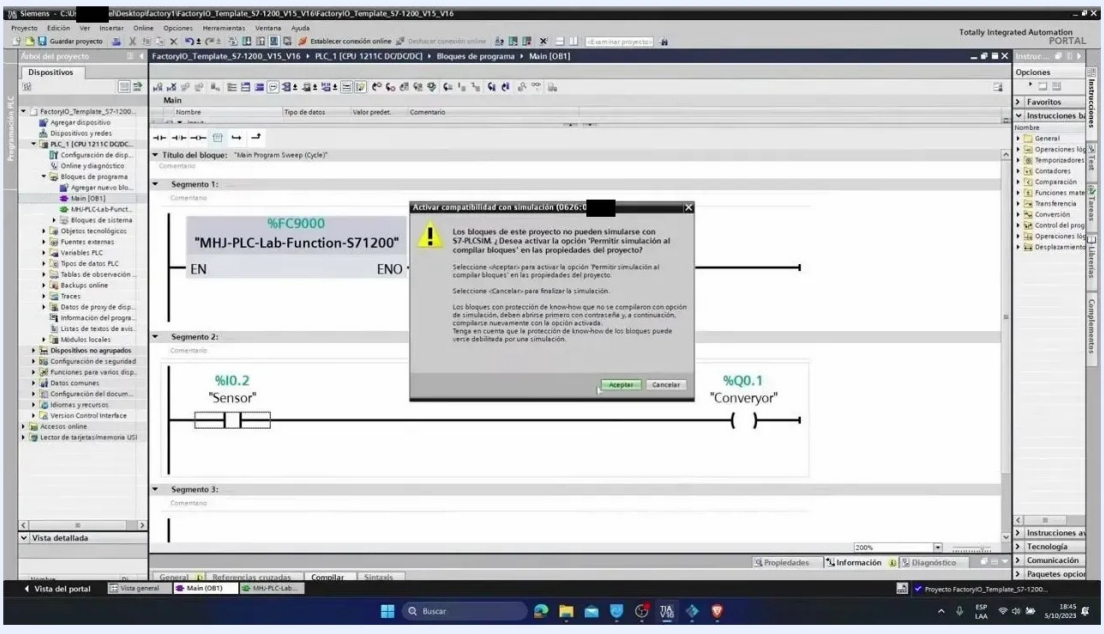


TIA Portal ladder logic editor with the context menu open on the Sensor contact, showing how to define the variable as an input

Step 30. Assign the sensor to a physical input address

In the variable definition dialog, assign the sensor to a physical input address, for example %I0.2. Make sure the section is set to "Global Input" to link it to the PLC's physical inputs.

Click **Definir** (Define) to save the configuration.

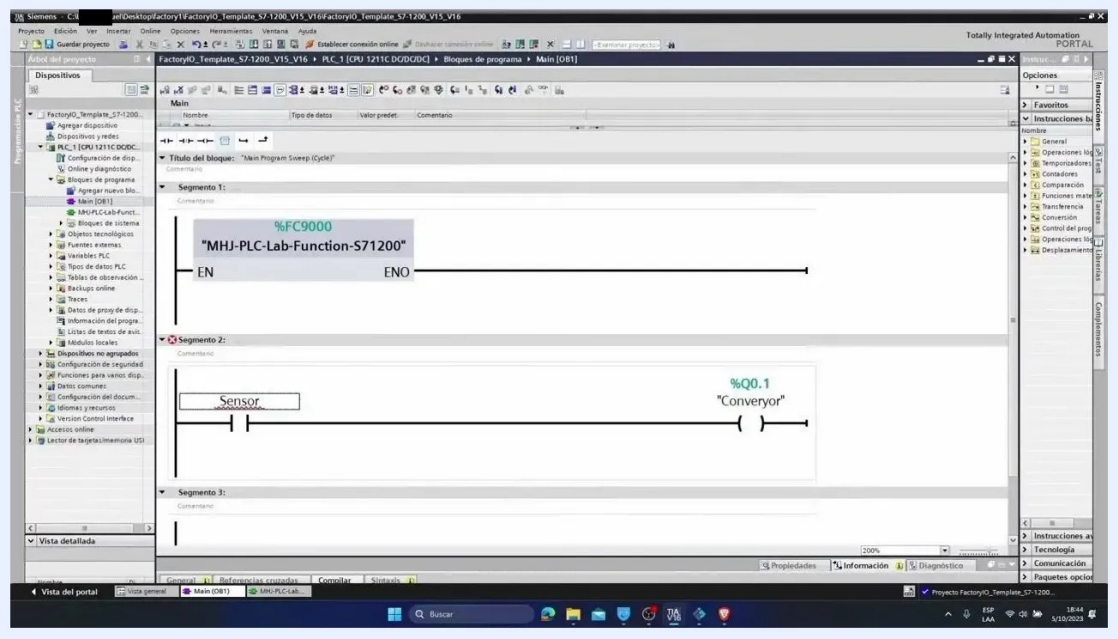


TIA Portal ladder logic editor with the variable definition dialog open, showing the Sensor variable assigned to Global Input

Step 31. Understand the sensor logic

The sensor in Factory I/O is a reflective barrier sensor. When no object is detected, the sensor contact is closed and the conveyor runs.

When an object passes and the sensor detects it, the contact opens and the conveyor stops. The completed rung shows a normally open contact labeled "Sensor" in series with an output coil labeled "%Q0.1 Conveyor".



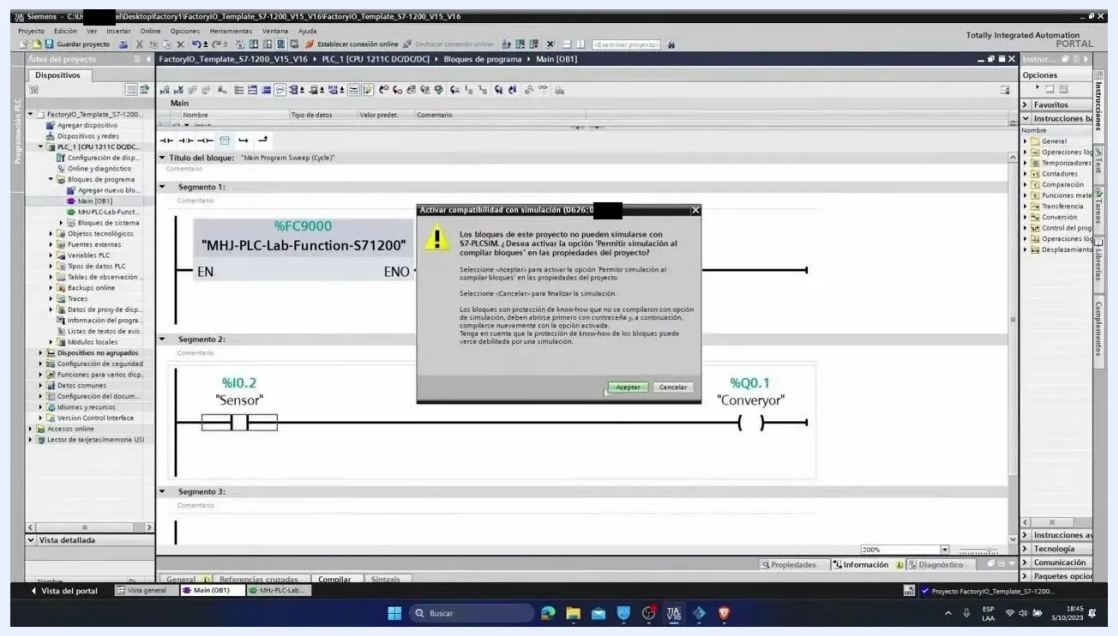
TIA Portal ladder logic editor showing the completed rung with a normally open Sensor contact in series with the %Q0.1 Conveyor output coil

Compile and load the program into PLCSIM

Step 32. Compile the program

Click the compile button or select the compile option from the menu. If TIA Portal shows a simulation compatibility warning, for example "Activar compatibilidad con simulación", click **Aceptar** (Accept) to allow simulation with S7-PLCSIM.

This enables the project blocks to be simulated in the virtual PLC environment.

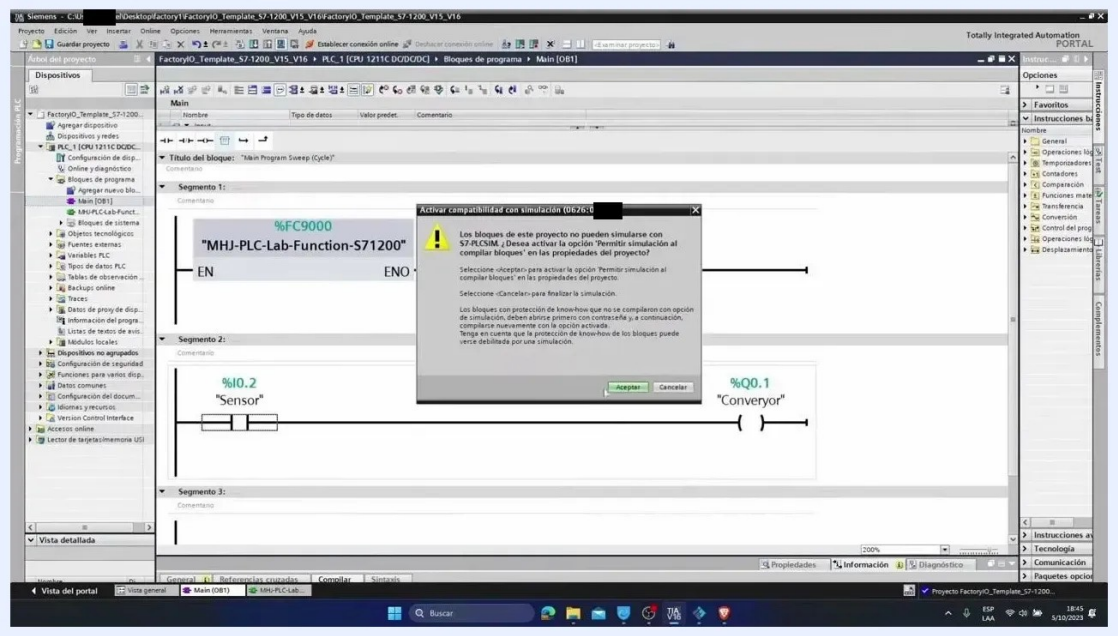


TIA Portal with a simulation compatibility warning dialog open, prompting you to allow simulation with S7-PLCSIM

Step 33. Load the program to the simulator

Let TIA Portal finish compiling the project. When compilation is complete, the "Vista preliminar carga" (Load Preview) dialog appears.

Review the list to make sure all modules and software are ready for loading. Then click **Cargar** (Load) to upload the program to the PLC simulator.

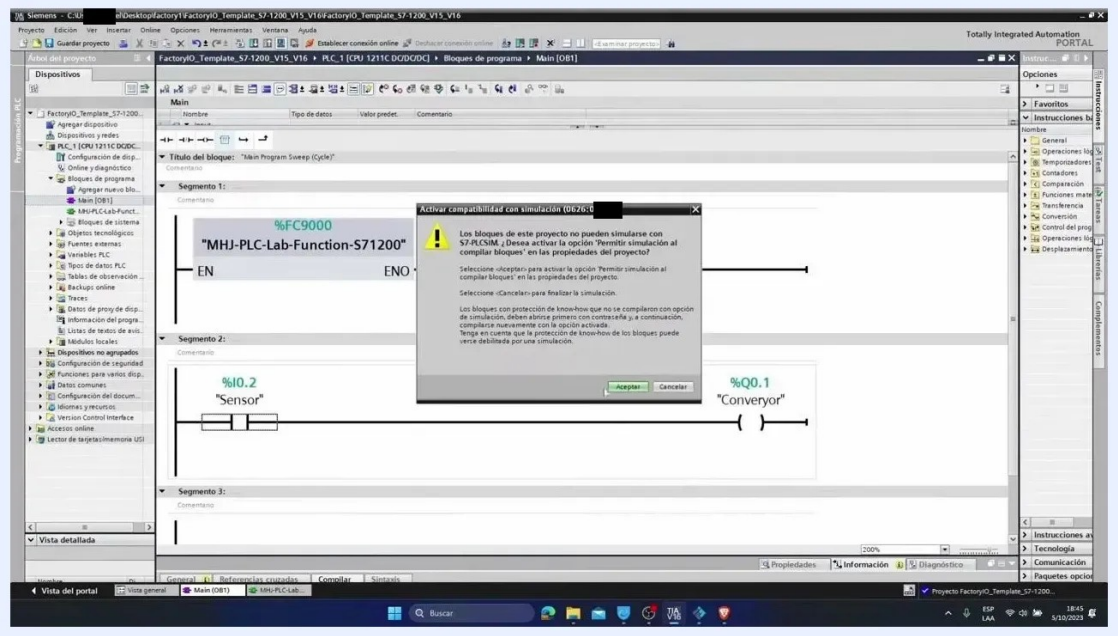


TIA Portal load preview dialog with all modules ready for loading and the Cargar button highlighted

Step 34. Finish the upload

Monitor the progress dialog while the program uploads to the PLC simulator. Wait for the message that the operation finished successfully, then click **Finalizar** (Finish) to close the dialog.

The PLC simulator (PLCSIM) is now running the uploaded program.



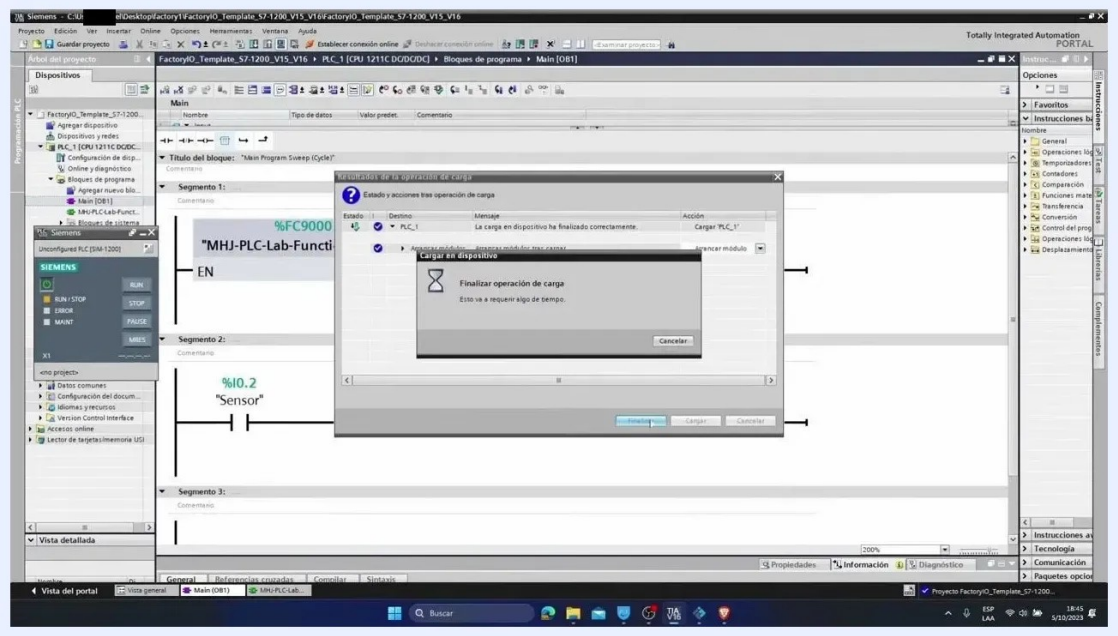
TIA Portal finalization dialog for loading the program into the PLC simulator, with the Finalizar button available

Configure the Factory I/O driver

Step 35. Open the Drivers menu

To finish connecting Factory I/O with TIA Portal, link the simulation to the PLC simulator. Open Factory I/O and make sure your simulation scene is loaded.

Click **FILE** in the top menu, then select **Drivers** (or press F4). This opens the driver configuration window.

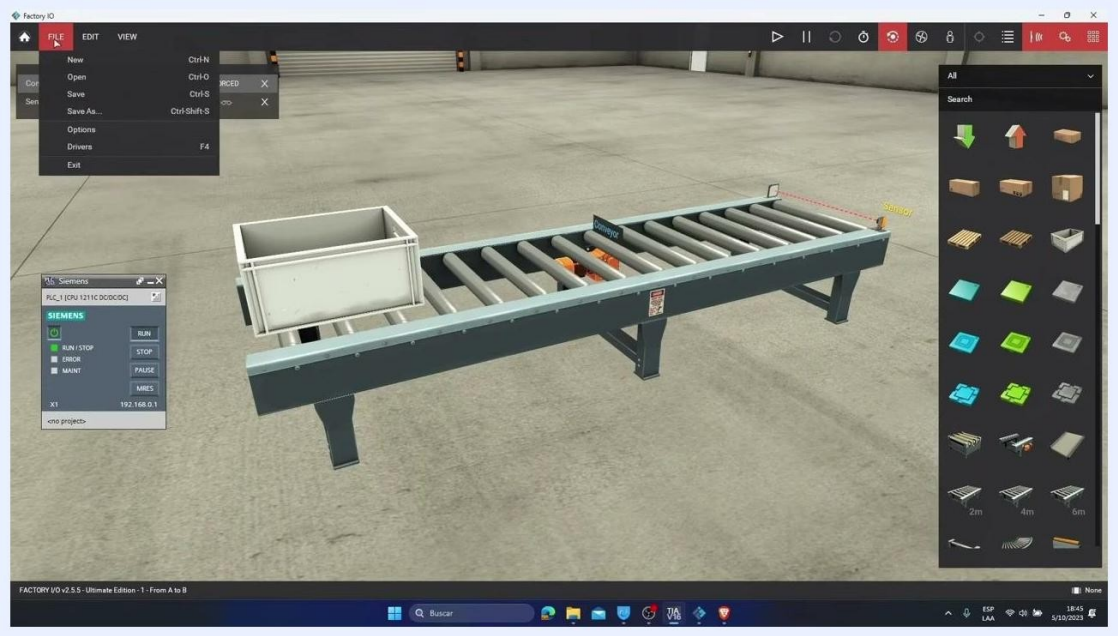


Factory I/O scene with the FILE menu open and the Drivers option highlighted

Step 36. Select the Siemens S7-PLCSIM driver

In the DRIVER configuration window, open the dropdown list of available drivers. Scroll down and select **Siemens S7-PLCSIM**.

This driver enables communication between Factory I/O and the TIA Portal PLC simulator.



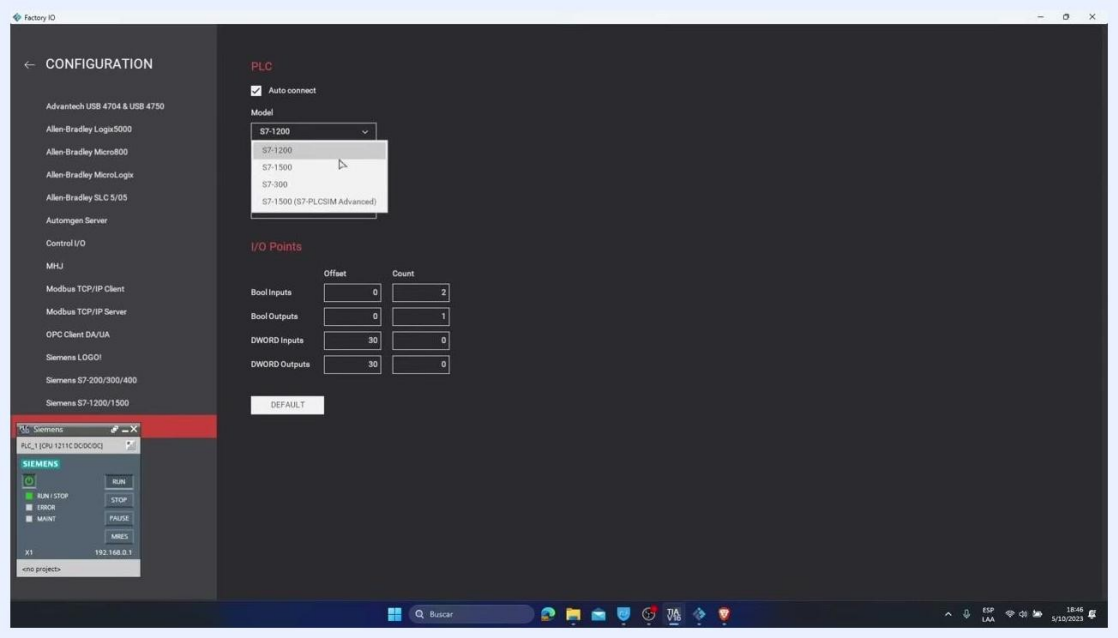
Factory I/O DRIVER configuration window with Siemens S7-PLCSIM selected from the dropdown list

Step 37. Open the Configuration section

In Factory I/O, go to the **Configuration** section. The left panel lists the available PLC and server types. The main panel displays the PLC connection settings and the I/O point configuration.

Step 38. Set the PLC model

In the **PLC** section, make sure **Auto connect** is checked. From the **Model** dropdown, select **S7-1200**.



PLC model dropdown open with S7-1200 highlighted, showing the configuration screen with I/O Points and the Siemens PLC window visible

Step 39. Review and reset the I/O points

Review the **I/O Points** section. By default, these values are set:

- **Bool Inputs:** Offset = 0, Count = 2
- **Bool Outputs:** Offset = 0, Count = 1
- **DWORD Inputs:** Offset = 30, Count = 0
- **DWORD Outputs:** Offset = 30, Count = 0

Click the **DEFAULT** button to populate the recommended I/O point values. The fields update to:

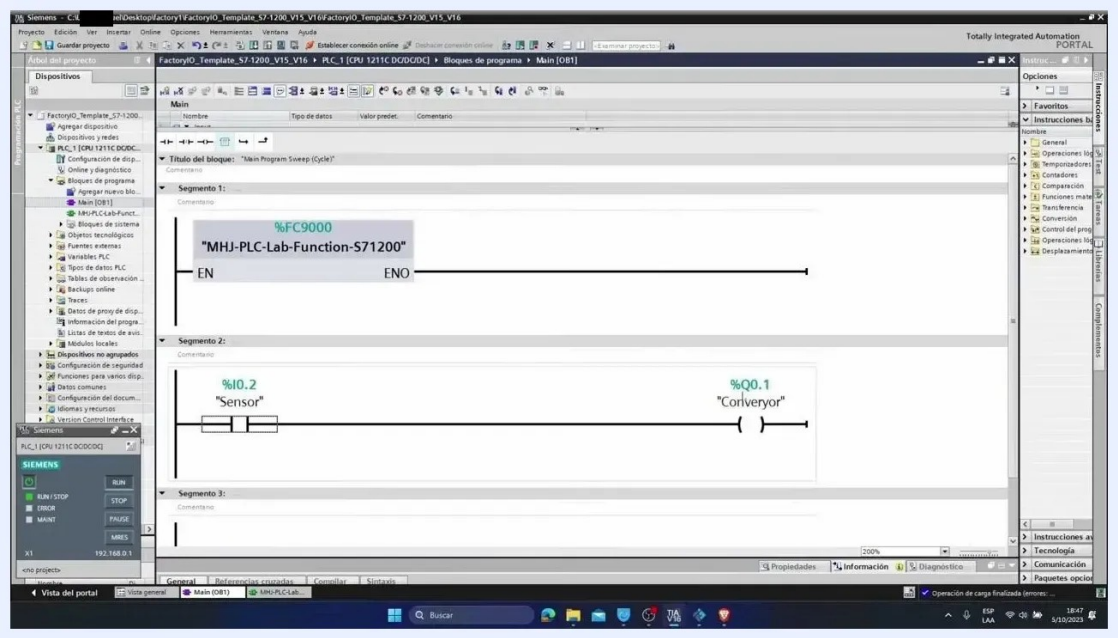
- **Bool Inputs:** Offset = 0, Count = 16
- **Bool Outputs:** Offset = 0, Count = 16
- **DWORD Inputs:** Offset = 30, Count = 8
- **DWORD Outputs:** Offset = 30, Count = 8

Step 40. Identify the sensor and conveyor mappings

Exit the configuration screen to return to the main driver interface. The driver screen displays the **Sensors** and **Actuators** lists, and the central

panel shows a mapping of I/O addresses such as %I0.0 and %Q0.0. The Siemens PLC window stays visible in the lower left.

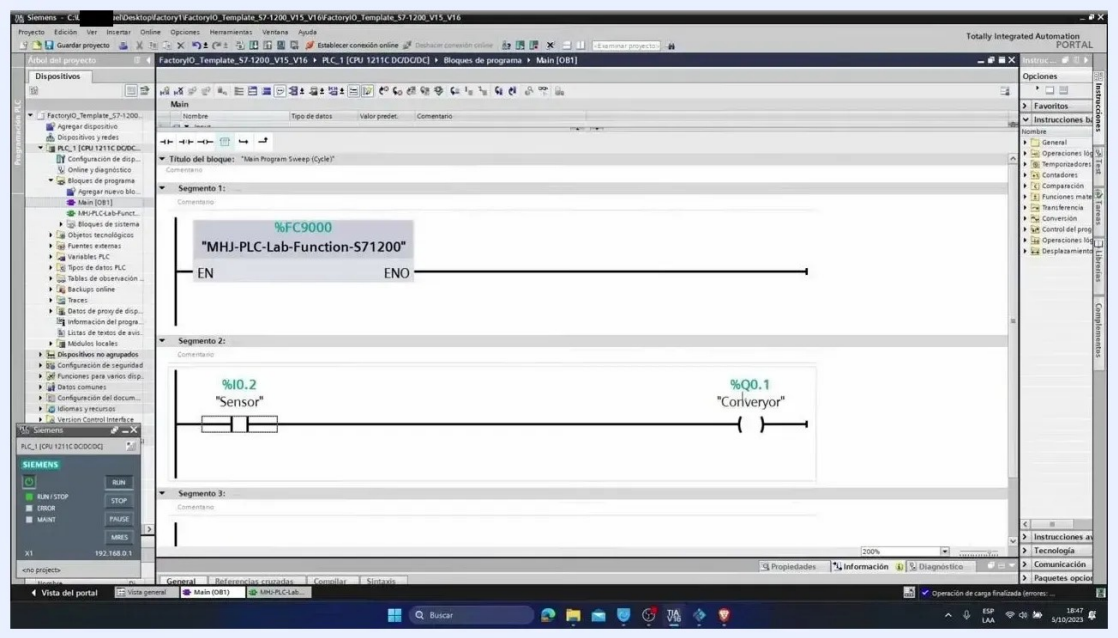
The sensor is mapped to input **%I0.2**, and the conveyor is mapped to output **%Q0.1**.



Driver screen with the sensors and actuators lists, the I/O address mapping, and the Siemens PLC window visible

Step 41. Confirm communication with PLCSIM

Select the sensor in the driver interface. The system automatically recognizes the running PLC SIM instance, and the sensor and conveyor mappings are highlighted in the I/O address list.



Driver screen with the sensor and conveyor mappings highlighted, confirming communication, and the Siemens PLC window visible

Step 42. Exit the driver interface

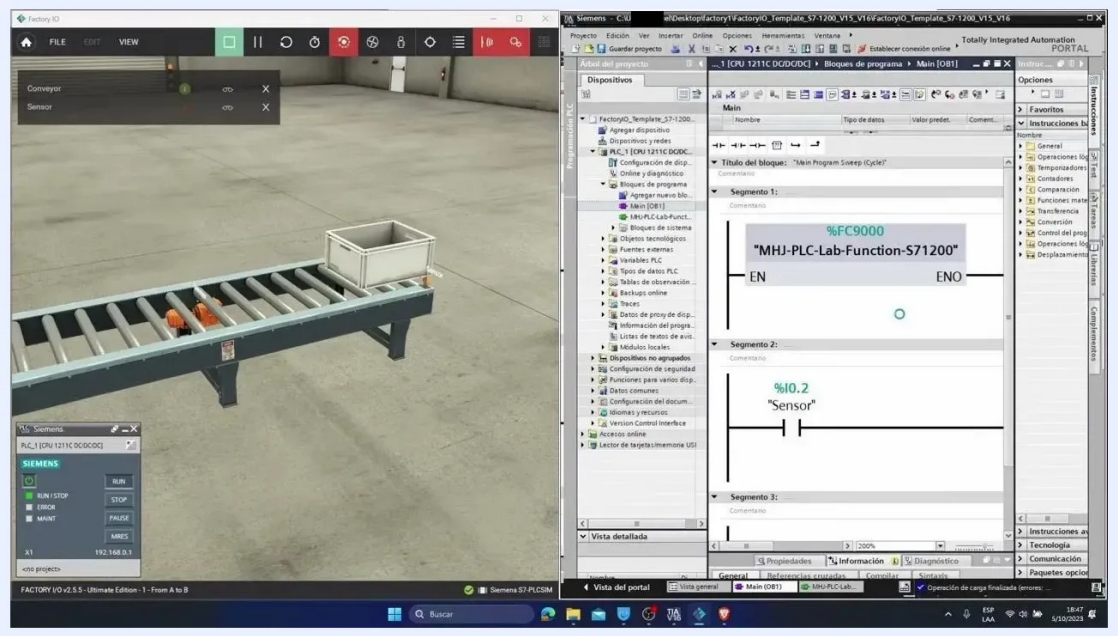
Click **Exit** in the driver interface to finish the configuration process.

Test the logic

Step 43. Run the simulation

Click the green **Play** button in Factory I/O to start the simulation. The conveyor and sensor remain visible, with the box positioned near the sensor.

The TIA Portal ladder logic shows the rung with %I0.2 ("Sensor") and %Q0.1 ("Conveyor") connected. The sensor indicator is orange, showing that it is detecting the box, and the PLC SIM window remains in RUN mode.

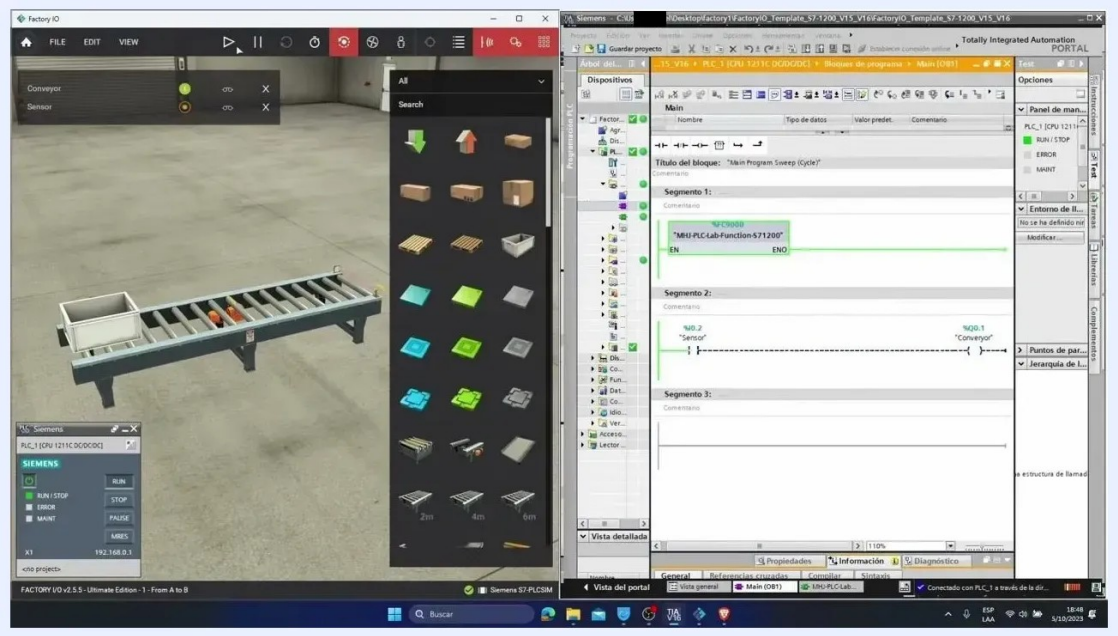


Factory I/O in run mode with the conveyor and sensor active, the TIA Portal ladder logic showing the sensor and conveyor rung, and PLC SIM in RUN mode

Step 44. Confirm that communication works

As the simulation continues, the conveyor moves the box. The sensor detects the box, and the conveyor output responds according to the ladder logic.

The TIA Portal ladder diagram updates in real time, showing the state of the sensor and conveyor. The Factory I/O interface and the PLC SIM window remain visible.

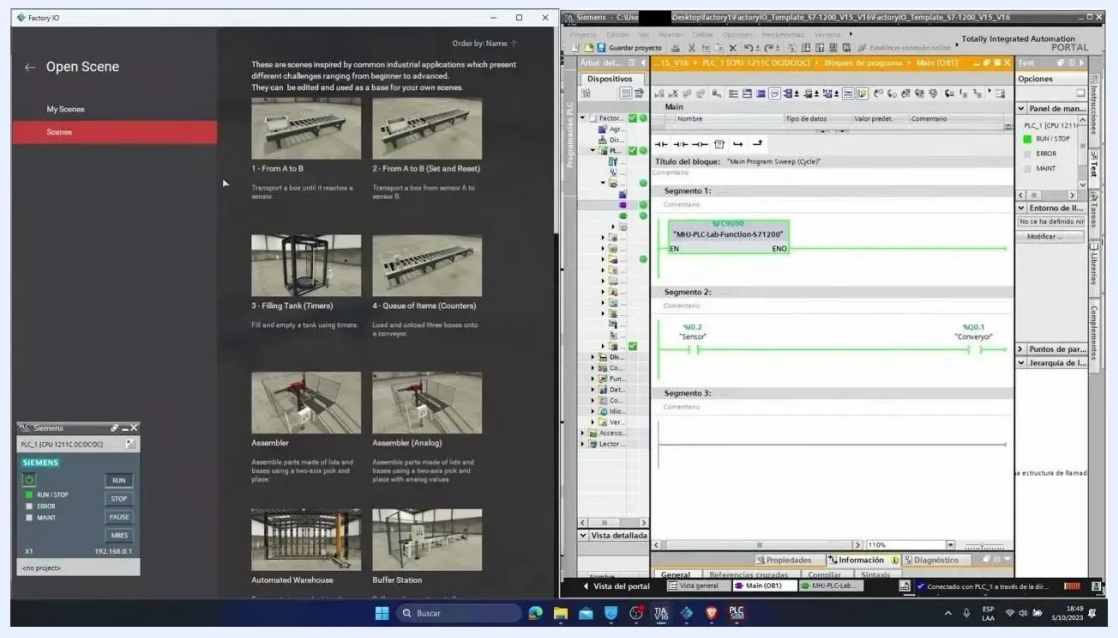


Factory I/O simulation running with the conveyor moving the box and the sensor active, the TIA Portal ladder logic updating, and PLC SIM in RUN mode

Step 45. Pause and restart the simulation

Pause the simulation with the pause button in Factory I/O, then resume it by clicking the play button. Watch the conveyor turn on, the box move, and the sensor deactivate as the box passes.

The TIA Portal ladder logic reflects these changes in real time.



Factory I/O simulation paused and restarted, with the conveyor and sensor status updating, the TIA Portal ladder logic reflecting the changes, and PLC SIM in RUN mode

Summary

You now know how to connect Factory I/O with TIA Portal. You downloaded and migrated the Siemens template project, reviewed the SCL communication code, and set the main block to Ladder Diagram. You then built a sensor and conveyor rung, loaded it into S7-PLCSIM, configured the Siemens S7-PLCSIM driver in Factory I/O, and confirmed that the ladder logic updates in real time as the simulation runs.

What's next

To go further, use the empty Segment 3 in the main block for additional logic, or load another pre-built scene such as "Buffer Station" or "Production Line" and map its sensors and actuators in the driver interface.