



TM210

Working with Automation Studio

Requirements

Necessary basic knowledge	Basic technical training Basic knowledge of how a control system functions
Training modules	-
Software	Automation Studio 4.11 Automation Runtime 4.11 or later
Hardware	X20 controller and X20 I/O modules ETA210 or ETAL210 + ETAL690 www.br-automation.com/eta-system



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1 Introduction

Automation Studio is the configuration environment used for B&R automation components. This includes controllers, motion control components, safety modules and HMI applications. Automation Studio offers the perfect environment for creating different variants of a machine and managing them neatly. Projects can be structured clearly and facilitate team work in this way.

Users can choose from a wide range of programming languages, diagnostics tools and editors to assist them at every stage of engineering. Standard libraries provided by B&R and the integrated IEC programming languages allow a highly efficient workflow. Extensive simulation options make it easier to configure and test applications independently of the hardware.

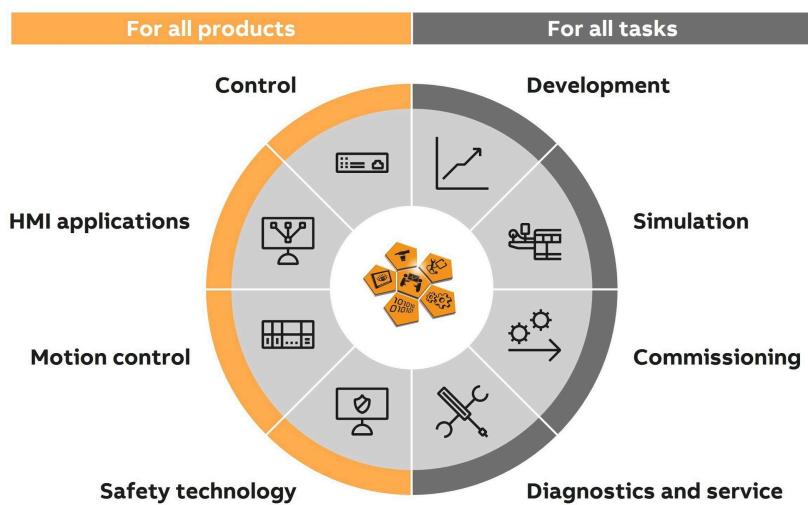


Figure 1: Automation Studio – One engineering tool for the machine's entire lifecycle

1.1 Learning objectives

This training module contains simple tasks to demonstrate the wide range of tools available in Automation Studio. In addition, it will frequently refer to the extensive Automation Help, an invaluable reference for completing the exercises in this training module.

- Participants will learn how to create and configure projects in Automation Studio.
- Participants will learn how to develop small programs and declare process variables.
- Participants will learn how to use Automation Help.
- Participants will learn how to set up hardware configurations and use the simulation features in Automation Studio.
- Participants will learn the steps required to commission a B&R controller.
- Participants will learn how to use the Automation Studio user interface and the various editors available.
- Participants will learn about the options for configuring modules with Automation Studio's hardware management features.

1.2 Safety notices and symbols

Safety notices in this manual are organized as follows:



Danger: Disregarding these safety guidelines and notices can result in severe injury, death or substantial damage to property.



Warning: Disregarding these safety guidelines and notices can result in severe injury or substantial damage to property.



Caution: Disregarding these safety guidelines and notices can result in injury or damage to property.
These instructions are important for avoiding malfunctions.

Additional notices and information in this manual are organized as follows:



Note: Provides important tips and additional information.



Help: References additional documentation. (Automation Help, data sheets, user's manuals)

Example:

Hardware \ Motion control \ <Device>¹ \ Technical data \ (<Type>)² \ Status indicators



Example: An example illustrates the topic in greater depth.



Result: The result of a completed task is summarized briefly.

Organization of safety notices in external manuals:

This manual contains references to other manuals. How safety notices are organized in external manuals is listed in the respective manual.

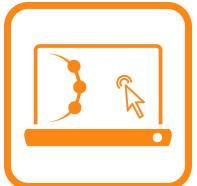
Exercise: Task definitions & exercises

Sections marked with an orange stripe on the left side contain information about exercises as well as the associated actions to be taken. The exercises are designed to provide a deeper understanding of the information provided.

1.3 B&R Tutorial Portal

The B&R Tutorial Portal provides tutorials on a wide range of subjects. Because the tutorials are interactive, they allow content to be learned effectively. To make it easier for you to find the tutorials you need, they are organized according to the structure of our modular training content.

[B&R Tutorial Portal](https://tutorials.br-automation.com/publisher/) (<https://tutorials.br-automation.com/publisher/>)



¹ Angle brackets indicate variable placeholders "<...>"

² Parentheses indicate optional entries "(...)"

Login required: Follow the link and you will be redirected to the B&R Tutorial Portal. Use the same access data as for the B&R website to log in.

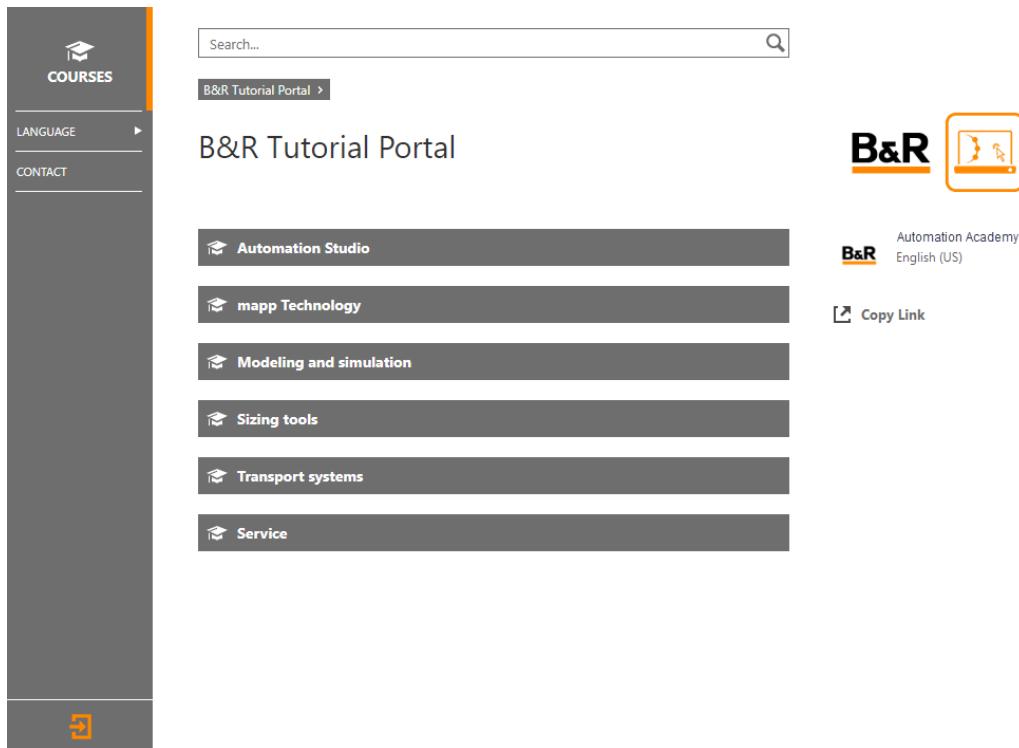


Figure 2: Navigating within the course in the B&R Tutorial Portal

2 Installation and licensing

Automation Studio is available for download on the B&R website.

All Automation Studio software versions are available at [Downloads](#), "Product groups = Software", "Software = Automation Studio".

Once Automation Studio has been installed, it needs to be licensed.

2.1 Installation wizard

The installation wizard guides the user through the installation process. After selecting the language for installation, a number of installation options are available. These include viewing version information, calling system requirements, etc.

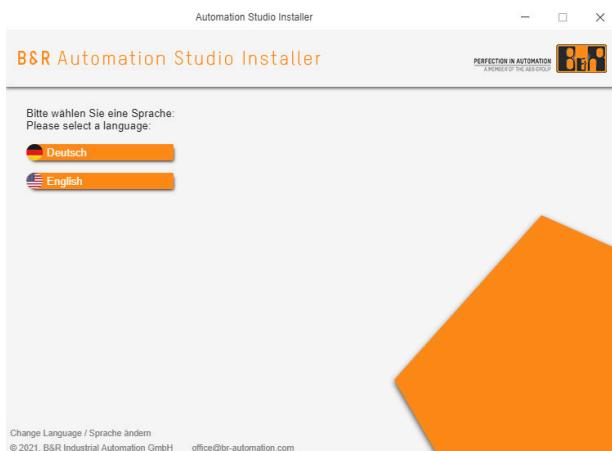


Figure 3: Automation Studio installation: Selecting the desired language

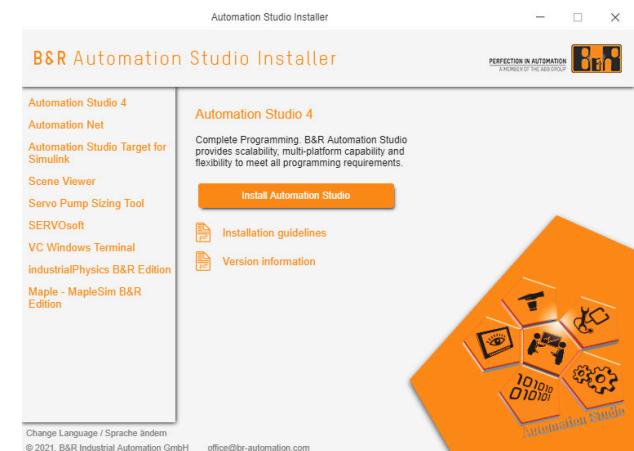
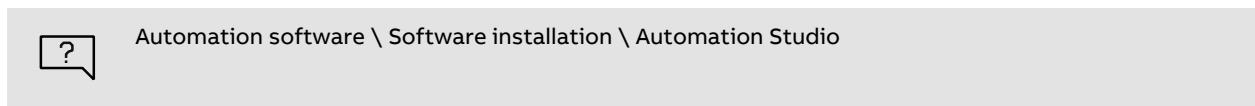


Figure 4: Automation Studio installation: Installation options and version information

In the following dialogs, the license agreement is accepted and a selection is made as to which components are to be installed.



2.1.1 Start Automation Studio

The Automation Studio installation automatically adds the necessary shortcuts to the Start menu and desktop in Windows. It is then possible to launch Automation Studio from the Windows Start menu or using the shortcut on the desktop.



Figure 5: Automation Studio desktop icon

When Automation Studio is started for the first time, the Automation Studio start page is displayed.

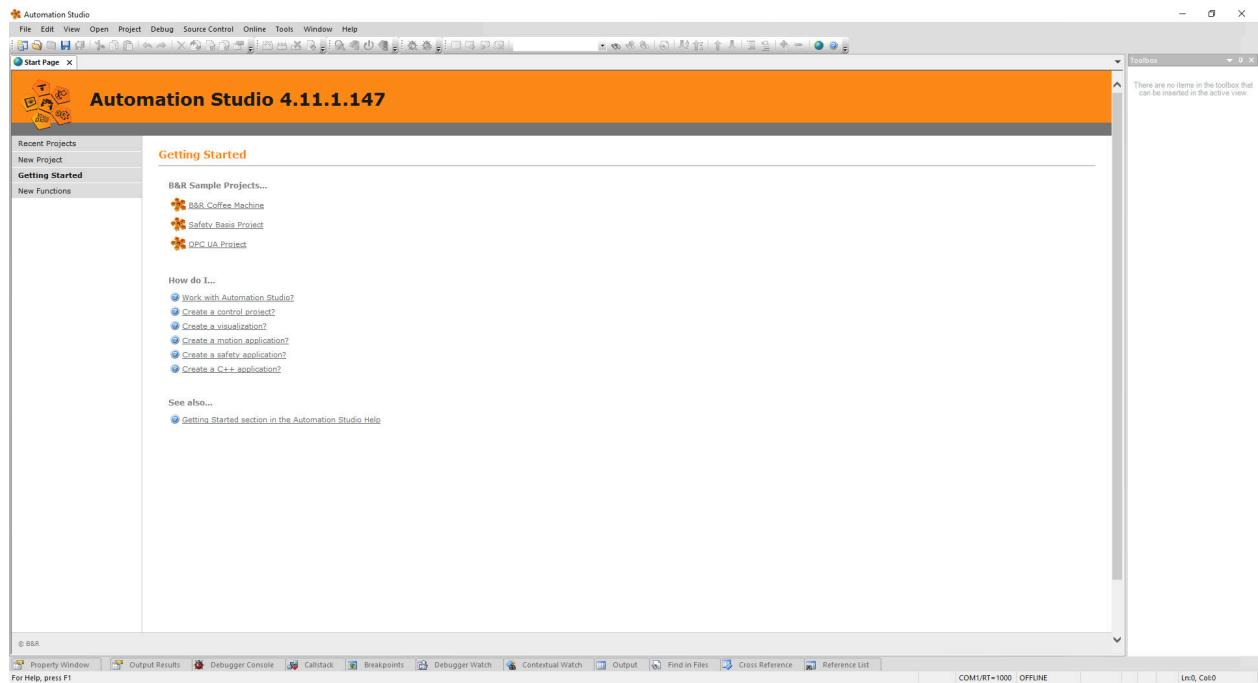


Figure 6: The Automation Studio home screen

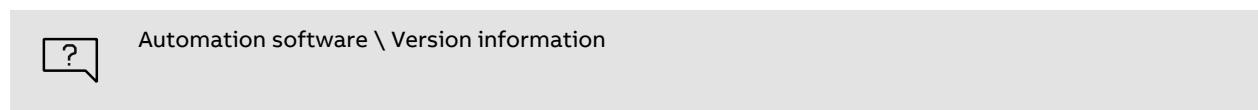
From the home screen, you can create a new project or open an existing one.

It also includes section "Getting started" to show users how to work with Automation Studio.

The home screen is displayed automatically after closing a project. It can also be opened via menu "Help" \ "Show start page".

2.1.2 Version information

For an overview of the functions of the new Automation Studio version, see the section in Automation Help with version information. The differences to the previous versions as well as new functions are explained briefly here.

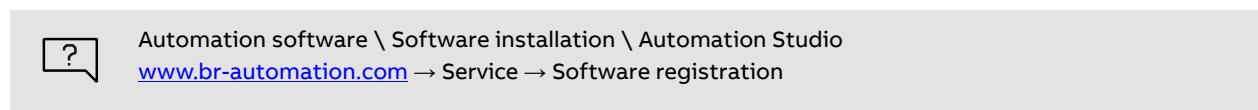


2.2 Automation Studio licensing

Once Automation Studio has been installed, it needs to be licensed. If Automation Studio has not yet been licensed, the licensing dialog box will be displayed automatically.

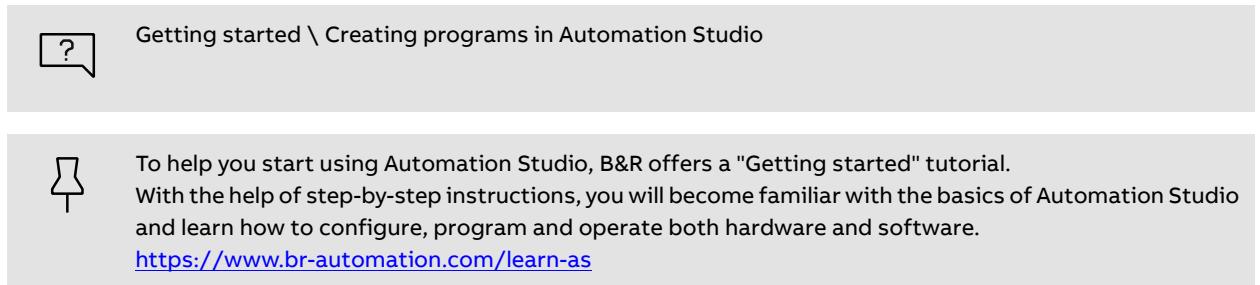
Depending on the selected license type, a Technology Guard is required as license storage, see [9.2 "Technology Guarding" on page 49](#). Evaluation licenses and student licenses can be requested directly on the B&R web page.

For a complete description of the licensing dialog box, see Automation Help.



3 My first project

In this section, you will use Automation Help as a reference to create a new project, transfer it to Automation Runtime Simulation and test it using Automation Studio.



Exercise: Create a new project with the support of Automation Help

The corresponding section of Automation Help can be opened directly from the Automation Studio home screen.

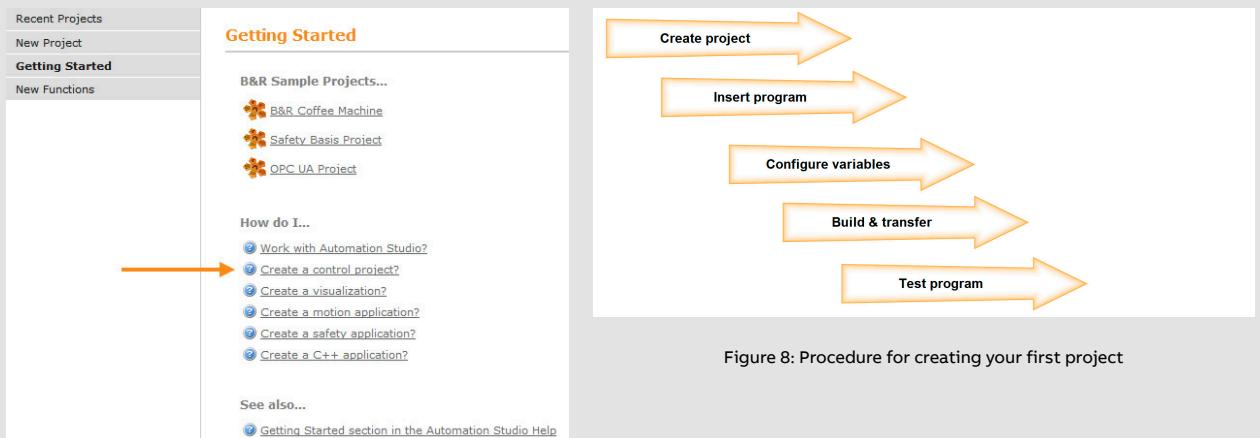
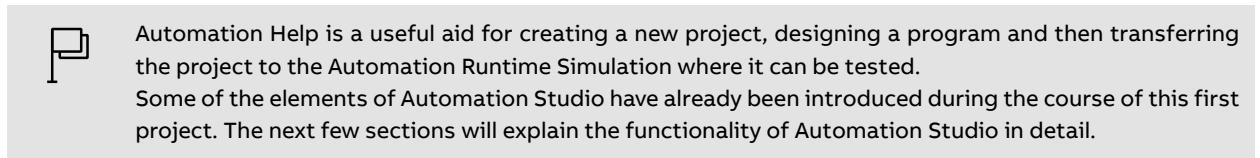


Figure 7: Automation Desktop home screen

- 1) Open the Automation Studio home screen.
- 2) Click on "How do I create an control project?"
- 3) Click on "Example project with Automation Runtime Simulation" in Automation Help
- 4) Work through the topics listed



4 Automation Studio

4.1 Basic concept of Automation Studio

In an Automation Studio project, the application software is managed and structured in the Logical View. The machine design and functions determine what the structure looks like. This direct relationship between the application and the machine makes the software structure intuitive and easy to navigate.

Completed software components are assigned to their respective configurations in the Configuration View. For each configuration, there is a corresponding hardware configuration that is managed in the Physical View.

Automation Studio allows automation projects to be structured modularly to support distributed development approaches and makes working in project teams more efficient.

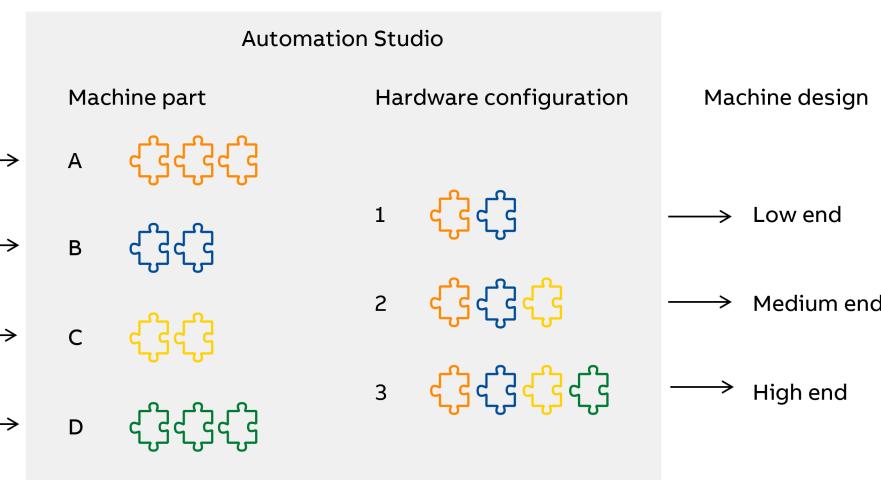


Figure 9: The structure and basic principle of Automation Studio

4.2 Automation Help – The integrated help documentation

Automation Help is an invaluable resource throughout the development, configuration and commissioning of a project. Automation Help is a comprehensive resource and the first place to look for answers to any questions that might arise.

Automation Help as a reference:

- Working with Automation Studio and its editors
- Creating programs
- Configuring an HMI application
- Configuring drives
- Complete B&R hardware documentation

If new hardware or software upgrades are installed in Automation Studio, the corresponding documentation is automatically extended in Automation Help (see [9.1 "Hardware and software upgrade" on page 48](#)).



How can the language in Automation Help be changed?

The language in Automation Help is set via menu option "View \ Language".

Exercise: Use Automation Help

Press the **<F1 key>** in Automation Studio to open Automation Help and view information about the selected element. There is also a search function to look for information about a specific topic. The functions of Automation Help are described in the section "Automation Software" \ "How do I use the help documentation?".

The technical data for controller X20CP1586 can be found via the **Search option**.

Use the technical data to get information about the power consumption of the selected controller.

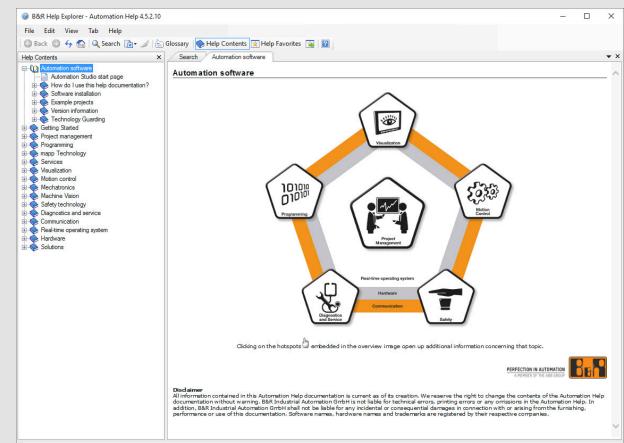


Figure 10: Automation Help

4.2.1 Manage help documentation favorites

Help favorites make it possible to manage and store helpful pages within a personalized structure. It is possible to save the Help favorites in a file. In this way, Help favorites can be managed as needed and even passed on to other people.

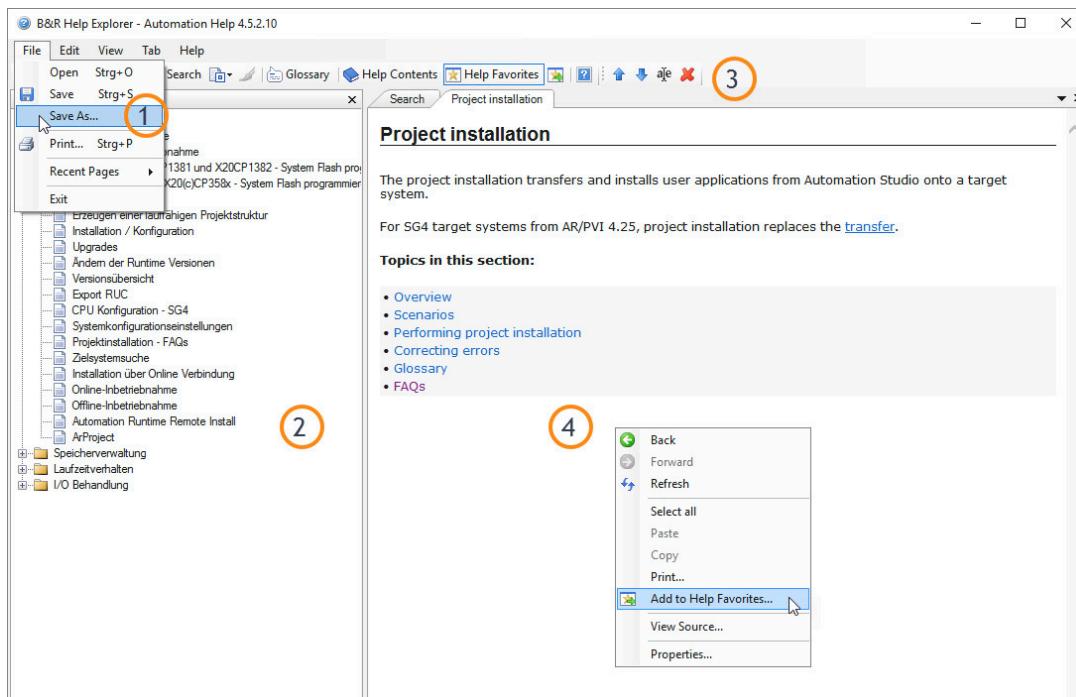
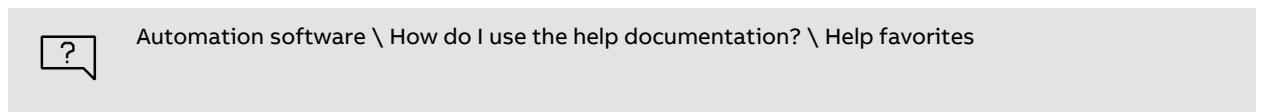


Figure 11: Managing Help favorites

- 1) **Save**
Help Favorites can be saved to a file via "File" \ "Save as". Any newly added entries are saved automatically.
- 2) **Help favorites**
The Help favorites are managed in a tree structure. Entries can be moved and renamed.
- 3) **Toolbar**
Buttons "Help contents" and "Help favorites" make it possible to switch between the Favorites view and the navigation tree. The navigation tree is synchronized at the same time.
- 4) **Adding Help favorites**
Add the currently open help page to your Help favorites by right-clicking on the document and then selecting "Add to help favorites". This will open a dialog box for selecting the position in the favorites list.



4.3 The workspace

Automation Studio is divided into several sections with different functions.

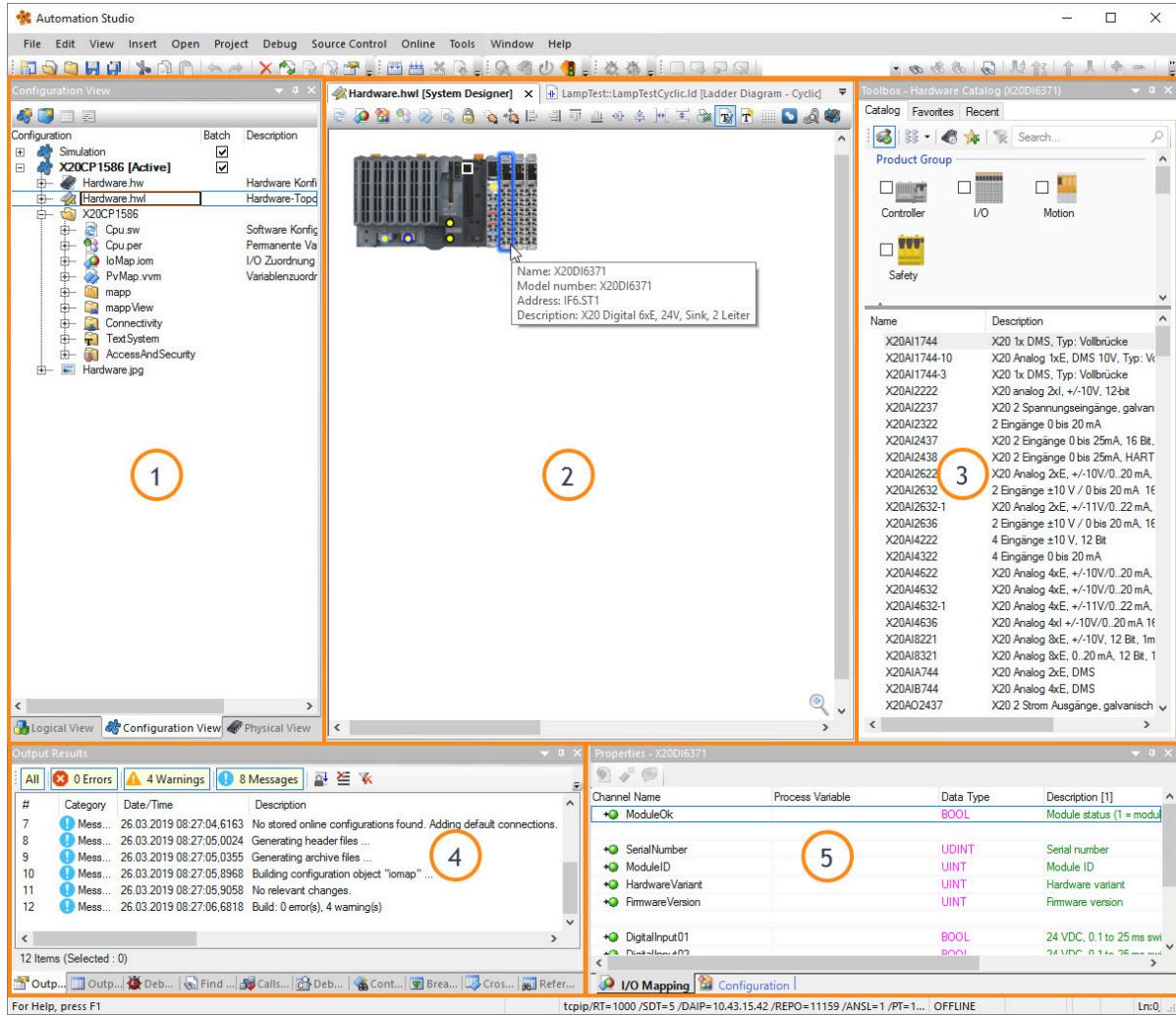


Figure 12: The Automation Studio workspace

1) Project Explorer

This is where we can manage and edit the hardware and software objects that make up a project.

2) Section for open documents

Programs are edited here, for example.

3) Toolbox

Depending on what object you are currently working on, the Toolbox window allows you to select and add hardware modules, program functions or software objects.

4) Output window

Compiler warnings, for example, are displayed here.

5) Properties window

This window displays configuration options for whichever object or hardware module is currently selected. It can also be used to edit the properties of the selected object.



4.3.1 Repositioning the windows

When a project is opened in Automation Studio, the various section windows are all docked to the main program window. All of the section windows can be rearranged by clicking and dragging the title bar.

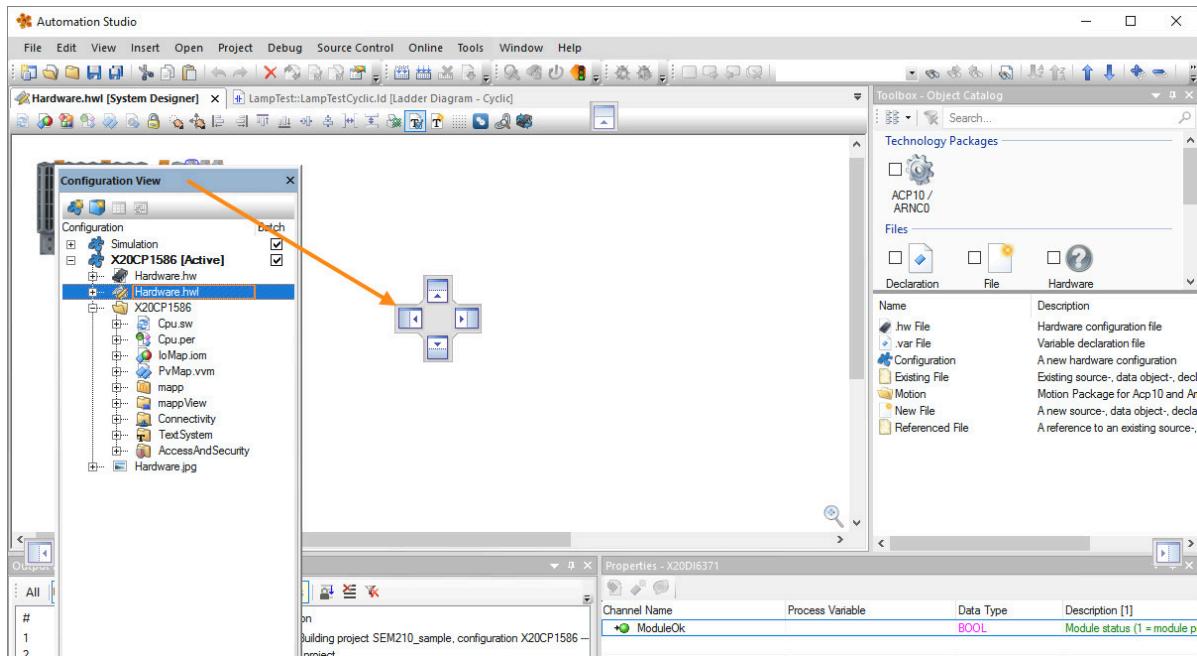
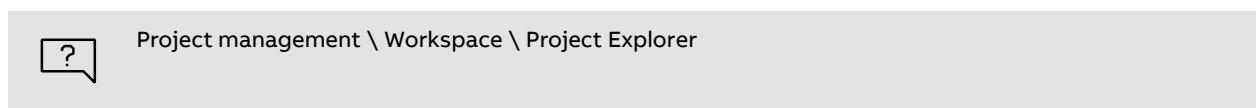


Figure 13: Docking and undocking windows

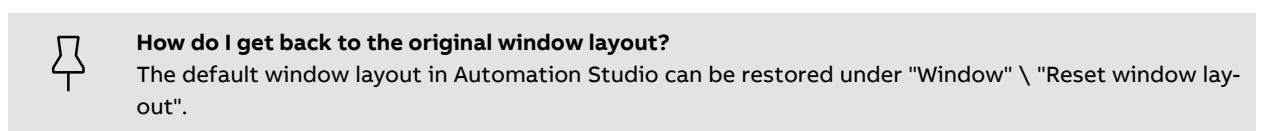


4.3.2 Hiding windows

To create more space on the screen, for example when working with visual programming editors, the Project Explorer and all other dockable windows can be hidden. The windows are hidden and shown by clicking on the pin icon in the title bar.



Figure 14: Click on the pin icon to dock or hide windows.



4.3.3 Workbooks

The Workbook mode presents a clear display of open windows and a convenient way to switch between them. Windows can be overlapping or arranged above or next to one another.



Figure 15: Workbooks in Automation Studio

If several editors are open at the same time, each one is displayed in a separate workbook. For an overview of all open workbooks, click on the drop-down symbol on the right side of the title bar.

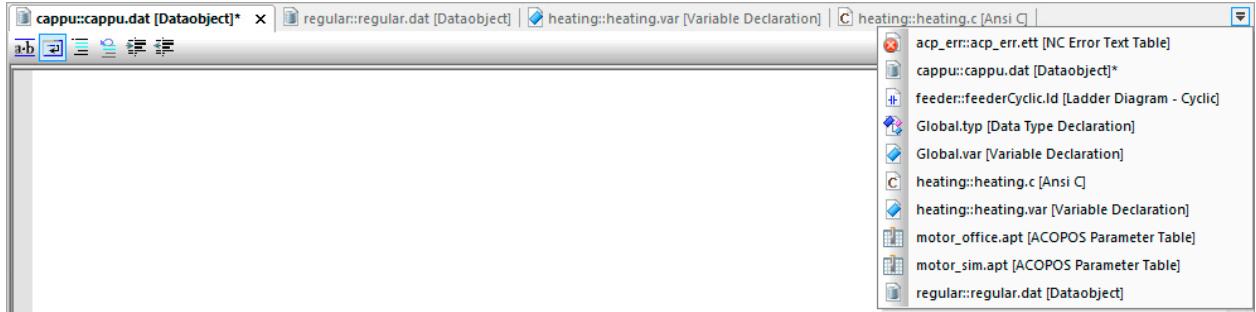


Figure 16: Overview of open workbooks

Project management \ Workspace

- Workbook mode
- Workbook mode \ Workbook configuration

Exercise: Work with Automation Studio

The aim of this task is to introduce participants to the Automation Studio workspace.

- 1) Identify individual work areas.
- 2) Open context-sensitive Automation Help for the individual work areas by pressing the <**F1 key**>.
- 3) Rearrange, show and hide windows.
- 4) Restore original window layout.

4.3.4 Menus and toolbox

The main menu provides access to all of the functions in Automation Studio.

Depending on the active editor, individual menu options are shown, hidden, enabled or disabled. In this way, only the functions available for the current context can be selected.

Toolbox - Catalog

The Toolbox provides access to program and configuration elements, programming symbols or hardware modules depending on the editor that is selected.

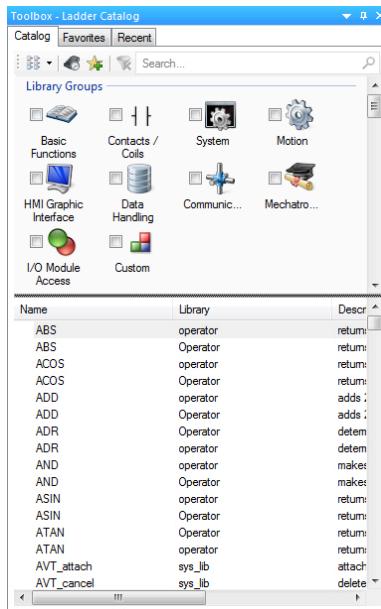


Figure 17: Toolbox - Ladder Diagram:
Programming functions, commands, functions
and function blocks

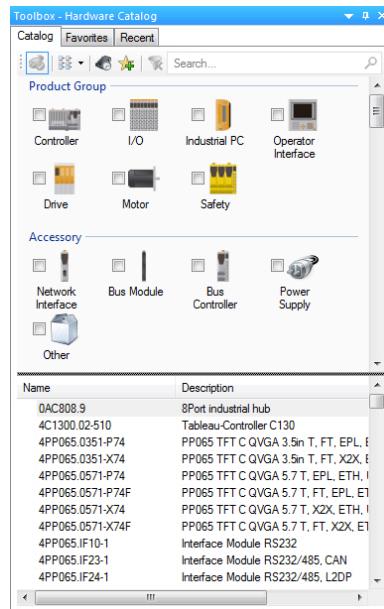


Figure 18: Toolbox - Hardware Catalog: Hardware
modules, infrastructure components

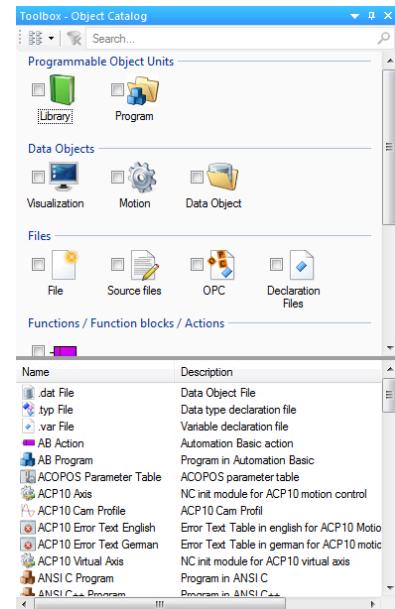
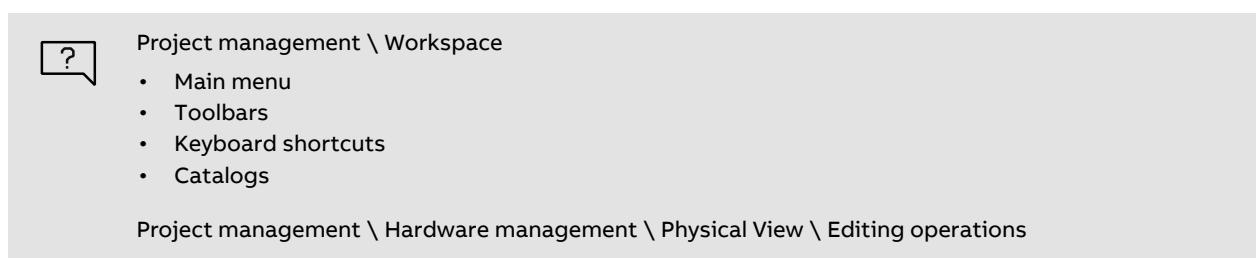


Figure 19: Toolbox - Object Catalog: Programs
and configuration files



4.3.5 The convenience of SmartEdit

The SmartEdit feature combines a range of intelligent functions that provide input support with Automation Studio editors.

Autocomplete

Keyboard shortcut **<CTRL> + <SPACE>** automatically complete partially entered terms. Characters already entered serve as a filter.

The following elements are supported:

- Variable names, structure elements, constants and enumerators
- Function names and function blocks

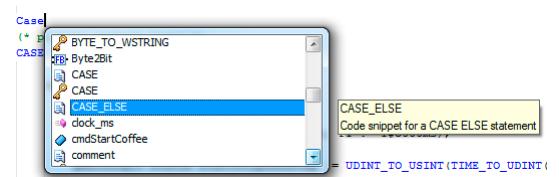


Figure 20: SmartEdit - Code completion

Code snippets

Keyboard shortcut **<CTRL> + <q>, <k>** can be used to add code snippets. Code snippets are ready-made bits of source code that can be managed by the user in the code snippet manager.

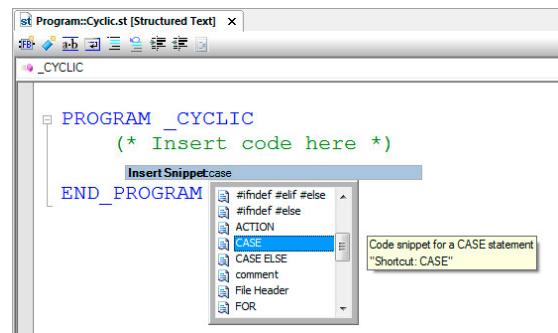


Figure 21: Adding a code snippet

Automatic declaration

Automatic declaration of new variables can be helpful depending on preference. In SmartEdit settings, the editors can be adjusted in various user-specific ways.

Open the configuration dialog box by selecting "Extras" \ "Options" from the main menu. Activate the setting for automatically declaring variables in tab "SmartEdit".

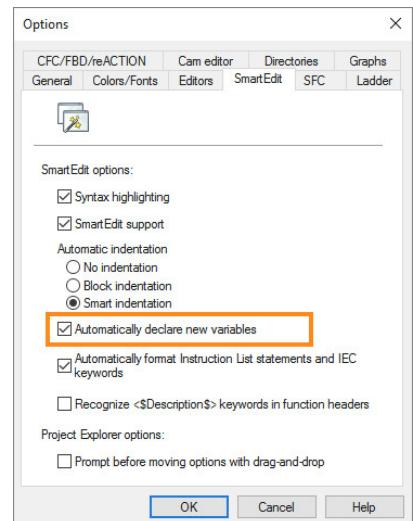


Figure 22: Setting for automatic declaration of new variables

Additional editor functions

The editors in Automation Studio offer additional functions that can help improve your overview of the program code.

- Tooltips
- Syntax coloring
- Coloring for modified lines of code
- Collapse or expand code segments
- Display corresponding parentheses pairs
- Automatic indenting
- Opening variable declarations and function implementations directly from the program code

Function	Keyboard shortcut
Complete a code snippet	<TAB>
Auto-complete a variable or function name	<CTRL> + <SPACE>
Jump to a variable declaration	<CTRL> + <d>
Jump to the declaration of a variable's data type	<CTRL> + <t>
Comments a line or selection	<CTRL> + <k>

Table 1: Useful SmartEdit keyboard shortcuts



Programming \ Editors

- General operation \ SmartEdit
- General operation \ SmartEdit \ Code snippets
- General operation \ Dialog boxes for input support \ Automatic declaration of variables
- Text editors
- Table editors - General

Project management \ Workspace \ Keyboard shortcuts

5 Software, hardware and configurations

The Project Explorer is a central element of the Automation Studio interface. The Project Explorer contains the Logical View for organizing software, the Physical View for organizing hardware and the Configuration View for managing configurations of multiple machine variants in a single project.

5.1 Software management in the Logical View

POUs (program organization units) are arranged in the **Logical View** in a tree structure.

Each of these units is organized into packages, which are comparable to directories. A package might include all of the software elements needed for a functional unit as well as accompanying documentation.

In this view, there is no direct relationship between the software and the actual hardware being used. It only serves to organize and manage the different POUs.

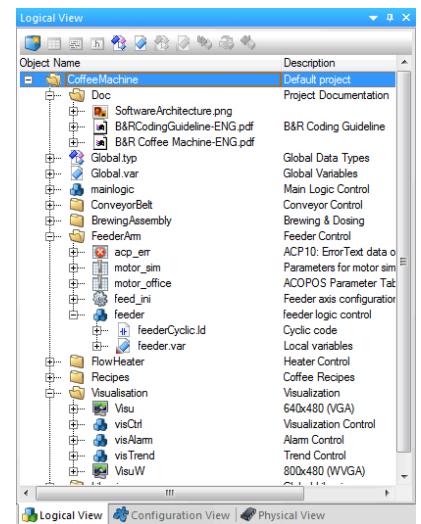
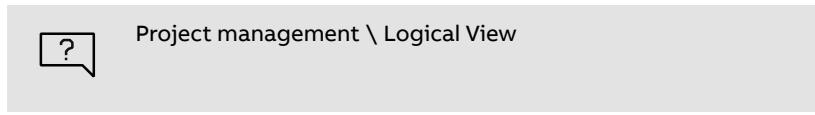


Figure 23: Logical View

5.2 Hardware organization - Physical View and System Designer

The hardware required for the machine can be managed either in a hierarchical view or in a graphical view.

Hardware management features in Automation Studio are used to perform the following tasks:

- Adding and configuring hardware modules
- Mapping variables to I/O data points
- Configuring fieldbus modules and interfaces

Physical view

The Physical View is a hierarchical topology overview of the configured hardware.

When creating a project or a new system configuration, a CPU is selected. The required hardware modules are then added into the topology from the Toolbox.

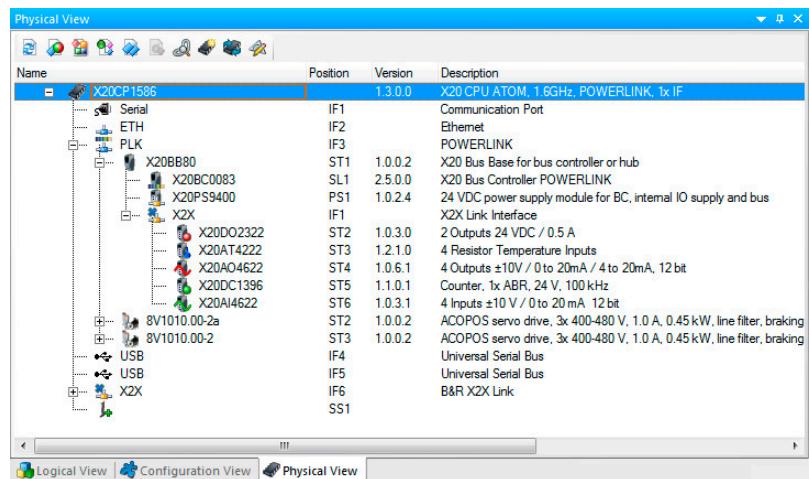


Figure 24: Physical View in Automation Studio

The configuration of individual hardware components and interfaces is opened in Physical View via the shortcut menu. This allows you to make module-specific settings, network configurations and configuration settings for system behavior.

System Designer

System Designer provides a visual representation of the Physical View. It allows control components to be arranged just as they would be in the actual machine. Hardware modules can be added both in System Designer and in the Physical View, see [6.2 "Adding I/O modules from the Hardware Catalog" on page 26](#). The two views are synchronized with each other.

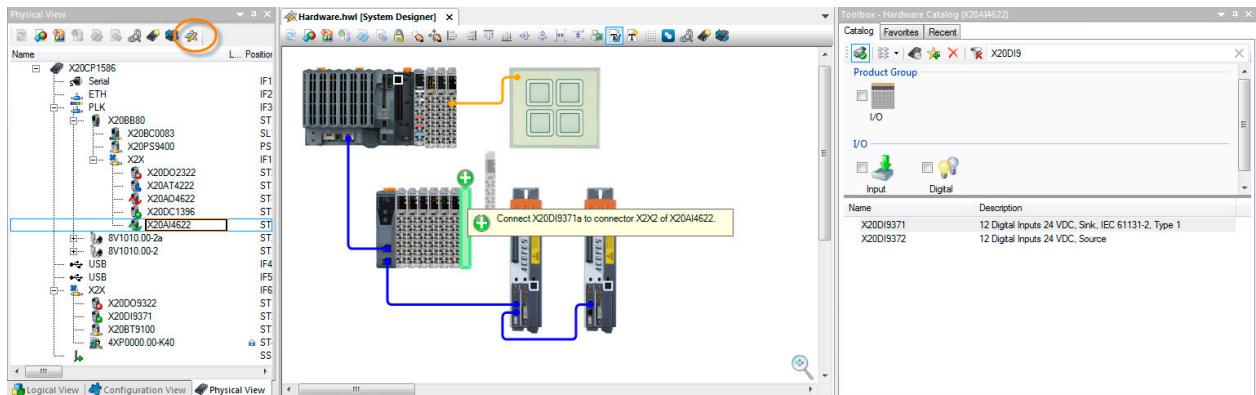


Figure 25: Opening System Designer via the toolbar of the Physical View and adding hardware modules from the Toolbox.



How can System Designer content be arranged clearly?

The System Designer editor allows objects to be laid out automatically. The ability to add text boxes makes it possible to group hardware components and assign them to a control cabinet, for example.



Project management \ Hardware management

- Physical view
- System Designer
 - Editing operations \ Text boxes
 - View settings \ Automatic layout

5.3 Organizing configurations in the Configuration View

All the different variants of a given machine are managed in the **Configuration View**. The configurations typically differ in terms of software scope and the exact hardware used.

You can add a new configuration using the toolbox.

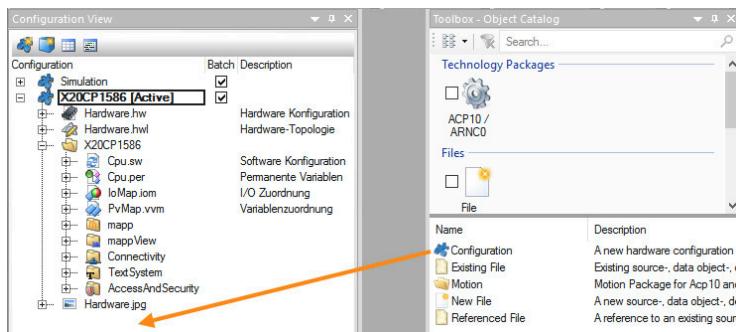
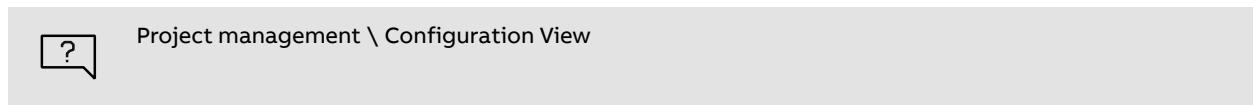


Figure 26: Configuration View with active configuration [Active]; adding a new configuration via drag-and-drop.

When you double-click on a configuration to activate it, the corresponding hardware assigned is displayed in the Physical View as well as in System Designer. Only one configuration can be active **[Active]** at a time.

The following configuration elements are managed in the Configuration View:

- Software configuration and I/O mapping
- Configuration of user role system, certificates, text system and OPC UA server.
- Configuration of mapp Technology components
- Configuration of motion control



5.4 Assigning programs - Software configuration

The software elements to be transferred to the target system for the active configuration are assigned in the software configuration.

There are several different ways to assign software to the software configuration:

- [5.4.1 "Automatic assignment when creating a program" on page 21](#)
- [5.4.2 "Adding existing programs manually" on page 22](#)

To open the software configuration in the Physical View, double-click on the controller or select "Software" from the controller's shortcut menu.

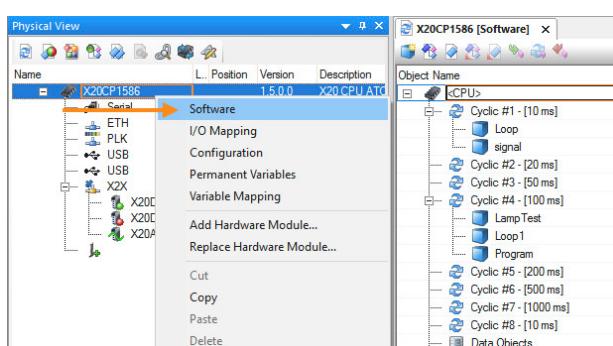


Figure 27: Opening the software configuration from the controller's shortcut menu.

Alternatively, file "CPU.sw" in the Configuration View can be used to open the software configuration.

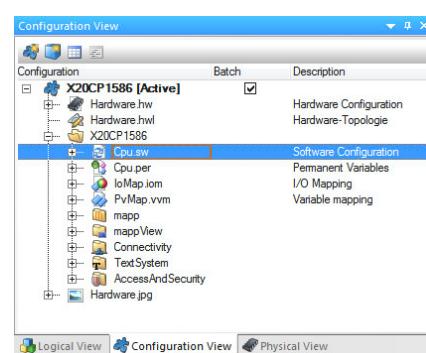


Figure 28: Opening the software configuration by selecting "CPU.sw" in the Configuration View.



Project management \ Logical View
Programming \ Editors \ Configuration editors \ Software configuration

5.4.1 Automatic assignment when creating a program

If a program is added to the Logical View via the toolbox, then it is automatically included in the software configuration for the active configuration.

Task class #4 is used as the default task class. The default task class is changed in the settings of the active configuration.

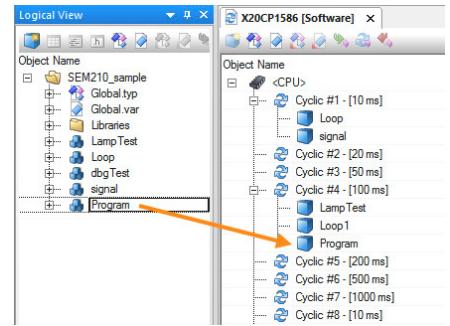


Figure 29: When added, the software object is automatically assigned to the software configuration of the active configuration.



How is the execution order of the software defined?

The execution order and priority of programs can be changed by moving the corresponding objects as necessary directly in the software configuration.



Real-time operating system \ Method of operation \ Runtime performance \ Task classes
Project management \ Configuration View \ Properties of the objects in the Configuration View

5.4.2 Adding existing programs manually

If a new hardware configuration is added to the Configuration View, the software elements must be assigned manually to the software configuration.

Open the software configuration, then select the Logical View in the Project Explorer. An object can then be assigned by moving it from the Logical View to the desired position in the software configuration.

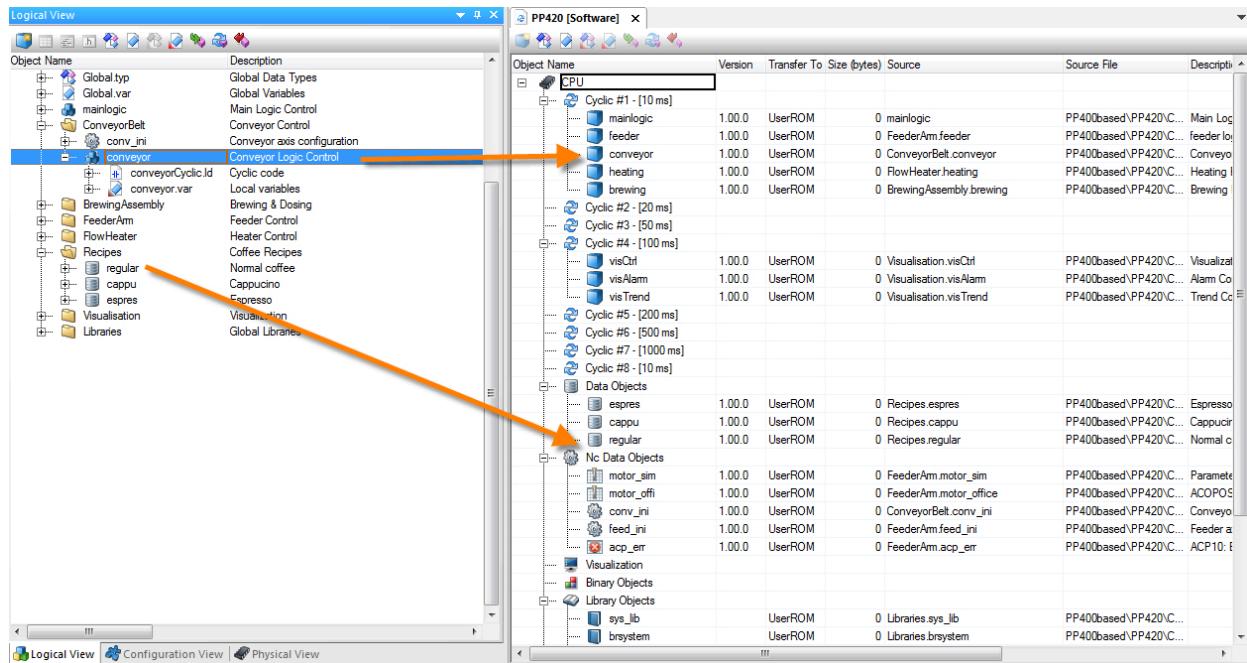


Figure 30: Assigning software elements to the software configuration

By double-clicking on an entry in the software configuration, the Logical View with the corresponding entry is selected.



Can more than one software of a package be assigned to the software configuration?

Entire packages from the Logical View can be added to the software configuration. To do this, drag the selected package from the Logical View to the highest position in the software configuration.

5.4.3 Creating variants by assigning software packages

The ability to manage multiple configurations in one project allows you to work with the different variants of a given machine type all in the same project. These configurations can vary with regard to the extent of software being used or in their hardware design.

The Logical View is shown in the image on the left. This view is used to manage libraries and programs. The image on the right shows a schematic representation of the different variants of a machine. In Automation Studio, each variant

is represented by a corresponding configuration. The configurations differ from each other in terms of the hardware used and the software packages that are assigned to them.

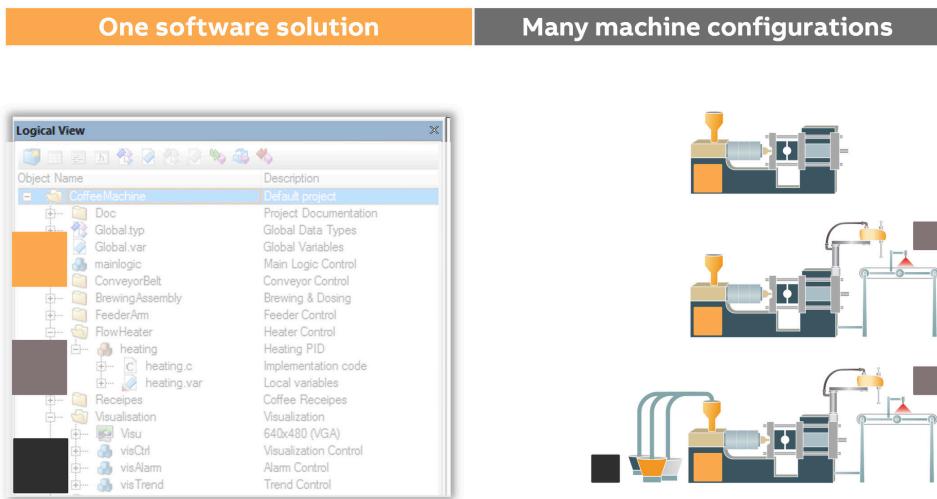
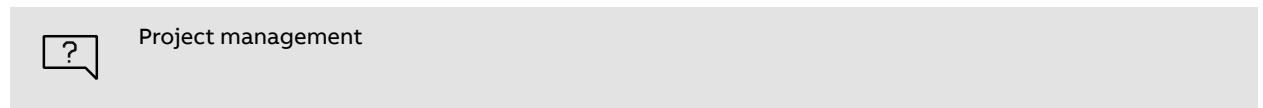


Figure 31: Different machine variants can be created by assigning software packages to them



6 Configure the hardware

This section is based on the previously created project, see [3 "My first project" on page 9](#).

This project already contains a configuration based on the "Automation Runtime Simulation" and a Ladder Diagram program with two variables.

Exercise: Configure the hardware and commission the system

Assign program "LampTest" to task class "Cyclic#1".

- 1) Create a new configuration.
- 2) Assign program "LampTest" to the software configuration.

[5.4.2 "Adding existing programs manually" on page 22](#)

- 3) [6.1 "Testing in simulation mode" on page 25](#)
- 4) [6.2 "Adding I/O modules from the Hardware Catalog" on page 26](#)
- 5) [6.3 "Mapping process variables to I/O channels" on page 27](#)
- 6) [6.5 "Configure the network interface of the controller" on page 29](#)
- 7) [6.6 "Compiling the project" on page 30](#)
- 8) [7.1.1 "Connection via target system search" on page 32](#)
- 9) Optional: [11.1 "Transferring Automation Runtime" on page 51](#)³
- 10) [7.2.1 "Online installation" on page 34](#)

Add a new configuration using the toolbox. To do this, open the Configuration View and add a new configuration via drag-and-drop or double-click.

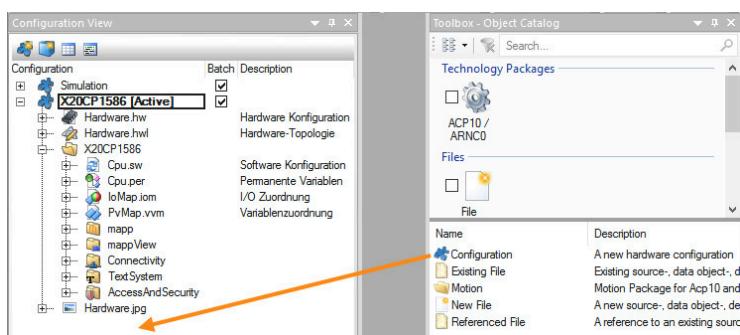
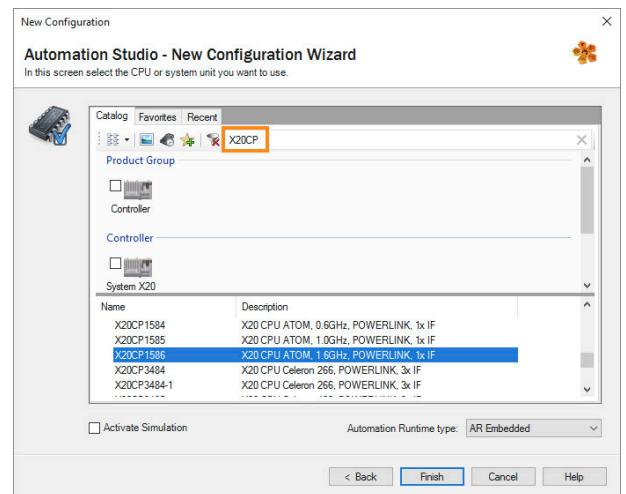


Figure 32: Adding a new configuration in the Configuration View using the toolbox

³ If Automation Runtime version C4.25 or later is already running on the target system, this step is not necessary. All the necessary processes are completed during online installation.

Then, select the desired controller in the wizard.



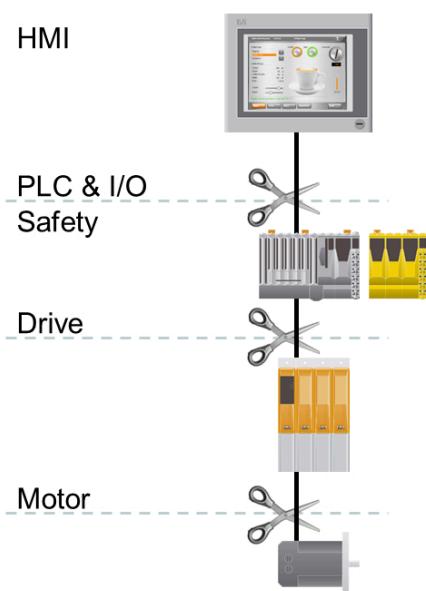
Exercise: Create a new configuration and assign programs

In this task, a new configuration with an X20 controller (e.g. X20CP1586) is added to the project.

- 1) Add a new configuration.
- 2) Select the desired control in the wizard.
- 3) Rename the configuration.
- 4) Open a software configuration.
- 5) Assign program "LampTest".

Program "LampTest" was already created using the "Getting Started" section.

6.1 Testing in simulation mode



Automation Studio provides extensive simulation options for the controller, HMI application, drive controller and motors. In essence, all components of an integrated automation solution from B&R can be simulated. If it is not possible or desirable to operate the actual motor on the machine, it can be simulated instead. Movement profiles can be carried out on the controller or PC, even if the entire drive system is not available.

The platform-independent Automation Runtime system allows control programs to be created and tested directly on the PC. This function is also available for the safety application. Control applications can be executed in slow motion or time lapse in order to hone in on different phases of the machine's lifecycle.

Integrated VNC and web server functionality makes it possible to operate HMI applications not just remotely, but also directly on the PC.

The integrated WinIO interface makes it possible to fully simulate I/O points.

Figure 33: Complete simulation at every level

Simulation of a controller can be started by selecting the simulation icon in Automation Studio. All control programs run directly on the PC. This means that all of the software functions in the control application can be configured and tested independently of the hardware.

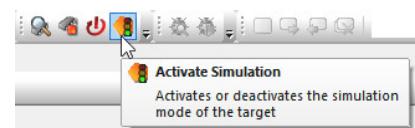


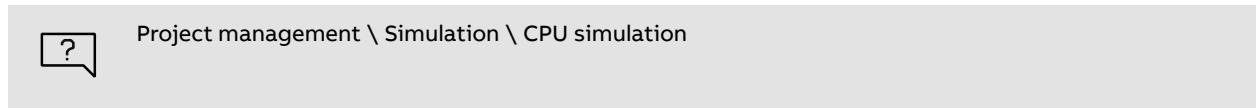
Figure 34: Activating CPU simulation via the Automation Studio toolbar

When you switch to simulation mode, the project is rebuilt, the simulation environment is automatically started and an online connection to Automation Runtime Simulation is established.

The Automation Studio status bar indicates when a CPU simulation is running.



Figure 35: Automation Studio status bar - Simulation running



Exercise: Activate a simulation of the control system

Automation Studio offers comprehensive simulation functions for hardware and software. The goal of this task is to put the active configuration into simulation mode and test it.

- 1) Activate the simulation mode via the toolbar.
- 2) Transfer the configuration.

Further information:

- [7.2.1 "Online installation" on page 34](#)
- [7.2.2 "Offline installation" on page 37](#)

- 3) Test program "LampTest".



After the configuration has been transferred, all the diagnostics tools⁴ become available. Program sequences can be tested and further developed without having to connect to the machine. To transfer a project to the real controller, simulation mode is ended via the menu. It is possible to check whether the configuration is running in simulation mode using the traffic light icon in the status bar.

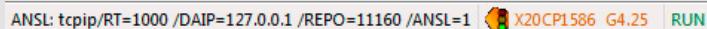


Figure 36: Automation Studio status bar - Simulation mode active

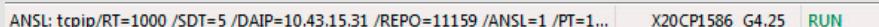


Figure 37: Automation Studio status bar - Connection to the real hardware

6.2 Adding I/O modules from the Hardware Catalog

When using an X20 system, I/O modules can be added directly to the X2X Link interface.

I/O modules can be added either in the Physical View or in System Designer. I/O modules can be dragged and dropped from the Hardware Catalog to the desired position.

⁴ Further information about the topic of diagnostics can be found in training module "TM223 - Automation Studio Diagnostics" and in Automation Help.

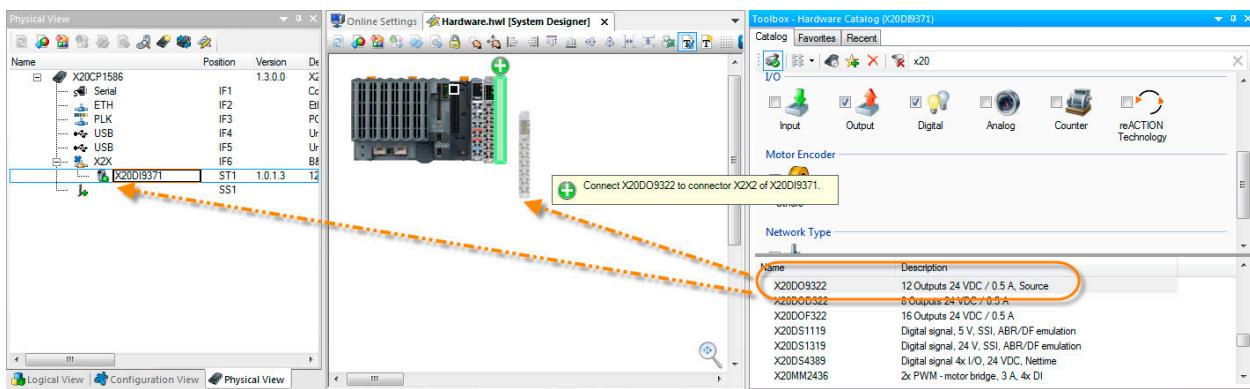


Figure 38: Assigning an I/O module via drag-and-drop



How are modules suggested for selection in System Designer?

Selecting an interface (e.g. X2X, POWERLINK) in the control system filters the Hardware Catalog to show only the modules that match this interface. The results list can be filtered by setting further filter categories.

It is also possible to filter the results by entering parts of the model ID in the search field.

Exercise: Add a digital input and output module

In this task, two X20 modules will be added in the Physical View using the "Getting started" section of Automation Help as a reference. A digital input module and a digital output module (corresponding to the modules inserted in the target system) should be added in each case.

Example for ETAL210: X20DI6371 and X20DO6322

- 1) Open Automation Help:



Getting started \ Creating programs in Automation Studio \ Mapping variables to I/Os

- 2) Select the X2X Link interface in the Physical View.
- 3) Drag and drop the inserted modules to the X2X Link interface.



Communication \ X2X Link
Communication \ POWERLINK

6.3 Mapping process variables to I/O channels

I/O mapping is another way of referring to the assignment of variables being used in the control program to a hardware module's I/O channels.

Variables are allocated to an I/O channel by selecting "Open" / "I/O Mapping" in the I/O mapping editor that is opened using the shortcut menu in the relevant module, or by double-clicking on the relevant I/O module.

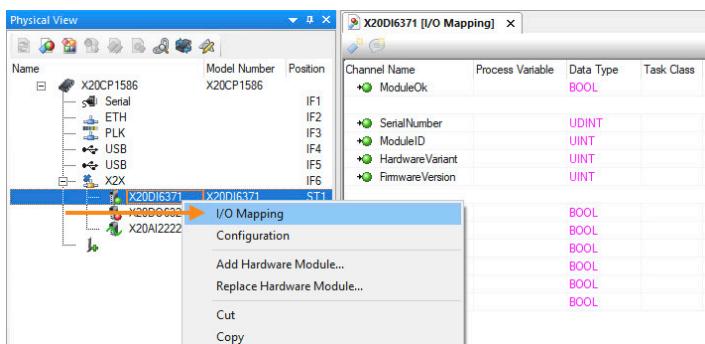


Figure 39: Open the I/O mapping for a module

Exercise: Assign process variables to I/O channels

In this task, two variables will be mapped (one to a digital input channel and one to a digital output channel) using the "Getting started" section in Automation Help.

- 1) Open Automation Help:



Getting started \ Creating programs in Automation Studio \ Mapping variables to I/Os

- 2) Opening the I/O mapping
- 3) Assign variable "Switch" to a digital input channel.
- 4) Assign variable "Lamp" to a digital output channel.



Programming \ I/O handling \ I/O mapping

6.4 Editing an I/O configuration

All B&R I/O modules have configuration options. The I/O configuration can be used to configure I/O modules without having to do any programming.

Selecting one or more I/O modules or interfaces in the Physical View or in System Designer updates the Properties window located at the bottom right of the Automation Studio window. The Properties window shows all of the configuration options that can be applied to the selected components. Individual property categories can be opened directly from workbooks.

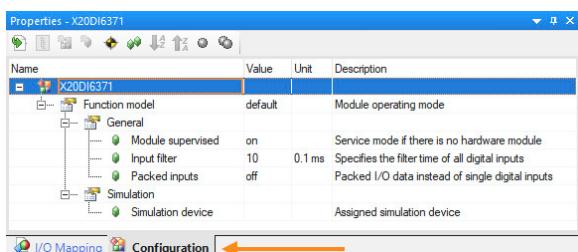


Figure 40: The Properties window is updated immediately when you select one or more modules.

The I/O configuration can only be opened by selecting "Configuration" in the respective I/O module's shortcut menu or via "Open" \ "Configuration" in the main menu.

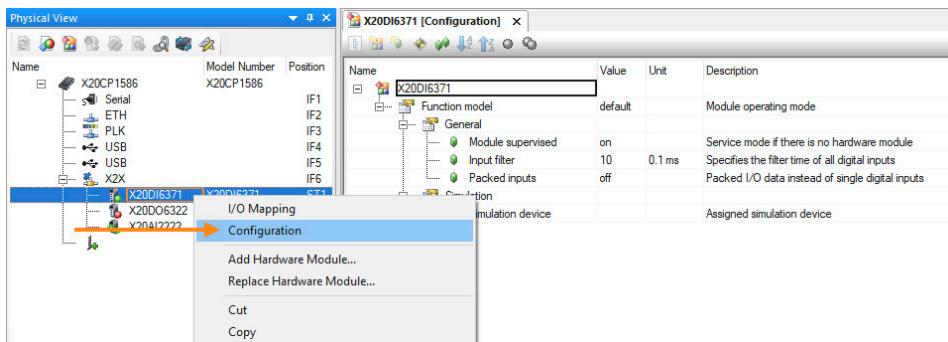


Figure 41: Opening a module's I/O configuration

**How can the technical data of an I/O module be found quickly?**

The data sheet for the selected I/O module can be accessed directly from the Physical View. To do this, select the I/O module in the Physical View. Press the **<F1 key>** to open Automation Help. The data sheet for the selected module appears. The data sheet contains technical information, configuration options, connection examples and details of the LED status indicators.



Programming \ I/O handling
Hardware \ X20 system \ X20 modules

6.5 Configure the network interface of the controller

Automation Studio requires a network connection in order to communicate with the controller. PC and controller must therefore be on the same subnet.

The network properties can be opened using the shortcut menu for the desired Ethernet interface of the controller. It is then possible to configure the device parameters for the network interface.

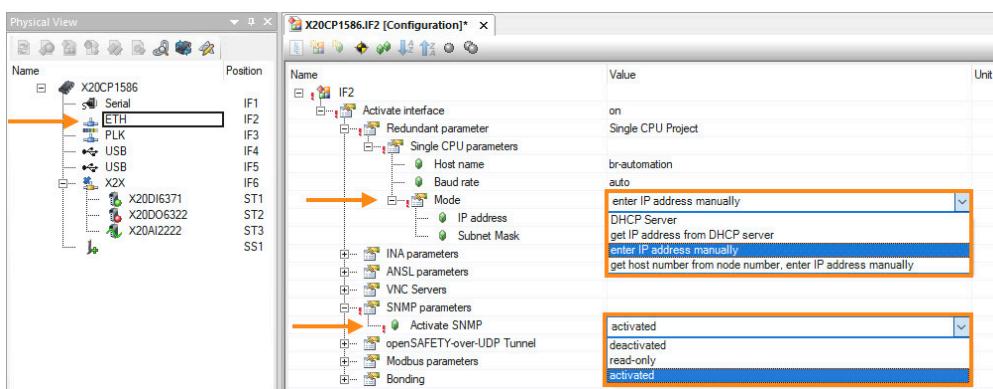


Figure 42: Opening and editing a controller's network settings

The network protocol **SNMP** (Simple Network Management Protocol) is enabled in order to find the controller using the "Search for target systems" dialog box even if the INA configuration is invalid. If this protocol is enabled, Ethernet parameters can also be changed temporarily.

**How are devices integrated into an existing network?**

Please contact your network administrator for information about the integration of devices into an existing network.

Exercise: Configure the network interface for the controller and PC

Configure the network interfaces on the PC and controller using Automation Help as a guide.

Getting started \ Creating programs in Automation Studio \ Example project for a target system with integrated flash memory

- Ethernet settings on the target system
- Ethernet settings on the workstation

Communication \ Ethernet \ AR configuration \ Ethernet interface configuration

6.6 Compiling the project

Once a program has been completed, it must first be compiled before it can be transferred to the target system.

Compiling the configuration

When compiling the project, all of the changes made since the last build are added.

This process is carried out using the toolbar or by pressing the **<F7 key>**.

A successful build is indicated in the output window.

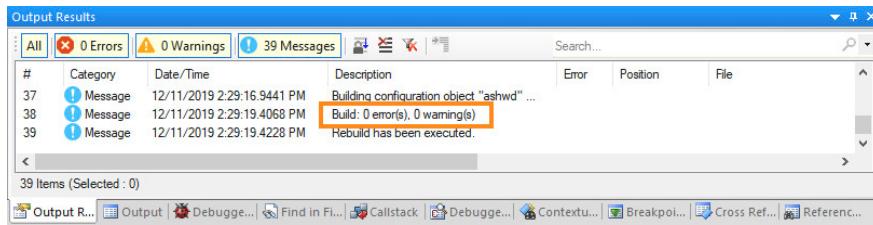


Figure 43: Output window: 0 errors, 0 warnings

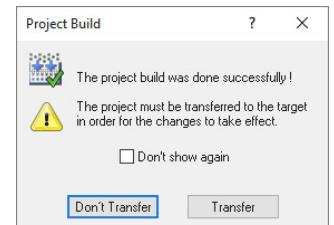


Figure 44: Dialog box indicating a successfully compiled configuration

Rebuilding the configuration

When you rebuild a configuration by pressing **<CTRL> + <F7>**, all the software objects in the active configuration are created again, even if their source files have not changed since the last time they were built.

Programming \ Build & Transfer \ Creating a project

7 Initial installation of the controller

To commission the controller, it is necessary to transfer Automation Runtime (operating system), the system components and the application project. Depending on the target system, an **online installation**, **offline installation** or a **USB installation** is performed.

Systems with integrated flash memory are delivered with preinstalled default Automation Runtime. This guarantees that a connection with Automation Studio is established and an online installation can be performed.

Offline installation is available for systems with CompactFlash and CFast cards.

Alternatively, USB installation is possible for any system.

Online installation

After a connection has been established, the Automation Runtime version configured in the project is installed in operating mode "BOOT". Subsequently, the Automation Studio project will be completely transferred.



The following steps are necessary:

- [7.1.1 "Connection via target system search" on page 32](#)
- [7.2.1 "Online installation" on page 34](#)



Online initial installation prior to Automation Runtime C4.25

If the default Automation Runtime version pre-installed on the target system is lower than C4.25 and the initial installation is to be carried out via an online connection, Automation Runtime must be transferred to the target system as follows, see [11.1 "Transferring Automation Runtime" on page 51](#).

Installation via data storage medium

For offline installation or to create a project installation package for USB installation, Automation Runtime, the system components and the application project are copied to the CompactFlash/CFast card or a transfer module is copied to a USB flash drive.



The following steps are necessary:

- [7.2.2 "Offline installation" on page 37](#) or
- [7.2.3 "Project installation package USB" on page 37](#)



Programming \ Build & Transfer \ Establishing a connection to the target system \ Ethernet connection
Project management \ Project installation

7.1 Establishing a connection to the target system

How to configure the network interface settings for the network controller has already been explained. These settings only have to be configured once before a connection can be made.

There are 2 ways to establish a connection:

- [7.1.1 "Connection via target system search" on page 32](#)
- [7.1.2 "Establishing a connection via manual configuration" on page 33](#)

The configuration dialog box for online connection is opened by selecting "Online" / "Settings" from the main menu.

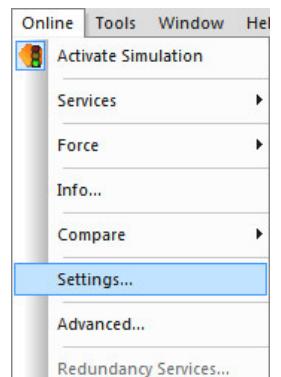
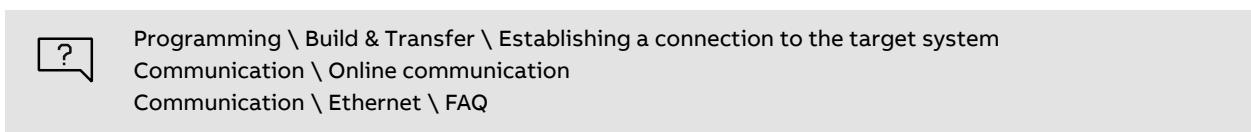


Figure 45: Menu option "Online"



7.1.1 Connection via target system search

Clicking on icon "Browse" activates the search function for the network. This will open up a second pane within the main window. The results of the network search will be displayed a few seconds later. If the CPU could be identified on the network, it will be shown in result list. The connection is then established by right-clicking on the CPU and selecting "Connect" from its shortcut menu.

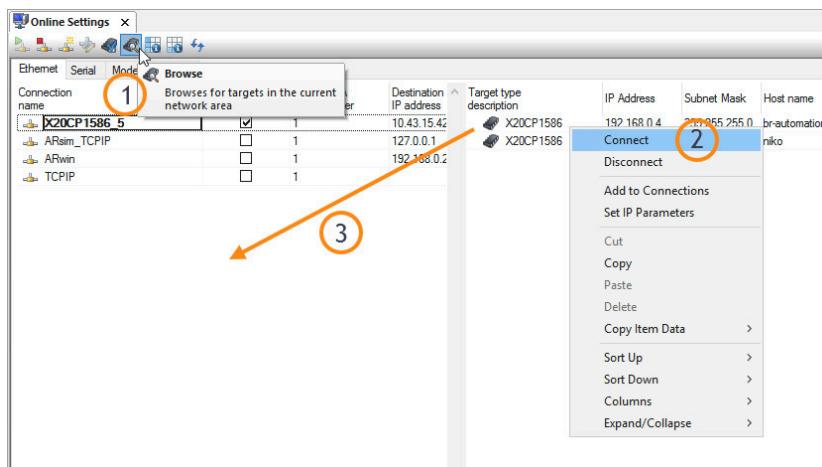


Figure 46: Browsing the network and connecting to the controller

- 1) Browse the network via toolbar "Browse" in the toolbar. Results will appear in the right pane.
- 2) Select "Connect" from the shortcut menu of the connection.
- 3) The connection can be dragged from the result list to the left pane.

Temporarily change IP parameters

If the network settings of the controller and PC don't match, the entry is highlighted in red in the search results. IP parameters can be changed temporarily from an entry's shortcut menu. The temporarily changed settings can be added directly to the project configuration. If the changes are not transferred, the original settings will be used again after the controller is restarted.

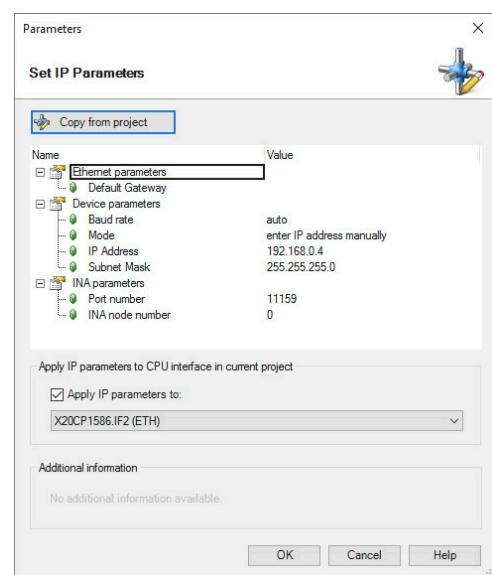
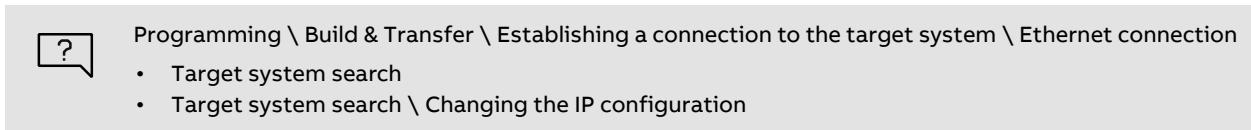


Figure 47: Temporary IP configuration



Exercise: Connect to the controller

In this task, the participants will establish a connection to the controller. The participants will identify the controller on the network by browsing for target systems and then establish the online connection.

- 1) Open the online settings.
- 2) Enable function "Browse for target systems".
- 3) Identify the target system in the result list.
Target systems can be distinguished by the MAC address, node numbers, hostnames and serial numbers.
- 4) Establish the connection.

7.1.2 Establishing a connection via manual configuration

Manual configuration

If it is not possible to browse the network, for example if SNMP broadcasts are blocked, it is possible to set up an online connection manually.

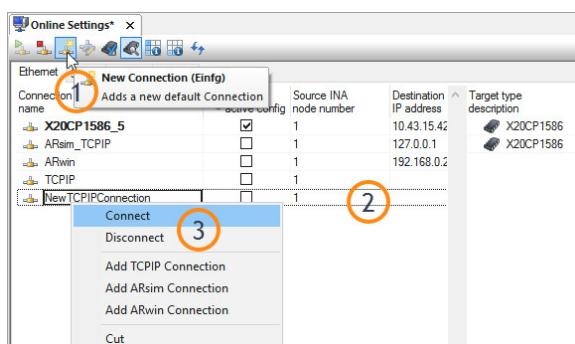
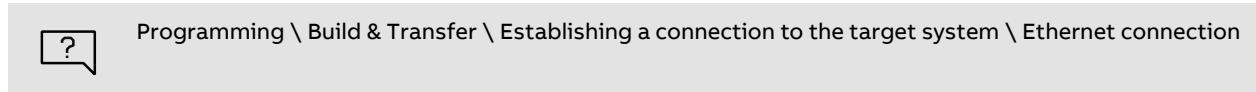


Figure 48: Adding and configuring a connection manually.

- 1) Add a new connection configuration using via the toolbar.
- 2) Specify the connection parameters (IP address, node number).
- 3) Enable the online connection from the shortcut menu of the new connection configuration.



As soon as a connection is established between the PC and the controller, its status will be shown in the Automation Studio status bar.

- In operating mode BOOT, Automation Runtime can then be transferred to the controller.

ANSI: tcpip/RT=1000 /SDT=5 /DAIP=10.43.15.34 /REPO=11159 /ANSL=1 /PT=1... 4PPC70.0573-20B Q4.08

BOOT

Figure 49: An online connection to the controller has been established. The controller is in BOOT mode.

- In operating mode RUN or SERVICE, the entire project can be transferred to the controller. Automation Studio diagnostics tools are available when there is an active online connection.

ANSI: tcpip/RT=1000 /SDT=5 /DAIP=10.43.15.34 /REPO=11159 /ANSL=1 /PT=1... 4PPC70.0573-20B 14.25

RUN

Figure 50: An online connection to the controller has been established. The controller is in RUN mode.

7.2 Project installation

When the project is compiled, a transfer module is created. This can then be transferred online, installed offline via a CompactFlash or CFast card or loaded onto the target system via a USB flash drive. Then, the transfer module is installed on the target system.

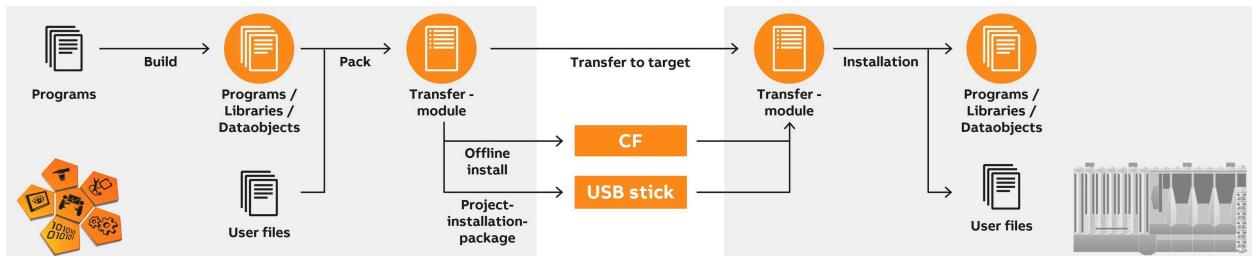


Figure 51: Project installation process

There are several ways to perform the project installation. The various transfer methods are found under "Project" / "Project installation".

- [7.2.1 "Online installation" on page 34](#)
- [7.2.2 "Offline installation" on page 37](#)
- [7.2.3 "Project installation package USB" on page 37](#)

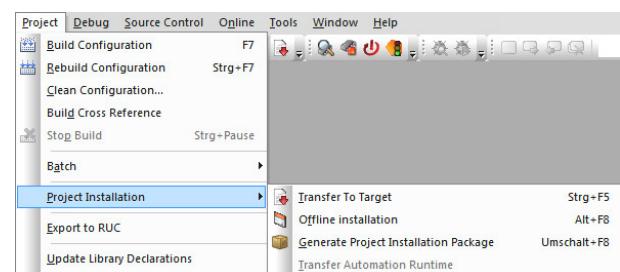


Figure 52: Opening the project installation



Can the toolbar be edited?

The entries in the Automation Studio menu can be added individually to the Automation Studio toolbar. The toolbar can be adjusted under "Toolbar options" \ "Add or remove button".



Project management \ Project installation

- Overview
- Scenarios
- Performing project installation

7.2.1 Online installation

If the project has been compiled and Automation Runtime installed on the target system⁵, then the next step is to transfer the project.

Clicking on "Transfer to target" in the project installation menu starts the process. If need be, the latest changes are compiled in the project.

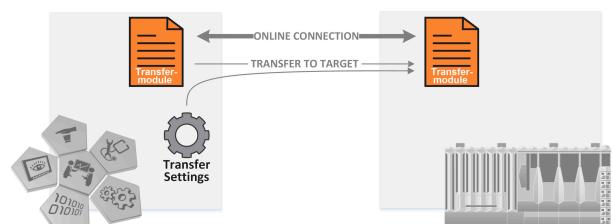


Figure 53: Online installation procedure

Initial transfer

An initial transfer is performed the first time a project is installed. During this, the target system is completely initialized. All data from any previous projects is removed. With an initial transfer, the entire project including Automation

⁵ If the default Automation Runtime version preinstalled on the target system is higher than C4.25, Automation Runtime is transferred and installed automatically. For installing older Automation Runtime versions, see [11.1 "Transferring Automation Runtime" on page 51](#).

Runtime is always transferred to the target system. The memory is partitioned, formatted and the target system is restarted. RETAIN and permanent variables are deleted during an initial transfer.

An initial transfer is performed under the following conditions:

- The configuration ID of the target system is different than the one defined in the project.
The configuration ID is established in the system configuration of the controller.
- The partitioning of the target system does not match the partitioning required for the project.
- Transfer to a data storage device, see [7.2.2 "Offline installation" on page 37](#).
- The user forces an initial transfer in the transfer settings.

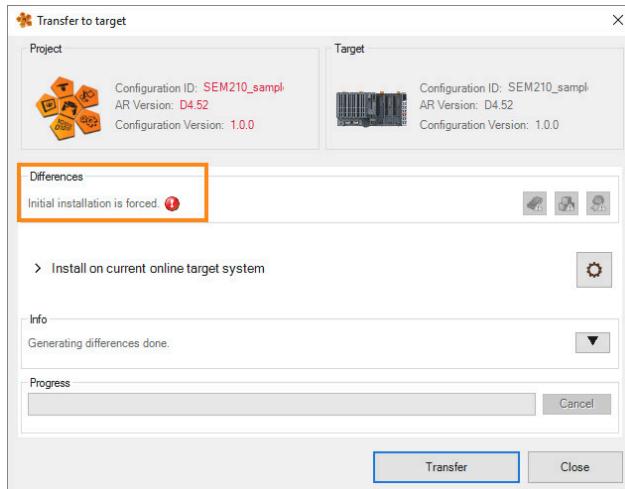


Figure 54: Transfer dialog box: Initial transfer forced

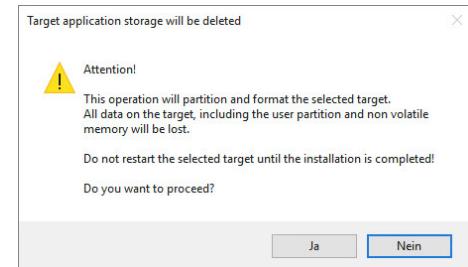


Figure 55: Note: The memory is formatted during an initial transfer

Update transfer

Automation Studio will generally first attempt an update transfer on the target system. If performing an update transfer is not possible (the configuration ID has changed, for example), then an initial transfer is performed instead. During an update transfer, only data that has been changed is transferred to the target system. Depending on the transfer settings, the Init and Exit programs are executed or values are received from process variables.

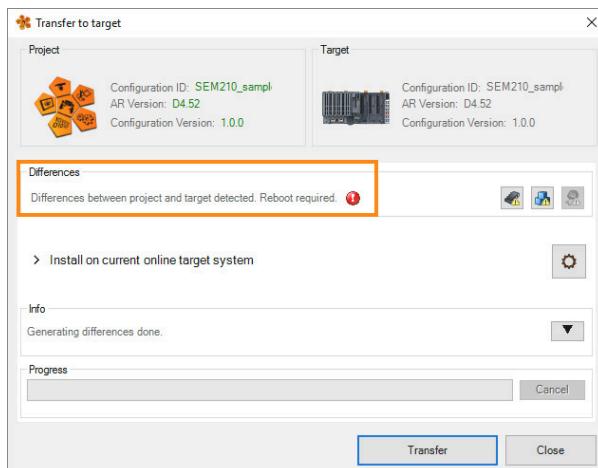


Figure 56: Transfer dialog box: Differences require a restart.

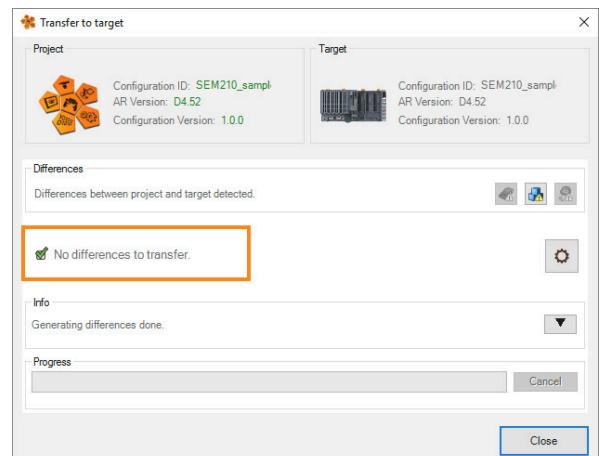


Figure 57: Transfer dialog box: No differences were identified between the project and the target system.



What do the icons in the transfer dialog box mean?

In addition to the textual notes, notification icons are shown in the transfer dialog box. These can be used to open tooltips with detailed information about the differences between the project and the target system configuration.



Figure 58: Additional information from notification icons in the transfer dialog box



Project management \ Project installation

- Perform project installation \ Transfer to target
- Scenarios \ Online commissioning
- Scenarios \ Online update
- Glossary

Exercise: Perform online project installation

After successful commissioning, the project must be installed on the target system. Any future changes to the project will be loaded to the target system via the online installation.

- 1) Compiling a project
- 2) Start the online installation.
- 3) Follow the instructions in the transfer dialog box.
- 4) Confirm the online installation.
- 5) Wait for transfer and optional restarts.



The target system is now up-to-date. The function of the program "LampTest" can now be tested directly on the target system.

Exercise: Test the program

Program "LampTest" can now be tested on the target system. Setting digital input "Switch" should set output "Lamp". Check the function in Automation Studio and also on the LED status indicators of the assigned I/O modules.

- 1) Enable the monitor mode.

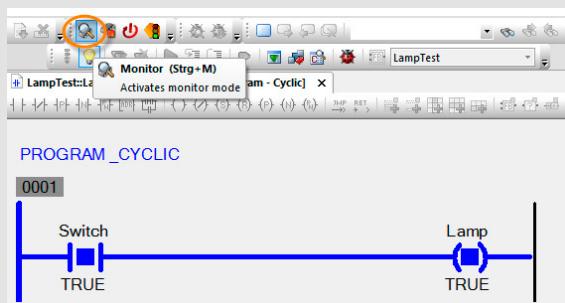


Figure 59: Ladder Diagram program "LampTest" in monitor mode with Powerflow

- 2) Set input "Switch" and observe output "Lamp".
- 3) Compare the status of the LED status indicators with that of the Automation Studio.

7.2.2 Offline installation

For offline installation, the project is installed on a data storage device. The transfer dialog box for doing this is slightly different from the one for online installation. In the transfer dialog box, a storage device is selected for the transfer.

The dialog box for offline installation is opened by selecting "Project" / "Project installation".

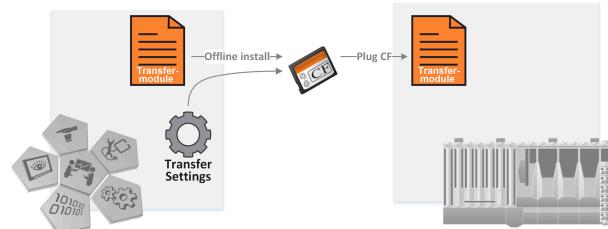


Figure 60: Offline installation procedure

Offline installation on CompactFlash or CFast card

An offline installation is performed on a CompactFlash or CFast card to commission the target system. This process carries out partitioning, transfers the operating system and the necessary system settings.

Once the CompactFlash or CFast card has been inserted into the target system and the supply voltage has been switched on, the controller starts the installed project.

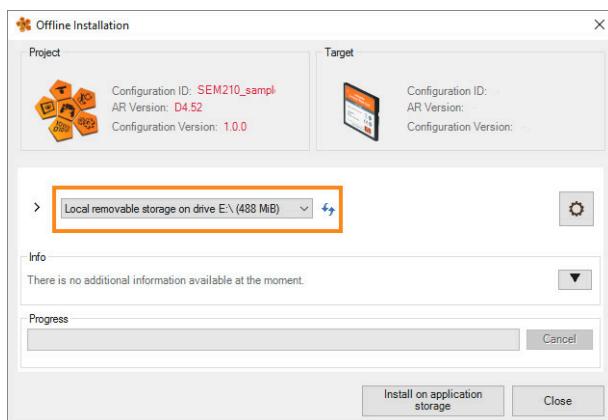
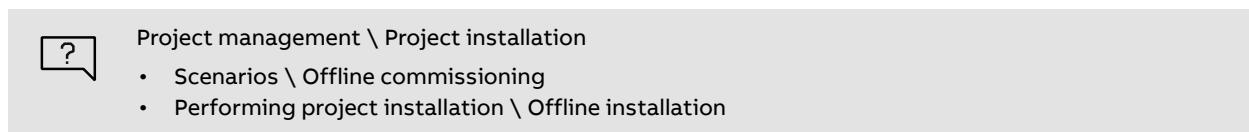


Figure 61: Dialog box for offline installation on a CompactFlash or CFast card

Automation Runtime Simulation

Offline installation can be used to generate an installation structure for Automation Runtime Simulation (ARsim). During this process, the Automation Runtime files, project configuration and programs are copied to a local folder. The Automation Runtime Simulation is then started automatically.



7.2.3 Project installation package USB

Automation Runtime and the application software can be included in an offline installation package and transferred to the target system on a USB flash drive, CompactFlash card or via a DHCP server.

The following section deals with project installation via a USB flash drive.

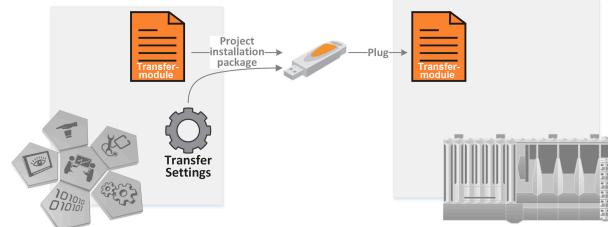
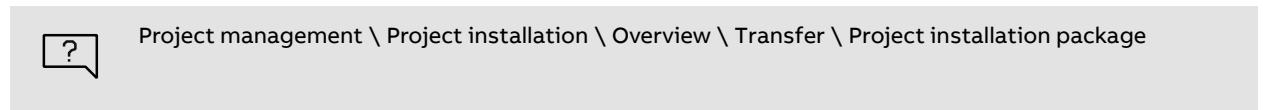


Figure 62: Procedure for generating project installation package

Description of steps:

- 1) Compile the Automation Studio project.
- 2) Generate the project installation package
- 3) Copy the project installation package to the USB flash drive.
- 4) Connect the USB flash drive to the target system.

During the next startup, the versions of Automation Runtime and the application software are checked and updated if necessary. Alternatively, the project installation package can be installed at runtime using library "ArProject".



Enable USB installation

In order for the control system⁶ to continue to support this function after the first update via USB installation, you must ensure that this function is enabled in the system configuration.

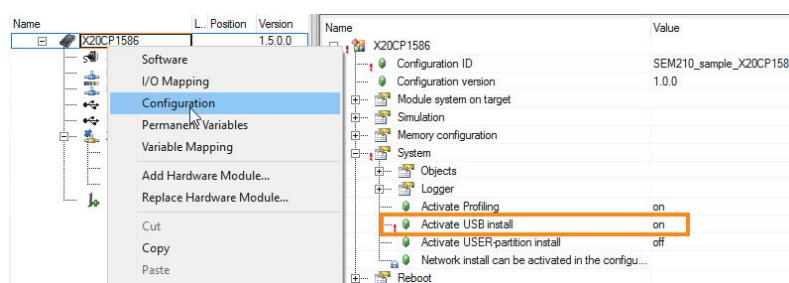


Figure 63: Enabling USB installation in system properties

The configuration is opened in Physical View via the controller's shortcut menu. The required configuration entry is stored under "System".

Generate the project installation package

The project installation package is generated via "Project" \ "Project installation" \ "Generate project installation package".

A USB flash drive is selected in the dialog box. Numerous installation settings make it possible to select exactly how to update the target system.

The system can now be updated using the configured USB flash drive.

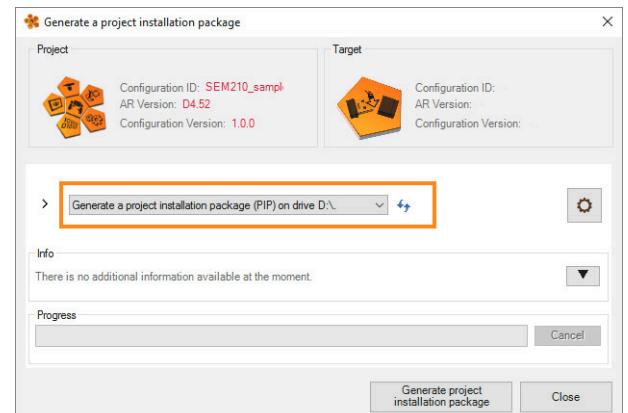
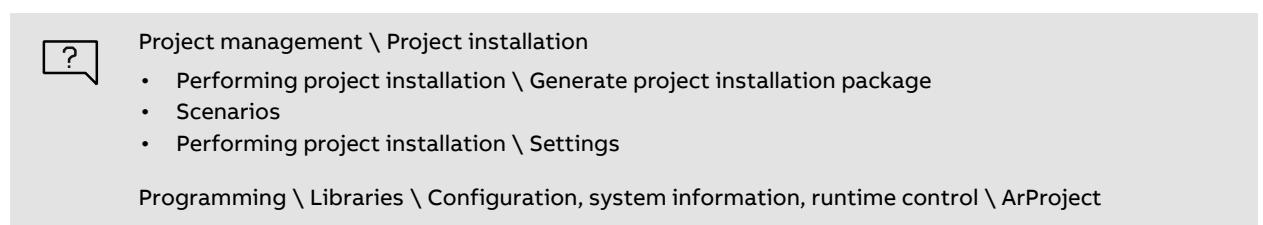


Figure 64: Generating project installation package on USB flash drive



Are there any other setting options?

The installation settings are used to configure target system identification, installation restrictions and handling of user data. The installation settings are opened by clicking on the toothed gear symbol on the right.



⁶ This applies to control systems using the default Automation Runtime.

7.2.4 Runtime Utility Center export

The Runtime Utility Center is a system tool that provides a range of utilities for diagnostics and service on B&R controllers. The installation program for the Runtime Utility Center is included in the Automation Studio installation or can be downloaded separately from the B&R website.

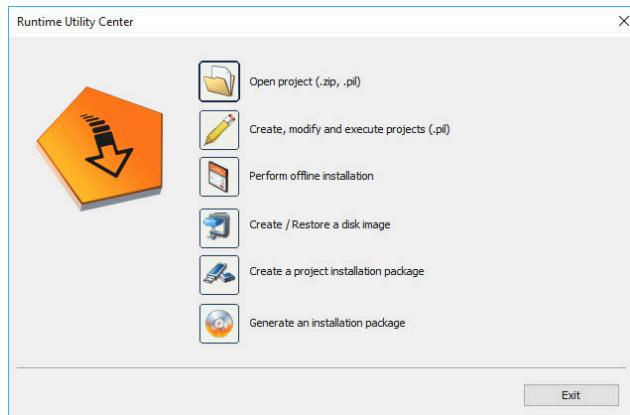


Figure 65: Runtime Utility Center start page

The most important functions are:

- Performing service functions via an online connection to the controller
- Variable functions for backing up and restoring process variables
- Creating individual Instruction Lists for testing and installation procedures
- Backing up and restoring a CompactFlash/CFast card
- Offline installation of a control project on a CompactFlash/CFast card
- Creating project installation packages for USB installation
- Custom mode allows the creation of a user-defined user interface



How can I open the Runtime Utility Center help documentation?

The Runtime Utility Center contains complete help documentation. This help documentation is opened by pressing the <**F1 key**>. The Runtime Utility Center must be opened before doing this. The following entries provide additional important information about using the Runtime Utility Center.



- Runtime Utility Center \ Start page
- Runtime Utility Center \ Operation \ Workspace
- Runtime Utility Center \ Operation \ Commands \ Establish connection, wait for new connection
- Runtime Utility Center \ Operation \ Commands \ PLC Info \ Logger

Downloading the Runtime Utility Center

The Runtime Utility Center is part of the **PVI development setup** and can be downloaded from the B&R website: www.br-automation.com → Downloads → "PVI Development Setup".

The screenshot shows the B&R website's Downloads page. At the top, there are navigation links for News, Academy, Career, and Downloads. Below that is the B&R logo and a search bar. The main content area has two dropdown menus: 'Product groups' set to 'Software' and 'Software' set to 'Automation NET/PVI'. A 'Results Filter by:' section includes 'Full Text Search', 'Language' (set to English), and 'Category'. To the right, it says 'Found downloads: 3' and lists the 'PVI Development Setup' file, which is version 4.12.2.24 (06/29/2022) and is a ZIP file (307 MB). There is also a link for 'Documentation'.

Figure 66: Downloads section, product group "Software" → "Automation NET/PVI"

Installing the Runtime Utility Center

The downloaded installation package must be extracted before installation. The installation program can then be started. No changes have to be made during the installation for use of the Runtime Utility Center.



Figure 67: Select a language

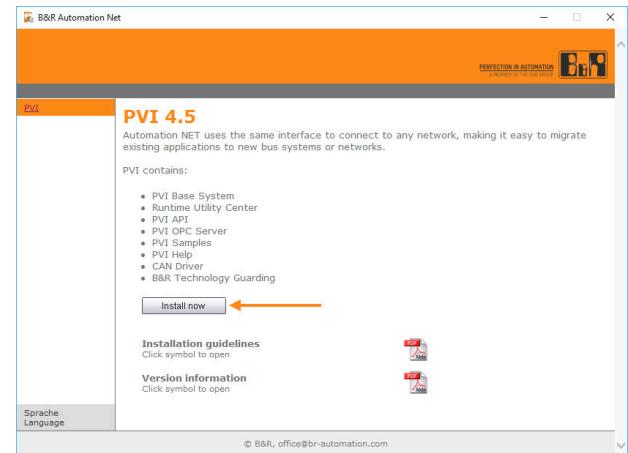


Figure 68: Clicking on "Start installation"

Create Runtime Utility Center export

The Runtime Utility Center export is started from the Project menu in Automation Studio. After the destination folder is selected and confirmed, the necessary data is exported as a ZIP file.

The export file can then be processed with the Runtime Utility Center.

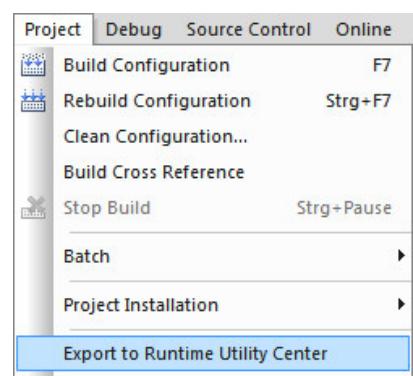
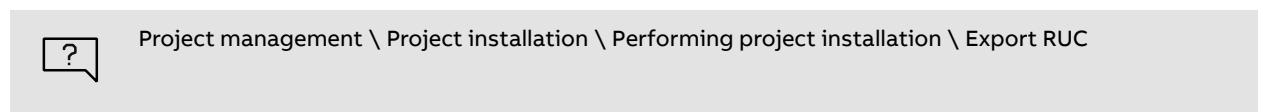


Figure 69: Runtime Utility Center (RUC) export in Automation Studio



Loading Runtime Utility Center export package

Select "Open project (.zip, .pil)" to load the Runtime Utility Center export package. Then, the following functions are available:

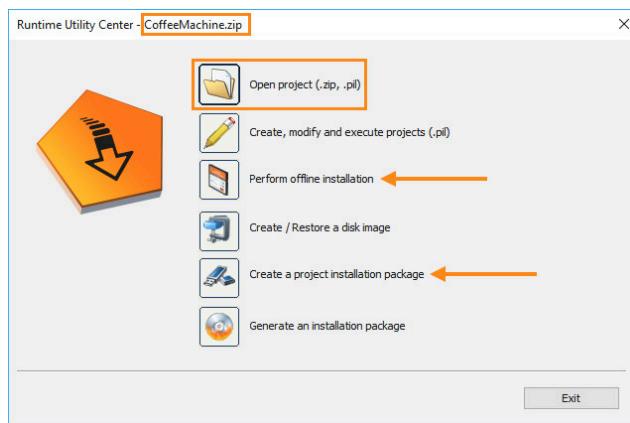
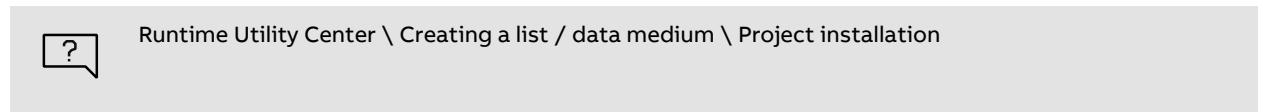


Figure 70: Runtime Utility Center start page with export file already loaded, see header of window

- Performing offline installation
This function can be used to perform an initial transfer to a CompactFlash/CFast card.
- Creating project installation package
This function can be used to create a project installation package, e.g. for USB installation.



8 Programming

A program is a POU (program organization unit) defined in the IEC 61131 standard that possesses the ability to directly access all global variables, functions and function blocks.

8.1 Programming languages

A variety of different programming languages are available in Automation Studio for creating programs. It is also possible to combine multiple programming languages within a single project.

Programming languages available in Automation Studio:

Programming language	IEC 61131	Description	Reference
Ladder Diagram (LD)	Yes	Visual	TM240
Function Block Diagram (FBD)	Yes	Visual	TM241
Sequential Function Chart (SFC)	Yes	Mixed	TM242
Structured Text (ST)	Yes	Text-based	TM246
Instruction List (IL)	Yes	Text-based	Automation Help
Continuous Function Chart (CFC)	No	Visual	Automation Help
ANSI C and C++	No	Text-based	Automation Help

Table 2: Overview of programming languages

All text-based programming languages in Automation Studio use the same editor. As a result, diagnostics tools always show the same behavior and are always operated in the same way. This high degree of uniformity simplifies workflows and increases productivity.



Are there restrictions to B&R standard libraries?

Function blocks included in B&R standard libraries can be called and used in all of the programming languages.



Programming \ Programs

8.2 Initialization and cyclic program section

When a program is added using the toolbox, the cyclic program sections, the initialization subroutine and the exit program are automatically added. Program sections that are not needed can be deleted in the Logical View. If the program is to be executed cyclically, it must have a cyclic program.

Further information:

- Training module "TM213 - Automation Runtime"

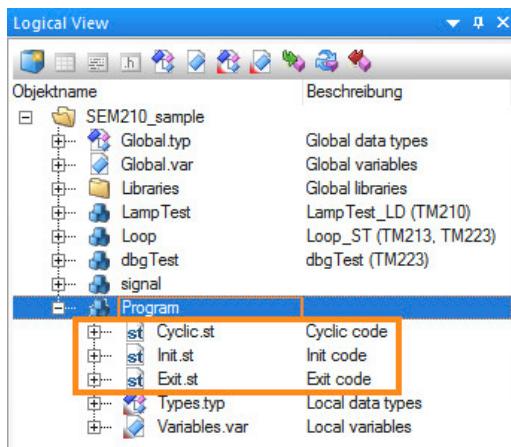


Figure 71: Image of a newly added program in the Logical View - initialization subroutine, cyclic program and exit program

Task initialization

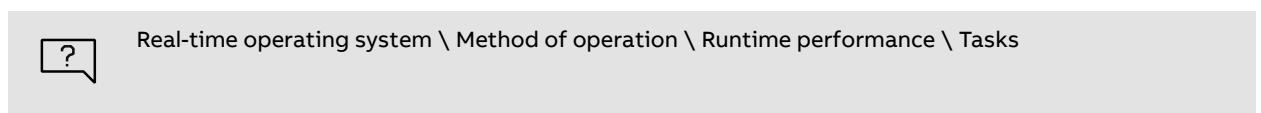
When the cyclic system is started, each task executes its initialization subroutine. This initialization subroutine can already contain program code that calculates and describes variable values, for example.

Cyclic subroutine

The program's cyclic subroutine starts once the task's initialization subroutine has completed. Variables that are described there retain their values until they are overwritten or until the system is restarted.

Exit subroutine

A task's exit subroutine is only called when the task is uninstalled (deleted). If resources (e.g. memory, interfaces, etc.) were requested in the initialization or cyclic subroutine, then these resources must be freed up properly.



8.3 Variables and data types

Variables serve as storage for values. Variables are given a name and are managed by the operating system in the controller's memory. In Automation Studio, variables are declared in files with the extension .var.

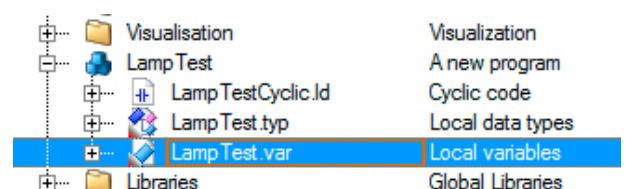


Figure 72: Declaring variables

Data types define the properties of variables. They define things like the range of values, the precision of the number stored in the variable or the possible operations.

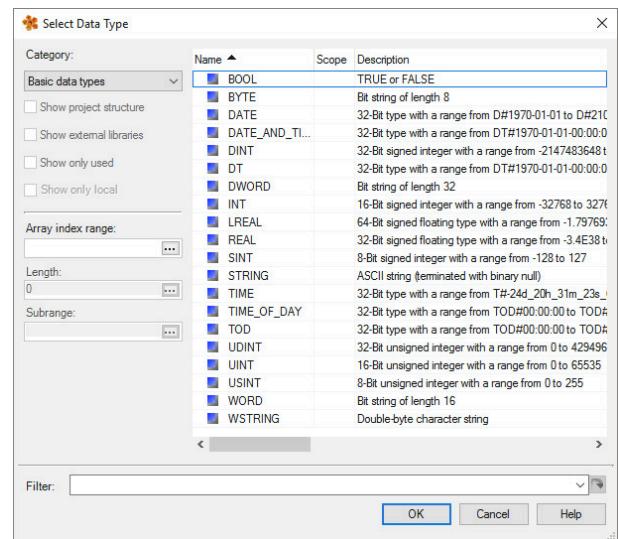


Figure 73: Variable data type

It is also possible for the user to create **user-defined data types** that are based on standard data types. In Automation Studio, these user-defined data types (or derived data types) are declared in a file with the extension .typ.

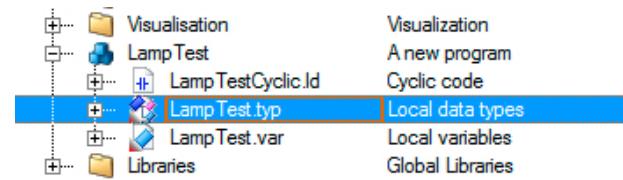


Figure 74: Declaring data types



- Programming \ Variables and data types
- Variables
 - Data types \ Basic data types
 - Data types \ Derived data types

8.3.1 Variable scope

The software can be structured in the Logical View using packages. The created structure facilitates the simple encapsulation of data and functionality.

The scope and visibility of the declared variables and data types is determined by the structure. This makes it possible to define variables in the appropriate "logical" place in the project.

Automation Studio controls the visibility of variables using the position of the VAR file.

(1) Local variables are defined as having a local scope within a program. For this reason, they are not available to other POU⁷s in the project.

(2) Package-global variables are declared within a specific package and are only valid in that package as well as in all subordinate packages and programs.

(3) Global variables are located at the highest possible level and are visible throughout the entire project. They can therefore be used in any program, regardless of the hierarchical level of the package containing it.

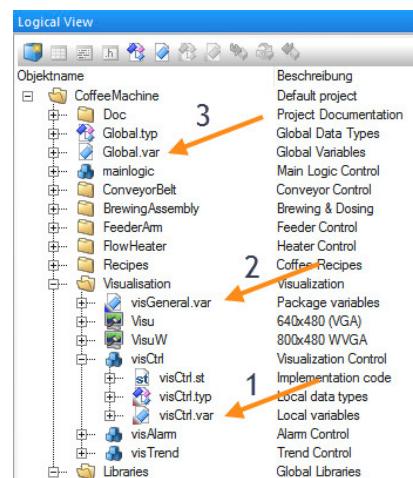
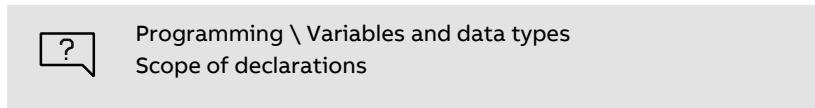


Figure 75: Scopes in the Logical View

8.3.2 Initializing and buffering variable values

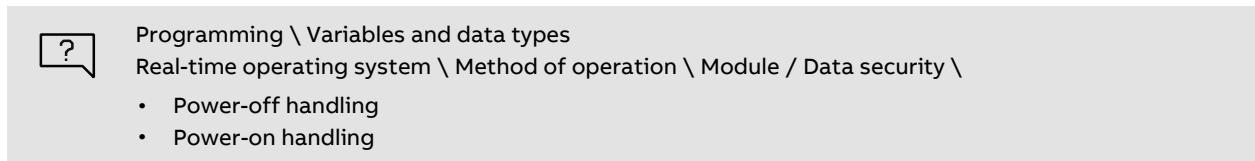
A variable always has a data type as one of its properties. The variable declaration can contain additional properties for the variable.

The screenshot shows a variable declaration window for 'brewing::brewing.var'. The table has columns for 'Name', 'Type', '& Reference', 'Constant', 'Retain' (which is highlighted with a red box), 'Replicable', 'Value', and 'Description [1]'. The 'Value' column contains the values 0, 0, 10, 20, 30, and three checkmarks. The 'Constant' column has several checkboxes: 'Constant', 'Retain', 'Replicable', and 'Value'.

Figure 76: Example of a variable declaration

Constants are variables with values that are not permitted to be changed while the program is being executed. A constant is assigned its initial value when the software is created (Value column).

Retain variables are protected in buffered memory so that they can be reloaded after a system restart (warm restart). Unlike RETAIN variables, permanent variables are also protected against a cold restart. In order for variables to be stored in the permanent memory area, they have to be defined as RETAIN and Global in the variable declaration window. Depending on the target system used, a buffer battery is used in the CPU to retain the data. More detailed information is listed in the data sheet of the respective device.



8.4 Creating an application

Automation Studio includes a number of components that enable efficient and platform-independent project configuration.

⁷ Program organization units are defined in the IEC 61131-3 standard and referred to as POU^s. POU^s correspond to programs functions and function blocks into which the control project is divided.

8.4.1 Libraries, samples and solutions

The standard libraries in Automation Studio provide access to many system functions. Physical interfaces can be freely programmed, reports can be used in a targeted manner and hardware can be configured with a high level of flexibility. It is also possible to import numerous sample programs that demonstrate how the libraries can be used. These encompass executable program codes for the controller or the simulation.

With solutions that are installed via the Automation Studio upgrade dialog box, you receive complete project templates with process control, simulation and visualization. These are imported into the project by the user and adjusted as required.

?

- Programming
 - Libraries
 - Examples

- Solutions \ Technology Solutions

8.4.2 mapp Technology

With mapp Technology⁸, we offer an easy-to-use interface and comprehensive functionality.

Many complex operations, such as loading and saving recipe data, controlling a drive axis and recording process values, can be implemented quickly and easily using mapp Technology components.



Figure 77: mapp Technology logo

mapp Technology unites configuration and programming. The functionality itself is implemented in the application program using standard libraries. In addition, mapp provides configuration interfaces. Similar to hardware modules, these are used to configure the functionality of the mapp components without programming.

User access to mapp Technology is enabled via independent Technology Packages. They are loaded via the B&R website or the Upgrades dialog box in Automation Studio.

?

- mapp Technology \ Concept
- Project management \ Workspace \ Upgrades

8.5 Import, export and team functions

Teamwork requires the division of responsibility and tasks.

Automation Studio supports functions designed to help teams work more efficiently:

- Passing on project data via export with small file sizes
- Applying project data via import
- Working with version control systems

?

- Project management
 - Automation Studio project \ Project import/export
 - Distributed development
 - Using source control systems

8.5.1 Exporting projects

An export function allows an Automation Studio project or parts of a project to be shared with other programmers.

Projects can be exported by selecting "File" / "Save project as ZIP" or "File" / "Save project as ZIP without upgrades" from the main menu.

Additional functions used to export or import hardware modules for ECAD systems are available.

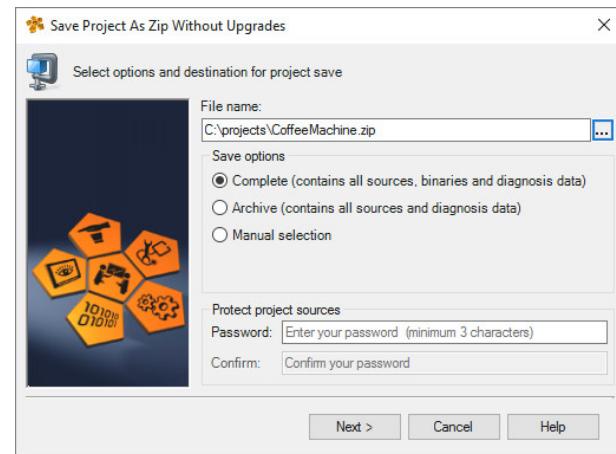


Figure 78: Exporting software components from the Logical View

Project management \

- Automation Studio project \ Project import/export
- Hardware management \ ECAD import/export

8.5.2 Exporting and importing software components

Completed software components can be exported and imported so that they can be shared or reused in other projects. Exports are performed individually for each package in the Logical View and include any dependencies to libraries. These are checked during import and automatically resolved.

Prepared samples are available in Automation Studio as packages for B&R standard libraries. These can be imported into an existing project as needed.

Importing to the Logical View is carried out using the toolbox.

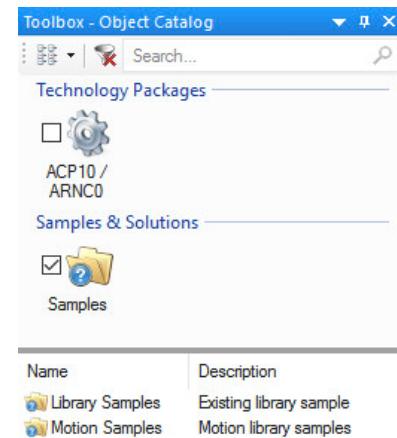


Figure 79: Adding samples from the toolbox

Programming \ Examples
Project Management \ Automation Studio project \ Project import/export

9 Updates and licenses

In addition to opening System Diagnostics Manager, Automation Studio's "Tools" menu offers other functions as well. This section briefly explains Technology Guarding and the function of dialog box "Upgrade".

9.1 Hardware and software upgrade

The ability to upgrade components makes it possible to update hardware, libraries, Automation Runtime versions and Technology Packages.

In order to download components from the Internet, it is necessary to open Automation Studio.

The upgrade process is started by selecting "Tools" \ "Upgrades". A dialog box opens, showing available upgrades. Once upgrades have been selected, they are downloaded in the background and installed automatically.

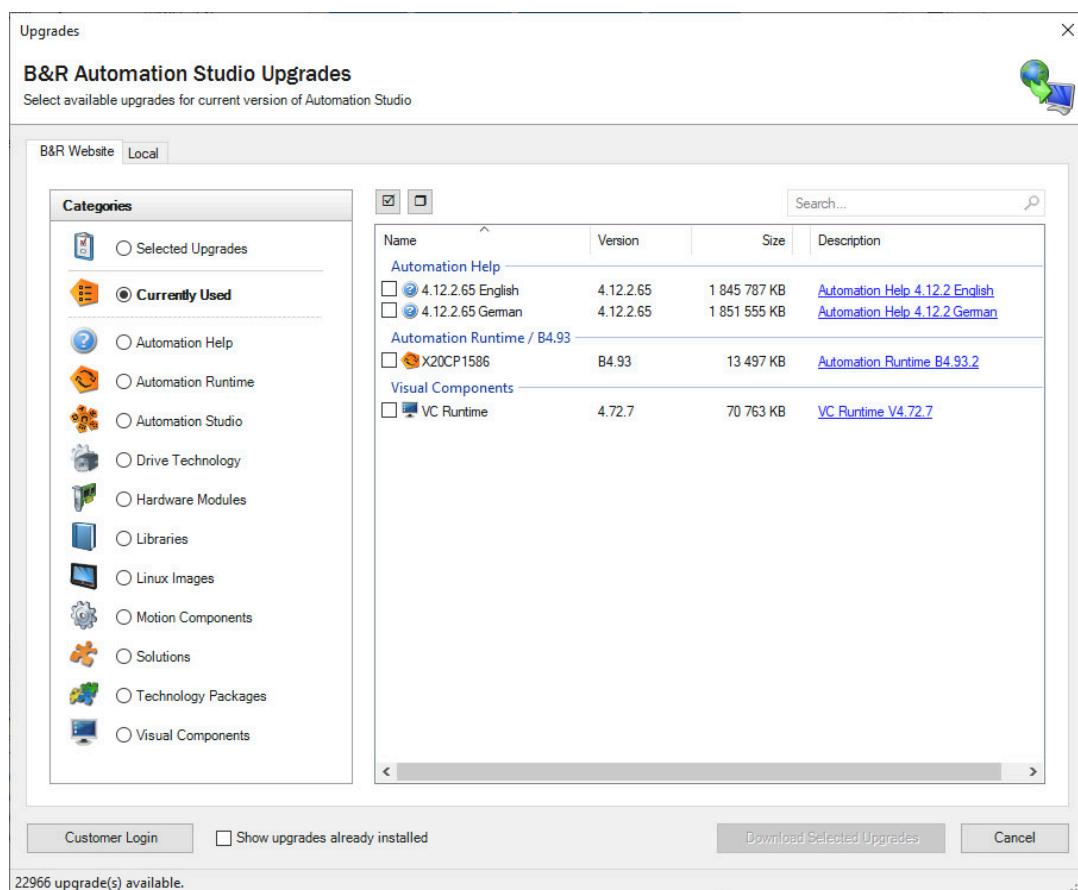
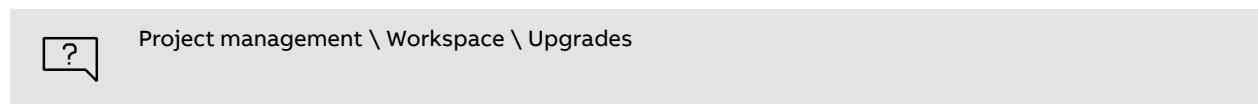


Figure 80: Selecting subsequently loadable components in Automation Studio



9.2 Technology Guarding

Technology Guarding is used to license protected software. This technology protects against unauthorized duplication of machine software and facilitates implementation of machine options. Licenses are stored in encrypted form to prevent tampering. Licenses can come preinstalled on a Technology Guard dongle from B&R or downloaded in the field using the Technology Guarding function in Automation Studio. The Technology Guarding portal on the B&R website provides full transparency of available and already activated licenses.

The Technology Guard provides two manipulation-proof operating hours counters and permanent data storage. These functions can be used via library "AsGuard" in the application software.



Figure 81: Technology Guard for license protection on the machine

Licenses on the inserted Technology Guard are verified automatically by Automation Runtime. The Technology Guard is used on the controller, in the simulation and as a license memory for Automation Studio single licenses.



Automation software \ Technology Guarding
Programming \ Libraries \ Configuration, system information, runtime control \ AsGuard

10 Summary

Automation Studio is more than just a programming tool. It provides support for the user throughout the entire life-cycle of a machine – from initial testing to finished project.

Structuring software via machine functions or working with different configurations makes it possible to manage machine variants in a project and facilitates teamwork.

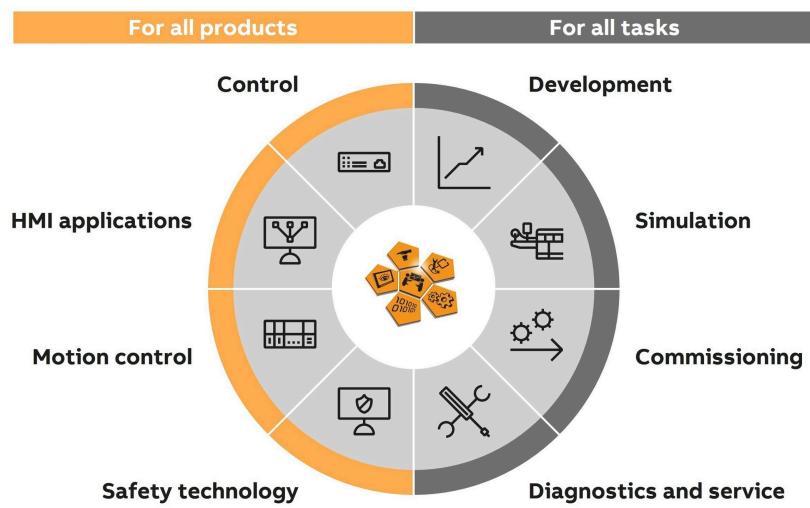


Figure 82: Automation Studio: One engineering tool for the machine's entire lifecycle

Automation Studio is an invaluable resource for programmers, service technicians and maintenance engineers for every stage of a machine's lifecycle.

11 Appendix

11.1 Transferring Automation Runtime

This section is relevant if all of the following apply:

- Initial installation on the system
- Online connection to the system established
- Default Automation Runtime on the target system is older than C4.25

In this case, Automation Runtime must be installed manually.

With newer default Automation Runtime versions, Automation Runtime is installed automatically in the transfer dialog box.

There is a wizard to assist you through the process of transferring Automation Runtime. It is recommended to select option "Modules from the project scheme". This option includes the system settings from the project in addition to Automation Runtime. As a requirement for this, the project must be compiled beforehand.

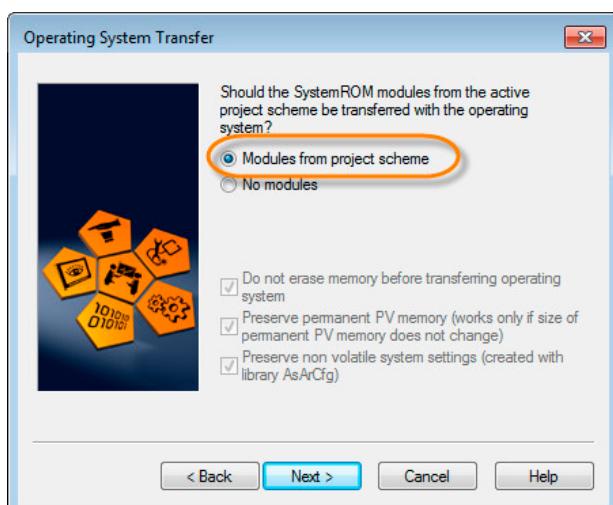


Figure 83: Transferring Automation Runtime: Transferring modules from the project scheme

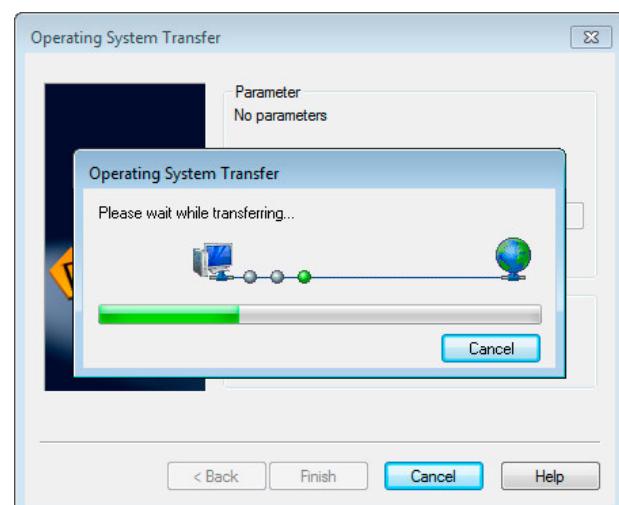


Figure 84: Transferring Automation Runtime: Progress indicator



All target systems have the option of deliberately starting in operating mode BOOT. Depending on the target system, this is done using the reset button, mode selector switch or node number selector switch. The reset button can be used to restart the system and change the operating mode. The mode selected with a mode selector switch is applied after restarting. Further information about the possible operating modes and actions can be found in the data sheet of the respective target system. Starting with Default Runtime⁹ V3.06, the target system search via SNMP is also supported for SG4 systems in the operating mode "BOOT"¹⁰.

⁹ Default Automation Runtime is pre-installed on all controllers and is a reduced version of Automation Runtime. Default Automation Runtime, for example, initiates the actual start process from flash memory.

¹⁰ The Simple Network Management Protocol is a network protocol used to monitor and control network elements (e.g. routers, servers, switches, printers, computers, etc.) from a central station. [Translated from source: de.wikipedia.org]



Programming \ Build & transfer \ Online services \ Transfer Automation Runtime

Hardware \ Power Panel \ Power Panel C70 \

- Installation \ Commissioning
- Device description \ Operating and connection elements \ Reset button / Operating modes

Hardware \ X20 system \ X20 modules \ CPUs \ X20(c)CP1301, X20CP1381 and X20CP1382 \ Operating and connection elements \

- Programming the system flash memory
- Button for reset and operating mode

Exercise: Transfer Automation Runtime

The objective of this task is to transfer Automation Runtime to the target system.

- 1) Browse for target systems in order to establish a connection to the controller.
- 2) Optional: Put the target system into operating mode BOOT via the reset button, the operating mode or node number switch.
- 3) Check the Automation Runtime version installed.
- 4) Perform online project installation.



After Automation Runtime has been transferred, the controller is in operating mode RUN. The entire project can now be transferred to the controller.

ANSI: `tcpip/RT=1000 /SDT=5 /DAIP=10.43.15.34 /REPO=11159 /ANSL=1 /PT=1... | 4PPC70.0573-20B 14.25`

RUN

Figure 85: Automation Runtime transferred successfully. Connection established. The controller is in operating mode RUN.

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Remote Lectures supplement B&R's continuing education portfolio with a virtual classroom, offering an alternative to our on-site seminars. Selected content from our standard seminars is offered online. In addition to remote learning methods, powerful simulation tools and secure remote maintenance are used.

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Take control of the content and learn at your own pace. With B&R **online courses**, you can take your first steps in the world of B&R automation at any time. Based on a comprehensive narrative, you will independently work out how to use our products. The mix of different media allows a logical sequence to be followed when learning as well as a targeted choice of information to be used as a reference.

Contact

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