

SIEMENS

SINUMERIK

SINUMERIK 840D sl SINUMERIK 840D sl STEP 7 Toolbox V16

Getting Started

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Valid for
SINUMERIK V4.93
TIA Portal V16

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

 DANGER

indicates that death or severe personal injury will result if proper precautions are not taken.
--

 WARNING
--

indicates that death or severe personal injury may result if proper precautions are not taken.

 CAUTION
--

indicates that minor personal injury can result if proper precautions are not taken.
--

NOTICE

indicates that property damage can result if proper precautions are not taken.
--

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

 WARNING
--

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.
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Trademarks

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Preface

SINUMERIK documentation

The SINUMERIK documentation is organized in the following categories:

- General documentation
- User documentation
- Manufacturer and service documentation

This documentation belongs to the manufacturer and service documentation category.

Additional information

You can find information at www.siemens.com/motioncontrol/docu for the following topics:

- Ordering documentation / overview of documentation
- Additional links to download documents
- Using documentation online (find and search in manuals/information)

Please send any questions about the technical documentation (e.g. suggestions for improvement, corrections) to the following address:

docu.motioncontrol@siemens.com

My Documentation Manager (MDM)

Under the following link you will find information to individually compile OEM-specific machine documentation based on the Siemens content:

www.siemens.com/mdm

Training

You can find information about the range of training courses under the following links:

- www.siemens.com/sitrain
SITRAIN - training courses from Siemens for products, systems and solutions in automation technology
- www.siemens.com/sinustrain
SinuTrain - training software for SINUMERIK

FAQs

You can find Frequently Asked Questions in the Service&Support pages under Product Support. <http://support.automation.siemens.com>

SINUMERIK

You can find information on SINUMERIK under the following link:

www.siemens.com/sinumerik

Technical Support

Country-specific telephone numbers for technical support are provided on the Internet at the following address (<https://support.industry.siemens.com/sc/ww/en/sc/2090>) in the "Contact" area.

If you have any technical questions, use the online form in the "Support Request" area.

Target group

This document is intended for first-time users wanting to familiarize themselves with the product.

Benefits

Getting Started provides information to the newcomer and brings about a sense of achievement to the first-time user in a very short time. First-time users learn the basic functions of the product or system and how to perform the essential activities and operations themselves.

Standard scope

This documentation only describes the functionality of the standard scope. Additions or revisions made by the machine manufacturer are documented by the machine manufacturer.

Other functions not described in this documentation might be executable in the control. This does not, however, represent an obligation to supply such functions with a new control or when servicing.

For the sake of simplicity, this documentation does not contain all detailed information about all types of the product and cannot cover every conceivable case of installation, operation, or maintenance.

Note regarding the General Data Protection Regulation

Siemens observes standard data protection principles, in particular the principle of privacy by design. That means that

this product does not process / store any personal data, only technical functional data (e.g. time stamps). If a user links this data with other data (e.g. a shift schedule) or stores personal data on the same storage medium (e.g. hard drive) and thus establishes a link to a person or persons, then the user is responsible for ensuring compliance with the relevant data protection regulations.

Conventions

The following terms/abbreviations are used synonymously in this document:

- "SINUMERIK 840D sl STEP 7 Toolbox <TIA Portal Version>" and "SINUMERIK Toolbox"

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Fundamental safety instructions

1.1 General safety instructions



WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or severe injury.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, the following six steps apply when establishing safety:

1. Prepare for disconnection. Notify all those who will be affected by the procedure.
2. Isolate the drive system from the power supply and take measures to prevent it being switched back on again.
3. Wait until the discharge time specified on the warning labels has elapsed.
4. Check that there is no voltage between any of the power connections, and between any of the power connections and the protective conductor connection.
5. Check whether the existing auxiliary supply circuits are de-energized.
6. Ensure that the motors cannot move.
7. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water. Switch the energy sources to a safe state.
8. Check that the correct drive system is completely locked.

After you have completed the work, restore the operational readiness in the inverse sequence.



WARNING

Electric shock due to connection to an unsuitable power supply

When equipment is connected to an unsuitable power supply, exposed components may carry a hazardous voltage. Contact with hazardous voltage can result in severe injury or death.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV- (Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.



⚠ WARNING

Electric shock due to equipment damage

Improper handling may cause damage to equipment. For damaged devices, hazardous voltages can be present at the enclosure or at exposed components; if touched, this can result in death or severe injury.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged devices.



⚠ WARNING

Electric shock due to unconnected cable shields

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- As a minimum, connect cable shields and the cores of cables that are not used at one end at the grounded housing potential.



⚠ WARNING

Electric shock if there is no ground connection

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.

⚠ WARNING

Spread of fire from built-in devices

In the event of fire outbreak, the enclosures of built-in devices cannot prevent the escape of fire and smoke. This can result in serious personal injury or property damage.

- Install built-in units in a suitable metal cabinet in such a way that personnel are protected against fire and smoke, or take other appropriate measures to protect personnel.
- Ensure that smoke can only escape via controlled and monitored paths.

 **WARNING****Unexpected movement of machines caused by radio devices or mobile phones**

When radio devices or mobile phones with a transmission power > 1 W are used in the immediate vicinity of components, they may cause the equipment to malfunction. Malfunctions may impair the functional safety of machines and can therefore put people in danger or lead to property damage.

- If you come closer than around 2 m to such components, switch off any radios or mobile phones.
- Use the "SIEMENS Industry Online Support app" only on equipment that has already been switched off.

 **WARNING****Fire due to inadequate ventilation clearances**

Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause severe injury or even death. This can also result in increased downtime and reduced service lives for devices/systems.

- Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component.

NOTICE**Overheating due to inadmissible mounting position**

The device may overheat and therefore be damaged if mounted in an inadmissible position.

- Only operate the device in admissible mounting positions.

 **WARNING****Unexpected movement of machines caused by inactive safety functions**

Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in serious injury or death.

- Observe the information in the appropriate product documentation before commissioning.
- Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.
- Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.
- Perform a function test.
- Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

Note

Important safety notices for Safety Integrated functions

If you want to use Safety Integrated functions, you must observe the safety notices in the Safety Integrated manuals.



WARNING

Malfunctions of the machine as a result of incorrect or changed parameter settings

As a result of incorrect or changed parameterization, machines can malfunction, which in turn can lead to injuries or death.

- Protect the parameterization against unauthorized access.
- Handle possible malfunctions by taking suitable measures, e.g. emergency stop or emergency off.

1.2 Equipment damage due to electric fields or electrostatic discharge

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.



NOTICE

Equipment damage due to electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g. conductive foam rubber or aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
 - Wearing an ESD wrist strap
 - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

1.3 Warranty and liability for application examples

Application examples are not binding and do not claim to be complete regarding configuration, equipment or any eventuality which may arise. Application examples do not represent specific customer solutions, but are only intended to provide support for typical tasks.

As the user you yourself are responsible for ensuring that the products described are operated correctly. Application examples do not relieve you of your responsibility for safe handling when using, installing, operating and maintaining the equipment.

1.4 Industrial security

Note

Industrial security

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Products and solutions from Siemens constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the Internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. using firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that can be implemented, please visit:

Industrial security (<https://www.siemens.com/industrialsecurity>)


Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they become available, and that only the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at:

Industrial security (<https://www.siemens.com/industrialsecurity>)

Further information is provided on the Internet:

Industrial Security Configuration Manual (<https://support.industry.siemens.com/cs/ww/en/view/108862708>)

 WARNING
Unsafe operating states resulting from software manipulation
Software manipulations, e.g. viruses, Trojans, or worms, can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.
<ul style="list-style-type: none">• Keep the software up to date.• Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.• Make sure that you include all installed products into the holistic industrial security concept.• Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.• On completion of commissioning, check all security-related settings.• Protect the drive against unauthorized changes by activating the "Know-how protection" converter function.

1.5 Residual risks of power drive systems

When assessing the machine- or system-related risk in accordance with the respective local regulations (e.g., EC Machinery Directive), the machine manufacturer or system installer must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of driven machine or system components during commissioning, operation, maintenance, and repairs caused by, for example,
 - Hardware and/or software errors in the sensors, control system, actuators, and cables and connections
 - Response times of the control system and of the drive
 - Operation and/or environmental conditions outside the specification
 - Condensation/conductive contamination
 - Parameterization, programming, cabling, and installation errors
 - Use of wireless devices/mobile phones in the immediate vicinity of electronic components
 - External influences/damage
 - X-ray, ionizing radiation and cosmic radiation
2. Unusually high temperatures, including open flames, as well as emissions of light, noise, particles, gases, etc., can occur inside and outside the components under fault conditions caused by, for example:
 - Component failure
 - Software errors
 - Operation and/or environmental conditions outside the specification
 - External influences/damage
3. Hazardous shock voltages caused by, for example:
 - Component failure
 - Influence during electrostatic charging
 - Induction of voltages in moving motors
 - Operation and/or environmental conditions outside the specification
 - Condensation/conductive contamination
 - External influences/damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc., if they are too close
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly
6. Influence of network-connected communication systems, e.g. ripple-control transmitters or data communication via the network

For more information about the residual risks of the drive system components, see the relevant sections in the technical user documentation.

Introduction

2.1 Classification in the documentation landscape

This Getting Started publication is aimed at those who are new to the field of SINUMERIK PLC programming and configuration, as well as those who are migrating and have previously worked with the SINUMERIK add-on for STEP 7 V5.x.

For this purpose, the SINUMERIK-specific configuration of the PLC is performed in the TIA Portal on the basis of a simple example. Also in this Getting Started, you will find tips for beginners, including a comparison of functions and descriptions of project migration.

If you are new to this field of SINUMERIK NC and drive commissioning (using SINUMERIK Operate), we recommend the following additional documentation:

- Commissioning Manual, CNC Commissioning: NC, PLC, Drive
This manual describes the basics of the complete commissioning, in other words all those commissioning steps that you must perform with SINUMERIK Operate outside the TIA Portal.

To extend your knowledge and for reference, you can use the following documentation:

- SINUMERIK STEP 7 Toolbox V15.1 Update 1 Configuration Manual
This manual describes all functionalities of the SINUMERIK STEP 7 Toolbox, including for example, PROFINET IO IRT, Safety or NC variables. It does not, however, contain any configuration example or any information on migration or changing over.
- Online help of the TIA Portal
The online help of the TIA Portal contains the documentation of all installed TIA Portal software, including the SINUMERIK STEP 7 Toolbox.
- Function Manual, SINUMERIK 840D sl Basic Functions
This documentation contains the detailed description of the SINUMERIK PLC basic program.

Note

SINUMERIK documentation in the SIEMENS Industry Online Support (SIOS)

Current documentation on SINUMERIK can be found in the SIOS:

SINUMERIK CNC automation system (<http://support.automation.siemens.com/WW/view/en/10805517/133300>)

2.2 Organization of the Getting Started

Structure of Getting Started

Getting Started is subdivided into the following sections:

- Getting started
- Configuring the hardware
- Creating a PLC program
- Optional: Tips for those changing over from another system and information on project migration

A detailed list of the individual configuration steps can be found in the following table. You can use the links to navigate directly to the required task.

Step	Task	Implementation
1.	Installing the SINUMERIK toolbox and creating a project (Page 33)	<ul style="list-style-type: none"> • Installing the SINUMERIK toolbox (Page 33) • Starting the TIA Portal (Page 34) • Creating a sample project (Page 35)
2	Inserting and configuring SINUMERIK hardware (Page 37)	<ul style="list-style-type: none"> • Insert NCU (Page 38) • Insert NX module (Page 40) • Inserting an ADI4 module (Page 45) • Inserting SINUMERIK I/O via the general station description (GSD) file (Page 48) • Configuring network interfaces (Page 56) • Configuration of telegrams and IO addresses (Page 61) • Setting up the communication (Page 62) • Loading and closing the hardware configuration in the PLC (Page 65)
3	Programming SINUMERIK PLC (Page 71)	<ul style="list-style-type: none"> • Overview of the PLC program (Page 71) • Adding the PLC basic program (Page 72) • Edit blocks (Page 83) • Configuring Ethernet machine control panels in the PLC program (Page 84) • Loading the PLC program to the PLC (Page 87) • Creating PLC symbols for SINUMERIK Operate • Completing the first commissioning of the PLC (Page 95)

Also in this documentation, you will find tips for those switching from SINUMERIK Toolbox for STEP 7 V5.x, including a comparison of functions and descriptions of project migration.

Step	Task	Implementation
Optional	Project migration (Page 97)	<ul style="list-style-type: none">• Comparison of functionality• Migrating projects• Troubleshooting

2.3 Views in the TIA Portal

Introduction

Two different views available for a differentiated introduction to the TIA Portal: The portal view and the project view.

Below you will find an explanation of the portal view and project view functions.

Note

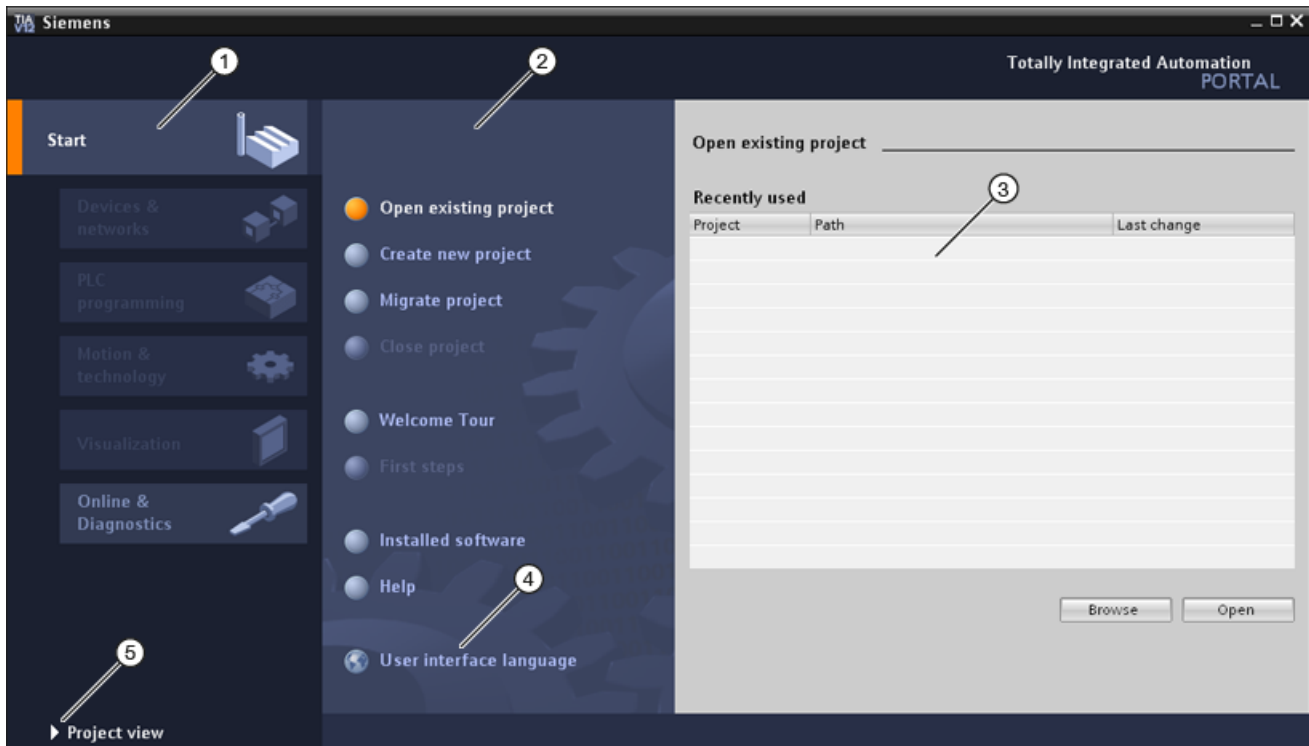
Please refer to the Online Help of the TIA Portal for further information on this topic.

The portal view

The portal view provides an overview of all configuration steps and enables a task-based start to your automation solution.

The individual portals ("Start", "Devices & Networks", "PLC programming", "Visualization", "Online & Diagnostics", etc.) show all required steps to solve an automation task clearly structured. Here, you can quickly decide what you want to do and start the tool required for it.

The following figure shows the layout of the portal view:



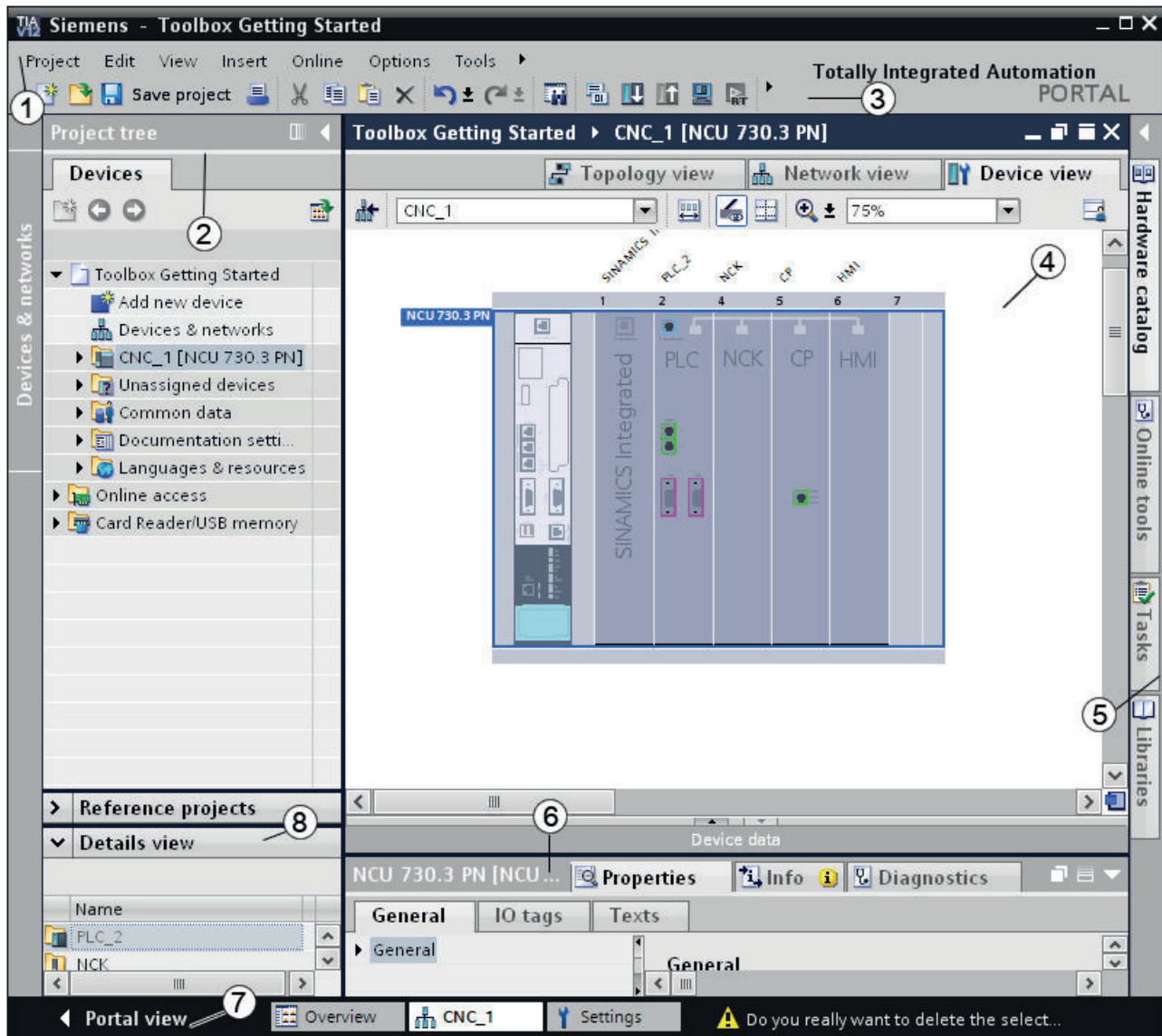
①	Portals for the various tasks: The portals provide the basic functions for the individual task areas. The portals that are provided in the portal view depend on the products that have been installed.
②	Actions for the selected portal: Here, you will find the actions available to you in the portal you have selected. You can open context-sensitive help in every portal.
③	Selection window for the selected action: The selection window is available in all portals. The content of the window adapts to your current selection.
④	Select user interface language.
⑤	Change to project view.

The project view

The project view is a hierarchically structured view of all components in a project. The project view enables quick and intuitive access to all objects in the project, the relevant work areas and editors. Using the available editors, you can create and edit all the objects required in the project.

The various work windows show you all the corresponding data for the selected objects.

The following figure shows the layout of the project view:



①	<p>Menu bar: The menu bar contains all the commands that you require for your work.</p>
②	<p>Project tree: The project tree provides access to all components and project data.</p>
③	<p>Toolbar: The toolbar provides you with buttons for commands you will use frequently. This setup gives you faster access to these commands compared to the menus in the menu bar.</p>
④	<p>Work area: The objects that you can open for editing purposes are displayed in the work area.</p>
⑤	<p>Task cards: Depending on the object being edited or that has been selected, task cards are available. You can find the task cards in a bar at the right-hand edge of the screen. You can collapse and reopen them at any time.</p>

⑥	Inspector window: The inspector window displays additional information on a selected object or on executed actions.
⑦	Portal view: Changing to the portal view
⑧	Detailed view: The detailed view shows specific content of a selected object. This might include text lists or tags.

Note**Adjusting the working area in the TIA Portal**

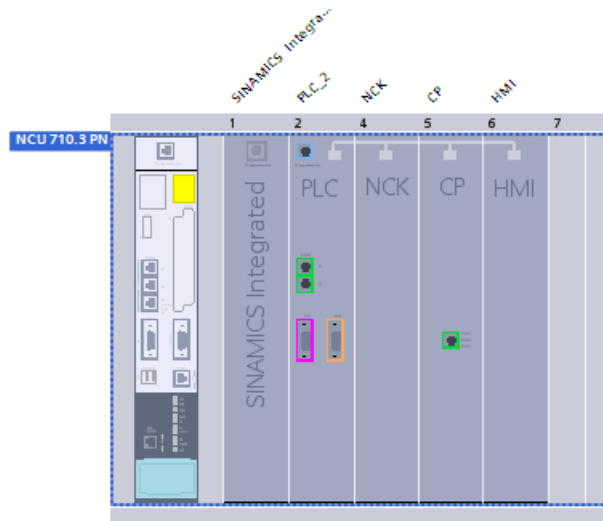
To increase the visible surface of the work area, you can temporarily hide other areas of the TIA Portal, e.g. the individual task cards, the project tree or the inspector window.

To do this, click "Minimize" in the title bar of the associated area or disable the appropriate option checkbox in the "View" menu.

You can use the same commands to redisplay the minimized areas at any time.

2.4 Structure of SINUMERIK NCU

The structure of the NCU will be explained as introduction to obtain a better understanding.



Subcomponents of the NCU

A SINUMERIK NCU comprises the following integrated subcomponents:

- PLC
- NCK
- CP
- HMI (SINUMERIK Operate)
- SINAMICS Integrated (DRIVE)

These subcomponents are always a fixed component of an NCU and can only be handled in combination with the NCU. Subcomponents cannot be individually pasted, copied or moved in the project or across projects (e.g. in libraries).

Note

Copying and pasting the NCU or the DP master system

You can copy and insert NCUs within a project. For this purpose, switch to the network view or to the topology view of the project view.

The DP master system (PROFIBUS Integrated) cannot be individually copied, pasted or deleted. It is considered as an integral part of the NCU.

If you copy an NCU, all integrated subcomponents are also copied, e.g. SINAMICS Integrated or PROFIBUS Integrated.

Additional connectable components

Optionally, the following components can be connected to the NCU:

- NX10.3 and NX15.3 modules

These components are not inserted automatically when inserting an NCU, but must be integrated manually (Page 40).

Product features

SINUMERIK 840D sl STEP 7 Toolbox V16 is an option package for SIMATIC STEP 7 Professional V16 (TIA Portal) with additional setup.

Functional scope

SINUMERIK 840D sl STEP 7 Toolbox V16 contains the following tools and functions:

- Supplementation of the hardware catalog with the following modules of the SINUMERIK 840D sl (as of firmware V4.5 SP2 or higher):
 - NCU 710.3
 - NCU 720.3
 - NCU 730.3
 - NX10.3
 - NX15.3
- Supplement of the hardware catalog to include the ADI4 module
- SINUMERIK PLC basic program
The SINUMERIK 840D sl STEP 7 Toolbox automatically installs the PLC basic program as the "SINUMERIK 840D sl PLC Basic Program" system library. Matching the firmware versions of the modules, there are different versions of the PLC basic program:
 - SINUMERIK 840D sl PLC basic program V4.5.x.x
 - SINUMERIK 840D sl PLC basic program V4.7.x.x
 - SINUMERIK 840D sl PLC basic program V4.8.x.x
 - SINUMERIK 840D sl PLC Basic Program V4.9.1.x
 - SINUMERIK 840D sl PLC Basic Program V4.9.2.x
 - SINUMERIK 840D sl PLC Basic Program V4.9.3.x
- Export of PLC symbols for SINUMERIK Operate
- Importing SINUMERIK user alarm texts
- Creating SINUMERIK PLC archives
- Support of PROFINET IO IRT for NCK
- Support of SINUMERIK Safety Integrated and Safety Integrated plus
- NC VAR selector (external tool)

Getting Started

4.1 Installing the SINUMERIK toolbox

Software requirements

SINUMERIK 840D sl STEP 7 Toolbox V16 is a TIA Portal options package which requires installation of the following products:

- SIMATIC STEP 7 Professional V16

Hardware requirements and other system requirements

All of the hardware and system requirements of SIMATIC STEP 7 Professional apply.

You can find the system requirements of STEP 7 Professional in the following documentation:

- STEP 7 Professional System Manual (<https://support.industry.siemens.com/cs/products?search=STEP%20%20Professional&ctp=Manual>)
- TIA Portal online help, search term "System requirements STEP 7 Professional"

Installation

Before installing, exit all of the applications (e.g. TIA Portal) and execute the "Start.exe" setup file in the master directory of the product DVD.

Uninstallation

Via the installation wizard of the TIA Portal, you can uninstall the software, which is entered in the Windows dialog "Uninstall or change program":

"Control Panel > Programs > Uninstall Program > Siemens Totally Integrated Automation Portal"

Note

The NC VAR selector must be uninstalled separately.

4.2 Starting the TIA Portal

Procedure

1. Start the TIA Portal by double-clicking the link to the Windows desktop or from the Start menu under "All Programs > Siemens Automation > TIA Portal V16".



Result

The TIA Portal opens. The functions of the SINUMERIK 840D sl STEP 7 are now available in the TIA Portal.

4.3 Creating a sample project

Introduction

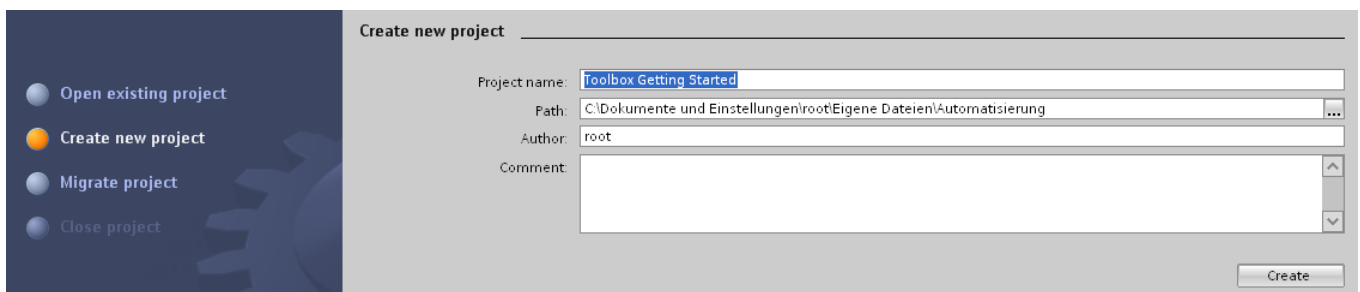
You create a new project in the following. Within a project, all of the automation tasks required, for example the hardware configuration and the PLC programming, are performed.

Precondition

- The TIA Portal has been started (Page 34).

Procedure

1. Click "Create new project" in the portal view.



2. Assign a project name and select the storage location of the project (path).
3. Click "Create".

Result

A new, empty project has been created.

Configuring the hardware

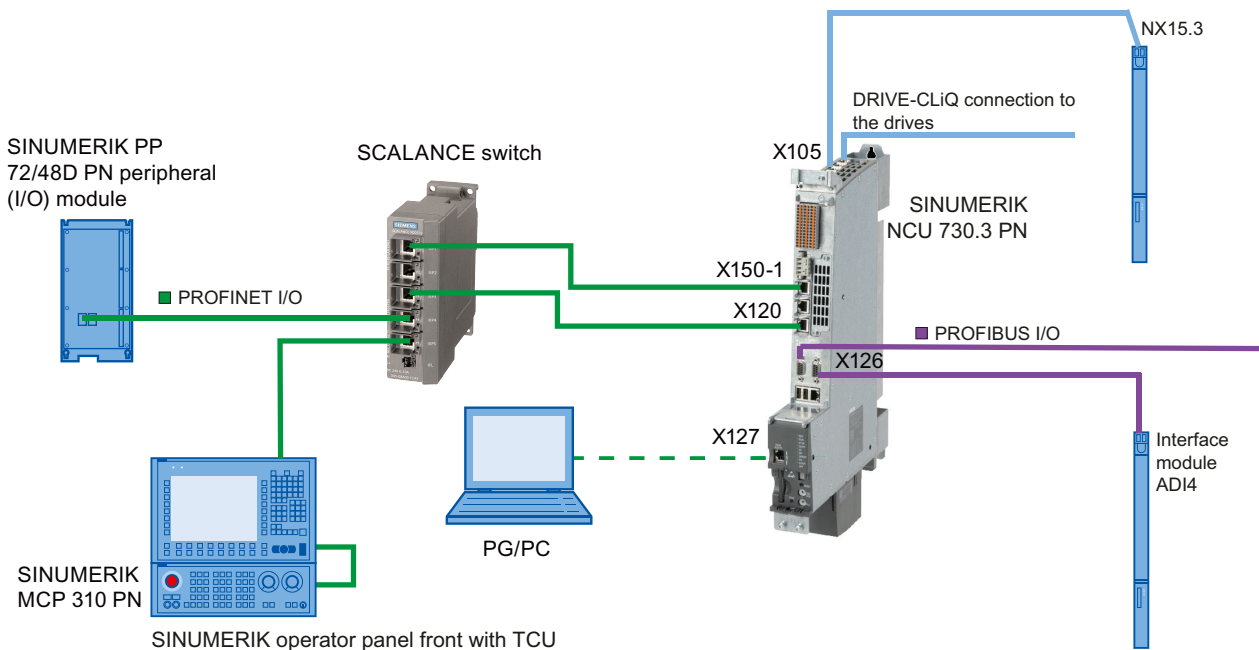
5.1 Configuration example

Introduction

The TIA Portal with the SINUMERIK Toolbox option package offers many options for configuring the hardware. To better understand the individual functions, this Getting Started is based on a specific configuration example. The following is an overview of this configuration example with all components and interfaces.

Configuration overview

As an example, the following configuration of a SINUMERIK 840D sl is to be configured using the TIA Portal:



In this sample configuration, drives are not connected to the control and therefore do not need to be configured. If you have connected drives to your control system, you must configure them outside of the TIA Portal. You can find a detailed explanation in the ""Commissioning CNC: NCK, PLC, drive".

5.2 Insert NCU

Introduction

In the following, you insert the "NCU 730.3 PN" into the sample project. The NCU module (Numeric Control Unit) is the CPU of the SINUMERIK 840D sl. It takes over all the CNC, PLC and communication tasks.

Requirement

- A project is open in the TIA Portal.

Procedure

To insert a SINUMERIK NCU in the project view, proceed as follows:

1. Click "Add new device" in the project tree.
2. Click the "Controllers" button.

- In the folder structure under "Controllers", expand the corresponding SINUMERIK device family (e.g. SINUMERIK 840D sl) and required NCU and select these.

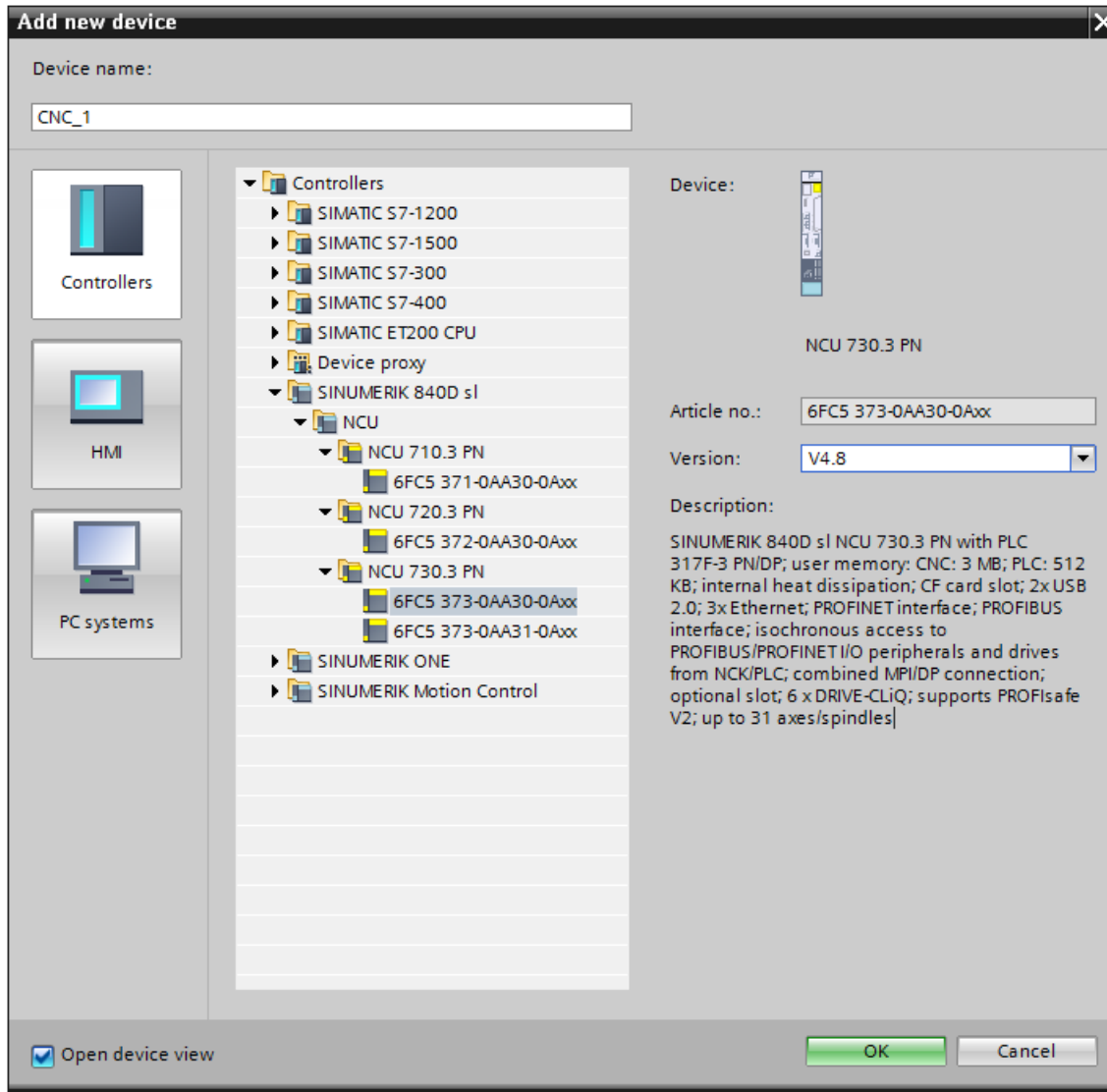


Figure 5-1 Selected NCU using the SINUMERIK 840D sl NCU 730.3 PN V4.8 as an example

- Select the firmware version that matches the envisaged firmware version of the real NCU in the "Version" drop-down list.
- Confirm your selection with "OK".

Result

The SINUMERIK NCU is created as new device.

5.3 Insert NX module

Introduction

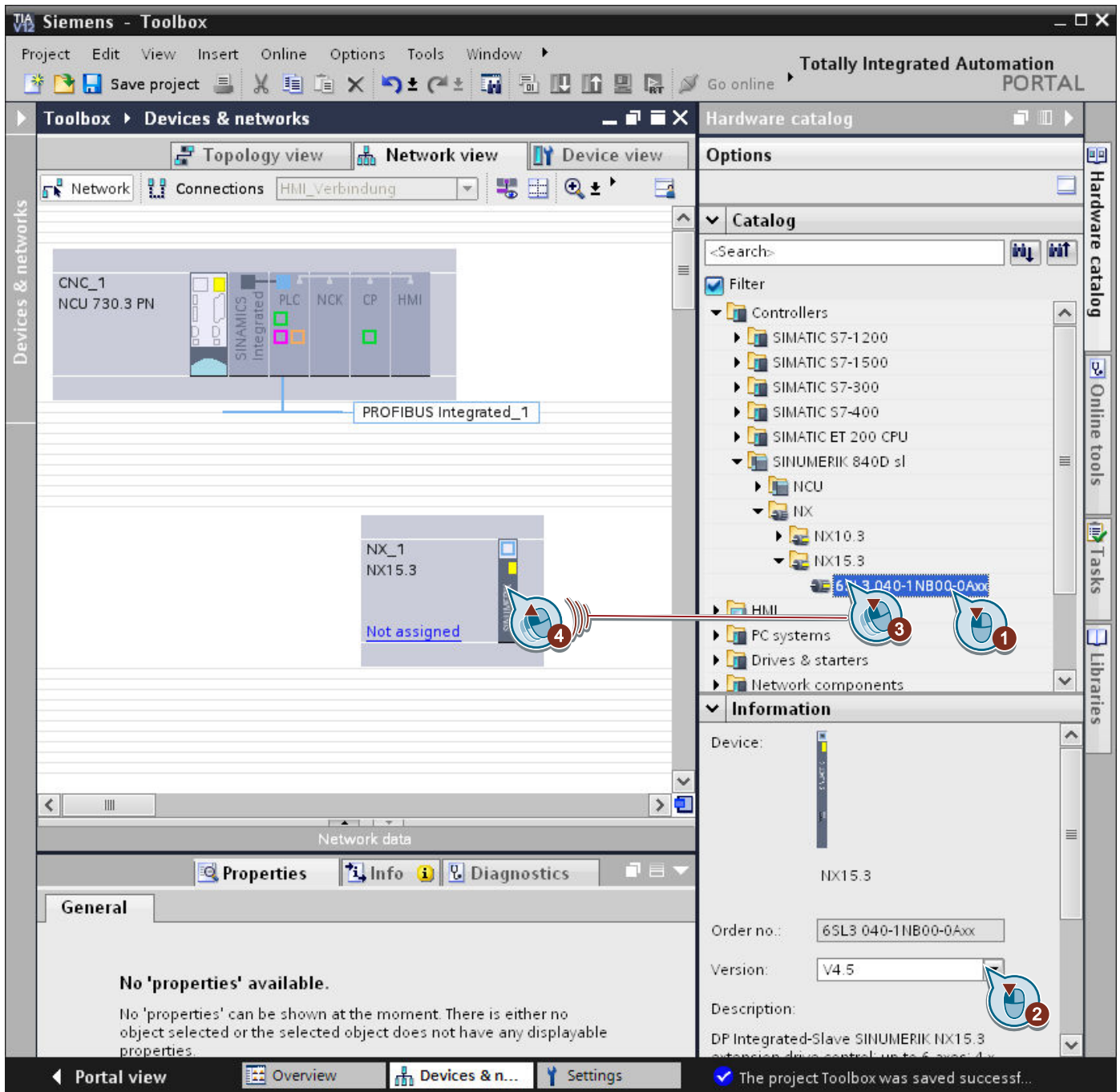
In the next step, you insert the NX module into the configuration. You can use this module to increase the number of controlled axes connected to an NX module. Each NX10.3 can control up to 3 additional axes and each NX15.3 can control up to 6 additional axes.

Procedure

In order to insert an NX module into the project via the hardware catalog, proceed as follows:

1. In the network view, navigate in the hardware catalog to the folder "Controller > SINUMERIK 840D sl > NX" and select, for example, NX15.3 .
2. You can select the firmware version of the NX module at "Information" in the hardware catalog. This must match the firmware version of the NCU. Firmware versions of the configured hardware and the real hardware must match.

3. Use drag-and-drop to move the NX module from the hardware catalog to the network view.



5.3 Insert NX module

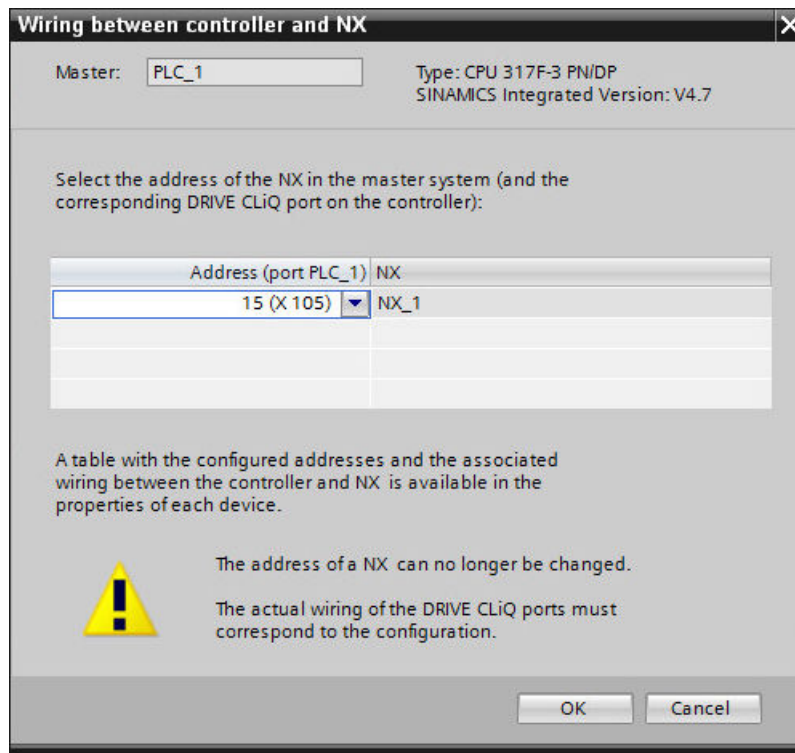
- To connect the NX module with a master system, click "Not assigned" and select the master system.

Note

Connection to DP Integrated

Note that the NX modules can only be connected to the DP Integrated of a SINUMERIK NCU, and not to external PROFIBUS interfaces!

The NX is connected with the NCU and the "Wiring between control and NX" dialog opens.



- In the "Wiring between control and NX" dialog, select the DP address of the NX in the master system that matches your real wiring. The DP addresses of the NX modules are permanently assigned to the DRIVE-CLiQ sockets of the NCU.

DP address of the NX in the master system	DRIVE-CLiQ socket on the NCU
10	X100
11	X101
12	X102
13	X103
14	X104
15	X105

Note

This setting cannot be undone

Please note that once set, the DP address of an NX cannot be subsequently changed. The NX modules must be connected to the DRIVE-CLiQ socket of the NCU in the real wiring that corresponds to the permanently assigned DP address.

If you have incorrectly set the DP address of an NX, delete this NX from the project and add a new one.

The DP address of the NX module is specified in accordance with your setting and the appropriate I/O addresses of the telegrams are set automatically.

Note

Default I/O addresses of the telegrams

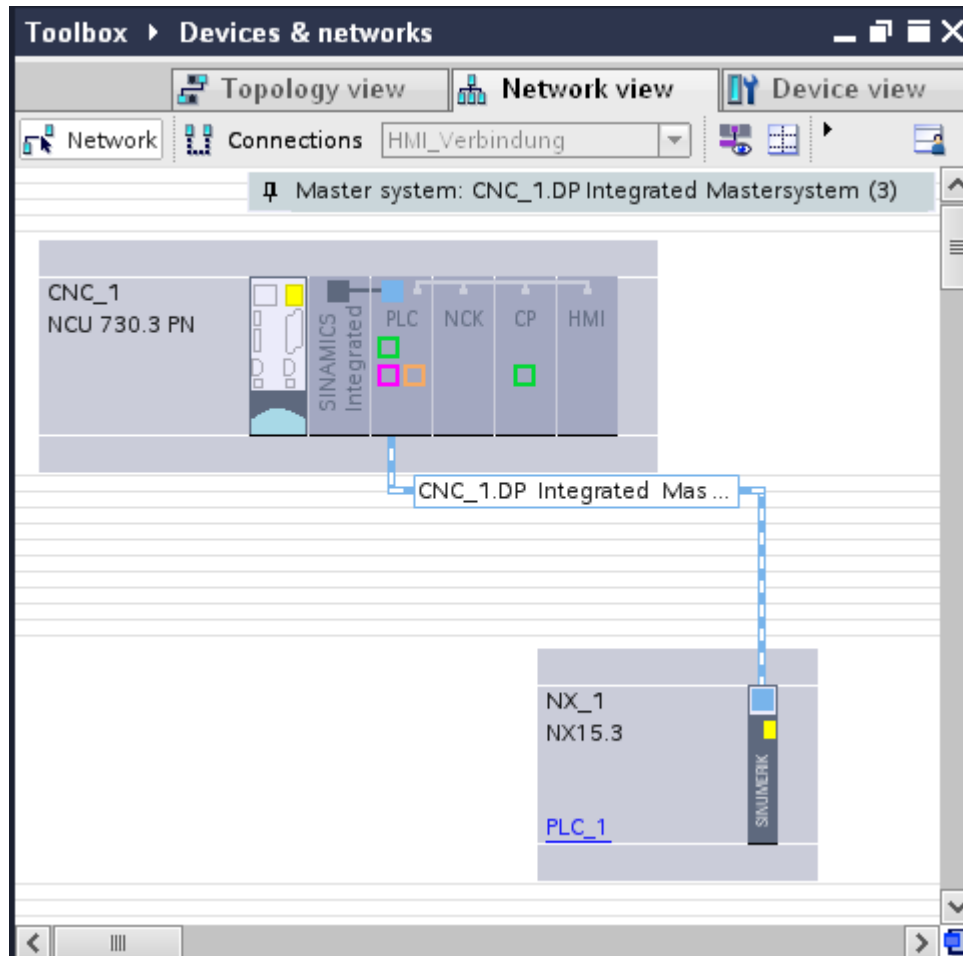
Depending on the set DP address, the appropriate I/O addresses of the telegrams are set automatically.

Change this setting only when the I/O addresses of your telegrams differ from the default setting!

You can also find information on the wiring between NCU and NX in the properties of the DP Integrated interface on the NCU and NX under "PROFIBUS address".

Result

The NX module has been inserted into the project and connected to an NCU.



Note

Handling the NX

- If NX modules were connected with the NCU and the NCU is subsequently deleted, the NX modules are kept in the project as unconnected slave modules. They can be subsequently assigned to another NCU. The parameter settings of the NX modules are retained.
- If the DP address of the NX is specified, then the I/O addresses matching the default setting on the NCK side are entered.

5.4 Inserting an ADI4 module

Introduction

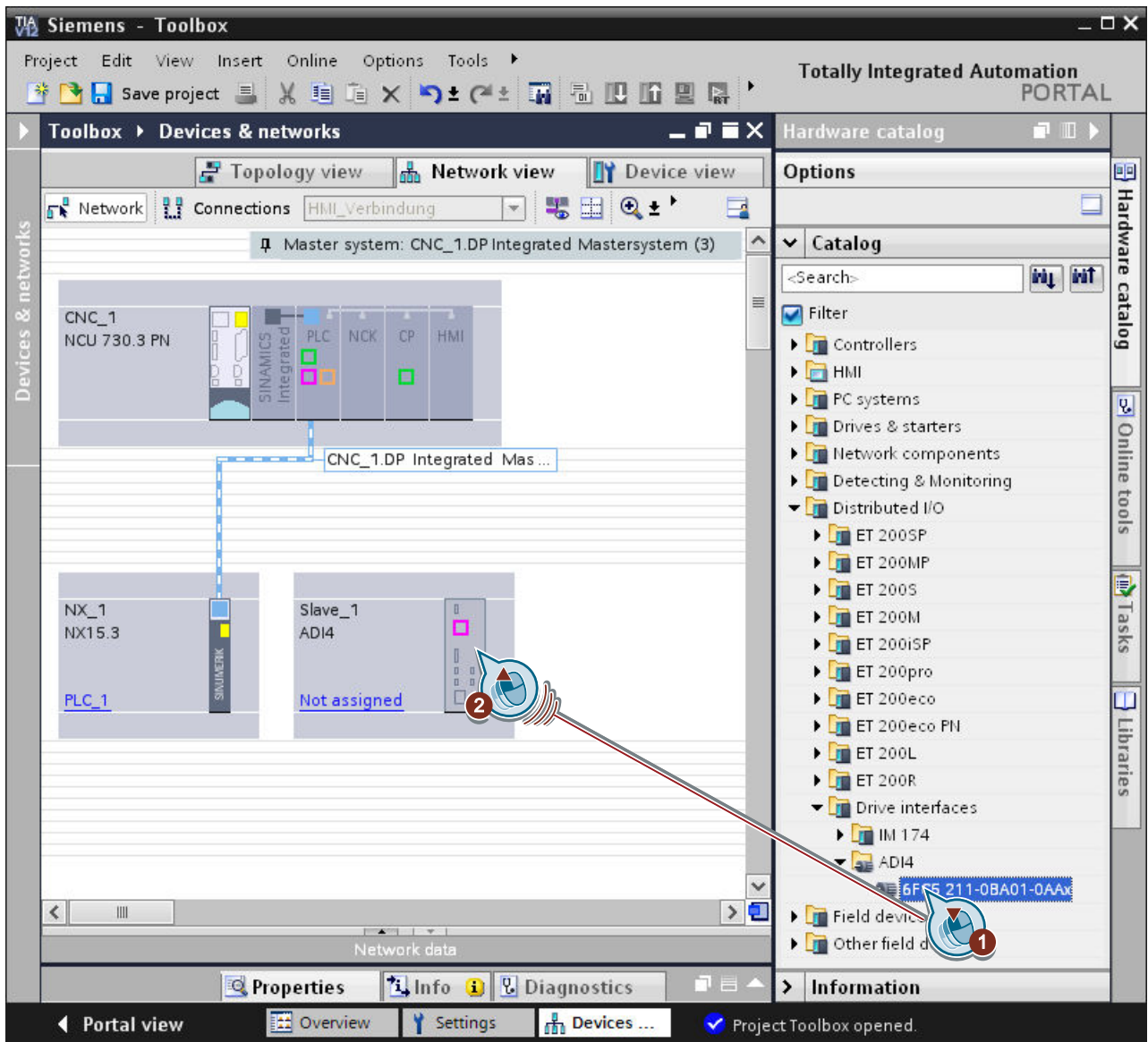
In the next step, insert the ADI4 module into the configuration and connect it with the MPI/DP interface (X126).

An ADI4 module (Analog Drive Interface for 4 axes) is an interface module suitable for operating up to four drives with an analog setpoint interface and TTL/SSI encoders on an equidistant PROFIBUS DP.

Procedure

In order to insert an ADI4 module into the project via the hardware catalog, proceed as follows:

1. In the hardware catalog, navigate to the folder "Distributed I/O > Drive Interfaces > ADI4" and select the ADI4 module.
2. Use drag-and-drop to move the ADI4 module from the hardware catalog and place it in the network view.



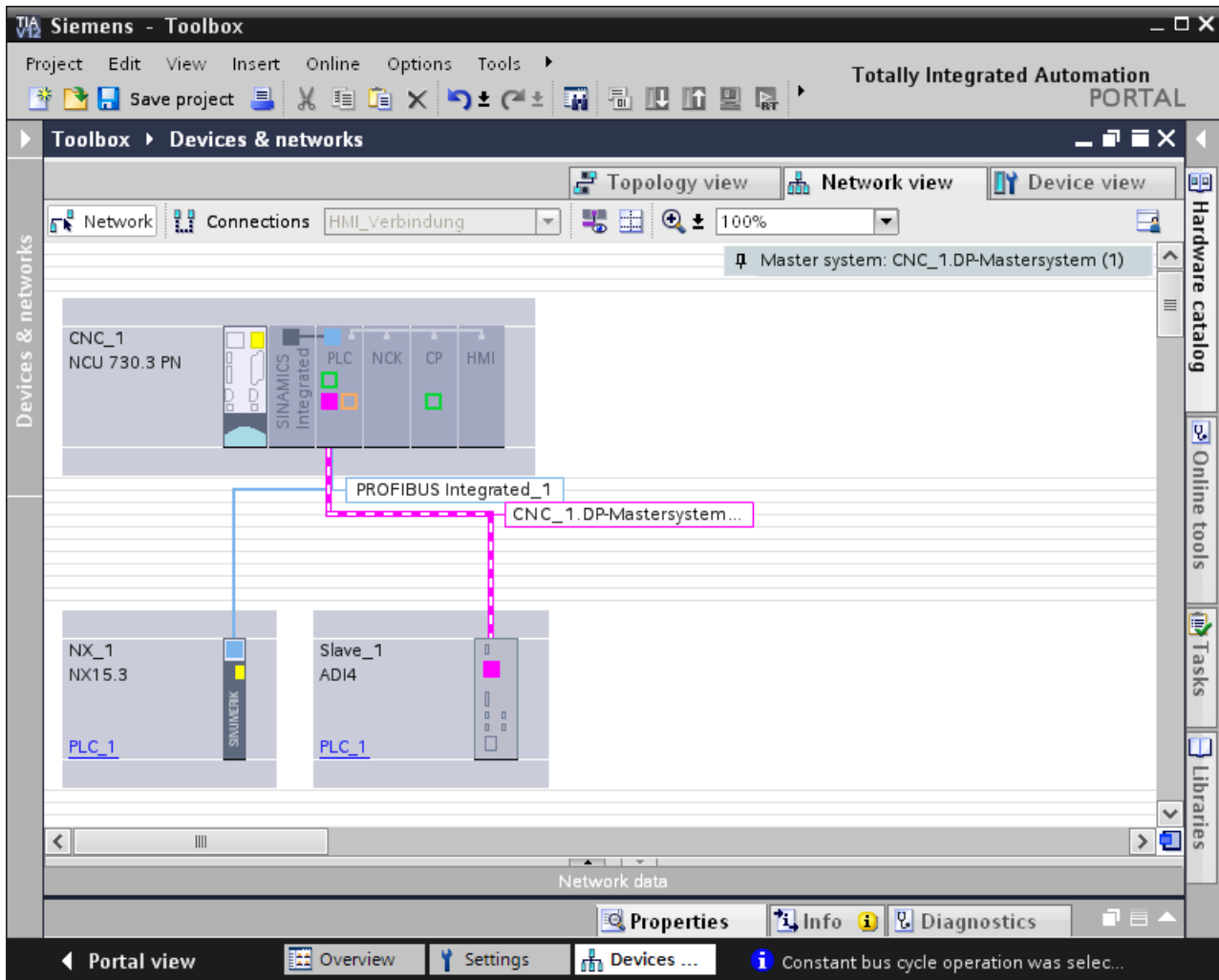
3. To connect the module to the master system, click "Not assigned" and select the DP interface.
4. Click the "PROFIBUS_1" bus system and at "General > Network settings" in the "Properties" tab in the inspector window, change the "Transmission rate" entry from 1.5 Mbit/s to 12 Mbit/s. The ADI4 module can only be operated with 12 Mbit/s.

Reference

You can find additional information on the precise parameter assignment of the ADI4 module in the "ADI4 - analog drive interface for four axes" manual.

Result

The ADI4 module has been created as new device and connected to the NCU.



5.5 Inserting SINUMERIK I/O via the general station description (GSD) file

Introduction

If you want to configure a SINUMERIK I/O that is not available in the hardware catalog, you must first install the general station description file provided by the manufacturer. SINUMERIK I/O installed using general station description files are displayed in the hardware catalog, and can then be selected and configured.

PROFIBUS/PROFINET I/O differences

The general station description file describes all the properties of a PROFIBUS DP slave or a PROFINET IO device.

- PROFIBUS DP slaves are described in GSD files
- PROFINET IO devices are described in GSDML files

The installation procedure does not differ.

Available SINUMERIK I/O

You can integrate the following SINUMERIK I/O via a GSD/GSDML file into the hardware catalog at a later point in time:

- SINUMERIK PP 72/48D PN peripheral (I/O) module
- SINUMERIK machine control panel MCP
- SINUMERIK machine pushbutton panel MPP
- SINUMERIK handwheel connection module

Getting Started configuration example

In our configuration example, the following PROFINET I/O should be included using a GSDML file:

- SINUMERIK MCP 310 PN machine control panel
- SINUMERIK PP 72/48D PN peripheral (I/O) module

5.5.1 Installing general station description files for SINUMERIK I/O

Requirement

The current version of the general station description (GSD/GSDML) files to be installed is stored on your PG/PC.

Note

General station description files on the Service&Support pages

You can find the current versions of the general station description files in the Siemens Industry Online Support:

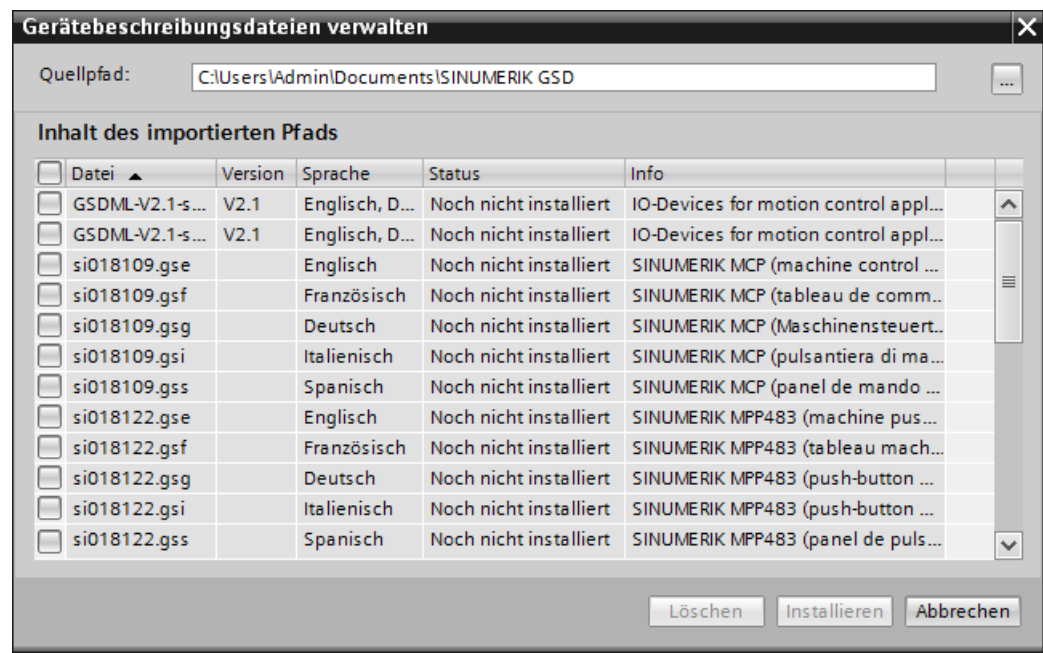
SINUMERIK I/O: GSD/GSDML files (<http://support.automation.siemens.com/WW/view/en/62332440>)

Procedure

To install SINUMERIK I/O via general station description files, proceed as follows:

1. In the "Options" menu, select the command "Manage general station description files (GSD)".
2. In the "Manage general station description files" dialog, select the folder that contains the GSD/GSDML files.

The device description files saved in the source path are listed.



3. Select the checkboxes of the files that you want to install.
4. Confirm your entry with "Install".

Result

The general station description files are installed, and then the SINUMERIK I/O in the hardware catalog displayed in the appropriate folders:

- SINUMERIK I/O for PROFINET IO: "Further field devices > PROFINET IO > I/O > SIEMENS AG > SINUMERIK"
- SINUMERIK I/O for PROFIBUS DP: "Further field devices > PROFIBUS DP > NC/RC > SIEMENS AG > MOTION CONTROL"

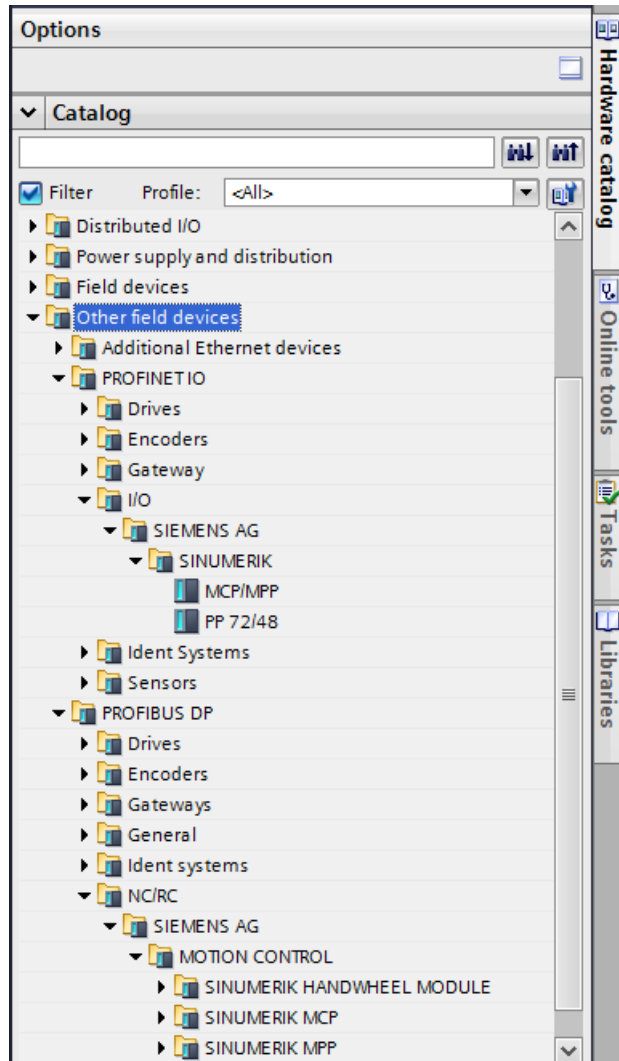


Figure 5-2 Installed SINUMERIK I/O in the hardware catalog

5.5.2 Inserting the SINUMERIK I/O module PP72/48

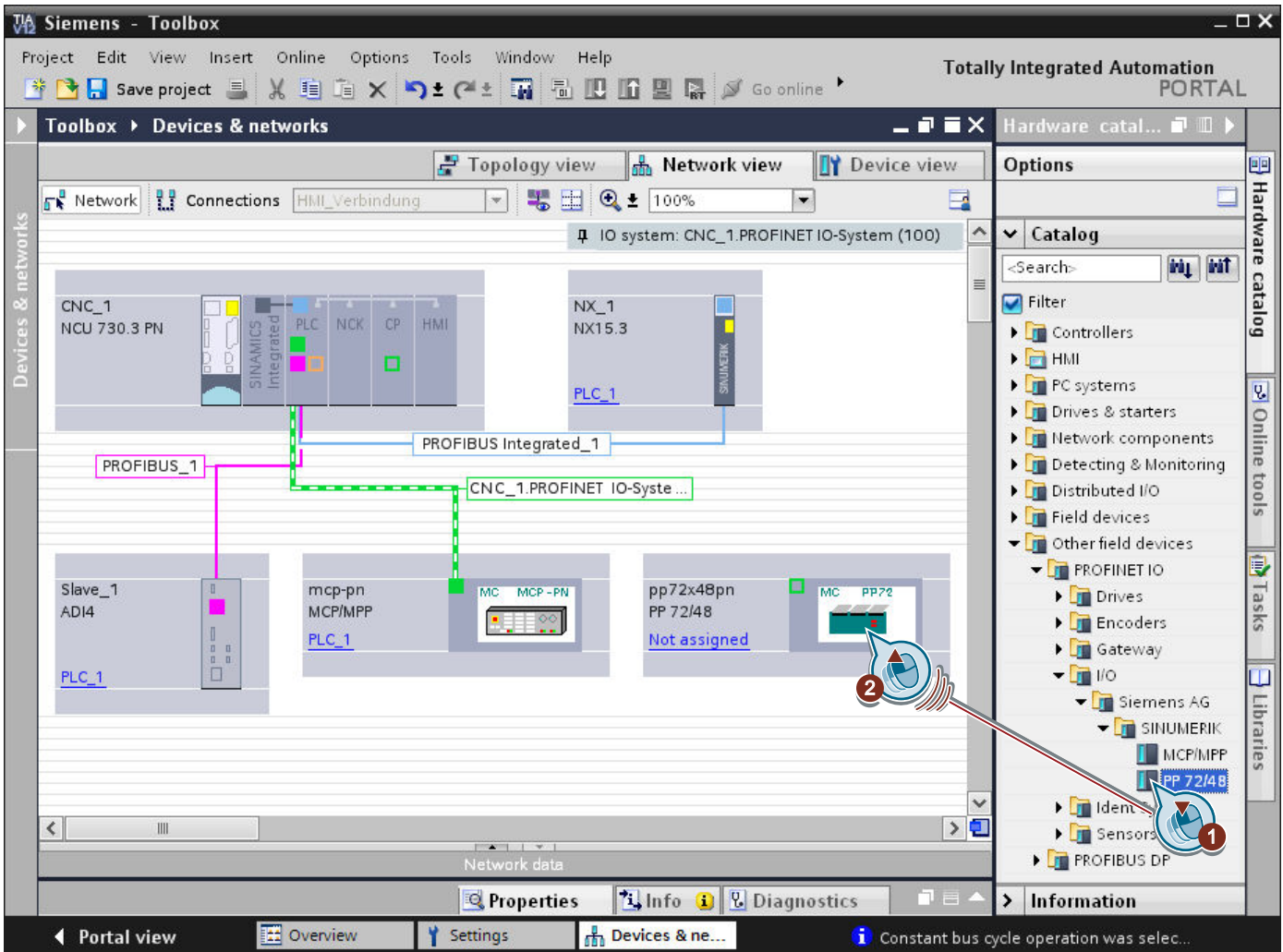
Requirement

- The respective PROFIBUS GSD file or PROFINET GSDML file is installed.
See: Installing general station description files for SINUMERIK I/O (Page 49)
- The network view is active.

Procedure

Proceed as follows to insert a PP72/48 I/O module:

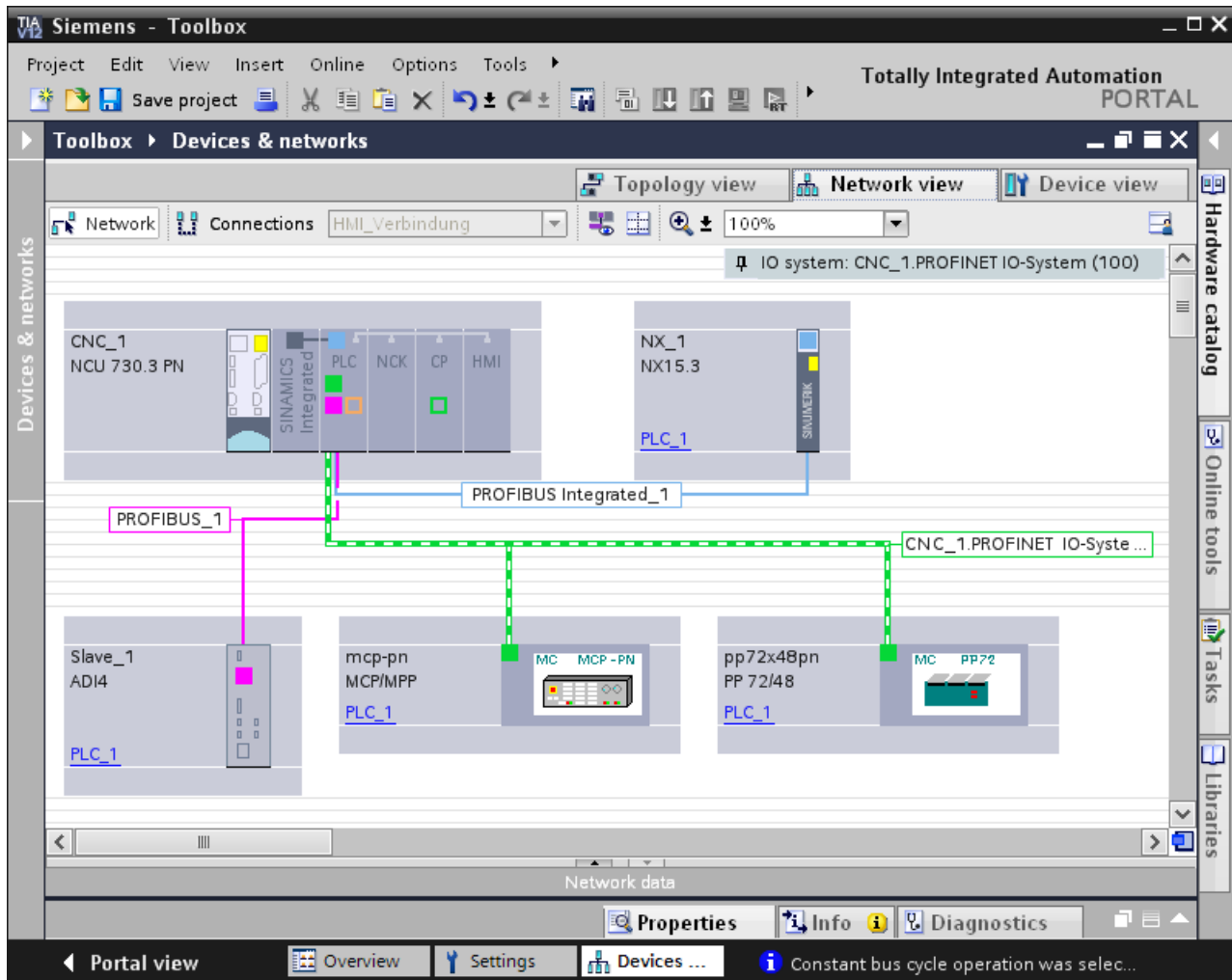
1. In the hardware catalog, navigate to the respective device:
 - PP72/48 (PROFIBUS): "Further field devices > PROFIBUS DP > NC/RC > SIEMENS AG > MOTION CONTROL"
 - PP72/48 (PROFINET): "Further field devices > PROFINET IO > I/O > SIEMENS AG > SINUMERIK > PP72/48"
2. Use drag-and-drop to move the PP72/48 from the hardware catalog to the network view.



3. Interconnect the inserted SINUMERIK I/O with the NCU.
See TIA Portal online help, search term "Interconnect devices in the network view"

Result

The SINUMERIK I/O modules were created as new devices and connected to the NCU.



Additional information

You can find general information about the device in the SINUMERIK I/O module PP72/48D 2/2A PN manual

5.5.3 Inserting SINUMERIK MCP/MPP

Requirement

- The respective PROFIBUS GSD file or PROFINET GSDML file is installed.
See: Installing general station description files for SINUMERIK I/O (Page 49)
- The network view is active.

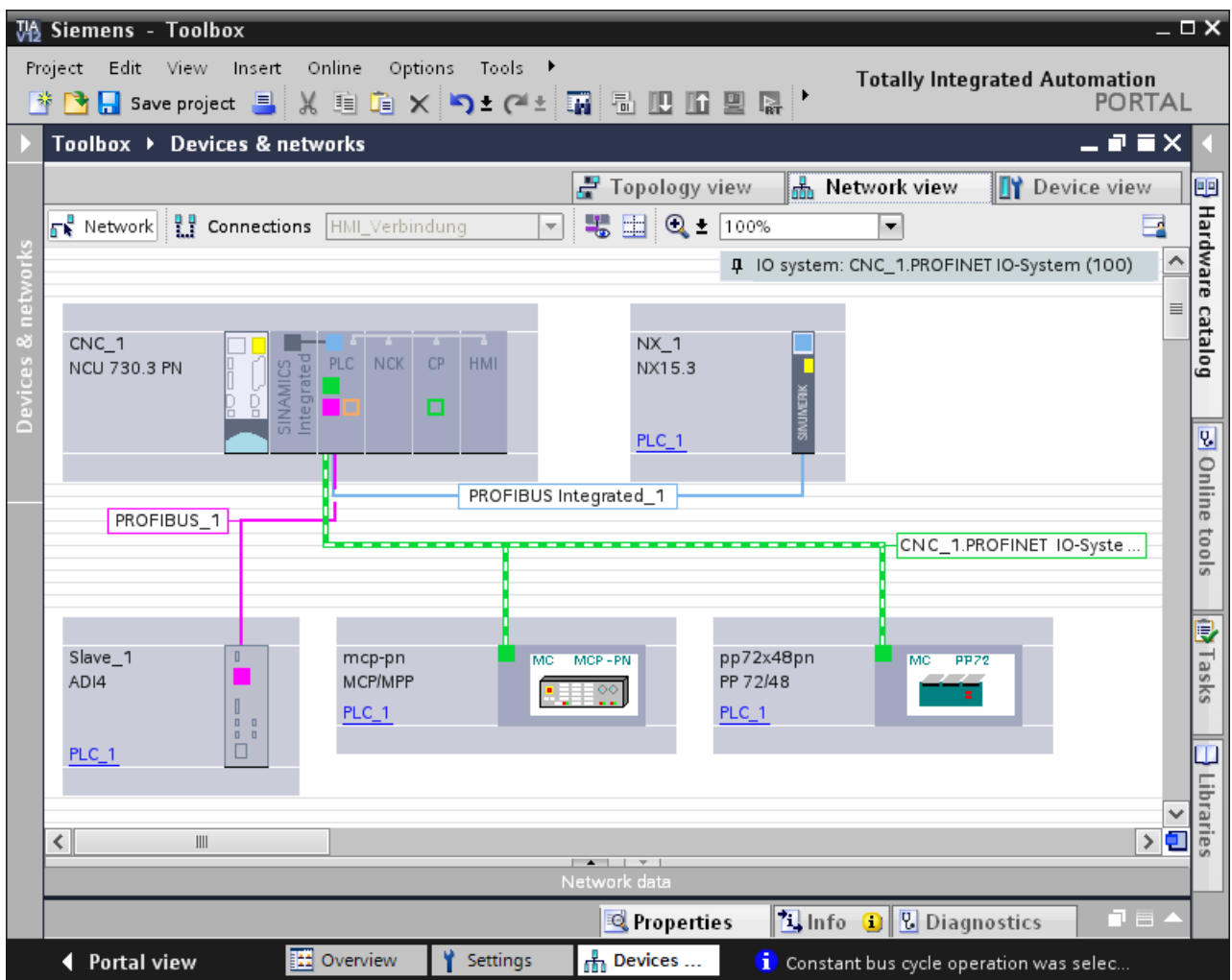
Procedure

Proceed as follows to insert a SINUMERIK MCP/MPP:

1. In the hardware catalog, navigate to the respective device:
 - MCP/MPP (PROFIBUS): "Further field devices > PROFIBUS DP > NC/RC > SIEMENS AG > MOTION CONTROL"
 - MCP/MPP (PROFINET): "Further field devices > PROFINET IO > I/O > SIEMENS AG > SINUMERIK"
2. Use drag-and-drop to move the corresponding MCP/MPP from the hardware catalog to the network view.
3. Interconnect the inserted SINUMERIK I/O with the NCU.
See TIA Portal online help, search term "Interconnect devices in the network view"

Result

The SINUMERIK MCP/MPP has been created as new device and connected to the NCU.



Additional information

General information on the device can be found in the respective manual.

5.6 Configuring network interfaces

5.6.1 Introduction

You must now configure or check the network interfaces. In our example configuration, they are the following interfaces:

Interface	Communications	Connected component
X127	Ethernet	PG/PC
X120	Ethernet	Machine Control Panel
X150	PROFINET IO	I/O module
X126	PROFIBUS DP	ADI4 module
X105	DRIVE-CLiQ	NX module

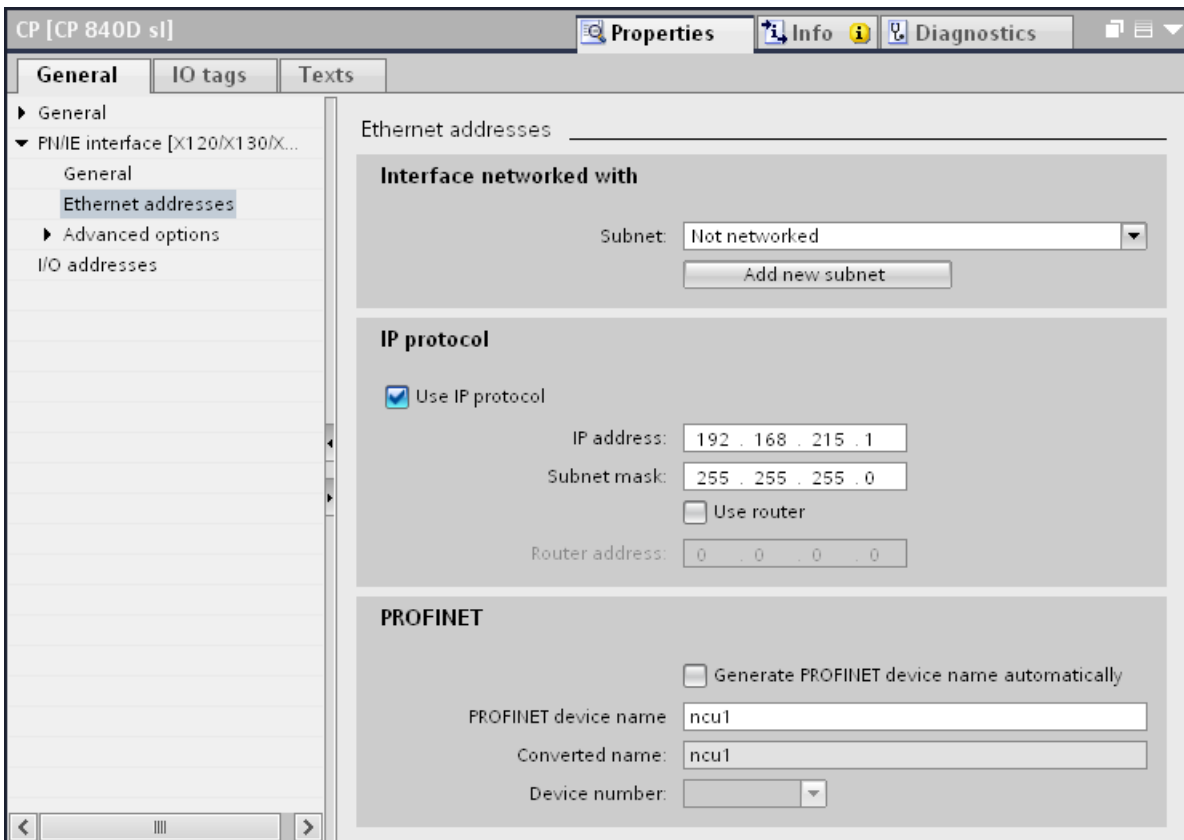
5.6.2 Configuring an Ethernet Interface

For the initial commissioning with a PG/PC, it is necessary to configure an Ethernet interface. In our example, this involves the interface to the X127 socket.

Procedure

In order to set the Ethernet interface, proceed as follows:

1. In the network view, click the CP in the basic rack of the NCU.
2. Under the "Properties" tab in the inspector window, select the "PN/IE interface > Ethernet addresses" entry.



3. Set the IP address matching your real configuration. If the PG/PC is connected to X127, the following IP address applies:

Hardware factory setting on the NCU for socket X127

IP address: 192.168.215.1

Subnet mask: 255.255.255.0

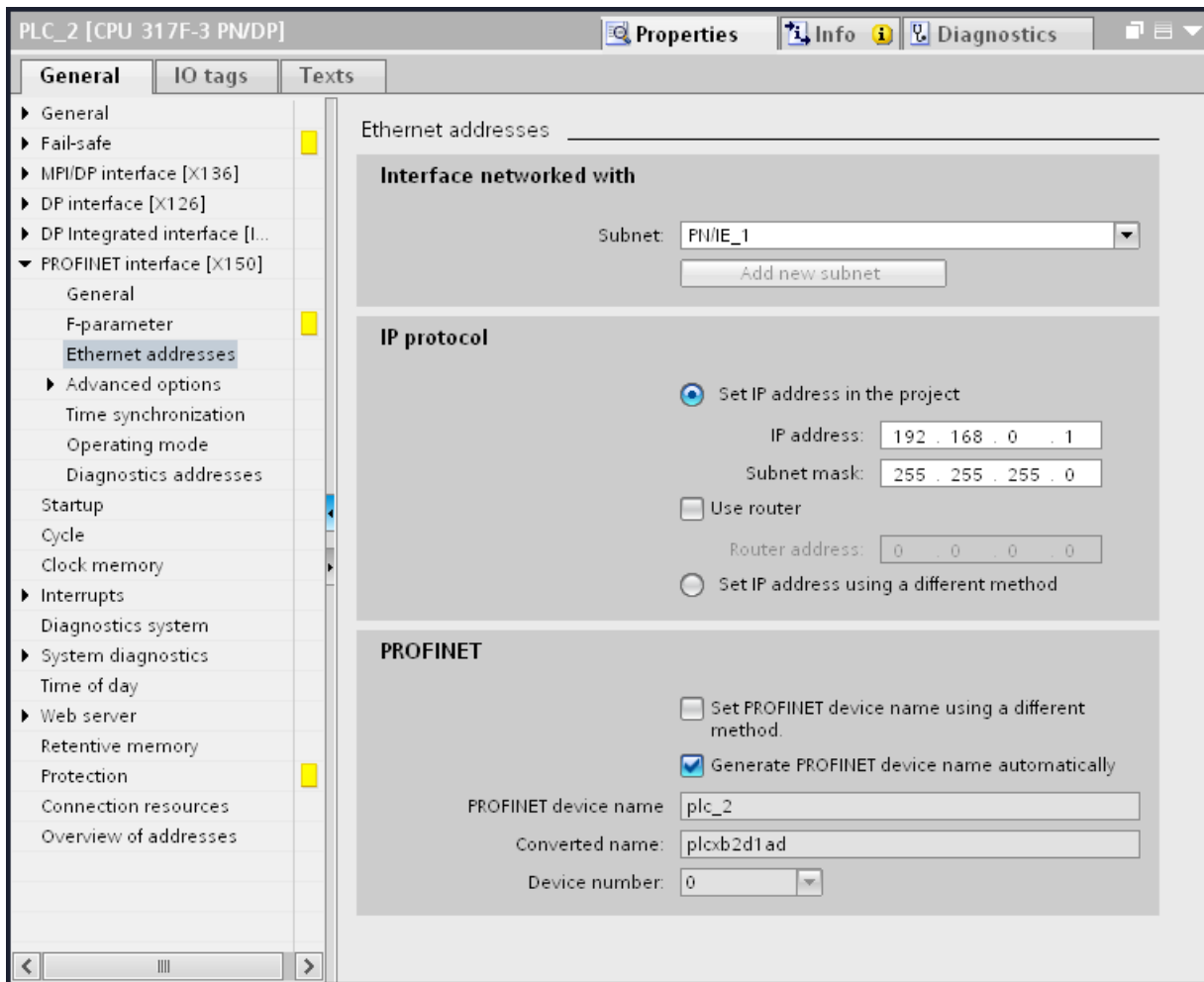
5.6.3 Configuring PROFINET

In our configuration example, the SINUMERIK I/O module PP 72/48D PN is connected to the NCU via PROFINET. You configure the properties of the PROFINET interface for socket X150 as follows:

Procedure

In order to set the PROFINET interface, proceed as follows:

1. In the network view, click the PLC in the basic rack of the NCU.
2. Under the "Properties" tab in the inspector window, select the "PROFINET interface > Ethernet addresses" entry.



3. Check under "IP protocol" whether the correct IP address is set ("192.168.0.1" in the example).

5.6.4 Configuring PROFIBUS DP

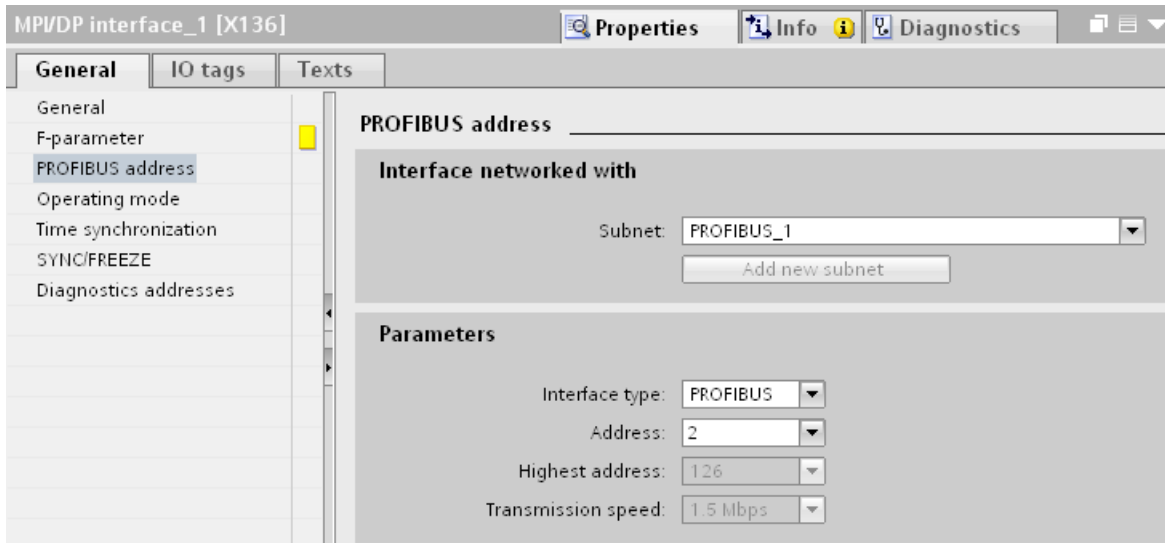
In our example, the ADI4 module is connected to the NCU via PROFIBUS DP. You configure the properties of the PROFIBUS DP interface for socket X126 as follows:

Procedure

Configuring the PROFIBUS DP address on the PLC

1. In the network view, click the PLC in the basic rack of the NCU.
2. In the "Properties" tab, in the inspector window, select the entry "DP Interface > PROFIBUS address".

The settings of the PROFIBUS address are displayed.



3. In the Parameters area, set the DP address of the interface on the PLC under "Address". This is transferred from the configuration to the PLC during the load action.

Configuring the PROFIBUS DP address for the ADI4 module

1. In the network view, click the "DP" interface of the ADI4.
2. In the inspector window "Properties", select the entry "PROFIBUS address".
3. Under "Address" set the DP address that matches the hardware. The configured address must match the hardware address. It is not accepted automatically. Information about setting the DP address on the hardware is contained in the "ADI4 - Analog drive interface for 4 axes" Device Manual.

Checking the transmission speed of the ADI4

Although you can view the "Transmission speed" parameter in the DP interface properties, you must select the bus system to change it:

1. Click the bus system.
2. In the "Properties" inspector window, check under "Network settings" the "Transmission speed" entry. The ADI4 module can be operated only with the transmission speed 12 Mbit/s.

5.6.5 Configure Integrated PROFIBUS (DP Integrated)

The PROFIBUS addresses at the DP Integrated were already defined when wiring the NX, and cannot be subsequently changed (see Insert NX module (Page 40)).

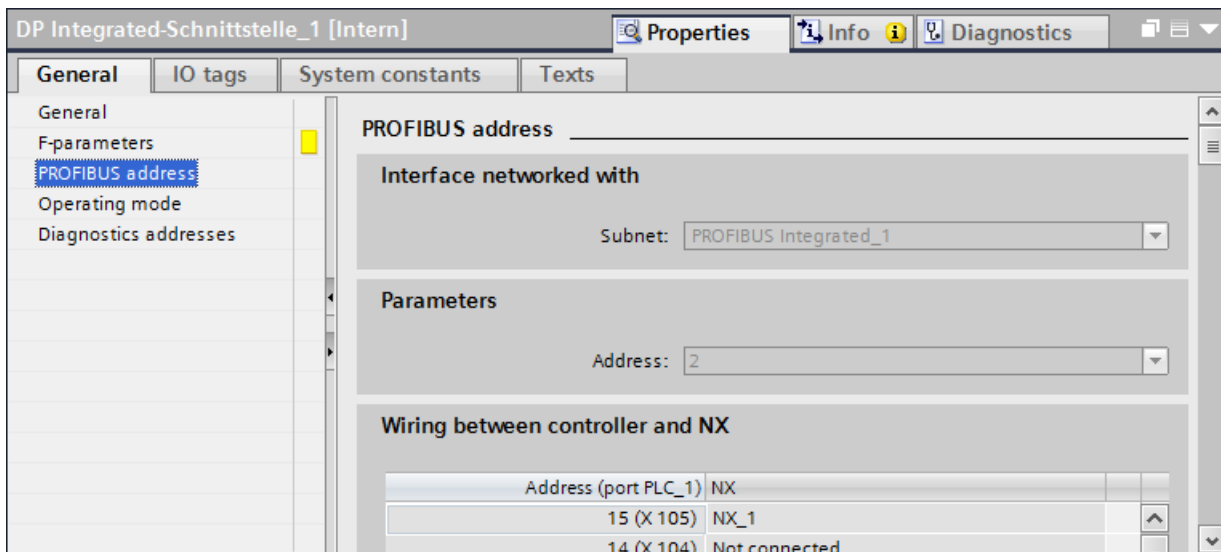
Procedure

To check the PROFIBUS addresses, proceed as follows:

1. In the network view, click the DP Integrated interface of the PLC or select the interface in the device overview.
2. In the "Properties" tab, in the inspector window, select the entry "PROFIBUS address".

Result

The DRIVE-CLiQ sockets of the real hardware are displayed to which the NX modules must be connected.



Note

Cycle clock settings

You can only make the cycle clock settings on the PROFIBUS Integrated subnet and not directly on the interface: For the selected subnet, you find the cycle clock settings under "Equidistance" in the inspector window.

Observe the rules for setting the clock cycle at the field buses (see Commissioning Manual, "Commissioning CNC: NCK, PLC, drive").

5.7 Configuration of telegrams and I/O addresses

The I/O addresses and telegram types of the NX and SINAMICS Integrated components are used for the communication between NCU and drive.

The telegrams and I/O addresses are already correctly preset and typically do not require any configuration because the default settings in the TIA Portal correspond to the default settings in the machine data of the NCU.

If you want to adapt the telegram configuration following creation of the Getting Started configuration example, you will find further information in the TIA Portal information (menu "Help > Show help"), keyword "Telegram configuration".

5.8 Setting up the communication

Introduction

To be able to load the configuration to the PLC, a communication connection (Ethernet) must be established between the PG/PC and the PLC.

In our configuration example, connect the PG with X127 via Ethernet.

Note

Use the DHCP client

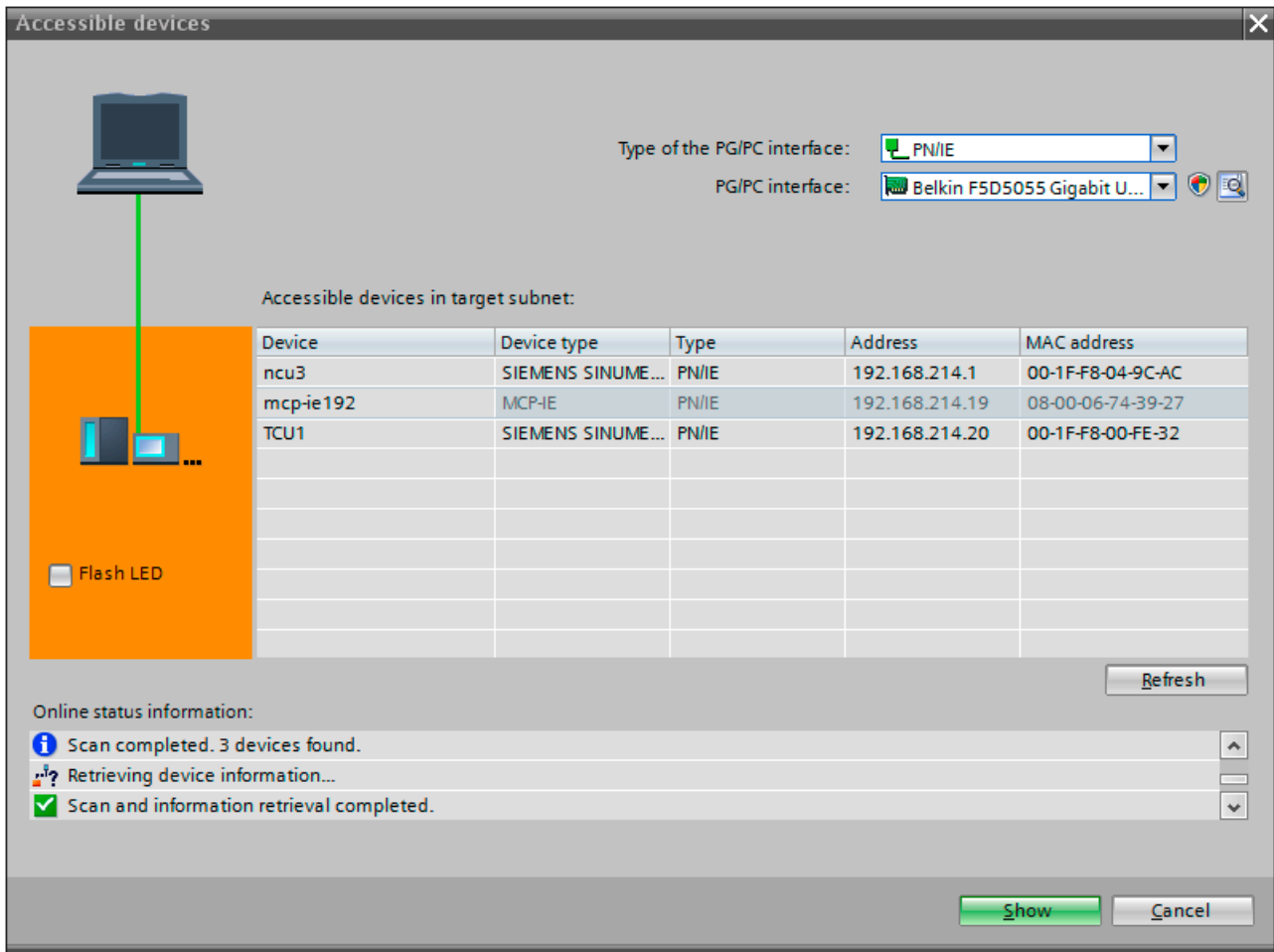
Make sure that the PG/PC at X127 is set to "DHCP Client" and the IP address can be assigned by the NCU.

Procedure

To establish a communication connection between two devices, proceed as follows:

1. In the "Online" menu, select the "Accessible devices" command.
2. In the drop-down lists "Type of PG/PC interface" and "PG/PC interface", search for the interface used.

If no devices are accessible at an interface, the connecting line between the PG/PC and the device is interrupted. If devices are accessible, the connecting line is shown and the devices accessible at the selected interface of the PG/PC are displayed in a list.



3. If you have connected a new device in the meantime, click the "Refresh" button to refresh the list of accessible devices.
4. Using "Display", transfer to the project navigator the device that has been found in the "Online accesses" folder.
The subfolder of the interface to which the selected device is connected is selected in the project tree.

Note

Several identical devices

If several identical devices can be accessed from the PG, by clicking on the "Flash LED" button you can then display which device corresponds to the entry in the list of accessible devices.

5.9 Loading and closing the hardware configuration in the PLC

Introduction

The project must be stored and compiled before the system data is created for the PLC and the complete configuration can be closed.

Requirement

- The hardware configuration is compiled.
- A communication connection exists between the PG/PC (TIA Portal) and the NCU.

Note

Loading configurations to simulated environments

If you want to use the configuration in a simulated environment, you must activate the simulation capability in the project properties before you load the configuration into the simulated environment or compile the hardware/software.

Note

General reset before loading into a PLC with Safety Integrated plus (F-PLC)

If the actual hardware has been operated in Safety Integrated plus (F-PLC) mode and you now want to load a configured hardware configuration with changed Safety Integrated mode, you must perform a general reset of the PLC prior to the loading.

Procedure

Proceed as follows to load the configured hardware configuration into the NCU:

1. In the project navigation, right-click the device name, e.g. "CNC_1", and select the "Hardware configuration" command in the "Download to device" shortcut menu.

Note

Scope of the data to be downloaded

Alternatively, you can select one of the other commands to start downloading additional data to the NCU in this step.

See TIA Portal help, keyword "General information on download".

The "Extended download" dialog opens.

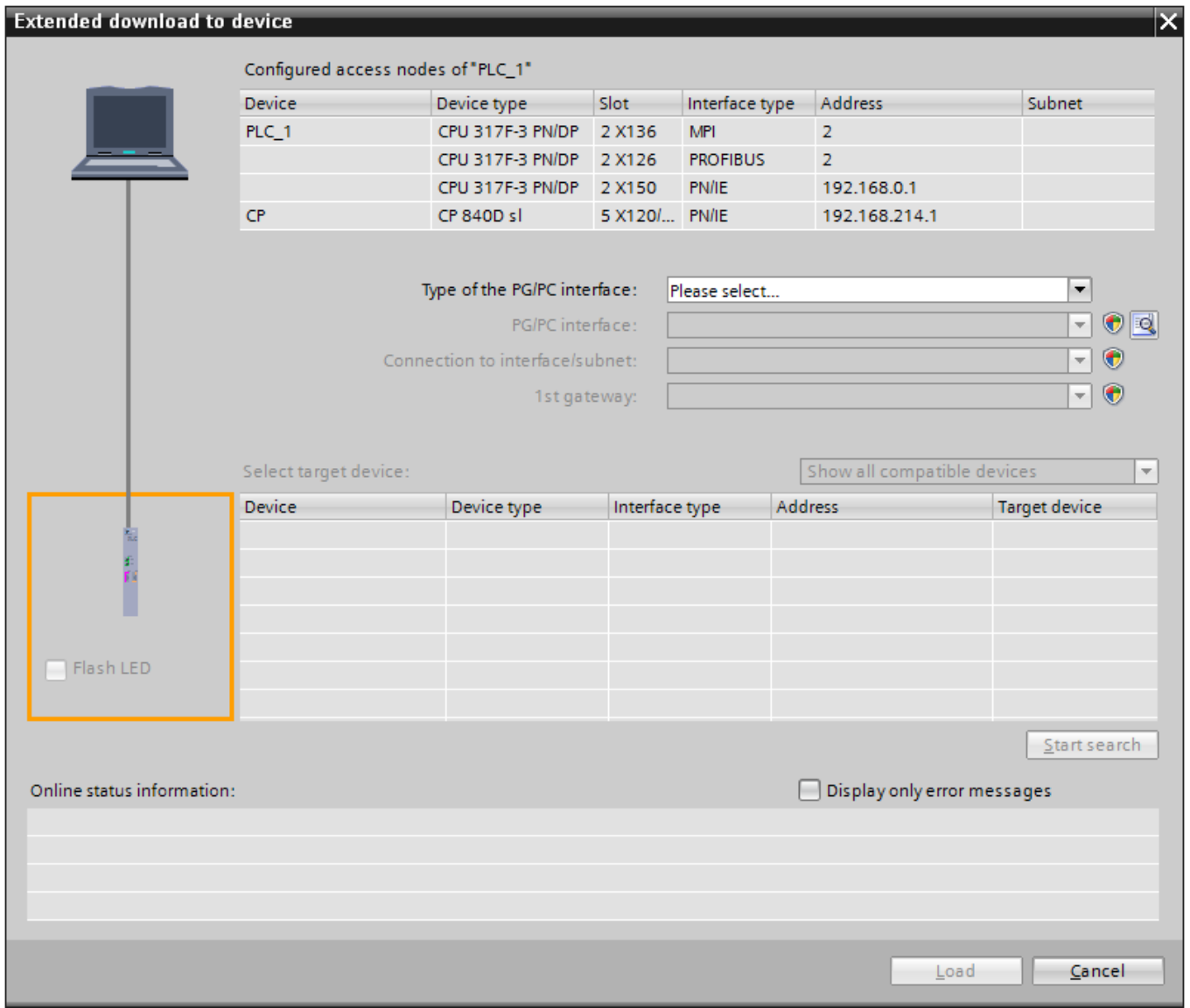


Figure 5-3 Dialog using the PLC of a SINUMERIK 840D s1 as an example

2. Make the following settings in the "Extended download" dialog:
 - PG/PC interface: Network card used, e.g. "Intel[R] Ethernet Connection I217-V"
 - Connection with interface/subnet: Specific interface on the NCU or "Try all interfaces"
3. Click on "Start search" and then select the found PLC from "Compatible nodes in the target subnet". Alternatively, you can specify an IP address directly in the "Compatible nodes in the target subnet" list in the "Address" column.

4. Confirm the download with "Load".
The "Download preview" dialog opens.

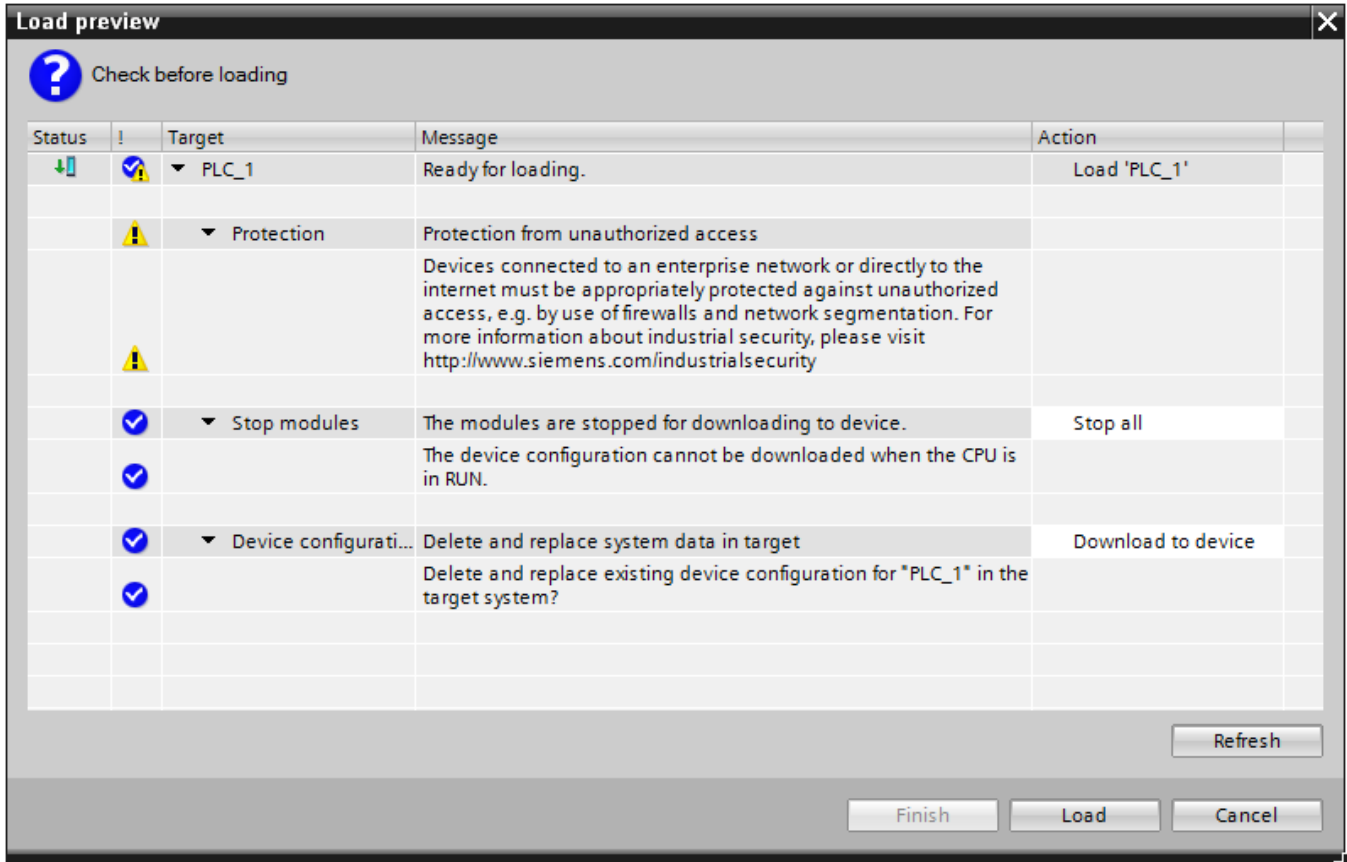


Figure 5-4 "Download preview" dialog

Note

Consistency check

Before the loading, the consistency of the download is checked. This means that a check is made as to whether the parameterized hardware of the TIA Portal project matches the hardware that has been actually installed.

Note

Adapt the IP address?

If the IP address of your PG/PC is located in a different subnet than the PLC, a dialog box is displayed as to whether the IP address in the PG/PC should be adapted.

5. In the "Download preview" dialog, check the settings and click "Load" to confirm the input.

Result

The PLC is stopped and the hardware configuring is loaded into the PLC. The "Results of the loading action" dialog opens and displays the status of the loading action. The dialog restarts the PLC after completion, provided the "Start" checkbox has not been deactivated.

Creating a PLC program

6.1 Overview

The PLC program is constructed modularly. It comprises the two parts:

- **PLC basic program**
The PLC basic program organizes the exchange of signals and data between the PLC user program and the NCK, HMI, and machine control panel components.
Use the appropriate PLC basic program depending on the firmware version of an NCU.
 - SINUMERIK 840D sl PLC basic program V4.5.x.x
 - SINUMERIK 840D sl PLC basic program V4.7.x.x
 - SINUMERIK 840D sl PLC basic program V4.8.x.x
 - SINUMERIK 840D sl PLC Basic Program V4.9.2.x
- **PLC user program**
The PLC user program is the user-specific part of the PLC program by which the PLC basic program has been augmented or extended.

Further information

General information about the PLC basic program is available in the online help of the TIA Portal under the following keywords:

- Execution structure
- Block listing as table
- Assignment overview
- Generating blocks at runtime on the NCU

6.2 Adding the PLC basic program

6.2.1 Opening the PLC basic program system library

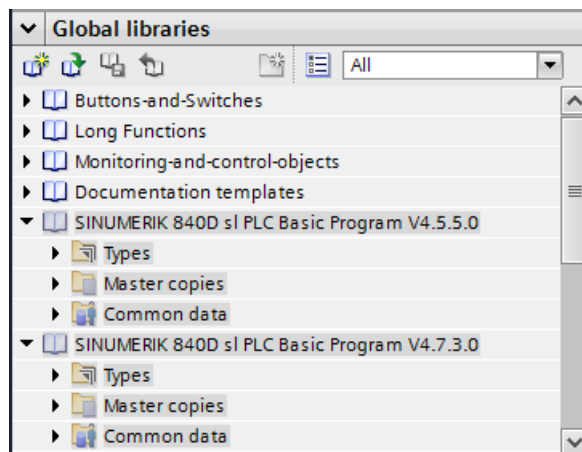
Procedure

Proceed as follows to open and display the system library of the PLC basic program:

1. Switch to the "Libraries" task card.
2. Select the PLC basic program that matches the firmware version of the inserted NCU:
 - SINUMERIK 840D sl PLC basic program V4.5.x.x
 - SINUMERIK 840D sl PLC basic program V4.7.x.x
 - SINUMERIK 840D sl PLC basic program V4.8.x.x
 - SINUMERIK 840D sl PLC Basic Program V4.9.2.x

Result

The system library of the PLC basic program has been opened. Information on handling can be found under Using copy templates (Page 73) and Adding the PLC basic program (Page 76).



Further information

The block descriptions and other information about the PLC basic program are contained in the P3 section of the SINUMERIK 840D sl Basic Functions Manual. PLC basic program.

6.2.2 Using copy templates

Introduction

The "Global libraries" folder of the "Libraries" TaskCard contains the system library of the SINUMERIK PLC program for your device version: "SINUMERIK 840D sl PLC basic program V4.x.x.x".

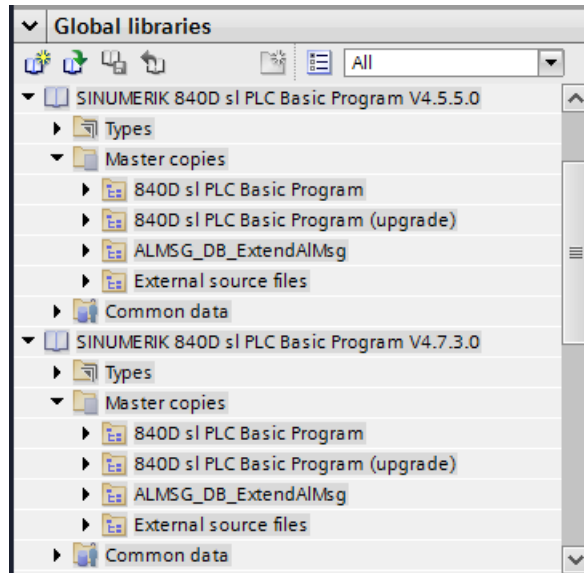


Figure 6-1 Master copies of the SINUMERIK PLC program

Under the "Master copies" folder there are four subfolders with different contents. You can copy the contents of these subfolders in their entirety or you can copy the individual objects as needed.

- Using the Ctrl or shift key, you can select several objects of the same type and then copy them.
- If you copy a master copies folder in its entirety (e.g. "840D sl PLC BP"), the folder structure is imported, i.e. new groups (subfolders) are created in your "Program blocks" folder.

Table 6-1 Use and content of the master copies of the PLC basic program

Folder	Purpose	Contents
840D sl PLC Basic Program	This master copy is intended to create a completely new project.	<p>The master copy contains all the blocks that you require for the maximum configuration (31 axes, 10 channels).</p> <p>Use of axis/channel DB</p> <p>If your machine is using fewer axes or channels, you can either copy only the required blocks or you can delete the blocks that are not required in the project tree after copying.</p> <p>If you have blocks in your project that are not required, this increases, for example, the time required for the loading or export of the PLC symbols.</p> <p>Use of ALMSG_DB [DB2]</p> <p>This master copy contains ALMSG_DB [DB2] in the variant ExtendAIMsg=False.</p> <p>The used DB2 variant must match in the startup for parameterization of the RUN_UP [FB1] in OB100 [OB100] (parameter ExtendAIMsg).</p>
840D sl PLC Basic Program (upgrade)	This master copy is used to upgrade blocks after the firmware version of an NCU is updated, i.e. if you have carried out a device replacement or a migration (Page 97).	<p>This master copy contains all the know-how-protected blocks that you require for the maximum configuration (31 axes, 10 channels).</p> <p>Blocks to be changed by the user are not included (no organization blocks and not FC12 [FC12], Diagnose [FB29], DB4 [DB4], DB5 [DB5]).</p> <p>Use of axis/channel DB</p> <p>If your machine is using fewer axes or channels, you can either copy only the required blocks or you can delete the blocks that are not required in the project tree after copying.</p> <p>If you have blocks in your project that are not required, this increases, for example, the time required for the loading or export of the PLC symbols.</p> <p>Use of ALMSG_DB [DB2]</p> <p>This master copy contains ALMSG_DB [DB2] in the variant ExtendAIMsg=False.</p> <p>The used DB2 variant must match in the startup for parameterization of the RUN_UP [FB1] in OB100 [OB100] (parameter ExtendAIMsg).</p>

Folder	Purpose	Contents
ALMSG_DB_ExtendAIMsg	<p>You need this master copy if you use the PLC alarm extension via AL_MSG [FC10] (ExtendAIMsg=True).</p> <p>Otherwise you use the DB2 variant "ExtendAIMsg=False", which is contained in the two above-named master copies folders.</p>	<p>This master copy contains ALMSG_DB [DB2] in the variant ExtendAIMsg=True (PLC alarm extension via AL_MSG [FC10]).</p> <p>The used DB2 variant must match in the startup for parameterization of the RUN_UP [FB1] in OB100 [OB100] (parameter ExtendAIMsg).</p>
External source files	<p>Contains master copies for different external sources (STL).</p> <p>You can copy these sources into the folder "External sources", e.g. under "CNC_1 > PLC_1 > External sources".</p> <p>You edit objects in the "External sources" folder using an external text editor, e.g. Microsoft Editor.</p> <p>See also: Create blocks from external sources (Page 80)</p>	<p>Contains the following master copies, from which you can generate the blocks named below:</p> <ul style="list-style-type: none"> • bhg_db.awl <ul style="list-style-type: none"> - strdat [DB<xy>] • diagnose.awl <ul style="list-style-type: none"> - FB29 [FB29] - DB80 [DB80] - DB81 [DB81] - FC99 [FC99] • gpob840d.awl <ul style="list-style-type: none"> - OB1 [OB1] - OB100 [OB100] - OB40 [OB40] - OB82 [OB82] - OB86 [OB86] • mdeclist.awl <ul style="list-style-type: none"> - DB75 [DB75]

Note

Selecting the appropriate master copy for ALMSG_DB [DB2]

There are 2 different variants of the block ALMSG_DB [DB2]. The used DB2 variant (ALMSG_DB [DB2]) must match in the startup for parameterization of the RUN_UP [FB1] in OB100 [OB100] (parameter ExtendAIMsg).

- DB2 variant "ExtendAIMsg=False"
This variant is contained in the master copies folders "840D sl PLC Basic Program" and "840D sl PLC Basic Program (upgrade)".
If you use the previous procedure (default value of the parameter ExtendAIMsg in RUN_UP [FB1]), you do not need to explicitly copy the "ALMSG_DB_ExtendAIMsg" master copy.
- DB2 variant "ExtendAIMsg=True"
This variant is exclusively contained in the separate master copies folder "ALMSG_DB_ExtendAIMsg".
If you use the extension of the PLC alarms via AL_MSG [FC10], you must use the right master copy, i.e. copy it separately into your "Program blocks" folder.

Further information about the extension of the PLC alarms via AL_MSG [FC10] is available under the keyword "ExtendAIMsg" in the Basic Functions Manual, in particular, in the "Extensions of the PLC alarms via block FC 10" section.

Further information

- General information on handling libraries in the TIA Portal can be found in the TIA Portal online help, Section "Using libraries".
- The block descriptions and other information about the PLC basic program is contained in the SINUMERIK 840D sl Basic Functions Manual in the P3: Basic PLC program section.

See also

Classification in the documentation landscape (Page 21)

6.2.3 Adding the PLC basic program

You can copy blocks of the PLC basic program from the respective system library. The "840D sl PLC Basic Program" folder that it contains is meant for creating a completely new project. You can copy the PLC basic program blocks in their entirety or individually.

Requirement

- A SINUMERIK 840D sl NCU is inserted.
- In the project, there are no blocks from other creators in the range of numbers of the PLC basic program.

Procedure

To copy program blocks of the basic program from a master copy to the program blocks folder of the project tree, proceed as follows:

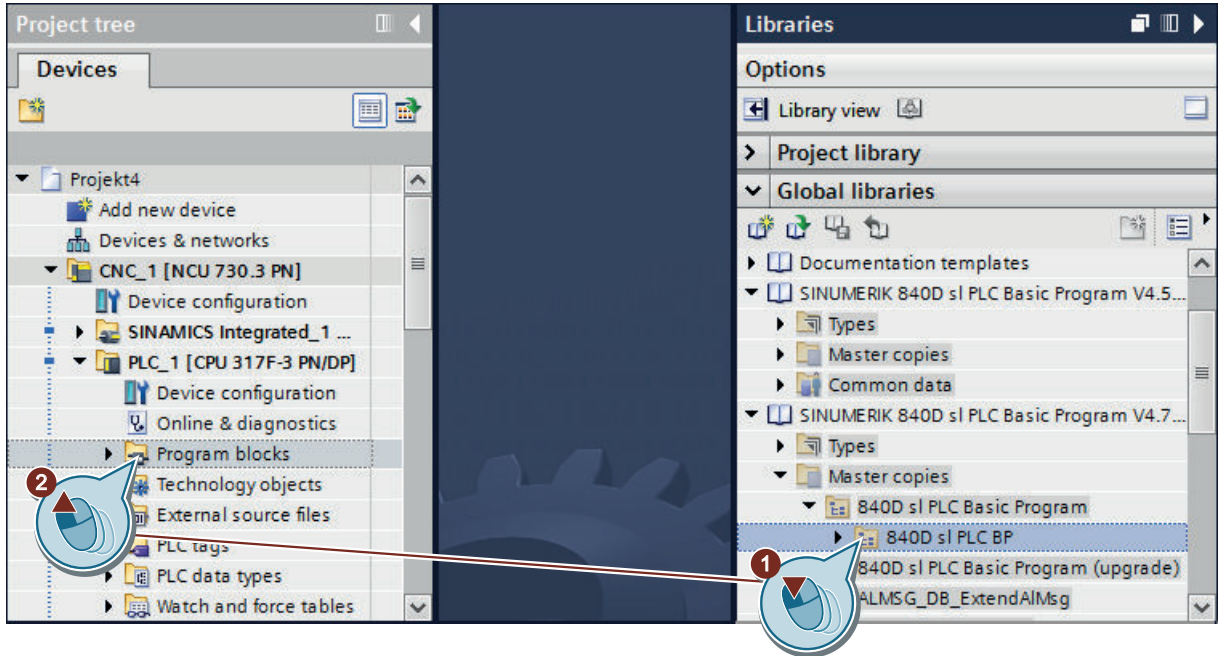
1. Switch to the "Libraries" task card and open the PLC basic program that matches the firmware version of the inserted NCU:
 - SINUMERIK 840D sl PLC basic program V4.5.x.x
 - SINUMERIK 840D sl PLC basic program V4.7.x.x
 - SINUMERIK 840D sl PLC basic program V4.8.x.x
 - SINUMERIK 840D sl PLC Basic Program V4.9.2.x

See also: Opening the PLC basic program system library (Page 72), Using copy templates (Page 73)

2. Open the folder "Master copies > 840D sl PLC Basic Program"

6.2 Adding the PLC basic program

- 3. You have several options for copying the PLC basic program blocks to your project:
 - **Copying the PLC basic program including folder structure as a whole**
Drag and drop the master copies folder "840D sI PLC BP" into the folder Program blocks, e.g. under "CNC_1 > PLC_1 > Program blocks".

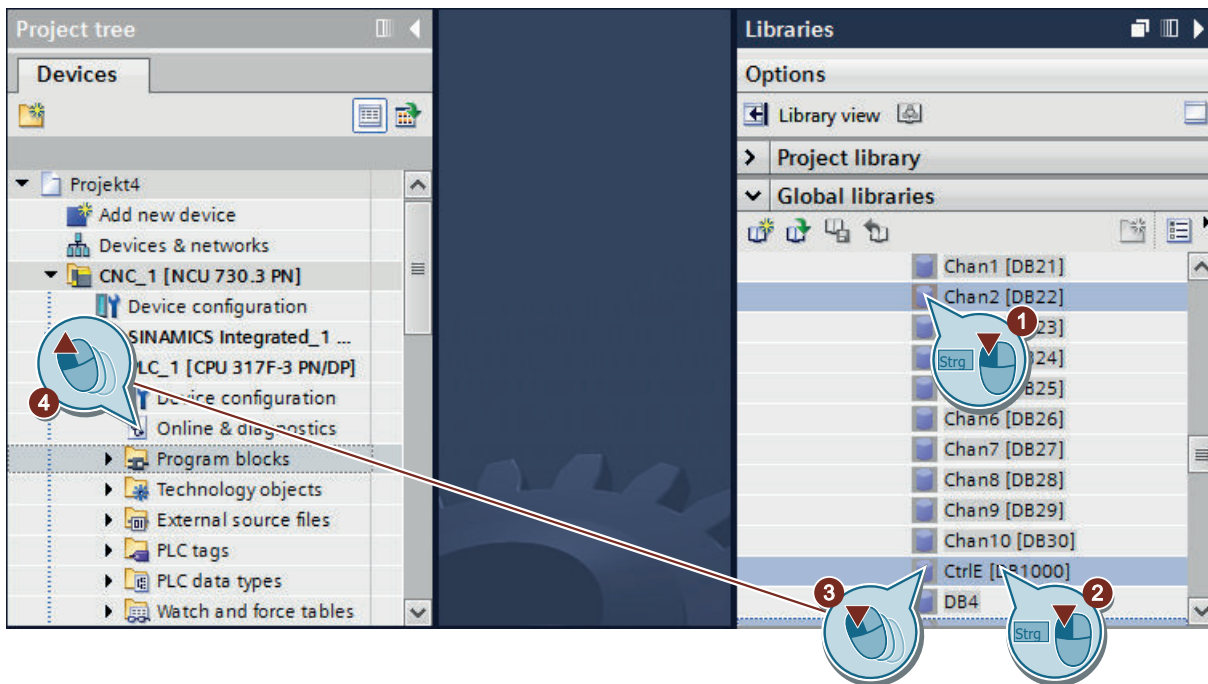


– **Copying specific PLC basic program blocks**

Open the master copies folder and, if applicable, other lower-level folders and manually define the blocks which you would like to copy by selecting them and then dragging and dropping them into the program blocks folder.

To select successive objects, click on the first object, press and hold the Shift key and then click on the last object.

To select non-successive objects, press and hold the Ctrl key and click on the objects one-by-one.



The blocks are copied to your project. If applicable, the "Conflicts during copying" dialog is displayed.

Note

Copy further required blocks separately (e.g. DB2 variant "ExtendAIMsg=True")

If you are using PLC basic program blocks that are not contained in the master copies folder "840D sl Basic Program > 840D sl PLC BP", you must copy them separately:

- DB2 variant "ExtendAIMsg=True" from the master copies folder "ALMSG_DB_ExtendAIMsg"
- Different external STL sources from the master copies folder "External source files"

See: Create blocks from external sources (Page 80), Using copy templates (Page 73)

4. In the project tree, right-click "Program blocks" and select the "Software (compile all blocks)" command in the "Compile" shortcut menu.

Result

The blocks of the SINUMERIK PLC basic program have been copied to your project. Any copied folder structure has been imported.

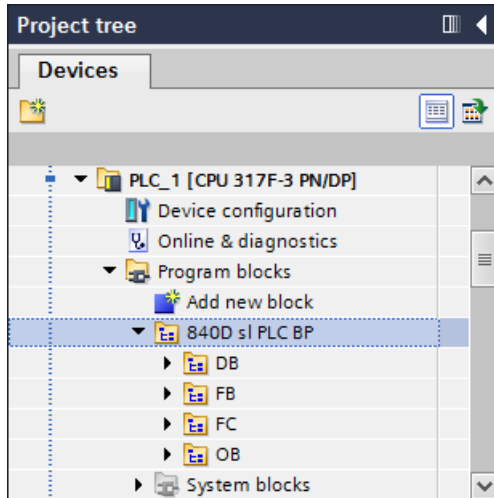


Figure 6-2 Program blocks folder

Now you can check the copied blocks and, if applicable, manually delete the PLC basic program blocks that you do not require (e.g. unused axis DB, channel DB, FB or FC). If you have unused blocks in your project, some tasks take unnecessarily long, e.g. the loading or the creation and import of SINUMERIK archives.

6.2.4 Create blocks from external sources

You do not manage external source files (e.g. *.STL or *.SCL) in TIA Portal in the "Program blocks" folder, but in the "External sources" folder, e.g. under "CNC_1 > PLC_1 > External sources". You can then generate blocks from the sources maintained there. These are saved in the "Program blocks" folder.

You do not edit the files in the "External sources" folder using a TIA Portal editor, but with any external editor, which you define under Windows.

Requirement

- An external source is available in STL or SCL format.
- The mnemonic set in the TIA Portal corresponds to the setting used in the external source. These settings are found in the menu bar of the TIA Portal as follows: "Extras > Settings > General > General settings > Mnemonic".

Note

Use of German mnemonics in external source files of the PLC basic program

The mnemonic setting "German" is required in all external source files contained in the copy templates of the PLC basic program. This affects the files "bhg_db.awl", "diagnose.awl", "gpob840d.awl" and "mdeclist.awl".

The process fails if the setting does not correspond to the setting of the source file when the block is generated.

Procedure

1. In the project tree, select the "Add new external file" command in the "CNC_1 > PLC_1 > External sources" folder.
2. Select the external file (*.STL or *.SCL) that you want to add in the "Open" dialog. The external file is copied to the "External sources" folder in the project tree.

Note

Displaying external sources (e.g. STL files) using an external editor

The internal editor of the TIA Portal does not display external sources.

If you add and open an external source in the TIA Portal, the file will be opened with the application linked with the associated file type (e.g. STL in Windows (e.g. Microsoft Editor)).

See also: TIA Portal online help, search term "Using external source files"

3. Right-click the external source, then select the "Generate blocks from source" command in the shortcut menu.

Result

You have successfully generated blocks from an external source.

Further information about external sources of the PLC basic program system library can be found in the SINUMERIK 840D sl Basic Functions Manual.

6.2.5 Correcting OB1

When inserting the blocks from a master copy of the library, the existing organization block OB1 is duplicated because it has a different name in the library than in the newly created PLC.

- Block in project tree: Main [OB1] or the name of your migrated block.
- Block in library: OB1 [OB1]

When the project is compiled, a message is displayed that there may only be one object of the type "OB1".

Procedure

To identify the not required version of the OB1 and to rectify the problem, proceed as follows:

1. Delete one of the duplicated OB1 blocks in the "program blocks" folder:
 - If the "program blocks" folder prior to the insertion contained only the empty Main [OB1] standard block, you can delete it.
 - If you have already programmed your own instructions in the OB1, this block normally already contains the call for the basic program and you can delete the newly added "OB1 [OB1]" block.

6.3 Edit blocks

The individual blocks in the PLC basic program can be processed as follows in the TIA Portal:

Procedure

1. Select the block that you would like to edit (e.g. OB100 [OB100]) in the project tree under "CNC_1 > PLC_1 > Program blocks".
2. Open the block by double-clicking it.

Note

Change the programming language

You can change the programming language under the "Properties" tab in the inspector window, under "General > Language". The following can be selected:

- LAD
 - FBD
 - STL
-

Further information

How you can specifically change and expand a user program is described in the documentation of SIMATIC STEP 7 as well as in the higher-level online help of the TIA Portal.

6.4 Configuring Ethernet machine control panels in the PLC program

The PLC basic program automatically transfers the machine control panel signals (MCP signals) and the addresses of the MCP in the hardware configuration if the configuration is set up as laid out below.

Procedure

1. In the project tree, under "CNC_1 > PLC_1 > Program blocks" open the "OB100" with a double-click.
2. Set the following parameters:

1	CALL	"RUN_UP", "gp_par"	%FB1, %DB7
2	MCPNum	:=1	1
3	MCP1In	:=P#	P#E0.0
4	MCP1Out	:=P#	P#A0.0
5	MCP1StatSend	:=P#	P#A8.0
6	MCP1StatRec	:=P#	P#A12.0
7	MCP1BusAdr	:=19	192
8	MCP1Timeout	:=	
9	MCP1Cycl	:=	
10	MCP2In	:=	
11	MCP2Out	:=	
12	MCP2StatSend	:=	
13	MCP2StatRec	:=	
14	MCP2BusAdr	:=	
15	MCP2Timeout	:=	
16	MCP2Cycl	:=	
17	MCPMPI	:=	
18	MCP1Stop	:=	
19	MCP2Stop	:=	
20	MCP1NotSend	:=	
21	MCP2NotSend	:=	
22	MCP5DB210	:=	
23	MCPCopyDB77	:=	
24	MCPBusType	:=B#	B#16#55

3. Open the OB1 and insert the following user program:

84	//Insert User program from here		
85	// Operator panel "Milling"		
86	CALL	"MCP_IFM"	%FC19
87	BAGNo	:=B#16#01	B#16#01
88	ChanNo	:=B#16#01	B#16#01
89	SpindleIFNo	:=B#16#00	B#16#00
90	FeedHold	:= "Tag_1"	%M100.0
91	SpindleHold	:= "Tag_2"	%M100.1
92			

Note

Hardware address must correspond to the software address

Make sure that the address of the MCP on the hardware corresponds to the configured address of the MCP in the TIA Portal. (Parameter MCPxBusAdr; see also Function Manual, SINUMERIK 840D sl Basic Functions)

In our example, you must set the address at the hardware (at the DIP switch of the device) to 192.

Result

You have completed the configuration of the PLC basic program.

Further information

Information on the addressing of the machine control panel can be found in Function Manual, SINUMERIK 840D sl Basic Functions, Section MCP interface in the PLC.

6.5 Loading the PLC program to the PLC

Introduction

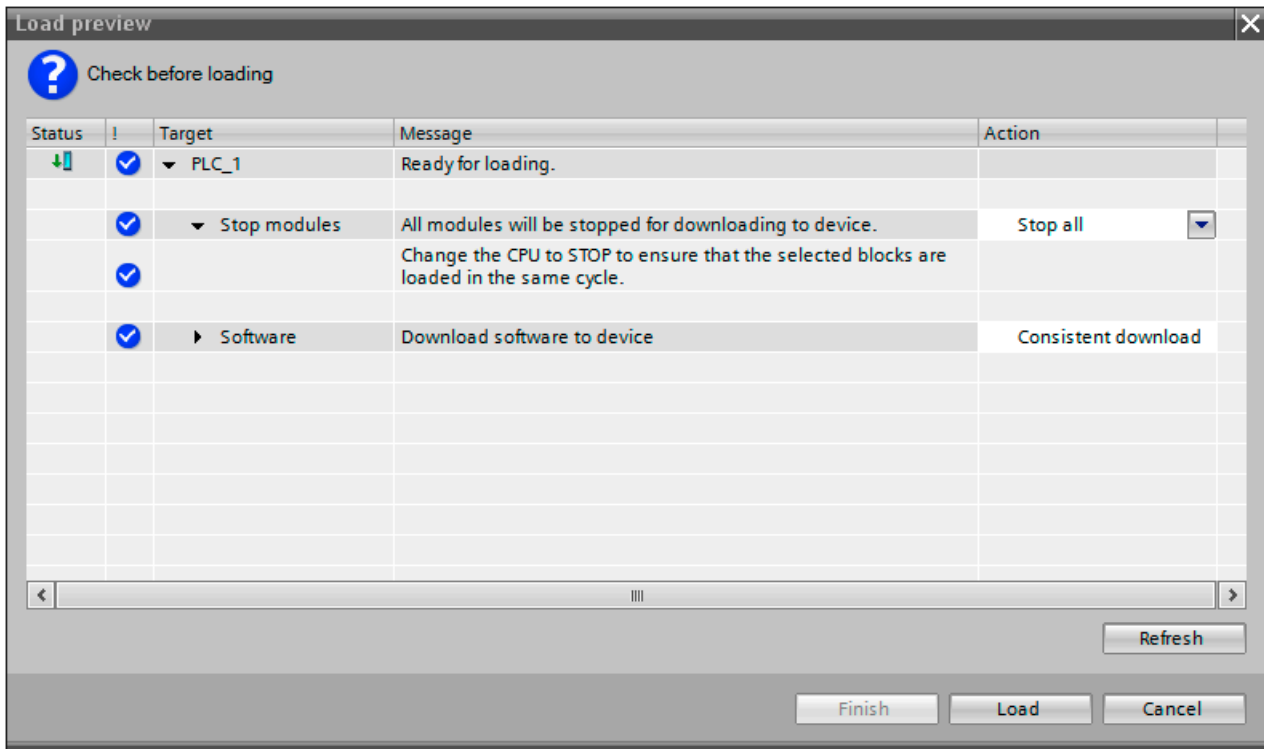
For loading the configured PLC project, the following preconditions must be fulfilled:

Precondition

- Typically, between the PG/PC and the PLC, there is an Ethernet network connection; this is also the case in our particular example (see Setting up the communication (Page 62)).
- The configuration to be loaded corresponds to the actual station configuration.
- In the previous Chapter Loading and closing the hardware configuration in the PLC (Page 65) you loaded the hardware configuration to the module.
- The NCU is active:
 - NCK is in cyclic mode.
 - PLC in RUN or STOP mode.

Procedure

1. In the project tree, right-click "CNC_1 > PLC_1" and select "Load to device > Software (changes only)" in the context menu.
The "Load preview" dialog opens.



2. In the "Download preview" dialog, check the settings and click "Load" to confirm the input.

Result

The PLC is stopped and the PLC program is loaded into the PLC. The "Results of the loading action" dialog opens and displays the status of the loading action. The dialog restarts the PLC after completion provided the "Start" checkbox has not been disabled.

6.6 Exporting PLC symbols for SINUMERIK Operate

6.6.1 Overview

You can make PLC symbols defined in the TIA Portal available for SINUMERIK Operate in able to use them for various functions there. You must export the symbols of the associated PLC in the TIA Portal and then import into SINUMERIK Operate.

Note**Deleting unwanted blocks before exporting PLC symbols**

If you have saved unwanted blocks in your project, this lengthens the time required for exporting and importing PLC symbols.

Consequently, delete unwanted blocks that you copied previously from the basic program library prior to the export.

See: Using copy templates (Page 73)

Requirement

- The software has been compiled completely.
- The associated languages are activated as project languages in the TIA Portal.
See: Information system, "Activate project languages" section

Note**Comments only in German or English**

Because SINUMERIK Operate can manage only German and English comments, you can export only German and English comments from the TIA Portal.

- The PLC symbols to be exported are valid.

Note**Only valid PLC symbols are exported**

The following PLC symbols are not taken into account during the export:

- PLC symbols of know-how-protected blocks
 - PLC symbols of F-blocks
 - Internal PLC symbols
 - Invalid/faulty PLC symbols
-

Procedure overview

Table 6-2 Example procedure for creating and loading PLC symbols

Step	Description
1	If necessary, check or edit symbols in the TIA Portal <ul style="list-style-type: none">You can change the symbolic names of blocks by right-clicking the block and selecting "Rename" from the shortcut menu.You can change symbols of the individual elements in the block editor.PLC variables for Flags, Times, Input, Output, Timer and Counter can be changed in the associated table field (e.g. under "CNC_1 > PLC 1 > PLC variables > Display all variables")
2	Exporting PLC symbols with the TIA Portal (Page 90)
3	If necessary, make export files available on the NCU or PCU, e.g. using a USB FlashDrive
4	Importing PLC symbols in SINUMERIK Operate (Page 93)

6.6.2 Exporting PLC symbols

Note

Deleting unwanted blocks before exporting PLC symbols

If you have saved unwanted blocks in your project, this lengthens the time required for exporting and importing PLC symbols.

Consequently, delete unwanted blocks that you copied previously from the basic program library prior to the export.

See: Using copy templates (Page 73)

Requirement

- The software has been compiled completely.
 - The associated languages are activated as project languages in the TIA Portal.
See: Information system, "Activate project languages" section
-

Note**Comments only in German or English**

Because SINUMERIK Operate can manage only German and English comments, you can export only German and English comments from the TIA Portal.

- The PLC symbols to be exported are valid.
-

Note**Only valid PLC symbols are exported**

The following PLC symbols are not taken into account during the export:

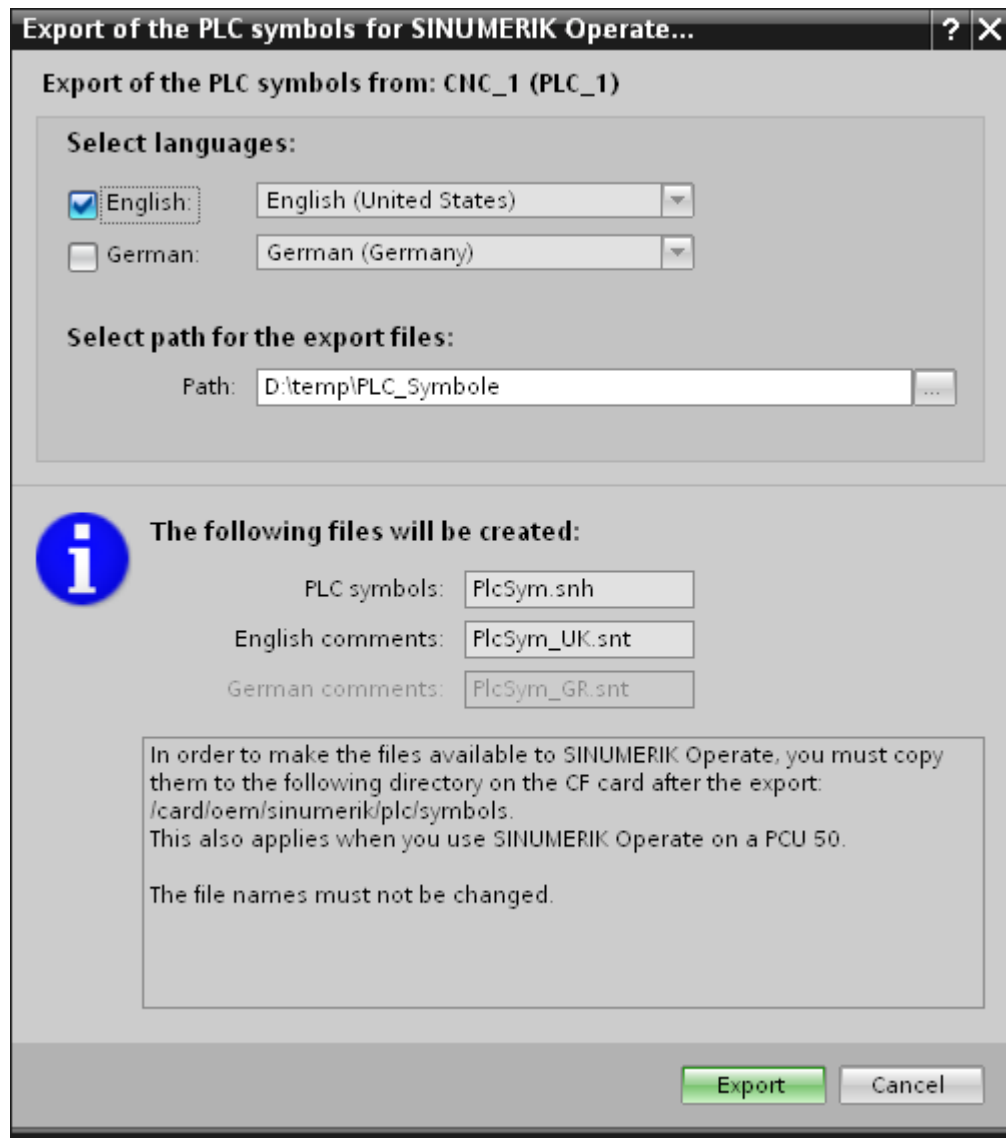
- PLC symbols of know-how-protected blocks
 - PLC symbols of F-blocks
 - Internal PLC symbols
 - Invalid/faulty PLC symbols
-

Procedure

To export PLC symbols for SINUMERIK Operate, proceed as follows:

1. In the project tree, right-click on the PLC or NCU and select the "Export PLC symbols for SINUMERIK Operate" in the shortcut menu.

The "Export PLC symbols for SINUMERIK Operate" dialog opens.



2. Enter the settings:

- Select the languages whose PLC symbols you want to export. Only those languages that you previously selected under "Project languages" are actively displayed.

Note

Comments only in German or English

Because SINUMERIK Operate can manage only German and English comments, you can export only German and English comments from the TIA Portal.

- Select the storage location in which the exported PLC symbols are to be saved. Use, for example, a USB FlashDrive to subsequently copy the files to the NCU.
3. Click "Export" to start the export operation.

Result

The PLC symbols will be copied to the chosen storage location. The "PlcSym.snh" file is created. Depending on your settings, the files are also created with German or English comments: "PlcSym_GR.snt" and "PlcSym_UK.snt".

Note

Notation

The notation (upper and lower case) of the file names created by the program is mandatory and must not be changed.

6.6.3 Importing PLC symbols

Requirement

- The symbol export files are available on the NCU or PCU, e.g. using a USB FlashDrive

Note

Notation

The notation (upper and lower case) of the file names created by the program is mandatory and must not be changed.

- The current PLC symbols in SINUMERIK Operate have been saved

Note

Saving or deleting old symbol tables

Note that already existing files are overwritten during the export if you confirm that this should be done. Furthermore, it can lead to inconsistencies if not all files are exported.

We recommend that the old files are backed up or deleted before a new export, or the files are exported to an empty directory.

Procedure

To use PLC symbols exported from the TIA Portal in SINUMERIK Operate, proceed as follows:

1. Copy the symbol export files in the following directory on the CF card of the NCU or PCU:
/oem/sinumerik/plc/symbols
2. Restart SINUMERIK Operate.

3. After the startup, confirm the "Diagnosis", ">>" and "NC/PLC variables" horizontal softkeys.
4. Select the "Insert variables" softkey.
The imported symbols are displayed in the "NC/PLC variables" table and can be imported.

Further information

Detailed information on how you can load the PLC symbols to the control system are contained in the SINUMERIK 840D sl Universal Operator Manual under the "Loading PLC symbols" keyword.

6.7 Completing the first commissioning of the PLC

Perform a reset (warm restart) of the NCK to synchronize the PLC and NCK.

Procedure

To perform a reset (warm start), proceed as follows:

1. On the operator panel, press the <MENU SELECT> key and select the "Commissioning" menu.
2. Press the "Reset..." softkey.
3. Acknowledge the "Do you want to trigger a reset (warm restart) for the NCK and the entire drive system (all drive units)?" prompt with the "Yes" softkey.

Result

- The "RUN" LED illuminates green continuously.
- Status display shows a "6" with a flashing point. This means that the PLC and NCK are in cyclic operation.

You have now completed the initial commissioning of the PLC.

This means that you have successfully completed the main part of Getting Started.

Additional chapter and references

If you require information about the migration of your STEP 7 project into the TIA Portal, you can find this in Section Tips for personnel changing over from another system (Page 97).

If you now wish to continue and complete commissioning your system together with the SINAMICS drives, you can find this information in the "Commissioning CNC: NCK, PLC, drive for TIA" Commissioning Manual, Chapter "Commissioning NC-controlled drives".

Tips for personnel changing over from another system

7.1 Overview for the migration

If you have worked previously with the SINUMERIK Toolbox for STEP 7 V5.x and as migrating party are already familiar with the commissioning and configuration of the SINUMERIK 840D sl, these sections contain more advanced information about the project migration, functionality and operation of the TIA Portal:

- The migration of program blocks or complete projects is described in the "Migrating projects" section (Page 98).
- The "Problem solution (Page 107)" section contains help for frequent questions concerning migrated SINUMERIK projects.
- The "Comparison of functionality (Page 114)" section contains information about the functionality and operation in comparison to STEP 7 V5.x. In this way, you can familiarize yourself with the TIA Portal when migrating from STEP 7 V5.x.

Note

Validity of the description

These descriptions concern the special considerations for the migration of projects that were created with SINUMERIK Toolbox for STEP 7 V5.5 SP4 or higher. The migration notes and descriptions for STEP 7 (TIA Portal) also apply.

If you want to migrate components that require further option packages, the migration notes of the associated documentation also apply.

A selection of general migration descriptions and notes are available under "Further information" (Page 106).

7.2 Migrating projects

7.2.1 Overview

Basic information on the content of this description

Validity of the description

These descriptions concern the special considerations for the migration of projects that were created with SINUMERIK Toolbox for STEP 7 V5.5 SP4 or higher. The migration notes and descriptions for STEP 7 (TIA Portal) also apply.

If you want to migrate components that require further option packages, the migration notes of the associated documentation also apply.

A selection of general migration descriptions and notes are available under "Further information" (Page 106).

Conventions

The term "SINUMERIK project" is used in this description to represent a project created with SINUMERIK Toolbox for STEP 7 V5.5 SP4 or higher.

Overview

To check whether the modules of your project are supported, use the Readiness Check Tool (<http://support.automation.siemens.com/WW/view/en/60162195>) prior to the migration.

If modules are not supported in the TIA Portal, alternative modules will be suggested in the Readiness Check Tool.

Depending on how many of the modules are supported in the TIA Portal, either migrate the complete project or only program blocks and symbols:

- You can migrate the complete project (Page 103).
- You can migrate only program blocks and symbols, and recreate the hardware configuration in the TIA Portal (Page 100).

To keep the reworking effort low, you can adapt the project prior to the migration (Page 98).

7.2.2 Preparing a STEP 7 V5.x project for the migration

You can migrate a consistent and executable STEP 7 as of V5.4 project directly to the TIA Portal. To keep the reworking effort for the migrated project low, you can prepare the project for the migration.

Section Troubleshooting (Page 107) also provides help for frequently asked questions concerning migrated projects.

Basic procedure

- **Creating user data blocks from the PLC basic program in the project**

User data blocks from the PLC basic program (e.g. axis DB) (Page 125) in the TIA Portal are not based on UDTs, but rather stored as dedicated data blocks in the project.

 - You can create the used data blocks prior to the migration in STEP 7 V5.x in the "Blocks" folder:

Select in the properties of the newly created block under "Name and type > DB of type" the associated UDT (e.g. "UDT31"). Use the same symbolic name as in the TIA Portal system library (see Section "Tabular block listing (Page 71)").

During the migration, the blocks are then transferred automatically to the "Program blocks" folder.
 - Alternatively, you can copy the required data blocks after the migration from the master copies folder "840D sl PLC Basic Program (upgrade) (Page 73)".

See also:

- User-defined data types from the basic program (Page 125)
 - Using user-defined data types (UDT) (Page 123)
 - Using copy templates (Page 73)
 - **Checking the user program for flags without symbol and data type**

During the migration, a symbol and a data type are assigned automatically to each used absolute address (e.g. flags, I/O addresses).

 - If you use absolute addresses in your STEP 7 V5.x project for intermediate results for which no symbol or data type is declared ("temporary flag"), type conflicts can occur after the migration.

Therefore, preferably augment this information in your STEP 7 V5.x project prior to the migration.
 - In particular, problems occur after the migration when you use in your program temporary global flags without defined data type (global "temporary flags") in which different data types are stored.

Correct your program and use instead local data with defined data type and symbol.
 - **Testing for implicit type conversions**

In the TIA Portal, each used absolute address is assigned a symbol and so a unique data type.

 - If the use of an absolute address differs from the declaration of the data type, an implicit data type conversion can cause problems.

In this case, change the affected implicit type conversions with incompatible operands to explicit type conversions.
 - If in your user program you save data of different types in the same address area, then possibly neither an implicit nor an explicit data type conversion can be performed.

The elimination of such a problem differs depending on the concrete situation.
- See also:
- LAD/FDB/SCL: Data type conversion with MOVE instruction (Page 109)
 - Data type conversion (S7-300, S7-400) (help for STEP 7)

7.2.3 Migrating program blocks and symbols

You can migrate PLC program blocks and symbols from an NCU of a STEP 7 project of Version 5.4 SP5 (or higher) to the TIA Portal.

To keep the reworking effort low, you can adapt the project prior to the migration (Page 98).

If you also want to migrate the hardware configuration, orient yourself on the corresponding handling overview "Migrating software and hardware configurations (Page 103)".

Requirement

- The project to be migrated is upgraded to SINUMERIK 840D sl Toolbox 4.5 SP2 or higher for STEP 7 V5.5 SP4 or higher.
- FC1007, FC1008 and FC1010 are not contained in the project.
FC1007, FC1008 and FC1010 are no longer part of the basic program and cannot be migrated. If these functions are contained in your user program, delete them and the associated calls.
- The STEP 7 project to be migrated is consistent and can be executed.
If your project cannot be executed, you must correct it in STEP 7 V5.x before you migrate it. You can check the consistency with SIMATIC Manager and restore by compiling the blocks.
- Both STEP 7 V5.5 SP4 (or higher) and the TIA Portal are installed on the PG/PC, or the project has been converted to AM 15 format with the migration tool.
See Migration tool (help for the TIA Portal).
- All option packages used to create the project in STEP 7 V5.x are installed and licensed (e.g. the option package for SCL).
Specific information concerning the migration of other option packages is contained in the associated documentation.

Procedure

To migrate program blocks and icons of a SINUMERIK project into the TIA Portal, proceed as follows:

1. In the "Project" menu, select the "Migrate project" command.

The "Migrate project" dialog opens

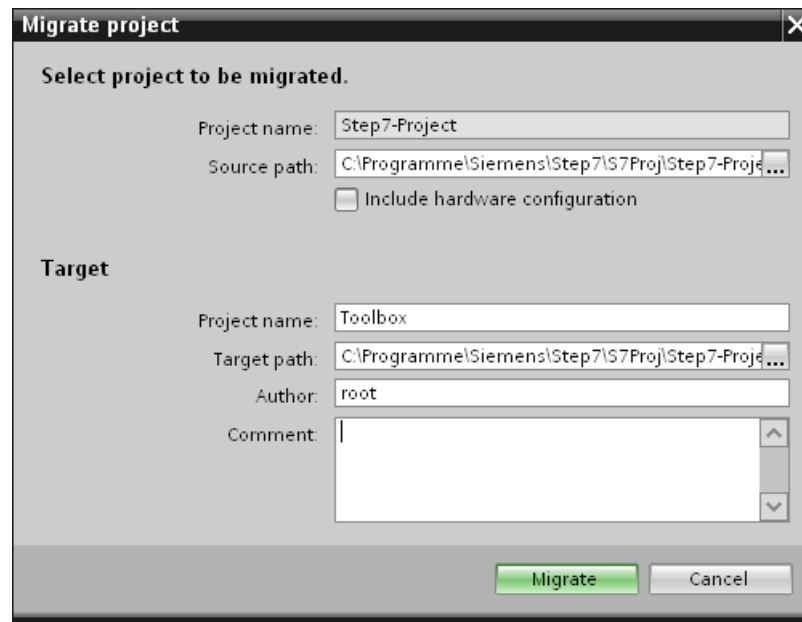


Figure 7-1 Migrate project dialog

2. Make the following settings:

Setting	Purpose
Source path	Path of the original project that is to be migrated. Select a project in the format of the initial project (*.s7p) or a project processed with the migration tool (*.am15).
Close hardware configuration	Keep the "Include hardware configuration" checkbox deactivated. If you also want to migrate the hardware configuration, orient yourself on the corresponding handling overview "Migrating software and hardware configurations (Page 103)".
Target > Project name	Input of the project name for the newly created project.
Target path	Input of the path on which the new project file is to be created.
Author	Name of the author or a person responsible for the project.
Comment	Input of a comment for the migration.

3. Click "Migrate" to confirm the details.

A not specified SIMATIC CPU that contains your migrated program blocks is added to the project tree. You cannot replace this CPU with a SINUMERIK NCU, but rather you must add it new.

4. Add from the hardware catalog the devices that belong to your migrated user program and make the settings as in the STEP 7 V5.x project.

Note

Set the module addresses correctly before copying the tag table

If you copy the migrated tag table (see step 6) into the newly created NCU before you correctly set the module addresses in the device properties, the "Tags in module" dialog is displayed.

Do not click "Rewire tags with the new module address" in the dialog.

Otherwise, the tags are assigned incorrectly to the tag table and you must correct it manually or recopy the tag table.

See also: Rewiring variables in the module (Page 112)

5. In the project tree, delete the "Main [OB1]" block under "CNC_x > PLC_x > program blocks".
6. Copy the migrated data from the not specified SIMATIC CPU into the newly created SINUMERIK NCU:
 - Copy the migrated blocks to the "Program blocks" folder of the newly created device.
 - Copy the migrated tag tables to the newly created device.
 - Copy the migrated PLC data types (UDT) to the "PLC data types" folder of the newly created device.
 - Copy the migrated technology objects (TO) to the "Technology objects" folder of the newly created device.
7. Upgrade the PLC basic program by means of the master copies folder "840D sI PLC Basic Program (upgrade)".
See: Upgrading the PLC basic program (Page 104)
8. Interconnect the devices and re-establish the connections.
See: Configuring of connections (Page 121)
9. Compile all the program blocks. If errors or warnings are issued during the compilation, help is available in Section Troubleshooting (Page 107).
10. Check the migration log in the project tree under "Shared data > Logs" and systematically work through the notes contained in the migration log.
Section "Troubleshooting (Page 107)" also provides help for frequently asked questions concerning migrated SINUMERIK projects.

Result

The program blocks and symbols of the PLC have been migrated and assigned to the new project in the TIA Portal.

If errors or warnings are issued during the migration, help is available in Section Troubleshooting (Page 107).

The PLC data types (UDT) contained in the SINUMERIK basic program for STEP 7 V5.x are transferred during the migration. The data blocks of the PLC basic program in the TIA Portal (e.g. axis DBs), however, do not use them. (See: Using user-defined data types (UDT) (Page 123))

You can now familiarize yourself with the TIA Portal when migrating from STEP 7 V5.x. Section "Comparison of functionality (Page 114)", for example, is interesting for migration. It contains information about the functionality and handling compared with STEP 7 V5.x.

7.2.4 Migrating software and hardware configurations

The general procedure for the migration with focus on the special considerations during the migration of a SINUMERIK project follows.

General information about migration is contained under Migrating STEP 7 projects (S7-300, S7-400) (help for the TIA Portal) or in the system manual STEP 7 Professional (<https://support.industry.siemens.com/cs/products?search=STEP%207%20Professional&ctp=Manual>) in the section on "Migrating projects".

Requirement

- The project to be migrated is upgraded to SINUMERIK 840D sl Toolbox 4.5 SP2 or higher for STEP 7 V5.5 SP4 or higher.
- The project to be migrated contains only those modules supported in the TIA Portal. Use the Readiness Check Tool to check whether the used modules are supported. Alternative modules will be displayed if modules are not supported in the TIA Portal. Readiness Check Tool (<http://support.automation.siemens.com/WW/view/en/60162195>)
- FC1007, FC1008 and FC1010 are not contained in the project. FC1007, FC1008 and FC1010 are no longer part of the basic program and cannot be migrated. If these functions are contained in your user program, delete them and the associated calls.
- The STEP 7 project to be migrated is consistent and can be executed. If your project cannot be executed, you must correct it in STEP 7 V5.x before you migrate it. You can check the consistency with SIMATIC Manager and restore by compiling the blocks.
- All option packages used to create the project in STEP 7 V5.x are installed and licensed (e.g. the option package for SCL).

Procedure overview

Step	Description
1	Preparations of the starting project <ul style="list-style-type: none"> • To keep the reworking effort low, you can adapt the project prior to the migration (Page 98). • If STEP 7 V5.x and the TIA Portal are not installed on the same PG/PC or the starting project is an integrated project, you must convert the starting project to a migration file using the migration tool. See: Migration tool (help for the TIA Portal)
2	Migrating the project You can import the complete project (hardware configuration, program blocks, PLC symbols) by activating the "Include hardware configuration" checkbox. See: Migration of projects with the TIA Portal (help for the TIA Portal)

Step	Description
3	Upgrading the PLC basic program (Page 104) If errors or warnings are issued during the compilation, help is available in Section Troubleshooting (Page 107).
4	Checking the migration log <ul style="list-style-type: none">• A migration log is created for each migration. It contains notes for changed project components. You can fetch the log in the project tree under "Shared data > Logs" or from the project history. After completion of the migration, the migration log is displayed in the TIA Portal. Check the log after completion of the migration.• If the migration failed, an XML file is created as log under "\Logs" in the project directory. You can open it with any XML editor and view the causes for the failed migration.
5	Post-editing a migrated project Because the configurations of the starting project are not always fully compatible with the TIA Portal, all configurations are not necessarily transferred identically in the migrated project. Consequently, systematically work through the notes contained in the migration log. The "Problem solution (Page 107)" section contains help for frequently asked questions concerning migrated SINUMERIK projects.

Result

The project has been migrated to the TIA Portal.

You can now familiarize yourself with the TIA Portal when migrating from STEP 7 V5.x. Section "Comparison of functionality (Page 114)", for example, is interesting for migration. It contains information about the functionality and handling compared with STEP 7 V5.x.

See also

Using copy templates (Page 73)

7.2.5 Upgrading the PLC basic program

If you upgraded the firmware of an NCU or carried out a project migration, you should then also upgrade the PLC basic program to the current version.

However, it is essential that you check beforehand whether you would inadvertently overwrite your own blocks (see requirement).

Requirement

- Block number ranges of the SINUMERIK PLC basic program in the project are not occupied by blocks of other creators or you have checked which blocks of other creators are located in the SINUMERIK number range.

Procedure

To upgrade the PLC basic program, proceed as follows:

1. Switch to the "Libraries" task card and open the PLC basic program that matches the firmware version of the inserted NCU:
 - SINUMERIK 840D sl PLC basic program V4.5.x.x
 - SINUMERIK 840D sl PLC basic program V4.7.x.x
 - SINUMERIK 840D sl PLC basic program V4.8.x.x

See also: Using copy templates (Page 73), Opening the PLC basic program system library (Page 72)

2. Open the folder "Master copies > 840D sl PLC Basic Program (upgrade)"
3. Depending on the block number assignment in your project, select one of the following options:

Assignment of the PLC GP No. range	Possible procedure
Through blocks of other creators or Exclusively through PLC basic program blocks	<p>Overwriting specific PLC basic program blocks</p> <ol style="list-style-type: none"> 1. Open the lower-level master copies folders and select only those PLC basic program blocks that you use in your project. <ul style="list-style-type: none"> – To select successive objects, click on the first object, press and hold the Shift key and then click on the last object. – To select non-successive objects, press and hold the Ctrl key and click on the objects one-by-one. 2. Drag and drop the selected blocks into your "Program blocks" folder, e.g. under "CNC_1 > PLC_1 > Program blocks".
Exclusively through PLC basic program blocks	<p>Overwriting the PLC basic program including folder structure as a whole</p> <p>Drag and drop the entire master copies folder "840D sl PLC BP" into your "Program blocks" folder, e.g. under "CNC_1 > PLC_1 > Program blocks".</p>

The blocks are copied to your project. A check is made for duplicate block names and the "Conflicts during copying" dialog is displayed.

Note

Copy further required blocks separately (e.g. DB2 variant "ExtendAIMsg=True")

If you are using PLC basic program blocks that are not contained in the master copies folder "840D sl Basic Program > 840D sl PLC BP", you must copy them separately:

- DB2 variant "ExtendAIMsg=True" from the master copies folder "ALMSG_DB_ExtendAIMsg"
- Different external STL sources from the master copies folder "External source files"

See: Using copy templates (Page 73) Create blocks from external sources (Page 80)

4. Select the option "Replace existing objects and move to this location" and confirm with "OK".
5. In the project tree, right-click "Program blocks" and select the "Software (compile all blocks)" command in the "Compile" shortcut menu.

Result

The PLC basic program has been upgraded and is currently compiled.

Now you can check the copied blocks and, if applicable, manually delete the PLC basic program blocks that you do not require (e.g. unused axis DB, channel DB, FB or FC). If you have unused blocks in your project, some tasks take unnecessarily long, e.g. the loading or the creation and import of SINUMERIK archives.

See also

Adding the PLC basic program (Page 76)

7.2.6 More information

The Siemens Industry Online Support and the online help of the TIA Portal contain general information about the migration of STEP 7 V5.x projects. It normally also applies to the migration of SINUMERIK projects.

Documentation in the TIA Portal online help

- Migrating projects in a TIA Portal project
- Migrating STEP 7 projects
- Special considerations for the migration (S7-300, S7-400)
- Migration of program blocks (S7-300, S7-400)

FAQs in Siemens Industry Online Support

- Overview of the most important documents and links to the TIA Portal (<http://support.automation.siemens.com/WW/view/en/65601780>)
- Webinar for the migration topic (<http://support.automation.siemens.com/WW/view/en/57425491>)
- Requirements for migrating a STEP 7 V5.x project (<http://support.automation.siemens.com/WW/view/en/62100731>)
- List with devices and modules supported in the TIA Portal (<http://support.automation.siemens.com/WW/view/en/50029532>)
- Migration of a SCL program (<http://support.automation.siemens.com/WW/view/en/59784005>)
- Comparison of the standard blocks and instructions in STEP 7 (TIA Portal) and STEP 7 V5.x (<http://support.automation.siemens.com/WW/view/en/54137142>)
- Differences for the keyboard operation (<http://support.automation.siemens.com/WW/view/en/48697265>) (key combinations)

7.3 Troubleshooting

7.3.1 Overview

This section provides help for frequently asked questions regarding migrated projects.

The following messages in the TIA Portal are discussed:

- "Objects with ambiguous addresses exist in the program"
See: Duplicate block addresses (Page 107)
- "Avoid absolute accesses on the local data stack" and "Access to x with non-unique address"
See: Automatically assigned absolute access (Page 108)
- "The data type of the actual parameter x does not match the data type y of the formal parameter"
See: Incompatible data types (Page 109)
- "Implicit conversion from data type x to data type y not possible"
See: LAD/FDB/SCL: Data type conversion with MOVE instruction (Page 109)
- "The called block DB20 in network x does not exist"
See: PLC machine data in DB20 (Page 127)
- "The settings for the system diagnostics are invalid. Please check the settings"
See: Configuration and activation of the Web server (Page 111)
- "The module address has been changed. How should the assigned variables be handled?"
See: Rewiring variables in the module (Page 112)

7.3.2 Duplicate block addresses

If multiple blocks are present with the same addresses or numbers in the "Program blocks" folder (or a subordinate folder), an error will be displayed in the "Info > Compile" inspector window during the compilation process.

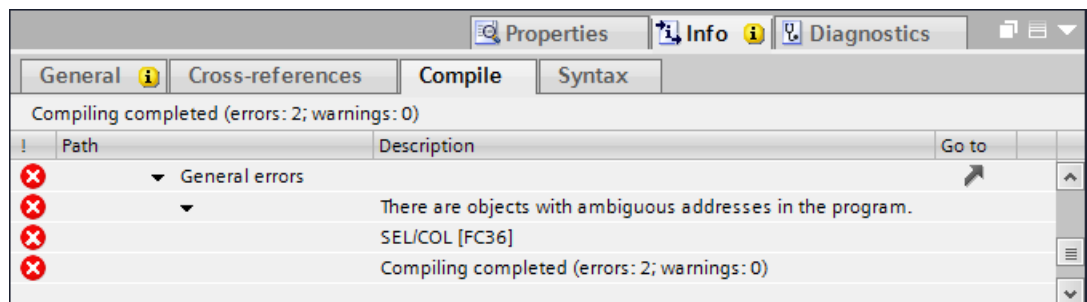


Figure 7-2 Error: "Objects with ambiguous addresses exist in the program"

Troubleshooting

If duplicate block numbers exist, proceed as follows:

- If this involves **one of the blocks of the basic program that you do not require** (e.g. unused axis DB, channel DB, FB or FC), you can delete it.
- If a **user block has the same block number** as a required basic program block, you must change the number of the user block. (You cannot change the addresses of required basic program blocks.)
- If after the **migration** an additional system block with a previously used address is added automatically, you can change the number of the automatically generated block. System blocks are not stored directly in the "Program blocks" folder, but rather in a subfolder, e.g. "CNC_1 > PLC_1 > Program blocks > System blocks > Program resources > SEL [FC36]".
If the "Number" property field cannot be edited, you can delete the block and recompile program blocks. During the compilation process of the calling block, the deleted block will be recreated with a free block address.
You can view information about the calling structure of the blocks by right-clicking a block and selecting the "Call structure" command.

7.3.3 Automatically assigned absolute access

Because blocks are tested more exactly in the TIA Portal than in STEP 7 V5.x, in some cases, after the migration, a consistent and executable LAD/FDB block can be represented only in STL. For the automatic conversion of such a block in STL, further errors or warnings may be displayed in the TIA Portal.

To avoid such messages, check your user program preferably prior to migration for flags without symbol and data type. If this is not possible, you can proceed as described below.

Troubleshooting

To rectify the problems, add new entries for address accesses in the block editor and assign a symbolic name to the associated address:

- Warning "Avoid absolute accesses on the local data stack"
If you use temporary results in a LAD/FDB block, after the migration in STL, they are absolute accesses to the local data stack.

Figure 7-3 Alarm: Absolute access to the local data stack

Declare symbolic variables in the Var_Temp area of the block and use them in the program.

- Error "Access to x with an ambiguous address"
An attempt is made to access a non-declared address area x of a symbolically declared variable.
Declare for the subarea x a symbolic name and use it in the program.

7.3.4 Incompatible data types

After the migration of a project to the TIA Portal, type conflicts can result, because during the migration, a symbol and a data type are assigned to each used absolute address of a flag.

Examples:

- In the STEP 7 V5.x project, flags were used for intermediate results for which no data type (and no symbol) was defined.
- In the STEP 7 V5.x project, a flag word for which no data type was defined was used for the block call.

If an incorrect data type is assigned for the migration, the error message shown below is displayed during the compilation:

- **"The data type of the actual parameter x does not match the data type y of the formal parameter"**

To correct the data type, switch in the block editor to the named parameter with incorrect data type (e.g. "Word") and specify the correct data type instead. Alternatively, you can use the "Rewire variable" (Page 112) dialog.

See also:

Migration help for STEP 7 in Section "General notes for the migration of program blocks" (programs with absolute addressing).

7.3.5 LAD/FDB/SCL: Data type conversion with MOVE instruction

If you use a MOVE instruction in a STEP 7 V5.x block, for example, to transport data types from axis/channel DBs to user DBs and implicitly convert the data type (e.g. "Real > DInt" or "Real > Word"), warnings or error messages may be displayed in the TIA Portal after the migration.

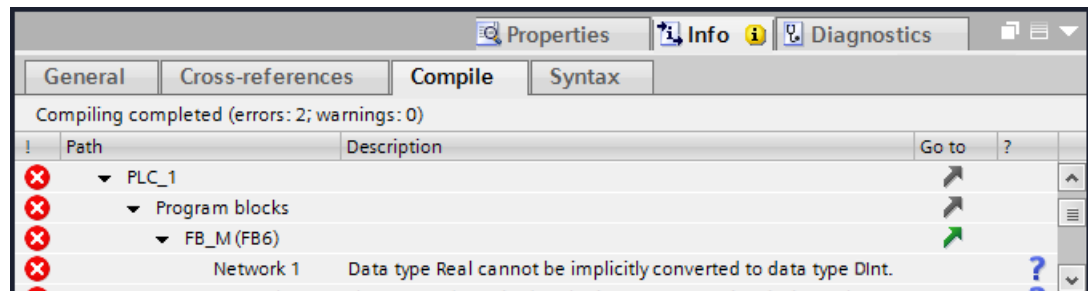


Figure 7-4 Implicit conversion of data type error

Troubleshooting

- If you use such a MOVE instruction but have not copied the axis/channel DBs to the "Program blocks" folder, the data type cannot be checked (absolute access). Warnings are displayed because of access made to blocks not present in the project. You can still compile and load the configuration; the required axis/channel DBs are then generated by the runtime on the NCU. However, you can then not address symbolically those axis/channel DBs not present in the project.

7.3 Troubleshooting

- If you use such a MOVE instruction, have already copied the axis/channel DBs present in the "Program blocks" folder and compiled the project, all absolute addressings are automatically converted into symbolic addressings. This cannot be undone. Because, in this case, the data type information is present in the TIA Portal and the above mentioned implicit data type conversions are not permitted, errors will be issued during the compilation.
To rectify the errors, you must convert the data type using two MOVE instructions. For example, for the REAL > DInt conversion, create a new variable of the DWord type, add a second MOVE instruction and convert using "REAL > DWord > DInt".

7.3.6 Inconsistency of the data blocks for a different runtime version

If the basic program blocks used in the TIA Portal belong to an older runtime version than that of the actual hardware, inconsistencies can occur between the blocks in the project and on the controller:

If a data block (e.g. axis DB) loaded onto the NCU from an older version is smaller than required by the runtime in the newer version, it will be deleted at runtime and replaced with a so-called CPU data block of the appropriate length. In the TIA Portal, an inconsistency is then detected and displayed in online mode. The monitoring of the current values is not possible in online mode.

In this case, you have the following options:

- Despite the inconsistency, you can continue working with the different block versions, but not symbolically address the additional functions of the new block. The PLC program, however, still functions because blocks of newer versions only append but not move signals.
- In the TIA Portal, you can add the appropriate Global DB to the runtime version of the NCU, explicitly delete the CPU DB on the PLC and reload the Global DB into the NCU. (A CPU DB cannot be overwritten by a global DB.)
- You can upload the new block from the NCU into the TIA Portal. This corrects the inconsistency, but also deletes the symbolic information of this data block. If the PLC program was addressed symbolically, errors will be issued during the compilation. See also the information system, "PLC programming > Create user program > Programming fundamentals > Blocks in the user program > CPU data blocks" section.

7.3.7 Renaming blocks

You cannot rename blocks used by know-how protected blocks if the password is not known or the know-how protection cannot be revoked for any other reasons.

If your user program contains blocks with non-revokable know-how protection that call other blocks of the basic program, they are affected.

The following blocks are affected within the SINUMERIK basic program:

- GP_PAR [DB7]
- FC12 [FC12]
- RUN_UP [FB1]: Renaming possible, complete compilation with the "Software (compile blocks completely)" command required.

7.3.8 Configuration and activation of the Web server

Overview

The Web server can be used to monitor the PLC via the Internet or the company-internal Intranet. Evaluations and diagnostics can therefore be performed remotely.

Connect the PG/PC to the PROFINET interface X150 and make the network settings on the PG/PC so that the subnet address configured for X150 is accessible. The Web server cannot be accessed via X120/X130/X127.

You can configure the Web server of the PLC in the same way in the TIA Portal as in STEP 7 V5.x. See also: Commissioning Manual, SINUMERIK 840D sl Commissioning CNC: NCK, PLC.

After activation of the Web server, the "Activate system diagnostics" dialog is called. If you confirm this dialog with "Yes", the following settings are made in the properties of the PLC: "System diagnostics > General > Activate system diagnostics for this PLC".

Note

Troubleshooting for double block assignment

The system diagnostics requires system diagnostic blocks that by default occupy the same address area as the blocks of the PLC basic program (FB49, DB49, FC49, DB50).

If you activate the system diagnostics for a SINUMERIK project, an error message with the prompt to adapt the settings of the system diagnostics will be issued for the next compilation.

In this case, switch to the properties of the system diagnostic blocks by double-clicking the error message and change the block numbers.

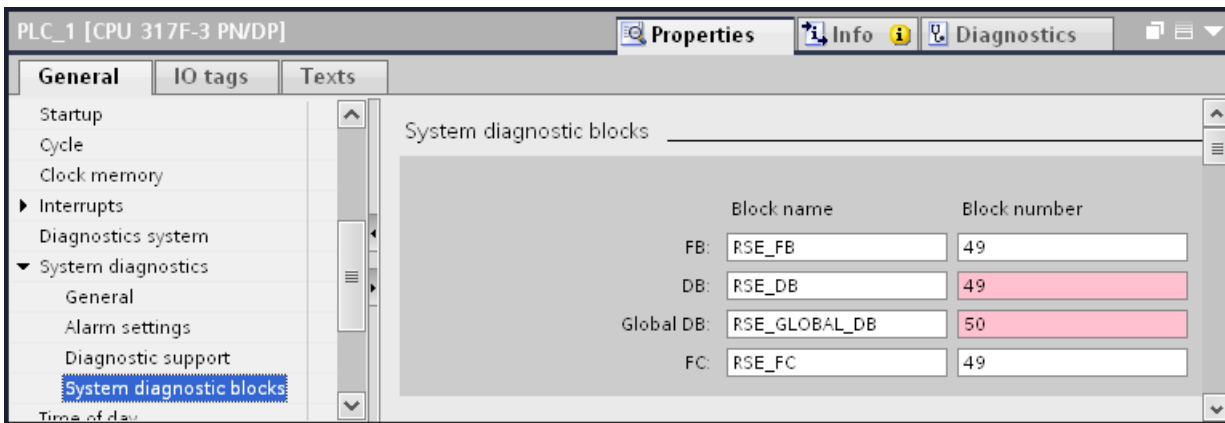


Figure 7-5 Default block numbers of the system diagnostics blocks are already assigned

Further information

- Information on the configuration of the PLC Web server on the NCU can be found in the Commissioning Manual, SINUMERIK 840D sl Commissioning CNC: NCK, PLC.
- General information on the Web server can be found in the information system of the TIA Portal, keyword "Web server".

7.3.9 Rewiring variables in the module

If a module address is assigned to a variable, and you change the address of this module, a dialog will be displayed indicating whether the address of the variable also needs to be changed (rewired).

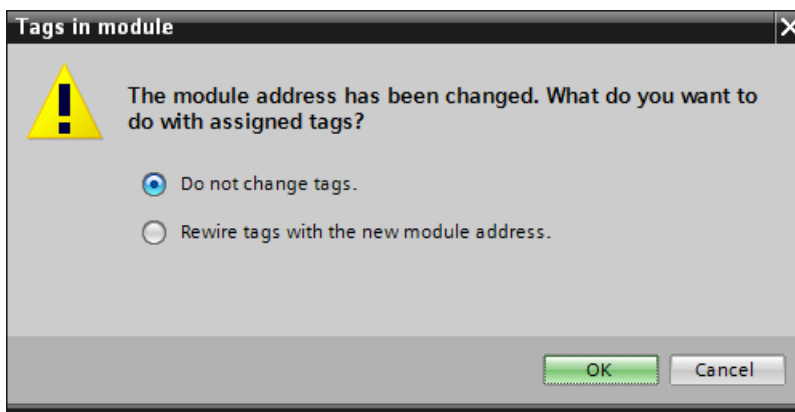


Figure 7-6 "Variables in the module" dialog

Migration: Set the module addresses correctly before copying the variables table

If you have migrated a project without hardware configuration and copy the migrated variable table to the newly created NCU before you have set the module addresses in the device properties, you are not permitted to rewire the variables.

Otherwise, the inputs in the function blocks of the basic program are assigned incorrectly and the program is no longer executable. You must correct it manually or copy the variable table again.

After completion of the migration including the adapted module addresses and the migrated variable table, you can use this dialog in order to transfer a planned change to module addresses automatically to the variable table.

7.4 Comparison of functionality

7.4.1 Overview

The SINUMERIK TIA Portal Toolbox offers a number of functional changes. Some functions differ from the functions that you know from migrating SINUMERIK Add-on for STEP 7 V5.x.

This section provides an overview of the new functionality and compares functions of the TIA Portal with functions from STEP 7 V5.x.

Function	SINUMERIK 840D sl Toolbox for STEP 7 V5.x	SINUMERIK TIA Portal Toolbox
Adding the SINUMERIK PLC basic program	The SINUMERIK Toolbox for STEP 7 V5.x contains a library with the PLC basic program for this specific firmware version.	<i>Extended functionality and changed handling</i> The TIA Portal Toolbox contains various copy templates with basic program blocks for each firmware version.
	Some data blocks are not contained in this library, but rather they are created at runtime on the controller (e.g. axis DB).	The copy templates also contain data blocks of the axes/spindles and DB2 alarms that differ from the toolbox for STEP 7 V5.x. Although this permits a simple symbolic addressing of the blocks, you should add only those blocks that you require in your program. See: User-defined data types from the basic program (Page 125)
Defining user-defined data types (UDT)	In STEP 7 V5.x you can create user-defined data types (UDT) and store them in the "Blocks" folder.	<i>Changed handling</i> In the TIA Portal you can create user-defined structured data types (UDT) in the special "PLC data types" folder. See: Using user-defined data types (UDT) (Page 123)
	The user data blocks from the basic program (e.g. axis DB) provided by SIEMENS are also based on UDT. Symbolic names have been declared for these UDTs in the symbol table without the associated blocks (CPU DBs) being contained in the project.	The user data blocks from the basic program are not based on UDT, but rather they are global DBs. These data blocks are supplied as copy templates and can be added to the project so they can be addressed symbolically. User-defined data types from the basic program (Page 125)
Addressing elements symbolically	In STEP 7 V5.x, you could address operands (I/O signals, flags, counters, times, DBs, FBs) either absolutely or symbolically, although absolute addressing had priority as default.	<i>Changed handling</i> In the TIA Portal, however, symbolic addressing has priority which increases the readability of the program and so simplifies error correction.
	In STEP 7 V5.x, you could assign a symbol to operands (I/O signals, flags, counters, times, DBs, FBs) using the symbol table without the operand itself needing to be contained in the project.	In the TIA Portal, there is no symbol table and all used objects have a symbolic name. See: Changing the operand priority (absolute/symbolic) (Page 127)

Function	SINUMERIK 840D sl Toolbox for STEP 7 V5.x	SINUMERIK TIA Portal Toolbox
Generating and loading PLC symbols	The "PLC Symbol Generator" external tool can be used to export PLC symbols for SINUMERIK Operate.	<i>Simple operation</i> You can export the PLC symbols directly via the TIA Portal. See: Exporting PLC symbols (PLC Symbol Generator) (Page 115)
Organizing objects into libraries	You can organize parts of your program into libraries so, for example, they can be added to other programs.	<i>Extended functionality</i> Libraries in the TIA Portal can contain additional hardware components. See: New library functions (Page 116)
Configuring connections	In STEP 7 V5.x, you open NetPro in order to edit connections.	<i>Simple operation</i> In the TIA Portal, you can edit connections in the net view under "Connections". See: Configuring of connections (Page 121)
Creating SINUMERIK archives	In STEP 7 V5.x, you can create SINUMERIK PLC hardware upgrade archives and PLC commissioning archives to obtain precompiled data for use with SINUMERIK Operate.	<i>Extended functionality</i> In addition to the SINUMERIK PLC archives known from STEP 7 V5.x, you can now create PLC reload archives in which a selection of program blocks is saved. See Handling SINUMERIK archives (Page 122)
Symbolic access to PLC machine data	In STEP 7 V5.x, you can use absolute addressing to access elements of the DB20 (interface for PLC machine data). You can use the symbol table to symbolically address the DB20. The DB20 is created at runtime on the controller.	<i>Changed handling</i> In the TIA Portal, you can symbolically directly access block elements of the DB20 and so access the PLC machine data when you add and declare the DB20 in the project. See: PLC machine data in DB20 (Page 127)

See also

Safety Integrated and Safety Integrated plus (Page 117)

Working in the project view and the portal view (Page 118)

Displaying program blocks in the tabular overview (Page 119)

7.4.2 Exporting PLC symbols (PLC Symbol Generator)

Comparison of functionality

When the SINUMERIK Toolbox is used for STEP 7 V5.x, you could prepare defined symbols for SINUMERIK Operate in the Engineering System by using the external "PLC Symbol Generator" tool.

In the TIA Portal, this functionality is fully integrated in the software and can be called from the menu bar or the shortcut menu (see Section "Generating and loading PLC symbols (Page 89)").

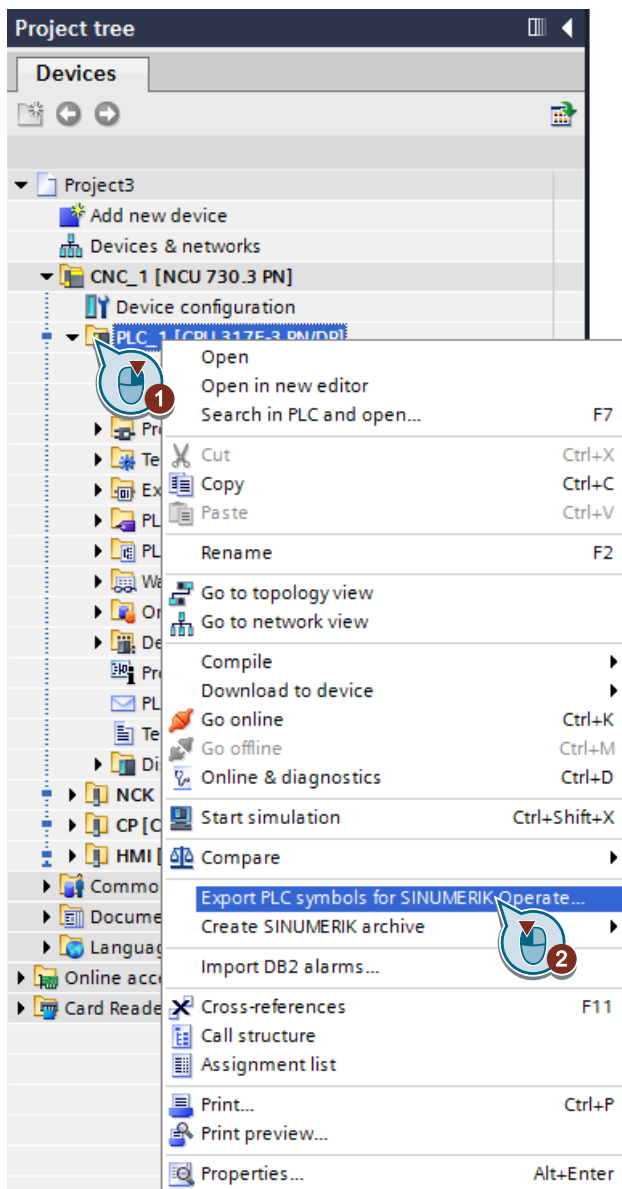


Figure 7-7 Exporting PLC symbols using the shortcut menu

7.4.3 New library functions

Unlike STEP 7 V5.x libraries, TIA Portal libraries can also contain hardware, including the device configuration or inserted modules.

This allows you to copy preconfigured components and configured hardware components with drag-and-drop to a global library in order to add them together with the made settings later to another project.

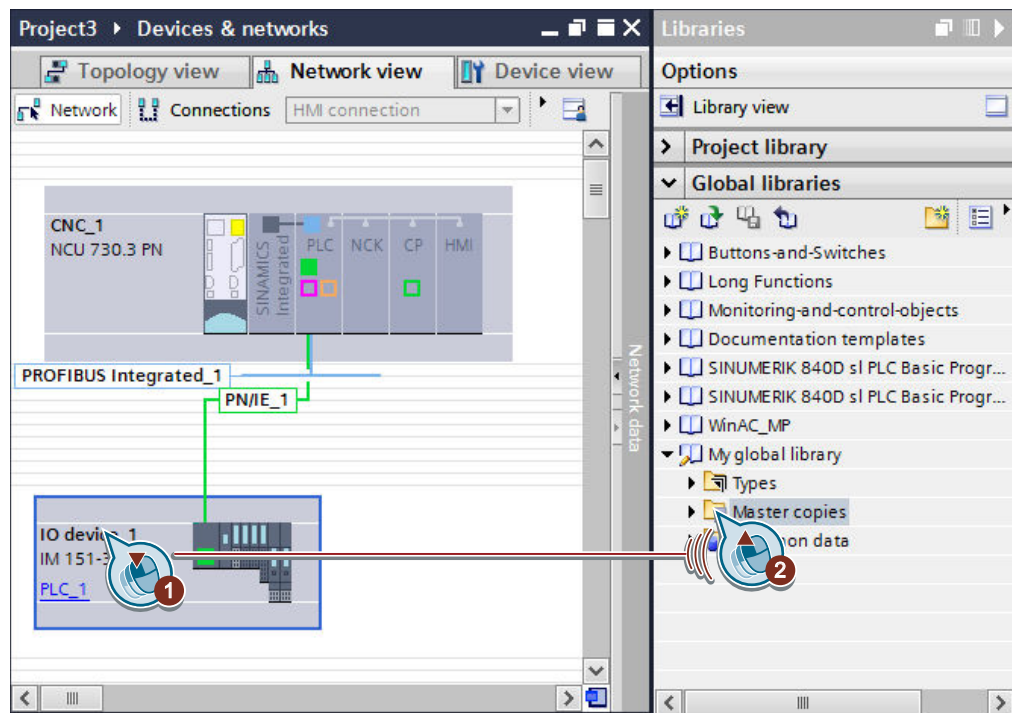


Figure 7-8 Copying hardware with drag-and-drop to a library

Further information for handling libraries in the TIA Portal can be found in the information system under the keyword "Library > Fundamentals".

7.4.4 Safety Integrated and Safety Integrated plus

The F-configuration tool allowed you to use the SINUMERIK Safety Integrated (SPL) safety functions with the SINUMERIK 840D sI Toolbox for STEP 7 V5.x.

Two different Safety Integrated modes are available in the TIA Portal (from NCU Version 4.8), whereby Safety Integrated is deactivated as default setting:

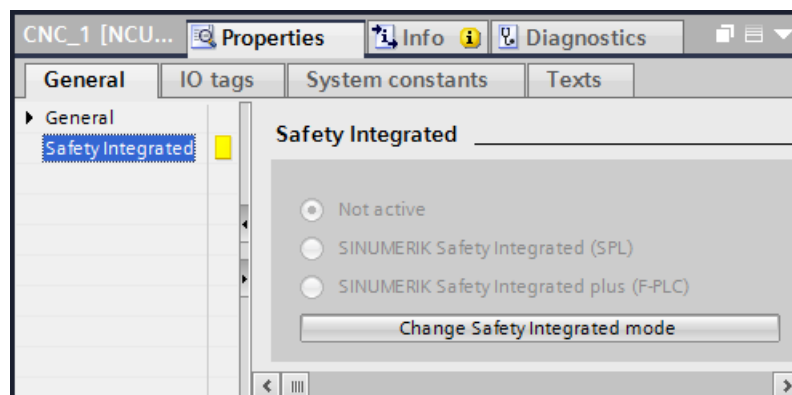


Figure 7-9 NCU Safety Integrated settings are "not active" by default.

The NCU always supports both Safety Integrated modes, although they must be licensed and configured differently. Whether Safety Integrated should be used and its preferred mode depends on the associated automation task.

Consequently, you must decide for a Safety Integrated mode directly after adding the NCU and activate its mode manually in the NCU properties.

The activation at the start of the configuring execution sequence allows the system to assign some safety-relevant parameters automatically (e.g. PROFIsafe addresses).

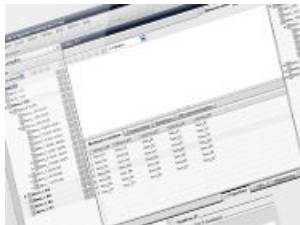
If you do not select the correct Safety Integrated mode already at the start, you may get error messages during the compilation and must set these safety-relevant parameters manually afterwards.

7.4.5 Working in the project view and the portal view

Views in the TIA Portal

The TIA Portal provides various views for the automation project between which you can switch at any time:

- Project view



The project view shows all components of the project as well as all associated work areas and editors.

Working in the project view is similar to working as you know from STEP 7 V5.x.

- Portal view

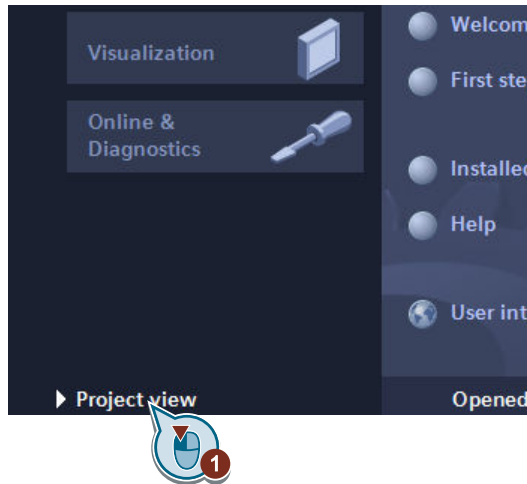


Although the portal view provides a task-oriented overview and configuration options for many important components, such as CPUs, HMI devices or drives, not all configuring options are available (e.g. configure I/O peripherals). If required, an automatic switch to the project view for the selected task is made.

Switching between views

The portal view is displayed during the first start of the TIA Portal or as default setting.

- The associated "Project view" or "Portal view" link in the lower left-hand area can be used to switch the views at any time.



- You can change the settings (via "General > General > Start view") to specify the view to be used to start the TIA Portal.

7.4.6 Displaying program blocks in the tabular overview

In STEP 7 V5.x, the list of the program blocks was not displayed in the project tree, but rather as an overview in the work area. The program blocks could be sorted in this overview, e.g. according to addresses or symbolic names.

In the TIA Portal, you can display the individual program blocks already in the project tree by expanding the "Program blocks" folder. The sorting, however, cannot be set in the project tree, but rather the blocks are always sorted according to type and name.

You can, however, maximize the project tree view in order to display the content of the "Program blocks" folder in the work area.

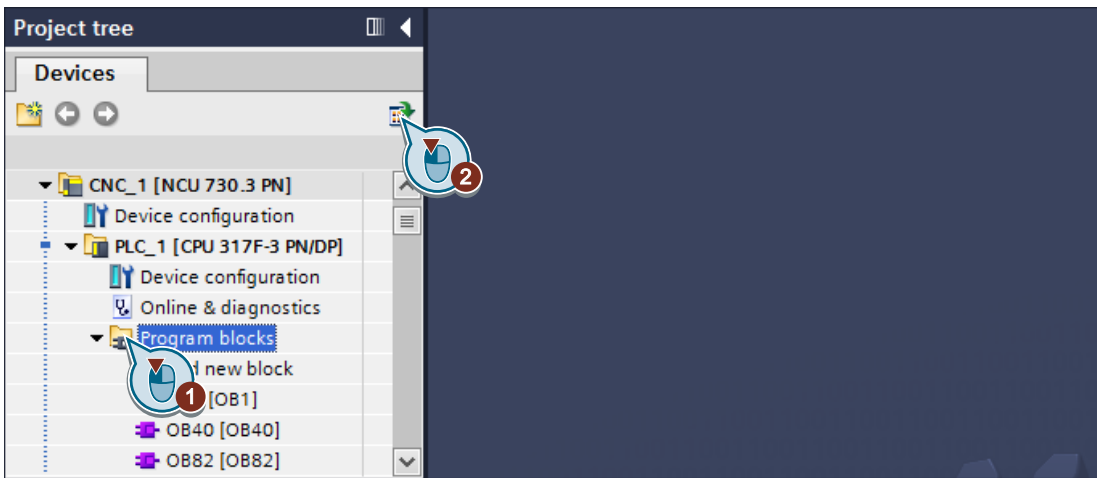


Figure 7-10 Maximizing the project tree

You can then display the program blocks as symbols, list or details. In the details view, you can sort the program blocks according to any column, e.g. according to the address or programming language.

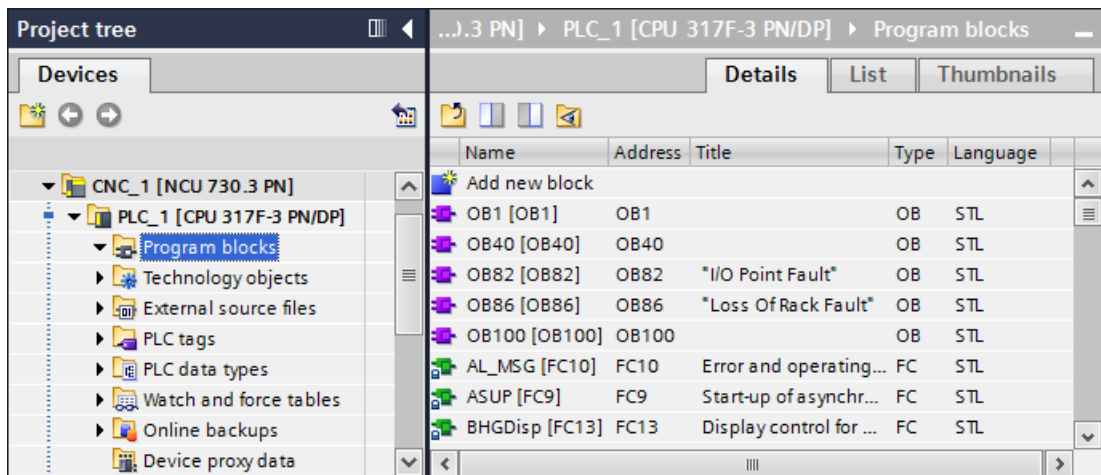


Figure 7-11 Maximized project tree

Further information

- You can find details on the maximized overview in the TIA Portal online help under "Overview window".
- A table with all blocks of the PLC basic program and the associated block addresses, PLC symbols, etc. (e.g. for printing) is available under Tabular listing of blocks (Online Help).

7.4.7 Configuring of connections

Comparison of functionality

In STEP 7 V5.x, you can create connections in NetPro, e.g. for the configuring of interconnected plants. In the TIA Portal, make these settings in the net view.

You can switch the net view by clicking "Interconnect" or "Connections" in the toolbar. In the "Connections" dropdown list, you can select a connection type directly and then use drag-and-drop in the work area to create connections between devices.

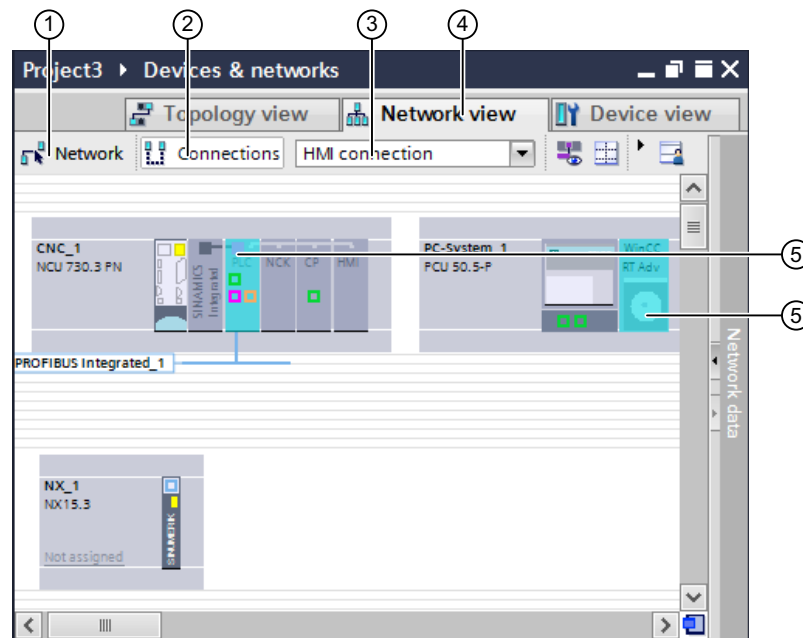


Figure 7-12 Net view with active "Connections" functionality

No	Function	Purpose
1.	Networking	Functionality within the net view with which you can interconnect devices and configure nets.
2	Connections	Functionality within the net view with which you can create connections.
3	Dropdown list for selecting the connection type	Depending on the operational purpose or device type, select in the dropdown list the connection type to be created. The associated possible communications partners are then color-highlighted.

7.4 Comparison of functionality

No	Function	Purpose
4	Net view tab	The "Net view" tab in the "Devices & nets" editor provides two functionalities: "interconnect" and "connections". If you switch to the net view, the "interconnect" functionality is initially active.
5	Color-highlighting of possible communication partners	If you activate the "connections" functionality in the net view, all possible communications partners that match the selected connection type are highlighted. The following can be used as communications partner: <ul style="list-style-type: none">• Controller (e.g. PLC of the SINUMERIK NCU)• PC applications (e.g. WinCC RT Advanced of the PCU 50.5)

Further information

General information on connections in the net view can be found in the online help of the TIA Portal, keyword "Communication via connections".

7.4.8 Handling SINUMERIK archives

Comparison of functionality

Unlike STEP 7 V5.x, data blocks for axes/spindles are now already contained in the project and also saved in the SINUMERIK PLC archive.

You can also create additional so-called PLC reload archives in the TIA Portal with which you can save a selection of program blocks.

Restrictions

The F-blocks used for the Safety Integrated plus (F-PLC) mode cannot be stored in PLC reload archives, because a mutual dependency between F-blocks and the associated hardware configuration with failsafe components exists. Instead, you can save F-blocks together with other blocks and hardware data in a PLC commissioning archive.

Time required for creating and importing archives

If the creation or import takes longer than usual, you may have saved data blocks of non-activated axes/spindles in the archive. In this case, delete the superfluous data blocks in the "Program blocks" folder and recreate the archive.

Further information

- Information about the general handling of copy templates in libraries can be found at Using copy templates (Page 73).
- The detailed procedure and an overview of the data for SINUMERIK PLC archives contained in the TIA Portal are available under Creation of SINUMERIK-PLC archives (online help).

7.4.9 Using user-defined data types (UDT)

Overview

Many programs require user-defined data types that can be edited by various program locations, e.g.

- UDT31: Axis/spindle signals for data blocks Axis1 [DB31]...Axis31 [DB61]
- UDT2: Alarms/messages for data block ALMSG_DB [DB2]

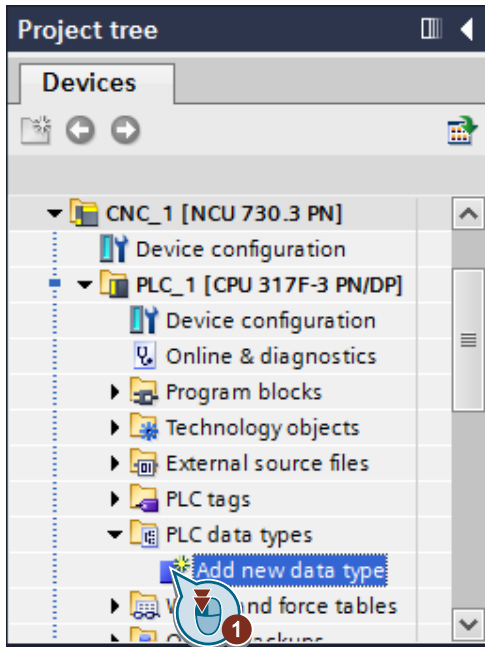
In the PLC basic program of the TIA Portal, the user-defined data types from the basic program (axes/spindles, channels, mode groups, alarms/messages, tool management, PLC/HMI, MCP/HHU) are not based on user-defined data types. Instead, these data blocks are contained in the basic program as global data blocks that define their elements appropriately for each block. This allows them to be directly addressed symbolically. See User-defined data types from the basic program (Page 125).

Comparison of functionality

In **STEP 7 V5.x**, you can define your data types and store these directly in your "S7 program > Blocks" folder in which the data blocks and other program blocks are also stored.

In the **TIA Portal**, you can also declare your own structured PLC data types (UDT), use them in data blocks and address these elements symbolically. These PLC data types, however, are located in a separate folder ("CNC_1 > PLC_1 > PLC data types"). You can also create the UDTs from an external source (STL).

7.4 Comparison of functionality



In **STEP 7 V5.x**, data blocks defined by SIEMENS are also based on UDT (data blocks of axes/spindles, channels, mode groups, alarms/messages, tool management, PLC/HMI, MCP/HHU).

Unlike STEP 7 V5.x, in the basic program in the **TIA Portal**, these data blocks are not based on UDTs, but rather are global DBs that define their elements in each DB. As previously, SIEMENS specifies the structure and the symbology. Consequently, you can copy these data blocks without further dependencies of UDTs in a single step from the system library into the "Program blocks" folder.

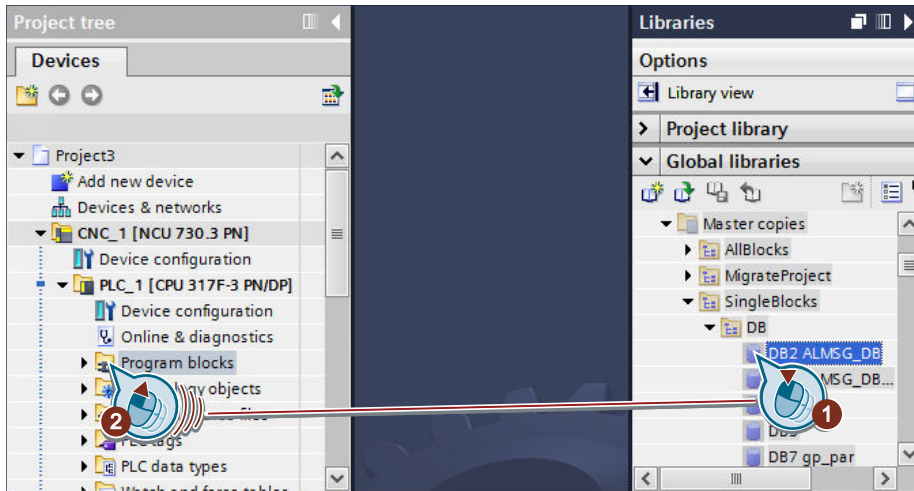


Figure 7-13 Copying blocks from a copy template

Further information

- An overview of the differences between STEP 7 V5.x and the TIA Portal as well as information about the procedure are contained in the Service & Support portal Programming user-defined data types in the TIA Portal (<http://support.automation.siemens.com/WW/view/en/51339156>).
- Information about the concept and the procedure for PLC data types are contained in the information system under the keyword "Data type, PLC data type".
- Information about symbolic programming with UDTs is contained in Section "Symbolic programming of the user program with interface DB" of the Base Functions (FB1) Function Manual.

7.4.10 User-defined data types from the basic program

Comparison of functionality

Unlike the SINUMERIK Toolbox for STEP 7 V5.x, the user data blocks from the basic program in the Engineering System are supplied for the TIA Portal Toolbox:

- Axes/spindles: Axis1 [DB31]...Axis31 [DB61]
- Channels: Chan1 [DB21]...Chan10 [DB30]
- PLC / mode group signals: Mode group [DB11]
- DB2 alarms from the PLC (alarm numbers 500000 to 799999): ALMSG_DB [DB2] or ALMSG_DB_ExtendAIMsg [DB2]
- Tool management DB74 [DB74]
- PLC/HMI signals: MMC [DB19]
- MCP / HHU (SDB210): DB77 [DB77]

They were not contained in the SINUMERIK basic program for STEP 7 V5.x, but rather were created on the NCU only at runtime. You could address them symbolically only with an appropriate symbol table.

In the TIA Portal, these blocks are provided as copy templates in the system library appropriate for your NCU version:

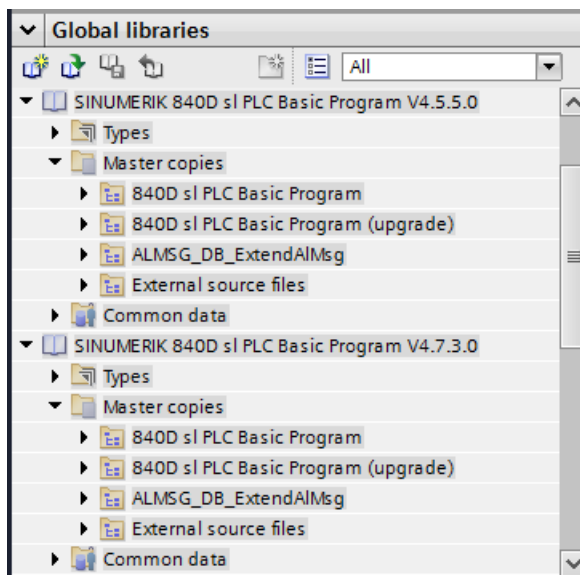


Figure 7-14 "Copy templates" folder in the "Libraries" task card

If you copy them in your project to the "Program blocks" folder, you can also address them symbolically like other blocks. Unlike STEP 7 V5.x, access is no longer made to user-defined data types (UDT), but rather the data structure is defined in the data blocks themselves.

Because of this different handling of the data blocks, you must augment a project migrated from STEP 7 V5.x subsequently with the data blocks, e.g. by means of the "840D sl PLC Basic Program (upgrade)" copy template. Otherwise, access in the user program is made to non-existent data blocks and warnings or errors will be issued during the compilation. (Symbolic access to the elements of a data block is not possible if the data block is not contained in the project.)

You should ensure that only the required axis/channel DBs are stored in the "Program blocks" folder:

- The copy template "840D sl PLC Basic Program (upgrade)" contains all of the know-how-protected blocks that you require for the maximum configuration (31 axes, 10 channels).
- If your machine is using fewer axes or channels, you can either copy only the required blocks or you can delete the blocks that are not required in the project tree after copying. If you have data blocks for non-activated channels or axes/spindles in the project, the procedure for compiling, loading and creating/importing of archives is delayed.

You can also create your own global libraries as copy templates in which, for example, you save only the blocks required for a specific configuration.

Further information

- You will find further information about the data blocks in the copy templates in Sections "Using copy templates (Page 73)" and "Overview (Page 71)".
- A functionality comparison of the symbolic addressing in STEP 7 V5.x and the TIA Portal is available under Changing the operand priority (absolute/symbolic) (Page 127).
- Information about creating your own libraries as copy templates can be found in the information system of the TIA Portal, keyword "Library".

7.4.11 PLC machine data in DB20

The DB20 provides the interface for PLC machine data and is not contained in either STEP 7 V5.x or in the TIA Portal part of the PLC basic program.

In STEP 7 V5.x, you can use absolute addressing to access elements of the DB20 (interface for PLC machine data). You can use the symbol table to symbolically address the DB20.

In the TIA Portal, you can symbolically directly access block elements of the DB20 and so access the PLC machine data when you add and declare the DB20 in the project.

Basic procedure

Add this data block in the "Program blocks" folder so that you can access this data symbolically in the TIA Portal. The declaration for DB20 in the project must match the specified values in the machine data for SINUMERIK Operate (MD14504, MD14506, MD14508).

If you do not create the DB20 in the TIA Portal, it will be created on the NCU at runtime. In this case, you cannot access symbolically the elements of the DB20, and warnings will be issued during the compilation because the block is not found in the project.

Further information

Information about the declaration of the DB20 is contained in the following documentation:

- SINUMERIK 840D sl / 828D Function Manual Basic Functions, Section "PLC machine data"
- SINUMERIK 840D sl List Manual, SINAMICS S120 Lists, Book 2, Section "PLC machine data (DB20)"

7.4.12 Changing the operand priority (absolute/symbolic)

7.4.12.1 Effects of the symbolic addressing

In STEP 7 V5.x, you could address operands (I/O signals, flags, counters, times, DBs, FBs) either absolutely or symbolically, although absolute addressing had priority as default. In the TIA Portal, however, symbolic addressing has priority which increases the readability of the program and so simplifies error correction.

In STEP 7 V5.x, you could assign a symbol to operands (I/O signals, flags, counters, times, DBs, FBs) using the symbol table without the operand itself needing to be contained in the project. In the TIA Portal, there is no symbol table and all used objects have a symbolic name.

7.4 Comparison of functionality

This change of the operand priority in the PLC program can, however, require changes in your migrated user program. Similarly, persons making the migration may need to make themselves familiar with the changed handling of certain functionalities:

- **Data type for PLC variables**

If you define PLC variables in the TIA Portal, you must specify the associated data type. This is tested more restrictively in the TIA Portal than in STEP 7 V5.x. In particular, after the migration, corrections must be made to the user program.

See also:

- Incompatible data types (Page 109)
- LAD/FDB/SCL: Data type conversion with MOVE instruction (Page 109)

- **Declarations only with symbolic addressing**

Each data type (e.g. UDT or blocks) has a symbolic name. You must use the symbolic addressing for the declaration of instances.

See also:

- Declaration of multi-instances (GET [FB2], PUT [FB3]) (Page 128)
- Declaration of static local data in the block interface (Page 131)

- Variables adaptation when changing the module address (Page 112)

7.4.12.2 Declaration of multi-instances

Both in STEP 7 V5.x and in the TIA Portal you can add function blocks as multi-instances using the FB2.

In the TIA Portal, you do not address the block using its address "FB2", but rather symbolically using its "GET" name.

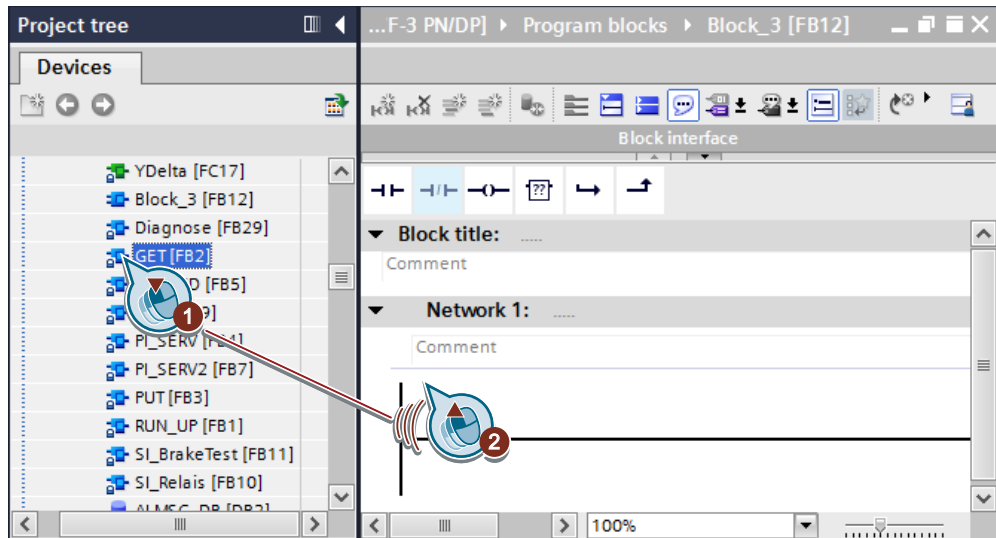
Because GET, however, is also the name of an instruction for S7 communication, you must take care when programming that the correct block is addressed:

- When you enter "GET" (with quotes), the FB2 of the SINUMERIK basic program is addressed.
- When you enter GET (without quotes), the instruction is used for S7 communication.

Procedure

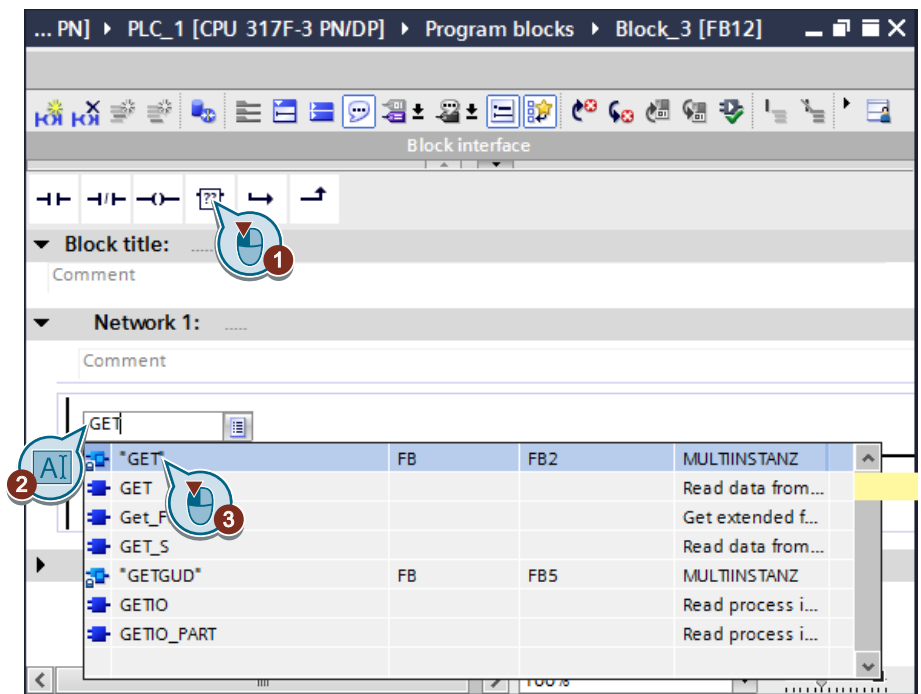
To correctly address the SINUMERIK "GET [FB2]" block rather than the S7 communications instruction GET for programming, use one of the following methods:

- **Addressing a block with drag-and-drop**



You can drag-and-drop the "GET [FB2]" block from the project tree into a network of your block. The "Call options" dialog is then displayed in which you can configure the associated instance data block.

- **Enter the "GET" block name directly (note the quotes)**
If you enter the block completely (e.g. in an STL source, in an empty box or as data type in the block interface), ensure that you write the name within quotes.
- **Enter the GET block name and select "GET" in the auto-complete list**



If you enter the block name itself (e.g. in an empty box or as data type in the block interface), you can select the FB2 from the auto-complete list.

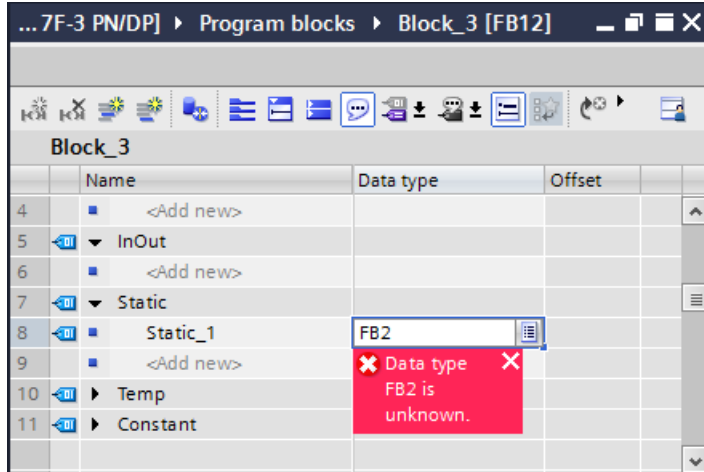
Further information

For further information, refer to the TIA Portal online help:

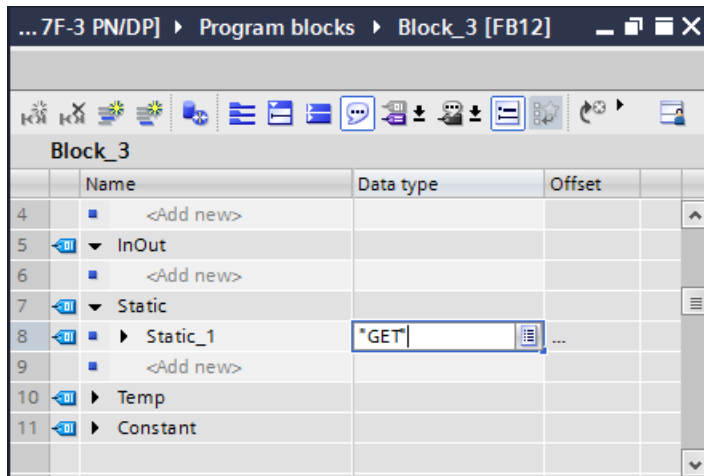
- Fundamentals of instances
- Fundamentals for block properties
- Overview of the block properties

7.4.12.3 Declaration of static local data in the block interface

If, when programming blocks in the block interface, you declare static local data ("Static" section) and want to specify a block as "data type" in order to declare an instance, unlike STEP 7 V5.x, you cannot address absolutely.



Instead, simply enter the symbolic name of the block (e.g. "GET" or "PUT").



In this case, use quotes explicitly to avoid inadvertently addressing an instruction with a similar name. (See also Declaration of multi-instances (Page 128))

7.4 Comparison of functionality

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