

EcoStruxure™ Control Engineering

Documentation

User Manual

Original instructions

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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 (English version prevails):

- 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 actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

Introduction

EcoStruxure Control Engineering - Documentation is a reverse engineering tool for control programs that analyses and documents program information from an existing source code. The tool generates an abstract representation of the program, in the form of dependency trees and cross-references, making it easier for you to understand even when unfamiliar with the system. Furthermore, as it is generated from the source code, the documentation will be coherent with the given version of the program, and therefore the tool can provide access to up-to-date program information at any moment even when the original paper documentation is out-of-date.

The documentation generated automatically by the tool includes two dynamic representations of the control program in the form of flow diagrams - a call tree for the procedures, and a data flow for the variables. These representations, unique regardless of the PLC format or brand of the source code, help serve two purposes:

- Re-documentation - Create a new representation of the **structure** of the control code so that it is easier to understand.
- Design recovery - Support the understanding of the **functionality** of the control code.

EcoStruxure Control Engineering - Documentation is a SaaS application and is accessible via a web platform. How to access and use the web platform is explained in this user guide.

EcoStruxure Control Engineering - Documentation is an agnostic tool and supports programs written for a number of different PLC makes and models, including: Schneider Electric Control Expert (formerly Unity Pro), Schneider Electric Machine Expert, Schneider Electric PL7-PRO, Siemens TIA Portal, Siemens Symatic Step 7, Rockwell Automation RS Logix 5000, and many more.

Highlights

The reverse engineering method used to develop the product is unable to guaranty the support for all the possible constructions of control codes, this may result in missing elements in the documentation.

NOTICE

RISK OF INACCURATE OR INCOMPLETE DOCUMENTATION DUE TO REVERSE ENGINEERING TECHNIQUES

- The user should consider that the results may be inaccurate or incomplete when interpreting them

Failure to follow these instructions can result in equipment damage.

Software development tools provide code protection features to prevent access to intellectual property, our tools are not able to read these locked codes. If your program contains any locked code, this code will not be converted, analyzed or documented.

The user is responsible for providing a complete, up-to-date code export of their PLC code. If some code is missing in your program, this code will not be documented.

NOTICE

RISK OF INACCURATE OR INCOMPLETE DOCUMENTATION DUE TO QUALITY OF INPUT FILES

Before using EcoStruxure Control Engineering – Documentation to document their program, the user must:

- Unlock the program elements in the input files.
- Check the completeness of the input files.
- Check that the input files contain the up to date version of the program

Failure to follow these instructions can result in equipment damage.

Web browser compatibility information

EcoStruxure Control Engineering - Documentation is using several recent web technologies to create its views and permits the user to use the tool in an intuitive way.

The following web browsers are supported :

- Mozilla Firefox from version 11
- Google Chrome from version 16
- Microsoft Edge from version 12
- Microsoft Internet Explorer from version 10
- Apple Safari from version 7

Be aware that if you are using a web browser version that is not completely supported, the interface may not act as expected and you may encounter some display issues.

Register on EcoStruxure Control Engineering

Before using the tools available in EcoStruxure Control Engineering, user should first register and the account should be activated. This section presents the registration process.

A user account is required to use EcoStruxure Control Engineering. If you are using the cloud version of the tool, the server is <https://ecostruxure-control-engineering.se.app/>. If you are using a private server installed on premise, you need to check with the server administrator for the URL. In both cases, the creation of a user account is required.

Once on the platform home, click on **Not registered? Sign up here** and fill in the form with your first and last names, your phone number, your email address (which will be used as your identifier) and choose a password. The password needs to contain at least one upper case character, one lower case character, one digit, one special character (such as "{", "/", "\$"...) and needs to be between 8 and 32 characters long.

When the form is filled in with the valid information, click on **Sign Up**.

Depending on the setup, the created account should be activated:

- On the cloud, to verify your email address, you will receive **an email with a link** that you need to **click on**. Once done, your account will be reviewed by our validation process which will **validate** your account within 48 working hours.
- On premise, the activation is automatic as the server's mails are usually not available.

Manage licenses

Different license options are available to best meet your use case requirements.

Paid license plans

Please contact your local Schneider Electric representative or partner for more information on the different license types available and how to acquire one. Or you can purchase a limited selection of EcoStruxure Control Engineering - Documentation license types directly from the Schneider Electric Exchange shop (<https://exchange.se.com/shop>).

Free trial licenses

Starting with the version 22.1 of the web platform, you have the opportunity to use free trial licenses to evaluate some of the products. These free trial licenses are associated with your user account on sign up and are available in a limited amount. They allow you to access the major functionalities of the products with a limitation on the number of results displayed.

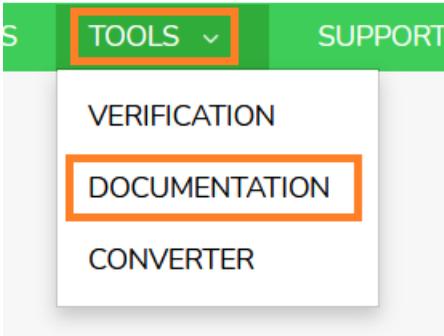
Project and Program creation

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Creation of a program stored inside the default project

To create a new EcoStruxure Control Engineering - Documentation application with the wizard, you can either click on the **New Documentation** button or click on **Tools** then **Documentation** in the menu on the top left of the page.



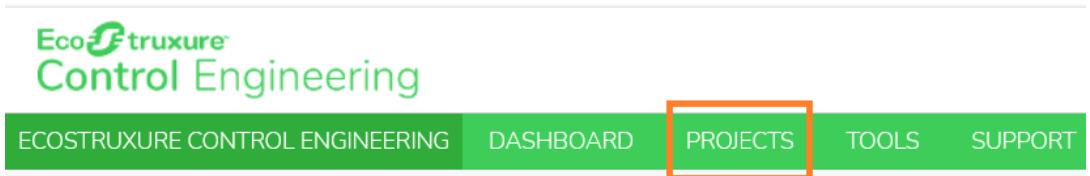
The application is created by default in your default project (usually named default). You can move it to another project after creation.

Once clicked, you are redirected to a program creation wizard. The different steps of this wizard are described in the chapter [Creation of a program and assignation to a project with the wizard](#), page 17.

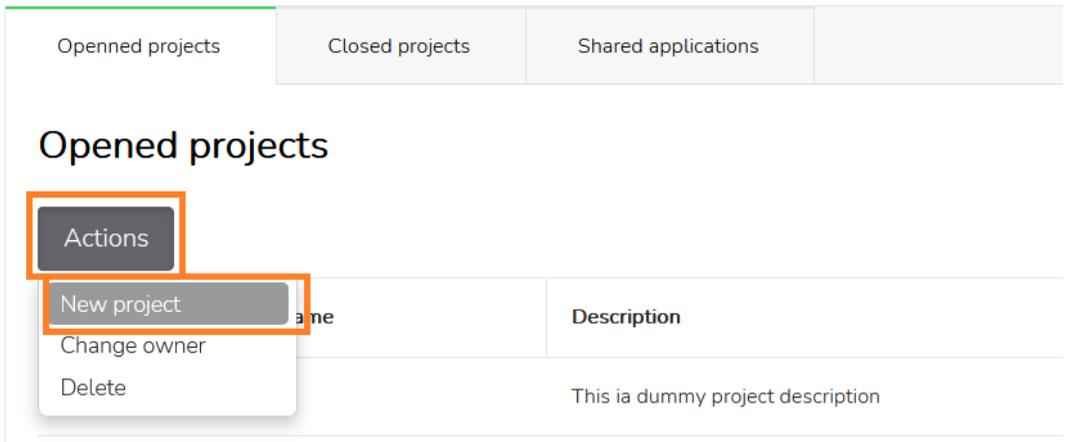
Creation of a program and assignment to a project with the wizard

To organize your programs, you can store them into projects. A project can contain several programs. This procedure describes how to create a project and how to put a program inside.

First, to create your project, you need to access the projects page by clicking **Projects** in the top menu.



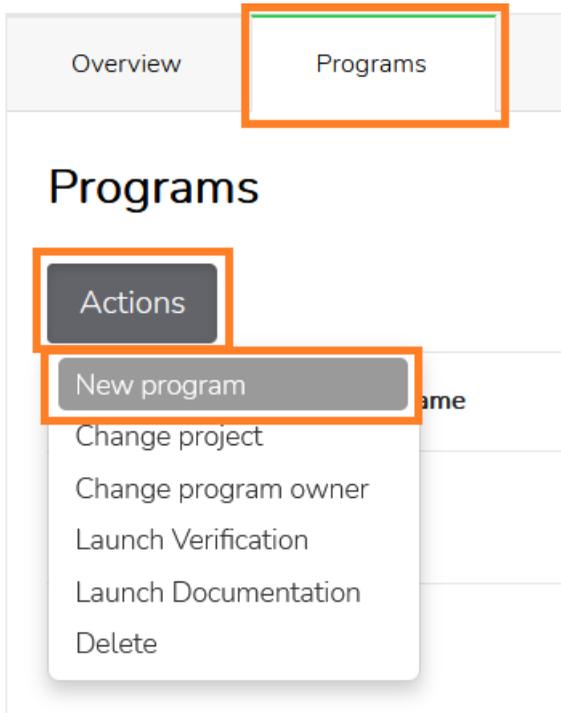
Then, press **Actions** followed by **New project**.



Provide a name for your project and click on **Add** to create it. You cannot create a project with the same name as another one (even if the case of the two projects is not the same).

Once created (you will find it into the “Opened projects” table), click on it to access its content. Once inside, two tabs are available. The first one, called “Overview” is the project’s overview, that provides you with some statistics about the programs it contains. The second one, called “Programs”, is the list of your programs.

To create a new program using the creation wizard, click on the tab **Programs**, then on **Actions** followed by **New program**.



Select **Documentation** to create a EcoStruxure Control Engineering - Documentation project and click on **Launch assistant** to start the creation wizard.

Once clicked, you are redirected to a program creation wizard. The different steps of this wizard are described in the chapter [Program creation wizard](#), page 19.

Program creation wizard

A wizard can be used to guide you through the different steps required to create your EcoStruxure Control Engineering - Documentation program and launch the analysis. Here is a step by step description of how to proceed.

The **first step** consists of identifying the program.

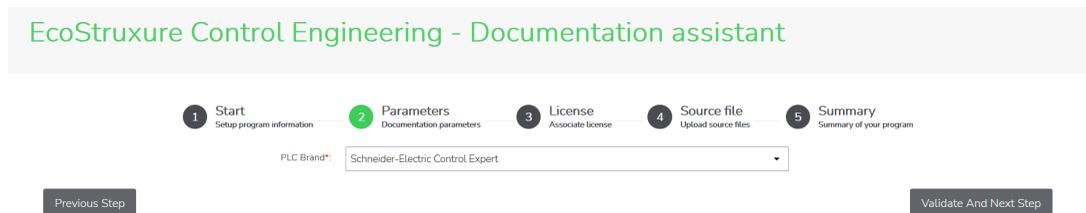
To proceed, you are asked to provide some information :

1. The fields **Program name** and **Customer name** are mandatory. The “Program name” will be used to identify the program in the different views of the EcoStruxure Control Engineering web platform.
2. Some complementary information can be specified for the program based on your needs.

Once the information has been provided, to proceed to the next step, click on the **Validate And Next Step** button.



The **second step** consists of identifying the PLC/development environment used to develop the PLC application.



The **third step** is where you choose the license that you want to use with your new program.

To achieve that, a list of your licenses is displayed and you can choose the one you want to use for the project being created.

If no license is available for this action, you can still continue creating the program by pressing **Validate And Next Step**, in such a case, a license can be added to the program once the creation process has been completed. Without a valid license, you will not be able to run EcoStruxure Control Engineering - Documentation.

If you have a license available for this action and want to use it, then select the license to associate with this application from the drop-down menu and press **Validate And Next Step** to continue.

In the case that your license has not yet been assigned to your current user account, you can use it by providing its identifier in the “License #id” box and click on the **Validate And Next Step** button.

Starting with the version 22.1 of the web platform, trial license(s) may be provided with your user account in order for you to try the product for free. If you want to use it, you will need to click on the checkbox **Use a free Documentation trial license on this program**. This action is not possible if you have already used all the trial licenses that have been associated with your user account. For more information about the result you will get with this license, please read the [Limitations of the free trial version](#), page 40 chapter. Once the checkbox is checked, click on the **Validate And Next Step** button to go further with the creation of your program.

EcoStruxure Control Engineering - Documentation assistant

1 Start 2 Parameters 3 License 4 Source file 5 Summary
Setup program information Documentation parameters Associate license Upload source files Summary of your program

Select a license from the drop-down list OR enter the license ID (15 characters) in the field below.
This step is optional, you can assign a licence later.

Available license(s):

Listed by Type (e.g. Subscription) - Name - Key (e.g. AXXXXXXXXXXXXXX)

License #id:

e.g. AXXXXXXXXXXXXXX

Free trial: Use a free Documentation trial license on this program

Previous StepValidate And Next Step

The **fourth step** is where you can upload an exported version of the PLC program to document.

To do so, click on the **SELECT FILES ...** button to import the source files of the application and the rules file (if needed), and then click **Validate And Next Step** to validate.

As a reminder, the interface displays the type of source files that you need to provide to start a documentation process based on your choice of development environment made in step 2.

In the case that you prefer to send your files later or if a third party will send the files for you, you can click on **Validate And Next Step** to continue and send them later. Consider that unless files are uploaded, the EcoStruxure Control Engineering - Documentation tool will not be able to run.

EcoStruxure Control Engineering - Documentation assistant

1 Start
Setup program information

2 Parameters
Documentation parameters

3 License
Associate license

4 Source file
Upload source files

5 Summary
Summary of your program

DRAG YOUR FILES HERE

OR

Select Files...

Associate tag to this application

More details about the allowed files for your PLC brand ?

Previous Step

Validate And Next Step

The **fifth step** is a summary of what has been done using the wizard.

In this step, you find the information you have entered during the application creation process.

To modify them, you can click on the **Previous step** button, otherwise click on **Create** to create the application or **Launch** to create and then launch EcoStruxure Control Engineering - Documentation (this is possible if you have chosen a valid license and if you have sent all the required files).

EcoStruxure Control Engineering - Documentation assistant

1 Start
Setup program information

2 Parameters
Documentation parameters

3 License
Associate license

4 Source file
Upload source files

5 Summary
Summary of your program

Application name	Demo_Application	Customer name	Schneider Electric
PLC site city	N/A	PLC reference	N/A
PLC site address	N/A	PLC function	N/A
PLC brand	Schneider-Electric Control Expert		
License	N/A		

Previous Step

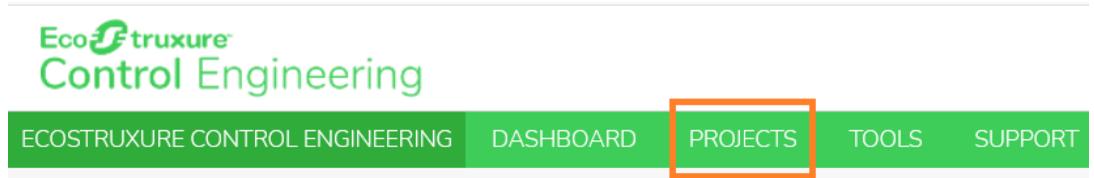
Create Launch

Access to a shared Program

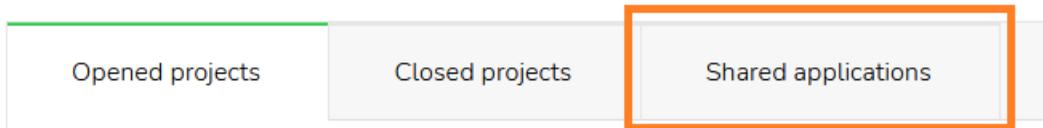
When a program is shared with you, or its access is not restricted, you can add it to your list of programs by providing its unique 6-digit key. The unique 6-digit key can be found in the program overview, under **Application key**.

To add a program to your list of programs using its unique 6-digit key, proceed as follows:

First, access the projects page by clicking on **PROJECTS** in the top menu.



Then click on the tab **Shared applications**.



Enter the program's unique 6-digit key in the **Application key** box below **User History** or **One time access**, depending if you want to save this program into your personal records for easier access later, or if you want to see it without saving it, then click on **Add to my history** or **One time access**.

Opened projects Closed projects **Shared applications**

Shared applications

User history

Add a new application

You can save any application shared with you in your personal history for future visit by providing the application key below.

[Add To My History](#)

List of Applications

Your visited applications history is currently empty. When an application is visited, an history is created and displayed on this page.

One time access

You can access any application shared with you without saving it in your visited applications history by providing the application key below.

[One Time Access](#)

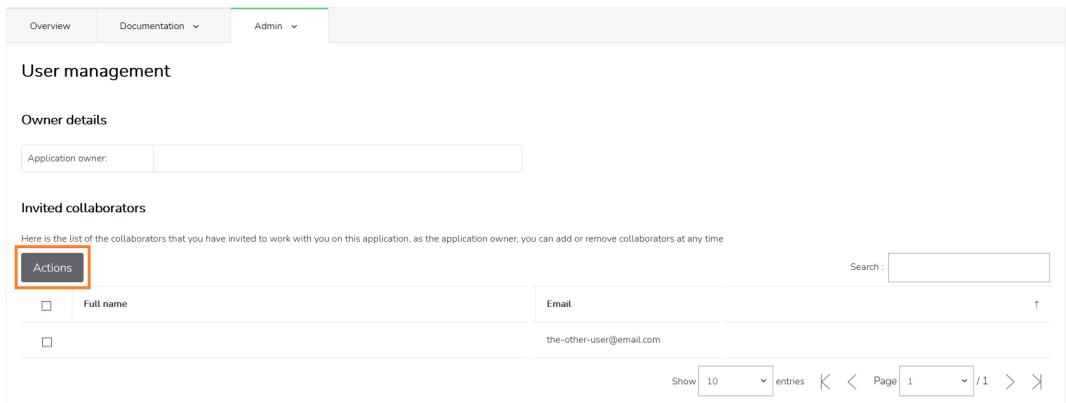
Share programs with other users

Your programs can be shared with other users in order for you and your collaborators or your commercial contacts to be able to work on a project together. To share a program, you need to be its owner, the other users cannot delegate their access.

There are 2 ways to share a program :

- User by user: You choose who can access your program. By default, the other users cannot do this.
- For everyone: Everyone can access your program, which is the opposite of the default behaviour.

To **share your program with a selected user**, open the program page and then go to the program users using the tabs **Admin** and **Users management**. Then, under “Invited collaborators”, click on **Actions** and select **Add**. You are prompted to provide the invited user e-mail address. You can give the e-mail address used by this user to register on EcoStruxure Control Engineering platform if the user is already registered, or any other e-mail address if the user is not yet registered. You can also choose to send an invitation, which is recommended, to tell the user that the program is now shared with them.



The screenshot shows the 'User management' interface. At the top, there are tabs for 'Overview', 'Documentation', and 'Admin'. Below the tabs, the 'User management' section is visible. Under 'Owner details', there is a text input field for 'Application owner'. Below that, the 'Invited collaborators' section is shown. A note states: 'Here is the list of the collaborators that you have invited to work with you on this application, as the application owner, you can add or remove collaborators at any time'. A table lists the collaborators with columns for 'Full name' and 'Email'. An 'Actions' button is highlighted with a red box. The table contains one entry with the email 'the-other-user@email.com'. A search bar is located to the right of the table. At the bottom, there are pagination controls showing 'Show 10 entries' and 'Page 1 / 1'.

Once another user is added to the invited users list, they will be able to perform the same actions as you, except sharing the program and accessing its settings (if your program is also using the EcoStruxure Control Engineering - Verification tool, then the rules file update and the justifications functionality may also be unusable by the invited user, for more details, please report to the EcoStruxure Control Engineering - Verification documentation). If you do not want your invited users to be able to update your program, then it is recommended to deactivate the program using the program settings. This action will put your program in a read-only state. You can revoke the invitation at any time by selecting the user(s) you want to remove from your program and then using the **Actions** button to select **Remove access**.

To **share your program with everyone**, open the program page and then go to the program settings using the tabs **Admin** and **Settings**. Simply enable the checkbox under **External share** to share your program with everyone.

Once another user accesses your program, they will be able to perform the same actions as you, except sharing the program and accessing its settings (if your program is also using the EcoStruxure Control Engineering - Verification tool, then the rules file update and the justifications functionality may also be unusable by the invited user, for more details, please report to the EcoStruxure Control Engineering - Verification documentation). If you do not want these users to be able to update your program, then it is recommended to deactivate the program using the program settings. This action will put your program in a read-only state. You can revoke the access to your program at any time by disabling the checkbox. Once your program access is revoked, then no user can access it, even if previously accessed, and unless being in the invited users list (see below for more details).

EcoStruxure Control Engineering - Documentation

What's in This Part

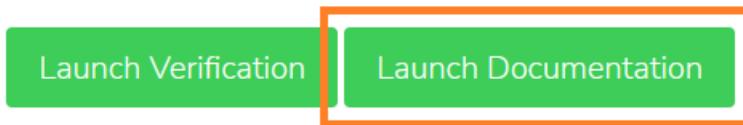
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Document a control program

Once a program has been created on the EcoStruxure Control Engineering platform, then the user can run several EcoStruxure Control Engineering - Documentation processes according to their licence type.

This action is relevant in the case where the user wants to document a different version of their program (either new or older, depending on their needs) or to use a different EcoStruxure Control Engineering - Documentation version.

To proceed, the user needs to click on the **Launch Documentation** button on the program page.



Once done, the user may choose to provide new exported program files to generate their program information in the form of flow trees and cross-references. If they choose to do so, then the user is invited to **upload** them using the EcoStruxure Control Engineering - Documentation wizard described in the chapter Program creation wizard, page 19.

Once the new files are uploaded or in the case there are no new files, then the EcoStruxure Control Engineering platform may ask the user to choose which files they want to analyse. If the user does not want to generate the abstract program information for every file, then they can remove the unwanted files by **unchecking** them in the list.

When satisfied with the list of files to analyse, the user can start the documentation process by clicking on **Launch**.

The algorithms used in EcoStruxure Control Engineering - Documentation are influenced by the size and complexity of the program and its memory, this may result in a longer analysis time. The user is able to follow the analysis process state with the progress information displayed in their project program page.

The generation of the control and data flows is dependent on the analysis of the code. If any parts of the code are unable to be analyzed correctly, this may result in incomplete control and data flows.

NOTICE

RISK OF INACCURATE OR INCOMPLETE DOCUMENTATION DUE TO CODE ANALYSIS PROCESS

- Keep a critical mindset when using the information generated by the tool

Failure to follow these instructions can result in equipment damage.

Understand the data flow view

What's in This Chapter

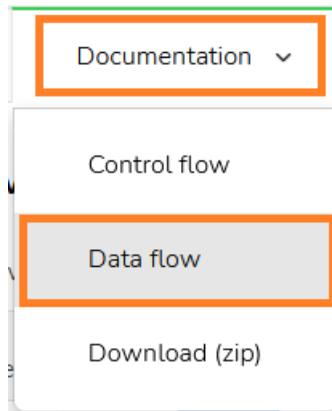
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The data flow view displays the relationships between variables of a control program, from input to output, or vice versa.

By using this view, the user is able to see how the control system variable values are read or written.

General presentation of the views

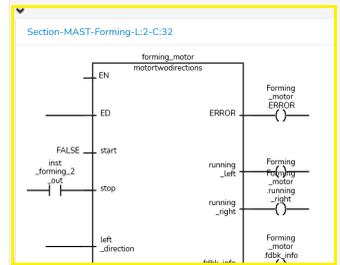
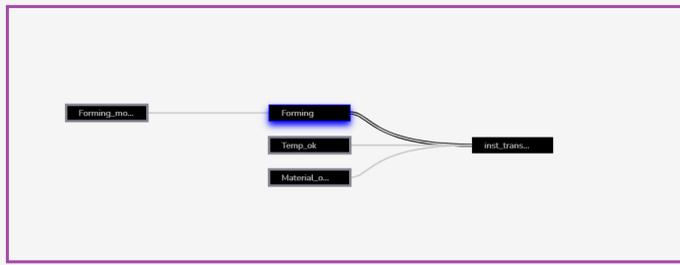
To access this view, if the user is using the EcoStruxure Control Engineering platform, they need to click on the **Documentation tab** and then on **Data flow**. If the user is using a standalone version of the documentation, they need to open the file **index.html** by double clicking on it and then click on the **Display Data Flow button**. The screenshots used in this manual have been created using the EcoStruxure Control Engineering platform, so they may differ from the standalone version in their aspect.



The data flow view consists of four parts that are: variables list and settings (top left, circled in green in the screenshot below), view settings (top right, circled in blue), dependency tree (bottom left, circled in purple) and cross-references snippets (bottom right, circled in yellow).

<p>Variable to explore</p> <p><i>Use this list to select the variable to explore</i></p> <p>List Of Variables ▾</p>	<p>Data flow direction</p> <p><i>Use these switches to select how the cross-references are shown</i></p> <p>Read Write Read And Write</p>	<p>Cross-references language</p> <p><i>Toggle this switch to switch from a view in Ladder to a view in Literal, or the opposite</i></p> <p>Ladder Literal</p>	<p>Cross-references displaying</p> <p><i>Toggle this switch to show or hide the cross-references panel</i></p> <p>Show Hide</p>
--	--	--	--

Variable	Location	Type	Comment
Forming	-	bool	Forming material in progress



Variables list

The variables list allows the user to select from which variable they want to see the dependencies. By clicking on the **Variables** drop-down menu, the user can list, search and select the appropriate variable.

Mnemonic	Memory reference	Comment
Machine_running	%Q0.3.3	-
inst_watchpoint_3_out	-	-
inst_transportation_belt_3_out	-	-
inst_transportation_belt_1_out	-	-
inst_forming_6_out	-	-
inst_forming_3_out	-	-
inst_forming_5_out	-	-
inst_forming_2_out	-	-
inst_forming_1_out	-	-
inst_mixer_1_out	-	-

Page 1 / 29

The more variables the user's program has, the more this list is filled. To easily locate the variables they want to deal with, the user has several choices:

1. They can choose to list every variable by using the pagination buttons on the bottom of the view, it is possible to increase the amount of displayed variables at a single time by changing it using the drop-down menu on the top-left part of the table.
2. They can filter the variables using the search engine on the top-right part of the view. Their search criteria can include parts of the variable name, parts of its address and part of its comment.

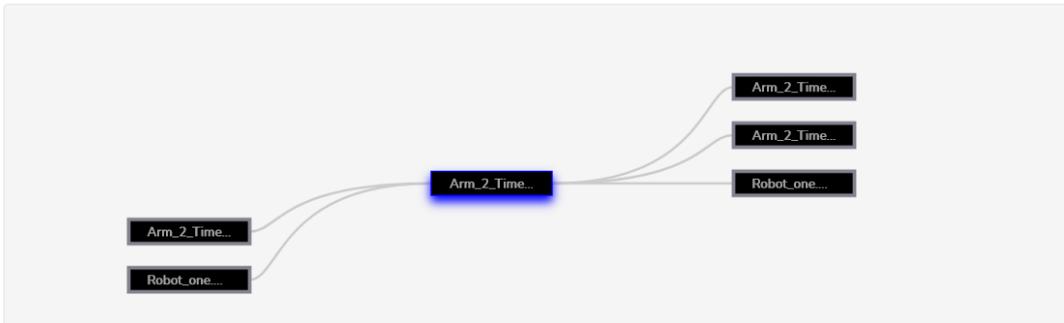
Once the user has localized the variable they want to use, then they need to **click on its name** to display it in the dependency tree and cross-references snippets parts of the page.

The user is also able to choose how the dependencies should be explored. The menu **Access mode** allows the user to select how the dependencies are deployed. In Write mode, only the dependencies that write the value of the variable are shown. In Read mode, only the variables that are written using the selected variable are shown. In the Dependency tree view explained below, this means that in Write mode, the left part of the graphic is displayed when clicking on a name, and in Read mode, it is the right part that is displayed.

Dependency tree

The Dependency tree graphically shows the dependencies between the variables. If a variable is used to compute or to elaborate another one value, then this variable is displayed with a link to the other variable.

Variable	Location	Type	Comment
Arm_2_Timer	-	ton	Timer for movement arm 2



In the example above, the selected variable in the middle:

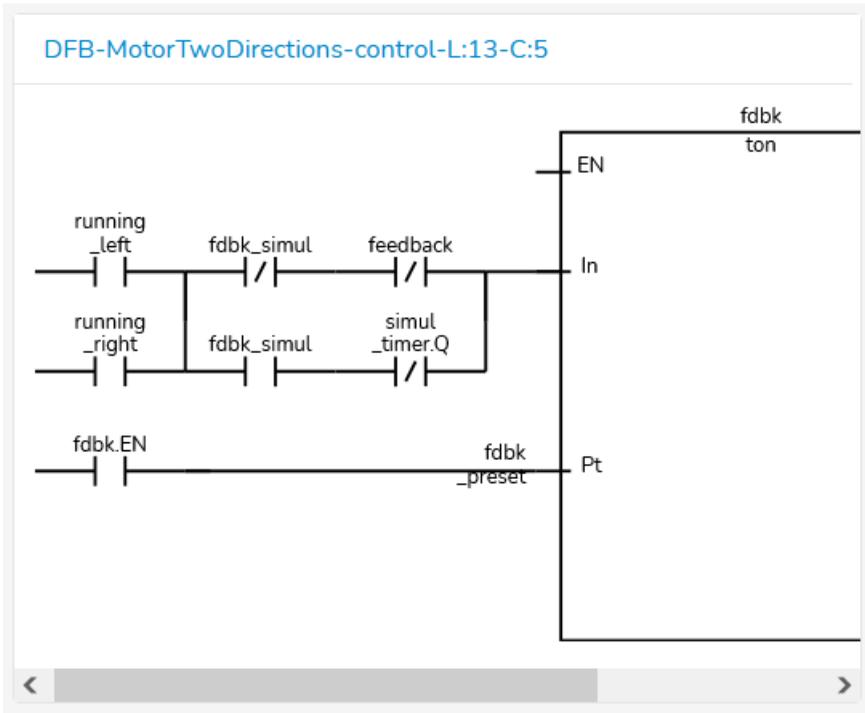
- Needs the values of the two variables that are on its left in order to calculate its own value
- Is used to calculate the values of all the variables on its right

The user is able to explore the relationships between the variables by clicking on their names.

This view is helpful to see which variables are affected if something is changed in the program, or to help diagnose an abnormal variable value found in the control system program while it is running.

Cross-references snippets

The cross-references snippets part of the page displays how the different procedures are calling each other. It consists of a code extract, displayed in Ladder or Literal language that highlights the relations. The code extract is not written in this screen in the same way it is written in the user's original code in order to provide a synthetic view. Its logic still remains the same as in the original code, which can be retrieved using the location displayed behind each snippet. For instance, if the user calls a procedure inside several nested conditional instructions, then the snippet will compress these instructions into a single one.



The cross-references snippets view is updated every time the user chooses a new variable either in the variables drop-down menu or in the dependency tree to reflect its own usage(s).

View settings

The view settings is where the user can customize the display. The options available are as follows:

- Cross-references displaying : Shows or hides the cross-references part of the view, allowing the user to have a greater view on the dependency tree
- Cross references language : Display language selection for the cross-references snippets either in Structured Text or Ladder language.

The Ladder representation requires a deep understanding of the different variables types. This may lead to the impossibility to represent the code in the Ladder language. In this case, the cross-references will be displayed in Structured Text.

Creating a data flow from a control program is an advanced and complex operation. This means that for some technical reasons, EcoStruxure Control Engineering - Documentation may be unable to build a precise flow when a variable is indexed and/or when its address is indirectly accessed using a variable in the program.

Understand the Control flow view

What's in This Chapter

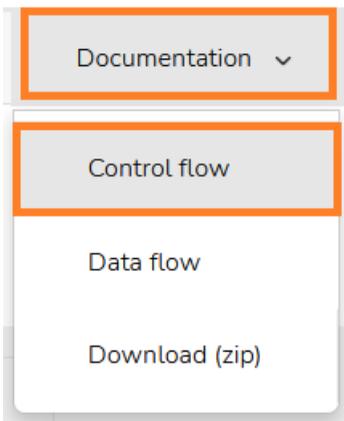
General presentation of the view	33
Procedures list.....	34
Dependency tree	35
Cross-references snippets.....	36
View settings	37

The control flow view of a program refers to the order in which the function or procedure calls are executed or evaluated.

By using this view, the user is able to see how the control system logic is called.

General presentation of the view

To access this view, if the user is using the EcoStruxure Control Engineering platform, they need to click on the **Documentation tab** and then on **Control flow**. If the user is using a standalone version of the documentation, they need to open the file **index.html** by double clicking on it and then click on the **Display Control Flow button**. The screenshots used in this manual have been created using the EcoStruxure Control Engineering platform, so they may differ from the standalone version in their aspect.



The Control flow view consists of four parts that are: procedures list and settings (top left, circled in green in the screenshot below), view settings (top right, circled in blue), dependency tree (bottom left, circled in purple) and cross-references snippets (bottom right, circled in yellow).

Procedures to explore

Use this list to select the procedure to explore

Procedures ▾

Cross-references language

Toggle this switch to switch from a view in Ladder to a view in Literal or the opposite

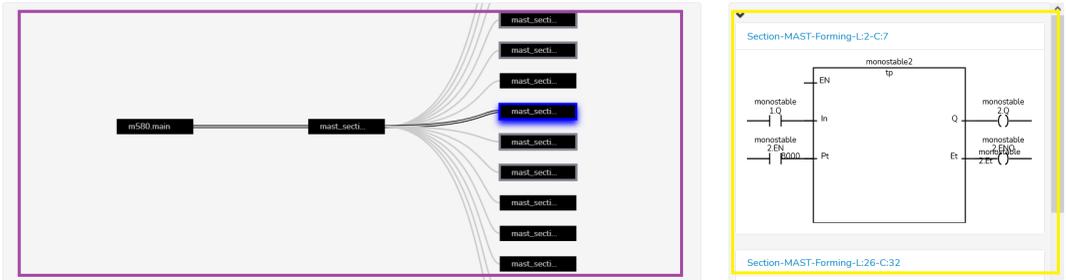
Ladder Literal

Cross-references displaying

Toggle this switch to show or hide the cross-references panel

Show Hide

Name	Full name	Language	Comment
forming	mast_section.forming	fdb	-



Procedures list

The procedures list allows the user to select from which procedure they want to see the call tree. By clicking on the **Procedures** drop-down menu, the user can list, search and select the appropriate function, function block or task (which are generically called “procedure” inside the software and this documentation).

Procedure name	Nb Dep references
demo_controlexpert_m580.loop	1
demo_controlexpert_m580.init	1
MotorTwoDirections	3
Heating	1
control	1
m580.loop	1
mast_section.loop	14
weighing_material_a	1
mixer	2
heating	1

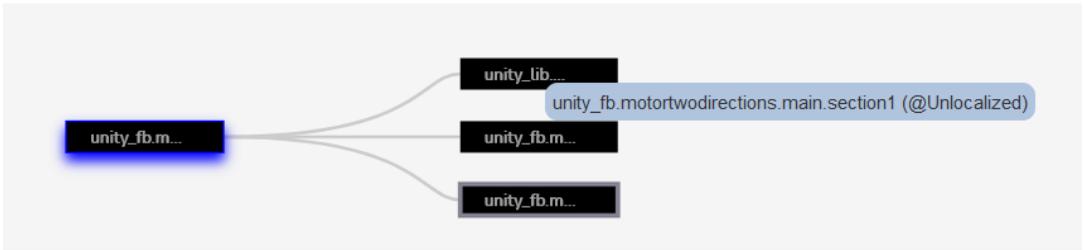
The more procedures the user's program has, the more this list is filled. To easily locate the procedures they want to deal with, the user has several choices:

1. They can choose to list every procedure by using the pagination buttons on the bottom of the view, it is possible to increase the amount of displayed procedures at a single time by changing it using the drop-down menu on the top-left part of the table.
2. They can filter the procedures using the search engine on the top-right part of the view, their search criteria can include parts of the procedure name.

Once the user has localized the procedure they want to use, then they need to **click on its name** to display it in the dependency tree and cross-references snippets parts of the page.

Dependency tree

The Dependency tree graphically shows the dependencies between the procedures.



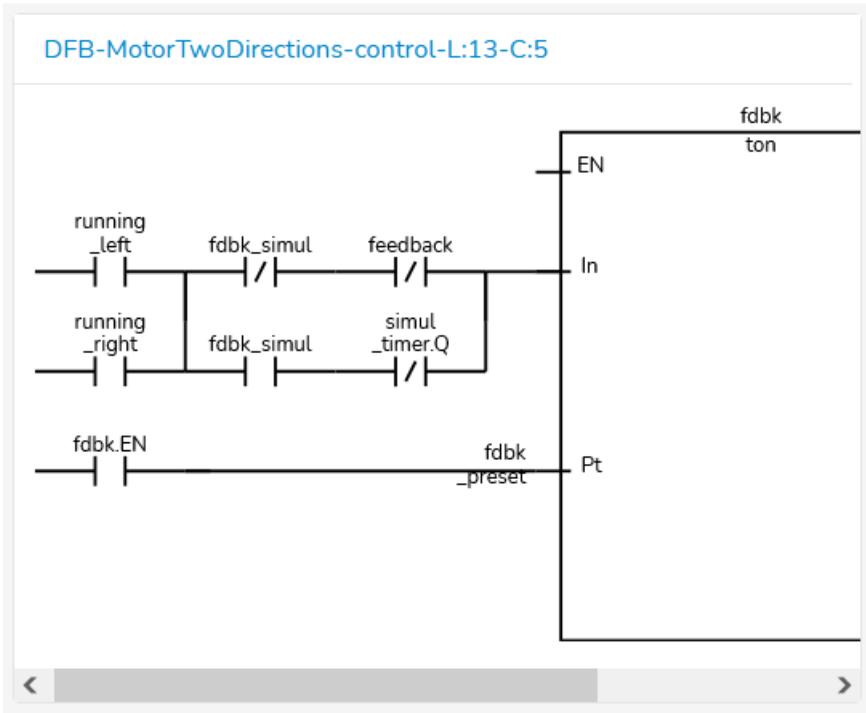
Starting from the selected procedure, highlighted in blue, every procedure displayed on its left is a procedure that calls it, and every procedure displayed on the right is a procedure that is called by it.

The user is able to explore the relationships between the procedures by clicking on their names.

This view is helpful to see how the procedures are calling each others and to explore the calls graphically.

Cross-references snippets

The cross-references snippets part of the page displays how the different procedures are calling each other. It consists of a code extract, displayed in Ladder or Literal language that highlights the relations. The code extract is not written in this screen in the same way it is written in the user's original code in order to provide a synthetic view. Its logic still remains the same as in the original code, which can be retrieved using the location displayed behind each snippet. For instance, if the user calls a procedure inside several nested conditional instructions, then the snippet will compress these instructions into a single one.



The cross-references snippets view is updated every time the user chooses a new variable either in the variables drop-down menu or in the dependency tree to reflect its own usage(s).

View settings

The view settings is where the user can customize the display. The options available are as follows:

- Cross-references displaying : Shows or hides the cross-references part of the view, allowing the user to have a greater view on the dependency tree
- Cross references language : Display language selection for the cross-references snippets either in Structured Text or Ladder language.

The Ladder representation requires a deep understanding of the different variables types. This may lead to the impossibility to represent the code in the Ladder language. In this case, the cross-references will be displayed in Structured Text.

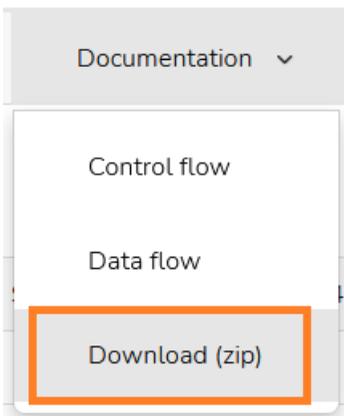
Creating a data flow from a control program is an advanced and complex operation. This means that for some technical reasons, EcoStruxure Control Engineering - Documentation may be unable to build a precise flow when a variable is indexed and/or when its address is indirectly accessed using a variable in the program.

Download an offline version of the documentation

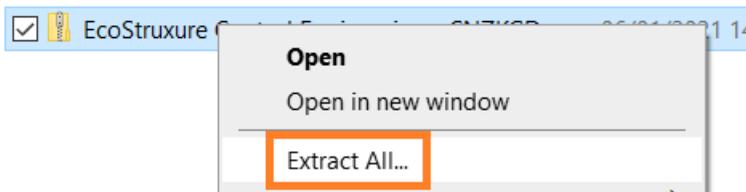
In order to use the documentation offline or to archive it, it is possible to download a standalone copy of the EcoStruxure Control Engineering - Documentation result.

To download a standalone copy of the documentation, the user first needs to generate at least one documentation through one of the launch processes described in the chapters Document a control program, page 27 or Program creation wizard, page 19.

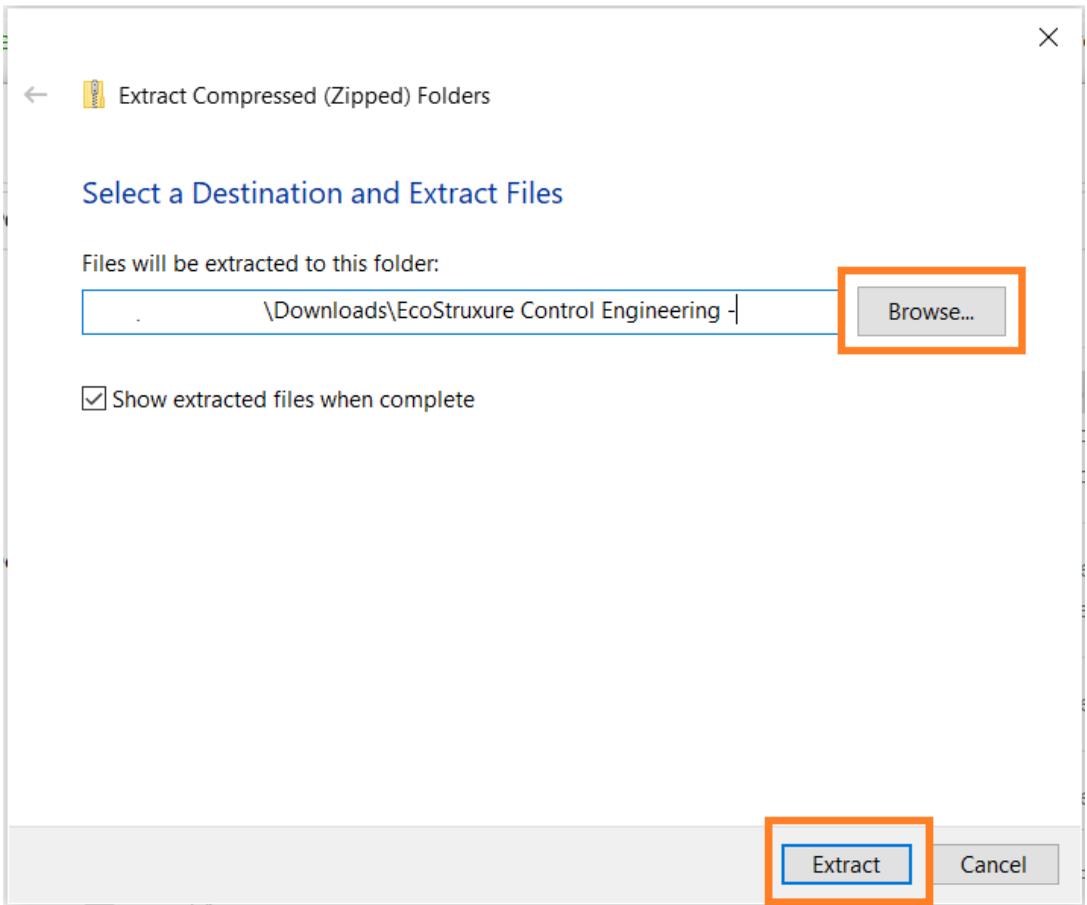
Then, the user needs to **go to their program page**, click on the **Documentation tab** and then click on **Download (zip)**. The download process should start immediately and the user will be provided with a ZIP file, which contains the standalone version of the documentation.



To use the standalone version of the documentation, the user first needs to extract it using an appropriate software or by using Windows standard interface if the user does not have another tool at their disposal. To extract the ZIP file content using Windows' tool, **right-click on its icon** and select **Extract All...**



Then, if it is relevant, select an appropriate place to put the extracted files by clicking on **Browse**. Click on **Extract** to start the extraction process.



Once extracted, the user will find the files in the location they chose. To consult the documentation, the user needs to open the file **index.html** by double-clicking on it.

Some modern browsers and/or some companies policies prevent their users/collaborators to open and browse local files and folders for security reasons. Due to that, the user may experience some issues while reading their documentation such as dependencies not loaded or graphical representation of the code not available. For more information on how the user's company is dealing with this security feature, the user needs to contact their local IT team.

Limitations of the free trial version

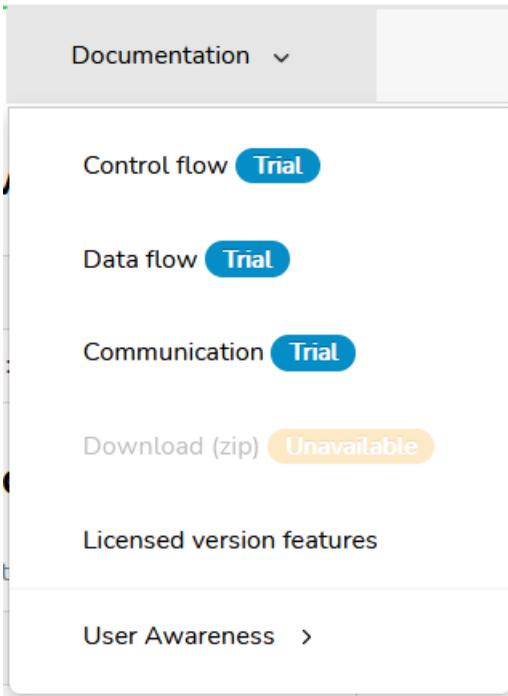
If the Documentation program has been created and run with a free trial license, then the result of the execution will be in trial version. This version of the product allows you to use the major functionalities for free with some limitations, so that you can try the tool and get an idea of how it works. These limitations are listed below:

Functionality	Trial version	Paid license
Control Flow		
List of procedures	Included	Included
Amount of dependencies shown by procedure	Limited to 3	All
Amount of cross-references shown by procedure	Limited to 2	All
Data Flow		
List of variables	Included	Included
Amount of dependencies / influences shown by variable	Limited to 3	All
Amount of cross-references shown by variable	Limited to 2	All
Flow direction	Unidirectional	Unidirectional and Bidirectional
Communications		
Amount of communications displayed	Limited to 2	All
Other features		
Save tree view	Unavailable	Included
Download offline version	Unavailable	Included

Due to the variety of behavioral characteristics of different PLCs, variable operations and programmable units, it is not always possible to retrieve all information during the program analysis process. The list of communications and cross-references reflects only the communications and cross-references that EcoStruxure Control Engineering - Documentation has been able to detect.

The functionalities that are not available or limited are signalled in the Documentation tab in your program:

- The “Trial” tag means that the functionality is limited
- The “Unavailable” tag means that the functionality is not accessible
- No tag means that the functionality is fully available.



Once you have tried Documentation, you can upgrade your program with a Paid license to get all of the product functionalities.

Brand dependant export procedures

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EcoStruxure Control Engineering tools read PLC application files. The exact required files depend on the kind of PLC. This section details for the PAC/PLC/DCS/RTU supported what is the procedure to get the file.

Each subsection is dedicated to a specific Control system (PAC/PLC/DCS/RTU) model.

Schneider Electric EcoStruxure Control Expert (.XEF / ZEF file export)

EcoStruxure Control Expert (formerly Unity Pro) applications need to be exported in a XEF or ZEF export file in order to be analyzed by EcoStruxure Control Engineering products. This export could be done manually, using the procedure described below or automatically with the help of the Import/Export tool. The procedure requires the installation of EcoStruxure Control Engineering Import/Export product available on [Exchange](#).

You can create a XEF or ZEF export file with the **File** and **Export application...** menu entries in the EcoStruxure Control Expert software.

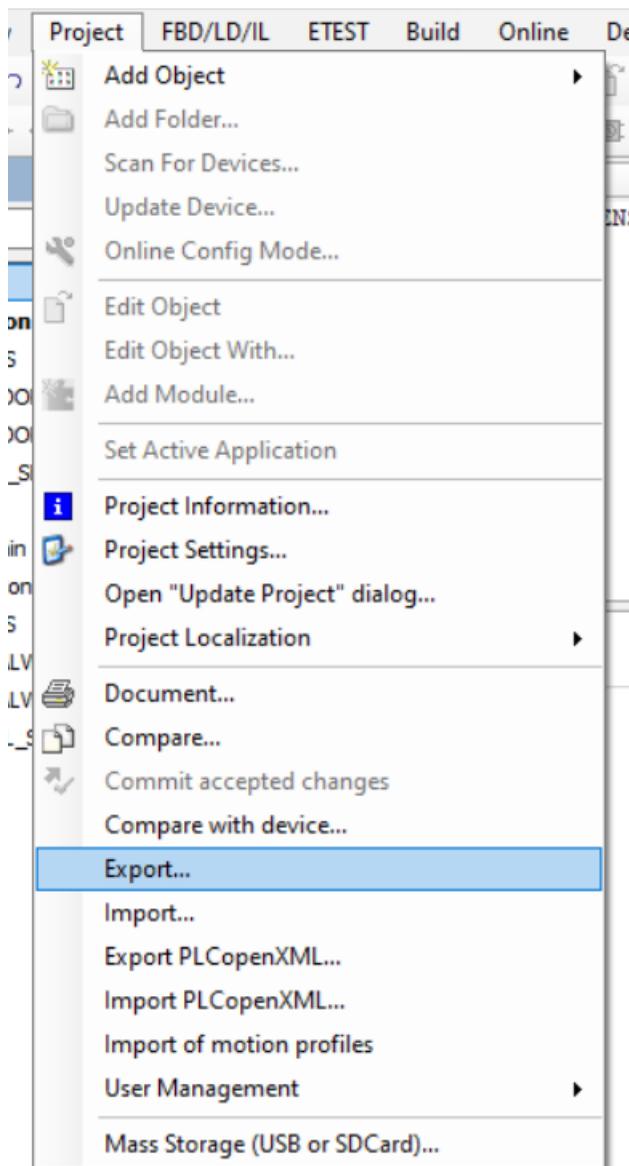
1. In EcoStruxure Control Expert menu, select **File** then **Export application...**
2. In the “Export application” dialog box, give a **name** to the XEF or ZEF file
3. If needed, change directory where the XEF or ZEF file will be created
4. Click on **Save**

Schneider Electric EcoStruxure Machine Expert (.EXPORT file export)

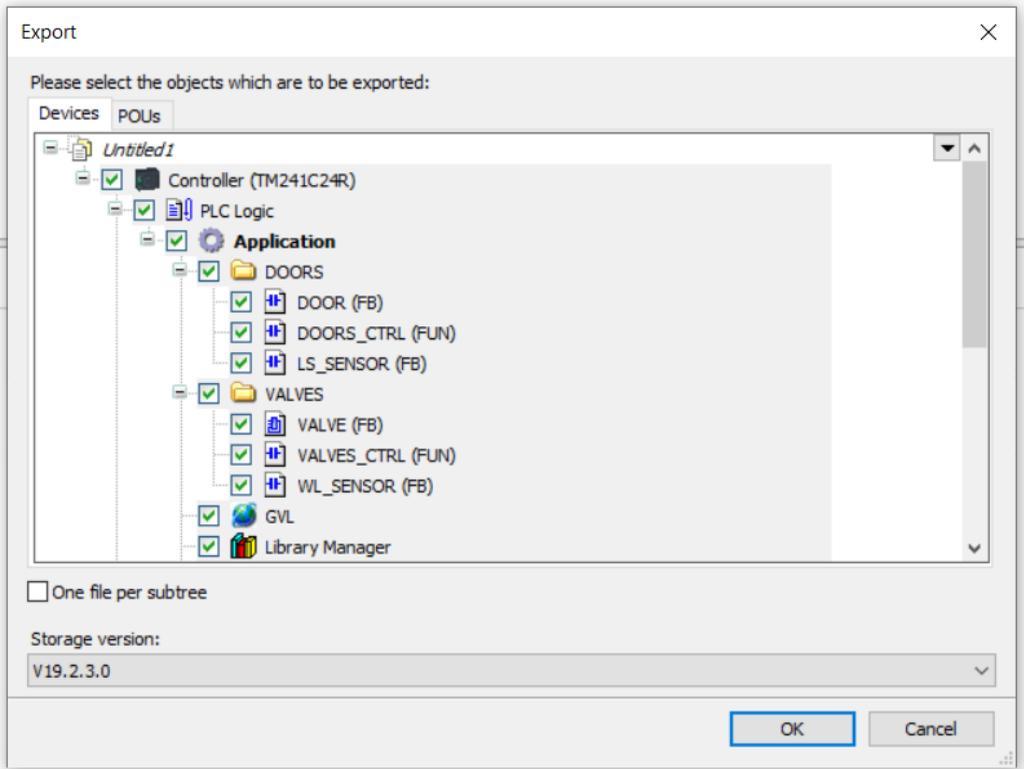
EcoStruxure Machine Expert (formerly SoMachine) applications need to be exported in an XML export file in order to be analyzed by EcoStruxure Control Engineering products.

You can create an XML export file with the **Project** then **Export...** menu entries in the EcoStruxure Machine Expert software.

1. In EcoStruxure Machine Expert menu, select **Project** then **Export...**



2. Choose the code blocks that you want to include in your export file, and if needed, change the storage version



3. Click on **OK** and select a name and a location for the export file when prompted

FEF export file generation from PL7 Pro

PL7 Pro application need to be exported in a FEF export file in order to be analyzed by EcoStruxure Control Engineering products.

You can create a FEF export file with the **File** and **Export application...** menu entries in PL7 Pro software.

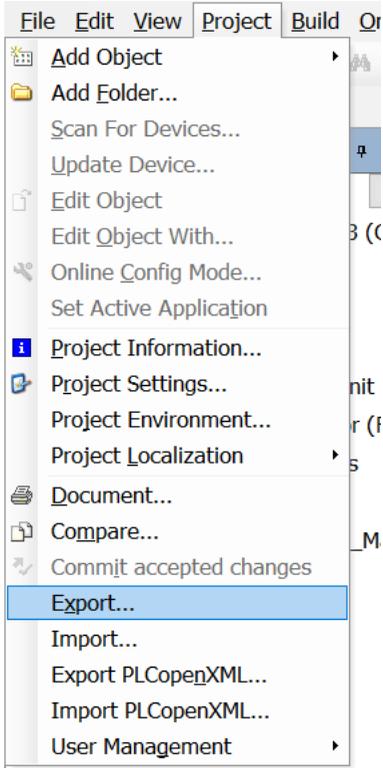
1. In PL7 Pro menu, select **File**, then **Export application...**
2. In the “Export application” dialog box, give a **name** to the FEF file
3. If needed, change directory where the FEF file will be created,
4. and click on **Save**

3S CODESYS V3 (.EXPORT file export)

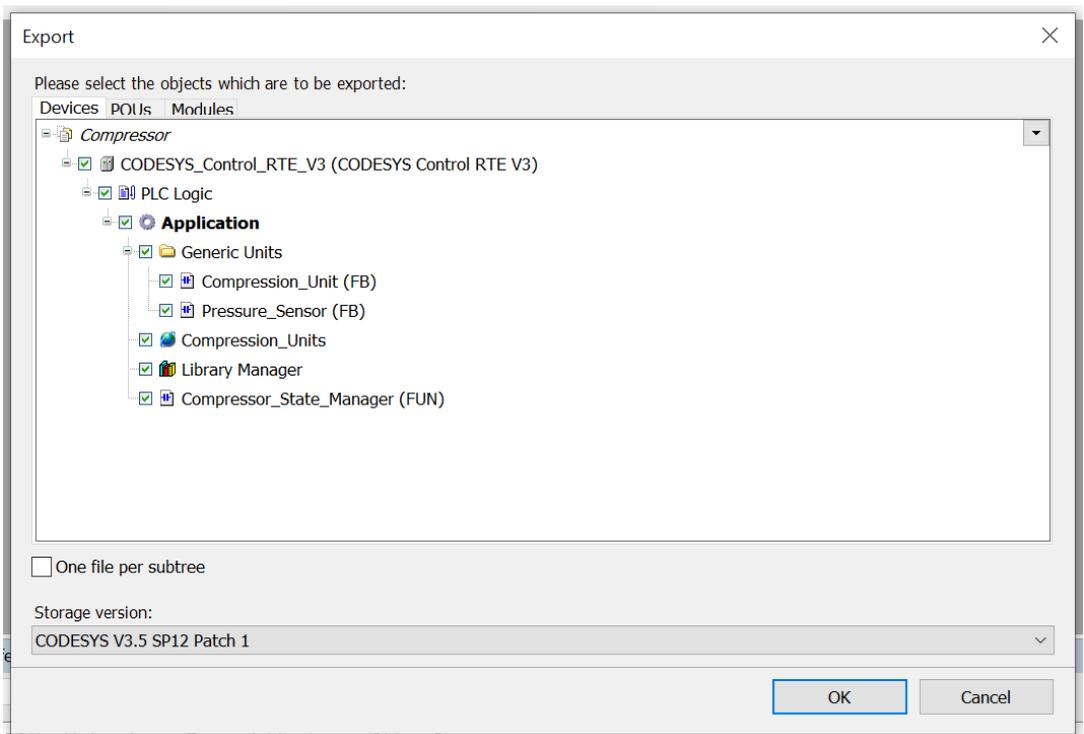
CODESYS V3 application need to be exported in a XML file (with the extension **.export**) in order to be analyzed by EcoStruxure Control Engineering - Verification.

You can create an export file with the **Project** then **Export...** menu entries in the CODESYS V3 software.

1. In CODESYS V3 menu, select **Project** then **Export...**



1. In the exportation window, select the code units that you want to include in your export, if needed, you can also choose the export format (if you are using EcoStruxure Control Engineering - Verification for CODESYS V3, make sure to select a format from the version 3 family (**CODESYS V3 ...**))



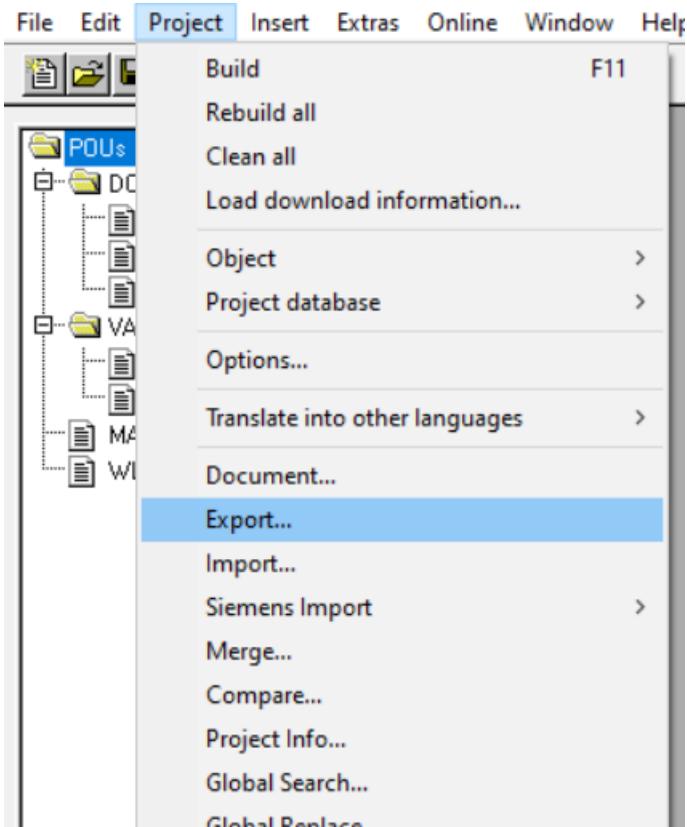
1. Click on **OK** and select a location to save your export file

3S CODESYS V2 (.EXP file export)

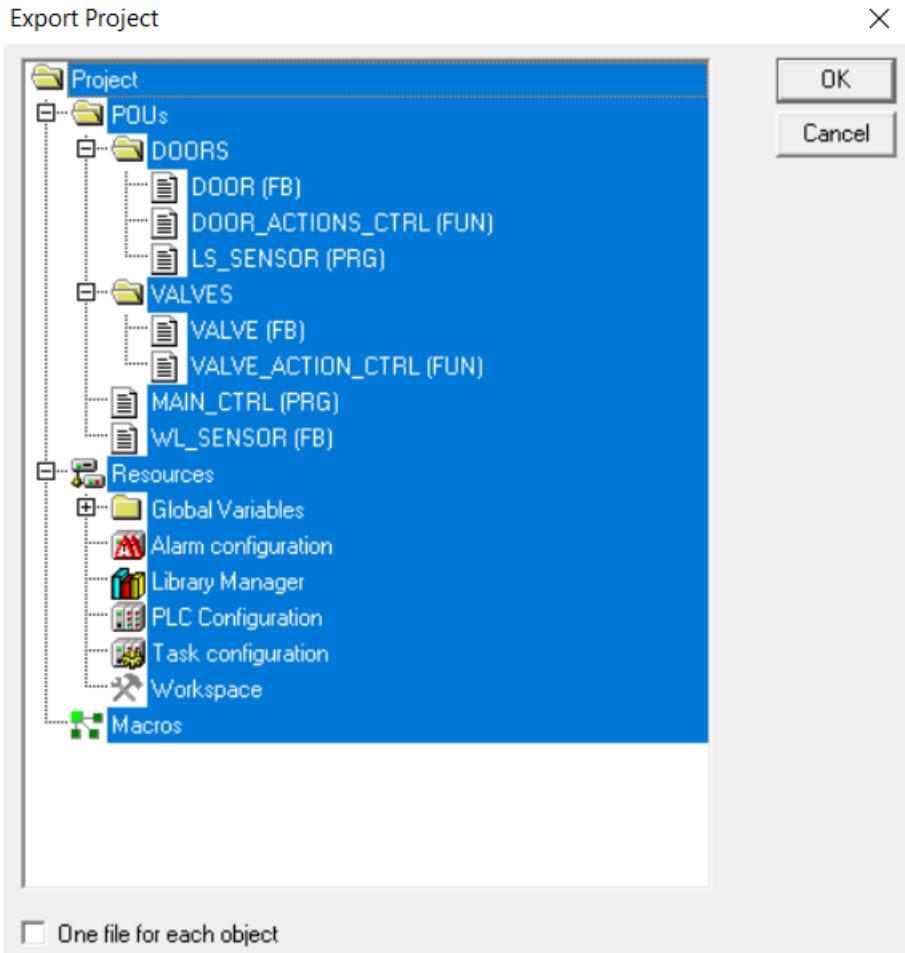
CODESYS V2 application need to be exported in a **.EXP** export file in order to be analyzed by EcoStruxure Control Engineering products.

You can create a **.EXP** export file with the **Project** then **Export...** menu entries in CODESYS V2 software.

1. In CODESYS V2 menu, select **Project** then **Export...**



2. In the “Export application” dialog box, ensure that all your code is selected (a selected item background is usually in blue), then click on **OK**



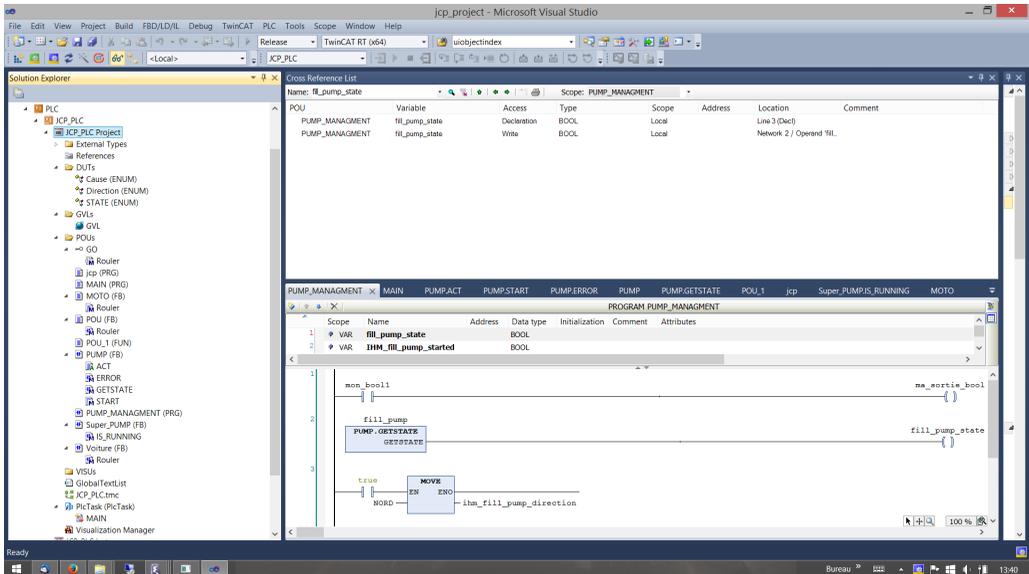
3. When prompted, give a **name** and choose a **location** for the EXP file and then click on **Save**

BECKHOFF TwinCAT V3 (.XML file export)

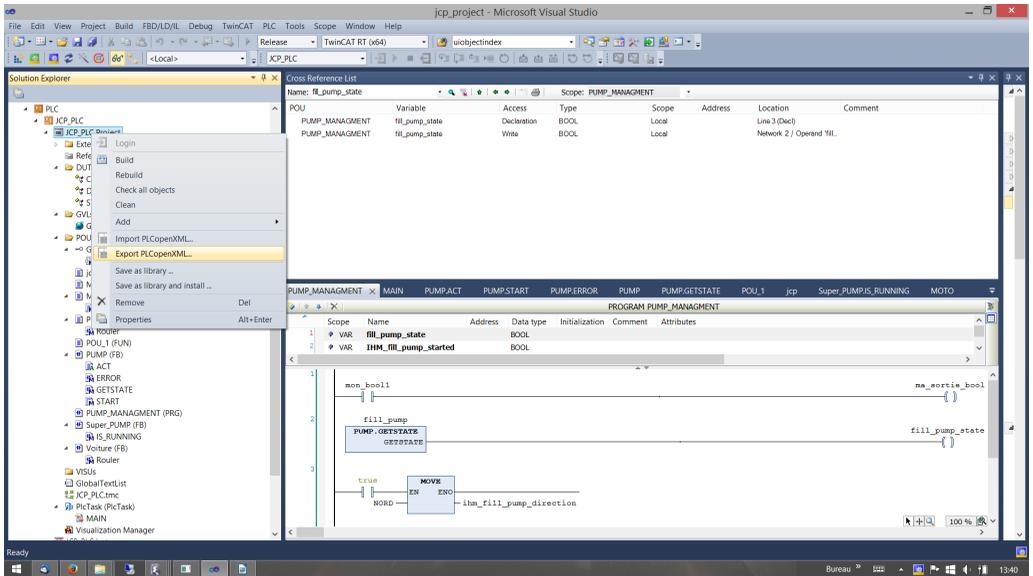
Beckhoff TwinCAT application needs to be exported in an PLCopen XML file in order to be analyzed by EcoStruxure Control Engineering - Verification.

You can create a PLCopen XML export file with the **Solution Explorer** then **Export PLCopenXML...** menu entries.

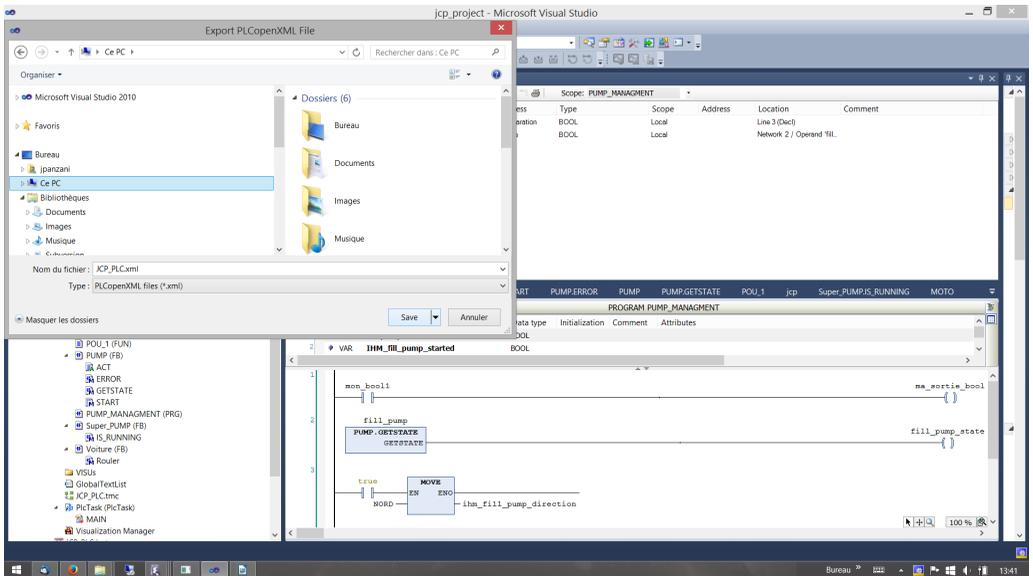
1. In the Solution Explorer window , select the project



2. Open the contextual menu by clicking on the right button and choose **Export PLCopenXML...**



3. Click on **Save**

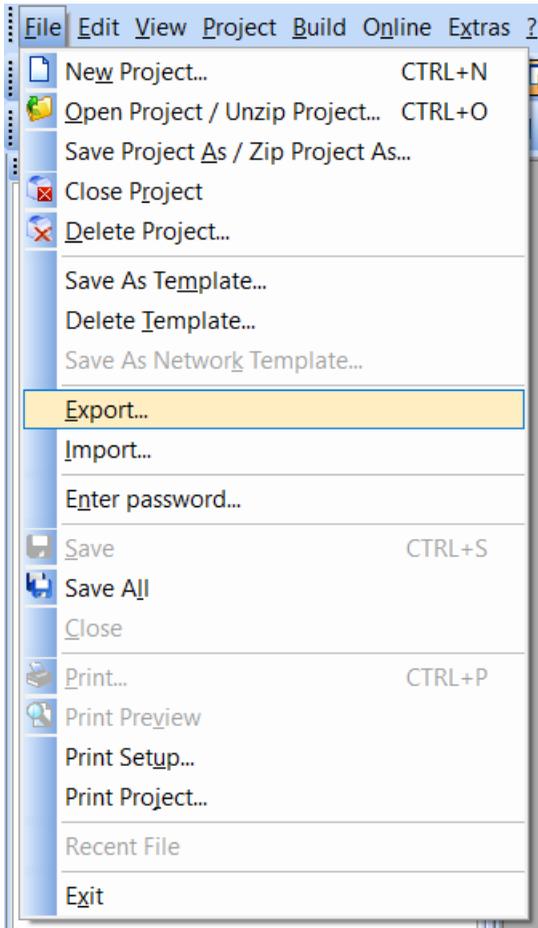


PHOENIX CONTACT Multiprog v5.5 (.XML export)

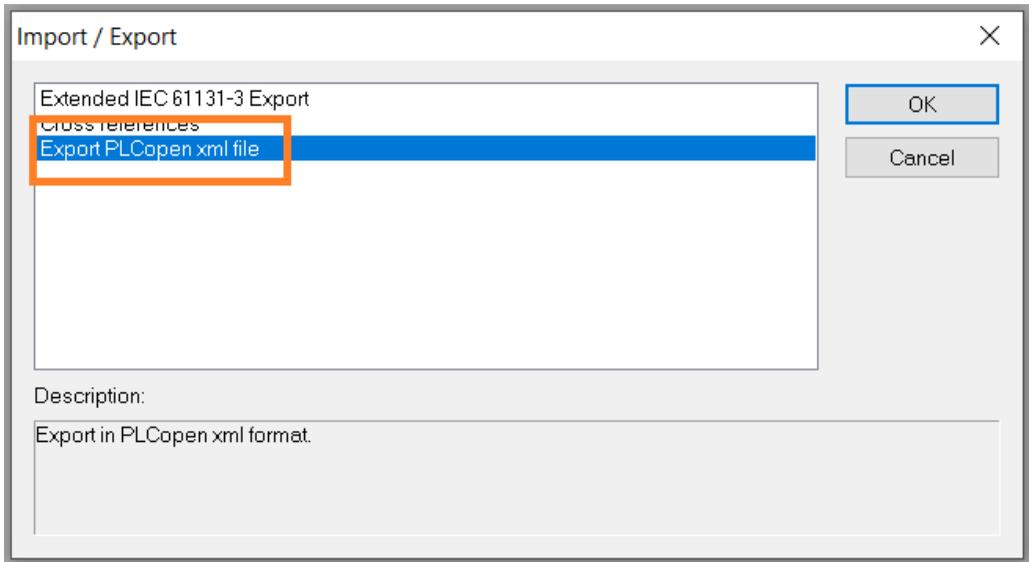
KW-Software GmbH MULTIPROG applications need to be exported in an XML export file in order to be analyzed by EcoStruxure Control Engineering - Verification.

You can create an XML export file with the **File** and **Export...** menu in KW-Software GmbH MULTIPROG software.

1. In the KW-Software GmbH MULTIPROG menu, select **File**, then **Export...**



2. Choose “Export PLCopen XML file...”



3. Rename the export file and then click on **Save**

As MULTIPROG is able to export the application in different versions of the PLCopen format, you may find some differences between the EcoStruxure Control Engineering - Verification results as the amount of exported elements and their format depends on the version of PLCopen.

Rockwell Automation RSLogix 5000® or Studio 5000 (.L5K export file)

Rockwell Automation RSLogix 5000® applications need to be exported in a L5K export file in order to be analyzed by EcoStruxure Control Engineering - products.

You can create an L5K export file with the **File** and **Save as...** menu entries in RSLogix 5000® software.

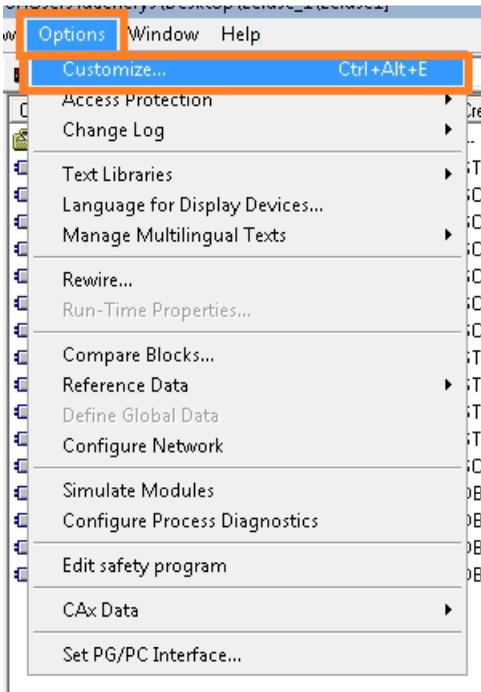
1. In RSLogix 5000® menu, select **File** and then **Save as...**
2. In the “Save as” dialog box, give a **name** to the L5K file
3. Choose the file type : **RSLogix 5000 Import/Export File (*.L5K)**
4. If needed, change directory where the L5K file will be created and then click on **Save** to create the L5K file

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

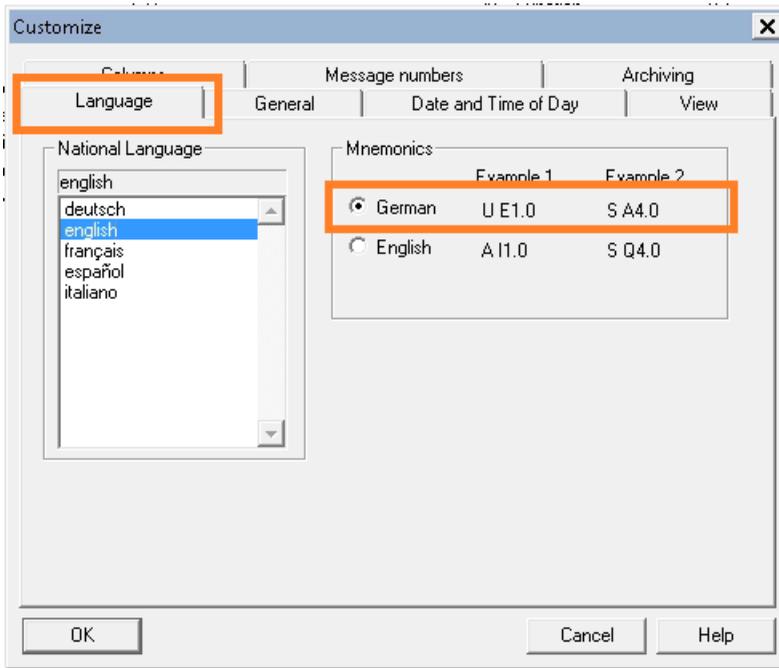
To analyze a Siemens SIMATIC STEP 7 application with EcoStruxure Control Engineering products, you need to:

- Create and export the symbols of this application in an **.ASC** file, using the German abbreviations,
- Create and export the contact code (CONT) in an **.AWL** file,
- Create and export all graph blocks (GRAPH) in **.GR7** files (if any),
- Compile CFC codes, if any, to create the corresponding **SCL** sources,
- Export structural codes (SCL) in **.SCL** files.

To create the export files, you must first make sure that your SIMATIC STEP 7 workshop uses the German abbreviations (they can be enabled using the menus **Options** and then **Customize...**)

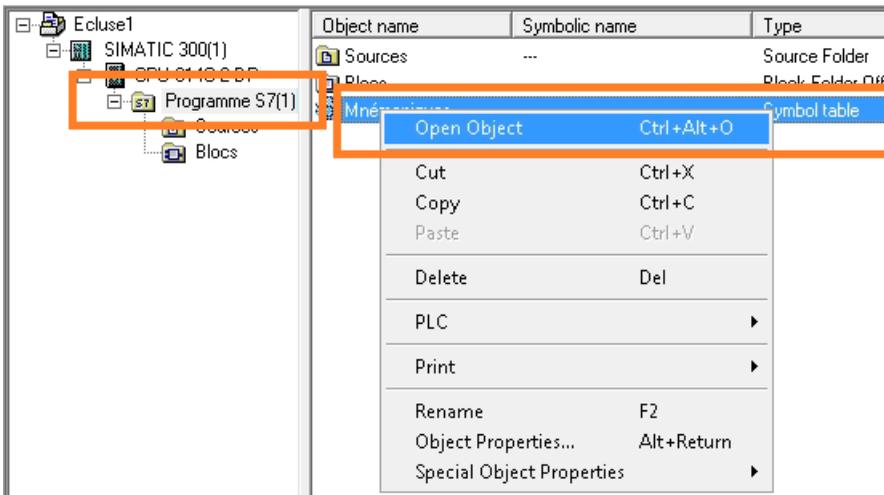


In **Language** tab, select **German mnemonics** and then click on **OK**.

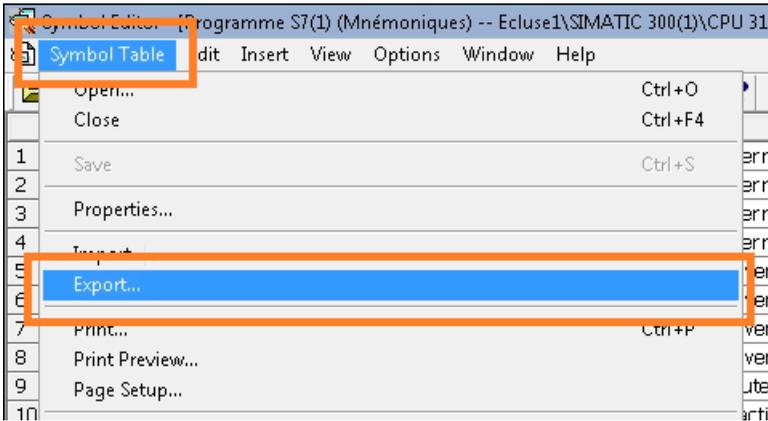


Create ASC file

To create an **.ASC** file, you need to open the symbols editor by going on your program folder and right-clicking on your Symbols table, then select **Open object**



In the symbols editor, click on the **Symbol Table** menu and then select the **Export...** entry



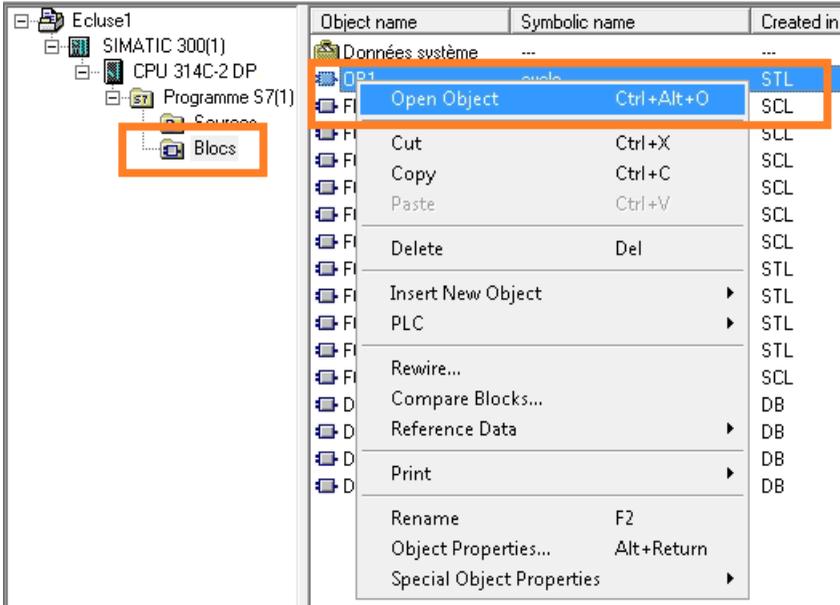
When prompted to save your symbols table, choose the **ASCII Format (*.ASC)** file type, the **name** and the **directory** where **.ASC** will be created, and click on **Save**.



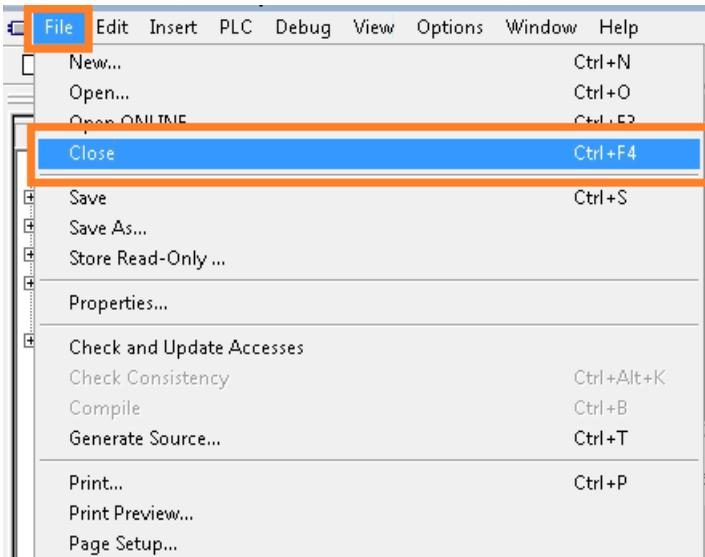
Create AWL file

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

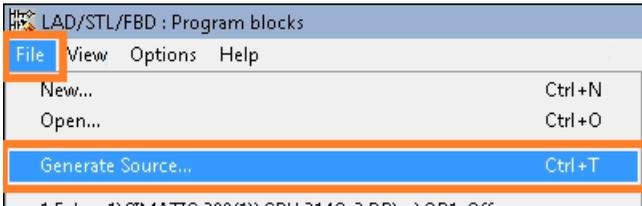
Open the CONT/LIST/LOG code editor by right-clicking on a CONT, LIST or LOG source and selecting **Open object**



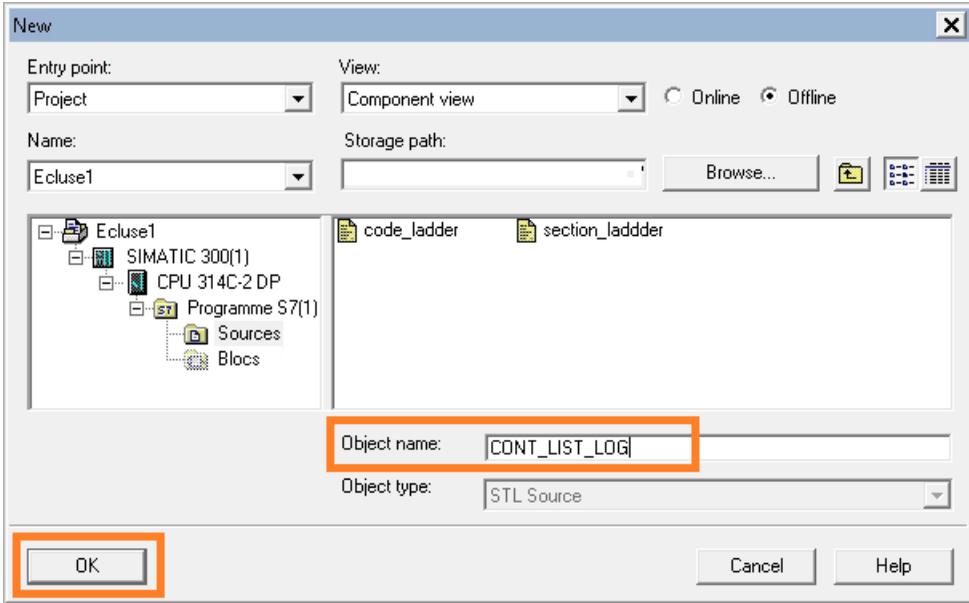
Close all objects being edited by clicking on the menu entries **File** and **Close**



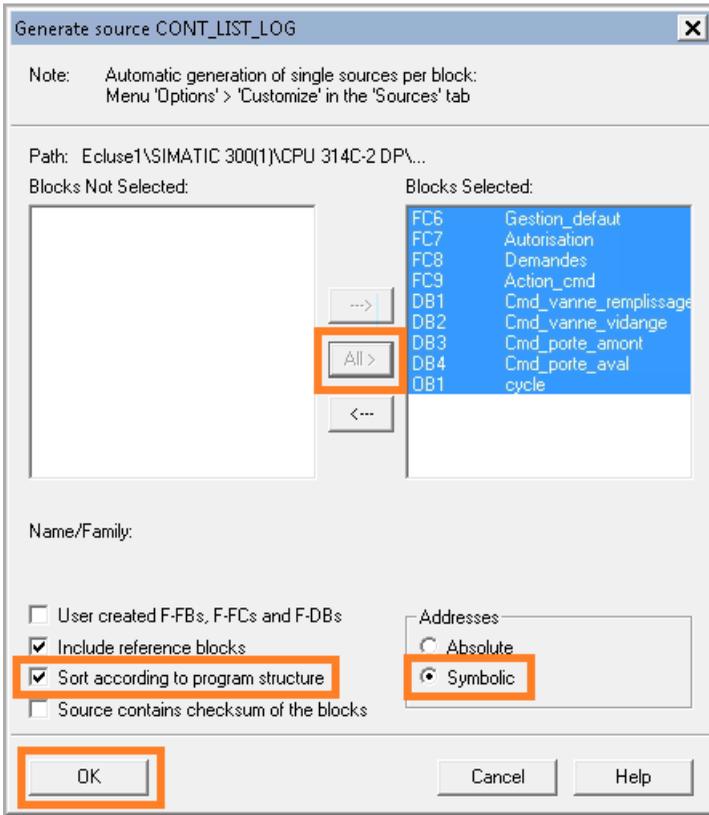
Then, generate the program source with the menu entries **File** and then **Generate source...**



Give a name to the object to be generated



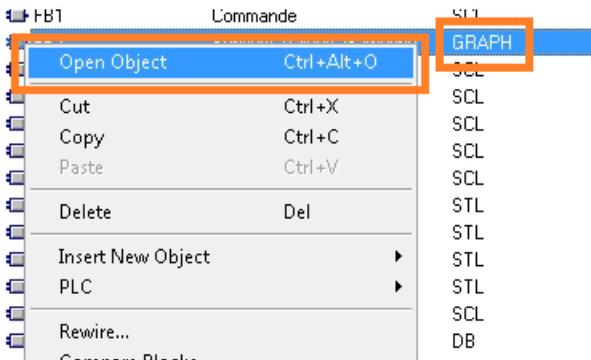
On the selection window, click on the button **All** to select all the program's blocks, select the options **Sort according to program structure** and **symbolic operands**, then click on **OK**



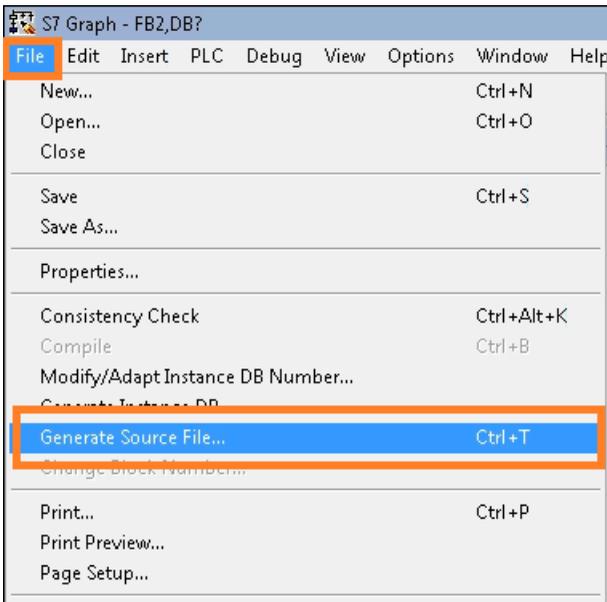
If your application contains Safety blocks, you need to export those blocks in a separated **AWL** file, more information is available below on how to proceed in the dedicated chapter.

Create GR7 file

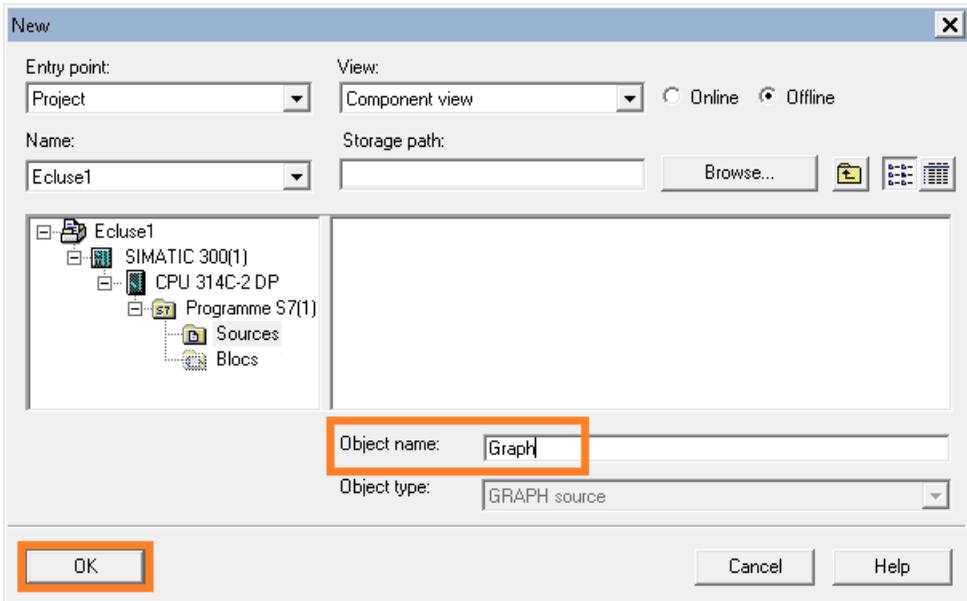
To create the **.GR7** sources, select **all** the GRAPH blocks and open the GRAPH editor by right-clicking on the selected elements and then selecting the **Open object** menu entry.



For **each** GRAPH block, generate the source using the menu entries **File** and **Generate source file**



Give a name to **each** GRAPH source file and press **OK**



Create CFG file

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

To get the CFG, you need to open the NetPro utility to edit the network configuration by double-clicking on your CPU's links, in the main window.

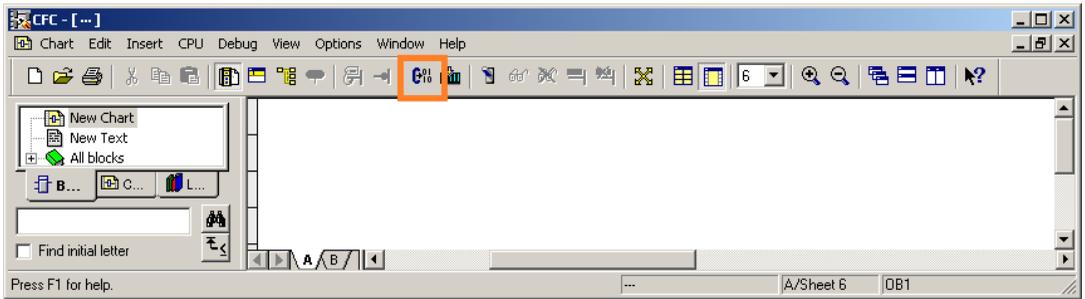
On NetPro window, select the station that you want to export by double clicking on its CPU, this opens the HW Config utility.

In the **Station** menu, select **Export...** to export your Station configuration (the default settings in the window are sufficient).

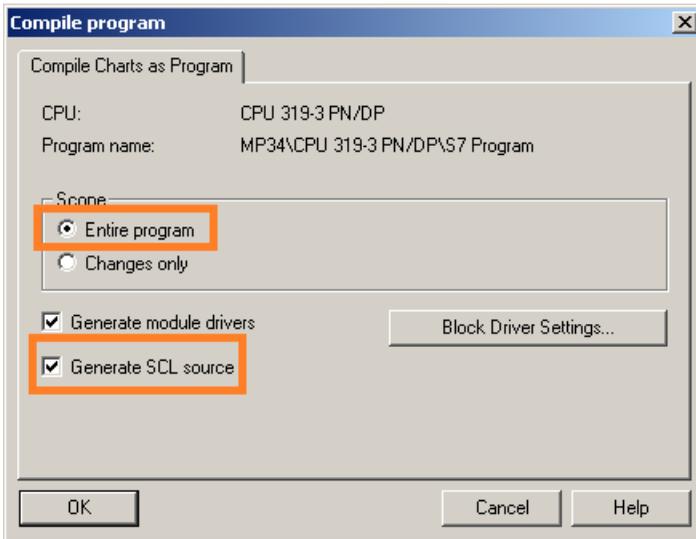
Create SCL source for CFC codes

If the application contains some CFC codes, those codes need to be compiled to generate the corresponding SCL source files which are the files analyzed by EcoStruxure Control Engineering products.

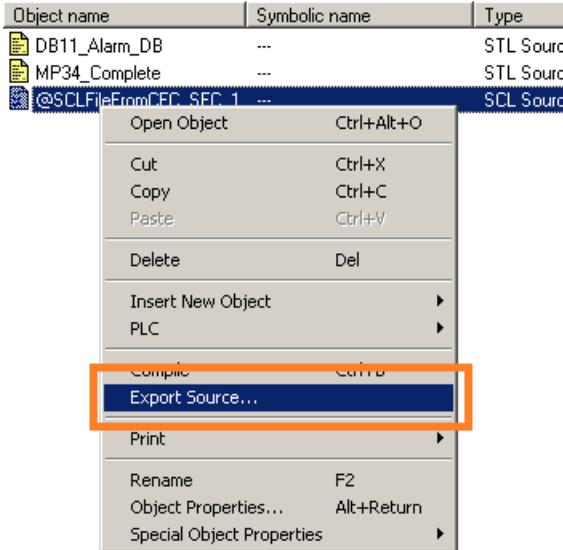
Open the CFC code editor by clicking on its icon on the main window menu.



Then, compile the code with the options **Entire Program** and **Generate SCL sources**



The generated SCL source file can then be exported like other source files, see **export files**



Safety applications

A Safety application contains two parts:

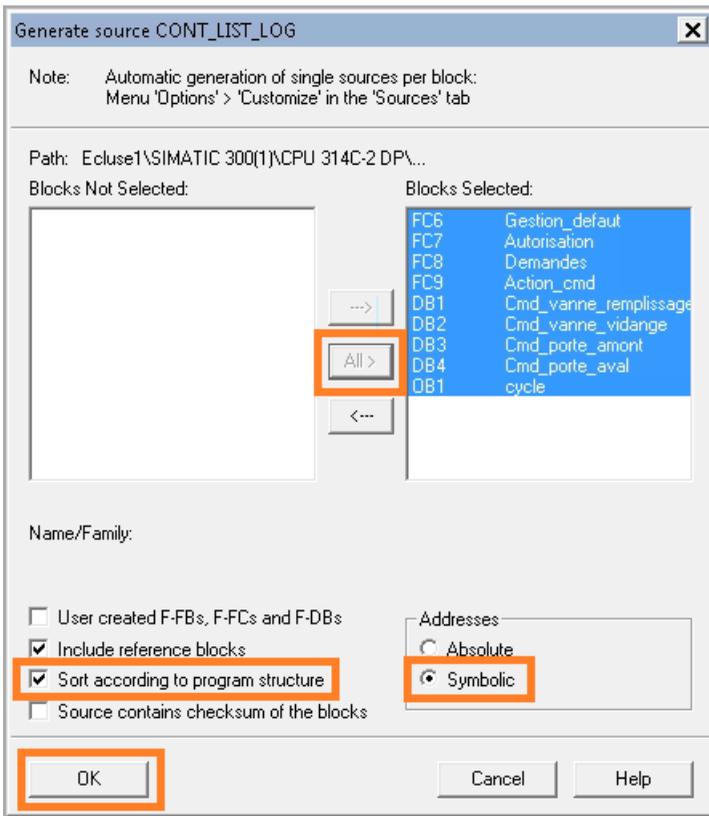
- The standard code part
- The safety code part

Exports for safety applications

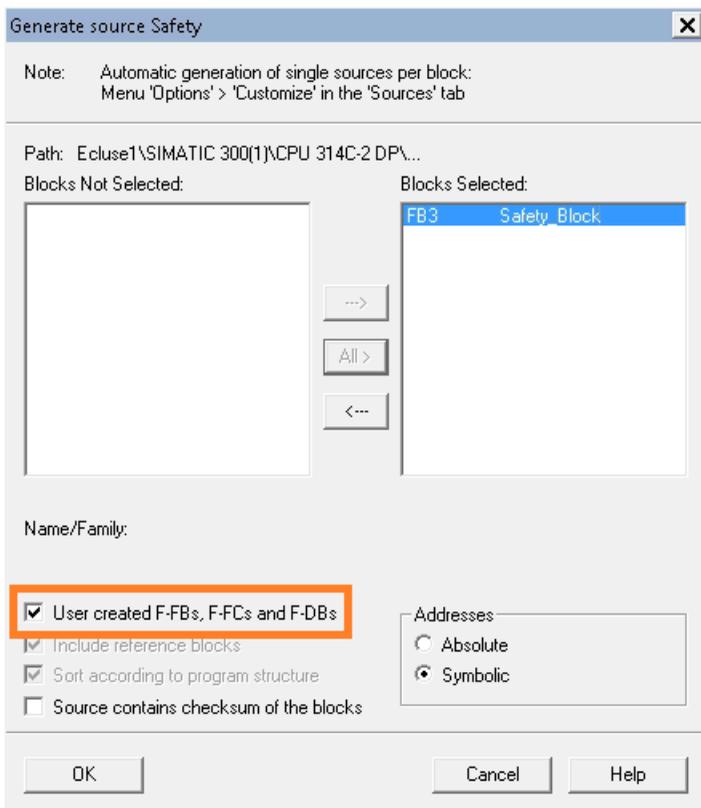
The export for safety applications is made with the following steps :

First export the **.ASC** file that contains the database for the program's Safety and standard codes, see above how to export the **.ASC** file

Then, generate the sources for the standard part (non-safety), see above how to generate **.AWL** and **.GR7** files



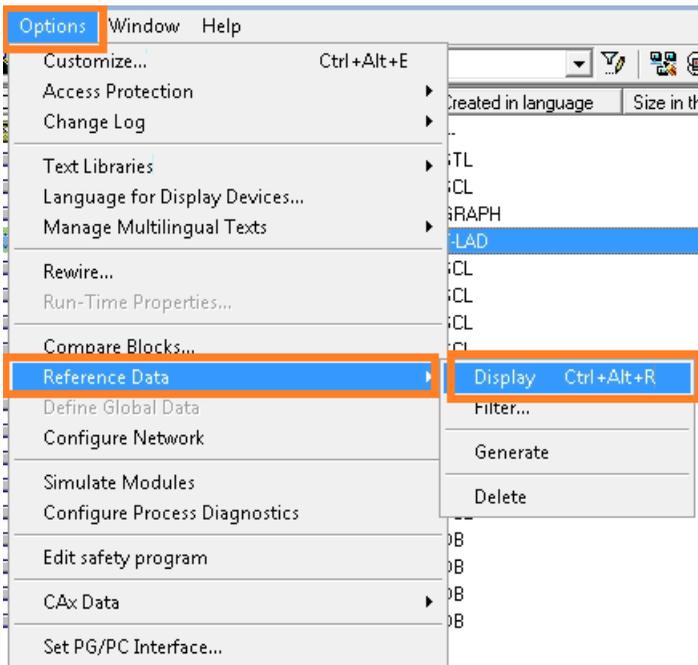
Continue by Generating the source for the safety part in a different **.AWL** file by following the same procedure until the **Generate Source Safety** window, where you need to select the **User-created F-FBs, F-FCs and F-DBs** option.



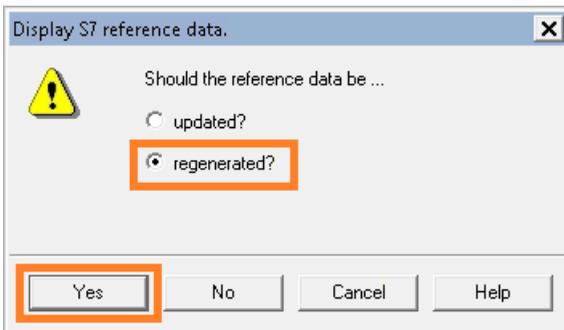
Finally, export the program structure in a **.dif** file (it will be used to determine whether a module is Safety or not)

Create dif file

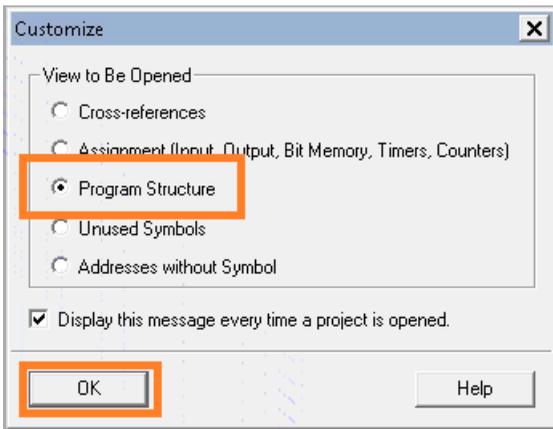
To create the **.dif** file, in the SIMATIC Manager of SIMATIC STEP 7, use the menu **Options, Reference Data** then **Display**



If prompted, let SIMATIC STEP 7 regenerate the references

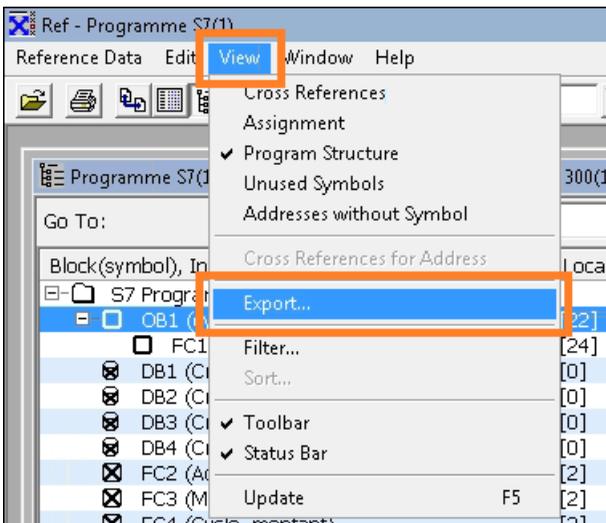


In the **Customize** window, select the **Program structure** entry and click on **OK**



The program structure is displayed

Use the menu entries **View** and **Export** to open the save dialog box



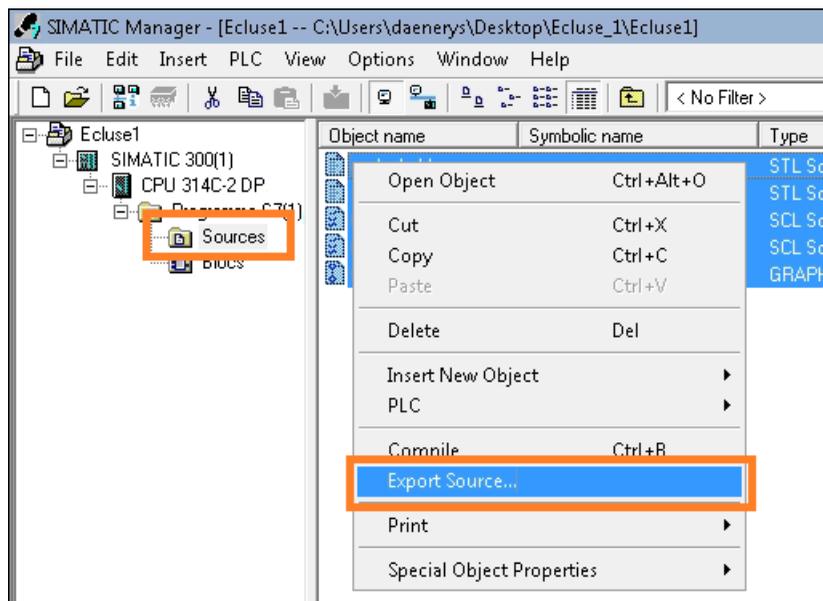
Give a name to the file (for instance structure.dif) and save it

Export files

Once the files are exported, then you need to extract them from SIMATIC STEP 7 to get them into a folder of your choice.

Select the LIST, GRAPH (resp. **.AWL** and **.GR7** files) and SCL sources that have been previously generated (when applicable)

Copy these sources using the contextual menu **Export source...**



Select the folder where you want to export the source files

Siemens TIAPortal SIMATIC STEP 7 (.zip export file)

Siemens TIA Portal SIMATIC STEP 7 application can be exported in a ZIP file in order to be analyzed by EcoStruxure Control Engineering products.

This export is done automatically with the help of the EcoStruxure Control Engineering - Import/Export tool, which can be downloaded from the Schneider Electric Exchange shop (<https://exchange.se.com/shop>).

Please refer to the EcoStruxure Control Engineering - Import/Export tool documentation for more information on how to proceed.

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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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