

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 4.4 Automation Runtime 4.44
Hardware	X20 controller and X20 I/O modules ETA210 or ETAL210 + ETAL690 <u>www.br-automation.com/eta-system</u>



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Introduction

1 Introduction

Automation Studio is the project development environment used specifically for B&R automation components. This includes controllers, motion control components, safety modules and HMI applications. Clearly organized project structuring options and the ability to manage multiple configurations ensure that teams can work together efficiently and all machine variants can be represented in a single project.

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

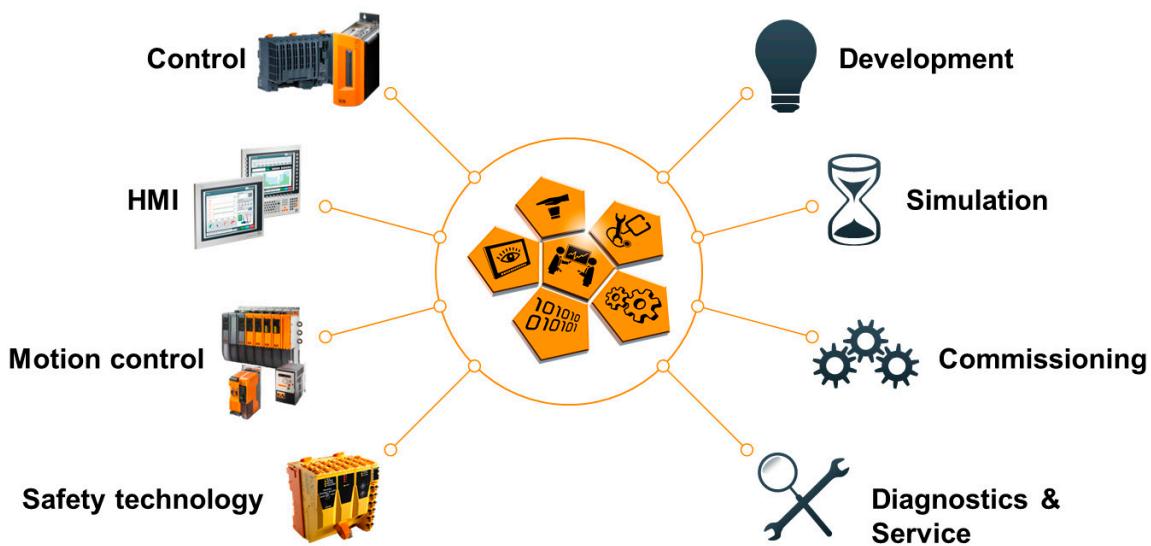


Figure 1: Automation Studio: one engineering tool for the machine's entire lifecycle

1.1 Learning objectives

This training module uses simple exercises 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 to follow in order 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 exercise 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: Tasks and exercises

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

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

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

Installation and licensing

2 Installation and licensing

Automation Studio is installed automatically when the Automation Studio DVD is inserted into the computer's DVD drive. It is also possible to start the installation manually by running the **Install.exe** file. 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 2: Automation Studio installation: Selecting the desired language

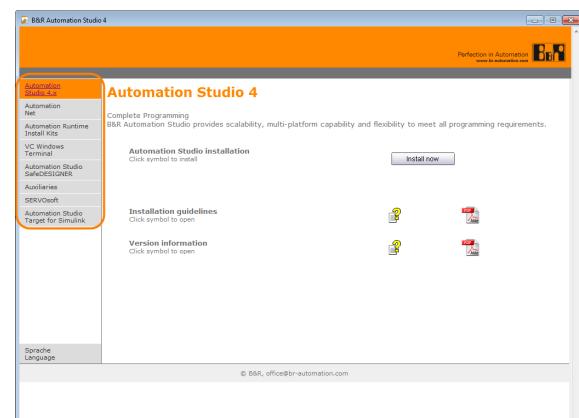


Figure 3: Automation Studio installation: installation options and version information

The license agreement is accepted and the components to be installed are then selected using the following installation dialog boxes.



2.1.1 Starting 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 4: Automation Studio desktop icon

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

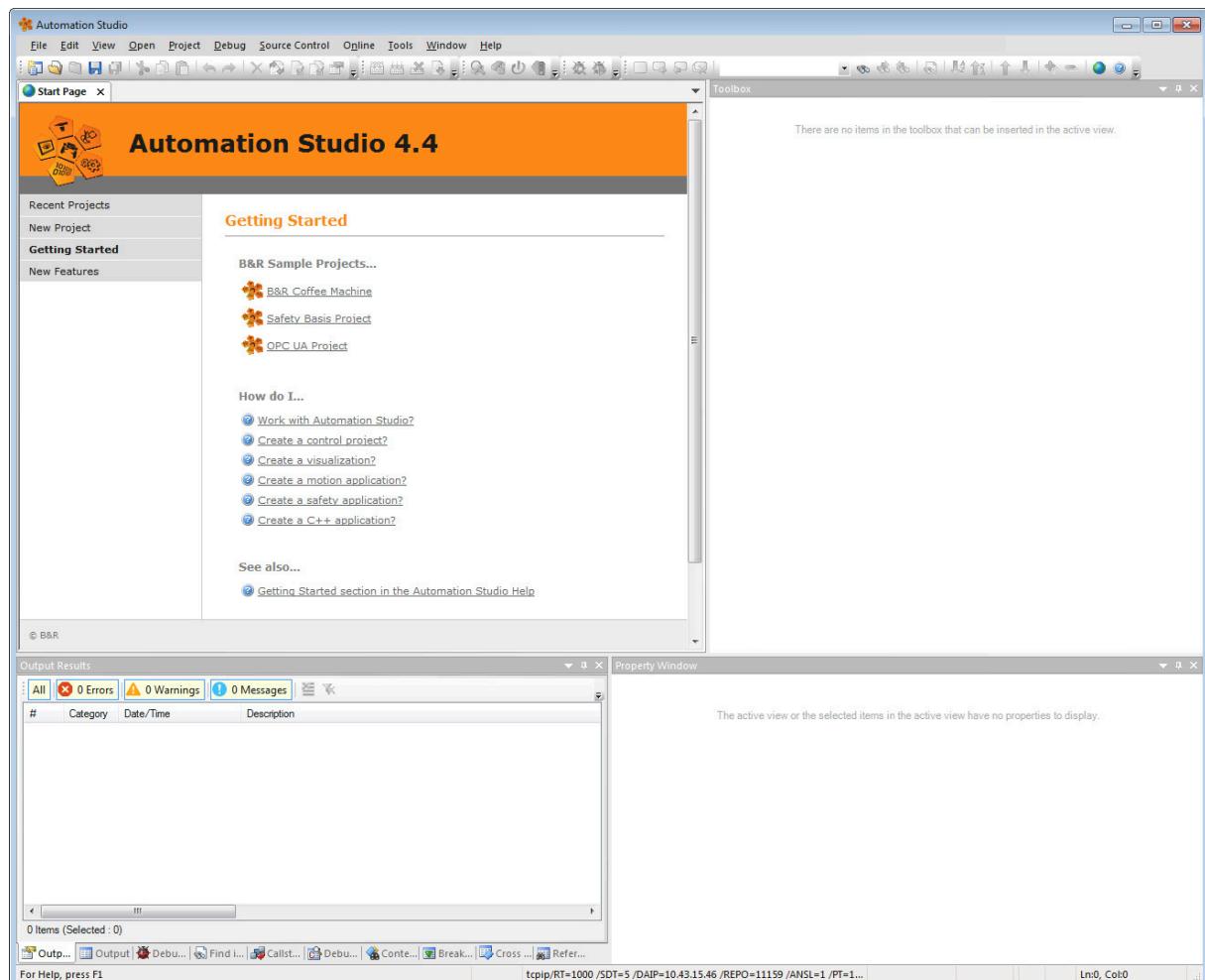


Figure 5: The Automation Studio start page

From the start page, you can create a new project or open an existing one.

It also includes the "Getting started" section for users to learn more about working with Automation Studio. The start page can be opened at any time by selecting <Help> / <Show start page> from the main menu; it is also displayed after a project is closed.

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.



Automation software \ Version information

Installation and licensing

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 to store the license (["Technology Guarding" on page 56](#)). Evaluation licenses and student licenses can be requested directly on the B&R website.

A complete description of the licensing dialog box can be found in Automation Help.



Automation software \ Software installation \ Automation Studio

www.br-automation.com → Service → Software registration

3 Your 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 start page in Automation Studio.

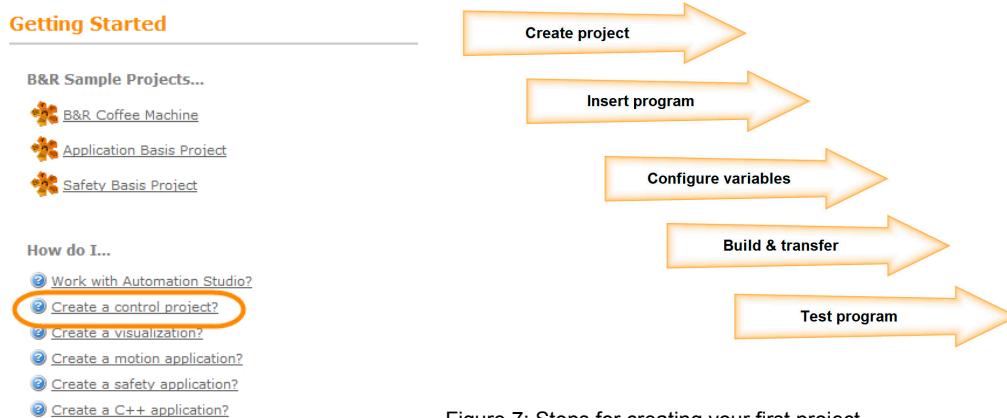


Figure 7: Steps for creating your first project

See also...

[Getting Started section in the Automation Studio Help](#)

Figure 6: Automation Desktop home screen

- 1) Click on the **How do I create a control project?** link on the start page.
- 2) Select one of the subsections.
- 3) Work through each of the steps.



Automation Help is a useful aid for creating a new project, designing a program and then transferring the project to the Automation Runtime Simulation where it can be tested.

Some of the elements of Automation Studio have already been introduced during the course of this first project. The next few sections will explain the functionality of Automation Studio in detail.



Getting started \ Creating programs in Automation Studio

Automation Studio

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 structure and machine functions determine what the structure looks like. This direct relationship between the application and the machine makes the structure of the software 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 make working in project teams more efficient.

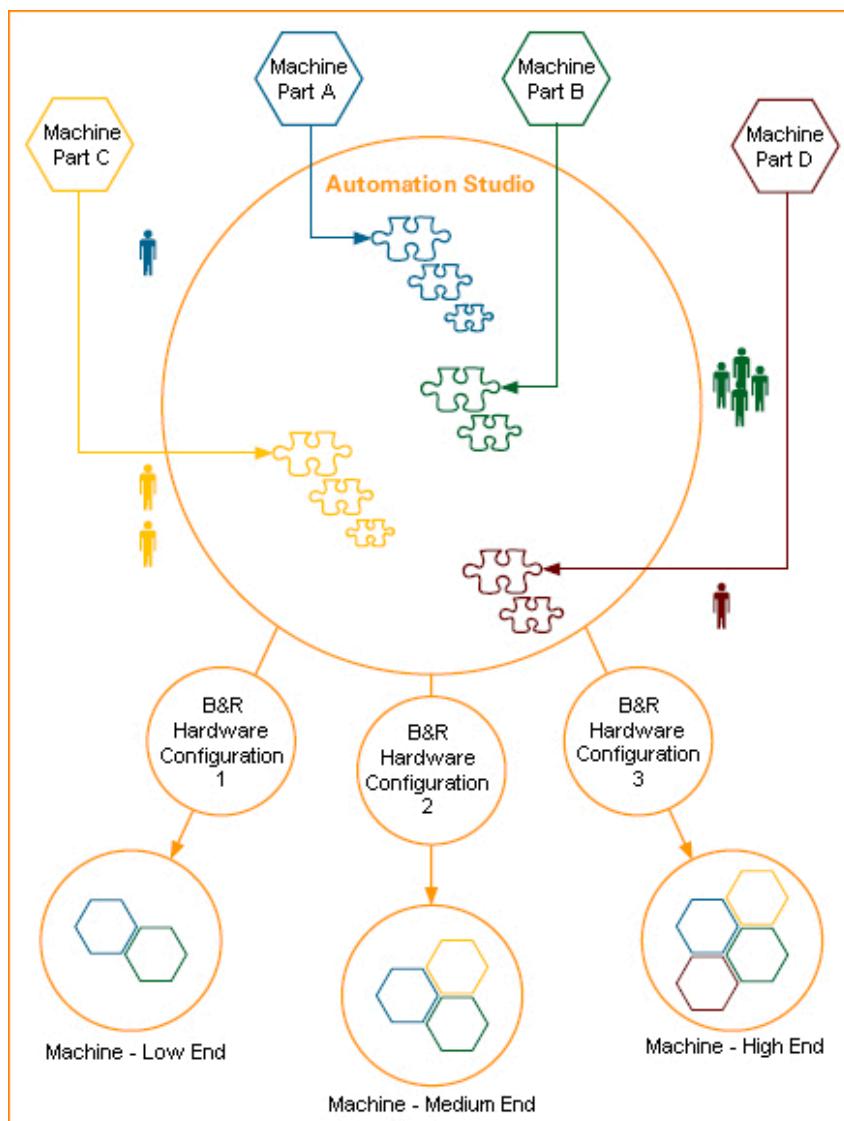


Figure 8: The structure and basic principle of Automation Studio

4.2 Automation Studio help documentation

Automation Help is an invaluable resource throughout the development, configuration and commissioning of a project. It serves as a reference guide for using Automation Studio and its editors, creating programs or HMI applications, configuring drives and much more. In addition, Automation help provides access to all B&R hardware documentation. When you install new hardware and software upgrades, Automation Help is expanded to include the necessary documentation. (see ["Hardware and software upgrade" on page 55](#))

Exercise: Use Automation Help

Press **<F1>** in Automation Studio to open the section of Automation Help that corresponds to 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"**.

Use the Automation Help search function to find the technical data for the X20CP1586 controller. Power consumption information can be taken from the technical data for the selected controller.

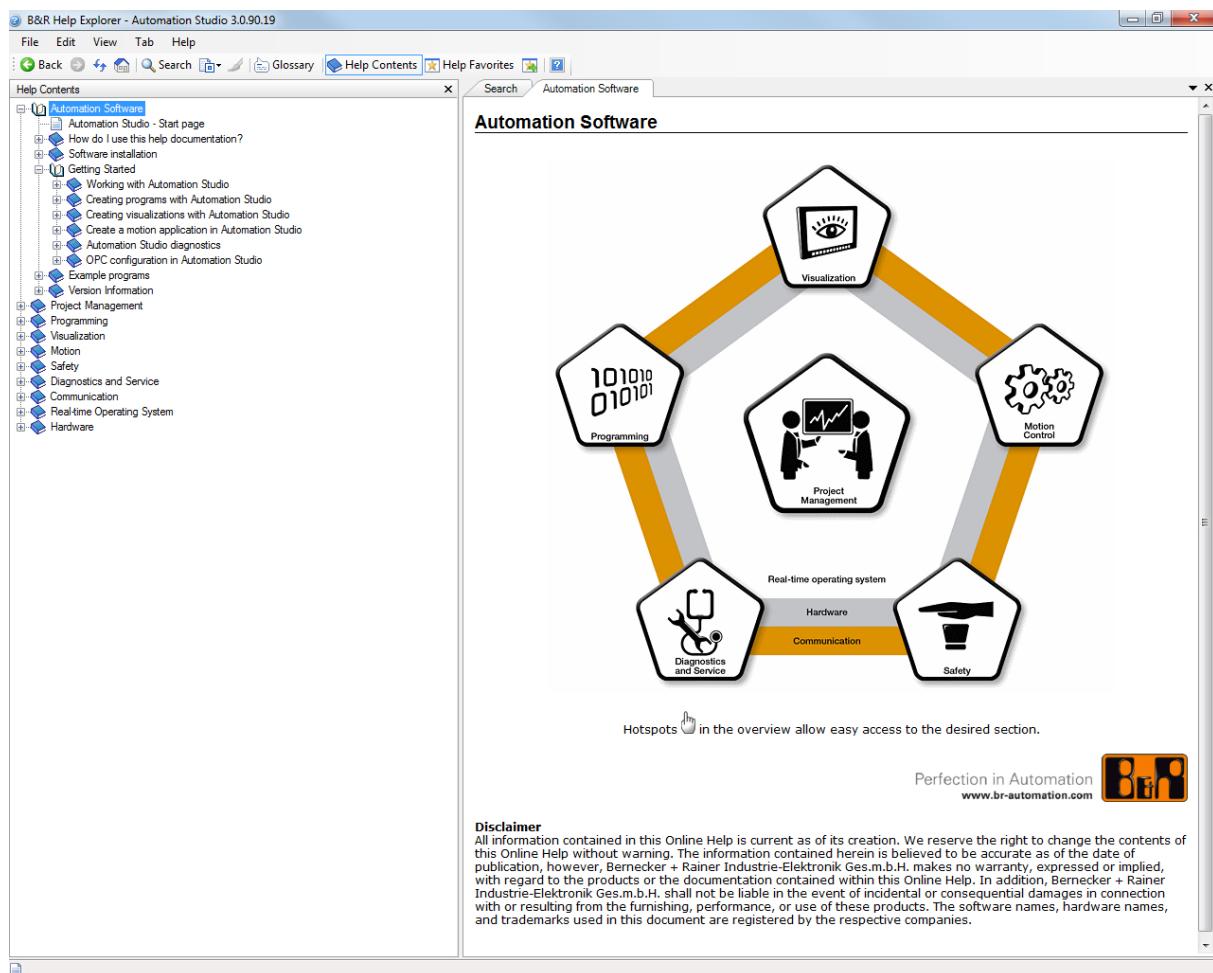


Figure 9: Automation Help

Automation Studio

4.2.1 Managing help favorites

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

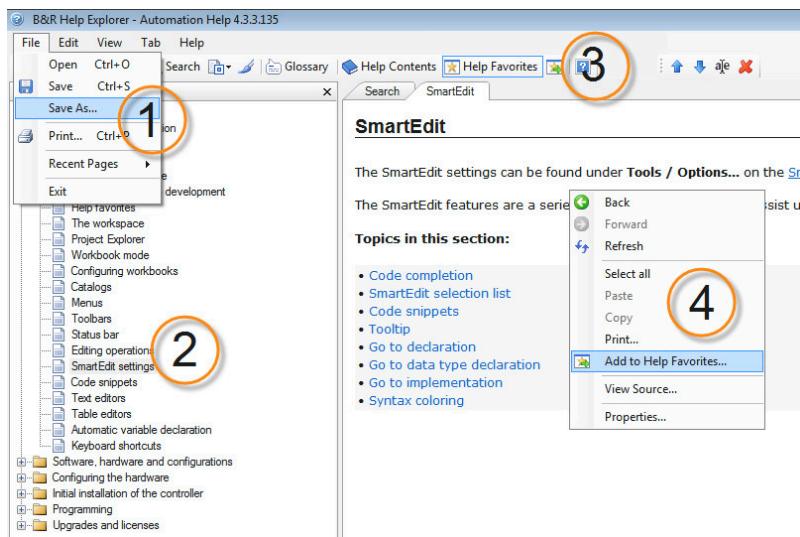


Figure 10: Managing help favorites

1) Saving and opening

Help favorites can be saved to a file by selecting "Save" or "Save as" from the File menu. Any newly added entries are saved automatically.

2) List of help favorites

The help favorites are managed in a tree structure. Entries can be moved and renamed. Clicking on one of the entries will open the corresponding help page.

3) Toolbar

The "Help contents" and "Help favorites" buttons in the toolbar switch between the Favorites view and the navigation tree in Automation Help. The navigation tree remains synchronized if a favorite is selected in the Favorites view.

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 window for selecting where the page should be ordered in the list of favorites.



The language of Automation Help can be set by selecting <Tools> / <Options> from the main menu.



Automation software \ How do I use the help documentation? \ Help favorites

4.3 The workspace

Automation Studio is divided into several different areas, each with a specific function.

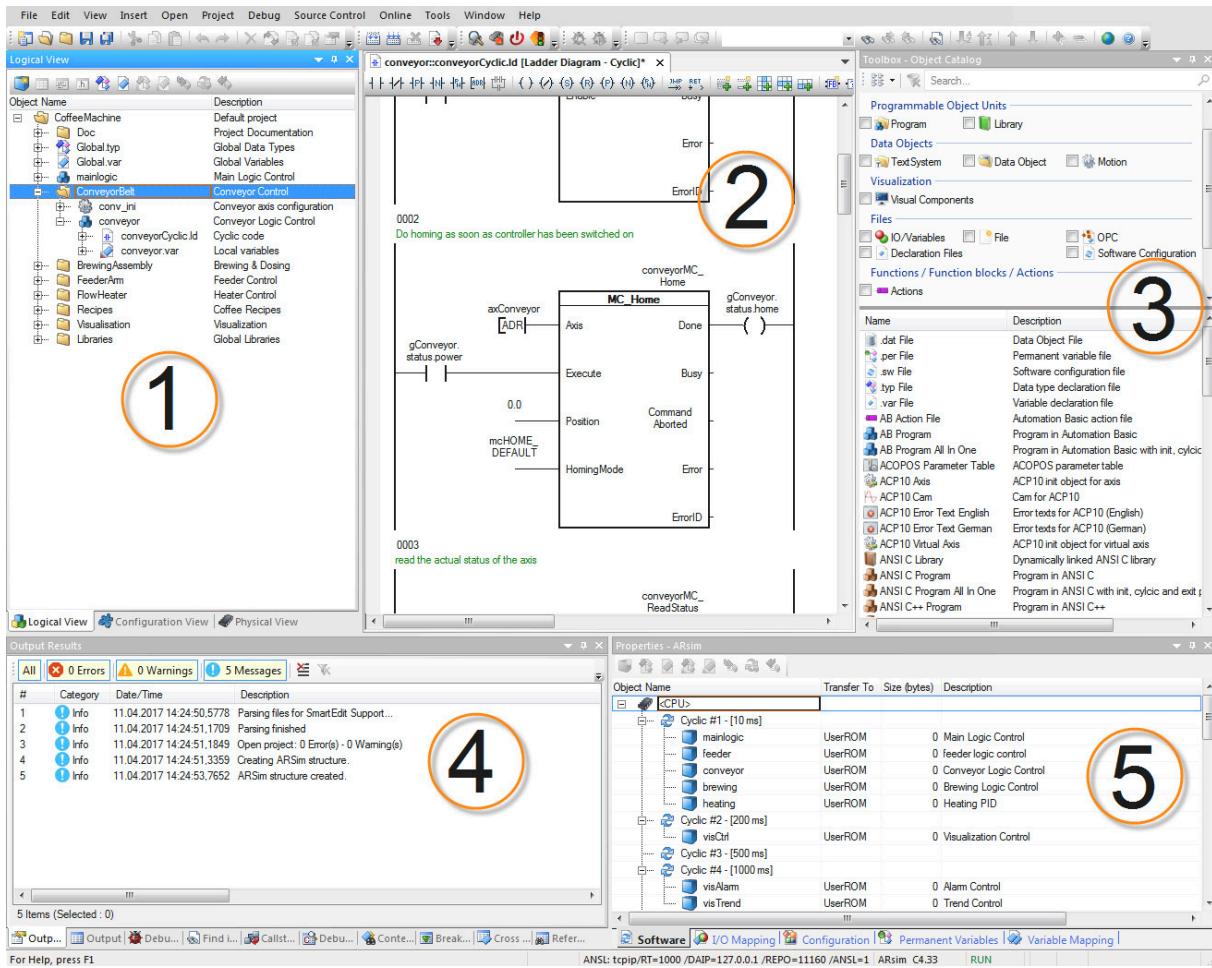


Figure 11: The Automation Studio workspace

- 1) The Project Explorer is located on the left side of the window. This is used to manage and edit software and configuration objects in a project.
- 2) The center of the screen is where open documents are worked on. This is where program code is edited, for example.
- 3) The Toolbox window is located on the right side of the window. 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) The output window is located on the lower left side of the main window. It is used to display information such as messages that are generated when a project is being built.
- 5) The Properties window is located on the bottom right. This window displays configuration options for whichever object or hardware module is currently selected. It can also be used to edit the properties of selected object.



Project management \ Workspace

Automation Studio

4.3.1 Reposition 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 windows can be rearranged by clicking and dragging the title bar.

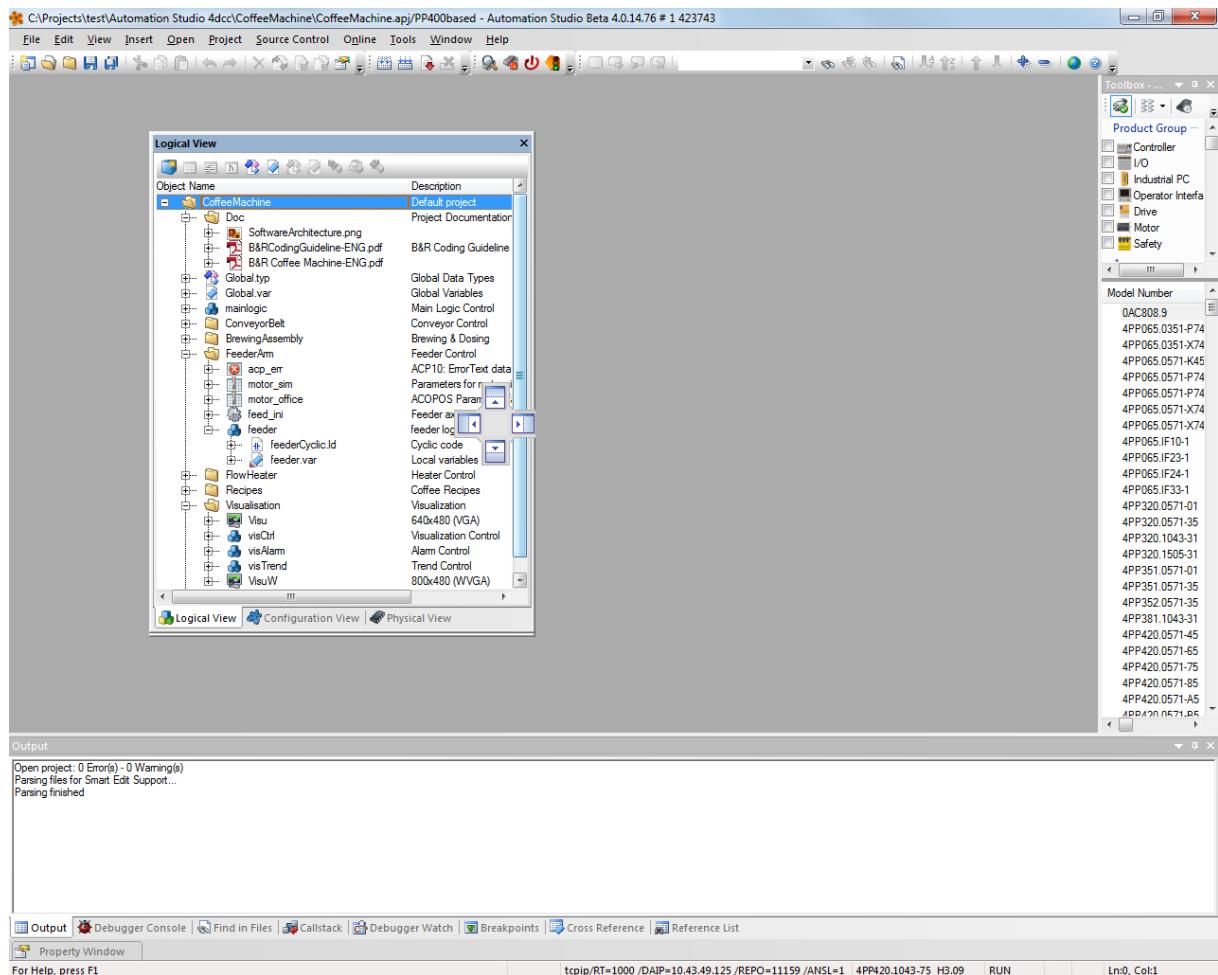


Figure 12: Docking and undocking windows

Project management \ Workspace \ Project Explorer

4.3.2 Auto-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 automatically. Clicking the pin icon in the title bar of the Project Explorer or any of the other dockable windows will toggle the auto-hide function.



Figure 13: Use the pin symbol to dock or hide windows

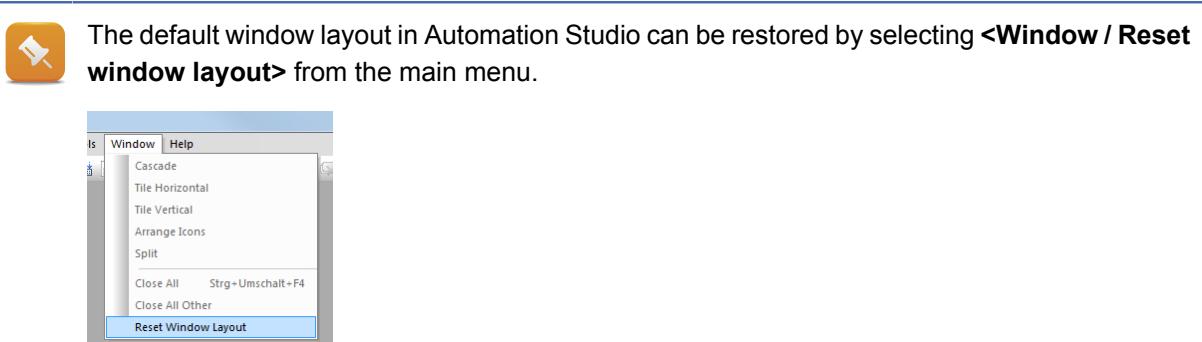


Figure 14: Restoring the default window layout in Automation Studio



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



Exercise: Work with Automation Studio

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

Automation Studio

- 1) Identify the various sections of the workspace.
- 2) Use the context-sensitive Automation Help (<F1>) to learn about each section.
- 3) Move the positions of windows and hide them.
- 4) Then restore the 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 context (active editor or window), however, individual menu items may be shown/hidden or enabled/disabled. In this way, only the functions possible within the current context are available for selection.

Toolbox window

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

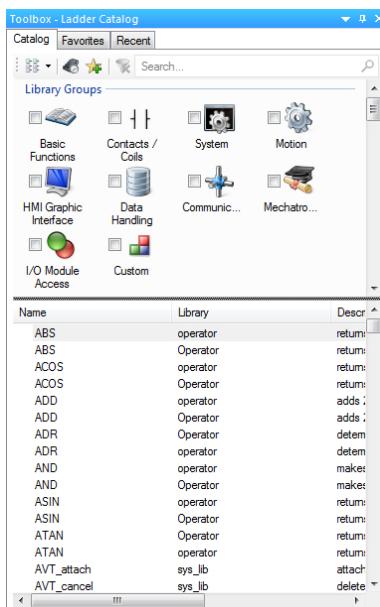


Figure 17: Toolbox - Ladder Diagram:
Programming functions, commands,
functions and function blocks

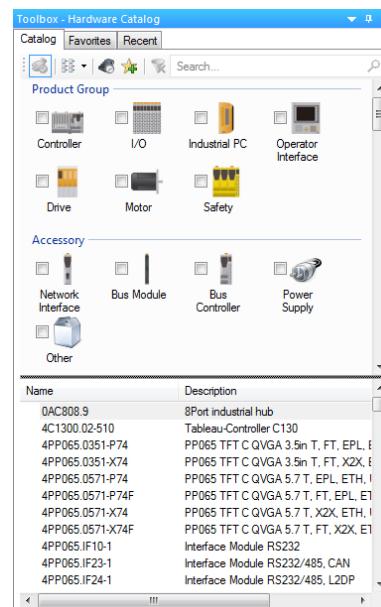


Figure 18: Toolbox - Hardware Catalog:
Hardware modules, infrastructure
components

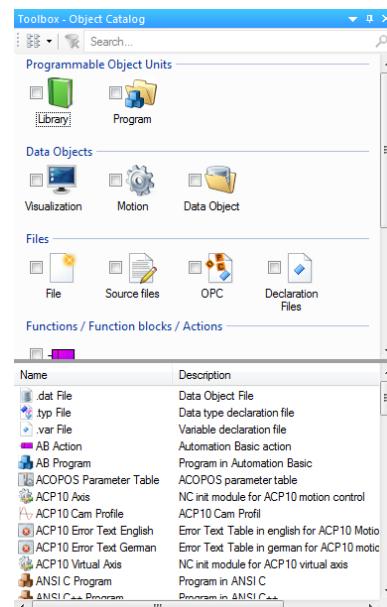


Figure 19: Toolbox - Object Catalog:
Programs and configuration files

Project management \ Workspace \

- Catalogs
- Main menu
- Toolbars
- Keyboard shortcuts

Project management \ Hardware management \ Physical View \ Editing operations

4.3.5 The convenience of SmartEdit

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

Auto-complete

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

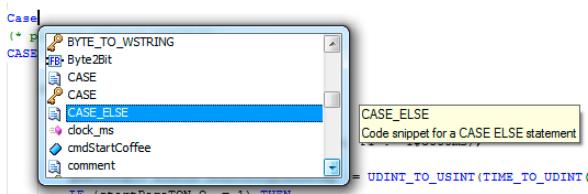


Figure 20: SmartEdit - Code completion

Automatic declaration

Depending on preference, automatic declaration of new variables can be helpful. In SmartEdit settings, you can make numerous custom adjustments to the editors. Open the configuration window by selecting **<Tools> / <Options>** from the menu. On the "SmartEdit" tab, activate the setting for automatically declaring variables.

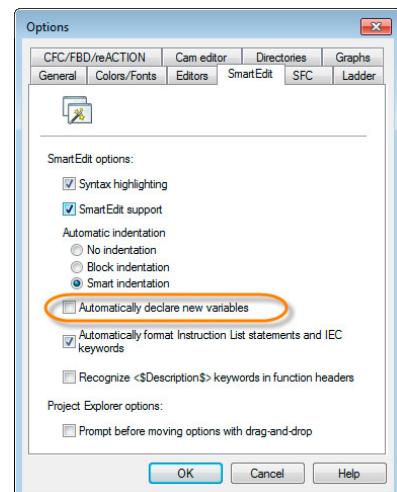


Figure 21: Setting for automatic declaration of new variables

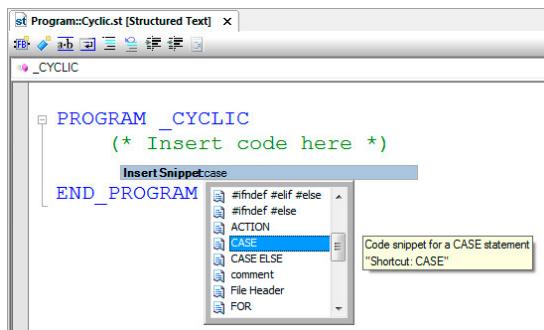


Figure 22: Adding a code snippet

Code snippets

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

Additional editor functions

The editors in Automation Studio offer additional functions which 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
- Open 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>
Open the code snippet selection window	<CTRL> + <q>, <k>
Collapse or expand outlining for all code segments	<CTRL> + <q>, <l>
Collapse or expand outlining for the current code segment	<CTRL> + <q>, <m>
Jump to a variable declaration	<CTRL> + <d>
Jump to the declaration of a variable's data type	<CTRL> + <t>
Jump to a function or function block implementation	<CTRL> + <i>

Table 1: Useful SmartEdit keyboard shortcuts

Programming \ Editors

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

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 to represent 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 folders or directories. A package might include all of the software elements needed for a particular part of the system as well as any 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.



Object Name	Description
CoffeeMachine	Default project
Doc	Project Documentation
SoftwareArchitecture.png	B&R Coding Guideline
B&RCodingGuideline-ENG.pdf	Global Data Types
B&R Coffee Machine-ENG.pdf	Global Variables
Global.typ	Main Logic Control
Global.var	Conveyor Control
mainlogic	Brewing & Dosing
ConveyorBelt	Feeder Control
BrewingAssembly	Feeder Control
FeederArm	ACP10: ErrorText data o
feederCyclicId	Parameters for motor sim
feeder.var	ACOPOS Parameter Tab
motor_sim	Feeder axis configuration
motor_office	feeder logic control
feed_ini	Cyclic code
FlowHeater	Local variables
Recipes	Heater Control
Visualisation	Coffee Recipes
Visu	Visualization
visCtrl	640x480 (VGA)
visAlarm	Visualization Control
visTrend	Alarm Control
VisuW	Trend Control
	800x480 (WVGA)

Figure 23: Logical View

Software, hardware and configurations

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.

Automation Studio's hardware management features are used to perform the following tasks:

- Insert and configure hardware modules
- Map variables to I/O data points
- Configure fieldbus modules and interfaces

Physical View

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

When you create a project or a new system configuration you select a CPU. Then the required hardware modules are added into the topology from the Toolbox.

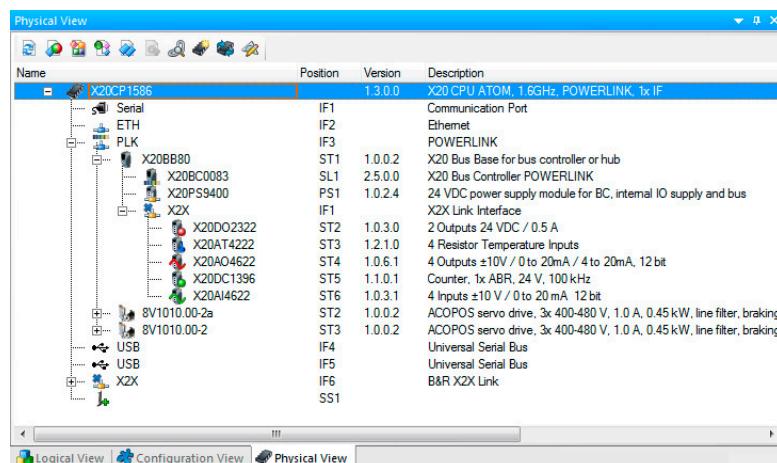


Figure 24: Physical View in Automation Studio

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. I/O modules are added and removed in the same way as in the Physical View (see ["Adding I/O modules from the Hardware Catalog" on page 30](#)). The two views are synchronized with each other.

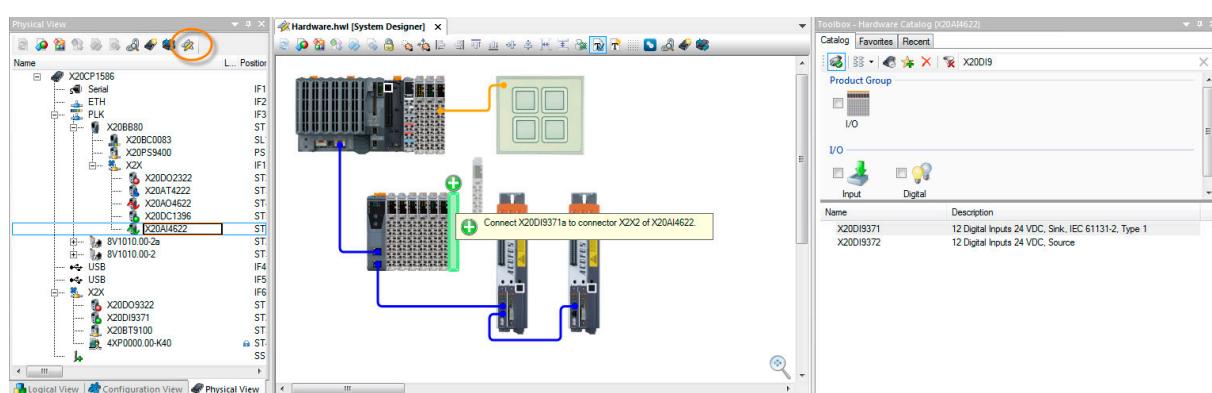


Figure 25: Open System Designer via the toolbar of the Physical View. Add hardware modules from the Toolbox.



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
 - View settings \ Automatic layout
 - Editing operations \ Text boxes

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.

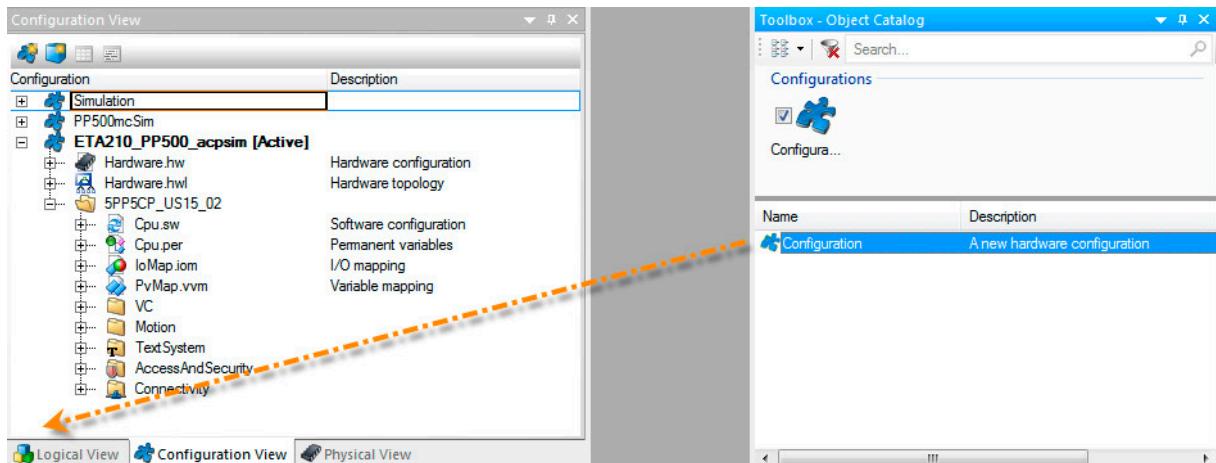


Figure 26: Configuration View with active configuration [Active]. Add a new configuration via drag-and-drop.

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

The following configuration elements are managed, among others, 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



Project management \ Configuration View

Software, hardware and configurations

5.4 Assignment of 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:

- ["Automatic assignment when creating a program" on page 23](#)
- ["Adding existing programs manually" on page 23](#)

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

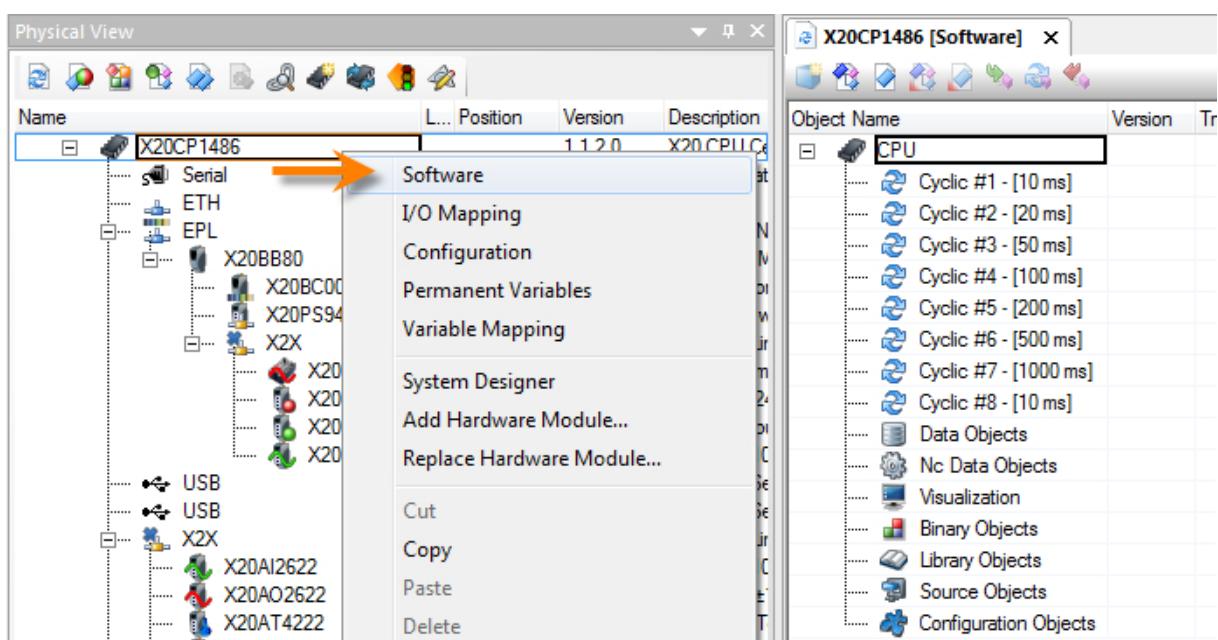
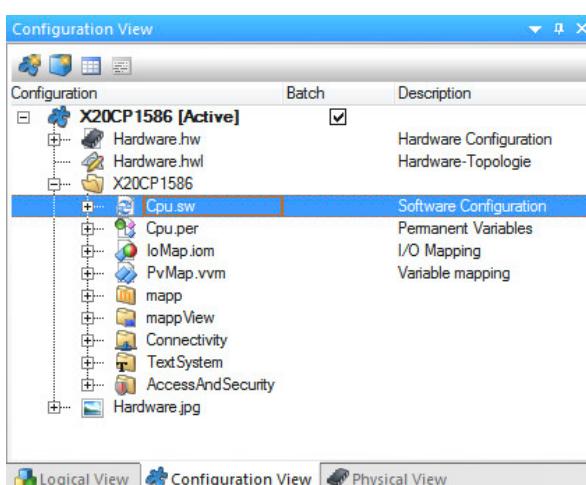


Figure 27: Open the software configuration from the controller's shortcut menu.



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

Figure 28: Open 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.

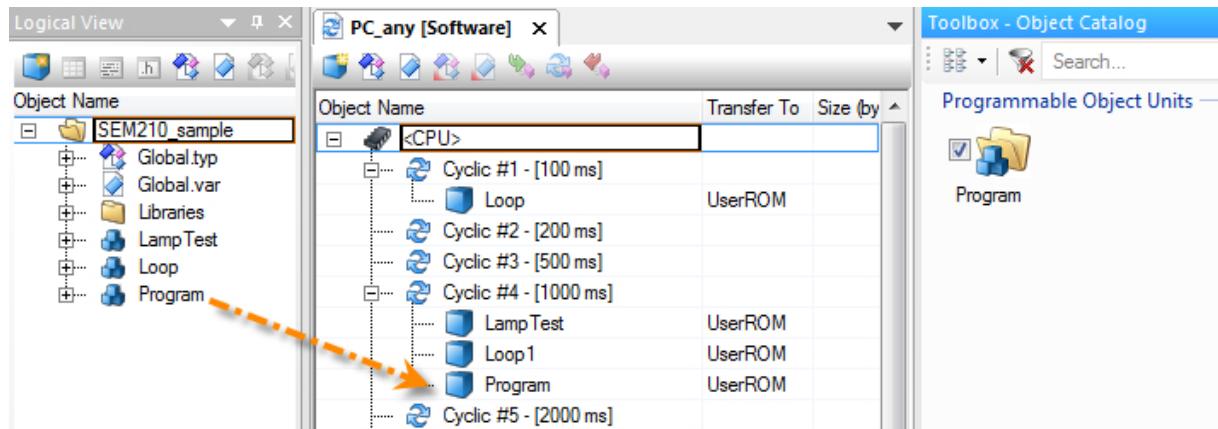


Figure 29: When added, the software object is automatically assigned to the software configuration of the active configuration.

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



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 manually assigned to the software configuration.

Software, hardware and configurations

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.

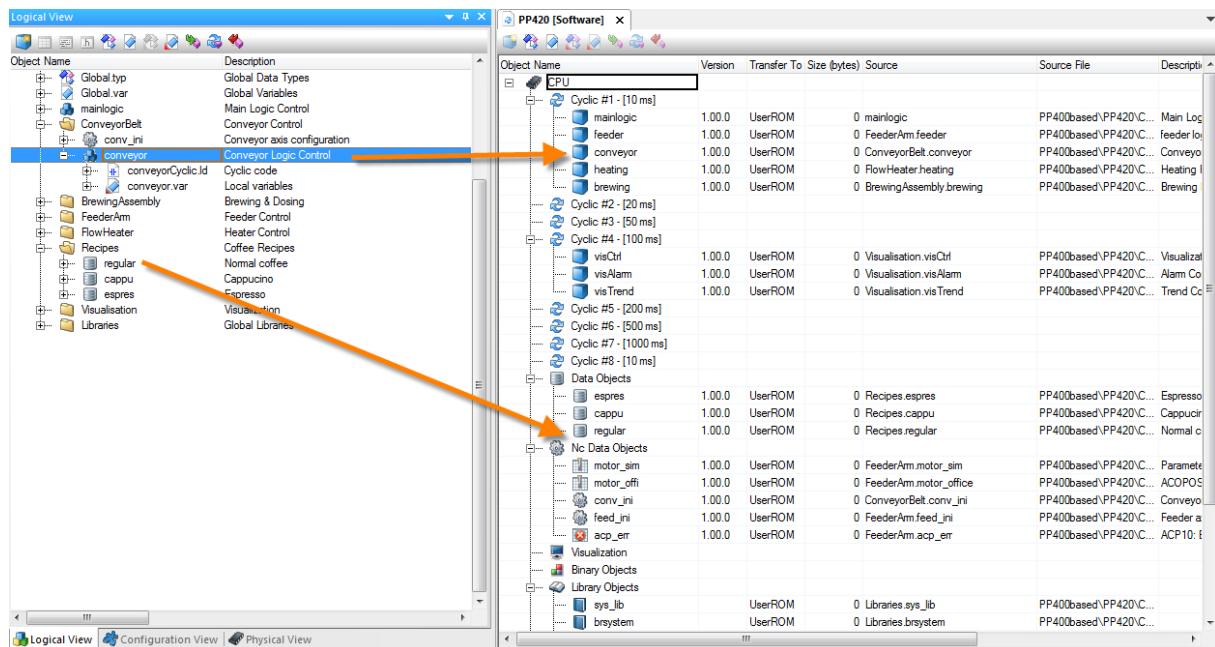


Figure 30: Assigning software elements to the software configuration



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.



Double-click on an entry in the software configuration to open the Logical View with the corresponding entry automatically selected.

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.

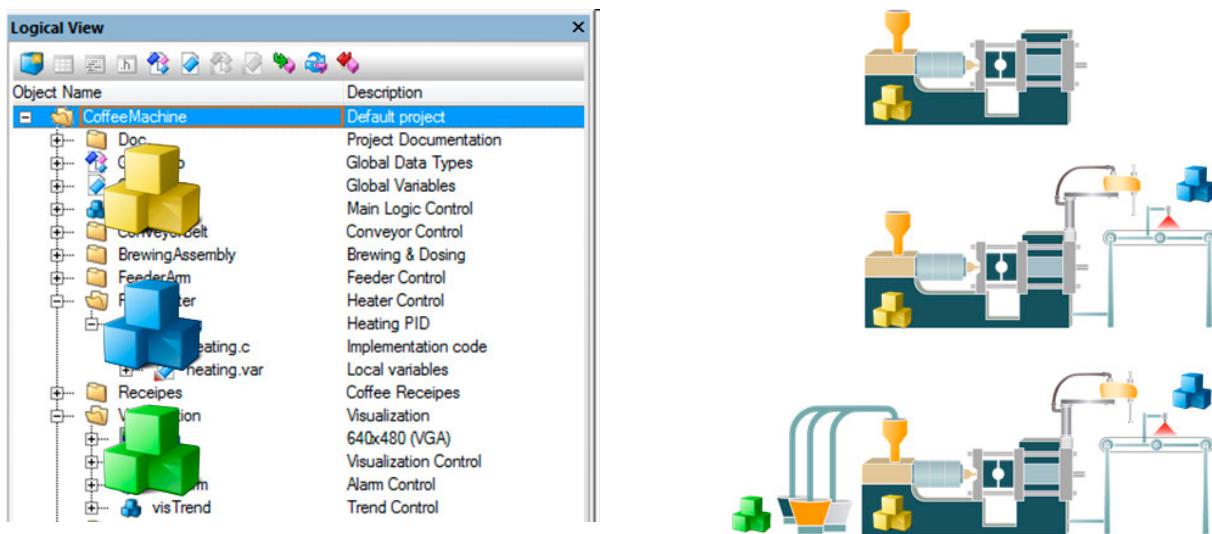


Table 2: Different machine variants can be created by assigning software packages to them.



Project management

Configuring the hardware

6 Configuring the hardware

This section is based on the previously created project. (see ["Your 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 the "LampTest" program to the Cyclic#1 task class.

- 1) Create a new configuration.
- 2) Assign the "LampTest" program to the software configuration.
["Adding existing programs manually" on page 23](#)
- 3) ["Testing in simulation mode" on page 28](#)
- 4) ["Adding I/O modules from the Hardware Catalog" on page 30](#)
- 5) ["Mapping process variables to I/O channels" on page 31](#)
- 6) ["Configuring the network interface of the controller" on page 33](#)
- 7) ["Build the project." on page 33](#)
- 8) ["Connection using "Browse for target systems"" on page 36](#)
- 9) [optional] ["Transferring Automation Runtime" on page 58³](#)
- 10) ["Online installation" on page 40](#)



This task consists of multiple subtasks that will be explained in detail in the linked sections.

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

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

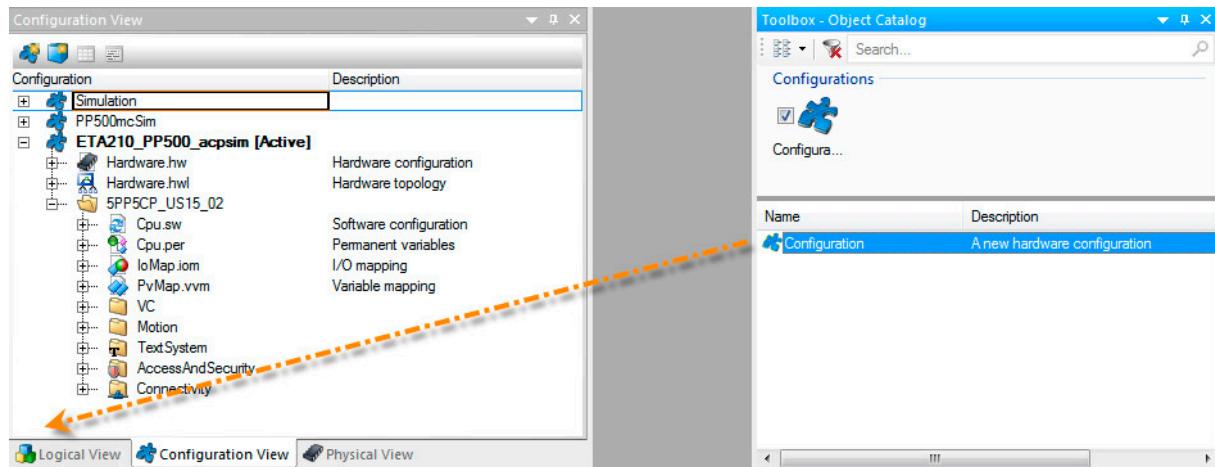
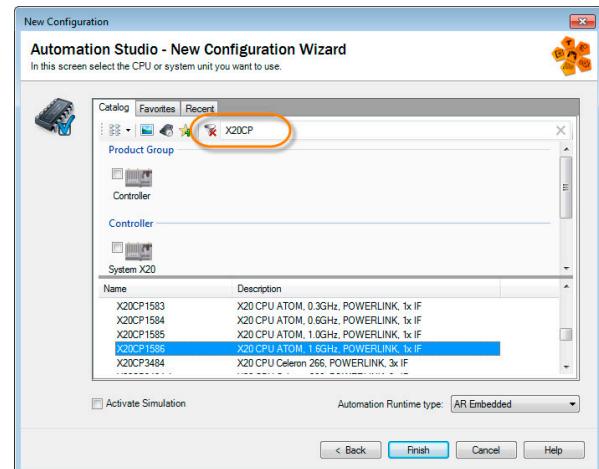


Figure 31: Add a new configuration in the Configuration View using the toolbox

Then select the desired controller in the wizard.



Exercise: Create a new configuration and allocate programs

In this exercise, we will add a new configuration with an X20 controller (e.g. X20CP1586) to our project.

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

We have already created the "LampTest" program using the Getting Started section.

Configuring the hardware

6.1 Testing in simulation mode

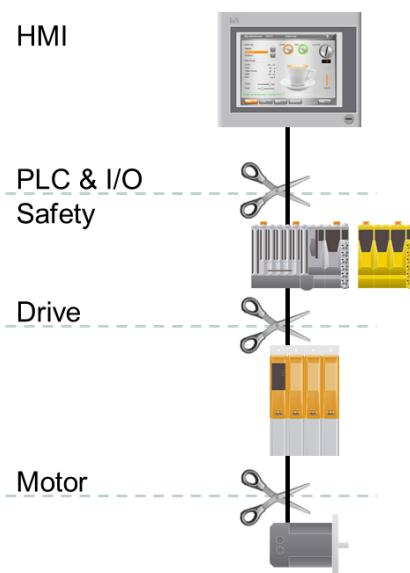


Figure 32: Complete simulation at every level

Automation Studio provides extensive simulation options for the controller, HMI, 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 instead be simulated. Motion 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 in 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.

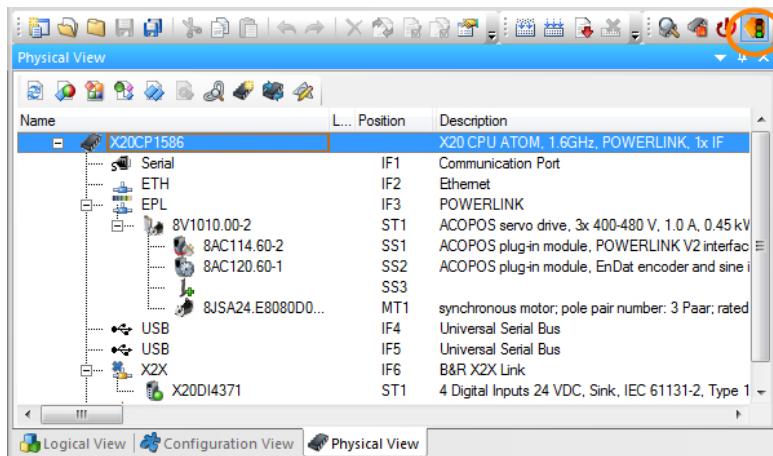


Figure 33: Activating controller simulation from the Automation Studio toolbar

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.

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.

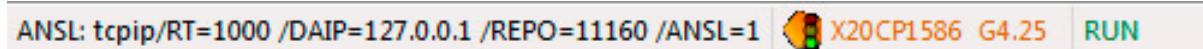
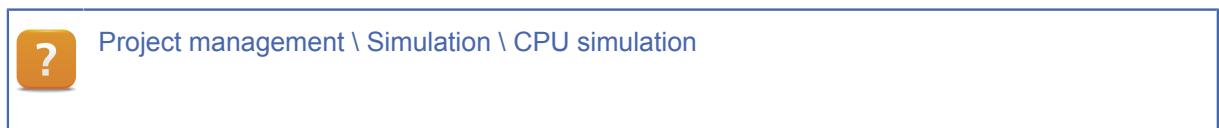


Figure 34: Automation Studio status bar - Simulation running



Exercise: Activate a simulation of the control system

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

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

See also:

- ° ["Online installation" on page 40](#)
- ° ["Offline installation" on page 43](#)

- 3) Testing the "LampTest" program



After the configuration has been transferred to ARsim, 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. You can tell whether the configuration is running in simulation mode using the traffic light icon in the status bar.

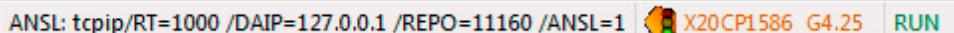


Figure 35: Automation Studio status bar - Simulation mode active

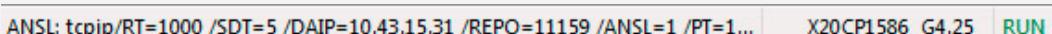


Figure 36: Automation Studio status bar - Connection to the real hardware

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

Configuring the 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 the System Designer. I/O modules can be dragged and dropped from the Hardware Catalog to the desired position.

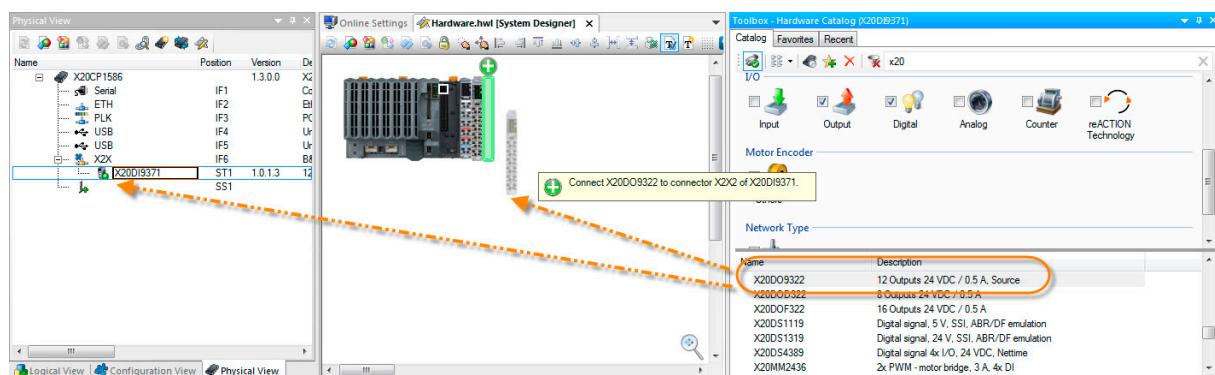


Figure 37: Assigning an I/O module via drag-and-drop



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

It is also possible to search for a particular module by entering all or part of its model number.

Exercise: Add a digital input and output module

In this exercise, two X20 modules will be added in the Physical View using the "Getting started" section of Automation Help a guide. The first is a digital input module (X20DI9371); the second is a digital output module (X20DO9322).

- 1) Open the help section:



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

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

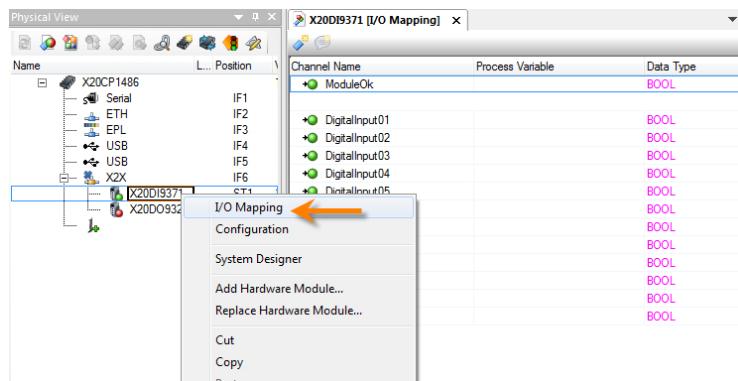


Figure 38: Open the I/O mapping for a module

Exercise: Assign process variables to I/O channels

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

- 1) Open the corresponding section in the help documentation:



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

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

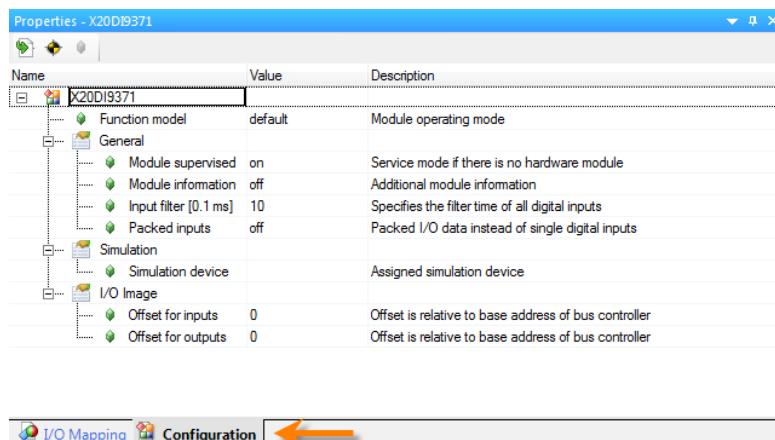


Programming \ I/O handling \ I/O mapping

Configuring the hardware

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.



Select one or more I/O modules or interfaces in the Physical View or in System Designer to update 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 in workbooks.

Figure 39: The Properties window is updated immediately when you select one or more modules.

The I/O configuration can only be opened by selecting **<Open>** / **<I/O configuration>** from the main menu or **<I/O configuration>** from the respective I/O module's shortcut menu.

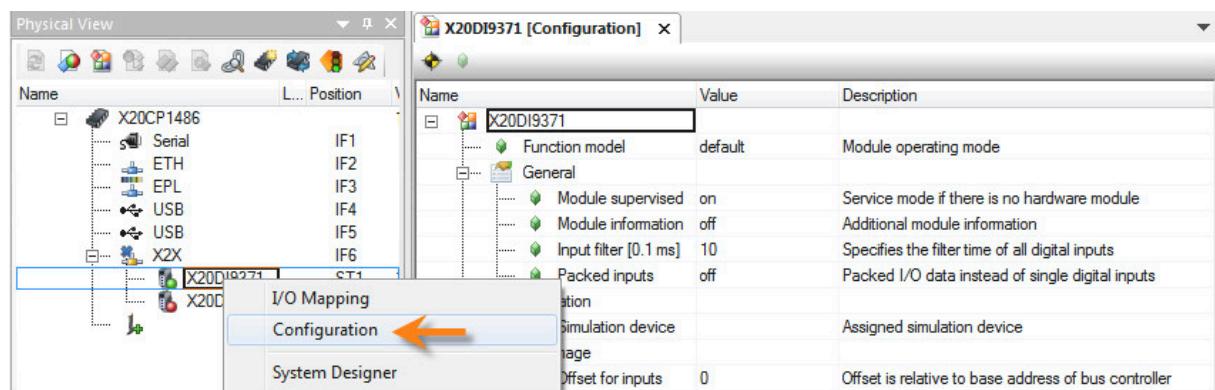


Figure 40: Opening a module's I/O configuration



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 Configuring 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.

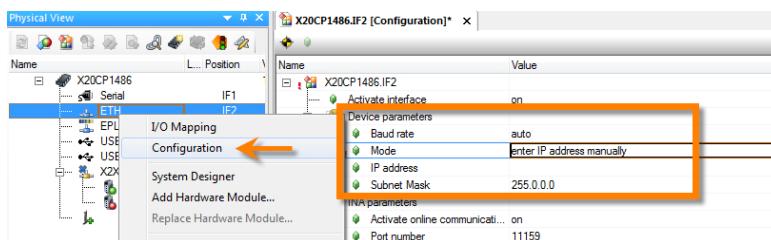


Figure 41: Opening and editing a controller's network settings

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



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 the integrated flash memory

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

Communication \ Ethernet \ AR configuration \ Interface configuration

6.6 Build the project.

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

Build the configuration.

Building a project will recompile all of the changes made since the last build.

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

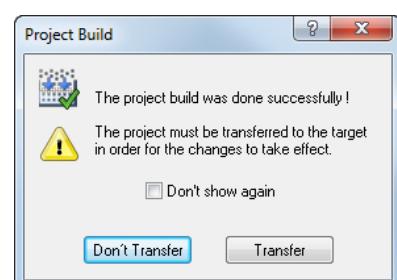


Figure 42: Dialog box indicating a successfully built configuration

A successful build is indicated in the output window.

Configuring the hardware

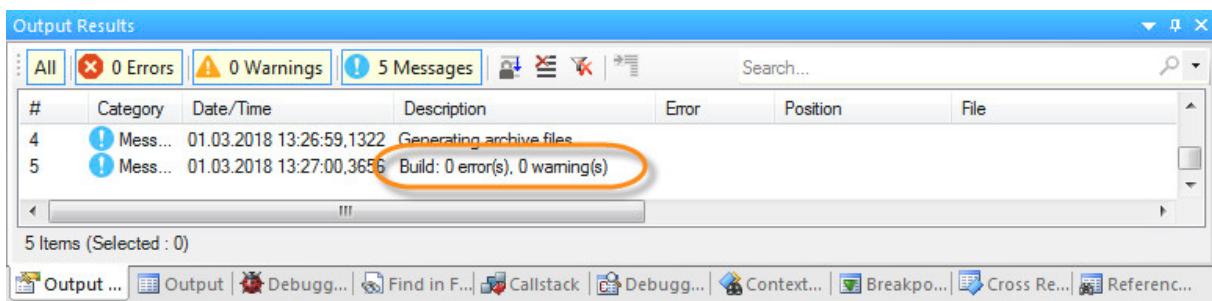


Figure 43: Output window: 0 errors, 0 warnings

Rebuild a configuration

When you recompile (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 compiled.



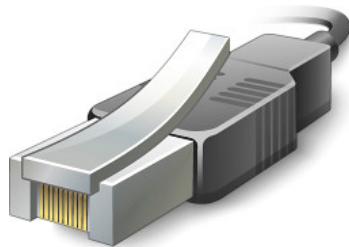
Programming \ Building and transferring projects \ Creating a project

7 Initial installation of the controller

To install the controller, it is necessary to transfer Automation Runtime (operating system), the system components and the application project. Whether installation is performed online, offline or via USB depends on the target system. Systems with integrated flash memory are delivered with preinstalled default Automation Runtime. This guarantees that a connection with Automation Studio is established and online installation can be carried out. Offline installation is available for systems with CompactFlash and CFast cards. Alternatively, USB installation is possible for any system.

Online installation

After a connection to the controller has been established, the Automation Studio project and Automation Runtime are transferred in full. It may be necessary to set the target system to BOOT mode using the reset button.



The following steps are necessary:

- ["Connection using "Browse for target systems"" on page 36](#)
- ["Online installation" on page 40](#)



It may be necessary to set the target system to BOOT mode using the reset button. Instructions on this can be found in the data sheet of the respective controller in section "System Flash programming".

Installation via data storage device

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



The following steps are necessary:

- ["Offline installation" on page 43](#) or
- ["USB installation" on page 43](#)



Programming \ Building and transferring projects \ Establishing a connection to the target system \ Ethernet connections

Project management \ Project installation

Initial installation of the controller

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 two ways to establish a connection:

- "[Connection using "Browse for target systems"" on page 36](#)
- "[Establish connection via manual configuration" on page 37](#)

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

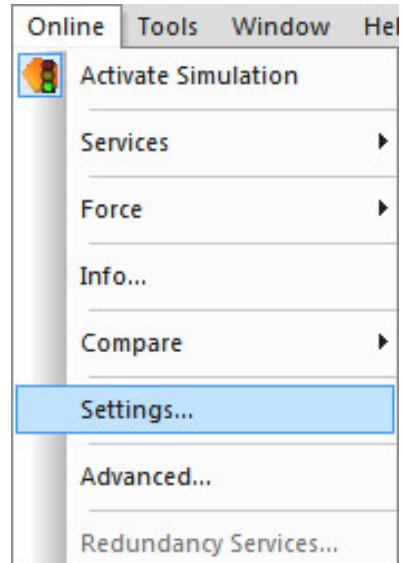


Figure 44: "Online" menu option



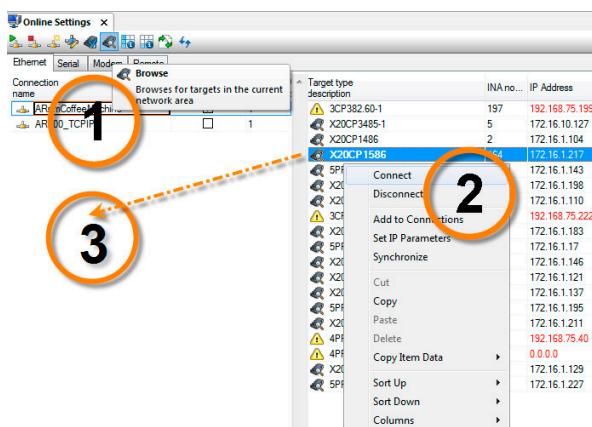
Programming \ Building and transferring projects \ Establishing a connection to the target system

Communication \ Online communication

Communication \ Ethernet \ FAQ

7.1.1 Connection using "Browse for target systems"

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



- 1) Browse the network by selecting the "Browse" icon in the toolbar. Results are listed in a new pane on the right.
- 2) Select "Connect" from the CPU's shortcut menu.
- 3) The connection can be dragged from the result list to the left pane

Figure 45: Browsing the network and connecting to the controller

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 to the project configuration directly. If the changes are not transferred, the original settings will be used again after the controller is restarted.

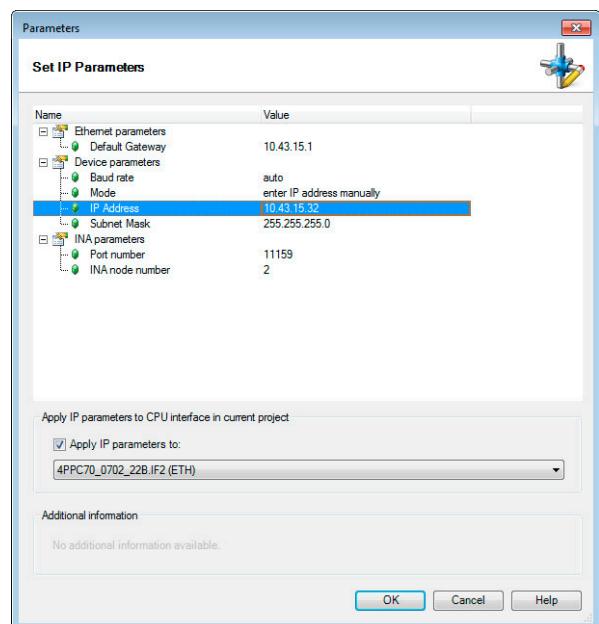


Figure 46: Temporary IP configuration



Programming \ Building and transferring projects \ Establishing a connection to the target system \ Ethernet connections

- Browse for targets
- Target system search \ Changing the IP configuration

Exercise: Connect to the controller

In this exercise, we will establish a connection to the controller. We will identify the controller on the network with target system search and then establish the online connection.

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

7.1.2 Establish 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.

Initial installation of the controller

- 1) Add a new connection using the icon in the toolbar.
- 2) Specify the connection parameters (IP address, node number).
- 3) Enable the new connection from its shortcut menu.

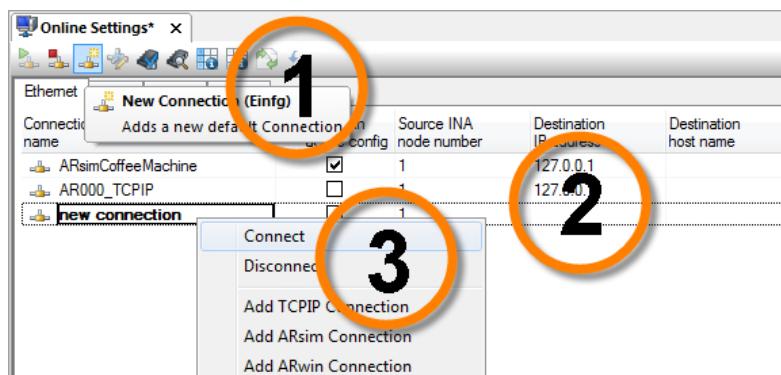


Figure 47: Add and configure a connection manually.



Programming \ Building and transferring projects \ Establishing a connection to the target system \ Ethernet connections



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

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

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

Figure 48: An online connection to the controller has been established. The controller is in BOOT mode.

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

`ANSL: tcpip/RT=1000 /SDT=5 /DAIP=10.43.15.34 /REPO=11159 /ANSL=1 /PT=1... 4PPC70.0573-20B I4.25` RUN

Figure 49: 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, 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.

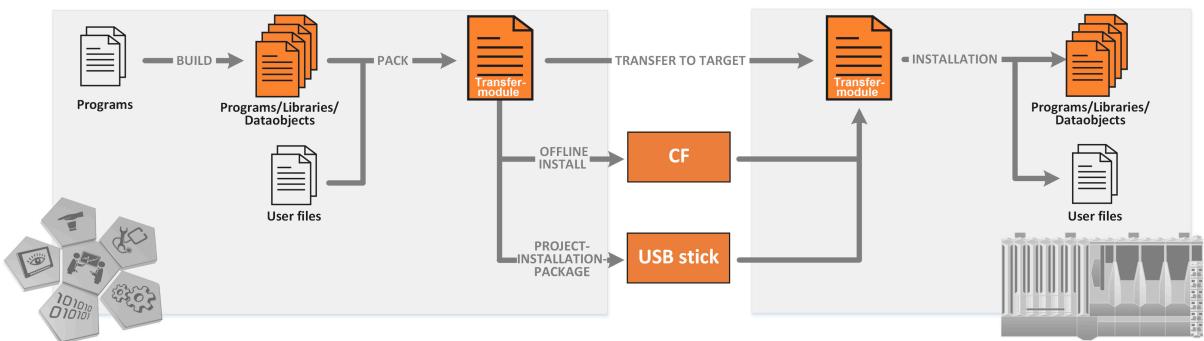


Figure 50: Project installation process

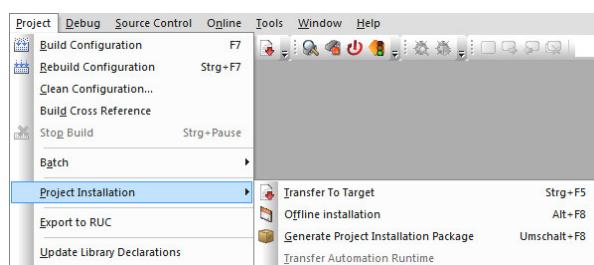


Figure 51: Open the project installation

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

- ["Online installation" on page 40](#)
- ["Offline installation" on page 43](#)
- ["USB installation" on page 43](#)



The entries in the Automation Studio menu can each be added to the Automation Studio toolbar.



Project management \ Project installation

- Overview
- Scenarios
- Performing project installation

Initial installation of the controller

7.2.1 Online installation

With Automation Runtime C4.25 and later, the Automation Runtime version is included in the transfer module and installed automatically.⁵, then the next step is to transfer the project.

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

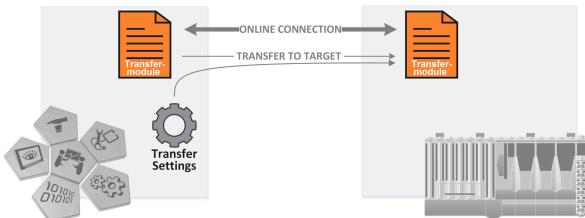


Figure 52: Online installation procedure

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 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.
- The transfer takes place to a data storage device (see "[Offline installation](#)" on page 43).
- The user forces an initial transfer in the transfer settings.

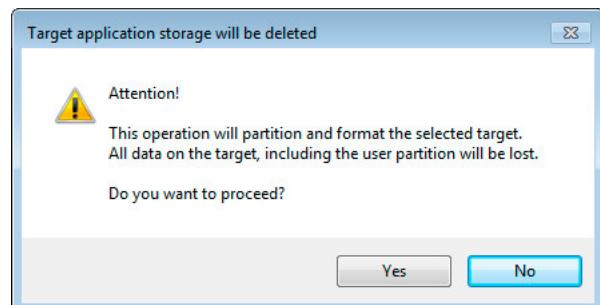
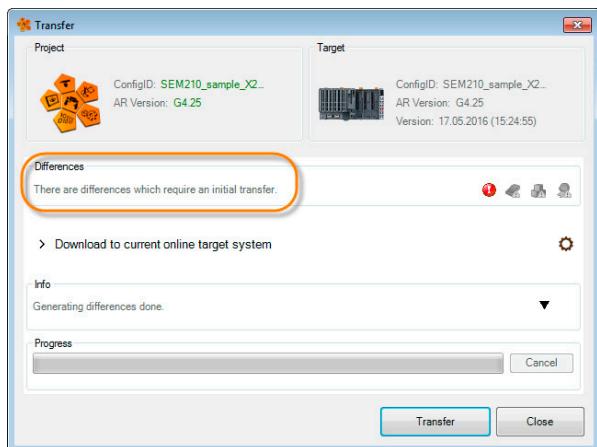


Figure 54: Note: The memory is formatted during an initial transfer

Figure 53: Transfer dialog box: initial transfer required

⁵ With Automation Runtime C4.25 and later, the Automation Runtime version is included in the transfer module and installed automatically. The installation for earlier Automation Runtime versions can be found here: "[Transferring Automation Runtime](#)" on page 58

Update transfer

Automation Studio will generally first attempt an update transfer on the target system. If 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.

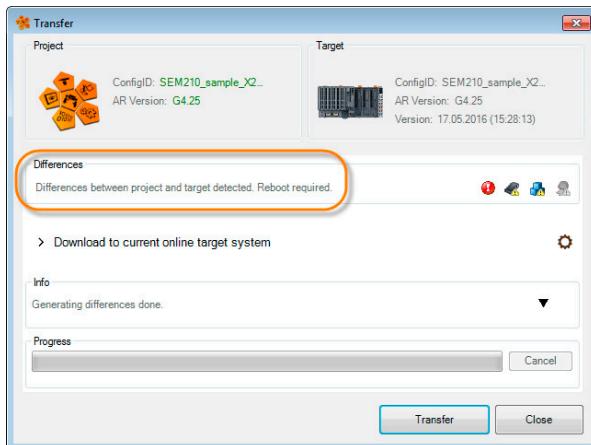


Figure 55: Transfer dialog box: differences require a restart.

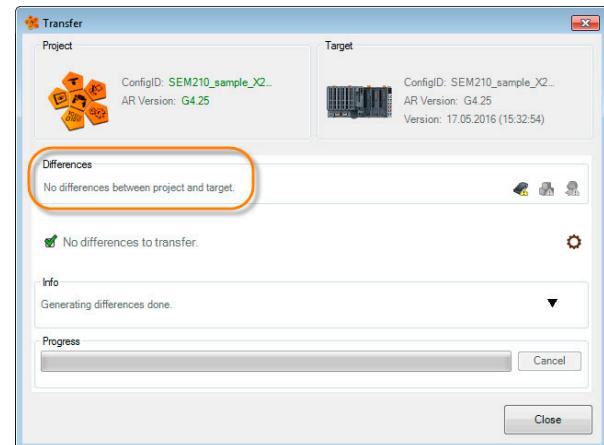


Figure 56: Transfer dialog box: no differences were identified between the project and the target system.



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 57: Additional information from notification icons in the transfer dialog box



Project management \ Project installation

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



Online installation generally occurs in RUN or SERVICE mode. If that is not possible, online installation can also be performed in BOOT mode.

See: ["Transferring Automation Runtime" on page 58](#)

Initial installation of the controller

Exercise: Perform online project installation

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

- 1) Building the project
- 2) Start online installation
- 3) Follow instructions in the transfer dialog box.
- 4) Confirm online installation
- 5) Wait for transfer and any restarts to complete



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

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

- 1) Enable monitor mode

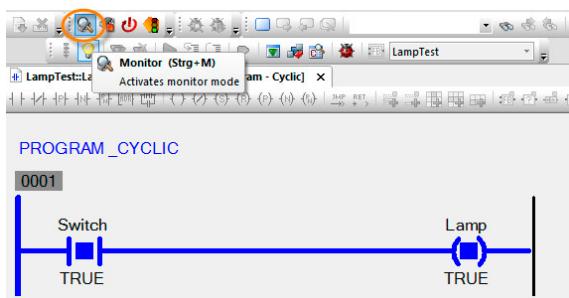


Figure 58: Ladder Diagram program "LampTest" in monitor mode with powerflow

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

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 than 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 "Offline installation" from the project installation menu.

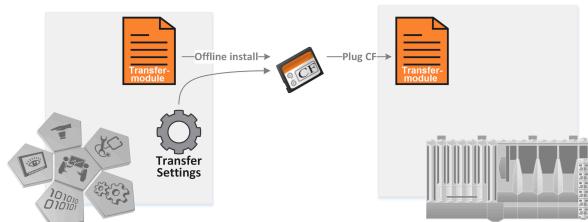


Figure 59: Offline installation procedure

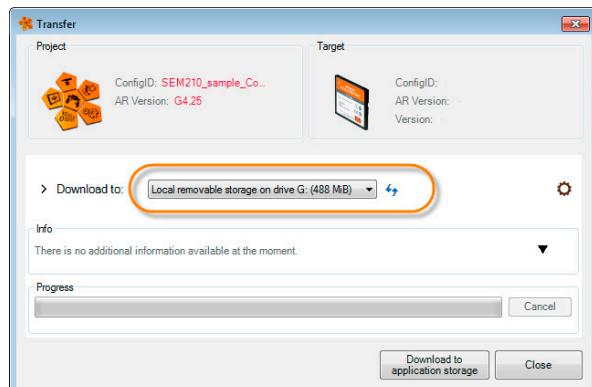


Figure 60: The dialog box for offline installation on a CompactFlash or CFast card

Automation Runtime simulation

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



Project management \ Project installation

- Performing project installation \ Offline installation
- Scenarios \ Offline commissioning

7.2.3 Project installation package - USB installation

Automation Runtime and the application software included in a project 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 USB flash drive.

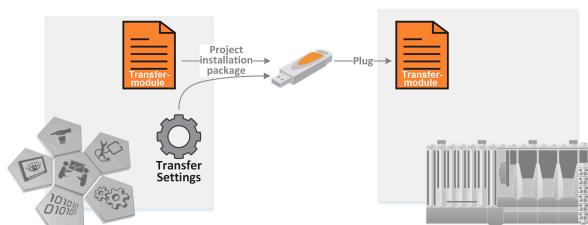


Figure 61: Procedure for generating project installation package

Initial installation of the controller

- First the Automation Studio project is compiled, then the project installation package is created and copied to a USB flash drive.
- The USB flash drive is inserted in the target system.
- The next time the controller starts, it checks the versions of Automation Runtime and the application software and updates them if necessary.
- Alternatively, the project installation package can be installed at runtime using library "ArProject".

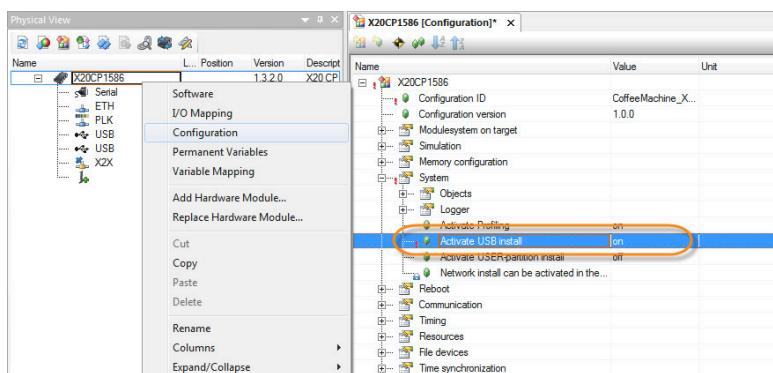


Figure 62: Enabling USB installation in system properties

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

Generate project installation package

The project installation package is generated by selecting "Generate project installation package".

In the dialog box, select a USB flash drive. Numerous installation settings make it possible to select exactly how to update the target system.

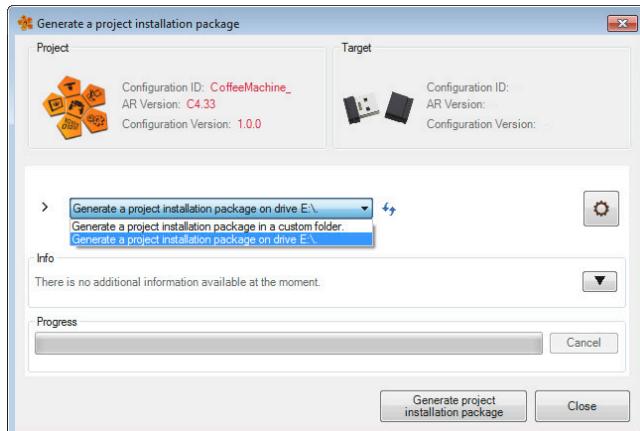


Figure 63: Generate project installation package on USB flash drive

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

The system can now be updated using the newly set-up USB flash drive.



The installation settings are used to configure target system identification, installation restrictions and handling of user data.



Project management \ Project installation

- Performing project installation \ Generating a project installation package
- Performing project installation \ Settings
- Scenarios

Programming \ Libraries \ Configuration, system information, runtime control \ ArProject

7.2.4 Runtime Utility Center export

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 Runtime Utility Center is included in the Automation Studio installation, or it can be downloaded separately from the B&R website.

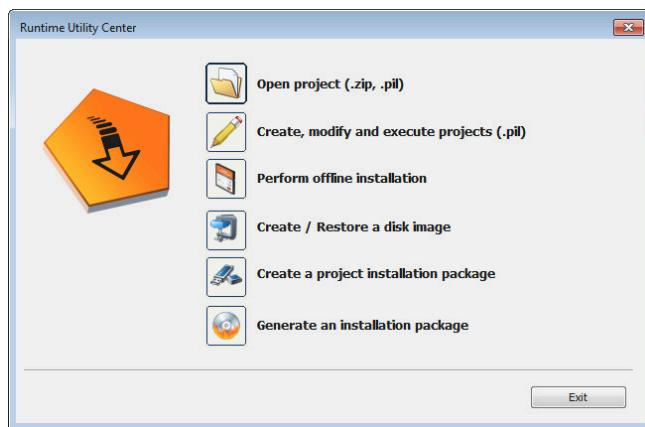


Figure 64: Runtime Utility Center - Start page

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



The Runtime Utility Center includes a complete help documentation. The help documentation can be started via the Windows start menu by selecting "Runtime Utility Center Help". The following entries provide additional important information about using the Runtime Utility Center.

Initial installation of the controller



- Runtime Utility Center \ Start page
- Runtime Utility Center \ Operation \ The Workspace
- Runtime Utility Center \ Operation \ Commands \ Establish connection, etc.
- 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 → Download "PVI Development Setup"

The screenshot shows the B&R website's 'Downloads' section. At the top, there are navigation links: Company, Industries, Technologies, Products, Events, and Academy. Below that is a breadcrumb trail: Homepage > Downloads. On the left, there's a sidebar with 'Product Groups' like Software, Industrial PCs and Panels, etc. On the right, under 'Software', 'Automation NET/PVI' is highlighted. At the bottom, there are filters for 'All Languages' and 'Latest Version'. A list of downloads is shown with 'Automation NET/PVI (4)' circled in orange with an arrow pointing to it.

Figure 65: Downloads section: Filter "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 66: Selecting the installation language

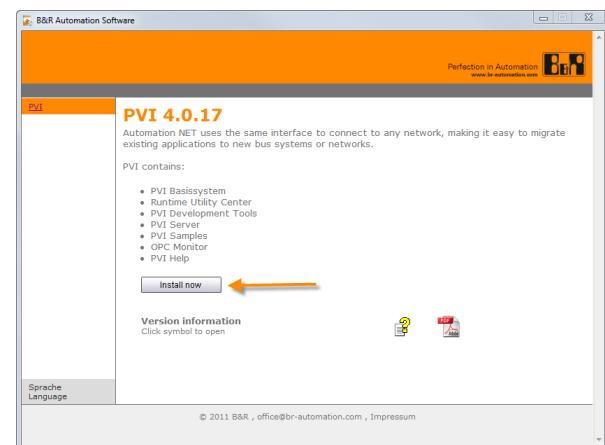


Figure 67: Select "Runtime Utility Center" →start installation

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.

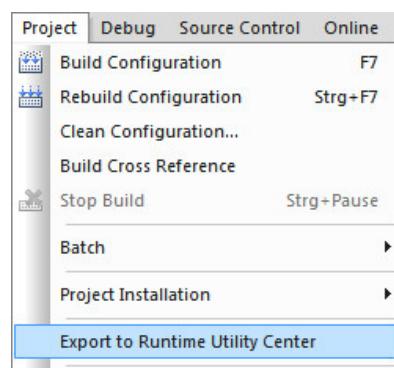


Figure 68: Runtime Utility Center (RUC) export in Automation Studio



Project management \ Project installation \ Performing project installation \ Export RUC

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:

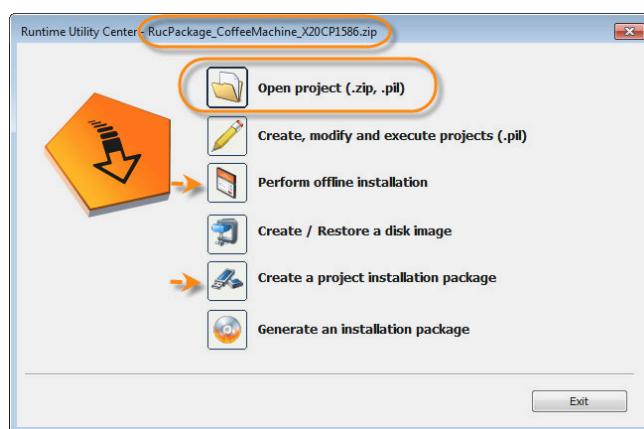


Figure 69: Runtime Utility Center start page with RUC export file already loaded

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



Runtime Utility Center \ Creating a list / data medium \ Project installation

- Offline installation
- Create a project installation package

8 Programming

A program is a POU (program organization unit, as 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	IEC61131	Comment	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 3: Overview of programming languages

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



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 subroutines

When a program is added using the toolbox, the cyclic program section, the initialization subroutine and the exit program are automatically added. Program sections that are not required can be deleted in the Logical View. A program must always have a cyclic program section.

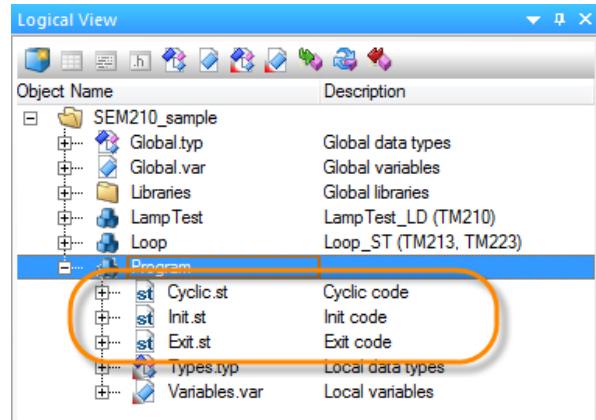


Figure 70: Image of a newly added program in the Logical View - initialization subroutine, cyclic program and exit program.

Task initialization

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

Cyclic subroutine

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

Exit subroutine

A task's exit program 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.



Additional information is included in the "TM213 – Automation Runtime" training module.



Real-time operating system \ Method of operation \ Runtime performance \ Tasks

Programming

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.

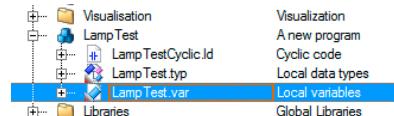


Figure 71: Variable declaration file

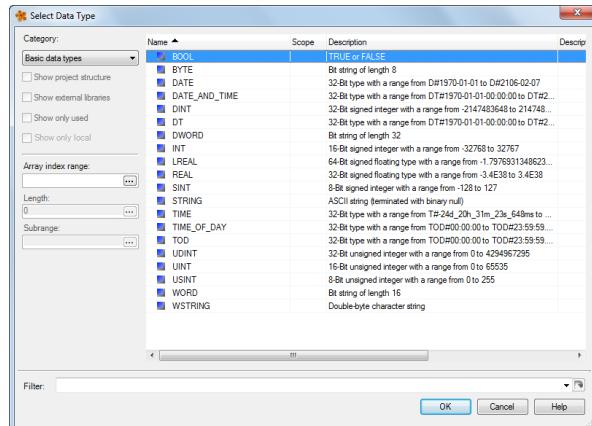


Figure 72: Variable data types

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

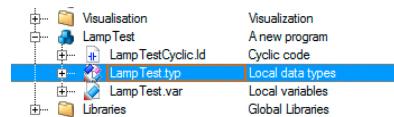


Figure 73: Data type declaration file



Programming \ Variables and data types

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

8.3.1 Variable scope

In the Logical View, you can structure the software as required using packages. This facilitates the simple encapsulation of data and functionality.

This structure determines the scope and visibility of the declared variables and data types. This allows you to define variables the appropriate "logical" place in the project.

Automation Studio controls the scope 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.

Objektname	Beschreibung
CoffeeMachine	Default project
Doc	Project Documentation
Global.typ	Global Data Types
Global.var	Global Variables
mainlogic	Main Logic Control
ConveyorBelt	Conveyor Control
conv_ini	Conveyor axis configuration
conveyor	Conveyor Logic Control
conveyor.var	Local variables
conveyorCyclic.Id	Cyclic code
Visualisation	Visualization
visGeneral.var	Paket Variablen
Visu	640x480 (VGA)
VisuCtrl	Visualization Control
visAlarm	Alarm Control
visTrend	Trend Control
VisuW	800x480 (WVGA)
Brewing.Assembly	Brewing & Dosing
FeederArm	Feeder Control
FlowHeater	Heater Control
Recipes	Coffee Recipes

Figure 74: Scopes in the Logical View

? Programming \ Variables and data types \ Scope of declarations

8.3.2 Initializing and buffering variables

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

Name	Type	& Reference	Constant	Retain	Value
* COPYRIGHT – B&R					
* Program: visCtrl					
* File: visCtrl.var					
* Author: B&R					
* Created: June 20, 2007					
* Local variables of program visCtrl					
systemHMI	sysset_typ				
date Time	DATE_AND_TIME				DT#1970-01-01-00:00:00
systemSetTime	DTSetTime				
systemGetTime	DTGetTime				
cmdStartCoffee	BOOL				FALSE
setPage	UINT				0
setPageOld	UINT				0
initTimeoutEnable	BOOL				TRUE
sP31_AlarmHistoryPage	UINT				31
sP20_TrendPage	UINT				20
sP30_AlarmPage	UINT				30
sP00_StartPage	UINT				0
sP11_TakeoutPage	UINT				11

Figure 75: Example of a variable declaration

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.

Constants are variables whose values cannot be changed while a 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.



Programming \ Variables and data types

Real-time operating system \ Method of operation \ Module / data security \

- Power-off handling
- Power-on handling

8.4 Creating an application

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

8.4.1 Libraries, samples and solutions

The standard libraries delivered with Automation Studio give users access to many different 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, which demonstrate how the libraries can be used. These encompass executable program code 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 users an easy-to-use interface for implementing 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 76: mapp Technology logo

⁸ mapp Technology stands for "Modular APPlication technology".

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 component without programming.

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

mapp Technology \ Concept

- Services \ mapp Services \
- Visualization \ mapp View \
- Motion \ mapp Motion \
- Mechatronics \ mapp Control \
- Project management \ Workspace \ Upgrades

8.5 Import, export and team functions

Working in a team means that the various responsibilities have to be divided up between team members. Automation Studio includes 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 source 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 menu option **<File>/<Save project as Zip without upgrades>** from the Logical View.

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

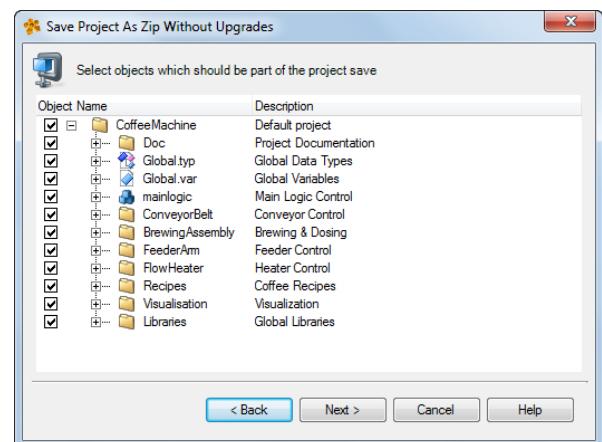


Figure 77: Exporting software components from the Logical View



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.

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

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

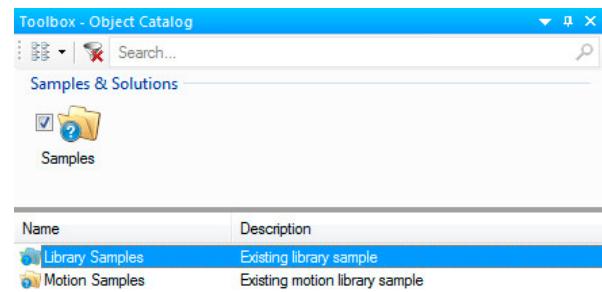


Figure 78: Adding samples from the toolbox



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 the function of the Upgrades dialog box as well as Technology Guarding.

9.1 Hardware and software upgrade

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

Upgrading components online is handled directly in Automation Studio.

The upgrade process is started by selecting **<Tools> / <Upgrades>** from the menu. A dialog box opens, showing available upgrades. Once upgrades have been selected, they are downloaded in the background and installed automatically.

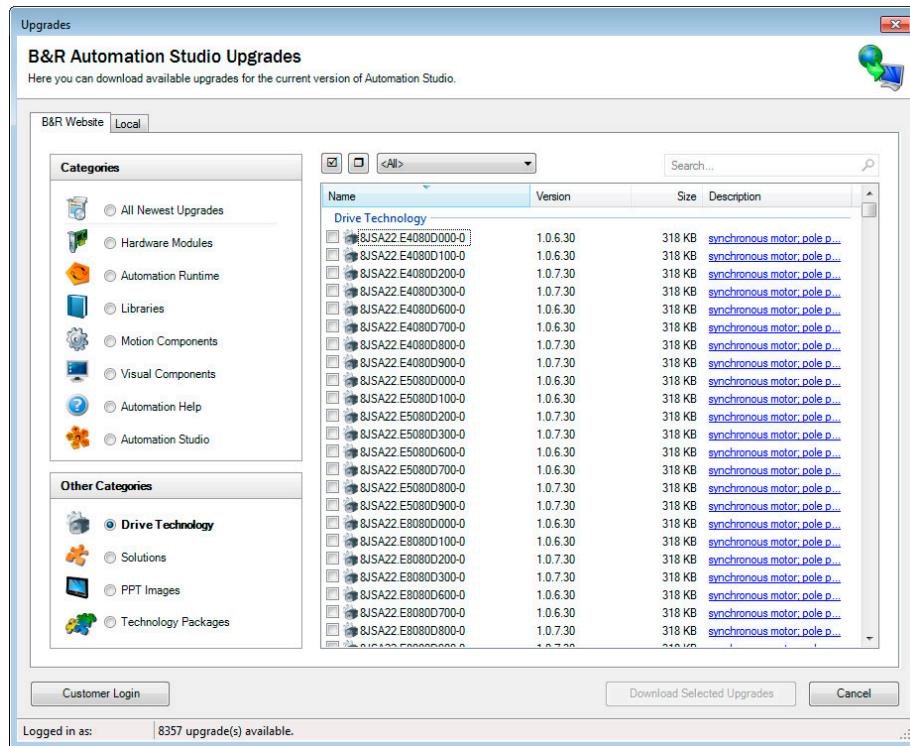


Figure 79: Selecting subsequently loadable components in Automation Studio



Project management \ Workspace \ Upgrades

Updates and licenses

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 users 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 the AsGuard library in the application software.

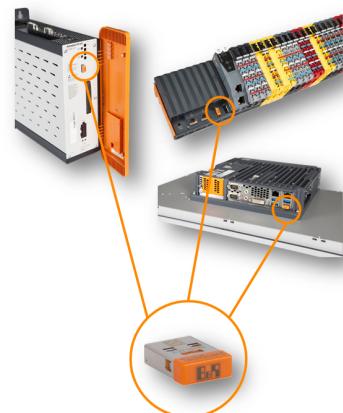


Figure 80: Technology Guard for license protection on the machine

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 lifecycle of a machine – from initial testing to finished project.

Whether it's being able to clearly structure software to match the functions of the machine, working with different configurations to design multiple variants of the same machine or working together concurrently in a team on the same project – Automation Studio always has the right tools for the job at hand.

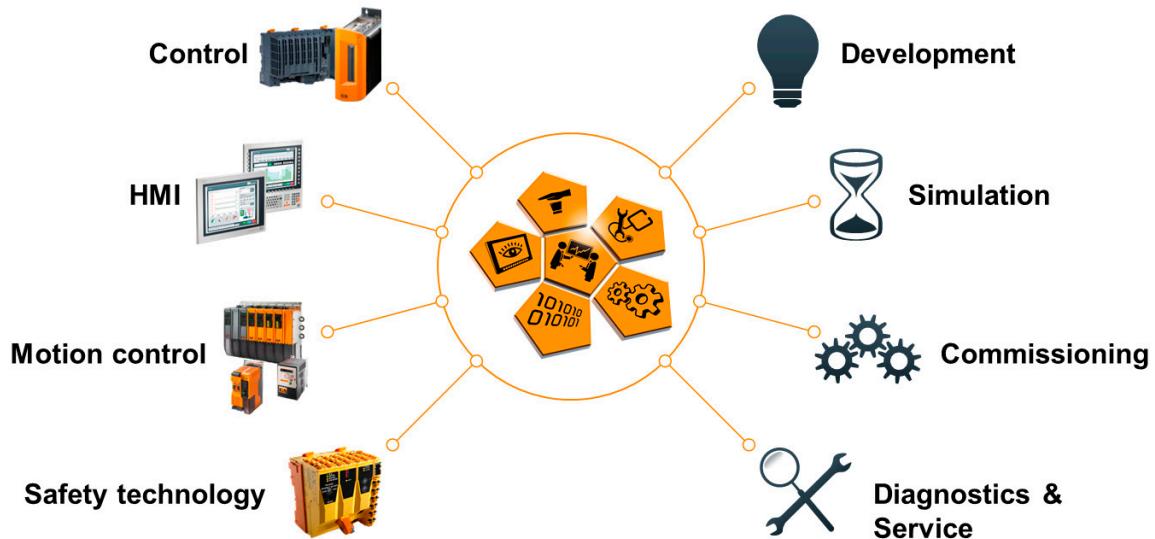


Figure 81: Automation Studio: one engineering tool for the machine's entire lifecycle

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

Appendix

11 Appendix

11.1 Transferring Automation Runtime

If the Automation Studio project is to be transferred via online installation, then an intermediate step is required, depending on the previously installed version of Automation Runtime. In this step, Automation Runtime is installed on the target system.



Starting with Automation Runtime C4.25 this step is no longer necessary. In newer versions, Automation Runtime is already contained in the transfer package.

There is a wizard to assist you through the process of transferring Automation Runtime. It is recommended to select the 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 in advance.

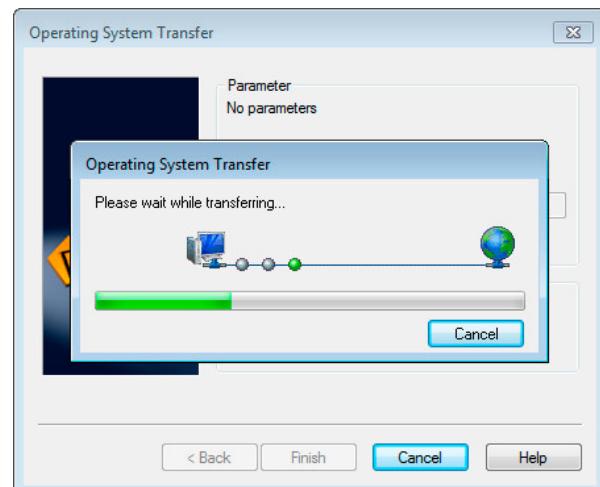
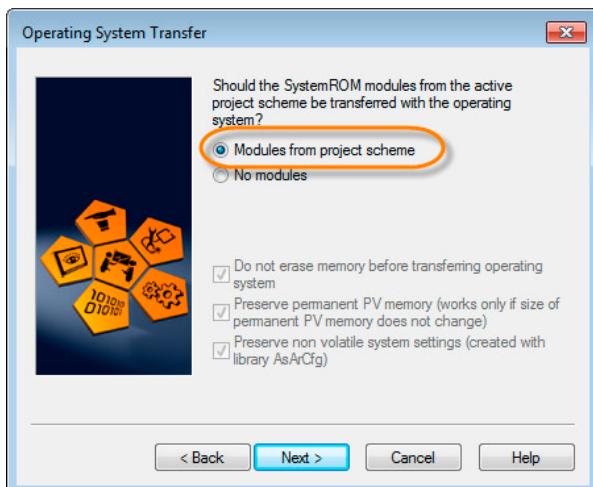


Figure 82: Transferring Automation Runtime: Transferring modules from the project scheme

Figure 83: Transferring Automation Runtime: Progress indicator



All target systems have the option of deliberately starting in BOOT mode. Depending on the target system, this is done using a reset button, the 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 from default Runtime⁹ Browsing for target systems via SNMP¹⁰ is also supported for SG4 systems with V3.06 and later.

⁹ The default Automation Runtime is a reduced variant of Automation Runtime that is preinstalled on all controllers. For example, the default Automation Runtime boots from flash memory.

¹⁰ The Simple Network Management Protocol is a network protocol used to monitor and control devices on a network from a central location (e.g. routers, servers, switches, printers, computers, etc.).



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

Hardware \ Power Panel \ Power Panel C70 \

- Installation \ Commissioning
- Device description \ Operating and connection elements \ Button for reset and 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) Establish a connection to the controller via "Browse for target systems" function.
- 2) [optional] Put the target system into BOOT mode via the reset button, the mode selector switch or node number selector switch.
- 3) Checking the installed Automation Runtime version
- 4) Perform online project installation



After Automation Runtime has been transferred, the controller is in RUN mode. Now, the entire project can 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 84: Automation Runtime transferred successfully. Connection established. The controller is in RUN mode.

Further information

Further information

Further sources of information are available to deepen participants understanding of the previous topics.



Topic	Source
Closer analysis of the configuration in Automation Studio and the runtime environment	TM213 - Automation Runtime
Diagnostic tools in Automation Studio	TM223 – Automation Studio diagnostics
Programming languages	<p>TM240 – Ladder Diagram (LD) TM241 - Function Block Diagram (FBD) TM242 - Sequential Function Chart (SFC) TM246 - Structured Text (ST)</p>
Programming, memory management, mapp Services	TM250 - Memory management and data processing
Configuration and programming of motion components	TM400 and following training modules
Configuration and programming of safety technology	TM500 and following training modules
Configuration of HMI applications	TM600 and following training modules

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Topic categories:

- ⇒ Control technology
- ⇒ Motion control
- ⇒ Safety technology
- ⇒ HMI
- ⇒ Process control
- ⇒ Diagnostics and service
- ⇒ POWERLINK and openSAFETY

ETA system



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www.br-automation.com/academy



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TM210TRE.444-ENG