

SIEMENS

SIMOTION

D410

Commissioning Manual

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Valid for SIMOTION D410 DP and D410 PN

08/2008 Edition

Safety Guidelines

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

 DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.
 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.
 CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.
CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.
NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

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 device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

 WARNING
This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

Trademarks

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Disclaimer of Liability

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

Preface

Contents of the commissioning manual

This manual is part of the SIMOTION D4xx documentation package, Edition 08/2008.

This manual describes commissioning of the SIMOTION devices D410 DP and D410 PN.

Information blocks in this manual

The following information blocks describe the purpose and use of the commissioning manual.

- **Description**
This section provides information pertaining to the SIMOTION system and its integration into the information landscape.
- **Commissioning (hardware)**
This section describes how to start up the device and what you must take into account.
- **Configuring SIMOTION D410**
This section describes how to integrate SIMOTION D410 in a project and how to configure the interfaces.
- **Commissioning (software)**
This section describes how to configure a plant and how to test the drives and axes you configured.
- **Maintenance and service**
This section describes how to replace a module, how to run updates, and how to modify settings.
- **Diagnostics data**
This section provides information about diagnostic possibilities and LED states.
- **Appendices with factual information for reference (for example, Standards and Approvals, and ESD)**
- **Index for locating information.**

SIMOTION Documentation

An overview of the SIMOTION documentation can be found in a separate list of references.

This documentation is included as electronic documentation with the supplied SIMOTION SCOUT.

The SIMOTION documentation consists of 9 documentation packages containing approximately 80 SIMOTION documents and documents on related systems (e.g. SINAMICS).

The following documentation packages are available for SIMOTION V4.1 SP2:

- SIMOTION Engineering System
- SIMOTION System and Function Descriptions
- SIMOTION Diagnostics
- SIMOTION Programming
- SIMOTION Programming - References
- SIMOTION C
- SIMOTION P350
- SIMOTION D4xx
- SIMOTION Supplementary Documentation

Hotline and Internet addresses

Technical support

If you have any technical questions, please contact our hotline:

	Europe / Africa
Phone	+49 180 5050 222 (subject to charge)
Fax	+49 180 5050 223
Internet	http://www.siemens.com/automation/support-request

	Americas
Phone	+1 423 262 2522
Fax	+1 423 262 2200
E-mail	mailto:techsupport.sea@siemens.com

	Asia / Pacific
Phone	+86 1064 719 990
Fax	+86 1064 747 474
E-mail	mailto:adsupport.asia@siemens.com

Note

Country-specific telephone numbers for technical support are provided under the following Internet address:

<http://www.siemens.com/automation/service&support>

Calls are subject to charge, e.g. 0.14 €/min. on the German landline network. Tariffs of other phone companies may differ.

Questions about this documentation

If you have any questions (suggestions, corrections) regarding this documentation, please fax or e-mail us at:

Fax	+49 9131- 98 63315
E-mail	mailto:docu.motioncontrol@siemens.com

Siemens Internet address

The latest information about SIMOTION products, product support, and FAQs can be found on the Internet at:

- General information:
 - <http://www.siemens.de/simotion> (German)
 - <http://www.siemens.com/simotion> (international)
- Product support:
 - <http://support.automation.siemens.com/WW/view/en/10805436>

Additional support

We also offer introductory courses to help you familiarize yourself with SIMOTION.

Please contact your regional training center or our main training center at D-90027 Nuremberg, phone +49 (911) 895 3202.

Information about training courses on offer can be found at:

www.sitrain.com

Disposal and recycling

SIMOTION D410 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 DIN 54840
- Less material used because the unit is smaller and with fewer components thanks to integration in ASICs

SIMOTION D410 can be recycled because it is made with low-polluting materials.

For state-of-the-art environmentally friendly recycling and disposal of your old modules, contact your Siemens representative. To locate your representative, visit us online at:

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

Further information / FAQs

You can find further information on this manual under the following FAQs:

<http://support.automation.siemens.com/WW/view/de/27585482>

The following resources are also available:

- SIMOTION - Utilities & Applications CD: This CD is supplied together with the SIMOTION SCOUT and, along with FAQs, also contains free utilities (e.g. calculation tools, optimization tools, etc.) and application examples (ready-to-apply solutions such as winder, cross cutter or handling).
- The latest FAQs for SIMOTION can be found at:

<http://support.automation.siemens.com/WW/view/de/10805436>

- SIMOTION SCOUT online help
- Additional documentation: see SIMOTION references

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Description

1.1 System overview

Overview

In SIMOTION D, the SIMOTION functionality is integrated directly in the closed-loop control module of the SINAMICS S120 drive system.

SIMOTION D410 is a module drive system for single axes, which solves demanding drive tasks for a very wide range of industrial applications. SIMOTION D410 supplements D425, D435 and D445, the three power levels for multi-axis connections.

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

Application

Combining a power module with SIMOTION D410 forms a compact single drive for machine and plant engineering.

Applications include:

- Machine concepts with central drive (e.g., pressing, printing and packaging machines, . . .)
- Modular machine concepts where the machine modules broken down to 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 cam 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)

Product variants

SIMOTION D410 comes in two variants:

- SIMOTION D410 DP with PROFIBUS DP interface.
- SIMOTION D410 PN with PROFINET interface.

System integration

SIMOTION provides an optimized system platform for automation and drive solutions where the main focus is on motion control applications and technology tasks.

The SIMOTION system is made up of three components:

- SIMOTION SCOUT Engineering System
- Runtime Software
- Hardware platforms

The innovative SIMOTION concept involves integrating pure automation and motion functions, which have been traditionally isolated in the past.

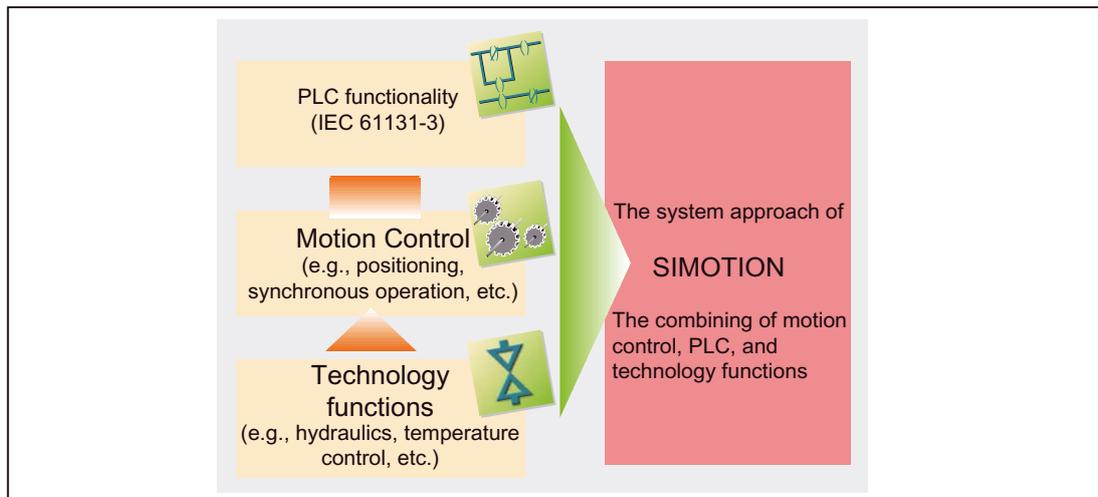


Figure 1-1 System solution

SIMOTION can be used with all machines with motion control tasks. The focus is on a simple and flexible solution to a wide variety of motion control tasks. In order to achieve this in the best way possible, a new system approach has been introduced:

the fusion of motion control with two other control functions, which are found in most machines: PLC and technology functions.

This approach enables motion control of axes and machines with only one system. The same applies to technology functions, such as pressure control of a hydraulic axis. A seamless switch can be made from position-controlled positioning mode to pressure control.

Combining the three control functions of motion control, PLC and technology functions has the following benefits:

- Lower engineering expenditure and higher machine performance.
- Interfaces between individual components requiring rapid response are no longer needed.
- Simple, standardized and transparent programming and diagnostics for the complete machine.

1.2 System components

Overview

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

- PROFIBUS DP (SIMOTION D410 DP only)
- PROFINET (SIMOTION D410 PN only)
- 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 (node 3) is via PROFIBUS mechanisms (DP integrated).

The most important system components and their functions are listed in the following table.

Table 1-1 System components

Components	Function
SIMOTION D410	<p>... is the central motion control module.</p> <p>The module contains the programmable SIMOTION Runtime in SIMOTION D410 and the SINAMICS S120 drive software.</p> <p>You can use the integrated rapid digital I/Os as:</p> <ul style="list-style-type: none"> • Homing inputs • Inputs for measuring inputs • User-addressable process inputs/outputs • Outputs for fast output cams <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 system software is delivered separately on a CompactFlash card (not included in the scope of delivery).</p> <p>Note: An additional license is not required for the real axis technology.</p>
Power supply (PS)	<p>... provides the electronic power supply for SIMOTION D410 (e.g., SITOP power supply).</p> <p>Note: If the SIMOTION D410 is snapped-on to a PM340 power module, the power module may be used as the sole supply for the SIMOTION D410 in certain cases (e.g., when digital outputs are not used, etc. . .). See the section entitled in the SIMOTION D410 Manual.</p>

PROFIBUS DP

SIMOTION D410 DP can communicate via PROFIBUS DP interface to the following components:

Table 1-2 Components on PROFIBUS DP

Components	Function
PG/PC programming device	... configures, sets parameters, programs and tests using the SIMOTION SCOUT Engineering System (ES).
SIMATIC HMI device	... is used for operator control and monitoring functions. It is not absolutely required to run SIMOTION D410.
Drive units with PROFIBUS DP interface (e.g., SINAMICS, SIMODRIVE 611 universal)	... convert speed setpoints into signals for controlling the motor and supply the power required to operate the motors. Can also be operated as an isochronous, equidistant Slave on the PROFIBUS DP.
SIMATIC ET 200M	Modular I/O system for control cabinet installation and high channel densities.
SIMATIC ET 200S	Finely scalable I/O system for control cabinet installation and particularly time-critical applications; including motor starters, safety technology and individual grouping of load groups.
SIMATIC ET 200pro	Modular I/O system with IP65/IP67 rating for machine-related applications with no control cabinet; with new 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 rating for machine-related applications with no control cabinet, with a flexible and fast connection system in ECOFAST or M12.
Gateways	<ul style="list-style-type: none"> DP/AS Interface Link 20E and DP/AS Interface Link Advanced for the PROFIBUS DP gateway to AS Interface DP/DP coupler to connect two PROFIBUS DP networks
Teleservice adapter	Remote diagnosis
Other controls (e.g., SIMOTION or SIMATIC)	

Note

Note that only one real axis can be used on a SIMOTION D410.

Note

Please note that not all modules for the I/O systems listed above are enabled for SIMOTION. Moreover, system-related functional differences can come into play when these I/O 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 list of all I/O modules that can currently be used with SIMOTION is available under the following link:

<http://support.automation.siemens.com/WW/view/de/11886029>

In addition to the I/O modules enabled for SIMOTION, all certified standard slaves can, in principle, be connected to SIMOTION if they support the following:

- Cyclic data traffic (DP-V0) and, possibly
- Acyclic data traffic (DP-V1) or
- Isochronous data traffic (DP-V2)

These modules are integrated via the GSD file from the device manufacturer.

Note

Please note that in individual cases further boundary conditions must be fulfilled in order to integrate a standard slave into SIMOTION. For example, "driver modules" in the form of function blocks are required for some modules, which enable integration or make it especially easy.

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

PROFINET

SIMOTION D410 PN can communicate via PROFINET interface to the following components:

Table 1-3 Components on PROFINET

Components	Function
The master computer (at company and production management level)	... communicates with other devices via Ethernet.
PG/PC programming device	... communicates with the SIMOTION SCOUT Engineering Systems (ES), STEP 7 and HMI (Human Machine Interface).
SIMATIC HMI device	... is used for operator control and monitoring functions. It is not absolutely essential for running SIMOTION D410.
Drive units with PROFINET interface (e.g., SINAMICS S120 with CBE20)	... convert speed setpoints into signals for controlling the motor and supply the power required to operate the motors.
SIMATIC ET 200M	Modular I/O system for control cabinet installation and high channel densities.
SIMATIC ET 200S	Finely scalable I/O system for control cabinet installation and particularly time-critical applications; including motor starters, safety technology and individual grouping of load groups.
SIMATIC ET 200pro	Modular I/O system with IP65/IP67 rating for machine-related applications with no control cabinet; with new features such as more compact designs, integrated PROFI-safe safety technology, PROFINET connection and live module replacement.
Gateways	<ul style="list-style-type: none"> • IE/AS Interface Link PN IO for the PROFINET IO gateway to AS Interface • PN/PN coupler to connect two PROFINET IO networks
Other controls (e.g., SIMOTION or SIMATIC)	

Note

Note that only one real axis can be used on a SIMOTION D410.

Note

A list of all I/O modules that can currently be used with SIMOTION is available at the following link:

<http://support.automation.siemens.com/WW/view/de/11886029>

DRIVE-CLiQ

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

Table 1-4 Components on DRIVE-CLiQ

Components	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 AC DRIVE component PM340 is connected via CUA31/CUA32. No more than one PM340 can be connected. Chassis power module is connected via DRIVE-CLiQ. Note: Booksize components are not supported!
TM15 and TM17 High Feature terminal modules	The terminal modules TM15 and TM17 High Feature are used to implement probe inputs and cam outputs. In addition, terminal modules provide drive-related digital inputs and outputs with short signal delay times.
TM31 terminal module	... enables terminal expansion via DRIVE-CLiQ (additional analog and digital inputs/outputs).
TM41 terminal module	... enables terminal expansion (analog and digital inputs/outputs) and encoder simulation via DRIVE-CLiQ. The TM41 can be connected to a real axis. It is important to note that exactly one real axis can be configured on the D410.
TM54F terminal module	... enables terminal expansion (secure digital inputs/digital outputs) for controlling the secure motion monitoring functions of the integrated drive.
SMx sensor modules	... enable the acquisition of encoder data from the 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	... expands the number of DRIVE-CLiQ nodes

Note

Note that SIMOTION D410 does not support the CX32 expansion!

1.3 SIMOTION D410 DP display

View

The following figure shows SIMOTION D410 DP with the interfaces and front elements.

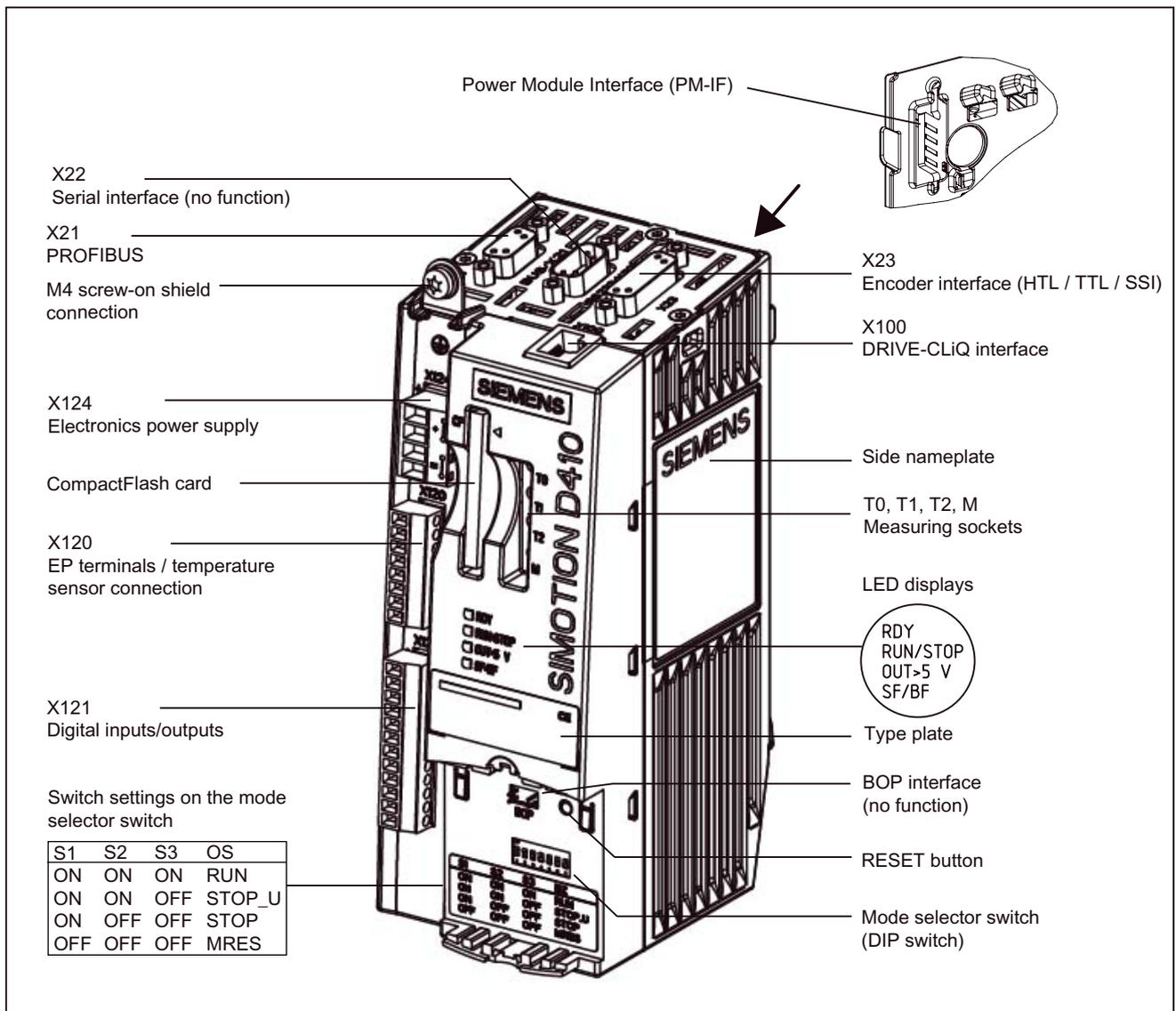


Figure 1-2 Location of interfaces and front elements in SIMOTION D410 DP

Note

The label underneath the mode selector lists the switch settings for the operating states of the SIMOTION D410.

Interfaces

The SIMOTION D410 DP interfaces are described in the following tables.

Table 1-5 SIMOTION D410 interfaces

Interface	Description
Digital inputs/outputs X121	12-pin Mini Combicon: <ul style="list-style-type: none"> • 4 digital inputs: for connecting switches or proximity sensors • 4 digital inputs/outputs: for connecting actuators and sensors
DRIVE-CLiQ interface X100	8-pin RJ45plus socket to connect DRIVE-CLiQ nodes
PROFIBUS DP interface X21	9-pin SUB-D socket to connect to PROFIBUS DP
Power Module Interface (PM-IF)	8-pin direct connector to connect to a blocksize power module
Encoder interface (HTL / TTL / SSI) X23	15-pin SUB-D socket for connecting HTL, TTL and SSI encoders.
EP terminals/temperature sensor connection X120	8-pin Mini Combicon for connecting Safety Integrated input terminals or for connecting temperature sensing via KTY or PTC
Power supply connection X124	4-pin screw terminal connection to connect the 24 V DC load power supply
Measuring sockets T0, T1, T2 and M	Sockets to output analog signals

Nameplates

The following figure shows you all the information included on the nameplates located on the side of the unit.

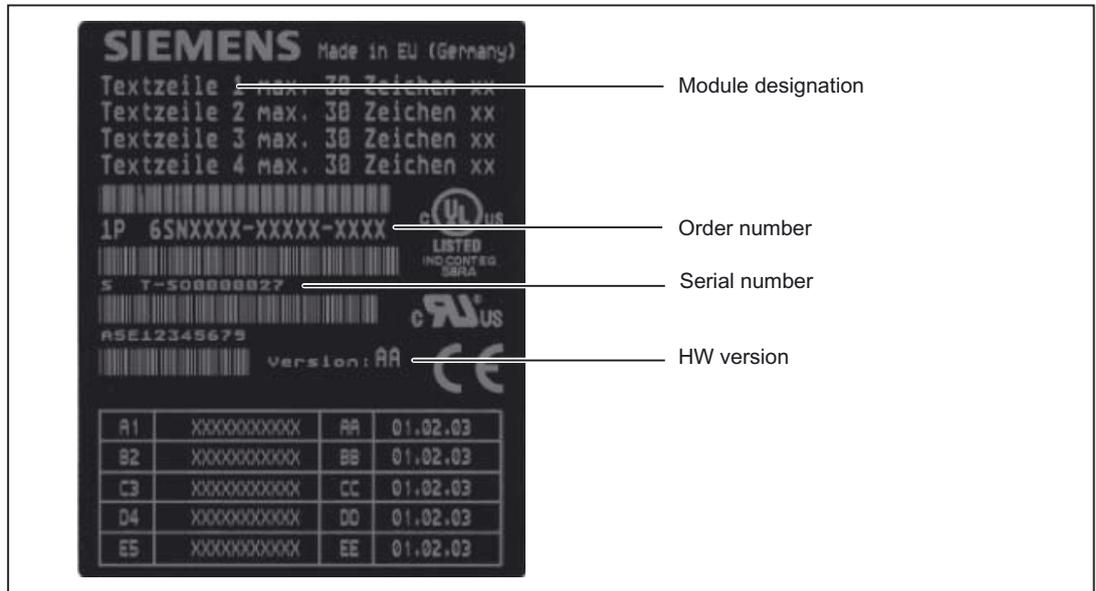


Figure 1-3 SIMOTION D410 nameplate

The following nameplate includes the SIMOTION D410 DP barcode numbers and is located on the front side of the module.

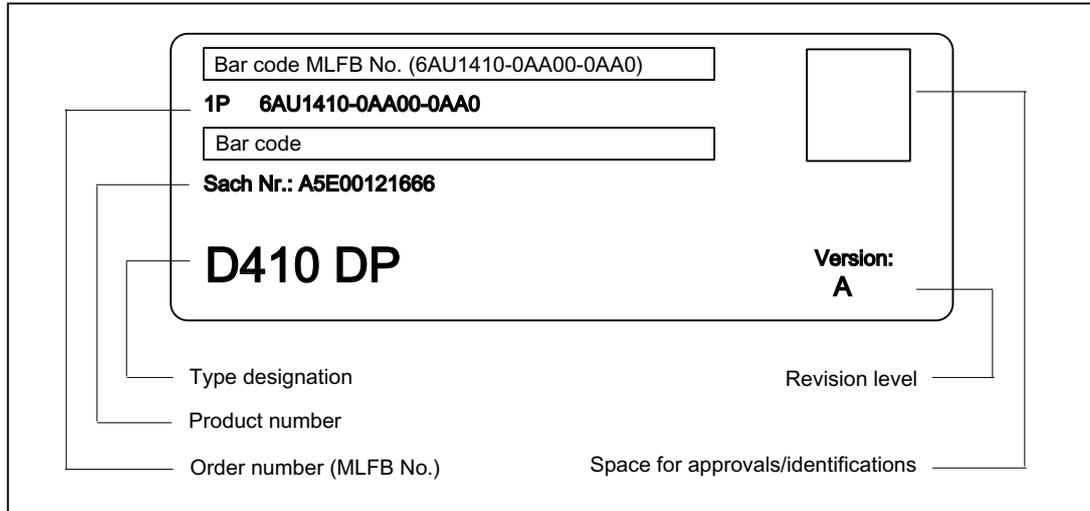


Figure 1-4 SIMOTION D410 DP nameplate (example)

Note

The contents of the individual nameplate fields on the current module may differ from those described in this Manual (e.g., updated product status, space for approvals and identifications, etc.).

1.4 SIMOTION D410 PN display

View

The following figure shows SIMOTION D410 PN with the interfaces and front elements.

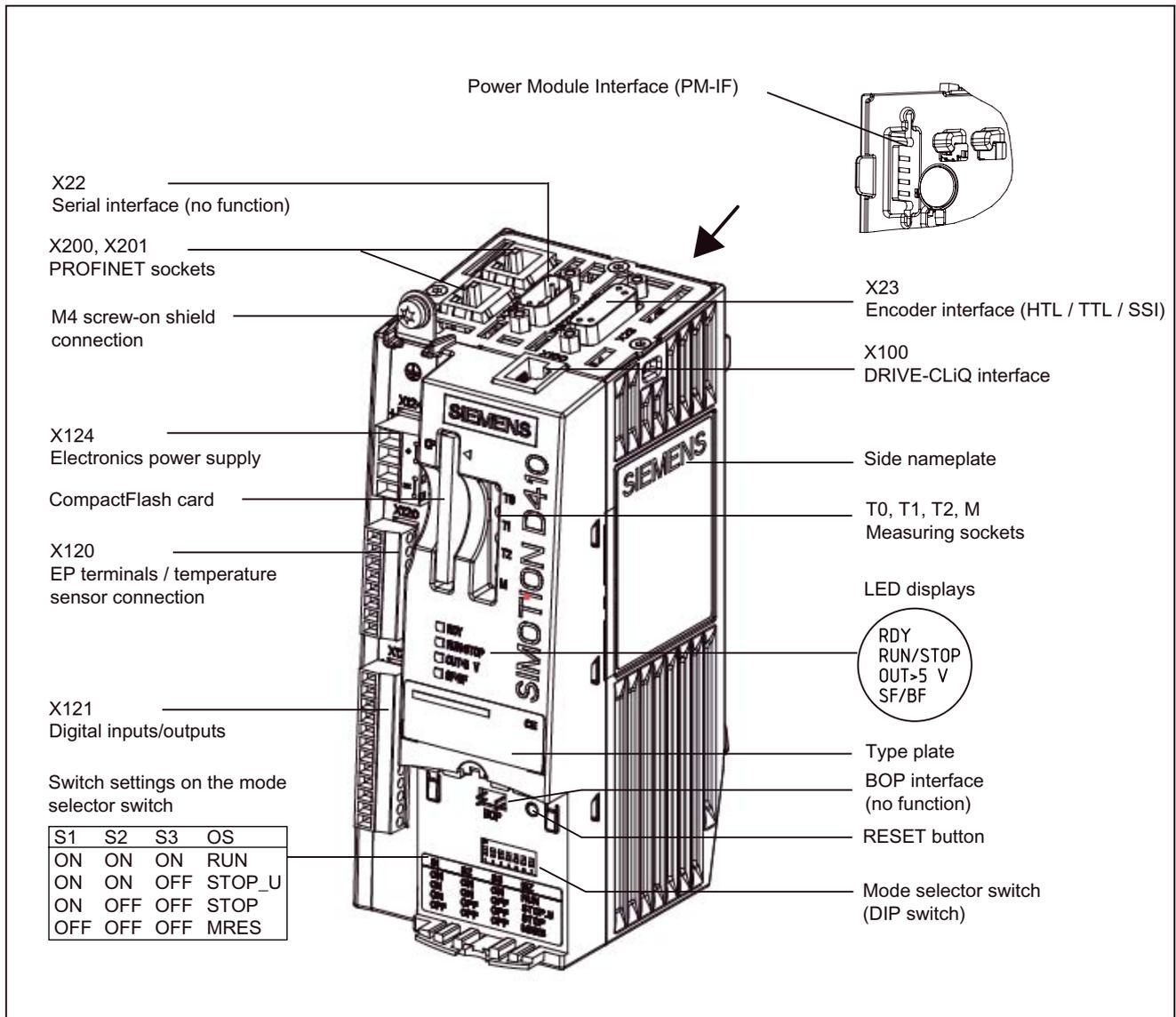


Figure 1-5 Location of interfaces and front elements in SIMOTION D410 PN

Interfaces

The SIMOTION D410 PN interfaces are described in the following tables.

Table 1-6 SIMOTION D410 interfaces

Interface	Description
Digital inputs/outputs X121	12-pin Mini Combicon: <ul style="list-style-type: none"> • 4 digital inputs: for connecting switches and proximity sensors • 4 digital inputs/outputs: for connecting actuators and sensors
DRIVE-CLiQ interface X100	8-pin RJ45plus socket to connect DRIVE-CLiQ nodes
PROFINET interface (ports X200 and X201)	8-pin RJ45plus socket to connect to PROFINET
Power Module Interface (PM-IF)	8-pin direct connector to connect to a blocksize power module
Encoder interface (HTL / TTL / SSI) X23	15-pin SUB-D socket for connecting HTL, TTL and SSI encoders.
EP terminals / temperature sensor connection X120	8-pin Mini Combicon for connecting Safety Integrated input terminals or for connecting temperature sensing via KTY or PTC
Power supply connection X124	4-pin screw terminal connection to connect the 24 V DC load power supply
Measuring sockets T0, T1, T2 and M	Sockets to output analog signals

Nameplates

The following figure shows you all the information included on the nameplates located on the side of the unit.

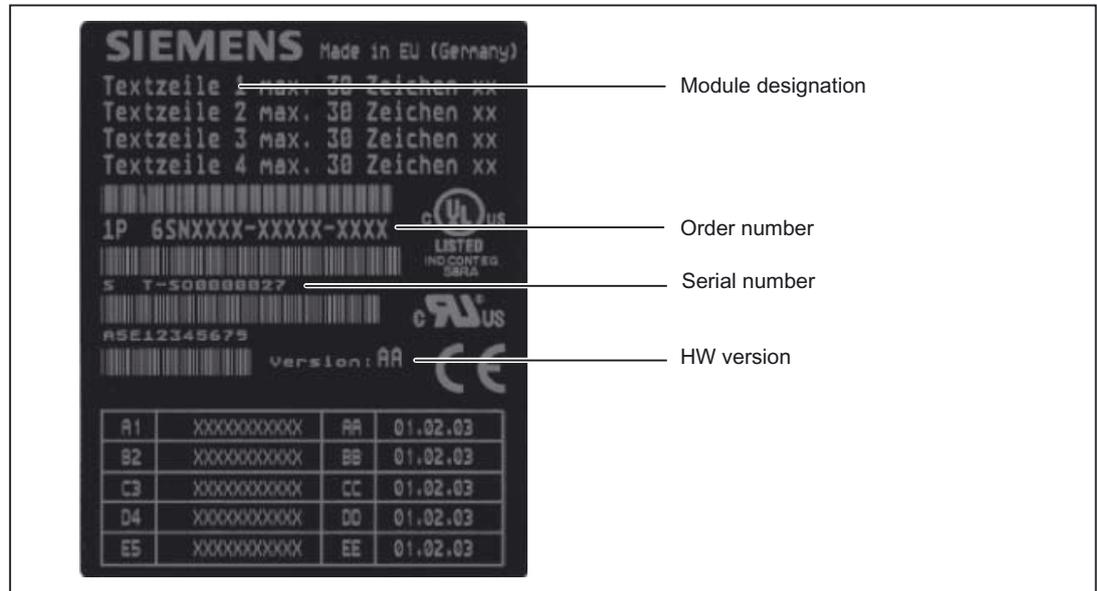


Figure 1-6 SIMOTION D410 nameplate

The following nameplate includes the MAC address of the PROFINET interface (ports X200 and X201) and is located on the front side of the module.

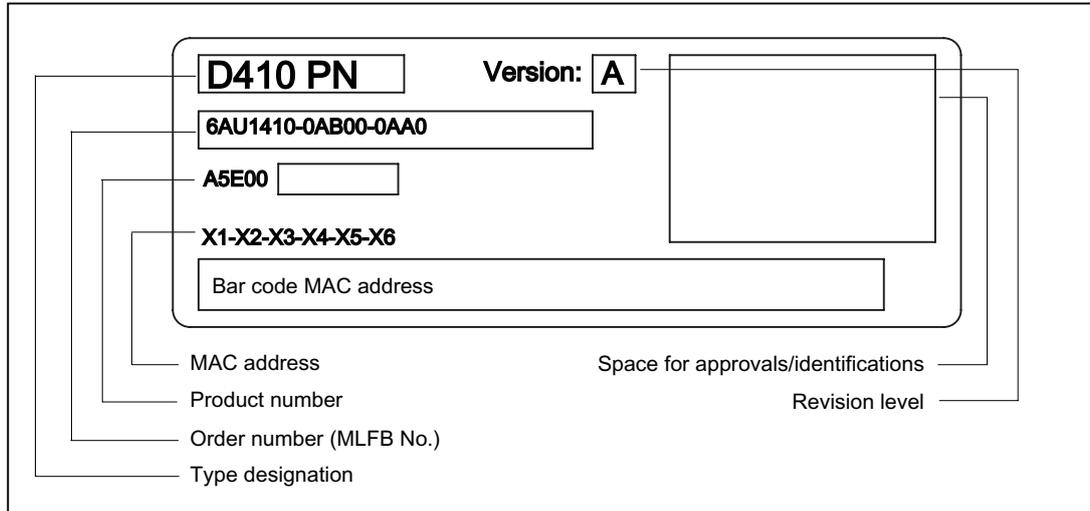


Figure 1-7 SIMOTION PN nameplate (example)

Note

The contents of the individual nameplate fields on the current module may differ from those described in this Manual (e.g., updated product status, space for approvals and identifications, etc.).

1.5 The CompactFlash card

CompactFlash card

The following figure shows you all the information included on the nameplate of the CompactFlash card (CF card).

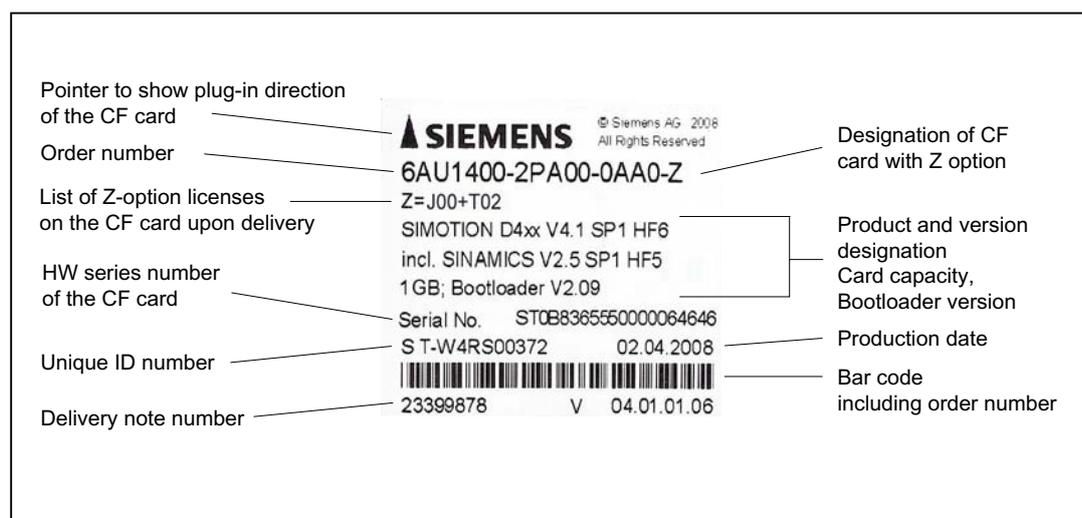


Figure 1-8 CompactFlash card

Pre-installed runtime licenses

For versions V4.1 SP1 HF6 and higher, pre-installed licenses are printed on the type plate of the CF card as a Z option underneath the order number.

Example with Z option for a combined SIMOTION IT license + 2 TControl licenses:

6AU1400-2PA00-0AA0-Z

Z=J00+T02

A maximum of 7 different Z options are printed on the type plate of the CF card. When there are more than 7 different Z options, the text "Z = see delivery order" is printed on the CF card in place of the Z option.

Available Z options / licenses for SIMOTION D CF cards

The following Z options are available for SIMOTION D410:

TControl temperature control:

- Txx – TControl license and number (e.g. T03 = 3 TControl licenses)

SIMOTION IT:

- D00 – IT DIAG license
- X00 – OPC XML-DA license
- J00 – Combined license for SIMOTION IT, comprises SIMOTION IT Virtual Machine for Java applications, SIMOTION IT DIAG and SIMOTION IT OPC XML-DA

Safety functions:

- Fxx - License for SINAMICS Safety Integrated Extended Functions (e.g., F01 = 1 license for safety functions)

1.6 Licensing

SIMOTION D410 licensing

SIMOTION D410 is a modular drive system for single-axis applications. D410 contains the Motion Control technology functions for exactly one real axis (speed-controlled, positioning, synchronized axis or cam). This means that these technology functions do not require an additional license. It is not possible to increase the number of axes using licenses. Along with the one real axis, further virtual axes can be configured and loaded.

Licenses are required for runtime functions such as SIMOTION IT DIAG. These can be pre-installed on a CompactFlash card (CF card) or ordered separately.

Additional references

For more information about license management, see the *SIMOTION SCOUT Configuring Manual*. General information about licensing can be found in the *Motion Control SIMOTION, SINAMICS S120 catalog and motors for production machines catalog, PM21 2008*.

1.7 Safety information

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

 CAUTION
--

The CompactFlash card may only be unplugged and plugged in when SIMOTION D410 is switched off (zero current)!

 CAUTION
--

The 50 mm clearances above and below the components must be observed. The ventilation openings may not be covered by connecting cables.

Commissioning (hardware)

2.1 Prerequisites for commissioning

Prerequisites

Prerequisites for commissioning the SIMOTION D410:

- You have completed installation and the wiring of your system with SIMOTION D410.
- A programming device / PC is available.

Connecting a programming device / PC to SIMOTION D410

You can interconnect the programming device / PC:

- With the PROFIBUS interface of SIMOTION D410 DP (X21 connector) using a connecting cable.

Information pertaining to cable lengths for PROFIBUS DP is available in the *SIMOTION D410* Manual.

- With the PROFINET interface of SIMOTION D410 PN (X200 or X201 connector) using a twisted pair cable.

Information pertaining to PROFINET communication is available in chapter "Configuring PROFINET".

System requirements

System requirements for hardware commissioning:

- The programming device must be equipped with a PROFIBUS or Ethernet adapter.
- The programming device / PC must be interconnected with SIMOTION D410 DP (connector X21) for online communication on PROFIBUS DP.
- The programming device / PC must be interconnected with SIMOTION D410 PN (connector X200 and 201) for online communication on PROFINET.
- You need a CF adapter on the programming device / PC to write to the Compact Flash Card (for example, a SIMOTION firmware update).

2.2 Inserting the Compact Flash card

Properties of the CF card

The CF card is mandatory for operation of SIMOTION D410. The SIMOTION kernel and the drive control software (SINAMICS firmware) are installed on the CF card.

The CompactFlash card must be inserted when you start up SIMOTION D410 in order to load the SIMOTION kernel.

Note

The Compact Flash Card may only be removed and inserted while SIMOTION D410 is in de-energized state!

Procedure

Insert the CompactFlash Card as follows:

1. The insertion direction of the CompactFlash Card is identified by an arrow on the card and a matching arrow on the slot. Align the arrows when inserting the CompactFlash Card.
2. Gently push the CompactFlash Card into the card slot of SIMOTION D410 until it engages. The properly inserted card does not protrude from the SIMOTION D410 housing.

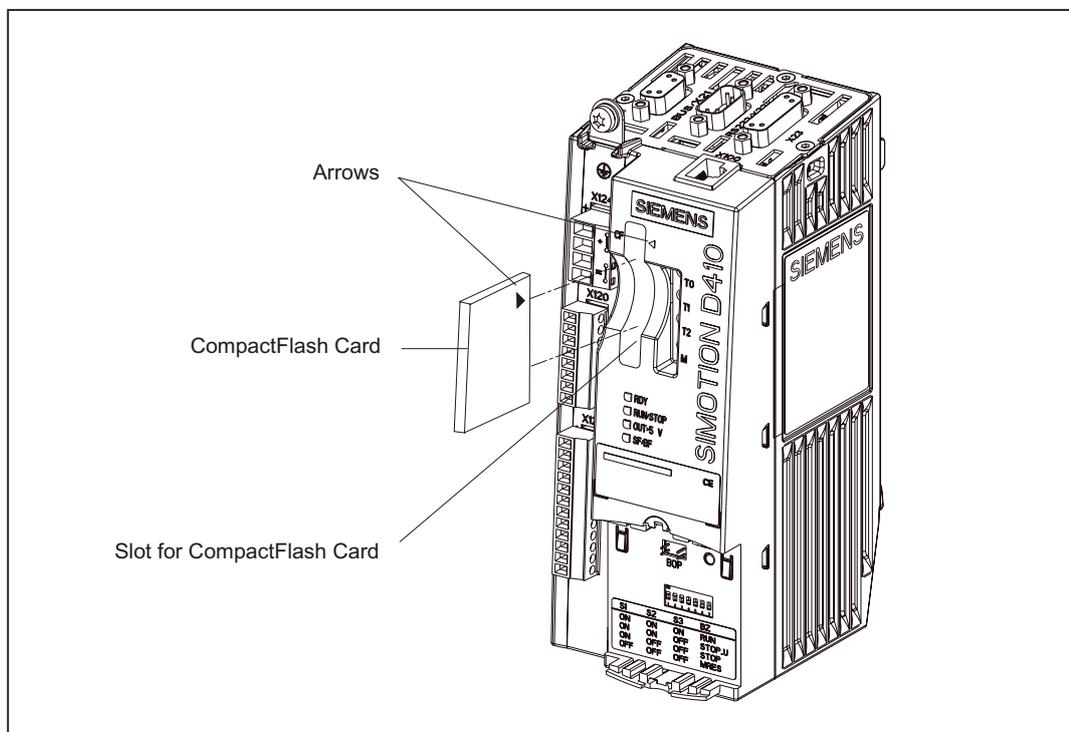


Figure 2-1 Inserting the CompactFlash Card

2.3 Switching on the power supply

Checking the system

Check the system installation and wiring once again before you switch it on. Observe the safety-relevant items of the following checklist:

- Have you observed all ESD measures when handling the components?
- Are all connectors properly inserted and interlocked / screwed on?
- Are all components grounded and all shields terminated?
- Have you made allowances for sufficient load capacity of the central power supply?

Switching on the external power supply

Power is supplied to the SIMOTION D410 using an external power supply unit, for example, using SITOP power supplies (in special circumstances, the SIMOTION D410 can also be supplied using the PM340 Power Module, see SIMOTION D410 Manual).

Switch on the power supply after having checked off all items of the checklist.

 CAUTION

It is imperative to prevent the external 24 VDC power supply to SIMOTION D410 from being interrupted for a duration longer than 3 ms. Operation of SIMOTION D410 is stopped on expiration of these 3 ms and can only be recovered by cycling power Off > On.
--

Additional information is available in chapter "User memory concept".

Startup of SIMOTION D410

The startup of SIMOTION D410 is initiated after the power supply is activated:

1. The RDY LED is lit and the red RUN/STOP LED briefly lights up at the beginning of the startup sequence. These LEDs can be used to monitor the startup sequence. Any errors are displayed.
2. Startup of the SIMOTION kernel.
3. All DRIVE-CLiQ connections (with SINAMICS S120 Power Module PM340, for example) are identified automatically.

Note

Startup of SIMOTION D410 is completed as soon as its RDY LED is lit in green color and the RUN/STOP LED is lit in yellow or green color.

The SIMOTION D410 is ready for configuring after successful completion of the startup.

2.4 RESET button

Arrangement

The RESET button is located behind the blanking plate on the SIMOTION D410.

Performing a reset operation

A reset causes the entire system to be reset and requires the system to be ramped-up again. It is similar to a "Power On Reset" except that the 24 V power supply does not have to be switched off.

2.5 User memory concept

2.5.1 SIMOTION D410 memory model

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

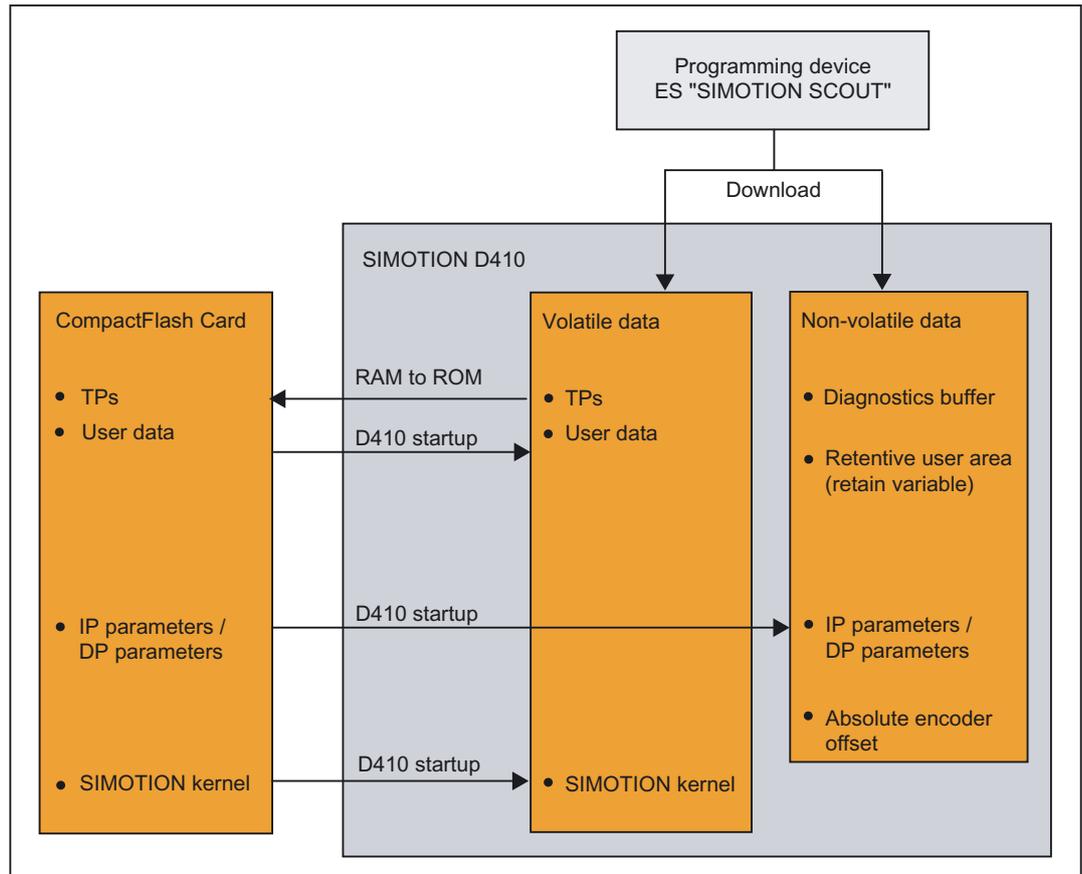


Figure 2-2 SIMOTION D410 memory model

The next chapters provide information pertaining to user memories and to the sequences of specific user actions.

See also

Properties of the user memories (Page 36)

Operator actions and their impact on user memory (Page 38)

2.5.2 Properties of the user memories

Non-volatile data

Non-volatile data is used with the objective of retaining user- and system-relevant data when SIMOTION D410 is in de-energized state. You will find information about the area that can be used for non-volatile data in the *SIMOTION SCOUT* Configuration Manual.

Non-volatile data available in SIMOTION devices:

Table 2-1 Content of non-volatile data

Non-volatile data	Content
Kernel data	<ul style="list-style-type: none"> Last operating state IP parameters (IP address, subnet mask, router address) DP parameters (PROFIBUS DP address, baud rate) Diagnostics buffer
Retain variables	<ul style="list-style-type: none"> Variables in the interface or implementation section of a unit declared with VAR_GLOBAL RETAIN Global device variables set with the "RETAIN" attribute
Retain TO	Absolute encoder offset

Properties of non-volatile data of SIMOTION D410:

Table 2-2 Properties of non-volatile data

Properties	Meaning
Location:	Non-volatile data resides in the FRAM of SIMOTION D410.
Backup battery:	A backup battery is not required.
Backup time:	Unlimited



More information

IP and DP parameters in non-volatile data

The IP and DP parameters are loaded from configuration data on the CompactFlash Card during startup for use by the SIMOTION device. The SIMOTION D410 can use the addresses defined in these data to go online. The IP and DP parameters on the CompactFlash Card are also written to non-volatile memory during startup. The IP and DP parameters in non-volatile data is retained and used by the SIMOTION device if the system is restarted with a CompactFlash Card which does not contain any configuration data. The SIMOTION device can always be made available online if the configuration was downloaded to the device at least once using SIMOTION SCOUT, or if the SIMOTION device was started up with Compact Flash Card.

Volatile data

Definition of the properties of volatile data:

- Volatile data resides in the RAM area of SIMOTION D410.
- The download data of SIMOTION SCOUT is written to this memory.
- These data is lost after the SIMOTION D410 is shut down.
- Contents of the "volatile data" area:
 - SIMOTION kernel
 - Technology packages (TP)
 - User data (programs, configuration data, parameters)

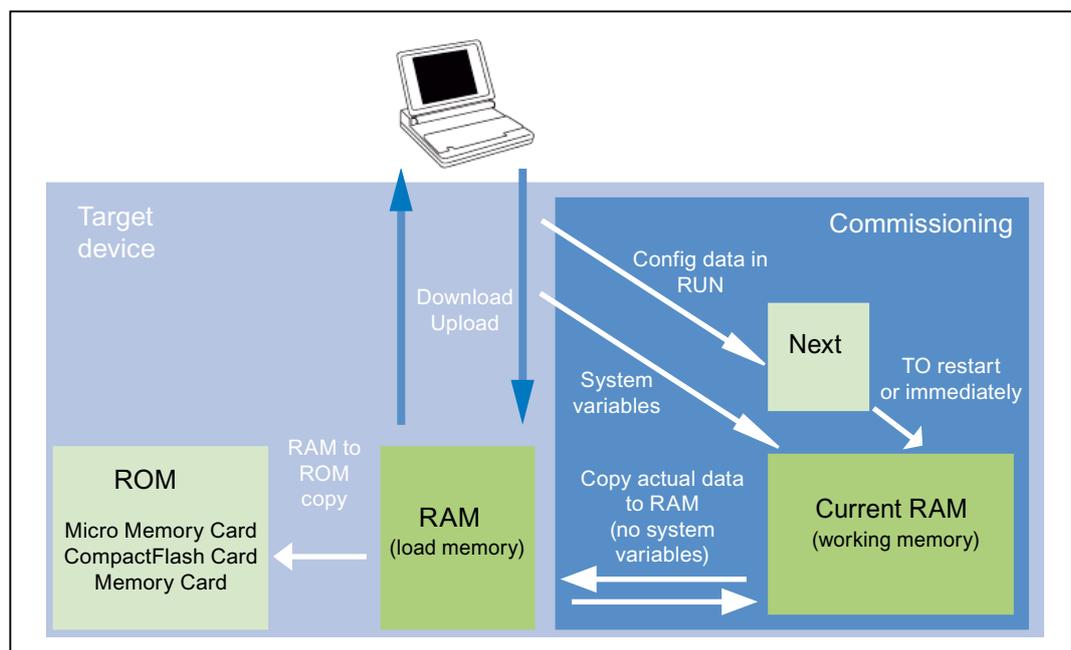


Figure 2-3 Configuration data and system variables on volatile memory

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

CompactFlash Card

The CompactFlash Card contains the following data:

- SIMOTION kernel
- Technology packages (TP)
- User data (units, configuration data, parameters, task configuration)
- IP parameters (IP address, subnet mask, router address)
- DP parameters (PROFIBUS DP address, baud rate)

2.5.3 Operator actions and their impact on user memory

The next section describes the user actions identified in the "SIMOTION D410 memory model" by arrows and their impact on user memory.

Download SIMOTION SCOUT

The "Download" command transfers the following data from the Engineering System to the "volatile data" area:

- User data (units, configuration data, parameters, task configuration)
- Technology packages

The IP and DP parameters are furthermore saved to the "non-volatile data" area. The retain variables are initialized with their start values. This however, depends on the settings in SIMOTION SCOUT. Volatile data is lost if you shut down the SIMOTION D410 module after the download.

Copy RAM to ROM

The "Copy RAM to ROM" command is used on the ES to save the following data to the CompactFlash Card:

- Technology packages and user data (units, configuration data, parameters, task configuration) of the "volatile data" area
- Actual values are copied to the "volatile data" area, depending on the settings in SIMOTION SCOUT

Note

The "Copy RAM to ROM" command does not save the actual values of the retain variables to the CompactFlash Card:

Startup of SIMOTION D410

The SIMOTION kernel is loaded from the CompactFlash Card to the "volatile data" area during the startup of SIMOTION D410.

Volatile data is lost if you shut down the SIMOTION D410 module after the download. Data loaded from the CompactFlash Card at the next restart:

- The technology packages and user data to the "volatile data" area
- IP and DP parameters to the "non-volatile data" area

Backup of non-volatile data

The "_savePersistentMemoryData" system function is used to save the contents of non-volatile data to the CompactFlash Card. This backup prevents the retain variables and the absolute encoder position from being lost if a component is replaced.

The backup copy is saved to the "PMEMORY.XML" backup file in the "USER/SIMOTION" folder. On system side it is always ensured that a consistent overall image of the non-volatile data is available at the next restart, 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 backup to this new file fails (for example, due to insufficient storage capacity of the CompactFlash Card), the existing backup file is used in the next attempt to restore the content of non-volatile data. The backup file is deleted if the new file was successfully created.

NOTICE

An absolute encoder overflow after "_savePersistentMemoryData" was executed indicates that the restored non-volatile data contains an incorrect actual position value. The encoder must be referenced again (absolute encoder adjustment)!

Startup and non-volatile data

The table below describes the startup situations which may develop in terms of the non-volatile data and how to handle such situations.

Table 2-3 Startup situations with non-volatile data

Situation	Initial condition	Result
1	Valid contents of non-volatile data.	Startup of SIMOTION D410 with the non-volatile data. The PROFIBUS address in non-volatile data is therefore valid, for example.
2	Invalid contents in non-volatile data, and neither a backup file (PMEMORY.XML), nor a backup copy (PMEMORY.BAK) exists.	SIMOTION D410 copies the factory defaults to its non-volatile data and restarts using this data. The default PROFIBUS address is valid in this case, for example.
3	Invalid contents in non-volatile data. A backup file (PMEMORY.XML) with valid contents is available.	SIMOTION D410 copies the contents of the backup file to its non-volatile data and starts using this data.
4	Invalid contents in non-volatile data and in the backup file, and a backup copy (PMEMORY.BAK) is not available.	SIMOTION D410 copies the factory defaults to its non-volatile data and restarts using this data. The default PROFIBUS address is valid in this case, for example.
5	Invalid contents in non-volatile data and in the backup file, and a backup copy (PMEMORY.BAK) with valid contents is available.	SIMOTION D410 copies the contents of the backup file to its non-volatile data and starts using this data.

Diagnostics of non-volatile data

Users can determine the status of non-volatile data by reading the diagnostics buffer and the system variable.

The following message events are entered once in the diagnostics buffer when they occur:

Table 2-4 Messages of the diagnostics buffer

Entry	Meaning	To correct or avoid errors
Non-volatile data loaded from file (Persistent Data File Loading done)	Non-volatile data successfully restored from the backup file to the CompactFlash Card.	-
Non-volatile data loaded from the backup file (Persistent Data Backup File Loading done)	Non-volatile data successfully restored from the backup copy to the CompactFlash 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"> • Backup file or backup copy not available • Invalid data in backup file 	Use the "_savePersistentMemoryData" system function to generate a backup file with valid contents.

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

System variable "persistentMemoryPowerMonitoring.persistentDataState" indicates the status of non-volatile data after startup:

Table 2-5 Status of non-volatile data after startup

Status	Meaning
FROM_RAM (1)	Non-volatile data is activated in the SIMOTION device
FROM_FILE (2)	Non-volatile data was restored from the backup file
FROM_BACKUP (3)	Non-volatile data was restored from the backup copy
INVALID (4)	Non-volatile data and data in the backup file / backup copy are invalid, or do not exist, or were deleted. The SIMOTION device copied the factory defaults to its non-volatile data and started using this data.

See also

SIMOTION D410 memory model (Page 35)

Configuring SIMOTION D410

3.1 Software requirements

SIMOTION SCOUT Engineering System

The SIMOTION SCOUT Engineering System must be installed on your programming device / PC in order to commission the SIMOTION D410. Observe the information on the current "SIMOTION SCOUT" CD.

For information on how to install SIMOTION SCOUT on your programming device / PC, refer to the *SIMOTION SCOUT* Configuration Manual.

3.2 Inserting SIMOTION D410 into a project

Creating a project and configuring the programming device / PC interface

Proceed as follows in order to create a project in SIMOTION SCOUT and to insert a SIMOTION D410:

1. Select the "Project > New..." menu.
2. Enter a name for your project in the "New Project" dialog box and confirm your entry with "OK".
A new folder is generated in the Project Navigator and assigned the name of the project.
3. Double-click "Create new device" in the Project Navigator. The "Create New Device" dialog box opens. Select D410 from the "CPU type" field and the characteristic of your module (D410 DP or D410 PN) from the "Variant" field. Confirm with "OK".
4. The "Properties" dialog box of the (PROFIBUS or PROFINET) interface opens where you set up the connection to the programming device / PC according to the module characteristics.

Communication with the programming device / PC via PROFIBUS (only for D410 DP)

1. Select the PROFIBUS interface from the "Properties - PROFIBUS/MPI" dialog box and confirm your selection with "OK".
2. The connection to the programming device / PC is activated automatically and **HW Config** opens.

Note

The active state setting of the connection to the programming device / PC is only visualized in **NetPro!**

Interconnection with the programming device / PC on PROFINET (only for D410 DN)

The "Properties - Ethernet Interface" dialog box is open.

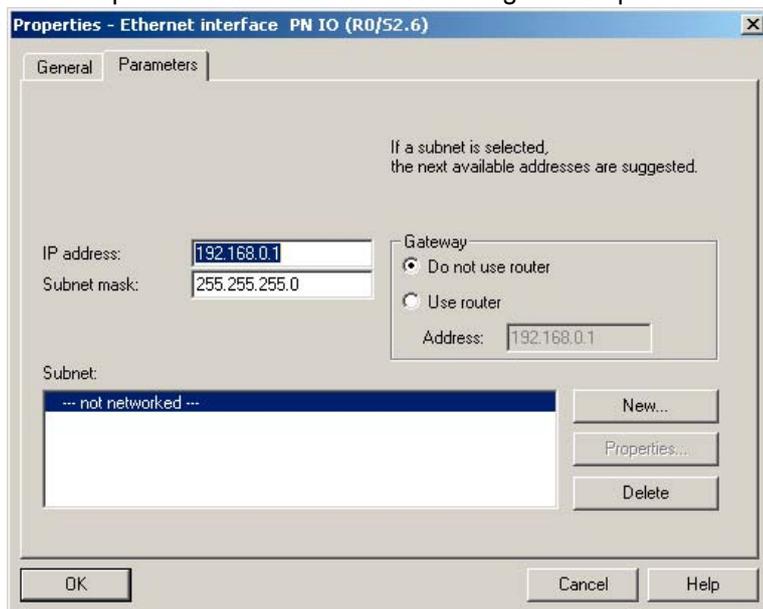


Figure 3-1 Properties of the Ethernet interface

Program the following parameters in the "Properties - Ethernet Interface" dialog box:

1. Click "New".
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. Define your addresses in the "IP address" and "Subnet mask" fields of the "Properties - Ethernet Interface" dialog box. Change to the "Network node" field and define whether you are going to use a router and, if yes, enter the router address. Confirm with "OK".
4. Select the PROFINET interface from the "Properties" dialog box and confirm your selection with "OK".
5. The connection to the programming device / PC is activated automatically and **HW Config** opens.

Note

The active state setting of the connection to the programming device / PC is only visualized in **NetPro!**

Representation in HW Config

SIMOTION D410 is represented in **HW Config**.

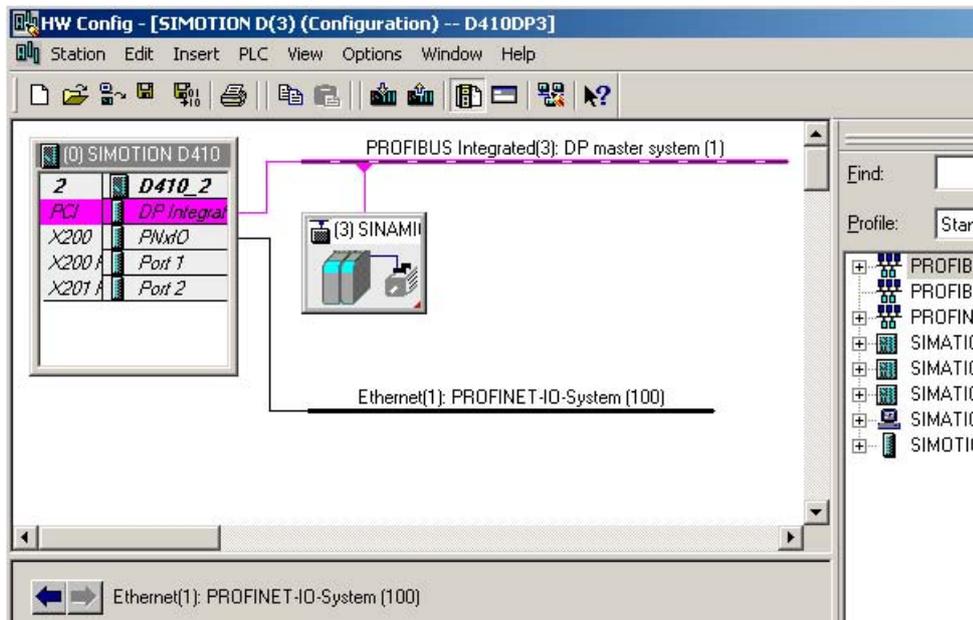


Figure 3-2 Image of a SIMOTION D410 PN in HW Config

3.3 Configuring the PROFIBUS DP interface (only D410 DP)

3.3.1 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 node)
Components representing a bus master determine the data traffic on the bus and are therefore also referred to as active bus nodes.
- Slaves (passive bus nodes)
These devices may only receive, acknowledge and return messages to the master if requested by the master.
Examples: SINAMICS drives, I/O modules

Note

If a SIMOTION D410 DP is operated as a passive PROFIBUS I-slave, the display, measuring functions and controller optimization engineering functions will be very slow. If possible, use the "active I-slave" setting for local commissioning (which does mean that an equidistance is no longer possible) and for complete commissioning, switch to "passive I-slave".

Additional references

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

3.3.2 Assignment of the 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

All PROFIBUS addresses you assign must be unique on the PROFIBUS subnet.

Information pertaining to the rules of communication on the PROFIBUS subnet is available in the *SIMOTION D410* Manual.

Define the PROFIBUS address separately for each device on your programming device / 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 programming device and "1" for a service HMI device which are connected to the subnet as required.

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

Reserve address "2" for a SIMOTION D410. This prevents redundancy of the addresses after SIMOTION D410 is installed in the subnet with default settings (for example, when replacing a SIMOTION D410). Assign addresses higher than "2" to any additional devices on the subnet.

3.3.3 Operating SIMOTION D410 on PROFIBUS DP.

PROFIBUS DP interface (X21)

SIMOTION D410 provides an interface for connecting to PROFIBUS DP. The interface supports transmission rates up to 12 Mbit/s.

The PROFIBUS DP interface can be operated as:

- DP slave, isochronous
- DP master, isochronous
- DP slave, not isochronous
- DP master, not isochronous

Both PROFIBUS DP interfaces are set by default for operation as master at address 2 at a transmission rate of 1.5 Mbit/s. The PROFIBUS DP network is automatically detected and generated for this setting.

However, you can select other settings. Such user-specific settings must be configured in **HW Config** and **NetPro**.

3.3.4 Creating a new PROFIBUS DP subnet

The SIMOTION D410 device is networked using SIMOTION SCOUT. Set up your user-specific bus parameters for the PROFIBUS interface when you configure the network.

Note

The actions outlined below only need to be taken if you have not selected an interface when integrating SIMOTION D410 into the project (cf. chapter "Integrating SIMOTION D410 into a project").

Next, interconnect the programming device / PC using **NetPro** with the device, see the chapter "Configuring the programming device / PC interface".

1. Double-click the "D410" entry in the Project Navigator in order to open **HW Config**.
2. Double-click the DP/MPI interface in the SIMOTION D410 representation in **HW Config**.
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 then enter its properties in the "Network settings" tab, for example, the transmission rate.
6. Click "OK" to accept the settings.

The new subnet is now displayed in the "Properties - PROFIBUS interface DP/MPI" dialog box and is ready for being interconnected with the PROFIBUS DP interface.

7. Save and compile the changes.

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

3.3.5 Setting the DP cycle and system cycle clocks

All system clocks for SIMOTION D410 DP are based on the DP cycle of SINAMICS Integrated, which must be set in **HW Config**.

Double-click the SINAMICS block at 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 3-1 Range of values for SIMOTION D410 DP

DP cycle:	≥ 1 ms
Resolution:	0.125 ms

The PROFIBUS DP interface of the SIMOTION D410 DP supports operation at a DP cycle time ≥ 1 ms, at a resolution of 0.125 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 cycle" in the "System Clocks - D410..." dialog box in SIMOTION SCOUT. Select the SIMOTION D410 DP in the project tree, and then select the "Set system clocks" option in the "Target system" > "Expert" menu.

The table below shows the ratios you can set for the system clocks of SIMOTION D410 DP based on the DP cycle.

Table 3-2 Possible factors between the system cycle clocks

Bus cycle: Servo cycle clock	Servo cycle clock: IPO cycle	IPO cycle: IPO2 cycle
1 ... 4, 6, 8	1 ... 6	2 ... 64

The minimum configurable length of the servo cycle is 1 ms. In conjunction with technology objects, a minimum servo cycle of 2 ms is recommended.

If you programmed the PROFIBUS DP interface for operation in isochronous master mode, you must synchronize its DP cycle with the DP cycle of SINAMICS Integrated in **HW Config**.

The timebase for the system clocks is generated internally if the DP interface is operated in isochronous or non-isochronous master mode. SIMOTION D410 does not have to synchronize itself with an external cycle.

The PROFIBUS DP interface can also be operated in isochronous slave mode. In this constellation system clocks are based on the clock signals received at the slave interface. A substitute clock of a duration equivalent to the configured clock is generated internally if the isochronous slave interface has not received a clock signal.

The clock settings are included in the project download to SIMOTION D410 DP and are adjusted according to specification.

At a PROFIBUS DP interface operated in isochronous slave mode you can also step down the clock ratio for synchronization with SINAMICS Integrated. This reduction of the clock ratio at the isochronous slave interface for synchronization with SINAMICS Integrated allows the operation of a DP cycle at the slave interface which is equivalent to an integer multiple SINAMICS Integrated. You set up this reduction by configuring the SINAMICS Integrated and DP interface cycles in **HW Config**. The rule is checked in **HW Config**.

3.3.6 Rules for SIMOTION D410 DP

Rules for synchronizing the system clocks

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

1. The DP cycle must be an integer multiple of the current controller cycle. Error A01902 (2) is reported in the drive if this rule is violated.
2. The master application cycle (T mapc), which corresponds to the servo cycle, must be an integer multiple of the speed controller cycle. Error A01902 (7) is reported in the drive if this rule is violated. The smallest-possible T mapc so results from the smallest common multiple of the DP cycle and the speed controller cycle.
If the master application cycle = 1, this means 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). Error A01902 (13) is reported in the drive if this rule is violated.

Note

In addition to the rules mentioned, also observe the rules outlined below. These rules apply both to SIMOTION D410 DP and to SIMOTION D410 PN!

An overview of errors reported in SINAMICS Integrated is provided in the SINAMICS S Parameter Manual

Rules for SIMOTION D410 DP

The general rule for SIMOTION D410 specifies that the DP cycle (D410 DP) forms the basic clock of the cycle system. All cycles longer than this basic clock must be an integer multiple of the basic clock.

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

- Speed controller p115[1]
- Flow controller p115[2]
- Setpoint channel p115[3]
- Position controller p115[4]
- Positioning p115[5]
- Technology controller (p0115[6])
- Onboard I/O p0799
- Terminal module I/O p4099

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

If any change to the DP 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" from "SINAMICS_Integrated" in the Project Navigator, and then open the "Expert List" by selecting the "Expert" command from the shortcut menu.

Example: A default value of 4 ms is set at the SINAMICS setpoint channel. If setting a DP cycle of 3 ms you must set an integer multiple value as required at the setpoint channel, for example, 3 ms or 6 ms.

3.4 Configuring PROFINET (only for D410 PN)

3.4.1 General information about PROFINET communication

Overview

PROFINET is an open component-based industrial communication system using Ethernet (IEC 61158) for distributed automation systems.

The PROFINET interface supports operation of SIMOTION D410 PN as IO controller and/or as intelligent device.

PROFINET distinguishes between the controller and its assigned devices. Controller and devices form a PROFINET IO system, comparable to a master-slave system on PROFIBUS.

SIMOTION D410 PN supports the following PROFINET communication methods:

- RT
- IRT
With IRT, a distinction is made between IRT with high flexibility and IRT with high performance.

Additional references

Additional information pertaining to PROFINET communication is available in the *SIMOTION Communication System Manual*.

3.4.2 Operating SIMOTION D410 PN on PROFINET

PROFINET interfaces (X200, X201)

SIMOTION D410 PN provides a dual-port PROFINET interface (X200 and X201). The interface supports transmission rates as high as 100 Mbit/s. It can also be operated isochronous and equidistant. The autocrossing functionality means both crossed and uncrossed cables can be used

A port has two integrated LEDs, a green LED and an orange LED. The following LED states can occur:

Table 3-3 LED states of the LED on the port of the PROFINET interface

LEDs	State	Meaning
Green	LED off	No connection to an active partner exists.
	LED on	A connection to an active partner exists.
Orange	LED off	No data is being exchanged.
	LED flashing	Data is being exchanged over the port. The LED flashes irregularly depending on the data exchange, i.e. the LED does not flash with a specific frequency.

Properties of PROFINET on SIMOTION D410 PN

SIMOTION D410 PN on PROFINET supports the following properties

- PROFINET specifies operation at 100 Mbit/s.
- The minimum send cycle is 0.5 ms, and the maximum is 4 ms.
- The setting accuracy for the send cycle is 125 µs.

The use of cycle reduction is possible for the D410. Detailed information concerning cycle reduction is available in the SIMOTION SCOUT Communication System Manual.

Initializing SIMOTION D410

SIMOTION D410 must be assigned an IP address and a device name in order to enable downloading of the project. This is performed online on the SIMOTION device using the so-called "node initialization". To perform the node initialization, the programming device / PC must be connected with the SIMOTION D410 PN. SIMOTION SCOUT must be open.

1. Click the "Reachable nodes" button on the SIMOTION SCOUT toolbar. The newly opened "Reachable nodes" window shows the SIMOTION D410 device as "bus node" with the address 0.0.0.0 and a name.
2. Select the "Bus node" entry and open the "Edit Ethernet node..." function in the context menu. The "Edit Ethernet Node" dialog box opens.
3. Enter a name in the "Device name" field.
4. Click the "Assign name" button and confirm the displayed message with "OK."
5. Enter an appropriate IP address for the Ethernet subnet in the "IP address" field.
6. Enter an appropriate subnet mask for the Ethernet subnet in the "Subnet mask" field.
7. If required, enter the data for a network gateway.
8. Click "Assign IP Configuration". The entered data is assigned to the SIMOTION device.
9. Confirm the displayed message with "OK".
10. Click the "Close" button to close the "Edit Ethernet Node" window.
11. Click the "Update" button in the "Reachable Nodes" window. The SIMOTION D410 device is now displayed as "Geraet_01" with the type designation of the device and the assigned IP address.
12. Click the "Close" button to close the "Reachable Nodes" window.

Reading the IP address

To fetch the IP address, the SIMOTION SCOUT must be in online mode.

The IP address of SIMOTION D410 PN can be viewed in SIMOTION SCOUT as follows:

1. Establish an online connection to the SIMOTION D410.
2. Right-click the SIMOTION device in SIMOTION SCOUT.
3. Select the "Target device > Device Diagnostics" command from the shortcut menu.

The address is displayed as follows, for example:

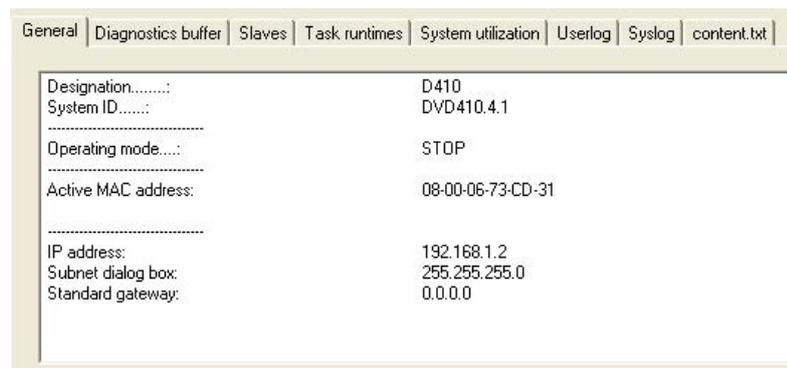


Figure 3-3 Reading the IP address

Note

The MAC address is available on the rating plate on the front panel of the module.

Changing the IP address, device name, network gateway

Set the IP address, the subnet mask and, if necessary, the data for a gateway (router address) in order to enable communication over PROFINET with SIMOTION D410.

If you want to change the properties in the PROFINET subnet, you can change them using the "Reachable nodes" function in SIMOTION SCOUT or in the HW Config.

The "Reachable nodes" function with SIMOTION SCOUT is described in the "SIMOTION D410 initialization" section.

To configure and transfer the properties in HW Config, proceed as follows:

1. Open your project in SIMOTION SCOUT.
2. Open **HW Config**. Double-click the PROFINET interface to open the "Properties" dialog box.
3. Click "Properties". The "Properties - Ethernet Interface" dialog box opens.
4. Click "New". The "New Subnet Industrial Ethernet" dialog box opens. Rename the new subnet, or accept the default name by clicking "OK".
5. Select the new Ethernet subnet which is now displayed in the "Properties - Ethernet Interface" dialog box.

6. Define your addresses in the "IP address" and "Subnet mask" fields of the "Properties - Ethernet Interface" dialog box. Change to the "Network node" field and define whether you are going to use a router and, if yes, enter the router address. Confirm with "OK".
7. Close the "Properties" dialog by clicking "OK".
8. Save and compile the modified hardware configuration.
9. Download the new hardware configuration on PROFINET to your SIMOTION D410.

3.4.3 Setting the send cycles and system clocks

Prerequisite

If, for the PROFINET interface, IRT (high performance) is **not** configured as the RT class, but no data is being transferred (no Controller-Controller cross-traffic, or no synchronized IO device in the internal IO system), the DP cycle of SINAMICS Integrated forms the basis of all clock settings for SIMOTION D410 PN.

Setting the DP cycle in HW Config

Set the DP cycle of SINAMICS Integrated in **HW Config**. Double-click the SINAMICS block at 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 3-4 Range of values for SIMOTION D410 PN

DP cycle:	≥ 1 ms
Resolution:	0.125 ms

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

Setting the send cycle in HW Config

The PROFINET send cycle always forms the basis of the SIMOTION cycles if RT class IRT is set and data is in actual fact transferred. Set the send cycle in the "Domain Management" dialog box of **HW Config**. Open this dialog by selecting the "Edit" > "PROFINET IO" > "Domain Management ..." command in **HW Config**.

The set PROFINET send cycle is displayed in SIMOTION SCOUT as "Bus cycle" in the "System Clocks - D410..." dialog box. Select the SIMOTION D410 PN in the project tree, and then select the "Set system clocks" option in the "Target system" > "Expert" menu.

The PROFINET interface supports send cycle times within the range $0.5 \text{ ms} < \text{send cycle} < 4 \text{ ms}$. The maximum configurable resolution is 0.125 ms.

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

Table 3-5 Possible factors for setting the system clocks

DP cycle / send cycle: Servo cycle clock	Servo cycle clock: IPO cycle	IPO cycle: IPO2 cycle
1 ... 4, 6, 8	1 ... 6	2 ... 64

The minimum configurable length of the servo cycle is 1 ms. In conjunction with technology objects, a minimum servo cycle of 2 ms is recommended.

3.4.4 Rules for SIMOTION D410 PN

Rules for using the PROFINET send cycle

If the PROFINET send cycle is the basis for the cycles, ensure that the DP cycle of the SINAMICS Integrated and the servo cycle are equal.

The timebase for the system clocks are generated internally if the PROFINET interface is not operated with RT class IRT with high performance or IRT with high performance is set, but no data is being transferred. This also applies if the PROFINET interface is operated as synchronization master with RT class IRT with high performance 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 with high performance. 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.

Rules for SIMOTION D410 PN

The general rule for SIMOTION D410 specifies that the send cycle (D410 PN) forms the basic clock of the cycle system. All cycles longer than this basic clock must be an integer multiple of the basic clock.

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

- Speed controller p115[1]
- Flow controller p115[2]
- Setpoint channel p115[3]
- Position controller p115[4]
- Positioning p115[5]
- Technology controller (p0115[6])
- Onboard I/O p0799
- 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" from "SINAMICS_Integrated" in the Project Navigator, and then open the "Expert List" by selecting the "Expert" command from the shortcut menu.

Example: A default value of 4 ms is set at the SINAMICS setpoint channel. If setting a DP cycle of 3 ms you must set an integer multiple value as required at the setpoint channel, for example, 3 ms or 6 ms.

Note

An overview of errors reported in SINAMICS Integrated is provided in the SINAMICS S Parameter Manual

Commissioning (software)

4.1 Overview of commissioning

Prerequisites

Prerequisites for commissioning the SIMOTION D410:

- The system has been connected and wired.
- The SIMOTION D410 is switched on and started up (STOP state).
- SIMOTION SCOUT (with integrated STARTER) has been installed and started on the programming device / PC.
- Communication between the SIMOTION D410 and the programming device / PC is configured.
- You have created a project and installed a SIMOTION D410 in the project.

NOTICE

For the SIMOTION D410, a reset of the drive must **not** be set using the expert list of the control unit in the p972 parameter (drive unit reset). This causes SIMOTION D410 malfunction, the RDY, RUN/STOP and SF/BF LEDs glow red. In this fault situation, the SIMOTION D410 must be switched off and on again.

Commissioning steps

This chapter describes the steps in configuring the plant and testing the configured stand-alone drive and axis. 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:

– Offline configuration

All components and their order number must be known for the offline configuration.

– Online configuration

The configuration in online mode allows you to upload all information of the connected DRIVE-CLiQ components to your user project.

4.2 Configuring the system in offline mode

2. Creating an axis
 3. Using the digital I/O
 4. Optionally, use TMx, DMC20 or other encoders
 5. Testing the configured drive
 6. Testing the configured axis
- Observe the corresponding references.

4.2 Configuring the system in offline mode

4.2.1 Overview

Prerequisites for offline configuration

- All components and their order number must be known for the offline configuration.
- You created a project in SIMOTION SCOUT and added a SIMOTION D410 to the project.
- You configured the communication between the programming device / PC and SIMOTION D410.

Procedure

Steps involved in offline configuring:

- Calling the Drive Wizard
- Configuring the components
- Aligning the **HW Config**
- Downloading the project to SIMOTION D410

Note

You can configure all available terminal modules such as TM15 in the course of the offline configuration, for example.

4.2.2 Accessing the drive wizard

Integrated drive

SIMOTION D410 features an integrated SINAMICS S120 drive (control unit) which is automatically included when you insert the SIMOTION D410 in the Project Navigator. The integrated drive must be operated in equidistant, isochronous mode using PROFIdrive-compliant message frame types.

The integrated drive and its associated modules (SINAMICS S120 motor modules, for example) are configured using the Drive Wizard of the integrated STARTER in SIMOTION SCOUT.

Note

Observe all necessary safety information and wiring rules in the corresponding current SINAMICS S120 documentation.

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 PM340 power module)
- Motor
- Encoder

4.2.3 Configuring the components

Procedure

1. Enter a drive name in the "Drive Properties" dialog box and select the drive type (servo or vector).

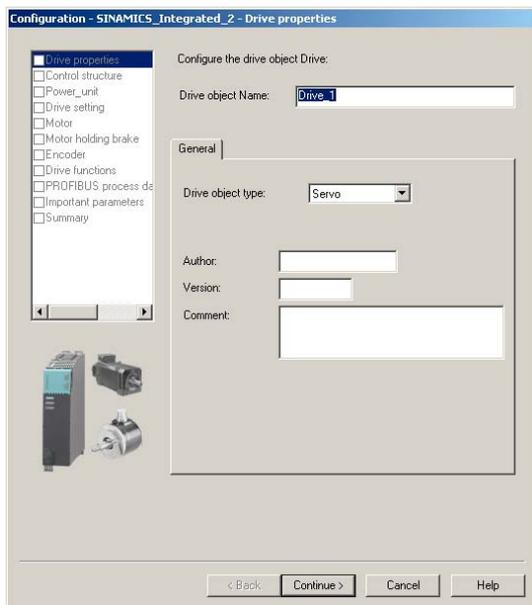


Figure 4-1 Drive properties

2. You can select the function modules and the control mode in the "Open-loop Control Structure" dialog box.

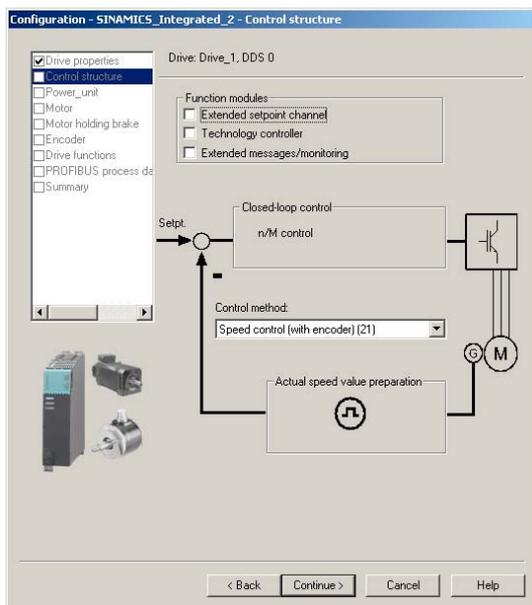


Figure 4-2 Control-loop structure

3. Select your motor module by order number from the list shown in the "Power Unit" dialog box.

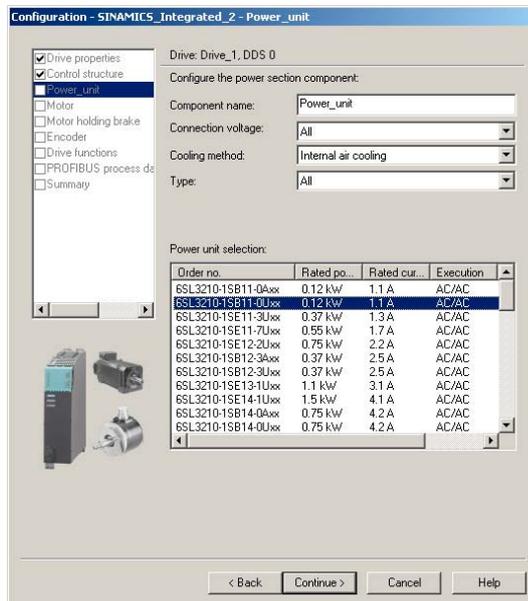


Figure 4-3 Selecting a power unit

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.
 - D410 DP with D410 PN: The SIMOTION D410 snapped directly onto the PM340 power module
 - CUA31 or CUA32: The CUA3x snapped directly onto the PM340. The D410 is mounted individually on a mounting plate. The D410 is connected with the CUA3x using a DRIVE-CLiQ cable.



Figure 4-4 Selecting an adapter module

5. Select the motor and possibly the motor type in the next dialog box.



Figure 4-5 Selecting a motor

6. Select a motor holding brake (if installed).

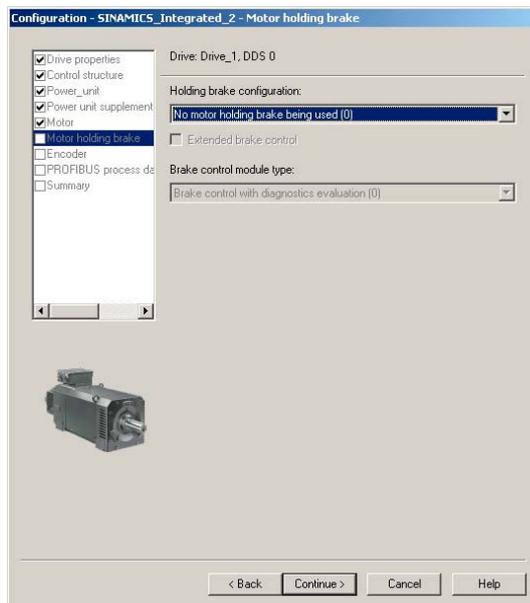


Figure 4-6 Selecting a motor holding brake

7. Select the encoder order number in the "Encoder selection by motor order number" if using a motor that is not equipped with a DRIVE-CLiQ interface.

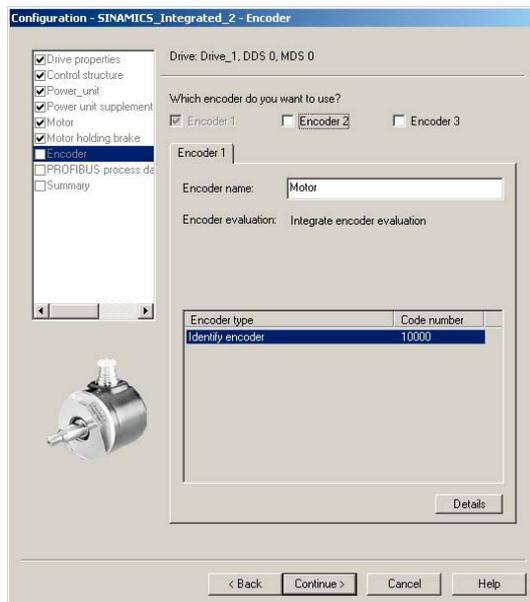


Figure 4-7 Selecting the encoder order number

8. In the following dialog, select the PROFIBUS message frame.
The following message frames can be used, for example, in conjunction with SINAMICS S120 drives:
 - SIEMENS message frame 105, PSD-10/10: Dynamic life sign, torque reduction, encoder data for an encoder, dynamic drive control (DSC)

- SIEMENS message frame 106, PSD-11/15: Dynamic life sign, torque reduction, encoder data for two encoders, dynamic drive control (DSC)

Advantages of DSC (compared to a position controller in the control unit):

- Higher Kv (position controller gain) possible
- Larger bandwidth and consequently higher dynamic response
- Shorter response times for disturbance characteristic

The DSC dynamic drive control can be used for the SIEMENS message frame 105, PSD-10/10 and SIEMENS message frame 106, PSD-11/15. The DSC is activated by default for the configuration of the axis using the Drive Wizard.

Detailed information for the various message frame types is contained in the Motion Control, Electrical/Hydraulic Axis Technology Object, External Encoder function manual.



Figure 4-8 Selecting the PROFIBUS message frame

A "Summary" dialog box opens with a listing of all settings after you completed all settings in the Drive Wizard. You can now choose to activate your settings by clicking "Finish", or to return to the component configuration for further editing.

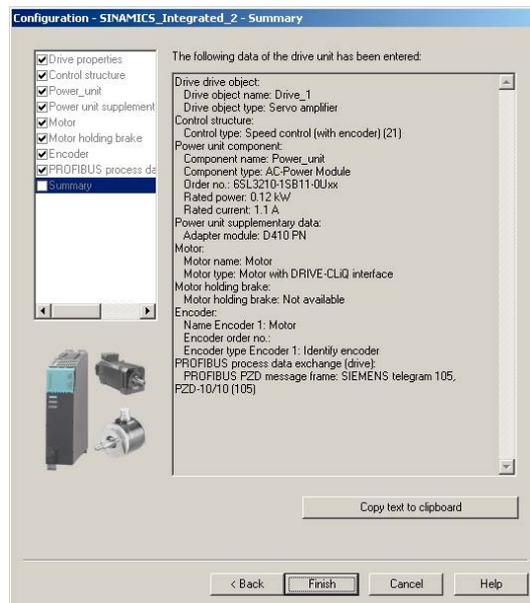


Figure 4-9 Finishing the drive

The configured drive is displayed in the Project Navigator. An overview of your configured SINAMICS components is available in the "SINAMICS_Integrated" > "Topology" dialog.

4.2.4 Aligning HW Config

After having completed the configuration of all SINAMICS components, align the data with **HW Config**.

Proceed as follows:

1. Open the "Configuration" entry in the "SINAMICS_Integrated" tree in the Project Navigator. The "SINAMICS_Integrated - Configuration" dialog box opens with a list of configured drive objects.

The question marks in the I/O address fields indicate that you have not yet defined the I/O addresses of the drive objects.

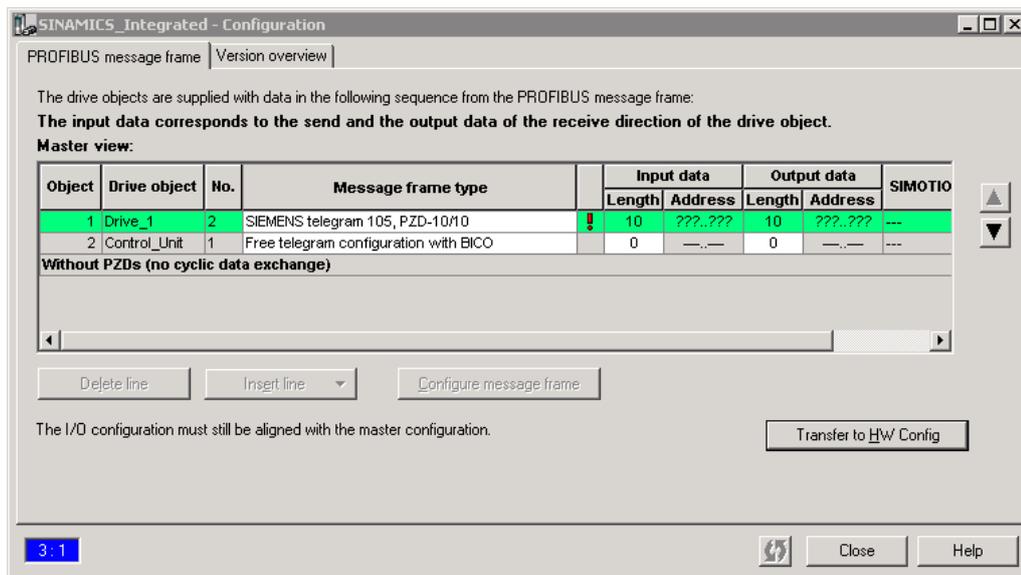


Figure 4-10 Configuration prior to HW Config alignment

Note

Drive objects without address must be positioned at the end of the list, for otherwise it is not possible to align HW Config ("Align with HW Config"). To move the order of a drive object without address, select the associated drive object and move it downwards using the arrow key.

2. Click "Align with HW Config" in order to assign addresses to the configured components. The addresses are written to **HW Config**.

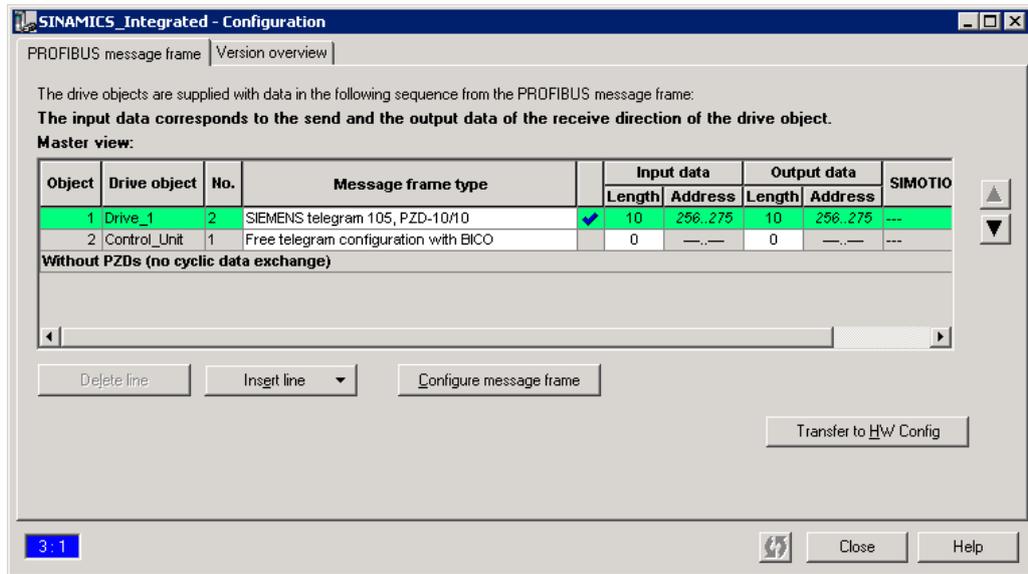


Figure 4-11 Configuration after HW Config alignment

Note

Repeat the HW Config alignment if the message frames for SINAMICS Integrated were changed. The addresses are not updated automatically.

4.2.5 Downloading the project to SIMOTION D410

Procedure for downloading a project into the target system

1. Save and compile the project.
2. Go online to SIMOTION D410.
3. Select the "Download project to target system" command to download the project to SIMOTION D410. The connection to SINAMICS Integrated is activated automatically.

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.

Procedure for downloading a created project to the CF card

You can use a card reader to also write the entire project to the CF Card in offline mode. In the SIMOTION SCOUT, you can call the "Download to the file system" function in the context menu of the SIMOTION device.

1. Save and compile the project.
2. Switch off the SIMOTION D410.
3. Remove the CF card and insert it in a card adapter. The card adapter must be connected with a programming device / PC.
4. Select in the SCOUT project the SIMOTION D410 device that you want to download to the CF card.
5. Click "Download to the file system" in the context menu. A dialog box opens.
6. Click the "Select target" button in the "Download to the file system" dialog box.
7. Select the target drive.
8. Confirm your entries with "OK". The data will be written to the CF card.
9. Remove the CF card and insert it in the D410 slot.
10. Switch on the D410. The D410 starts with the downloaded project.

Note

The initial startup from the CompactFlash Card you configured in offline mode takes longer.

The firmware of the SINAMICS component is updated automatically if any higher firmware version is found on the CF card. Observe any messages and alarms in the details window of the SIMOTION SCOUT after a firmware update. After having updated the firmware of a SINAMICS component, go offline and then switch off the power supply of the upgraded component (Power Off/On).

4.3 Configuring the system in online mode

4.3.1 Overview

Introduction

You can configure the plant in online mode after having completed its wiring. You can upload the data of SINAMICS components connected via DRIVE-CLiQ to your programming device / PC using the "Automatic configuration" function. However, this functionality is only available within the initial commissioning phase.

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 created a project in SIMOTION SCOUT and added a SIMOTION D410 to the project.
- You configured the communication between the the programming device / PC and SIMOTION D410.

Procedure

Steps involved in offline configuring:

- Establishing the online connection
- Starting automatic configuration
- Configuring SINAMICS components
- Aligning HW Config
- Downloading the project to SIMOTION D410

4.3.2 Establishing the online connection

The procedure for an initial commissioning follows.

To perform an online configuration, you must establish an online connection to the SIMOTION D410. In this case, no connection can yet be established to SINAMICS Integrated. An appropriate message is output. Once the hardware configuration has been loaded into 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 device in the Project Navigator.

Note

Ensure that you use the "Download to the target device" function rather than "Download to the target system". An automatic commissioning is no longer possible after "Download to the target system". If "Download to the target system" has been used, "Restore factory settings" must be performed on the drive element in order to start an automatic commissioning afterwards.

4. Use the "Download to the target device" function to download the SIMOTION D410 device into the target device. The connection to SINAMICS Integrated is activated automatically.

You can now run the automatic configuration at SINAMICS Integrated. For details, see Section Starting automatic configuration (Page 75).

Additional references

Further information about establishing an online connection to the programming device / PC is contained in the following documentation:

- *SIMOTION SCOUT* Configuration Manual
- *SIMOTION SCOUT* Online Help
- In FAQ on the "*Utilities & Applications*" CD

4.3.3 Starting automatic configuration

Prerequisites

- You activated the online connection to SINAMICS Integrated.
- You have not yet configured any drive objects.
- The default settings of SINAMICS Integrated were activated.

Right-click "SINAMICS Integrated" and select the "Target device" > "Restore defaults" command from the shortcut menu in SIMOTION SCOUT in order to restore the factory settings.

Procedure

1. Open the "Automatic Configuration" dialog box by selecting the "SINAMICS_Integrated > Automatic configuration" command in the Project Navigator.

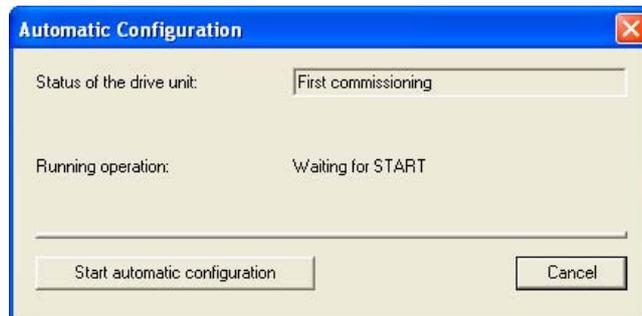


Figure 4-12 Starting automatic configuration

2. Click "Start automatic configuration".
The "Drive Object Type" dialog box opens.

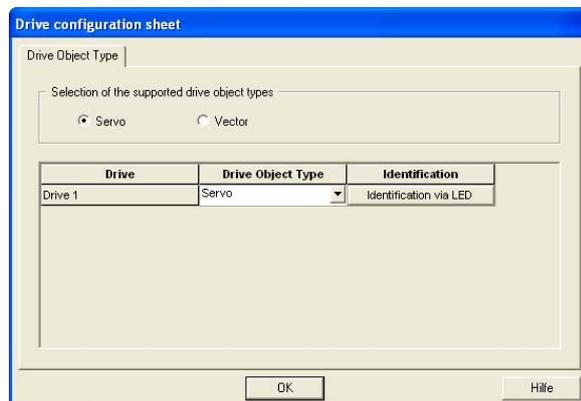


Figure 4-13 Selecting the drive object type

3. Select either a servo or a vector drive object.
4. Click "Close" to complete automatic configuration.

The configuration data is uploaded (Upload to PG) automatically as soon as automatic commissioning is completed.

Note

If the firmware of the SINAMICS components differs from the firmware on the CF card, the firmware of the SINAMICS components will be upgraded automatically.

5. Click "Close" to exit automatic configuration.

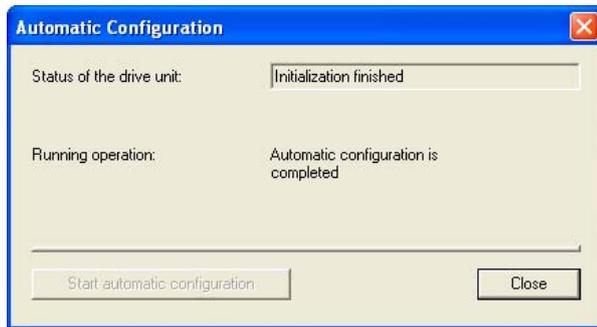


Figure 4-14 Automatic configuration completed

6. Perform the "Copy RAM to ROM ..." function on the D410 and on SINAMICS Integrated. This saves the project on the CF card and does not need to be reloaded after a switch-on/switch-off.
-

Note

After having updated the firmware of a SINAMICS component, go offline and then switch off the power supply of the upgraded component (Power Off/On).

Result

The DRIVE-CLiQ components transferred to the user project by means of the automatic configuration are displayed in the Project Navigator.

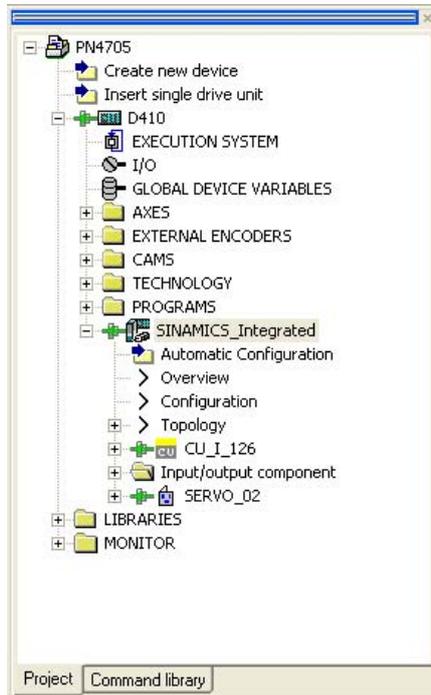


Figure 4-15 Project Navigator with the downloaded DRIVE-CLiQ components

You must then define the axis message frame and possibly edit the SINAMICS components (e.g. components without DRIVE-CLiQ interface and an encoder connected to the onboard encoder interface).

See also

Editing SINAMICS components (Page 77)

4.3.4 Editing SINAMICS components

Prerequisites

- You have uploaded all connected DRIVE-CLiQ components to the user project.
- You shut down the connection to the target system (offline mode).

Procedure

Now go ahead and adapt your components to suit the application.

Run the wizards for all DRIVE-CLiQ components to be customized and configure the motor, encoder, and process data message frames (PROFIBUS message frame type).

This procedure corresponds with the description in chapter "Configuring the system in offline mode".

Note

If only the message frame type needs to be selected for the edit, you can also set this in the "Configuration" screen form of the drive element. A HW Config match is then required.

Configuring the system in offline mode (Page 62)

4.3.5 Aligning HW Config

See also

Aligning HW Config (Page 70)

4.3.6 Download the project to SIMOTION D410

After having aligned HW Config, download the configuration to SINAMICS Integrated.

1. Save and compile the project.
2. Go online to SIMOTION D410.
3. Select the "Download project to target system" command to download the project to SIMOTION D410. The connection to SINAMICS Integrated is activated automatically.

Drive programming and commissioning is completed. You can now test the drive using the drive control panel.

4.4 Creating an axis

Overview

The SIMOTION SCOUT Engineering System can be used to insert axes in your project.

1. Start a session of the Axis Wizard in order to configure the axes and interconnect these with the SINAMICS Integrated drive.
2. Insert your user programs into the project.
3. Compile the project and download it to SIMOTION D410.

Note

Note that only one real axis can be used on a SIMOTION D410.

Creating an axis using the Axis Wizard

Axes are integrated as technology objects (TOs) in SIMOTION. Create the axis with corresponding settings under the SIMOTION D410 and then interconnect it with SINAMICS Integrated.

How to insert an axis:

1. Double-click the "Axis > Insert Axis" entry in the Project Navigator.

This opens the Axis Wizard.

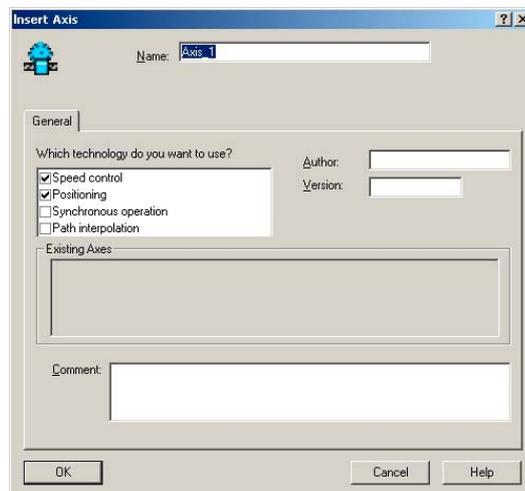


Figure 4-16 Inserting an axis

2. Name the axis TO in the "Insert Axis" dialog box, select the technology and save and confirm your entries with "OK".
3. Continue the Axis Configuration Wizard and enter your system settings until the "Drive Assignment" dialog box opens.
4. Click "Align SINAMICS devices..." to open the "Device Alignment" dialog box.

5. Select the drive to be aligned (SINAMICS Integrated) in this dialog box and then click "Align".

The addresses are assigned to the configured components and entered in **HW Config**.

Note

This device alignment is only necessary if not already done in the course of drive commissioning. This shows that no interconnectable drive of the SINAMICS Integrated type is displayed.

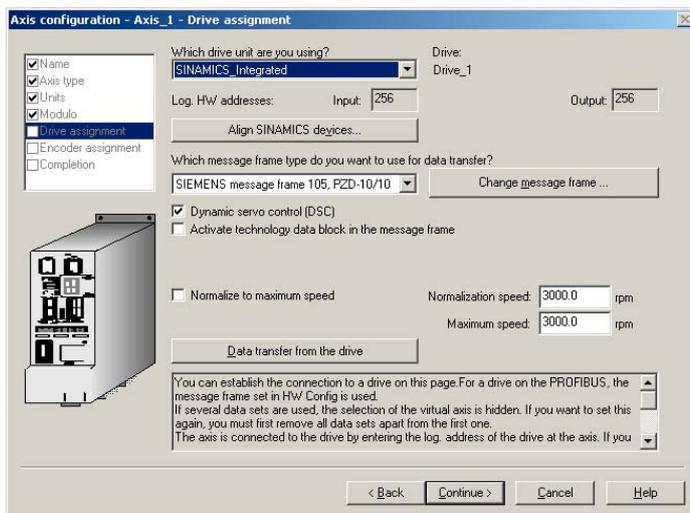


Figure 4-17 Assigning a drive

6. Select a drive unit in the "Drive Assignment" dialog box. Normally only a SINAMICS Integrated drive will be offered. Exception: A D410 has been configured, for example, with a hydraulic axis. You have already defined the message frame type in the previous steps and so only need to accept it. To do this, click the "Accept data from the drive" button to transfer the SINAMICS Integrated values in the axis wizards.
7. Select the encoder from the "Encoder Assignment" dialog box and then adapt its properties. Click the "Accept data from the drive" button to transfer the SINAMICS Integrated values in the axis wizards.

Note

For motors with DRIVE-CLiQ interface, a "Accept data from the drive" automatically transfers the determined drive and encoder data (e.g. encoder type). This requires that the data has already been fetched from the attached devices. Namely, an offline configuration has already been used to establish an online connection or an online configuration has been performed.

8. Complete the Axis Wizard session.

The configured axis is displayed in the Project Navigator. After having downloaded it to the target system, you can test the axis using the axis or drive control panel.

4.5 Integrating additional encoders (optional)

4.5.1 General information

SIMOTION D410 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:

- Encoders with DRIVE-CLiQ interface
- Encoders connected to SIMOTION D410 using the onboard encoder interface (X23)
- Encoders connected to SIMOTION D410 using an SMx module
- Encoders connected using PROFIBUS or PROFINET

Prerequisite

SIMOTION D410 features a DRIVE-CLiQ X100 interface for connecting an encoder. An additional encoder can be connected, for example, using the on-board encoder interface (X23).

Configuring two encoders

The second encoder can be used at SIMOTION D410, for example, as:

- Machine encoder (second encoder)
- External encoder.

The external encoder can be used, for example, to measure an actual position value directly on a geared motor. If operating with a second encoder as machine encoder you can work with encoder changeover.

Configuring tasks

Encoders connected using PROFIBUS or PROFINET are configured only for SIMOTION.

Encoders connected using SMx, DRIVE-CLiQ or the onboard encoder interface, must be configured for the drive (SINAMICS Integrated) and SIMOTION.

Configure this additional encoder on drive side (SINAMICS Integrated) and in SIMOTION:

1. Configure the encoder interface on the drive side (second encoder)
2. Configuring a second encoder for a TO axis in SIMOTION
3. Configuring an external encoder in SIMOTION

These steps in configuring are described in the next section.

4.5.2 Configure the encoder interface on the drive side

Prerequisite

You configured the drive with an encoder in the Drive Wizard.

Procedure

1. Open the "Configuration" entry of your drive by selecting the "SINAMICS_Integrated" > Drives" command in the Project Navigator. The "Configuration" dialog box opens.
2. Click "Configure DDS..." to open the Drive Wizard.
3. Step the Drive Wizard forward until the "SINAMICS_Integrated - Encoders" dialog box opens.
4. Select the "Encoder 2" option in this dialog. The dialog box displays a list of available encoders.
5. Select for "encoder evaluation":
 - SMx for the encoder connection using DRIVE-CLiQ / SMx
 - D410 DP (or D410 PN) for the encoder connection using the onboard encoder interface

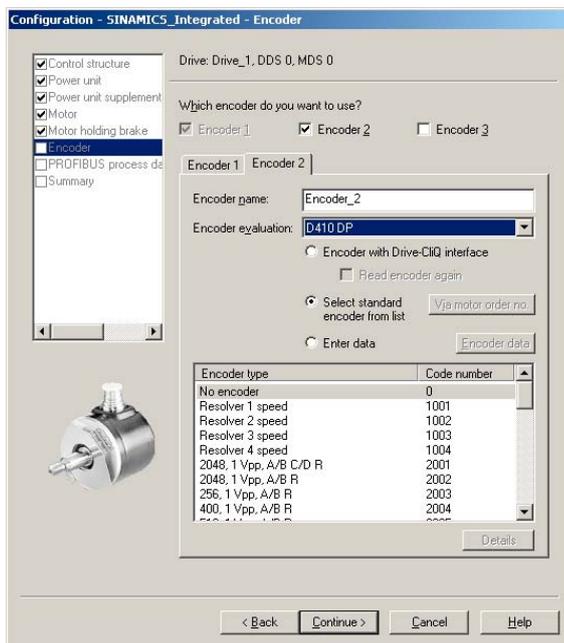


Figure 4-18 Selecting the internal encoder interface

6. Select the connected encoder and confirm with "Continue".

7. In the "Configuration - SINAMICS Integrated - PROFIBUS (drive) Process Data Exchange" dialog box, select a message frame that supports the transmission of two encoder values (e.g. SIEMENS message frame 106, PSD-11/15).
8. Click "Continue" to complete the Drive Wizard.
9. Click "Transfer to HW Config" in the "SINAMICS_Integrated - Configuration" dialog box in order to align HW Config.

The drive is configured for operation with two encoders.

4.5.3 Configuring a second encoder for a TO axis in SIMOTION

Requirements

- You have configured a drive with two encoders as specified in Section Configure the encoder interface on the drive side (Page 82).
- The set message frame supports the transmission of two encoder values.
- The configuration of the PROFIBUS message frames has been matched with HW Config.

Procedure

1. In the Project Navigator, open the Axis Wizard of the axis.
2. In the "Drive Assignment" dialog box, select **the same** message that you have already used to configure the second encoder on the SINAMICS Integrated or in the "SINAMICS Integrated > Configuration" screen form (e.g. SIEMENS message frame 106, PSD-11/15).
3. Complete the Axis Wizard session.

You have configured a second encoder for an axis TO in SIMOTION. The set message frame type now allows you to use the value of a second encoder.

4.5.4 Configuring external encoders in SIMOTION

Prerequisite

Encoder using PROFIBUS/PROFINET

You have used HW Config to configure an encoder on the PROFIBUS or PROFINET. Two different possibilities are available for the encoder connection:

- Encoder interconnection using a PROFIdrive message frame (encoder with message frame type 81)
- Encoder interface as a direct value in the I/O area

Detailed information is contained in the "SIMOTION TO Axis, Electric/Hydraulic, External Encoder" Function Manual

Encoder on the drive

You configured a drive with two encoders, and then an electric axis with the PROFIBUS message frame to be used.

Procedure

1. Open the wizard for configuring an external encoder by selecting the "External Encoders" > "Insert external encoder" folder in the Project Navigator.
2. Assign a name in the "Inserting an external encoder" screen form and, if required, enter the author and version.
3. Execute the wizard for the encoder configuration and enter the appropriate values in the screen forms.

The external encoder is now configured and uses the second value which is transferred by means of the selected PROFIBUS message frame.

Additional references

Detailed information for the external encoder is contained in the *SIMOTION SCOUT TO Axis, Electric/Hydraulic, External Encoder* Function Manual.

4.6 Using drive-related I/Os by SIMOTION

4.6.1 Onboard I/Os and terminal modules configuration overview

Using SINAMICS I/Os by SIMOTION

Digital inputs/outputs (I/Os) assigned to SINAMICS can be used completely or partially by SIMOTION. Examples here are the use of terminal modules (TMs) or onboard I/Os of the D410. To allow the I/Os to be used by SIMOTION, the input and output data must be transferred using message frames. This message frame configuration is used to represent the I/Os in the logical address space of SIMOTION and so can be used by a SIMOTION application. The BICO interconnections on the drive specify which I/Os are represented on the message frame.

These BICO interconnections can be:

- Freely defined (free message frame configuration; message frame extension).
- Permanently defined (standard message frames, e.g. message frame 39x; axis message frames). . .)
- Configuration dependent (TM15/TM17 High Feature).

The access to the message frame for SIMOTION D410 is made using I/O variables or input/output addresses. Depending how the I/Os are to be used, various configuration possibilities are appropriate:

Table 4-1 Use of I/Os by SIMOTION, overview

Configuration	Description	Applications	Supported I/Os (drive objects)
Use of message frame 39x	Possible only for D410 onboard I/Os. The 39x message frames can be used by SIMOTION to access the onboard I/Os of the D410.	Configuration when, for example, all SIMOTION I/Os are to be used. Use of: <ul style="list-style-type: none"> • High-speed outputs of output cams • Global measuring inputs 	<ul style="list-style-type: none"> • Onboard I/Os on the D410 • Onboard I/Os on CU310 (no high-speed outputs for output cams)
Free message frame configuration with P915/P916 (TM15/TM17 High Feature special case)	For the TM15/TM17 High Feature, when the module is created, an automatic interconnection to a "free message frame with P915/P916" is made. This means TMs are available exclusively for SIMOTION.	Use of TM15 and TM17 High Feature for: <ul style="list-style-type: none"> • High-speed DI/DO • Outputs of output cam • Probe inputs 	<ul style="list-style-type: none"> • TM15 • TM17 High Feature
Configuring free message frames by means of BICO	Dedicated message frame for the data transmission are assigned to the associated drive objects. The "free message frame configuration using BICO", message frame 999, is used for the data transmission here.	Preferred solution when I/Os are to be divided between SIMOTION and SINAMICS and a module view is preferred. The message frame, for example, is created on a drive object (for example, on a TM or a control unit).	<ul style="list-style-type: none"> • Onboard I/Os on the D410 • Onboard I/Os on CU310 • TM15 DI/DO • TM31 • TM41

Configuration	Description	Applications	Supported I/Os (drive objects)
Expanding a message frame	For the data transmission of the I/O data, existing message frames are extended with the process status data (PSD). These additional PSDs must then be interconnected using BICO.	Preferred solution when I/Os are to be divided between SIMOTION and SINAMICS and, for example, an axis view is preferred. (Drive-related I/Os are appended to each axis message frame.)	<ul style="list-style-type: none"> • Onboard I/Os on the D410 • Onboard I/Os on CU310 • TM15 DI/DO • TM31 • TM41

Note

The module hardware for TM15 and TM15 DI/DO is identical. The differentiation is made only with the addition of the component in the Project Navigator of the SIMOTION SCOUT using "Inserting input/output component".

Further information about the TM15 and TM17 High Feature is contained in the *TM15 and TM17 High Feature Commissioning Manual*.

Note

The "free message frame configuration using BICO" and the "message frame extension" allow you to use inputs/outputs channel-granular by SIMOTION or SINAMICS.

For message frame 39x, however, all onboard terminals are interconnected automatically to message frame 39x using BICO interconnections and so available only for SIMOTION. The following is true:

- All onboard I/Os configured as digital output for the drive are only available for SIMOTION, i.e. they can no longer be used by SINAMICS.
- Digital inputs can be used by SIMOTION and SINAMICS.

4.6.2 Use of message frame 39x

The following section describes the configuration of the onboard I/Os of a SIMOTION D410. The configuration of the onboard I/Os of a CU310 connected to a SIMOTION controller is performed similarly. With the exception of the "high-speed output cams / DOs", the same functionality is available for a CU310 as the D410.

Functionality of the 390, 391 and 392 message frames

The onboard I/Os of the D410 assigned to SINAMICS can be used by SIMOTION with the 39x message frames. This functionality is available as of SIMOTION V4.1, SP1. If a message frame 39x is set, however, all the onboard I/Os are interconnected automatically to this message frame 39x using BICO interconnections and so available for SIMOTION. All onboard I/Os of a control unit parameterized as digital output, e.g. D410s are available only for SIMOTION. Digital inputs can be used by both SIMOTION and SINAMICS.

In addition to the use of the onboard I/Os, the 39x message frame permits the use of:

- High-speed outputs for output cams and high-speed digital outputs (DO)
- "Global" measuring inputs
- The control and status word of the control unit (CU_STW, CU_ZSW)

Depending on the selected 39x message frame, various functionalities can be used with SIMOTION D.

Table 4-2 Functionality of the 390, 391 and 392 message frames, overview

Concise	Functionality available on the DI/DO of the D410
390	<ul style="list-style-type: none"> • CU_STW, CU_ZSW • I/O access to the DIs and DOs • Maximum of four high-speed output cams / DOs
391	<ul style="list-style-type: none"> • CU_STW, CU_ZSW • I/O access to the DIs and DOs • Maximum of four high-speed output cams / DOs • Maximum of two inputs for measuring inputs (global measuring inputs)
392	<ul style="list-style-type: none"> • CU_STW, CU_ZSW • I/O access to the DIs and DOs • Maximum of four high-speed output cams / DOs • Maximum of three inputs for measuring inputs (global measuring inputs)

Because the same terminals are used, the maximum "high-speed output cams / DOs" quantity framework reduces by the number of used inputs for measuring inputs.

The configuration of **local** measuring inputs does not require the configuration of message frame 39x.

Message frame 39x configuration

The following requirements must be satisfied:

- A SCOUT project has been created
- The D410 has been created
- A SINAMICS Integrated drive has been configured

Proceed as follows:

1. In the Project Navigator, double-click the "Configuration" entry under "SINAMICS Integrated". In the workarea, the "PROFIBUS message frame" tab is displayed in the "SINAMICS Integrated - Configuration" dialog box.
2. Select the message frame type (SIEMENS message frame 390, 391 or 392) for the control unit.
3. Click the "Transfer to HW Config" button to transfer the message frame data to hardware configuration.

A message frame 39x is configured for the D410 control unit. The address area of the message frame is displayed in "SINAMICS_Integrated – Configuration" dialog. The 39x message frame configuration automatically makes the BICO interconnections for the DI and DI/DO which are then available for SIMOTION.

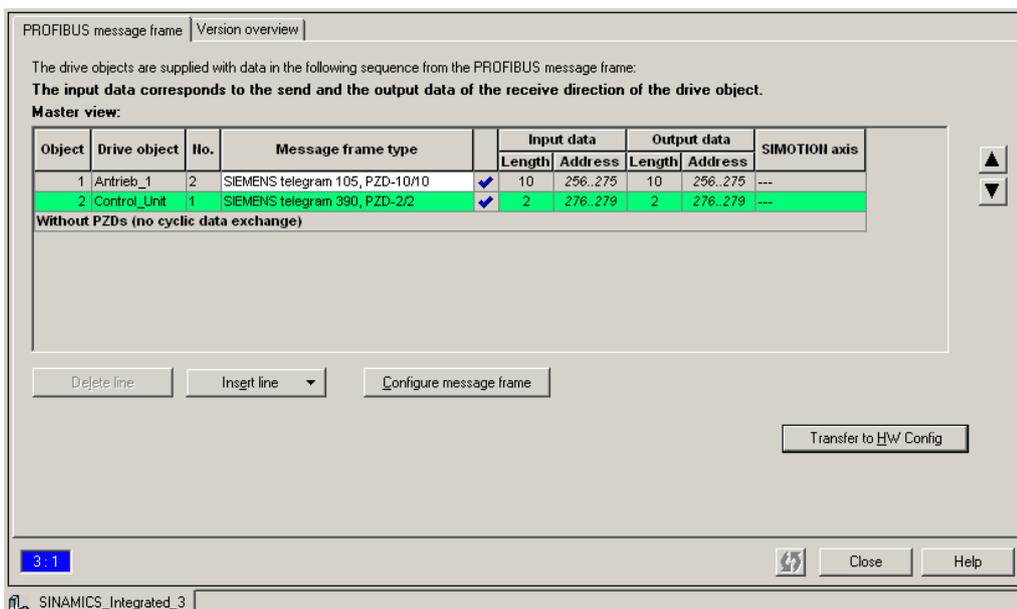


Figure 4-19 Message frame 39x configuration

Use of the onboard I/O by SIMOTION

For DI/DO channels, the terminal status of the output can be fetched back using the input (DI).

The 390 message frame transfers in PSD1 the control and status word of the control unit and in PSD2 the status of the onboard inputs/outputs.

For the 391 and 392 message frames, additional control and status information for the global measuring inputs is transferred. The content of these PSD3 to PSD15 is used exclusively by the measuring input technology object.

Table 4-3 D410 assignment of the addresses: Control/status word and onboard I/Os

PSD	Logical hardware address and bit number:	Input	Output
PSD1	Start address message frame $39x + 0$	CU_ZSW	CU_STW
PSD2	Start address message frame $39x + 2$, bit 0	DI 0	–
	Start address message frame $39x + 2$, bit 1	DI 1	–
	Start address message frame $39x + 2$, bit 2	DI 2	–
	Start address message frame $39x + 2$, bit 3	DI 3	–
	Start address message frame $39x + 3$, bit 0	DI 8	DO 8
	Start address message frame $39x + 3$, bit 1	DI 9	DO 9
	Start address message frame $39x + 3$, bit 2	DI 10	DO 10
	Start address message frame $39x + 3$, bit 3	DI 11	DO 11
PSD3	Start address message frame $39x + 4$	Used internal for global measuring inputs (only for message frame 391, 392)	–
PSD4-7	Start address message frame $39x + +6$	Used internal for global measuring inputs 1 to 2 (only for message frame 391, 392)	–
PSD8-15	Start address message frame $39x + +10$	Used internal for global measuring input 3 (only for message frame 392)	–

To allow access by the I/Os to the individual PSDs, I/O variables must be created in SIMOTION. For this purpose, the input/output addresses displayed in the "PROFIBUS message frame" tab in the "SINAMICS Integrated - Configuration" dialog box are required.

The following figure shows an example of I/Os created in SCOUT: In this example, the start address of the 390 message frame for the input and output data is each 276.

	Name	I/O address	Read only	Data type	Field length	Process image	Strategy	Substitute value	Display form	Comment
1	cu_stw	PMV 276		WORD	1		CPU stop	0000	HEX	
2	cu_zsw	PGM 276	<input checked="" type="checkbox"/>	WORD	1		CPU stop	0000	HEX	
3	cu_di_0	PI276.0		BOOL	1				BOOL	
4	cu_do_8	PG279.0	<input checked="" type="checkbox"/>	BOOL	1				BOOL	
5					1					

Figure 4-20 Example: Access to message frame 390 using I/O variables.

Configuring DI/DO as input or output

When a DI/DO is to be used as digital input or digital output, interconnection screen forms can be used for configuring.

Proceed as follows:

1. Double-click the "Inputs/outputs" entry below the SINAMICS_Integrated > Control Unit in the Project Navigator.
2. Click the "Bidirectional digital inputs/outputs" tab.
3. In this tab, configure the required inputs or outputs.

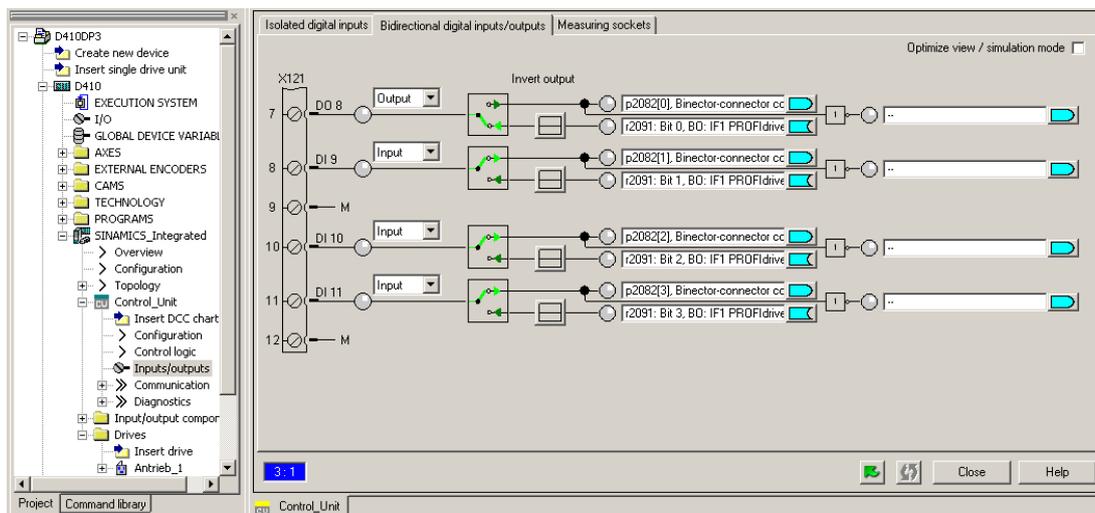


Figure 4-21 Configuring DI/DOs as input or output

The configuration can also be set channel-granular on the p728 parameter using the expert list of the control unit.

Note

When the 39x message frames are used, a HW Config must always be performed after changes have been made to onboard I/O-relevant parameters. "Download to the target system" must then be used to download the changed configuration data into the target device. The matching is always made only for the associated selected control unit and not project-global.

4.6.3 Free message frame configuring with P915/P916 (only TM15/TM17 High Feature)

The TM15 and TM17 High Feature terminal modules are connected to the control unit using the DRIVE-CLiQ interface. This assigns the terminal modules to the SINAMICS. When a TM15 or TM17 High Feature is added to SIMOTION SCOUT, an automatic interconnection to a "free message frame with P915/P916" is made. Other interconnection possibilities exist. Not for TM15 (but not TM15 DI/DO) and TM17 High Feature.

The structure and the length of the message frame depends on the configured properties of the inputs and outputs. The I/O channels can be parameterized as digital input, digital output, input for measuring input or output for output cam.

The automatic interconnection of the message frame means the functionality of the modules can only be used by SIMOTION and is controlled from the SIMOTION user program using input/output addresses or I/O variables. A drive-side configuring using BICO / DCC SINAMICS is not possible.

Additional references

Additional information about this topic is available in the following documents:

- To configure TM15 and TM17 High Feature, refer to the *TM15 and TM17 High Feature Commissioning Manual*.
- To configure output cams and measuring inputs, refer to the *SIMOTION Motion Control Output Cams and Measuring Inputs Function Manual*.
- For the I/O processing with TM15 and TM17 High Feature (timing, classification in the task system), refer to the *SIMOTION SCOUT Basic Functions Function Manual*.

4.6.4 Configuring free message frames by means of BICO

Overview

For the "free message frame configuring using BICO", dedicated message frames for the data transmission are assigned to the associated drive objects (e.g. terminal modules).
 Message frame type: Free message frame configuring using BICO (only slaves)

To allow SIMOTION to access the SINAMICS drive signals, e.g. I/Os, they must be interconnected to the SINAMICS using BICO to the message frame. The "free message frame configuring using" is a preferred solution when I/Os are to be divided channel-granular between SIMOTION and SINAMICS and a module view is preferred.

Table 4-4 Drive object: Maximum number of PSDs

Drive object	Maximum number of PSDs for the configuring of the PROFIBUS message frames	
	Input data (from the SIMOTION D viewpoint)	Output data (from the SIMOTION D viewpoint)
TM15 DI/DO	5	5
TM31	5	5
TM41	19	16
Control Unit (CU)	15	5

Free message frame configuring using the TM31 as example

The example describes the interconnection of a signal to the TM31 connected to a SIMOTION D410.

Steps in configuring user-specific message frames using BICO:

- Configure a user-specific message frame
- Interconnect the message frame for TM31
- Create I/O variables in SIMOTION SCOUT

Prerequisite

You have already created a project and configured a drive.

Configuring user-specific message frames

1. Double-click the "Insert I/O component" entry in "SINAMICS_Integrated" in the Project Navigator and then select terminal module "TM31" from the "Operating type" field of the dialog box shown.
2. Enter a name for the module to be inserted and confirm your entry with OK.
3. Double-click the "Configuration" entry at "SINAMICS Integrated" in the Project Navigator to open the "PROFIBUS Message Frame" screen form.

"Free message frame configuration with BICO" (message frame 999) is set for the inserted TM31. Insert the number of PSDs (Process Status Data) for I/O data. Observe the maximum possible number of PSDs for the various drive objects (see previous table). An TM31, for example, supports five PSDs in both the send and the receive direction.

4. Enter the value 5 in the "Length" column in the "Input data" or "Output data" fields.

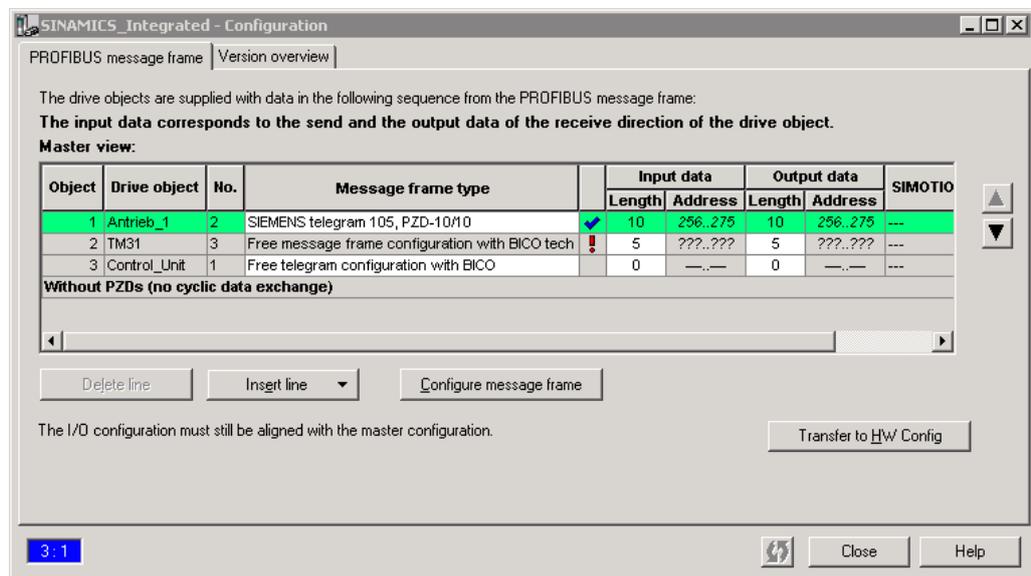


Figure 4-22 Inserting a specific number of PSDs for the I/O data.

5. Click "Transfer to HW Config" in order to transfer the data to **HW Config** and to read the address space of the I/O data.

Note

Before the matching, all drive objects without input/output addresses ("----.----") must be moved behind the objects with valid input/output addresses or those still to be matched ("???..???").

The icons in the status column show the following information:

-  The message frame is configured differently in HW Config. You must match with HW Config.
-  You use a predefined standard message frame or free BICO interconnection.
-  You use a changed standard message frame that you have extended with additional data.
-  You use a message frame for which one of the two message frame lengths is too long. The drive object cannot process this entry.

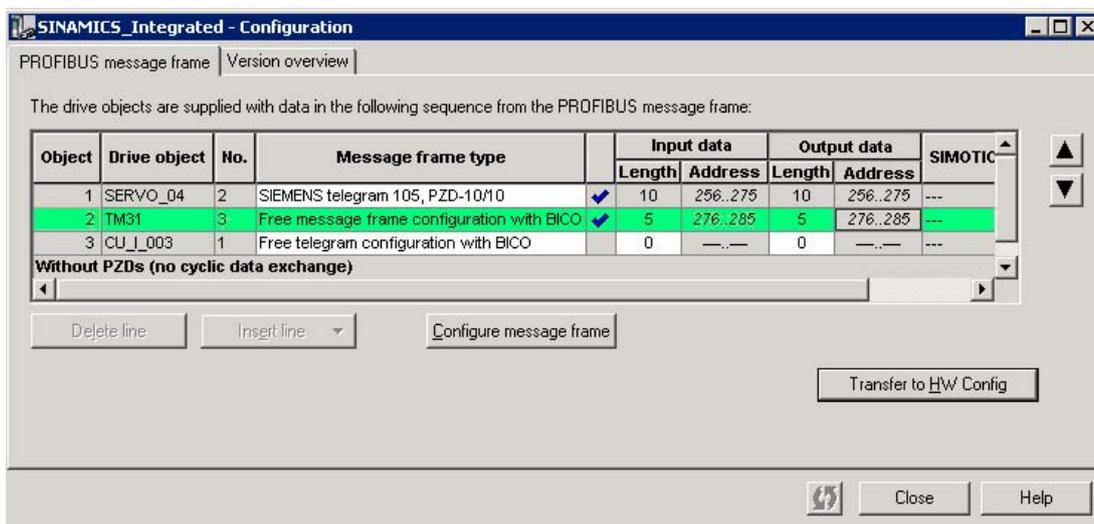


Figure 4-23 Reading the I/O address space

You can now transfer data from TM31 to SIMOTION (PROFIBUS send direction) or receive data from there (PROFIBUS receive direction).

Interconnecting the message frame for TM31

The next section describes how you can transfer signals from TM31 to SIMOTION (PROFIBUS send direction).

Note

To perform interconnections in online mode, you must:

- Prior to the interconnection, download the message frame configuration into the target device. Function: Download the CPU / drive device to the target unit.
 - After the interconnection, download the settings from the target device into the programming device / PC. Function: Download the CPU / drive unit to the programming device.
-

1. Double-click the "PROFIBUS" entry in the "Communication" dialog of the TM31 you created. The corresponding dialog box opens.
2. Click "Binector/connector converter" in the "PROFIBUS send direction" tab. The "Binector/connector converter" tab opens
3. Select the source for status word 1 by clicking the "Source status word 1" field and then select the corresponding PSD, in this example, TM31 -> p2051. . . Select PSD1.

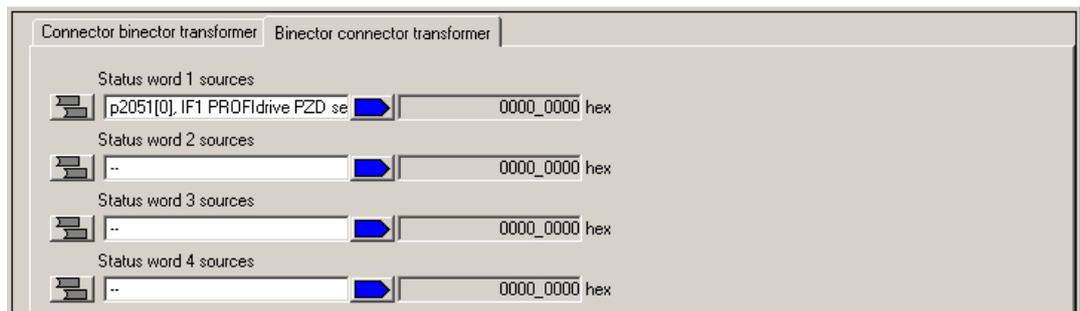


Figure 4-24 Selecting the PSD

4. Click the button leading the "Source status word 1" field. The PSD bits are now displayed.
5. Click in a field and select the default signal, for example, bit 0.

This bit can be used, for example, to transmit the status at digital input DI 0 to SIMOTION.

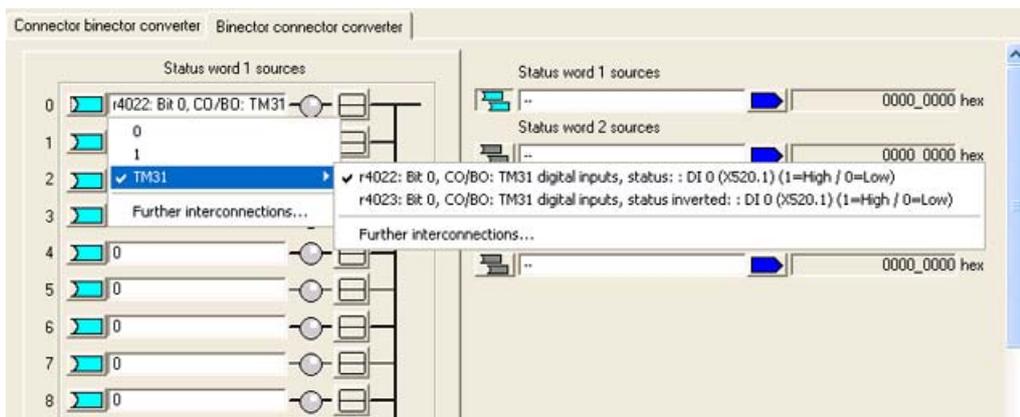


Figure 4-25 Selecting a signal

6. Interconnect all signals you need.

How to transfer a signal from SIMOTION to TM31 (PROFIBUS receive direction):

1. Double-click the "PROFIBUS" entry in the "Communication" dialog of the TM31 you created. The corresponding dialog box opens.
2. Click "Binector/connector converter" in the "PROFIBUS receive direction" tab. The "Connector/binector converter" tab opens
3. Interconnect all required signals. Proceed as defined in the description of the "PROFIBUS send direction".

Creating an I/O variable in SIMOTION

Create the I/O variables in SIMOTION SCOUT in order to access the signals of TM31. You require the input or output addresses for the TM31 message frame in the "PROFIBUS Message Frame" dialog box. This allows you to assign the variable either as a complete word, a byte or a single bit.

1. In the Project Navigator, double-click "I/O" below the created D410. The symbol browser opens
2. Enter a name for the I/O variable.
3. Enter an I/O address, e.g.
 PI277.0 - This accesses PSD1, bit 0 of the configured message frame.
 PI276.0 - This accesses PSD1, bit 8 of the configured message frame.
 SIMOTION can now access the signal.

The PROFIdrive profile specifies that the process status data (PSD) is defined as a 16-bit value. Take into account when determining the I/O address that the least significant byte of the SIMOTION I/O variable is assigned to the most significant PSD bits of the message frame and vice versa:

I/O address	Byte 276								Byte 277							
Bytes represented in bit format	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
PSD in bit representation	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

4.6.5 Expanding a message frame

The message frame extension extends existing standard message frames (e.g. axis message frames) with additional process status data (PSD). These additional PSDs are then interconnected using BICO (e.g. to an actual speed value or to the status of a digital input).

A message frame extension is then the preferred variant when I/Os are to be distributed between SIMOTION and SINAMICS and, for example, an axis view is preferred (drive-related I/O should be appended to each axis message frame).

Proceed as follows:

1. Insert a drive using the Drive Wizard and select PROFIBUS (drive), e.g. "standard message frame 103", for process data exchange.
2. Double-click the "Configuration" entry below "SINAMICS Integrated" in the Project Navigator in order to open the "PROFIBUS message frame" tab.

The tab contains the default length of I/O data for the drive you inserted. As the addresses of I/O data have not yet been transferred to **HW Config** the default entry "???" is set.

3. Select the row of the object of which you want to expand the message frame.

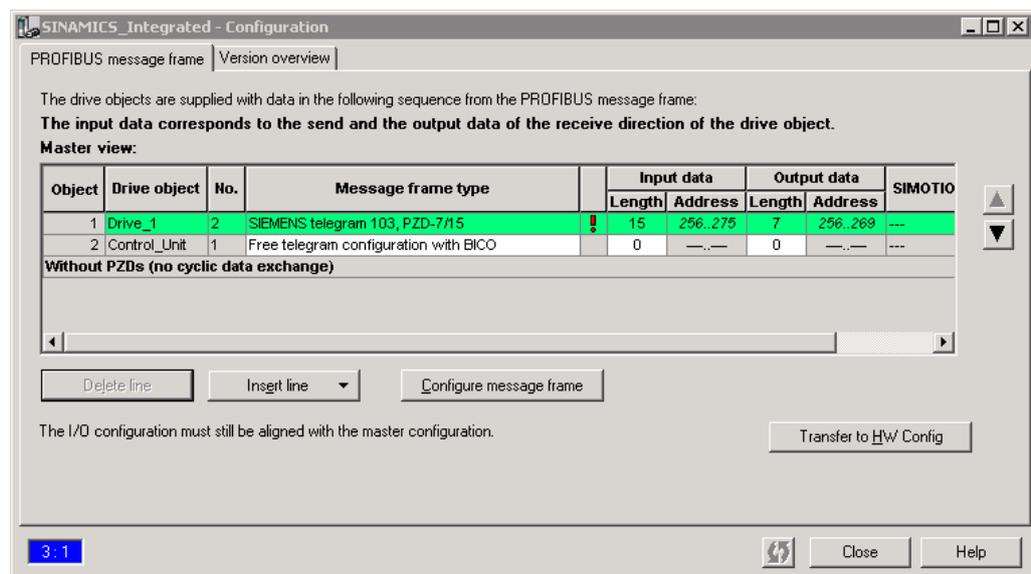


Figure 4-26 PROFIBUS message frame

4. Click "Add line" and select the "Message frame expansion" option in the menu shown.
A new line which contains the message frame expansion is inserted below the current line.
5. Enter the "length" for the number of PSDs by which the message frame is to be extended in the Input data and Output data columns.

Note

Before the matching, all drive objects without input/output addresses ("----.----") must be moved behind the objects with valid input/output addresses or those still to be matched ("???..???").

The icons in the status column show the following information:

 The message frame is configured differently in HW Config. You must match with HW Config.

 You use a predefined standard message frame or free BICO interconnection.

 You use a changed standard message frame that you have extended with additional data.

 You use a message frame for which one of the two message frame lengths is too long. The drive object cannot process this entry.

6. Click "Transfer to HW Config" in order to transfer the changes to **HW Config**.

The red check mark at the line indicates that a modified standard protocol is being used. The I/O address data is entered after its transfer to **HW Config**.

7. Change to the configured drive and double-click the "PROFIBUS" entry in "Communication".
8. Deactivate the "Hide inactive interconnections" option to display all PSDs of the message frame.

The send and receive data (at least 16 entries) will be displayed. The first PSDs are assigned the standard message frame by default and cannot be changed.

9. Interconnect the PSDs (at the end of the PSD list) that you have added with the required signals by means of BICO.

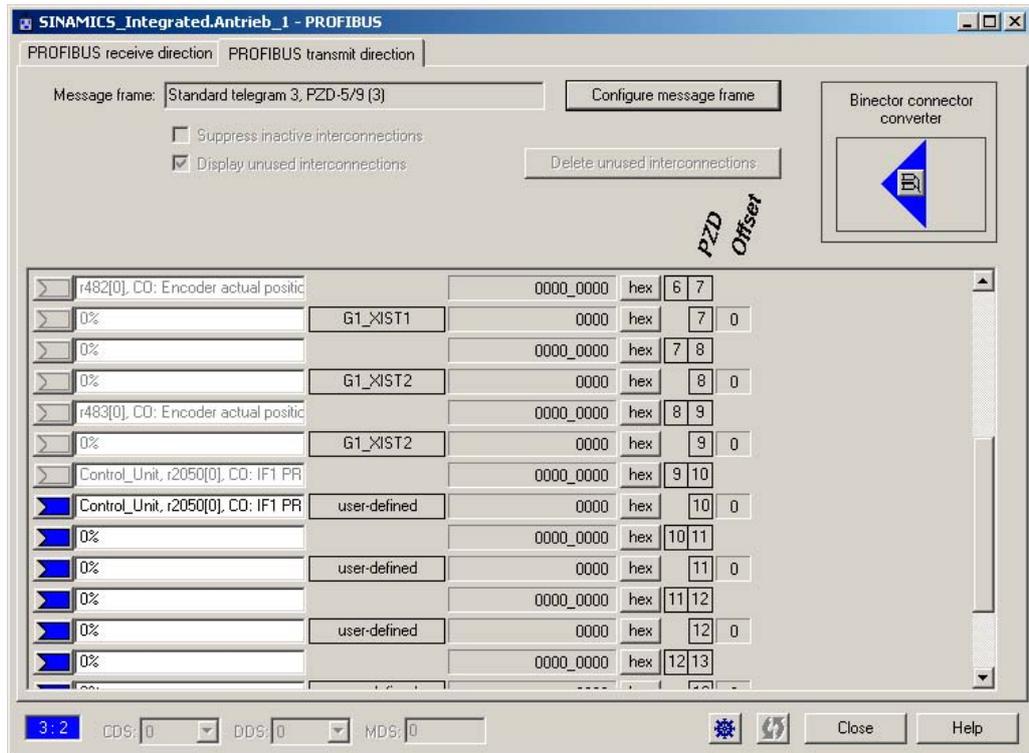


Figure 4-27 Example: Interconnection of the onboard DI in the PROFIBUS send direction

Note

A warning message is not output if you interconnect more PSDs than were set in the additional PSDs. Note that a SERVO drive object supports a maximum of 16 PSD setpoints and 19 PSD actual values. Each VECTOR drive object supports a maximum of 32 PSD setpoints.

4.6.6 Using high-speed outputs for output cams on D410

Using high-speed outputs for output cams / DOs with D410

Output cams are defined as being the position-dependent output of switching signals. The TO output cams and TO output cam track technology objects control the output of output cams for SIMOTION.

The integrated digital outputs of the SIMOTION D can be used as cam output or as high-speed output with write access to the user program. In order to be able to use the high-speed outputs, one of the 39x message frames must be created.

Note

If I/O data is transferred using bus message frames, the update of the I/O data is subject to the set bus cycle. This means an I/O using a 39x message frame can change its status just once in each bus cycle of the PROFIBUS Integrated.

For SIMOTION D onboard outputs, the outputs are controlled using direct write accesses to the hardware (i.e. bypassing the message frame). This means:

- Write accesses to digital outputs act with a particularly short delay time because the write access is independent of the bus cycle.
- A more accurate output of the cam output is possible

For fast write accesses from the user program, the resulting delay time has the following form:

- User program delay time -> terminal register: max. 75 µs
 - Load-dependent output delay time of the hardware for D410:
 - L -> H: max. 400 µs
 - H -> L: max. 100 µs
-

High-speed outputs of output cams

If you use the output as high-speed output of a cam output, for the configuration of the TO output cams / TO output cam track, enter the logical hardware address and the bit number of the used output in the configuration screen form of the TO.

For additional information, see the *SIMOTION Motion Control Output Cams and Measuring Outputs* Function Manual.

High-speed digital outputs

If you use the output as high-speed digital output, create an I/O variable in SIMOTION SCOUT. The same addresses should be used for the high-speed digital outputs as those normally used for the digital outputs.

Table 4-5 Logical hardware address and the bit number (high-speed outputs for cam outputs / DOs)

Logical hardware address and bit number	Output on the D410
Start address message frame 39x +3, bit 0	DO 8
Start address message frame 39x +3, bit 1	DO 9
Start address message frame 39x +3, bit 2	DO 10
Start address message frame 39x +3, bit 3	DO 11

For information about message frame configuring, see Use of message frame 39x (Page 87).

4.6.7 Using probe inputs on D410

Configuration of probe inputs

Measuring inputs are used for fast, accurate measurement of actual positions. This is achieved with hardware support (for example, the measuring input on the assigned drive unit). Digital inputs for standard peripherals, e.g. distributed SIMATIC ET 200 peripheral system, cannot generally be used as probe inputs.

For SIMOTION, the TO probe input technology object controls the probe input functionality. SIMOTION differentiates between two classes of the probe inputs; these classes have different properties that are configured differently.

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 actual position value is measured.
- **Global measuring inputs** can be freely assigned to the axes and add an internal timestamp to the measurement result for more precise determination of the axis positions.

Table 4-6 Comparison of local and global measuring inputs on the D410

	Local measuring input	Global measuring input
Measurement operation	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 timestamp 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 Measuring Input TO in the 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 Measuring Input TO using the measuring input number.	The assignment of inputs is not fixed depending on the hardware and is performed during the configuration of the Measuring Input TO using the hardware address.
Measuring Input technology object setting Single measurement (Measurement jobs must be issued individually for each measurement. Several interpolation cycle clocks lie between two measurements.)	Yes	Yes
Measuring Input technology object setting Cyclical measurement (The measurement is activated just once and runs cyclically until deactivated.)	(yes) Although the Measuring Input TO can be requested to perform a cyclical measurement, it subdivides such a measurement into the execution of a series of single tasks. In such a case, the minimum separation between two measurements is several servo cycles.	yes The minimum separation between two measurements is three servo cycles (maximum two edges per measurement possible).
Use of multiple Measuring Input TOs on one axis/encoder, whereby these can be active concurrently.	No	Yes
Listening Measuring Input TO	No	Yes
Measuring on virtual axes	No	Yes
Measuring on axes attached to a different drive unit	No	Yes

A maximum of three probe inputs can be configured onboard on the D410.

Configuring of local measuring inputs on the D410

Local measuring inputs are always permanently assigned to an axis (drive). They are configured separately for each drive. The drive and the probe input must always be located on the same control unit. The measuring 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.

Table 4-7 Local measuring inputs, required settings in the expert list

	Parameters in the expert list of the CU	Parameterization as
DI/DO parameterization as input on the control unit	p728[8] (DI/DO 8)	Input
	p728[9] (DI/DO 9)	Input
	p728[10] (DI/DO 10)	Input
	p728[11] (DI/DO 11)	Input
	Parameters in the expert list of the drive	Parameterization as
Specification of the input terminal of the measuring input in the expert list of the drive	p488[0] (measuring input 1 input terminal, encoder 1)	DI/DO 9, DI/DO 10 or DI/DO 11
	p488[1] (measuring input 1 input terminal, encoder 2)	
	p488[2] (measuring input 1 input terminal, encoder 3)	
	p489[0] (measuring input 2 input terminal, encoder 1)	
	p489[1] (measuring input 2 input terminal, encoder 2)	
	p489[2] (measuring input 2 input terminal, encoder 3)	

Because a maximum of three encoders can be assigned to a drive, the index [1..2] specifies whether the measurement applies to 1, 2 or 3.

The following must be taken into account:

- Only two Measuring Input TOs can be configured per Axis TO or External Encoder TO.
- Only one Measuring Input TO can be active on an Axis TO or External Encoder TO.

Table 4-8 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.
Local measuring	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 is contained in the *SIMOTION Motion Control Output Cams and Measuring Outputs* Function Manual.

Configuring of global measuring inputs on the D410

Global measuring inputs can be freely assigned to the axes (drives) and add an internal timestamp to the measurement result for more precise determination of the axis positions. The drive and the probe input do not need to be located on the same control unit. The measuring results are not transferred using the axis message frame, but using the 391/392 axis message frame.

Table 4-9 Global measuring inputs, required settings in the expert list

	Parameters in the expert list of the CU	Parameterization as
DI/DO parameterization as input in the expert list on the control unit	p728[8] (DI/DO 8)	Input
	p728[9] (DI/DO 9)	Input
	p728[10] (DI/DO 10)	Input
	p728[11] (DI/DO 11)	Input
	Parameters in the expert list of the drive	Parameterization as
Specification of the input terminal of the measuring input in the expert list of the control unit	p680[0] (input terminal of the central measuring input)	DI/DO 9, DI/DO 10 or DI/DO 11
	p680[1] (input terminal of the central measuring input)	
	p680[2] (input terminal of the central measuring input)	

In addition to the settings of the parameters, message frame 391 (max. two measuring inputs) or message frame 392 (max. three measuring inputs) must be set for the control unit. The p680 parameter is used to define a terminal as global probe inputs. Message frame 391 can be used to assign the p680[0..1] parameter; message frame 392 can be used to assign the p680[0..2] parameter. The parameter used to set the required terminal is not relevant. The assignment of the measuring input to an axis is made using the logical hardware address and the bit number of the digital input to be used as measuring input (see also Section Use of message frame 39x (Page 87)).

The p490 parameter of the control unit can be used to invert a measuring input.

Note

The p684, and r685 to r688 parameters of the control unit have no relevance for SIMOTION.

Note

When the 39x message frames are used, a HW Config must always be performed after changes have been made to onboard I/O-relevant parameters. "Download to the target system" must then be used to download the changed configuration data into the target device.

Table 4-10 Global 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.
Global measuring	Activate the checkbox when a global measuring input is used.
Logical hardware address and bit number:	Enter here the logical HW address and the bit number of the used input.
	Start address message frame $39x + 3$, bit 1 for input DI/DO 9
	Start address message frame $39x + 3$, bit 2 for input DI/DO 10
	Start address message frame $39x + 3$, bit 3 for input DI/DO 11

Detailed information is contained in the *SIMOTION Motion Control Output Cams and Measuring Outputs* Function Manual.

4.6.8 Outputs of cam outputs and probe inputs on TM15/TM17 High Feature

Quantity framework for TM15/TM17 High Feature

The TM15/TM17 High Feature Terminal Modules can be used to extend the number of outputs for cam outputs and probe inputs that can be installed.

- TM15, maximum 24 outputs for cam outputs / probe inputs
- TM17 High Feature, maximum 16 outputs for cam outputs / probe inputs

Additional references

Detailed information for the configuration is contained in the following documents

- SIMOTION Output Cams and Measuring Inputs Function Manual
- TM15/TM17 High Feature Terminal Modules Commissioning Manual

4.7 Creating and programming TM41

4.7.1 Overview

The TM41 terminal module can be used to expand the number of digital I/O and of 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.

Configuring the TM41 involves the following steps:

- Configuring TM41 at SINAMICS Integrated
- Configuring TM41 using the Axis Wizard.

Note

The digital I/Os can be interconnected similar to those of TM31.

The TM41 encoder interface (incremental encoder representation) can

- Be interconnected with an encoder signal of the control unit using parameterization, e.g. sin/cos incremental encoder. For detailed information, consult the SINAMICS manuals.
- From the SIMOTION viewpoint, can be accessed as axis. This allows you to return the axis position (a master value) as encoder signal to a second controller, for example. Detailed information is contained in the SIMOTION D4x5 Commissioning and Hardware Installation Manual.

The second application case can only be used with SIMOTION D410 with restrictions, because the TM41 is configured as a real axis. Because SIMOTION D410 supports just one real axis, no additional real axis can be configured.

4.7.2 Configuring TM41 at SINAMICS Integrated

TM41 can be configured after you completed the configuration of SINAMICS Integrated. Proceed as follows:

1. Double-click "Insert InputOutput Ccomponent" at "Input/output component" in the Project Navigator.
2. Select TM41 from the "Control type" field of the "Insert input/output component" dialog box and assign a unique name to the module.
3. Confirm your entry with "OK".

The TM41 is inserted in the Project Navigator by the name you entered.

4.8 Creating a DMC20

4.8.1 DMC20 hub properties

DRIVE-CLiQ hub properties

The DMC20 DRIVE-CLiQ hub can be used to extend the number of DRIVE-CLiQ interfaces and to configure a star topology. You must increase the number of DRIVE-CLiQ interfaces if connecting the following additional components:

- Direct measuring systems
- Terminal modules
- Reduction of the network hierarchy levels

A star topology has the following advantages:

- The components can operate as end node of your segment.
- Line communication is not affected.

Application examples

Encoder expansion and hot-plugging are typical applications implemented by means of a DRIVE-CLiQ hub.

- An encoder expansion involves integration of direct measuring systems. These are installed in the control cabinet directly at the machine. Several encoders can be connected to the same hub.

Note: SIMOTION D410 has just one DRIVE-CLiQ interface. You can use the DMC20 to evaluate the motor encoder and an additional encoder by means of SMx.

- 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

Information pertaining to the DMC20 DRIVE-CLiQ hub is available in the *SIMOTION D410* Manual.

4.8.2 Creating a DRIVE-CLiQ hub

The hub is not wired when you insert the DMC20 and is represented in the topology tree in the component storage. The hub has to be wired manually. Proceed as follows:

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.

The hub you inserted is displayed as icon at the "Topology" entry in the Project Navigator. All components connected to a hub are also displayed in the course of automatic configuration.

4.9 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.

Prerequisites

- The project has been downloaded to the target system.
- SIMOTION SCOUT is in online mode.
- The drive is not in use by a current project in RUN mode.

WARNING

Make sure that the drive test does not pose any risk to persons.

Testing the drive using the drive control panel

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.

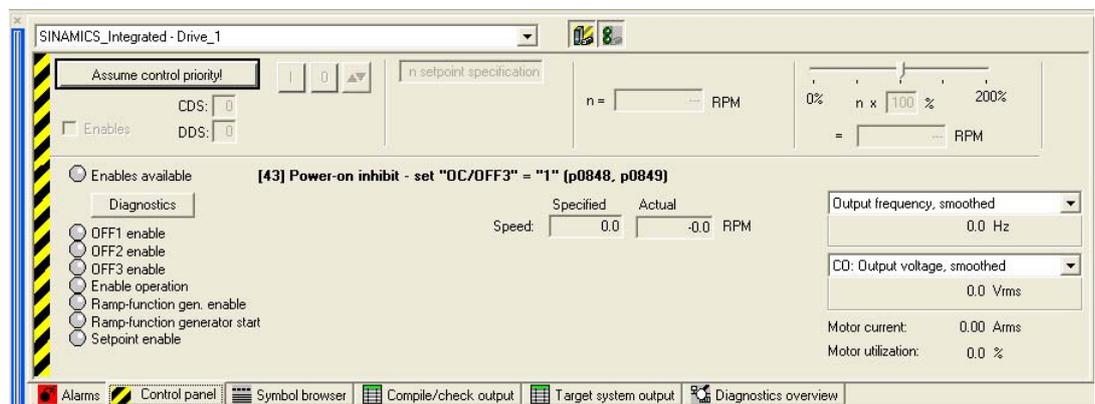


Figure 4-28 Drive control panel

2. In order to view the control range and axis diagnostics data, click "Show/hide control" and "Show/hide axis diagnostics".
3. Click "Assume control priority". The "Assume Control Priority" dialog box opens.

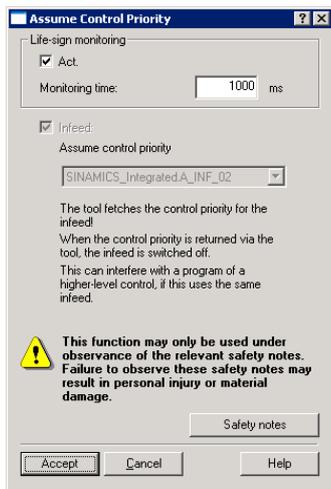


Figure 4-29 Assuming control priority

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 your setpoint in the input field and shift the scaling to 0% as safety setting.

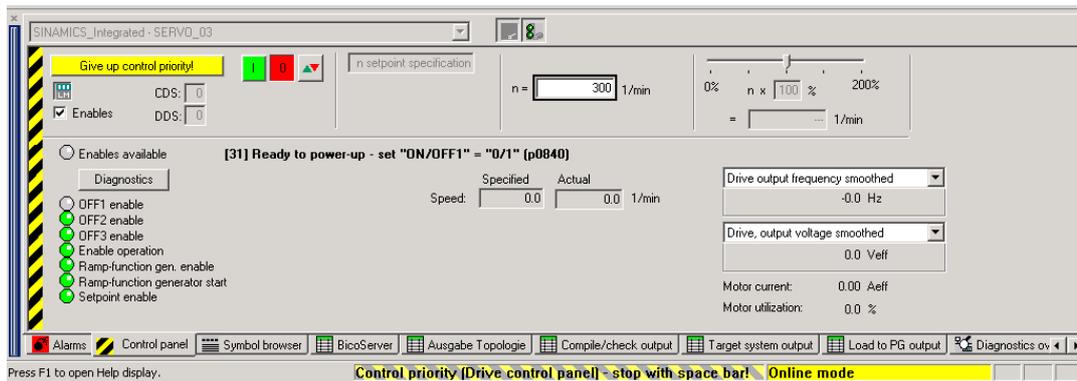


Figure 4-30 Entering the setpoint

7. Click the "Drive On" button. The "Enable is set" LED lights up in green color. The drive starts moving as you move the slider towards the right side. 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 signal and click "Give up control priority" to deactivate controlling at the programming device / PC.

4.10 Testing the configured axis using 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 a connected axis

Prerequisites

Prerequisites 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.

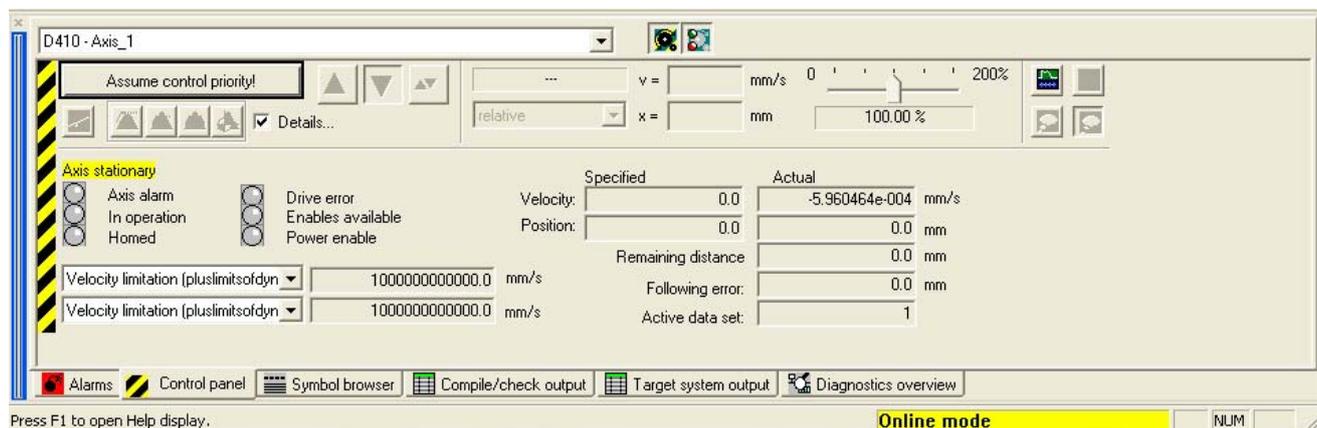


Figure 4-31 Axis control panel

2. In order to view the control range and axis diagnostics data, click "Show/hide control" and "Show/hide axis diagnostics".

3. Click "Assume control priority".

Confirm the next message with "Yes" in order to set the controller to STOPU state.

Note

You must assume control priority in order to move the axis using the programming device / PC. You can always stop the axis by pressing the SPACEBAR.

4. The "Assume Control Priority" dialog box opens.

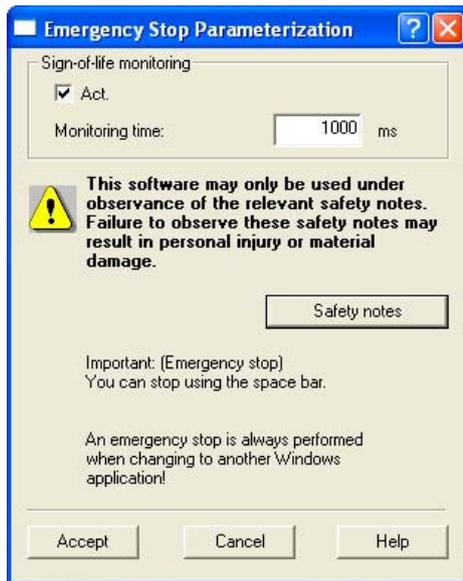


Figure 4-32 Assuming control priority

5. Read the notes and confirm these with "Accept".
6. To enable the axis, click "Set/reset enables".
Confirm the "Set Axis Enable" dialog box with "OK".
7. Enable jog mode by clicking "Position-controlled axis motion".
8. Enter a velocity.
9. Click "OK" to confirm the displayed "Set Axis Enable" window.
10. Click the "Jog" button. The axis moves as long as you keep the left mouse button pressed. You can monitor the traversing motion at the velocity and position entries.
11. Click "Set/reset enables" to remove the enable. Confirm the "Reset Axis Enable" dialog box with "OK".
12. Click "Give up control priority" to deactivate axis control at the programming device / PC. You can no longer control the axis at the programming device / PC if this state is set.

4.11 Downloading and saving user data

Overview

It is advisable to backup all user data (programs, configuration data, parameters) to the CompactFlash Card after having completed commissioning of SIMOTION D410.

Downloading user data

Use the "Target system > Download > Download to the target system" command to transfer the following data from the SIMOTION SCOUT Engineering System (ES) to the "non-volatile data" area of SIMOTION D410:

- Configuration data
- Programs
- Parameterization
- Technology packages

The hardware configuration of SIMOTION D410 and the retain variables are also saved to the "nonvolatile data" area.

Note

Using the menu:

- "Target system > Download > Download to the target system" downloads the complete project data to the target system.
- "Target system > Download > To the target system" downloads only the data of the selected device / drive element to the target system.

All contents of the "volatile data" area are lost after you shut down SIMOTION D410!

Additional references

For more information about the SIMOTION SCOUT Engineering System, consult 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 CompactFlash card:

- The technology data / user data from the "volatile data" area
- Baud rate, PROFIBUS DP addresses, IP address, subnet mask and router address, including the retain variables with their initial values from the "non-volatile data" area

Note

The "Copy RAM to ROM" command **cannot** be used to save the actual value of retain variables to the CompactFlash Card.

Execute the "Copy RAM to ROM" function separately for SINAMICS Integrated. This requires that the drive element has been selected in the Project Navigator.

See also

Properties of the user memories (Page 36)

4.12 Deleting data

4.12.1 Overview of data deletion

You can define the scope of data to be deleted from SIMOTION D410 memory described in the "user memory concept". That is, you can choose to delete all data or only specific parts.

You have the following options of deleting data from SIMOTION D410:

- Resetting the memory of SIMOTION D410
- Deleting user data from the CompactFlash Card
- Restoring the default settings of SINAMICS Integrated
- Restoring the default settings of SIMOTION D410

4.12.2 Resetting the memory of SIMOTION D410

Introduction

A memory reset deletes all data from RAM on the SIMOTION D410 and non-volatile data in SRAM with the exception of the communication configuration (baud rates, network addresses, etc.). Data on the CompactFlash Card is retained if you reset the memory.

Reset the memory on SIMOTION D410 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 (slow flashing) to indicate that SIMOTION D410 is requesting a memory reset.
- Non-volatile data does not match the project on the CF card and an error is generated (diagnostics buffer entry).

You can reset memory either in offline mode using the DIL switch of SIMOTION D410, or in online mode using SIMOTION SCOUT.

Data deleted by memory reset

The following data is deleted during a memory reset:

- User data (units, configuration data, parameters, task configuration)
- Technology packages
- Retain TO (absolute encoder adjustment)
- Retain variables

Retain variables in the interface or implementation section of a UNIT are declared with VAR_GLOBAL RETAIN

Note

As a memory reset deletes all absolute encoder data the encoder must be re-adjusted after memory reset.

Data retained during memory reset

The following data is retained during memory reset:

- TCP/IP and DP parameters
- Diagnostics buffer
- Data that was saved with the `_savePersistentMemoryData`, `_saveUnitDataSet`, `_exportUnitDataSet` and `RAMtoROM` commands and with the "Copy RAM to ROM" function.

The data contents of a backup file generated by executing `_savePersistentMemoryData` (PMEMORY.XML/PMEMORY.BAK) is written back to non-volatile data after memory reset. Users can therefore force the restoration of non-volatile data by means of memory reset.

- Licenses

The technology packages and user data (configuration data, programs, parameter assignments) you previously backed up to a CompactFlash Card by means of the "Copy RAM to ROM" command are transferred to the "non-volatile data" area of the SIMOTION 410 during the next startup. This operation transfers any configuration data found on the CompactFlash Card to the SIMOTION device after memory reset.

Memory reset by means of SIMOTION SCOUT

You can only reset memory using SIMOTION SCOUT if SIMOTION D410 is operating in online mode.

1. Select SIMOTION D410 from the Project Navigator of SIMOTION SCOUT.
2. Select the "Target device > Control system mode" command from the shortcut menu in order to open the "D410: System Mode" dialog box.
3. Select the STOP mode.
4. Next, select the MRES mode to reset the memory.

Memory reset using the mode selector switch

The mode selector switch function is implemented in SIMOTION D410 by means of a DIL switch (DIL = Dual-In-Line). Use this DIL switch (switch S1 - S3) to set the binary code for the mode of operation.

Information pertaining to the switch positions and corresponding modes of operation is available in the *SIMOTION D410* Manual.

You can only reset memory using the mode selector switch if SIMOTION D410 is operating in offline mode.

How to reset the memory:

1. Set the MRES mode on the DIL switch (see the picture below).



Figure 4-33 Switch position MRES

The STOP LED begins to flash.

2. Set DIL switch 1 to ON (STOP mode) after the STOP LED is lit in yellow color.
3. Return the DIL switch to MRES mode within three seconds.

The memory is now being reset.

4. Wait for SIMOTION D410 to complete its restart. Set DIL switch 1, 2 and 3 to ON (RUN mode).

The STOP LED lights after SIMOTION D410 has completed its memory reset.

Note

Memory reset is cancelled if you do not return the DIL switch to MRES as specified within three seconds. Repeat the procedure in this case.

4.12.3 Deleting user data from the CompactFlash Card

Overview

You can delete the user data using SIMOTION SCOUT. SIMOTION D410 must be operating in online mode. This deletes the following data:

- 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 folders), including the SINAMICS configuration data

You can still go online to SIMOTION D410 at your programming device / PC. All licenses on the CompactFlash Card are retained.

4.12 Deleting data

Deleting user data

1. Open the project you want to edit in SIMOTION SCOUT.
2. Go online to SIMOTION D410.
3. Select SIMOTION D410 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 from card" message with "OK".
The user data are deleted. SINAMICS Integrated goes into offline mode.

4.12.4 Restoring the default settings of SINAMICS Integrated

Prerequisite

You must be online to SINAMICS Integrated in order to restore its default settings.

Restoring the default settings

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.

4.12.5 Restoring the default settings of SIMOTION D410

Overview

SIMOTION D410 is supplied with default parameters such as the transmission rate or PROFIBUS addresses. You can restore the default settings using the DIL switch. This deletes the following data:

- Non-volatile data in the SIMOTION device
- The backup copy of non-volatile data on the CompactFlash Card (PMEMORY.XML/PMEMORY.BAK)
- User data in the "volatile data" area and on the CompactFlash Card
- The communication configuration (IP and DP parameters)

All licenses on the CompactFlash Card are retained.

Restoring the default settings using the DIL switch

1. The power supply is shut down.
2. Set the MRES mode on the DIL switch of SIMOTION D410 (see the picture below).

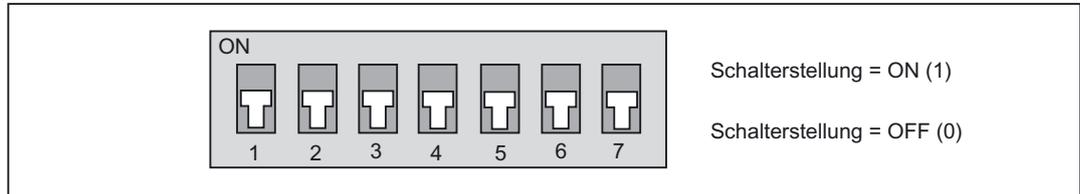


Figure 4-34 Switch setting MRES

3. Restart the power supply.
The buffered SRAM and user data are deleted. The default settings are loaded. SIMOTION D140 remains in STOP mode.
4. Change to the required mode by setting the DIL switch.

Note

The default communications parameters are now restored. You must re-configure the communication parameters of SIMOTION D410.

4.13 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.

Maintenance and service

5.1 Replacing modules

5.1.1 Removing and replacing the SIMOTION D410

Overview

You must replace the entire SIMOTION D410 module.

 WARNING

Always shut down the load power supply before you replace the SIMOTION D410 module. You shut down power using the On/Off switch of the PS power supply module, for example.

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.

You can replace a SIMOTION D410 DP with a SIMOTION D410 PN module and vice versa. Replace the device in **HW Config**

Replacing a SIMOTION D410 DP with a SIMOTION D410 PN module and vice versa

Note

The following procedure describes how you replace a SIMOTION D410 DP with a SIMOTION D410 PN **of the same firmware version** (and vice versa). The procedure for performing a software and firmware upgrade is described in Section Performing a software and firmware update (Page 126).

Proceed as follows:

1. Double-click the SIMOTION D410 to be replaced in the Project Navigator of SIMOTION SCOUT. **HW Config** opens.
2. In the hardware catalog, open the appropriate folder structure:
e.g. Drive Based\SIMOTION D410\6AU1 410-0AB0-0AA0

Note

DO NOT delete the module in Slot 2 when replacing it!

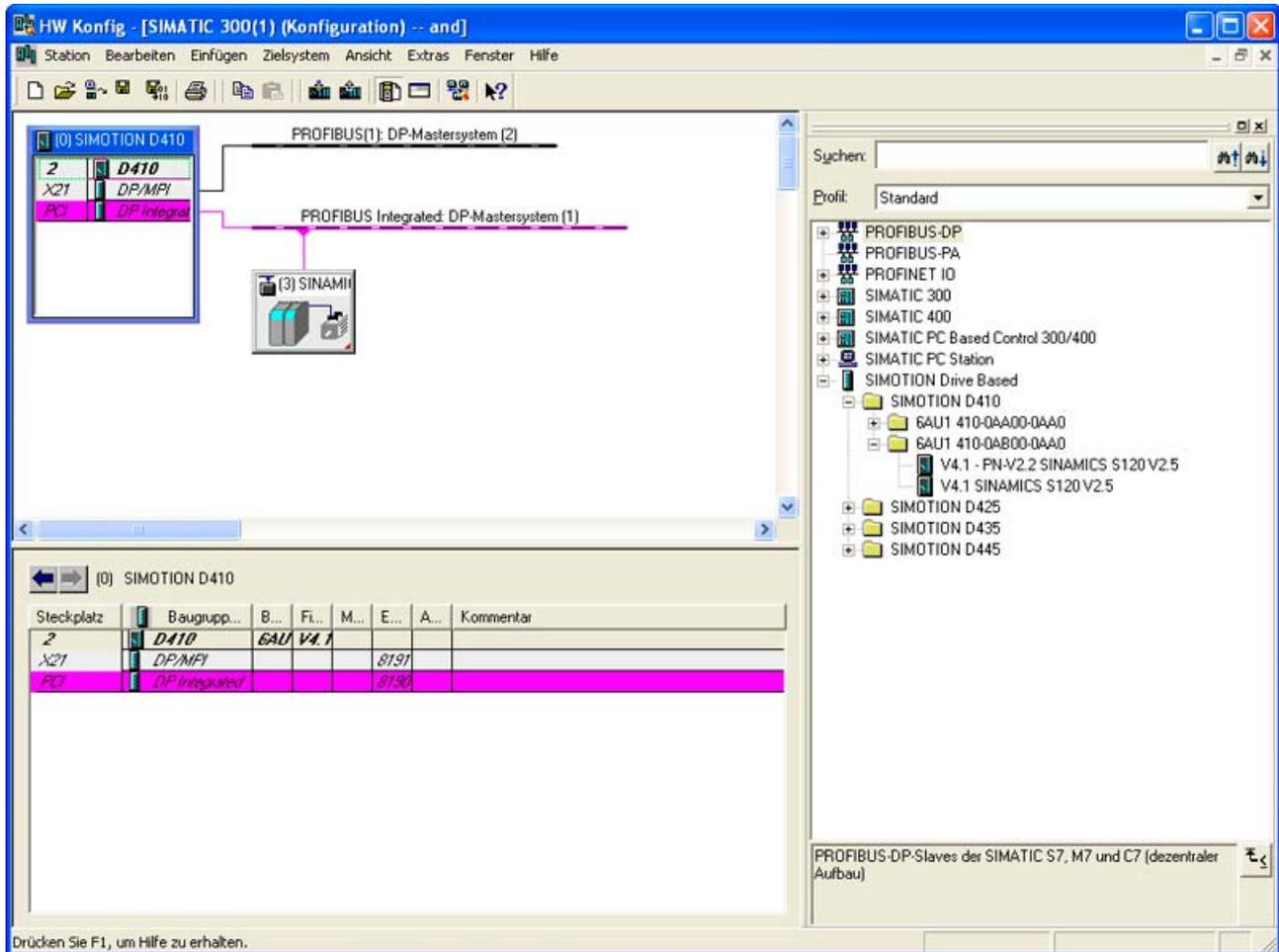


Figure 5-1 HW Config module replacement

3. "Drag-and-drop" the new module to the upper field of the card rack and confirm the dialog shown with "Yes".
The module is replaced.
4. Save and compile the hardware configuration in order to activate the changes.
5. Close **HW Config**.
The configuration data for your SIMOTION device is immediately activated in the SIMOTION SCOUT project and the **entire project** saved. This includes activation of all changes made to the project, for example, to the axis configuration.
6. Select "SINAMICS Integrated" in the Project Navigator.
7. Open the context menu and click "Target device > Device version". A window opens in which you can change the appropriate version.
8. Select the version of the replaced D410.

9. Click the "Change version" button and confirm the displayed message. The version of SINAMICS Integrated is changed.
10. Shut down the power supply.
11. Replace the module as described in "Replacing defective modules".
12. Restart the power supply.

Replacing defective modules

How to remove the SIMOTION D410 module:

1. Shut down the power supply.
2. Remove the CompactFlash Card from the card slot.
3. Remove the connections for the power supply.
4. Disconnect the DRIVE-CLiQ connector from the device, and the PROFIBUS DP interface (X21) or PROFINET interface (X200 and X201) connectors.
5. Disconnect the digital I/O connectors at interface X121.
6. Disconnect the plug of any encoder connected to the X23 encoder interface.
7. Remove the SIMOTION D410 module from the power module or from the mounting panel, depending on the type of assembly (see the "Installation" chapter in the *SIMOTION D410* Manual).

How to install the new SIMOTION D410 module:

Note

Observe the information in the *SIMOTION D410* Manual, when installing, wiring and connecting the SIMOTION D410 module.

1. Mount the new SIMOTION D410 onto the power module, or onto the mounting panel (see the "Installation" chapter in the *SIMOTION D410* Manual).
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 CompactFlash Card into the card slot of the new SIMOTION D410.
6. Restart the power supply. The new SIMOTION D410 is immediately ready for operation.

5.1.2 Replacing DRIVE-CLiQ components

Replacing components

DRIVE-CLiQ components support hot-plugging, that is, replacement or re-insertion while the system is in on or off state.

Automatic upgrading/downgrading

As of SINAMICS firmware version 2.5, the DRIVE-CLiQ components are automatically upgraded or downgraded to the version of the component firmware on the CF card. Components that cannot be upgrade or downgraded to the component firmware version on the CF card retain their firmware version. This is the case, for example, when a downgrade should be inhibited (e.g. "older firmware" is not supported by the "newer hardware"). The system ensures that the resulting combination possibilities of firmware versions are permitted.

An upgrade/downgrade operation in progress is indicated on the components by a 0.5 Hz red-green flashing LED and on SIMOTION D410 by a 0.5 Hz yellow-flashing RDY LED.

A successfully completed firmware upgrade/downgrade is indicated on the components by flashing at a frequency of 2 Hz and on the SIMOTION D410 by the yellow flashing of the RDY LED at 2 Hz. After the upgrade/downgrade is completed, the power must be cycled off and back on (POWER OFF/ON). The upgrade/downgrade function can be deactivated using the p7826 parameter in the expert list.

Additional references

Additional information is available in the *SINAMICS S120* Commissioning Manual.

5.2 Replacing the fan

Prerequisite

Replace the fan if a fault message is output by the temperature monitoring function as a result of fan failure. The fan must be replaced if the fan is defective or the maximum operating hours counter is attained.

The fan can be ordered as spare part, see "Spare parts and accessories" in the *SIMOTION D410* Manual.

 CAUTION
--

The fan of the SIMOTION D410 module may only be replaced by qualified technical personnel and strictly in accordance with ESD guidelines!

Replacing the fan

How to replace the fan:

1. Unlock all snap-on hooks holding the plastic housing of the SIMOTION D410 using a flat-blade screwdriver.
2. Remove the plastic enclosure.
3. You can now remove and replace the fan from the front without any additional tools.
4. Set the parameter of the p251 operating hours counter to "0". The parameter can only be changed in online mode.

Note

The parameter of the operating hours counter can only be set to "0". Any other values will be rejected. Restoring factory settings does not affect this parameter.

5.3 Performing a software and firmware update

Upgrading SIMOTION D410

The actions described in this section also apply to downgrading to an older version.

Various possibilities are available to perform a software and firmware update for SIMOTION D410:

- Upgrade the supplied upgrade data using the CF card adapter
- Upgrade using IT-DIAG (license required)
- Upgrade using the SCOUT "Start update devices tool" function

The first method is described in the following section. The two other methods are described in the SIMOTION SCOUT Configuration Manual, in the *Upgrading SIMOTION Devices* Function Manual and in the online help.

Note

A firmware update using IT-DIAG is supported only as of SIMOTION version V4.1 SP2.

Upgrade the supplied upgrade data using the CF card adapter

Prerequisite

The current firmware for the SIMOTION devices is contained on the SIMOTION SCOUT CDs (e.g. the d4xx.zip file for the SIMOTION D4xx firmware is located in the \3_D4xx\Firmware\... directory). Upgrading the SIMOTION D410 automatically updates the firmware of all connected SINAMICS components.

Note

Observe the readme files and upgrade instructions included in the delivery of new SIMOTION versions.

Use only CF cards released for SIMOTION D410 and which have an appropriate correct boot loader version.

You can obtain the compatibility relationships from the "software products" compatibility list on the SIMOTION SCOUT Add-On CD and in the Internet at <http://support.automation.siemens.com/WW/view/de/18857317>.

NOTICE
The upgrade operation deletes all project data and parameters from the CompactFlash Card!

Note

Retain data can be backed up with SIMOTION SCOUT; see *SIMOTION SCOUT* Configuration Manual or Online Help. See also Section User memory concept (Page 35).

Procedure

The following procedure describes how to perform the upgrade:

1. Switch off the power supply to the D410.
2. Remove the CompactFlash Card from SIMOTION D410 and insert it into the CompactFlash Card adaptor of your PC.
3. Open Windows Explorer. The CompactFlash Card must be visible as removable data volume Windows Explorer under an arbitrary drive letter.
4. If generating a backup copy of your data on the CompactFlash card (`_saveunitdataset`) using your own application: Save the `"..\USER\SIMOTION\USER_DIR\UPP\UNITDS"` folder to the CompactFlash Card using the Card Reader tool and Windows Explorer on the PC / programming device.
5. Delete all the data from the CompactFlash Card.
6. Unpack the file delivered to you on the CompactFlash Card. Always maintain the file structure when setting up the unpacking tool.
7. Copy the folder saved in step 4 back to the appropriate folder structure on the CF card.
8. Remove the CompactFlash Card from the CompactFlash Card adaptor of your programming device / PC.
9. Insert the CF card into the D410.
10. Switch on power to the D410. The new firmware is loaded from the CompactFlash Card to the SIMOTION D410 module.

Note

The license key is stored in the "KEYS" directory on the CF card. For the initial startup of the SIMOTION device, as of Kernel Version V4.1, the license key is saved in the boot sector of the CF card. The license key in the boot sector cannot be deleted by an operation action. The license key remains saved even by formatting the CF card or rewriting the boot loader.

If the license key is no longer present on the card, for example, as the result of deleting the "KEYS" directory, it will be written again during the startup of the SIMOTION device from the boot sector into the "KEYS" directory. The license key can be changed at any time, for example, by relicensing. At the next startup, the license key will be saved again in the boot sector.

Re-compiling and downloading project data in SIMOTION SCOUT

Re-compile and download the project data after upgrading the D410. If you download the SIMOTION plus the SINAMICS configuration (default setting when clicking the download button in the toolbar) the SCOUT tool downloads the SIMOTION configuration and then goes online to the SINAMICS in order to download the SINAMICS configuration to the device. The firmware update is performed automatically. After an automatic firmware update, the modules must be switched off and on. This is also indicated with a message in the alarms window in the details area.

Updating the firmware of the SINAMICS components

How to update the firmware:

1. Select the SINAMICS component in the Project Navigator, for example, SINAMICS Integrated.
2. Double-click "Configuration" for the drive element.

The "SINAMICS Integrated - Configuration" dialog box opens and displays a list of all available drive objects.

3. Click "Version Overview" to open the list of connected SINAMICS components.
4. Establish the online connection 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. Select all components whose firmware is to be updated.
6. Switch the power supply to the updated components off and on after you have performed the firmware update. The device is now ready for operation.

Note

For a firmware update, the SINAMICS components must be installed appropriately. The firmware cannot be updated if the components are not programmed.

You can also update the firmware by means of the Expert list. Refer to the *SINAMICS S120* Commissioning Manual for a description of this procedure.

Upgrading a project

In order to allow the further use of existing projects you must take the following steps when upgrading the software:

1. Replace the module in **HW Config**
2. Upgrade the technology packages
3. Upgrade the libraries

Replace the module in HW Config

See Removing and replacing the SIMOTION D410 (Page 121)

Upgrading technology packages

When modules are replaced or project data is imported, the versions of the technology packages (TP) assigned to the individual technology objects (TO) are not automatically upgraded to a version valid for the SIMOTION device. This upgrade requires a separate step.

To adapt the technology package version of the new SIMOTION device:

1. Select the desired SIMOTION device in the Project Navigator.
2. Choose "Select Technology Packages" from the context menu.

Note

If the last step you performed was to replace the SIMOTION device, the "Technology Packages from Another Version" dialog box appears. Confirm this with "OK" to delete the existing links to the technology packages, thus enabling new technology packages to be assigned. The "Select Technology Packages" dialog box will now appear.

The "Select Technology Packages" window opens.

1. Activate the checkbox for the technology packages.
The technology packages must have the same version as the kernel. Consequently, in SIMOTION SCOUT, the same version as the kernel is automatically assigned to each technology package.
2. If technology objects for your project indicating an incorrect version appear under "Incorrect version", click "Update". The "Update Technology Packages" dialog box opens. Otherwise, continue with step 8.
3. Confirm with "OK". A message appears.
4. Confirm the message with "OK".
5. If the update is successful, a message appears. Confirm with "OK".
6. Confirm the "Select Technology Packages" dialog window with "OK". The TP upgrade is complete.

Upgrading the library

An upgrade of the libraries you are using is required if the version of the SIMOTION device or TOs in your existing project has changed.

1. Open the LIBRARY 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.

Download the project to the target system

1. Click "Connect with target system" to go online to the target system.
2. Execute the "Download to target system" command, and then select "Copy RAM to ROM" to download the updated offline project to the target device.
3. For the automatic subsequent configuring in the SINAMICS Integrated drive, you must now perform "Download to programming device".
4. Save the project.

5.4 SIMOTION CompactFlash Card

5.4.1 Replacing the CompactFlash Card

Prerequisite

Note

Always power down the unit before you insert or remove the CompactFlash Card!

The RDY LED on the SIMOTION D410 flashes in green color as long as any application is accessing the CompactFlash Card (see the chapter "Fault and status displays").

Procedure

How to replace the CompactFlash Card:

1. Shut down the power supply.
2. Remove the CompactFlash Card from the card slot of SIMOTION D410.
3. Hold the card between your thumb and finger on the gripping cavity and then pull it out.
4. Insert the new CompactFlash Card into the card slot. Push it in all the way with slight pressure until it engages. The insertion direction of the CompactFlash Card is identified by an arrow on the card and a matching arrow on the slot.
The properly inserted card does not protrude from the SIMOTION D410 housing.
5. Restart the power supply.

5.4.2 Writing and deleting data on CompactFlash Cards

Overview

You have the following options of writing data to a CompactFlash Card:

- Saving technology and user data to the CompactFlash Card
The programming device / PC must be online to SIMOTION D410 in order to execute this function.
- Saving data from the programming device / PC to the CompactFlash Card.
This function requires a CompactFlash Card adapter.

Note

CompactFlash Card are always shipped in formatted state.

Trouble-free operation of the CompactFlash Card can only be guaranteed if you do not modify its partitioning.

Saving technology and user data to the CompactFlash Card

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. Go online to SIMOTION D410 on your programming device / PC (see the chapter "Creating a project").
2. Select the "Copy RAM to ROM" command in SIMOTION SCOUT to write the data to your CompactFlash Card.

Writing data to a CompactFlash Card on your programming programming device / PC

A CompactFlash Card adapter must be installed on the programming device / PC and can be used to write data to the CompactFlash Card. Always save your project data to CompactFlash Card using the programming device / 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.

5.4.3 Formatting the CompactFlash Card

You can format a faulty CompactFlash Card, for example. Proceed as follows:

1. Insert the CompactFlash Card into a CompactFlash Card adapter which is connected to your programming device / PC.
2. Format the CompactFlash Card in Windows (FAT file system).

The CompactFlash Card is formatted.

5.4.4 Bootloader on the CompactFlash card

Writing a bootloader

A bootloader may need to be written in the following situations:

- When a new bootloader is required for the used SIMOTION D410 firmware version.
- When a new bootloader is required for the used SIMOTION D410 hardware version.
- When the bootloader is defective.

The bootloader version can be fetched using the SIMOTION SCOUT device diagnosis. If this is not possible because of the following reason, this can be caused by an incorrect bootloader version. In this case, replace the bootloader version with the current version.

- The SIMOTION D410 does not startup, the RDY LED flashes red at 0.5 Hz and the RUN/STOP LED lights red or all LEDs remain off.

Use the "Options > Write boot sector..." function to write the bootloader version in the SIMOTION SCOUT to the CF card.

Detailed information for the CF card, bootloader version, SIMOTION D410 hardware and SIMOTION firmware version compatibility relationships is contained in the software compatibility list. This list is available both in the supplied documentation of the SIMOTION SCOUT CD at \1_Important\German\Kompatibilität\ . . . and also in the Internet at "<http://support.automation.siemens.com/WW/view/de/18857317>"

Diagnostics data

6.1 Diagnostics by means of LED displays

Overview

The status LEDs display the operating modes or fault states of SIMOTION D410.

Legend of the LED states

Table 6-1 Legend of the LED states

Symbol	Meaning
1	LED on
0	LED off
0,5/1	LED flashes at 0.5 Hz:
2/1	LED flashes at 2 Hz:
Λ	LED flickers
x	The LED display is irrelevant to the states shown in the table

LED displays

The following table provides an overview of all relevant LED display combinations. Each LED can be lit in yellow, red, or green color. The color which corresponds with the LED signal state is also defined.

Table 6-2 Diagnostics by means of LED display

Meaning	RDY	RUN/STOP	OUT > 5V	SF/BF:
SINAMICS Integrated ready for operation	1 (green)	x	x	x
SINAMICS Integrated in fault state	∧ (red)	x	x	x
Startup of the D410 without CF card or with CF card without valid operating system (the bootloader may be defective)	0,5/1 (red)	1 (red)	0	0
Write access to CompactFlash Card	2/1 (green)	x	x	x
SIMOTION ready for operation	x	1 (green or yellow)	x	x
Fault event to which the user program (SIMOTION) cannot respond, or firmware error at the PROFINET interface. The following actions may be required to rectify the fault: <ul style="list-style-type: none"> • Power OFF/ON • Check of the CompactFlash Card • Re-commissioning • Replacement of SIMOTION D410 	∧ (red)	∧ (red)	x	∧ (red)
A warning is present on the SINAMICS Integrated. This state can occur, for example, when the DRIVE-CLiQ components are loaded but have not been inserted.	1 (yellow)	x	x	x
Ethernet LED (only for SIMOTION D410 PN) DCP flashing of the module activated in the HW Config at Target system > Ethernet > Edit Ethernet node > "Search" button > "Flashing" button Priority: 0 ¹⁾	x	x	x	2/1 (green)
Active interrupt which can be acknowledged (alarm, message, note) Priority: 1 ¹⁾	x	x	x	1 (red)
Bus fault <ul style="list-style-type: none"> • PROFIBUS master: At least one slave is missing • PROFIBUS slave: No parameter assignment master found • PROFINET: Failure of a connected I/O device; at least one of the assigned I/O devices cannot be addressed; faulty or missing configuration data. Priority: 2 ¹⁾	x	x	x	2/1 (red)
Sublicensing of technology/option objects Priority: 3 ¹⁾	x	x	x	0.5/1 (red)
Upgrade/downgrade operation running.	0,5/1 (yellow)	x	x	x

Meaning	RDY	RUN/STOP	OUT > 5V	SF/BF:
The upgrade/downgrade operation has completed (power OFF/ON of the upgraded/downgraded devices is necessary)	2/1 (yellow)	x	x	x
STOP to RUN transition	x	2/1 (green)	x	x
STOP/STOPU	x	1 (yellow)	x	x
RUN to STOP transition	x	2/1 (yellow)	x	x
Memory reset requested by SIMOTION D410, or by means of mode selector switch.	x	0,5/1 (yellow)	x	x
Memory reset in progress	x	0	x	0
Memory reset completed	x	1 (yellow)	x	x
Firmware download to the integrated PROFINET interface is busy	0	2/1 (yellow)	x	2/1 (yellow)
Firmware download to the integrated PROFINET interface is completed SIMOTION cannot enter the RUN and Online mode	1 (green)	1 (yellow)	x	Λ (red)

1) Priority of the displays: The displays always visualize the state which is assigned the numerically lowest priority level. The error of the next highest priority class is displayed after the cause of the previous signal state was eliminated.

The LED "OUT > 5V" display is controlled only by the encoder evaluation for the integrated X23 encoder interface in SINAMICS Integrated. The table below lists the display states and their meaning.

Table 6-3 LED display OUT > 5V

Status	Meaning
0	Electronic power supply is missing or outside the valid tolerance range. Power supply ≤ 5 V. Use of an encoder with 5 V power supply.
1 (yellow)	Electronics power supply for measuring system available. Power supply >5 V. Caution: Always ensure that you can operate the encoder on the 24 V power supply (e.g. HTL encoder). Operation of a 5 V encoder on the 24 V encoder supply may lead to the destruction of its electronic components! This setting can be selected in the expert list of the drive in parameter p405.1.

6.2 Extended diagnostic capabilities

SIMOTION Task Profiler application

The SIMOTION Task Profiler is a dedicated application installed parallel to SIMOTION SCOUT during the SIMOTION SCOUT setup. The Task Profiler can be called in online mode from the device diagnosis in SIMOTION SCOUT or the Windows application. In cases of malfunction or errors, the Task Trace data can be written in a directory or on the CF card. This data can then be processed using the Task Trace Viewer.

For further information, see the *SIMOTION Task Trace* Function Manual.

Diagnostic functions with the DIP switch

The following diagnostic functions are possible using the specified switch settings on the DIP switch of the D410:

- **Downgrading a SIMOTION device - switch 6**
You can use this function to undo a SIMOTION devices update.
Place switch 6 of the DIP switch on the D410 to ON (0000010), and switch the D410 off and on.
The "Start devices update tool" function is described in the *Upgrading SIMOTION Devices* Function Manual.
- **Writing diagnostic data to the CF card - switch 7**
This diagnostic data can provide important information after a D410 malfunction (crash). If this function has been performed, diagnostic data is written to the CF card. This data can then be sent in a suitable form, e.g. compressed as *.zip file, to the Technical Support for evaluation.

Proceed as follows:

1. To do this, set the DIP switch 7 to ON.
2. Shutdown the D410.
3. Switch on the D410. The data will be written to the CF card. Wait until the D410 has completed its start.
4. Shutdown the D410 and remove the CF card.
5. A DIAG folder is created in the \USER\SIMOTION\HMI\SYSLOG directory. This folder contains the diagnostic data.
6. Transfer the diagnostic data for processing to the Technical Support.

Standards and approvals

A.1 General rules

IEC 1131

The SIMOTION programmable controller meets the requirements and criteria of the Standard IEC 1131, Section 2.

CE marking

Our products meet the general and safety-related requirements of the following EC guidelines and conform to the uniform standards (EN) for programmable controllers published in the official gazettes of the European Union:

89/336/EEC "Electromagnetic Compatibility" (EMC guideline)

The EC declaration of conformity is contained in this manual.

EMC Directive

SIMOTION products are designed for industrial use.

Table A-1 EMC Directive

Field of application	Requirements for	
	Emitted interference	Immunity to noise
Industry	EN 50081-2	EN 61000-6-2

UL certification

Recognized component mark for United States and the Canada Underwriters Laboratories (UL) according to Standard UL 508, File 16 4110.

Declaration of conformity

The current Declaration of Conformity is on the Internet at
<http://support.automation.siemens.com/WW/view/de/15257461>

A.2 Safety of electronic controllers

Introduction

The following remarks relate to fundamental criteria and apply irrespective of the type of controller and the manufacturer.

Reliability

Comprehensive and cost-effective measures have been taken during development and production to increase the reliability of the devices and components as far as possible.

These include

- The selection of high-quality components
- Worst-case dimensioning of all circuits
- Systematic and computerized inspection of all supplied components
- Burning in of all LSI circuits (e.g. processors, memories, etc.)
- Measures to prevent static discharge when handling MOS circuits
- Visual checks during various stages of manufacture
- Continuous heat testing at higher ambient temperatures for several days
- Computerized final inspection
- Statistical analysis of all returned goods so that corrective measures can be initiated immediately
- Monitoring of the primary controller components using online tests

These measures are considered to be basic measures for safety engineering. They avoid or control the majority of faults that may occur.

Risk

A higher degree of safety standard applies to all applications and situations where there is a risk of material damage or injury to persons if there is a failure. Special regulations specific to the system apply to such applications. These must be taken into account for configuration of the controller (e.g. VDE 0116 for furnaces).

For electronic controllers with safety responsibility, the measures required for preventing or controlling faults depend on the hazard inherent in the plant. In this respect, the basic measures listed above are no longer adequate once the hazard exceeds a certain potential. Additional measures (e.g. double redundancy, tests, checksums, etc.) for the controller must be implemented and certified (DIN VDE 0801).

Division into safety-critical and non-safety-critical areas

Nearly all systems contain parts that perform safety-related tasks (e.g. emergency stop switch, protective grating, two-hand controls). To avoid having to apply safety-related criteria to the entire controller, it is customary to divide the controller into two areas - one that is **critical to safety** and one that is **not critical to safety**. No special demands are made concerning safety in the area that is not safety-critical as an electronic fault would not have any effect on the safety of the system. However, in the safety-critical area, only controllers and circuits that comply with the relevant regulations, may be used.

Important note

Even if an extremely high level of conceptual safety has been achieved in the design of an electronic controller - e.g. through implementation of a multi-channel design - strict adherence to all instructions in the operator's guide is mandatory, as incorrect handling could invalidate measures taken to prevent hazardous faults or create additional potential hazards.

 DANGER
Electrical, magnetic and electromagnetic fields (EMF) that occur during operation can pose a danger to persons who are present in the direct vicinity of the product - especially persons with pacemakers, implants, or similar devices.
The relevant directives and standards must be observed by the machine/plant operators and persons present in the vicinity of the product. These are, for example, EMF Directive 2004/40/EEC and standards EN 12198-1 and -3 pertinent to the European Economic Area (EEA), as well as accident prevention code BGV 11 and the associated rule BGR 11 "Electromagnetic fields" of the German employer's liability accident insurance association.
These state that a hazard analysis must be drawn up for every workplace, from which measures for reducing dangers and their impact on persons are derived and applied, and exposure and danger zones are defined and observed.
The safety information in the Storage, Transport, Installation, Commissioning, Operation, Maintenance, Disassembly and Disposal sections must also be taken into account.

A.3 Electromagnetic Compatibility

Definition

Electromagnetic compatibility (EMC) is the ability of an electrical device to function sufficiently in its electromagnetic environment without interfering with this environment.

The SIMOTION D410 control meets the requirements of the EU directive on EMC and the EMC law of the European single market 89/339/EEC.

Relevant standards regarding electromagnetic compatibility

The following EMC standards are met if the EMC installation guideline (order number 6FC5297-□AD30-0AP□) is complied with:

Table A-2 EMC standards

Informational topic	Standard
Product standard	DIN EN 61800-3
Emitted interference	DIN EN 61000-6-4
Noise immunity	DIN EN 61000-6-2

ESD guidelines

B.1 ESD definition

What does ESD mean?

All electronic modules are equipped with highly integrated modules or components. Because of the technology used, these electronic components are very sensitive to overvoltages and thus to discharge of static electricity.

The acronym **ESD** has become the established designation for such **E**lectrostatic **S**ensitive **D**evices. The **ESD** designation is used internationally to refer to electrostatic sensitive devices.

Electrostatic sensitive devices are identified by the following symbol:

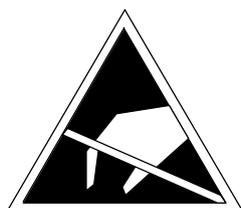


Figure B-1 Symbol for identification of electrostatic sensitive devices

 CAUTION
Electrostatic sensitive devices can be irreparably damaged by voltages that are far lower than anything a person can perceive. These voltages occur if you touch a component or the electrical connection of a module without having previously discharged any static from your body. Any damage that occurs to a module as a result of overvoltage is generally not recognized immediately and only comes to light after the equipment has been operating for some time.

B.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.

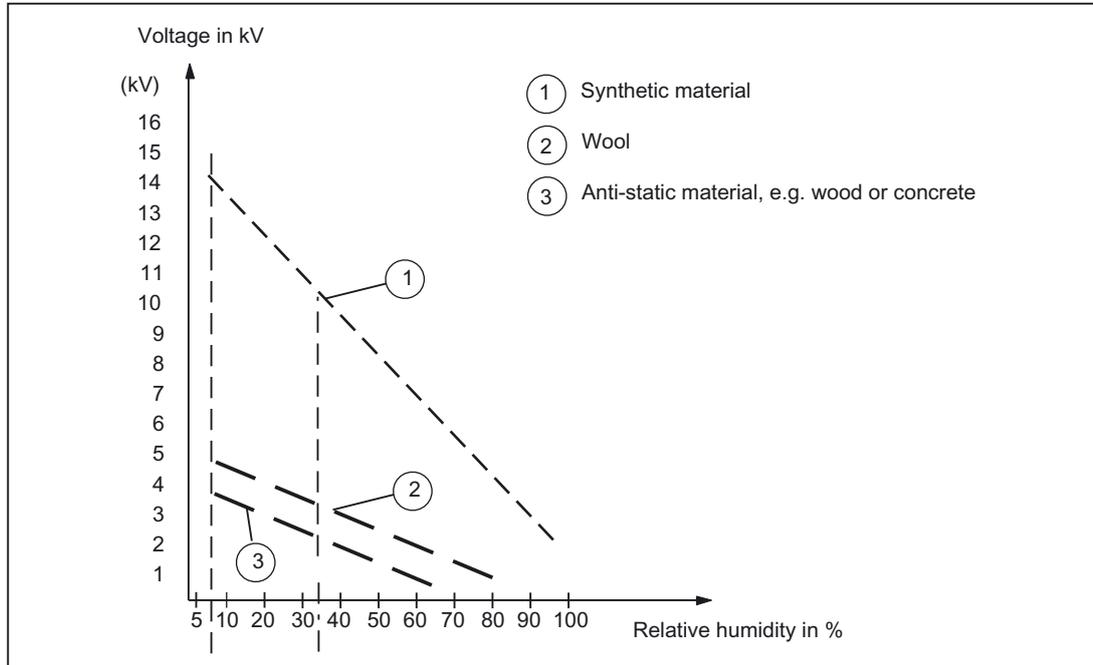


Figure B-2 Electrostatic voltage that can accumulate on operating personnel

B.3 Basic measures for protection against discharge of static electricity

Ensure sufficient grounding

When working with electrostatic sensitive devices, make sure that the 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.

Appendix

C.1 List of abbreviations

Table C-1 Abbreviations

Abbreviation	Description
ASIC	Application Specific Integrated Circuit
CF card	CompactFlash Card
CUA	Control Unit Adapter
DAC	Digital-to-analog converter
DESINA	Decentralized and standardized installation technology for machine tools and manufacturing systems
DI	Digital Input
DIP	Dual In Line Package
DO	Digital Output
DP	Distributed I/O
DRIVE-CLiQ	DRIVE Component Link with IQ
DSC	Dynamic Servo Control (DSC) enables the actual position value to be evaluated in a fast speed controller cycle directly in the drive.
ECOFAS	Energy and Communication Field Installation System
EMC	Electromagnetic Compatibility
EP	Enable Pulses
ES	Engineering System
ESD	Electrostatically Sensitive Devices
FW	Firmware
GSD	Device master data (device parameter list for integration in HW config)
HTL	High Threshold-Logic
HW	Hardware
I/O	Input/Output
IM	Interface module
IRT	Isochronous Real Time Ethernet
KTY	Special temperature sensor
LED	Light Emitting Diode
OLP	Optical Link Plug
OS	Operating state
PB	PROFIBUS
PELV	Protective Extra Low Voltage

Abbreviation	Description
PG/PC	Programming Device / Personal Computer
PN	PROFINET
PROFIBUS DP	Process Field Bus - Decentral Periphery
PS	Power Supply
PTC	Positive Temperature Coefficient
PZD	Process status data
RT	Real Time Ethernet (non-isochronous PROFINET)
SBC	Safe Brake Control
SCOUT	SIMOTION Controlling with Optimized Usability Toolbox (Engineering system in the SIMOTION product family)
SITOP	Power supply
SM	Sensor module (SINAMICS)
SMC	Sensor Module Cabinet, encoder connection to DRIVE-CLiQ
SME	Sensor Module External, encoder connection to DRIVE-CLiQ (with high safety class)
SMx	Sensor Module (overview for various sensor modules, e.g. SMI (integrated sensor module) or SME (external sensor module))
SS1	Safe Stop 1
STO	Safe Torque Off
SW	Software
TCP/IP	Transmission Control Protocol / Internet Protocol
TIA	Totally Integrated Automation
TM	Terminal Module for DRIVE-CLiQ
TO	Technology object
TP	Technology package
TTL	Transistor Transistor Logic

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