SIEMENS

SIMOTION D4x5-2

SIMOTION

Manual

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Valid for SIMOTION D445-2 DP/PN and D455-2 DP/PN as well as CX32-2 and TB30

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

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Preface

Content of the Manual

This document is part of the SIMOTION D documentation package.

Scope

The *SIMOTION D4x5-2* Manual is applicable to the SIMOTION D445-2 DP/PN and SIMOTION D455-2 DP/PN devices as well as the CX32-2 and TB30 supplementary system components.

A separate *SIMOTION D4x5* Manual is available for the SIMOTION D425, SIMOTION D435 and SIMOTION D445/D445-1 devices including the CX32, CBE30 and TB30 system components.

Standards

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

Content of the manual

The following is a description of the purpose and use of the product manual:

Description

Provides information about the SIMOTION system and its integration in the automation environment.

• Operator control (hardware)

Provides information about the structure and architecture of the devices.

Interfaces

Provides information about the different interfaces of the devices, their pin assignment, and possible applications.

Technical data

Provides information about the properties and features of the devices.

- Dimension drawings
- Spare parts/accessories

Provides information about spare parts and accessories of the SIMOTION D4x5-2 and SIMOTION CX32-2.

• Appendix

Provides information about the various standards and specifications fulfilled by the device.

Index for locating information.

SIMOTION Documentation

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

This documentation is included as electronic documentation in the scope of delivery of SIMOTION SCOUT. It comprises 10 documentation packages.

The following documentation packages are available for SIMOTION V4.2:

- SIMOTION Engineering System
- 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

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

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

Disposal and recycling of the device

SIMOTION D is an environmentally friendly product. It includes the following features:

- In spite of its excellent resistance to fire, the flame-resistant agent in the plastic used for the housing does not contain halogens.
- Identification of plastic materials in accordance with DIN 54840.
- Less material used because the unit is smaller and with fewer components thanks to integration in ASICs.

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:

http://www.automation.siemens.com/partner/index.asp

Further information / FAQs

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

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

You can also find additional information such as:

- SIMOTION Utilities & Applications: SIMOTION Utilities & Applications will be included in the SIMOTION SCOUT scope of delivery and, along with FAQs, also contain free utilities (e.g. calculation tools, optimization tools etc.) as well as application examples (ready-toapply solutions such as winders, cross cutters or handling).
- The latest SIMOTION FAQs at http://support.automation.siemens.com/WW/view/en/10805436/133000
- SIMOTION SCOUT online help.
- For additional documentation (separate document), please refer to the list of references.

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Description

1.1 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 D is available in two versions:

- SIMOTION D410 is a compact control unit for single-axis applications and is snapped on to the SINAMICS S120 PM340 power module in blocksize format.
- SIMOTION D4x5-2 is a control unit for multi-axis applications in the SINAMICS S120 booksize format. SIMOTION D4x5-2 is the successor to the SIMOTION D4x5 control unit. The integrated drive control of a D4x5-2 is based on a CU320-2, firmware version ≥ V4.x).

The following performance versions are offered:

- SIMOTION D445-2 DP/PN (HIGH performance) for up to 64 axes
- SIMOTION D455-2 DP/PN (ULTRA-HIGH performance) for up to 128 axes or applications with very short control cycle clocks

This manual describes the SIMOTION D4x5-2 for multi-axis applications. Separate manuals are available for the SIMOTION D410 and SIMOTION D4x5.

Like SINAMICS S120, SIMOTION D also follows 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 D.

Note

In order to cover all versions of SIMOTION D for multi-axis applications, the product will be referred to as "D4x5-2". Specific product designations will be used for information that applies only to one product version, e.g. D445-2 DP/PN.

Description

1.1 System overview

Application

The SIMOTION D4x5-2 is ideally suited to applications with many coordinated axes with high clock-pulse rates.

Typical applications include:

- Compact multiple-axis machines
- High-performance applications with short machine cycles
- Compact machines
 - Including the complete machine control in the drive
 - With extensive connection possibilities for communication, HMI and I/O
- Distributed drive concepts
 - Applications with many axes
 - Synchronization of several SIMOTION D control units using distributed synchronous operation

Versions

The control units are available in the versions SIMOTION D425 (BASIC performance), SIMOTION D435 (STANDARD performance), SIMOTION D445-2 DP/PN (HIGH performance) and SIMOTION D455-2 DP/PN (ULTRA-HIGH performance). The versions differ in their PLC performance and in their motion control performance. The main distinguishing features are:

	SIMOTION D425	SIMOTION D435	SIMOTION D445-2 DP/PN	SIMOTION D455-2 DP/PN
Maximum number of axes	16	32	64	128
Minimum servo/interpolator cycle clock	2.0 ms	1.0 ms	0.5/0.25 ms ¹⁾	0.5/0.25 ms ¹⁾
DRIVE-CLiQ interfaces	4	4	6	6
Description	See SIMOTION D4x5 Manuals		See this manual	

Table 1-1 Device versions and characteristics

¹⁾ Explanation:

• 0.5 ms in connection with SINAMICS S120 (incl. SINAMICS Integrated / CX32-2)

 0.25 ms in connection with SERVOfast and IPOfast for rapid I/O processing and/or high-performance hydraulics applications. The sensors and actuators are connected via high-speed PROFINET IO I/O modules.

The control units feature PLC and motion control performance (open-loop control and motion control) for up to 16, 32, 64 or 128 axes, as required.

The integrated drive computing performance of the control units enables the operation of the following axis configurations:

- Up to six servo, six vector or twelve *Vf* axes on each D4x5-2 control unit. (Drive control based on CU320-2, firmware version ≥ V4.x)
- Up to six servo, four vector or eight *VI* faxes on each D4x5 control unit. (Drive control based on CU320, firmware version V2.x)

The drive control supports servo control (for a highly dynamic response), vector control (for maximum torque accuracy) and Mf control.

The SIMOTION D4x5-2 control units and their CX32-2 and TB30 supplementary system components are described in the following.

Note

With the SIZER configuration tool, you can easily configure the SINAMICS S120 drive family including SIMOTION.

It provides you with support for selecting and dimensioning the components required for a motion control task.

You can also determine the possible number of axes and the resulting load with SIZER in accordance with your performance requirements.

1.1 System overview

Hardware components

As the central hardware, SIMOTION D uses the SIMOTION D4x5-2 as control unit consisting of the SIMOTION runtime system and the SINAMICS drive control. The control unit uses the SINAMICS Integrated drive with various SINAMICS S120 drive modules (line and motor modules) to perform open-loop and closed-loop control of the axis grouping. A range of additional SINAMICS S120 components, such as SMx encoder systems or terminal modules can also be connected via DRIVE-CLiQ. With a few exceptions (e.g. no basic positioner EPOS, no basic operator panel BOP20, etc.), the drive control integrated in SIMOTION D has the same control characteristics and performance features as the SINAMICS S120 CU320-2 control unit. The EPOS functionality is provided by the SIMOTION technology functions. The functionality of SIMOTION D can be expanded with the distributed I/O via PROFIBUS or PROFINET IO.

The following figure shows a typical SIMOTION D axis grouping.

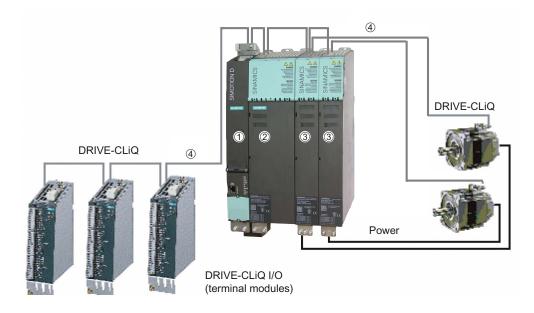


Figure 1-1 Example of an axis grouping with SIMOTION D4x5-2

A SIMOTION D axis grouping generally consists of the following elements:

• SIMOTION D (control unit) (1)

This unit contains the programmable runtime system of SIMOTION and the drive software of SINAMICS S120. In principle, SIMOTION D is capable of controlling multiple axes/drives.

• One SINAMICS infeed (line module) (2)

This module generates a DC link from the supply system.

• SINAMICS power units (motor modules) (3)

These modules are used to control motors.

It is also possible to operate SINAMICS PM340 power modules with the SINAMICS control unit adapter (CUA). A separate infeed is then unnecessary.

• DRIVE-CLiQ components (4)

In SINAMICS S120 / SIMOTION D, the individual components of the drive system communicate with each other via DRIVE-CLiQ. In addition to power components, encoder systems and special DRIVE-CLiQ I/O devices can also be linked via DRIVE-CLiQ.

Extension of the drive computing performance

The motion control performance of a SIMOTION D4x5-2 can be utilized in full by expanding the computing performance at the drive in two different ways:

- SINAMICS S110/S120 control units (e.g. CU320-2, CU305, etc.) complete with further drive components can be connected via PROFIBUS or PROFINET.
- With SIMOTION D4x5-2, the CX32-2 controller extension can be connected via DRIVE-CLiQ. This module is extremely compact, does not require a separate CompactFlash card and can control up to six servo, six vector or twelve *V f* axes.

Software components

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

The SIMOTION runtime system with the following functions:

- User-programmable runtime system (IEC 61131)
- Various runtime levels (tasks)
- PLC and arithmetic functionality
- Motion control functions
- Communication functions

The SINAMICS S120 drive control with the following functions:

- Closed-loop current and torque control
- Closed-loop speed control
- Closed-loop infeed

1.2 System components

1.2 System components

Central components

SIMOTION D4x5-2 communicates with automation components via the following interfaces:

- PROFIBUS DP
- Ethernet
- PROFINET IO
- DRIVE-CLiQ (DRIVE Component Link with IQ)

SIMOTION D features a SINAMICS Integrated drive element. The communication with the SINAMICS Integrated is performed via PROFIBUS mechanisms (DP Integrated), i.e. the communication is handled, for example, via PROFIdrive message frames.

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

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

Component	Function	
SIMOTION D4x5-2 controller	is the central motion control module. This module contains the programmable SIMOTION runtime for the SIMOTION D4x5-2 and the SINAMICS S120 drive software. You can use the integrated high-speed digital I/Os as:	
	Homing inputs	
	Inputs for measuring inputs	
	User-addressable process inputs/outputs	
	Outputs for fast output cams	
	The measuring sockets can output any analog signals.	
System software	The basic functionality of SIMOTION D is supplied on a CompactFlash card containing the following:	
	SIMOTION runtime (kernel)	
	Drive software of SINAMICS S120 - implements all drive functions	
Power supply	provides the electronic power supply for SIMOTION D, e.g. via the SITOP power supply.	

Table 1-2 Central components

PROFIBUS DP

The control unit can communicate with the following components via the PROFIBUS DP interfaces:

Component	Function		
Programming device (PG/PC)	configures, parameterizes, programs, and tests with the "SIMOTION SCOUT" engineering system (ES)		
SIMATIC HMI device	is used for operating and monitoring functions. This is not an essential requirement for the operation of a control unit.		
Other controllers (e.g. SIMOTION or SIMATIC)	e.g. higher-level controller (plant controller); modular machine concepts with multiple controls, distributed across individual machine modules		
Distributed I/O systems			
SIMATIC ET 200M	Modular I/O system for control cabinet installation and high channel density		
SIMATIC ET 200S	Finely scalable I/O system for control cabinet configuration and particularly time-critical applications; including motor starters, safety technology and individual grouping of load groups		
SIMATIC ET 200pro	Modular I/O system with IP65/67 degree of protection for machine- related applications with no control cabinet; with features such as compact designs, integrated PROFIsafe safety technology, PROFINET connection and live module replacement.		
SIMATIC ET 200eco	I/O system with IP65/67 degree of protection for cabinet-free use close to the machine with flexible and fast ECOFAST or M12 connection methods.		
Other PROFIBUS I/O			
Gateways	 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		
Drive interfaces	 ADI4 (Analog Drive Interface for four axes) for connection of drives with analog ±10 V setpoint interface or for external encoders 		
	 IM174 (interface module for four axes) for connection of drives with analog ±10 V setpoint interface, for external encoders, or for connection of stepper drives with pulse-direction interface 		
Drive units with PROFIBUS DP interface (e.g. SINAMICS S120)	convert speed setpoints into signals for controlling the motor and supply the power required to operate the motors. Also can be operated as an isochronous slave on PROFIBUS DP.		
Teleservice adapter	Remote diagnostics		

Table 1-3 Components on PROFIBUS DP

Description

1.2 System components

Ethernet

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

Table 1-4	Components on the Ethernet	t
		•

Component	Function
Programming device (PG/PC)	configures, parameterizes, programs, and tests with the "SIMOTION SCOUT" engineering system (ES)
Master computer	communicates with other devices via UDP, TCP/IP
SIMATIC HMI device	is used for operating and monitoring functions. This is not an essential requirement for the operation of a control unit.

PROFINET IO

The D4x5-2 DP/PN can communicate with the following components via the onboard PROFINET IO interface.

0		
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 operating and monitoring functions. This is not an essential requirement for the operation of a control unit.	
Other controllers (e.g. SIMOTION or SIMATIC)	e.g. higher-level controller (plant controller); modular machine concepts with multiple controls, distributed across individual machine modules	
Master computer	communicates with other devices via UDP, TCP/IP.	
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 configuration and particularly time-critical applications; including motor starters, safety technology and individual grouping of load groups	
SIMATIC ET 200pro	Modular I/O system with IP65/67 degree of protection for machine- related applications with no control cabinet; with features such as compact designs, integrated PROFIsafe safety technology, PROFINET IO connection and live module replacement.	
SIMATIC ET 200eco PN	Compact block I/O with IP65/66/67 degree of protection for cabinet-free usage in machines with M12 connection method. Very rugged and resistant encapsulated metal enclosure.	
Other PROFINET IO I/O devices		
Drive units with PROFINET IO interface	convert speed setpoints into signals for controlling the motor and supply the power required to operate the motors.	
Gateways	IE/AS-Interface link PN IO for the PROFINET IO gateway to AS-Interface	
	PN/PN coupler for connecting two PROFINET IO networks	

Table 1-5 Components on the PROFINET IO

DRIVE-CLiQ

The DRIVE-CLiQ interfaces permit a fast connection to the SINAMICS drive components.

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

- Expandability of components
- Automatic detection of components by the control unit
- Standardized interfaces to all components
- Uniform diagnostics down to the components
- Complete service down to the components
- Simple mechanical handling

The controller can communicate with the following components via DRIVE-CLiQ:

Table 1- 6	Components	connected to	DRIVE-CLiQ

Component	Function
Control unit (SINAMICS S110/S120)	Central control module in which the open- and closed-loop control functions for the drive are implemented.
Line module (SINAMICS S120)	generates a DC link from the supply system.
Motor module (SINAMICS S120)	used to control motors (DC/AC inverters, booksize).
Power module (SINAMICS S110/S120)	used to control motors (AC/DC converters, blocksize).
CX32-2 controller extension	enables additional axes to be connected for SIMOTION D4x5-2.
CUA31/CUA32 control unit adapter	enables a blocksize power module (PM340) to be connected to a booksize control unit D4x5-2, CX32-2 or CU320-2.
TM31 terminal module	enables a terminal expansion via DRIVE-CLiQ (additional analog and digital I/Os).
TM41 terminal module	enables a terminal expansion (analog and digital I/Os) and encoder simulation.
TM54F terminal module	enables terminal expansion (secure digital inputs/outputs) for controlling the secure motion monitoring functions of the integrated drives.
TM15, TM17 High Feature terminal modules	The terminal modules TM15 and TM17 High Feature are used to implement inputs of measuring inputs and outputs of output cams. In addition, these terminal modules provide drive-related digital inputs and outputs with short signal delay times.
SMx sensor modules	enable acquisition of encoder data from connected motors via DRIVE-CLiQ.
Motors with DRIVE-CLiQ interface	allow simplified commissioning and diagnostics, as the motor and encoder type are identified automatically.
DMC20/DME20 DRIVE-CLiQ hub	enables the number of DRIVE-CLiQ interfaces to be increased and the creation of a point-to-point topology.

Note

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

It is possible that older DRIVE-CLiQ components can no longer be used with SIMOTION D4x5-2/CX32-2. Detailed information can be found at "Migration of D4x5 to D4x5-2" in Section Permissible combinations.

Optional components

The functionality of the D4x5-2 control unit can be expanded by using one of the components listed below.

Table 1- 7	Optional component
------------	--------------------

Component	Function
TB30 terminal board	Terminal expansion, i.e. additional analog and digital I/Os

The component is plugged into the option slot of the control unit.

1.3 I/O integration

Note

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

A detailed, regularly updated list of the I/O modules approved for use with SIMOTION, as well as notes on their use, can be found on the Internet at:

In addition to the I/O modules enabled for SIMOTION, in principle all certified standard PROFIBUS slaves (DP-V0/DP-V1/DP-V2) and PROFINET IO devices with RT and IRT realtime classes may be connected to SIMOTION D4x5-2. These modules are integrated using the GSD file (PROFIBUS) or GSDML file (PROFINET) provided by the relevant device manufacturer.

Note

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

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

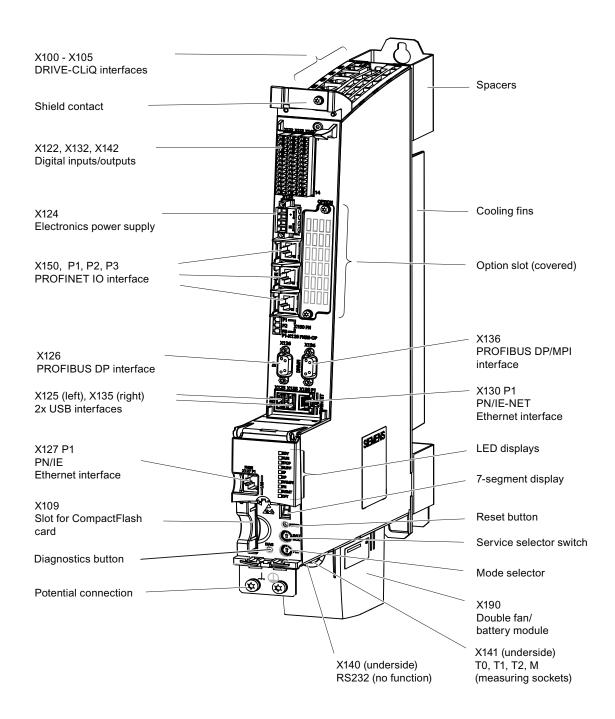
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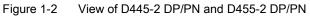
On the Internet at: (http://support.automation.siemens.com/WW/view/en/11886029)

1.4 View of SIMOTION D445-2 DP/PN and D455-2 DP/PN

1.4 View of SIMOTION D445-2 DP/PN and D455-2 DP/PN

The following figure shows the SIMOTION D445-2 and D455-2 with its interfaces and front panel elements (fault and status displays).





1.5 Nameplates

SIMOTION D445-2 DP/PN and D455-2 DP/PN must be operated with a double fan/battery module for heat dissipation. Without this module, the control units will not start up and cannot be commissioned.

Information on how to install the double fan/battery module can be found in "Supplementary system components", in Section Installing the fan/battery module (Page 80).

Note

With the D445-2 DP/PN and D455-2 DP/PN, the spacers can only be removed with the "external air cooling" installation method. In this installation method, the cooling fins are inserted through a cutout in the rear cabinet panel.

For further details, see the *SIMOTION D4x5-2* Commissioning and Hardware Installation Manual.

1.5 Nameplates

Side-mounted type plate

The following figure shows the information contained on the type plate mounted on the side of the housing.

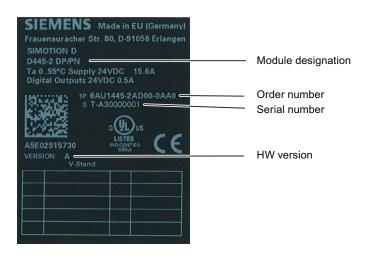


Figure 1-3 Type plate using the D445-2 as an example

1.5 Nameplates

Note

You might need to access the information provided on the side-mounted type plate after the installation. The type plate is located on the right-hand side of the module housing and is covered by a SINAMICS S120 module when mounted. For this reason, we recommend that you make a note of the serial number of the control unit prior to assembly.

Note

The information contained in each field of the type plate on your actual control unit may differ from that presented in this manual (for example, a later product version, approvals and marks that have not yet been granted, e.g. C-Tick, etc.).

MAC addresses

A second type plate for the MAC addresses of the two Ethernet interfaces and the PROFINET IO interface is attached to the front of the device. You see this type plate when you open the front cover of the control unit.

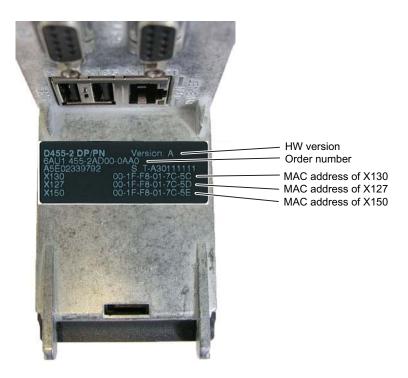


Figure 1-4 MAC addresses

1.6 Safety notes

Note the following safety information when working with the control unit and its components.

NOTICE

The 80 mm clearances above and below the components must be observed. The unit protects itself from overheating by shutting down.

An option board may only be inserted and removed when the control unit and option board are disconnected from the power supply.

The CompactFlash card may only be inserted or removed when the control unit is disconnected from the power supply.

The SIMOTION D4x5-2 is in a de-energized state when all the LEDs are OFF.

1.7 CompactFlash card

1.7.1 Usage and function of the CompactFlash Card

The CompactFlash card (CF card) is inserted in the CF plug-in slot (X109 interface).



Figure 1-5 Slot for CompactFlash card

The CF card does not extend beyond the housing. An ergonomic recessed grip enables the CF card to be removed.

Properties of the CF card

The CF card is essential for operation of the SIMOTION D4x5-2. The CF card is not supplied with the SIMOTION D4x5-2 and must be ordered separately.

The SIMOTION Kernel (SIMOTION D4x5-2 firmware) and the software used to control the drives (SINAMICS firmware) are contained on the CF card.

The CF card is used for:

- Backing up the technology packages and user data (programs, configuration data, parameter assignments)
- Updates (e.g. SIMOTION firmware update)

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

The CF card is supplied in a bootable format with the latest SIMOTION Kernel and drive software. Please note that a CF card with a D4x5 kernel/drive software cannot run on a D4x5-2. The same applies for the reverse situation.

If an error occurs, all LEDs flash yellow with 2 Hz. An entry is also made in the diagnostic buffer and the D4x5-2 does not start.

Licenses purchased for SIMOTION D can be used for both the D4x5 and D4x5-2.

Note

The CF card may only be unplugged and plugged in when the system is deenergized! The SIMOTION D4x5-2 is in a de-energized state when all the LEDs are OFF.

Additional information

For additional information about inserting, changing, writing and formatting the CF card, refer to the *SIMOTION D4x5-2* Commissioning and Hardware Installation Manual.

1.7 CompactFlash card

1.7.2 CompactFlash card

Type plate information

The following figure shows you all the information contained on the type plate of the CF card.

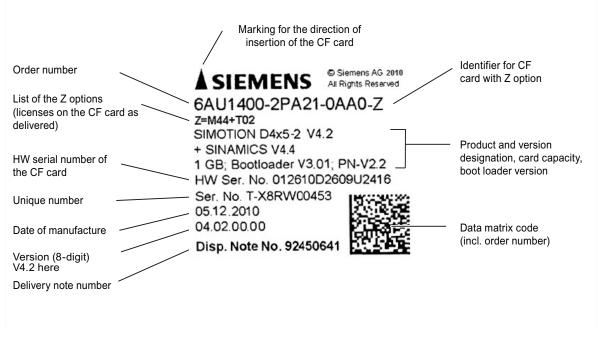


Figure 1-6 Type plate of the CF card

Pre-installed runtime licenses

The preinstalled licenses are printed on the label as Z option below the order number.

Example

Example with MultiAxes package Z option for D445/D445-1/D445-2/D455-2 + two TControl licenses:

- 6AU1 400-2PA21-0AA0-Z
- Z=M44+T02

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

Available Z options / licenses for CF cards

- Axis licenses
 - Pxx POS license and number (e.g. P02 = 2x POS licenses)
 - Gxx GEAR license and number (e.g. G03 = 3 x GEAR licenses)
 - Cxx CAM license and number (e.g. C01 = 1x CAM license)
- MultiAxes package
 - M00 MultiAxes package license (platform independent)
 - M42 MultiAxes package license for D425
 - M43 MultiAxes package license for D435 (incl. D425)
 - M44 MultiAxes package license for D445/D445-1/D445-2/D455-2 (incl. D425 and D435)
- TControl temperature control
 - Txx TControl license and number (e.g. T03 = 3x TControl licenses)
- SIMOTION IT
 - D00 SIMOTION IT DIAG license (no longer under license as of SIMOTION V4.2)
 - X00 SIMOTION IT OPC XML-DA license (no longer under license as of SIMOTION V4.2)
 - J00 SIMOTION IT Virtual Machine license for Java applications
- Safety functions
 - Fxx license for SINAMICS Safety Integrated extended functions (for integrated SINAMICS drives for SIMOTION D) (e.g. F02=2x Safety Integrated extended functions)
- Other functions
 - B01 Direct Product Motion (DPM) technology function license, D435/D445/D445-1/D445-2/D455-2 only
 - B02 Multipurpose Information Interface (MIIF) communication function license

1.7.3 Data matrix code on CF card

SIMOTION D CF cards have a machine-readable identification in the form of a data matrix code (2D code).

Reader units that support the data matrix code in accordance with ECC 200 are suitable for reading the code used here.

Description

1.7 CompactFlash card

Analysis

Example of a data string from the reader unit:

1P6AU1400-2PA21-0AA0-Z+ST-WOQB02934+30SST0B8365550000079001

Table 1-8 Machine-readable identification via 2D code

Characteristic	Property
Order number	6AU1 400-2PA21-0AA0-Z
("1P" identifier to identify the products)	
Serial number	T-WOQB02934
("S" identifier, item number)	
HW serial number	ST0B8365550000079001
("30S" identifier)	

In addition to the "serial number", CF cards also have a "HW serial number".

If licenses are purchased for functions under license, a "license key" is generated from the HW serial number of the CF card and the serial number of the purchased licenses, which is only valid for the respective CF card.

The data required for the licensing can be read by reader unit via the bar codes on the license certificates (Certificate of License "CoL") and the 2D code on the CF card in order, for example, to automate the licensing process.

Operation (hardware)

2.1 Overview of operator control and display elements

The following figure shows the arrangement of the operator control and display elements of a SIMOTION D4x5-2.

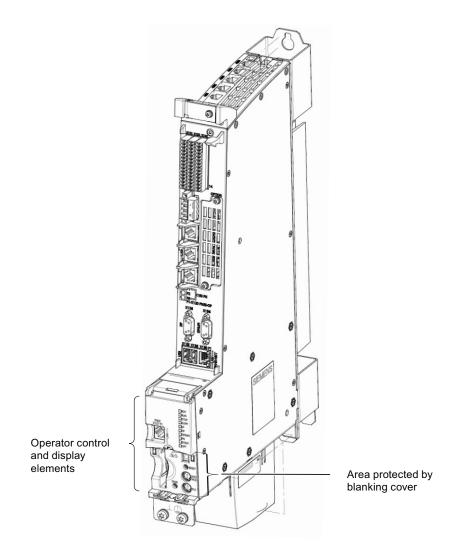


Figure 2-1 Position of operator control and display elements

The lower part of the operator control and display elements has a blanking cover during operation. This cover is removed for service work.

2.2 Operator controls

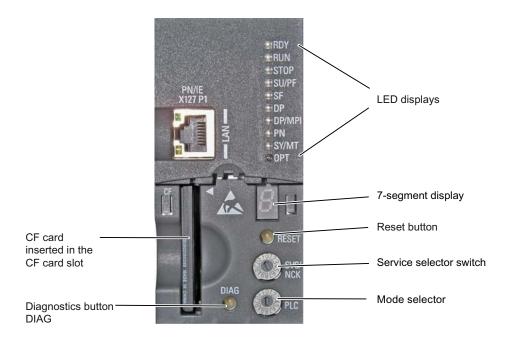


Figure 2-2 Operator control and display elements of D445-2 DP/PN and D455-2 DP/PN

2.2 Operator controls

2.2.1 Service and operating mode switch

Properties of the Service switch and mode selector

SIMOTION D4x5-2 has two selector switches on the lower front side for selection of the service functions and operating modes.

The upper selector switch (labelled SVC/NCK) is for the selection of service and diagnostic functions. In "normal" operation this switch must remain in the 0 position (see figure below).

The lower switch, labelled PLC, is used to set one or more operating modes of the SIMOTION D4x5-2.

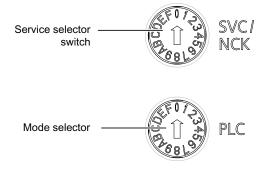


Figure 2-3 Selector switches for service and operating modes of the SIMOTION D4x5-2

CAUTION

Always use an insulated screwdriver to turn the rotary switch. Otherwise, static electricity can destroy the switch.

Mode selector

The following table contains the possible mode selector positions and the associated LED displays. The mode selector positions are explained in the order in which they are arranged on the SIMOTION D4x5-2.

Selector position	Meaning	LED
0	RUN	RUN
1	STOPU	SU/PF
2	STOP	STOP
3	MRES The MRES operating modes are indicated via the STOP LED. (ON/OFF/flashing, see <i>SIMOTION D4x5-2</i> Commissioning and Hardware Installation Manual)	
Other selector positions are not assigned		

Table 2-1 Mode selector position

2.2 Operator controls

The following table contains the states of the SIMOTION D4x5-2 that can be set via the mode selector.

Meaning	Explanations	
RUN	SIMOTION D4x5-2 processes the user program and the associated system services:	
	Reading process image of inputs.	
	Execution of the user programs assigned to the execution system.	
	Writing process image of outputs.	
	The technology packages are active in this state. They can execute commands from the user program.	
STOPU	SIMOTION D4x5-2 is not processing a user program.	
	• 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. This means, for example, that digital outputs are "LOW" and analog outputs are de-energized or at zero current.	
STOP	SIMOTION D4x5-2 is not processing a user program.	
	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. This means, for example, that digital outputs are "LOW" and analog outputs are de-energized or at zero current.	
	• The technology packages are inactive, i.e. all enables are deleted. No axis motions can be executed.	
MRES	Performing an overall reset on the SIMOTION D4x5-2 / restoring the factory setting	
	Using the MRES switch position, you can perform an overall reset on the	
	SIMOTION D4x5-2 or	
	 Restore the SIMOTION D4x5-2 to its factory setting, depending on the operating sequence. For further details, see the <i>SIMOTION D4x5-2</i> Commissioning and Hardware 	
	Installation Manual.	

Table 2-2 Mode selector settings

Note

It is recommended that SIMOTION SCOUT be used exclusively to switch the operating modes of the module. Therefore, leave the mode selector at position 0 (RUN). The LED display indicates the current mode selection.

For information on how to set the operating mode using SIMOTION SCOUT, refer to the *SIMOTION SCOUT* Configuration Manual.

Service selector switch

The following table shows the possible positions of the Service selector switch. The Service selector switch positions are explained in the order in which they are arranged on the SIMOTION D4x5-2.

Service mode	Selector position	Meaning
-	0	No service/diagnosis functions activated (default setting).
Delete/restore non-volatile data	1	When the "Delete/restore non-volatile data" switch setting is selected, the non-volatile data of the D4x5-2 is first deleted and then restored along with the contents of the PMEMORY backup file.
Downgrade (device update tool)	В	SIMOTION D4x5-2 control units and projects can be updated using update data created at an earlier point in time. This update data is generated with the device update tool (Menu: "Project>Start device update tool" in SIMOTION SCOUT).
		If the updating process fails to bring about the desired result, the update can be rejected by means of the switch position. This will roll the system back to the previous configuration.
Backing up diagnostic data and non-volatile data	D	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 information (via websites) and TO alarm information.

Table 2-3 Switch positions of the Service selector switch

Note

Alternatively, diagnostics data and non-volatile data can also be backed up via the DIAG button, see Section DIAG button (Page 36).

Additional references

Detailed information on the individual topics can be found in the following table.

Subject	Reference
Setting of the operating modes	SIMOTION SCOUT Configuration Manual
Upgrading devices (device update tool)	Updating SIMOTION Devices Operating Instructions and
	SIMOTION D4x5-2 Commissioning and Hardware Installation Manual
Creating diagnostics data andSaving/restoring non-volatile data	SIMOTION D4x5-2 Commissioning and Hardware Installation Manual

Table 2-4 References

2.2 Operator controls

2.2.2 DIAG button

Arrangement

The DIAG button is located behind the blanking cover on the SIMOTION D4x5-2.

Function

The diagnostics data and non-volatile data is backed up on the CF card via the DIAG button.

The DIAG button function therefore corresponds to the function of switch position "D" of the Service selection switch.

Various options are available for backing up the data:

- Option 1: Backup during operation (in STOP/STOPU/RUN mode)
- Option 2: Backup during booting of the module

With option 1, the DIAG button only has to be pressed briefly to trigger the data backup. The DIAG button is therefore preferable to switch position "D" of the Service selection switch.

With option 2, the DIAG button has to be pressed until the boot procedure is completed. As this can take 20-30 seconds, switch position "D" is preferable here.

Additional references

For detailed information on creating diagnostic data and backing up / restoring non-volatile data, refer to the *SIMOTION D4x5-2* Commissioning and Hardware Installation Manual.

2.2.3 RESET button

Arrangement

The RESET button is located behind the blanking cover on the SIMOTION D4x5-2.

Performing a reset operation

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

2.3 7-segment and LED displays

Arrangement of the displays

The front side of the SIMOTION D4x5-2 has ten LED displays arranged arranged vertically in one row. There is also a 7-segment display below the blanking cover.

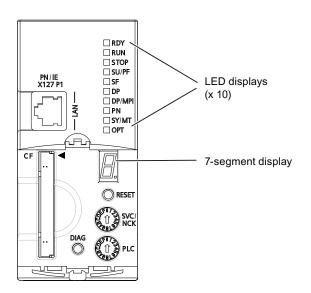


Figure 2-4 7-segment and LED displays on the D4x5-2

Meaning of the LED displays

This table describes the LEDs and their meaning.

Table 2- 5	Error and	status	displays

LED	Meaning
RDY	Operating modes of SIMOTION D incl. SINAMICS Integrated.
RUN	User program is running
STOP	No user program is running. The technology packages are not active
SU/PF	The technology packages are active. The user program is not active
SF	An error state of the SIMOTION D4x5-2
DP	State of the PROFIBUS DP interface
DP/MPI	State of the PROFIBUS DP/MPI interface
PN	State of the onboard PROFINET IO interface (X150)
SY/MT	 Synchronization status (SY) of the onboard PROFINET IO interface (X150) Maintenance status (MT) of the D4x5-2 (currently without function)
OPT	State of the option module (if available).

2.3 7-segment and LED displays

Note

While the SIMOTION D4x5-2 is ramping up, all LEDs are briefly illuminated in yellow.

7-segment display

The 7-segment display provides further status information in addition to the LED displays.

The status "6" and a flashing "." indicate that the D4x5-2 has ramped up and communication has been established to the SINAMICS Integrated.

Additional information

You can carry out a detailed diagnosis using a PG/PC and the Engineering System. Information on the diagnostics via LED displays can also be found in the *SIMOTION D4x5-2* Commissioning and Hardware Installation Manual and in the online help of this chapter via the link under the menu instructions.

3

Interfaces

3.1 Interface overview

This section describes the interfaces of the SIMOTION D4x5-2.

Available interfaces

Interface	Name	Connector type
DRIVE-CLiQ interface	X100	DRIVE-CLiQ socket
DRIVE-CLiQ interface	X101	DRIVE-CLiQ socket
DRIVE-CLiQ interface	X102	DRIVE-CLiQ socket
DRIVE-CLiQ interface	X103	DRIVE-CLiQ socket
DRIVE-CLiQ interface	X104	DRIVE-CLiQ socket
DRIVE-CLiQ interface	X105	DRIVE-CLiQ socket
Ethernet interface PN/IE	X127 P1	RJ45 socket connector
Ethernet interface PN/IE-NET	X130 P1	RJ45 socket connector
PROFINET IO interface PN	X150 (P1, P2, P3)	RJ45 socket connector
Digital inputs/outputs	X122, X132, X142	Mini Combicon, 3.5 mm 3x14-pin
Power supply connector	X124	Combicon, 4-pin
PROFIBUS DP interface	X126	9-pin Sub-D socket
PROFIBUS DP/MPI interface	X136	9-pin Sub-D socket
Measuring sockets (T0, T1, T2, and M)	X141	4-pin, socket
SIMOTION CF plug-in	X109	CompactFlash Card connector
Fan/battery module interface	X190	Fan/battery module
1. USB interface	X125	USB socket
2. USB interface	X135	USB socket
Option slot		Sockets

Table 3-1 Overview of available interfaces

3.2 DRIVE-CLiQ interfaces

Note

The 3rd port of the PROFINET IO interface X150 P3 has an additional inscription. It is called X120 PN/IE-OP.

This designation is not relevant for SIMOTION D.

Non-usable interfaces

Table 3-2 Overview of interfaces that cannot be used for SIMOTION D

Interface name	Interface	Connector type
RS232 interface	X140	9-pin Sub-D connector

3.2 DRIVE-CLiQ interfaces

DRIVE-CLiQ interfaces

All SINAMICS S120 drive system components, including the motors and encoders, are interconnected by a shared serial interface called DRIVE-CLiQ. The standardized cables and connectors reduce the variety of different parts and cut storage costs.

DRIVE-CLiQ has the following properties:

- Automatic detection of components by the control unit
- Standardized interfaces to all components
- Uniform diagnostics down to the components
- · Complete service down to the components
- 24 V / 450 mA per DRIVE-CLiQ interface are provided for the connection of encoders and measuring systems.

Note:

The DRIVE-CLiQ cable with 24 V supply is used only for components that require this (e.g. motors with a DRIVE-CLiQ interface).

Position of connectors

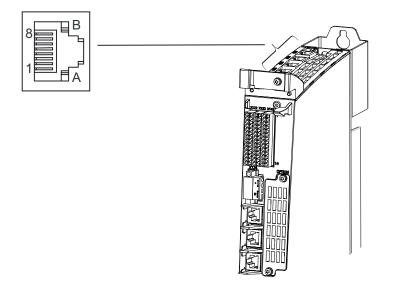


Figure 3-1 Position of the DRIVE-CLiQ interfaces on the D4x5-2

Characteristics

Table 3- 3 X100 – X105

Characteristic	Туре
Connector type	DRIVE-CLiQ connector (RJ45 socket)
Cable type	DRIVE-CLiQ standard (inside the control cabinet)
Cable type	MOTION CONNECT (outside the control cabinet)
Max. cable length	100 m
Dust protection blanking plugs for sealing unused DRIVE-CLiQ ports	Five blanking plugs contained in the D4x5-2 scope of delivery Blanking plugs (50 pcs) order number: 6SL3066-4CA00-0AA0

3.3 Ethernet interfaces

DRIVE-CLiQ pin assignment

PIN	Signal name	Signal type	Meaning	
1	TXP	0	Transmit data +	
2	TXN	0	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	
А	+ (24 V)	VO	Power supply for DRIVE-CLiQ, 450 mA maximum	
В	M (0 V)	VO	Ground to 24 V	
Signal t	Signal type: I = Input; O = Output; VO = Voltage Output			

Table 3-4 DRIVE-CLiQ interface X100 – X105

Additional references

- SINAMICS S120 Control Units and Additional System Components Manual
- SINAMICS S120 Booksize Power Units Manual
- SINAMICS S120 for AC Drives Manual
- SINAMICS S120 Commissioning Manual
- Terminal Modules TM15 and TM17 High Feature Commissioning Manual
- TM15/TM17 High Feature Manual
- For order numbers, refer to the list of references (separate document).

3.3 Ethernet interfaces

Interfaces for connection to Industrial Ethernet

Industrial Ethernet is a communication network with a transmission rate of 10/100/1000 Mbit/s.

SIMOTION D4x5-2 offers the following functions via Ethernet interfaces:

- Communication with STEP 7 and SIMOTION SCOUT
- Communication between SIMOTION and SIMATIC NET OPC

The following software must be installed on the PG/PC for this function: "SIMATIC NET SOFTNET-S7 (S7-OPC server)"

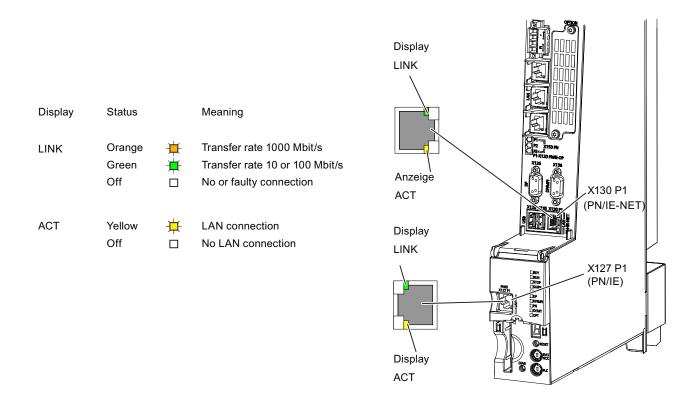
Connection of HMI systems

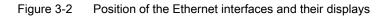
- Communication with other devices over TCP/IP or UDP communication
- IT communication (via SIMOTION IT DIAG, SIMOTION IT OPC XML-DA, SIMOTION IT Virtual Machine)

For more information regarding the software packages, see *Catalog PM 21*, refer to the list of references (separate document) for the order number.

Position of connectors

The following figure shows the position of the Ethernet interfaces on the D4x5-2 and their displays.





3.3 Ethernet interfaces

Note

The two interfaces support Industrial Ethernet (IE). The designation of the interfaces PN/IE-NET or PN/IE has already been designed for the support of PROFINET basic services (e.g. DCP, LLDP, SNMP) via these interfaces in a future version. These PROFINET basic services provide uniform functions for the address assignment and diagnostics, but do not provide PROFINET IO communication for the connection of drives or I/O modules, for example.

Additional references

Detailed information on the states of the status LEDs can be found in the *SIMOTION D4x5-2* Commissioning and Hardware Installation Manual, Diagnostics chapter.

Interface characteristics

Table 3- 5	X127 P1 and X130 P1

Characteristic	Туре		
Connector type	RJ45 socket connector		
Cable type	Industrial Ethernet cable		
	• 4- and 8-wire cables can be used for 10/100 Mbit/s		
	8-wire cables must be used for 1000 Mbit/s		
Max. cable length	100 m		
Autocrossing	Yes		
Dust protection blanking plugs for sealing unused Ethernet ports	Five blanking plugs contained in the D4x5-2 scope of delivery Blanking plugs (50 pcs) order number: 6SL3 066-4CA00-0AA0		
Miscellaneous	X127 P1 and X130 P1 are full-duplex 10/100/1000 Mbit/s Ethernet ports		

Pin assignment

Table 3-6	Ethernet interfaces	(X120 P1 and X130) P1)
-----------	---------------------	-------------------	-------

Pin	Assignment in 10/100 Mbit mode			Assignment in 1 Gbit mode		
	Signal name 1)	Signal type	Meaning	Signal name 1)	Signal type	Meaning
1	ТХР	0	Ethernet transmit differential signal	DA+	В	Bidirectional pair A+
2	TXN	0	Ethernet transmit differential signal	DA-	В	Bidirectional pair A-

Interfaces

3.4 PROFINET IO interface

3	RXP	1	Ethernet receive differential signal	DB+	В	Bidirectional pair B+
4			Reserved, do not use	DC+	В	Bidirectional pair C+
5			Reserved, do not use	DC	В	Bidirectional pair C-
6	RXN	1	Ethernet receive differential signal	DB-	В	Bidirectional pair B-
7			Reserved, do not use	DD+	В	Bidirectional pair D+
8			Reserved, do not use	DD-	В	Bidirectional pair D-

I = Input; O = Output; B = Bidirectional

¹⁾ Autocrossing functionality (if required, transmit and receive lines switch over)

Note

The MAC addresses are imprinted on an adhesive label that is located behind the protective cover and can be seen from the front.

3.4 PROFINET IO interface

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

SIMOTION D4x5-2 DP/PN has a PROFINET interface with three ports (X150 P1-P3) onboard. The PROFINET interface supports operation of a SIMOTION D4x5-2 DP/PN as an IO controller and/or as an I device.

Interfaces

3.4 PROFINET IO interface

Interface position

The following figure contains information on the PROFINET interface of the control unit. Position of the interface, labeling of the ports and the associated displays are described.

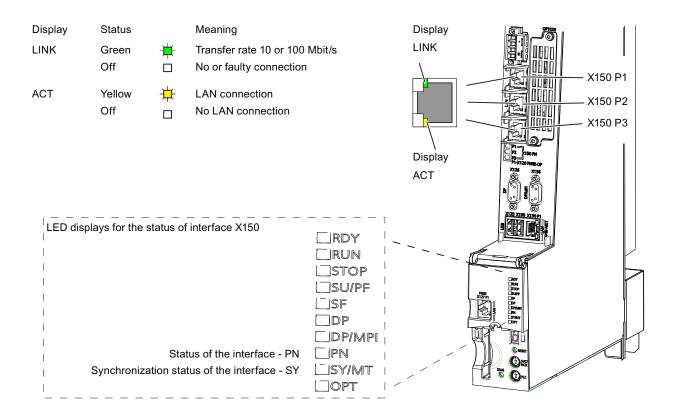


Figure 3-3 Position of the PROFINET interface X150 P1 to P3 their displays

Note

The 3rd port of the PROFINET IO interface X150 P3 is also designated as X120 PN/IE OP. This designation is not relevant for SIMOTION D.

Additional references

Detailed information on the states of the status LEDs can be found in the *SIMOTION D4x5-2* Commissioning and Hardware Installation Manual, Diagnostics chapter.

Interface characteristics

Table 3-7	Ports X150 P1 to P3
-----------	---------------------

Characteristic	Туре
Connector type	RJ45plus socket
Cable type	PROFINET
Maximum cable length	100 m
Minimum transmission cycle	0.25 ms
Autocrossing	Yes i.e. both crossed and uncrossed cables can be used
Dust protection blanking plugs for sealing unused PROFINET ports	Five blanking plugs contained in the D4x5-2 scope of delivery Blanking plugs (50 pcs) order number: 6SL3066-4CA00-0AA0

Interface assignments

Table 3-8	Assignment of the ports X150 P1 to P3
-----------	---------------------------------------

View	Pin	Name	Description
	1	ТХР	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 IO interface:

- PG/PC programming devices (communication with SIMOTION SCOUT / STEP 7)
- SIMATIC HMI devices
- SIMATIC controllers with PROFINET interface
- Distributed I/O
- Drive units with PROFINET IO interface (standard devices)

Interfaces

3.4 PROFINET IO interface

The SIMOTION D4x5-2 DP/PN then assumes the role of a PROFINET IO controller and can offer the following functions:

- PROFINET IO controller, I device (also controller and device simultaneously)
- Supports real-time classes of PROFINET IO:
 - RT (real-time)
 - IRT (isochronous real-time)

The following functions are also supported by Industrial Ethernet:

- Communication between SIMOTION and SIMATIC NET OPC. The "SIMATIC NET SOFTNET S7 (S7 OPC server)" software must be installed on the PG/PC for this function.
- Communication with other devices over TCP/IP or UDP communication
- IT communication (via SIMOTION IT DIAG, SIMOTION IT OPC XML-DA, SIMOTION IT Virtual Machine)

For more information regarding the software packages, see Catalog PM 21, refer to the list of references (separate document) for the order number.

Note

A list of the modules released with SIMOTION is available at (http://support.automation.siemens.com/WW/view/en/11886029).

The list is updated regularly and contains information on the use of these modules.

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

3.5 Digital inputs/outputs

3.5.1 Features

Interface characteristics

The digital inputs and outputs on the X122, X132 and X142 connectors are for the connection of sensors and actuators.

Table 3-9	Wiring of X122, X132 and X142
-----------	-------------------------------

Characteristics		Туре
Connector type	Mini Combicon	
Connectable cable types and conductor cross-sections	Rigid Flexible Flexible with end sleeve AWG	0.2 mm ² to 1.5 mm ² 0.2 mm ² to 1.5 mm ² 0.25 mm ² to 1.5 mm ² 24 to 16
Stripped length	10 mm	
Tool	Screwdriver 0.4 x 2.0 mm	
Max. cable length	30 m	
Max. current carrying capacity (ground)	8 A	

Position of connectors

The following figure shows the position of the interface connectors on the D4x5-2 and the distribution of the various digital inputs and outputs.

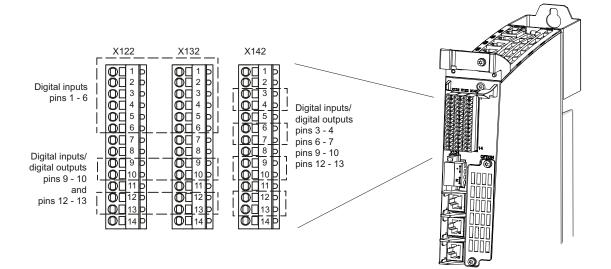


Figure 3-4 Position of the digital interfaces X122, X132 and X142

SIMOTION D4x5-2 Manual, 11/2010

3.5 Digital inputs/outputs

Connection and circuit diagram for SIMOTION D4x5-2

The following figure shows the connection and circuit diagram of the digital inputs and outputs on the D4x5-2.

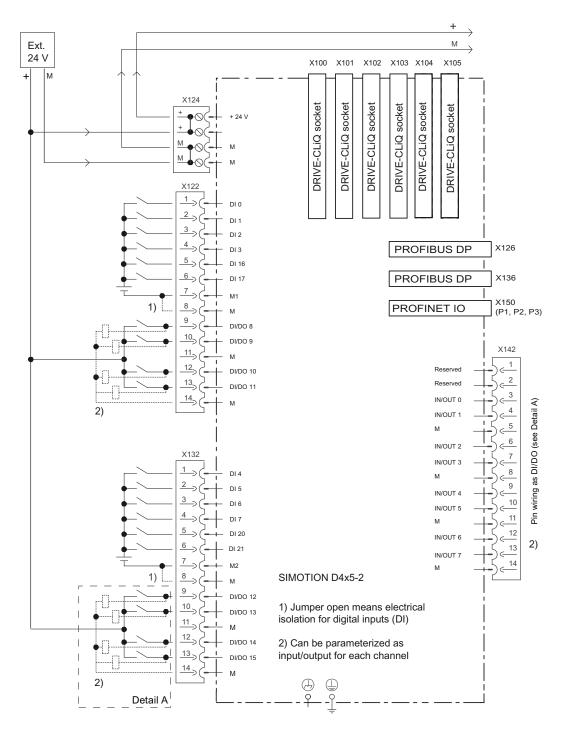


Figure 3-5 Connection and circuit diagram of the digital inputs/outputs

Interface assignment of X122, X132 and X142

Pin	Designation ¹⁾	Signal type	Notes
1	DI 0	1	Digital input 0
2	DI 1	Ι	Digital input 1
3	DI 2	Ι	Digital input 2
4	DI 3	Ι	Digital input 3
5	DI 16	Ι	Digital input 16
6	DI 17	Ι	Digital input 17
7	M1	GND	Ground for DI 0 – DI 3, DI 16, DI 17 (electrically isolated relative to M)
8	Μ	GND	Ground
9	DI/DO 8	В	Digital input/output 8 (can also be used as input for measuring input or as input for the external zero mark)
10	DI/DO 9	В	Digital input/output 9 (can also be used as input for measuring input or as input for the external zero mark)
11	М	GND	Ground
12	DI/DO10	В	Digital input/output 10 (can also be used as input for measuring input or as input for the external zero mark)
13	DI/DO 11	В	Digital input/output 11 (can also be used as input for measuring input or as input for the external zero mark)
14	М	GND	Ground

Table 3-10 Digital inputs/outputs X122

¹⁾ DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M1: Ground reference

²⁾ B = Bidirectional; I = Input; GND = Reference potential (ground)

Table 3- 11 Digital inputs/outputs X	132	Itputs X	inputs/ou	Digital	Table 3-11
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Pin	Designation 1)	Signal type	Notes
1	DI 4	I	Digital input 4
2	DI5	Ι	Digital input 5
3	DI 6	I	Digital input 6
4	DI 7	Ι	Digital input 7
5	DI 20	Ι	Digital input 20
6	DI 21	Ι	Digital input 21
7	M2	GND	Ground for DI 4 – DI 7, DI 20, DI 21 (electrically isolated relative to M)
8	М	GND	Ground
9	DI/DO 12	В	Digital input/output 12 (can also be used as input for measuring input or as input for the external zero mark)
10	DI/DO 13	В	Digital input/output 13 (can also be used as input for measuring input or as input for the external zero mark)

Interfaces

3.5 Digital inputs/outputs

Pin	Designation ¹⁾	Signal type	Notes
11	М	GND	Ground
12	DI/DO 14	В	Digital input/output 14 (can also be used as input for measuring input or as input for the external zero mark)
13	DI/DO 15	В	Digital input/output 15 (can also be used as input for measuring input or as input for the external zero mark)
14	М	GND	Ground

¹⁾ DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M2: Ground reference

²⁾ B = Bidirectional; I = Input; GND = Reference potential (ground)

Note

An open input is interpreted as "low".

To enable the digital inputs to work, terminal M1 or M2 must be connected. The following alternatives are available:

- Connect the carried digital input reference ground to M1 or M2.
- Insert a bridge between terminals M and M1 (or between M and M2). This removes the electrical isolation for these digital inputs.

Pin	Designation ¹⁾	Signal type	Notes
1			Reserved, do not use
2			Reserved, do not use
3	IN/OUT 0	В	Digital input/output 0 (can be used as input of a measuring input or output of an output cam)
4	IN/OUT 1	В	Digital input/output 1 (can be used as input of a measuring input or output of an output cam)
5	М	GND	Ground
6	IN/OUT 2	В	Digital input/output 2 (can be used as input of a measuring input or output of an output cam)
7	IN/OUT 3	В	Digital input/output 3 (can be used as input of a measuring input or output of an output cam)
8	М	GND	Ground
9	IN/OUT 4	В	Digital input/output 4 (can be used as input of a measuring input or output of an output cam)
10	IN/OUT 5	В	Digital input/output 5 (can be used as input of a measuring input or output of an output cam)
11	М	GND	Ground
12	IN/OUT 6	В	Digital input/output 6 (can be used as input of a measuring input or output of an output cam)

Table 3- 12	Digital inputs/outputs X142
-------------	-----------------------------

3.5 Digital inputs/outputs

Pin	Designation 1)	Signal type	Notes
13	IN/OUT 7	В	Digital input/output 7 (can be used as input of a measuring input or output of an output cam)
14	М	GND	Ground

¹⁾ IN/OUT: Bidirectional digital input/output; M: Electronic ground

²⁾ B = Bidirectional; GND = Reference potential (ground)

3.5.2 Using the digital inputs/outputs

Connecting sensors and actuators

Digital inputs and digital outputs can be used to connect various sensors and actuators to the three 14-pin X122, X132 and X142 front connectors.

The following types of digital inputs/outputs are available:

- Digital inputs (DI)
- Bidirectional digital inputs/outputs (DI/DO, IN/OUT)

Bidirectional digital inputs and outputs can be configured individually as digital inputs or outputs.

Assignment of the inputs/outputs to functions can be parameterized as required. Special functions (e.g. input of measuring input and output for output cam) can be assigned to the inputs/outputs.

The digital inputs/outputs on the X122 and X132 front connectors can be used by either SIMOTION or SINAMICS (e.g. as enable signal for a drive).

The digital inputs/outputs on the X142 front connector are firmly allocated to SIMOTION.

	DI 0-7, DI 17, DI 18, DI 20, DI 21 (X122, X132)	DI/DO 8-15 (X122, X132)	IN/OUT 0-7 (X142)
Galvanic isolation	Electrically isolated (ground reference M1 or M2)	Non-isolated (ground reference M)	Non-isolated (ground reference M)
Use as:			
Freely addressable I/Os for SIMOTION	Yes	Yes	Yes
• I/Os that are assigned to the drive	Yes	Yes	No
Measuring inputs	No	Yes (global and local measuring inputs)	Yes (global measuring inputs)

Table 3-13 Use of the digital inputs/outputs

3.5 Digital inputs/outputs

	DI 0-7, DI 17, DI 18, DI 20, DI 21 (X122, X132)	DI/DO 8-15 (X122, X132)	IN/OUT 0-7 (X142)
Inputs for the external zero mark	No	Yes	No
Outputs of output cams / fast DO	No	No	Yes
Configuration:			
Assignment	Can be configured channel-by-channel on the drive	Can be configured channel-by-channel on the drive	Can be configured channel-by-channel in HW Config

Note

For optimal noise immunity of the digital inputs, the use of shielded cables is necessary if they are to be used as

- Inputs of measuring inputs or
- Inputs for the external zero mark

Additional references

For information on configuring the digital inputs/outputs as freely addressable I/Os, inputs of measuring inputs or outputs of output cams, see the *SIMOTION D4x5-2* Commissioning and Hardware Installation Manual.

For information on the configuration and function of the measuring input, output cam, and cam track technology objects, refer to the *SIMOTION Output Cams and Measuring Inputs* Function Manual.

3.6 Power supply

This interface is provided for connection of the external power supply.

Note

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

Characteristics of the interface

Table 3- 14 Interface X124

Characteristics	Туре
Connector type	Combicon
Connection possibility	Up to 2.5 mm ²
Max. current carrying capacity incl. loop-through	20 A
Max. cable length	10 m

Interface assignments

Table 3-15 Power supply X124

Pin	Signal name	Meaning
1	P24	24 V power supply
2	P24	24 V power supply
3	Μ	Ground
4	Μ	Ground

Note

The 24 V is looped through via the 24 V connector. In this case, pin 1 is jumpered with pin 2, and pin 3 is jumpered with pin 4 in the connector. The maximum current can be limited through the current carrying capacity of the cable. The current carrying capacity of the cable depends, for example, on the type of cable installation (cable duct, laying on a cable rack, etc.)

3.7 PROFIBUS DP interfaces

Position of power supply interface

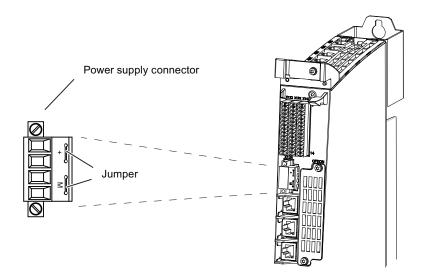


Figure 3-6 Position of the power supply interface

Note

The power supply terminal strip must be screwed on tightly using a flat-bladed screwdriver.

3.7 PROFIBUS DP interfaces

Characteristics of the interface

Table 3-16 Interfaces X126 and X136

Characteristics	Туре
Connector type	9-pin Sub-D socket
Cable type	PROFIBUS cable
Max. cable length	100 m at 12 Mbit/s

Position of connectors

The following figure shows the mounting position and designation of the connectors on the control unit.

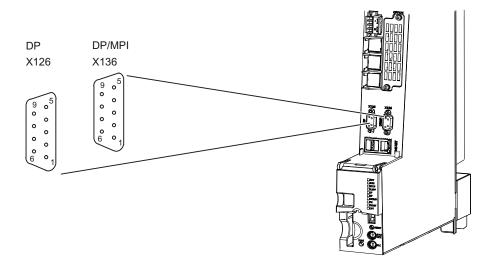


Figure 3-7 Position of the PROFIBUS interfaces X126, X136

Interface assignment for X126

Pin	Signal name	Signal type	Meaning
1			Reserved, do not use
2	Μ	VO	Ground to P24_SERV
3	1RS_DP	В	RS-485 differential signal
4	1RTS_DP	0	Request to send
5	1M	VO	Ground to 1P5
6	1P5	VO	5 V power supply for bus terminal, external, short-circuit proof
7	P24_SERV	VO	24 V for teleservice, short-circuit proof, 150 mA maximum
8	1XRS_DP	В	RS-485 differential signal
9			Reserved, do not use
The 1P5 voltage is provided exclusively for the bus terminal.			
No OLF	No OLPs are permitted.		
Signal type: VO = Voltage output (power supply) O = Output B = Bidirectional			

Table 3- 17 PROFIBUS DP interface X126

Interfaces

3.7 PROFIBUS DP interfaces

Interface assignment for X136

Pin	Signal name	Signal type	Meaning
1			Reserved, do not use
2	Μ	VO	Ground to P24_SERV
3	2RS_DP	В	RS-485 differential signal
4	2RTS_DP	0	Request to send
5	1M	VO	Ground to 1P5
6	1P5	VO	5 V power supply for bus terminal, external, short-circuit proof
7	P24_SERV	VO	24 V for teleservice, short-circuit proof, 150 mA maximum
8	2XRS_DP	В	RS-485 differential signal
9			Reserved, do not use
The 1P5 voltage is provided exclusively for the bus terminal. No OLPs are permitted.			
Signal type: VO = Voltage output (power supply) O = Output B = Bidirectional			

Table 3-18 PROFIBUS DP interface X1

Connectable devices

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

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

Note

A teleservice adapter can only be connected to one of the two interfaces.

A detailed, regularly updated list of the modules approved for use with SIMOTION, as well as notes on their use, can be found on the Internet at (http://support.automation.siemens.com/WW/view/en/11886029):

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

3.8 Slot for CompactFlash Card

Characteristics

Type: 50-pin connector

This interface should only be used to insert a special SIMOTION CompactFlash card (CF card).

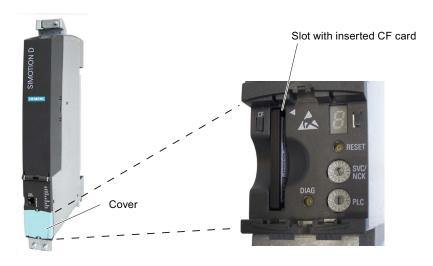


Figure 3-8 Slot for the CF card

Consult the relevant references for detailed information about the SIMOTION CF card in Section CompactFlash card (Page 28).

3.9 Measuring sockets

Application

The measuring sockets X141 (T0, T1 and T2) are on the lower side of the module and are used to output analog signals. Any interconnectable signal can be output via SINAMICS on every measuring socket on the control unit.

3.9 Measuring sockets

Interface assignments

	Socket	Function	Technical specifications
	ТО	Measuring socket 0	Voltage: 0 V to 5 V
	T1	Measuring socket 1	Resolution: 8 bits
	T2	Measuring socket 2	Load current: Max. 3 mA Continuous short-circuit-proof
	М	Ground	Reference potential is terminal M
The measuring sockets are suited for multiple-spring wire connectors with a diameter of 2 mm.			

Table 3- 19 Measurii	ng sockets 10, 11, 12	2
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Note

The measuring sockets support commissioning and diagnostic functions. Connection for normal operation is not permitted.

Measuring socket position

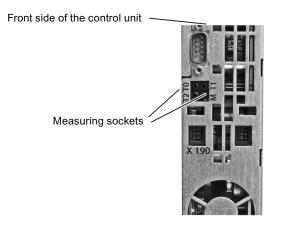


Figure 3-9 Measuring socket position

3.10 USB interfaces

The USB interfaces are used for upgrading the SIMOTION D4x5-2 via a USB stick.

Table 3- 20 Interfaces X125 and X135

Characteristics	Versions
Connector type	Double USB socket – type A
Version	USB 2.0
Power supply	5 V (short-circuit proof)
Current carrying capacity	0.5 A per channel

The USB interfaces are located on the front of the SIMOTION D4x5-2.

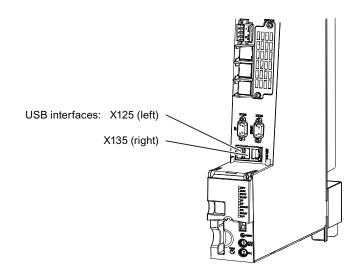


Figure 3-10 Position of the USB interfaces X125, X135

Interfaces

3.10 USB interfaces

Technical data of the D4x5-2

4.1 Shipping and storage conditions

Shipping and storage conditions

With regard to shipping and storage conditions, the SIMOTION D4x5-2 surpasses the requirements specified in EN 61131-2.

The following conditions apply to modules that are shipped and stored in the original packaging.

Conditions

Type of condition	Permissible range/class		
	Transport	Long-term storage	
Climate class	2K4 acc. to EN 60721-3-2	1K4 acc. to EN 60721-3-1	
Temperature	From -40° C to +70° C	From -25° C to +55° C	
Relative humidity	From 5% to 95%	From 10% to 100%	
Height	Max. 5000 m above sea level Note: Max. 4000 m for SINAMICS S120 drive components (motor modules, etc.) ¹⁾		
Atmospheric pressure	• > 620 hPa	• > 620 hPa	
	• < 1060 hPa	• < 1060 hPa	
	The specified values apply to a transportation altitude of up to 4000 m	The specified values apply to a storage altitude of up to 4000 m	
Biological environmental conditions	Class 2B1 acc. to EN 60721-3-2	Class 1B1 acc. to EN 60721-3-1	
Chemically active environmental conditions	Class 2C2 acc. to EN 60721-3-2	Class 1C2 acc. to EN 60721-3-1	

Table 4-1 Shipping conditions

¹⁾ Details can be found in the *SINAMICS S120 Control Units and Supplementary System Components*Manual

4.2 Mechanical and climatic ambient conditions

Shipping backup batteries

Backup batteries may only be shipped in the original packaging. No special authorization is required to ship backup batteries. The lithium content of the backup battery is approximately 300 mg.

Note

The backup battery is classified as a hazardous substance, Class 9 in accordance with the relevant air-freight transportation regulations.

Information on handling backup batteries can be found in Chapter "Supplementary system components" of this manual in Section Replacing the battery in the fan/battery module

Storage of backup batteries

Always store backup batteries in a cool and dry place. The batteries have a maximum shelf life of 10 years.

Note

If you have a spare parts inventory, you must not store a SIMOTION D4x5-2 with the fan/battery module mounted. Only connect the fan/battery module if the fan or battery backup voltage is required.

See also

Fan/battery module (Page 79) Replace battery in the fan/battery module (Page 82)

4.2 Mechanical and climatic ambient conditions

Conditions of use

SIMOTION D4x5-2 is designed for use in stationary, weather-protected locations. Operating conditions surpass EN 61131-2 requirements.

4.2 Mechanical and climatic ambient conditions

Use prohibition

SIMOTION D4x5-2 must not be used in the following applications without additional measures:

- 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 installations in particularly hazardous rooms

An additional measure for using SIMOTION D4x5-2 can, for example, be installation in cabinets.

Ambient conditions for operation

SIMOTION D4x5-2 may be used under the following ambient conditions:

Table 4- 2 Environmental requirements			
Ambient conditions	Application range	Comments	
Climatic ambient conditi	ons		
Climate class	3K3	According to EN 60721-3	
Permissible ambient temperature: During operation when	From 0° C to +55° C, up to 2000 m above sea level	As of an altitude of 2000 m, the max. ambient temperature decreases by 7° C every 1000 m increase in altitude.	
installed vertically		The maximum supply air temperature for all modules is 55° C.	
		A fan/battery module is always required for SIMOTION D445-2 DP/PN and D455-2 DP/PN.	
Relative humidity	From 5% to 90%		
Condensation, icing, drip, spray and splash water	Not permissible		
Installation altitude	Max. 5000 m above sea level	Max. 4000 m installation altitude for SINAMICS S120 drive components (motor modules, etc.) ¹⁾	
Atmospheric pressure	620 hPa to 1060 hPa	Corresponding height 4000 m - 0 m above mean sea level	
Biological, chemical and mechanical influences, pollutants			
Biological environmental conditions		 Class 3B1 according to EN 60 721-3-3; Mold, mold growth, slime, rodents, termite and other animal vermin are not permissible. 	

4.3 Dimensions and weights

Ambient conditions	Application range	Comments	
Chemically active environmental conditions		Class 3C1 according to EN 60721-3-3	
Mechanically active environmental conditions		Class 3S1 according to EN 60721-3-3, conductive dust not permitted	

¹⁾ Details can be found in the *SINAMICS S120 Control Units and Supplementary System Components*Manual

Other data

Table 4-3 Other data

Data	
Degree of protection according to EN 60529 (IEC 60529)	IP 20
Pollution degree	2 according to EN 60 664-1

4.3 Dimensions and weights

Dimensions and weights

Table 4- 4	Dimensions and weight of a SIMOTION D4x5-2
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Parameter	SIMOTION D445-2 DP/PN	SIMOTION D455-2 DP/PN
Dimensions W x H x D [mm]		
• Without fastening using spacers, without fan/battery module	50 x 380 x 230	50 x 380 x 230
With fastening using spacers, without fan/battery module	50 x 380 x 270	50 x 380 x 270
Weight [g] - Without packaging - With packaging	Approx. 4.4 kg Approx. 5.0 kg	Approx. 4.4 kg Approx. 5.0 kg

Note

With the D445-2 DP/PN and D455-2 DP/PN, the spacers can only be removed with the "external air cooling" installation method. In this installation method, the cooling fins are inserted through a cutout in the rear cabinet panel.

For further details, see the *SIMOTION D4x5-2* Commissioning and Hardware Installation Manual.

4.4 Power supply

External 24 V power supply

The control unit is supplied by an external 24 V power supply (e.g. SITOP).

The tolerance range for the input voltage of the SIMOTION D4x5-2 is between 20.4 and 28.8 VDC.

Table 4- 5	Power supply data
	i ower ouppiy dutu

Data	SIMOTION D445-2 DP/PN	SIMOTION D455-2 DP/PN
Power supplyRated valuePermissible range	Safety extra-low voltage DVC A (PELV) 24 VDC (20.4 28.8 V)	
Current consumption, typically 1)	1.9 A	1.9 A
Starting current, typically ¹⁾	5 A	5 A
Power loss, typically 1)	46 W	46 W

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

Table 4- 6Specification of the input voltage and input current

	Input voltage		Typical current o	onsumption ¹⁾	Maximum curren	t consumption
Device type	D445-2 DP/PN	D455-2 DP/PN	D445-2 DP/PN	D455-2 DP/PN	D445-2 DP/PN	D455-2 DP/PN
Minimum input voltage	20.4 V	20.4 V	2.24 A	2.24 A	18.35 A	18.35 A
Nominal Input voltage	24 V	24 V	1.9 A	1.9 A	15.6 A	15.6 A
Maximum input voltage	28.8 V	28.8 V	1.58 A	1.58 A	13 A	13 A

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

Note

If the D4x5-2 detects undervoltage, the module performs a RESET. If all LEDs are OFF, either there is no power supply or the voltage level is too low.

When the voltage level is in the permissible range again, the D4x5-2 restarts.

Undervoltages are detected when:

- The voltage level of the 24 V supply falls below the minimum permissible input voltage of the D4x5-2.
- A temporary voltage dip (> 3 ms) results in the supply falling below the minimum permissible input voltage on the D4x5-2.

4.5 Interfaces and performance features

Additional references

Recommended power supply units and tables for calculating the current consumption for the assembly with SINAMICS S120 modules can be found in the "Control cabinet installation and EMC booksize" chapter in the *SINAMICS S120 Booksize Power Units* Manual.

4.5 Interfaces and performance features

Memory for system data

Data	Memory size SIMOTION D445-2 DP/PN	Memory size SIMOTION D455-2 DP/PN
Diagnostics buffer (protected against power failure)	200 messages (SIMOTION) 200 messages (SINAMICS Integrated)	200 messages (SIMOTION) 200 messages (SINAMICS Integrated)
RAM (working memory) ¹⁾	128 MB	256 MB
RAM disk (load memory)	50 MB	70 MB
Retentive memory	512 KB	512 KB
Persistent memory (user data on CF) $^{2)}$	300 MB	300 MB

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

¹⁾ A separate 20 MB of working memory is available for Java applications.

²⁾ These figures relate to CF cards with a capacity of 1 GB. If the "Upgrade SIMOTION devices" function is used, the downgrade option requires CF cards with double the memory requirement for "each switch position". The 300 MB persistent memories can therefore only be achieved with CF cards with at least 1 GB memory capacity.

PLC and motion control performance

Table 4-8	Maximum number of axes and minimum cycles for D4x5-2
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Data	SIMOTION D445-2 DP/PN	SIMOTION D455-2 DP/PN
Maximum number of axes	64	128
Minimum PROFIBUS cycle	1 ms	1 ms
Minimum PROFINET transmission cycle	0.25 ms	0.25 ms
Minimum servo/interpolator cycle clock	0.5/0.25 ms ¹⁾	0.5/0.25 ms ¹⁾

- ¹⁾ Explanation:
- 0.5 ms in conjunction with SINAMICS S120 (incl. SINAMICS Integrated / CX32-2)
- 0.25 ms in conjunction with SERVOfast and IPOfast for high-speed I/O processing or highperformance hydraulic applications. The sensors and actuators are connected via high-speed PROFINET IO I/O modules.

4.5 Interfaces and performance features

Integrated drive control

Table 4-9 Controls for integrated drives

Data	SIMOTION D445-2 DP/PN	SIMOTION D455-2 DP/PN
Max. number of axes for integrated drive control (servo/vector/ <i>V/f</i>)	6 / 6 / 12 (alternative) Drive control based on CU320-2, firmware version 4.x	6 / 6 / 12 (alternative) Drive control based on CU320-2, firmware version 4.x

Communication

Table 4- 10 Interfaces

Data	SIMOTION D445-2 DP/PN	SIMOTION D455-2 DP/PN
DRIVE-CLiQ interfaces	6	6
Ethernet interfaces	2	2
PROFIBUS interfaces 1)	2	2
PROFINET interfaces 2)	1 interface with 3 ports, onboard	1 interface with 3 ports, onboard

¹⁾ Supports PROFIBUS DP, isochronous, can be configured either as master or slave

²⁾ Supports PROFINET IO with IRT and RT, can be configured as PROFINET IO controller and/or device

Address space

Table 4- 11	Address space
	7 1001 000 00000

Address space	SIMOTION D445-2 DP/PN	SIMOTION D455-2 DP/PN
Logical I/O address space in KB	16 KB	16 KB
Physical I/O address space in KB		
• PROFIBUS (for each interface): Max. for inputs and outputs respectively:	• 1 Kbyte ¹⁾	• 1 Kbyte ¹⁾
PROFINET: Max. for inputs and outputs respectively:	• 4 KB ¹⁾	• 4 KB ¹⁾
Permanent process image for BackgroundTask (I/O variables)	64 bytes	64 bytes
Additional configurable process image for each cyclic task (I/O variables)	Yes	Yes
Address space for each PROFIBUS DP station	244 bytes	244 bytes

Technical data of the D4x5-2

4.5 Interfaces and performance features

Address space for each SINAMICS Integrated/CX32-2 (PROFIBUS Integrated)	512 bytes	512 bytes
Address space for each PROFINET device	1400 bytes	1400 bytes

¹⁾ When PROFIBUS and PROFINET are used, the total address space applies

Digital inputs

Table 4- 12 Digital inputs on SIMOTION D4x5-2

Data	SIMOTION D445-2 DP/PN	SIMOTION D455-2 DP/PN
Digital inputs	12	12
Rated value	24 VDC	24 VDC
For signal "1"	15 30 V	15 30 V
• For signal "0" ²⁾	-3 +5 V	-3 +5 V
Galvanic isolation	Yes, in groups of 6 ¹⁾	Yes, in groups of 6 ¹⁾
Current consumption typ. at signal level "1"	9 mA at 24 V	9 mA at 24 V
Input delay, typ. (hardware)	L -> H: 50 µs	L -> H: 50 µs
	Η -> L: 150 μs	Η -> L: 150 μs

¹⁾ Reference potential is terminal M1 or M2

 $^{2)}\,$ The digital inputs are protected against polarity reversal up to -30 V

Digital inputs/outputs (parameterizable)

Table 4-13 Digital inputs/outputs on SIMOTION D4x5-2

Data	SIMOTION D445-2 DP/PN	SIMOTION D455-2 DP/PN
Digital inputs/outputs	16	16
	Max. 16 as inputs of measuring inputs	 Max. 16 as inputs of measuring inputs
	• Max. 8 as outputs of output cams / fast DOs	• Max. 8 as outputs of output cams / fast DOs
If used as an input		
Input voltage, rated value	24 VDC	24 VDC
Input voltage, for signal "1"	15 30 V	15 30 V
Input voltage, for signal "0" ²⁾	-3 +5 V	-3 +5 V
Galvanic isolation	No	No
Current consumption typ. at signal level "1"	9 mA at 24 V	9 mA at 24 V

4.5 Interfaces and performance features

Data	SIMOTION D445-2 DP/PN	SIMOTION D455-2 DP/PN
Input delay, typ. (hardware)	L -> Η: 5 μs Η -> L: 50 μs	L -> Η: 5 μs Η -> L: 50 μs
Input of measuring input, accuracy (reproducibility)	3)	3)
If used as an output		
Rated load voltage, permissible range	24 VDC, 20.4 28.8 V	24 VDC, 20.4 28.8 V
Galvanic isolation	No	No
Current load, max.	500 mA per output	500 mA per output
Residual current, max.	2 mA	2 mA
 Output delay, typ./max. (hardware) ¹⁾ 	L -> Η: 150/400 μs Η -> L: 75/150 μs	L -> Η: 150/400 μs Η -> L: 75/150 μs
Cam output, accuracy reproducibility, terminal X142	3)	3)
Switching frequency of the outputs, max.		
With resistive load	100 Hz	100 Hz
With inductive load	2 Hz	2 Hz
With lamp load	11 Hz	11 Hz
Short-circuit protection	Yes	Yes

 $^{1)}$ Specification for Vcc = 24 V, load 48 Ohm, H = 90% V_{Out}; L = 10% V_{Out}

 $^{2)}\,\,$ The digital inputs are protected against polarity reversal up to -30 V

 $^{3)}\,$ The values were not available at the time for going to press.

Current information

can be found at (http://support.automation.siemens.com/WW/view/en/27585482)

Other technical data

Table 4-14	Fan, non-volatile data backup and approvals
------------	---

Data	SIMOTION D445-2 DP/PN	SIMOTION D455-2 DP/PN
Fan	Double fan/battery module included in scope of delivery	Double fan/battery module included in scope of delivery
Backup time, min.Charging time, typ.	4 days (real-time clock backup) A few minutes	4 days (real-time clock backup) A few minutes
Approvals	cULus ¹⁾	cULus ¹⁾
Marking for Australia	C-Tick mark ¹⁾	C-Tick mark ¹⁾

¹⁾ The approval/marking was not available at the time for going to press. Current information is available at: http://support.automation.siemens.com/WW/view/en/27585482

4.6 CompactFlash card

If a double fan/battery module is used with a battery installed, the backup time of the realtime clock is at least 3 years.

For further technical data, such as the maximum 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 Catalog PM 21, SIMOTION Motion Control, SINAMICS S120 and Motors for Production Machines

4.6 CompactFlash card

CompactFlash card

Table 4-	15	CF	card
----------	----	----	------

Memory capacity	1 GB (order no. 6AU1400-2PA21-0AA0)
Weight	10 g

4.7 Clock

Properties of the real-time clock

The following table lists the properties and functions of the SIMOTION D clock.

Table 4- 16	Clock properties
-------------	------------------

Properties	Meaning
Туре	Hardware clock (integrated "real-time clock")
Default setting when delivered	12:00 a.m. (date 2001.01.01)
Accuracy	Max. deviation per day:
• +25° C	• ±2 s
• -40° C +85° C	• ±5 s
Backup time at least	 4 days (at 0 25° C) With double fan/battery module 3 years
Charging time	A few minutes
Backup	Maintenance-free SuperCap or battery in the double fan/battery module

With power OFF

In the POWER OFF state, the SIMOTION D clock continues to run during the backup time (with the exception of the software clock). The backup battery is recharged in the POWER ON state.

An error message is output if the backup function is defective. When the power is switched ON, the clock then resumes at the time set at the factory.

If the SIMOTION D4x5-2 is reset to its factory setting, the clock is also reset to the "default setting when delivered".

4.8 Input and output circuit

Protective circuit

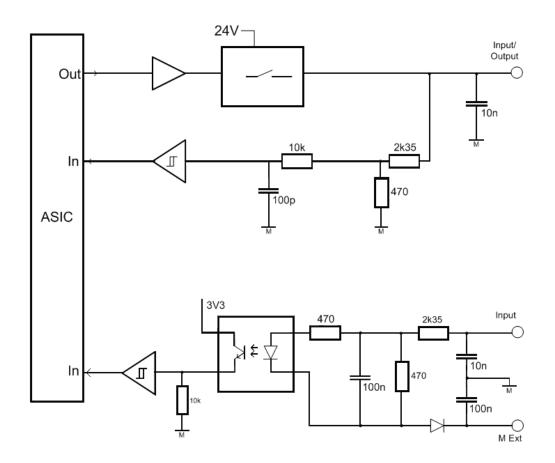


Figure 4-1 SIMOTION D4x5-2/CX32-2 input and output circuits

Technical data of the D4x5-2

4.8 Input and output circuit

Dimension drawings

5.1 Dimension drawing of D445-2 DP/PN and D455-2 DP/PN

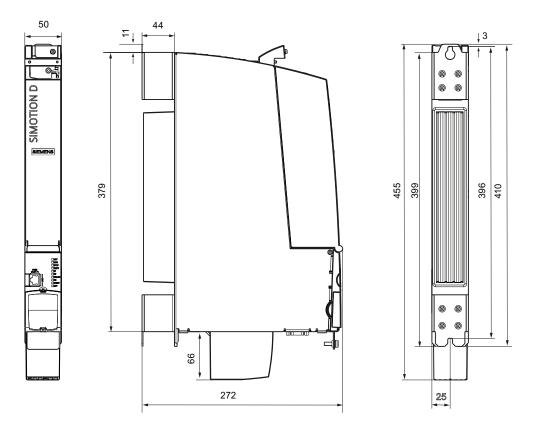


Figure 5-1 Dimension drawing of D445-2 DP/PN and D455-2 DP/PN

SIMOTION D445-2 DP/PN and D455-2 DP/PN must always be operated with a double fan/battery module.

NOTICE

The 80 mm clearances above and below the components must be observed. The unit protects itself from overheating by shutting down.

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

5.2 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 this, see the following Internet address (http://support.automation.siemens.com/WW/view/en/30559271).

Circuit-diagram macros

EPLAN circuit-diagram macros are available for SIMOTION D. The macros assist you when creating circuit diagrams. The following address will take you to the macros (http://support.automation.siemens.com/WW/view/en/31622426).

6

Supplementary system components

6.1 Supplemental system components

Supplementary system components

The following figure shows the connection of the supplementary system components. The connection is:

- Directly on the SIMOTION D module (fan/battery module)
- Via the option slot (TB30)
- Via the DRIVE-CLiQ interfaces (terminal modules, control unit adapter, ...).

Supplementary system components

6.1 Supplemental system components

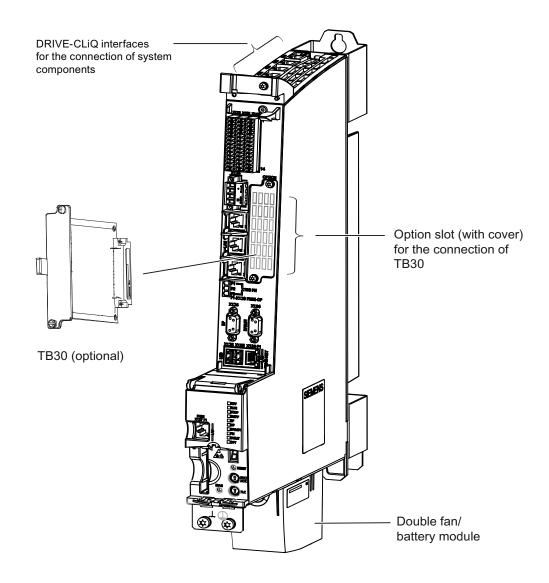


Figure 6-1 Connection of supplementary system components on the D4x5-2.

Note

The CBE30 (order no. 6FC5312-0FA00-0AA0) cannot be used with the D4x5-2.

6.2 Fan/battery module

6.2.1 Cooling the SIMOTION D4x5-2 and backing up the real-time clock

Functions of a fan/battery module

The fan/battery module has the following tasks:

- CPU cooling
- Backing up the real-time clock if the SuperCap is insufficient.

The control unit monitors the temperature and the functioning of the fan.

Cooling the SIMOTION D4x5-2

A fan/battery module is always required with SIMOTION D445-2 DP/PN and D455-2 DP/PN for the heat dissipation of the control unit.

Property	SIMOTION D445-2 DP/PN	SIMOTION D455-2 DP/PN
Fan/battery module	Always required (double fan/battery module included in the D445-2 DP/PN scope of delivery)	Always required (double fan/battery module included in the D455-2 DP/PN scope of delivery)
Usable fan/battery modules	Double fan/battery module, 6FC5 348-0AA02-0AA0	Double fan/battery module, 6FC5 348-0AA02-0AA0
Max. permissible supply air temperature	55° C	55° C
Fan control	Temperature-controlled fan unit will be switched on depending on supply air temperature and CPU load	Temperature-controlled fan unit will be switched on depending on supply air temperature and CPU load

Table 6-1 Fan/battery module for SIMOTION D4x5-2

The double fan/battery module also guarantees sufficient cooling with just one functional fan.

Note

Use of the fan/battery module **with single fan** (order no. 6FC5 348-0AA01-0AA0) on the D4x5-2 is **not** possible.

An entry is made in the diagnostic buffer when a fan fault occurs (failure of one or both fans in the double fan/battery module). The fan failure is also signaled by the generation of an event in the PeripheralFaultTask and via a system variable.

If only one of the fans fails, the remaining fan continues under full load.

If both fans fail or with overtemperature, the controller switches to RESET mode, whereby the SF LED flashes red/yellow (2 Hz) and the 7-segment display shows the state "8".

The clearance below the component is calculated from the bottom edge of the module, i.e. if there is a fan, it will not be included in the clearance.

6.2 Fan/battery module

Buffering data

For the retentive storage of process variables, the SIMOTION D4x5-2 has an NVRAM memory that permanently backs up the data against a power failure.

The real-time clock is backed up by a SuperCap and continues to run when there is a power failure. This backup is for at least four days.

If this backup time is not sufficient, the real-time clock can be backed up by a battery that is inserted in the fan/battery module. The battery is already included in the scope of delivery of fan/battery modules.

Note

The backup time when a battery is used is at least 3 years. For the replacement part case, you should back up the NVRAM data additionally on the CF card via the application ("_savePersistentMemoryData"). Temperature faults are recorded and signaled by the control.

Battery

A 3 V lithium battery can be inserted in the fan/battery module. The battery is pre-assembled with an approximately 4 cm long cable with plug connector. The appropriate mating connector is attached to a small printed circuit board for connection in the fan/battery module.

See also

Available spare parts and accessories (Page 113) Replace battery in the fan/battery module (Page 82)

6.2.2 Installing the fan/battery module

Overview

The procedure for installing the double fan/battery module is described below.

Procedure

There are cutouts on the lower side of the control unit to attach the module. Proceed as follows to install the double fan/battery module:

- 1. If required, insert a battery in the double fan/battery module.
- 2. Hold the double fan/battery module at an angle to the front with the open side facing up. The battery must be visible.

- 3. Push the plastic lug into the slot-like cutout on the lower side of the control unit.
- 4. Tilt the double fan/battery module up until the two latches snap into place at the front. Note the two contact strips that are lead through cutouts of the control unit.

This establishes the electrical connection between the double fan/battery module and the control unit.

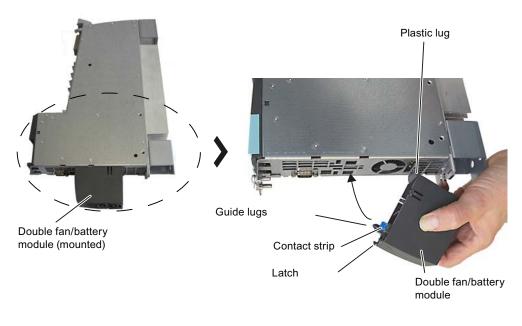


Figure 6-2 Installing the double fan/battery module

6.2.3 Replace battery in the fan/battery module

Overview

The procedure for replacing the double fan/battery module's battery is described below.

Procedure

Proceed as follows to replace the battery:

1. Press the latch. This detaches the module from its front latching device.



Figure 6-3 Unlatch the double fan/battery module

- 2. Tilt the double fan/battery module forwards at an angle and pull out the plastic lug from the control unit cutout.
- 3. Remove the battery using a screwdriver (at the side) and disconnect the battery from the module by unplugging the connector.

4. Connect the cable connector of the new battery to the mating connector in the fan/battery module and push the battery in.

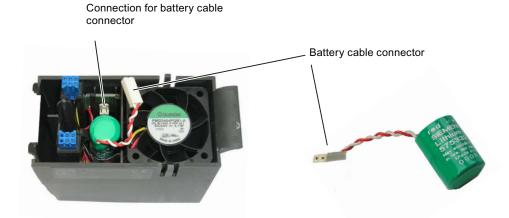


Figure 6-4 Changing the battery in the double fan/battery module

- 5. Hold the double fan/battery module at an angle to the front with the open side facing up (battery visible).
- 6. Push the plastic lug into the cutout on the lower side of the control unit.
- 7. Tilt the double fan/battery module up until the front latch snaps into place.

The electrical connection between the double fan/battery module and the control unit is made automatically.

Note

The fan/battery module should preferably be replaced in the POWER OFF state.

The battery should be replaced at least once every 3 years, at the latest when the prewarning level is reached (see *SIMOTION D4x5-2* Commissioning and Hardware Installation Manual).

Later replacement of the battery can result in a backup failure of the RTC (real-time clock) and therefore loss of the date and time!

6.2 Fan/battery module

Replacement during POWER ON

The fan/battery module should preferably be replaced in the POWER OFF state. In principle, replacement during POWER ON is possible, but the following aspects must be taken into consideration:

- If the fan/battery module is disconnected and heat dissipation is required because of the temperature conditions, a fan fault is signaled (fan fault is signaled via system variable, PeripheralFaultTask and diagnostic buffer entry; if no PeripheralFaultTask is configured, the control unit switches to STOP mode)
- With the D445-2 DP/PN and D455-2 DP/PN, the control unit switches to the RESET mode after approx. 1 minute when a fan fault occurs in order to protect itself
- During the replacement, the missing fan and battery is signaled via the system variables fanbattery.fanexisting and fanbattery.batteryexisting.

The fan/battery module should only be replaced when the CPU is in STOP mode so that there is no risk of an unintentional failure of the machine/plant.

The causes of an unintentional failure can be, for example:

- No PeripheralFaultTask has been configured; if no PeripheralFaultTask is configured, the control unit switches to STOP mode when a fan fault occurs
- A delayed replacement can result in a RESET mode
- Cables may be unintentionally disconnected during the replacement

Rules for handling backup batteries

Improper handling of backup batteries can lead to a risk of ignition, explosion and combustion. The regulations of DIN EN 60086-4, in particular regarding avoidance of mechanical or electrical tampering of any kind, must be complied with.

- Do not open a battery. Replace a faulty battery only with the same type.
- Only use a replacement from Siemens (see Section Available spare parts and accessories (Page 113)).
- Always try to return old batteries to the manufacturer or deliver these to a registered recycling company.

For information on shipping and storage of backup batteries, see Section Shipping and storage conditions.

See also

Shipping and storage conditions (Page 63)

6.3 TB30 terminal board

6.3.1 Description

The TB30 terminal board is a terminal expansion module for SIMOTION D4x5-2. The module is inserted in the option slot of the D4x5-2 control unit.

Table 6- 2	Interface	overview	of the	TB30

Туре	Quantity
Digital inputs	4
Digital outputs	4
Analog inputs	2
Analog outputs	2

6.3.2 Safety information for the TB30

CAUTION

The terminal board may only be inserted and removed when the D4x5-2 control unit and the terminal board are de-energized.

CAUTION

The TB30 must only be installed by qualified personnel. Note the ESD information, further information can be found in the Section ESD guidelines.

6.3.3 Interfaces

6.3.3.1 Overview

The following figure shows the arrangement of the interfaces on the front of the TB30.

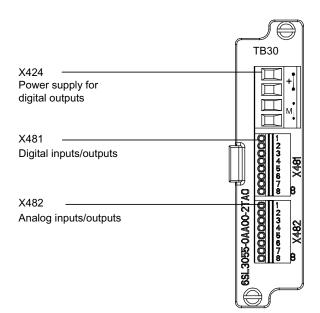


Figure 6-5 Interface arrangement on the TB30

6.3.3.2 Connection diagram

The following figure shows the schematic diagram of the TB30 as well as its connections for inputs (DI, AI), outputs (DO, AO) and power supply.

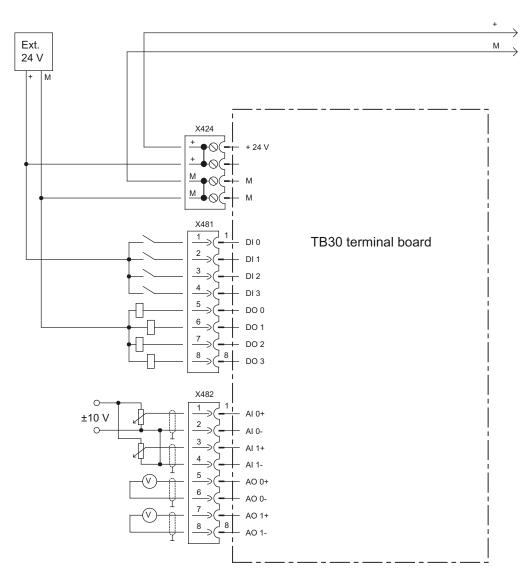


Figure 6-6 TB30 connection diagram

6.3 TB30 terminal board

6.3.3.3 Power supply of digital outputs

Table 6- 3	Terminal block X424

	Terminal	Function	Technical specifications
	+	Power supply	Voltage: 24 VDC (20.4 V – 28.8 V)
 	+	Power supply	Max. power consumption: 4 A
	М	Ground	Max. power consumption per digital output: 0.5 A
⋛⋜	Μ	Ground	Max. current via bridges in the connector: 20 A

Table 6- 4 X424 wiring

Characteristics	Туре
Connectable cable types and conductor cross-sections	
Rigid, flexible	• 0.08 mm ² to 2.5 mm ²
 with wire-end ferrule without plastic sleeve: 	 0.5 mm² to 2.5 mm²
• with wire-end ferrule and with plastic sleeve:	• 0.5 mm ² to 1.5 mm ²
Stripped length	7 mm
Tool	Screwdriver 0.6 x 3.5 m
Tightening torque	0.5 to 0.6 Nm

Characteristics

Two "+" terminals and two "M" terminals are available. These are jumpered in the connector. This loops through the power supply.

This power supply is only required for the digital outputs.

The option slot of the D4x5-2 control unit also provides the following power supplies:

- Electronic power supply of the TB30
- Supply of the analog inputs and outputs

The power supply of the digital outputs and the electronics power supply of the control unit are isolated.

6.3.3.4 Digital inputs/outputs

Table 6- 5	Terminal block X481

Terminal	Designation 1)	Technical specifications
1	DI 0	Voltage: -3 V to 30 V
2	DI 1	Typical current consumption: 10 mA at 24 VDC
3	DI 2	Ground reference: X424 (M terminal)
4	DI 3	 Input delay: L ⇒ H: approx. 20 µs H ⇒ L: Approx. 100 µs Level (including ripple): High signal level: 15 V to 30 V Low signal level: -3 V to 5 V
5	DO 0	Voltage: 24 VDC
6	DO 1	Max. load current per output: 500 mA
7	DO 2	Ground reference: X424 (M terminal)
8	DO 3	output delay:
		• L \Rightarrow H: Typically 150 µs at 0.5 A ohmic load (500 µs max.)
		• $H \Rightarrow L$: Typically 50 µs at 0.5 A ohmic load Switching frequency:
		With resistive load: Max. 100 Hz
		With inductive load: Max. 0.5 Hz
		With lamp load: Max. 10 Hz
		Maximum lamp load: 5 W

1) DI: digital input, DO: Digital output

Table 6- 6 X481 wiring

Characteristics	Туре
Connectable cable types:	Conductor cross-sections:
- Rigid	0.14 mm ² to 0.5 mm ²
- Flexible	0.14 mm ² to 0.5 mm ²
- Flexible, with end sleeve without plastic sleeve	0.25 mm ² to 0.5 mm ²
- AWG/kcmil	26 to 20
Stripped length	8 to 9 mm
Tool	Screwdriver 0.4 x 2.0 mm

Note

An open input is interpreted as "low".

The power supply and the digital inputs/outputs are isolated from the control unit.

6.3 TB30 terminal board

Note

With momentary interruptions in the 24 V supply, the digital outputs are deactivated during this time.

6.3.3.5 Analog inputs and outputs

Table 6- 7	Terminal block X482
------------	---------------------

Terminal	Designation 1)	Technical specifications
1	AI 0+	Analog inputs (AI):
2	AI 0-	 Voltage: -10 V to +10 V
3	AI 1+	 Internal resistance: 65 kΩ
4	AI 1-	Resolution: 13 bits + sign
5	AO 0+	Analog outputs (AO):
6	AO 0-	 Voltage range: -10 V to +10 V
7	AO 1+	Load current: max3 mA to +3 mA
8	AO 1-	Resolution: 11 bits + sign
		Sustained short-circuit strength

Table 6-8 X482 wiring

Characteristics	Туре	
Connectable cable types	Conductor cross-sections	
Rigid	• 0.14 mm ² to 0.5 mm ²	
Flexible	• 0.14 mm ² to 0.5 mm ²	
• Flexible, with wire-end ferrule without plastic sleeve	• 0.25 mm ² to 0.5 mm ²	
AWG / kcmil	• 26 to 20	
Stripped length	8 to 9 mm	
Tool	Screwdriver 0.4 x 2.0 mm	

Note

An open input is interpreted as approximately "0 V".

The power supply of the analog inputs/outputs of the TB30 is via the option slot of the D4x5-2 control unit and not via X424.

The shield is connected to the control unit. For further information on "Creating a shield connection", see *SIMOTION D4x5-2* Commissioning and Hardware Installation Manual, Section "Connecting".

CAUTION

The common-mode range must not be infringed.

The analog differential voltage signals can have a maximum offset voltage of ± 30 V with respect to the ground potential. If the range is infringed, incorrect results may occur during analog/digital conversion.

6.3.3.6 Working with analog inputs

The following reference contains more information about analog inputs:

- /IH1/ SINAMICS S120 Commissioning Manual.
- /GH1/ SINAMICS S120 Control Units and Additional System Components Manual

6.3.3.7 Commissioning

Information about commissioning can be found in the *SIMOTION D4x5-2*Commissioning and Hardware Installation Manual.

6.3.4 Technical Specifications

Table 6- 9	Technical data of the TB30

	Unit	Value
Electronic power supply:		
- Voltage	VDC	24 (20.4 28.8)
- Current via the option slot of the D4x5-2 (without digital outputs)	A _{DC}	0.05 < 3
- Power loss		
Response time	The response time of digital inputs/outputs and analog inputs/outputs depends on the evaluation on the control unit (see function diagram).	
	References: SINAMICS S120/S150 List I	Vianual, Chapter "Function diagrams"
Dimensions (H x W x D), approx.	mm	25 x 95 x 143
Weight	g	100

6.4 CX32-2 controller extension

6.4.1 Overview of CX32-2

Properties

The CX32-2 (order no. 6AU1432-0AA00-0AA0) is a module in the SINAMICS S120 booksize format. The CX32-2 allows scaling for the drive-end computing performance of the SIMOTION D4x5-2 control units.

Each CX32-2 can control up to six additional servo, six vector or twelve Mf axes. The controller extension has six DI, four DI/DO and four DRIVE-CLiQ interfaces.

Note

The CX32 (order no. 6SL3040-0NA00-0AA0) cannot be used with the D4x5-2. If an incorrect controller extension is used, a topology error is signaled (F01360 Topology: Invalid actual topology).

Drive quantity structure

Characteristic	Quantity structure	
Number of CX32-2	D445-2 DP/PN: Max. 5 CX32-2 D455-2 DP/PN: Max. 5 CX32-2	
Max. number of drives on the SINAMICS Integrated with connected CX32-2	 6 servo or 6 vector or 12 <i>Nf</i> incl. an infeed (ALM, BLM, SLM) 	
Max. number of drives per CX32-2	 6 servo or 6 vector or 12 <i>Vlf</i> incl. an infeed (ALM, BLM, SLM) 	
Supplementary conditions	Of which max. six drives with safety extended functions (see also the following SIZER section for a detailed dimensioning)	

Table 6- 10 Drive quantity structure

Note

In principle, a sixth CX32-2 can be connected to a D445-2 DP/PN and D455-2 DP/PN. Note however that no further drives can then be connected on the SINAMICS Integrated of the D4x5-2. Possible fields of application, for example, are modular machine concepts with a central controller.

Note

Mixed operation of servo and vector-controlled drives

Mixed operation of servo and vector-controlled drives is not possible on a CX32-2. Therefore, drives on a CX32-2 must be operated either in servo or in vector mode only. The following mixed operation is possible on a CX32-2:

- Servo and *VF*-controlled drives
- Vector and *Vf*-controlled drives

This corresponds to the possible mixed operation on the SIMOTION D4x5-2.

Mf controlled drives

A maximum of twelve *VIF* controlled drives are supported by each CX32-2.

SIZER

For a detailed estimation of the drive quantity structures, we recommend that you use the SIZER configuration tool.

With SIZER, you can easily configure the SINAMICS S120 drive family including SIMOTION. It provides you with support for selecting and dimensioning the components required for a Motion Control task.

You can also determine the possible number of axes and the resulting load with SIZER in accordance with your performance requirements.

6.4.2 Interfaces

6.4.2.1 Overview of interfaces

Position of the interfaces

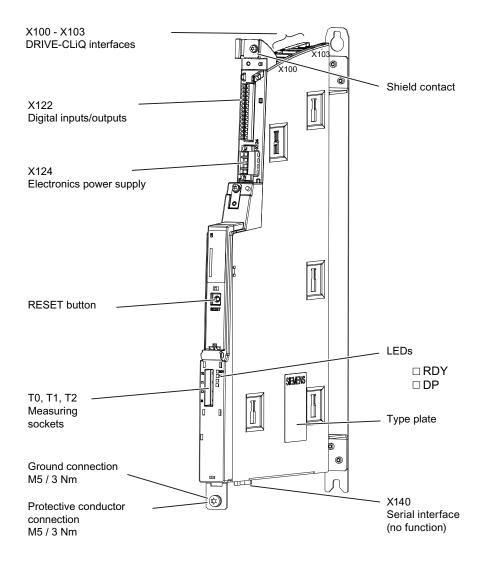


Figure 6-7 CX32-2 (without cover) with interfaces and operator control

The cooling clearances of 80 mm above and below the components must be observed.

6.4.2.2 List of interfaces

The CX32-2 has the following interfaces:

- 4 DRIVE-CLiQ interfaces
- 4 digital inputs/outputs
- 6 digital inputs
- Power supply connector

Available interfaces

Table 6- 11	Overview of available interfaces

Interface	Name	Connector type
DRIVE-CLiQ interface	X100	DRIVE-CLiQ socket
DRIVE-CLiQ interface	X101	DRIVE-CLiQ socket
DRIVE-CLiQ interface	X102	DRIVE-CLiQ socket
DRIVE-CLiQ interface	X103	DRIVE-CLiQ socket
Digital inputs/outputs	X122	Mini Combicon, 3.5 mm, 1x14-pin
Power supply connector	X124	Combicon, 4-pin
	- 1	
Measuring sockets (T0, T1, T2, and M)	X131 - X134	Sockets

Non-usable interfaces

Table 6-12 Overview of interfaces that cannot be used for the CX32-2

Interface name	Interface	Connector type
RS232 interface	X140	9-pin Sub-D connector

6.4.2.3 **DRIVE-CLiQ** interface

	Pin	Signal name	Technical specifications	
	1	TXP	Transmit data +	
	2	TXN	Transmit data -	
B	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		
	A	+ (24 V)	Power supply	
	B M (0 V) Electronic ground		Electronic ground	
Dust protection blanking plugs for sealing unused DRIVE-CLiQ ports:				
Three blanking plugs contained in the CX32-2 scope of delivery				

Table 6- 13 DRIVE-CLiQ interface X100 – X103

Blanking plugs (50 pcs) order number: 6SL3066-4CA00-0AA0 .

6.4.2.4 Digital inputs/outputs (X122)

Interface characteristics

Sensors and actuators can be connected to the X122 connector via digital inputs and outputs.

Table	6-	14	X122 wiring
	•		/ · · · · · · · · · · · · · · · · · · · · ·

Characteristics	Туре
Connector type	Mini Combicon
Connectable cable types:	Conductor cross-sections:
- Rigid	0.2 mm ² to 1 mm ²
- Flexible	0.2 mm ² to 1.5 mm ²
- Flexible, with end sleeve without plastic sleeve	0.25 mm ² to 1.5 mm ²
- AWG/kcmil	24 to 16
Stripped length	8 mm
Tool	Screwdriver 0.4 x 2.0 mm
Max. current carrying capacity (ground)	6 A

Position of the connector

The X122 connection is on the front side of the CX32-2 at the top, see appropriate figure in Chapter Overview of interfaces (Page 94).

Connection and circuit diagram

The following figure shows the schematic diagram and the connection of the digital inputs/outputs on the CX32-2 and the associated external power supply.

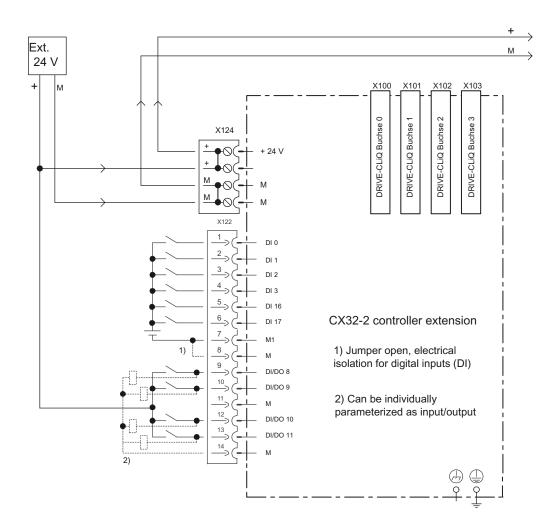


Figure 6-8 Digital inputs/outputs connection diagram

Supplementary system components

6.4 CX32-2 controller extension

Interface assignment of X122

Pin	Designation 1)	Signal type	Notes
1	DI 0	I	Digital input 0
2	DI 1	I	Digital input 1
3	DI 2	I	Digital input 2
4	DI 3	I	Digital input 3
5	DI 16	I	Digital input 16
6	DI 17	1	Digital input 17
7	M1	GND	Ground for DI 0 – DI 3, DI 16, DI 17 (electrically isolated relative to M)
8	М	GND	Ground
9	DI/DO 8	В	Digital input/output 8 (can also be used as input for measuring input or as input for the external zero mark)
10	DI/DO 9	В	Digital input/output 9 (can also be used as input for measuring input or as input for the external zero mark)
11	М	GND	Ground
12	DI/DO10	В	Digital input/output 10 (can also be used as input for measuring input or as input for the external zero mark)
13	DI/DO 11	В	Digital input/output 11 (can also be used as input for measuring input or as input for the external zero mark)
14	М	GND	Ground

 Table 6- 15
 Digital inputs/outputs X122

¹⁾ DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M1: Ground reference

²⁾ B = Bidirectional; I = Input; GND = Reference potential (ground)

Note

An open input is interpreted as "Low".

Terminal M1 must be connected for the digital inputs to function. The following alternatives are available:

- Connect the incorporated ground reference of the digital input to M1.
- Create the bridge between terminal M and terminal M1. This removes the electrical isolation for these digital inputs.

Using the digital inputs/outputs

Connecting sensors and actuators

Digital inputs and digital outputs can be used to connect various sensors and actuators to the 14-pin X122 front connector.

The following types of digital inputs/outputs are used:

- Digital inputs (DI)
- Bidirectional digital inputs/outputs (DI/DO)

Bidirectional digital inputs and outputs can be configured individually as digital inputs or outputs.

Assignment of the inputs/outputs to functions can be parameterized as required. Special functions (e.g. input of the measuring input) can be assigned to the inputs/outputs.

The digital inputs/outputs on the X122 front connector can be used by either SIMOTION or SINAMICS (e.g. as enable signal for a drive).

	DI 0-3, DI 16, DI 17 (X122)	DI/DO 8-11 (X122)		
Galvanic isolation	Electrically isolated (ground reference M1)	Non-isolated (ground reference M)		
Use as:				
Freely addressable I/Os for SIMOTION	Yes	Yes		
 I/Os that are assigned to the drive 	Yes	Yes		
Measuring inputs	No	Yes (global and local measuring inputs)		
Inputs for the external zero mark	No	Yes		
Outputs of output cams / fast DO	No	No		
Configuration:				
Assignment	Can be configured channel-by- channel on the drive	Can be configured channel-by- channel on the drive		

Table 6-16 Use of the digital inputs/outputs

Note

For optimal noise immunity of the digital inputs, the use of shielded cables is necessary in certain cases. This is necessary when the digital inputs are to be used as

- Inputs of measuring inputs or
- Inputs for the external zero mark

Additional references

For information on configuring the DI/DOs as freely addressable I/Os or as measuring inputs, see the *SIMOTION D4x5-2* Commissioning and Hardware Installation Manual.

For information on the configuration and function of the measuring input, output cam, and cam track technology objects, refer to the *SIMOTION Output Cams and Measuring Inputs* Function Manual.

6.4.2.5 Power supply

Application

This interface is provided exclusively for connection of an external power supply.

Note

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

Characteristics of the interface

Table 6- 17 Interface X124

Characteristics	Туре
Connector type	Combicon
Connection possibility	Up to 2.5 mm ²
Max. current carrying capacity incl. loop-through	20 A
Max. cable length	10 m

Interface assignments

Table 6-18 Power supply X124

Pin	Signal name	Meaning
1	P24	24 V power supply
2	P24	24 V power supply
3	М	Ground
4	М	Ground

Note

The 24 V supply voltage is looped through via the 24 V connector. In this case, pin 1 is jumpered with pin 2, and pin 3 is jumpered with pin 4 in the connector. The maximum current can be limited through the current carrying capacity of the cable. The current carrying capacity of the cable depends, for example, on the type of cable installation (cable duct, laying on a cable rack, etc.)

6.4.2.6 Measuring sockets

Application

The X131-X134 measuring sockets are used to output analog signals. Any signal interconnectable via SINAMICS can be output on any measuring socket of the CX32-2.

The measuring sockets should be used exclusively for servicing purposes.

The measurements may only be performed by appropriately trained specialists.

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

6.4.3 Displays of the LEDs

Description

Table 6- 19 CX32-2 LEDs

LED	Description
READY	Operating modes of the CX32-2
DP	Status of the communication connection between the D4x5-2 and the CX32-2

Additional references

Detailed information on the states of the status LEDs can be found in the *SIMOTION D4x5-2* Commissioning and Hardware Installation Manual, Diagnostics chapter.

6.4.4 Cause and rectification of faults

Cause and rectification of faults

The following reference contains information about the cause of faults and how they can be rectified:

• SIMOTION D4x5-2 Commissioning and Hardware Installation Manual.

6.4.5 RESET button

RESET button

The RESET button is on the front of the device under the cover.

Function of the RESET button

The following reference contains information about the RESET button function:

• SIMOTION D4x5-2 Commissioning and Hardware Installation Manual.

6.4.6 Commissioning

Information on the commissioning in the following reference: *SIMOTION D4x5-2* Commissioning and Hardware Installation Manual.

6.4.7 Technical data of the CX32-2

Memory for system data

Table 6- 20 Diagnostic buffer

Data	SIMOTION CX32-2
Diagnostics buffer (protected against power failure)	200 messages

The data for the CX32-2 is stored on the SIMOTION D4x5-2, which means no action has to be taken on the CX32-2 when the module is replaced.

Dimensions and weights

Table 6- 21	Dimensions and weight of a SIMOTION CX32-2
	Dimensions and weight of a Onno Hort OXO2 2

Parameter	SIMOTION CX32-2
Dimensions W x H x D [mm] (max. expansion)	
• Without fastening using spacers	• 25 x 380 x 230
With fastening using spacers	• 25 x 380 x 270
Weight CX32-2 [g]	
without packaging	• approx. 2600
with packaging	• approx. 3150

Ambient conditions

The following conditions apply to modules that are shipped and stored in the original packaging.

Table 6-22 CX32-2 environmental requirements

Parameter	Values
Permissible ambient temperature	
Transport	• -40° C +70° C
Long-term storage	• -25° C +55° C
Operation	 0° C +55° C up to 2000 m above sea level. As of an altitude of 2000 m, the maximum ambient temperature decreases by 7° C every 1000 m increase in altitude
Atmospheric pressure	620 1060 hPa
Permissible relative humidity	
During transport and storage	• 10 % 100 %
• During operation (condensation, icing, drip, spray and splash water not permitted)	• 5 % 90 %
Installation altitude	5000 m max. above sea level ¹⁾
Biological environmental conditions	
Storage	Class 1B1 according to EN 60 721-3-1
Transport	Class 2B1 according to EN 60 721-3-2
Operation	Class 3B1 according to EN 60 721-3-3

Parameter	Values
Degree of protection according to EN 60529 (IEC 60529)	IP20
Pollution degree	2 according to EN 60 664-1

¹⁾ The max. installation altitude for SINAMICS S120 drive components (motor modules, etc.) is 4000 m.

Details can be found in the SINAMICS S120 Control Units and Supplementary System Components Manual.

Integrated drive control

Table 6- 23Controls for integrated drives

Data	SIMOTION CX32-2
Max. number of axes for integrated drive control (servo/vector/ <i>VIf</i>)	6 / 6 / 12 (alternative) Drive control based on CU320-2, firmware version 4.x

Communication

Table 6- 24	Interface	communication
-------------	-----------	---------------

Data	SIMOTION CX32-2
DRIVE-CLiQ interfaces	4

General technical data

Table 6-25 Technical data (general)

Data	SIMOTION CX32-2
Power supply	
Rated value	24 VDC
Permissible range	(20.4 28.8 V)
Current consumption, typically 1)	300 mA
Starting current, typical	1.6 A
Power loss, typical	7 W
Power loss, max.	14 W

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

Digital inputs

Table 6- 26	Digital inputs on SIMOTION CX32-2
-------------	-----------------------------------

Data	SIMOTION CX32-2
Digital inputs	6
Rated value	24 VDC
• For signal "1"	15 30 V
• For signal "0" ²⁾	-3 +5 V
Galvanic isolation	Yes, in groups of 6 ¹⁾
Current consumption typ. at High level	9 mA at 24 V
Input delay, typical (hardware)	L -> H: 50 μs H -> L: 150 μs

¹⁾ The reference potential is terminal M1

 $^{\rm 2)}$ The digital inputs are protected against polarity reversal up to -30 V

Digital inputs/outputs (parameterizable)

Data	SIMOTION CX32-2
Number of digital inputs/outputs	4
	• Max. 4 as inputs of measuring inputs
	 Max. 0 as outputs of output cams / fast DOs
If used as an input:	
Input voltage, rated value	24 VDC
Input voltage, for signal "1"	15 30 V
Input voltage, for signal "0" ²⁾	-3 +5 V
Galvanic isolation	No
Current consumption typ. at signal level "1"	9 mA at 24 V
Input delay, typical (hardware):	L -> H: 5 µs
For DI/DO 08 - 11	Η -> L: 50 μs
Input of measuring input, accuracy (reproducibility)	3)
If used as an output	
Rated load voltage, permissible range	24 VDC, 20.4 28.8 V
Galvanic isolation	No
Current load, max.	500 mA per output
Residual current, max.	2 mA

Table 6- 27 Digital inputs/outputs on SIMOTION CX32-2

6.5 Terminal module TM31

Data	SIMOTION CX32-2
• Output delay, typ./max. (hardware) ¹⁾	L -> H: 150 µs / 400 µs
	Η -> L: 75 μs / 100 μs
Switching frequency of the outputs, max.	
• With resistive load	100 Hz
With inductive load	2 Hz
With lamp load	11 Hz
Maximum lamp load	5 W
Short-circuit protection	Yes

¹⁾ Data for: Vcc = 24 V; load 48 Ohm; H = 90% V_{out}, L = 10% V_{out}

²⁾ The digital inputs are protected against polarity reversal up to -30 V

³⁾ The values were not available at the time for going to press. Current information is available at: (http://support.automation.siemens.com/WW/view/en/27585482)

6.5 Terminal module TM31

Properties of the TM31

With the TM31 terminal module, the number of available digital inputs/digital outputs and the number of analog input/analog outputs within a drive system can be expanded. The TM31 is connected via DRIVE-CLiQ. It has two DRIVE-CLiQ interfaces for this.

The TM31 contains the following terminals:

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

Table 6-28 In	terface overview
---------------	------------------

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

Additional references

You will find detailed information about the TM31 in the

- SINAMICS S120 Control Units and Additional System Components Manual
- SIMOTION D4x5-2 Commissioning and Hardware Installation Manual.

6.6 Terminal module TM41

Properties 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, the TTL output can be used for encoder emulation. The TM41 is connected via DRIVE-CLiQ.

The TB41 contains the following terminals:

Table 6- 29 Interface overview

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

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

Additional references

You will find detailed information about the TM41 terminal module in the

- SINAMICS S120 Control Units and Additional System Components Manual
- SIMOTION D4x5-2 Commissioning and Hardware Installation Manual.

6.7 Terminal Module TM54F

Properties 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 control of Safety Integrated functions of SINAMICS.

6.7 Terminal Module TM54F

Exactly one TM54F can be assigned to each drive control (SINAMICS Integrated of a D4x5-2, CX32-2, CU320-2, etc.). Connection is via DRIVE-CLiQ. Each drive control must have its own dedicated TM54F.

Additional nodes (e.g. TMxx, SMxx, MMxx) can be connected to the same DRIVE-CLiQ line. TM54 is equipped with the following terminals:

Table 6- 30 Int	terface overview
-----------------	------------------

Туре	Quantity
Fail-safe digital outputs (F-DO)	4
Fail-safe digital inputs (F-DI)	10
Sensor ¹⁾ power supplies, dynamic response supported ²⁾	2
Sensor ¹⁾ power supplies, no dynamic response	1
Digital inputs for testing the F-DO with 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 has four fail-safe digital outputs and ten 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.

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

Additional references

You will find detailed information about the TM54F terminal module in the following sources

- SINAMICS S120 Control Units and Additional System Components Manual
- SINAMICS S120 Safety Integrated Function Manual

6.8 Terminal modules TM15 and TM17 High Feature

6.8 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 inputs and digital outputs with short signal delay times. TM15 and TM17 High Feature are connected via DRIVE-CLiQ.

TM15

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

TM15 DI/DO

Each of the 24 isolated DI/DO can be configured on a channel-specific basis as a digital input (DI) or digital output (DO). The DI/DO can be interconnected using BICO technology and thus used from the drive side as well. Unlike the TM15, measuring inputs and outputs of output cams are not available with the TM15 DI/DO.

Note: The module hardware for the TM15 and TM15 DI/DO is identical. A distinction is only made by the addition of the component in the SIMOTION SCOUT project navigator using "Insert input/output component".

TM17 High Feature

Each of the 16 DI/DO can be parameterized channel-by-channel as a digital input (DI), digital output (DO), input of a measuring input, or output of an output cam.

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 parameterizable 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

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

Additional references

You will find further information on TM15 and TM17 High Feature in the

- TM15 / TM17 High Feature Terminal Modules Manual
- *Terminal Modules TM15 and TM17 High Feature* Commissioning Manual

6.9 CUA31/CUA32 control unit adapter

6.9 CUA31/CUA32 control unit adapter

Properties of the CUA31/CUA32

You can connect power modules in blocksize format via DRIVE-CLiQ to the D4x5-2 control units using the CUA31/CUA32 adapter modules.

The CUA32 adapter module also has an additional encoder interface for a HTL, TTL or SSI encoder.

Table 6- 31 Number of interfaces on the adapter modules

Interface	CUA31	CUA32
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)	0	1
Only SSI encoders without incremental tracks may be operated.		
DRIVE-CLiQ cable length, max.	50 m / 100 m ¹⁾	100 m

¹⁾ Max. length 50 m for CUA31 with order number 6SL3040-0PA00-0AA0 Max. length 100 m for CUA31 as of order number 6SL3040-0PA00-0AA1

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.

6.10 DMC20 DRIVE-CLiQ hub

Properties

The DMC20 and DME20 DRIVE-CLiQ hub modules are used to implement point-to-point distribution of a DRIVE-CLiQ line. With the DMC20/DME20, an axis grouping can be expanded with four DRIVE-CLiQ sockets for additional subgroups.

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

The modules are especially suitable for applications which require DRIVE-CLiQ nodes to be removed in groups, without interrupting the DRIVE-CLiQ line and therefore the data exchange.

Additional references

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

Supplementary system components

6.10 DMC20 DRIVE-CLiQ hub

7

Available spare parts and accessories

7.1 Available spare parts and accessories

Table 7-1 Spare parts and accessories

Parts for the SIMOTION D4x5-2	Order number	Accessori es	Spare part
CompactFlash card (CF card) 1 GB	6AU1 400-2PA21-0AA0	x	
With drive software and SIMOTION Kernel			
Seal for external air cooling	6FC5 348-0AA07-0AA0	x	
Double fan/battery module incl. battery	6FC5 348-0AA02-0AA0		x
The double fan/battery module is already included in the scope of delivery for SIMOTION D445-2 DP/PN and D455-2 DP/PN.			
3 V lithium battery for fan/battery module	6FC5 247-0AA18-0AA0		х
Terminal kit, contains	6SL3 064-2CB00-0AA0		x
• 3 x I/O connectors for X122/X132/X142			
1 x 24 V connector for X124			
 5 x DRIVE-CLiQ blanking cover for X100-X105 			
Option slot protective cover	6SL3 064-3CB00-0AA0		x
Dust protection blanking plugs for sealing unused DRIVE-CLiQ, Ethernet or PROFINET ports			
Blanking plugs (50 pcs)	6SL3 066-4CA00-0AA0	x	x
Blanking cover for the protection of the operator controls	6SL3 064-3BB00-0AA0		x
PROFIBUS RS485 bus connector with angular cable outlet (35°) with screw-type terminals, max. transmission rate 12 Mbit/s			
Without PG/PC interface	6ES7 972-0BA41-0XA0	x	
With PG/PC interface	6ES7 972-0BB41-0XA0	х	
PROFIBUS RS485 Fast Connect bus connector with angular cable outlet (35°) with insulation displacement terminals, max. transmission rate 12 Mbit/s	6ES7 972-0BA60-0XA0	x	
Without PG/PC interface	6ES7 972-0BB60-0XA0	x	
With PG/PC interface			
RJ45 FastConnect connector for Industrial Ethernet / PROFINET			
• 145° cable outlet (preferred type when the front cover is to be c	losed)		
- 1 pack = 1 unit	6GK1 901-1BB30-0AA0	x	
- 1 pack = 10 units	6GK1 901-1BB30-0AB0	x	
180° cable outlet			

Available spare parts and accessories

7.1 Available spare parts and accessories

Parts for the SIMOTION D4x5-2	Order number	Accessori es	Spare part
- 1 pack = 1 unit	6GK1 901-1BB10-2AA0	х	
- 1 pack = 10 units	6GK1 901-1BB10-2AB0	х	
FastConnect cables for Industrial Ethernet / PROFINE	т		
IE FC Standard Cable GP 2x2	6XV1 840-2AH10	х	
IE FC Flexible Cable GP 2x2	6XV1 870-2B	x	
IE FC Trailing Cable GP 2x2	6XV1 870-2D	x	
IE FC Trailing Cable 2x2	6XV1 840-3AH10	х	
IE FC Marine Cable 2x2	6XV1 840-4AH10	x	
Stripping tool for Industrial Ethernet / PROFINET Fast	Connect cables	•	
IE FC Stripping Tool	6GK1 901-1GA00	х	

To obtain ordering data information for other SINAMICS drive components, such as line modules, motor modules, DRIVE-CLiQ cables, etc., refer to the PM 21 Catalog.

Spares On Web

Spares On Web is an information system that displays which spare parts are available for your device.

http://workplace.automation.siemens.de/sparesonweb

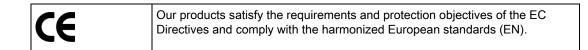
Standards and approvals

A.1 General rules

EN 61131, EN 60950

The SIMOTION programmable controller meets the requirements and criteria of the standards EN 61131 and EN 60950.

CE marking



EMC Directive

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

cULus Approval

C US	Listed component mark for United States and the Canada Underwriters Laboratories (UL) according to Standard UL 508, File E164110, File E115352, File E85972.
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EMC

USA	
Federal Communications Commission	This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when
Radio Frequency Interference Statement	the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
Shielded Cables	Shielded cables must be used with this equipment to maintain compliance with FCC regulations.

A .1 General rules

USA	
Modifications	Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.
Conditions of Operations	This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CANADA	
Canadian Notice	This Class B digital apparatus complies with Canadian ICES-003.
Avis Canadien	Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

AUSTRALIA	
C	D445-2 DP/PN, D455-2 DP/PN and CX32-2 meets the requirements of the AS/NZS CISPR 22.

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).

Electromagnetic compatibility

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

CAUTION

There is a risk of injury or of damage to assets. In hazardous areas, personal injury or damage to assets can occur if plug-in connections are disconnected during operation. Always de-energize your equipment in hazardous areas before disconnecting plug-in connections.

A.2 Safety of electronic controllers

Note

The product standard EN 61800-3 describes the EMC requirements placed on "Variablespeed 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.

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

A.2 Safety of electronic controllers

Introduction

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

Risk

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

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

A.2 Safety of electronic controllers

The residual risk

When assessing his machine's risk in accordance with the EC Machinery Directive, the machine manufacturer must take into account the following residual risks emanating from the control and drive components:

- 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 not within the scope of the specification
 - Parameterization, programming, cabling, and installation errors
 - Use of radio devices / cellular phones in the immediate vicinity of the controller
 - External influences / damage
- 2. Exceptional temperatures as well as emissions of light, noise, particles, or gas caused by, for example:
 - Component malfunctions
 - Software errors
 - Operating and/or ambient conditions not within the scope of the specification
 - External influences / damage
- 3. Hazardous shock voltages caused by, for example:
 - Component malfunctions
 - Influence of electrostatic charging
 - Induction of voltages in moving motors
 - Operating and/or ambient conditions not within the scope 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

ESD guidelines

B.1 ESD definition

What does ESD mean?

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

The acronym **ESD** has become the established designation for such **E**lectrostatic **S**ensitive **D**evices. The **ESD** designation is used internationally to refer to **e**lectrostatic **s**ensitive **d**evices.

Electrostatic sensitive devices are identified by the following symbol:



Figure B-1 Symbol for identification of electrostatic sensitive devices

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

B.2 Electrostatic charging of individuals

B.2 Electrostatic charging of individuals

Any person who is not conductively connected to the electrical potential of the environment can accumulate an electrostatic charge.

This figure indicates the maximum electrostatic charges that can accumulate on an operator when he comes into contact with the indicated materials. These values comply with the specifications in IEC 801-2.

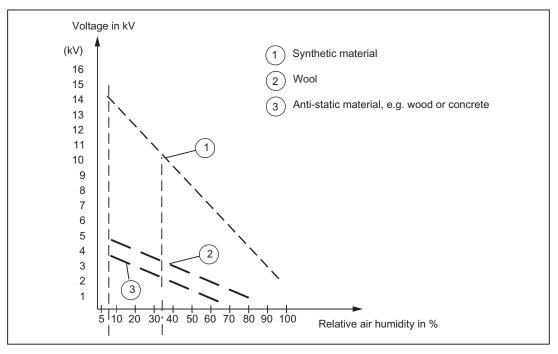


Figure B-2 Electrostatic voltage that can accumulate on operating personnel

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

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.

ESD guidelines

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

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