EcoStruxure™ Control Engineering Verification

User Guide

Original instructions

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www.se.com

Legal Information

The information provided in this document contains general descriptions, technical characteristics and/or recommendations related to products/solutions.

This document is not intended as a substitute for a detailed study or operational and site-specific development or schematic plan. It is not to be used for determining suitability or reliability of the products/solutions for specific user applications. It is the duty of any such user to perform or have any professional expert of its choice (integrator, specifier or the like) perform the appropriate and comprehensive risk analysis, evaluation and testing of the products/solutions with respect to the relevant specific application or use thereof.

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Safety Information

Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Before You Begin

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

⚠WARNING

UNGUARDED EQUIPMENT

- Do not use this software and related automation equipment on equipment which does not have point-of-operation protection.
- Do not reach into machinery during operation.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

This automation equipment and related software is used to control a variety of industrial processes. The type or model of automation equipment suitable for each application will vary depending on factors such as the control function required, degree of protection required, production methods, unusual conditions, government regulations, etc. In some applications, more than one processor may be required, as when backup redundancy is needed.

Only you, the user, machine builder or system integrator can be aware of all the conditions and factors present during setup, operation, and maintenance of the machine and, therefore, can determine the automation equipment and the related safeties and interlocks which can be properly used. When selecting automation and control equipment and related software for a particular application, you should refer to the applicable local and national standards and regulations. The National Safety Council's Accident Prevention Manual (nationally recognized in the United States of America) also provides much useful information.

In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the operator's hands and other parts of the body are free to enter the pinch points or other hazardous areas and serious injury can occur. Software products alone cannot protect an operator from injury. For this reason the software cannot be substituted for or take the place of point-of-operation protection.

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

NOTE: Coordination of safeties and mechanical/electrical interlocks for point-of-operation protection is outside the scope of the Function Block Library, System User Guide, or other implementation referenced in this documentation.

Start-up and Test

Before using electrical control and automation equipment for regular operation after installation, the system should be given a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such a check are made and that enough time is allowed to perform complete and satisfactory testing.

⚠WARNING

EQUIPMENT OPERATION HAZARD

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
- Remove tools, meters, and debris from equipment.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and temporary grounds that are not installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove all temporary grounds from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

Operation and Adjustments

The following precautions are from the NEMA Standards Publication ICS 7.1-1995:

(In case of divergence or contradiction between any translation and the English original, the original text in the English language will prevail.)

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer’s instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer’s instructions and the machinery used with the electrical equipment.
- Only those operational adjustments required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

About the Book

Document Scope

The present user guide describes the functionality provided by EcoStruxure Control Engineering - Verification.

Validity Note

This document has been updated for the release of EcoStruxure Control Engineering V24.2.

Available Languages of this Document

This document is available in these languages:

- English (EIO0000004424)
- French (EIO0000004772)

Related Documents

Title of documentation	Reference number
EcoStruxure Control Engineering - Converter - User Guide	EIO0000004425 (eng) EIO0000004773 (fre)
EcoStruxure Control Engineering - Documentation - User Guide	EIO0000004426 (eng) EIO0000004774 (fre)
EcoStruxure Control Engineering - Monitoring - User Guide	EIO0000004427 (eng) EIO0000004775 (fre)
Cybersecurity Best Practices	CS-Best-Practices-2019-340
EcoStruxure Control Engineering, Hardening Guide	EIO0000004982 (eng)

To find documents online, visit the Schneider Electric download center (www.se.com/ww/en/download/).

Product Related Information

⚠WARNING

LOSS OF CONTROL

- Perform a Failure Mode and Effects Analysis (FMEA), or equivalent risk analysis, of your application, and apply preventive and detective controls before implementation.
- Provide a fallback state for undesired control events or sequences.
- Provide separate or redundant control paths wherever required.
- Supply appropriate parameters, particularly for limits.
- Review the implications of transmission delays and take actions to mitigate them.
- Review the implications of communication link interruptions and take actions to mitigate them.
- Provide independent paths for control functions (for example, emergency stop, over-limit conditions, and error conditions) according to your risk assessment, and applicable codes and regulations.
- Apply local accident prevention and safety regulations and guidelines.[1]
- Test each implementation of a system for proper operation before placing it into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

[1] For additional information, refer to NEMA ICS 1.1 (latest edition), *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control* and to NEMA ICS 7.1 (latest edition), *Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems* or their equivalent governing your particular location.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Perform a risk assessment as per ISO 12100 and/or other equivalent assessment in view of your use of EcoStruxure Control Engineering.
- In your risk assessment, consider all applicable regulations and standards that apply to your development process and to your machine/process.
- Verify that your use of EcoStruxure Control Engineering is fully covered in the definition of your software development process and that your software development process meets all applicable regulations and standards.
- After modifications of any type whatsoever to the source code of your application resulting from your use of EcoStruxure Control Engineering, commission or recommission the machine/process in compliance with all regulations, standards, and process definitions applicable to your machine/process.
- During commissioning or recommissioning of the machine/process, verify the correct operation and effectiveness of all safety-related functions and non-safety-related functions by performing comprehensive tests for all operating states, for the defined safe state of your machine/process, and for all potential error situations.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

No tool can provide analysis procedures for all potential types of code and methods of creating code. For example, a code block in your source code may be semantically invalid, but syntactically correct. The tool may not be able to detect such a condition.

Software development environments may provide code protection features intended to, for example, block access to intellectual property. Unlock such protected code blocks in your software development environment before creating export files to be used with EcoStruxure Control Engineering.

⚠WARNING

INCORRECT OR INCOMPLETE SOURCE CODE ANALYSIS

- In your risk assessment, consider all potential effects of inappropriate, incorrect, or incomplete input files used with EcoStruxure Control Engineering.
- Verify that the source code exported from your software development environment and to be used by EcoStruxure Control Engineering is complete and up to date.
- After modifications of any type whatsoever to the source code of your application resulting from your use of EcoStruxure Control Engineering, verify the correctness of the modified source code.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

EcoStruxure Control Engineering - Verification may not be able to detect incorrect or incomplete source code, depending on, for example, the analysis rules used. The Schneider Electric default rules files are provided as are.

⚠WARNING

INCORRECT OR INCOMPLETE SOURCE CODE ANALYSIS

Do not use the Schneider Electric default rules files, or rules files created or modified by you in EcoStruxure Control Engineering without verifying their appropriateness and completeness for the task at hand by appropriate measures such as test cases.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Machines, controllers, and related equipment are usually integrated into networks. Unauthorized persons and malware may gain access to the machine as well as to other devices on the network/fieldbus of the machine and connected networks because of insufficiently secure access to software and networks.

Schneider Electric adheres to industry best practices in the development and implementation of control systems. This includes a "Defense-in-Depth" approach to secure an Industrial Control System. This approach places the controllers behind one or more firewalls to restrict access to authorized personnel and protocols only.

⚠ WARNING

UNAUTHENTICATED ACCESS AND SUBSEQUENT UNAUTHORIZED MACHINE OPERATION

- Evaluate whether your application environments are connected to your critical infrastructure and, if so, take appropriate steps in terms of prevention, based on Defense-in-Depth, before connecting the automation system to any network.
- Limit the number of devices connected to a network to the minimum necessary.
- Isolate your industrial network from other networks inside your company.
- Protect any network against unintended access by using firewalls, VPN, or other, proven security measures, such as an Intrusion Prevention System or Intrusion Detection System.
- Monitor activities within your systems.
- Prevent subject devices from direct access or direct link by unauthorized parties or unauthenticated actions.
- Install certificates that are issued by publicly known Trusted Certificate Authorities.
- Keep your systems up-to-date and rely only on legitimate sources.
- Prepare a recovery plan including backup of your system and process information.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

For more information on organizational measures and rules covering access to infrastructures, refer to ISO/IEC 27000 series, Common Criteria for Information Technology Security Evaluation, ISO/IEC 15408, IEC 62351, ISA/IEC 62443, NIST Cybersecurity Framework, Information Security Forum - Standard of Good Practice for Information Security, and refer to Cybersecurity Guidelines for EcoStruxure Machine Expert, Modicon and PacDrive Controllers and Associated Equipment.

For reasons of Internet security, for those devices that have a native Ethernet connection, TCP/IP forwarding is disabled by default. Therefore, you must manually enable TCP/IP forwarding. However, doing so may expose your network to possible cyberattacks if you do not take additional measures to protect your enterprise. In addition, you may be subject to laws and regulations concerning cybersecurity.

⚠ WARNING

UNAUTHENTICATED ACCESS AND SUBSEQUENT NETWORK INTRUSION

- Observe and respect any and all pertinent national, regional and local cybersecurity and/or personal data laws and regulations when enabling TCP/IP forwarding on an industrial network.
- Isolate your industrial network from other networks inside your company.
- Protect any network against unintended access by using firewalls, VPN, or other, proven security measures.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Consult the Schneider Electric Cybersecurity Best Practices for additional information.

Information on Non-Inclusive or Insensitive Terminology

As a responsible, inclusive company, Schneider Electric is constantly updating its communications and products that contain non-inclusive or insensitive terminology. However, despite these efforts, our content may still contain terms that are deemed inappropriate by some customers.

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in the information contained herein, or that appear in or on the products themselves, are generally derived from the terms or definitions of international standards.

In the area of functional safety systems, drives and general automation, this may include, but is not limited to, terms such as *safety*, *safety function*, *safe state*, *fault*, *fault reset*, *malfunction*, *failure*, *error*, *error message*, *dangerous*, etc.

Among others, these standards include:

Standard	Description
IEC 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2023	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2013	Safety of machinery: Electro-sensitive protective equipment. Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
IEC 62061:2021	Safety of machinery - Functional safety of safety-related electrical, electronic, and electronic programmable control systems
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements.
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784-3:2021	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions.
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

In addition, terms used in the present document may tangentially be used as they are derived from other standards such as:

Standard	Description
IEC 60034 series	Rotating electrical machines
IEC 61800 series	Adjustable speed electrical power drive systems
IEC 61158 series	Digital data communications for measurement and control – Fieldbus for use in industrial control systems

Finally, the term *zone of operation* may be used in conjunction with the description of specific hazards, and is defined as it is for a *hazard zone* or *danger zone* in the *Machinery Directive* (*2006/42/EC*) and *ISO 12100:2010*.

NOTE: The aforementioned standards may or may not apply to the specific products cited in the present documentation. For more information concerning the individual standards applicable to the products described herein, see the characteristics tables for those product references.

Introduction to EcoStruxure Control Engineering - Verification

Overview

EcoStruxure Control Engineering - Verification (formerly known as PLC Checker) is a static code analysis tool that evaluates the code for industrial controllers used in automation. The tool helps to verify that the code respects the specified design and programming rules. In addition, the tool provides information on key metrics. You can use default rules or create your own rules for the verification.

EcoStruxure Control Engineering - Verification supports, for example, code development or code migration processes by providing methods of determining the quality of a controller application, as well as monitoring the development progress and helping ensure process quality with consistent, automated code reviews and code audits.

The code verification results are available in two views:

- **Dashboard** view: Graphical overview as a summary
- **Result details** view: List of messages indicating non-conformities

EcoStruxure Control Engineering - Verification is a Software as a Service (SaaS) tool accessible using a web browser. It is an agnostic tool and supports controller applications written for a variety of controller types and models such as EcoStruxure™ Control Expert (formerly Unity Pro), EcoStruxure™ Machine Expert, PL7-PRO, Siemens TIA Portal, Siemens Simatic Step 7, Rockwell Automation® RSLogix 5000®.

Workflow

The typical workflow for EcoStruxure Control Engineering - Verification includes:

- Register for EcoStruxure Control Engineering - Verification, either with the cloud version or with the dedicated server for your organization.
- Obtain licenses for working with EcoStruxure Control Engineering - Verification. You can start with a free trial license to evaluate the functionality and then upgrade to license plans adapted to the requirements of your organization.
- Create the work structure by establishing one or multiple projects.
- Create one or more programs to use the code verification features of EcoStruxure Control Engineering - Verification, including:
  - Exporting the code of your controller application and uploading the code to EcoStruxure Control Engineering - Verification.
  - Preparing a rules file that defines the criteria for analyzing your controller application. Default rules files are available for immediate use and can be customized to meet your requirements.
- Review the results provided by EcoStruxure Control Engineering - Verification.

Registration, Login, Account Settings, Licenses and Sessions

Registration

Overview

The EcoStruxure Control Engineering tools are accessible using the cloud version or using a dedicated server for your organization.

The URL of the cloud version is https://ecostruxure-control-engineering.se.app/.

If a dedicated server has been set up for your organization, the URL is available from your system administrator.

In both cases, you must create a user account to use the tools.

Browser Compatibility

The following web browsers are supported:

- Mozilla Firefox from version 102
- Google Chrome from version 127
- Microsoft Edge from version 127
- Apple Safari from version 17

Account Types

The following types of accounts are available:

- For the cloud version: Schneider Electric Account
- For the dedicated server version: EcoStruxure Control Engineering Account

Registration with the Cloud Version

Registration procedure:

Step	Action
1	Go to https://ecostruxure-control-engineering.se.app/.
2	Click **Use a Schneider Electric Account**.
3	Click **Register**.
4	Enter your registration information and complete the registration by following the on-screen instructions.

Registration with the Dedicated Server Version

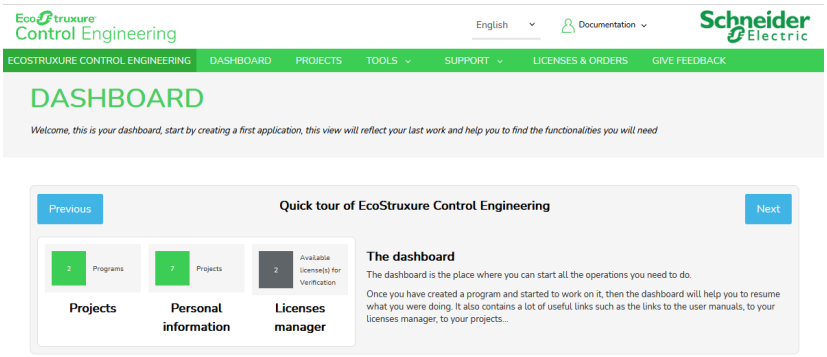
Contact your system administrator to coordinate the registration before you begin the registration procedure.

Registration procedure:

Step	Action
1	In your browser, go to the URL of the dedicated server.
2	Click **Sign up**.
3	Fill in the form with your first and last names, your phone number, your e-mail address (which is used as your identifier) and select a password. Password requirements: • At least one uppercase character • At least one lowercase character • At least one numerical character • At least one special character (such as ”{”, ”/”, “$”) • Password length at least 12 characters
4	Read the *Terms and Conditions* and, if you agree, select **I agree to the Terms and Conditions**.
5	Click **Sign Up**. **Result**: If the dedicated server version is configured to send emails, a verification e-mail is sent to you. If the dedicated server version is not configured to send emails, your account is activated immediately.
6	If the verification e-mail is sent to you: The email contains a link that you must follow. **Result**: Your account is activated.

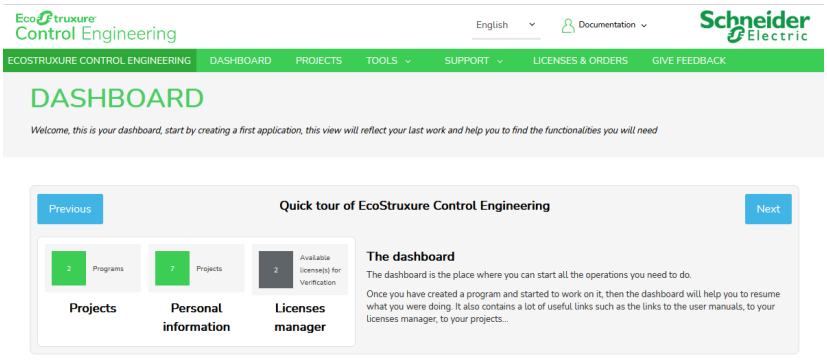
Login

Logging into the Cloud Version Using a Schneider Electric Account

Step	Action
1	When your registration on the Schneider Electric account is completed and your account is ready, go to https://ecostruxure-control-engineering.se.app/.
2	Click **Use a Schneider Electric Account**.
3	Enter your email address, click **Next** and then enter your password. **Result**: After validation, you are redirected to your dashboard. 

NOTE: If you use an EcoStruxure Control Engineering account but want to migrate to a Schneider Electric account, create a Schneider Electric user account that uses the same email address as your EcoStruxure Control Engineering account. After the first login with a Schneider Electric account, subsequent logins must be completed using your Schneider Electric account. For more information on Schneider Electric accounts, contact your local Schneider Electric service representative.

Logging into the Dedicated Server Version Using an EcoStruxure Control Engineering Account

Step	Action
1	In your browser, go to the URL of the dedicated server.
2	Enter your email address and password.
3	Click **Login**. **Result**: After validation, you are redirected to your dashboard. 

Account Settings

Account Settings if a Schneider Electric Account is Used

The **Settings** page lets you access the personal information of the account and the global EcoStruxure Control Engineering platform settings.

Step	Action
1	In the **Dashboard** window, click  . **Result**: A menu is displayed.
2	Click **Settings**. **Result**: The **Settings** page is displayed.

The **Schneider Electric Profile** tab displays your personal information such as the identity, phone number and country. To update this information, you must edit your Schneider Electric profile, which is accessible using the **Schneider Electric Account** button.

The **Third-Party Apps Settings** tab allows you to generate a password to connect your application to EcoStruxure Control Engineering if your application does not support the Schneider Electric account authentication.

The **Notifications** tab allows you to configure the type of email notifications sent to you by the web platform. For example, you can choose to receive a confirmation email after a controller code analysis.

The **View Settings** tab allows you to select the default view for projects.

The **Accessibility** tab allows you to adapt the on-screen representation to your personal needs, for example, high contrast colors.

The **Privacy** tab provides general information on privacy and on the cookies policy. It describes how personal data is used and how you can exercise your rights relating to personal data.

You can delete the personal information under the following conditions:

- If you are using the dedicated server version and if the server is configured to send emails.
- If you are using the cloud version.

Account Settings if an EcoStruxure Control Engineering Account is Used

The **Settings** page helps you to access the personal information of the account and the global EcoStruxure Control Engineering platform settings.

Step	Action
1	In the **Dashboard** window, click  . **Result**: A menu is displayed.
2	Click **Settings**. **Result**: The **Settings** page is displayed.

The **Profile** tab displays your personal information such as the identity, phone number and country. You can update this information at any time.

The **Password** tab provides the password change form. You can change your password at any time.

The **Notifications** tab allows you to configure the type of email notifications sent to you by the web platform. For example, you can choose to receive a confirmation email after a controller code analysis.

The **View Settings** tab allows you to select the default view for projects.

The **Accessibility** tab allows you to adapt the on-screen representation to your personal needs, for example, high contrast colors.

The **Privacy** tab provides general information on privacy and on the cookies policy. It describes how personal data is used and how you can exercise your rights relating to personal data.

You can delete the personal information under the following conditions:

- If you are using the dedicated server version and if the server is configured to send emails.
- If you are using the cloud version.

Licenses

General

Schneider Electric offers various license plans for EcoStruxure Control Engineering tools.

Paid License Plans

Contact your local Schneider Electric representative for details on the available license plans for EcoStruxure Control Engineering tools. A selection of licenses is also directly available from Schneider Electric Software Shop Catalog at https://www.se.com/us/en/shop/software/?offerid=ECEE.

Free Trial Licenses

As of version 22.1 of EcoStruxure Control Engineering, free trial licenses are available to help you evaluate the EcoStruxure Control Engineering tools after you have created a user account. A trial license allows you to work with many of the functions of the EcoStruxure Control Engineering tool. The number of results provided by the tools and the available functions are limited if you use a trial license. You can upgrade a trial license to a paid license.

Overview of Your Paid Licenses, Your Orders And Your Contract

In the main menu click **LICENSES & ORDERS** to get an overview of your paid licenses, your orders and your contract.

The overview contains three tabs:

- The **Licenses** tab contains a list of your available licenses.
- The **Orders** tab contains a list of your orders.
- The **Contract** tab contains details of your contract.

Licenses Tab

The **Licenses** tab contains a list of licenses associated with your account. The list contains information such as license ID, name and type.

The buttons **Buy New Licenses On Schneider Electric Software Shop** (cloud version) and **Order Licenses** (dedicated server version) allows you to buy additional licenses.

- If you use the cloud version, the **Buy New Licenses On Schneider Electric Software Shop** button opens the Schneider Electric Software Shop Catalog (https://www.se.com/us/en/shop/software/?offerid=ECEE). After the checkout process, your licenses are automatically added to your account (within approximately 30 minutes).
- If you use the dedicated server version, the **Order Licenses** button opens a wizard. With the wizard you can add the licenses you want to buy. At the end of the wizard you must download the license request file and send it to your Schneider Electric service representative. The Schneider Electric service representative sends you then a license file. You must install the license file manually using the **Install Licenses** button.

The **Quick Filters** button allows you to filter your licenses. The licenses can be filtered by logic controller brand or by expiration date (licenses that expire within the next three weeks).

The **Transfer Licenses** button allows you to transfer one or more licenses to a different user. A license can only be transferred if the license has not yet been used, has not expired and is not currently associated to a program.

Orders Tab

The **Orders** tab contains a list of orders associated with your account. The list contains information such as name, status and description.

The details of an order can be displayed by clicking the name of an order.

Information for each order:

- The **Overview** tab shows details on the person who created the order and the state of the order.
- The **Order content** tab shows details on the ordered products.
- The **Licenses** tab shows a list of the associated licenses.

If you use the dedicated server version, this tab allows you to download once again the license request file for orders created via the wizard.

Contract Tab

The **Contract** tab contains details of your contract. A contract allows you to provide seat licenses for a group of users and to set default **Glips versions**.

The **Summary** button provides a summary of your contract (contract name, description, contract manager, company and subscribed products) and a list of the members of the contract.

The **Repository** button shows a list of files that are shared between the contract members, for example, the rules file.

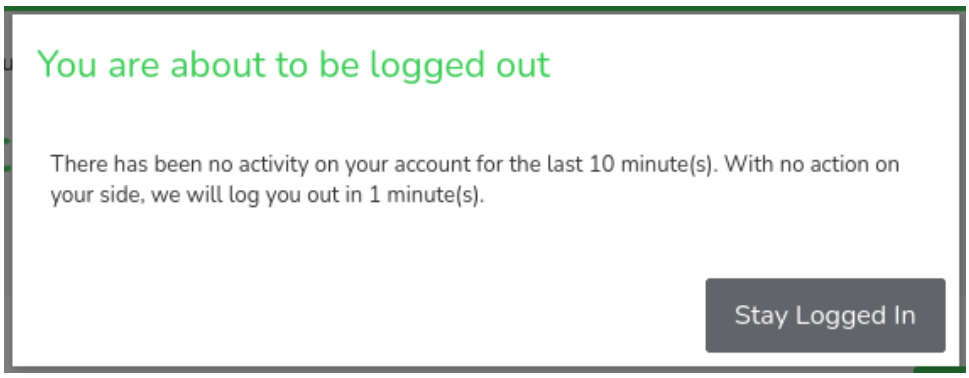
As a contract manager, you can do the following:

- The buttons **Reporting > Activity summary** and **Reporting > History** show usage statistics of the contract members.
- The **Administrate > Contract members** button allows you to add and remove contract members.
- The **Administrate > Default Glips versions** button allows you to set the default **Glips version** for each use case. Verify that the **Glips version** you select meets your requirements and matches the specifics of the input code.

Sessions

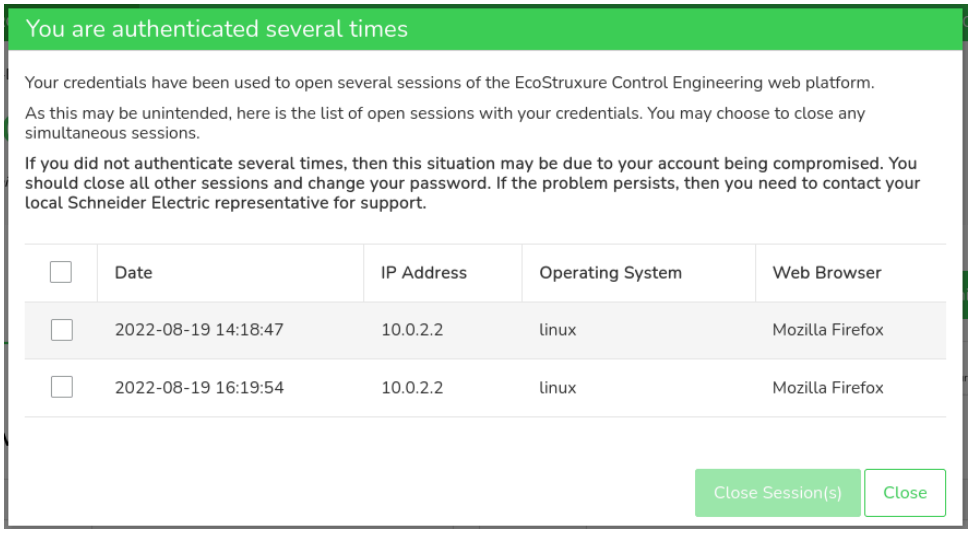
Automatic Log-Out (Session Time-Out)

After 11 minutes of inactivity in an EcoStruxure Control Engineering session, you are automatically logged out. If you work with multiple browser tabs, the most recent activity in any of the tabs applies. For example, if you work in tab 1, but not in tab 2, tab 2 does not disconnect you because there is activity in tab 1.



Multiple Sessions

If your credentials are used in multiple sessions, you receive a notification. For example, if you are logged in and another session is established with the same credentials, you receive the following message:



The information on the connection date and time, the IP address, the operating system and the browser help you to determine whether or not a session is legitimate. You can select and close a session with **Close Session(s)**.

Creating Projects and Programs

Introduction to Projects and Programs

Overview

EcoStruxure Control Engineering provides projects and programs for you to organize your work.

A project is a type of container that can hold programs. A project is not specific to an EcoStruxure Control Engineering tool.

When you register with EcoStruxure Control Engineering, the platform provides one default project for you.

A program is assigned to a project. A program is created in conjunction with one of the tools provided by EcoStruxure Control Engineering. A program typically comprises metadata you entered during its creation, the uploaded source code of a controller application, and the results generated with the EcoStruxure Control Engineering tools.

The EcoStruxure Control Engineering tools are launched from within a program. Whether or not a specific EcoStruxure Control Engineering tool is available for a program depends on the source controller/development environment you select during the creation of the program (**PLC Brand** or **PLC source brand**).

Programs can be shared with other users.

Example

Assume you have been assigned the task of improving a machine ABC with two controllers X and Y. In a first step, you want a deeper understanding of the code of the two controller applications. You create a project “Machine ABC”. Then you add two programs to this project: “Controller X” and “Controller Y”.

In both of these programs, you run EcoStruxure Control Engineering - Documentation to visualize the data flow and the control flow.

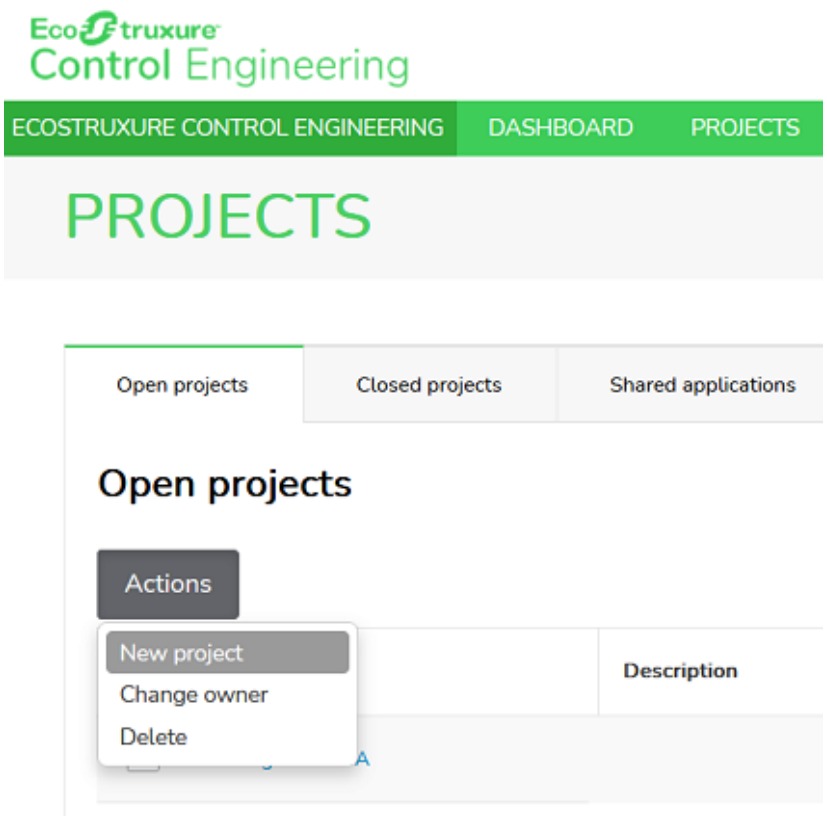
In the next phase, you manage the creation of a new version of the controller applications with improved quality. You start by running EcoStruxure Control Engineering - Verification in your programs to verify the existing code. You share the two programs with the developers so they can access the results of the code verification for assistance in updating the code.

In subsequent phases, you can upload intermediate versions of the updated code into your program and re-run EcoStruxure Control Engineering - Documentation and EcoStruxure Control Engineering - Verification to document the progress and verify that your coding rules have been properly implemented.

Creating Projects and Programs

Creating Projects

Procedure for creating a project:

Step	Action
1	Select **PROJECTS** in the top menu to display the **Projects** page.
2	Select **Actions** > **New project**. 
3	Provide a unique name for your project. Lowercase and uppercase are ignored which means that, for example, the name of a project to be created cannot be “Controller xyz” if you already have a project with the name “Controller XYZ”.
4	Click **Add** to create the project. **Result**: The project is added to your list of projects on the **Open projects** tab.

Clicking a project in the list displays three tabs. The **Overview** tab provides general information on the project. The **Programs** tab contains the list of programs assigned to this project. The **Settings** tab contains the project settings.

Creating Programs

There are three ways to start the creation of a program:

- From outside of a project select **TOOLS** on the main menu
- From the dashboard click **New ...**
- From inside a project on its **Programs** tab select **Actions > New program**

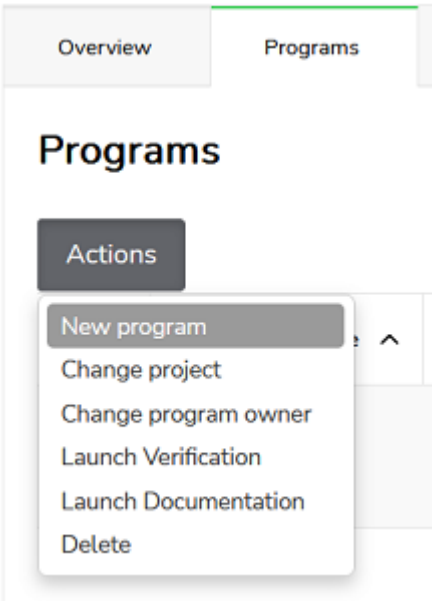
Creating a program from outside of a project:

Step	Action
1	From the main menu, select **TOOLS** to display a list of the available tools.
2	Select the tool you want to use for the program. **Result**: EcoStruxure Control Engineering starts the program creation wizard.

Creating a program from the dashboard:

Step	Action
1	From the main menu, select **DASHBOARD**.
2	Click the **New ...** button for the tool you want to use for the program. **Result**: EcoStruxure Control Engineering starts the program creation wizard.

Creating a program from inside a project:

Step	Action
1	From the main menu, select **PROJECTS**.
2	Select the required project from the list.
3	Display the **Programs** tab of the project.
4	Select **Actions** > **New program**.  **Result**: EcoStruxure Control Engineering prompts you for the tool to be used for the program and starts the program creation wizard.

Program Creation Wizard

Overview

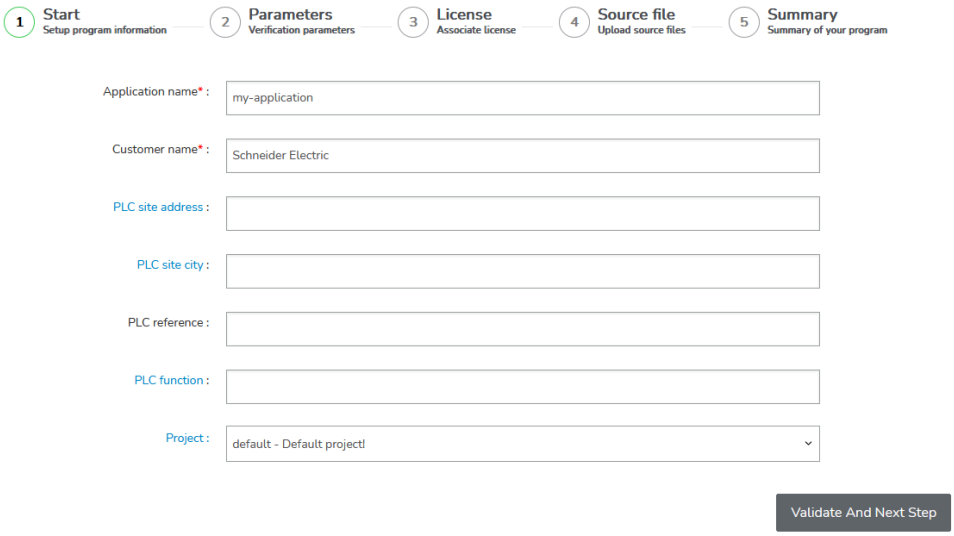
A wizard guides you through the different steps required to create your program and launch the selected EcoStruxure Control Engineering tool.

The project to which the new program is assigned depends on how the wizard is started. If the wizard is started from outside of a project or from the dashboard, the program is assigned to your default project. If the wizard is started from inside a project, the program is assigned to this project. In both cases, the project assignment can be adjusted in step 1 of the wizard.

Refer to Creating Programs, page 24 for details.

Step 1 - Start

The first step consists of providing setup information on the program.



Provide the following information:

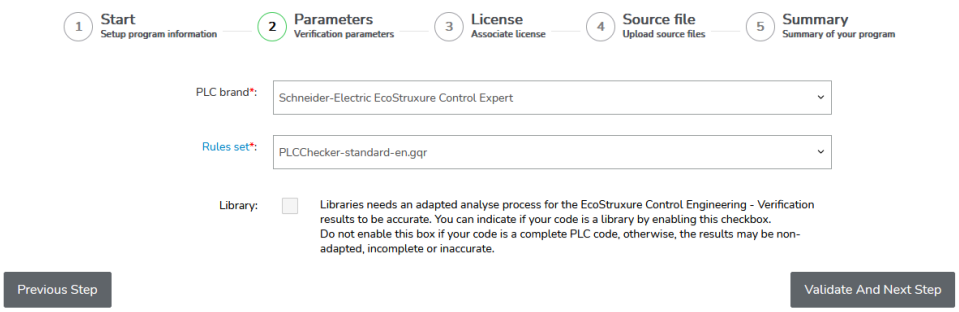
- The fields **Application name** and **Customer name** are mandatory. The defined **Application name** is used to identify the program in the different views of EcoStruxure Control Engineering.
- Add additional information in the other fields so that you can identify this program in your project.

Continue with the next step by clicking **Validate And Next Step**.

Step 2 - Parameters

The second step consists of selecting the development environment that was used to develop the controller application.

In addition, you select the rules file to be used for the analysis of the source code. You may use one of the default rules files, or upload your own rules file in step 4, page 28.



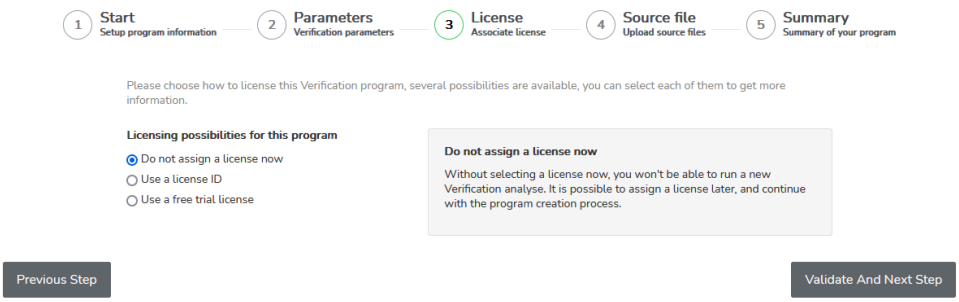
Select the **PLC Brand** and the **Rules set**.

If the source code is not a full controller application, but a library, select the **Library** checkbox. You can also identify the source code as a library after the wizard has been completed using the menu **Admin > Settings** of the corresponding program.

Continue with the next step by clicking **Validate And Next Step**.

Step 3 - License

The third step consists of selecting the EcoStruxure Control Engineering license to be used with your new program.



Choose one of the **Licensing possibilities for this program**:

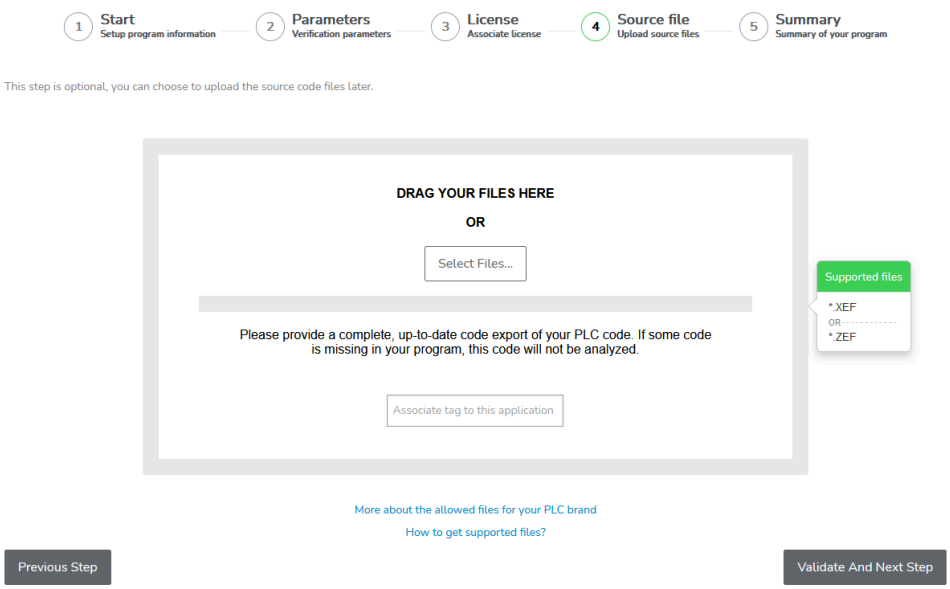
Licensing possibilities	Description
Do not assign a license now	Select this option if you want to continue now and to assign a license later on.
Use a license ID	Select this option if you have a license code. If you have a license, but the license has not yet been assigned to your user account, you can still use it by entering its identifier in the **License #id** field.
Use a free trial license	Select this option to launch a trial version of the tool. This is not possible if you have already used all trial licenses that have been associated with your user account.
Use a contract license	This option becomes available when you have a contract for EcoStruxure Control Engineering. This allows you to automatically generate a license, as part of your contract, to run the analysis.
Use an account license	This option becomes available when licenses are available in your account. In this case, you can select the license from a dropdown list.

Click **Validate And Next Step** to continue.

If no license is available, you can still continue creating the program by clicking **Validate And Next Step**. In this case, a license can be added to the program after you have created the program. Without a valid license, the EcoStruxure Control Engineering tool selected for this program cannot be used.

Step 4 - Source file

The fourth step consists of uploading the file with the source code of the controller application that you have exported from the development environment (refer to Manufacturer-Specific File Export Procedures, page 53 for details). This source code is the input material for EcoStruxure Control Engineering. Depending on the EcoStruxure Control Engineering tool used for the program, you may be prompted to upload additional files.



Drag and drop the files to the location indicated or click **Select Files…** to import the files. Also specify the rules file to be used if you have not selected a default file in step 2, page 26.

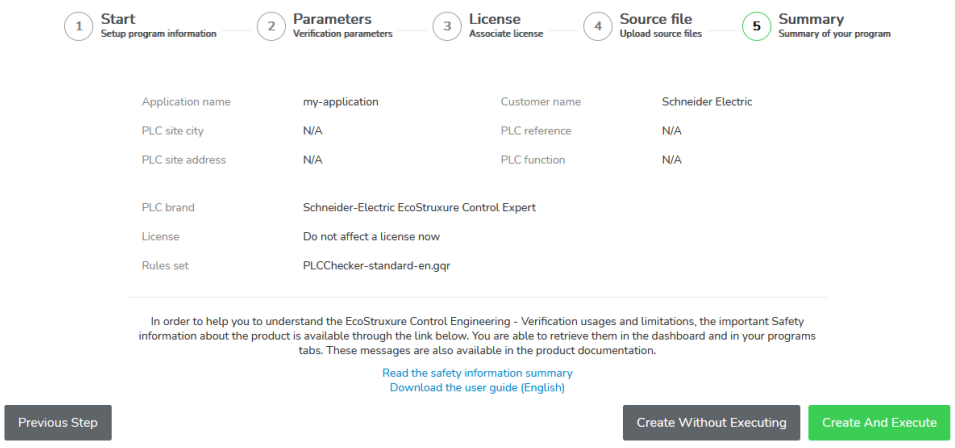
Unwanted files can be removed with the garbage can symbol.

Then click **Validate And Next Step** to continue.

If the input files are not yet available when you create the program, you can skip the upload with **Validate And Next Step** and provide the files at a later point in time. Without the uploaded input files, the EcoStruxure Control Engineering tool selected for this program cannot be used.

Step 5 - Summary

The fifth step displays a summary of the information you have provided in creating your program.



Review the information. If you want to make modifications, click **Previous Step** to return to the step you want to modify.

If the information is correct, click **Create Without Executing** to create the program or click **Create And Execute** to create the program and to start the EcoStruxure Control Engineering tool selected for this program (this is possible if you have selected a valid license and if you have uploaded the required files).

Overview of the Program

General Information

After you have completed the wizard, the system displays an overview of the program with the following tabs:

- **Overview** tab
- Tool-specific tab
- **Admin** tab

Overview Tab

The **Overview** tab displays program-specific information, such as creation date and controller-related information.

The **Glips version** determines the way the code is interpreted.

The default **Glips version** for each program is either set by the system or, if you are a Contract Member, by your Contract Manager.

You can modify the **Glips version** to be used for your program. This implies that the results that you receive after a modification of the **Glips version** may be different. Verify that the **Glips version** you select meets your requirements and matches the specifics of the input code.

Tool-Specific Tab

The tool-specific tab allows you to access settings and results related to the tool used for the program.

The menu **<tool-specific> > User awareness > Execution messages** allows you to access the list of categorized messages regarding errors detected while using the tool.

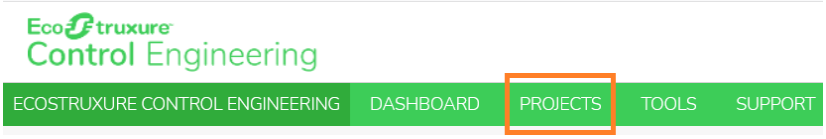
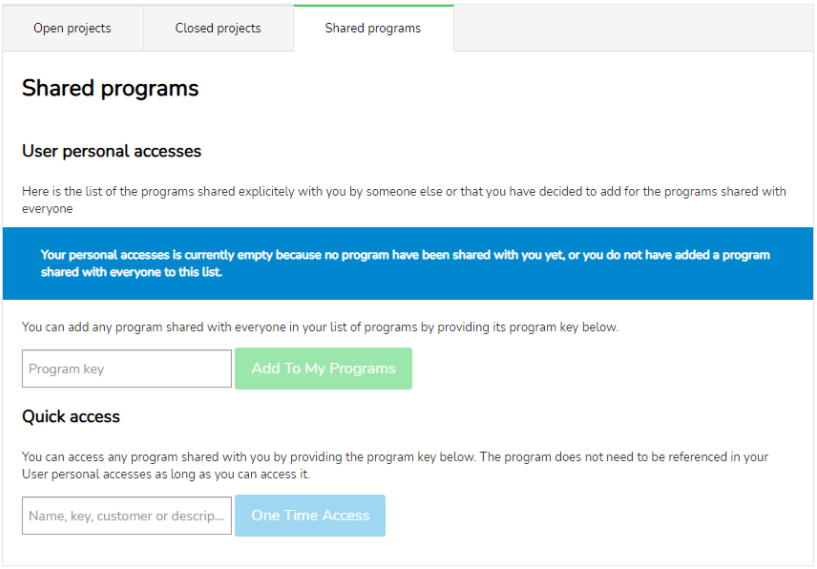
Admin Tab

The **Admin** tab allows you to access settings specific to the program.

Accessing a Shared Program

If a program is shared with you, or if access to the program is not restricted (refer to Sharing a Program, page 32), you can add it to your list of programs by providing its unique program key. The unique program key can be found in the program overview under **Program key**.

Procedure for adding a program to your list of programs:

Step	Action
1	From the main menu, select **PROJECTS** to access the Projects page. 
2	Click **Shared programs** to display the corresponding tab.
3	Enter the unique program key in the **Add To My Programs** field if you want to add this program to your personal records for access at a later point in time. If you only want to access it once without adding it to your list of programs, enter the program key in the **One Time Access** field. 
4	Click **Add To My Programs** or **One Time Access**, depending on the field in which you entered the program key.

Sharing Programs with Other Users

Overview

You can share your programs with other users so that a team can work on the same project. As the owner, you can share your program. Selected users with whom you share your program cannot delegate their access rights, that is, they cannot share this shared program with further users.

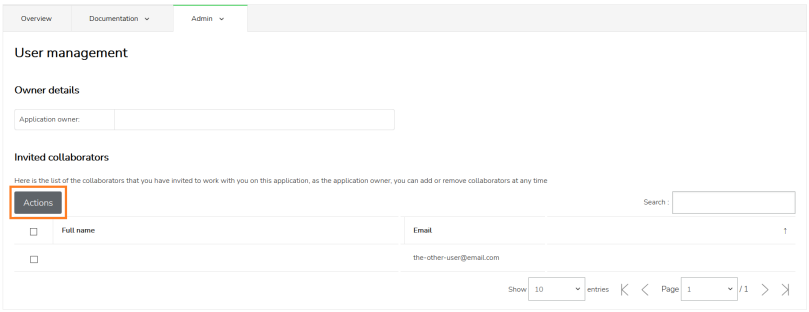
In sharing programs, consider confidentiality rules that may apply.

There are two ways of sharing a program:

- Share with selected users: You choose who can access your program. By default, other users cannot share this program because you are the owner.
- Share with everyone: Everyone can access your program.

Sharing with a Specific User

Procedure for sharing a program with selected users:

Step	Action
1	Navigate to the **Program** page.
2	Select **Admin > Collaboration > Users access rights** to display the **User management**.
3	Below **Invited collaborators**, select **Actions > Add** . 
4	Enter the email address of the user to be invited. You can enter the email address the user specified for registration with EcoStruxure Control Engineering, or you can use any other email address. You can also send an invitation notification to the user. On a dedicated server, the invitation notification function requires an email server. Users added to the list of invited users can perform the same actions as you, except for sharing the program and modifying its settings. If you do not want invited users to perform any further actions, deactivate the program with the **Active program** checkbox in **Admin > Settings**. This sets your program to read-only.

NOTE: If your program uses the EcoStruxure Control Engineering - Verification tool, invited users may not be able to update the rules file and may not be able to work with the **Justifications** function. Refer to the EcoStruxure Control Engineering - Verification user guide for details.

You can revoke sharing by selecting the user account(s) you want to remove from your program and selecting **Actions > Remove access**.

Sharing with Everyone

Procedure for sharing a program with everyone:

Step	Action
1	Navigate to the **Program** page.
2	Select **Admin > Settings**.
3	Deactivate the checkbox **Private program**. Users accessing your program can perform the same actions as you, except for sharing the program and modifying its settings. If you do not want invited users to perform any further actions, deactivate the program with the **Active program** checkbox in **Admin > Settings**. This sets your program to read-only.

NOTE: If your program uses the EcoStruxure Control Engineering - Verification tool, invited users may not be able to update the rules file and may not be able to work with the **Justifications** function. Refer to the EcoStruxure Control Engineering - Verification user guide for details.

You can disable sharing with everybody by activating the checkbox **Private program**. With this setting, only users explicitly invited can access your program.

File Repository of Programs

General

Each program has a file repository. You can directly access the files belonging to a program via the file repository.

File Operations

The **Actions** menu contains the following menu items:

Menu item	Description
Add file	You can add additional files to the repository.
Add file synchronized with contract	You can add links to files contained in the contract repository which are then available in your program repository. Any subsequent modifications to such linked files in the contract repository are reflected in your program repository.
Rename file	You can rename a file in the repository.
Delete	You can delete one or several files from the repository.

Get Checksum	You can display the SHA256 checksum of one or several files in the repository.
	
	Use the following **Windows PowerShell** command to compute the checksum of your local file:
	`Get-FileHash <Path to the file> -Algorithm SHA256 | Format-List`
	
	The result is, for example:
	`Get-FileHash C:\Users\SE\Downloads\rulesset_ documentation.pdf -Algorithm SHA256 | Format-List`
	
	`Algorithm : SHA256`
	`Hash : A5978FECDBE98C2C9C6479328AB2F717EBC239C9DA59-D55015AD3D5D50C63750`
	`Path : C:\Users\SE\Downloads\rulesset_ documentation.pdf`

The **Download Repository (ZIP)** button lets you download the files contained in the repository as a single zip file.

Verifying the Code of Controller Applications

Running a Verification of a Controller Application

Procedure

No tool can provide analysis procedures for all potential types of code and methods of creating code. For example, a code block in your source code may be semantically invalid, but syntactically correct. The tool may not be able to detect such a condition.

Software development environments may provide code protection features intended to, for example, block access to intellectual property. Unlock such protected code blocks in your software development environment before creating export files to be used with EcoStruxure Control Engineering.

⚠WARNING

INCORRECT OR INCOMPLETE SOURCE CODE ANALYSIS

- In your risk assessment, consider all potential effects of inappropriate, incorrect, or incomplete input files used with EcoStruxure Control Engineering.
- Verify that the source code exported from your software development environment and to be used by EcoStruxure Control Engineering is complete and up to date.
- After modifications of any type whatsoever to the source code of your application resulting from your use of EcoStruxure Control Engineering, verify the correctness of the modified source code.

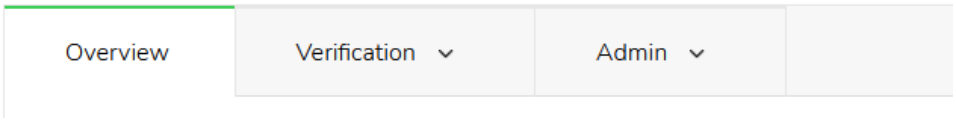
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Step	Action
1	Click **Launch Verification** on the **Program** page. **Result**: EcoStruxure Control Engineering - Verification prompts you to upload new files for the verification. If you do not have new files to upload, click **Launch** to run the verification. If you have new files to upload, continue with step 2.
2	Upload the source files of the controller application exported from your software development environment, as well as the rules file, if applicable, as described in Program creation wizard, page 26.
3	Start the verification process by clicking **Launch**.

Displaying Code Verification Results

Overview

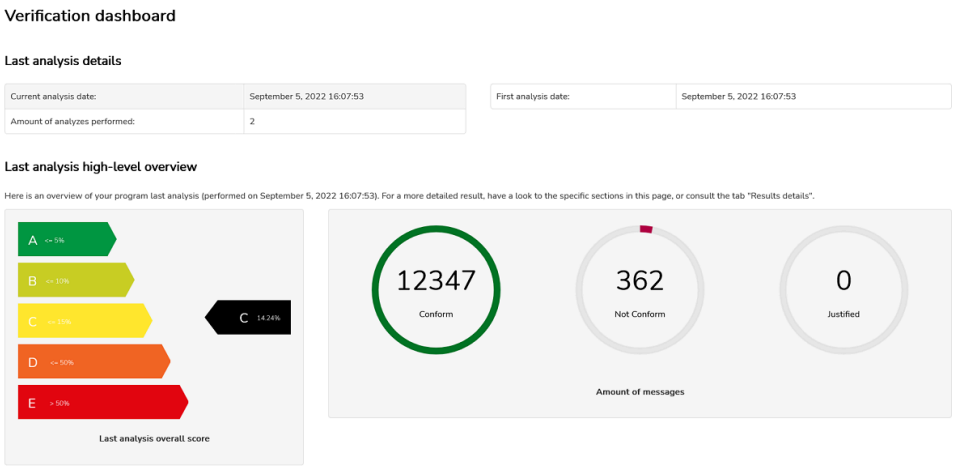
After you run EcoStruxure Control Engineering - Verification for the first time, the **Verification** tab provides access to the dashboard and to the verification details.



Dashboard

The dashboard provides a summary of the verification results. To display the dashboard, click **Verification > Dashboard**.

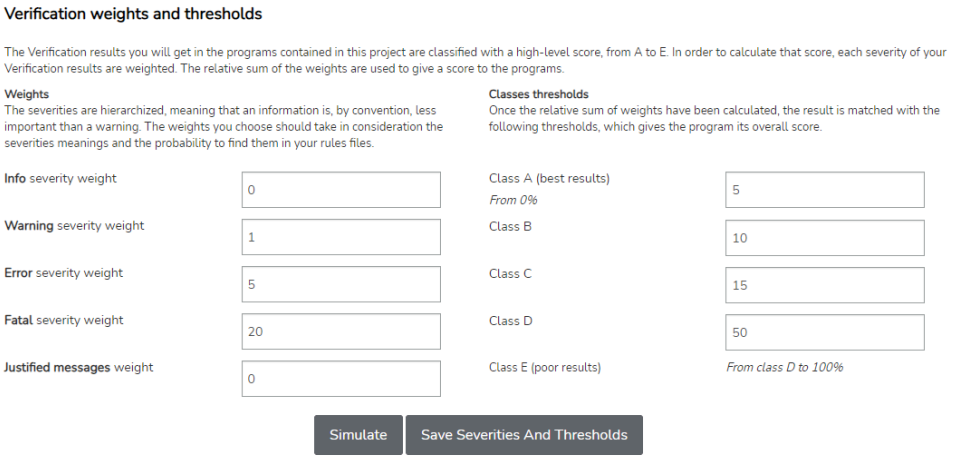
The dashboard provides various metrics, for example, percentage values for non-conformity to specific rules and an overall score of the verification result from A to E. The scoring is based on the severity assigned to the five individual message types.



Adapting Severities and Thresholds

In the project configuration, you can adapt the scoring by setting your own values for the severities of the message types and for the thresholds for the individual scores.

The severity and threshold values are set per project.

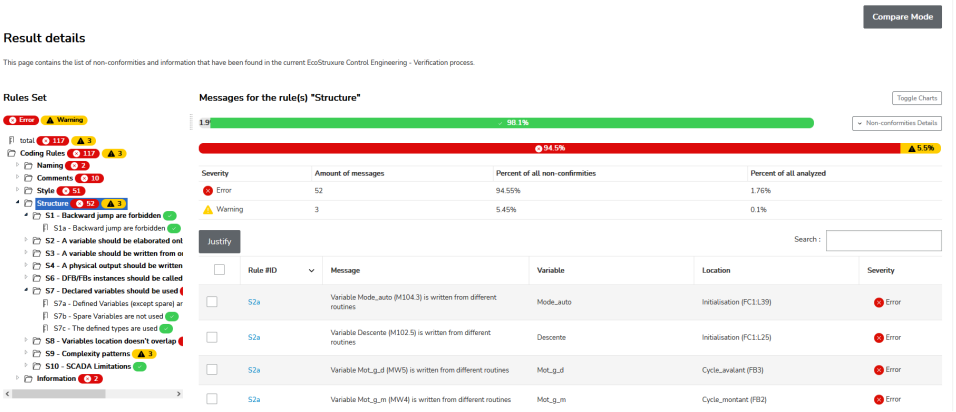


To get a simulated result of your modified values click **Simulate**. On the next screen enter the number of messages for the various severities and click **Simulate** to visualize the result. Click **Close** to close the simulation screen.

Click **Save Thresholds And Classes** to save the modified severity and threshold values.

Detailed Results

To display the details of the verification results, click **Verification > Results > Detailed results**.



Selecting a rule to the left displays the corresponding messages to the right.

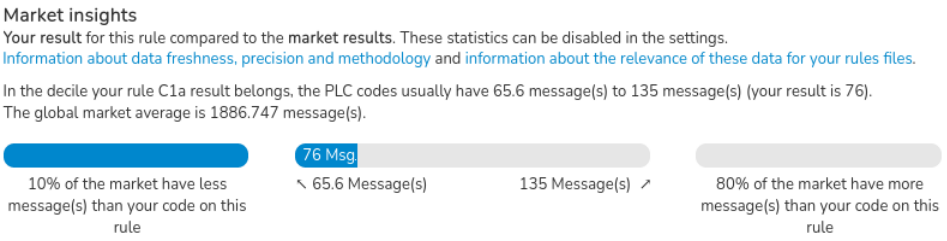
Search functions allow you to search for, for example, variables, locations in the code or severity categories within messages generated by a selected rule.

The maximum number of messages per rule that can be displayed is 9999. If there are more than 9999 messages per rule, they are contained in the PDF or CSV file that you can download, page 38.

Market Insights Function

The **Market Insights** function compares the number of messages (per rule) of your program to the number of messages of other code on the market.

Example:



By default, the **Market Insights** function is disabled. For information on enabling it, refer to Verification Settings, page 47.

NOTE: Use the standard rules files provided for the **Market Insights** function. Modified rules files may lead to less accurate results.

Downloading the Detailed Results

The details of the verification results can be downloaded as a PDF file or a CSV file.

To download the detailed results as a PDF file, click **Verification > Results > Download the detailed results PDF**.

To download the detailed results as a CSV file, click **Verification > Results > Download the detailed results CSV**.

Market Trends

Overview

This function compares the results of the program analysis of your specific program to other programs to the extent appropriate comparison data is available.

Select **Verification > Results > Market Trends details** to open the comparison for the selected program.

The following sections are available:

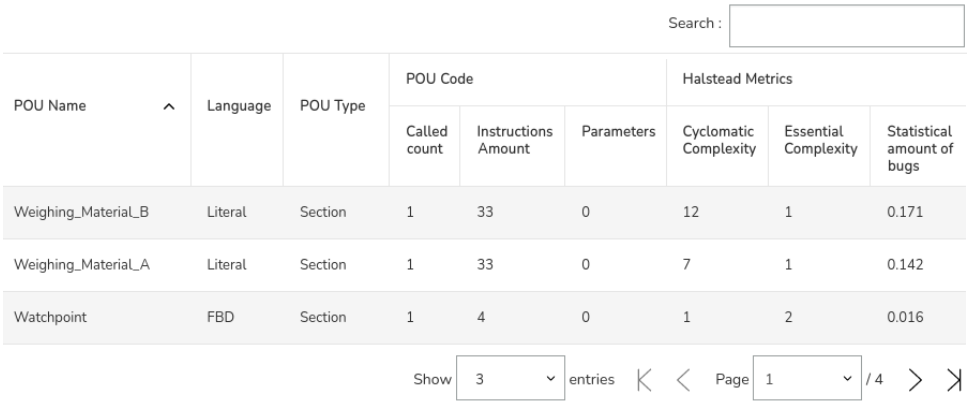
- **Your program metrics**, which provides an overview of the metrics of your program.
- **Market metrics**, which provides a comparison of the metrics of your program to the metrics of other programs.

Section Your program metrics

The section **Your program metrics** provides an overview of the metrics of your program.

The metrics of your program serve as a basis for the comparison to the metrics of other programs.

Overview:



Halstead Metrics:

- **Cyclomatic Complexity**

  Measures the difficulty a person may have to understand the code (for instance, during code reviews)
- **Essential Complexity**

  Complexity of the code unit for it to be able to do what it is designed to do
- **Statistical number of bugs**

  Evaluation of the number of bugs expectable in the code unit (statistical value, not a measured value)

Section Market metrics

The section **Market metrics** provides a comparison of the metrics of your program to the metrics of other programs.

The following categories are compared:

- **Code density**

  Density of the number of instructions per code unit

  An appropriate code density helps to reduce the code complexity, the number of bugs and the maintenance costs, and increase the code readability, memory footprint and portability.

- **Theoretical number of bugs**

  Estimation of the number of bugs that can be found in the implementation (appropriate testing strategy can help to mitigate)

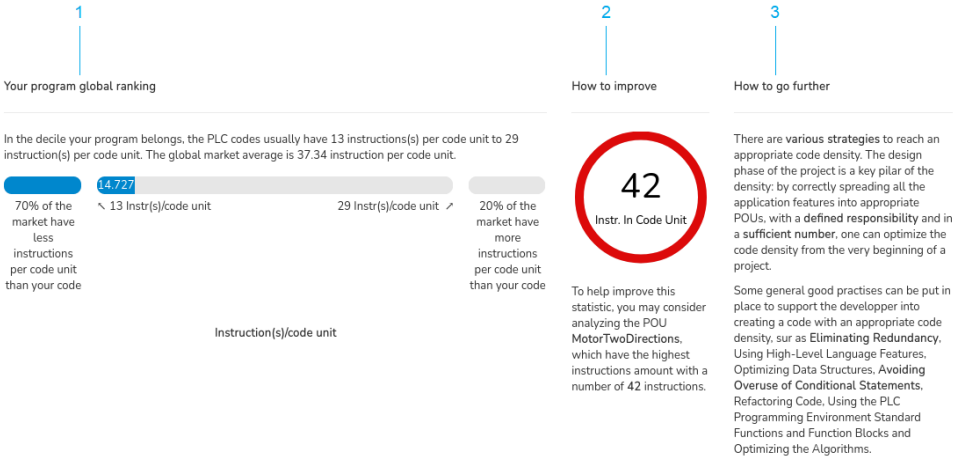
  Based on the content of the code units, it is possible to evaluate the probable number of bugs this code unit contains. The more instructions, operators and operands a code unit contains, the more it is prone to errors, resulting in bugs in the implementation. The estimation provided here does no take in account the programs test strategy.

- **Cyclomatic Complexity**

  Measures the difficulty a person may have to understand the code (for instance, during code reviews)

  The **Cyclomatic Complexity** is the number of paths a code unit contains. For instance, a code unit containing one IF/THEN/ELSE structure with one return instruction in the THEN body and another one in the ELSE body has a **Cyclomatic Complexity** of two. Lower **Cyclomatic Complexity** indicates better readability and maintainability of code units.

Each category provides the following information (code density is used as an example):



Item	Description
1 **Your program global ranking**	This section displays the ranking of your program. Depending on the decile your program belongs to, two or three bars are displayed. If three bars are displayed, you see one bar each with the proportion of programs with a lower score and a higher score than your program, and a bar for your own program. If your program is in the first or last decile, a bar for your program and a bar for the neighboring decile are displayed.
2 **How to improve**	This section indicates the POU that may require the most improvements.
3 **How to go further**	This section provides information on best practices that may help improving your code.

Justifications for Exceptions

EcoStruxure Control Engineering - Verification generates a message for each non-conformity with a rule it detects. However, there may be conditions in which the choice of code was made for a valid reason and is not to be flagged for improvement, for example, code on which the developer has no impact or code relating to specific technology that cannot be implemented in a different way. In such cases, you want to define a justified exception.

EcoStruxure Control Engineering - Verification provides a mechanism referred to as **Justification** that allows you to ignore the corresponding message.

Procedure for removing a message from the list and entering a justification for the exception:

Step	Action
1	In your program, select **Verification > Results details**.
2	Select the checkbox of the message.
3	Select **Actions > Justify**.
4	Enter the reason for the justification.
5	Click **Send** to confirm the justification.

NOTE: To display a list of the justifications, their reasons and their authors, select **Verification > Justification** in your program. You can remove an exception and the justification by selecting **Actions > Delete** in this list view. As a result, the corresponding message is generated again the next time you run EcoStruxure Control Engineering - Verification.

Rules and Rules Files

Introduction

The rules file is the file containing the rules used in the verification procedure. Only the rules configured in the rules file specified for a given verification procedure are applied.

A program can contain one or more rules files. However, only one of these rules files is used in a given verification procedure.

A rule consists of two elements:

- A type which defines the verification operation of the rule. For example, the rule can focus on comments, or on computing certain statistics.
- Configuration attributes that define how the rule operates. For example, the attributes are used to select the elements to which the rule is applied, specify the type of message to be displayed if a non-conformity is detected, or set the number of messages to be generated.

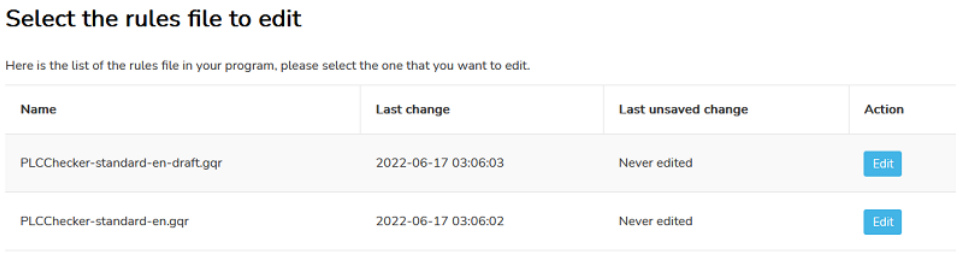
The rules editor lets you customize attributes of rules.

Rules Editor

The rules in a rules file can be updated using the rules editor.

In your program, select **Verification > Rules set > Rules editor** to open the rules editor.

Select the rules file you want to modify and click **Edit** in the **Action** column of the corresponding row.



The rules editor provides the following buttons:

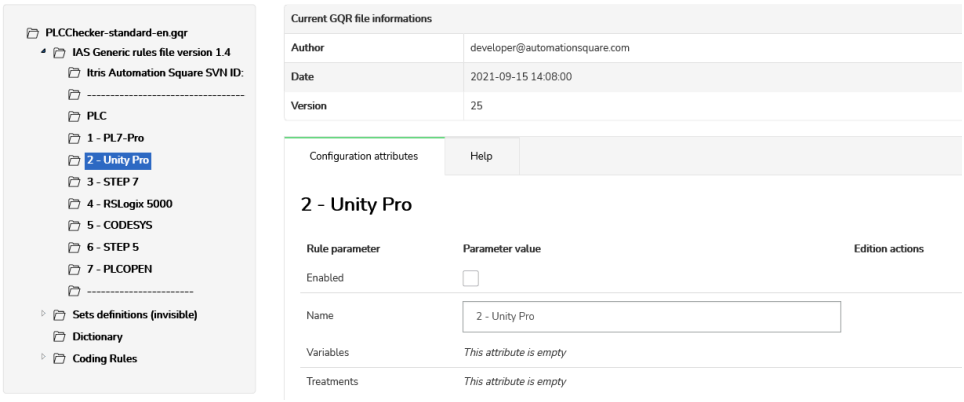
Buttons for the rules file:

- **PROPERTIES**: Allows you to display the properties of the rules file currently being edited.
- **SAVE PROJECT**: Allows you to save the modifications to the rules file. Until the modifications are saved, they are stored in a temporary location.
- **SAVE AS**: Saves the rules file under a different name.
- **DROP UPDATES**: Discards the modifications stored in the temporary location.

Buttons for the rules of the rules file:

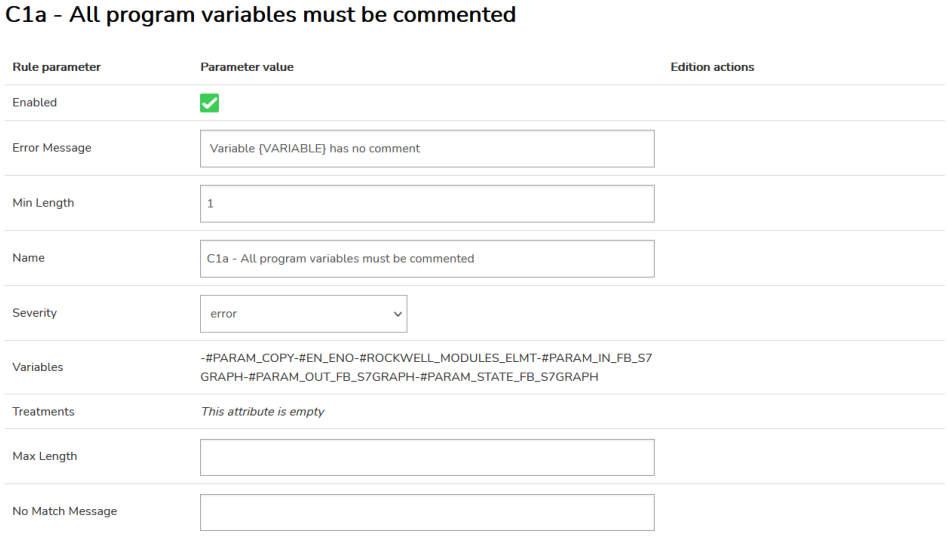
- **ADD RULE**: Adds a new rule from a list of pre-defined rules.
- **DELETE RULE**: Deletes a rule from the rules file.

The tree view to the left contains the rules hierarchy. You can expand the tree to navigate in the hierarchy.



Selecting a rule displays the configuration attributes that can be modified. Additional information on the rule is available in the **Help** tab.

Example of rule attributes that you can configure:



After you have modified an attribute, the following buttons are displayed in the **Edition actions** column of the attribute:

	Clicking the button saves the modification to a temporary storage location, not to the rules file. This means that the rules file itself is not yet modified and code verifications are still performed with the unmodified rules file.
	Clicking the button discards the modifications and resets the attributes to their original value.

Click **SAVE PROJECT** to save the modifications to the rules file. Then, succeeding code verifications will be performed with the modified rules file.

> **NOTE:** If you confirm a modification, this may imply that attributes of a different rule are also updated. For example, enabling a rule may require another rule to be activated as well. In such a case, a summary of the modifications is displayed.

List of the Configuration Attributes

The rules editor allows you to configure the attributes described below. The meaning of the attributes can vary depending on the rule type. Click the **Help** tab to display additional information on an attribute.

Attribute	Description	Notes
Enabled	Enables/disables a rule.	An enabled rule works only if the parent rule is also enabled. Certain rules can only be enabled if further rules are also enabled in addition to their parent rules.
Name	Name of the rule, visible in the rules trees, in the rules editor and in the verification results.	-
Error Message	Message displayed if the rule detects an error.	-
No Match Message	Message displayed if the rule does not detect an error.	This message is displayed only if no element in the program can be selected by the rule for analysis. For example, if the rule looks for the variables in the program but no such variable is declared.
Severity	Importance of resolving the errors reported by the rule.	The severity “nolog” allows you to suppress the generation of an error message. However, the match is still included in the statistics.
Min Length	Minimum length of a verified element in the program.	The result depends on the rule type.
Max Length	Maximum length of a verified element in the program.	The result depends on the rule type.

In addition to these modifiable attributes, two non-modifiable configuration attributes are displayed: variables and treatments. These two attributes explain which set of elements in the program the rules are applied to.

Configuration of the Default Rules Files

The default rules files are organized in three main parts (their names depend on the rules file language and may be different from the names in the present user guide):

- **IAS Generic rules file version X.Y.Z**: Contains the controller configuration (the version number depends on the rules file that you are using)
- **Sets definition**: Contains several lists of the elements in the controller application that can be matched by the rules
- **Coding rules**: Contains the list of rules to be applied

If the objective of the configuration is to modify the controller to be verified with EcoStruxure Control Engineering - Verification using this rules file, customize the first part of the rules file (**IAS Generic rules file version X.Y.Z**). Modifications to these elements may result in several modifications in the rest of the rules file because certain rules depend on the controller type and cause the corresponding rules to be enabled or disabled as well.

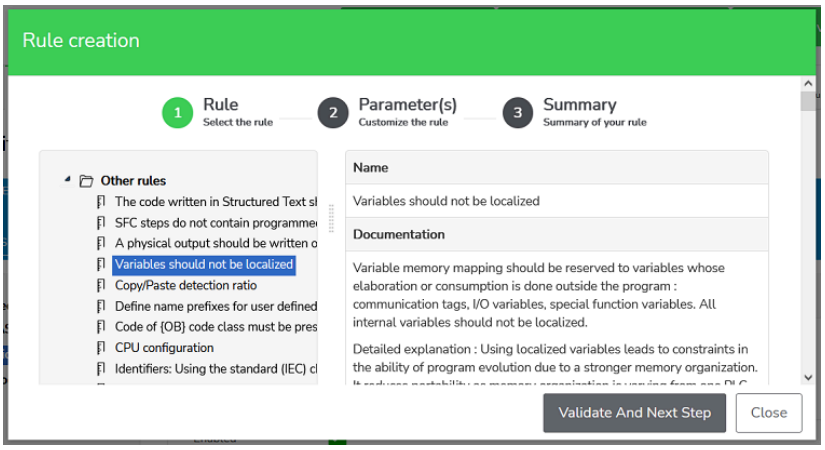
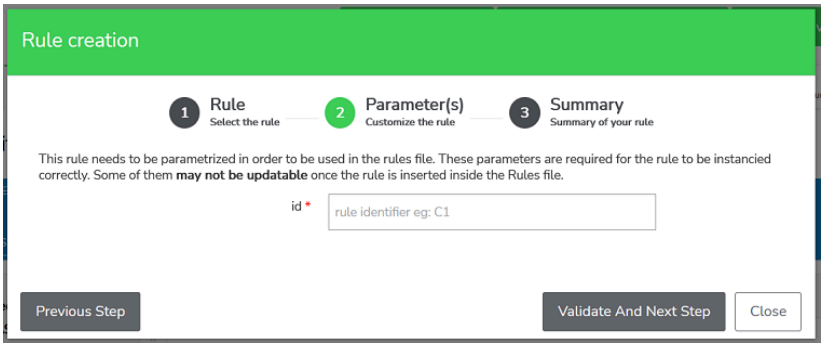
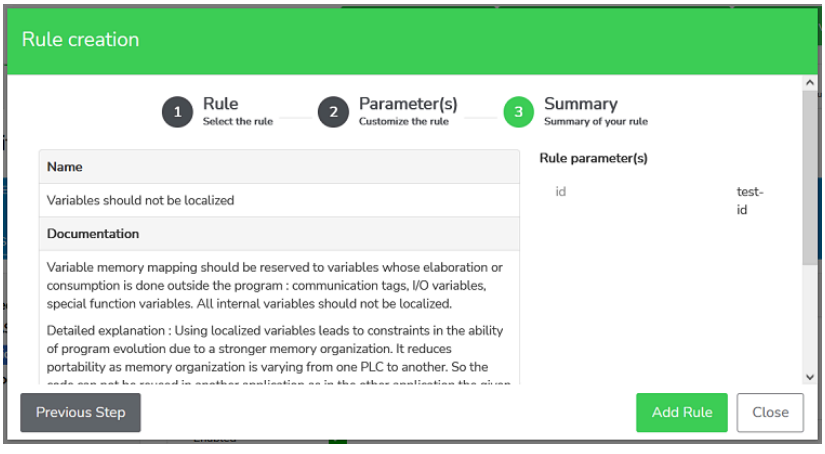
If the objective of the configuration is to update the messages, the severity or the activation state of a particular rule, modify the last part of the rules file containing the coding rules.

No action is required in the Sets definition part of the rules file.

Adding a Rule

You can add a rule from a pre-defined list of rules and customize this rule. A rule is added to the location in the rules hierarchy that is selected when you click **ADD RULE**.

Procedure for adding a rule:

Step	Action
1	Select a location in the rules hierarchy to specify where the new rule is to be added.
2	Click **ADD RULE**. **Result**: EcoStruxure Control Engineering - Verification displays step 1 of the Rule Creation Wizard.
3	Select the required rule. 
4	Click **Validate And Next Step**. **Result**: EcoStruxure Control Engineering - Verification displays step 2 of the Rule Creation Wizard. 
5	Configure the customizable elements of the rule displayed in step 2 of the Rule Creation Wizard.
6	Click **Validate And Next Step**. **Result**: EcoStruxure Control Engineering - Verification displays step 3 of the Rule Creation Wizard. 
7	Carefully examine the summary details. To confirm and proceed, click **Add Rule**. If you need to make any modifications, click **Previous Step** to return and adjust your settings.

NOTE: You can modify the order of your rules with the "Drag and Drop" function, if needed.

Download a Documentation of a Rules Set

A documentation of a rules set can be downloaded as a PDF file.

To download a documentation of a rules set, click **Verification > Rules set > Download a documentation of the rules set PDF**.

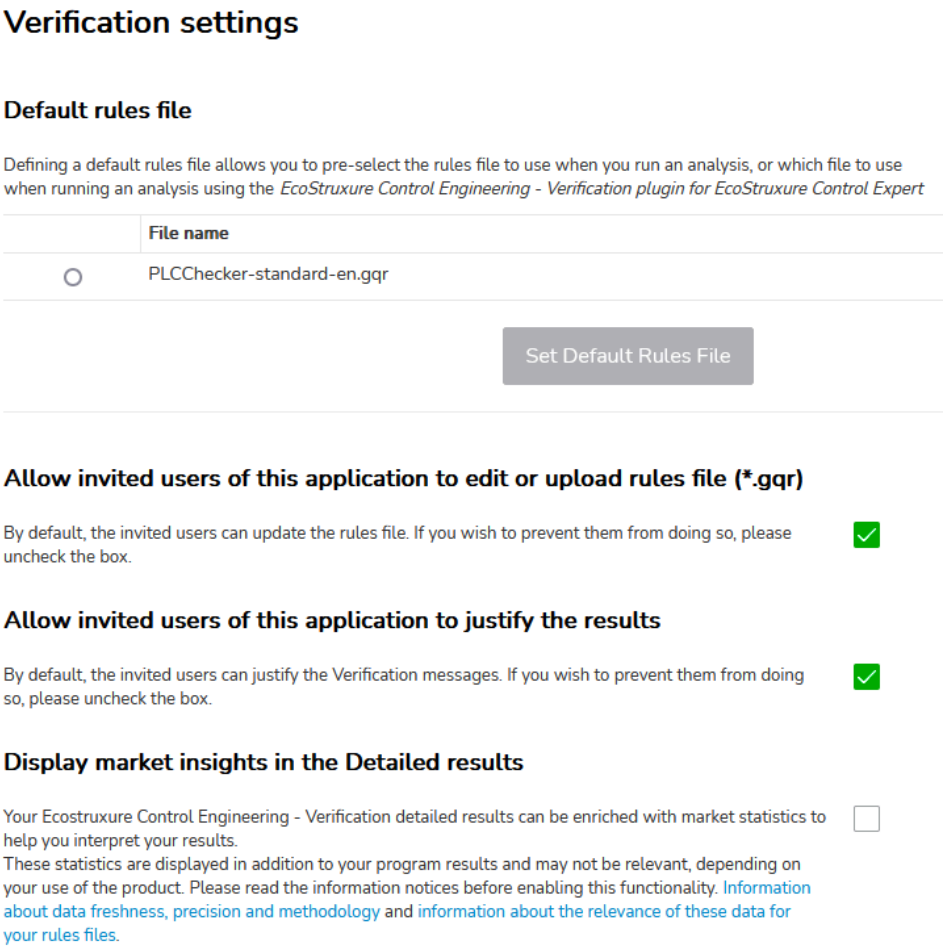
Verification Settings

Select **Verification > Settings** to open the verification settings for the selected program.

For each program you can set the following:

- Select a default rules file to be used with the EcoStruxure Control Expert Plug-In for EcoStruxure Control Engineering - Verification, page 48.
- For invited users of a shared program, page 32:
  - Enable and disable the possibility to update the rules files.
  - Enable and disable the possibility to justify the results.
- Enable and disable the **Market Insights** function for the detailed results.

  NOTE: Use the standard rules files provided for the **Market Insights**, page 37 function. Modified rules files may lead to less accurate results.



EcoStruxure Control Expert Plug-In for EcoStruxure Control Engineering - Verification

General Information

The EcoStruxure Control Expert plug-in for EcoStruxure Control Engineering - Verification is designed for use with the software development environments EcoStruxure Control Expert and Unity Pro.

The plug-in allows you to launch a verification procedure from within the software development environment. The code is automatically exported and uploaded for verification. The verification results are displayed in a special view in the plug-in. A “back-to-source” feature in the plug-in allows you to navigate directly to the corresponding location in the code highlighted by the message.

Compatibility and System Requirements

The EcoStruxure Control Expert plug-in for EcoStruxure Control Engineering - Verification is compatible with the following versions of EcoStruxure Control Expert and Unity Pro:

- Unity Pro: From version 8.2 to version 13.1
- EcoStruxure Control Expert: From version 14 to latest supported version

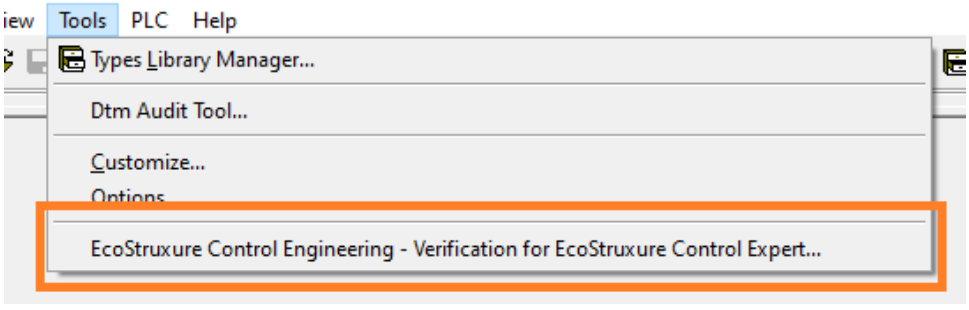
The EcoStruxure Control Expert plug-in requires access to EcoStruxure Control Engineering - Verification, either in the cloud or on the dedicated server of your organization.

Download and Installation

The EcoStruxure Control Expert plug-in for EcoStruxure Control Engineering - Verification is available by clicking **SUPPORT > DOWNLOADS**.

Follow the instructions during the installation. Compatibility with your software development environment is verified during the installation.

After the installation, the menu item **EcoStruxure Control Engineering - Verification for EcoStruxure Control Expert** is available on the **Tools** menu:



Program Configuration

The EcoStruxure Control Expert plug-in for EcoStruxure Control Engineering - Verification requires a program to launch the code verification and return the results to the plug-in.

The program contains the information on the controller/development environment that is used to develop the controller application, on the rules file to be used for the verification, and on the licenses used with EcoStruxure Control Engineering -

Verification. Refer to Program Creation Wizard, page 26 for details on creating and configuring a program.

Certain licenses for unlimited usage do not require the configuration of a license. If you do not have an unlimited license, specify your license in step 3 of the program creation wizard or thereafter select **Admin > Licenses > Actions > Associate new license** in the program view.

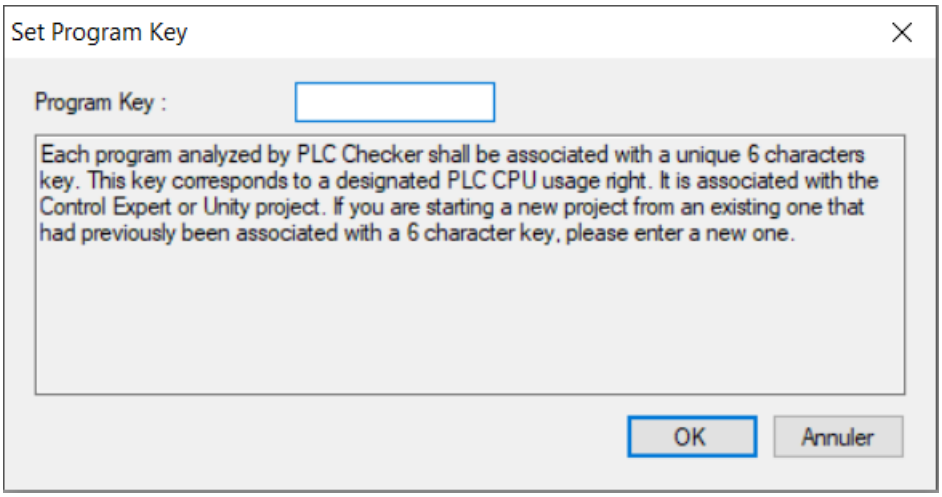
Refer to Verification Setting, page 47 for details on setting the default rules file and setting the sharing options.

Share the program key with the collaborators who are to use EcoStruxure Control Engineering - Verification through the plug-in.

Working with the Plug-In

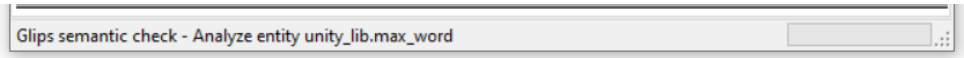
In EcoStruxure Control Expert, compile your controller application and select **Tools > EcoStruxure Control Engineering - Verification for EcoStruxure Control Expert**.

If you have not assigned the EcoStruxure Control Expert controller application to a program in EcoStruxure Control Engineering - Verification you are prompted for the program key:



After you have entered the program key, the plug-in attempts to contact EcoStruxure Control Engineering - Verification. If you are not authenticated, a new screen is displayed that allows you to provide a custom proxy configuration. Use this screen if your organization uses a proxy for outgoing Internet traffic (the required information to be provided is available from your administrator). After that, you are prompted for your credentials. You can modify these settings by selecting **? > Preferences**.

The first time you are authenticated, a verification is started. The progress bar at the bottom of the screen provides details:

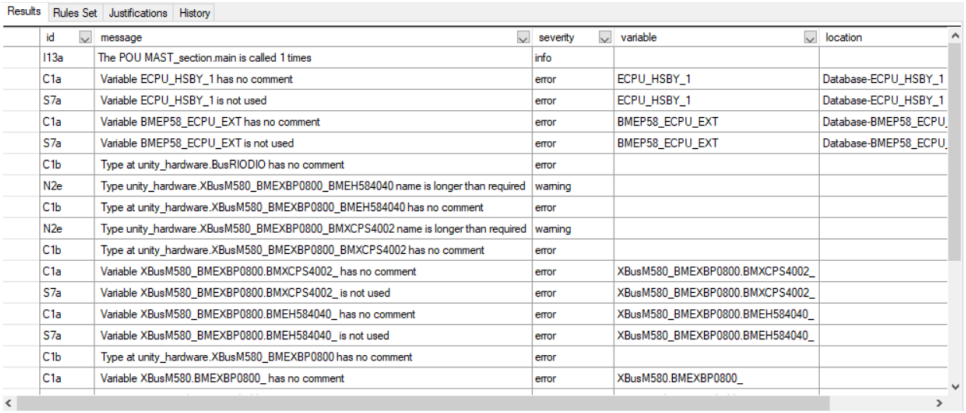


The next time you log in, you can start the verification manually by selecting **Actions > Launch analysis**.

When the verification is complete, the results are downloaded from EcoStruxure Control Engineering - Verification and displayed on the plug-in screen.

You can also display the latest results on the EcoStruxure Control Engineering - Verification server by selecting **Actions > Get remote last results**. If the results have already been downloaded to your local PC, you can display them by selecting **Actions > Display local results**. The local results may not reflect the latest results available on the EcoStruxure Control Engineering - Verification server, for example, because another member of your team has performed a verification after you have downloaded your results to your local PC.

The results are displayed in a table:



Results | Rules Set | Justifications | History

id	message	severity	variable	location
I13a	The POU MAST_section.main is called 1 times	info		
C1a	Variable ECPU_HSBY_1 has no comment	error	ECPU_HSBY_1	Database-ECPU_HSBY_1
S7a	Variable ECPU_HSBY_1 is not used	error	ECPU_HSBY_1	Database-ECPU_HSBY_1
C1a	Variable BMEP58_ECPU_EXT has no comment	error	BMEP58_ECPU_EXT	Database-BMEP58_ECPU_
S7a	Variable BMEP58_ECPU_EXT is not used	error	BMEP58_ECPU_EXT	Database-BMEP58_ECPU_
C1b	Type at unity_hardware.BusRIODIO has no comment	error		
N2e	Type unity_hardware.XBusM580_BMEXBP0800_BMEH584040 name is longer than required	warning		
C1b	Type at unity_hardware.XBusM580_BMEXBP0800_BMEH584040 has no comment	error		
N2e	Type unity_hardware.XBusM580_BMEXBP0800_BMXCPS4002 name is longer than required	warning		
C1b	Type at unity_hardware.XBusM580_BMEXBP0800_BMXCPS4002 has no comment	error		
C1a	Variable XBusM580_BMEXBP0800.BMXCPS4002_ has no comment	error	XBusM580_BMEXBP0800.BMXCPS4002_	
S7a	Variable XBusM580_BMEXBP0800.BMXCPS4002_ is not used	error	XBusM580_BMEXBP0800.BMXCPS4002_	
C1a	Variable XBusM580_BMEXBP0800.BMEH584040_ has no comment	error	XBusM580_BMEXBP0800.BMEH584040_	
S7a	Variable XBusM580_BMEXBP0800.BMEH584040_ is not used	error	XBusM580_BMEXBP0800.BMEH584040_	
C1b	Type at unity_hardware.XBusM580_BMEXBP0800 has no comment	error		
C1a	Variable XBusM580.BMEXBP0800_ has no comment	error	XBusM580.BMEXBP0800_	

Columns in this table:

- **id**: Identifier of the rule that generated the message
- **message**: Generated message
- **severity**: Severity of the message (for example, “error” or “info”) as defined in the rules file
- **variable**: Name of the variable that matched the applied coding rule
- **location**: Location in the code where the coding rule is not respected
- **address**: Topological address of the variable that matched the applied coding rule

You can jump to the location in your code where the highlighted elements are by right-clicking a message and selecting **Display Data Editor** or **Display Code Editor**, depending to the kind of the element.

You can set non-conformities as exception and create an appropriate justification by selecting **Justify exceptions…**. Refer to Exceptions and Justifications, page 41 for details. You can select multiple messages to be justified in a single step. However, this is only possible for messages triggered by the same rule.

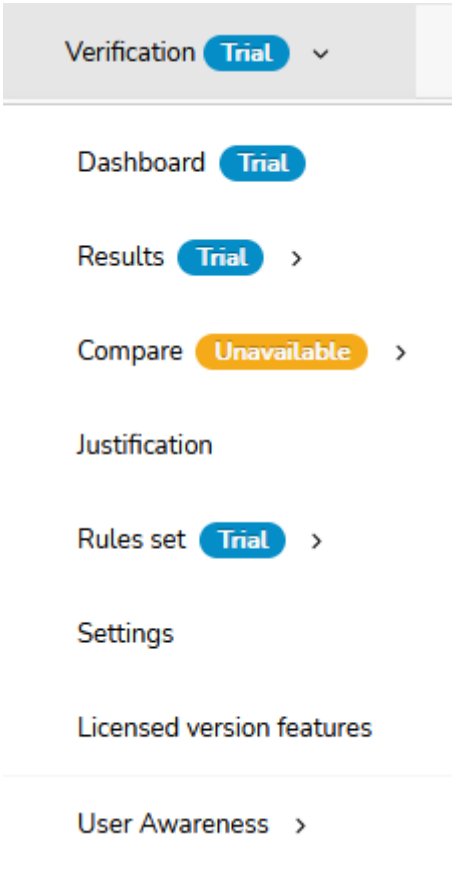
From within the corresponding tabs in the plug-in, you can also display the rules file, the program history and list the justifications of the program in EcoStruxure Control Engineering - Verification.

Limitations of the Free Trial Version

If the verification has been performed with a free trial license of EcoStruxure Control Engineering - Verification, the results are limited as shown in the following list.

Functionality	Trial version	Paid license
Result details summary	Limited	No license limitations
Number of messages per rule	Limited to 2	No license limitations
Rules set visualizer	Included	Included
Message justifications	Included	Included
Comparison of results between program versions	Unavailable	Included
Download detailed result as CSV (for import into Microsoft Excel)	Unavailable	Included
Download detailed result as PDF	Unavailable	Included
Download rules set documentation as PDF	Unavailable	Included
Program versions comparison as PDF	Unavailable	Included
Online rules editor	Unavailable	Included
Market trends for your program	Unavailable	Included
Market insights in the detailed results	Limited to median value	No license limitations (up to deciles)

The functions that are not available or limited are highlighted on the **Verification** tab of your program:



- Trial: Limited results
- Unavailable: Function is not accessible
- No indication: No license limitations

You can upgrade to a paid license to get the full functionality of your program.

Manufacturer-Specific File Export Procedures

EcoStruxure Control Engineering tools use the source code files of controller applications as input files. These files are exported from the corresponding software development environments. The following sections provide information on generating these export files in various software development environments.

EcoStruxure Control Expert (.XEF / .ZEF / .XVM File Export)

Export the EcoStruxure Control Expert (formerly Unity Pro) controller application to an XEF, ZEF or XVM export file in order to process them with EcoStruxure Control Engineering tools.

To export the file, you can use the EcoStruxure Control Engineering Import/Export tool. In the menu, select **SUPPORT > DOWNLOADS**.

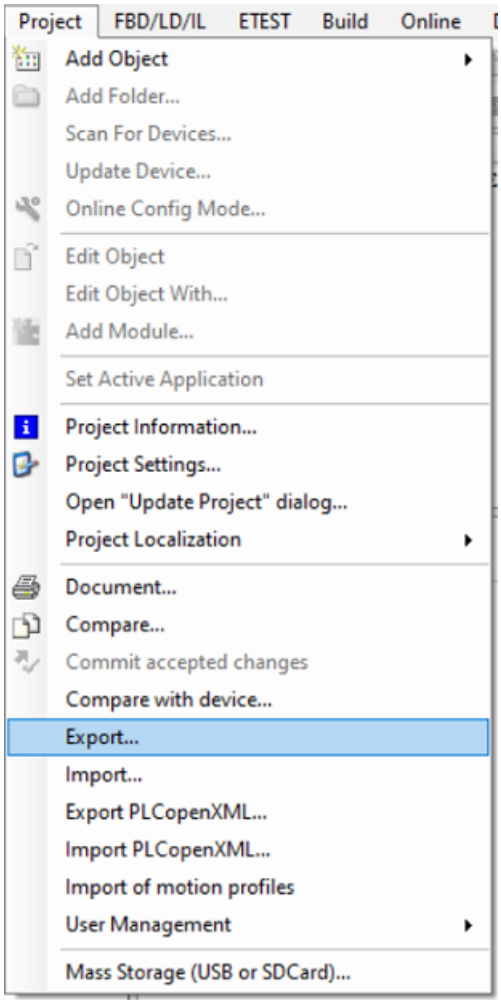
It is also possible to export the files using the EcoStruxure Control Expert menu:

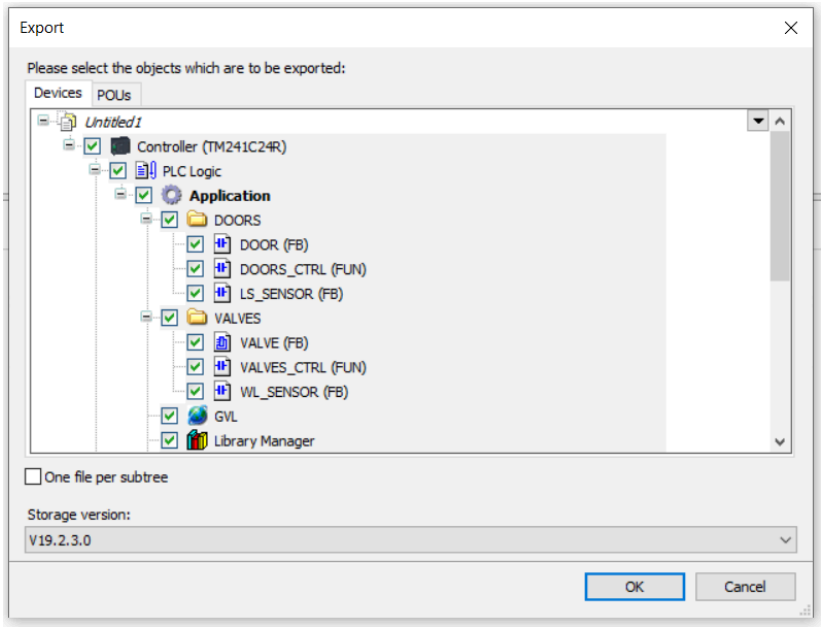
Step	Action
1	From the menu, select **File > Export application…**.
2	In the **Export application…** dialog box, provide a name for the XEF, ZEF or XVM file.
3	If required, modify the storage location for the XEF, ZEF or XVM file.
4	Click **Save**.

EcoStruxure Machine Expert (.EXPORT File Export)

Export the EcoStruxure Machine Expert controller application to an XML export file (with the extension **.export**) in order to be processed with EcoStruxure Control Engineering tools.

Procedure:

Step	Action
1	From the menu, select **Project > Export…**. 
2	You can export particular objects or a full tree. From the tabs in the **Export** dialog, select the objects to be included in the export file.

Step	Action
	 **NOTE:** The checkbox **One file per subtree** allows you to generate separate export files for the selected subtrees. You can export the file with a specific EcoStruxure Machine Expert version that you select from the dropdown list **Storage version**. To re-import the file, this EcoStruxure Machine Expert version is used.
3	Click **OK** and provide a file name and a folder name as prompted.
4	Click **Save**.

EcoStruxure Machine Expert Basic (.SMBP File Export)

Export the EcoStruxure Machine Expert Basic controller application to an SMBP export file in order to be processed with EcoStruxure Control Engineering - Verification.

Step	Action
1	From the menu, select **File > Save as…**.
2	In the **Save as…** dialog box, provide a name for the SMBP file.
3	If required, modify the storage location.
4	Select the file type: **Machine Expert - Basic Project Files (*.smbp)**.
5	Click **Save**.

PL7 Pro (.FEF File Export)

Export the PL7 Pro controller application to an FEF export file in order to be processed with EcoStruxure Control Engineering tools.

Prerequisites:

Step	Action
1	Open the PL7 Pro configuration file **Pl7sys.ini** using a text editor. The file is located in the **Windows** folder (for example, C:\Windows or C:\Winnt).
2	Search for the section **[PL7TOOL132]**.
3	Verify that the entry **ExportPl7Converter=True** exists. If the entry does not exist, add the entry in the section **[PL7TOOL132]**.
4	Save the file. The modification is taken into account with the next start of PL7 Pro. **NOTE:** This feature is only available with version 4.5 or later of PL7 Pro.

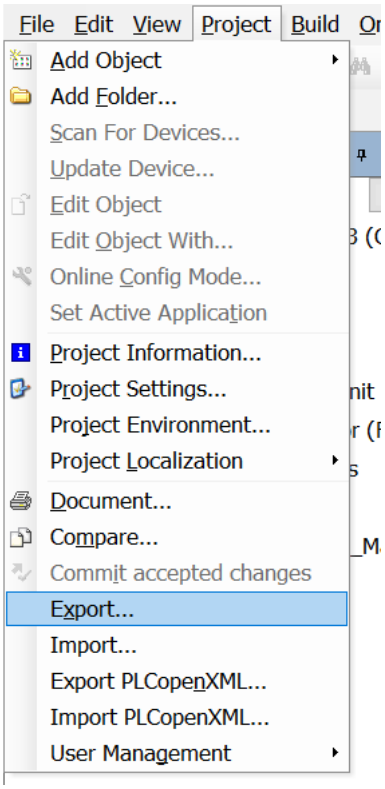
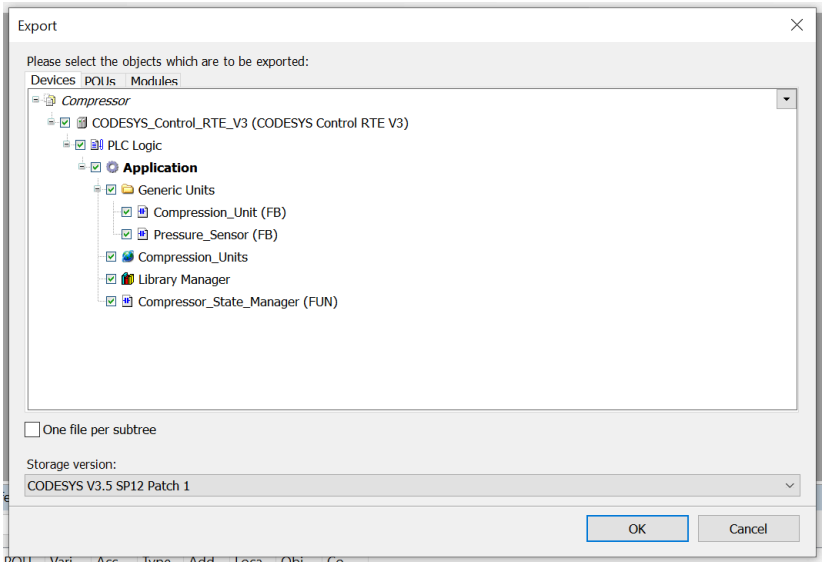
Procedure:

Step	Action
1	From the menu, select **File** > **Export application…**.
2	In the **Export application…** dialog box, provide a name for the FEF file.
3	If required, modify the storage location for the FEF file.
4	Click **Save**.

3S CODESYS V3 (.EXPORT File Export)

Export the CODESYS V3 controller application to an XML export file (with the extension **.export**) in order to be processed with EcoStruxure Control Engineering tools.

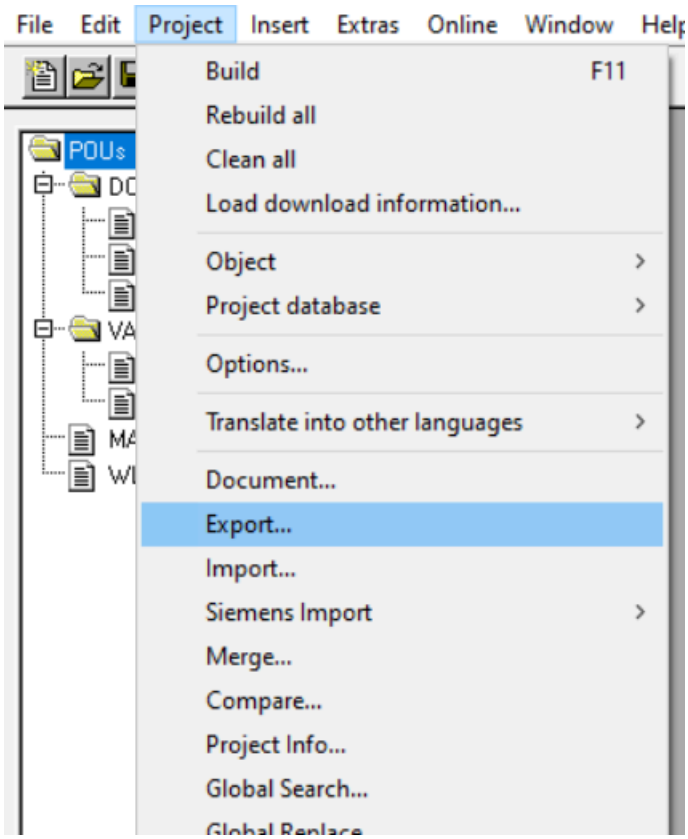
Procedure:

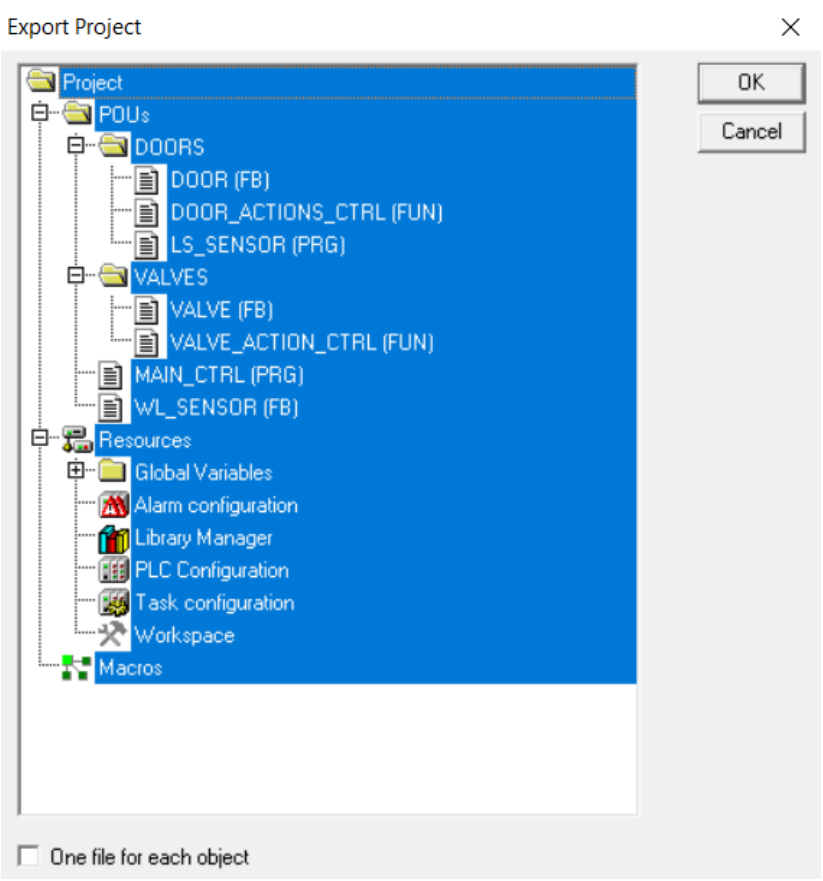
Step	Action
1	From the menu, select **Project > Export...**. 
2	You can export particular objects or a full tree. From the tabs in the **Export** dialog, select the objects to be included in the export file.  **NOTE:** The checkbox **One file per subtree** allows you to generate separate export files for the selected subtrees. You can export the file with a specific CODESYS version that you select from the dropdown list **Storage version**. This version is then used to re-import the file in CODESYS. If you work on CODESYS V3 code, select a version from the version 3 family (**CODESYS V3 ...**).

Step	Action
3	Click **OK**.
4	Provide a file name and a folder name as prompted and click **Save**.

3S CODESYS V2 (.EXP File Export)

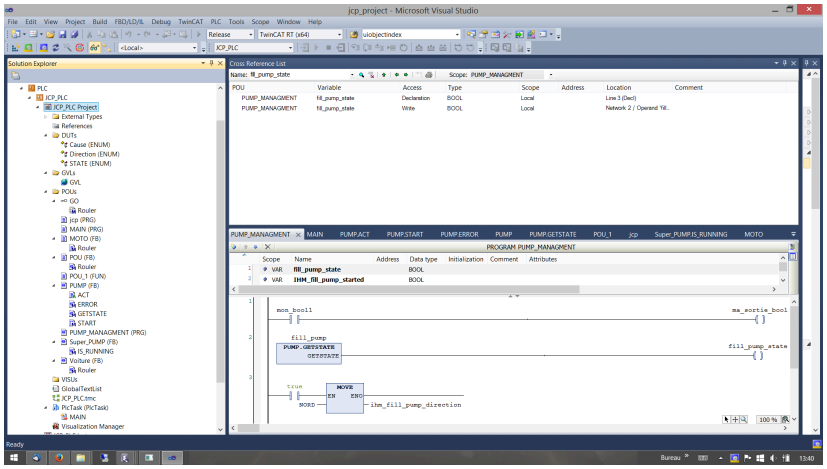
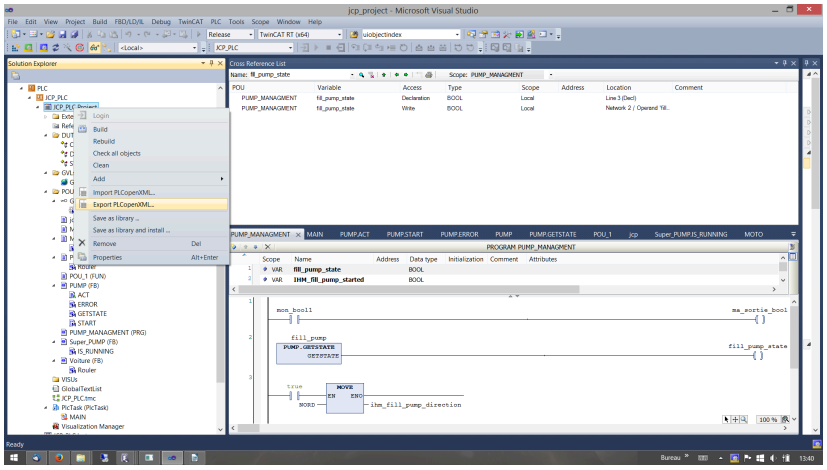
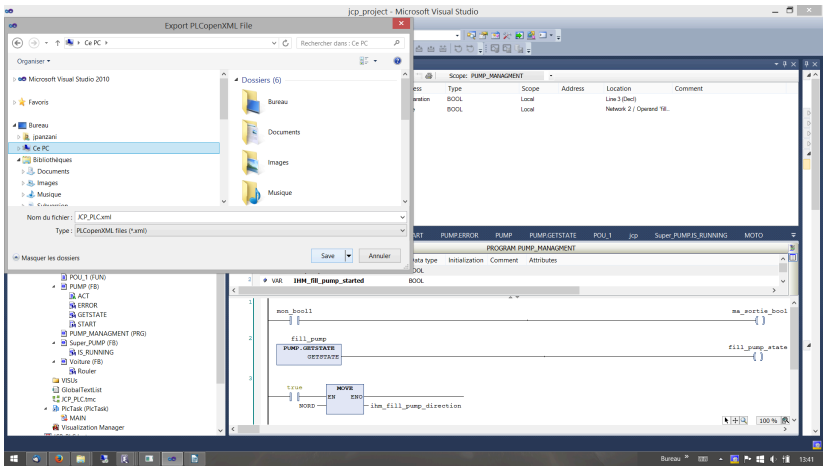
Export the CODESYS V2 controller application to an EXP export file in order to be processed with EcoStruxure Control Engineering tools.

Step	Action
1	From the menu, select **Project** > **Export**…. 
2	In the **Export Project** dialog box, select the objects to be included in the export file (with the default settings, a selected item has a blue background), then click **OK**.

Step	Action
	
3	Click **OK** and provide a file name and a folder name as prompted.
4	Click **Save**.

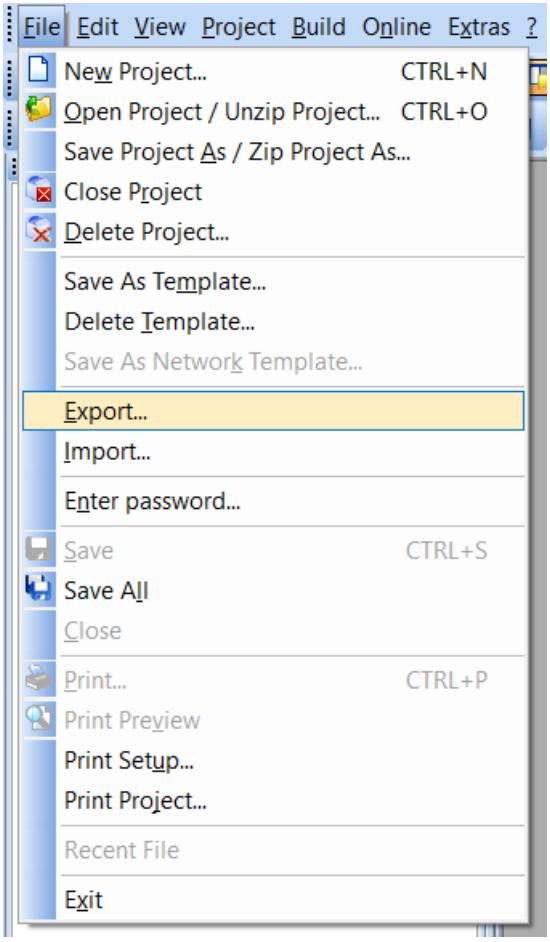
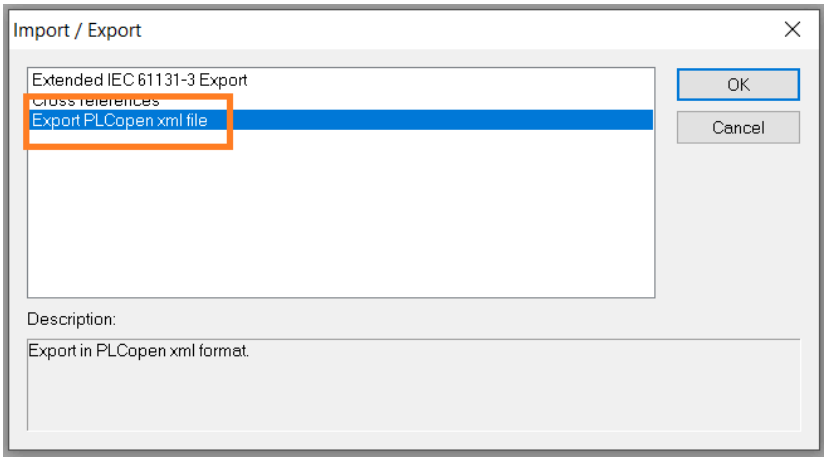
BECKHOFF TwinCAT V3 (.XML File Export)

Export the Beckhoff TwinCAT controller application to an XML export file (PLCopen) in order to be processed with EcoStruxure Control Engineering tools.

Step	Action
1	In the **Solution Explorer** window, select the project. 
2	Right-click the project and select **Export PLCopenXML...**. 
3	Click **Save**. 

PHOENIX CONTACT Multiprog v5.5 (.XML File Export)

Export the MULTIPROG controller application to an XML export file in order to be processed with EcoStruxure Control Engineering tools.

Step	Action
1	From the menu, select **File** > **Export...**. 
2	Select **Export PLCopen xml file**. 
3	Provide a name for the export file.
4	Click **Save**.

As MULTIPROG can export the controller application in different versions of PLCopen, there may be differences in the way your EcoStruxure Control Engineering tool processes the export file, depending on the PLCopen version.

Rockwell Automation® RSLogix 5000® or Studio 5000 (. L5K File Export)

Export the Rockwell Automation® RSLogix 5000® controller application to a L5K export file in order to be processed with EcoStruxure Control Engineering tools.

Step	Action
1	From the menu, select **File > Save as…**.
2	In the **Save as…** dialog box, provide a name for the L5K file.
3	If required, modify the storage location.
4	Select the file type: **RSLogix 5000 Import/Export File (*.L5K)**.
5	Click **Save**.

Siemens SIMATIC STEP 7 (.ASC, .AWL, .GR7 and .SCL File Export)

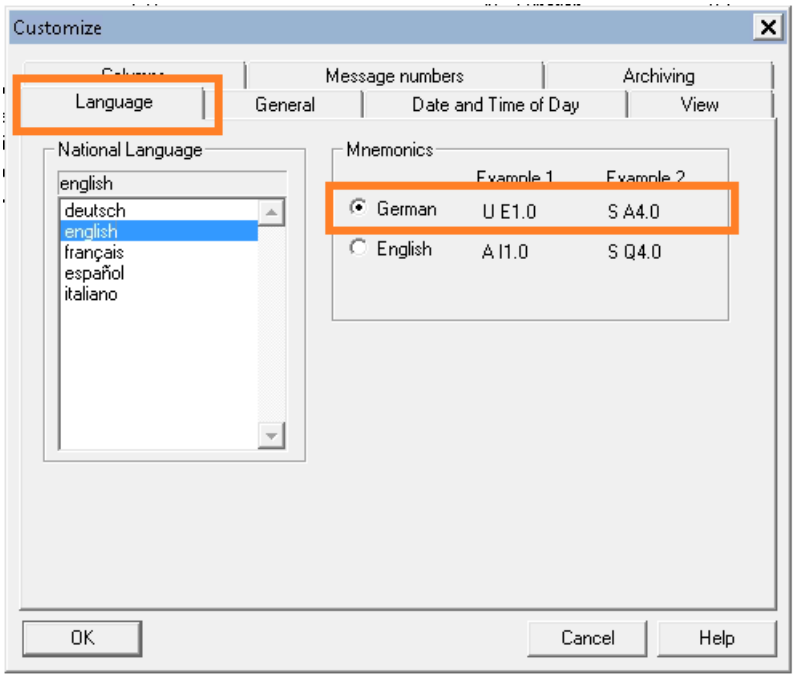
Overview

The following steps are required to process a Siemens SIMATIC STEP 7 controller application with EcoStruxure Control Engineering tools:

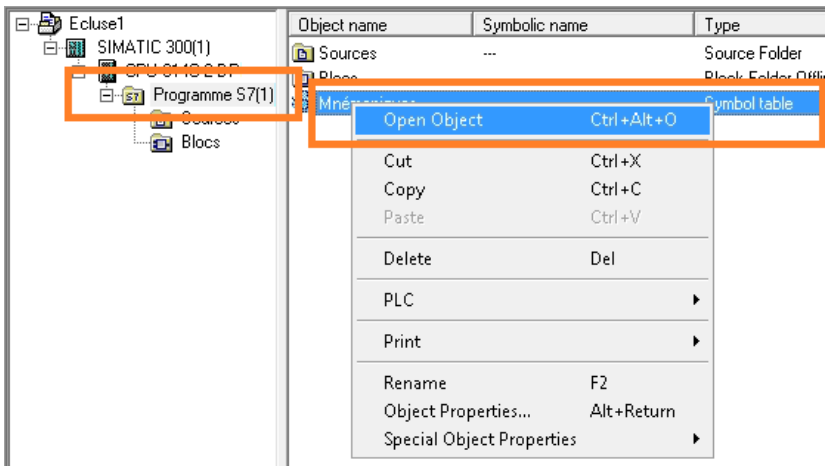
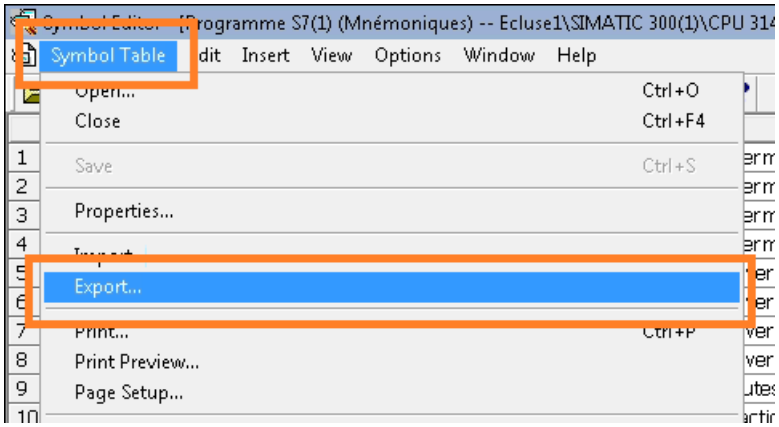
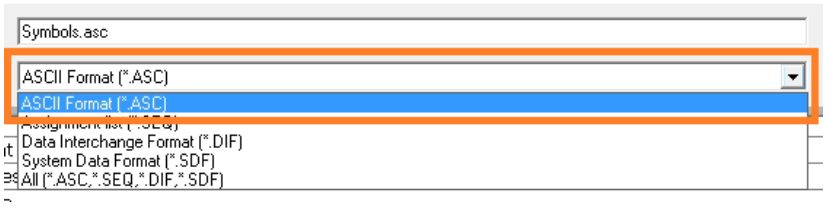
- Set your SIMATIC STEP 7 workshop to German abbreviations (mnemonics).
- Create and export the symbols of the controller application to an **.ASC** file.
- Create and export the contact code (CONT) to an **.AWL** file.
- Create and export the graph blocks (GRAPH) to **.GR7** files.
- Compile the CFC code (if any) to create the corresponding **SCL** sources.
- Export structural codes (SCL) to **.SCL** files.

Setting German Mnemonics

Before creating the export files, set your SIMATIC STEP 7 workshop to German abbreviations (mnemonics):

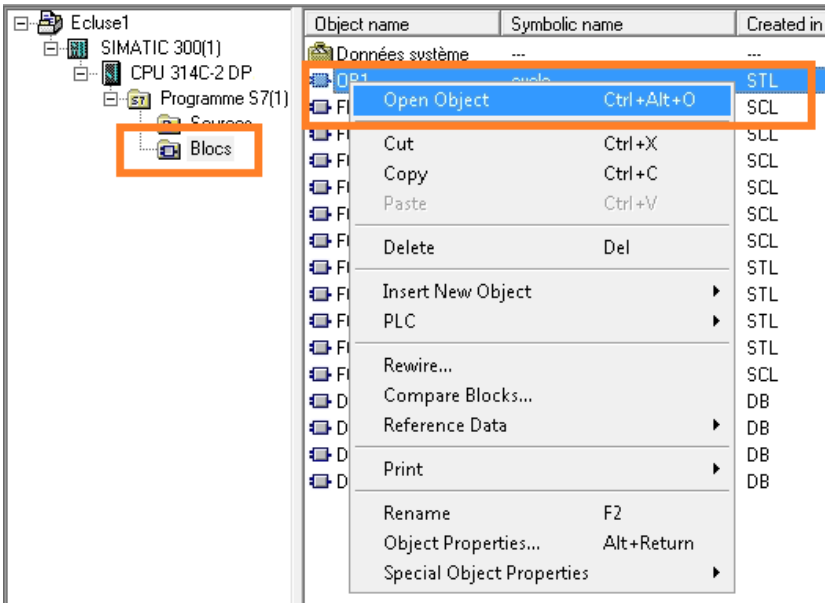
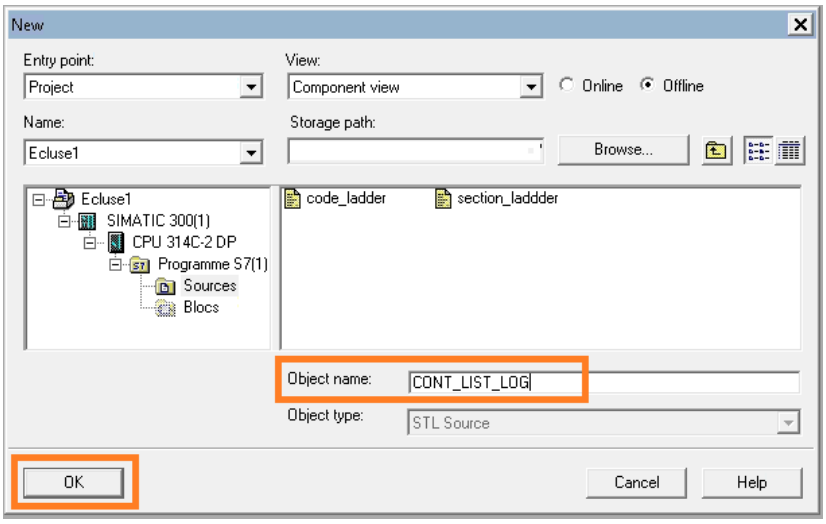
Step	Action
1	From the menu, select **Options > Customize...**.
2	Display the **Language** tab. 
3	Select **German** mnemonics.
4	Click **OK**.

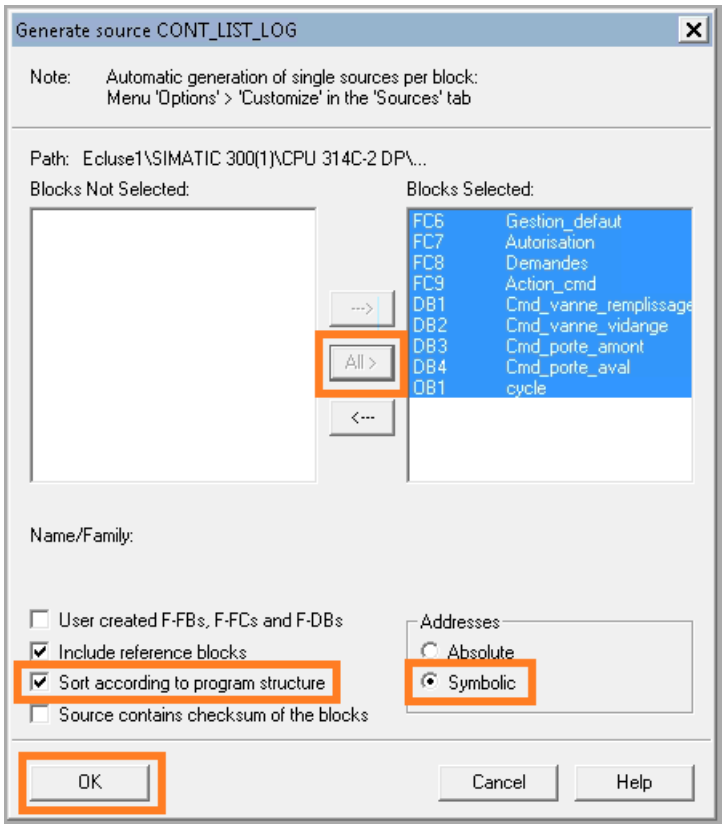
Creating an ASC File

Step	Action
1	Right-click the **Symbol Table** in your program folder and select **Open object**. 
2	From the menu of the **Symbol Editor**, select **Symbol Table > Export...**. 
3	Select **ASCII Format (*.ASC)**. 
4	Provide a name and select a directory for the **.ASC** export file.
5	Click **Save**.

Creating an AWL File

To create an **.AWL** file, first generate the LIST source for the code blocks developed in the languages CONT, LIST and LOG.

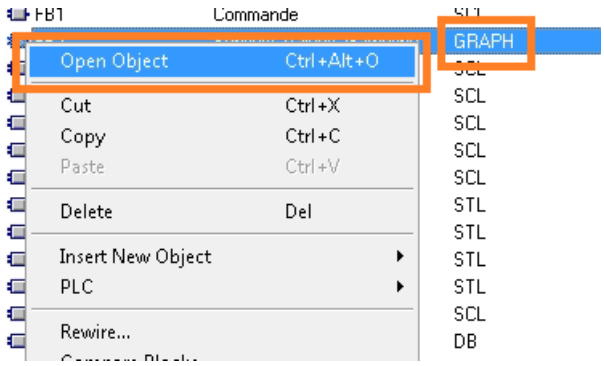
Step	Action
1	Right-click a CONT, LIST or LOG source and select **Open Object** to open the CONT/LIST/LOG code editor. 
2	From the menu, select **File > Close** to close all open objects.
3	From the menu, select **File > Generate source…** to generate the program source.
4	Provide an object name and click **OK**. 

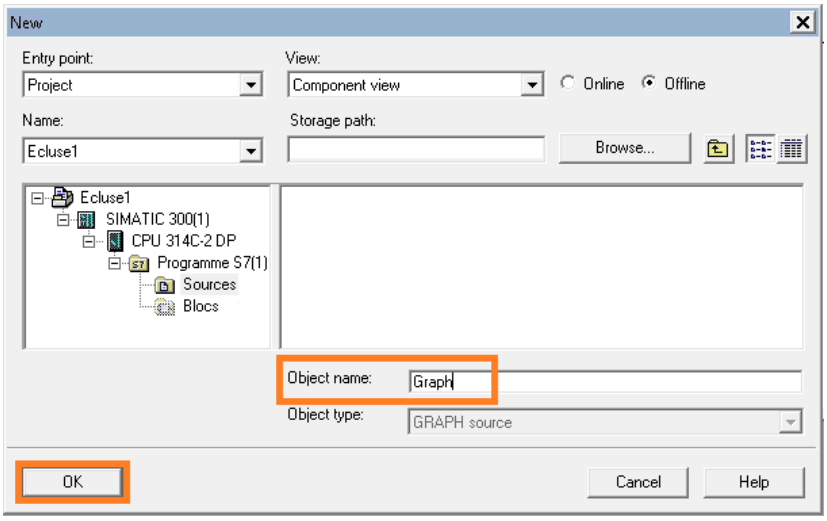
Step	Action
5	Click **All** to select all program blocks and select the options **Sort according to program structure** and **Symbolic** addresses. 
6	Click **OK** to confirm.

If your controller application contains safety-related blocks, export those blocks in a separate **AWL** file. Refer to Safety-Related Applications, page 70 for details.

Creating GR7 Files

The **.GR7** sources must be created for each GRAPH blocks separately. Repeat the following procedure for each GRAPH block to be exported.

Step	Action
1	Right-click a GRAPH object and select **Open Object**. 
2	From the menu, select **File > Generate Source File**.

Step	Action
3	Provide a name for the GRAPH object. 
4	Click **OK** to confirm.
5	Repeat the procedure for each GRAPH object to be exported.

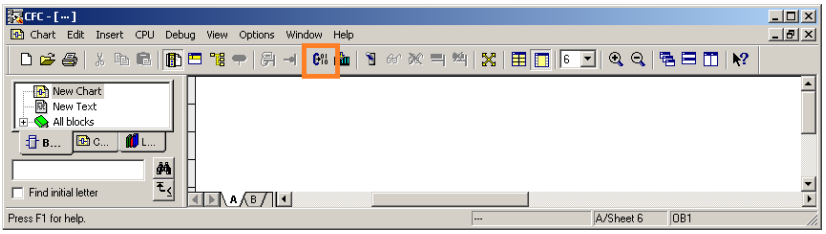
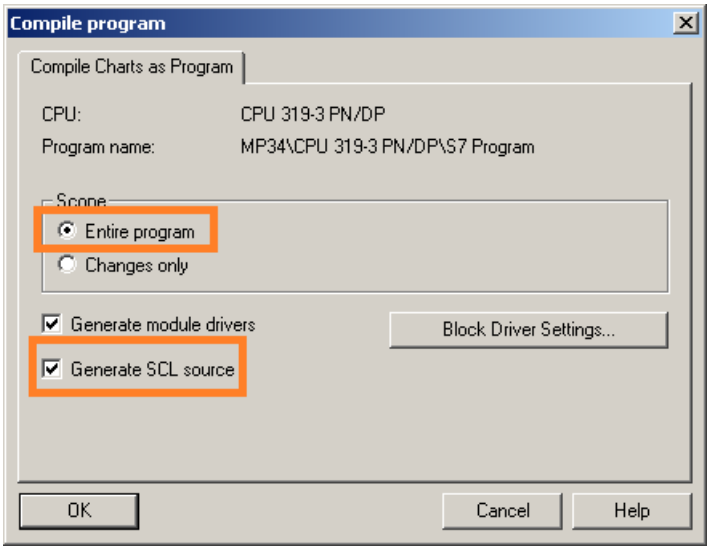
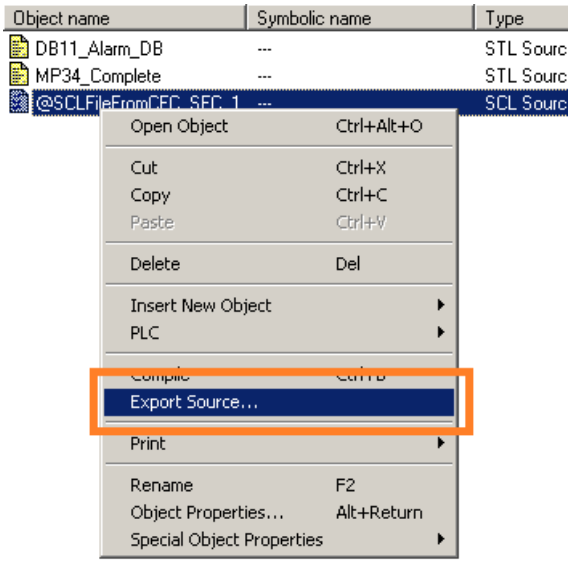
Creating a CFG File

The CFG file is required for analyzing the communication and the hardware configuration of the station.

Step	Action
1	Double-click your controller links in the main window to open NetPro.
2	In the NetPro window, double-click the controller of the station to be exported open the HW Config utility.
3	From the **Station** menu, select **Export...** to export your station configuration (leave the default settings in the dialog box).

Creating a SCL File for CFC Codes

If the controller application contains CFC code, compile the code to generate the corresponding SCL source file which is the file to be processed with EcoStruxure Control Engineering tools.

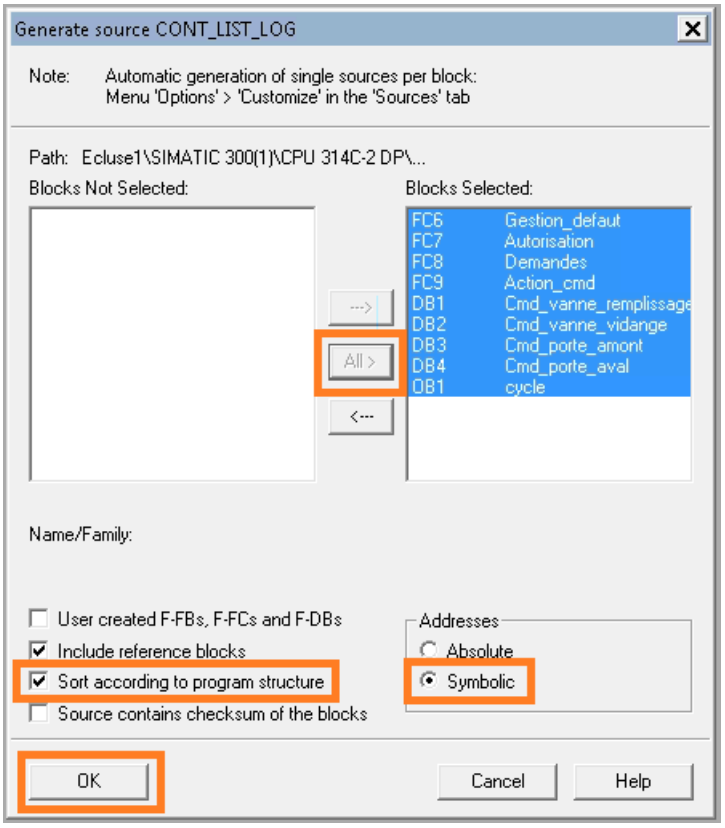
Step	Action
1	Open the CFC code editor by clicking its icon in the toolbar of the main window. 
2	Compile the code with the options **Entire program** and **Generate SCL sources** and click **OK**. 
3	The generated SCL source file can then be exported like other source files (refer to Exporting Files, page 73). 

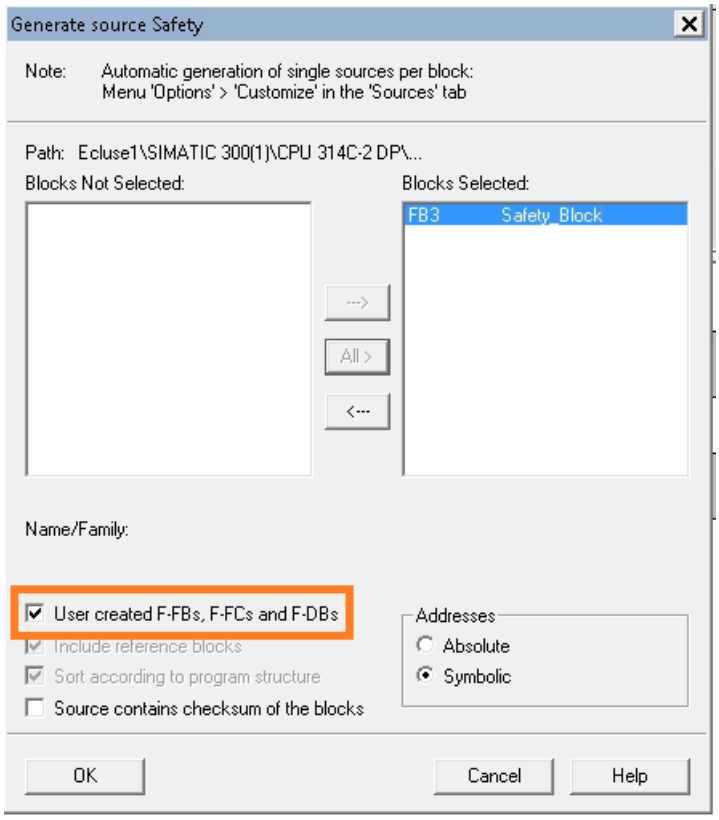
Safety-Related Applications

A safety-related controller application contains two code parts:

- The non-safety-related code part
- The safety-related code part

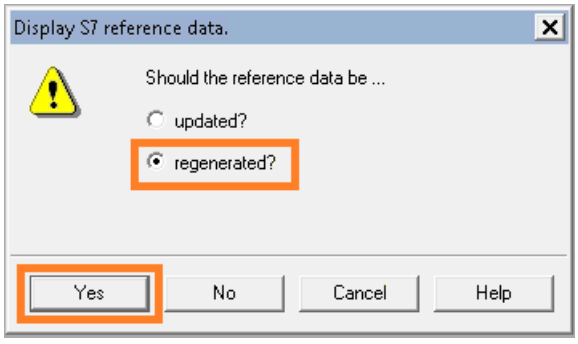
Procedure for exporting controller applications that contain safety-related code:

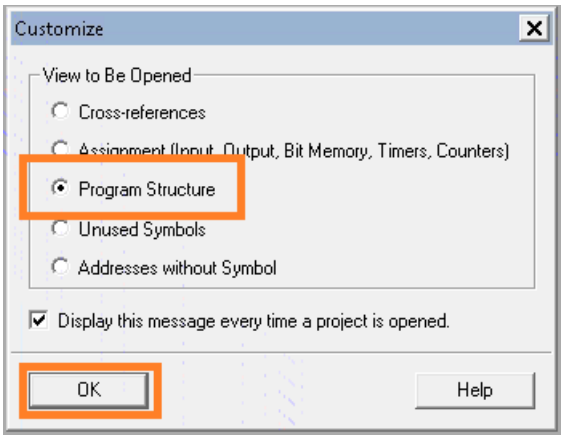
Step	Action
1	Export the **.ASC** file that contains the database for the safety-related code and for the non-safety-related code (refer to Creating an ASC File, page 66).
2	Generate the sources for the non-safety-related code parts (refer to Creating an AWL File, page 66 and Creating a GR7 File, page 68).
3	Click **All** to select all program blocks and select the options **Sort according to program structure** and **Symbolic** addresses. 
4	Click **OK** to confirm.
5	Follow the procedure for Creating an AWL File, page 66 until the dialog box **Generate source Safety** is displayed.

Step	Action
6	Select the option **User-created F-FBs, F-FCs and F-DBs** and click **OK** to confirm. 
7	Create a **.dif** file (refer to Creating a dif File, page 72). The **.dif** file is used to determine whether code is safety-related.

Creating a dif File

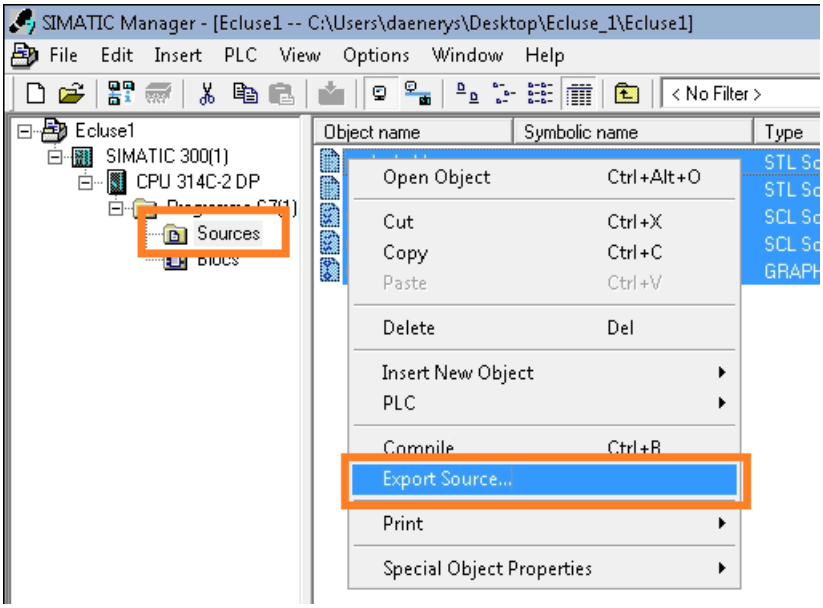
A **.dif** file is created in the SIMATIC Manager of SIMATIC STEP 7 in the following way:

Step	Action
1	From the menu, select **Options > Reference Data > Display**.
2	In the **Display S7 reference data** dialog box, select the option **regenerated?** and click **Yes**. 

Step	Action
3	In the **Customize** dialog box, select the option **Program Structure** and click **OK** to display the program structure. 
4	From the menu, select **View > Export** to open the **Save** dialog box.
5	Provide a name for the **.dif** and click **Save**.

Exporting Files

After you have created the files, export them from SIMATIC STEP 7:

Step	Action
1	Select the LIST, GRAPH (or **.AWL** and **.GR7** files) and SCL sources that you have generated.
2	Right-click the sources and select **Export source…**. 
3	Select a file name and a storage location and click **Save**.

Siemens TIA Portal SIMATIC STEP 7 (.ZIP File Export)

Export the Siemens TIA Portal SIMATIC STEP 7 controller application to a ZIP export file in order to be processed with EcoStruxure Control Engineering tools.

The export can be performed automatically with the EcoStruxure Control Engineering - Import/Export tool. Select **SUPPORT > DOWNLOADS**.

Refer to the EcoStruxure Control Engineering - Import/Export user guide for details on the export procedure.

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As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

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