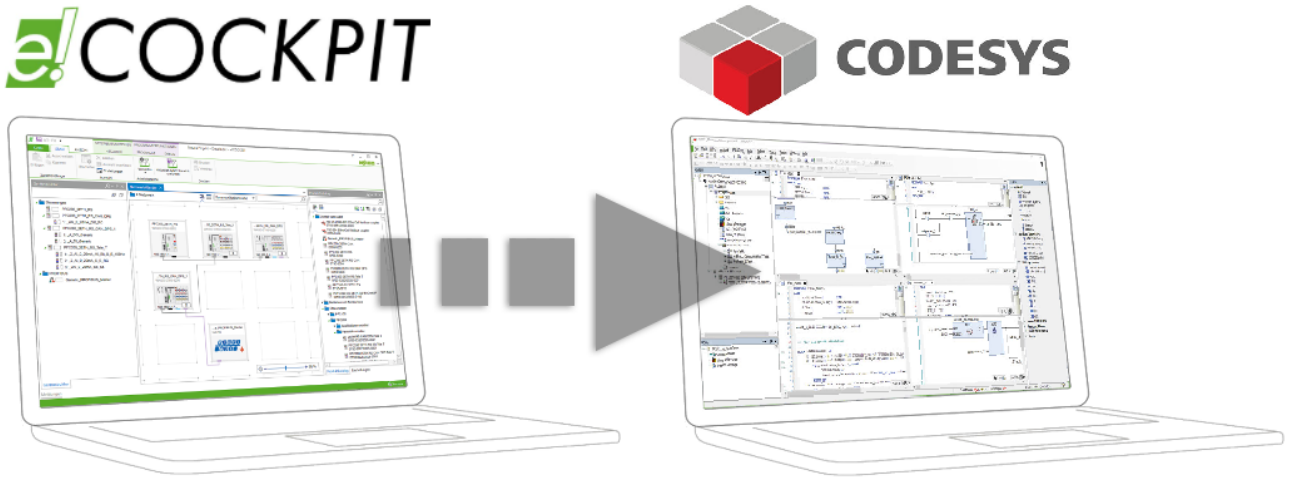
TECHDOCS

Migration Guide

Migration from *e!COCKPIT* projects to CODESYS V3.5



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WAGO GmbH & Co. KG
Hansastraße 27
D - 32423 Minden
Phone: +49 571/887 – 0
E-Mail: info@wago.com
Internet: www.wago.com

Technical Support
Phone: +49 571/887 – 44555
E-Mail: support@wago.com
Internet: www.wago.com/support

Every conceivable measure has been taken to ensure the accuracy and completeness of this documentation. However, as errors can never be fully excluded, we always appreciate any information or suggestions for improving the documentation.

E-Mail: documentation@wago.com

Table of Contents

1 Provisions

This document is intended as a guide for the migration of ***e!****COCKPIT* projects to CODESYS.

The software must only be installed and operated in accordance with the operating instructions. Knowledge of the operating instructions is required for proper use.

The legal information in the document applies accordingly:

🕮 **Product Manual e!COCKPIT** (also available as **e!*COCKPIT* Online help**).

You can find more information on ***e!****COCKPIT* at: **www.wago.com**.

You can find more information on CODESYS V3.5 in the CODESYS online help at **help.codesys.com** (up to service pack 17) and in the new online help at **helpme-codesys.com** (current service pack).

Limitation of Liability

This documentation describes the use of various hardware and software components in specific example applications. The components may represent products or parts of products from different manufacturers. The respective operating instructions from the manufacturers apply exclusively with regard to intended and safe use of the products. The manufacturers of the respective products are solely responsible for the contents of these instructions.

The sample applications described in this documentation represent concepts, that is, technically feasible application. Whether these concepts can actually be implemented depends on various boundary conditions. For example, different versions of the hardware or software components can require different handling than that described here. Therefore, the descriptions contained in this documentation do not form the basis for assertion of a certain product characteristic.

Responsibility for safe use of a specific software or hardware configuration lies with the party that produces or operates the configuration. This also applies when one of the concepts described in this document was used for implementation of the configuration.

WAGO GmbH & Co. KG is not liable for any actual implementation of the concepts.

2 Overview

The CODESYS V3.5 software represents an additional engineering solution alongside ***e!*** *COCKPIT*, which is based on an open platform and can already be used for many WAGO controllers.

This migration guide provides an overview of all the important issues for migrating ***e!****COCKPIT* projects to CODESYS. ***e!****COCKPIT* is based on CODESYS, so the IEC programming basis is identical for both software products. However, ***e!****COCKPIT* differs in terms of the handling and integration of software or device components. This guide offers assistance and tips and gives recommendations that must be followed when switching from ***e!****COCKPIT* to CODESYS in order to continue using projects in CODESYS or to create new ones.

3 General Information

Firmware and Compatibility

Project conversions from ***e!****COCKPIT* to CODESYS are already supported for many WAGO devices. For the list of compatible devices, refer to the release notes included in the downloaded firmware packages from the **WAGO Download Center**.

Prerequisite for the conversion:
Before conversion, ***e!****COCKPIT* projects must be updated in ***e!****COCKPIT* to the ***e!****COCKPIT* version 1.11, firmware version 22, compiler version 3.5.17; see **Updating a Project in *e! COCKPIT* [▸ 8]**.
Devices that are used in the project must then be updated to firmware version 23 through a firmware update. CODESYS Runtime is supported on the firmware side for this version and above (see **Updating Firmware for Use in CODESYS [▸ 8]**).

Note: You cannot update a device with firmware version 22 directly to firmware version 24 in CODESYS. This requires a few additional steps; these are described through the examples of **Edge Controllers/Touch Panels 600 [▸ 33]** and **PFC200s [▸ 40]**.

The **WAGO Download Center** offers a 64 bit version of CODESYS V3.5 for download (recommended: CODESYS SP17 Patch 3, firmware version 23). If a 32 bit version has already been installed via CODESYS, it can also be used.

Parallel operation of ***e!****COCKPIT* and CODESYS on one PC is possible.

Licenses

CODESYS itself can be used free of charge and without a license. However, some additional components require a license.

Licenses for fee-based **CODESYS components** that you have already purchased for ***e!*** *COCKPIT* (for example, the “Profiler,” “Static Analysis,” “UML” or “SVN” add-ons) cannot be reused in CODESYS. Licenses cannot be transferred due to the differences between the two software products’ license models. However, CODESYS offers bundles of different components that you can purchase together in one software package. You can transfer and synchronize these licenses using CODESYS mechanisms (“Tools” tab > “License Manager”/“License Repository”).

The required licenses for fee-based **WAGO components** (e.g., certain WAGO libraries, telecontrol configurators or WAGO Solution Builder) are indicated in CODESYS with the help of the CODESYS “WAGO Licensing” add-on. To transfer the required WAGO licenses, use WAGOupload.

4 Installing and Launching

The following components are available for starting the migration of your project and working with CODESYS. Download the components you need via the WAGO Download Center and other links provided.

Through the WAGO Download Center (downloadcenter.wago.com), you can obtain:

- Applications such as CODESYS V3.5, the WAGO Navigator for receiving updates or WAGOupload for updating the firmware.
  You also need WAGOupload in order to transfer licenses from WAGO components to devices.
- Device descriptions, CODESYS libraries and visualization styles for WAGO devices
- Firmware for WAGO devices
- WAGO add-ons (e.g., WAGO Telecontrol, WAGO Solution Builder, WAGO Licensing)

All the desired components can be downloaded from the WAGO Download Center, either individually or as a package you can assemble individually.

Through the WAGO website, you can obtain:

- WAGO I/O-*CHECK* software (fee-based) (**WAGO I/O-CHECK**)
  You need the WAGO I/O-*CHECK* software in order to configure I/O modules.

Tip: If you need further WAGO components (e.g. a specific firmware version, device description, application etc.), you will find them in the WAGO Download Center under **downloadcenter.wago.com**.

4.1 Updating a Project in *e!COCKPIT*

You must first make sure that your project works in ***e!***COCKPIT with firmware version 22. Since this firmware already uses the same compiler version (3.5.17) as you will then use to perform the conversion to CODESYS, this preliminary test can be used to minimize sources of error.

✓ You need to have opened your project in ***e!***COCKPIT.

1. In the Backstage view > "Updates & Add-ons" page, check whether you are using the latest ***e!***COCKPIT version 1.11. If not, select it and install the update.
2. Update the firmware of your devices to firmware version 22, if you have not already. For a description of the firmware changes, see **Downloading the Firmware** and **Replacing the Firmware** in the ***e!***COCKPIT manual.
3. Check whether the updated project works as desired.

4.2 Updating Firmware for Use in CODESYS

✓ You need to have downloaded and unpacked the firmware. The firmware is available as *.wup and *.img file.
Note: Firmware version 23 is required for using WAGO devices with CODESYS Runtime (see **General Information [▸ 6]**). After the update, use the devices only in CODESYS. If you want to use firmware version 24, this online help provides two examples of migrating **Edge Controllers/Touch Panels 600 [▸ 33]** and **PFC200 [▸ 40]**.

- Load the firmware onto your device(s) either with WAGOupload (*.wup) or via SD card (*.img):

Updating Firmware with WAGOupload

1. Click **[Update Firmware]** in WAGOupload. A wizard guides you through the different steps of the firmware update.
2. Enter the IP address of the controller and select **[Find Controller]**.
3. Check the box to the left of the desired controller.
4. Select the update file (*. wup).
5. Perform the firmware update.

or

Updating Firmware via SD Card

1. Copy the firmware file (*.img) to the SD card, for instance using the "Win32 Disk Imager" or "UNetbootin" freeware tool.
2. Switch the controller off, insert the memory card into the SD slot and switch the controller back on.
   ⇨ The controller boots from the memory card with the firmware image to be installed.
3. After the controller boots up, open the WBM "Administration" page > "Create Boot Image" (you may have to change the IP address temporarily to do so).
4. To create a new boot image on the internal memory, click **[Start Copy]**.

5. After the process is complete, turn the controller off, remove the memory card and turn the controller back on.

   ⇨ The controller now starts with the new firmware version.

4.3 Installing CODESYS

1. Download CODESYS.
   Note: Use only the following CODESYS version for migrating ***e!****COCKPIT* projects:
   CODESYS V3.5 Service Pack 17 (3.5.17.3)
2. Install CODESYS.
3. Open CODESYS and install additional components from CODESYS as described below.

4.4 Installing CODESYS Add-ons

Note: To install files, you must be logged into the CODESYS Installer as an administrator.

✓ You need to have downloaded and unpacked CODESYS.

1. On the "Tools" tab, click **CODESYS Installer**.
   Note: If you cannot find the CODESYS installer (for the relevant the CODESYS version/ update) under "Tools," open it alternatively via the Start menu > "CODESYS" > "CODESYS Installer."
2. In the lower "Add-ons" section, click **[Install Files]** and select the downloaded package files.

4.5 Installing WAGO Components collectively via Package Files

Note: To install files, you must be logged into the CODESYS Installer as an administrator.

✓ You have downloaded a package that contains several device descriptions and/or libraries, visualization styles, etc. You can install package contents together in only one step.

1. On the "Tools" tab, click **CODESYS Installer ...** (via the "Tools" tab or the Start menu > "CODESYS" > "CODESYS Installer").
2. In the lower section, click **[Install File]**.
3. Select the respective *.package file and click **[Open]**.

➡ All components contained in the *.package file are installed.
Installed device descriptions/devices are now automatically displayed for you to select when you create a new project and select "Standard Project" as the template. I/O modules resulting from the installed device descriptions are also displayed when you search for I/O modules (right-click on "kbus" > **Scan for Devices ...**).

4.5.1 Integrating Available WAGO Device Descriptions and Libraries into CODESYS

CODESYS can search configured lists of servers for device descriptions and libraries. Install the "WAGO CODESYS Download Server" package to enter links to corresponding WAGO download servers in CODESYS. That way, you automatically always have access to all available WAGO device descriptions and libraries.

1. Download the "WAGO CODESYS Download Server" package in the WAGO Download Center (downloadcenter.wago.com).
2. In CODESYS, click **[CODESYS Installer...]** on the "Tools" tab.
3. Click **[Install File]** in the lower area.
4. Select the *.package file to download and click **[Open]**.
   ⇨ All components in the *.package file are installed.
5. If device descriptions are missing, you can now reload them automatically. Note that the **[Download Missing Descriptions]** button only appears if a project has been loaded that uses devices or libraries that are not installed.

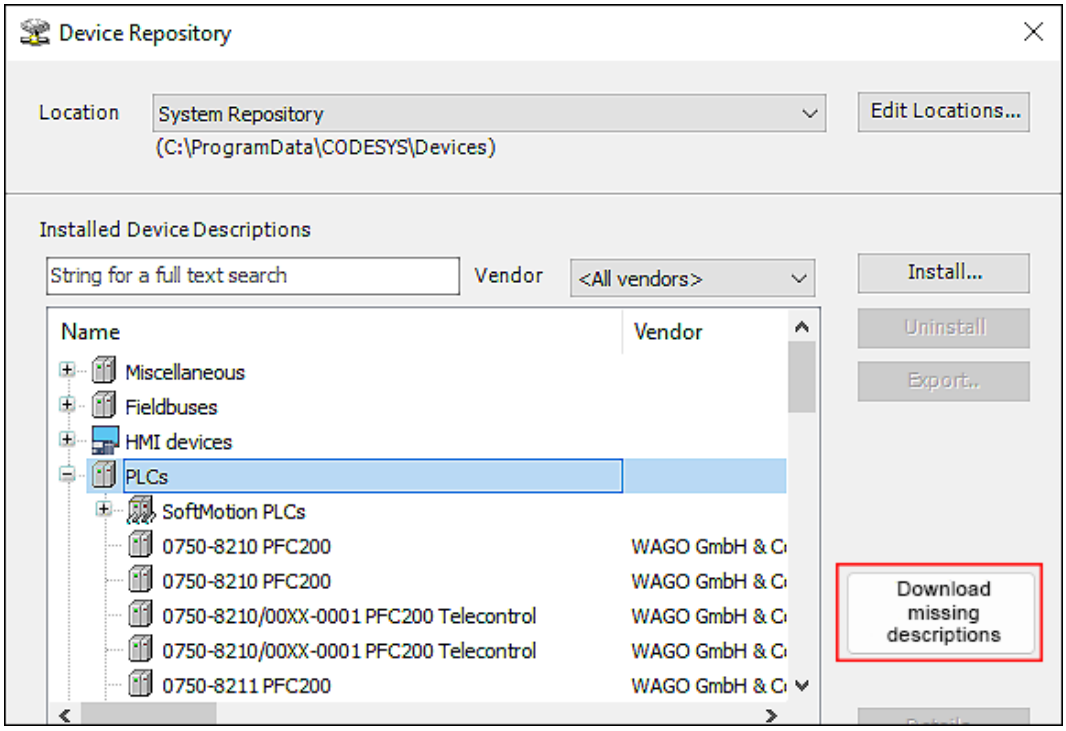

Figure 1: Download Missing Device Descriptions

   ⇨ The WAGO server for libraries is also integrated.
6. If a missing WAGO library is available on the WAGO server, you can now load it in the library manager.

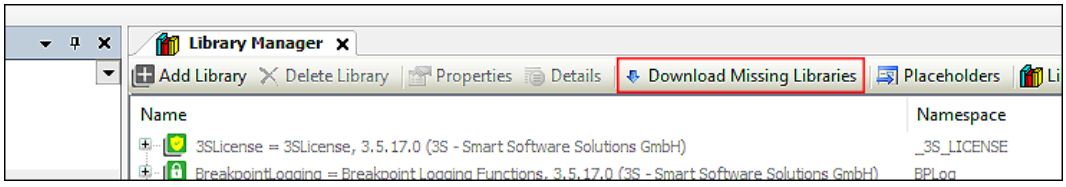

Figure 2: Adding Missing Libraries

Tipp: The WAGO Download Center and the WAGO Navigator are linked in the "WAGO" tab of the menu ribbon for quick access to components.
When downloading CODESYS via the **WAGO Download Center**, WAGO offers a bundle download that already contains all available device descriptions.
If you use the **WAGO Navigator** for downloading, the **[Download & Install]** button automatically installs the components in the correct order after downloading.

4.5.2 Installing WAGO Device Descriptions separately

If you need devices/device descriptions that are not included in a package, you can also load them individually later.

Tip: If you do not have the device description file, visit WAGO's website and search for your device (e.g., 750-337). In the lower section of the product page under "Downloads" > "Device Files," you can download the file.

1. On the "Tools" tab, click **Device Repository ...**.
2. Click **[Install ...]**.
3. Select the device description.
4. Click **[Open]**.

➡ The device description has been installed.

4.5.3 Installing WAGO Libraries separately

If you need libraries that are not included in a package, you can also load them individually later:

1. On the "Tools" tab, click **Library Repository ...**.
2. Click **[Install ...]**.
3. Select the library.
4. Click **[Open]**.

➡ The library is installed.

Tip: If you want to use a library that you have already used in ***e!****COCKPIT*, for example, you can export the library from ***e!****COCKPIT* as follows: Open the library manager in ***e!****COCKPIT*. In the manager, right-click the desired library and select **Export Library**. This gives you a compiled library that you can use in CODESYS.

Note: If you use a licensed library, e.g. the library "WagoAppPowerPlantcontrol", then you must use the latest version of these libraries. Older versions of licensed libraries from ***e!****COCKPIT*, which may be further used in a CODESYS project, can lead to errors when compiling the project (see also **Adding Missing Libraries and/or Library Licenses [▸ 49]**).

4.5.4 Installing WAGO Visualization Styles separately

If you need visualization libraries that are not included in a package, you can also load them individually later:

1. On the "Tools" tab, click **Visualization Style Repository ...**.
2. Click **[Install ...]**.
3. Select the visualization styles.
4. Click **[Open]**.

➡ The visualization styles are installed and available through the visualization manager.

4.6 Installing the "WAGO Telecontrol" Add-on

Note: To install files, you must be logged into the CODESYS Installer as an administrator.

✓ You need to have downloaded and unpacked "WAGO Telecontrol" add-on.

1. Open the **CODESYS Installer** (via the "Tools" tab or the Start menu > "CODESYS" > "CODESYS Installer").
2. Click **[Install Files]** in the lower area and select the downloaded *.package file.
3. For information on how to integrate the installed configurator into your project, see **"WAGO Telecontrol" Add-on "(Telecontrol Configurator) – First Steps [▸ 62]**.

4.7 Installing the "WAGO Solution Builder" Add-on

Note: To install files, you must be logged into the CODESYS Installer as an administrator.

✓ You need to have downloaded and unpacked "WAGO Solution Builder" add-on.

1. Open the **CODESYS Installer** (via the "Tools" tab or the Start menu > "CODESYS" > "CODESYS Installer").
2. Click **[Install Files]** in the lower area and select the downloaded *.package file.

➡ After installation, you will find the "WAGO Solution Builder" Add-on in the "WAGO" tab.

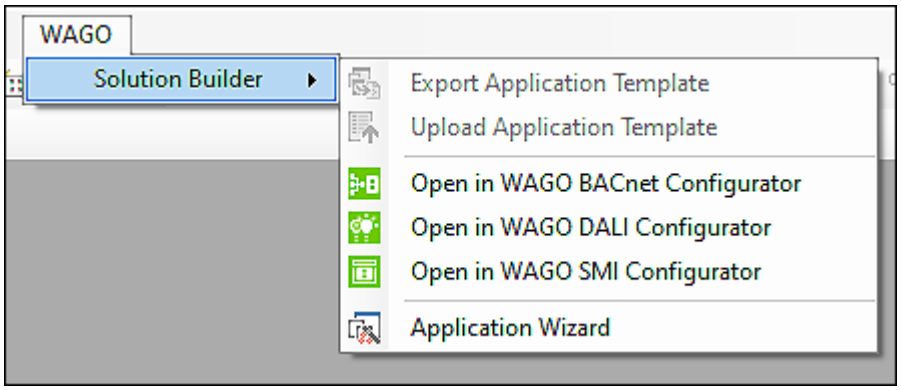

Figure 3: "WAGO Solution Builder" Add-on in the "WAGO" tab

4.8 Installing the "WAGO Licensing" Add-on

You need the add-on if you want to use licensed WAGO libraries or fieldbus functions from WAGO in CODESYS (e.g., certain WAGO libraries, the WAGO telecontrol configurator or WAGO Solution Builder). The "WAGO Licensing" add-on indicates the required licenses in CODESYS.

Note: To install files, you must be logged into the CODESYS Installer as an administrator.

✓ You need to have downloaded and unpacked the "WAGO Licensing" add-on.
You also need to have installed the WAGOupload software.

1. Open the **CODESYS Installer ...**. (via the "Tools" tab or the Start menu > "CODESYS" > "CODESYS Installer").
2. Click **[Install Files]** in the lower area.
3. Select the *.package file for the add-on.
4. To install the add-on, click **[Open]**.

⇨ The add-on shows you which licenses you need for your project.

4.9 Transferring Licenses with WAGOupload

If you have installed the "WAGO Licensing" add-on, required licenses are displayed in CODESYS in the message window. Transfer these licenses to the device using WAGOupload:

1. Click **[Manage Licenses]** in the WAGOupload main menu.
2. Click **[Add]** and enter your license data.
3. Go **[Back to the Main Menu]**.
4. Click **[Synchronize Licenses]**.
5. Enter the IP address of your controller, click **[Find Controller]** and select it from the list.
6. The **[Next]** button takes you to the list of licensed products.
7. Next to the licensed product, select the number of licenses to transfer, click **[Next]** and perform the synchronization.

➡ The device's licensing requirements are met.

Note: The "WAGO Licensing" add-on only applies to WAGO components; license-based CODESYS components are transferred/synchronized via CODESYS mechanisms ("Tools" tab > "License Manager"/"License Repository").

4.10 Installing and Using WAGO I/O-CHECK

I/O modules are not configured using CODESYS, but rather the WAGO I/O-*CHECK* software. You can obtain a license key and the CD with the software from the following page: **https://www.wago.com/global/software/wago-i-o-check/p/759-920** (fee-based). If you do not have a CD drive, you can obtain the download version after your purchase upon request from WAGO Support (**support@wago.com**).

5 Project Conversion

The basic steps in converting the project are as follows. First, read through the entire workflow before you begin.

Note: Note that an export of archives from ***e!****COCKPIT* cannot be used for conversion, because the exported device descriptions are not suitable for CODESYS Runtime, which is integrated in the firmware from firmware version 23. Similarly, certain actions cannot be performed in ***e!****COCKPIT*, certain actions cannot be performed in CODESYS, and you cannot import/export projects between the two tools multiple times. Perform the conversion to CODESYS only once and perform all further actions there exclusively.
The following initial steps apply equally to all fieldbuses. The conversion steps differ according to the fieldbus used. Note the example conversions for Modbus, CANopen, EtherNet/IP and EtherCAT.

5.1 General Information and Preparation for Conversion

1. Prepare your project and CODESYS installation as described in **Installing and Launching [▸ 7]**:
   - Update your ***e!****COCKPIT* version to 1.11.
   - In ***e!****COCKPIT*, update your projects to the newest version (firmware version 22, compiler version 3.5.17).
   - Check your application.
   - Update your devices' firmware to firmware version 23 or higher (with WAGOupload or an SD card).
   Note: Firmware 23 is required for a functional test after migration. Do not upgrade to newer firmware until you are sure that the migration was successful. After the update, use the devices only in CODESYS.
   If you want to use the firmware version 24, this online help provides two examples of migrating **Edge Controllers/Touch Panels 600 [▸ 33]** and **PFC200 [▸ 40]**.
   - Install CODESYS and all required components.
2. Make a backup copy of your project in case data is lost during conversion.
3. Now change your ***e!****COCKPIT* project's file extension from `*.ecp` to `*.project`.
4. In CODESYS click **Open Project** on the File tab and select the project file (`*.project`).
   ⇨ The project appears in the device tree. A red circle with a question mark indicates that device descriptions need to be updated.
   The "Project Environment" dialog also opens. This dialog shows all the settings related to visualization profiles/symbols and placeholders for which a newer version is available.
5. Update the project settings with **[OK]**.

Note:

- Libraries may be missing in the project during configuration. Some libraries may also require a license. Please refer to the notes under **Adding Missing Libraries and/or Library Licenses [▸ 49]**.
- Device descriptions may also be missing in the project. Install them afterwards if necessary (see **Installing WAGO Device Descriptions separately [▸ 11]**).

5.2 Project Conversion with Application of Locally Connected I/O Modules

In the example below a project with a node consisting of a PFC200 and linked I/O modules is applied to CODESYS by ***e!****COCKPIT*. This does not involve a special fieldbus, but only the application of the locally connected I/O modules.

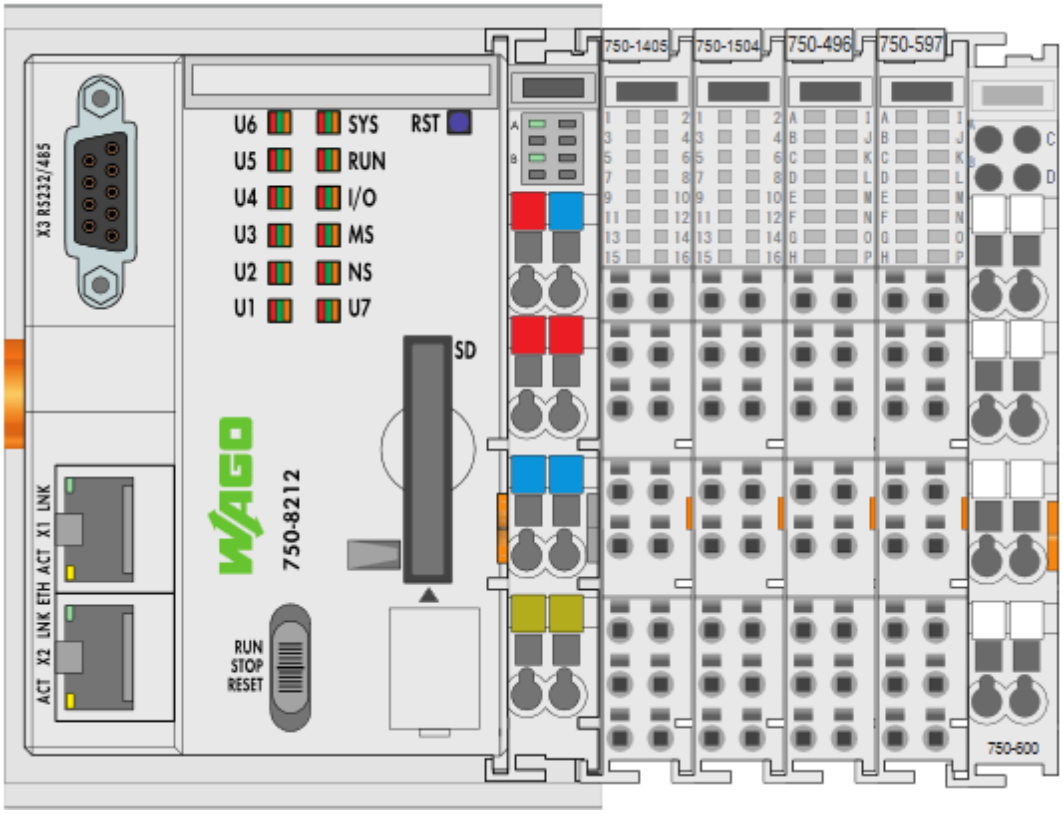

Figure 4: Node in the detail view in ***e!****COCKPIT*

The I/O modules are displayed with the following designations in the device structure:

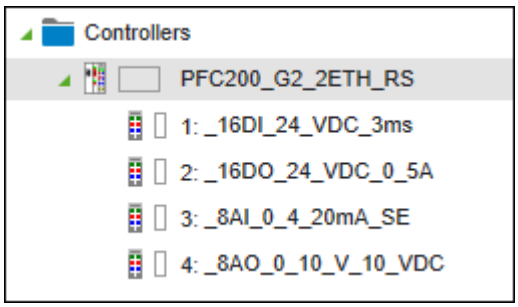

Figure 5: Designation of I/O modules in ***e!****COCKPIT*

The channels of each I/O module are mapped as global variables in ***e!****COCKPIT*. These variables can be named by direct input, or allocated using mapping.

Variable	Mapping	Channe	Address	Type	Default Value	Unit	Description
		_IN	%IW1	WORD			Eingangskanäle
xDI01		_IN	%IX2.0	BOOL			Digitaleingang
xDI02		_IN	%IX2.1	BOOL			Digitaleingang
		_IN	%IX2.2	BOOL			Digitaleingang
		_IN	%IX2.3	BOOL			Digitaleingang
		_IN	%IX2.4	BOOL			Digitaleingang

Figure 6: Global Variables for an I/O Module

1. In *e!COCKPIT* right-click on the PFC200 and select **[Export]** in the contextual menu.

   ⇨ A CSV file with I/O mapping containing the allocation between global variables and I/O modules is then exported.

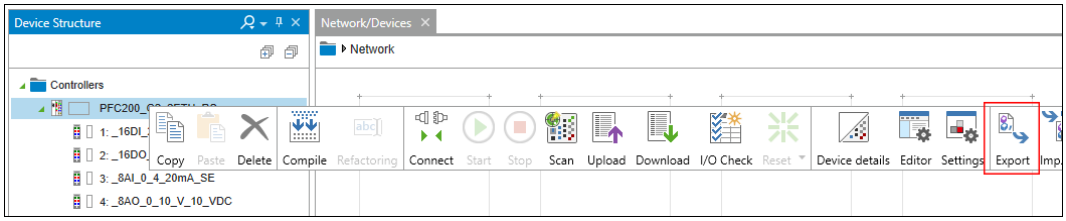

Figure 7: Exporting I/O mapping

2. Save the *e!COCKPIT* project.
3. Make a backup copy of your project in case data is lost during conversion.
4. Change your *e!COCKPIT* project's file extension from *.ecp to *.project.
5. Double-click on the project file (*.project) to open the CODESYS project.

   ⇨ The project appears in the device tree.
   The "Project Environment" dialog also opens. This dialog shows all the project components for which a newer version is available.

6. Click on **[Set all to Newest]** and then click **[OK]**.

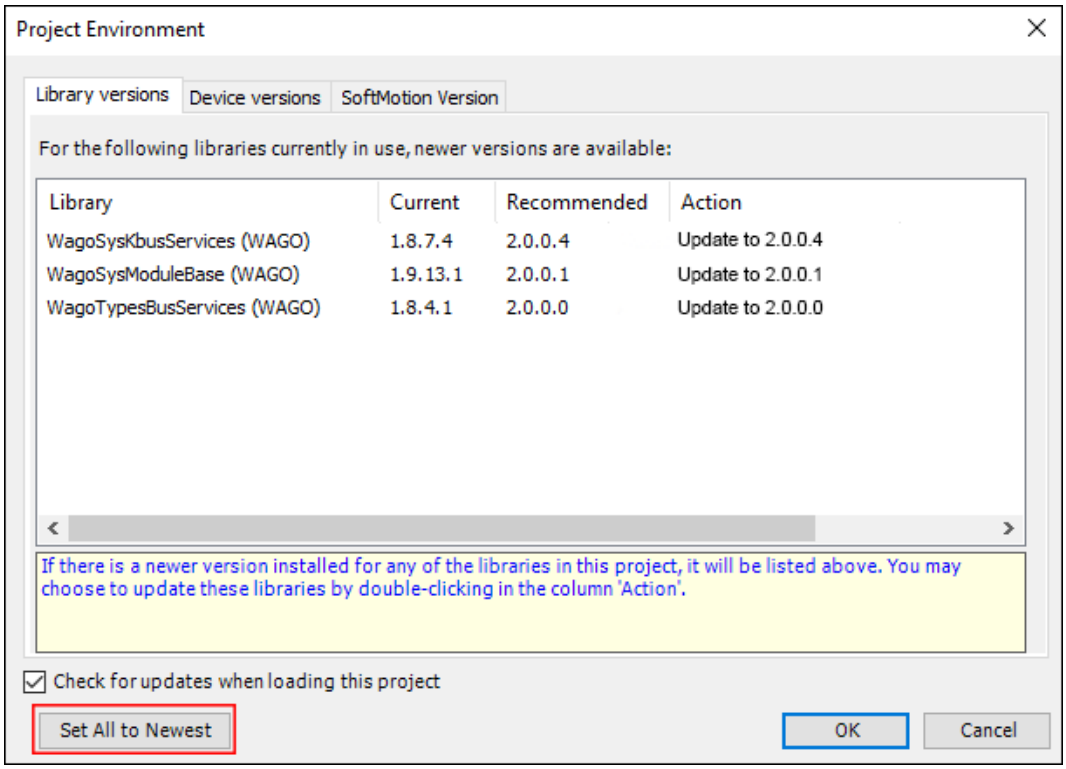

Figure 8: Updating project environment

7. Red circles with a question mark in the device tree indicate that device descriptions need to be updated. First, update the PCF200.
   To do this, right-click on the PFC200 and select **[Update device...]**.
8. Select the PFC200 from the list and confirm with **[Update device]**.

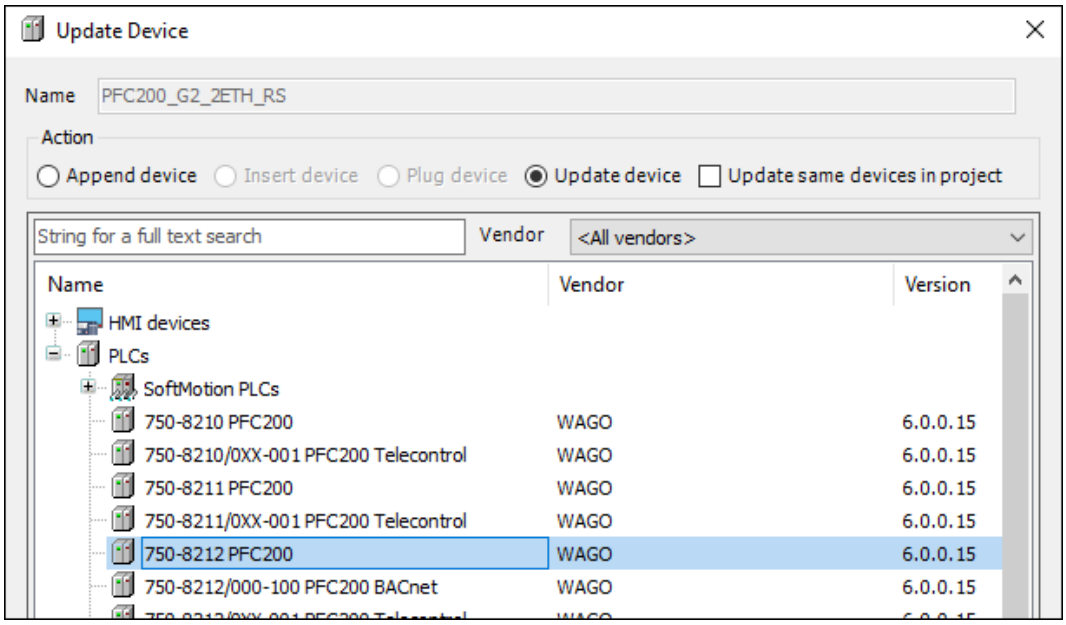

Figure 9: Selecting PFC200

9. Update the individual I/O modules the same way. The selection dialog can remain open during this process. Each I/O module that is marked will be edited.

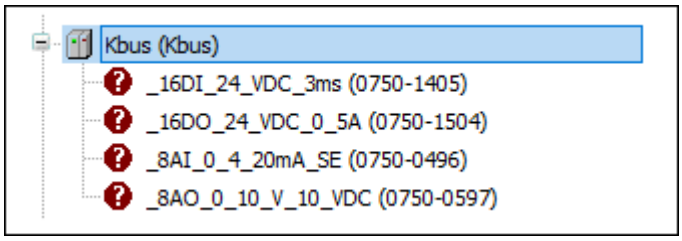

Figure 10: Updating I/O Modules

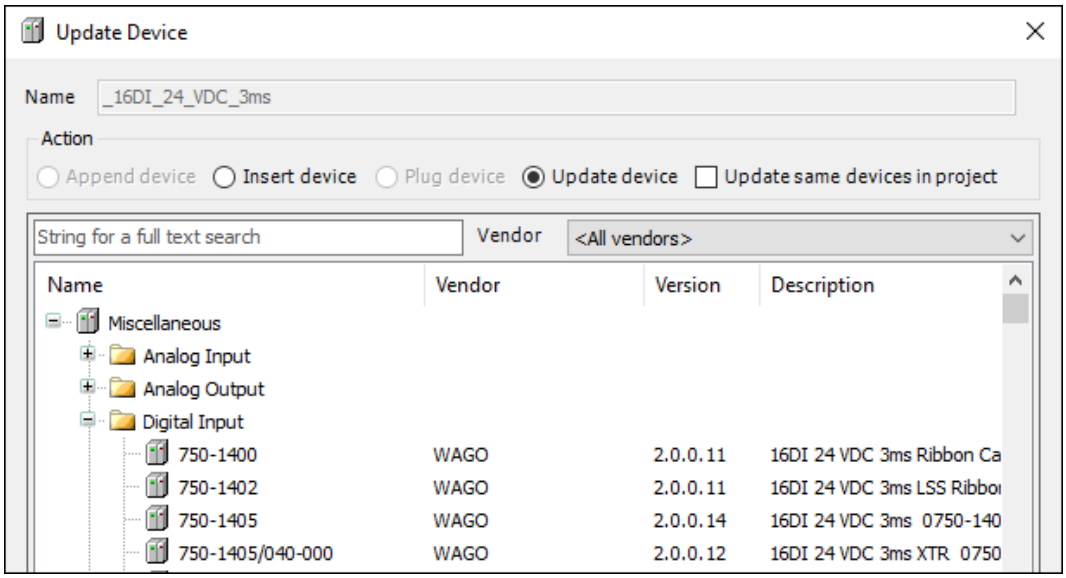

Figure 11: Selecting I/O Modules

10. The filter field can provide quick assistance when searching for I/O modules.

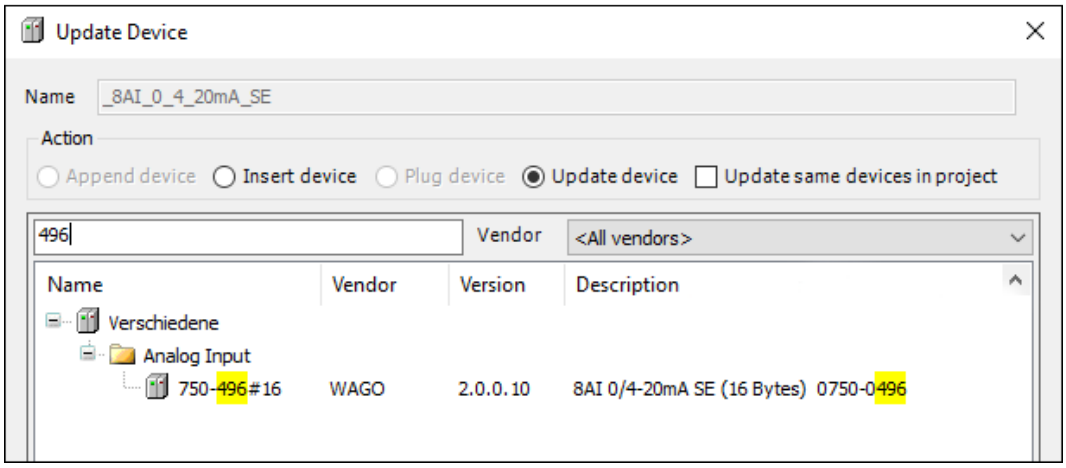

Figure 12: Selecting I/O Modules Using the Filter

11. As you can see, the I/O module designations from the import are retained in this procedure.
    If you have already modified standard designations for I/O modules in ***e!****COCKPIT* for a specific project, these modified names will also be applied.

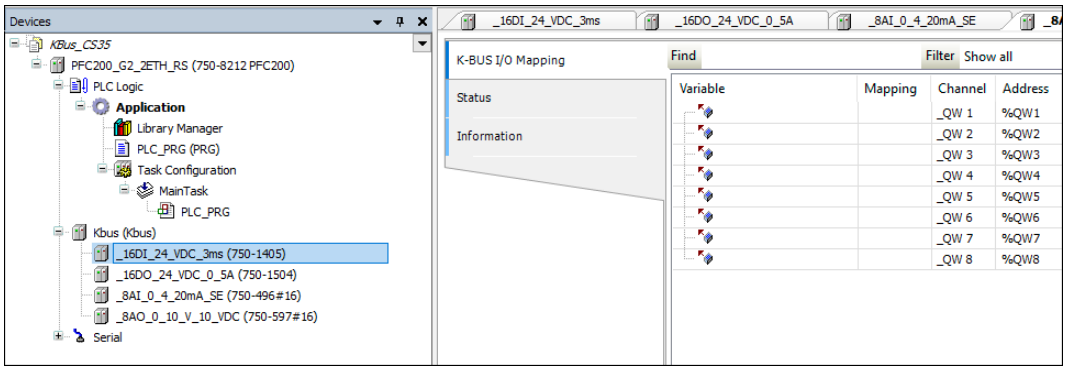

Figure 13: Designation of I/O Modules

⇨ As a comparison: When generating new I/O modules (with no import), other names would be assigned:

```
_750_1405 (750-1405)
_750_1505 (750-1505)
_750_469_16 (750-469#16)
_750_597_16 (750-597#16)
```

In this case, it would not be possible to allocate the I/O module variables from ***e!*** *COCKPIT* to those in CODESYS from a CSV file import. These names must be the same.

12. Now, import the CSV file containing the I/O mapping and the variable names from the ***e!*** *COCKPIT* project. To do this, right-click on “Kbus (Kbus)” and in the contextual menu select “Import I/O mapping from CSV ...”.

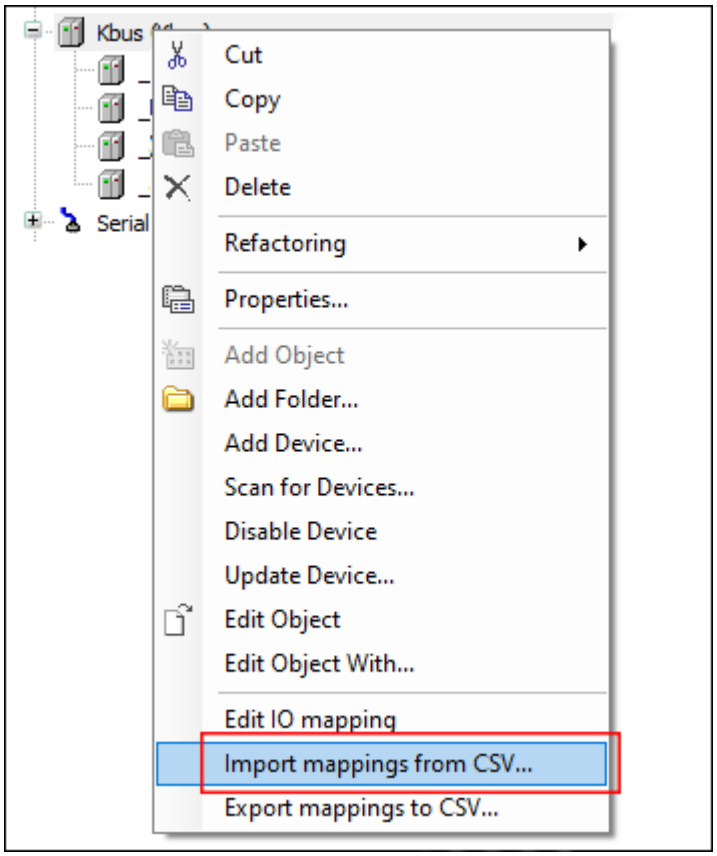

Figure 14: Import I/O mapping

13. Check to ensure that the I/O module data points and their naming through CSV import have been applied. Double-click on the corresponding I/O module to do this.

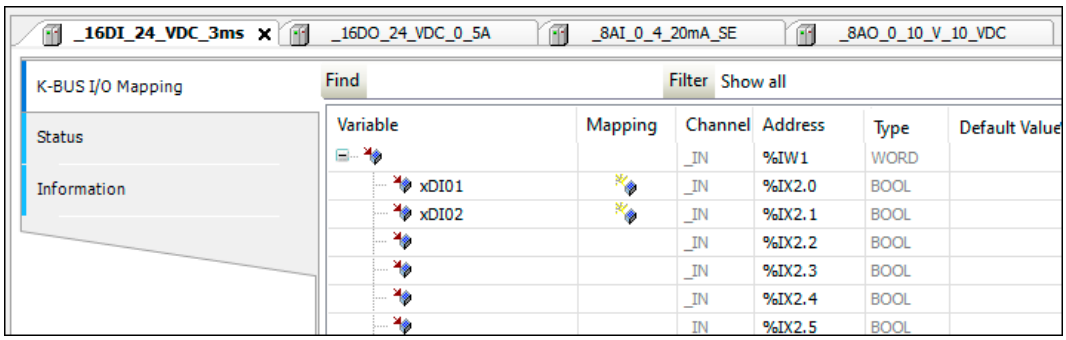

Figure 15: Naming of variables after CSV import

5.3 Project conversion using the example of Modbus

Initial state:

In this example, an ***e!****COCKPIT* project is converted, consisting of a PFC200 (750-8212) as the master with a connected CANopen coupler (750-352) as the slave. There are three I/O modules plugged into the coupler: a 2-channel digital input module (750-400), a 2-channel analog input module (750-469) and a 2-channel analog output module (750-550). You can see the data points of these three I/O modules in the fieldbus configurator under "Local Bus Data Points." These data points were mapped to master variables by dragging and dropping them.

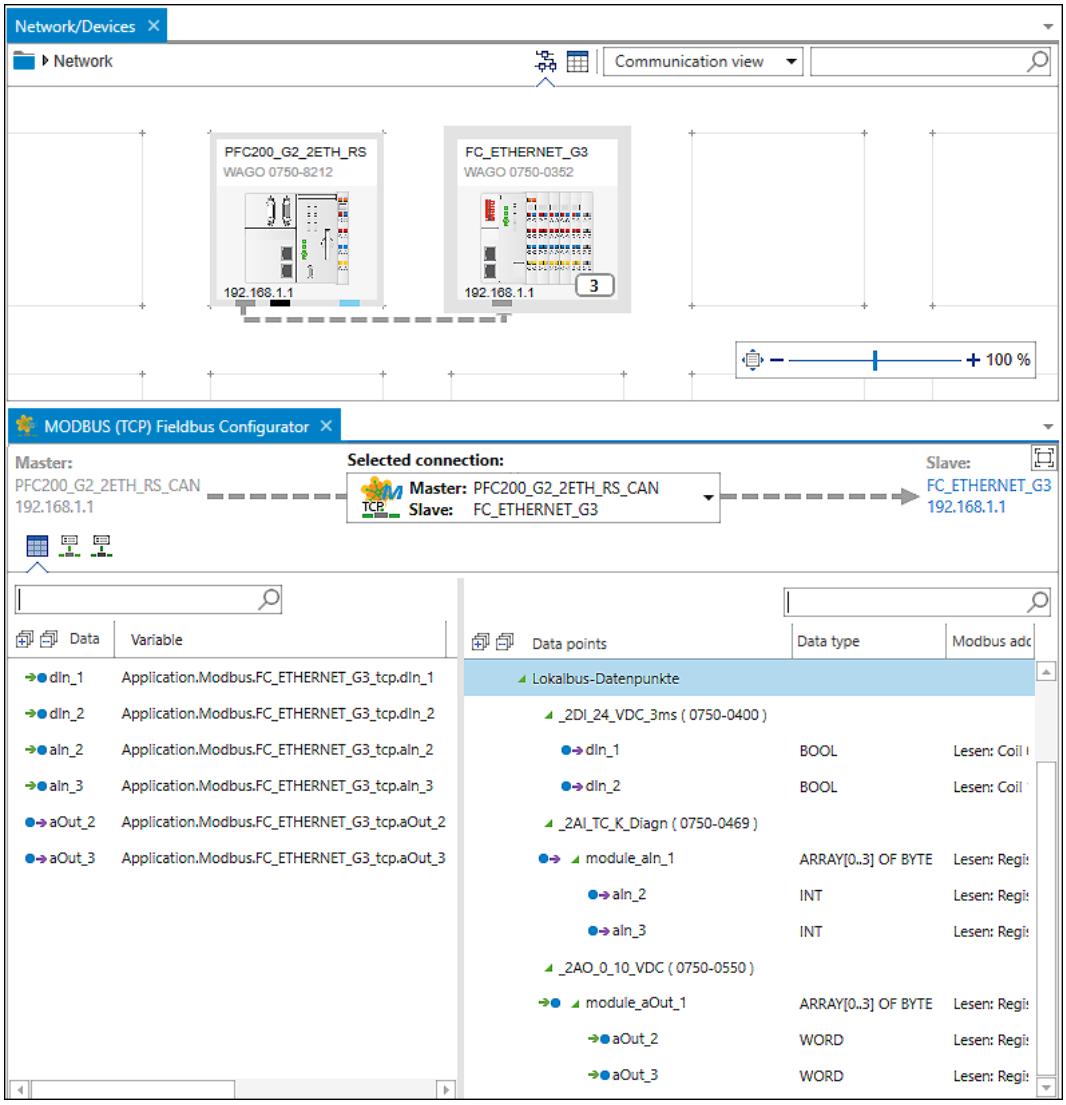

Figure 16: Modbus Project in ***e!****COCKPIT*

In brief:

In the following description, you perform the following steps in CODESYS: You delete the slave device and update the master device. Global Modbus variables are retained. You then recreate the Modbus structure with the master and slave in the device tree and recreate the I/O image (channels, length of input/output data depending on I/O modules). You then reassign the existing global Modbus variables.

1. First delete the slave device. It contains no data you will need.

   ⇨ The required Modbus variables are generally created globally. In the device tree under “Application” > “Modbus,” you will find a structure that shows these globally stored variables:

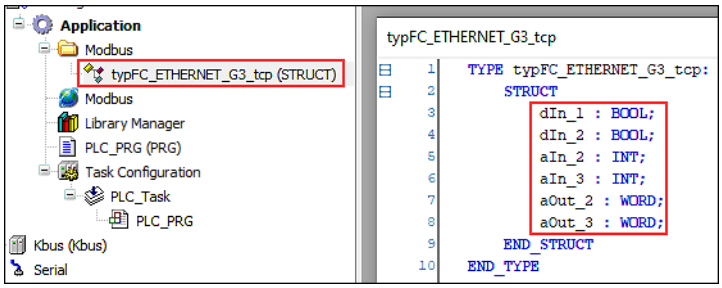

Figure 17: Global Variables via Modbus

   ⇨ For the new slave that you will create, you will reuse these variables and assign them to the input/output data of your I/O modules in CODESYS.

2. First, right-click on the device and select **Update Device ...** to load the device description for the device.
3. Select your device from the list and click the **[Update Device]** button.

   ⇨ The fieldbus elements are removed. However, the global variables are retained.

4. Now recreate the master and the slave. To do so, right-click on the device and select **Insert Device ...**.
5. Leave the dialog open for the next three steps and click **[Insert Device]** to insert the “Ethernet” fieldbus, as well as the master and the slave inserted below it:
   - First select the “Ethernet” fieldbus in the dialog.
   - Click on the new “Ethernet” element in the device tree and select the Modbus master in the dialog.
   - Click on the new “Modbus_TCP_Master” element in the device tree and select the Modbus slave in the dialog.

   ⇨ This procedure creates the following structure in the device tree:

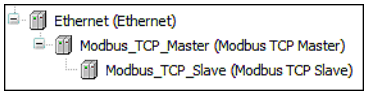

Figure 18: Modbus Master with Modbus Slave

6. Double-click on the slave (“Modbus_TCP_Slave” element).

   ⇨ The configuration opens.

7. Click “Modbus Slave Channel” and click the **[Add Channel ...]** button there on the bottom right.

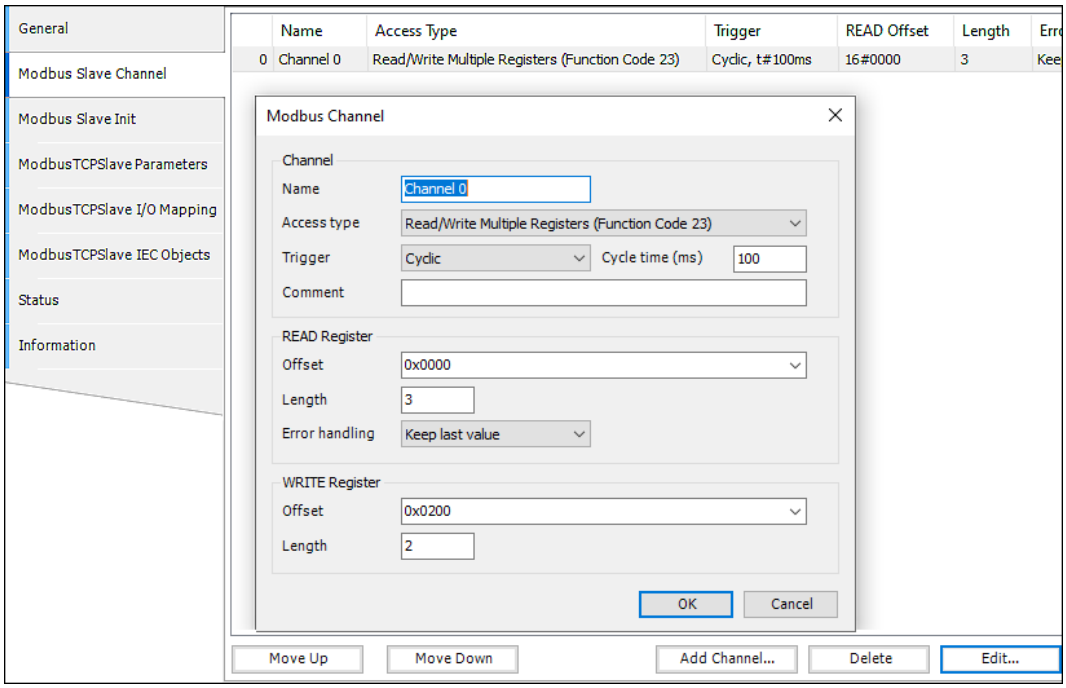

Figure 19: Adding "Modbus Slave Channel"

8. Set the channel, access type and length for reading and writing according to the I/O modules you use.
   Here, for example, the "READ Register" is set to a length of 3 (one 2-channel DI + one 2-channel AI) and the "WRITE Register" to length 2 (2-channel AO).
9. Click "Modbus TCP Slave I/O Mapping."
   ⇨ You now see the channel and variables that were created. You will remap/reassign the global variables of the I/O modules to these.
10. To do so, in the corresponding variable field, click the **[...]** button that appears to the right to open the Input Assistant.
11. Under "Application" > "Modbus" > "FC_ETHERNET_G3_tcp," you will find the global variables for selection.

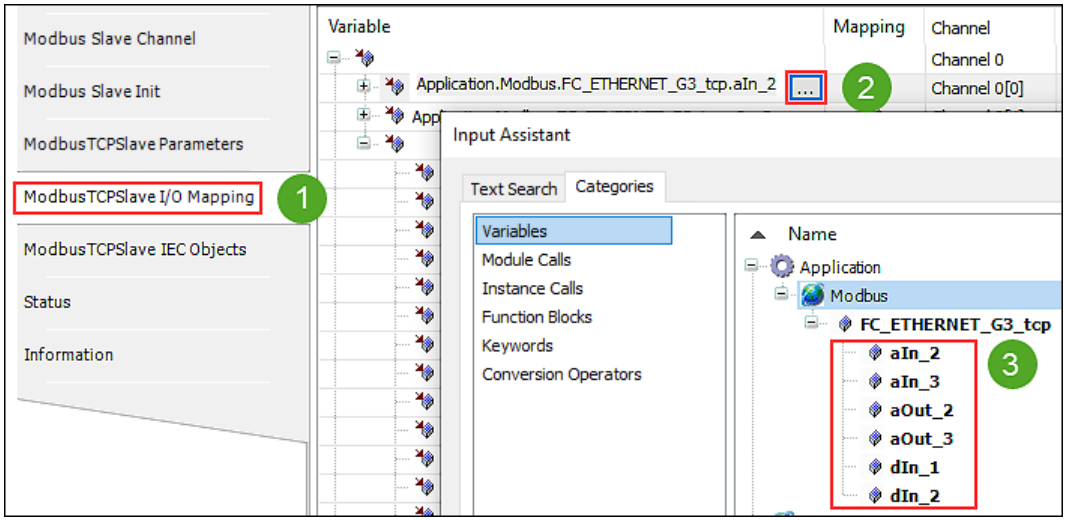

Figure 20: Performing the Mapping

12. Go through these one by one to recreate your slave from the ***e!****COCKPIT* project in this way.

Variable	Mapping	Channel	Address	Type
		Channel 0	%IW1	ARRAY [0.
Application.Modbus.FC_ETHERNET_G3_tcp.aIn_2		Channel 0[0]	~~%IW1~~	WORD
Application.Modbus.FC_ETHERNET_G3_tcp.aIn_3		Channel 0[1]	~~%IW2~~	WORD
		Channel 0[2]	%IW3	WORD
Application.Modbus.FC_ETHERNET_G3_tcp.dIn_1		Bit0	~~%IX6.0~~	BOOL
Application.Modbus.FC_ETHERNET_G3_tcp.dIn_2		Bit1	~~%IX6.1~~	BOOL
		Bit2	%IX6.2	BOOL
		Bit3	%IX6.3	BOOL
		Bit4	%IX6.4	BOOL
		Bit5	%IX6.5	BOOL
		Bit6	%IX6.6	BOOL
		Bit7	%IX6.7	BOOL
		Bit8	%IX7.0	BOOL
		Bit9	%IX7.1	BOOL
		Bit10	%IX7.2	BOOL
		Bit11	%IX7.3	BOOL
		Bit12	%IX7.4	BOOL
		Bit13	%IX7.5	BOOL
		Bit14	%IX7.6	BOOL
		Bit15	%IX7.7	BOOL
		Channel 0	%QW0	ARRAY [0.
Application.Modbus.FC_ETHERNET_G3_tcp.aOut_2		Channel 0[0]	~~%QW0~~	WORD
Application.Modbus.FC_ETHERNET_G3_tcp.aOut_3		Channel 0[1]	~~%QW1~~	WORD

Figure 21: Assigning Variables

➡ This completes the conversion.

ⓘ Note

Please note the following restrictions in CODESYS as opposed to *e!COCKPIT*:

- Modbus RTU and UDP are currently not supported in the configurator. However, you can use MODBUS functions for RTU and UDP via the IEC library "WagoAppPlcModbus".
- Specific TCP/IP parameters (Keep Alive, Type of Service) are not supported.
- Function code FC22 (masking of registers) is not supported.
- Nor is function code FC66 (polling of larger amounts of data in one request).
- Device-specific special registers are not supported.
- The MODBUS service is only available when the PLC application is running.

5.4 Project conversion using the example of CANopen

Initial state:

In this example, an ***e!****COCKPIT* project consisting of a PFC200 (750-8214) as the master with a connected CANopen coupler (750-337) as the slave is converted. For the coupler, a device description (EDS) has been installed in ***e!****COCKPIT* via the **Backstage View** > **Product Catalog** > **[Import Device]**. Three I/O modules are plugged into the coupler: a 4-channel digital input module (750-402), a 2-channel digital output module (750-501) and an 8-channel digital input module (750-449). A program using CAN variables is running on the PFC200.

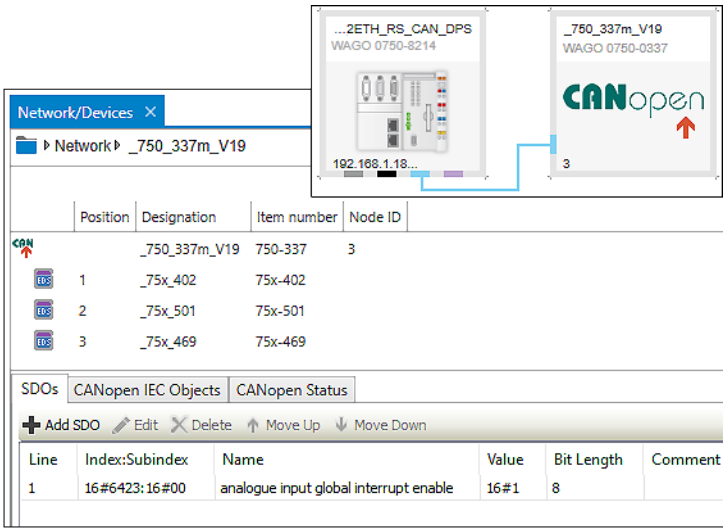

Figure 22: CANopen Project in ***e!****COCKPIT*

In brief:

In the following description, you perform the following steps in CODESYS: You create a copy of the master device to back up the CANopen data. You then update the master device to the current CODESYS device description. The CANopen data (fieldbus, slave and variables) is lost. You now import the slave device via an EDS file. Then you recreate the structure from the CANbus and CANopen manager (master) in the device tree. You then copy the CANopen device (slave) of the device copy with the variables it still contains to under the newly created CANopen master.

1. First create a copy of the controller in the device tree: Right-click on the controller and select **Copy**.
2. Then right-click on the project name at the top of the device tree and select **Insert**.
   ⇨ A copy of the controller has been created. You will use the CANopen data of the copy later.
3. Now swap the ***e!****COCKPIT* device description of the original device that it still contains and the CODESYS device description. To do so, right-click on the device and select **Update Device...**.
4. Select your device – in this case, the 750-8214 device – under "Controllers (PFC)" and click **[Update Device]**.
   ⇨ The device is updated. In the device tree, the red question mark symbol disappears. However, the substructures with CANopen device and CANopen data are also deleted.

5. Restore the configuration. For this, the EDS file of the CANopen slave must be installed (see Installing WAGO Device Descriptions separately [▸ 11]).
6. Now recreate the CANopen structure of your project. In the device tree, right-click on your device and select **Insert Device...**.
7. First select the CANbus, click on the empty item below it and select the "WAGO CANopen Manager" in the same way using "Plug Device."

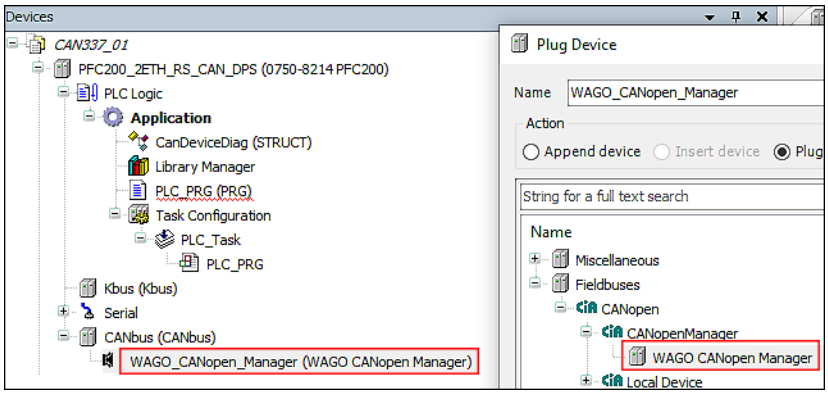

Figure 23: Adding CANopen Manager

8. Now copy the CANopen device (750-337) from the CANopen device you backed up at the beginning and re-insert it under the newly created "WAGO CANopen Manager" (you can also drag and drop it).

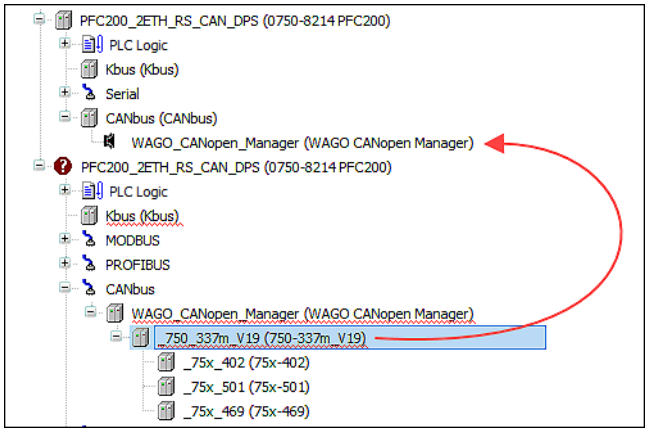

Figure 24: Inserting the Saved CANopen Device under the Newly Created CANopen Manager

9. Delete the device that was copied at the beginning. You can use all the variables in the new device as usual.

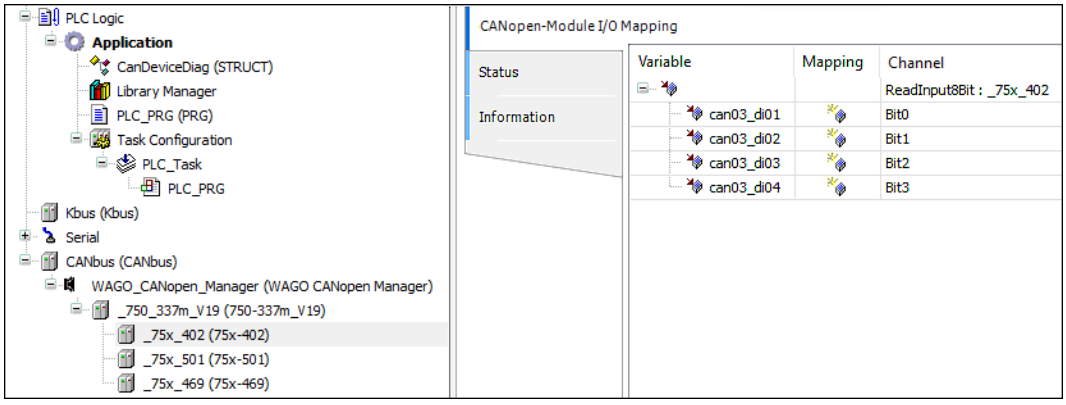

Figure 25: Using Variables

5.5 Project Conversion on the Example of EtherNet/IP

Initial state:
In this example, an ***e!****COCKPIT* project consisting of a PFC200 (750-8212) and a coupler (750-363) connected via EtherNet/IP is converted. An analog input module, a digital input module and a digital output module are plugged into the coupler; this yields an input data size of six bytes and an output data size of one byte. Variables corresponding to these data sizes have been created in the lower area of the Data Point Configurator. In the fieldbus configurator, the variables have been mapped to data points.
Important: A global variable list has been created in ***e!****COCKPIT* for the input/output data so the data will be retained in CODESYS throughout the update (Program Structure > right-click on "Application" > "Global Variable List").

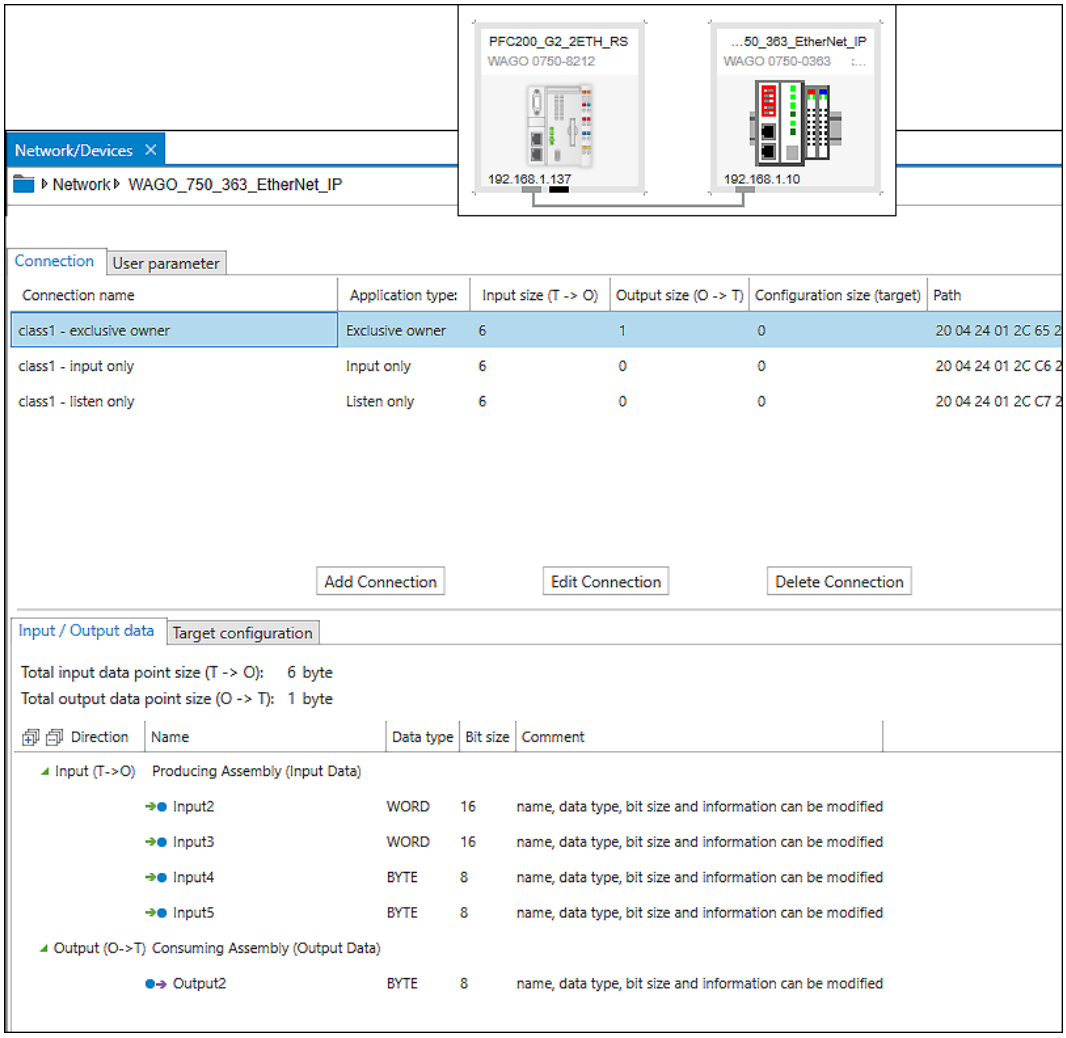

Figure 26: EtherNet/IP Project in ***e!****COCKPIT*

In brief:
In the following description, you perform the following steps in CODESYS: You update the device and create an Ethernet fieldbus under the device. You attach an EtherNet/IP scanner to it and the EtherNet/IP device below it. You adjust the EtherNet/IP connection and the length of the input/output data. Then you assign the address for each variable according to the hardware, and you can continue using your project.

1. First delete the slave device (in this case: 750-363). It contains no data you will need.
2. Right-click on the PFC200 and select **Update Device ...**.

3. Select your device (in this case: 750-8212) and click **[Update Device]**.

   ⇨ EtherNet/IP is removed from the tree. However, the variables you saved globally in ***e!****COCKPIT* are still available.

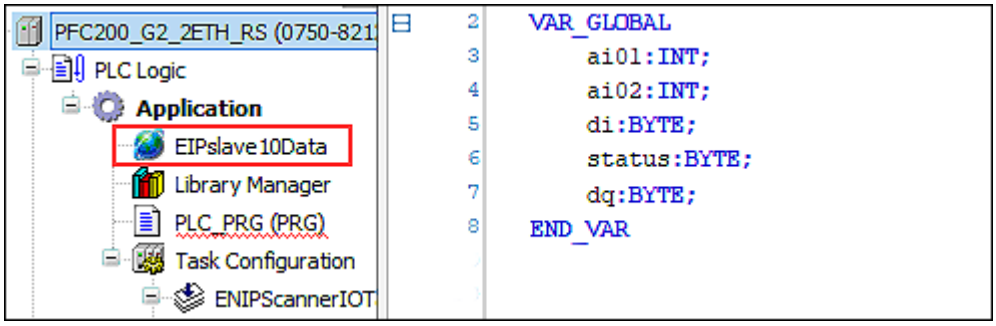

Figure 27: Global Variables

4. Now recreate the master and the slave. To do so, right-click on the PFC200 and select **Insert Device ...**.

5. Leave the dialog open for the next three steps and click **[Insert Device]** to insert the "Ethernet" fieldbus, as well as the master and the slave inserted below it:
   - First select the "Ethernet" fieldbus in the dialog.
   - Click on the new "Ethernet" element in the device tree and select the "EtherNet/IP Scanner" in the dialog under "EtherNet/IP."
   - Click the new "EtherNet_IP_Scanner (EtherNet/IP Scanner)" element in the device tree and select the EtherNet/IP device 750-363 in the dialog under "EtherNet/IP Remote Adapter."

   If you do not see the EtherNet/IP device in the list of selections, then you must first install the corresponding device description; see **Installing WAGO Device Descriptions separately [▸ 11]**.

   ⇨ This procedure creates the following structure in the device tree:

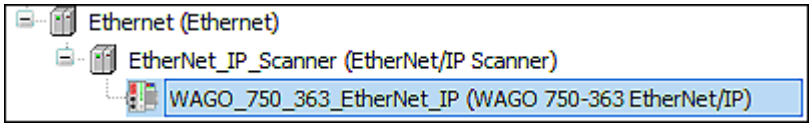

Figure 28: EtherNet/IP Scanner and Adapter

6. Double-click the EtherNet/IP adapter to make further settings:

7. To enter the IP address of the device, open the "General" tab.

8. To adjust the EtherNet/IP connection, open the "Connections" tab.

9. Double-click on the connection that was automatically created before and enter the data length of your input/output data:
   - Scanner to target (output) = data length of the output modules (in this case: one byte)
   - Target to scanner (input) = data length of the input modules (in this case: six bytes)

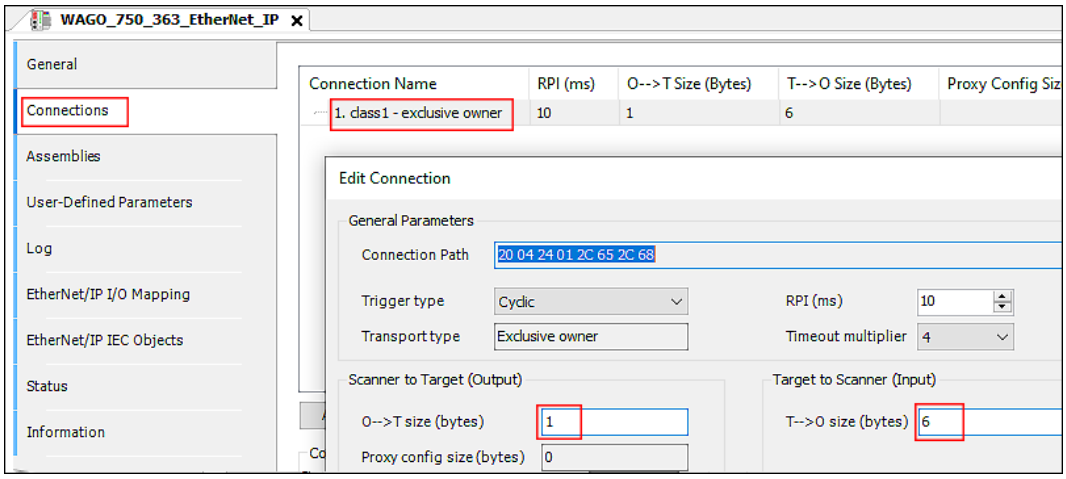

Figure 29: Entering the Input/Output Data Size of the Connection

10. Click **[OK]** to confirm.

    ⇨ Under "EtherNet/IP I/O Mapping," you can now see the input/output variables that have been created with the required size. No variables for the respective input/output data of the I/O modules are assigned here yet. You will perform the mapping in what follows.

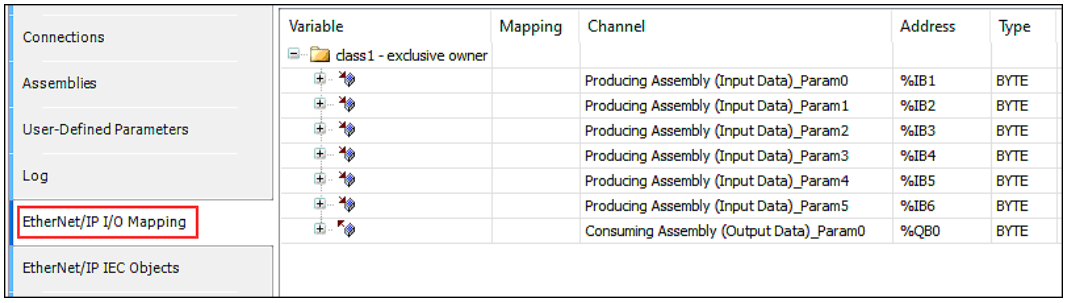

Figure 30: Input/Output Variables That Have Been Created

11. First take a look at your hardware configuration to see which I/O module is the first I/O module to be addressed at the node and what data length it occupies. The representation of the node in WAGO I/O-*CHECK* can be helpful for this purpose.

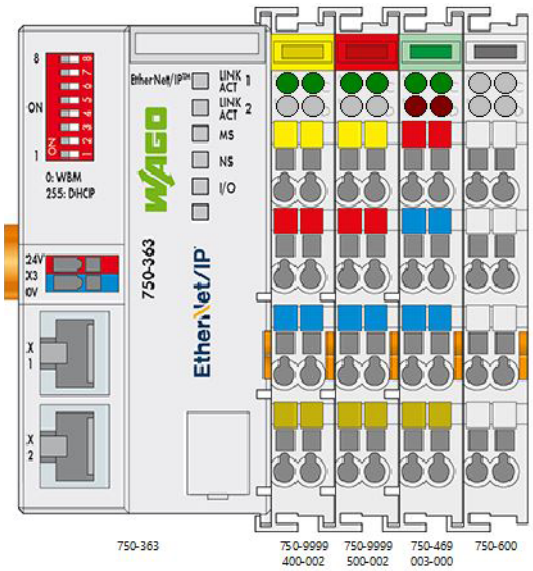

Figure 31: Representation of the Node in WAGO I/O-*CHECK*

12. Switch to the global variables (cf. item 3).
13. Click on a variable and press **[Shift]** + **[F2]**. This opens the variable declaration dialog.
14. Now enter the addresses for the input/output variables of the I/O modules in order according to your hardware structure:
    In this example:
    - Analog input starting from byte 1 – address %IB1 → occupies two bytes
    - Analog output starting from byte 3 – address %IB3 → occupies two bytes
    - Digital input starting from byte 5 – address %IB5 → occupies one byte
    - Status byte starting from byte 6 – address %IB6 → occupies one byte
    - Digital output starting from byte 0 – address %QB0 → occupies one byte

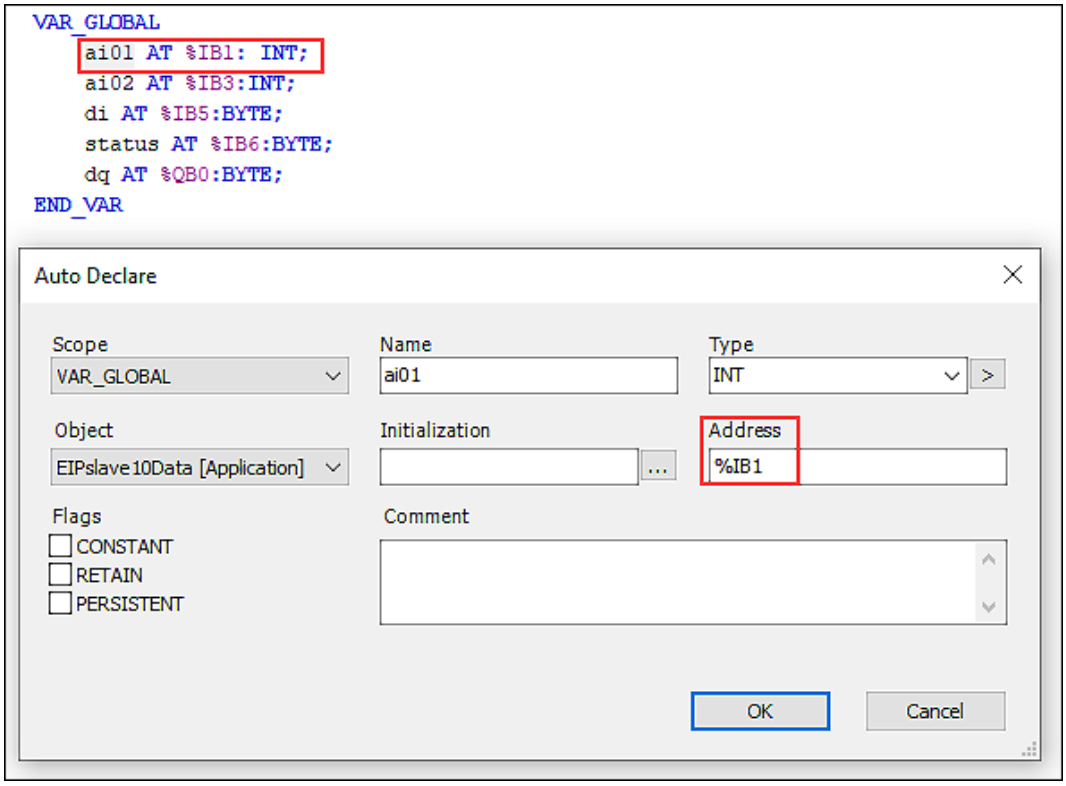

Figure 32: Hardware Addressing

15. Represent your hardware in this way.

➡ The full scope of the program can then be used.

5.6 Project Conversion on the Example of EtherCAT

Initial state:
In this example, an ***e!COCKPIT*** project consisting of a PFC200 (750-8212) as the master with a connected CANopen coupler (750-354) as the slave is converted. For the coupler, a device description (ESI) has been installed in ***e!COCKPIT*** via the **Backstage View** > **Product Catalog** > **[Import Device]**. Four I/O modules are plugged into the coupler. Variables have been created for the input/output data.
Important: In ***e!COCKPIT***, right-click on the EtherCAT coupler and use **[Export]** to save a CSV file. The CSV file contains the I/O image with all the variable names; you will reimport these into CODESYS.

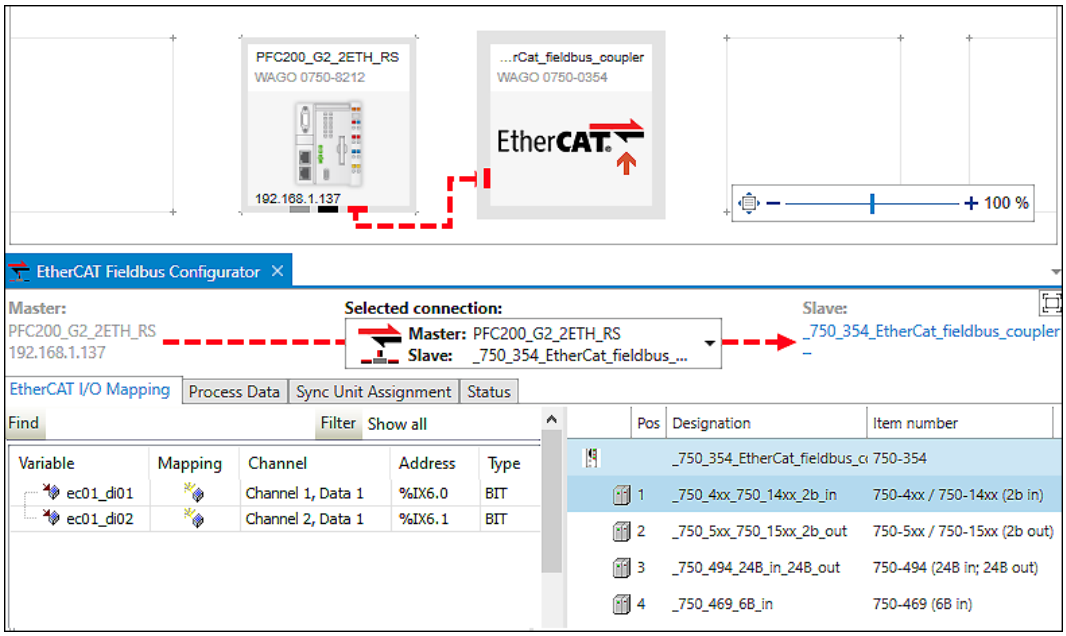

Figure 33: EtherCAT Project in ***e!COCKPIT***

In brief:
In the following description, you perform the following steps in CODESYS: You create a copy of the master device to back up the EtherCAT data. You then update the master device to the current CODESYS device description. The EtherCAT data (fieldbus, slave and variables) is lost. You now import the slave device via an ESI file. You will then insert an EtherCAT master into the device tree and copy the EtherCAT slave from the device copy, with the variables it still contains, under the newly created EtherCAT master. In order to use the variables from ***e!COCKPIT***, import the I/O image (CSV) for the EtherCAT slave.

1. First click “Common.PCI.” Here you will find the EtherCAT master and slave.
2. Now first create a copy of the controller in the device tree: Right-click on the controller and select **Copy**.
3. Then right-click on the project name at the top of the device tree and select **Insert**.
   ⇨ A copy of the controller has been created. You will use the EtherCAT data of the copy later.
4. Now swap the ***e!COCKPIT*** device description of the original device that it still contains and the CODESYS device description. To do so, right-click on the controller and select **Update Device ...**.

5. Select your device – in this case, the 750-8212 device – under "Controllers (PFC)" and click **[Update Device]**.

   ⇨ The device is updated. In the device tree, the red question mark symbol disappears. However, the substructures with the EtherCAT data (previously under "Common.PCI") are also deleted.

6. Restore the configuration. For this, the ESI file of the EtherCAT slave must be installed (see **Installing WAGO Device Descriptions separately [▸ 11]**).

7. Now recreate the EtherCAT structure of your project. In the device tree, right-click on your device and select **Insert Device ...**.

8. Select the EtherCAT Master.

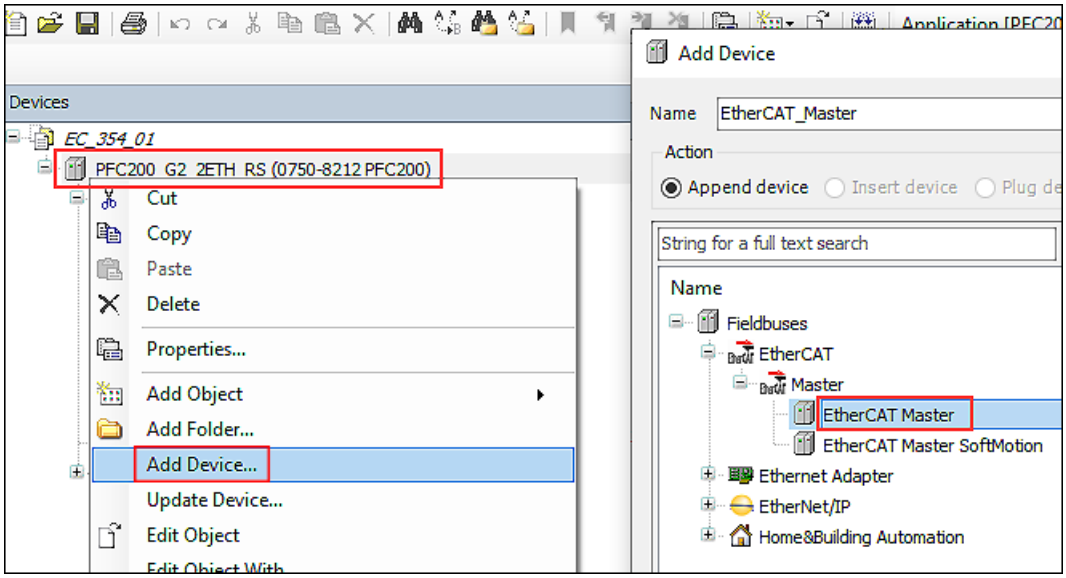

Figure 34: Adding EtherCAT Master

9. Now copy the EtherCAT coupler (750-354) from the device you backed up at the beginning and add it again under the newly created "EtherCAT master" (you can also drag and drop it).

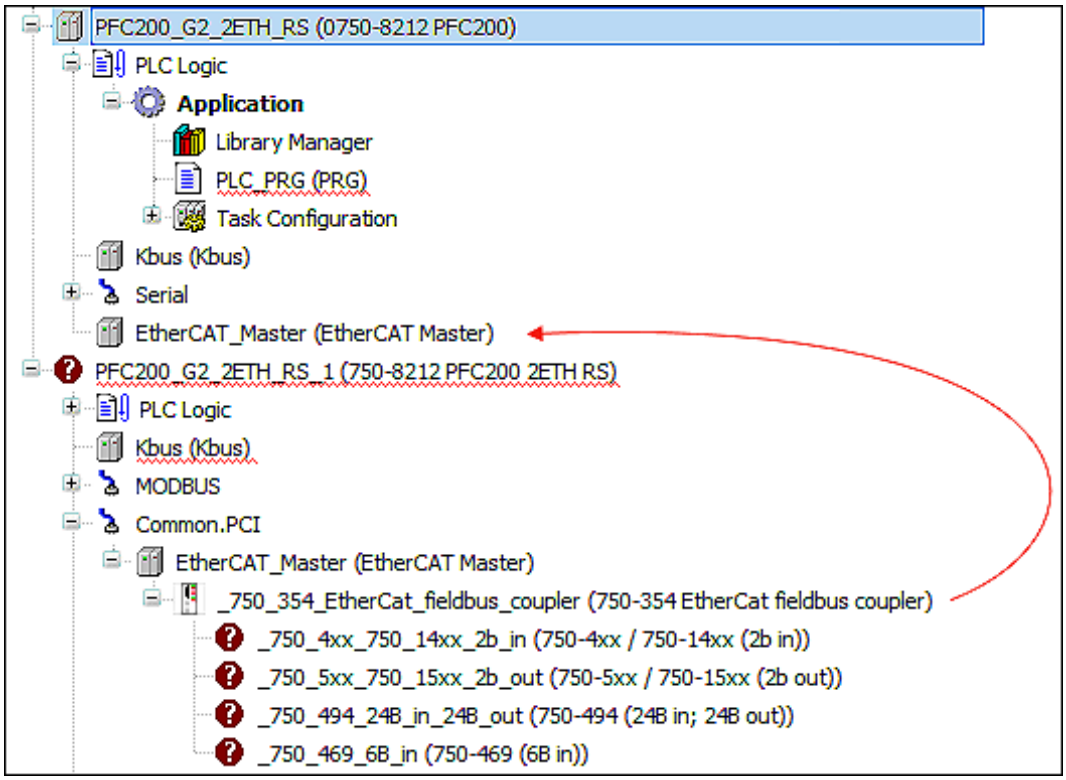

Figure 35: Inserting the Saved EtherCAT Device under the Newly Created EtherCAT Master

10. Delete the device that was copied at the beginning.
11. For all I/O modules marked with a question mark in the device tree, right-click **Update Device ...**.
12. In the dialog, select the appropriate device description for the selected device.
13. Click **[Update Device]**.

    ⇨ The device descriptions are updated, and the question mark symbols disappear. However, the variable names assigned in ***e!****COCKPIT* for the input/output data are still missing.

14. Right-click on the EtherCAT device and select **Import mappings from CSV ...**.

    ⇨ The variable names are carried over. You can use all the variables in the new device as usual.

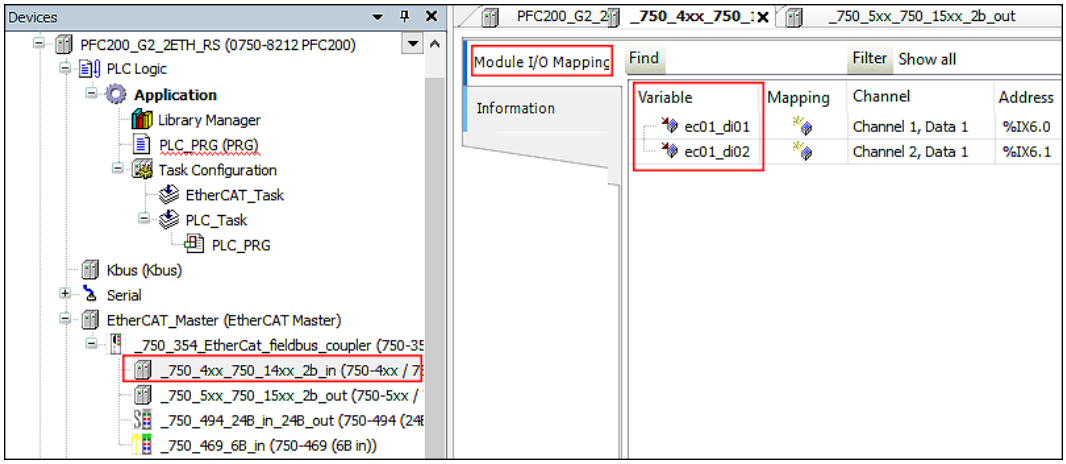

Figure 36: Using Variables

5.7 Project Conversion from Firmware Version 22 *(e!COCKPIT)* to 24 (CODESYS V3.5 SP18 Patch 2)

Since the changes between firmware versions 22 and 24 are quite significant, direct conversion is not possible, and error messages will occur in CODESYS. Therefore, the following conversion steps are required. Transferring fieldbus-specific content is not covered here; the preceding sections address this.

5.7.1 Project Conversion Example: Edge Controller / Touch Panel 600

In the following example, an **Edge Controller 752-8303/8000-0002** is migrated from ***e!*** *COCKPIT* (firmware version 22) to CODESYS (firmware version 24).
The Edge Controller is used as an example. The example also applies to **Touch Panels 600**.

1. To export the "Onboard IO I/O Mapping" shown under the device to a CSV file, go to the "DEVICE" tab and click **[Export I/O mapping]** on the ribbon.

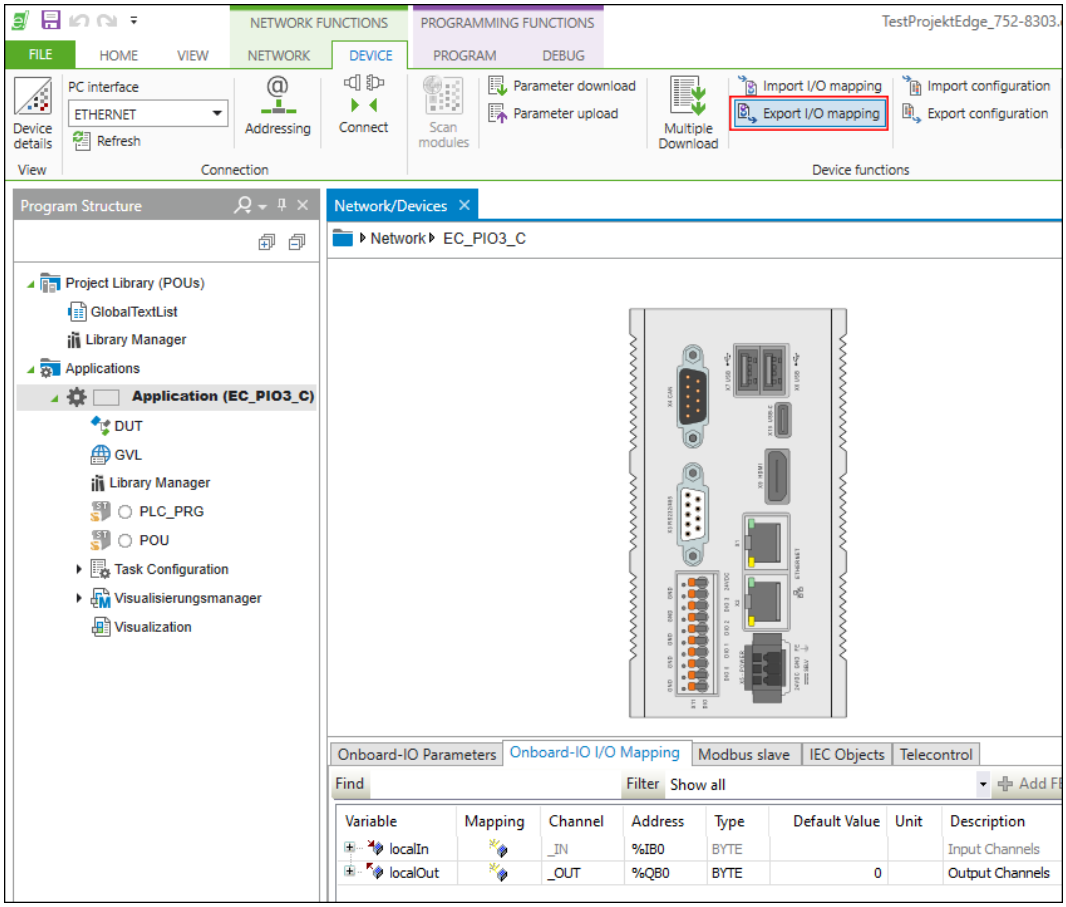

Figure 37: Exporting an I/O Image in ***e!****COCKPIT*

2. Provide a filename for the export file and click **[Save]**.
3. Save and close the project in ***e!****COCKPIT*.
4. Copy the project file.
5. Change the file extension of the copy from ".ecp" to ".project."

   ⇨ `EC_PIO3_C.csv`
   `TestProjektEdge_752-8303 - Copy.project`
   `TestProjektEdge_752-8303.ecp`

6. Open the project with the new extension in the CODESYS version that matches the firmware. Version information can be found in the release notes that accompany the downloaded firmware packages.
   In this example, the project is opened in CODESYS V3.5 SP18 Patch 2. This CODESYS version is compatible with firmware version 24.
7. Click **[OK]** to confirm the dialog for updating the project environment.

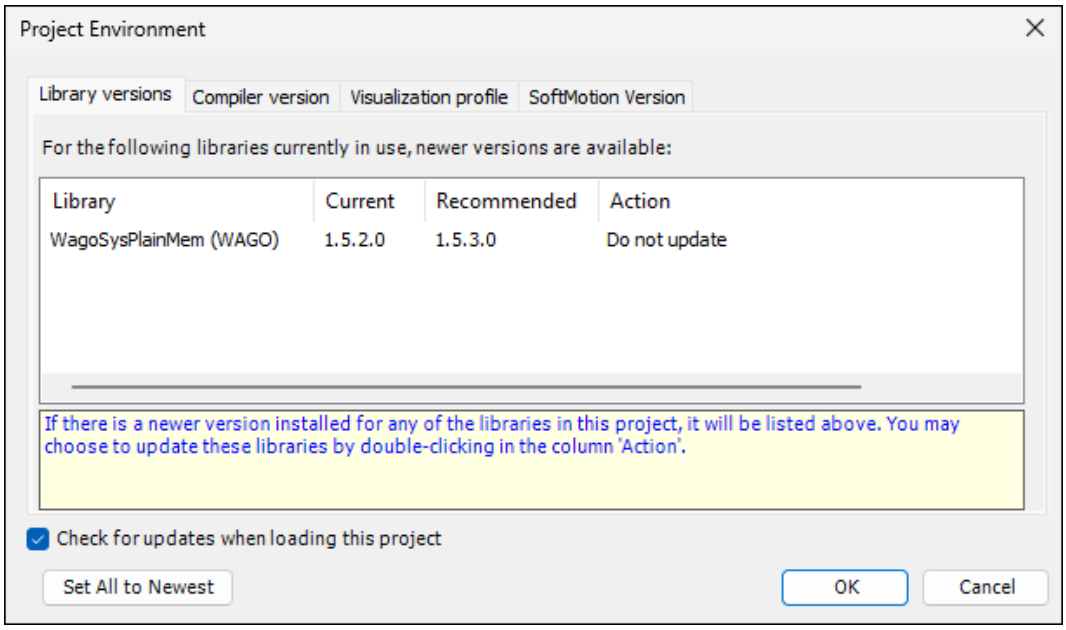

Figure 38: Updating the Project Environment

8. Confirm that the project's saving format has been updated by clicking **[Yes]**.
   In future, further processing of the project will only be possible in CODESYS.

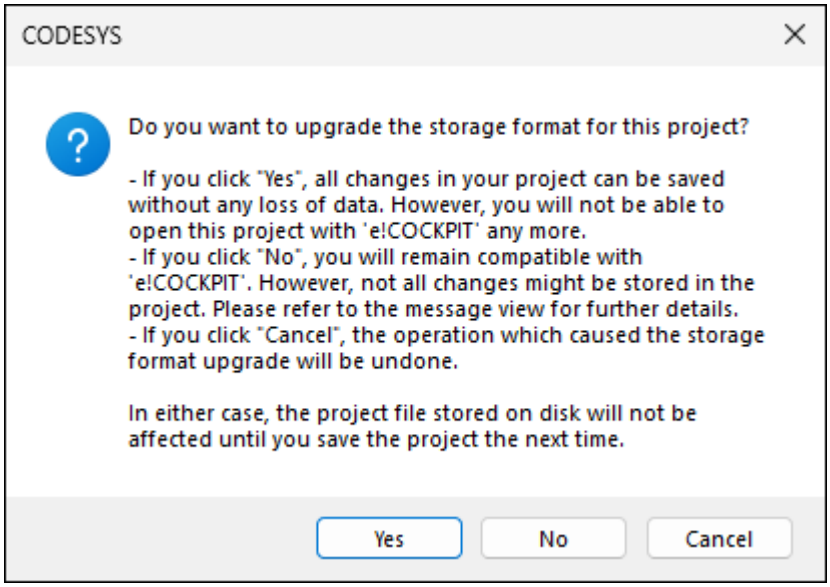

Figure 39: Updating the Saving Format

⇨ The opened project is displayed in CODESYS as follows:

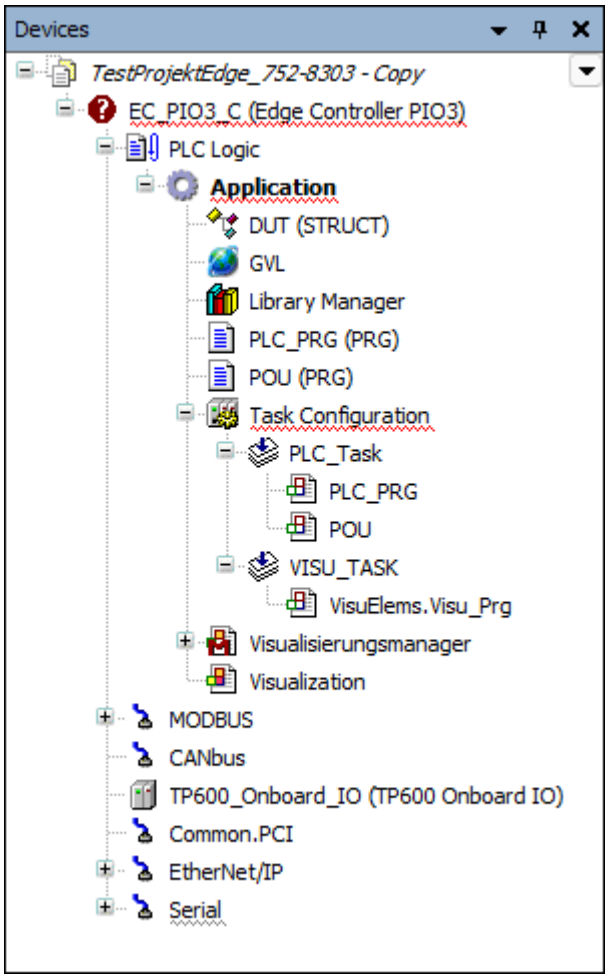

Figure 40: Imported Project in CODESYS

9. Right-click on the project name in the device tree at the top and select "Add Device" from the context menu.
10. In the dialog, select the new target device – in this case "752-8303/8000-0002."

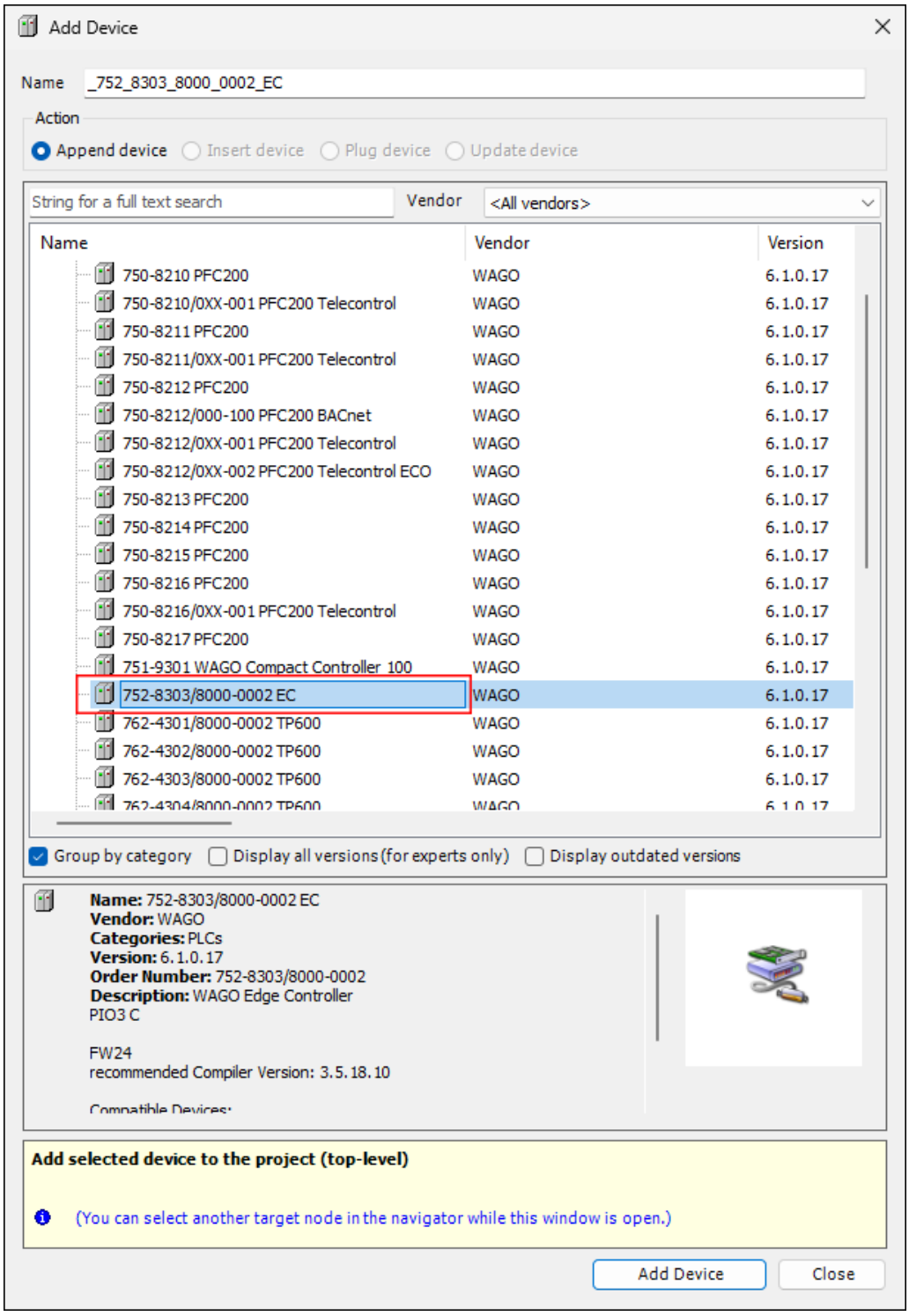

Figure 41: Selecting the Target System

11. Click **[Add Device]** and close the window.

    ⇨ The device is attached to the tree:

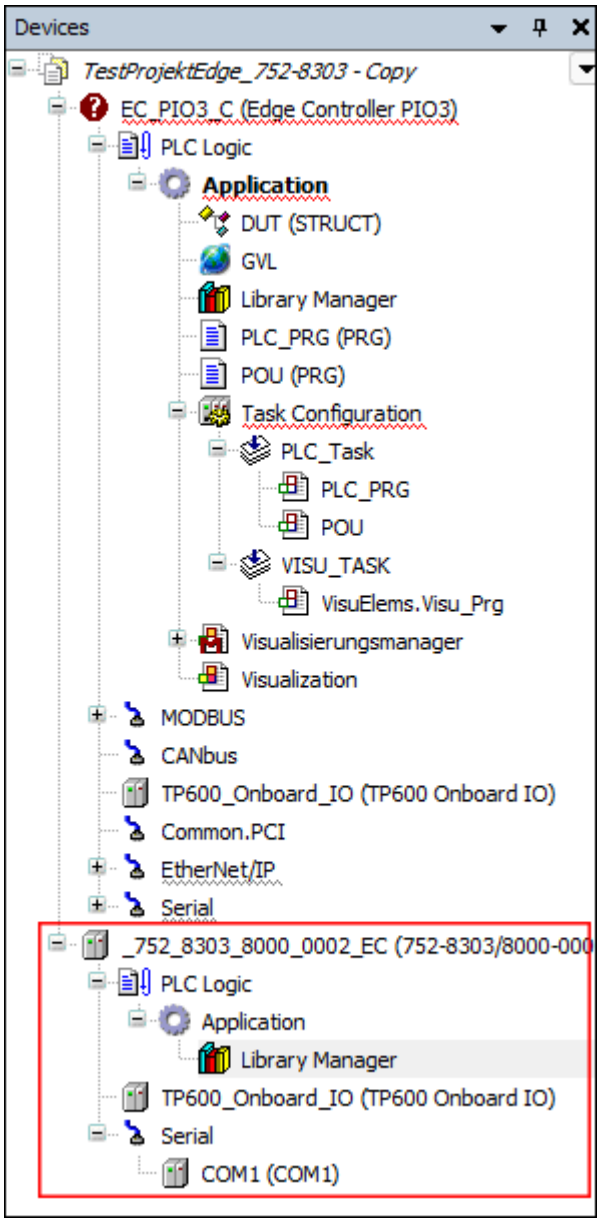

Figure 42: Attached Device

12. Delete the library manager for the newly attached device.
13. Now copy all the elements of the old device under “Application” and insert them back into the new device under “Application.”

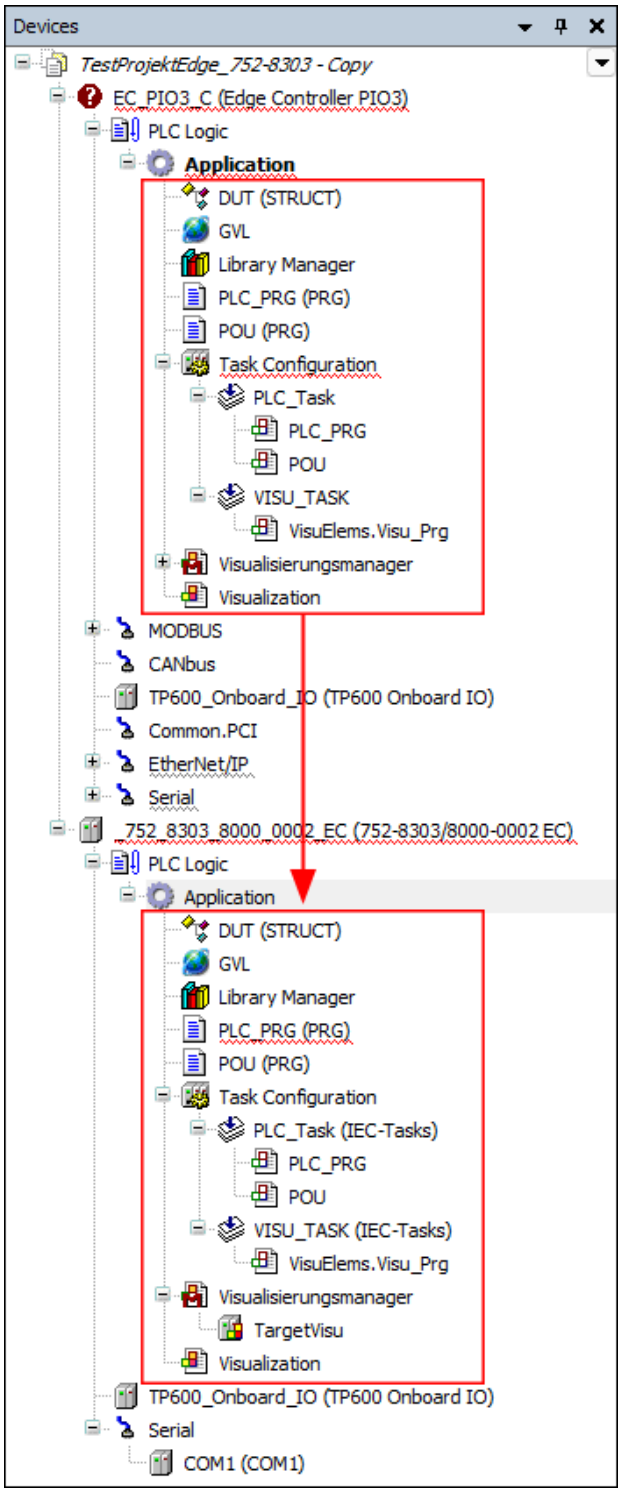

Figure 43: Copying Content from "Application" to New Device

14. Right-click on "TP600_Onboard_IO (TP600 Onboard IO)" and select "Import mappings from CSV..." from the context menu.

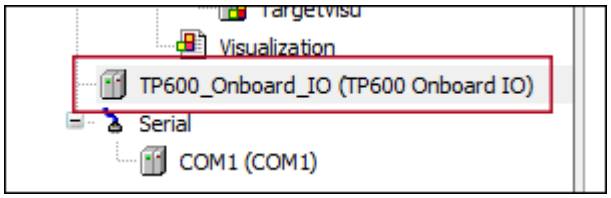

Figure 44: Importing I/O Image from CSV

15. Select the CSV file you saved in ***e!****COCKPIT* and open it.

    ⇨ The variables from the CSV file are transferred and displayed under "Onboard IO I/O Mapping," similarly to how they are in ***e!****COCKPIT*.

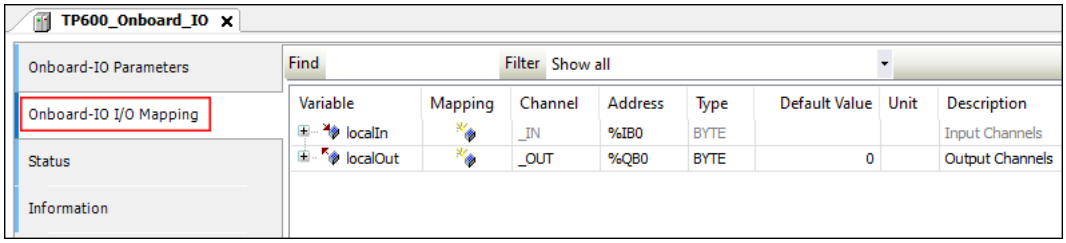

Figure 45: Imported Variables

16. Since you no longer need the old device, delete the old device from the project tree.
17. Save and close the project.
18. Reopen the project.
19. Update the project environment by clicking **[Set All to Newest]**.

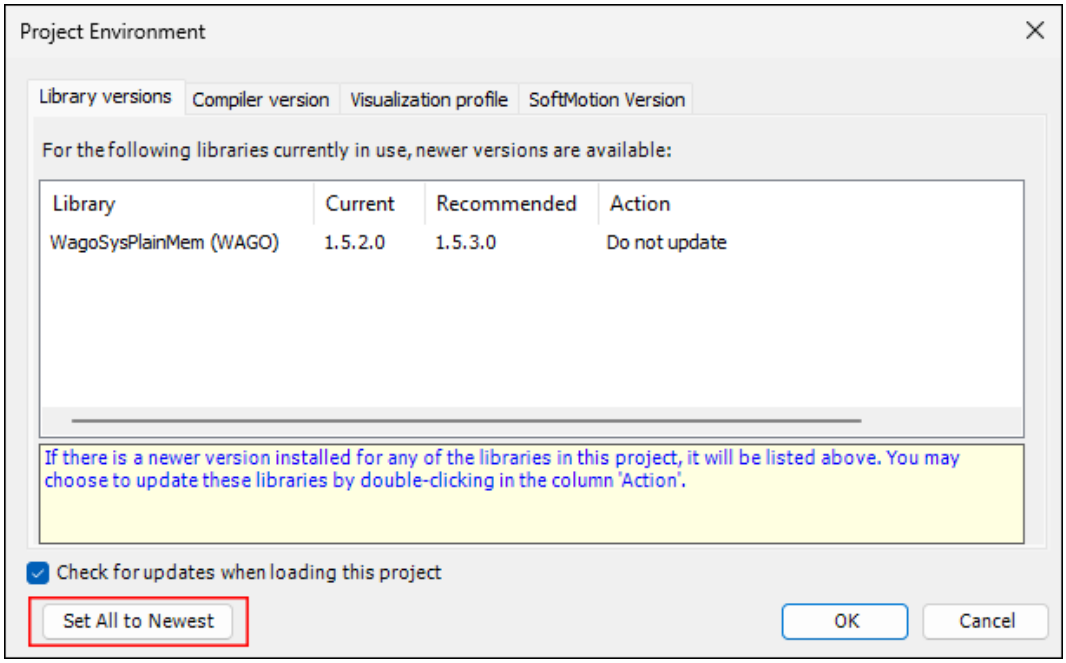

Figure 46: Setting Everything to "Latest"

20. Click **[OK]** to confirm.
21. Save the project.

5.7.2 Project Conversion Example: PFC200

In the following example, a **PFC200 750-8217** is migrated from ***e!****COCKPIT* (firmware version 22) to CODESYS (firmware version 24).
A PFC200 750-8217 is used as an example; the example also applies to other **PFC200** devices.

1. To export the "Local Bus I/O Mapping" shown under the device to a CSV file, go to the "DEVICE" tab and click **[Export I/O mapping]** on the ribbon.

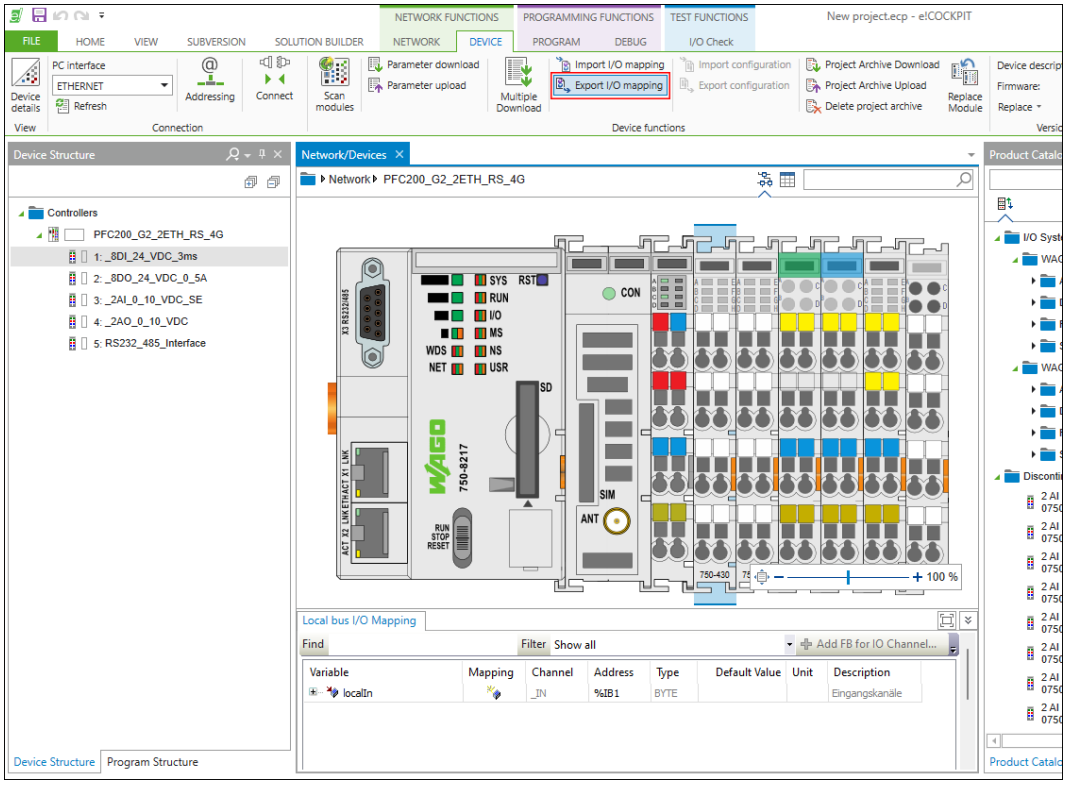

Figure 47: Exporting I/O Image

2. Provide a filename for the export file and click **[Save]**.
3. Save and close the project in ***e!****COCKPIT*.
4. Copy the project file.
5. Change the file extension of the copy from ".ecp" to ".project."

   ⇨ `PFC200_G2_2ETH_RS_4G.csv`
   `TestProjektPFC200_750-8217 - Copy.project`
   `TestProjektPFC200_750-8217.ecp`

6. Open the project with the new extension in the CODESYS version that matches the firmware. Version information can be found in the release notes that accompany the downloaded firmware packages.
   In this example, the project is opened in CODESYS V3.5 SP18 Patch 2. This CODESYS version is compatible with firmware version 24.
7. Click **[OK]** to confirm the dialog for updating the project environment.

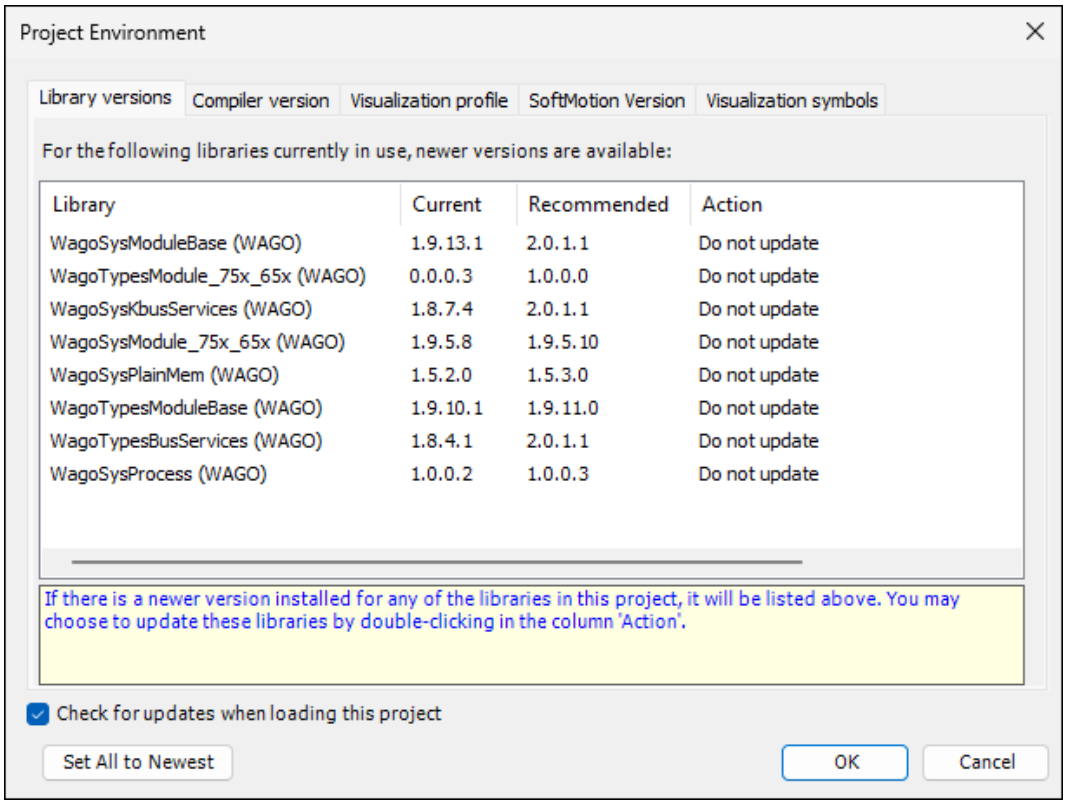

Figure 48: Updating the Project Environment

8. Confirm that the project's saving format has been updated by clicking **[Yes]**.
   In future, further processing of the project will only be possible in CODESYS.

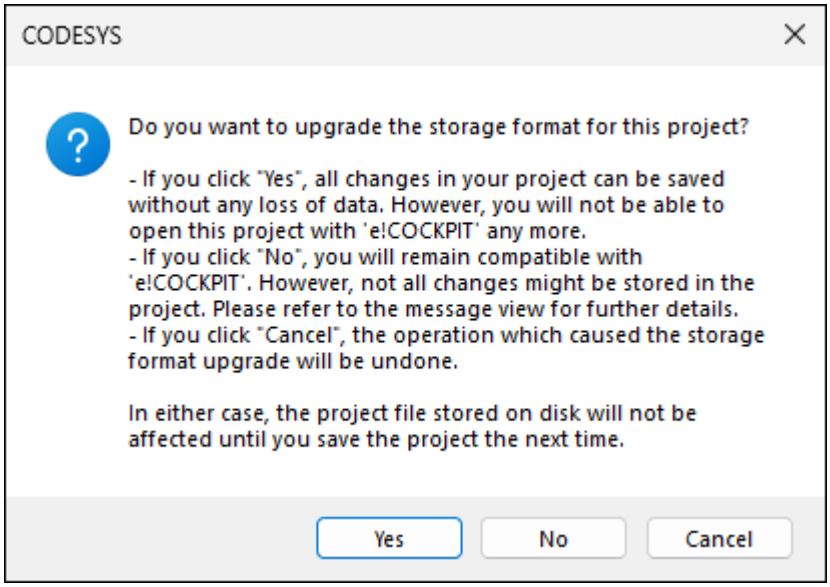

Figure 49: Updating the Saving Format

⇨ The opened project is displayed in CODESYS as follows:

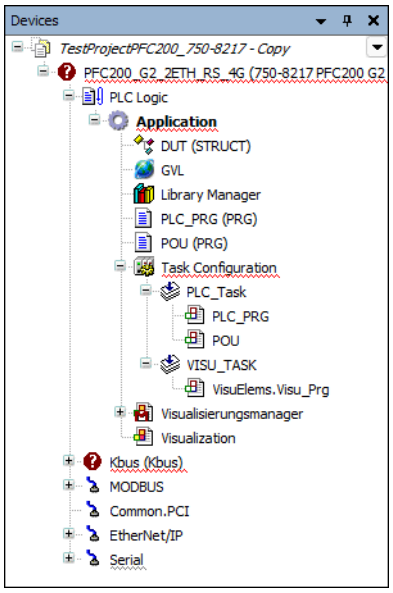

Figure 50: Imported Project in CODESYS

9. Right-click on the project name in the device tree at the top and select “Add Device” from the context menu.
10. In the dialog, select the new target device, in this case “750-8217 PFC200.”

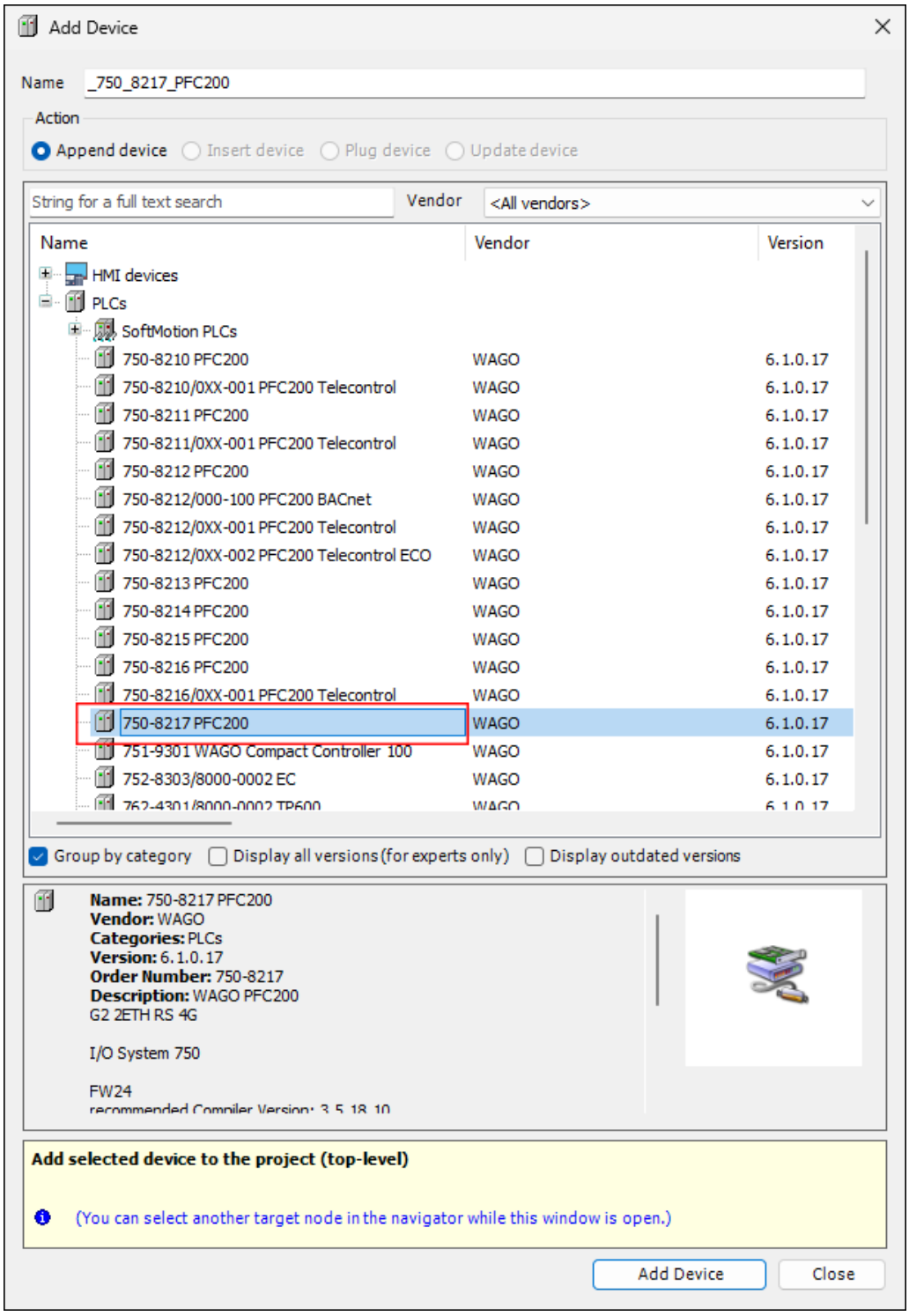

Figure 51: Selecting the Target System

11. Click **[Add Device]** and close the window.

    ⇨ The device is attached to the tree:

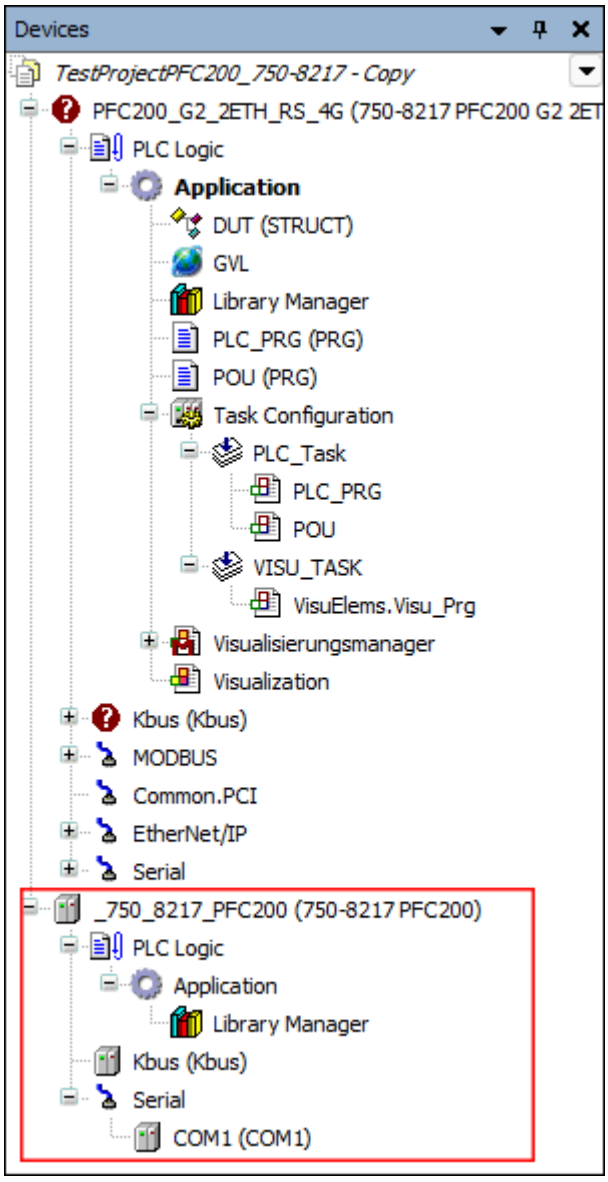

Figure 52: Attached Device

12. Delete the library manager for the newly attached device.
13. Now copy all the elements of the old device under “Application” and insert them back into the new device under “Application.”

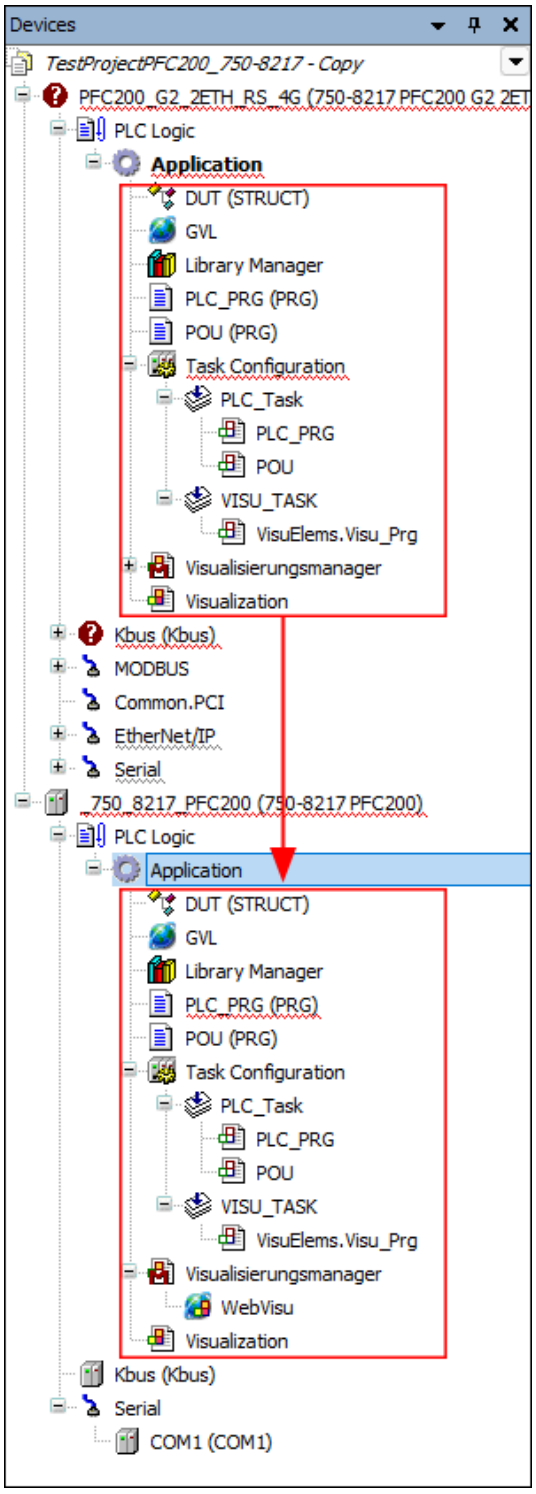

Figure 53: Copying Content from "Application" to New Device

14. Now copy all the elements of the old device under "Kbus (Kbus)" and insert them back into the new device under "Kbus (Kbus)."

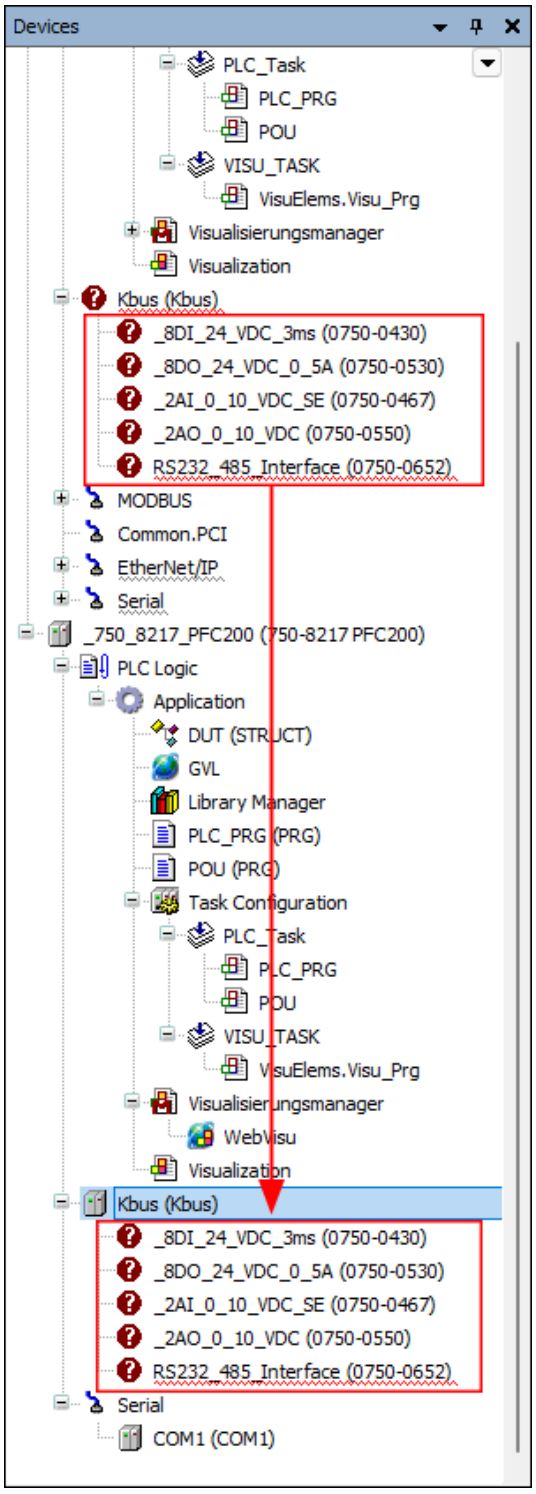

Figure 54: Copying Content of "Kbus" under New Device

⇨ The question marks in red circles indicate that these I/O modules still need to be updated with the latest device description.

15. To do so, right-click on one of the I/O modules and select "Update Device ...."

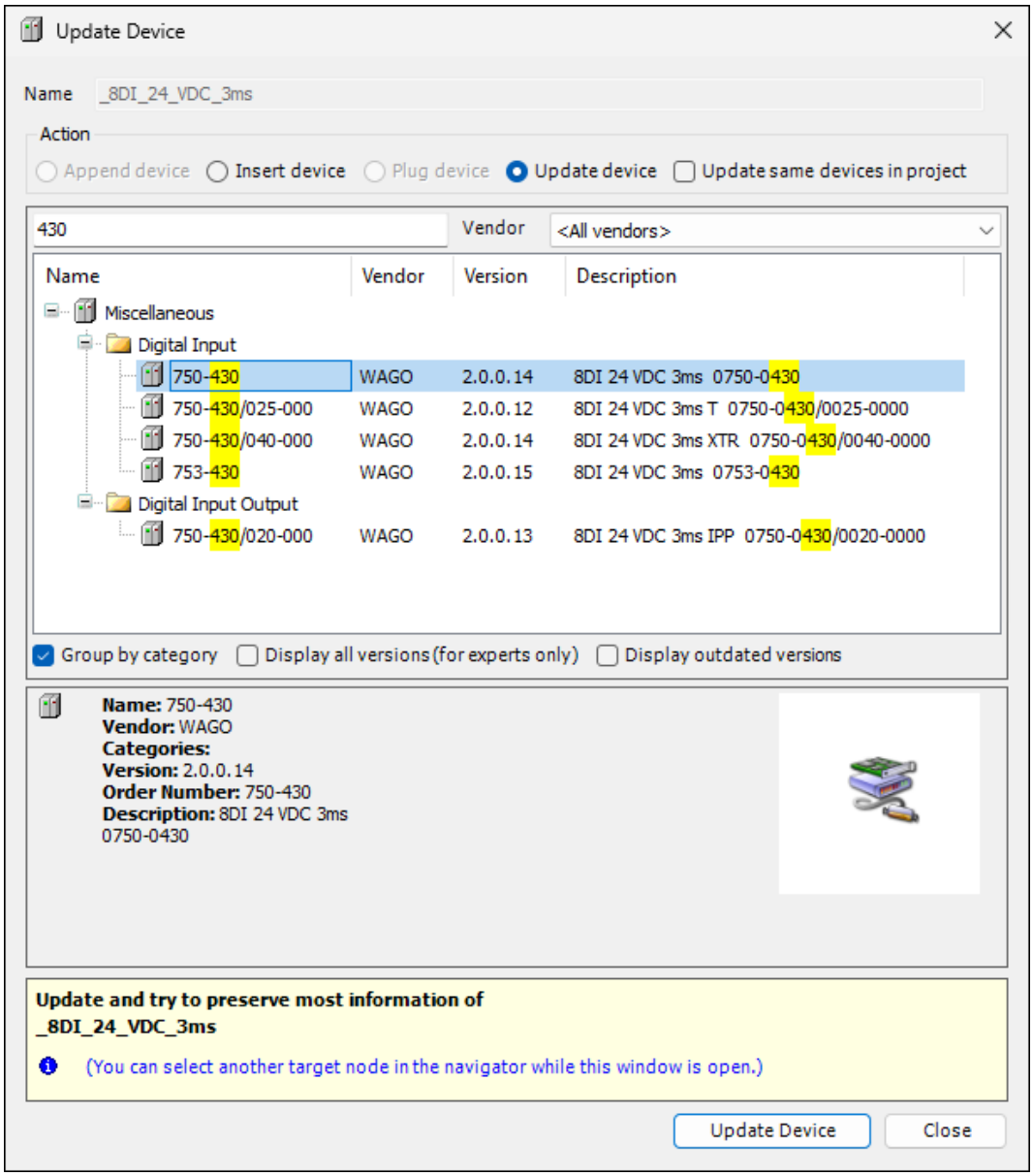

Figure 55: Updating I/O Modules

16. Repeat the procedure for all I/O modules until all the I/O modules have been updated and no more question marks remain.
17. Click on the I/O modules to open the "K-BUS I/O Mapping" tab on the right.
    ⇨ The variables from the I/O images of the I/O modules appear here. After the update, the variables are initially missing. The I/O images must be imported from the CSV file.
18. To do so, right-click on "Kbus (Kbus)" and select "Import mappings from CSV..." from the context menu.
19. Select the CSV file you saved in ***e!****COCKPIT* and open it.
    ⇨ The variables from the CSV file are loaded and displayed on the "K-BUS I/O Mapping" tab, similarly to how they are in ***e!****COCKPIT*.

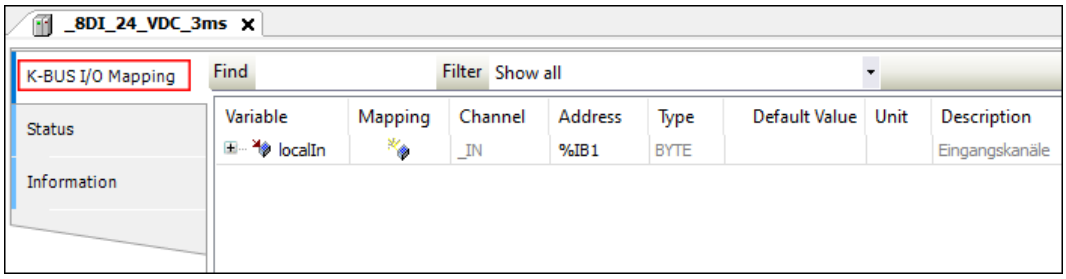

Figure 56: Imported Variables

20. Since you no longer need the old device, delete the old device from the project tree.
21. Save and close the project.
22. Reopen the project.
23. Update the project environment by clicking **[Set All to Newest]**.

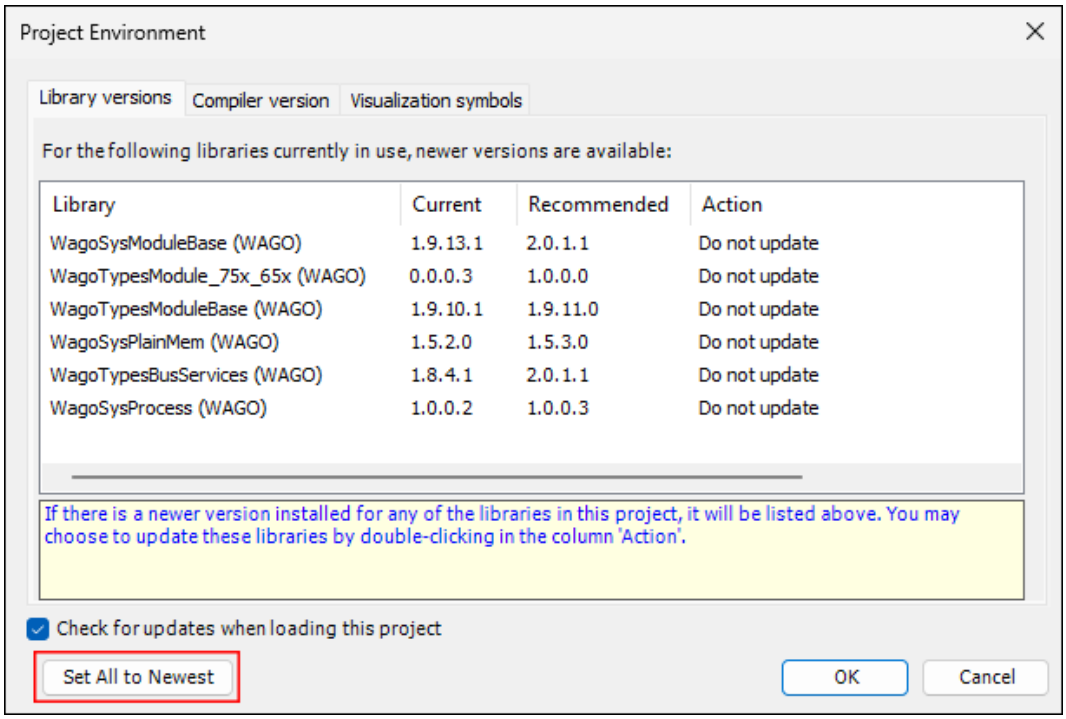

Figure 57: Setting Everything to "Latest"

24. Click **[OK]** to confirm.
25. Save the project.

5.8 Adding Missing Libraries and/or Library Licenses

You may find that libraries are missing from the project. The message window will indicate this for you.

1. Install missing libraries via the "Tools" > **Library Repository...** tab as described in **Installing WAGO Libraries separately [▸ 11]**.
2. If you have installed the library in the library repository, add it to your project with **[Add Library]**.

   ⇨ The system checks whether the library has a license requirement. The "WAGO Licensing" add-on monitors the licensing of WAGO components and, if you need a license, opens a pop-up indicating this.

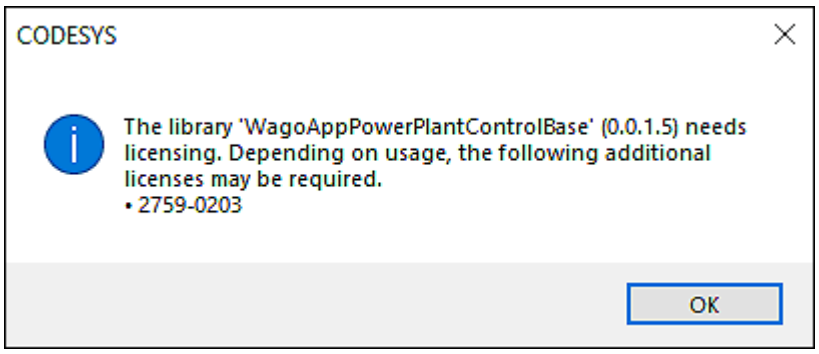

Figure 58: Notification of Missing License

   ⇨ The license requirement is also indicated in the message window. A notification appears for each device used.

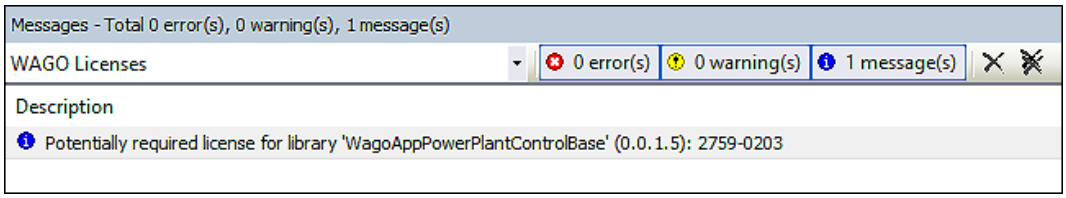

Figure 59: Notifications of Missing Licenses in the Message Window

   ⇨ **Notes**
   You can obtain the "WAGO Licensing" add-on from the WAGO Download Center (see also **Installing the "WAGO Licensing" Add-on [▸ 12]**). Without this add-on, you will not see any license requirement notifications.
   You may receive notifications if you open a project that already contains licensed libraries, as well as later in a project, for example during code generation. The actual license requirement arises at runtime on the PFC, for example when certain functions are used.
   During code generation, the notifications refer only to the current application. If you want to view all the project's license requirements in the message window, close the project and reopen it.
3. Purchase the licenses via the WAGO website.
4. Install the purchased licenses as described in **Transferring Licenses with WAGOupload [▸ 13]**.

Note: If no license is purchased, the unmet license requirement will cause errors. The LED flash codes on the PFC signal these:
- Flashing orange/red in "Evaluation Mode" (30 days of operation with active license require-

ment) if the license requirement is not met
- Flashing red in "Expired Mode" (evaluation period expired) if the license requirement is not met

Reusing "Old" Libraries from *e!COCKPIT*

You can reuse "old" libraries from ***e!****COCKPIT*, but this is not recommended. In particular, older licensed libraries can lead to errors in the project during compilation. Use the latest version of these libraries instead.

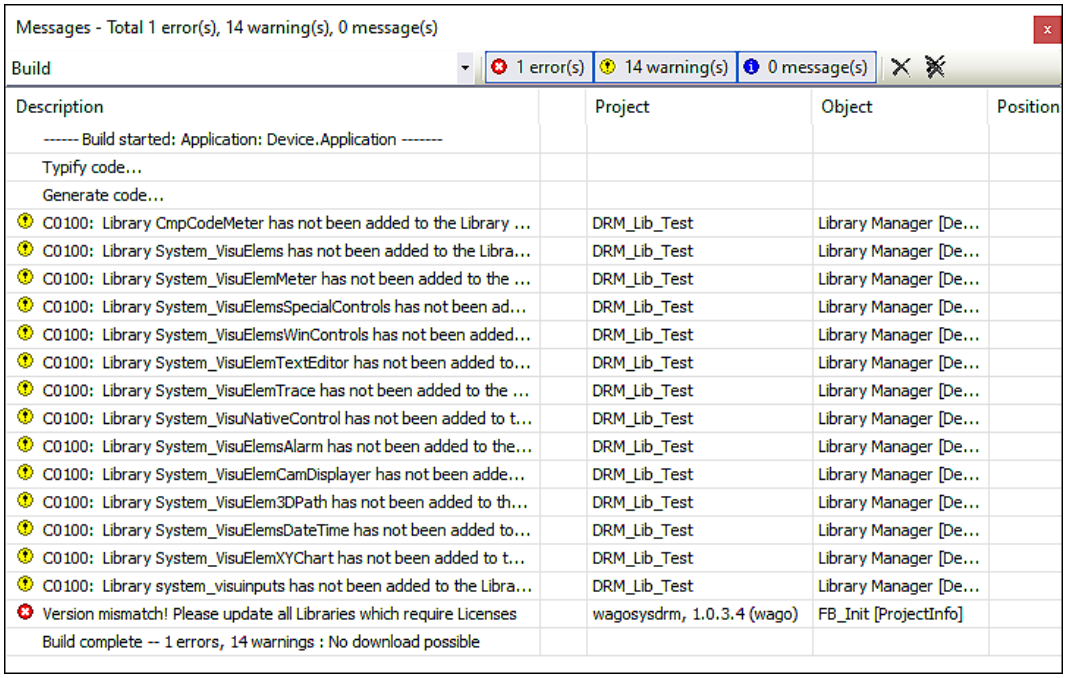

Figure 60: Notifications of Missing Licenses in the Message Window

1. To update the old libraries in question or replace them with the new versions, first open the **Library Manager**.
2. Click **[Placeholder]**.
3. In the dialog, double-click the corresponding libraries and select the latest library version.
4. Purchase licenses for the new libraries via the WAGO website.
5. Install the purchased licenses as described in **Transferring Licenses with WAGOupload [▸ 13]**.

6 Differences in Workflows and Functions

The following table gives an overview of the differences in the operation of CODESYS and ***e!****COCKPIT* and indicates where certain ***e!****COCKPIT* functions and settings can be found in CODESYS.

The biggest difference between the two tools is the user interface, especially the graphical representation of the network view that ***e!****COCKPIT* offers. For project engineering, devices can be dragged and dropped into the project in the form of graphical device tiles and connected to each other to form a network by drawing lines. Graphical aids (colored connectors) are also used to specify fieldbuses. Many functions can be accessed directly from the graphical network view through the context menu.
In contrast, in CODESYS, all operations are performed from the device tree. For example, here you can connect a network's devices by entering the IP address, and fieldbuses are also added and configured through the device tree.

The fieldbus configurators are similar because many CODESYS functions and interfaces are used in ***e!****COCKPIT*. The basic use of various fieldbuses is described in **Fieldbus Configuration in CODESYS [▸ 55]**. You can find more information on fieldbus configuration in CODESYS in the CODESYS online help at **help.codesys.com** (up to service pack 17) and **helpme-codesys.com** (current service pack).

Table 1: Differences in Workflows and Functions

e!COCKPIT	**CODESYS**
Licenses	
You can activate the license for ***e!****COCKPIT* itself via the Backstage view, "Licensing" page, **[License Management]** > **[Enter Licenses]**.	Entering a CODESYS license is not required. CODESYS itself is available free of charge and license-free.
Licenses for additional functions can be purchased, assigned to devices and synchronized on devices via the "Project Licensing" panel.	Licenses for WAGO libraries or additional functions can be displayed in CODESYS via the "WAGO Licensing" add-on and transferred with WAGOupload (see **Installing the "WAGO Licensing" Add-on [▸ 12]** and **Transferring Licenses with WAGOupload [▸ 13]**. **Note:** Always use the "WAGO Licensing" add-on and WAGOupload for displaying and activating licensed WAGO products. For licensed CODESYS products on the other hand, use the CODESYS functions under "Tools" > "License Manager"/"License Repository."
Downloading Additional Components	
Updates for ***e!****COCKPIT*, as well as add-ons and firmware, can be downloaded and installed via the Backstage view on the "Updates & Add-ons" page.	CODESYS updates appear on the software's start page when available. Add-ons can be downloaded via **CODESYS Website** and installed in CODESYS (see **Installing CODESYS Add-ons [▸ 9]**). Firmware can be downloaded via the **WAGO Download Center**; however, it is updated not in CODESYS, but rather via WAGOupload or an SD card (see **Updating Firmware for Use in CODESYS [▸ 8]**). **Note**: WAGO is currently working on a central download solution via the WAGO Download Center. We will inform you as soon as this is available.

e!COCKPIT	CODESYS
Importing Devices	
Device descriptions for WAGO devices are automatically integrated when ***e!****COCKPIT* is installed. Additional devices can be integrated via the Backstage view, "Product Catalog" page > **[Import Device]**.	Required device descriptions are first downloaded through **WAGO Download Center** and integrated via the "Tools" tab > **CODESYS Installer...** (see **Installing WAGO Components collectively via Package Files [▸ 9]**). Additional devices can be integrated via "Tools" > "Device Repository ..." (see **Installing WAGO Device Descriptions separately [▸ 11]**).
Adding Devices in the Project	
Devices can be added to the project by dragging and dropping them from the product catalog.	Devices are offered for selection in a dialog when a new project is created. For this to work, the corresponding device descriptions must already have been installed. In an existing/empty project, devices can be added by clicking on the root node and **Insert Device ...**.
I/O modules can be connected to the device by dragging and dropping them.	I/O modules can be added by right-clicking on "Kbus (Kbus)" in the device tree and **Insert Device ...**.
Selecting and Configuring a Fieldbus	
The fieldbus is defined in a graphical network view by drawing connecting lines between fieldbus-specific connectors. For Modbus, the protocol is also specified via a context menu (e.g., TCP or UDP). In addition, the communication direction (master/slave) can be assigned via the context menu.	The fieldbus is added via **Insert Device ...** in the context menu of the device. Only the fieldbuses that the device supports are displayed in the dialog. **Note:** For the "Modbus" fieldbus, "Ethernet" is selected first. Modbus can then be selected via **Insert Device ...** under the Ethernet element in the device tree.
Establishing a Connection between Devices	
In ***e!****COCKPIT*, devices are connected by drawing connecting lines between them.	As a general rule, in CODESYS, a connection is established between devices by adding/nesting elements in the device tree and (depending on the fieldbus) by entering the slave IP address for the master device. **Fieldbus Configuration in CODESYS [▸ 55]** describes how devices are integrated/connected depending on the fieldbus used. An example for commissioning a Modbus node is described in **Example Project: Creating a New Modbus Project in CODESYS [▸ 64]**.
Mapping Data Points	
For Modbus couplers, the I/O image is created automatically.	The I/O image/mapping of a Modbus coupler can be created manually with the help of the CODESYS manual (the Modbus configuration) and the product manuals (the structure of the I/O data).
Replacing Devices	
In ***e!****COCKPIT*, devices of a project of the same type can be replaced via the menu ribbon, "DEVICE" tab, or by right-clicking in the device's context menu and clicking **[Replace Device]**.	In CODESYS, a device can be replaced by right-clicking in the device tree and selecting **Update Device ...**. Functions that the new device does not support are eliminated; additional functions that the new device supports are added (see also "Adjusting Device Type Versions/Device Descriptions" in this table).
Network Scan	
The network scan for devices is performed in ***e!****COCKPIT* via the menu ribbon > "NETWORK" tab > **[Scan]**. Here you can also set the PC interface and IP range.	In CODESYS, scanning the entire network is not supported, but searching for an individual device is. To perform the scan, double-click on the device in the device tree > "Communication" tab > **[Scan Network ...]** Limiting the IP range, scanning multiple devices and setting different interfaces are not possible.

e!COCKPIT	CODESYS
Module Scan	
You can perform a module scan in ***e!****COCKPIT* via the menu ribbon >"DEVICE" tab > **[Scan Modules]**, or in a device's context menu.	You can find I/O modules by right-clicking on "Kbus (Kbus)" in the device tree and selecting **Scan for Devices**.
Compiler Version, Visualization Profile, Device Description and Firmware Compatibility	
In ***e!****COCKPIT*, message windows appear in the event of incompatibility and provide recommendations for changes. A compatibility list is available for guidance: **https://techdocs.wago.com/Software/eCOCKPIT/en-US/index.html#1889686667**.	The following versions are compatible for devices using CODESYS Runtime: see product manuals of the PFC G2 as of FW23 under "CODESYS V3 Compatibility".
Adjusting Compiler Version/Visualization Profile	
The compiler version/visualization profile can be adjusted in the Backstage view, "Project Settings" page > "CODESYS Project Settings" > "Project Settings."	The compiler version and the visualization profile can be adjusted on the "Project" tab under **Project Settings ...** > **Compiler Options** or **Visualization Profile**.
Adjusting Device Type Versions/Device Descriptions	
Device type versions/device descriptions can be modified in the menu ribbon > "DEVICE" tab > "Version Information" tab group with the **[Replace]** button.	Device type versions/device descriptions are displayed for selection in the "Update Devices" dialog (right-click on the device > **Update Devices ...**). To display all available versions of a device, the "Show All Versions (Experts Only)" option must be enabled in the dialog.
Updating Firmware	
The firmware can be downloaded in the Backstage view > "Updates & Add-ons" page and installed via the menu ribbon > "DEVICE" tab > "Replace Firmware."	The firmware is downloaded via the **WAGO Download Center**. However, replacing the firmware is done not with CODESYS, but rather with WAGOupload or via SD card (see **Updating Firmware for Use in CODESYS [▸ 8]**).
Compiling, Connecting and Launching an Application	
You can compile an application via the "PROGRAM" tab > "Compile." You can connect devices online either by right-clicking on a device and selecting "Connect," or alternatively via the button in the menu ribbon. "PROGRAM"/"DEBUG" tab > **Start** launches the application.	You can compile the application via the "Build" tab > **Generate Code**. You can connect the application online by double-clicking on the device and the "Online" tab > **Login** or right-clicking "Application" > **Login**. Right clicking "Application" > **Start** launches the application.
Debug Mode	
After login, you can start the execution and verification of the source code via the menu ribbon > "PROGRAM"/"DEBUG" tab > **[Simulate Application]**.	After login, you can start execution and verification of source code via the "Debug" tab > **Start**.
Creating a Visualization	
You can create a visualization by right-clicking on an application and selecting the new "Visualization" element.	You can create a visualization by right-clicking on an application and choosing **Add Object** > **Visualization**.
Program Download	
A program can be downloaded via the menu ribbon > "PROGRAM" tab > "Program Download" or "Multiple Download," for example.	A program can be downloaded via the "Online" tab > **Source Download to Connected Device** or **Multiple Download**.

e!COCKPIT	CODESYS
Adding Libraries	
Libraries are added via the "Program Structure" panel by double-clicking "Library Manager" and **[Add Library]**.	Required libraries are first downloaded via the **WAGO Download Center** and installed via the "Tools" tab > **CODESYS Installer ...** (see **Installing WAGO Components collectively via Package Files [▸ 9]**). Additional libraries can be installed via the "Tools" tab > **Library Repository ...** (see **Installing WAGO Libraries separately [▸ 11]**) and added from the repository to the project in the device tree by double-clicking "Library Manager" > **[Add Library]**.
Add-ons	
License-based additional components (add-ons) appear on the "Updates & Add-ons" page of the Backstage view together with other components such as firmware, service packs, libraries and visualization styles. They can be downloaded, installed and licensed there.	License-based additional components (add-ons) can be downloaded via **CODESYS Website** and installed via the "Tools" tab > **CODESYS Installer ...** (see **Installing CODESYS Add-ons [▸ 9]**). Unlike ***e!****COCKPIT*, CODESYS bundles the add-ons together; they are not available individually.
Configuring I/O Modules	
WAGO I/O-*CHECK* is already integrated into ***e!*** *COCKPIT* for I/O module configuration.	The stand-alone WAGO I/O-*CHECK* software is used for I/O module configuration (see **Installing and Using WAGO I/O-CHECK [▸ 13]**).
Importing/Exporting Program Elements (PLCopen XML)	
Program elements can be imported/exported in the Backstage view on the "Import/Export" page.	Program elements can be imported/exported on the "Project" tab > **Import PLCopenXML .../Export PLCopenXML ...**.
Documenting/Printing a Project	
The "Document Project" function can be found in the Backstage view > "Print" page.	The "Document Project" function can be found on the "Project" tab.
Version Management (SVN)	
If the "e!COCKPIT SVN" add-on has been installed and licensed (Backstage view, "Updates & Add-ons" page), different versions of a project can be managed via the "SUBVERSION" tab.	CODESYS version management for projects is included in the CODESYS Professional Developer Edition (fee-based; see **Installing and Launching [▸ 7]**).
Python	
e!*COCKPIT* can be operated via Python scripts in the Backstage view, "Scripting" page.	Python scripts can be executed from the Tools tab > **Scripting**.

7 Fieldbus Configuration in CODESYS

Fieldbus configuration in ***e!****COCKPIT* and CODESYS can differ to varying degrees depending on the fieldbus used. Some CODESYS configurators can be integrated into ***e!****COCKPIT* with slight adjustments. In this regard, the differences between the use of the two tools are comparatively small. For other configurators (such as Modbus), various modifications have been made for ***e!****COCKPIT*. This results in bigger differences in the comparison between ***e!****COCKPIT* and CODESYS. After migrating your project, use the native fieldbus configurators from CODESYS. Note that this renders WAGO fieldbus configuration documentation inapplicable; use the CODESYS online help instead at **help.codesys.com** (up to service pack 17) and **helpme-codesys.com** (current service pack).

When you start a new project and add a device, the device tree below the device is initially empty. At the beginning, you create fieldbus elements in the device tree and arrange further devices below them. Devices are generally connected by adding master/slave elements below the respective fieldbus element. For devices of a project, generally only fieldbuses that the device supports can be selected and configured.

7.1 Modbus – First Steps

For the "Modbus" fieldbus, note that for the Modbus master and slave device, an "Ethernet" element has to be created first. The Modbus master and slave are inserted under it. A representative of the slave is inserted under the Modbus master and establishes a connection between the master and slave via the slave IP address.

✓ You need to have inserted two devices in your project. One of the devices will play the role of the Modbus master and the other that of the Modbus slave.

1. First create an "Ethernet" fieldbus element for both devices in the device tree. To do so, right-click on the respective device and select **Insert Device ...**.
2. Select the "Ethernet" fieldbus under "Ethernet Adapter."

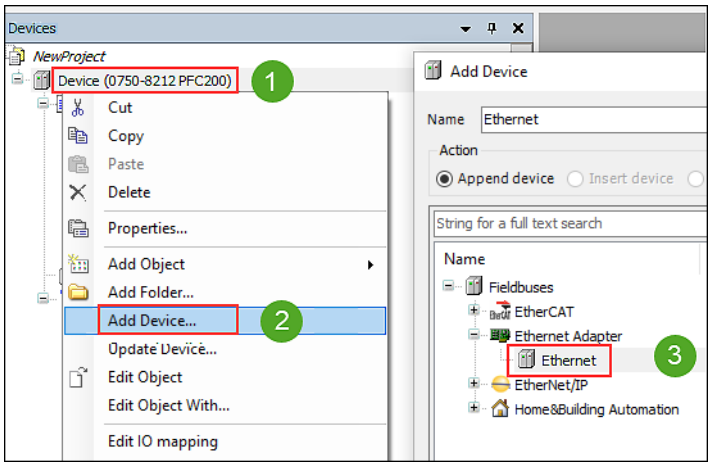

Figure 61: Inserting an "Ethernet" Fieldbus

3. Click **[Insert Device]** and leave the dialog open.

   ⇨ A new "Ethernet (Ethernet)" element is created in the device tree.
4. Click on the new "Ethernet (Ethernet)" element.
5. Under "Modbus," select the "Modbus TCP Slave" for the slave device in the dialog that is still open, confirm with **[Insert Device]** and leave the dialog open.

6. Under "Modbus," select the "Modbus TCP master" for the master device in the dialog that is still open, confirm with **[Insert Device]** and leave the dialog open.

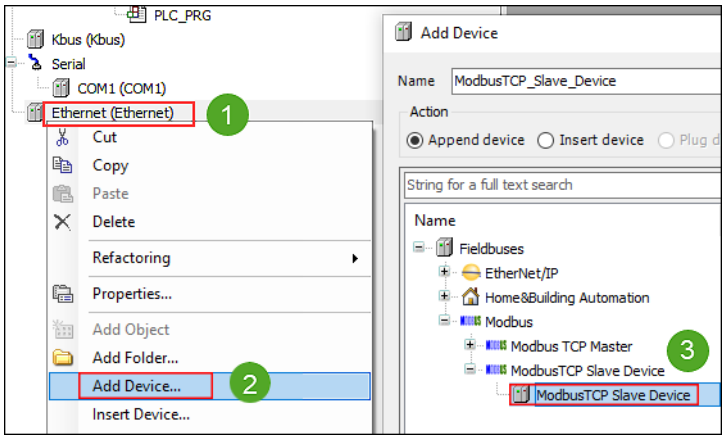

Figure 62: Inserting Devices

7. Click the "Modbus_TCP_Master (Modbus TCP Master)" element in the device tree and insert the "Modbus TCP Slave Device" element from the dialog that is still open.

   ⇨ You have now inserted a slave element under the master in the device tree, through which the connection between the master and the physical slave is established.

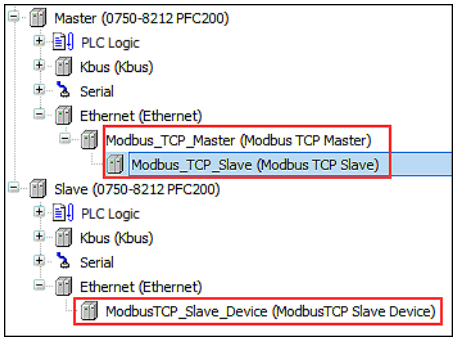

Figure 63: Modbus Master and Slave Created

8. To link the master and slave, now enter the IP address of the slave device for the "Modbus_TCP_Slave (Modbus TCP Slave)" slave element below the master. To do so, double-click "Modbus_TCP_Slave (Modbus TCP Slave)" to open the configuration and enter the IP address of the slave device on the "General" tab.

You can find a complete example project in **Example Project: Creating a New Modbus Project in CODESYS [▸ 64]**.

7.2 CANopen – First Steps

✓ You need to have inserted two devices in your project. One of the devices will play the role of the CANopen device (slave) and the other that of the CANopen manager (master).

1. You first create a "CANopen" fieldbus element for both devices in the device tree. To do so, right-click on the respective device and select **Insert Device ...**.
2. Under "CANbus," select the "CANbus" item and click **[Insert Device]**.

Configuring CANopen Device (Slave)

1. Right-click on the new, still empty item under the "CANbus (CANbus)" element of the slave device.

2. To insert a slave, select the "WAGO CANopen Device" and confirm with **[Plug Device]**.

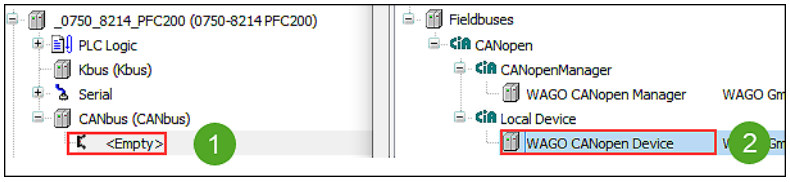

Figure 64: Inserting "WAGO CANopen Device"

3. To open the device settings, double-click on the new "WAGO_CANopen_Device (WAGO CANopen Device)" element in the device tree.

   ⇨ On the "General" tab you can edit the I/O area for the CANopen device, among other things:

4. Click **[Edit I/O Area ...]** and add one or more new areas.
5. Click **[OK]** to confirm.

   ⇨ After that, you can either export the I/O image and additional data as an "Electronic Data Sheet" (EDS) (and re-import it later) or install the data directly in the device repository:

6. **Option 1: Exporting the Slave's EDS**
   On the "General" tab, click **[Export EDS File ...]**.
   If you are using multiple CANopen devices, save the EDS file with a unique filename.
   Option 2: Installing EDS Directly in the Device Repository
   Instead of exporting the slave's EDS file and then re-importing it in the device repository, you can also install the EDS file of a CANopen device (slave) directly in the device repository using the corresponding button. After that, you can find the slave there under the selected product name.

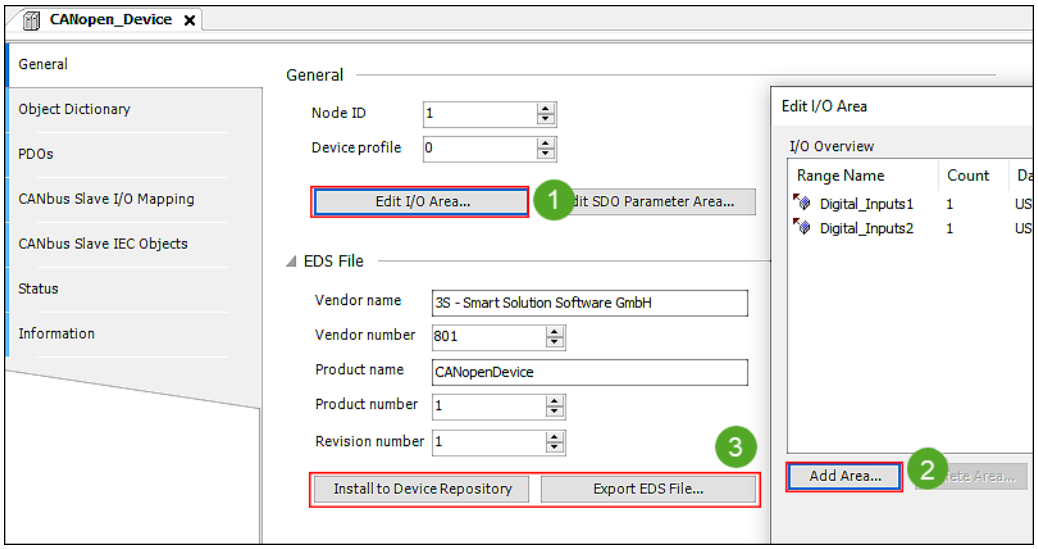

Figure 65: Exporting an EDS File or Installing It Directly in the Device Repository

Configuring CANopen Manager (Master)

1. Right-click on the new, still empty item under the "CANbus (CANbus)" element of the master device.
2. To insert a master, select the "WAGO CANopen Manager" and confirm with **[Plug Device]**.

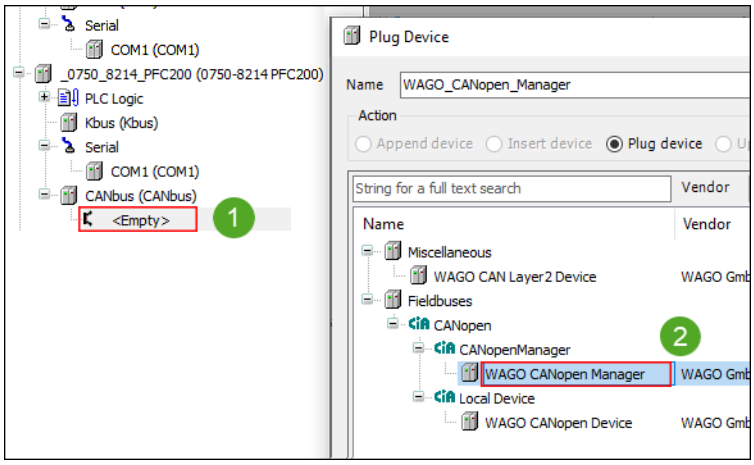

Figure 66: Inserting "WAGO CANopen Manager"

⇨ To assign one or more slaves to the master, the EDS files of the slaves must be installed; they can then be attached to the master:

3. To import or install the EDS file of a slave, click **[Device Repository ...]** on the Tools tab and **[Install ...]** in the dialog.
   Select the previously exported EDS file (or another one) to import and click **[Open]**.
4. To attach the slave to the master, right-click the "WAGO_CANopen_Manager (WAGO CANopen Manager)" in the device tree and select **Insert Device ...**.
5. Select the corresponding slave device from the list and click **[Insert Device]**.

➡ The devices are now created and connected.

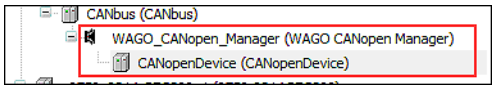

Figure 67: Connected CANopen Devices

7.3 EtherNet/IP – First Steps

1. Add a controller that is to be used as an EtherNet/IP master (scanner) to your project.
2. Import the EDS file of a slave device (adapter) via the "Tools" tab > "Device Repository."
3. Right-click on the controller and click **Insert Device ...**.
4. Select the "Ethernet" item under "EtherNet/IP" > "EtherNet/IP Adapter" and click **[Insert Device]**.

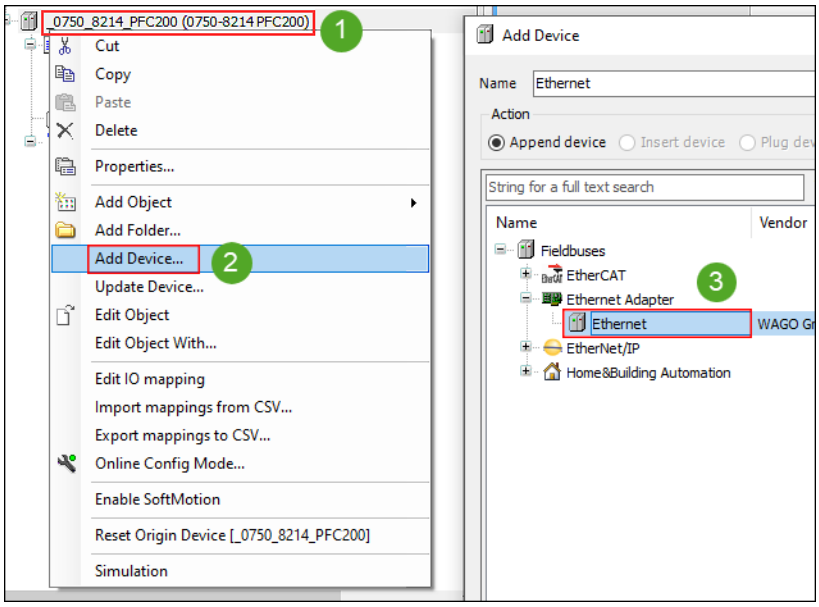

Figure 68: Inserting Ethernet/IP Device

5. Double-click the "Ethernet (Ethernet)" element to configure the Ethernet interface.
6. On the General tab, click **[Browse ...]**, select network adapter "br0" and enter the IP address for the EtherNet/IP interface.

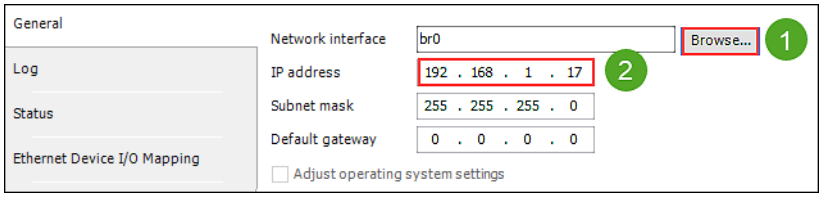

Figure 69: Configuring EtherNet/IP Interface

7. In the device tree, right-click "Ethernet (Ethernet)" and select **Insert Device ...**.
8. Select the "EtherNet/IP Scanner" under "EtherNet/IP."
9. Select **Insert Device ...** and leave the dialog open.

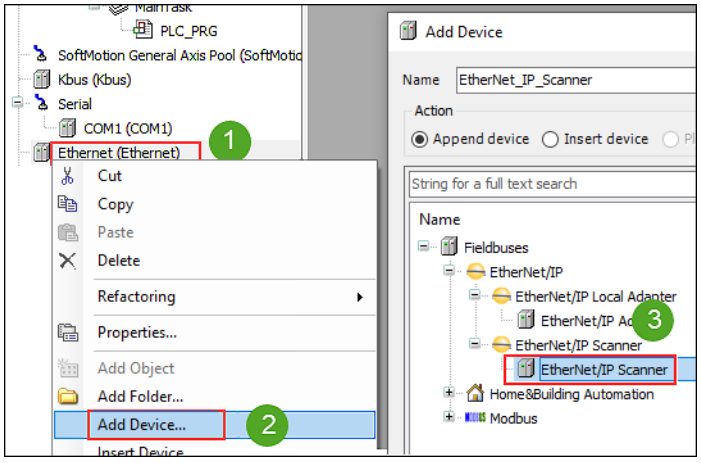

Figure 70: Inserting EtherNet/IP Scanner

10. Click on the "EtherNet_IP_Scanner (EtherNet/IP Scanner)" element in the device tree and select the slave device (adapter) imported via the EDS file in the dialog that is still open.

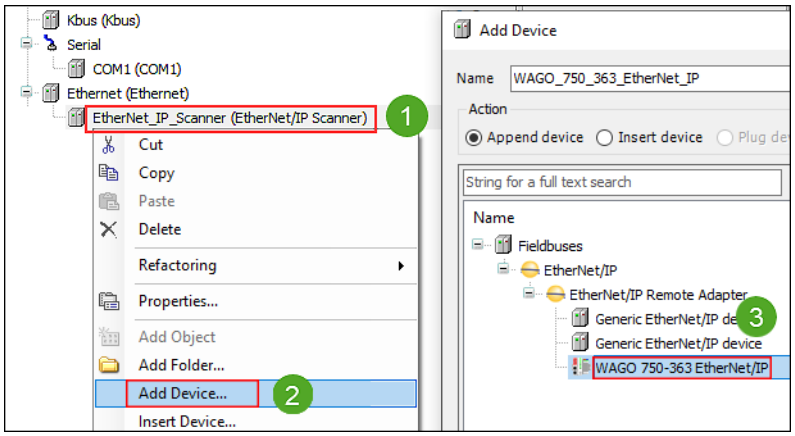

Figure 71: Selecting EtherNet/IP Slave

11. Click **[Insert Device]**.
12. Double-click on the slave device in the device tree to open the slave configuration and specify connections and assemblies.

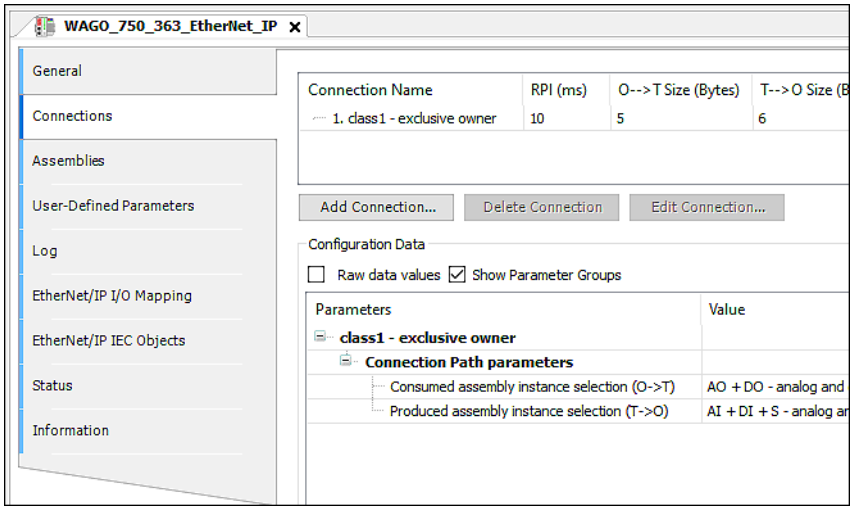

Figure 72: Configuring EtherNet/IP Slave

⇨ In EtherNet/IP, I/O data (input and output data points) is transferred via so-called connections (the term "Connections" is also used in ***e!****COCKPIT*). When the fieldbus starts up, one or more of these connections can be established between an EtherNet/IP master and an EtherNet/IP slave. The input and output data points of a connection and the configuration data are grouped into so-called assemblies. To see which connections a slave device supports, consult the device description file (EDS file) or the respective product manual of the slave. The connections and the data to be transferred are usually configured automatically using the information contained in the EDS file.

13. On the "Connections" tab, use **[Add Connections ...]** to create new connections according to your product manual.
14. Click on the new connection and then click **[Edit Connection ...]** to set the path in the dialog and to set or change the size of the input/output data (T → O / O → T) for your connections.
15. Click the Assemblies tab to see how the assemblies were created according to your input/output data.

7.4 EtherCAT – First Steps

For EtherCAT communication, the Ethernet ports of the controller that are connected internally via a switch must be disconnected. EtherCAT communication is only permitted via port X2.

1. To separate the ports, first open the WBM of the controller that is to be used as the EtherCAT master. To do so, enter the IP address of the controller in the browser and log in.
2. On the "Configuration" > "Networking" tab of the WBM, click "Ethernet Configuration."
3. Select port X2 for bridge 2 (also referred to as "br1" in CODESYS) to separate the ports.

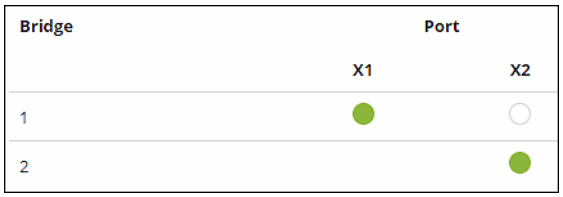

Figure 73: Separating Ethernet Ports

4. Then reboot the controller.
5. Now add the controller to your CODESYS project.
6. First, double-click on the controller to open the configuration.
7. Configure the gateway and enter the IP address of the controller.
8. Right-click on the controller and click **Insert Device ...**.
9. Select the "EtherCAT Master" item in the tree under "EtherCAT" > "Master" and click **[Insert Device]**.

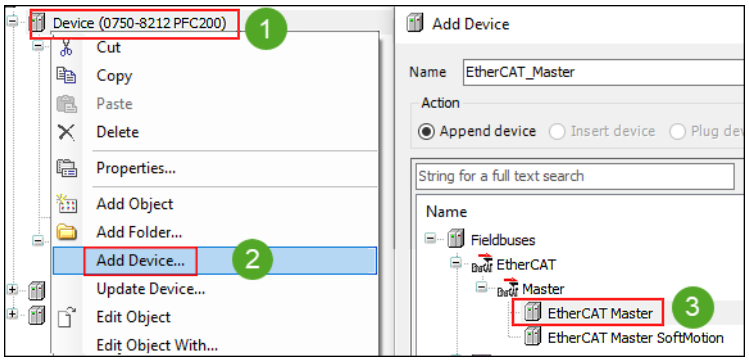

Figure 74: Inserting EtherCAT Master

10. To configure the EtherCAT master, double-click it in the device tree.
11. Click **[Select ...]** on the General tab of the EtherCAT configuration to specify the network adapter that is to be used, i.e. the EtherCAT interface.
12. Select the "br1" item. This identifies the EtherCAT interface on port X2.

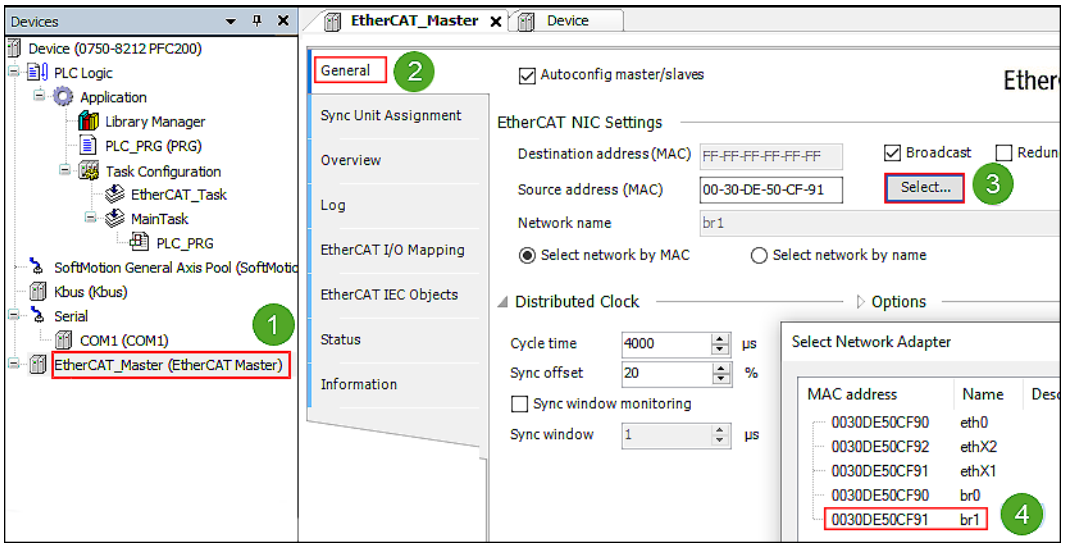

Figure 75: Specifying the Interface

13. Right-click on the "EtherCAT_Master (EtherCAT_Master)" in the device tree and select **Insert Device ...**.
14. Select a (previously installed) EtherCAT slave from the list and click **[Insert Device]**.

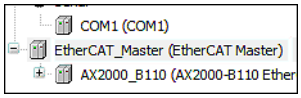

Figure 76: EtherCAT Master with Attached Slave

7.5 "WAGO Telecontrol" Add-on "(Telecontrol Configurator) – First Steps

1. Install the add-on as described in Installing the "WAGO Telecontrol" Add-on [▸ 11].
2. Add a controller to your project that supports "Telecontrol," such as a PFC200, 750-8212.
3. Right-click on the controller and click **[Insert Device ...]**.

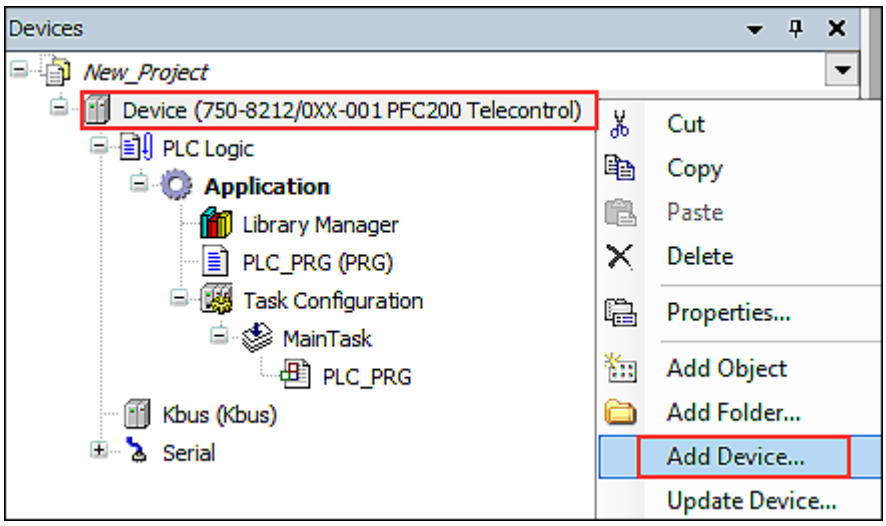

Figure 77: Inserting a Device

4. Select the "WAGO Telecontrol Configurator" entry and click **[Insert Device]**.

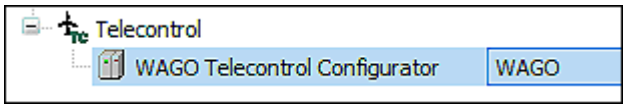

Figure 78: Selecting "WAGO Telecontrol Configurator"

⇨ The configurator is inserted into the device tree.

5. Double-click on the configurator to open the configuration interface.

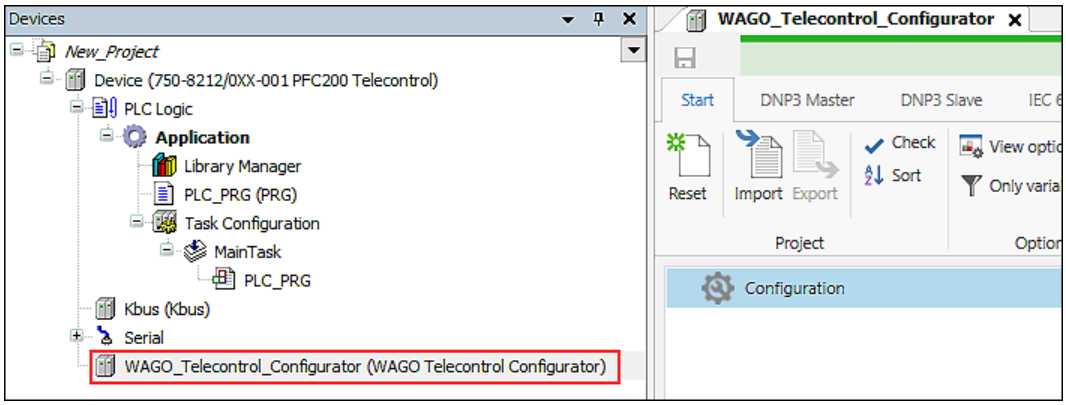

Figure 79: Opening the Telecontrol Configurator

Tip: Documentation on the use of the Telecontrol Configurator can be found on the WAGO website.

8 Example Project: Creating a New Modbus Project in CODESYS

In this example, you will create a Modbus project with two PFC200 750-8212 Controllers, which are to be used the Modbus master and Modbus slave. You will add I/O modules, create a small program and exchange data between the devices.

Initial state:
- The 750-8212 Controllers have firmware version 23.
- You need to have installed CODESYS and required components, such as device descriptions and libraries (see **Installing and Launching [▸ 7]**).

Create the Project

1. Click **New Project** on the start page or the "File" tab.
2. Select the "Standard Project" as the template and assign a name for the project.
   ⇨ The "Standard Project" dialog shows all the available devices. The devices result from the installed device descriptions.
3. Select the first controller (in this example, a PFC200 750-8212) and the programming language you want to use.
4. To add I/O modules, right-click on the "Kbus" element in the device tree and select **Insert Device**.
5. Select the I/O modules of the node from the list and click **[Insert Device]** for each I/O module. In this example, the 750-430 and 750-530 I/O modules are used.
   ⇨ The I/O modules of the node are attached below the "Kbus" element.
6. To add the second controller to the project, right-click on the project name (the first element of the device tree) in the device tree and select **Insert Device**.
7. Repeat steps 4 and 5 for this controller.

Connect to the Device

1. To connect to the controller, double-click it in the device tree.
2. In the graphical view consisting of the PC, gateway and device, enter the IP address of the controller – for example, 192.192.168.1.17 in this case – for the controller that is locally connected to the PC.
   Alternatively, click **[Scan Network]** to search the network for devices.
   Tip: To be able to identify the device more easily during a network scan, it is useful to define a unique host name for the device beforehand via the WBM.
3. Select your device and transfer it by clicking **[OK]**.
4. The login screen of the device opens.
5. Log in to the device with your access data (default: user "admin," password "wago)."
6. Repeat steps 1 to 5 for the second controller.

Configure the Slave Device

1. First create an "Ethernet" fieldbus element for the controller that is to be used as the slave. To do so, right-click on the device and select **Add Device ...**.

2. Select the “Ethernet” fieldbus under “Ethernet Adapter.”

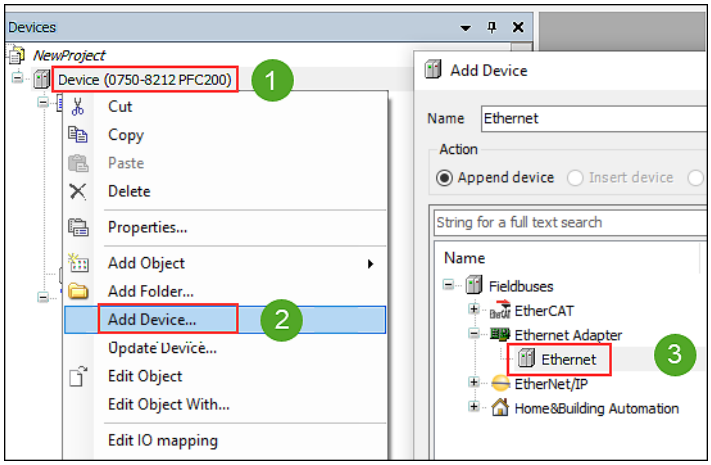

Figure 80: Inserting an “Ethernet” Fieldbus

3. Click **[Add Device]** and leave the dialog open.

   ⇨ A new “Ethernet (Ethernet)” element is created in the device tree.

4. Click on the new element and select the “Modbus TCP Slave” for the slave device under “Modbus” in the dialog that is still open.

5. Confirm with **[Insert Device]**.

   ⇨ In what follows, you will create variables and write a short program to test the data exchange between the master and slave:

6. **Create Variables:** Double click on the slave device to open the configuration.

7. Create two variables on the “Modbus TCP Slave Device I/O Mapping” tab: one with the name “fromMaster” in the holding register and one with the name “toMaster” in the input register.

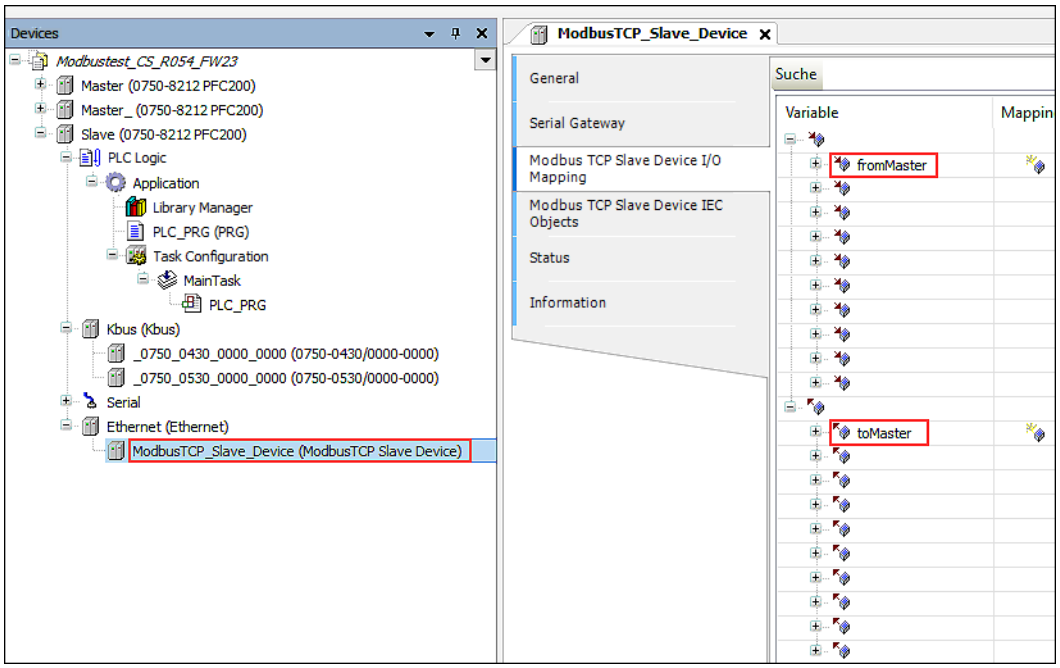

Figure 81: Creating Variables

8. To output variables to the I/O modules, double-click on each I/O module:
   For the 750-430 Digital Input Module, enter "localIn" as the variable.
   For the 750-530 Digital Output Module, enter "localOut" as the variable.

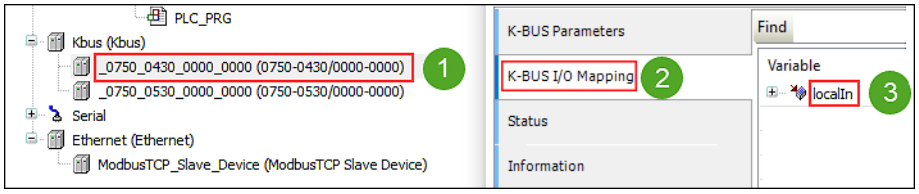

Figure 82: Variable "localIn"

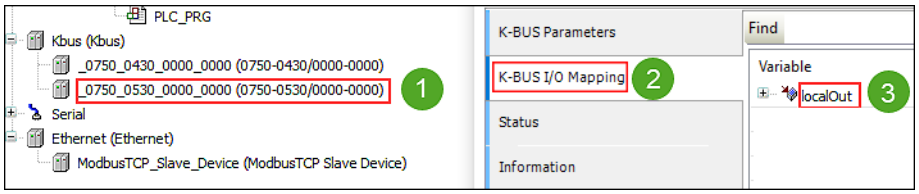

Figure 83: Variable "localOut"

9. **Write the Slave Program:** To open the program editor, double-click on the "PLC_PRG" slave program in the device tree.
10. Create a simple program:

```
localOut := WORD_TO_BYTE(fromMaster);
toMaster := fromMaster / 10;
localIn;
```

    The variable value sent from the master to the slave is output once on the I/O module as a test, divided by 10 and sent back to the master.
11. To compile the program, click **Generate Code** on the "Build" tab (alternatively: function key **F11**).

Configure the Master Device

1. Create an "Ethernet" fieldbus element for the controller that is to be used as the master. To do so, right-click on the device and select **Insert Device ...**.
2. Select the "Ethernet" fieldbus under "Ethernet Adapter."
3. Click **[Insert Device]** and leave the dialog open.
   ⇨ A new "Ethernet (Ethernet)" element is created in the device tree.
4. Click on the new element and select the "Modbus TCP Master" for the master device under "Modbus" in the dialog that is still open.
5. Confirm with **[Insert Device]** and leave the dialog open.
6. Click the new "Modbus_TCP_Master (Modbus TCP Master)" element in the device tree and insert the "Modbus TCP Slave Device" element from the dialog that is still open.
   ⇨ It is placed in the device tree below the Modbus master and represents the slave device.

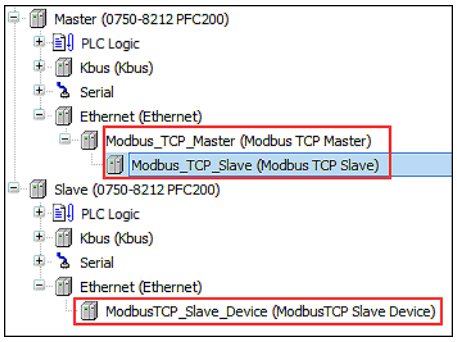

Figure 84: Master and Representative of the Slave

7. To link the master and slave, now enter the IP address of the slave device for the "Modbus_TCP_Slave (Modbus TCP Slave)" below the master. To do so, double-click "Modbus_TCP_Slave (Modbus TCP Slave)" to open the configuration and enter the IP address of the slave device on the "General" tab.
8. Click the "Modbus Slave Channel" tab and create two channels, which you will use these to specify where and how much to read/write.

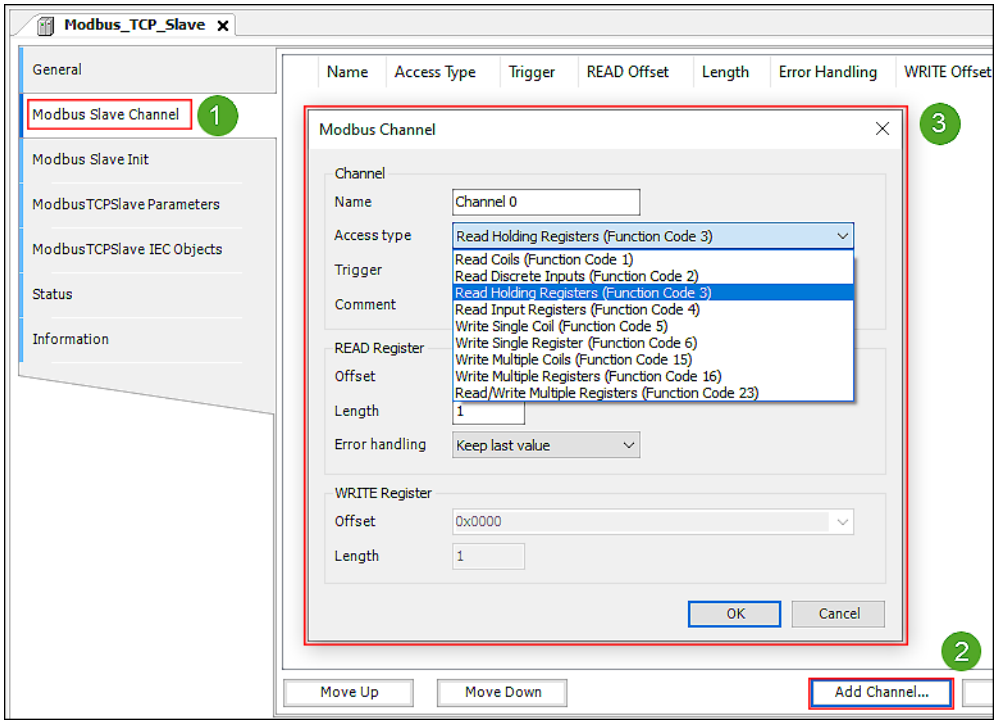

Figure 85: Creating Channels

⇨ Your choice of the access type (or Modbus service) and offset for addressing on what your slave supports. Selecting function codes 4 and 16 is often useful for reading and writing multiple values. For more information about supported Modbus services, refer to the manual of your slave device.
In this example, one channel is created with "WriteSingleRegister" and one channel with "ReadInputRegisters," since only one value is read and written in this case.

9. Click the "Modbus TCP Slave I/O Mapping" tab and create two variables here: "toSlave" (WriteSingleRegister) and "fromSlave" (ReadInputRegisters).
10. **Write the Master Program:** To open the program editor, double-click on the "PLC_PRG" master program in the device tree.

11. Create a simple program:
    ```
    toSlave:=toSlave+1;
    fromSlave;
    ```
    One variable value is incremented and one is output.
12. To compile the project, click **Generate Code** on the "Build" tab (alternatively: function key **F11**).

Connect the Master and Slave Applications Online

1. To connect the application, right-click "Application" for the master and slave respectively and select **[Login]**.
2. For each, download the program to the device.
3. Launch the application by right-clicking "Application" and **Start**.
   ⇨ The program is now running.

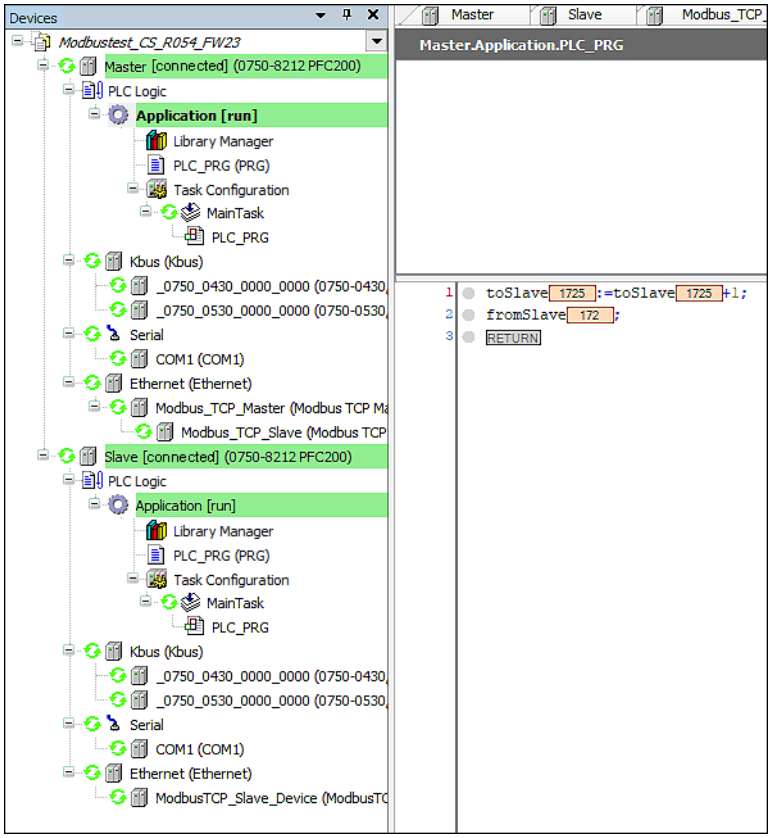

Figure 86: Master Program

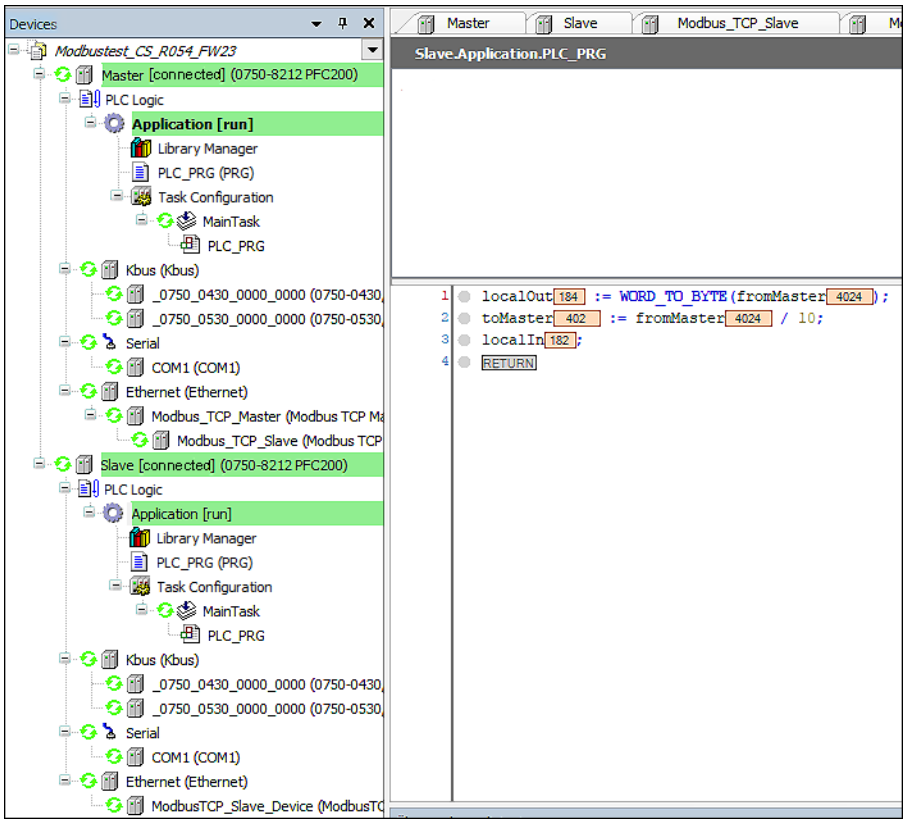

Figure 87: Slave Program

List of Figures

WAGO GmbH & Co. KG
Postfach 2880 · D - 32385 Minden
Hansastraße 27 · D - 32423 Minden
info@wago.com
www.wago.com

Headquaters	+49 571/887 – 0
Sales	+49 (0) 571/887 – 44 222
Order Service	+49 (0) 571/887 – 44 333