EcoStruxure Machine Expert
How to
User Guide

08/2020

Schneider Electric

Table of Contents

EcoStruxure Machine Expert
How To Download and Upload Your Latest Source Code
User Guide

06/2019

Schneider Electric

Table of Contents

Safety Information

Important Information

NOTICE

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.

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 be 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.

About the Book

At a Glance

Document Scope

This document describes a method to connect with your controller for which the latest version of the project is available and usable directly from the controller and not only from your PC servers.

The following knowledge is required:
- programming in the FBD, LD, ST, IL or CFC language
- information on functionality, structure and configuration of the controllers
- information in using of USB memory key or gateway

Validity Note

This document has been updated for the release of EcoStruxure^{TM} Machine Expert V1.1.

Related Documents

Title of Documentation	Reference Number
Modicon M241 Logic Controller Hardware Guide	*EIO0000001456 (ENG)*; *EIO0000001457 (FRE)*; *EIO0000001458 (GER)*; *EIO0000001459 (SPA)*; *EIO0000001460 (ITA)*; *EIO0000001461 (CHS)*
Modicon M251 Logic Controller Hardware Guide	*EIO0000001486 (ENG)*; *EIO0000001487 (FRE)*; *EIO0000001488 (GER)*; *EIO0000001489 (SPA)*; *EIO0000001490 (ITA)*; *EIO0000001491 (CHS)*
Modicon M258 Logic Controller Hardware Guide	*EIO0000000432 (ENG)*; *EIO0000000433 (FRE)*; *EIO0000000434 (GER)*; *EIO0000000435 (SPA)*; *EIO0000000436 (ITA)*; *EIO0000000437 (CHS)*

Title of Documentation	Reference Number
Modicon LMC058 Motion Controller Hardware Guide	*EIO0000000438 (ENG)*; *EIO0000000439 (FRE)*; *EIO0000000440 (GER)*; *EIO0000000441 (SPA)*; *EIO0000000442 (ITA)*; *EIO0000000443 (CHS)*
Modicon LMC078 Motion Controller Hardware Guide	*EIO0000001925 (ENG)*; *EIO0000001926 (FRE)*; *EIO0000001927 (GER)*; *EIO0000001928 (SPA)*; *EIO0000001929 (ITA)*; *EIO0000001930 (CHS)* *EIO0000001932 (TUR)*

You can download these technical publications and other technical information from our website at https://www.schneider-electric.com/en/download

Product Related Information

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.[1]
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed 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

● Only use software approved by Schneider Electric for use with this equipment.
● Update your application program every time you change the physical hardware configuration.

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

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, 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 13849-1:2015	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 62061:2015	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 61784-3:2016	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions.

Standard	Description
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.

Short Description

Overview

This document describes a method to connect with your controller for which the latest version of the project is available and usable directly from the controller and not only from your PC servers.

System Requirements and Limitations

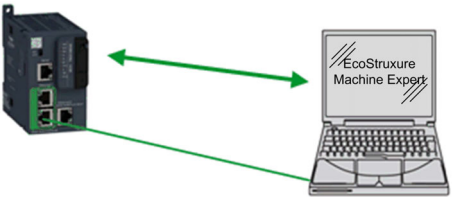The procedure has been tested with the components listed in the table:

Component	Type and Version
Software	EcoStruxure Machine Expert V1.0 or greater
Controller	• Modicon M241 Logic Controller • Modicon M251 Logic Controller • Modicon M258 Logic Controller • Modicon LMC078 Motion Controller
Additional devices	RJ45 connector **NOTE:** The concepts presented in the example procedure are transferable to other programming port connections of your controller.

Example Overview

Download and upload source code operation allows you to save your project source code onto a controller and to retrieve it later on. With this retrieved EcoStruxure Machine Expert project file, you can connect to the controller without the need to first load the application into EcoStruxure Machine Expert, for example, for maintenance purposes.

NOTE: You must maintain the coherency between the source code of the application and the compiled object code of the application. If you modify the source code, be sure to compile the application and download it as well to the controller.

The following table gives an overview of the procedure steps:

Step	Description	Graphical display
1	Develop and download your application to your controller.	

Step	Description	Graphical display
2	Download the project source code to the controller *(see page 14)*.	compileinfo file, archive.prj file, opt files
3	Later on, you might have the need to modify the project, or to maintain it. ● Upload the project source code from the controller to EcoStruxure Machine Expert. ● Connect with the uploaded project to the controller. ● Modify the uploaded project and perform Online changes *(see EcoStruxure Machine Expert, Programming Guide)*.	compileinfo file, archive.prj file, opt files
4	Download the project source code after modifying.	–

Hardware Configuration

Overview

Refer to the hardware guide of your controller to connect your controller.
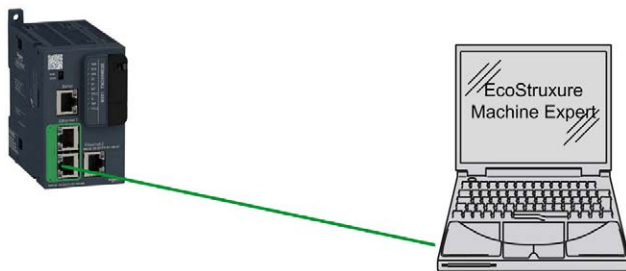
Transfer Procedures

Downloading the Source Code of the Project to the Controller

Downloading the source code as described in the following steps:

EcoStruxure Machine Expert version 1.1 does not support the M258, LMC058 and LMC078 controllers.

Step	Action
1	Create or open your project.
2	Open the project settings in the Logic Builder with **Project → Project Settings...**.
3	Select **Source Download** and clear the check box **Use compact download**. Optionally, in the **Timing** area you can activate the option **Implicity at creating bootproject** so that the source download is executed at each boot project creation. **NOTE:** Other options are available, refer to the **Project Settings... → Source Download** dialog box. Click on the **Additional files...** button and activate the check box **Download information files**. **NOTE:** Select the options **Referenced devices**, **Referenced libraries**, in case your project contains libraries or devices not delivered with EcoStruxure Machine Expert, or if download and upload source are planned to be performed from different EcoStruxure Machine Expert installations (on different PCs). Select **Library Profile** and **Visualization Profile** to perform download and upload source by using different EcoStruxure Machine Expert versions.
4	Click **OK** twice to exit the windows.
5	Select **Online → Create boot application**. **Result:** The boot project is created and the source code is downloaded. **NOTE:** If you activated in step 3 the option **Only on demand** in the **Timing** area, you have to do it manually: 1. Select **File → Source download...**. **Result:** The **Controller selection** view opens. 2. Double-click the controller from the list where the sources shall be downloaded to. The node name at the bottom must correspond to the chosen controller at the top of the window. 3. Click **OK**. **Result:** The progress of the source download will be indicated in the status bar.
6	In the controller device editor, open the **Files** tab to verify that the source project has been downloaded. **Result:** The new archive.prj file has been created. Verify the modification date of the file.

Upload your Project from the Controller

Upload your project from the controller as described in the following steps:

Step	Action
1	Close your project in EcoStruxure Machine Expert.
2	Connect the controller to the PC. **Result:** The **Select Controller** dialog box opens, and the Ethernet network and the USB ports are scanned for available controllers.
3	Select your controller in the displayed list and click the **Select** button.
4	In the **Options** dialog box, select the option **Upload project from controller** and click **Continue**. **Result:** After a brief delay, the **Project Archive** dialog box opens.
5	Choose an empty folder where you want to copy the extracted elements from your controller and click **Extract**. **Result:** A message is displayed, if you want to open the project in EcoStruxure Machine Expert.
6	Click **Yes**. **Result:** When the system is ready, the **Logic Builder** button is active.
7	Click the **Logic Builder** button. **Result:** Your uploaded project is opened in the Logic Builder.
8	Login to your controller.

EcoStruxure Machine Expert version 1.1 does not support the M258, LMC058 and LMC078 controllers.

How To Help Protect Your Source Code

User Guide

12/2019

Schneider Electric

Table of Contents

Safety Information

Important Information

NOTICE

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.

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 be 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.

About the Book

At a Glance

Document Scope

This document describes the steps for encrypting and decrypting your EcoStruxure Machine Expert projects using Windows certificates to help protect the source code they contain.

Validity Note

This document has been updated for the release of EcoStruxure^{TM} Machine Expert V1.2.

Related Documents

Document title	Reference
EcoStruxure Machine Expert Programming Guide	*EIO0000002854 (ENG)*; *EIO0000002855 (FRE)*; *EIO0000002856 (GER)*; *EIO0000002858 (SPA)*; *EIO0000002857 (ITA)*; *EIO0000002859 (CHS)*

Product Related Information

> ## ⚠ WARNING
>
> **LOSS OF CONTROL**
>
> - The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
> - Separate or redundant control paths must be provided for critical control functions.
> - System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
> - Observe all accident prevention regulations and local safety guidelines.[1]
> - Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed 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

- Only use software approved by Schneider Electric for use with this equipment.
- Update your application program every time you change the physical hardware configuration.

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

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, 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 13849-1:2015	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 62061:2015	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.

Standard	Description
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784-3:2016	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.

Protecting Projects by Encryption Using Certificates

General Information on Certificates

When you need to protect the privacy of an EcoStruxure Machine Expert project, encrypt it. Encrypting a project in EcoStruxure Machine Expert means that you convert a project file into an unintelligible form that can only be deciphered in a system employing public and private keys. The keys are simply large numbers that have been paired together but are not the same between the public and private keys. This system is therefore referred to as Asymmetric Cryptography.

One key, the public key, can be shared with everyone; the other key is to be kept secret and is referred to as the private key. Either key can be used for encryption, but it requires the opposite key used for encryption to decrypt the file.

Without the corresponding key, you cannot open the project with EcoStruxure Machine Expert and the content of the project file is meaningless. Normally, you would use a private key to encrypt the file, and then use public keys distributed to others to decrypt the file.

Private and public keys are managed by certificates. On the Windows PC certificates with public keys are shown with a certificate icon   . If the certificate additionally includes a private key it is also marked with a key symbol   .

Certificates with a private key remain on your computer and should be kept safe from unauthorized access. The public key can be freely installed on other PCs.

If you want to encrypt and decrypt projects, the certificates must be installed on your PC. Additionally, all users that want to open the project on other PCs must have at least the public key installed on their PC. To do this, you can export a certificate with a public key from your private key certificate in the Windows settings **Manage user certificates**. Then you can give the certificate with the public key to others, for example, via Email.
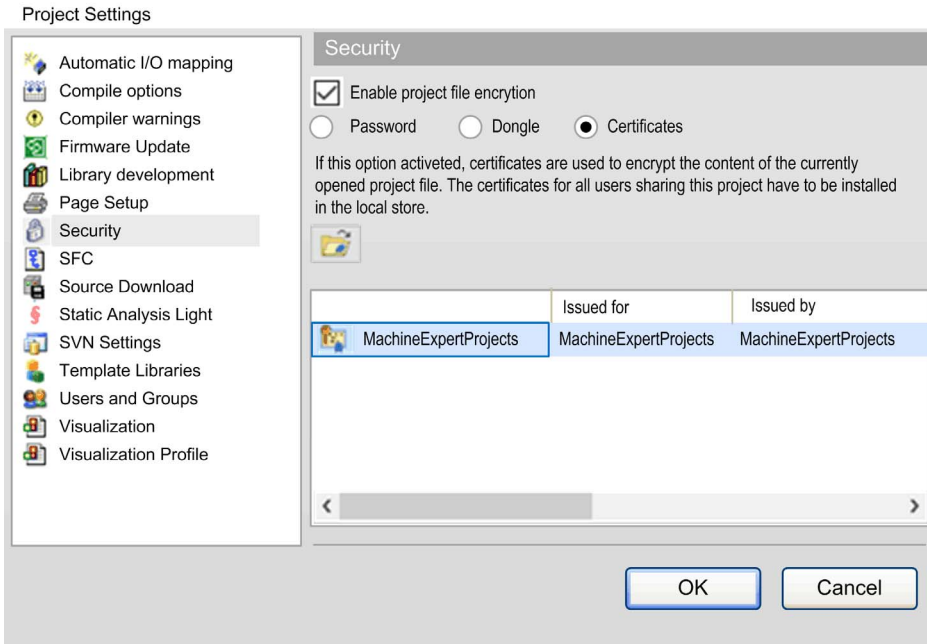
Encrypting a Project

Overview

To help protect an EcoStruxure Machine Expert project by using certificates, perform the following steps in the EcoStruxure Machine Expert Logic Builder:
- Activating the **Certificates** option in the **Project Settings → Security** dialog box.
- Adding certificates to a project.

Activating the Certificates Option in the Project Settings → Security Dialog Box

Step	Action
1	Open the EcoStruxure Machine Expert project you want to encrypt.
2	Execute the **Project → Project Settings** command, and select the **Security** dialog box. Alternatively, click the [ ] button from the **Project file encryption** section of the **View → Security Screen** editor to open the **Project → Project Settings → Security** dialog box.
3	Activate the **Enable project file encryption** option.
4	Activate the **Certificates** option.

The graphic indicates the **Project Settings → Security** dialog box with **Certificates** option selected:

Adding Certificates to a Project

To assign certificates to encrypt the open project, proceed as follows:

Step	Action	Further information
1	Click the **Select certificates for the users sharing this project** button from the **Project Settings → Security** dialog box. **Result**: The **Certificate Selection** dialog box for defining the users that should get access to the project opens.	**Select certificates for the users sharing this project** button
2	From the **Available certificates in the local Windows Certificate Store** section, select a certificate with a public key.	Icon representing certificates with public key:
3	Click the **Add certificate from the store below to the selection above** button. **Result**: The selected certificate is added to the **Certificates for project encryption** list of the dialog box.	**Add certificate from the store below to the selection above** button: **NOTE:** Add the public keys for all users that should have access to the project.
4	To select further certificates in order to provide access to this project to several users, repeat steps 2 and 3. **NOTE:** The certificates with public key of all users who should be allowed to open the project must be installed on your local PC.	This step is optional.
5	To confirm your selection, click the **OK** button. **Result**: The certificates that are available in the upper part of the **Certificate Selection** dialog box are added to the open project.	–
6	Save the EcoStruxure Machine Expert project to save it with encryption.	–

NOTE: You need a private key to open the project after it has been encrypted with a public key. In general, it is a good practice to encrypt projects using a private key and decrypt projects using a corresponding public key.

NOTE: If your private key certificate is lost or the certificate becomes outdated, and the project is encrypted with the public key, then the project cannot be decrypted and cannot be opened any more, nor can the file contents be restored.

⚠ CAUTION

LOSS OF APPLICATION DATA

Store the private key certificate in a safe place and manage the certificates carefully to be able to open the protected EcoStruxure Machine Expert project.

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

Administration of certificates is required as they have a limited validity and therefore need to be updated at regular intervals. Consider this with respect to the life cycle of your machine or control.

Decrypting a Project

How to Decrypt a Project

For decrypting an encrypted EcoStruxure Machine Expert project, proceed as follows:

Step	Action
1	Start EcoStruxure Machine Expert.
2	Execute the command **View → Security Screen** to open the **Security Screen** editor.
3	In the **User** tab, click the ⬜ button from the **Project file decryption** area. **Result**: The **Certificate Selection** dialog box is displayed.
4	From the **Available certificates in the local Windows Certificate Store** section, select the certificate with a private key that corresponds to one of the certificates with public key the project has been encrypted with.
5	Click the ⬆ button. **Result**: The certificate you selected is added to the list of certificates for decrypting project files in the upper part of the dialog box.
6	Click **OK** to confirm. **Result**: The **Certificate Selection** dialog box is closed and the selected certificate is displayed in the **Project file decryption** section of the **User** tab of the **Security Screen** editor.

Assigning Security Levels to the User Profiles

To force encryption or signing options for this user profile, activate the corresponding options from the **Security level** section of this dialog box. For detailed information, refer to the description of the **Security Screen** editor.

EcoStruxure Machine Expert

How To Use a TeSys™ island
User Guide

06/2019

Schneider Electric

Table of Contents

Safety Information

ⓘ

Important Information

NOTICE

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.

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 be 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.

About the Book ◪

At a Glance

Document Scope

This document describes the steps required in EcoStruxure Machine Expert for creating a project with a TeSys™ island and a logic/motion controller by using the EtherNet/IP or Modbus TCP protocol.

The following knowledge is required:
- Information on functionality, structure, and configuration of the TeSys™ island
- Information on functionality, structure, and configuration of the controller

Validity Note

This document has been updated for the release of EcoStruxure^{TM} Machine Expert V1.1.

Related Documents

Document title	Reference
TeSys^{TM} island System Guide	_www.schneider-electric.us/en/download/_;
TeSys^{TM} island DTM Library Online Help	_www.schneider-electric.us/en/download/_;
Modicon M241 Logic Controller Hardware Guide	_EIO0000001456 (ENG)_; _EIO0000001457 (FRE):_ _EIO0000001458 (GER):_ _EIO0000001459 (SPA):_ _EIO0000001460 (ITA):_ _EIO0000001461 (CHS)_
Modicon M251 Logic Controller Hardware Guide	_EIO0000001486 (ENG):_ _EIO0000001487 (FRE):_ _EIO0000001488 (GER):_ _EIO0000001489 (SPA):_ _EIO0000001490 (ITA):_ _EIO0000001491 (CHS)_
Modicon M262 Logic/Motion Controller Hardware Guide	_EIO0000003659 (ENG):_ _EIO0000003660 (FRE):_ _EIO0000003661 (GER):_ _EIO0000003662 (SPA):_ _EIO0000003663 (ITA):_ _EIO0000003664 (CHS)_

Document title	Reference
EcoStruxure Machine Expert Programming Guide	*EIO0000002854 (ENG)*; *EIO0000002855 (FRE)*; *EIO0000002856 (GER)*; *EIO0000002858 (SPA)*; *EIO0000002857 (ITA)*; *EIO0000002859 (CHS)*

Product Related Information

> ### ⚠ WARNING
>
> **LOSS OF CONTROL**
>
> - The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
> - Separate or redundant control paths must be provided for critical control functions.
> - System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
> - Observe all accident prevention regulations and local safety guidelines.[1]
> - Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed 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**
>
> - Only use software approved by Schneider Electric for use with this equipment.
> - Update your application program every time you change the physical hardware configuration.
>
> **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, 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 13849-1:2015	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 62061:2015	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 61784-3:2016	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.

General Information

Overview

This document describes the steps required in EcoStruxure Machine Expert for creating a project with a TeSys™ island and a logic/motion controller by using the EtherNet/IP or Modbus TCP protocol.

- Integrating the TeSys™ island into the EcoStruxure Machine Expert project.
- Accessing the TeSys™ island DTM (Device Type Manager) via EcoStruxure Machine Expert for configuring the TeSys™ island modules and processes by using avatars.
- Using the function blocks of the TeSys island library that is available in EcoStruxure Machine Expert for developing applications and to control avatar modules.

System Requirements

The following components are required for communication via EtherNet/IP or Modbus TCP:

Component	Type and Version
Software	EcoStruxure Machine Expert V1.1 or later
Controller	- TM241CE••• logic controller supporting EtherNet/IP and Modbus TCP/IP - TM251MESE logic controller supporting EtherNet/IP and Modbus TCP/IP - TM262L10/20 logic controller - TM262M15/25/35 motion controller

Overview of the TeSys™ island Concept

TeSys™ island describes an open, modular distributed input/output system comprising different modules residing on a DIN rail backplane:
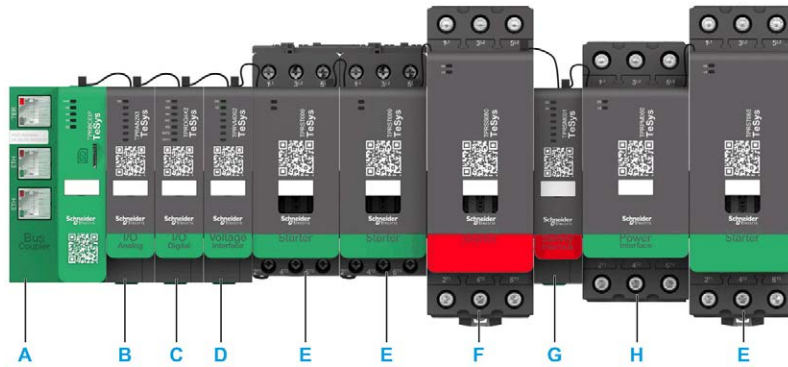
A Bus coupler
B Analog input / output module
C Digital input / output module
D Voltage interface module
E Standard starter
F SIL (Safety Integrity Level) starter
G SIL interface module
H Power interface module

The entire TeSys™ island acts as a node in a fieldbus network. The bus coupler is the core module that provides internal communication with the TeSys™ island modules via ribbon cables and external communication via EtherNet/IP or Modbus TCP. For further information, refer to the TeSys^{TM} island System Guide.

The integration of this bus coupler as a TeSys™ island communication node in your EcoStruxure Machine Expert project is described in the next topic Integrating the TeSys™ island into the EcoStruxure Machine Expert Project .

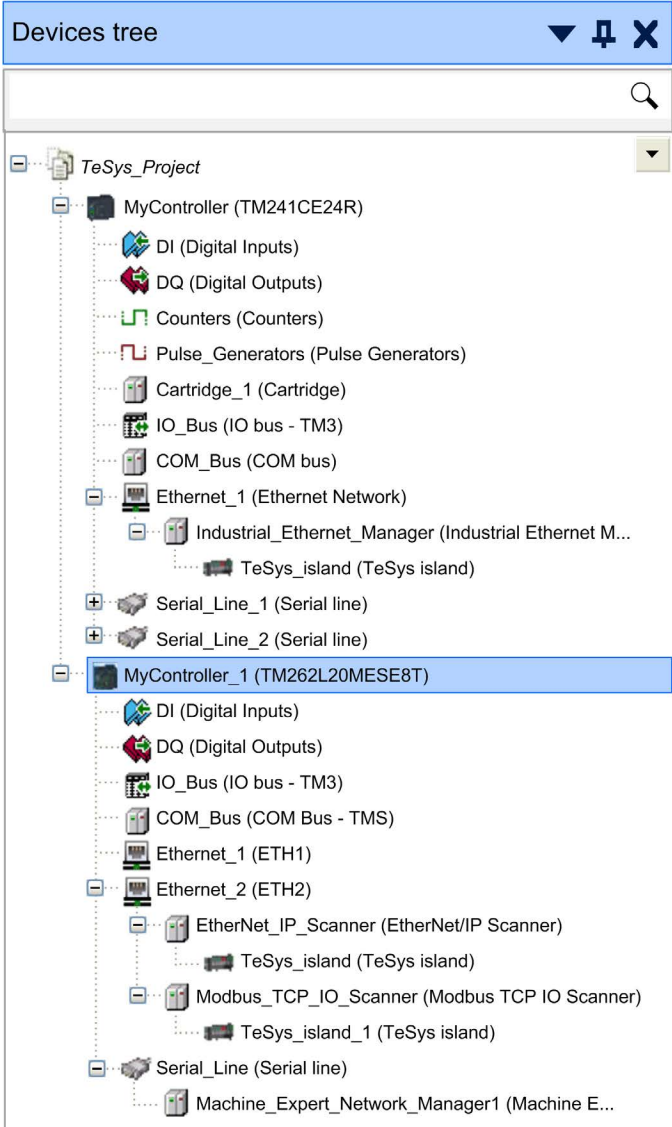# Integrating the TeSys™ island into the EcoStruxure Machine Expert Project

How to Add the TeSys™ island to the EcoStruxure Machine Expert Project

As the bus coupler acts as a single communication node for the complete TeSys™ island, you have to add the bus coupler as communication node to your EcoStruxure Machine Expert project.

Proceed as follows:

Step	Action	Comment
1	Create or open your EcoStruxure Machine Expert project.	–
2	Add a controller supporting EtherNet/IP or Modbus TCP/IP from the **Hardware Catalog → Controller** to your project. **Result**: A controller node is added to the **Devices tree** with several subnodes.	For further information, refer to the chapter *Adding Devices by Drag and Drop* in the Programming Guide *(see EcoStruxure Machine Expert, Programming Guide)*.
3	From the hardware catalog, select the following communication manager, depending on the controller you use: ● For M241 or M251 controllers, select **Industrial Ethernet Manager**. ● For M262 controllers, select **EtherNet/IP Scanner** or **Modbus TCP IO Scanner** depending on whether EtherNet/IP or Modbus TCP scanner services are required. **Result**: The selected communication manager is added as a subnode below the **Ethernet** node in the **Devices tree**.	For further information, refer to the chapter *Adding Communication Managers* in the Programming Guide *(see EcoStruxure Machine Expert, Programming Guide)*.
4	Right-click the communication manager subnode, and execute the command **Add Device** to add a **TeSys island** element. **Result**: A **TeSys_island** subnode is added below the selected communication manager node in the **Devices tree**.	For further information, refer to the chapter *Adding Devices to a Communication Manager* in the Programming Guide *(see EcoStruxure Machine Expert, Programming Guide)*.

The figure illustrates the **TeSys_island** configuration in the **Devices tree** for M241 and M262 controllers:

Devices tree

- TeSys_Project
  - MyController (TM241CE24R)
    - DI (Digital Inputs)
    - DQ (Digital Outputs)
    - Counters (Counters)
    - Pulse_Generators (Pulse Generators)
    - Cartridge_1 (Cartridge)
    - IO_Bus (IO bus - TM3)
    - COM_Bus (COM bus)
    - Ethernet_1 (Ethernet Network)
      - Industrial_Ethernet_Manager (Industrial Ethernet M...
        - TeSys_island (TeSys island)
    - Serial_Line_1 (Serial line)
    - Serial_Line_2 (Serial line)
  - MyController_1 (TM262L20MESE8T)
    - DI (Digital Inputs)
    - DQ (Digital Outputs)
    - IO_Bus (IO bus - TM3)
    - COM_Bus (COM Bus - TMS)
    - Ethernet_1 (ETH1)
    - Ethernet_2 (ETH2)
      - EtherNet_IP_Scanner (EtherNet/IP Scanner)
        - TeSys_island (TeSys island)
      - Modbus_TCP_IO_Scanner (Modbus TCP IO Scanner)
        - TeSys_island_1 (TeSys island)
    - Serial_Line (Serial line)
      - Machine_Expert_Network_Manager1 (Machine E...

Configuring the TeSys™ island in EcoStruxure Machine Expert
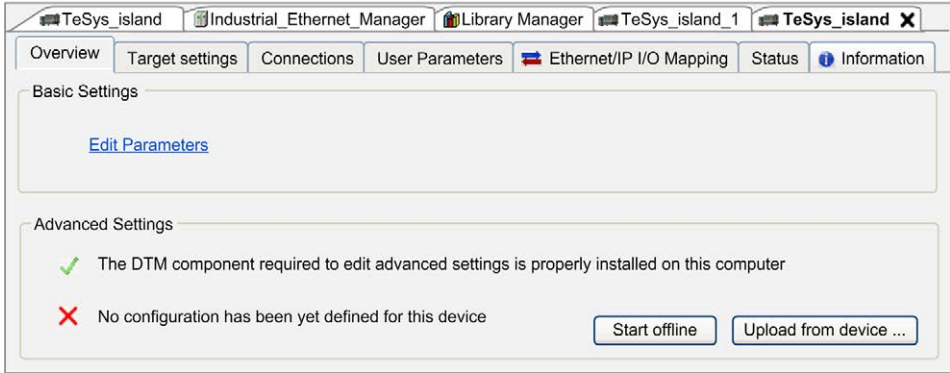
TeSys™ island Configuration

To configure the TeSys™ island, double-click the **TeSys_island** node in the **Devices tree**.

Result: The **TeSys_island** device editor is displayed in the multi-tabbed editor view of the Logic Builder with the default settings and the default device editor tabs (for example, **Configuration**, **Parameters**, **I/O Mapping**).

For further information, refer to the chapter *Common Device Editor Dialogs* in the Programming Guide *(see EcoStruxure Machine Expert, Programming Guide)*.

Opening the Configuration Tab

To open the **Configuration** tab for TeSys™ island configuration, proceed as follows:

Step	Action
1	Double-click the **TeSys_island** node in the **Devices tree**. **Result**: The **TeSys_island** device editor is displayed in the multi-tabbed editor view of the Logic Builder.

Step	Action
2	For initial configuration, click the **Start offline** button to load the default configuration, and then click the **Edit configuration...** link. **Result**: The **Configuration** tab opens in the **TeSys_island** device editor, allowing configuration of the TeSys™ island in an FDT (Field Device Tool) frame.

The offline configuration mode is indicated as follows:
- By the blue line in the toolbar and the status **Device not connected**.
- By the red status **Disconnected** in the status bar.

You can now configure the TeSys™ island parameters in offline mode using the avatar concept.

Avatar Concept of the TeSys™ island DTM

The TeSys™ island DTM is using an avatar concept. Avatars are functional and digital represen-
tations of the physical modules and processes that are available in the TeSys™ island.

The following types of avatars are available:

Avatar	Representing	Description
System	Bus coupler	Managing and integrating the TeSys™ island.
Device	Individual modules (such as starter, input / output modules)	Managing modules as stand-alone devices.
Load	Module operation relating to a specific load	Managing different load type applications. For example, a forward-reverse motor avatar includes a forward and reverse starter, along with pre-programmed forward-reverse operating logic.

For further information, on the avatar concept and the TeSys™ island parameters, refer to the
TeSys™ island DTM Library Online Help that is provided via context-sensitive help of EcoStruxure
Machine Expert.

Downloading the Configuration to the TeSys™ island

After you have performed the configuration of the TeSys™ island parameters in offline mode, you
must download the settings to your TeSys™ island by executing one of the following commands:
- Click the **Download** button from the **Configuration** tab of the device editor.
- Right-click the **TeSys_island** node in the **Devices tree**, and execute the command **Download to Device**.

Result: A connection to the TeSys™ island is established:
- The status line in the toolbar changes color into orange and indicates **Device connected**.
- The status bar changes to green and indicates **Connected**.

This indicates that the configuration settings have successfully been transferred to the TeSys™
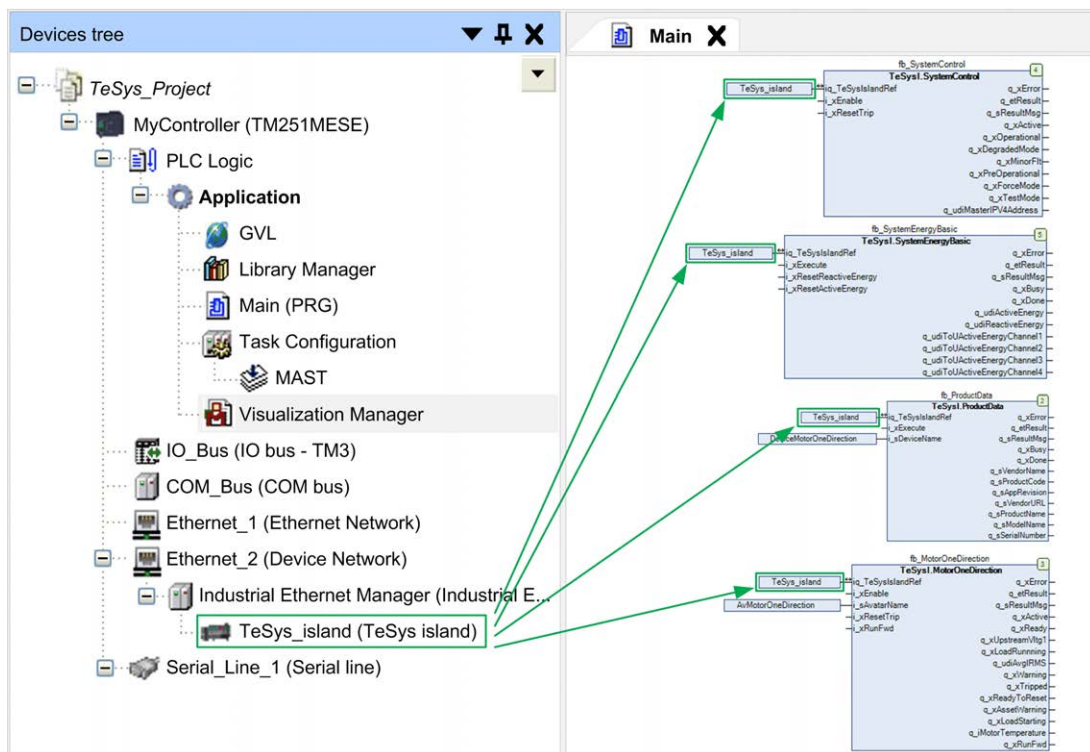island.

Using the TeSys island Library for Developing Applications

Overview

The TeSys island library is added to the **Library Manager** with the integration of the **TeSys_island**
element in your EcoStruxure Machine Expert project. It provides function blocks to support you in
developing applications and to control avatar modules.

Referencing the TeSys™ island Bus Coupler from the Function Blocks

A reference to the TeSys™ island bus coupler is required by each function block of the TeSys island library. To achieve this, configure the name you assigned to the **TeSys_Island** node in the **Devices tree** as input `iq_TeSysIslandRef` of the function blocks.

Referencing Avatars

The name you assign to each avatar with the parameter **Avatar Name** in the **MY AVATAR** tab, section **AVATAR PARAMETERS** of the **Configuration** tab in the **TeSys_island** device editor, must be referenced in the library with the input `i_sAvatarName`.

The name is used to select the avatar to be controlled by the function block. It is available at the avatar function blocks, except the asset management function blocks. If the parameter **Avatar Name** is not configured or not correctly configured, the error message `AvatarNotAvailable` is returned. Modifying this name during the execution of the function block will be ignored.

The following figure provides an example of the `DigitalIO` function block that is only available for **Digital I/O** avatars:

The following figure provides an example of the `Energy` function block that is available for all avatars, except for the **System** avatar:

Referencing Devices

The name you assign to each device of the TeSys™ island with the parameter **Name Tag** in the **MY AVATAR** tab, section **DEVICE PARAMETERS** of the **Configuration** tab in the **TeSys_island** device editor, must be referenced in the library with the input `i_sDeviceName`.

The name is used to select the device at the function blocks for asset management. If the parameter **Name Tag** is not configured or not correctly configured, the error message `DeviceNotAvailable` is returned. Modifying this name during the execution of the function block will be ignored.

The following figure provides an example of the asset management `ProductData` function block that is available for all devices, except for the bus coupler (system device):

System Function Blocks Automatically Referencing the Bus Coupler

In contrast to the above described function blocks, the system functions blocks do not require references to avatars or devices.

The `SystemControl` and `SystemEnergyBasic` function blocks, for example, do not have inputs referencing avatars or devices because they are directly linked to the bus coupler (system device):

How To Exchange Data Between Tools

User Guide

12/2019

Schneider Electric

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

You agree not to reproduce, other than for your own personal, noncommercial use, all or part of this document on any medium whatsoever without permission of Schneider Electric, given in writing. You also agree not to establish any hypertext links to this document or its content. Schneider Electric does not grant any right or license for the personal and noncommercial use of the document or its content, except for a non-exclusive license to consult it on an "as is" basis, at your own risk. All other rights are reserved.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

Table of Contents

Safety Information

Important Information

NOTICE

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.

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 be 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.

About the Book

At a Glance

Document Scope

This document describes the steps required in the different software programs for exchanging data between the tools by using system projects. It is assumed that you have thorough knowledge of the software program you are using. The present document concentrates on listing the required steps and does not provide further information.

Validity Note

This document has been updated for the release of EcoStruxure^{TM} Machine Expert V1.2.

Related Documents

Document title	Reference
EcoStruxure Machine Expert Programming Guide	*EIO0000002854 (ENG)*; *EIO0000002855 (FRE)*; *EIO0000002856 (GER)*; *EIO0000002858 (SPA)*; *EIO0000002857 (ITA)*; *EIO0000002859 (CHS)*
Motion Sizer Online Help	*EIO0000002157 (ENG)*; *EIO0000002158 (FRE)*; *EIO0000002159 (GER)*; *EIO0000002161 (SPA)*; *EIO0000002160 (ITA)*; *EIO0000002162 (CHS)*; *EIO0000002163 (TUR)*; *EIO0000002164 (POR)*; *EIO0000002165 (RUS)*

Product Related Information

⚠ **WARNING**
LOSS OF CONTROL
● The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart. ● Separate or redundant control paths must be provided for critical control functions. ● System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link. ● Observe all accident prevention regulations and local safety guidelines.[1] ● Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed 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
● Only use software approved by Schneider Electric for use with this equipment. ● Update your application program every time you change the physical hardware configuration.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, 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.

Standard	Description
ISO 13849-1:2015	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 62061:2015	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 61784-3:2016	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.

General Information

Overview

This document lists the steps required in the different software programs for exchanging data by using system projects.

A system project can contain one or more application projects that are intended to be edited by different users or from different software programs. Beyond project-specific data, the application projects that are part of system projects contain system data that can be shared in different software programs, as for example, cam diagrams that were created with Motion Sizer can be edited in EcoStruxure Machine Expert Logic Builder.

System projects must be saved in a central repository. This is a user-definable local or network folder that must be made available to all users that should have access to a system project. The users that have access to this folder can consecutively open and edit the project locally. While an application project is being edited by a user, it is locked for other users. An application project can only be edited by one user at a time.

For further information on handling system projects in EcoStruxure Machine Expert Logic Builder, refer to the *Menu Commands* online help.

System Requirements

The software programs that are used for editing system projects must meet the following requirements:

Software program	Version
Motion Sizer	V4.1 or later installed via the Machine Expert Installer
EcoStruxure Operator Terminal Expert	V3.1 SP1 or later installed via the Machine Expert Installer
EcoStruxure Machine Expert Logic Builder	EcoStruxure Machine Expert V1.1 or later with the following additional components installed via the Machine Expert Installer: ● **Tools → Tool2Tool** ● **MachineExpert Components → LogicBuilder → ToolCollaboration**

Steps to be Performed in Motion Sizer

Optional Preparatory Step: Creating and Configuring a Working Directory

You can create your own working directory. This is a folder where system projects are saved on your local PC when they are opened for editing. If you do not configure your own working directory as described in the following steps, the default directory is used by Motion Sizer.

Proceed as follows:

Step	Action
1	By using the Windows Explorer, create an empty folder on the local disk of your PC. Example: Local disk *C:\Work\MotionSizer*.
2	Start Motion Sizer.
3	Make sure that no system project is open.
4	Click the **Options** button from the toolbar. **Result**: The **User preferences** dialog box opens.
5	In the **User preferences** dialog box, select the **ToolCollaboration** view.
6	In the **ToolCollaboration** view, paste the path to the local folder you created to the **Working Copy Base Path** field, or click the folder button to navigate to the folder. Example: *C:\Work\MotionSizer*.
7	Click **Apply** to confirm the selected folder.
8	Click **OK** to close the dialog box.

Prerequisite: Creating a System Location Folder for Saving System Projects

Create a system location folder that is a folder that acts as system repository where system projects are saved to allow access by different users or from different software programs:
- In order to work individually on a system project and to open it in different software programs, such as EcoStruxure Machine Expert Logic Builder or Motion Sizer, you can create a folder on your local PC.
  Example: Local disk *C:\Exchange_local*

Creating a New System Project for Sharing a Cam Diagram

To create a new Motion Sizer project as part of a system project, perform the following steps:

Step	Action
1	In Motion Sizer, click the **Open System Explorer** button from the toolbar. **Result**: The **System Explorer** dialog box opens.
2	Enter the path to the system location folder in the **System Location** box. Example as created in step *Prerequisite (see page 14)*: *C:\Exchange_local*)
3	Click the **Create System Project** button.

Step	Action
4	In the **Create System** part of the **System Explorer** dialog box, enter the **System Name**, for example, `System1` and the optional **System Description**, and click the **Create** button. **Result**: The new system project `System1` is added to the list of **SYSTEM PROJECTS** on the left-hand side of the **System Explorer** dialog box.
5	Click the **Add Current Project** button. **Results**: ● The open Motion Sizer project is added to the system project `System1`. ● The **System Explorer** dialog box closes.
6	In the Motion Sizer **Project Explorer**, right-click an **Axis** node, and execute the **Add CAM diagram** command. **Result**: A **CamDiagram** node is added below the **Axis** node.
7	Configure the movement of your axis in the cam diagram according to your individual requirements.
8	Click the **Save** button from the toolbar to save the Motion Sizer project to the local working directory.
9	Click the **Save to Repository** button from the toolbar to save the Motion Sizer project as part of the system project `System1` to the system location folder. **Result**: The cam diagram has been published to the system repository and is therefore available for use in other software programs as for example, the EcoStruxure Machine Expert Logic Builder.

Linking a Cam Diagram to an EcoStruxure Machine Expert Logic Builder Project

You can link your cam diagram in Motion Sizer directly to a cam diagram in EcoStruxure Machine Expert Logic Builder in order to retrieve updates that have been performed on the cam diagram in Logic Builder and have been saved to the system project:

Step	Action	Comment
1	Right-click the **CamDiagram** node in the Motion Sizer **Project Explorer** and execute the command **Bind with system CamDiagram entry**. **Result**: A dialog box is displayed indicating the list of cam diagram entries in the system.	–
2	Select the suitable Logic Builder project from the list and click the **Link** button. **Result**: The cam diagram in Motion Sizer is linked to the cam diagram in Logic Builder and the values in Motion Sizer are updated.	This step is only required if several Logic Builder projects are available as system projects.

To refresh the view of the cam diagram in Motion Sizer with the updates made in EcoStruxure Machine Expert Logic Builder, right-click the **CamDiagram** node in the Motion Sizer **Project Explorer** and execute the command **Update from system**. The modifications made in EcoStruxure Machine Expert Logic Builder are applied to the axis in the cam diagram in Motion Sizer.

Steps to be Performed in EcoStruxure Operator Terminal Expert

Prerequisite: Creating a System Location Folder for Saving System Projects

Create a system location folder that is a folder that acts as system repository where system projects are saved to allow access by different users or from different software programs.

Example: Local disk *C:\Exchange_local*

Creating a New System Project for Sharing Symbols

To create a new EcoStruxure Operator Terminal Expert project as part of a system project, perform the following steps:

Step	Action
1	Start EcoStruxure Operator Terminal Expert.
2	Open the project that you want to add to a system project.
3	Click the **Show System Explorer** button from the toolbar. **Result**: The **System Explorer** dialog box opens.
4	Enter the path to the system location folder *(see page 16)* in the **System Location** box.
5	Click the **Create System Project** button.
6	In the **Create System** part of the **System Explorer** dialog box, enter the **System Name**, for example, `System1` and the optional **System Description**, and click the **Create** button. **Result**: The new system project `System1` is added to the list of **SYSTEM PROJECTS** on the left-hand side of the **System Explorer** dialog box.
7	Click the **Add Current Project** button. **Results**: ● The open EcoStruxure Operator Terminal Expert project is added to the system project `System1`. ● The **System Explorer** dialog box closes. ● The **System Mode** icon is displayed in the upper right corner of the EcoStruxure Operator Terminal Expert dialog box to indicate that a system project is open.

Configuring a Target Controller of an EcoStruxure Machine Expert Logic Builder Project

Configure the controller of an EcoStruxure Machine Expert project from which you want to retrieve the symbol configuration:

Step	Action
1	In the **Project Explorer** tree, select the **System Architecture → Target → Driver** node and click the **+Driver** button. **Result**: The **Add Driver** dialog box is displayed.
2	From the list **Manufacturer**, select **Schneider Electric**. From the list **Driver**, select **SoMachine Network**. Click the **OK** button. **Result**: A **Schneider Electric SoMachine Network** node is created below the **Driver** node.
3	In the **System Architecture** view in the middle of the EcoStruxure Operator Terminal Expert screen, click the **+Equipment** button. **Result**: A **SoMachineNetworkEquipment** entry is added to the **Equipment** list.
4	Select the **SoMachineNetworkEquipment** entry and configure the **Properties** on the right-hand side of the EcoStruxure Operator Terminal Expert screen.
5	Select the **SoMachineNetworkEquipment** entry (column **Name**) and rename it by using the controller name. **NOTE:** Since this name is used as prefix for the symbols that will be imported from the EcoStruxure Machine Expert symbol configuration, enter a meaningful and unique name.
6	To define the controller, retrieve the exact node name or IP address from the **Communication Settings** tab *(see EcoStruxure Machine Expert, Programming Guide)* in EcoStruxure Machine Expert Logic Builder, enter this information in the **NodeName** or **IP Address** text box in the **Basic** tab of the **Properties**.

Importing a Symbol Configuration of an EcoStruxure Machine Expert Logic Builder Project

You can link the symbol configuration of the configured controller directly to your EcoStruxure Operator Terminal Expert project in order to retrieve updates that have been performed in Logic Builder and have been saved to the system project:

Step	Action
1	In the **Project Explorer** tree, select the **Variables → Symbol Link** node and click the **+Symbol** button.
2	From the **Equipment Name** list, select the entry of the Schneider Electric controller you defined. From the **Format List**, select **SoMachine Symbol File**. Click the **Import** button. **Result**: The **Device Selector** dialog box is displayed.
3	From the **Device Selector** dialog box, select a controller entry and click **OK**. **Result**: The variables of the selected controller are imported and displayed in the **Variables** view in the middle of the EcoStruxure Operator Terminal Expert screen. You can use them in the EcoStruxure Operator Terminal Expert screens.

Refreshing a Symbol Configuration after Modifying an EcoStruxure Machine Expert Logic Builder Project

After the symbol configuration of the system project has been modified in Logic Builder, perform the following steps to retrieve the updated variables:

Step	Action
1	In the **Project Explorer** tree, select the controller node below **Variables → Symbol Link** whose variables you want to refresh.
2	Click the **Delete** button from the toolbar and confirm the **Confirmation** message with **Yes**. **NOTE:** Variables configured in the EcoStruxure Operator Terminal Expert screens will still be available after deleting the variable list. **Result**: The selected controller node is removed from the **Project Explorer** tree.
3	Proceed by executing the steps described for *Importing a Symbol Configuration of an* EcoStruxure Machine Expert Logic Builder *Project (see page 17)*.

Steps to be Performed in EcoStruxure Machine Expert Logic Builder

Optional Preparatory Step: Creating and Configuring a Working Directory

You can create your own working directory. This is a folder where system projects are saved on your local PC when they are opened for editing. If you do not configure your own working directory as described in the following steps, the default directory is used by EcoStruxure Machine Expert Logic Builder.

Proceed as follows:

Step	Action
1	By using the Windows Explorer, create an empty folder on the local disk of your PC. Example: Local disk *C:\Work\LogicBuilder*.
2	Start EcoStruxure Machine Expert Logic Builder.
3	Make sure that no system project is open.
4	Open the **Tools → Options → System Project** dialog box.
5	Paste the path to the local folder you created to the **Working Copy Base Path** field, or click the browse (**...**) button to navigate to the folder. Example: *C:\Work\LogicBuilder*.
6	Click **OK** to confirm and to close the dialog box.

Creating a New EcoStruxure Machine Expert Project that is Part of a System Project

To create a new EcoStruxure Machine Expert project as part of a system project, perform the following steps:

Step	Action
1	Execute the **File → New Project** command.
2	In the **New Project** dialog box, configure the parameters for creating a new **Default Project**.
3	In the **Select project file location** section, select the option **Create as part of System Project**.
4	Enter the path to the system location folder in the **System Location** box, or click the browse button (**...**) to open the **System Explorer** dialog box. Example as created in step *Prerequisite* for Motion Sizer *(see page 14)*: *C:\Exchange_local*)
5	Select the system project `System1` from the list of **SYSTEM PROJECTS** on the left-hand side of the **System Explorer** dialog box.
6	Click the **Select** button to close the **System Explorer** dialog box and to return to the **New Project** dialog box. **Result**: The **New Project** dialog box contains the following values: ● **System Location** = *C:\Exchange_local* ● **System Project Name** = `System1`
7	Click **OK** to close the **New Project** dialog box and to create the new EcoStruxure Machine Expert project as part of a system project. **Result**: EcoStruxure Machine Expert Logic Builder opens the project you have defined.

Editing a Cam Diagram via System Project

To edit the cam diagram that has been saved in a Motion Sizer project that is part of the open system project `System1`, proceed as follows:

Step	Action
1	In the **Tools tree**, right-click the **Application** node and execute the command **Add Object → System Import: CamDiagram...**. **Result**: The **Add System Import: CamDiagram** dialog box opens and displays the cam diagrams available in the system project.
2	Select the cam diagram from the list, and click the **Add** button. **Result**: A **CamDiagram** node is added below the **Application** node in the **Tools tree**, and the cam motion editor opens, displaying the cam diagram that has been created in Motion Sizer.

In order to retrieve updates that have been performed on the cam diagram via Motion Sizer and have been saved to the system project, right-click the **CamDiagram** node in the **Tools tree**, and execute the command **Update from System**.

Result: The modifications made in Motion Sizer are applied to the cam motion editor in EcoStruxure Machine Expert Logic Builder.

For the steps to be performed in Motion Sizer, refer to the Motion Sizer chapter *(see page 14)*.

Sharing the Symbol Configuration with EcoStruxure Operator Terminal Expert via System Project

To provide the variables declared in the EcoStruxure Machine Expert Logic Builder **Symbol Configuration** *(see EcoStruxure Machine Expert, Programming Guide)* to EcoStruxure Operator Terminal Expert, proceed as follows:

Step	Action
1	In the **Symbol Configuration** editor, configure the variables you want to share with EcoStruxure Operator Terminal Expert and save the project as part of a system project.
2	Publish this symbol configuration by executing the command **System Project → Save to Repository** or by opening the **System Explorer**, right-clicking the system project, and executing the command **Publish Changes**. **Result**: The variables saved in the symbol configuration are available for import *(see page 17)* into EcoStruxure Operator Terminal Expert via the **System Explorer**.

For the steps to be performed in EcoStruxure Operator Terminal Expert, refer to the EcoStruxure Operator Terminal Expert chapter *(see page 16)*.

How To Manage Certificates on the Controller
User Guide

06/2019

Table of Contents

Safety Information

Important Information

NOTICE

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.

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 be 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.

About the Book

At a Glance

Document Scope

This document describes the steps for managing certificates which should be used for secured TCP communication at application level.

Validity Note

This document has been updated for the release of EcoStruxure^{TM} Machine Expert V1.1.

Related Documents

Document title	Reference
Modicon M262 Logic/Motion Controller Hardware Guide	EIO0000003659 (ENG); EIO0000003660 (FRE); EIO0000003661 (GER); EIO0000003662 (SPA); EIO0000003663 (ITA); EIO0000003664 (CHS)
EcoStruxure Machine Expert Programming Guide	EIO0000002854 (ENG); EIO0000002855 (FRE); EIO0000002856 (GER); EIO0000002858 (SPA); EIO0000002857 (ITA); EIO0000002859 (CHS)

Product Related Information

⚠ WARNING
LOSS OF CONTROL
● The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart. ● Separate or redundant control paths must be provided for critical control functions. ● System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link. ● Observe all accident prevention regulations and local safety guidelines.[1] ● Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed 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
● Only use software approved by Schneider Electric for use with this equipment. ● Update your application program every time you change the physical hardware configuration.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, 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 13849-1:2015	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 62061:2015	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 61784-3:2016	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.

Applications Implementing Secured TCP Communication

Communication Libraries

EcoStruxure Machine Expert provides libraries that support secured communication using TLS (Transport Layer Security). They provide client and/or server functionality as indicated in the following table:

Library	Providing the functionality of:
TcpUdpCommunication	• TCP client • TCP server
HttpHandling	HTTP/HTTPS client
MqttHandling	MQTT / secured MQTT client
EmailHandling	• SMTP/SMTPS client • POP3/POP3S client

The clients or server can be configured to use TLS for encrypted communication.

Whether a connection using TLS is supported depends on the controller where the corresponding function block is used. Refer to the specific manual of your controller to verify if TCP communication using TLS is supported.

Certificates

In the context of TLS, certificates can be used to verify the identity of the communication partners. Certificates are sent during the establishing of a connection, the so-called TLS handshake. The sending of the certificate is optional for the client, unless the server requests the client certificate. The server is sending its certificate at every time. Only if the result of the verification of the certificate is positive a connection with the communication partner can be established.

Verification of Certificates

The EcoStruxure Machine Expert libraries that support secured connection using TLS provide the parameter `etCertVerifyMode` for selecting the mode of verification of the certificate which is sent by the communication partner during the TLS handshake.

The following modes are supported:

`etCertVerifyMode` Mode	Description
`TrustedOnly`	A certificate from the communication partner is required. The certificate must be classified as trusted.
`AllCertificates`	A certificate from the communication partner is required. Further verification on the certificate is not performed.
`NotVerified`	No certificate from the communication partner is required.

If the client or server is configured to verify the server certificate in mode `TrustedOnly`, it is required to manage the certificates on your controller in a manual manner. This can be performed using the editor **Security Screen** in EcoStruxure Machine Expert Logic Builder. The required steps are described in the following section.

NOTE: `TrustedOnly` is the only way to authenticate the communication partner.

Managing Certificates on the Controller

Overview

If the client or server is configured to verify the certificate of the communication partner in mode `TrustedOnly`, the corresponding certificate must be available on the controller and it must be declared as trusted. To achieve this, use the editor **Security Screen** in EcoStruxure Machine Expert Logic Builder to manage the certificates on your controller.

Security Screen Editor

The **Security Screen** editor is available in EcoStruxure Machine Expert Logic Builder via the **View → Security Screen** command. The **Devices** tab of the **Security Screen** editor provides access to the folders that are dedicated to managing certificates on the connected controller.

Click the ⟳ button to display the corresponding folders and their content for the certificate handling on the connected controller.

For example, the following categories are available for the Modicon M262 Logic/Motion Controller:
- **Own Certificates**: Certificates owned by the controller which are used for associated services it provides.
- **Trusted Certificates**: Certificates that have been created by a trusted certificate source.
- **Untrusted Certificates**: Certificates that you have declared as untrusted.
- **Quarantined Certificates**: Certificates that do not meet the criteria of the other categories.
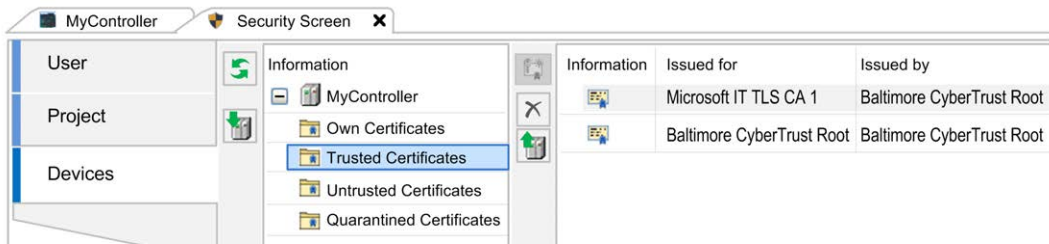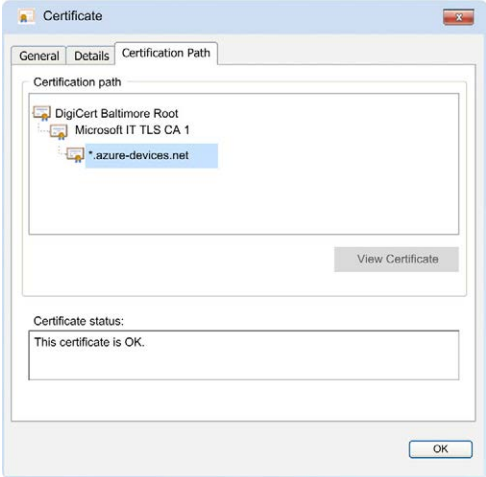
Successful verification of a certificate in mode `TrustedOnly` is only possible if the corresponding certificate(s) are available in the folder **Trusted Certificates**.

Declare a Certificate as Trusted

In order to declare certificates as trusted on your controller, perform the following steps:

| Step	Action	Comment
1	Save the certificate of a device / software that you received from the manufacturer to your PC running EcoStruxure Machine Expert.	If you did not receive a certificate from the manufacturer of your device / software, you can obtain it by trying to establish a connection as described in the paragraph *Obtaining an Unknown Certificate* .
2	Double-click the certificate. **Result**: The **Certificate** dialog box opens.	–
3	Inspect the certificate carefully in the **General** tab and decide whether you want to declare it as trusted.	–
4	Select the **Certification Path** tab and verify whether there is only one entry.	If there is only one entry in the **Certification Path** tab, then this is a self-signed certificate, as for example, for the Modicon M262 Logic/Motion Controller. You can skip the next two steps and proceed with step 7. If there is a tree structure in the **Certification Path** tab, then this certificate has been signed by a CA (Certificate Authority). In this case, perform the following steps for CA certificates.
5	If the certificate has been signed by a CA: Verify each certificate from the tree structure including the root CA certificate from the **Certification Path** tab.	–
6	For each CA certificate of the **Certification Path**, select the certificate and click the **View Certificate** button. **Result**: A new dialog box opens for the selected certificate.	–
7	Select the **Details** tab and click the **Copy to file...** button to save the certificate on the PC.	–
8	Download the saved certificate files to the **Trusted Certificates** folder of your controller.	Refer to the paragraph *Downloading Certificate(s) Declared as Trusted to the Controller* .

Downloading Certificate(s) to the Controller
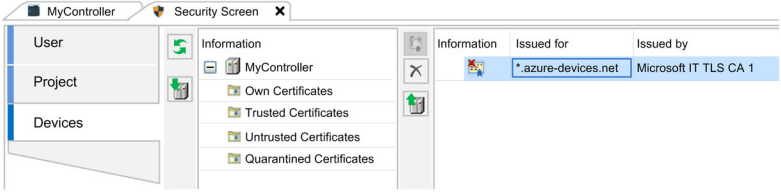
To save certificates that you have declared as trusted to the folder **Trusted Certificates** on your controller, proceed as follows:

Step	Action
1	In EcoStruxure Machine Expert Logic Builder, execute the **Security Screen** editor from the **View** menu.
2	In the **Security Screen** editor, select the **Devices** tab.
3	Click the button **Refresh the list of available devices and their certificate stores**. **Result**: The display is updated according to the information received from the connected controller.
4	Select the folder **Trusted Certificates**, and click the **Download** button.
5	In the **Open** dialog box, navigate to the folder on your PC running EcoStruxure Machine Expert where you saved the certificate file(s).
6	Select the certificate file(s) and click the **Open** button. **Result**: The certificates are downloaded to the controller and are displayed on the right-hand side of the **Security Screen** editor as content of the folder **Trusted Certificates**.
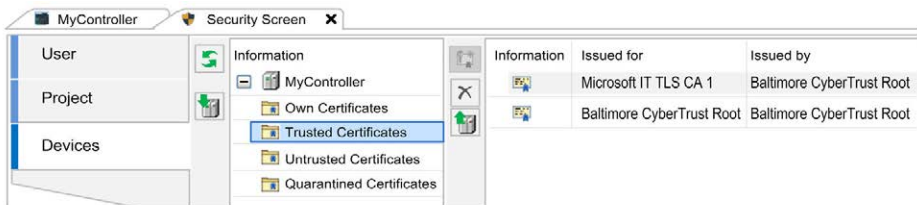
Obtaining an Unknown Certificate

If the certificate of a communication partner is not available and you cannot obtain it from the manufacturer or another source, proceed as follows:

Step	Action	Further information
1	Establish a secured connection with `etCertVerifyMod` set to `TrustedOnly` between the client and the server: ● If your application implements a client, connect to the server. ● If your application implements a server, open the server and accept the incoming connection from the client. **Results**: ● As the certificate that has been sent by the server or client is unknown, the connection cannot be established. ● The unknown certificate is stored in the folder **Quarantined Certificates** on your controller.	● If your controller application implements a client, the result `ConnectionFailed` may indicate that the certificate that has been received from the server is unknown. ● If your controller application implements a server, the result `TlsError` may indicate that the certificate that has been received from the client is unknown. **NOTE:** If the folder is empty, the communication partner may have not sent its certificate. Verify the configuration of the remote server or client in order to find out whether a certificate can be expected.
2	In EcoStruxure Machine Expert Logic Builder, open the **Security Screen** editor and click the button **Refresh the list of available devices and their certificate stores**.	–
3	Select the folder **Quarantined Certificates**.	–
4	Select the certificate from the list on the right-hand side of the **Security Screen** editor, and click the **Upload the selected certificate from the device and save it to your PC** button. 	
5	In the **Save as** dialog box, navigate to a folder on your PC running EcoStruxure Machine Expert where you want to save the certificate file(s) and click the **Save** button.	–
6	Verify the certificate(s) and decide if you want to declare them as trusted as described in the paragraph *How to Obtain Trusted Certificates* .	–
7	Download the certificate(s) declared as trusted to the controller .	–

Considerations When Using Certificates

Considerations

Consider the following when you use certificates for secured communications:

- Administration of certificates is required as they have a limited validity and therefore need to be updated in regular intervals. Consider this with respect to the life cycle of your machine or control.
- The controller clock is used to verify whether the certificate is still valid. Make sure that the controller clock is synchronized with UTC (Universal Time Coordinated) in regular intervals. To verify the controller clock, refer to the **Services** tab of your controller configuration.
- You can also declare certificates as untrusted by saving them to the folder **Untrusted Certificates** in the controller.

How To Manage Certificates for the OPC UA Client
User Guide

03/2020

Schneider Electric

Table of Contents

Safety Information

Important Information

NOTICE

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.

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 be 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.

About the Book

At a Glance

Document Scope

This document describes the steps for managing certificates which are applied by the OPC UA client provided by the controller.

Validity Note

This document has been updated for the release of EcoStruxure^TM Machine Expert V1.2.3.

Related Documents

Document title	Reference
Modicon M262 Logic/Motion Controller Hardware Guide	*EIO0000003659 (ENG):* *EIO0000003660 (FRE):* *EIO0000003661 (GER):* *EIO0000003662 (SPA):* *EIO0000003663 (ITA):* *EIO0000003664 (CHS)*
Modicon M262 Logic/Motion Controller Programming Guide	*EIO0000003651 (ENG):* *EIO0000003652 (FRE):* *EIO0000003653 (GER):* *EIO0000003654 (SPA):* *EIO0000003655 (ITA):* *EIO0000003656 (CHS):*
EcoStruxure Machine Expert Programming Guide	*EIO0000002854 (ENG);* *EIO0000002855 (FRE);* *EIO0000002856 (GER);* *EIO0000002858 (SPA);* *EIO0000002857 (ITA);* *EIO0000002859 (CHS)*
OpcUaHandling Library Guide	*EIO0000004021 (ENG);* *EIO0000004022 (FRE);* *EIO0000004023 (GER);* *EIO0000004025 (SPA);* *EIO0000004024 (ITA);* *EIO0000004026 (CHS);*

Product Related Information

WARNING
⚠ **WARNING**
LOSS OF CONTROL
• The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart. • Separate or redundant control paths must be provided for critical control functions. • System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link. • Observe all accident prevention regulations and local safety guidelines.[1] • Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed 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
⚠ **WARNING**
UNINTENDED EQUIPMENT OPERATION
• Only use software approved by Schneider Electric for use with this equipment. • Update your application program every time you change the physical hardware configuration.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

For reasons of Internet security, 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 an 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.

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, 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 13849-1:2015	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 62061:2015	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.

Standard	Description
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784-3:2016	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.

Managing Certificates for the OPC UA Client

Overview

The OPC UA client provided on the Modicon M262 Logic/Motion Controller supports a secured communication using TLS (Transport Layer Security)

In the context of TLS, certificates can be used to verify the identity of the communication partners. Certificates are sent during the establishing of a connection, known as the TLS handshake. Only if the result of the verification of the certificate is positive can a connection with the communication partner be established.

If the connection with the OPC UA server cannot be established, it might be that the result of the certificate verification was unsuccessful.

To solve such an issue, consider the following points:
● Verify whether the OPC UA server accepts only connections with trusted certificates. If so, verify if the certificate of the controller is added to the list of trusted certificates.
● Verify whether your application is configured to accept only connections with trusted certificates. In this case, verify if the received certificate is added to the list of trusted certificates.

The certificate of the communication partner should always be verified for authenticity. This helps to prevent unintentionally accepting a connection with an unauthorized device or service. For this, the certificate of the communication partner or the certificate of its issuer must be classified as trusted beforehand.

The main purpose of this document is to describe two things:
● How you can declare a digital server certificate as trusted for the OPC UA client provided on the M262 controller.
● How you can obtain the digital certificate of the controller in order to transfer it manually to the M262 server.

General Workflow

The following steps describe the OPC UA client certificate management workflow using manually exchanged certificates between client and server:

Step	Action
1	Obtain the client certificate for the Modicon M262 Logic/Motion Controller. Refer to the section below *(see page 15)*.
2	Transfer the Modicon M262 Logic/Motion Controller certificate to the server.
3	Verify that the server trusts the M262 OPC UA client certificate.
4	Obtain the server Certificate.
5	Download the server certificate to the Modicon M262 Logic/Motion Controller. Refer to the section below *(see page 16)*.
6	Declare the received server certificate as a trusted certificate. Refer to the section below *(see page 16)*.
7	Connect the M262 OPC UA client with the server.

OPC UA client certificate management workflow using automatically exchanged certificates between client and server:

Step	Action
1	Attempt to connect the M262 OPC UA client with the server. (Without the trusted server certificate this first connection is expected to be unsuccessful but allows the M262 OPC UA client to exchange certificates automatically with the server).
2	Verify that the Server trusts the M262 OPC UA client certificate.
3	Declare the received server certificate as a trusted certificate. Refer to the section below *(see page 16)*.
4	Connect the M262 OPC UA client with the server.

Declare a Digital Certificate as Trusted

For the M262 controller, each unknown or untrusted certificate, which is received with the TLS handshake during initialization of an OPC UA connection, is stored in a dedicated folder on the controller. This folder as well as the folder containing the trusted certificates can be accessed via the Web server of the controller. There you can see the rejected/untrusted certificates and the trusted ones. Further you can determine whether a certificate should be declared as trusted.

From the webpage **Certificates** on the Web server of the controller, you can move the received certificates (from OPC UA servers or clients) from the folder **Rejected** to **Trusted**. In the same way, certificates which are already trusted can be downgraded to rejected (untrusted).

NOTE: For managing the certificates, a secured connection Web server of the controller (via *https://*) is required.

For further information about the Web server, refer to Modicon M262 Logic/Motion Controller Programming Guide\...\Maintenance: Certificates Submenu *(see Modicon M262 Logic/Motion Controller, Programming Guide)*.

Obtain the Controller Certificate

You may need to transfer the digital certificate of the controller manually to the OPC UA server. The M262 controller has its own self-signed certificate that is created on the first power-on of the controller. This certificate can be obtained using the **Security Screen** in EcoStruxure Machine Expert Logic Builder, proceeding as described in the following table.

Step	Action	Description/Comment
1	Open the EcoStruxure Machine Expert Logic Builder and create a project with the corresponding M262 controller.	-
2	In the EcoStruxure Machine Expert Logic Builder, execute the **Security Screen** editor from the **View** menu.	-
3	Switch to the **Devices** tab of the **Security Screen**.	-
4	Click the button **Refresh the list of available devices and their certificate stores**.	**Result**: The display is updated according to the information received from the connected controller.
5	Select the **Own Certificates** tab.	-
6	Select the certificate from the list on the right-hand side of the **Security Screen** editor, and click the **Upload the selected certificate from the device and save it to your PC** button.	See figure below.
7	In the **Save as** dialog, navigate to a folder on your PC where you want to save the certificate file and click the **Save** button.	-
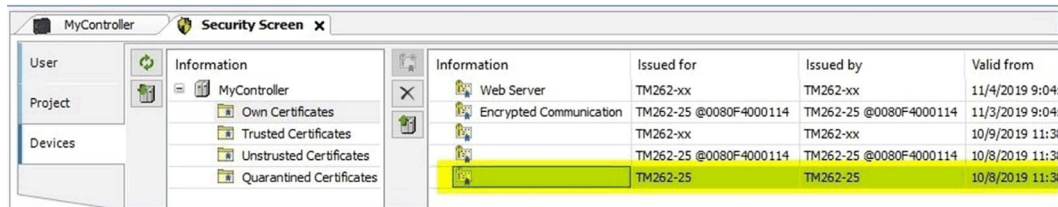
Also refer to chapter *Security Screen Editor (see How To Manage Certificates on the Controller, User Guide)* in the *How To Manage Certificates User Guide*.

Download the Server Certificate to the Modicon M262 Logic/Motion Controller

Step	Action	Description/Comment
1	Open EcoStruxure Machine Expert.	-
2	Create a project corresponding to your Modicon M262 Logic/Motion Controller.	-
3	Configure the communication settings of the controller.	-
4	Open the **Security Screen**. Also refer to chapter *Security Screen Editor (see How To Manage Certificates on the Controller, User Guide)* in the *How To Manage Certificates User Guide*.	**NOTE:** The **Security Screen** is represented by a shield icon in the lower right corner of the EcoStruxure Machine Expert window.
5	Open the **Devices** tab of the **Security Screen**.	-
6	Click the **Refresh** button.	-
7	Select your M262 controller.	-
8	Select the **Untrusted Certificates** tab.	-
9	Click the **Download Certificate** button (on the left-hand side).	-
10	Select the folder on your computer where the server certificate is located and select the certificate file to download.	-
11	Click the **Open** button.	**NOTE:** To update the certificate lists present in the **Security Screen**, a controller reboot is required.

Declare a Received Certificate as a Trusted Certificate

Step	Action	Description/Comment
1	Log in to the Web server of your controller by launching an Internet browser and entering the address: *https://<your_controller_ip_address>/*	-
2	Enter your user credentials.	-
3	Select the **Maintenance** tab.	-
4	Select the **Certificates** submenu on the left-hand side.	-
5	Select the OPC UA certificate in the **Rejected** list (untrusted).	**NOTE:** Verify that you either uploaded the desired certificate (through EcoStruxure Machine Expert **Security Screen**) or that you have already tried to connect to this OPC UA server before.
6	Click the **>>** button to move the certificate to the **Trusted** list.	-

Declare a Received Certificate as an Untrusted Certificate

Step	Action	Description/Comment
1	Log in to the Web server of your controller by launching an Internet browser and entering the address: *https://<your_controller_ip_address>/*	-
2	Enter your user credentials.	-
3	Select the **Maintenance** tab.	-
4	Select the **Certificates** submenu on the left-hand side.	-
5	Select the OPC UA certificate in the **Trusted** list.	**NOTE:** Verify that you either uploaded the desired certificate (through EcoStruxure Machine Expert **Security Screen**) or that you have already tried to connect to this OPC UA server before.
6	Click the **<<** button to move the certificate to the **Rejected** list (untrusted).	-

NOTE: Move certificates that are no longer active/needed to the **Rejected** list. This prevents unintentional connections to the OPC UA server.

Considerations When Using Certificates

Considerations

Consider the following when you use certificates for secured communications:
- Administration of certificates is required as they have a limited validity and therefore need to be updated in regular intervals. Consider this with respect to the life cycle of your machine or process.
- The controller clock is used to verify whether the certificate is still valid. Make sure that the controller clock is synchronized with UTC (Universal Time Coordinated) in regular intervals. To verify the controller clock, refer to the **Services** tab of your controller configuration.
- You can also declare certificates as untrusted by saving them to the folder **Untrusted Certificates** in the controller.

Glossary

C

certificate

A digital representation of information which at least:
- Identifies the certification authority issuing it.
- Names or identifies its subscriber.
- Contains the public key of the subscriber.
- Identifies its operational period
- Is digitally signed by the certification authority issuing it.

credentials

A qualification, achievement, quality, or aspect the background of a person, especially when used to indicate their suitability for something.

T

TLS

(*transport layer security*) A protocol for encrypted data transfer. Successor of *SSL*.

trusted

Confidence that an operation, data transaction source, network, or software process can be relied upon to behave as expected.

trusted certificate

A certificate that is trusted by the relying party based on secured and authenticated delivery. The public keys included in trusted certificates are used to start certification paths. Also known as a "trust anchor".

U

untrusted

Not meeting predefined requirements to be trusted.