

SIEMENS

SIMOTION

SIMOTION D410

Manual

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Valid for SIMOTION D410 DP and D410 PN


04/2014


Legal information

Warning notice system

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

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

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

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

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


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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

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

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

Equipment Manual contents

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

Scope

The *SIMOTION D410* device manual is valid for the devices SIMOTION D410 DP and SIMOTION D410 PN.

A separate *SIMOTION D410-2* Manual is available for the SIMOTION D410-2 DP and D410-2 DP/PN devices.

Information in this manual

The following is a description of the purpose and use of the equipment Manual:

- **Description**
This section provides information pertaining to the SIMOTION system and its integration into the information landscape.
- **Operator Control (hardware)**
This section describes the operating elements and how to operate them.
- **Interfaces**
This section provides information on the interfaces, pin assignments and application options.
- **Installing**
This section explains how you configure a mechanical layout and install the SIMOTION D410 in a control cabinet.
- **Connecting**
This section describes how to connect and network the SIMOTION D410.
- **Technical data**
This section describes the properties and features of the SIMOTION D410.
- **Spare Parts/Accessories**
This section provides information on accessories and spare parts for the SIMOTION D410.
- **Appendix**
This section provides information on the various standards, approvals and ESD guidelines.
- **Index to locate information**

SIMOTION Documentation

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

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

The following documentation packages are available for SIMOTION V4.4:

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

Additional information

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

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

<http://www.siemens.com/motioncontrol/docu>

Please send any questions about the technical documentation (e.g. suggestions for improvement, corrections) to the following e-mail address:
docu.motioncontrol@siemens.com

My Documentation Manager

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

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

Training

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

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

FAQs

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

<http://support.automation.siemens.com>

Technical support

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

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

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 ISO 11469.
- Less material used because the unit is smaller and with fewer components thanks to integration in ASICs

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

The products can be largely recycled owing to their low pollutant content. To recycle and dispose of your old device in an environmentally friendly way, please contact a recycling company certified for electronic waste.

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

Internet address (<http://www.automation.siemens.com/partner>).

Further information / FAQs

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

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

The following information sources are also available:

- SIMOTION Utilities & Applications: SIMOTION Utilities & Applications are included in the SIMOTION SCOUT scope of delivery and, along with FAQs, they also contain free utilities such as calculation tools, optimization tools, etc. as well as application examples (ready-to-apply solutions such as winders, cross cutters or handling).
- The latest FAQs for SIMOTION under <http://support.automation.siemens.com/WW/view/de/10805436/133000>

- SIMOTION SCOUT online help
- For additional documentation, see the *Overview of SIMOTION documentation* (separate document).

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Safety instructions

1.1 Fundamental safety instructions

1.1.1 General safety instructions



DANGER

Danger to life due to live parts and other energy sources

Death or serious injury can result when live parts are touched.


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

Generally, six steps apply when establishing safety:


1. Prepare for shutdown and notify all those who will be affected by the procedure.
2. Disconnect the machine from the supply.
 - Switch off the machine.
 - Wait until the discharge time specified on the warning labels has elapsed.
 - Check that it really is in a no-voltage condition, from phase conductor to phase conductor and phase conductor to protective conductor.
 - Check whether the existing auxiliary supply circuits are de-energized.
 - Ensure that the motors cannot move.
3. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water.
4. Isolate or neutralize all hazardous energy sources by closing switches, grounding or short-circuiting or closing valves, for example.
5. Secure the energy sources against switching on again.
6. Ensure that the correct machine is completely interlocked.

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




 WARNING
Danger to life from hazardous voltage when connecting an unsuitable power supply
Touching live components can result in death or severe injury.
<ul style="list-style-type: none">• Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.




 WARNING
Danger to life from touching live parts on damaged devices
Improper handling of devices can result in damage.
For damaged devices, hazardous voltages can be present at the enclosure or at exposed components; if touched, this can result in death or severe injury.
<ul style="list-style-type: none">• Observe the limit values specified in the technical specifications during transport, storage, and operation.• Do not use damaged devices.



 WARNING
Danger to life through electric shock due to unconnected cable shields
Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.
<ul style="list-style-type: none">• As a minimum, connect cable shields and the cores of power cables that are not used (e.g. brake cores) at one end at the grounded housing potential.



 WARNING
Danger to life due to electric shock when not grounded
For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.
<ul style="list-style-type: none">• Ground the device in compliance with the applicable regulations.

**WARNING****Danger to life due to fire spreading if housing is inadequate**

Fire and smoke development can cause severe personal injury or material damage.

- Install devices without a protective housing in a metal control cabinet (or protect the device by another equivalent measure) in such a way that contact with fire inside and outside the device is prevented.
- Ensure that smoke can only escape via controlled and monitored paths.

**WARNING****Danger to life from unexpected movement of machines when using mobile wireless devices or mobile phones**

Using mobile radios or mobile phones with a transmit power > 1 W closer than approx. 2 m to the components may cause the devices to malfunction, influence the functional safety of machines therefore putting people at risk or causing material damage.

- Switch off wireless devices or mobile phones in the immediate vicinity of the components.

**WARNING****Danger to life due to fire if overheating occurs because of insufficient ventilation clearances**


Inadequate ventilation clearances can cause overheating of components followed by fire and smoke development. This can cause death or serious injury. This can also result in increased downtime and reduced service life for devices/systems.

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

**WARNING****Danger of an accident occurring due to missing or illegible warning labels**

Missing or illegible warning labels can result in accidents involving death or serious injury.

- Check that the warning labels are complete based on the documentation.
- Attach any missing warning labels to the components, in the national language if necessary.
- Replace illegible warning labels.

 WARNING
Danger to life when safety functions are inactive
Safety functions that are inactive or that have not been adjusted accordingly can cause operational faults on machines that could lead to serious injury or death.
<ul style="list-style-type: none">• Observe the information in the appropriate product documentation before commissioning.• Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.• Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.• Perform a function test.• Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.


Note

Important safety notices for safety functions

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

1.1.2 Safety instructions for electromagnetic fields (EMF)



 WARNING
Danger to life from electromagnetic fields
Electromagnetic fields (EMF) are generated by the operation of electrical power equipment such as transformers, converters or motors.
People with pacemakers or implants are at a special risk in the immediate vicinity of these devices/systems.
<ul style="list-style-type: none">• Ensure that the persons involved are the necessary distance away (minimum 2 m).

1.1.3 Handling electrostatic sensitive devices (ESD)

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

**NOTICE****Damage through electric fields or electrostatic discharge**

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

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


1.1.4 Industrial security

Note**Industrial security**

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. For more information about industrial security, visit <http://www.siemens.com/industrialsecurity>.

To stay informed about product updates as they occur, sign up for a product-specific newsletter. For more information, visit <http://support.automation.siemens.com>

 WARNING
Danger as a result of unsafe operating states resulting from software manipulation
Software manipulation (e.g. by viruses, Trojan horses, malware, worms) can cause unsafe operating states to develop in your installation which can lead to death, severe injuries and/or material damage.
<ul style="list-style-type: none">• Keep the software up to date. Information and newsletters can be found at: http://support.automation.siemens.com• Incorporate the automation and drive components into a state-of-the-art, integrated industrial security concept for the installation or machine. For more detailed information, go to: http://www.siemens.com/industrialsecurity• Make sure that you include all installed products into the integrated industrial security concept.

1.1.5 Residual risks of power drive systems

The control and drive components of a drive system are approved for industrial and commercial use in industrial line supplies. Their use in public line supplies requires a different configuration and/or additional measures.

These components may only be operated in closed housings or in higher-level control cabinets with protective covers that are closed, and when all of the protective devices are enabled.

These components may only be handled by qualified and trained technical personnel who are knowledgeable and observe all of the safety instructions on the components and in the associated technical user documentation.

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

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example:
 - Hardware defects and/or software errors in the sensors, controllers, actuators, and connection technology
 - Response times of the controller and drive
 - Operating and/or ambient conditions outside of the specification
 - Condensation / conductive contamination
 - Parameterization, programming, cabling, and installation errors
 - Use of radio devices / cellular phones in the immediate vicinity of the controller
 - External influences / damage
2. In the event of a fault, exceptionally high temperatures, including an open fire, as well as emissions of light, noise, particles, gases, etc. can occur inside and outside the inverter, for example:
 - Component malfunctions
 - Software errors
 - Operating and/or ambient conditions outside of the specification
 - External influences / damage

Inverters of the Open Type / IP20 degree of protection must be installed in a metal control cabinet (or protected by another equivalent measure) such that the contact with fire inside and outside the inverter is not possible.
3. Hazardous touch voltages caused by, for example:
 - Component malfunctions
 - Influence of electrostatic charging
 - Induction of voltages in moving motors
 - Operating and/or ambient conditions outside of the specification
 - Condensation / conductive contamination
 - External influences / damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc. if they are too close.
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly.

Note

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

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

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

1.2 Specific safety information for SIMOTION D410



! WARNING

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

Only safety extra low voltage in accordance with EN/IEC 60950-1 may be connected at all connectors and terminals.

! WARNING

Danger to life from unexpected movement of machines on automatic restart

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

Make sure this presents no hazard to personnel or property.

NOTICE

Damage to the CompactFlash card from electrical fields or electrostatic discharge

The CompactFlash card is an ESD-sensitive component.

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

Comply with the ESD rules.

NOTICE

Overheating if ventilation clearances are too small

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

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

Description

2.1 System overview

Overview

SIMOTION D is a drive-based version of SIMOTION based on the SINAMICS S120 drive family. With SIMOTION D, the SIMOTION PLC and motion control functionalities as well as the SINAMICS S120 drive software run on shared control hardware.

SIMOTION 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 the SIMOTION D4x5/D4x5-2 control units for multi-axis applications.

Note

The SIMOTION D410 is described in this manual. Separate manuals are available for the SIMOTION D410-2, D4x5 and D4x5-2.

SIMOTION D is an integral part of the Totally Integrated Automation (TIA) concept. TIA is characterized by integrated data management, configuration, and communication for all products and systems. Thus, an extensive toolbox of automation modules is also available for 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 cams or cams
- Drives without power recovery (wire drawing, extruding)
- Drive connections with high availability requirements (incoming supply failure may not cause all axes to fail)

Versions

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.

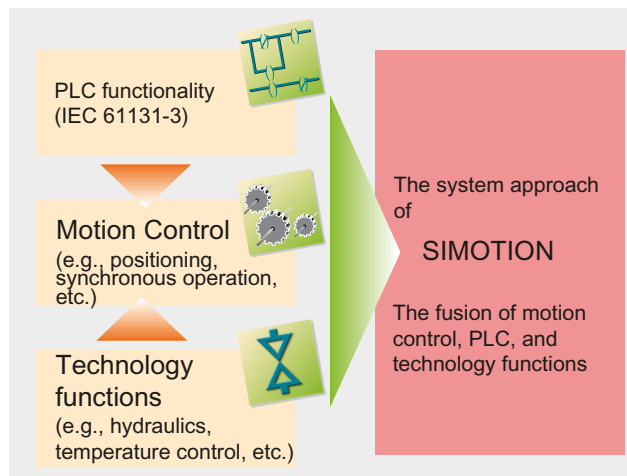


Figure 2-1 System solution

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 costs 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.

2.2 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 established via PROFIBUS mechanisms (DP Integrated).

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

Table 2-1 System components

Component	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 I/Os • 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 method of supplying power to the SIMOTION D410 in certain cases (e.g. when digital outputs are not used, etc. . .). Also see the Power supply section in the SIMOTION D410 Manual.</p>

PROFIBUS DP

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

Table 2-2 Components on PROFIBUS DP

Component	Function
Programming device (PG/PC)	... 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 essential for running SIMOTION D410.
Drive units with PROFIBUS DP interface (e.g. CU310 DP)	... 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 slave on the PROFIBUS DP.
Other controllers (e.g. SIMOTION or SIMATIC)	
Distributed I/O systems	
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.
Other PROFIBUS I/O	
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 for connecting two PROFIBUS DP networks
Teleservice adapter	Remote diagnostics

Note

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

PROFINET

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

Table 2-3 Components on PROFINET

Component	Function
The master computer (at company and production management level)	... communicates with other devices via Ethernet.
Programming device (PG/PC)	... 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.
Antriebsgeräte mit PROFINET-Schnittstelle (z. B. SINAMICS S120)	... convert speed setpoints into signals for controlling the motor and supply the power required to operate the motors.
Other controllers (e.g. SIMOTION or SIMATIC)	
Distributed I/O systems	
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.
SIMATIC ET 200eco PN	Compact block I/O with IP65/66/67 degree of protection for cabinet-free usage in machines with M12 connection method. Very rugged and resistant encapsulated metal enclosure.
Other PROFINET I/O	
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

Note

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

I/O integration

Note

Please note that not all modules for the I/O systems listed 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.

You can find an up-to-date list of I/O modules that can be used with SIMOTION at Internet address (<http://support.automation.siemens.com/WW/view/en/11886029>).

In addition to the I/O modules enabled for SIMOTION, in principle all certified standard PROFIBUS slaves (DP-V0/DP-V1/DP-V2) and PROFINET devices with RT and IRT real-time classes may be connected to SIMOTION D410.

These modules are integrated using the GSD file (PROFIBUS) or GSDML file (PROFINET) provided by the relevant device manufacturer.

Note

Please note that in isolated cases, additional boundary conditions must be fulfilled in order to integrate a module into SIMOTION. 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.

DRIVE-CLiQ

DRIVE-CLiQ offers the following advantages within the DRIVE-CLiQ topology rules:

- Independent expansion of components possible
- Automatic detection of components by the Control Unit
- Standardized interfaces in all components
- Uniform diagnostics down to the components
- Complete service down to the components
- Mechanical parts are easy to use

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

Table 2-4 Components on DRIVE-CLiQ

Component	Function
SINAMICS S120 AC DRIVE drive units (with CUA31/CUA32)	... convert speed setpoints into signals for controlling the motor and supply the power required to operate the motors. The AC DRIVE component PM340 is connected via CUA31/CUA32. No more than one PM340 can be connected. The chassis Power Module is connected via DRIVE-CLiQ. Note: Components in booksize format are not supported!
TM15, TM17 High Feature Terminal Modules	The Terminal Modules TM15 and TM17 High Feature are used to implement measuring inputs and output cam outputs. In addition, these Terminal Modules provide drive-related digital I/Os with short signal delay times.
TM31 Terminal Module	... enables terminal expansion via DRIVE-CLiQ (additional analog and digital I/Os).
TM41 Terminal Module	... enables terminal expansion (analog and digital 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 SIMOTION Version V4.1 SP2 and higher, 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/DME20 DRIVE-CLiQ hub	... enables the number of DRIVE-CLiQ interfaces to be increased and the creation of a point-to-point topology.

Note

Please note that components in booksize format (Controller Extension, Motor Modules, Line Modules, etc.) as well as SINAMICS G120 (PM2x0) Power Modules are not supported by SIMOTION D410.

See also

Power supply (Page 57)

2.3 SIMOTION D410 DP display

View

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

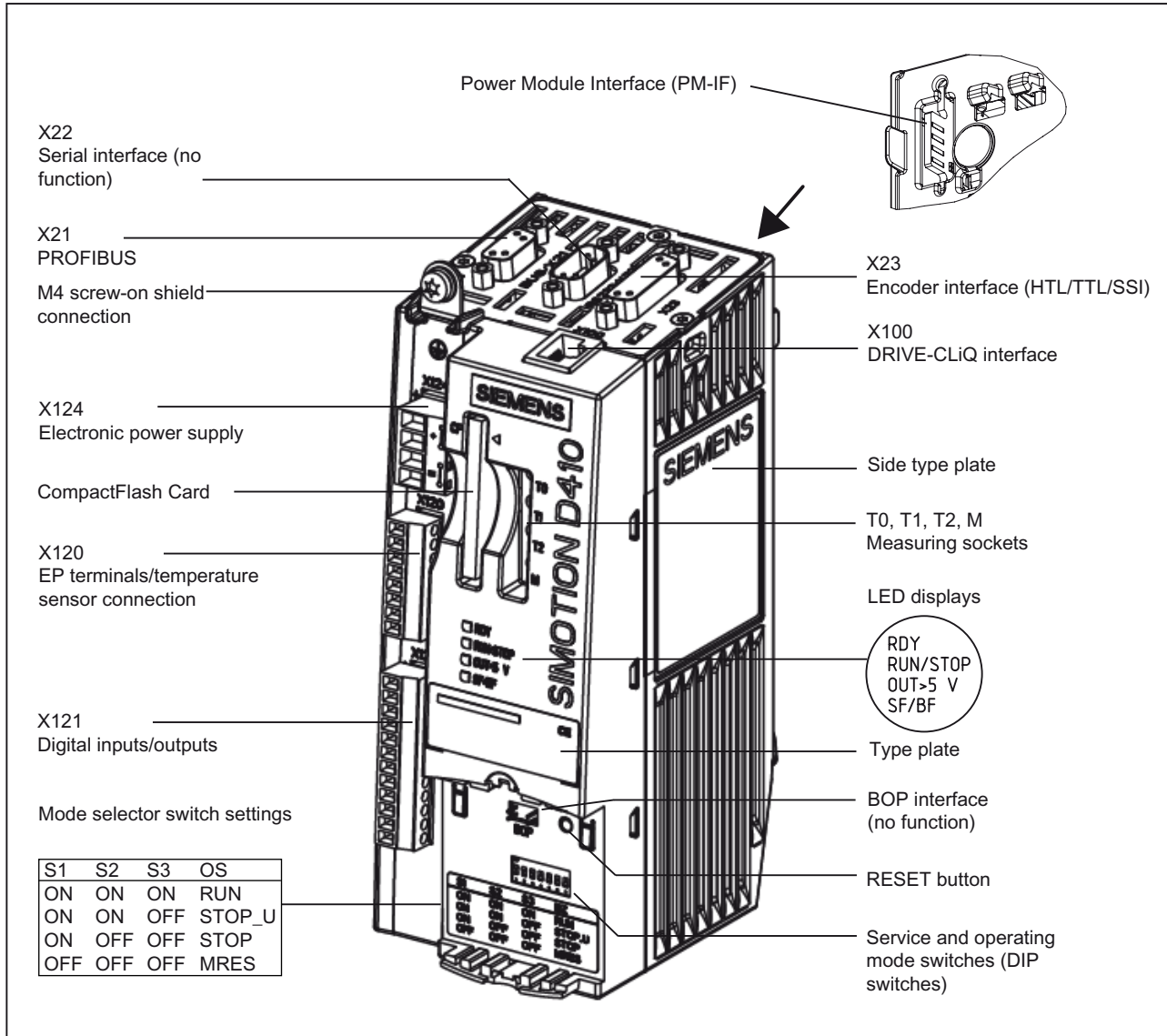


Figure 2-2 Location of interfaces and front elements in SIMOTION D410 DP

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 2-5 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

Type plates

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

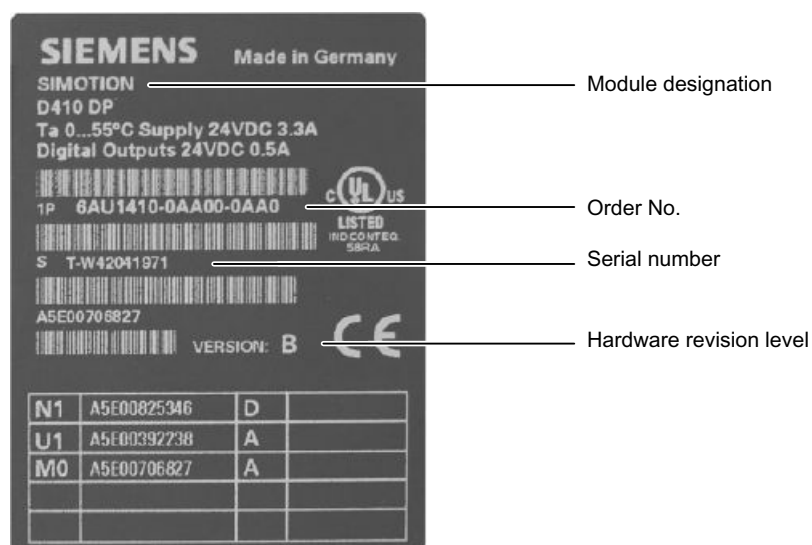


Figure 2-3 SIMOTION D410 nameplate

2.3 SIMOTION D410 DP display

The type plate below is located on the front of the SIMOTION D410 DP.

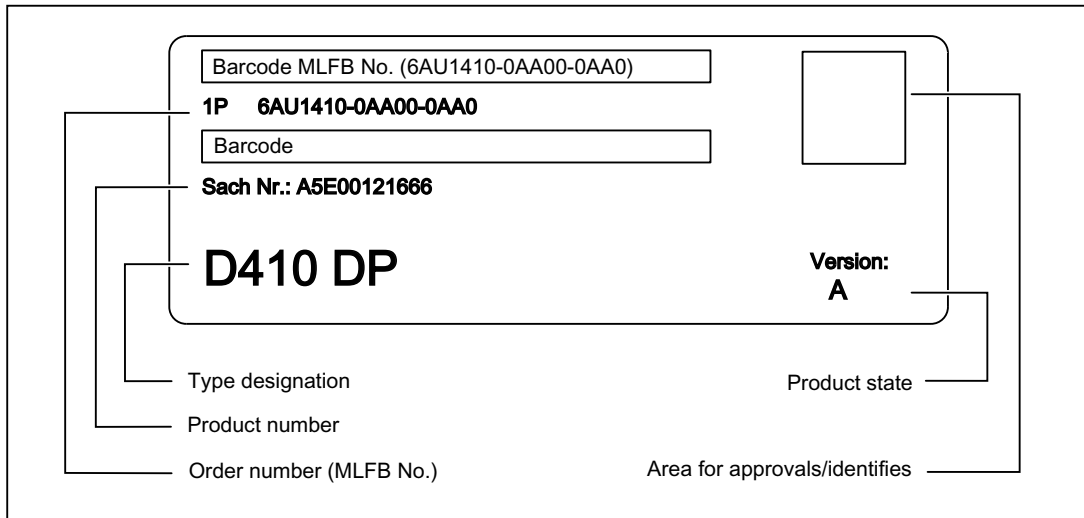


Figure 2-4 SIMOTION D410 DP nameplate (example)

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.).

2.4 SIMOTION D410 PN display

View

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

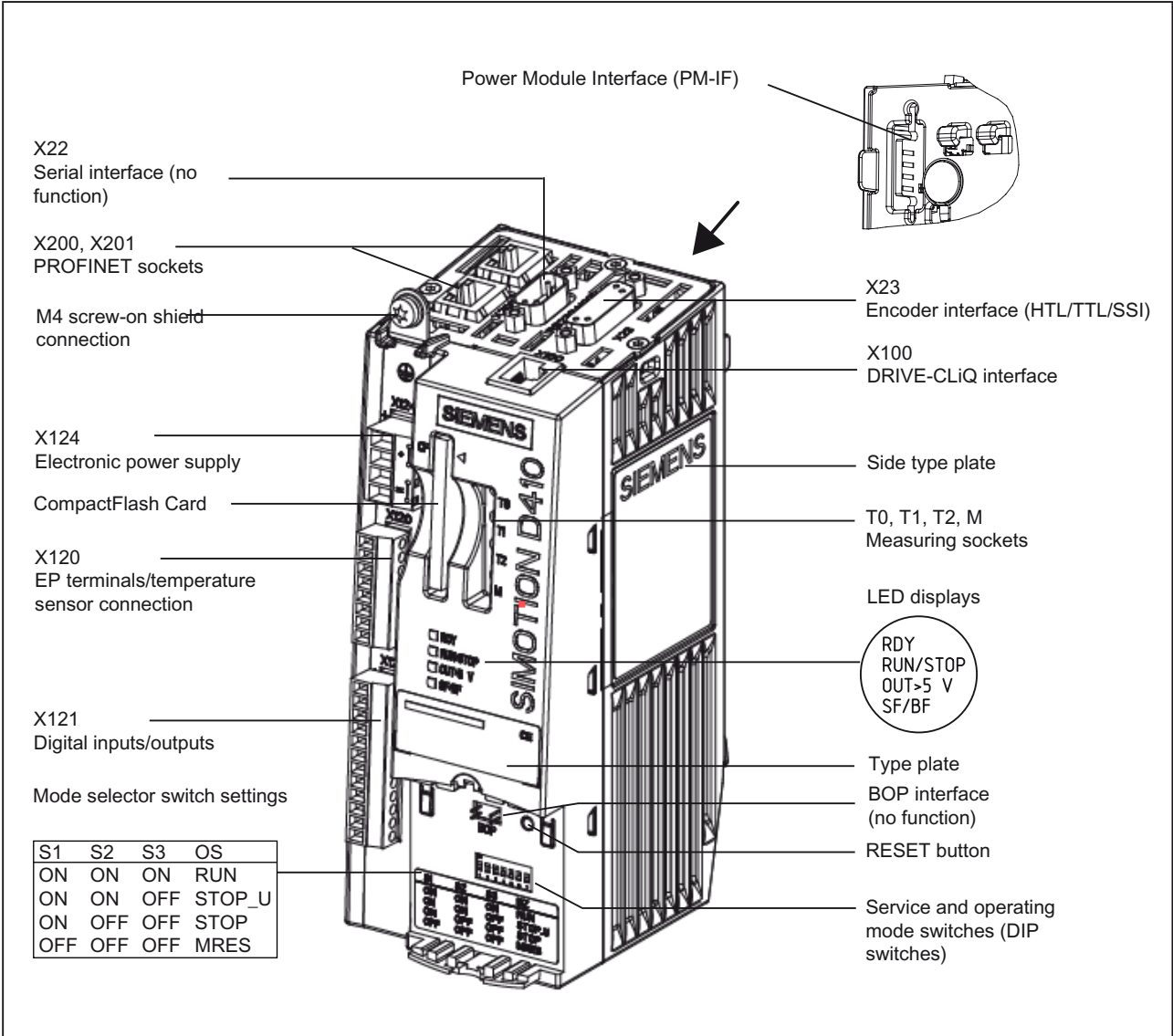


Figure 2-5 Location of interfaces and front elements in SIMOTION D410 PN

Interfaces

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

Table 2-6 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 RJ45 socket to connect to PROFINET
Power Module Interface (PM-IF)	8-pin direct connector to connect to a Power Module in blocksize format
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

Type plates

The figure below shows all the information included on the type plate located on the side of the unit.

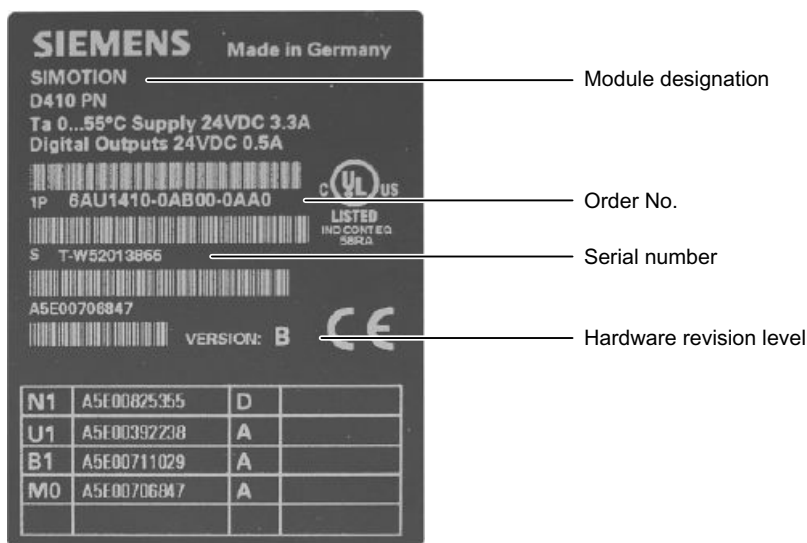


Figure 2-6 SIMOTION D410 PN type plate

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.

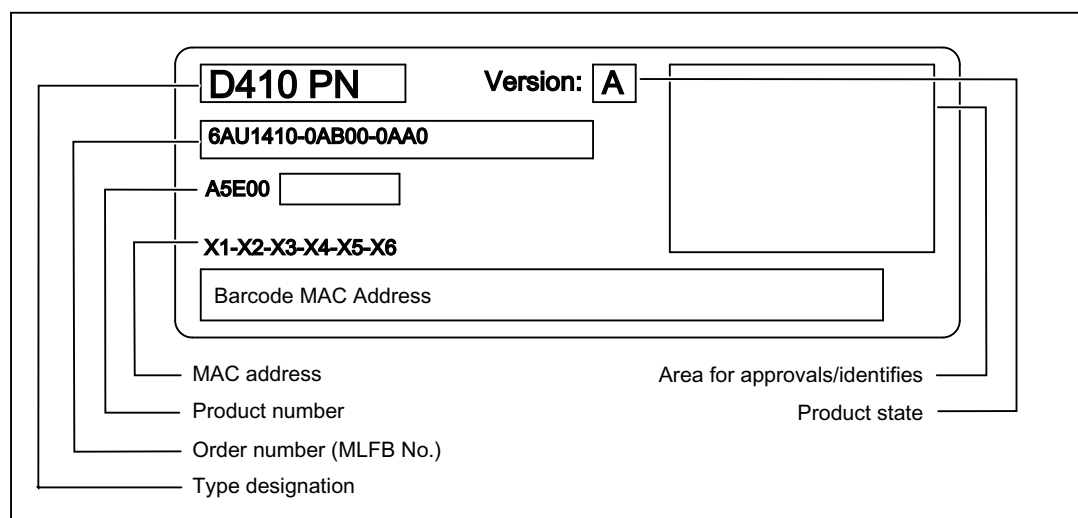


Figure 2-7 SIMOTION PN nameplate (example)

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.).

2.5 The CompactFlash card

CF card

CF cards with different storage capacities are available for SIMOTION D410. At the time of writing, these were:

- 1-GB CF, order number 6AU1400-2PA0*-0AA0
- 512-MB CF, order number 6AU1400-2NA00-0AA0

You will find detailed information on the compatibility relationships for the CF card, boot loader version, SIMOTION D hardware and SIMOTION firmware version in the software compatibility list. You can find this list both in the documentation that comes with the SIMOTION SCOUT DVD under \1_Important\Germany\Kompatibilitaet\... and on the Internet (<http://support.automation.siemens.com/WW/view/en/18857317>).

2.5 The CompactFlash card

Type plate information

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

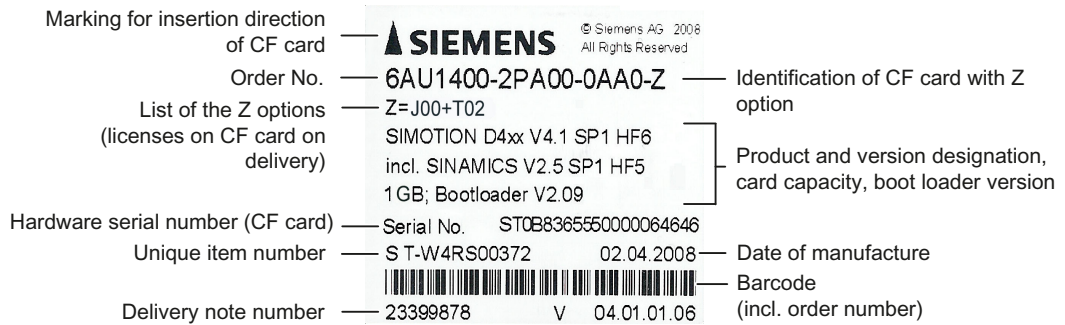


Figure 2-8 CompactFlash card (example of a 1-GB CF card)

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 SIMOTION IT Virtual Machine 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 - SIMOTION IT DIAG license (license no longer required as of SIMOTION V4.2)
- X00 - SIMOTION IT OPC XML-DA license (license no longer required as of SIMOTION V4.2)
- J00 - SIMOTION IT Virtual Machine license for Java applications

Safety functions:

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

2.6 Licensing

SIMOTION D410 licensing

SIMOTION D410 is a modular drive system for single-axis applications. D410 contains the motion control technology functions for precisely one real axis (speed control, positioning, synchronous operation, 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 Virtual Machine. 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 Configuration Manual*. General information about licensing can be found in the *Motion Control SIMOTION, SINAMICS S120 catalog and motors for production machines catalog, PM21*.

Operation (hardware)

3.1 Overview of operator controls and indicators

The following figure shows the operator controls and indicators arrangement on the SIMOTION D410.

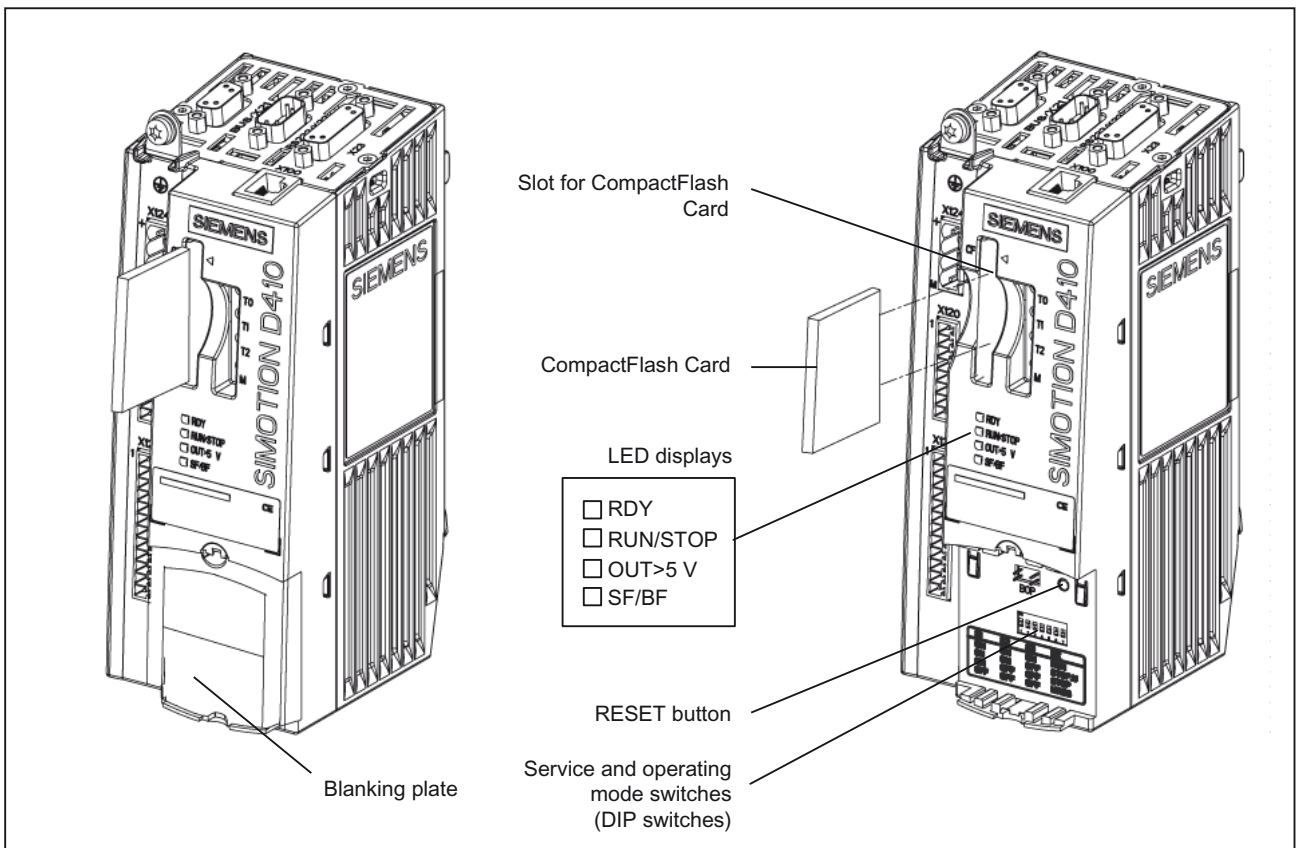


Figure 3-1 Operator controls and indicators

3.2 Operator controls

3.2.1 Service and operating mode switches

DIP switches

The SIMOTION D410 features operating mode and service selector switches at the bottom of its front side (see Overview of operator controls and indicators (Page 35)). These function using a DIP switch (DIP = Dual In Line Package), where:

- switches S1 to S3 set the operating mode and
- switches S4 to S7 select the service functions

During "normal" operation, the switch settings shown in the figure below must be retained.

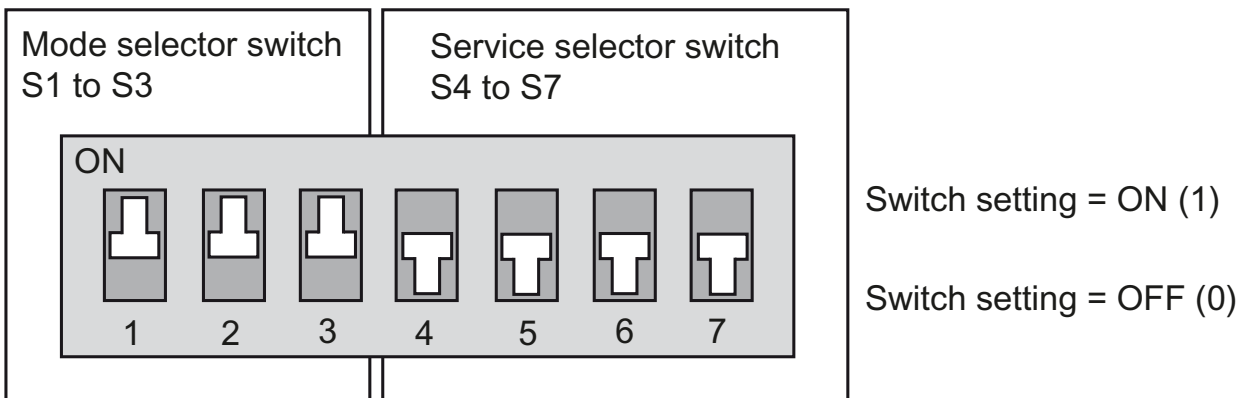


Figure 3-2 DIP switches (factory setting)

The modes and service functions that can be set are outlined below.

Mode selector switches

The table shows the possible settings for the mode selector switches.

Table 3-1 Mode selector switch settings

Operating mode	S1	S2	S3	Meaning
RUN	1	1	1	<p>SIMOTION D410 runs the user program and all connected system performances:</p> <ul style="list-style-type: none"> • Read process image of inputs. • Execution of the user programs assigned to the execution system. • Write process image of outputs. <p>The technology packages are active in this state. They can execute commands from the user program.</p>
	(three switches = ON)			

Operating mode	S1	S2	S3	Meaning
STOPU	110 / 101 / 011 (two switches = ON)			<p>SIMOTION D410 does not run a user program.</p> <ul style="list-style-type: none"> The technology packages are active. Test and commissioning functions can be executed. The user program is not active. The I/O modules are in a secure state, i.e. the digital outputs have the status "LOW" and the analog outputs are at zero current/voltage.
STOP	100 / 010 / 001 (one switch = ON)			<p>SIMOTION D410 does not run a user program.</p> <ul style="list-style-type: none"> It is possible to load a complete user program. All system services (communications, etc.) are active. The I/O modules are in a secure state, i.e. the digital outputs have the status "LOW" and the analog outputs are at zero current/voltage. The technology packages are inactive, i.e., all enables are deleted. No axis motions can be executed.
MRES	0	0	0	<p>Module memory reset/restoring D410 to factory settings</p> <p>Regardless of the operating sequence, you can use the MRES switch setting to</p> <ul style="list-style-type: none"> - reset the SIMOTION D410 memory or - restore the SIMOTION D410 to its factory settings. <p>With V4.1 SP2 and higher, MRES is only used if no service function has been selected (i.e. switches S1 to S7 must remain OFF (0)).</p> <p>For additional details on the operating sequence, refer to the <i>SIMOTION D410</i> Commissioning Manual.</p>
	(no switches = ON)			

Note

In the "RUN" setting (S1, S2, and S3 = ON; S4 to S7 = OFF), you can even control the SIMOTION D410 operating mode using the SIMOTION SCOUT engineering system. This means that it is not necessary to adjust the DIP switch in order to change the operating mode.

Service selector switches (V4.1 SP2 and higher)

The table below shows the possible settings for the service selector switches. The service functions are selected using switches S4 to S7 and may, in principle, be used in any operating mode set (switch S1 to S3).

Table 3-2 Service selector switch settings

Service mode	S4	S5	S6	S7	Meaning
Back up diagnostic data and non-volatile data	0	0	0	1	The diagnostic data and non-volatile data can be backed up in STOP, STOPU, and RUN mode. The advantage of backing up in RUN mode is the availability of enhanced diagnostic functions (via websites) and TO alarm information.
Delete/restore non-volatile data	0	1	0	0	When the "Delete/restore non-volatile data" switch setting is selected, the non-volatile data of the D410 is first deleted and then restored along with the contents of the PMEMORY backup file.
Downgrade (device update tool)	0	0	1	0	SIMOTION D410 Control Units and projects can be updated using update data created at an earlier point in time. This involves creating update data using a device update tool ("Project > Start Device Update Tool" menu in SIMOTION SCOUT). If the result of the update is not what was desired, this switch setting can be used to discard it and downgrade to the previous configuration.

Additional references

Detailed information

- For information on setting the operating modes, refer to the *SIMOTION SCOUT Configuration Manual*.
- For information on updating devices (device update tool), refer to the *Updating SIMOTION Devices Operating Instructions*.

3.2.2 SIMOTION CompactFlash card

CompactFlash card slot

The CompactFlash card (CF card) is inserted into the plug-in module over the blanking plate (see "Overview of operator controls and indicators").

Characteristics of the CF card

The CF card is mandatory for operation of SIMOTION D410. The CF card must be ordered as a separate component; it is not included in the SIMOTION D410 scope of delivery.

The SIMOTION firmware is located on the CF card.

The licenses for the technology functions are linked to serial number of the CF card. This means the CF card can be inserted in various SIMOTION D410s without having to change the licenses.

The CF card is supplied in a bootable format with the latest SIMOTION Kernel and drive software.

The CF card is used for:

- Backup technology packages and user data
- Update (e.g. SIMOTION firmware update)

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

The CompactFlash card is an ESD-sensitive component.

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

Comply with the ESD rules.

Additional information

For more information on writing to and formatting the CF card, see the *SIMOTION D410 Commissioning Manual*.

See also

System data, connection values, dimensions and weight (Page 87)

3.3 Error and status indicators

Arrangement of LED displays

The LED displays are located under the CF card plug-in slot on the SIMOTION D410 (see the section titled Overview of operator controls and indicators (Page 35)).

Further information

For the meanings of LED statuses, see the *SIMOTION D410 Commissioning Manual*.

Interfaces

4.1 Overview of interfaces

This chapter describes the SIMOTION D410 interfaces.

Available interfaces

Table 4-1 Overview of available SIMOTION D410 interfaces

Interface	Designation	Connector type
Digital inputs	X121	Mini Combicon, 12-pin
Digital inputs/outputs	X121	Mini Combicon, 12-pin
DRIVE-CLiQ interface	X100	DRIVE-CLiQ connector
PROFIBUS DP interface (SIMOTION D410 DP only)	X21	9-pin SUB-D socket
PROFINET interface (SIMOTION D410 PN only)	X200 and X201	8-pin RJ45 socket
Power Module Interface	PM-IF	8-pin direct connector
Encoder interface (HTL / TTL / SSI)	X23	15-pin SUB-D socket
EP terminals/temperature sensor connection	X120	Mini Combicon, 8-pin
Power supply connection	X124	Combicon 4-pin
Measuring sockets	T0, T1, T2 and G	Sockets

Non-usable interfaces

Table 4-2 Overview of non-usable SIMOTION D410 interfaces

Interface	Designation	Connector type
RS232 serial interface	X22	9-pin SUB-D socket
Interface for BOP20	X142	8-pin multipoint connector

See also

SIMOTION D410 DP display (Page 26)

SIMOTION D410 PN display (Page 29)

4.2 Digital inputs/outputs

Sensors and actuators can be connected to the X121 connector via digital inputs and outputs. The following types of digital inputs/outputs are used:

- Digital inputs (4 pcs)
- Bidirectional digital inputs/outputs (4 pcs)

Bidirectional digital I/Os can be configured individually as digital inputs or outputs.

Assignment of the I/Os to functions can be parameterized as required. Special functions, such as measuring input and output of the output cam, can be assigned to the inputs/outputs.

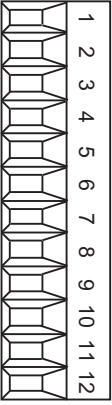
Interface characteristics

Table 4-3 Interface X121

Features	Type
Connector type	Mini Combicon
Connection possibility	Up to 1.5 mm ²
Load capacity ground G	max. 4 A

Interface assignments

Table 4-4 Interface assignment X121

Representation	Pin	Designation ¹⁾	Notes	Technical details	
	1	DI 0		<ul style="list-style-type: none"> • Voltage: -3...30 V • Current input (typical): 10 mA at 24 V DC • Electrical isolation: reference potential is G1 terminal • Level (including ripple): <ul style="list-style-type: none"> - 0 signal: -3...5 V - 1 signal: 15...30 V • Input delay, typ. (hardware): <ul style="list-style-type: none"> - 0 → 1 signal: 50 µs - 1 → 0 signal: 150 µs 	
	2	DI 1			
	3	DI 2			
	4	DI 3			
	5	M1	Ground for DI 0 - DI 3 (electronically isolated relative to G)		
	6	G			As input: <ul style="list-style-type: none"> • Voltage: -3...30 V • Current input (typical): 10 mA at 24 V DC • Level (including ripple): <ul style="list-style-type: none"> - 0 signal: -3...5 V - 1 signal: 15...30 V • Input delay, typ. (hardware, for DI 8): <ul style="list-style-type: none"> - 0 → 1 signal: 50 µs - 1 → 0 signal: 100 µs • Input delay, typ. (hardware, for DI 9 - 11) ²⁾:
	7	DI/DO 8	fast DO		
	8	DI/DO 9	fast DI/DO		
	9	G			
	10	DI/DO 10	fast DI/DO		

Representation	Pin	Designation ¹⁾	Notes	Technical details
	11	DI/DO 11	fast DI/DO	<ul style="list-style-type: none"> - 0 → 1 signal: 5 μs - 1 → 0 signal: 50 μs <p>As output:</p> <ul style="list-style-type: none"> • Voltage: 24 V DC • Max. load current per output: 500 mA • sustained short-circuit proof • Output delay, typ./max. (hardware) ³⁾: <ul style="list-style-type: none"> - 0 → 1 signal: 150 μs / 400 μs - 1 → 0 signal: 75 μs / 100 μs
	12	G		

¹⁾ DI: digital input; DI/DO: bidirectional digital input/output; G: electronic ground; G1: reference ground

²⁾ The rapid inputs can be used as probe inputs or as inputs for the external zero mark

³⁾ Data for $V_{cc} = 24 \text{ V}$; load 48Ω ; high ("1") = 90% V_{out} ; low ("0") = 10% V_{out}

Note

An open input is interpreted as "low".

The G1 terminal must be connected for the digital inputs (DI) 0 to 3 to function. The following options are available:

- Connect the carried digital input reference ground to M1.
 - Create a bridge between terminal G and terminal G1 (Important: This will cancel the electrical isolation for these digital inputs!)
-

Note

If digital outputs are used, an external 24 V supply is required across terminal X124.

If the 24 V supply is briefly interrupted, the digital outputs are deactivated for this time.

Connection and circuit diagram

The following figure shows the wiring and block diagrams of the digital inputs/outputs using the example of a SIMOTION D410 DP.

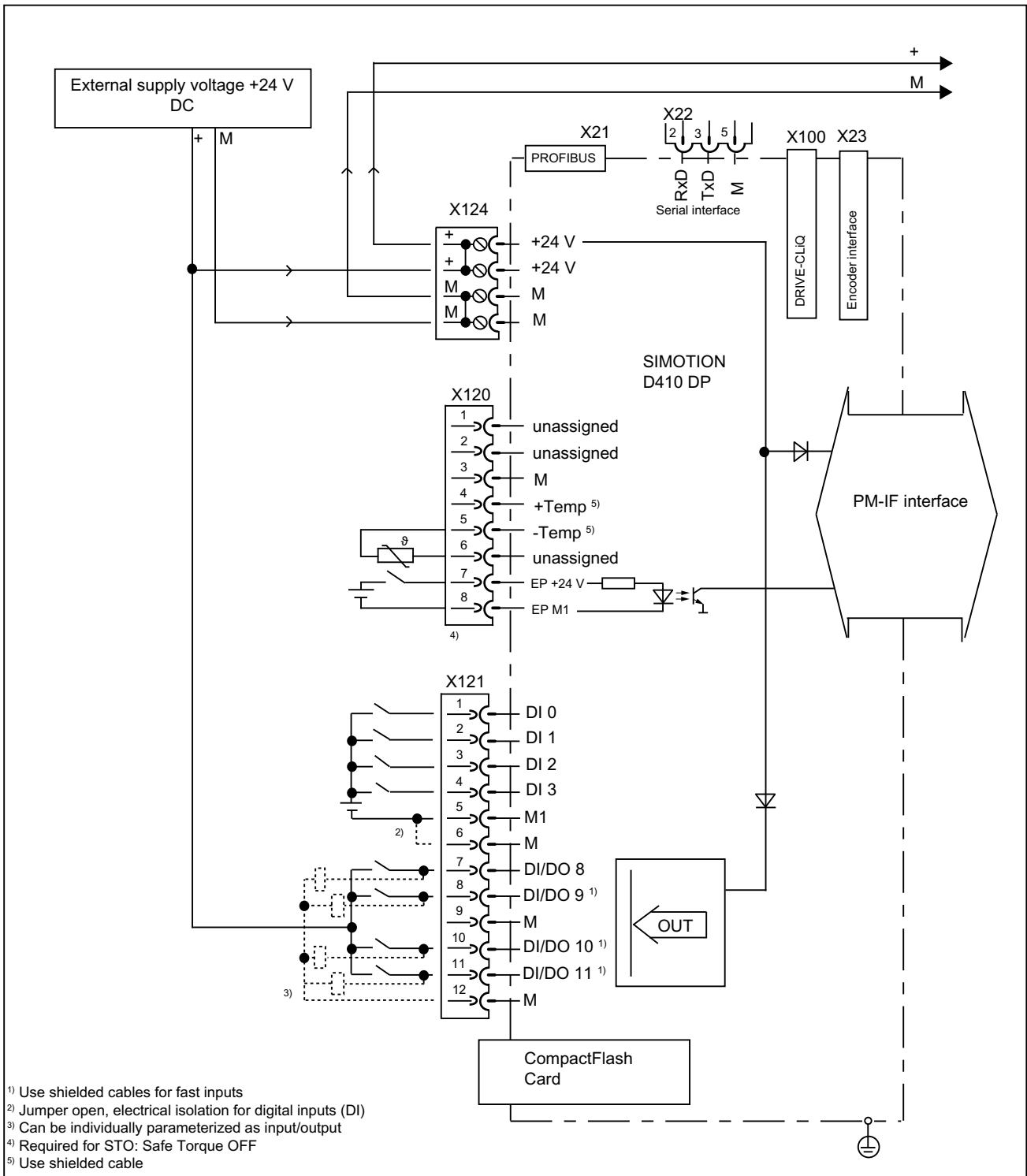


Figure 4-1 Connection example

4.3 DRIVE-CLiQ interface

Digital inputs

4 digital inputs are available on the control unit.

The electrically isolated inputs can be used as freely addressable inputs.

Switches or proximity encoders (2- or 3-wire encoders) can be connected.

Bidirectional digital inputs/outputs

4 digital inputs/outputs (DI/DO) are available on the SIMOTION D410.

The following application options are available when configuring the DI/DO as digital inputs:

- The DI/DO9, 10 and 11 can be used as "fast inputs" for measuring inputs or for external zero marks.
In the event of a signal edge on the respective input, the actual values of one or more encoders are measured to the exact position to determine lengths and distances.
The inputs can be arranged in any way; the special application is activated in the SIMOTION SCOUT Engineering System.
- All 4 DI/DO can be used as user-addressable inputs or as homing inputs.

The following application options are available when configuring the DI/DO as digital outputs:

- Use as onboard outputs
- Use as "fast cam outputs"

Note

Shielded cables are required when connecting probes or external zero marks to ensure optimum noise immunity.

Additional references

For information on commissioning the DI/DO as a user-addressable I/O, measuring inputs, or cam outputs, refer to the *SIMOTION D410 Commissioning Manual*.

For additional information on the commissioning and function of the technology objects TO probes, TO cams, and TO cam tracks, refer to the *SIMOTION Output Cams and Measuring Inputs Function Manual*.

4.3 DRIVE-CLiQ interface

Characteristics

The DRIVE-CLiQ interface has the following features:

- Automatic detection of components
- For the DRIVE-CLiQ interface, 24 V / 450 mA are available to connect encoders and measuring systems.

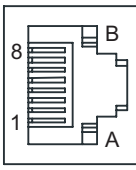
Interface characteristics

Table 4-5 Interface X100

Characteristic	Type
Connector type	DRIVE-CLiQ connector
Maximum cable length	100 m
Data rate	100 Mbits
Connector type: RJ45 socket; blanking cover for DRIVE-CLiQ interface included in the scope of delivery; blanking cover (50 pieces) Order no.: 6SL3066-4CA00-0AA0)	

Interface assignment

Table 4-6 Interface assignment X100

Representation	Pin	Name	Signal type	Description
	1	TXP	O	Transmit data +
	2	TXN	O	Transmit data -
	3	RXP	I	Receive data +
	4	Reserved, do not use	-	-
	5	Reserved, do not use	-	-
	6	RXN	I	Receive data -
	7	Reserved, do not use	-	-
	8	Reserved, do not use	-	-
	A	+ (24 V)	VO	Power supply
	B	M (0 V)	VO	Electronic ground

Signal type: I = Input; O = Output; VO = Voltage Output

Connectable devices

The following table contains the components that can communicate with SIMOTION D410 via the DRIVE-CLiQ interface. Note the max. number of nodes that can be connected to the DRIVE-CLiQ!

Table 4-7 DRIVE-CLiQ connection topology

Component	Max. number of connectable nodes
Drive	Max. 1 drive from the following: <ul style="list-style-type: none"> • Blocksize Power Module (PM340), only possible for operation away from the Power Module with CUA31/CUA32 (see Chapter "Installation") • Chassis Power Module AC/AC
Motors with DRIVE-CLiQ interface, DRIVE CLiQ encoder and SMx Sensor Modules	Max. 2 of the following components: <ul style="list-style-type: none"> • Sensor Modules (SMx) for transferring an encoder signal to DRIVE-CLiQ • Encoders with DRIVE-CLiQ interface • Motors with DRIVE-CLiQ interface

4.3 DRIVE-CLiQ interface

Component	Max. number of connectable nodes
Terminal expansion modules	Max. 3 of the following Terminal Modules: <ul style="list-style-type: none"> • TM15 Terminal Module • High feature Terminal Module TM17 • TM31 Terminal Module • TM41 Terminal Module Plus a TM54F Terminal Module.
DRIVE-CLiQ hub module 20 (DMC20)	Max. 1 DMC20 Note: As an SMx Sensor Module and a motor with a DRIVE-CLiQ interface only have one DRIVE-CLiQ interface, a DMC20 must be used with a second encoder on DRIVE-CLiQ. If a CUA31/CUA32 is used, the DMC20 is not required. Alternatively, a second encoder can also be connected via the X23 encoder interface.

The following figures show 2 example topologies of components that can be connected to the DRIVE-CLiQ.

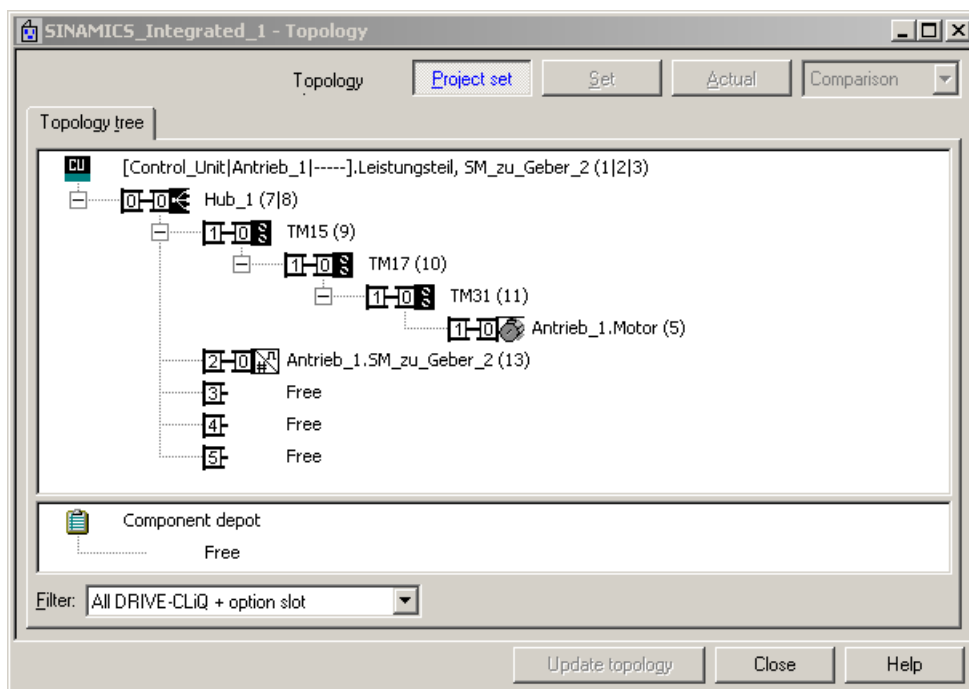


Figure 4-2 Example topology: 3 Terminal Modules, 1 encoder via motor with a DRIVE-CLiQ interface, 1 encoder via SMx

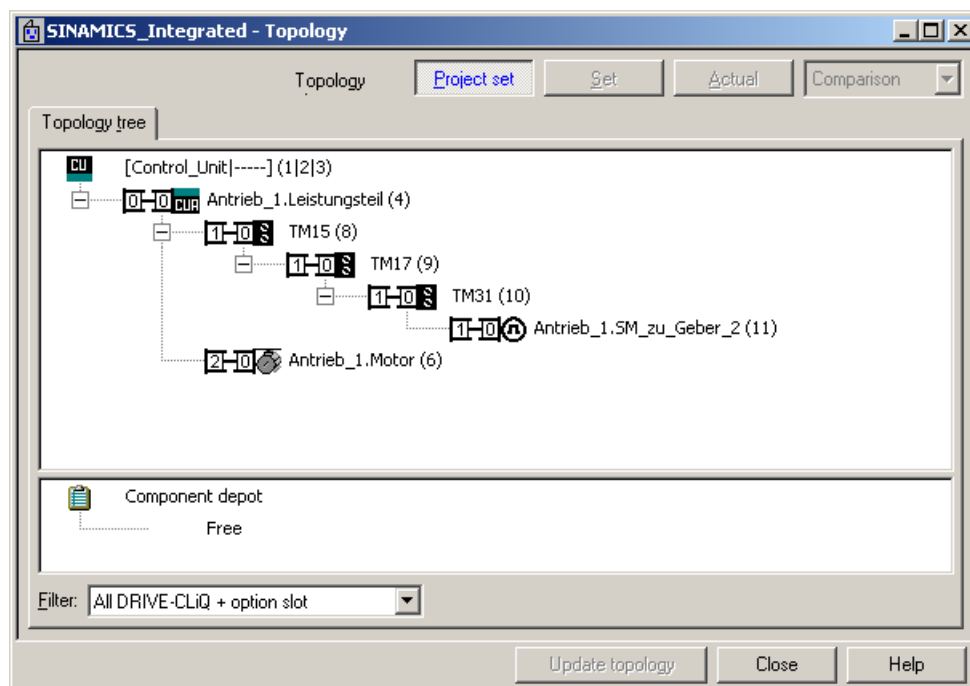


Figure 4-3 Example topology: 3 Terminal Modules, 1 CUA31, 1 encoder via motor with DRIVE-CLiQ interface, 1 encoder via SMx

Additional information

For information on the components that can be connected via DRIVE-CLiQ (setup, connection, configuration, etc.) see

- *SINAMICS S120 Control Units and Additional System Components Manual*
- *SINAMICS S120 for AC Drives Manual*
- *SINAMICS S120 Commissioning Manual*
- *SINAMICS S120 Booksize Power Units Manual*
- *SINAMICS S120 Safety Integrated Function Manual*
- *TM15/TM17 High Feature SIMOTION Terminal Modules Commissioning Manual*
- *SIMOTION Terminal Modules TM15 / TM17 Manual*

4.4 PROFIBUS DP interface (SIMOTION D410 DP only)

SIMOTION D410 DP provides one interface to connect to PROFIBUS DP. The interface can be run asynchronously or isochronously.

A baud rate of up to 12 Mbit/s can be set for the PROFIBUS DP interface.

4.4 PROFIBUS DP interface (SIMOTION D410 DP only)

SIMOTION D410 includes master and I-slave functionality.

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".

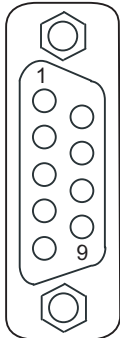
Interface characteristics

Table 4-8 Interface X21

Characteristic	Type
Connector type	9-pin SUB-D socket
Cable type	PROFIBUS cable
Maximum cable length	100 m at 12 Mbit/s
Maximum data rate	12 Mbit/s

Interface assignment

Table 4-9 Interface assignment X21

Representation	Pin	Name	Description	Area
	1	-	unassigned	
	2	M24_SERV	Teleservice supply, ground	0 V
	3	RxD/TxD-P	Receive/transmit data P (B)	RS485
	4	CNTR-P	Control signal	TTL
	5	DGND	PROFIBUS data reference potential	
	6	VP	Supply voltage plus	5 V +/- 10 %
	7	P24_SERV	Teleservice supply, + (24 V)	24 V (20.4 V - 28.8 V)
	8	RxD/TxD-N	Receive/transmit data P (N)	RS485
	9	-	unassigned	

Note

A teleservice adapter can be connected to the PROFIBUS interface (X21) for remote diagnosis.

The power supply for the teleservice (terminals 2 and 7) can take up to 150 mA and is sustained short-circuit proof.

NOTICE**Device fault with missing equipotential bonding**

An equipotential bonding conductor with a cross-section of at least 25 mm² must be used between components in a system that are located at a distance from each other. If an equipotential bonding conductor is not used, leakage currents that could destroy the Control Unit or other PROFIBUS nodes can be conducted via the PROFIBUS cable.

PROFIBUS connector

The terminating resistors must be switched on at the first and last terminal in a line to ensure uninterrupted communication.

The bus terminating resistors are activated in the connector.

The cable shield must be applied over a large area and on both sides.

Connectable devices

The following devices can be connected to the PROFIBUS DP interface:

- PG/OP programming devices
- SIMATIC HMI devices
- SIMATIC S7 controllers with PROFIBUS DP interface
- Distributed I/O
- Teleservice adapter
- Drive units with PROFIBUS DP interface (standard slaves)

Note

An overview of the components used with SIMOTION D410 is available in the *PM21 Catalog*.

Take note of the documentation on the individual modules or devices!

4.5 PROFINET interface (SIMOTION D410 PN only)

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

SIMOTION D410 PN includes a PROFINET interface with 2 ports (X200 and X201).

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

4.6 Encoder interface (HTL/TTL/SSI)

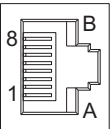
Interface characteristics

Table 4-10 Ports X200 and X201

Characteristic	Type
Connector type	RJ45 socket connector
Cable type	PROFINET
Maximum cable length	100 m
Minimum transmission cycle	0.5 ms
Autocrossing	Yes i.e. both crossed and uncrossed cables can be used

Interface assignment

Table 4-11 Assignment of ports X200 - X201

Representation	Pin	Name	Description
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	

Connectable devices

The following devices can be connected to the PROFINET interface:

- PG/PC programming devices (communication with SIMOTION SCOUT / STEP 7 and HMI)
- SIMATIC HMI devices
- Distributed I/O
- Other SINAMICS drive units (e.g., CU310 PN or CU320 with CBE20)

See also

Connecting the PROFINET interface (D410 PN only) (Page 82)

4.6 Encoder interface (HTL/TTL/SSI)

The HTL/TTL/SSI encoder interface is used to connect external encoders.

Interface characteristics

Table 4-12 Interface X23

Characteristic	Type
Encoder interface	<ul style="list-style-type: none"> • TTL or HTL incremental encoders (with adjustable parameters) • Absolute encoder SSI
Connector type	15-pin SUB-D connector
Encoder power supply	24 V DC/0.35 A or 5 V DC/0.35 A
Limit frequency	500 kHz
SSI baud rate	100 . . .250 kBaud
Resolution absolute position SSI	30 bits
Max. cable lengths	<ul style="list-style-type: none"> • For TTL incremental encoder • For HTL incremental encoder • For SSI absolute encoder
	<ul style="list-style-type: none"> • 100 m (bipolar signals only) ²⁾ • 100 m (for unipolar signals) • 300 m (for bipolar signals) ^{1) 2)} • 100 m

¹⁾ As of a cable length of 200 m, use a power supply cable with a cable cross-section $\geq 0.75 \text{ mm}^2$!

²⁾ Signal cables twisted in pairs and shielded.

NOTICE**Destruction of the encoder electronics**

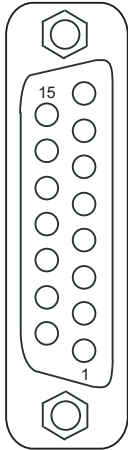
Operation of a 5 V encoder on the 24 V encoder supply may result in the destruction of its electronic components!

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

4.6 Encoder interface (HTL/TTL/SSI)

Interface assignments

Table 4-13 Interface assignment X23

Representation	Pin	Name	Description
	1	+Temp	KTY or PTC input
	2	SSI_CLK	SSI clock positive
	3	SSI_XCLK	SSI clock negative
	4	P_Encoder 5 V / 24 V	Encoder power supply
	5	P_Encoder 5 V / 24 V	Encoder power supply
	6	P_Sense	Sense input encoder power supply
	7	G_Encoder (G)	Ground for sensor power supply
	8	-Temp (G)	Ground for KTY or PTC
	9	G_Sense (G)	Ground sense input
	10	RP	R track positive
	11	RN	R track negative
	12	BN	B track negative
	13	BP	B track positive
	14	AN_SSI_XDAT	A track negative / SSI data negative
	15	AP_SSI_DAT	A track positive / SSI data positive

For Pin 1 / Pin 8: The associated temperature channel (T1) can be assigned parameters as an individual channel or together in combination with the second temperature channel (T2) at interface X120.
 (For parameterization, see the *SINAMICS S120 Commissioning Manual*).

For Pin 6 / Pin 9: At an encoder supply of 5 V, the voltage drops on the encoder supply cables are recorded and compensated by means of the sense cables. For this purpose, the encoder supply is adjusted to the SIMOTION D410.

NOTICE
Motor overheating due to an incorrectly connected KTY temperature sensor
A sensor connected with the incorrect polarity cannot detect the motor overheating.
Connect the KTY temperature sensor with the correct polarity.
For more information on the temperature sensors and how to use them, see the <i>SINAMICS S120 Commissioning Manual</i> , in Chapter Temperature sensors for SINAMICS components.

Table 4-14 Specification of measuring systems that can be connected

Parameter	Designation	Threshold	Min.	Type	Max.	Unit
High signal level (TTL bipolar at X23) ¹⁾	U_{Hdiff}		2		5	V
Low signal level (TTL bipolar at X23) ¹⁾	U_{Ldiff}		-5		-2	V
High signal level (HTL unipolar)	U_H	High	17		V_{CC}	V
		Low	10		V_{CC}	V
Low signal level (HTL unipolar)	U_L	High	0		7	V
		Low	0		2	V

Parameter	Designation	Threshold	Min.	Type	Max.	Unit
High signal level (HTL bipolar) ²⁾	U_{Hdiff}		3		V_{CC}	V
Low signal level (HTL bipolar) ²⁾	U_{Ldiff}		$-V_{\text{CC}}$		-3	V
High signal level (SSI bipolar at X23) ¹⁾	U_{Hdiff}		2		5	V
Low signal level (SSI bipolar at X23) ¹⁾	U_{Ldiff}		-5		-2	V
Signal frequency	f_{s}		-		500	kHz
Edge clearance	t_{min}		100		-	ns
Zero pulse (with $T_{\text{s}} = 1/f_{\text{s}}$)	Length		$\frac{1}{4} \cdot T_{\text{s}}$		$\frac{3}{4} \cdot T_{\text{s}}$	
	Center of the pulse position		50	135	220	Degrees

1) Other signal levels according to the RS 422 standard.

2) The absolute level of the individual signals varies between 0 V and V_{CC} of the measuring system.

Note

We recommend that bipolar encoders are used.

If you are using unipolar encoders, open the 15-pin SUB-D connector and connect the unused inverse signals (AN pin 14, BN pin 12 and RN pin 11) to ground (pin 7).

4.7 EP terminals/temperature sensor connection

The EP terminal is the input terminal for SINAMICS Safety Integrated Basic Functions: STO (Safe Torque Off), SS1 (Safe Stop 1) and SBC (Safe Brake Control). For SBC, you also require a Safe Brake Relay. The basic functions are selected when the EP terminal is activated at the same time as one of the digital inputs of terminal X121 (X121.1 to X121.4).

Using the temperature sensor connection, you can connect the temperature sensing via KTY (special temperature sensor) or PTC (positive temperature coefficient). The temperature sensing provides thermal motor protection by detecting critical motor conditions.

4.7 EP terminals/temperature sensor connection

For more information on "thermal motor protection", see the *SINAMICS S120 Commissioning Manual*.

Note

For SIMOTION D410, the following safety functions are available with version V4.1 SP2 and higher:

- Safety Integrated Basic Functions via the EP terminals
- Safety Integrated Extended Functions with TM54F
- Safety Integrated Extended Functions via secure communication from "PROFIsafe to PROFIBUS"
Control (F logic) is via a SIMATIC F-CPU which is connected to PROFIsafe via PROFIBUS (e.g. a CPU 317F-2 DP)

For further information on Safety Integrated, see the *SINAMICS S120 Safety Integrated Function Manual*.

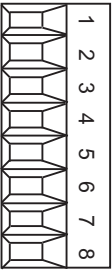
Interface characteristics

Table 4-15 Interface X120

Characteristic	Type
Connector type	Mini Combicon, 8-pin
Grid	2.5 mm
Maximum connectable cross-section	1.5 mm ²

Interface assignments

Table 4-16 Interface assignment X120

Representation	Pin	Name	Description
	1	Reserved, do not use	
	2	Reserved, do not use	
	3	G	Ground
	4	+ Temp ¹⁾	KTY or PTC input
	5	- Temp ¹⁾	Ground for KTY or PTC
	6	Reserved, do not use	
	7	EP +24 V ²⁾	Safety Integrated Basic Functions (+)
	8	EP M1 ²⁾	Safety Integrated Basic Functions (-)

¹⁾ This is the second temperature channel (T2), which depending on the parameterization, is used as a single channel or in combination with the first temperature channel (T1, see X23).

²⁾ The EP terminals must be wired on the Power Module on chassis units.

NOTICE**Motor overheating due to an incorrectly connected KTY temperature sensor**

A sensor connected with the incorrect polarity cannot detect the motor overheating.

Connect the KTY temperature sensor with the correct polarity.

For more information on the temperature sensors and how to use them, see the *SINAMICS S120* Commissioning Manual, in Chapter Temperature sensors for SINAMICS components.

Further information on the temperature sensors can be found in the following literature:
Literature: /IH1/ SINAMICS S120, Commissioning Manual, Chapter "Temperature sensors for SINAMICS components."

**DANGER****Danger to life from electric shock due to insufficient safety isolation**

Only temperature sensors that meet the safety isolation specifications stipulated in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp."

Use a Sensor Module External (SME120 or SME125) or Terminal Module TM120 if safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), .

4.8 Power supply

SIMOTION D410 can be supplied with power by connecting a PM340 power module. In the following situations, a 24 V DC load power supply must also be connected via X124:

- For supplying the digital outputs (X121)
- For the 24 V supply on the DRIVE-CLiQ cable (e.g. for DRIVE-CLiQ encoders that do not have their own power supply)
- For supplying the motor holding brake

4.8 Power supply

- For commissioning/diagnostics with deactivated Power Module supply voltage
- If the SIMOTION D410 is snapped on to a mounting plate and not on to a PM340 Power Module

Note

A control DC power supply is required to operate a motor with an integrated holding brake. A 24 V connection supplies the voltage (X124). Take note of the motor holding brake voltage tolerances and the connecting cable voltage drop.

Set the DC power supply to 26 V. This can ensure that the motor holding brake supply voltage is in the permissible range if the following boundary conditions are fulfilled:

- You are using a Siemens AC motor.
- You are using Siemens Motion-Connect power cables.
- The motor cables are no longer than 100 m.

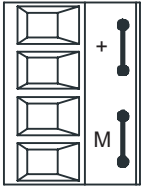
Interface characteristics

Table 4-17 Interface X124

Features		Type
Connector type		4-way screw-type terminal
Connectable cable types and conductor cross-sections		
	Rigid	0.2 mm ² ... 2.5 mm ²
	Flexible	0.2 mm ² ... 2.5 mm ²
	Flexible, with wire-end ferrule without plastic sleeve	0.2 mm ² ... 2.5 mm ²
	Flexible, with wire-end ferrule with plastic sleeve	0.2 mm ² ... 1.5 mm ²
	AWG / kcmil	22 ... 12
Stripped length		6 ... 7 mm
Tool		Screwdriver 0.5 x 3 mm (M2.5)
Tightening torque		0.4 to 0.5 Nm
Max. current carrying capacity, incl. loop-through		20 A (15 A per UL/CSA)
Max. cable length		10 m

Interface assignments

Table 4-18 Interface X124

Representation	Pin	Description	Technical details
	+	Electronic power supply	Voltage: 24 V DC (20.4 V - 28.8 V)
	+	Electronic power supply	Current consumption: max. 0.8 A (without DRIVE-CLiQ and digital outputs)
	G	Electronic ground	
	G	Electronic ground	max. current via the bridges in the connector: 10 A at 55 °C

Note

When using external power supplies, e.g., SITOP, the ground potential must be connected with the protective ground terminal (PELV).

See also

Connecting the power supply (Page 75)

4.9 Measuring sockets

Interface features

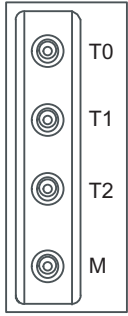
The T0 - T2 measuring sockets are used to output analog signals. Any interconnectable signal can be output to any measuring socket on the control unit.

Note

The measuring sockets are suited for multiple-spring wire connectors with a diameter of 2 mm.

Interface assignments

Table 4-19 Interface assignments T0, T1 and T2

View	Pin	Designation	Technical details
	T0	Measuring socket 0	<ul style="list-style-type: none"> • Voltage: 0 V to 5 V • Resolution: 8-bit • Load current: max. 3 mA • sustained short-circuit proof • Reference potential is G terminal
	T1	Measuring socket 1	
	T2	Measuring socket 2	
	G	Ground	

Note

The test sockets are provided as a support to commissioning and diagnostics; they must not be connected for normal operation.

4.10 Power Module Interface

SIMOTION D410 can be connected to a SINAMICS S120 PM340 blocksize power module via the power module interface.

Note

SIMOTION D410 can only be connected to a SINAMICS S120 PM340 blocksize power module via the power module interface. A Power Module in chassis format must be connected via the DRIVE-CLiQ interface (see the section titled Connecting DRIVE-CLiQ components (Page 76)). A SIMOTION D410 cannot be operated with SINAMICS G120 (PM2x0) Power Modules. Booksize Motor Modules can likewise not be connected.

See also

SIMOTION D410 mounted on the power module (Page 62)

Assembling

5.1 General requirements

Mounting options

SIMOTION D410 comes in two designs:

- Mounted on the Power Module: SIMOTION D410 is mounted on the PM340 Power Module.
- Operation away from the Power Module: SIMOTION D410 is mounted on a mounting plate.

Open device

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



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

Note

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

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

See Residual risks of power drive systems (Page 16).

5.2 SIMOTION D410 mounted on the power module

Overview

A SIMOTION D410 can be snapped directly on to a SINAMICS S120 PM340 Power Module in blocksize format via the PM-IF interface. Operation with SINAMICS G120 PM2x0 Power Modules or booksize Motor Modules is not possible.

Note

You can connect a PM340 Power Module in blocksize format to the DRIVE-CLiQ interface of SIMOTION D410 using the CUA31/CUA32 adapter module. Power Modules in chassis format AC/AC are connected to SIMOTION D410 via the DRIVE-CLiQ interface of the Power Module.

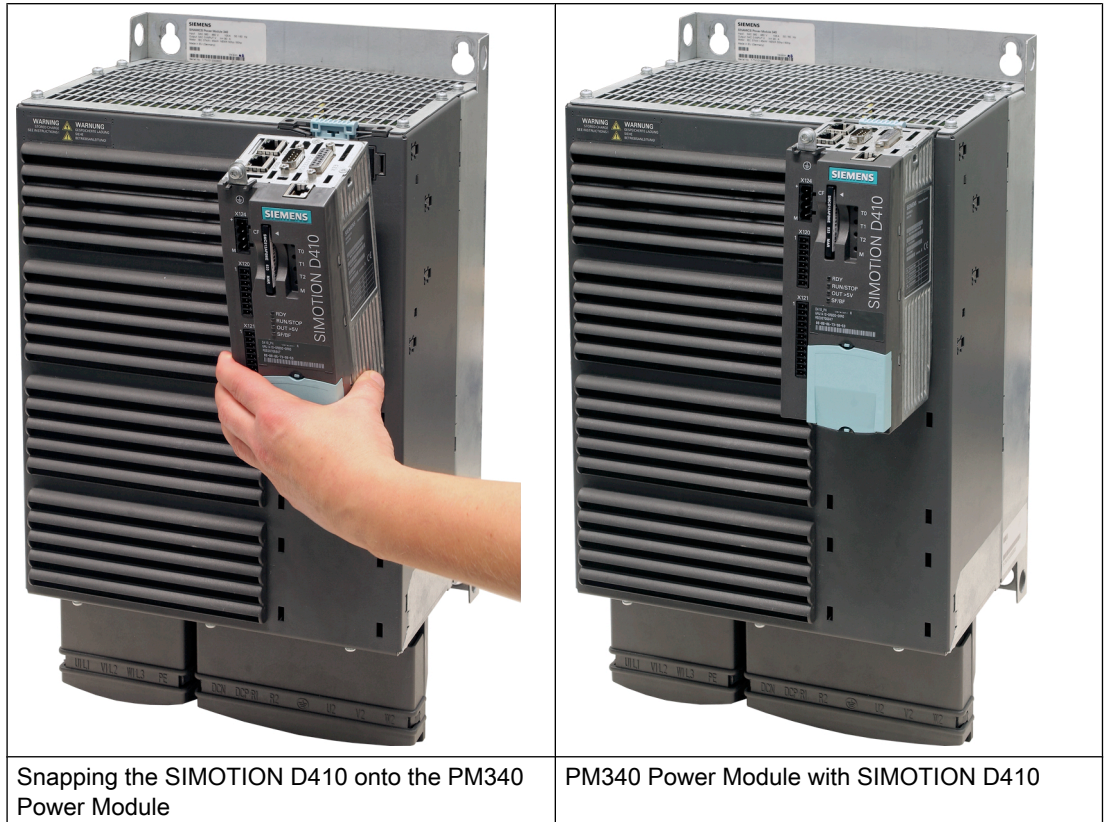
Requirement

As soon as the PM340 Power Module is properly installed, you can mount the SIMOTION D410 on the Power Module.

Note

Take note of the associated user documentation when commissioning the Power Module!

Mounting on the Power Module



Disassembling SIMOTION D410

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



Figure 5-1 Removing the SIMOTION D410 from the PM340 Power Module

5.3 Mounting SIMOTION D410 on the mounting plate

Overview

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

Application examples:

- Offset installation using CUA31/CUA32 control unit adapter (e.g. for reducing the mounting depth or in order to use additional interfaces on the CUA). The SIMOTION D410 is snapped on to the mounting plate and connected to the PM340 Power Module via DRIVE-CLiQ using CUA31/CUA32. No more than one Control Unit Adapter can be connected to the SIMOTION D410.
- Using the SIMOTION D410 without the PM340
A SIMOTION D410 snapped on to the mounting plate is operated without the PM340 (e.g. for hydraulic applications).

Requirements

You must order the mounting plate for SIMOTION D410 separately. See Chapter "Spare Parts and Accessories" for the order number.

Mounting on mounting plate

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



Figure 5-2 Mounting SIMOTION D410 on the mounting plate

Note

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

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

5.4 Mounting SIMOTION D410 in the Power Module Chassis

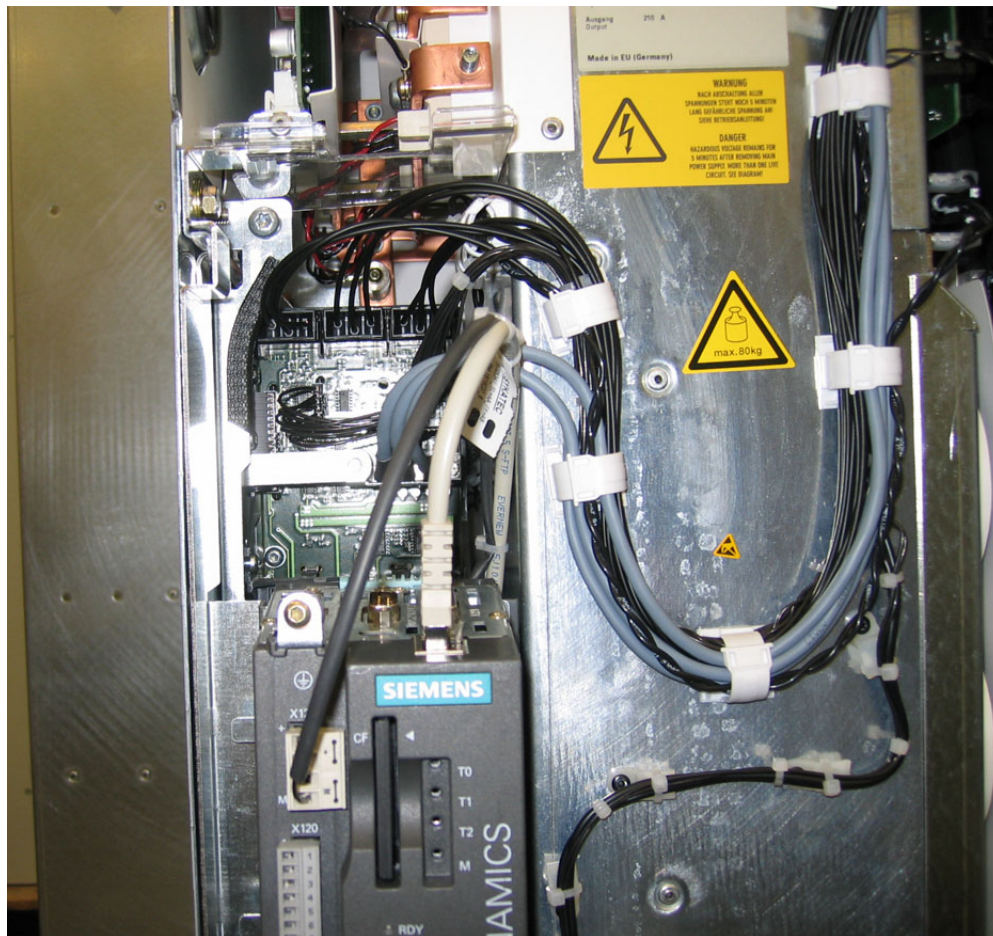


Figure 5-3 Mounting the CU310, for example, in the Power Module Chassis, FX frame size

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

Note

For the Power Module, a connecting cable is also supplied for the power supply of the D410. Customers must connect-up this cable.

This means that the D410 no longer has to be supplied from an external 24 V DC.

Connecting

6.1 Overview

This chapter describes the basic guidelines for the electrical setup. You must observe these guidelines to ensure uninterrupted operation.

Safety rules

To safely operate your system, take the following measures and adapt them to your specific conditions:

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

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

Please note Chapter "Guidelines for handling electrostatic sensitive devices (ESD)" in this Manual.

Additional references

For further information on EMC, we recommend the configuration manual *EMC Installation Guidelines / Basic System Requirements*, order number 6FC5297-0AD30-0AP3.

Standards and regulations

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

6.2 General rules for operating the SIMOTION D410

You must observe these general rules when integrating the SIMOTION D410 into a system.

System startup after certain events

The following table identifies considerations required for startup of a system following certain events.

Table 6-1 System startup

When ...	then ...
Startup after voltage drop or power loss	no dangerous states must result. If necessary, force an EMERGENCY OFF.
Startup after releasing the EMERGENCY OFF equipment	uncontrolled or undefined startup operations must be excluded.

Supply voltage

The following table identifies the considerations required for the supply voltage.

Table 6-2 Supply voltage

When ...	make sure that ...
Stationary systems or systems without all-pole power disconnect switches	the building installation must be equipped with a power disconnect switch or a fuse.
Load power supply, power supply modules	the set range of the rated voltage complies with the local mains voltage.
All electric circuits	deviation of the line voltage from the rated value must be within the permitted tolerance (refer to "Technical data of the installed components").

24 V DC supply voltage

The following table identifies the considerations required for the 24 V supply voltage.

Table 6-3 24 V DC supply voltage

When ...	ensure ...	
Buildings	External lightning protection	Provide lightning protection (e.g., lightning protection devices)
24 V DC supply voltage cables, signal cables	internal lightning protection	
24 V supply voltage	safe (electrical) isolation of the extra-low voltage	



! WARNING
Danger to life from hazardous voltage when connecting an unsuitable power supply
Configure the 24 V DC voltage as a protective extra-low voltage (PELV according to DIN EN 60204-1).

Protection against external electrical interference

The following table shows what you have to take into account to protect your system against electrical interference or faults.

Table 6-4 Protection against external electrical interference

When ...	make sure that ...
all installations or systems, in which SIMOTION is installed	The installation or system is connected to protective ground to divert electromagnetic interferences.
Supply, signal, and bus cables	The wiring arrangement and installation complies with EMC regulations.
Signal and bus cables	A wire or conductor strand break must not cause any undefined installation or system states.

Rules for current consumption and power loss in an installation

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

Note

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

6.3 Safety information for wiring

Requirement


You have mounted the Control Unit in the control cabinet.

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

Note

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



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

Protective conductor connection

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

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

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

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

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

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

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

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

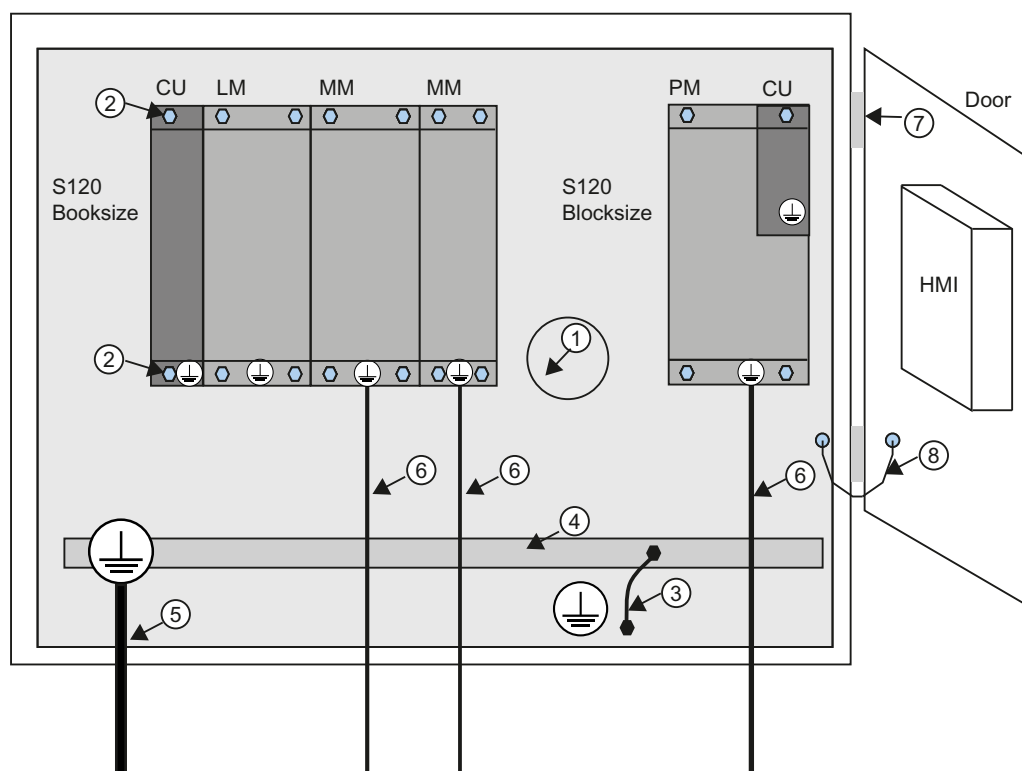


Figure 6-1 Protective conductor connection, cabinet with mounting plate / equipotential bonding surface

The protective conductor connections must be dimensioned as follows:

Table 6-5 Conductor cross-section for copper protective connections

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

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

Equipotential bonding

A mounting plate serves simultaneously as an equipotential bonding surface. This means that no additional equipotential bonding is required within the drive line-up. If a common bright mounting plate is not available, then equally good equipotential bonding ⑨ must be

established using cable cross-sections as listed in the table above or, as a minimum, with the same conductivity.

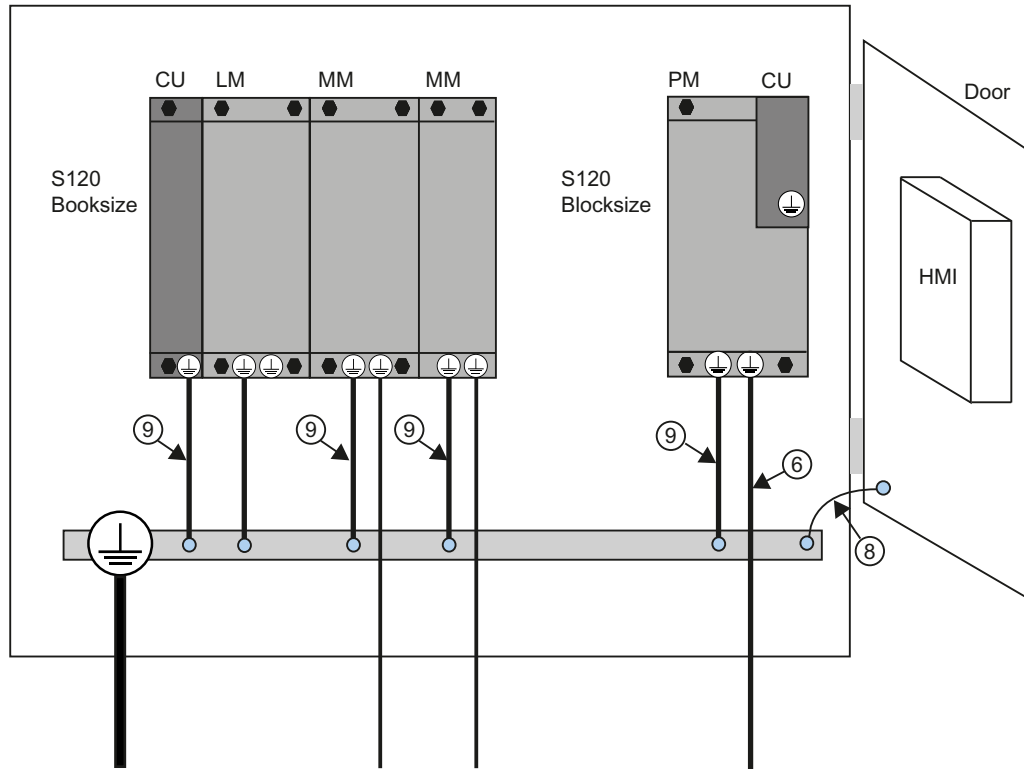


Figure 6-2 Protective conductor connection, cabinet without equipotential bonding surface

Communication links

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

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

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

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

- For copper, at least 6 mm²
- For aluminum, at least 16 mm²
- For steel, at least 50 mm²

Note

If this is not observed, high leakage currents can flow through the cable. This can result in a fault in the data connection or device defects.

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

Additional information

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

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

6.4 Overview of SIMOTION D410 connections

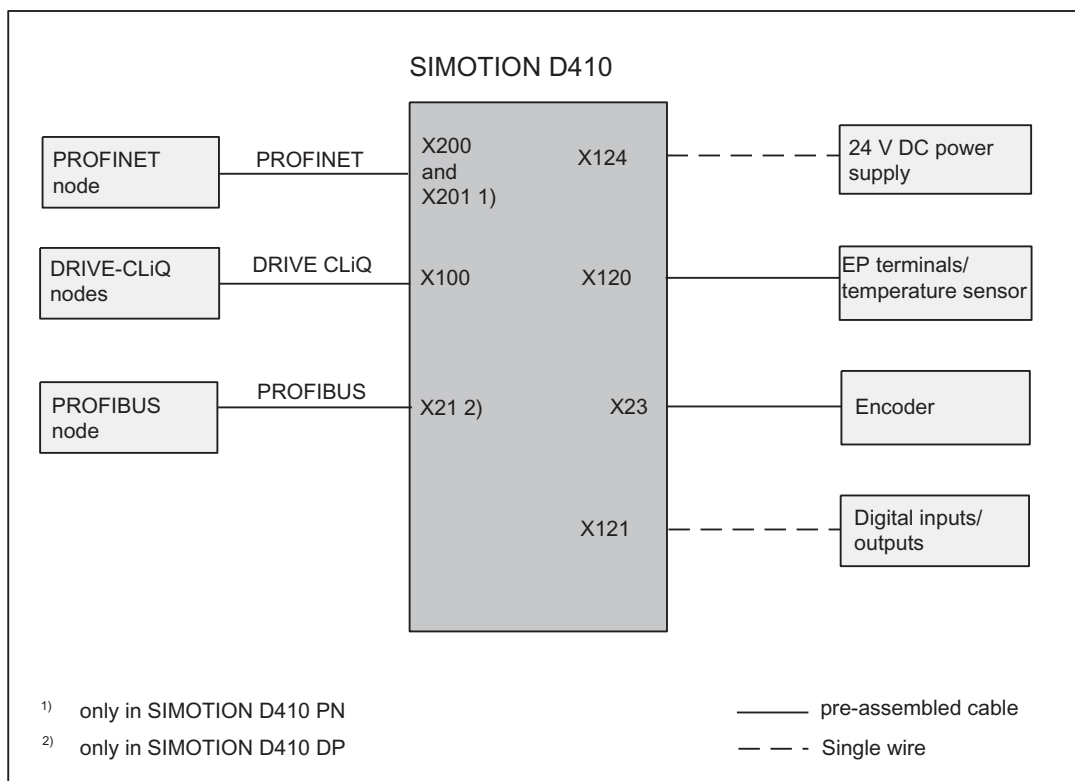


Figure 6-3 Overview of connections

6.5 Connecting the protective ground

Connect SIMOTION D410 to the protective ground. An M4 protective ground screw is available (see figure "Location of interfaces and front elements in SIMOTION D410" in Chapter "Description").

The cross-section of the cable running to the protective ground must be at least 10 mm².

1. Remove the M4 protective ground screw.
2. Connect the protective ground and screw the protective ground screw back into the insert nut (Torx screwdriver, size 20).



WARNING

Danger to life from electric shock due to insufficient grounding

Ensure the connection to the protective ground is low resistance.

Provide a flexible cable to the protective conductor if SIMOTION D410 is mounted on a movable frame.

6.6 Connecting the power supply

The 24 V DC load power supply required for the supply must be wired to the screw-type terminal block (connector X124).

Note

The interface X124 is provided exclusively to connect the external power supply.

Properties of the load power supply





 WARNING
Danger to life from hazardous voltage when connecting an unsuitable power supply
The 24 V DC voltage must be generated as functional extra-low voltage with safe electrical isolation (according to IEC 204-1, Chapter 6.4, PELV) and grounded by the user (establish a connection between PELV signal M and central grounding point of the system).

Table 6-6 Electrical parameters of the required load power supply

Parameter	Values	Conditions
Voltage range - mean value	20.4...28.8 V DC	
Ripple	max. 5 %	at 24 V DC
Non-periodic overvoltage	max. 35 V DC	max. 500 ms, 50 s recovery time, max. 10 results/h.
Rated current consumption	0.8 A	Without DRIVE-CLiQ and digital outputs
Starting current	3 A	Without Power Module, DRIVE-CLiQ and digital outputs
Power consumption	20 W	

Wiring the screw-type terminal block



 DANGER
Danger to life from energized parts
Death or serious injury will result if energized parts are touched.
Ensure that the system is de-energized when you wire the modules!

Use flexible cables with a cross-section of at least 1 mm² when you wire the power supply.

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

1. Strip the cable ends.
2. Put on the wire-end sleeve if applicable.
3. Plug the cable end (with wire-end sleeve) into the screw-type terminal connection.

4. Tighten the mounting screw.
5. Plug the screw-type terminal with cables into the X124 connection.

Reverse polarity protection

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

Note

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

Fuse

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

6.7 Connecting DRIVE-CLiQ components

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

You will find information on the components that can be connected to DRIVE-CLiQ in the section DRIVE-CLiQ interface (Page 46).

Rules for wiring DRIVE-CLiQ

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

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

Connecting DRIVE-CLiQ components

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

Note

Please note that SIMOTION D410 components in booksize format (CX32 Controller Extension, Motor Modules, Line Modules, etc.) are not supported.

6.8 Connecting digital I/Os

Connecting cables for digital inputs/outputs

Use flexible cables with a cross-section of at least 0.25 mm² when you wire the digital inputs/outputs.

If you wire two cables per connection, use cables with a cross-section of 0.25 mm² each and a wire-end sleeve. Use wire-end sleeves without insulating collars according to DIN 46228, Form A long version.

Note

Shielded cables are required when connecting probes or external zero marks to ensure optimum noise immunity.

Tools required

3.5-mm screwdriver or power screwdriver

Wiring digital inputs/outputs

1. Strip the cable ends 6 mm.
2. Put on the wire-end sleeve if applicable.
3. Wire the interface digital inputs for the connection of sensors.
4. Wire the interface digital outputs for the connection of actuators.
5. Plug the cable into the corresponding screw terminals on the X121 interface.
6. Tighten the screw terminals.

6.9 Connecting the PROFIBUS DP interface (410 DP only)

6.9.1 PROFIBUS connection components

Connection components

Individual nodes are connected via bus connectors and PROFIBUS cables. Remember to provide a bus connector with a programming port at the ends of the subnet. This provides you with the option to expand the subnet if needed, e.g., with a PG or SIMATIC HMI device.

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

PROFIBUS line (DP line)

A DP line is a bus cable between two terminating resistors and can contain up to 64 PROFIBUS slaves. In addition, a DP line is limited by the permissible cable length, which varies according to the transmission rate.

Terminating resistor

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

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

6.9.2 PROFIBUS cables and connectors

Features of PROFIBUS cables

The PROFIBUS cable is a two-core, twisted and shielded cable with the following features:

Table 6-7 Features of PROFIBUS cables

Features	Values
Wave impedance	Approximately 135 to 160 Ω (f = 3 to 20 MHz)
Loop resistance	$\leq 115 \Omega/\text{km}$
Working capacity	30 nF/km
Attenuation	0.9 dB/100 m (f = 200 kHz)
Permissible core cross-section	0.3 mm ² to 0.5 mm ²
Permissible cable diameter	8 mm + 0.5 mm

Connector features

The bus connector is used to connect the PROFIBUS cable to the PROFIBUS DP interface (X21), thus establishing a connection to additional nodes.

You will find an overview of the bus connectors available for order in the chapter titled "Spare parts and accessories".

6.9.3 PROFIBUS cable lengths

Cable lengths and baud rate

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

Table 6-8 Permitted cable length of a subnet segment for specific baud rates

Baud rate	Max. cable length of a segment (in m)
19.6 to 187.5 Kbits/s	1,000 ¹⁾
500 Kbits/s	400
1.5 Mbits/s	200
3 to 12 Mbit/s	100

¹⁾ With isolated interface

Greater cable lengths

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

Note that an RS 485 repeater must be counted as a subnet node when determining the total number of nodes to be connected. This is true even if the RS 485 repeater is not assigned its own PROFIBUS address.

6.9.4 Rules for routing PROFIBUS cables

Routing bus cables

When routing the PROFIBUS cable, you must avoid:

- Twisting
- Stretching
- Squeezing

Boundary conditions

You must pay attention to the following boundary conditions when routing the bus cable for indoor use (dA = external cable diameter):

Table 6-9 Boundary conditions for routing of PROFIBUS cables

Features	Boundary conditions
Bending radius for a single bend	80 mm (10 x dA)
Bending radius for multiple bends	160 mm (20 x dA)

6.9 Connecting the PROFIBUS DP interface (410 DP only)

Features	Boundary conditions
Permissible temperature range for cable routing	-5 °C to +50 °C
Temperature range for storage and stationary operation	-30 °C to +65 °C

Additional references

For more information on the pre-assembled cables, refer to:

- *Motion Control SIMOTION, SINAMICS S120 catalog and motors for production machines catalog, PM21*
- *Automation Systems for Machine Tools NC60 Catalog*

6.9.5 Connecting PROFIBUS DP (interface X21)

Introduction

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

Connecting the bus connector

Proceed as follows to connect the bus connector:

1. Plug the bus connector into the module.
2. Screw the bus connector firmly into place.
3. If the bus connector is located at the start or end of a segment, you must connect the terminating resistor (switch setting "ON").



Figure 6-4 Terminating resistor switched on and off

Note

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

Unplugging the bus connector

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

NOTICE

Data communication disturbed because bus terminator missing

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

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

6.9.6 Connection rules in the PROFIBUS subnet

Introduction

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

Connection rules

- **Before** you interconnect individual nodes in a subnet, you must assign a unique PROFIBUS address to each node.
- Narrow down the number of nodes by limiting the PROFIBUS addresses to the highest address in the network.
Tip: Mark the address on the housing of all nodes in a subnet. Then you can always see which address is assigned to which node in your system.
- Connect all nodes in a subnet "in a series". No spur lines may be routed to the PROFIBUS DP.
In addition, connect the programming devices and SIMATIC HMI devices to the subnet in a series for commissioning or maintenance work.
- If you are running more than 32 nodes in one subnet, you must couple the bus segments via RS 485 repeaters (see also the description of the RS 485 repeater in the reference Manual, *SIMATIC Automation Systems S7-300, Module Data*).
In a PROFIBUS subnet, all bus segments combined must have at least one DP master and one DP slave.
- Use RS 485 repeaters to connect ungrounded bus segments and grounded bus segments.
- The maximum number of nodes per bus segment decreases with each RS 485 repeater. This means that when a bus segment contains an RS 485 repeater, the bus segment can contain no more than 31 additional nodes. However, the number of RS 485 repeaters does not affect the maximum number of nodes on the bus.

6.10 Connecting the PROFINET interface (D410 PN only)

- Up to ten segments can be connected in a series.
- **At least** one terminal must be supplied with **5 V**. This is done by connecting the PROFIBUS DP connector with inserted terminating resistor to an energized device.
- Before inserting a new node on the subnet, you must switch off its supply voltage. The node must **first** be connected, and then switched on. When a node is disconnected, the connection must **first** be deactivated and then the connector removed.
- The bus cable of a segment must be terminated at **both ends**. This is achieved by switching on the terminating resistor in the PROFIBUS DP connector at the first and last node and switching off the other terminating resistors.

Networking example

The following figure shows an example configuration of a subnet with SIMOTION D410 DP.

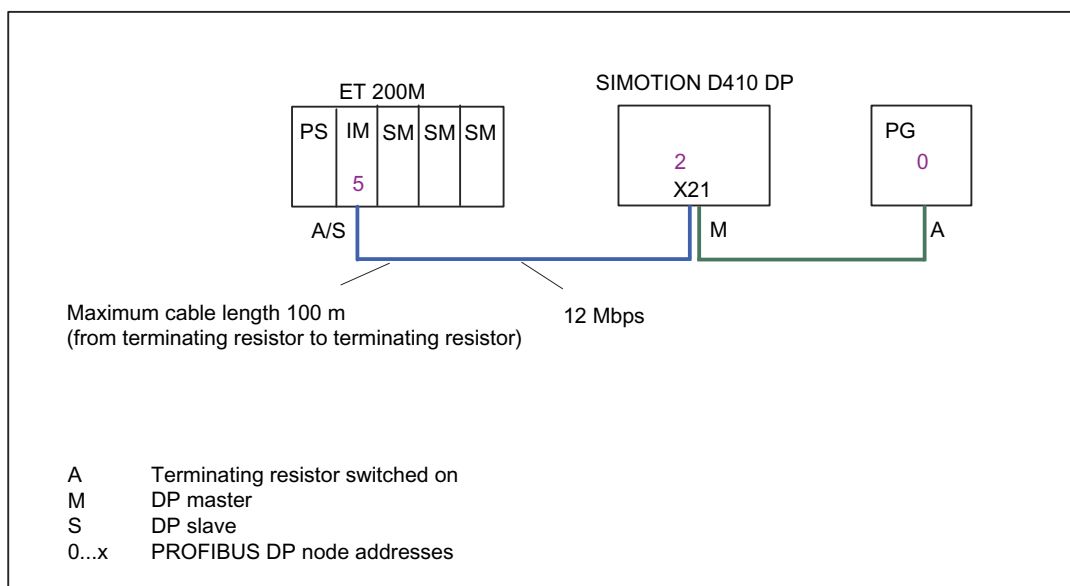


Figure 6-5 Networking example

6.10 Connecting the PROFINET interface (D410 PN only)

Information on PROFINET

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

SIMOTION D410 PN supports the following PROFINET communication methods:

- RT
- IRT

For further information, see the SIMOTION Communication System Manual.

Networking

The network is created via shielded twisted pair cables (TP cables). For additional information, see the *SIMATIC NET, Industrial Twisted Pair and Fiber Optic Networks* Manual.

Note

Note that the connector engages when you connect it.

Connector features

The PROFINET connector is used to connect the PROFINET cable to the PROFINET interface (X100), thus establishing a connection to additional nodes.

You will find an overview of the RJ45 plug connector available for order in the chapter entitled "Spare parts and accessories".

Additional references

Detailed information

- For information on assigning the IP address, refer to the *SIMOTION D410* Commissioning Manual.
- For information on PROFINET, refer to the *SIMOTION Communication System* Manual.

6.11 Connecting an external encoder

Connecting the connecting cable

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

We recommend that bipolar encoders are used. When using unipolar encoders, the unused negative track signals can either be connected or connected to ground. This results in different switching thresholds. See Section Encoder interface (HTL/TTL/SSI) (Page 52).

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

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

Procedure for connecting encoders

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

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

NOTICE
Destruction of the encoder electronics
Operation of a 5 V encoder on the 24 V encoder supply may result in the destruction of its electronic components!
Make sure that you can operate the connected encoder on a 24 V power supply (e.g. HTL encoder). This setting can be set in the expert list of the drive in parameter p0400 and in the following parameters.

Technical data

7.1 SIMOTION D410 dimensional diagram

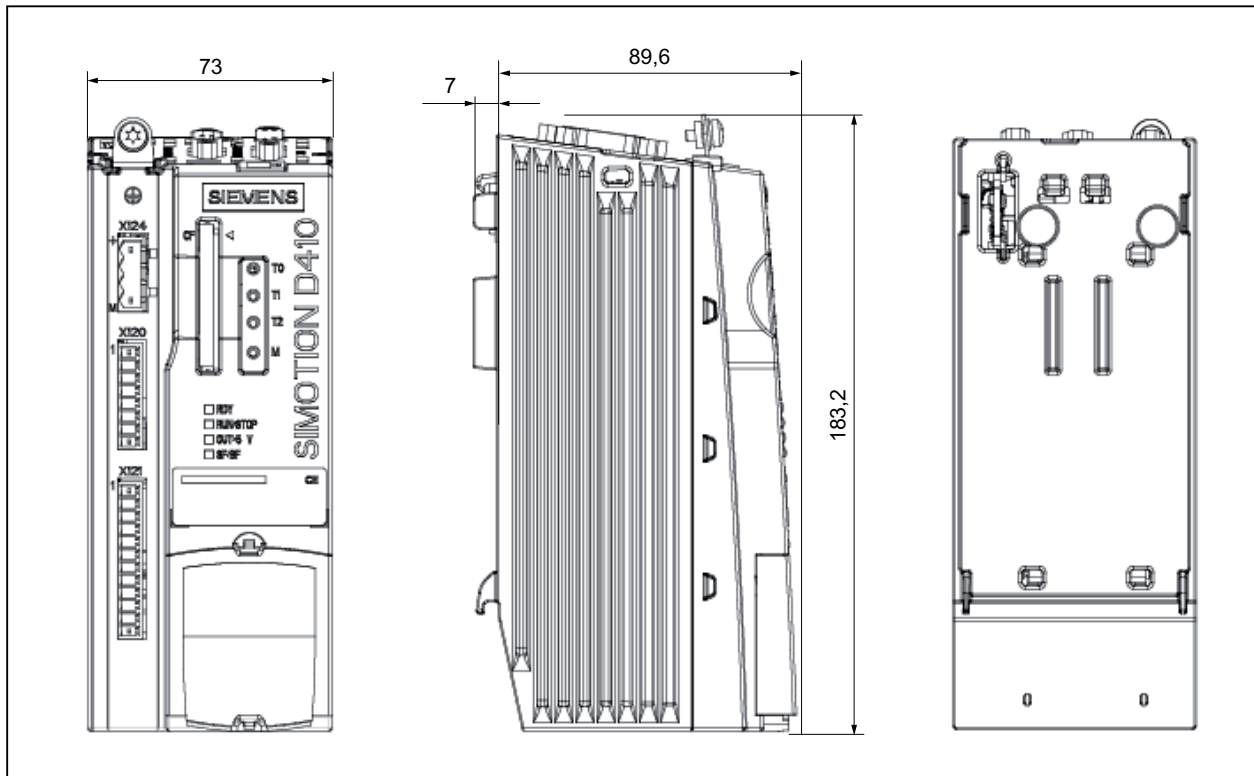


Figure 7-1 SIMOTION D410 dimensional diagram

7.2 SIMOTION D410 mounting plate dimensional diagram

Dimensions of the SIMOTION D410 mounting plate

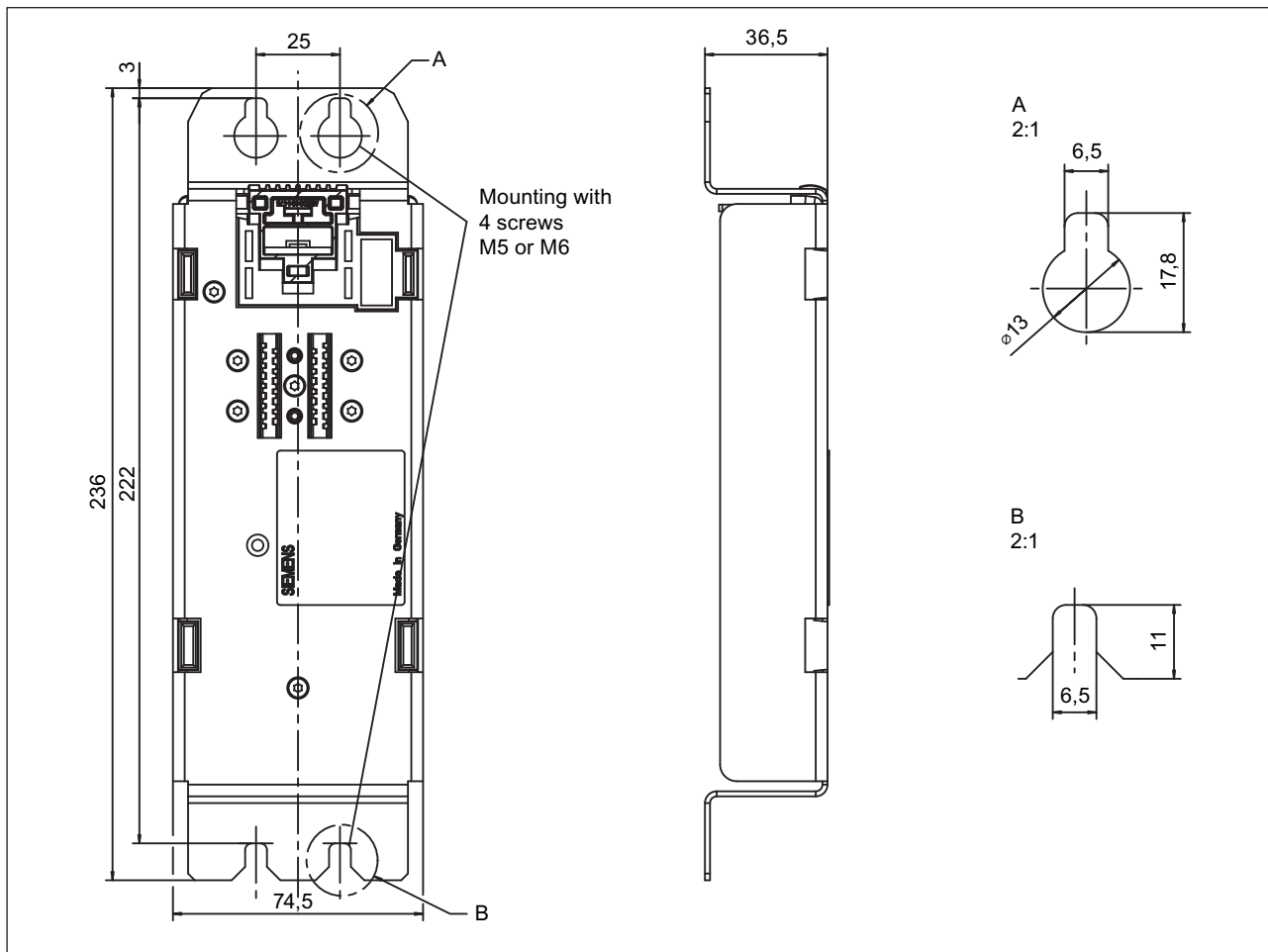


Figure 7-2 D410 mounting plate

7.3 CAD data, dimension drawings, and circuit-diagram macros

Dimension drawings and CAD data

Dimension drawings, as well as 2D and 3D CAD data, can be generated in commonly used formats using CAD CREATOR.

For information on how to do this, refer to: Internet address (<http://support.automation.siemens.com/WWW/view/en/30559271>).

Circuit-diagram macros

EPLAN circuit-diagram macros are available for SIMOTION D410. The macros are supported when you create circuit diagrams.

For information on how to do this, refer to: Internet address (<http://support.automation.siemens.com/WW/view/en/31622426>).

7.4 System data, connection values, dimensions and weight

PLC and motion control performance

Table 7-1 General information about SIMOTION D410

Maximum number of axes	1 (real axis)
Minimum PROFIBUS cycle clock	2 ms (D410 DP)
Minimum PROFINET send cycle clock	0,5 ms (D410 PN)
Minimum position control/interpolator cycle clock	2,0 ms

Table 7-2 Integrated drive control

Max. number of axes for integrated drive control (servo/vector/ V/f)	1 / 1 / 1 (alternative) drive control based on SINAMICS S120 CU310, firmware version V2.x
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Memory

Table 7-3 Memory data

RAM (Random Access Memory)	38 MB (as of V4.2) 26 MB (A 20 MB RAM is available for java applications with V4.1 SP2 and higher.)
RAM disk (load memory)	23 Mbyte (as of V4.3) 17 Mbytes
Retentive memory	9 KB
Persistent memory (user data on CF card)	1-GB CF: 300 MB
Non-volatile data backup	
Backup time, min.	Unlimited (maintenance-free backup)
Real-time clock, min.	5 days (maintenance-free backup)

Table 7-4 Memory for system data and its memory size

Diagnostic buffer (non-volatile)	100 messages (SIMOTION) 100 messages (SINAMICS Integrated)
----------------------------------	---

Communication

Table 7-5 SIMOTION D410 interfaces

DRIVE-CLiQ interface	1
PROFIBUS interface	1 (D410 DP only) <ul style="list-style-type: none"> • Isochronous • Can be configured as master or slave
PROFINET interface	1 interface with 2 ports (D410 PN only) <ul style="list-style-type: none"> • Supports PROFINET IO with IRT and RT • Can be configured as PROFINET IO controller and/or device

Table 7-6 Address space

Address space	D410
Logical I/O address space	8 KB
Physical I/O address space <ul style="list-style-type: none"> • PROFIBUS: max. each for inputs and outputs • PROFINET: max. each for inputs and outputs 	1 KB (D410 DP) 1 KB (D410 PN)
Permanent process image for BackgroundTask (I/O variables)	64 bytes
Additional configurable process image for each cyclic task (I/O variables)	Yes
Address space for each PROFIBUS DP station	244 Byte
Address space per SINAMICS Integrated (PROFIBUS Integrated)	512 Byte
Address space for each PROFINET device	1400 Byte

General technical data

The SIMOTION D410 has an integrated fan.

Table 7-7 SIMOTION D410 electrical connection values

Power supply	24 V DC (permissible range: 20,4 ... 28.8 V)
Current consumption, typically ¹⁾	Basic configuration 0.8 A
Inrush current	3,0 A
Power loss, typ.	20 W

¹⁾ With no load on inputs/outputs, no 24 V supply via DRIVE-CLiQ and PROFIBUS interface

Table 7-8 SIMOTION D410 dimensions and weight

Dimensions W x H x D	73 x 183,2 x 89,6 mm
SIMOTION D410 weight	
- Without packaging	990 g
- With packaging	1200 g

CompactFlash card

Table 7-9 CF card

Memory capacity	1 GB (Order No. 6AU1400-2PA0*-0AA0) 512 MB (Order No. 6AU1400-2NA00-0AA0)
Weight	10 g

With CF cards, SIMOTION versions up to and including V4.1 SP1 inc. hotfixes support a maximum memory addressing of 512 MB. Limiting is valid for use both by means of SIMOTION runtime functions and in other capacities, such as document archiving.

If more than 512 MB is saved on the CF card, SIMOTION runtime considers the card to have been utilized to its full capacity, i.e.

- SIMOTION runtime cannot write any further data,
- SIMOTION runtime cannot read data beyond the 512 MB range.

Note

Please note that

- In their as-delivered condition, the 1-GB CF cards with order number 6AU1400-2PA0*-0AA0 contain firmware that can only run on SIMOTION D4xx modules;
- In their as-delivered condition, the 1-GB CF cards with order number 6AU1400-*PA2*-0AA0 contain firmware that can only run on SIMOTION D4xx-2 modules.

It is also possible to use the 1-GB CF cards for SIMOTION D4xx-2 (order number 6AU1400-*PA2*-0AA0) for SIMOTION D4xx modules by loading the latest boot loader and the D4xx firmware. The reverse case is also possible. The CF card must only be formatted with FAT or FAT16, and must not be formatted with FAT32 or NTFS. Note that CF cards for SIMOTION D4xx-2 may have FAT32 formatting!

Mounting plate

Table 7-10 Mounting plate data

Dimensions W x H x D	74,5 x 236 x 36,5 mm
Weight	
- Without packaging	380 g
- With packaging	450 g

Further technical data

For further technical data such as the max. number of online connections, HMI devices that can be used as well as a list of tasks available in the execution system, see the function overview in the *PM 21 Catalog, Motion Control SIMOTION, SINAMICS S120 and motors for production machines.*

7.5 Digital inputs/outputs

Digital inputs

Table 7-11 Technical data for digital inputs

Number of inputs	4
Input voltage <ul style="list-style-type: none"> • Rated value • For signal "1" • For signal "0" 	<ul style="list-style-type: none"> • 24 V DC • 15 ... 30 V • -3 ... +5 V
Electrical isolation	Yes, in groups of 4
Current consumption typical at 1 signal level	10 mA at 24 V
Input delay, typical (hardware)	<ul style="list-style-type: none"> • 0 → 1 signal: 50 µs • 1 → 0 signal: 150 µs
<ul style="list-style-type: none"> • Connection of a 2-wire encoder • Permissible quiescent current 	<ul style="list-style-type: none"> • Possible • 2 mA

Digital inputs/outputs

Table 7-12 Technical data regarding the digital I/Os with adjustable parameters

Quantity	4 (max. 3 as high-speed measuring input inputs, max. 4 as high-speed cam outputs)
----------	--

Table 7-13 Digital inputs/outputs when used as input

Input voltage <ul style="list-style-type: none"> • Rated value • For signal "1" • For signal "0" 	<ul style="list-style-type: none"> • 24 V DC • 15 ... 30 V • -3 ... +5 V
Electrical isolation	no
Current consumption typical at 1 signal level	10 mA at 24 V

Input delay, typ. (hardware): <ul style="list-style-type: none"> • DI/DO 9-11: (can also be used as measuring input inputs) • DI/DO 8 	<ul style="list-style-type: none"> • 0 → 1 signal: 5 µs • 1 → 0 signal: 50 µs • 0 → 1 signal: 50 µs • 1 → 0 signal: 100 µs
Measuring input input, reproducibility	5 µs

Table 7-14 Digital inputs/outputs when used as output

Rated load voltage	24 V DC
Permissible range	20.4 ... 28.8 V
Electrical isolation	no
Current load, max.	500 mA per output
Residual current, max.	2 mA
Output delay, typ./max. (hardware) ¹⁾	<ul style="list-style-type: none"> • 0 → 1 signal: 150 µs / 400 µs • 1 → 0 signal: 75 µs / 100 µs
Output cam output, reproducibility, typ. ²⁾	<ul style="list-style-type: none"> • 200 µs with 3 ms bus/servo cycle clock • 300 µs with 6 ms bus/servo cycle clock
Short-circuit protection	yes
Total current of the outputs	Maximum permitted total current at X121 each 1 A over the total operating temperature range (equals 50 % coincidence)
Extinguishing energy per output	400 mJ
Lamp load	1 A for 50 ms
Maximum lamp load	5 W
Switching frequency	<ul style="list-style-type: none"> • With resistive load, max. • With inductive load, max. • With lamp load, max.
	<ul style="list-style-type: none"> • 100 Hz • 0.5 Hz • 10 Hz

¹⁾ Data for: $V_{cc} = 24 \text{ V}$; load 48Ω ; high ("1") = 90% V_{out} ; low ("0") = 10% V_{out}

²⁾ Reproducibility is cycle dependent. Short cycle times must be used for good reproducibility

7.6 Clock

Features of real-time clock

The table below contains the features and functions of the Control Unit clock.

Table 7-15 Clock features

Features	Description
Type	Hardware clock (integrated "real-time clock")
Default setting when delivered	DT#1992-01-01-00:00:00

7.8 Mechanical and climatic ambient conditions

Features	Description
Maximum deviation per day with supply voltage switched on and switched off at 0 to 55° C	±9 s
Backup time	Typically 5 days (at 0 to 25° C)
Charging time	1 h

With power OFF

The Control Unit clock continues to operate with the POWER OFF for the duration of the battery backup time (excluding software clock). The buffer is recharged in the POWER ON state. If the real-time clock backup time is exceeded, the time is reset. If the SIMOTION D410 is reset to its factory settings, the clock is also reset to the "default setting when delivered".

7.7 Shipping and storage conditions

The following information applies to modules transported and stored in the original packaging.

Table 7-16 Shipping and storage conditions

Type of condition	Permissible range
Free fall, checked according to DIN EN60721-3-2, Class 2M2	≤ 1 m
Permissible ambient temperature during storage and transport	-40° C to +70° C
Atmospheric pressure	700 to 1060 hPa (equals a height of up to 3000 m)
Relative humidity	5% to 95%, without condensation

7.8 Mechanical and climatic ambient conditions

Conditions of use

SIMOTION D410 is designed for use in stationary, weather-protected locations. The conditions of use exceed the requirements of the environmental test according to DIN IEC 60068-2-2.

SIMOTION D410 meets the conditions of use, Class 3C3, according to DIN EN 60721-3-3 (operating locations with high traffic densities and in the immediate vicinity of industrial equipment with chemical emissions).

Use prohibition

Without additional measures, SIMOTION D410 may not be used in

- Locations with a high percentage of ionizing radiation
- Locations with extreme operating conditions, e.g.,
 - Dust accumulation
 - corrosive vapors or gases
- In systems, which require special monitoring, e.g.,
 - Elevator installations
 - Electrical systems in particularly hazardous rooms

An additional measure for using SIMOTION D410 can, for example, be installation in cabinets.

Mechanical ambient conditions

SIMOTION D410 meets the following standards for mechanical stress:

- Vibration load: DIN EN 60721-3-3, Class 3M4
- Shock load: DIN EN 60721-3-3, Class 3M4
- Free fall: DIN EN 60721-3-2, Class 2M1 and 2M2
- Toppling: DIN EN 60721-3-2, Class 2M1

The mechanical ambient conditions for SIMOTION D410 are listed in the following table in the form of sinusoidal vibrations.

Table 7-17 Mechanical ambient conditions

Ambient conditions	Operation	Transport (in packaging)
Vibration tested in accordance with DIN EN 60068-2-6	10 to 57 Hz: 0.35 mm 58 to 200 Hz: 50 m/s ²	5 to 9 Hz: 3.5 mm 9 to 200 Hz: 10 m/s ²
Shock resistance tested in accordance with DIN EN 60068-2-27	10 g peak value, 6 ms duration 100 shocks in each axis vertical with respect to each other	10 g peak value, 6 ms duration 100 shocks in each axis vertical with respect to each other

Vibration reduction

If SIMOTION D410 is subjected to larger shocks or vibrations, you must use suitable measures to reduce the acceleration or the amplitude.

We recommend installation on shock-absorbing material (e.g. rubber-metal vibration dampers).

Climatic ambient conditions

SIMOTION D410 may not be used under the following climatic ambient conditions:

Note

Observe the application ranges of the PM340 power modules along with their derating. For further information, see SINAMICS documentation.

Table 7-18 Climatic ambient conditions

Ambient conditions	Application range	Remarks
Permissible ambient temperature for operation	0 to +55 °C	Oil mist, ice formation, moisture condensation, dripping water, spraying water, splashing water and water jets are not permitted (EN 60204, Part 1)
Maximum installation altitude	2000 m to max. 5000 m above sea level	From an altitude of 2000 m, the maximum ambient temperature decreases by 7°C every 1000 m.
Relative humidity	5 to 95 %	Without condensation, corresponds to a relative humidity (RH) severity level 2 according to IEC 1131-2
Air pressure	795 to 1080 hPa	-
Pollution degree	2 acc. to EN 60664-1	-
Pollutant concentrations	Substances: SO ₂ : <0.5 ppm; Relative humidity <60 %, no condensation H ₂ S: <0.1 ppm; Relative humidity <60 %, no condensation	Test: 10 ppm 4 days 1 ppm; 4 days

Spare parts/Accessories

8.1 Terminal module TM31

Characteristics of the TM31

The TM31 Terminal Module allows you to expand the number of available digital inputs/outputs as well as the number of analog inputs/outputs within a drive system. The TM31 is connected via DRIVE-CLiQ. It has 2 DRIVE-CLiQ interfaces for this.

The TM31 contains the following terminals:

Table 8-1 Interface overview of the TM31

Interface	Quantity
Digital inputs	8
Bidirectional inputs/outputs	4
Relay outputs with changeover contact	2
Analog inputs	2
Analog outputs	2
Temperature sensor input (KTY84-130 or PTC)	1

NOTICE

Overheating if ventilation clearances are too small

Insufficient ventilation clearances result in overheating and therefore in more failures and a shortened life of the component.

Maintain 50 mm ventilation clearances above and below the component.

Additional references

For further information on TM31, see the *SIMOTION D410* Commissioning Manual.

8.2 Terminal module TM41

Characteristics of the TM41

With the TM41 Terminal Module, the number of available digital inputs/digital outputs and the number of analog inputs within a drive system can be expanded. In addition, it enables the use of the TTL output for encoder simulation. The TM41 is connected via DRIVE-CLiQ. The

8.3 TM54F terminal module

use of the TM41 on the SIMOTION D410 is limited, as precisely one real axis can be configured on the SIMOTION D410. You can find more information in the *SIMOTION D410* Commissioning Manual.

The TM41 contains the following terminals:

Table 8-2 TM41 interface overview

Type	Quantity
Digital inputs	4
Digital inputs/outputs	4
Analog inputs	1
TTL encoder output	1

NOTICE**Overheating if ventilation clearances are too small**

Insufficient ventilation clearances result in overheating and therefore in more failures and a shortened life of the component.

Maintain 50 mm ventilation clearances above and below the component.

Additional references

For detailed information on the TM41 Terminal Module, see the *SIMOTION D410* Commissioning Manual.

8.3 TM54F terminal module

Characteristics of the TM54F

The TM54F Terminal Module is a terminal expansion module for snapping on to a DIN EN 60715 mounting rail. The TM54F offers safe digital inputs and outputs for controlling SINAMICS Safety Integrated functions and is supported by SIMOTION D410, V4.1 SP2 and higher.

A SIMOTION D410 can be assigned no more than one TM54F, which is connected via DRIVE-CLiQ. Additional nodes (e.g. TMxx, SMxx) can be connected to the same DRIVE-CLiQ line.

Table 8-3 The following terminals are located on the TM54F:

Type	Quantity
Fail-safe digital outputs (F-DO)	4
Fail-safe digital inputs (F-DI)	10
Sensor ¹⁾ power supplies, dynamic response supported ²⁾	2

Type	Quantity
Sensor ¹⁾ power supply, no dynamization	1
Digital inputs for testing the F-DO during test stop	4

- ¹⁾ Sensors: Fail-safe devices for commanding and detecting, such as emergency stop pushbuttons and safety locks as well as position switches and light arrays / light curtains.
- ²⁾ Dynamic response: The sensor power supply is switched on and off during test stop for testing the sensors, the cable routing, and the evaluation electronics of TM54F.

The TM54F provides 4 fail-safe digital outputs and 10 fail-safe digital inputs. A fail-safe digital output consists of a P/M-switching output as well as a digital input for reading back the switching state. A fail-safe digital input is made up of two digital inputs.

NOTICE

Overheating if ventilation clearances are too small

Insufficient ventilation clearances result in overheating and therefore in more failures and a shortened life of the component.

Maintain 50 mm ventilation clearances above and below the component.

Additional references

You will find detailed information on the TM54F Terminal Module in the *SINAMICS S120 Safety Integrated* Function Manual.

8.4 Terminal modules TM15 and TM17 High Feature

Features of TM15 and TM17 High Feature

The TM15 and TM17 High Feature Terminal Modules are used to implement inputs of measuring inputs and outputs of output cams for SIMOTION D. In addition, these Terminal Modules provide drive-related digital I/Os with short signal delay times. TM15 and TM17 High Feature are connected via DRIVE-CLiQ.

TM15

Each of the 24 electrically isolated digital I/Os can be parameterized channel-by-channel as a digital input (DI), digital output (DO), a measuring input input, or an output cam output.

TM15 DI/DO

Each of the 24 isolated digital I/Os can be configured on a channel-specific basis as a digital input (DI) or digital output (DO). The digital I/Os can be interconnected using BICO technology

8.4 Terminal modules TM15 and TM17 High Feature

and thus used from the drive side as well. Unlike the TM15, measuring input inputs and cam outputs are not available with the TM15 DI/DO.

Note

The module hardware for TM15 and TM15 DI/DO is identical. A distinction is only made by the addition of the component in the SIMOTION SCOUT project navigator using "Inserting I/O component".

TM17 High Feature

Each of the 16 DI/DO can be configured on a channel-specific basis as digital input (DI), digital output (DO), measuring input or output cam output.

TM17 High Feature has fewer I/O channels than TM15, but more functionality. TM17 High Feature is distinguished by especially high resolution and accuracy as well as a configurable input filter and enabling inputs (max. 6 units). Parameterized enable inputs can enable measuring inputs or outputs of output cams (gate function). Due to their high accuracy, the DI/DO channels of the TM17 High Feature are non-isolated.

Note

NOTICE

Overheating if ventilation clearances are too small

Insufficient ventilation clearances result in overheating and therefore in more failures and a shortened life of the component.

Maintain 50 mm ventilation clearances above and below the component.

Additional references

Detailed information about the TM15 and TM17 High Feature can be found in the *SIMOTION Terminal Modules TM15 / TM17 High Feature Commissioning Manual*.

8.5 CUA31/CUA32 control unit adapter

Characteristics of the CUA31/CUA32

You can connect a Power Module in blocksize format to the DRIVE-CLiQ interface using the CUA31 adapter module. The CUA32 adapter module also provides an encoder interface for an HTL, TTL or SSI encoder.

Table 8-4 Overview of the interfaces for the adapter modules

Interface	CUA31	CUA32 (V4.1 SP2 and higher)
DRIVE-CLiQ interface	3	3
EP terminals/temperature sensor connection	1	1
Power Module Interface (PM-IF)	1	1
24 V electronic power supply	1	1
Encoder interface (HTL, TTL, SSI) Only SSI encoders without incremental tracks may be operated.	0	1
Maximum DRIVE-CLiQ cable length	with order number 6SL3040-0PA00-0AA0 → 50 m as of order number 6SL3040-0PA00-0AA1 → 100 m	100 m

NOTICE

Overheating if ventilation clearances are too small

Insufficient ventilation clearances result in overheating and therefore in more failures and a shortened life of the component.

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

Additional references

You will find more information on the CUA31/CUA32 control unit adapter in the *SINAMICS S120 AC Drive Manual*.

8.6 DMC20/DME20 DRIVE-CLiQ Hub

Characteristics

The DMC20 and DME20 DRIVE-CLiQ hub modules are used to implement point-to-point distribution of a DRIVE-CLiQ line.

- DMC20 is the hub for the control cabinet configuration
- DME20 is the hub for use without a control cabinet (IP67 degree of protection).

The modules are particularly well suited to applications that require DRIVE-CLiQ link nodes to be removed in groups without interrupting the DRIVE-CLiQ link and therefore the data exchange.

The DMC20/DME20 is also used with a D410 when a second encoder is required. As an SMx Sensor Module and a motor with DRIVE-CLiQ interface only have one DRIVE-CLiQ interface, a DMC20/DME20 must be used for a second encoder via DRIVE-CLiQ. If a CUA31/CUA32 is used, the DMC20/DME20 is not required. Alternatively, a second encoder can also be connected via the X23 interface on the D410.

NOTICE

Overheating if ventilation clearances are too small

Insufficient ventilation clearances result in overheating and therefore in more failures and a shortened life of the component.

The 50 mm clearances above and below the components must be observed.

Additional references

You will find detailed information about the DMC20/DME20 in the *SINAMICS S120 Control Units and Additional System Components Manual*.

8.7 List of spare parts and accessories

Table 8-5 Spare parts and accessories

Parts for SIMOTION D410	Order No.	Accessories	Spare part
M4 screw-on shield connection e.g. from Weidmüller GmbH & Co. KG, see: Internet address (http://www.weidmueller.com)	-	x	-
Protective conductor connection M4/1.8 Nm e.g. from Weidmüller GmbH & Co. KG, see: Internet address (http://www.weidmueller.com)	-	x	-
Mounting plate for operation away from the Power Module	6AU1400-7AA05-0AA0	x	-
Spare fan for SIMOTION D410	6SL3064-0AC00-0AA0	-	x

8.7 List of spare parts and accessories

Parts for SIMOTION D410	Order No.	Accessories	Spare parts
CompactFlash card 1 GB Latest CF card at the time of writing	6AU1400-2PA03-0AA0	x	-
Terminal kit, contains <ul style="list-style-type: none"> • 2 x I/O connectors for X120/X121 • 1 x 24 V connector for X124 • 1 x DRIVE-CLiQ blanking cover for X100 	6SL3064-8LA00-0AA0	-	x
Plug connector for power supply (X124)	6SL3065-2AA00-0AA0	-	x
Blanking cover	6SL3064-3BB00-0AA0	-	x
Plug connector for PROFIBUS interface up to 12 Mbit/s, 90° cable outlet:			
Without PG socket without FastConnect insulation displacement	6ES7972-0BA12-0XA0	x	-
Without PG socket with FastConnect insulation displacement	6ES7972-0BA50-0XA0	x	-
With PG socket without FastConnect insulation displacement	6ES7972-0BB12-0XA0	x	-
With PG socket with FastConnect insulation displacement	6ES7972-0BB50-0XA0	x	-
Plug connector for PROFIBUS interface up to 12 Mbit/s, angular cable outlet:			
Without PG socket without FastConnect insulation displacement	6ES7972-0BA42-0XA0	x	-
Without PG socket with FastConnect insulation displacement	6ES7972-0BA60-0XA0	x	-
With PG socket without FastConnect insulation displacement	6ES7972-0BB42-0XA0	x	-
With PG socket with FastConnect insulation displacement	6ES7972-0BB60-0XA0	x	-
Connector for PROFINET interface			
RJ45 plug connector, IE FC RJ45 Plug 180			
1 pack = 1 unit	6GK1901-1BB10-2AA0	x	-
1 pack = 10 units	6GK1901-1BB10-2AB0	x	-
1 pack = 50 units	6GK1901-1BB10-2AE0	x	-
FastConnect cables for Industrial Ethernet / PROFINET			
• IE FC standard cable GP 2x2	6XV1840-2AH10	x	
• IE FC flexible cable GP 2x2	6XV1870-2B	x	
• IE FC trailing cable GP 2x2	6XV1870-2D	x	
• IE FC trailing cable 2x2	6XV1840-3AH10	x	
• IE FC marine cable 2x2	6XV1840-4AH10	x	
Stripping tool for Industrial Ethernet / PROFINET FastConnect cables			
• IE FC Stripping Tool	6GK1901-1GA00	x	

To obtain order data information for other SINAMICS drive components, such as Line Modules, Motor Modules, DRIVE-CLiQ cables, etc., see the *PM 21* Catalog.

Note

If the fan for the SIMOTION D410 is defective, it can be replaced. The procedure for replacing the SIMOTION D410 fan is described in the *SIMOTION D410* Commissioning Manual.

Spares On Web

Spares On Web is an information system that enables you to find out which spare parts are available for your device. To find out more, go to: Internet address (https://b2b-extern.automation.siemens.com/spares_on_web).


In order to view the spare parts, you require the order number and the serial number of the module.

Both numbers can be found on the type plate on the module or the packaging label.

Standards and approvals

A.1 General rules

CE marking


	<p>Our products satisfy the requirements and protection objectives of the EC Directives and comply with the harmonized European standards (EN).</p>
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Electromagnetic compatibility

Standards for EMC are satisfied if the EMC Installation Guideline is observed.

SIMOTION products are designed for industrial use in accordance with product standard DIN EN 61800-3, Category C2.

cULus Approval

	<p>Listed component mark for United States and the Canada Underwriters Laboratories (UL) according to Standard UL 508, File E164110, File E115352, File E85972.</p>
---	---

You can find more information on the respective device on the Internet at <http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm>. Enter the first 7 characters of the order number under **Keyword**. Then click **Search**.

EMC

<p>KOREA</p>	<p>이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.</p> <p>For sellers or other users, please keep in mind that this device is an A-grade electromagnetic wave device. This device is intended to be used in areas other than home.</p> <p>The EMC limit values to be observed for Korea correspond to the limit values of the EMC product standard for variable-speed electric drives EN 61800-3 of Category C2 or the limit value class A, Group 1 to CISPR11. By implementing appropriate additional measures, the limit values according to category C2 or limit value class A, Group 1, are observed. For this purpose, additional measures, such as e.g., the use of an additional RFI suppression filter (EMC filter) may be necessary. In addition, measures for EMC-compliant configuration of the plant are described in this Manual and/or the Configuration Manual "EMC Installation Guideline". Please note that ultimately it is always the label on the device that provides the decisive information on the compliance with standards.</p>
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Declaration of conformity

The current Declaration of conformity is available on the Internet at Declaration of conformity (<http://support.automation.siemens.com/WW/view/en/10805446/134200>).

A.2 Device-specific information

Note regarding SIMOTION D

Note

The product standard EN 61800-3 describes the EMC requirements placed on "Variable-speed drive systems". As such, it defines different limits depending on the location of the drive system.

SINAMICS S120 power units are designed for use in the second environment. The term second environment refers to all locations outside residential areas. These are basically industrial areas which are supplied from the medium-voltage line supply via their own transformers.

It is essential to follow the installation instructions in the SINAMICS S120 Manuals in order to ensure compliance with emitted interference and immunity values.

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

For more information on this topic also refer to Catalog PM21 as well as the SINAMICS Function Manuals.

ESD directives

B.1 ESD definition

What does ESD mean?

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



NOTICE

Damage caused by electric fields or electrostatic discharge

Electric fields or electrostatic discharge can result in malfunctions as a result of damaged individual parts, integrated circuits, modules or devices.

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

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.

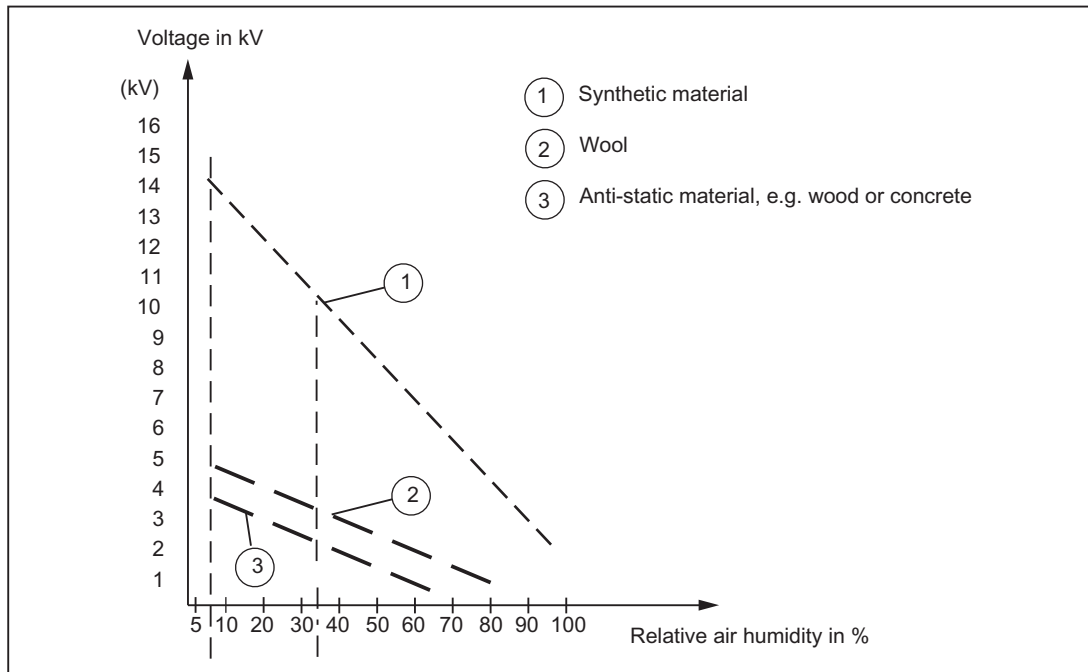


Figure B-1 Electrostatic voltage that can accumulate on operating personnel

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.

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