Contents

12

12. Connecting an HMI Device

At the end of the chapter the participant will ...

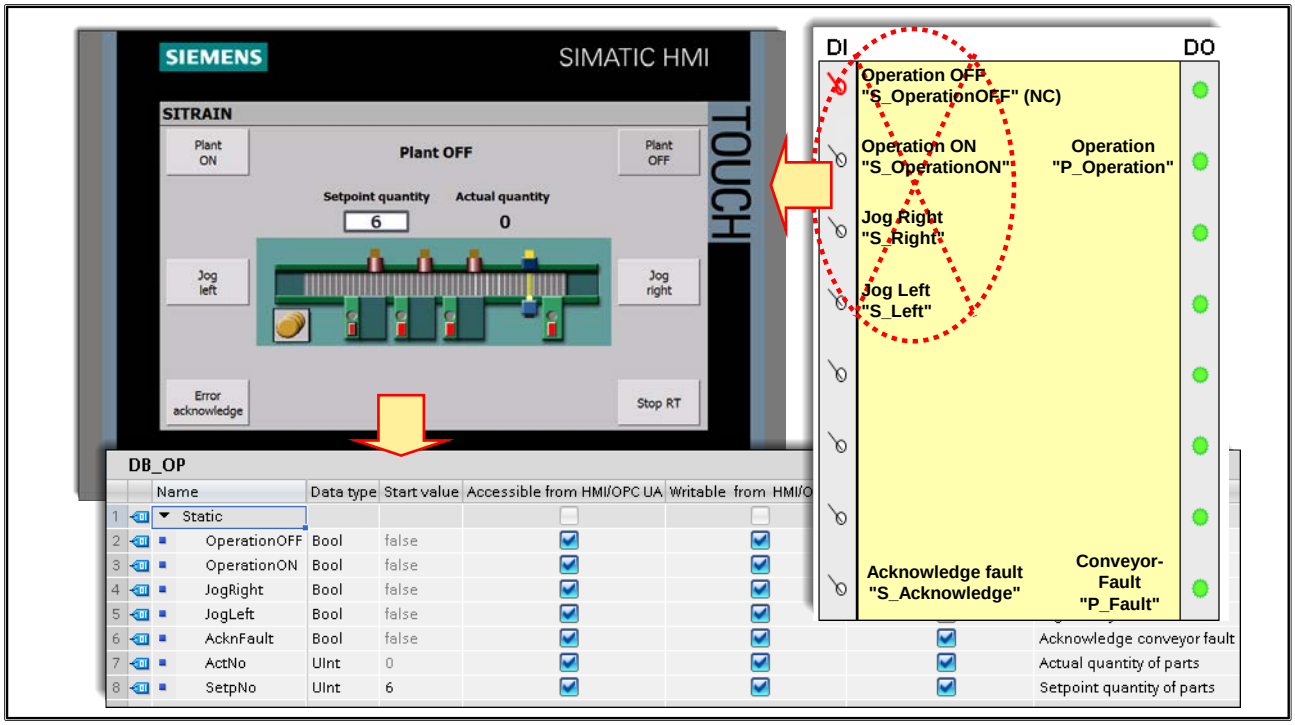
... be able to explain the principle of data exchange between HMI device and CPU using tags

... be able to set the interface of the touchpanel

... be able to commission a touchpanel project

… be able to adjust a STEP 7 program

12.1. Task Description: Operating the ‘Plant’ via the Touchpanel

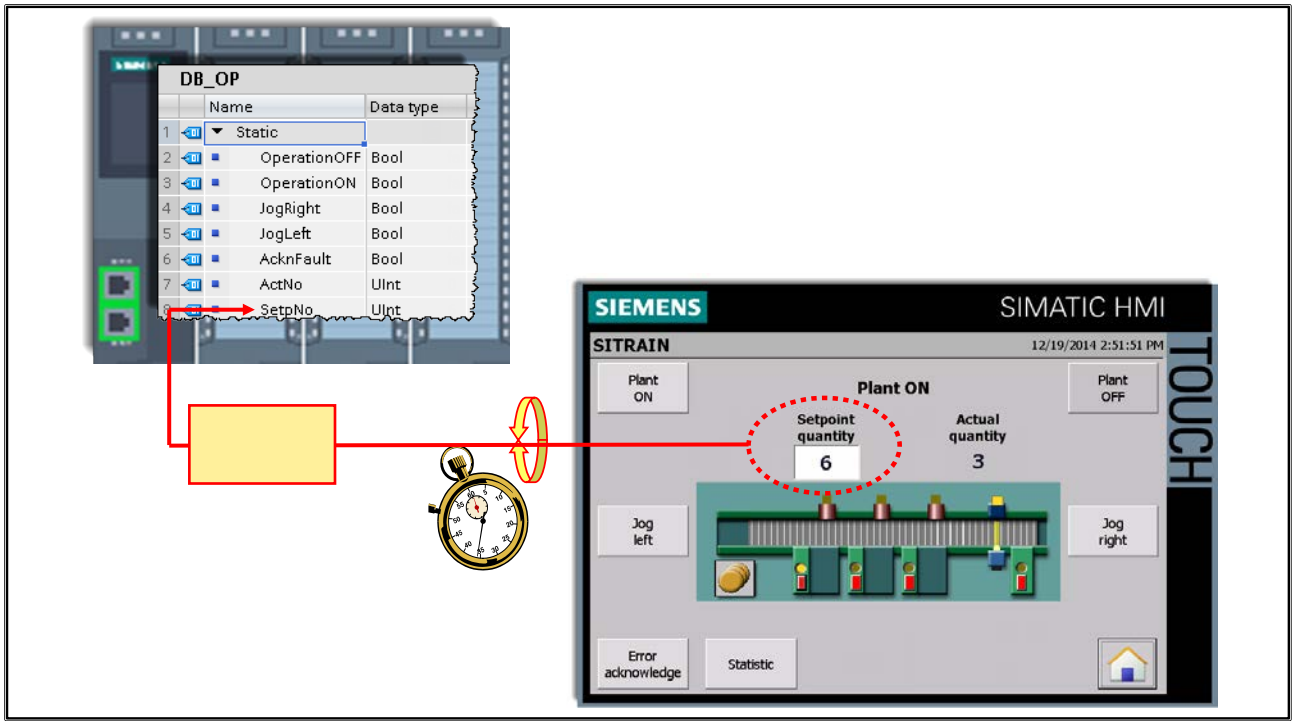


Task Description

The touchpanel project is to be commissioned and the S7 program of the controller is to be adjusted in such a way that…

- the functions "Operation ON/OFF" and "Jog Right/Left" are no longer realized via the simulator switches but via the corresponding buttons on the touchpanel.
- the acknowledgement of a conveyor fault should still be possible via the simulator switch "S_Acknowledge", and, in addition, also via the corresponding button on the touchpanel.
- The SETPOINT quantity is no longer a constant 3, but can be preset via an input field on the touchpanel.

12.2. Data Exchange between HMI Devices and CPU



Data Exchange between HMI Devices and CPU

Data is exchanged between SIMATIC S7 and the HMI system via tags. In the configuration of the HMI device, the screen objects, such as, buttons and input/output fields are linked to HMI tags which in turn are connected to PLC tags of the CPU. The HMI system cyclically exchanges the values between these tags. Data is transferred cyclically between SIMATIC S7 and the HMI system, that is, process variables are cyclically read and written by the HMI device depending on the configured update time.

HMI Tags

HMI tags can be connected to the global PLC tags or to the following global data areas of the CPU:

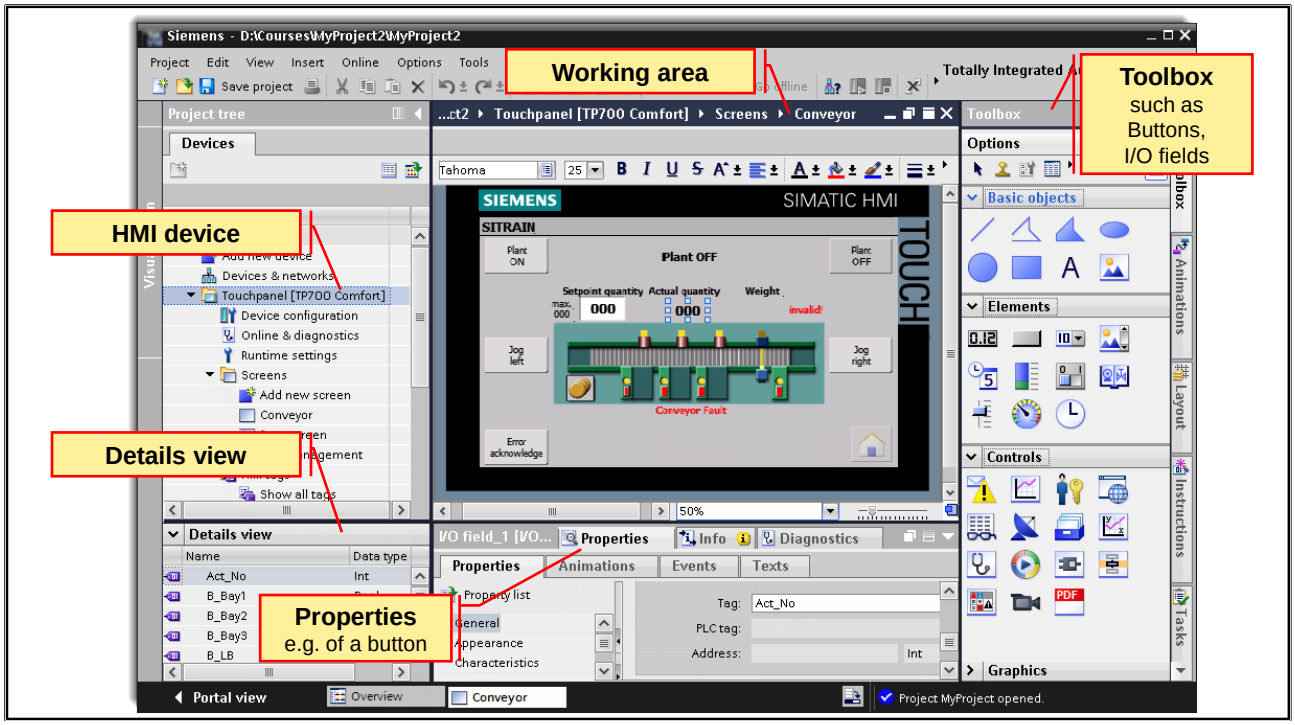
- Data blocks (DB)
- Memory bits (M)
- Inputs (I) and outputs (Q)
- I/O inputs (PI) and I/O outputs (PQ)

HMI systems also recognize local tags without a link to the PLC, i.e. these tags are exclusively processed internally and also do not reserve any communication resources whatsoever.

Communication

The operator panels can communicate with the (PLC) controller via the PROFIBUS or Industrial Ethernet bus systems. The S7 protocol is used for this purpose. Communication is organized by the operating systems of the S7 CPU and the HMI system. There is no user programming effort required. An operator panel can also exchange data with several (PLC) controllers.

12.3. WinCC Configuration Interface



Project Window

In the Project tree, all devices and their configuration and parameter assignments are displayed in a tree structure. From there, the relevant editors can be opened. Furthermore, the "language support" and the "version management" can be found here.

Working Area

This is the central configuration area in which objects of the operator panel are edited with the started editor. Several editors can be open at the same time.

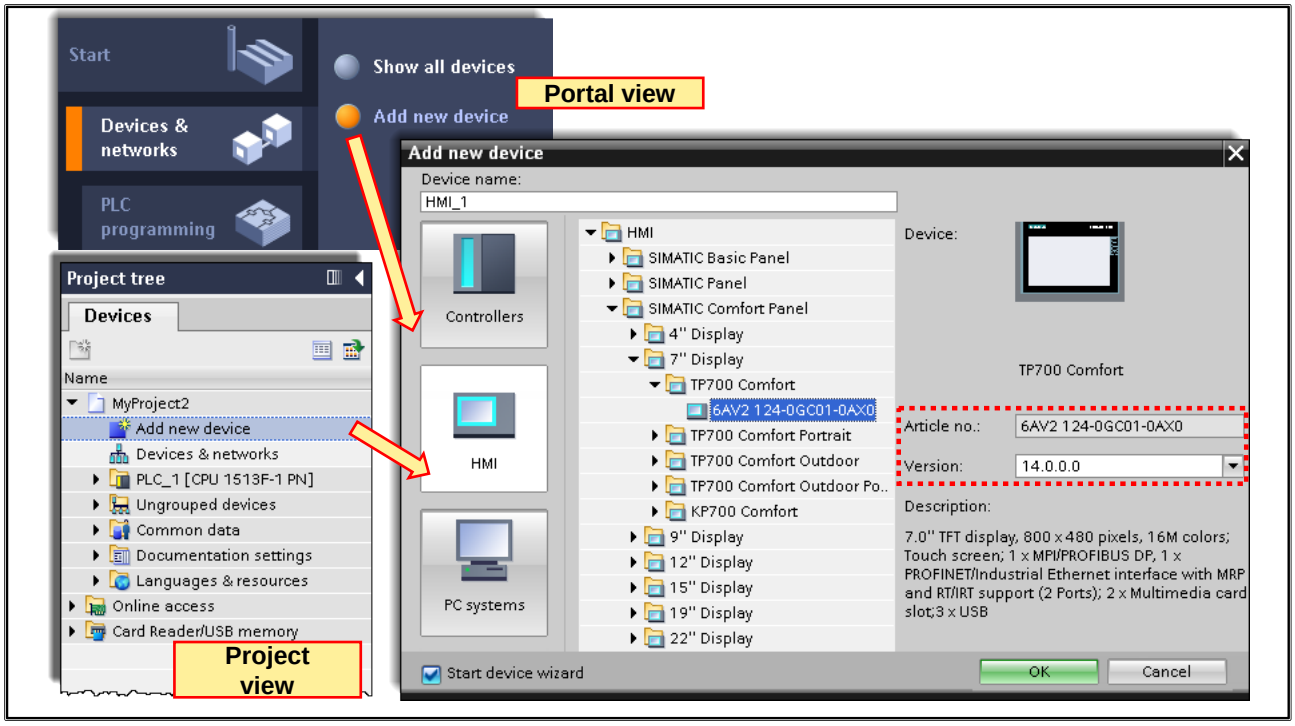
Properties Window

The properties of selected objects (for example, of screens, screen objects, tags) can be edited in the Properties window. This window is only available in those editors where object properties have to be set.

Toolbox Window

The toolbox window contains all configurable objects which can be configured in screens, and permits access to libraries.

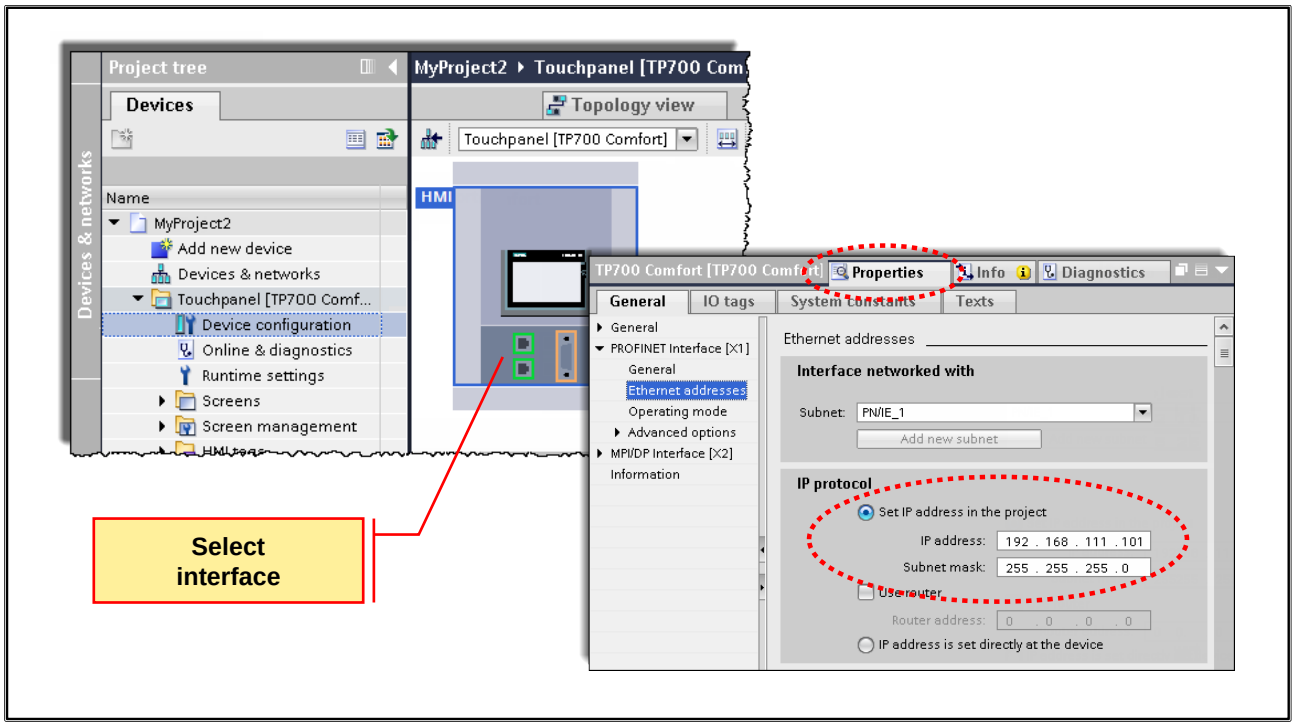
12.4. Adding an HMI Device



Adding an HMI Device

New HMI devices can be added from both the Portal view and the Project view. More than anything else, attention has to be paid to the device data such as Article number (order number) and version number.

12.4.1. Configuring the IP Address of an HMI Device

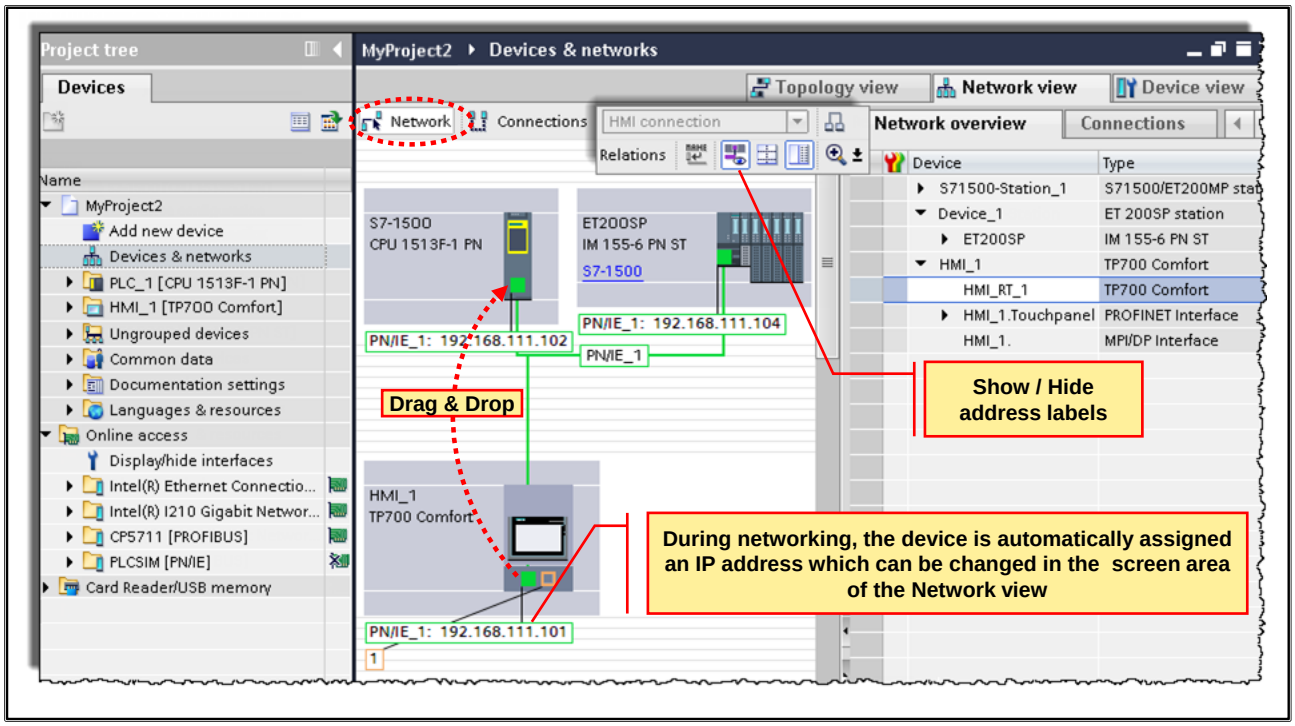


PROFINET Interface of the HMI Device

Regardless of whether the Hardware and Network editor is in the Devices view or the Network view, the settings of the PROFINET interface (IP address and subnet mask) can be made in the "Properties" tab in the Inspector window for a selected HMI device interface.

If an online connection between the HMI device and the CPU is to be established, both devices must be assigned the same subnet mask and IP addresses that are in the same subnet.

12.4.2. Networking an HMI Device

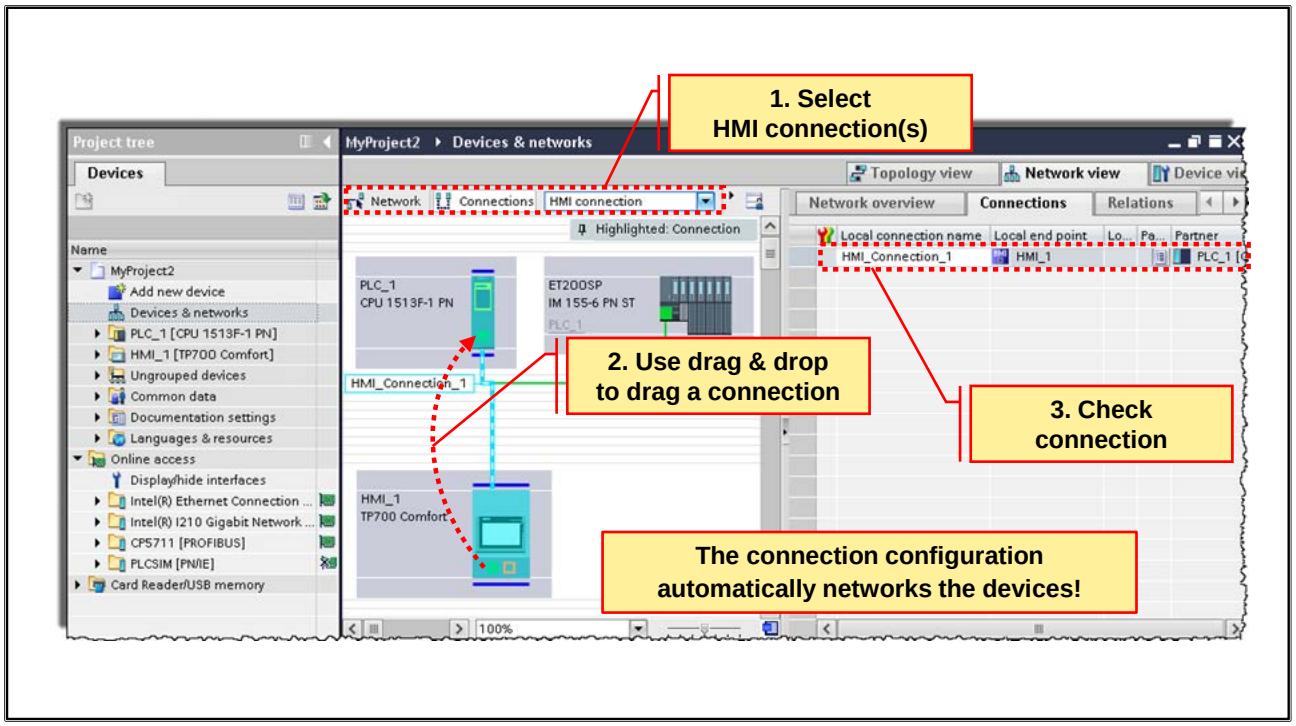


Networking an HMI Device

During networking, devices are connected to a subnet. The device interface must be compatible with the type of network.

The devices are networked in the Network view of the Hardware and Network editor under "Network" by connecting the device interfaces using drag & drop.

12.4.3. Configuring an HMI Connection

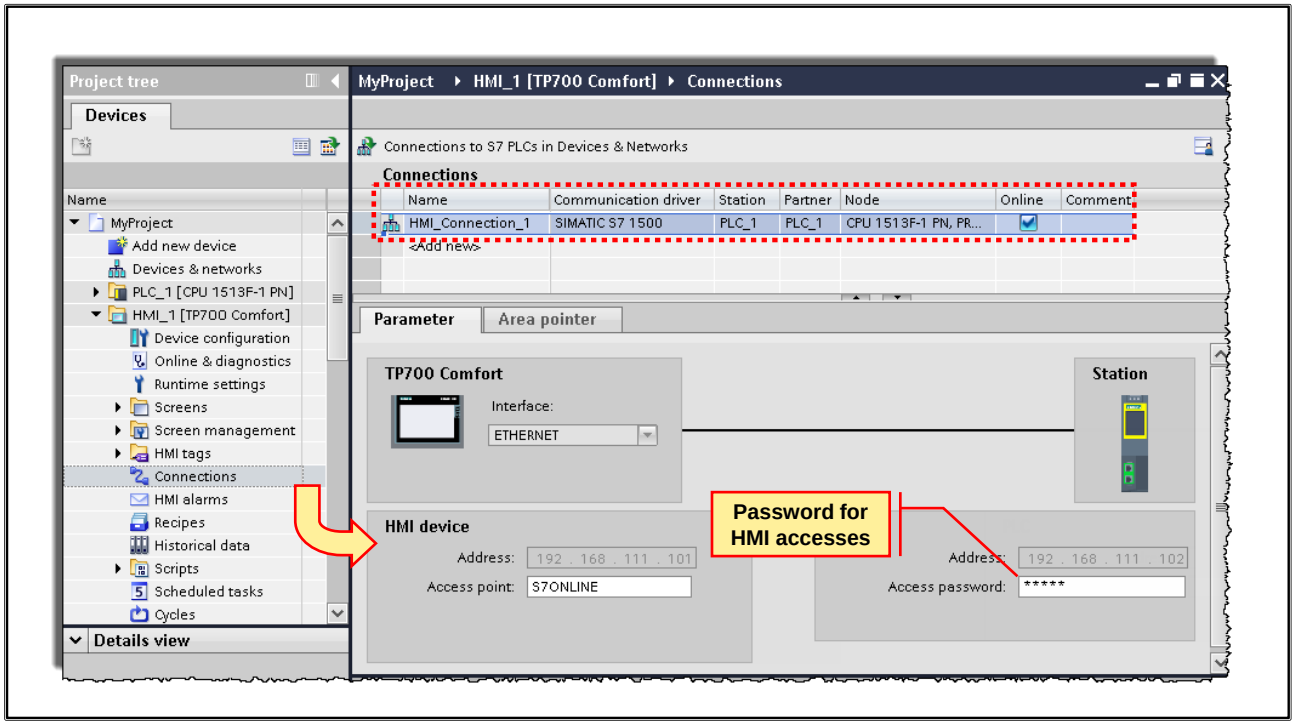


Configuring HMI Connections

In configuring HMI connection(s), the communications partners are defined with which the HMI device will later exchange data in the process control phase. The HMI device can also be connected to or exchange data with several controllers.

There can also be controllers in the same network with which the HMI device does not exchange data. Then, the HMI device is "networked" with these controllers but it is not "connected".

12.4.3.1. Checking the Connection and Entering the Password for CPU Accesses



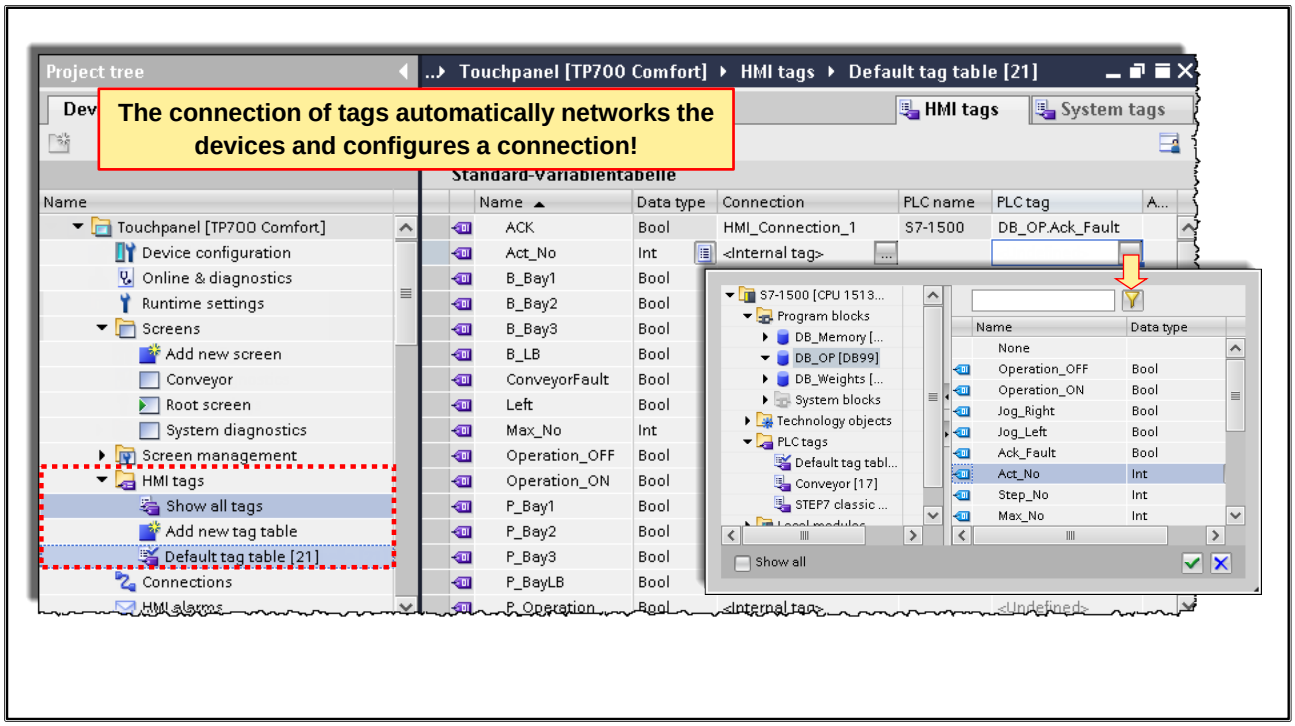
Connection:

The configured connections are visible in the Connections of the HMI device.

Password Query for HMI Accesses

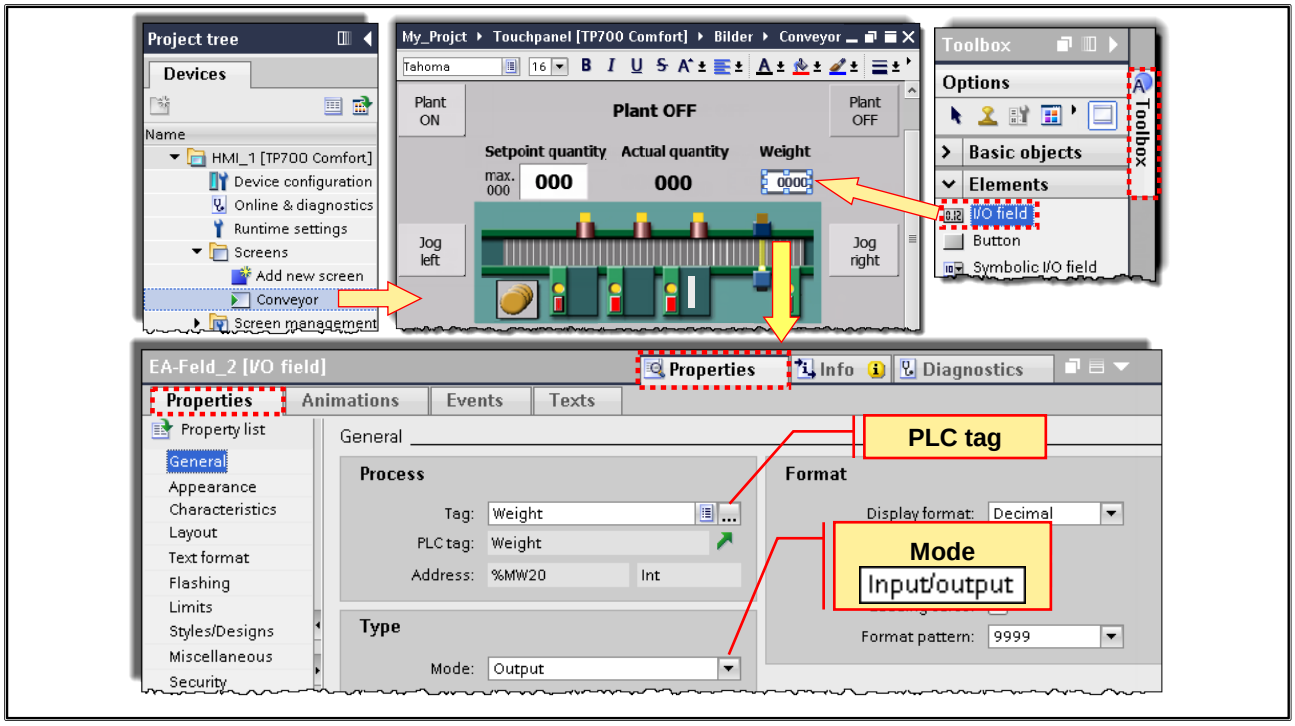
In order to get access rights to a CPU that is password-protected, the HMI device must log on to the CPU with a password when Runtime is started. This password must be specified in the Connections configuration of the HMI device (see picture bottom right).

12.4.4. Creating HMI Tags and Connecting them with PLC Tags



In the HMI tags folder, the HMI tags can be created and they can be connected with the associated PLC tags via an existing connection. The properties, such as, Access mode, Acquisition cycle etc., can be defined.

12.5. I/O Field for Inputting and Outputting Values



I/O Fields

The values of tags are displayed via output fields; the values of tags can also be preset via input fields. The mode can be set in the Properties window.

Mode

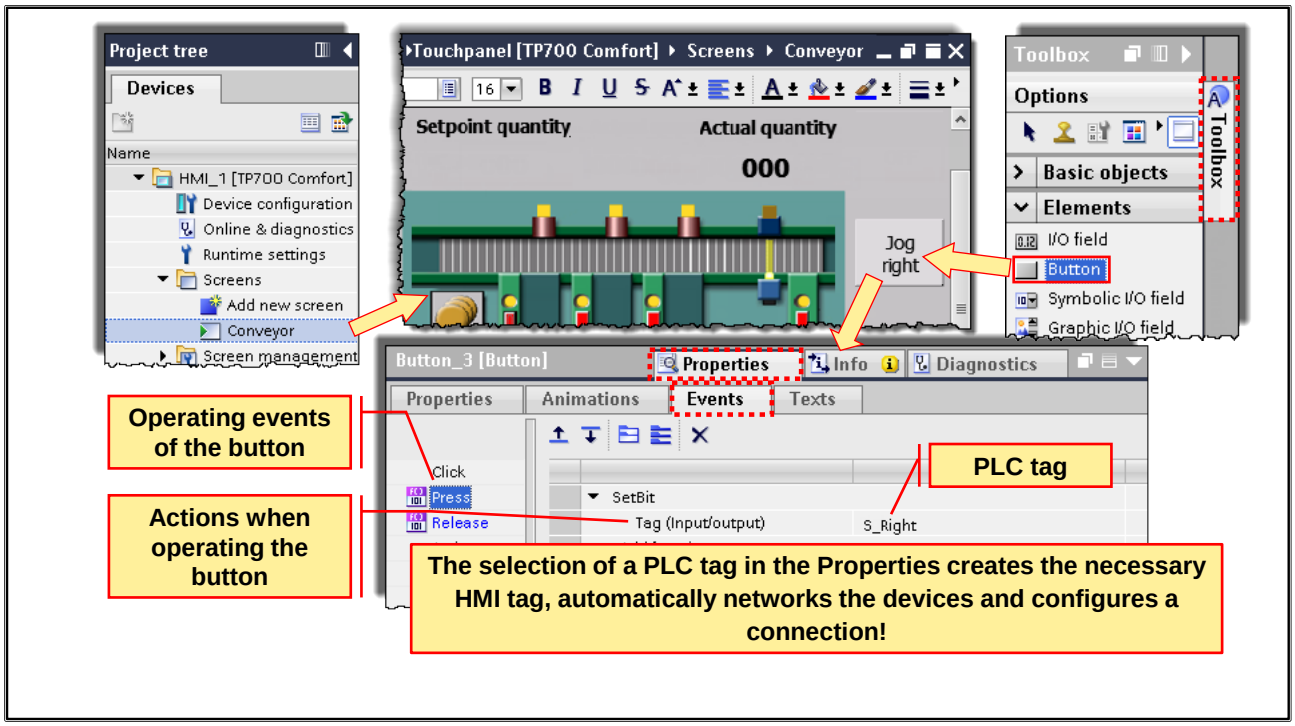
Output
The value of the tags is only displayed. The tag is read and updated in the interval of the configured acquisition cycle.
A value change (input) on the operator panel is not possible.

Input/Output
The value of the tags is displayed. The tag is read and updated in the interval of the configured acquisition cycle.
A value change (input) on the operator panel is possible – on touch displays, using the automatically displayed Display (screen) keyboard, and, with key devices, using the device keyboard.

Note:

I/O fields can also be generated by dragging & dropping a tag directly from a tag table or a data block (or with the help of the Details view). In so doing, an HMI tag is automatically created which is connected via an existing connection to the PLC tag.

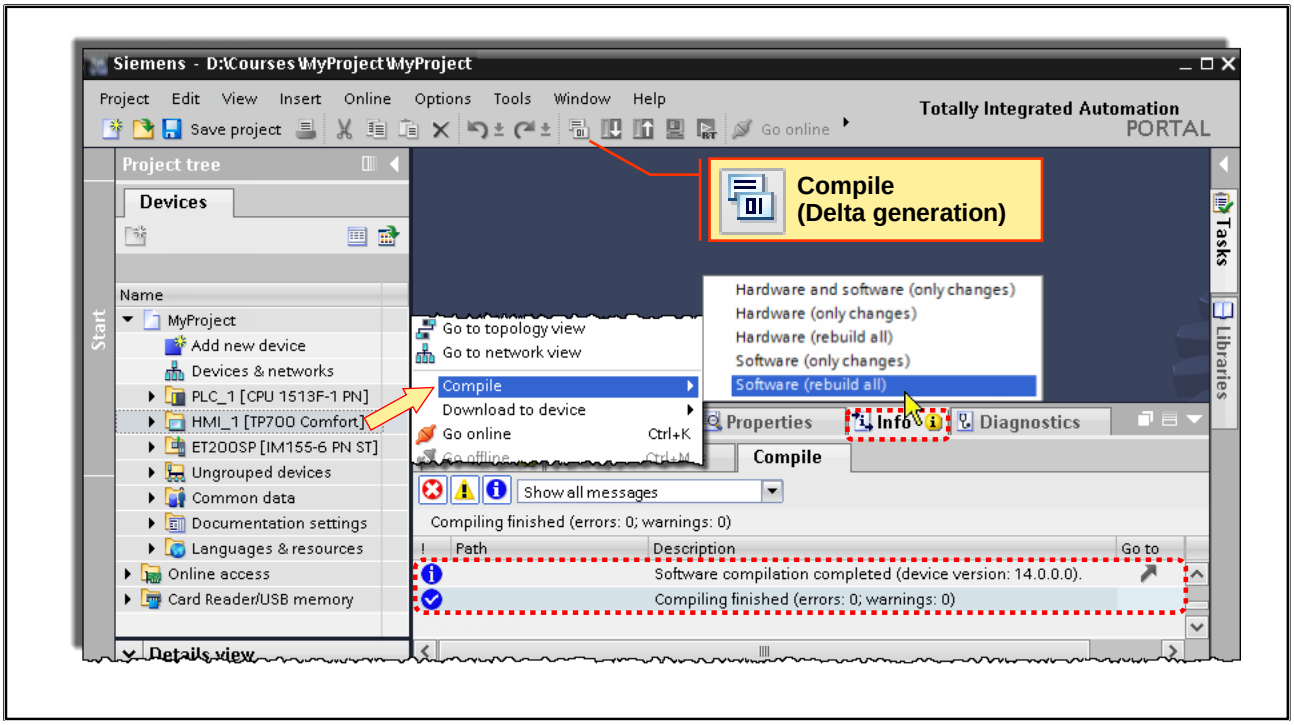
12.5.1. Buttons for Executing Functions



Buttons

System functions can be initiated by the operator via buttons, such as, the selection of a screen or the setting and resetting of a tag shown in the screen. The "Events" of a button are used to specify for which event which system function is to be executed.

12.6. Compiling the Configuration



Compile (only changes) 

- Here, all changes since the last generation are regenerated.
  → Delta generation

Software/Hardware (rebuild all blocks)

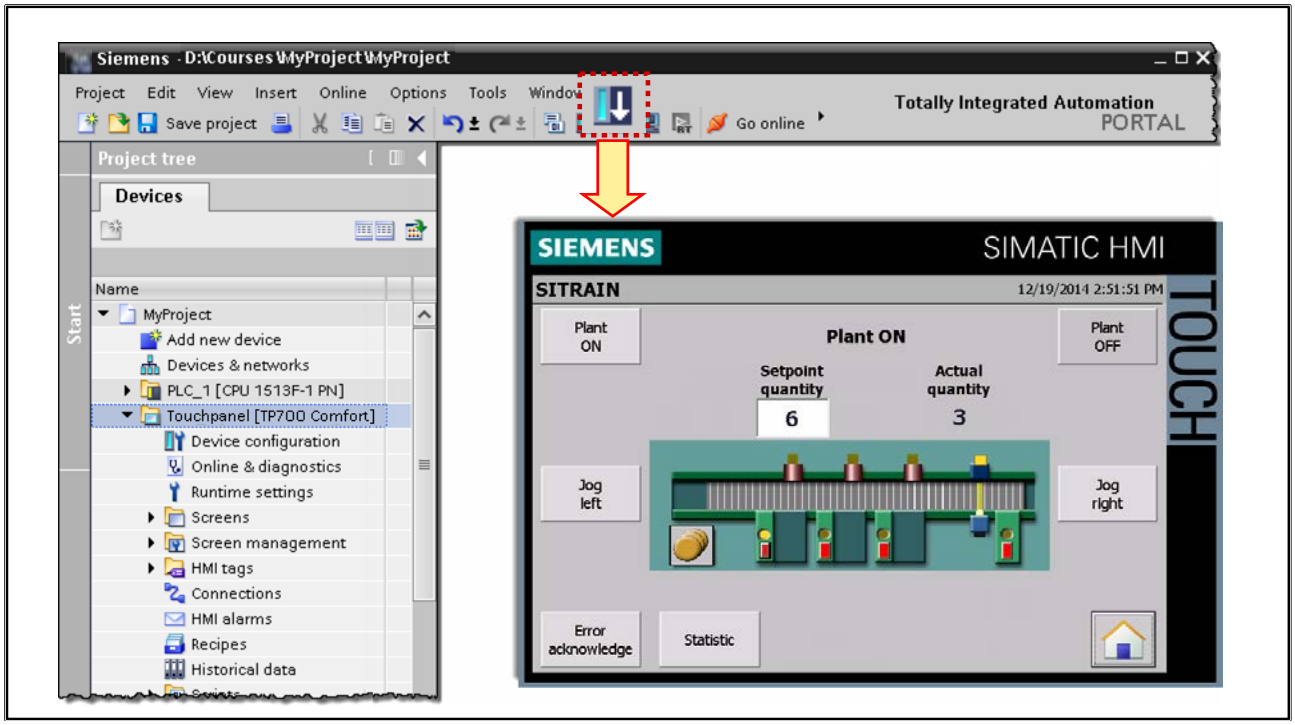
- Regenerates the entire operator panel.

When is a Rebuild all blocks necessary?

- When correctly configured functions are not correctly executed or are not executed at all.

When error messages occur during compiling that are not "correct".

12.7. Downloading the Project into the HMI Device



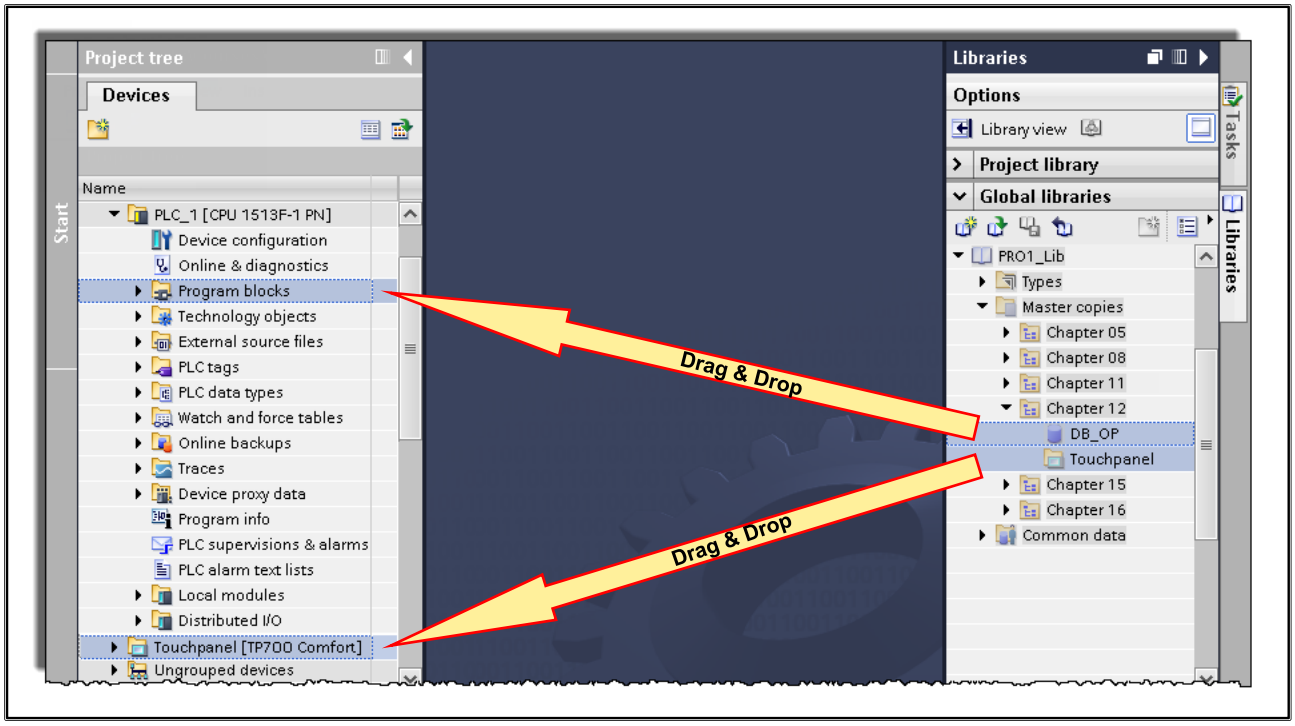
Downloading the Project into the HMI Device

When you transfer an HMI project to one or more operator panels, the part of the project that has been changed since the last transfer is automatically compiled before downloading. This ensures that the current project status is always transferred. Beyond that, it is also possible to activate the option "Overwrite all" before loading starts.

For commissioning, the project should be completely compiled using the command "Compile > Software (rebuild all blocks)" in the context menu of the operator panel. If HMI tags that are connected to PLC tags are also used in the project, all modified STEP 7 blocks should also be compiled using the command "Compile > Software" in the context menu and then be downloaded into the CPU.

In order to reduce the time required for compiling delta data in current engineering sessions, it is also recommended that you occasionally use the "Compile > Software (rebuild all blocks)" command.

12.8. Exercise 1: Copying the Touchpanel Project and the Interface DB into the Project

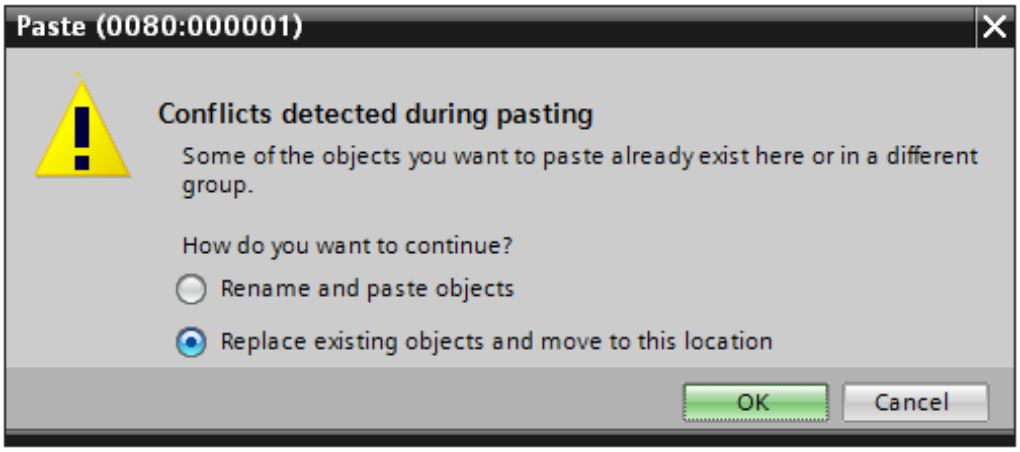


Task

Up until now, your project doesn't contain an HMI device. Instead of a completely new configuration, you are to copy an already configured Panel and the data block "DB_OP" that is to serve as the interface between the controller and the touchpanel, from the global library "PRO1_Lib" into your project.

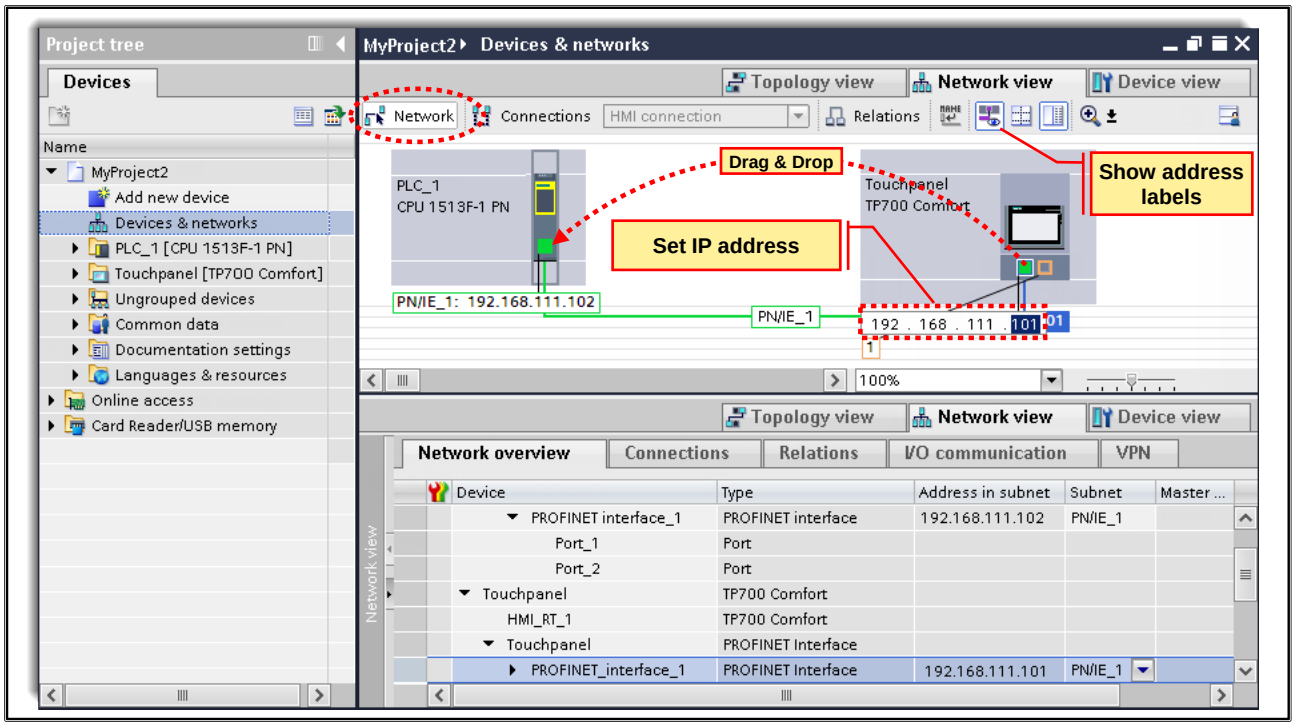
What to Do

1. Open the global library <Drive>:\02 Archives\TIA_Portal\TIA-PRO1\PRO1_Lib.
2. Using drag & drop, copy the library element "DB_OP" into your project (see picture) and, in the dialog that appears, confirm that objects that already exist in the project are to be overwritten.



3. Using drag & drop, copy the library element "Touchpanel" into your project (see picture).
4. Save your project.

12.8.1. Exercise 2: Networking the Touchpanel

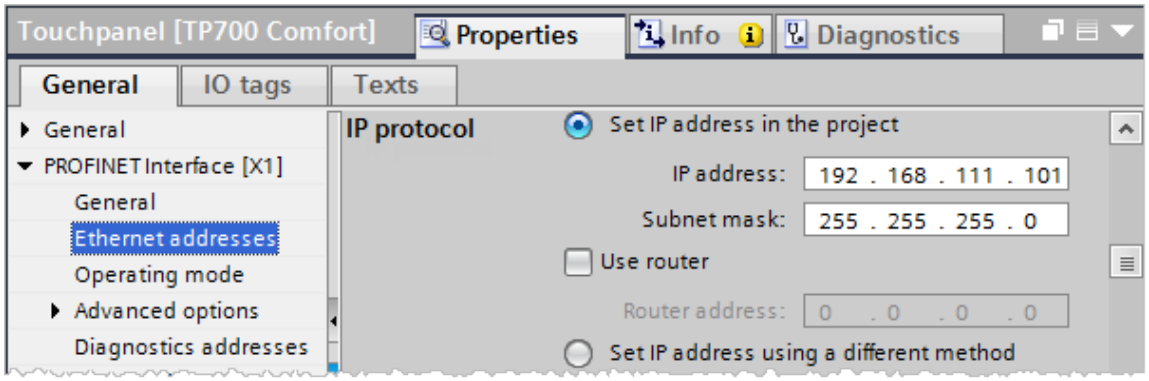


Task

The added touchpanel is to be networked offline with the Ethernet network.

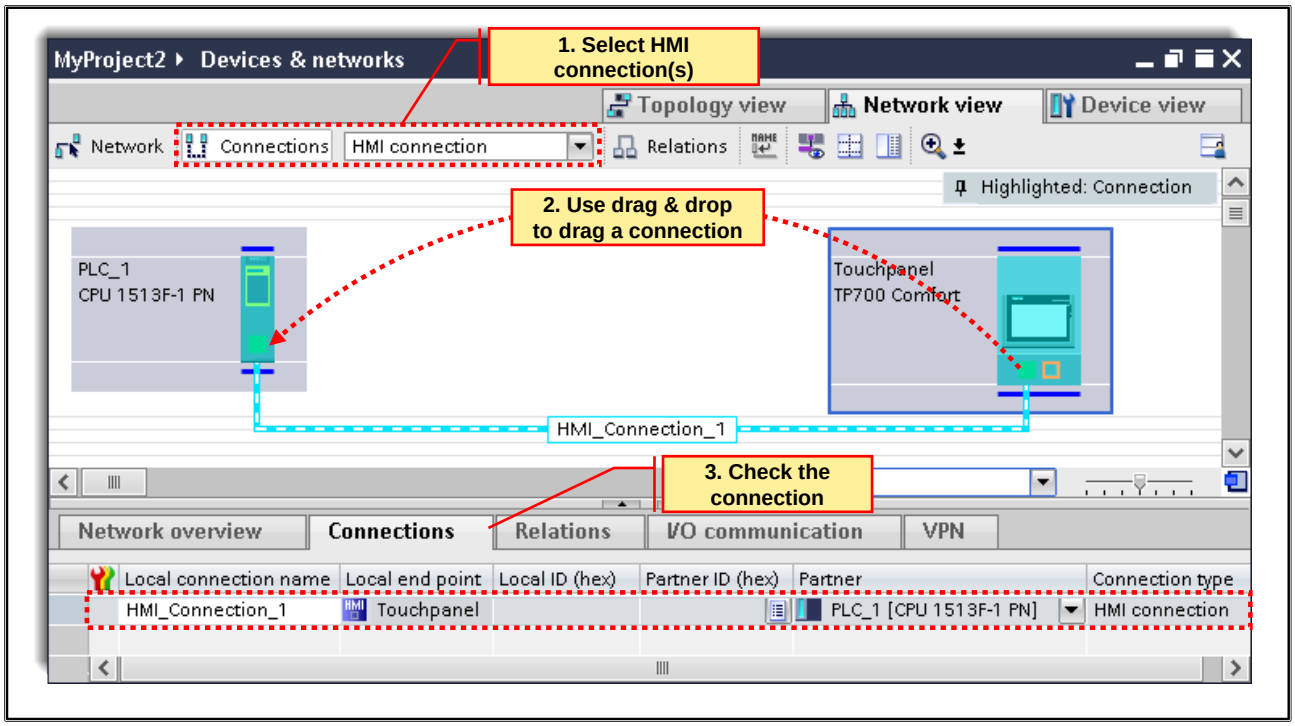
What to Do

1. In the Project tree, start the Hardware and Network editor, switch to the "Network view" and there select "Network".
2. Position the mouse pointer on the small green square of the HMI device and, while keeping the left mouse button pressed down, drag a connection to the CPU. The network is created; the associated subnet and the parameters appropriate for the network (IP address and subnet mask) are automatically created.
3. With the help of the “Show address labels” button, show the IP addresses, check the IP addresses of the CPU (192.168.111.102) and the touchpanel (192.168.111.101) and, if necessary, correct these.
   This can be set directly at the shown address or also via the Properties of the devices in the Inspector window.



4. In the Network view, the interfaces of the CPU and the touchpanel should be connected with the same subnet.

12.8.2. Exercise 3: Configuring the HMI Connection



Task

After the TP has been networked with the Ethernet network, an HMI connection between the TP and the CPU must be created. You can use the automatically assigned name of the connection, "HMI_Connection_1", without changing it.

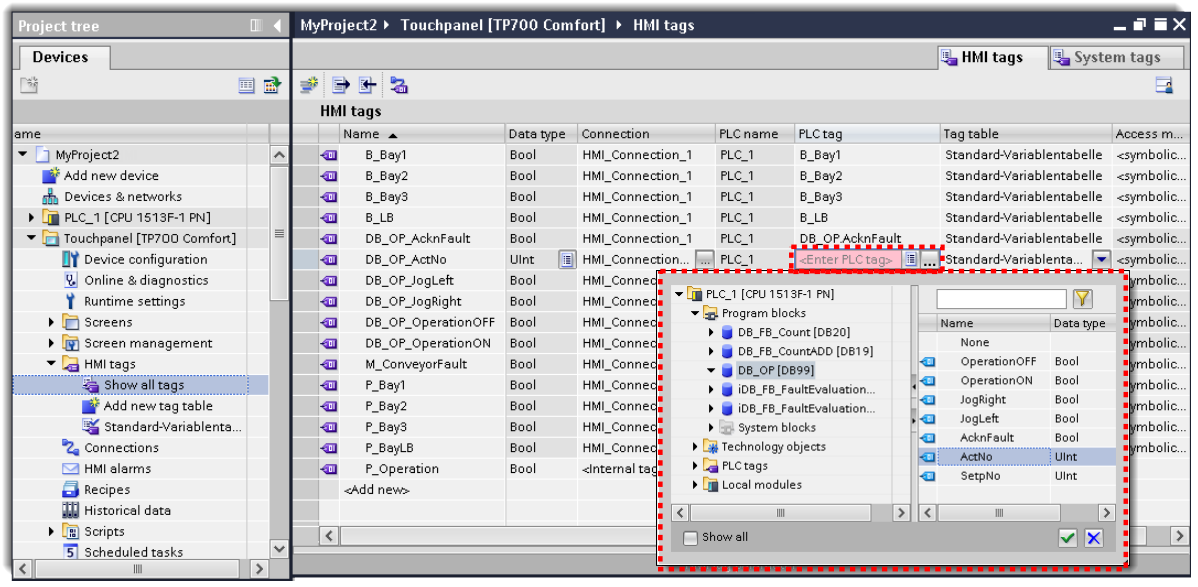
What to Do

1. In the Network view, switch from "Network" to "Connections" and there select "HMI connection" (see picture).
2. Position the mouse pointer on the small green square of the HMI device and, while keeping the left mouse button pressed down, drag a connection to the CPU. The connection is created and given the default name "HMI_Connection_1".

   In the Details window in the "Connections" tab, check whether the HMI connection was correctly created (see picture).
   You should also be able to see the connection in the Connections folder of the touchpanel.

   - ➢ If, in the graphic area, the type of connection between the S7-CPU and the HMI device is not displayed but only the network(ing) is displayed, then position the mouse pointer on the network and, in the dialog window that appears, select the connection or double-click on the connection in the tabular area.
3. Save your project.

12.8.3. Exercise 4: Updating and Completing the HMI Tag Table



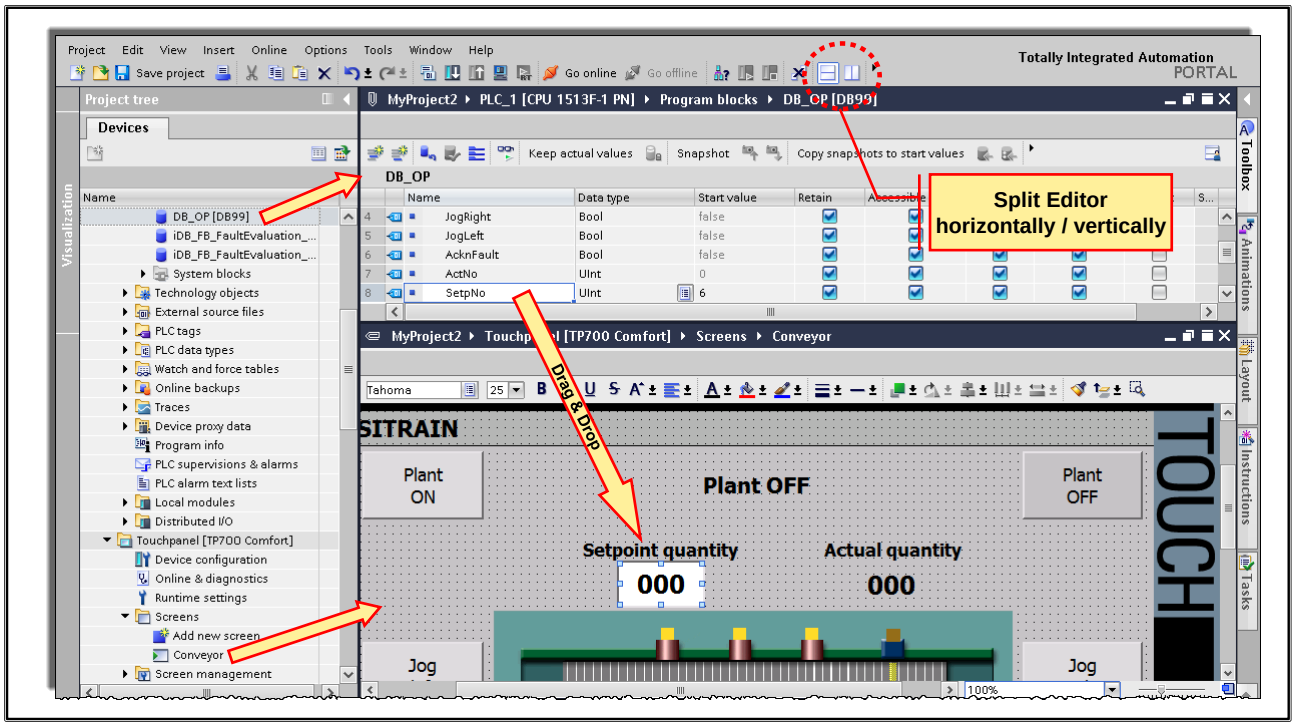
Task

The HMI tags "P_Operation", "M_ConvFault" and "DB_OP_ActNo" are not yet connected to PLC tags; for other tags, the "connection" is possibly highlighted in red. Your task is now to supplement missing tag connections and to correct faulty connections.

What to Do

1. Open "Show all tags" in the HMI tags folder of the Touchpanel.
2. Correct the first faulty (highlighted in red) connection by selecting the existing connection "HMI_Connection_1".
3. Adopt the connection of the corrected tag for all other tags. The fastest way to do this is to select the tag connection, click on the lower right corner of the cell and, while keeping the left mouse button pressed down, drag it over all other cells (familiar Excel function). Confirm the "Autocompletion" dialog that follows with the selection "Overwrite Tag attributes".
4. Connect the HMI tags that are not yet connected to the corresponding PLC tags. Proceed as shown in the picture.
5. Save your project.

12.8.4. Exercise 5: Configuring the SETPOINT Quantity Display

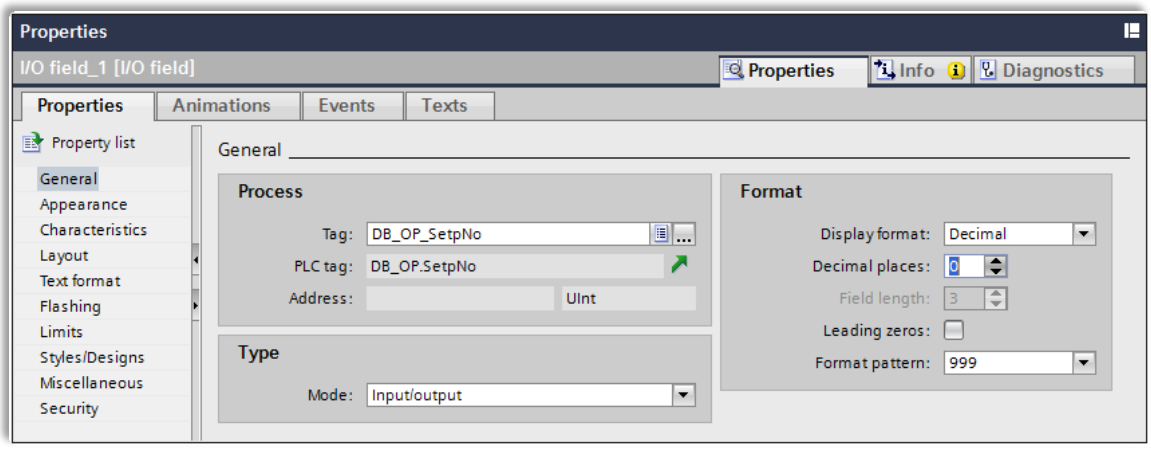


Task

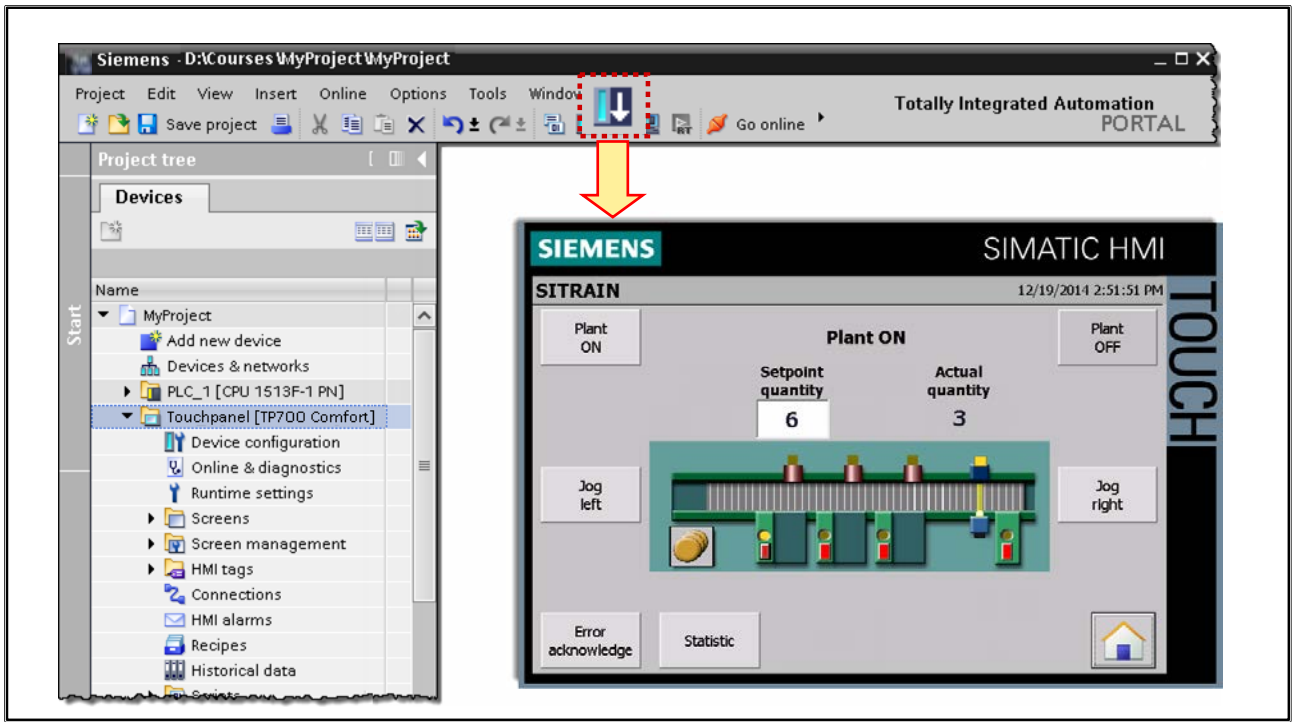
Up until now, the SETPOINT quantity of the parts to be transported was preset with the value 3 via the tag "DB_OP.SetpNo". Now, you should be able to preset the SETPOINT quantity via an input field on the touchpanel instead. For that, an additional input/output field must be configured in the touchpanel screen (see picture).

What to Do

1. Close all objects that are open in the Editor.
2. Open the "DP_OP" data block in which the SETPOINT quantity is stored.
3. As well, open the "Conveyor" screen in the "Screens" folder of the Touchpanel.
4. Split the Editor area in two using the button shown in the picture.
5. Configure the input field for specifying the setpoint quantity by dragging the "SetpNo" tag from the data block into the screen using drag & drop.
6. Select the newly created input/output field and in the Inspector window in "Properties -> General -> Format" set the "Format pattern" (three digits). In addition, you can adjust how everything looks in the menus "Appearance" and "Text format".



12.8.5. Exercise 6: Compiling and Saving the Touchpanel



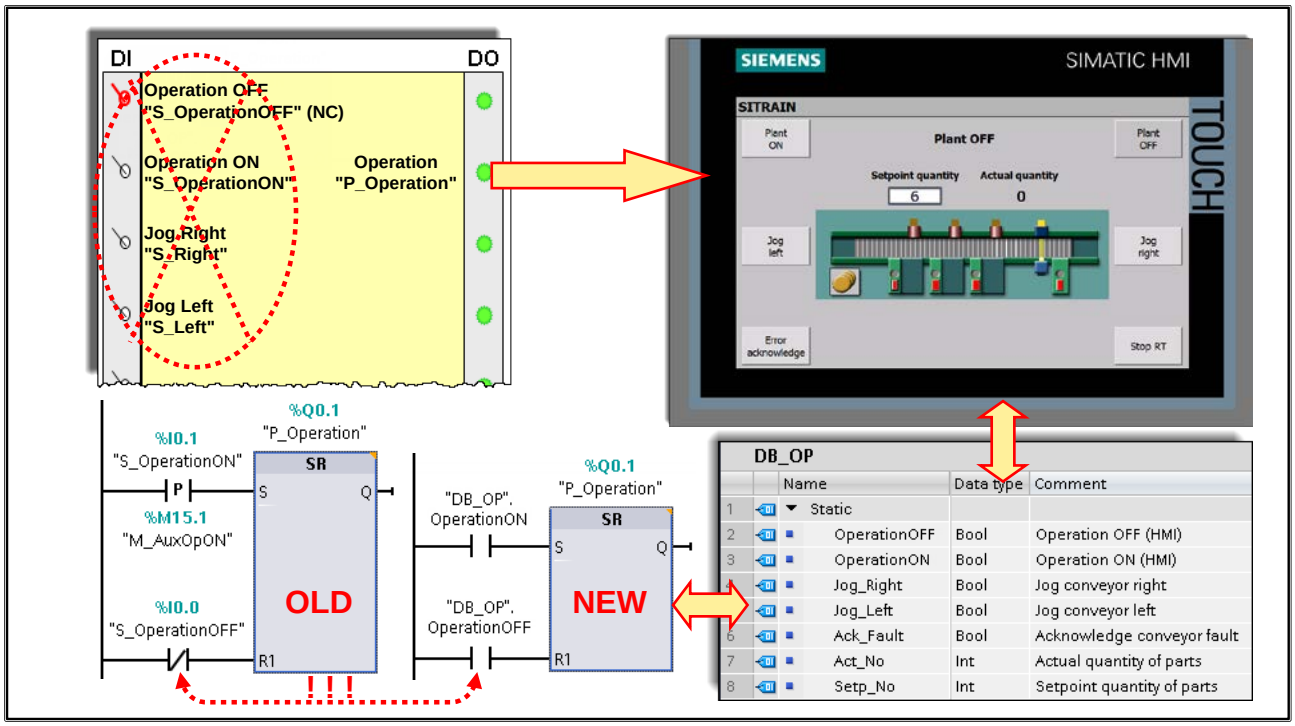
Task

You are to compile and save the now complete HMI project.

What to Do

1. Compile the HMI project by selecting the touchpanel in the Project tree and then clicking on the "Compile" button (see picture).
2. In the Inspector window under "Info", read the results of the compilation and eliminate any errors which may have occurred.
3. Save your project.

12.8.6. Exercise 7: Adjusting the STEP 7 Program



Task

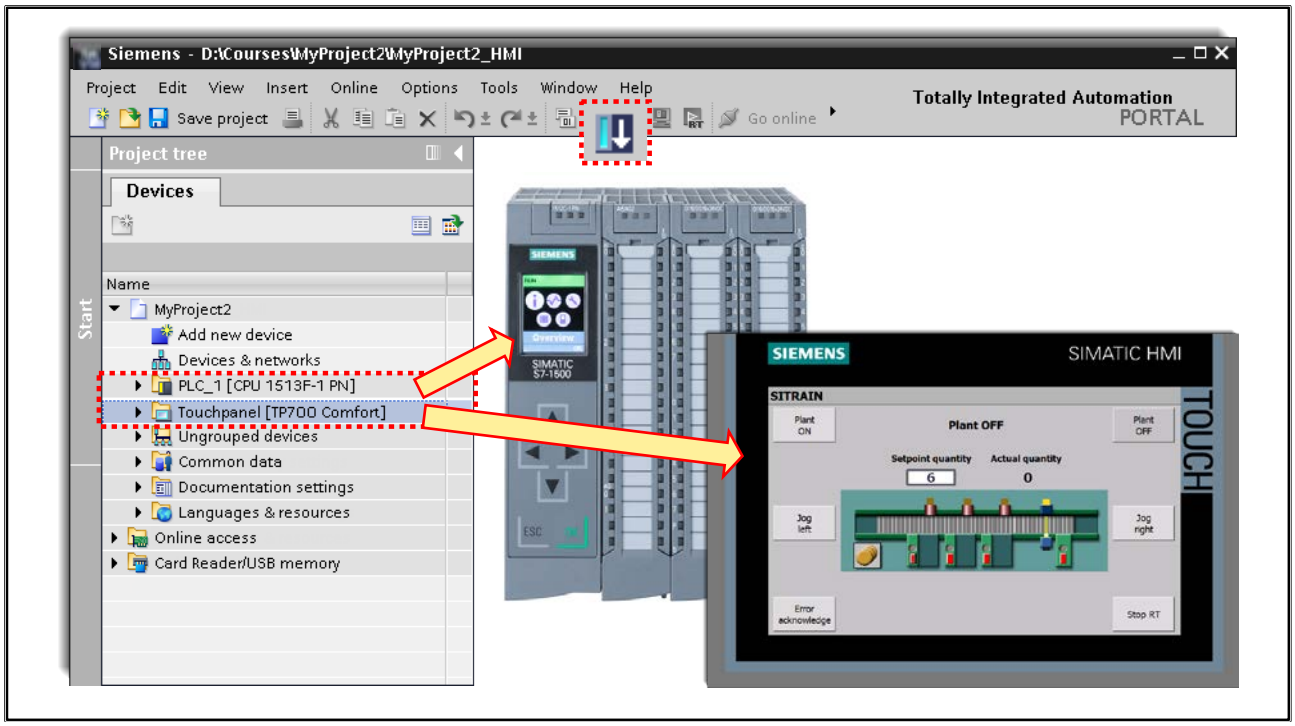
The S7 program of the controller is to be adjusted in such a way that …

- the functions "Operation ON/OFF" and "Jog Right/Left" are no longer realized via the simulator switches but via the corresponding buttons on the touchpanel.
- the acknowledgement of a conveyor fault should still be possible via the simulator switch "S_Acknowledge" (I 0.7), and, in addition, also via the corresponding button on the touchpanel.
- The SETPOINT quantity is no longer a constant 3, but can be preset via an input/output field on the touchpanel.

What to Do

1. In "FC_Mode", replace the variables "S_OperationON" (I 0.1) and "S_OperationOFF" (I 0.0) with the corresponding DB tags (see picture). Remember to also take into account that a hardware-based NC contact is connected to "S_OperationOFF" (I 0.0).
2. Expand "FC_Fault" in such a way that a fault acknowledgement is still possible via "S_Acknowledge" (I 0.7) and, in addition, also via the touchpanel, that is, the DB tag "DB_OP".AcknFault .
3. In "FC_Conveyor", replace the variables "S_Right" (I 0.2) and "S_Left" (I 0.3) with the corresponding DB tags.
4. Compile and save your program.

12.8.7. Exercise 8: Downloading the HMI and CPU Project



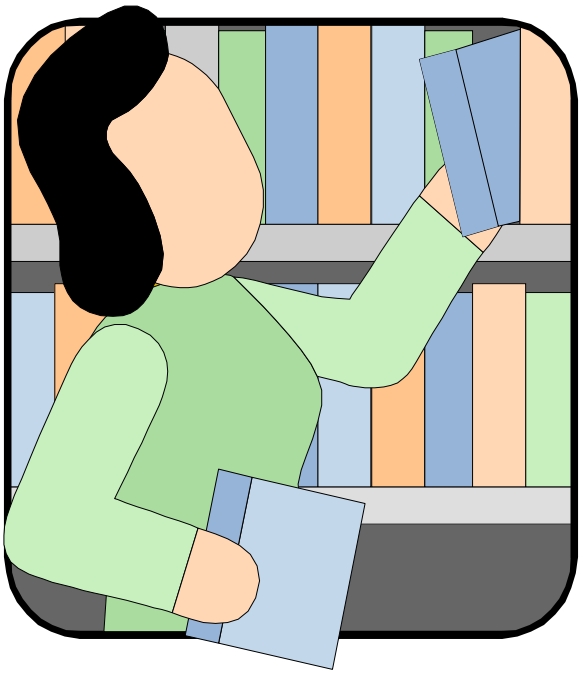
Task

From the now complete project, all S7 blocks are now to be transferred once more into the CPU and the entire Panel project is to be transferred into the touchpanel.

What to Do

1. Download all S7 blocks into the CPU.
2. Download the Panel project into the touchpanel.
3. Carry out a function test by
   - Switching the Operation ON and OFF via the touchpanel.
   - When Operation is OFF, jog the conveyor model to the right and left using the touchpanel.
   - When Operation is ON, preset a SETPOINT value and start transporting parts,
   - Monitor how the ACTUAL number is updated.
   - Cause a conveyor fault, monitor its display on the touchpanel and acknowledge it on the touchpanel.
4. Correct – if necessary – your program and check the functions once more.
5. Save your project.

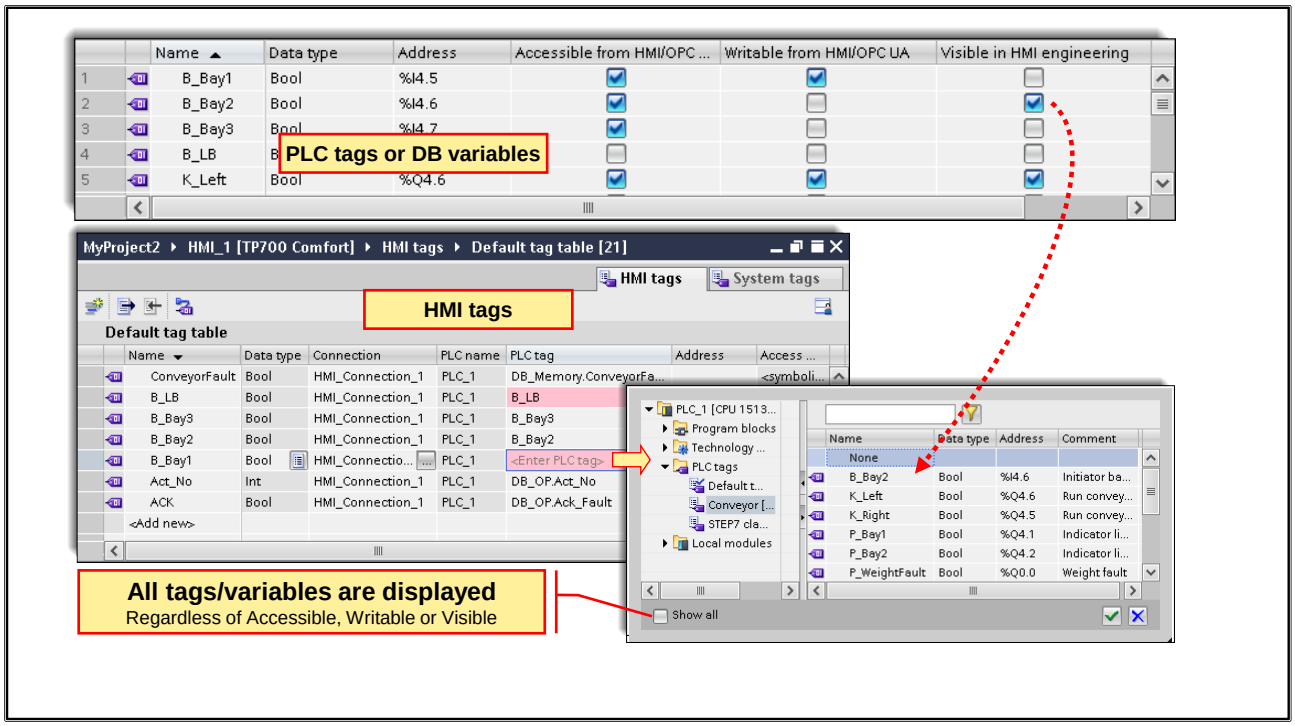
12.9. Additional Information



Note

The following pages contain either further information or are for reference to complete a topic. For more in-depth study we offer advanced courses and self-learning mediums.

12.9.1. HMI/OPC UA Access to PLC Tags and DB Variables



HMI Tag Access

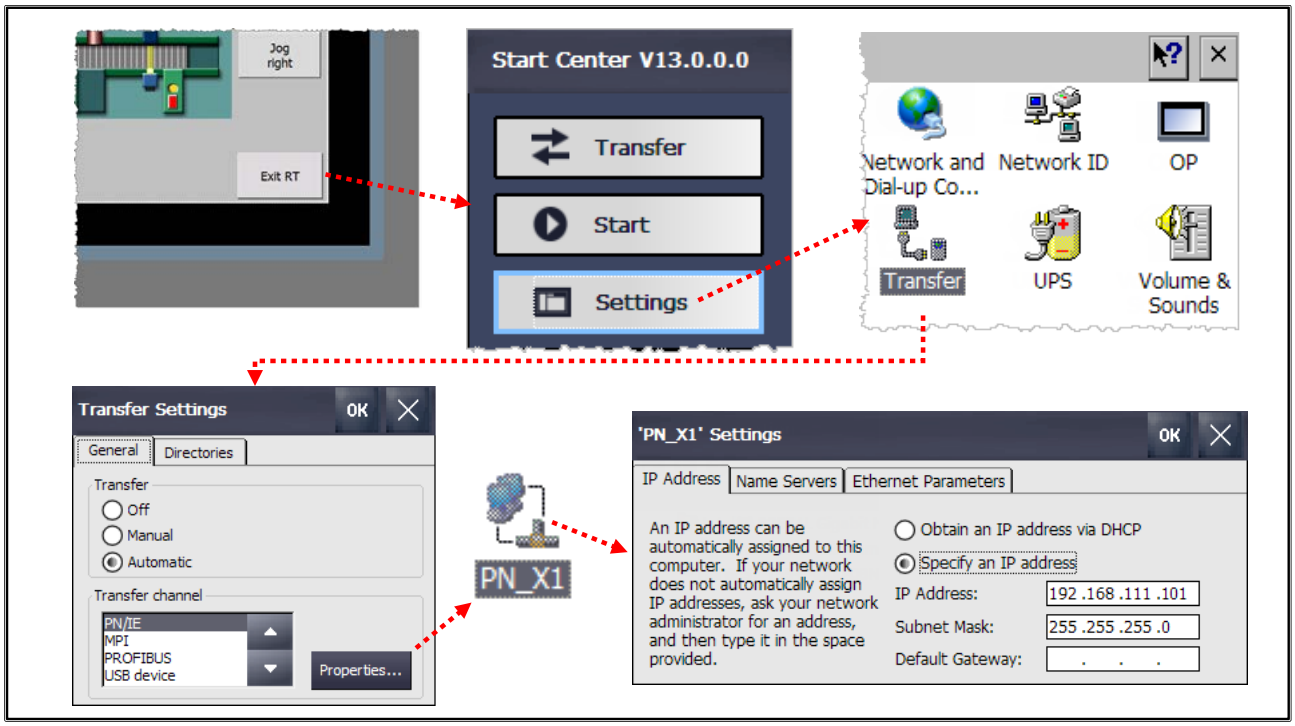
In the PLC tag tables and data blocks, protective mechanisms can be declared with whose help unwanted accesses to PLC tags and DB variables from HMI devices or OPC UA-Clients can be prevented:

- "Visible in HMI Engineering":
  During HMI configuration, only tags/variables with the attribute "Visible in HMI Engineering" can be selected. This filter function can, however, be disabled in the selection dialog shown by activating "Show all".
- "Writable from HMI/OPC UA" (only S7-1200 and S7-1500):
  This indicates whether the tag/variable can be written from HMI / OPC UA at runtime. This protective function integrated in the S7-1200/1500 operating system ensures that the HMI device or OPC UA-Client does not overwrite certain tags/variables.
- "Accessible from HMI/OPC UA" (only S7-1200 and S7-1500):
  The HMI device can only access online the tags/variables which have the attribute "Accessible from HMI/OPC UA". This protective function integrated in the S7-1200/1500 operating system ensures that the HMI device or OPC UA-Client can neither read-access nor write-access certain tags/variables. Tags/variables which are not "Accessible from HMI/OPC UA", accordingly are also not "Visible in HMI Engineering".

Note:

OPC UA is a standard which enables operating system platform-independent data exchange.

12.9.2. Manually Setting the IP Address on the Panel



Manually Setting the IP Address of a Panel

You can manually set the IP address of the Panel's interface via the Start Center > Settings.