SIMOTION D - Drive-based

Overview

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

The SIMOTION D Control Units are available in the following variants:

- SIMOTION D410 are compact Control Units for single-axis applications and are snapped on to the SINAMICS S120 PM340 Power Modules in blocksize format.
- SIMOTION D4x5/D4x5-2 are Control Units for multi-axis applications in the SINAMICS S120 booksize format and are available in the following performance variants:
  - SIMOTION D425 (BASIC performance)
    Control Unit for up to 16 axes
  - SIMOTION D435 (STANDARD performance)
    Control Unit for up to 32 axes
  - SIMOTION D445-1 (HIGH performance)
    Control Unit for up to 64 axes
  - SIMOTION D445-2 DP/PN (HIGH performance)
    Control Unit for up to 64 axes
  - SIMOTION D455-2 DP/PN (ULTRA-HIGH performance)
    Control Unit for up to 128 axes

SIMOTION D445-2 DP/PN and D455-2 DP/PN are Control Units of the new generation. With PROFINET onboard, more onboard I/Os and a larger RAM working memory, they round off the top end of the performance range for multi-axis systems.

SIMOTION D is finely scalable – starting with the compact SIMOTION D410 Control Unit for single-axis applications up to the powerful SIMOTION D4x5-2 multi-axis system for up to 128 axes.

This flexibility ensures a quick response to changing requirements in automation without having to change the system.

Device concept

With SIMOTION D, the PLC, motion control and technology functionalities as well as the SINAMICS S120 drive software run on a shared control hardware. The IEC 61131-3-compliant PLC integrated in SIMOTION D means that the system is not just capable of controlling motion sequences, but that the entire machine can also be controlled with a single compact unit.

Depending on the SIMOTION D platform, HMI devices can be operated on the onboard PROFINET, Ethernet or PROFINET interface for operator control and monitoring. Functions such as remote maintenance, diagnostics and teleservice can also be used via these interfaces.

Benefits

- Cost-effective thanks to the integration of PLC, motion control and technology functions direct in the drive
- Employs the innovative SINAMICS S120 design
- Compact type of construction reduces control cabinet size
- Ideally suited to modular and distributed machine concepts
- User-friendly operation
- Variable networking via a wide range of communication interfaces:
  - D410: PROFIBUS DP or PROFINET IO onboard
  - D425, D435, D445-1: Industrial Ethernet and PROFIBUS DP onboard; PROFINET IO optional via CBE30 plug-in module
  - D445-2 DP/PN, D455-2 DP/PN: Industrial Ethernet, PROFIBUS DP and PROFINET IO onboard
- Powerful thanks to a range of technology functions
- Very simple engineering, from drive commissioning to open-loop control and Motion Control applications
- Easy to service thanks to the CompactFlash Card, which can be easily replaced and contains all data (programs, data, and drive parameters)
- Very dynamic because the interfaces between PLC and Motion Control are no longer required

Application

SIMOTION D can be used optimally wherever

- the SINAMICS S120 drive family is used
- the motion control and PLC functionalities are directly executed in the drive (SINAMICS S120)
- a compact, space-saving construction is required
- high performance for motion control and high-speed I/O are required
- high electromagnetic compatibility and a high resistance to shock and vibration are required due to harsh ambient conditions
- modular machine concepts with high-speed isochronous coupling is required

The flexible solution for modular machine concepts

SIMOTION D optimally supports the implementation of modular machine concepts in which single-axis drives and high-performance multi-axis drives have to be combined:

- SIMOTION D410 is the cost-effective solution for the compact design of single drives.
- SIMOTION D4x5/D4x5-2 undertakes the open and closed-loop control of the multi-axis groups.

Important applications include:

- Packaging machines
- Plastic and rubber processing machines
- Presses, wire-drawing machines
- Textile machines
- Printing machines
- Wood, glass, ceramics and stone working machines
- Converting
- Handling devices

Due to the increasing use of servo and vector drives, these machines require a high degree of integration of PLC, motion control and technology functions.
Typical design of an automation solution using SIMOTION D

**SIMOTION D components and interfaces**

- Various status/error displays
- Onboard digital inputs and outputs
- Option slot (receptacle, only for D4x5/D4x5-2), e.g. for expansion with additional I/Os with the TB30 Terminal Board
- Integrated communications interfaces for linking:
  - SINAMICS S120 drive modules
  - Distributed I/Os
  - HMI systems
  - PG/PC
  - Other motion control and automation systems
  - Other SINAMICS S110/S120 drives with digital setpoint interface
- Slot for CompactFlash Card for data backup

**Structure of a single axis with SIMOTION D410**

The following components make up a SIMOTION D410 single-axis system:

- A SIMOTION D410 Control Unit, designed for open and closed-loop control of a single axis
- A SINAMICS S120 PM340 Power Module, blocksize format (combined infeed and power module)
- Other drive components, such as
  - Power supply
  - Filter
  - Choke, etc.

The connection between SIMOTION D410 and the SINAMICS S120 PM340 Power Module is made with the integrated PM-IF interface or, when the CUA31/CUA32 Control Unit Adapter is used, via DRIVE-CLiQ.

**Structure of an axis grouping with SIMOTION D4x5/D4x5-2**

The following components comprise a SIMOTION D4x5/D4x5-2 axis grouping:

- A SIMOTION D4x5/D4x5-2 control unit, designed for open and closed-loop control of a multi-axis drive line-up
- A SINAMICS S120 Line Module (infeed module)
- One or more SINAMICS S120 Motor Modules (power modules)
- Other drive components, such as
  - Power supply
  - Filter
  - Choke, etc.

The connection between the SIMOTION D Control Unit and the SINAMICS S120 drive modules is performed via DRIVE-CLiQ.

**Note:**
SINAMICS S120 PM340 Power Modules in blocksize format can also be operated on a SIMOTION D4x5/D4x5-2 with the CUA31/CUA32 Control Unit Adapters.

**Expansion using I/O**

SIMOTION D can be expanded with the following I/O:

- Distributed I/O systems (e.g. SIMATIC ET 200S)
- Drive-based control cabinet I/O (e.g. TM15, TM31 Terminal Modules, etc.)
Function

Basic functionality

The SIMOTION D basic functionality is supplied with the CompactFlash card (CF) and is loaded when the voltage is switched on. The basic functionality includes:

- SIMOTION runtime system
  - User-programmable with several languages conforming to IEC 61131
  - Various methods of program execution (cyclic, sequential, event-driven)
  - PLC and arithmetic functionalities
  - Communication and management functions
  - Motion control functions (Motion Control Basic)

- SINAMICS S120 drive control
  - SIMOTION D410: Current/speed control (based on CU310, firmware version V2.x) for up to 1 servo axis, 1 vector axis or 1 V/f axis
  - SIMOTION D425, D435, D445-1: Current/speed control (based on CU320, firmware version V2.x) for up to 6 servo axes, 4 vector axes or 8 V/f axes, closed-loop control for infeed (Active Line Module)
  - SIMOTION D445-2 DP/PN, D455-2 DP/PN: Current/speed control (based on CU320-2, firmware version V4.x) for up to 6 servo axes, 6 vector axes or 12 V/f axes, closed-loop control for infeed (Active Line Module)

- Testing and diagnostic tools

This basic functionality can be expanded with loadable technology packages, if required.

Position-controlled motion control for drives

- Integrated drives (SINAMICS Integrated):
  The power units are connected via DRIVE-CLIQ or for the SIMOTION D410 optionally via the integrated PM-IF interface.

- Drives with digital setpoint interfaces (D4x5/D4x5-2 only): SIMOTION D enables position-controlled motion control for drives with a digital setpoint interface via PROFIBUS DP / PROFINET IO with PROFIdrive.

- Drives with analog setpoint interface (D4x5/D4x5-2 only), e.g. for retrofit or hydraulic applications:
  The ADI 4 (Analog Drive Interface for 4 Axes) or IM 174 (Interface Module for 4 Axes) module can be used to connect drives with analog ± 10 V setpoint interfaces. The IM 174 also makes it possible to connect stepper drives with a pulse direction interface.
  Both modules are connected over PROFINET BUS. The following can be connected to one ADI 4 or IM 174 module:
    - 4 drives
    - 4 encoders
    - Digital inputs and outputs

SIMOTION technology packages

A special feature of SIMOTION is that the basic functionality can be expanded by loading technology packages, such as:

- Motion Control with the technology functions:
  - POS – Positioning
  - GEAR – Synchronous operation/electronic gear
  - CAM – Cam
  - PATH – Path interpolation (not D410)
  - TControl – Temperature controller

- MIIF – Multipurpose Information Interface (D4x5/D4x5-2 only)

Since the technology functions have modular licenses, you only pay for what you will actually use.

Note

With SIMOTION D410, the Motion Control technology functions (POS/GEAR/CAM) are already included for exactly one real axis, therefore an additional license is not required for this purpose.

Performance

Hardware-supported floating-point arithmetic enables complex arithmetic functions to be used effectively.

Fast instruction execution opens up completely new application possibilities in the mid-performance to high-performance range.

Configuring/parameterizing/programming

SIMOTION SCOUT is a powerful and user-friendly engineering tool. It is an integrated system for all engineering steps, from configuring and parameterization, through programming, to testing and diagnostics. Graphical operator prompting, using dialog boxes and wizards, as well as text-based and graphical languages for programming, considerably reduce the familiarization and training periods.

Operator control and monitoring (HMI)

Communication services which support user-friendly data exchange with HMI devices are integrated in the basic functionality of SIMOTION D.

Operator control and monitoring can be implemented using SIMATIC HMI devices, such as TPs (Touch Panels), OPs (Operator Panels) or MPs (Multi Panels).

These devices can be connected to SIMOTION D over PROFINET, Industrial Ethernet (D4x5/D4x5-2 only) or PROFIBUS, and they are configured using WinCC flexible.

With the SIMATIC NET communications software, an open, standardized OPC interface is available for accessing SIMOTION from other Windows-based HMI systems.

SIMOTION IT service and diagnostic functions

SIMOTION IT provides SIMOTION D with an integrated Web server on which, for example, user-specific Web pages can be stored.

Read and write access can be made to the Control Unit variables. Java scripts or applets also allow the implementation of active operation and display functions in the Web pages that can be executed on a client PC with an Internet browser.

Process and data communication

Thanks to its integrated interfaces, SIMOTION D supports both process and data communication. The SIMOTION SCOUT engineering system is provided for user-friendly communication configuration and diagnostics.
Safety Integrated functions

The integrated safety functions of SINAMICS S120 allow SIMOTION D to provide practical, highly-effective protection for personnel and machinery.

The following Safety Integrated functions are currently available for the integrated SINAMICS S120 drive system: (Terms in accordance with IEC 61800-5-2)

- Safe Torque Off (STO)
- Safe Brake Control (SBC)
- Safe Stop1 (SS1)
- Safe Stop2 (SS2)
- Safe Operating Stop (SOS)
- Safety Limited Speed (SLS)
- Safe Speed Monitor (SSM)
- Safe Direction (SDI) (D4x5-2, CX32-2 and CU3x0-2 only)

Activation of Safety Integrated functions

Safety Integrated functions can be activated by the following methods:

- Via terminals on the Control Unit and on the power unit (STO, SBC, SS1 only)
- Via terminals on the TM54F Terminal Module
- Via PROFINET/PROFIBUS with PROFIsafe.

The Safety Integrated functions are implemented electronically and therefore offer short response times in comparison to solutions with externally implemented monitoring functions.

Safety Integrated functions via PROFIsafe

Safety Integrated functions are activated via “PROFINET with PROFIsafe” or “PROFIBUS with PROFIsafe” safe communication. The control (F logic) is implemented using an F-CPU connected via PROFINET or PROFIBUS, for example, a SIMATIC S7-300 F-CPU.

Safety Integrated functions are routed through from the SIMOTION D4x5/D4x5-2 Control Units to the following drives:

- Integrated SINAMICS S120 drives on SIMOTION D4x5/D4x5-2
- Drives on the SIMOTION CX32/CX32-2 controller extension
- Drives on SINAMICS Control Units connected via PROFIBUS to SIMOTION D
- Drives on SINAMICS Control Units connected to SIMOTION D via PROFINET (F-CPU must be connected via PROFINET in this case)

For SIMOTION D410, the Safety Integrated functions are routed to just one drive (single-axis application with the PM340 Power Module).

Note

For more information about possible topologies, axis quantity structures and suitable components, please contact your local Siemens sales office.

Detailed information can be found in the SIMOTION D Commissioning Manuals as well as in the SINAMICS documentation.
Overview

SIMOTION D410 is the SIMOTION D version for single-axis applications. It supplements the SIMOTION D4x5/D4x5-2 controller family, which is the solution of choice for multi-axis applications. It is available in both PROFIBUS (D410 DP) and PROFINET (D410 PN) versions.

The SIMOTION D410 Control Unit is specially designed for use with the SINAMICS S120 PM340 Power Modules in blocksize format and can be directly connected to the Power Modules of this series. The SIMOTION D410 can also be installed on a separate mounting plate if required (to be ordered separately).

Application

SIMOTION D410 is the ideal solution when PLC functionality and motion control for one axis are required in a compact format.

Examples of SIMOTION D410 applications include:
- Autonomous control of single axes
- Cross cutters
- Winder applications
- Feeder devices/roller infeed/press feeders
- Synchronized machining equipment
- Compact machine modules, e.g.
  - Feeders in post press applications
  - Shrink wrapping machines

Apart from positioning functions, SIMOTION D410 also provides all the synchronizing and cam functions; the second axis required for synchronous operation and camming can be a virtual axis, a position encoder or the axis of another SIMOTION controller. SIMOTION D410 can be easily integrated into synchronized groups.

This is an advantage in modular machine concepts that make up
- a basic machine, e.g. SIMOTION D4x5/ D4x5-2 as the PROFINET IRT controller with leading axis function
- several machine modules connected over PROFINET based on SIMOTION D410.

Design

Interfaces

Display and diagnostics
- LEDs to display operating states and errors
- 3 measuring sockets

Integrated I/Os
- 4 digital inputs
- 4 digital inputs/outputs (max. 4 as cam output or 3 as measuring inputs)

Communication
- 1 x DRIVE-CLIQ
- 1 X PROFINET (1 interface with 2 ports, D410 PN only)
- 1 x PROFIBUS DP (D410 PN only)

Data backup
- 1 slot for SIMOTION CompactFlash Card

Additional interfaces
- Terminals for 24 V electronic power supply
- 1 encoder input for
  - HTL/TTL incremental encoder
  - SSI absolute encoder (without incremental signals)
- 1 temperature sensor input (KTY84-130 or PTC)
- PM-IF interface (Power Module interface) on rear for direct operation with a SINAMICS S120 PM340 Power Module in blocksize format
## Assembly/Installation

SIMOTION D410 can be directly plugged in to the SINAMICS S120 PM340 Power Module in blocksize format. Alternatively, the SIMOTION D410 can be mounted on a separate mounting plate (to be ordered separately) and connected to the PM340 Power Module via DRIVE-CLiQ. In this case, the CUA31/CUA32 Control Unit Adapter has to be connected to the PM340 Power Module. No more than one Control Unit Adapter can be connected to a SIMOTION D410.

Power Modules in AC/AC chassis format are connected to the SIMOTION D410 over the DRIVE-CLiQ interface. Motor Modules in booksize format cannot be connected to SIMOTION D410.

A SIMOTION D410 inserted on the mounting plate can also be operated without PM340 (e.g. for hydraulic applications with connected TM31 for the analog inputs and outputs).

## Data storage / data backup

SIMOTION D410 has a 9 KB memory for retentive storage of process variables. The storage is maintenance-free and permanent. The runtime software, user data and user programs are backed up on the SIMOTION CompactFlash Card. The retentive process data of the Control Unit can also be stored on this CompactFlash Card via system command, e.g. if spare parts are required.

## Connectable I/Os

### PROFINET IO: (D410 PN only)
- Certified PROFINET devices
- Distributed I/Os SIMATIC ET 200S/M/eco PN/pro
- HMI

### PROFIBUS DP: (D410 DP only)
- Certified PROFIBUS standard slaves (DP-V0, DP-V1, DP-V2)
- Distributed I/O systems SIMATIC ET 200S/M/eco/pro
- HMI

### DRIVE-CLiQ:

Modules from the SINAMICS range:
- TM15, TM17 High Feature, TM31 Terminal Modules (max. 3), etc.
- TM54F (max. 1)
- SMC/SME Sensor Modules (max. 2)
- DMC20/DME20 DRIVE-CLiQ Hub Modules (max. 1)
- Motors with DRIVE-CLiQ interface

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### SIMOTION D410 overview of connections

When dimensioning cables, you must always observe the maximum permissible cable lengths. If these maximum lengths are exceeded, malfunctions can occur.

The permissible length of PROFIBUS DP cables depends on the configuration.

The DRIVE-CLiQ and encoder cables used for the SINAMICS S120 CU310 Control Unit can also be used for SIMOTION D410.

For more information about signal cables, refer to Section "Connection system MOTION-CONNECT".

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## Integration

<table>
<thead>
<tr>
<th>SIMOTION D410 DP/PN</th>
<th>PROFINET cables</th>
<th>PROFIBUS cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>X200</td>
<td>PROFINET node</td>
<td>PROFIBUS DP node</td>
</tr>
<tr>
<td>X201</td>
<td>e.g. ET 200S</td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>DRIVE-CLiQ X100</th>
<th>DRIVE-CLiQ cable</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>SINAMICS Drive components</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EP terminals X120</th>
<th>Temperature sensor and Safety terminals</th>
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</thead>
</table>

[Diagram]

<table>
<thead>
<tr>
<th>Onboard I/Os X121</th>
<th>Digital inputs/outputs</th>
</tr>
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<tbody>
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<table>
<thead>
<tr>
<th>Power supply X124</th>
<th>24 V supply</th>
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<table>
<thead>
<tr>
<th>PROFIBUS DP X21</th>
<th>Incremental absolute encoder</th>
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<table>
<thead>
<tr>
<th>Power Module interface PM-IF</th>
<th>SINAMICS PM340</th>
</tr>
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<tbody>
<tr>
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<td></td>
</tr>
</tbody>
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### Technical specifications

<table>
<thead>
<tr>
<th><strong>Maximum number of axes</strong></th>
<th>1 (real axis)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum PROFIBUS cycle clock</strong></td>
<td>2 ms (D410 DP)</td>
</tr>
<tr>
<td><strong>Minimum PROFINET transmission cycle clock</strong></td>
<td>0.5 ms (D410 PN)</td>
</tr>
<tr>
<td><strong>Minimum servo/interpolator cycle clock</strong></td>
<td>2.0 ms</td>
</tr>
<tr>
<td><strong>Integrated drive control</strong></td>
<td>Max. number of axes for integrated drive control (servo / vector / V/f) 1 / 1 / 1 (alternative) Drive control based on the SINAMICS S120 CU310, firmware version V2.x</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>RAM (Random Access Memory) 38 MB + 20 MB for Java applications</td>
</tr>
<tr>
<td></td>
<td>RAM disk (load memory) 17 MB</td>
</tr>
<tr>
<td></td>
<td>Retentive memory 9 KB</td>
</tr>
<tr>
<td></td>
<td>Persistent memory (user data on CF) 300 MB</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>DRIVE-CLiQ interfaces 1</td>
</tr>
<tr>
<td></td>
<td>PROFIBUS interfaces 1 (D410 DP only) Equidistant and isochronous Can be configured as master or slave</td>
</tr>
<tr>
<td></td>
<td>PROFINET interfaces 1 interface with 2 ports (D410 PN only) Supports PROFINET IO with IRT and RT Can be configured as PROFINET IO controller and/or device</td>
</tr>
<tr>
<td><strong>General technical specifications</strong></td>
<td><strong>Weight</strong></td>
</tr>
<tr>
<td><strong>Supply voltage</strong></td>
<td>SIMOTION D410 990 g (2.18 lb)</td>
</tr>
<tr>
<td></td>
<td>CompactFlash card 10 g (0.35 oz)</td>
</tr>
<tr>
<td><strong>Digital inputs</strong></td>
<td>4</td>
</tr>
<tr>
<td><strong>Input voltage</strong></td>
<td>- Rated value 24 V DC</td>
</tr>
<tr>
<td></td>
<td>- For signal &quot;1&quot; 15 ... 30 V</td>
</tr>
<tr>
<td></td>
<td>- For signal &quot;0&quot; -3 ... +5 V</td>
</tr>
<tr>
<td><strong>Galvanic isolation</strong></td>
<td>Yes, in groups of 4</td>
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<tr>
<td><strong>Current consumption typ. at signal level 1</strong></td>
<td>10 mA at 24 V</td>
</tr>
<tr>
<td><strong>Input delay, typ. (hardware)</strong></td>
<td>L → H: 50 µs</td>
</tr>
<tr>
<td></td>
<td>H → L: 150 µs</td>
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<tr>
<td><strong>Digital inputs/outputs (parameterizable)</strong></td>
<td>4 (max. 3 as high-speed measuring inputs, max. 4 as high-speed cam outputs)</td>
</tr>
<tr>
<td><strong>If used as an input</strong></td>
<td><strong>If used as an output</strong></td>
</tr>
<tr>
<td><strong>Input voltage</strong></td>
<td>- Rated value 24 V DC</td>
</tr>
<tr>
<td></td>
<td>- For signal &quot;1&quot; 15 ... 30 V</td>
</tr>
<tr>
<td></td>
<td>- For signal &quot;0&quot; -3 ... +5 V</td>
</tr>
<tr>
<td><strong>Galvanic isolation</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Current consumption typ. at signal level 1</strong></td>
<td>10 mA at 24 V</td>
</tr>
<tr>
<td><strong>Input delay, typ. (hardware)</strong></td>
<td>L → H: 5 µs</td>
</tr>
<tr>
<td></td>
<td>H → L: 50 µs</td>
</tr>
<tr>
<td><strong>Digital inputs/outputs (parameterizable)</strong></td>
<td>4 (max. 3 as high-speed measuring inputs, max. 4 as high-speed cam outputs)</td>
</tr>
<tr>
<td><strong>If used as an input</strong></td>
<td><strong>If used as an output</strong></td>
</tr>
<tr>
<td><strong>Supply voltage</strong></td>
<td>- Rated value 24 V DC</td>
</tr>
<tr>
<td></td>
<td>- Permissible range 20.4 ... 28.8 V</td>
</tr>
<tr>
<td><strong>Current consumption, typ. (Without load on inputs/outputs, without 24 V supply via DRIVE-CLiQ and PROFIBUS interfaces)</strong></td>
<td>800 mA</td>
</tr>
<tr>
<td><strong>Starting current, typ.</strong></td>
<td>3.0 A</td>
</tr>
<tr>
<td><strong>Power loss, typ.</strong></td>
<td>20 W</td>
</tr>
<tr>
<td><strong>Permissible ambient temperature</strong></td>
<td>- Storage and transport -40 ... +70 °C (-40 ... +158 °F)</td>
</tr>
<tr>
<td></td>
<td>Operation 0 ... 55 °C (32 ... 131 °F); maximum installation altitude 5000 m (16405 ft) above sea level. As of an altitude of 2000 m (6565 ft) the max. ambient temperature decreases by 7 °C (44.6 °F) every 1000 m (3281 ft).</td>
</tr>
<tr>
<td><strong>Permissible relative humidity (without condensation)</strong></td>
<td>5 ... 95 %</td>
</tr>
<tr>
<td><strong>Permissible air pressure</strong></td>
<td>700 ... 1060 hPa</td>
</tr>
<tr>
<td><strong>Degree of protection acc. to EN 60529 (IEC 60529)</strong></td>
<td>IP20</td>
</tr>
<tr>
<td><strong>Dimensions (W x H x D)</strong></td>
<td>73 x 183.2 x 89.6 mm (2.87 x 7.21 x 3.53 in)</td>
</tr>
</tbody>
</table>
## Technical specifications (continued)

### Onboard encoder interface

- **Encoder interface**
  - TTL or HTL incremental encoders (with adjustable parameters)
  - SSI absolute encoder (without incremental signals)

- **Encoder supply**
  - 24 V DC / 0.35 A or 5 V DC / 0.35 A

- **Limit frequency, max.**
  - 500 kHz

- **SSI baud rate**
  - 100 ... 250 kBaud

- **Resolution absolute position SSI**
  - 30 bits

- **Encoder supply**
  - 24 V DC / 0.35 A or 5 V DC / 0.35 A

- **Cable length, max.**
  - For TTL incremental encoder (only bipolar signals permitted)
    - 100 m (328 ft) 1)
  - For HTL incremental encoder
    - For unipolar signals: 100 m (328 ft)
    - For bipolar signals: 300 m (984.3 ft) 2)
  - For SSI absolute encoder: 100 m (328 ft)

### Additional technical specifications

- **Input for temperature sensing**
  - KTY84-130 or PTC

- **Non-volatile data backup**
  - Retentive data: unlimited
  - Real-time clock: 5 days, minimum (maintenance-free backup)

- **Charging time, typ.**
  - Only a few minutes

### Approvals, according to

- cULus

### Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.</th>
</tr>
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<tbody>
<tr>
<td>SIMOTION D410 DP Control Unit</td>
<td>6AU1410-0AA00-0AA0</td>
</tr>
<tr>
<td>SIMOTION D410 PN Control Unit</td>
<td>6AU1410-0AB00-0AA0</td>
</tr>
<tr>
<td>SIMOTION CompactFlash Card (CF) 1 GB with the current SIMOTION Kernel and SINAMICS S120 drive software V2.x</td>
<td>6AU1400-2PA01-0AA0</td>
</tr>
</tbody>
</table>

**Note:**
- A separate CompactFlash Card is available for the SIMOTION D4x5-2 Control Units. (6AU1400-2PA21-0AA0)

<table>
<thead>
<tr>
<th>Accessories for PROFIBUS</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFIBUS RS485 bus connector with angular cable outlet (35°) and screw-type terminals</td>
<td>6ES7972-0BB42-0XA0</td>
</tr>
<tr>
<td>Max. transmission rate 12 Mbit/s</td>
<td>6ES7972-0BA42-0XA0</td>
</tr>
<tr>
<td>Without PG interface</td>
<td>6ES7972-0BA60-0XA0</td>
</tr>
<tr>
<td>With PG interface</td>
<td>6ES7972-0BB60-0XA0</td>
</tr>
</tbody>
</table>

### Accessories for PROFINET

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RJ45 FastConnect connector for Industrial Ethernet / PROFINET 180° cable outlet</td>
<td>6GK1901-1BB10-2AB0</td>
</tr>
<tr>
<td>1 pack = 10 units</td>
<td>6GK1901-1BB10-2AA0</td>
</tr>
<tr>
<td>Without PG interface</td>
<td>6ES7972-0BB42-0XA0</td>
</tr>
<tr>
<td>With PG interface</td>
<td>6ES7972-0BA42-0XA0</td>
</tr>
</tbody>
</table>

### Accessories for DRIVE-CLiQ

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust-proof blanking plugs (50 units) for sealing unused DRIVE-CLiQ ports</td>
<td>6SL3066-4CA00-0AA0</td>
</tr>
</tbody>
</table>

---

1) Signal cables twisted in pairs and shielded

2) Note about licenses for runtime software:
   - Runtime software licenses can either be pre-installed on a CompactFlash Card (CF) or ordered separately.
   - See "Ordering of licenses for runtime software".

3) Sold by the meter; max. length 1,000 m; minimum order 20 m
More information

Further information

- about PROFIBUS DP/MPI cables and MOTION-CONNECT can be found in Section "Connection system MOTION-CONNECT".

- about PROFIBUS DP, Industrial Ethernet and PROFINET can be found in Catalog IK PI and the Industry Mall under "Automation Systems/Industrial Communication".

- about the ordering data for SINAMICS drive components such as Power Modules, DRIVE-CLiQ cables, etc. can be found in Section "SINAMICS S120 drive system" and the Industry Mall under "Drive Technology/AC Converters/...".

Integrated drive control

The drive control functions integrated in a SIMOTION D410 are based on the drive control of a SINAMICS S120 CU310 (firmware version 2.x), although there is a slight difference in functionality. For example, the SIMOTION D410 does not have a basic positioner function (EPos), since this is already covered by SIMOTION technology functions.

For more information, refer to Section "System description – Dimensioning" and the documentation for SIMOTION and SINAMICS.

Licensing notes

SIMOTION D410 is the SIMOTION D variant for single-axis applications and already contains the motion control technology functions for one real axis (speed control, positioning, synchronous operation, cam). An additional license is therefore not needed for this purpose. It is not possible to increase the number of axes using licenses. Apart from one real axis, further virtual axes can be configured.

Licensed runtime functions such as SIMOTION IT Virtual Machine require licenses which can be ordered pre-installed on a CompactFlash Card (CF) or individually.

For more information, refer to section "Ordering of licenses for runtime software".

SIZER configuration tool

With the SIZER configuration tool, you can easily configure the SINAMICS S110 and S120 drive families including SIMOTION. It provides you with support for selecting and dimensioning the components 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.

For more information about SIZER, refer to Section "System description – Dimensioning".
SIMOTION D4x5 Control Units

Overview

SIMOTION D435 Control Unit with CBE30 plug-in module for PROFINET IO

SIMOTION D4x5s are drive-based Control Units for multi-axis systems. The individual versions SIMOTION D425 (BASIC performance), SIMOTION D435 (STANDARD performance) and SIMOTION D445-1 (HIGH performance) differ in their PLC performance and motion control performance. The main distinguishing features are:

<table>
<thead>
<tr>
<th>Feature</th>
<th>SIMOTION D425</th>
<th>SIMOTION D435</th>
<th>SIMOTION D445-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number of axes</td>
<td>16</td>
<td>32</td>
<td>64</td>
</tr>
<tr>
<td>Minimum servo/interpolator cycle clock</td>
<td>2.0 ms</td>
<td>1.0 ms</td>
<td>0.5 ms</td>
</tr>
<tr>
<td>DRIVE-CliQ interfaces</td>
<td>4</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

The SIMOTION D425, D435 and D445-1 Control Units feature PLC and motion control performances (open-loop control and motion control) for up to 16, 32 or 64 axes, as required.

The integrated drive control allows each D4x5 Control Unit to operate up to 6 servo, 4 vector or 8 V/f axes.

The drive control is based on the drive control of a SINAMICS S120 CU320 Control Unit (firmware version V2.x) and supports servo control (for a highly dynamic response), vector control (for maximum torque accuracy) and V/f control.

Extension of the drive computing performance

The motion control performance of the SIMOTION D425, D435 and D445-1 Control Units can be utilized in full by expanding the computing performance at the drive in two different ways:

- Over PROFIBUS or PROFINET, SINAMICS S120 Control Units complete with further SINAMICS S120 drive modules can be connected.
- With the SIMOTION D435 and D445-1 Control Units, the SIMOTION CX32 Controller Extension can be connected via DRIVE-CliQ. This module is extremely compact and can control up to 6 servo, 4 vector or 8 V/f axes.

Application

Field of application for the SIMOTION D425, D435 and D445-1 Control Units are applications with a large number of coordinated axes and short cycle times.

Typical fields of application are:
- Compact multi-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 a large number of axes
  - Synchronization of several SIMOTION D Control Units via distributed synchronous operation

Design

Interfaces

Display and diagnostics
- LEDs to display operating states and errors
- 3 measuring sockets
- Service switch and mode selector

Onboard I/Os
- 8 digital inputs
- 8 digital inputs/outputs (max. 8 as high-speed cam outputs, max. 6 as high-speed measuring inputs)

Communication
- 4 x DRIVE-CliQ (6 x DRIVE-CliQ for D445-1)
- 2 x Industrial Ethernet
- 2 x PROFIBUS DP
- 2 x USB

Data backup
- 1 x slot for SIMOTION CompactFlash Card

Additional interfaces
- Terminals for 24 V electronic power supply

Option modules

The following option modules are available for the SIMOTION D425, D435 and D445-1 Control Units:
- CBE30 Communication Board for the connection to PROFINET IO
- TB30 Terminal Board for the expansion with 4 digital inputs, 4 digital outputs, 2 analog inputs and 2 analog outputs

Assembly/Installation

The SIMOTION D425, D435, D445-1 Control Units can be mounted in the control cabinet in one of three ways:

- Hooking it into the Line Module on the left-hand side (not with D445-1)
- Screwing it directly to the control cabinet, if it is required/desired that SIMOTION D is separate from the Line Module
- Using spacers if it is not possible to mount SIMOTION D to the side of the Line Module (e.g. if no Line Module is installed) but the difference between the mounting depth of Control Unit and the Motor Modules still has to be compensated for. The SIMOTION D425, D435, and D445-1 Control Units come with pre-assembled spacers. These can be removed if necessary.
Data storage / data backup

The SIMOTION D425, D435 and D445-1 Control Units have 364 KB of non-volatile and battery-backed SRAM for retentive process data. This backup is stored for at least 5 days.

There are two options for storing retentive data for a longer period:

- System commands for storing retentive data on the CompactFlash Card (CF) of the Control Unit
- Use of a battery module (combined fan/battery module already included in the scope of delivery of a SIMOTION D445-1, optional for SIMOTION D425/D435)

The runtime software, user data and user programs are stored retainently on the CompactFlash Card (CF).

Connectable I/Os

PROFINET IO: (optionally via CBE30)
- Certified PROFINET devices
- SIMATIC ET 200S/M/eco PN/pro distributed I/Os
- Drive systems (e.g. SINAMICS S110/S120)

PROFIBUS DP:
- Certified PROFIBUS standard slaves (DP-V0, DP-V1, DP-V2)
- SIMATIC ET 200S/M/eco/pro distributed I/O systems
- Drive systems (e.g. SINAMICS S110/S120)

DRIVE-CLiQ:
Modules from the SINAMICS S120 range:
- TM15, TM17 High Feature, TM31 Terminal Modules, etc.
- SMC/SME Sensor Modules
- DMC20/DME20 DRIVE-CLiQ Hub Modules

USB:
The integrated USB interface allows, for example, a USB memory stick to be connected for a project or firmware update.

Expansion with SINAMICS S120 drive modules

SINAMICS S120 drive modules in blocksize format (Line Modules, Motor Modules, etc.) are connected to the SIMOTION D4x5 Control Units via DRIVE-CLiQ.

SINAMICS S120 PM340 Power Modules in blocksize format can be operated on the SIMOTION D4x5 Control Units with the CUA31/CUA32 Control Unit Adapters.

Note:
DRIVE-CLiQ cables that are required to connect Line/Motor Modules to SIMOTION D are supplied in a standard length with the Line/Motor Modules.

Integration

SIMOTION D4x5 Control Units connection overview

When dimensioning cables, you must always observe the maximum permissible cable lengths.

If these maximum lengths are exceeded, malfunctions can occur.

The permissible length of PROFIBUS DP cables depends on the configuration.

The DRIVE-CLiQ cables used for the SINAMICS S120 CU320/ CU320-2 Control Unit can also be used for SIMOTION D4x5 Control Units.

For more information about signal cables, refer to Section "Connection system MOTION-CONNECT".
## Technical specifications

<table>
<thead>
<tr>
<th>SIMOTION D425</th>
<th>SIMOTION D435</th>
<th>SIMOTION D445-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASIC performance</td>
<td>STANDARD performance</td>
<td>HIGH performance</td>
</tr>
<tr>
<td>Multi-axis system</td>
<td>Multi-axis system</td>
<td>Multi-axis system</td>
</tr>
</tbody>
</table>

### Basic Performance

**Multi-axis system**

<table>
<thead>
<tr>
<th>PLC and motion control performances</th>
<th>SIMOTION D425</th>
<th>SIMOTION D435</th>
<th>SIMOTION D445-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number of axes</td>
<td>16</td>
<td>32</td>
<td>64</td>
</tr>
<tr>
<td>Minimum PROFIBUS cycle clock</td>
<td>2 ms</td>
<td>1 ms</td>
<td>1 ms</td>
</tr>
<tr>
<td>Minimum PROFINET transmission cycle clock</td>
<td>0.5 ms</td>
<td>0.5 ms</td>
<td>0.5 ms</td>
</tr>
<tr>
<td>Minimum servos/interpolator cycle clock</td>
<td>2.0 ms</td>
<td>1.0 ms</td>
<td>0.5 ms</td>
</tr>
</tbody>
</table>

**Integrated drive control**

Max. number of axes for integrated drive control (servo / vector / V/f)

<table>
<thead>
<tr>
<th>SIMOTION D425</th>
<th>SIMOTION D435</th>
<th>SIMOTION D445-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Drive control based on SINAMICS S120 CU320, firmware version V2.x)</td>
<td>(Drive control based on SINAMICS S120 CU320, firmware version V2.x)</td>
<td>(Drive control based on SINAMICS S120 CU320, firmware version V2.x)</td>
</tr>
</tbody>
</table>

**Memory**

<table>
<thead>
<tr>
<th>SIMOTION D425</th>
<th>SIMOTION D435</th>
<th>SIMOTION D445-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAM (Random Access Memory) (+ 20 MB for Java applications)</td>
<td>48 MB</td>
<td>48 MB</td>
</tr>
<tr>
<td>RAM disk (load memory)</td>
<td>23 MB</td>
<td>23 MB</td>
</tr>
<tr>
<td>Retentive memory</td>
<td>364 KB</td>
<td>364 KB</td>
</tr>
<tr>
<td>Persistent memory (user data on CF)</td>
<td>300 MB</td>
<td>300 MB</td>
</tr>
</tbody>
</table>

**Communication**

<table>
<thead>
<tr>
<th>SIMOTION D425</th>
<th>SIMOTION D435</th>
<th>SIMOTION D445-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRIVE-CLiQ interfaces</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>USB interfaces</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ethernet interfaces</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PROFIBUS interfaces</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Equidistant and isochronous</td>
<td>Equidistant and isochronous</td>
<td>Equidistant and isochronous</td>
</tr>
<tr>
<td>Can be configured as master or slave</td>
<td>Can be configured as master or slave</td>
<td>Can be configured as master or slave</td>
</tr>
<tr>
<td>PROFINET interfaces</td>
<td>Optionally over CBE30:</td>
<td>Optionally over CBE30:</td>
</tr>
<tr>
<td>1 interface with 4 ports</td>
<td>1 interface with 4 ports</td>
<td>1 interface with 4 ports</td>
</tr>
<tr>
<td>Supports PROFINET IO with IRT and RT</td>
<td>Supports PROFINET IO with IRT and RT</td>
<td>Supports PROFINET IO with IRT and RT</td>
</tr>
<tr>
<td>Can be configured as PROFINET IO controller and/or device</td>
<td>Can be configured as PROFINET IO controller and/or device</td>
<td>Can be configured as PROFINET IO controller and/or device</td>
</tr>
</tbody>
</table>

**General technical specifications**

**Fan**

<table>
<thead>
<tr>
<th>SIMOTION D425</th>
<th>SIMOTION D435</th>
<th>SIMOTION D445-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optional fan/battery module (single fan)</td>
<td>Optional fan/battery module (single fan)</td>
<td>Double fan/battery module included in scope of delivery</td>
</tr>
</tbody>
</table>

**Supply voltage**

<table>
<thead>
<tr>
<th>SIMOTION D425</th>
<th>SIMOTION D435</th>
<th>SIMOTION D445-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated value</td>
<td>24 V DC</td>
<td>24 V DC</td>
</tr>
<tr>
<td>Permissible range</td>
<td>20.4 ... 28.8 V</td>
<td>20.4 ... 28.8 V</td>
</tr>
<tr>
<td>Current consumption, typ. (Without load on inputs/outputs, without 24 V supply via DRIVE-CLiQ and PROFIBUS interfaces)</td>
<td>600 mA</td>
<td>600 mA</td>
</tr>
<tr>
<td>Starting current, typ.</td>
<td>6 A</td>
<td>6 A</td>
</tr>
<tr>
<td>Power loss, typ.</td>
<td>15 W</td>
<td>15 W</td>
</tr>
</tbody>
</table>

**Permissible ambient temperature**

<table>
<thead>
<tr>
<th>SIMOTION D425</th>
<th>SIMOTION D435</th>
<th>SIMOTION D445-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage and transport</td>
<td>-40 ... +70 °C (-40 ... +158 °F)</td>
<td>-40 ... +70 °C (-40 ... +158 °F)</td>
</tr>
<tr>
<td>Operation</td>
<td>0 ... 55 °C (32 ... 131 °F)</td>
<td>0 ... 55 °C (32 ... 131 °F)</td>
</tr>
<tr>
<td>Maximum installation altitude</td>
<td>5000 m (16405 ft) above sea level. As of an altitude of 2000 m (6562 ft), the max. ambient temperature decreases by 7 °C (44.6 °F) every 1000 m (3281 ft).</td>
<td>5000 m (16405 ft) above sea level. As of an altitude of 2000 m (6562 ft), the max. ambient temperature decreases by 7 °C (44.6 °F) every 1000 m (3281 ft).</td>
</tr>
</tbody>
</table>
### Technical specifications (continued)

<table>
<thead>
<tr>
<th>SIMOTION D425 BASIC performance Multi-axis system</th>
<th>SIMOTION D435 STANDARD performance Multi-axis system</th>
<th>SIMOTION D445-1 HIGH performance Multi-axis system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Permissible relative humidity (without condensation)</strong></td>
<td>5 ... 95%</td>
<td>5 ... 95%</td>
</tr>
<tr>
<td><strong>Permissible air pressure</strong></td>
<td>700 ... 1060 hPa</td>
<td>700 ... 1060 hPa</td>
</tr>
<tr>
<td><strong>Degree of protection acc. to EN 60529 (IEC 60529)</strong></td>
<td>IP20</td>
<td>IP20</td>
</tr>
<tr>
<td><strong>Dimensions (W x H x D)</strong></td>
<td>50 x 380 x 270 mm (1.97 x 14.96 x 10.63 in)</td>
<td>50 x 380 x 270 mm (1.97 x 14.96 x 10.63 in)</td>
</tr>
<tr>
<td></td>
<td>230 mm (9.06 in) depth with disassembled spacer; all dimensions without fan/battery module</td>
<td>230 mm (9.06 in) depth with disassembled spacer; all dimensions without fan/battery module</td>
</tr>
</tbody>
</table>

### Weight
- **SIMOTION D** | 2600 g (5.73 lb) | 2600 g (5.73 lb) | 3100 g (6.84 lb) |
- **CompactFlash card** | 10 g (0.35 oz) | 10 g (0.35 oz) | 10 g (0.35 oz) |

### Digital inputs
- **Input voltage**
  - **Rated value** | 24 V DC | 24 V DC | 24 V DC |
  - **For signal "1"** | 15 ... 30 V | 15 ... 30 V | 15 ... 30 V |
  - **For signal "0"** | -3 ... +5 V | -3 ... +5 V | -3 ... +5 V |
- **Galvanic isolation** Yes, in groups of 4
- **Current consumption typ. at signal level 1** | 10 mA at 24 V | 10 mA at 24 V | 10 mA at 24 V |
- **Input delay, typ. (hardware)**
  - **L → H:** 50 µs | 50 µs | 50 µs |
  - **H → L:** 150 µs | 150 µs | 150 µs |

### Digital inputs/outputs (parameterizable)
- **Input voltage**
  - **Rated value** | 24 V DC | 24 V DC | 24 V DC |
  - **For signal "1"** | 15 ... 30 V | 15 ... 30 V | 15 ... 30 V |
  - **For signal "0"** | -3 ... +5 V | -3 ... +5 V | -3 ... +5 V |
- **Galvanic isolation** No
- **Current consumption typ. at signal level 1** | 10 mA at 24 V | 10 mA at 24 V | 10 mA at 24 V |
- **Input delay, typ. (hardware)**
  - **L → H:** 5 µs | 5 µs | 5 µs |
  - **H → L:** 50 µs | 50 µs | 50 µs |

### If used as an input
- **Input voltage**
  - **Rated value** | 24 V DC | 24 V DC | 24 V DC |
  - **For signal "1"** | 15 ... 30 V | 15 ... 30 V | 15 ... 30 V |
  - **For signal "0"** | -3 ... +5 V | -3 ... +5 V | -3 ... +5 V |
- **Galvanic isolation** No
- **Current consumption typ. at signal level 1** | 10 mA at 24 V | 10 mA at 24 V | 10 mA at 24 V |
- **Input delay, typ. (hardware)**
  - **L → H:** 5 µs | 5 µs | 5 µs |
  - **H → L:** 50 µs | 50 µs | 50 µs |

### If used as an output
- **Rated load voltage** | 24 V DC | 24 V DC | 24 V DC |
  - **Permissible range** | 20.4 ... 28.8 V | 20.4 ... 28.8 V | 20.4 ... 28.8 V |
- **Galvanic isolation** No
- **Current load, max.** | 500 mA per output | 500 mA per output | 500 mA per output |
- **Leakage current, max.** | 2 mA | 2 mA | 2 mA |
- **Output delay time, typ./max. (hardware, with 48 Ω load)**
  - **L → H:** 150 µs / 400 µs | 150 µs / 400 µs | 150 µs / 400 µs |
  - **H → L:** 75 µs / 100 µs | 75 µs / 100 µs | 75 µs / 100 µs |
- **Cam output, reproducibility** | 125 µs | 125 µs | 125 µs |
### Technical specifications (continued)

<table>
<thead>
<tr>
<th>SIMOTION D425</th>
<th>SIMOTION D435</th>
<th>SIMOTION D445-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASIC performance</td>
<td>STANDARD performance</td>
<td>HIGH performance</td>
</tr>
<tr>
<td>Multi-axis system</td>
<td>Multi-axis system</td>
<td>Multi-axis system</td>
</tr>
</tbody>
</table>

- **Switching frequency of the outputs, max.**
  - With resistive load: 100 Hz
  - With inductive load: 2 Hz
  - With lamp load: 11 Hz

- **Short-circuit protection:** Yes

### Additional technical specifications

- **Non-volatile data backup**
  - Backup time, min.: 5 days
  - Charging time, typ.: Only a few minutes

### Approvals, according to
- cULus and C-Tick

### Selection and ordering data

#### SIMOTION D425 Control Unit
- **Order No.:** 6AU1425-0AA00-0AA0
- **MultiAxes Bundle SIMOTION D425**
  - Consists of 1 item each
  - SIMOTION D425 Control Unit
  - CompactFlash Card 1 GB with MultiAxes Package license for the D425 platform

#### SIMOTION D435 Control Unit
- **Order No.:** 6AU1435-0AA00-0AA1
- **MultiAxes Bundle SIMOTION D435**
  - Consists of 1 item each
  - SIMOTION D435 Control Unit
  - CompactFlash Card 1 GB with MultiAxes Package license for the D435 platform

#### SIMOTION D445-1 Control Unit
- **Order No.:** 6AU1445-0AA00-0AA1
- **MultiAxes Bundle SIMOTION D445**
  - Consists of 1 item each
  - SIMOTION D445-1 Control Unit

### Accessories

- **Fan/battery module incl. battery**
  - 6FC5348-0AA01-0AA0
  - Note: A fan/battery module is required only for the D425/D435 for backing up non-volatile data for more than 5 days when the free convection for heat dissipation does not suffice and the air supply temperature thus increases above 55 °C.

- **Double fan/battery module incl. battery**
  - 6FC5348-0AA02-0AA0

- **Battery**
  - 6FC5247-0AA18-0AA0

- **PROFIBUS RS485 bus connector with angular cable outlet (35°) and screw-type terminals**
  - Max. transmission rate: 12 Mbit/s
  - 6ES7972-0BA42-0XA0 (Without PG interface)
  - 6ES7972-0BB42-0XA0 (With PG interface)

- **PROFIBUS Fast Connect RS485 bus connector with angular cable outlet (35°) and insulation displacement terminals**
  - Max. transmission rate: 12 Mbit/s
  - 6ES7972-0BA60-0XA0 (Without PG interface)
  - 6ES7972-0BB60-0XA0 (With PG interface)

- **Dust-proof blanking plugs (50 units)**
  - 6SL3066-4CA00-0AA0

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1) **Note about licenses for runtime software:**
   Runtime software licenses can either be pre-installed on a CompactFlash Card (CF) or ordered separately. See "Ordering of licenses for runtime software".

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1) Alternative: Longer backup duration using a battery inserted in the fan/battery module or permanent backup of retentive data via system command on the CompactFlash card.
More information

Further information

- about PROFIBUS DP/MPI cables and MOTION-CONNECT can be found in Section "Connection system MOTION-CONNECT".

- about PROFIBUS DP, Industrial Ethernet and PROFINET can be found in Catalog IK PI and the Industry Mall under "Automation Systems/Industrial Communication" as well as the Section "Communication".

- about the ordering data for other SINAMICS drive components such as Line Modules, Motor Modules, DRIVE-CLIQ cables, etc. can be found in Section "SINAMICS S120 drive system" and the Industry Mall under "Drive Technology/Converters/...".

Integrated drive control

The drive control integrated in the SIMOTION D425, D435 and D445-1 Control Units and in the CX32 Controller Extension is based on the drive control of a SINAMICS S120 CU320 Control Unit (firmware version V2.x), whereby there are minor functional differences. For example, the integrated drive control does not have a basic positioner function (EPos), since this is already covered by SIMOTION technology functions.

For more information, refer to Section "System description – Dimensioning" and the documentation for SIMOTION and SINAMICS.

SIZER configuration tool

With the SIZER configuration tool, you can easily configure the SINAMICS S110/S120 drive families including SIMOTION. It provides you with support for selecting and dimensioning the components 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.

For more information about SIZER, refer to Section "System description – Dimensioning".

Catalog supplement SIMOTION D  -  9/2011
Overview

SIMOTION D445-2 DP/PN and D455-2 DP/PN are Control Units of the new generation. They round off the top end of the performance range for multi-axis systems.

The new Control Units SIMOTION D4x5-2 Control Units feature the following innovations:

- PROFINET interface onboard
- Higher performance with SIMOTION D455-2 DP/PN:
  - For applications with up to 128 motion control axes (three times more performance compared to the SIMOTION D445-1 depending on the application)
  - Optimized execution system with additional runtime level (SERVOfast / IPOFast)
  - More RAM working memory, more retentive memory
  - Maintenance-free, permanent backup of retentive user data
  - Number of onboard I/Os increased to 28
  - Number of technologically usable I/Os doubled
  - Innovative integrated drive for larger drive quantity structures and new functions
  - Diagnostics button and easily accessible Service Ethernet interface

The Control Units feature PLC and motion control performances (open-loop control and motion control) for up to 64 (D445-2 DP/PN) or 128 axes (D455-2 DP/PN).

The integrated drive control allows the D4x5-2 Control Unit to operate up to 6 servo, 6 vector or 12 V/f axes.

The integrated drive control is based on the drive control of a SINAMICS S120 CU320-2 Control Unit (firmware version V4.x) and supports servo control (for a highly dynamic response), vector control (for maximum torque accuracy) and V/f control.

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 S120 Control Units (e.g. CU320-2) can be connected together with further SINAMICS S120 drive modules via PROFIBUS or PROFINET.
- The SIMOTION CX32-2 Controller Extension can be connected via DRIVE-CLiQ. This module is extremely compact and can control up to 6 servo, 6 vector or 12 V/f axes.

Application

Field of application for the SIMOTION D4x5-2 Control Units are applications with a large number of coordinated axes and short cycle times.

Typical fields of application are:

- Compact multi-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 a large number of axes
  - Synchronization of several SIMOTION D Control Units via distributed synchronous operation

Design

Interfaces

Display and diagnostics
- LEDs to display operating states and errors
- 3 measuring sockets
- Service switch and mode selector
- Diagnostics button

Onboard I/Os
- 12 digital inputs
- 16 digital inputs/outputs (max. 16 as high-speed measuring inputs, max. 8 as high-speed cam outputs)

Communication
- 6 x DRIVE-CLiQ
- 2 x Industrial Ethernet (of which one interface easily accessible on the module front)
- 2 x PROFIBUS DP
- 1 x PROFINET (1 interface with 3 ports)
- 2 x USB

Data backup
- 1 x slot for SIMOTION CompactFlash Card

Additional interfaces
- Terminals for 24 V electronic power supply

Option modules

With the TB30 Terminal Board, the SIMOTION D4x5-2 Control Units can be extended with 4 digital inputs, 4 digital outputs, 2 analog inputs and 2 analog outputs. The TB30 Terminal Board is plugged into the option slot on the Control Unit.

The CBE30 Communication Board for PROFINET IO is not supported by the SIMOTION D4x5-2. An onboard PROFINET interface is available for the PROFINET connection.

Assembly/Installation

The SIMOTION D4x5-2 Control Units can be mounted in the control cabinet in one of two ways:

- Mounting with spacers
- Mounting without spacers (external air cooling)

With external air cooling, the cooling fins of the Control Unit are outside of the control cabinet. A seal (option) is required so that the Control Unit can be hermetically mounted in the rear cabinet panel.

The SIMOTION D4x5-2 Control Units are supplied with pre-assembled spacers. These can be removed if necessary.
Data storage / data backup

The SIMOTION D4x5-2 Control Units have a 512 KB memory for retentive storage of process variables. The storage is maintenance-free and permanent.

The real-time clock is backed up for at least 4 days via a SuperCap. The backup time can be extended via a battery in the double fan/battery module.

The double fan/battery module incl. battery is contained in the scope of delivery of the SIMOTION D445-2 DP/PN and D455-2 DP/PN.

The runtime software, user data and user programs are stored retentively on the CompactFlash Card (CF). The retentive process data of the Control Unit can also be stored on this CompactFlash Card via system command, e.g. if spare parts are required.

Connectable I/Os

PROFINET IO:
- Certified PROFINET devices
- SIMATIC ET 200S/M/eco PN/pro distributed I/Os
- Drive systems (e.g. SINAMICS S110/S120)

PROFIBUS DP:
- Certified PROFIBUS standard slaves (DP-V0, DP-V1, DP-V2)
- SIMATIC ET 200S/M/eco/pro distributed I/Os
- Drive systems (e.g. SINAMICS S110/S120)

DRIVE-CLiQ:

Modules from the SINAMICS S120 range:
- TM15, TM17 High Feature, TM31 Terminal Modules, etc.
- SMC/SME Sensor Modules
- DMC20/DME20 DRIVE-CLiQ Hub Modules

USB:

The integrated USB interface allows, for example, a USB memory stick to be connected for a project or firmware update.

Expansion with SINAMICS S120 drive modules

SINAMICS S120 drive modules in booksize format (Line Modules, Motor Modules, etc.) are connected to the SIMOTION D4x5-2 Control Unit via DRIVE-CLiQ.

SINAMICS S120 PM340 Power Modules in blocksize format can be operated on the SIMOTION D4x5-2 Control Units with the CUA31/CUA32 Control Unit Adapters.

Note:

DRIVE-CLiQ cables that are required to connect line/motor modules to SIMOTION D are supplied in a standard length with the Line/Motor Modules.
Extended execution system (SERVO\textsubscript{Fast} / IPO\textsubscript{Fast})

The SIMOTION D445-2 DP/PN and D455-2 DP/PN Control Units have (in addition to SERVO, IPO and IPO2) an additional second runtime level (SERVO\textsubscript{Fast} and IPO\textsubscript{Fast}).

The additional runtime level allows the distribution of electric and/or hydraulic axes with different dynamic responses on a slow and a fast bus system so that the performance of the controller can be used more efficiently.

It also enables a particularly fast I/O processing in conjunction with high-speed PROFINET I/O modules.

Thanks to the extended execution system, electrical positioning drives can be controlled with cycle times in the millisecond range requiring fewer resources and at the same time the pressure-controlled axes of an hydraulic press can be controlled with a high dynamic response and short cycle times.

If SERVO\textsubscript{Fast} and IPO\textsubscript{Fast} are activated, the following assignment applies:

- SERVO\textsubscript{Fast} and IPO\textsubscript{Fast} are assigned to the PROFINET.
- SERVO, IPO and IPO2 are assigned to the PROFIBUS or the integrated drives of the SIMOTION D4x5-2/CX32-2.

Closed-loop control of an hydraulic press with SERVO\textsubscript{Fast} and IPO\textsubscript{Fast}
**SIMOTION D4x5-2 Control Units**

**Integration**

**SIMOTION D4x5-2 Control Unit connection overview**

When dimensioning cables, you must always observe the maximum permissible cable lengths.

If these maximum lengths are exceeded, malfunctions can occur.

The permissible length of PROFIBUS DP cables depends on the configuration.

The DRIVE-CLiQ cables used for the SINAMICS S120 CU320-2 Control Unit can also be used for SIMOTION D4x5-2 Control Units.

For more information about signal cables, refer to Section "Connection system MOTION-CONNECT".

---

**Diagram: SIMOTION D4x5-2 Control Unit connection overview**

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFINET IO</td>
<td>e.g. SINAMICS S120 ET 2008</td>
</tr>
<tr>
<td>DRIVE-CLiQ</td>
<td>SINAMICS S120 Drive components</td>
</tr>
<tr>
<td>Ethernet</td>
<td>Ethernet node</td>
</tr>
<tr>
<td>Onboard I/Os</td>
<td>Digital inputs/outputs</td>
</tr>
<tr>
<td>Power supply</td>
<td>24 V supply</td>
</tr>
<tr>
<td>PROFIBUS DP</td>
<td>PROFIBUS node</td>
</tr>
<tr>
<td>USB</td>
<td>USB memory stick</td>
</tr>
</tbody>
</table>

---

*Catalog supplement SIMOTION D - 9/2011*
## Technical specifications

<table>
<thead>
<tr>
<th></th>
<th>SIMOTION D445-2 DP/PN</th>
<th>SIMOTION D455-2 DP/PN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PLC and motion control performances</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum number of axes</td>
<td>64</td>
<td>128</td>
</tr>
<tr>
<td>Minimum PROFIBUS cycle clock</td>
<td>1 ms</td>
<td>1 ms</td>
</tr>
<tr>
<td>Minimum PROFIBUS transmission cycle clock</td>
<td>0.25 ms</td>
<td>0.25 ms</td>
</tr>
<tr>
<td>Minimum servo/interpolator cycle clock</td>
<td>0.5/0.25 ms</td>
<td>0.5/0.25 ms</td>
</tr>
<tr>
<td>• 0.5 ms in conjunction with integrated SINAMICS S120 drives (SINAMICS Integrated)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 0.25 ms in conjunction with SERVOFAST and IPOFAST and high-speed PROFINET I/O modules</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Integrated drive control</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. number of axes for integrated drive control (servo / vector / V/f)</td>
<td>6 / 6 / 12 (alternative) (Drive control based on SINAMICS S120 CU320-2, firmware version V4.x)</td>
<td>6 / 6 / 12 (alternative) (Drive control based on SINAMICS S120 CU320-2, firmware version V4.x)</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAM (Random Access Memory) (+ 20 MB for Java applications)</td>
<td>128 MB</td>
<td>256 MB</td>
</tr>
<tr>
<td>RAM disk (load memory)</td>
<td>50 MB</td>
<td>70 MB</td>
</tr>
<tr>
<td>Retentive memory</td>
<td>512 KB</td>
<td>512 KB</td>
</tr>
<tr>
<td>Persistent memory (user data on CF)</td>
<td>300 MB</td>
<td>300 MB</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRIVE-CLiQ interfaces</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>USB interfaces</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ethernet interfaces</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PROFIBUS interfaces</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>• Equidistant and isochronous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Can be configured as master or slave</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROFINET interfaces</td>
<td>1 interface with 3 ports</td>
<td>1 interface with 3 ports</td>
</tr>
<tr>
<td>• Supports PROFINET I/O with IRT and RT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Can be configured as PROFINET I/O controller and/or device</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>General technical specifications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fan</strong></td>
<td>Double fan/battery module included in scope of delivery</td>
<td>Double fan/battery module included in scope of delivery</td>
</tr>
<tr>
<td><strong>Supply voltage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Rated value</td>
<td>24 V DC</td>
<td>24 V DC</td>
</tr>
<tr>
<td>• Permissible range</td>
<td>20.4 ... 28.8 V</td>
<td>20.4 ... 28.8 V</td>
</tr>
<tr>
<td><strong>Current consumption, typ.</strong> (Without load on inputs/outputs, without 24 V supply via DRIVE-CLiQ and PROFIBUS interfaces)</td>
<td>1.9 A</td>
<td>1.9 A</td>
</tr>
<tr>
<td><strong>Starting current, typ.</strong></td>
<td>5 A</td>
<td>5 A</td>
</tr>
<tr>
<td><strong>Power loss, typ.</strong></td>
<td>46 W</td>
<td>46 W</td>
</tr>
<tr>
<td><strong>Permissible ambient temperature</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Long-term storage</td>
<td>-25 ... +55 °C (-13 ... +131 °F)</td>
<td>-25 ... +55 °C (-13 ... +131 °F)</td>
</tr>
<tr>
<td>• Transport</td>
<td>-40 ... +70 °C (-40 ... +158 °F)</td>
<td>-40 ... +70 °C (-40 ... +158 °F)</td>
</tr>
<tr>
<td>• Operation</td>
<td>0 ... 55 °C (32 ... 131 °F)</td>
<td>Maximum installation altitude 4000 m (13124 ft) above sea level. As of an altitude of 2000 m (6562 ft), the max. ambient temperature decreases by 7 °C (44.6 °F) every 1000 m (3281 ft).</td>
</tr>
<tr>
<td><strong>Permissible relative humidity (without condensation)</strong></td>
<td>5 ... 95%</td>
<td>5 ... 95%</td>
</tr>
<tr>
<td><strong>Permissible air pressure</strong></td>
<td>620 ... 1060 hPa</td>
<td>620 ... 1060 hPa</td>
</tr>
</tbody>
</table>
### Technical specifications (continued)

<table>
<thead>
<tr>
<th>SIMOTION D445-2 DP/PN</th>
<th>SIMOTION D455-2 DP/PN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HIGH performance</strong></td>
<td><strong>ULTRA-HIGH performance</strong></td>
</tr>
<tr>
<td>Multi-axis system</td>
<td>Multi-axis system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degree of protection acc. to EN 60529 (IEC 60529)</th>
<th>IP20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (W x H x D)</td>
<td>50 x 380 x 270 mm (1.97 x 14.96 x 10.63 in)</td>
</tr>
<tr>
<td></td>
<td>230 mm (9.06 in) depth with disassembled spacer; all dimensions without double fan/battery module</td>
</tr>
</tbody>
</table>

#### Weight

- Control Unit, approx. 4400 g (9.7 lb)
- CompactFlash Card 10 g (0.35 oz)

#### Digital inputs

- **12**
  - Input voltage
    - Rated value 24 V DC
    - For signal "1" 15 ... 30 V
    - For signal "0" -3 ... +5 V
  - Galvanic isolation Yes, in groups of 6
  - Current consumption typ. at signal level 1 9 mA at 24 V

#### Digital inputs(outputs (parameterizable))

- **16**
  - Max. 16 as inputs of measuring inputs
  - Max. 8 as cam outputs

#### If used as an input

- Input voltage
  - Rated value 24 V DC
  - For signal "1" 15 ... 30 V
  - For signal "0" -3 ... +5 V
  - Galvanic isolation No
  - Current consumption typ. at signal level 1 9 mA at 24 V

#### If used as an output

- Rated load voltage 24 V DC
  - Permissible range 20.4 ... 28.8 V
  - Galvanic isolation No
  - Current load, max. 500 mA per output
  - Leakage current, max. 2 mA
  - Output delay time, typ./max. (hardware, with 48 Ω load)
    - L → H: 150 µs / 400 µs
    - H → L: 75 µs / 150 µs
  - Cam output
    - Reproducibility 10 µs
    - Resolution 1 µs
  - Switching frequency of the outputs, max.
    - With resistive load 100 Hz
    - With inductive load 2 Hz
    - With lamp load 11 Hz
  - Short-circuit protection Yes
SIMOTION D4x5-2 Control Units

Technical specifications (continued)

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-axis system</td>
<td>Multi-axis system</td>
</tr>
</tbody>
</table>

Additional technical specifications

**Non-volatile data backup**

- Backup time, min.
  - Retentive data: unlimited
  - Real-time clock: 4 days, minimum (maintenance-free backup)
- Charging time, typ.
  - Only a few minutes

**Approvals, according to**
- cULus and C-Tick

1) Alternative: Longer backup duration of the real-time clock via battery inserted in the double fan/battery module

Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.</th>
<th>Description</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMOTION D445-2 DP/PN Control Unit incl. double fan/battery module and battery (as of SIMOTION V4.2 SP1)</td>
<td>6AU1445-2AD00-0AA0</td>
<td>Accessories for SIMOTION D4x5-2 Double fan/battery module incl. battery</td>
<td>6FC5348-0AA02-0AA0</td>
</tr>
<tr>
<td>SIMOTION D455-2 DP/PN Control Unit incl. double fan/battery module and battery (as of SIMOTION V4.2 SP1)</td>
<td>6AU1455-2AD00-0AA0</td>
<td>Spare part for SIMOTION D445-1 and D4x5-2 Battery</td>
<td>6FC5247-0AA18-0AA0</td>
</tr>
<tr>
<td>CompactFlash Card (CF) 1 GB for SIMOTION D4x5-2 with the current SIMOTION Kernel and SINAMICS S120 drive software V4.x Pre-installed license using additional order codes 1)</td>
<td>6AU1400-2PA21-0AA0</td>
<td>Seal for external air cooling (1 pack = 10 units) With external air cooling, the cooling fins of the Control Unit are outside of the control cabinet. A seal is required so that the D4x5--2 can be hermetically mounted in the rear cabinet panel.</td>
<td>6FC5348-0AA07-0AA0</td>
</tr>
<tr>
<td>As Z option</td>
<td>M44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>As single license</td>
<td>6AU1820-0AA44-0AB0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Note about licenses for runtime software:
Runtime software licenses can either be pre-installed on a CompactFlash Card (CF) or ordered separately. See "Ordering of licenses for runtime software".

Note:
MultiAxes bundles are no longer available for the SIMOTION D4x5-2 (packages comprising Control Unit, CompactFlash Card + MultiAxes Package license).

You can instead order the Control Unit and CompactFlash Card with MultiAxes Package license individually:

For SIMOTION D445-2 DP/PN:
- Control Unit: 6AU1445-2AD00-0AA0
- CompactFlash Card with MultiAxes Package license: 6AU1400-2PA21-0AA0 -Z M44

For SIMOTION D455-2 DP/PN:
- Control Unit: 6AU1455-2AD00-0AA0
- CompactFlash Card with MultiAxes Package license: 6AU1400-2PA21-0AA0 -Z M44

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## SIMOTION D4x5-2 Control Units

### Accessories (continued)

#### Accessories for PROFIBUS

<table>
<thead>
<tr>
<th>Component Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFIBUS RS485 bus connector with angular cable outlet (35°) and screw-type terminals</td>
<td>6ES7972-0BA42-0XA0</td>
</tr>
<tr>
<td>PROFIBUS Fast Connect RS485 bus connector with angular cable outlet (35°) and insulation displacement terminals</td>
<td>6ES7972-0BB42-0XA0</td>
</tr>
</tbody>
</table>

#### Accessories for PROFINET

<table>
<thead>
<tr>
<th>Component Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>RJ45 FastConnect connector for Industrial Ethernet / PROFINET 145° cable outlet</td>
<td>6GK1901-1BB30-0AA0</td>
</tr>
<tr>
<td>RJ45 FastConnect connector for Industrial Ethernet / PROFINET 180° cable outlet</td>
<td>6GK1901-1BB10-2AA0</td>
</tr>
</tbody>
</table>

#### FastConnect cables for Industrial Ethernet / PROFINET

<table>
<thead>
<tr>
<th>Type</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE FC Standard Cable GP 2x2</td>
<td>6XV1840-2AH10</td>
</tr>
<tr>
<td>IE FC Flexible Cable GP 2x2</td>
<td>6XV1870-2B</td>
</tr>
<tr>
<td>IE FC Trailing Cable GP 2x2</td>
<td>6XV1870-2D</td>
</tr>
<tr>
<td>IE FC Trailing Cable 2x2</td>
<td>6XV1840-3AH10</td>
</tr>
<tr>
<td>IE FC Marine Cable 2x2</td>
<td>6XV1840-4AH10</td>
</tr>
</tbody>
</table>

#### Stripping tool for Industrial Ethernet/PROFINET FastConnect cables

<table>
<thead>
<tr>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>6GK1901-1GA00</td>
</tr>
</tbody>
</table>

#### Dust-proof blanking plugs

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>(50 units) for sealing unused DRIVE-CLiQ ports</td>
<td>6SL3066-4CA00-0AA0</td>
</tr>
</tbody>
</table>

1) Sold by the meter; max. length 1000 m; minimum order 20 m.

### Integrated drive control

The drive control integrated in the SIMOTION D4x5-2 Control Units is based on the drive control of a SINAMICS S120 CU320-2 Control Unit (firmware version V4.x), whereby there are minor functional differences. For example, the integrated drive control does not have a basic positioner function (EPos), since this is already covered by SIMOTION technology functions.

For more information, refer to Section “System description – Dimensioning” and the documentation for SIMOTION and SINAMICS.

### SIZER configuration tool

With the SIZER configuration tool, you can easily configure the SINAMICS S110/S120 drive family including SIMOTION. It provides you with support for selecting and dimensioning the components 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.

For more information about SIZER, refer to Section “System description – Dimensioning”.

### More information

- about PROFIBUS DP/MPI cables and MOTION-CONNECT can be found in Section "Connection system MOTION-CONNECT".
- about PROFIBUS DP, Industrial Ethernet and PROFINET can be found in Catalog IK PI and the Industry Mall under "Automation Systems/Industrial Communication" as well as the Section "Communication".
- about the ordering data for other SINAMICS drive components such as Line Modules, Motor Modules, DRIVE-CLiQ cables, etc. can be found in Section "SINAMICS S120 drive system" and the Industry Mall under "Drive Technology/Converters/...".

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The SIMOTION CX32 Controller Extension is a module in SINAMICS S120 booksize format and extends the drive-side computing performance of the SIMOTION D435 and D445-1 Control Units.

Up to 6 servo, 4 vector or 8 V/f axes can be operated on the SIMOTION D435 and D445-1 Control Units via the integrated drive computing performance.

The SIMOTION CX32 Controller Extension extends the drive computing performance by up to 6 additional servo, 4 vector or 8 V/f axes. This allows the number of axes of a multi-axis system to be increased according to the requirements of the application.

If required, several CX32 Controller Extensions can be operated on one SIMOTION D435/D445-1 Control Unit.

Benefits
- With a width of 25 mm, the CX32 Controller Extension requires very little space and is therefore well-suited for use in compact machines.
- The CX32 Controller Extension is connected to SIMOTION D435/D445-1 via DRIVE-CLiQ, so high-performance, isochronous closed-loop control of the drives is possible without the need for additional modules. The communication interfaces on the SIMOTION D435/D445-1 remain available for other connections.
- The addressing of the Controller Extension is independent of the addressing on PROFIBUS/PROFINET. This is advantageous for modular machine concepts.
- Simple cabling and configuration
- The "Control operation" signal from an infeed connected to the SIMOTION D4x5 is particularly easy to interconnect to the drives of the CX32 Controller Extension.
- The CX32 Controller Extension does not require its own CompactFlash card. Data is managed centrally on the CompactFlash card of the SIMOTION D435/D445-1 Control Unit. This has the following advantages:
  - Simple module replacement (no operator action required on the CX32, such as memory card replacement)
  - During firmware upgrades, the CX32 Controller Extension is automatically upgraded with the integrated drive of the SIMOTION D435/D445-1 Control Unit
  - Central license handling via the SIMOTION D4x5

Example: Group of 10 axes with SIMOTION D445-1 and SIMOTION CX32 Controller Extension

The SIMOTION CX32 Controller Extension is connected to the SIMOTION D435/D445-1 via DRIVE-CLiQ. In this way, a very compact axis grouping can be implemented, for example, with 10 axes.

If required, several SIMOTION CX32 Controller Extensions can be operated on one SIMOTION D435/D445-1 Control Unit.
- Max. 2 CX32 on one SIMOTION D435
- Max. 4 CX32 on one SIMOTION D445-1.

Additional drive controls can also be implemented with SINAMICS S110/S120 Control Units via PROFIBUS or PROFINET.

Note
The SIMOTION CX32 Controller Extension can only be used with SIMOTION D435 and D445-1 Control Units. Operation with SIMOTION D4x5-2 Control Units is not possible.

The SIMOTION CX32-2 Controller Extension (Order No. 6AU1432-2AA00-0AA0) must be used for SIMOTION D445-2 DP/PN and D455-2 DP/PN Control Units.
### Technical specifications

<table>
<thead>
<tr>
<th>Integrated drive control</th>
<th>6 / 4 / 8 (alternative) Drive control based on SINAMICS S120 CU320, firmware version V2.x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>DRIVE-CLiQ interfaces 4</td>
</tr>
<tr>
<td>General technical specifications</td>
<td></td>
</tr>
<tr>
<td>Supply voltage</td>
<td></td>
</tr>
<tr>
<td>• Rated value</td>
<td>24 V DC</td>
</tr>
<tr>
<td>• Permissible range</td>
<td>20.4 ... 28.8 V</td>
</tr>
<tr>
<td>Current consumption, typ. (Without load on inputs/outputs, without 24 V supply via DRIVE-CLiQ interfaces)</td>
<td>800 mA</td>
</tr>
<tr>
<td>Starting current, typ.</td>
<td>1.6 A</td>
</tr>
<tr>
<td>Power loss, typ.</td>
<td>20 W</td>
</tr>
<tr>
<td>Permissible ambient temperature</td>
<td></td>
</tr>
<tr>
<td>• Storage and transport</td>
<td>-40 ... +70 °C (-40 ... +158 °F)</td>
</tr>
<tr>
<td>• Operation</td>
<td>0 ... 55 °C (32 ... 131 °F) Maximum installation altitude 5000 m (16405 ft) above sea level. As of an altitude of 2000 m (6562 ft), the max. ambient temperature decreases by 7 °C (44.6 °F) every 1000 m (3281 ft).</td>
</tr>
<tr>
<td>Permissible relative humidity (without condensation)</td>
<td>5 ... 95%</td>
</tr>
<tr>
<td>Permissible air pressure</td>
<td>700 ... 1060 hPa</td>
</tr>
<tr>
<td>Degree of protection acc. to EN 60529 (IEC 60529)</td>
<td>IP20</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>25 x 380 x 270 mm (0.98 x 14.96 x 10.63 in) 230 mm (9.06 in) depth with disassembled spacer</td>
</tr>
<tr>
<td>Weight</td>
<td>2200 g (4.85 lb)</td>
</tr>
<tr>
<td>Digital inputs/outputs (parameterizable)</td>
<td>4 (max. 3 as high-speed measuring inputs)</td>
</tr>
</tbody>
</table>

#### Digital inputs/outputs

| If used as an input |  
| • Input voltage |  
| | - Rated value | 24 V DC |
| | - For signal "1" | 15 ... 30 V |
| | - For signal "0" | -3 ... +5 V |
| | • Galvanic isolation | No |
| | Current consumption typ. at signal level 1 | 10 mA at 24 V |
| | • Input delay, typ. (hardware) |  
| | - 3 inputs (can also be used as measuring inputs) | L → H: 5 µs H → L: 50 µs |
| | - 1 input | L → H: 50 µs H → L: 100 µs |
| | • Measuring input, reproducibility | 5 µs |

#### Digital inputs

| If used as an output |  
| • Rated load voltage | 24 V DC |
| • Permissible range | 20.4 ... 28.8 V |
| • Galvanic isolation | No |
| • Current load, max. | 500 mA per output |
| • Leakage current, max. | 2 mA |
| • Output delay time, typ./max. (hardware, with 48 Ω load) | L → H: 150 µs / 400 µs H → 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 |
| • Short-circuit protection | Yes |

## Additional technical specifications

### Approvals, according to cULus

The SIMOTION CX32 Controller Extension comes with pre-installed spacer.

### Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMOTION CX32 Controller Extension</td>
<td>6SL3040-0NA00-0AA0</td>
</tr>
<tr>
<td>For SIMOTION D435 and D445-1</td>
<td></td>
</tr>
</tbody>
</table>
Supplementary components / SIMOTION CX32-2 Controller Extension

Overview

The SIMOTION CX32-2 Controller Extension is a module in SINAMICS S120 booksize format. It enables the extension of the drive-side computing performance of the SIMOTION D4x5-2 Control Units.

Up to 6 servo, 6 vector or 12 V/f axes can be operated on the SIMOTION D445-2 DP/PN and D455-2 DP/PN Control Units via the integrated drive computing performance.

The SIMOTION CX32-2 Controller Extension extends the drive computing performance by up to 6 additional servo, 6 vector or 12 V/f axes. This allows the number of axes of a multi-axis system to be increased according to the requirements of the application.

If required, several CX32-2 Controller Extensions can be operated on one SIMOTION D4x5-2 Control Unit.

Benefits

- With a width of 25 mm, the CX32-2 Controller Extension requires very little space and is therefore well-suited for use in compact machines.
- The CX32-2 Controller Extension is connected to the SIMOTION D4x5-2 via DRIVE-CLiQ, so high-performance, isochronous closed-loop control of the drives is possible without the need for additional modules. The communication interfaces on the SIMOTION D4x5-2 remain available for other connections.
- The addressing of the Controller Extension is independent of the addressing on PROFIBUS/PROFINET. This is advantageous for modular machine concepts.
- Simple cabling and configuration
- The "Control operation" signal from an infeed connected to the SIMOTION D4x5-2 is particularly easy to interconnect to the drives of the CX32-2 Controller Extension.
- The CX32-2 Controller Extension does not require its own CompactFlash card. Data is managed centrally on the CompactFlash card of the SIMOTION D4x5-2 Control Unit. This has the following advantages:
  - Simple module replacement (no operator action required on the CX32-2, such as memory card replacement)
  - During firmware upgrades, the CX32-2 Controller Extension is automatically upgraded with the integrated drive of the SIMOTION D4x5-2 Control Unit
  - Central license handling via the SIMOTION D4x5-2

Design

Example: Group of 12 axes with SIMOTION D4x5-2 and SIMOTION CX32-2 Controller Extension

The SIMOTION CX32-2 Controller Extension is connected to the SIMOTION D4x5-2 via DRIVE-CLiQ.

In this way, a very compact axis grouping can be implemented, for example, with 12 servo axes.

If required, up to 5 SIMOTION CX32-2 Controller Extensions can be operated on a SIMOTION D445-2 DP/PN or SIMOTION D455-2 DP/PN Control Unit.

In principle, a sixth CX32-2 Controller Extension can also be connected. In this case, no drives / drive components can be connected any longer to the integrated drive control of the SIMOTION D4x5-2. All drives must then be operated via the connected Controller Extensions. This can be useful, for example, when implementing distributed, modular machine concepts.

Additional drive controls can be implemented with SINAMICS S110/S120 Control Units via PROFIBUS or PROFINET.

Note

The SIMOTION CX32-2 Controller Extension can only be used with SIMOTION D4x5-2 Control Units. Operation with SIMOTION D4x5 Control Units is not possible.

The SIMOTION CX32 Controller Extension must be used for the SIMOTION D435 and D445-1 Control Units (Order No. 6SL3040-0NA00-0AA0).
### Technical specifications

#### Integrated drive control

| Max. number of axes for integrated drive control (servo / vector / V/f) | 6 / 6 / 12 (alternative) Drive control based on SINAMICS S120 CU320-2, firmware version V4.x |

#### Communication

| DRIVE-CLiQ interfaces | 4 |

#### General technical specifications

**Supply voltage**

- **Rated value**: 24 V DC
- **Permissible range**: 20.4 ... 28.8 V

**Current consumption, typ.**

(Without load on inputs/outputs, without 24 V supply via DRIVE-CLiQ interfaces)

- **Typical**: 300 mA

**Starting current, typ.**

- **Typical**: 1.6 A

**Power loss, typ.**

- **Typical**: 7 W

**Permissible ambient temperature**

- **Long-term storage**: -25 ... +55 °C (-13 ... +131 °F)
- **Transport**: -40 ... +70 °C (-40 ... +158 °F)
- **Operation**: 0 ... +55 °C (32 ... 131 °F) Maximum installation altitude 4000 m (13124 ft) above sea level. As of an altitude of 2000 m (6562 ft), the max. permissible ambient temperature decreases by 7 °C (44.6 °F) every 1000 m (3281 ft).

**Permissible relative humidity**

- **Without condensation**: 5 ... 95%

**Permissible air pressure**

- **Typical**: 620 ... 1060 hPa

**Degree of protection acc. to EN 60529 (IEC 60529)**

- **Typical**: IP20

**Dimensions (W x H x D)**

- **Typical**: 25 x 380 x 270 mm (0.98 x 14.96 x 10.63 in) 230 mm (9.06 in) depth with disassembled spacer

**Weight**

- **Typical**: 2600 g (5.73 lb)

#### Digital inputs/outputs

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMOTION CX32-2 Controller Extension for SIMOTION D445-2 DP/PN and D455-2 DP/PN</td>
<td>6AU1432-2AA00-0AA0</td>
</tr>
</tbody>
</table>

The SIMOTION CX32-2 Controller Extension comes with pre-installed spacer.

### Selection and ordering data

**Description** | **Order No.**
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMOTION CX32-2 Controller Extension for SIMOTION D445-2 DP/PN and D455-2 DP/PN</td>
<td>6AU1432-2AA00-0AA0</td>
</tr>
</tbody>
</table>
Overview

The CBE30 Communication Board allows SIMOTION D4x5 to be connected to a PROFINET IO network. The SIMOTION D4x5 then assumes the function of a PROFINET IO controller and can perform the following functions:

- PROFINET IO controller, I-Device (also controller and device simultaneously)
- 100 Mbit/s full-duplex/autocrossing
- Supports real-time classes of PROFINET IO:
  - RT (Real Time)
  - IRT (Isochronous Real Time)
- Integration of distributed I/O as PROFINET IO devices
- Integration of drives as PROFINET IO devices through PROFIdrive according to the V4 specification
- Support for standard Ethernet communication, e.g.:
  - for interfacing with SIMOTION SCOUT
  - for the connection of HMI systems
  - for communication with any other devices over TCP/IP or UDP communication
- Integrated 4-port switch with four RJ45 sockets based on the PROFINET ASIC ERTEC400. The optimum topology (line, star, tree) can therefore be configured without additional external switches.

Integration

The CBE30 Communication Board is plugged into the option slot on the SIMOTION D4x5.

Note

The CBE30 Communication Board can only be used with the SIMOTION D425, D435, and D445-1 Control Units. The Communication Board cannot be operated with the SIMOTION D445-2 DP/PN and D455-2 DP/PN. These Control Units have an onboard PROFINET interface.

Technical specifications

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current requirement at 24 V DC</td>
<td>0.25 A</td>
</tr>
<tr>
<td>Permissible ambient temperature</td>
<td></td>
</tr>
<tr>
<td>• Storage and transport</td>
<td>-40 ... +70 °C (-40 ... +158 °F)</td>
</tr>
<tr>
<td>• Operation</td>
<td>0 ... 55 °C (32 ... 131 °F)</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>25 x 95 x 143 mm (0.98 x 3.74 x 5.63 in)</td>
</tr>
<tr>
<td>Weight, approx.</td>
<td>100 g (0.22 lb)</td>
</tr>
<tr>
<td>Approvals, according to</td>
<td>ciULus</td>
</tr>
</tbody>
</table>

Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE30 Communication Board For SIMOTION D4x5</td>
<td>6FC5312-0FA00-0AA0</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RJ45 FastConnect plug connector for Industrial Ethernet/PROFINET</td>
<td></td>
</tr>
<tr>
<td>• 145° cable outlet 1)</td>
<td></td>
</tr>
<tr>
<td>- 1 pack = 1 unit</td>
<td>6GK1901-1BB30-0AA0</td>
</tr>
<tr>
<td>- 1 pack = 10 units</td>
<td>6GK1901-1BB30-0AB0</td>
</tr>
<tr>
<td>• 180° cable outlet</td>
<td></td>
</tr>
<tr>
<td>- 1 pack = 1 unit</td>
<td>6GK1901-1BB10-2AA0</td>
</tr>
<tr>
<td>- 1 pack = 10 units</td>
<td>6GK1901-1BB10-2AB0</td>
</tr>
<tr>
<td>FastConnect cables for Industrial Ethernet/PROFINET 2)</td>
<td></td>
</tr>
<tr>
<td>• IE FC Standard Cable GP 2x2</td>
<td>6XV1840-2AH10</td>
</tr>
<tr>
<td>• IE FC Flexible Cable GP 2x2</td>
<td>6XV1870-2B</td>
</tr>
<tr>
<td>• IE FC Trailing Cable GP 2x2</td>
<td>6XV1870-2D</td>
</tr>
<tr>
<td>• IE FC Trailing Cable 2x2</td>
<td>6XV1840-3AH10</td>
</tr>
<tr>
<td>• IE FC Marine Cable 2x2</td>
<td>6XV1840-4AH10</td>
</tr>
<tr>
<td>Stripping tool for Industrial Ethernet/PROFINET FastConnect cables</td>
<td></td>
</tr>
<tr>
<td>• IE FC stripping tool</td>
<td>6GK1901-1GA00</td>
</tr>
</tbody>
</table>

More information

More information about FastConnect cables can be found in Catalog IK PI (Industrial Communication) and the Industry Mall under Automation technology/Industrial Communication/Industrial Ethernet/Cabling technology/...
Overview
The TB30 Terminal Board supports the addition of digital inputs/digital outputs and analog inputs/analog outputs to the CU320-2 and SIMOTION D4x5/D4x5-2 Control Units.

Design
The following are located on the TB30 Terminal Board:
- Power supply for digital inputs/digital outputs
- 4 digital inputs
- 4 digital outputs
- 2 analog inputs
- 2 analog outputs

The TB30 Terminal Board plugs into the option slot on a Control Unit.
A shield connection for the signal cable shield is located on the Control Unit.

Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB30 Terminal Board</td>
<td>6SL3055-0AA00-2TA0</td>
</tr>
</tbody>
</table>

Technical specifications

<table>
<thead>
<tr>
<th>TB30 Terminal Board 6SL3055-0AA00-2TA0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power requirement, max.</td>
</tr>
<tr>
<td>At 24 V DC via Control Unit without taking account of digital outputs</td>
</tr>
<tr>
<td>• Conductor cross-section, max.</td>
</tr>
<tr>
<td>• Fuse protection, max.</td>
</tr>
<tr>
<td>Digital inputs</td>
</tr>
<tr>
<td>In accordance with IEC 61131-2 Type 1</td>
</tr>
<tr>
<td>• Voltage</td>
</tr>
<tr>
<td>• Low level (an open digital input is interpreted as &quot;low&quot;)</td>
</tr>
<tr>
<td>• High level</td>
</tr>
<tr>
<td>• Current consumption at 24 V DC, typ.</td>
</tr>
<tr>
<td>• Delay time of digital inputs 1), approx.</td>
</tr>
<tr>
<td>- L → H</td>
</tr>
<tr>
<td>- H → L</td>
</tr>
<tr>
<td>• Conductor cross-section, max.</td>
</tr>
</tbody>
</table>

Digital outputs
Sustained short-circuit strength

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB30 Terminal Board</td>
<td>6SL3055-0AA00-2TA0</td>
</tr>
<tr>
<td>Digital outputs</td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>24 V DC</td>
</tr>
<tr>
<td>Load current per digital output, max.</td>
<td>500 mA</td>
</tr>
<tr>
<td>• Delay time of digital outputs 1), approx.</td>
<td>150 μs</td>
</tr>
<tr>
<td>• Conductor cross-section, max.</td>
<td>0.5 mm²</td>
</tr>
</tbody>
</table>
| Analog inputs  
(Difference) |                            |
| Voltage range (an open analog input is interpreted as 0 V) | -10 … +10 V |
| Internal resistance $R$                  | 65 kΩ  |
| Resolution 2)                          | 13 bit + sign |
| Conductor cross-section, max.           | 0.5 mm² |
| Analog outputs  
(Sustained short-circuit strength) |                            |
| Voltage range                                         | -10 … +10 V |
| Max. load current                                    | -3 … +3 mA |
| Resolution                                            | 11 bit + sign |
| Settling time, approx.                               | 200 μs  |
| Conductor cross-section, max.                       | 0.5 mm² |
| Power loss                                            | < 3 W   |
| Weight, approx.                                      | 0.1 kg (0.22 lb) |
| Approvals, according to cULus                        |        |

1) The specified delay times refer to the hardware. The actual reaction time depends on the time slot in which the digital input is processed.
2) If the analog input is to be operated in the signal processing sense with continuously variable input voltage, the sampling frequency $f_s = 1/f_{\text{time slice}}$ must be at least twice the value of the highest signal frequency $f_{\text{max}}$. 
Supplementary components / TB30 Terminal Board

Integration

Connection example of TB30 Terminal Board
The information provided in this catalog contains descriptions or characteristics of performance which in case of actual use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract. Availability and technical specifications are subject to change without notice.

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www.siemens.com/automation

Additional information

Motion Control System SIMOTION:
www.siemens.com/simotion

SINAMICS drive family:
www.siemens.com/sinamics

Motion Control systems and solutions for equipping production machines and machines tools:
www.siemens.com/motioncontrol

Contacts worldwide:
www.siemens.com/automation/partner