EN



CODESYS V3.5

First Start

User manual

version 1.0

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1 Introduction

1.1 About document

This document contains the information necessary to get started with CODESYS V3.5. It is intended for beginners without significant experience with programmable PLCs. The document presents only basic information with an emphasis on simplicity and clarity of presentation. The introduction to the CODESYS V3.5 environment is based on akYtec PLCs, but the main part of the document is universal and can be used to learn to work with any PLC programmable in this environment. It is also considered that the reader may not have a PLC at all, so the execution of an application on a virtual PLC installed together with CODESYS is discussed separately.

The document corresponds to the CODESYS V3.5 SP17 Patch 3 version.

Currently (2025) akYtec manufactures the following lines of PLCs programmable in CODESYS V3.5.17.30:

- PLC210-XX
- SPC210

1.2 About CODESYS V3.5

CODESYS V3.5 is an application development environment for programmable PLCs developed by German company CODESYS Group. PLCs from more than 500 manufacturers including the modern line of akYtec PLCs can be programmed in this environment. CODESYS provides IEC 61131-3 programming language editors, visualization editor, configurators for industrial communication protocols, debugging tools and other components. The software is distributed free of charge. Installation package can be downloaded here:

CODESYS 3.5.17.30 IDE 64-Bit

CODESYS 3.5.17.30 IDE 32-Bit

1.3 About CODESYS versions

CODESYS V3.5 is the successor of the CoDeSys V2.3 environment, support for which has been terminated in 2019.

The transition from the V2.3 platform to the V3.0 platform began in 2005. The V3.5 version was released in 2011, the development and support of which continues until now. A major update to the environment, called service pack (SP), is released once a year. Between service pack releases, several patches with bug fixes are issued. Therefore, the full version designation looks as follows:

V3.5 SP17 Patch 3

where

- ***V3.5*** – platform version
- ***SP17*** – service pack number
- ***Patch 3*** – patch number

The environment version is written often in a short form: ***3.5.17.30***. The short form is used not only for the environment version, but also for its components: plug-ins, libraries, etc.

A specific PLC cannot be programmed in any version of CODESYS, only the version specified by the PLC manufacturer must be used. The firmware version of the PLC can be viewed in the Web Configurator. The firmware version of an SPC210 is also shown on the device display if the CODESYS user application has not yet been downloaded to the device.

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2 Software installation

2.1 CODESYS installation

To install CODESYS, run the downloaded ***.exe*** file.

NOTE

- CODESYS requires an Internet connection for installation, as additional software is downloaded during installation to ensure the full performance of the environment.
- Disable your antivirus software before installing CODESYS.
- Supported operating systems: Windows 8 / 10 / 11.
- Windows 7 is no longer supported by V3.5 SP17 Patch 3.
- To install CODESYS under Linux, read this article.

In the opened window (Fig. 2.1.1), click the ***Install*** button to install ***CODESYS Installer***, a utility required to install the target file package (sect. 2.2).

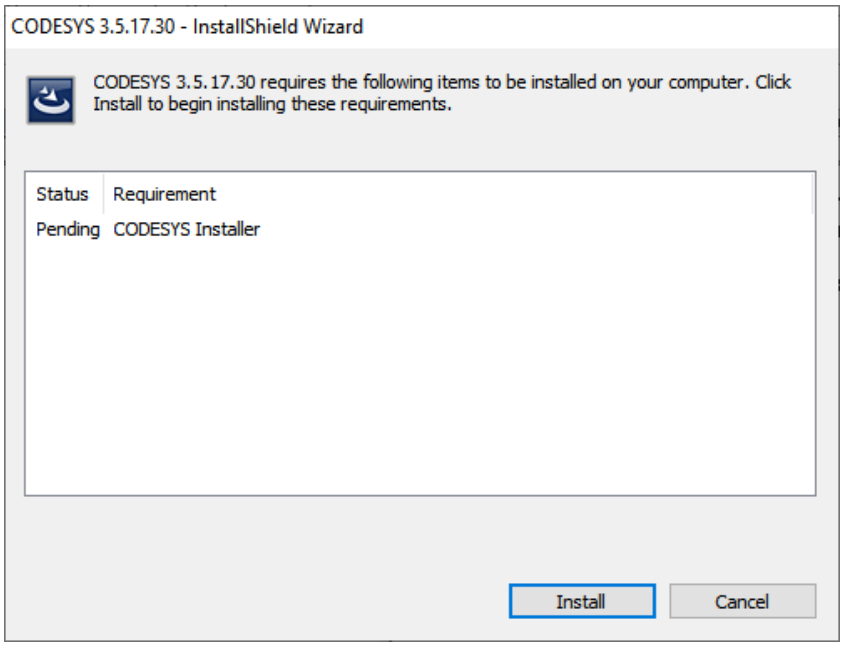


Fig. 2.1.1 CODESYS Installer installation

In the next window (Fig 2.1.2), click the ***Next*** button.



Fig. 2.1.2 Welcome window

In the next window (Fig 2.1.3), read the text of the license agreement, select ***I accept the terms in the license agreement*** and click ***Next***.

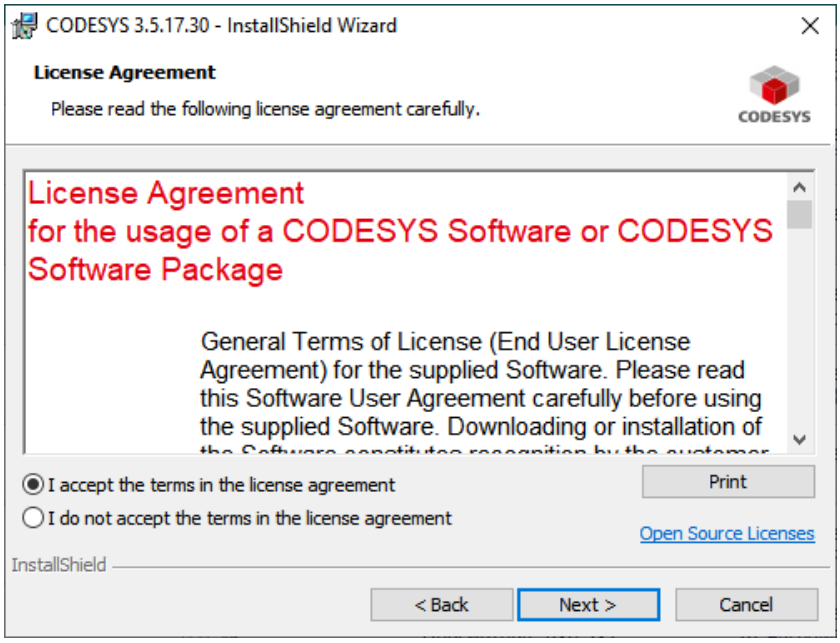


Fig. 2.1.3 License agreement window

In the next window (Fig 2.1.4), read the information about the major changes in the new version, select ***I have read the information***, and click ***Next***.

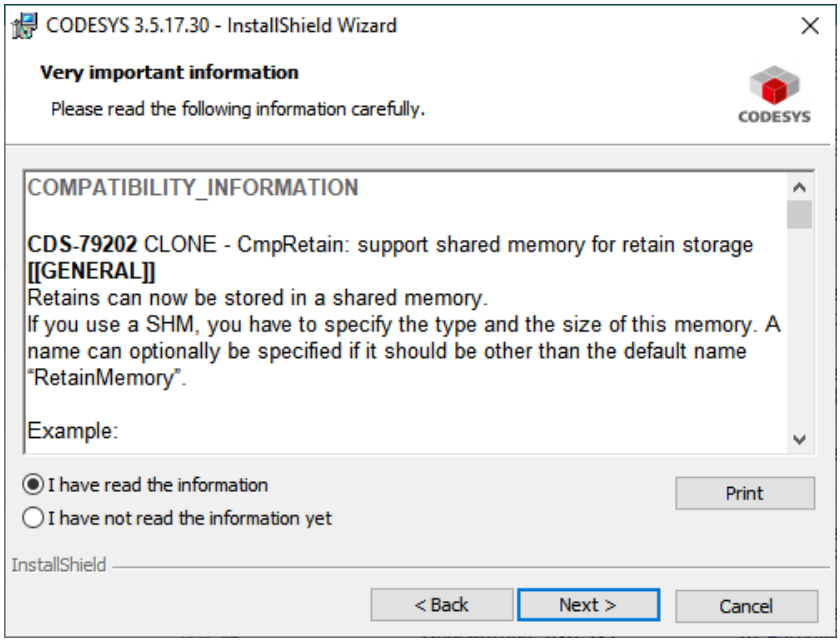


Fig. 2.1.4 Information about the major changes in the new version

In the next window (Fig 2.1.5), select the directory where CODESYS will be installed, and click ***Next***.

NOTE
If you want to use different CODESYS versions on your PC, each version must be installed in a separate directory.

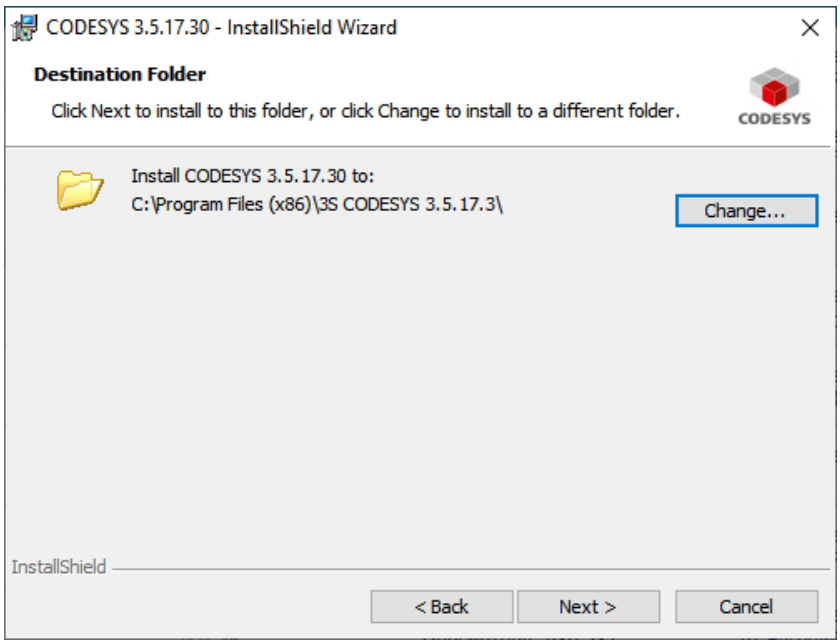


Fig. 2.1.5 Installation directory selection

In the next window (Fig 2.1.6), select a setup type and click ***Next***.

It is recommended to select ***Complete*** type to install all available plug-ins.

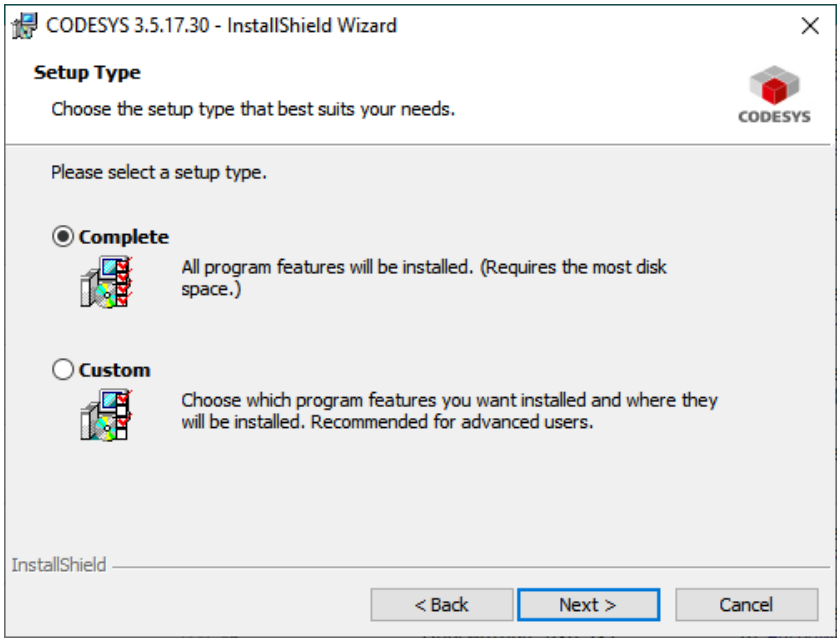


Fig. 2.1.6 Installation type selection

In the next window (Fig 2.1.7), click ***Install*** to start the installation.

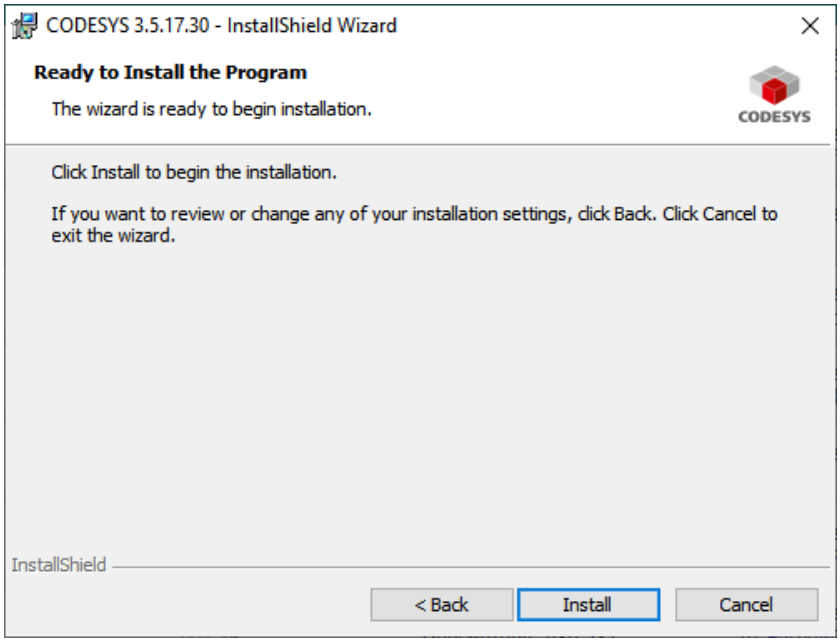


Fig. 2.1.7 Installation start

The installation process takes from 10 minutes to one hour depending on the characteristics of your PC. When the installation is successfully completed, the following window appears:

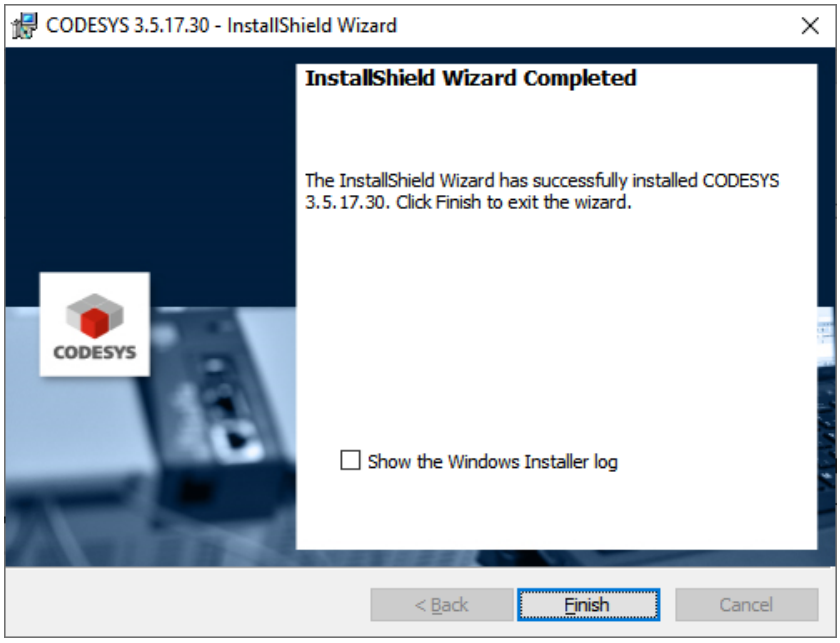


Fig. 2.1.8 Installation completion

Click ***Finish*** to close the window.

2.2 Installation of targets and other packages

Many manufacturers use CODESYS to program their PLCs. Since different PLCs have different hardware and software resources, CODESYS must "know" about them to select a suitable compiler, show the supported and hide unsupported functions, etc. A ***target file*** that contains all information about hardware and software resources of the device is an integral part of the CODESYS project. E.g., without a target file it is impossible to establish connection to the PLC and download a user application.

Target files for all akYtec PLCs are distributed as a single package file (****.package***) that can be downloaded here. Alternatively, you can download the required version of the target package for your PLC via the Web Configurator.

The firmware version of your PLC determines both the version of CODESYS used to program it and the version of the target package.

The versioning of the target package corresponds to the CODESYS versioning, e.g., the target package version 3.5.17.34 is currently used for PLCs programmed in CODESYS 3.5.17.30. The last digit (4) is the ordinal number of the package, i.e., the next package version will be 3.5.17.35.

In the examples we will use the akYtec target files, so it is necessary to install the akYtec target package.

Starting with CODESYS V3.5 SP17, the packages are installed using the ***CODESYS Installer*** utility. The utility can be launched via Windows Start menu (***CODESYS*** > ***CODESYS Installer***) or from the CODESYS interface menu (***Tools*** > ***CODESYS Installer***).

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2 Software installation

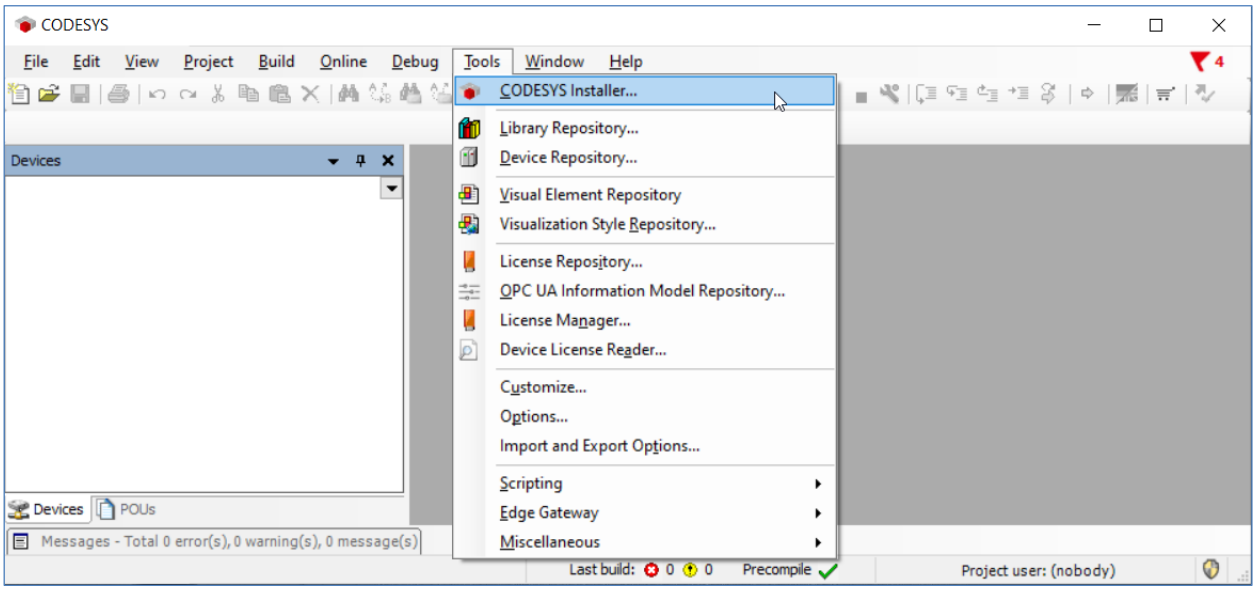


Fig. 2.2.1 Calling CODESYS Installer via CODESYS menu

If the ***CODESYS Installer*** utility is launched from the ***Start*** menu, the list of environments installed on this PC will be displayed (Fig. 2.2.2). An environment is a specific version of CODESYS with a specific set of plug-ins of specific versions. You can create a new environment directly in CODESYS Installer using the ***Add Installation*** button. For example, if you already have a CODESYS V3.5 SP17 Patch 3 environment installed, you can create another environment with the same CODESYS version and update its plugins to the latest available versions to test their functionality. In this case, you will still have the previously installed "stable" environment with the versions of plug-ins included in the "clean" CODESYS V3.5 SP17 Patch 3 installation package, and these two environments will not affect each other.

Select the environment in which you are going to install the target package and click the ***Change*** button.

If you run CODESYS Installer from CODESYS interface (Fig. 2.2.1), the dialog of this environment will open (Fig. 2.2.3).

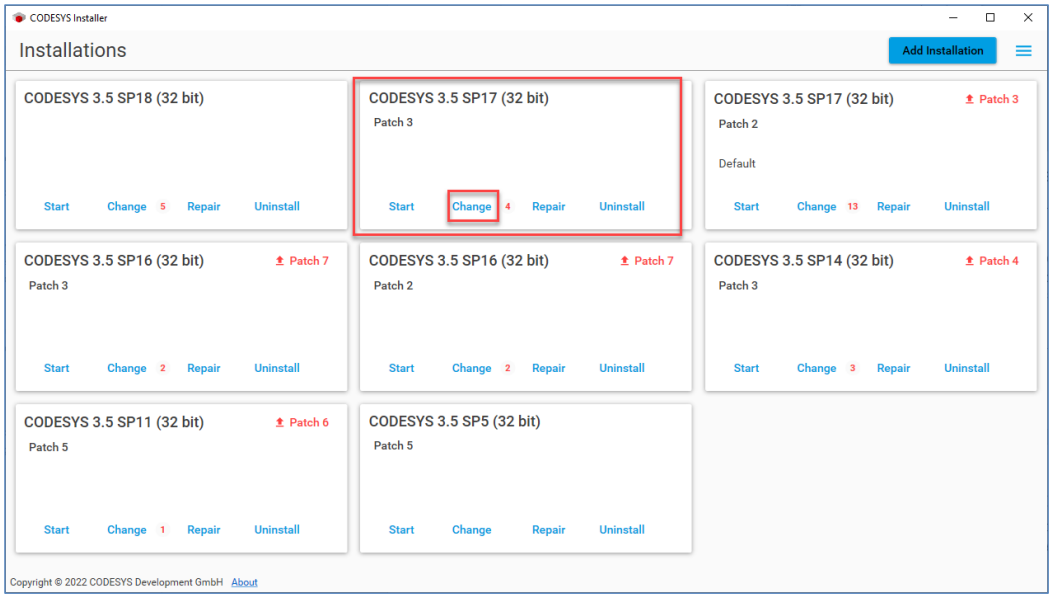


Fig. 2.2.2 List of CODESYS environments installed (user specific)

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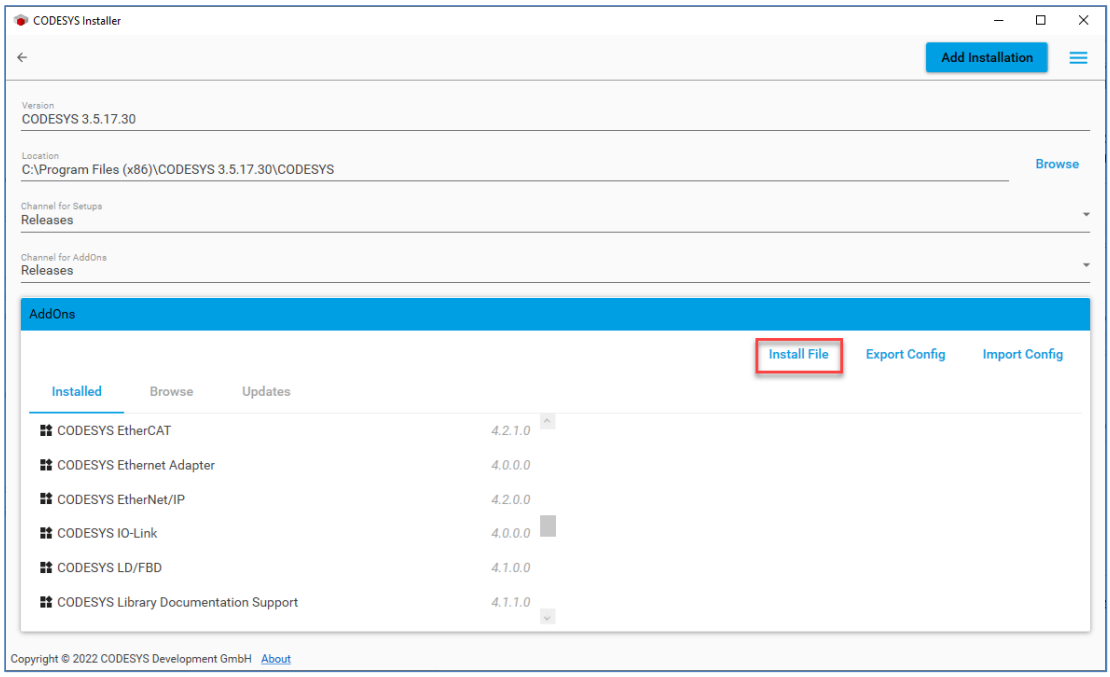


Fig. 2.2.3 Environment view

When the environment dialog window is open (Fig. 2.2.3), close all running instances of the CODESYS, click ***Install File***, select the target package (Fig. 2.2.4) and click ***Open***.

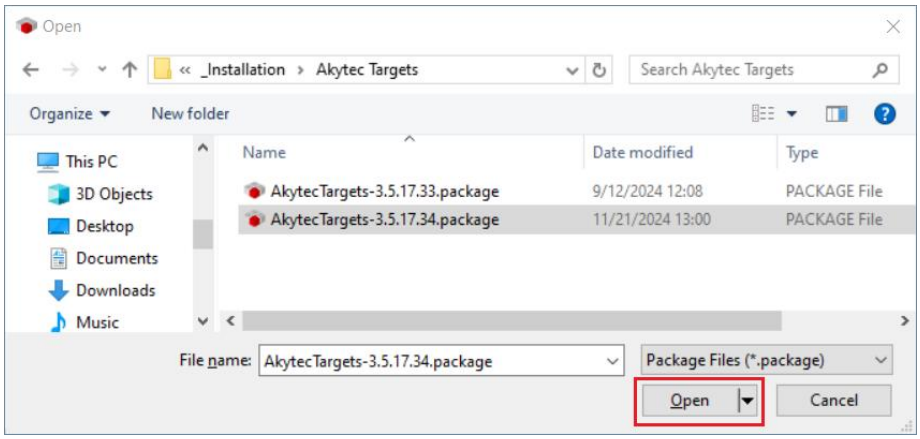


Fig. 2.2.4 Target package selection

In the new window (Fig. 2.2.5), click ***OK*** to confirm the installation of the package.



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Fig. 2.2.5 Confirm package installation

In the new window (Fig. 2.2.6), check the checkbox "***I want to continue despite the missing signature(s)***" to confirm the installation of the package without digital signature and click ***Continue***.

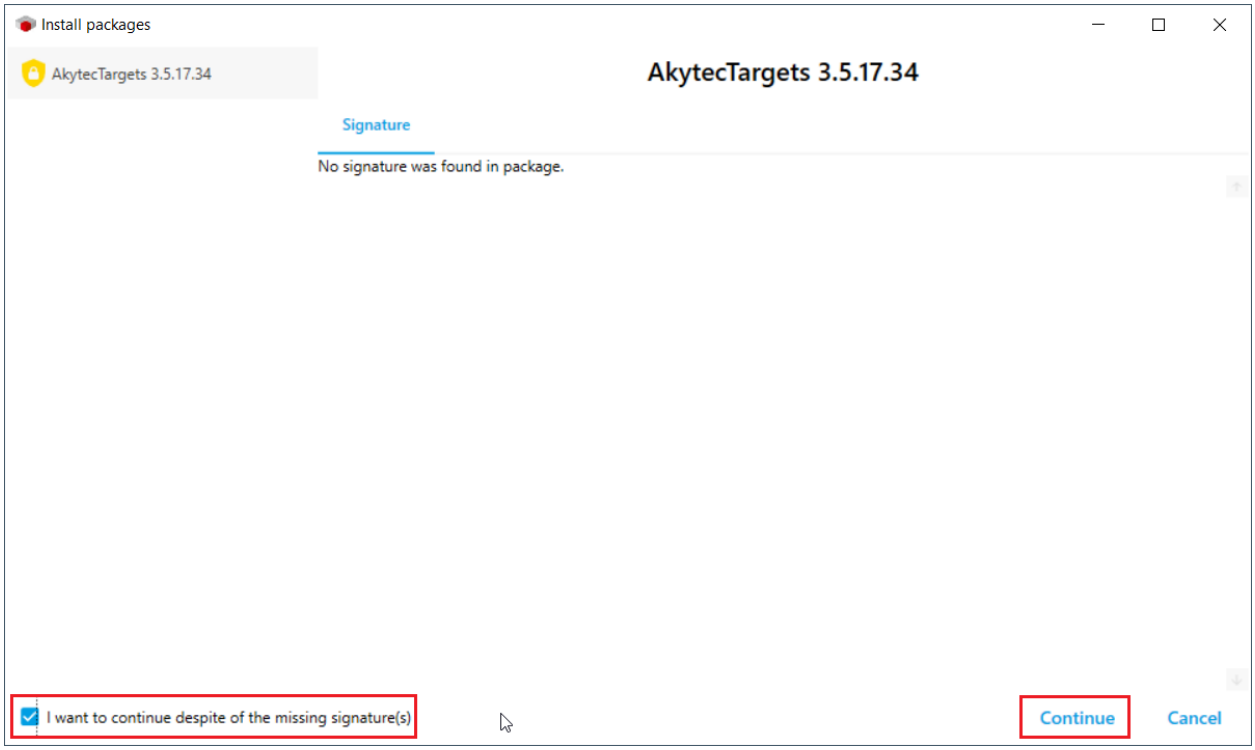


Fig. 2.2.6 Confirm package installation without digital signature

When the installation is completed, click the **Ok** button in the last window.

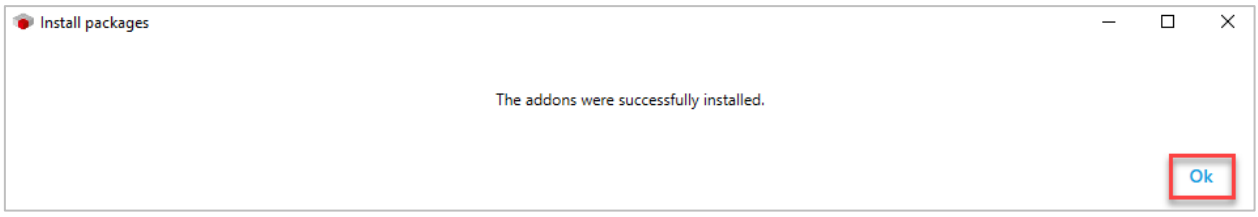


Fig. 2.2.7 Installation completion window

Other packages, such as polling template packages for the akYtec devices, can be installed in the same way.

2.3 Installation of libraries

To extend CODESYS capabilities, PLC manufacturers and users can develop their own objects (function blocks, visualization dialogs, templates etc.) and share them as libraries.

Libraries developed by akYtec and some free libraries from CODESYS users can be downloaded here.

To install a library in CODESYS, select ***Tools*** > ***Library Repository***, click ***Install*** and specify the path to the library file (Fig. 2.3.1).

Libraries can be distributed in two formats:

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- ***.compiled-library*** (with protected source code)
- ***.library*** (with unprotected source code)

> **NOTE**
> If an unsuitable format is specified in the library file selection window, you will not be able to install the library. Therefore, it is recommended to switch the filter to ***All files***.

In the following example we will only use the libraries included in the CODESYS installation package. No new libraries need to be installed.

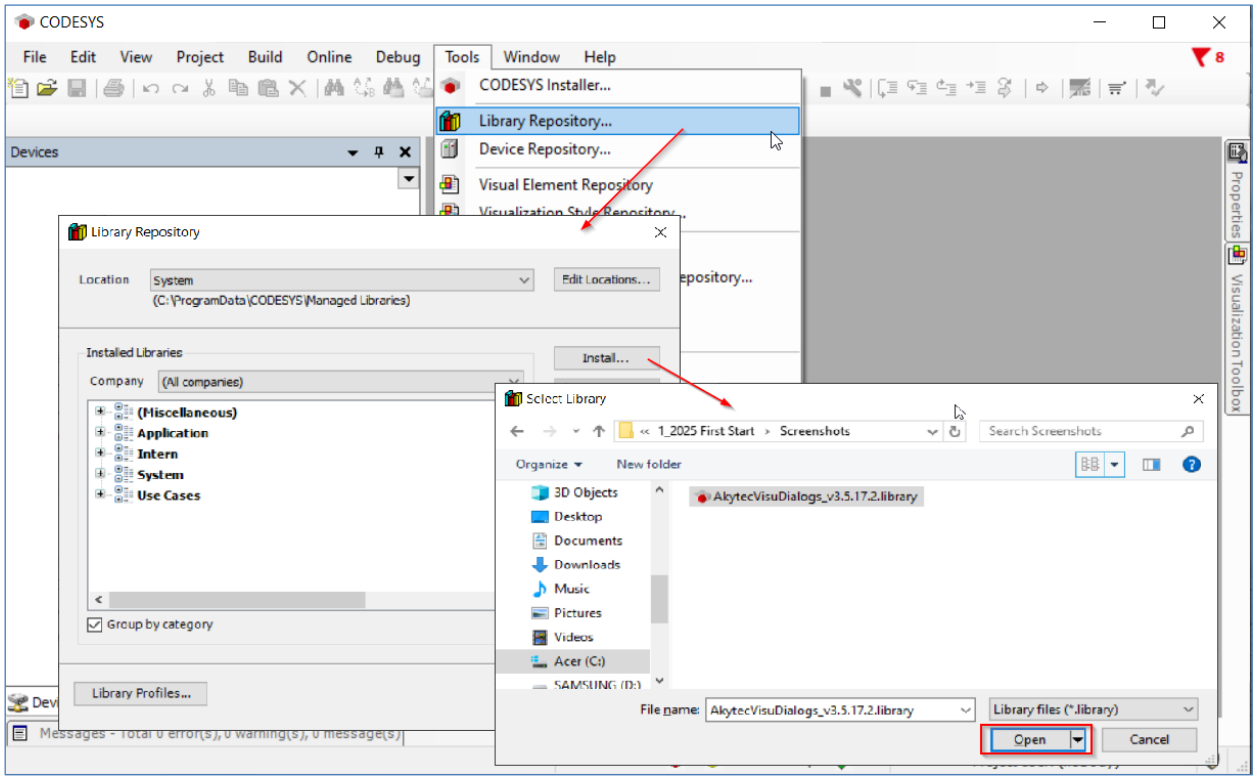


Fig. 2.3.1 Library Installation in Library Repository

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3 Quick start

In this section we will learn to create a simple project and download it to the PLC. The aim of the section is to get a user application running on the PLC as soon as possible, so most aspects of project creation are not explained in detail.

3.1 Project creation

To create a new project, use the menu items ***File*** > ***New project***. To open an existing project, select ***Open project*** or ***Recent projects*** (Fig. 3.1.1).

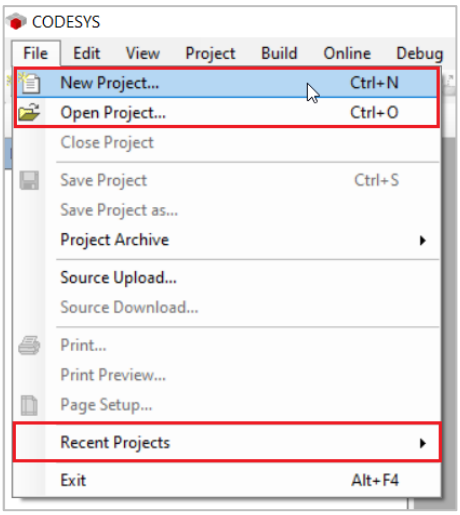


Fig. 3.1.1 Create a new project or open an existing one

Project Wizard window will open (Fig. 3.1.2). If you have already installed the akYtec target package, the window will show the project templates. If not yet, it is time to install it (sect. 2.2).

Target files can be treated as project templates because they contain not only the necessary information about the device resources, but also a number of pre-configured components: interfaces, visualizations etc. It is much easier to create a project based on templates than to do it from scratch. We will discuss the SPC210 panel as an example, so we will take its template. If you are working with another akYtec PLC, select the appropriate template. If you do not have a PLC at all, you can take any template. In sect. 3.4 we will explain how to work with a virtual PLC.

In the lower part of the window, you can determine the name of the project file and the directory in which it will be saved.

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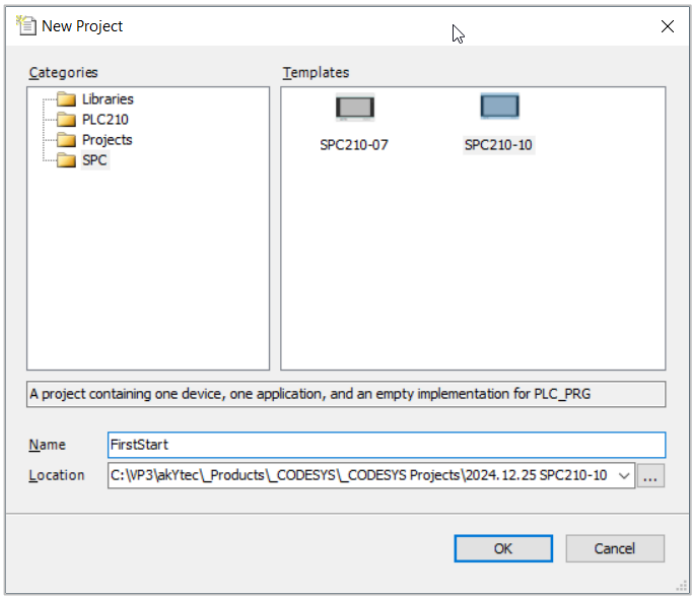


Fig. 3.1.2 Project template selection

The CODESYS interface looks as follows:

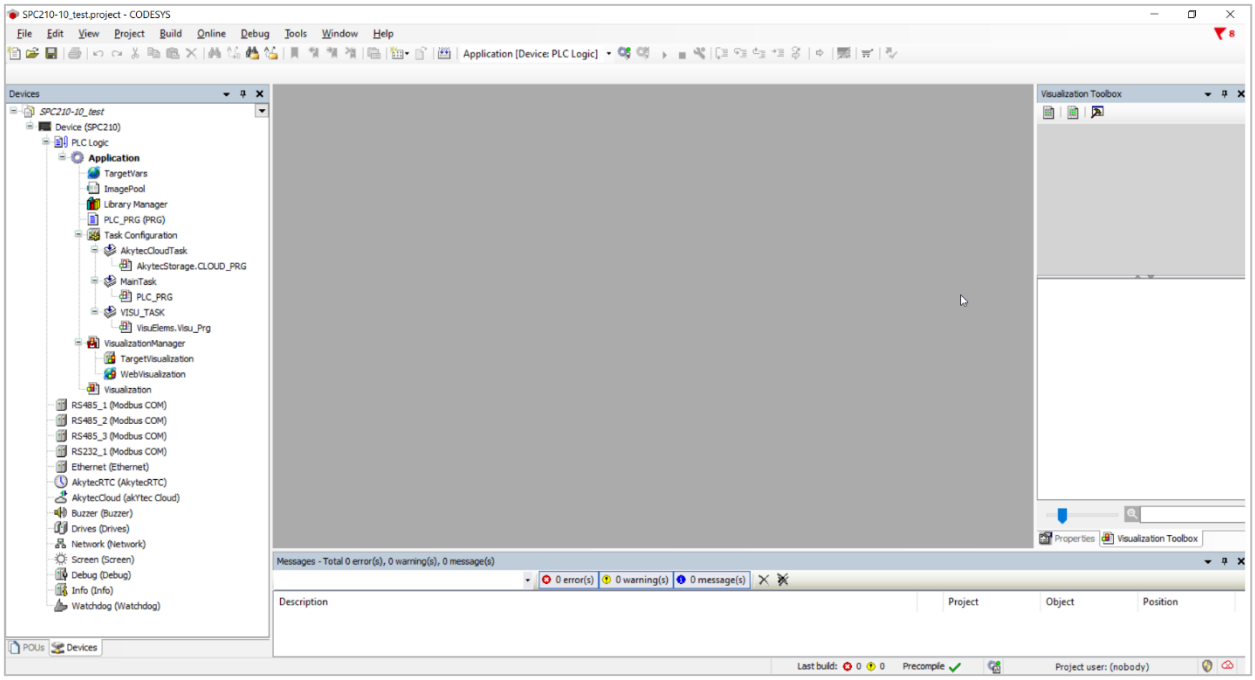


Fig. 3.1.3 CODESYS user interface

The panel ***Devices*** (left) contains a tree with project components: programs, function blocks, visualizations, exchange protocol nodes, etc. The currently opened editor (the programming language editor or the visualization editor) is displayed in the center panel. The panel ***ToolBox*** (to the right) is the toolbar of the open editor. Various panels can be displayed at the window bottom: the compilation message panel, the monitoring panel, etc.

To open the main program in an editor, double-click the ***PLC_PRG*** item in the node ***Application*** in the project tree. It will open in the ST editor since the ST language is selected for the main program in the project template.

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3 Quick start

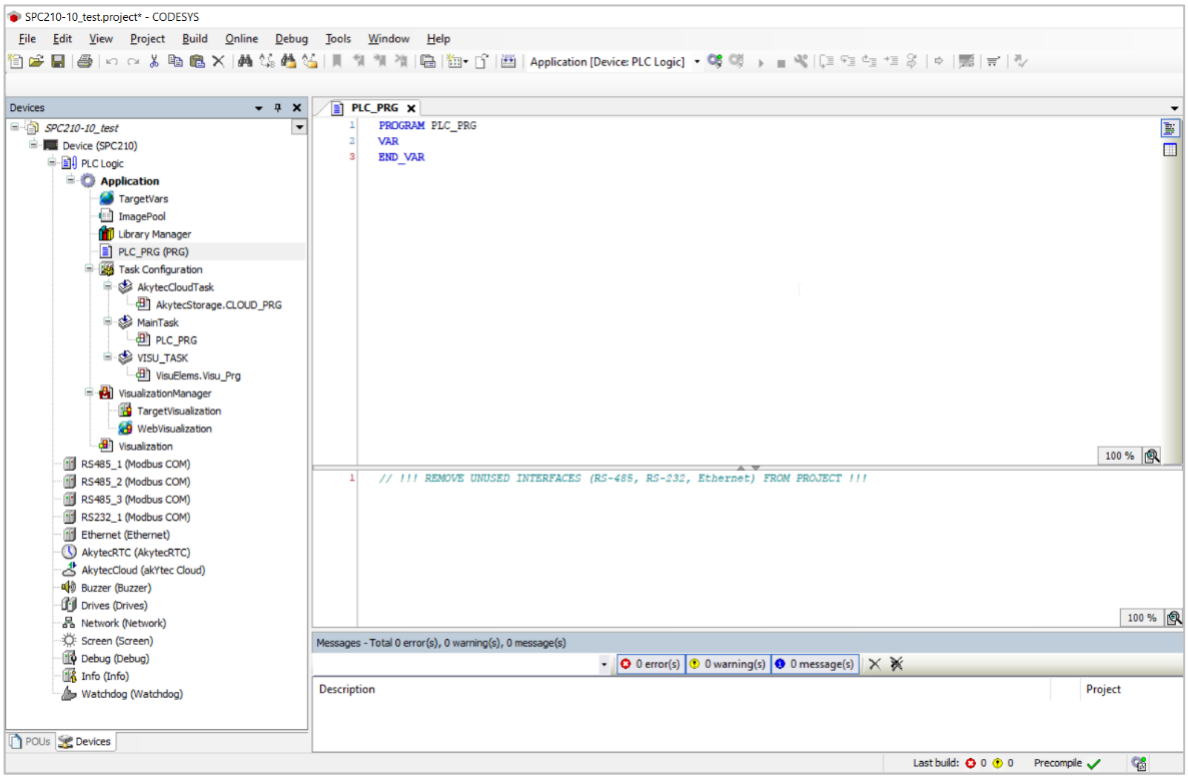


Fig. 3.1.4 ST Editor

The ST editor panel (as well as other programming editors in CODESYS) consists of two parts – in the upper one (declaration part) the variables are declared and the lower one (Instruction part) contains the program code and uses the resources of the declaration part.

Variables are declared within specific blocks (e.g. ***INPUT***, ***OUTPUT***, ***GLOBAL***, etc.). By default, the ***PLC_PRG*** program contains only one empty block between the keywords ***VAR*** and ***END_VAR*** – the block of local (internal) variables.

We declare two variables:

- ***iValue*** – variable of INT type represents the value of a certain parameter, e.g. a signal from the temperature sensor connected to the input module, or a slider position;
- ***xAlarm*** – variable of BOOL type represents an alarm signal that indicates that the value of ***iValue*** has exceeded a permissible limit (e.g. 50).

```
PLC_PRG
1  PROGRAM PLC_PRG
2  VAR
3      // Current parameter value
4      iValue: INT := 20;
5      // Alarm when the current value exceeds the permissible value
6      xAlarm: BOOL;
7  END_VAR
```

Fig. 3.1.5 Variable declaration

When declaring a variable, you must specify its name and data type. If necessary, you can specify the initial value – we did it for the ***iValue*** variable in the example above. The variable name and its type are separated by a colon (:), and the declaration line ends with a semicolon (;).

Add a comment explaining the meaning of the variable. One-line comment begins with double forward slash (//).

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Now we will write the program code – in the example it consists of only one line.

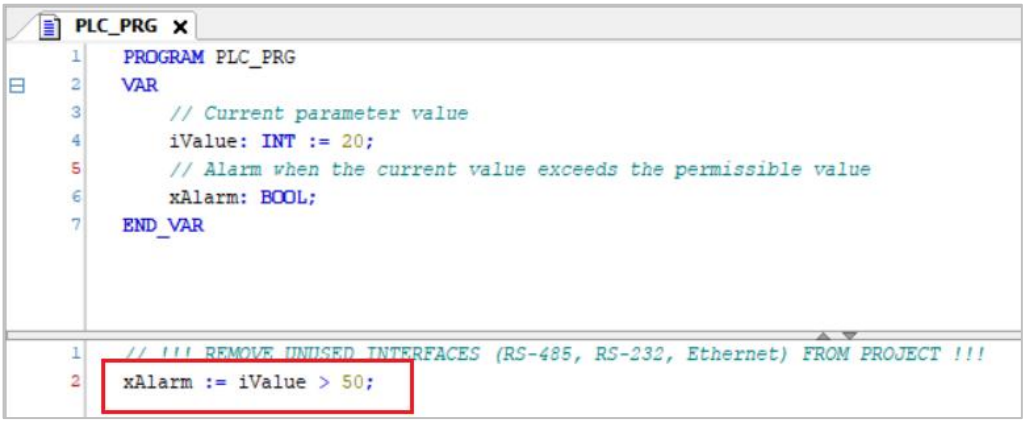


Fig. 3.1.6 Program code

In this line, the value of the variable ***iValue*** is compared with the constant value 50. The result of the comparison is a logical value: if ***iValue*** > 50, the expression result is ***TRUE***, and if it is not (***iValue*** ≤ 50), the result is ***FALSE***. The result of the comparison is written to the variable ***xAlarm*** using the assignment operator (:=). Spaces between these two characters are not allowed.

In the first line of the ***PLC_PRG*** program in the project template there is a comment with a recommendation to delete unused interfaces from the project, otherwise they will waste the PLC's resources. In our example, the interfaces are not used at all, so we will select all of them in the project tree (multiple selection with ***<Shift>*** key) and select the item ***Delete*** from the context menu (right mouse button on the selection) (Fig. 3.1.7).

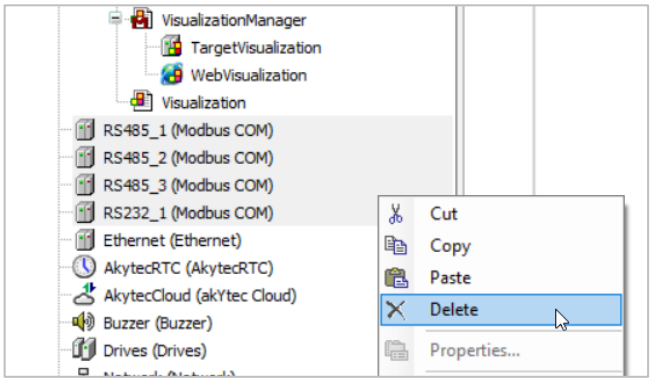


Fig. 3.1.7 Removing unused interfaces from the project tree

Now we will create the visualization screen. Double-click the node ***Visualization*** to open the visualization editor.

For convenient working in the visualization editor it is recommended to enable the grid: open ***Tools*** > ***Options*** > ***Visualization*** > ***Grid*** and check the checkbox ***Visible***.

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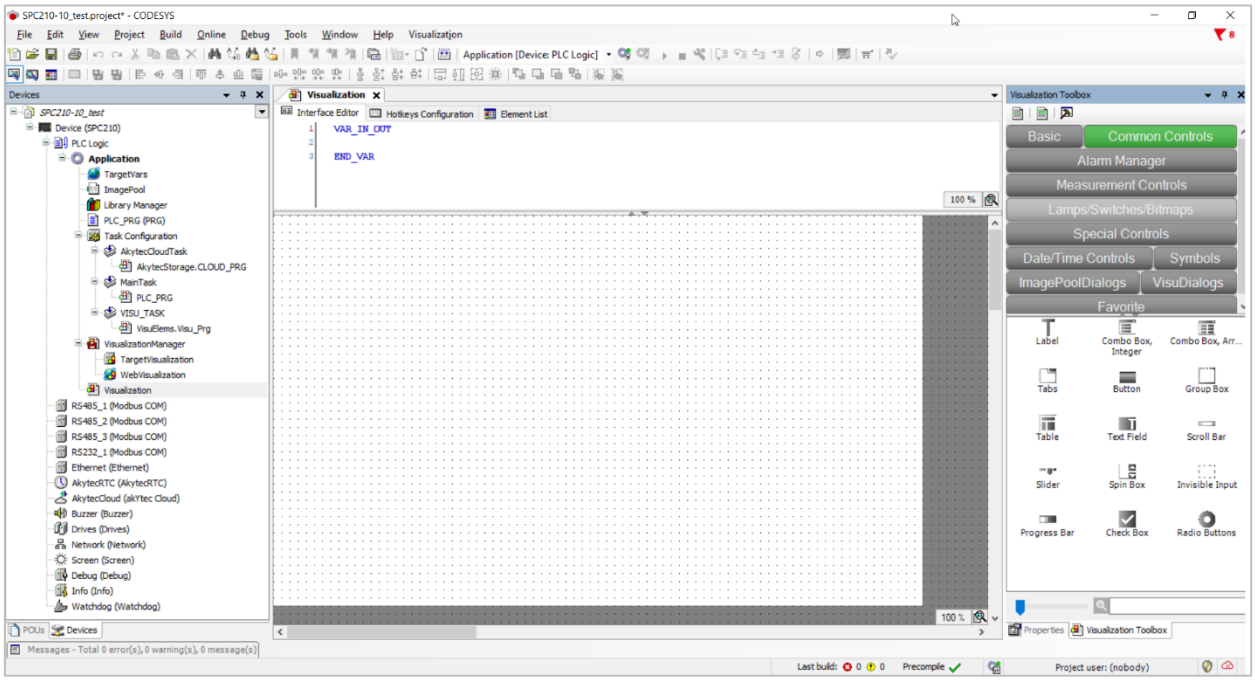


Fig. 3.1.8 Visualization editor with Visualization Toolbox panel

The visualization elements in the ***Visualization Toolbox*** panel (Fig. 3.1.8) are grouped in tabs. Select the ***Slider*** element in the ***Common controls*** tab and drag-and-drop it on the screen (or select it and click in the screen). Add the ***Lamp*** element from the ***Lamps/Switches/Bitmaps*** tab in the same way.

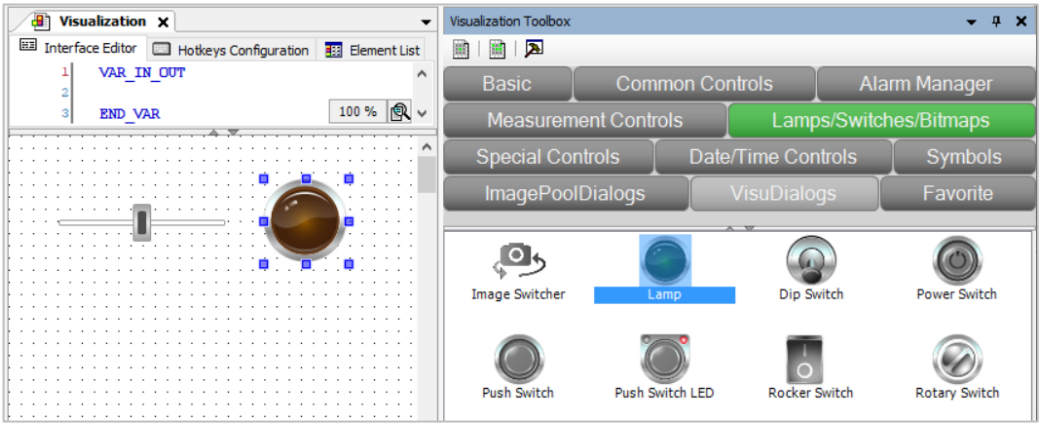


Fig. 3.1.9 Placing Slider and Lamp elements on the screen

To position an element in the screen, drag and drop it to the desired position. To resize an element, move one of its reference points with the left mouse button pressed (highlighted in blue in Fig. 3.1.9).

When an element is selected, the properties panel opens to the right of the screen.

Now we will customize the ***Slider*** element: set its size, define the scaling and assign the variable ***iValue*** to it. To assign a variable, double-click the left mouse button on the empty line next to the parameter ***Variable***, then click the "**...**" button that appears to the right of it and select the desired variable from the list of project variables.

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3 Quick start

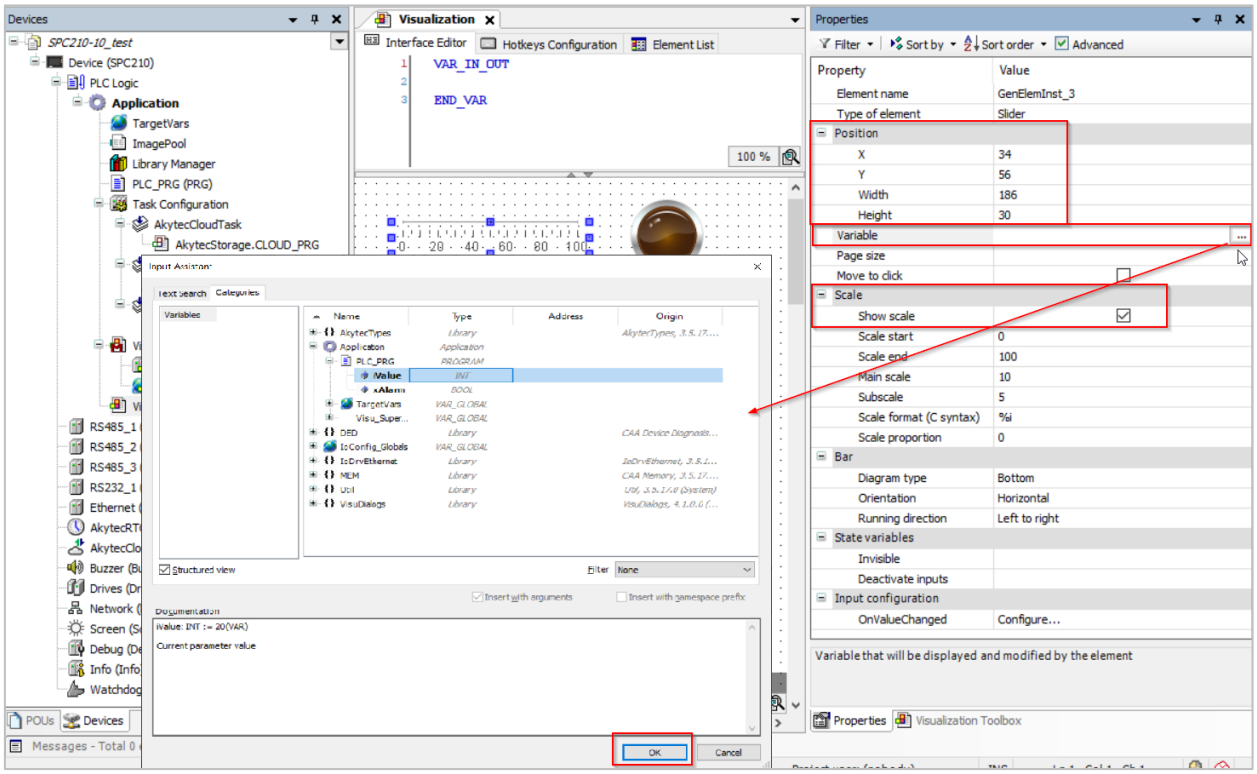


Fig. 3.1.10 Slider element settings

In the same way, set the position and dimensions of the ***Lamp*** element, set its color to red and assign the ***xAlarm*** variable to it.

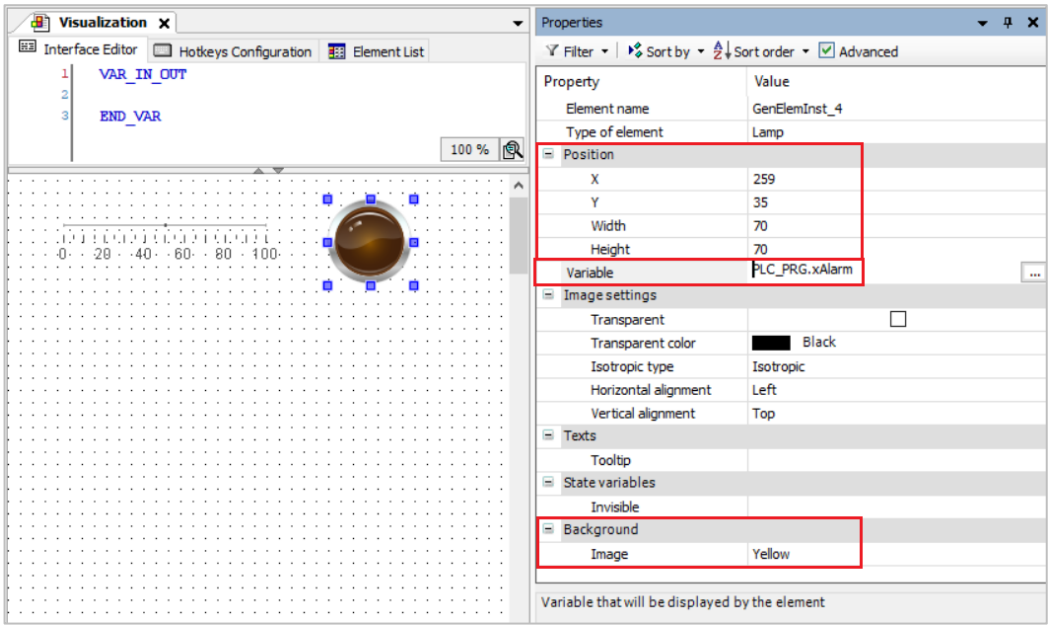


Fig. 3.1.11 Lamp element settings

Our simple project is ready. Now we can download it to the PLC and make sure that it functions properly. If you already have an akYtec PLC, go to sect. 3.2. If you don't have a PLC yet, go to sect. 3.3 that describes how to run the project on a PC using a virtual PLC ***CODESYS Control Win V3***.

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3.2 Connection between PC and akYtec PLC

Connection between PC and akYtec PLC can be established over Ethernet (sect. 3.2.1) or USB interface (sect. 3.2.2).

3.2.1 Connection over Ethernet

There are two basic variants of mutual positioning of PLC and PC in the network:

- The PLC and the PC are in the **same local area network** (direct connection between PLC and PC is a special case of this variant).
- The PLC and the PC are in **different local area networks**, connected using appropriate network devices (routers).

We will consider an example of the first variant with Ethernet ports of the PLC and PC connected directly using RJ45-RJ45 cable.

> **NOTE**
> There must be no IP address conflicts in a local network, i.e., different devices must not have the same address.

First, the network parameters of the PLC must be defined. For the default network settings of the akYtec-PLC's Ethernet interfaces, see Tab. 3.2.1.

Table 3.2.1 Default Ethernet settings

PLC	Interface	DHCP Client	IP address	Subnet mask	Gateway
PLC210	Ethernet 1–3	off	192.168.0.10	255.255.0.0	192.168.0.1
	Ethernet 4	on	-	-	-
SPC210	Ethernet	off	192.168.0.10	255.255.0.0	192.168.0.1

We consider the connection between the PC and the PLC with the default network settings.

The interface with a static IP address should be used for connection.

The DHCP client mode is used to obtain network settings automatically when the PLC is connected to a local network with a DHCP server. Since our PLC is directly connected to the PC, this option will not work in most cases.

To change the PLC's network settings, use the Web Configurator. If you are working with an SPC210 touchscreen controller, you can also use the display configurator.

To start the Web Configurator, connect the PLC to the PC over Ethernet interface and enter the IP-address of the interface in the address bar of your web browser. On the opened login page (Fig. 3.2.1), enter the username "**root**" and the password. The default password is "***akytec***".

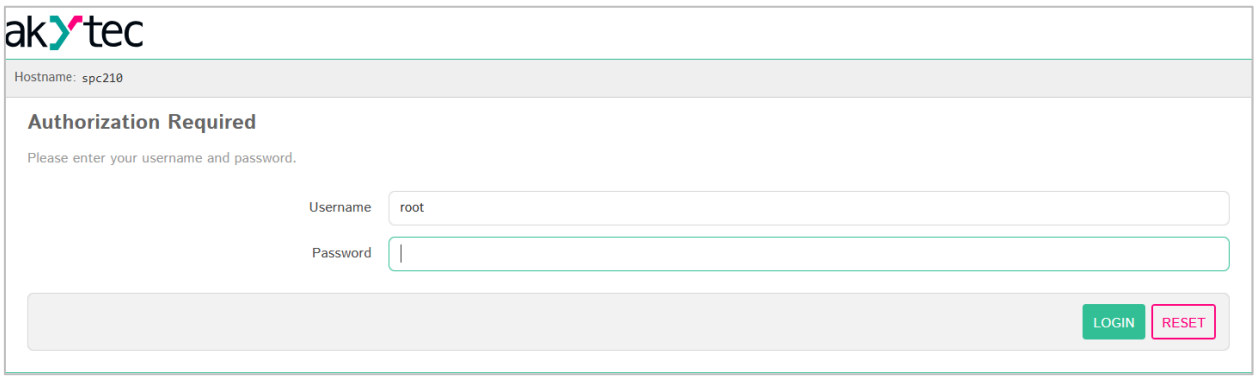


Fig. 3.2.1 Login page in Web Configurator

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3 Quick start

The first time the PLC is connected to the Web Configurator, the ***Setup Wizard*** will be launched to configure the PLC's network settings. If necessary, the ***Setup Wizard*** can be restarted at any time on the ***System*** > ***Setup Wizard*** tab. Network settings can also be set on the ***Network*** > ***Interfaces*** tab. Here, select the required interface and click the ***Edit*** button.

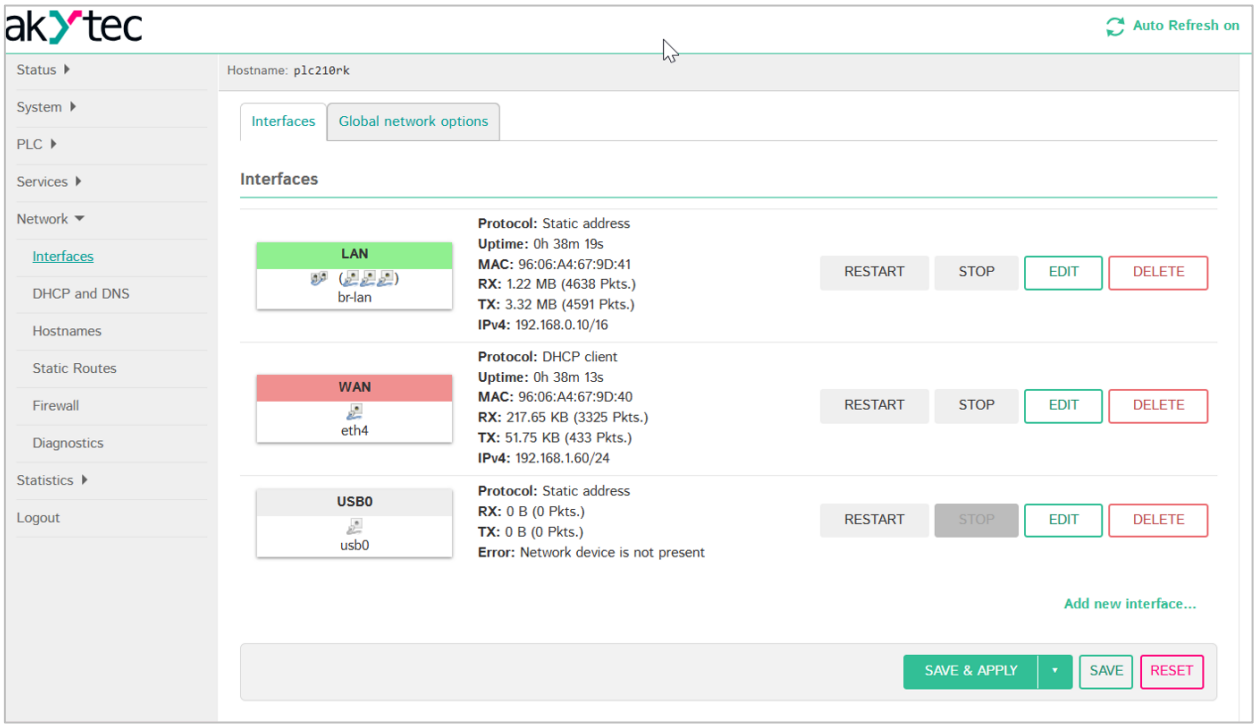


Fig. 3.2.2 List of PLC interfaces

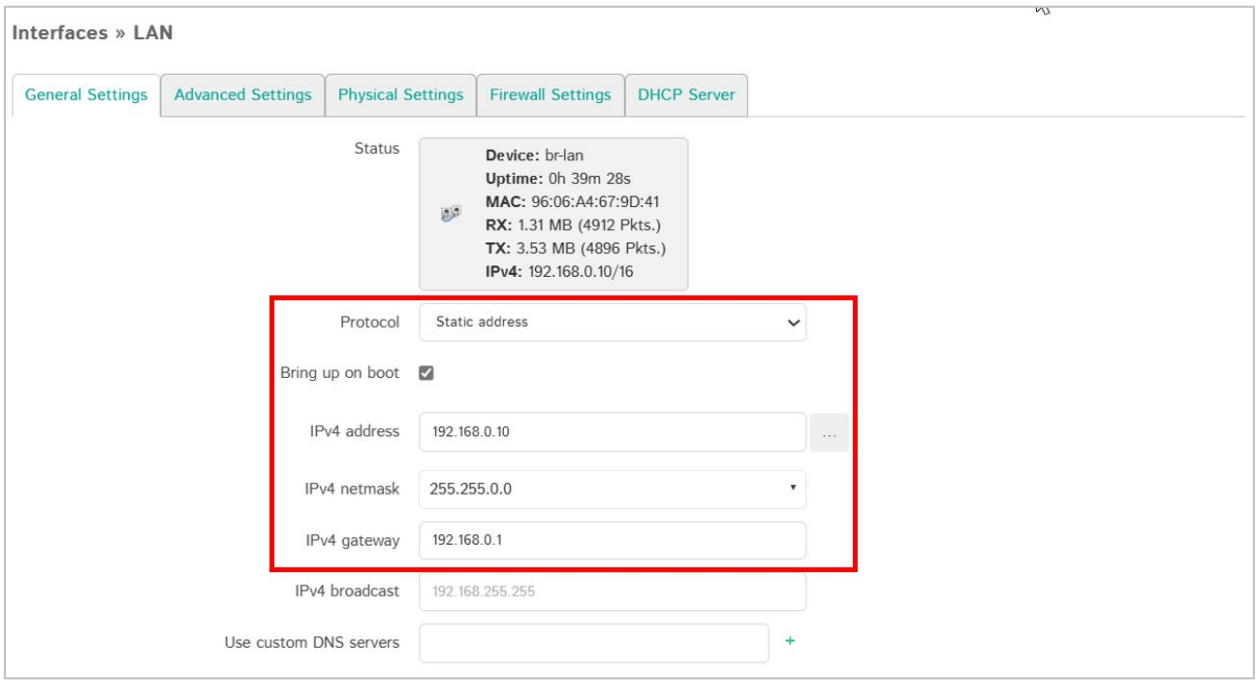


Fig. 3.2.3 Ethernet settings

Click ***Save and Apply*** button to apply the new network settings SAVE & APPLY. We will not change the default network settings.

NOTE
After changing network settings, you must reconnect Web Configurator for the new settings to be applied.

To configure the PC network settings, open ***Start*** > ***Settings*** > ***Network & Internet*** and select ***Change adapter options*** (Fig. 3.2.4).

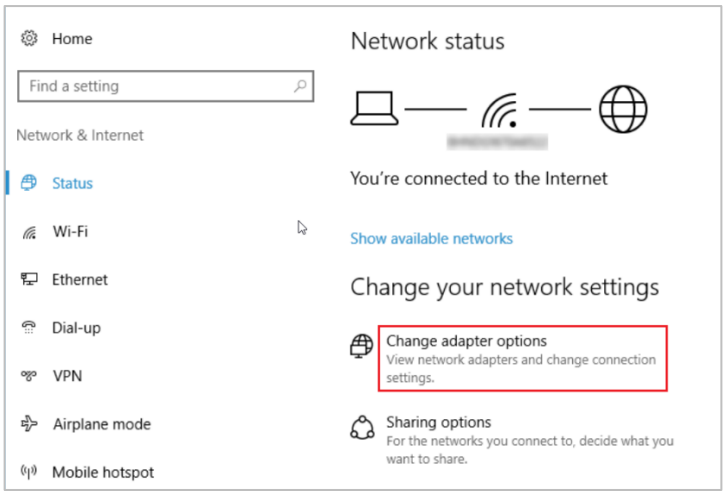


Fig. 3.2.4 Settings > Network & Internet

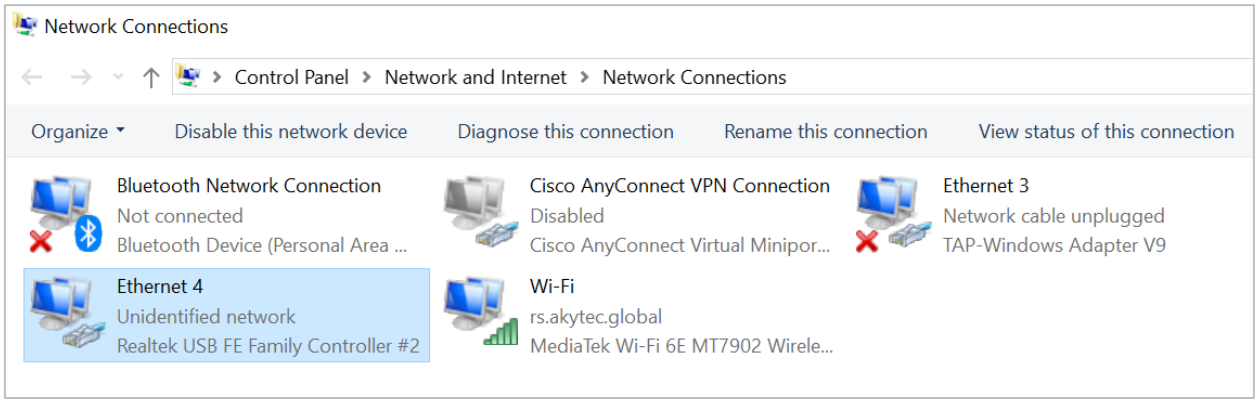


Fig 3.2.5 Change adapter options

Connect the PLC Ethernet interface with the Ethernet interface on the PC over an Ethernet cable. One of the network adapters become active.

Open ***Properties*** in the context menu of the adapter, select ***Internet Protocol version 4 (TCP/IPv4)*** and click the ***Properties*** button.

3 Quick start

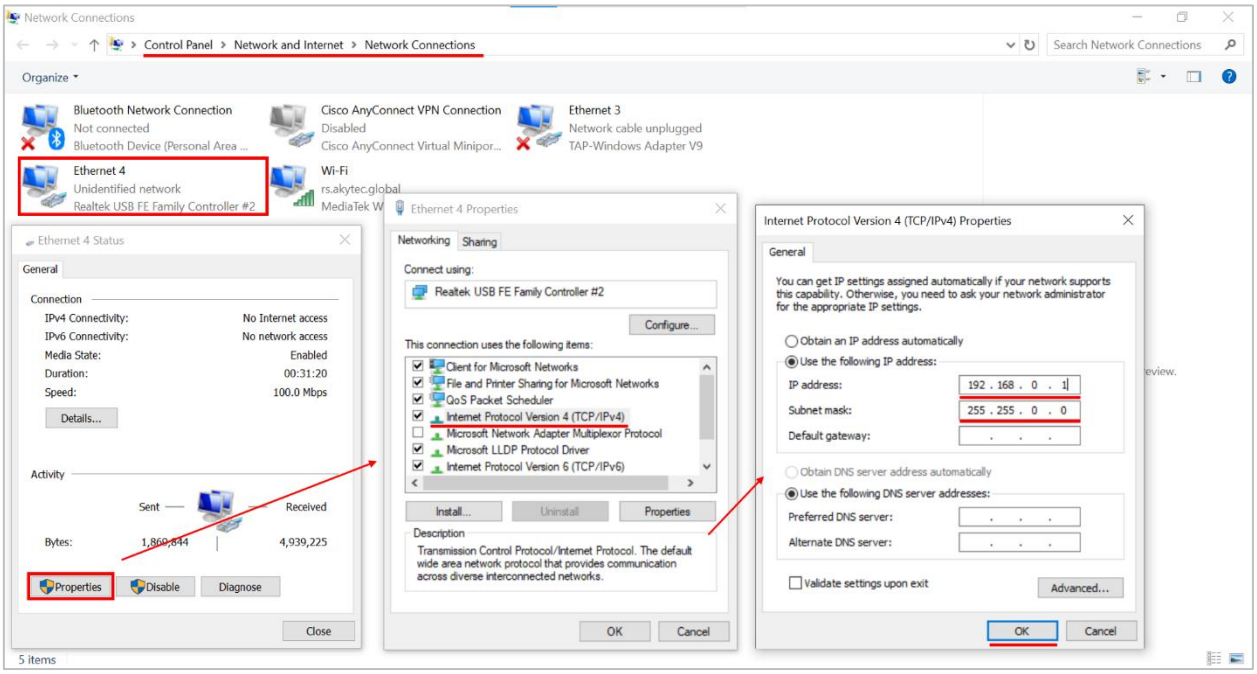


Fig. 3.2.6 PC Ethernet settings

Set the IP address to ***192.168.0.1*** and subnet mask to ***255.255.0.0***. The other fields remain empty. After clicking ***OK***, it will take a few seconds for the adapter to apply the new settings.

To check the PC-PLC connection, open the command line (+ ***R*** and enter ***cmd*** in the input field). Enter the command "***ping 192.168.0.10 -t***" in the command line. If the connection is established, the result is as follows:

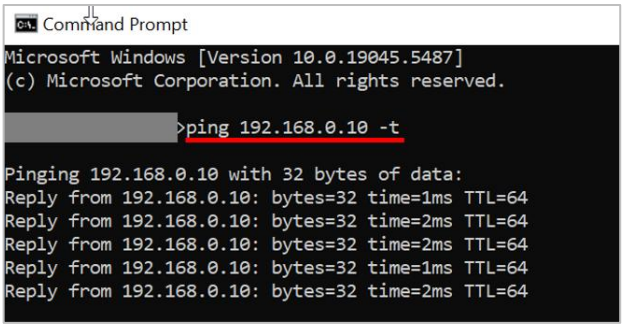


Fig. 3.2.7 Result of successful ping test

Close the window. Now you can connect the PLC to CODESYS (sect. 3.3).

3.2.2 Connection over USB

Use USB A-to-B cable for SPC210 and USB-to-MicroUSB cable for PLC210, to connect them to a PC with running CODESYS. The default network settings for the USB interface of the device are as follows:

Table 3.2.2 USB default settings

PLC	DHCP Server	IP address	Subnet mask	Gateway
PLC210	on	172.16.0.1	255.255.255.248	-
SPC210	on	10.0.6.10	255.255.255.248	-

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The USB interface of the PLC210 or SPC210 works in DHCP server mode (Fig. 3.2.8), therefore the PC network adapter receives the required settings automatically.

To check the PC-PLC communication, open the command line (⊞ + ***R*** and enter ***cmd*** in the input field). Enter the command ***ping 172.16.0.1 -t*** for PLC210, and ***ping 10.0.6.10 -t*** for SPC210 in the command line.

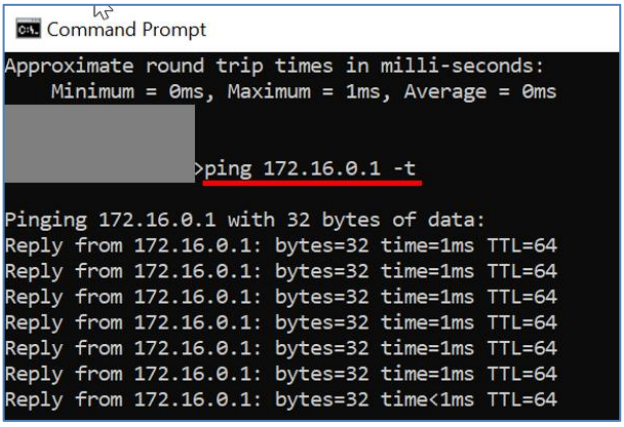


Fig. 3.2.9 Result of successful ping test

Close the window. Now you can connect the PLC to CODESYS (sect. 3.3).

If it is necessary to change the USB interface network settings, use the Web Configurator. If you are working with an SPC210, you can also use the on-screen configurator.

To adjust the settings of the network adapter on the PC, open ***Properties*** in the context menu of the adapter, select ***Internet Protocol version 4 (TCP/IPv4)*** and click the ***Properties*** button.

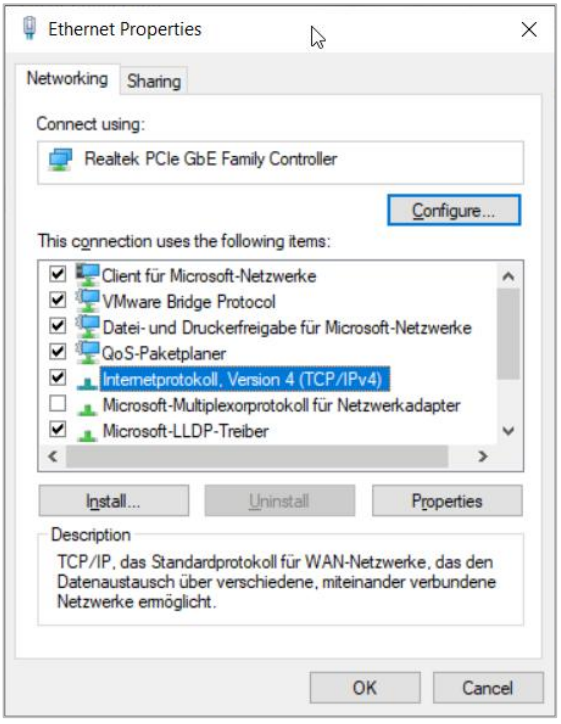


Fig. 3.2.8 Network adapter settings

Make changes in the opened input dialog and click ***OK*** to confirm.

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3.3 Connection between akYtec PLC and CODESYS

If the network parameters of the PLC and the PC are configured, the communication between the PLC and CODESYS can be established.

First, check the ***Device*** node in the project tree (defined by the target file) matches the model of the PLC to be connected. If an inappropriate PLC type has been selected at project creation, it can be changed using the command ***Update Device*** in the context menu of the ***Device*** node.

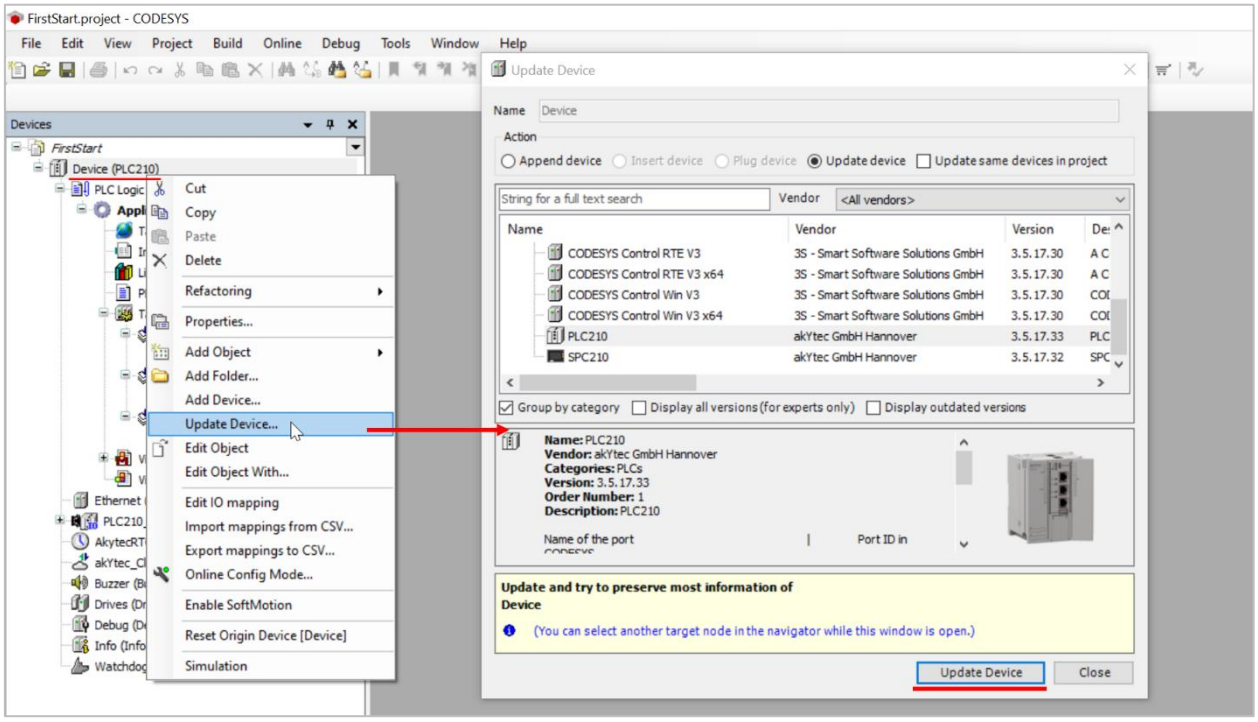


Fig. 3.3.1 Change target device

Select the required target file from the list. Its version, as well as the CODESYS version, must match the PLC firmware version.

By default, only the newest versions of the installed target files are displayed. To view all available versions, check the checkbox ***Display all versions***.

Click the ***Update Device*** button and then the ***Close*** button. The name of the selected device will be displayed in the ***Device*** node in the project tree.

Next, you need to configure the gateway. This configuration should only be done once and is usually required if the current version of CODESYS is the first one installed on this PC.

Double-click the **Device** node to open the ***Device*** tab in the workspace. Select ***Communication Settings*** > ***Gateway*** > ***Add New Gateway***.

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3 Quick start

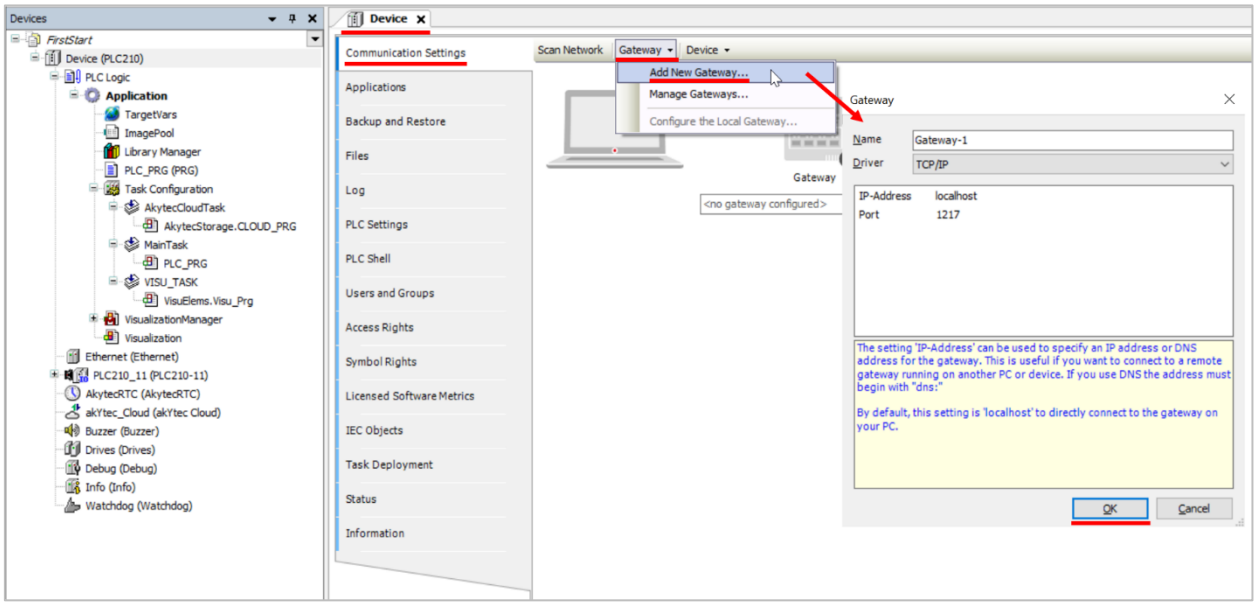


Fig. 3.3.2 Create new gateway

It is recommended to use the default settings (***name*** = ***Gateway-1***, ***IP address*** = ***localhost***). Close the ***Gateway*** window and click the ***Scan Network*** button. Select the required PLC in the opened device list and click ***OK*** to establish communication.

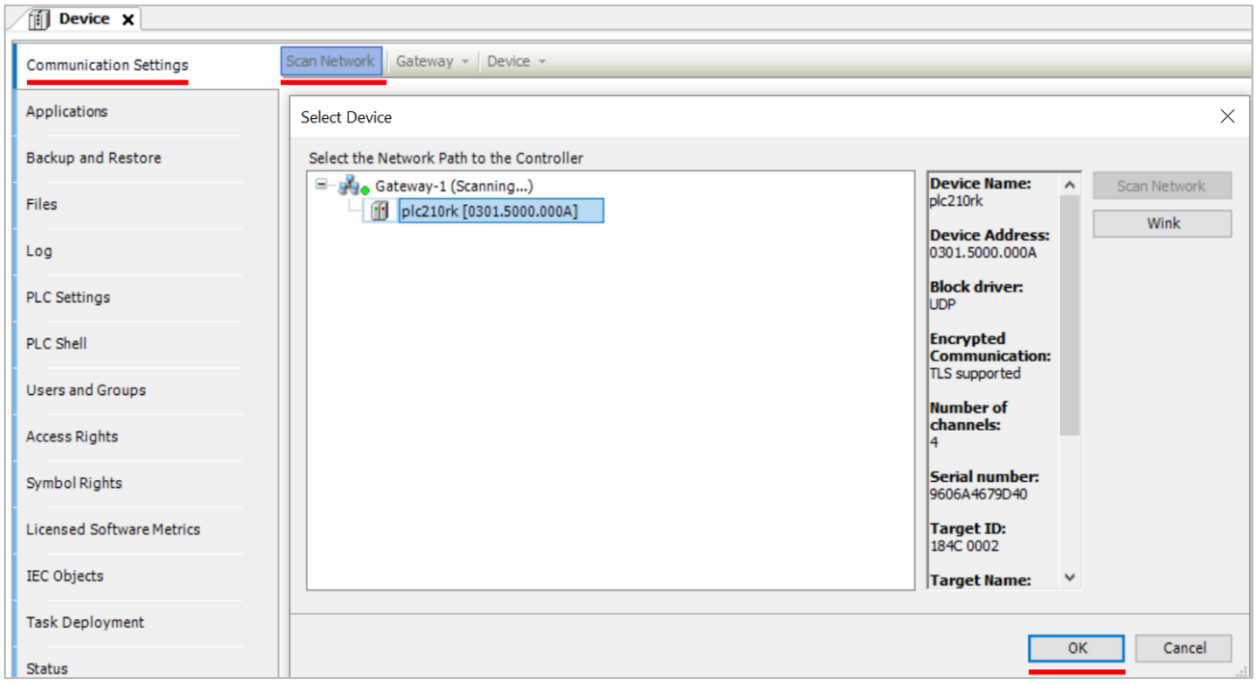


Fig. 3.3.4 "Select Device" window

In case of successful connection, the gateway and PLC indicators will light green.

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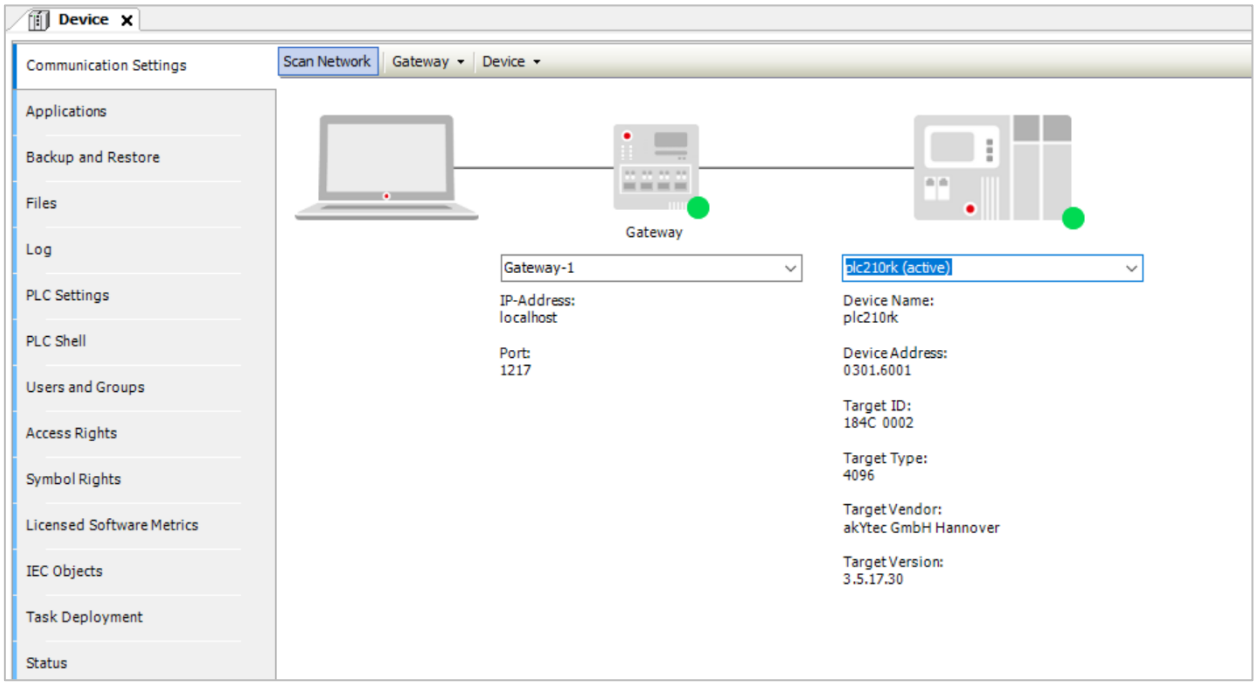


Fig. 3.3.5 Connection successfully established

In some cases, (e.g. if the antivirus is running on the PC, which blocks sending UDP broadcast packets or receiving packets on ports 1740-1743) the PLC may not be detected during network scanning. In this case, enter the PLC's IP address manually and press ***Enter***.

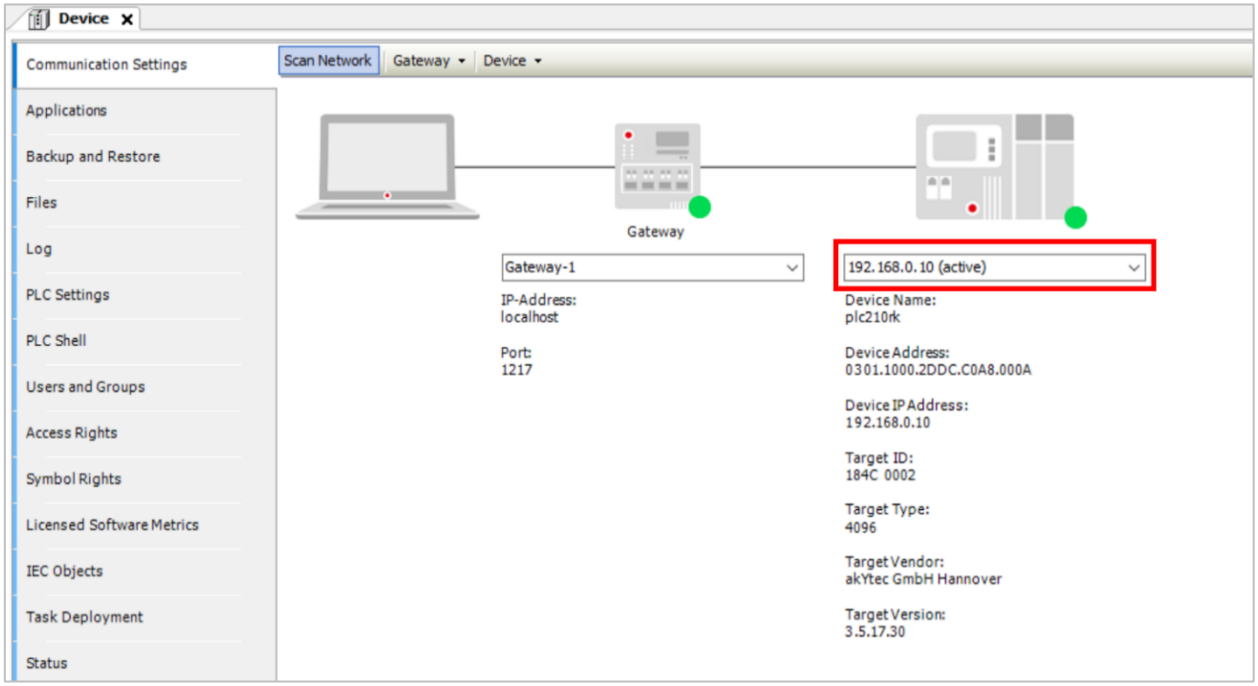


Fig. 3.3.6 Enter device IP address to establish connection without network scanning

NOTE
Connection with an SPC210 is only possible if the on-screen configurator is not active.

After successful connection you can download the project to the device (sect. 3.5). If you do not have a real PLC, you can use a virtual PLC (sect. 3.4).

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3.4 Connection between virtual PLC and CODESYS

The virtual PLC is a full-fledged control system running on PC. The CODESYS installation package includes a virtual PLC ***CODESYS Control Win V3*** with a continuous operation time limit of 2 hours. After expiration of this time, it can be restarted.

The virtual PLC enables to test all basic functions of the project, including web-visualization, communication with other devices and file management. Only PLC-specific functions cannot be tested, such as operation of I/Os and external libraries (e.g. ***CmpSysExec*** library, which is used to call PLC OS utilities).

To start the virtual PLC, open the Windows System Tray, click on the virtual PLC icon and select the command ***Start PLC***. If you start the virtual PLC for the first time, an information window will appear. Click ***OK*** to continue.

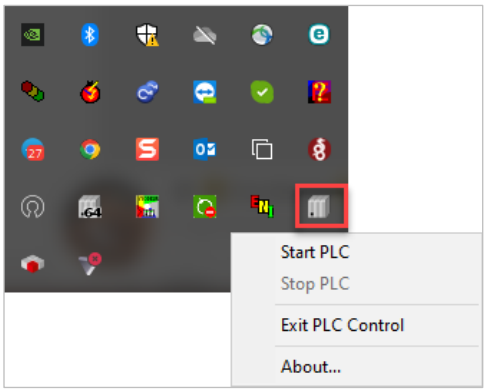


Fig. 3.4.1 Start virtual PLC

Next, you need to replace the PLC in the project with the virtual PLC (Fig. 3.4.2). Use the command ***Update Device*** from the ***Device*** node context menu and select the target file ***CODESYS Control Win V3***. Its version must correspond to the version of CODESYS (e.g., for CODESYS V3.5 SP17 Patch 3, use target file version 3.5.17.30).

By default, only the newest versions of the installed target files are displayed. To view all available versions, check the checkbox ***Display all versions***.

NOTE
If a 64-bit version of CODESYS is installed, select the target file ***CODESYS Control Win V3 x64***.

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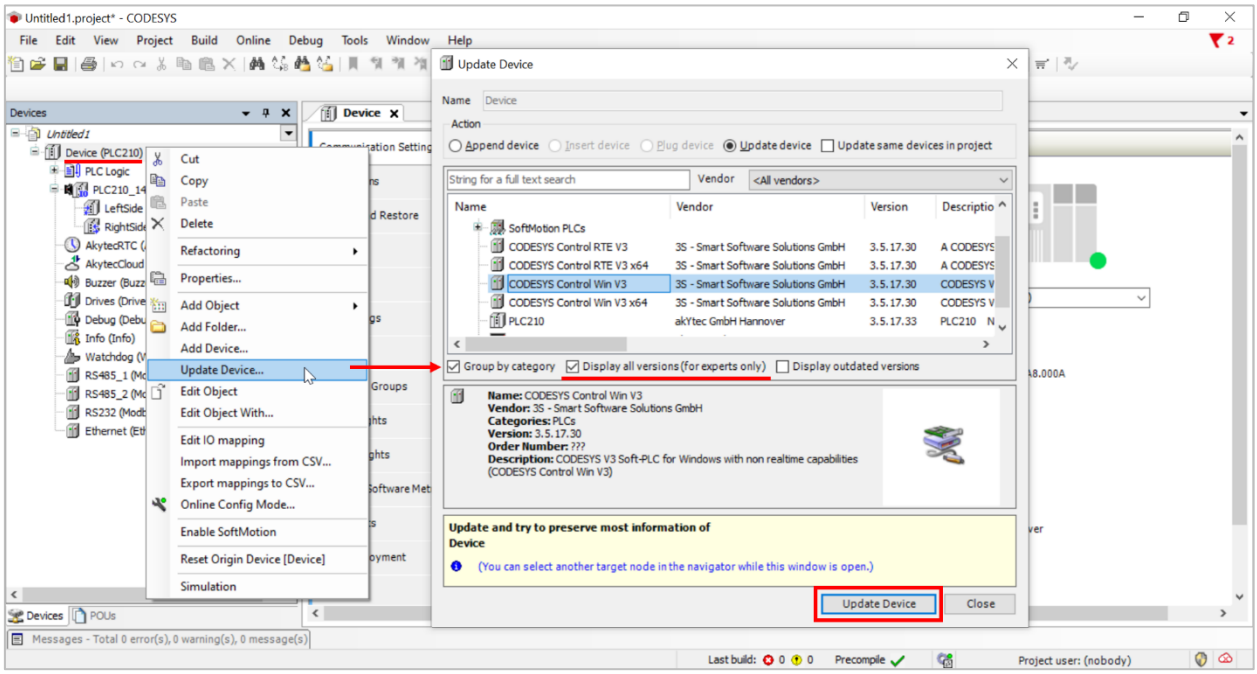


Fig. 3.4.2 Replacing the project PLC with a virtual PLC

NOTE
If the project was originally created for an akYtec PLC, open the node ***Task Configuration*** and remove the task ***AkytecCloudTask*** from the project tree, otherwise the project cannot be downloaded to the virtual PLC.

Next, you need to configure the gateway. This configuration should only be done once and is usually required if the current version of CODESYS is the first one installed on this PC.

Double-click the ***Device*** node to open the ***Device*** tab in the workspace. Select ***Communication Settings*** > ***Gateway*** > ***Add New Gateway***.

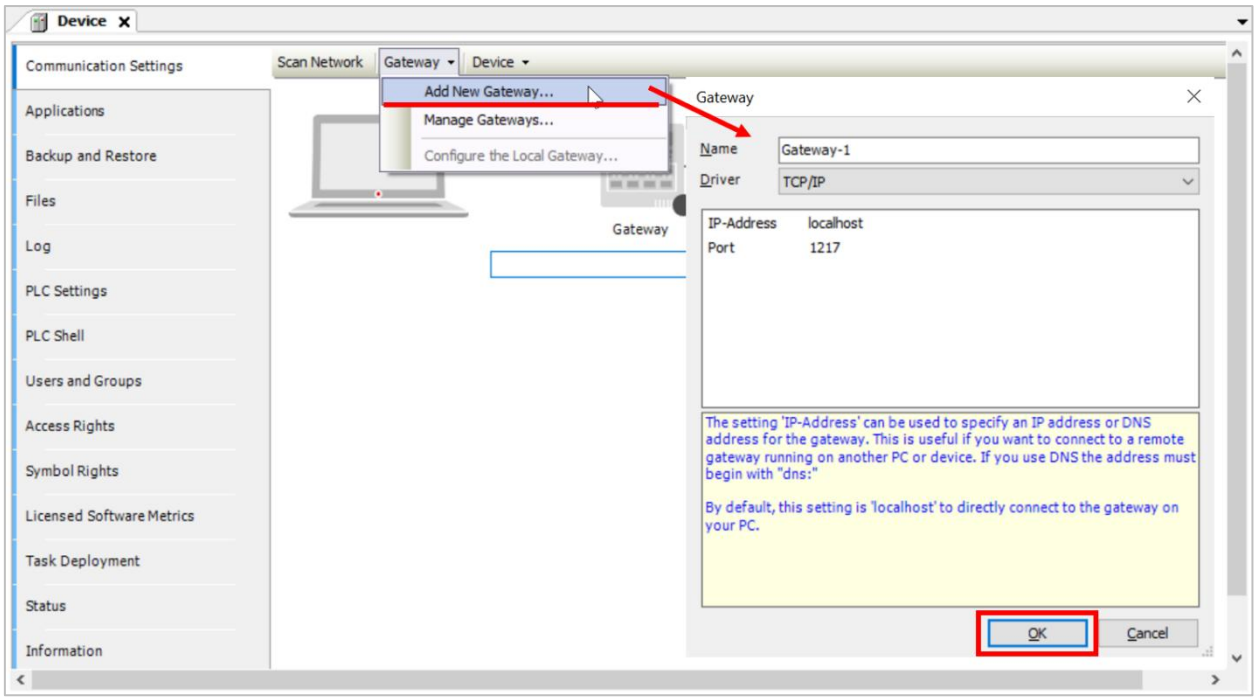


Fig. 3.4.3 Create new gateway

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3 Quick start

It is recommended to use the default settings (***name*** = ***Gateway-1***, ***IP address*** = ***localhost***). Close the ***Gateway*** window and click the ***Scan Network*** button. Select the required PLC in the opened device list and click ***OK*** to establish connection.

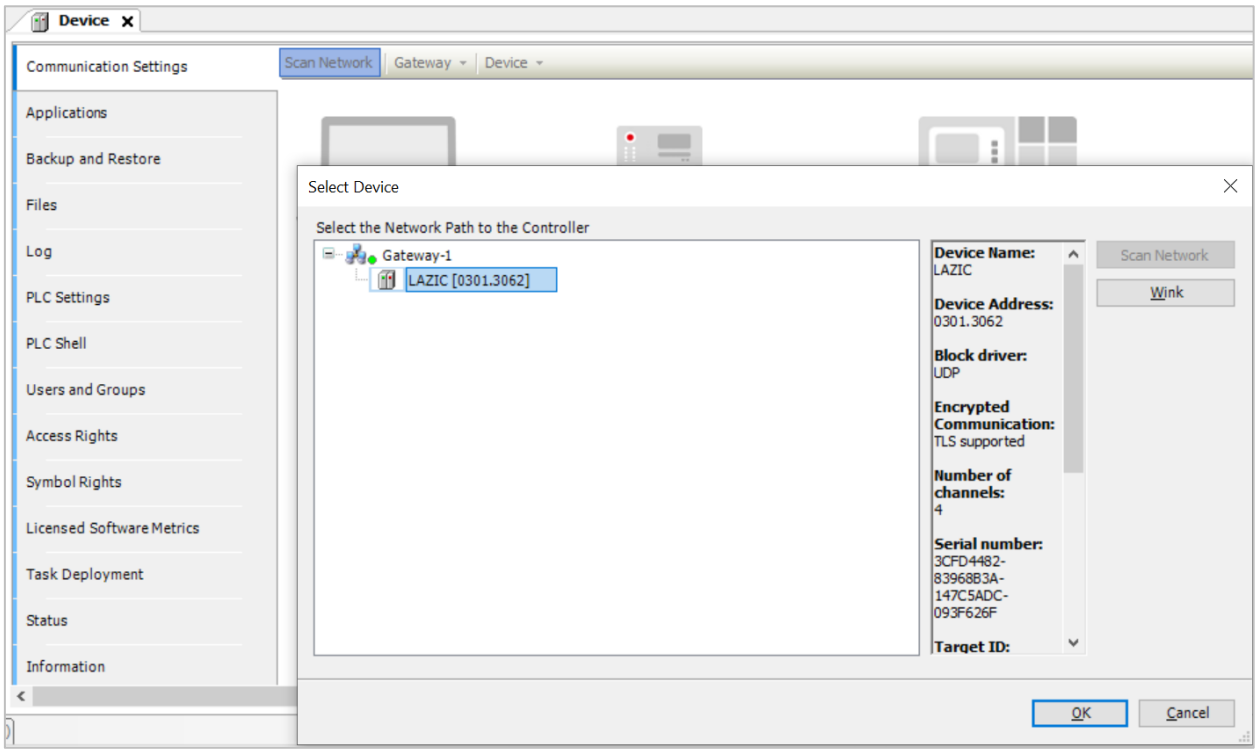


Fig. 3.4.4 “Select Device” window

If you are using CODESYS V3.5 SP17 or higher, after clicking the ***OK*** button, a window appears with a prompt to create a PLC user with a login and a password. This login and password must be entered each time you connect to the virtual PLC.

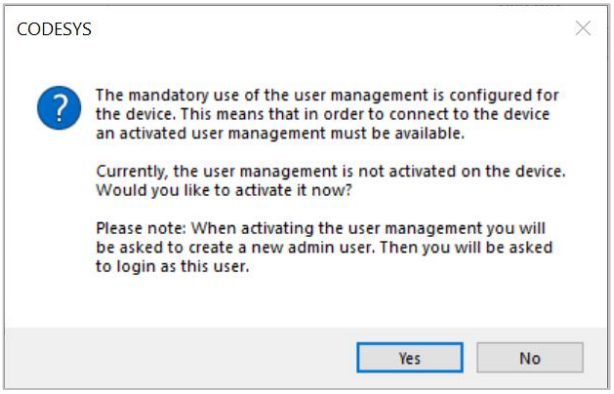


Fig. 3.4.5 Prompt to create a user at first connection to virtual PLC

If you want to avoid this, you can disable the mandatory user management:

- open the folder ***C:\ProgramData\CODESYS\CODESYSControlWinV3\<PLC ID>***,
- open the file ***CODESYSControl.cfg***,
- go to the component ***[CmpUserMgr]***
- in the line ***;SECURITY.UserMgmtEnforce=NO*** remove the semicolon (first character in the line) to uncomment the parameter.

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3 Quick start

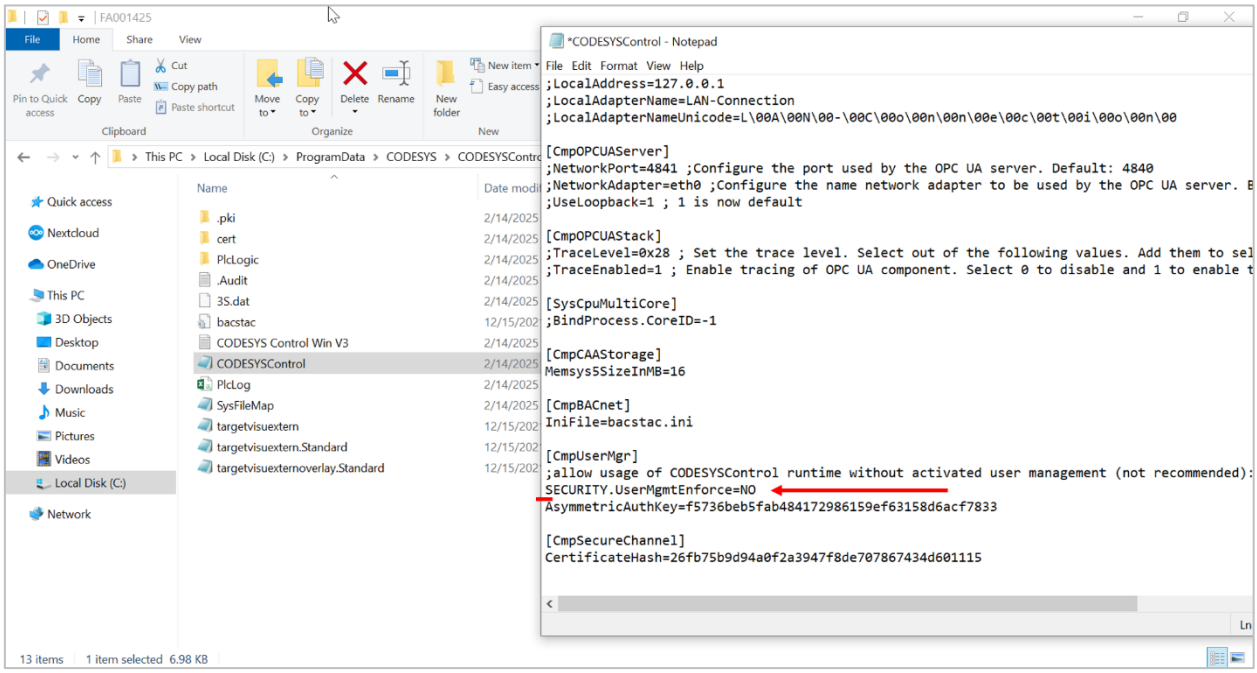


Fig. 3.4.6 CODESYSControl.cfg

Save the changes in the file and restart the virtual PLC: click on its icon in the System Tray, select the command ***Stop PLC*** and then the command ***Start PLC*** again. When reconnecting the PLC in CODESYS, this time there will be no prompt to create a user.

In case of successful connection, the gateway and PLC indicators will light green.

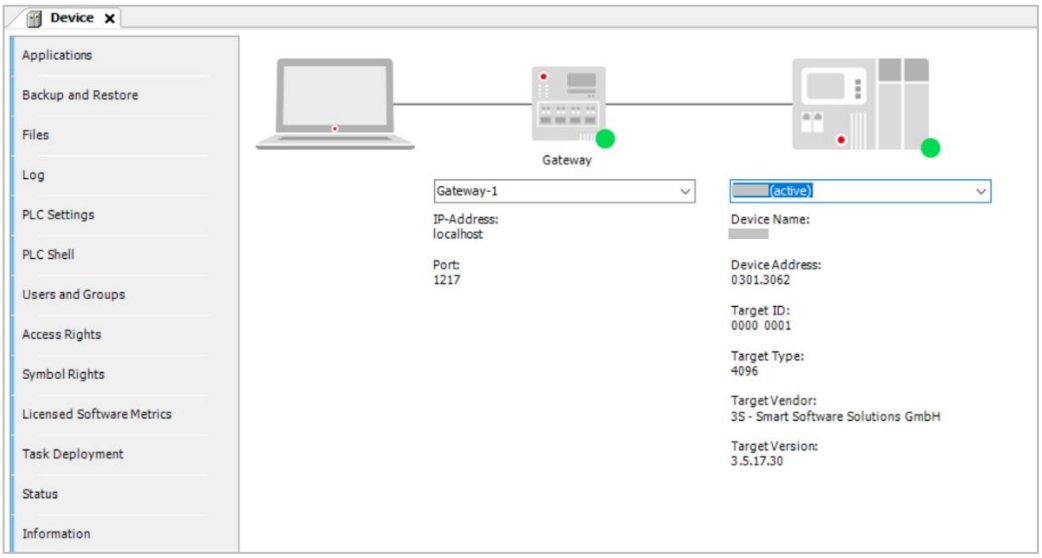


Fig. 3.4.7 Communication successfully established

After successful connection, you can download the project to the device (sect. 3.5).

3.5 Project download, start and management

To download the project to the device, use the command ***Online*** > ***Login*** .

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3 Quick start

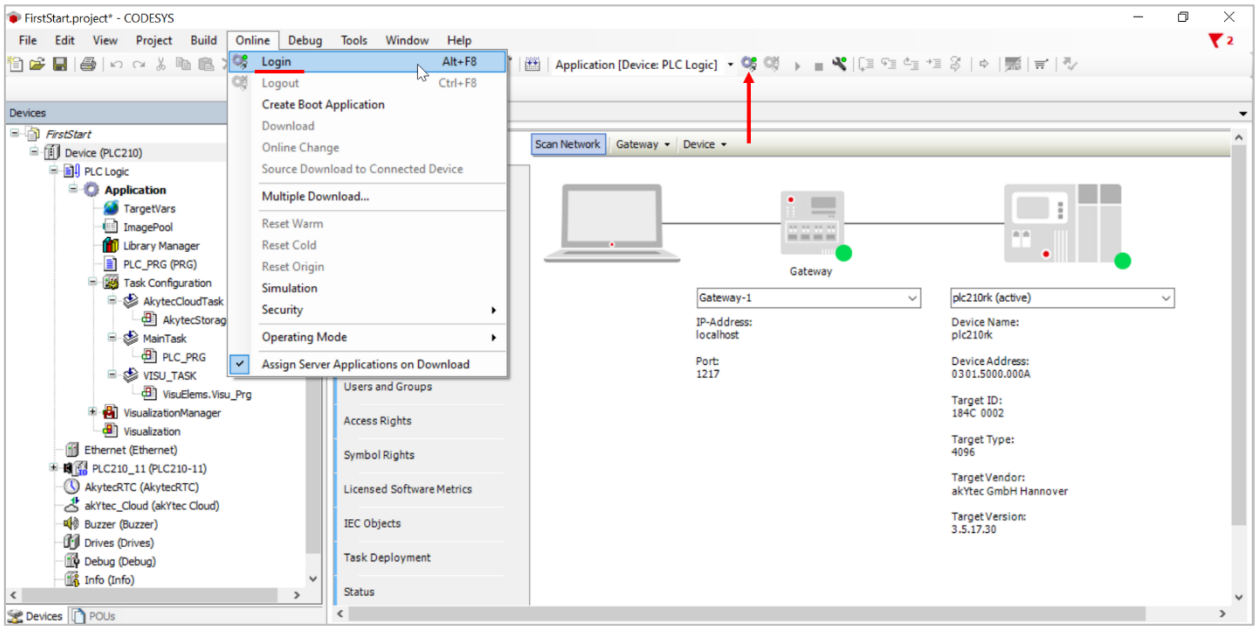


Fig. 3.5.1 Login to PLC

If there is no project in the PLC yet, you will be prompted to create a boot project and download it into the device. Click ***Yes*** to continue.

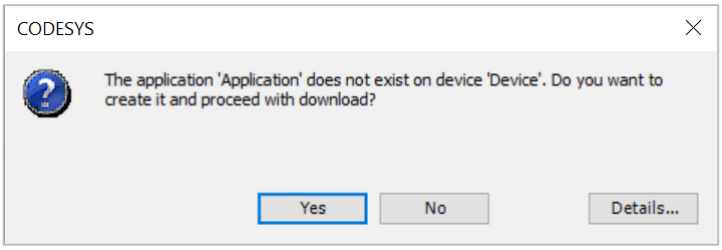


Fig. 3.5.2 Prompt to create a boot application

As a result, the project file will be converted to a binary file, which will be downloaded to the PLC, but not executed. This can be recognized by ***[stop]*** status of the ***Application*** node in the project tree, as well as by gray icons near tasks and components.

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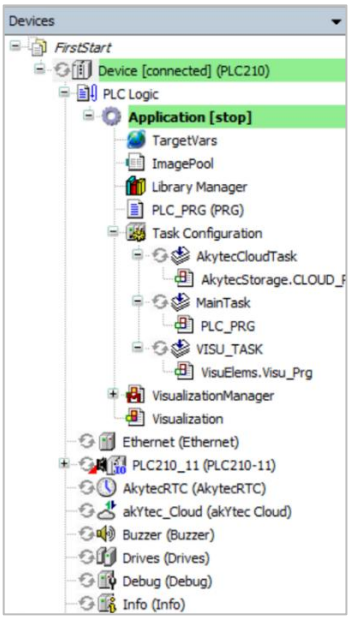


Fig. 3.5.3 Application status: downloaded, stopped

To start the application, use the menu command ***Debug*** > ***Start*** (or its icon in the toolbar). If you run the project on a virtual PLC, the target visualization will open. If the visualization is opened in full-screen mode, use ***Win*** or ***Alt***+***Tab*** keys to exit the mode. The window can be closed then.

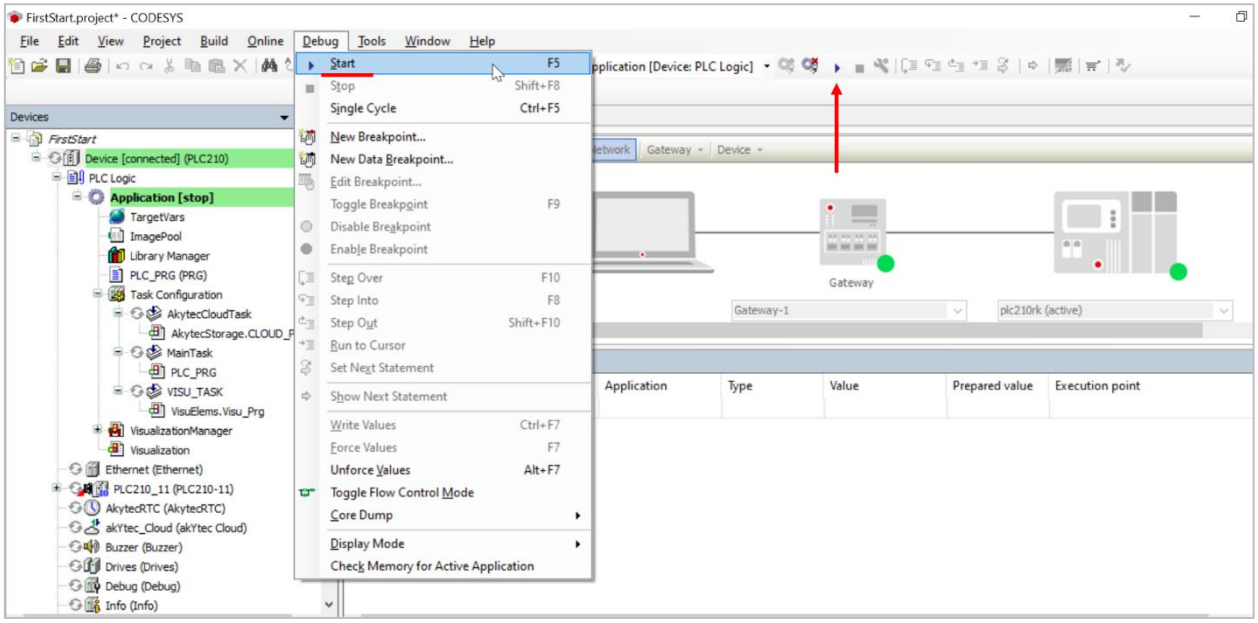


Fig. 3.5.4 Start application

Now the application is running: the status in the ***Application*** node has changed to ***[run]***, and the icons near tasks and components have turned green .

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NOTE
Important! As a result of the previous operations, the application is downloaded to the device RAM, but it is not yet saved in its flash memory. If you reboot the PLC now, the application will be removed. To avoid this, make it bootable using the command ***Online*** > ***Create Boot Application***. Then it will be saved in the flash memory of the PLC and will be automatically launched after its restart.

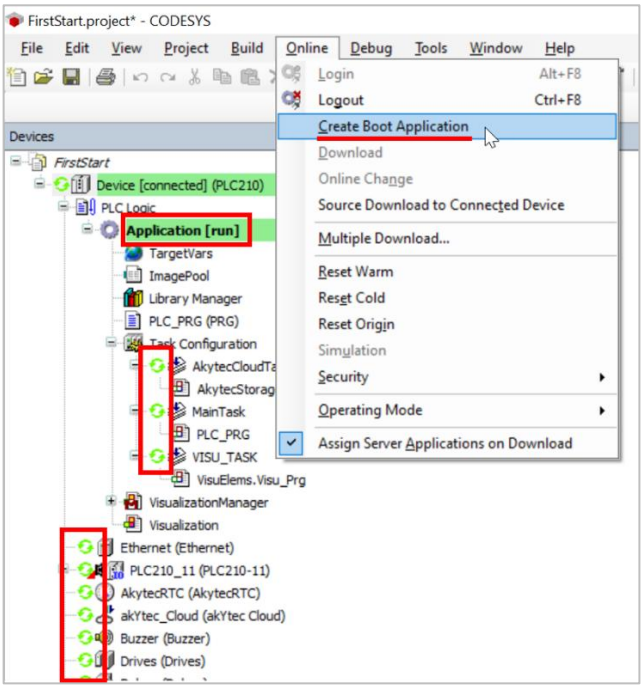


Fig. 3.5.5 Indication of the running application in the project tree

Above we have outlined the difference between the terms “**project**” and “**application**”. The “project” is the ***.project** file you work with in the CODESYS.

When you click the menu item ***Online > Login***, the boot application file is created on the PLC.

When the project is started, you can check the visualization program in web-visualization. Enter the IP address of the PLC and the port of the web-visualization server (8080 by default) in the browser address line.

- If your PC is connected to the PLC with factory settings over Ethernet interface (Tab. 3.2.1), enter ***192.168.0.10:8080***
- If your PC is connected to the PLC with factory settings over USB interface (Tab. 3.2.2), enter ***172.16.0.1:8080*** for PLC210 or ***10.0.6.10:8080*** for SPC210.
- If you use a virtual controller, enter ***localhost:8080***.

After that the web-browser will display the visualization page we created in section 3.1, and if you use SPK210, the same visualization will be displayed on the device screen immediately after the application start.

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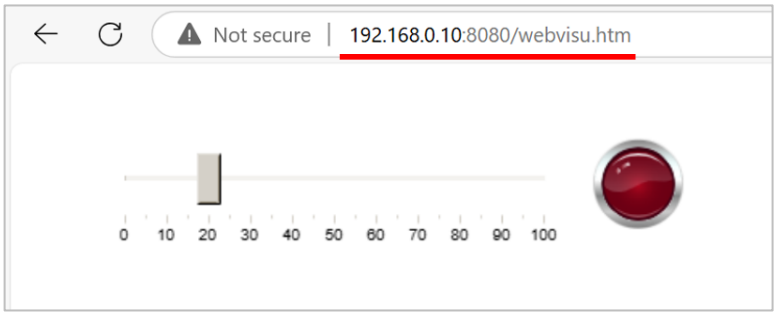


Fig. 3.5.6 Web-visualization in browser

Change the slider position. If its value exceeds 50, the alarm indicator will turn on. If the value becomes less than or equal to 50, the indicator will turn off. Thus, the program works exactly as it was intended.

At this moment CODESYS is still connected to the PLC. If we open the PLC_PRG program, we can see that next to the variable names, their current values are displayed. It is often useful to change these values „on the fly" and see how the program reacts. Of course, it can be done through web-visualization - but in a real project there may be hundreds or even thousands of variables, and a significant part of them will not be used in the visualization.

The easiest way to do this:

1. in the variable table, select a variable and double-click in the field ***Prepared value***
2. enter the value you want to assign to the variable and press ***Enter***
3. use the command ***Debug*** > ***Write Values*** (or press Ctrl+F7)

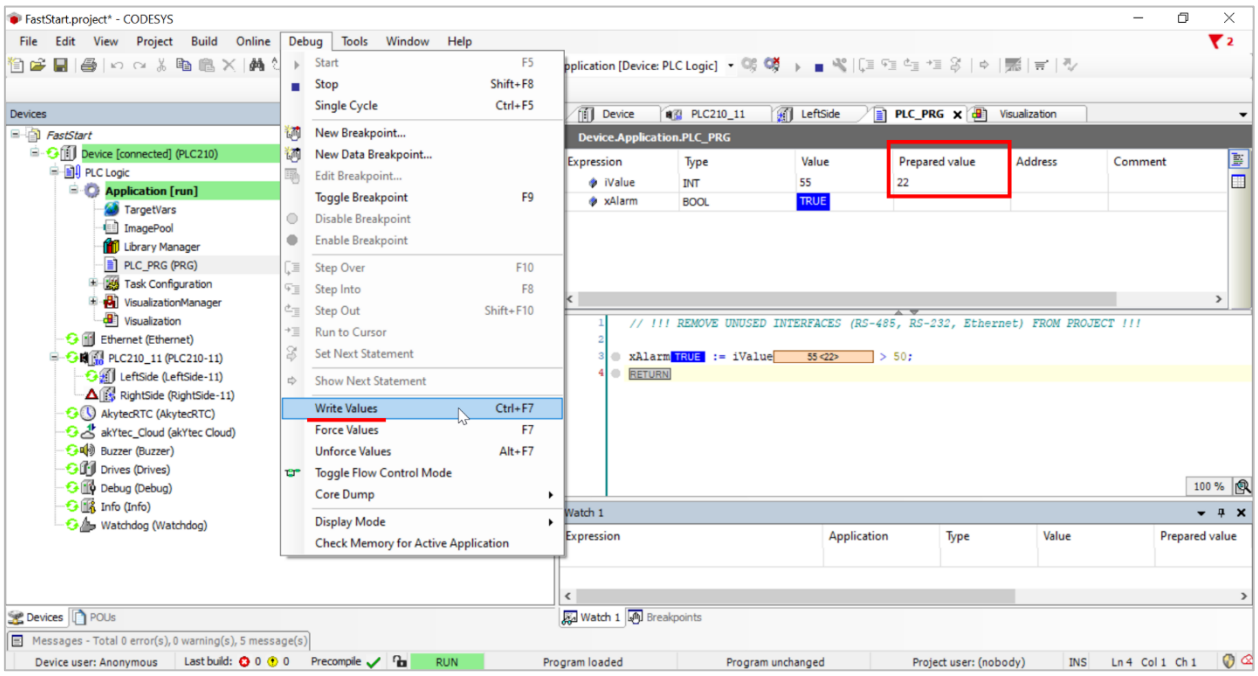


Fig. 3.5.7 Changing the variable value

After writing, you can change the value of the variable by moving the slider in the visualization.

But if you use the command ***Force Values*** instead of ***Write Values***, it will be impossible to move the slider, because the prepared value will be written to the variable every program cycle.

To disconnect the PLC from CODESYS for project editing, use the command ***Online*** > ***Logout*** .

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If you make any changes to the project (e.g. change the initial value of the variable ***iValue*** from 20 to 30) and use the command ***Login***, the following window will appear:

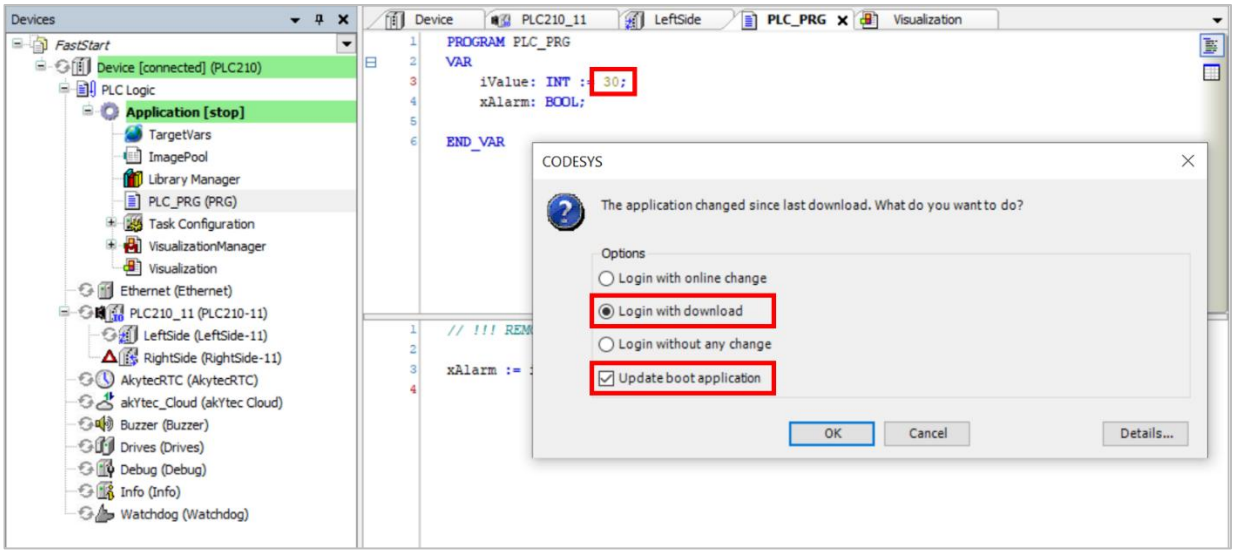


Fig. 3.5.8 Application loading window after making changes to the application

This window prompts you to select one of the options for connecting to the PLC.

NOTE
Important! It is not recommended to select the option ***Login with online change*** (active by default). This option implies a "hot update" of the application code, during which only the changed code fragments will be downloaded. In practice, this procedure may work incorrectly in many cases, as a result, you may encounter a range of hard-to-detect errors (e.g. arbitrary change of variable values due to incorrect reallocation of their addresses in memory). Therefore, it is safer to use the option ***Login with download***, in this case, the complete application will be downloaded to the PLC.
You can also check the checkbox ***Update boot application***, in this case, the command ***Create boot application*** will be automatically executed after the download of the application, and you do not have to execute it manually.

So, in this section we have:

- created a simple project with a program in ST language and visualization
- established connection between the PLC and CODESYS
- downloaded this project to the PLC
- worked with web-visualization
- learned how to change the values of variables when connecting online to the PLC
- learned about different options for downloading the application

If you already have some experience with PLCs, you probably already have some questions. In the following section we will try to answer the most predictable of them.

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3.6 FAQ

3.6.1 No boot application after device reboot

If after rebooting the PLC there is no boot application in the device, i.e. you see the message from Fig. 3.5.2, this means you have not made the application bootable. To fix this, see Fig. 3.5.5 and the information above.

3.6.2 How can I remove the application from the PLC?

In Sect. 3.5 we have learned how to download the application to the PLC. If it is necessary to remove it, use the command ***Online*** > ***Reset Origin***. The CODESYS application will be deleted while all other settings, including network settings, will retain their current values.

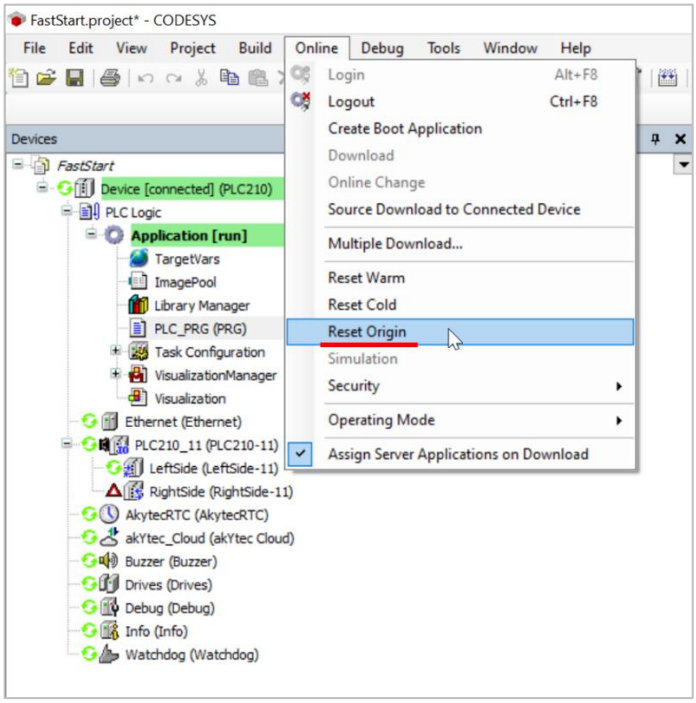


Fig. 3.6.1 Removing boot application from PLC

3.6.3 Is it possible to transfer an application from one PLC into another?

There are generally two different interpretations for this question:

- The operation engineer is interested in the possibility of preparing a backup, so that in case of a PLC failure he can get a spare device, download the same project into it and restore the operation of the automation system.
- The software engineer is interested in the issue of intellectual property protection, so that the project developed by him cannot be changed or replicated to other PLC without his permission.

The main aspects of this issue:

- When executing the command ***Create boot application***, a binary file with the boot application is saved in the PLC. A copy of this file does not give another person access to the source file, the project file (*.***project***) cannot be restored from it.
- Generally, the boot application file can be transferred to another PLC of the same model and with the same firmware version, but this feature may be password protected or completely disabled.

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Besides, it is possible to read out the device serial number from the program code, compare it with the specified one and, for example, prohibit the execution of any actions in the program in case of serial numbers mismatch. This makes the transfer of the boot application to another PLC meaningless, since the serial number is assigned to the PLC at the production stage and cannot be changed by user.

- CODESYS has functionality to back up the application and then deploy its copy. The akYtec PLCs also enable, using the Web Configurator as well as the SPC on-screen configurator, to create backups that include both the user application and all device settings (including network settings). Both tools provide the ability to create password protected backups.
- Source files (***.project***) can be downloaded into the PLC using the command ***Online*** > ***Source Download to Connected Device*** (Fig. 3.6.2). To upload this file to CODESYS, use the command ***File*** > ***Source Upload…*** (Fig. 3.6.3).

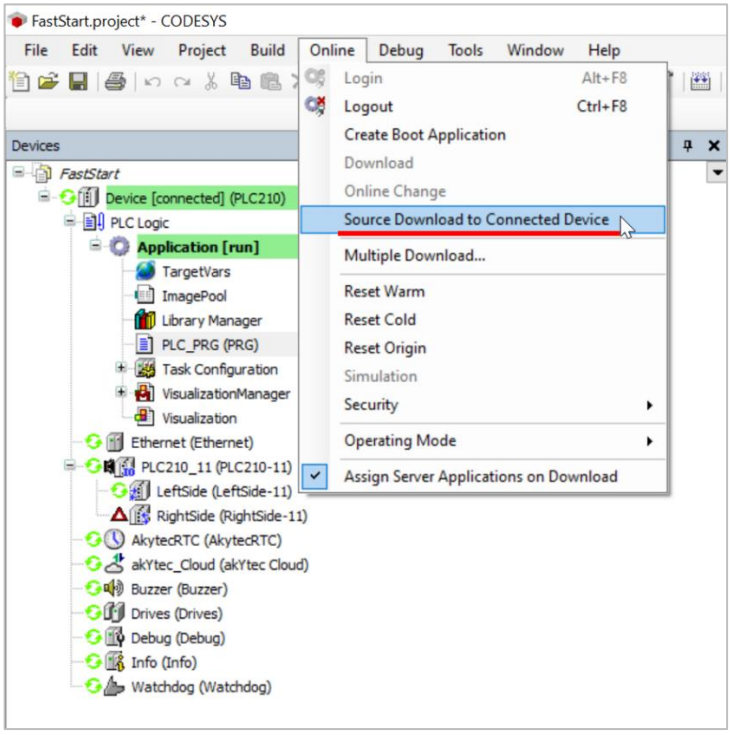


Fig. 3.6.2 Source Download to Connected Device

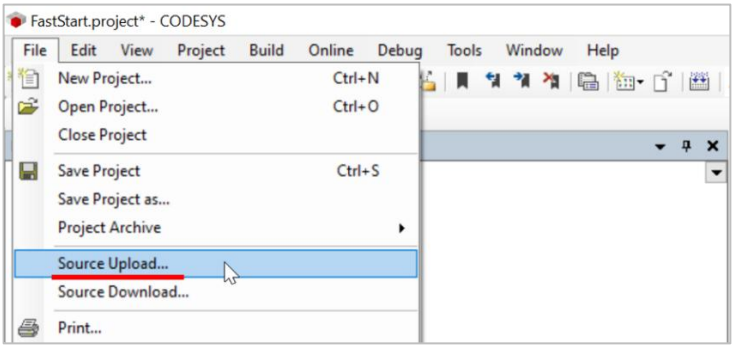


Fig. 3.6.3 Source Upload

3.6.4 The correct way to transfer the project to another PC with CODESYS installed

Before transferring project files between different PCs, make sure that the version of CODESYS in which the project was created is installed on all these PCs.

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The project may contain additional components, libraries, etc. To avoid transferring all these files together with the project, you should use project archives (***.projectarchive***). To create a project archive, use the command ***File*** > ***Project Archive*** > ***Save/Send Archive***. The archive file is much larger than the project file (usually ≥ 60 MB), but it contains all the components and libraries used in the project.

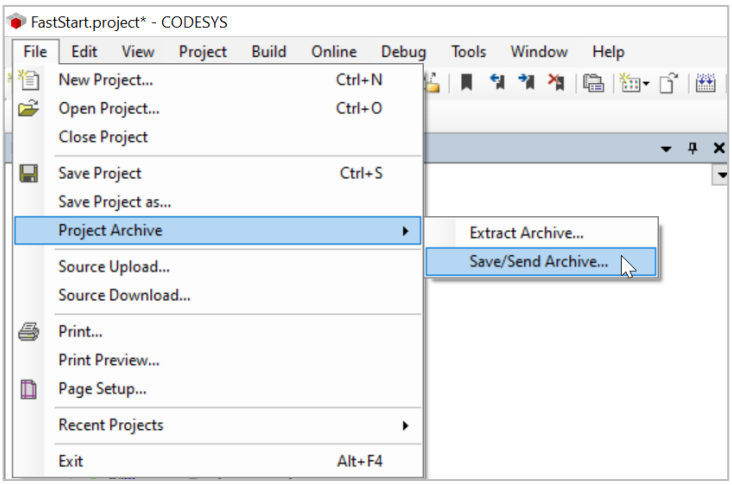


Fig. 3.6.4 Project archive creation

3.6.5 How can I view the PLC message log?

To view the message log, double-click the ***Device*** node to open the ***Device*** tab in the workspace and select the ***Log*** section. It can also be viewed in the Web Configurator in the section ***PLC*** > ***Log Files***.

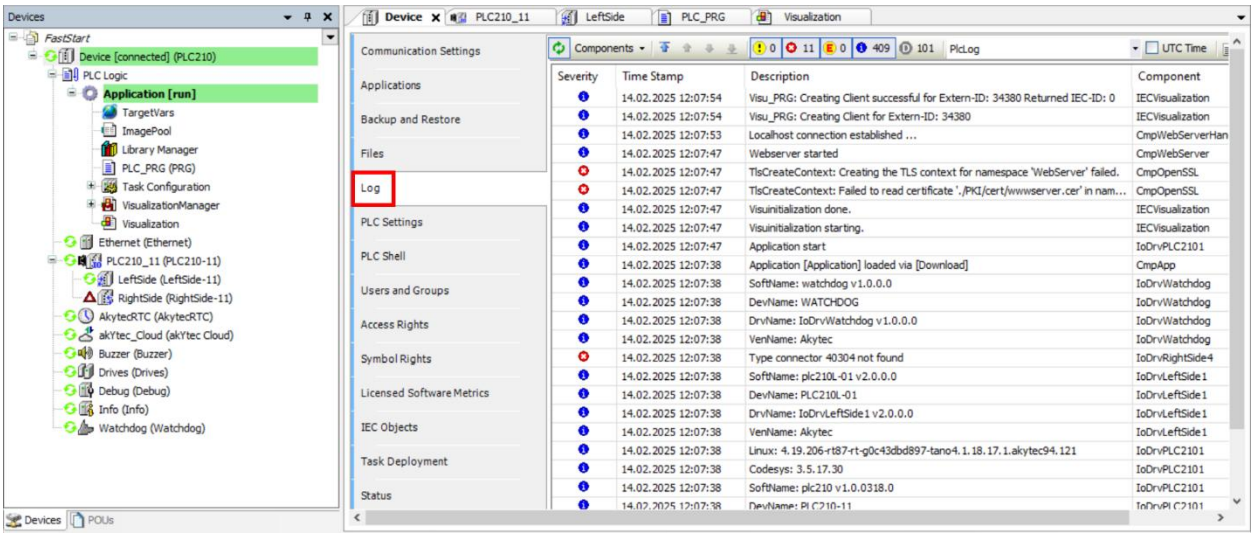


Fig. 3.6.5 PLC message log in CODESYS

3.6.6 How do I know if there are errors in the project?

If there is an error in the project, in most cases it will be detected by compiler during automatic check.

Suppose you forgot to put a semicolon at the end of an expression in the program code. The object in which the error is detected (in our case, it is the ***PLC_PRG*** program) will be underlined in the project tree with a red wavy line, and the compilation message bar displayed at the bottom of the screen will show an error message indicating the object in which the error occurred and the expected position (in our case, it is the line number).

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The error can be detected at different stages (precompilation, compilation, etc.). To view messages for a particular stage, you should select it in the drop-down list.

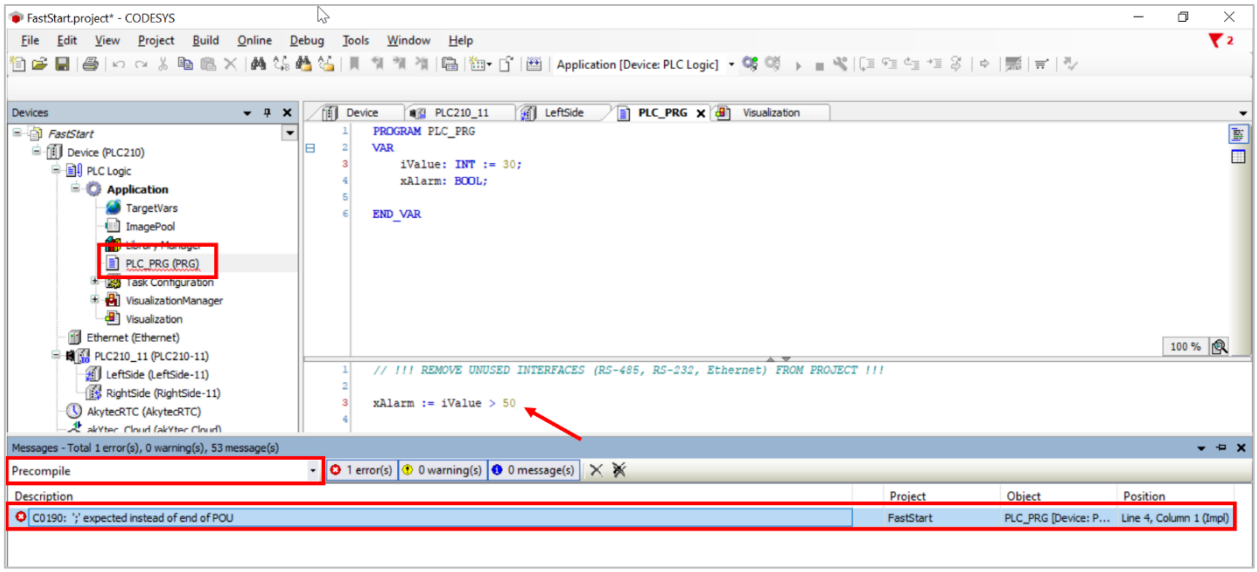


Fig. 3.6.6 Error message in compilation message bar

If you accidentally close the message panel, you can get it back using the command ***View*** > ***Messages***.

In some cases, an error cannot be detected during automatic checks. Therefore, it is recommended to execute the command ***Build*** > ***Generate Code*** regularly. This command checks the project for errors, and if there are no any, creates an application file that will be downloaded to the PLC if connected.

The check results are saved in internal CODESYS files. Sometimes these files may be corrupted or incorrectly overwritten e.g. during regular automatic checks. This can lead to records about errors that do not actually exist in the program. Therefore, it is recommended to execute the command ***Build*** > ***Clear All*** before ***Generate Code*** to remove information about previous program checks.

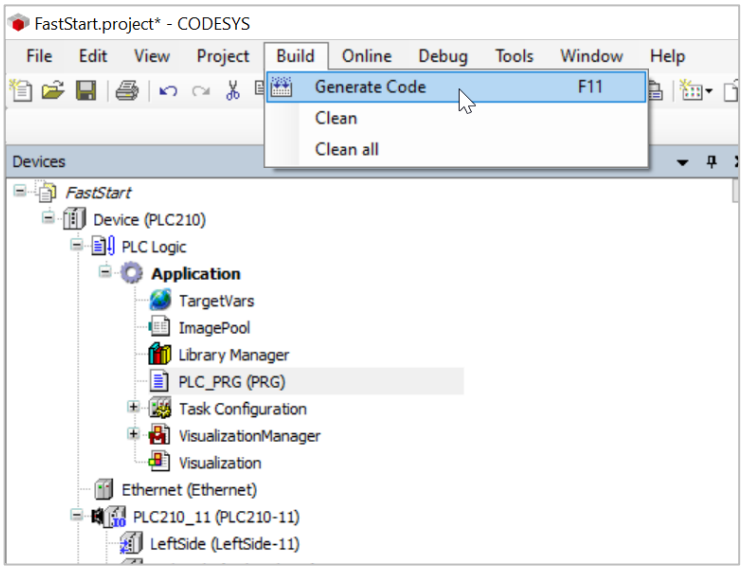


Fig. 3.6.7 Build menu

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3.6.7 With what interval is the program code executed?

In sect. 3.1 we added the code to the program that compares the value of the ***iValue*** variable with the set value 50. How often is this check performed?

The interval at which the program is called is determined by the task to which the program is attached. The interval is usually specified in milliseconds. We have created a project based on a template in which the ***PLC_PRG*** program is assigned to the task ***MainTask*** in the node ***Task Configuration*** (Fig. 3.6.8). Double-click ***MainTask*** to open it in the workspace. The interval of ***MainTask*** is 10 ms, it is also the interval of ***PLC_PRG*** program execution.

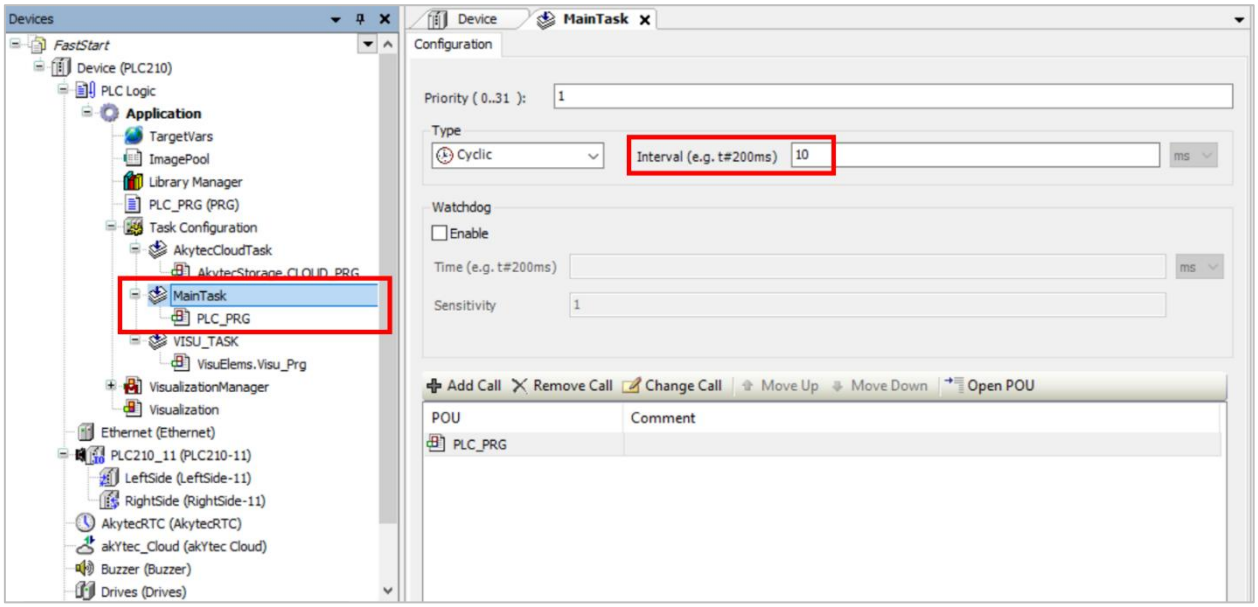


Fig. 3.6.8 MainTask parameters

3.6.8 How to enable grid in visualization editor?

To enable grid in the visualization editor, open ***Tools*** > ***Options*** > ***Visualization*** > ***Grid*** and check the checkbox ***Visible***.

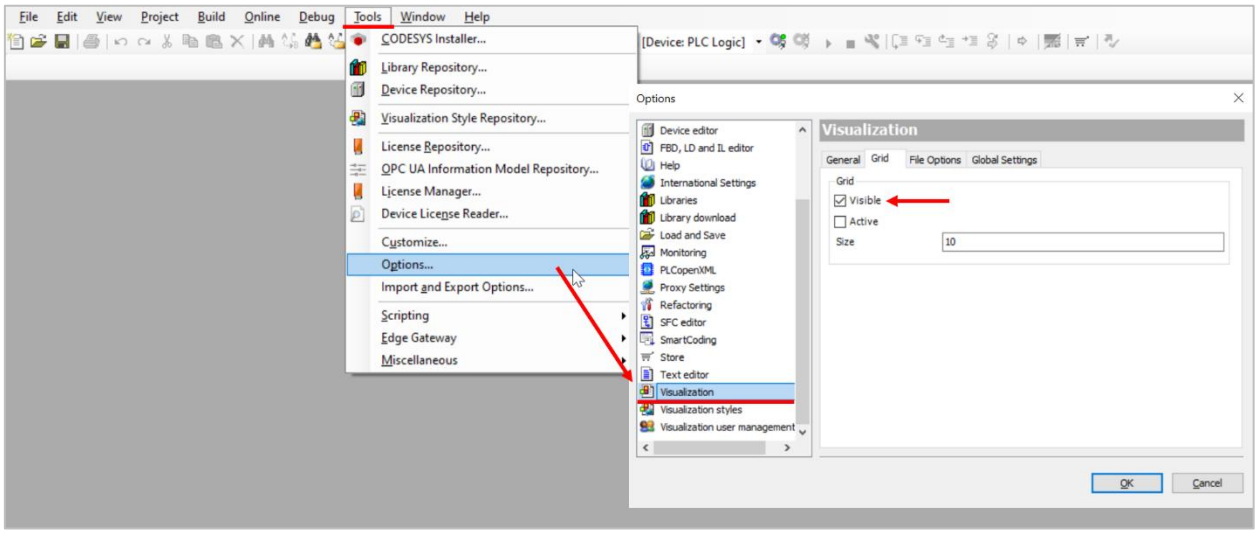


Fig. 3.6.9 Make grid in visualization editor visible

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3.6.9 Is the size of application limited?

There are no explicit limitations on the size of the application, there is only a limitation on the size of free device memory. For PLC210 the size of memory available to the user is about 70 MB, for SPC210 – 2 GB.

You can view the current size of free memory with a connected PLC in the ***Drives*** node. Double-click the node and set the value in the channel ***Enable Drives*** to ***TRUE***. The size of free memory in bytes will be displayed in the channel ***FS free***.

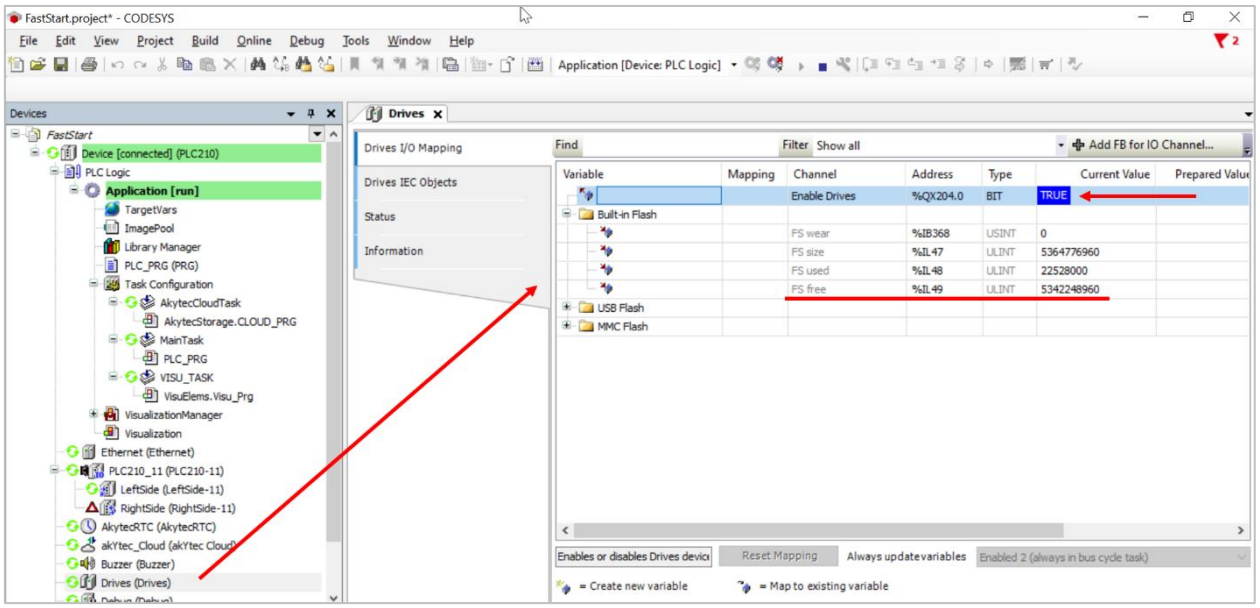


Fig. 3.6.10 Size of free PLC memory in Drives node

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