Motion Control System SIMOTION
Controller based Platform

Update Catalog PM21 • 2008
SIMOTION C is the controller version of the SIMOTION family with the proven design of the SIMATIC S7-300. Flexible modular expansion of SIMOTION C is possible by using the SIMATIC S7 module spectrum. Both SIMOTION C240 and C240 PN represent two powerful motion controllers for advanced control and motion control tasks.

Depending on the controller type, HMI devices can be connected directly to the onboard PROFIBUS, 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**

- Mounting flexibility due to the SIMATIC S7 module spectrum and thus optimal adaptation to the automation task
- For universal use with digital and analog coupling to servo/vector, stepper and hydraulic drives (depending on the controller type)
- User-friendly mounting and simple design with no moving parts
- Flexible networking through onboard Industrial Ethernet, PROFIBUS DP and PROFINET IO interfaces
- Powerful due to the range of integrated functions
- Easy engineering of Logic and Motion Control applications in the same program

**Application**

SIMOTION C can be used wherever

- Motion Control, technology and PLC functionalities are to be programmed, configured and executed in a single unit,
- a modularly expandable device is to be placed near or in the machine,
- communication with other programmable controllers is necessary.

SIMOTION C is universally applicable and meets the highest standards with respect to suitability for industrial use, because of high EMC compatibility and resistance against shock and vibration loads.

**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
- Retrofit

Due to the increasing use of servo drives, these machines require a high degree of integration of PLC, Motion Control and technology functions.

**Design**

The Motion Control System SIMOTION C is designed with modular principles in mind. It comprises of a comprehensive hardware spectrum which uses components of the SIMATIC S7-300 series and Siemens drive technology.

**Components and interfaces of the SIMOTION C Motion Controller:**

- Analog drive interfaces (C240 only)
  - For setpoint outputs to servo/vector drives
  - For setpoint outputs to the actuating valves of hydraulic drives
  - As freely assignable analog outputs
- Pulse outputs for controlling stepper drives (C240 only)
- Interfaces for incremental/absolute encoders for cyclic acquisition of an actual position value or as freely assignable up/down counter (C240 only)
- Onboard I/O for high-speed I/O signals
- SIMOTION Micro Memory Card (MMC) for storing:
  - SIMOTION Kernel
  - User programs
  - User variables
- Integrated communications interfaces for linking:
  - Distributed I/Os
  - HMI systems
  - PG/PC
  - Other Motion Control and automation systems
  - Drives with digital setpoint interface
- Various status/error displays and a mode selector
Design (continued)

The following components make up a SIMOTION C system:
- Motion Controller and Micro Memory Card (MMC)
- As well as other system components (depending on requirements) such as:
  - Load power supplies (PS) for connecting SIMOTION C to a power supply of 120 V/230 V AC
  - Central (not onboard) and distributed I/O components
  - Servo/vector drives with analog or digital setpoint interface or stepper drives

Mounting and connection technology
The simple design makes SIMOTION C flexible and easy to maintain:
- Rail mounting
  Simply attach the module to the standard mounting rail, swing it in and screw it tight.
- Integrated backplane bus
  The backplane bus is integrated in the Motion Controller.
  The Motion Controller is connected to the I/O modules via bus connectors which are plugged into the rear of the housing.
  The front connector coding prevents front connectors from being plugged into the wrong module type.
- Screw-type terminals, spring-loaded terminals or Fast Connect system for I/O modules
- TOP connect
  This connection method provides preassembled wiring with 1 to 3-wire connection systems with screw-type or spring-loaded terminal as an alternative to wiring directly on the I/O module.
- Defined mounting depth for all modules since all connections and connectors are recessed in the module and are protected and covered by doors on the front.
- No slot rules.

Expansion with central I/O modules
Up to 8 slots can be used to the right of the Motion Controller for SIMATIC S7-300 I/O modules.

The IM 365 can be used to connect an expansion rack (two-tier design) to increase the number of slots available for I/O modules from 8 to 16. Multitier configuration with IM 360/IM 361 is not supported by SIMOTION C.

SIMOTION C can be mounted horizontally or vertically.

If additional I/O modules are required, the distributed SIMATIC ET 200 I/O can be connected to SIMOTION C over PROFIBUS DP or PROFINET I/O (with C240 PN).

The number of pluggable I/O modules is also limited by the power required from the backplane bus. The power consumption of all modules which are connected to the same backplane bus must not exceed 1.2 A.

Expansion using distributed I/Os
Distributed I/Os can be assembled with intelligent I/O system components:
- SIMATIC ET 200S
- SIMATIC ET 200M
- SIMATIC ET 200pro
- SIMATIC ET 200eco

Function
SIMOTION C provides the following basic functionality for the various automation requirements:
- SIMOTION runtime system
  - Programmable with several languages conforming to IEC 61131
  - Various methods of program executions (cyclic, sequential, event-driven)
  - PLC and arithmetic functionality
  - Communication and management functions
  - Motion Control functions (Motion Control Basic)
- Testing and diagnostic tools
  This basic functionality can be expanded, for example, with loadable technology packages, if required.

Technology packages (TP)
A special feature of SIMOTION is that the operating system functionality can be expanded by loading technology packages, such as:
- Motion Control with the functions:
  - POS - Positioning
  - GEAR - Synchronous operation/electronic gear
  - CAM - Cam
  - PATH - Path interpolation
- TControl - Temperature controller
  Since the technology functions have modular licenses, you only pay for what you use.

Configuration/parameterization/programming
SIMOTION SCOUT is a powerful and user-friendly engineering tool. It is an integrated system for all engineering steps, from configuration 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 utilities which support user-friendly data exchange with HMI devices are integrated in the basic functionality of the SIMOTION C Controller. 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 C via Industrial Ethernet, PROFIBUS or PROFINET (with C240 PN) and they are configured using ProTool/Pro or WinCC flexible.

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

Together with SIMOTION IT the integrated Web-Server of SIMOTION C allows e.g. user specific web pages to be placed on the Motion controller.

The variables available on the Motion Controller can be either read or written via an internet browser on a Client-PC. In addition active display and operating function can be implemented within the web pages by using Java-Scripts or Applets.
General Information

Function (continued)

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

Further information

- about SIMOTION and SINAMICS can be found in the catalogs PM21, IK PI, ST70 and ST80.
Overview

SIMOTION C is a motion controller in S7-300 design. In addition to the already integrated interfaces, the controller can be expanded using I/O modules from the SIMATIC S7-300 range. The two versions SIMOTION C240 and SIMOTION C240 PN have the same PLC- and Motion Control Performance, but differ in the interfaces that they provide.

Drive interfaces (C240 only)
- 1 setpoint output interface for up to 4 axes (alternatively analog, stepper or hydraulic drives; can also be used as freely assignable analog outputs)
- 4 encoder inputs for incremental or absolute encoders (can also be used as freely assignable up/down counter)

Communication
- 1 interface for Industrial Ethernet
- 2 interfaces for PROFIBUS DP (thereof one interface for MPI)
- 3 ports for PROFINET IO (C240 PN only)

Data backup
- 1 slot for SIMOTION Micro Memory Card (MMC)

Additional interfaces
- Power supply terminals

Data storage/data backup
The SIMOTION C Motion Controller has an integrated non-volatile data memory for storing process variables. The data is backed up on a SIMOTION Micro Memory Card (MMC).

Expansion with central I/O modules
The central I/O is directly plugged into the SIMOTION C Motion Controller. The I/O configuration for centralized I/O can comprise of two tiers (second tier using IM 365 interface) with up to 8 I/O modules each and a total of 4 analog modules. I/O modules from the SIMATIC S7-300 spectrum can be used here.

Expansion using distributed I/Os
The following can be used as distributed I/O components:

PROFIBUS DP
- All certified PROFIBUS standard slaves (DP-V0, DP-V1, DP-V2)
- Distributed I/O systems such as ET 200S/M/eco/pro
- Servo drives of the MASTERDRIVES, SIMODRIVE and SINAMICS series over PROFIBUS DP interface with PROFIdrive
- MICROMASTER and COMBIMASTER frequency drives
- Stepper drives over PROFIBUS DP interface with PROFIdrive

PROFINET IO (C240 PN only)
- Distributed I/O systems such as ET 200S/M/pro
- Servo drives SINAMICS S120 over PROFINET IO with IRT (PROFIdrive)

Design

Interfaces

Operation, display and diagnostics
- 1 mode selector
- 1 LED strip for fault and status indicators

Integrated I/Os
- 18 digital inputs (C240: thereof 2 for measuring inputs and 4 for measuring inputs / zero marks; C240 PN: thereof 4 for measuring inputs)
- 8 digital outputs
The control and motion control functionality runs centrally on the SIMOTION C controller. The functionality ranges from simple positioning up to complex motion control tasks over cams.

**Position-controlled motion control**

Setpoint output/actual value acquisition:

- Position control with analog setpoint output
  The Motion Controller SIMOTION C240 has one analog output for the speed setpoint and one encoder input for cyclic detection of the actual position value for each axis. With hydraulic drives the analog output is used to provide the setpoint value for the actuating valves.

- Position control with pulse direction output for stepper drives
  The SIMOTION C240 has one pulse output for the position setpoint for each axis. Stepper drives can either be operated without an encoder or be position-controlled with an encoder.

- Position control with digital setpoint output
  The PROFIBUS DP interface with PROFIdrive or PROFINET IO interface of the C240 PN are available for this purpose. The actual position value is read in over PROFIBUS DP or PROFINET IO and the speed setpoint is output.

- Position control with mixed setpoint output
  With the C240 analog, stepper and PROFIBUS drives can be used in a mixed configuration. The channels of the 4 onboard interfaces can be used for either analog or stepper drives. With the C240 PN PROFIBUS and PROFINET drives can be used in a mixed configuration.

- Incremental position detection (Onboard on C240 only)
  Incremental encoders supply counter pulses for the traversed path in accordance with their resolution. It is generally necessary to use reference point approach.

  The following can be used:
  - Rotary encoders
  - Translatory encoders (length dimensions)

- Absolute position detection (Onboard on C240 only)
  Absolute value encoders with serial interfaces can be used (SSI absolute value encoders).

  It is not necessary to use reference point approach.

- Position control/position detection with ADI 4 or IM 174
  The ADI 4 (Analog Drive Interface for 4 axes) or IM 174 (Interface Module for 4 axes) module can be used to connect additional drives with analog setpoint interfaces.

  The IM 174 also supports the connection of stepper drives with a pulse direction interface.

  Both modules are connected via PROFIBUS DP.

  The following can be connected to an ADI 4 or IM 174 module:
  - 4 drives
  - 4 encoders

- Isochronous PROFIBUS encoder
### Technical data

#### SIMOTION C240/C240 PN Motion Controller

**Power supply**
- Rated value: 24 V DC
- Permissible range: 20.4 V to 28.8 V

**Current consumption, typ.**
- 1.2 A

**Inrush current, typ.**
- 8.0 A

**Power loss**
- 15 W

**Permissible ambient temperature**
- Storage and transport: -40 °C to +70 °C (-40 °F to +158 °F)
- Operation: 0 °C to +55 °C (32 °F to +131 °F)

**Permissible relative humidity**
- 5% to 95% (without condensation)

**Atmospheric pressure**
- 700 hPa to 1060 hPa

**Degree of protection in accordance with IEC 529**
- Degree of protection: IP20

**Dimensions (W x H x D)**
- 200 mm x 125 mm x 118 mm (7.87 in x 4.92 in x 4.65 in)

**Weight**
- SIMOTION C240/C240 PN: 1.15 kg (2.5 lb)
- Memory card: 0.016 kg (0.03 lb)

**Relay-Outputs**
- 5 (C240)
- 1 (C240 PN)

- Thereof controller enable (C240 only): 4
- Thereof READY: 1

**Encoder inputs, max.**
- 4 (C240 only)

**Inputs, SSI absolute value encoder**
- Interface type (RS 422): 5 V
- Encoder supply: 5 V/0.3 A
- Isolation: No
- Encoder frequency, max.: 1 MHz
- Cable length, max.:
  - at 1 MHz: 10 m (32.8 ft)
  - at 500 kHz and 300 mA: 25 m (82 ft)
  - at 500 kHz and 210 mA: 35 m (115 ft)

**Outputs, SSI absolute value encoder**
- Interface type (RS 422): 5 V synchronous serial, single or multiturn
- Encoder supply: 24 V/0.3 A
- Isolation: No
- Transmission rate: 187.5/375/750/1500 kbit/s
- Message length, max.: 25 bit
- Cable length, max.:
  - at 187.5 kbit/s: 250 m (820 ft)
  - at 1500 kbit/s: 10 m (32.8 ft)
- Monitoring:
  - Short circuit of the sensor supply: Yes
  - Wire break: Yes

**Drive interfaces**
- 4 (C240 only)

**Analog outputs**
- Voltage range: ± 10.5 V
- Resolution: 16 Bit including sign
- Isolation: No
- Load impedance: > 3 kΩ
- Cable length, max.: 35 m (115 ft)

**Pulse outputs for stepper drives**
- Output voltage for signal “1”, Io = 20 mA: 3.7 V
- Output voltage for signal “0”, Io = 20 mA, max.: 1 V
- Load resistance, min.: 55 Ω
- Cable length, max.: 50 m (164 ft)
- Pulse frequency, max.: 750 kHz

**Real-time clock buffering**
- Buffer time, typ.: 4 weeks
- Charging time, typ.: 1 h

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### Technical data (continued)

#### Integrated digital inputs

- 18

**with special functions for:**
- Measuring probe (C240 only): 2
- Bero: 4

**also usable for measuring probes**
- (with C240 PN for measuring probes only)
- All inputs can be used as standard inputs

**Input voltage**
- Rated value: 24 V DC
- For signal “+”: 11 V to 30 V
- For signal “0”: -3 V to +5 V

**Isolation**
- Inputs in groups of: 18

**Input current**
- For signal “*”, min./typ.: 6 mA/8 mA

**Input delay (at rated value of input voltage)**
- 0 → 1, typ./max.: 6 μs/15 μs
- 1 → 0, typ./max.: 40 μs/150 μs

**Connection of 2-wire Bero**
- Yes

**Permissible quiescent current**
- 2 mA

#### Integrated digital outputs

- 8

**Rated load voltage**
- 24 V DC
- Permissible range: 20.4 V to 28.8 V

**Output voltage**
- For signal “+”, max.: L+

**Isolation in groups of**
- 8

**Output current**
- For signal “+”:
  - Minimum current per channel: 5 mA
  - For signal “0”, max.: 0.5 mA

**Residual current, max.**
- 2 mA

**Derated loading**
- at 40 °C (104 °F): 4 A
- at 55 °C (131 °F): 2 A

**Switching frequency of the outputs**
- With ohmic load: 100 Hz
- With inductive load: 2 Hz

**Lamp load**
- 5 W
- Purge energy/channel: 400 mJ (not simultaneous)

**Output delay, typ.**
- 150 μs

**Short-circuit protection**
- Yes

### Communication

**Ethernet Interfaces**
- 1
  - 10 MBit: Yes
  - 100 MBit: Yes

**PROFIBUS Interfaces**
- 2
  - Thereof usable for MPI: 1
  - PROFIBUS DP with PROFIdrive: Yes

**PROFINET Interfaces**
- 1 Interface with 3 Ports
  - PROFINET IO with IRT and RT: Yes
  - Configurable as PROFINET IO Controller and/or Device: Yes

### Approval

- cULus-approval: Yes
## SIMOTION C - Controller-based

**SIMOTION C240/C240 PN Motion Controller**

### Selection and Ordering Data

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>6AU1 240-1AA00-0AA0</td>
<td>SIMOTION C240 1) Motion Controller</td>
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<tr>
<td>6AU1 240-1AB00-0AA0</td>
<td>SIMOTION C240 PN 2) Motion Controller</td>
</tr>
<tr>
<td>6AU1 720-1KA00-0AA0</td>
<td>SIMOTION C240/C240 PN MMC 64 MB for SIMOTION C240/C240 PN</td>
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<tr>
<td>6AU1 720-1KA00-0AA0</td>
<td>SIMOTION C240/C240 PN MMC 64 MB with License Multi Axes Package for SIMOTION C</td>
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<tr>
<td>6AU1 240-1AA00-0CA0</td>
<td>SIMOTION C240 MultiAxes Bundle consists of 1 item each</td>
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<tr>
<td></td>
<td>• SIMOTION C240</td>
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<tr>
<td></td>
<td>• MMC 64 MB with License MultiAxes Package for SIMOTION C</td>
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<tr>
<td>6AU1 240-1AB00-0CA0</td>
<td>SIMOTION C240 PN MultiAxes Bundle (in preparation)</td>
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<td></td>
<td>• SIMOTION C240 PN</td>
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<tr>
<td></td>
<td>• MMC 64 MB with License MultiAxes Package for SIMOTION C</td>
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<tr>
<td>6ES7 392-1AM00-0AA0</td>
<td>Front connector, 40-pole</td>
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<tr>
<td></td>
<td>• with screw contacts</td>
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<tr>
<td>6ES7 392-1BM01-0AA0</td>
<td>• with spring-loaded contacts</td>
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<tr>
<td>6ES7 392-1CM00-0AA0</td>
<td>• with Fast Connect fast connection method</td>
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<tr>
<td>6ES7 390-7BA00-0AA0</td>
<td>PS - C2xx connecting comb for PS307 power supply</td>
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<tr>
<td>6ES7 365-0BA01-0AA0</td>
<td>IM 365 interface for expanding the Motion Controller with up to max. 1 ER</td>
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<td>(expansion rack), 2 modules with permanent connecting cable (1 m) (3.28 ft)</td>
</tr>
<tr>
<td>6ES7 390-1AB60-0AA0</td>
<td>• Standard temperature range</td>
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<td>6ES7 390-1AE80-0AA0</td>
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<td>6ES7 390-1AF30-0AA0</td>
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<tr>
<td>6ES7 390-1AJ30-0AA0</td>
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<tr>
<td>6ES7 390-1BC30-0AA0</td>
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### Further information

- about SIMOTION and SINAMICS can be found in the catalogs PM21, IK PI, ST70 and ST80.

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1) Requires SIMOTION V4.0 HF2  
2) Requires SIMOTION V4.1 SP2 HF3/4
Notes
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 product. 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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