

# SIEMENS

## SIMOTION

### SIMOTION D410-2

#### Commissioning and Hardware Installation Manual

#### Preface

---

Safety instructions

1

Description

2

Installing

3

Connecting

4

Commissioning (hardware)

5

Parameter assignment /  
addressing

6

Commissioning (software)

7

Service and maintenance

8

Diagnostics

9

Configuring drive-related  
I/Os (without symbolic  
assignment)

A

Standards and approvals

B

ESD guidelines

C

Valid for  
SIMOTION D410-2 DP and D410-2 DP/PN  
as of version 5.3

## 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.

 <b>DANGER</b>
---

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

 <b>WARNING</b>
--

indicates that death or severe personal injury <b>may</b> result if proper precautions are not taken.
---

 <b>CAUTION</b>
--

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

<b>NOTICE</b>
---------------

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:

 <b>WARNING</b>
--

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.
--

### Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

### 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

## Contents of the Commissioning and Hardware Installation Manual

This document is part of the **SIMOTION D** documentation package.

## Scope

The SIMOTION D410-2 Commissioning and Hardware Installation Manual describes the commissioning and installation of the SIMOTION D410-2 DP and SIMOTION D410-2 DP/PN control units. A separate *SIMOTION D410* Commissioning Manual is available for the SIMOTION D410 DP and SIMOTION D410 PN Control Units.

The software configuration is described in this manual based on SIMOTION SCOUT and SIMATIC STEP 7 Version V5.x.

Information of configuration of the SIMOTION D Control Units in the Engineering Framework Totally Integrated Automation Portal (SCOUT in the TIA Portal), you will find in the configuration manual *SIMOTION SCOUT TIA*. The TIA Portal requires at least SIMOTION SCOUT V4.4 and SIMOTION D4xx-2 Control Units as of firmware V4.3.

## Standards

The SIMOTION system was developed in accordance with ISO 9001 quality guidelines.

## Sections in this manual

The following is a description of the purpose and use of this Commissioning and Hardware Installation Manual:

- **Description**  
This section describes the SIMOTION system and its integration into the information landscape.
- **Installing**  
This section provides information on the the various installation options for the device.
- **Connecting**  
This section provides information about connecting and cabling the various devices, and about the communication interfaces.
- **Commissioning (hardware)**  
This section describes how to start up the device and what you must take into account.
- **Parameter assignment / addressing**  
This section describes how to integrate the SIMOTION D410-2 cm a project and how to configure the interfaces.
- **Commissioning (software)**  
This section describes how to configure a system and how to test the configured drives and axes.

- Service and maintenance  
This section describes how to replace a module, how to run updates, and how to modify settings.
- Diagnostics  
This section provides information on the service and diagnostics options, as well as LED states.
- Appendices with factual information for reference (for example, Standards and Approvals, ESD guidelines, etc.)
- Index for locating information.

## **SIMOTION Documentation**

An overview of the SIMOTION documentation can be found in the SIMOTION Documentation Overview document.

This documentation is included as electronic documentation in the scope of delivery of SIMOTION SCOUT. It comprises ten documentation packages.

The following documentation packages are available for SIMOTION product version V5.3:

- SIMOTION Engineering System Handling
- SIMOTION System and Function Descriptions
- SIMOTION Service and Diagnostics
- SIMOTION IT
- SIMOTION Programming
- SIMOTION Programming - References
- SIMOTION C
- SIMOTION P
- SIMOTION D
- SIMOTION Supplementary Documentation

## **Hotline and Internet addresses**

### **SIMOTION at a glance**

We have compiled an overview page from our range of information about SIMOTION with the most important information on frequently asked topics - which can be opened with only one click.

Whether beginner or experienced SIMOTION user – the most important downloads, manuals, tutorials, FAQs, application examples, etc. can be found at

<https://support.industry.siemens.com/cs/ww/en/view/109480700>

## Additional information

Click the following link to find information on the following topics:

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

<https://support.industry.siemens.com/cs/ww/en/view/109479653>

## My Documentation Manager

Click the following link for information on how to compile documentation individually on the basis of Siemens content and how to adapt it for the purpose of your own machine documentation:

<https://support.industry.siemens.com/My/ww/en/documentation>

## Training

Click the following link for information on SITRAIN - Siemens training courses for automation products, systems and solutions:

<http://www.siemens.com/sitrain>

## FAQs

Frequently Asked Questions can be found in SIMOTION Utilities & Applications, which are included in the scope of delivery of SIMOTION SCOUT, and in the Service&Support pages in **Product Support**:

<https://support.industry.siemens.com/cs/de/en/ps/14505/faq>

## Technical support

Country-specific telephone numbers for technical support are provided on the Internet under **Contact**:

<https://support.industry.siemens.com/cs/ww/en/sc/2090>

## Disposal and recycling

SIMOTION D410-2 is an environmentally friendly product! It includes the following features:

- In spite of its excellent resistance to fire, the flame-resistant agent in the plastic used for the housing does not contain halogens.
- Identification of plastic materials in accordance with ISO 11469.
- Less material used because the unit is smaller and with fewer components thanks to integration in ASICs.

The disposal of the products described in this manual should be performed in compliance with the valid national regulations.

The products can be largely recycled owing to their low pollutant content. For environmentally friendly recycling and disposal of your old device, please contact a company certified for the disposal of electronic waste and dispose of the device in accordance with the regulations in your country.

If you have any further questions about disposal and recycling, please contact your local Siemens representative. Contact details can be found in our contacts database on the Internet at:

<http://www.automation.siemens.com/partner>

## Further information / FAQs

You can find further information on this manual at the following FAQ:

<https://support.industry.siemens.com/cs/ww/de/view/27585482>

The following information sources are also available:

- SIMOTION Utilities & Applications: SIMOTION Utilities & Applications will be included in the SIMOTION SCOUT scope of delivery and, along with FAQs, also contain free utilities (e.g. calculation tools, optimization tools, etc.) as well as application examples (ready-to-apply solutions such as winders, cross cutters or handling)
- The latest SIMOTION FAQs at <https://support.industry.siemens.com/cs/ww/de/ps/14505/faq>
- SIMOTION SCOUT online help
- For additional documentation, see the *Overview of SIMOTION documentation* (separate document).

# Table of contents

	<b>Preface</b> .....	<b>3</b>
<b>1</b>	<b>Safety instructions</b> .....	<b>13</b>
1.1	Fundamental safety instructions .....	13
1.1.1	Safety instructions for electromagnetic fields (EMF) .....	13
1.1.2	Handling electrostatic sensitive devices (ESD) .....	13
1.1.3	Security information .....	14
1.1.4	Note regarding the general data protection regulation .....	14
1.1.5	Danger to life due to software manipulation when using removable storage media .....	14
1.1.6	Residual risks of power drive systems .....	15
1.2	Specific safety information for SIMOTION D410-2 .....	16
<b>2</b>	<b>Description</b> .....	<b>17</b>
2.1	System overview .....	17
2.2	System components .....	21
2.3	I/O integration .....	26
2.4	Commissioning software .....	27
<b>3</b>	<b>Installing</b> .....	<b>29</b>
3.1	General requirements .....	29
3.2	Mounting the SIMOTION D410-2 on the power module .....	30
3.3	Mounting the SIMOTION D410-2 on the mounting plate .....	32
3.4	Mounting the SIMOTION D410-2 in the power module chassis .....	34
<b>4</b>	<b>Connecting</b> .....	<b>35</b>
4.1	General Overview .....	35
4.2	General rules for operating the SIMOTION D410-2 .....	38
4.3	Electromagnetic compatibility .....	40
4.3.1	General .....	40
4.3.2	Environments and categories .....	40
4.4	Protective conductor connection and potential equalization .....	42
4.5	Connecting the power supply .....	46
4.5.1	Safety rules .....	46
4.5.2	Wiring the power supply .....	46
4.6	Connecting DRIVE-CLiQ components .....	48
4.7	Connecting I/Os .....	48
4.8	Creating a shield connection .....	50
4.9	Connecting PROFIBUS/MPI .....	51
4.9.1	PROFIBUS connection components .....	51

4.9.2	PROFIBUS cables and connectors .....	51
4.9.3	Length of PROFIBUS cables .....	52
4.9.4	Rules for the laying of PROFIBUS cables.....	53
4.9.5	Connecting PROFIBUS DP (interface X21 and X24).....	53
4.9.6	Connection rules in the PROFIBUS subnet .....	54
4.9.7	Operating interface X21 as an MPI .....	56
4.10	Connecting PROFINET IO components (D410-2 DP/PN only).....	58
4.10.1	Wiring PROFINET .....	58
4.10.2	PROFINET cables and connectors .....	59
4.11	Connecting Ethernet .....	60
4.12	Routing .....	61
4.12.1	Routing on SIMOTION D .....	61
4.12.2	Routing on SIMOTION D (SINAMICS integrated).....	64
4.13	Connecting an external encoder .....	65
<b>5</b>	<b>Commissioning (hardware).....</b>	<b>67</b>
5.1	Overview .....	67
5.2	Inserting the CompactFlash card .....	67
5.3	Checking the system.....	69
5.4	Switching on the power supply.....	69
5.5	Performing a reset.....	70
5.6	User memory concept.....	71
5.6.1	SIMOTION D410-2 memory model.....	71
5.6.2	Properties of the user memory .....	72
5.6.3	Operations and their effect on the user memory .....	74
5.6.4	Replacing modules in the spare part scenario .....	81
5.7	Fan .....	83
5.7.1	Cooling the SIMOTION D410-2 .....	83
5.7.2	Overview of fan states.....	84
5.7.3	Response to overtemperature.....	85
<b>6</b>	<b>Parameter assignment / addressing.....</b>	<b>87</b>
6.1	Software requirements .....	87
6.2	Creating a project and configuring the communication .....	87
6.2.1	Creating a SIMOTION project and inserting a SIMOTION D410-2.....	87
6.2.2	Configuring the PROFIBUS PG/PC interface .....	89
6.2.3	Configuring the Ethernet PG/PC interface .....	91
6.2.4	Display of the SIMOTION D410-2 in HW Config.....	93
6.3	Configuring PROFIBUS DP .....	94
6.3.1	General information about PROFIBUS DP communication .....	94
6.3.2	Operating SIMOTION D410-2 on PROFIBUS DP .....	96
6.3.3	Assigning PROFIBUS addresses in HW Config .....	98
6.3.4	Setting the DP cycle and system cycle clocks .....	98
6.3.5	Rules for cycle clock settings with SIMOTION D410-2 DP .....	100
6.3.6	Cycle clock scaling of external PROFIBUS interface to internal PROFIBUS interface .....	102
6.3.7	Creating a new PROFIBUS DP subnet.....	104



6.3.8	Establishing a PG/PC assignment .....	105
6.4	Configuring the MPI bus.....	106
6.4.1	Operating interface X21 as an MPI .....	106
6.4.2	MPI parameters.....	106
6.5	Configuring PROFINET IO.....	107
6.5.1	General information about communication via PROFINET IO.....	107
6.5.2	Setting a send cycle clock and system cycle clocks .....	111
6.5.3	Properties of PROFINET.....	114
6.5.4	Configuration tasks .....	114
6.5.5	Rules for cycle clock settings with SIMOTION D410-2 DP/PN .....	115
6.6	Configuring an Ethernet subnet .....	117
6.6.1	General information about communication via Ethernet .....	117
6.6.2	Configuring the Ethernet connection in HW Config.....	119
6.6.3	Configuring Ethernet addresses in HW Config .....	120
6.6.4	Reading out IP and MAC address.....	121
<b>7</b>	<b>Commissioning (software).....</b>	<b>123</b>
7.1	Overview of commissioning .....	123
7.1.1	Requirements for commissioning.....	123
7.1.2	Symbolic assignment / adaptation .....	123
7.1.3	Procedure when commissioning .....	127
7.1.4	Important functions for the project handling and for the commissioning.....	127
7.2	Performing an offline configuration .....	128
7.2.1	Overview .....	128
7.2.2	Accessing the drive wizard.....	129
7.2.3	Configuring components .....	130
7.2.4	Downloading the project to the target system .....	141
7.2.5	Loading a project created offline to the CompactFlash card.....	142
7.2.6	Downloading the project incl. sources and additional data .....	143
7.2.7	Archiving a project on the CompactFlash card (zip file).....	144
7.3	Performing an online configuration .....	145
7.3.1	Overview .....	145
7.3.2	Establishing the online connection.....	146
7.3.3	Starting automatic configuration.....	147
7.3.4	Reconfiguring SINAMICS components.....	149
7.3.5	Downloading the project to SIMOTION D410-2 .....	150
7.4	Additional information on configuring the SINAMICS Integrated .....	151
7.4.1	Setting DP Slave properties .....	151
7.4.2	Using vector drives .....	153
7.4.3	Setting the SIMOTION time of day.....	156
7.4.4	Synchronizing the SINAMICS clock .....	156
7.4.5	Backing up / restoring / deleting SINAMICS NVRAM data .....	159
7.4.6	SINAMICS diagnostic buffer .....	163
7.4.7	Acyclic communication with the drive.....	163
7.4.8	Control properties and performance features .....	164
7.4.9	Current controller cycle clocks <> 125 µs / use of output cams and measuring inputs .....	165
7.4.10	Licenses for the SINAMICS Integrated .....	167
7.4.11	Support of motors with PT1000 temperature sensor .....	168
7.5	Testing the configured drive using the drive control panel.....	168

7.6	Creating and testing axes .....	170
7.6.1	Overview of SIMOTION Engineering .....	170
7.6.2	Creating an axis with the axis wizard .....	171
7.6.3	Testing an axis with the axis control panel.....	178
7.7	Setting up addresses and message frames.....	180
7.7.1	Setting up communication for symbolic assignment .....	180
7.7.2	Message frame configuration .....	180
7.8	Linking an additional encoder (optional) .....	184
7.8.1	General information.....	184
7.8.2	Configuring additional encoders on the drive.....	185
7.8.3	Connecting additional encoders via PROFIBUS/PROFINET.....	186
7.9	Symbolic assignment of I/O variables .....	187
7.9.1	Assignment to the PROFIdrive message frame of the TO axis .....	187
7.9.2	Assignment to drive parameters .....	187
7.10	Configuring drive-related I/Os .....	191
7.10.1	Overview of the symbolic configuration of I/Os .....	191
7.10.2	Configuration options .....	192
7.10.3	SIMOTION D410-2 Configuring I/Os.....	193
7.10.4	Configuration of CU3xx/TMxx I/Os .....	195
7.10.5	Configuration of the ET 200SP/MP timer DIDQ .....	195
7.11	Configuring technology objects and I/O variables.....	196
7.11.1	Configuring global measuring inputs.....	196
7.11.2	Configuring local measuring inputs .....	197
7.11.3	Configuring output cams / cam tracks.....	197
7.11.4	Configuring an I/O variable .....	199
7.12	Creating a DMC20/DME20 DRIVE-CLiQ hub .....	201
7.12.1	Hub properties.....	201
7.12.2	Creating a DRIVE-CLiQ hub .....	202
7.13	Creating and programming TM41 .....	203
7.13.1	TM41 properties .....	203
7.13.2	Configuring TM41 at SINAMICS Integrated .....	203
7.13.3	Configuring the TM41 using the axis wizard .....	204
7.14	Optimizing the drive and controller.....	205
7.14.1	Overview of automatic controller setting .....	205
7.14.2	Automatic speed controller setting .....	206
7.14.3	Automatic position controller setting .....	207
7.14.4	Measuring functions, trace, and function generator.....	208
7.14.5	Manual speed controller optimization.....	210
7.15	Loading and saving SIMOTION user data .....	213
7.16	Deleting data .....	215
7.16.1	Overview of data deletion.....	215
7.16.2	SIMOTION D410-2 memory reset.....	215
7.16.3	Deleting user data on CompactFlash card.....	218
7.16.4	Setting SINAMICS Integrated to the factory settings .....	219
7.16.5	Restoring the default settings for the SIMOTION D410-2.....	219
7.17	System shutdown.....	220

7.18	Configuring Safety Integrated functions .....	220
7.18.1	Overview .....	220
7.18.2	Activate Safety Integrated functions .....	223
7.19	Hot plugging .....	229
7.20	Quantity structures .....	229
7.21	Migration from SIMOTION D410 to SIMOTION D410-2 .....	230
7.21.1	Upgrade from SIMOTION D410 to SIMOTION D410-2 .....	230
7.21.2	Permissible combinations .....	233
7.21.3	CompactFlash card and license combinations.....	234
7.22	Special functions SIMOTION D410-2 .....	235
7.22.1	Automatic restart after FAULT state.....	235
7.22.2	Triggering a restart with a user program .....	236
<b>8</b>	<b>Service and maintenance .....</b>	<b>239</b>
8.1	Overview .....	239
8.2	Replacing modules.....	243
8.2.1	Spare parts replacement for SIMOTION D410-2 .....	243
8.2.2	Removing and replacing the SIMOTION D410-2.....	243
8.2.3	Replacing DRIVE-CLiQ components .....	245
8.2.4	Replacing the fan .....	247
8.2.5	Replacing the CompactFlash card .....	249
8.3	Customizing the project.....	249
8.3.1	Overview .....	249
8.3.2	Creating backup copies (project/CF).....	249
8.3.3	Backing up user data (back up variables) .....	250
8.3.4	Upgrading a user project to the new SCOUT version .....	251
8.3.5	Platform replacement via XML export/import .....	252
8.3.6	Preparing the device replacement .....	254
8.3.7	Device replacement in HW Config .....	255
8.3.8	Upgrading technology packages.....	256
8.3.9	Upgrading the device version of SINAMICS S120 Control Units .....	258
8.3.10	Upgrade the libraries.....	259
8.3.11	Save project, compile and check consistency.....	260
8.4	Performing a firmware and project update .....	260
8.4.1	Upgrading the boot loader on the CompactFlash card .....	260
8.4.2	Update - preparatory measures .....	261
8.4.3	Update via SIMOTION IT web server .....	262
8.4.4	Upgrade via device update tool (upgrading SIMOTION devices) .....	262
8.4.5	Update via CompactFlash card.....	265
8.4.5.1	Backup of CompactFlash card data .....	265
8.4.5.2	Firmware update using a CompactFlash Card.....	266
8.4.5.3	Upgrading SINAMICS .....	267
8.4.5.4	Download project to target system.....	268
8.5	SIMOTION CompactFlash card .....	269
8.5.1	Changing the CompactFlash card.....	269
8.5.2	Writing to a CompactFlash card.....	270
8.5.3	Formatting the CompactFlash card.....	271
8.5.4	Boot loader on the CompactFlash card.....	271

8.5.5	Recommended method of handling CompactFlash cards .....	272
8.5.6	Card reader for CompactFlash cards .....	273
8.5.7	License key on the CF card .....	273
<b>9</b>	<b>Diagnostics .....</b>	<b>275</b>
9.1	Diagnostics via LED displays .....	275
9.2	Diagnostic data and non-volatile SIMOTION data .....	282
9.2.1	Overview .....	282
9.2.2	Backup of diagnostic data and non-volatile SIMOTION data .....	282
9.2.2.1	Diagnostics data .....	282
9.2.2.2	Non-volatile SIMOTION data (retain data) .....	283
9.2.3	Save diagnostic data during running operation .....	283
9.2.4	Save diagnostic data during the startup .....	284
9.2.5	Storing the diagnostic data and non-volatile SIMOTION data .....	286
9.2.6	Diagnostics via websites .....	287
9.2.7	Delete/restore non-volatile SIMOTION data .....	288
9.2.7.1	Overview .....	288
9.2.7.2	Restoring data with switch position "1" or "A" .....	290
9.2.8	Back up diagnostic data and non-volatile SIMOTION data via the web server .....	290
9.2.9	Storing diagnostics data and trace on the CF card .....	292
9.3	Additional service and diagnostics options .....	292
9.3.1	SIMOTION Task Profiler application .....	292
9.3.2	Diagnostics via the SIMOTION IT web server .....	292
<b>A</b>	<b>Configuring drive-related I/Os (without symbolic assignment) .....</b>	<b>295</b>
A.1	Overview .....	295
A.2	Local and global measuring inputs .....	295
A.3	Configuring local measuring inputs .....	297
<b>B</b>	<b>Standards and approvals .....</b>	<b>299</b>
B.1	General rules .....	299
B.2	Device-specific information .....	301
<b>C</b>	<b>ESD guidelines .....</b>	<b>303</b>
C.1	ESD definition .....	303
C.2	Electrostatic charging of individuals .....	303
C.3	Basic measures for protection against discharge of static electricity .....	304
	<b>Index .....</b>	<b>305</b>

# Safety instructions

## 1.1 Fundamental safety instructions

### 1.1.1 Safety instructions for electromagnetic fields (EMF)



#### WARNING

##### **Danger to life from electromagnetic fields**

Electromagnetic fields (EMF) are generated by the operation of electrical power equipment such as transformers, converters or motors.

People with pacemakers or implants are at a special risk in the immediate vicinity of these devices/systems.

- Ensure that the persons involved are the necessary distance away (minimum 2 m).

### 1.1.2 Handling electrostatic sensitive devices (ESD)

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



#### NOTICE

##### **Damage through 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).

### 1.1.3 Security information

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. Siemens' products and solutions 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. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that can be implemented, please visit (<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 are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customers' exposure to cyber threats.


To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed visit (<https://www.siemens.com/industrialsecurity>).

### 1.1.4 Note regarding the general data protection regulation

Siemens observes the principles of data protection, in particular the principle of data minimization (privacy by design). For this product this means:

The product does not process / store any personal data, only technical functional data (e.g. time stamp). If the user links this data with other data (e.g. shift plans) or stores personal data on the same medium (e.g. hard disk) and thus establishes a personal reference, the user must ensure compliance with data protection regulations.

### 1.1.5 Danger to life due to software manipulation when using removable storage media

 <b>WARNING</b>
<b>Danger to life due to software manipulation when using removable storage media</b>
The storage of files on removable storage media involves a high risk of infection, e.g. via viruses or malware. Incorrect parameter assignment can cause machines to malfunction, which can lead to injuries or death.
<ul style="list-style-type: none"><li>• Protect the files on removable storage media against harmful software through appropriate protective measures, e.g. virus scanners.</li></ul>

## 1.1.6 Residual risks of power drive systems

When performing the risk assessment for a machine or plant in accordance with the respective local regulations (e.g. EC Machinery Directive), the machine manufacturer or plant constructor must take into account the following residual risks associated with 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-rays, 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

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

## 1.2 Specific safety information for SIMOTION D410-2

Observe the following safety information when working with SIMOTION D410-2 and its components!



**⚠ WARNING**

**Danger to life from hazardous voltage when connecting an unsuitable power supply**

Only safety extra low voltage in accordance with EN/IEC 609501 may be connected at all connectors and terminals.

**⚠ WARNING**

**Danger to life from unexpected movement of machines on automatic restart**

An automatic restart can be programmed for SIMOTION controllers. When the power returns, the axes start automatically.

Make sure this presents no hazard to personnel or property.

**NOTICE**

**Damage to the CompactFlash card from electrical fields or electrostatic discharge**

The CompactFlash card is an ESD-sensitive component.

De-energize the SIMOTION D410-2 device before inserting or removing the CompactFlash card. The SIMOTION D410-2 is in a de-energized state when all the LEDs are OFF.

Comply with the ESD rules.

**NOTICE**

**Overheating if ventilation clearances are too small**

Insufficient ventilation clearances result in overheating and therefore in more failures and a shortened life of systems / devices.

Make sure the ventilation clearances of 50 mm are provided above and below the components. The ventilation openings may not be covered by connecting cables.



## Description

### 2.1 System overview

#### SIMOTION D

SIMOTION D is a drive-based version of SIMOTION based on the SINAMICS S120 drive family.

With SIMOTION D, the SIMOTION PLC and motion control functionalities as well as the SINAMICS S120 drive software run on shared control hardware.

SIMOTION D is available in two versions:

- SIMOTION D410-2 is a compact Control Unit predestined for single-axis applications.
- SIMOTION D4x5-2 is a Control Unit for multi-axis applications in the SINAMICS S120 booksize format.

The following performance variants of the SIMOTION D4x5-2 Control Units are offered:

Control Unit	Performance variant	Range of applications
SIMOTION D425-2	BASIC performance	For up to 16 axes
SIMOTION D435-2	STANDARD performance	For up to 32 axes
SIMOTION D445-2	HIGH performance	For up to 64 axes
SIMOTION D455-2	ULTRA-HIGH performance	For up to 128 axes or applications with very short control cycles

---

#### Note

The SIMOTION D410-2 is described in this manual.

Separate manuals are available for the SIMOTION D4x5-2 and the SIMOTION D4x5 and SIMOTION D410 predecessor modules.

---

SIMOTION D is an integral part of the Totally Integrated Automation (TIA) concept. TIA is characterized by integrated data management, configuration, and communication for all products and systems. Thus, an extensive toolbox of automation modules is also available for the SIMOTION D410-2.

---

#### Note

In order to cover all variants of SIMOTION D in blocksize format, the product will be referred to as "D410-2". Specific product designations will be used for information that applies only to one product version, e.g. D410-2 DP/PN.

---

## SIMOTION D410-2



Figure 2-1 SIMOTION D410-2 DP (pictured on left), SIMOTION D410-2 DP/PN (pictured on right)

SIMOTION D410-2 is a compact Control Unit for single-axis applications.

The Control Unit is snapped directly on to the SINAMICS Power Module in blocksize format and has an integrated drive control for either one servo, one vector or one V/f axis.

SIMOTION D410-2 can be extended with additional SINAMICS S110/S120 control units (e.g. CU310-2) and so can also be used for smaller multi-axis applications (e.g. with 2 - 3 axes).

Example of a single-axis application

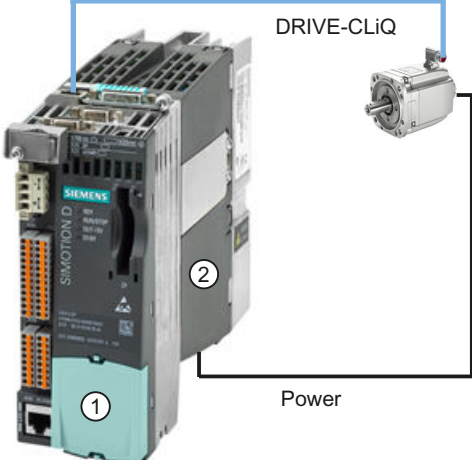


Figure 2-2 Application example with one axis

The example shows a single-axis application, consisting of a SIMOTION D410-2 (Control Unit) ① that is snapped directly on to the SINAMICS Power Module in blocksize format ②. The motors are supplied with power via the Power Module. The encoder is connected by means of DRIVE-CLiQ.

Example of a multi-axis application

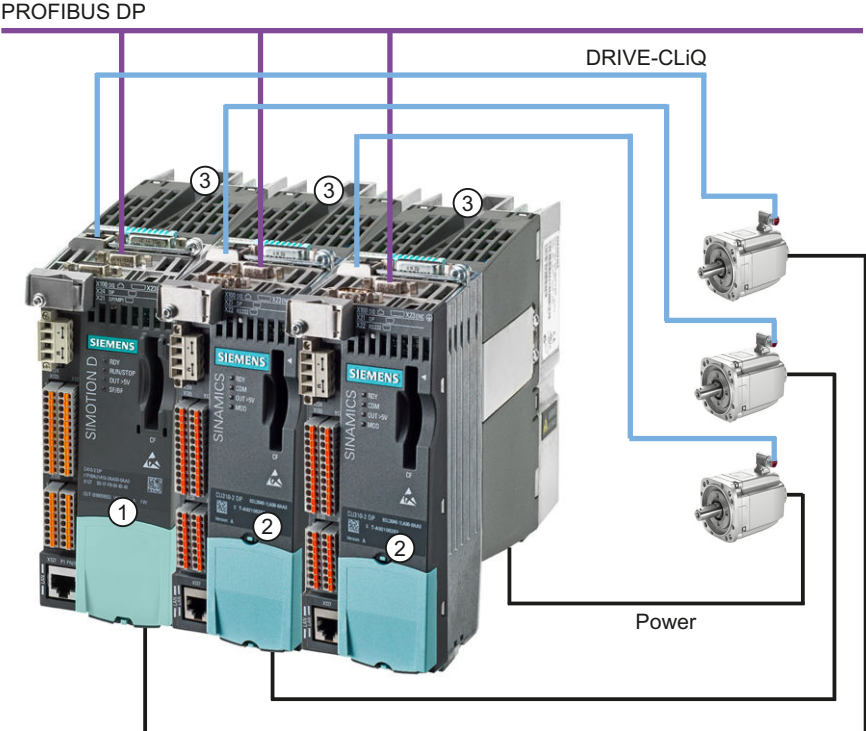


Figure 2-3 Application example with 3 axes

The example shows an application with 3 axes, consisting of:

- One SIMOTION D410-2 DP (Control Unit) ①, snapped on to the Power Module in blocksize format ③  
The SIMOTION D410-2 DP is snapped directly on to the SINAMICS Power Module. The motors are supplied with power via the Power Module. The encoder is connected by means of DRIVE-CLiQ.
- Two SINAMICS S120 CU310-2 DP ②, snapped onto a Power Module in blocksize format ③  
The Control Units are connected to the SIMOTION D410-2 DP via PROFIBUS DP. The two SINAMICS S120 CU310-2 DP are snapped directly on to the SINAMICS Power Module. The motors are supplied with power via the Power Modules. The encoders are connected by means of DRIVE-CLiQ.

---

**Note**

Path interpolation is supported as of V4.4.

---

## Application

Combining a Power Module with SIMOTION D410-2 forms a compact single drive for machine and plant engineering.

Applications include:

- Machine concepts with central drive (e.g. presses, printing and packaging machines, etc.)
- Modular machine concepts where the machine modules were broken down into single axes
- Single drives with high accuracy, stability and concentricity requirements (compared with standard drives) in machine and industrial plant engineering
- Single drives for transport tasks (conveying, raising, lowering)
- Single drives with integrated PLC functionality and expanded motion control functionality such as output cams or cams
- Drives without power recovery (wire drawing, extruding)
- Drive connections with high availability requirements (incoming supply failure may not cause all axes to fail)
- Small multi-axis groupings (typically 2 to 3 axes) based on SINAMICS S110/120 blocksize.

## Hardware components

As central hardware the SIMOTION D410-2 Control Unit is made up of the SIMOTION runtime system and the SINAMICS drive control.

A range of additional SINAMICS S120 components, such as SMx encoder systems or Terminal Modules can be connected via DRIVE-CLiQ.

With a few exceptions (e.g. no BOP20 Basic Operator Panel, etc.), the drive control integrated in SIMOTION D410-2 has the same control properties and performance features as the SINAMICS S120 CU310-2 Control Unit.

## Extension of the drive computing performance

To fully utilize the motion control performance of a SIMOTION D410-2 when required, the drive-side computing performance can be extended by connecting additional SINAMICS S/G Control Units (e.g. CU305, CU310-2, CU320-2, CU250S-2, etc.) via PROFIBUS or PROFINET to the SIMOTION D410-2.

## Software components

The basic functionality of SIMOTION D is supplied on a CompactFlash card containing the following:

- The SIMOTION runtime system with the following functions:
  - Freely programmable runtime system (IEC 61131)
  - Various runtime levels (tasks)
  - PLC and arithmetic functionality
  - Motion control functions
  - Communication functions
- The SINAMICS S120 drive control with the following functions:
  - Closed-loop current and torque control
  - Closed-loop speed control

## 2.2 System components

### Overview

SIMOTION D410-2 communicates with the components of the automation landscape via the following interfaces:

- PROFIBUS DP (D410-2 DP and D410-2 DP/PN)
- PROFINET IO (D410-2 DP/PN only)
- Ethernet
- DRIVE-CLiQ (DRIVE Component Link with IQ)
- Power Module interface (PM-IF)

SIMOTION D features a SINAMICS Integrated drive element. Communication with the SINAMICS Integrated is via PROFIBUS mechanisms (DP Integrated), via PROFIdrive telegrams.

Shorter cycle times and greater numbers of addresses for each node are achieved with the "DP Integrated" compared to the "external PROFIBUS DP."

2.2 System components

The most important components of the system and their functions are shown below.

Table 2-1 System components

Component	Function
SIMOTION D410-2	<p>... is the central motion control module.</p> <p>The module contains the programmable SIMOTION runtime of SIMOTION D410-2 and the SINAMICS S120 drive runtime software.</p> <p>You can use the integrated high-speed I/Os (onboard I/Os) as:</p> <ul style="list-style-type: none"> <li>• User-addressable process I/Os</li> <li>• Homing inputs</li> <li>• Fail-safe digital inputs</li> <li>• Fail-safe digital output</li> <li>• Inputs for measuring inputs</li> <li>• Outputs for fast output cams</li> <li>• Analog input</li> </ul> <p>The measuring sockets can output any analog signals.</p> <p>The DRIVE-CLiQ interface permits a fast connection to the SINAMICS drive components.</p>
System software	<p>The basic functionality of SIMOTION D410-2 is supplied separately on a CompactFlash Card containing the following:</p> <ul style="list-style-type: none"> <li>• SIMOTION runtime (kernel)</li> <li>• Drive software of SINAMICS S120</li> </ul> <p>The CompactFlash card is not included in the scope of delivery.</p>
Power supply (PS)	<p>... provides the electronic power supply for SIMOTION D410-2 (e.g. SITOP power supply).</p>

PROFIBUS DP

SIMOTION D410-2 can communicate with the following components via the PROFIBUS DP interface.

Table 2-2 Components on PROFIBUS DP

Component	Function
Programming device (PG/PC)	<p>... configures, assigns parameters, programs, and tests using the SIMOTION SCOUT Engineering System (ES).</p>
SIMATIC HMI device	<p>... is used for operating and monitoring functions. This is not an essential requirement for the operation of the SIMOTION D410-2.</p>
Other controllers (e.g. SIMOTION or SIMATIC)	<p>... e.g. higher-level controller (plant controller); modular machine concepts with multiple controllers, distributed across individual machine modules.</p>
<b>Distributed I/O systems</b>	
SIMATIC ET 200MP	<p>Modular I/O system for cabinet installation and high channel densities in the SIMATIC S7-1500 packaging system. SIMATIC ET 200MP permits the shortest bus cycle times and fastest response time even with large volumes of data.</p>
SIMATIC ET 200M	<p>Modular I/O system for cabinet installation and high channel densities in the SIMATIC S7-300 packaging system.</p>

Component	Function
SIMATIC ET 200SP	Finely scalable I/O system for cabinet installation; ET 200SP features a single-cable and multi-cable connection with push-in terminals, compact dimensions, high performance, and low part variety.
SIMATIC ET 200S	Finely scalable I/O system for cabinet installation and particularly time-critical applications; including motor starters, safety technology and individual grouping of load groups.
SIMATIC ET 200AL	Modular, distributed I/O system with compact I/O modules in IP65/67; simple installation in all mounting positions even in small spaces; front and transverse screw fastenings on flat surfaces or on aluminum supporting channels; flexible connection to PROFINET or PROFIBUS or simple integration in SIMATIC ET 200SP.
SIMATIC ET 200pro	Modular I/O system with IP65/IP67 degree of protection for machine-related applications with no cabinet; with features such as more compact designs, integrated PROFIsafe safety technology, PROFINET connection, and live module replacement.
SIMATIC ET 200eco	I/O system with IP65/IP67 degree of protection for machine-related applications with no cabinet, with a flexible and fast connection system in ECOFAST or M12.
<b>Other PROFIBUS I/O</b>	
Gateways	<ul style="list-style-type: none"> <li>DP/AS-Interface Link 20E and DP/AS-Interface Link Advanced for the PROFIBUS DP gateway to AS-Interface</li> <li>DP/DP coupler for connecting two PROFIBUS DP networks</li> </ul>
Drive interfaces	<ul style="list-style-type: none"> <li>ADI4 (Analog Drive Interface for 4 axes) for the connection of drives with analog <math>\pm 10</math> V setpoint interface or for external encoders</li> <li>IM 174 (Interface Module for 4 axes) for the connection of drives with analog <math>\pm 10</math> V setpoint interface, external encoders or the connection of stepper drives with pulse/direction interface</li> </ul>
Drive units with PROFIBUS DP interface (e.g. CU310-2 DP)	<p>... convert speed setpoints into signals for controlling the motor and supply the power required to operate the motors.</p> <p>Can also be operated as an isochronous slave on the PROFIBUS DP.</p>
Teleservice adapter	Remote diagnostics

## PROFINET IO

The SIMOTION D410-2 DP/PN can communicate with the following components via the onboard PROFINET IO interface.

Table 2-3 Components on the PROFINET IO

Component	Function
Programming device (PG/PC)	... configures, assigns parameters, programs, and tests using the SIMOTION SCOUT Engineering System (ES).
SIMATIC HMI device	... is used for operating and monitoring functions. This is not an essential requirement for the operation of a Control Unit.
Other controllers (e.g. SIMOTION or SIMATIC)	... e.g. higher-level controller (plant controller); modular machine concepts with multiple controllers, distributed across individual machine modules.
Master computer	... communicates with other devices via UDP, TCP/IP.
<b>Distributed I/O systems</b>	
SIMATIC ET 200MP	Modular I/O system for cabinet installation and high channel densities in the SIMATIC S7-1500 packaging system. SIMATIC ET 200MP permits the shortest bus cycle times and fastest response time even with large volumes of data. With the time-based I/O, signals can be recorded or output to the precise $\mu$ s.

2.2 System components

Component	Function
SIMATIC ET 200M	Modular I/O system for cabinet installation and high channel densities in the SIMATIC S7-300 packaging system.
SIMATIC ET 200SP	Finely scalable I/O system for cabinet installation; ET 200SP features a single-cable and multi-cable connection with push-in terminals, compact dimensions, high performance, and low part variety. With the time-based I/O, signals can be recorded or output to the precise $\mu$ s.
SIMATIC ET 200S	Finely scalable I/O system for cabinet configuration and particularly time-critical applications; including motor starters, safety technology and individual grouping of load groups.
SIMATIC ET 200AL	Modular, distributed I/O system with compact I/O modules in IP65/67; simple installation in all mounting positions even in small spaces; front and transverse screw fastenings on flat surfaces or on aluminum supporting channels; flexible connection to PROFINET or PROFIBUS or simple integration in SIMATIC ET 200SP.
SIMATIC ET 200pro	Modular I/O system with IP65/67 degree of protection for machine-related applications with no cabinet; with features such as compact designs, integrated PRO-FIsafe safety technology, PROFINET IO connection and live module replacement.
SIMATIC ET 200eco PN	Compact block I/O with IP65/66/67 degree of protection for cabinet-free usage in machines with M12 connection method. Very rugged and resistant encapsulated metal enclosure.
<b>Other PROFINET IO I/O devices</b>	
Drive units with PROFINET IO interface	... convert speed setpoints into signals for controlling the motor and supply the power required to operate the motors.
Gateways	<ul style="list-style-type: none"> <li>• IE/AS-Interface link PN IO for the PROFINET IO gateway to AS-Interface</li> <li>• PN/PN coupler for connecting two PROFINET IO networks</li> </ul>

Ethernet

The Control Unit can communicate with the following components via the Ethernet interfaces or be embedded in an automation environment:

Table 2-4 Components on the Ethernet

Component	Function
Programming device (PG/PC)	... configures, assigns parameters, programs, and tests using the SIMOTION SCOUT Engineering System (ES).
Master computer	... communicates with other devices via UDP, TCP/IP.
SIMATIC HMI device	... is used for operating and monitoring functions. This is not an essential requirement for the operation of the SIMOTION D410-2.



## DRIVE-CLiQ

SIMOTION D410-2 can communicate via the DRIVE-CLiQ interface with the following components:

Table 2-5 Components on DRIVE-CLiQ

Component	Function
SINAMICS S120 AC DRIVE drive units (with CUA31/CUA32)	... convert speed setpoints into signals for controlling the motor and supply the power required to operate the motors. The Power Module is connected via CUA31/CUA32. No more than one Power Module can be connected. The chassis Power Module is connected via DRIVE-CLiQ. <b>Note:</b> Components in booksize format are not supported!
TM15, TM17 High Feature Terminal Modules	The Terminal Modules TM15 and TM17 High Feature are used to implement measuring inputs and output cam outputs. In addition, these Terminal Modules provide drive-related digital I/Os with short signal delay times.
TM31 Terminal Module	... enables terminal expansion via DRIVE-CLiQ (additional analog and digital I/Os).
TM41 Terminal Module	... enables terminal expansion (analog and digital I/Os) and encoder simulation via DRIVE-CLiQ. The TM41 can be connected to a real axis.
TM54F Terminal Module	... enables terminal expansion (fail-safe digital inputs/outputs) for controlling the safe motion monitoring functions of the integrated drive. A TM54F is not usually necessary because the SIMOTION D410-2 has 3 F-DI and 1 F-DO.
TM120 Terminal Module	Four temperature sensors (KTY84-130 or PTC) can be evaluated via the TM120 Terminal Module. The temperature sensor inputs are safely electrically separated from the evaluation electronics in the TM120 Temperature Module and are suitable for evaluating the temperature of special motors, e.g. 1FN linear motors and 1FW6 built-in torque motors.
TM150 Terminal Module	The TM150 Terminal Module can be used to evaluate temperature sensors (KTY, PT100, PT1000, PTC, and bimetal normally closed contact). This means, for example, that other temperatures from the process can be measured in addition to the motor temperature. Temperature sensors can be evaluated using a 2, 3 or 4-wire system. Twelve temperature sensors can be evaluated with 2-wire evaluation and six temperature sensors with 3 and 4-wire evaluation.
SMx Sensor Modules	... enable acquisition of encoder data from connected motors via DRIVE-CLiQ.
Motors with DRIVE-CLiQ interface	... allow simplified commissioning and diagnostics, as the motor and encoder type are identified automatically.
DMC20/DME20 DRIVE-CLiQ hub	... enables the number of DRIVE-CLiQ interfaces to be increased and the creation of a point-to-point topology.

**Note**

Please note that SIMOTION D410-2 components in booksize format (Controller Extension, Motor Modules, Line Modules, etc.) are not supported.

SIMOTION D410-2 can only be used with the following Power Modules:

- PM340
- PM240-2 as of SIMOTION V4.4/SINAMICS V4.7

Other Power Modules are not supported by SINAMICS G120 (e.g. PM230).

**Note**

You will find detailed information on components in the SINAMICS S110/S120 family of products in the SINAMICS S110/S120 manuals.

It is possible that older DRIVE-CLiQ components can no longer be used with SIMOTION D410-2. You will find detailed information on this in the SIMOTION D410-2 Commissioning and Hardware Installation Manual in Section "Migration of SIMOTION D410 to SIMOTION D410-2" under "Permissible combinations".

---

**See also**

Permissible combinations (Page 233)

## 2.3 I/O integration

---

**Note**

Note that not all modules in the ET 200 I/O family are approved for SIMOTION. Moreover, system-related functional differences can come into play when these I/Os or I/O systems are used on SIMOTION vs. on SIMATIC. For example, special process-control functions (e.g. HART modules, etc.) are not supported by SIMOTION for the ET 200M distributed I/O system.

A detailed, regularly updated list of the I/O modules approved for use with SIMOTION, as well as notes on their use, can be found at Internet address (<https://support.industry.siemens.com/cs/ww/en/view/11886029>)

---

In addition to the I/O modules enabled for SIMOTION, in principle all certified standard PROFIBUS slaves (DP-V0/DP-V1/DP-V2) and PROFINET IO devices with RT and IRT real-time classes may be connected to SIMOTION D410-2. These modules are integrated using the GSD file (PROFIBUS) or GSDML file (PROFINET) provided by the relevant device manufacturer.

---

**Note**

Please note that in isolated cases, additional boundary conditions must be fulfilled in order to integrate a module into SIMOTION. Thus, a few modules require "driver blocks" , e.g. in the form of function blocks, that permit (or simplify) integration.

For modules enabled for SIMOTION (e.g. SIMATIC S7-300 module FM 350-1, etc.), these driver blocks are part of the SIMOTION SCOUT engineering system command library.

---

## 2.4 Commissioning software

### Requirement

To create and edit projects on your PG/PC, you need the SIMOTION SCOUT commissioning and configuration tool.

For information on how to install SIMOTION SCOUT, see the *SIMOTION SCOUT* Configuration Manual.

---

### Note

SIMOTION SCOUT contains the functionality of STARTER and SIMATIC S7-Technology.

Simultaneous operation of SIMOTION SCOUT, STARTER and SIMATIC S7-Technology as a single installation on one PG/PC is **not** possible.

---

### Integrated STARTER

You can insert a standalone drive (e.g. SINAMICS S120) with the "Insert single drive unit" element in the project navigator. It is commissioned using wizards in the working area of the workbench that contains the STARTER functionality.

### SINAMICS Support Package (SSP)

The following SSPs are relevant for SIMOTION SCOUT:

- SSP "SINAMICS" for single drive units (e.g. CU3xx)
- "SIMOTION SINAMICS Integrated" SSP for the SINAMICS drive integrated into SIMOTION D410-2.

You will find detailed information on the SSPs in the readme files and in the software compatibility list at Internet address (<https://support.industry.siemens.com/cs/ww/en/view/18857317>).

### Upgrading SIMOTION D410-2 projects and hardware

Projects that you have created for one SIMOTION D410-2 firmware version can also be converted for other firmware versions. See, for example, Section Service and maintenance (Page 239).

### SIMOTION IT web server

The SIMOTION D410-2 features an integrated web server.

The web server supports the display of diagnostics and system data in standard Internet browsers, even in the absence of an engineering system, and the carrying out of project/firmware updates.

**Additional references**

You will find detailed information on working with projects in the *SIMOTION SCOUT* Configuration Manual.

You will find detailed information on SIMOTION IT web server in the *SIMOTION IT Diagnostics and Configuration* Diagnostics Manual.

# Installing

## 3.1 General requirements

### Mounting options

SIMOTION D410-2 comes in two designs:

- Mounting on the Power Module in blocksize format (mounted use).
- Mounting on a mounting plate (detached use).

### Open components

SIMOTION D410-2 is an open device! This means, you can only install the modules in housings, cabinets or electrical equipment rooms. These may only be accessible via key or tool. Housings, cabinets, or electrical equipment rooms may only be accessed by trained or authorized personnel. An external fire protection casing is required.



 <b>DANGER</b>
<b>Danger to life from energized parts</b>
Death or serious injury will result if energized parts are touched.
Turn off and lock out all power supplying this device before working on this device.

---

#### Note

The components must be protected against conductive contamination, e.g. by installing them in a control cabinet with degree of protection IP54 according to IEC 60529 or NEMA 12.

If conductive contamination can be excluded at the installation site, a lower degree of cabinet protection may be permitted.

---

## 3.2 Mounting the SIMOTION D410-2 on the power module

### Overview

A SIMOTION D410-2 can be snapped directly on to a SINAMICS S120 Power Module in blocksize format via the PM-IF interface. Power Modules PM340 and PM240-2 (PM240-2 as of SIMOTION V4.4/SINAMICS V4.7) can be used. Operation with SINAMICS G120 PM2x0 Power Modules or booksize Motor Modules is not possible.

---

#### Note

You can connect a Power Module in blocksize format to the DRIVE-CLiQ interface of SIMOTION D410-2 using the CUA31/CUA32 adapter module. Power modules in chassis format AC/AC are connected to SIMOTION D410-2 via the DRIVE-CLiQ interface of the Power Module.

---

### Requirement

As soon as the Power Module is properly installed, you can mount the SIMOTION D410-2 on the Power Module.

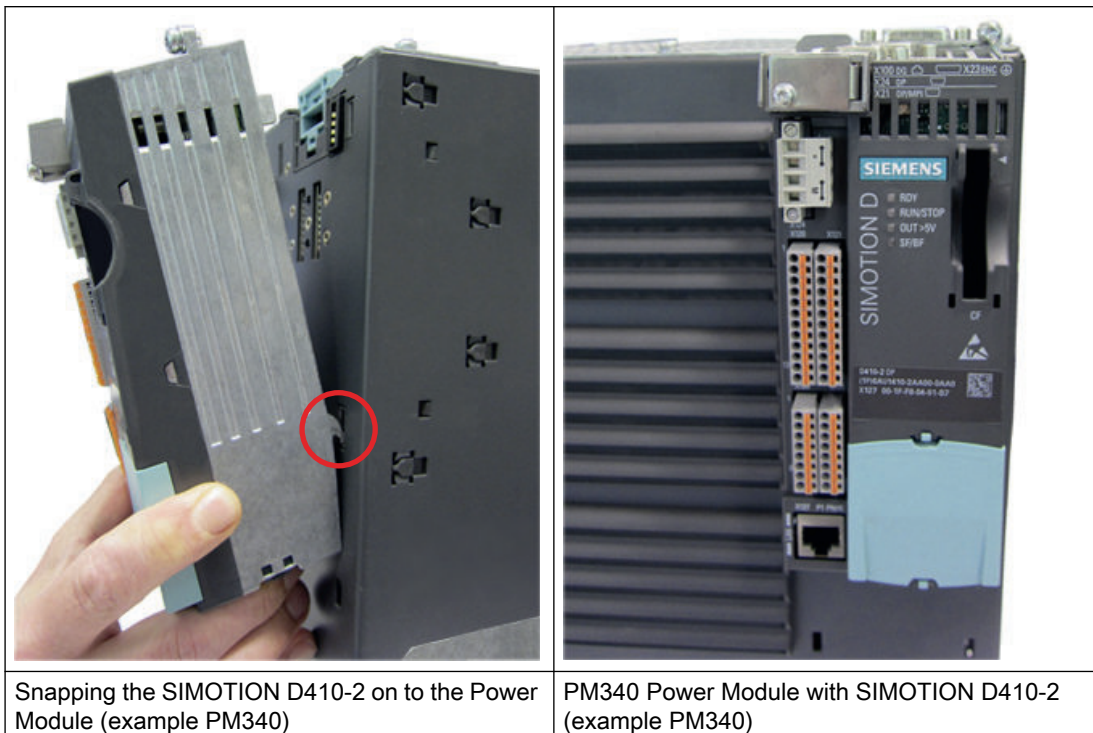
---

#### Note

Note the information in the *SINAMICS S120 AC Drive* Manual when commissioning the Power Module.

---

### Mounting on the Power Module



### Disassembling the SIMOTION D410-2

To remove the SIMOTION D410-2 from the Power Module, the blue release, as shown in the figure, must be pressed down and SIMOTION D410-2 tilted forward.

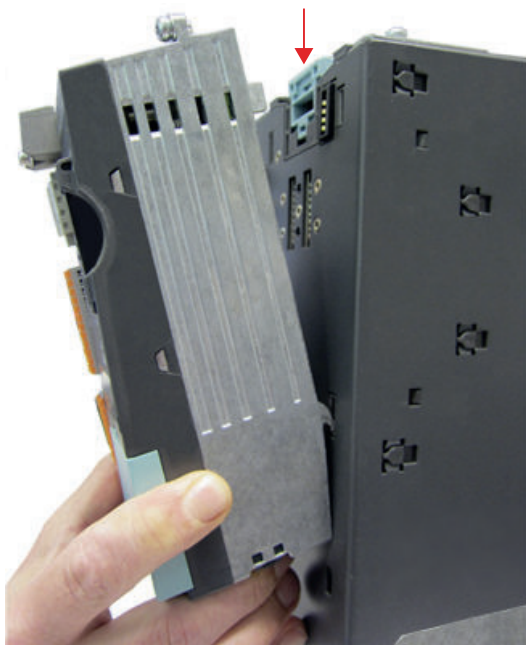


Figure 3-1 Removing the SIMOTION D410-2 from the Power Module

## 3.3 Mounting the SIMOTION D410-2 on the mounting plate

### Overview

Using a mounting plate, SIMOTION D410-2 can be operated separately, which means it is not mounted directly on the Power Module.

Application examples:

- Offset installation using CUA31/CUA32 Control Unit Adapter (e.g. for reducing the mounting depth or in order to use additional interfaces on the CUA).  
The SIMOTION D410-2 is snapped on to the mounting plate and connected to the Power Module in blocksize format via DRIVE-CLiQ using CUA31/CUA32. No more than one Control Unit Adapter can be connected to the SIMOTION D410-2.
- Using SIMOTION D410-2 without a Power Module.  
A SIMOTION D410-2 mounted on the mounting plate is operated without the Power Module (e.g. for hydraulic applications).

### Requirements

You must order the mounting plate for the SIMOTION D410-2 separately. For the article number, see Section "Spare parts and accessories" in the *SIMOTION D410-2* Manual.



## Mounting on mounting plate

1. The mounting plate is attached to the control cabinet.
2. The SIMOTION D410-2 is snapped on to the mounting plate.



Figure 3-2 Mounting the SIMOTION D410-2 on the mounting plate

---

### Note

When operating away from the Power Module, generally the power supply must be realized via the power supply connection (X124).

It is also not possible to use the Safety Integrated Extended and Advanced Functions via the onboard terminals (F-DI, F-DO) in distributed operation.

Observe the information on control cabinet installation in the *SINAMICS S120 AC Drive Manual*.

---

### 3.4 Mounting the SIMOTION D410-2 in the power module chassis

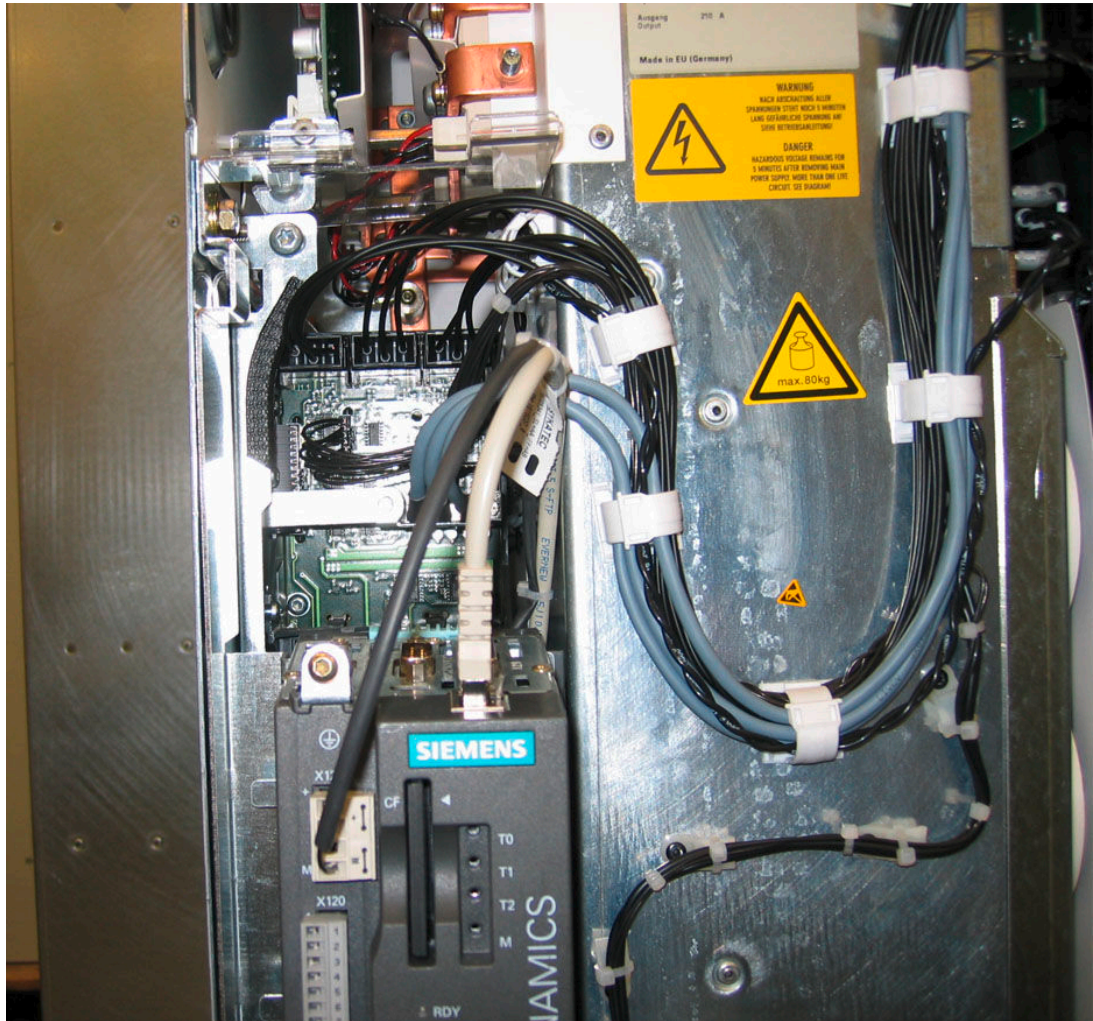


Figure 3-3 Mounting the CU310, for example, in the power module chassis, FX frame size

The DRIVE-CLiQ cable and the cable for the 24 V supply must be correctly routed so that the front flap can close.

---

#### Note

For the power module, a connecting cable is also supplied for the power supply of the SIMOTION D410-2. This cable must be connected to the SIMOTION D410-2.

---

# Connecting

## 4.1 General Overview

### Overview

The SIMOTION D410-2 has a number of interfaces that can be used for connecting the power supply and for communication with the other components of the system.

- The different SINAMICS components are interconnected via DRIVE-CLiQ.
- Actuators and sensors can be connected to the inputs/outputs.
- The SIMOTION D410-2 can be connected to PROFIBUS DP, MPI, Ethernet, and PROFINET (D410-2 DP/PN only) for communication purposes.

Arrangement of the interfaces on the device

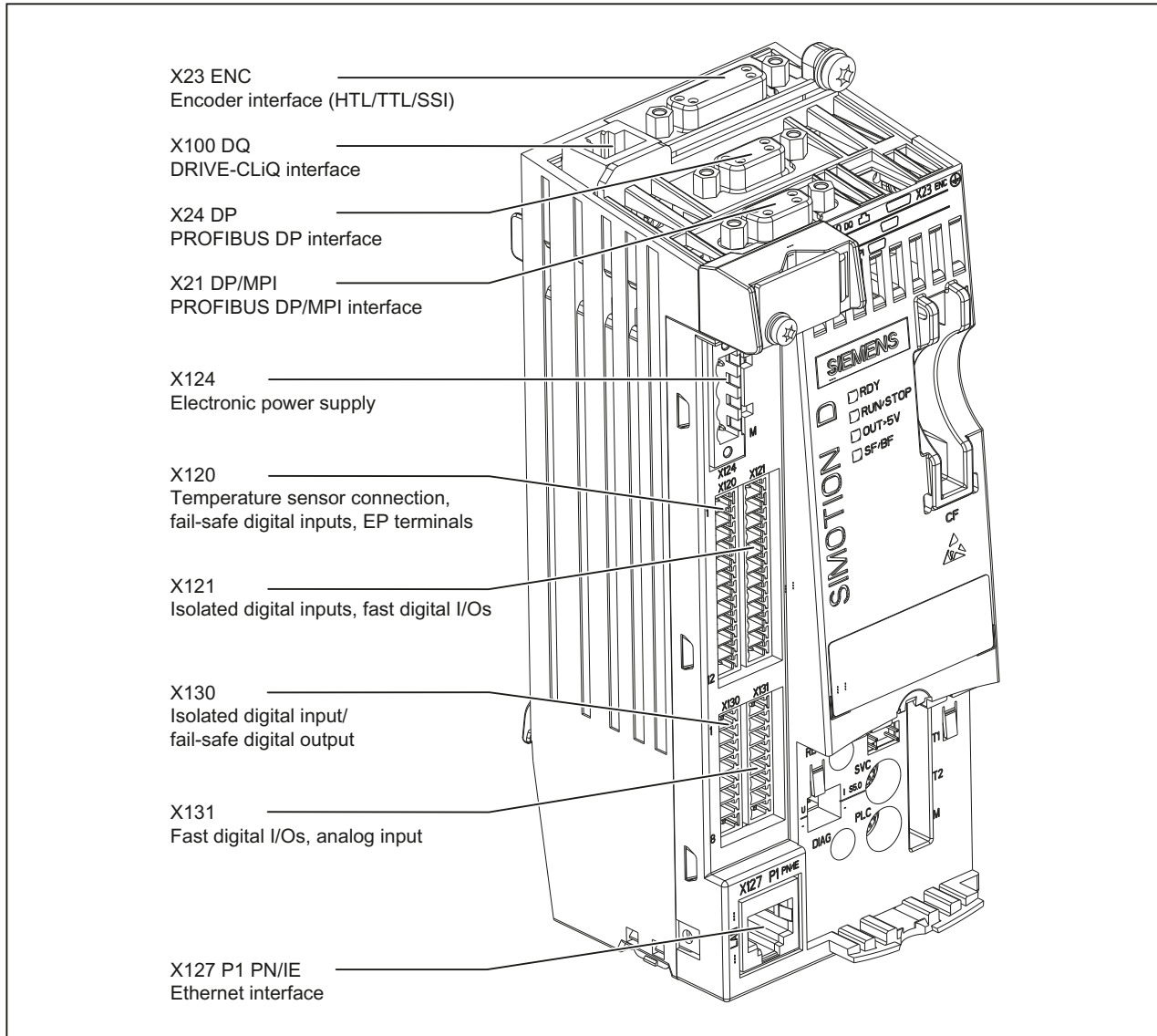


Figure 4-1 SIMOTION D410-2 DP, arrangement of the interfaces on the device

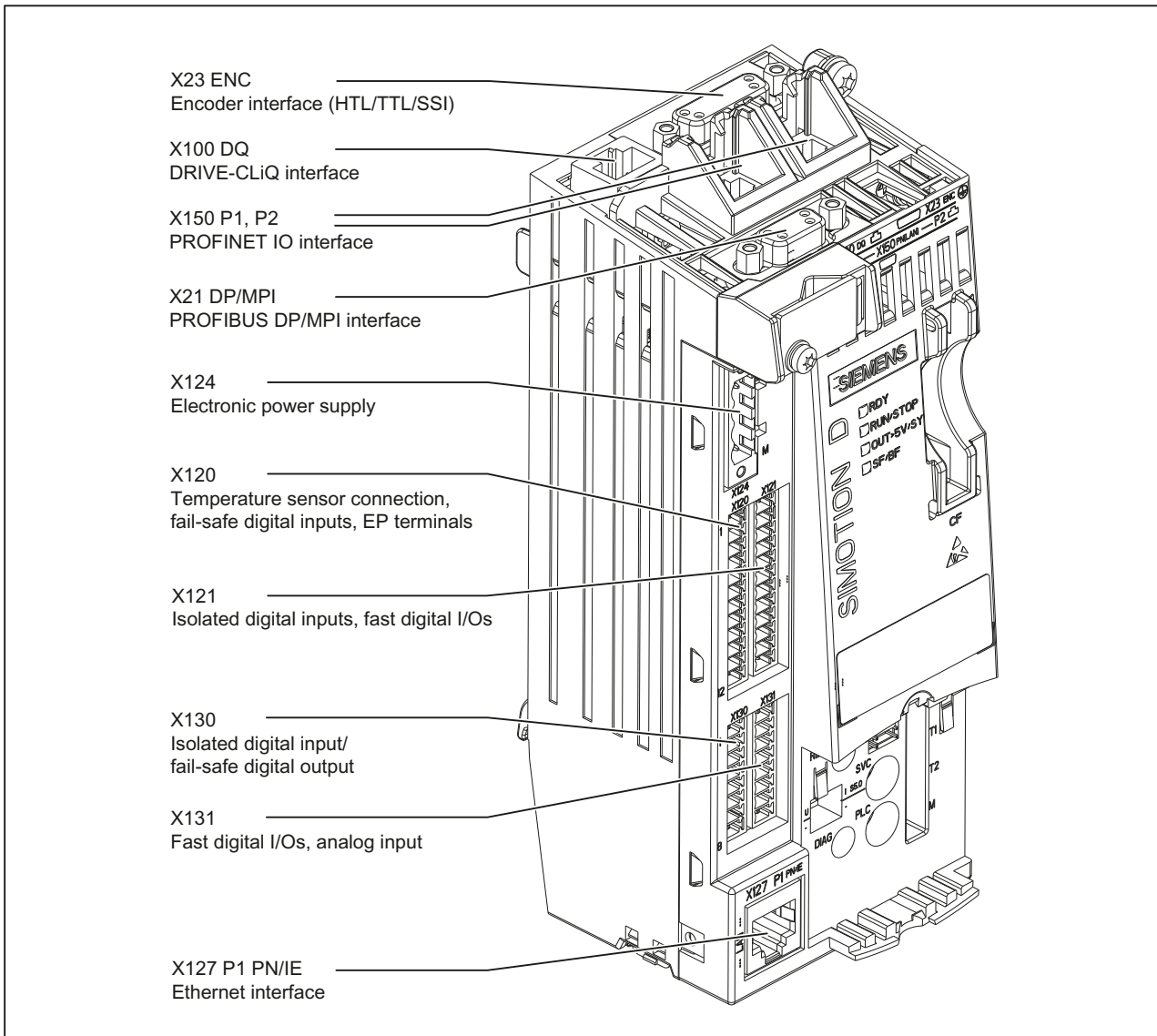


Figure 4-2 SIMOTION D410-2 DP/PN, arrangement of the interfaces on the device

### Overview of connections

The following overview shows examples of the various interfaces and their connection possibilities.

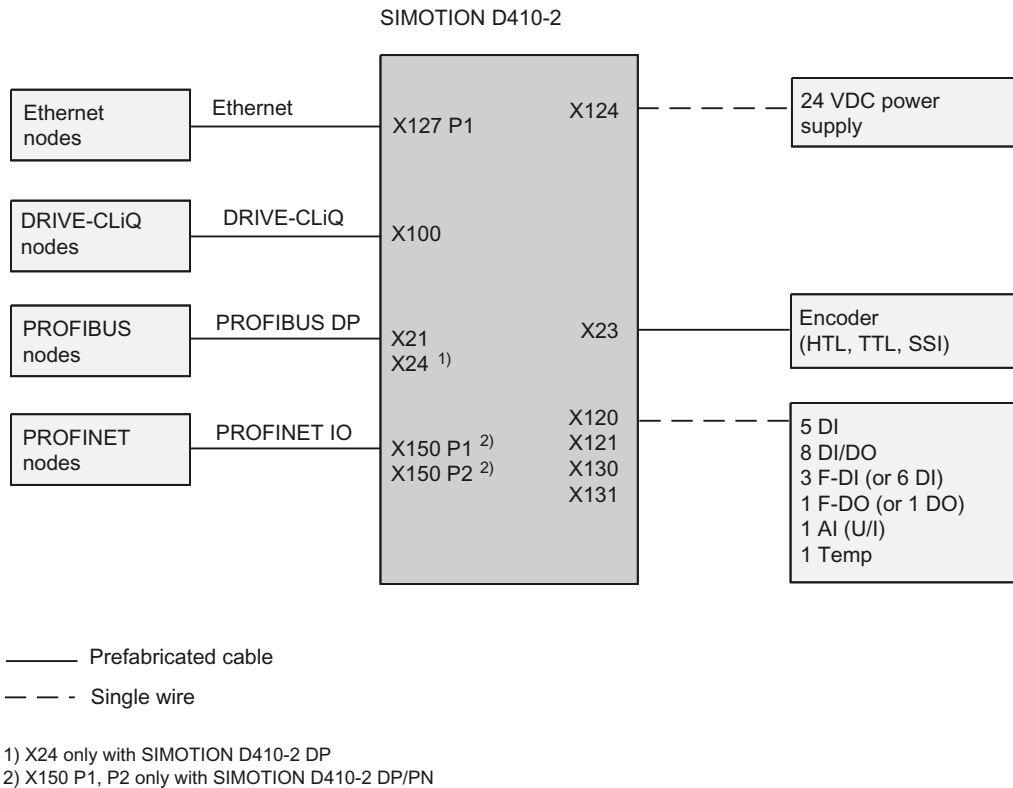


Figure 4-3 SIMOTION D410-2 connection possibilities

## 4.2 General rules for operating the SIMOTION D410-2

When integrating the SIMOTION D410-2 into a system, you must observe the following general rules.

### System startup after certain events

Observe the following rules when starting up a system following certain events:

- During startup after a voltage dip or power failure, no dangerous operating states may result. If necessary, force an EMERGENCY STOP.
- At startup, after unlocking the EMERGENCY STOP apparatus, there must not be an uncontrolled or undefined startup.

## Supply voltage

Observe the following rules for the supply voltage:

- For stationary installations or systems that do not have all-pole line disconnect switches, the building installation must include a line side switch or a fuse.
- For load power supplies and power supply modules, the rated voltage range set must correspond to the local line voltage.
- For all electrical circuits, the fluctuation/deviation of the line voltage from the rated value must be within the permitted tolerance (refer to the technical data of the used components)

## 24 V DC supply voltage

Observe the following rules for the 24 V supply:

- Provide lightning protection (e.g. lightning protection devices):
  - External lightning protection is required for buildings.
  - An internal lightning protection must be provided for for 24 V DC supply cables and signal cables.
- Ensure safe (electrical) isolation of the extra-low voltage for the 24 V supply.



	<b>WARNING</b>
<b>Danger to life from hazardous voltage when connecting an unsuitable power supply</b>	
Implement the 24 V DC supply with protective separation as protective extra-low voltage.	

## Protection against external electrical interference

Observe the following rules for protection against electric effects or faults:

- For all plants or systems, in which SIMOTION is installed, the plant or system must be connected to a protective conductor for the discharge of electromagnetic interference.
- The wiring arrangement and installation must comply with EMC regulations for the supply, signal and bus cables.
- A cable or wire break cannot lead to undefined states in the plant or system for signal or bus cables.

### Rules for current consumption and power loss in an installation

The power loss of all components used in a cabinet must not exceed the maximum amount that can be dissipated from the cabinet.

---

#### Note

When designing the control cabinet, ensure that the temperature inside the cabinet does not exceed the permitted ambient temperature for the components even at high external temperatures.

---

### Additional references

The same installation instructions apply for the SIMOTION D410-2 control unit as for the SINAMICS S120 CU310-2 control unit with regard to EMC.

Refer to *SINAMICS S120 for AC Drives Manual*.

## 4.3 Electromagnetic compatibility

### 4.3.1 General

Electromagnetic compatibility (EMC) means that the devices function satisfactorily, without interfering with other devices and without being disrupted by other devices. The EMC requirements for variable-speed drive systems (PDS, Power Drive System) are described in the product standard IEC/EN 61800-3.

A variable-speed drive system consists of the Control Unit and Power Module as well as the relevant electric motors and encoders, including connecting cables. The driven machine is not part of the drive system.

---

#### Note

##### PDS as component of machines or systems

For the integration of PDS into machines or systems, additional measures may be required so that the product standards of these machines or systems are complied with. The machine or system builder is responsible for taking these measures.

---

### 4.3.2 Environments and categories

The EMC environments and categories are defined in the EMC Product Standard EN 61800-3, as follows:



## Environments

IEC/EN 61800-3 differentiates between the first and second environments - and defines different requirements for these environments.

### First environment

Residential buildings or locations at which the drive system is directly connected to a public low-voltage line supply without intermediate transformer.

### Second environment

All locations outside residential areas. These are basically industrial areas which are supplied from the medium-voltage line supply via their own transformers.

## Categories

IEC/EN 61800-3 differentiates between four drive system categories:

### Category C1

Drive systems for rated voltages < 1000 V for unrestricted use in the first environment.

### Category C2

Stationary drive systems for rated voltages < 1000 V for operation in the second environment. The drive system must be installed by appropriately qualified and trained personnel. Additional measures are required for operation in the first environment.

### Category C3

Drive systems for rated voltages < 1000 V, only for operation in the second environment.

### Category C4

Drive systems for IT line supplies for operation in complex systems in the second environment. An EMC plan must be drawn up.

## SIMOTION

SIMOTION D is designed for industrial use in accordance with Category C2.

### Interference immunity

SIMOTION D and SINAMICS S120 are suitable for operation in the second environment. With regard to interference immunity, SIMOTION D and SINAMICS S120 can be used in the first and second environments.

### Emitted interference

With regard to interference emission, to comply with the limit values in accordance with IEC/EN 61800-3 second environment, Category C2; in particular for the drive system, certain measures must be observed (EMC-conform installation by appropriately qualified and trained personnel, possibly required radio interference suppression filters, etc.) Observe the information on electromagnetic compatibility (EMC).

### EMC notes

---

**Note**

Further information can be found in chapter "Control cabinet installation and EMC" in the SINAMICS S120 AC-Drive Equipment Manual.

---

**Note**

Requirements for implementing EMC are listed in EN 61000-6-2, EN 61000-6-4, EN 61800-3, EN 60204-1 and in the "EMC Installation Guidelines" Configuration Manual. (<https://support.industry.siemens.com/cs/ww/de/view/60612658>)

---

**Note**

Conformance with the EMC Directive of the EC is ensured by following the measures described in the "EMC Installation Guideline" Configuration Manual.

---

## 4.4 Protective conductor connection and potential equalization

### Requirement

You have mounted the Control Unit in the control cabinet.

The SIMOTION D410-2 control unit has a protective conductor connection (M4 screw, Torx T20). This connection is also for the connection of an equipotential bonding conductor.

---

**Note**

Requirements for functional safety for machines and systems; reliability and EMC are only guaranteed with original SIEMENS cables.

---



 <b>DANGER</b>
<b>Danger to life from energized parts</b>
Death or serious injury will result if energized parts are touched.
Turn off and lock out all power supplying this device before working on this device.

### Protective conductor connection

SIMOTION D and the SINAMICS S120 drive system are designed for use in cabinets with a protective conductor connection.

All system components and machine parts must be incorporated in the protection concept.

## 4.4 Protective conductor connection and potential equalization

The drive line-up must be arranged on a common bright mounting plate ① in order to comply with the EMC limit values. The connection ② establishes a low-impedance connection to the mounting plate.

The mounting plate must be connected to the protective conductor connection of the control cabinet. For this purpose, a connection ③ must be established to the protective conductor bar ④. The protective conductor bar ④ must be connected to the protective conductor ⑤.

The protective connection (PE connection) that is used for the motors ⑥ must be established through the motor cable.

For EMC reasons, the motor cable shield must be laid flat at both the Motor Module (MM) / Power Module (PM) and motor.

A protective connection ⑧ must also be established for components that are **not** connected with low impedance (e.g. control cabinet door via hinges ⑦).

Example: Booksize axis grouping comprising Control Unit (CU), Line Module (LM), and Motor Modules (MM) as well as drive in blocksize format comprising a Power Module (PM) with snapped on Control Unit (CU)

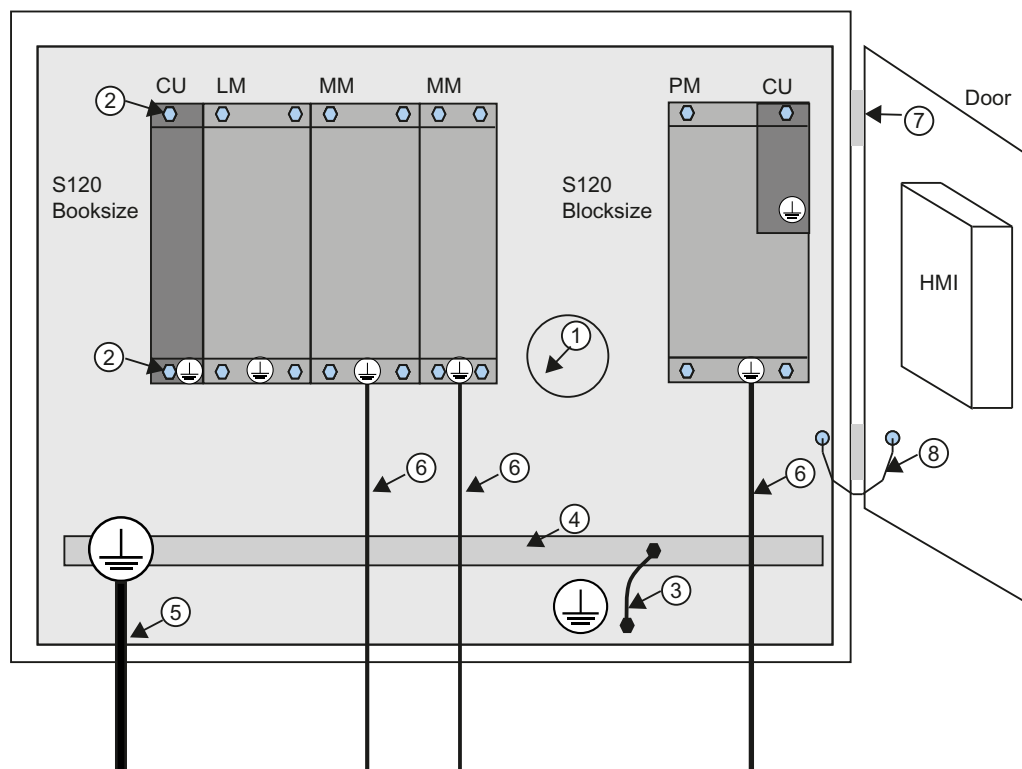


Figure 4-4 Protective conductor connection, cabinet with mounting plate / equipotential bonding surface

4.4 Protective conductor connection and potential equalization

The protective conductor connections must be dimensioned as follows:

Table 4-1 Conductor cross-section for copper protective connections

Line supply cable in mm <sup>2</sup>	Copper protective connections in mm <sup>2</sup>
Up to 16 mm <sup>2</sup>	The same as the line supply cable
From 16 mm <sup>2</sup> to 35 mm <sup>2</sup>	16 mm <sup>2</sup>
From 35 mm <sup>2</sup>	0.5 x line supply cable

For materials other than copper, the cross-section should be increased so that as a minimum, the same conductivity is attained.

**Equipotential bonding**

A mounting plate serves simultaneously as an equipotential bonding surface. This means that no additional equipotential bonding is required within the drive line-up. If a common bright mounting plate is not available, then equally good equipotential bonding ⑨ must be established using cable cross-sections as listed in the table above or, as a minimum, with the same conductivity.

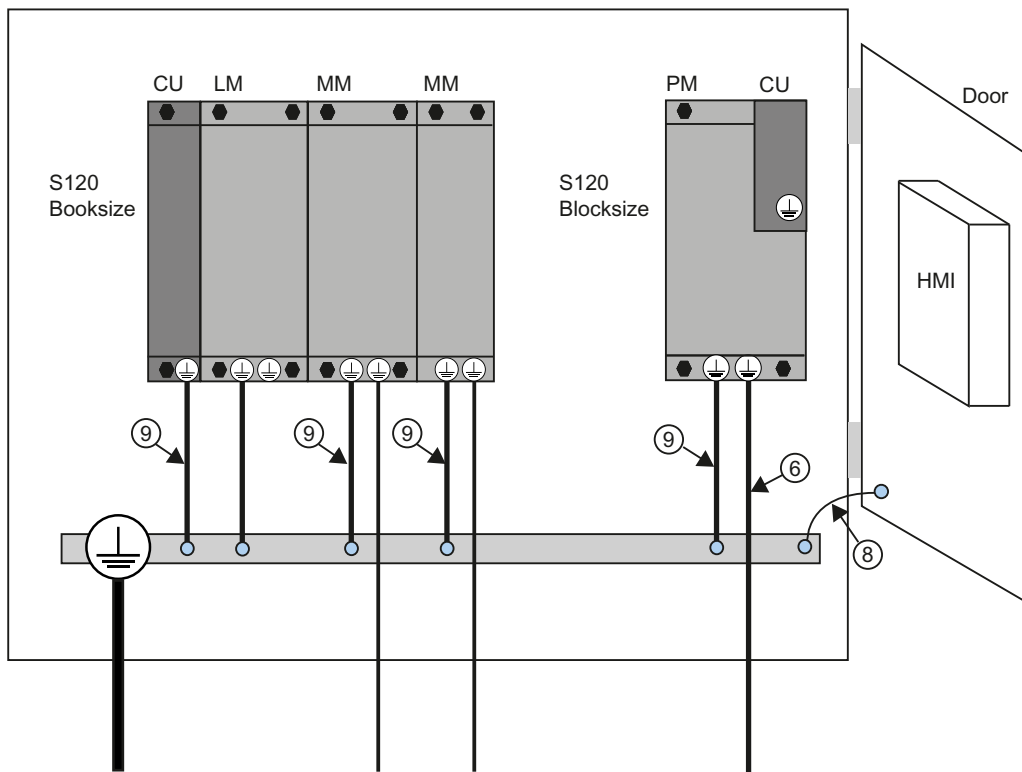


Figure 4-5 Protective conductor connection, cabinet without equipotential bonding surface

**Note**

Ground potential and housing (PE) for the SIMOTION D410-2 are connected internally with low impedance.

**Communication links**

Within the same control cabinet, no equipotential bonding conductor is required for fieldbus components if they installed as described above.

You have to ensure equipotential bonding for communication connections between remote components in a system (e.g. devices in different control cabinets) as well as between buildings or building sections.

If, for example, data cables (PROFIBUS, PROFINET, Ethernet or DRIVE-CLiQ) are routed through several control cabinets, equipotential bonding must be established with an equipotential bonding conductor. Install the equipotential bonding conductor together with the data cable.

The following minimum cross-sections are required according to IEC 60364-5-54:

- For copper, at least 6 mm<sup>2</sup>
- For aluminum, at least 16 mm<sup>2</sup>
- For steel, at least 50 mm<sup>2</sup>

**NOTICE****Fault of the data link or device defect with missing equipotential bonding**

Considerable leakage currents can flow via the data cable if equipotential bonding is not provided. Disturbance of the data link or device faults may result.

Install an equipotential bonding conductor together with the data cable.

Due to the maximum length of 100 m for PROFIBUS copper cable at 12 Mbit/s or for PROFINET copper cable and due to the electrical isolation, EMC protection and equipotential bonding aspects, it is recommended that fiber-optic cables be used for connections between buildings.

**Additional information**

Further information on the protective connection and equipotential bonding can be found in the following references:

- SINAMICS drive system: See the SINAMICS manuals
- PROFIBUS and PROFINET: See the following Internet address (<http://www.profibus.com>) (at Downloads)

## 4.5 Connecting the power supply

### 4.5.1 Safety rules

Because of the wide range of possible applications, only the basic rules for electrical installation are described in this section. At a minimum, you must comply with these basic rules to ensure problem-free operation.

#### Rules for safe operation

In order to ensure safe operation of your equipment, implement the following measures and adapt them to suit your particular conditions:

- An EMERGENCY-OFF concept based on applicable technical specifications (e.g. European Standards EN 60204, EN 418 and associated standards).
- Additional measures to limit the travel of axes (e.g. hardware limit switch).
- Equipment and measures to protect motors and power electronics according to the SINAMICS Installation Guidelines.

In order to identify hazards, we also recommend that a risk analysis be conducted on the entire system in accordance with the basic safety requirements set out in Appendix 1 of the EU machinery directive.

#### Additional references

- Guidelines on Handling Electrostatic Sensitive Devices (ESD), see Appendix ESD guidelines (Page 303) in this manual.
- For installing a system with SIMATIC ET 200 I/O (e.g. ET 200SP, ET 200 MP, etc.), see the manuals for the relevant ET 200 I/O systems.
- For further information on EMC, we recommend the *EMC Installation Guidelines / Basic System Requirements* Configuration Manual  
Download: <https://support.industry.siemens.com/cs/ww/en/view/60612658>

#### Standards and regulations

You must comply with the applicable VDE guidelines when wiring the SIMOTION D410-2, in particular VDE 0100 and VDE 0113 for disconnecting devices, short-circuit and overload protection.

### 4.5.2 Wiring the power supply

If no digital outputs are used or if the SIMOTION D410-2 is being operated on a mounting plate, the SIMOTION D410-2 can be supplied by the Power Module via the PM-IF interface.

If digital outputs are used, a 24 V load power supply must be connected to the X124 screw-type terminal block.

---

#### Note

If a digital output is parameterized and the 24 V load power supply is not connected (or the level is too low), alarm A03506 is issued on the SINAMICS side (can also be parameterized as a fault).

---



 <b>WARNING</b>
--

<b>Danger to life from hazardous voltage when connecting an unsuitable power supply</b>
---

Implement the 24 V DC supply with protective separation as protective extra-low voltage.
--

### Wiring the screw-type terminal block



 <b>DANGER</b>
---

<b>Danger to life from energized parts</b>
--

Death or serious injury will result if energized parts are touched.
---

Turn off and lock out all power supplying this device before working on this device.
--

Use flexible cables with a cross-section of at least 1 mm<sup>2</sup> when you wire the power supply.

Wire-end sleeves are required if you wire several cables per connection.

1. Strip the cable ends.
2. Put on the wire-end sleeve if applicable.
3. Plug the cable end (with wire-end sleeve) into the screw-type terminal connection.
4. Tighten the mounting screw.
5. Plug the screw-type terminal with cables into the X124 connection.
6. Tighten the screw-type terminal block with a flat-bladed screwdriver.

### Reverse polarity protection

The LED "RDY" lights up green when the power supply is connected correctly and switched on.

---

#### Note

The control does not run if the polarity is reversed. However, integrated reverse polarity protection protects the electronics from damage.

---

## Fuse

If the control is defective, an internal fuse protects the electronics from consequential damage (e.g. fire). In this case, the module must be replaced.

## 4.6 Connecting DRIVE-CLiQ components

### Overview

DRIVE-CLiQ connects the components in the SINAMICS S120 drive family as well as SIMOTION D410-2. DRIVE-CLiQ is a communications system, which enables SIMOTION D410-2 to automatically detect connected components. DRIVE-CLiQ provides a wiring tree, the topology of which can be visualized in SIMOTION SCOUT.

Information on the components that can be connected to DRIVE-CLiQ can be found in Section "DRIVE-CLiQ interface" of the *SIMOTION D410-2* Manual.

### Rules for wiring DRIVE-CLiQ

The following rules must be followed for wiring DRIVE-CLiQ:

- Ring wiring is not permitted.
- Components must not be double-wired.

You will find detailed information about DRIVE-CLiQ wiring in the *SINAMICS S120 Control Units and Additional System Components* Manual.

### Procedure

Connect the SIMOTION D410-2 X100 socket to the corresponding sockets on the drive components using the DRIVE-CLiQ signal cable (motor with DRIVE-CLiQ interface, TM and SMx modules).

---

#### Note

Please note that SIMOTION D410-2 components in booksize format (controller extension, motor modules, line modules, etc.) are not supported.

---

## 4.7 Connecting I/Os

### Connecting cables

For the input/output wiring (X120, X121, X130, X131), use rigid or flexible cables with a conductor cross-section as stated in the manual.



See *SIMOTION D410-2* Manual, Section "Digital inputs/outputs / temperature sensor / analog input."

---

### Note

To achieve optimum interference immunity, shielded cables must be used for connecting analog signals, measuring inputs or external zero marks.

---

### Tools required

Screwdriver 0.4 x 2.0 mm

### Wiring inputs/outputs

1. Strip 10 mm off the cable ends and press on a ferrule if required.
2. Wire:
  - The digital inputs for connection of sensors.
  - The digital outputs for the connection of actuators.
  - The analog input
3. Insert the cable into the corresponding spring-loaded terminals of the interfaces. Pressure can be applied to the spring with the tool to facilitate insertion.

### Switching the analog input

For the use of the analog input (X131 connector) as analog voltage or current input, DIP switch S5.0 must be switched accordingly:

Table 4-2 S5.0 switch positions

Position	Function
U (left)	The analog input is used as voltage input.
I (right)	The analog input is used as current input.

### Additional references

The connection examples for the wiring of the inputs/outputs can be found in the *SIMOTION D410-2* Manual, Section "Digital inputs/outputs / temperature sensor / analog input".

## 4.8 Creating a shield connection

### Using shielded cables

The following options are available for the shield connection when using shielded cables:

- A shield connection using a shielding bus supplied separately
- Shield connection via the M3 screw-on shield connecting element on the housing of the SIMOTION D410-2

### Using a shielding bus

If a shielding bus is used, proceed as follows:

1. Attach the cable shield to a grounded shielding bus after the cable entry point in the cabinet. Strip the insulation off the cable first.
2. Continue routing the shielded cable as far as the module, but do not make a connection to the shield there.

### Using a shield connection on the SIMOTION D410-2

1. Unscrew the holding clamp of the M3 shield connection (Torx screwdriver T10) at the top of the SIMOTION D410-2 until there is a space below the clamp.
2. Insert the cable. The cable shield must first be exposed.
3. Tighten the fixing bracket so that the cable shield and cable are pressed against the shield connection (tightening torque 0.8 Nm).

The following figure shows how to connect the cable shield.

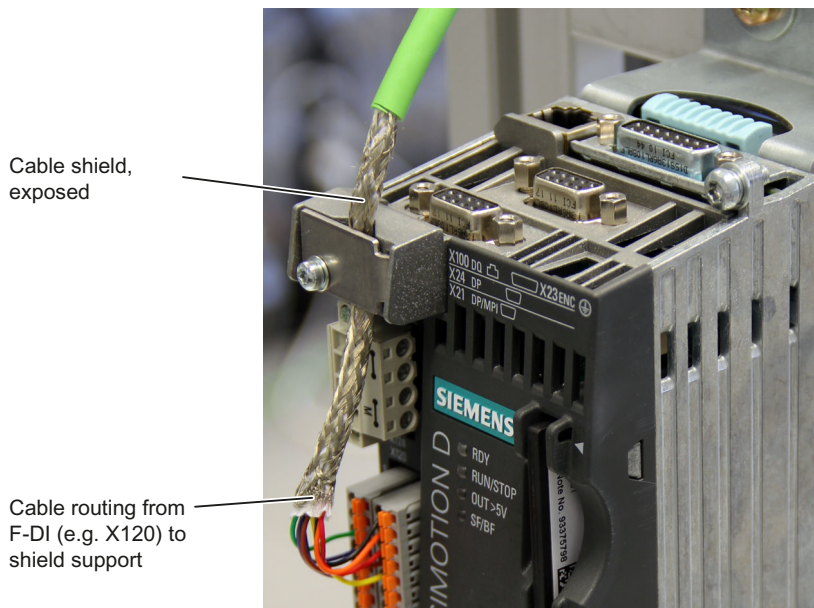


Figure 4-6 Shield connection using the SIMOTION D410-2 DP as an example

## 4.9 Connecting PROFIBUS/MPI

### 4.9.1 PROFIBUS connection components

#### Connection components

Individual nodes are connected by means of bus connectors and PROFIBUS cable. Remember to provide a bus connector with a programming port at the ends of the subnet. This will give you the option of expanding the subnet if required (for example, for a PG or SIMATIC HMI device).

Use RS 485 repeaters for the connection between segments and to extend the cable.

#### Segments

A segment is a bus cable between two terminating resistors. A segment can contain up to 32 nodes. In addition, a segment is limited by the permissible cable length, which varies according to the transmission rate.

#### Terminating resistor

A cable must be terminated with its own surge impedance to prevent line disturbances caused by reflections. Activate the terminating resistor at the first and last node of a subnet or segment.

Make sure that the nodes to which the terminating resistor is connected are always supplied with voltage during power-up and operation.

### 4.9.2 PROFIBUS cables and connectors

#### Properties of PROFIBUS cables

The PROFIBUS cable is a two-core, twisted and shielded cable with defined properties:

Table 4-3 Properties of PROFIBUS cables

Characteristics	Values
Characteristic impedance	Approximately 135 to 160 $\Omega$ (f = 3 to 20 MHz)
Loop resistance	$\leq 115 \Omega/\text{km}$
Effective capacitance	30 nF/km
Damping	0.9 dB/100 m (f = 200 kHz)
Permissible conductor cross-section	0.3 mm <sup>2</sup> to 0.5 mm <sup>2</sup>
Permissible cable diameter	8 mm + 0.5 mm

### Connector features

The bus connector is used to connect the PROFIBUS cable to the PROFIBUS DP interfaces, thus establishing a connection to additional nodes.

Table 4-4 SIMOTION D410-2 PROFIBUS interfaces

	D410-2 DP	D410-2 DP/PN
PROFIBUS DP/MPI interface	X21	X21
PROFIBUS DP interface	X24	–

You will find an overview of the bus connectors available for order in the *SIMOTION D410-2* Manual, Section "Spare parts and accessories".

### 4.9.3 Length of PROFIBUS cables

#### Cable lengths and baud rate

The baud rate determines the cable length of a subnet segment.

Table 4-5 Permitted cable length of a subnet segment for specific baud rates

Baud rate	Max. cable length of a segment (in m)
19.6 to 187.5 kbit/s	1000 <sup>1)</sup>
500 kbit/s	400
1.5 Mbit/s	200
3 to 12 Mbit/s	100

<sup>1)</sup> With isolated interface

#### Longer cable lengths

If you must implement longer cable lengths than permitted in one segment, you must use RS 485 repeaters. The maximum possible cable lengths between two RS 485 repeaters correspond to the cable length of a segment. You can connect up to nine RS 485 repeaters in series.

Note that an RS 485 repeater must be counted as a subnet node when determining the total number of nodes to be connected, even if it does not have its own PROFIBUS address.

## 4.9.4 Rules for the laying of PROFIBUS cables

### Laying of bus cable

During laying of the PROFIBUS cable, you must:

- Not twist the cable
- Not stretch the cable
- Not squeeze the cable

### Supplementary conditions

In addition, when laying a bus cable for indoor use, you must take into account the following supplementary conditions (dA = external cable diameter):

Table 4-6 Supplementary conditions for the laying of PROFIBUS cables

Characteristics	Supplementary conditions
Bending radius for a single bend	80 mm (10xdA)
Bending radius for multiple bends	160 mm (20xdA)
Permissible temperature range for cable routing	-5° C to +50° C
Temperature range for storage and stationary operation	-30° C to +65° C

### Additional references

Length codes for prefabricated cables can be found in:

- *SIMOTION PM 21, SIMOTION Motion Control Catalog*
- *IK PI Industrial Communication Catalog*

## 4.9.5 Connecting PROFIBUS DP (interface X21 and X24)

PROFIBUS cables are connected to the corresponding interface via a bus connector.

Table 4-7 SIMOTION D410-2 PROFIBUS interfaces

	D410-2 DP	D410-2 DP/PN
PROFIBUS DP/MPI interface	X21	X21
PROFIBUS DP interface	X24	–

### Connecting the bus connector

Proceed as follows to connect the bus connector:

1. Plug the bus connector into the corresponding interface of the control unit.
2. Screw the bus connector into place.  
If the control unit is located at the start or end of a segment, you must switch on the terminating resistor ("ON" switch setting).



Figure 4-7 Terminating resistor "switched on" or "switched off"

#### Note

Make sure that the nodes at which the terminating resistor is located are always supplied with voltage during startup and operation.

### Removing the bus connector

You can remove the bus connector with a looped-through bus cable from the PROFIBUS DP interface at any time without interrupting data traffic on the bus.

#### NOTICE

##### Data communication disturbed because bus terminator missing

A bus segment must be terminated at both ends with a terminating resistor. This is not the case if the last bus connector node is de-energized, for example. Because the bus connector takes its voltage from the station, this terminating resistor is ineffective.

Make sure that the stations at which the terminating resistor is connected are always energized.

## 4.9.6 Connection rules in the PROFIBUS subnet

### Introduction

There are a number of rules for configuring and installing cables for PROFIBUS networks to ensure seamless communication over PROFIBUS. These rules apply to both configuring and cabling as well as address assignment for the different network nodes.

## Connection rules

- **Before** you interconnect individual nodes in a subnet, you must assign a unique PROFIBUS address to each node.
- Narrow down the number of nodes by limiting the PROFIBUS addresses to the highest address in the network.  
Tip: Mark the address on the housing of all nodes in a subnet. Then you can always see which address is assigned to which node in your system.
- Connect all nodes in a subnet "in series". No spur lines may be routed to the PROFIBUS DP. In addition, integrate the PGs and SIMATIC HMI devices for commissioning or servicing in the subnet in series.
- If you operate more than 32 nodes on a subnet, you must use RS 485 repeaters to connect the bus segments. More detailed information can be found in the description of the RS 485 repeater, see the *S7-300 Automation Systems, Module Data Manual*.  
In a PROFIBUS subnet, all segments combined must have at least one DP master and one DP slave.
- Use RS 485 repeaters to connect ungrounded bus segments and grounded bus segments.
- The maximum number of nodes per bus segment decreases with each RS 485 repeater. This means that when a bus segment contains an RS 485 repeater, the bus segment can contain no more than 31 additional nodes. However, the number of RS 485 repeaters does not affect the maximum number of nodes on the bus.
- Up to 10 segments can be connected in a row (max. 9 repeaters).
- **At least** one terminator must be supplied with **5 V**.  
To accomplish this, the PROFIBUS DP connector with an activated terminating resistor must be connected to a device that is switched on.
- Before inserting a new node on the subnet, you must switch off its supply voltage. The station must be inserted **first** and then switched on.  
When a station is disconnected, the connection must **first** be deactivated and then the connector withdrawn.
- The bus line of a segment must be terminated at **both ends**. This is achieved by switching on the terminating resistor in the PROFIBUS DP connector at the first and last node and switching off the other terminating resistors.

**Example**

This illustration below shows an example configuration of a subnet with SIMOTION D410-2 DP.

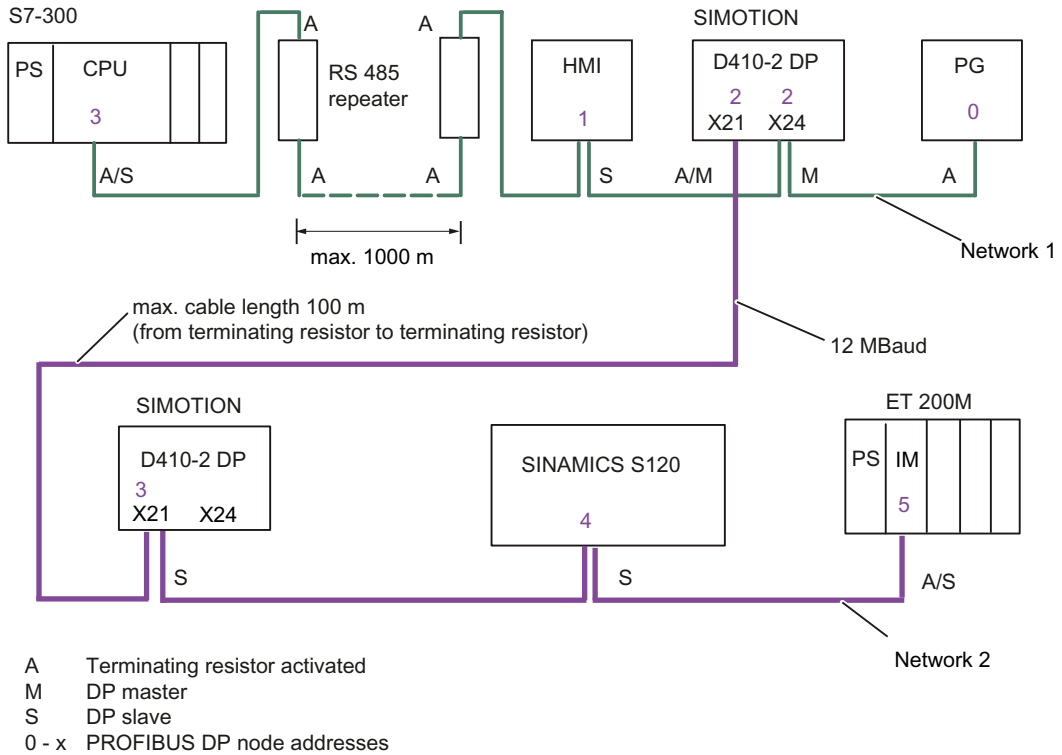


Figure 4-8 Networking example of SIMOTION D410-2 DP

**4.9.7 Operating interface X21 as an MPI**

**Applications**

The X21 interface can also be operated as an MPI interface instead of a PROFIBUS DP interface. The typical (default) baud rate is 187.5 Kbaud. A baud rate of up to 12 MBaud can be set for communication with other CPUs. It should be noted, however, that a rate of 12 MBaud is not supported by all CPUs (e.g. smaller SIMATIC S7 CPUs).

The following list provides examples of when using MPI (multi-point interface) may prove effective:

- If a PC/PG is being used with an MPI interface
- If an OP/TP only has an MPI interface (newer devices have PROFIBUS or PROFINET interfaces)
- If SIMOTION and SIMATIC CPUs are coupled via XSEND/XRECEIVE



When communicating with XSEND/XRECEIVE, there is no need to configure the connection in **NetPro**. XSEND/XRECEIVE can be used via PROFIBUS or MPI.

- Via PROFIBUS: For communication between SIMOTION devices
- Via MPI: For communication between SIMOTION and SIMATIC S7 devices  
The SIMOTION interface must be connected to the MPI interface of the SIMATIC S7 devices. Connection via PROFIBUS is not possible.  
The baud rate of the SIMATIC S7 device must be set at the SIMOTION interface (see documentation for the relevant SIMATIC S7 devices).

## Operate MPI like PROFIBUS

The information on wiring the connector (terminating resistors) and the rules for routing of cables for PROFIBUS apply to this interface as well. When carrying out this procedure, consult the relevant references.

## Connector features

The bus connector is used to connect the MPI bus cable to the MPI interface (X21). This enables you to establish connections to additional nodes (e.g. PG or SIMATIC S7-CPU).

You will find an overview of the bus connectors available for order in the *SIMOTION D410-2* Manual, Chapter "Spare parts and accessories".

## MPI bus cable

The PROFIBUS cable specifications apply here as well;

Please note the relevant information on setting up an MPI network.

## Setting up an MPI network

Keep in mind the following basic rules when setting up an MPI network:

- When using interface X21 as an MPI interface, it is not possible to arrange additional control for a drive in isochronous mode or to connect distributed I/Os to this interface.
- An MPI bus line must be terminated at both ends. This is achieved by activating the terminating resistor in the MPI connector in the first and last station and deactivating the other terminating resistors.
- At least one terminator must be supplied with 5 V.  
This means that an MPI connector with an activated terminating resistor must be connected to a device that is switched on.
- Spur lines (cables leading from the bus segment to the station) should be as short as possible, that is, < 5 m in length. Unused spur lines should be removed wherever possible.

4.10 Connecting PROFINET IO components (D410-2 DP/PN only)

- Every MPI station must be connected to the bus first and then activated. To disconnect the station, it must first be deactivated. Then, the station can be removed from the bus.
- Maximum cable lengths:
  - 200 m per bus segment
  - 2,000 m total length with RS 485 repeaters

**Note**

You can also use intelligent DP slave functionality for PROFIBUS communication between CPUs.

## 4.10 Connecting PROFINET IO components (D410-2 DP/PN only)

### 4.10.1 Wiring PROFINET

#### Procedure

As standard, a SIMOTION D410-2 DP/PN has a PROFINET IO interface with two ports.

Suitable PROFINET cables and connectors must be used for the PROFINET connection. The autocrossing functionality of the PROFINET interface means crossed as well as uncrossed cables can be used.

#### Mixed operation of IRT and RT

For mixed operation of IRT and RT, note that the IRT-capable devices must form a so-called IRT domain, i.e. there must not be any non-IRT devices on the data transmission link between the IRT devices.

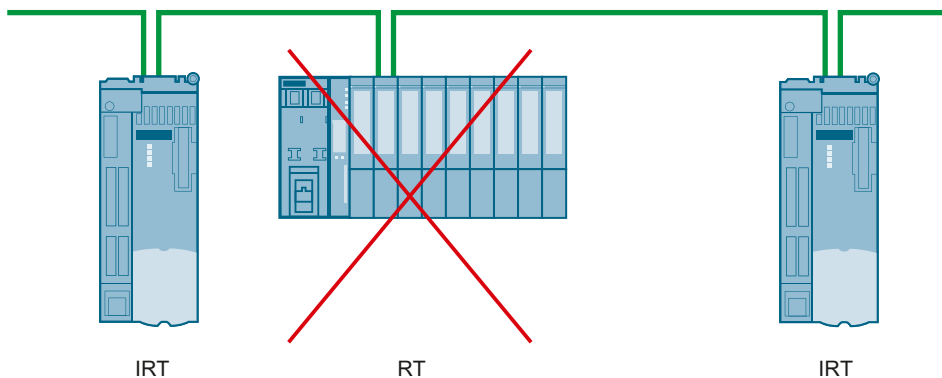


Figure 4-9 Mixed operation of IRT and RT

## 4.10.2 PROFINET cables and connectors

### Cable and connector types

#### Note

For connecting PROFINET IO to D410-2, a connector with a 180° cable outlet is recommended (IE FC RJ45 plug 180).

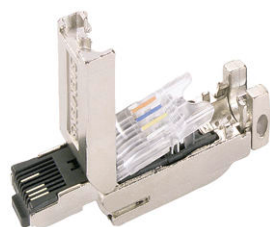


Figure 4-10 RJ45 PN connector with a 180° cable outlet

Table 4-8 Connector types for PROFINET

Connectors	Designation	Article number
IE FC RJ45 plug 180	RJ45 FastConnect connector for Industrial Ethernet/PROFINET with 180° cable outlet	
	1 pack = 1 unit	6GK1901-1BB10-2AA0
	1 pack = 10 units	6GK1901-1BB10-2AB0

Table 4-9 Cable types for PROFINET

Cable	Designation	Article number
IE FC Cable GP 2x2 (Type A)	4-wire, shielded TP installation cable for IE FC RJ45	6XV1840-2AH10
IE FC Flexible Cable GP 2x2 (Type B)	4-wire, shielded flexible TP installation cable for IE FC RJ45	6XV1870-2B
IE FC Trailing Cable GP 2x2 (Type C)	4-wire TP installation cable for trailing cable use	6XV1870-2D
IE FC Trailing Cable 2x2 (Type C)	4-wire, shielded TP installation cable for connection to FC OUTLET RJ45, for trailing cable use	6XV1840-3AH10
IE FC Marine Cable 2x2	4-wire, shielded marine-certified TP installation cable for connection to FC OUTLET RJ45	6XV1840-4AH10

Table 4-10 Stripping tool for Industrial Ethernet / PROFINET

Tool	Designation	Article number
IE FC Stripping Tool	Stripping tool for Industrial Ethernet / PROFINET	6GK1901-1GA00

### Additional references

For further information about the cables, connectors, and stripping tool, see

- Section "Spare parts and accessories" in the SIMOTION D410-2 Manual
- *IK PI, Industrial Communication Catalog*

## 4.11 Connecting Ethernet

### Wiring Ethernet

An Industrial Ethernet can be connected to the 8-pin RJ45 socket X127 P1.

The interface supports a transmission rate of 10/100 Mbit/s. Suitable Ethernet cables and connectors must be used for the Ethernet connection.

A shielded twisted pair cable is used for the networking.

---

#### Note

The Ethernet interface supports PROFINET basic services and therefore has the designation PN/IE. These PROFINET basic services (e.g. DCP, LLDP, SNMP) provide uniform functions for the address assignment and diagnostics, but do not provide PROFINET IO communication for the connection of drives, I/O modules, etc.

---

### Recommended connecting cables

The following cables are available:

- SIMATIC NET, Industrial Ethernet TP XP CORD RJ45/RJ45
  - TP cable prefabricated with 2xRJ45 connectors
  - Crossed send and receive cable
  - Article number: 6XV1870-3R□□□ (□□□ - length code)
- SIMATIC NET, Industrial Ethernet TP CORD RJ45/RJ45
  - TP cable prefabricated with 2xRJ45 connectors
  - Uncrossed send and receive cable
  - Article No.: 6XV1870-3Q□□□ (□□□ - length code)

The autocrossing functionality of the Ethernet interface means crossed as well as uncrossed cables can be used.

## Autocrossing

Per default, the Ethernet interface is set to "Automatic setting" in **HW Config**, so that autocrossing is available. The settings can be found in the port properties (X127 P1) in the module rack of **HW Config**.

Autocrossing is deactivated with "Manual setting". As the Ethernet interface of the D410-2 is wired as Ethernet terminal, in this case you must use crossed cables for the networking with a PG/PC or another D410-2.

If the communication peer has autocrossing (e.g. PC, switch or hub), crossed and uncrossed cables can be used.

## Additional references

For further information about the cables and connectors, see the *Industrial Communication IK PI* Catalog.

## 4.12 Routing

Routing describes the cross-network transfer of information from Network x to Network y.

### 4.12.1 Routing on SIMOTION D

#### Routing between the different interfaces

SIMOTION D410-2 supports S7 routing between the following interfaces:

- Between Ethernet interface X127 and PROFIBUS interfaces X21 and X24 (X24 only available on D410-2 DP)
- Between Ethernet interface X127 and PROFINET interface X150 (only available on D410-2 DP/PN)
- Between PROFINET interface X150 and PROFIBUS interface X21 (only available on D410-2 DP/PN)

Each combination of Ethernet interface X127 and PROFINET interface X150 represents a separate IP subnet.

All ports of the X150 PROFINET interface belong to the same IP subnet.

IP routing from IP subnet to IP subnet is not supported. You can use an external IP router for this.

Below is a list of the options available for connecting a PG/PC or HMI device to a SIMOTION D using S7 routing.

### Engineering System/HMI on PROFIBUS (example: D410-2 DP)

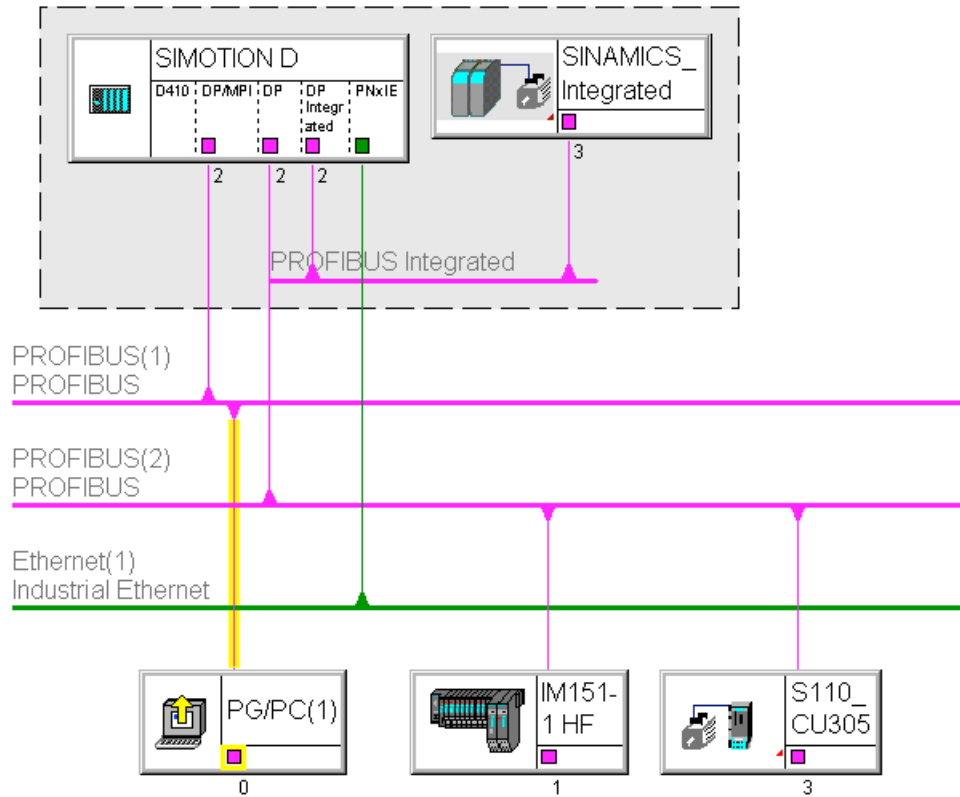


Figure 4-11 Example of PG/PC to PROFIBUS interface (X21)

- S7 routing to the other (master) PROFIBUS interfaces (only if configured)
- S7 routing to the PROFIBUS Integrated
- S7 routing to the Ethernet interface (X127 P1)

### Engineering System/HMI on PROFINET (example: D410-2 DP/PN)

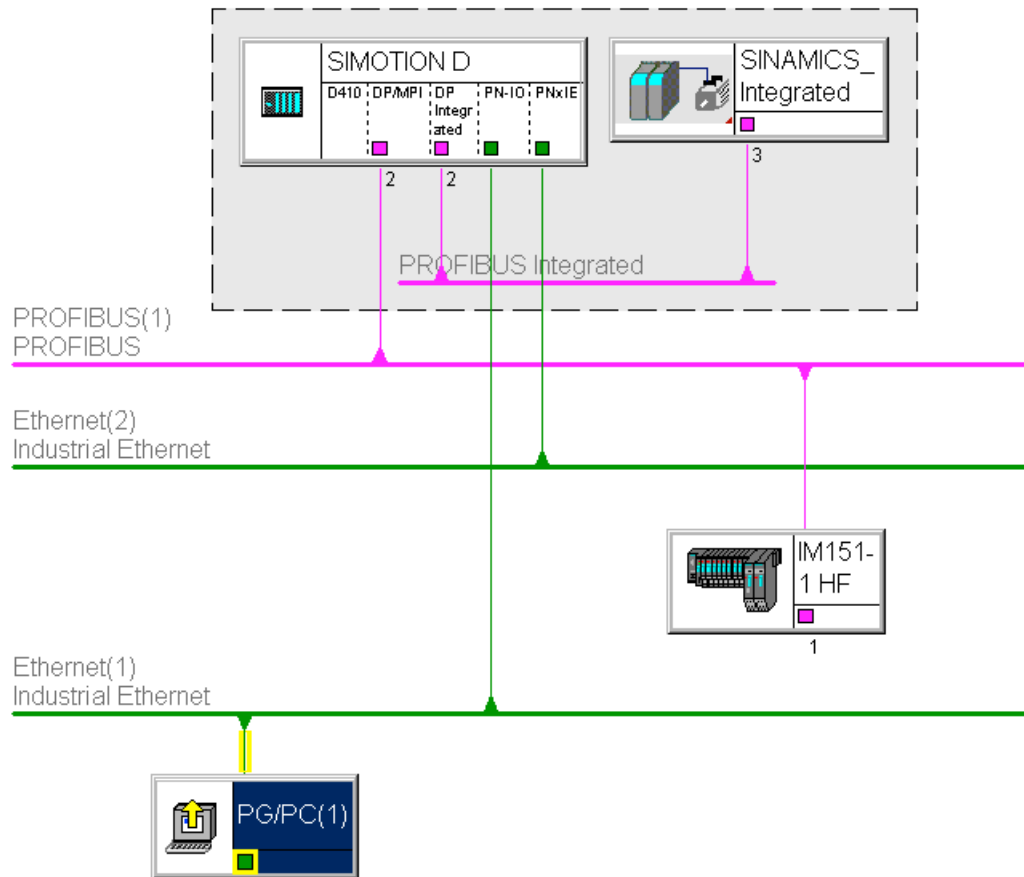


Figure 4-12 Example of PG/PC to PROFINET interface (PNxIO, X150)

- S7 routing to the (master) PROFIBUS interface (only if configured)
- S7 routing to the PROFIBUS Integrated
- S7 routing to Ethernet interface PN/IE (X127 P1)
- Access to the components on the same subnet via the switch functionality of the PROFINET IO interface

### Engineering System/HMI on Ethernet (example: D410-2 DP)

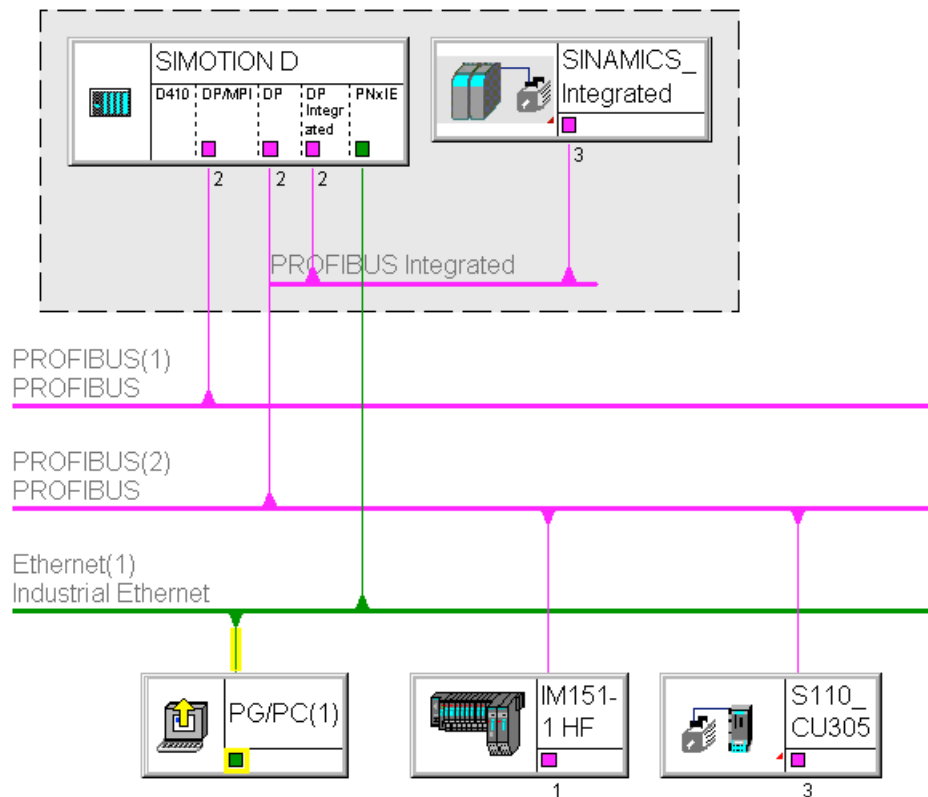


Figure 4-13 Example of PG/PC to Ethernet interface (X127 P1)

- S7 routing to the other (master) PROFIBUS interfaces (only if configured)
- S7 routing to the PROFIBUS Integrated

#### 4.12.2 Routing on SIMOTION D (SINAMICS integrated)

##### S7 routing to the internal PROFIBUS on SINAMICS Integrated

All SIMOTION D have an integrated SINAMICS drive control. In order to be able to access drive parameters, the message frames must be routed from the external SIMOTION D interfaces to the internal PROFIBUS DP. S7 routing can be used to access the integrated PROFIBUS. Here, the internal PROFIBUS DP forms a separate subnet. This must be especially taken into account for the communication to several routing nodes.

##### Additional references

Further information about routing and the differences between IP and S7 routing can be found in the *SIMOTION Communication System Manual*.



## 4.13 Connecting an external encoder

### Connecting the connecting cable

Use only shielded cables to connect an external encoder to the encoder interface (X23). The shielding must be connected with the metallic or metallized connector housing.

We recommend that bipolar encoders are used. When using unipolar encoders, the unused negative track signals can either be connected or connected to ground. This results in different switching thresholds.

See *SIMOTION D410-2* Manual, Section "Encoder interface (HTL/TTL/SSI)".

The pre-assembled connecting cables offer optimal noise immunity as well as sufficiently measured cross-sections for the supply voltage of the external encoder.

The connecting cables are available in various lengths, see *NC 60* Catalog.

### Procedure for connecting encoders

To connect an external encoder (HTL, TTL or SSI encoder), proceed as follows:

1. Connect the connecting cable to the encoder.
2. Plug the D-Sub connector (15-pin) to the socket X23.
3. Lock the connector using the finger screws.

#### NOTICE

##### **Destruction of the encoder electronics**

Operation of a 5 V encoder on the 24 V encoder supply may result in the destruction of its electronic components!

Make sure that you can operate the connected encoder on a 24 V power supply (e.g. HTL encoder). This setting can be set in the expert list of the drive in parameter p0400 and in the following parameters.



# Commissioning (hardware)

## 5.1 Overview

### Requirements

The following requirements must be satisfied for the first commissioning of the SIMOTION D410-2:

- Your system with SIMOTION D410-2 has been installed and wired.
- Your PG/PC is connected to the SIMOTION D410-2 via the PROFIBUS DP, Ethernet, or PROFINET (D410-2 DP/PN only) interface.

### Commissioning steps

Commissioning the hardware involves the following steps:

1. Inserting the CompactFlash card (Page 67)
2. Checking the system (Page 69)
3. Switching on the power supply (Page 69).

### Additional references

For information on installing/mounting and commissioning the SINAMICS S120 components, refer to the *SINAMICS S120* Commissioning Manual.

## 5.2 Inserting the CompactFlash card

### Characteristics of the CF card

The CF card is mandatory for operation of the SIMOTION D410-2. The SIMOTION Kernel (SIMOTION D firmware) and the software used to control the drives (SINAMICS firmware) are on the CF card.

5.2 Inserting the CompactFlash card

To load the SIMOTION Kernel, the CF card must be inserted when the SIMOTION D410-2 is powered up.

**NOTICE**

**Damage to the CompactFlash card from electrical fields or electrostatic discharge**

The CompactFlash card is an ESD-sensitive component.

De-energize the SIMOTION D410-2 device before inserting or removing the CompactFlash card. The SIMOTION D410-2 is in a de-energized state when all the LEDs are OFF.

Comply with the ESD rules.

**Procedure**

To insert the CF card, perform the following steps:

1. The direction of insertion of the CF card is indicated by an arrow located on both the plug-in slot and the CF card. Align the CF card with the arrows.
2. Gently insert the CF card into the empty plug-in slot of the SIMOTION D410-2 until it clicks into place.  
If correctly inserted, the CF card is flush with the housing.

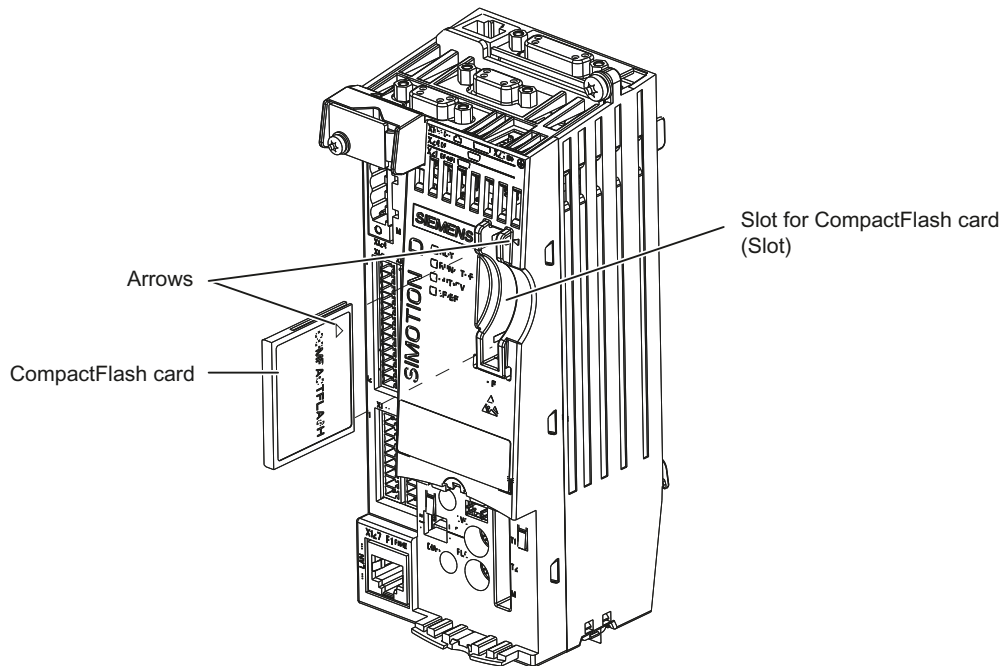


Figure 5-1 Inserting the CF card

## 5.3 Checking the system

### Procedure

Check the final installed and wired system one more time before it is switched on, Observe the safety-relevant items of the following checklist.

Checklist	✓
Have you observed all ESD measures when handling the components?	
Have all screws been tightened to their specified torque?	
Have all connectors been properly inserted and locked/screwed?	
Are all components grounded and have all shields been attached?	
Have you taken the load capacity of the central power supply into consideration?	

## 5.4 Switching on the power supply

### Switching on the external power supply

Power is supplied to the SIMOTION D410-2 via an external power supply unit, e.g. via a SITOP power supply. In exceptional cases, the SIMOTION D410-2 can also be supplied via the Power Module in blocksize format, see Section "Power supply" in the SIMOTION D410-2 Manual.

Switch on this power supply.

NOTICE
<p><b>SIMOTION D410-2 shuts down if the power supply is interrupted</b></p> <p>It is essential to ensure that the external 24 VDC power supply to the SIMOTION D410-2 is not interrupted for longer than 3 ms. After a longer interruption, the SIMOTION D410-2 shuts down and can only be restarted with OFF/ON.</p> <p>You will find further information in Section Properties of the user memory (Page 72).</p>

### Power-up of Control Unit

Once the power supply has been switched on, the SIMOTION D410-2 begins to power up:

1. At the start of the power-up, all LEDs are briefly illuminated in yellow for a short LED test. The LEDs on the SIMOTION D410-2 enable you to track the progress of the power-up. Any errors are displayed.
2. Startup of the SIMOTION Kernel.

3. All DRIVE-CLiQ connections (with SINAMICS Power Module, for example) are identified automatically.

---

**Note**

As long as the RDY LED continues to flicker, power-up is not complete and it is not possible to go online.

During commissioning the firmware of the components is upgraded or downgraded automatically based on the FW version on the CF card and the FW version on the SINAMICS components (DRIVE-CLiQ components, Power Modules, etc.).

The update can take several minutes and its progress is tracked by corresponding messages appearing in the alarm window of SIMOTION SCOUT.

**SIMOTION D410-2 / DRIVE-CLiQ components:**

A FW update on the SIMOTION D410-2 is indicated by yellow flashing and for DRIVE-CLiQ components by red-green flashing of the RDY LED:

- FW update running: RDY LED flashes slowly (0.5 Hz)
- FW update complete: RDY LED flashes quickly (2 Hz), POWER ON required

Components requiring POWER ON following a firmware update signal this by means of the fast flashing RDY LED. Go offline with SCOUT and switch the 24 V supply to the relevant components off/on (POWER ON) to initialize.

---

4. The first time it is switched on, the SIMOTION D410-2 goes into STOP state following power-up.

Following power-up, the SIMOTION D410-2 is in a state in which it can be configured.

## Fan

SIMOTION D410-2 has an integrated fan. This fan is always required for operation.

Fan faults as well as overtemperature of the module are signaled by a system variable, PeripheralFaultTask and a diagnostic buffer entry .

## 5.5 Performing a reset

The RESET button is located behind the blanking cover on the SIMOTION D410-2.

The entire system is reset when the RESET button is pressed and a new power-up of the system forced. This operation is comparable with a "Power on Reset" but does not require the disconnection of the 24 V power supply.

## 5.6 User memory concept

### 5.6.1 SIMOTION D410-2 memory model

The following figure provides an overview of the memory model of SIMOTION D410-2.

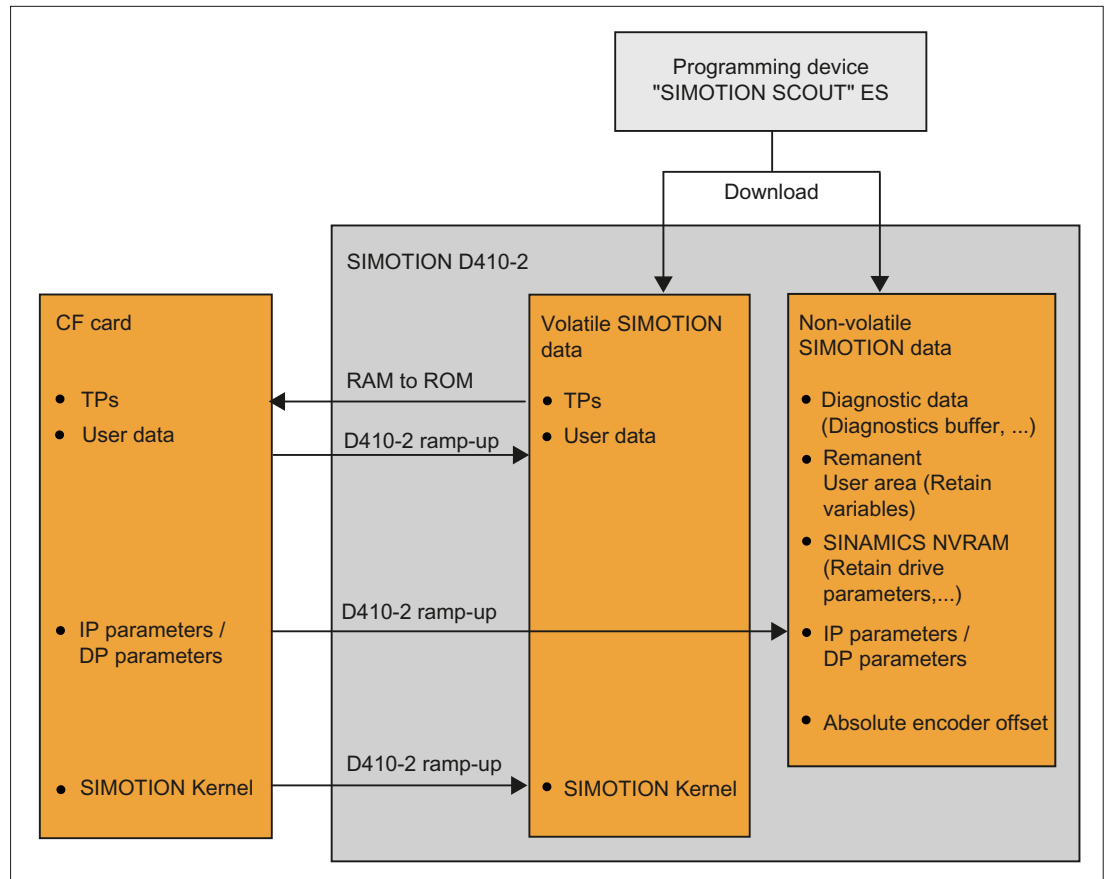


Figure 5-2 SIMOTION D410-2 memory model

The SIMOTION Kernel (SIMOTION D firmware, including SINAMICS Integrated Firmware) contains the functions required for virtually all applications, and essentially acts as a PLC with the command set in accordance with IEC 61131-3 as well as system functions for controlling various components, such as inputs and outputs.

The SIMOTION Kernel can be expanded by loading technology packages (TPs), e.g. for motion control or temperature controllers.

In the following sections, you will find information about the user memories and the steps involved in certain operations.

## 5.6.2 Properties of the user memory

### Non-volatile data

Non-volatile data makes it possible to retain relevant data for the user and the system even when the SIMOTION D410-2 has been switched off. Information about the area which can be used for non-volatile data is available in the *SIMOTION D410-2 Manual*, section "Technical Data".

A SIMOTION device has the following non-volatile data:

Table 5-1 Non-volatile data contents

Non-volatile data	Content
Kernel data	<ul style="list-style-type: none"> <li>Last operating state</li> <li>IP parameters (IP address, subnet mask, router address)</li> <li>DP parameters (PROFIBUS DP address, baud rate)</li> <li>Diagnostic data (diagnostics buffer,...)</li> </ul>
Retain variables	<ul style="list-style-type: none"> <li>Variables in the interface or implementation section of a unit declared with VAR_GLOBAL RETAIN</li> <li>Global device variables with the "RETAIN" attribute</li> </ul>
Retain TO	Absolute encoder offset
DCC blocks	SAV blocks and user-defined blocks with retain behavior ("SAV = SAVE", blocks for the non-volatile data backup).
NVRAM (SINAMICS)	For the SINAMICS Integrated and for the SINAMICS S120 CU310-2/ CU320-2, data protected against loss at power failure is called NVRAM data or non-volatile data.

#### Note

DCC SIMOTION blocks with retain behavior act like retain variables in terms of copying RAM to ROM, resetting memory, downloading, backing up non-volatile SIMOTION data (`_savePersistentMemoryData`) and backing up data.

With DCC SINAMICS blocks, data buffering is only via NVRAM. SINAMICS data is not saved with `_savePersistentMemoryData`. The non-volatile SINAMICS data (NVRAM data) is backed up by setting the CU parameter `p7775` to 1.

For further information on DCC, see the *DCC Programming Programming Manual*.



The non-volatile data of the SIMOTION D410-2 has the following properties:

Table 5-2 Non-volatile data and real-time clock properties

Properties	Non-volatile data	Real-time clock (RTC)
Location	Non-volatile data is located in the NVRAM of the SIMOTION D410-2.	The real-time clock is backed up maintenance-free via a SuperCap.
Back-up battery	No	No
Backup time	There is no maximum backup time	At least 5 days

If the buffer time is exceeded on the real-time clock, the time is reset.

## CF card

With the `_savePersistentMemoryData` system function, the user program can back up the contents of the non-volatile SIMOTION data to the CF card. This ensures that the retain variables and the absolute encoder position are backed up in the event that a spare part is used.

For the SINAMICS Integrated and SINAMICS S120 CU310-2/CU320-2, the non-volatile SINAMICS data (NVRAM data) is backed up by setting the CU parameter `p7775` to 1.

---

### Note

#### IP and DP parameters in the non-volatile data

If the CF card contains a configuration, the IP and DP parameters are loaded from the CF card during ramp-up and used by the SIMOTION device. The SIMOTION D410-2 uses the addresses defined in these parameters to go online. During ramp-up, the IP and DP parameters on the CF card are also written to the non-volatile data. If the SIMOTION device is then powered up with a CF card with no configuration, the IP and DP parameters are retained in the non-volatile data and are used by the device. Thus, the SIMOTION device can continue to go online if a configuration was loaded with SIMOTION SCOUT at least once or if the SIMOTION device is powered up with a CF card containing a configuration.

---

The CF card contains the following data:

- SIMOTION Kernel (SIMOTION D firmware)
- Technology packages (TP)
- User data (units, configuration data, parameter settings, task configuration)
- IP parameters (IP address, subnet mask, router address)
- DP parameters (PROFIBUS DP address, baud rate)

It may also contain:

- User data saved with `_savePersistentMemoryData` and `_export/_saveUnitDataSet`
- Non-volatile SINAMICS data (NVRAM data) of the SINAMICS Integrated backed up with CU parameter `p7775 = 1`

- Data from SIMOTION IT
- Archived SCOUT project

**Volatile SIMOTION data (RAM / current data RAM)**

The volatile SIMOTION data is defined by the following properties:

- The volatile SIMOTION data is located in the RAM memory of the SIMOTION device.
- The download data of SIMOTION SCOUT is written to this memory.
- This data is lost when the SIMOTION D410-2 is switched off.
- The "volatile SIMOTION data" area contains the following data:
  - SIMOTION Kernel (D410-2 firmware)
  - Technology packages (TP)
  - User data (programs, configuration data, parameter settings)

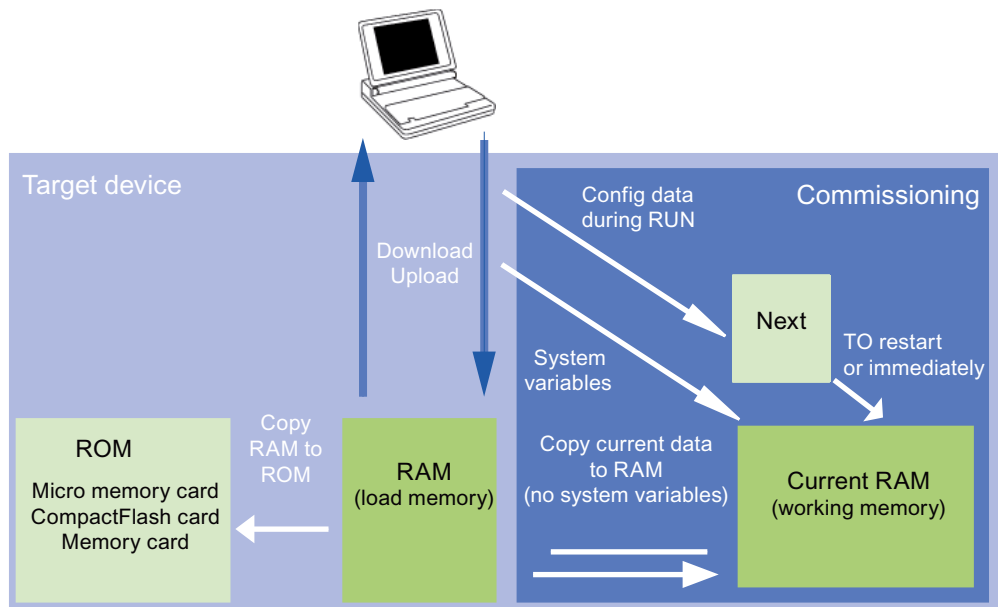


Figure 5-3 Configuration data and system variables in the volatile memory (memory concept, principle)

You can find additional information about memory management in SIMOTION in the *SIMOTION Runtime Basic Functions* Function Manual.

**5.6.3 Operations and their effect on the user memory**

The operator actions and their effects on the user memory are described below. These operator actions are marked with arrows in the following displays:

- Figure 5-2 SIMOTION D410-2 memory model (Page 71)
- Figure 5-3 Configuration data and system variables in the volatile memory (memory concept, principle) (Page 74)

## SIMOTION SCOUT download

The following data is transferred with "Load project to target system" or "Load CPU / drive unit to target device" from the engineering system to the "volatile SIMOTION data" area:

- User data (units, configuration data, parameter settings, task configuration)
- Technology packages (TPs)

In addition, the IP and DP parameters are saved to the "non-volatile SIMOTION data" area. The retain variables are set to their initial values, but this depends on the settings in SIMOTION SCOUT. If the SIMOTION D410-2 is switched off following the download, the volatile SIMOTION data is lost.

## Copy RAM to ROM

The Copy RAM to ROM menu command saves the following data via the engineering system to the CF card:

- Technology packages and user data (units, configuration data, parameter assignments, task configuration) from the "volatile SIMOTION data" area.
- Current values are copied to the "volatile SIMOTION data" area, depending on the settings in SIMOTION SCOUT.

---

### Note

The "Copy RAM to ROM" menu command does not save the current values of the retain variables to the CF card. Use the system function "\_savePersistentMemoryData" for this.

---

### Note

The "Copy RAM to ROM" function is also available for drive units and saves the volatile SINAMICS data to the non-volatile memory (CF card).

---

## Current RAM

If you change the system variable values, these take immediate effect in the current RAM. New configuration data values are initially stored in the Next memory. Configuration data that take immediate effect are automatically transferred to the current RAM. Configuration data that will only become active following a RESTART on the technology object (set the restartactivation system variable to the ACTIVATE\_RESTART value) is not written to the current RAM until after the RESTART.

To save the configuration data changed online to the offline project, you must first transfer the content of the current data RAM to the RAM using the menu command "Target system" > "Copy current data to RAM".

Once you have done this, the configuration in SCOUT will no longer be consistent with the configuration in the target device, as a consistency check is performed on the RAM data. Read the data from the RAM using the menu command "Target system" > "Load" > "Load CPU / drive unit to PG" (for the configuration data only) to re-establish a consistent system state.

Use the "Target system" > "Copy RAM to ROM" menu command to save the configuration to the non-volatile memory on the CF card.

---

**Note**

The "Copy current data to RAM" command does not transfer the values of the system variables to the RAM memory. This means that "Save to memory card (Copy RAM to ROM)" or "Save in the engineering project (Load CPU / drive unit to PG)" is not possible.

In order to ensure that system variable values can also be saved to the engineering project and memory card, the system variable values must be changed OFFLINE and then downloaded to the target device and saved.

---

### SIMOTION D410-2 power-up

During power-up of the SIMOTION D410-2, the SIMOTION Kernel is loaded from the CF card to the "volatile SIMOTION data" area.

When the SIMOTION D410-2 is switched off, the contents of the "volatile SIMOTION data" area are lost. When the unit is powered up again, the following data is loaded from the CF card:

- Technology packages and user data to the "volatile SIMOTION data" area.
- IP and DP parameters to the "non-volatile SIMOTION data" area.

### Backing up non-volatile SIMOTION data

You have the following options for backing up non-volatile SIMOTION data on the CF card:

- In the user program:  
With the "\_savePersistentMemoryData" system function, the user program can back up the non-volatile SIMOTION data content to the CF card. This ensures that the retain variables and the absolute encoder position are backed up in the event that a spare part is used. The contents are saved to the "PMEMORY.XML" backup file in the "USER\SIMOTION" directory.
- Via switch/button (service selector switch or DIAG button of the SIMOTION D410-2) or SIMOTION IT web server. See Section Diagnostic data and non-volatile SIMOTION data (Page 282). The contents are saved to the "PMEMORY.XML" backup file in the "USER \SIMOTION\HMI\SYSLOG\DIAG" directory.

On the system side, this system function ensures that a consistent overall image of the non-volatile SIMOTION data is always available the next time the unit is switched on, even if there is a power failure during backup. An already existing backup file is renamed to "PMEMORY.BAK" before a new backup file is generated. If the save operation to the new backup file fails (e.g. because the capacity of the CF card is insufficient), this backup copy of

the backup file is used the next time an attempt is made to restore the non-volatile SIMOTION data content.

#### NOTICE

##### Loss of data due to failure to make backup copies

Non-backed-up non-volatile SIMOTION data can be lost on hardware replacement (module defect), for example, if the current value of the retain variables have not been backed up and replaced by their initial values again.

Back up the non-volatile SIMOTION data on the CF card.

#### NOTICE

##### Repeat referencing necessary after absolute encoder overflow

If an absolute encoder overflow occurs after `_savePersistentMemoryData`, the actual position value is no longer correct after the non-volatile SIMOTION data is restored.

In this case, homing (absolute encoder adjustment) must be repeated.

With the SCOUT functions "Save variables" and "Restore variables," you also have the option of backing up to your PC and restoring data that was changed during operation and only stored in the runtime system.

### Reloading non-volatile SIMOTION data

SIMOTION data backed up on the CF card with `_savePersistentMemoryData` is reloaded in the following scenarios:

1. After a module replacement, see Section Replacing modules in the spare part scenario (Page 81)
2. After a memory reset, see Section SIMOTION D410-2 memory reset (Page 215)
3. Via switch position, see Section Delete/restore non-volatile SIMOTION data (Page 288)

### Reloading non-volatile SINAMICS data

For the SINAMICS Integrated and SINAMICS S120 CU310-2/CU320-2, as of SINAMICS FW version V4.5, the non-volatile SINAMICS data (NVRAM data) is backed up by setting the CU parameter p7775 to 1.

Restoring

- Is performed automatically in the event of a module replacement  
A module replacement is detected on the basis of the serial number.
- Can be performed manually  
Restoring can be initiated manually by setting the CU parameter p7775 to 2.

For further information, see Section Backing up / restoring / deleting SINAMICS NVRAM data (Page 159).

### Power failure

If a power failure occurs, the real-time clock is buffered by means of an internal SuperCap.

The non-volatile data is backed up on the D410-2 permanently and maintenance-free in an NVRAM. In this way, the Control Unit is immediately ready for operation without data loss after a power failure.

### Power-up and non-volatile SIMOTION data

The table below lists the cases that can arise during power-up in conjunction with the non-volatile data and explains how they are handled.

Table 5-3 Power-up scenarios for non-volatile SIMOTION data

Case	Initial condition	Result
1	The non-volatile SIMOTION data is valid.	SIMOTION D410-2 powers up with the non-volatile SIMOTION data, i.e. with the PROFIBUS address in the non-volatile data.
2	The non-volatile SIMOTION data is invalid and there is no backup file (PMEMORY.XML) and no backup copy of the backup file (PMEMORY.BAK).	SIMOTION D410-2 copies the default settings to the non-volatile SIMOTION data and powers up with this data. In this case, for example, the default PROFIBUS address is used.
3	The non-volatile SIMOTION data is invalid and backup file (PMEMORY.XML) exists and is valid.	SIMOTION D410-2 copies the backup file contents to the non-volatile SIMOTION data and powers up with this data.
4	The non-volatile SIMOTION data is invalid, the backup file is invalid and there is no backup copy of the backup file (PMEMORY.BAK).	SIMOTION D410-2 copies the default settings to the non-volatile SIMOTION data and powers up with this data, in which case, for example, the default PROFIBUS address is used.
5	The non-volatile SIMOTION data is invalid; a backup file exists, but it is invalid; a backup copy of the backup file exists and is valid.	SIMOTION D410-2 copies the backup file contents to the non-volatile SIMOTION data and powers up with this data.

### Non-volatile SIMOTION data diagnostics

The user can determine the state of the non-volatile SIMOTION data using the diagnostic buffer, system variables, and PeripheralFaultTask.

## Evaluating via the diagnostic buffer

When they are issued, the following messages are entered once in the diagnostic buffer:

Table 5-4 Messages of the diagnostic buffer

Entry	Meaning	Remedy
Non-volatile data loaded from a file (Persistent Data File Loading done)	Non-volatile SIMOTION data has been successfully restored from the backup file on the CF card.	-
Non-volatile data loaded from the backup file (Persistent Data Backup File Loading done)	Non-volatile SIMOTION data has been successfully restored from the backup copy of the backup file on the CF card.	-
Error while loading non-volatile data from a file (Persistent Data File Loading Failure)	Backup file or backup copy could not be loaded. Possible causes: <ul style="list-style-type: none"> <li>• Backup file or backup copy not available</li> <li>• Invalid data in backup file</li> </ul>	Use the "_savePersistentMemoryData" system function to generate a valid backup file.
Module replacement detected - NVRAM has been initialized	A module replacement was detected on the basis of the serial number. The non-volatile SIMOTION data on the controller is deleted and the data from the CF card transferred to the controller.	
Module replacement not detected - NVRAM has not been initialized	An error has occurred. The non-volatile SIMOTION data on the controller has not been deleted.	Possible causes: <ul style="list-style-type: none"> <li>• Incorrect controller type</li> <li>• File system of the CF card defective</li> </ul>

Refer to the *SIMOTION SCOUT* Configuration Manual for how to read out the contents of the diagnostic buffer.

## Evaluating via system variables

The system variables in the `device.persistentDataPowerMonitoring` structure indicate the state of the non-volatile SIMOTION data.

Table 5-5 State of the non-volatile SIMOTION data

System variable	Designation	State	Updating
<code>rtcFailure</code>	Indicates that the clock contents (RTC) are invalid (clock must be set again)	NO (91) YES (173)	The status is updated once during power-up; the status must be reset to "NO" via the application; the status is retained even after power off/on.
<code>retainDataFailure</code>	Indicates a checksum error of the non-volatile SIMOTION data; can be an indication of defective hardware	NO (91) YES (173)	The status is updated once during power-up; the status must be reset to "NO" via the application; the status is retained even after power off/on.
<code>persistentDataState</code>	Reading the persistent data	See the table below	The status is updated during power-up.

5.6 User memory concept

A data loss of the real-time clock is signaled via the system variable **device.persistentDataPowerMonitoring.rtcFailure = YES**.

The system variable **device.persistentDataPowerMonitoring.persistentDataState** shows the state of the non-volatile SIMOTION data after power-up.

Table 5-6 State of the non-volatile SIMOTION data after power-up (persistentDataState system variable)

State	Meaning
FROM_RAM (1)	Non-volatile SIMOTION data in the SIMOTION device is used
FROM_FILE (2)	Non-volatile SIMOTION data is restored from the backup file
FROM_BACKUP (3)	Non-volatile SIMOTION data is restored from the backup copy of the backup file
INVALID (4)	Data in the non-volatile SIMOTION data and in the backup file / backup copy of backup file is invalid or non-existent/deleted. The SIMOTION device has copied the default settings to the non-volatile SIMOTION data and used this data to power up.

**Requirement/availability of the battery**

System variables can be used to evaluate:

- Whether a battery is required for the operation of the device (or not)
- Whether a battery is available (or not)

SIMOTION D410-2 has no battery.

Table 5-7 System variable batterynecessary/batteryexisting

System variable on the device	States	Description
<b>fanbattery of data type StructDeviceFanBattery (the system variables are of the data type EnumFanBattery)</b>		
.batterynecessary	MANDATORY	Battery is required for the backup of the non-volatile data and the real-time clock (RTC) of the device. <b>.batteryexisting</b> can be used to query whether a battery is installed.
	OPTIONAL	The non-volatile data and the real-time clock (RTC) are backed up via Super-Cap. A battery can be used as an option to extend the backup time. <b>.batteryexisting</b> can be used to query whether a battery is installed. <b>Example: D4x5</b>
	OPTIONAL_RTC <sup>1)</sup>	A battery is not required for backing up the non-volatile data. Only the real-time clock (RTC) is backed up via SuperCap. A battery can be used as an option to extend the backup time of the real-time clock. <b>.batteryexisting</b> can be used to query whether a battery is installed. <b>Example: D4x5-2</b>
	NOT_MANDATORY <sup>1)</sup>	A battery is not required for backing up the non-volatile data. The real-time clock (RTC) is backed up via SuperCap. <b>Example: D410-2</b>



System variable on the device	States	Description
.batteryexisting	EXISTING	EXISTING is only displayed when <b>.batterynecessary</b> is set to: <ul style="list-style-type: none"> <li>• MANDATORY or</li> <li>• OPTIONAL or</li> <li>• OPTIONAL_RTC</li> </ul> and a battery is installed.
	NOT_EXISTING	Battery is not available. <b>State is statically set for D410-2.</b>

<sup>1)</sup> If the SuperCap is discharged, the contents of the real-time clock (RTC) are lost.

## 5.6.4 Replacing modules in the spare part scenario

### SIMOTION module replacement

During a module replacement, a CF card that contains the non-volatile SIMOTION data backed-up with `_savePersistentMemoryData`, is inserted in a new device of the same type.

A module replacement is detected by the SIMOTION D410-2 on the basis of the serial number. The data backed up on the CF card with `_savePersistentMemoryData` are then automatically transferred to the new device.

---

#### Note

As an additional option, you can back up the non-volatile data by switching the service selector switch, with the DIAG button, or via SIMOTION IT web server. For details, see Section Diagnostic data and non-volatile SIMOTION data (Page 282).

---

#### Initial power-up with the CF card

This requires a CF card on which no device serial number is stored.

If the SIMOTION D410-2 powers up successfully with a new CF card, the serial number of the device is stored on the CF card. In this case, a module replacement cannot be detected.

---

#### Note

The serial number stored on the CF card remains unaffected by the following actions:

- Copy RAM to ROM
- Project download
- Writing the CF card via the SCOUT function "Load to file system"
- FW/project update via device update tool

If the CF card contents are copied to another CF card, the serial number is also copied. A serial number stored on the CF card can only be removed by deleting the CF card contents.

---

**SIMOTION D410-2 power-up with the CF card (no module replacement)**

Prerequisite is that the same CF card and the same device are used.

If the SIMOTION device powers up successfully, the serial number stored on the CF card is compared with the serial number of the device.

If the serial numbers are identical, there has been no module replacement.

The device powers up. In the non-volatile data present in the device is valid, this will be used (for details, see Table 5-3 Power-up scenarios for non-volatile SIMOTION data (Page 78)).

**SIMOTION D410-2 power-up with the CF card (module replacement)**

Prerequisite is that the same CF card and a different device (e.g. replacement because of a defect) are used.

If the device powers up successfully, the serial number stored on the CF card is compared with the serial number of the device.

If the serial numbers are not identical, there has been a module replacement.

This means:

- The serial number of the new module is stored on the CF card.
- The non-volatile SIMOTION data are deleted in the device.
- A diagnostic buffer entry is issued which signals that a module has been replaced.
- The non-volatile SIMOTION data stored on the CF card is transferred to the device (for details, see Table 5-3 Power-up scenarios for non-volatile SIMOTION data (Page 78)).

**NOTICE**

**Irrevocable data deletion due to incorrect CF card with stored device serial number**

A module replacement is detected only on the basis of the changed serial number.

Inserting the wrong CF card with saved device serial number has the following consequences:

- The non-volatile data on the device is permanently deleted.
- The IP/DP address set in the device is deleted. You can no longer go online via the IP/DP address set originally.

Make sure that the correct CF card is inserted into the SIMOTION D410-2.

**Error scenarios**

In the event of an error, a diagnostic buffer entry signals that it was not possible to determine whether a module has been replaced. This may have the following reasons:

- The serial number of the device cannot be determined.
- The serial number saved on the CF card cannot be determined (e.g. due to a corrupt file system).
- The controller has not powered up.
- The new serial number could not be transferred to the CF card (e.g. due to a corrupt file system).

## Restart after reloading

The system variable **device.startupData.operationMode** is used to define whether the SIMOTION D410-2 Control Unit goes into the RUN state or the last operating state after a power-on/restart.

Possible values of **device.startupData.operationMode**:

- LAST\_OPERATION\_MODE [0] (default setting)  
The module remains in the STOP operating state after reloading the non-volatile SIMOTION data and must be switched manually to the RUN state with SCOUT, the web server, or the mode switch .
- RUN [1]  
The module goes automatically into the RUN state after reloading.

## SINAMICS module replacement

A module replacement is detected as of SINAMICS V4.5.

For the SINAMICS Integrated and SINAMICS S120 CU310-2/CU320-2, a module replacement is also identified via the serial number.

Non-volatile SINAMICS data (NVRAM data) backed up previously via the CU parameter p7775 = 1 on the CF card, is then automatically transferred to the Control Unit.

# 5.7 Fan

## 5.7.1 Cooling the SIMOTION D410-2

### Overview

A fan is always required for operation of the SIMOTION D410-2. This is included in the scope of delivery of the D410-2 control unit. The fan operates temperature-controlled and is switched on depending on the air intake temperature and the CPU load.

### Fan faults

Fan faults are indicated as follows:

- Entry in diagnostic buffer
- Indicated via system variable
- Calling the PeripheralFaultTask

If a fan fault occurs or the fan is unplugged, the module continues to run. The controller goes into FAULT state when overtemperature occurs (temperature threshold 2 exceeded), whereby all LEDs flicker red. The state can only be exited through power off/on

For further information on the evaluation of fan faults, see Section Overview of fan states (Page 84).

## 5.7.2 Overview of fan states

### Evaluation of fan faults

SIMOTION D410-2 has a single fan.

Fan faults are detected through a cyclic fan test or when a malfunction is determined when the fan is activated (fan does not rotate or fan rotates at too low a speed).

Fan faults are signaled by the following diagnostic buffer entry:  
Fan on the module is defective.

The states that can occur during operation are described in the following.

Table 5-8 Overview of fan states

State	PeripheralFaultTask	System variable <sup>1)</sup>
		<code>._cpuDataRW.fanWarning</code>
The fan fails in the STOP operating state, then RUN	PeripheralFaultTask: Is not called	=YES
The fan fails in the RUN operating state	PeripheralFaultTask: TSI#InterruptId = <code>_SC_PC_INTERNAL_FAILURE</code> (= 205) TSI#details = <code>16#00000080</code>	=YES

<sup>1)</sup> The "YES" value must be reset to "NO" by the application.

### Requirement for/presence of a fan

System variables can be used to evaluate:

- Whether a fan is required for the operation of the device (or not)
- Whether a fan is installed (or not)

Table 5-9 System variable `fannecessary/fanexisting`

System variable on the device	States	Description
<b>fanbattery of data type StructDeviceFanBattery (the system variables are of the data type EnumFanBattery)</b>		
<code>.fannecessary</code> <sup>1)</sup>	MANDATORY	Fan is required for operation of the device. <code>.fanexisting</code> can be used to query whether a fan is installed. <b>Examples: D410-2, D445-2, D455-2</b>
	OPTIONAL	Fan can be used optionally. <code>.fanexisting</code> can be used to query whether a fan is installed. <b>Examples: D425, D435</b>
	NOT_MANDATORY	Fan is not required for operation of the device.

System variable on the device	States	Description
.fanexisting <sup>1)</sup>	SINGLE	A single fan is installed <b>Examples: D410-2</b>
	REDUNDANT	Double fan is installed. <b>Examples: D445-2, D455-2</b>
	NOT_EXISTING	No fan is installed. <b>Example: D425 and D435 without optional fan.</b>

1) Value is statically set to MANDATORY/SINGLE in the SIMOTION D410-2.

SIMOTION D410-2 only detects an unplugged fan indirectly.

The system variable fanexisting has statically the state SINGLE for the SIMOTION D410-2 . If the module temperature increases to impermissible values due to a fan having been unplugged, the module signals overtemperature.

The fan speed is available in system variable `_cpuData.fanRpm` as of V4.4.

### Additional references

You will find detailed information on setting up Taskstartinfo (#TSI) in the *SIMOTION Runtime Basic Functions* Function Manual.

### 5.7.3 Response to overtemperature

Operation at overtemperature reduces the module service life and can result in damage to the module.

#### Causes

Cause of problems in the heat dissipation of the module can be, for example:

- Violation of the maximum permissible air intake temperature
- Free convection is not ensured (clearances are not maintained, pollution, convection is prevented by cables)
- Impermissible mounting position of the module

#### Temperature thresholds

The internal module temperature is monitored via two module-specific temperature thresholds:

- Overtemperature is signaled when the first (lower) temperature threshold is exceeded.
- When the temperature falls below the first temperature threshold again (minus a hysteresis of approx. 5° C), "Normal temperature" is signaled.
- When the second (higher) temperature threshold is exceeded, the module goes into the FAULT state to protect itself.

The internal module temperature is available in system variable `_cpuData.moduletemperature` as of V4.4.

## Response to overtemperature

Table 5-10 Response of the temperature monitoring

Temperature...	Response
... exceeds the 1st temperature threshold (overtemperature)	Call of the PeripheralFaultTask: <ul style="list-style-type: none"> <li>• TSI#InterruptId = _SC_PC_INTERNAL_FAILURE (= 205)</li> <li>• TSI#details = 16#00000002</li> </ul> Diagnostic buffer entry: "Temperature exceeded in the housing"
... falls below the 1st temperature threshold minus a hysteresis of approx. 5° C	Call of the PeripheralFaultTask: <ul style="list-style-type: none"> <li>• TSI#InterruptId = _SC_PC_INTERNAL_FAILURE (= 205)</li> <li>• TSI#details = 16#00000004</li> </ul> Diagnostic buffer entry: "Temperature in the housing has returned to normal"
... exceeds the 2nd temperature threshold	Module goes into the FAULT state to protect itself (all LEDs flicker red) Diagnostic buffer entry: "Temperature in the housing too high, self-protection function of the module activated"

## Behavior of SINAMICS Integrated

If the internal temperature of the SIMOTION D410-2 exceeds the permissible limit value, the following warning message is displayed:

A1009: CU warning: Control unit overtemperature

The warning message will be cleared as soon as the fault is rectified and the temperature falls below the maximum permissible limit.

The behavior for overtemperatures in the power unit as well as possible STOP responses for the SIMOTION D410-2 corresponds to the behavior for a SINAMICS S120 CU310-2.

## Parameter assignment / addressing

### 6.1 Software requirements

#### Engineering

The following requirements must be satisfied for the commissioning of the SIMOTION D410-2 Control Units:

- SIMOTION D410-2 DP: at least SCOUT V4.3 SP1 HF1 and firmware V4.3 SP1 HF2
- SIMOTION D410-2 DP/PN: at least SCOUT V4.3 SP1 HF3 and firmware V4.3 SP1 HF3

Please note the information on the latest SIMOTION SCOUT DVD.

For information on how to install SIMOTION SCOUT on your PG/PC, see the *SIMOTION SCOUT* Configuration Manual.

---

#### Note

The software configuration is described in this manual based on SIMOTION SCOUT and SIMATIC STEP 7 Version V5.x.

Information of configuration of the SIMOTION D Control Units in the Engineering Framework Totally Integrated Automation Portal (SCOUT in the TIA Portal), you will find in the configuration manual *SIMOTION SCOUT TIA*.

The TIA Portal requires at least SIMOTION SCOUT V4.4 and SIMOTION D4xx-2 Control Units as of firmware V4.3.

---

### 6.2 Creating a project and configuring the communication

#### 6.2.1 Creating a SIMOTION project and inserting a SIMOTION D410-2

##### Procedure

Proceed as follows to create a new project in SIMOTION SCOUT and insert a SIMOTION D410-2:

1. Select the Project > New... menu command.
2. Enter a name for your project in the "New Project" dialog box and confirm your entry with "OK".

A new folder with the name of the project will be created in the project navigator.

6.2 Creating a project and configuring the communication

3. In the project navigator, double-click "Insert SIMOTION device". The "Insert SIMOTION Device" dialog box is opened:

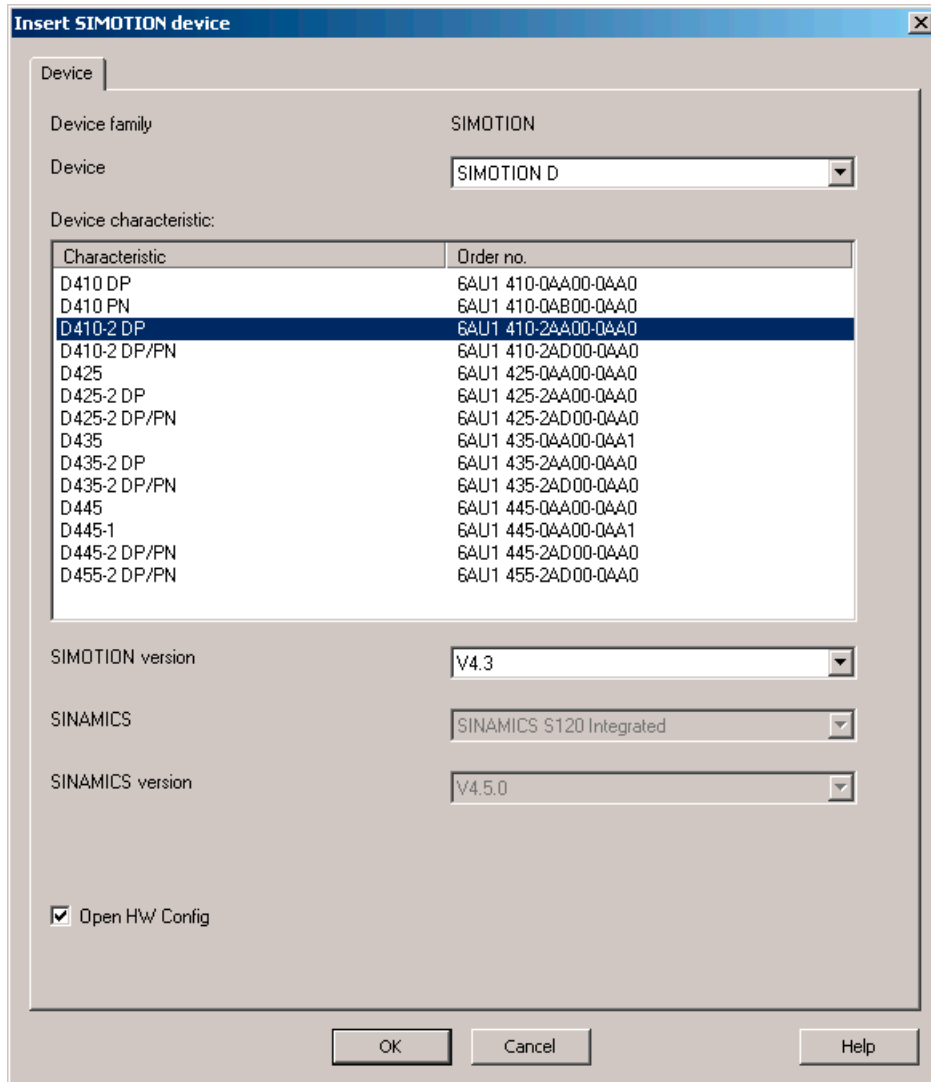


Figure 6-1 Inserting a SIMOTION device

4. In the "Insert SIMOTION Device" dialog box, select the device, its version and the SIMOTION version.
5. If required, make further settings:
  - SINAMICS: For SIMOTION D410-2 always set "SINAMICS S120 Integrated".
  - SINAMICS version: Select the SINAMICS Integrated version if several drive versions are available for a SIMOTION version.
6. The "Open HW Config" option allows you to select whether **HW Config** is opened in the next step (e.g. to configure the bus interfaces).
7. Confirm the "Insert SIMOTION Device" dialog with "OK".



## SINAMICS Integrated type

For SIMOTION D410-2, the type is always SINAMICS S120 Integrated.

## Version of the SINAMICS Integrated

Depending on the selected SIMOTION version, several versions are available for the SINAMICS Integrated. Please note that separate SIMOTION D firmware is available for each version of the SINAMICS Integrated.

## Configuring the PROFINET interface

After you have acknowledged the "Insert SIMOTION Device" dialog with "OK", the "Properties - Ethernet Interface" dialog box opens in the case of a D410-2 DP/PN.

If you are using the PROFINET interface, set the interface properties in the "Properties - Ethernet Interface" dialog box.

To this end, proceed as follows:

1. Click the "New" button.  
The "New Subnet Industrial Ethernet" dialog box opens. Rename the new subnet, or accept the default name by clicking "OK".
2. Select the new Ethernet subnet, which is now displayed in the "Properties - Ethernet Interface" dialog box.
3. Enter the required addresses in the "IP address" and "Subnet mask" fields of the "Properties - Ethernet Interface" dialog box. Under "Gateway", define whether you are going to use a router and, if yes, enter the router address. Confirm with "OK".

## Result

If you have not yet configured a PG/PC in your project, you can select the interface for the PG/PC connection now.

## 6.2.2 Configuring the PROFIBUS PG/PC interface

### Requirements

The following requirements must be satisfied in order to configure the PG/PC interface:

- You have completed the "Insert SIMOTION Device" dialog box with "OK"
- A PG/PC has not yet been configured in the project.

If these requirements have been satisfied, you can configure the interface for the PG/PC connection in the "Interface Selection - D410" dialog box.

## Procedure

Proceed as follows to configure the PROFIBUS DP interface:

1. In the "Interface Selection - D410" dialog box, select the entry "PROFIBUS DP/MPI (X21)" (in the case of the D410-2 DP, the following alternative is also available: PROFIBUS DP (X24)).

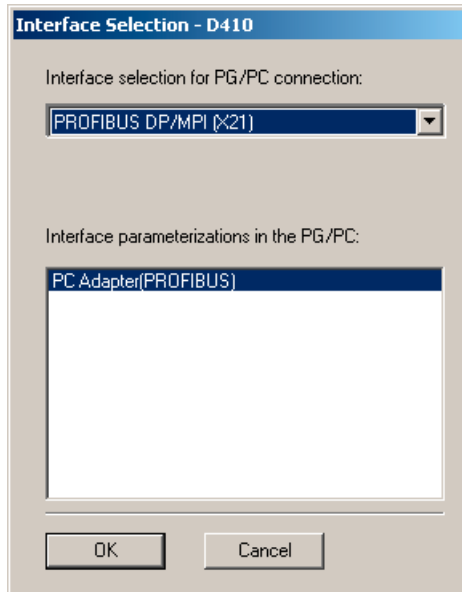


Figure 6-2 Selecting a PROFIBUS interface

2. Select the interface parameter assignment that you would like to use to go online, and confirm with "OK".

The dialog box is closed, the SIMOTION D410-2 is created in the project navigator and **HW Config** is started automatically (if parameterized).

A PROFIBUS subnet with factory settings (1.5 Mbit/s transmission rate) is created automatically.

## Result

The PG/PC is now connected to the SIMOTION D410-2 via PROFIBUS. You can configure and parameterize your system.

---

### Note

If you do not use the factory settings, you must configure the PROFIBUS interfaces in **HW Config**.

Please make sure that the S7 online access has been **activated** (PG/PC connection must be yellow and bold in **NetPro**).

---

### Inserting a further SIMOTION device

If you insert a further SIMOTION device using "Insert SIMOTION device", the PG/PC interface selection dialog box is not displayed. Any further SIMOTION device is automatically connected to the PG/PC via PROFIBUS and a new unique DP address (address 4, 5 ... up to 125) is calculated.

### Additional references

Further information on the topic of "Going online" can be found

- In the online help via the "Contents" tab at
  - "Diagnostics" > "Overview of service and diagnostics options" > "Part III" > "Go online"
  - "Insert device and connect to target system" > "Go online/offline"
- On the Internet at Internet address (<https://support.industry.siemens.com/cs/ww/en/view/22016709>)
- In SIMOTION Utilities & Applications, FAQ "Online connections to SIMOTION devices".  
SIMOTION Utilities & Applications is part of the scope of delivery of SIMOTION SCOUT.

## 6.2.3 Configuring the Ethernet PG/PC interface

### Requirements

The following requirements must be satisfied in order to configure the PG/PC interface:

- You have completed the "Insert SIMOTION Device" dialog box with "OK".
- A PG/PC has not yet been configured in the project.

If these prerequisites have been satisfied, you can configure the interface for the PG/PC connection in the "Interface selection - D410" dialog box.

Proceed as follows to configure the Ethernet interface:

### Procedure

1. In the "Interface Selection - D410" dialog box, select the entry "Ethernet PNxIE (X127)".

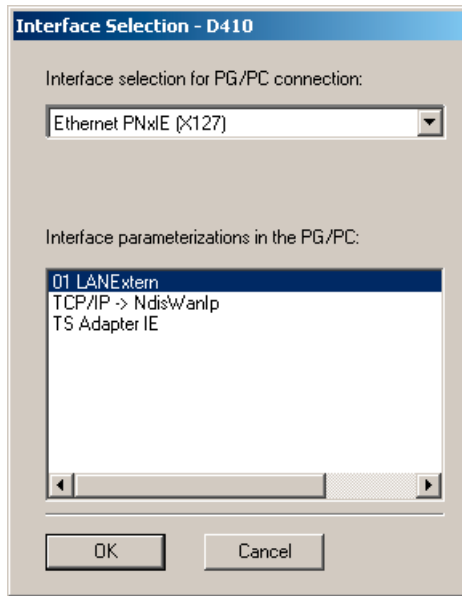


Figure 6-3 Selecting the Ethernet interface

2. Select the interface parameter assignment that you would like to use to go online, and confirm with "OK".

The dialog box is closed, the SIMOTION D410-2 is created in the project navigator and **HW Config** is started automatically (if parameterized).

An Ethernet subnet with factory settings is created automatically. For factory settings, see Section General information about communication via Ethernet (Page 117).

### Result

The PG/PC is now connected to the SIMOTION D410-2 via Ethernet.

You can configure and parameterize your system.

---

#### Note

If you want to change the default settings for IP addresses and the transmission rate, you must configure the Ethernet interfaces in **HW Config** and **NetPro**.

Make sure that the PG/PC and SIMOTION D410-2 are located in the same subnet and that S7Online access has been **activated** (the PG/PC connection must appear yellow and bold in **NetPro**).

---

### Inserting a further SIMOTION device

If you insert a further SIMOTION device using "Insert SIMOTION device", the PG/PC interface selection dialog box is not displayed. The second SIMOTION device is automatically connected to the PG/PC via Ethernet and a new unique IP address (last digit + 1 up to 255) is calculated.

### Additional references

Further information on the topic of "Going online" can be found

- In the online help via the "Contents" tab at
  - "Diagnostics" > "Overview of service and diagnostics options" > "Part III" > "Go online"
  - "Insert device and connect to target system" > "Go online/offline"
- On the Internet at Internet address (<https://support.industry.siemens.com/cs/ww/en/view/22016709>)
- In SIMOTION Utilities & Applications, FAQ "Online connections to SIMOTION devices".  
SIMOTION Utilities & Applications is part of the scope of delivery of SIMOTION SCOUT.

### 6.2.4 Display of the SIMOTION D410-2 in HW Config

Once you have created a project and inserted a SIMOTION D410-2 as module, **HW Config** opens automatically (if parameterized).

In **HW Config**, the SIMOTION D410-2 is displayed with the SINAMICS Integrated and the interfaces.

6.3 Configuring PROFIBUS DP

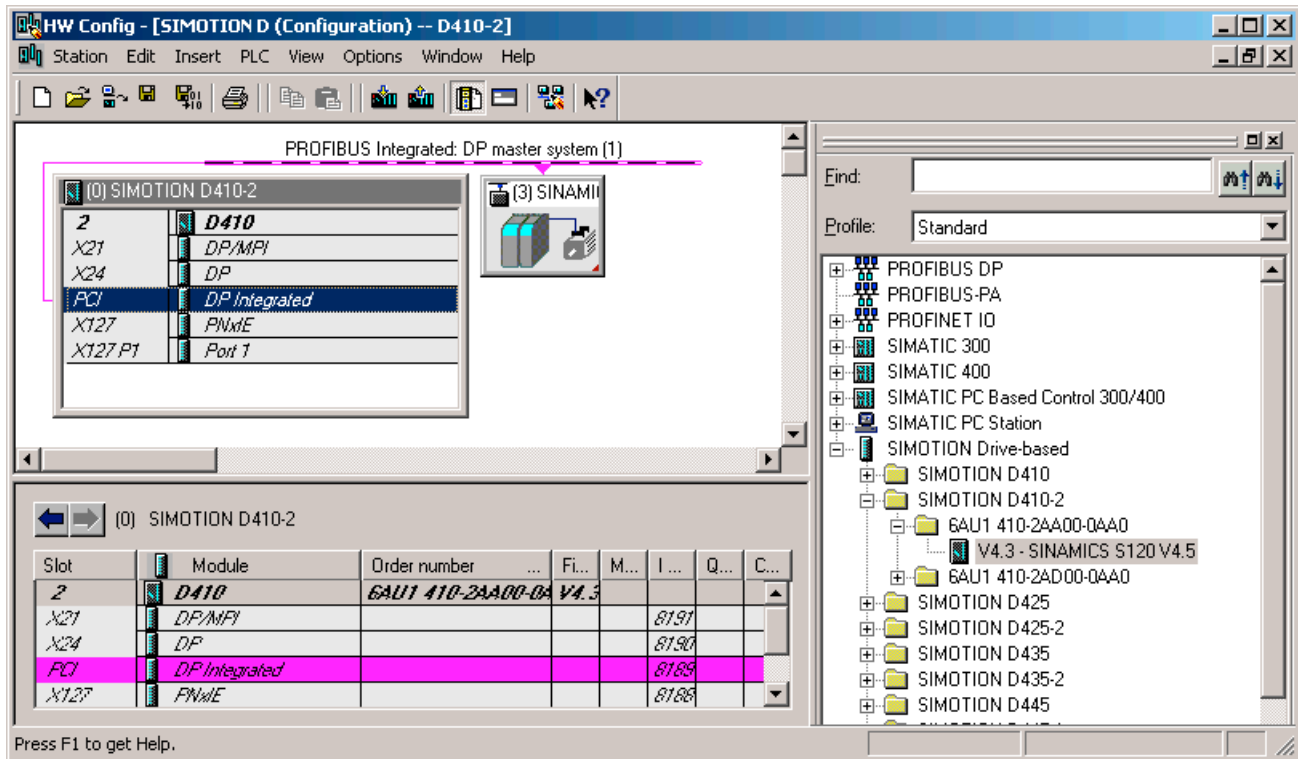


Figure 6-4 Display of a SIMOTION D410-2 in HW Config

**Note**

According to the DNS conventions, "/" is a permissible character. For this reason, the Ethernet and PROFINET interfaces have a different name in the engineering software than on the module lettering ("/" is replaced by "x").

Example: PN/IE (lettering on module) → PNxIE (as shown in SCOUT, HW Config, NetPro)

**6.3 Configuring PROFIBUS DP**

**6.3.1 General information about PROFIBUS DP communication**

**Definition of PROFIBUS DP**

PROFIBUS DP is an international, open field bus standard specified in the European field bus Standard EN 50170 Part 2. PROFIBUS DP is optimized for high-speed, time-sensitive data transfer at field level.

Components communicating on PROFIBUS DP are classified as master and slave components.

- Master (active bus device)  
Components that represent a master on the bus define data transfer along the bus, and are therefore known as active bus nodes.  
Masters components are divided into two classes:
  - DP master class 1 (DPMC1):  
Central master devices are thus designated, which exchange information with the slaves in specified message cycles.  
Examples: SIMOTION D410-2 DP, C240, P350, SIMATIC S7, etc.
  - DP master class 2 (DPMC2):  
These are devices for configuration, commissioning, and operator control and monitoring while the bus is in operation.  
Examples: Programming devices, operator control/monitoring devices
- Slaves (passive bus nodes):  
These devices may only receive, acknowledge and transfer messages to a master when so requested.  
Examples: SINAMICS drives, I/O modules

## Functions on PROFIBUS DP

The functional scope can differ between DP masters and DP slaves. The functional scope is different for DP-V0, DP-V1 and DP-V2.

These functions on the PROFIBUS DP are characterized by:

- Configurable, equidistant, isochronous PROFIBUS DP cycle
- Synchronization of slaves by the master by means of a global control message frame in each cycle clock
- Independent maintenance of the isochronous cycle clock by the slaves in the event of a short-term communication failure.

## Additional references

You will find additional information about PROFIBUS DP in the *SIMOTION Communication System Manual*.

### 6.3.2 Operating SIMOTION D410-2 on PROFIBUS DP

#### PROFIBUS DP interfaces (X21, X24)

For connection to PROFIBUS DP, the SIMOTION D410-2 DP has two interfaces (X21 and X24) and the SIMOTION D410-2 DP/PN has one interface (X21).

Table 6-1 SIMOTION D410-2 PROFIBUS interfaces

	D410-2 DP	D410-2 DP/PN
PROFIBUS DP/MPI interface	X21	X21
PROFIBUS DP interface	X24	–

Transmission rates up to 12 Mbits/s are possible. Interfaces X21 and X24 can both be operated isochronously.

Alternatively, the X21 interface can be used as an MPI interface with a transmission rate of 19.2 kbit/s up to 12 Mbit/s, see Section Configuring the MPI bus (Page 106).

In the delivery condition, PROFIBUS DP interfaces X21 and X24 are both preset as a master with address 2 and a transmission rate of 1.5 Mbit/s. The PROFIBUS DP network is automatically detected and generated for this setting.

However, other settings can also be configured. This requires that you configure the network manually using **HW Config** and **NetPro**.

**Note**

Communication with the SINAMICS Integrated of a SIMOTION D410-2 is always equidistant. Here, the SIMOTION D410-2 is the master and the SINAMICS Integrated drive is the slave.

#### SIMOTION D410-2 DP master-slave configuration

Master-slave configurations can be used, for example, to establish hierarchical PROFIBUS networks that can be used to implement a modular machine concept.

Table 6-2 SIMOTION D410-2 DP master-slave configuration

X21 DP/MPI	X24 DP	Remark	Actions in the application
DP master, isochronous	DP slave, isochronous	Application synchronized to DP master (X21), application controls synchronization to DP slave (X24) Internal drive is synchronous with external cycle clock Cycle clock X21 = cycle clock DP Integrated	DP master / DP slave synchronization mechanisms
DP slave, isochronous	DP master, isochronous	Application synchronized to DP master (X24), application controls synchronization to DP slave (X21) Internal drive is synchronous with external cycle clock Cycle clock X24 = cycle clock DP Integrated	DP master / DP slave synchronization mechanisms



X21 DP/MPI	X24 DP	Remark	Actions in the application
DP master, not isochronous	DP slave, isochronous	Application synchronized to DP slave (X24) (can be monitored by the application) Internal drive is synchronous with X24	DP slave synchronization mechanisms
DP slave, isochronous	DP master, not isochronous	Application synchronized to DP slave (X21) (can be monitored by the application) Internal drive is synchronous with X21	DP slave synchronization mechanisms
DP master, isochronous	DP master, isochronous	Application synchronized to DP master (X24, X21) Internal drive is synchronous with external cycle clock Cycle clock X24 = cycle clock X21 = cycle clock DP Integrated	None
DP master, not isochronous	DP master, isochronous	Application synchronized to DP master (X24) Internal drive is synchronous with X24 Cycle clock X24 = cycle clock DP Integrated	None
DP slave, not isochronous	DP master, isochronous	Application synchronized to DP master (X24) Internal drive is synchronous with X24 Cycle clock X24 = cycle clock DP Integrated	None
DP master, isochronous	DP master, not isochronous	Application synchronized to DP master (X21) Internal drive is synchronous with X21 Cycle clock X21 = cycle clock DP Integrated	None
DP master, isochronous	DP slave, not isochronous	Application synchronized to DP master (X21) Internal drive is synchronous with X21 Cycle clock X21 = cycle clock DP Integrated	None
DP master, not isochronous	DP master, not isochronous	Application synchronized to internal drive cycle clock	None
DP master, not isochronous	DP slave, not isochronous	Application synchronized to internal drive cycle clock	None
DP slave, not isochronous	DP master, not isochronous	Application synchronized to internal drive cycle clock	None
DP slave, not isochronous	DP slave, not isochronous	Application synchronized to internal drive cycle clock	None
DP slave, not isochronous	DP slave, isochronous	Application synchronized to DP slave (X24) (can be monitored by the application) Internal drive is synchronous with X24	DP slave synchronization mechanisms
DP slave, isochronous	DP slave, not isochronous	Application synchronized to DP slave (X21) (can be monitored by the application) Internal drive is synchronous with X21	DP slave synchronization mechanisms

For detailed information about controlling synchronization across the application, see the *Basic Functions for Modular Machines* Description of Functions.

### 6.3.3 Assigning PROFIBUS addresses in HW Config

#### Assigning PROFIBUS addresses

Assign a PROFIBUS address to all devices **before** you start networking these in order to enable intercommunication.

---

#### Note

Before you assign any PROFIBUS addresses, please remember that all addresses must be unique on the PROFIBUS subnet.

---

Define the PROFIBUS address separately for each device with the PG/PC in **HW Config**. Certain PROFIBUS DP slaves are equipped with an address switch.

---

#### Note

The PROFIBUS addresses set at the devices using these switches must correspond with the address settings in **HW Config**.

---

#### Recommendation for PROFIBUS addresses

Reserve PROFIBUS address "0" for a service PG and "1" for a service HMI device which are connected to the subnet as required.

Recommended PROFIBUS address setting for SIMOTION D410-2 in case of replacement or service:

Reserve address "2" for a SIMOTION D410-2. This prevents duplicate addresses when installing a SIMOTION D410-2 with a default setting on the subnet (e.g. when a SIMOTION D410-2 is replaced). Assign addresses higher than "2" to any additional devices on the subnet.

### 6.3.4 Setting the DP cycle and system cycle clocks

#### Adapting the DP cycle of SINAMICS Integrated

SINAMICS Integrated serves as the basis for all cycle clocks of a SIMOTION D410-2 under the following circumstances:

- SIMOTION D410-2 DP: Always
- SIMOTION D410-2 DP/PN: Only if no synchronized data exchange takes place via the PROFINET interface (see also Section Setting a send cycle clock and system cycle clocks (Page 111)).

To set the DP cycle of the SINAMICS Integrated, double-click the SINAMICS drive on the integrated PROFIBUS. The "DP Slave Properties" dialog box opens. You can synchronize the DP cycle of SINAMICS Integrated in the "Isochronous mode" tab.

Table 6-3 SIMOTION D410-2 value range

DP cycle	$\geq 0.5$ ms (DP internal) $\geq 1$ ms (DP external)
Grid	0.125 ms (the use of a clock grid $\geq 0.250$ ms is recommended)

External DP interfaces can only be operated with a DP cycle of  $\geq 1$  ms.

SINAMICS Integrated always runs in isochronous mode. The cyclic tasks of SIMOTION are therefore always in synchronism with SINAMICS Integrated.

The set DP cycle of SINAMICS Integrated is displayed as "Bus data cycle" in the "System Cycle Clocks - D410" dialog box in SIMOTION SCOUT. Select the SIMOTION D410-2 in the project tree, and then select the "Set system cycle clocks" option in the "Target system" > "Expert" menu.

The table below shows the ratios you can set for the system cycle clocks of SIMOTION D410-2 based on the bus cycle clock.

Table 6-4 Ratios of system cycle clocks

Servo cycle clock <sup>1)</sup> : Bus cycle clock	IPO cycle clock: Servo cycle clock	IPO2 cycle clock: IPO cycle clock
1 ... 4, 8	1 ... 6	2 ... 64

<sup>1)</sup> When using the TO axis and the integrated drive control, the minimum servo cycle clock is 1 ms.

### Note

The following statements relate to a SIMOTION D410-2 DP with 2 DP interfaces (X21/X24). The statements are equally applicable to a SIMOTION D410-2 DP/PN with only one DP interface (X21).

In addition, if the DP interfaces (X21/X24) are configured as equidistant master interfaces, you must set both DP cycles equal to the bus cycle clock of the SINAMICS Integrated in **HW Config**.

If the DP interfaces (X21/X24) are operated as the master, the system cycle clocks are obtained from an internal cycle clock of the module.

Of the two DP interfaces (X21/X24), no more than one can also be operated as an isochronous slave interface. In this case, the system cycle clocks are obtained from the cycle clock of the slave interface. As a result, the task system of SIMOTION and SINAMICS Integrated runs synchronously to the slave cycle clock. This assumes that a slave cycle clock exists and synchronization with the slave cycle clock has been achieved. If this is not the case, the system cycle clocks are acquired from an internal replacement cycle clock.

When the project is downloaded, the cycle clock configuration is downloaded to the SIMOTION D410-2 and automatically set according to the specifications.

### 6.3 Configuring PROFIBUS DP

Also observe the cycle clock setting rules in Section Rules for cycle clock settings with SIMOTION D410-2 DP (Page 100).

#### 6.3.5 Rules for cycle clock settings with SIMOTION D410-2 DP

The rules for making SIMOTION D410-2 DP cycle clock settings are described below.

For SIMOTION D410-2 DP/PN, see Section Rules for cycle clock settings with SIMOTION D410-2 DP/PN (Page 115).

#### Rules for adjusting system cycle clocks in the case of SIMOTION D410-2 DP

You must conform to the following rules when setting the DP cycle and SINAMICS Integrated cycle clocks:

1. The DP cycle must be an integer multiple of the current controller cycle.
2. The master application cycle ( $T_{mapc}$ ), which corresponds to the servo cycle, must be an integer multiple of the speed controller cycle. The smallest-possible  $T_{mapc}$  thus results from the smallest common multiple of the DP cycle and the speed controller cycle.  
If the master application cycle = 1, it follows that the DP cycle is also an integer multiple of the speed controller cycle.
3. The DP cycle must be an integer multiple of the basic cycles r0110[x] (DRIVE-CLiQ basic sampling rates).  
You can determine parameter r0110[x] using the expert list in SIMOTION SCOUT (select the "Control\_Unit" from "SINAMICS\_Integrated" in the project navigator, and then open the "Expert list" by selecting the "Expert" command from the shortcut menu).

---

#### Note

An overview of errors reported by the SINAMICS Integrated is provided in the *SINAMICS S List Manual*.

---

#### Dependencies of SINAMICS cycle clocks

The general rule for SIMOTION D410-2 DP is that the DP cycle serves as the basic cycle clock for the task system. All SIMOTION clock cycles (servo, IPO, IPO\_2, etc.) longer than this basic cycle clock must be an integer multiple of the basic cycle clock.

This rule also applies to SINAMICS Integrated cycle clocks, if one of the successive cycle clocks is longer than the basic cycle clock:

- Speed controller p0115[1] (drive)
- Flow controller p0115[2] (drive)
- Setpoint channel p0115[3] (drive)
- Position controller p0115[4] (drive)
- Positioning p0115[5] (drive)
- Technology controller p0115[6] (drive)

- Onboard I/O p0799[0...2] (Control Unit)
- Terminal module I/O p4099

The corresponding cycle must be an integer multiple of the basic clock (DP cycle).

If any change to the DP cycle violates this rule you must also change the SINAMICS cycle clocks. In order to change the cycles in the Expert list of **SIMOTION SCOUT**, select the "Control\_Unit" or the "Drive" from "SINAMICS\_Integrated" in the Project Navigator, and then open the "Expert List" by selecting the "Expert" command from the shortcut menu.

If p0115 sampling times are required which cannot be set using  $p0112 > 1$ , then you can directly set the sampling times using p0115. This requires that p0112 must be set to "0" (expert).

If p0115 is changed online, the values of the higher indices are adapted automatically.

---

**Note**

At the SINAMICS end, there are further rules for setting the sampling times. You will find these described in the *SINAMICS S120* Function Manual, Section Rules for setting the sampling time.

---

**Example**

A default value of 4 ms is set for the SINAMICS Integrated setpoint channel p0115[3]. If the DP cycle is to be set to 3 ms, the fact that an integer multiple value is required means that you will need to set 3 ms or 6 ms (for example) for the setpoint channel.

**Incorrect cycle clock setting**

If the SINAMICS cycle clocks are not set correctly, this can be seen by the following messages:

- A01223 CU: Sampling time inconsistent and/or
- A01902 PB/PN isochronous operation parameterization impermissible and/or
- F01043 severe error downloading project
- F01951 CU SYNC: Synchronization application cycle clock missing

In this case, check the cycle clock settings on all drive objects signaling this error. For F01951, check the DP cycle. In this case, use a DP cycle that is a multiple of 0.25 ms or 0.5 ms.

---

**Note**

An overview of errors reported by the SINAMICS Integrated is provided in the *SINAMICS SList* Manual.

---

### 6.3 Configuring PROFIBUS DP

#### Current controller cycle clock

With the SIMOTION D410-2, the following current controller cycle clocks p0115[0] can be configured for the SINAMICS Integrated:

- for servo: 125 µs (default) or 250 µs
- For vector and vector V/f:
  - For blocksize Power Modules: 250 µs or 500 µs (default)
  - For chassis Power Modules: 375 µs.

#### See also

Using vector drives (Page 153)

### 6.3.6 Cycle clock scaling of external PROFIBUS interface to internal PROFIBUS interface

#### Definition

Cycle clock scaling means that an external PROFIBUS interface of the SIMOTION D410-2 DP (X21/X24) or SIMOTION D410-2 DP/PN (X21) can be operated in an integer multiple of the internal PROFIBUS interface. This reduces the CPU load, thereby allowing you to operate more axes, for example. The settings of the scaled cycle clocks for the external DP interfaces are made in **HW Config**.

#### Supplementary conditions

The following supplementary conditions are applicable to cycle clock scaling:

- An external DP interface of the D410-2 is used as an isochronous slave interface. Only in this case can an **integer** cycle clock scaling of isochronous external DP slave interface to internal interface be specified. This is checked during compilation and an error message is output in the event of noncompliance. If the external DP interfaces are configured as equidistant interfaces but none are configured as slaves and cycle clock scaling is specified for these interfaces, an error is output during compilation.
- For SERVO, IPO, and IPO2, settings can also be made for all permissible cycle clocks. Master and slave axes can run in different IPO levels. Different cycle clocks and phase offsets are tolerated by the system.

---

#### Note

The IPO cycle clock of the IPO in which the synchronous operation technology object runs must be set equal to the cycle clock of the isochronous external DP slave interface.

---

- The second external DP interface of a SIMOTION D410-2 DP can be operated as an isochronous master (while the other is an isochronous slave) in order to operate external drives, for example. In this case, the cycle clock must be the same as the cycle clock of the internal PROFIBUS DP. If this condition is not satisfied, an error message is output during compilation.
- One or both external DP interfaces can also be operated as non-isochronous, free-running interfaces. In this case, there is no effect on the cycle clock settings.

### Application example

The system consists of a synchronous master (DP master) and at least one SIMOTION D410-2 DP synchronous slave (DP slave). The synchronous master contains the master axis; the synchronous slave contains the following axes:

- The axes in the SINAMICS Integrated of the D410-2 DP synchronous slave must exhibit high performance with a servo cycle clock of 1.5 ms and an internal DP cycle of 1.5 ms. This requires that the internal fast PROFIBUS DP be decoupled from the slower external PROFIBUS DP.
- The PROFIBUS DP has, for example, a cycle time of 6 ms due to the quantity framework on the bus; in all cases, its cycle time exceeds that of the cycle clock of the internal DP interface.
- The master values are transmitted via the DP bus. Further nodes can also be connected to the DP bus, e.g. DP drives, distributed I/O, etc.

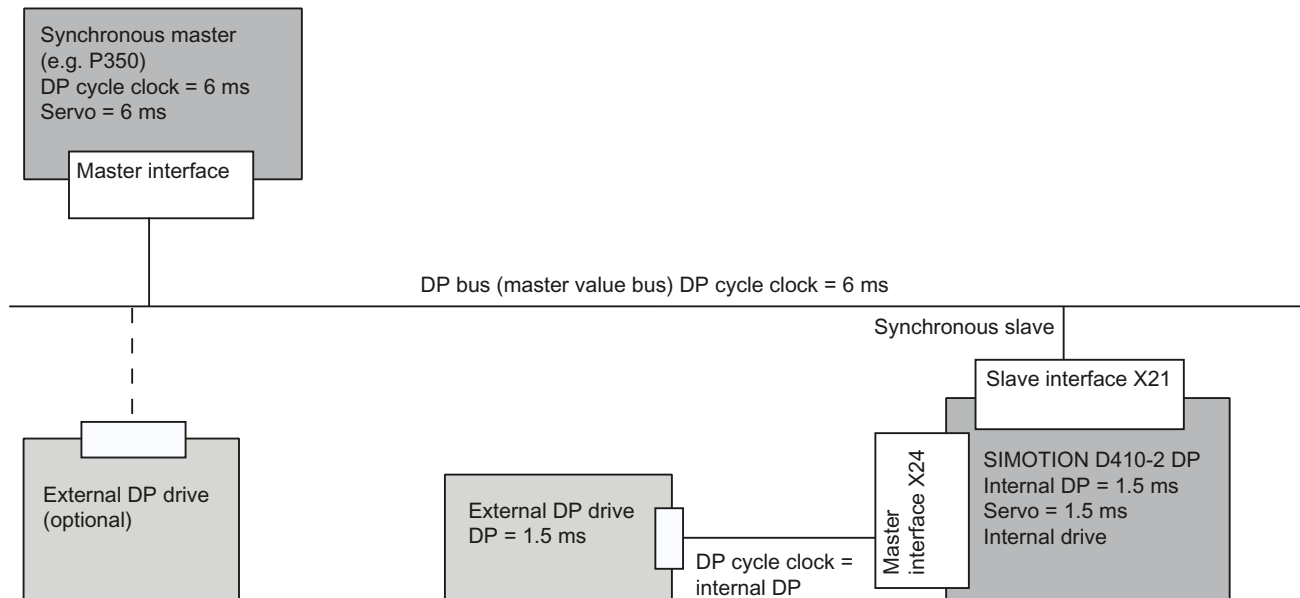


Figure 6-5 Example of a cycle clock scaling for PROFIBUS DP

### 6.3.7 Creating a new PROFIBUS DP subnet

SIMOTION SCOUT is used to network the SIMOTION D410-2. Set up your user-specific bus parameters for the PROFIBUS DP interfaces when you configure the network.

---

#### Note

If a hardware configuration is loaded without a PROFIBUS network being configured on the CPU, a new PROFIBUS address that was previously set in **HW Config** or **NetPro** will not be accepted by the CPU.

---

#### Requirement

You have created a project and have inserted a SIMOTION D410-2.

---

#### Note

The actions outlined below only need to be taken if you have not selected an interface when integrating the SIMOTION D410-2 into the project (see Section Creating a project and configuring the communication (Page 87)).

Next the connection to the PG/PC must be established via **NetPro**, refer to:

- Section Configuring the PROFIBUS PG/PC interface (Page 89)
  - Section Configuring the Ethernet PG/PC interface (Page 91).
- 

#### Procedure

To create a new PROFIBUS subnet, proceed as follows:

1. Double-click the "D410-2" entry in the project navigator in order to open **HW Config**.
2. In the SIMOTION D410-2 representation, double-click the DP interface for which you want to create a PROFIBUS subnet.  
The "Properties - DP/MPI" dialog box opens.
3. Click "Properties" in the "General" tab to open the "PROFIBUS Interface DP/MPI" dialog box.
4. Click "New" to open the "Properties - New PROFIBUS Subnet" dialog box.
5. Name the new subnet and enter the properties of the new subnet, e.g. transmission rate, on the "Network settings" tab.
6. If the PROFIBUS interface is to be operated isochronously, click "Options". Activate the "Activate isochronous bus cycle" option in the opened dialog box and set the DP cycle. Confirm the settings with "OK" to exit the "Options" dialog box.
7. Accept the settings in the "Properties - New PROFIBUS Subnet" dialog box with "OK".  
The new subnet is now displayed in the "Properties - PROFIBUS Interface DP/MPI" dialog box. You can now connect the new subnet to the corresponding PROFIBUS interface. Follow the same steps to configure the second PROFIBUS interface for a SIMOTION D410-2 DP.
8. Save and compile the changes.



The PROFIBUS subnet you created is displayed as a graphic object in **HW Config**.

---

**Note**

PROFIBUS DP functionality is both equidistant and isochronous in nature. As such, it can guarantee that bus cycles will have exactly the same length and ensures deterministic behavior.

Applications: Connecting drives or synchronized I/O devices.

---

### Additional references


For further information, see the *SIMOTION Runtime Basic Functions* Function Manual, Section "Isochronous I/O processing on fieldbus systems".

## 6.3.8 Establishing a PG/PC assignment


### Introduction

A PG/PC is required to create projects for a SIMOTION D410-2 and download them to the target device. The interface via which the PG/PC can be connected is polled during the automatic communication configuration. If you change these settings, you must reestablish the active designation of the PG/PC in **NetPro** (the PG/PC connection must appear yellow and bold in **NetPro**).

### Procedure

1. Open the project in SIMOTION SCOUT.
2. Click the "Open NetPro"  button.  
**NetPro** is accessed, and the configured network is graphically displayed. The PG/PC connection to the configured network is shown in bold in a color other than yellow.
3. Double-click the PG/PC you would like to configure.  
The "Properties - PG/PC" dialog will be displayed with the "Assignment" tab in foreground.
4. Select the interface in the "Assigned" field and activate S7ONLINE access by clicking the appropriate checkbox.
5. Click "OK" to accept the settings.  
The PG/PC connection to the configured network is displayed again in bold and yellow.
6. Save and compile the changes and download them to the SIMOTION D410-2.

Now you can go online again via the PG/PC.

Alternatively, you can make the assignment in SIMOTION SCOUT by clicking the  "Assign PG/PC" button. This calls the properties window for PG/PC assignment, where you can modify the assignment and "activate" it (S7ONLINE access).

## 6.4 Configuring the MPI bus

### 6.4.1 Operating interface X21 as an MPI

The X21 interface can also be operated as an MPI interface.

The typical (default) baud rate is 187.5 Kbaud. A baud rate of up to 12 MBaud can be set for communication with other CPUs. It should be noted, however, that a rate of 12 MBaud is not supported by all CPUs (e.g. smaller SIMATIC S7 CPUs).

The following list provides examples of when using MPI (Multi Point Interface) may prove effective:

- If a PC/PG is being used with an MPI interface
- If an OP/TP only has an MPI interface (newer devices have PROFIBUS or PROFINET interfaces)
- If SIMOTION and SIMATIC CPUs are coupled via XSEND/XRECEIVE

---

#### Note

When the X21 interface is used as an MPI bus, additional activation of a drive on this interface is not possible.

---

#### Additional references

For general information on MPI, see the *SIMOTION Communication System Manual*.

### 6.4.2 MPI parameters

#### MPI bus addresses and data transmission rate

Every node on the MPI bus must have a bus address in the range 0 to 31.

The data transmission rate on the MPI bus can be set to any value for the SIMOTION D410-2.

#### Communication attempt unsuccessful

If communication cannot be established at all, or if it cannot be established with individual nodes on the MPI bus, check the following:

- Is the transmission rate setting for the SIMOTION D410-2 used for all nodes?
- Are there any loose plug connections?
- Are all bus segments terminated properly?  
Bus segments that are not terminated properly will disrupt communication on the MPI bus.

## 6.5 Configuring PROFINET IO

### 6.5.1 General information about communication via PROFINET IO

#### Communication cycle

In PROFINET, the communication cycle is subdivided into different, time-specific intervals. The first interval is used for isochronous real-time communication (IRT), followed by real-time communication (RT) and standard TCP/IP communication. The bandwidth reservation for IRT ensures that RT communication and standard communication have no effect on the transmission of IRT telegrams, which are important for motion control applications.

The following figure shows how the PROFINET communication cycle is divided into isochronous real-time communication (IRT), real-time communication (RT), and standard TCP/IP communication.

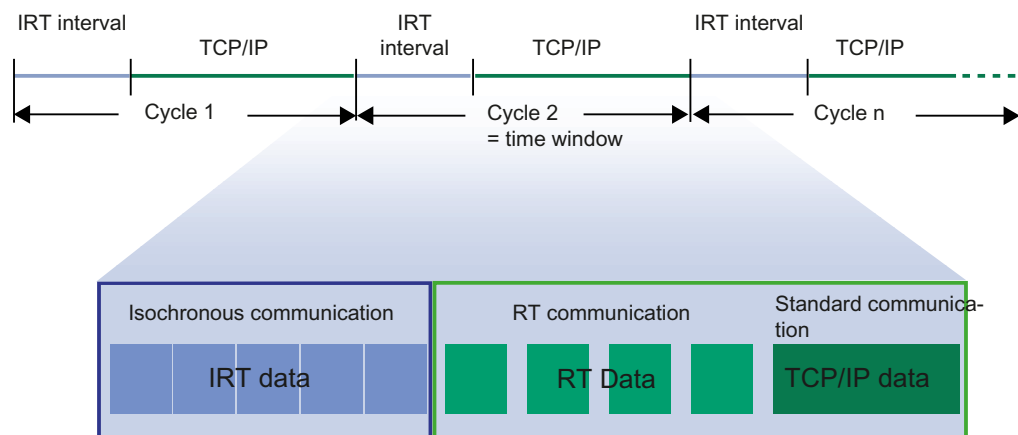


Figure 6-6 PROFINET communication cycle

#### Isochronous real-time Ethernet

STEP 7 can be used to configure PROFINET devices supporting data exchange via isochronous real-time Ethernet (IRT). IRT telegrams are transferred deterministically via planned communication paths in a defined sequence to achieve the best possible synchronism and performance.

IRT requires special network components supporting a planned data transfer.

#### Isochronous operation and mode

Equidistant mode and isochronous mode function similarly in PROFINET IO to the way they function in PROFIBUS DP.

For PROFIBUS DP, in isochronous operation all nodes are synchronized using a Global Control Signal created by the DP master.

## 6.5 Configuring PROFINET IO

In PROFINET IO with IRT, a sync master generates a signal to which sync slaves synchronize themselves. Sync master and sync slaves belong to a sync domain which is assigned a name via configuration. The role of the sync master can in principle be played by an I/O controller as well as an I/O device. A sync domain has exactly one sync master.

### Context: Sync domain and I/O systems

An important fact is that sync domains do not need to be limited to one PROFINET IO system: The devices of several I/O systems can be synchronized by a single sync master, provided they are connected to the same Ethernet subnet.

The following applies the other way around: An I/O system must only belong to a single sync domain.

### Signal propagation delays not negligible

For the extremely exact synchronization interval, line lengths, namely the associated delay times, must be taken into consideration. You can use a topology editor to enter the properties of the lines among the ports of the switches. STEP 7 uses this data and the other configuration data to calculate the optimized process of the IRT communication and the resulting updating time.

### IRT runs in parallel to real-time and TCP/IP communication

Apart from IRT communication, for which a defined bandwidth is reserved within the update time, RT communication and TCP/IP communication are also permitted within the update time.

With RT communication (real-time communication), the cyclic data is transferred between I/O controller and I/O device, but without "best possible synchronism".

With non-synchronized I/O devices, data is exchanged automatically via RT communication.

Due to the fact that TCP/IP communication is also possible, other data, e.g. non-real-time data, configuration data or diagnostic data, can be transported.

### PROFINET IO controller

Typically, the function of a PROFINET IO controller is taken on by controllers (e.g. SIMOTION C/P/D, SIMATIC S7 CPUs, ...).

The PROFINET IO controller takes on the master function for I/O data communication of the distributed field devices. The function is comparable to a PROFIBUS DP master class 1.

### PROFINET IO device

Distributed field devices such as I/Os, drives (e.g. SINAMICS S120) or operator terminals are designated as IO devices. The function is comparable to a PROFIBUS DP slave.

## Addressing

In the delivery condition, the onboard PROFINET IO interface does not have an IP address or a subnet mask.

---

### Note

The IP addresses 192.168.215.240 to 192.168.215.255 are reserved for internal communication in the SIMOTION D410-2 (subnet mask 255.255.255.240). When configuring the PROFINET interface (X150), make sure that the internal addresses are not located within the network of this interface. In IP, the network is defined as an AND link of IP address and subnet mask.

---

## Media redundancy (MRP)

Requirement: SIMOTION V4.4.

It is possible to establish redundant networks via the Media Redundancy Protocol (MRP). Redundant transmission links (ring topology) ensure that an alternative communication path is made available when a transmission link fails. The PROFINET devices that are part of this redundant network form an MRP domain.

MRP guarantees media redundancy in the event of a problem in the ring. The switchover of the ring is performed by the Redundancy Manager.

The switchover times depend on:

- The actual topology
- The devices used and
- The network load in the relevant network

The typical reconfiguration time of the communication paths for TCP/IP and RT frames in the event of a fault is < 200 ms.

In most systems, the switchover time of MRP is far above the PROFINET update time for cyclic data, so that a failure for cyclic data is detected. The PROFINET connection therefore fails and is reestablished after the switchover by the Redundancy Manager. In this way, an error can be corrected in the network, while the system continues to run **with bumps**.

---

### Note

During the interruption of the ring, as well as when correcting the interruption (e.g. repair of the defective cable), there is a brief failure of the communication.

---

### Ring ports

A SIMOTION/SINAMICS device may only be inserted in an MRP ring as a node with MRP-capable ports. For SIMOTION D, the first two ports of the PROFINET IO interfaces are designed as ring ports.

These two ports are marked with an "R" in the module rack in HW Config.

---

**Note**

Only devices with MRP-capable ports may be inserted in an MRP ring. If MRP-capable ports are not used, the reconfiguration times can be in the seconds range.

---

### Bumpless media redundancy (MRPD)

Requirement for SIMOTION D410-2:

- SIMOTION SCOUT as of V4.4
- SIMOTION SCOUT TIA as of V4.5

MRPD is a procedure for bumpless media redundancy for PROFINET IO with IRT. MRPD also requires MRP.

The combination of MRP with MRPD provides bumpless PROFINET operation for short cycle times in the event of a fault in the ring. MRPD is based on IRT and ensures bumpless operation by the provider sending the cyclic data in both directions which the consumers then receive twice. If the ring is interrupted at one position (e.g. through the failure of a ring node), receipt of the cyclic data via the problem-free side of the ring is still guaranteed.

Bumpless media redundancy MRPD always requires the activation of MRP in the individual rings.

A maximum of two Ethernet nodes may be between the sync master and the redundant sync master. If the redundant sync master is used together with MRPD, it is recommended that the redundant sync master be connected directly to the sync master and the two nodes located in a shared cabinet so that the cable connection between both nodes is protected.

If there is an interruption in the link between the sync master and the redundant sync master, the system continues to run without bumps, but after switching off and on again faults can occur.

Too high a network load or too-rapid coming and going of faults can also result in unfavorable cases in the failure of the PROFINET connection with activated MRPD because of delayed or incomplete switchover actions of MRP/MRPD.

For example, with two consecutive faults at different points in the ring, bumpless operation is only ensured when there is approx. three seconds between the two faults.

### Additional information

You will find additional information about media redundancy in the *SIMOTION Communication System Manual*.

## 6.5.2 Setting a send cycle clock and system cycle clocks

### Requirement

The SIMOTION system cycle clocks (servo/IPO/IPO\_2) are based on the SINAMICS Integrated DP cycle or the PROFINET send cycle clock, depending on the PROFINET real-time class and the type of data transfer. The cycle clock source can be generated "internally" by the SIMOTION D410-2; otherwise, it is obtained "externally" from the clock signals received at the PROFINET interface.

Table 6-5 Basis for the SIMOTION system cycle clocks/cycle clock source

Real-time class in which the PROFINET interface is operated	Data transfer	Basis for the SIMOTION system cycle clocks		Cycle clock source
		DP cycle (Integrated)	PROFINET send cycle clock <sup>1)</sup>	
RT communication		X		Internal
IRT communication	The D410-2 DP/PN is the SYNC master in the I/O system; synchronized data traffic takes place <sup>2)</sup>		X	Internal
	The D410-2 DP/PN is the SYNC slave in the I/O system; synchronized data traffic takes place <sup>2)</sup>		X	External Internal (as substitute value)
	No synchronized data traffic <sup>2)</sup>	X		Internal

<sup>1)</sup> If the PROFINET send cycle clock forms the basis for the SIMOTION system cycle clocks, the DP cycle (SINAMICS Integrated and external PROFIBUS interface) and the servo cycle clock must be the same.

<sup>2)</sup> Synchronized data traffic, e.g. by means of:

- controller-controller slave-to-slave communication
- IO device in its own IO system

### Setting the DP cycle in HW Config

To set the DP cycle of the SINAMICS Integrated, double-click the SINAMICS block on the integrated PROFIBUS in HW Config.

The "DP Slave Properties" dialog box opens. You can adjust the DP cycle of the SINAMICS Integrated on the "Isochronous mode" tab. See also Setting DP Slave properties (Page 151).

Table 6-6 SIMOTION D410-2 DP/PN value range

	D410-2 DP/PN
DP cycle	≥ 0.5 ms (DP internal) ≥ 1.0 ms (DP external)
Grid	0.125 ms (the use of a clock grid ≥ 0.250 ms is recommended)

6.5 Configuring PROFINET IO

If, in addition to the drive on the SINAMICS Integrated, external drives are also to be connected via isochronous PROFIBUS, the DP cycle must be  $\geq 1$  ms.

**Setting the send cycle clock in HW Config**

The send cycle clock for PROFINET IO must be set in the "Domain Management" dialog in **HW Config**. To do this, select the "Edit" > "PROFINET IO" > "Domain management ..." menu command in **HW Config** and set the desired cycle clock.

The PROFINET interface can be operated with a send cycle clock in the range of:  $0.25 \text{ ms} \leq \text{send cycle clock} \leq 4 \text{ ms}$ . The smallest configurable time base is 0.125 ms.

**Note**

**Information for version < V4.4**

If there are IO devices with RT class "RT" in a sync domain, it is only possible to set the send cycle clocks 0.5 ms, 1 ms, 2 ms, and 4 ms.

**Cycle clock scaling**

The PROFIBUS cycle clock can be scaled down in relation to the servo cycle clock. The reduction ratio is only permitted when PROFINET IO with IRT has not been configured. A reduction ratio for the PROFINET send cycle clock to the PROFIBUS cycle clock is also possible.

**Example:**

PROFINET send cycle clock = 0.5 ms  
 PROFIBUS cycle clock = servo cycle clock = 1 ms

The PROFIBUS cycle clock can be operated relative to the PROFINET send cycle clock at a ratio of 1:1 to 16:1.

The table below shows which ratios you can set for the system cycle clocks of the SIMOTION D410-2 DP/PN based on the DP cycle of SINAMICS Integrated or on the PROFINET send cycle clock.

Table 6-7 Ratios of system cycle clocks

Cycle clock name	Settable factors	Reference cycle clock
PROFIBUS DP bus cycle clock	1, 2, 3, 4, 6, 8, 10, 12, 14, 16	PROFINET IO send cycle clock
Servo <sup>1)</sup>	1, 2, 3, 4, 8 <sup>2)</sup>	PROFIBUS DP bus cycle clock
IPO	1, 2, 3, 4, 5, 6	Servo
IPO_2	2, 3, 4, 5, ..., 64	IPO

1) When using the TO axis and the integrated drive control, the minimum servo cycle clock is 1 ms.

2) Always "1", if PROFINET with IRT is configured.



## Setting the cycle clock ratios

The set bus cycle clock is displayed in SIMOTION SCOUT as the "Bus data cycle" in the "System Cycle Clocks - D410" dialog box. Select the SIMOTION D410-2 and then select the "Set system cycle clocks" option in the "Target system" > "Expert" menu.

Set the required cycle clock ratios for the servo, IPO, and IPO\_2 in the "System Cycle Clocks - D410" dialog box.

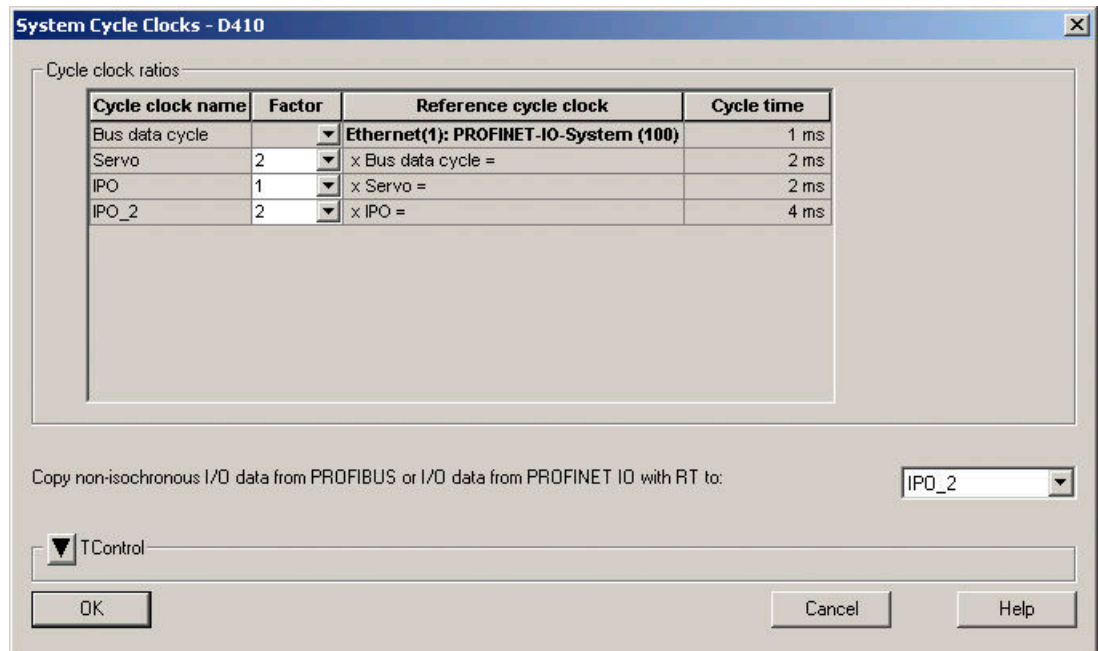


Figure 6-7 System cycle clocks

## Additional information

For further information, see the *SIMOTION Communication System Manual*.

### 6.5.3 Properties of PROFINET

#### Properties

The onboard PROFINET IO interface supports the parallel operation of:

- IRT - isochronous real-time Ethernet
  - Operation of IRT I/O (e.g. ET 200SP)
  - Operation of a SINAMICS S120 as an IRT device
- RT - real-time Ethernet
  - Operation of RT I/O (e.g. ET 200SP, ET 200pro, etc.)
  - Operation of a SINAMICS S120 as an RT device
- TCP/IP, UDP, HTTP, ... standard Ethernet services

---

#### Note

For mixed operation of IRT and RT, make sure that the IRT-compatible devices form what is referred to as an IRT domain; i.e. there must not be any non-IRT devices on the data transmission link between the IRT devices.

---

#### Additional references

You will find an overview of the specific properties of PROFINET IO on SIMOTION D in the *SIMOTION Communication System Manual*.

### 6.5.4 Configuration tasks

Configuration of PROFINET involves the following steps:

1. Insert the SIMOTION D410-2 DP/PN.
2. Configure the onboard PROFINET IO interface in **HW Config**.
3. Create a topology: Here, you specify how the individual ports of the PROFINET IO devices are interconnected.
4. Configure the sync domain: Here, you specify which PROFINET nodes are sync masters (clock generators) and sync slaves.
5. Specify the send clock: Describes the time during which a PROFINET IO device exchanges user data with the PROFINET IO controller.
6. Configure the direct data exchange: The direct data exchange specifies which address areas are to be used for sending and receiving respectively.

## Additional references

You will find a detailed description of each configuration step in Section "Configuring PROFINET IO with SIMOTION" of the *SIMOTION Communication System Manual*.

### 6.5.5 Rules for cycle clock settings with SIMOTION D410-2 DP/PN

The rules for making SIMOTION D410-2 DP/PN cycle clock settings are described below.

For SIMOTION D410-2 DP, see Section Rules for cycle clock settings with SIMOTION D410-2 DP (Page 100).

#### Rules for using the PROFINET send cycle

If the PROFINET send cycle clock is the basis for the cycle clocks, ensure that the DP cycle and the servo cycle clock are the same. This applies to PROFIBUS interface X21 and the PROFIBUS of the SINAMICS Integrated.

The basis for the system clocks is generated internally if the PROFINET interface is not operated with RT class IRT or if IRT is set and no data is being transferred. This also applies if the PROFINET interface is operated as synchronization master with RT class IRT and data is being transferred. The SIMOTION device does not have to synchronize itself with an external cycle.

The basis for system clocks is derived from the clock signals received at the PROFINET interface if this interface is operated as synchronization slave with RT class IRT. The SIMOTION device does not have to synchronize itself with this external clock.

A substitute clock of a duration equivalent to the configured clock is generated internally if the PROFINET interface has not received a clock signal.

The clock settings are included in the project download to the SIMOTION device and are adjusted according to specification.

#### Dependencies of SINAMICS cycle clocks

The rule for SIMOTION D410-2 DP/PN in the case of synchronized data traffic is that the send cycle clock serves as the basic cycle clock for the task system. All SIMOTION clock cycles (servo, IPO, IPO\_2, etc.) longer than this basic cycle clock must be an integer multiple of the basic cycle clock.

This rule also applies to SINAMICS cycles, if one of the successive cycles is longer than the basic clock:

- Speed controller p0115[1] (drive)
- Flow controller p0115[2] (drive)
- Setpoint channel p0115[3] (drive)
- Position controller p0115[4] (drive)
- Positioning p0115[5] (drive)
- Technology controller p0115[6] (drive)

- Onboard I/O p0799[0...2] (Control Unit)
- Terminal module I/O p4099

The corresponding cycle must be an integer multiple of the basic clock.

If any change to the send cycle violates this rule you must also change the SINAMICS cycles. In order to change the cycles in the Expert list of **SIMOTION SCOUT**, select the "Control\_Unit" or the "Drive" from "SINAMICS\_Integrated" in the Project Navigator, and then open the "Expert List" by selecting the "Expert" command from the shortcut menu.

If p0115 sampling times are required which cannot be set using  $p0112 > 1$ , then you can directly set the sampling times using p0115. This requires that p0112 must be set to "0" (expert). If p0115 is changed online, the values of the higher indices are adapted automatically.

---

**Note**

At the SINAMICS end, there are further rules for setting the sampling times. You will find these described in the *SINAMICS S120* Function Manual, Section Rules for setting the sampling time.

---

**Example**

A default value of 4 ms is set for the SINAMICS setpoint channel p0115[3]. If the send cycle is to be set to 3 ms, the fact that an integer multiple value is required means that you will need to set 3 ms or 6 ms (for example) for the setpoint channel.

**Incorrect cycle clock setting**

If the SINAMICS cycle clocks are not set correctly, this can be seen by the following messages:

- A01223 CU: Sampling time inconsistent and/or
- A01902 PB/PN isochronous operation parameterization impermissible and/or
- F01043 severe error downloading project
- F01951 CU SYNC: Synchronization application cycle clock missing

In this case, check the cycle clock settings on all drive objects signaling this error. For F01951, check the DP Integrated cycle. In this case, use a DP Integrated cycle that is a multiple of 0.25 ms or 0.5 ms.

---

**Note**

An overview of errors reported by the SINAMICS Integrated is provided in the *SINAMICS S* List Manual.

---

### Current controller cycle clock

With the SIMOTION D410-2, the following current controller cycle clocks p115[0] can be configured for the SINAMICS Integrated:

- for servo: 125  $\mu$ s (default) or 250  $\mu$ s
- For vector and vector V/f:
  - For blocksize Power Modules: 250  $\mu$ s or 500  $\mu$ s (default)
  - For blocksize Power Modules: 375  $\mu$ s.

### See also

Using vector drives (Page 153)

## 6.6 Configuring an Ethernet subnet

### 6.6.1 General information about communication via Ethernet

#### Properties of Ethernet

SIMOTION D410-2 has an onboard Ethernet interface X127 P1 PN/IE.

You can connect an Industrial Ethernet with a transmission rate of 10/100 Mbit/s to the 8-pin RJ45 socket **X127 P1**.

---

#### Note

The Ethernet interface supports PROFINET basic services. It therefore has the designation PN/IE.

---

The Ethernet interface has autocrossing functionality.

#### Ethernet communication

SIMOTION D410-2 offers the following functions via Industrial Ethernet:

- Communication with STEP 7, SIMOTION SCOUT and SIMATIC NET OPC via a PG/PC
- Communication via UDP (user datagram protocol) with other components, e.g. other D410-2 devices
- Communication with other devices via TCP/IP
- Connection of SIMATIC HMI devices or PC-based HMIs
- IT communication (e.g. via SIMOTION IT OPC XML-DA)

6.6 Configuring an Ethernet subnet

- Communication based on OPC UA (Unified Architecture)
- PROFINET basic services (e.g. DCP, LLDP, SNMP).  
These PROFINET basic services provide uniform functions for the address assignment and diagnostics, but do not provide PROFINET IO communication for the connection of drives or I/O modules, for example.

**Routing**

S7 routing is possible from the Ethernet interface to the PROFIBUS interfaces and the PROFIBUS Integrated.

You can find the MAC address on the rating plate located on the front of the SIMOTION D410-2.

For further information on routing, see the *SIMOTION Communication System Manual*.

**Default Ethernet addresses**

The following IP addresses are assigned by default for the Ethernet interface:

Table 6-8 IP address assignment for SIMOTION D410-2

Interface	Use case	Default address	
X127 P1 PN/IE	Insert SIMOTION device or HW Config	IP address:	169.254.11.22
		Subnet mask:	255.255.0.0
		Router address:	0.0.0.0
		Automatic private IP address	
	SIMOTION D410-2 in the delivery condition	IP address:	169.254.11.22
		Subnet mask:	255.255.0.0
		Router address:	0.0.0.0
		Automatic private IP address	

**Note**

The IP addresses 192.168.215.240 to 192.168.215.255 are reserved for internal communication in the SIMOTION D410-2 (subnet mask 255.255.255.240). When configuring the external Ethernet interface (X127 P1), make sure that the internal addresses are not inside their network. In IP, the network is defined as an AND link of IP address and subnet mask.

**Note**

If you want to go online via Ethernet, you have to make sure that the connection from PG/PC to SIMOTION D410-2 is active. You can check this in **NetPro**. You will find a description of how to reactivate the connection in Section Establishing a PG/PC assignment (Page 105).

**Automatic Private IP Addressing**

The Ethernet interface supports the automatic IP assignment according to the Automatic Private IP Addressing (APIPA) process.

Interface X127 P1 already has IP address 169.254.11.22 in the delivery condition. Further information on Automatic Private IP Addressing can be found on the Internet, e.g. in WIKIPEDIA with the keywords *APIPA* or *Zeroconf*.

## 6.6.2 Configuring the Ethernet connection in HW Config

The Ethernet connection of the SIMOTION D410-2 can be configured in **HW Config**.

### Procedure

1. Open your project.
2. Open **HW Config**. Double-click the Ethernet port (X127 P1) to open the "Properties - PNxIE" dialog box.
3. You can configure the Ethernet connection in the "Options" tab.  
Recommendation: Use the default setting "Automatic setting". With Automatic setting, the baud rate and duplex operating mode are automatically aligned with the connection partner. The autocrossing functionality is also available so that you can use crossed and uncrossed cables.  
If transmission is to be set manually, not only must the connection (e.g. 10 Mbit/s half duplex) be set manually but autonegotiation must also be deactivated.
4. Close the "Properties - PNxIE" dialog box with "OK".
5. Save and compile the modified hardware configuration.
6. Load the new hardware configuration to the SIMOTION D410-2 via PROFIBUS DP/ Ethernet/PROFINET IO.

Shielded twisted pair cables are used for the networking. 4- and 8-wire cables can be used for 10/100 Mbit/s.

---

### Note

The TCP/IP timeout parameters are configured in **HW Config** by double-clicking the D410 module in the "Ethernet extended" tab.

---

### Additional references

For additional information, see the *SIMATIC NET, Industrial Twisted Pair, and Fiber Optic Networks Manual*.

For further information about the cabling spectrum for Ethernet, see the *Industrial Communication IK PI Catalog*.

### 6.6.3 Configuring Ethernet addresses in HW Config

#### Requirement

For configuration using Industrial Ethernet, SIMOTION D410-2 must be provided with an IP address, the subnet mask and the router address.

---

#### Note

Only one router may be configured.

---

#### Procedure

To configure and transfer Ethernet addresses to the D410-2, proceed as follows:

1. Open your project.
2. Open **HW Config**. Double-click the interface to be configured (X127) to open the "Properties" dialog box.
3. On the "General" tab, click the "Properties" button of the Ethernet interface. The "Properties - Ethernet Interface" dialog is displayed.
4. Click the "New" button. The "New Industrial Ethernet" subnet dialog is displayed. In this dialog box, you can change the name of the new subnet or confirm the default setting with "OK".
5. The newly created Ethernet subnet is now displayed under "Subnet" in the "Properties - Ethernet Interface" dialog box and must be selected.
6. In this dialog box, enter the required addresses for "IP Address" and "Subnet". Under "Router", choose whether a router is to be used. If using a router, enter the router address.
7. Confirm this dialog box with "OK".
8. Close the "Properties" dialog by clicking "OK".
9. Save and compile the modified hardware configuration.
10. Load the new hardware configuration to the SIMOTION D410-2.

#### Assigning the Ethernet address later

It is possible to assign the IP address later on (e.g. on modular machines). In this case, an IP address is not assigned in HW Config, but activated differently with the "Set IP address using different method" option. The address will then be assigned later on the machine, for example, by a the user program or by commissioning tools, such as PRONETA.

Further information on PRONETA can be found on the Internet:

- PRONETA: See Internet address (<https://support.industry.siemens.com/cs/ww/en/view/67460624>)



## 6.6.4 Reading out IP and MAC address

### Requirement

To read out the IP and MAC addresses, the following requirements must be met:

- SIMOTION D410-2 is wired.
- You have assigned the communication parameters.
- You are online.

### Procedure

The IP address and MAC address of SIMOTION D410-2 can be displayed as follows via SIMOTION SCOUT.

1. Right-click the module.
2. Select "Target device" > "Device diagnostics" in the context menu.

### Example

The addresses are displayed as follows for SIMOTION D410-2:

#### X127 (IE)

- Active MAC Address: 08-00-06-73-25-3E
- IP address: 169.254.11.22
- Subnet mask: 255.255.0.0
- Standard gateway: 0.0.0.0.

As an alternative, you can determine the IP address as follows:

- By selecting "Project" > "Accessible nodes" in SIMOTION SCOUT
- By calling "Target system" > "Ethernet" > "Edit Ethernet node..." in HW Config and browsing to "Online accessible nodes"
- Using the system function `_getIpConfig`

---

#### Note

The MAC address is listed on the nameplate on the front of the module.

---



## Commissioning (software)

### 7.1 Overview of commissioning

#### 7.1.1 Requirements for commissioning

The requirements for commissioning the SIMOTION D410-2 are as follows:

- The system has been connected and wired.
- The SIMOTION D410-2 is switched on and powered up (STOP operating state).
- SIMOTION SCOUT (with integrated STARTER) has been installed and started on the PG/PC.
- Communication between the SIMOTION D410-2 and the PG/PC is configured.
- You have created a project and installed a SIMOTION D410-2 in the project.

#### 7.1.2 Symbolic assignment / adaptation

##### Symbolic assignment

SIMOTION supports the symbolic assignment on SINAMICS drive objects (DOs) during the configuration of technology objects (TOs) and I/Os.

This simplifies the configuration of the technological relationships including the communication between controller and drive.

With the symbolic assignment:

- Only suitable assignment partners are offered in an assignment dialog box.
- Communication between axis and drive is set up automatically by the engineering system and the required PROFIdrive axis telegrams as well as the used addresses set up.
- Telegrams are extended and interconnections created automatically in the drive depending on the selected TO technology (e.g. SINAMICS Safety Integrated).
- Axis and drive configuration are first performed independently.
- Communication connections are established automatically during the configuration of I/O variables on SINAMICS I/Os (telegrams are set up automatically, the I/Os interconnected to the telegram and the addresses set up).

Apart from the symbolic assignment, no further configuration is required for the communication. As addresses no longer have to be configured, the connection is retained even with address offsets.

---

**Note**

During the configuration of drive objects (DO drive, DO encoder, ...) as well as in the Telegram Configuration dialog box (see Section Telegram configuration (Page 180)), you can deactivate the **automatic telegram configuration** and the **automatic telegram adaptation**.

A deactivation should only be performed in justified exceptional cases because many of the above mentioned benefits are lost.

---

The symbolic assignment enables an independent configuration of the axes on the SIMOTION side and the drives on the SINAMICS side. This allows the following:

- The PLC and motion control functions can be completely configured by a programmer even without drive know-how using technology objects (e.g. TO axis) and loaded to the device.
- The drives can be separately configured and optimized by a drive expert.
- The technology objects can be symbolically assigned later to the drive objects via an interconnection dialog box.

---

**Note**

The previous methods of drive, axis and I/O configuration are still available. Symbolic assignment must be deactivated for these methods.

For newly created projects, the symbolic assignment is used by default.

If projects < V4.2 are upgraded, the symbolic assignment is deactivated by default and must be activated when required.

Symbolic assignment can be activated or deactivated in SIMOTION SCOUT via the menu "Project" > "Use symbolic assignment."

---

### Activating symbolic assignment later

Symbolic assignment is recommended and is automatically activated.

Conversion from upgraded projects to symbolic assignment is possible, but this requires post-editing of the project, especially for free telegram configurations (e.g. for TM15 DI/DO, TM31).

---

**Note**

If the symbolic assignment is activated later, previously existing telegram settings and BICO interconnections for all SINAMICS telegrams that are set to Standard/Automatic (Communication -> Telegram configuration) are replaced at the next compilation. This may change telegrams and BICO interconnections and delete telegram extensions previously set up manually.

For this reason, make a backup copy of your project before activating the symbolic assignment.

To retain the settings that have been made, after the selection of "Use symbolic assignment," the setting "User-defined" must be selected and the check box cleared for automatic telegram setting/address adaptation for the respective message before compilation.

For further details, see the *SIMOTION Runtime Basic Functions* Function Manual.

---

## Assigning a drive later

You can create an axis in SIMOTION SCOUT and assign it to a drive later. You can thus load your user program to the controller and (with the exception of the non-existent drives) test it.

Compared to a procedure with temporarily created "virtual axes", "axes without assigned drive" have the advantage that the configuration data is completely available and do not require a "virtual axis -> real axis" reconfiguration.

## Simulation of axes

You can also use the axis simulation to test the user program. You can find a script for switching the axis simulation on and off in SIMOTION Utilities & Applications, which is part of the scope of delivery of SIMOTION SCOUT.

Further details can be found in the *TO Axis Electrical/Hydraulic, External Encoder* Function Manual.

## Adaptation

In addition to the symbolic assignment, the **automatic adaptation** also facilitates the configuration of SINAMICS S120 data. When SIMOTION devices ramp up, reference variables, along with drive and encoder data for SINAMICS S120, are transferred automatically for the configuration data of the SIMOTION technology objects "Axis" and "External Encoder". This data no longer has to be entered in SIMOTION.

For additional information, see the following sources:

- *SIMOTION Runtime Basic Functions* Function Manual
- *TO Axis Electrical/Hydraulic, External Encoder* Function Manual

## Requirement

Symbolic assignment is supported by the TO axis, TO externalEncoder and the TO outputCam, TO camTrack and TO measuringInput. The onboard I/Os of a SIMOTION D, of a SINAMICS S110/S120 Control Unit, and selected Terminal Modules can be interconnected symbolically.

Module	Supports symbolic assignment
SIMOTION D <ul style="list-style-type: none"> <li>• SIMOTION D410-2</li> <li>• SIMOTION D410</li> <li>• SIMOTION D4x5-2</li> <li>• SIMOTION D4x5</li> </ul>	<ul style="list-style-type: none"> <li>• As of SIMOTION V4.3</li> <li>• As of SIMOTION V4.2</li> <li>• As of SIMOTION V4.2</li> <li>• As of SIMOTION V4.2</li> </ul>
Controller extension <ul style="list-style-type: none"> <li>• CX32-2</li> <li>• CX32</li> </ul>	As of SIMOTION V4.2
SINAMICS S110 CU305	As of SINAMICS V4.3
SINAMICS S120 <ul style="list-style-type: none"> <li>• CU310-2</li> <li>• CU310</li> <li>• CU320-2</li> <li>• CU320</li> </ul>	<ul style="list-style-type: none"> <li>• As of SINAMICS V4.4</li> <li>• As of SINAMICS V2.6.2</li> <li>• As of SINAMICS V4.3</li> <li>• As of SINAMICS V2.6.2</li> </ul>

## See also

Only the drive configuration by means of symbolic assignment is described in this documentation.

You will find the documentation of older SIMOTION versions on the Internet at the following address (<https://support.industry.siemens.com/cs/ww/en/view/40211807>).

For further information on the configuration of the TO axis and TO externalEncoder, see the *TO Axis Electrical/Hydraulic, External Encoder* Function Manual.

### 7.1.3 Procedure when commissioning

#### Commissioning steps

This section shows you how to configure a system and test the configured drives and axes. The steps in commissioning are listed below in the order as recommended:

1. Configuring SINAMICS Integrated  
The integrated drive SINAMICS Integrated can be configured in offline or online mode:
  - Performing an offline configuration (Page 128)  
For offline configuration, all of the components and their article numbers must be known.
  - Performing an online configuration (Page 145)  
During online configuration, you can load all of the information from the connected DRIVE-CLiQ components to your user project.
2. Test the configured drive using the drive control panel (Page 168)
3. Create an axis with the axis wizard (Page 171)
4. Test a configured axis with the axis control panel (Page 178)
5. Set up addresses and telegrams (Page 180)
6. Link an additional encoder (optional) (Page 184)
7. Configure drive-related I/Os (with symbolic assignment) (Page 191)
8. Configure technology objects and I/O variables (Page 196)
9. Optimize the drive and controller (Page 205)

When carrying out this procedure, consult the relevant references.

This section also contains additional configuration information, e.g. for vector drives, Safety Integrated, etc.

### 7.1.4 Important functions for the project handling and for the commissioning

Below you will find an overview of the most important functions for project handling and for commissioning with the associated icons.



#### **Save project and compile changes**

The entire project is saved and the project data (e.g. programs) compiled into an executable code.



#### **Connect to selected target devices**

The online connection is established to the selected target devices. Under "Target system" > "Select target devices", you can set which target devices are to go online.



#### **Download project to target system**

The programs are loaded to the SIMOTION device as well as the configuration for the SINAMICS Integrated.



**Download CPU / drive unit to target device**

The configuration is only loaded to the device selected in the project tree which means that the function needs to be performed separately for each D410-2 and SINAMICS Integrated.



**Load CPU / drive unit to PG**

The unit's configuration is only loaded to the PG selected in the project tree which means that the function needs to be performed separately for each D410-2 and SINAMICS Integrated.



**Copy RAM to ROM**

Copying from RAM to ROM is only performed for the device selected in the project tree which means that the function needs to be performed separately for each D410-2 and SINAMICS Integrated.

---

**Note**

**Tips for going online:**

In online operation, SIMOTION SCOUT attempts to conduct online operation with all hardware components contained in the project. This means that the time needed for going online increases.

We recommend that you make settings for SIMOTION SCOUT so that online operation is made only with those components currently needed. The setting can be found at "Target system" > "Select target devices ..." in the menu. The selection and deselection of the devices in the online state can be made via the "Connect target device" context menu on the device.

This procedure is also advantageous when the configuration of the drive unit is completed. Without going completely offline, the connection can be simply deselected via the context menu on the drive unit.

---

## 7.2 Performing an offline configuration

### 7.2.1 Overview

#### Introduction

In the case of offline configuration, the project is created while not all of the hardware components (in particular drives) are available. In this way, a SIMOTION project in the office environment can be created up to a point where a basic project specification including a program exists. At a later time, the finished project can be loaded to the SIMOTION D410-2 and tested together with the drive.



## Requirements

- For offline configuration, all of the components and their article numbers must be known.
- You have created a project in SIMOTION SCOUT and inserted a SIMOTION D410-2 in the project.
- You have configured the communication between the SIMOTION D410-2 and the PG/PC, see Section Creating a project and configuring the communication (Page 87).

## Procedure

The offline configuration involves the following steps:

- Accessing the drive wizard (Page 129)
- Configuring components (Page 130)
- Downloading the project to SIMOTION D410-2, by means of the following options:
  - Downloading to the target system (Page 141)
  - Downloading to the CF card (Page 142)
  - Downloading incl. sources and additional data (Page 143)
  - Archiving to the CF card (Page 144)

---

### Note

During offline configuration, you can configure Terminal Modules such as the TM15, for example.

---

## 7.2.2 Accessing the drive wizard

### Integrated drive

SIMOTION D410-2 features an integrated SINAMICS S120 drive (control unit) which is automatically included when you insert the SIMOTION D410-2 in the project navigator. The integrated drive must be operated in isochronous mode using PROFIdrive-compliant telegram types.

The drive wizard for the integrated STARTER in SIMOTION SCOUT is available for the purpose of configuring the integrated drive and its associated modules (SINAMICS S120 Power Module, for example).

---

### Note

Take note of all the necessary safety instructions and rules governing connections, which can be found in the latest SINAMICS S120 documentation on the SIMOTION SCOUT DVD.

---

## Procedure

Select the "SINAMICS\_Integrated" > "Configure drive unit" drive element in the project navigator to open the drive wizard.

You can configure the following components:

- Power unit (e.g. SINAMICS S120 Power Module)
- Motor
- Encoder

### 7.2.3 Configuring components

## Procedure

---

### Note

An overview of permissible configurations, quantity structures and DRIVE-CLiQ topologies can be found in Section Quantity structures (Page 229) and in the *SINAMICS S120* Commissioning Manual.

Failure to comply with the rules listed in this manual will result in errors that are not output until the download is performed, rather than at the configuration stage.

---

1. Enter a drive name in the "Drive Properties" dialog box and select the drive type (servo or vector).

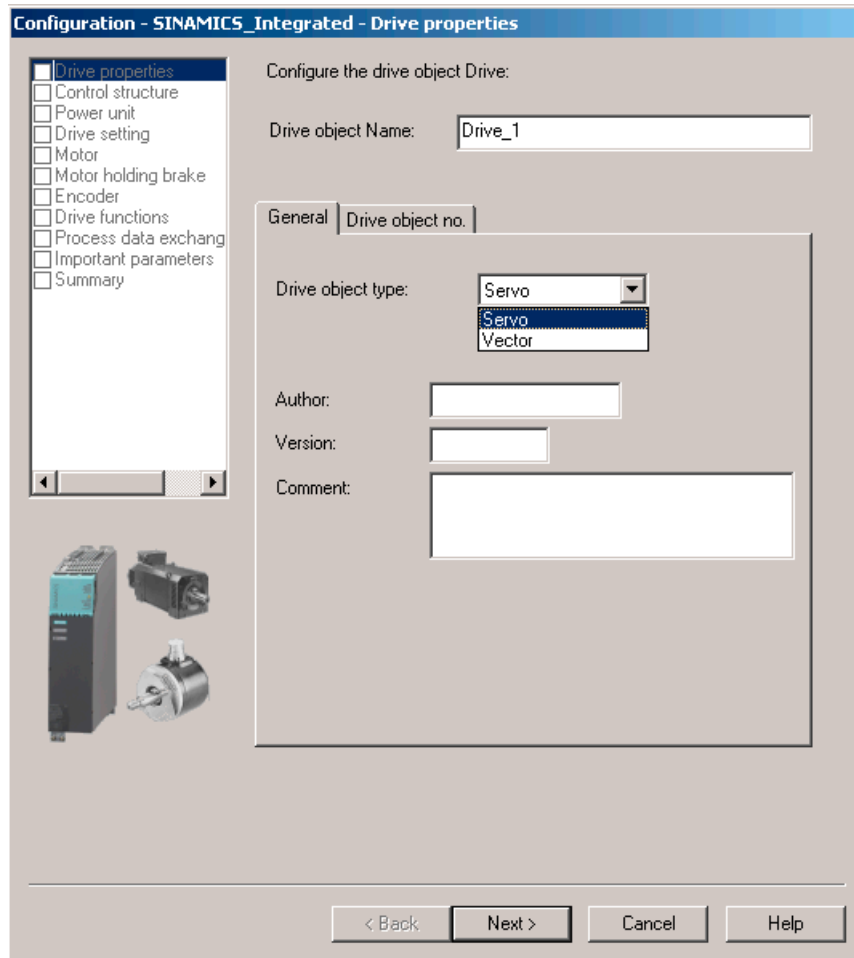


Figure 7-1 Drive properties

2. In the "Control Structure" dialog, you can select the function modules and the control type.

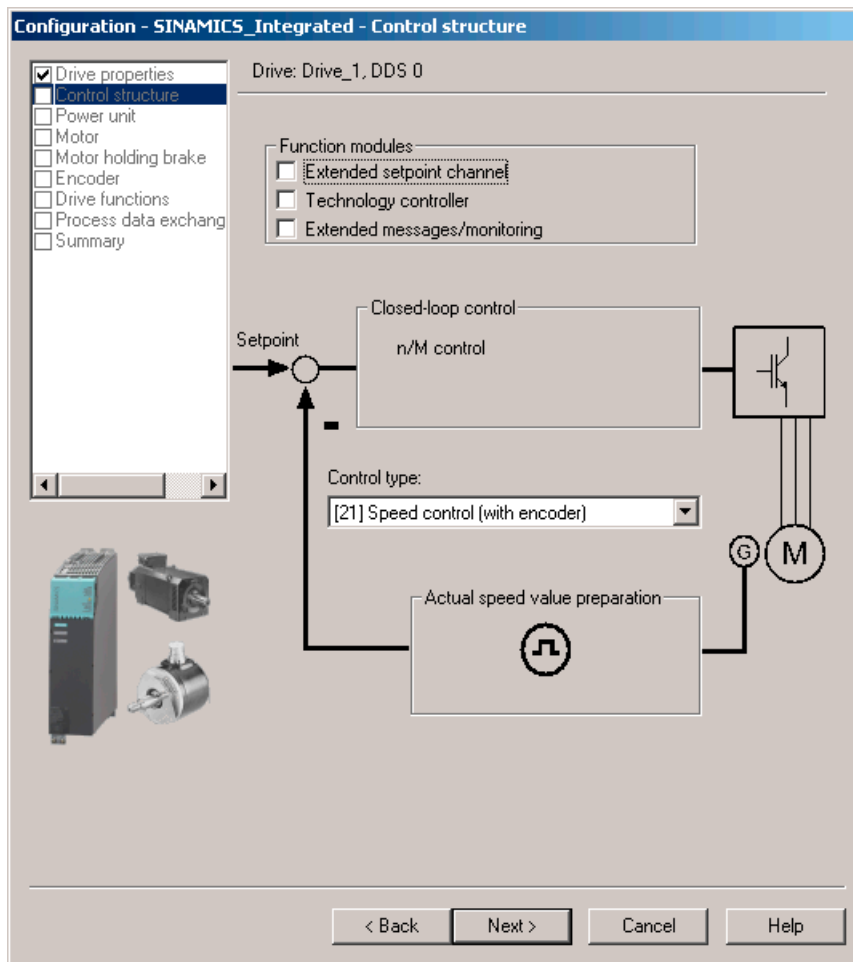


Figure 7-2 Control structure

3. In the "Power Unit" dialog, use the article number to select your power unit from the list.

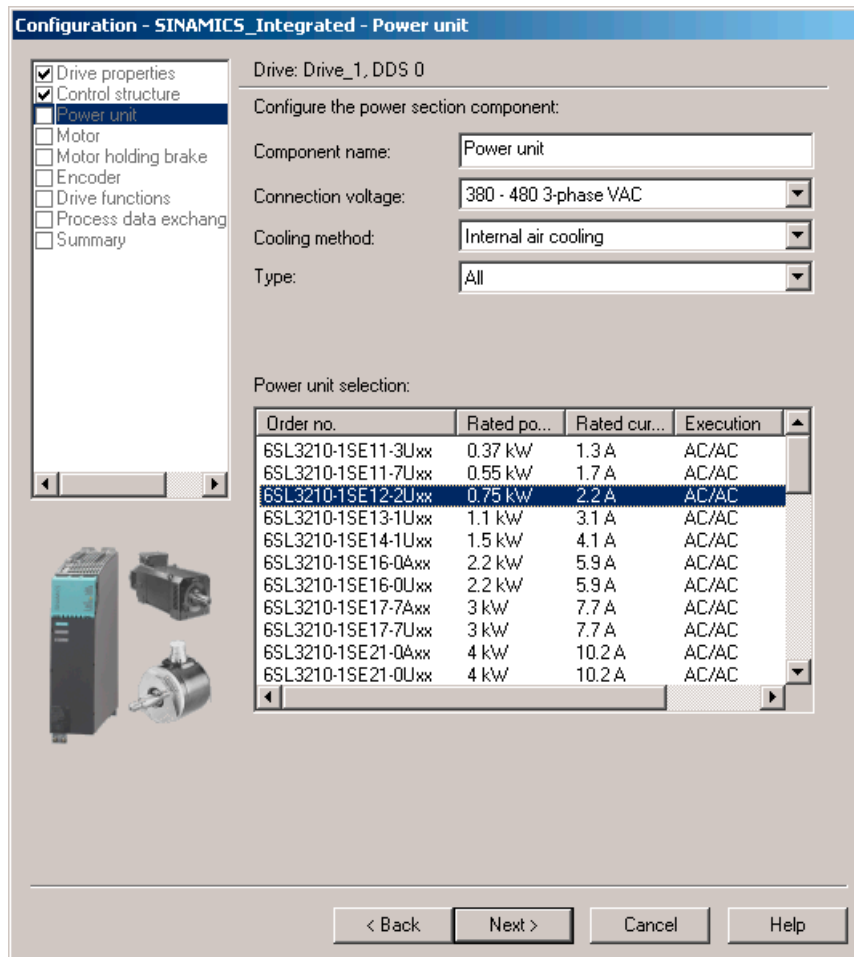


Figure 7-3 Selecting a power unit

- 4. Select in the "Power Unit Supplementary Data" dialog the component added to the power unit.

The selection of the component depends on the construction type.

- SIMOTION D410-2 DP or D410-2 DP/PN: The SIMOTION D410-2 is snapped directly onto the blocksize format Power Module.
- CUA31 or CUA32: The CUA3x is snapped directly onto the blocksize format Power Module. The SIMOTION D410-2 is mounted separately on a mounting plate. The SIMOTION D410-2 is connected to the CUA3x using a DRIVE-CLiQ cable.

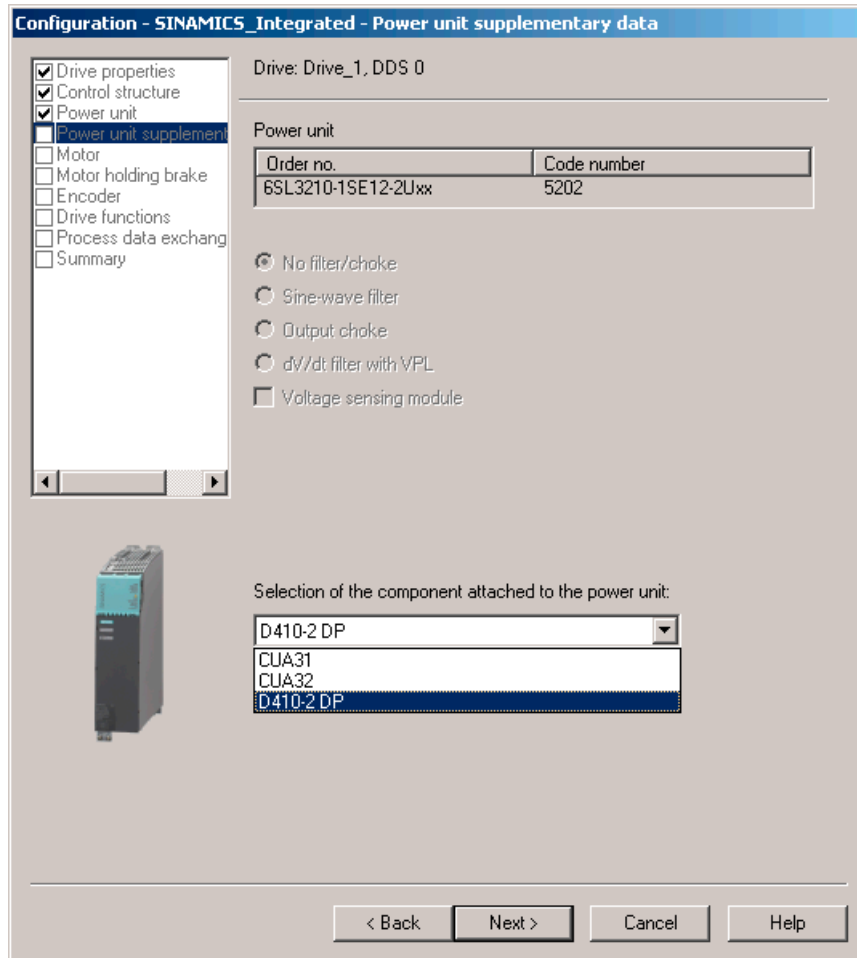


Figure 7-4 Selecting the mounting type

**Note**

If SIMOTION D410-2 is mounted separately (Power Module in blocksize format connected to SIMOTION D410-2 via CUA31/32), use of the Safety Integrated Extended and Advanced Functions via the onboard terminals (F-DI, F-DO) is not possible.

5. In the next dialog, select the motor and, where applicable, the motor type:
  - Either by selecting a standard motor from the list
  - Or by entering the motor data
  - Or by automatically identifying the motor (motor with DRIVE-CLiQ interface)

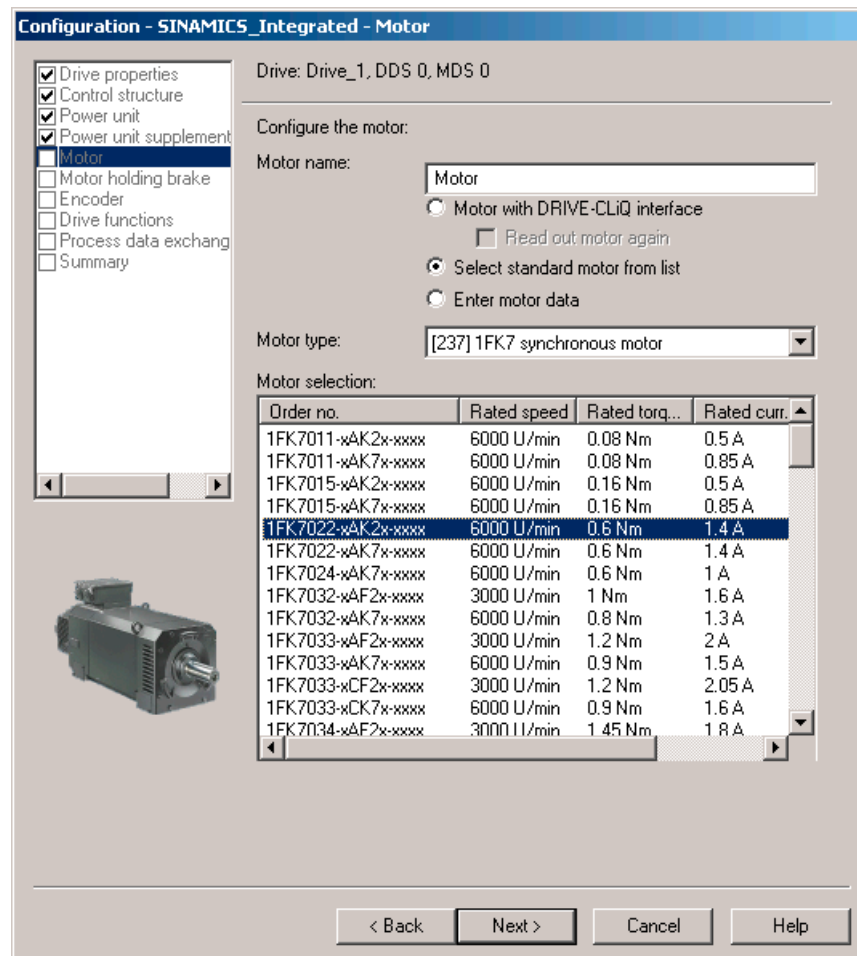


Figure 7-5 Selecting a motor

**Note**

Motors with DRIVE-CLiQ interface have an integrated encoder evaluation that is connected to the Power Module via a fully digital communication interface (DRIVE-CLiQ).

In this way, motor encoder and temperature signals as well as electronic rating plate data, such as unique article numbers, rated data (voltage, current, torque) can be transferred directly to the Control Unit.

6. Select a motor holding brake (if installed).

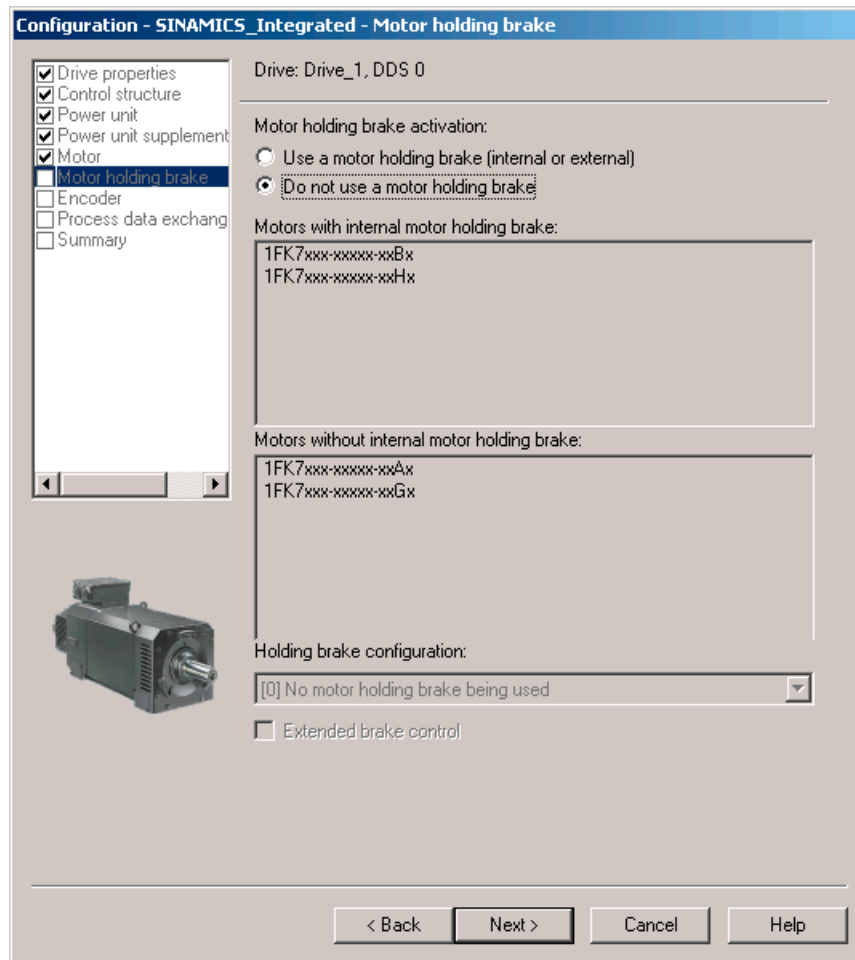


Figure 7-6 Selecting a motor holding brake



7. If you are using a motor that is not equipped with a DRIVE-CLiQ interface, select the encoder order number in the "Encoder Selection via Motor Order Number" dialog box.

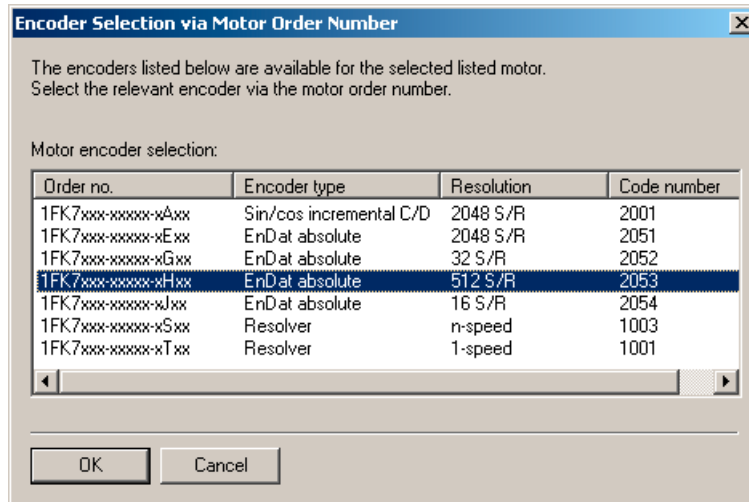


Figure 7-7 Selecting a motor encoder (1)

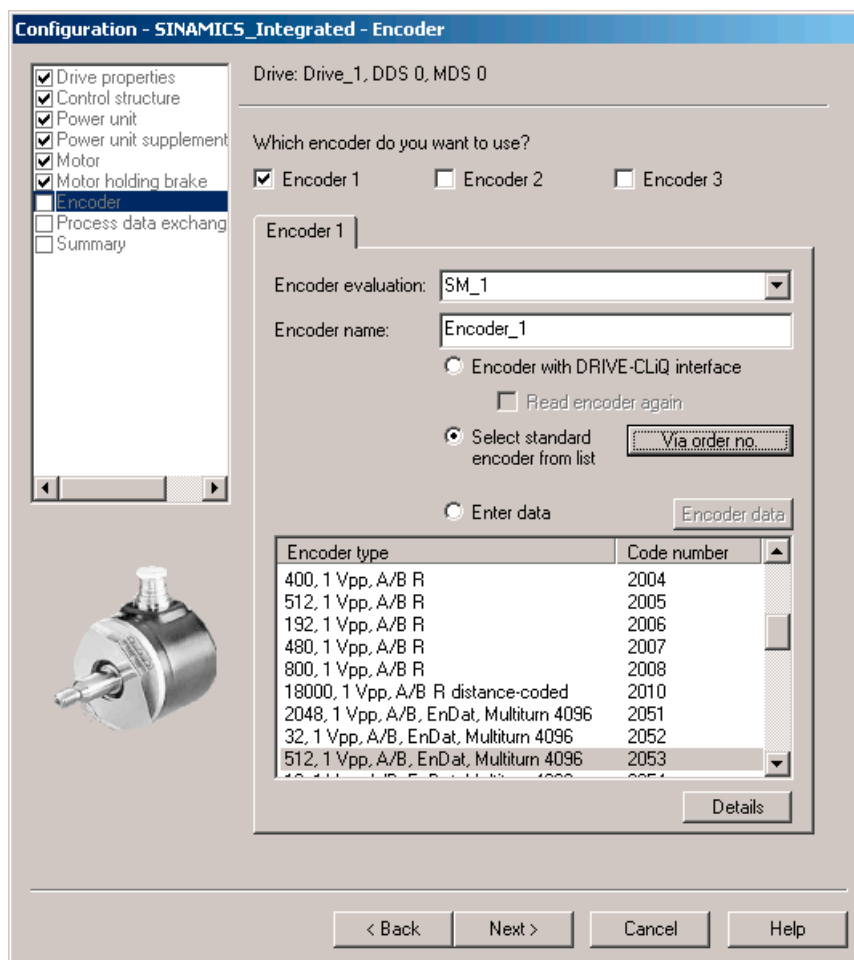


Figure 7-8 Selecting a motor encoder (2)

---

**Note**

If required, you can configure a second or third encoder in the "Encoder" dialog box. You can transmit a maximum of two encoder values to SIMOTION via the axis telegram. In the case of motors with a DRIVE-CLiQ interface, the motor encoder is identified automatically. It is not necessary to enter encoder data in such cases (the box for selecting Encoder 1 is grayed out and therefore inactive).

---

- The communication for the control of the SINAMICS drive is configured in the following dialog box. It is recommended that these settings be made automatically by the engineering system.

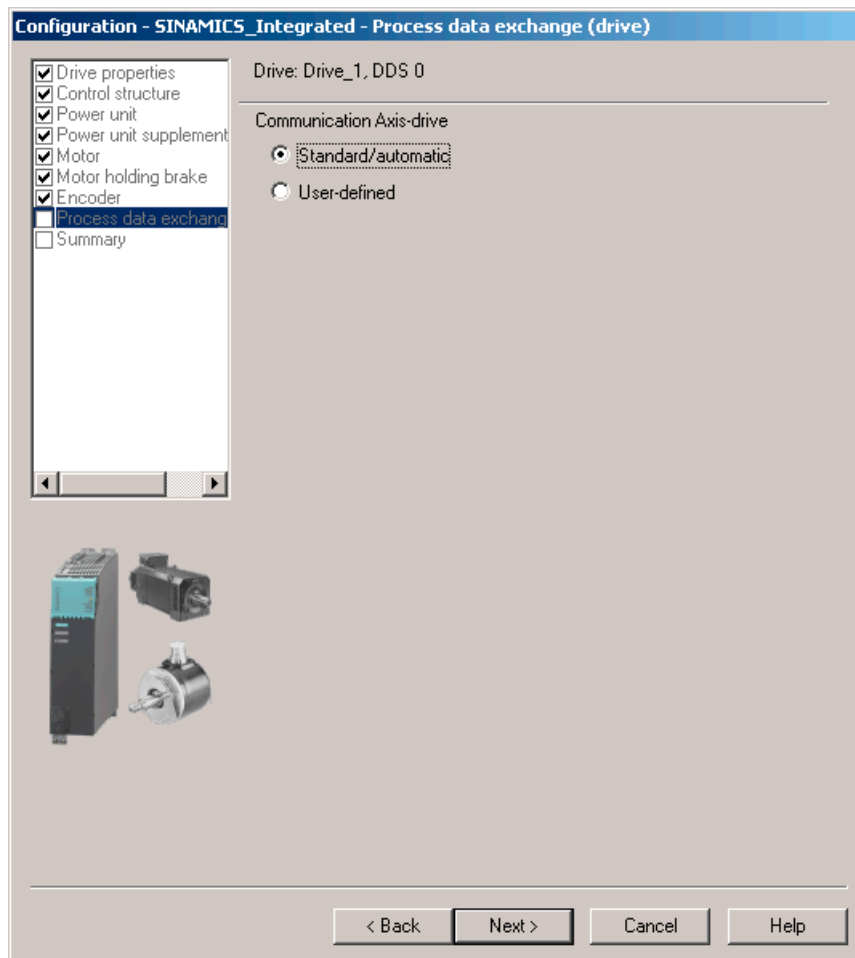


Figure 7-9 Configuring the process data exchange (standard)

You can also make the settings manually for the process data exchange by selecting "User-defined".

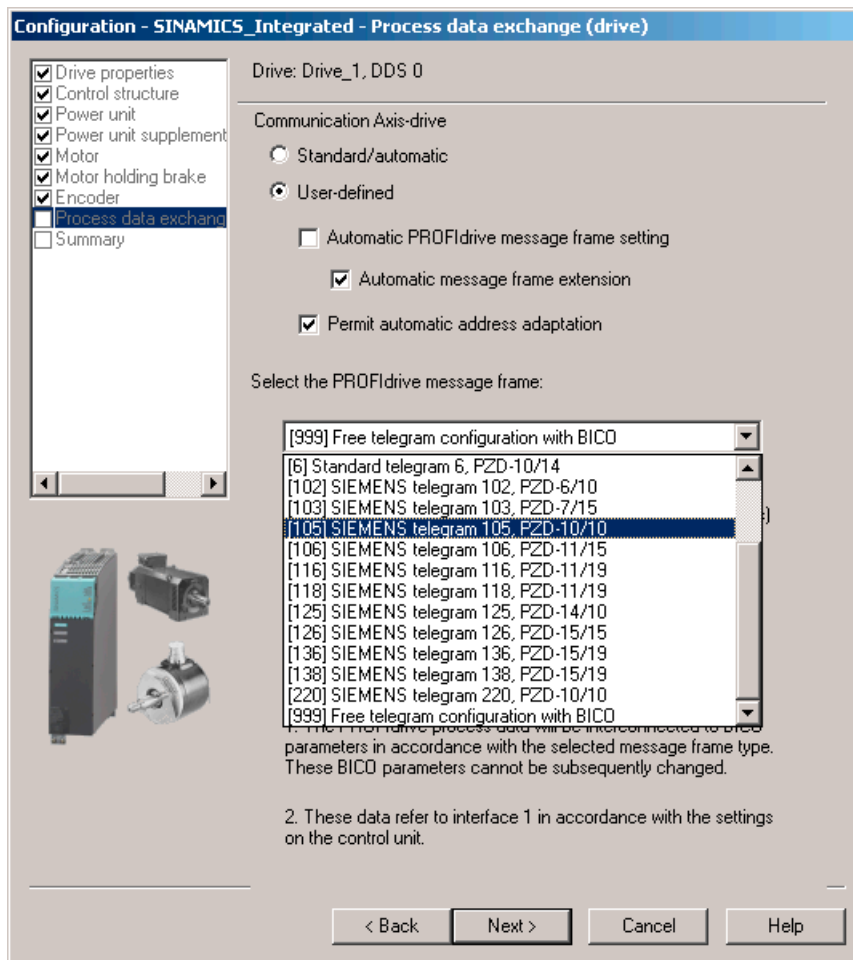


Figure 7-10 Configuring the process data exchange (user-defined)

Information about the manual setting options can be found in the online help and in the manuals for the SINAMICS S120 drive system.

9. After you have configured all of the settings in the drive wizard, the "Summary" dialog box displays a list of all settings. You can now choose to activate your settings by clicking "Finish", or to return to the component configuration for further editing.

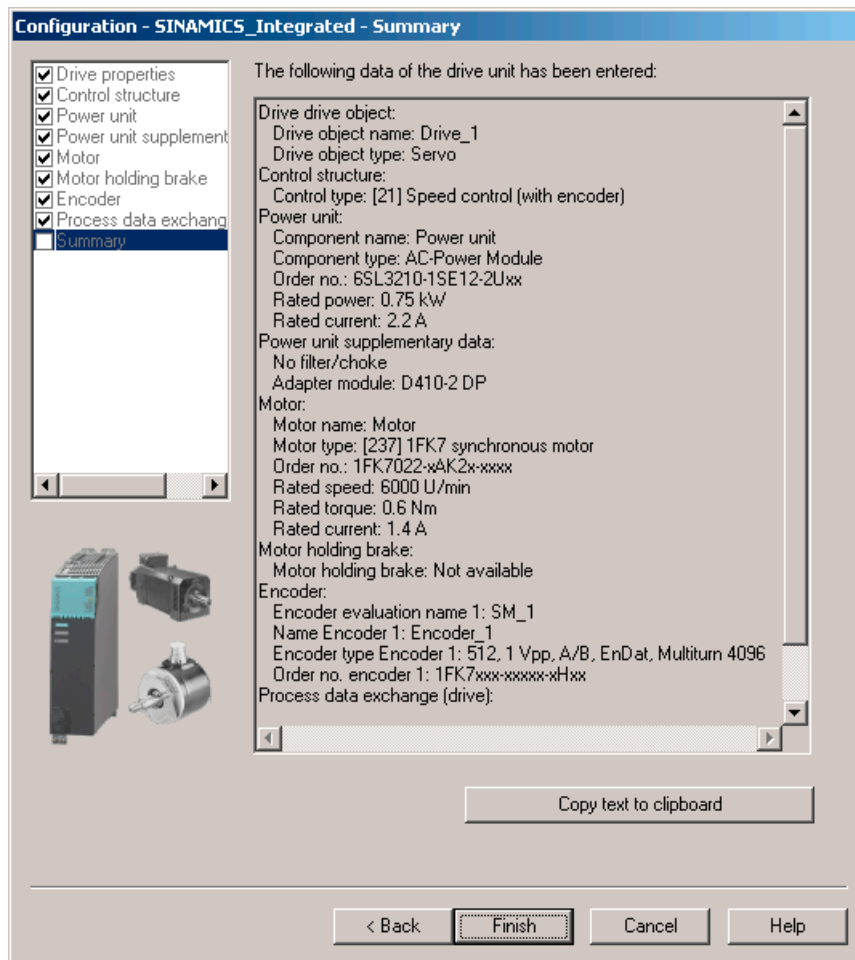


Figure 7-11 Finishing the drive

The configured drive is displayed in the project navigator. An overview of your configured SINAMICS components is available in the "SINAMICS\_Integrated" > "Topology" dialog.

### Additional references

If you configure the drive telegrams manually, you can find detailed information on the respective telegram types in the following:

- *Motion Control, TO Axis Electric/Hydraulic, External Encoder* Function Manual
- *SINAMICS S120* Function Manual

## 7.2.4 Downloading the project to the target system

### Procedure

1. Save and compile the project.
2. Go online with the SIMOTION D410-2.

3. To load the project, perform "Download project to target system".  
The data must also be saved on the CompactFlash card to ensure that the project is retained in the event of a power failure. The following options are available:
  - Perform the "Copy RAM to ROM..." function manually on the SIMOTION D410-2 and the drive (SINAMICS Integrated).
  - In the "Download to Target System" dialog box, select the option "After loading, copy RAM to ROM". You can change the default setting for this dialog box in "Options" > "Settings" > "Download".
4. To save the parameter calculations of the drive in the project, perform "Target device" > "Load CPU / drive unit to PG" for the drive.

## Result

The drive has been assigned parameters and commissioned. You can now test the drive using the drive control panel.

---

### Note

Online access to SINAMICS Integrated is not possible if **HW Config** is not loaded at the time you initially connect to the target system.

Download the data to **HW Config** in order to enable online access to SINAMICS Integrated.

---

### Note

If you have deselected the "Drives" option under "Tools" > "Settings" > "Download" in SIMOTION SCOUT, you must download the configuration separately to each drive (SINAMICS Integrated).

To do this, select the drive (e.g. SINAMICS Integrated) in the project navigator and perform "Download CPU / drive unit to target device".

To work quickly, we recommend that drives be generally deselected and a download only be performed when required.

---

## 7.2.5 Loading a project created offline to the CompactFlash card

### Procedure

You can use a card reader to write the entire project to the CF card, even in offline mode. In SIMOTION SCOUT, you can call the "Load to file system" function in the context menu of the SIMOTION device.

1. Save and compile the project.
2. Switch off the SIMOTION D410-2.
3. Remove the CF card and insert it in a card adapter. The card adapter must be connected to a PG/PC.

4. In the SCOUT project, select the SIMOTION D410-2 device that you want to download to the CF card.
5. Click "Load to file system" in the context menu. A dialog box opens.
6. In the "Load to File System" dialog box, select the "Save normally" option and click the "Select target" button.
7. Select the target drive.
8. Confirm your entries with "OK". The data is written to the CF card.
9. Remove the CF card and insert it into the slot on the SIMOTION D410-2.
10. Switch on the SIMOTION D410-2.

---

**Note**

With "Load to file system", the project data of the controller (including SINAMICS Integrated) is written directly to the CF card. Separate execution of "Load to file system" for the SINAMICS Integrated is not possible.

---

**Result**

The SIMOTION D410-2 ramps up with the loaded project.

---

**Note**

The components' firmware is automatically updated, depending on the firmware version on the SINAMICS components and on the CF card. During a firmware update, please take note of the messages and alarms in the SIMOTION SCOUT detail window. A FW update on the SIMOTION D410-2 is indicated by the RDY LED flashing yellow, while on the DRIVE-CLiQ components (TM, SMC, etc.) it is indicated by the RDY LED flashing red/green.

- FW update running: RDY LED flashes slowly (0.5 Hz)
- FW update complete: RDY LED flashes quickly (2 Hz), POWER ON required

Components that require a POWER ON after the firmware update will indicate this through a rapidly flashing RDY-LED. Go offline with SCOUT and switch the 24 V supply off/on (POWER ON) at the respective components for initialization.

---

## 7.2.6 Downloading the project incl. sources and additional data

**Overview**

It is possible to download additional data (e.g. sources) to the target device when saving a project to the CF card or downloading to the SIMOTION D410-2.

These data are required for:

- Online object comparison (e.g. additional properties)
- Various detailed comparisons (e.g. ST source file comparison)
- Synchronization with online objects.

In order to be able to load a project's sources and additional data to the PG, this must be specified in the project under "Options" > "Settings" > "Download" > "Store additional data on the target device". Alternatively, this setting can also be made when the data is loaded to the target device/target system.

You can, for example, perform a project comparison with the sources and additional data stored on the CF card (see example below).

### Project comparison (example)

You intend to perform servicing work on a commissioned system and have placed a project on your PG/PC. This project is not consistent with the project on the SIMOTION D410-2 cm the system. In order to analyze the differences, perform an object comparison via "Start object comparison".

You have the following options in terms of re-establishing consistency:

- In the object comparison, it is possible to establish consistency in sources and technology objects on an object-granular basis.
- Consistency can be established for the entire Control Unit by loading from the CF card with "Target system" > "Load" > "Load CPU / drive unit to PG..."

### Additional references

Detailed information on loading data to the target device can be found in the *SIMOTION Runtime Basic Functions* Function Manual.

## 7.2.7 Archiving a project on the CompactFlash card (zip file)

### Procedure

In SIMOTION SCOUT, you can save the project as a \*.zip file to the CompactFlash card.

Proceed as follows to archive the SIMOTION project on the CompactFlash card:

1. Open SIMOTION SCOUT and select the "Project" > "Archive" menu command.
2. In the "Archive" dialog box, select the SIMOTION project and save it to your drive (PG/PC).
3. Open the project.
4. Go online with the SIMOTION D410-2.



5. In the project navigator, select the SIMOTION D410-2 and select the "Target system" > "Load" > "Save archived project to card..." menu command.
6. In the dialog that is displayed, select the project and click "Open". This saves the project to the CompactFlash card as Project.zip in the directory: USER\SIMOTION\HMI\PRJLOG.

---

**Note**

If you want to load the current project from the card, select the "Target system" > "Copy archived project from card to PG/PC..." menu command.

Prerequisite is that you have backed up the project with "Save archive project on card..." each time a change was made.

---

**Additional references**

Detailed information on loading data to the target device can be found in the *SIMOTION Runtime Basic Functions* Function Manual.

## 7.3 Performing an online configuration

### 7.3.1 Overview

#### Introduction

You can configure the plant in online mode after having completed its wiring. You can use the "Automatic configuration" function to load the SINAMICS components connected via DRIVE-CLiQ to your PG/PC. However, this is only possible for initial commissioning.

---

**Note**

Components without DRIVE-CLiQ connection must be edited in offline mode. You may need to edit DRIVE-CLiQ components which were detected in the course of automatic configuration (for example, adding encoder data if using SMC modules).

---

#### Prerequisites for online configuration

- You have created a project in SIMOTION SCOUT and inserted a SIMOTION D410-2 in the project.
- You have configured the communication between the SIMOTION D410-2 and the PG/PC.
- Your system has been installed and wired.

## Procedure

The online configuration involves the following steps:

- Establishing the online connection (Page 146)
- Starting automatic configuration (Page 147)
- Reconfiguring SINAMICS components (Page 149)
- Downloading a project to the SIMOTION D410-2 (Page 150)

### 7.3.2 Establishing the online connection

#### Procedure when commissioning the drive for the first time

To perform an online configuration, you must establish an online connection to the SIMOTION D410-2. In this case, no connection can yet be established to SINAMICS Integrated. An appropriate message is output. Once the hardware configuration has been loaded to the target device, an online connection to the SINAMICS Integrated is established automatically. Proceed as follows:

1. Save and compile the project.
2. Establish an online connection.
3. Select the SIMOTION D410-2 device in the project navigator.
4. Use the "Download CPU / drive unit to target device" function to download the SIMOTION D410-2 device to the target device. The connection to SINAMICS Integrated is activated automatically.

You can now run automatic configuration on the SINAMICS Integrated. For details, see Section Starting automatic configuration (Page 147).

#### Additional references

Further information about establishing an online connection to the programming device/PC can be found in the following documentation:

- *SIMOTION SCOUT* Configuration Manual
- *SIMOTION SCOUT* Online Help
- In the FAQ for *SIMOTION Utilities & Applications* *SIMOTION Utilities & Applications* is provided as part of the SIMOTION SCOUT scope of delivery.
- FAQ Online connection to SIMOTION (<https://support.industry.siemens.com/cs/ww/en/view/22016709>)

### 7.3.3 Starting automatic configuration

#### Requirement

You have established the online connection to SINAMICS Integrated.

#### Procedure

1. In the project navigator, open the "Automatic Configuration" dialog with the "SINAMICS\_Integrated" > "Automatic configuration" menu command.

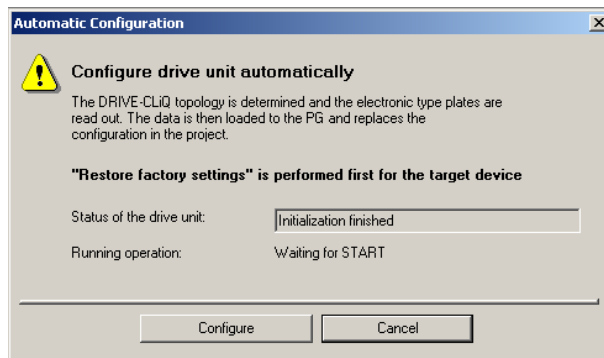


Figure 7-12 Starting automatic configuration

2. Click the "Configure" button.
3. If the drive unit is not in the "First commissioning" state, the factory settings are restored after acknowledging a prompt.
4. The drive object types can now be selected via a further dialog box.

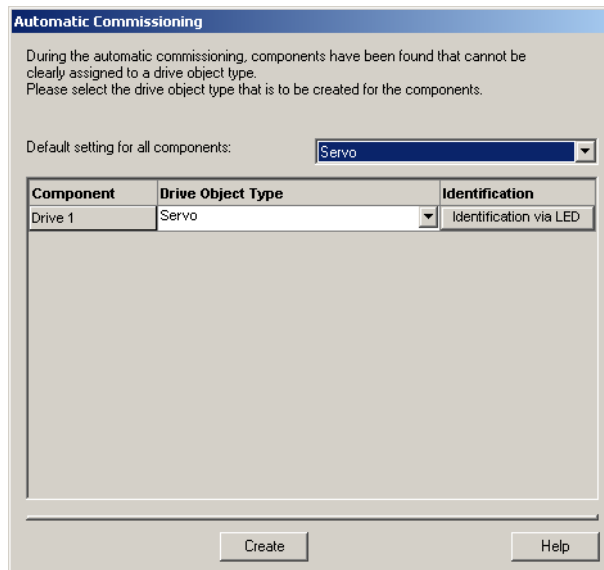


Figure 7-13 Selecting the drive object type

5. Select whether a servo- or vector-type drive object is to be used.

6. Click "Create" to start the automatic configuration.  
The configuration data is uploaded (Load to PG) automatically as soon as automatic configuration is completed.

---

**Note**

The components' firmware is automatically updated, depending on the firmware version on the SINAMICS components and on the CF card.

The update procedure can take several minutes and is indicated in the "Automatic Configuration" dialog box by the following message:

"State of the drive unit: Automatic FW update of DRIVE-CLiQ components".

A FW update on the SIMOTION D410-2 is indicated by the RDY LED flashing yellow, while on the DRIVE-CLiQ components (TM, SMC, etc.) it is indicated by the RDY LED flashing red/green.

- FW update running: RDY LED flashes slowly (0.5 Hz)
- FW update complete: RDY LED flashes quickly (2 Hz), POWER ON required

Components requiring POWER ON following a firmware update signal this by means of the fast flashing RDY LED. Go offline with SCOUT and switch the 24 V supply to the relevant components off/on (POWER ON) to initialize.

---

Following the automatic configuration, a prompt appears as to whether you want to "Go offline" or "Remain online" with the drive unit.

7. Execute the "Copy RAM to ROM ..." function on the SIMOTION D410-2 and SINAMICS Integrated. This saves the project on the CF card so that it does not need to be reloaded after switching off and on.

## Result

The DRIVE-CLiQ components loaded to the user project by means of automatic configuration are displayed in the project navigator.

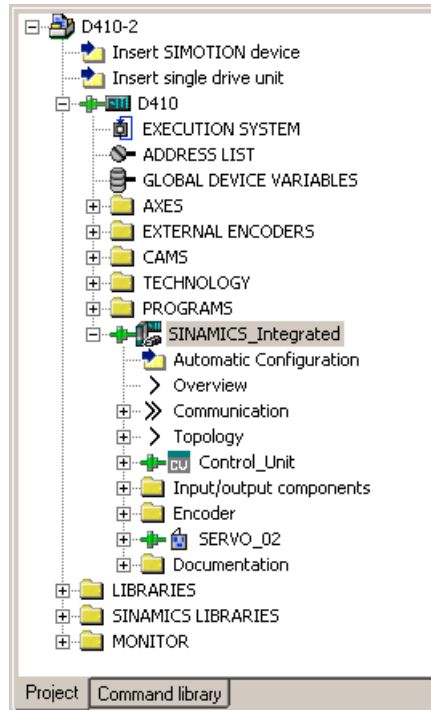


Figure 7-14 Project navigator with the downloaded DRIVE-CLiQ components

You must then

- If required, reconfigure SINAMICS components (e.g. components without a DRIVE-CLiQ interface, such as an encoder connected to the onboard encoder interface).
- Assign the "TO axis" to "Drive".

### 7.3.4 Reconfiguring SINAMICS components

#### Requirements

- You have uploaded all connected DRIVE-CLiQ components to the user project.
- You have shut down the connection to the target system (offline mode).

#### Procedure

Now go ahead and adapt your components to suit the application.

Run through the wizard for all the DRIVE-CLiQ components to be adapted and perform the required reconfigurations.

### 7.3 Performing an online configuration

This procedure corresponds to the description in Section Performing an offline configuration (Page 128).

The amount of editing work involved depends on the components used. For example, in the case of a motor with a DRIVE-CLiQ interface, the motor and encoder type are identified automatically.

#### 7.3.5 Downloading the project to SIMOTION D410-2

##### Procedure

After you have performed the reconfigurations, you must download the configuration to the SINAMICS Integrated.

1. Save and compile the project.
2. Go online with the SIMOTION D410-2.
3. To load the project, perform "Download project to target system".  
The data must also be saved on the CompactFlash card to ensure that the project is retained in the event of a power failure. The following options are available:
  - Perform the "Copy RAM to ROM..." function manually on the SIMOTION D410-2 and the drive (SINAMICS Integrated).
  - In the "Download to Target System" dialog box, select the option "After loading, copy RAM to ROM". You can change the default setting for this dialog box in "Options" > "Settings" > "Download".
4. To save the parameter calculations of the drive in the project, perform "Target device" > "Load CPU / drive unit to PG" for the drive.

##### Result

The drive has been assigned parameters and commissioned. You can now test the drive using the drive control panel.

---

##### Note

Online access to SINAMICS Integrated is not possible if **HW Config** is not loaded at the time you initially connect to the target system.

Download the data to **HW Config** in order to enable online access to SINAMICS Integrated. During the "Download to target system" process, SIMOTION SCOUT automatically attempts to establish an online connection to SINAMICS Integrated.

---

**Note**

If you have deselected the "Drives" option under "Tools" > "Settings" > "Download" in SIMOTION SCOUT, you must download the configuration separately to each drive (SINAMICS Integrated).

To do this, select the drive (e.g. SINAMICS Integrated) in the project navigator and perform "Download CPU / drive unit to target device".

To work quickly, we recommend that drives be generally deselected and a download only be performed when required.

---

## 7.4 Additional information on configuring the SINAMICS Integrated

### 7.4.1 Setting DP Slave properties

#### Settings in HW Config

Depending on the cycle clock ratios (bus cycle, servo cycle) and the drive used, it may be necessary to adapt the properties of the DP slave (SINAMICS Integrated) on the PROFIBUS Integrated.

Open **HW Config**. Double-clicking the SINAMICS Integrated enables you to display and, if required, change the properties of the DP slave on the "Clock synchronization" tab. Possible changes include:

- Synchronize drive to the equidistant DP cycle  
The SINAMICS Integrated of a SIMOTION D410-2 can only be operated isochronously. For this reason, this option cannot be deactivated.
- Changing the master application cycle ( $T_{MAPC}$ )  
The master application cycle must always be the same as the servo cycle clock set (setting: in context menu of the D410-2 > "Set system cycle clocks" in the project tree).  
Provided that the DP cycle is not scaled down to the servo cycle, the master application cycle will always be the same as the DP cycle.

---

**Note**

The PROFIBUS cycle clock can be scaled down in relation to the servo cycle clock. Down-scaling is only permitted if PROFINET IO with IRT has not been configured.

---

7.4 Additional information on configuring the SINAMICS Integrated

- Changing the DP cycle ( $T_{DP}$ )

Depending on the requirements in terms of the quantity structures and response times, the DP cycle may need to be changed. (See also *SIMOTION Runtime Basic Functions* Function Manual).

In addition, the minimum DP cycle for vector drives also depends on the speed controller cycle clock, which in turn depends on the used device type. This means that, particularly in the case of vector drives, the DP cycle must be checked and changed if necessary, see Section Using vector drives (Page 153).

**Note**

After  $T_{DP}$  has been changed on the PROFIBUS master, the drive system must be switched on (POWER ON).

- Changing the  $T_i$  and  $T_o$  times

A change to  $T_i/T_o$  is required in the case of vector drives, for example, where the  $T_i/T_o$  time for devices in chassis format depends on the type of device used.

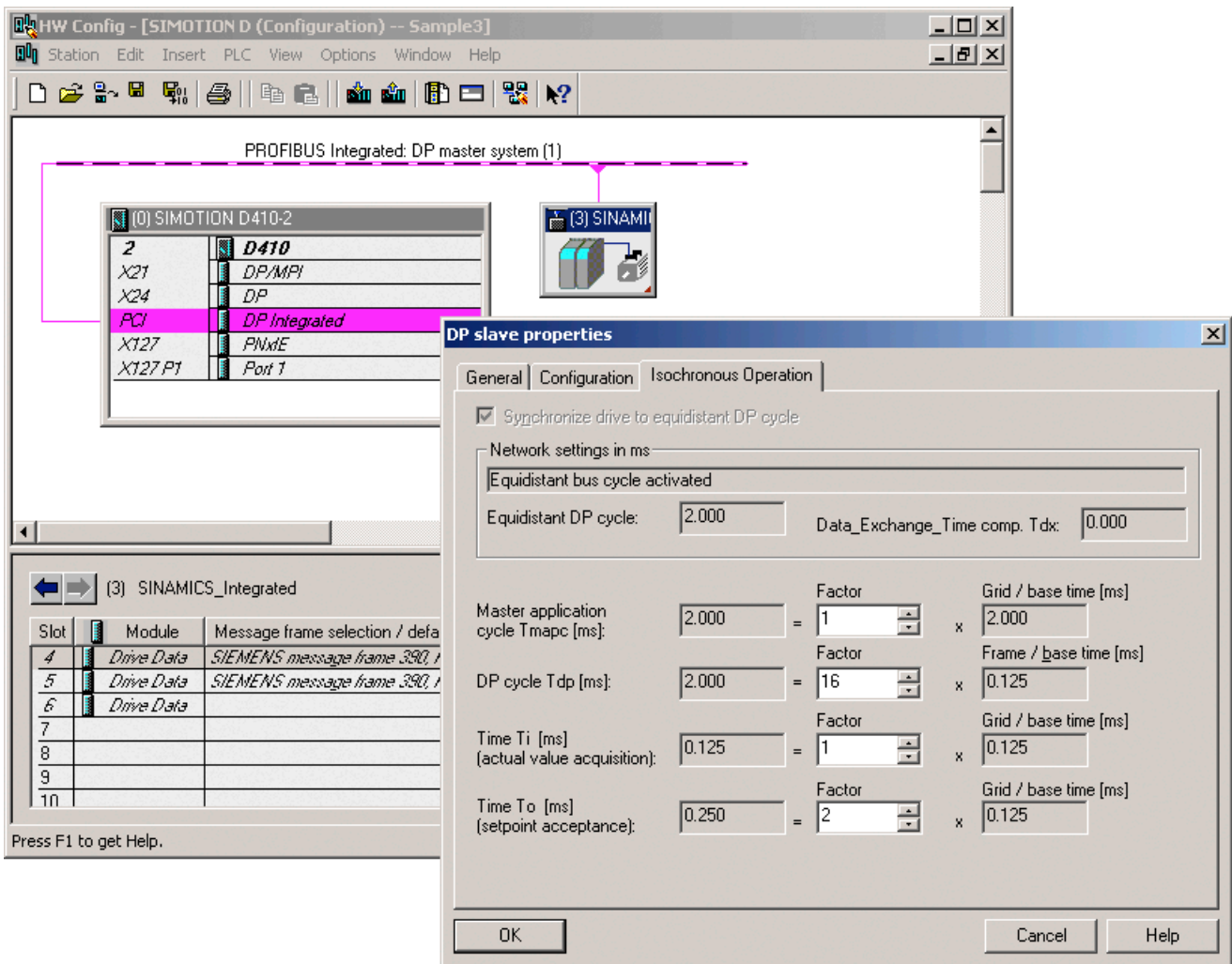


Figure 7-15 HW Config setting

The times are modified by changing the value in the "Factor" field.



## SCOUT TIA

In order to parameterize the isochronous cycle clock for the PROFIBUS Integrated in the TIA Portal, proceed as follows:

1. Select the PROFIBUS Integrated in the network view.
2. Select the "General" tab in the Inspector window and click "Equidistance" to display the parameters for the isochronous PROFIBUS. The "Activate isochronous bus cycle" setting is permanently selected and cannot be edited.

The other parameters are set to default settings and can be edited.

### Additional references

Additional information can be found

- In the *SINAMICS S120* Function Manual
- *SIMOTION Runtime Basic Functions* Function Manual
- *SIMOTION SCOUT TIA* Configuration Manual

## 7.4.2 Using vector drives

Changes need to be made in **HW Config** when SINAMICS vector drives are used. This means, for example, that the  $T_I/T_O$  time and the minimum DP cycle for drives in chassis format depend on the type of device used.

Therefore, we recommend adopting the following procedure when using a vector drive with the SIMOTION D410-2.

### Procedure

1. Open **HW Config**. By "double clicking" the SINAMICS Integrated, you can change the properties of the DP slave in the "Clock synchronization" tab.
2. For  $T_I = T_O =$ , enter an integer multiple of the current controller cycle. For the current controller cycle clock, use 375  $\mu$ s for devices in chassis format and 250  $\mu$ s or 500  $\mu$ s for the blocksize devices (PM340, PM240-2).
3. For  $T_{DP}$ , enter an integer multiple of the speed controller cycle. For a drive on the SINAMICS Integrated,  $T_{DP}$  must be  $\geq T_O$  in all cases.
4. Enter  $T_{MAPC} = T_{DP}$  (exception: You are working with cycle reduction; i.e. servo cycle > DP cycle).
5. Use the "Target system" > "Load" > "Load project to target system" menu command to download the parameterization to the SIMOTION D410-2.

7.4 Additional information on configuring the SINAMICS Integrated

6. After the download has successfully completed, you should determine the current and speed controller cycles of the drive from the drive's expert list, because the cycle clocks are set in the SINAMICS drive unit after a project has been downloaded.
  - p0115[0] current controller cycle clock
  - p0115[1] speed controller cycle clock
7. If the current and speed controller cycles from the expert list are different to the cycles used in steps 2 and 3, you will have to repeat the steps using the most up-to-date values for the current and speed controller cycles.

**Note**

The described procedure is also required for an online configuration with an automatic configuration.

Table 7-1 Vector drive

Example	Settings
Vector drive (chassis format) Current controller cycle = 375 $\mu$ s Speed controller cycle = 1.5 ms	$T_I = T_O =$ at least 375 $\mu$ s $T_{DP} =$ 1.5 ms (... or 3 ms, or 6 ms ....) $T_{MAPC} = T_{DP}$ For the SIMOTION D410-2, a minimum of 1 ms is recommended for the servo cycle clock. For this reason, set $T_{MAPC} = T_{DP} =$ 3 ms or higher.
Vector drive (PM340/PM240-2) Current controller cycle clock = 500 $\mu$ s (default) Speed controller cycle = 2 ms	$T_I = T_O =$ at least 500 $\mu$ s $T_{DP} =$ 2 ms (... or 4 ms, 8 ms, ...) $T_{MAPC} = T_{DP}$

**Blocksize Power Modules**

**Current controller cycle clock 500  $\mu$ s (default)**

The default current controller sampling time for SIMOTION D410-2 with PM340/PM240-2 is 500  $\mu$ s. This current controller cycle is set automatically following project download if p0112 = 3 (default). The sampling times in p0115 are adapted automatically by the system following the download; therefore, they may deviate from the offline values. The system also sets p0112 = 0 (expert) after the download.

**Current controller cycle clock 250  $\mu$ s (manual setting required)**

If the current controller cycle clock for SIMOTION D410-2 is to be changed from 500  $\mu$ s (default) to 250  $\mu$ s, p0112 = 0 (expert) must be set.

p0112 = 0 enables the individual sampling times to be adjusted in p0115. Moreover, with this setting, the system does not change the current controller sampling time automatically.

---

**Note**

SIMOTION D410-2 is a single-processor system. CPU utilization is, therefore, dependent on the SIMOTION configuration (PLC and motion control) and the SINAMICS configuration (drive control).

For more performance on the SIMOTION side, we recommend not setting any unnecessary cycle clocks on the SINAMICS side.

---

### 400 µs current controller cycle clock

Vector drives in chassis format can also be operated with a current controller sampling time of 400 µs (amongst other settings).

In the SIMOTION context, the following should be considered:

- A current controller sampling time of 400 µs is only possible if control is via a SINAMICS S120 Control Unit, which is not operated isochronously via PROFIBUS/ PROFINET on the SIMOTION D410-2.
- If the bus is operated isochronously, only cycle clocks with an integer multiple of 125 µs are possible (i.e. 375 µs or 500 µs instead of 400 µs, for example).
- The PROFIBUS Integrated of a SIMOTION D410-2 is always isochronous! This means that a current controller sampling time of 400 µs is not possible.
- With CU parameter p0092 = 1, the sampling times are preassigned in a way that enables isochronous operation with a control system.

### Output cams / measuring inputs with vector drives

In the case of devices in chassis format, the cycle clock ratios (current controller cycle clock, speed controller cycle clock, input/output sampling time, etc.) also depend on the type of device used.

Note the information in Section Current controller cycle clocks <> 125 µs / use of output cams and measuring inputs (Page 165).

### Additional references

Additional information on quantity structures and cycle clock settings can be found in the *SINAMICS S120* Function Manual.

### 7.4.3 Setting the SIMOTION time of day

#### Time on SIMOTION (real-time clock)

SIMOTION D410-2 features an integrated real-time clock. All events on a module (alarms, messages, etc.) are "time-stamped" based on the time shown by this real-time clock.

#### Procedure

Various options are available to set the clock of the SIMOTION D410-2:

- Setting the clock via the engineering system
  - SIMOTION SCOUT: Select the SIMOTION D410-2 in the project tree and then "Target system" > "Set time" in the menu.
  - SIMOTION SCOUT TIA: Call the "Set time" function at "Online & diagnostics" in the TIA Portal in the project tree.
- Setting the clock using the "rtc" system function block
- Synchronization of the local time with an NTP time server (as of V4.5)

The status of the NTP time synchronization can be determined with the `_getStateOfNTPClockSynchronisation` system function.

For further information on the NTP process, see the *SIMOTION Communication System Manual* and the *SIMOTION SCOUT TIA Configuration Manual*.

### 7.4.4 Synchronizing the SINAMICS clock

#### SINAMICS system runtime (operating hours counter)

For SINAMICS S120 Control Units and the SINAMICS Integrated on a SIMOTION D410-2, faults and alarms are "time-stamped" on the basis of the system runtime. This means that events are recorded by default on the basis of operating hours rather than a particular time of day or date.

#### System runtime

The entire system runtime is displayed in CU parameter p2114.

- r2114[0] indicates the system runtime in milliseconds. After reaching 86,400,000 ms (24 hours), the value is reset.
- r2114[1] indicates the system runtime in days.

The counter value is saved when the power is switched off. After the drive unit has been switched on, the counter continues to run with the value stored when the power was last switched off.

As a result, the drive displays the system runtime from 00:00:00 on 01/01/1992 in both the alarm window in SIMOTION SCOUT and the diagnostic buffer for entries.

If faults and alarms need to be "time-stamped" on the basis of a time of day, "Time-stamp operating hours" needs to be changed to "Time-stamp UTC format" as described below.

## Requirements

A telegram 39x is required for the time synchronization. If the automatic PROFIdrive telegram setting is selected for the Control Unit, this telegram is used automatically (see Section Accessing the drive wizard (Page 129), Standard/Automatic setting).

If the telegrams are specified manually, telegram 39x must be set up. See Section Message frame configuration (Page 180)

So that drive units can be synchronized with the SIMOTION time, they must support telegram 39x and the UTC (coordinated universal time) time format.

For precise time synchronization, the drive unit must also be operated via an isochronous bus on SIMOTION.

The SINAMICS Integrated with SIMOTION D is always connected isochronously.

The following Control Units support time synchronization:

- SINAMICS Integrated of the SIMOTION D410-2
- SINAMICS S120 CU310, CU310-2, CU320, CU320-2 Control Units connected via PROFIBUS or PROFINET
- SINAMICS S110 Control Units CU305, connected via PROFIBUS or PROFINET (precondition: as from SCOUT V4.4)

## Procedure

Proceed as follows to convert the SINAMICS clock to UTC format and to synchronize this with the SIMOTION clock:

1. In the project navigator, call the shortcut menu of the SIMOTION D410-2.
2. Select the "Properties" entry in the context menu.
3. Select the "Perform time synchronization with SINAMICS drive units" option in the "Settings" tab of the "D410-2 Properties" dialog box.

---

### Note

This setting is activated automatically and applies to all drive units connected to the SIMOTION D410-2. The SINAMICS clock is automatically synchronized with the SIMOTION clock for all drive units with configured telegram 39x.

---

The first time synchronization is performed after the SIMOTION D Control Unit has reached the RUN operating mode.

To compensate for deviations between the SIMOTION and SINAMICS clocks, the time of day is automatically resynchronized at regular intervals.

The user program can use the `_driveStates.allClocksSynchronized` on the device to query whether automatic time synchronization is enabled (=YES) or disabled (=NO).

Before the first synchronization, alarms and messages are stored with the time stamp valid in the SINAMICS at this time, all subsequent alarms and messages with the synchronized time.

The first time synchronization after switching on is entered with the status of the operating hours counter and the time (UTC time, synchronized with SIMOTION) in the diagnostic buffer of the drive (e.g. SINAMICS Integrated).

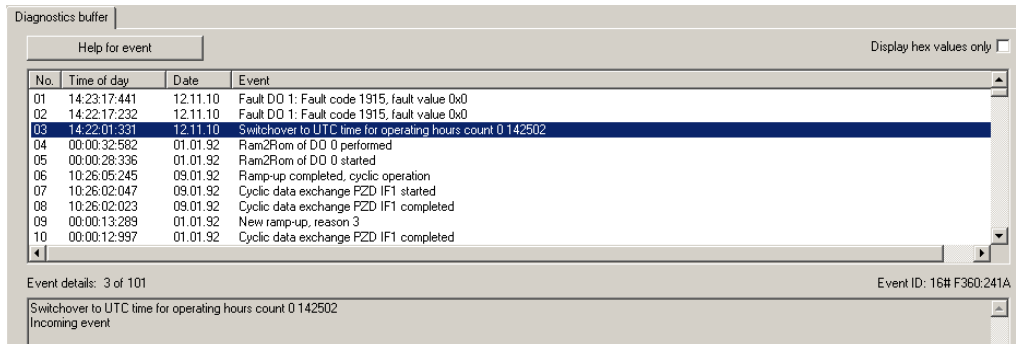


Figure 7-16 Diagnostic buffer entry, time synchronization

### Error correction

If problems occur with time synchronization, this may be due to deactivated symbolic assignment to incorrect configuration information (Fast IO configuration).

For more information, see Section Message frame configuration (Page 180).

### Compensation of runtime deviations

To compensate for deviations between the SIMOTION and SINAMICS clocks, the time of day is automatically synchronized at regular intervals.

The following behavior must be taken into consideration when setting the SIMOTION time:

- "Time/date to be set" is after "Time/date on SINAMICS": Time and date are corrected on the SINAMICS.
- "Time/date to be set" is before "Time/date on SINAMICS": The SINAMICS clock must be stopped until the SINAMICS "Time/date" has caught up with "Time/date to be set".

Adopting this procedure ensures that the sequence of SINAMICS diagnostic buffer entries remains the same, even when the runtime differences are aligned.

The SINAMICS clock operates with a resolution of 1 ms. A synchronization accuracy of 1 ms can be achieved for all bus cycle clocks that can be divided exactly by 1 ms (e.g. 1 ms, 2 ms, 3 ms, etc.).

Due to system considerations, a slightly lower synchronization accuracy is achieved for all bus cycle clocks that cannot be divided exactly by 1 ms (e.g. 1.25 ms).

If the drive unit does not have an isochronous connection on SIMOTION, this can result in runtime differences of milliseconds (depending on the set cycle clock ratios).

## Resetting the time

Requirement:

- SIMOTION D410-2: As of SIMOTION V4.3
- SINAMICS S120: As of SINAMICS V4.5
- SINAMICS S110: Not available

A threshold value is defined via parameter cu.p3109 and is effective as follows:

- In the case of negative time jumps less than the threshold value (p3109), the time is halted (for details, see "Compensation of runtime deviations")
- In the case of negative time jumps greater than the threshold value (p3109), the time is reset.  
Default setting: cu.p3109 = 100 ms  
This means that in the case of negative time jumps greater than 100 ms, the time is reset. The default value is configured so that normal runtime deviations (drift of the quartzes) are below the threshold value.  
If the SIMOTION clock is reset by more than 100 ms, this is interpreted as a "specific reset of the time" and the time of the drives is also immediately reset.

If the real-time clock is reset by more than 60 seconds, a diagnostic buffer entry is also made in the drive:

Time correction (reset) by **<correction value> seconds**

After a resynchronization (negative time jump greater than the threshold value)

- cu.r3107[0..1] the UTC time after synchronization
- cu.r3107[2..3] the UTC time before synchronization

is displayed in the parameter, whereby [0] and [2] are milliseconds and [1] and [3] are days.

---

### Note

The diagnostic buffer entries are not converted to the new time when the time is changed.

---

## 7.4.5 Backing up / restoring / deleting SINAMICS NVRAM data

### Requirement

SIMOTION D410-2 as of SIMOTION V4.3

SINAMICS S120 CU310-2/CU320-2 as of SINAMICS V4.5

For other supported SINAMICS Control Units, refer to the SINAMICS manuals.

### Saving the NVRAM data

The backup of the SINAMICS NVRAM data is performed by setting parameter p7775 to 1. The following applies:

- Parameter p7775 can also be set to 1 during pulse enable.
- A warm restart is not required.

---

#### Note

The consistent backup of the NVRAM data must be ensured by the application.

Make sure that there is no change of the NVRAM contents during the data backup. The greatest possible consistency is achieved when

- Backup is performed during pulse disable or
  - The drives are run down to 0 Hz.
- 

The data for the S120 Control Units and the SINAMICS Integrated is stored in the backup file "PMEMORY.ACX" in the folder " ... \USER\SINAMICS\NVRAM" on the CF card.

For the S120 Control Units, the data is stored on the CF card of the S120 Control Unit.

Similar to the non-volatile SIMOTION data, an already existing PMEMORY.ACX file is first renamed as PMEMORY.BAK and then the PMEMORY.ACX file is generated when you save the SINAMICS data.

If an error occurs during backup, the BAK file can be used to restore the data.

Parameter p7775 is set to 0 at the end of the backup.

### Restoring the NVRAM data

The SINAMICS NVRAM data can only be restored when none of the connected drives has a pulse enable.

When restoring, the PMEMORY.ACX file is accessed first. If this is available and is error-free, it is loaded. If no PMEMORY.ACX file is available or is corrupt, the PMEMORY.BAK file is loaded (if available and error-free).

Restoration of the NVRAM data can be performed manually and automatically.

#### Automatic restoration during module replacement

SINAMICS detects whether the Control Unit has been replaced on the basis of the serial number. In this case, the NVRAM of the used Control Unit is deleted first after POWER ON.

The following are not deleted:

- CU operating hours counter
- CU temperature and
- Safety logbook
- Crash diagnostic data

If there is an error-free PMEMORY.ACX or PMEMORY.BAK file on the CF card, the data is then loaded to the NVRAM.



If no error-free backup file is available, ramp-up is as for SINAMICS < V4.5. A fault is not issued and any existing "corrupt" backup files are not deleted.

#### Manual restoration

The manual restoration of the NVRAM data is performed by setting parameter p7775 to 2.

If the backup file (ACX or BAK) is error-free is, a warm restart is performed. The contents of the NVRAM are deleted first and then the data is loaded from the backup file to the NVRAM.

The following are not loaded:

- CU operating hours counter
- CU temperature
- Safety logbook
- Crash diagnostic data

Parameter p7775 is set to 0 at the end of the backup.

If the backup files are corrupt or no backup exists, the job is acknowledged with an error value in parameter p7775.

#### Deleting the NVRAM data

The SINAMICS NVRAM data can only be deleted when none of the connected drives has a pulse enable.

The deletion of the NVRAM data is performed by setting parameter p7775 to 3.

A warm restart is then performed automatically.

During the subsequent ramp-up, all NVRAM data on the CU is first deleted.

The following are not deleted:

- CU operating hours counter
- CU temperature and
- Safety logbook
- Crash diagnostic data

At the end of the deletion, the initialization data of the applications is in the NVRAM, similar to after a device automatic commissioning (with the exception of the above-mentioned data).

Parameter p7775 is set to 0 at the end of the deletion.

#### Explanations for the parameter p7775

The following jobs can be set with the parameter p7775:

Value of the parameter p7775	Job
1	Backup NVRAM data (on CF card)
2	Restore NVRAM data (from CF card)
3	Delete NVRAM data on the Control Unit

The acknowledgement of a parameter job is delayed.

- If the job cannot be executed, it is acknowledged negatively.
- If the job can be executed, it is acknowledged with the value 255.

Table 7-2 Acknowledgments of the parameter jobs

Acknowledgement	Description
17	Job cannot be executed because of the operating state
20	Illegal value
107	Write access is not permitted (cause: At least one DO has a pulse enable) Because the SINAMICS must perform a warm restart when restoring and deleting the data, none of the connected drives may have a pulse enable.
132	Parameter change blocked (see p0300, p0400, p0922, p7760, macro being executed)
204	Write access not permitted
255	"OK": Job being executed

If an error is detected during the execution of a parameter job, the error cause is signaled via the parameter itself (no message via the fault buffer).

Table 7-3 Causes of error for parameter jobs

Error	Cause
10	Error occurred while deleting
11	No backup possible: Memory card is not inserted
12	No backup possible: Memory card is full
13	Backup could not be completed (e.g. memory card removed during the backup)
14	Restoration not possible: Memory card is not inserted
15	Restoration not possible: Checksum of the NVRAM data backup file is faulty
16	Restoration not possible: No backup available

**Note**

The memory card must always remain inserted for the SIMOTION D410-2. For information which SINAMICS Control Units permit the removal of the memory card, refer to the SINAMICS manuals.

Parameter p7775 is only reset automatically to 0 after the successful completion of a job.

**Know-how and write protection**

Parameter p7775 is not part of the know-how protection. This allows the parameter to be read and written independent of the know-how protection.

Parameter p7775 is part of the write protection. This means the parameter can only be written by the controller that configured a PZD cyclic communication with the SINAMICS when write protection is activated (p7761 = 1).

All other write jobs are acknowledged negatively, e.g.

- SIMOTION SCOUT / STARTER
- For SINAMICS BOP, IOP, AOP Control Units
- Other masters that only communicate acyclically with the SINAMICS

## 7.4.6 SINAMICS diagnostic buffer

### Requirements

The SINAMICS Integrated diagnostic buffer can be displayed in SIMOTION SCOUT.

### Procedure

Select the SINAMICS Integrated in the project tree, and then "Target system" > "Device diagnostics" in the menu.

In addition, the SINAMICS diagnostic buffer entries are also displayed in the SIMOTION D410-2 device diagnostics. All SIMOTION D410-2 diagnostic buffer entries are displayed first, and then all diagnostic buffer entries of the the SINAMICS Integrated. The start of the SINAMICS Integrated diagnostic buffer entries is identified by the following entry:

```
>>>>> Start of SINAMICS Integrated diagnostic buffer, station address = x <<<<<<
```

You also have the option of viewing the SIMOTION D410-2 and SINAMICS Integrated diagnostic buffers via SIMOTION IT web server.

## 7.4.7 Acyclic communication with the drive

### Overview

PROFIdrive drive units are supplied with control signals and setpoints by the controller and return status signals and actual values. These signals are normally transferred cyclically (i.e. continuously) between the controller and the drive.

For SINAMICS S110/S120, configure the axis message frames for data exchange (refer to Performing an offline configuration (Page 128)).

In addition to cyclic data exchange, PROFIdrive drive units feature an acyclic communication channel. In particular, this is used for reading and writing drive parameters (e.g. error codes, warnings, controller parameters, motor data, etc.).

As a result, data can be transferred on an acyclic as opposed to a cyclic basis when required. Acyclic reading and writing of parameters for PROFIdrive drives is based on the DP V1 services "read data set" and "write data set".

The acyclic DP V1 services are transferred while cyclic communication is taking place via PROFIBUS or PROFINET. The PROFIdrive profile specifies precisely how these basic mechanisms are used for read/write access to parameters of a PROFIdrive-compliant drive.

The PROFIdrive standard states that "pipelining" of jobs on PROFIdrive drives is not supported.

- Only one "write/read data record" can be performed at any one time on a drive unit (e.g. SINAMICS S120 control unit or the SINAMICS Integrated of a SIMOTION D).
- However, if several PROFIdrive drive units are connected to a controller, a job can be processed for each of these drive units at the same time. In this case, the maximum total number of jobs will depend on the control system. (for SIMOTION, this is a maximum of 8 jobs at a time).

In the case of acyclic data exchange with SINAMICS drives, this means you will have to coordinate the write/read jobs with one another (buffer management). An interlock must be set in order to prevent the application or different parts of the application from sending overlapping jobs to the same PROFIdrive drive unit.

### Additional references

Additional information on how to use DP V1 services can be found in the *SIMOTION Communication System Manual*.

*SIMOTION Utilities & Applications* also has a DP V1 library with functions that are capable of undertaking coordination tasks commonly associated with acyclic communication. The library not only coordinates access to the system functions (`_ReadRecord/_WriteRecord/_readDriveParameter/_writeDriveParameter/` etc.), but also expands the range of functions for frequently required tasks, e.g. the reading of faults and alarms from the drive unit.

*SIMOTION Utilities & Applications* is provided as part of the SIMOTION SCOUT scope of delivery.

The functions available in the DP V1 library include:

- Buffer management (coordination of a number of parallel DP V1 services)
- StartUp (function for coordinating startup of the SINAMICS drive with SIMOTION)
- TimeSync (applicative time synchronization: Transfer of SIMOTION time of day to the SINAMICS drives)
- SetActIn (activating/deactivating objects in SIMOTION and SINAMICS)
- RwnPar (reading and writing of drive parameters)
- GetFault (reading errors and warnings from the drive)

### 7.4.8 Control properties and performance features

With a few exceptions, the integrated drive control of the SIMOTION D410-2 has the same control properties and performance features as the SINAMICS S120 CU310-2 control unit.

However, the following points must be particularly observed:

- The SINAMICS Integrated does not feature a basic positioner (EPOS). EPOS functionality is provided by SIMOTION technology functions.
- It is not possible to connect a BOP20 Basic Operator Panel to the SIMOTION D410-2. The following alternative options are available:
  - Use of SIMATIC HMI devices (e.g. TP177B, configurable with WinCC flexible)
  - Use of the SIMOTION IT web server.  
You can use a Web browser to access the Standard diagnostics pages of the SIMOTION D410-2 (diagnostic and alarm buffer, watch table, SIMOTION variables and read/write drive parameters, access protection, trace function, ... ).  
You also have the option of creating your own Web pages, for example, to visualize machine states and to permit service functions. The SIMOTION D410-2 web pages can be accessed, for example, using a PC or PDA via Ethernet. Wireless access is also possible in conjunction with WLAN.
- Not all SINAMICS function modules are supported (e.g. the function modules free function blocks, spindle diagnostics, and CAN are not supported)
- The SINAMICS Integrated of the SIMOTION D410-2 does not support a reset via parameter p0972. A reset via p0972, is only supported by SINAMICS Control Units.

#### 7.4.9 Current controller cycle clocks <> 125 µs / use of output cams and measuring inputs

If current controller cycle clocks <> 125 µs are used, the parameter calculations of the drive must be transferred to the PG, in particular when using cam outputs on the TM15 / TM17 High Feature or for global measuring inputs, so as to regenerate the Fast IO configuration.

A change of the current controller cycle clock will have effects on the sampling times of the I/Os on the drive side (e.g. TM15/TM17 High Feature, p4099 sampling time of I/Os). For the cam outputs and the measuring input inputs (only for global measuring inputs) to function correctly, the sampling times must be known to the engineering system.

Sampling times <> 125 µs occur in the following cases:

- For servo drives with manual change of the current controller sampling time (drive parameters p0112 and p0115[0])
- For vector drives.

Table 7-4 Influence of the current controller cycle clock on the dead time compensation

	Current controller cycle clock has no effect on the function	Current controller cycle clock has an effect on the function
Cam outputs	<ul style="list-style-type: none"> <li>• SIMOTION D</li> <li>• ET 200MP TM timer DIDQ 16x24V</li> <li>• ET 200SP TM timer DIDQ 10x24V</li> </ul>	TM15 / TM17 High Feature
Measuring input inputs (global measuring inputs)	<ul style="list-style-type: none"> <li>• D4x5-2 (terminal X142)</li> <li>• ET 200MP TM timer DIDQ 16x24V</li> <li>• ET 200SP TM timer DIDQ 10x24V</li> </ul>	<ul style="list-style-type: none"> <li>• TM15 / TM17 High Feature</li> <li>• SIMOTION D (except D4x5-2, terminal X142)</li> <li>• SINAMICS S110/S120 Control Units</li> </ul>
Measuring input inputs (local measuring inputs)	-	-

In order that the changed cycle clock ratios are taken into account by the engineering system, proceed as follows:

1. Go online and perform a project download. The SINAMICS performs parameter calculations once.
2. Perform an upload to the PG ("Target system" > "Load" > "Load CPU / drive unit to PG").
3. This transfers the parameter calculations of the drive to the PG. The cycle clock ratios are then known in the engineering system.
4. Go offline.
5. Generate the configuration information (Fast IO configuration) again. To do this, select the SIMOTION CPU in the project tree and right-click to open the context menu "Fast IO" > "Create new configuration".
6. Execute "Project" > "Save and compile all".
7. Go online and download the project to the target system.
8. Save the data on the CF card.

SIMOTION SCOUT uses the described procedure to calculate internal system data that is required for outputting/detecting signals with a high level of position accuracy.

**Note**

If the cycle clock ratios are not set correctly, an appropriate message is output in the diagnostic buffer.

### 7.4.10 Licenses for the SINAMICS Integrated

The following SINAMICS functions are licensed via SIMOTION:

- SINAMICS Safety Integrated Extended Functions for SIMOTION D
- SINAMICS Safety Integrated Advanced Functions for SIMOTION D (as of V5.2)
- SINAMICS high output frequency for SIMOTION D

#### SINAMICS Integrated

##### **SINAMICS Safety Integrated Extended Functions for SIMOTION D**

Highly effective protection of personnel and machinery can be implemented with SIMOTION D thanks to the integrated safety functions of SINAMICS S120.

Whereas the Safety Integrated Basic Functions are license-free, the Safety Integrated Extended Functions and Advanced Functions require a license for the SINAMICS Integrated.

- SINAMICS Safety Integrated Extended Functions for SIMOTION D or
- SINAMICS Safety Integrated Advanced Functions for SIMOTION D

The Safety Integrated Extended and Advanced Functions are licensed for the SINAMICS Integrated of SIMOTION D410-2 Control Unit with the licenses. The Safety Integrated Advanced Functions include the Safety Integrated Extended Functions.

##### **SINAMICS high output frequency for SIMOTION D**

Because of legal specifications, the output frequency for converter systems is limited to 550 Hz per default.

- SINAMICS S120 Control Units as of firmware V4.7 HF7
- SIMOTION D Control Units as of firmware V4.4 HF6

The **SINAMICS high output frequency for SIMOTION D** license allows users to cancel the output frequency limit if, as a result of the application, output frequencies of more than 550 Hz are required for drives. The license cancels the limitation **for the SINAMICS Integrated** of SIMOTION D410-2 Control Unit.

---

#### **Note**

The display of the Runtime licenses in the SCOUT Licensing dialog is updated after the power-up of the SINAMICS Integrated.

---

#### SINAMICS Control Units

SINAMICS Control Units connected via PROFINET or PROFIBUS (e.g. CU310-2, CU320-2) are licensed via the SINAMICS memory card. Licensing via SIMOTION is not possible.

### Further information

- Changes to the EC Dual Use regulation and how it impacts SIMOTION  
<https://support.industry.siemens.com/cs/ww/en/view/104020777>
- SINAMICS S120/S150: Release for delivery, license for high output frequency  
<https://support.industry.siemens.com/cs/en/en/view/104020669>

#### 7.4.11 Support of motors with PT1000 temperature sensor

Because of the discontinuation of the KTY84-130 temperature sensor, SIMOTICS motors will be equipped with PT1000 temperature sensor in the future.

- Motors with DRIVE-CLiQ interface remain compatible and can be operated on any SW version.
- Motors without DRIVE-CLiQ interface require SIMOTION SCOUT as of V4.5 for the configuration of the PT1000 temperature sensor.

### 7.5 Testing the configured drive using the drive control panel

You can test a configured drive using the drive control panel where you can define a speed value by setting a scaling factor. The drive control panel should only be used for commissioning.

#### Requirements

- The project has been downloaded to the target system.
- SIMOTION SCOUT is in online mode.
- The drive is not being used by a current project in RUN mode.



#### **WARNING**

**Danger to life from unexpected movement of driven machine parts**

Make sure this presents no hazard to personnel or property.



## Procedure

1. Change to the configured drive in the Project Navigator and open the drive control panel by selecting "Commissioning" > "Control panel". The drive control panel opens in the detail view.

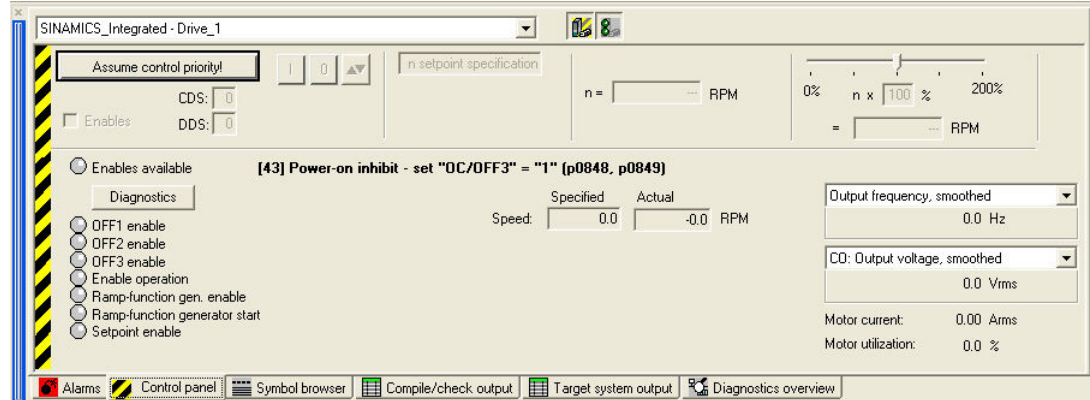


Figure 7-17 Drive control panel

2. To display the control area and axis diagnostics, click the "Show/hide control area" and "Show/hide diagnostics area" buttons.
3. Click "Assume control priority". The "Assume Control Priority" dialog box is opened.

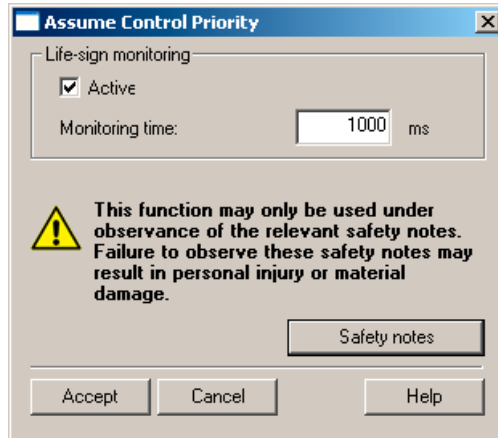


Figure 7-18 Assuming control priority

4. Read the notes and confirm these with "Accept."
5. Activate the "Enables" checkbox to enable the drive. All enables are now set with the exception of ON/OFF1.

6. Enter the desired setpoint in the entry field, and, as a safety setting, slide the scaling to 0%.

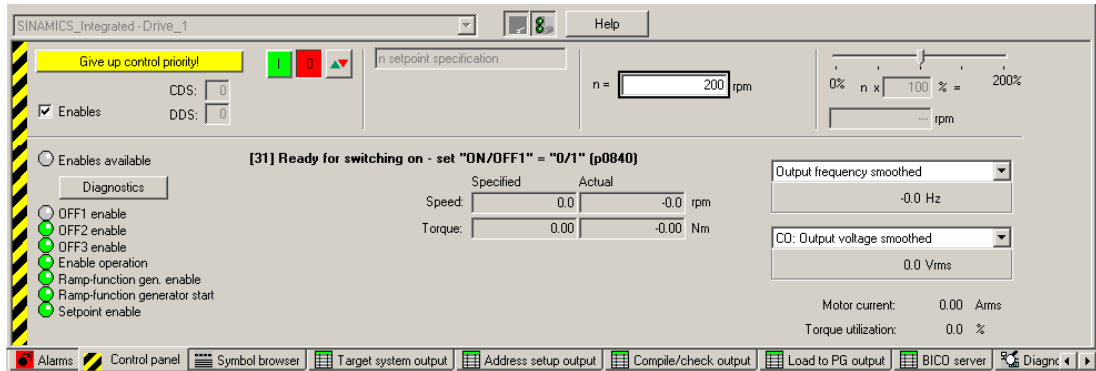


Figure 7-19 Entering a setpoint

7. Click the "Drive On" button. The green "Enable available" LED lights up. If you move the slider to the right, the drive rotates. The current motor speed is displayed in "Actual."
8. Click "Drive Off" to stop the drive after you completed the test.
9. Deactivate the enable and click the "Give up control priority" button to deactivate control from the PG/PC.

## 7.6 Creating and testing axes

### 7.6.1 Overview of SIMOTION Engineering

#### Performing engineering with SIMOTION SCOUT

The SIMOTION SCOUT engineering system can be used to insert axes in your project.

1. First, run through the axis wizard to configure the axes and interconnect to the real drive (e.g. SINAMICS Integrated).
2. Provided you have completed the configuration at the drive end, we strongly recommend for faster working that the SINAMICS Integrated is deactivated via "Target system" > "Select target device".
3. Complete your SIMOTION application, for example, by creating axis functions and SIMOTION execution programs.
4. Compile the project and download it to the SIMOTION D410-2.

## 7.6.2 Creating an axis with the axis wizard

### Overview

The TO axis provides the user with the technological functionality and the interface to the drive/ actuator. The TO axis processes the motion control commands from the user program (e.g. MCC) and coordinates the interface to the drives. It executes control and motion commands and indicates statuses and actual values.

The TO axis communicates with an actuator (drive or hydraulic valve) via a fieldbus system (PROFIBUS or PROFINET via PROFIdrive protocol) or via a direct setpoint interface (analog  $\pm 10$  V or pulse/direction).

When running through the axis wizard, the basic settings are made for the axis and the TO axis interconnected to a drive (e.g. SINAMICS Integrated). The following extended options are available when "Use symbolic assignment" has been activated:

- A real axis is interconnected to an already configured drive
- A real axis including drive is created via the axis wizard and the drive interconnected to the axis
- A real axis is created without assigning this to a drive (assignment is made later)

### Inserting an axis

1. In the Project Navigator, double-click the entry "Axis" > "Insert Axis."  
This will access the axis wizard. Set the required technology and then click "OK."

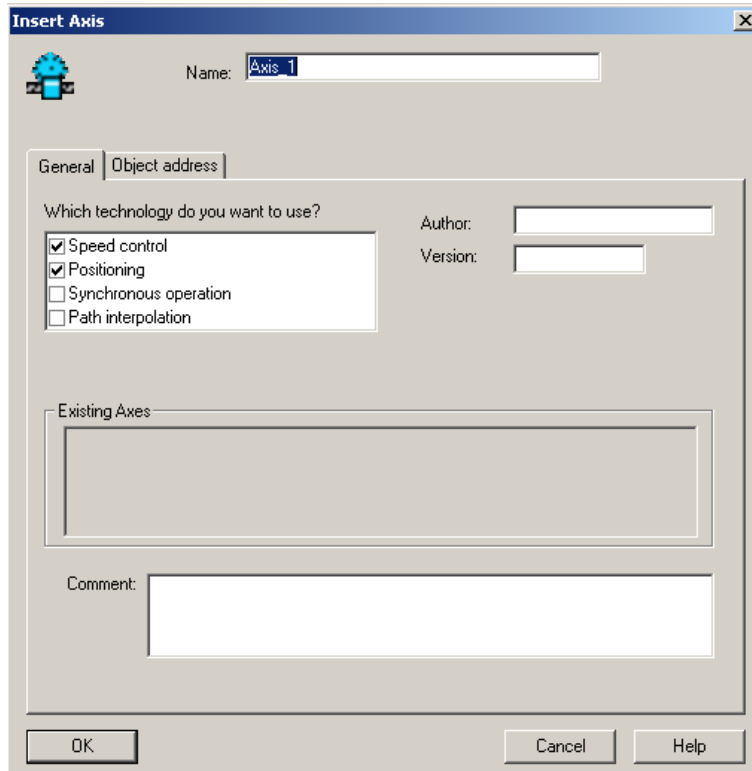


Figure 7-20 Inserting an axis

2. Set an axis type and, if required, configure the units.

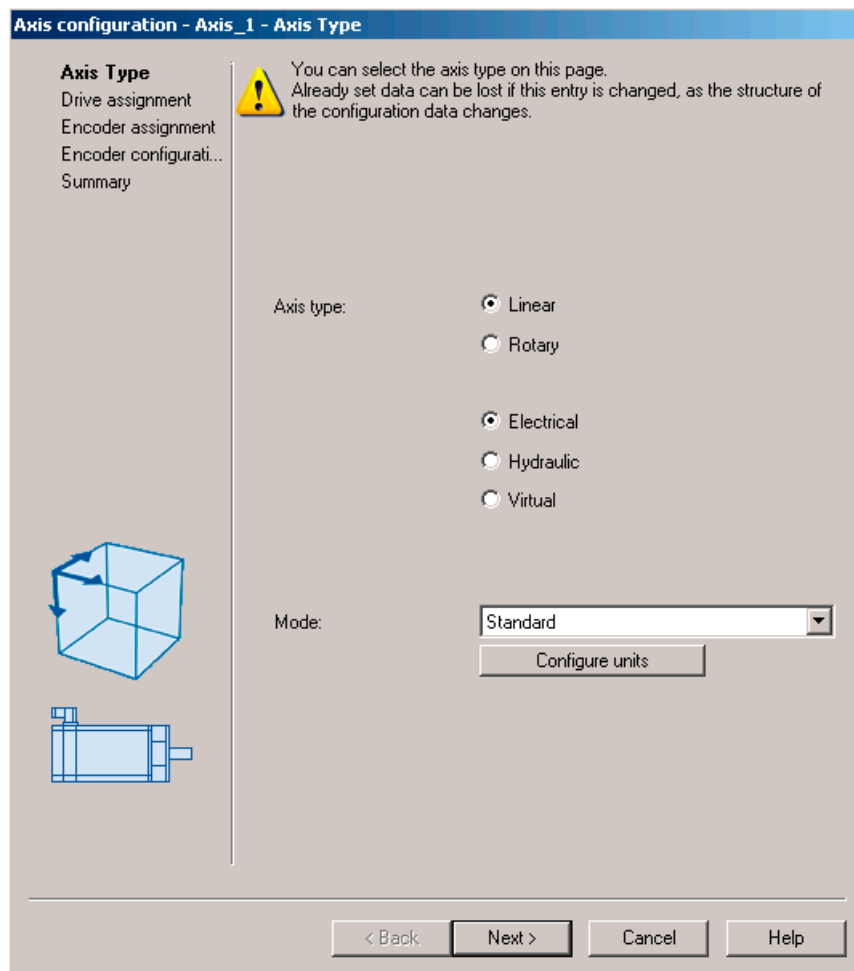


Figure 7-21 Defining the axis type

3. Create a new drive or make the assignment to an existing drive.

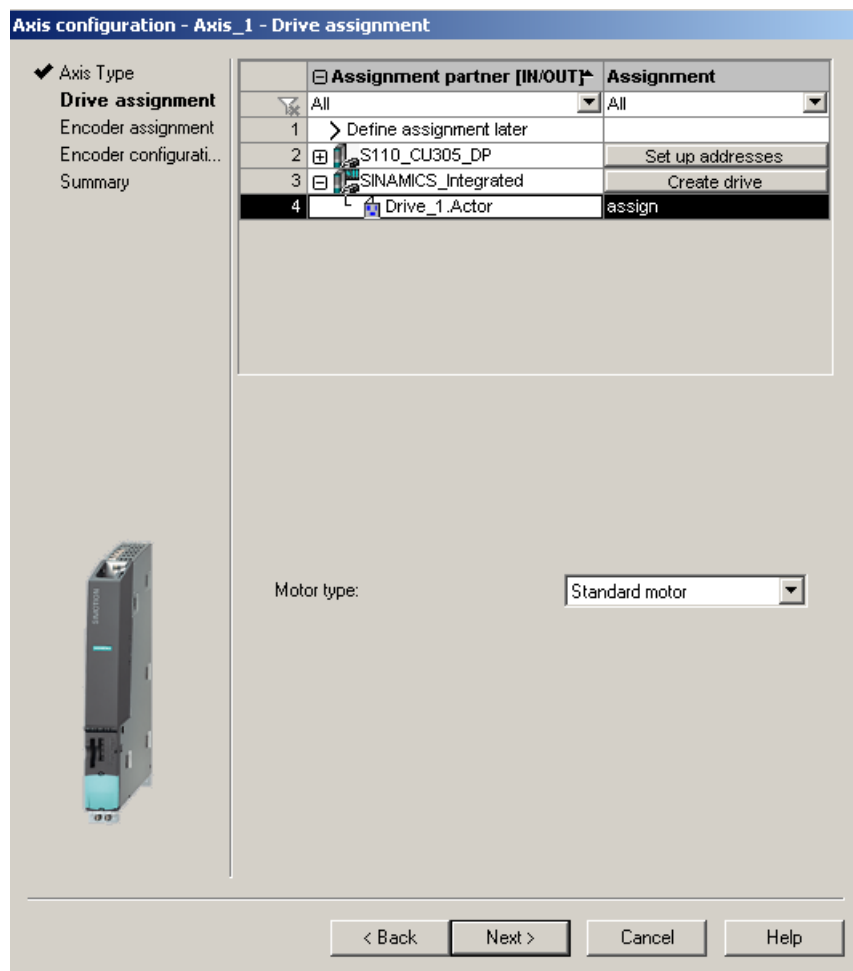



Figure 7-22 Assigning a drive

The following setting options are available for the drive assignment:

- Assigning a drive  
Assigning a previously configured drive.
- Define a subsequent assignment  
The axis should not be assigned to a drive until a later point in time. Accordingly:
  - The PLC and motion control functions to be completely configured by a programmer even without drive know-how using technology objects (e.g. TO axis) and loaded to the device.
  - The drives to be separately configured and optimized by a drive expert.
  - The technology objects to be symbolically assigned later to the drive objects via an interconnection dialog box.

- **Creating a drive**  
From the Assignment dialog box, a new drive can be created on an existing drive unit (e.g. SINAMICS Integrated) and assigned to the axis. This allows the axis, including the drive, to be created in one operation. It is not necessary to configure a drive before creating an axis.
- **Setting up addresses**  
If "Use symbolic assignment" has been deactivated, the addresses must be set up manually. This is required, for example, for drive units that do not support symbolic assignment (e.g. SINAMICS S120 with FW version < 2.6.2, MASTERDRIVES, SIMODRIVE, etc.).

The address list in the "All Addresses" view provides an overview of the assignments to all interfaces of the TO axis. From this view, the assignments can also be changed via the Interconnection dialog box ( button).

---

### Note

The symbolic assignment must be deactivated for the drive and axis configuration without symbolic assignment and adaptation.

---

Run through the wizard and enter the settings of your system. The required axis telegram as well as the addresses used are automatically determined by the engineering system. The telegram is also extended and interconnections in the drive created automatically depending on the selected TO technology (e.g. SINAMICS Safety Integrated).

Click **Finish** to confirm the "Summary" window.

The configured real axis is displayed in the project navigator.

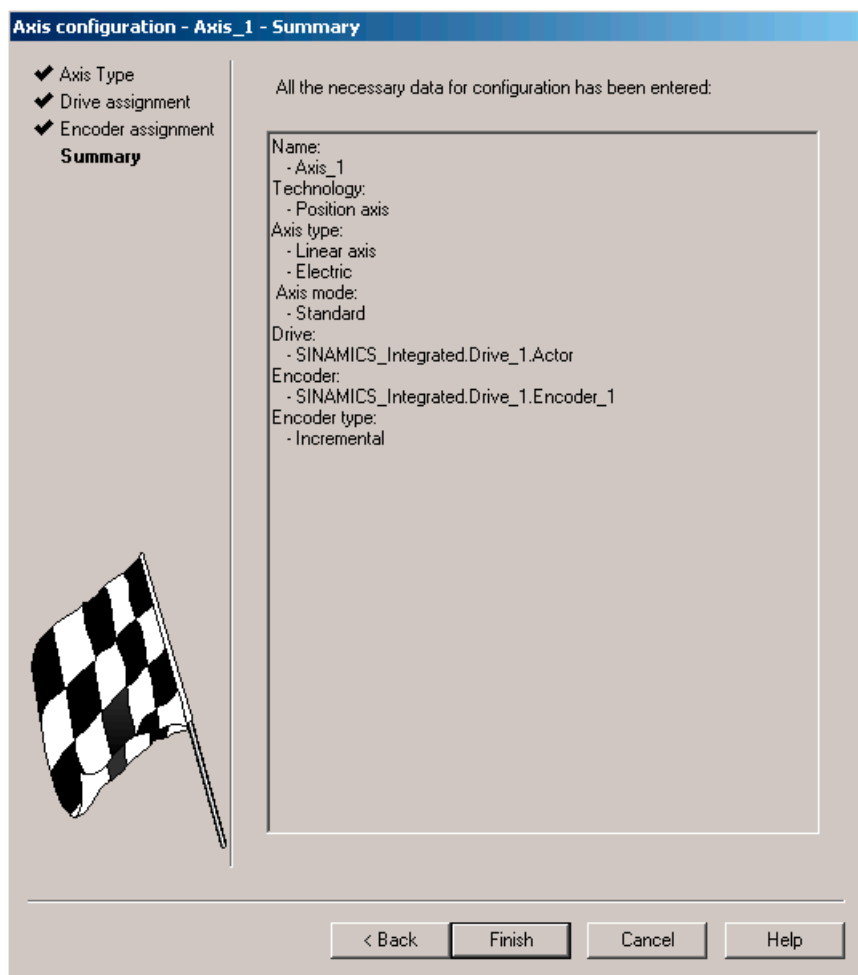


Figure 7-23 Axis wizard summary

**Note**

During system power-up, reference variables as well as drive and encoder data of the SINAMICS are automatically taken over for the SIMOTION configuration data of the SIMOTION technology objects "TO axis" and "TO externalEncoder".

**Encoder assignment**

With a position axis, encoder 1 is also created on the TO axis (motor encoder) and automatically assigned to the first encoder on the drive.

If encoder 2 (direct encoder) is created at the TO axis, it is assigned to the second encoder of the drive control.


**Result**

The configured axis will appear in the project navigator.

Save and compile the project and download it to the target system.



After running through the axis wizard, the symbolic drive assignment is displayed via "Configuration" of the axis as well as via the address list (All addresses view).

The Assignment dialog box can be called again from these dialog boxes using the  button.

Instead of calling the Assignment dialog box, it is also possible to edit the input field

 containing the symbolic name directly.

## TBD, DSDB, and SIDB

In the "Configuration" dialog box of the TO axis, you can activate the following functions from "Functions" > "Change":

- Technology data block (TDB): for the cyclic exchange of technology data, e.g. actual torque value
- Drive Safety data block (DSDB), V4.4 and higher: to support the SINAMICS Safety Integrated Functions by means of the TO
- Safety Info Data Block (SIDB): Predecessor of the DSDB (for compatibility only)

The assignment is always made to the drive DO of the actuator of the axis. The system automatically generates a telegram extension and the BICO interconnection of the relevant SINAMICS parameters.

---

### Note


The safety data blocks (DSDB or SIDB) are automatically configured by the engineering system and interconnected in the drive.

The PROFIsafe telegram must be configured by the user.

---

If the activation of the safety functions is to be made using PROFIsafe, configure the PROFIsafe communication to the higher-level SIMATIC F-CPU (see *SINAMICS S120 Safety Integrated Function Manual*).

## I/O signals at the TO axis

For the assignment of I/O signals on the TO axis (e.g. the inputs for the homing output cam or hardware limit switches), call the assignment dialog box from the parameterization dialog boxes of the TOs created or from the address list (view of all addresses) by clicking the  button.

## Additional references

See Section Downloading the project to the target system (Page 141).

For further information about the symbolic assignment, see the *SIMOTION Runtime Basic Functions Function Manual*.

### 7.6.3 Testing an axis with the axis control panel

#### Axis control panel

The axis control panel is used exclusively for testing axes.

You can use the axis control panel for the following tasks, for example:

- Testing all system components before the axis movement is controlled by a program.
- Testing as to whether you can move the axis using the axis control panel if a fault is detected.
- Moving the axes for tuning purposes (controller tuning).
- Executing active homing.
- Setting and resetting the axis enable signal.
- Testing the axis that was created.

#### Requirements

The following requirements must be fulfilled for testing:

- The project has been downloaded to the target system.
- SIMOTION SCOUT is in online mode.

#### Axis test

1. Open the "AXES" folder in the Project Navigator and click the "Control panel" entry below the axis (for example, Axis\_1).  
The axis control panel is displayed.

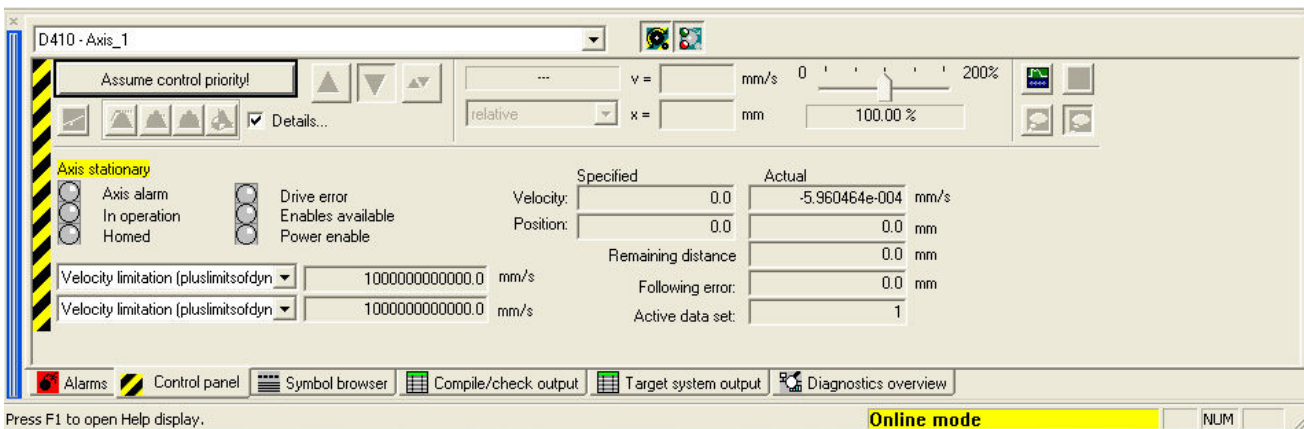


Figure 7-24 Axis control panel

2. To display the control area and axis diagnostics, click the "Show/hide control area" and "Show/hide diagnostics area" buttons.

3. Click "Assume control priority".

---

**Note**

In order to move the axis from the PG/PC, you must assume control priority. However, by pressing the SPACER bar, you can stop the axis at any time.

---

4. The further procedure depends on the CPU status:
  - Case 1: CPU in the STOP/STOPU state  
If the CPU is in the STOP state, a message will appear, indicating that the CPU has been put in the STOPU state.  
A safety message appears in a further dialog box and must be accepted.  
The activated service function is then displayed via the LEDs (RUN/STOP flashing yellow/green with 2 Hz).
  - Case 2: CPU in the RUN state (as of SCOUT/Kernel V4.4)  
Control priority can only be assumed if the axis is not in motion.  
After accepting the safety message, a message is shown on the control panel that the CPU is in the RUN state, that the user program is running, and further axes may be moving. (LED display: RUN).  
If the control priority for a TO is active, commands for the TO from the user program are rejected with an error code. Alarm 30009: reason 0x04 is output.
5. To enable the axis, click "Set/reset enables".  
Confirm the "Switch Axis Enable" dialog box with "OK".

---

**Note**

If the control panel is operated in the RUN state, setting/canceling the axis enable can alternatively be controlled via the user program.

---

6. To traverse the axis, click the "Position-controlled traversing of the axis" button.
7. Enter a velocity and close the dialog box by clicking "OK".
8. Click the "Start movement" button. You can monitor the traversing motion under velocity and position. Use "Stop motion" to stop axis movement again.
9. Click "Set/reset enables" to remove the enable. Confirm the "Remove Axis Enable" dialog box with "OK".
10. Click the "Give up control priority" button to deactivate axis control from the PG/PC. In this operating state, the axes can no longer be controlled from the PG/PC.

---

**Note**

For commissioning kinematics transformations, a path control panel is available as of SIMOTION V4.4

---

**See also**

Please refer to the additional information in the SCOUT Online Help (Axis control panel index).

## 7.7 Setting up addresses and message frames

### Overview

After all SINAMICS components have been configured, addresses must be determined for the process data exchange between the drive and the controller.

This procedure depends on whether **symbolic assignments** are used.

- With symbolic assignment, the addresses are determined automatically by the engineering system; refer to Section Setting up communication for symbolic assignment (Page 180).
- In the absence of symbolic assignment, addresses must be determined manually; refer to Section Message frame configuration (Page 180).

### 7.7.1 Setting up communication for symbolic assignment

The communication for the symbolic assignment can be set up with the following actions:

- From the SCOUT menu  
Call the "Project" > "Setup communication for symbolic assignment" menu.
- At "Download project to target system"
- At "Save project and compile changes"

When setting up the communication, the message frames, BICO interconnections and addresses are set up for the entire project.

### 7.7.2 Message frame configuration

#### Requirement

You have configured the drive unit.

On the basis of this configuration, one or more of the following actions should be performed:

- The automatic PROFIdrive telegram setting for a drive object should be activated/deactivated.
- The automatic telegram extension for a drive object should be activated/deactivated.
- The automatic address adaptation for a drive object should be activated/deactivated.
- PROFIdrive telegrams should be configured for drive objects.
- The addresses should be set up.
- Telegrams should be extended manually.

## Procedure

In the project navigator, open the "Communication" > "Telegram configuration" entry under "SINAMICS\_Integrated."

The "SINAMICS Integrated - Telegram Configuration" dialog box is displayed with the PROFIdrive PZD telegrams tab.

The dialog box lists all the available drive objects. The possible setting options are described in the following.

## Note

When using the symbolic assignment, the default setting does not have to be changed or configured.

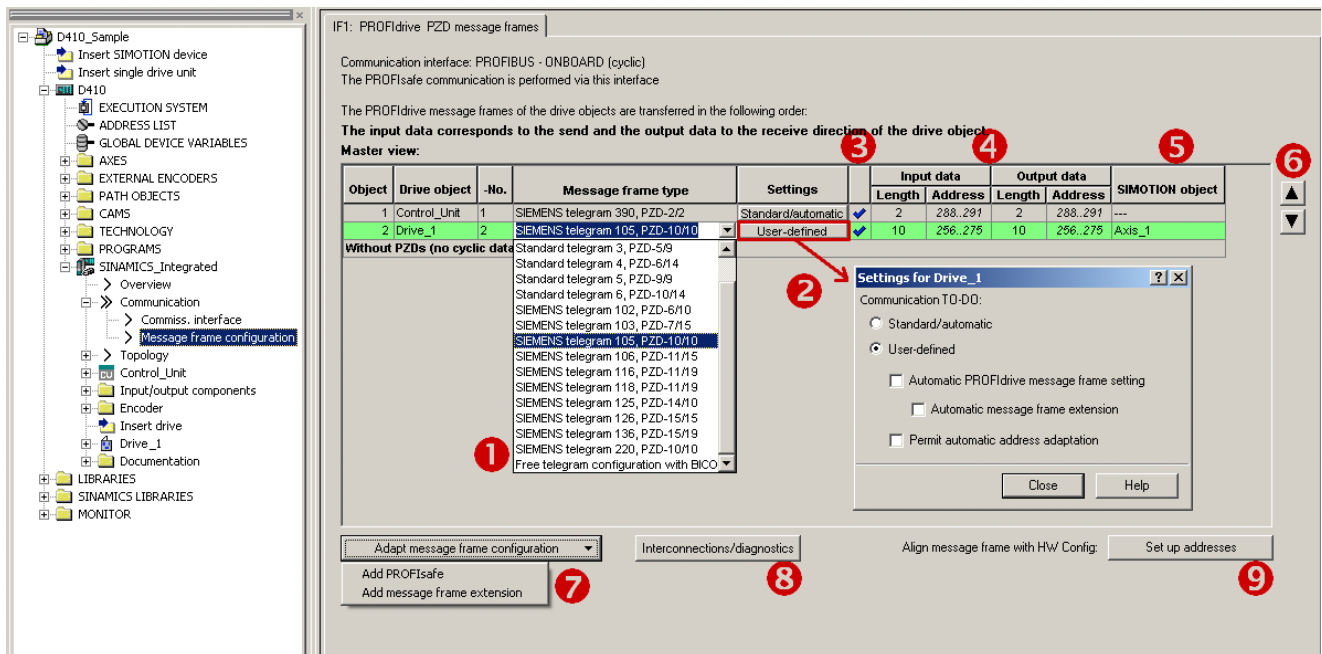


Figure 7-25 Telegram configuration

7.7 Setting up addresses and message frames

Table 7-5 Explanation of the figure

No.	Meaning
①	<p>Selection of a telegram</p> <ul style="list-style-type: none"> <li>• The drive telegrams (telegrams 1 ... 6 and telegram 1xx) are defined in accordance with the PROFIdrive specification and can be selected based on the required functional scope.</li> <li>• You can transfer the signals of the I/Os or the global measuring inputs, for example, via the telegrams 39x. Telegram 39x is also required for the time synchronization between SIMOTION and SINAMICS.</li> <li>• Free telegram configuration with BICO allows you to define your own telegram.</li> <li>• Free telegram configuration with p0915/p0916 (for TM15/17).</li> </ul>
②	<p>The "Standard/automatic" and "User-defined" settings are only visible if "Use symbolic assignment" is activated. Using the setting "Standard/automatic" is generally recommended.</p> <p>The "User-defined" setting allows the automatic telegram setting, telegram extension, and address adaptation to be deactivated or activated.</p> <ul style="list-style-type: none"> <li>• "Automatic PROFIdrive telegram setting" allows the telegram to be set by the system depending on the configured technology (telegram selection, e.g. for drive and control unit incl. onboard I/O).</li> <li>• "Automatic telegram extension" allows the telegram to be extended by the system depending on the configured technology (e.g. if the technology data block is activated in the axis configuration).</li> <li>• "Permit automatic address adaptation" allows addresses to be adapted by the system in the case of address offsets, for example. Address offsets can occur, for example, if a telegram is extended and the adjacent addresses are already occupied by other telegrams.</li> </ul> <p>With TM15/TM17 High Feature, "Automatic PROFIdrive telegram setting", "Automatic telegram extension", and "Automatic address adaptation" cannot be deactivated by design, since for these drive objects the telegram is always set up in accordance with the parameterized terminal functionality (DI, DO, output cam, measuring input) and cannot be extended.</p> <p>"Automatic PROFIdrive telegram setting" and "Automatic telegram extension" must be deactivated if the telegrams are to be configured manually for TM15 DI/DO and TM31 and interconnected with BICO.</p> <p>See Section Setting up communication for symbolic assignment (Page 180).</p>
③	<p>Telegram status (Meaning of the symbols, see table below)</p>
④	<p>Length: Displays the size of the telegram component. Address: Addresses in <b>HW Config</b> The addresses will be displayed only if the addresses have been defined.</p>
⑤	<p>Displays the SIMOTION object that is interconnected to the SINAMICS object (e.g. axis or encoder).</p>
⑥	<p>Changing the telegram order</p> <p>Note: Before the alignment, all drive objects without I/O addresses ("---...---") must be moved behind the objects with valid I/O addresses or those still to be aligned ("???..???").</p>
⑦	<p>"Manual" adaptation of the telegram configuration (e.g. when additional data, such as a motor temperature, is to be transferred via the telegram).</p>
⑧	<p>Display of the individual control and status words of the associated telegram.</p>
⑨	<p>Setting up the addresses (alignment of the addresses with <b>HW Config</b>)</p> <p>Only the addresses for the respective drive unit are determined (no automatic determination of telegrams / BICO interconnections).</p>

**Note**

If symbolic assignment is deactivated, the following applies:

If the telegrams for drive objects (drives, Terminal Modules, etc.) change, you must set up the addresses again. The addresses are not updated automatically.

**Telegram status**

The icons in the status column show the following information:



The telegram differs from the configuration in **HW Config**. You must align the configuration with **HW Config**.



You are using a predefined standard telegram or a free BICO interconnection.



You are using an altered standard telegram that you have extended to include supplementary data.



You are using a telegram for which one of the two telegram lengths is too long. The drive project cannot process this entry.

**Error correction (symbolic assignment deactivated)**

Based on the 39x telegram, SIMOTION generates further configuration information (FastIO configuration) for the following functions:

- Time-of-day synchronization SIMOTION ↔ SINAMICS
- Use of onboard I/Os of SIMOTION D, CU, or CX
- Use of cams and global measuring inputs
- System function `_setDriveObjectSTW`

If the telegrams are defined manually (symbolic assignment is deactivated), a telegram 39x must be set up in the telegram configuration. The telegram then has to be aligned with HW Config via "Set up addresses."

If use of the functions stated above is not possible, generate the FastIO configuration anew. For this purpose select in the project tree the affected SIMOTION D Control Unit, the SINAMICS CU or Controller Extension CX and open the "FastIO" > "Create new configuration" shortcut menu with the right mouse button. Then compile the project and load it into the CPU. Perform a restart.

The FastIO configuration is also used for the telegram of the Terminal Modules TM15 and TM17 High Feature. Proceed in the same way if problems occur.

## 7.8 Linking an additional encoder (optional)

### 7.8.1 General information

SIMOTION D410-2 features a DRIVE-CLiQ X100 interface for connecting an encoder. SIMOTION D410-2 provides the option of integrating and configuring further encoders in addition to the motor encoder.

The following encoders are supported for operation with SIMOTION D410-2:

- Encoders with a DRIVE-CLiQ interface
- Encoders connected to SIMOTION D410-2 or CUA32 via the onboard encoder interface (X23)
- Encoders connected to SIMOTION D410-2 using an SMx module
- Encoders connected using PROFIBUS or PROFINET

### Configuring additional encoders

The second encoder can be used at SIMOTION D410-2, for example, as:

- A machine encoder (second encoder = direct measuring system).  
A direct measuring system measures the technological parameter directly, i.e. without the interference of influences such as torsion, backlash, slip, etc. This may enable improved smoothing of mechanical influences. If you use a second encoder as a machine encoder, you can work with the encoder changeover function.
- An external encoder.  
You can use the external encoder for recording an external master value, for example.
- Encoder for hydraulic axes
- Encoders for the implementation of cam controllers

### Configuring tasks

Encoders connected via PROFIBUS/PROFINET are only configured in SIMOTION.

Encoders connected using SMx, DRIVE-CLiQ or the onboard encoder interface must be configured on the drive side (SINAMICS Integrated) and in SIMOTION.

Configure this additional encoder on drive side (SINAMICS Integrated) and in SIMOTION:

1. Configuring additional encoders on the drive (Page 185)
2. Connecting additional encoders via PROFIBUS/PROFINET (Page 186)

These steps in configuring are described in the next section.



## 7.8.2 Configuring additional encoders on the drive

The following options are available for configuring additional encoders on the drive:

- Configuration of a second encoder on the drive
- Configuration of an encoder as drive object (as of SINAMICS firmware V4.3)

### Configuring a second encoder on the drive

The configuration of a second encoder on the drive is useful when the second encoder value is also to be used for this drive (e.g. motor or machine encoder). Note that a maximum of only two encoder values can be transferred via PROFIdrive message frames.

In principle, the second encoder value can be freely used (e.g. for acquisition of an external master value), however the use of an encoder as a separate drive object (drive object DO encoder) is preferable because of the clear functional separation.

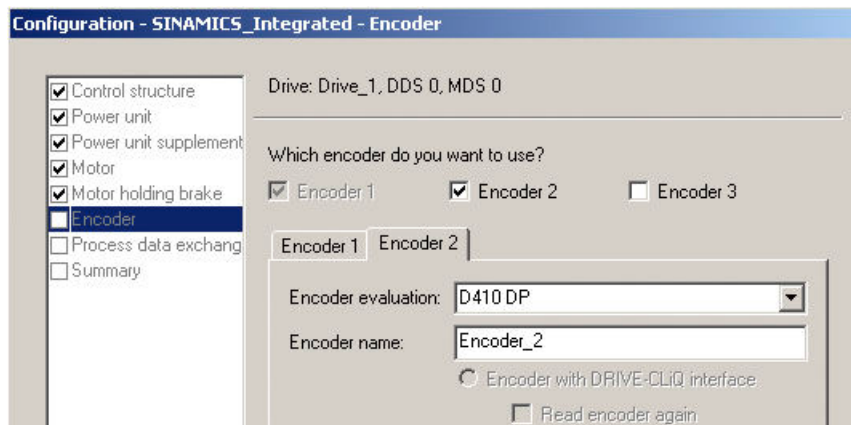


Figure 7-26 Configuration of a second encoder on the drive

### Configuring an encoder as drive object

The configuration of an encoder as drive object (drive object DO encoder) has the advantage that this encoder can be used independently of a configured drive (e.g. for acquisition of a master value).

The configuration is performed by inserting an encoder via the project navigator.

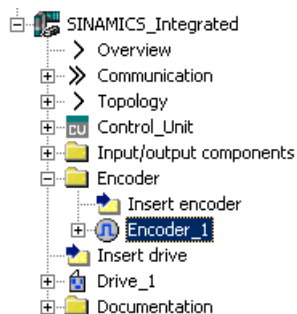


Figure 7-27 Configuration of an encoder as drive object

---

**Note**

In the same way as for axes, a "DO encoder" can also be symbolically interconnected to a "TO externalEncoder".

---

### 7.8.3 Connecting additional encoders via PROFIBUS/PROFINET

#### Options

With regard to encoder integration, further encoders can also be connected via PROFIBUS or PROFINET. The following options are available:

- Encoder interconnection using a PROFIdrive message frame (encoder with message frame type 81 and 83)
- Encoder interface as a direct value in the I/O area.

#### Additional references

Detailed information is contained in the *SIMOTION TO Axis, Electric/Hydraulic, External Encoder Function Manual*

## 7.9 Symbolic assignment of I/O variables

### 7.9.1 Assignment to the PROFIdrive message frame of the TO axis

I/O variables which you require for purposes such as display and diagnostics can be assigned from the address list to individual components (status word, for example) via the assignment dialog of the PROFIdrive message frame. Only components suitable for the data type of the I/O variable are displayed. If no data type is specified at the I/O variable, this is determined via the assignment partner after the selection.

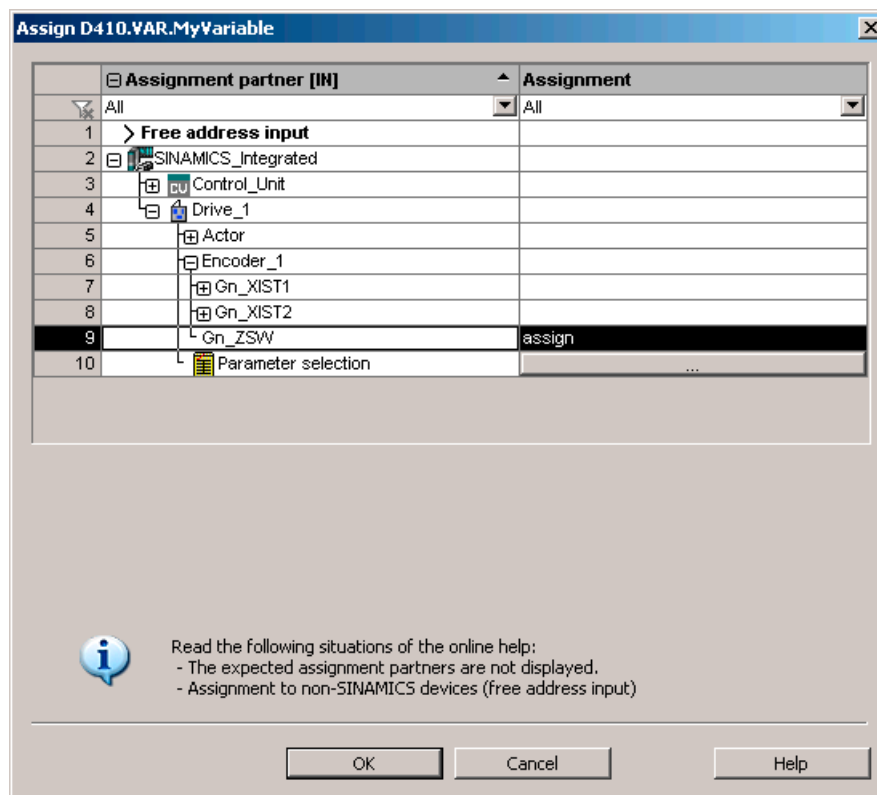


Figure 7-28 Assignment of I/O variables to the PROFIdrive message frame

### 7.9.2 Assignment to drive parameters

I/O variables from the address list can be assigned to drive parameters using the assignment dialog. Only parameters suitable for the data type of the I/O variable are displayed. If no data type is specified at the I/O variable, this is determined by the parameter selection.

An extension of the standard message frame is created automatically for the transfer of the parameters to/from the drive.

### Procedure

1. Open the Assignment dialog box from the address list (view of all addresses). The Assignment dialog opens with the corresponding assignment partners.
2. Click the "..." button in the parameter selection line to open the parameter list.

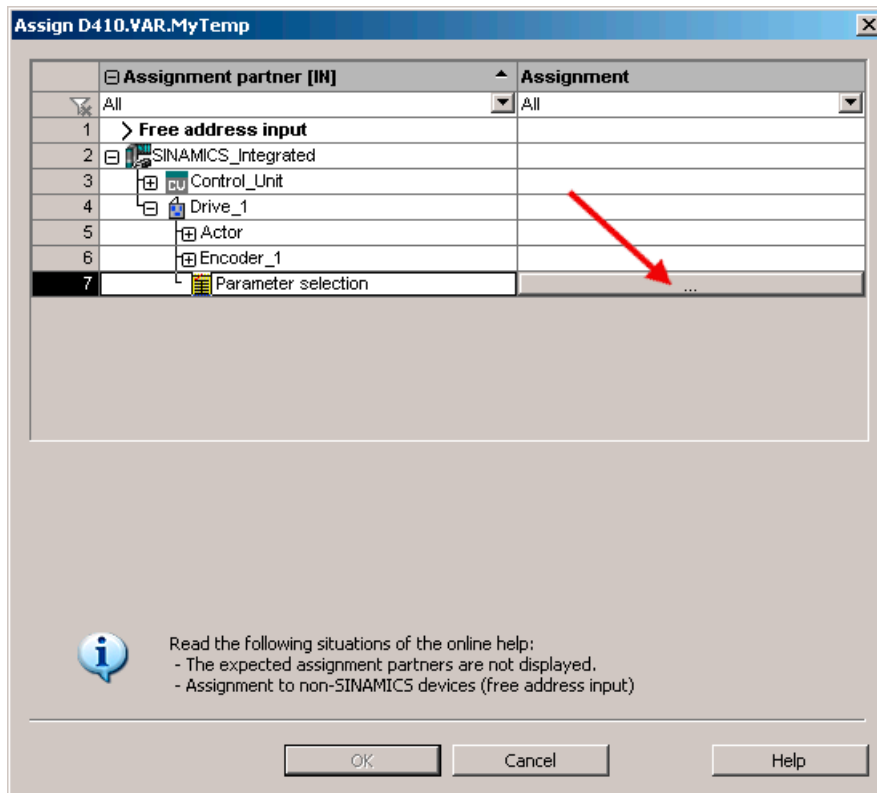


Figure 7-29 Assignment dialog for drive parameters

3. Select the desired signal source (e.g. DO drive). Then select the required parameter.

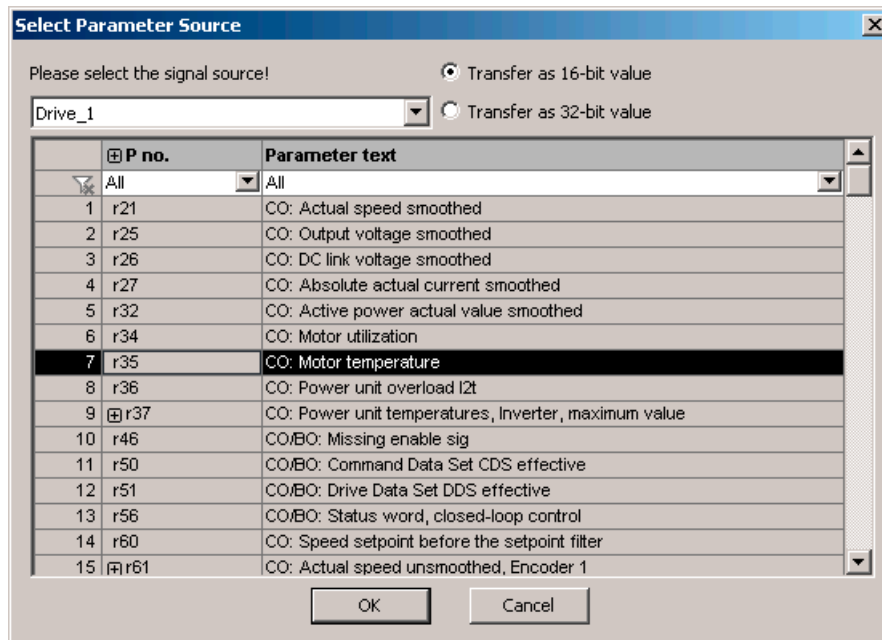


Figure 7-30 Dialog box for the DO and parameter selection

4. Click "OK" to accept the selection.

- The desired SINAMICS parameter is assigned to the I/O variable in the interconnection dialog box.

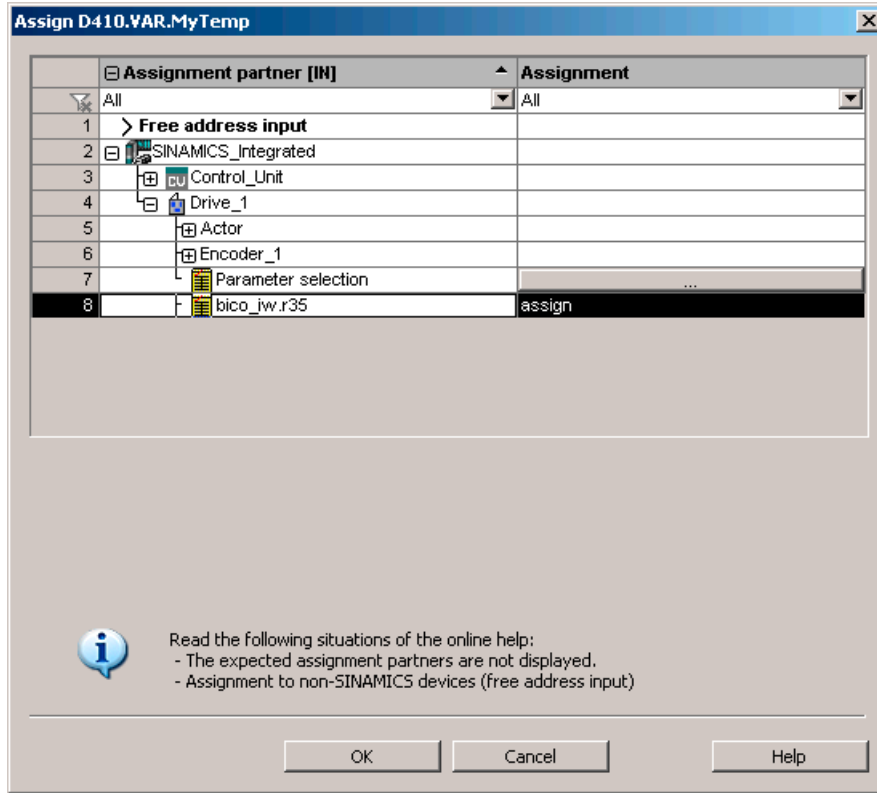


Figure 7-31 Assigned drive parameters

- Click "OK" to accept the assignment.

The following table shows the possible types of assignment:

Name of the assignment	Data type	Direction	Transferrable BICO parameters
BICO_IW.<parameter number>	WORD	Input	All CO parameters (BICO source)
BICO_QW.<parameter number>	WORD	Output	All CI parameters (BICO sink)
BICO_ID.<parameter number>	DWORD	Input	All CO parameters (BICO source)
BICO_QD.<parameter number>	DWORD	Output	All CI parameters (BICO sink)

### Syntax of the assignment names

- A number of parameters (separated by periods) are specified for outputs (SINAMICS side = received data) which can be interconnected with a number of BICO sinks
- If the transferred parameter is on another drive object (DO), the DO name precedes the parameter. "#" is used as a separator between the DO name and the parameter.
- Individually transferred bits of a parameter appear in brackets [x]

## 7.10 Configuring drive-related I/Os

### 7.10.1 Overview of the symbolic configuration of I/Os

#### Overview

SIMOTION D410-2 as well as the SINAMICS S110/S120 control units and additional components (TMs) have I/Os that can be used by the drive unit and by SIMOTION.

I/Os originally assigned to SINAMICS can be used by SIMOTION only when they have been interconnected to a message frame.

#### Symbolic assignment

SIMOTION SCOUT supports by default the symbolic configuration of I/Os, see Section Symbolic assignment / adaptation (Page 123).

The symbolic assignment simplifies the configuration significantly:

Table 7-6 Comparison of configuration with/without symbolic assignment

Configuration	With symbolic assignment	Without symbolic assignment
Configuring message frames	So that SIMOTION can use SINAMICS I/Os, the required message frames are created automatically	Message frames must be set manually (either predefined message frame (e.g. 39x) or free message frame configuration)
BICO interconnections	The required BICO interconnections are performed automatically (I/Os are interconnected to a message frame)	With predefined message frames (e.g. 39x), the BICO interconnections are made automatically With free message frame configuration with BICO, the interconnection must be made by the user
Parameterization of the I/O functionality (e.g. measuring input)	Parameterization via screen forms	Parameterization via screen forms and partly via parameters in the expert list
Handling of I/O addresses	Handling of addresses is not required because of symbolic assignment	I/O addresses must be determined
Setting up addresses	Addresses are set up automatically, refer also to Section Setting up communication for symbolic assignment (Page 180)	Addresses must be set up manually, refer also to Section Message frame configuration (Page 180)

Only the configuration with symbolic assignment is described in the following. For further information on the configuration of drive-related I/Os without symbolic assignment, see Appendix Configuring drive-related I/Os (without symbolic assignment) (Page 295).

**Procedure**

The configuration of the I/Os is divided into two basic steps:

1. Configuring I/O terminals (Page 192)  
The functionality of an I/O channel is configured (e.g. configuration of a DI/DO as digital output).
2. Configuring technology objects and I/O variables (Page 196)  
The access of technology objects and I/O variables to I/Os is configured. The configuration is symbolical, whereby only "function-compatible" I/O channels are offered for selection.  
**Example:**  
For the TO measuringInput, only symbolic assignments of the type MI (measuring input) are offered for selection.

The engineering system automatically makes the required message frames and the interconnections to the configured I/Os.

**7.10.2 Configuration options**

The following table provides an overview of the configuration options for the I/O terminals of various modules.

Table 7-7 Configuration of the I/O terminals overview

Module	Use of the I/Os by		Configuration of the I/O terminals	Supports symbolic assignment
	SIMOTION	SINAMICS		
SIMOTION D410-2 • Terminal X120/X121 • Terminal X130/X131	X <sup>1)</sup>	X	On the drive unit (CU)	As of SIMOTION V4.3
SIMOTION D4x5-2 • Terminal X122/X132 • Terminal X142	X <sup>1)</sup> X	X -	On the drive unit (CU) On the D4x5-2 (HW Config)	As of SIMOTION V4.2
SIMOTION D4x5	X <sup>1)</sup>	X	On the drive unit (CU)	As of SIMOTION V4.2
CX32-2, CX32	X <sup>1)</sup>	X	On the drive unit (CU)	As of SIMOTION V4.2
SINAMICS S110 CU305	X <sup>1)</sup>	X	On the drive unit (CU)	As of SINAMICS V4.3
SINAMICS S120 • CU310 • CU310-2 • CU320 • CU320-2	X <sup>1)</sup>	X	On the drive unit (CU)	• As of SINAMICS V2.6.2 • As of SINAMICS V4.4 • As of SINAMICS V2.6.2 • As of SINAMICS V4.3
TB30, TM15 DI/DO, TM31	X <sup>1)</sup>	X	On the drive unit (TB30 or TM)	Yes
TM41 <sup>2)</sup>	X <sup>1)</sup>	X	On the drive unit (TM41)	Yes <sup>2)</sup>



Module	Use of the I/Os by		Configuration of the I/O terminals	Supports symbolic assignment
	SIMOTION	SINAMICS		
TM15, TM17 High Feature	X	-	On the drive unit (TM15 or TM17)	Yes
Time-based I/O <ul style="list-style-type: none"> <li>ET 200MP TM timer DIDQ 16x24V</li> <li>ET 200SP TM timer DIDQ 10x24V</li> </ul>	X	-	On the ET 200 I/O system	As of SIMOTION V4.4 HF6

- 1) I/Os are originally assigned to a SINAMICS drive unit and can be assigned to SIMOTION via configuration
- 2) TM41 supports symbolic assignment only for encoder interfaces (not symbolic assignment for DI, DO and AI)

---

### Note

The module hardware for TM15 and TM15 DI/DO is identical. A distinction is only made by the addition of the component in the SIMOTION SCOUT project navigator using "Insert input/output component".

---

I/Os that are originally assigned to the SINAMICS drive unit can also be used by SIMOTION via configuration.

- An output is always only exclusively available for the SINAMICS drive unit or SIMOTION.
- An input used by SIMOTION can also be interconnected on the drive side.

In the following sections describe in detail how to configure the I/O terminals.

## 7.10.3 SIMOTION D410-2 Configuring I/Os

### Procedure

The onboard inputs/outputs of the SIMOTION D410-2 are assigned to SINAMICS Integrated. The configuration is therefore performed via the drive unit ("SINAMICS\_Integrated" > "Control\_Unit" > "Inputs/outputs").

The properties of the I/O channel can be configured in the parameterization dialog box. With the bidirectional digital I/Os, for example, an I/O channel can be:

- Parameterized as input or output
- Inverted
- BICO-interconnected (use as drive I/O)
- Used as digital input for SIMOTION with "DI (SIMOTION)"
- Used as digital output for SIMOTION with "DO (SIMOTION)"

- Used as a global measuring input input for SIMOTION with "Measuring input (SIMOTION)"
- Used as an output cam output for SIMOTION with "output cam (SIMOTION)"

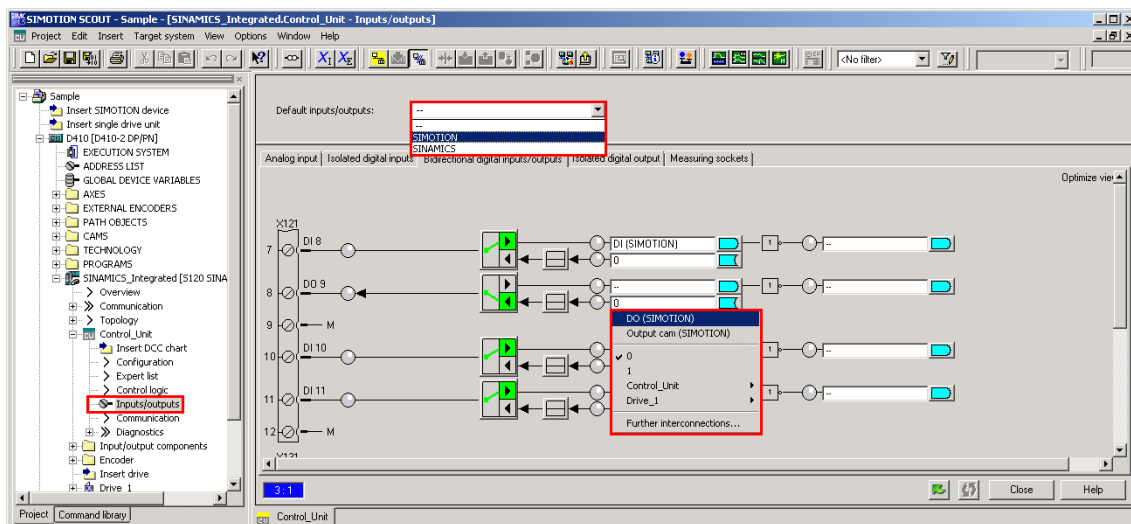


Figure 7-32 Configuration of D410-2 I/Os (terminal X121)

## 24 V supply for DO

If no digital outputs are used, the SIMOTION D410-2 can be supplied via the Power Module. A 24 V supply must be connected to terminal X124 for the digital outputs to be used. If a digital output is parameterized and the 24 V supply is not connected (or the level is too low), alarm A03506 is issued on the SINAMICS side (can also be parameterized as a fault).

## Data transfer

If the D410-2 onboard I/Os are interconnected using symbols (or if telegram 39x is used for the onboard I/Os), the status information of the DI and DO will be transmitted to cu.p2048 at the PROFIdrive PZD sampling rate. Sampling of the inputs and outputs is also performed in the sampling time parameterized according to cu.p0799.

The same applies if the I/Os are manually interconnected to a drive telegram via a BICO converter.

Transfer of the output values and feedback of the input values is therefore subject to dead times and jitter.

For time-critical applications, use of measuring probes or cams is recommended. Alternately, the isochronous I/Os, I/Os of TM15, TM17, or isochronous ET 200 I/Os can be used.

## 7.10.4 Configuration of CU3xx/TMxx I/Os

### Overview

The configuration is performed in a similar way as for the onboard I/Os for the SIMOTION D410-2, i.e. the I/Os can be

- BICO-interconnected (use as drive I/O)
- Used by SIMOTION

See also Section SIMOTION D410-2 Configuring I/Os (Page 193)

---

#### Note

If symbolic assignment is subsequently activated for a project in which telegrams have already been configured and interconnected, this project can be changed together with the BICO interconnections!

For this reason, make a backup copy of your project before activating the symbolic assignment.

The TM15 DI/DO and the TM31 are particularly affected here (see Section Symbolic assignment / adaptation (Page 123)).

---

## 7.10.5 Configuration of the ET 200SP/MP timer DIDQ

The I/O terminals of the ET 200SP and ET 200MP timer DIDQ can be used as drive-related I/Os for measuring input and output cam applications.

The DI/DQ timers are configured via the hardware configuration of STEP 7 or TIA Portal. The properties of the I/O channel can be configured in the parameterization dialog box, for example

- Timer DI for use of the I/O as measuring input input or
- Timer DQ for use of the I/O as cam output

---

#### Note

For the technological use of the timer DIDQ, you must operate the I/O station isochronously on PROFINET:

- ET 200SP timer DIDQ: With SCOUT or SCOUT TIA, IM 155-6 PN HF required
- ET 200MP timer DIDQ: Only with SCOUT TIA, IM 155-5 PN ST or HF required

Operation via PROFIBUS is not possible.

---

For detailed information on the configuration, see *Technology Modules TM Timer DIDQ for SIMOTION SCOUT and SIMOTION SCOUT TIA Commissioning Manual*

## 7.11 Configuring technology objects and I/O variables

### 7.11.1 Configuring global measuring inputs

#### Overview

The type of measuring input must be selected during the configuration of the TO measuring input, see following table.


Table 7-8 Measuring input types

Measuring input types	Explanation
Standard (global measuring input)	Compared with the drive-related local measuring inputs, global measuring inputs have extended functionality and also support a symbolic configuration. They are therefore set as standard.
Drive-related (local measuring input)	The drive-related local measuring inputs are configured via drive parameters, see Section Configuring drive-related I/Os (without symbolic assignment) (Page 295) in the Appendix.
Listening measuring input	Through the configuration of a listening measuring input, measuring can be performed simultaneously on several axes or external encoders with one measuring input. Detailed information can be found in the <i>SIMOTION Motion Control Output Cams and Measuring Inputs</i> Function Manual.

A detailed comparison of "local" and "global" measuring inputs as well as an overview of which modules support local or global measuring inputs can be found in Appendix Configuring drive-related I/Os (without symbolic assignment) (Page 295).

#### Procedure

If a global measuring input is selected, it must be assigned a hardware input.

Click the "Assign" button  to open the Assignment dialog box and select a free (i.e. not yet used) I/O.

#### Note

Only those I/Os are displayed that have the appropriate measuring input functionality (MI\_xx [channel name, terminal number]). If no suitable I/Os are displayed, you must first configure the I/Os (I/O must be configured as "measuring input").

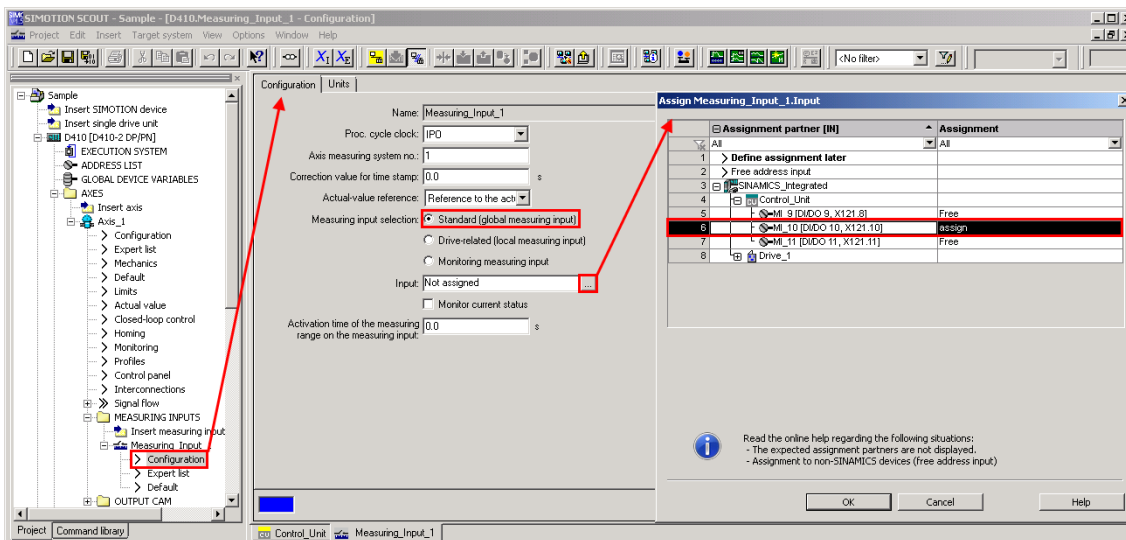


Figure 7-33 Configuration of a global measuring input for SIMOTION D410-2

## Additional references

Detailed information on the configuration of the TO measuring input can be found in the *SIMOTION Output Cams and Measuring Inputs Function Manual*.

### 7.11.2 Configuring local measuring inputs

Local measuring inputs are drive-related measuring inputs. The configuration is performed via drive parameters.

For further details, see:

- Configuring drive-related I/Os (without symbolic assignment) (Page 295) In the Appendix
- *SIMOTION Output Cams and Measuring Inputs Function Manual*

### 7.11.3 Configuring output cams / cam tracks

## Overview

The type of cam output must be selected during the configuration of the TO outputCam and TO camTrack.


The following output types are available:

Table 7-9 TO outputCam / TO camTrack output types

Cam output on...	Explanation
Output cam output (CAM)	<p>The cam output is performed on the basis of an internal time stamp. The temporal resolution of the cam output depends on the hardware used.</p> <p>Supported hardware:</p> <ul style="list-style-type: none"> <li>• SIMOTION D4x5-2 (terminal X142): Resolution 1 µs</li> <li>• TM17 High Feature: Resolution 1 µs</li> <li>• TM15: Typical resolution 125 µs (DRIVE-CLiQ cycle clock)</li> <li>• SIMOTION D410-2 (DI/DO 8 to 15): Typical resolution 125 µs</li> <li>• ET 200MP TM timer DIDQ 16x24V: Resolution 1 µs</li> <li>• ET 200SP TM timer DIDQ 10x24V: Resolution 1 µs</li> </ul>
High-speed digital output (DO)	<p>The cam output is performed via onboard outputs of the SIMOTION CPU. The output is via a hardware timer and the cam output is achieved with a resolution with respect to time &lt; servo cycle.</p> <p>Supported hardware:</p> <ul style="list-style-type: none"> <li>• SIMOTION D410 (terminal X121)</li> <li>• SIMOTION D4x5 (terminal X122, X132)</li> <li>• SIMOTION C240, C240 PN (terminal X1)</li> </ul>
Standard digital output (DO)	<p>The output cam calculations are performed in the processing cycle (IPO or IPO2 cycle or in the servo cycle). Actual cam output is performed in servo cycles. The resolution with respect to time of the cam output is generally reduced by the output cycle of the I/O used.</p> <p>The resolution is therefore dependent as follows:</p> <ul style="list-style-type: none"> <li>• For the standard I/O (e.g. ET 200), on the cycle time of the bus system (PROFIBUS DP / PROFINET I/O)</li> <li>• For the TM15 / TM17, on the cycle time of the bus system (PROFIBUS Integrated / PROFIBUS DP / PROFINET IO)</li> <li>• For the TM15 DI/DO, TM31, TM41, TB30, on the configured sampling time: <ul style="list-style-type: none"> <li>– cu.p0799 (CU inputs/outputs sampling time) for the onboard outputs</li> <li>– p4099 (TMxx inputs/outputs sampling time) for TB30, TM15 DI/DO, TM31, and TM41</li> </ul> </li> </ul> <p>Supported hardware:</p> <ul style="list-style-type: none"> <li>• Onboard outputs (SIMOTION D, Controller Extension CX, SINAMICS Control Unit CU3xx)</li> <li>• Centralized I/O (SIMOTION C)</li> <li>• Distributed I/O via PROFIBUS DP / PROFINET IO (e.g. ET 200, etc.)</li> <li>• Drive-related I/O (TM15, TM15 DI/DO, TM17 High Feature, TM31, TM41, TB30)</li> </ul>

**Procedure**

To achieve the best possible output cam resolution on the onboard I/Os of a SIMOTION D410-2, activate the output and select "Cam output on output cam output (CAM)."

Then assign a hardware output. For this purpose, click  ("assign") to open the Assignment dialog box and select a free (i.e. not yet used) I/O.

### Note

Only those I/Os that have the appropriate functionality (DO\_xx [channel name, terminal number]) are displayed. If no suitable I/Os are displayed, you must first configure the I/Os (I/O must be configured as "output cam (CAM)")

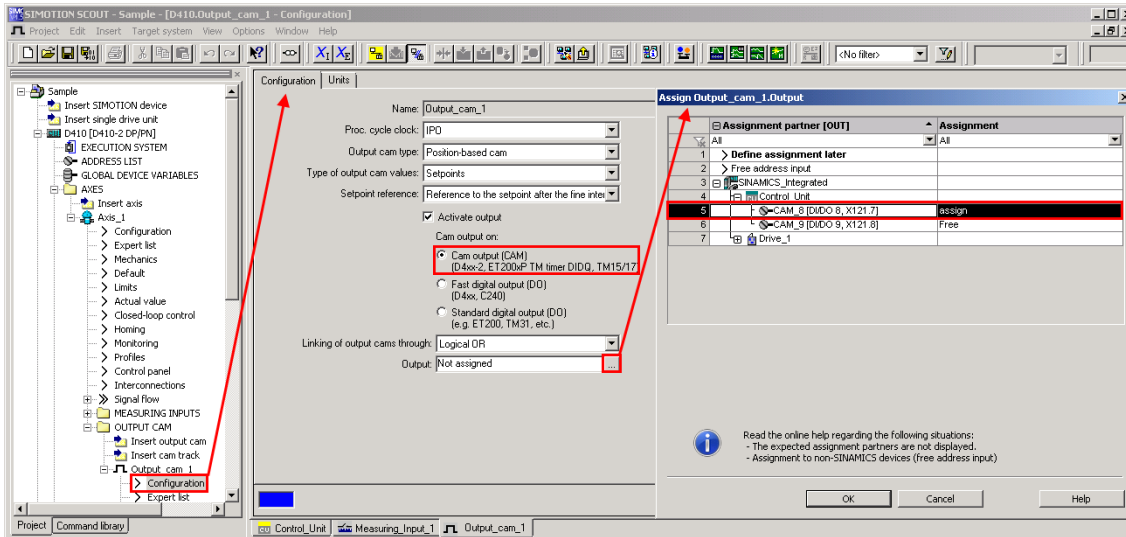


Figure 7-34 Configuration of a cam for SIMOTION D410-2

A maximum of two edges can be output per processing cycle clock of TO outputCam or TO camTrack.

### Additional references

Detailed information on configuring the output cam and cam track technology objects can be found in the *SIMOTION Output Cams and Measuring Inputs* Function Manual.

## 7.11.4 Configuring an I/O variable

### Overview

You have two ways to assign an I/O variable to I/O terminals:

- Assignment via preferred interconnection (e.g. DI\_8 [DI/DO 8, X121.7])  
To do this, you must use the SIMOTION preferred interconnection for the corresponding input/outputs of the SINAMICS DOs. The BICO interconnection is performed automatically.
- Assignment via PZD (e.g. via DI\_0\_15 or DO\_0\_15).  
Note that for these signals a message frame of the appropriate length is generated, but the BICO interconnection is not performed.

### Interconnection via preferred interconnection

The I/O variables are configured via the address list. Components that support a symbolic assignment can be configured without I/O addresses.

Preferred interconnections are displayed as assignment targets in the Assignment dialog box (e.g. DI\_8 [DI/DO 8, X127.7]). The assignment is made by direct selection of the corresponding terminal signal.

Components that do not support symbolic assignment (e.g. standard PROFIBUS I/O) are configured via I/O addresses.

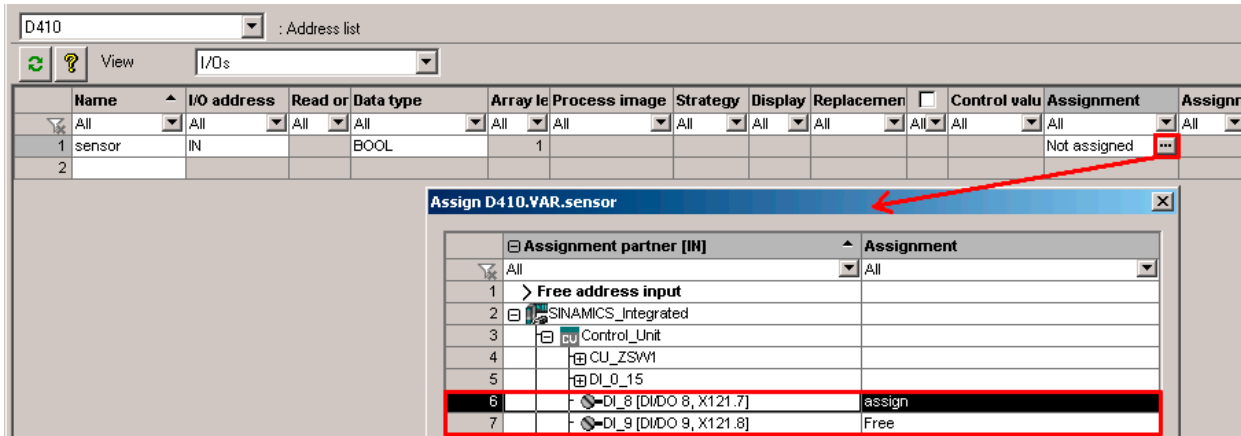


Figure 7-35 Address list

### Interconnection via PZD

In principle, an assignment via the PZD is also possible (e.g. via DI\_0\_15 or DO\_0\_15). Note that for these signals a message frame of the appropriate length is generated, but the BICO interconnection is not performed.

For this purpose, switch to the "Communication" dialog box of the corresponding SINAMICS DO. You can now see the individual bits of the PZD (e.g. I\_Digital or O\_Digital) listed there. Interconnect the appropriate bit of the PZD with a signal.

Alternatively, you can assign SIMOTION to an I/O channel during the terminal configuration (e.g. by selecting "DI (SIMOTION)", see Section SIMOTION D410-2 Configuring I/Os (Page 193)).

### TO axis

The symbolic assignment of I/Os is also supported by the TO axis (e.g. for a HW limit switch).



## Substitute values for I/O variables

Substitute values cannot be specified for input variables of the BOOL data type. If you do require substitute values however, proceed as follows:

1. Assign a digital input (e.g. SINAMICS\_Integrated.Control\_Unit.DI\_8 [DI/DO 8, X121.7]) to an input variable of the BOOL type (e.g. sensor).
2. Create a global variable (e.g. all\_inputs) (at least data type WORD, e.g. SINAMICS\_Integrated.Control\_Unit.DI\_0\_15).

3. Configure the substitute value

The corresponding bit of the substitute value must then contain the substitute value for the BOOL variables.

In the same way, you can assign a substitute value to a BICO parameter.

For various SINAMICS drive objects, higher-level types are available for the assignment of substitute values.

Name	I/O address	Read or	Data type	Array le	Process image	Strategy	Display	Replacemen	Control valu	Assignment	Assignm
1 sensor	IN		BOOL	1						SINAMICS_Integrated.Control_Unit.DI_8 [DI/DO ...	4: Set up
2 all_inputs	IN		WORD	1		Substitut...	HEX	16#00_00		SINAMICS_Integrated.Control_Unit.DI_0_15	4: Set up
3											

Figure 7-36 Configuration of substitute values

## 7.12 Creating a DMC20/DME20 DRIVE-CLiQ hub

### 7.12.1 Hub properties

#### DRIVE-CLiQ hub characteristics

The DMC20 and DME20 DRIVE-CLiQ hub modules are used to implement point-to-point distribution of a DRIVE-CLiQ line. With the DMC20/DME20, an axis grouping can be expanded with 4 DRIVE-CLiQ sockets for additional subgroups.

- DMC20 is the hub for the control cabinet configuration
- DME20 is the hub for use without a control cabinet (IP67 degree of protection).

The modules are especially suitable for applications which require DRIVE-CLiQ nodes to be removed in groups, without interrupting the DRIVE-CLiQ line and therefore the data exchange.

## Application examples

Encoder expansion and hot-plugging are typical applications implemented by means of a DRIVE-CLiQ hub.

- In an encoder expansion, direct measuring systems are connected. For example, these are attached directly to the machine in the control cabinet. Several encoders can be connected to one hub in the cabinet.

---

### Note

The SIMOTION D410-2 has just one DRIVE-CLiQ interface. You can use the DMC20/DME20 to evaluate the motor encoder and an additional encoder by means of SMx. The DRIVE-CLiQ hub must be directly connected to the Control Unit.

---

- Hot plugging is the option for changing motor components while in operation. These components are connected to a star topology using a DRIVE-CLiQ hub. This setup allows their deactivation without impairing downstream components.

## Additional references

Additional information on the DMC20/DME20 DRIVE-CLiQ hub is contained in the

- *SIMOTION D410-2 Manual*
- *SINAMICS S120 Control Units and Supplementary System Components Manual*

## 7.12.2 Creating a DRIVE-CLiQ hub

### Introduction

You can directly insert a DMC20/DME20 in the project navigator. The hub is not wired when you insert the DMC20/DME20 and is displayed in the topology tree in the component storage. The hub has to be wired manually. Proceed as follows:

### Procedure

1. Right-click the "Topology" entry in the Project Navigator.
2. Select the "Insert new object" > "DRIVE-CLiQ Hub" command from the shortcut menu and confirm with "OK".
3. Double-click "Topology" to open the topology tree.  
The hub is saved to the component storage of the topology tree.
4. Drag-and-drop the hub to the required DRIVE-CLiQ interface.  
The components connected to the hub are displayed in the topology tree.

### Result

The hub you inserted is displayed as an icon at the "Topology" entry in the Project Navigator. All components connected to a hub are also displayed in the course of automatic configuration.

## 7.13 Creating and programming TM41

### 7.13.1 TM41 properties

The TM41 terminal module can be used to expand the number of digital I/Os and analog inputs within a drive system. TM41 also returns TTL signals which emulate an incremental encoder, for example, for a master control system.

The emulated encoder signal has the signal characteristic of an incremental TTL encoder (A track, B track, R track). The resolution of the encoder signal can be specified in the configuration.

---

#### Note

The digital I/Os and the analog input can be interconnected using the BICO configuration.

---

The TM41 encoder interface (incremental encoder representation) can

- Be interconnected with a Control Unit encoder signal (from sin/cos incremental encoders, for example), using parameterization. For detailed information, consult the SINAMICS manuals.
- From the SIMOTION viewpoint, be accessed as an axis. This allows you to make the axis position (a master value) available to a second controller as an encoder signal, for example.

Configuring the TM41 involves the following steps:

- Configuring TM41 at SINAMICS Integrated (Page 203)
- Configuring the TM41 using the axis wizard (Page 204)

### 7.13.2 Configuring TM41 at SINAMICS Integrated

#### Procedure

The TM41 can be configured after you completed the configuration of SINAMICS Integrated. Proceed as follows:

1. Double-click "Insert input output component" at "Input/output component" in the Project Navigator.
2. Select the TM41 from the "Drive object type" field of the "Insert Input/Output Component" dialog box and assign a unique name to the module.
3. Confirm your entry with "OK".

#### Result

The TM41 is inserted in the Project Navigator by the name you entered.

### 7.13.3 Configuring the TM41 using the axis wizard

#### Requirement

After configuring the TM41 for a SINAMICS Integrated device in the project navigator, you can interconnect it with an axis using the Axis Wizard. The Wizard implements the TM41 as drive device.

#### Procedure

1. Open the Axis Wizard and create a positioning or synchronization axis (electrical).
2. Step the Axis Wizard forward until the "Drive Assignment" dialog box opens.
3. Select "SINAMICS\_Integrated" as the drive device and "TM41" as the drive. TM41 operates as setpoint sink of the axis with this setup.

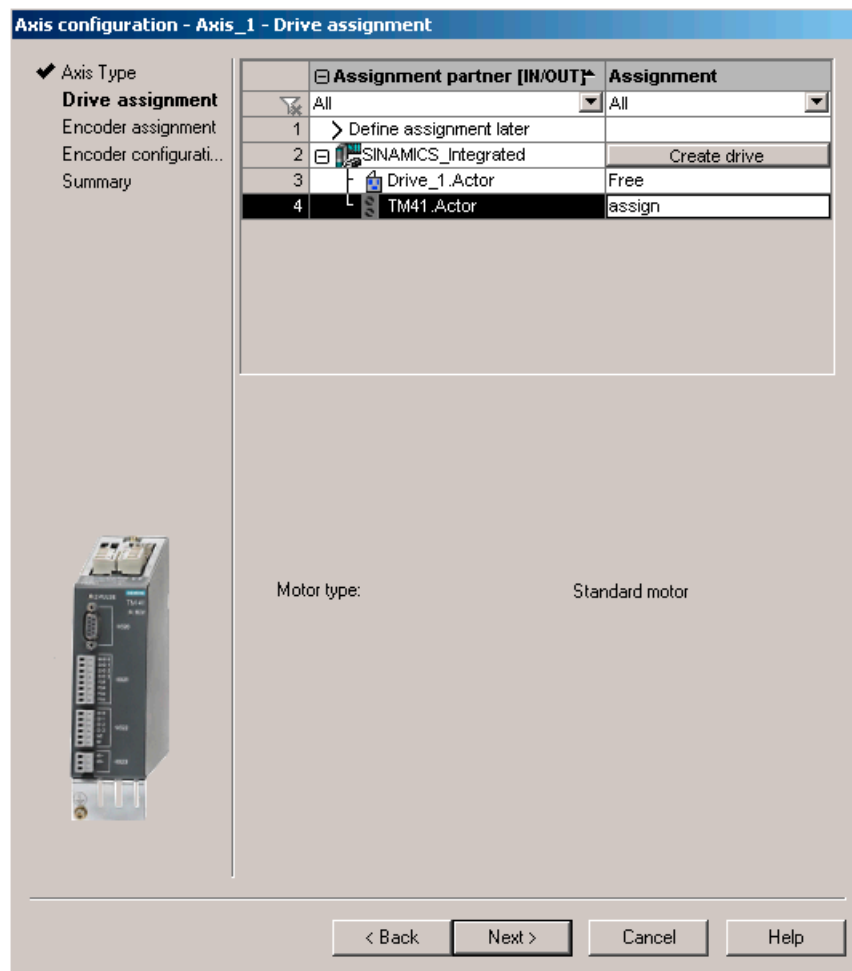


Figure 7-37 Drive assignment

4. Work through the remainder of the Axis Wizard.

## Reference

Detailed information on configuring incremental encoder emulation with the TM41 can be found in:

- FAQs at the following Internet address (<https://support.industry.siemens.com/cs/ww/en/view/27554028>)
- SIMOTION Utilities & Applications  
SIMOTION Utilities & Applications is part of the scope of delivery of SIMOTION SCOUT.

## 7.14 Optimizing the drive and controller

### 7.14.1 Overview of automatic controller setting

#### Overview

The SIMOTION SCOUT engineering system offers a wizard for the automatic controller setting for the controller optimization of the drive.

In the "Automatic Controller Setting" screen form, you can configure an automatic setting for the speed controller and the DSC (dynamic servo control) position controller for SINAMICS drive units. The necessary steps for this calculation can be controlled from this screen form. The calculated parameter values for the speed controller or position controller are displayed and can then be transferred online to the drive or axis on the controller.

The automatic control setting is made from the "Target system" > "Automatic control setting" menu.

A detailed description of the settable parameters can be found in the *SIMOTION SCOUT* Online Help.

#### Requirements

- You have configured a SINAMICS drive.
- The configured drive is operated in the "Servo" drive object type.
- Closed-loop control takes place with the motor encoder.
- There is an online connection to the relevant drive unit.

#### Procedure

Automatic controller setting involves the following steps:

1. Setting the speed controller (Page 206)
2. Setting the position controller (Page 207)

---

**Note**

You can cancel the automatic controller setting by pressing the SPACEBAR.

- The step currently being executed is aborted.
  - The drive enable is canceled.
- 

**Additional references**

Information on the controller structure can be found in the *SIMOTION TO Axis, Electric/ Hydraulic, External Encoder* Function Manual.

In addition to the automatic controller setting, SIMOTION SCOUT also offers the option to optimize the drive and controller manually using the measuring functions, trace, and function generator.

**See also**

Measuring functions, trace, and function generator (Page 208)

Manual speed controller optimization (Page 210)

## 7.14.2 Automatic speed controller setting

**Characteristics**

The automatic speed controller setting has the following features:

- Damping of resonances in the speed-controlled system
- Automatic setting of the Kp gain factor and the Tn reset time of the speed controller
- The speed setpoint filter and the reference model are not changed.

**Procedure**

To perform an automatic setting of the speed controller, proceed as follows:

1. Select the "Target system" > "Automatic controller setting" menu command.
2. Select the drive unit and the drive.
3. Select the "Speed controller" from the "Controller selection".
4. Click "Assume control priority" to assume control priority.
5. Click the "Drive on" button to enable the drive.  
Perform these steps (1 to 4) in automatic mode or as individual steps.
6. Click "Transfer" to transfer the calculated parameter values for the speed controller to the drive.
7. Disable the drive by clicking the "Drive off" button.

8. Click "Give up control priority" to give up control priority of the PG/PC.
9. Save the online parameters.

You can now transfer the automatically set parameters to the project.

### Backing up parameters

Proceed as follows to back up the parameters:

1. In the project navigator, select the SINAMICS unit with the drive for which you want to perform the automatic setting.
2. Select "Target device" > "Copy RAM to ROM" in the context menu.
3. Select "Target device" > "Load CPU / drive unit to PG" in the context menu.

If required, the automatic controller settings can be checked using the measuring functions.

## 7.14.3 Automatic position controller setting

### Introduction

In the "Automatic Controller Setting" screen form, you can select the SINAMICS drive unit and the drive for which you want to carry out an automatic DSC position controller setting. The necessary steps for this calculation can be performed from this screen form. The calculated Kv value is displayed and can then be accepted online in the configuration data of the axis that is assigned to the drive.

### Requirements

In addition to the General requirements for the automatic controller setting, the following boundary conditions apply for setting the position controller:

- DSC is required for the position controller setting.  
**Tip:** Activate the project setting "Use symbolic assignment" and select the Standard/ Automatic option for the axis-drive communication when configuring the drives. You automatically use DSC for the servo drives with these settings.
- The speed controller has already been configured (e.g. with the automatic speed controller setting).
- At least one axis is connected to the SINAMICS drive (servo).
- An online connection to the SIMOTION device must be established to transfer the results of the automatic position controller setting.
- The balancing filter is not changed.
- For operation without precontrol, the equivalent time constant of the position controller must be adjusted manually by the user ( $\text{PositionTimeConstant} = 1/\text{Kv}$ ).
- Vibration on the load side is not taken into account for the position controller setting.

## Procedure

To perform an automatic setting of the position controller, proceed as follows:

1. Select the "Target system" > "Automatic controller setting" menu command.
2. Select the drive unit and the drive (axis).
3. Select the "Position controller (DSC)" from "Controller selection".
4. Click "Assume control priority" to assume control priority.
5. Click the "Drive on" button to enable the drive.  
Perform the steps either in automatic mode or as individual steps.
6. Select the axis data sets to which the Kv factor is to be transferred.
7. Click "Accept values" to transfer the calculated Kv factor to the axis data sets.
8. Disable the drive by clicking the "Drive off" button.
9. Give up the control priority of the PG/PC.
10. Save the online parameters.

You can now transfer the automatically set parameters to the project.

## Backing up parameters

Proceed as follows to back up the parameters:

1. In the project navigator, select the SIMOTION unit with the axis for which you want to perform the automatic setting.
2. Select "Target device" > "Copy current data to RAM" in the context menu.
3. Select "Target device" > "Copy RAM to ROM" in the context menu.
4. Select "Target device" > "Load CPU / drive unit to PG" in the context menu.

If necessary, you can check the automatic controller settings using the measuring functions.

### 7.14.4 Measuring functions, trace, and function generator

#### Drive optimization

Drive optimization is part of commissioning and can be performed with SIMOTION SCOUT.

---

#### Note

Controller optimization may only be performed by skilled personnel with control engineering knowledge.

---



## Controller optimization

Various measuring functions are available for controller optimization of the drive. These measuring functions enable the control of the higher-level control loop to be selectively switched off and the dynamic response of individual drives to be analyzed through simple parameter assignment. The function generator and the trace recorder are used.

The control loop is supplied with the ramp-function generator signal at a specific point (e.g. speed setpoint), and the signal from the trace recorder is recorded at another point (e.g. speed actual value).

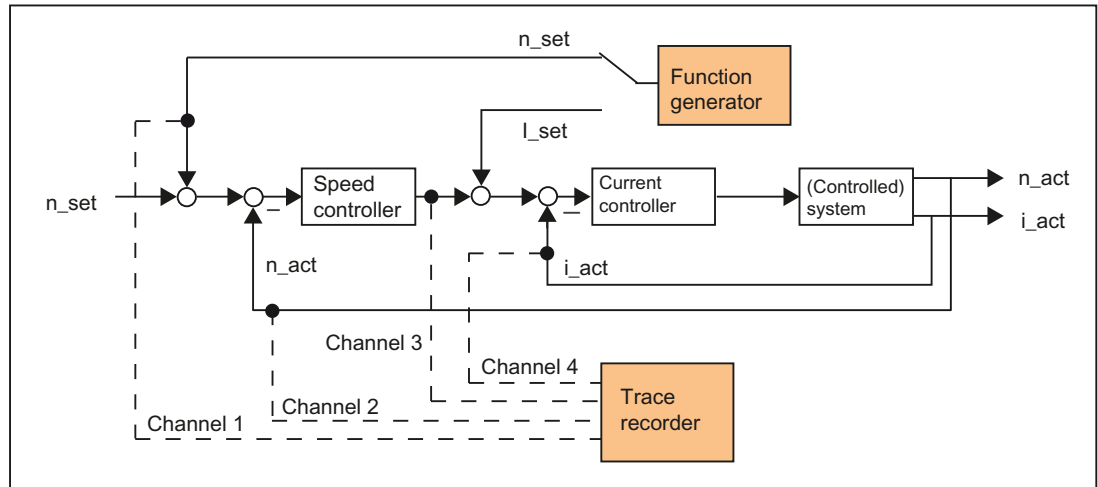


Figure 7-38 Optimizing a controller

Depending on the form of controller optimization to be performed, it is possible to define the quality (e.g. signal form, amplitude, transient recovery time) of the disabled signal, the measuring duration for step functions in the time range, or the bandwidth and number of averaging operations in the frequency range for the trace. The analytical and graphical evaluation can then be performed accordingly (FFT diagram, Bode diagram).

The following measuring functions are available:

- Setpoint jump at current controller
- Reference frequency response at current controller
- Setpoint jump at speed controller
- Disturbance variable jump at speed controller
- Reference frequency response at speed controller
- Disturbance frequency response at speed controller
- Speed-controlled system (input at current setpoint filter)

## Additional references

For additional information about drive optimization, consult the *SINAMICS S120* Commissioning Manual.


Additional information on trace and measuring functions, as well as on the function generator, can be found in the *SIMOTION SCOUT* online help.

### 7.14.5 Manual speed controller optimization

#### Requirement

You have already created a project and configured an axis and a drive. You can now optimize the speed controller.

#### Procedure

1. Open the project and go to online mode.
2. Click  to call the "Measuring Functions" dialog.
3. Select the drive unit and the drive.
4. Select "Speed controller setpoint jump".  
You can change the values in the following fields: "Settling time", "Amplitude", "Offset", "Ramp-up time" and "Measuring time".

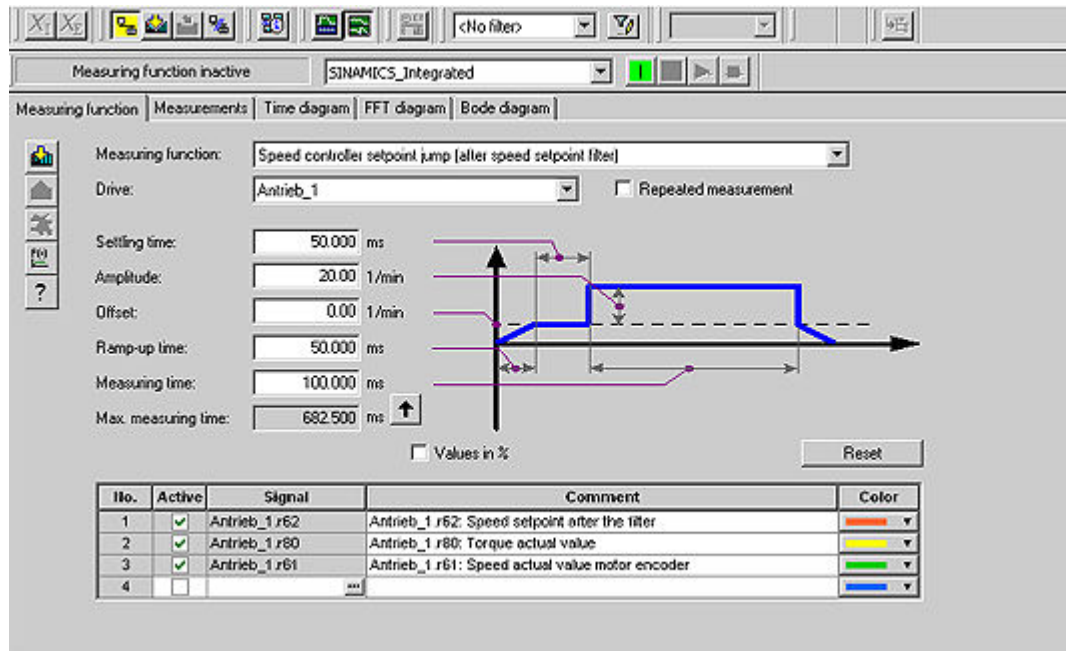



Figure 7-39 Speed controller measuring function

Four channels can be traced. Certain channels are preassigned, depending on the measuring function.

5. Download the changes to the drive by clicking  (Download parameter assignment).

#### Starting the measuring function

1. Click "Assume control priority" to assume control priority.  
Read the notice that appears and click "Accept" to confirm. The activated service function is displayed via the LEDs (RUN/STOP flashing yellow/green with 2 Hz).
2. Click the "Drive on" button to enable the drive.

3. Click  (Start measuring function) to start the measuring function.  
The axis is moved during the measurement. For this reason, a safety message that allows the process to be aborted is displayed.
4. The traced signals are represented on the "Time diagram" tab.

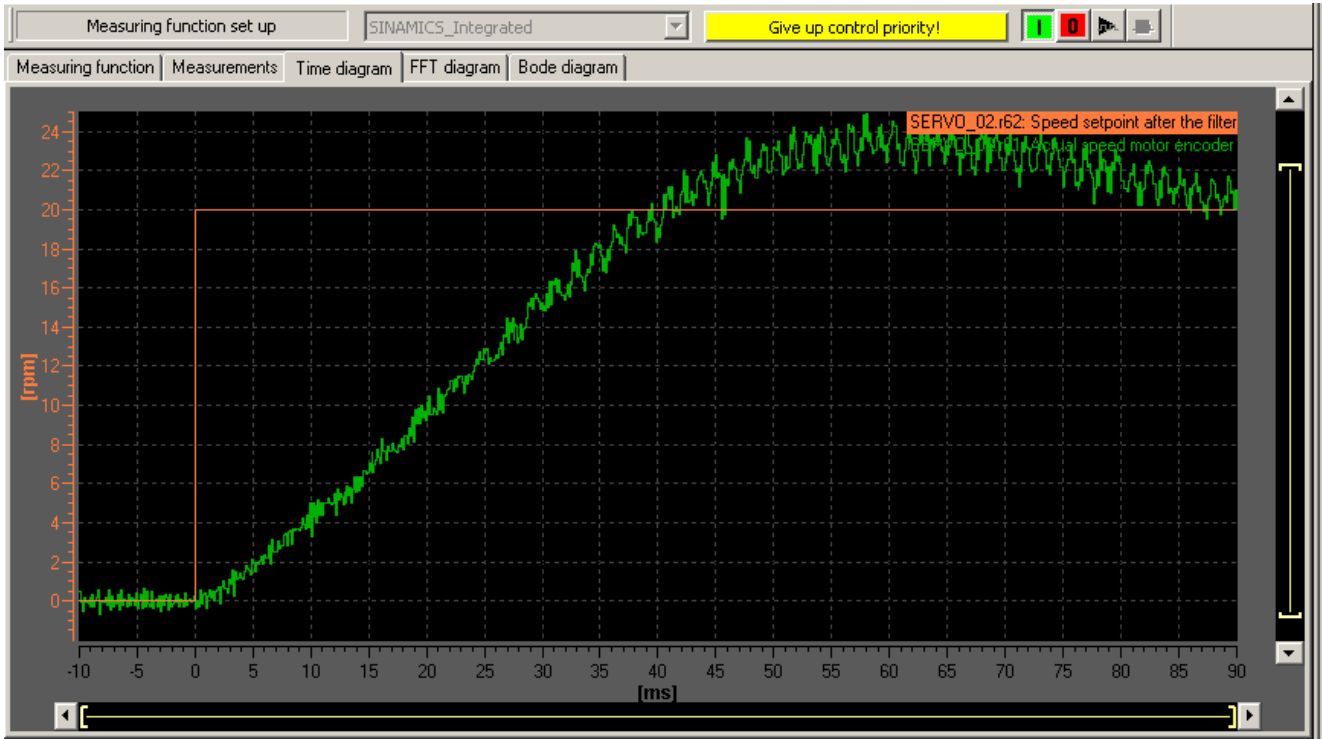


Figure 7-40 Time diagram before parameter change

### Adjusting the P-gain

You can adjust the P-gain of the controller to optimize the transient response.

1. In the project navigator under the corresponding drive, for example, Servo\_1, use the menu command "Open-loop/closed-loop control" > "Speed controller" to display the "Speed Controller with Encoder" dialog box.
2. Enter an appropriate value in the "P-gain" field and the "Integral time" field.

#### Note

The values entered take immediate effect.

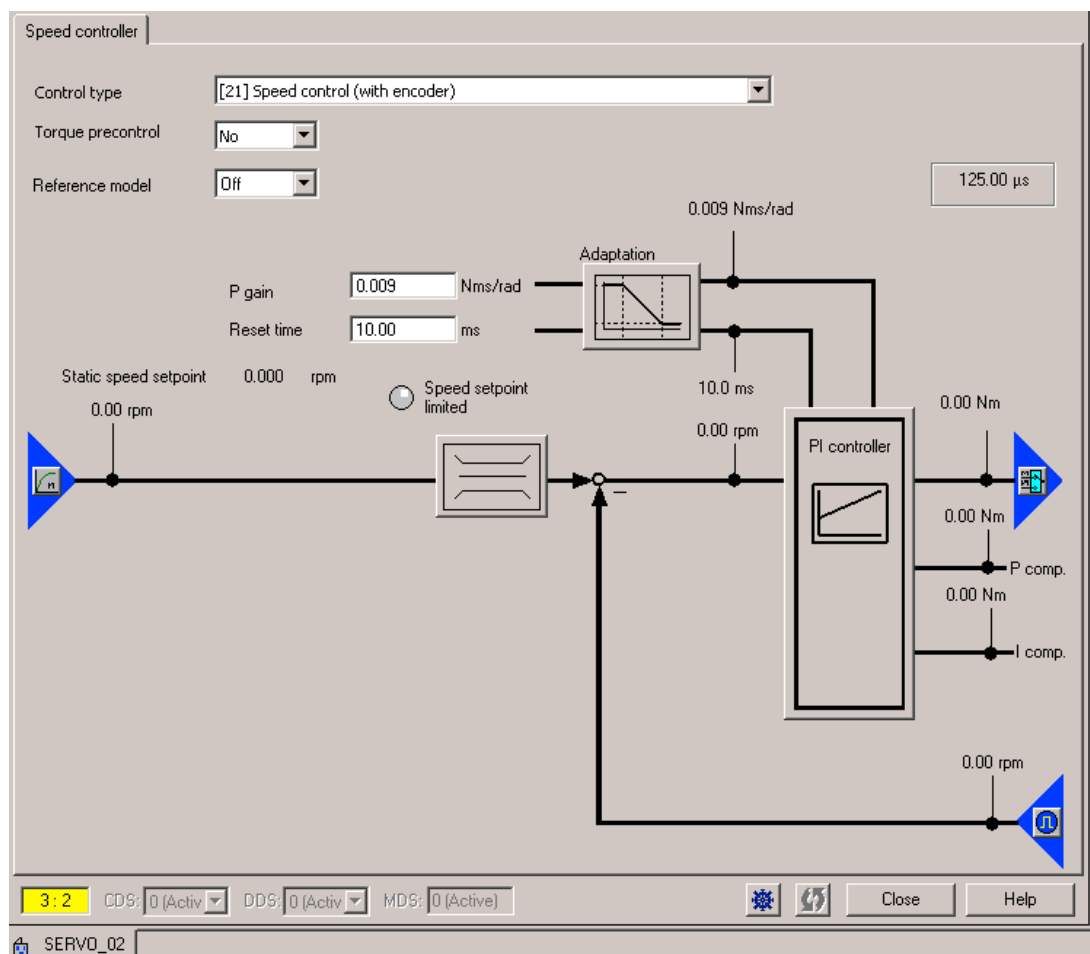


Figure 7-41 Entering P-gain

3. For verification purposes, perform the measurement again.
4. With the modified parameters, the controller displays a much better transient response. If necessary, you can continue changing the value until the transient response is optimal.

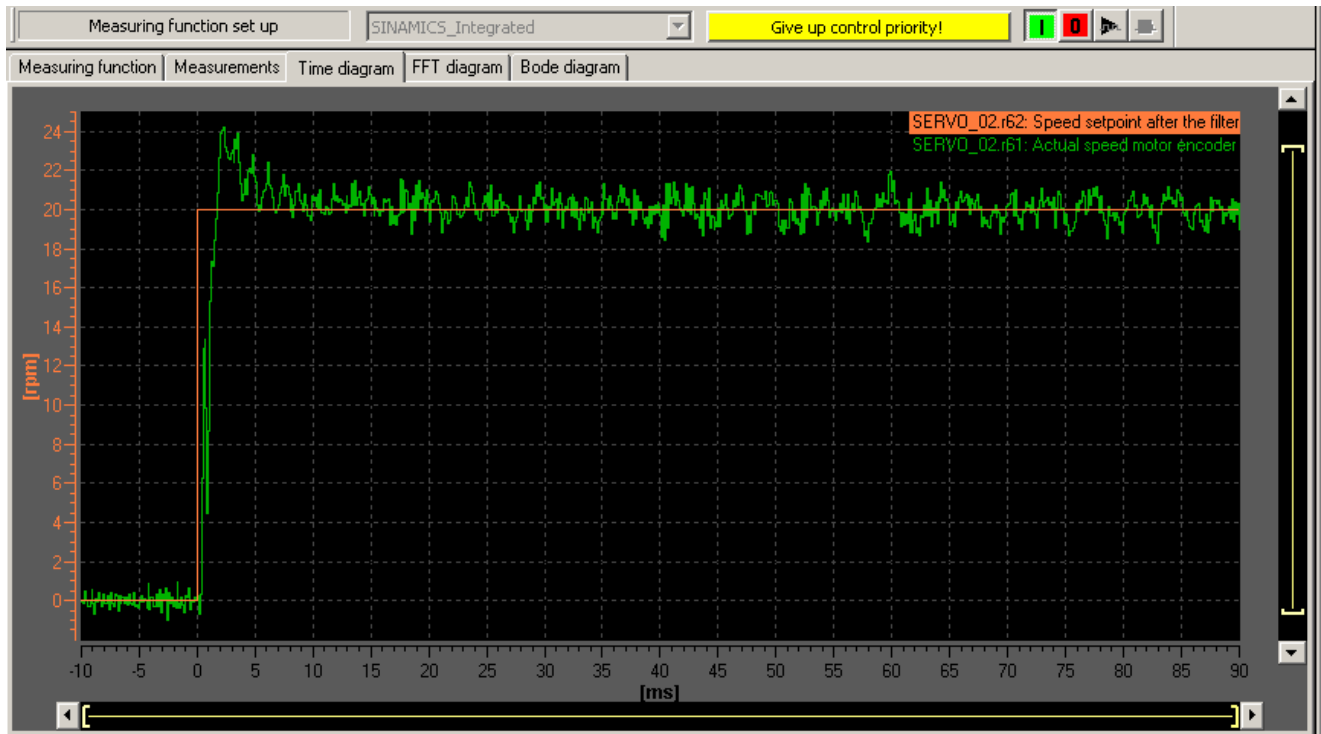


Figure 7-42 Measurement with modified P-gain

## 7.15 Loading and saving SIMOTION user data

### Overview

After commissioning the SIMOTION D410-2, we recommend that you back up the SIMOTION user data (programs, configuration data and parameter assignments) on the CF card.

### Loading user data

Use the "Target system" > "Load" > "Load to target system" command to transfer the following data from the SIMOTION SCOUT engineering system (ES) to the "non-volatile SIMOTION data" area of SIMOTION D410-2:

- Configuration data
- Programs
- Parameterization
- Technology packages

The hardware configuration of the SIMOTION D410-2 and the retain variables are also stored in the "non-volatile SIMOTION data" area.

---

**Note**

Using the menu:

- "Target system" > "Load" > "Load project to target system" loads all of the project data to the target system.
- "Target system" > "Load" > "Load CPU / drive unit to target device" only loads the data of the selected device / drive element to the target device.

After the SIMOTION D410-2 is switched off, the contents of the "volatile SIMOTION data" area are lost.

---

### Additional references

Additional information about the SIMOTION SCOUT engineering system can be found in the *SIMOTION SCOUT* Configuration Manual.

### Saving user data

The "Copy RAM to ROM" function is used in SIMOTION SCOUT to save the following data from RAM to the CF card:

- Technology packages and user data (units, configuration data, parameter assignments, task configuration) from the "volatile SIMOTION data" area
- Current data values are copied to the "volatile SIMOTION data" area, depending on the settings in SIMOTION SCOUT.

---

**Note**

The "Copy RAM to ROM" command **cannot** be used to save the current values of retain variables to the CF card.

---

You have the following options for backing up the current values of retain variables to the CF card:

- User program  
Use the "\_savePersistentMemoryData" system function in the user program.
- Save with the service selector switch or the DIAG button on the SIMOTION D410-2 or using SIMOTION IT web server, see Section Diagnostic data and non-volatile SIMOTION data (Page 282)

The SCOUT functions "Save variables" and "Restore variables" also give you the option of backing up to your PC and restoring data that was changed during operation and only stored in the runtime system.

Execute the "Copy RAM to ROM" function separately for the SINAMICS Integrated. This requires that the drive element has been selected in the Project Navigator.

**See also**

Properties of the user memory (Page 72)

## 7.16 Deleting data

### 7.16.1 Overview of data deletion

The memory of the SIMOTION D410-2 described in the User memory concept (Page 71) can be deleted in various granularities. That is, you can choose to delete all data or only specific parts.

You have the following means of deleting the SIMOTION D410-2 data:

- SIMOTION D410-2 memory reset (Page 215)
- Deleting user data on CompactFlash card (Page 218)
- Setting SINAMICS Integrated to the factory settings (Page 219)
- Restoring the default settings for the SIMOTION D410-2 (Page 219)
- Deleting/restoring non-volatile SIMOTION data (Page 288)
- Backing up / restoring / deleting SINAMICS NVRAM data (Page 159)

### 7.16.2 SIMOTION D410-2 memory reset

#### Introduction

During the memory reset, the memory of the SIMOTION D410-2 and the non-volatile SIMOTION data in the NVRAM with the exception of the communication configuration (baud rates, network addresses, etc.), are deleted. The data on the CF card is retained during the memory reset.

Reset the memory on the SIMOTION D410-2 if

- If you want to undo changes made to user data (programs, configuration data, parameter assignments) which you have not backed up by means of the "Copy RAM to ROM" command.
- The RUN/STOP LED is flashing (slowly flashing yellow) to indicate that the SIMOTION D410-2 is requesting a memory reset.
- If the non-volatile SIMOTION data with the project on the CF card do not match and an error occurs (diagnostic buffer entry).

You can perform a memory reset either in offline mode using the mode switch of the SIMOTION D410-2 or in online mode using the SIMOTION SCOUT.

### Data deleted on memory reset

The following data are deleted during a memory reset:

- User data (units, configuration data, parameter settings, task configuration)
- Technology packages
- Retain TO (absolute encoder adjustment)
- Retain variables  
Retain variables are variables in the interface or implementation section of a UNIT that are declared with VAR\_GLOBAL RETAIN, or global device variables with the RETAIN attribute.

---

#### Note

Absolute encoder data are deleted during a memory reset and must therefore be readjusted after the memory reset.

---

### Data retained during memory reset

The following data are retained during a memory reset:

- TCP/IP and DP parameters
- Diagnostic buffer
- Data that was saved with the `_savePersistentMemoryData`, `_saveUnitDataSet` or `_exportUnitDataSet` commands and with the "Copy RAM to ROM" function.  
If backup files (PMEMORY.XML/PMEMORY.BAK) have been created with `_savePersistentMemoryData`, the data in these files will be backed up again to the non-volatile SIMOTION data after the memory reset. Users can therefore force the restoration of non-volatile SIMOTION data by means of memory reset. This also includes the absolute encoder position.
- Licenses
- SINAMICS NVRAM data

The technology packages and user data (configuration data, programs, parameter assignments) that were previously backed up on the CF card using the "Copy RAM to ROM" menu command will be transferred to the "non-volatile SIMOTION data" area of the SIMOTION D410-2 during the next power-up. Thus, an existing configuration on the CF card is loaded to the SIMOTION device following the memory reset.



## Memory reset by means of SIMOTION SCOUT

The SIMOTION device for which overall reset is to be performed must be online.

1. Open the "Control Operating State" dialog box in SIMOTION SCOUT. Select the "Target system" > "Control operating state" menu command. Or click on "Control Operating State" on the toolbar.
2. Switch the SIMOTION device for which memory reset is to be performed to STOP in the "Control Operating State" dialog box.
3. Select the SIMOTION device under "Memory reset (MRES)." Click the "Run" button. Confirm the command by clicking "Yes."  
The memory reset will now be performed.

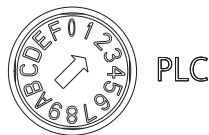
## Memory reset with the mode switch

You can perform a memory reset with the mode switch when you are offline with the SIMOTION D410-2.

NOTICE
<p><b>Damage from electrostatic discharge</b></p> <p>The rotary switch can be destroyed by static electricity.</p> <p>Operate the rotary switch only with an insulated screwdriver.</p> <p>Comply with the ESD rules.</p>

Proceed as follows to reset the memory:

1. Place the mode switch in the STOP position (selector setting 2).



2. When the RUN/STOP LED is steadily yellow, turn the switch to the MRES position (switch position 3).



The RUN/STOP LED starts to flash slowly (slow yellow flashing).  
Wait until the RUN/STOP LED stops flashing.

3. Turn the selector back to the STOP setting.



4. You must turn the selector back to the MRES position again within 3 seconds.



The memory reset will now be performed.  
The SIMOTION D410-2 has completed the memory reset when the RUN/STOP LED is steadily yellow.

**Note**

Memory reset is canceled if you do not return the mode switch to MRES as specified within 3 seconds. Repeat the procedure in this case.

5. Now move the mode switch back to the required operating mode.

**NOTICE**

**Unintentional restoration of the default settings instead of memory reset**

Note that the MRES position (switch setting 3) during power-up causes the default settings to be restored. See Section Restoring the default settings for the SIMOTION D410-2 (Page 219).

Make sure you do not accidentally switch the power supply OFF/ON in the MRES selector setting, as this restores the default settings instead of performing the desired memory reset.

### 7.16.3 Deleting user data on CompactFlash card

#### Overview

Deletion of the user data from the CompactFlash card is necessary, for instance, if you wish to load another (new) project to the CompactFlash card and therefore find it necessary to delete the existing user data for an "old project" (e.g. unit data sets) from the CompactFlash card.

You can delete the user data with SIMOTION SCOUT. The SIMOTION D410-2 must be operating in online mode. The following data is deleted:

- User data from the "volatile data" area
- Non-volatile data, with the exception of IP and DP parameters
- User data on the CompactFlash card (user directories), including the SINAMICS configuration

You can still go online to SIMOTION D410-2 at your PG/PC. The licenses on the CompactFlash card are retained.

## Procedure

1. Open the project you want to edit in SIMOTION SCOUT.
2. Go online with the SIMOTION D410-2.
3. Select SIMOTION D410-2 in the Project Navigator and then select the "Delete user data on card" option from the "Target system" menu.
4. Confirm the "Delete user data on card" prompt with "OK".  
The user data is deleted. SINAMICS Integrated goes into offline mode.

### 7.16.4 Setting SINAMICS Integrated to the factory settings

#### Requirement

You must be online to SINAMICS Integrated in order to restore its default settings.

#### Procedure

1. Right-click "SINAMICS\_Integrated" in the Project Navigator.
2. Select the "Target device > Restore default settings" command from the shortcut menu.  
This restores the delivery state of SINAMICS Integrated.

### 7.16.5 Restoring the default settings for the SIMOTION D410-2

#### Overview

SIMOTION D410-2 is supplied with default parameters such as the transmission rate or PROFIBUS addresses. You can restore the factory settings with the mode selector switch. The following data is deleted:

- Non-volatile SIMOTION data in the SIMOTION device
- The backup copy of non-volatile SIMOTION data on the CompactFlash card (PMEMORY.XML/PMEMORY.BAK)
- User data in the "volatile SIMOTION data" area and on the CompactFlash card
- The communication configuration (IP and DP parameters) on the CompactFlash card is set to the factory settings.

All licenses on the CompactFlash card are retained.

### Restoring factory settings with the mode selector switch

1. The power supply is switched off.
2. Set the mode selector switch on the SIMOTION D410-2 to MRES (switch position 3).



3. Switch on the power supply.  
The NVRAM and the user data is deleted. The factory settings are loaded.  
SIMOTION D410-2 remains in the STOP operating state.
4. Now use the mode selector switch to change to the desired operating state.

---

#### Note

The default communications parameters are now restored. You must re-configure the communication parameters of SIMOTION D410-2.

---

## 7.17 System shutdown

All axes and system components must be in safe state before you shut down the system. You can set up this safe state by providing a separate motion task, for example.

You can shut down the power supply after the system has reached a standstill state.

---

#### Note

You must observe the safety notices for SINAMICS components, which you can find in the corresponding SINAMICS manuals.

---

## 7.18 Configuring Safety Integrated functions

### 7.18.1 Overview

#### Integrated safety functions

When used in conjunction with SIMOTION D, the integrated safety functions of SINAMICS S120 provide highly effective practical protection for personnel and machinery.

- Safety Integrated Basic Functions
- Safety Integrated Extended Functions
- Safety Integrated Advanced Functions

**Note**

As of SIMOTION V5.2 / SINAMICS Integrated V5.1, a distinction is made between Safety Integrated Extended and Advanced Functions. The Safety Integrated Advanced Functions also include the Safety Integrated Extended Functions.

The safety functions listed here conform to:

- Safety Integrity Level (SIL) 2 according to IEC 61508
- Category 3 according to DIN EN ISO 13849-1
- Performance Level (PL) d according to DIN EN ISO 13849-1

The safety functions correspond to the functions according to DIN EN 61800-5-2 (if they are defined there).

**Übersicht der Safety Integrated Functions**

If motors without a (safety-capable) encoder are being used, not all Safety Integrated Functions can be used.

**Note****Definition: "Without encoder"**

When "without encoder" is used in this manual, then this always means that either no encoder or no safety-capable encoder is being used.

In operation without encoder, the actual velocity values are calculated from the measured electrical actual values. Therefore, velocity monitoring is also possible during operation without encoder.

Table 7-10 Overview of the Safety Integrated Functions

	Functions	Abbrevia- tion	With en- coder	Without encoder	Brief description
Basic Func- tions	Safe Torque Off	STO	Yes	Yes	Safe torque off
	Safe Stop 1	SS1 <sup>1)</sup>	Yes	Yes	Safe stop according to stop category 1
	Safe Brake Control	SBC <sup>2)</sup>	Yes	Yes	Safe brake control

7.18 Configuring Safety Integrated functions

	Functions	Abbreviation	With encoder	Without encoder	Brief description
Extended Functions	Safe Torque Off	STO	Yes	Yes <sup>4)</sup>	Safe torque off
	Safe Stop 1	SS1 <sup>1)</sup>	Yes	Yes <sup>4)</sup>	Safe stop according to stop category 1
	Safe Brake Control	SBC	Yes	Yes <sup>4)</sup>	Safe brake control
	Safe Operating Stop	SOS	Yes	No	Safe monitoring of the standstill position
	Safe Stop 2	SS2	Yes	No	Safe stop according to stop category 2
	Safely-Limited Speed	SLS	Yes	Yes <sup>5)6)</sup>	Safe monitoring of the maximum velocity
	Safe Speed Monitor	SSM	Yes	Yes <sup>5)4)</sup>	Safe monitoring of the minimum velocity
	Safe Direction	SDI	Yes	Yes <sup>5)4)</sup>	Safe monitoring of the direction of motion
	Sicheres Referenzieren	SR	Yes	No	Safe homing
	Safe Acceleration Monitor	SAM	Yes	Yes <sup>4)</sup>	Safe monitoring of the drive acceleration
	Safe Brake Ramp	SBR	Yes	Yes <sup>4)</sup>	Safe braking ramp
	Safe gear change	–	Yes	No	–
	Safely-Limited Acceleration	SLA <sup>3)</sup>	Yes	No	Safely-limited acceleration
	Safe Brake Test	SBT	Yes <sup>5)</sup>	No	Safe test of the required holding torque of a brake
Advanced Functions	Safely-Limited Position	SLP	Yes <sup>5)</sup>	No	Safely-limited position
	Transfer of safe position values	SP	Yes <sup>5)</sup>	Yes <sup>4)</sup>	Transfer of safe position values
	Safe Cam	SCA <sup>3)</sup>	Yes	No	Safe cams

- <sup>1)</sup> Incl. SS1E (SS1 with external brake). In this variant of SS1, SIMOTION is responsible for the stop response.
- <sup>2)</sup> For SBC, you also need a Safe Brake Relay for SIMOTION D410-2 in conjunction with a Power Module in blocksize format (PM340, PM240-2). A Safe Brake Adapter is required for Power Modules in chassis format.
- <sup>3)</sup> As of SIMOTION V5.2 / SINAMICS Integrated V5.1
- <sup>4)</sup> The use of this safety function without encoder is permitted only for induction motors or synchronous motors of the SIMOTICS A-1FU (previously: SIEMOSYN).
- <sup>5)</sup> As of SIMOTION V4.4 / SINAMICS Integrated V4.7. (SBT: As of V4.4 HF4)

**Note**

Details on the Safety Integrated Functions, such as information on the configuration of safety functions as well as operating conditions for the encoderless operation can be found in the *SINAMICS S120 Safety Integrated Function Manual*.

**Notes**

Parameterize the desired Safety Integrated functions and the monitoring with or without encoder and activate them in the safety screen forms of the SIMOTION SCOUT engineering system.

If motors are used without an encoder or with an encoder that is not suitable for Safety Integrated Extended/Advanced Functions, not all Safety Integrated Functions can be used (see previous table, "Without encoder" column).

The safe speed monitoring without encoder also functions at standstill as long as the drive is switched on.

### PROFIsafe telegrams

SIMOTION D410-2 supports PROFIsafe telegrams 30, 31, 901, 902 and 903. (902 as of SIMOTION V4.4; only in conjunction with the TIA Portal; 903 as of SIMOTION V5.1 for Safe Cam, SCA).

Telegrams 31, 901, 902 and 903 enable the states of the F-DIs to be routed through to an F-CPU via PROFIsafe. Telegrams 901 and 902 enable you to apply a factor to SLS limit value 1 that has been set in the drive, allowing the SLS monitoring limit to be changed during operation. Moreover, in telegrams 901 and 902, the safe position actual values communicated in the SINAMICS S120 are transferred via PROFIsafe to the F-CPU (function SP).

With telegram 903, the state of up to 30 cams can be transferred.

Direct fail-safe data exchange via telegram 901 is supported as of SIMOTION V4.3 SP1 HF9.

The "Transfer safe position values via PROFIsafe" function is supported as of SIMOTION V4.4.

## 7.18.2 Activate Safety Integrated functions

### Control

The Safety Integrated functions are fully integrated in the drive system. They can be activated as follows:

- Via the onboard terminals (F-DI, F-DO) on the Control Unit
- Via a PROFIsafe telegram using PROFIBUS or PROFINET
- Via the terminals of a connected TM54F
- As of SIMOTION V4.5, the Safety Integrated Basic Functions STO, SS1 and SBC can also be controlled license-free via the TM54F. (Requirement: STARTER V4.4 SP1; STARTER V4.4 SP1 is not part of SCOUT V4.4 - the functionality is therefore only available as of SCOUT V4.5)
- The SLS and SDI functions can also be activated permanently via parameter assignment.
- The SLA Extended Function can only be activated via PROFIsafe.

The Safety Integrated functions are implemented electronically and therefore offer short response times compared to solutions with externally implemented monitoring functions.

The output signals of the SCA Advanced Function can only be output via PROFIsafe.

---

**Note**

Although SIMOTION does not contain any safety-related functionality, it provides support for SINAMICS drives that can perform safety-related functions.

The purpose of this support that SIMOTION offers for the safety-related monitoring functions is to prevent fault reactions at the drive end by ensuring that the drive does not exit the operating state being monitored.

---

Further information about support of the SINAMICS Integrated functions on the TO axis can be found in the *TO Axis Electric/Hydraulic, External Encoder* Function Manual.

The Safety Integrated Basic Functions via the onboard terminals (F-DI 0) and the Safety Integrated Extended/Advanced Functions (via TM54F or PROFIsafe) can be used simultaneously.

---

**Note**

Safety Integrated Extended and Advanced Functions can be controlled via:

- The onboard terminals of the Control Unit or
- PROFIsafe or
- TM54F

Mixed operation is not permitted.

---

**Note**

If SIMOTION D410-2 is mounted separately (Power Module in blocksize format connected to SIMOTION D410-2 via CUA31/32), use of the Safety Integrated Extended and Advanced Functions via the onboard terminals (F-DI, F-DO) is not possible.

---

## F-DI and F-DO as standard I/Os

Unused F-DI and F-DO can be used as standard I/Os (one F-DI as two standard inputs, the F-DO as a standard output).

## Using F-DI through F-CPU

Prerequisite for use of the F-DI by F-CPU:

- With encoder as of SIMOTION V4.3 SP1 HF3
- Without encoder as of SIMOTION V4.4

The onboard F-DIs can be used as F-DI for the F-CPU if these are not used by SIMOTION D410-2.

In "Extended Functions via PROFIsafe and Basic Functions via onboard terminal" mode, the Basic Functions STO or SS1 (with or without SBC) can be controlled locally. At the same time the routing of F-DI 1 and F-DI 2 for the F-CPU is possible.



## Filter setting F-DI

The F-DIs of SIMOTION D410-2 have a parameterizable input filter (drive parameter p10017, debouncing time for digital inputs).

With this input filter, unwanted signals (e.g. fault signals or test pulses of F-DO) can be filtered out so that these do not cause any faults.

Failsafe output modules (e.g. ET 200S F-DO) test the outputs at regular intervals. To achieve this, the F-DO modules switch test signals to their outputs in the form of bit patterns to detect a short-circuit, short-circuit to frame, or a short-circuit to ground.

If the filter time of the F-DI is set too small, these test pulses will result in unwanted triggering of the safety function in the case of D410-2.

For setting the input filter, the following rules must therefore be complied with:

- Debouncing time  $p10017 \geq 3 \times$  sampling time inputs/outputs p0799
- If  $3 \times p0799 < 1$  ms, then: Debouncing time  $p10017 = N \times 1$  ms ( $N = 1, 2, 3, \dots$ )
- Debouncing time  $p10017 \gg$  fault pulse time

Unwanted triggering of the safety function can indicate incorrect settings.

Note that the settings also impact the response time of the system.

### Example

ET 200S I/O system with F-DO modules

Because of the test pulses, the debouncing time p10017 must be at least 4 ms.

This results in the following setting options, for example:

- $p10017 = 12$  ms;  $p0799 = 4$  ms **or**
- $p10017 = 4$  ms;  $p0799 = 1$  ms

You will find additional information on ET 200S test pulses in Internet (<https://support.industry.siemens.com/cs/ww/en/view/44452714>).

## SI monitoring cycle clock

The response times of the various safety functions are derived from the Safety Integrated monitoring cycle clock (r9780).

The value of the Safety Integrated monitoring cycle clock (r9780) is determined automatically - you therefore only see it when you are connected online to the drive. With the SINAMICS Integrated of a SIMOTION D410-2, different values can be determined as for a SINAMICS S120 CU310-2 connected to SIMOTION D410-2 because of the architecture.

The Safety Integrated monitoring cycle can be calculated as follows for the SINAMICS Integrated:

$x = 32 \times p0115[0]$  ( $p0115[0]$  = current controller cycle clock; for D410-2, typically 125  $\mu$ s for servo drives)

Case A: For PROFIBUS Integrated cycle clock  $> x$ :  $r9780 = x$

Case B: For PROFIBUS Integrated cycle clock  $\leq x$ :  $r9780 = (\text{rounded up } (x/Tdp))^* Tdp$

For drives connected via CU310-2, case A applies generally.

**Example:**

Servo drive with current controller cycle clock (p115[0] = 125 µs)

PROFIBUS Integrated cycle clock: Tdp = 3 ms

$x = 32 \times 125 \mu\text{s} = 4 \text{ ms} \Rightarrow \text{case B}$

$r9780 = (\text{rounded up } (4 \text{ ms} / 3\text{ms})) \times 3 \text{ ms} = 6 \text{ ms}$

For detailed information about Safety Integrated response times, see the *SINAMICS S120 Safety Integrated Function Manual*.

**SI monitoring cycle clock**

The response times of the various safety functions are derived from the Safety Integrated monitoring cycle clock (r9780).

The value of the Safety Integrated monitoring cycle clock (r9780) is determined automatically - you therefore only see it when you are connected online to the drive.

With the SINAMICS Integrated of a SIMOTION D410-2, different values can be determined as for a SINAMICS S120 CU310-2 connected to SIMOTION D410-2 because of the architecture.

The Safety Integrated monitoring cycle can be calculated as follows for the SINAMICS Integrated:

$x = 32 \times p0115[0]$  (p0115[0] = current controller cycle clock; for D410-2, typically 125 µs for servo drives)

Case A: For PROFIBUS Integrated cycle clock > x:  $r9780 = x$

Case B: For PROFIBUS Integrated cycle clock ≤ x:  $r9780 = (\text{rounded up } (x/Tdp)) \times Tdp$

For drives connected via CU310-2, case A applies generally.

**Example:**

Servo drive with current controller cycle clock (p115[0] = 125 µs)

PROFIBUS Integrated cycle clock: Tdp = 3 ms

$x = 32 \times 125 \mu\text{s} = 4 \text{ ms} \Rightarrow \text{case B}$

$r9780 = (\text{rounded up } (4 \text{ ms} / 3\text{ms})) \times 3 \text{ ms} = 6 \text{ ms}$

For detailed information about Safety Integrated response times, see the *SINAMICS S120 Safety Integrated Function Manual*.

**Required hardware**

Controlling the safety functions requires at least the following hardware versions:

Table 7-11 Required hardware versions

Module	Article number	Required product version
SIMOTION D410-2 DP	6AU1410-2AA00-0AA0	C
SIMOTION D410-2 DP/PN	6AU1410-2AD00-0AA0	B

The hardware requirements of the drive components can be found in the *SINAMICS S120 Safety Integrated Function Manual*.

### Safety Integrated functions with PROFIsafe (PROFINET example)

Safety Integrated functions are activated via "PROFIsafe on PROFINET" safe communication. Control (F logic) is via a SIMATIC F-CPU which is connected to PROFIsafe via PROFINET, e.g. a SIMATIC S7-1500 F-CPU.

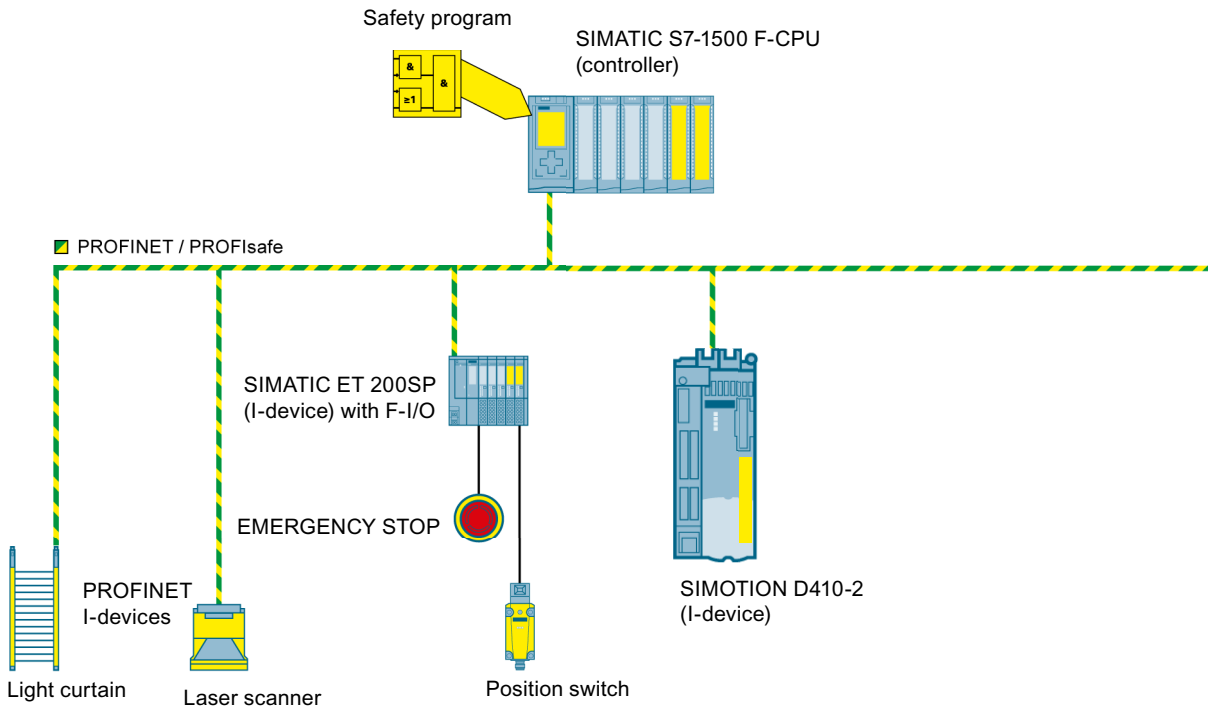


Figure 7-43 SIMOTION D, control of F functions via PROFINET with PROFIsafe

### Topologies (F proxy)

The F proxy functionality enables transparent routing of safety telegrams from the SIMOTION I-device (or slave) to the SIMOTION controller (or master).

The topologies that may be used with the SIMOTION D410-2 are listed below. In each case, the description specifies whether the control of Safety Integrated functions is routed through to the drives.

- SIMATIC F CPU (master), connected via PROFIBUS with PROFIsafe to SIMOTION D410-2 (I-slave).  
**Note:** PROFIBUS not possible configuration via SCOUT TIA
  - Routing to the SINAMICS Integrated drive of SIMOTION D410-2.
  - Routing to drives of CUs that are connected to SIMOTION D410-2.  
The CUs are connected as slaves via PROFIBUS to the DP master interface of the SIMOTION D410-2.
- SIMATIC F-CPU (controller), connected via PROFINET with PROFIsafe to SIMOTION D410-2 DP/PN (I-device)
  - Routing to the SINAMICS Integrated drive of the D410-2 DP/PN.
  - Routing to the drives of a SINAMICS S110/S120 CU connected to the D410-2 DP/PN.  
The CU is connected as a device via PROFINET to the PROFINET interface of the D410-2 DP/PN (= controller) or the CU is connected as a slave via PROFIBUS to the DP master interface of the D410-2 DP/PN.
- The SIMOTION D410-2 is the PROFIBUS master for a direct fail-safe slave-to-slave communication, e.g. between a SIMATIC F-CPU and a SINAMICS S110/S120 CU. Direct fail-safe slave-to-slave communication with telegram 901: As of V4.3 SP1 HF9. Not for SCOUT TIA (SIMOTION in the TIA Portal)  
See also application example at the following Internet address (<https://support.industry.siemens.com/cs/ww/en/view/38701812>).

---

**Note**

Control for the Safety Integrated functions cannot be routed through to the SINAMICS Integrated of the SIMOTION D410-2 in this configuration.

---

### Topologies (Shared Device)

With the Shared Device functionality, you can configure access to an IO device with several IO controllers using PROFINET. This enables channels/modules to be flexibly assigned to different IO controllers. This option is available for inputs and outputs. You can use this mechanism to access the fail-safe data of a drive configured below a SIMOTION CPU via the F-CPU (e.g. access of an S7-1500 F-CPU to a SINAMICS S120 CU310-2 which is subordinate to a SIMOTION D410-2).

Requirement:

SIMOTION SCOUT (not possible with SCOUT TIA)

---

**Note**

When configuring PROFIsafe, it is recommended that you use the I-device F proxy functionality instead of the Shared Device.

---

## Additional references

Additional information on configuring Safety Integrated functions can be found in the

- *SINAMICS S120 Safety Integrated* Function Manual
- *TO Axis Electric/Hydraulic, External Encoder* Function Manual
- *SIMOTION Communication System* Manual
- Internet at the following Internet address (<https://www.automation.siemens.com/safety>)

## 7.19 Hot plugging

SIMOTION D410-2 is capable of hot plugging, i.e. SIMOTION D410-2 can be unplugged or plugged in again to the PM340/PM240-2 energized.

The following scenarios are therefore possible:

- SIMOTION D410-2 is supplied with power via X124, Power Module is de-energized
- SIMOTION D410-2 is de-energized, Power Module is energized
- SIMOTION D410-2 is supplied with power via X124, Power Module is energized

Unplugging and plugging of a SIMOTION D410-2 is only permitted on one and the same Power Module. If the SIMOTION D410-2 is plugged into a different Power Module (power, type, article number, serial number), then alarm 30074 is issued on the drive side.

SIMOTION D410-2 must always be supplied via X124 **for operation**. There is no warm restart when plugged in again.

If the SIMOTION D410-2 is unplugged from the Power Module, a drive connected to the Power Module stops.

## 7.20 Quantity structures

With SIMOTION D, the SIMOTION PLC and motion control functionalities as well as the SINAMICS S 120 drive software run on a shared control hardware. The IEC 61131-3-compliant PLC integrated in SIMOTION D means that the system is not just capable of controlling sequences of motions, but the entire machine as well.

The **scaling of the PLC and motion control functionality** is performed via Control Units of various performance classes for SIMOTION D

- SIMOTION D410-2 for single-axis solutions and small multi-axis solution with typically 2 to 3 axes
- SIMOTION D425-2 (BASIC performance) for up to 16 axes
- SIMOTION D435-2 (STANDARD performance) for up to 32 axes
- SIMOTION D445-2 (HIGH performance) for up to 64 axes
- SIMOTION D455-2 (ULTRA-HIGH performance) for up to 128 axes or applications with very short control cycle clocks

The possible axis quantity structures depend on the required servo and interpolator cycle clocks and apply for electric, hydraulic and virtual axes.

The **scaling of the drive computing performance** is performed via SINAMICS drive controls for the SIMOTION D410-2. The drive control of a CU310-2 is already integrated (SINAMICS Integrated) for the SIMOTION D410-2. This can be extended with SINAMICS S110/S120 Control Units connected via PROFIBUS or PROFINET.

## SIZER

With the SIZER configuration tool, you can easily configure the SINAMICS S110/S120 drive family including SIMOTION. It provides you with support for selecting and dimensioning the components required for a Motion Control task.

- Dimensioning of the PLC and motion control functionality --> selection of the SIMOTION D Control Unit
- Dimensioning of the drive computing performance and the required drive components.

Depending on your performance requirements, SIZER determines the possible number of axes and the resulting utilization on the SIMOTION and SINAMICS side.

## Quantity structure of DRIVE-CLiQ components

The following maximum number of DRIVE-CLiQ components can be connected to the SIMOTION D410-2:

- Max. 8 Terminal Modules, of these max.
  - 3 TM15, TM17, TM41
  - 8 TM15 DI/DO, TM31, TM120, TM150
  - 1 TM54F
- Max. 5 encoder systems (SMx Sensor Modules or encoders/motors with DRIVE-CLiQ interface)
- Max. 1 DMC20/DME20

You require a DRIVE-CLiQ hub module (DMC20/DME20) or a CUA32 to connect more than one encoder system via DRIVE-CLiQ.

## 7.21 Migration from SIMOTION D410 to SIMOTION D410-2

### 7.21.1 Upgrade from SIMOTION D410 to SIMOTION D410-2

SIMOTION D410-2 differs both in the structure and in the functionality of a SIMOTION D410.

This has effects that must be taken into account during a changeover.

### Change from D410 to D410-2 (upgrade)

The change from SIMOTION D410 to SIMOTION D410-2 is performed with a module replacement in **HW Config**. The procedure when changing is similar to that when changing, for example, from SIMOTION D445-2 DP/PN to SIMOTION D455-2 DP/PN.

The module replacement is started by dragging the new module to the frame of the module rack with the existing module in **HW Config**, see Section Device replacement in HW Config (Page 255).

The module replacement is performed automatically. During this operation, the technology packages and the device versions are updated. Existing configurations of the SIMOTION D410 are transferred to the SIMOTION D410-2 during the module replacement.

Information on where project adaptations are required or not required when changing from a SIMOTION D410 to a SIMOTION D410-2 can be found in the following sections (see Table "Transfer of existing SIMOTION D410 projects to SIMOTION D410-2").

For further information on generally required measures for project adaptations, see Section Service and maintenance (Page 239).

### Change from D410-2 to D410 (downgrade)

As a SINAMICS drive cannot be downgraded, a module replacement of a SIMOTION D410-2 (SINAMICS Integrated firmware V4.x/V5.x) with a SIMOTION D410 (SINAMICS Integrated firmware V2.x) is not possible.

However, project data can be transferred by means of an XML export/import.

### Transfer of existing projects

Existing configurations of the SIMOTION D410 are transferred to the SIMOTION D410-2 during the module replacement.

The following table provides information on where project adaptations are required or not required:

Table 7-12 Transfer of existing SIMOTION D410 projects to SIMOTION D410-2

Keyword	Explanation
PROFIBUS interfaces	<p>The configuration on the PROFIBUS interfaces including any existing PG/PC assignment is retained.</p> <p>Figure: SIMOTION D410 to SIMOTION- D410-2: X21 DP/MPI → X21 DP/MPI</p> <p>One of the differences of SIMOTION D410-2 DP compared to D410 DP is that it has an additional (second) PROFIBUS interface (X24).</p> <p>A key difference of SIMOTION D410-2 DP/PN compared to D410 PN is that it also has a PROFIBUS interface (X21).</p>
PROFINET interface	<p>The configuration on the PROFINET interface, including any existing PG/PC assignment, is retained.</p> <p>Figure: SIMOTION D410 PN to SIMOTION D410-2 DP/PN: X200 → X150 P1 X201 → X150 P2</p>

7.21 Migration from SIMOTION D410 to SIMOTION D410-2

Keyword	Explanation
Message frame configurations	The message frame configurations on the PROFIBUS or PROFINET interface are retained. The same applies for the addresses of the slots/subslots.
SINAMICS Integrated	The SINAMICS Integrated is to be replaced with the new type and its corresponding version. The drive configuration and the assignment of the DRIVE-CLiQ interface are retained.
PG/PC connection / Ethernet interface	In contrast to SIMOTION D410, SIMOTION D410-2 has an Ethernet interface. Due to the significantly improved engineering performance, we recommend that you connect a PG/PC via the Ethernet interface of the SIMOTION D410-2 instead of via PROFIBUS.
Configuration of the on-board I/Os	The configuration of the onboard I/Os (4 DI, 4 DI/DO) is retained. The new features mean the functionality, quantity structures and terminal designations for the onboard I/Os differ for the SIMOTION D410-2 compared with the SIMOTION D410.  The number of onboard I/Os has more than doubled so that previously required terminal modules / I/O modules may no longer be necessary.
Safety	SIMOTION D410-2 has 3 F-DI and 1 F-DO for Safety Integrated Extended/Advanced Functions so that a TM54F used for SIMOTION D410 may be omitted.
CompactFlash card / firmware	SIMOTION D410 and SIMOTION D410-2 have different CompactFlash cards and different card mappers (firmware).  A CompactFlash card of the SIMOTION D410/D4x5-x must not be inserted into a SIMOTION D410-2 and vice-versa!  1 GB CompactFlash cards of the SIMOTION D410/D4x5-x can also be used for the SIMOTION D410-2 when a new boot loader is loaded. For details, see Section Boot loader on the CompactFlash card (Page 271).
Connectable drive components	Like the SINAMICS S120 CU310-2, the SIMOTION D410-2 also no longer supports some older drive components.  For details, see Section Permissible combinations (Page 233)



Keyword	Explanation
User program	<p>Although, in principle, a SIMOTION D410 user program can run on a SIMOTION D410-2, modifications may be required because of innovations in the hardware. Examples:</p> <ul style="list-style-type: none"> <li>• The runtime behavior of the SIMOTION D410-2 changes because of the increased performance. As long as the user program does not contain any "runtime-dependent code", adaptations should not be necessary.</li> <li>• Fan faults for the SIMOTION D410-2 are signaled via a diagnostic buffer entry PeripheralFaultTask and a system variable (fanWarning). For the SIMOTION D410, fan faults were signaled by a warning on the drive side (A1009).</li> <li>• The following additional functions are available for the SIMOTION D410-2: <ul style="list-style-type: none"> <li>– Backup of the non-volatile SINAMICS data (NVRAM data) via CU parameter p7775</li> <li>– Automatic detection of a module replacement on the basis of the serial number of the Control Unit</li> </ul> </li> </ul>
Hardware	<p>Due to the innovative hardware, the following changes have been made for the SIMOTION D410-2 compared with the SIMOTION D410:</p> <ul style="list-style-type: none"> <li>• The control elements of the SIMOTION D410-2 have been standardized with the SIMOTION D4x5-2 (rotary switch instead of DIP switch for SIMOTION D410, DIAG button, etc.).</li> <li>• The interfaces on the top of the module are positioned differently.</li> <li>• Changed I/O terminals: <ul style="list-style-type: none"> <li>– Spring-loaded terminals instead of screw terminals</li> <li>– Fitting for the 24 V terminal block</li> <li>– The SIMOTION D410 connector X120 must be re-wired</li> <li>– The wiring of the SIMOTION D410 connector X121 can be taken over exactly for the new connector of the SIMOTION D410-2 (the terminal designation for the reference ground DI 0 - DI 3 changes from M1 to M2)</li> </ul> </li> </ul> <p>SIMOTION D410-2 has the following additional interfaces:</p> <ul style="list-style-type: none"> <li>• Additional Ethernet interface</li> <li>• Additional PROFIBUS interface</li> </ul> <p>The mounting depth of the SIMOTION D410-2 has been reduced by approx. 15% compared to the SIMOTION D410.</p>

## See also

Operations and their effect on the user memory (Page 74)

### 7.21.2 Permissible combinations

Some "older" DRIVE-CLiQ components can no longer be used with the SIMOTION D410-2.

Table 7-13 DRIVE-CLiQ components not supported with SIMOTION D410-2

DRIVE-CLiQ components	Article number suffix
SMC30 Sensor Module Cabinet	< 2
TM31/TM41 Terminal Modules	< 1
SME20/25 Sensor Modules External	< 3

DRIVE-CLiQ components	Article number suffix
CUA31 Control Unit Adapter	< 1
Power Modules (chassis)	< 3

A detailed, regularly updated list of the DRIVE-CLiQ components approved for use with SIMOTION, as well as notes on their use, can be found on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/11886029>).

If incorrect components are used, a topology error is signaled  
**F01360 Topology: Actual topology not permitted.**

### 7.21.3 CompactFlash card and license combinations

#### CF card

A CF card with D410 firmware / drive software cannot run on a D410-2. The same applies for the reverse situation.

In the event of a fault all 4 LED displays light up yellow.

#### SIMOTION D410-2 licensing

SIMOTION D410-2 is a compact Control Unit predestined for single-axis applications. SIMOTION D410-2 has an integrated drive control for either a servo, a vector or a V/f axis. One real axis can be used without requiring a license for a SIMOTION D410-2. Speed-controlled axes and virtual axes never require a license.

SIMOTION D410-2 can be extended with additional SINAMICS S110/S120 Control Units (e.g. CU305) and so can also be used for smaller multi-axis applications (e.g. with 2 - 3 axes). These additional axes must be licensed with the single-axis licenses or the "D410-2 MultiAxes Package." See Section "CompactFlash card" in the *SIMOTION D410-2* Manual.

If you need to license one POS axis, use the POS single-axis license; in the case of GEAR/CAM or if you require more than one POS licenses, it is better to use the D410-2 MultiAxes Package,

---

#### Note

If you use more than one real axis with SIMOTION D410-2, you must license these additional axes. The axis license with the highest functionality is covered by the inclusive license (a real axis). The functionality has the following granularity: CAM > GEAR > POS.

Example:

You use 2 real axes: 1 POS, 1 CAM.

Because the CAM license has a higher value, and so inclusive, you only need to purchase a POS license.

---

Licenses are required for runtime functions such as SIMOTION IT Virtual Machine. These can be pre-installed on a CompactFlash card (CF card) or ordered separately.

---

**Note**

Path interpolation is supported as of V4.4.

---

## 7.22 Special functions SIMOTION D410-2

### 7.22.1 Automatic restart after FAULT state

#### Overview

A SIMOTION D410-2 can perform a restart automatically after the FAULT operating state has occurred via the system variable **\_automaticRestart** available as of V4.4.

The system variable **\_automaticRestart** is intended for applications in which an automatic restart is mandatory after a crash caused by an extreme situation, e.g. wind generators after a lightning strike.

The automatic restart causes the device with the project to boot automatically from the CF card.

---

**Note**

System variable **\_automaticRestart** is visible on all SIMOTION CPUs, but the functionality is only supported by SIMOTION D410-2.

---

**Note**

Restart cannot be ensured in all cases, for example, if a hardware fault occurs.

---

#### Programming

Table 7-14 System variable **\_automaticRestart**

Value	Response
16#00000000	Automatic restart after FAULT state is not active (default).
16#00000000 < n < 16#FFFFFFFF	Automatic restart after FAULT state is active until the value 0 is reached. On a restart after FAULT state, the value is decremented by 1.
16#FFFFFFFF	Automatic restart after FAULT state. The value remains unchanged.

The system variable can be set to the desired value and decrementing monitored in the user program.

Alternately, the start value can be set manually in the SIMOTION SCOUT symbol browser under "force variable." To ensure the manually set start value remains effective, note the following:

- The start value must be set in the offline project and loaded onto the device by project download.
- The value that is loaded onto the device must differ from the start value that was last loaded onto the device by project download.  
This ensures that the current value of the system variable **\_automaticRestart** in the runtime system is not reset on every project download (crash history is not deleted).

The system variable is retentive, its content and therefore the "automatic restart after FAULT state" function is retained after an interruption in the power supply.

An automatic restart after FAULT state that has occurred can be diagnosed by the diagnostic buffer entry **Automatic restart of the CPU performed after FAULT operating state**.

System variable **\_automaticRestart** is not backed up with **\_savePersistentMemoryData**:

- Because an automatic restart can be caused by hardware problems and this cause is not to be transferred to the new module if a module is replaced.
- Because the user program will decide for itself under what condition system variable **\_automaticRestart** will be set to a certain value.

If an error occurs after the automatic restart, there is not special error handling for this case. If this error prevents startup, the SIMOTION device cannot enter the RUN state. An error during startup does not trigger an automatic restart.

## 7.22.2 Triggering a restart with a user program

A user program of the SIMOTION device can trigger restart of the device via the system function **\_restart** available as of V4.4.

This system function, like the system variable **\_automaticRestart**, described in Section Automatic restart after FAULT state (Page 235) is intended for applications in which an automatic restart is mandatory after a crash caused by an extreme situation, e.g. wind generators after a lightning strike.

The system function **\_restart** enables a response to non-acknowledgeable drive errors with a OFF2 reaction, which result in the inability of the drive to move. These drive errors can only be exited via a restart or by power off/on.

---

### Note

The system function **\_restart** is provided for all SIMOTION devices, but restart itself is only performed for the D410-2 device.

---

The restart causes the device with the project to boot from the CF card.

So that, after a restart has been performed, the SIMOTION device enters the RUN state again, the system variable **\_startUpData.operationMode** must be on RUN.

The system function **\_restart** only supports synchronous command processing.

Return values:

- 16#00000000: Function performed without errors.
- 16#FFFF8091: Functionality is not supported for the device.

If the restart was triggered by the system function **\_restart**, the following entry is made in the diagnostic buffer: The SIMOTION device has been switched to STOP and restarted by the user program using the **\_restart** system function.

The user program must ensure that, when the D410-2 restarts, no axis movements or other unwanted influences on the machine by the user program occur.

If an error occurs after the automatic restart, there is not special error handling for this case. If this error prevents startup, the SIMOTION device cannot enter the RUN state. An error during startup does not trigger an automatic restart.



# Service and maintenance

## 8.1 Overview

### Introduction

It is possible to distinguish between the following scenarios when replacing and updating components:

- Replacing modules (spare part scenario)
  - Spare parts replacement for SIMOTION D410-2 (Page 243)
  - Removing and replacing the SIMOTION D410-2 (Page 243)
  - Replacing DRIVE-CLiQ components (Page 245)
  - Replacing the fan (Page 247)
  - Replacing the CompactFlash card (Page 249)
- Adapting a project (new device type / new device version)

The project needs to be adapted if you want to change the type (e.g. D410 DP -> D410-2 DP) or version of the SIMOTION device in your existing project.

  - Creating backup copies (project/CF) (Page 249)
  - Backing up user data (back up variables) (Page 250)
  - Upgrading a user project to the new SCOUT version (Page 251)
  - Platform replacement via XML export/import (Page 252)
  - Preparing the device replacement (Page 254)
  - Device replacement in HW Config (Page 255)
  - Upgrading technology packages (Page 256)
  - Upgrading the device version of SINAMICS S120 Control Units (Page 258)
  - Upgrade the libraries (Page 259)
  - Save project, compile and check consistency (Page 260)
- Performing a firmware and project update
  - Upgrading the boot loader on the CompactFlash card (Page 260)
  - Update - preparatory measures (Page 261)
  - Update via SIMOTION IT web server (Page 262)
  - Upgrade via device update tool (upgrading SIMOTION devices) (Page 262)

- Update via CF card
  - Backup of CompactFlash card data (Page 265)
  - Firmware update using a CompactFlash Card (Page 266)
  - Upgrading SINAMICS (Page 267)
  - Download project to target system (Page 268)

---

**Note**

Upgrading using the device update tool offers a number of advantages (keeping retain data, option of downgrading, no license key handling, etc.). We would, therefore, recommend using this method for firmware and project updates.

---

Please also observe the information on handling the CompactFlash card.

- Changing the CompactFlash card (Page 269)
- Writing to a CompactFlash card (Page 270)
- Formatting the CompactFlash card (Page 271)
- Boot loader on the CompactFlash card (Page 271)
- Recommended method of handling CompactFlash cards (Page 272)
- Card reader for CompactFlash cards (Page 273)

---

**Note**

This document uses the following terms:

- Upgrade: Denotes upgrading to a higher version of a component/software
  - Downgrade: Denotes reverting to a previous version of a component/software
  - Update: In general terms, denotes the act of bringing a component/software up-to-date (in isolated cases, this may see an upgrade or downgrade)
- 

## Upgrade options

The exact procedure when replacing or updating components depends on various factors.

If a project is upgraded, the procedure depends on the scope of change of the versions.

- Change of the SIMOTION main version
- Change of the SIMOTION service pack or hotfix version
- Change of the PROFINET version
- Change of the SINAMICS version  
(There are SIMOTION versions that contain several SINAMICS versions for a device.)

If a different SIMOTION controller is to be used, the procedure depends on whether a device or a platform replacement is required.

Examples of upgrade scenarios are listed in the following overview table. They are shown in the columns. The lines list the principle measures that have to be performed. Whether the measure



---

has to be performed in a specific case, must be decided project-specifically.  
Grayed-out cells mean that a measure is not required.

---

**Note**

If the version is changed and the SIMOTION controller replaced at the same time, then all measures apply; the measures must be performed in the TOP-DOWN sequence according to the table.

---

8.1 Overview

Action/Measure	Upgrade project				Replacement of SIMOTION controller		Activity relates to
	Main version	Service pack or hotfix version	PROFINET version	SINAMICS version	Device replacement via HW Config	Platform replacement via XML export/import	
<b>Customize project</b>							
Examples	V4.1 ⇔ V4.2	V4.1 SP2 ⇔ V4.1 SP4	PN2.1 ⇔ PN2.2	V2.5 ⇔ V2.6.2	D445-2 ⇔ D455-2 D4x5 ⇔ D4x5-2 D410-2 DP ⇔ D410-2 DP/PN	C240 ⇔ D445-2 D410-2 ⇔ D445-2 D445 ⇔ D445 (S120) (SM150)	Project/SIMOTION SCOUT
Create backup copy (project/CF)							
Back up user data (back up variables)	Only if required				Only if required	Only if required	
Upgrade user project to new SCOUT version							
Platform replacement via XML export/import	During platform replacement, the target version is specified (= version of the device that is the recipient of the import)						
Prepare device replacement							
Device replacement in HW Config							
Upgrade technology packages (TP)	4)	4)			4)		
Upgrade device version of SINAMICS S120 CUs 3)				For external CUs, only if necessary			
Upgrade library	Libraries are version-dependent				Libraries may be device-dependent	Libraries may be device-dependent	
Save/compile project; check consistency							
<b>Perform a firmware and/or project update</b>							
Upgrade the boot loader on the CompactFlash card	Check whether new version requires a new boot loader 2)				Check whether the new 2) device requires a new boot loader		Memory card/Target hardware
Update - preparatory measures							
Upgrade via IT DIAG	Selection of one of the 3 update methods				Only possible if the CF card contains valid firmware		
Update via device update tool							
Update via CompactFlash Card							
Backup of the CompactFlash card data							
Firmware update using a CompactFlash card							
Upgrade SINAMICS 5)							
Download the project to the target system 1)							

Not relevant       Relevant

- 1) Alternative: Load the project to the CF card using a card reader
- 2) Refer to the compatibility list (<https://support.industry.siemens.com/cs/ww/en/view/18857317>)
- 3) The versions of SINAMICS Integrated and Controller Extensions are upgraded automatically in the **HW Config** during device replacement
- 4) The technology packages are automatically upgraded. The user can directly specify a TP
- 5) SINAMICS components are upgraded/downgraded to the component version of the CF card. Observe the LED codes! After the upgrade it is necessary to switch the device off and on.

Figure 8-1 Overview of upgrade options

## 8.2 Replacing modules

### 8.2.1 Spare parts replacement for SIMOTION D410-2

A replaced module is detected by the controller on the basis of the serial number. This automatically deletes the non-volatile data and transfers the data saved on the CF card to the controller. See Section Replacing modules in the spare part scenario (Page 81).

### 8.2.2 Removing and replacing the SIMOTION D410-2

#### Overview

The following describes the procedure for replacing a module (spare part). In principle, it is also possible to replace the SIMOTION D410-2 when the PM340/PM240-2 is energized.

You will find more information on this in Section Hot plugging (Page 229).



#### **WARNING**

##### **Danger to life through electric shock**

Note that Power Modules with FSB performance rating or higher still carry a residual intermediate voltage after shutdown.

Wait 10 minutes before you remove any screws.

For further information, see the *SINAMICS S120 AC Drive* Manual.

#### Removing a defective module

How to remove the SIMOTION D410-2 module:

1. Switch off the power supply to terminal X124.
2. Remove the CF card from the card slot.
3. Remove the connections for the power supply (X124).
4. Disconnect the communication interface connectors from the device:
  - DRIVE-CLiQ interface (X100)
  - PROFIBUS DP interface (X21)
  - PROFIBUS DP interface (X24; D410-2 DP only)
  - PROFINET interface (X150 P1 and P2; D410-2 DP/PN only)
  - Ethernet interface (X127)
5. If necessary, disconnect the plug-in connectors to the digital inputs/outputs of the interfaces (X120, X121, X130, X131).

6. Disconnect the plug of any encoder connected to the X23 encoder interface.
7. Depending on the mounting method, disassemble the SIMOTION D410-2 from the Power Module or remove the SIMOTION D410-2 from the mounting plate (see Section Mounting (Page 29)).

### Installing a new module

How to install the new SIMOTION D410-2 module:

---

#### Note

Observe the information for installation (Page 29), wiring and connecting (Page 35) the SIMOTION D410-2.

---

1. Install the new SIMOTION D410-2 on the Power Module or on the mounting plate.
2. Connect all previously removed connectors.
3. Terminate the load voltage supply cables at the terminal block.
4. Rewire the shielding of all cables.
5. Insert the original CF card into the card slot of the new SIMOTION D410-2.
6. Switch on the power supply. The new SIMOTION D410-2 is immediately ready for operation.

### Replacing SIMOTION D410-2 modules without PG/PC

To enable a module replacement without a PG/PC, you must back up the current non-volatile SIMOTION and SINAMICS data on the CF card during operation.

<b>NOTICE</b>
---------------

<b>Loss of data due to failure to make backup copies</b>
--

Non-backed-up non-volatile SIMOTION data can be lost on hardware replacement (module defect), for example, if the current value of the retain variables have not been backed up and replaced by their initial values again.
---

Back up the non-volatile SIMOTION data on the CF card.
--

<b>NOTICE</b>
---------------

<b>Repeat referencing necessary after absolute encoder overflow</b>
---

If an absolute encoder overflow occurs after <code>_savePersistentMemoryData</code> , the actual position value is no longer correct after the non-volatile SIMOTION data are restored.
---

In this case, homing (absolute encoder adjustment) must be repeated.
--

## See also

- Hot plugging (Page 229)
- Spare parts replacement for SIMOTION D410-2 (Page 243)
- Operations and their effect on the user memory (Page 74)
- Replacing modules in the spare part scenario (Page 81)

## 8.2.3 Replacing DRIVE-CLiQ components

### Requirement

DRIVE-CLiQ components not only support replacement in the switched-off state of the machine/system (Power Off), but also replacement during operation. For this, the component to be replaced must be at the end of the DRIVE-CLiQ line.

### Removing DRIVE-CLiQ components

1. Deactivate the affected component or drive object.
2. Remove the DRIVE-CLiQ connector.
3. Remove the supply voltage of the component and uninstall the component.

### Installing DRIVE-CLiQ components

1. Mount the component and reconnect the supply voltage.
2. Reconnect the DRIVE-CLiQ cable at the same location (port). The cable must have the same length as the old one.
3. Activate the affected component or drive object.

### Parameters for topology comparator and component replacement

In the expert list, you can use CU parameter p9906 to specify how the electronic rating plates are compared for all the components of a Control Unit. The type of comparison can be changed subsequently for each individual component by using p9907/p9908 or right-clicking in the topology. All data on the electronic rating plate is compared by default.

- When p9909 = 1, the serial number and the hardware version of the new replacement component are automatically transferred from the actual topology to the target topology, and then saved in the non-volatile memory.
- When p9909 = 0, serial numbers and hardware versions are not automatically transferred.

The setting p9901 = 1 enables the **spare parts / components replacement without tool support** to be carried out. The new serial number of the spare part is automatically transferred from the actual topology to the target topology and saved in non-volatile memory. In order for this to occur, the components that have been replaced must be of the same type and have the same article number, such as "6SL3055-0AA0-5BA0". The last or last two digits of the article number

(depending on the component type) are not checked, as the HW version, for example, is coded in these. This mechanism is also applied when several components are replaced.

### Modified wiring following module replacement

In the default setting for the topology comparator, modified wiring configurations of the DRIVE-CLiQ components (e.g. a cross-exchange) are not accepted for safety reasons and are generated by a fault.

If a cross-exchange of components is required (i.e. existing components are replaced with other existing components, and no spare parts are used), e.g. for troubleshooting purposes, the topology comparator must be reduced via parameter p9906 or preferably via p9907/p9908; or as an alternative, by right-clicking in the topology.

---

#### Note

In this case, incorrect insertion of components is no longer monitored.

---

### Automatic upgrading/downgrading (firmware update)

During the startup, the system automatically upgrades or downgrades all DRIVE-CLiQ components to the version of the component firmware on the CF card. Components that cannot be downgraded to the component firmware version of the CF card (e.g. old firmware on the CF card and new components to which the old firmware cannot be loaded) retain their firmware version. The resulting firmware version combinations are always functional.

The CONTENT.TXT file in the main directory of the CF card contains the component version.

---

#### Note

During an automatic FW update, please take note of the messages and alarms in the SIMOTION SCOUT detail window.

A firmware update on the SIMOTION D410-2 is signaled by the RDY LED flashing yellow, while on the DRIVE-CLiQ components (TM, SMC, etc.) it is signaled by the RDY LED flashing red/green.

- FW update running: RDY LED flashes slowly (0.5 Hz)
- FW update complete: RDY LED flashes quickly (2 Hz), POWER ON required

Components requiring POWER ON following a firmware update signal this by means of the fast flashing RDY LED. Go offline with SCOUT and switch the 24 V supply to the relevant components off/on (POWER ON) to initialize.

The update function can be deactivated using CU parameter p7826 in the expert list.

---

### Additional references

For more information on this topic, see the following references:

- *SINAMICS S120* Commissioning Manual
- *SINAMICS S120* Function Manual

## 8.2.4 Replacing the fan

### Overview

The SIMOTION D410-2 fan switches on depending on the internal module temperature.

Fan faults are signaled by a diagnostic buffer entry, system variable and PeripheralFaultTask, see section Fan (Page 83).

The SIMOTION D410-2 does not have to be removed from the Power Module in blocksize format to replace the fan. A defective fan can also be replaced when the SIMOTION D410-2 is switched on.

### Note

The fan/battery module should preferably be replaced when the power is switched off and only when the CPU is in the STOP state. Otherwise you risk an unintentional failure of the machine/system, e.g. through accidental disconnection of cables.

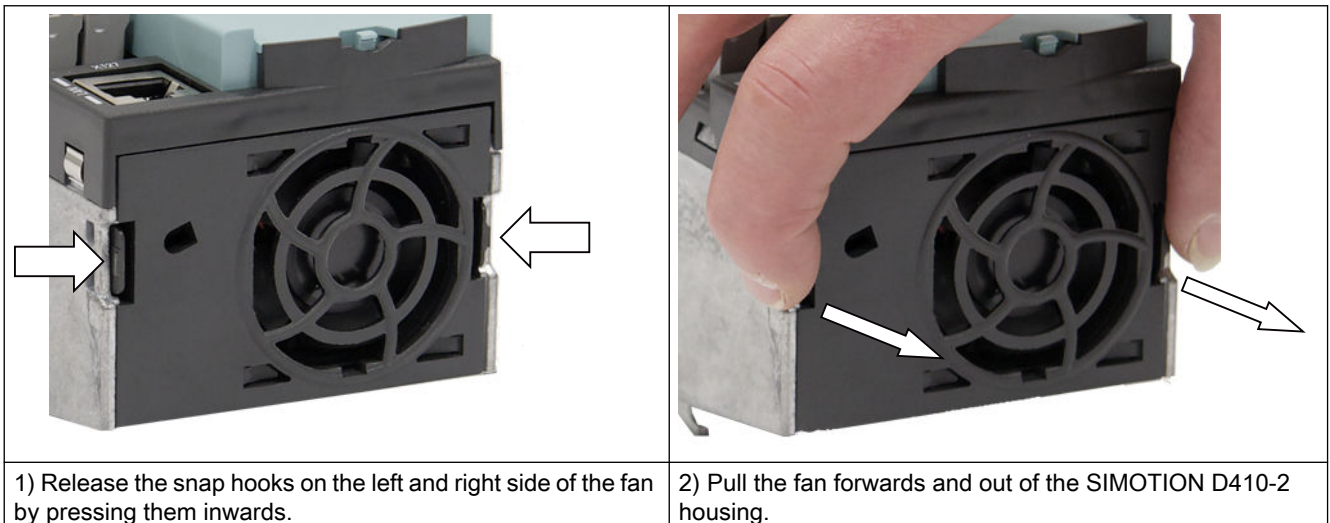
### Replacing the fan

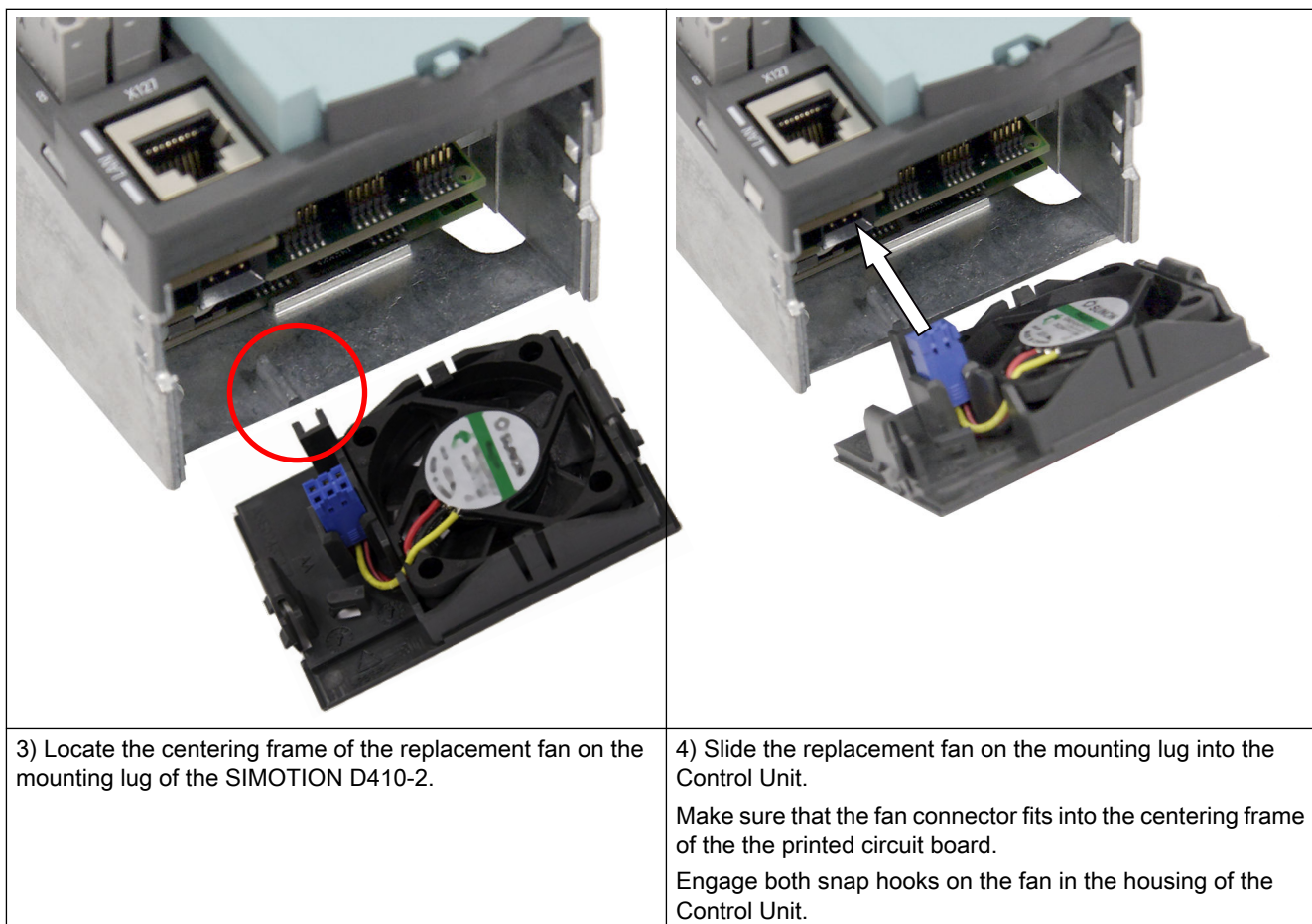
The fan is available as a spare part. For the article number, see section "Spare parts and accessories" in the SIMOTION D410-2 Manual.

#### NOTICE

#### Damage to device electronics caused by electric fields or electrostatic discharge

The fan on the SIMOTION D410-2 may only be replaced by qualified skilled personnel and strictly in accordance with ESD guidelines (Page 303).





### Fan service life

Fans are parts subject to wear. The fan is monitored for SIMOTION D410-2. A failure is signaled in the diagnostic buffer and can be evaluated by the user program (e.g. via the PeripheralFaultTask).

Contamination is the main cause of fan failure. A visual inspection should be made as a first criterion for replacement. If the fan is highly contaminated, it must be replaced.

If no contamination is present, we recommend that the service period is used as criterion. Because the service life of the fans depends greatly on the operating conditions (temperature, humidity, number of operating hours per day, contamination caused by dust, etc.), no fixed limits for all applications are can be specified.

In the field, under average industrial conditions, a replacement interval of 5 to 7 years has proven itself.

We recommend that the maintenance intervals are adapted for the specific application based on empirical values.



## 8.2.5 Replacing the CompactFlash card

If spare parts are used, you must contact the Technical Support Center to transfer the license key of the defective CompactFlash card to the new CompactFlash card.

Proceed as follows to write your project to the new CompactFlash card:

- Changing the CompactFlash card (Page 269)
- Writing to a CompactFlash card (Page 270)

Detailed information about licensing can be found:

- In the *SIMOTION SCOUT* Configuration Manual
- In the FAQs on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/73501913>)

## 8.3 Customizing the project

### 8.3.1 Overview

#### Overview

The project needs to be adapted if you want to replace the type (e.g. D410-2 DP ⇒ D410-2 DP/PN) or version of the SIMOTION device in your existing project.

#### Procedure

The exact procedure for project adaptations depends on the scope of the target hardware and version changes.

An overview can be found in the Upgrade options overview (Page 242) figure.

### 8.3.2 Creating backup copies (project/CF)

#### Requirement

Before adapting the project, it is essential that you create the following backup copies:

- A backup copy of the project and
- A backup copy of the CF card contents, see Saving CF card data (Page 265).

#### See also

Update - preparatory measures (Page 261)

### 8.3.3 Backing up user data (back up variables)

#### Overview

With the SCOUT functions "Save variables" and "Restore variables", you have the option of backing up and restoring data that were changed during operation and only stored in the runtime system. This is necessary if a SIMOTION platform is changed or a version upgraded, for example.

The "Save variables" function creates XML files that can be saved in any folder.

The following types of data can be backed up:

- Remanent global device variables and unit variables, as well as TO retain data located in the NVRAM of the controller
- Data saved with `_saveUnitDataSet` or `_exportUnitDataSet` and located on the CF card

---

#### Note

During an upgrade, this function is only required for the purpose of backing up and restoring unit data records created with `_saveUnitDataSet`.

Retain and unit data (saved with `_exportUnitDataSet`) remain valid even after a version upgrade.

SIMOTION retain data can also be backed up to a memory card without the use of SIMOTION SCOUT. For this purpose, use:

- The `_savePersistentMemoryData` function or
  - The service selector switch or the DIAG pushbutton or SIMOTION IT web server, see Section Non-volatile SIMOTION data (retain data) (Page 283).
- 

#### Procedure

The user data must be saved **before** the SCOUT project is upgraded. This can be done regardless of whether the version upgrade is performed with the "old" or the "new" SCOUT version.

The procedure is described below based on the example of a new SCOUT version.

1. Open the project.

When you open the project, a window appears with a message that the project you are opening was created with a different SCOUT version, as well as a query asking whether you want to perform an upgrade.

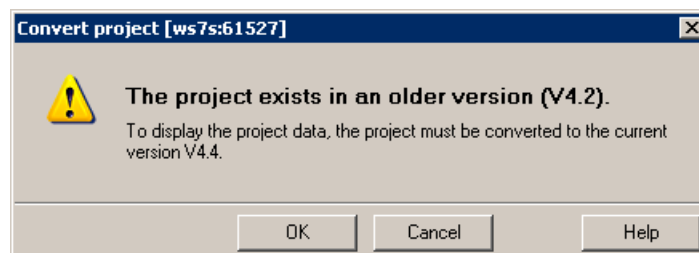


Figure 8-2 "Convert project" message

2. Confirm the prompt with "OK". The project will be converted to the current version.

3. A dialog then appears with a prompt asking whether the project should be opened write-protected.

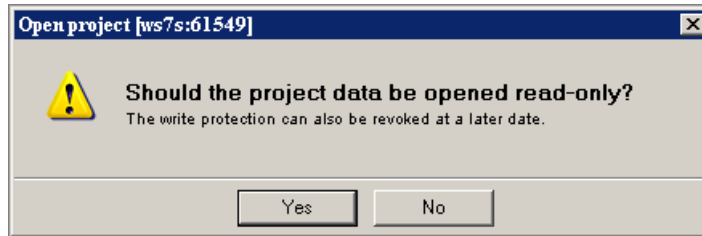



Figure 8-3 Prompt for write-protected opening

4. Confirm this prompt with "Yes" (open write-protected).
5. Set the SIMOTION D410-2 to the STOP operating state.
6. Set the SIMOTION D410-2 to online mode and perform the SCOUT **Save variables** function. The retain variables (interface and implementation) and the user files (with `_saveUnitDataSet` or `_exportUnitDataSet`) are saved to the PG/PC.
7. Then close the project.

---

#### Note

An online connection is possible only when the PG/PC is configured for the controller. Update the PG/PC assignment using . Online connection is now possible.

---

#### Additional references

For further information, see the *SIMOTION SCOUT* Configuration Manual.

#### See also

Diagnostic data and non-volatile SIMOTION data (Page 282)

### 8.3.4 Upgrading a user project to the new SCOUT version

#### Requirement

It is essential that a backup copy be made of the original project before the upgrade, because the data storage of the project is also upgraded during the upgrade. This ensures that you can always return to the original project if the upgrade fails (power interruptions, unexpected faults, incorrect operation, etc.).

### Procedure

1. Open the project. A window appears with a message that the project to be opened was created with another SCOUT version as well as a prompt as to whether the upgrade should be performed.

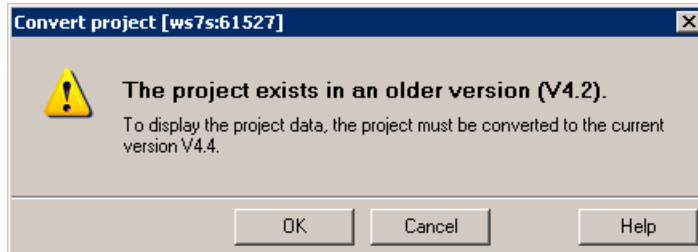


Figure 8-4 "Convert project" message

2. Confirm the prompt with "OK". The project will be converted to the current version.
3. A dialog then appears with a prompt asking whether the project should be opened write-protected.

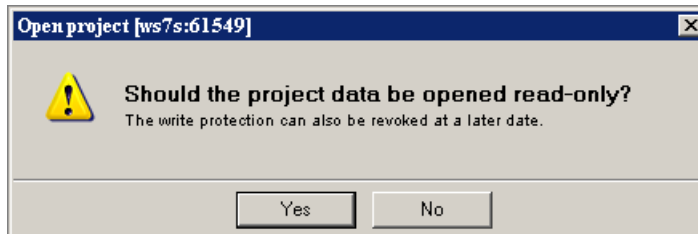


Figure 8-5 Prompt for write-protected opening

4. When upgrading the version, click "No" (open not write-protected).

---

#### Note

A project that was last edited with a higher SCOUT version cannot be opened by a SCOUT with a lower version.

#### Remedy:

Convert the project beforehand with the more recent SCOUT version to the required software version ("Project" > "Old project format" > "Save in old project format"). The project can then be opened with the lower SCOUT version.

---

### 8.3.5 Platform replacement via XML export/import

#### Overview

A platform replacement is always required when an existing project is to be used for another SIMOTION platform. The platform replacement is always performed via an XML export/import.

The following devices can be interchanged via a platform replacement:

- Replacement between SIMOTION C, P and D (e.g. C240 ⇒ D445-2 DP/PN)
- Replacement between D410/D410-2 and D4x5/D4x5-2 (e.g. D410-2 DP/PN ⇒ D445-2 DP/PN)
- Replacement between SIMOTION D (SINAMICS S120 Integrated) ⇒ SIMOTION D (SINAMICS SM150 Integrated)

Platform replacement during project downgrades:

It is not possible to downgrade to a lower SINAMICS version. However, it is possible to transfer project data by means of an XML export/import.

## Preparations

Before the platform replacement can be performed, preliminary work may be necessary in the existing project.

If a SIMOTION D4x5-2 is to be imported into a SIMOTION D410-2, then only the permitted quantity structure of the D410-2 may be configured in the D4x5-2. This applies for all components, e.g. not only an infeed, but also the permissible power units.

A SIMOTION D4x5-2 with CU adapter and Power Module in blocksize format can be imported into a SIMOTION D410-2 when the CU adapter is connected to port 0. Otherwise, the topology will be destroyed.

Generally, the success of an import always also depends on the specific configurations of the drive units, and whether the configuration is possible for the device to which the import is to be performed. Also note any error messages that may occur.

## Procedure

Proceed as follows:

1. In the project navigator of SIMOTION SCOUT, right-click the SIMOTION controller that is to be replaced.  
Select "Expert" > "Save project and export object" in the context menu.  
"Save project and export object" exports selected data of the selected object in XML format. This data export can then be reimported into other projects. The entire project is not exported, only the data of the selected object (e.g. only the D410-2 or only the SINAMICS Integrated).
2. Specify the desired path and start the XML export.
3. When the export has been performed error-free, delete the device from the project and confirm the prompt.
4. Insert the desired platform as new device in the project navigator of SIMOTION SCOUT. With the selection of the device, you also define the SIMOTION version, and with a SIMOTION D, also the SINAMICS version.
5. Import the data of the original platform into the new device. To do this, right-click the new device and select "Expert" > "Import object" in the context menu.
6. Select the location where the XML export data is to be stored and start the import. Confirm the prompt to continue with the import.

Confirm the message with regard to the import of a "non-compatible type" with "OK".

## 8.3.6 Preparing the device replacement

### Overview

In contrast to the platform replacement, project data can be particularly easily transferred when a device is replaced. The device replacement is performed via **HW Config**, whereas an **XML export/import** is required for a platform replacement.

A device replacement is only possible within SIMOTION D.

The following devices can be interchanged:

- Replacement between generations (D410 ⇒ D410-2)
- Replacement between variants of the generations (D410-2 DP ⇒ D410-2 DP/PN)
- Replacement of SIMOTION, SINAMICS and/or PROFINET version (e.g. D410 V4.1 - PN V2.1 SINAMICS S120 V2.5 ⇒ D410 V4.2 - PN V2.2 SINAMICS S120 V2.6.2).

---

#### Note

When replacing a device, note that the SINAMICS version of the new SIMOTION device must be the same or higher.

A downgrade to a lower SINAMICS version (e.g. SIMOTION D410-2 with SINAMICS V4.x to SIMOTION D410 with SINAMICS V2.x) is not possible.

---

When carrying out a "D410-2 DP/PN ⇒ D410-2 DP" device replacement, the PROFINET IO system is omitted and the bus interface changes. You must reconfigure this after the device replacement. Any existing PROFINET field devices on the PROFINET interface must be replaced with PROFIBUS field devices on the PROFIBUS interface.

### Migration D410 ⇒ D410-2

If a SIMOTION D410 is replaced with a SIMOTION D410-2, the SINAMICS Integrated is also automatically changed to a new type and the corresponding version.

## 8.3.7 Device replacement in HW Config

### Procedure

1. Double-click the SIMOTION device to be replaced in the project navigator in SIMOTION SCOUT. **HW Config** opens.
2. Open the "SIMOTION Drive Based" folder in the hardware catalog.

#### Note

SIMOTION D is modeled as a compact device in **HW Config**. When replacing a module, you must drag the new module to the header of the displayed module rack and **not to slot 2**. Ensure that you do not delete the D410-2 rack!

3. Drag-and-drop the new module to the header of the module rack.  
The old module is replaced.  
Alternatively, you can:
  - Select the rack header and double-click the new module in the module catalog to replace the previous module, or:
  - Right-click the rack header and select the "Replace object" option.

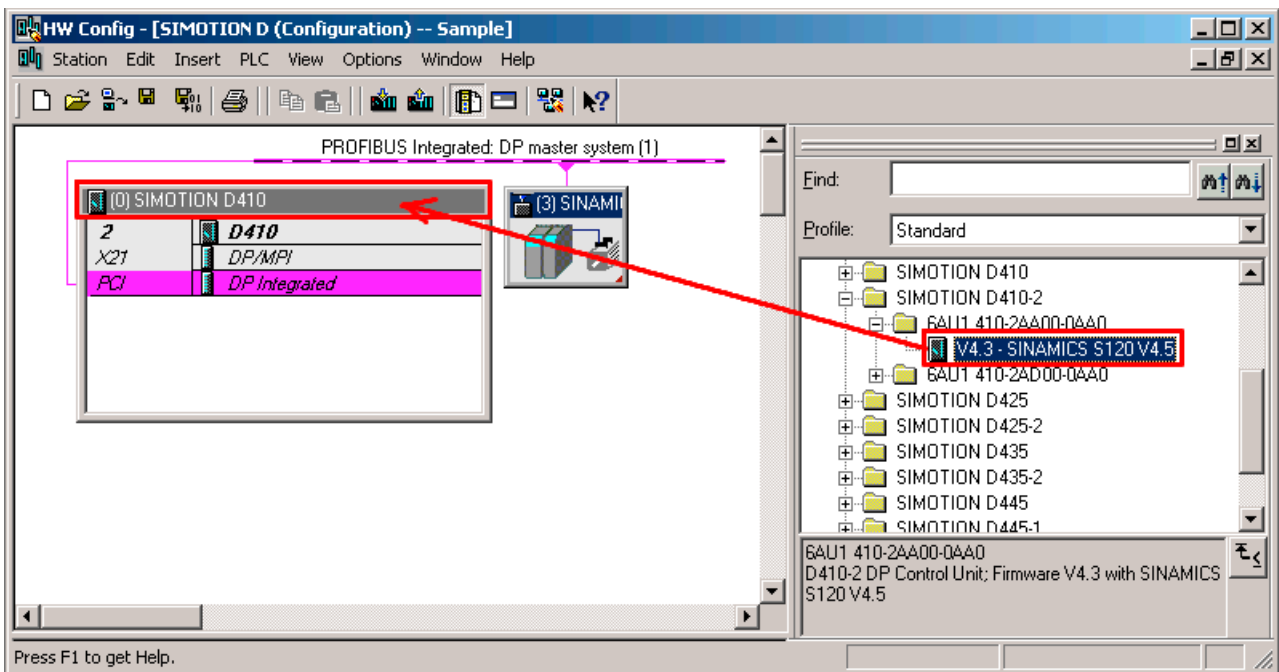


Figure 8-6 HW Config module replacement

4. Confirm the dialog box that appears with "Yes" to replace the SIMOTION device. The module is replaced.

5. Accept the changes made to the hardware configuration with "Station" > "Save and compile".
6. Close **HW Config**.

---

**Note**

The engineering system automatically performs the following actions when replacing a module (if necessary):

- Update of the technology packages (TPs)
- Automatic upgrade of the SINAMICS Integrated

The updated data is transferred to the project and the entire project saved.

---

### 8.3.8 Upgrading technology packages

#### Overview

The SIMOTION technology packages (e.g. TP CAM, DCBlib) are available in various versions.

You can only use the functions of the technology objects selected if the technology objects are available in the target system. You can select the technology packages and their version for each SIMOTION device. Each version of SIMOTION SCOUT has a kernel (FW version) for the SIMOTION CPU and an appropriate technology package.

#### TPs during upgrades

Device replacement (in **HW Config**), platform replacement (XML export/import), or even upgrades may cause versions of SIMOTION technology packages (TPs), which are assigned to individual technology objects (TOs), to change.

- The TP version may change if the main version changes.  
The TP version depends on the relevant main version in all cases; it may, however, remain unchanged through a number of main versions.
- If service packs and hotfixes are installed, there may even be a selection of TP product versions available for the same TP version.

**During device replacement (in HW Config)** the TP version is automatically updated. If the TP version is changed and more than one version of the new TP version is available, the latest version is automatically installed. If another product version is preferred, this must be set manually (e.g. selection of V4.1.5.3).

**During platform replacement (XML Export/Import)**, however, the required technology package including the TP version and, if necessary, the product version must be selected manually after the import.

**When a SIMOTION CPU is inserted**, the TP CAM (latest TP version and product version) is preset by default.



Special displays in the "version" field:

- "Select" means that no TP product version has been selected; this state occurs when older projects, in which the selection of a specific product version was not supported, are upgraded. If the project is loaded to the CPU without having previously made a selection, then the latest available technology package is loaded automatically.
- "---" means that no version can be determined (e.g. for the TP DCBlib or for older CPU versions < V4.1). If no version can be determined, you must select "---".

### Selecting the TP product version

The desired technology package is selected with fine granularity in SIMOTION SCOUT at "Target device" > "Select technology packages ...".

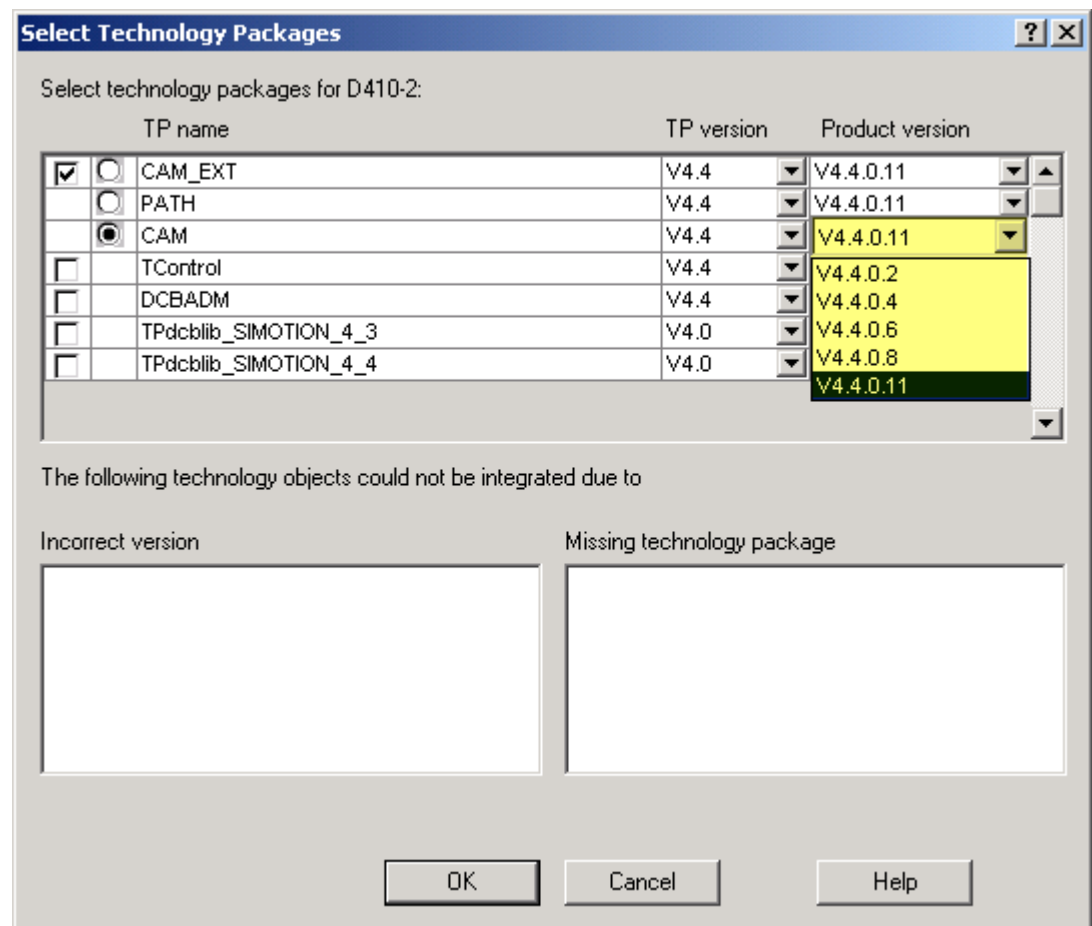


Figure 8-7 Selecting technology packages (based on the example of the D410-2)

#### Note

Device diagnostics can provide information on which technology package product version has been loaded to a CPU.

### Loading technology packages to the target device

Technology packages are only loaded to the target device if no technology package has been loaded so far or if "Load to file system" is executed.

If a technology package version changes, the technology package must be explicitly reloaded to the target device. To do this, proceed as follows:

1. Select "Download project to target system" in SIMOTION SCOUT.
2. Select the "Replace product versions of the technology packages" option at "Additional CPU options" and confirm with "OK".

For further information, please see the online help for SIMOTION SCOUT.

## 8.3.9 Upgrading the device version of SINAMICS S120 Control Units

### Overview

You can upgrade the device versions of SINAMICS S120 Control Units that are connected to the SIMOTION D via PROFIBUS or PROFINET in the SIMOTION SCOUT. The SINAMICS version can only ever be upgraded in a project; it cannot be downgraded.

---

#### Note

During device replacement in **HW Config**, the SINAMICS version of the SINAMICS Integrated of the SIMOTION D410-2 is automatically upgraded.

---

During module replacement in **HW Config**, the selection of a SIMOTION D410-2 module always defines the SIMOTION and the SINAMICS version.

If a SINAMICS S120 Control Unit is connected via PROFIBUS or PROFINET, the SINAMICS version can be selected independently of the SINAMICS Integrated version.

## Procedure

To upgrade a SINAMICS drive unit, proceed as follows:

1. Right-click the relevant device, e.g. the SINAMICS S120 CU310-2 DP.
2. Select "Target device" > "Upgrade Device Version/Characteristic" in the context menu. The "Upgrade Device Version/Characteristic" dialog box is displayed. It lists all available firmware versions.

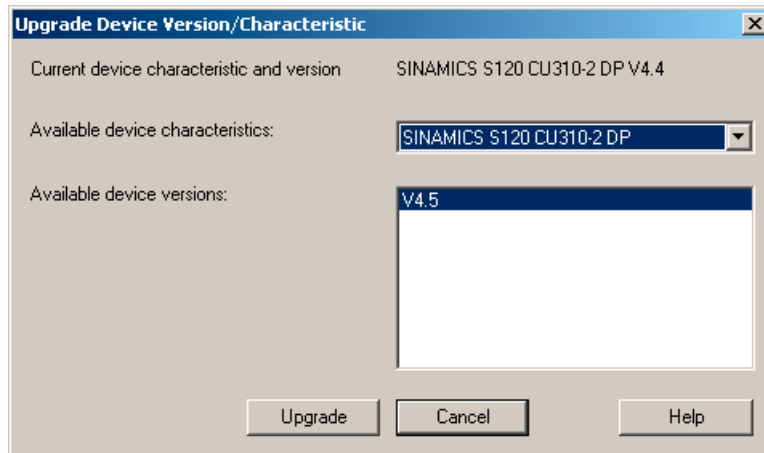


Figure 8-8 Upgrading the device version

3. Select the desired device version/characteristic and click "Upgrade". This upgrades the SINAMICS S120 Control Unit.

### 8.3.10 Upgrade the libraries

Depending on the configured properties of the libraries used in the project (device-dependent or device-independent), an upgrade of the libraries may be required if the SIMOTION device or the device version changes.

1. Open the LIBRARIES directory in the project navigator.
2. Select a library, right-click to open the context menu, and select "Properties...."
3. Select the "TPs/TOs" tab in the "Properties" window.
4. Select the SIMOTION device and the technology packages for which the library is to be valid.
5. Close the dialog box with "OK".

---

#### Note

Please also observe the notes on device-dependencies in the SIMOTION SCOUT online help.

---

### 8.3.11 Save project, compile and check consistency

#### Procedure

1. Save and compile the project from the "Project" > "Save and recompile all" menu.
  2. Then perform a consistency check with the "Project" > "Check consistency" menu.
- If error messages occur, correct these and repeat the operation.

---

#### Note

Note the difference between

- "Save and recompile all" and
  - "Save and compile changes"
- 

#### Save and recompile all

All sources of the entire project are recompiled with this command.

The command is suitable if you are quite sure that all the old data from older SCOUT versions should be removed and replaced with new compilation results.

**Use this command if you specifically want to convert a project from an earlier SCOUT version to a newer version.** In this way, you take over all error corrections and optimizations.

#### Save and compile changes

On this command, the whole project is searched for changes. Therefore only the changes are compiled. Use this command for day-to-day operations within a SCOUT version.

## 8.4 Performing a firmware and project update

### 8.4.1 Upgrading the boot loader on the CompactFlash card

The boot loader may have to be upgraded in the following cases:

- Upgrade of the SIMOTION D
- If a D4x5-2 CF card is to be used for a D410-2 (or vice versa).
- Error corrections and optimizations

Generally, we recommend using the latest boot loader available for the respective CF card.

Upgrading the SIMOTION D410-2 may also render it necessary to upgrade the boot loader of the CF card.

Detailed information on the CF card, boot loader version, SIMOTION D410-2 hardware, and SIMOTION firmware version compatibility relationships can be found in the software

compatibility list at Internet address (<https://support.industry.siemens.com/cs/ww/en/view/18857317>).

## 8.4.2 Update - preparatory measures

### Upgrading the SIMOTION D410-2

The actions described in this section also apply to downgrading to an older version.

Various options are available for performing a firmware and/or project update on the SIMOTION D410-2:

- Update via CompactFlash card (Page 265)
- Update via SIMOTION IT web server (Page 262)
- Firmware and project update using the device update tool (Page 262)

---

#### Note

Upgrading using the device upgrade tool offers a number of advantages (keeping retain data, option of downgrading, no license key handling, etc.).

We therefore recommend using this method for firmware and/or project updates.

---

### Requirement (firmware update)

The current firmware for SIMOTION D can be found on the Internet at Internet address (<https://support.industry.siemens.com/cs/ww/en/view/31045047>).

Upgrading the SIMOTION D410-2 automatically upgrades the firmware of all connected SINAMICS DRIVE-CLiQ components.

---

#### Note

Observe the information in the the Read Me files and the upgrade instructions included in the scope of delivery of new SIMOTION versions.

Use only CF cards that have been approved for use with the SIMOTION D410-2 and whose boot loader version is correct.

---

You can find the compatibility relationships in the software compatibility list at Internet address (<https://support.industry.siemens.com/cs/ww/en/view/18857317>).

<b>NOTICE</b>
<b>The upgrade operation deletes all project data and parameters from the CF card!</b>
Back up the data before starting an upgrade.

### Requirement (project update)

You have updated your project and, if necessary, adapted the device type and device version. See section Customizing the project (Page 249).

### 8.4.3 Update via SIMOTION IT web server

SIMOTION D410-2 has an integrated web server.

In addition to customized web pages and comprehensive device/diagnostic information, SIMOTION IT web server also allows you to update the firmware and project using a standard PC with a web browser.

You will find detailed information in the *SIMOTION IT Diagnostics and Configuration Diagnostics Manual*.

### 8.4.4 Upgrade via device update tool (upgrading SIMOTION devices)

#### Overview

SIMOTION D Control Units and projects can be upgraded using previously created upgrade data.

Performing an upgrade using upgrade data has the following advantages:

- User-friendly creation of upgrade data via SIMOTION SCOUT with the aid of a wizard (at the machine manufacturer's site)
- SIMOTION devices can be upgraded by the machine operator without the SIMOTION SCOUT engineering system
- The machine manufacturer can conveniently send upgrade data via e-mail or post to the machine operator
- There is no need to use license keys, as licenses are retained
- Retain data and unit data is retained when upgrades are performed, even across versions
- An upgrade which has been imported can be discarded again, and the previous configuration restored
- You can upgrade either a single SIMOTION device or multiple devices from one or more SIMOTION projects.
- It is possible to upgrade parts of a configuration only, e.g. Technology Packages only, firmware only, project only, etc.

## Handling

Upgrade data is created by the application engineer at the machine manufacturer's premises using SIMOTION SCOUT. The upgrade data can then be handled flexibly depending on both the SIMOTION device in question (SIMOTION C, D, or P) and the customer requirements:

- Creating upgrade data and then copying it to a storage or upgrade medium:
  - CF card
  - USB stick (D4x5/D4x5-2 only; not for D410-2)
  - Upgrade file for the SIMOTION IT web server
- Alternatively, the upgrade data can be created and stored in an archive on the PC, with a view to importing it to an upgrade medium suitable for SIMOTION devices at a later point.
- The process of importing the data to an upgrade medium can be performed at the machine manufacturer's premises; alternatively, if the upgrade archive has been transferred to the machine operator, the service engineer can do this on site.
- The service engineer imports the upgrade data on an operator-guided basis (without any involvement by the application engineer) to the SIMOTION device(s), and upgrades the SIMOTION devices in the process (SIMOTION SCOUT is not required on site).

---

### Note

If a SIMOTION D410-2 is upgraded with an upgrade archive of a SIMOTION D4x5-2, the upgrade and the later downgrade fail. In this case, a correct card image (firmware incl. project) must be loaded to the CF card.

---

## Upgrading with a CF card

1. Switch off the SIMOTION D410-2 to be updated.
2. Insert the CF card into the SIMOTION D410-2.
3. Switch on the SIMOTION D410-2 again. The SIMOTION D410-2 starts to process the upgrade data.  
The SF/BF LED flashes green (0.5 Hz) during the upgrade.
4. Monitor the green flashing of the SF/BF LED.
  - As soon as the upgrade has been completed successfully, the SF LED goes out. An automatic power-up with the upgraded configuration is then performed (SF/BF LED display then depends on the associated operating state of the device).
  - If the upgrade was not successful, the SF/BF LED flickers red.

## Downgrading

If the upgrade has not been successful (for example, the machine is not behaving as desired), the upgrade can be undone as follows:

1. Switch off the SIMOTION D410-2.
2. Set the service selector switch to the switch position B (service mode: downgrade).

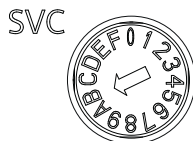


Figure 8-9 Service selector switch, switch position for downgrading

3. Switch the D410-2 on again.  
The flickering green SF/BF LED indicates that restoration is requested.
4. Set the service selector switch back to position "0."  
The system restores the data saved during the upgrade. The data from the upgrade will be deleted.

The downgrade is indicated by a green flashing SF LED (0.5 Hz) and can take several minutes. After successful restoration, the module starts up automatically. (SF/BF LED display will then depend on the respective operating state of the device).

If the restore was not successful, the SF/BF LED will flicker red.

---

### Note

For SIMOTION < V4.4, restoration will start when the module is switched on (step 3). For this, the service selection switch must be rotated to position "0" immediately when the flashing code is displayed (SF/BF LED flashes green with 0.5 Hz).

If the service selector switch is not reset or not reset in good time to "0," this results in fault state "Service selector switch is still set to restore" (SF/BF LED flickers red).

In this case, switch the D410-2 off, reset the service selector switch and switch the D410-2 on again. If the restoration was otherwise successful, the D410-2 boots up with the restored configuration.

---

### Note

The components' firmware is automatically updated, depending on the firmware version on the SINAMICS components and on the CF card. During a firmware update, please heed the messages and alarms in the SIMOTION SCOUT detail window. A firmware update on the SIMOTION D410-2 is signaled by the RDY LED flashing yellow, while on the DRIVE-CLiQ components (TM, SMC, etc.) it is signaled by the RDY LED flashing red/green.

- FW update running: RDY LED flashes slowly (0.5 Hz)
- FW update complete: RDY LED flashes quickly (2 Hz), POWER ON required

Components that require a POWER ON after the firmware update will indicate this through a rapidly flashing RDY-LED. Go offline with SCOUT and switch the 24 V supply off/on (POWER ON) at the respective components for initialization.

---



## Additional references

You will find detailed information for the device upgrade in the *Upgrading SIMOTION Devices Operating Instructions*.

## 8.4.5 Update via CompactFlash card

### 8.4.5.1 Backup of CompactFlash card data

#### Backing up licenses, retain data, and user data

Prior to upgrading/downgrading firmware, as a precaution we would generally recommend backing up the entire content of the CF card to the PG/PC using the card adapter and Windows Explorer.

How you should proceed to back up and subsequently restore data on the CF card depends on whether the CF data contains any licenses and/or other retain data and user data which will be required again in the future.

#### Case 1: The CF card contains no licenses and no retain or user data that is still required

You do not need to take any steps in this case. Delete the contents of the CF card and install the firmware as described.

#### Case 2: The CF card contains licenses (e.g. axis licenses)

Before loading the new firmware, back up the "KEYS" directory to your PC. This can then be copied back to the CF card once you have installed the new firmware.

---

#### Note

The license key is stored in the "KEYS" directory on the CF card. When the SIMOTION device starts up for the first time, the license key is saved in the boot sector of the CF card.

A license key saved in the boot sector cannot be deleted by means of a user operation; nor can it be deleted by formatting the CF card or rewriting the boot loader.

If the Keys.txt file is no longer present on the CF card (because the "KEYS" directory has been deleted, for example), it will be written again from the boot sector to the "KEYS" directory while the SIMOTION device is starting up. The license key can be changed at any time (by relicensing, for example). When the device is next started up, the license key will be saved in the boot sector again.

---

If you lose the license key, you can get it back via the Web License Manager on the Internet, at Internet address (<http://www.siemens.com/automation/license>). You require the hardware serial number printed on the CF card to do this. In the Web License Manager, you have the option of displaying the associated license key.

### Case 3: The CF card contains retain data / user data that is still required in the future

If you are using your application to back up data to the CF card, you must back this up before upgrading the new firmware.

Example:

- Backing up retain data (non-volatile data saved using `_savePersistentMemoryData`):
  - `user\simotion\pmemory.xml`
- Backing up SIMOTION IT user files, settings (e.g. `trace.xml`), task trace data, log files, and Java files (classes, archives, user data system, etc.), stored in the following directories:
  - `user\simotion\hmicfg`
  - `user\simotion\hmi`
- Backing up configuration data for modular machines in conjunction with the `_activateConfiguration` system function, stored in the following directory:
  - `install\simotion`
- Backing up unit data (data saved on the CF card using `_saveUnitDataSet/ _exportUnitDataSet`), stored in the following directory:
  - `user\simotion\user dir\<<unitname>`

---

#### Note

When a version is changed, you must use the "Save variables" function to back up data saved using `_saveUnitDataSet` or `_exportUnitDataSet` in a way that is not dependent on the version. You then have the option of restoring them using "Restore variables."

During an upgrade, the two functions are required only for the backup and restore of unit data records created with `_saveUnitDataSet`.

Retain and unit data (saved with `_exportUnitDataSet`) remain valid even after a version upgrade.

---

#### 8.4.5.2 Firmware update using a CompactFlash Card

##### Procedure

Proceed as follows to perform the upgrade:

1. Switch off the power to the SIMOTION D410-2.
2. Remove the CF card from the SIMOTION D410-2 and insert it into the CF card adaptor of your PC.
3. Open Windows Explorer. The CF card must be visible as a removable data carrier in the Windows Explorer under an arbitrary drive letter.
4. If necessary, back up the licenses, retain data and user data on the CF card to your PC (see Backup of CompactFlash card data (Page 265)).
5. Delete all the data from the CF card.

6. Unzip the firmware file to the CF card using a ZIP file utility such as WinZip. Always maintain the file structure when setting up the unpacking tool.
7. Copy the data saved in step 4 back to the appropriate folder structure on the CF card.
8. Remove the CF card from the CF card adapter on your PG/PC.
9. Insert the CF card into the SIMOTION D410-2.
10. Switch on the power supply for the SIMOTION D410-2. The new firmware is loaded from the CF card to the SIMOTION D410-2 module.

### 8.4.5.3 Upgrading SINAMICS

Depending on the settings, the SINAMICS components are also automatically upgraded to the component version of the CF card with a firmware update of the SIMOTION D.

In order for a FW update to be performed for all components, the components must be correctly connected in accordance with the configured topology.

The CONTENT.TXT file in the main directory of the CF card contains the component version.

### Upgrading the firmware of SINAMICS components automatically

When starting up, the system automatically upgrades or downgrades all DRIVE-CLiQ components to the version of the component firmware on the CF card. Components that cannot be downgraded to the component firmware version on the CF card (for example, old firmware on the CF card and new components to which the old firmware cannot be loaded) retain their firmware version. The resulting firmware version combinations are always functional.

---

#### Note

The components' firmware is automatically updated, depending on the firmware version on the SINAMICS components and on the CF card. During an FW update, please take note of the messages and alarms in the SIMOTION SCOUT detail window. A firmware update on the SIMOTION D410-2 is signaled by the RDY LED flashing yellow, while on the DRIVE-CLiQ components (TM, SMC, etc.) it is signaled by the RDY LED flashing red/green.

- FW update running: RDY LED flashes slowly (0.5 Hz)
- FW update complete: RDY LED flashes quickly (2 Hz), POWER ON required

Components requiring POWER ON following a firmware update signal this by means of the fast flashing RDY LED. Go offline with SCOUT and switch the 24 V supply to the relevant components off/on (POWER ON) to initialize.

---

### Updating the firmware of the SINAMICS components

The SINAMICS components' firmware is updated automatically, depending on the setting of parameter p7826.

- p7826 = 0: Upgrade/downgrade deactivated
- p7826 = 1: Upgrade and downgrade (factory setting)
- p7826 = 2: Upgrade only

---

#### Note

The automatic FW update via p7826 = 1 (upgrade and downgrade) must not be deactivated when Safety Integrated is used.

---

If you are updating the firmware manually, proceed as follows:

1. Select the SINAMICS component in the Project Navigator, e.g. SINAMICS Integrated.
2. Double-click "Overview" in the Project Navigator.  
The "SINAMICS\_Integrated - Overview" dialog box opens with a list of available drive objects.
3. Click "Version overview" to open the list of connected SINAMICS components.
4. Go online and select the devices whose firmware you wish to update.  
The list displays the current firmware version of the devices.
5. Click "Firmware update" to download the new firmware to the devices. To do so, you must select all components whose firmware is to be updated.
6. When the firmware update is complete, switch the 24 V power supply off and back on again.  
The device is now ready for operation.

---

#### Note

The SINAMICS components must be configured for a firmware update to take place. The firmware cannot be updated if the components have not been configured.

You can also update the firmware using the expert list. See the *SINAMICS S120* Commissioning Manual for a description of how to do this.

---

#### 8.4.5.4 Download project to target system

Once all the changes required for upgrading your project have been made, you must download the project to the SIMOTION D410-2.

#### Requirement

The firmware required is located on the CompactFlash card; for information, refer to the section titled Firmware update using a CompactFlash Card (Page 266).

You have recompiled the project and checked it for consistency. See Section Save project, compile and check consistency (Page 260).

## Procedure

1. Save and compile the project.
2. Click "Connect to selected target systems" to establish a connection to the target system.
3. Execute "Download project to target system" and then "Copy RAM to ROM" to download the upgraded project to the CompactFlash card as well.
4. Because of the automatic follow-up configuration in the SINAMICS Integrated drive, you must now execute "Load CPU / drive unit to PG".
5. Save the project.

---

### Note

When upgrading SINAMICS drive units (e.g. SINAMICS Integrated) only the p parameters (setting parameters) are loaded into the upgraded project. The r parameters (monitoring parameters) are not loaded.

The r parameters in the drive unit are derived or calculated from an automatic subsequent parameterization and must therefore be uploaded to the project.

To do this, execute "Load CPU/drive unit to PG".

If the upload cannot be performed, this can lead to inconsistencies in the drive parameterization dialog boxes.

---

## 8.5 SIMOTION CompactFlash card

### 8.5.1 Changing the CompactFlash card

#### Requirement

<b>NOTICE</b>
<b>Damage to the CompactFlash card from electrical fields or electrostatic discharge</b>
The CompactFlash card is an ESD-sensitive component.
De-energize the SIMOTION D410-2 device before inserting or removing the CompactFlash card. The SIMOTION D410-2 is in a de-energized state when all the LEDs are OFF.
Comply with the ESD rules.

## Procedure

To change the CF card, proceed as follows:

1. Switch off the power supply.
2. Remove the CF card from the plug-in slot on the SIMOTION D410-2.  
To do this, grasp the gripping cavity between your thumb and forefinger and pull the card out.
3. Gently insert the new CF card into the empty plug-in slot until it clicks into place. The direction of insertion of the CF card is indicated by an arrow located on both the plug-in slot and the CF card.  
The properly inserted card does not protrude from the SIMOTION D410-2 housing.
4. Switch the power supply on again.

## 8.5.2 Writing to a CompactFlash card

### Overview

You have the following options of writing data to a CompactFlash card:

- Writing to a CompactFlash card that is inserted in a SIMOTION D  
The PG/PC must be online to SIMOTION D410-2 in order to execute this function.
- Writing to a CompactFlash card without a SIMOTION D module  
This function requires a CompactFlash card adapter.

---

#### Note

CompactFlash cards are always shipped in formatted state. It contains the SIMOTION Kernel (SIMOTION D firmware).

Trouble-free operation of the CompactFlash card can only be guaranteed if you do not modify its partitioning.

---

### Writing to a CompactFlash card that is inserted in the SIMOTION D

The CompactFlash card can be used as storage volume for technology and user data (programs, configuration data and parameters) from the "volatile data" area. Proceed as follows:

1. Establish the connection between the SIMOTION D410-2 and the PG/PC (see Section Creating a project and configuring the communication (Page 87)).
2. Select the "Copy RAM to ROM" command in SIMOTION SCOUT to write the data to your CompactFlash card.

### Writing to a CompactFlash card without a SIMOTION D module

A CompactFlash card adapter must be installed on the PG/PC and can be used to write data to the CompactFlash card. Always save your project data to CompactFlash card using the PG/PC before you update the SIMOTION firmware, for example.

---

**Note**

Do not use any of the onboard tools in Windows to modify or delete files which were written to the CompactFlash card using the "Copy RAM to ROM" function in SIMOTION SCOUT. Such actions may irrevocably destroy your project.

---

### 8.5.3 Formatting the CompactFlash card

You can format a faulty CF card, for example.

Before formatting the CF card, please observe the notes in Section Backup of CompactFlash card data (Page 265).

Proceed as follows to format the CF card:

1. Insert the CF card into a CF card adapter connected to your PG/PC.
2. Format the CF card in Windows (FAT, FAT16 or FAT32 file system).  
The CF card is formatted.
3. If the CF card boot loader is also defective, you will have to rewrite it.

---

**Note**

The CF card may not be formatted with NTFS.

The following formats are permitted: FAT, FAT16 and FAT32.

Because of the improved memory utilization on the CF card, FAT32 formatting is preferable. SIMOTION D410-2 CF cards are supplied as standard with FAT32 formatting.

---

### 8.5.4 Boot loader on the CompactFlash card

#### Writing a boot loader

A boot loader may need to be written in the following situations:

- A new boot loader is required for the used SIMOTION D410-2 firmware version.
- A new boot loader is required for the used SIMOTION D410-2 hardware.
- The boot loader is defective.
- A D4x5-2 CF card is to be used for SIMOTION D410-2.

The boot loader version can be fetched using SIMOTION SCOUT device diagnostics. If this is not possible, the boot loader version may be incorrect.

8.5 SIMOTION CompactFlash card

A potential fault description could be as follows:

The SIMOTION D410-2 does not power up, the RDY LED flashes red at 0.5 Hz and the RUN/STOP LED lights up red, or all the LEDs remain off.

In this case, replace the boot loader version with the current version.

Use the "Options > Write boot sector..." function to write the boot loader version in SIMOTION SCOUT to the CF card.

---

**Note**

You require PG/PC administrator rights to write to the boot sector. If you do not have administrator rights on your PG/PC, an administrator can enter an administrator login for you to use this function at "Options" > "Settings" > "Rights."

---

Detailed information on the CF card, boot loader version, SIMOTION D410-2 hardware, and SIMOTION firmware version compatibility relationships can be found in the software compatibility list at Internet address (<https://support.industry.siemens.com/cs/ww/en/view/18857317>).

---

**Note**

Note that the CF cards for SIMOTION D4x5-2 and D410 can have a different boot loader!

---

## 8.5.5 Recommended method of handling CompactFlash cards

### Handling CF cards correctly

Note the following points when working with the CF card:

- The CF card may only be inserted or removed when the system is de-energized.

<b>NOTICE</b>
<b>Damage to the CompactFlash card from electrical fields or electrostatic discharge</b>
The CompactFlash card is an ESD-sensitive component.
De-energize the SIMOTION D410-2 device before inserting or removing the CompactFlash card. The SIMOTION D410-2 is in a de-energized state when all the LEDs are OFF.
Comply with the ESD rules.

- CF cards are not designed to be rewritten as many times as the user wishes. With this in mind, you should avoid writing user data from the application to the CF card cyclically. Depending on the system, a write operation from the application may trigger one or more write operations on the CF card. We therefore recommend that the user program does not make more than 100,000 write accesses over the estimated service life of the application.



- Never switch off the SIMOTION D Control Unit during write accesses to the CF card. If the SIMOTION D Control Unit is switched off during write accesses, this can result in destruction of the data and, in the worst case, to damage to the file system (FAT Table = directory) on the CF card.  
If the FAT table is destroyed, the CF card will have to be reformatted and the firmware/user data reloaded. During this process the licenses remain on the CF card.  
The FAT table can be destroyed if updating the FAT table is interrupted by switching off the SIMOTION D Control Unit. The FAT table is updated, for example, by functions such as **\_exportUnitDataSet**, copy RAM to ROM, or save SINAMICS NVRAM data via p7775.  
The FAT table can also be destroyed if you pull a CF card out of a CF card adapter while Windows is accessing the CF card.
- The following functions do not update the FAT table:
  - **\_saveUnitDataSet** (writing the data to an existing file)
  - **savePersistentMemoryData** (as of V4.4: writing the data to an existing file)Once the backup files have been created with **\_saveUnitDataSet** / **savePersistentMemoryData**, this also results in updating the FAT table.

### 8.5.6 Card reader for CompactFlash cards

Because of the quickly changing market and the large differences in the quality of card readers, no specific recommendation can be made (except for the following card reader).

If problems occur identifying the CF card, this may be due to an incorrect power up of the card reader.

#### Designation and ordering data

Card reader for CF/SD memory media  
with USB connection  
Article number: 6FC5 335-0AA00-0AA0

### 8.5.7 License key on the CF card

Depending on the type and number of runtime functions used in the project, licenses must be purchased as part of the licensing procedure for SIMOTION.

For further information on the licensing of runtime functions, see (<https://support.industry.siemens.com/cs/en/en/view/42014324>)

The licenses required for SIMOTION D are assigned to an individual license key for the CF card (license key cannot be transferred to another CF card).

The license key must be stored in the \KEYS\SIMOTION directory in the keys.txt file on the CF card.

## Backup in the boot sector

The license key is stored in the "KEYS" directory on the CF card. When the SIMOTION D Control Unit is ramped up for the first time, the license key is backed up in the boot sector of the CF card.

A license key saved in the boot sector cannot be deleted by means of a user operation; nor can it be deleted by formatting the CF card or rewriting the boot loader.

If the keys.txt file is no longer present on the CF card (e.g. because the "KEYS" directory has been deleted), it will be written again from the boot sector to the "KEYS" directory while the SIMOTION D Control Unit is ramping up. The license key can be changed at any time (e.g. through relicensing). At the next power-up, the license key is backed up in the boot sector again.

## Loss of the license key

In the event of the loss of a license key, a copy can be obtained via the Web License Manager at the following Internet address (<http://www.siemens.com/automation/license>). You require the hardware serial number printed on the CF card to do this. You can display the associated license key in the Web License Manager. The license file (Keys.txt) is also offered as download.

## Notes for Keys.txt

- If a firmware card image is unpacked on the CF card, a KEYS directory is not available per default.
- If the CF card ramps-up **without a KEYS directory** in a controller, an empty file structure (\KEYS\SIMOTION) is created.
- The keys.txt must be stored in this directory (\KEYS\SIMOTION\keys.txt).
- If the directory contains a keys.txt with an invalid license key, this is deleted from the keys.txt when the controller ramps up, i.e. the keys.txt file exists, but is empty.
- If the directory contains a keys.txt with a valid license key, this is also stored in the boot sector of the CF card as backup when the controller ramps up.
- The keys.txt can be written online via SCOUT, with a CF card reader, or via a set up remote access (FTP).
- When licensing via the Web License Manager, you receive a keys.txt that you must store on the CF card under \KEYS\SIMOTION
- It is also possible to create this text file yourself (without formatting) with a text editor (e.g. Notepad). In this case, make sure that only the license key and a line break (CR/LF) is contained in the file.
- If the SF LED flashes slowly in red (0.5 Hz) after the control has ramped up, then either the keys.txt file is faulty (error in the license key, formatting or file/directory name) or the licensing is not adequate for the used objects that require a license.

## Diagnostics

### 9.1 Diagnostics via LED displays

#### Overview

The status LEDs display the operating states or fault states of SIMOTION D410-2. They do so by illuminating, flashing, or flickering in different colors.

#### Arrangement of LED displays

The front side of the SIMOTION D410-2 has four LED displays arranged vertically one above the other.



Figure 9-1 LED displays: D410-2 DP (pictured on the left), D410-2 DP/PN (pictured on the right)

#### Legend of the LED states

The LED displays can assume the following illumination states.

Table 9-1 Table with explanation of the LED states

Symbol	Meaning
1	LED static ON
0	LED off
0.5/1	LED flashes at 0.5 Hz:
2/1	LED flashes at 2 Hz:
Λ	LED flickers
x	Any LED state

**LED displays**

The two tables below provide an overview of all relevant LED display combinations. Every LED can illuminate in yellow, red, or green. The color which corresponds with the LED signal state is also defined.

Table 9-2 SIMOTION D410-2 DP and D410-2 DP/PN: Diagnostics by means of LED display

Meaning	Display priority <sup>1)</sup>	RDY	RUN/STOP	OUT>5V OUT>5V/SY <sup>2)</sup>	SF/BF:
<b>States during power-up</b>					
Hardware reset Power-up of the D410-2 without a CF card or power-up with a CF card (CF card with incorrect / missing / faulty boot loader or without a valid operating system)	1	1 (yellow)	1 (yellow)	1 (yellow)	1 (yellow)
Firmware error <ul style="list-style-type: none"> <li>No or incorrect firmware on the CF card</li> <li>File system of the CF card is destroyed (e.g through power off during writing operation)</li> </ul>	x <sup>3)</sup>	2/1 (red)	0	0	2/1 (red)
Firmware checked (checksum incorrect)	x <sup>3)</sup>	0.5/1 (red)	0	0	0.5/1 (red)
Firmware being loaded	x <sup>3)</sup>	∧ (yellow)	0	0	1 (red)
<b>SIMOTION states</b>					
Write/read SIMOTION access to CF card	1	∧ (yellow)	x	x	x
"FAULT" state (F state) Fault to which the user program (SIMOTION) cannot respond (e.g. overtemperature). The following actions may be required to rectify the fault: <ul style="list-style-type: none"> <li>Power OFF/ON</li> <li>Check of the CF card</li> <li>Re-commissioning</li> <li>Replace the SIMOTION D410-2</li> </ul>	2	∧ (red)	∧ (red)	∧ (red)	∧ (red)

Meaning	Display priority <sup>1)</sup>	RDY	RUN/STOP	OUT>5V OUT>5V/SY <sup>2)</sup>	SF/BF:
DCP flashing (for interface X150, X127) This function is used to check the correct assignment to a module and its interfaces. DCP flashing of the module is activated in HW Config under "Target system" > "Ethernet" > "Edit Ethernet node" > "Browse" button > "Flashing" button	3	x	x	x	2/1 (green)
PROFIBUS DP interface bus error <ul style="list-style-type: none"> <li>PROFIBUS master: At least one slave is missing</li> <li>PROFIBUS slave: No parameter assignment master available</li> </ul>	4	x	x	x	2/1 (red)
Communication error PROFINET <sup>7)</sup>	4	x	x	x	2/1 (red)
An interrupt that can be acknowledged (alarm, message, note) is pending	5	x	x	x	1 (red)
Underlicensing of technology/option objects	6	x	x	x	0.5/1 (red)
SIMOTION ready for operation	6	x	Static/flashing (green or yellow)	x	x
RUN	6	x	1 (green)	x	x
Transition from STOP/STOPU to RUN	6	x	2/1 (green)	x	x
STOP/STOPU	6	x	1 (yellow)	x	x
Transition <ul style="list-style-type: none"> <li>from RUN to STOP/STOPU</li> <li>STOP to STOPU</li> <li>STOPU to STOP</li> </ul>	6	x	2/1 (yellow)	x	x
Service operating state (axis control panel in the STOPU/measuring function)	5	x	2/1 (yellow/green)	x	x
General reset requested by SIMOTION D410-2 or with the mode switch	5	x	0.5/1 (yellow)	x	x
General reset in progress	5	x	0	x	0
General reset stopped (STOP)	6	x	1 (yellow)	x	x
<b>States of the SINAMICS Integrated (LED RDY)</b>					

9.1 Diagnostics via LED displays

Meaning	Display priority <sup>1)</sup>	RDY	RUN/STOP	OUT>5V OUT>5V/SY <sup>2)</sup>	SF/BF:
Updating the firmware of the DRIVE-CLiQ components	6	0.5/1 (yellow)	x	x	x
Firmware update of the connected DRIVE-CLiQ components has been completed (Power OFF/ON of the upgraded/downgraded devices is required)	6	2/1 (yellow)	x	x	x
Detection of the components via LED <b>Note:</b> The displayed color combination depends on the p0124[0] parameter =1 yellow/green flashing =0 yellow/red flashing	6	2/1 (yellow/green) (yellow/red)	x	x	x
Commissioning/reset	6	0.5/1 (green)	x	x	x
Write/read SINAMICS access to CF card	6	∧ (yellow)	x	x	x
SINAMICS Integrated ready for operation	6	1 (green)	x	x	x
SINAMICS Integrated in fault state (Check parameterization/configuration)	6	2/1 (red)	x	x	x
Underlicensing SINAMICS functions <sup>6)</sup>	6	x	x	x	0.5/1 (red)
SIMOTION IT service mode / switch position 8 for 120 minutes.	6	x	x	x	0.5/1 (red)
<b>Backing up and restoring diagnostic data and non-volatile SIMOTION data</b>					
Backing up diagnostic data and non-volatile SIMOTION data (back-up running)	4	x	∧ (yellow)	x	x
Backing up diagnostic data and non-volatile SIMOTION data (back-up completed)	4	x	∧ (green)	x	x
Request: "Restore non-volatile data" (with switch position "A")	4	x	x	x	∧ (green)
<b>Upgrading SIMOTION devices (device update tool)</b>					
Restoration requested		x	x	x	∧ (green)
Upgrade/downgrade running		x	x	x	0.5/1 (green)
Upgrade/downgrade completed with error		x	x	x	∧ (red)
Upgrade/downgrade completed without error		x	x	x	0 <sup>4)</sup>

Meaning	Display priority <sup>1)</sup>	RDY	RUN/STOP	OUT>5V OUT>5V/SY <sup>2)</sup>	SF/BF:
<b>Encoder power supply <sup>5)</sup></b>					
The electronics power supply is missing or outside the permissible tolerance range. Power supply ≤ 5 V. Use of an encoder with 5 V power supply.		x	x	D410-2 DP: 0	x
				D410-2 DP/PN: 0 1 2/1 (green)	
Electronics power supply for measuring system available. Power supply >5 V. <b>Notice:</b> Always ensure that you can operate the connected encoder on a 24 V power supply (e.g. HTL encoder). Operation of a 5 V encoder on the 24 V encoder supply may result in the destruction of its electronic components! This setting can be selected in the expert list of the drive in parameter p0405.1.		x	x	D410-2 DP: 1 (yellow)	x
				D410-2 DP/PN: 0.5/1 1 2/1 (yellow)	

- 1) Priority of the displays: The displays always visualize the state assigned the highest priority. "1" has the highest priority. The state of the next lower priority class is displayed after the cause of the previous signal state was eliminated. If a state does not have any specified priority, no other state other than the associated state can occur.
- 2) Labeling of LEDs:  
D410-2 DP: OUT>5V  
D410-2 DP/PN: OUT>5V/SY
- 3) States occur in succession during power-up.
- 4) The upgrade or downgrade has been completed when the SF/BF LED goes out. The device then powers up automatically in the upgraded or downgraded configuration (the SF/BF LED display then depends on the operating state of the device).
- 5) The "OUT>5V" or "OUT>5V/SY" LED display indicates whether the encoder supply level is > 5 V. In the case of SIMOTION D410-2 DP/PN, not only is the configured encoder supply indicated, but also the state of PROFINET interface synchronization to the send cycle clock. See the following table.
- 6) In the case of SINAMICS licenses (e.g. SINAMICS DCB Extension), underlicensing of SINAMICS Integrated via the flashing SF-LED is indicated on the SIMOTION D Control Unit. An entry is also made in the diagnostic buffer and the underlicensing is displayed in the license dialog box of SIMOTION SCOUT. The licensing is effected (like for SIMOTION licenses) via SIMOTION SCOUT or via the SIMOTION license key on the CF card.
- 7) PROFINET communication error  
As IO controller:  
- Failure of a connected I/O device  
- At least one of the assigned I/O devices cannot be addressed  
- Incorrect or no configuration  
As I-Device:  
The LED flashes until at least one controller has correctly established communication with this I-Device.  
Possible causes:  
- IP address is incorrect  
- Incorrect configuration / parameterization  
- IO controller not available / switched off, but Ethernet connection is established.  
- In Shared IDevice operation: All configured IO controllers are not available / switched off, but Ethernet connection is established (link established to a neighboring device)  
- Incorrect or missing device name

9.1 Diagnostics via LED displays

- The response monitoring interval has elapsed
- The CPU is I-Device and the communication to the higher-level controller fails

Table 9-3 SIMOTION D410-2 DP/PN: SYNC state of the PROFINET IO interface diagnosed via the OUT>5V/SY LED display

Meaning	SYNC state LED display <sup>1)</sup>	
	Encoder supply ≤ 5V	Encoder supply > 5V
<p>The PROFINET interface has not synchronized yet to the send cycle clock of PROFINET IO with IRT, or PROFINET IO with IRT has not been configured (e.g. only PROFINET IO with RT or TCP/IP communication).</p> <p>If IRT data has been configured for SIMOTION, the PROFINET interface generates a local substitute cycle clock as long as there is no synchronization to the send cycle clock of PROFINET IO with IRT:</p> <p>SIMOTION task system has synchronized to the local substitute cycle clock of the PROFINET interface. SINAMICS Integrated and the external isochronous DP interface are synchronized to the local substitute cycle clock of the PROFINET interface.</p>	0	0.5/1 (yellow)
<p>The PROFINET interface has synchronized to the send cycle clock of PROFINET IO with IRT.</p> <p>If isochronous IRT data has been configured for SIMOTION, then the following applies:</p> <p>The task system of SIMOTION has synchronized to the send cycle clock of PROFINET IO with IRT.</p> <p>SINAMICS Integrated and the external isochronous DP interface are synchronized to the send cycle clock of PROFINET IO with IRT.</p> <p>If no isochronous IRT data has been configured for SIMOTION, this state indicates that only the PROFINET interface is synchronized to the send cycle clock of PROFINET IO with IRT. The PROFINET interface is then used to forward the IRT data.</p>	1 (green)	1 (yellow)
<p>The PROFINET interface has synchronized to the send cycle clock of PROFINET IO with IRT</p> <p>If IRT data has been configured for SIMOTION, then the following applies:</p> <p>The task system of SIMOTION has synchronized to the send cycle clock of PROFINET IO with IRT.</p> <p>SINAMICS Integrated and the external isochronous DP interface are not yet synchronized to the send cycle clock of PROFINET IO with IRT.</p>	2/1 (green)	2/1 (yellow)

<sup>1)</sup> How the colors are assigned differs from the SYNC color code used for other SIMOTION devices.

**Additional references**

You will find detailed information in the *Upgrading SIMOTION Devices Operating Instructions*.



## LED displays of the PROFINET interface

The PROFINET ports X150 P1 and P2 have 2 integrated LEDs each for displaying link and activity.

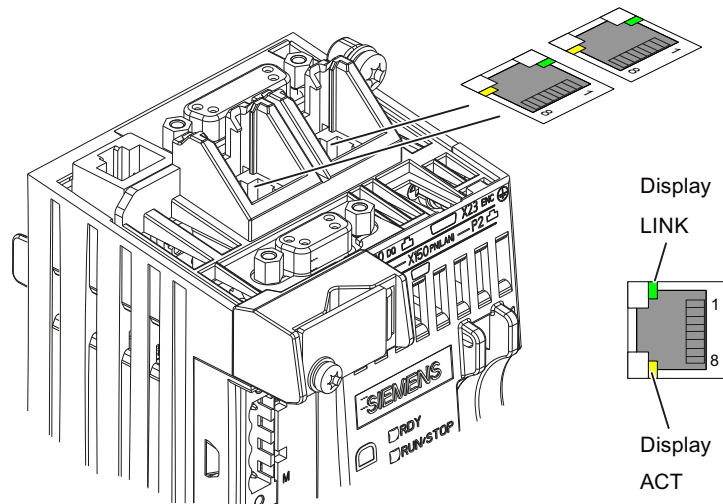


Figure 9-2 PROFINET ports of the D410-2 DP/PN

Table 9-4 State of the Link and Activity LEDs

LED	State	Meaning
LINK	OFF	No or faulty connection
	Lights up green	Transfer rate 10 or 100 Mbit/s: A different device is connected to port x and a physical connection exists
ACT	OFF	No data exchange
	Flickers yellow	Data exchange: Data is being received or sent at port x.

## 9.2 Diagnostic data and non-volatile SIMOTION data

### 9.2.1 Overview

On the basis of simple operations (e.g. by setting the switch position) and without the need for the SIMOTION SCOUT engineering system, you can

- Back up diagnostic data, including non-volatile SIMOTION data (retain data) on a CF card:
  - Save diagnostic data during running operation (Page 283)
  - Save diagnostic data during the startup (Page 284)
- Back up HTML pages (including the most up-to-date content) to the CF card for diagnostic purposes; for information, see Section Diagnostics via HTML pages (Page 287).
- Restore backed-up non-volatile SIMOTION data (retain data); for information, see Section Delete/restore non-volatile SIMOTION data (Page 288).

### 9.2.2 Backup of diagnostic data and non-volatile SIMOTION data

#### 9.2.2.1 Diagnostics data

Following a fault on a SIMOTION device, diagnostic data (e.g. diagnostic buffer content, up-to-date content of HTML pages, etc.) can provide important information on the cause of the fault. For this purpose, data can be backed up to the CF card with a "simple operator action" (e.g. via service selector switch or DIAG button on the SIMOTION D410-2).

You then have the following options for the diagnostic data:

- Fetching them from the CF card using a card reader
- You can load it with the SIMOTION IT web server or by FTP

You can also use them for diagnostic purposes or provide Technical Support with them for evaluation purposes.

Various options are available to you for backing up diagnostic data:

- Backup during operation (in STOP/STOPU/RUN operating state)
  - with SIMOTION IT web server;  
The web server also offers the possibility of fetching the diagnostic data online.
  - Via the DIAG button
  - Via the service selector switch
- Backup during the module startup
  - Via the DIAG button
  - Via the service selector switch
  - Controlling diagnostic data creation using an INI file stored on the CF card

### 9.2.2.2 Non-volatile SIMOTION data (retain data)

In addition to the diagnostic data, non-volatile SIMOTION data (retain data) is also saved on the CompactFlash card. Use the function when the non-volatile SIMOTION data has not been saved on the CompactFlash card using the `_savePersistentMemoryData` system function but you wish to restore the non-volatile SIMOTION data after a CPU has been replaced.

---

#### Note

While the non-volatile SIMOTION data is stored as a "PMEMORY.XML" backup file in the "...USER\SIMOTION" directory using the `_savePersistentMemoryData` system function, backing up diagnostic data and non-volatile data stores the data in the "...USER\SIMOTION\HMI\SYSLOG\DIAG" directory.

---

### 9.2.3 Save diagnostic data during running operation

#### Options

The advantage of backing up diagnostic data and non-volatile SIMOTION data during operation is that enhanced diagnostic information via HTML pages and TO alarm information is available.

Data are backed up:

- Using "Diagnostics > Diagnostics Files" in SIMOTION IT web server; see Section Back up diagnostic data and non-volatile SIMOTION data via the web server (Page 290)
- Via the DIAG button
- Via the service selector switch

#### Backup of the data via the DIAG pushbutton (preferred solution)

The diagnostic data and non-volatile SIMOTION data can be created in the STOP, STOPU, and RUN operating states.

1. Press the DIAG pushbutton.  
The diagnostic data and non-volatile SIMOTION data are backed up to the CF card. The backup task progress is displayed by the RUN/STOP LED flickering yellow.
2. The backup is finished when the RUN/STOP LED flickers green.  
Switch off the SIMOTION D410-2.
3. Remove the CF card.

#### Backup of the data using the service selector switch (alternative)

The positions of the mode switch are not relevant, i.e. the set operating mode remains unchanged.

The diagnostic data and non-volatile SIMOTION data can be created in the STOP, STOPU, and RUN operating states.

1. Set the service selector switch to "Diagnostics" ("D" position).

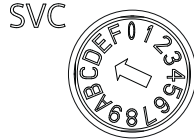


Figure 9-3 Service selector switch (position D)

The diagnostic data and non-volatile SIMOTION data are backed up to the CF card. The backup task progress is displayed by the RUN/STOP LED flickering yellow.

2. The backup is finished when the RUN/STOP LED flickers green. Switch off the SIMOTION D410-2.
3. Remove the CF card and reset the service selector switch to its original setting.

### 9.2.4 Save diagnostic data during the startup

#### Options

Backing up diagnostic data and non-volatile SIMOTION data during power-up provides you with diagnostic information **without HTML pages / TO alarm information**.

"Backing up during startup" is particularly advisable for SIMOTION devices that cannot run or have crashed.

Diagnostic data and non-volatile SIMOTION data are backed up

- Via the service selector switch
- Via the DIAG button
- Using an INI file saved on the CF card.

#### Backup of the data using the service selector switch (alternative)

The positions of the mode switch are not relevant, i.e. the set operating mode remains unchanged.

1. Set the service selector switch to "Diagnostics" ("D" position).

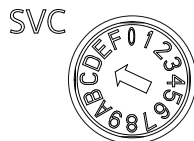


Figure 9-4 Service selector switch (position D)

2. Switch the SIMOTION D410-2 off and on again.

3. Wait for the device to ramp up.  
The diagnostic data and non-volatile SIMOTION data are backed up to the CF card during power-up provided this is still possible and is not prevented by hardware defects, etc.  
The backup task progress is displayed by the RUN/STOP LED flickering yellow.
4. The backup is finished when the RUN/STOP LED flickers green.  
Switch off the SIMOTION D410-2.
5. Remove the CF card and reset the service selector switch to its original setting.

### Backup of the data via the DIAG pushbutton (alternative)

1. Switch off the SIMOTION D410-2.
2. Press the DIAG button and hold it down. Switch on the SIMOTION D410-2 again.
3. Wait for the device to ramp up.  
The diagnostic data and non-volatile SIMOTION data are backed up to the CF card during power-up provided this is still possible and is not prevented by hardware defects, etc.  
The backup task progress is displayed by the RUN/STOP LED flickering yellow.
4. The backup is finished when the RUN/STOP LED flickers green.  
Release the DIAG pushbutton and switch the SIMOTION D410-2 off.
5. Remove the CF card.

---

#### Note

When backing up data during power-up, the DIAG button must be held down until the backup is completed. As this can easily take 20-30 seconds, it is better to use the service selector switch with switch position "D" for a backup during power-up.

---

### INI file in the main directory of the CF card

1. Use a text editor (such as Notepad) to create a file called **simotion.ini**
2. Add the following text: **DIAG\_FILES=1**  
You must use a text editor and may not use any formatting in the text.
3. Copy the simotion.ini file to the main directory of the CF card.
4. Insert the CF card into the module, which is switched off.
5. Switch the SIMOTION D410-2 on and allow the SIMOTION device to start up.  
The diagnostic data and non-volatile SIMOTION data are backed up to the data medium during startup provided this is still possible and is not prevented by hardware faults, etc.  
The backup task progress is displayed by the RUN/STOP LED flickering yellow.
6. The backup is finished when the RUN/STOP LED flickers green.  
Switch off the SIMOTION D410-2.
7. Remove the CF card.

**Note**

To suppress startup in diagnostics mode again, you must delete the simotion.ini file from the CF card.

**9.2.5 Storing the diagnostic data and non-volatile SIMOTION data**

You can find diagnostic data and non-volatile SIMOTION data on the CF card in the \USER \SIMOTION\HMI\SYSLOG\DIAG directory.

Copy these data and transfer them to Technical Support when requested to do so. A standard card reader can be used to transfer the diagnostic data from the CF card via standard SIMOTION IT web server pages or via FTP.

The following data are stored:

Table 9-5 Diagnostic data on the CF card

File	Application
DIAGBUF.TXT	Diagnostic buffer in a simple text format: Numerical values; no specific plain text. A text editor is used for evaluation purposes.
PMEMORY.XML	Non-volatile SIMOTION data (retain data) An operator action can be used to restore the backed up non-volatile SIMOTION data after a CPU has been replaced See Delete/restore non-volatile SIMOTION data (Page 288)
TOALARMS.TXT	Text file containing the pending TO alarms. Only TO IDs, alarm numbers, and associated HEX values. <b>Note:</b> The TO alarms are only created if diagnostic data has been created during operation (STOP/STOPU/RUN).
HTML page	If the diagnostic data are backed up, the URLs are requested from the text file (DIAGURLS.TXT) and stored as HTML pages together with their content. See Diagnostics via HTML pages (Page 287) <b>Note:</b> The HTML pages are only stored if diagnostic data are created during operation (STOP/STOPU/RUN).
Other files	All other files stored in the directory are only of relevance to Technical Support.

**Note**

Use HTML pages if you wish to back up diagnostic data in plain-text format. HTML pages enable user-friendly diagnostics. In addition to the standard SIMOTION IT web server pages, you have the option of creating your own HTML pages (e.g. for the axis status or for machine diagnostics). Customized diagnostics pages are particularly suitable for application problems, as you can define the contents yourself.

## 9.2.6 Diagnostics via websites

In the "DIAGURLS.TXT" text file, located in the ...\\USER\\SIMOTION\\HMI\\SYSLOG\\DIAG directory, you can specify HTML files whose state will be stored on the CF card when diagnostic data is created during operation. For example, "devinfo.mwsl" must be entered for the "devinfo.mwsl" website.

Since the pages in question are stored together with their most up-to-date contents, this enables the latest status information regarding the SIMOTION device, as well as the machine/system, from the point at which diagnostic data was created (e.g. when the service selector switch was activated) to be archived.

In addition to the standard SIMOTION IT web server pages, it is possible to store customized pages. Information on creating pages of this type can be found in, for example, an FAQ of the Utilities & Applications.

A tutorial on the creation of user-defined websites is also contained on the Utilities & Applications-DVD.

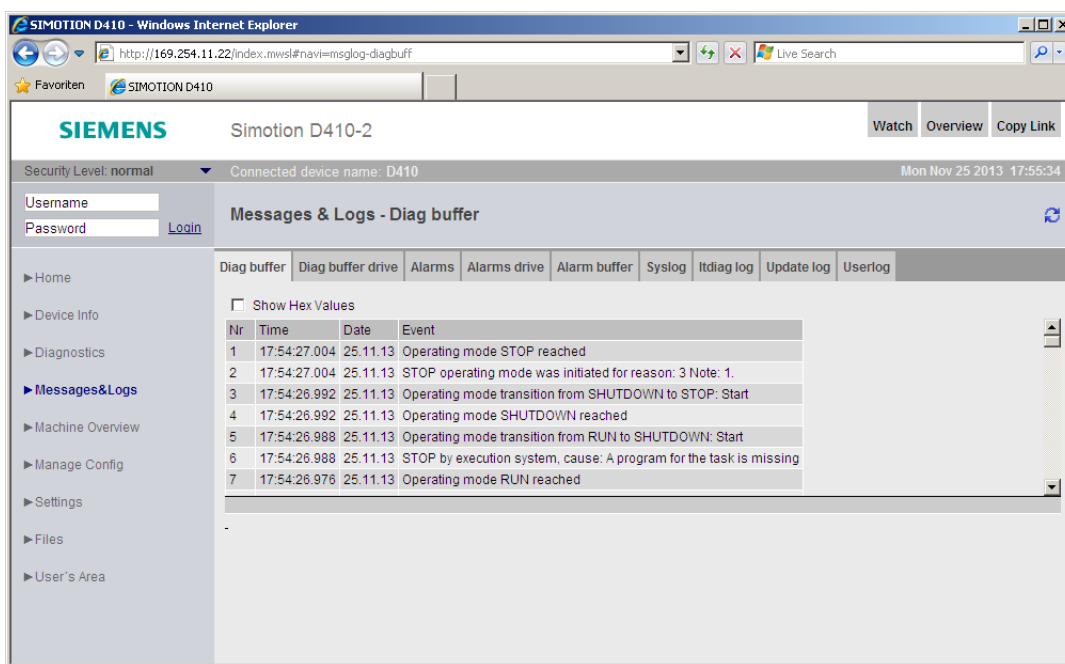


Figure 9-5 Diagnostic buffer at the point when diagnostic data was created

The following points must be noted for the DIAGURLS.TXT file:

- A DIAGURLS.TXT file containing the standard websites is automatically created if you have not stored your own DIAGURLS.TXT file.
- Standard websites are entered "without" specifying a path (e.g. "devinfo.mwsl" for the standard website "devinfo.mwsl").
- User websites (such as "user.mwsl") in the \\USER\\SIMOTION\\HMI\\FILES directory on the CF card must contain the FILES/ path specification.
- If you have created subfolders (e.g. "myfolder" in the FILES directory), these must also appear in the path.
- Only one file name may be used per line.

- Empty lines are not permitted (an empty line will be interpreted as the end of the list).
- No distinction is made between upper-case and lower-case letters.
- It does not matter whether you use "\" or "/" in the path name.

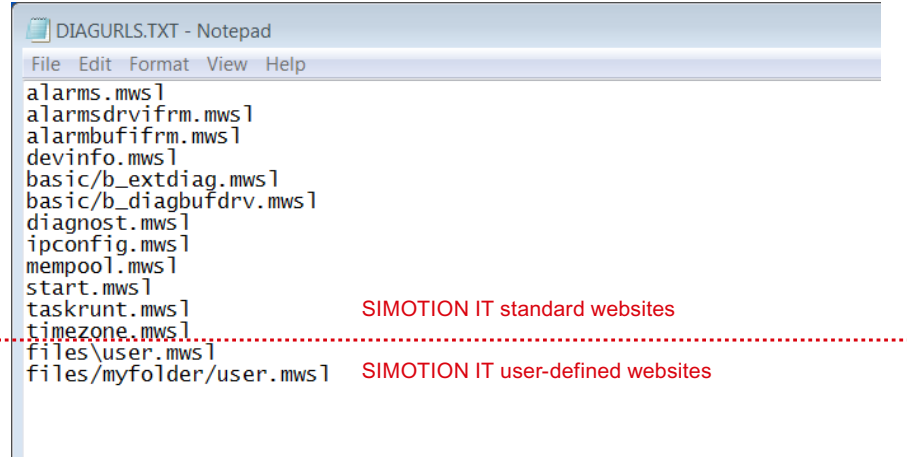


Figure 9-6 Depiction of DIAGURLS.TXT editor

### Additional references

You will find detailed information on SIMOTION IT in the *SIMOTION IT Diagnostics and Configuration* Diagnostics Manual.

## 9.2.7 Delete/restore non-volatile SIMOTION data

### 9.2.7.1 Overview

#### Requirement

The non-volatile SIMOTION data have been backed up on the CF card by one of the following methods:

- by system function (`_savePersistentMemoryData`), see also Section Operations and their effect on the user memory (Page 74)
- manually by service selector switch / Web server / DIAG button, see Section Backup of diagnostic data and non-volatile SIMOTION data (Page 282).

#### Procedure

The non-volatile SIMOTION data is restored automatically during a module replacement, see Section Replacing modules in the spare part scenario (Page 81). The non-volatile data can also be restored manually (by manual operation).



The CF card may contain backups of non-volatile SIMOTION data in various storage locations:

- data backed up with the system function `_savePersistentMemoryData`  
Storage location on CF card:
  - `/USER/SIMOTION/PMEMORY.XML`
  - `/USER/SIMOTION/PMEMORY.BAK` (backup file)
- manually by service selector switch / Web server / DIAG button, backed-up data  
Storage location on CF card:
  - `/USER/SIMOTION/HMI/SYSLOG/DIAG/PMEMORY.XML`

On manual restoration, the position of the service selector switch defines which of these data will be preferably restored.

During restoration, the non-volatile SIMOTION data is first deleted and then the non-volatile SIMOTION data is restored via the PMEMORY backup file.

If restoration is not possible (e.g. file does not exist or corrupt), the next file in the priority list is accessed.

Table 9-6 Restoration of the non-volatile SIMOTION data

Position of the service selector switch	Use case	Priority sequence for use of the data backups
1	The data backed up with the system function <code>_savePersistentMemoryData</code> is preferably restored	1. <code>/USER/SIMOTION/PMEMORY.XML</code> 2. <code>/USER/SIMOTION/PMEMORY.BAK</code> 3. <code>/USER/SIMOTION/HMI/SYSLOG/DIAG/PMEMORY.XML</code>
A (as of V4.4)	The data backed up by service selector switch position "D" / Web server / DIAG pushbutton are preferably restored	1. <code>/USER/SIMOTION/HMI/SYSLOG/DIAG/PMEMORY.XML</code> 2. <code>/USER/SIMOTION/PMEMORY.XML</code> 3. <code>/USER/SIMOTION/PMEMORY.BAK</code>

For how to proceed, see Section Restoring data with switch position "1" or "A" (Page 290).

#### Note

##### Firmware / kernel < V4.4

Because switch position "A" is only supported as of V4.4, for < V4.4, restoration must be performed with switch position "1." To force restoration of the data backed up by service selector switch position "D" / Web server / DIAG button, it may be necessary to delete existing files `PMEMORY.XML` and `PMEMORY.BAK` in the directory `/USER/SIMOTION/` on the CF card.

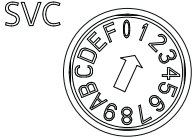
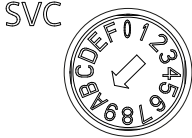
#### Note

If the data has been restored once via switch setting "A", this advantage is retained, even when the data should be restored later with "1".

### 9.2.7.2 Restoring data with switch position "1" or "A"

#### Procedure

To restore the non-volatile SIMOTION data, proceed as follows:

Step	Switch position "1"	Switch position "A" (as of V4.4)
1.	Insert the CF card into the new SIMOTION D410-2. The SIMOTION D410-2 must be switched off!	Insert the CF card into the new SIMOTION D410-2. The SIMOTION D410-2 must be switched off!
2.	<p>Set the service selector switch to "1." The position of the mode switch is not relevant, i.e. the set operating mode remains unchanged.</p>  <p>Service selector switch (position 1)</p>	<p>Set the service selector switch to "A." The position of the mode switch is not relevant, i.e. the set operating mode remains unchanged.</p>  <p>Service selector switch (position A)</p>
3.	Switch on the SIMOTION D410-2.	<p>Switch on the SIMOTION D410-2. The flickering green SF LED indicates that restoration is requested via position "A."</p>
4.	Restoration is started automatically.	Turn the service selector switch to "1" to start restoration.
5.	Once restoration has been completed, the module will start up automatically.	
6.	Switch the module off and turn the service selector switch back to "0."	
7.	Switch on the SIMOTION D410-2 again	

### 9.2.8 Back up diagnostic data and non-volatile SIMOTION data via the web server

SIMOTION devices provide a web server with already prepared standard web pages. These pages can be displayed via Ethernet using a commercially available browser. Additionally, you have the option of creating your own HTML pages and incorporating service and diagnostic information.

Diagnostic data and non-volatile SIMOTION data can be backed up via the web server. The home page of the web server is opened by entering the IP address of the SIMOTION device in the address line of the browser; e.g. <http://169.254.11.22>

This opens the home page of the web server. To back up diagnostic data and non-volatile data, call the "Diagnostic files" page from the "Diagnostics" menu.

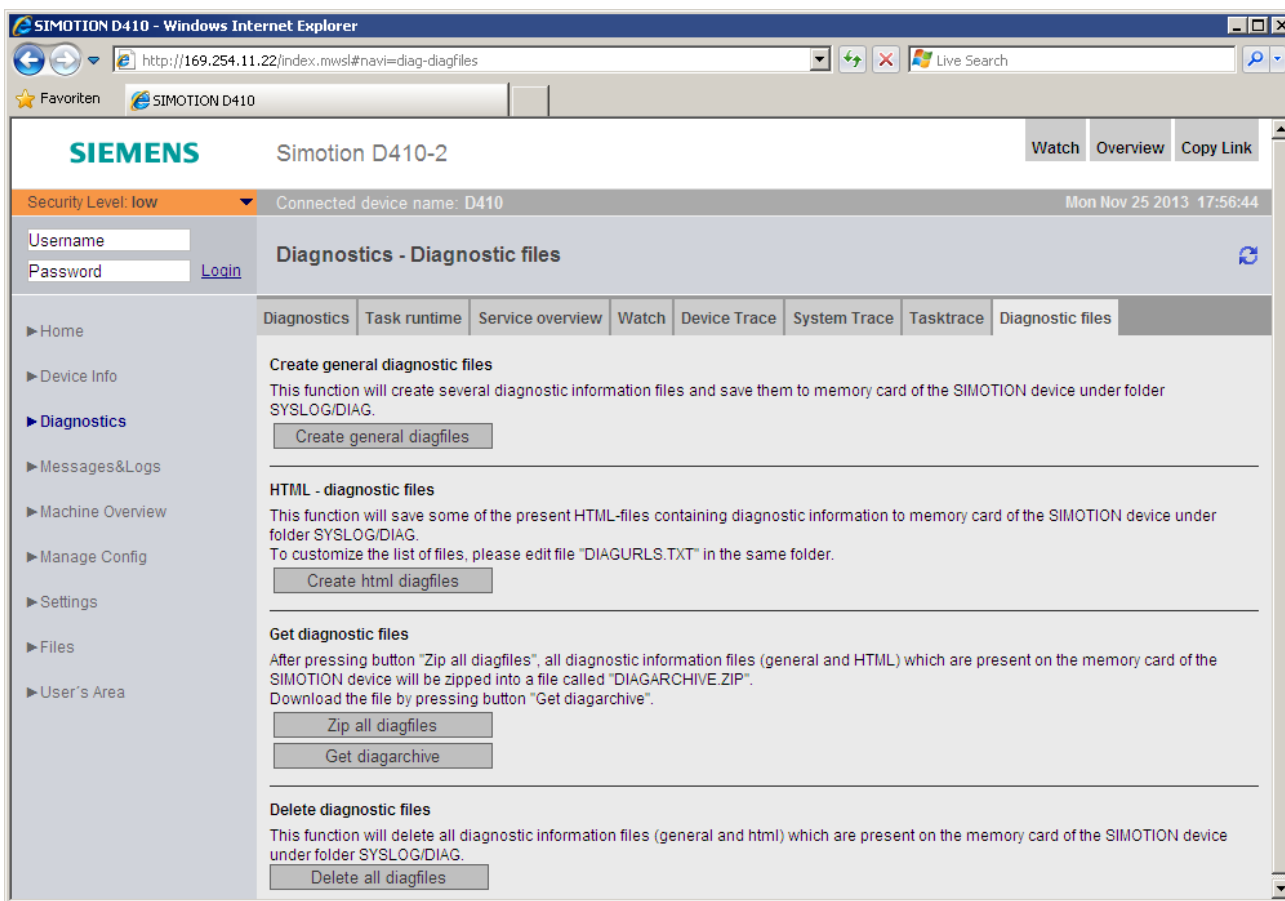


Figure 9-7 SIMOTION IT web server

Table 9-7 Functions on the "Diagnostic files" HTML page

Button	Function
Create general diagfiles	The diagnostic data and non-volatile SIMOTION data are backed up in the ...\\USER\\SIMOTION\\HMI\\SYSLOG\\DIAG directory. HTML files used for diagnostics purposes are not saved.
Create html diagfiles	The diagnostic websites are saved on the data medium. Note that only those sites listed in the DIAGURLS.TXT file in the ...\\USER\\SIMOTION\\HMI\\SYSLOG\\DIAG are saved, see Section Diagnostics via websites (Page 287).
Zip all diagfiles	The diagnostic files are compressed and stored with their original folder structure in the DIAGARCHIVE.ZIP ZIP file in the ...\\USER\\SIMOTION\\HMI\\SYSLOG\\DIAG directory.
Get diagarchive	The ZIP file is saved on a connected PG/PC.
Delete all diagfiles	This button is used to delete all data stored in the ...\\USER\\SIMOTION\\HMI\\SYSLOG\\DIAG directory; the directory itself is not removed, however.

The diagnostic data and non-volatile SIMOTION data can be found on the CF card in directory: \\USER\\SIMOTION\\HMI\\SYSLOG\\DIAG

## Additional references

You will find detailed information in the *SIMOTION IT Diagnostics and Configuration Diagnostics Manual*.

### 9.2.9 Storing diagnostics data and trace on the CF card

As of V4.5, the following data can be saved to the CF card with the `_saveTraceAndDiagnosticFiles` system function:

- Diagnostics data (same data as when the DIAG button is actuated)
- TO trace
- Device trace

The function can be used, for example, to collect diagnostic information (e.g. in the event of a fault) locally on the machine and without backing up SCOUT. The function saves the available data in a ZIP file, whereby the file name and the archive directory can be specified.

The packed data can be accessed, for example, via the web server.

## 9.3 Additional service and diagnostics options

### 9.3.1 SIMOTION Task Profiler application

The SIMOTION Task Profiler is a dedicated application installed parallel to SIMOTION SCOUT during SIMOTION SCOUT setup. The Task Profiler can be called in online mode using device diagnostics in SIMOTION SCOUT or the Windows application. In the event of a malfunction or error, the Task Trace data can be written to a directory or the CompactFlash card. It can then be processed using the Task Trace Viewer.

#### Additional references

For detailed information, refer to the *SIMOTION Task Trace* Function Manual.

### 9.3.2 Diagnostics via the SIMOTION IT web server

SIMOTION D410-2 has an integrated web server. Use is not subject to a license.

In addition to customized websites and the option of performing firmware and project updates, SIMOTION IT web server provides comprehensive device and diagnostic information that can be called using a standard PC with a web browser.

#### Security concept of HTTP/S, FTP, and Telnet access on the web server

As of version V4.4, access to the SIMOTION IT web server is protected by a multi-level security concept.

The security state of the web server is indicated by the security level on the website. This security level can have three different stages: Low, normal, high.

##### Security Level Low

The device is supplied with an empty user database. No projects exist yet. The security level is low to allow configuration of the device.

- In this state, access to the web server as an anonymous user is possible to enable use of functions such as the project and firmware update or OPC XML.
- Access to the FTP and Telnet is also possible.
- New users can be entered in the empty user database.

In this state, series commissioning is possible via the web server.

#### NOTICE

##### Protecting the device

Security level low should only be used for commissioning and service as otherwise the device is not adequately access protected.

#### Security Level Normal

The controller has a user database. There is a project on the controller; HTTP, HTTPS, FTP, and Telnet have been activated in the HW Config.

User password authentication is mandatory for access to websites with sensitive content (e.g. firmware update watch table, ...), FTP, and Telnet.

#### Security Level High

High security with maximum access protection:

HTTP, HTTPS, FTP, and Telnet have been deactivated via HW Config. Access to the Ethernet via the various ports of the services is then no longer possible.

#### State transition from security level low to normal

After taking delivery of the device, the user creates a project and loads it onto the device. This can be done by using the download functions of the SCOUT, by loading it directly onto the memory card (e.g. also via FTP), or via the Manage Config website, Device update tab.

Whichever method is used, the act of loading a project onto the device corresponds to a transition from security level low to security level normal from the point of view of the web server.

#### Resetting the security level from normal to low

If the user forgets to edit the UserDataBase.xml during initial commissioning, it will no longer be possible to access FTP, web services, or access-protected pages during use.

If there is no mechanical access to the memory card or the device, this can be achieved with the SCOUT function "Delete user data on card". After setting up the user administration, the project must be downloaded again.

#### Alternatives without SCOUT:

Setting the service selector switch to position "8" restores security level low (SIMOTION IT service mode). Using this method, the device can always be reset to security level low by hardware means.

The following behavior must be taken into account:

- The "Service mode" is activated by turning the SVC switch to position "8".
- If the switch is already set to "8" at ramp-up, it is ignored (protection against forgetfulness).
- The service mode stops immediately when position "8" is exited.
- The service mode stops automatically after 120 minutes.
- It is possible to retrigger 120 minute timeout at any time by turning the switch briefly from "8" to "7" and back, for example.
- The service mode is indicated (as for underlicensing) through slow red flashing of the SF LED.

---

**Note**

As an alternative to switch position "8," security level low can also be activated via a `simotion.ini` file in the main directory of the CF card.

To achieve this, use a text editor (such as Notepad) to create a file called `simotion.ini`. Add the following text: `SERVICE_SELECTOR_MODE=8`

You must use a text editor and may not use any formatting in the text.

To exit security level low again, undo the changes you have made.

---

**Additional references**

You will find detailed information in the *SIMOTION IT Diagnostics and Configuration* Diagnostics Manual.

# Configuring drive-related I/Os (without symbolic assignment)

# A

## A.1 Overview

The configuration of **local measuring inputs** is fundamentally different to the configuration of **global measuring inputs**.

The assignment of the local measuring inputs is permanently related to the hardware of the control unit and is performed

- On the drive side via the drive expert list and
- During the configuration of the TO measuringInput via the measuring input number.

Local and global measuring inputs have different properties. Detailed information concerning the differences can be found in Section Local and global measuring inputs (Page 295).

Information about the configuration can be found

- for global measuring inputs (with symbolic assignment) in Section Configuring global measuring inputs (Page 196)
- for local measuring inputs in the appendix, in Section Configuring local measuring inputs (Page 297).

### Additional references

Further information and programming examples for configuring drive-related I/Os without symbolic assignment can be found

- at Internet address (<https://support.industry.siemens.com/cs/ww/en/view/29063656>)
- in the SIMOTION Utilities & Applications

SIMOTION Utilities & Applications is part of the scope of delivery of SIMOTION SCOUT.

## A.2 Local and global measuring inputs

### Local and global measuring inputs

Depending on the used hardware platform, the following local and global measuring inputs are available for the measuring tasks:

- **Local measuring inputs** are axis-related and implemented in the SINAMICS drive. The measurement records the actual position value.
- **Global measuring inputs** can be freely assigned to the axes and add an internal time stamp to the measurement result for more precise determination of the axis positions. The term "central measuring input" is also used within the context of drives.

A.2 Local and global measuring inputs

Table A-1 Comparison of local and global measuring inputs

	Local measuring input	Global measuring input
Hardware supported	D410, D410-2, D4x5, D4x5-2 (terminal X122/X132), CX32, CX32-2, CU310, CU310-2, CU320, CU320-2	TM15, TM17 High Feature, D410, D410-2, D4x5, D4x5-2 (terminal X122, X132, X142), CX32, CX32-2, CU310, CU310-2, CU320, CU320-2, ET 200SP/MP timer DIDQ
Measurement procedure	With a signal edge at the relevant input, the current actual values of an encoder connected to a Control Unit are measured with positioning accuracy to determine lengths and distances.	With a signal edge at the relevant input, the current actual values of one or more encoders are measured using time stamp functionality with positioning accuracy in order to provide information for determining lengths and distances (possible with any encoders included in the project).
Configuration of the TO measuringInput in SIMOTION SCOUT	The assignment of inputs is always permanent depending on the hardware of the Control Unit and is performed during the configuration of the TO measuringInput using the measuring input number.	The assignment of inputs is not fixed depending on the hardware and is performed during the configuration of the TO measuringInput by means of symbolic assignment or the hardware address.
TO measuringInput setting: Single measurement <sup>1)</sup>	Yes	Yes
TO measuringInput setting: Cyclic measurement <sup>2)</sup>	No	Yes <b>D410, D410-2, D4x5, D4x5-2 (terminal X122, X132), CX32, CX32-2, CU310, CU310-2, CU320, CU320-2:</b> The minimum interval between 2 measurements is 3 servo cycle clocks (max. 2 edges per measurement). <b>D4x5-2 (terminal X142), TM17 High Feature, ET 200SP/MP timer DIDQ:</b> The minimum interval between 2 measurements is 1 servo cycle (max. 2 edges per measurement). <b>TM15:</b> No cyclic measurement available
Use of multiple TO measuringInputs on one axis/encoder. They can be active concurrently	No	Yes
Listening TO measuringInput	No	Yes
Measuring on virtual axes	No	Yes
Measuring on axes attached to a different drive unit	No	Yes

<sup>1)</sup> Measurement jobs must be issued individually for each measurement. Several interpolation cycle clocks lie between two measurements.

<sup>2)</sup> The measuring is activated just once and runs cyclically until deactivated.

SIMOTION Utilities & Applications includes, for example, a tool with the following functions:

- Estimate of the time between initiating a measurement job to the time at which the measuring input job in the drive acts
- Estimate of the minimum time between two measurement jobs.



SIMOTION Utilities & Applications is part of the scope of delivery of SIMOTION SCOUT.

Table A-2 Measuring inputs - Overview of quantity structures and functionality

Functionality/device	Max. number of measuring input inputs	As local measuring input configurable	As global measuring input configurable
D410-2, CU310-2	8	x	x
D4x5-2			
• X122/X132	• 8	• 8	• 8
• X142	• 8	• 0	• 8
CX32-2	4	x	x
D410, CU310, CX32	3	x	x
D4x5, CU320	6	x	x
TM15	24	-	x
TM17 High Feature	16	-	x
ET 200SP TM timer DIDQ 10x24V	4	-	x
ET 200MP TM timer DIDQ 16x24V	8	-	x

## A.3 Configuring local measuring inputs

### Properties

Local measuring inputs are always permanently assigned to an axis (drive). They are configured separately for each drive. The drive and the measuring input must always be located on the same control unit. The measurement results are transferred using the axis message frame in accordance with the PROFIdrive profile. Message frame 39x does not need to be configured for local measuring inputs.

The settings for the use of the local measuring inputs must be made in the expert list.

### Procedure

To use an I/O terminal on the SIMOTION D410-2 or SINAMICS Control Unit as a measuring input, proceed as follows:

1. Double-click the "Inputs/outputs" entry below the control unit in the project navigator.
2. Configure the desired I/O terminal as input in the "Bidirectional digital I/Os" tab. The configuration can also be set channel-granular on the p0728 parameter using the expert list of the control unit.

A.3 Configuring local measuring inputs

The specification of the measuring input terminal must be performed at the local measuring inputs in the expert list of the respective drive (refer to the following table).

Table A-3 Local measuring inputs, required settings in the expert list of the drive

Parameters in the expert list of the drive	Parameterization as	
	D410-2, CU310-2	D4x5-2, CU320-2
p0488[0] (measuring input 1 input terminal, encoder 1)	DI/DO 8 or DI/DO 9 or DI/DO 10 or DI/DO 11 or DI/DO 13 or DI/DO 14 or DI/DO 15	DI/DO 8 or DI/DO 9 or DI/DO 10 or DI/DO 11 or DI/DO 13 or DI/DO 14 or DI/DO 15
p0488[1] (measuring input 1 input terminal, encoder 2)		
p0488[2] (measuring input 1 input terminal, encoder 3)		
p0489[0] (measuring input 2 input terminal, encoder 1)		
p0489[1] (measuring input 2 input terminal, encoder 2)		
p0489[2] (measuring input 2 input terminal, encoder 3)		

Since a maximum of three encoders can be assigned to a drive, the index [0...2] specifies whether the measurement applies to encoder 1, 2, or 3.

The following must be taken into account:

- Two TO measuring inputs can be configured per TO axis or TO external encoder.
- Only one TO measuring input can be active on a TO axis or TO external encoder.

Table A-4 Local measuring inputs, configuration of the Measuring Input TO


Axis measuring system no.	Under axis measuring system number, enter the number of the used encoder system (namely, encoder 1, 2 or 3). Encoder system 1 is the default setting.
Drive-related (local measuring input)	Activate the checkbox when a local measuring input is used.
Measuring input number	Enter here which measuring input is used (namely, 1 or 2). Input 1 is the default setting.

Detailed information can be found in the *SIMOTION Motion Control Output Cams and Measuring Inputs* Function Manual.

## Standards and approvals

### B.1 General rules

#### CE marking


	<p>Our products satisfy the requirements and protection objectives of the EC Directives and comply with the harmonized European standards (EN).</p>
---	---

#### Electromagnetic compatibility

Standards for EMC are satisfied if the EMC Installation Guideline is observed.


SIMOTION products are designed for industrial use in accordance with product standard DIN EN 61800-3, Category C2.

#### cULus approval

	<p>Listed component mark for United States and the Canada Underwriters Laboratories (UL) according to Standard UL 508, File E164110, File E115352, File E85972.</p>
---	---

You can find further information on the respective device on the Internet at <http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm> Enter the first seven characters of the article number at **Keyword**. Then click **Search**.



#### Korea certification

	<p>KC registration number: KCC-REM-S49-SIMOTION</p> <p>Note that this device complies with limit class A with regard to the emission of radio frequency interference. This device can be used in all areas except residential areas.</p> <p>이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.</p>
---	---


#### Declaration of conformity

The current Declaration of conformity is available on the Internet at Declaration of conformity (<https://support.industry.siemens.com/cs/ww/en/ps/14506/cert>).


### Marking for Australia and New Zealand

	SIMOTION D410-2 satisfies the requirement of the standard AS/NZS CISPR 16.
or	
	Marking with RCM (Regulatory Compliance Mark) or C-Tick with older components.

### Marking for the Eurasian customs union

	EAC (Eurasian Conformity) Customs union of Russia, Belarus and Kazakhstan Declaration of conformity in accordance with the technical regulations of the customs union (TR CU).
---	--

### Standards that are not relevant

	China Compulsory Certification SIMOTION D does not belong to the validity area of the China Compulsory Certification (CCC).
---	--

## B.2 Device-specific information

### Note regarding SIMOTION D

---

#### Note

The product standard EN 61800-3 describes the EMC requirements placed on "Variable-speed drive systems". As such, it defines different limits depending on the location of the drive system.

SINAMICS S120 power units are designed for use in the second environment. The term second environment refers to all locations outside residential areas. These are basically industrial areas which are supplied from the medium-voltage line supply via their own transformers.

It is essential to follow the installation instructions in the SINAMICS S120 Manuals in order to ensure compliance with emitted interference and immunity values.

The same installation instructions apply for the SIMOTION D410-2 Control Unit as for the SINAMICS S120 CU310-2 Control Unit with regard to EMC.

For further information on this topic also refer to the *SIMOTION PM 21* Catalog as well as the SINAMICS Function Manuals.

---



# ESD guidelines

## C.1 ESD definition

### What does ESD mean?

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



#### NOTICE

##### Damage caused by electric fields or electrostatic discharge

Electric fields or electrostatic discharge can result in malfunctions as a result of damaged individual parts, 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 if you are first grounded by applying one of the following measures:
  - 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).

## C.2 Electrostatic charging of individuals

Any person who is not conductively connected to the electrical potential of the environment can accumulate an electrostatic charge.

This figure indicates the maximum electrostatic charges that can accumulate on an operator when he comes into contact with the indicated materials. These values comply with the specifications in IEC 801-2.

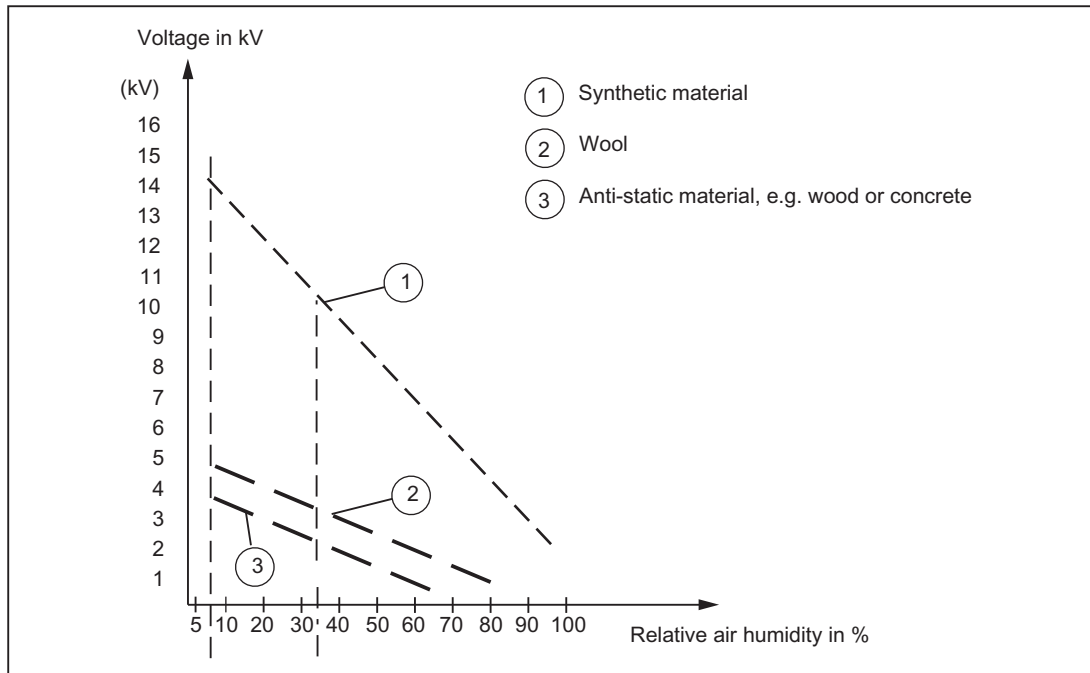


Figure C-1 Electrostatic voltage that can accumulate on operating personnel

### C.3 Basic measures for protection against discharge of static electricity

#### Ensure sufficient grounding

When working with electrostatic sensitive devices, make sure that you, your workstation, and the packaging are properly grounded. This prevents the accumulation of static electricity.

#### Avoid direct contact

You should only touch ESD components if unavoidable (for example, during maintenance work). When you touch modules, make sure that you do not touch either the pins on the modules or the printed conductors. If you follow these instructions, electrostatic discharge cannot reach or damage sensitive components.

If you have to take measurements on a module, make sure that you first discharge any static that may have accumulated in your body. To do this, touch a grounded metal object. Only use grounded measuring instruments.



# Index

## A

- Active setting
  - PG/PC, 105
- Acyclic communication
  - Overview, 163
- Adaptation, 125
- Additional data
  - Loading, 143
- Addresses
  - Calculating, 180
- Automatic commissioning, 147
- Automatic configuration, 147
- Automatic controller setting
  - Position controller, 207
  - Speed controller, 206
- Automatic downgrading, 246
- Automatic position controller setting, 207
- Automatic speed controller setting, 206
- Automatic upgrading, 246
- Axis
  - Creating with axis wizard, 171
  - Testing, 178
- Axis control panel
  - Axis test, 178

## B

- Backup copy
  - Creating, 249
- Boot loader
  - Upgrading, 260
  - Writing, 260, 271
- Bus connector, 52
  - MPI, 57
  - Setting the terminating resistor, 54

## C

- Cam output
  - SIMOTION D410-2, 197
- CE marking, 299
- CF card
  - Content, 73
  - Correct handling, 272
  - Formatting, 271

- CF card
  - Changing, 270
- Clock
  - Runtime deviations, 158
  - Synchronizing, 157
- Combinations
  - Licenses, 234
  - Of different generations, 233
- Commissioning
  - Acyclic communication, 163
  - Automatic configuration, 147
  - Comparing a project, 143
  - Configuring a second encoder, 184
  - Configuring components, 131
  - Configuring the TM41, 203
  - Control properties, 164
  - Creating a DMC20, 202
  - Creating a DME20, 202
  - Download project to target system, 142, 150
  - Downloading additional data, 143
  - Downloading project to CF card, 142
  - Downloading sources, 143
  - Editing components, 149
  - Inserting another encoder, 184
  - Load to file system, 142
  - Loading SIMOTION user data, 213
  - Offline configuration, 129
  - Online configuration, 145
  - Overview, 128
  - Performance features, 164
  - SIMOTION D410-2, 87, 127
  - SIMOTION D410-2, 123
  - SINAMICS Integrated, 151
  - Supplementary information, 151
  - Testing the drive, 168
  - TM41, 203
  - Vector drive, 153
- Communication
  - symbolic assignment, 180
- CompactFlash card
  - Changing, 249, 270
  - Characteristics, 67
  - Correct handling, 272
  - Deleting, 218
  - Formatting, 271
  - Inserting, 68
  - Saving user data, 270
  - Writing data using the PG/PC, 271
  - Writing to, 270

- Component
  - on DRIVE-CLiQ, 25
  - on Ethernet, 24
  - on PROFIBUS, 22
  - on PROFINET, 23, 58
  - Replacing, 245
- Components
  - Configuring, 131
- Configuration
  - Global D410-2 measuring inputs, 295
  - I/O terminals, 192
  - I/O variables, 199
  - Inserting another encoder, 184
  - Local D410-2 measuring inputs, 295
  - Measuring inputs on D410-2, 295
- Connection
  - Power supply, 47
- Controller optimization, 209
  - Automatic position controller setting, 207
  - Automatic speed controller setting, 206
  - Function generator, 209
  - Measuring functions, 209
  - Trace, 209
- Creating a subnet
  - PROFIBUS DP, 104
- cULus approval, 299
- Current controller cycle clock, 165
- Cycle clock scaling
  - external/internal PROFIBUS, 102

## D

- Data storage
  - Diagnostic data, 286
- DCP flashing, 277
- Declaration of conformity, 299
- Diagnostic buffer, 78
  - SINAMICS, 163
- Diagnostic data
  - Backing up, 282, 290
  - Backing up during operation, 283
  - Backing up during startup, 284
  - Backing up via web server, 290
  - Data storage, 286
- Diagnostics, 275
  - LED display, 276
  - SIMOTION Task Profiler, 292
  - Via HTML, 287
  - Web server, 292
- Disassembly, 31

- DMC20
  - Creating, 202
  - DRIVE-CLiQ Hub, 201
- DME20
  - Creating, 202
  - DRIVE-CLiQ Hub, 201
- Downgrading
  - D410-2 device update tool, 262
  - DRIVE-CLiQ components, 246
- Downgrading devices
  - D410-2, 261
- DP cycle, 100
  - PROFIBUS DP, 98
  - PROFINET, 111
- Drive
  - Testing, 168
- Drive control panel
  - Testing the drive, 168
- Drive optimization, 208
- DRIVE-CLiQ
  - Connecting components, 48
  - Create a hub, 202
  - Hub, 201
  - Versions that can be combined with D410-2, 233
  - Wiring, 48
- DRIVE-CLiQ component
  - Replacing, 245

## E

- Electromagnetic compatibility, 299
- EMC directives, 46, 299
- Encoder
  - Inserting, 184
- Engineering system
  - Create axes., 170
- ESD guideline, 303
- Ethernet
  - Configuring addresses, 120
  - Interface, 91
  - PG/PC interface, 91
  - Properties, 117
- External encoder
  - Connecting, 65

## F

- Fan
  - Replacing, 247
- fanexisting, 84
- fannecessary, 84

- Firmware
    - Updating automatically, 267
    - Updating manually, 268
    - Upgrading, 261
  - Firmware downgrade, 268
  - Firmware update
    - D410-2 device update tool, 262
    - Performing, 261
    - Web server, 262
  - Formatting
    - CF card, 271
  - Functions
    - Project handling, 127
  - Further encoders, 185
    - via PROFIBUS, 186
    - Via PROFINET, 186
  - FW update
    - Automatic, 246
    - Performing, 261
- G**
- Global D410-2 measuring inputs, 295
  - Guideline
    - ESD, 303
- H**
- Hardware components, 20
  - Hot plugging, 202, 229
  - HW Config
    - Replacing the module, 255
    - Settings, 151
- I**
- I/O
    - Configuration, 191
    - Configuration with symbolic assignment, 191
    - Configuration without symbolic assignment, 191
    - CU3xx, 195
    - symbolic assignment, 191
    - Terminal X120, 193
    - Terminal X121, 193
    - Terminal X130, 193
    - Terminal X131, 193
  - I/O systems
    - PROFINET, 23, 24
  - I/O terminals
    - Configuration, 192
  - I/O variables
    - Configuration, 199
    - Substitute values, 201
    - symbolic assignment, 187
  - Installation
    - Installing on the Power Module, 30
    - on mounting plate, 32
  - Installing, 30, 32
  - Integrated drive, 129
  - Interface
    - PG/PC, 91
    - PROFIBUS DP, 96
  - Interfaces
    - Arrangement on the device, 36, 37
    - MPI, 106
    - Overview of connections, 38
    - PG/PC, 89
    - PROFIBUS DP, 22, 90, 106
    - PROFINET, 23
  - Isochronous operation, 151
- L**
- LED
    - Diagnostics, 276
    - Display, 275
  - Library
    - Upgrading, 259
  - Licenses
    - Backing up, 265
  - Licensing, 234
  - Load power supply, 47
  - Loading
    - To file system, 142
    - To the target system, 268
  - Local D410-2 measuring inputs, 295
    - Parameter, 297
- M**
- Maintenance
    - Overview, 239
  - Master application cycle, 100
  - Measuring input
    - Globals for D410-2, 196
    - Local, 197
  - Measuring input types, 196
  - Measuring inputs on D410-2
    - Local/global measuring inputs, 295
  - Memory model, 71

- Memory reset, 215
  - Data deleted on memory reset, 216
  - Data retained during memory reset, 216
  - Using the mode switch, 217
  - With SIMOTION SCOUT, 217

- Migration
  - D410 to D410-2, 231

- Mode selector switch
  - Restoring the factory settings, 219

- Mode switch
  - Memory reset, 217

- Module
  - Replacing in HW Config, 255

- Module replacement
  - SIMOTION, 81
  - SINAMICS, 83

- Modules
  - Permissible combinations, 233

- MPI, 96, 106

- MPI bus
  - Bus connector, 57
  - Connection rules, 57
  - Parameter, 106

- Multi-Point Interface, 106

## N

- Non-volatile data
  - Saving to CF card, 73

- Non-volatile SIMOTION data
  - Backing up, 76, 283
  - Backing up via web server, 290
  - Diagnostics, 78
  - Power-up, 78
  - Restoring, 77, 288

- Non-volatile SINAMICS data
  - Restoring, 77

- NVRAM data
  - Backing up, 160
  - Deleting, 161
  - Restoring, 160

## O

- Offline configuration
  - SIMOTION D410-2, 128

- Onboard I/Os of the SIMOTION D410-2
  - Configuring, 191

- Online configuration, 145
  - Overview, 145

- Operating hours counter, 156

- Operating state, 275

- Output cam
  - Configuring the SIMOTION D410-2, 198

- Overview
  - Diagnostic data, 282
  - Upgrading and downgrading, 261

- Overview of connections, 38

## P

- PG/PC
  - Establishing the online connection, 146
  - Interface, 91

- PG/PC connection
  - enabling the active setting, 105

- PG/PC interface
  - Configuring, 89
  - Inserting a device, 91

- Platform replacement, 252

- Possible applications, 20

- Power failure, 78

- Power supply, 47
  - Safety rules, 46
  - Switching on, 69

- Power-up
  - Control Unit, 69

- Process data exchange
  - Determining addresses, 180

- PROFIBUS address
  - Assign, 98

- PROFIBUS cable
  - Baud rate, 52
  - Cable length, 52
  - Connecting, 53
  - Properties, 51
  - removing, 54
  - Rules for cabling, 53

- PROFIBUS DP
  - Configure interface, 90
  - Configuring, 94
  - Creating a subnet, 104
  - Definition, 94
  - DP cycle, 98
  - Interface, 96

- PROFINET
  - Cable types, 59
  - Cabling, 58
  - Configuring, 107
  - Connector types, 59
  - Definitions, 107
  - Diagnostics via LED displays, 275

- DP cycle, 111
  - Send cycle clock, 115
  - Project
    - Adapting, 249
    - Archiving to the CompactFlash card, 144
    - Comparing, 143
    - creating, 87
    - Downloading to the target system, 150
    - Loading, 268
  - Project handling
    - Functions, 127
  - Project update
    - D410-2 device update tool, 262
    - Performing, 262
    - Web server, 262
- Q**
- Quantity structure
    - D410-2, 229
- R**
- Real-time clock
    - Setting, 156
  - References, 4
  - Replace module
    - DRIVE-CLiQ component, 245
  - Replacing the device
    - SIMOTION D410-2, 254, 255
  - Restoring
    - Non-volatile SIMOTION data, 288
  - Restoring the factory settings
    - SIMOTION D410-2, 219
    - SINAMICS Integrated, 219
  - Retain data
    - Backing up, 250, 283
  - Retain data and user data
    - Backing up, 265
  - Rules
    - PROFIBUS system clocks, 100
    - PROFINET send cycle, 115
- S**
- Safety instructions, 16
  - Safety Integrated
    - Advanced Functions, 221
    - Basic Functions, 221
    - Configuration, 220
    - Controlling, 223
    - Extended Functions, 221
    - Topology, 228
    - With PROFIsafe, 227
  - Send cycle clock, 111
  - Service, 275
  - Servicing
    - Overview, 239
  - Shield connection
    - Using, 50
  - SIMOTION D410-2
    - Commissioning, 127
    - Memory reset, 215
    - Removing modules, 243
    - Replace module, 243
    - Upgrade options, 241
  - SIMOTION Task Profiler, 292
  - SIMOTION user data
    - Loading, 213
    - Saving, 213
  - SIMOTION D410-2
    - Cam output, 197
    - Commissioning, 87, 123
    - Offline configuration, 128
    - Replacing a device in HW Config, 255
    - Replacing the device, 254
    - Time of day, 156
    - User memory concept, 71
  - SIMOTION SCOUT
    - Documentation, 27
    - Inserting a SIMOTION D410-2, 87
  - SINAMICS clock
    - Synchronizing, 157
  - SINAMICS Integrated
    - Isochronous operation, 151
    - Restoring the factory settings, 219
    - Supplementary information, 151
    - Telegram configuration, 181
  - Software components, 21
  - Sources
    - Loading, 143
  - Speed controller
    - Adjusting the P-gain, 212
    - Optimizing, 210
    - Starting the measuring function, 210
  - Standard IE cable types, 59
  - Subnet
    - Connection components, 51
    - Connection rules, 55
    - Segment, 51
    - Terminating resistor, 51
  - Switching on
    - Requirement, 67

- Symbolic assignment, 123
  - Communication, 180
  - I/O configuration, 191
  - I/O variables, 187
  - I/O variables to the drive parameters, 187
  - I/O variables to the PROFIdrive message frame, 187
- System cycle clock
  - DP cycle, 111
  - IPO cycle clock, 111
  - Ratio, 99
  - Rules, 100
  - Setting, 98, 111
- System function
  - \_savePersistentMemoryData, 77
- System runtime, 156
- System variable
  - fanexisting, 84
  - fannecessary, 84

## T

- Task Profiler, 292
- Technology packages
  - Upgrading, 256
- Telegram
  - Configuring, 181
- Terminal Module
  - TM41, 203
- Terminating resistor, 51
- Time of day
  - Setting, 156
  - SIMOTION D410-2, 156
  - SINAMICS, 156
- TM41
  - Configuring, 204
  - Overview, 203
- TO axis
  - Configuring I/O variables, 200

## U

- UL certification, 299
- Unit data
  - Backing up, 250
- Upgrading
  - Automatic, 246
  - D410-2 device update tool, 262
  - Library, 259
  - Overview, 241

- SINAMICS components, 258
  - Technology packages, 256
- Upgrading firmware, 268
- User data
  - Deleting from the CompactFlash card, 218
- User memory concept, 71
  - Non-volatile data, 72
  - Volatile SIMOTION data, 74

## V

- Variables
  - Backing up, 250
  - Restoring, 250
- Vector drive
  - Use, 153
- Volatile SIMOTION data, 74

## W

- Web server
  - Diagnostics, 292
  - FW update, 262