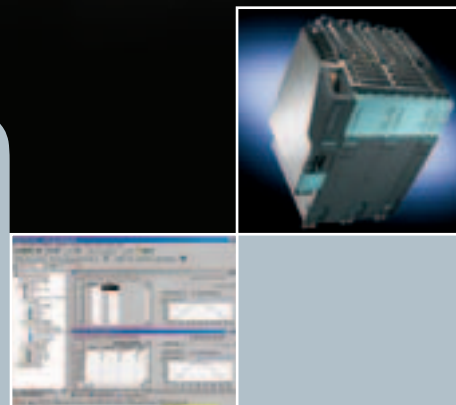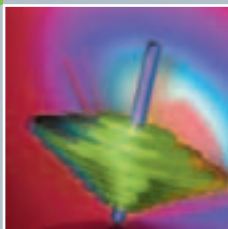# simotion

SIMOTION
Motion Control System

SIEMENS

Related catalogs

SINAMICS S120 D 21.1
Vector Control Drive System

Order No.:
E86060-K5521-A111-A1-7600

SINAMICS S120 D 21.2
Servo Control Drive System

Order No.:
E86060-K5521-A121-A1-7600

MICROMASTER DA 51.2
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Inverters
0.12 kW to 250 kW (0.16 HP to 335 HP)
Order No.:
E86060-K5151-A121-A4-7600

Servo Motors DA 65.3
Synchronous and Asynchronous
Servo Motors for
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E86060-K5465-A301-A2-7600

SIMODRIVE 611 universal DA 65.4
and POSMO
0.075 kW to 120 kW (0.1 HP to 161 HP)

Order No.:
E86060-K5165-A401-A2-7600

Vector Control DA 65.10
SIMOVERT MASTERDRIVES VC
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Paper: E86060-K6850-A101-B6 (German)
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Catalog CA 01 CA 01
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DVD: E86060-D4001-A500-C3-7600

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SIMOTION
Motion Control System

Catalog PM 10 · 2005

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Automation and Drives

We would like to welcome you to Automation and Drives and our comprehensive range of products, systems, solutions and services for production and process automation and building technology worldwide.

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They will be glad to assist you.
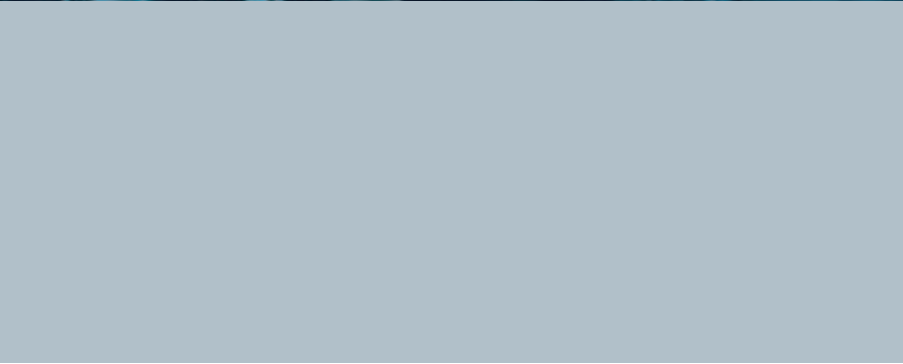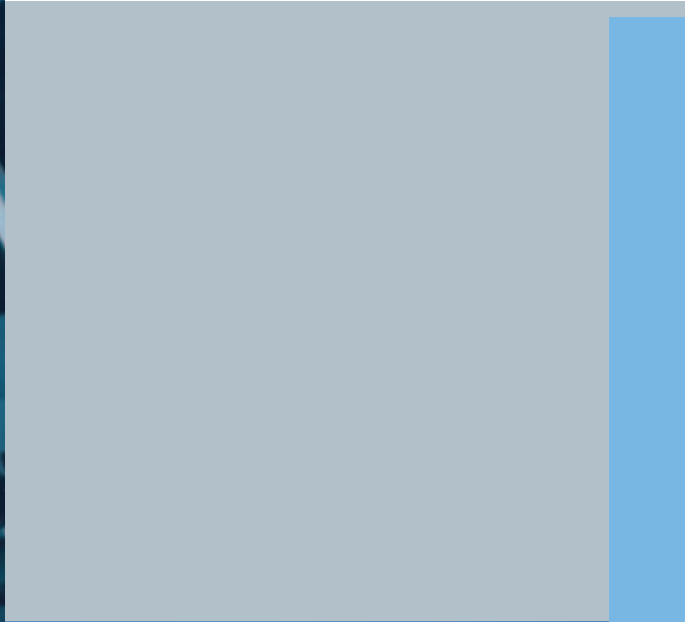
Totally Integrated Automation – innovations for more productivity

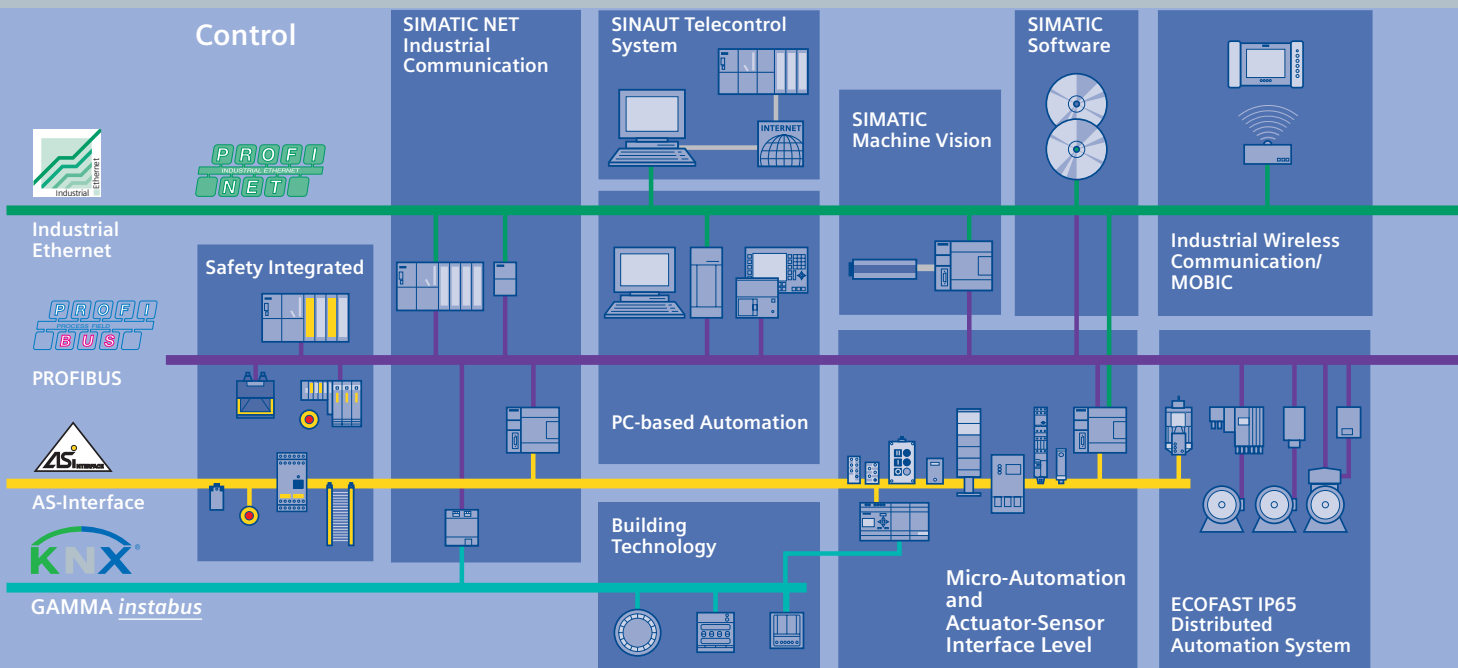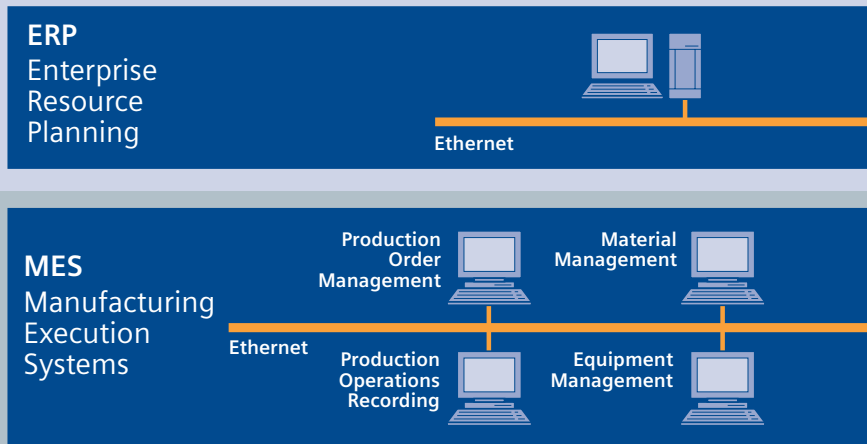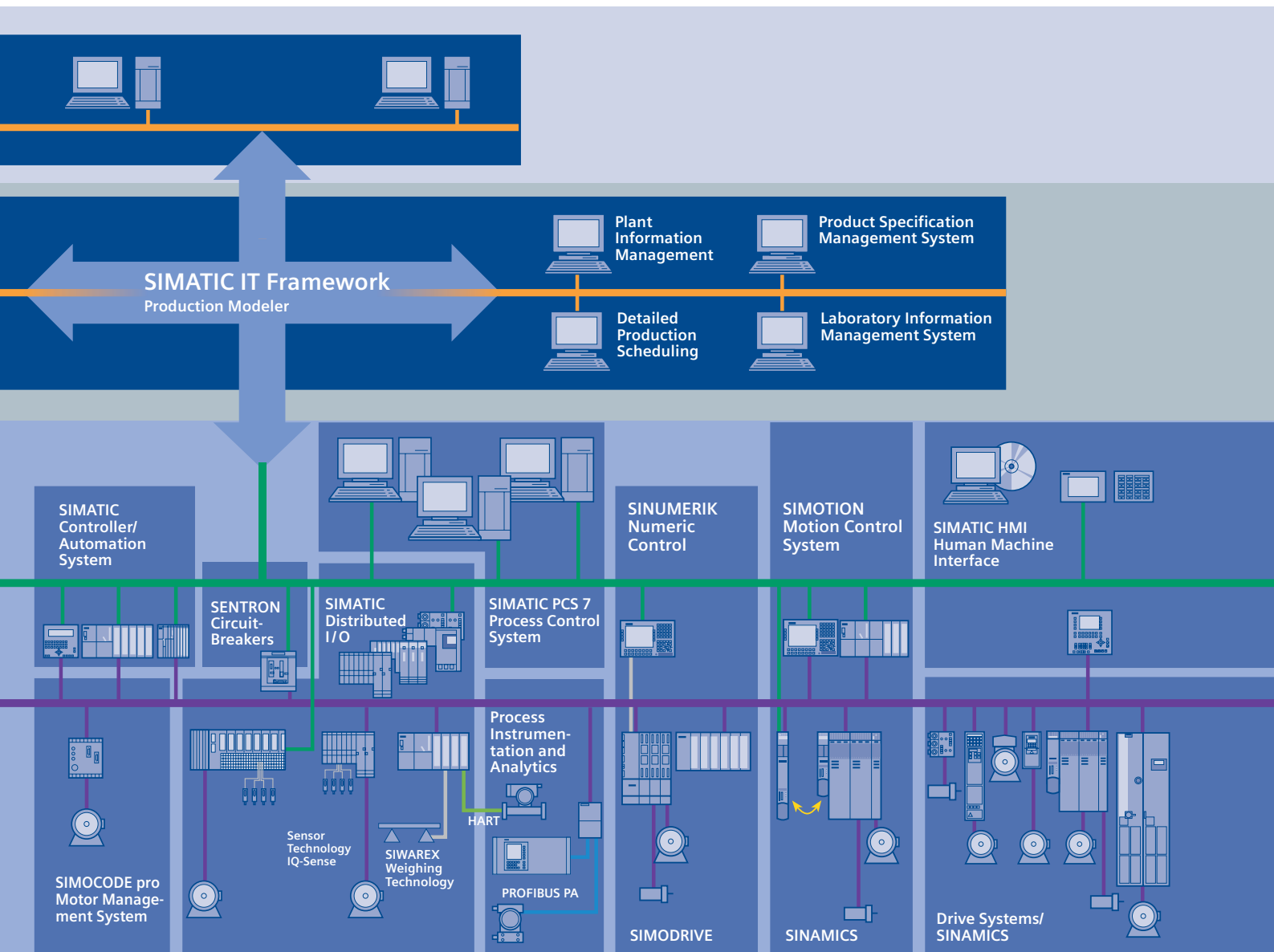With the launch of Totally Integrated Automation, we were the first ones on the market to consistently implement the trend from equipment to an integrated automation solution, and have continuously improved the system ever since. Whether your industry is process- and production-oriented or a hybrid, Totally Integrated Automation is a unique "common solution" platform that covers all the sectors.

Totally Integrated Automation is an integrated platform for the entire production line - from receiving to technical processing

ERP
Enterprise
Resource
Planning

Ethernet

MES
Manufacturing
Execution
Systems

Ethernet

Production Order Management

Material Management

Production Operations Recording

Equipment Management

Control

SIMATIC NET Industrial Communication

SINAUT Telecontrol System

INTERNET

SIMATIC Software

SIMATIC Machine Vision

Industrial Ethernet

Safety Integrated

Industrial Wireless Communication/ MOBIC

PROFIBUS

PC-based Automation

AS-Interface

Building Technology

GAMMA *instabus*

Micro-Automation and Actuator-Sensor Interface Level

ECOFAST IP65 Distributed Automation System

and production areas to shipping. Due to the system-oriented engineering environment, integrated, open communications as well as intelligent diagnostics options, your plant now benefits in every phase of the life cycle.
In fact, to this day we are the only company worldwide that can offer a control system based on an integrated platform for both the production and process industry.

SIMATIC IT Framework
Production Modeler

Plant Information Management

Product Specification Management System

Detailed Production Scheduling

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PROFIBUS PA

SIMOCODE pro Motor Management System

SIMODRIVE

SINAMICS

Drive Systems/ SINAMICS

Excellence in Motion Control

Motion Control solutions "Made by Siemens"

The Motion Control systems division of the Automation and Drives Group offers complete future-oriented automation solutions for machine tools and production machines.

Due to the strong innovation capacity, the sector know-how and the outstanding customer benefit of these solutions, Siemens is one of the leading suppliers of Motion Control systems worldwide. For this reason, we can supply many references in different areas.

Innovative products, systems, solutions and services for each sector

Siemens Motion Control systems fulfill very high requirements: All products stand out due to the latest technologies, high functionality and quality. In addition, the individual systems and products are optimally matched to one another so that they can be easily and consistently combined into an economic machine solution.

Examples of this are the Motion Control system SIMOTION and the drive system SINAMICS. These products constitute an innovative system platform with which you can optimally adapt your machine to your requirements. As a result you can find optimized, economic and future-oriented Motion Control solutions for different sectors such as the packaging, plastics and glass, timber and metal, textile and printing industries which can be easily expanded for increased requirements and combined with our high performance servo, linear, torque and standard motors.

Furthermore, Siemens supports its customers over the whole life cycle of a machine, e. g. with worldwide presales and aftersales service at more than 295 service points in 130 countries or with special services for Motion Control solutions such as application consulting and mechatronic support.

Application consulting:
The safe way to top solutions

Several application centers in Germany, Italy, France, Turkey, the USA, and China support the specialist and application consultants on site who accompany customer projects from planning up to commissioning - from the idea to the operational machine.

Application consulting includes:

- Planning and implementing projects
- Technical verification with test configuration and simulation
- Development of requirements and functional specifications
- Application workshops and customer-specific training courses

Partnership for joint success

During this cooperation Siemens not only supports its customers, but also includes them as technology partners in the development process of systems and components which results in practical and future-oriented automation solutions.

In this way Siemens helps its customers to increase productivity, competitiveness and profitability over the long term.

The system approach

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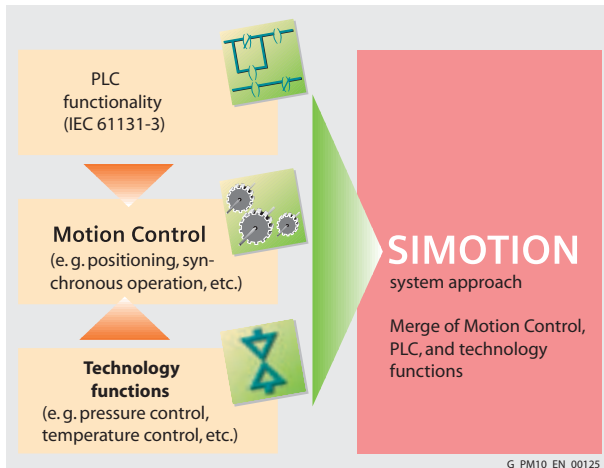
SIMOTION is available for all machines carrying out Motion Control tasks - from simple machines to the high-performance variety. The focus is on a simple and flexible solution to a huge variety of Motion Control tasks. In order to achieve this in the best way possible, a new system approach has been introduced:

Motion Control has been combined with two other control functions found in most machines: PLC and technology functions.

This approach enables the Motion Control of axes and machine control within the same system. The same applies to technology functions, such as pressure control of a hydraulic axis. A seamless switch can be made from position-controlled positioning mode to pressure control.

Combining the three control functions of Motion Control, Logic control (PLC) and technology functions has the following benefits:

- Reduced engineering overhead and increased machine performance
- Time-critical interfaces between the individual components are no longer required
- Simple, uniform and transparent programming and diagnostics of the entire machine

The SIMOTION system comprises three components:

Engineering system

Motion Control, PLC and technology tasks can all be performed within an integrated system. The engineering system provides all the tools required for these tasks: From programming and parameterization, through testing and commissioning, to diagnostics.

Runtime software modules

These modules provide the various Motion Control and technology functions. The entire system functionality can be adapted to the machine as required by selecting the appropriate modules.

Hardware platforms

The hardware platforms form the basis of the SIMOTION Motion Control system. The application created by the engineering system and the associated Runtime software modules can be used on various hardware platforms.

Thus you can always select the platform which is most suited to your machine, whether as a controller, an industrial PC or an Intelligent Module directly in the drive.

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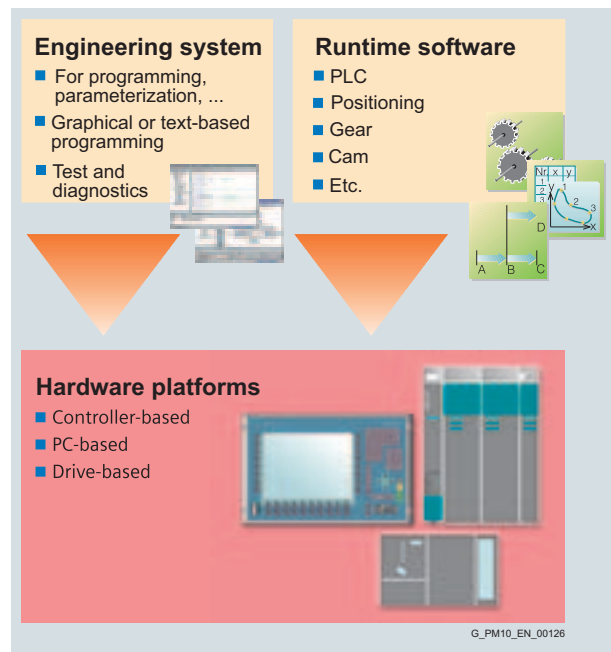
The fast path to the automation solution

With these system components and our concept of ready-to-apply standard applications and ready-to-run machine solutions in the form of SIMOTION Easy Set you can reduce your engineering costs, shorten your project times and thus get quicker to your complete automation solution.

The hardware platforms

Automation systems are primarily identified by the following characteristics:

- System-specific characteristics, e. g. functionality and engineering
- Hardware-dependent characteristics, e. g. performance, design and expandability

However, mechanical engineering demands vary greatly, depending on the version of the machine in question.

Every hardware platform has its benefits when used in certain applications. The various platforms can also be combined very easily, which is a particular advantage in modular machines and plants. This is because the individual hardware platforms always contain the same system characteristics, i. e. functionality and engineering are always identical, irrespective of the platform used.

PROFIBUS (PROFINET available soon) can be used to connect drives and I/Os decentrally to the SIMOTION control. PROFIBUS can also be used to communicate with operator panels, such as SIMATIC HMI, or with higher-level controls, such as SIMATIC S7. This means that SIMATIC HMI panels as well as PCs with ProTool/Pro or WinCC flexible can be used as operator systems. Other applications can be linked over of the OPC interface.

SIMOTION D – Compact and integrated in the drive

With SIMOTION D, the SIMOTION functionality is integrated directly in the Control Unit of the new SINAMICS S120 multi-axis drive system. Therefore, the complete system (containing of all control and drive functionalities) is extremely compact and responds very quickly. SIMOTION D is available in three performance versions (D425, D435 and D445), ensuring maximum scalability and flexibility. The field of application ranges from single axes to high-performance multi-axis machines. SIMOTION D is supplied with two integrated PROFIBUS interfaces with PROFIdrive and two integrated Industrial Ethernet interfaces on board.

SIMOTION C – Modularity and flexibility

SIMOTION C230-2 uses the S7-300 mounting technology. It is supplied with four integrated interfaces for analog or stepper drives and several integrated digital inputs and outputs on board. The C230-2 can also be expanded using I/O Modules from the SIMATIC S7 300 range. At other interfaces, the C230-2 has already built in two PROFIBUS interfaces with PROFIdrive and one Industrial Ethernet interface, thus offering great flexibility in communication.

SIMOTION P – Open for other tasks

SIMOTION P350 is a PC-based Motion Control system. The operating system is Windows XP Professional, with a real-time expansion for SIMOTION. This enables PC applications to be carried out alongside SIMOTION machine applications at any time. For example, the SIMOTION engineering system, an operator control application, a process data evaluation, a standard PC application, etc.

Several panel variants in various screen sizes are available for operating the industrial PC. These panels can either be operated using a keyboard and mouse, or a touch screen. Two PROFIBUS interfaces are used to link the drives and the I/Os.

Multi-layer software architecture

With SIMOTION, motion tasks in many different machines are performed easily and uniformly.

To facilitate this, a very special, multi-layer architecture was chosen as the Runtime system. All SIMOTION devices provide you with a basic functionality, such as PLC functionality with a command set in accordance with IEC 61131-3 and a Motion Control basic functionality (speed-controlled axes, output cam, etc.). You can expand this basic functionality using technology packages and function libraries.

Scalable functionality

The technology packages, function libraries and multi-layer architecture of the Runtime system account for the scalable functionality of SIMOTION:

Scalable

- Due to various functionality levels
- Due to Software Modules and technology packages with extensive functionality

Flexible

- Due to the integrated programmable PLC in accordance with IEC 61131-3
- Due to the instantiable technology packages with extensive command sets
- Due to the option to run servo, vector, stepper, and hydraulic drives
- Due to the ability to combine the various technology packages and function libraries

Expandable

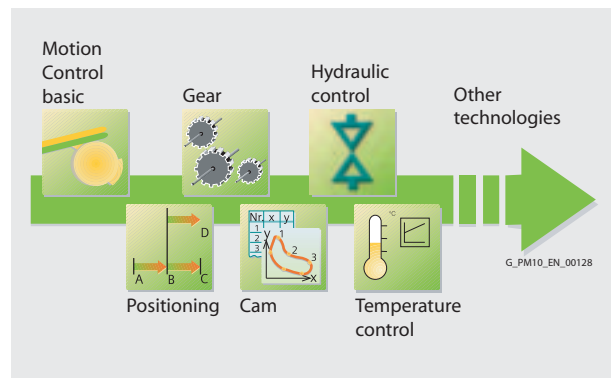- Due to the function library standard functions

Technology packages

Each of these packages provides complete functionality for the technology in question. For example, the technology package Motion Control provides all functions from precise positioning movements to sophisticated synchronous cam operation.

Cyclic exchange of setpoints and actual values with the drive, the position controller, calculation of the movement profiles, removal or overriding of motions, reference functions, encoder changeover, axis release, status information, etc. are included in this package.
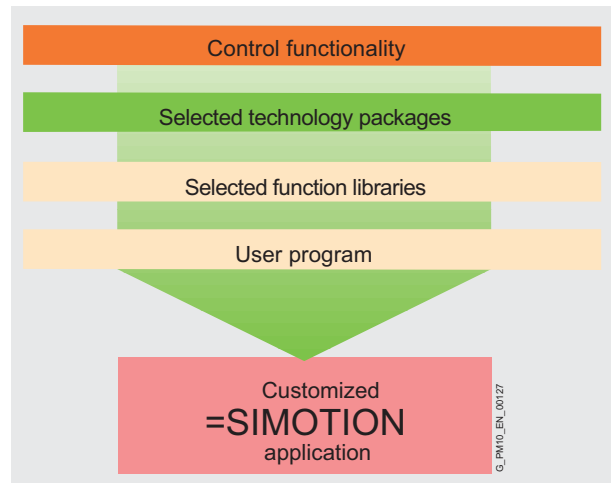
In addition to the Motion Control technology package (including positioning, synchronous operation, cam), packages for other technologies, e. g. temperature control, are also available.

Function libraries

The libraries contain standard functions for frequently performed tasks. In addition to the standard functions supplied, users can also create their own functions and store them in a library.

The engineering system

Focus is on user friendliness

As the performance capability of a system grows, so do the requirements for user friendliness. Only in this way can simple operation of the system be ensured for users. For this reason, SIMOTION places particular emphasis on the user friendliness of the SCOUT engineering system, as follows:

- Engineering for Motion Control, PLC and technology, as well as drive configuration and commissioning are integrated in one system.
- Virtually all tasks are performed graphically, including configuring, programming, testing and commissioning.
- Intelligent operator prompting, a context-sensitive help function and an automatic consistency check all make life easier for users, particularly if they are only just beginning to work with Motion Control programming.
- All SCOUT engineering system tools are integrated and have a uniform look and feel.

In this way, the SCOUT engineering system assists you every step of the way, making engineering as a whole simple and efficient.

SCOUT can be used in SIMATIC STEP 7, either with integrated data management and configuration, or as a stand-alone engineering tool.

Programming for everyone

When programming SIMOTION you can choose between: Graphic programming using the MCC (Motion Control Chart), LAD (Ladder Diagram)/FBD (Function Block Diagram), or the ST (Structured Text) high-level language - the SCOUT engineering system understands all of these.

In addition to Motion Control commands (e. g. referencing of axis), commands for I/O access, logic and calculations, subroutine calls and controlling of the program flow are also available.

Complex motion relationships can also be programmed easily using cam editors.

Graphic programming

Motion Control Chart enables machine procedures to be programmed graphically as flowcharts. Since commands can be selected and parameterized easily, even beginners are able to achieve their objectives quickly.

PLC programming languages

Are you familiar with the proven LAD (Ladder Diagram) and FBD (Function Block Diagram) programming languages? Then SCOUT will allow you to use this knowledge.
As well as the PLC functions defined in accordance with IEC 61131-3, additional system commands and functions are available to you, e. g. for Motion Control in accordance with PLCopen.

High-level language

The Structured Text high-level language allows you to create applications which can be particularly well structured. You are supported in this by powerful editing and debugging functions.

Centralized management with integrated tools

All data for a particular machine can be managed within one project, including configuration data, programs, movement profiles, and drive data.

The appropriate tools, e. g. for entering a cam or commissioning a drive, are then called from the centralized project management.
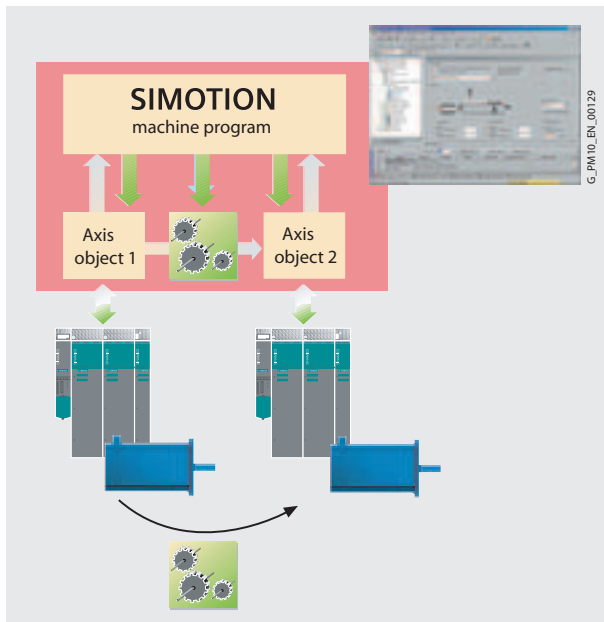
Configuring axes

SIMOTION provides intelligent axis objects for simple handling of axes. You can create and configure such an object for each axis. The following details are specified:

- Name of the axis
- Associated drive
- Encoder parameterization
- Technology of the axis (e. g. speed-controlled, positioning or synchronized axis)
- Other data relating to the mechanical system of the axis (position control, limitations, etc.)

Using these axis objects has the following benefits:

Regardless of which drive type and connection or which measuring system is used by an axis: All axes are referred to in the same way by the application program i. e. with the axis name, commands and setpoints and return values such as status and actual values.
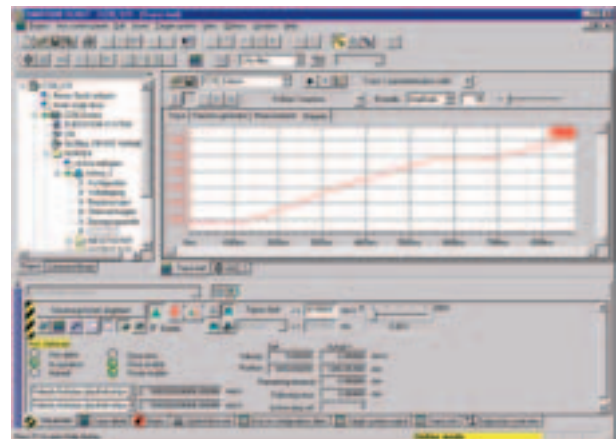
The variables to be recorded, the start condition and the duration of the trace are defined using SCOUT and this configuration is then loaded into the SIMOTION device. The values are recorded with accurate times and stored in a trace buffer. On completion of the trace, the content of the trace buffer can be read by SCOUT and displayed graphically. The traced curves can be stored or exported to Microsoft Excel as a table and evaluated further there.

As well as recording, the trace function also offers, e. g.:

- Bode diagram
- FFT analysis
- Function generator
- Mathematical functions

Axis control panel

The axis control panel integrated in SCOUT provides user-friendly support during commissioning, testing and optimization of the machine, due to the option of traversing the axes without the user program.

Test and diagnostics

SCOUT provides a wide range of functions which support testing, commissioning and error diagnostics of SIMOTION applications, such as program status, control variables, trace and axis control panel.

Trace

SIMOTION contains a very powerful trace function which can trace system variables, such as actual values and setpoints, as well as integrated PLC user data.

Overview of functions

2

Overview of functions

Hardware platforms

		SIMOTION C	SIMOTION P	SIMOTION D
● Basic model (function or license is acquired with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible				
	Note	C230-2	P350	D4x5
System clocks/performance				
PROFIBUS DP cycle in 0.25 ms steps		1.5...8	1...8	1...8
Position-control cycle and interpolation cycle (IPO) are a multiple of the PROFIBUS DP cycle	Adjustable ratio			
• Position control cycle to PROFIBUS DP cycle		1:1, 2:1	1:1...4:1	1:1...4:1
• Interpolation cycle 1 (IPO1) to position control cycle		1:1...6:1	1:1...6:1	1:1...6:1
• Interpolation cycle 2 (IPO2) to interpolation cycle 1 (IPO1)		2:1...64:1	2:1...64:1	2:1...64:1
With Dynamic Servo Control (DSC), the dynamically acting component of the position controller is located in the drive (with cycles of up to 125 μs)		●	●	●
BackgroundTask (OB1) coasting	Adjustable monitoring time	●	●	●
Interval in ms	TimerInterruptTasks	10...5000	10...5000	10...5000
Address area				
• Logical address space in KB	Quantity of data transferred 1 KB	2	2	4
• Permanent process image for background task (I/O variables) in bytes		64	64	64
• Additional configurable process images for cyclic tasks (I/O variables)		●	●	●
• Address space per DP station in bytes		244	244	244
Memory				
• Exchangeable memory media	MMC: Micro Memory Card CF: CompactFlash card	MMC 32 MB	File(s) on hard disk	CF 64 MB
• Retentive user variable (retain variable) in KB	SIMOTION P: with UPS up to 256 KB	10	15	320
• Permanent memory for user data in MB (data storage on exchangeable memory medium)		26	Any	47
• Load memory (RAM disk) for user data in MB (for downloading the configuration and programs)	Memory size can be configured with SIMOTION P	11	16	D425/ D435: 11 D445: 23
• User memory (user RAM) in MB (for code and data)		15	14	D425/ D435: 15 D445: 30
Drives	See "System components"			
• Maximum number of axes	Higher number of axes possible using multiple synchronized devices	32	64	D425: 16 D435: 32 D445: 64
• Integrated drive control (in combination with SINAMICS S120)	SIMOTION D: with D435 and D445 more are possible via CX32	–	–	1..6

	Hardware platforms	SIMOTION C	SIMOTION P	SIMOTION D
● Basic model (function or license is acquired with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible	**Note**	C230-2	P350	D4x5
Speed-controlled axis over PROFIBUS DP	SIMOTION D: SINAMICS as standard drive system	●	●	●
• SINAMICS S/SINAMICS G (Servo, Vector)				
• SIMODRIVE 611 universal				
• SIMODRIVE POSMO CA				
• SIMODRIVE POSMO CD				
• SIMODRIVE POSMO SI				
• SIMOVERT MASTERDRIVES MC				
• SIMOVERT MASTERDRIVES VC				
• MICROMASTER/MICROMASTER Vector				
• MIDIMASTER Vector				
• COMBIMASTER/MICROMASTER Integrated				
• Standard drives with speed profile in accordance with standard message frames (PROFIdrive profile 1-6)				
Closed-loop position-controlled axis over PROFIBUS DP with PROFIdrive	SIMOTION D: SINAMICS as standard drive system	●	●	●
• SINAMICS S120				
• SIMODRIVE 611 universal	Also linear motor			
• SIMODRIVE POSMO CA				
• SIMODRIVE POSMO CD				
• SIMODRIVE POSMO SI				
• SIMOVERT MASTERDRIVES MC				
• SIMOVERT MASTERDRIVES VC				
• MICROMASTER MM4	With external encoder (limited dynamic response)			
Reading/writing drive parameters via system functions		●	●	●
Standard drive over PROFIBUS DP • SIMODRIVE POSMO A	Standard functions available in the function library	●	●	●
Drives with analog ±10 V setpoint interface				
• On board I/O	Either for analog or stepper drive	4	–	–
• ADI 4 (Analog Drive Interface for 4 axes)	ADI 4 see "System components"	●	●	●
Hydraulic drives over ±10 V setpoint interface				
• On board I/O		4	–	–
• Analog outputs in the I/O area		●	●	●
• ADI 4 (Analog Drive Interface for 4 axes)		●	●	●
• Encoder over I/O area or over PROFIBUS		●	●	●
Stepper drives				
• On board I/O with pulse direction interface	Either for analog or stepper drive	4	–	–

Overview of functions

Hardware platforms

	Note	SIMOTION C	SIMOTION P	SIMOTION D
● Basic model (function or license is acquired with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible		C230-2	P350	D4x5
Connectable measuring systems on board	See "System components"			
Quantity	SIMOTION D: Encoder connection via Motor Modules (DRIVE-CLiQ)	4	–	●
Absolute value encoder connection with SSI interface		●	–	–
Incremental rotary measuring systems with RS 422 (TTL)		●	–	–
Typical connections for second encoder (external encoder)				
On board interfaces		●	–	–
Second encoder acquisition in SIMOVERT MASTERDRIVES MC	Option for SIMOVERT MASTERDRIVES MC	●	●	–
SIMODRIVE 611 universal over second axis control (dual-axis module)	Option for SIMODRIVE 611 universal	●	●	
SINAMICS S120	SIMOTION D: Encoder connection via Motor Modules (DRIVE-CLiQ)	●	●	●
Isochronous PROFIBUS encoder	See "System components"	●	●	●
Encoder on ADI 4 (Analog Drive Interface for 4 axes)		4	4	4
Probe				
High-speed measuring input	SIMOTION C: Measurement on on board encoder SIMOTION D: On board probe (for integrated drives)	2	–	6
Probe on the drives				
• SIMODRIVE 611 universal, SIMOVERT MASTERDRIVES		1/axis	1/axis	–
• SINAMICS S120		6/closed-loop control	6/closed-loop control	6/closed-loop control
• TM15 Terminal Module on SINAMICS S120 or SIMOTION D	See "System components"			
- Accuracy in µs		125	125	125
- Number of probes per Terminal Module, max.		24	24	24
• TM17 High Feature Terminal Module on SINAMICS S120 or SIMOTION D	See "System components"			
- Accuracy in µs		≤ 1	≤ 1	≤ 1
- Number of probes per Terminal Module, max.		16	16	16
Output cams, switching accuracy				
• Fast output cams: (hardware-supported output cams with higher resolution)				
- On board outputs (typically) in µs	SIMOTION P: Via MCI board extension	● 140	○ 100	–
- TM15 Terminal Module on SINAMICS S120 or SIMOTION D in µs	See "System components"	125	125	125
- TM17 High Feature Terminal Module on SINAMICS S120 or SIMOTION D in µs	See "System components"	≤ 10	≤ 10	≤ 10

2

		Hardware platforms		
● Basic model (function or license is acquired with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible		SIMOTION C	SIMOTION P	SIMOTION D
	Note	C230-2	P350	D4x5
• Standard output cams (updated in position controller or interpolation cycle, switching accuracy depends on the output accuracy of the I/O)				
- On board outputs	SIMOTION P: Via MCI board extension	●	○	●
- TM15/TM17 High Feature Terminal Module on SINAMICS S120 or SIMOTION D		○	○	○
- S7-300 backplane bus		●	–	–
- PROFIBUS DP		●	●	●
- Output to internal system variable		●	●	●
On board I/O	See "SIMOTION C - Controller - based", "SIMOTION P - PC - based", "SIMOTION D - Drive - based"			
Digital programmable inputs/outputs (individually parameterizable as input or output)	Further inputs/outputs can be implemented for cam output or probes via the TM15 or TM17 High Feature Terminal Modules.	–	–	8
• of which for cam output, max.		–	–	8
• of which as probe, max.		–	–	6
Digital inputs (fixed inputs, not parameterizable)	SIMOTION P: I/O via MCI board extension	18	4 ○	8
• of which inputs with specific functions				
- Probe, max. (set actual value on-the-fly or measurement on-the-fly)		2	–	–
- External zero mark signal for referencing, max.		4	–	–
Digital outputs (fixed outputs, not parameterizable)	SIMOTION P: I/O via MCI board extension	8	4 ○	–
• of which for fast cam output, max.		8	4 ○	–
Additional relay outputs with specific functions				
• Controller enable		4	–	–
• Ready		1	–	–
Analog outputs	SIMOTION C: Can only be used as a drive interface. SIMOTION D: Via TB or TM, see "SIMOTION D - Drive-based" or "System components"	4	–	○
Pulse direction interface for stepper drives	SIMOTION C: Each, as alternative to analog drive.	4	–	–

Hardware platforms

		SIMOTION C	SIMOTION P	SIMOTION D
● Basic model (function or license is acquired with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible	**Note**	C230-2	P350	D4x5
I/O				
Centralized I/O – modules per system, max.		16	–	–
Central/expansion rack, max.	SIMOTION C: Max. two-tier configuration with IM 365 Interface Module	○	–	–
Connectable central SIMATIC S7-300 I/O	For modules that can be implemented, see "System components"	●	–	–
Connectable drive system overview • TM15, TM17, TM31 Terminal Modules • TB30 Terminal Board	For connection to SIMOTION C and P via SINAMICS S120, see "System components".	●	●	●
Connectable distributed I/O • ET 200S • ET 200X • ET 200pro • ET 200M • ET 200eco • DP/AS-Interface Link 20E • ADI 4 (Analog Drive Interface for 4 axes) • All certified standard slaves (DP-V0, DP-V1, DP-V2)	For modules that can be implemented, see "System components"	●	●	●
Connectable HMI devices	See "System components"			
Connection via PROFIBUS DP • SIMATIC Touch Panel TP 170B and TP 270 • SIMATIC Operator Panel OP 170B and OP 270 • SIMATIC Multi Panel MP 270B and MP 370 • SIMATIC Panel PC IL 77, PC 677 and PC 877		●	●	●
Connection over Ethernet • SIMATIC Touch Panel TP 170B and TP 270 • SIMATIC Operator Panel OP 170B and OP 270 • SIMATIC Multi Panel MP 270B and MP 370 • SIMATIC Panel PC IL 77, PC 677 and PC 877	Only in combination with WinCC flexible SIMATIC Net is required	●	●	●
HMI software				
• WinCC flexible	See "System components"	○	○	○
• ProTool/Pro		○	○	○
• SIMATIC NET OPC server	See "Communication"	○	○	○

• SIMOTION IT OPC XML-DA (via Ethernet)
  - Open communication via TCP/IP and SOAP standard protocols
  - Clients on any hardware with various operating systems (Windows, Linux, etc.)
  - In accordance with OPC Foundation standard OPC XML-DA V1.0
		○	○	○

2

		Hardware platforms		
● Basic model (function or license is acquired with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible		SIMOTION C	SIMOTION P	SIMOTION D
	Note	C230-2	P350	D4x5

Communication

PROFIBUS DP interfaces				
• On board/of which isochronous as option	One interface can be used as MPI. SIMOTION P: On IsoPROFIBUS board	2/2	2/2	2/2
• Baud rates in Mbaud (transfer rates in Mbit/s)		1.5; 3; 6; 12	1.5; 3; 6; 12	1.5; 3; 6; 12
• Number of PROFIBUS DP slaves	Per PROFIBUS DP line	32	32	32
• DP slaves can be connected to and disconnected from application		●	●	●
• Integrated CP5611	For PG/PC and HMI	–	1	–
PROFINET interfaces		–	available soon	available soon
On board Ethernet interface	See "SIMOTION software"	1 10/100 Mbit/s	1 10/100 Mbit/s	2 10/100 Mbit/s
On board serial interface		–	2	–
On board parallel interface		–	1	–
On board USB interface	E. g. for mouse and keyboard	–	2	–
DRIVE-CLiQ interface		–	–	D425/D435: 4 D445: 6
Connections via PROFIBUS DP and Ethernet The connection resources can be assigned either via PROFIBUS DP or Ethernet.				
• PROFIBUS DP		●	●	●
• Ethernet		●	●	●
• Connection end points (online connections), max.		16	16	16
• Basic communication Xsend/Xreceive (currently not via Ethernet)		5	5	5
• SCOUT engineering system		1	1	1
• HMI		2	2	2
Communication functions via PROFIBUS between:	Basic version with regard to SIMOTION	●	●	●
• SIMOTION - SIMATIC HMI/WinCC flexible - HMI data exchange: Support from the SIMOTION operating system - Plant-wide access to process data and displays				
• SIMOTION - SIMATIC HMI/ProToolPro - HMI data exchange: Support from the SIMOTION operating system - Interrupt mechanism: Send alarms event-driven				
• SIMOTION - SIMOTION - Distributed I/O mechanisms Process image, e. g. (% I1.3) I/O variables (symbolic) - XSND/XRCV, max. 200 bytes				

Hardware platforms

		SIMOTION C	SIMOTION P	SIMOTION D
● Basic model (function or license is acquired with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible				
	Note	C230-2	P350	D4x5

• SIMOTION - SIMATIC S7
  - Distributed I/O mechanisms
    Process image, e. g. (% I1.3)
    I/O variables
  - XSND/XRCV, max. 76 bytes
	Basic version with regard to SIMOTION			

• SIMOTION - SIMATIC NET OPC				
• SIMOTION - PG/PCs with STEP 7 and SCOUT				
• PROFIBUS DP slave-to-slave communication				
Communication functions over Ethernet between:	Basic version with regard to SIMOTION			

• SIMOTION - SIMATIC HMI/WinCC flexible
  - HMI data exchange: Support from the SIMOTION operating system
  - Plant-wide access to process data and displays
  - Interrupt mechanism: Send alarms event-driven
		●	●	●

• SIMOTION - SIMATIC HMI/ProTool/Pro
  - HMI data exchange: Support from the SIMOTION operating system
  - Interrupt mechanism: Send alarms event-driven
	On Panel PC 670 with ProTool/Pro V6.0, Service Pack 2	●	●	●

• SIMOTION - SIMATIC NET OPC		●	●	●
• SIMOTION - OPC/XML clients		○	○	○
• SIMOTION - PG/PCs with STEP 7 and SCOUT		●	●	●
• Ethernet/ PROFIBUS DP routing		●	●	●
UDP and TCP/IP communication functions via Ethernet between: • SIMOTION - SIMOTION • SIMOTION - SIMATIC CP • SIMOTION - PC		●	●	●
Serial communication via point-to-point connection	Basic version with regard to SIMOTION			
• CP 340 and CP 341 Communication Modules		●	●	●
• 1SI Communication Module (connected via ET 200S)		●	●	●
Communication via AS-Interface	Basic version with regard to SIMOTION			
• CP 343-2 P Communication Module		●	●	●
• DP/AS-Interface Link 20E		●	●	●
Service and diagnostic functions without SCOUT (over Ethernet)	See "SIMOTION software"			
SIMOTION IT DIAG				
• Service/diagnostic functions via Internet browsers		○	○	○
• Project and firmware update		○	–	–
• Password-protected access		○	○	○
• Remote access to SIMOTION file system		○	○	○
• User-defined service and diagnostics pages		○	○	○

		Hardware platforms		
● Basic model (function or license is acquired with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible		SIMOTION C	SIMOTION P	SIMOTION D
	Note	C230-2	P350	D4x5
Runtime functionality SIMOTION Kernel	See "SIMOTION software"			
Runtime system				
• Task structure/program execution				
- BackgroundTask	Adjustable monitoring time	1	1	1
- TimerInterruptTasks		5	5	5
- MotionTasks		20	20	20
- IPOSynchronousTasks		2	2	2
- InterruptTasks (for user)		2	2	2
- TControlTasks		5	5	5
- StartupTask		1	1	1
- ShutdownTask		1	1	1
• Task structure/error processing (SystemInterruptTasks)	Central troubleshooting is possible			
- ExecutionFaultTask		1	1	1
- TechnologicalFaultTask		1	1	1
- PeripheralFaultTask		1	1	1
- TimeFaultTask		1	1	1
- TimeFaultBackgroundTask		1	1	1
Program organization		●	●	●
• Units (ST program)				
• Programs				
• Function blocks (FB)				
• Functions (FC)				
• System functions (SF)				
• Libraries				
PLC operation set (IEC 61131-3; optionally expandable with technology packages)		●	●	●
System functions, e. g. for		●	●	●
• Interrupt and error handling				
• Copying data				
• Clock functions				
• Diagnostics functions				
• Module parameterization				
• Operating mode transitions, Run/Stop				
• Reading and writing of data blocks from the user program from and to an exchangeable memory medium				
Counter (IEC commands)		●	●	●
Timer (IEC commands)		●	●	●
Real-time clock, format [DATE_AND_TIME]		●	●	●

Overview of functions

Hardware platforms

		SIMOTION C	SIMOTION P	SIMOTION D
● Basic model (function or license is acquired with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible				
	Note	C230-2	P350	D4x5
Ethernet communication package	See "SIMOTION software"			
		●	●	●
Motion Control technology package	See "SIMOTION software"			
with the technology functions:				
• Motion Control Basic		●	●	●
• Positioning - POS		○	○	○
• Synchronous operation - GEAR		○	○	○
• Output cam - CAM		○	○	○
Axis types				
• Electrical speed axis		●	●	●
• Electrical/hydraulic/stepper motor axis	Included from technology function POS positioning and above			
- Rotary axis		○	○	○
- Linear axis		○	○	○
- Modulo for linear and rotary axis		○	○	○
- Force/pressure-controlled axis		○	○	○
- Force/pressure-limited axis		○	○	○
• Virtual axis		●	●	●
• Simulation axis		●	●	●
Travel range ±1000 m (3280 ft)		●	●	●
Speed 0.01 mm/min to 500 m/min (1640 ft/min)		●	●	●
Acceleration 1.0 to 99.999 mm/s^2 (0.04 to 3.94 in/s^2)		●	●	●
Jerk limitation 1.0 to 99.999 mm/s^3 (0.04 to 3.94 in/s^3)		●	●	●
Programmable acceleration		●	●	●
Basic resolution in				
• mm (inch)		10^{-3}	10^{-3}	10^{-3}
• Degrees (Fahrenheit)		10^{-2}, 10^{-4}	10^{-2}, 10^{-4}	10^{-2}, 10^{-4}
Axis monitoring functions				
The monitoring functions set to active will be executed cyclically.		●	●	●
• Watchdog				
• Hardware and software limit switches				
• Position/downtimes monitoring				
• Dynamic following error monitoring				
• Encoder monitoring, cable break				
• Force/pressure monitoring				
• Setpoint				
• Plausibility in data exchange				

		Hardware platforms		
● Basic model (function or license is acquired with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible		SIMOTION C	SIMOTION P	SIMOTION D
	Note	C230-2	P350	D4x5
TControl technology package (temperature control)	See "SIMOTION software"			
Engineering functionality				
Engineering - Drives Start-up/parameterization				
STARTER (integrated in SCOUT) for		●	●	●
• MICROMASTER 410/420/430/440				
• COMBIMASTER 411				
• SINAMICS S/SINAMICS G				
SimoCom U/SimoCom A (stand-alone) for	Not included in scope of supply of SIMOTION SCOUT	●	●	●
• SIMODRIVE				
DriveMonitor (stand-alone) for		●	●	●
• SIMOVERT MASTERDRIVES				
Drive ES BASIC engineering tools and integrated data storage in SIMATIC S7/SIMOTION projects for:		●	●	●
• MICROMASTER 410/420/430/440 (STARTER)				
• COMBIMASTER 411 (STARTER)				
• SINAMICS S/SINAMICS G (STARTER)				
• SIMODRIVE (SimoCom U/SimoCom A)				
• SIMOVERT MASTERDRIVES (DriveMonitor)				
Engineering – SIMOTION				
SCOUT engineering system Basic tools integrated into SCOUT:	See "SIMOTION software"	●	●	●
• Workbench				
• STARTER Drive commissioning/parameterization				
• Hardware and network configuration				
• Diagnostics for testing and commissioning				
• Axis control panel				
• Program editors/programming languages (instruction set in accordance with IEC 61131-3)				
- Structured Text (ST)				
- Ladder Diagram (LAD)				
- Function Block Diagram (FBD)				
- Motion Control Chart (MCC)				
• Creation of output cams (basic)				
• Creation of technology objects				
• Technology tools (function generator)				
• User interface, online help and documentation in English, German, French and Italian				

2

Hardware platforms

		SIMOTION C	SIMOTION P	SIMOTION D
● Basic model (function or license is acquired with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible				
Note		C230-2	P350	D4x5
Test and diagnostics				
● Information functions		●	●	●
- Hardware/software version indication				
- Processor utilization				
- Memory utilization				
- Operating status				
- Time				
● Program test functions		●	●	●
- Control/status variables				
- Status program/FB/FC (with specification of the call point)				
- Single-step MCC				
- Breakpoints ST				
● Trace		●	●	●
- Recording I/O, system and program variables				
- Recording from LR cycle onwards (n × LR cycle)				
- Trigger: Instantaneous, rising/falling edge system variable, function generator				
- Arithmetic functions				
- Endless trace				
- Recording over defined measuring period				
● Module diagnostics		●	●	●
- Central				
- Distributed (e. g. ET 200M)				
● DP station diagnostics via system functions		●	●	●
● Diagnostics buffer				
- No. of entries, max.		100	100	100
● Process fault diagnostics (Alarm_S)				
- Messages from user program		●	●	●
- No. of entries, max.		40	40	40

SIMOTION C
Controller-based

3

SIMOTION C - Controller-based

General information

Overview

SIMOTION C is the modular controller variant with the proven design of the SIMATIC S7-300 using its simple expansion options. SIMOTION C230-2 is a high-performance Motion Controller for control functions and Motion Control tasks.

HMI devices can be connected directly to the on board PROFIBUS or Ethernet interface for operator control and monitoring. Functions such as remote maintenance, diagnostics and teleservice can also be used via these interfaces.

Benefits

- Can be flexibly used due to the SIMATIC S7 module range and thus optimal adaptation to automation task
- For universal use with digital and analog servo drives or stepper drives
- User-friendly handling and uncomplicated design without a fan
- Versatile networking due to on board PROFIBUS DP and Industrial Ethernet interfaces
- Powerful due to a range of integrated functions
- Simple engineering of open-loop control and Motion Control applications within the same program

Application

SIMOTION C can be used wherever

- Motion Control, technology and control functionalities are to be programmed, parameterized and executed as a unit
- A modular 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, due to high EMC compatibility and resistance against shock and vibration loads.

Main applications are:

- Packaging machinery
- Plastic and rubber processing machinery
- Presses, wire-drawing machinery
- Textile machinery
- Printing machinery
- Wood, glass, ceramic, and stone working machinery
- Retrofitting

Due to the increasing use of servo drives, such machinery requires integrated logic, Motion Control and technology functions.
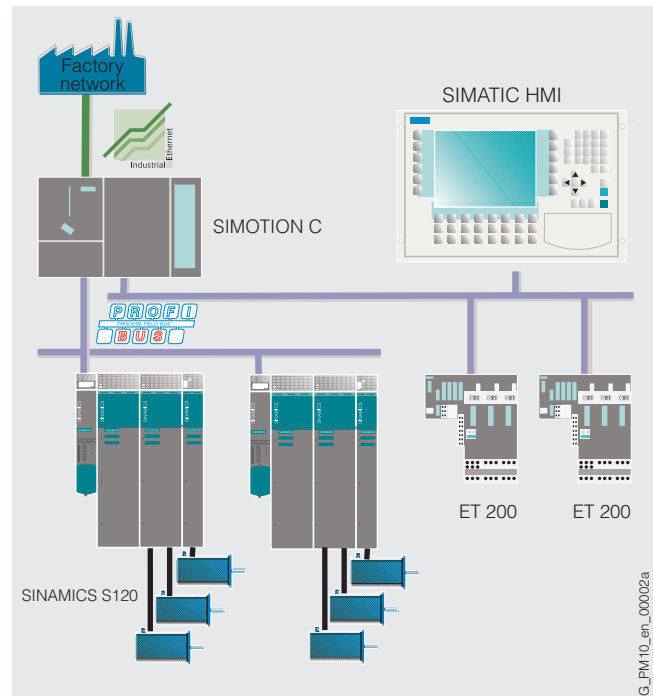
Design

SIMOTION C with central and distributed I/O

The Motion Control system SIMOTION C is designed to be modular. It comprises a comprehensive module range which uses components of the SIMATIC S7-300 series and from drive technology.

Components and interfaces of the SIMOTION C Motion Controller:

- Analog drive interfaces for setpoint output for servo drives
- Pulse outputs for controlling stepper drives
- Interfaces for incremental/absolute value encoders for cyclic detection of actual position values
- Onboard I/O for especially fast I/O signals
- SIMOTION Micro Memory Card (MMC) for storing:
  - SIMOTION Kernel
  - User programs
  - User variables
- Integrated communication ports 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 mode selectors

The following components comprise a SIMOTION C system:

- Motion Controller and Micro Memory Card
- If required, further system components such as:
  - Load power supplies (PS) for connecting SIMOTION C to a power supply of 120V/230 V AC
  - Central (not on board) and distributed I/O components
  - Servo drives with analog or digital setpoint interface or stepper drives

Design (continued)

Design technology

The simple design technology makes SIMOTION C flexible and easy to service:

- Module 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 with 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 or spring-loaded terminals for I/O Modules
- TOP connect
  This connection method provides pre-assembled 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.
- This system uses a defined mounting depth since all connections and connectors are recessed in the module and are protected and covered by doors on the front.
- No slot rules.

Expansion

Up to 8 slots can be used to the right of the Motion Controller in the main unit 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.

| PS[1] | Motion Controller | SIMATIC S7-300 I/O Modules |

SIMOTION C

1) Power supply

G_PM10_en_00001
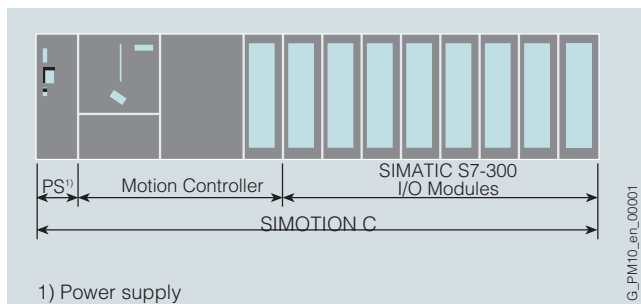
SIMOTION C can be mounted horizontally or vertically.

If additional I/O Modules are required, the distributed SIMATIC ET 200 I/O can be connected to the Motion Controller over PROFIBUS DP.

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 200X
- SIMATIC ET 200pro
- SIMATIC ET 200eco

Function

SIMOTION C provides the following basic functionality for the various automation requirements:

- SIMOTION Runtime system
  - Freely programmable with several languages in accordance with IEC 61131
  - Various Runtime levels (cyclic, sequential, event-driven)
  - PLC and arithmetic functionality
  - Communications and management functions
  - Motion Control functions (Motion Control Basic)
- Test and diagnostic interfaces

This basic functionality can be expanded, e. g. 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:
  - Positioning - POS
  - Synchronous operation/electronic gear - GEAR
  - Synchronous operation/electronic cam - CAM
- Temperature controller - TControl

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, testing and diagnostics. Graphical operator prompting, using technological dialog boxes and wizards, as well as textual 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 C230-2. 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 via PROFIBUS or Ethernet interfaces, and 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.

Communication

Due 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

- *on TOP connect can be found in Catalog KT 10.2 and in the Interactive Catalog under "Automation Systems", "System Cables/Control Cabinets", "SIMATIC TOP connect System Cables".*

SIMOTION C - Controller-based

SIMOTION C230-2 Motion Controller

Overview

SIMOTION C230-2 is an S7 300-design controller. In addition to the already integrated interfaces, the controller can also be expanded using I/O Modules from the SIMATIC S7 300 range.

Design

Interfaces

- Switches, LEDs ...
  - 1 x mode selector
  - 1 x LED strip for fault and status indicators
  - 1 x slot for SIMOTION Micro Memory Card
  - 1 x interface for Industrial Ethernet
  - 2 x interfaces for PROFIBUS DP
    (of which one interface is for MPI)
  - Power supply terminals
- Drive interfaces
  - 1 x interface for setpoint output for up to 4 axes (either analog or stepper drives)
  - 4 x encoder inputs for incremental or absolute value encoders
- Integrated I/Os
  - 18 digital inputs (of which 2 are for sensors and 4 for Bero)
  - 8 digital outputs

Data storage/data backup

The SIMOTION C230-2 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).

Connectable periphery

The following periphery can be used:
- All certified PROFIBUS standard slaves (DP-V0, DP-V1, DP-V2)
- Isochronous I/O such as ET 200S or ET 200M
- Servo drives of the MASTERDRIVES, SIMODRIVE and SINAMICS series over PROFIBUS DP interface with PROFIdrive
- MICROMASTER and COMBIMASTER frequency drives
- Stepper drives such as SIMOSTEP motors with FM STEPDRIVE power unit

Position-controlled Motion Control

The control and Motion Control functionality runs centrally on SIMOTION C230-2.

The functionality ranges from simple positioning up to complex Motion Control tasks using cams.

Setpoint output/actual value acquisition:
- Position control with analog setpoint output
  The SIMOTION C230-2 Motion Controller has one analog output for the speed setpoint and one encoder input for cyclic detection of the actual position value for each axis.
- Position control with pulse direction output for stepper drives
  The Motion Controller 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 is available for this purpose.
  The actual position value is read in over PROFIBUS DP and the speed setpoint is output.
- Position control with mixed setpoint output
  The analog, stepper and PROFIBUS drives can be used in a mixed configuration. The channels of the 4 on board interfaces can be used for analog or stepper drives.
- Incremental position detection
  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
  Absolute value encoders with serial interfaces can be used (SSI absolute value encoders).
  It is not necessary to use reference point approach.
- Isochronous PROFIBUS encoder

Expansion using central I/Os

The central I/O is connected directly to the SIMOTION C230-2 Motion Controller.
The I/O installation comprises two tiers for central I/O (second tier with IM 365 interface) with up to 8 I/O Modules each and up to 4 Analog Modules.
I/O Modules from the SIMATIC S7 300 series can be used for a central design.

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Integration
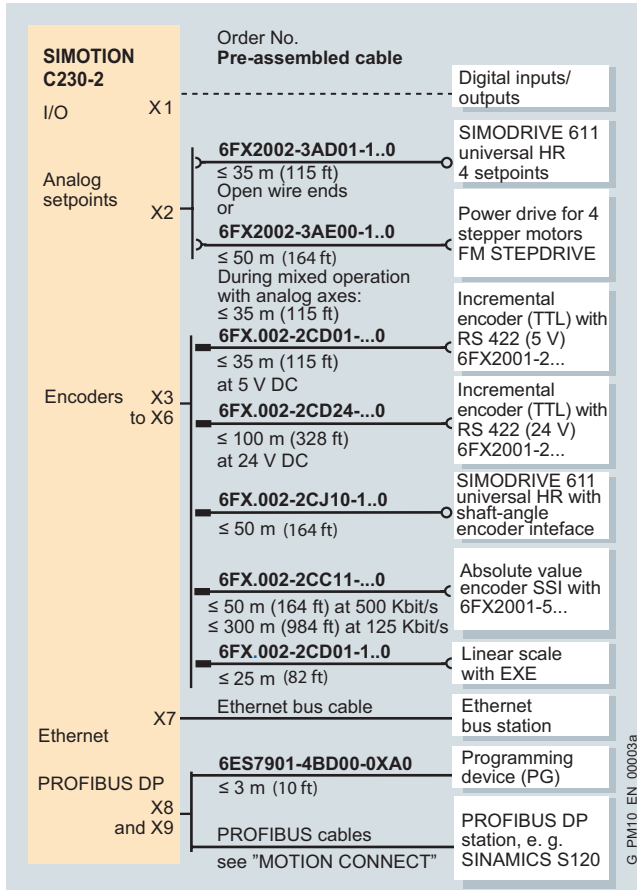
Overview of connections for SIMOTION C230-2

The maximum permissible cable lengths should be taken into account when planning the cable layout.

Malfunctions may occur if longer lengths are used.

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

Technical data

SIMOTION C230-2 Motion Controller

Power supply	
• Rated value	24 V DC
• Permissible range	20.4 V to 28.8 V
Current consumption, typ.	1.1 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 (without condensation)	5% to 95%
Atmospheric pressure	700 hPa to 1060 hPa
Degree of protection in accordance with IEC 529	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 C230-2	1.15 kg (2.5 lb)
• Memory card	0.016 kg (0.03 lb)
Relay outputs	**5**
• of which controller enable	4
• of which READY	1
• Data	
- Operational voltage, max.	50 V DC
- Operational current, max.	1 A
- Interrupting capacity, max.	30 W
Operating cycles	
• at 24 V, 1 A	3×10^6
Encoder inputs, max.	**4**
Incremental encoder inputs	
• 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)
Inputs, 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** (each either analog or stepper)
Analog outputs	
• Voltage range	± 10.5 V
• Isolation	No

SIMOTION C - Controller-based

SIMOTION C230-2 Motion Controller

Technical data (continued)

• Load impedance	> 3 kΩ
• Cable length, max.	35 m (115 ft)
Pulse outputs for stepper drives	
Output voltage for signal "1", I_o = -20 mA	3.7 V
Output voltage for signal "0", I_o = 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
Integrated digital inputs	**18**
with special functions for:	
• Measuring input (sensor)	2
• Bero connection	4
(all inputs can be used as standard inputs)	
Input voltage	
• Rated value	24 V DC
• For signal "1"	11 V to 30 V
• For signal "0"	-3 V to +5 V
Isolation	
• Inputs in groups of	18
Input current	
• For signal "1", 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 "1", max.	L+
Isolation in groups of	8
Output current	
• For signal "1"	
- 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
UL-approval	Yes

Selection and ordering data

	Order No.
SIMOTION C230-2 Motion Controller	**6AU1230-2AA01-0AA0**
SIMOTION 32 MB Micro Memory Card (MMC) for SIMOTION C230-2 Motion Controller	**6AU1700-0AA02-0AA0**
SIMOTION 32 MB Micro Memory Card (MMC) for SIMOTION C230-2 with license Multi Axes package	**6AU1700-0AA02-0CA0**
Front connector, 40-pole	
• Screw-type connection	**6ES7392-1AM00-0AA0**
• Spring-tension type	**6ES7392-1BM01-0AA0**
PS - C230-2 connecting comb for PS307 power supply	**6ES7390-7BA00-0AA0**
IM 365 interface for expanding the Motion Controller with up to max. 1 ER (expansion rack), 2 modules with permanent connecting cable (1 m) (3.28 ft)	
• Standard temperature range	**6ES7365-0BA01-0AA0**
Adapter for programming SIMOTION Micro Memory Card (MMC)	**See "SIMOTION software/ engineering software"**

Further information

• on PROFIBUS DP and Industrial Ethernet can be found under "Communication" as well as in Catalog IK PI or in the Interactive Catalog under "Automation Systems/SIMATIC NET Communication Systems".

SIMOTION P
PC-based

4

SIMOTION P - PC-based

General information

Overview

SIMOTION P is an open PC-based, Motion Control system. PLC, Motion Control and HMI functions are executed together with standard PC applications on one platform.

Open architecture with Windows operating system

The boundaries between the manufacturing environment and the office level are becoming increasingly blurred.

With SIMOTION P, the benefits of the office data processing environment, such as

- networking
- high memory capacity for data
- data backup concepts and
- integrated communication

are included in your machine.

SIMOTION P combines the benefits of a Microsoft Windows operating system and a real time SIMOTION Motion Control operating system on one industrial PC platform.

With SIMOTION P, visualization tasks and even engineering can easily be implemented directly on the PC. When using HMI software from other development systems, the standardized OPC server interface can be used.

Functions such as remote maintenance, diagnostics and teleservice can also be used via the integrated Ethernet interface. In addition, standard PC interfaces are also available for your applications.

Standard interfaces

They can be used for:

- Hardware, such as a printer, keyboard, mouse, etc.
- Software, such as visualization software or Microsoft Office programs

Benefits

- Open-loop control, Motion Control, technology, visualization and standard Microsoft applications on a single platform – ready-to-operate, no lengthy installation procedures
- Increased performance due to powerful PC process architectures
- Very simple configuration of HMI functions using ProTool/Pro and WinCC flexible
- Open architecture for standard applications based on the Windows operating system
- Standard PC communication mechanisms can be used via Industrial Ethernet
- User-friendly software updates on PC standards, such as CD-ROM
- User-friendly operation
- Versatile networking due to on board PROFIBUS DP and Industrial Ethernet interfaces
- Powerful due to a range of integrated functions
- Very simple engineering of open-loop control and Motion Control applications within the same program

Application

SIMOTION P is ideal for use in:

- Applications for which a PC is preferred, e. g. those with extensive data management, evaluation tasks, etc.
- Applications in which Motion Control, open-loop control and visualization functions are implemented on one platform, offering both high performance and compactness

Main applications are:

- Packaging machinery
- Plastic and rubber processing machinery
- Presses, wire-drawing machinery
- Textile machinery
- Printing machinery
- Wood, glass, ceramic, and stone working machinery

Due to the increasing use of servo drives, such machinery requires integrated logic, Motion Control and technology functions.

Design

SIMOTION P topology

The SIMOTION P Motion Control system can control the drives and distributed I/O Modules via two PROFIBUS DP interfaces with PROFIdrive.

Topology

The connection is made via the integrated IsoPROFIBUS board. This is a PCI card with two ports for PROFIBUS DP (max. 12 Mbit/s). Users can parameterize the clock-pulse rate on the bus. An option is to define one of the two PROFIBUS DP interfaces as an programming interface (MPI protocol).

PLC and Motion Control software runs on the SIMOTION Kernel basic system.

Internal communication provides high-performance data exchange between SIMOTION Kernel and the Microsoft Windows operating system. This data can be processed further by any other Microsoft program using the OPC server.

The SIMOTION P system can be integrated into Local Area Networks (LANs), due to its on board Industrial Ethernet interface. An external operator panel or an engineering system (e. g. for remote maintenance) can also be connected.

Engineering is either performed via a separate engineering device or on the SIMOTION P system directly.

SIMOTION P – Turnkey PC system

The SIMOTION P Motion Control system is a turnkey PC system, consisting of:
- SIMOTION P350 PC box
- IsoPROFIBUS card
- SIMOTION Kernel
- Microsoft Windows operating system

A type with a CD-ROM drive can also be ordered.

The SIMOTION P system is available with various panel fronts:
- SIMOTION P panel fronts are available with a 12" or 15" TFT display for either keyboard or touch screen operation

The SIMOTION P system requires a 24 V power supply. We recommend that you use a UPS (Uninterruptible Power Supply). If connecting to a 120 V/230 V/400 V voltage source, you will require one of the following power supplies, e. g.:
- SIMATIC PS 307 or
- SITOP power DC UPS Module

I/O signals are connected via distributed I/O systems, which are in turn connected to the IsoPROFIBUS board, such as:
- SIMATIC ET 200S
- SIMATIC ET 200M
- SIMATIC ET 200X
- SIMATIC ET 200pro
- SIMATIC ET 200eco

The signals are transferred from the I/O systems to the SIMOTION P system. This transfer procedure is implemented digitally, noise-free and with high-performance (up to 12 Mbit/s) via the PROFIBUS DP of the IsoPROFIBUS board.

Extra on board inputs/outputs can be added to SIMOTION P, using the MCI board extension, for particularly fast I/O signals. This MCI board extension can be inserted into the free slot adjacent to the IsoPROFIBUS board.

SIMOTION P - PC-based

Function

SIMOTION P provides the following basic functionality for the various automation requirements:

- SIMOTION Runtime system
  - Programmable with several languages conforming to IEC 61131
  - Various Runtime levels (cyclic, sequential, event-driven)
  - PLC and arithmetic functionality
  - Communications and management functions
  - Motion Control functions (Motion Control Basic)
- Test and diagnostic interfaces

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

Position-controlled Motion Control for servo axes

- Drives with digital setpoint interface:
  SIMOTION P enables position-controlled Motion Control for drives with digital setpoint interfaces via PROFIBUS DP interfaces with PROFIdrive.
- Drives with analog setpoint interfaces (for retrofitting):
  The ADI 4 (Analog Drive Interface) Module can be used to connect drives with analog ± 10 V setpoint interfaces. This module is connected to PROFIBUS DP.
  The following can be connected to an ADI 4 Module:
  - 4 drives
  - 4 encoders
  - Binary inputs and outputs

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
  - Positioning - POS
  - Synchronous operation/electronic gear - GEAR
  - Synchronous operation/electronic cam - CAM
- Temperature controller - TControl

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

Performance

- The latest PC processor technology, currently Pentium III, 1.26 GHz, increases performance.
- Hardware-supported floating-point arithmetic enables complex arithmetic functions to be used effectively.
- Very short instruction execution times open up completely new application possibilities in the mid-performance to high-performance range.

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 technological dialog boxes and wizards, as well as textual and graphical languages for programming, considerably reduce the familiarization and training periods.

Operator control and monitoring (HMI)

Operator control and monitoring can be performed
- separately on an operator panel or
- on the SIMOTION P system directly

Communication utilities which support user-friendly data exchange with HMI systems are integrated in the basic functionality of the SIMOTION P350. Therefore, communication can be performed via PROFIBUS as well as Industrial Ethernet or, with SIMOTION P, integrated in the device itself. Data exchange is processed autonomously by SIMOTION Kernel.

The standard HMI systems for SIMOTION are SIMATIC Pro-Tool/Pro and WinCC flexible. Data from a SIMOTION project can be configured directly with both HMI systems. SIMOTION panel fronts can be used for the display.

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

Communication interfaces

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

Display and diagnostics

By definition, the software Kernel of a SIMOTION P does not have any pushbuttons or switches for changing operating states (RUN/STOP). This task is performed by a software monitor (SIMOTION P state), which is operated using the keyboard or mouse.
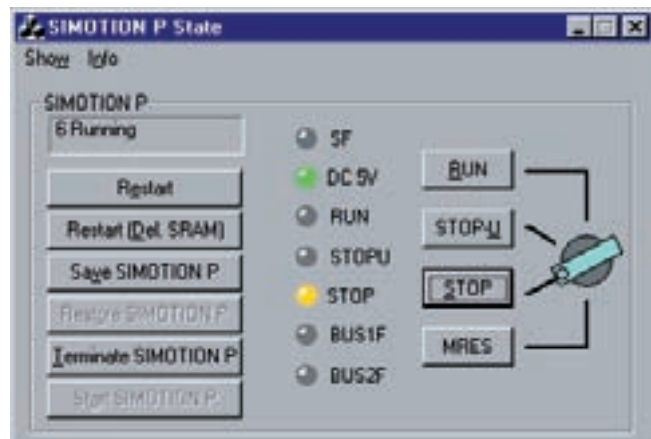
SIMOTION P state

This monitor visualizes the operating states during ramp-up and operation. Other functions are, e. g. loading and saving user programs or ramp up and shut down of the SIMOTION P system. During shutdown, important data (retain data) is stored on the IsoPROFIBUS board while the device's power supply is shutting down, so that the most up-to-date data is ready for use as soon as the device is restarted.

The SIMOTION P intelligent diagnostic system constantly controls the functionality of the system and registers errors or specific system events (e. g. timing errors, module or network failures, etc.). PC-specific functions, such as fan speeds or temperatures, can also be continuously controlled and alarms are generated if they fail.

The stability of the SIMOTION Kernel is **independent** of the Microsoft Windows operating system. Even in the event of a Windows blue screen, SIMOTION P continues to run and the machine can be shut down safely in accordance with user specifications.

Overview

SIMOTION P350 is a PC-based Motion Control system. The operating system is Windows XP Professional, with a real-time expansion for SIMOTION. This enables PC applications to be carried out alongside SIMOTION machine applications on SIMOTION P350 at any time.

Design

Interfaces

The SIMOTION P350 industrial PC contains the following interfaces:

- 1 x IsoPROFIBUS board with two PROFIBUS DP interfaces with PROFIdrive to connect
  - Distributed I/Os (SIMATIC ET200, PROFIBUS DP standard slaves, etc.)
  - Servo converters (e. g. SINAMICS S120, MASTERDRIVES MC, etc.)
  - Engineering systems (PG/PC) or
  - HMI devices (e. g. MP, TP, OP)
- On board interfaces for standard Windows applications integrated in the PC
  - 1 x MPI/PROFIBUS DP (not isochronous)
  - 1 x Industrial Ethernet (e. g. engineering system connection)
- Another slot is occupied if the MCI extension board is used.

Compatible panel fronts

SIMOTION P350 can be connected to the following panel fronts:

- 12" with membrane-type keys
- 12" for touch screen operation
- 15" with membrane-type keys
- 15" for touch screen operation

An external monitor can also be connected via the VGA port.

Compatible I/Os

The following can be used as I/Os:

- All certified PROFIBUS standard slaves (DP-V0, DP-V1, DP-V2)
- Servo converters, e. g. SINAMICS S120
  These devices are connected via PROFIBUS DP interfaces with PROFIdrive.

Other features

- Processor: Intel® Pentium® III, 1.26 GHz
- 256 MB SDRAM, can be upgraded to 512 MB
- Hard disk with shock damping, approx. 40 GB
- CD-ROM drive (optional)
- Floppy disk drive (integrated)
- Microsoft Windows XP Professional operating system, English
- Data backup/restore using the Symantec Ghost data backup software (preinstalled)
- Integrated ports:
  - COM 1 (V.24), COM 2 (V.24), LPT 1, VGA
  - PS/2 keyboard, PS/2 mouse
  - 2 USB channels (1 x internal/1 x external)
  - 1 x MPI/PROFIBUS DP interface (integrated, not isochronous)
  - 1 x Industrial Ethernet 10/100 Mbit/s (on board)
  - 1 x PCMCIA (PC card) slot type III
- Expansion slots:
  - 1 x PCI/ISA 170 mm (6.69 in) (free)
  - 1 x PCI 265 mm (10.43 in) (occupied by IsoPROFIBUS board)
- IsoPROFIBUS boards (preinstalled):
  - 2 x PROFIBUS DP with PROFIdrive

4

SIMOTION P - PC-based

SIMOTION P350

Integration
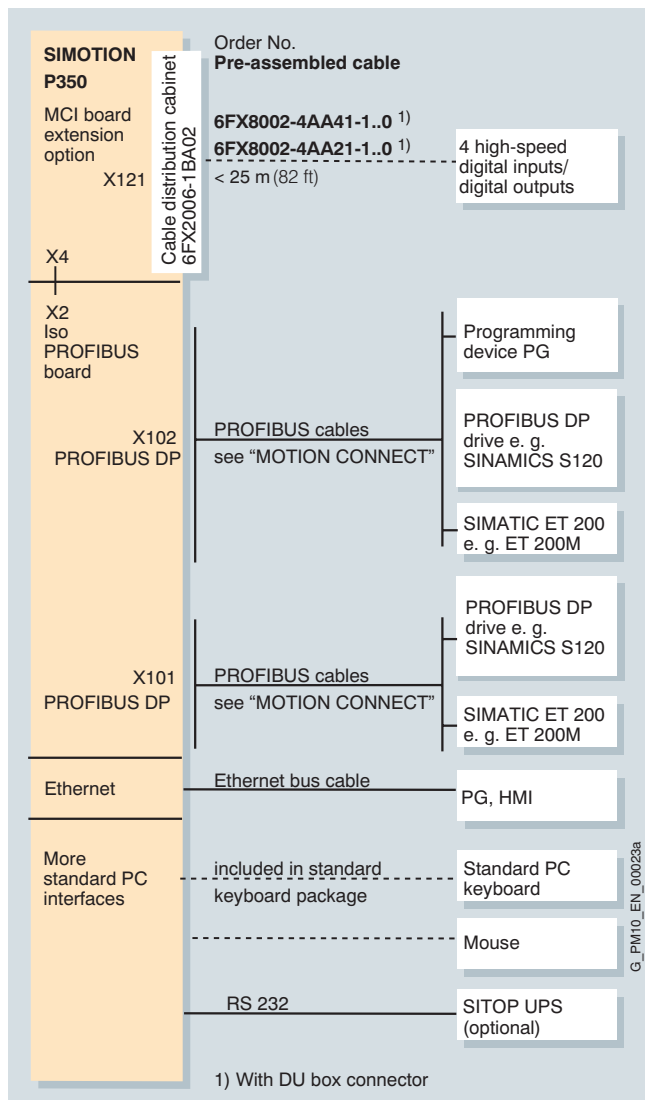
Overview of SIMOTION P350 connections

Technical data

SIMOTION P350

Input voltage	24 V DC
Power consumption, max.	130 W
Mains buffering	Max. 20 ms
Degree of protection in accordance with DIN EN 60529 (IEC 60529)	IP20
Temperature change, max.	10°K/h
Rel. humidity limit values in accordance with DIN IEC 68-2-3, DIN IEC 68-2-30, DIN IEC 68-2-56	
• Storage and transport	5% to 95% at +25 °C (+77 °F)
• Operation	5% to 80% at +25 °C (+77 °F)
Humidity rating in accordance with DIN EN 60721-3-3	Class 3K5, condensation and icing excluded. Low air temperature 0 °C (32 °F).
Permissible ambient temperature	
• Storage and transport	-20 °C to +60 °C (-4 °F to +140 °F)
• Operation	+5 °C to +45 °C (+41 °F to +113 °F)
Weight, approx.	6 kg (13 lb)
Dimensions (W x H x D)	297 mm x 267 mm x 85 mm (11.69 in x 10.51 in x 3.35 in) (excluding CD drive)
	297 mm x 267 mm x 106 mm (11.69 in x 10.51 in x 4.17 in) (including CD drive)

Selection and ordering data | Order No.

	Order No.
SIMOTION P350 With Intel Pentium III; 1.26 GHz/ with Windows XP Professional English, 256 MB SDRAM, 24 V DC, with IsoPROFIBUS board, with integrated floppy drive	
• without CD-ROM drive	**6AU1350-2AH21-1BE1**
• with CD-ROM drive	**6AU1350-2AH23-1BE1**
Memory expansion	
• 128 MB SO-DIM-PC-100	**6ES7648-2AC10-0CA0**
• 256 MB SO-DIM-PC-100	**6ES7648-2AC20-0CA0**
Spare parts	
• Battery for IsoPROFIBUS board	**6FC5247-0AA18-0AA0**
Runtime and engineering software	**See "SIMOTION software"**

Overview
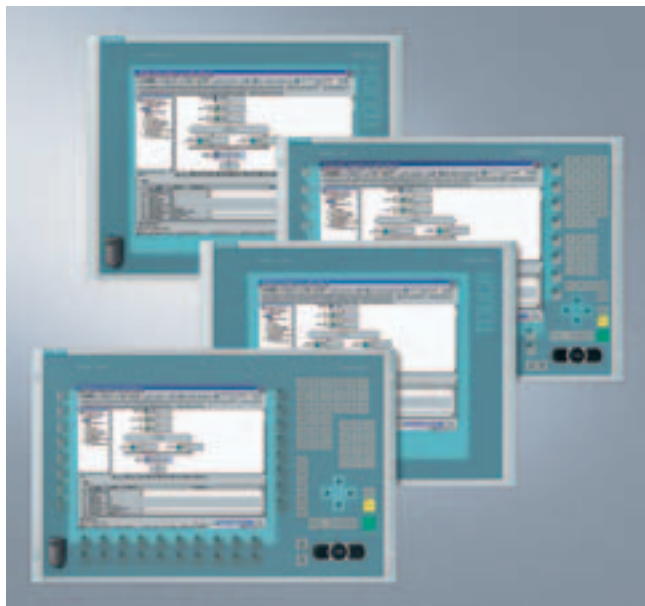
Four different panel fronts with TFT color display are available for the SIMOTION P350:

- 12" with membrane keyboard, resolution: 800 x 600 pixels
- 12" for touch screen operation, resolution: 800 x 600 pixels
- 15" with membrane keyboard, resolution: 1024 x 768 pixels
- 15" for touch screen operation, resolution: 1024 x 768 pixels

Design

The panel fronts are suitable for installation in consoles, control cabinets and support arm systems.

The SIMOTION P350 is mounted directly behind the panel front as standard. Four knurled-head screws are used to form a mechanical interlock between the SIMOTION P350 and the panel front. No special tool is needed for this.

It is also possible to distribute the SIMOTION panel fronts at distances of up to 20 m (66 ft). The components required for this, i. e. video link transmitter, video link receiver and associated mounting brackets, are listed in Catalog NC 60.

Technical data

Panels

Degree of protection in accordance with DIN EN 60529 (IEC 60529) Front panel	IP65

Rel. humidity limit values in accordance with DIN IEC 68-2-3, DIN IEC 68-2-30, DIN IEC 68-2-56

• Storage and transport	5% to 95% at +25 °C (+77 °F)
• Operation	5% to 80% at +25 °C (+77 °F)
Condensation	Not permitted
Permissible ambient temperature	
Storage and transport	-20 °C to +60 °C (-4 °F to +140 °F)
Operation	+5 °C to +45 °C (+41 °F to +113 °F)

Weight	
• 12" panel front, membrane-type keys	6 kg (13 lb)
• 12" panel front, touch screen operation	6 kg (13 lb)
• 15" panel front, membrane-type keys	6 kg (13 lb)
• 15" panel front, touch screen operation	6 kg (13 lb)

Dimensions (W x H x D)	
• 12" panel front, membrane-type keys	483 mm x 310 mm x 100 mm (19.02 in x 12.21 in x 3.94 in)
• 12" panel front, touch screen operation	400 mm x 310 mm x 125 mm (15.75 in x 12.21 in x 4.92 in)
• 15" panel front, membrane-type keys	483 mm x 355 mm x 130 mm (19.02 in x 13.98 in x 5.12 in)
• 15" panel front, touch screen operation	483 mm x 310 mm x 130 mm (19.02 in x 12.21 in x 5.12 in)

Selection and ordering data

	Order No.
The panel fronts below can only be used in conjunction with SIMOTION P350.	
SIMOTION P012T 12" Touch panel front	**6AU1300-0CA00-0AA0**
SIMOTION P012K 12" Keys panel front	**6AU1300-0DA00-0AA0**
SIMOTION P015K 15" Keys panel front	**6AU1300-0FA00-0AA0**
SIMOTION P015T 15" Touch panel front	**6AU1300-0EA00-0AA0**
Accessories	
Caps 10 units for USB terminal	**6FC5248-0AF05-0AA0**
Key labeling strips For labeling soft keys and function keys, blank, 3 per set (plastic) for	
• 12" Keys	**6AV7671-3CA00-0AA0**
• 15" Keys	**6AV7671-5CA00-0AA0**

4

SIMOTION P - PC-based
Supplementary components

MCI board extension	Standard PC keyboard KBPC USB US

Overview

The MCI board extension is offered as an option for connecting 4 fast digital inputs/outputs each. Additionally required are a cable distributor, connecting cables and a special DU box connector if assembly is performed by the customer.

Technical data

MCI board extension, slot option

Power input, max.	2.1 W
Permissible ambient temperature	
• Storage and transportation	-20 °C to +60 °C (-4 °F to +140 °F)
• Operation	+5 °C to +55 °C (+41 °F to +131 °F)
Weight, approx.	0.09 kg (0.2 lb)
Dimensions	short PCI card

Selection and ordering data — Order No.

MCI board extension	6FC5222-0AA00-0AA1
Cable distributor Without DU box connector for connecting: • 4 fast digital inputs • 4 fast digital outputs	6FX2006-1BA02
Connecting cables	
Supplied with DU box connector (pre-assembled)	6FX8002-4AA21-1..0
Supplied without DU box connector Note: DU box connectors must be ordered separately for self-assembly.	6FX8002-4AA41-1..0
DU box connector (10 units) For connecting devices to cable distributor	6FX2003-0FA00

Overview

The standard PC keyboard KBPC USB US with hub features an impressive modern design and integrated hub for three USB ports. A USB mouse can be connected to the keyboard. The supplied wrist rest permits an ergonomic working position.

The standard PC keyboard enables you to comfortably edit programs and texts.

The standard PC keyboard is only of limited suitability for industrial use (EMC) and is not suitable for continuous use. It should only be used for commissioning and service purposes.

Integration

The standard PC keyboard KBPC USB US can be used for:

• SINUMERIK 810D powerline/840Di/840D powerline with PCU 50/PCU 70 and Windows XP
• SINUMERIK 840Di sl/840D sl
• SIMOTION P350

The standard PC keyboard cannot be used in combination with the full CNC keyboard.

Technical data

Standard PC keyboard KBPC USB US

Order No.	6FC5 203-0AC01-2AA0
Product name	SINUMERIK standard PC keyboard KBPC USB US
Input voltage	5.25 V DC
Power consumption, max.	0.3 W
Degree of protection in accordance with DIN EN 60529 (IEC 60529)	IP20
Humidity rating in accordance with DIN EN 60721-3-3	Class 3K5, condensation and icing excluded. Low air temperature 0° (32 °F).
Ambient temperature	
• for storage	-20 to +50 °C (-4 to +122 °F)
• for transport	-20 to +50 °C (-4 to +122 °F)
• for operation	15 to 32 °C (59 to 90 °F)
Weight, approx.	1 kg (2.2 lb)
Dimensions	
• Width	463 mm (18.23 in)
• Height	37 mm (1.46 in)
• Depth	166 mm (6.54 in)

Selection and ordering data — Order No.

Standard PC keyboard KBPC USB US	6FC5203-0AC01-2AA0
Compatible for MF-II 104/105 Key layout with integrated hub Interface: USB, including connection cable, Length: 1.9 m (6.23 ft)	

Overview
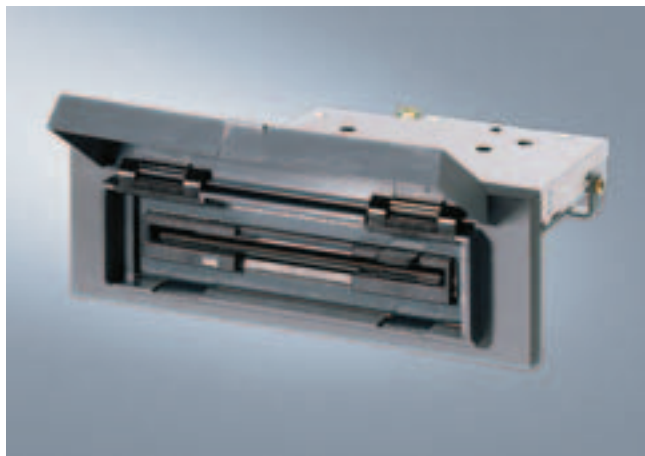
The 3.5" disk drive is suitable for archiving user data and can be installed in front panels. It is connected via a USB 1.1 interface.

Function

The 3.5" disk drive is used for transfer of user data. Installation in front panels makes it possible to transfer data without opening the control cabinet door. You can use normal density (720 KB) and high density (1.2/1.44 MB) 3.5" disks to store user data.

Integration

The disk drive is suitable for connecting to:
- SINUMERIK PCU 50.3
- SINUMERIK PCU 50/PCU 70 with Windows XP
- SINUMERIK PCU 50/PCU 70 with Windows NT 4.0 and PCU-Base software from March 7, 2003
- SIMATIC Panel PC 670/870/IL 70 with Windows 2000/XP
- SIMOTION P350 with Windows XP Professional

Technical data

Order No.	6FC5 235-0AA05-1AA2
Product name	SINUMERIK 3.5" disk drive, USB
Input voltage	5.25 V DC
Power consumption, max.	Max. 2.5 W
Degree of protection in accordance with DIN EN 60529 (IEC 60529)	
• Front side	IP54
• Rear side	IP00
Humidity rating in accordance with DIN EN 60721-3-3	Class 3K5, condensation and icing excluded. Low air temperature 0° (32 °F).
Relative air humidity	
• Storage	5 to 90% at -22 to +60 °C (-8 to +140 °F)
• Transport	5 to 95% at -40 to +65 °C (-40 to +149 °F)
• Operation	20 to 80% at 4 to 51.7 °C (39 to 125 °F)
Ambient temperature	
• for storage	-20 to +60 °C (-4 to +140 °F)
• for transport	-20 to +60 °C (-4 to +140 °F)
• for operation	4 to 50 °C (39 to 122 °F)
Distance to PCU, max.	5 m (16 ft)
Weight, approx.	0.32 kg (0.7 lb)
Dimensions	
• Width	145 mm (5.71 in)
• Height	50 mm (1.97 in)
• Depth	161 mm (6.34 in)

Selection and ordering data	Order No.
SINUMERIK 3.5" disk drive, USB 1.1 Incl. connection cable Length: 1 m (3.28 ft)	**6FC5235-0AA05-1AA2**
Accessories	
Cover for disk drive With masking frame, cover and bearing bracket	**6FC5247-0AA20-0AA0**

Notes

4

SIMOTION D
Drive-based

5

SIMOTION D - Drive-based

General information

Overview

SIMOTION D is the compact, drive-based version of SIMOTION based on the new SINAMICS family of drives. With SIMOTION D, the PLC and Motion Control functionalities of SIMOTION and the drive software of SINAMICS run on control hardware in the SINAMICS S120 design.

SIMOTION D is offered in various performance versions. Thereby, the highest scalability and flexibility are guaranteed. By means of the integrated PLC in accordance with IEC 61131-3, SIMOTION D can control beside of motion the whole machine.

HMI devices can be connected to the on board PROFIBUS or Ethernet interface for operating and monitoring. Via these interfaces, functions such as remote maintenance, diagnostics and teleservice are possible.

Benefits

- Cost-effective due to integrated Motion Control, technology and PLC functionality direct in the drive
- Directly employs the innovative SINAMICS S120 design
- Compact type of construction reduces control cabinet size
- Ideally suited to modular or distributed machine concepts
- User-friendly operation
- Versatile networking due to on board PROFIBUS DP and Industrial Ethernet interfaces
- Powerful due to a range of integrated functions
- Simple engineering, from drive commissioning to open-loop control and Motion Control applications
- Easy to service due to CompactFlash, which can be easily replaced and contains all data (programs, data, drive parameters)
- Responds quickly as the interfaces between PLC and Motion Control are no longer required

Application

SIMOTION D can be used wherever

- the new SINAMICS drive family is used,
- Motion Control and open-loop control functionality are executed direct in the drive (SINAMICS),
- a compact, space-saving design is required,
- high performance is required for Motion Control, as are fast I/Os,
- modular machine concepts with fast isochronous links are required.

SIMOTION D, together with the associated SINAMICS components, meets the highest standards in respect of suitability for industrial use, due to high electromagnetic compatibility and resistance against shock and vibration loads. SIMOTION D can be used as intelligent drive on higher-level PC controls (e. g. WinAC).

Main applications are:

- Packaging machinery
- Plastic and rubber processing machinery
- Presses, wire-drawing machinery
- Textile machinery
- Printing machinery
- Wood, glass, ceramic, and stone working machinery

Due to the increasing use of servo drives, such machinery requires integrated logic, Motion Control and technology functions.

Design

SIMOTION D + SIMANICS S120
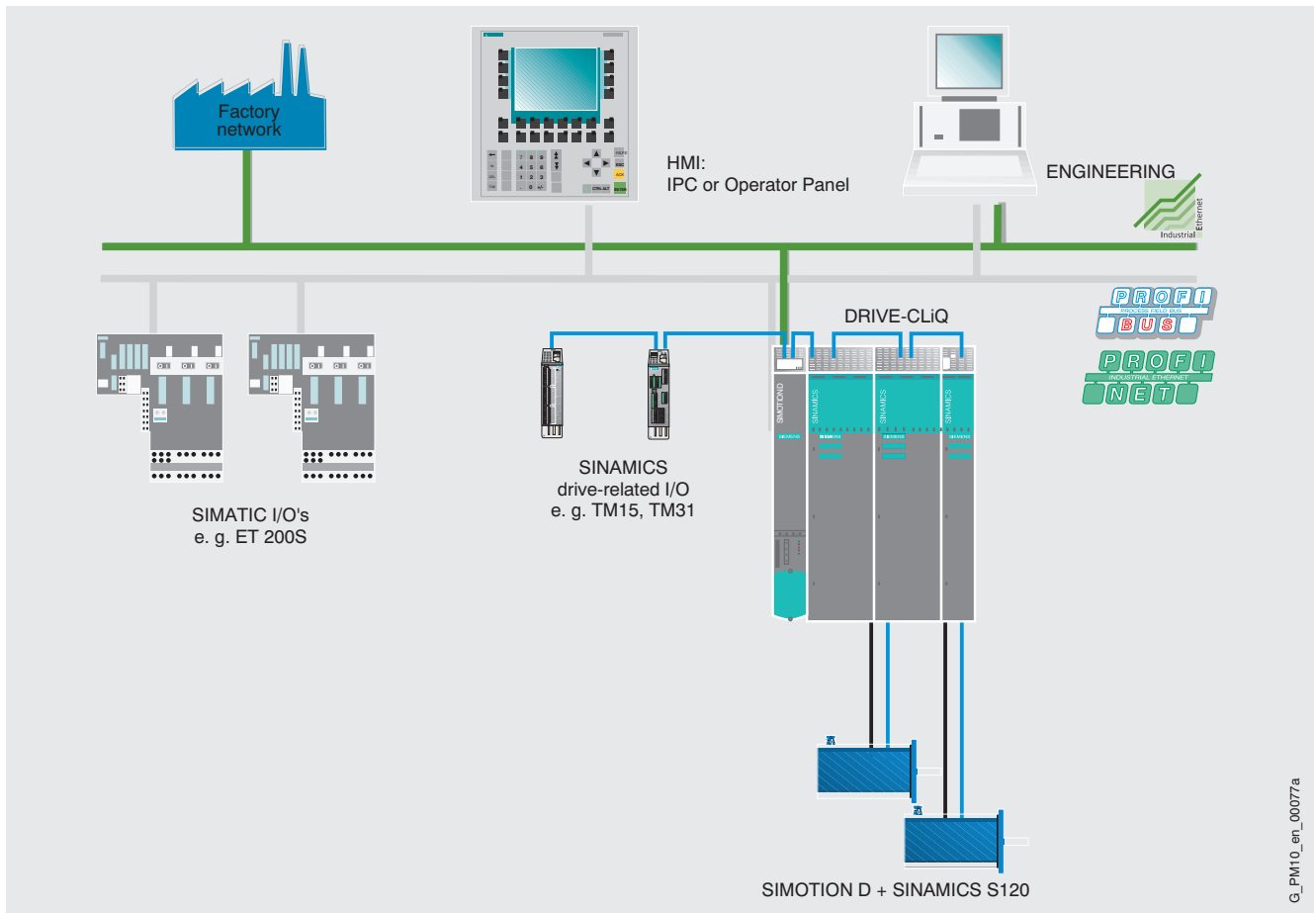
SIMOTION D topology

The following components comprise a SIMOTION D axis grouping:

- The SIMOTION D control unit, designed for open-loop and closed-loop control of a multi-axis drive group, contains drive control and the SIMOTION Runtime system
- SINAMICS S120 Line Module (Infeed Module)
- SINAMICS S120 Motor Modules (Power Modules)
- Other drive components, such as
  - Power supply
  - Filter
  - Choke, etc.
- DRIVE-CLiQ provides the link between SIMOTION D and the SINAMICS S120 drive components.

The SIMATIC ET 200 distributed I/O and drive-related control-cabinet I/O (e. g. Terminal Modules TM15, TM31, etc.) can also be connected to SIMOTION D.

SIMOTION D components and interfaces:

- On board digital inputs and outputs
- Option slot for operating:
  - terminal expansion (additional I/Os) or
  - bus interface (e. g. PROFINET, available soon)

- Integrated communication ports for linking:
  - SINAMICS S120 drive components
  - Distributed I/Os
  - HMI systems
  - PG/PC
  - Other motion control and automation systems
  - Other SINAMICS S120 drives with digital setpoint interfaces
- Various status/error displays

Design

There are various designs for SINAMICS S120, which vary in accordance with performance class. The "booksize" design is usually used in SIMOTION D applications.

SIMOTION D can be mounted in the control cabinet in one of three ways:

- Hooking it in to the Line Module on the left-hand side
- Screwing it on to the panel of the control cabinet directly, if it is required/desired that SIMOTION D is separate from the Line Module
- Using spacers (accessories) if it is not possible to mount SIMOTION D on to the side of the Line Module (e. g. if no Line Module is present), but the difference between the mounting depth of SIMOTION D and the Motor Modules still has to be compensated for.

SIMOTION D - Drive-based

General information

■ Design (continued)

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 200X
- SIMATIC ET 200pro
- SIMATIC ET 200eco

Alternatively, certified PROFIBUS DP standard slaves (DP-V0, DP-V1, DP-V2) can also be connected.

■ Function

The SIMOTION D basic functionality is supplied with the CF (CompactFlash card) and is loaded when the voltage is switched on. The basic functionality contains the following software components:
- SINAMICS S120 drive control
  - Current/torque controller
  - Speed controller for up to 6 servo axes
  - Controller for active infeed (Active Line Module)
- SIMOTION Runtime system
  - Programmable with several languages conforming to IEC 61131
  - Various Runtime levels (cyclic, sequential, event-driven)
  - PLC and arithmetic functionality
  - Communication and management functions
  - Motion Control functions (Motion Control Basic)
- Test and diagnostic interfaces

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

Technology packages (TP)

A special feature of SIMOTION is that the basic functionality can be expanded by loading technology packages, such as:
- Motion Control with technology packages:
  - Positioning - POS
  - Synchronous operation/electronic gear - GEAR
  - Synchronous operation/electronic cam - CAM
- Temperature controller - TControl

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

Performance

- Hardware-supported floating-point arithmetic enables complex arithmetic functions to be used effectively.
- Very short instruction execution times open up completely new application possibilities in the mid-performance to high-performance range.

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 technological dialog boxes and wizards, as well as textual 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 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 via PROFIBUS or Ethernet interfaces, and 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.

Communication

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

Overview

SIMOTION D is available in various performance variants. This ensures the highest degree of scalability and flexibility. The individual variants SIMOTION D425, SIMOTION D435 and SIMOTION D445 have the following different characteristics:

- Maximum number of axes
  - SIMOTION D425: 16
  - SIMOTION D435: 32
  - SIMOTION D445: 64
- DRIVE-CLiQ interfaces
  - SIMOTION D425: 4
  - SIMOTION D435: 4
  - SIMOTION D445: 6
- Fan/Battery Module
  - SIMOTION D425: optional
  - SIMOTION D435: optional
  - SIMOTION D445: required

The integrated drive control can operate up to 6 servo drives.

Additional drives of the SINAMICS S120 series can be operated with a SINAMICS CU320 for the D4xx or directly on DRIVE-CLiQ with CX32 for the D435 and D445. Alternatively to the servo control, the speed control can be operated using a vector or *V/f* control.

Design

Interfaces

- Displays, diagnostics
  - LEDs to display operating states and errors
  - 7-segment status/error display during system ramp up
  - 3 test sockets
- Interfaces
  - 4 x DRIVE-CLiQ (6 x DRIVE-CLiQ for D445)
  - 2 x Industrial Ethernet
  - 2 x PROFIBUS DP
- Integrated I/Os
  - 8 digital inputs
  - 8 digital inputs/outputs

- Other
  - Terminals for 24 V electronic power supply
  - Option slot for a terminal expansion or additional communication port

Data storage/data backup

SIMOTION D425, D435 and D445 Control Units have 320 KB of non-volatile and battery-backed SRAM for remanent tag storage. This backup is stored for at least 5 days. There are two options for storing remanent data for a longer period:

- System commands for storing remanent data on the SIMOTION CF (CompactFlash card)
- Use of a Battery Module

Runtime software, user data and user programs are saved remanently using a CF (CompactFlash card).

Compatible I/Os

PROFIBUS DP:

- Certified PROFIBUS standard slaves (DP-V0, DP-V1, DP-V2)
- SIMATIC ET 200S/M/X/eco/pro distributed I/O systems

DRIVE-CLiQ:

- Modules from the SINAMICS range
- DRIVE-CLiQ cables, which are required to connect Line/Motor Modules to SIMOTION D, are supplied with the Line/Motor Modules (standard length).

Integration
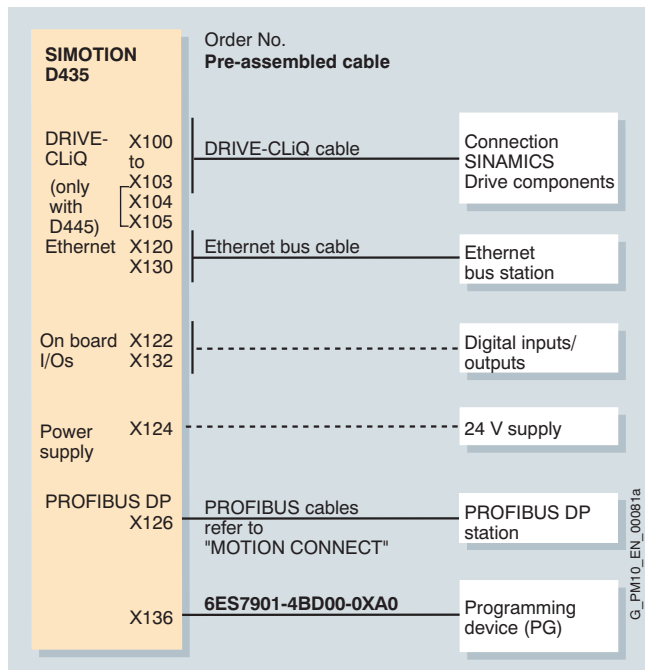
Overview of SIMOTION D425/D435/D445 connections

The maximum permissible cable lengths should be taken into account when planning the cable layout.

Malfunctions may occur if longer lengths are used.

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

SIMOTION D - Drive-based

SIMOTION D425/D435/D445

Technical data

SIMOTION	D425 – Basic Performance	D435 – Standard Performance	D445 – High Performance
Supply voltage			
• Rated value	24 V DC	24 V DC	24 V DC
• Permissible range	20.4 V to 28.8 V	20.4 V to 28.8 V	20.4 V to 28.8 V
Current consumption, typ.	600 mA	600 mA	2 A
Inrush current, typ.	6.0 A	6.0 A	6.0 A
Power loss	15 W	15 W	48 W
Permissible ambient temperature			
• Storage and transport	-40 °C to +70 °C (-40 °F to 158 °F)	-40 °C to +70 °C (-40 °F to 158 °F)	-40 °C to +70 °C (-40 °F to 158 °F)
• Operation	0 °C to +55 °C (32 °F to +131 °F)	0 °C to +55 °C (32 °F to +131 °F)	0 °C to +55 °C (32 °F to +131 °F)
Permissible relative humidity (without condensation)	5% to 95%	5% to 95%	5% to 95%
Atmospheric pressure	700 hPa to 1060 hPa	700 hPa to 1060 hPa	700 hPa to 1060 hPa
Degree of protection in accordance with IEC 529	IP20	IP20	IP20
Dimensions (W x H x D)	50 mm x 380 mm x 230 mm (1.97 in x 14.96 in x 9.1 in)	50 mm x 380 mm x 230 mm (1.97 in x 14.96 in x 9.1 in)	50 mm x 380 mm x 270 mm (1.97 in x 14.96 in x 10.63 in)
Weight			
• SIMOTION D	2.5 kg (5 lb)	2.5 kg (5 lb)	3.6 kg (8 lb)
• ContractFlash memory card	0.007 kg (0.02 lb)	0.007 kg (0.02 lb)	0.007 kg (0.02 lb)
Digital inputs	**8**	**8**	**8**
Rated value	24 V DC	24 V DC	24 V DC
• For signal "1"	15 V to 30 V	15 V to 30 V	15 V to 30 V
• For signal "0"	-3 V to +5 V	-3 V to +5 V	-3 V to +5 V
Isolation	Yes, in groups of 4	Yes, in groups of 4	Yes, in groups of 4
Current consumption typ. for signal level 1	10 mA at 24 V	10 mA at 24 V	10 mA at 24 V
Signal propagation delays	100 µs	100 µs	100 µs
Digital inputs/outputs (parameterizable)	**8**	**8**	**8**
When used as an input			
• Input voltage			
- Rated value	24 V DC	24 V DC	24 V DC
- For signal "1"	15 V to 30 V	15 V to 30 V	15 V to 30 V
- For signal "0"	-3 V to +5 V	-3 V to +5 V	-3 V to +5 V
• Isolation	No	No	No
• Current consumption typ. for signal level 1	10 mA at 24 V	10 mA at 24 V	10 mA at 24 V
• Signal propagation delays	100 µs (1 µs as measuring input)	100 µs (1 µs as measuring input)	100 µs (1 µs as measuring input)
When used as an output			
• Rated load voltage	24 V DC	24 V DC	24 V DC
- Permissible range	20.4 V to 28.8 V	20.4 V to 28.8 V	20.4 V to 28.8 V
• Output voltage			
- For signal "1", max.	15 V to 30 V	15 V to 30 V	15 V to 30 V
• Isolation	No	No	No
• Current load, max.	500 mA per output	500 mA per output	500 mA per output
• Residual current, max.	2 mA	2 mA	2 mA
• Switching frequency of the outputs			
- With ohmic load	100 Hz	100 Hz	100 Hz
- With inductive load	2 Hz	2 Hz	2 Hz
• Short-circuit protection	Yes	Yes	Yes
Real-time clock/SRAM backup			
• Backup time, min.	5 days	5 days	5 days
• Charging time, typ.	Only a few minutes	Only a few minutes	Only a few minutes
UL-approval	Issued	Issued	Issued

Selection and ordering data	Order No.
SIMOTION D425	**6AU1425-0AA00-0AA0**
SIMOTION D435	**6AU1435-0AA00-0AA1**
SIMOTION D445	**6AU1445-0AA00-0AA0**
CF (CompactFlash card) 64 MB With SINAMICS drive software V2.2 and SIMOTION Kernel (current version)	**6AU1400-2KA00-0AA0**
CF (CompactFlash card) 64 MB With Multi Axes package license, SINAMICS drive software V2.2 and SIMOTION Kernel (current version)	**6AU1400-2KA00-0CA0**
CF (CompactFlash card) 64 MB With SINAMICS drive software V2.3 and SIMOTION Kernel 3.2 SP1 (current version)	**6AU1400-2KA01-0AA0**
CF (CompactFlash card) 64 MB With SINAMICS drive software V2.3 and SIMOTION Kernel 3.2 SP1 (current version)	**6AU1400-2KA01-0CA0**
Spacers Kit, 2 units (option)	**6SL3064-1BB00-0AA0**
Adapter For programming the CF (CompactFlash card)	**See "SIMOTION software/ engineering software"**
Battery and fan module (Optional for D425/D435; required for D445)	**6FC5348-0AA01-0AA0**

Further information

- on PROFIBUS DP and Industrial Ethernet can be found in Catalog IK PI or in the Interactive Catalog under "Automation Systems/SIMATIC NET Communication Systems" as well as in the "Communication" section.

- on ordering data for other SINAMICS drive components such as Line Modules, Motor Modules, DRIVE CLiQ cables etc., see Catalogs D 21.1 (Vector Control Drive System) and D 21.2 (SINAMICS S120 Servo Control Drive System) or the Interactive Catalog under "Drive Technology/AC Converters/...".

5

SIMOTION CX32

Overview
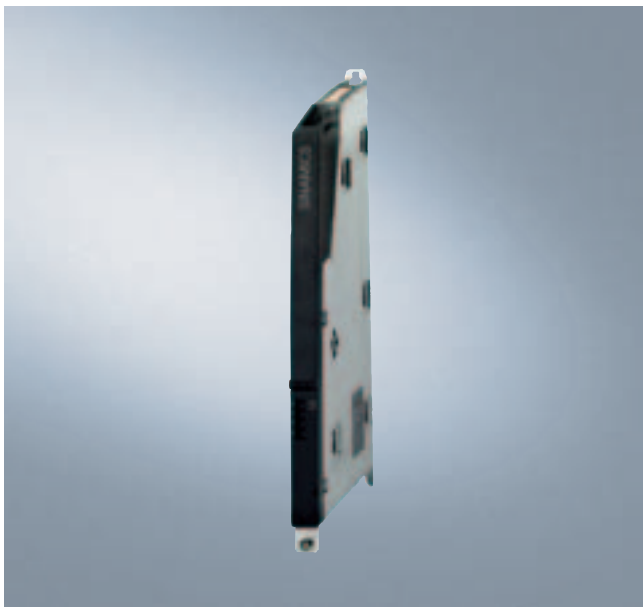
The CX32 controller extension is a SINAMICS S120-type component and permits the drive-side computing power for the SIMOTION D product range to be scaled. Each CX32 can control up to six additional servo axes.

The controller is connected to SIMOTION D over DRIVE-CLiQ which ensures high-performance isochronous drive control without additional modules. The communication interfaces on the SIMOTION D remain available for other connections. With a width of 25 mm (0.98 in) the module requires very little space and is therefore perfectly suited for use in compact machines.

The data for the SIMOTION CX32 is stored exclusively on the SIMOTION D which means no action has be taken when the module is replaced. The SIMOTION CX32 can be operated on the SIMOTION D445 and D435.

Design

Automation solutions with many axes can be implemented with SIMOTION D and CX32. SIMOTION D can manage and control the motion of up to 64 axes and already has the drive controller for up to 6 servo axes plus the infeed integrated. Alternatively, vector axes or *V/f* axes can be used. The drive control for up to 6 additional servo axes can be implemented with SIMOTION CX32. Several SIMOTION CX32 can be used for an axis group.

DRIVE-CLiQ is used for connecting to SIMOTION D. Additional CU320s can be operated via PROFIBUS on a SIMOTION D425, D435 or D445.
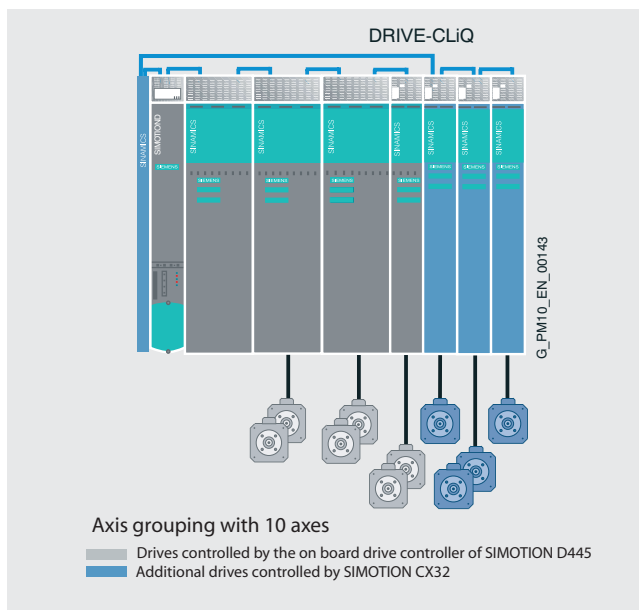
Example of an axis group for 10 axes

Technical data

SIMOTION CX32

Power supply	
• Rated value	24 V DC
• Permissible range	20.4 V to 28.8 V
Current consumption, typ.	800 mA
Inrush current, typ.	1.6 A
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 (without condensation)	5% to 95%
Atmospheric pressure	700 hPa to 1060 hPa
Degree of protection to IEC 529	IP20
Dimensions (W x H x D)	25 mm x 380 mm x 230 mm (0.98 in x 14.96 in x 9.1 in)
Weight	1.5 kg (3.3 lb)
UL-approval	Issued
Digital inputs	4
Digital inputs/outputs (parameterizable)	4

Selection and ordering data	Order No.
SIMOTION CX32 controller extension	**6SL3040-0NA00-0AA0**

SIMOTION software

SIMOTION software

■ **Overview**

Scalable system platform

The SIMOTION system has created a scaleable system platform for automation tasks, particularly Motion Control applications.

The scalability of the system allows you to implement tailor-made and economic applications.

The modular SIMOTION software is perfectly integrated and offers easy-to-use functions for all phases of the automation process.

Software categories

The software for SIMOTION can be classified into the following categories:

- Runtime software
  The following types of Runtime software can be distinguished:
  - SIMOTION Kernel – Basic functionality
  - SIMOTION Technology Packages
  - SIMOTION Function Library

The SIMOTION Kernel provides the basic functionality and is a component of all SIMOTION devices. The SIMOTION Technology Packages and the SIMOTION Function Library as a sector-independent library offer a modular expansion of the functionality.

- Engineering software
  The SIMOTION SCOUT engineering system provides high-performance tools that provide simple, optimal support for all engineering steps required in the context of machine automation.
  The SIMOTION CamTool is available as an options package which permits simple creation of cams.
  The SCOUT engineering system can be used in SIMATIC STEP 7, either with integrated data management and configuration, or as a stand-alone engineering tool.

- Additional software
  In addition to the SIMOTION software, other standard software packages are available which may be required to configure the complete system, e. g. for HMI.

Available software packages

- SIMOTION SCOUT
  SCOUT is the basis for every SIMOTION application and essentially contains the SIMOTION SCOUT engineering system including the STARTER drive commissioning tool, the Runtime software for all SIMOTION hardware platforms and the SIMOTION Function Library. The SCOUT software package comprises the following components:
  - SCOUT with corresponding license
  - Authorization disk for SCOUT
  - SIMOTION Function Library
  - SIMOTION CamTool without license. The license must be ordered separately.
    The CamTool option package expands SIMOTION SCOUT with a powerful tool for the graphical creation and optimization of cams.
  - SIMOTION DOConCD
    Complete SIMOTION documentation on CD with comprehensive search functions for all documents.
  - SIMOTION Utilities & Applications
    Free utilities (e. g. calculation tools, optimization tools, ...) and application examples (ready-to-apply solutions such as winders, cross cutters or handling)
  - SIMATIC Net without license
  - DriveES Basic with license

- SIMATIC software
  STEP 7 as the required basis for SIMOTION SCOUT.

- SIMOTION SCOUT Standalone
  If STEP 7 is not available, SCOUT Standalone can be used which contains the STEP 7 components required for SIMOTION.
  SCOUT Standalone is supplied with the CDs for SIMOTION SCOUT (see above) as well as an additional CD and authorization disk for SCOUT Standalone.

- SIMATIC HMI software
  The following optional software packages are available:
  - ProTool/Pro and WinCC flexible for implementing HMI on operator/touch panels
  - SIMATIC NET for implementing HMI over OPC in Windows environments

6

Overview

SIMOTION Kernel – Basic functionality

The basic functionalities of the SIMOTION devices are combined within the SIMOTION Kernel.

The SIMOTION Kernel provides high-performance functions for

- PLC functionality (to IEC 61131-3)
- Program control
- Timers
- I/O operation
- Communication

It also provides a powerful Runtime system with

- Cyclic
- Sequential
- Time-driven and
- Event-driven tasks

The scope of the language conforms to the IEC 61131-3 standard and contains all PLC commands required for I/O management and process and machine control. LAD (Ladder Diagram), FBD (Function Block Diagram), ST (Structured Text), and MCC (Motion Control Chart) are used for programming.

The SIMOTION Kernel basic functionality can be expanded by loading SIMOTION technology packages.

SIMOTION Technology packages

Technology packages combine software functions which are required for automation in mechanical engineering in various sectors. Technology packages are loaded into the controller during configuration and expand the basic functionality by additional system functions.

SIMOTION Motion Control technology package

The SIMOTION Motion Control technology package contains the following technology functions:

- Motion Control Basic
- Positioning - POS
- Synchronous operation/electronic gear - GEAR
- Synchronous operation/electronic cam - CAM
- Supplementary technology functions

The technology package functions are accessed via additional language commands and system variables. Programming of motional sequences is therefore simple and integrated.

SIMOTION Temperature control technology package – TControl

The SIMOTION technology package for temperature control provides temperature channels with extensive functions.

These functions are also accessed via additional language commands and system variables.

SIMOTION Function Library

The SIMOTION Function Library is a sector-independent library, which is divided into the sub-libraries below:

- System Function Library
  with standard functions, e. g. for the integration of special I/O Modules
- Motion Function Library
  with standard functions for controlling axes in accordance with PLCopen
- Mechatronic function library,
  contains SIMOTION Easy Set – Roller feed for implementing roller feeds
- Examples

6
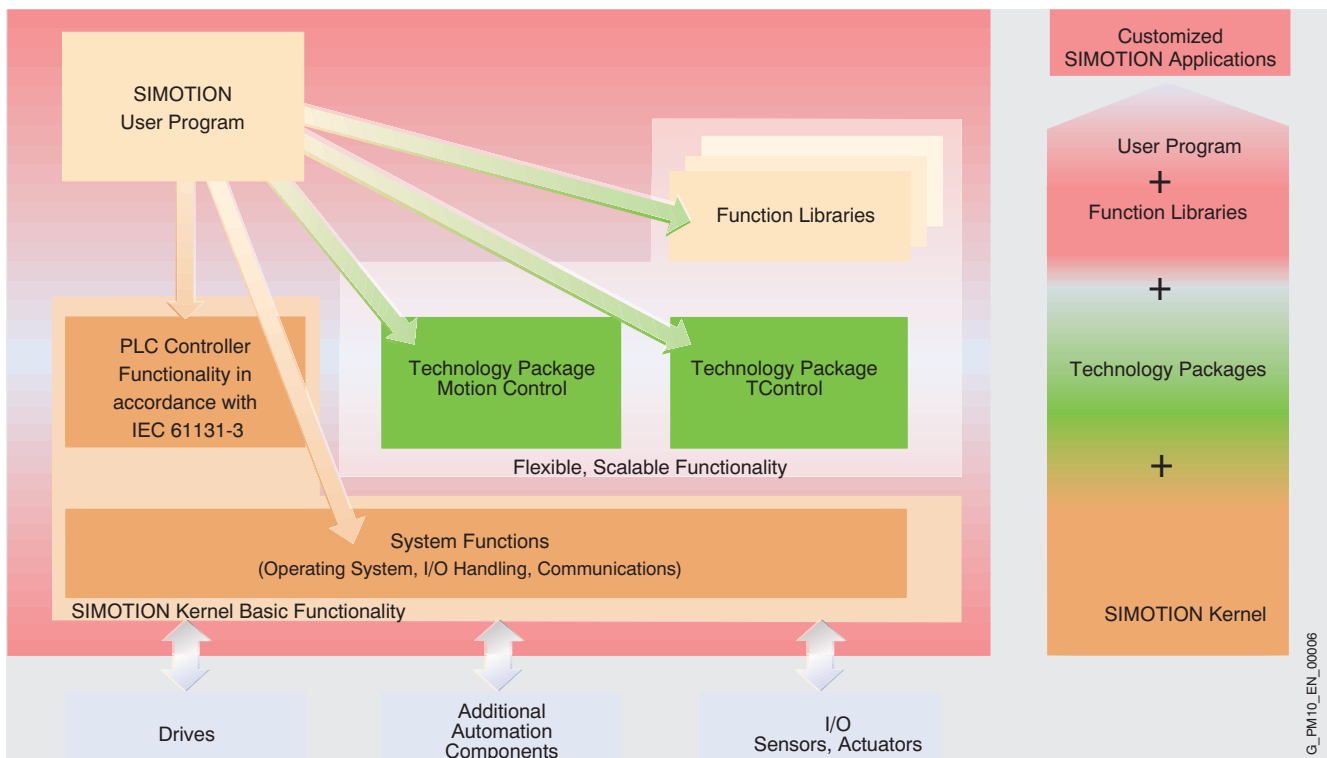
SIMOTION software structure

G_PM10_EN_00006

SIMOTION software
Runtime software

■ **Overview** (continued)

SIMOTION User program

The SIMOTION technology package functions are accessed in the same way as the SIMOTION Kernel functions, via language commands from the user program.

Programming can be performed either textually, using ST (Structured Text), or graphically.

The graphical programming languages LAD (Ladder Diagram), FBD (Function Block Diagram) and MCC (Motion Control Chart) make programming particularly user-friendly.

Combining the PLC with Motion Control and Technology simplifies the optimization of motional sequences (no PLC/motion interaction necessary), reduces engineering costs and increases both product quality and machine productivity (machine cycle and output) by eliminating interfaces and dead times.

Direct access to the drive bus allows:

- Increased uniformity and integration depth as far as the drive (access to control/status words and drive data, flexible torque limits, additive torque setpoint)
- Synchronization with drives and modular controls
- Highly-dynamic applications due to DSC (DynamicServoControl) with position-controller cycles of 125 μs

SIMOTION supports additional modular machine approaches with its

- modular software development with libraries and reusable modules,
- sectioning into individual machine modules, which are linked via distributed synchronous operation, and
- activation/deactivation of DP slaves (I/O components) and technology objects (drives, axes, external encoders, and cams),

thus reducing engineering and commissioning costs.

SIMOTION Communication functions

Communication via PROFIBUS

The following communication functions are available via PROFIBUS on all platforms:

- Communication with programming devices (programming device functions)
- Communication with ProTool/Pro and WinCC flexible
- Communication with PCs on which SIMATIC NET OPC is installed.
  SIMATIC NET IE SOFTNET S7 (Lean) software is required on the PC side.

Communication via Ethernet

The following communication functions are available via Ethernet on all platforms:

- Communication with programming devices (programming device functions)
- Communication with SIMOTION devices, SIMATIC communication boards (CP) and non-Siemens devices via UDP and TCP/IP
- Communication with ProTool/Pro and WinCC flexible
- Communication with PCs on which SIMATIC NET OPC is installed.
  SIMATIC NET IE SOFTNET S7 (Lean) software is required on the PC side.

SIMOTION IT

SIMOTION IT enables additional communication functions via Ethernet:

- Diagnostics functions via SIMOTION IT DIAG
- Communication via SIMOTION IT OPC XML-DA

Runtime software licensing

The functions below are provided by the basic functionality. The rights of use for these software components are included when the SIMOTION device is purchased:

- SIMOTION Kernel Runtime software
  SIMOTION Kernel is already installed on the device.
- Motion Control Basic technology functions
  Use of technology functions for speed-controlled axes, single output cams and cam tracks, sensor probes, and external encoders.
- Supplementary technology functions
  Use of supplementary technology functions, such as adder, formula, and fixed gear.
- Communication functions
  This covers SIMATIC S7 communication functions on the SIMOTION side (programming device/OP communication to programming devices, for engineering and communication to OPs and PCs with SIMATIC HMI, e. g. ProTool/Pro, WinCC flexible or SIMATIC NET OPC), as well as UDP and TCP/IP communication.

Other functions can be licensed using the following software options:

Motion Control technology functions
Other technology functions in the Motion Control technology package are licensed axis-specifically:

- POS (use of technology functions for positioning axis)
- GEAR (use of technology functions for synchronized axis) and
- CAM (use of technology functions for cam axes)

You license these technology functions for each axis, using a separate order number for each. Licensing only applies to real axes, virtual axes are not subject to license.
The GEAR technology function contains the POS technology function, while the CAM technology function contains the POS and GEAR technology functions.
The Multi Axes package allows multi-axes machines to be licensed very easily. It contains a license permitting unrestricted use of the CAM technology function on one SIMOTION device (C230-2, P350 or D425, D435, and D445). If there are many axes, the Multi Axes package also offers a price advantage, e. g. if there are more than 6 synchronized axes (GEAR licenses).

TControl technology function
The TControl technology package is licensed channel-specifically, in packages of 8 temperature channels.

SIMOTION Easy Set – Roller feed
Licenses for:

- Single-axis roller feed
- Zig/zag roller feed
- Double-axis roller feed

are supplied for each application (instance) and contain the required Motion Control technology function licenses.

SIMOTION IT DIAG option
The IT DIAG option is licensed for each SIMOTION device.

SIMOTION IT OPC XML-DA option
The OPC-XML option is licensed for each SIMOTION device.

Overview (continued)

Licensing notes

Runtime licenses are not version-specific.

The functionally scalable software options and axis-specific licensing result in a simple pricing structure, allowing you to pay only for what you really need.

When configuring using SIMOTION SCOUT, the required software options (licenses) are displayed. Licenses do not have to be acquired until the machine is delivered.

The required software options are assigned to hardware (memory cards or PC) by generating a license key online.

Pre-installed licenses

Another option is to order SIMOTION memory cards (MMC and CF) and SIMOTION P350 with pre-installed licenses. When hardware is ordered (MMC, CF or P350), the number of licenses must also be specified:

- Pxx – POS license and number (e. g. P02 = 2x POS license)
- Gxx – GEAR license and number (e. g. G03 = 3x GEAR license)
- Cxx – CAM license and number (e. g. C01 = 1x CAM license)
- Txx – TControl license and number (e. g. T03 = 3x TControl license)
- X00 – OPC XML license
- D00 – IT DIAG license
- M00 – Multi Axes package license
- Sxx – Single-axis roller feed license (e. g. S02 = 2x single-axis roller feed license)
- Rxx – Double-axis roller feed license (e. g. R02 = 2x double-axis roller feed license)
- Qxx – Zigzag roller feed license (e. g. Q02 = 2x zigzag roller feed license)
- Vxy – Software version for SIMOTION P350 XP variant (e. g. V32 = Version 3.2)
- W0x – Service Pack number for SIMOTION P350 XP variant (e. g. W02 = Service Pack 2)
- K00 – OPC server license, on SIMOTION P350, XP variant

Ordering example

CompactFlash 64 MB for SIMOTION D with 3 POS licenses, 2 CAM licenses and 1 TControl license

Order No.: 6AU1400-2KA00-0AA0-Z P03 C02 T01

Ordering configurator on the Internet

An electronic ordering configurator is available on the Internet for simple ordering of SIMOTION hardware with corresponding licenses. Customers with Mall access can order directly through the ordering configurator.

Selection and ordering data — Order No.

	Order No.
Technology functions **Licenses for Runtime software** **(not version-specific)**	
• POS, license for using the positioning technology functions for 1 axis	**6AU1820-1AA20-0AB0**
• GEAR, license for using the synchronous-operation technology functions for 1 axis	**6AU1820-1AB20-0AB0**
• CAM, license for using the cam technology functions for 1 axis	**6AU1820-1AC20-0AB0**
• Multi Axes package License for unrestricted use of the POS, GEAR and CAM technology function on a SIMOTION device (C230-2, P350 or D4x5)	**6AU1820-0AA20-0AB0**
• TControl, license for using the TControl technology functions for 8 temperature channels on a SIMOTION device	**6AU1820-2AA20-0AB0**
SIMOTION Easy Set - Roller Feed **Licenses for Runtime software** **(not version-specific)**	
• License for using the single-axis roller feed. Contains the required technology function license for 1 axis.	**6AU1830-0AC10-0AB0**
• License for using the zigzag roller feed. Contains the required technology function license for 2 axes.	**6AU1830-0AC10-1AB0**
• License for using the double-axis roller feed. Contains the required technology function license for 2 axes.	**6AU1830-0AC10-2AB0**
Communication functions **Licenses for Runtime software** **(not version-specific)**	
SIMOTION IT DIAG option License for standard diagnostics pages	**6AU1820-8BA20-0AB0**
SIMOTION IT OPC XML-DA option License for OPC XML-DA server	**6AU1820-8BB20-0AB0**

6

SIMOTION Kernel

Function

In addition to the high-performance functions for I/O handling, logic and arithmetic, program control, timers and communication, SIMOTION also has a very powerful Runtime system.

The SIMOTION Motion Control system uses high-performance CPUs on which a real-time operating system suitable for fast control processes is implemented. Each task is allocated a slice of the computing time. The organization of the task sequences is performed by the operating system.

A distinction is made between user and system tasks which are independent of each other.
The user program can be executed on different execution levels (tasks).
The advantage of the task system is that user programs hung in the appropriate task levels can run in parallel.
In addition, execution levels are available which are synchronized with the control cycle of the drives or the isochronous PROFIBUS. In this way, the whole application is in isochronous mode (Application program ↔ Drives ↔ I/O). This results in short response times and the application is easily reproducible.

The task structure of the Runtime system supports PLC, technology and Motion Control tasks and provides different tasks.
- Cyclic
- Sequential (tasks which are started and executed once and then terminated)
- Time-controlled
- Interrupt-driven

The following execution levels are available:
- StartupTask
  The StartupTask is executed once at operating mode transition from STOP to RUN; it controls the system startup.
- BackgroundTask
  The BackgroundTask is executed cyclically and is used for general PLC tasks. Cycle time monitoring checks the maximum processing time of the BackgroundTask. The BackgroundTask can be compared with the OB1 of the SIMATIC.
- MotionTasks
  The MotionTasks are used for (motion) sequences. Command sequences in a MotionTask are usually executed sequentially,

for example, the next motion command is only started when the previous command has been completed. The MotionTask does not require computing time for these waiting states.
- SynchronousTasks
  These tasks are synchronized with the isochronous PROFIBUS DP. The two IPO synchronous user tasks are started synchronously immediately before the interpolator cycles IPO or IPO2. Here control tasks can be implemented where acquisition of actual values and output of setpoints must be synchronized.
  The user program is therefore synchronized with the control cycle of the drives and with I/O processing. Synchronization ensures short response times and, above all, deterministic and reproducible machine behavior.
- TimerInterruptTasks
  Several time-controlled tasks are available. The call cycles can be parameterized. Periodically recurring tasks are typically stored here.
- InterruptTasks
  InterruptTasks allow very fast responses to internal events. These can be triggered by interrupts, timeouts or user interrupts.
- ShutdownTask
  The ShutdownTask is called when there is a transition to STOP mode. Here you can define the specific behavior during the transition to this system state.

The complete instruction set is available for all tasks. This allows the current positioning command to be superimposed with an additional movement from a MotionTask which was triggered by e. g. a UserInterruptTask.

Other features of the execution system are:
- Operating states - Run, Stop, StopU (Stop User Program for test and commissioning functions)
- Process images for inputs/outputs, separate for BackgroundTask, SynchronousTasks and TimerInterruptTasks
- Debug functions such as
  - Controlling and monitoring of variables
  - Display of the program status
  - Breakpoints or single steps
  - Trace functions
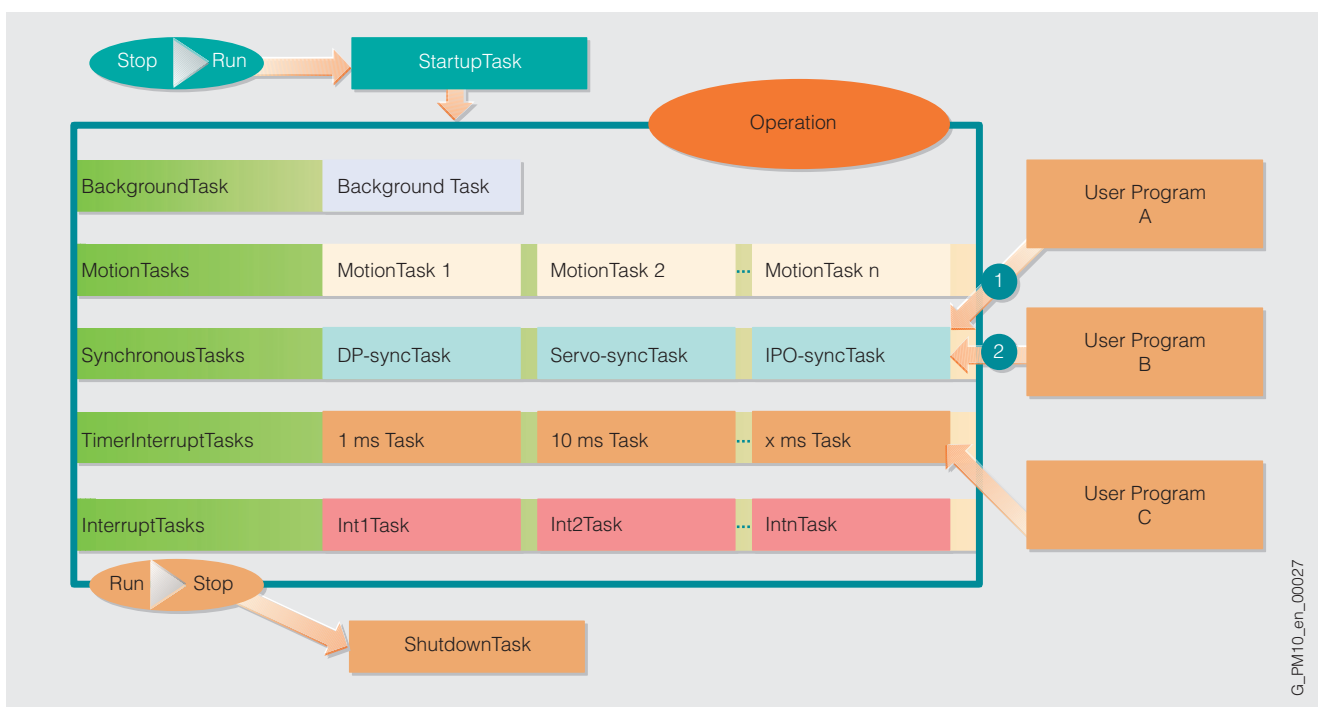
Task structure of SIMOTION

■ Overview

The SIMOTION technology packages expand the basic functionality of the SIMOTION devices as required.

The functionality of the technology packages can be used by additional language commands.

Currently the following SIMOTION technology packages are available:

- Motion Control
  with the technology functions:
  - Motion Control Basic
  - Positioning - POS
  - Synchronous operation/electronic gear - GEAR
  - Synchronous operation/electronic cam - CAM
  - Supplementary technology functions
- TControl
  with the technology functions:
  - Temperature control - TControl

In this way the SIMOTION technology packages can be easily adapted to the corresponding task.

The loadable technology packages contain technology objects (e. g. positioning and synchronous axis, cam, external encoders, etc.) which can be accessed over system functions and system variables.

License model

Use of the technology functions

- Motion Control Basic and
- supplementary technology functions

are already included in the basic device.

Use of the technology functions

- Positioning - POS
- Synchronous operation/electronic gear - GEAR
- Synchronous operation/electronic cam - CAM and
- Temperature control - TControl

in applications must be licensed for runtime.

The right to use these functions is obtained by purchasing the corresponding technology function license. Please observe the notes in the selection and ordering data.

■ Function

SIMOTION Motion Control technology package

The comprehensive Motion Control functions offer very open and flexible ways of influencing application programming and ensure that you can also implement future Motion Control applications.

Using the Motion Control functions in conjunction with the powerful PLC functionality results in high machine cycles due to short response times as well as high product quality due to reproducible machine behavior.

Technology functions for Motion Control Basic
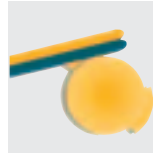
The "speed-controlled axis" technology object

The technology functions for Motion Control Basic are suitable for speed-controlled, electrical and hydraulic drives.

- Speed setpoints are defined in the program (for servo and vector drives)
- In addition, accumulative torque setpoints and torque limits can be defined, e. g. for controlling a winder drive
- Access to status and control words of the drive
- Reading and writing of drive parameters

"External encoder" technology object
External encoders can be used to detect position values of axes (on PROFIBUS, on board for C230-2 and as second encoder on the drive).

"Output cam and cam tracks" technology object
The following output cam types are available:

- Trip cams
- Position-position output cams
- Position-time output cams
- Position-time-based output cams with maximum ON length
- Counter output cams

The output cam statuses can be output with:

- Internal variables
- Standard digital outputs (SIMATIC S7-300, ET 200, ...)
- On board outputs and TM15/TM17 High Feature (for high accuracy requirements in the µs range)

The following can be used as reference points for the switching edges of the output cams:

- Setpoints for real and virtual axes
- Actual values of real axes and external encoders

The following functions are available:

- Parameterizable hysteresis and effective direction
- Activation and deactivation times can be specified separately (dead time compensation)
- One-time and cyclic output of cam tracks
- Parameterizable start/stop mode for cam tracks (immediately, with next track cycle, ...)
- Edge-triggered enable of cam tracks in conjunction with TM17 High Feature Terminal Module

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SIMOTION Technology packages

■ **Function** (continued)

"Measuring input" technology object
Measuring input can be assigned to positioning and synchronous axes, external encoders or virtual axes and supply the axis position at the time of measuring.

The following functions are available:

- One-time measurement
- Cyclic measurement (2 edges per IPO cycle in conjunction with TM17 High Feature)
- Measuring on virtual axes (in conjunction with TM15 or TM17 High Feature)
- Parameterizable edge evaluation (rising, falling, both edges)
- Dynamic resolution range

Positioning technology functions - POS
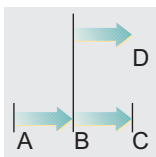
"The positioning axis" technology object

- Supported axis types:
  - Linear axis, rotary axis
  - Modulo axis for linear and rotary axes
  - Real and virtual axis
  - Simulation axis
- Position control for:

  Electrical axes
  - Position control with digital setpoint output
    The following PROFIBUS DP protocol is used for this purpose: Profile drive technology, PROFIdrive, Version 3 (isochronous mode)
    Position control with analog setpoint output (on board I/O for C230-2, ADI 4)

  Hydraulic axes
  - Position control with analog setpoint output (on board I/O for C230-2, analog outputs for I/O range, ADI 4)
    The characteristics of the hydraulic valves are specified with cams.

  Stepper motors
  - Position control with pulse direction output for stepper drives (on board I/O for C230-2)
    The Motion Controller provides one pulse output per axis for the position setpoint.
    Stepper drives can be operated without encoder or position-controlled with encoder.
- Position-controlled positioning:
  Axes can be manipulated individually without interpolation context by specifying, e. g.:
  - Axis name
  - Position
  - Velocity
  - Acceleration/deceleration, jerk
  - Transition behavior to next motion
- Speed-controlled operation of positioning axes
- Reversing block (prevents the output of setpoints which would cause a reversing motion)

- Movement profiles on axis defined over cams:
  - Position over time
  - Velocity over time
  - Velocity over position
- Force and pressure control of an axis:
  - Direct switchover from position to pressure-controlled operation and vice versa
  - Several pressure sensors possible
  - Pressure difference measurement
- Force and pressure limitation of an axis
- Force and pressure profiles specifiable over cams:
  - For closed-loop control and limitation
  - Force/pressure over time
  - Force/pressure over position
- Traveling to a fixed stop point
  - Stop on reaching a following error limit
  - Stop on reaching a torque limit
  - Stop with defined torque
- Traversing with adjustable torque limitation
- Transition behavior of successive motions:
  - attach, i. e. each motion is completed and the axis stops between motions (exact stop)
  - blend, i. e. the transition to the next motion begins when deceleration starts
  - replace, i. e. the programmed motion is performed immediately. The active command is aborted.
- An additional motion can be superimposed during an active motion, e. g. an active positioning motion can be superimposed simultaneously to a compensation motion.
- Synchronized start of positioning axes
- Referencing:
  The following referencing types are currently supported:
  - Active referencing/passive referencing (continuous referencing)
    with reference bero and encoder zero marker
    with external zero marker only
    with encoder zero marker only
  - Direct referencing/setting the home position
  - Relative direct referencing (shift by specified offset)
  - Absolute encoder referencing/absolute encoder calibration
- Compensations and reference points:
  - Reference point offset
  - Backlash on reversal compensation
  - Static friction compensation
  - Sliding friction compensation for hydraulics
  - Drift compensation for analog drives
- Encoder failover, second encoder:
  Up to two encoders can be specified for an axis:
  - For the position control, only one encoder is active at any time.
  - The switchover between encoders can be performed immediately.
  - The actual value for the non-active encoder can be read with the application program and used for specific monitoring, for example.
- Override:
  - Factors can be superimposed online on the current traverse velocity and acceleration/deceleration.
- Programmable Motion Control
  - The motion programs can be assigned to the different execution levels such as cyclic, sequential, event-driven or time-controlled.

■ **Function** (continued)

Synchronous operation/electronic gear technology functions - GEAR

"Synchronous operation" technology object

- Synchronized speed for position-controlled axes

- Angular synchronization, electronic gear:
  Stable, long-time angular synchronization over several axes is ensured. The gear ratio can be adjusted in small steps.

- Absolute and relative gearbox synchronism

- Offset of the following axis

- Master axis:
  A following axis can follow different master axes. The transition can be done on the fly (transition dynamics must be specified).
  The following master axis types can be used for slave axes:
  - Virtual axis:
    The virtual axis only exists in the control and therefore does not have a real drive, motor or encoder. A virtual axis can be controlled with commands in the same way as a real axis. The Motion Controller calculates the setpoints which can be used as a master value for synchronized following axes.
  - Real axis:
    The real axis operates a real drive, motor, and encoder. Position setpoint as well as actual value of the real axis can be used as master value for following axes.
  - External encoder:
    The actual value of an external encoder is detected with an encoder and can be supplied as a master value for following axes.

- Position setpoint as well as actual value coupling with compensation of dead times

- Angular position and electronic gear ratio can also be changed during operation

- Engaging/disengaging:
  Following axes can be stopped for one cycle or moved for only one cycle to remove a faulty component. This can be flexibly implemented with the programmable synchronism functionality.

- Synchronization and desynchronization:
  - Following axes can be synchronized and desynchronized while the master axis is in motion or standing still. The offset position to the master position can be specified.
  - Different modes for length-specific or time-specific synchronization and the start of the synchronization are available.

- Smooth transitions from positioning to gearing or gearing to positioning.

- Comprehensive synchronous operation monitoring functions

- External synchronization:
  By measuring a print-mark. E. g. a material slip can be corrected with a superimposed positioning function.

- Superimposed motion during synchronous operation:
  A positioning motion or other synchronous operation can be performed during synchronous operation.

- Distributed synchronous operation, i. e. synchronous operation across different devices.
  Master axis on PROFIBUS master, following axes on PROFIBUS slaves. Dead times are compensated automatically.

Synchronous operation/electronic cam - CAM

"Electronic cam" technology object

- The number of cams depends on the available system resources.

- The number of support points per cam depends on the available system resources.

- Cam functions:
  - Definition over table support point or polynomials up the 6th degree with trigonometrical functions
  - Motion rules implementable to VDI 2143
  - Transition between points/polynomials supports: Linear, cubic splines and bezier splines

- Cam functions can be scaled, offset and switched even during operation:
  - The master and following axis positions of the cam functions can be scaled and offset during operation.
  - The active cam can be switched to another cam even during operation.

- Non-cyclic and cyclic execution of cams

- Absolute and relative cam execution

- Absolute and relative master value referencing

- Synchronization and desynchronization:
  - Following axes can be synchronized and desynchronized while the master axis is in motion or standing still. The offset position to the master position can be specified.
  - Different modes for length-specific or time-specific synchronization and the start of the synchronization are available.

- Superimposition of 2 synchronized cams

- Cams can be created and modified with the SCOUT engineering system or with an application program during runtime.

Supplementary technology functions

"Fixed gear" technology object
You can use the technological object fixed gear to implement a fixed synchronous operation (with limited capabilities for synchronization and desynchronization) using a specified gear ratio. Fixed master converts an input variable to an output variable with a configured transmission ratio (gear ratio).
A fixed gear technology object can be used as follows, e. g. gear object:

- For the inclusion of diameters in a master variable

- To implement a fixed gear ratio without coupling

- For speed gearing on speed-controlled axes

- As a motion-coupled gear on master axis, following axes are engaged or disengaged to the fixed gear. In this way, the fixed gear object is always synchronized with the master value. Example: a paper web runs synchronously with the master.

"Addition" technology object
The addition object can be used to summate up to four input vectors (motion vectors) with one output vector. An addition object can be used as follows, e. g.:

- To add up superimpositions/offsets in the main signal path, e. g. color register, cut-off register on the paper web.

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SIMOTION Technology packages

Function (continued)

"Formula" technology object

Formula object for scalar variables and motion vectors. A formula object can be used between interconnected objects to modify scalar variables in the main signal path, e. g.:

- Superimposition of torque
- Superimposition of master velocity
- Modification of torque variables B+, B-
- Interconnection of torque limitations
- Interconnection of torque values

"Sensor" technology object

The sensor object can be used to acquire scalar measuring values. A sensor object reads out a value from the periphery and supplies an actual value as an output signal in standardized formats.

"Controller" technology object

The controller object can be used to prepare and control scalar variables.

A controller object can be used as a universal PIDT1 controller for scalar control variables as well as a PI and P controller.

Interconnection

The individual technology objects can be interconnected. The supplementary technology functions, for example, can be used to implement additional winder applications directly on the system level.

SIMOTION TControl technology package

Temperature controller technology functions - TControl
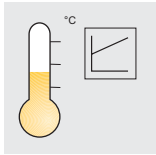
"Temperature Channel" technology object

The controller core of the temperature technology package has a DPID structure. Pure heating controllers and cooling controllers as well as combined heating/cooling controllers can be configured and parameterized.

How to use and expand the functionality of the TControl technology package is explained with the help of an application example (A). The application example provides function interfaces to the application and data interfaces for the HMI and is part of the SIMOTION Function Library, which is contained in the scope of supply of SIMOTION SCOUT.

Different, freely selectable functions are available for each temperature channel (the supplementary functions of the application project are marked):

- Each temperature channel can either be configured as a heating or cooling section or as a combined heating/cooling section.
- The controllers either use a PID or DPID control algorithm or use an optional control zone functionality.
- In manual output mode, a substitute value can be output.

- You can select the operating mode for each controller channel separately. In this way, you can switch the output to a fixed value.
  The following operating modes are available:
  - Closed-loop control for operating setpoint
  - Closed-loop control for reduced setpoint (A)
  - Actual value acquisition and output of the manual manipulated variable value
  - Actual value acquisition and output of 0
  - Self tuning
  - Actual value acquisition and output of average value (A) (replacement value in case of error)
- Actual value acquisition and processing
  - Plausibility check for each new actual value and correction before corresponding filter measures
  - Filtering (by PT1 element)
- Setpoint acquisition and processing
  - Two setpoints can be switched with command (A)
  - Setpoint rounding with ramp function (A)
- Actuating signal preparation and output
  - Digital, pulse-length modulated actuating signal
  - Prevention of minimal pulse durations for I/O cycles by integration of lost pulses
  - Manual actuating value (for manual output mode)
  - Output value limitation
  - Replacement value (calculated dynamically)
- Self-tuning for heating controllers
  - This ensures fast startup without overshooting and maintains the setpoint value without lasting control deviations.
  - Self-tuning can be used in parallel for all desired channels to ensure optimal parameter acquisition even for strongly coupled temperature sections.
- Hot channel controller
  - Startup characteristic (A)
- Monitoring and alarm functions
  - Actual value monitoring by definition of tolerance bands. The inner and outer tolerance bands can be defined independently as absolute or relative tolerance bands
  - Measuring circuit monitoring for increased operational safety of a plant
  - Plausibility check
  - Alarm functions
- Seven-day timer (A)

Selection and ordering data — Order No.

Technology functions Licenses for Runtime software (not version-specific)	Order No.
• POS, license for using the positioning technology functions for 1 axis	6AU1820-1AA20-0AB0
• GEAR, license for using the synchronous-operation technology functions for 1 axis	6AU1820-1AB20-0AB0
• CAM, license for using the cam technology functions for 1 axis	6AU1820-1AC20-0AB0
• Multi Axes package License for unrestricted use of the CAM technology function on a CPU (C230-2, P350 or D4x5)	6AU1820-0AA20-0AB0
• TControl, license for using the TControl technology functions for 8 temperature channels on a CPU	6AU1820-2AA20-0AB0

Overview

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The SIMOTION Function Library is a industry sector-independent library, which is supplied with SIMOTION SCOUT. The SIMOTION Function Library is divided into several sublibraries:

- System Function Library
- Motion Function Library
- Mechatronic Function Library
- Examples

Licensing
A license is required for the components of the Mechatronic Function Library. All other components of the Function Library can be used on as many devices as required. The general conditions for licensing automation and drives software are applicable.

Design

- System Function Library
  The System Function Library is the library which expands the SIMOTION system functionality on the basis of standard functions (e. g. controller functions) and with which special periphery can be integrated (e. g. integration of FM Function Modules, CP Communication Modules, POSMO A positioning motor, etc.).

- Motion Function Library
  The Motion Function Library is the library for standard functions used to control axes.

- Mechatronic Function Library
  The Mechatronic Function Library contains mechatronic standard functions (e. g. roller feed).

- Examples
  Programming and application examples show how to use the SIMOTION system (e. g. how to integrate HMI systems).

Function

System Function Library

Standard functions, programming examples and supplementary SIMOTION documentation for:

- SIMODRIVE POSMO A, intelligent positioning motor
- "Basic Control" controller (continuous-action PID controller, PI step controller, pulse width modulation)
- FM 350-1, single-channel Counter Module
- FM 350-2, 8-channel Counter Module
- FM 352, output cam controller
- CP 340, Communication Module
- CP 341, Communication Module
- ET 200S, 1SI Serial Interface Module (3964R, ASCII)
- Reading and writing drive data (individual drive parameters over cyclic "Read/Write" service)

Motion Function Library

The Motion Control Library comprises general and PLCopen standard functions for controlling positioning axes, programming examples and documentation.

The following PLCopen single-axis blocks for positioning are available:

- MC_Power (axis releases)
- MC_Stop (stop axes)
- MC_Home (reference point approach for axes)
- MC_MoveAbsolute (absolute positioning of axes)
- MC_MoveRelative (relative positioning of axes)
- MC_MoveVelocity (traversing axes at a specified velocity)
- MC_MoveAdditive (relative traversing of axes by a defined path additively to the remaining path)
- MC_MoveSuperimposed (relative superimposition of a new motion in addition to existing motion)
- MC_VelocityProfile (traversing axis by a predefined and specified velocity/time profile as cam)
- MC_ReadActualPosition (read actual position of axis)
- MC_ReadStatus (read status of an axis)
- MC_ReadParameter (axis parameter, read LREAL data type)
- MC_ReadBoolParameter (axis parameter, read BOOL data type)
- MC_WriteParameter (axis parameter, write LREAL data type)
- MC_WriteBoolParameter (axis parameter, write BOOL data type)

The following standard axis functions are included in addition to the standard functions for controlling positioning axes (PLCopen single axis):

- Achsreset _FB_Axis_reset
- Speed-controlled and position-controlled jogging _FB_Axis_jogPos

Mechatronic Function Library

The Mechatronic Function Library comprises SIMOTION Easy Set - Roller feed.

For more information on SIMOTION Easy Set - Roller feed, see "Sector solutions with SIMOTION".

Examples

- HMI parameterization screen for positioning axes
- Application example for temperature control
  - Uses the TControl technology package (license required)
  - Offers simple and powerful function interfaces to the machine application
  - Offers data interface to HMI

6

General information

Overview

While the SIMOTION Motion Control system provides a wide variety of preprogrammed functions, you can also parameterize and program it for customized use.

High performance tools, which provide optimum support and ease of use for the necessary engineering steps, are required for this.

The SCOUT engineering system is the basis for uniform automation in mechanical engineering with SIMOTION and is integrated into the SIMATIC environment in accordance with TIA.

SCOUT provides

- an integrated, function-oriented view of your automation task, combined with
- a high level of user friendliness.

The possible SIMOTION applications range from a simple, parameterizable, speed-controlled single axis through to complex, mechatronically-coupled and programmable multi-axes machines.

Therefore, SCOUT provides views adapted to the task and can be expanded with additional tools (e. g. tool for the graphic creation of cams).

The figure below provides a complete overview of the individual SCOUT tools.

SCOUT is the engineering system for SIMOTION integrated in STEP 7 and provides all the required tools for

- Configuration
- Parameterization
- Programming
- Testing
- Diagnostics

Tasks such as

- the creation of the hardware and network configuration and the
- creation, configuration and parameterization of technological objects, such as
  - axes,
  - measuring inputs,
  - output cams, cam tracks,
  - electronic cams etc.

are graphically supported with operator prompting.

The following programming languages are available for programming a SIMOTION application:

- ST (Structured Text in accordance with IEC 61131) textual high-level language
- LAD (Ladder Diagram) and FBD (Function Block Diagram)
- MCC (Motion Control Chart), which is a graphical flow diagram language, optimized to provide the simplest operation possible

The integrated test and diagnostics functions are useful when commissioning and servicing.

STARTER: drive commissioning tool

The aim of STARTER is the simple and rapid commissioning, optimization and diagnostics of all new-generation Siemens drives with only one tool.

The STARTER drive commissioning tool supports the following drives:

- SINAMICS
- MICROMASTER 420/430/440
- MICROMASTER 411/COMBIMASTER 411
- COMBIMASTER

CamTool: cam editor option package

Basic editors for the creation of cams are already integrated in the basic SCOUT package.

The CamTool option package expands SCOUT with a powerful tool for the graphical creation and optimization of cams.

CamTool is fully integrated into the SCOUT engineering environment.
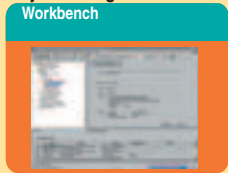
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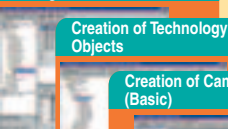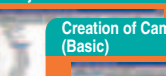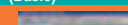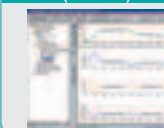
■ **Overview** (continued)

System requirements

Software

- SCOUT
  - Windows NT4 SP6 or
  - Windows 2000 SP3 or
  - Windows XP Professional SP2
  - SIMATIC STEP 7, V5.2 SP1 and higher (not required for SCOUT stand-alone)
  - Optional:
    Drive-ES Basic V5.3 Service Pack 1 and higher required, if SIMODRIVE 611 universal or MASTERDRIVES MC are to be integrated in the project data management.
- CamTool
  - Requirements as for SCOUT
  - SCOUT must be installed

Hardware

Minimum system requirements PG/PC for SCOUT

- Hardware requirements for
  - Windows NT4 and Windows 2000, Pentium II
    400 MHz/512 MB and higher
  - Windows XP Professional, Pentium III
    500 MHz/512 MB and higher
- Main memory configuration 512 MB for:
  - PG/PC
  - SIMOTION P350
- Min. screen resolution: 600 x 800 pixels
- Free hard-disk storage: 790 MB, 1 GB for SCOUT stand-alone

PC card adapter

Special hardware requirements

SIMOTION Kernel updates for SIMOTION C230-2 and SIMOTION D are supplied on CD and can then be copied from the PG/PC to the SIMOTION Micro Memory Card (C230-2) or SIMOTION CompactFlash card (D4x5). An adapter is needed to write to the SIMOTION MMC (Micro Memory Card) or the SIMOTION CF (CompactFlash card).

We recommend the following products for the SIMOTION Micro Memory Card:

- Windows NT and Windows 2000 operating systems:
  - Floppy disk adapter
    Manufacturer: JVC
    Product designation: SD/MultiMediaCard CU-VFSD50U
- Suitable for Windows 2000/XP operating system only:
  - USB adapter
    Manufacturer: Simple Technologies
    Product designation: UMSD-100

Note:
If you choose to use a different USB adapter, you must ensure that it supports both the SD Card and the SIMOTION Micro Memory Card by Infineon Technologies AG.

Adapters can usually be found in PC shops and at electronics shops.

We do not recommend any special product for the CF (CompactFlash card), since electronics dealers offer a large range.

■ **Selection and ordering data** Order No.

SIMOTION SCOUT V3.2 (German/English/Italian) Single license including STARTER, Runtime software and documentation with data carrier for SIMOTION SCOUT (current version)	**6AU1810-0BA32-0XA0**
SIMOTION SCOUT V3.2 upgrade (German/English/Italian) Single license including STARTER, Runtime software and documentation with data carrier for SIMOTION SCOUT (current version)	**6AU1810-0BA32-0XE0**
SIMOTION SCOUT stand-alone V3.2 (German/English/Italian) Single license including STARTER, Runtime software and documentation with data carrier for SIMOTION SCOUT (current version)	**6AU1810-0CA32-0XA0**
SIMOTION SCOUT stand-alone V3.2 upgrade (German/English/Italian) Single license including STARTER, Runtime software and documentation with data carrier for SIMOTION SCOUT (current version)	**6AU1810-0CA32-0XE0**
SIMOTION SCOUT software maintenance service Current software version required	**6AU1810-0BA00-0XL0**
SIMOTION CamTool V2.1 SP1 (German/English) Single license, with data carrier	**6AU1810-0FA21-0XA0**
SIMOTION CamTool V2.1 SP1 Upgrade (German/English) Single license, with data carrier	**6AU1810-0FA21-0XE0**
SIMOTION CamTool V2.1 SP1 Upgrade to Service Pack 1 With data carrier	**6AU1810-0FA21-1XU0**

■ **Further information**

A number of additional software products can be used in conjunction with SIMOTION SCOUT. It must be ensured that the corresponding versions of these software products are compatible. Please consult the compatibility list "Software Products for Use with SIMOTION".

Additional information is available on the Internet under:

http://www4.ad.siemens.de

6

SIMOTION software
Engineering software

<table>
<tr><td>

SIMOTION SCOUT
Workbench

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SIMOTION SCOUT
Hardware and network configuration

</td></tr>
</table>

■ **Overview**

The SCOUT Workbench is the common basis for all tools in the engineering system. The Workbench therefore acts as "navigation center" for individual engineering steps, is used to create and manage SIMOTION projects, and provides a uniform, integrated view of all data and programs.

SCOUT Workbench – three basic sections:

- Project navigator (left-hand section): The technological tree structure of the project. This area provides a hierarchical view that can be filtered of all devices (controls, drives, etc.), all technology objects (axes, output cams, cams, etc.), and all application programs. In the project navigator, you can create new objects and programs or call and modify existing ones.

- Work area (right-hand section): The work area is used to snap in all of the processing tools for the engineering system (parameter assignment dialogs, program editors, etc.), providing a custom-tailored view of each engineering activity in a permanent outer framework. If several windows are open at the same time, you can either arrange them as necessary or you can quickly switch from window to window using the tabs.

- Detail vue (bottom section): The detail view, which can be activated and deactivated, provides a view of data and messages for each situation. Included in the data are system variables for the devices and technological objects, I/O data (inputs/outputs), and the user variables you have defined. The current status of the data can be displayed by means of an online connection to the SIMOTION control. The message view includes online messages and alarms from the SIMOTION controls, as well as warnings and errors generated when the program was created.

■ **Benefits**

- Integral function-based view optimized for ease-of-use
- Integrated intuitive engineering system
- Central data and program management, even for distributed systems
- Function-based, technological project structure with filterable views
- Fast access to individual engineering tools, for e. g. configuration, programming, and commissioning

■ **Overview**
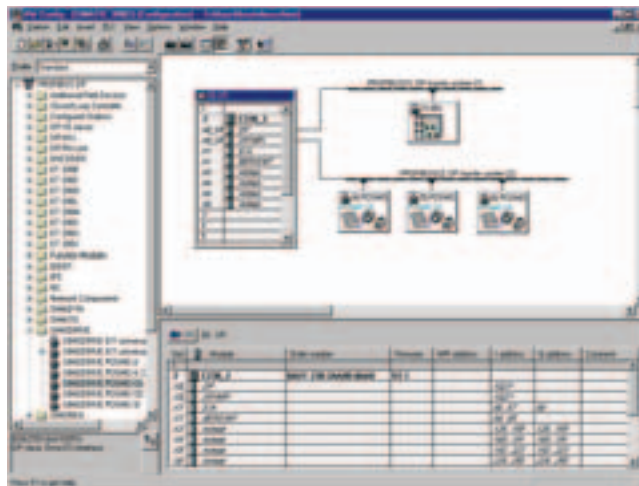
One of the first engineering steps to define the automation topology and assign parameters to the components and networks is to create:

- Hardware configuration
- Network configuration

To do so, SCOUT uses the STEP 7 tools HW-Config and NetPro.

You make selections from a hardware catalog to combine all required hardware components graphically in the work area, assign parameters to the components, and create bus connections between the individual components. You are warned immediately of any illegal inputs, so that only plausible configurations can be generated.

6

Overview
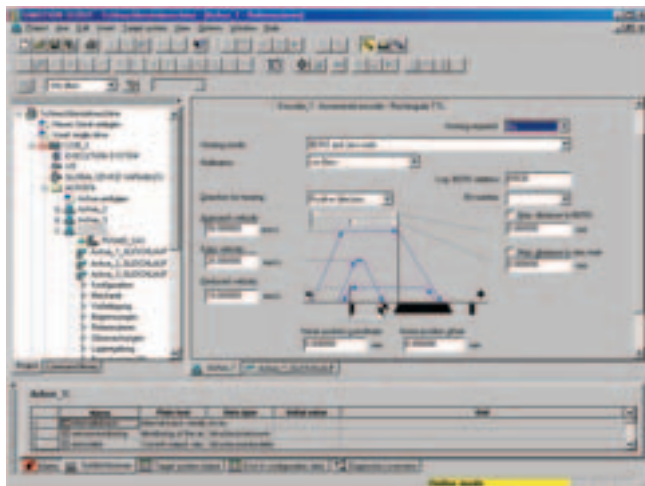
The SIMOTION devices always offer basic functionality (Kernel) programmable in accordance with IEC 61131.

Additional functionalities such as positioning, synchronous operation, cams and temperature channels are available with loadable technology packages.

These technology packages permit the generation of technology objects which provide you with a very simple and uniform view of the functions of the technology packages.

There are many technology objects, but all are generated, configured and parameterized in the same way.

In addition, the technology objects have programming interfaces so that you can use the functionalities from application programs.

Benefits

- Simple generation of technology objects to define specifications for:
  - Axes
  - Output cams
  - Cams, etc.
- Dialogs containing graphics to guide you through the parameter-assignment process
- Simple display of and access to functions using system variables and system functions of the technology objects
- Convenient diagnostics information for optimization of technology object functions
- Informative messages with numbers and text in the event of errors

Function

Technology object axis

A brief description of the individual engineering steps will be given using the example of the technology object axis:

- Creation:
  A new axis object is created by double-clicking the "Insert axis" symbol.
- Configuration:
  An assistant helps to specify object properties such as:
  - Name of the axis
  - Functional quality
    (e. g. positioning axis or synchronous axis)
  - Connection to the drive
    (e. g. analog drive on SIMOTION C230-2 or SINAMICS S120 over PROFIBUS DP)

After the axis has been generated or configured, it is displayed in the project tree along with additional tabs for parameterizing the axis and an option for generating other technological objects associated with the axis (e. g. oputput cams and measuring inputs).

- Parameterization:
  By double-clicking the "Referencing" symbol, for example, all parameters for referencing can be set.

The "axis" object generated in this way also has a specified number of system variables which can be displayed in the "detailed view" when the axis is selected in the project tree.

The system variables are mainly used to visualize axis states such as

- display of the following error,
- target position to be reached,
- condition of motion
  (axis is accelerating, decelerating, in standstill, etc.)

and much more.

These system variables can be used for:

- Online diagnostics
- Display on HMI
- Logging with the SIMOTION trace functionality
- Application programming through querying/comparing these system variables

Application programs access the axis functionality with system functions (commands) which are part of the "axis" object when it is generated.

The command _pos(axis:=Axis1, position:=100, velocity:=123) would cause positioning axis "Axis1" to move to position 100 with velocity 123 (example for system functions in Structured Text).

6

SIMOTION software
Engineering software

SIMOTION SCOUT
Creation of cams (basic)

Overview
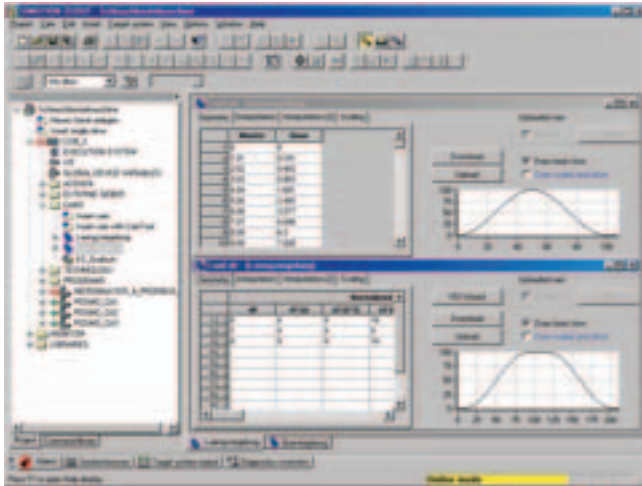
A cam generally specifies the motion relationship between a leading axis (master axis) and a following axis (slave axis). Cams can also be speed profiles, pressure characteristics or valve characteristic corrections for hydraulic axes. The cam technology package can process cams which are defined as interpolation point tables or polynomial descriptions.

The basic scope of SCOUT contains editors to create simple cams in the form of text in a table or polynomials (VDI assistant) in the form of graphics symbols with configuration support.

Benefits

- Editors for simple cams are already included in the basic configuration of SCOUT
- Graphics-based display of the cam to permit rapid detection of erroneous entries
- Display as interpolation point table with the option of importing from external sources (ASCII, Excel)
- Polynomials to the 6th degree with input support using polynomial description dialog and VDI wizard

Function

When the technology object "cam" is created, the type "Support point table" or "Polynomial" is defined.

- Interpolation point table:
  With this type the master and slave positions are entered in a two-column table. It is also possible to use external support point tables (ASCII file, Excel table).

- Polynomials:
  Polynomials describe motion rules in accordance with VDI 2143. SIMOTION supports polynomials up to the 6th degree. In polynomial mode, the cam is described by a number of consecutive polynomials. Polynomials are entered in the form of a polynomial table. Users can use a polynomial description dialog and/or the VDI assistant.

The result of the input is displayed in the right-hand side of the window in form of a curve in the coordinate system.

In addition, other parameters such as the interpolation type between points or the scale of the cam can be specified.

The SIMOTION CamTool option package can be used to display and optimize cams graphically.

6

SIMOTION SCOUT	SIMOTION SCOUT
Structured Text (ST)	**Motion Control Chart (MCC)**

■ Overview
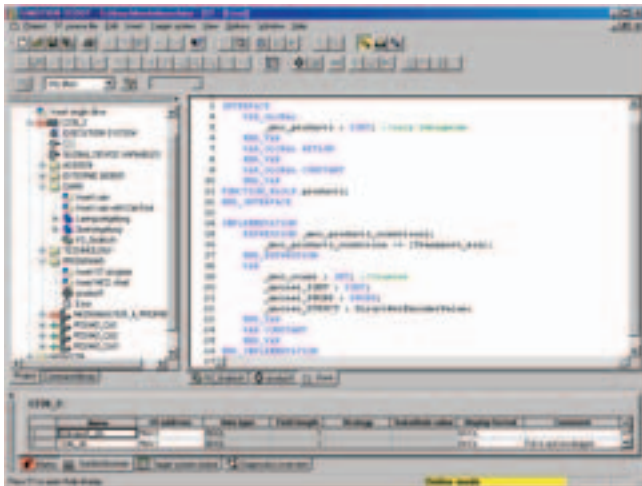
The high-level language Structured Text (ST) provides all language resources in form of commands. This permits the generation of well-structured applications.

The basic commands implement all requirements for:

• Data management
• Computing functions
• Control structures
• I/O operations

The addition of the technology packages for Motion Control increases the scope of commands by adding powerful, highly flexible Motion Control commands (e. g.: _pos(...) for position controlled axis positioning).

An ST source file basically consists of continuous text. This text can be divided and structured in sections, which represent logical sections of an ST source file.

These sections can consist of the following:

• Program assigned to a runtime task
• Function block with a dedicated memory
• Function without a dedicated memory

Functions and function blocks are not assigned to a runtime task. They are called in from programs.

■ Benefits

• Motion Control, PLC, and technology functions in one language
• Well-structured programs with comment capability
• Powerful editing functions, such as syntax coloring and automatic indenting
• Easy-to-use debug functions for ONLINE testing and diagnostics: e. g. display of actual variable content of the code sequence and break points selected in the editor

■ Overview
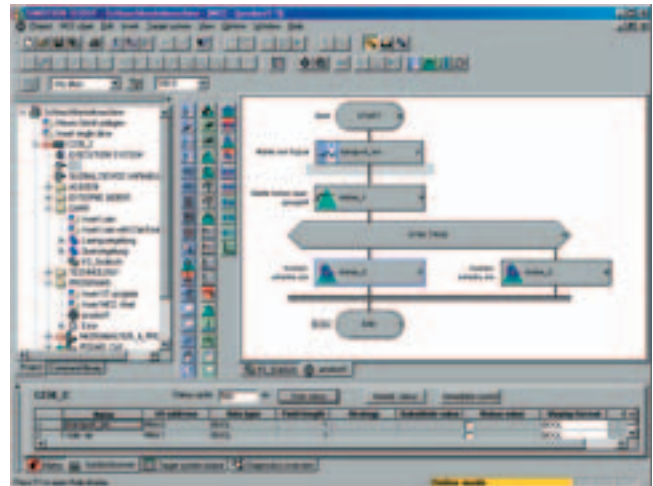
Motion Control Chart (MCC) can be used to formulate the processes of a machine graphically with simple and logical tools. The result is one or more flowcharts showing the chronological sequence of the individual actions.

Above all, MCC supports the simple description of the motion sequences of machines with many axes with the help of powerful Motion Control commands (e. g. reference axis, position axis, synchronize or desynchronize cam, and many more).

Different commands are available for controlling the machine, e. g. if conditions must be fulfilled, I/O signals can be read or set, calculations can be formulated and different control structures such as condition (IF), cases (CASE) and loops (WHILE, REPEAT UNTIL) can be programmed.

Several MCC programs may be created to describe different process situations. For example, you can create one MCC program to bring the machine to a defined initial state when it is powered on, a second MCC program for the normal production sequence, and a third MCC program to specify what the machine is to do in the event of a fault.

All commands are available in tool bars (sorted according to functions) and are automatically inserted in the flowchart at the selected point with a click. By clicking on different elements individual dialogs for further parameterization are opened. Of course, it is also possible to include individual comments to document the sequence.

■ Benefits

• Easy-to-use due to graphical flowchart representation
• Hierarchical command library for Motion Control, PLC, and technology functions
• Control structures (IF, WHILE, CASE, etc.)
• Zoom-in functions for LAD, FBD and ST
• Subroutine calls (FB/FC)
• Structuring based on module creation, i. e. combination of command sequences to form a module command. Clicking on the module command invokes the corresponding command sequence.
• Powerful test functions for ONLINE connection with the SIMOTION control such as chart monitoring and single-step mode.

6

SIMOTION SCOUT Ladder Diagram/ Function Block Diagram (LAD/FBD)	SIMOTION SCOUT Diagnostics for testing and commissioning

■ Overview
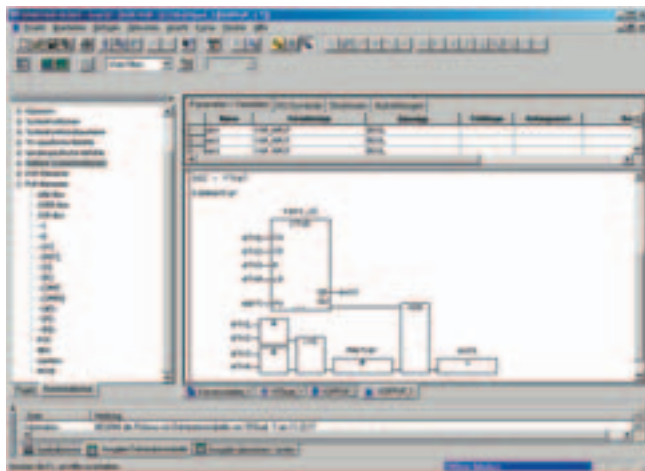
A powerful editor for LAD/FBD programming is available for ladder diagrams (LAD) or function block diagrams (FBD).

This editor expands the LAD/FBD programming in MCC included in SCOUT. LAD/FBD also include commands for SIMOTION control using standard logic functions. Blocks which have been programmed in other SIMOTION languages can be called without problems. User-friendly functions such as "on the fly" variable declarations or automatic syntax checks are available when programming in LAD or FBD. Programs can change between LAD and FBD representations at any time.

■ Benefits

- LAD/FBD blocks can be stored in the SIMOTION project.
- Existing PLCopen, ST, LAD/FBD or MCC blocks can be called from within the LAD/FBD program.
- Network titles and comments are available.
- Special functions such as automatic syntax checking or "on the fly" variable declaration can be activated.
- Commands from a command library can be used.
- For commissioning and troubleshooting purposes, the status of the LAD/FBD programs is displayed in online mode.

■ Overview
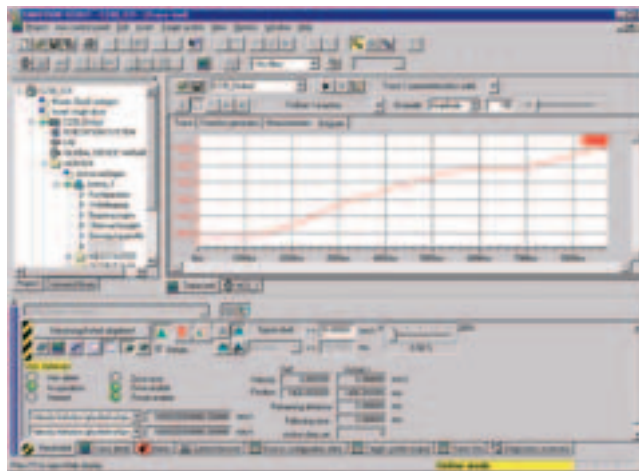
SCOUT includes a number of diagnostics tools to make testing and commissioning of SIMOTION applications as simple as possible:

- Device diagnostics can be used to display the cycle status, system load and memory usage.
- The diagnostic buffer is used to log the fault history. The following events are logged in the diagnostics buffer of the SIMOTION device:
  - All system status changes (RUN, STOP, etc.) and
  - System interrupts with date and time
- All error messages which are output by technology objects (e. g. axis errors) are displayed in the error window of SCOUT with number and in plain text.
- All SIMOTION system and application variables can be dynamically updated, monitored and controlled if the SIMOTION device is online.
- All programming errors are visualized with location and cause on compilation.
- The status display for programs with possible stop points (ST) and step-by-step tracing (MCC) helps the user to commission software.
- Watch tables can be used to list and visualize important variables.
- On commissioning, the axes can be traversed and optimized directly from SIMOTION SCOUT with an axis control panel. The functions of the axis control panel can also be used without the SIMOTION application program.

The most powerful tool for testing and commissioning is the trace function integrated in SCOUT.

Each SIMOTION device has a trace buffer which can be configured with the trace functionality of SCOUT.

When the trace is started, the configured data are logged in the SIMOTION device.

On completion of the trace, the content of the trace buffer can be read by SCOUT and displayed graphically.

During trace configuration, the following is specified:

- Trigger condition (e. g. rising edge of a definable signal) and pre-trigger
- Logging resolution (a multiple of the basic cycle of the SIMOTION device)
- Logging duration (or endless trace with ring buffer)
- System variables to be logged (system, I/O and user variables)

6

SIMOTION SCOUT	SIMOTION CamTool
Diagnostics for testing and commissioning	**Graphical cam editor**

Overview (continued)

The logged data are displayed in form of a curve over time for evaluation.

Curves can be displayed in different colors and can be deactivated and reactivated.

The zoom function can be used to view details.

Signal levels and signal durations can be measured with measuring cursors.

Possible changes can be visualized by superimposing measuring curves from different trace logs.

In addition to logging, the trace function also offers Bode diagrams, FFT analysis, a function generator and mathematical functions.

The traced curves can be stored or exported to Microsoft Excel as a table and evaluated further there. Of course, the curves can also be stored for documentation purposes, inserted in documents or printed out.

Benefits

- A large number of easy-to-use and informative diagnostics tools fully integrated in SCOUT
- Helpful support for process optimization and troubleshooting
- All information can be printed in the same layout as displayed on the screen for documentation purposes.
- Axis machine control panel for commissioning and optimization without a user program

Overview
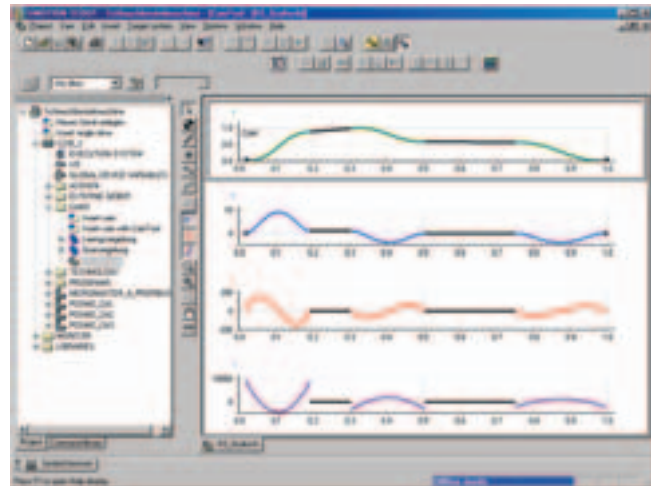
SIMOTION CamTool is a powerful, graphical editor for creating and optimizing cams.

SIMOTION CamTool can be used as an expansion package for SIMOTION SCOUT and is completely integrated in the SIMOTION SCOUT engineering environment.

Benefits

- Precise, graphic display of the curve
- Entries can be made quickly and easily by inserting curve elements with a drag-and-drop operation
- Fast and easy optimization of the curve by means of "dragging the profile"
- Simultaneous display of position, speed, acceleration, and jerk characteristics immediately indicates the effect on the maximum speed, the required motor torque, and the mechanical load
- Curve can also be optimized in relation to speed, acceleration, or jerk
- Basic principles of motion correspond to VDI 2143

Function

- The curve is displayed graphically in an x-y-diagram (positions of master and following axes). The curve profile is first roughly entered here with individual elements such as control points, lines and interpolation points. Lines can be entered as straight lines, sine lines or arc sine lines.
- SIMOTION CamTool then connects these individual elements automatically to a continuous curve. The transitions between the individual curve sections are shaped as homogeneously as possible.
- You can optimize the curve by simply moving the specified curve sections with the mouse. The curve profile is immediately adapted to your changes.
- In addition, SIMOTION CamTool can display the curve of the velocity, acceleration and jerk of the following axis over the motion of the master axis.
- SCOUT can be used to convert cams created with CamEdit to the format used by CamTool or vice versa.

6

STARTER
Drive commissioning tool

■ Overview
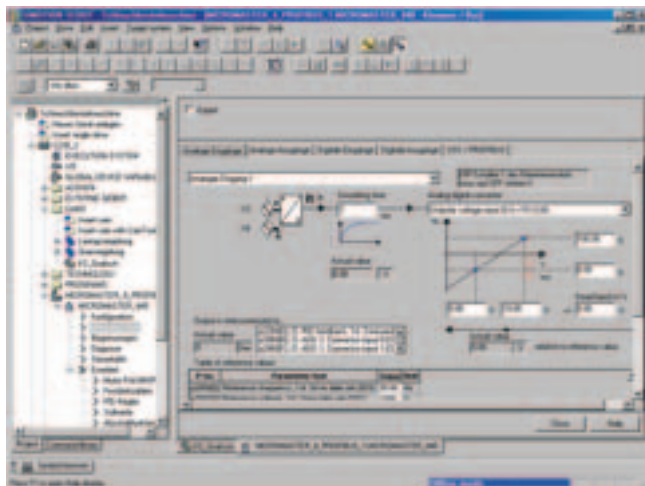
The easy-to-use STARTER drive commissioning software can be used for:

- Commissioning
- Optimization
- Diagnostics

This software is integrated in the SCOUT engineering system. The functionality is identical to the STARTER stand-alone variant.

In addition to the SINAMICS drives, the current version of STARTER also supports MICROMASTER 4 and COMBIMASTER 411 devices.

The project wizards can be used to create the drives within the structure of the project tree.

Beginners are supported by solution-based dialog guidance, whereby a standard graphics-based display maximizes clarity when setting the drive parameters.

First commissioning is guided by wizards, which make all the basic settings in the drive. This ensures that even though only a small number of parameter settings have been made, the drive configuration has already progressed far enough to permit axis movement.

The individual settings required are made using graphics-based parameterization screenforms, which also display the mode of operation.

Examples of individual settings that can be made include:

- Terminals
- Bus interface
- Setpoint channel (e. g. fixed setpoints)
- Closed-loop speed control (e. g. ramp-function generator, limits)
- BICO interconnections
- Diagnostics

Experts can gain rapid access to the individual parameters via the expert list, meaning that they do not have to navigate dialogs.

In addition, the following functions are available for optimization purposes:

- Self-optimization
- Trace

Diagnostics functions provide information about:

- Control/status words
- Parameter status
- Conditions of use
- Communication states

■ Benefits

- Easy-to-use: Initial commissioning in a few settings results in initial success → the axis rotates
- Solution-based dialog prompting simplifies the commissioning procedure
- Self-optimization functions reduce the amount of manual optimization required
- The integral trace functionality provides optimum support for commissioning, optimization, and troubleshooting.

Communication

7

Communication

Overview

Nowadays, most production machines use digital bus systems. These handle the communication between the management level, the machine control and the executing organs, i. e. the sensors and actuators. These use two types of communication: Process communication and data communication.

Process communication

Process communication involves cyclically transmitting control data and setpoints. The number of data to be transmitted is comparatively low. A drive, for example, only requires about 4 to 16 bytes. The number of connected sensors and actuators is usually specified by the configuration which makes the bus cycle of process communication very constant.

Data communication

Data communication is not directly linked to the execution of the production process and is often required for engineering. Data are sporadically (acyclically) exchanged with connected devices. The volume of this communication can be very large with > 100 bytes per device and communication task.

Bus cycle

The bus cycle comprises process communication and data communication. The cycle of the bus system is much shorter without data communication. Some say: The bus cycle breathes. However, this breathing is unsuitable for highly accurate applications in drive technology.
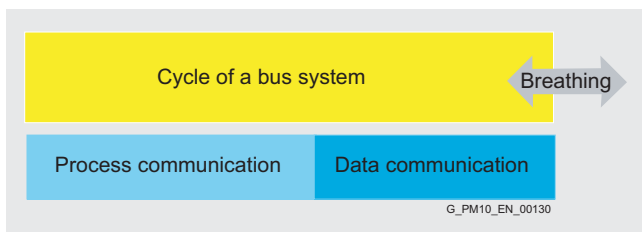
Communication types of a bus system

Requirements for drive controls

Most current drives have a digital closed-loop control. This closed-loop control ensures that the controlled variable of the drive, e. g. the speed or position, are achieved and maintained. Such a digital closed-loop control comprises several intertwined controls (position, speed, current, ...). These must be matched to one another, i. e. they must be synchronized. This synchronization is important to keep the controls stable and to accurately maintain the controlled variable or/and to achieve it quickly. If some of the components of the closed-loop control are located outside the drive, a bus system must be used to manage the communication between these components. This bus system must be as synchronized as the closed-loop controls. This is referred to as isochronous operation. For drives in the area of Motion Control systems isochronous operation must be extremely quick and very accurate. It ensures that the length of the bus cycle deviates only very slightly. This is then no longer referred to as the breathing of the bus cycle (large deviations), but as jitter (small deviations). Acceptable values are < 1 µs. This synchronization is achieved through clock signals.
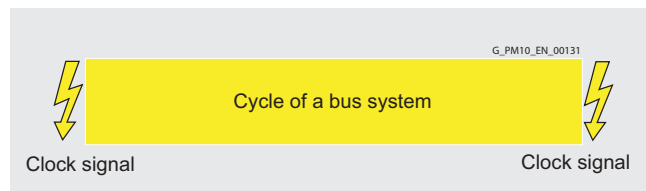
Constant bus cycle

So that a bus system can be used for Motion Control applications it must permit process communication and isochronous operation. An additional bus system is often used for data communication. PROFIBUS and PROFINET can combine all of these requirements in a single bus system. Industrial Ethernet, the predecessor of PROFINET, does not fulfill the requirements with respect to real-time communication.

T1<T2<T3   Clock cycles

T1 - T3   Start in the same time (isochronous mode)

The lightning symbol indicates the cycle in which a controller is operating, e. g. the current controller is operating in cycle T1.
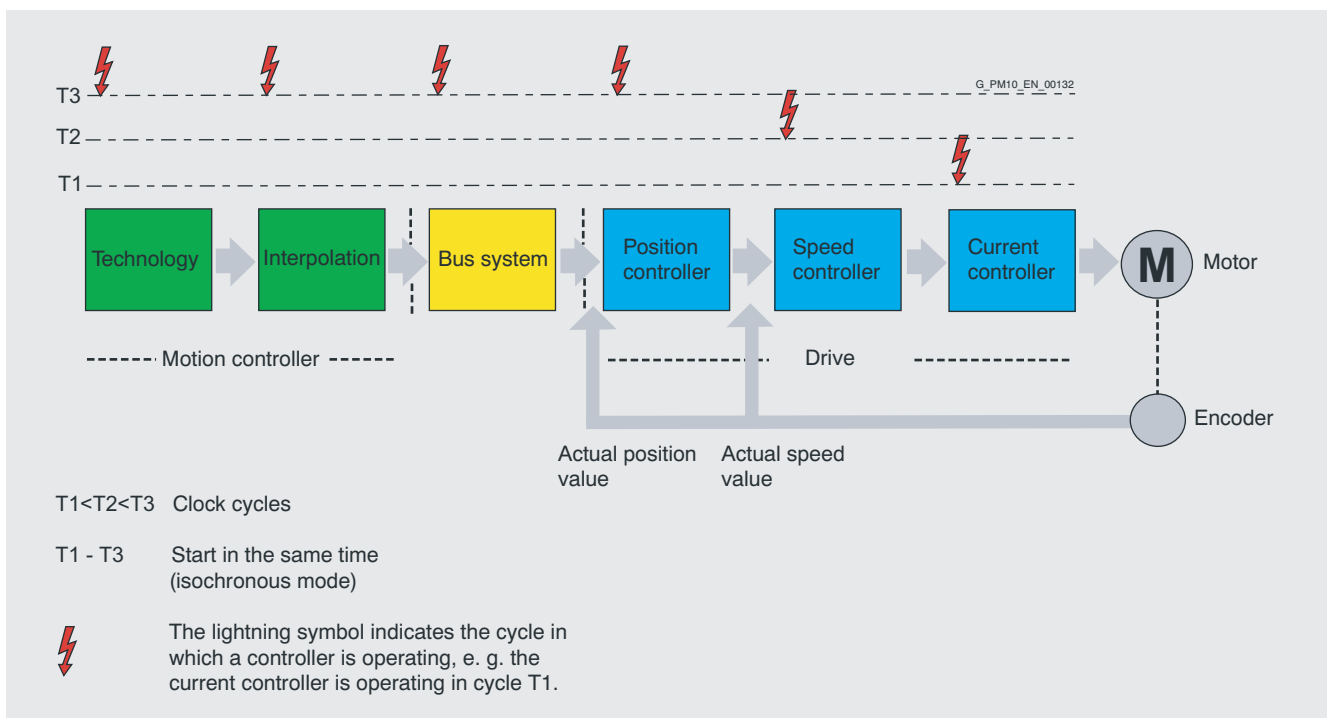
The principle of digital drive controls

Overview

What are profiles?

Profiles used in automation technology define certain characteristics and responses for devices, device groups or whole systems which specify their main and unique properties. Only devices with manufacturer-independent profiles can behave in exactly the same way on a fieldbus and thus fully exploit the advantages of a fieldbus for the user.

Profiles are specifications defined by manufacturers and users for certain characteristics, performance features and behaviors of devices and systems. They aim to ensure a certain degree of interoperabiltiy of devices and systems on a bus which are part of the same product family due to "profile-compliant" development.

Profile types

Different types of profile can be distinguished such as so-called application profiles (general or specific) and system profiles:

- Application profiles mainly refer to devices, in this case drives, and contain an agreed selection of bus communication modes as well as specific device applications.
- System profiles describe system classes and include the master functionality, program interfaces and integration methods.

PROFIdrive

The PROFIdrive profile is a specific application profile.

Design

PROFIdrive in drive applications

The PROFIdrive profile defines the device behavior and the access procedure to drive data for electrical drives on PROFIBUS, from simple frequency converters up to high performance servo controllers.

It contains a detailed description of how the communication functions "direct data communication", "equidistance" and "isochronous operation" are used meaningfully for drive applications. In addition, it specifies all device characteristics which influence interfaces connected to a controller over PROFIBUS or PROFINET. This includes the state machine, encoder interface, standardization of values, definition of standard messages, and access to drive parameters, etc.

The PROFIdrive profile supports both central as well as distributed Motion Control concepts.

The basic philosophy: Keep it simple

The PROFIdrive profile tries to keep the drive interface as simple as possible and free from technology functions. This philosophy ensures that reference models as well as the functionality and performance of the PROFIBUS/PROFINET master have no or very little influence on the drive interface.

Segmentation into application/utilization categories

The integration of drives into automation solutions depends strongly upon the drive task. To cover the extensive range of drive applications from the most simple frequency converter up to highly dynamic, synchronized multi-axis systems with a single profile, PROFIdrive defines six application categories which define most drive applications.

- Category 1 - Standard drives (such as pumps, fans, stirring units, etc.)
- Category 2 - Standard drives with technology functions
- Category 3 - Positioning drives
- Category 4 - Motion Control drives with central, higher-level Motion Control intelligence
- Category 5 - Motion Control drives with central, higher-level Motion Control intelligence and the patented "Dynamic Servo Control" position concept
- Category 6 - Motion Control drives with distributed Motion Control intelligence integrated in the drives

PROFIdrive defines a device model based on function modules which cooperate in the device and generate the intelligence of the drive system. These modules have objects assigned to them which are described in the profile and are defined with respect to their functions. The overall functionality of a drive is therefore described through the sum of its parameters.

In contrast to other drive profiles, PROFIdrive defines only the access mechanisms to the parameters as well as a few profile parameters (about 30) such as the fault buffer, drive control and device identification.

All other parameters are vendor-specific which gives drive manufacturers great flexibility with respect to implementing control functions. The elements of a parameter are accessed acyclically over the so-called DP-V1 parameter channel.

PROFIdrive uses DP-V0, DP-V1, and the DP-V2 expansions for PROFIBUS and the functions "Slave cross communication" and "Isochronous communication" contained therein as the communication protocol.
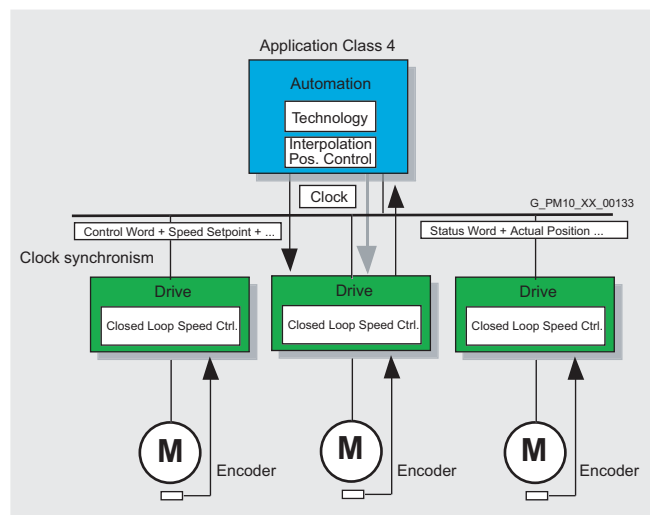
PROFIdrive and SIMOTION

Category 4 is the most important category for highly dynamic and highly complex Motion Control tasks. This application category describes in detail the master/slave relationship between the control and the drives which are connected to each other over PROFIBUS or PROFINET.

The DSC (Dynamic Servo Control) function significantly improves the dynamic response and stiffness of the position controller circuit by minimizing the dead times which usually occur for speed setpoint interfaces with an additional, relatively simple feedback network in the drive.

In SIMOTION the drive interface has been implemented according to the PROFIdrive profile and application category 4 with and without DSC and is simply referred to as the PROFIdrive interface in the catalog below.

7

Communication

Overview

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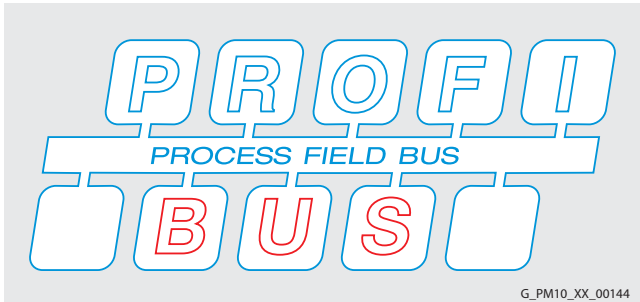
What is PROFIBUS?

PROFIBUS is the most successful open fieldbus used for automation technology which can be used for a wide range of applications. Standardization in accordance with EC 61158/EN 50170 provides future protection for your investment.

PROFIBUS defines the technical and functional features of a serial fieldbus system with which distributed programmable field controls of the low-end (sensor/actuator level) to mid performance range (cell level) can be networked.

The demands of users for an open, vendor-independent communication system resulted in the specification and standardization of the PROFIBUS protocol.

Multi-vendor installations

Through the conformity and interoperability test performed by the test laboratories authorized by the PROFIBUS International (PI) and the certification of the devices by the PNO, the user can rest assured that quality and functionality are also ensured for multi-vendor installations.

PROFIBUS variants

PROFIBUS FMS (Fieldbus Message Specification) - The universal solution for communication tasks on the field and cell level of the industrial communication hierarchy.

PROFIBUS PA (Process Automation) - The variant for applications in process automation. PROFIBUS PA uses the intrinsically safe transmission technology specified in IEC 61158-2.

PROFIBUS DP (Distributed I/Os) - This variant, which is optimized for speed, is tailored especially for the communication of automation systems with distributed I/O stations and drives. The outstanding features of PROFIBUS DP are

• Very short response times
• High interference immunity

PROFIBUS DP replaces cost-intensive parallel signal transmission with 24 V and the measured value transmission with 0 / 4 – 20 mA technology.

PROFIBUS and SIMOTION

SIMOTION uses the PROFIBUS protocol PROFIBUS DP.

Design

Bus station

PROFIBUS DP distinguishes between two different master classes and one slave class:

DP master, Class 1:
The DP master Class 1 is the central component on PROFIBUS DP. The central master station exchanges information with distributed stations (DP slaves) in a fixed, repeated message cycle.

DP master, Class 2:
Devices of this type are used (programming, configuration or control devices) during start-up, for configuring the DP system, for diagnostics or controlling the plant during normal operation. A DP master Class 2 can be used, e. g. to read the input, output, diagnostics and configuration data of the slaves.

DP slave:
A DP slave is an I/O device which receives output information or setpoints from the DP master and sends input information, measured values or actual values to the DP master in response. A DP slave never sends data independently, it must always be prompted by the DP master.

The volume of input and output data depends on the device and can be up to 244 bytes per DP slave and transfer direction.

Function

Functions on PROFIBUS DP

The functional scope can differ between DP masters and DP slaves. The functional scope is different for DP-V0, DP-V1 and DP-V2.

DP-V0:
The DP master functions (DP-V0) comprise the functions "Configuration", "Parameter Assignment", "Read Diagnostics Data" as well as cyclic reading of input data/actual values and writing output data/setpoints.

DP-V1:
The additional DP function expansions (DP-V 1) make it possible to perform non-isochronous read and write functions as well as processing cyclic data communication. This type of slave must be supplied with extensive parameterization data during start-up and during normal operation. These acyclically transferred parameterization data are only rarely changed, in comparison to the cyclic setpoints, actual values, and measured values, and are transferred at lower priority in parallel with the cyclic high-speed useful data transfer. Detailed diagnostic information can be transferred in the same way.

DP-V2:
The additional DP master function expansions (DP-V2) essentially comprise isochronous functions and direct data transmission functions between DP slaves.
Isochronous operation is implemented through the use of an constant clock signal on the bus system. This isochronous, constant cycle is sent by the DP master to all bus stations in the form of a global control message. The master and slaves can then synchronize their applications with this signal. The jitter of the clock signal from cycle to cycle is smaller than 1 µs.
Direct data communication between slaves is implemented with the so-called publisher/subscriber model. Slaves declared as publishers make their input data/actual values and measured values available to other slaves, the subscribers, for reading. This is performed by sending the response message to the master as a broadcast. Direct data communication is therefore performed cyclically.

SIMOTION systems and PROFIBUS DP

The SIMOTION systems can be used as DP masters as well as DP slaves and support all communication functions (DP-V0, DP-V1 and DP-V2).

7

▮ Overview

Ethernet is the basic Internet technology for worldwide networking. The many possibilities of intranet and Internet, which have been available for office applications for a long time, are now utilized for production automation with Industrial Ethernet.

IT technology as well as the use of distributed automation systems is continuously increasing. This entails breaking up complex control tasks into small, simple control systems close to the drive. This increases the demand for communication which requires a comprehensive and powerful communication system.

Industrial Ethernet offers a powerful area and cell network to IEEE 802.3 (ETHERNET) for industrial applications.

▮ Benefits

Ethernet with its 100 MBaud data rate and full duplex capability is the ideal basis. With a share of over 80% Ethernet is now the Number One Network worldwide and offers important features which have essential advantages:

- Fast start-up due to the simplest connection method
- High availability since existing networks can be extended without any adverse effects
- Almost unlimited communications performance because scalable performance is available through switching technology and high data rates if required
- Networking of different application areas such as the office and production areas
- Company-wide communication based on WAN (Wide Area Network) technology such as ISDN or Internet
- Investment security through continuous compatible further development

To make Ethernet suitable for industrial applications requires essential expansions with respect to functionality and design:

- Network components for use in rugged industrial environments
- Fast assembly of the RJ45 technology
- Failure safety through redundancy
- Expanded diagnostics and message concept
- Use of future-oriented network components (e. g. switches)

SIMATIC NET offers corresponding network components and products.

▮ Design

SIMOTION has been integrated into the Industrial Ethernet communication architecture by equipping each SIMOTION device with at least one Ethernet interface as standard.

Industrial Ethernet is mainly used for data communication. For SIMOTION, cyclic process communication with drives and distributed I/O is implemented over PROFIBUS DP and PROFIdrive. In the future, PROFINET will combine data communication and cyclic process communication for SIMOTION on the basis of Ethernet.

▮ Function

G_PM10_EN_00138
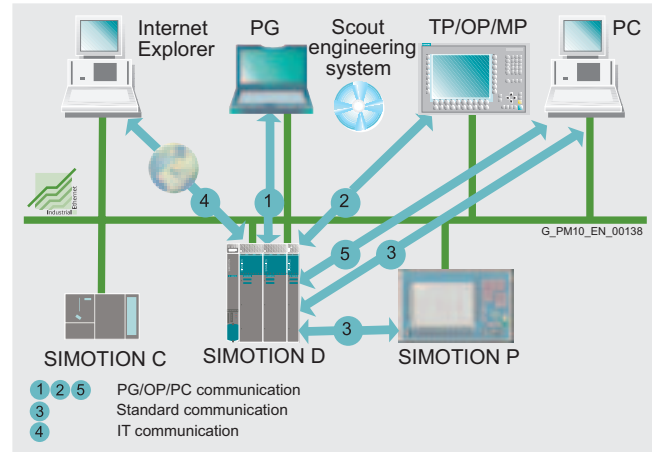
The communication types below are available for SIMOTION via Industrial Ethernet:

PG/OP communication (1, 2, 5)

- Engineering and diagnostics with SIMOTION SCOUT (1)
- Connection of SIMATIC HMI panels with Ethernet interface using ProTool Pro (only PC-based) or WinCC flexible (2)
- For example, open communication of vendor-specific HMI tools over OPC server from SIMATIC NET (5)

Standard communication (3)

This uses the basic protocols UDP and TCP/IP which are also used for Ethernet. In this way, SIMOTION offers the corresponding system functions for UDP and TCP/IP communication. This permits data to be exchanged over TCP/IP and UDP communication between:

- Different SIMOTION devices (3)
- SIMOTION and SIMATIC S7 devices (3)
- SIMOTION devices and any other device which uses standard TCP/IP or UDP communication. Such devices can be any kind of PC with any kind of operating system or other programmable controllers (3)

IT communication (4)

IT communication is performed using protocols which are based on the basic TCP/IP protocol. The most important IT protocols are:

HTTP: Hypertext Transfer Protocol

FTP: File Transfer Protocol

SMTP: Simple Mail Transfer Protocol

SNMP: Simple Network Management Protocol

SIMOTION supports the HTTP protocol. In addition, the following communication options are available for SIMOTION:

- HTML files on the SIMOTION device (4)
  A standard Internet browser can be used to access predefined HTML pages with diagnostics information on the SIMOTION device. Furthermore, user-defined HTML files can be stored in the SIMOTION device which contain information defined by the user.
- OPC XML-DA (4)
  SIMOTION offers an OPC XML-DA server integrated into the device. This server supplies SIMOTION process data. Communication from any external device is performed with the SOAP protocol (in accordance with the specification of the OPC Foundation) which is integrated into the HTTP protocol.
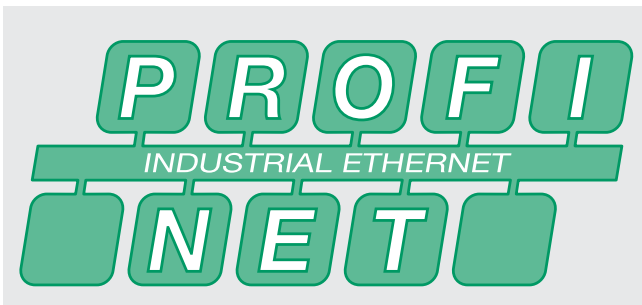
7

Communication

■ Overview

PROFINET is the innovative and open Industrial Ethernet standard (IEC 61158) for industrial automation. With PROFINET, devices can be linked up from the field level through to the management level.

PROFINET enables system-wide communication, supports plant-wide engineering and uses the IT standards right down to the field level. IT communication, data communication and cyclic process communication are combined on the basis of Industrial Ethernet.

Existing fieldbus systems such as PROFIBUS can be easily integrated without any modification of existing devices.

G_IK10_XX_30035

■ Design

PROFINET device concept

PROFINET distinguishes between the controller and devices assigned to it. These are initialized and parameterized by the controller on startup. The controller and its devices together constitute an I/O system (compare master/slave system for PROFIBUS).

For PROFINET, cyclic communication between an I/O controller and its I/O devices is performed in the same way as for PROFIBUS over the process image. The process image is updated cyclically, depending on the requirements and device characteristic this is done in real-time (RT, devices are typically distributed I/O devices) or isochronous real-time (IRT, devices are typically servo drives). In addition, PROFINET permits communication between controllers and devices of different I/O systems.

G_PM10_EN_00134

PROFINET IO with IRT for Motion Control

SIMOTION controls or synchronizes axes over PROFINET. This requires cyclic, isochronous data exchange with the drives. PROFINET I/O with IRT fulfills this requirement. The communication cycle is subdivided into different, time-specific channels for this purpose. The first channel is used for isochronous real-time communication (IRT), followed by real-time communication (RT) and standard TCP/IP communication. By configuring the application, e. g. synchronous operation of two axes, the IRT messages are determined implicitly and the corresponding configuration data are generated.

The temporal sequence of the individual messages for each network section is calculated with a special algorithm which takes the topology into account. This permits a switch to forward the IRT messages without delay from the input port to the specified output port and then to the target device.

G_PM10_EN_00139

Transition from PROFIBUS to PROFINET

The functional interface between SIMOTION and the drives for PROFINET and PROFIBUS is defined by the PROFIdrive drive profile of the PROFIBUS International (PI). It is not necessary to change an application program for the transfer between PROFIBUS and PROFINET.
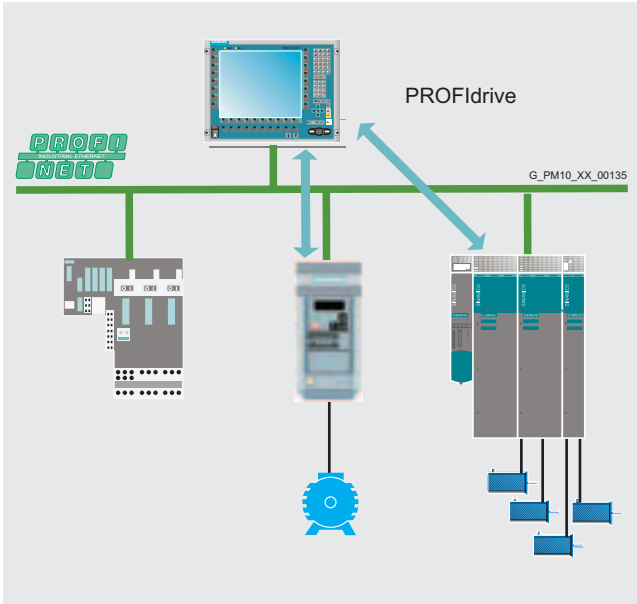
PROFINET with PROFIdrive

MOTION CONTROL concepts with PROFINET

With SIMOTION, PROFINET supports the implementation of different automation structures. Distributed drive-based Motion Control concepts (e. g. with SIMOTION D) or central architectures with a control (e. g. SIMOTION P) are supported in the same way as distributed automation solutions with modular automation components.
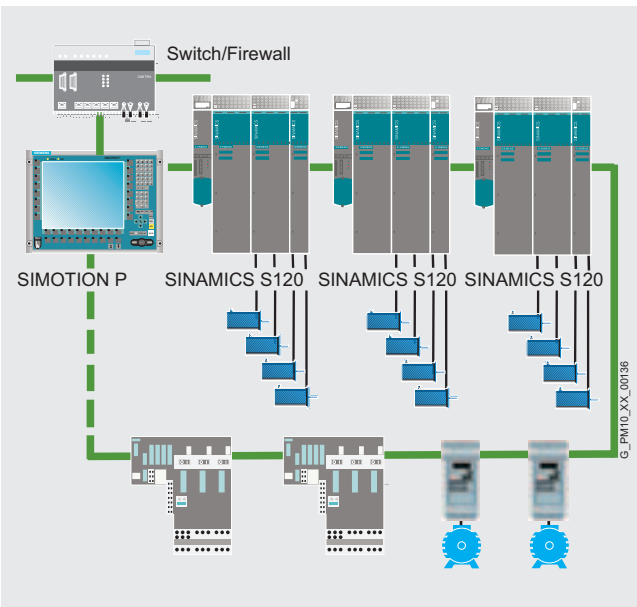
Central Motion Control architecture
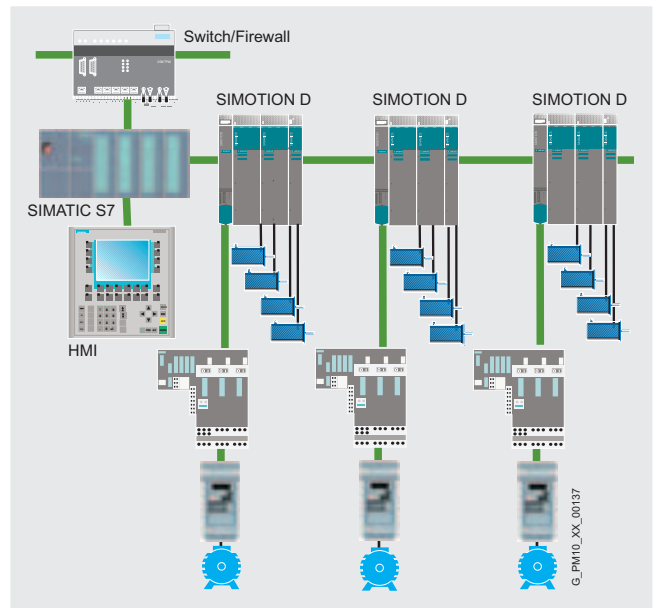
Distributed Motion Control architecture

Available soon:
The interface to PROFINET will be implemented with an optional module for the SIMOTION P and SIMOTION D Motion Control systems as well as for the SINAMICS S120 drive system with the CU320 Control Unit. These modules have 4 Ethernet ports with integrated switch functionality. The real-time communication types PROFINET I/O with RT and IRT as well as the standard protocols TCP/IP are supported.

7

Communication

PROFINET with SIMOTION

■ Function

Real-time communication with PROFINET I/O

PROFINET uses standard TCP/IP for parameter assignment, configuration and diagnostics. Real-time communication for the transmission of process data is performed on the same line. PROFINET I/O has the following real-time features:

- Real-time (RT) uses the option of prioritizing the communication stack of the stations. This permits high-performance data transmission with standard network components.

- Isochronous real-time (IRT)
  IRT permits strict deterministic, cyclic data transmission with short response times and minimum jitter for high performance Motion Control applications. This feature is implemented with a special ASIC, the so-called ERTEC (Enhanced Real Time Ethernet Controller), in the corresponding interfaces (switch integrated into device) or network components (switch).

Distributed intelligence with PROFINET CBA

Machines and plants can be broken up into reusable, technological modules. These modules include the mechanical and electrical/electronic components and application programs of a plant section. In the first step, the modules are created, tested and enclosed and in the second step they are graphically wired up with the communication system of the system. This procedure permits efficient engineering and short commissioning times.

Automation with PROFINET

With these and other features PROFINET fulfills all automation requirements: Industry-compatible installation technology, real-time capability, deterministic responses, integration of distributed field devices, simple network administration and diagnostics, protection against unauthorized access, efficient vendor-independent engineering as well as isochronous Motion Control applications.

PROFINET relies on switch technology and has expanded this technology for real-time applications (RT). This has the advantage that the network topology can be optimally utilized and adapted to the requirements of the machine. Collisions are prevented and an optimal data throughput is achieved.

7

Overview
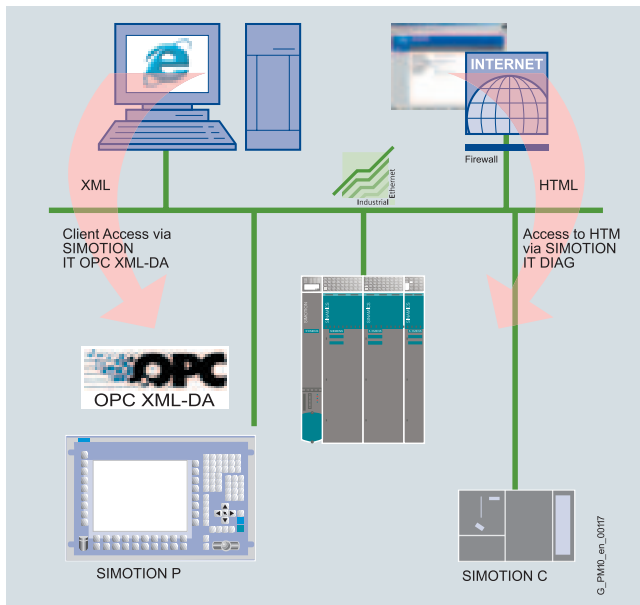
The SIMOTION devices offer communication with standard IT protocols (HTTP) over the integrated Ethernet interface. This makes it possible to access data on the SIMOTION devices from any location within the network or over the intranet/Internet. The use of standard protocols makes the communication client completely platform-independent.

SIMOTION offers two Runtime software options for this purpose:
• SIMOTION IT DIAG
• SIMOTION IT OPC XML DA

This makes is possible to create simple service and diagnostics tools as well as small HMI applications without having to use vendor-specific software components on the client device. These applications can be created for an Internet browser, e. g. with C#, JAVA or on HTML basis.

Design

A firmware variant is available for the SIMOTION devices into which the HTTP server is integrated and which can be used for the SIMOTION IT DIAG and OPC XML-DA functions.

The SIMOTION IT DIAG and OPC XML DA functions are options and must be licensed.

All SIMOTION devices are supplied with a standard firmware which does not include the above functions. To to be able to use the SIMOTION IT DIAG and OPC XML DA functions, the standard firmware must be replaced with the special SIMOTION IT firmware (on SIMOTION IT CD).

Function

SIMOTION IT DIAG

Standard diagnostics pages in HTML format are stored in the internal file system of the SIMOTION device. These diagnostics pages can be accessed from anywhere with a standard Internet browser over Ethernet and provide the following information and functions:

• Device information
Detailed information about the firmware versions, hardware components and technology objects of the device

• Diagnostics
Information about device resources, such as CPU load, memory usage, task duration times, operating status and diagnostic buffer
• Device file system
The Internet browser can be used to store and access any number of files in the file system of the SIMOTION device. In this way, documentation and service instructions can be stored directly in the device, for example.
• Firmware update and project update
Special HTML pages can be used to update the SIMOTION project and SIMOTION firmware
• Access protection
The pages are protected with a user name and password. Different user groups can be defined for different pages.
• User-specific HTML pages
The user can create his or her own HTML pages and store them on the device. So-called "Server side includes" are used to access SIMOTION variables. This is a special HTML syntax extension which allows the values of the selected variable to be included on an HTML page.
Read and write access to the SIMOTION variables is possible.

SIMOTION IT OPC XML DA

OPC XML DA is a communication mechanism defined by the OPC Foundation and is based on the standard IT protocol HTTP. SIMOTION devices have an OPC XML server integrated in their Runtime system. The data requests of a client are coded in XML and transmitted to SIMOTION using the IT protocol. These are evaluated by the integrated OPC XML DA server and the response is then sent back to the client over the same path.

The data are accessed directly on the SIMOTION device and in symbolic form. In this way, the development of the control application is decoupled from the HMI application.

• Access protection (password-based) can be configured, if required.
• SIMOTION OPC XML can only be operated on the Ethernet connection of the SIMOTION devices. The Ethernet address must be set and activated on the device.

SIMOTION IT OPC XML DA is integrated directly in the SIMOTION Kernel. The functionality responds in accordance with the specification of the OPC Foundation "OPC XML DA Specification Version 1.0".

Additional information is available on the Internet under:

http://www.opcfoundation.org

7

Communication

SIMOTION IT

■ Selection and ordering data

	Order No.
SIMOTION IT V3.2 firmware with Ethernet-based HMI and diagnostics functions CD-ROM with firmware for all SIMOTION platforms with SIMOTION IT functions (current version)	**6AU1800-0KA32-0AA0**
SIMOTION IT DIAG License for standard diagnostics pages option	**6AU1820-8BA20-0AB0**
SIMOTION IT OPC XML-DA License for OPC XML-DA server option	**6AU1820-8BB20-0AB0**

For more information on licensing the Runtime software, see "SIMOTION software/Runtime software/General".

■ Further information

- on licensing the Runtime software can be found under "SIMOTION software/Runtime software/General".

- on OPC can be found on the Internet under http://www.opcfoundation.org/.

7

■ Overview

OPC servers

- are included in the scope of supply of the SIMATIC NET communication software
- offer standardized, open and vendor-independent interfaces to access SIMOTION and SIMATIC S7 devices from a Windows PC
- offer interfacing of OPC-capable Windows applications to S7-communication and S5-compatible communication functions (SEND/RECEIVE)
- are based on the software programming interfaces
- implement efficient data exchange for Windows NT 4.0, Windows 2000 and Windows XP
- have OPC client tool (SIMATIC NET OPC SCOUT) with browser functionality and OCX data control

■ Benefits

- Standardized access to SIMATIC S7 and SIMOTION for OPC-capable applications under Windows NT/2000/XP
- Continuity between automation products from different manufacturers
- Identical and easy-to-use interfaces for different components
- Access to every computer in the LAN
- High-performance data access by means of the "custom interface" (C++)
- Easy-to-use by means of the "automation interface" (VB) or the supplied OCX data control

■ Application

OPC (OLE for Process Control) is used by Windows NT/2000/XP as a communication interface.

This is based on the COM (Component Object Model) and DCOM (Distributed COM) functions.

The basic principle of OPC is that OPC client applications communicate with the OPC server over a standardized, open and manufacturer-independent interface.

It is also possible to connect to COM-capable Windows applications (MS Office or HMI systems).

The following OPC servers are available:

- S7 OPC servers for S7 communication, S5-compatible communication as well as SIMOTION communication
- The OPC servers fulfill the following specification of the OPC Foundation:
  - Data Access Automation Interface Version 2.02
  - Data Access Custom Interface Version 2.05
  - Alarm and Events Custom Interface Version 1.02

Requirements

The corresponding SIMATIC NET communication package is required for communication from a PC/PG to SIMOTION C/P/D over OPC (depends on bus system and communication module).

The following shows which software package (which SIMATIC NET license) is required for which communication path to SIMOTION.

Communication via PROFIBUS for

- PC/PG with integrated communication module (CP5611): Communication software for PROFIBUS DP SOFTNET S7
- PC with PCI card CP5611: Communication software for PROFIBUS DP SOFTNET S7
- Notebook with PCMCIA card CP5511/5512: Communication software for PROFIBUS DP SOFTNET S7
- PC with PCI card CP5613 or CP5614: Communication software for PROFIBUS DP S7-5613

Communication via Industrial Ethernet for

- PC/PG with standard Ethernet interface: Communication software for Industrial Ethernet SOFTNET S7 or
  communication software for Industrial Ethernet SOFTNET S7/LEAN (only 8 connections, not with Windows NT)
- PC with PCI card CP1613: Communication software for Industrial Ethernet S7-1613

For internal communication on SIMOTION P350

- from Windows level to SIMOTION Runtime level over internal bus ("softbus"):
  SIMATIC NET OPC server preinstalled on P350

■ Technical data

OPC server

Programming	• Synchronous and asynchronous reading and writing of variables
	• Monitoring of variables using the OPC server with a signal to the client when a change occurs
	• Transmission of alarms and events to client
	• Use of quantity operations; so a large amount of data can be processed in a short time
Interfaces	• Custom Interface (C++); therefore OPC high-performance
	• Automation Interface (VB, Excel, Access, Delphi, ...) easy-to-use
	• Graphics with OCX for configuring instead of programming
Bus systems	Communication via OPC for PROFIBUS and Industrial Ethernet is supported.
Operating systems	Windows NT 4.0
	Windows 2000
	Windows XP Professional

7

Communication

OPC servers

Selection and ordering data	Order No.
Communication software for PROFIBUS DP SOFTNET-S7 V6.2 and higher Software for S7 communication incl. FDL and S7 OPC server, with electronic manual on CD-ROM, for use with modules CP 5511, CP 5611	6GK1704-5CW63-3AA0
CP 5512 PCMCIA card for connecting a PG or notebook computer to PROFIBUS DP and MPI	6GK1551-2AA00
CP 5611 PCI card for connecting a PG or AT PC to PROFIBUS or MPI	6GK1561-1AA00
Communication software for PROFIBUS DP S7-5613 V6.2 and higher Software for S7 communication incl. FDL and S7 OPC server with electronic manual, for use with modules CP 5614, CP 5613	6GK1713-5CB63-3AA0
CP 5613 PCI card for connecting a PG or AT PC to PROFIBUS or MPI	6GK1561-3AA01
CP 5614 PCI card for master and slave connection of a PG or AT PC to PROFIBUS or MPI	6GK1561-4AA01
Communication software for Industrial Ethernet SOFTNET S7 V6.2 and higher Software for S7 communication, S5-compatible communication (SEND/RECEIVE) incl. OPC, PG/PC communication incl. S7 OPC server, with electronic manual	6GK1704-1CW63-3AA0
Communication software for Industrial Ethernet SOFTNET S7 LEAN/V6.2 Software for S7/S5-compatible communication, incl. OPC, PG/OP communication, NCM PC, up to 8 connections	6GK1704-1LW63-3AA0
CP 1613 PCI card for connection to Industrial Ethernet (10/100 Mbits/s)	6GK1161-3AA01
Communication software for Industrial Ethernet S7-1613 V6.2 and higher Software for S7 communication, S5-compatible communication (SEND/RECEIVE) incl. OPC, PG/PC communication incl. S7 OPC server, with electronic manual, for use with module CP 1613	6GK1716-1CB63-3AA0
SIMATIC NET OPC server preinstalled on P350 **License for the communication software already preinstalled on SIMOTION P**	6AU1380-0AA20-0YB0

Further information

For further information on the SIMATIC NET software package with OPC server, see Catalog IK PI and the Interactive Catalog under "Communication/Networks".

Notes:

The current version of the communication packages of SIMATIC NET incl. OPC server is only available for Windows XP Professional and Windows 2000.

7

System components

8

Load power supplies for SIMOTION C/ET 200M

Overview

PS 307 power supply, 5 A

The PS 305/PS 307 load power supplies convert the line voltage (120 V/230 V AC, 24 V to 110 V DC) into the 24 V DC operating voltage.

The following versions are available for the output currents:

- 2 A
- 5 A
- 10 A

The required summation current should be taken into account when dimensioning the load power supply (e. g. current draw of SIMOTION C, supply for the digital outputs, etc.).

Application

The PS 305/PS 307 modules supply 24 V DC for:

- SIMOTION C
- Distributed I/O (ET 200M, ...)
- Sensors
- Actuators

The PS 305/PS 307 load power supplies are snapped directly onto the SIMATIC S7-300 mounting rail and convert the line voltage (120 V/230 V AC, 24 V to 110 V DC) into the 24 V DC operating voltage.

Design

The load power supplies are mounted to the left of the Motion Controller or ET 200M interface (IM 153) on the mounting rail.

The front of the module contains:

- An LED
  (signals that the 24 V DC output voltage is ON)
- Supply voltage selector switch with protective cap
  for selecting the input voltage of 120 V AC or 230 V AC
- ON/OFF switch for 24 V DC output voltage
- Terminals
  for input voltage, output voltage and protective conductor, covered by the front door

The load power supplies can also be mounted onto a 35 mm (1.38 in) DIN rail (DIN EN 50022). Mounting adapters are required for this purpose:

- 1 adapter for PS 307, 24 V/2 A DC, 24 V/5 A DC
- 2 adapters for PS 307, 24 V/10 A DC

Selection and ordering data   Order No.

Load power supplies for SIMOTION C/ET 200M:	
SIMATIC S7-300, load power supplies	
• 120/230 V AC; 24 V/2 A DC	**6ES7307-1BA00-0AA0**
• 24 V to 110 V DC; 24 V/2 A DC (extended temperature range)	**6ES7305-1BA80-0AA0**
• 120/230 V AC; 24 V/5 A DC	**6ES7307-1EA00-0AA0**
• 120/230 V AC; 24 V/5 A DC (extended temperature range)	**6ES7307-1EA80-0AA0**
• 120/230 V AC; 24 V/10 A DC	**6ES7307-1KA01-0AA0**
Mounting adapter For snapping the PS 307 onto 35 mm (1.38 in) standard rails (DIN EN 50022)	**6ES7390-6BA00-0AA0**

Further information

For further information see Catalog ST 70 and the Interactive Catalog under "Automation Systems/SIMATIC Industrial Automation Systems".

8

Overview
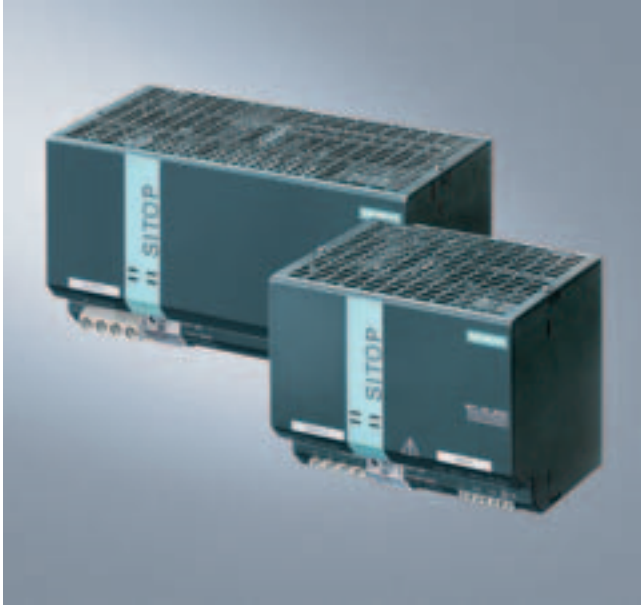
Power supplies (one, two or three-phase)

In contrast to the PS 305/PS 307 load power supplies, the SITOP power supplies listed in the ordering data are snapped onto 35 mm (1.38 in) DIN rails (DIN EN 50022). They cannot be snapped onto the SIMATIC S7-300 mounting rail.

Application

The modular power supply

The modular power supply comprises basic devices with 5 A, 10 A, 20 A and 40 A which can be functionally expanded with additional modules. The modularity offers advantages with respect to flexibility, simple handling and price/performance. The wide-range input, Class B radio interference category to DIN EN 55022 and limitation of input current harmonics to EN 61000-3-2 make these power supplies suitable for use in many different application areas.

Basic units/features:

- 5 A and 10 A basic units
  with 120 V/230 V to 500 V AC wide-range input for operation on single-phase network as well as two-phase operation on three-phase network (connection to two phases of a three-phase supply network)
- 20 A and 40 A basic units
  with 120 V/230 V AC input voltage for single-phase operation or with 3 x 400 V to 500 V AC wide-range input for three-phase operation
- Selectable "constant current" or "stored tripping" short-circuit behavior
- 3 LEDs for signaling "24 V o.k.", "Overload" and "Stored tripping"
- Adjustable output voltage up to 28.8 V for compensating voltage drops
- Power boost with up to three times the rated current

Supplementary modules for function expansions

- Buffer Module for extending the network failure buffering time to 100 ms for 40 A load currents and up to 800 ms for 5 A load currents
- Signaling Module for providing signals about the operating status of the power supply ("DC Voltage OK", "Ready") as well as for remote activation/deactivation of the power supply.

- Redundancy Module for decoupling two power supplies during parallel operation
- Diagnostics Module for dividing the load current into four current paths for monitoring the individual subcurrents

Additional power supplies

Industrial power supply
Reliable power supply as 2 A, 5 A and 10 A version for use in industrial environments without limitation of the input current harmonics to EN 61000-3-2.

Flat design
The flat design is preferred where only small mounting depths are available, for example, when distributed I/O is used, in machines or recesses.

IP65 design
Power supply with IP65 degree of protection. The design and functionality are optimally suited for the distributed ET 200X I/O system. If used without ET 200X, the connector seal accessory is required.

Selection and ordering data

	Order No.
Universal load power supplies	
• **Modular power supply, single-phase and two-phase**	
- 120 V/230 V to 500 V AC; 24 V/5 A DC	**6EP1333-3BA00**
- 120 V/230 V to 500 V AC; 24 V/10 A DC	**6EP1334-3BA00**
- 120 V/230 V AC; 24 V/20 A DC	**6EP1336-3BA00**
- 120 V/230 V AC; 24 V/40 A DC	**6EP1337-3BA00**
• **Modular power supply, three-phase**	
- 400 V to 500 V AC; 24 V/20 A DC	**6EP1436-3BA00**
- 400 V to 500 V AC; 24 V/40 A DC	**6EP1437-3BA00**
• **Modular power supply, supplementary modules**	
- Buffer Module	**6EP1961-3BA00**
- Signaling Module	**6EP1961-3BA10**
- Redundancy Module	**6EP1961-3BA20**
• **Diagnostics Module (4 channels)**	**6EP1961-2BA00**
• **Industrial power supply, single-phase**	
- 120 V/230 V AC; 24 V/2 A DC	**6EP1331-2BA00**
- 120 V/230 V AC; 24 V/5 A DC	**6EP1333-2AA00**
- 120 V/230 V AC; 24 V/10 A DC	**6EP1334-2AA00**
• Flat design, single-phase	
- 120 V/230 V AC; 24 V/5 A DC	**6EP1333-1AL12**
- 120 V/230 V AC; 24 V/10 A DC	**6EP1334-1AL12**
• **IP65 power supply for ET 200X** 120/230 V AC; 24 V/10 A DC, wall-mounted	**6EP1334-2CA00**
• **IP65 connector seal** For stand-alone operation	**6EP1971-2CA00**

Further information

For further information and additional power supplies see Catalog KT 10.1 and the Interactive Catalog under "Power Supplies/SITOP Power Supplies".

8

Uninterruptible power supplies

Overview
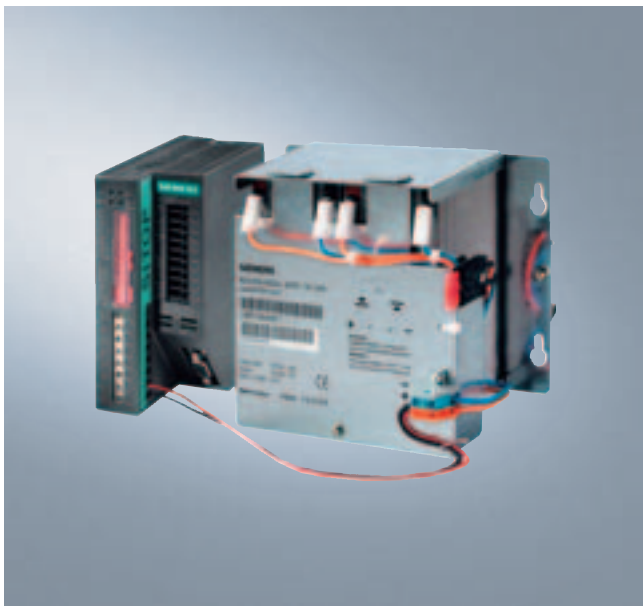
DC-UPS Module with Battery Module

By combining a DC-UPS Module with at least one 24 V Battery Module and SITOP power supply, longer power failures can be completely bridged.

This combination can be used e. g. in

• mechanical engineering
• textile industry
• all types of production lines and filling systems

This prevents the negative effects which often result due to power failures.

Siemens offers the uninterruptible power supplies DC-UPS 6 A, DC-UPS 15 A and DC-UPS 40 A as well as the Battery Modules 1.2 Ah, 2.5 Ah, 3.2 Ah, 7 Ah and 12 Ah for "NONSTOP" applications.

Application

DC-UPS Modules for complete uninterruptible bridging of power failures including exhaustive discharge protection, battery life time monitoring and ON/OFF control current circuit.

• 24 V DC input voltage
(supply through SITOP power supply from 5 A rated current)
• Rated output power 144 W (DC-UPS 6 A) and 360 W (DC-UPS 15 A)
• Rated output power 480 W or 960 W (DC-UPS 40 A with one or two Battery Modules)
• High efficiency of approx. 95 to 97%
• Power ON threshold adjustable through DIP switch between 22 V to 25.5 V
• Bridging time adjustable with DIP switch in the range between 5 s to 635 s or until switched off automatically due to complete discharge
• Option: Signals can be output via serial interface or USB interface, automatic restart of industrial PCs supported through selectable deactivation behavior

Function

The rechargeable battery is connected to the system as soon as the load voltage or the voltage between the connections L+/M of the DC-UPS Module falls below the set value of the 22 V to 25.5 V threshold.

After a power failure the Battery Module is disconnected automatically from the loads by electronic means and immediately recharged with a 0.2/0.4 A (DC-UPS Module 6 A), 0.35/0.7 A (DC-UPS Module 15 A) or 1/2 A (DC-UPS Module 40 A) constant current (V/I characteristic with 26.3 V to 29.3 V end-of-charge voltage).

For increased load current demands (e. g. when incandescent lamps, power contactors with DC auto-connected windings, DC motors, DC/DC converters, Electronic Modules with high input capacity are connected to the system), electronically limited peak currents are supplied automatically.

The operating state (mains/battery operation, battery level > 85% as well as buffer ready/alarm) is signaled with LEDs and floating relay contacts.

Especially for SIMOTION P350 applications (V3.1 and higher), the module can be used with a serial interface. The operating state is transmitted to the system software over a Software Module which is already installed on P350 and can then be evaluated in the user program. For details, please consult the device and installation and commissioning manual for SIMOTION P350.

Selection and ordering data   Order No.

Uninterruptible power supplies	
• **DC-UPS Modules**	
- DC-UPS Module 6 A	**6EP1931-2DC21**
- DC-UPS Module 6 A with serial interface	**6EP1931-2DC31**
- DC-UPS Module 6 A with USB interface	**6EP1931-2DC41**
- DC-UPS Module 15 A	**6EP1931-2EC21**
- DC-UPS Module 15 A with serial interface	**6EP1931-2EC31**
- DC-UPS Module 15 A with USB interface	**6EP1931-2EC41**
- DC-UPS Module 40 A	**6EP1931-2FC21**
- DC-UPS Module 40 A with USB interface	**6EP1931-2FC41**
• **Battery Modules**	
- 1.2 Ah Battery Module for DC-UPS Module, 6 A	**6EP1935-6MC01**
- 2.5 Ah Battery Module for DC-UPS Module, 6 A and 15 A	**6EP1935-6MD31**
- 3.2 Ah Battery Module for DC-UPS Module, 6 A and 15 A	**6EP1935-6MD11**
- 7 Ah Battery Module for DC-UPS Module, 6 A, 15 A and 40 A	**6EP1935-6ME21**
- 12 Ah Battery Module for DC-UPS Module, 6 A, 15 A and 40 A	**6EP1935-6MF01**

Further information

For further information see Catalog KT 10.1 and the Interactive Catalog under "Power Supplies/SITOP power".

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Overview
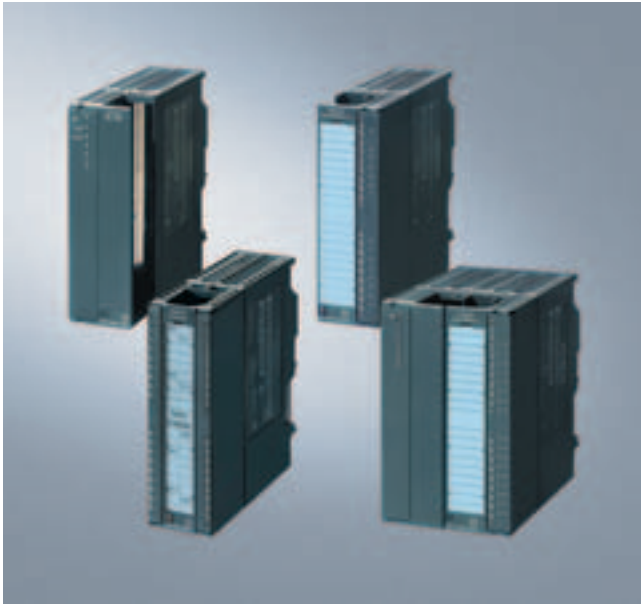
SIMATIC S7-300 I/O Modules

The following SIMATIC S7-300 I/O Modules can be used as:

- Central I/O within SIMOTION C230-2
  The I/O configuration comprises two tiers for central I/O with up to 8 I/O Modules per tier, of which up to 4 can be Analog Modules. The second tier is connected over IM 365.
- Distributed I/O in the modular I/O system ET 200M with the IM 153 Head Module
  (up to 8 I/O Modules per ET 200M)

The I/O Modules which can be used with SIMOTION are listed in a compatibility list which can be found at:

http://www4.ad.siemens.de/WW/view/en/11886029

Application

Signal conditioning

I/O Modules transform the levels of the external digital and analog process signals into the internal signal levels for SIMOTION and vice versa. In addition, signal-preprocessing Function Modules and Communication Modules are available.

Connectable devices

The following can be connected to SIMOTION over I/O Modules:

- Digital and analog sensors
- Digital and analog actuators
- Switches
- Encoders
- Printers, barcode readers, ...
- AS-Interface slaves
- Identification systems

Advantages to the customer through the use of SIMATIC S7-300 I/O Modules

- Optimal adaptation
  The number of inputs/outputs can be adapted to the corresponding task with the help of modules which can be combined as required. Unnecessary investments can be avoided.
- Flexible process connection
  SIMOTION can be connected to the process over different digital and analog actuators and sensors.
- Powerful analog technology
  Different input/output ranges and high resolution allow connection of many different analog sensors and actuators.
- Intelligent Function Modules
  Function Modules (FM) relieve the CPU from time-intensive tasks such as counting and outputting cams.
- Communication Modules
  Communication Modules (CP) implement serial data exchange over point-to-point connections and connection of AS-Interface slaves.

Design

SIMATIC S7-300 I/O Modules for digital and analog inputs/outputs have the following mechanical characteristics:

- Compact design
  The rugged plastic casing contains:
  - Green LEDs for indicating the signal states on the inputs/outputs
  - Red LED to indicate that a diagnostics is being performed (for modules capable of diagnostics)
  - Sockets for front connectors, protected behind front door
  - Labeling area on front door
- Simple assembly
  The modules are mounted one after the other to the mounting rail from the left to the right and connected to neighboring modules with bus connectors. There are no slot rules. The addresses of the inputs are determined by the slot.
- User-friendly wiring
  The modules are wired with front connectors. When the module is connected for the first time, a coding latches in the connector so that the connector now only fits onto modules of the same type. When a module is replaced, the front connector can be plugged onto the new module of the same type with the complete wiring. The front connectors are available as screw-type or spring-loaded connectors.

Further information

For further information see Catalog ST 70 and the Interactive Catalog under "Automation Systems/SIMATIC Industrial Automation Systems".

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Digital Modules

Selection and ordering data	Order No.	Selection and ordering data	Order No.
Digital Input Modules SM 321, isolated [1]		• 8 DO, 120 V/230 V AC, 1 A	**6ES7322-1FF01-0AA0**
• 16 DI, 24 V DC		• 8 DO, 120 V/230 V AC, 2 A, with single root and selectable failure mode, 40-pole	**6ES7322-5FF00-0AB0**
- Standard	**6ES7321-1BH02-0AA0**		
- Isochronous, High Speed	**6ES7321-1BH10-0AA0**	• 16 DO, 120 V/230 V AC, 1 A	**6ES7322-1FH00-0AA0**
- Source input	**6ES7321-1BH50-0AA0**	• 32 DO, 120 V/230 V AC, 1 A, double-width, 2 x 20-pole	**6ES7322-1FL00-0AA0**
• 32 DI, 24 V DC, 40-pole	**6ES7321-1BL00-0AA0**		
• 8 DI, 120 V/230 V AC		• 8 DO (relay outputs), 24 V DC, 2 A or 230 V AC, 2 A	**6ES7322-1HF01-0AA0**
- Standard	**6ES7321-1FF01-0AA0**	• 8 DO (relay outputs), 120 V DC, 5 A or 230 V AC, 5 A, connector with spring-loaded terminal can be used for 6ES7392-1BM01-0AA0 and higher, 40-pole	**6ES7322-1HF10-0AA0**
- With single-root, 40-pole	**6ES7321-1FF10-0AA0**		
• 16 DI, 24 V to 48 V AC/DC with single root, 40-pole	**6ES7321-1CH00-0AA0**		
• 16 DI, 48 V to 125 V DC	**6ES7321-1CH20-0AA0**	• 8 DO (relay outputs), 24 V DC, 120 V to 230 V AC, 5 A, with RC filter, overvoltage protection, 40-pole	**6ES7322-5HF00-0AB0**
• 16 DI, 120 V/230 V AC	**6ES7321-1FH00-0AA0**		
• 32 DI, 120 V AC, 40-pole	**6ES7321-1EL00-0AA0**	• 16 DO, solid state relays, 24 V to 48 V AC/DC, 0.5 A, with single root, 40-pole	**6ES7322-5GH00-0AB0**
• 16 DI, 24 V DC Process alarm, diagnostics, parameterizable input delay, isochronous	**6ES7321-7BH01-0AB0**		
		• 16 DO (relay outputs), 24 V to 120 V DC, 2 A or 48 V to 230 V AC, 2 A	**6ES7322-1HH01-0AA0**
Digital Output Modules SM 322, isolated [1]		• 8 DO, 24 V DC, 0.5 A, short-circuit protection, diagnostics	**6ES7322-8BF00-0AB0**
• 8 DO, 24 V DC, 2 A	**6ES7322-1BF01-0AA0**	**Digital Input/Output Modules SM 323 / SM 327, isolated** [1]	
• 8 DO, 48 V to 125 V DC, 1.5 A	**6ES7322-1CF00-0AA0**	• 8 DI, 8 DO, 24 V DC, 0.5 A	**6ES7323-1BH01-0AA0**
• 16 DO, 24 V DC, 0.5 A		• 16 DI, 16 DO, 24 V DC, 0.5 A, 40-pole	**6ES7323-1BL00-0AA0**
- Standard	**6ES7322-1BH01-0AA0**	• 8 DI, 8 DX, 24 V DC, 0.5 A, 8 DX per single channel parameterizable as DI or DO	**6ES7327-1BH00-0AB0**
- Isochronous, High Speed	**6ES7322-1BH10-0AA0**		
• 32 DO, 24 V DC, 0.5 A, 40-pole	**6ES7322-1BL00-0AA0**	**Accessories and spare parts**	See "Accessories and spare parts"

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1) Incl. labeling strips and bus connectors, 20-pole front connector required (if not specified otherwise).

Selection and ordering data	Order No.
Analog Input Modules SM 331, isolated [1]	
• 2 AI (1 AI for resistor), U/I/thermoelement/resistor/ Pt 100/Ni 100, alarm, diagnostics, resolution 9/12/14 bits (+ sign)	**6ES7331-7KB02-0AB0**
• 8 AI (4 AI for resistor), U/I/thermoelement/resistor/ Pt 100/Ni 100, alarm, diagnostics, resolution 9/12/14 bits (+ sign)	**6ES7331-7KF02-0AB0**
• 8 AI, U/I/resistor/Pt 100/Ni 100/Ni 1000/ LG-Ni 1000 (standard, air-conditioned), resolution 12 bits + sign/13 bits, 40-pole	**6ES7331-1KF01-0AB0**
• 8 AI, U/I, alarm and diagnostics, resolution 13 bits + sign/14 bits, isochronous, high speed	**6ES7331-7HF01-0AB0**
• 8 AI, U/I, alarm and diagnostics, resolution 15 bits (+sign), 40-pole	
- 2 channels with limit value monitoring, isolation between channels and backplane bus	**6ES7331-7NF00-0AB0**
- Fast measured value update, 8 channels with limit value monitoring, isolation between channels and backplane bus as well as between channels in groups of 2	**6ES7331-7NF10-0AB0**
• 8 AI, 2/3/4-wire, resistor, Pt 100/200/500/1000, Ni 100/120/200/500/1000, Cu 10, characteristics in accordance with Gost, 16 bits (24 bits internally), 40-pole	**6ES7331-7PF01-0AB0**
• 8 AI, thermoelements Type B, E, J, K, L, N, R, S, T, U, 16 bits (24 bits internally), 40-pole	**6ES7331-7PF10-0AB0**
Analog Output Modules SM 332, isolated [1]	
• AO, 0 V to 10 V, ±10 V, 1 V to 5 V, 0 mA/4 mA to 20 mA, 11 bits +sign/12 bits	
- 2 AO	**6ES7332-5HB01-0AB0**
- 4 AO	**6ES7332-5HD01-0AB0**
- 8 AO	**6ES7332-5HF00-0AB0**
• 4 AO, 0 V to 10 V, ±10 V, 1 V to 5 V, 0 mA/4 mA to 20 mA, 14 bits +sign/15 bits +sign, isochronous, high speed	**6ES7332-7ND02-0AB0**

Selection and ordering data	Order No.
Analog Input/Output Modules SM 334 [1]	
• 4 AI, 2 AO, non-isolated, 0 V to 10 V, 0 mA to 20 mA, 8 bits	**6ES7334-0CE01-0AA0**
• 4 AI, 2 AO (2 AI under power), isolated, 12 bits, input: 0 V to 10 V, Pt 100 (climatic range only), resistance measurement 10 kΩ, output: 0 V to 10 V	**6ES7334-0KE00-0AB0**
Fast SM 335 Analog Input/Output Module [1]	
4 fast analog inputs (basic conversion time for 4 channels, max. 1 ms), 4 fast analog outputs (conversion time per channel, max. 0.8 ms), encoders supplied with 10 V/25 mA, 1 counter input (24 V/500 Hz), special operating modes: "Measuring only" and "Comparator"	
• 4 AI, 4 AO, isolated, alarm and diagnostics, input: ±1 V, ±2.5 V, ±10 V, 0 V to 2 V, 0 V to 10 V, ±10 mA, 0 mA/4 mA to 20 mA, 13 bits +sign, 14 bits; (up to 2 channels parameterizable as current input) Output: ±10 V, 0 V to 10 V, 11 bits +sign, 12 bits	**6ES7335-7HG01-0AB0**
• Interference protection filter The interference protection filter must be connected to the 24 V power circuit of the power supply for the SM 335 and can protect up to 4 SM 335. This is specified to ensure that the usual interference immunity for SIMOTION can be achieved.	**6ES7335-7HG00-6AA0**
Manual for SM 335	
• German	**6ES7335-7HG00-8AA1**
• English	**6ES7335-7HG00-8BA1**
Accessories and spare parts	**See "Accessories and spare parts"**

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[1] Incl. labeling strips and bus connectors, 20-pole front connector required (if not specified otherwise).

| SM 338 Ultrasonic Position Sensing Module | SM 338 POS Input Module |

■ **Overview**

The SM 338 is a Position Sensing Module for ultrasonic sensors.

Up to four sensors can be connected to the module. In turn, each sensor can have up to four measuring points. The total number of measuring points on all of the connected sensors must not exceed 8.

■ **Application**

The Position Sensing Module can be operated as follows:

• Centrally on SIMOTION C
• Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

A configuration kit is required to integrate the SM 338 Module into SIMOTION.

■ Selection and ordering data	Order No.
SM 338 Ultrasonic Position Sensing Module For detecting positions with ultra-sound sensors with start/stop interface	6ES7338-7UH01-0AC0
Configuration kit for SM 338 Including manual (electronic)	6AT1733-5DA00-2YA0
Manual for SM 338 Ultrasonic Position Sensing Module Languages:	
• German	6ES7338-7UH00-8AC0
• English	6ES7338-7UH00-8BC0
Sub D connector 25-pole, pins	6ES5750-2AA31

■ **Overview**

The SM 338 POS Input Module converts SSI encoder signals from the process into digital values for SIMOTION.

In addition, SSI encoder statuses can be picked up via two module-internal digital inputs.

The POS Input Module supports isochronous operation and has:

• 3 SSI encoder inputs
• 2 digital inputs
• 24 V DC encoder supply

■ **Application**

The SM 338 POS Input Module can be used as an encoder module for position-controlled hydraulic applications, for example.

It can be used with SIMOTION in the following way:

• Centrally on SIMOTION C
• Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

■ Selection and ordering data	Order No.
SM 338 POS Input Module For connecting 3 SSI encoders, incl. 2 freeze inputs	6ES7338-4BC01-0AB0
SIMATIC Manual Collection	6ES7998-8XC01-8YE0
20-pole front connector	**See "Accessories and spare parts"**

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FM 350-1 Counter Module	FM 350-2 Counter Module

■ Overview

- Single-channel intelligent Counter Module for simple counting tasks
- For direct connection of incremental encoders
- Compare function with two definable comparison values
- Integrated digital outputs for response output when the comparison value is reached
- Operating modes:
  - Continuous counting
  - One-time counting
  - Periodic counting
- Special functions:
  - Set counter
  - Latch counter
  - Start/stop counter via gate function

■ Application

The single-channel FM 350-1 Counter Module can be operated as follows:

- Centrally on SIMOTION C
- Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

The standard functions required to use the FM 350-1 in connection with SIMOTION are included in the SIMOTION Function Library.

■ Selection and ordering data   Order No.

FM 350-1 Counter Module Including SIMATIC configuration package on CD with 1 channel, 500 kHz; maximum; for incremental encoders	6ES7350-1AH03-0AE0
20-pole front connector, shield connecting element and shield terminals	See "Accessories and spare parts"
Connectable incremental encoder 6FX2001-2...	See catalogs NC 60, NC Z, or CA 01

■ Overview

- 8-channel intelligent Counter Module for universal counting and measuring tasks
- For direct connection of 24 V incremental encoders, direction encoders, initiators, or NAMUR encoders
- Compare function with definable comparison values (number depends on operating mode)
- Integrated digital outputs for response output when the comparison value is reached
- Operating modes:
  - Continuous/one-time/periodic counting
  - Frequency/speed measurement
  - Period measurement
  - Dosing

■ Application

The 8-channel FM 350-2 Counter Module can be operated as follows:

- Centrally on SIMOTION C
- Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

The standard functions required to use the FM 350-2 in connection with SIMOTION are included in the SIMOTION Function Library.

■ Selection and ordering data   Order No.

FM 350-2 Counter Module Including SIMATIC configuration package on CD with 8 channels, 20 kHz; maximum; for 24 V incremental encoders and NAMUR encoders	6ES7350-2AH00-0AE0
40-pole front connector, shield connecting element and shield terminals	See "Accessories and spare parts"

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| FM 352 electronic output cam controller | FM 352-5 high-speed boolean processor |

Overview

- High-speed electronic output cam controller
- Economic alternative to mechanical output cam controllers
- 32 output cam tracks, 13 on board digital outputs for direct output of actions
- Position sensing by means of incremental encoders or absolute encoders with synchronous-serial transmission (SSI)

Application

The FM 352 electronic cam controller can be operated as follows:

- Centrally on SIMOTION C
- Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

The standard functions required to use the FM 352 in connection with SIMOTION are included in the SIMOTION Function Library.

Selection and ordering data

	Order No.
FM 352 electronic cam controller Incl. SIMATIC configuration package on CD	6ES7352-1AH01-0AE0
Sub D connector 15-pole, pins; for encoder cable	6ES5750-2AA21
20-pole front connector, Shield connecting element and shield terminals	See "Accessories and spare parts"

Overview

The FM 352-5 Module is a high-speed processor for boolean operations (LAD, FBD) that processes these operations with a fixed cycle time of 1 microsecond.

Application

The module has been designed for applications which require extremely short response times.

The program stored on the module links:
- 12 integrated digital inputs
- 8 integrated digital outputs

An SSI absolute encoder, 5 V incremental encoder (RS 422) or 24 V incremental encoder can be connected to the encoder interface.

The application program is written with the STEP 7 program editor and stored on the Micro Memory Card (MMC) in compiled form after successful simulation.

The FM 352-5 Module can be operated as follows:
- Centrally on SIMOTION C
- Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

Selection and ordering data

	Order No.
FM 352-5 high-speed boolean processor	
• with current sinking digital outputs	6ES7352-5AH00-0AE0
• with current sourcing digital outputs	6ES7352-5AH10-0AE0
Configuration software FM 352-5 (German, English, French, Italian, Spanish) on CD with electronic manual	6ES7352-5AH00-7XG0
128 KB Micro Memory Card	6ES7953-8LG11-0AA0
512 KB Micro Memory Card	6ES7953-8LJ11-0AA0
2 MB Micro Memory Card	6ES7953-8LL11-0AA0
40-pole front connector	See "Accessories and spare parts"

8

| **CP 340 Communication Module** | **CP 341 Communication Module** |

■ Overview
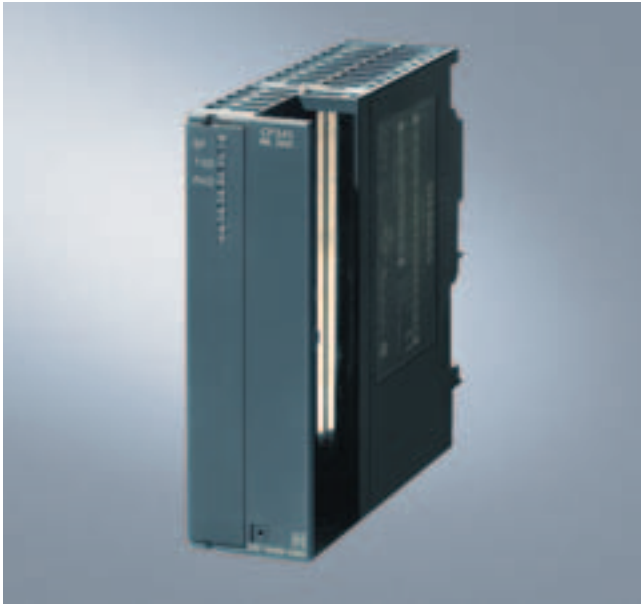
- The cost-effective, complete solution for serial communication over a point-to-point connection
- 3 versions with different physical transmission characteristics:
  - RS 232 C (V.24)
  - 20 mA (TTY)
  - RS 422/RS 485 (X.27)
- Implemented protocols: ASCII, 3964 (R) and printer driver (3964 (R) not for RS 485)
- Simple configuration over SCOUT with integrated parameterization tool

■ Application

The CP 340 Communication Module can be operated as follows:
- Centrally on SIMOTION C
- Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

The standard functions required to use the CP 340 in connection with SIMOTION are included in the SIMOTION Function Library.

■ Overview
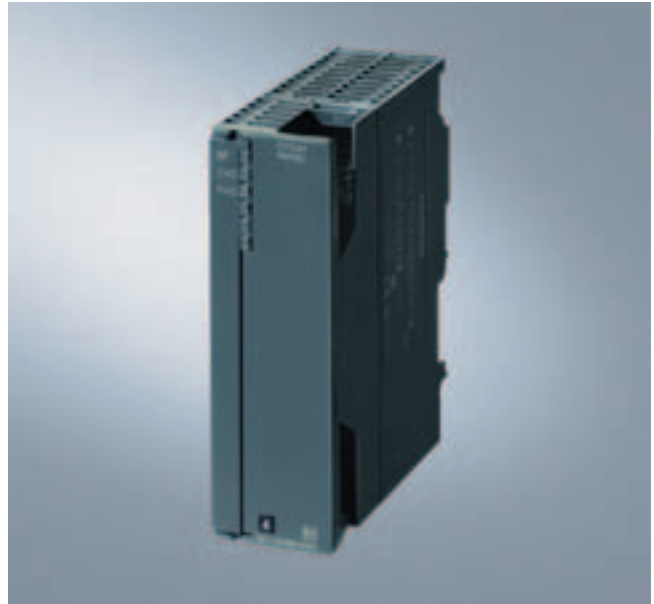
- The fast and powerful serial data exchange over a point-to-point connection
- 3 versions with different physical transmission characteristics:
  - RS 232 C (V.24)
  - 20 mA (TTY)
  - RS 422/RS 485 (X.27)
- Implemented protocols: ASCII, 3964 (R), RK 512 (3964 (R), RK 512 not for RS 485)
- Simple configuration over SCOUT with integrated parameterization tool

■ Application

The CP 341 Communication Module can be operated as follows:
- Centrally on SIMOTION C
- Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

The special drivers that can be downloaded for the CP 341 are not supported by SIMOTION.

The standard functions required to use the CP 341 in connection with SIMOTION are included in the SIMOTION Function Library.

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■ Selection and ordering data — Order No.

CP 340 Communication Module Incl. SIMATIC configuration package on CD with:	
• 1 RS 232 C interface (V.24)	**6ES7340-1AH01-0AE0**
• 1 20 mA interface (TTY)	**6ES7340-1BH00-0AE0**
• 1 RS 422/485 (X.27) interface	**6ES7340-1CH00-0AE0**
CP 341 Communication Module Incl. SIMATIC configuration package on CD with:	
• 1 RS 232 C interface (V.24)	**6ES7341-1AH01-0AE0**
• 1 20 mA interface (TTY)	**6ES7341-1BH01-0AE0**
• 1 RS 422/485 (X.27) interface	**6ES7341-1CH01-0AE0**

■ Selection and ordering data — Order No.

RS 232 C connection cable 9-pole Sub D socket each	
5 m (16 ft)	**6ES7902-1AB00-0AA0**
10 m (32 ft)	**6ES7902-1AC00-0AA0**
15 m (49 ft)	**6ES7902-1AD00-0AA0**
20 mA (TTY) connection cable 9-pole Sub D connector each	
5 m (16 ft)	**6ES7902-2AB00-0AA0**
10 m (32 ft)	**6ES7902-2AC00-0AA0**
50 m (164 ft)	**6ES7902-2AG00-0AA0**
RS 422/485 connection cable 15-pole Sub D connector each	
5 m (16 ft)	**6ES7902-3AB00-0AA0**
10 m (32 ft)	**6ES7902-3AC00-0AA0**
50 m (164 ft)	**6ES7902-3AG00-0AA0**

SM 374 Simulator Module	DM 370 Dummy Module

Overview

- Simulator Module for program testing during commissioning and operation
- Simulation of sensor signals over switches
- Display of signal states on outputs with LEDs

Design

The front panel is equipped with:
- 16 switches for the simulation of input signals
- 16 LEDs for displaying the signal state at outputs
- Mode selector
  With the aid of a screwdriver, you can set three operating modes:
  - 16 inputs (input simulation only)
  - 16 outputs (output simulation only)
  - 8 inputs and 8 outputs (input and output simulation)

Function

The module is mounted onto the mounting rail instead of a Digital Input or Output Module.

The CPU reads the set input signal states of the Simulator Module and processes these in the user program. The output signal states are sent to the module as a result and indicated there with LEDs. The LEDs allow conclusions to be drawn about the execution of the program.

Selection and ordering data   Order No.

SM 374 Simulator Module	6ES7374-2XH01-0AA0
For the simulation of 16 inputs or 16 outputs (16 switches, 16 LEDs)	

Overview

- Dummy Module for reserving slots for unconfigured Signal Modules
- When replaced with a Signal Module (SM), configuration and address assignment remain unchanged.

The DM 370 Dummy Module reserves a slot for an unconfigured Signal Module.

When replaced with a Signal Module, the mechanical configuration and address assignment of the overall configuration remain unchanged.

Selection and ordering data   Order No.

DM 370 Dummy Module	6ES7370-0AA01-0AA0
Incl. bus connector, labeling strips	

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Selection and ordering data	Order No.
Bus connectors	**6ES7390-0AA00-0AA0**
Key for C230-2 2 units	**6ES7911-0AA00-0AA0**
Slot label	**6ES7912-0AA00-0AA0**
Labeling sheets (for WORD template see: http://www4.ad.siemens.de/WW/ view/en/11978022) For Signal Modules (except 32-chan- nel) and Function Modules, DIN A4, for printing with laser printer, 10 units	
• petrol	**6ES7392-2AX00-0AA0**
• light-beige	**6ES7392-2BX00-0AA0**
• yellow	**6ES7392-2CX00-0AA0**
• red	**6ES7392-2DX00-0AA0**
For 32-channel Signal Modules, DIN A4, for printing with laser printer; 10 units	
• petrol	**6ES7392-2AX10-0AA0**
• light-beige	**6ES7392-2BX10-0AA0**
• yellow	**6ES7392-2CX10-0AA0**
• red	**6ES7392-2DX10-0AA0**
Labeling strips 10 units (spare part)	
• For modules with 20-pole front connector	**6ES7392-2XX00-0AA0**
• For modules with 40-pole front connector	**6ES7392-2XX10-0AA0**
Cover foil for labeling strips 10 units (spare part)	
• For modules with 20-pole front connector	**6ES7392-2XY00-0AA0**
• For modules with 40-pole front connector	**6ES7392-2XY10-0AA0**
Shield connection element	**6ES7390-5AA00-0AA0**
Shield terminal element 2 units per packing unit	
• For 2 cables with 2 mm to 6 mm (0.08 in to 0.24 in) Ø each	**6ES7390-5AB00-0AA0**
• For 1 cable with 3 mm to 8 mm (0.12 in to 0.31 in) Ø each	**6ES7390-5BA00-0AA0**
• For 1 cable with 4 mm to 13 mm (0.16 in to 0.51 in) Ø each	**6ES7390-5CA00-0AA0**

Selection and ordering data	Order No.
Front door Raised design 5 units per packing unit	**6ES7328-0AA00-7AA0**
Front connector With screw-type terminals	
• 20-pole, 1 unit	**6ES7392-1AJ00-0AA0**
• 20-pole, 100 units	**6ES7392-1AJ00-1AB0**
• 40-pole, 1 unit	**6ES7392-1AM00-0AA0**
• 40-pole, 100 units	**6ES7392-1AM00-1AB0**
Front connector With spring-type terminals, 1 unit	
• 20-pole	**6ES7392-1BJ00-0AA0**
• 40-pole	**6ES7392-1BM01-0AA0**
2 Effective Range Modules for analog inputs	**6ES7974-0AA00-0AA0**
Fuse set 10 fuses, 8 A, quick-response, 2 fuse holders	**6ES7973-1HD00-0AA0**
SIMATIC Manual Collection Electronic manuals on CD-ROM and DVD, multilingual	**6ES7998-8XC01-8YE0**
Sub D connector	
• 9-pole, pins	**6ES5750-2AA11**
• 9-pole, socket	**6ES5750-2AB11**
• 15-pole, pins	**6ES5750-2AA21**
SIMATIC S7-300, DIN rail	
• L = 160 mm (6.3 in)	**6ES7390-1AB60-0AA0**
• L = 480 mm (18.9 in)	**6ES7390-1AE80-0AA0**
• L = 530 mm (20.87 in)	**6ES7390-1AF30-0AA0**
• L = 830 mm (32.68 in)	**6ES7390-1AJ30-0AA0**
• L = 2000 mm (78.74 in)	**6ES7390-1BC00-0AA0**
Connection method SIMATIC TOP connect	**See Catalog ST 70 and Interactive Catalog CA 01**

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General information

■ Overview
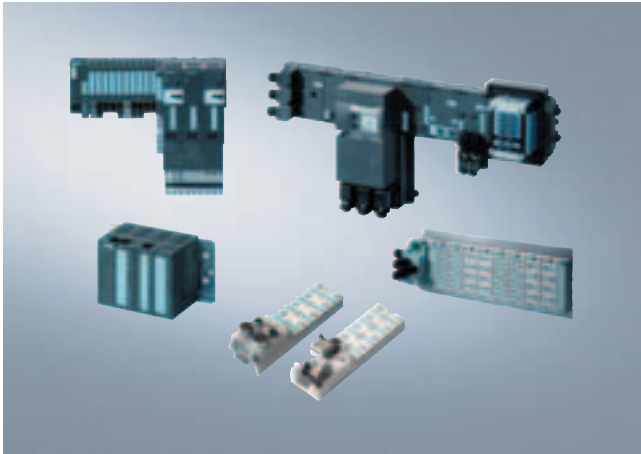
ET 200 variants

Perfect communication on all levels

Distributed machine and plant configurations have now become common practice in automation technology. This reduces the wiring outlay and significantly increases flexibility and reliability.

Data transmission on the field level is handled by the standardized fieldbus PROFIBUS DP. And the AS-Interface handles communication on the actuator/sensor level. This allows problem-free data exchange throughout the whole automation world.

PROFIBUS DP

PROFIBUS DP is a fast, standardized bus system for the field level.

The following automation components, for example, can be connected to each other over the PROFIBUS DP fieldbus:

- Programmable SIMATIC controllers
- SIMOTION Motion Control system
- Numerical SINUMERIK controls
- SIMADYN control systems
- SIMATIC industrial PC computer systems or PC-based control

With the distributed SIMATIC ET 200 I/O system digital and analog inputs and outputs can be connected to SIMOTION. Intelligent, distributed I/O Modules can also be used with SIMATIC ET 200.

PROFIBUS DP is already completely integrated in the new SIMOTION world: Both the hardware and the software. This results in simple handling right from the start. The interfaces for PROFIBUS DP are integrated in all SIMOTION devices.

The isochronous mode functionality also allows PROFIBUS DP to be used to integrate drives.

PROFINET

PROFINET is the innovative and open Industrial Ethernet standard (IEC 61158) for industrial automation. With PROFINET, devices can be linked up from the field level through to the management level.

It will soon be possible to integrate the distributed SIMATIC ET 200 I/O systems into SIMOTION over PROFINET.

AS-Interface

With the AS-Interface, actuators and sensors on the field level can be connected with a simple two-core cable. In addition to communication, this two-core cable is also used to supply the individual stations with power.
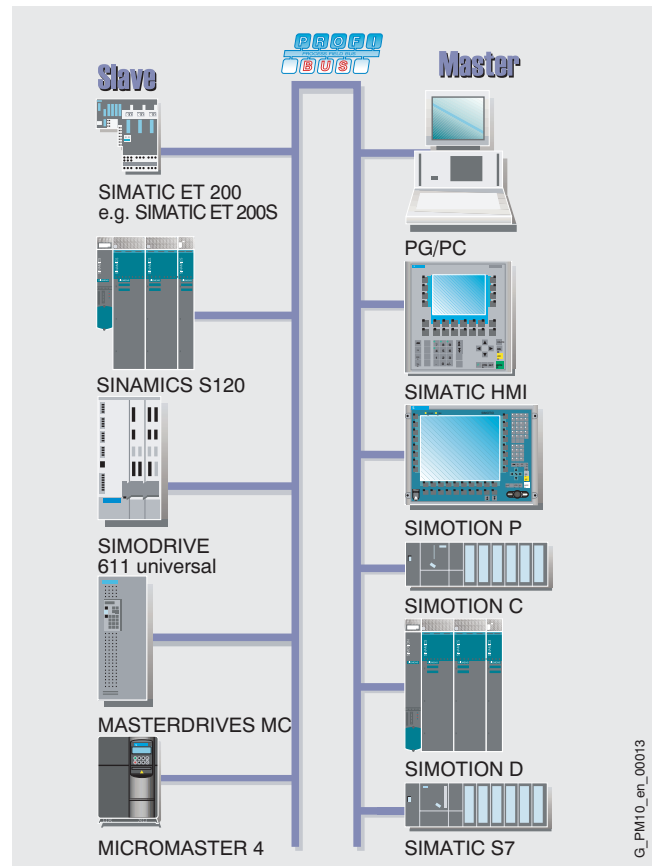
Master/slave configuration on PROFIBUS DP

ET 200 distributed I/O

The distributed SIMATIC ET 200 I/O provide I/O systems for many different applications:

- SIMATIC ET 200M, the modular I/O system for control cabinet installation and high channel densities
- SIMATIC ET 200S, the bit-modular I/O system for control cabinet installation including motor starters, safety technology and individual grouping of the load groups
- SIMATIC ET 200X, the modular I/O system with IP65/67 degree of protection for control cabinet-free use close to the machine including motor starters and Pneumatic Modules as well as DESINA and ECOFAST-compliant modules
- SIMATIC ET 200pro, the new modular I/O system with IP65/66/67 degree of protection for control cabinet-free use close to the machine; with new features such as small frame size, integrated PROFIsafe safety technology, PROFINET connection and hot swapping of modules
- SIMATIC ET200eco, the compact, economical I/O system with IP67 degree of protection for control cabinet-free use close to the machine with flexible and fast ECOFAST or M12 connection system

■ Further information

For further information see Catalog IK PI and the Interactive Catalog under "Automation Systems/SIMATIC Industrial Automation Systems/Distributed I/O".

The I/O Modules that can be used with SIMOTION are listed in the compatibility list which can be found at:

http://www4.ad.siemens.de/WW/view/en/11886029

SIMATIC ET 200M

Application

ET 200M with power supply

SIMATIC ET 200M is a modular I/O system with IP20 degree of protection.

It can be expanded with the Signal and Function Modules of the SIMATIC S7-300 automation system.

Due to its wide range of modules, the SIMATIC ET 200M I/O system is especially well-suited for individual and complex automation tasks with high channel densities.

SIMATIC ET 200M is a passive station (Slave) on the PROFIBUS DP field bus. The maximum data transfer rate is 12 Mbit/s.

In conjunction with the IM 153-2 High Feature interface, it is possible to synchronously detect or output signal states at precisely defined times by means of the isochronous PROFIBUS DP. Isochronous mode is supported by selected I/O Modules (see the ET 200M manual). It is possible to combine isochronous and non-isochronous modules in a single station.

Design

The SIMATIC ET 200M modular I/O system consists of
- one IM 153 interface,
- up to 8 I/O Modules of the SIMATIC S7-300 automation system and
- one PS 307 power supply if required.

Any combination of I/O Modules is possible, permitting optimum adaptation to requirements.

The SIMATIC ET 200M I/O system is connected to the PROFIBUS DP using an IM 153 interface.

A connection to the PROFIBUS DP can be implemented with optical fiber technology by means of integrated interfaces on the IM 153-2 FO or by means of additional OLMs (Optical Link Modules) or OBTs (Optical Bus Terminals).

Connection with bus connectors

The SIMATIC S7-300 simple design using bus connectors makes the SIMATIC ET 200M flexible and easy to maintain:
- Module installation
  The modules are simply hooked onto the rail, swung into place, and screwed tight.
- Integrated backplane bus
  The backplane bus is integrated in the modules. Module interfacing takes place by means of bus connectors inserted into the rear of the housing.

Function

The inputs and outputs of the modular SIMATIC ET 200M I/O system can be accessed from the user program in the SIMOTION Motion Control system in the same manner as central inputs and outputs.

Communications over the bus system are handled completely by the SIMOTION Master and the IM 153 interface. Diagnostic functions verify proper operation of the SIMATIC ET 200M.

The SIMATIC ET 200M diagnoses the following:
- Module faults
- Short-circuits (outputs)
- Bus faults, that is, faulty data transfer
- 24 V DC load voltage supply problems

The diagnostics data are analyzed as follows:
- In a distributed configuration through diagnostic LEDs on the SIMATIC ET 200M
- In a central configuration by means of the SIMOTION Master

Selection and ordering data

	Order No.
IM 153-1 interface For connecting to PROFIBUS DP, with RS 485 interface	**6ES7153-1AA03-0XB0**
IM 153-2 High Feature interface For connecting to PROFIBUS DP, with RS 485 interface isochronous	**6ES7153-2BA00-0XB0**
IM 153-2 FO interface High Feature For connecting to PROFIBUS DP, with FOC interface	**6ES7153-2BB00-0XB0**
Distributed I/O system ET 200M manual With description of S7-300 Signal Modules	
• German	**6ES7153-1AA00-8AA0**
• English	**6ES7153-1AA00-8BA0**
I/O Modules For use with the ET 200M I/O system	**See SIMATIC S7-300 I/O**

Further information

For further information see Catalog IK PI or the Interactive Catalog under "Automation Systems/SIMATIC Industrial Automation Systems/Distributed I/O".

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SIMATIC ET 200S

■ Overview
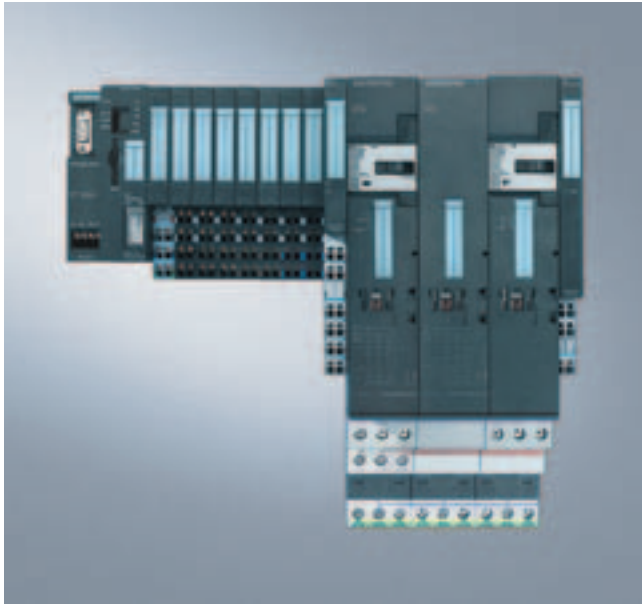
ET 200S with IM 151-7 CPU and 2 motor starters

- Distributed I/O system with IP20 degree of protection
- Bit-modular design for exact adaptation to the automation task
- Permanent wiring
- Large module range:
  - Interface Module with/without integrated CPU
  - Input/Output Modules
  - Technology Modules
  - Motor starter
- Can also be used for time-critical tasks
- Integration of safety technology
- Channel-specific diagnostics for high availability
- Integrated CPU as mini PLC on PROFIBUS DP
- Variable voltage groups through Power Modules
- Flexible connection method (2/3/4-wire connections as screw-type and spring-loaded terminals and Fast Connect)
- ET 200S configurator software (see Catalog CA 01 on CD/DVD, SIMATIC selection tool)

■ Application

The comprehensive module range with uniform handling for configuration, assembly and programming allows the SIMATIC ET 200S to be used as a universal I/O system.

The bit-modular design permits fast and optimal adaptation to the requirements of the automation task:

- No reserves
- No unnecessary channels

Even if requirements change frequently, setup times can be reduced significantly by replacing or combining different I/O Modules.

The transmission rate of up to 12 Mbit/s on PROFIBUS DP and the powerful internal data transmission makes the SIMATIC ET 200S also perfectly suited for time-critical applications.

Signal states can be acquired and output synchronously and at specified times over the isochronous PROFIBUS DP in conjunction with the IM 151-1 High Feature Interface Module. Isochronous mode is supported by selected I/O Modules (see ET 200S manual). It is possible to combine Isochronous and Non-isochronous Modules in a single station.

In addition to an Interface Module for connecting the ET 200S to PROFIBUS DP (either RS 485 or FOC) for distributed automation tasks, an Interface Module with integrated CPU is also available. The maintenance-free CPU (without battery) integrated in the Interface Module is based on the SIMATIC S7-300 CPU 314 and is programmed with STEP 7. The CPU permits distributed on site preprocessing of process data and communicates with the higher-level Motion Control system as a PROFIBUS DP slave.

Due to the integration of the SIGUARD safety technology, the SIMATIC ET 200S can also be used for safety-related applications.

The construction of the SIMATIC ET 200S allows it to be used under increased mechanical load. The system features support high machine availability requirements.

■ Design

The SIMATIC ET 200S distributed I/O system consists of:

- IM 151 Interface Module
- Digital and Analog Electronics Modules
- Technology Modules, e. g. for counter/position detection tasks
- Motor starters
- Terminating Module (part of the scope of supply of the IM 151)
- Power Modules

A SIMATIC ET 200S station consists of up to 63 I/O Modules with up to 244 bytes for inputs and 244 bytes for outputs. The I/O Modules can be combined as required.

The SIMATIC ET 200S is installed with permanent wiring:

All modules are plugged onto purely mechanical Terminal Modules. These Terminal Modules contain the complete wiring and can be mounted on standard 35 x 15 mm (1.38 x 0.59 in) or 35 x 7.5 mm (1.38 x 0.29 in) mounting rails.

This results in the following advantages:

- Simple implementation of the wiring without additional electronics components
- Fast and safe testing of wiring even under power
- Tool-free replacement of Electronics Modules
- Automatic coding of Electronics Modules for safe replacement (protected against polarity reversal)

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Selection and ordering data	Order No.
Interface Modules Transmission rate up to 12 Mbit/s	
• **IM 151-1 BASIC Interface Module** Up to 12 Power, Electronics and Motor Starter Modules connectable (except F Modules), for connection to PROFIBUS DP, with RS 485 interface	**6ES7151-1CA00-0AB0**
• **IM 151-1 Standard Interface Module** Data volume 128 bytes per input and output, up to 63 I/O Modules connectable, for connection to PROFIBUS DP with RS 485 interface	**6ES7151-1AA04-0AB0**
• **IM 151-1 High Feature Interface Module** As IM 151-1 standard, but with 244 byte data volume per input and output for use with isochronous I/O	**6ES7151-1BA00-0AB0**
• **IM 151-1 FO Interface Module** As IM 151-1 standard, but with FOC interface	**6ES7151-1AB03-0AB0**
• **IM 151-7 CPU Interface Module** With integrated PROFIBUS DP interface (RS 484 interface), 64 KB main memory	**6ES7151-7AA11-0AB0**
• **IM 151-7 CPU FO Interface Module** As IM 151-7 CPU, but with FOC interface, 48 KB main memory	**6ES7151-7AB00-0AB0**
IM 151-7 F-CPU Interface Module Integrated, failsafe CPU	*For further information on the F-CPU and F-I/O, see Catalog IK PI and the Interactive Catalog under "Automation Systems/ Industrial Automation Systems/ Distributed I/O".*
Master Interface Module Expands the IM 151-7 CPU (6ES7151-7AA1*-0AB0) by a DP master interface; max. up to one module per CPU	**6ES7138-4HA00-0AB0**
Micro Memory Card (MMC) For IM 151-7 CPU absolutely required for program backup	
• 64 KB	**6ES7953-8LF11-0AA0**
• 128 KB	**6ES7953-8LG11-0AA0**
• 512 KB	**6ES7953-8LJ11-0AA0**
• 2 MB for program backup and/or firmware update	**6ES7953-8LL11-0AA0**
• 4 MB	**6ES7953-8LM11-0AA0**
• 8 MB	**6ES7953-8LP11-0AA0**
Power Modules Ordering unit: 1 unit	
PM-E 24 V DC For Electronics Modules, with diagnostics	**6ES7138-4CA01-0AA0**
PM-E 24 V to 48 V DC For Electronics Modules, with diagnostics	**6ES7138-4CA50-0AB0**
PM-E 24 V to 48 V DC, 24 V to 230 V AC For Electronics Modules, with diagnostics and fuse	**6ES7138-4CB10-0AB0**

Selection and ordering data	Order No.
Digital Electronics Modules Ordering unit: 5 units, width 15 mm (0.59 in)	
• 2 DI, 24 V DC, standard	**6ES7131-4BB01-0AA0**
• 4 DI, 24 V DC, standard	**6ES7131-4BD01-0AA0**
• 4 DI, 24 V DC, SOURCE INPUT (source inputs)	**6ES7131-4BD51-0AA0**
• 4 DI, 24 V DC, NAMUR (ordering unit: 1 unit)	**6ES7131-4RD01-0AB0**
• 2 DI; 120 V AC	**6ES7131-4EB01-0AB0**
• 2 DI; 230 V AC	**6ES7131-4FB01-0AB0**
• With parameterizable input delay and diagnostics	
- 2 DI, 24 V DC, High Feature [1]	**6ES7131-4BB01-0AB0**
- 4 DI, 24 V DC, High Feature [1]	**6ES7131-4BD01-0AB0**
- 4 DI, 24 V to 48 V DC [1]	**6ES7131-4CD00-0AB0**
• 2 DO, 24 V DC/0.5 A, standard	**6ES7132-4BB01-0AA0**
• 4 DO, 24 V DC/0.5 A, standard [1]	**6ES7132-4BD01-0AA0**
• 2 DO, 24 V DC/2 A, standard	**6ES7132-4BB31-0AA0**
• 4 DO, 24 V DC/2 A, standard	**6ES7132-4BD31-0AA0**
• With diagnostics for short-circuit and wire break, output of replacement value	
- 2 DO, 24 V DC/0.5 A, High Feature [1]	**6ES7132-4BB01-0AB0**
- 2 DO, 24 V DC/2 A, High Feature [1]	**6ES7132-4BB31-0AB0**
- 2 DO, 24 V to 230 V AC/1 A, output of replacement value	**6ES7132-4FB01-0AB0**
- 2 DO, 24 V DC to 230 V AC/5 A, relay, NO contact, output of re- placement value	**6ES7132-4HB01-0AB0**
- 2 DO, 24 V DC to 230 V AC/5 A, relay, changeover contact, output of replacement value	**6ES7132-4HB11-0AB0**
Analog Electronics Modules Ordering unit: 1 unit, width 15 mm (0.59 in)	
• 2 AI, U, standard, cycle time 65 ms per channel, ±5 V, ±10 V, 1 V to 5 V, 13 bits (+ sign)	**6ES7134-4FB01-0AB0**
• 2 AI, U, High Speed [1], process and diagnostic alarm, cycle time 1 ms (both channels), ±2.5 V, ±5 V, ±10 V, 1 V to 5 V, 13 bits (+ sign)	**6ES7134-4FB51-0AB0**
• 2 AI, U, High Feature, cycle time 210 ms (both channels), ±5 V, ±10 V, 1 V to 5 V, 15 bits (+ sign), operational limit ±0.1 %	**6ES7134-4LB00-0AB0**
• 2 AI, I, 2-wire, standard, cycle time 65 ms per channel, 4 mA to 20 mA, 13 bits	**6ES7134-4GB01-0AB0**
• 4 AI, I, 2-wire, standard, cycle time 40 ms per module, 4 mA to 20 mA, 13 bits	**6ES7134-4GD00-0AB0**
• 2 AI, I, 4-wire, standard, cycle time 65 ms per channel, 4 mA to 20 mA, ±20 mA, 13 bits (+ sign)	**6ES7134-4GB11-0AB0**

1) Usable as isochronous I/O; for information on T_{DPmin}, see manual.

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Selection and ordering data	Order No.
• 2 AI, I, 2-wire, High Speed [1], process and diagnostic alarm, cycle time 1 ms (both channels), 0/4 mA to 20 mA, 13 bits	6ES7134-4GB51-0AB0
• 2 AI, I, 4-wire, High Speed [1], process and diagnostic alarm, cycle time 1 ms (both channels), 0/4 mA to 20 mA, ±20 mA, 13 bits (+ sign)	6ES7134-4GB61-0AB0
• 2 AI, I, 2/4-wire, High Feature, cycle time 210 ms (both channels), 4 mA to 20 mA, ±20 mA, 15 bits (+ sign), operational limit ±0.1 %	6ES7134-4MB00-0AB0
• 2 AI, TC, standard, cycle time 65 ms per channel, characteristic linearization for thermoelements of types: B, E, J, K, L, N, R, S, T, voltage measuring: ±80 mV, 15 bits + sign	6ES7134-4JB00-0AB0
• 2 AI, TC, High Feature, with internal temperature compensation, cycle time 80 ms per channel, characteristic linearization for thermoelements of types: B, E, J, K, L, N, R, S, T, voltage measuring: ±80 mV, 15 bits + sign (special TM required)	6ES7134-4NB01-0AB0
• 2 AI, RTD, standard, cycle time 130 ms per channel, Pt 100, Ni 100, (standard, climate) Resistance: 150 Ω, 300 Ω and 600 Ω, 14 bits to 15 bits + sign	6ES7134-4JB50-0AB0
• 2 AI, RTD, High Feature as RTD Standard, but with additional functions such as: higher accuracy, additional measuring ranges, internal compensation of cable resistances	6ES7134-4NB51-0AB0
• 2 AO, U, standard, cycle time < 1.5 ms (both channels), ±10 V, 13 bits + sign, 1 V to 5 V, 12 bits	6ES7135-4FB01-0AB0
• 2 AO, U, High Feature [1], conversion time per channel max. 1 ms, ±10 V, 15 bits + sign, 1 V to 5 V, 14 bits, operational limit ±0.07 %	6ES7135-4LB01-0AB0
• 2 AO, I, standard, cycle time < 1.5 ms (both channels), ±20 mA, 4 mA to 20 mA, 13 bits + sign	6ES7135-4GB01-0AB0
• 2 AO, I, High Feature [1], conversion time per channel max. 1 ms, ±20 mA, 4 mA to 20 mA, 15 bits + sign, operational limit ±0.07 %	6ES7135-4MB01-0AB0
Technology Modules Ordering unit: 1 unit (if not specified otherwise)	
• **SSI Module, 1 channel** [1] For connecting SSI absolute encoders, with latch input and comparison value, width 15 mm (0.59 in)	6ES7138-4DB02-0AB0

Selection and ordering data	Order No.
• **Pulse generator 2 PULSES, 2 channels** Pulse generator and Timer Module for controlling actuators, valves, heating elements, etc., optionally over PWM modulation, pulse chains or time-limited permanent signals at the 24 V output, width 15 mm (0.59 in)	6ES7138-4DD00-0AB0
• **Counter Module 1 COUNT, 24 V/100 kHz, 1 channel** [1] Connection of incremental encoders, direction encoders and initiators; counting operating mode: once, endless or periodic; measuring operating mode: speed, frequency or cycle duration, with DI, DO and comparison value, width 15 mm (0.59 in)	6ES7138-4DA04-0AB0
• **Counter Module 1 COUNT, 5 V/500 kHz, 1 channel** [1] Connection of RS 422 incremental encoders; counting operating mode: once, endless or periodic, measuring operating mode: speed, frequency or cycle duration, with DI, DO and comparison value, width 30 mm (1.18 in)	6ES7138-4DE02-0AB0
• **Sensor Module 4 IQ-Sense** For connecting up to 4 IQ-Sense sensors, with SF-LED, width 15 mm (0.59 in), ordering unit: 5 units *For suitable sensors, see Catalogs NS K, IK PI or the Interactive Catalog under "Sensors, Test and Measurement Technology"*	6ES7138-4GA00-0AB0
• **1 SI Interface Module** Serial interface (1 channel): RS 232C, RS 422, RS 485, protocols: ASCII, 3964 (R), width 15 mm (0.59 in)	6ES7138-4DF01-0AB0
• **Stepper Module 1 STEP, 1 channel** For controlled positioning of stepper motor axes, interface to RS 422 and 2 DI, width 15 mm (0.59 in) *Power section for FM STEPDRIVE stepper motors, see System Components/Drives*	6ES7138-4DC00-0AB0
• **Positioning Module 1 POS U, 1 channel** For controlled positioning with digital outputs for 5 V/24 V incremental encoder, SSI encoder, width 30 mm (1.18 in)	6ES7138-4DL00-0AB0
Reserve Module For reserving space in unused slots	
• Width 15 mm (0.59 in) (5 units)	6ES7138-4AA01-0AA0
• Width 30 mm (1.18 in) (1 unit)	6ES7138-4AA11-0AA0

1) Usable as isochronous I/O; for information on T_{DPmin}, see manual.

Selection and ordering data	Order No.
Terminal Modules **for TM-P Power Modules** [1] Ordering unit: 1 unit, width 15 mm (0.59 in)	
• 2 x 3 terminals **with terminal access to AUX1,** **AUX1 connected through to the** **left**	
- TM-P15S23-A1, screw-type terminals	**6ES7193-4CC20-0AA0**
- TM-P15C23-A1, spring-loaded terminals	**6ES7193-4CC30-0AA0**
- TM-P15N23-A1, Fast Connect	**6ES7193-4CC70-0AA0**
• 2 x 3 terminals **with terminal access to AUX1,** **AUX1 interrupted to the left**	
- TM-P15S23-A0, screw-type terminals	**6ES7193-4CD20-0AA0**
- TM-P15C23-A0, spring-loaded terminals	**6ES7193-4CD30-0AA0**
- TM-P15N23-A0, Fast Connect	**6ES7193-4CD70-0AA0**
• 2 x 2 terminals **without terminal access to** **AUX1, AUX1 connected through** **to the left**	
- TM-P15S22-01, screw-type terminals	**6ES7193-4CE00-0AA0**
- TM-P15C22-01, spring-loaded terminals	**6ES7193-4CE10-0AA0**
- TM-P15N22-01, Fast Connect	**6ES7193-4CE60-0AA0**
Terminal Modules **for TM-E Electronics Modules** [1] Ordering unit: 1 unit, width 30 mm (1.18 in) for 1 COUNT 5 V/500 kHz and 1 POS U	
• 4 x 4 terminals without terminal access to AUX1, AUX1 connected through to the left	
- TM-E30S44-01, screw-type terminals	**6ES7193-4CG20-0AA0**
- TM-E30C44-01, spring-loaded terminals	**6ES7193-4CG30-0AA0**
• 4 x 6 terminals with terminal access to AUX1, AUX1 connected through to the left	
- TM-E30S46-A1, screw-type terminals	**6ES7193-4CF40-0AA0**
- TM-E30C46-A1, spring-loaded terminals	**6ES7193-4CF50-0AA0**
Terminal Modules For TM-E Electronics Modules [1] Ordering unit: 1 unit, width 15 mm (0.59 in), for 2 AI TC High Feature	
• Terminal Modules for internal **temperature compensation** **for 2 AI TC High Feature**	
- TM-E15S24-AT, screw-type terminals	**6ES7193-4CL20-0AA0**
- TM-E15C24-AT, spring-loaded terminals	**6ES7193-4CL30-0AA0**

Selection and ordering data	Order No.
Terminal Modules **for TM-E Electronics Modules** [1] Ordering unit: 5 units, width 15 mm (0.59 in)	
• 2 x 4 terminals With terminal access to AUX1, AUX1 connected through to the left	
- TM-E15S24-A1, screw-type terminals	**6ES7193-4CA20-0AA0**
- TM-E15C24-A1, spring-loaded terminals	**6ES7193-4CA30-0AA0**
- TM-E15N24-A1, Fast Connect	**6ES7193-4CA70-0AA0**
• 2 x 6 terminals With terminal access to AUX1, AUX1 connected through to the left	
- TM-E15S26-A1, screw-type terminals	**6ES7193-4CA40-0AA0**
- TM-E15C26-A1, spring-loaded terminals	**6ES7193-4CA50-0AA0**
- TM-E15N26-A1, Fast Connect	**6ES7193-4CA80-0AA0**
• 2 x 3 terminals Without terminal access to AUX1, AUX1 connected through to the left	
- TM-E15S23-01, screw-type terminals	**6ES7193-4CB00-0AA0**
- TM-E15C23-01, spring-loaded terminals	**6ES7193-4CB10-0AA0**
- TM-E15N23-01, Fast Connect	**6ES7193-4CB60-0AA0**
• 2 x 4 terminals Without terminal access to AUX1, AUX1 connected through to the left	
- TM-E15S24-01, screw-type terminals	**6ES7193-4CB20-0AA0**
- TM-E15C24-01, spring-loaded terminals	**6ES7193-4CB30-0AA0**
- TM-E15N24-01, Fast Connect	**6ES7193-4CB70-0AA0**
Standard motor starter With diagnostics, electromechanical, fuseless, expandable with Brake Control Module	
• DS1-x direct starters	3RK1301- ■ ■ B00-0AA2
• RS1-x reversing starters	3RK1301- ■ ■ B00-1AA2
< 0.06 kW (0.1 HP) [2]; 0.14 A to 0.20 A [3]	**0 B**
0.06 kW (0.1 HP) [2]; 0.18 A to 0.25 A [3]	**0 C**
0.09 kW (0.12 HP) [2]; 0.22 A to 0.32 A [3]	**0 D**
0.10 kW (0.13 HP) [2]; 0.28 A to 0.40 A [3]	**0 E**
0.12 kW (0.16 HP) [2]; 0.35 A to 0.50 A [3]	**0 F**
0.18 kW (0.24 HP) [2]; 0.45 A to 0.63 A [3]	**0 G**
0.21 kW (0.28 HP) [2]; 0.55 A to 0.80 A [3]	**0 H**
0.25 kW (0.3 HP) [2]; 0.70 A to 1.0 A [3]	**0 J**
0.37 kW (0.5 HP) [2]; 0.9 A to 1.25 A [3]	**0 K**
0.55 kW (0.7 HP) [2]; 1.1 A to 1.6 A [3]	**1 A**
0.75 kW (1 HP) [2]; 1.4 A to 2.0 A [3]	**1 B**

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1) Consult corresponding TM-P/TM-E manual for selection.
2) Motor output for three-phase standard motor at 400 V
3) Setting range of the overcurrent release

SIMATIC ET 200S

Selection and ordering data	Order No.
0.90 kW (1.2 HP) [1]; 1.8 to 2.5 A [2]	**1 C**
1.1 kW (1.5 HP) [1]; 2.2 A to 3.2 A [2]	**1 D**
1.5 kW (2 HP) [1]; 2.8 A to 4.0 A [2]	**1 E**
1.9 kW (2.5 HP) [1]; 3.5 A to 5.0 A [2]	**1 F**
2.2 kW (2.9 HP) [1]; 4.5 A to 6.3 A [2]	**1 G**
3.0 kW (4 HP) [1]; 5.5 A to 8.0 A [2]	**1 H**
4.0 kW (5.4 HP) [1]; 7.0 A to 10 A [2]	**1 J**
5.5 kW (7.4 HP) [1]; 9.0 A to 12 A [2]	**1 K**
High Feature motor starter With diagnostics; fuseless, expandable with Brake Control Module	
• DS1e-x direct starters	**3RK1301-■ ■ B10-0AA3**
• RS1e-x reversing starters	**3RK1301-■ ■ B10-1AA3**
• DSS1e-x soft starters	**3RK1301-■ ■ B20-0AA3**
0.3 A to 3.0 A [2]	**0 A**
2.4 A to 8.0 A [2]	**0 B**
2.4 A to 16.0 A [2]	**0 C**
Power Module for motor starter	
• PM-D Power Module For 24 V DC with diagnostics	**3RK1903-0BA00**
• Terminal Module For motor starter Power Module PM-D TM-P15-S27-01	**3RK1903-0AA00**
Accessories for standard motor starters	
• **Control kit**	
- For manually operating the contactor contacts during commissioning and servicing (one set contains five control kits)	**3RK1903-0CA00**
- For direct control of contactor (manual control) 24 V DC	**3RK1903-0CG00**
• **Terminal Modules for direct starter**	
- TM-DS45-S32 with supply connection for power bus incl. three caps for terminating the power bus	**3RK1903-0AB00**
- TM-DS45-S31 without supply connection for power bus	**3RK1903-0AB10**
• **Terminal Modules for reversing starter**	
- TM-RS90-S32 with supply connection for power bus incl. three caps for terminating the power bus	**3RK1903-0AC00**
- TM-RS90-S31 without supply connection for power bus	**3RK1903-0AC10**
Accessories for motor starters DS1-x, RS1-x	
• **DM-V15 Distance Module**	**3RK1903-0CD00**
- For direct starters with high temperature and current load; 15 mm (0.59 in) wide	

Selection and ordering data	Order No.
• **Terminal block PE/N**	
- M45-PEN-F, 45 mm (1.57 in) wide; incl. 2 caps; in combination with TM-DS45-S32 or TM-RS90-S32	**3RK1903-2AA00**
- M45-PEN-S, 45 mm (1.57 in) wide; in combination with TM-DS45-S31 or TM-RS90-S31	**3RK1903-2AA10**
Accessories for standard and High Feature motor starters	
• **Jumper Module**	
- M30-PEN, 30 mm (1.18 in) wide; for bridging a 30 mm (1.18 in) module	**3RK1903-0AJ00**
- M15-PEN, 15 mm (0.59 in) wide; for bridging a 15 mm (0.59 in) module	**3RK1903-0AH00**
- M30-L123, 30 mm (1.18 in) wide; Jumper Module; for bridging a 30 mm (1.18 in) module	**3RK1903-0AF00**
- M15-L123, 15 mm (0.59 in) wide; Jumper Module; for bridging a 15 mm (0.59 in) module	**3RK1903-0AE00**
• **Brake Control Module** For motors with a mechanical brake	
- xB1 24 V DC/4 A	**3RK1903-0CB00**
- xB2 500 V DC/0.7 A	**3RK1903-0CC00**
- xB3 24 V DC/4 A, 2 DI 24 V DC Local control with diagnostics: with 2 inputs with quick-stop function	**3RK1903-0CE00**
- xB4 500 V DC/0.7 A, 2 DI 24 V DC Local control with diagnostics: with 2 inputs with quick-stop function	**3RK1903-0CF00**
• **Terminal Modules**	
- TM-xB15 S24-01 for xB1 or xB2	**3RK1903-0AG00**
- TM-xB215 S24-01 for xB1 to xB4	**3RK1903-0AG01**
Accessories for High Feature motor starters	
• **Control Module 2DI, 24 V DC COM** Digital Input Module with two inputs	
- for local motor start functions for mounting to the front of a motor starter	**3RK1903-0CH10**
- for local motor start functions or manual operation for mounting to the front of a motor starter	**3RK1903-0CH20**
• **LOGO! PC cable** For connecting the High Feature motor starter with Switch ES interface to a PC	**6ED1057-1AA00-0BA0**

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1) Motor output for three-phase standard motor at 400 V
2) Setting range of the overcurrent release

■ **Selection and ordering data**	Order No.
• **Terminal Modules**	
- **TM-DS65-S32** For direct starters DS1e-x, DSS1e-x with supply cable connection for power bus incl. three caps for terminating the power bus	**3RK1903-0AK00**
- **TM-DS65-S31** For direct starters DS1e-x, DSS1e-x without supply cable connection for power bus	**3RK1903-0AK10**
- **TM-RS130-S32** For RS1e-x reversing starter with supply cable connection for power bus incl. three caps for terminating the power bus	**3RK1903-0AL00**
- **TM-RS130-S31** For RS1e-x reversing starter without supply cable connection for power bus	**3RK1903-0AL10**
• **M65-PEN-F Power & Control Module** 65 mm (2.56 in) wide incl. two caps in conjunction with TM-DS65-S32/ TM-RS130-S32	**3RK1903-2AC00**
• **M65-PEN-S Connection Module** 65 mm (2.56 in) wide in conjunction with TM-DS65-S31/ TM-RS130-S31	**3RK1903-2AC10**
SIGUARD **Safety Technology**	
• **SIGUARD Power Modules**	
- **PM-D F1,** with diagnostics, for EMERGENCY-OFF applications monitored startup	**3RK1903-1BA00**
- **PM-D F2,** with diagnostics, for protective door monitoring automatic startup	**3RK1903-1BB00**
- **PM-D F3,** with diagnostics, for motor starter expansion for PM-D F1/2 for additional voltage group, time-delayed 0 to 15 seconds	**3RK1903-1BD00**
- **PM-D F4,** with diagnostics, for motor starter expansion for PM-D F1/2 for additional voltage group	**3RK1903-1BC00**
- **PM-D F5,** with diagnostics, for motor starter expansion for PM-D F1 to F4, with four floating release circuits, contact multiplier	**3RK1903-1BE00**
• **SIGUARD Connection Module**	
- **PM-X,** with diagnostics; Connection Module for connecting a safety group and external supply contactor or external safety circuit	**3RK1903-1CB00**

■ **Selection and ordering data**	Order No.
• **Terminal Modules for SIGUARD Power Modules**	
- **TM-PF30 S47-B1,** for PM-D F1/2 with incoming supply U1/U2 and sensor connection	**3RK1903-1AA00**
- **TM-PF30 S47-B0,** for PM-D F1/2 with sensor connection	**3RK1903-1AA10**
- **TM-PF30 S47-C1,** for PM-D F 3/4 with incoming supply U1/U2 and IN+/IN- control input	**3RK1903-1AC00**
- **TM-PF30 S47-C0,** for PM-D F3/4 with incoming supply U2	**3RK1903-1AC10**
- **TM-PF30 S47-D0,** for PM-D F5	**3RK1903-1AD10**
• **Terminal Module for Connection Module SIGUARD** TM-X15 S27-01	**3RK1903-1AB00**
• **F kit 1** Failsafe equipment for DS1-x standard direct starter [1]	**3RK1903-1CA00**
• **F kit 2** Failsafe equipment for RS1-x standard reversing starter [1]	**3RK1903-1CA01**
ET 200S accessories	
• **Shield connection element** Ordering unit: 5 units, pluggable on TM-E and TM-P	**6ES7193-4GA00-0AA0**
• **Shield terminal** Ordering unit: 5 units, for 3 x 10 mm (0.39 in) busbar	**6ES7193-4GB00-0AA0**
• **Grounding terminal** Ordering unit: 1 unit, for cable cross-sections up to 25 mm^2	**8WA2868**
• **3 x 10 mm (0.39 in) busbars** Ordering unit: 1 unit	**8WA2842**
• **SIMATIC, DIN rail**	
- 35 mm (1.38 in), length 483 mm (19 in) for 19" cabinets	**6ES5710-8MA11**
- 35 mm (1.38 in), length 530 mm (20.87 in) for 600 mm (23.62 in) cabinets	**6ES5710-8MA21**
- 35 mm (1.38 in), length 830 mm (32.68 in) for 900 mm (35.43 in) cabinets	**6ES5710-8MA31**
- 35 mm (1.38 in), length 2 m (7 ft)	**6ES5710-8MA41**
ET 200S manual	**Available as a PDF file in different languages over the Internet.**
• Part 1 "System Manual", Part 2 "Motor Starters"	
• IM151-7 CPU	
• Technology Modules	
• Positioning Modules	
• Serial interfaces	

■ **Further information**

For further information on SIMATIC ET 200S and additional accessories, see Catalog IK PI and the Interactive Catalog under "Automation Systems/SIMATIC Industrial Automation Systems/Distributed I/O".

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1) The function of the failsafe kit is already integrated into High Feature motor starters.

SIMATIC ET 200X

Overview
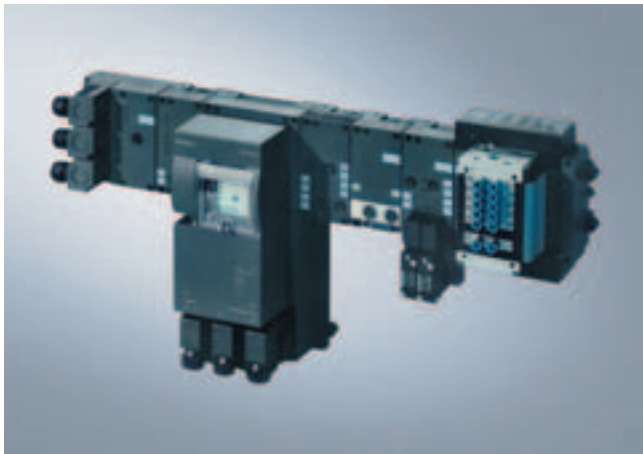
- Distributed I/O system with IP65/67 degree of protection for cabinet-free use close to the machine
- Modular design for adaptation to the automation task in hand
- Input/Output Modules, motor starters, Pneumatic Modules and modules for signal pre-processing (CPU)
- Can also be used for time-critical tasks
- Separate auxiliary supply for easy implementation of load groups
- DESINA-compliant Modules

Application

SIMATIC ET 200X is a distributed I/O system with IP65/67 degree of protection.

Due to its high degree of protection and ruggedness, it is particularly suitable for use close to the machine.

The modular design and high degree of protection, the plug-in connections, and the integration of pneumatic and drive components permit fast and optimal adaptation to the technological function units of a machine.

Even if requirements change frequently, equipment setup times can be reduced significantly by replacing or combining different Basic Modules and Expansion Modules.

The transmission rate of up to 12 Mbit/s on PROFIBUS DP makes the SIMATIC ET 200X also perfectly suited for time-critical applications.

By feeding in separate auxiliary voltages (load supply) for the Power Module, individual modules or module groups can be switched off selectively.

Connection to PROFIBUS DP

On PROFIBUS DP, the ET 200X occupies only a single node address on the bus that is set on the Basic Module. A separate I/O address can be assigned to each Basic Module and Expansion Module.

For the Basic Module with PLC functionality, the addresses for the Expansion Modules are already set by the slot.

The ET 200X complies with EN 50170 for PROFIBUS DP and can be operated with all standardized masters. The 12 Mbit/s transmission speed also permits fast machine functions to be implemented.

Design

The ET 200X distributed I/O system consists of:

- One Basic Module each, with either
  - Digital inputs
  - Digital outputs
  - PLC functionality
  - ECOFAST-compliant
  - DESINA-compliant with parameterizable inputs and outputs
- Max. 7 Expansion Modules

The following Expansion Modules are available:

- Digital inputs/outputs
- Digital inputs/outputs in acc. with DESINA
- Analog inputs/outputs
- Modules with and without channel diagnostics
- Moby Ident System
- Pneumatic Module with integrated valves
- Pneumatic interface for mounting a CPV valve assembly by FESTO; up to 6 interfaces per ET 200X station
- Motor starter (electromechanical or electrical) for controlling any three-phase load (up to 5.5 kW (7.4 HP) at 400 V AC); up to 6 motor starters per ET 200X station
- SITOP power supply (24 V DC optional)

The Expansion Modules are arranged side-by-side by means of integrated plug-in connectors. All the necessary signal leads and auxiliary voltages for inputs and outputs are looped through in this arrangement. The modules can be replaced during servicing, without the entire station having to be dismantled.

Further information

For further information and ordering data see Catalog IK PI and the Interactive Catalog under "Automation Systems/SIMATIC Industrial Automation Systems/Distributed I/O".

Overview

- Compact, cost-effective I/O devices for processing digital signals
- Design without control cabinet, with IP67 degree of protection, with flexible and fast connections
- Comprises a Basic Module and various connection blocks for application-specific implementation options
  - ECOFAST: 2 x RS 485 hybrid fieldbus connection with identification plug for setting the PROFIBUS address
  - M12: 2 x M12 and 2 x 7/8" with 2 rotary coding switches for assigning the PROFIBUS address
- Connection block contains T-functionality for PROFIBUS DP and power supply so that during commissioning and service, the modules can be disconnected from and reconnected to the PROFIBUS without interruption
- Module variants:
  8 DI, 16 DI, 8 DI/8 DO (1.3 A), 8 DI/8 DO (2.0 A), 8 DO, 16 DO
- Module diagnostics for load voltage and encoder short-circuit
- Transmission rates up to 12 Mbit/s

Application

ET 200eco is the compact block I/O with IP67 degree of protection and is distinguished by simple handling and installation.

Et 200eco allows the user to cost-effectively process digital signals on PROFIBUS DP.

Due to its high degree of protection and ruggedness, it is particularly suitable for use close to the machine.

The flexible connection blocks can be used to connect PROFIBUS DP over M12 or a standardized hybrid fieldbus connection (ECOFAST).

The compact ET 200eco can be used as an expansion for applications with high degree of protection in addition to the modular I/O families ET 200X and ET 200pro.

Design

ET 200eco comprises a Basic Module and a connection block.

For applications in many different sectors, a compact, perfectly matched module spectrum of digital I/Os is available:

Number of channels	Type of connection
8 DI	8 individual channels over 8 x M12 screw connections for 8 digital input signals
16 DI	16 channels over 8 x M12 screw connections with double assignment for 16 digital input signals
8 DO	8 individual channels over 8 x M12 screw connections for 8 digital output signals (2 A)
16 DO	16 channels over 8 x M12 screw connections with double assignment for 16 digital output signals (0.5 A)
8 DI/8 DO (2 variants)	16 channels over 8 x M12 screw connections with double assignment for 8 digital input and 8 digital output signals (2 A or 1.3 A)

With the variable and flexible connection blocks, PROFIBUS DP can be connected over 2 x M12, 2 x 7/8" or 2 x hybrid fieldbus interfaces (ECOFAST).

The T-functionality for PROFIBUS DP and power supply are integrated in the connection block so that machines can be operated without interruption during commissioning and service of bus lines and without having to use supplementary components.

The pin assignment for the actuators and sensors is modelled on the IP65/67 standardization trends.

The PROFIBUS address can be set and seen from the outside or plugged. The proven identification connector is used for ECOFAST interfaces. For M12 7/8" interfaces, two rotary coding switches which can be seen from the outside are used to set the PROFIBUS address.

Function

Communication is handled completely over PROFIBUS DP.

Diagnostic functions are available for checking the mode of operation of the ET 200eco:
- BF (bus fault)
- SF (system fault)
- Encoder and load power supply

The diagnostics data are indicated by LEDs on the module and can be evaluated by software on the PG/PC or by SIMOTION.

Short-circuits of the encoder supply as well as missing load voltages are diagnosed for each module.

The connection block can be removed from and screwed back to the Basic Module while the power is on so that PROFIBUS and the power supply remain active for the application all the time.

Further information

For further information as well as ordering data see Catalog IK PI and the Interactive Catalog under "Automation Systems/ SIMATIC Industrial Automation Systems/Distributed I/O".

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SIMATIC ET 200pro

Overview
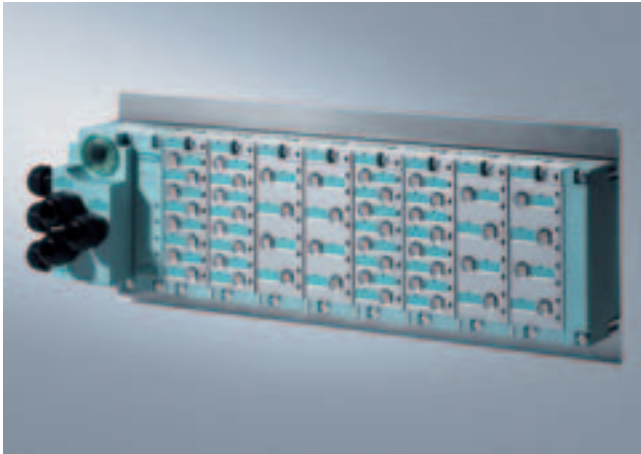
SIMATIC ET 200pro is the new modular I/O system with high IP65/66/67 degree of protection for cabinet-free use close to the machine. ET 200pro distinguishes itself through a small frame size and an innovative installation concept. The ET 200pro station can be adapted very flexibly to the requirements of the corresponding automation task with respect to the connection method, required I/Os and fieldbus connection. New features such as the integrated PROFIsafe safety technology, the PROFINET connection and the ability to hotswap modules permit it to be used for a wide range of applications.

Benefits

- Distributed I/O system with high IP65/66/67 degree of protection
- Flexible fieldbus connection through Interface Modules for PROFIBUS DP and PROFINET
- Modular design with up to 16 Expansion Modules for flexible adaptation to the automation task
- Comprehensive module range
  - Digital and Analog Input and Output Modules
  - Power Module for simple implementation of 24 V load groups
  - Additional modules will be available soon (motor starter, frequency converter, pneumatic components, Moby Ident Module, ...)
- Simple, quick assembly and high vibration strength through rack
- Integration of safety technology with PROFIsafe
- High plant availability through permanent wiring and the ability to replace Electronics Modules during operation and hot swapping
- Low space requirements through small footprint (I/O Module e. g. 130 mm (5.12 in) high and 45 mm (1.77 in) wide)
- Scalable diagnostics concept, optionally with module-specific or channel-specific diagnostics of faults of connected sensors and actuators
- Simple configuration through ET 200pro configurator software

Design

SIMATIC ET 200pro comprises an Interface Module which contains the fieldbus interface (expandable with a comprehensive module range).

The system bus and 24 V power wiring are configured with a busbar system which is integrated in the modules. Wiring using connecting cables is therefore not necessary.

Quick assembly and high vibration strength is achieved through a rack which is available in different variants and is an integral part of the system. The modules are first latched onto this rack and then secured with a few screws to achieve a good fit and very high vibration strength.

The modules of the ET 200pro series usually have two or three components. Interface and Power Modules as well as Digital and Analog Expansion Modules comprise:

- one bus connector which constitutes the backplane bus of the system,
- one Electronics Module or Interface Module and
- one Connection Module.

The tried and tested separation of module and bus/power connection technology which has already been used for the ET 200eco is now also used for the Digital and Analog Expansion Modules of the ET 200pro. For the Interface Module this allows use of the T-functionality for the bus and 24 V power supply, and for the Expansion Modules it permits pre-wiring of sensor/actuator connections. This permanent wiring allows exactly one Electronics Module to be hotswapped in the event of a fault without having to switch off the whole station. This ensures very high plant availability. When an electronics component is replaced, the whole I/O wiring can remain on the Connection Module and does not have to be marked or removed.

Power Modules can be added to the system if selective load groups have to be configured within a station or if a 24 V back-feed is required. The Power Modules interrupt the busbar integrated into the system for the 24 V load supply and feed the power back into the system at the point of connection.

- Up to 16 Expansion Modules can be used (max. station width: 1 meter (3.28 ft))
- Build-as-you-go busbars for 24 V power and communication within the station
- Flexible connection system
  - Connection for PROFIBUS DP and 24 V power supply over direct coupling (M20 cable gland), ECOFAST or M12 / 7/8"
  - Sensors and actuators for 8-channel I/O Modules can be optionally connected to 4 x M12 or 8 x M12

Further information

For further information as well as ordering data see Catalog IK PI and the Interactive Catalog under "Automation Systems/ SIMATIC Industrial Automation Systems/Distributed I/O".

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Overview
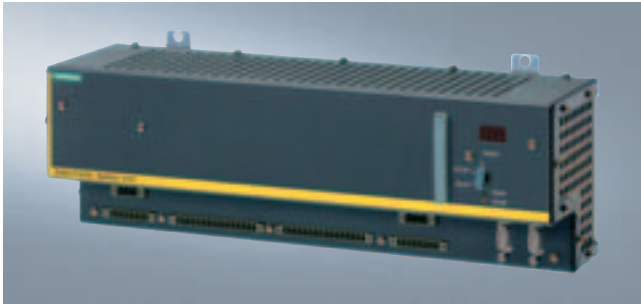
SIMOTION Safety Unit TM 121C

The SIMOTION Safety Unit TM 121 C is an independent, parameterizable electronic safety controller which complies with the requirements of Cat. 4 to EN 954 as well as SIL 3 to IEC 61508. The Canadian requirements for mechanical presses (CSA-Z142-02) are also approved. The safety unit is distinguished by extremely short response times, compact dimensions and simple handling. It has been designed to replace contactor-based safety combinations.

This has the following essential advantages:

- Minimum wiring overheads
- User-friendly diagnostics
- Fast commissioning
- Small space requirements

The SIMOTION safety unit is parameterized with a parameterization software which can be run on any PC with Windows NT4.0/2000/XP. The PC is connected to the Safety Unit over the RS 232 C (V.24) interface for this purpose.

The machine-specific parameter set is stored on a plug-in memory card.

Application

This controller can be used on all production machines with safety-related characteristics, such as presses and woodworking machines.

Design

Depending on its type, the Safety Unit has the following elements:

- 24 or 32 safe inputs
- 8 safe outputs
- 2 safe frequency counters (e. g. for watchman's reporting of operations)
- 8 additional standard outputs for encoder clocking or other output signals

Operating statuses and error messages can be displayed using a 4-digit, 7-segment display.

Function

The safe function blocks listed below are stored on the safety unit as blocks. These function blocks are already programmed and approved and must simply be parameterized by the user for the specific application or linked with the inputs/outputs.

The function blocks can be used several times within a parameter set.

Available function blocks:

- Two-hand operation including simultaneous operation
- Foot operation
- EMERGENCY-OFF connection with monitoring and step-enabling
- Protective door and guard monitoring
- Light curtain (protection and cyclic operation)
- Safe operating mode selection
- Control and monitoring of safety valves
- Safe evaluation of cam signals
- Safe rotary control
- Control of the clutch/brake combination (with monitoring)
- Follow-on time measurement (CSA)
- Start variants for mechanical presses (CSA)

Technical data

Safety Unit TM 121C

Power voltage	24 V DC
Weight, approx.	3 kg (7 lb)
Dimensions (H × W × D)	125 mm × 365 mm × 115 mm (4.92 in × 14.37 in × 4.53 in)
Approval in accordance with UL	Certificate No. 280303-E179336

Selection and ordering data   Order No.

SIMOTION Safety Unit TM 121C Technology Module 8 F-DO 24 V/2 A DC; 8 DO, 24 V/0.5 A DC; 2 24 V/500 Hz counter inputs; including 128 KB memory card; connector set and manual	
• with 24 F-DI, 24 V DC; stand-alone device	**6AU1121-2CA00-0AA0**
• with 32 F-DI, 24 V DC; stand-alone device	**6AU1121-3CA00-0AA0**
• with 32 F-DI, 24 V DC; stand-alone device; **Canadian version** for mechanical presses	**6AU1121-3CA00-1AA0**
Accessories	
Connector sets For TM 121C Safety Unit	
• 5 connector sets (spare part)	**6AU1712-1CB00-0AA0**
Memory card For TM 121C Safety Unit, spare part, 128 KB memory	**6AU1712-1MA00-0AA0**
Software package V2.0 Configuration tool for TM 121C Safety Unit in German and English, standard license including manual on CD-ROM and link cable (RS 232 C)	**6AU1810-0XA20-0XA0**
Manual For TM 121C Safety Unit in German and English	**6AU1900-0CM20-0XA0**
Application manual For presses in German and English	**6AU1900-0DM20-0XA0**

8

ADI 4 (Analog Drive Interface)

Overview

The ADI 4 Interface Module (analog drive interface for 4 axes) can be used to operate up to 4 drives with analog setpoint interface on the isochronous PROFIBUS DP. These can be electrical or hydraulic drives. The ADI 4 can also be used as an external encoder for SIMOTION.

Application

The actual values (encoder values) are transmitted from the ADI 4 Module over PROFIBUS DP to the Motion Control system SIMOTION. The position controller in SIMOTION calculates the speed setpoint value. This value is transmitted over PROFIBUS DP to the ADI 4 Module and output as an analog value there.

The ADI 4 Module is not a DP standard slave which is compliant with the PROFIDrive profile and is therefore only approved for use in conjunction with SIMOTION C/P/D, SINUMERIK 802D/840Di (see Catalog NC 60) or SIMATIC CPU 317T-2 DP (see Catalog ST 70). For this reason, the ADI 4 Module does not support acyclic communication, for example.

The ADI 4 Module must be operated on an isochronous PROFIBUS DP with DP cycle times from 1 ms.

Design

The following interfaces and status indicators are available when using ADI 4 with SIMOTION:

- Connection via PROFIBUS DP to Motion Control functionality (isochronous, max. 12 Mbit/s)
- 4 inputs for incremental encoder (TTL signals) or optionally 4 inputs for absolute encoder (SSI interface). Encoders with SINE/COSINE signals (1 Vpp) can be connected using external pulse shaping electronics (EXE) which convert the signals to the 5 V TTL level.
- 4 analog outputs ±10 V for the setpoint
- 4 relay contacts for drive enable (axes 1 to 4)
- 8 digital outputs
  - DO 1 to DO 4
  - DO 5 to DO 8, general outputs or axis-specific direction signal for axes (for SIMOTION: general outputs only)
- Relay contact 1 and 2 (not supported by SIMOTION)
- 10 digital drive-specific inputs
  - BERO 1 to BERO 4
  - Sensor 1 and sensor 2
  - Ready signal "Drive Ready" for axes 1 to 4
- Onboard status display on 4 diagnostics LEDs

An external power supply (+24 V DC) is required for the module and the digital outputs.

Function

The following functions are available in conjunction with SIMOTION:

- Speed-controlled axes
- Position-controlled axes
- External encoders for SIMOTION
- Homing over BERO or
- Homing over zero marks (non-distance-coded zero marks/ reference marks)
- Measuring over sensor 1 and sensor 2 (one edge, rising or falling)

8

ADI 4 (Analog Drive Interface)

■ **Integration**

ADI 4

	Order No. **Pre-assembled cable**	
X1	Plug [2] **MSTB 2,5/3-ST-5.08 Phoenix** Wire (1.0 to 2.5 mm²)	24 V DC external power supply
X2	PROFIBUS cable see "MOTION CONNECT"	PROFIBUS DP SIMOTION
X3	**6FX2 002-3AD01-1..0** ≤ 35 m (115 ft)	SIMODRIVE 611 4 setpoints
X4/X5	**6FX8 002-2CD01-1..0** [1]	Incremental encoder (TTL) RS 422 5 V DC 6FX2 001-2...
	6FX5 002-2CD24-1..0 [1]	Incremental encoder (TTL) RS 422 24 V DC 6FX2 001-2...
	6FX8 002-2CC11-1..0 [1]	Absolute encoder SSI 6FX2 001-5...
X6-1 Dig. outputs X6-2 Dig. inputs	Plug [2] **FK-MCP 1,5/15-ST-3.81 Phoenix** Wire (0.14 to 2.5 mm²) ≤ 30 m (98 ft)	24 V DC external power supply Sensors 1-n Actuators 1-n

G_PM10_EN_00091

1) The max. cable lengths on the current consumption, power supply and frequency of the encoders (see Manual ADI 4).
2) Included in scope of supply.

Overview of connections for ADI 4

Please observe the maximum permitted cable lengths. Malfunctions may occur if longer lengths are used.

■ **Technical data**

ADI 4 (Analog Drive Interface for 4 axes)

Input voltage	24 V DC
Power capacity, max.	30 W
Inputs/outputs	Isolated
Relay contacts	max. current load: 2 A at 150 V DC or 125 V AC
	Period time: - at 24 V DC, 1 A: 1×10^{7} - at 24 V DC, 2 A: 1×10^{5}
Degree of protection in accordance with DIN EN 60529	IP20
Condensation	not permissible
Perm. ambient temperature	
Storage	-20 °C to +55 °C (-4 °F to +131 °F)
Transport	-40 °C to +70 °C (-40 °F to +158 °F)
Operation	0 °C to +55 °C (32 °F to +131 °F)
Weight, approx.	1.5 kg (3 lb)
Dimensions (W × H × D)	48.5 mm × 325 mm × 154.4 mm (1.91 in × 12.79 in × 6.1 in)

■ **Selection and ordering data**   Order No.

ADI 4 (Analog Drive Interface for 4 axes)	**6FC5 211-0BA01-0AA1**
Manual for ADI 4	
• German	**6FC5297-0BA01-0AP3**
• English	**6FC5297-0BA01-0BP3**
• Italian	**6FC5297-0BA01-0CP3**

8

AS-Interface

■ Overview

An important characteristic of the AS-Interface technology is the use of an unshielded two-core cable for data transmission and distribution of auxiliary power to the sensors and actuators. The special AS-Interface power supply unit supports the AS-Interface transmission method. The mechanically coded and thus polarized AS-Interface cable is used for wiring. The AS-Interface Modules are connected to the AS-Interface cable with insulation piercing contacts.

The ASIsafe concept supports direct integration of safety-related components, such as EMERGENCY-STOP switches, protective door switches or safety light arrays, in the AS-Interface network.

■ Application

Process or field communication

Complex control cable wiring in the control cabinet and control cabinets full of terminal blocks can be replaced with AS-Interface. Thanks to a specially developed ribbon cable (easily recognized by its yellow color) and insulation piercing technology, the AS-Interface cable can be connected anywhere. This concept results in enormous flexibility and significant cost savings. AS-Interface is an open standard (EN 50295/IEC 62026-2). Leading manufacturers of actuators and sensors worldwide support AS-Interface.

AS-Interface is used where individual actuators/sensors are spatially distributed over a machine (e. g. in a bottling plant or production line). AS-Interface replaces complex cable harnesses and connects binary and analog actuators and sensors such as proximity switches, measuring sensors, valves or indicator lights with a SIMOTION control. In practice, this means: Installation runs smoothly because data and power are transported together over a single line. No special expertise is required for installation and commissioning. Furthermore, through simple cable laying and the freely configurable network topology as well as the special design of the cable, you not only significantly reduce the risk of errors, but also service and maintenance costs.

Safety included

The ASIsafe concept supports direct integration of safety-related components, such as EMERGENCY-STOP switches, protective door switches or safety light arrays, in the AS-Interface network. These are fully compatible with the other AS-Interface components (masters, slaves, power supply units, repeaters, etc.) and are operated together on the yellow AS-Interface cable.

The signals of the safety sensors are evaluated by a safety monitor. The safety monitor not only monitors the switching signals of the safety sensors, but also continuously checks whether data transmission is functioning properly. Depending on the variant, the safety monitor has one or two release circuits which are used to put the machine or plant into a safe state. Each release circuit has two switching contacts to fulfill Safety Category 4 in accordance with EN 954-1 or SIL 3 to IEC 61508. Sensors and monitor can be connected at any point in the AS-Interface network. It is also possible to use several safety monitors on a single network.

A failsafe control or special master are not required. The master treats safety slaves in the same way as all other slaves. The safety data are evaluated in the safety monitor. In this way, existing AS-Interface networks can also be expanded.

■ Design

AS-Interface is a single master system. A communication processor (CP 343-2 P), which controls the process or field communication as a master, is used for central application with SIMOTION C or distributed applications over ET 200M. The DP/AS-Interface link 20E is used to establish a direct connection between AS-Interface and PROFIBUS DP.

With the DP/AS-Interface link 20E, AS-Interface can be utilized as a subnet for PROFIBUS DP on SIMOTION C, SIMOTION P and SIMOTION D. Up to 62 slaves can be operated on the AS-Interface. SIMOTION supports all digital and analog AS-Interface slaves (in acc. with Analog Profile 7.3 or 7.4).

The maximum extension of an AS-Interface network is 200 m (600 ft) (with AS-i extension plug) or 100 m (300 ft) (without AS-i extension plug). This length can be greatly increased with the help of repeaters.

The following AS-Interface masters are available for SIMOTION:
- The DP/AS-Interface link 20E connects PROFIBUS DP with AS-Interface.
- The CP 343-2 P is the AS-Interface master for central application with SIMOTION C or for the ET 200M distributed I/O system.

Design

SIMOTION C/P/D

PROFIBUS DP

AS interface master
- LINK 20E
- CP 343-2 P

ET 200

AS interface power supply

AS interface power supply

24 V DC power supply

AS interface distributor
(without AS interface chip)

Repeater

LOGO!

Max. AS-i cable length per segment:
100 m (300 ft) without extension plug
200 m (600 ft) with extension plug

AS interface distributor
(without AS interface chip)

Control panel

Digital/analog I/O module

Max. AS-i cable length per segment:
100 m (300 ft) without extension plug
200 m (600 ft) with extension plug

Safe slave with emergency stop

Signal evaluation

IP65 compact starter

AS-i extension plug
(for segment length up to 200 m (600 ft))

Safety monitor

AS-Interface network topology

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G_PM10_EN_000123

AS-Interface

Selection and ordering data	Order No.
DP/AS-Interface link 20E Router between PROFIBUS DP and AS-Interface with IP20 degree of protection	6GK1415-2AA01
Manual **DP/AS-Interface link 20E** Printed version including type and GSD files	
• German	6GK1971-2DS01-0AA0
• English	6GK1971-2DS01-0AA1
• French	6GK1971-2DS01-0AA2
• Italian	6GK1971-2DS01-0AA4
CP 343-2 P communications processor For connecting SIMOTION C and ET 200M to AS-Interface; without front connector	6GK7343 2AH10-0XA0
20-pole front connector for CP 343-2 P	**See "Accessories and spare parts"**
CP 343-2 P Manual Printed version	
• German	6GK7343-2AH00-8AA0
• English	6GK7343-2AH00-8BA0
• French	6GK7343-2AH00-8CA0
• Italian	6GK7343-2AH00-8EA0

Further information

For further information on AS-Interface slaves, ASIsafe and ordering data please go to

- *http://www.siemens.com/as-interface*
- *Catalog IK PI*
- *Interactive Catalog under "Communication/Networks - SIMATIC NET Communication Systems - AS-Interface".*

8

Overview

The PROFIBUS DP fieldbus is a powerful, open and rugged bus system for fast, cyclic data exchange between field devices. The openness of PROFIBUS DP permits connection of standard components from other manufacturers.

In addition to the I/O Modules approved for SIMOTION, all certified standard slaves can, in principle, be connected to SIMOTION if they support

- cyclic data traffic (DP-V0) and, possibly,
- acyclic data traffic (DP-V1) or
- isochronous data traffic (DP-V2).

These modules are integrated by means of a GSD file provided by the corresponding device manufacturer.
Please note that, in some cases, other conditions may have to be fulfilled to integrate standard slaves into SIMOTION. Some modules need "Driver Modules", e. g. in the form of function blocks, which make integration possible or much easier.
For modules released for use with SIMOTION (e. g. S7-300 Module FM 350-1, ...) these driver blocks are part of the Function Library.

The I/O Modules which can be used with SIMOTION are listed in the compatibility list which can be found at:
http://www4.ad.siemens.com/WW/view/en/11886029

SIPLUS S7-300 and SIPLUS DP

SIPLUS is the product family with hardened/specially treated components based on SIMATIC standard products. SIPLUS permits distributed use of SIMATIC Automation Modules, even under harsh environmental conditions:

- Automation for use under extremely harsh environmental conditions
- With extended temperature range from -25 °C to +60 °C (-13 °F to +140 °F)
- Use in environments with pollutant gases (corrosive gas atmospheres)
- Condensation and increased mechanical loads (shock and vibration) permitted
- Based on the proven PLC technology of the SIMATIC S7-300 with identical functionality
- Approvals and licenses as for SIMATIC types

For further information on SIPLUS, see:
http://www.siemens.com/siplus

MOBY® identification systems

MOBY identification systems control and optimize the flow of materials. They identify reliably, quickly and economically, they are unaffected by contamination and they store data directly on the product.

The data exchange between the mobile data memory and the write/read device is fully automatic and contactless by means of radio frequencies (RF), and does not require a direct line of sight.

MOBY identification systems are available for different fields of application, i. e. for smart labels for logistics, rugged data memories for production lines or long-range data memories for locating and localization.

For further information on MOBY identification systems, see:
http://www.siemens.com/moby

Machine Vision

Visual inspection and recognition of products in manufacturing is more important than the demands on quality and production speed increase. The advantages:

- Decrease of rejects
- Supply of inspected products

The intelligent SIMATIC VS 110, VS 120 and VS 130 vision sensors have been developed especially for application-specific image processing. Due to their user-friendly operation, no special image processing knowledge is required since the intelligent vision sensors are trained rather than programmed.

The general purpose systems SIMATIC VS 710 and SIMATIC VS 720 offer the perfect image processing solution for every sector and image processing task. The vision sensors offer scalability with respect to the test task, processing speed, resolution, monochrome and color identification.

For further information on Machine Vision, see:
http://www.siemens.com/machine-vision

Further information

*For further information on **"Industrial Communication and Field Devices"** see Catalog IK PI and the Interactive Catalog under "Communication/Networks – SIMATIC NET Communication Systems" or the SIMATIC NET home page at:*
http://www.siemens.com/simatic-net

Up-to-date information on PROFIBUS can be found at:
http://www.siemens.com/automation/profibus

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General information

Overview

from left to right:

• SIMOTION D
• Smart Line or Active Line Module
• Double Motor Module
• Single Motor Module

Terminal Modules   Option Boards

Sensor Module

—— MOTION-CONNECT power cable
—— MOTION-CONNECT signal cable
—— DRIVE-CLiQ
-- -- DRIVE-CLiQ MOTION-CONNECT

Synchronous motors with DRIVE-CLiQ interface

Synchronous motor without DRIVE-CLiQ-interface

G_PM10_de_00113
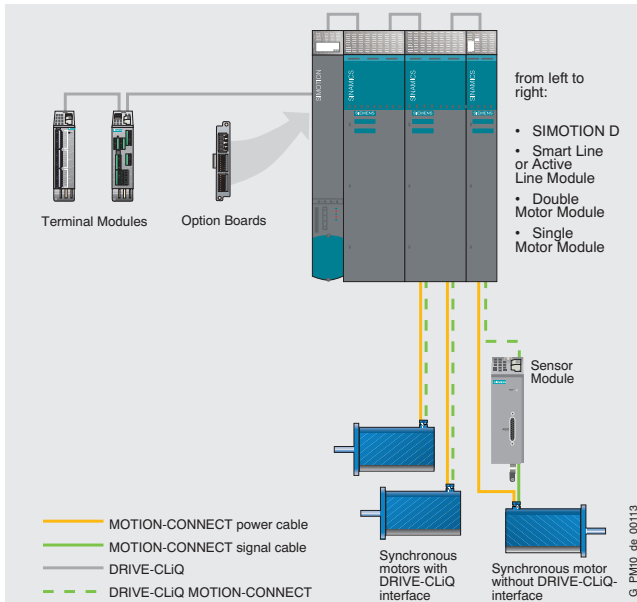
SINAMICS S120 drive system overview

SINAMICS S120 drive system overview

The SINAMICS S120 drive system overview as well as the SIMOTION Motion Control system can be expanded with digital and analog inputs and outputs as well as encoder interfaces with the Option Boards (OB) and Terminal Modules (TM). This is possible with the help of Option Boards (TB30 is plugged into the option slot of the Control Unit) or TMs which are connected via DRIVE-CLiQ to the Control Unit (TM31, TM15, TM17 High Feature).

The Sensor Modules SMC10, SMC20 and SMC30 are required if motors are to be connected without DRIVE-CLiQ and/or if other encoders must be evaluated in addition to the motor encoder.

DRIVE-CLiQ

DRIVE-CLiQ is used to connect the Control Unit with the power components, encoders and other drive system components such as Terminal Modules. Setpoints and actual values, control commands, status messages, and name plate data for the components are transferred via DRIVE-CLiQ.

DRIVE-CLiQ significantly simplifies commissioning and diagnostics since all connected components are identified with the help of an electronic nameplate.

The standardized cables and connectors reduce the variety of different parts and cut storage costs.

Application

TB30

Expansion of the Controller Module with additional digital and analog inputs/outputs. (Plug-in Module for option slot of SIMOTION D or SINAMICS S120 CU320 Control Unit)

TM31

Expansion with digital and analog inputs and outputs over DRIVE-CLiQ

SMC10/20/30

Motor encoder and temperature evaluation of motors without DRIVE-CLiQ or when additional encoders are used (e. g. machine encoders)

TM15 / TM17 High Feature

Implementation of sensor inputs and cam outputs as well as drive-related digital inputs and outputs with short signal delay times (TM17 High Feature can only be used in conjunction with SIMOTION).

Overview of the SINAMICS S120 drive system overview	
TB30	4 DI, 4 DO, 2 AI, 2 AO
TM15	24 isolated, bidirectional DI/DO with sensor and output cam functionality (sensor and output cam functionality only in conjunction with SIMOTION).
TM17 High Feature	16 non-floating, bidirectional DI/DO with sensor and output cam functionality for the highest demands with respect to resolution, accuracy and short input delay times. In addition, enabling inputs can be parameterized.
TM31	8 DI, 4 bidirectional DI/DO, 2 relay outputs, 2 AI, 2 AO, 1 temperature sensor input (KTY84-130 or PTC)
SMC10	One encoder connection for evaluating the resolver signals (two-pole and multi-pole). In addition, the motor temperature can be monitored with a KTY84-130 PTC thermistor.
SMC20	One encoder connection for evaluating incremental encoders (sin/cos 1 V_{pp}) and absolute encoders (EnDat encoders). In addition, the motor temperature can be monitored with a KTY84-130 PTC thermistor.
SMC30	One encoder connection for evaluating incremental encoders (TTL/HTL) with and without wire break detection. In addition, the motor temperature can be monitored with a KTY84-130 PTC thermistor.

Detailed information on TB30, TM31 and SMCs as well as further accessories can be found in Catalog D 21.2 (SINAMICS S120 Servo Control Drive System) and Catalog D 21.1 (SINAMICS S120 Vector Control Drive System).

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■ Integration

For the connection of the drive system overview via DRIVE-CLiQ, two principal possibilities are available for SIMOTION:

- direct connection to SIMOTION D via DRIVE-CLiQ
- connection to a SINAMICS S120 Control Unit CU320, which is
  - via PROFIBUS - connected to the Motion Control system SIMOTION C, P
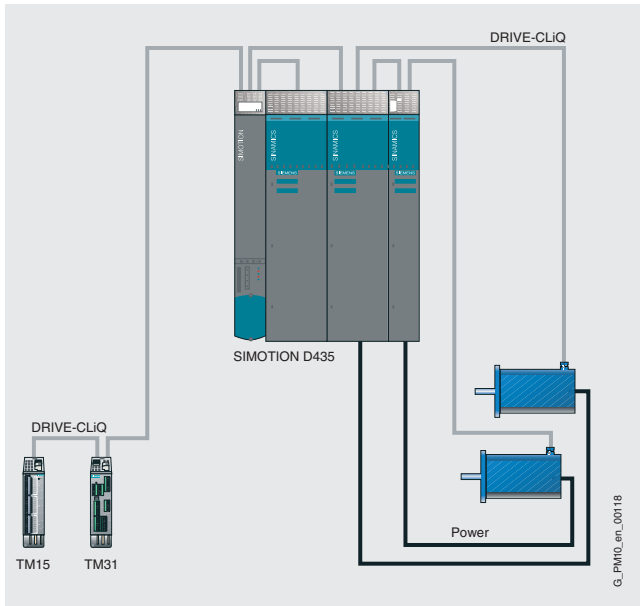
TM15 and TM31 to SIMOTION D
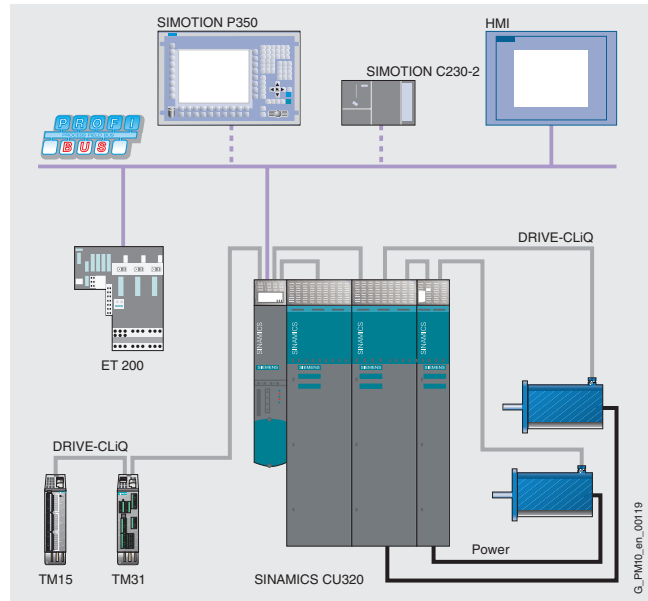
TM15 and TM31 via CU320 to SIMOTION C230-2 or SIMOTION P350

TM15 and TM17 High Feature Terminal Modules

Overview

Terminal Modules TM15 (left) and TM17 High Feature (right)

By means of the Terminal Modules TM15 and TM17 High Feature the sensor inputs and cam outputs for the Motion Control system SIMOTION can be established. Furthermore the Terminal Modules provide drive-related digital inputs and outputs with minor signal delay times.

Application

The main field of application for the TM15 and TM17 High Feature Terminal Modules are applications which in addition to regular digital inputs and outputs also require very accurate sensor inputs and cam outputs. Several sensor inputs or cam outputs can be assigned to a real, virtual axis, or external encoder.

Examples for precise sensing with binary signals:

• Edge detection
• Quality monitoring (e. g. product is good/bad)
• Product tracing (e. g. product is available/not available)
• Detection of print marks
• Misalignment correction with two print marks
• Tool monitoring (e. g. for presses)
• Machine status monitoring (e. g. for broken threads in the textile industry)

Examples for precise output of binary signals

• Position-dependent switching of actuators
  - Camera trigger signal (quality assurance)
  - Control of an air nozzle for blowing away cut-offs
  - Controlling a nozzle for applying glue
• Product extraction from production line
• Implementation of line Motion Control systems
• Output of pulse patterns

Design

On the Terminal Modules are:

• 2 x DRIVE-CLiQ sockets
• Connection for the electronic power supply over the 24 V DC connector

• The logical status of the channel is indicated with the corresponding green status LED.
• The status of the TM15/TM17 High Feature Terminal Module is indicated via a multi-color LED.

The signal cable shield is connected to the TM15 and TM17 with a shield connection terminal, e. g. type SK8 by Phoenix Contact or type KLBÜ CO 1 by Weidmüller.

The TM15 and TM17 High Feature Terminal Modules are snapped onto a standard mounting rail to DIN EN 50022 (35 x 15/7.5).

Function

This results in an easy-to-use, integrated system with the SIMOTION "Sensor", "Output Cam" and "Cam Track" technology packages.

Each of the 24 DI/DO (TM15) or 16 DI/DO (TM17 High Feature) can be parameterized as a digital input (DI), digital output (DO), or sensor input or cam output and can also be inverted. Parameterization is performed with the SCOUT engineering software.

• Each channel can be parameterized as a digital input (DI) or digital output (DO).
• Each channel can be parameterized as a sensor input.
• Each sensor input has selectable edge detection (falling, rising or both edges).
• Each channel can be parameterized as a cam output.
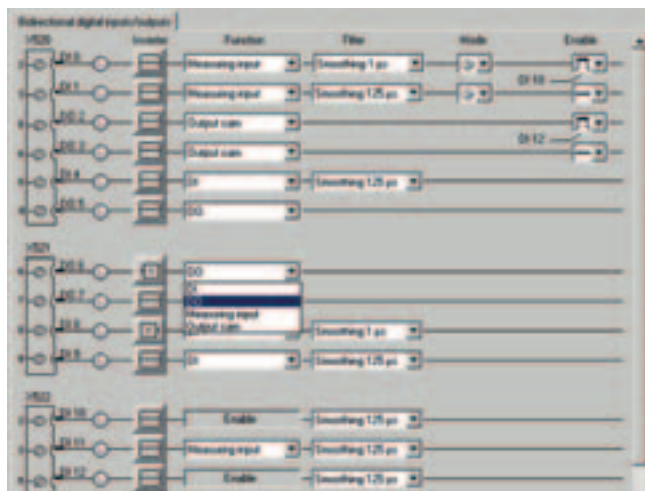
Parameterization of the TM17 High Feature Terminal Module

The differences between the TM15 and TM17 High Feature Terminal Modules depend on the field of application. TM17 High Feature has fewer I/O channels than TM15, but more functionality.

TM17 High Feature is distinguished by especially high resolution and accuracy as well as a parameterizable input filter and enabling inputs.

Parameterized enable inputs can enable sensor inputs or cam outputs (gate function):

• Level-controlled enable for sensor inputs
• Level or edge-controlled enable for cam outputs

TM17 High Feature also supports cyclic measuring of up to 2 edges per interpolator cycle.

Due to their high accuracy, the DI/DO channels of the TM17 High Feature are non-isolated.

Integration

The TM15 and TM17 High Feature Terminal Modules are connected directly to SIMOTION D via DRIVE-CLiQ. Alternatively, TM15 and TM17 High Feature can be connected to a SINAMICS S120 CU320 Control Unit, which is connected with the SIMOTION C, P Motion Control system over PROFIBUS.

The number of Terminal Modules which can be used depends on the number of axes configured with SIMOTION D, CU320 or CX32 as well as the functionality configured for TM15 and TM17 High Feature.

For details please refer to the operating instructions for the TM15 and TM17 High Feature Terminal Modules.

Important notes:
* *TM17 High Feature can only be used on a SINAMICS S120 CU320 Control Unit in conjunction with the SIMOTION Motion Control system.*
* *TM15 with DI/DO functionality can be used on a SINAMICS S120 CU320 Control Unit without SIMOTION for SINAMICS V2.3 or higher.*

Technical data

		TM15 Terminal Modules	TM17 High Feature Terminal Modules
General data			
Supply voltage (rated voltage)		24 V DC	24 V DC
No-load current consumption, max.		0.15 A	0.2 A
Connectable cable cross sections		2.5 mm^2	2.5 mm^2
Power loss, max.		3 W	4 W
Number of DRIVE-CLiQ interfaces		2	2
Drive system overview			
I/O		DI/DO, parameterizable channel-by-channel	DI/DO, parameterizable channel-by-channel
Number of digital inputs/outputs		24	16
Isolation		yes, in groups of 8	no
Connections		Plug-in screw-type terminals	Plug-in screw-type terminals
Conductor cross section, max.		1.5 mm^2	1.5 mm^2
Digital inputs			
Functions		Each channel can be parameterized as: Digital input/sensor input	Each channel can be parameterized as: Digital input/ sensor input/enabling input (max. 6)
Rated value (DC)		24 V	24 V
For signal "0"	min.	-30 V	-30 V
	max.	5 V	5 V
For signal "1"	min.	15 V	15 V
	max.	30 V	30 V
Input delay			
At rated value of input voltage		0 → 1 / 1 → 0: typical 50 μs/100 μs	1 μs/125 μs ± 15% (parameterizable in 2 steps)
Measuring input function	Accuracy	± 125 μs	≤ ± 1 μs
	Resolution	125 μs	1 μs
Digital outputs			
Sustained short-circuit strength		yes	yes
Functions		Each channel can be parameterized as: Digital output/cam output	Each channel can be parameterized as: Digital output/cam output
Note		The logical status of the digital outputs can be read back	The logical status of the digital outputs can be read back
Rated value for output voltage (DC)		24 V	24 V
Output current per channel		0.5 A	0.5 A
Total current of outputs (per group)			
• up to 60 °C (140 °F), max.		2 A	2 A
• up to 50 °C (122 °F), max.		3 A	3 A
• up to 40 °C (104 °F), max.		4 A	4 A

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TM15 and TM17 High Feature Terminal Modules

Technical data (continued)

		TM15 Terminal Modules	TM17 High Feature Terminal Modules
Output delay (ohmic load)			
At "0" to "1"			
• Typical		50 µs	50 µs
• Max.		100 µs	100 µs
At "1" to "0"			
• Typical		150 µs	75 µs
• Max.		225 µs	150 µs
Cam output function	Accuracy	± 125 µs	≤ ± 10 µs
	Resolution	125 µs	1 µs
Further data			
Weight, approx.		0.86 kg (1.9 lb)	0.86 kg (1.9 lb)
Dimensions	Width	50 mm (1.97 in)	50 mm (1.97 in)
	Height	150 mm (5.9 in)	150 mm (5.9 in)
	Depth	111 mm (4.37 in)	111 mm (4.37 in)
Approval		UL and cULus	UL and cULus

Selection and ordering data — Order No.

	Order No.
TM15 Terminal Modules 24 DI/DO; 24 V DC/0.5 A (without DRIVE-CLiQ cable)	**6SL3055-0AA00-3FA0**
TM17 High Feature Terminal Modules 16 DI/DO; 24 V DC/0.5 A (without DRIVE-CLiQ cable)	**6SL3055-0AA00-3HA0**
Operating instructions TM15 and TM17 High Feature Terminal Modules	
• German	**6SL3097-0AH01-0AP1**
• English	**6SL3097-0AH01-0BP1**
• Italian	**6SL3097-0AH01-0CP1**
• French	**6SL3097-0AH01-0DP1**

Further information

Detailed information on the possible accessories as well as ordering data can be found in catalog D 21.2 (SINAMICS S120 Servo Control Drive System) and Catalog D 21.1 (SINAMICS S120 Vector Control Drive System).

For the Terminal Modules TM15 and TM17 High Feature the same DRIVE-CLiQ cables as for Terminal Module TM31 can be used.

8

Overview

HMI devices

A finely graded range of HMI devices is available for local operator control and monitoring.

Mobile panels

The portable operator panels facilitate operator control and monitoring at the actual scene of the event with direct access and visual contact to the process. They offer simple and secure hot-swapping and can be used flexibly on machines or systems.

Graphics panels 170/270 series

With full graphics display for realistic representation of sequences (for 170B and higher also in color), either as touch panels (TPs) with touch-sensitive display or as operator panels (OPs) with membrane keyboard.

Multi-panels 270/370 series

These can be used for operator control and monitoring in the same way as the panels, with operation by means of touch screens or membrane keyboards. In addition, the multi-panels (MPs) permit installation of additional applications and thus allow integration of several automation tasks on a single platform with the PLC WinAC MP software, for example.

Rugged and compact for use at machine level

With IP65/NEMA 4 degree of protection on the front side, high EMC and extreme vibration resistance, the SIMATIC operator panels are ideally suited for the use at machine level in tough industrial environments. Due to their compact design with a shallow mounting depth, the stationary operator panels can be fitted anywhere, even where only restricted space is available.

The extremely rugged and shock-proof housing with IP65 degree of protection makes the mobile panels especially suitable for industrial applications. Their low weight and ergonomic design means that they are user-friendly and easy to operate.

One configuration software for everything

SIMATIC ProTool or SIMATIC WinCC flexible are tools for consistent configuration of all SIMATIC panels as well as PC-based systems with the visualization software ProTool/Pro Runtime or WinCC flexible Runtime. Graded variants are available for every task. The software permits simple and efficient configuration. Programming experience is not required.

Completed configurations can be reused within the family.

Innovative HMI

The mobile panels, panels and multi-panels of the 170, 270 and 370 series, which are based on the Windows CE operating system, allow innovative operator control and monitoring combined with ruggedness, stability and simplicity. Standard hardware and software interfaces provide more flexibility and openness to the office world, e. g. the MMC/PC/CF card, USB, Ethernet, PROFIBUS DP, Visual Basic scripts or customer-specific ActiveX controls.

HMI software

With the product families SIMATIC ProTool and SIMATIC WinCC flexible, SIMATIC HMI offers visualization and configuration software for the whole spectrum.

SIMATIC ProTool

SIMATIC ProTool covers the applications of the machine-related area with PC-based control and monitoring solutions for single-user systems based on ProTool/Pro through to the SIMATIC HMI operator panels. For the configuration of the ProTool/Pro Runtime for PCs as well as SIMATIC HMI operator panels, the ProTool family has the uniform and scalable configuration tools ProTool/Lite, ProTool and ProTool/Pro CS.

SIMATIC WinCC flexible

SIMATIC WinCC flexible is the consistent further development of the SIMATIC HMI software products. WinCC flexible offers an essential hub for applications close to the machine (until now this has been covered by the ProTool family) with respect to configuration efficiency and new automation concepts. For process-oriented plant and mechanical engineering as well as series production of machines, SIMATIC WinCC flexible 2005 also offers:

- Further productivity improvements (configuration efficiency) when creating HMI projects
- Implementation of innovative TCP/IP and web-based automation and HMI concepts
- Increase of the availability of the machines and systems through new service concepts
- Safe, flexible and world-wide access to process data
- New SIMATIC HMI devices

Changing from the ProTool family to WinCC flexible is possible by simply using the same or converting the old configuration data. The ProTool family, however, will be available alongside WinCC flexible for the foreseeable future.

SIMATIC WinCC will remain the process visualization system for plant monitoring with single or multiple station solutions and the platform for IT & Business integration under Windows 2000 and XP Professional.

The next step will be to use WinCC flexible also as the platform for integrating the SIMATIC WinCC visualization system. As is the case today for ProTool V6 projects, WinCC V6 projects will then also be compatible.

Further information

Further information on HMI can be found in

- *Catalog ST 80*
- *the Interactive Catalog under "Automation Systems/SIMATIC HMI Systems".*

8

SIMATIC TP 170B

Overview

- Touch panel for operating and monitoring machines and plants
- Universal unit for first-time users in the category of touch panels with graphics capability with extensive functionality
- Pixel graphics STN display bluemode/color with touch screen (analog/resistive)
- Interfaces for communication with Siemens SIMATIC S7 PCLs and SIMOTION Motion Control system (e. g. MPI, PROFIBUS DP) are on board
- S5 PLCs and non-Siemens PLCs can be connected through easy-to-use drivers or converters

Benefits

- Integral component of Totally Integrated Automation (TIA): increases productivity, minimizes the engineering outlay, reduces the lifecycle costs
- Reduction of service and commissioning costs through:
  - Backup/restore over a process interface or optionally over a CompactFlash card (CF card)
  - Remote download of the configuration with automatic transfer recognition also over WAN (Wide Area Network) by means of teleservice adapter
  - Maintenance-free design (no battery) and long service life of the backlighting
- Worlwide implementation:
  - Wide range of languages can be configured (incl. Asian and Cyrillic fonts)
  - Online language can be selected directly on the device
- Graphics library available with pre-configured images
- Standard hardware and software interfaces to increase flexibility:
  - CompactFlash card, used for recipe data sets and for backup of configuration/system data
- Integrated printer port
- Comprehensive documentation on the SIMATIC HMI Manual Collection CD

Application

The TP 170B touch panels can be used in all applications in which operator control and monitoring of machines and installations is required on site - whether in production automation, process automation or building service automation. They are in use in an extensive range of sectors and applications.

Design

- STN, CCFL[1]-backlit display, bluemode or color
- Resistive analog touch
- Numeric "On-screen" system keyboard for decimal, binary and hexadecimal numeric formats
- On-screen alpha keyboard (English font)
- Compact design with shallow installation depth
- Rugged plastic housing
- The front is resistant to various oils, greases and standard detergents
- A protected cover is available as an option for achieving the NEMA 4 degree of protection and as additional protection against fouling and scratching
- Plug-type terminals for connection of a power supply
- Interfaces for plugging the connection cables into the PLC, printer or configuration computer are integrated
- Slot for standard CompactFlash card

1) **C**old **C**athode **F**luorescence **L**amps

8

Overview

- Operator panel for operating and monitoring machines and plants
- Universal unit for first-time users in the category of panels with graphics capability with extensive functionality
- Pixel graphics STN 5.7" display, bluemode (4 levels)
- Membrane keyboard with system keys, freely configurable and freely inscribable function keys (some with LED)
- Interfaces for communication with Siemens SIMATIC S7 PCLs and SIMOTION Motion Control system (e. g. MPI, PROFIBUS DP) are on board
- S5 PLCs and non-Siemens PLCs can be connected through easy-to-use drivers or converters

Benefits

- Integral component of Totally Integrated Automation (TIA): increases productivity, minimizes the engineering outlay, reduces the lifecycle costs
- Reduction of service and commissioning costs through:
  - Backup/restore over a process interface or optionally over a CompactFlash card (CF card)
  - Remote download of the configuration with automatic transfer recognition also over WAN (Wide Area Network) by means of teleservice adapter
  - Maintenance-free design (no battery) and long service life of the backlighting
- Worlwide implementation:
  - Wide range of languages can be configured (incl. Asian and Cyrillic fonts)
  - Online languages can be selected directly on the device
- Graphics library available with pre-configured images
- Standard hardware and software interfaces to increase flexibility:
  - CompactFlash card, used for recipe data sets and for backup of configuration/system data
- Integrated printer port
- Comprehensive documentation on the SIMATIC HMI Manual Collection CD

Application

The OP 170B operator panels can be used in all applications in which operator control and monitoring of machines and installations is required on site - whether in production automation, process automation or building service automation. They are in use in an extensive range of sectors and applications.

Design

- STN, CCFL[1]-backlit display, bluemode
- System keys, freely configurable and freely inscribable function keys (some with LED)
- Numeric and alphanumeric membrane keyboard
- Compact design with shallow installation depth
- Rugged plastic housing
- The front is resistant to various oils, greases and standard detergents
- Plug-type terminals for connection of a power supply
- Interfaces for plugging the connection cables into the PLC, printer or configuration computer are integrated
- Slot for standard CompactFlash card

8

1) **C**old **C**athode **F**luorescence **L**amps

SIMATIC TP 270

Overview
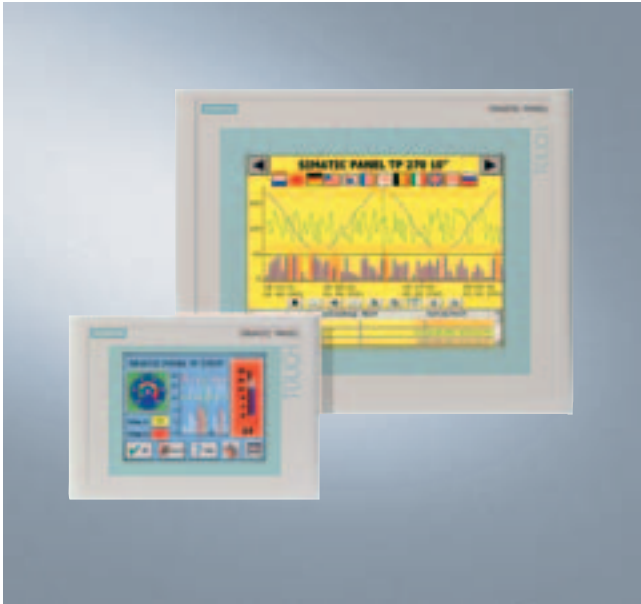
- Touch panel with extensive functional scope for demanding machine visualization applications
- 5.7" or 10.4" pixel graphics STN touch screen (analog/resistive), color (256 colors)
- All interfaces on board, e. g. MPI, PROFIBUS DP, USB; Ethernet optional
- SIMATIC TP 270 touch panels are innovative successors to the SIMATIC TP27 touch panels

Benefits

- Integral component of Totally Integrated Automation (TIA): increases productivity, minimizes the engineering outlay, reduces the lifecycle costs
- Modular expansion possible with options such as:
  - WinCC flexible/Sm@rtAccess for communication between various SIMATIC HMI systems
  - WinCC flexible/Sm@rtService for remote maintenance and servicing of machines/plants via the Internet/Intranet
- Reduction of service and commissioning costs through:
  - Backup/restore via USB, MPI, PROFIBUS DP, RS 232 (serial) and optionally via Ethernet (TCP/IP) or CompactFlash card (CF card)
  - Remote download/upload of the configuration and firmware
  - Specific drivers can be downloaded
  - Long service life of the backlighting
- Graphics library available with pre-configured images
- Worlwide implementation:
  - 32 languages can be configured (incl. Asian and Cyrillic fonts)
  - Up to 5 languages are selectable online
- Standard hardware and software interfaces to increase flexibility:
  - CompactFlash card, used for recipe data sets and for backup of configuration/system data
  - Integrated USB interface for "Hot Plug-in/-out" of I/O devices (printer, keyboard, mouse, barcode reader)
  - Standard Windows storage format (CSV) for archives and reciped for further processing using standard tools (e. g. MS Excel)
  - Optional Ethernet (TCP/IP) for centralized data management and project management; connection of PLC to SIMATIC S7 possible when configuring with WinCC flexible

Application

The SIMATIC TP 270 touch panels can be used in all applications in which operator control and monitoring of machines and installations is required on site - whether in production automation, process automation or building service automation. They are in use in an extensive range of sectors and applications.

Their operation without a hard disk or fan, real-time capability as well as short startup times make demanding machine visualization tasks possible even under harsh industrial conditions.

Design

- 5.7" (TP 270 6") or 10.4" (TP 270 10") STN color cisplay, 256 colors
- Resistive analog touch
- Compact design with shallow installation depth
- Rugged plastic (TP 270 6") or aluminum die-cast housing (TP 270 10") with IP65/NEMA 4/NEMA 12 (front) or IP20 (rear of unit) degree of protection
- The front is resistant to various oils, greases and standard detergents
- High electromagnetic compatability (EMC) and extreme vibration resistance
- Plug-type terminals for connection of a 24 V DC power supply
- Interfaces:
  - Serial RS 232 interface and RS 485/422 for process connections and for downloading the configuration (MPI and PROFIBUS DP up to 12 Mbit/s)
  - Serial RS 232 interface (printer, download/upload)
  - USB for mouse, keyboard, printer and download/upload of the configuration
  - Optional Ethernet (TCP/IP) using network card for exchanging data with a higher-level PC, connecting a network printer and download/upload of the configuration; connection of PLC to SIMATIC S7 possible when configuring with WinCC flexible
- Slot for CompactFlash card

Overview
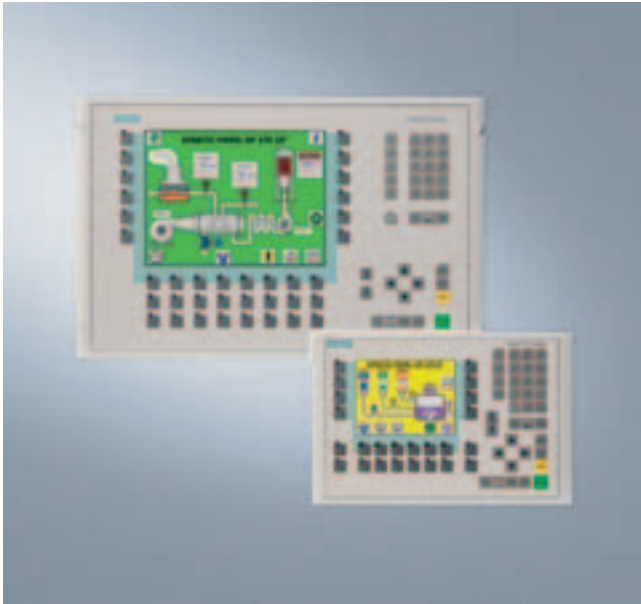
- Operator panel with extensive functional scope for demanding machine visualization applications
- Pixel graphics 5.7" or 10.4" STN display, color (256 colors)
- OP 270 6":
  36 system keys, 24 freely configurable and freely inscribable function keys (18 with LED)
  OP 270 10":
  38 system keys, 36 freely configurable and freely inscribable function keys (28 with LED)
- All interfaces on board, e. g. MPI, PROFIBUS DP, USB; Ethernet optional
- SIMATIC OP 270 operator panels are the innovative successors of the SIMATIC OP27 operator panels

Benefits

- Integral component of Totally Integrated Automation (TIA): increases productivity, minimizes the engineering outlay, reduces the lifecycle costs
- Modular expansion possible with options such as:
  - WinCC flexible/Sm@rtAccess for communication between various SIMATIC HMI systems
  - WinCC flexible/Sm@rtService for remote maintenance and servicing of machines/plants via the Internet/Intranet
- Reduction of service and commissioning costs through:
  - Backup/restore via USB, MPI, PROFIBUS DP, RS 232 (serial) and optionally via Ethernet (TCP/IP) or CompactFlash card (CF card)
  - Remote download/upload of the configuration and firmware
  - Specific drivers can be downloaded
  - Long service life of the backlighting
- Graphics library available with pre-configured images

- Worldwide implementation:
  - 32 languages can be configured (incl. Asian and Cyrillic fonts)
  - Up to 5 languages are selectable online
- Standard hardware and software interfaces to increase flexibility:
  - CompactFlash card, used for recipe data sets and for backup of configuration/system data
  - Integrated USB interface for "Hot Plug-in/-out" of I/O devices (printer, keyboard, mouse, barcode reader)
  - Standard Windows storage format (CSV) for archives and reciped for further processing using standard tools (e. g. MS Excel)
  - Optional Ethernet (TCP/IP) for centralized data management and project management;
    connection of PLC to SIMATIC S7 possible when configuring with WinCC flexible

Application

The OP 270 operator panels can be used in all applications in which operator control and monitoring of machines and installations is required on site - whether in production automation, process automation or building service automation. They are in use in an extensive range of sectors and applications.

Their operation without a hard disk or fan, real-time capability as well as short startup times make demanding machine visualization tasks possible even under harsh industrial conditions.

Design

- 5.7" (OP 270 6") or 10.4" (OP 270 10") STN color display, 256 colors
- Membrane keyboard:
  - OP 270 6":
    36 system keys, 24 freely configurable and freely inscribable function keys (18 with LED)
    OP 270 10":
    38 system keys, 36 freely configurable and freely inscribable function keys (28 with LED)
- Compact design with shallow installation depth
- Rugged plastic (OP 270 6") or aluminum die-cast housing (OP 270 10") with IP65/NEMA 4/NEMA 12 (front) or IP20 (rear of unit) degree of protection
- The front is resistant to various oils, greases and standard detergents
- High electromagnetic compatability (EMC) and extreme vibration resistance
- Plug-type terminals for connection of a 24 V DC power supply
- Interfaces:
  - Serial RS 232 interface and RS 485/422 for process connections and for downloading the configuration (MPI and PROFIBUS DP up to 12 Mbit/s)
  - Serial RS 232 interface (printer, download/upload)
  - USB for mouse, keyboard, printer and download/upload of the configuration
  - Optional Ethernet (TCP/IP) using network card for exchanging data with a higher-level PC, connecting a network printer and download/upload of the configuration; connection of PLC to SIMATIC S7 possible when configuring with WinCC flexible
- Slot for CompactFlash card

8

SIMATIC MP 270B

◼ Overview
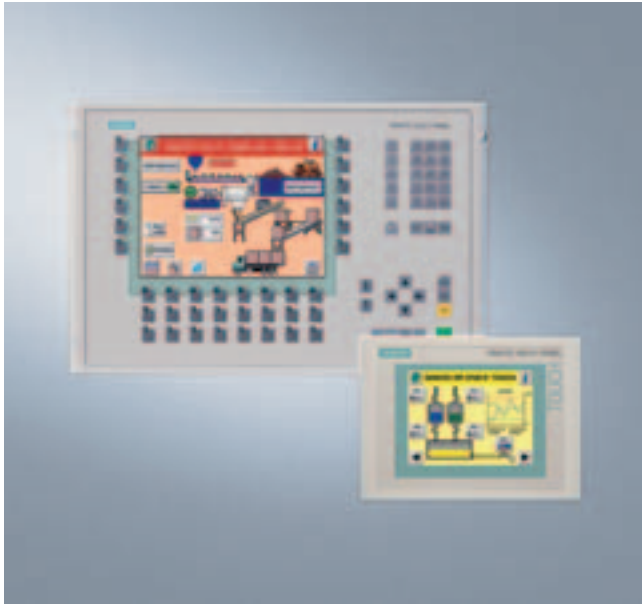
- Like operator panels, multi-panels (MP) are used for on site machine operation and monitoring

- Their functionality can be expanded by installing additional Windows CE applications (multi-panels and panel options)

- SIMATIC MP 270B multi-panels combine the ruggedness of operator panels with the flexibility of PCs based on Windows CE

- Pixel graphics 5.7" or 10.4" TFT display, color (256 colors)

- MP 270B 10" Keys:
  38 system keys, 36 freely configurable and freely inscribable function keys (28 with LED)
  MP 270B 6" and 10" Touch:
  Touch screen (analog/resistive)

- All interfaces on board, e. g. MPI, PROFIBUS DP, USB, Ethernet, serial

◼ Benefits

- Integral component of Totally Integrated Automation (TIA): Increases productivity, minimizes the engineering outlay, reduces the lifecycle costs

- Modular expansion possible with options such as:
  - ThinClient/MP for use as terminal client on a Windows terminal server (only MP 270B 10" Touch)
  - WinCC flexible/Sm@rtAccess for communication between various SIMATIC HMI systems
  - WinCC flexible/Sm@rtService for remote maintenance and servicing of machines/plants via the Internet/Intranet
  - WinCC flexible/OPC server for communication with applications from various vendors
  - MS Pocket Internet Explorer (included in scope of supply)

- Reduction of service and commissioning costs through:
  - Backup/restore via Ethernet (TCP/IP), USB, MPI, PROFIBUS DP, RS 232 (serial) or optionally via PC/CF card
  - Remote download/upload of the configuration and firmware
  - Specific drivers can be downloaded
  - Long service life of the backlighting

- Graphics library available with pre-configured images

- Worldwide implementation:
  - 32 languages can be configured (incl. Asian and Cyrillic fonts)
  - Up to 5 languages are selectable online

- Standard hardware and software interfaces to increase flexibility:
  - PC/CF card slot for memory expansions, backup/restore or additional interfaces
  - Ethernet (TCP/IP) for centralized data management and project management; connection of PLC to SIMATIC S7 possible when configuring with WinCC flexible
  - Standard Windows storage format (CSV) for archives and reciped for further processing using standard tools (e. g. MS Excel)

◼ Application

The SIMATIC MP 270B multi-panels can be used in all applications in which operator control and monitoring of machines and installations is required on site - whether in production automation, process automation or building service automation. They are used in a variety of sectors and applications and their field of applications can be expanded using the multi-panel options, e. g. by displaying HTML documents via the MS Pocket Internet Explorer.

Windows CE provides the fundamentals for use in harsh industrial environments. The lack of a hard disk and fan means that it can also be used in applications in which high levels of vibration or dust place restrictions on the operation of a PC. Short startup times mean that the multi-panels are quickly ready for use.

◼ Design

- 5.7" or 10.4" TFT color display, 256 colors

- MP 270B 10" Keys:
  - Membrane keyboard, 38 system keys, 36 freely configurable and freely inscribable function keys (28 with LED)

- MP 270B 6" and 10" Touch:
  - Touch screen (analog/resistive)

- Compact design with shallow installation depth

- The front is resistant to various oils, greases and standard detergents

- Degree of protection IP65/NEMA 4x/NEMA 12 (front) or IP20 (rear of unit)

- Plug-type terminals for connection of a 24 V DC power supply

- Interfaces:
  - RS 232/RS 485/RS 422 interface for process connections (MPI, PROFIBUS DP up to 12 Mbit/s)
  - Serial RS 232 interface (printer, download/upload)
  - USB for mouse, keyboard, printer, barcode reader and download/upload of the configuration
  - Ethernet interface (TCP/IP) for data transmission to a higher-level PC and for connecting a network printer and download/upload of the configuration; connection of PLC to SIMATIC S7 possible when configuring with WinCC flexible

- Slot for CompactFlash card (CF card)

- Slot for PC card

8

■ Overview

- Like operator panels, multi-panels (MP) are used for on site machine operation and monitoring
- Their functionality can be expanded by installing additional Windows CE applications (multi-panels and panel options)
- SIMATIC MP 370 multi-panels combine the ruggedness of operator panels with the flexibility of PCs based on Windows CE
- Pixel graphics 12.1" or 15.1" TFT display, color (256 colors)
- MP 370 12" Keys:
  38 system keys, 36 freely configurable and freely inscribable function keys (36 with LED)
  MP 370 12" and 15" Touch:
  Touch screen (analog/resistive)
- All interfaces on board, e. g. MPI, PROFIBUS DP, USB, Ethernet, serial

■ Benefits

- Integral component of Totally Integrated Automation (TIA): Increases productivity, minimizes the engineering outlay, reduces the lifecycle costs
- Modular expansion possible with options such as:
  - PLC SIMATIC WinAC MP software
  - ThinClient/MP for use as terminal client on a Windows terminal server
  - WinCC flexible/Sm@rtAccess for communication between various SIMATIC HMI systems
  - WinCC flexible/Sm@rtService for remote maintenance and servicing of machines/plants via the Internet/Intranet
  - WinCC flexible/OPC server for communication with applications from various vendors
  - MS Pocket Internet Explorer (included in scope of supply)
- Reduction of service and commissioning costs through:
  - Backup/restore via Ethernet (TCP/IP), USB, MPI, PROFIBUS DP, RS 232 (serial) or optionally via PC/CF card
  - Remote download/upload of the configuration and firmware
  - Specific drivers can be downloaded
  - Long service life of the backlighting
- Graphics library available with pre-configured images

- Worldwide implementation:
  - 32 languages can be configured (incl. Asian and Cyrillic fonts)
  - Up to 5 languages are selectable online
- Standard hardware and software interfaces to increase flexibility:
  - PC/CF card slot for memory expansions, backup/restore or additional interfaces
  - Ethernet (TCP/IP) for centralized data management and project management; connection of PLC to SIMATIC S7 possible when configuring with WinCC flexible
  - Standard Windows storage format (CSV) for archives and reciped for further processing using standard tools (e. g. MS Excel)

■ Application

The SIMATIC MP 370 multi-panels can be used in all applications in which operator control and monitoring of machines and installations is required on site - whether in production automation, process automation or building service automation. They are used in a variety of sectors and applications and their field of applications can be expanded using the multi-panel options, e. g. by displaying HTML documents via the MS Pocket Internet Explorer.

Windows CE provides the fundamentals for use in harsh industrial environments. The lack of a hard disk and fan means that it can also be used in applications in which high levels of vibration or dust place restrictions on the operation of a PC. Short startup times mean that the multi-panels are quickly ready for use.

■ Design

- 12.1" or 15.1" TFT color display, 256 colors
- MP 370 12" Keys:
  - Membrane keyboard, 38 system keys, 36 freely configurable function keys (36 with LED), 36 of them are soft keys
- MP 370 12" and 15" Touch:
  - Touch screen (analog/resistive)
- Compact design with shallow installation depth
- The front is resistant to various oils, greases and standard detergents
- Degree of protection IP65/NEMA 4x/NEMA 12 (front) or IP20 (rear of unit)
- Plug-type terminals for connection of a 24 V DC power supply
- Interfaces:
  - TTY/RS 232/RS 485/RS 422 interface for process connections (MPI, PROFIBUS DP up to 12 Mbit/s)
  - Serial RS 232 interface (printer, download/upload)
  - USB for mouse, keyboard, printer, barcode reader and download/upload of the configuration
  - Ethernet interface (TCP/IP) for data transmission to a higher-level PC and for connecting a network printer and download/upload of the configuration; connection of PLC to SIMATIC S7 possible when configuring with WinCC flexible
- Slot for CompactFlash card (CF card)
- Slot for PC card

8

SIMATIC Panel PC IL 77

Overview
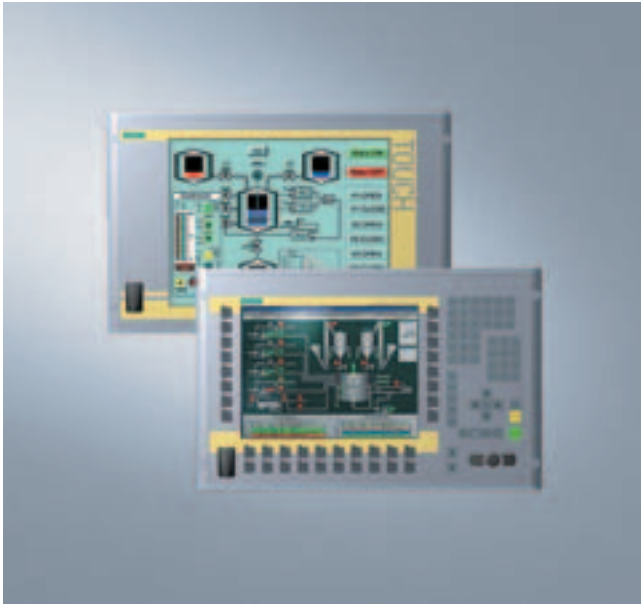
- Industrial PC platform for demanding operator control and monitoring tasks
- Maximum performance due to high processor performance at an attractive entry-level price
- Front panel versions:
  - 12", 15" and 19" TFT Touch
  - 12" and 15" TFT Key

Benefits

- Industry standard resistance to vibrations and shocks
- Investment safeguarding through guaranteed availability of spare parts for the components
- USB interface for simple and fast connection of required components
- Integral Ethernet interface
- Minimization of downtimes through high system availability: solutions for data backup (preventive data backup)
- Integral component of Totally Integrated Automation (TIA): increases productivity, minimizes the engineering outlay, reduces the lifecycle costs

Application

The SIMATIC Panel PC IL 77 is used both in manufacturing automation and in process automation and can be installed in control cabinets and control panels.

A SIMATIC Panel PC IL 77 is a platform for PC-based automation:

- PC-based machine-level visualization on site with SIMATIC ProTool/Pro or SIMATIC WinCC flexible
- Complex solutions with SIMATIC WinCC process visualization
- PC-based control with SIMATIC WinAC software PLC or with SIMATIC WinAC Slot PLC

Siemens offers the complete building block set of automation components that are perfectly matched to one another.

The SIMATIC Panel PCs can be ordered in combination with ProTool/Pro, WinCC flexible or WinCC as SIMATIC HMI packages at a special price (see SIMATIC HMI complete systems).

Design

The Panel PC IL 77 comprises a computer unit (box PC) and an operator control unit (front panel).

Components of the computer unit:

- Metal housing, resistant to vibrations and shocks, with high electromagnetic compatibility
- Processor:
  - Intel Celeron 2.0 GHz
  - Intel Pentium 4 2.4 GHz
- Memory:
  - 256 MB DDR 400
  - 512 MB DDR 400
  - 1 GB DDr 400
  - With expansion capability up to 3 GB
- Hard disk: ≥ 40 GB
- Disk drive: 1.44 MB, 3.5", optionally via USB, can be ordered as accessory
- DVD-ROM or CD-RW/DVD (combo) drives optional
- Interfaces:
  - Ethernet on board
  - 4x USB connection (USB 2.0)
  - 1x USB connection on front (USB 2.0)
- Free slots for expansions:
  - 3 x PCI (slots with card retainer + 1 slot specially prepared for WinAC Slot Module)
- Power supply: 110 V/230 V AC (wide range), 50/60 Hz

Components of the operator control unit:

The front panels are available in the following designs:

12" Touch

- 12.1" TFT color display, 800 x 600 pixels (SVGA)
- Touch screen, analog/resistive
- USB 2.0 interface on front

15" Touch

- 15.1" TFT color display, 1024 x 768 pixels (XGA)
- Touch screen, analog/resistive
- USB 2.0 interface on front

**19" Touch**

- 19.1" TFT color display, 1280 x 1024 pixels (SXGA)
- Touch screen, analog/resistive
- USB 2.0 interface on front

12" Key

- 12.1" TFT color display, 800 x 600 pixels (SVGA)
- Membrane keyboard with international PC character set and 36 additional function keys and an integrated mouse
- USB 2.0 interface on front

15" Key

- 15.1" TFT color display, 1024 x 768 pixels (XGA)
- Membrane keyboard with international PC character set and 36 additional function keys and an integrated mouse
- USB 2.0 interface on front

Expansion components

SIMATIC PC/PG Image & Partition Creator

- Software tool for preventive data backup of hard disk contents
- Fast, bit-exact restoration of system and data partitions; user software and special installations are also saved
- Software tool for adaptation of hard disk partitioning

■ **Design** (continued)

3.5" USB disk drive

The USB disk drive is provided for fast exchange of user data, e. g. recipes, or of files. The drive must not be used as a cyclic archiving drive. The front panel installation with IP54 degree of protection permits data exchange from the front without opening the control cabinet door.

The drive is connected via the USB interface of the Panel PC. The power is also supplied over the USB interface. The scope of supply includes a 1 m (3.28 ft) long USB cable. The disk drive complies with the USB 1.1 standard.

3.5" high density disk can be used (1.44 MB).

Use of the USB disk drive with SIMATIC Panel PCs:
• Windows XP: possible without separate driver
• Windows 2000: the required driver is included in the scope of supply of the operating system
• Windows 98/NT: use of the USB disk drive not possible

Note:
For further information see "Expansion components"

8

SIMATIC Panel PC 677

■ Overview
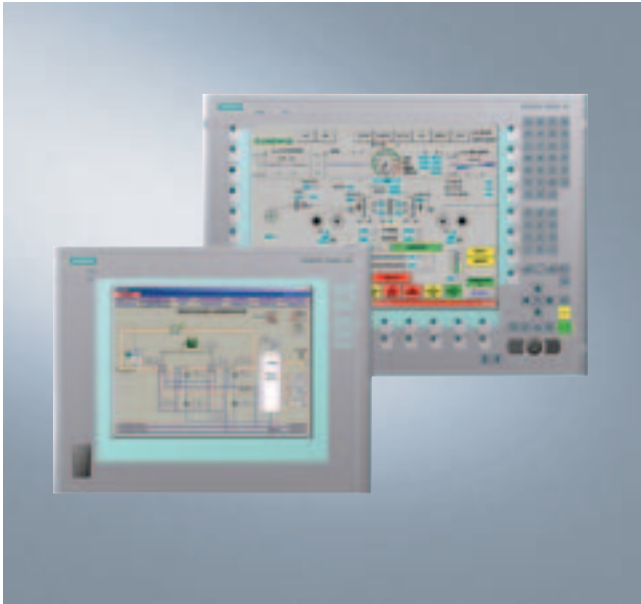
- PC platform with high degree of industrial compatibility for demanding tasks in the area of PC-based automation
- Rugged construction:
  The PC can even withstand the harshest mechanical stress and offers functional reliability
- Compact design
- High degree of investment security
- Fast integration capability
- Front panel versions:
  - 12", 15" or 19" TFT color display
  - Membrane keyboard or touch screen

■ Benefits

- High degree of industrial compatibility due to its rugged design, even in the case of extreme vibrations and shocks
- High degree of investment security due to the guaranteed availability of spare parts for the components (5 years beyond the end of active marketing)
- High degree of continuity of components for long-term machine concepts without the need for further engineering outlay
- Savings in time and costs due to maintenance-friendly equipment design:
  - The computer unit and operator control unit are simply hinged open for fast replacement of components or future expansions
  - Front and rear USB 2.0 interfaces for connecting additional hardware components easily and quickly
- High industrial functionality due to the integral PROFIBUS DP/MPI and Ethernet interfaces
- Operational reliability:
  - With the optional Direct Control Key Module, the process can be operated without delay over PROFIBUS DP, independently of the operating system
- Minimization of standstill times due to high system availability
  - Efficient self-diagnostics (SIMATIC PC DiagMonitor)
  - Solutions for data backup (preventive data backup)
- Integral component of Totally Integrated Automation (TIA): increases productivity, minimizes the engineering outlay, reduces the lifecycle costs

■ Application

The SIMATIC Panel PC 677 is designed for use on site at the machine. The shallow installation depth of only 104/130 mm (4.1/5.1 in) allows it to be installed in extremely confined spaces.

The PC is used both in manufacturing automation and in process automation, installed in control cabinets and desks, 19" cabinets/racks and swivel arms (girders).

A SIMATIC Panel PC is the ideal platform for PC-based automation:

- PC-based visualization on site at the machine with SIMATIC WinCC flexible
- Complex solutions with SIMATIC WinCC process visualization
- PC-based control with SIMATIC WinAC software PLC or with SIMATIC WinAC Slot PLC

Siemens offers the complete building block set of automation components that are perfectly matched to one another.

The SIMATIC Panel PCs can be ordered in combination with WinCC flexible or WinCC as SIMATIC HMI packages at a special price (see SIMATIC HMI complete systems).

■ Design

The Panel PC 677 comprises a computer unit and an operator control unit.

Components of the computer unit:

- Rugged metal housing, resistant to vibrations and shocks, with high electromagnetic compatibility
- Processor:
  - Intel Celeron M 370 / 1.5 GHz or
  - Intel Pentium M 730 / 1.6 GHz or
  - Intel Pentium M 760 / 2.0 GHz
- Main memory, standard configuration:
  256 MB
- SATA hard disk: ≥ 40 GB;
  the special vibration-absorbing hard disk support ensures reliable operation even under extremely high mechanical stress
- Graphics on board
- Interfaces:
  - 2 x Ethernet on board
  - PROFIBUS DP/MPI on board, isolated
  - 4 x USB 2.0 port
- Free slots for expansions:
  - 2 x PCI (slots for card retainers)
  - 1 x slot for CompactFlash card
- Power supply: 110 V/230 V AC (auto range), 50/60 Hz or 24 V DC

Optional additional components:

- Main memory expansion to 512 MB or 1 GB
- SATA hard disk ≥ 80 GB
- DVD-ROM drive
- CD-RW/DVD drive
- Direct Control Key Module
- 2 x ≥ 60 GB hard disk system (RAID1 controller function is integrated into the chip set and can be connected to implement a mirror disk system over BIOS; no PCI card necessary!)

■ **Design** (continued)

Components of the operator control unit:

The operator control units are available in the following versions:

12" Key
- 12.1" TFT color display, 800 x 600 pixels (SVGA)
- Membrane keyboard with international PC character set and 36 additional function keys with LED and an integrated mouse

12" Touch
- 12.1" TFT color display, 800 x 600 pixels (SVGA)
- Touch screen, analog/resistive

15" Key
- 15.1" TFT color display, 1024 x 768 pixels (XGA)
- Membrane keyboard with international PC character set and 36 additional function keys with LED and an integrated mouse

15" Touch
- 15.1" TFT color display, 1024 x 768 pixels (XGA)
- Touch screen, analog/resistive

19" Touch
- 19.1" TFT color display, 1280 x 1024 pixels (SXGA)
- Touch screen, analog/resistive

The operator units feature a USB 2.0 interface on the front for connecting an external I/O device such as a mouse or keyboard. They comply with the requirements of degree of protection IP65 and NEMA 4.

The computer unit is connected via connection cables at the rear of the operator unit.

Panel PC 677 side view

Expansion components

SIMATIC PC/PG Image & Partition Creator
- Software tool for preventive data backup of hard disk contents
- Fast, bit-exact restoration of system and data partitions; application software and special installations are also saved
- Software tool for adaptation of hard disk partitioning

SIMATIC PC DiagMonitor
- PC diagnostics/signaling software for early detection and diagnostics of PC problems
- Comprehensive monitoring of temperature, fans, hard disks (SMART), watchdog
- Operating hours counter for preventive maintenance
- Integral log function, comprehensive text messages, online help (English/German)
- Network-wide monitoring via SNMP and OPC interface possible

3.5" USB disk drive

The USB disk drive is provided for fast exchange of user data, e. g. recipes, or of files. The drive must not be used as a cyclic archiving drive. The front panel installation with IP54 degree of protection permits data exchange from the front without opening the control cabinet door.

The device is connected via the USB interface of the Panel PC. The power is also supplied via the USB interface. A USB cable of 1 m (3.28 ft) in length is included in the scope of supply. The disk drive complies with the USB 1.1 standard. 3.5" high density disk can be used (1.44 MB).

Operation of the USB disk drive with SIMATIC Panel PCs:
- Windows XP: possible without separate driver
- Windows 2000: the required driver is included in the scope of supply of the operating system

Note:
For further information see "Expansion components"

8

SIMATIC Panel PC 877

■ Overview
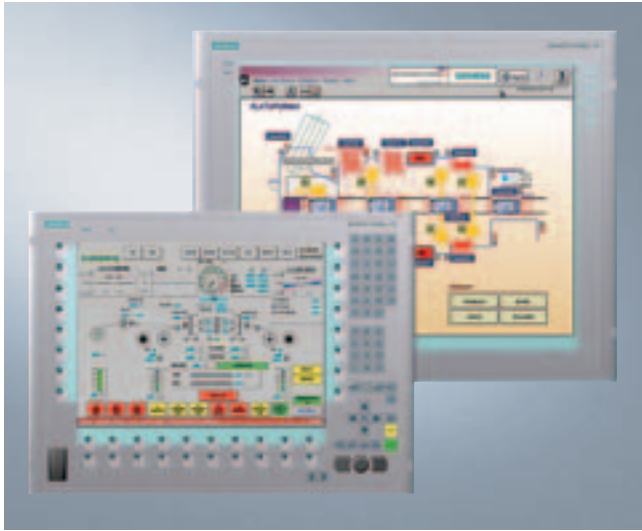
- PC platform with a high degree of industrial compatibility for demanding tasks in the field of PC-based automation
- Rugged construction:
  The PC can even withstand extremely harsh mechanical stress and is reliable in operation
- Flexible expansion capability
- High degree of investment security
- Fast integration capability
- Front panel versions:
  - 12", 15" or 19" TFT color display
  - Membrane keyboard or touch screen

■ Benefits

- High degree of industrial compatibility due to its rugged construction, even in the case of extreme vibrations and shocks
- High degree of investment security due to the guaranteed availability of spare parts for the components (5 years beyond the end of active marketing)
- High degree of continuity of components for long-term machine concepts without the need for further engineering outlay
- Savings in time and costs due to maintenance-friendly equipment design:
  - The computer unit and operator control unit are simply hinged open for fast replacement of components or future expansions.
  - Front and rear USB 2.0 interfaces for connecting additional hardware components easily and quickly
- Wide scope of industrial functionality due to PROFIBUS DP/MPI and Ethernet interfaces
- Reliability of operation:
  - With the optional direct key input module, the process can be operated without delay over PROFIBUS DP, independently of the operating system
- Minimization of standstill times due to high system availability
  - Efficient self-diagnostics (SIMATIC PC DiagMonitor)
  - Solutions for data security (preventative data security)
- Integral component of Totally Integrated Automation (TIA): Increased productivity, minimized engineering outlay, reduced lifecycle costs

■ Application

The SIMATIC Panel PC 877 is designed for use on site at the machine.

The PC is used both in manufacturing automation and in process automation, installed in control cabinets and desks, 19" cabinets/racks and swing arms (girders).

A SIMATIC Panel PC is the ideal platform for PC-based automation:

- PC-based visualization on site at the machine with SIMATIC WinCC flexible
- Complex solutions with SIMATIC WinCC process visualization
- PC-based control with SIMATIC WinAC Software PLC or with SIMATIC WinAC Slot PLC

Siemens offers the complete building block set of automation components that are perfectly matched to one another.

The SIMATIC Panel PCs can be ordered in combination with WinCC flexible or WinCC as SIMATIC HMI packages at special price (see SIMATIC HMI complete systems).

■ Design

The Panel PC 877 comprises a computer unit and an operator unit.

Components of the computer unit:

- Rugged metal casing for building in, resistant to vibrations and shocks, high degree of electromagnetic compatibility
- Processor:
  - Intel Celeron 2.0 GHz or
  - Intel Pentium 4, 2.8 GHz
  - Intel Pentium 4, mobile 2.2 GHz
- Main memory, standard configuration: 256 MB
- EIDE hard disk: ≥ 40 GB;
  the special vibration-absorbing harddisk support ensures reliable operation even under extremely high mechanical stress
- Diskette drive: 1.44 MB, 3.5"
- Graphics on board
- Interfaces:
  - Ethernet on board
  - PROFIBUS DP/MPI on board, isolated
  - 2 x USB 2.0 port
- Free slots for expansions:
  - 2 x PCI, 2 x ISA/PCI shared, 1 x ISA (slots for card retainers),
- Power supply: 110 V/230 V AC (auto range), 50/60 Hz or 24 V DC

Optional additional components:

- Main memory expansion to 512 MB, 1 GB or 2 GB
- EIDE hard disk ≥ 80 GB
- DVD-ROM drive
- CD-RW/DVD drive
- Direct Control Key Module
- Dual hard disk (2 x ≥ 40 GB)
- RAID system (plug-in PCI card)

8

■ **Design** (continued)

Components of the operator control unit:

The operator units are available in the following versions:

12" Key

- 12.1" TFT color display, 800 x 600 pixels (SVGA)
- Membrane keyboard with international PC character set and 36 additional function keys with LED and integrated mouse

15" Key

- 15.1" TFT color display, 1024 x 768 pixels (XGA)
- Membrane keyboard with international PC character set and 36 additional function keys with LED and integrated mouse

15" Touch

- 15.1" TFT color display, 1024 x 768 pixels (XGA)
- Touch screen, analog/resistive

19" Touch

- 19.1" TFT color display, 1280 x 1024 pixels (SXGA)
- Touch screen, analog/resistive

The operator units feature a USB 2.0 interface on the front for connecting an external I/O device such as a mouse or keyboard. They comply with the requirements of degree of protection IP65 and NEMA 4.

Connecting cables on the rear of the operator unit are used to connect the computer unit.

Panel PC 877 side view
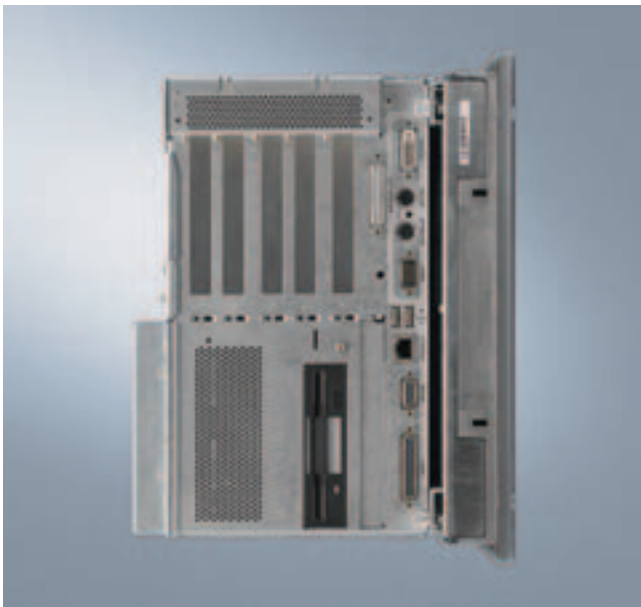
Expansion components

SIMATIC PC/PG Image & Partition Creator

- Software tool for preventive data backup of the hard disk contents
- Fast, bit-exact restoration of system and data partitions; application software and special installations are also saved
- Software tool for adaptation of hard disk partitioning

SIMATIC PC DiagMonitor

- PC diagnostics/signaling software for the early detection and diagnostics of PC problems
- Comprehensive monitoring of temperature, fans, hard disks (SMART), watchdog
- Operating hours counter for preventive maintenance
- Integrated log function, comprehensive text messages, online help (English/German)
- Network-wide monitoring via SNMP and OPC interface possible

3.5" USB disk drive

The USB disk drive is provided for fast exchange of user data, e. g. recipes, or of files. The drive must not be used as a cyclic archiving drive. The front panel installation with IP54 degree of protection permits data exchange from the front without opening the control cabinet door.

The device is connected via the USB interface of the Panel PC. The power is also supplied via the USB interface. A USB cable of 1 m (3.28 ft) in length is included in the scope of supply. The disk drive complies with the USB 1.1 standard. 3.5" high density disks can be used (1.44 MB).

Operation of the USB disk drive with SIMATIC Panel PCs:

- Windows XP: possible without separate driver
- Windows 2000: the required driver is included in the scope of supply of the operating system

Note:
For further information see "Expansion components"

8

Panel PC-R

Overview

The "Panel PC-R" industrial PC offers high resilience against shocks and vibrations. The Panel PC-R is based on the Siemens industrial PCs, which already have an excellent track record for demonstrating performance capability and robustness in tough industrial applications.

With a multitude of communication options, e. g. integrated interfaces for Ethernet and PROFIBUS, the Panel PC-R is easy to integrate into the general automation landscape.

The Panel PC-R has a very rugged mechanical design and satisfies the extremely stringent quality requirements of the industry.

Application

The "Panel PC-R" PC has been designed for use around sources of extreme shocks and vibrations, such as

- Presses
- Printing machines
- Mobile applications

Owing to its special design, the Panel PC-R can be mounted directly onto the machine bed or stand.

Design

The computer unit and the display of the PC-R panel are mounted over a special damping system in an oscillating frame within the rugged outdoor casing. This protects the PC-R panel against shocks and vibrations from the machine bed or stand.

Technical data

Panel PC-R	Version 1	Version 2
Power supply	115 V/230 V AC	115 V/230 V AC
Processor	INTEL PENTIUM® III, 500 MHz	INTEL PENTIUM® III, 1.26 GHz
Memory		
• RAM	128 MB, expandable up to 512 MB	256 MB, expandable up to 512 MB
• Hard disk special version for Panel PC-R	>10 GB	>10 GB
• AGP graphics	2 MB	UXGA-LCD controller on AGB bus, up to 32 MB SDRAM are part of the main memory and configurable (8/16/32MB)
Interfaces	• Ethernet • PROFIBUS/MPI, isolated	• Ethernet • PROFIBUS/MPI, isolated
Keyboard	Full keyboard (QWERTZ) and 28 function keys	Full keyboard (QWERTZ) and 28 function keys
Floppy disk	3.5"	3.5"
Display	15" TFT	15" TFT with glass or optional touch screen
Operating system German version	MS Windows NT 4.0	MS Windows 2000 MUI (multilingual)
Degree of protection in accordance with EN 60529 (IEC 60529)	IP54	Front side IP65
Mechanical environmental conditions		
• Vibration load during operation, max. approved in accordance with DIN IEC 68-2-27: Class 3 M4 0.307 mm (0.01 in) to 45 Hz, 24.5 m/s^2 (80 ft/s^2) to 200 Hz, 9.8 m/s^2 (32 ft/s^2) to 300 Hz	2.5 g (0.01 lb)	2.5 g (0.01 lb)
• Shock load during operation, max. approved in accordance with DIN IEC 68-2-27: Class 3M4 (117 m/s^2 (384 ft/s^2), 6 ms)	12 g (0.03 lb)	12 g (0.03 lb)
Permissible ambient temperature		
• Storage and transport	-20 °C to +60 °C (-4 °F to +140 °F)	-20 °C to +60 °C (-4 °F to +140 °F)
• Operation	+5 °C to +45 °C (+41 °F to +113 °F)	+5 °C to +45 °C (+41 °F to +113 °F)
Weight, approx.	14.5 kg (32 lb)	14.5 kg (32 lb)
Dimensions (W x H x D)	443 mm x 359 mm x 170 mm (17.44 in x 14.13 in x 6.69 in)	443 mm x 359 mm x 170 mm (17.44 in x 14.13 in x 6.69 in)
Front dimensions	19", 9 HM (height modules)	19", 9 HM (height modules)

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Selection and ordering data	Order No.
Panel PC-R (version 1) **15" TFT display,** Intel Pentium III processor, 500 MHz, 128 MB RAM, hard disk 10.2 GB	6AU1355-1FF13-0AB0
• 230 V AC power supply, membrane keyboard, MS Windows NT 4.0 D operating system	
Panel PC-R (version 1) **15" TFT display with touch,** Intel Pentium III processor, 500 MHz, 128 MB RAM, hard disk 10.2 GB	6AU1355-1EF13-0AB0
• 230 V AC power supply, membrane keyboard, MS Windows NT 4.0 D operating system	
• **Panel PC-R (version 2)** **15" TFT display,** Intel Pentium III processor, 1.26 GHz, 256 MB RAM, hard disk 10.2 GB 2.5"	6AU1360-3FH26-0AD0
• 230 V AC power supply, membrane keyboard, MS Windows 2000 MUI (multilingual) operating system	
Panel PC-R (version 2) **15" TFT display with touch,** Intel Pentium III processor, 1.26 GHz, 256 MB RAM, hard disk 10.2 GB 2.5"	6AU1360-3EH26-0AD0
• 230 V AC power supply, membrane keyboard, MS Windows 2000 MUI (multilingual) operating system	

8

SIMATIC ProTool/Pro

■ Overview

- **PC-based HMI solution** for single-user systems directly at the machine
- SIMATIC ProTool/Pro comprises:
  - SIMATIC ProTool/Pro RT Runtime software for PC-based systems
  - SIMATIC ProTool/Pro Configuration (CS) configuration software for configuring PC-based systems as well as for configuring SIMATIC operator panels
- Executable under Windows 98 SE/ME and Windows NT4.0/2000/XP Professional
- **Current version:**
  - SIMATIC ProTool/Pro Configuration V6.0 + SP3
  - SIMATIC ProTool/Pro Runtime V6.0 + SP3

■ Benefits

- Integral component of Totally Automated Integration (TIA): The full integration of ProTool/Pro in the SIMATIC S7/ SIMOTION environment provides conformity in communications, in data management and in configuration and programming
- Openness:
  Consistent support of the Windows standards such as OLE-Automation and OPC (OLE for Process Control)
- Flexibility:
  Individual function expansions can be implemented with Visual Basic scripts
  Archiving of process data and alarms, e. g. in an ODBC (Open Data Base Connectivity) database
- Convenient process visualization:
  Ranging from archiving through print functions, graphics libraries, trend displays, messaging system, logging system, recipe management through to comprehensive controller drives
- Language selection:
  Reduction in handling and configuration costs by management of up to 32 languages in the project and online switching of up to 5 languages on the device

■ Application

SIMATIC ProTool/Pro is the up-to-date visualization software for simple visualization tasks at the machine level. It can be used as a single-user solution for all automation applications in production automation, process automation and building services automation.

ProTool/Pro includes the functions of ProTool for configuring SIMATIC operator panels, but also enables implementation of machine visualization tasks with PC-based systems.

■ Design

SIMATIC ProTool/Pro consists of:
- Configuration software SIMATIC ProTool/Pro Configuration (CS) for configuring PC-based systems as well as SIMATIC operator panels
- SIMATIC ProTool/Pro RT Runtime software for PC-based system

The SIMATIC ProTool/Pro RT Runtime software is available as a software package with 128, 256, 512 or 2048 PowerTags. The term PowerTags is applied only to process variables that have a process connection to the PLC control. Variables without process integration, constant variable and message limits (up to 2000 fault messages and 2000 operating messages) are available as additional system features.

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Overview
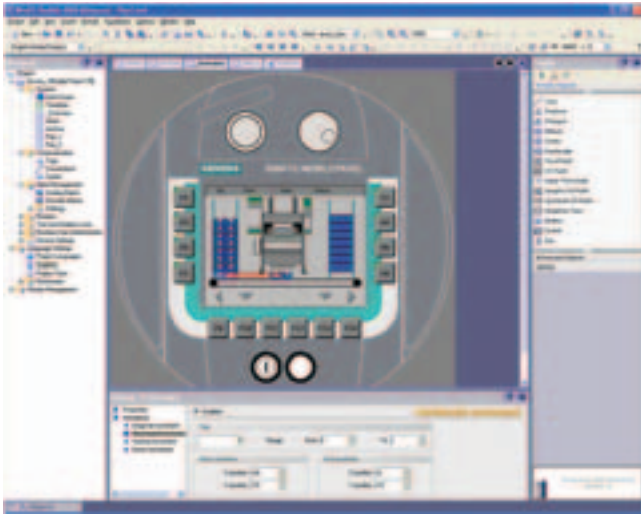
- Integrated family of **engineering tools** for configuring SIMATIC HMI operator units, the operator control part of SIMATIC C7 systems, SIMOTION/SINUMERIK Panel PCs as well as the PC-based visualization software WinCC flexible Runtime

- Executable under Windows 2000/XP Professional

- **Current version:**
  - SIMATIC WinCC flexible 2005 Advanced
  - SIMATIC WinCC flexible 2005 Standard
  - SIMATIC WinCC flexible 2005 Compact
  - SIMATIC WinCC flexible 2005 Micro

Benefits

- Uniformity of configuration software reduces training, maintenance and updating requirements, and guarantees future compatibility

- Minimization of engineering requirements and reduction in life cycle costs through Totally Integrated Automation (TIA)

- Minimization of configuration requirements through repeated use of scalable, dynamic objects

- Intelligent tools for simple and efficient configuration:
  - Wizard for definition of basic structure for an HMI project
  - Table-based editors simplify the generation and processing of objects of the same type, e. g. for variables, texts or messages
  - Graphic configuration simplifies complex tasks such as the definition of trajectories or the generation of fundamental operator prompting

- Comprehensive support of multi-language configurations for global use
  - Selectable views for multi-language input of configuration data
  - System-specific and user-specific dictionaries
  - Export/import of language-dependent texts

- Investment protection through
  - Importing of configuration from the configuration tools of the ProTool range
  - Transfer of static picture components and variables from WinCC V6.0

Design

The engineering tools of the SIMATIC WinCC flexible range are based on one another. The available editors largely depend on the respectively configured target systems and their functions. A more comprehensive engineering tool such as WinCC flexible Standard, also offers the facilities of the smaller engineering tools, e. g. WinCC flexible Compact or Micro.

Upgrading of a smaller engineering tool to a larger one is possible using a Powerpack. An exception is WinCC flexible Micro.

The scope of functions of the WinCC flexible engineering tools already includes project support for the Runtime options available for SIMATIC Panels or WinCC flexible Runtime, independent of the RT licenses purchased. Separate licensing is required for the target system on order to use the configured Runtime options.

Function

Integration into automation systems

- Integration into SIMATIC STEP 7 (for Version V5.3 and higher or Professional Edition 2004)
  - Administration of the HMI projects within STEP 7
  - Shared use of communication settings and process point definitions, i. e. symbols and messages
  - Display of the HMI engineering objects in the SIMATIC manager of STEP 7

- Integration into component based automation (CBA) with SIMATIC iMap (available soon)
  - Management of CBA components with Runtime and HMI components in SIMATIC iMap
  - Connection of CBA components with/without HMI components in SIMATIC iMap
  - Generation of HMI basic data in SIMATIC iMap for WinCC flexible Advanced, e. g. tag list and connected HMI Modules

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SIMATIC WinCC flexible RT

Overview
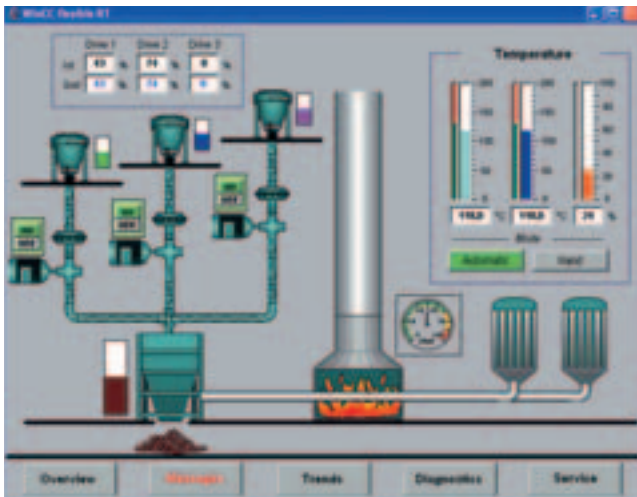
- **PC-based visualization software** for single-user systems at the machine
- Executable under Windows 2000/XP Professional
- **Current version:**
  - SIMATIC WinCC flexible 2005 Runtime with 128, 512 or 2048 PowerTags (available soon)

Benefits

- Optimized price/performance ration through individually scalable system functionality
- Functions for all visualization tasks:
  Input functions, graphics and curves, message system, protocol system, logging system, archiving (option), recipe management (option), process fault diagnostics (option)
- Flexible Runtime functionality using Visual Basic scripts
- Innovative servicing concepts with remote operation, diagnostics, administration using Internet/Intranet and e-mail communication increase the availability (option)
- Support of simple, distributed automation solutions on basis of TCP/IP networks at machine level (option)

Application

SIMATIC WinCC flexible Runtime is the high-performance visualization software for simple visualization tasks at the machine. It can be implemented as a single-user solution for all automation applications in production automation, process automation and building services automation.

SIMATIC WinCC flexible Runtime can be used in combination with the following operator units:

- SIMATIC Panel PCs
  - Panel PC 670
  - Panel PC 677
  - Panel PC 870
  - Panel PC 877
  - Panel PC IL 77
- SIMOTION Panel PCs
  - PCR, PCR-Touch
- SINUMERIK Panel PCs
  - OP010, OP012, OP015
  - TP012, TP015, OP015A
- Standard PCs with resolutions of (W x H in pixels):
  - 640 x 480, 800 x 600, 1024 x 768, 1280 x 1024, 1600 x 1200

Design

SIMATIC WinCC flexible Runtime is available as a software package with 128, 512 and 2048 PowerTags. The term PowerTags is applied only to process variables that have a process connection to the PLC control. Variables with no process link, constant limit values of variables and messages (up to 4000 bit-triggered messages) are also available as additional system performance.

The scope of WinCC flexible Runtime functions includes HMI components for visualization and signaling, and can be expanded appropriate to requirements and costs using option packages.

SIMATIC WinCC flexible Runtime is configured using the SIMATIC WinCC flexible Advanced configuration software.

Options

WinCC flexible RT can be expanded by the following features:

- WinCC flexible archives for logging process values and messages
- WinCC flexible recipes for managing data sets in recipes which contain associated machine or production data
- WinCC flexible Sm@rtAccess for communication between different SIMATIC HMI systems
- WinCC flexible Sm@rtService for remote maintenance and servicing of machines/plants via the Internet/Intranet
- WinCC flexible OPC server for use as a data server (OPC server) for higher-level automation components such as control systems or systems in the office area

8

Overview

In modern mechanical engineering, mainly variable-speed drives are used. These provide flexibility, high product quality and power savings.
Siemens offers a wide range of drives with graded performances. Selection of the right drive depends on the task. The SIMOTION Motion Control system supports the following converter systems:

- The SINAMICS S and SINAMICS G converter systems can be used for speed-controlled drives and are connected to SIMOTION over the
  - PROFIBUS DP interface
- SINAMICS S120
  The SINAMICS S120 converter system
  - can be used as a servo drive for highest demands and connected to SIMOTION over
    - isochronous PROFIBUS DP
    - in case of SIMOTION D the SINAMICS S120 Control Unit is integrated into the SIMOTION D Control Unit
  - can be used as a speed-controlled drive (Vector Control) and connected to SIMOTION over
    - PROFIBUS DP
    - in case of SIMOTION D the SINAMICS S120 Control Unit is integrated into the SIMOTION D Control Unit
- SIMODRIVE 611 universal and SIMOVERT MASTERDRIVES MC
  Both converter systems can be used as servo drives and connected to SIMOTION over
  - isochronous PROFIBUS DP or
  - analog interface.
- SIMOVERT MASTERDRIVES VC
  The SIMOVERT MASTERDRIVES VC converter system is used as a speed-controlled drive and can be connected to SIMOTION over

- PROFIBUS DP or
- analog interface.
- SIMODRIVE POSMO CD/CA and SI
  The intelligent SIMODRIVE POSMO CD/CA and SI drives can be used as distributed servo drives and connected to SIMOTION over
  - isochronous PROFIBUS DP.
- SIMOREG DC MASTER
  The SIMOREG DC MASTER converters are used as speed-controlled drives and can be connected to SIMOTION over
  - PROFIBUS DP or
  - analog interface.
- MICROMASTER 420/430/440 and COMBIMASTER
  The MICROMASTER converter system can be used as a speed-controlled drive and connected to SIMOTION over
  - PROFIBUS DP or
  - analog interface.
- Stepper drives such as the FM STEPDRIVE with SIMOSTEP motors
  The C230-2 Motion Controller has a pulse train output for the position setpoint for each axis (up to 4 axes). Stepper drives can either be operated without an encoder or be position-controlled with an encoder.
- SIMODRIVE POSMO A
  The intelligent positioning motor SIMODRIVE POSMO A can be connected to SIMOTION over
  - PROFIBUS DP.

Drive	Interface			Motion Control functions with SIMOTION	Startup tool
	Analog interface	PROFIBUS DP	PROFIBUS DP with isochronous operation		
SINAMICS S and SINAMICS G		●		●	STARTER (integrated in SCOUT)
SINAMICS S120		●	●	●	STARTER (integrated in SCOUT)
SIMODRIVE 611 universal	●	●	●	●	SimoCom U
SIMOVERT MASTERDRIVES MC	●	●	●	●	DriveMonitor
SIMOVERT MASTERDRIVES VC	●	●		● [1]	DriveMonitor
SIMODRIVE POSMO CD/CA/SI		●	●	●	SimoCom U
SIMOREG DC MASTER	●	●		●	DriveMonitor
MICROMASTER 420/430/440 and COMBIMASTER	●	●		● [1]	STARTER (integrated in SCOUT)
SIMODRIVE POSMO A		●			SimoCom A
Stepper drives, e. g. over FM STEPDRIVE power section	●			●	SCOUT

[1] With ext. encoder and limited dynamics

Connecting the drives to SIMOTION; Motion Control functions and commissioning tools

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Connection of the drive systems to SIMOTION - Schematic representation (not SIMODRIVE POSMO A)
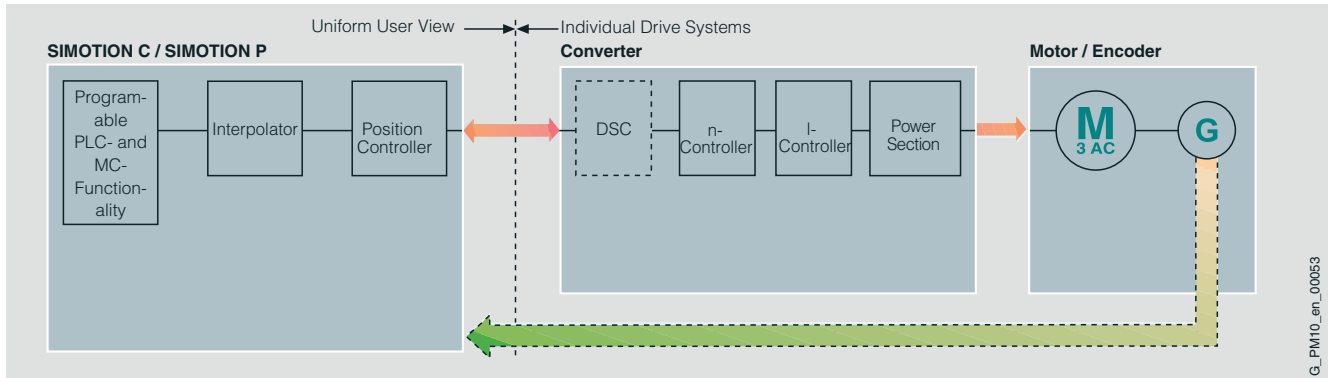
- The whole Motion Control functionality including the position control is provided by SIMOTION. For this reason, all drive systems are used in speed-controlled mode. The Motion Control functionalities which may be included in the drive are not used.
- SIMOTION has a interface driver for each drive system which provides a uniform view on the different drive systems. This means that applications can be created (programmed) in SIMOTION independent of the connected drive. This makes engineering significantly easier. Example: A drive can be enabled or positioning command can always be given in the same way independent of the actually used drive system.

Note:
SIMODRIVE POSMO A is operated as a standard slave on PROFIBUS DP. The Motion Control functionalities of the SIMODRIVE POSMO A are controlled by the function blocks from the SIMOTION Function Library. The Motion Control functionalities of SIMOTION cannot be used with SIMODRIVE POSMO A.

Analog connection of drive systems to SIMOTION C - Schematic representation
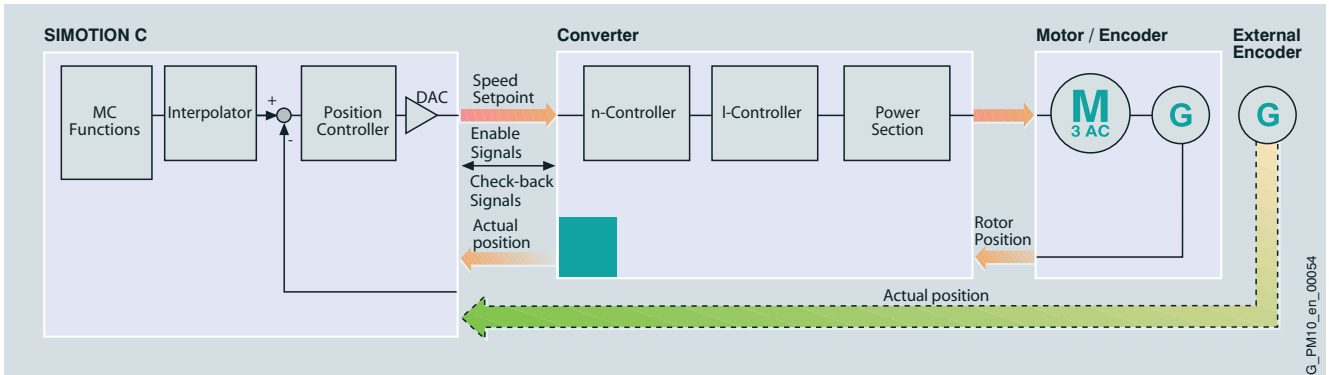
- SIMOTION C provides the hardware (encoder inputs, analog outputs, digital I/Os) for connection of up to four analog drives.
- The drives are operated by the ± 10 V analog outputs.

The actual position values can either be transmitted directly from the encoder to SIMOTION C or acquired from the encoder simulation of the converter (e. g. angular encoder). The corresponding digital I/Os are used for drive enables and drive feedback signals.

PROFIBUS DP - Connection of drive systems to SIMOTION C - Schematic representation
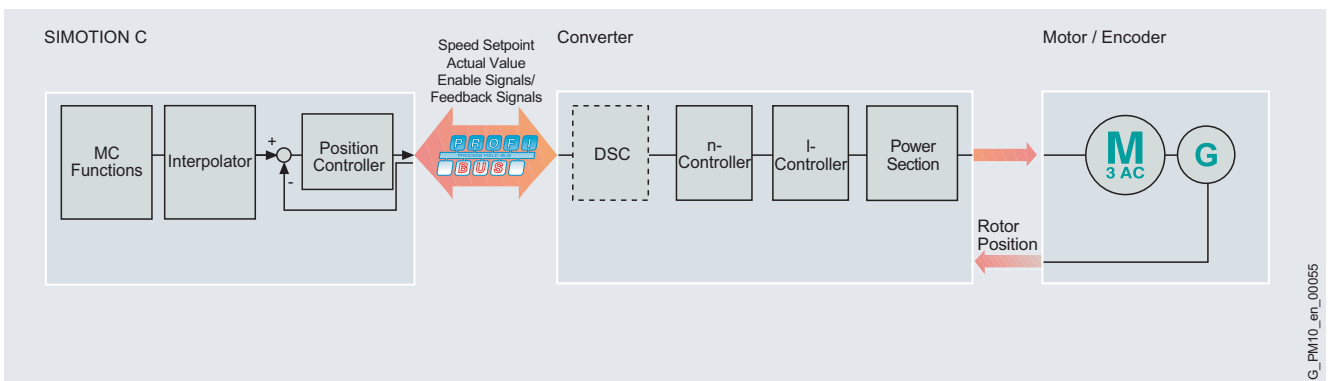
- Coupling via PROFIBUS DP enables the drive system and SIMOTION to exchange all of their data over this link. Isochronous operation on PROFIBUS DP (PROFIdrive, version 3, isochronous operation) ensures synchronized communication between SIMOTION and the drive.

- This type of connection allows all parameter data of the drive to be exchanged over PROFIBUS DP. This also allows commissioning, testing and diagnostics without having to reconnect cables.
- To achieve higher dynamics, shorter response times to faults and reduce the following error, the function DSC (Dynamic Servo Control) can be used. The position controller is executed in the drive with the same frequency as the speed controller (e. g. in 125 µs).

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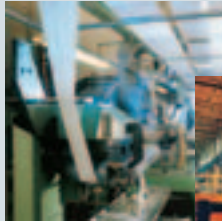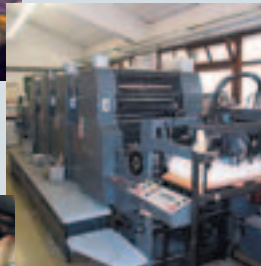
SINAMICS

Applications of the SINAMICS drive family

Application

SINAMICS is the new family of Siemens drives designed for machine and plant engineering applications. SINAMICS offers solutions for all drive tasks:

- Simple pump and fan applications in the process industry.
- Complex single drives in centrifuges, presses, extruders, elevators, as well as conveyor and transport systems.
- Drive line-ups in textile, plastic film and paper machines, as well as in rolling mill plants.
- Highly dynamic servo drives for machine tools, as well as packaging and printing machines.

Versions

Depending on the application, the SINAMICS range offers the ideal version for any drive task.

- SINAMICS G is designed for standard applications with asynchronous motors. These applications have less stringent requirements regarding the dynamics and accuracy of the motor speed.
- SINAMICS S handles complex drive tasks with synchronous/asynchronous motors and fulfills stringent requirements regarding:
  - dynamics and accuracy
  - integration of extensive technological functions in the drive control system

Platform concept and Totally Integrated Automation

All SINAMICS versions are based on a platform concept. Joint hardware and software components, as well as standardized tools for design, configuration and commissioning tasks, ensure high-level integration across all components. SINAMICS handles a wide variety of drive tasks with no system gaps. The different SINAMICS versions can be easily combined with each other.

SINAMICS is a part of the Siemens "Totally Integrated Automation" concept. Integrated SINAMICS systems covering configuration, data storage and communication at automation level, ensure low-maintenance solutions with SIMATIC and SIMOTION.
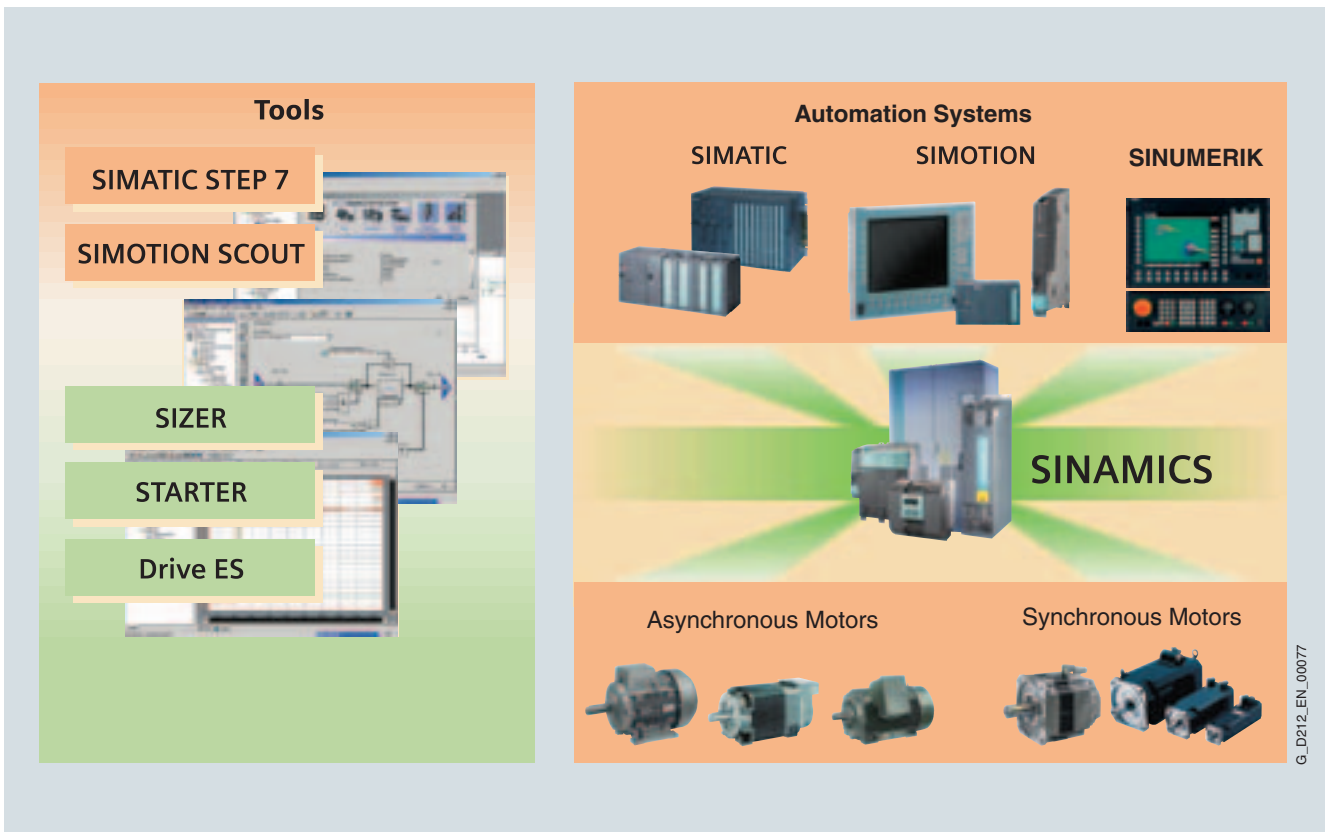
SINAMICS as part of the Siemens modular automation system

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Quality to DIN EN ISO 9001

SINAMICS conforms with the most exacting quality requirements. Comprehensive quality assurance measures in all development and production processes ensure a consistently high level of quality.

Of course, our quality assurance system is certified by an independent authority to DIN EN ISO 9001.

Suitable for use anywhere in the world

SINAMICS meets the requirements of relevant international standards and regulations – from the EN standards through IEC standards to UL and cULus regulations.

The SINAMICS drive family

The SINAMICS family comprises members tailored to the respective application fields:

- SINAMICS G110 – the versatile drive in the lower power range
- SINAMICS G130 and SINAMICS G150 – the universal drive solution for single drives with high output ratings

- SINAMICS S120 – the flexible, modular drive system for demanding drive tasks
- SINAMICS S150 – the sophisticated drive solution for single drives with high output ratings

The SINAMICS family is characterized by the following system features:

- Uniform functionality based on a common platform strategy
- Uniform engineering
- High degree of flexibility and combination
- Wide output power range
- Designed for worldwide use
- SINAMICS Safety Integrated
- Increased economy and effectiveness
- Flexible interfacing facilities to host controllers
- Totally Integrated Automation

8

SINAMICS S120

■ Overview

① Control Unit
② Smart Line or Active Line Module
③ Single Motor Module
④ Double Motor Module
⑤ Single Motor Module

Power line MOTION-CONNECT
Signal line MOTION-CONNECT
DRIVE-CLiQ
DRIVE-CLiQ MOTION-CONNECT
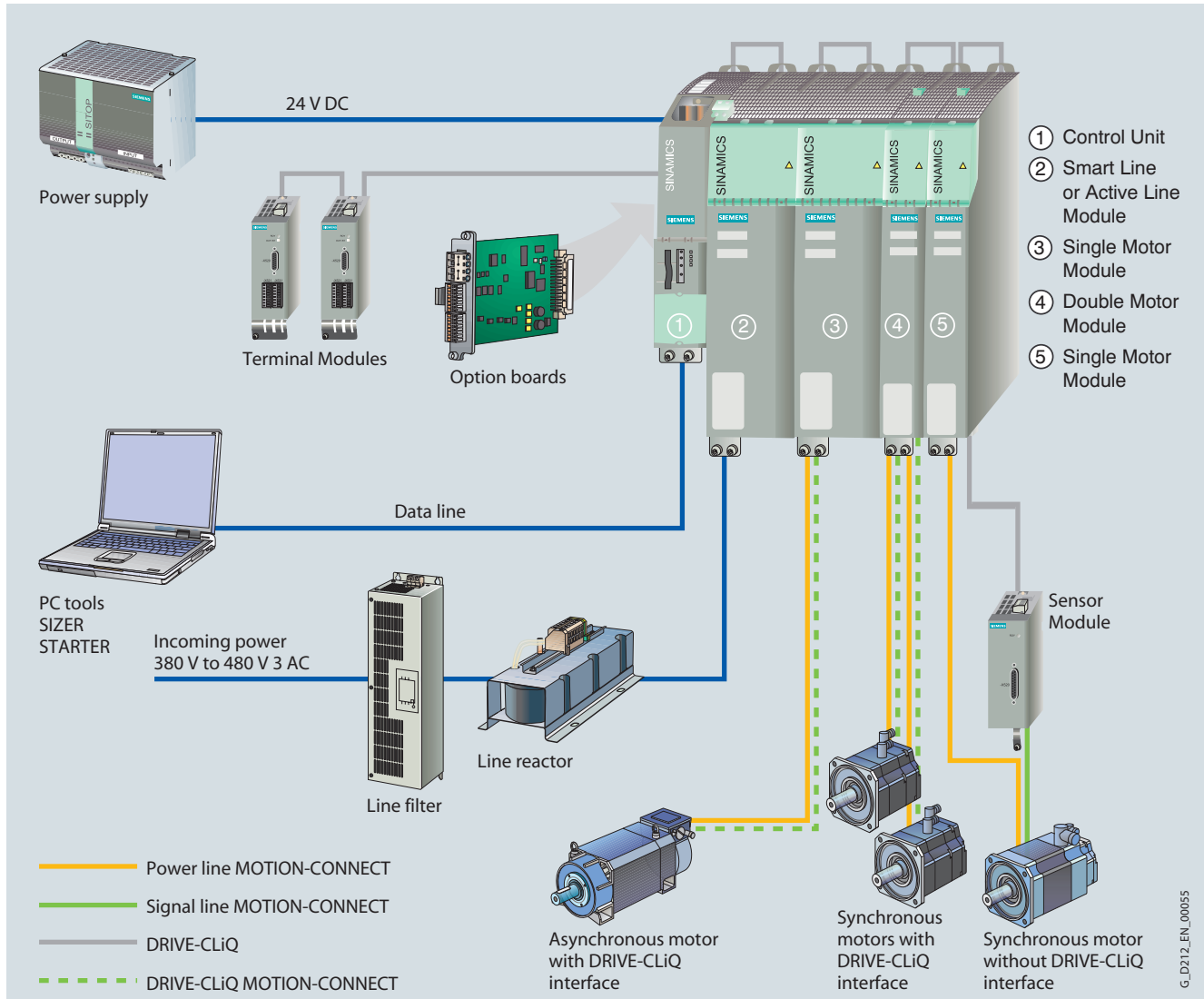
SINAMICS S120 system overview

Modular system for demanding drive tasks

SINAMICS S120 solves demanding drive tasks for a wide range of industrial applications and is, therefore, designed as a modular system. Users can choose from many different harmonized components and functions to create a solution that best meets their requirements. SIZER, a high-performance configuration tool, makes it easier to choose and determine the optimum drive configuration.

SINAMICS S120 is enhanced by a wide range of motors. Whether synchronous or asynchronous, all motor types are supported by SINAMICS S120.

Drive for multi-axis applications

The trend towards separate axes in machine building is growing all the time. Where possible, central drives are being replaced by electronically coordinated servo drives. Drives with coupled DC links are required for this purpose, as they support economic energy exchange between braking and driving axes.

SINAMICS S120 covers a wide power range of Line and Motor Modules, which, having been designed for seamless integration, pave the way for compact multi-axis drive configurations.

New system architecture with a central Control Unit

Electronically coordinated axes work together to perform your drive tasks. Higher-level controllers operate the drives to achieve the required coordinated movement. This requires cyclic data exchange between the control and all the drives. This exchange usually took place via a field bus, which required a great deal of time and effort for installation and configuration. SINAMICS S120 takes a different approach: A central Control Unit controls the drives for all connected axes and also establishes the technological links between the drives and/or axes. Since all the required data is stored in the central Control Unit, it does not need to be transferred. Inter-axis connections can be established within a Control Unit and easily configured in the STARTER commissioning tool.

Simple technological tasks can be carried out automatically by the SINAMICS S120 Control Unit. For complex numerical or Motion Control tasks, high-performance SIMOTION D Modules can be used instead.

DRIVE-CLiQ – the digital interface between all components

All SINAMICS S120 components, including the motors and encoders, are interconnected via a serial interface called DRIVE-

CLiQ. The standardized cables and connectors reduce the variety of different parts and cut inventory costs.

Sensor Modules for converting standard encoder signals to DRIVE-CLiQ are available for third-party motors or retrofit applications.

Electronic rating plate in all components
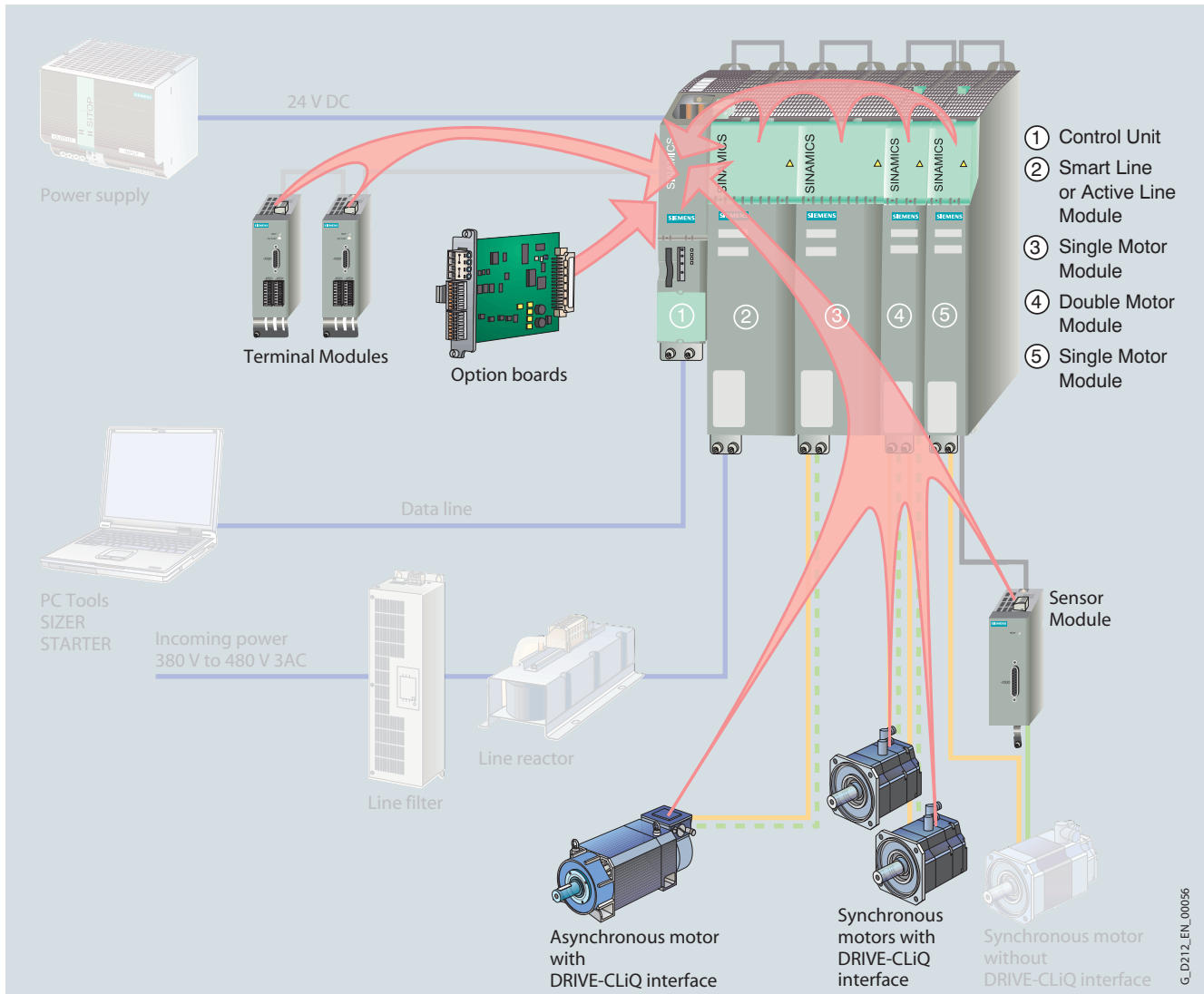
Detection of electronic rating plates via DRIVE-CLiQ with SINAMICS S120

All SINAMICS S120 components with DRIVE-CLiQ interface have an electronic rating plate that contains all the relevant data about that particular component. In the motors, for example, this data includes the parameters of the electric equivalent circuit diagram and characteristic values for the built-in motor encoder. The Control Unit records this data automatically via DRIVE-CLiQ so that it does not need to be entered during commissioning or when the equipment is replaced.

In addition to the technical data, the rating plate includes logistical data (manufacturer ID, order number, and globally unique ID). Since this data can be called up electronically on site or remotely, all the components used in a machine can always be individually identified, which helps simplify servicing.

Further information

Further information on technical data and ordering data can be found in the catalogs

- *D 21.1: SINAMICS S120 Vector Control Drive System*
- *D 21.2: SINAMICS S120 Servo Control Drive System*

and in the Interactive Catalog under "Drive Technology/AC Converters".

Further information also on the Internet:
http://www.siemens.com/sinamics

System components
Drives

■ Overview

The SIMODRIVE 611 universal drive system, with its modular design, covers a wide performance spectrum.
The wide variety of Control Modules makes it possible to interface virtually any drive combination to SIMOTION. The Double-axis Modules make a space-saving configuration of the module group possible.

With the available modularity, virtually any drive combination is possible. This permits integrated configuring for every installation, ranging from compact machines to complex plants.

The SIMODRIVE 611 universal drive system is designed for direct operation on grounded systems (TN networks) with rated voltages of 400 V three-phase AC, 415 V three-phase AC, and 480 V three-phase AC. Adaptation transformers tailored to the system are available for adaptation of the system to other network forms, such as for operation with ungrounded systems (IT or TT networks).

■ Benefits

- Suitable for synchronous and asynchronous motors
- Compact configurations with Single-axis and Double-axis Modules
- Communications with PROFIBUS DP, the most successful field bus standard in the world
- Powerful, easy-to-use SimoCom U commissioning tool
- All data in the package are on a transferable Memory Sub-Module

■ Application

The SIMODRIVE 611 universal drive system is designed for highly dynamic applications.

■ Design

SIMODRIVE 611 universal is a component of the modular SIMODRIVE 611 system. All components, such as supply connections and Power Modules, may be used.

Control plug-in units with single-axis design and double-axis design

The SIMODRIVE 611 universal provides several types of control plug-ins (Control Unit):

- Type 1
  Single-axis design with resolver and speed/torque setpoint
- Type 2
  Single-axis design with resolver and speed/torque setpoint and an additional positioning functionality
- Type 3
  Double-axis design with resolver and speed/torque setpoint
- Type 4
  Double-axis design with resolver and speed/torque setpoint and an additional positioning functionality
- Type 5
  Double-axis design with sin/cos 1 V_{pp}/EnDat absolute encoder and speed/torque setpoint
- Type 6
  Double-axis design with sin/cos 1 V_{pp}/EnDat absolute encoder and speed/torque setpoint, and an additional positioning functionality

A double-axis design must be selected if a direct measuring system (additional encoder) is connected.

Because SIMOTION takes on the Motion Control functionality, the positioning functionality of the SIMODRIVE 611 universal is not required. This also applies if the DSC function is used for the axis (in addition, DSC can be used in a configuration with n-control only). Thus, for a SIMODRIVE 611 universal interface with SIMOTION, only types 1, 3, and 5 should be used.

Communication interfaces

SIMODRIVE 611 universal provides a number of communication interfaces to SIMOTION:

- Analog setpoint interface (speed/torque setpoint)
- Incremental shaft-angle encoder interface (WSG, RS 422)
  - The actual speed value is output incrementally via two pulse trains displaced by 90°
  - Specification of a speed setpoint either via two pulse chains displaced by 90° or by frequency specification with a directional signal
- PROFIBUS DP
- 4 digital inputs/outputs

8

■ Integration

Encoder technology

The following encoder evaluations are available on some of the control units:

- Resolvers:
  Number of pole pairs from 1 to 6; operating frequency max. 375 Hz, internal pulse multiplication 4096 x number of pole pairs
- Incremental encoder
  With sin/cos 1 V_{pp} signals 1 to 65535 pulses, max. 350 kHz, internal pulse multiplication 128 x pulses
- Absolute encoders
  With EnDat interface same as sin/cos 1 V_{pp} encoders, plus absolute position via EnDat protocol

Applicable motors

Control units with analog speed setpoint interface and optional PROFIBUS DP interface as well as with/without positioning functionality are available for the following motors:

- Synchronous servo motors 1FT6, 1FK
- Asynchronous servo motors 1PH
- Linear motors 1FN
- Asynchronous motors 1LA5, 1LA6 with/without encoder
- External motors suitable for converter operation

Commissioning

Commissioning can be done using either the 7-segment display and keyboard on the module or the "SimoCom U" commissioning tool for PCs with Windows 95/98/NT/2000/XP.
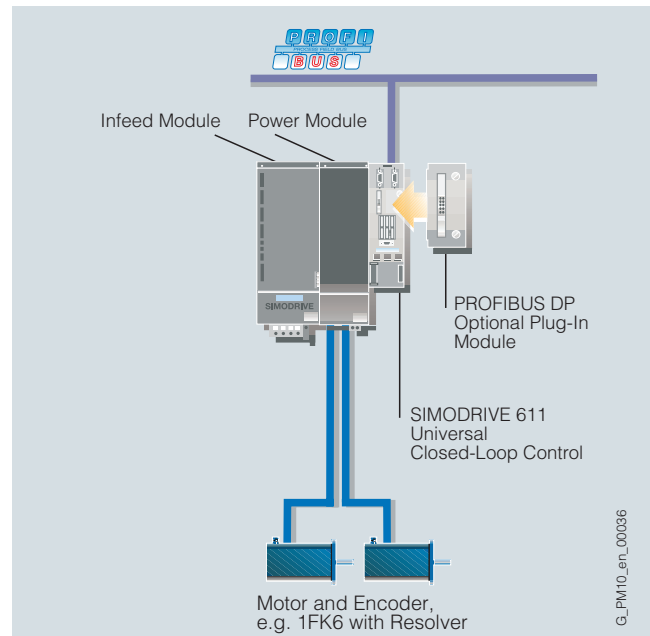
SIMODRIVE 611 universal on the PROFIBUS DP

Important notes:

- *In conjunction with SIMOTION, the option Module "PROFIBUS DP for Motion Control" has to be used.*
- *The operation with SIMOTION requires:*
  - software version ≥ V6.2 or higher for the Control Unit
  - speed/torque setpoint function,
  is required for operation with SIMOTION.

A SIMODRIVE 611 universal control unit with the positioning function is not required. This is also true when the DSC function is used with SIMOTION.

■ Further information

Further information on technical data and ordering data can be found in Catalog DA 65.4 and in the Interactive Catalog under "Drive Technology/AC Converters".

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System components
Drives

■ Overview

SIMOVERT MASTERDRIVES – Consistently uniform frequency converters

SIMOVERT MASTERDRIVES are AC frequency converters. They allow the speed of AC motors to be adjusted very accurately. This device series has been designed for worldwide use. It is suitable for all supply voltages from 230 to 690 V and has been approved worldwide.

SIMOVERT MASTERDRIVES is a well thought-out, modular device series which can be adapted to each application and used in every sector. And it has the right controller for each application: Frequency controller and vector controller for SIMOVERT MASTERDRIVES VC and servo controller for highest dynamics with SIMOVERT MASTERDRIVES MC.

SIMOVERT MASTERDRIVES have a consistent uniform design: They have a uniform user interface; even devices with different controller designs can be combined and connected in series and have a uniform design. As System Modules they always offer a suitable solution regardless of whether they are used as individual drives or multi-motor drives.

Features

- Modular expansion capability through operator panels, terminal expansions, Braking Modules, input and output filters
- High speed and torque accuracy
- Good dynamics
- Very smooth running at low speeds
- High overload capability
- High power density
- Excellent price and performance
- Easy and user-friendly configuration with PFAD

SIMOVERT MASTERDRIVES frequency converters – Vector Control

The SIMOVERT MASTERDRIVES Vector Control converter series comprises modular, powerful components which can be combined for individual applications.

The SIMOVERT MASTERDRIVES are available in two versions:
- Converters for connection to three-phase supplies
- Inverters for connection to DC busbars which are supplied by rectifier or rectifier/regenerative feedback units

SIMOVERT MASTERDRIVES are also available as compact devices and chassis units.

- Compact PLUS devices are the specialists where space is at a premium. The "BOOKSIZE" format with IP20 degree of protection and the optimal connection method for the devices permits installation of extremely compact multi-motor drives. Compact PLUS devices can be installed in cabinets with a depth of 300 mm (11.8 in).
- Compact devices
  Have IP20 degree of protection and have been designed in the space saving "BOOKSIZE" format. The devices are simply latched in a standard DIN G-profile rail and fixed with a screw at the bottom of the device.
  Compact devices can be installed in cabinets with a depth ≥ 400 mm (15.7 in).
- Chassis units
  Have IP00 degree of protection:
  Covers fulfill the safety regulations to DIN VDE 0113 Part 5 and DIN VDE 0106 Part 100 (VBG4). The unit can be retrofitted with an assembly kit to achieve IP20 degree of protection (option).

The compact devices and chassis units can be mounted without spacing.

SIMOVERT MASTERDRIVES – Motion Control

The SIMOVERT MASTERDRIVES Motion Control (MC) frequency converters are tailored especially for industrial applications with servo drives.

In addition to the proven hardware modularity, SIMOVERT MASTERDRIVES Motion Control also offers consistent software modularity:

- Freely configurable function blocks
- Integrated technology functions

The SIMOVERT MASTERDRIVES Motion Control series is consistent with respect to

- Communication
- Technology
- Operation and visualization

and is available for the mains voltages 380 V to 480 V 3 AC, 50/60 Hz and the following designs depending on output:

- Compact PLUS (0.55 kW to 18.5 kW) (0.7 HP to 25 HP)
- Compact and chassis units (2.2 kW to 250 kW) (2.9 HP to 335 HP)
- Chassis units 45 kW to 250 kW (60 HP to 335 HP)

The SIMOVERT MASTERDRIVES concept is distinguished by:

- Very high dynamics
- Positioning
- Angular synchronization of drives
- Cams

and thus fulfills the high demands which servo technology must meet.

SIMOVERT MASTERDRIVES Motion Control converters are optimally adapted to the compact and highly dynamic Siemens servo motors.

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These synchronous and asynchronous servo motors are especially suited for highly dynamic applications.

As a complement to the highly dynamic MC controller on the motor side, the MASTERDRIVES AFE (Active Front End) now also offers an active vector control to ensure optimized power supply.

MASTERDRIVES AFE is distinguished by:

- No phase effects on the system, i. e. a very good overall performance factor
- Stable operation even in the event of voltage dips or power failure
- Highly dynamic infeed and feedback
- Reactive power compensation possible
- Four-quadrant operation

A comprehensive range of system components and accessories complete the spectrum.

Customer-specific, uniform system solutions (automation/converter/motor) are available for many different applications in all industrial sectors.

User-friendly tools for configuration (PFAD) AND commissioning are available for MASTERDRIVES.

All our customers and SIMOVERT MASTERDRIVES users have direct access to competent advice, configuration, training and service through the worldwide Siemens service and sales network.

Customer-specific solutions

The compact devices and chassis units can be used in air-cooled and water-cooled control cabinets and plant configurations.

Rectifier and regenerative feedback units can also be implemented as active front ends.

Our sales personnel and application workshops will find an optimal system solution for you.

Benefits

- Suitable for operation with synchronous and asynchronous motors
- Space-saving versions as Compact PLUS units, compact units and built-ins
- Communications with PROFIBUS DP, the most successful field bus standard in the world
- Powerful, user-driven DriveMonitor commissioning tool

The version with self-commutated rectifier/regenerative feedback unit Active Front End (AFE) has the following advantages:

- Low system perturbation
- No shoot-through
- High dynamic operation

Application

SIMOVERT MASTERDRIVES are particularly well suited both for extremely dynamic applications and continuous webs (tension-controlled sectional drives).

Design

The SIMOVERT MASTERDRIVES Motion Control converter series is of modular design. The units are available in the following versions:

- Compact PLUS units, IP20
- Compact units, IP20
- Chassis units, IP00

Interfaces and I/Os

The SIMOVERT MASTERDRIVES converters are equipped with:

- Digital and analog inputs/outputs
- One or more RS 232/RS 485 serial interfaces

Optional Modules

The following modules make it possible to customize the system to meet specific user requirements in conjunction with SIMOTION:

- Communication Modules
- Encoder Modules
- Technology Modules
- Terminal Expansion Modules
- Interface Modules

System components

The range is completed with these system components:

- Rectifier/regenerative feedback units
- Interference suppression filters
- Line filters

Integration

Encoder technology

The SIMOVERT MASTERDRIVES Motion Control converters support the following encoders:
- Incremental encoder
- Resolver
- Encoder/absolute encoder

Applicable motors

The SIMOVERT MASTERDRIVES converters are suitable for nearly all types of motors:
- Standard asynchronous motors
- Asynchronous servo motors
- Synchronous servo motors

Important notes:

The following software versions are required for SIMOVERT MASTERDRIVES when operated with SIMOTION:

- *MASTERDRIVES VC*
  CUVC Control Module or Compact Plus: Software version ≥ V3.3
  CBP2 Communication Module: Software version ≥ V2.21
- *MASTERDRIVES MC*
  CUMC Control Module or Compact Plus: Software version ≥ V1.6
  CBP2 Communication Module: Software version ≥ V2.21

Further information

Further information on technical data and ordering data can be found in Catalog DA 65.10 and DA 65.11 as well as in the Interactive Catalog under "Drive Technology/AC Converters".

Further information also on the Internet:
http://www.siemens.com/masterdrives

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SIMODRIVE POSMO CD/CA

Overview

SIMODRIVE POSMO CD

SIMODRIVE POSMO CD/CA are complete converter and control units for a distributed single-axis drive system and are direct nodes on the PROFIBUS DP.

They make it possible to solve control and drive tasks using independent, modular functional units directly "on site" at the machine.

The system can be installed virtually anywhere close at machine level due to its high degree of protection IP65.

A line infeed module is usually required for generating the DC supply voltage for the SIMODRIVE POSMO CD. The SIMODRIVE POSMO CA can be directly connected to the 3-phase AC TN system. The 24 V DC electronics power supply is generated in the device. For diagnostics, a 24 V DC electronics power supply can also be fed in externally.

SIMODRIVE POSMO CA

Benefits

- Flexibility due to installation at machine level, for various types of motors
- Reduced control cabinet overhead by locating the drives directly "on site" at the machine
- Low installation overhead due to linking via the communication bus and power bus
- Direct linking of drive-related process signals via 4 terminals programmable as either inputs or outputs
- Reduced installation costs due to pre-assembled power cables
- High-speed diagnostics via
- LED for Fault/Ready on the drive unit
- PROFIBUS DP and SimoCom U
- Easy drive replacement for servicing because all commissioning data is stored on the memory card

Application

- Handling
- Packaging machinery
- Textile machinery
- Woodworking machinery
- Machine tools

Design

- The SIMODRIVE POSMO CD/CA is a complete functional unit consisting of:
  - Power section
  - Electronic control system
  - Positioning control with program memory
  - Motion Control with PROFIBUS DP interface
- Power infeed, looping through and motor connection are implemented with non-interchangeable safety locking devices
- Connection is made using the plug-in PROFIBUS DP unit or via ECOFAST. Pre-assembled cables with built-on flanges are offered for the PROFIBUS DP unit.
- M12 plug-in connectors are used for
  - parameterizable digital inputs/outputs
  - parameterizable diagnostic signals
- The measuring systems for recording the position and speed are connected using plugs protected against reversed polarity. These have a design identical to the power socket connectors.

Further information

Further information on technical data and ordering data can be found in Catalog DA 65.4 and in the Interactive Catalog under "Drive Technology/Distributed Drive Technology".

8

SIMODRIVE POSMO SI

Overview

SIMODRIVE POSMO SI is a single-axis servo drive for a distributed servo-drive system as direct node on the PROFIBUS DP.

This servo-drive system is a self-contained, fully functional mechatronic unit. Control and drive tasks can be solved directly on site using autonomous, modular function units.

The high IP65/IP67 degree of protection of the system permits individual installation on the machine.

A line infeed module is usually required to generate the DC supply voltage. The 24 V DC electronics power supply is generated in the device.

For diagnostic purposes, a 24 V DC electronics power supply can also be fed in externally.

Benefits

- Reduced control cabinet overhead by locating the drives directly "on site" at the machine
- Fast machine installation due to mounting of a complete drive unit
- Low installation overhead due to linking via the communication bus and power bus
- Direct linking of drive-related process signals via 4 programmable inputs or outputs
- Reduced installation costs due to pre-assembled power cables
- High-speed diagnostics via
- LED for Fault/Ready on the drive unit
- PROFIBUS DP and SimoCom U
- Easy drive replacement for servicing because all commissioning data is stored on the memory card

Application

- Handling
- Packaging machinery
- Textile machinery
- Woodworking machinery
- Machine tools

Design

Power and information electronics is integrated in the motor with the SIMODRIVE POSMO SI.

- The SIMODRIVE POSMO SI is a complete function unit consisting of:
  - 1FK6 synchronous motor
  - Power section
  - Electronic control system
  - Positioning control with program memory
  - Motion Control with PROFIBUS DP interface
- Power infeed, looping through and motor connection are implemented with non-interchangeable safety locking devices
- Connection is made using the plug-in PROFIBUS DP unit. Pre-assembled cables with built-on flanges are offered for the PROFIBUS DP unit.
- M12 plug-in connectors are used for
  - parameterizable digital inputs/outputs
  - parameterizable diagnostic signals

Further information

Further information on technical data and ordering data can be found in Catalog DA 65.4 "SIMODRIVE 611 universal and POSMO" and in the Interactive Catalog under "Drive Technology/Distributed Drive Technology".

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System components
Drives

MICROMASTER standard drives

■ Overview

The converters of the MICROMASTER series are frequency converters for controlling the speed of induction motors. The factory settings for the MICROMASTER converters cover a wide range of simple control tasks. The comprehensive setting options also allow them to be used for complex drive control tasks.

MICROMASTER 420

Application

The MICROMASTER 420 converter is suitable for a variety of variable-speed drive applications. It is especially suitable for applications with pumps, fans and in conveyor systems.

It is the ideal cost-optimized frequency inverter solution. The converter is especially characterized by its customer-oriented performance and ease-to-use. Its large range of mains voltages enables it to be used all over the world.

Design

The MICROMASTER 420 converter has a modular design. The operator panels and Communication Modules can be easily exchanged without requiring any tools.

Main characteristics
- Easy, guided commissioning
- Modular construction allows maximum configuration flexibility
- Three fully parameterizable isolated digital inputs
- One analog input (0 V to 10 V, scaleable) or for use as 4th digital input
- One parameterizable analog output (0 mA to 20 mA)
- One parameterizable relay output
  30 V DC/5 A resistive load
  250 V AC/2 A inductive load
- Low-noise motor operation through high pulse frequency, adjustable (observe derating if necessary)
- Complete protection for motor and converter

MICROMASTER 430

Application

The MICROMASTER 430 converter is suitable for a variety of variable-speed drive applications. Its flexibility provides for a wide spectrum of applications. It is especially suitable for use with industrial pumps and fans.

The converter is especially characterized by its customer-oriented performance and ease-to-use. It has more inputs and outputs than the MICROMASTER 420, an optimized operator panel with manual/automatic switchover and adapted software functionality.

Design

The MICROMASTER 430 has a modular design. The operator panels and Communication Modules can be easily exchanged.

Main characteristics
- Easy, guided commissioning
- Modular construction allows configuration flexibility
- Six parameterizable isolated digital inputs
- Two analog inputs (0 V to 10 V, 0 mA to 20 mA, scalable) can also be used as a 7th/8th digital input
- Two parameterizable analog outputs (0 mA to 20 mA)
- Three parameterizable relay outputs
  30 V DC/5 A, resistive load
  250 V AC/2 A, inductive load
- Low-noise motor operation through high pulse frequency, adjustable (observe derating if necessary)
- Complete protection for motor and converter
- Control of up to three additional drives on the basis of PID control (motor staging)
- Operation of drive directly on mains (with external bypass circuit)
- Energy-saving mode
- Detects dry run of pumps (belt failure detection)

MICROMASTER 440

Application

The MICROMASTER 440 converter can be used for different speed-controlled drive applications. Its flexibility makes it suitable for a wide range of applications. These also include cranes and hoisting gear, high-bay warehouses, production machines for food, beverages and tobacco, packaging machines etc.; i. e. applications which require the frequency converter to have a higher functionality and dynamic response than usual.

The converter is especially characterized by its customer-oriented performance and ease-to-use. Its large range of mains voltages enables it to be used all over the world.

Design

The MICROMASTER 440 converter has a modular design. The operator panels and modules can be easily exchanged.

Main characteristics
- Easy, guided commissioning
- Modular construction allows maximum configuration flexibility
- Six parameterizable isolated digital inputs
- Two analog inputs (0 V to 10 V, 0 mA to 20 mA, scalable) can also be used as a 7th/8th digital input
- Two parameterizable analog outputs (0 mA to 20 mA)
- Three parameterizable relay outputs (30 V DC/5 A, resistive load; 250 V AC/2 A, inductive load)
- Low-noise motor operation through high pulse frequency, adjustable (observe derating if necessary)
- Complete protection for motor and converter

■ Further information

Further information on technical data and ordering data can be found in Catalog DA 51.2 "MICROMASTER 410/420/430/440 Converters" and in the Interactive Catalog under "Drive Technology/AC Converters".

Further information also on the Internet:
http://www.siemens.com/micromaster

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COMBIMASTER standard drives

■ Overview

COMBIMASTER

The COMBIMASTER 411/MICROMASTER 411 represents the integration of a frequency converter into a DS low-voltage motor. The COMBIMASTER 411 is already mounted onto the motor whereas the MICROMASTER 411 has to be mounted on Siemens or other motors by the customer. The power range lies between 0.37 kW (0.5 HP) and 3.0 kW (4 HP). This unit has the following advantages over a combination of the separate converter and motor units:

- No wiring between the converter and the motor
- Suitability of use in harsh industrial environments due to its high degree of protection (converter IP66 and motor IP55)
- Compact design facilitates compliance with the EMC regulations
- Integrated potentiometer for speed adjustment

■ Further information

Further information on technical data and ordering data can be found in Catalog DA 51.3 and in the Interactive Catalog under "Drive Technology/Low-Voltage Motors" or under "Drive Technology/Distributed Drive Technology".

Further information also on the Internet:
http://www.siemens.com/combimaster

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System components
Drives

Overview

Intelligent positioning motor as distributed node on PROFIBUS DP with the following features:

- Power section and complete motion control in the motor
- Coupled using a communication and power bus
- Degree of protection IP65 (dust-proof and jet-proof) in the SIPLUS POSMO A version

Benefits

- Simplification of the machine infrastructure by interfacing over the communication and power bus
- Straightforward communication interface for incorporation into any PROFIBUS environment. Uses the simple PROFIBUS services exclusively
- Two terminals (programmable as either inputs or outputs) for monitoring or controlling external drive-related signals, such as clamping and limit switches
- User-friendly function blocks simplify configuration
- Easy commissioning with the clear, user-friendly commissioning tool SimoCom A which is available on the Internet
- TIA-compatible through Drive ES.
  Thus common
  - Communication
  - Configuration
  - Data management

Additional information is available in the Internet under:

http://www.siemens.com/posmo

Application

- Positioning of formats, stops and tools
- Re-setting of process variables (e. g. via valves)
- Simple positioning tasks (in the handling sector)

Areas of application are found wherever simple positioning tasks must be solved on a decentralized basis on the machine or in the plant, without taking up additional space in the control cabinet and having to accommodate for the associated power losses. Flexible retrofitting of axes is possible without having to extend the control cabinet.

Design

Compact design of converter power section, motor control, position encoder, holding brake (300 W), positioning controller, program memory, and communications interface at the motor.

The motor can be equipped with a modular gearbox with graduated planetary gearing (one gearbox per motor) or worm gearing (75 W).

- The removable terminal cover with integrated PROFIBUS address switch and terminating resistor makes it possible to disconnect the motor without any interruption to communications or power supply of downstream stations.
- All connections are made using standard cables
- Local diagnostics by means of LED (fault/ready), plus two diagnostic socket connectors (programmable analog outputs) for service purposes

Further information

Further information on technical data and ordering data can be found in Catalog DA 65.4 "SIMODRIVE 611 universal and POSMO" and in the Interactive Catalog under "Drive Technology/Distributed Drive Technology".

Overview

The SIMOREG DC MASTER current converters are fully digital compact devices which are used for the armature and field current supply of the variable-speed DC machines.

The SIMOREG DC MASTER current converters are available for the following current and voltage ranges:

- 15 A to 2000 A
- For parallel connection of several devices up to 10000 A
- 400 V to 830 V 3 AC

The devices are designed as single-quadrant or four-quadrant devices.

The SIMOREG DC MASTER current converters comply with the relevant international standards and regulations and can therefore be used all over the world.

Benefits

- Low-cost four-quadrant drive
- Continuous operation at low speed
- Large speed setting range with constant output
- Small space requirements
- Low power losses
- Communication over PROFIBUS DP - the most successful fieldbus standard in the world
- DriveMonitor - a powerful, user-controlled commissioning tool

Application

SIMOREG DC MASTER units are especially suitable for applications with a large speed setting range, and as drives for continuous conveyors and hoisting gear.

Design

SIMOREG DC MASTER are compact devices with IP20 degree of protection.

Interfaces and I/Os

The SIMOREG DC MASTER current converters have:

- Digital and analog inputs/outputs
- One or more serial RS 232/RS 485 interfaces

Option Modules

The following modules permit the precise adaptation to customer-specific requirements in conjunction with SIMOTION:

- Communication Modules
- Encoder Modules
- Technology Modules
- Terminal Expansion Modules
- Interface Modules

Supplementary system components

The product range is rounded off with the following system components:

- Commutating reactors
- RFI suppression filters

Integration

Encoder technology

SIMOREG DC MASTER supports the use of the following encoders:

- Pulse encoders
- Analog tachogenerator

Applicable motors

- DC motors

Important information:

The following software releases are required for operating SIMOREG DC MASTER units on SIMOTION:

- *CUD1 Closed-loop Control Module: software release ≥ V 2.02*
- *CBP2 Communication Module: software release ≥ V 2.21*

Further information

Further information on technical data and ordering data can be found in Catalog DA 21 and in the Interactive Catalog under "Drive Technology/DC Converters".

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FM STEPDRIVE

Overview

The FM STEPDRIVE Power Module controls the motion of the stepper motors in the SIMOSTEP 1FL3 series with the utmost precision. In combination with the SINUMERIK 802S base line/802S manual machine controls and SIMOTION C230-2 or FM 353 and FM 357-2 Function Modules as well as the SIMATIC ET 200S Stepper Modules 1 STEP, it performs highly accurate positioning tasks in the lower output range up to 600 W.

The FM STEPDRIVE can be used for stepper motors with torques in the 2 Nm (1.5 lb-ft) to 15 Nm (11 lb-ft) range.

Design

The FM STEPDRIVE has the same design as the SIMATIC S7-300 family.

Further information

- on technical data and ordering data can be found in Catalog NC 60 and in the Interactive Catalog under "Automation Technology/Controls/SIMATIC S7/S7-300/Function Modules".
- on stepper motors can be found under "System Components/Motors".

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Overview

The three-phase motors are perfectly adapted to the converter systems SINAMICS, SIMODRIVE 611 and SIMOVERT MASTERDRIVES MC.

The high power density of the servo motors makes them extremely suitable for use in compact machines.

The windings are insulated with DURIGNIT IR 2000 in accordance with temperature class F. This provides the basis for high thermal reserves for long life and overloading.

Designs/features	1FT6	1FK6	1FK7	1FN3 linear motor
Speed/velocity	1500 rpm to 6000 rpm	3000 rpm/6000 rpm	3000 rpm/4500 rpm/ 6000 rpm	58 m/min to 836 m/min (190 ft/min to 2742 ft/min)
Static torque M_0/feed force F_N	0.4 Nm to 175 Nm (0.3 lb-ft to 130 lb-ft)	1.1 Nm to 36 Nm (0.8 lb-ft to 26 lb-ft)	0.8 Nm to 36 Nm (0.6 lb-ft to 26 lb-ft)	200 N to 20700 N
Overload capability up to max.	$4 \times M_0$	$3 \times M_0$		$2.75 \times F_N$
Encoder system	Incremental encoder sin/cos 1 V_{pp}, 2048 pulses/revolution			Linear scale (enclosed or open)
	Absolute encoder, multiturn, 2048 pulses/revolution (from frame size 48) and traversing range 4096 R with EnDat			• Incremental encoder
	Absolute encoder, multiturn, 512 pulses/revolution (frame size 28 to 36) and traversing range 4096 R with EnDat			• Absolute encoders
	–	Basic absolute encoder, multiturn, 32 pulses/ revolution (from frame size 48) and traversing range 4096 R with EnDat		
	Resolvers, two and multi-pole (number of poles corresponds to number of pole pairs of motor)			
Sound pressure level in accordance with EN 21 680	55 dB(A) to 70 dB(A)			–
Degree of protection in accordance with EN 60 034-7 (IEC 60 034-7)	IP64 to IP68	IP64, IP65 additional IP67 drive end flange		IP65
Cooling	Natural cooling Forced ventilation Water cooling	Natural cooling Water cooling		
Insulation of the stator winding in accordance with EN 60 034-1 (IEC 60 034-1)	Temperature class F for a winding temperature of $\Delta T = 100$ K at an ambient temperature of +40 °C (+104 °F)			Temperature class H for a winding temperature of +120 °C (+240 °F)
	In the case of water cooling inlet temperature max. +25 °C (+77 °F)			Coolant +20 °C to +35 °C (+68 °F to +95 °F)
Holding brake	Built-in (option)			–
Machine type	Permanent-magnet excited synchronous motor, 3-phase			
Paint finish	Anthracite	Unpainted	Anthracite/unpainted	Unpainted
Planetary gearing (attachment)	i = 4 to 50, graded	5, 10, etc.		–

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1FT6 three-phase servo motors

◼ Overview

The 1 FT6 three-phase servo motors offer:

- Optimum surface quality of workpiece due to high rotational accuracy (sinusoidal current injection)
- Short non-productive times due to high dynamic performance
- Power and signal connections for use in severely contaminated areas
- Simple installation due to reduced cabling requirements
- High resistance to lateral force

1FT6 three-phase servo motors are extremely compact permanent-field synchronous motors. 1FT6 motors can be operated with the following integrated encoder systems:

- Incremental encoder sin/cos 1 V_{pp}
- Multi-pole resolver
- Absolute encoder EnDat

The digital control system of the converter systems and the new encoder technology of the 1FT6 servo motors fulfill the highest demands in terms of dynamic performance, speed setting range, and rotational and positioning accuracy.

The motors are primarily designed for operation without external cooling, and the heat is dissipated through the motor surface. The heat generated in the stator winding and stator core can be directly dissipated via the good thermal coupling to the motor enclosure. The concept of brushless, permanent-field synchronous motors shows its special merits here.

◼ Application

- Machines for industrial use, e. g. woodworking machines
- Special machines
- Handling equipment
- Gantries
- Compact machine tools
- Robots

◼ Further information

Further information on technical data and ordering data can be found in Catalog DA 65.3/DA 65.4 and in the Interactive Catalog under "Drive Technology/AC Motors".

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Overview

The 1FK6 three-phase servo motors offer:

- Low space requirements due to compact dimensions
- Flexible machine design due to swivel connector orientation
- Simple installation due to reduced cabling requirements
- Shaft and flange compatibility with 1FT6 motors

1FK6 three-phase servo motors are permanent-field synchronous motors.

1FK6 motors can be operated with the following integrated encoder systems:

- Incremental encoder sin/cos 1 V_{pp}
- Multi-pole resolver
- Absolute encoder (EnDat)
- Basic absolute encoder (EnDat)

The motors are designed for operation without external cooling and the heat is dissipated through the motor surface. The heat generated in the stator winding and stator core can be directly dissipated via the good thermal coupling to the motor enclosure. The concept of brushless, permanent-field synchronous motors shows its special merits here.

Application

- Machines for industrial use, e. g. woodworking machines
- Special machines
- Handling equipment
- Gantries
- Compact machine tools
- Robots

Further information

Further information on technical data and ordering data can be found in Catalog DA 65.3/DA 65.4 and in the Interactive Catalog under "Drive Technology/AC Motors".

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1FK7 three-phase servo motors

◼ Overview

1FK7 three-phase servo motors are permanent-magnet excited synchronous motors, like the 1FK6 motors.

The new 1FK7 servo motors are based on the experience gained from the 1FK6 series and have an even more compact design with improved dynamic performance.

1FK7 CT servo motors (compact)

1FK7 CT servo motors offer:

- Compact design (up to 25% smaller than 1FK6)
- Mechanical compatibility with 1FK6 (shaft, flange and connector)
- Wide performance range and many options

1FK7 HD (High Dynamic) servo motors

1FK7 HD servo motors offer:

- Extremely high dynamic performance due to the new rotor design (very low rotor moment of inertia)
- Mechanical compatibility with 1FK6 (shaft, flange and connector)
- High momentary overload capability

1FK7 motors can be operated with the following integrated encoder systems:

- Incremental encoder sin/cos 1 V_{pp}
- Multi-pole resolver
- Absolute encoder EnDat
- Basic absolute encoder (EnDat)

◼ Application

- Machines for industrial use, e. g. woodworking machines
- Special machines
- Handling equipment
- Gantries
- Compact machine tools
- Robots

◼ Further information

Further information on technical data and ordering data can be found in Catalog DA 65.3 and in the Interactive Catalog under "Drive Technology/AC Motors".

8

Overview

In combination with the SIMODRIVE 611 digital/universal HR, 1FN1/1FN3 linear motors provide an optimally tuned linear direct drive system for the requirements of modern machine construction.

The motors comprise a primary section and a secondary section with magnets made of rare-earth material. The primary section has fixed dimensions, while the secondary section is made up of individual elements (segments) to suit the required traversing range. Through parallel operation of the motors, force and length can be scaled beyond the available spectrum.

Benefits

- Outstanding dynamic response and very high traversing velocity
- Excellent precision
- Simple installation
- Drive components are free of wear due to contactless drive force transmission

The main advantage of linear direct drive technology is the extensive avoidance of the effects of elasticity, play, and friction, as well as natural oscillation in the drive train. This results in a higher dynamic response and increased precision. If suitable measuring systems are used and the temperature conditions are appropriate, the motors can be positioned in the nanometer range.

Design

The simple mechanical construction without transmission elements, such as ballscrew, coupling or belt, enhances the reliability of the drive components.

Heat loss occurs almost exclusively in the primary section and is dissipated via an integrated liquid cooling system. The Thermo-Sandwich dual-circuit cooling system (integral in 1FN1, optional for 1FN3) permits both a thermal decoupling of the motor from the machine, and also a low-priced cooling concept.

The stainless metal encapsulation of the primary section ensure high the mechanical ruggedness and resistance to soiling required for use in machine tools, as well as high resistance to corrosive liquids. In addition, the motor places minimal demands on the preparation of mounting surfaces due to the large air gap. The mounting tolerances for the air gap are ±0.3 mm (0.01 in).

Construction variants

1FN linear motors are available as single-sided or double-sided motors.

- Single-sided motors
  The single-sided version consists of a primary section with standard winding that is mounted parallel to the associated secondary section.
- Double-sided motors
  The secondary section of the double-sided version lies between two primary sections (one primary section with standard winding and one with complementary winding).
  The construction as double-sided motor is particularly suitable for applications with movable secondary section and small traversing paths with fast acceleration (e. g. non-circular machining).

Further information

Further information on technical data and ordering data can be found in Catalog DA 65.4 and in the Interactive Catalog under "Drive Technology/AC Motors".

8

System components
Motors

Overview

Stepper motors are functionally simple servo motors. In terms of performance and economy, these motors are the ideal supplement to the position controlled motors 1FT and 1FK. The applications in automation systems are varied, and are not restricted to machine tools.

The SIMOSTEP stepper motor can be operated via the FM STEPDRIVE power section. This converts the stepping and direction signals of the upstream controller into exact angular movements by appropriate current feeding to the motor windings.

SIMOSTEP 1FL3 with holding brake (optional)

The holding brake normally fixes the position after the motor current has been switched off. In emergencies, such as after power failure or EMERGENCY STOP, it stops the drive and thus helps to maintain safety. Fixing is mainly required in case of torque load resulting from weight forces, e. g. Z axes in robotics (vertical axis).

Benefits

- Low-noise, high-precision operation due to special mechanical design and the 3-phase microstep procedure
- Simple and favorably priced drive concept for high-precision positioning tasks in the performance range up to 600 W
- Easy handling, particularly during commissioning
- No measuring system or measuring system cable required
- High acceleration capability to lower speeds
- Low-resonance operation with optimum power output due to 3-phase microstep procedure.
- Step counts of 500, 1000, 5000 and 10,000 per motor revolution by applying the microstep procedure (adjustable via FM STEPDRIVE)

Application

- Actuators in general automation systems
- Positioning drives in processing plants
- Positioning in the basic handling area

Integration

The SIMOSTEP stepper motors can be used with:
- SINUMERIK 802S base line
- SIMOTION C230-2
- Positioning Modules FM 353 and FM 357-2 together with SIMATIC S7-300
- SIMATIC ET 200S 1STEP Stepper Module

The SIMOSTEP stepper motor is connected via heavy gauge threaded joints to internal terminal boxes.

The FM STEPDRIVE power section can be used as a link between the controller and the 1FL3 stepper motor.

Further information

Further information on technical data and ordering data can be found in Catalog NC 60 and in the Interactive Catalog under "Drive Technology/AC Motors".

8

Overview

SIMODRIVE sensors are optoelectronic extension encoders for measuring displacement, angle, and speed in machines. They can be used in conjunction with drives and position displays, e. g.:

• SINAMICS drive systems
• SIMOTION Motion Control systems
• SINUMERIK CNC controls
• SIMATIC programmable logic controllers
• SIMODRIVE and SIMOVERT MASTERDRIVES drive systems

Application

A distinction is made between incremental and absolute measuring methods. In the case of incremental encoders, the machine must travel to a reference point after each power-off state, as the position is not usually stored in the controller, and movements of the machine while the power is off are not recorded.

Absolute encoders, on the other hand, also record these movements while the power is off and return the actual position at power-on. Reference point approach is not necessary.

Design

All encoders are available in synchronous flange and supported flange joint versions. Encoders with a synchronous flange can be attached to the machine by means of three clamp straps. Mounting with axial screws is also possible. The encoder is driven by means of a plug-in coupling or a spring disk coupling. Alternatively, pulleys can also be used.

The encoder supply voltage is 5 V DC or alternatively 10 V to 30 V DC. The 10 V to 30 V DC version supports longer cable lengths. Most control systems apply the supply voltage directly on the measuring circuit connector.

For rotary encoders with cables, the cable length including the connector is 1 m (3 ft).
The following bending radius for the cables at the encoder must be complied with:

Single bend: ≥ 20 mm (0.79 in)
Permanent bend: ≥ 75 mm (2.95 in)

Further information

Further information on technical data and ordering data can be found in Catalog NC 60 and in the Interactive Catalog under "Automation Systems/SINUMERIK & SIMODRIVE Automation Systems".

8

Pre-assembled cables

Overview

MOTION-CONNECT cables are suitable for use on all types of machine tool and production machines.

The power cables and signal cables can be ordered by the meter or pre-assembled.

The following MOTION-CONNECT cable designs are available:

- **MOTION-CONNECT 500**, the solution for mainly fixed routing.
- **MOTION-CONNECT 500 PLUS** is suitable for trailing, resistant against mineral oils (except biological oils and cutting oils) and therefore especially suited for wood processing machines, printing machines and simple machine tools. The current MOTION-CONNECT 500 signal cables already fulfill the requirements for MOTION-CONNECT 500 PLUS making a new type of signal cable unnecessary.
- **MOTION-CONNECT 700**, the ideal complement to linear motors and machines with high mechanical requirements.
- **MOTION-CONNECT 800** meets all requirements for use in cable carriers on machine tools and production machines.

Benefits

The use of pre-assembled MOTION-CONNECT cables offers the following advantages:

- High quality, ensuring safety at perfect functioning
- Cost savings with logistics, design, assembly and purchasing
- Liability for defects by Siemens
- Supplied in exact meter lengths (other lengths on request)

Application

The maximum permissible technical cable lengths specified must be observed when determining the cable lengths for systems and applications described in this catalog. Function faults can occur if longer lengths are used.

Siemens AG provides no liability for correct transmission of signals or power in this case.

The cables are not suitable for outdoor use.

Technical data

Cables	MOTION-CONNECT 500 PLUS	MOTION-CONNECT 500	MOTION-CONNECT 700	MOTION-CONNECT 800
	Type 6FX51	Type 6FX50	Type 6FX7	Type 6FX8
Approvals				
Power/signal cables				
• VDE [1]	Yes	Yes	Yes	Yes
• cUL or UL/CSA	UL758-CSA-C22.2 N210.2-M90	UL758/C22.2 N210.2-M90	UL758-CSA-C22.2 N210.2-M90	UL758-CSA-C22.2 N210.2-M90
• UL-CSA File No. [2]	Yes	Yes	Yes	Yes
Electrical data DIN VDE 0472				
Rated voltage				
• Power cable V_0/V				
- Power conductors	600 V/1000 V	600 V/1000 V	600 V/1000 V	600 V/1000 V
- Signal conductors	24 V (VDE) 1000 V (UL/CSA)	24 V (VDE) 1000 V (UL/CSA)	24 V (VDE) 1000 V (UL/CSA)	24 V (VDE) 1000 V (UL/CSA)
• Signal cable	–	30 V	30 V	30 V
Test voltage (eff)				
• Power cable				
- Power conductors	4 kV	4 kV	4 kV	4 kV
- Signal conductors	2 kV	2 kV	2 kV	2 kV
• Signal cable	–	500 V	500 V	500 V

■ **Technical data** (continued)

Cables	MOTION-CONNECT 500 PLUS	MOTION-CONNECT 500	MOTION-CONNECT 700	MOTION-CONNECT 800
	Type 6FX51	Type 6FX50	Type 6FX7	Type 6FX8
Operating temperature				
at the surface				
• Fixed routing	-20 to +80 °C (-4 to +176 °F)	-20 to +80 °C (-4 to +176 °F)	-50 to +80 °C (-58 to +176 °F)	-50 to +80 °C (-58 to +176 °F)
• In motion	0 to +60 °C (32 to 140 °F)	0 to +60 °C (32 to 140 °F)	-20 to +60 °C (-4 to +140 °F)	-20 to +60 °C (-4 to +140 °F)
Mechanical data				
Max. tensile stress on power/signal cables				
• Fixed routing	50 N/mm^2 (7.25 ksi)	50 N/mm^2 (7.25 ksi)	50 N/mm^2 (7.25 ksi)	50 N/mm^2 (7.25 ksi)
• In motion	20 N/mm^2 (2.9 ksi)	20 N/mm^2 (2.9 ksi)	20 N/mm^2 (2.9 ksi)	20 N/mm^2 (2.9 ksi)
Smallest bending radius				
• Power cable				
- Fixed routing	5 x D_{max}	5 x D_{max}	4 x D_{max}	6 x D_{max}
- In motion	See "Power cables"	See "Power cables"	See "Power cables"	See "Power cables"
• Signal cable, max.				
- Fixed routing	–	60 mm (2.36 in)	60 mm (2.36 in)	60 mm (2.36 in)
- In motion	–	100 mm (3.94 in)	95 mm (3.74 in)	100 mm (3.94 in)
Torsional stress	Absolute 30°/m	Absolute 30°/m	Absolute 30°/m	Absolute 30°/m
Bending				
• Power cables				
- 1.5 to 6 mm^2	2 million	100,000	10 million	10 million
- 10 to 185 mm^2	–	100,000	10 million	3 million
• Signal cables	–	2 million	10 million	10 million
Traversing speed				
• Power cables				
- 1.5 to 6 mm^2	180 m/min (591 ft/min)	30 m/min (98 ft/min)	200 m/min (656 ft/min)	180 m/min (591 ft/min)
- 10 to 50 mm^2	–	30 m/min (98 ft/min)	200 m/min (656 ft/min)	100 m/min (328 ft/min)
• Signal cables	–	180 m/min (591 ft/min)	200 m/min (656 ft/min)	180 m/min (591 ft/min)
Acceleration				
• Power cables	5 m/s^2 (16.5 ft/s^2)	2 m/s^2 (6.6 ft/s^2)	30 m/s^2 (99 ft/s^2)	5 m/s^2 (5 m) (16.5 ft/s^2) (16 ft) 10 m/s^2 (2.5 m) (33 ft/s^2) (8 ft 2 in)
• Signal cables	–	5 m/s^2 (16.5 ft/s^2)	30 m/s^2 (99 ft/s^2)	5 m/s^2 (5 m) (16.5 ft/s^2) (16 ft) 10 m/s^2 (2.5 m) (33 ft/s^2) (8 ft 2 in)
Chemical data				
Insulation material	CFC/silicone-free	CFC/silicone-free	CFC/halogen/silicone-free DIN 472 815/IEC 60754-1	CFC/halogen/silicone-free DIN 472 815/IEC 60754-1
Oil resistance	EN 60811-1-1/-2-1 (mineral oil only)	VDE 0472, Part 803 Test mode B (mineral oil only)	VDE 0472, Part 803 Test mode B	VDE 0472, Part 803 Test mode B
Outer shield	PVC	PVC	PUR, DIN VDE 0282, Part 10	PUR, DIN VDE 0282, Part 10
• Power cable	DESINA color orange RAL 2003	DESINA color orange RAL 2003	DESINA color orange RAL 2003	DESINA color orange RAL 2003
• Signal cable	–	DESINA color green RAL 6018	DESINA color green RAL 6018	DESINA color green RAL 6018
Flame retardant	IEC 60332.1	IEC 60332.1	IEC 60332.1	IEC 60332.1

1) The respective registration number is printed on the cable shield (only applies to power cables).

2) The file number is printed on the cable shield.

The technical specifications of these cables only apply to single bending with horizontal traverse paths up to 5 m (16 ft).

Degree of protection of pre-assembled power and signal cables and their extension cables in closed and inserted state: IP67

8

Length code

Further information

- on MOTION CONNECT connection technology can be found in the catalogs
  - D 21.1 "SINAMICS S120 Vector Control Drive System",
  - D 21.2 "SINAMICS S120 Servo Control Drive System",
  - DA 65.3 "Servo Motors for SIMOVERT MASTERDRIVES",
  - DA 65.4 "SIMODRIVE 611 universal and POSMO"
  - as well as in the Interactive Catalog.
- on PROFIBUS cables, see Catalog IK PI "Industrial Communication and Field Devices" in the PROFIBUS section under electrical networks.

Overview

Length code for pre-assembled cables

Length code	6FX....-.....-■ ■ ■ 0
	6SX....-.....-■ ■ ■ 0
0 m (0 ft)	1
100 m (328 ft)	2
200 m (656 ft)	3
300 m (984 ft)	4
0 m (0 ft)	A
10 m (32.8 ft)	B
20 m (65.6 ft)	C
30 m (98.4 ft)	D
40 m (131 ft)	E
50 m (164 ft)	F
60 m (197 ft)	G
70 m (230 ft)	H
80 m (262 ft)	J
90 m (295 ft)	K
0 m (0 ft)	A
1 m (3.3 ft)	B
2 m (6.6 ft)	C
3 m (9.8 ft)	D
4 m (13.1 ft)	E
5 m (16.4 ft)	F
6 m (19.7 ft)	G
7 m (23 ft)	H
8 m (26.2 ft)	J
9 m (29.5 ft)	K

Examples:

1 m (3.3 ft):	1 A B 0
2 m (7.2 ft):	1 A C 0
8 m (26.3 ft):	1 A J 0
299 m (981 ft):	3 K K 0

Length definition for pre-assembled cables
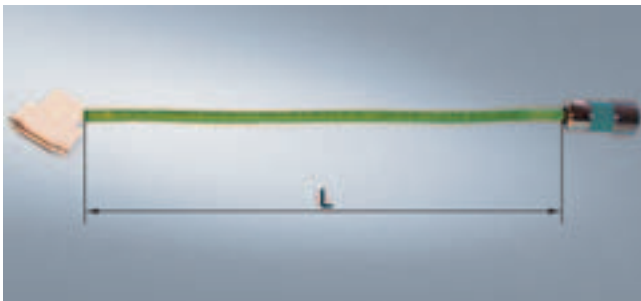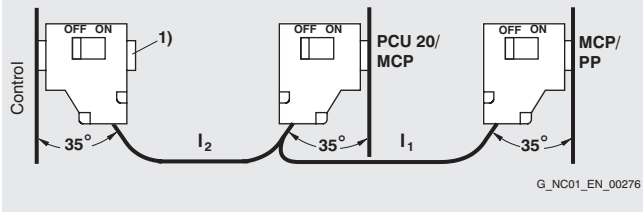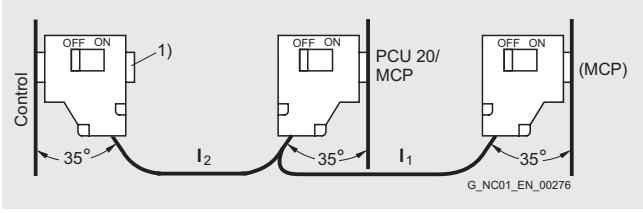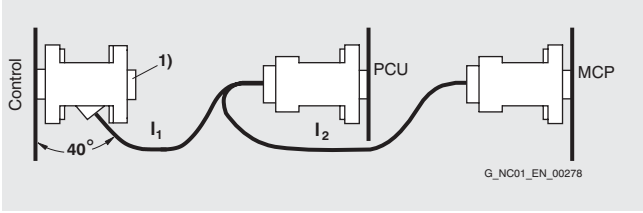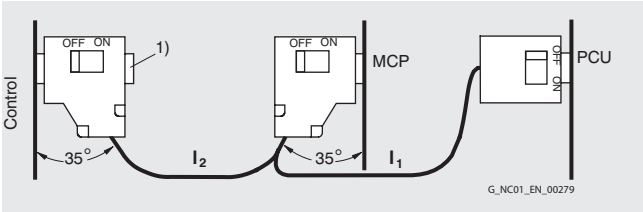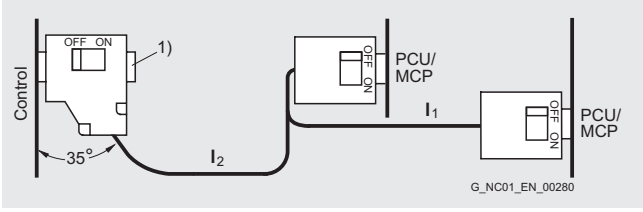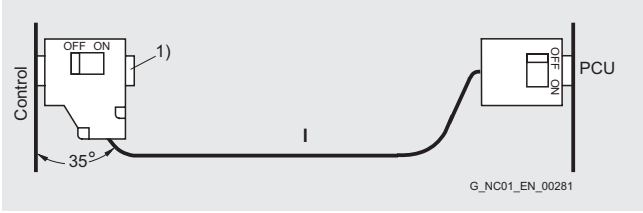
L = Length in m (ft)

- Tolerance for a cable length of up to 10 m (32.8 ft): 2%
- Tolerance for a cable length of more than 10 m (32.8 ft): 1%

8

Technical data	Order No.	
Pre-assembled MPI bus cable with variable length l_2 (not for PCU 50/PCU 70) with 3 connectors		
• Trailing possible	6FX2002-4EA02-....	
• Trailing not possible	6FX2002-4EA01-....	
Length l_1: 1 m (3.28 ft)		
Length l_2: variable		
Pre-assembled MPI bus cable with variable length l_2 (not for PCU 50/PCU 70) with 3 connectors		
• Trailing possible	6FX2002-4EA06-....	
Length l_1: 3 m (9.8 ft)		
Length l_2: variable		
Pre-assembled MPI bus cable with fixed length l_2 = 1 m (3 ft 3 in) (not for PCU 50/PCU 70) with 3 connectors		
• Trailing not possible		
Length l_1: 5 m (16.4 ft)	6FX2002-4EA04-1AF0	
10 m (32.8 ft)	6FX2002-4EA04-1BA0	
Length l_2: 1 m (3.28 ft)		
Pre-assembled MPI bus cable with variable length l_2 with 3 connectors		
• Trailing possible	6FX2002-4EA80-....	
• Trailing not possible	6FX2002-4EA00-....	
Length l_1: 1 m (3.28 ft)		
Length l_2: variable		
Pre-assembled MPI bus cable with variable length l_2 with 3 connectors		
• Trailing possible	6FX2002-4EA70-....	
Length l_1: 1 m (3.28 ft)		
Length l_2: variable		
Pre-assembled MPI bus cable with variable length l with 2 connectors		
• Trailing possible	6FX2002-4EA88-....	
• Trailing not possible	6FX2002-4EA08-....	

MPI bus connectors

Technical data	Order No.	
Pre-assembled MPI bus cable with <u>variable</u> length l with 2 connectors • Trailing possible • Trailing not possible	**6FX2002-4EA87-....** **6FX2002-4EA17-....**	 G_NC01_EN_00282
Pre-assembled MPI bus cable with <u>variable</u> length l with 2 connectors • Trailing not possible	**6FX2002-4EA07-....**	 G_NC01_EN_00283

1) Connection socket for programming device or other devices.

OFF ON Terminators can be shutt off

MCP – Machine control panel   PP - Pushbutton panel

Selection and ordering data	Order No.
Connector without PG connection socket • Cable outlet 35°	**6FX2003-0AA02**
Connector with PG connection socket • Cable outlet 35°	**6FX2003-0AA03**

only for pre-assembled cables 6FX2002-4EA..

PG: Programming device

Further information

• on MOTION CONNECT connection technology can be found in the catalogs
  - D 21.1 "SINAMICS S120 Vector Control Drive System",
  - D 21.2 "SINAMICS S120 Servo Control Drive System",
  - DA 65.3 "Servo Motors for SIMOVERT MASTERDRIVES",
  - DA 65.4 "SIMODRIVE 611 universal and POSMO"
  - as well as in the Interactive Catalog.

• on PROFIBUS cables, see Catalog IK PI "Industrial Communication and Field Devices" in the PROFIBUS section under electrical networks.

8

Services and documentation

Services and documentation

Overview

Our understanding of an application is the customer-specific solution of a motion control task based on standard hardware and software components. In this respect, our industry knowledge and technological expertise are just as important as expert knowledge about how our products and systems work. We are setting ourselves this challenge with more than 120 application engineers at 12 locations in 7 countries in various parts of the world.

Application centers

We currently have application centers in:

- Germany: Chemnitz, Erlangen, Cologne, Mannheim, Stuttgart
- Italy: Bologna, Milan
- USA: Atlanta
- China: Beijing
- France: Paris
- Turkey: Istanbul
- India: Mumbai

Further application centers are coming soon.

These application centers specialize in the use of SIMOTION/SINAMICS. They can provide skilled motion control specialists to help you set up successful concepts. By involving your personnel at an early stage in the process, we can provide a solid basis for rapid knowledge transfer, maintenance and further development of your motion control solution.

Application advice and implementation

In order to help you work out the optimum solution for the SIMOTION/SINAMICS application you wish to implement, we offer a variety of consultancy services:

As part of our quotation service, we

- clarify technical questions
- discuss machine designs and customized solutions
- help you select the appropriate technology
- work out proposals for implementing the application.

A technical feasibility study is performed at the outset. In this way, we can identify any "glitches" at an early stage and eliminate them. If you wish, we can configure and implement your application as a complete system (including control cubicle) from one source.

Reference can be made to a host of proven standards at the implementation stage, helping to cut engineering costs.

At your request, commissioning support can be provided by experienced, competent personnel, helping to save your time and energy.

We can provide you with servicing assistance on site or via a teleservice line. For further information about servicing, please look under "Service and Support".

On-site application training

Training courses on the implemented applications can be organized and held on site. This training is not limited to teaching machine manufacturers and their customers about individual products, but focuses on the hardware and software of the system as a whole (e. g. automation, drives and visualization).

From initial concept to successfully commissioned system: We will support you all the way with your SIMOTION/SINAMICS product! Please contact your local Siemens representative.

For further information, please go to:
http://www.siemens.com/motioncontrol/apc

9

Overview

Because training is the key to your success

SITRAIN [R] – Siemens training for automation and industrial solutions – will be constantly by your side to help you find solutions for your tasks.

With training provided by the market leader in automation, plant installation and support, you can have complete confidence in any decisions you make, in particular concerning the optimum use of products and the efficient running of systems. You can rectify deficits in existing systems and rule out expensive planning errors right from the start.

All in all, this is a massive plus for your company, as you will benefit in terms of shorter commissioning times, optimized plant sections, faster troubleshooting and reduced downtimes. The result? Profits go up and costs come down.

■ Top trainers

Our trainers are skilled specialists with extensive experience of training provision. The designers of our courses are directly involved in product development and forward their knowledge directly to our trainers.

■ A firm basis in practice

As our trainers have direct experience of practical applications, they are able to render their theoretical knowledge with real plausibility. However, as we all know that any theory has its gray areas, we prioritize practical exercises, and allocate up to half of the course program to them. This means that you can apply what you have learned immediately in everyday activities. We use state-of-the-art customized training equipment. Once you have completed your training with us, you will feel ready for anything.

■ Training variety

With a total of some 300 participant-based courses, we can provide training for the entire range of products and a large number of system solutions. Remote learning services, self-teach software and moderated online seminars complement our traditional training offer.

■ Customer proximity

We are never very far away. We have approximately 60 locations in Germany and a presence in 62 countries all over the world. Would you prefer individual training to taking part in one of our 300 courses? Our solution: We can customize our program to meet your personal requirements. Training takes place in our training centers or on your site.

The ideal combination: Blended learning

Blended learning combines a variety of teaching media and sequences. For example, a participant-based course in a training center can be ideally combined with self-teach programs prior to or following completion. SITRAIN also uses moderated online learning to provide training live on the Internet at agreed times.

The combination is the key, because blended learning is able to communicate complex subjects and transfer knowledge on a networked basis. Additional benefit: Travel expenses and downtimes are reduced as training is no longer restricted to a specific time and place.

The international learning portal

Additional information is available on the Internet under:
http://www.siemens.com/sitrain

All your learning options at a glance! Take your time to browse our international training package, call up all course dates online, use the available places indicator (updated daily) - and apply directly.

Alternatively, contact us directly for personal advice:

Training Office, Infoline Germany
Phone: +49 (0) 18 05 23 – 56 11
Fax: +49 (0) 18 05 23 – 56 12

Training Office, US
Phone: +1 800 241 4453
sitrain.registrar@sea.siemens.com

... and request a copy of our latest training catalog:

	Language	Order No.
ITC Catalog (paper version)	German	**E86060-K6850-A101-B5**
List of dates and prices including CD-ROM	German	**E86060-P6850-A101-C9**
Interactive training information system SITRAIN on CD-ROM	English/ German	**E86060-D6850-A100-C2-7400**
Overview of training worldwide	English/ German	**E86060-K6899-A101-B4-7400**

SITRAIN in USA:
http://www.automation.usa.siemens.com/sitrain

9

Services and documentation
Training

SIMOTION training courses

Overview
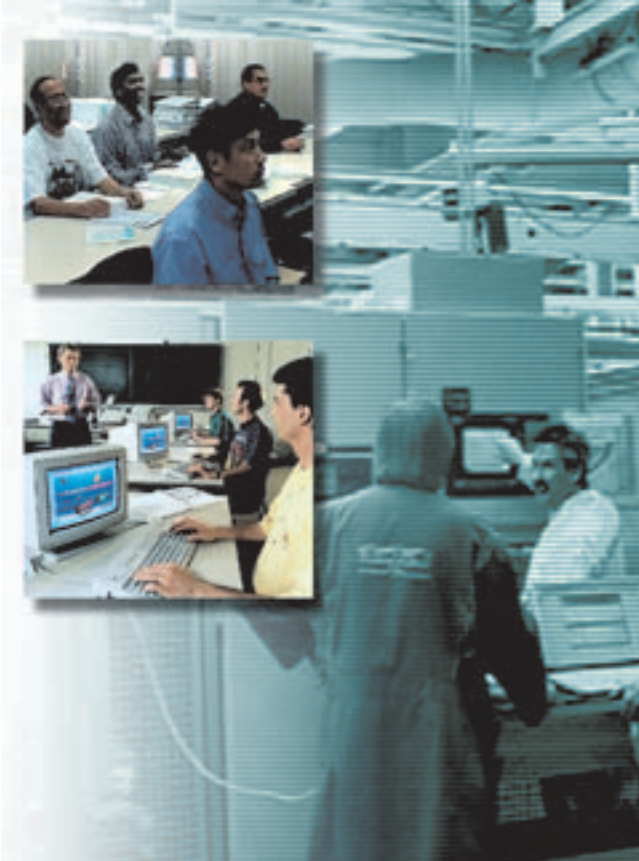
To use PLCs economically, specialists are required who can operate, program and service the devices.

The training centers of the Automation and Drives Group train your employees to master this innovative technology. Well-trained employees are motivated and implement optimal automation tasks with dedication.

The courses are modular in design and are intended for a variety of target groups as well as individual customer requirements. We offer courses for:

- Decision makers and managers
- Operators
- Programmers
- Configuration engineers
- Maintenance personnel

In addition to the standard training courses at our training centers, we also offer individual courses which are tailored to the special requirements of our customers and can be held on site, if required.

The training courses for SIMOTION are as follows: For further information, see Catalog ITC.

SIMOTION training courses

The following training courses are available for the SIMOTION Motion Control system:

Service Personnel	Configuring Engineers, Commissioning Personnel, Programmers	Sales and Marketing Personnel
	General Knowledge of Automation Engineering	
SIMOTION Service and Maintenance Course MC-SMO-SER 3 Days	**SIMOTION System and Programming Course** MC-SMO-SYS 5 Days	**SIMOTION Overview Training Course** MC-SMO-UEB 3 Days
	SIMOTION Programming Course MC-SMO-PRG 5 Days	
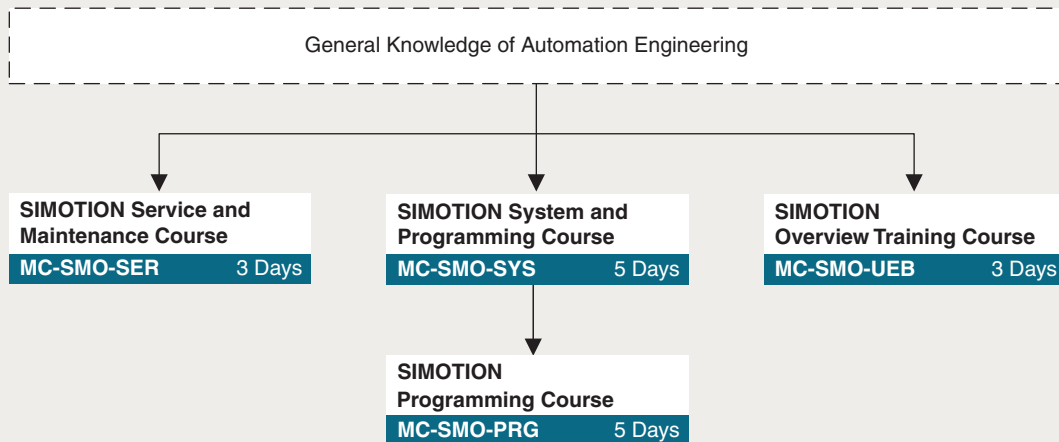
Courses available in English and German

G_PM10_en_00039

Design

Title	Target group							Duration/medium	Abbreviated title
	Decision makers, sales personnel	Project managers, project workers	Program-mers	Commis-sioning engineers, configura-tors	Service personnel	Operators, users	Mainte-nance personnel		
SIMOTION intro-ductory course	X	X						3 days	MC-SMO-UEB
SIMOTION system and programming course			X	X	X			5 days	MC-SMO-SYS
SIMOTION pro-gramming course			X	X				5 days	MC-SMO-PRG
SIMOTION service and maintenance course				X	X	X		3 days	MC-SMO-SER

Description

SIMOTION introductory course
MC-SMO-UEB
This course has been designed especially for decision makers and sales staff who want to have a quick introduction to the SIMOTION Motion Control system.

Exercises and presentations also provide a hands-on introduction to the SIMOTION SCOUT engineering system.

SIMOTION system and programming course
MC-SMO-SYS
This course provides commissioning engineers, configurators, programmers and service experts with the knowledge required for working with the SIMOTION Motion Control system and to be able to configure, program and commission a SIMOTION controller.

The practical exercises of the course are performed on exercise setups of the SIMOTION C230-2 hardware platform and complement the course schedule.

The course provides the basis required for advanced and more detailed courses.

SIMOTION programming course
MC-SMO-PRG
This course allows SIMOTION programmers and users to deepen their knowledge of programming with Structured Text (ST) and Motion Control Chart (MCC) on the basis of the knowledge acquired from the system course. Practical examples are used to create application programs and solution strategies for programming with SIMOTION and its functionalities.

SIMOTION service and maintenance course
MC-SMO-SER
This course is intended for service and commissioning personnel and requires experience with SIMOTION as provided by the system course.

The objective of the course is to become familiar with commissioning and using SIMOTION components and diagnostics features. The course provides in detail information on installation and functions of the SIMOTION C230-2 and SIMOTION P350 hardware platforms as well as the SIMOTION SCOUT engineering system, and diagnostics features are explained with examples.

SIMOTION trainings in USA:
The SIMOTION courses MC-SMO-SYS and MC-SMO-PRG are also offered in Atlanta/Georgia.

Training schedule:
http://www.automation.usa.siemens.com/sitrain

Implementation and concept

The SITRAIN course program for SIMOTION began with the system and programming course in parallel to the market introduction of the new Motion Control system. The standard courses are offered at the Nuremburg-Moorenbrunn head office or somewhere close to you.

The practical exercises are based on the course content and are performed on specially developed and well-equipped training devices.

For further information on our SIMOTION courses please refer to the SIMOTION training brochure (see ordering data).

Selection and ordering data	Order No.
SIMOTION training brochure	**E20001-A130-P850**

Further information

Contact

For further information on the courses offered, please contact:

Course office infoline: **(01805) 235611** or visit us on the Internet.

Additional information is available on the Internet under:

http://www.siemens.com/sitrain

Here you can find our complete course program with the latest additional dates, the current number of participants and further information.

Siemens AG
A&D Training Center
Gleiwitzer Str. 555
90475 Nuremberg-Moorenbrunn
Phone: (01805) 235611
Fax: (01805) 235612
E-mail: A&D.kursbuero@nbgm.siemens.de

9

SIMOTION D435 training case

Application

For pure SIMOTION D applications, the SINAMICS S120 case is supplied with the D435 Control Unit.

The training case is used for training and familiarization with the SIMOTION D Motion Control system. It is also suitable for test purposes in the laboratory.

Design

- Case optimized in terms of weight and volume
- Set up complete with transport wheels and ready for connection
- Supply voltage 230 V AC or via line adapter 115 V AC (USA)
- Regenerative feedback not possible
- Drive system comprising:
  - SIMOTION D435 with TB30 Terminal Board
  - Smart Line Module 5 kW (6.5 HP)
  - Double Motor Module 3 A
  - 1 x synchronous motor 1FK7022-5AK71-1DG3 with incremental encoder sin/cos 1 V_{pp} 2048 pulses/revolution and DRIVE-CLiQ interface
  - 1 x synchronous motor 1FK7022-5AK71-1LG3 with absolute value encoder 2048 pulses/revolution and DRIVE-CLiQ interface: Absolute value encoder EnDat 512 pulses/revolution
  - Reference loops for position monitoring
- Control box for setpoint/actual-value linkage via terminals
- Prefabricated connection option for an external motor, e. g. asynchronous motor

The training case is supplied ready-to-use with a demo project and Multi Axes License on CompactFlash card, SCOUT engineering system, and documentation.

Technical data

SIMOTION D training case

Input voltage	230 V AC
Degree of protection in accordance with DIN VDE 0470 Part 1/EN 60529/ IEC 529	IP00
Weight, approx.	34 kg (75 lb)
Dimensions (W × H × D)	320 × 650 × 330 mm (12.6 × 25.6 × 13 in)

Selection and ordering data	Order No.
SIMOTION D435 TK-SIM-D435 training case With control box, demo project on CompactFlash card and license for technology package	**6ZB2470-0AE00**
Line adapter For 115/230 V supply	**6AG1064-1AA02-0AA0**

9

SIMOTION D435 upgrade kit	HMI/SIMULATOR upgrade kit

■ Application

The SIMOTION D435 upgrade kit is used for the problem-free upgrade of the SINAMICS S120 training case for training and familiarization with the SIMOTION D Motion Control system. It is also suitable for test purposes in the laboratory.

An HMI operator control and monitoring training case is available for SIMOTION D, comprising a panel and a remote ET 200M I/O Module, to which a Simulation Module is connected. Alternatively, the HMI can be simulated via a PC/PG.

■ Design

The upgrade kit comprises:
- SIMOTION D435 Control Unit
- CompactFlash card with demo project and Multi Axes License
- Documentation

■ Selection and ordering data   Order No.

SIMOTION D435 upgrade kit For TK-SIN-CU320 with demo project on CompactFlash card	6ZB2470-0AH00

■ Application

An HMI operator control and monitoring training case is available for SIMOTION D, comprising a panel and a remote ET 200M I/O Module, to which a Simulation Module is connected. Alternatively, the HMI can be simulated via a PC/PG.

■ Design

The HMI training case comprises:
- An operator panel
- An ET 200M remote I/O Module with Simulation Module

■ Selection and ordering data   Order No.

HMI case for SIMOTION D435 With ET 200 and OP	6ZB2470-0AG00

9

SINAMICS S120 training case

■ Application

The training case is used for training and familiarization with the SINAMICS S120 drive system.

It can also be used for test purposes in the laboratory and as a drive for the SIMOTION Motion Control system. The SIMOTION D435 upgrade kit can be used to convert the SINAMICS S120 training case to a SIMOTION D training case.

■ Design

- Case optimized in terms of weight and volume
- Set up complete with transport wheels and ready for connection
- Supply voltage 230 V AC or via line adapter 115 V AC (USA)
- Regenerative feedback not possible
- Drive system comprising:
  - CU320 Control Unit with TB30 Terminal Board
  - Smart Line Module 5 kW (6.5 HP)
  - Single/Double Motor Module 3 A
  - 1 x synchronous motor 1FK7022-5AK71-1DG3 with incremental encoder sin/cos 1 V_{pp} 2048 pulses/revolution and DRIVE-CLiQ interface
  - 1 x synchronous motor 1FK7022-5AK71-1LG3 with absolute value encoder 2048 pulses/revolution and DRIVE-CLiQ interface: Absolute value encoder EnDat 512 pulses/revolution
  - Reference loops for position monitoring
- Control box for setpoint/actual-value linkage via terminals
- Prefabricated connection option for an external motor, e. g. asynchronous motor

The training case is supplied ready-to-use with a demo project on the CompactFlash card and documentation.

■ Technical data

SINAMICS S120 training case

Input voltage	230 V AC
Degree of protection in accordance with DIN VDE 0470 Part 1/EN 60529/ IEC 529	IP00
Weight, approx.	30 kg (66 lb)
Dimensions (W × H × D)	320 × 650 × 330 mm (12.6 × 25.6 × 13 in)

■ Selection and ordering data · Order No.

	Order No.
SINAMICS S120 TK-SIN-CU320 training case With CU320, demo project on CompactFlash card and control box	
• Single-axis version with 1FK7 motor	**6ZB2480-0AA00**
• Double-axis version with 1FK7 motors	**6ZB2480-0BA00**
Line adapter 115 V AC/230 V AC	**6AG1064-1AA02-0AA0**
Control box SINAMICS (if ordered separately)	**6AG1064-1AA01-0AA0**

9

**SIMODRIVE 611 universal training case
for Motion Control**

■ Application
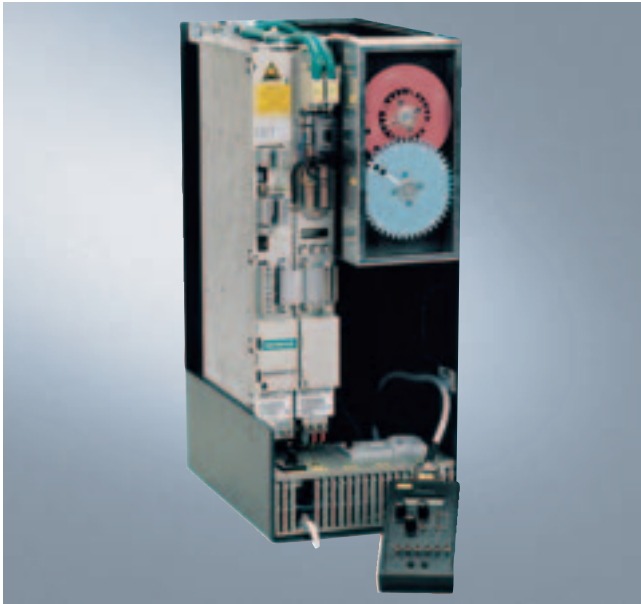
The training case can be used for customer presentations and to teach technical know-how for configuration, commissioning and service.

With the "Motion Control" variant, functions such as synchronous operation or positioning can be simulated using the toothed discs with scale divisions and stroboscopic equipment.

■ Design

- RIMOWA hard shell case with rollers
- SIMODRIVE U/I Module with double-axis Power Module for 0.5 kW (0.67 HP) motors
- Double-axis control unit with Optional Module Motion Control with PROFIBUS DP
- Commissioning box

■ Technical data

SIMODRIVE 611 universal training case for Motion Control

Degree of protection in accordance with DIN VDE 0470 Part 1/ EN 60529/IEC 60529	IP00
Permissible ambient temperature	
• Storage and transport	-5 to +60 °C (+23 to +140 °F)
• Operation	+5 to +40 °C (+41 to +104 °F)
Weight, approx.	36 kg (79 lb)
Dimensions (W x H x D)	700 mm × 520 mm × 260 mm (27.56 in × 20.47 in × 10.24 in)

■ Selection and ordering data — Order No.

	Order No.
SIMODRIVE 611 universal training case for Motion Control Version with 1FK6 motors with encoders and Optional Module Motion Control with PROFIBUS DP	
• 230 V AC power connection	**6ZB2420-0AB00**
• 110 V AC power connection	**6ZB2420-0AD00**
SIMODRIVE 611 universal training case Version with 1FT6 motors with absolute value encoders and Optional Module Motion Control with PROFIBUS DP	**6ZB2420-0AA02**

9

Services and documentation
Training cases

Application
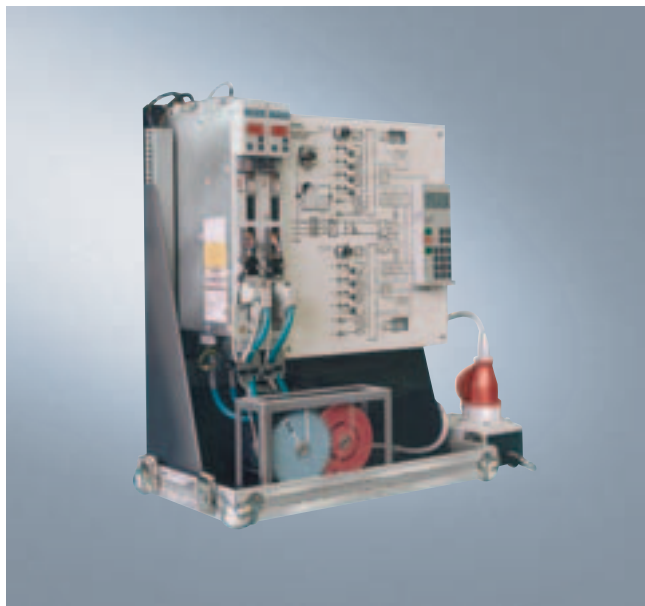
The training system can be used for customer presentations and to teach technical know-how for configuration, commissioning and service.

Design

The training case is designed as a double-axis drive and includes a converter/inverter, operating panel, OP1S plain text operator panel, braking resistor, interference suppression filter and 1FT6 and 1FK6 motors including actual value encoder (resolver/encoder) as well as a CEE coupling for 400 V 3 AC mains connection. It is also equipped with the CBP 2 Communication Module. The case includes:

- Converter
- Inverter
- CBP 2 Communication Modules (for communication with the PROFIBUS DP and SIMATIC S7 Motion Control training cases)
- SLB Modules SIMOLINK
- Operator panel
- Pulsed resistor
- RFI suppression filter
- Servo motors with actual value encoder (1 x 1FT6 and 1 x 1FK6)
- CEE coupling for 400 V 3 AC network connection
- PC DriveMonitor visualization program
- OP1S operator panel
- Combination cable

Technical data

SIMOVERT MASTERDRIVES MC training case

Input voltage	400 V 3 x AC
Degree of protection in accordance with DIN VDE 0470 Part 1/EN 60529/ IEC 529	IP00
Permissible ambient temperature	0 to 40 °C (32 to 104 °F)
Weight, approx.	47 kg (104 lb)
Dimensions (W x H x D)	510 mm × 610 mm × 300 mm (20.1 in × 24.01 in × 11.81 in)

Selection and ordering data

	Order No.
SIMOVERT MASTERDRIVES MC training case, complete Code: TG-SIMMC2A	**6SX7000-0AF10**

Design

Adapter box for SIMOVERT MASTERDRIVES MC training cases

The adapter box includes:
- 230 V AC network connector
- CEE socket outlet for training cases
- 24 V power supply with terminal for MC converter/inverter

Shipping case for SIMOVERT MASTERDRIVES MC training cases

Sturdy shipping case for training cases made from aluminum tubing with telescopic handle and roller bearing-mounted wheels. The shipping case is equipped with a clamping band designed to hold the training cases in place during transportation. The case can be folded away for storage purposes.

Technical data

Adapter box for SIMOVERT MASTERDRIVES MC training cases

Weight, approximate	3 kg (7 lb)
Dimensions (W x H x D)	230 mm × 170 mm × 170 mm (9.06 in × 6.69 in × 6.69 in)

Shipping case for SIMOVERT MASTERDRIVES MC training cases

Weight, approximate	5 kg (11 lb)
Dimensions (collapsed):	
Height folded/open, approx.	662 mm/1020 mm (26.06 in/40.16 in)
Width, approximate	480 mm (18.9 in)

Selection and ordering data

	Order No.
Adapter box For SIMOVERT MASTERDRIVES MC training cases for single-axis and double-axis systems	**9AK1013-1AA00**
Shipping case For SIMOVERT MASTERDRIVES MC training cases	**6SX7000-0AE01**

9

■ Overview

We combine mechanics, electronics and information technology in one simulation environment.

The name clearly identifies that mechatronics is more than just mechanics or just electronics. Mechatronics is the holistic consideration of mechanics, electronics and information technology.

And this means:

This discipline covering all engineering sciences helps towards optimization of the interactions between mechanical engineering, electrical engineering and information technology such that the most important parameters of the machine to be developed fit together even before the first (and only) prototype is built. Clearly a source for quality improvements and savings which you can't afford to ignore.

We offer this service!

Because we consider ourselves as a solution provider, and not just as a manufacturer of products, systems and plants. We can offer you with our know-how as a service this comprehensive product and solution method in connection with the corresponding mechatronics support.

Virtual prototyping

Traditional Approach in the New Equipment Manufacturing

| Mechanical Design Study | → | Electrical Components | → | Prototype | → | **Test Phase Changes to Prototype** Time, Overhead, Cost | → | Result |

Mechatronic Approach

Interdisciplinary Design Study

Simulation and Test Phase

Savings Potential

| Mechanics Electronics IT | → | Resulting Virtual Machine | → | Prototype is the Result | ← | **Time-to-Market Security** |

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Mechatronic support was previously only applied when completed machines did not fulfil the expected functions. However, it is far more effective to position the complete consideration right at the beginning of the engineering process.

Instead of an actual prototype (or several prototypes), our Mechatronic support initially helps towards generation of a virtual product.
This virtual product permits consideration of production conditions (in the simulation mode) on the basis of integrated application of computer-based planning tools.

Any weak points can already be detected during the preliminary development and can still be eliminated at low cost during this phase.

Complete support

With our Mechatronic support we provide the best prerequisites for integration of mechanical elements and motors on a mechanical functional base such that machines with intelligent control are the result.

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Services and documentation

Virtual prototyping is the top offer of our Mechatronic support

Virtual Prototyping with Mechatronics Support

Consulting	Simulation	Machine Optimization	Production

Review and Establish Objectives → Review Machines and Axes → Review Machines after Modifications → Verification of Simulation → Implementation on Machine →

Offer **Initial Results and Recommendations** **Final Result**

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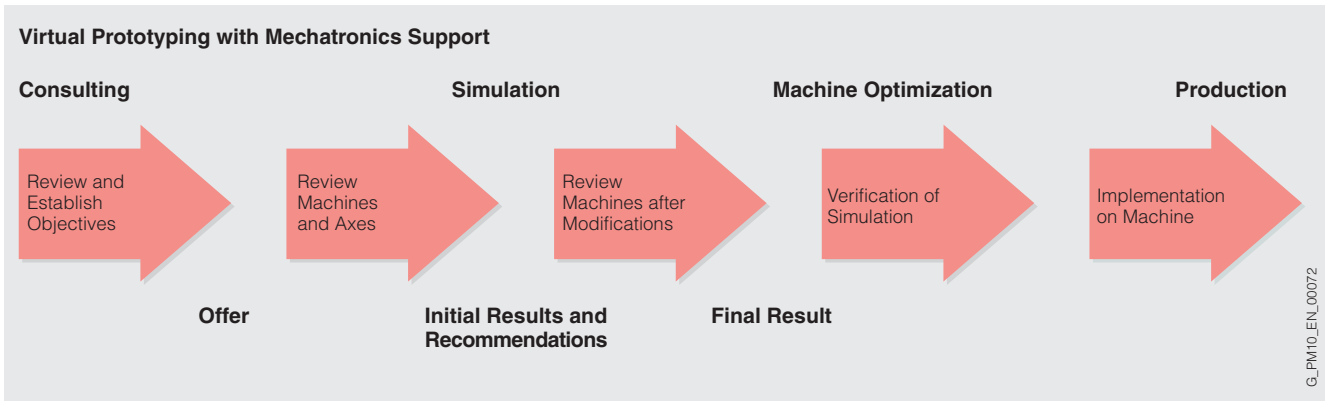
Sequence

Consulting during the design phase of the machine includes registration of the task up to a quotation for simulation. **Simulation** of the machine with the FE model (finite element model) determines the natural oscillation characteristics including simulation of the control loops, and offers possibilities for calculation of different versions. **Machine optimization** verifies the results gained during the simulation on the prototype or on the final machine.

Customer benefits

- Shorter development times result in earlier market presence
- More safety during development
- Creative concepts – higher quality – increased productivity

Mechatronic support components

The range of provided services can be tailored to the customer's individual requirements and special demands. Support components are available which can be ordered separately or in a package, e. g. for virtual prototyping.

Whether you wish to improve or innovate an existing machine, and wish to have a preliminary discussion with experts, or whether you wish to examine the feasibility of new ideas prior to implementation, our mechatronics service will provide you with individual support.

For further information and specific quotations, please contact your Motion Control partner at your local Siemens office or representative.
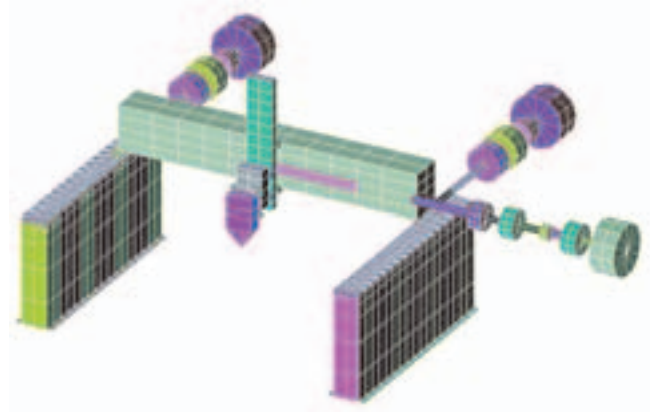
Example: FE model

Selection and ordering data	Order No.
Consulting Technical consulting at the customer	6FC5088-1. . . .
Machine optimization Setting of the control and drives on the customer's machine	6FC5088-2. . . .
Machine analysis and optimization Analysis of machine and its limits. Recommendations for manufacturer	6FC5088-3. . . .
Machine simulation Simulation of individual axes and of the dynamic response on the machine	6FC5088-4. . . .
Machine simulation with interpolating axes Simulation of interpolating axes	6FC5088-5. . . .
Machine simulation with FE model Generation of model of machine using finite element method	6FC5088-6. . . .

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Services and documentation

The right support in every phase

In the face of harsh competition you need optimum conditions to keep ahead all the time:
A strong starting position, a sophisticated strategy and team for the necessary support - in every phase.
Service & support from Siemens provides this support with a complete range of different services for automation and drives.

In every phase: from planning and commissioning to maintenance and upgrading.

Our specialists know when and where to act to keep the productivity and cost-effectiveness of your system running in top form.

Online support

The comprehensive information system available round the clock via Internet ranging from Product Support and Service & Support services to Support Tools in the Shop.

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

Technical support

Competent consulting in technical questions covering a wide range of customer-oriented services for all our products and systems.

Phone: +49 (0)180 50 50 222
Fax: +49 (0)180 50 50 223
E-Mail:
adsupport@siemens.com

In the United States, call toll-free:
Phone: +1 800 333 7421
Fax: +1 423 262 2200
E-Mail: solutions.support
@sea.siemens.com

In Canada, call:
Phone: +1 888 303 3353
E-Mail: cic@siemens.ca

In Asia:
Phone: +86 10 6475 7575
Fax: +86 10 6474 7474
E-Mail:
adsupport.asia@siemens.com

Service & support

Technical consulting

Support in the planning and designing of your project from detailed actual-state analysis, target definition and consulting on product and system questions right to the creation of the automation solution. [1]

Optimization and upgrading

To enhance productivity and save costs in your project we offer high-quality services in optimization and upgrading. [1]

Configuration and software engineering

Support in configuring and developing with customer-oriented services from actual configuration to implementation of the automation project. [1]

Service on site

With service on site we offer services for commissioning and maintenance, essential for ensuring system availability.

In Germany
Phone: 0180 50 50 444 [1]

In the United States, call toll-free:
Phone: +1 800 333 7421

In Canada, call:
Phone: +1 888 303 3353

Repairs and spare parts

In the operating phase of a machine or automation system we provide a comprehensive repair and spare parts service ensuring the highest degree of operating safety and reliability.

In Germany
Phone: 0180 50 50 448 [1]

In the United States, call toll-free:
Phone: +1 800 241 4453

In Canada, call:
Phone: +1 888 303 3353

SPARESonWeb - Online spare parts catalog
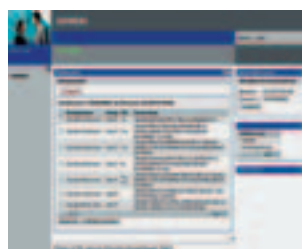
SPARESonWeb is a web-based tool for selecting the spare parts available for the SINAMICS system. After you have registered and entered the serial number and order number, the spare parts available for the relevant unit are displayed.

The delivery state for specific orders can be displayed for all shipped SINAMICS products.

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

1) For country-specific telephone numbers go to our Internet site at:
http://www.siemens.com/automation/service&support

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Services and documentation

Complete installations

Overview

Innovative installations for production machines and plants

Providing complete installations involves more than just wiring control cabinets. From consultation to configuration of software and hardware to customer acceptance, you get a complete range of services from a single source.

Consultation

Our aim is to transform functional requirements into efficient automation solutions. In this process, we advise you on material selection, implementation of country-specific standards (such as UL/CSA), particular end-customer regulations, and assurance of effective protective measures for segment-specific environmental impacts.

Engineering

For us, engineering means implementation of automation requirements in software and hardware configurations in conformance with standards. To this end, we use mainstream CAD systems (Sigraph, Eplan, and AutoCad). We tailor our scope of services (list of components, installation layout, schematic diagrams, PLC program, user interface program, closed-loop controller structures, etc.) to suit customer requirements for each project.
We create software solutions using our knowledge of each technology process and industry sector, based on proven standards.

Logistics

Our aim:
One automation solution - **one** order - **one** point of contact!

We achieve this objective and provide high quality supply performance by means of:

- Customized internal processes
- Preferred suppliers
- Customer-specific logistics agreements
- Experience with transborder deliveries
- Ship to line deliveries

Production

Complete installations are produced in accordance with high industry standards. Innovative production concepts ensure short delivery times and flexible available capacity.

We also provide:

- Testing of the order documentation for consistency
- Verification of compliance with the relevant specifications and standards
- Testing and preliminary commissioning in accordance with agreed-upon functional scopes
- Documentation (including multilingual documentation)
- Conformance declaration for low-voltage guidelines and manufacturer's declaration for machine guidelines

Quality management

Quality assurance and certification of the overall installation considerably increase worldwide sales opportunities for your plant. Our production is based on the EFQM quality model and is DIN/ISO 9001-certified.

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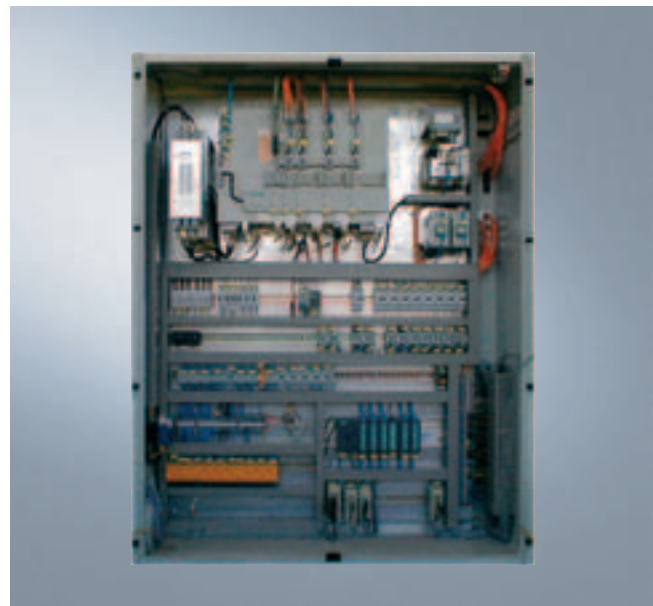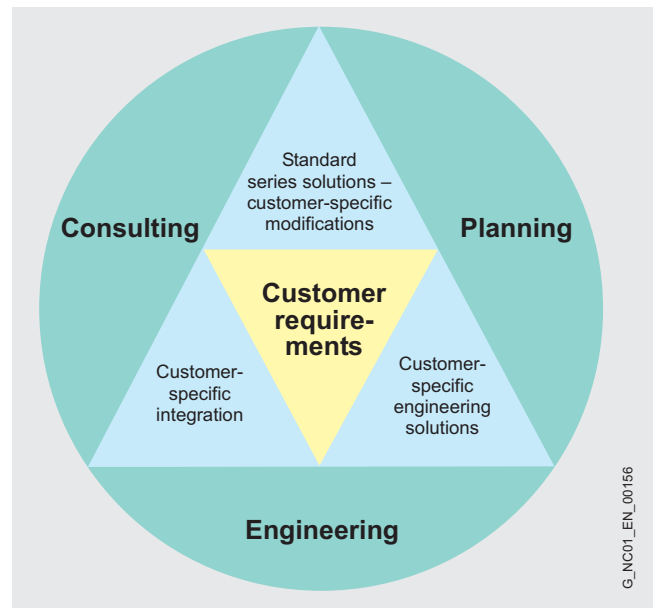
Documentation

Overview

General information

A powerful programmable controller can only be used in the best possible way if in addition to intensive training you also have access to professionally prepared documentation.

Information is available in the following formats:

- Windows help in conjunction with the SCOUT engineering system
- PDF file on the Internet as DOConWEB – application with search option covering all documents
  http://www.siemens.com/automation/doconweb
- Printed version

Manuals

The SIMOTION documentation comprises different documentation packages and is supplied as different manuals sorted in accordance with functionality and content.

Additional information is available on the Internet under:

http://www.siemens.com/machine

via "Support/Technical documentation/Overview of publications".

Selection and ordering data

	Order No.
SIMOTION manuals, printed version	
• Operation of the engineering system	**6AU1900-1AB32-0■A0**
• System and function description	**6AU1900-1AC32-0■A0**
• Diagnostics	**6AU1900-1AD32-0■A0**
• Programming	**6AU1900-1AE32-0■A0**
• Programming - reference lists	**6AU1900-1AF32-0■A0**
• C230	**6AU1900-1AG32-0■A0**
• P350	**6AU1900-1AH32-0■A0**
• D4xx	**6AU1900-1AJ32-0■A0**
• Function Library	**6AU1900-1AK32-0■A0**
- German	**A**
- English	**B**
- Italian	**E**

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Services and documentation

Notes

9

Sector solutions with SIMOTION

10

Sector solutions with SIMOTION

General information

■ **Overview**

The ability to innovate and to directly address the interests of customers is more important today than ever. Products alone, as innovative as they may be, do not suffice any longer. To recognize trends and respond to them, that is the key – whether in the form of innovative systems, intelligent solutions or the provision of unique services.

Innovative systems and intelligent solutions

One of the most important trends is toward modular machines and plant. One-off solutions are being gradually replaced by modular systems and distributed automation concepts. This offers advantages especially with regard to project runtimes and enhanced quality through the use of tried and tested modules in hardware and software.

In modular machine concepts, the mechanical components are being replaced more and more with electronic components (e. g. electronic gearing), which means, for example, that by isolating the drives, the line shaft can be completely omitted. The individual mechanical machine components can be separately designed, built, modified and individually combined to suit requirements for increased flexibility and reduced commissioning time. Siemens is offering an integrated solution here with distributed automation concepts in combination with a drive system.

Our extremely wide range of powerful and innovative standard components for automation technology and drive systems has a uniform system basis and supports integrated programming, data management and communication. This prevents problems with interfaces. Holistic, integrated solutions are created with uniform handling and uniform engineering and yet considerable scope remains for implementing your individual solutions.

Using our SIMOTION and SINAMICS system platforms, on the one hand you have ready-to-use solutions such as SIMOTION Easy Set and on the other hand due to the openness you have plenty of freedom for your special expertise. Our solutions and components are open for you to integrate your own developments, because we use open standards. Your special expertise is neither changed nor revealed.

Our specialists will, however, be happy to help you to create individual complete solutions, either for new projects or for modernization of existing plants including development, dimensioning of components and engineering with clearly defined statements on the performance of the overall system, with us as the partner who accepts responsibility for it.

Our technology is as long-lived as your machines. Expansions are still possible after many years, you therefore rely on system expansion capability that is assured for the long term.

Provision of unique services

Innovative services such as mechatronic support and application support round off Siemens' range of products, systems and services. With "Mechatronic support", for example, the generally costly construction of a prototype can become considerably less risky and faster by using virtual prototypes – the first real prototype is then final. The time to market and construction costs are therefore drastically reduced. The range of complete solutions offers potential for rationalization, e. g. a completely assembled, tested and customized control cabinet that can practically be delivered to the production line of the end customer with plug and play functionality.

Another emerging trend is the transformation into a "full supplier". In this case, the end customer requests everything from a single source for the new production line with vertical and horizontal integration throughout the complete process. To satisfy these and further future requirements and to open up new markets at the same time, machine manufacturers need strong partners at their side. With Siemens, you have an experienced partner that focuses on a wide range of different sectors and that will support you with individual solutions, powerful systems and innovative services and which, as a global player, maintains an all-encompassing, worldwide service network. Wherever your machine may be one day: Our technology complies with the applicable standards – and is supported locally. If you wish, round the clock, every day of the year. Always exactly what you want.

All types of references

Our extensive experience in various sectors helps us to concentrate on the important aspects. This is one of the reasons for the considerable amount positive feedback concerning our complete range of products and services.

Investment in the future

We are competent and reliable partners for Motion Control solutions in machine construction. We will be happy to work out future-oriented solutions with you for many different sectors. Partnership with Siemens secures your future.

The following are examples of various sector solutions implemented with SIMOTION. We make a distinction here between system-tested packages that can be ordered (SIMOTION Easy Set) and applications in the form of ordering examples that we will be happy to adapt to your specific machine.

■ **Further information**

Further details of reference projects and sector solutions using SIMOTION are available on the Internet at
http://www.siemens.com/simotion and
http://www.siemens.com/industries or from your contact at
your local Siemens office.

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■ Overview
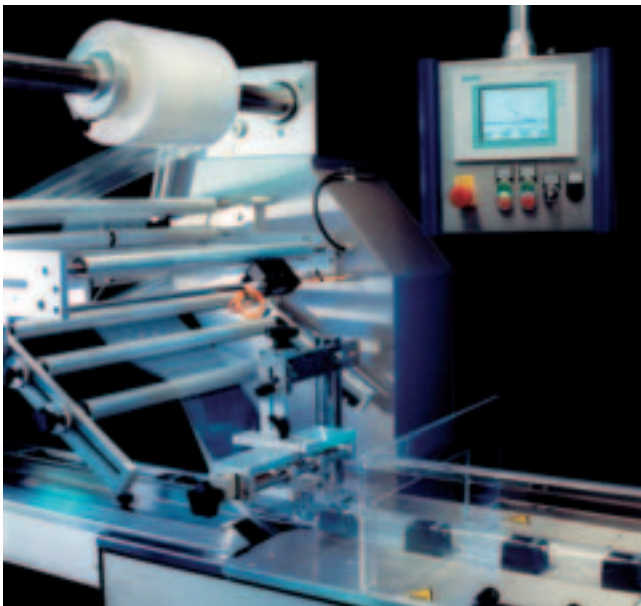
SIMOTION Easy Set – Baggers & Wrappers is a system comprising hardware and software packages for automating tubular bag machines. The technological basis of the packages is the motion control system SIMOTION.

The hardware packages are available in two versions: Comfort Package and Basic Package.

The Comfort Packages offer you an "80% solution" for automating your machine and can be adapted to the design of the machine using ordering options.

The Basic Package is more general and contains only the basics for automating your machine with SIMOTION.

As an option, we can offer you support with tasks ranging from hardware adaptation to your machines through to delivery of a control cabinet that is ready for switch on.

The software library contains expandable software modules for standard tasks and a pre-configured user interface. This significantly simplifies program development and commissioning.

Comfort packages SIMOTION Easy Set – Baggers & Wrappers

The following comfort packages are available:

SIMOTION Easy Set – Baggers & Wrappers for

- intermittent, vertical tubular bag machines
- continuous, vertical tubular bag machines
- horizontal standard tubular bag machines (up to approx. 300 bags/min.)
- horizontal high-speed tubular bag machines (from approx. 300 bags/min.)

Scope of delivery

The comfort packages contain:

- SITOP 24 V/20 A power supply
- SIMOTION D4x5 Control Module with 64 MB CompactFlash card and all the necessary Runtime licenses (temperature controller for 8 channels, positioning and synchronous operation)
- SINAMICS S120 drive system with
  - SINAMICS 5 kW (6.7 HP) rectifier regenerative feedback unit (Smart Line Modules) with line reactor and line filter
  - SINAMICS Double Motor Modules with 5 A each for foil extractor and cross sealer (for synchronous and asynchronous motors)
- Distributed ET 200S I/O system (bit modular expendability) with
  - 20 digital inputs (24 V)
  - 20 digital outputs (24 V/0.5 A)
  - 4 analog inputs for resistance thermometer (e. g. PT 100)
- Control cabinet on request

Ordering options

The ordering options are used to adapt the comfort packages to the machine design. Please refer to the explanations in the functional description and the selection and ordering data.

In addition to the options listed there, other adaptations to the hardware design can, of course, also be made, e. g. by adding Drive and I/O Modules.

Supplementary components

Motors, gear units, connection system, and switchgear are not included in the package. These components must be ordered separately.

Basic package SIMOTION Easy Set – Baggers & Wrappers

If Motor Modules with a different power rating are required for automating the tubular bag machine than are included in the comfort packages, the SIMOTION Easy Set – Baggers & Wrappers basic package can be used. The basic package also contains a SINAMICS infeed unit (Smart Line Modules) and must be expanded with the required Motor Modules.

Difference to the comfort packages

- CompactFlash card for SIMOTION D, Runtime licenses and required SINAMICS S120 Motor Modules must be ordered separately.

Scope of delivery

The basic package contains:

- SITOP 24 V/20 A power supply
- SIMOTION D4x5 closed-loop Control Module
- The SINAMICS S120 drive system with
  - SINAMICS infeed/regenerative feedback unit with line reactor and line filter
- Distributed ET 200S I/O system (bit modular expendability) with
  - 20 digital inputs (24 V)
  - 20 digital outputs (24 V/0.5 A)
- Control cabinet on request

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Baggers & Wrappers

■ Overview (continued)

Supplementary components

Motors, gear units, connection system, and switchgear are not included in the package. These components must be ordered separately.

Software library Easy Set – Baggers & Wrappers

In addition to the hardware packages, a software library SIMOTION Easy Set – Baggers & Wrappers is available. This library contains the following components:

- Function blocks for automating the machine functions of tubular bag machines
- SIMOTION application examples for the various machine types
  - intermittent, vertical tubular bag machine
  - continuous, vertical tubular bag machine
  - horizontal tubular bag machine
- Standard user interfaces
- Electronic manual on CD-ROM (German/English)

SIMOTION Easy Set – Baggers & Wrappers support package

For easy familiarization with SIMOTION Easy Set – Baggers & Wrappers, Siemens offers a support package for first commissioning. This package comprises the following freely selectable services:

- Hardware and software instructions
- Support with
  - creation and modification of software
  - expansion with customized machine functionality
  - commissioning of the machine

Please direct all enquiries to your local Siemens contact.

■ Benefits

The intense competition in packaging machine manufacture means that new applications must be created quickly and easily. Our response to this is: SIMOTION Easy Set – Baggers & Wrappers reduces the outlay for creating the basic functionality of the packaging machine. This gives you more time to create customer-specific functions.

Using SIMOTION Easy Set– Baggers & Wrappers has the following advantages:

- Significantly reduces the time required for program creation and commissioning
- Increases program reliability through standardized and comprehensively tested Software Modules
- Simple expansion with customer-specific software functions
- Reduces costs for the configuration and commissioning phase by more than 50%
- No additional resources are required for electrical construction and modification of peripherals - when ordered mounted in a control cabinet

■ Application

Tubular bag machines form, fill and seal bags made of strips of packaging material which is pulled off a packaging material reel.

Tubular bag machines are subdivided into intermittent (clocked) and continuous machines depending on the movement of the foil. They are available in vertical and horizontal versions.

- Vertical tubular bag machines are used to package bulk solids, pasty solids and liquids in bags. Bag sizes vary from a few cubic centimeters up to several liters. The cycle time depends on the size of the package and its contents. Depending on the actual application, up to 200 bags per minute can be achieved.
- Horizontal tubular bag machines are used to package individual items. Depending on the application, cycle times of up to 1500 bags per minute can be achieved with the current state of the art (2005).

The following machine functions can be automated with the help of SIMOTION Easy Set:

- Intermittent (clocked packaging material extraction) or continuous operation
- Use of synchronous servo motors, asynchronous motors or linear drives
- Operating mode management and production data acquisition in accordance with the OMAC Standard (OMAC = Open Modular Architecture Controls, see http://www.omac.org)
- Coordination of the movements of the packaging material extractor, cross sealer, dosing device or infeed unit
- No Product – No Bag
- No Gap – No Seal
- Optimization of the parallel movement of the aggregates to increase the cycle time
- Packaging material extractor with print-mark correction and/ or slip compensation
- Pre-extractor with dancer control
- Web aligner
- Control of marking devices
  - over fast output cams
  - over PROFIBUS
- Different designs of cross sealing tools, e. g.
  - rotating cross sealers
  - coupled-motion cross sealers (box motion)
- Lagging cross sealer opposite to packaging material extractor (compress factor)
- Temperature control for continuously heated seal plates with autotuning function
- Connection of external impulse welding devices
- Interfacing to different dosing and counting devices, e. g.
  - multihead scale
  - auger filler
  - cup filler
- Automatic product feed unit with accumulating conveyors for horizontal tubular bag machines
- Recipe management
- Linking higher-level controls to the management level (operating data, messages) in accordance with OMAC standard

In addition, other aggregates can be integrated or created depending on the application, for example,

- Side gusset, block bottom, punching and zipping unit
- Edge sealing (Quattro seal)
- Vacuum chamber
- Gassing units (MAP)
- Sidelay control
- Detection of trapped products in sealing seams

■ Design

Hardware structure
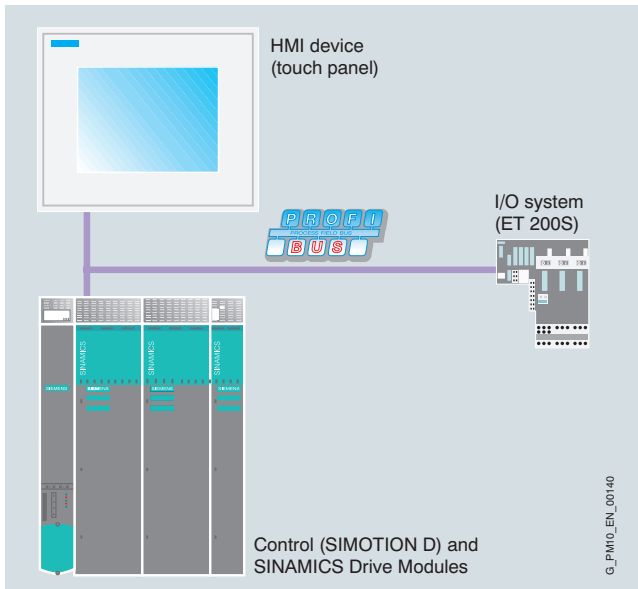
Automation solution example for SIMOTION D

The SIMOTION Easy Set – Baggers & Wrappers comfort packages include all essential automation components such as control, Drive Modules, I/O system and optional operator panel (HMI). The open-loop control, I/O system and operator panel communicate with each other over PROFIBUS (PROFINET will be possible soon). The hardware is configured depending on the machine design.

Software structure

Automating with pre-configured Software Modules

With the help of the open software library, all machine functions of tubular bag machines that are listed under "Function" can be automated. The Software Modules offer functionalities for the different aggregates of a tubular bag machine, e. g. for cross sealers, foil extractors, temperature control with self-adjustment.

The modular software concept makes it easier to automate different machine types. When different cross sealing stations are used, the corresponding Software Module from the library is selected. In addition, the Software Modules can be expanded and adapted to individual machine requirements. Special know-how of the machine manufacturer can therefore be implemented.

The operating modes of the machine are coordinated clearly in an OMAC PACK ML-compatible operating mode manager (OMAC = Open Modular Architecture Controls). The coordination of the continuous tubular bag machine aggregates can be checked visually with the "jog in synchronous operation group" function.

Sample project as starting point

The Easy Set – Baggers & Wrappers software library contains a SIMOTION project example. This sample project is the starting point for individual expansions and adaptations to actual machines. The modules of the software library can be changed and expanded by customer-specific functions with the help of the SCOUT engineering system.

Adaptable user interface

There is a standard configuration for the optional 6" or 10" touch panels included in the comfort packages. The user interface covers standard machine control tasks such as jogging drives, setting the temperature control or displaying diagnostics information. The user interface can be changed and adapted to the individual requirements of the machine manufacturer with the help of the SIMATIC ProTool/Pro HMI software.
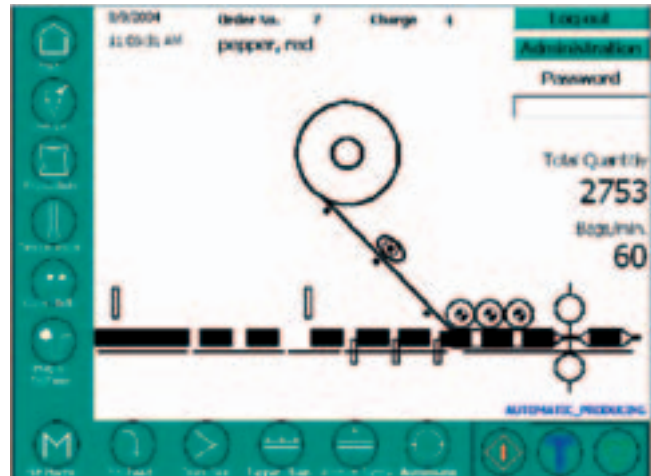
■ Function
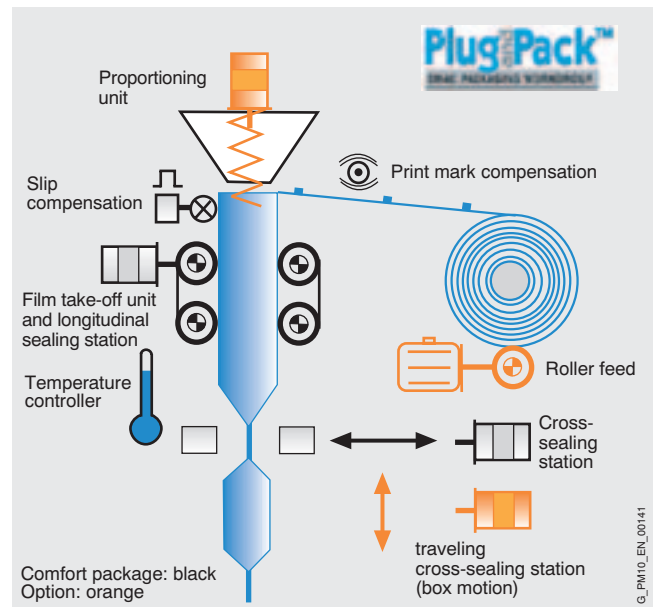
Vertical tubular bag machine

Functional description for the vertical tubular bag machine

This functional description explains the functional relationships in a simplified manner. It serves to explain the ordering options for the comfort packages. The detailed description can be found in the function manual on the CD "Software Library SIMOTION Easy Set – Baggers & Wrappers". For up-to-date information, visit www.siemens.com/packaging/easy_set.

10

Baggers & Wrappers

■ **Function** (continued)

Foil extractor

The foil extractor pulls the foil over the forming part. It consists of take-down rollers which are powered by a servo motor. The SINAMICS Motor Module required for foil extraction is included in the comfort package.

Print-mark correction/slip compensation

These functions are used to compensate the slip between the take-down rollers and foil. The position of the foil is determined with a print-mark sensor or measuring wheel with actual position sensor which runs on the foil. Both software functions influence the foil extractor and are contained in the comfort package.

Cross sealer

The cross sealer seals the foil bag in the transverse direction. The cross sealer is powered by a servo motor.

The SINAMICS Motor Module required for the cross sealer is included in the comfort package.

Temperature control

The temperature controller for 8 heating elements is included in the comfort package. The controller parameters are set with an autotuning function.

Coupled motion cross sealer option

In continuous machines the sealing jaws are moved with the foil. In box motion systems this motion is achieved with a second servo motor. The SINAMICS Motor Module required for the coupled motion of the cross sealer is included in this option.

Pre-extractor option

The pre-extractor supports foil extraction with an asynchronous motor at the packaging material reel. The MICROMASTER frequency converter required for this purpose is included in this option.

Dosing unit option

The dosing unit fills the product to be packaged into the tubular bag. The comfort package includes a controller for an external dosing unit (e. g. multihead scale) which uses the handshake procedure.

An additional servo motor is required when using an auger filler or cup filling device. The required SINAMICS Motor Module is included in this option.

HMI option

The comfort packages include a touch panel ordering option for operator control and monitoring.
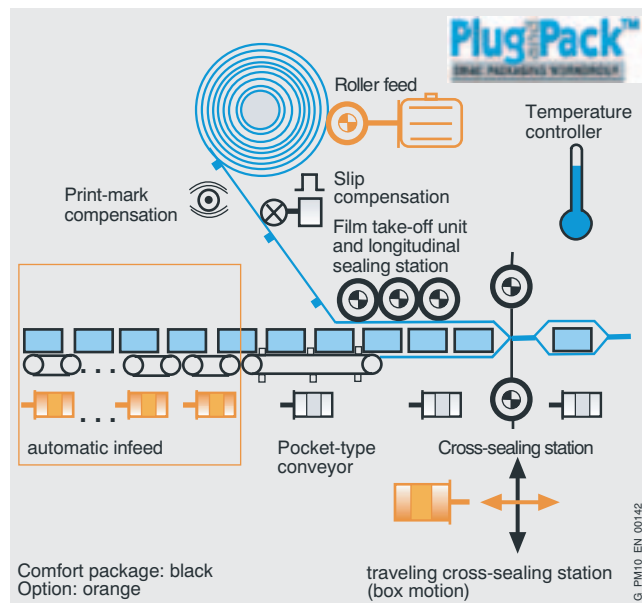
Horizontal tubular bag machine

Functional description for the horizontal tubular bag machine

This functional description explains the functional relationships in a simplified manner. It serves to explain the ordering options for the comfort packages. The detailed description can be found in the function manual on the CD "Software Library SIMOTION Easy Set – Baggers & Wrappers". For up-to-date information, visit www.siemens.com/packaging/easy_set.

Foil extractor

The foil extractor guides the foil over the forming shaft. It consists of take-down rollers which are powered by a servo motor.

The SINAMICS Motor Module required for foil extraction is included in the comfort package.

Print-mark correction/slip compensation

These functions are used to compensate the slip between the take-down rollers and foil. The position of the foil is determined with a print-mark sensor or measuring wheel with actual position sensor which runs on the foil. Both software functions influence the foil extractor and are contained in the comfort package.

Pocket-type conveyor

The pocket-type conveyor pushes the products into the foil bag and is powered by a servo motor. The SINAMICS Motor Module required is included in the comfort package.

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■ **Function** (continued)

Cross sealer

The cross sealer seals the foil bag in the transverse direction. The rotating cross sealer is powered by a servo motor.

The SINAMICS Motor Module required for the rotating cross sealer is included in the comfort package.

Temperature control

The temperature controller for 8 heating elements is included in the comfort package. The controller parameters are set with an autotuning function.

Coupled motion cross sealer option

In box motion systems this coupled motion of the cross sealer jaws is achieved with a second servo motor. The required SINAMICS Motor Module is included in this option.

Pre-extractor option

The pre-extractor supports foil extraction with an asynchronous motor at the packaging material reel. The MICROMASTER frequency converter required for this purpose is included in this option.

Automatic feeder option

When the tubular bag machine is coupled with an upstream automatic production plant, the products must be correctly spaced and positioned for the flighted chain. For this purpose, the products are aligned on 4 infeed belts and synchronized with the flighted chain. The infeed belts can be powered with servo synchronous or asynchronous motors. The SINAMICS Motor Modules required for this are included in this option.

For information about non-contact product infeed, visit www.siemens.com/packaging/easy_set.

HMI option

The comfort packages include a touch panel ordering option for operator control and monitoring.

■ **Selection and ordering data**   Order No.

SIMOTION Easy Set – **Baggers & Wrappers** For intermittent, vertical tubular bag machines	**6AU1650-0DA0■-1■A■**	

Comfort package with
- SITOP 24 V/20 A power supply
- SIMOTION D425 with 64 MB CompactFlash card and licenses for intermittent vertical tubular bag machine
- The SINAMICS S120 drive system with
  - SINAMICS 5 kW (6.7 HP) rectifier/regenerative infeed unit (Smart Line Modules) with line reactor and line filter
  - SINAMICS Double Motor Modules with 5 A each for foil extractor and cross sealer (for synchronous and asynchronous motors)
- Distributed ET 200S I/O system (bit modular expendability)

Dosing unit
- External   **0**
- Internal
  (additional 5 A Motor Modules for synchronous or asynchronous motor)   **1**

Pre-extractor
- Without   **A**
- With
  (additional 0.37 (0.5 HP) frequency converter)   **E**

Touch panel
- Without   **0**
- TP170B 6" blue mode   **1**
- TP170B 6" color   **2**
- TP270 10" color   **3**

10

Baggers & Wrappers

■ Selection and ordering data	Order No.
SIMOTION Easy Set – **Baggers & Wrappers** For continuous, vertical tubular bag machines	**6AU1650-0CA0■-1■■■**

Comfort package with

- SITOP 24 V/20 A power supply
- SIMOTION D435 with 64 MB CompactFlash card and licenses for continuous vertical tubular bag machines
- The SINAMICS S120 drive system with
  - SINAMICS 5 kW (6.7 HP) rectifier/ regenerative infeed unit (Smart Line Modules) with line reactor and line filter
  - SINAMICS Double Motor Modules with 5 A each for foil extractor and cross sealer (for synchronous and asynchronous motors)
- Distributed ET 200S I/O system (bit modular expendability)

Dosing unit

- External   0
- Internal (additional 5 A Motor Modules for synchronous or asynchronous motor)   1

Pre-extractor

- Without   A
- With (additional 0.37 kW (0.5 HP) frequency converter)   E

Cross sealer

- Rotating   A
- Coupled-motion cross sealer/ box motion (additional 5 A Motor Modules for synchronous or asynchronous motor)   D

Touch panel

- Without   0
- TP270 10" color   3

■ Selection and ordering data	Order No.
SIMOTION Easy Set – **Baggers & Wrappers** For horizontal standard tubular bag machines (up to 300 bags/min.)	**6AU1650-0LA0■-1■■■**

Comfort package with

- SITOP 24 V/20 A power supply
- SIMOTION D435 with 64 MB CompactFlash card and licenses for horizontal tubular bag machine
- The SINAMICS S120 drive system with
  - SINAMICS 5 kW (6.7 HP) rectifier/ regenerative infeed unit (Smart Line Modules) with line reactor and line filter
  - SINAMICS Double Motor Modules with 5 A each for foil extractor, flighted chain and cross sealer (for synchronous or asynchronous motors)
- Distributed ET 200S I/O system (bit modular expendability)

Automatic feed

- None   0
- 4 buffer conveyors [1]   1

Pre-extractor

- Without   A
- With (additional 0.37 kW (0.5 HP) frequency converter)   E

Cross sealer

- Rotating   A
- Coupled-motion cross sealer/ box motion (additional 5 A Motor Modules for synchronous or asynchronous motor)   D

Touch panel

- Without   0
- TP270 10" color   3

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[1] Additional CU320 with CompactFlash card with performance expansion 1 and Motor Modules of 5 A each for 4 synchronous or asynchronous motors.

■ **Selection and ordering data**   Order No.

SIMOTION Easy Set –   **6AU1650-0HA0■-1■■■**
Baggers & Wrappers

For horizontal high-speed tubular bag machines (from 300 bags/min)

Comfort package with

- SITOP 24 V/20 A power supply
- SIMOTION D445 with 64 MB CompactFlash card and licenses for horizontal tubular bag machine
- The SINAMICS S120 drive system with
  - SINAMICS 5 kW (6.7 HP) rectifier/ regenerative infeed unit (Smart Line Modules) with line reactor and line filter
  - SINAMICS Double Motor Modules with 5 A each for foil extractor, pocket-type conveyor and cross sealer (for synchronous or asynchronous motors)
- Distributed ET 200S I/O system (bit modular expendability)

Automatic feed

- None   **0**
- 4 buffer conveyors [1]   **1**

Pre-extractor

- Without   **A**
- With (additional 0.37 kW (0.5 HP) frequency converter)   **E**

Cross sealer

- Rotating   **A**
- Coupled-motion cross sealer/ box motion (additional 5 A Motor Modules for synchronous or asynchronous motor)   **D**

Touch panel

- Without   **0**
- TP270 10" color   **3**

■ **Selection and ordering data**   Order No.

SIMOTION Easy Set –   **6AU1650-0A■■0-0AA0**
Baggers & Wrappers

Basic package with

- SITOP 24 V/20 A power supply
- SIMOTION D4x5 Control Unit
- Distributed ET 200S I/O system (bit modular expendability)

Ordering options for basic package

Control Units

- SIMOTION D425   **B**
- SIMOTION D435   **A**

Rectifying/regenerative infeed unit

- SINAMICS 5 kW (6.7 HP) rectifying/ regenerative infeed unit   **0**
- SINAMICS 10 kW (13 HP) rectifying/ regenerative infeed unit   **1**

CompactFlash cards

The CompactFlash cards required to operate the SIMOTION D control contain the drive software and SIMOTION Kernel.

CompactFlash card 64 MB   **6AU1400-2KA00-0AA0**
Without licenses

For required licenses refer to chapter 6

■ **Selection and ordering data**   Order No.

Software library Easy Set –   **6AU1836-5AA10-0XA8**
Baggers & Wrappers

Sample project, software library and standard user interface

SIMOTION Easy Set –   On request
Baggers & Wrappers
Mounted in control cabinet ready for switch on

acc. to customer specification for batches of 5 items or more

SIMOTION Easy Set – Baggers &   On request
Wrappers support package

Hardware and software instructions

Support with

- Creating and modifying software
- Expansion with customized machine functions
- Commissioning of the machine

10

1) Additional CU320 with CompactFlash card with performance expansion 1 and Motor Modules of 5 A each for 4 synchronous or asynchronous motors.

Baggers & Wrappers

Further information

Package contents

For further information on the contents of the individual packages, please refer to the "Ordering examples" node.

Supplementary components

Further information on selection and ordering of supplementary components can be found in the following catalogs:

- Touch panels: Catalog ST 80 (SIMATIC HMI: HMI systems)
- SINAMICS and motors: Catalog D 21.2 (SINAMICS S120 Servo Control Drive System)
- Distributed I/O, PROFIBUS: Catalog IK PI (Industrial Communication)
- Control cabinet components, for SINAMICS and other systems: Catalog D 21.2 or LV 10

SIMOTION Easy Set – Baggers & Wrappers – assembled ready to operate

The SIMOTION Easy Set – Baggers & Wrappers components in batches of 5 items upwards can also be ordered mounted in the control cabinet and wired up. Please direct all enquiries to your local Siemens contact.

Advice and support

The A&D Technical Support will be pleased to help you adapt SIMOTION Easy Set – Baggers & Wrappers to your packaging machine.

Please contact:

A&D Technical Support:
Phone: +49 (180) 50 50 222
E-mail: easy-set-support@automation.siemens.com
Internet: www.siemens.com/packaging/easy_set

10

■ Overview
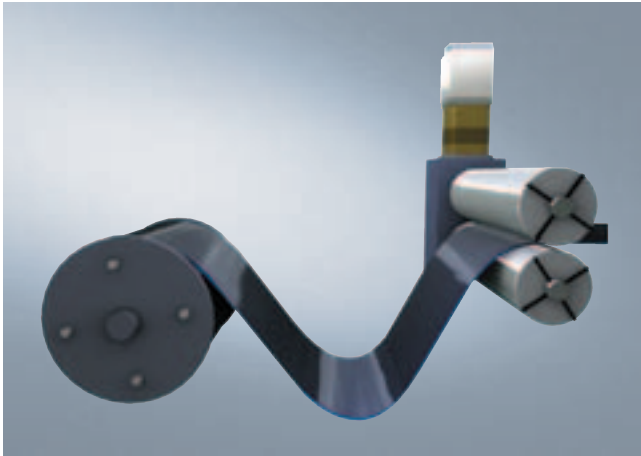
Machine requirements

The electronic roller feed is an integral part of almost every modern conveyor fed press and punch and is frequently implemented as a stand-alone, electrically driven machine unit. Mechanical components of a complex construction are replaced with intelligent feed units, whereby apart from the flexibility, the productivity of the production equipment is permanently increased. In sheet-metal processing too, the trend continues in cost-effective manufacturing both of large batches at maximum cycle rates as well as a broad range of components in small batches. Accordingly, the roller feed has to respond to changing production data and at the same time avoid unnecessary production downtimes. The production stroke number of the press or punch directly depends on the positioning time, so the feed distances must be covered in a time optimized for the parameterized traversing data. This can only be achieved when highly dynamic motional sequences are used. The sheet metal is transported (force-fit) between the two rollers. To reduce the risk of impairing the surface of the sheet metal, the conveyor between these rollers must be reliably prevented from slipping. For this reason, Motion Control to protect the material is necessary which pays particular attention to favorable jerk and bump conditions.

The automation system must provide the following functions:

- Relative positioning that supports isochronous material feed
- Special positioning algorithms to prevent slipping and for simultaneous time-optimization

■ Benefits

The automation solution with SIMOTION offers you the following advantages:

- Graded performance of drive and operating components optimized for the requirements and freely selectable hardware platform
- Transparency in the process due to comprehensive diagnostic tools
- User friendliness due to graphical programming and wizards to assist with dialog
- Flexibility and modularity in the machine concept (single-axis, double-axis and zig-zag roller feed)
- Roller feed can be integrated as a compact, stand-alone module in a plant
- Integrated cam controller
- Sector-specific functions are provided, such as operating mode management, slip monitoring, encoder switch-over, feed control, roller diameter compensation
- Feed lengths changed on the fly

■ Design

Automation solution

The modular Motion Control system SIMOTION in combination with the SINAMICS S120 drive system as well as highly dynamic servo motors provide a precise and highly dynamic response and therefore create a high-quality roller feed solution for optimized adaptation to the specific field of application.
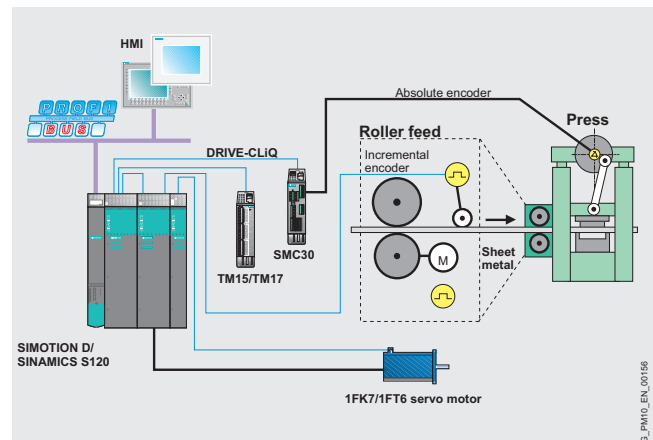
Automation solution based on the example of SIMOTION D

Due to the independence of the SIMOTION platform from the drives to be controlled, the mechatronic function "Roller feed" is also ideally suited for retrofitting of an existing plant.

Roller feed

Design (continued)

The following options are covered by the mechatronic function "Roller feed":

- Single-axis roller feed
- Double-axis roller feed in the versions:
  - Double-axis roller feed comprising one roller pair in front and another roller pair behind the press or punch
  - Zig-zag roller feed comprising a roller feed in the direction of travel and a cross motion matched to the feed motion

With regard to creating a highly dynamic traversing response and the resulting maximization of productivity, numerous process-oriented functions are provided by the mechatronic function "Roller feed":

- Presetting of feed movement using program blocks based on DIN 66024 and DIN 66025
- Traversing curve:
  - ramp up and ramp down can be set separately
  - initial and final rounding (jerk limiting) can be set separately
  - presetting of maximum speed
  - override
- Operating modes:
  - jog
  - set up
  - reference point approach
  - single traversing block
  - automatic single block and program execution
- Discharge rollers
- Actual value switch-over from measuring wheel to motor encoder
- Print mark control
- Messages and monitoring functions
- Slip monitoring
- Pre-position reached
- Position reached and stopped
- Difference between direct and indirect measuring system
- Utilization ratio
- Documented sample project

Selection and ordering data — Order No.

Single-axis roller feed
License for use of mechatronic function "single-axis roller feed". Includes all necessary licenses for one axis.
6AU1830-0AC10-0AB0

Zig-zag roller feed
License for use of mechatronic function "zig-zag roller feed". Includes all necessary licenses for two axes.
6AU1830-0AC10-1AB0

Double-axis roller feed
License for use of mechatronic function "double-axis roller feed". Includes all necessary licenses for two axes.
6AU1830-0AC10-2AB0

SIMOTION Function Library
On CD-ROM, included in scope of supply with "SIMOTION SCOUT" (German/English/Italian)
See engineering software

10

■ **Overview**

Machine requirements

Electric injection molding machines require high-speed, finely tuned closed-loop control of the velocities, positions, and pressures of all machine axes involved in the process. Moreover, the temperatures of the heating strips on the cylinder, the injection screw on the injection nozzle, and the mold temperature must all be precisely controlled.

The typical process sequence of an injection molding machine is as follows:

- Mold closure:
  The mold is closed, and the clamping pressure builds up. This enables the mold to remain closed while the liquified plastic is being injected. During this process, the mold protection function continually monitors the clamping pressure, thus preventing the mold from being damaged during closure in the event that material remains in the mold.

- Injection unit forward:
  For injection to take place, the injection nozzle must be seated in the mold. In this step of the process, the nozzle is seated in the mold at a defined nozzle contact pressure.

- Injection:
  The plasticated material located in the tab of the injection screw is injected at high pressure into the mold until the mold is filled. The material is injected using velocity profiles that are adjusted for the mold.

- Hold:
  To compensate for material loss during the cooling phase, pressure is reapplied. This hold-pressure phase requires closed-loop pressure control.

- Decompression:
  To discharge the melted material, the screw can be retracted before and after recovery.

- Injection unit retracted:
  To prevent cooled molds from affecting the temperature of the heated injection cylinder, the entire injection unit is retracted, thus removing the heated nozzle from the mold.

- Mold open:
  When the cooling period is complete, the mold is reopened. The mold contains the finished, cooled part.

- Ejector:
  The produced part is ejected from the mold, falls from the machine or is removed by the gripper of a retrieving device, and is then fed to additional production steps (such as imprinting).

- Recovery
  The granulate is melted (plasticated) by the rotation (shear warmth) and heating of the screw. The plasticated material is transported to the retention chamber by the rotation and simultaneous retraction (performed using pressure control, for example) of the screw.

■ **Benefits**

The SIMOTION automation solution described below offers you the following advantages:

- Cost savings due to scalability of the SIMOTION system, which enables precise customization to the performance requirement

- Simple engineering due to well-structured software design with wide-ranging options for access by the mechanical equipment builder

- Flexible expansion for injection molding cells with retrieving devices using the SIMOTION application solution for removal devices

- Simple commissioning of machines due to powerful engineering tools

- Elimination of belts and gearing and increased dynamic response from use of torque motors instead of standard servo motors

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Electric injection molding machine

■ **Design**

Automation solution

The SIMOTION Motion Control system offers, in combination with the SINAMICS S120 drive system and our highly dynamic motors (e. g. the 1FT series), sophisticated complete solutions for electrically driven injection molding machines.

The motor range offered can implement forces in full stroke position of over 8000 kN. Torque motors allow axes with high torques to be directly driven at a low speed, so no mechanical translation by means of belts or gears is required. In combination with the SIGUARD 3TK safety relay, protection against restarting of axes after emergency stop can be cost-effectively implemented in accordance with EN 954-1 Category 3. The required test certificates are available.

HMI
Visualization/
Controlling

PROFIBUS
PROCESS FIELD BUS

**SIMOTION D/
SINAMICS S120**

**Temperature
controller
TControl**
(16 channels)

Mold Height Adjustment

Injection Unit forward/backward

Open/Close Mold

Ejector

**Servo
motors
1FK7**

Plastification

Injection

**Servo
motors
1FT6**

⊓ Isochronous

G_PM10_en_00094
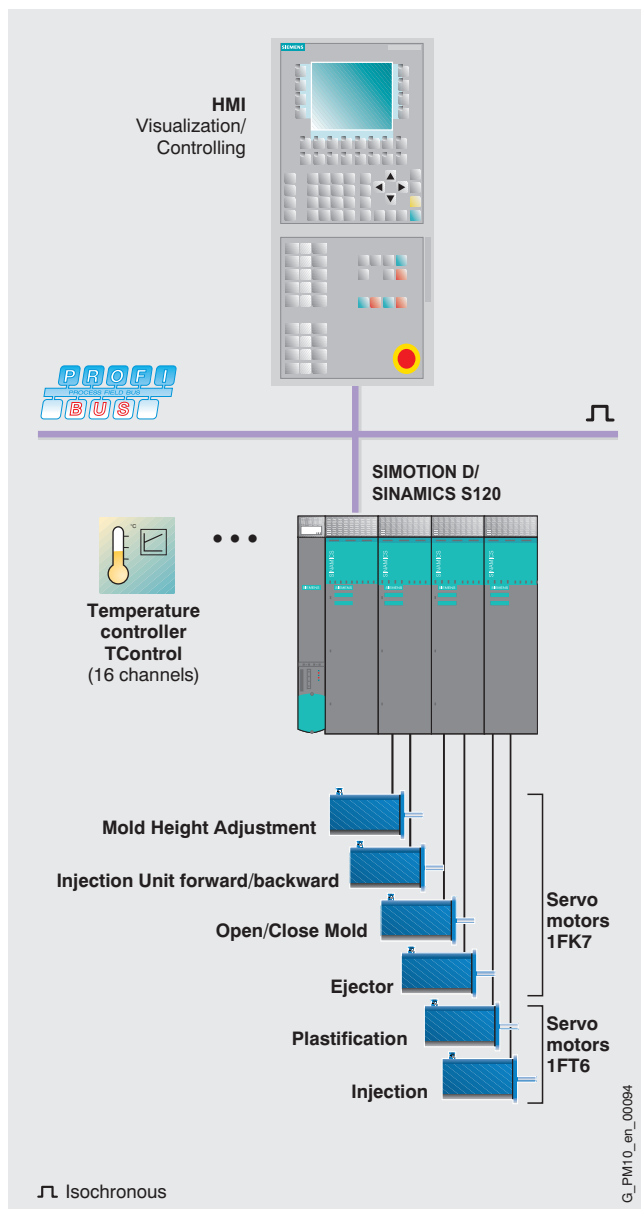
Automation solution example for SIMOTION D

Application IMe (Injection Molding Electric) for SIMOTION

- **Supports** the complete machine control
- **Comprises** all the technology functions for controlling a fully-electronic injection molding machine with 6 axes: Dosing, decompression, injection, injection unit, mold, ejector and mold height adjustment.
- **Implements**
  - Motion Control (closed-loop control of position, speed and pressure) of all machine axes as well as
  - temperature control
- **Executes** both on
  - drive-based (SIMOTION D) control in combination with SINAMICS S120
  - PC-based (SIMOTION P)
  - controller-based (SIMOTION C) controls in combination with SIMATIC panels
  - A special machine control panel can be connected over PROFIBUS, if required.
- **The application** is supplied with the complete documentation (German and English).
- **Prerequisite** for using the application IMe for SIMOTION is the software license "Injection molding". This license supports operation of 6 electrical axes and 16 temperature channels.

Machine control

- Structured Text (ST) programming language in accordance with the IEC 61131-3 standard
- Support for different mechanical construction types (e. g. dual-plate locking system or toggle lever locking unit, nozzle unit pressure through motor torque or locked through a motor brake)
- Predefined sequence using the operating modes automatic, semi-automatic, manual for setting up the machine, dry cycle (dry running of the locking unit) or jog mode for single axes
- Freely definable speed profile "velocity over distance" with optional jerk limitation for smooth traversing of axes during all positioning movements
- Freely definable pressure profile "Pressure over distance" or "Pressure over time"
- Pressure control during the dwell pressure phase
- Mold protection function either via pressure sensor or motor torque
- Kinematics of the toggle lever can be adapted by means of electronic cams or formulas
- Logging (trace) of all important process values (up-to-date speed and pressure curves) for the mold also during dosing and injection

Temperature control

- 16 temperature channels (expandable)
- Self tuning of closed-loop controllers on heating up with self tuning of all controllers in parallel
- Switching of the strip-type heaters with digital, pulse length modulated actuating signal with adjustable minimum on-time
- Operation of heating sections, cooling sections or combined heating and cooling sections
- Operating modes (operating setpoint closed-loop control, reduced setpoint closed-loop control, metering mode, self tuning, etc.)
- Starting function, e. g. for defined drying of hot channels
- Plausibility check and filtering of actual values
- Parameterizable PID or DPID controller with high dynamic response and control quality

■ Overview

Machine requirements

Use of retrieving devices for injection molding machines enables a completely automated, unattended process for the production of plastic parts, as retrieving devices remove the plastic part directly from the injection molding machine and feed it to subsequent production steps. In subsequent production steps, the plastic part can be imprinted, partially assembled, or welded to other parts, for example. Retrieving devices for injection molding machines are usually designed as Cartesian triaxial linear robots. The form and function of the grippers are customized to fit the part to be retrieved.

Typical process sequence of an automated injection molding machine cell:

- Once the part in the injection molding machine has cooled off, the clamping unit of the injection molding machine opens.
- When the clamping unit is completely opened, the machine controller of the injection molding machine signals this to the retrieving device. The retrieving device may now enter the working space of the clamping unit.
- The retrieving device moves the gripper (from the side or from above) into the mold, in front of the part that has just been produced.
- The part is ejected from the mold by the ejector of the injection molding machine.
- The gripper of the retrieving device grips the part (pneumatically, for example, via negative air pressure) and removes it from the mold.
- Once the gripper with the part has moved out of the working space of the mold, the controller of the retrieving device signals this to the controller of the injection molding machine.
- The injection molding machine can now close the mold again and start the next production cycle.
- The retrieving device feeds the plastic part through subsequent production steps (e. g. imprinting) or deposits it on pallets.
- For inserts, the retrieving device first inserts metal parts into the mold. Material is then injected around the metal inserts, and they are then removed as part of the finished part. For inmold labeling applications, imprinted plastic foils are first inserted, and the plastic material is then injected. The decorated part is then removed.

■ Benefits

The automation solution with SIMOTION described below offers you the following advantages:

- Cost savings due to the scalability of the SIMOTION system that allows it to be precisely matched to the performance requirements
- Easy adaptation to special machine requirements due to the open software structure
- Easy commissioning of the drives due to powerful engineering tools
- Shortest possible cycle times due to the ability to use linear motors for high-performance applications
- Additionally, when unloading automation is integrated into the electric injection molding machine:
  - shorter unloading times due to simultaneous movement of the mold and unloading unit
  - savings in costs and space due to lack of a separate control cabinet and infeed

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Retrieving device for injection molding machines

■ Design
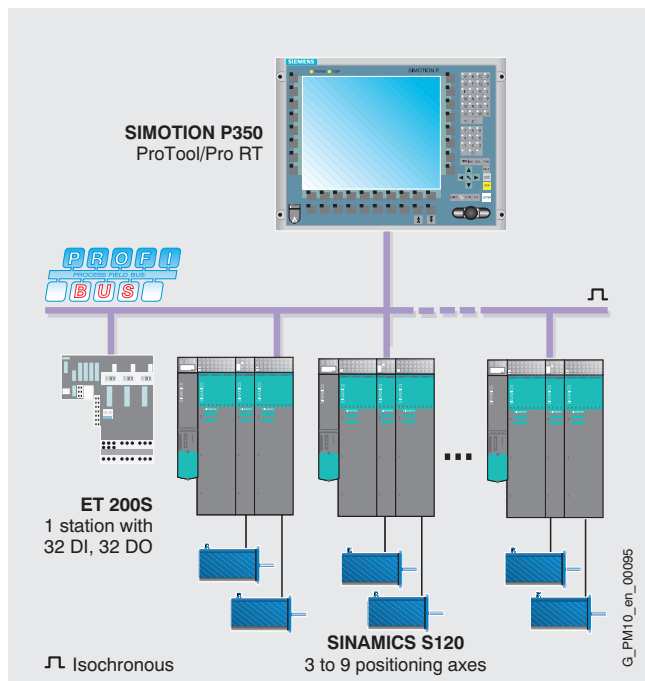
Automation solution with SIMOTION P in the example

Automation solution

The SIMOTION Motion Control system offers, in combination with the SINAMICS S120 drive system and the 1FK7 High Dynamic motors, powerful complete solutions for unloading units. For vertical axes, the motors can be fitted with integral holding brakes. All the functions necessary for controlling the holding brakes are included in the drive system. Linear motors are available for maximum performance requirements. In combination with the SIGUARD 3TK safety relay, protection against restarting of axes after emergency stop can be cost-effectively implemented in accordance with EN 9541 Category 3. The corresponding test certificates are available. Portable handheld units (e. g. Mobile Panel 170) can be connected, if required.

Application IMu (Injection Molding Unloading systems) for SIMOTION

- **Supports** the machine control
- **Comprises** the interface for injection molding machine control in accordance with the standard EUROMAP 12 "Electrical interface between injection molding machine and handling device"
- **Executes** both on
  - drive-based (SIMOTION D) controls in combination with SINAMICS S120
  - PC-based (SIMOTION P)
  - controller-based (SIMOTION C) controls in combination with SIMATIC panels
- **Prerequisite** for the application software IMu for SIMOTION are the axis licenses

Software functions

- Operating screens created with ProTool/Pro; screens that can be expanded by the user
- Operating modes:
  - manual mode (JOG mode) fast/slow forwards/backwards
  - ± 0.1 mm (0.004 in) positioning from the handheld unit
  - position approach (position, speed)
  - override
  - reference point approach
  - automatic (restart, continue)
  - single step
- Selectable drive parameter sets for reduced speeds in set-up mode

Overview

Machine requirements

Mechanical universal presses are characterized by high flexibility because they are suitable both for cutting and reforming. In combination with single, follow-on and progression tools, small to medium-sized parts can be manufactured. In these machines, the drive concept of the main press drive is identical. The press plunger complete with tool is driven via a mechanical conversion (eccentric, toggle lever) using an electrical drive and flywheel. The plunger motion is activated via the combined clutch and brake.
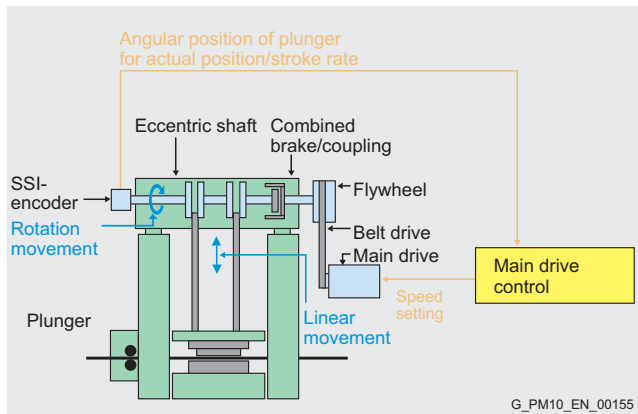
Principle of the mechanical universal press

With insertion presses, the material is introduced by hand and with automated presses (punching and reforming machines) continuously from a roll and then over the conveyor system by means of rollers or extractor tongs to the press itself. The press control performs various tasks such as operator control and monitoring, general machine control, operating mode control, main drive control, tool management, cam control and positioning tasks.

With reforming and punching machines, stringent requirements apply to the sampling time for time-critical functions (cam control, process controllers, etc.). Universal presses with stroke numbers of up to 100, max. 200 strokes per minute, are usually simple presses with a minimal degree of automation. For 200 to 500 strokes per minute, and in the case of punching machines even up to 2000 strokes per minute, the complexity increases and better response times and an increased degree of automation are required.

Benefits

The automation task demands almost complete integration of sequencing (logic) functions, motion functions and technology functions. With SIMOTION, it has been possible to resolve the different tasks with one system concept.

Logic programming can be implemented in the familiar LAD or FBD languages.

Technology-specific programs are programmed wherever possible in high-level languages (similar to Structured Text) and the motion tasks are programmed with the graphical tool Motion Control Chart (MCC).

Different tasks are, for example:

- Operating mode control
- Main drive control with stroke number preset and ramp up
- Positioning of the main drive for stroke depth adjustment or tool changing
- Cam control with dynamic deceleration angle calculation for TDC Stop (TDC = top dead center)
- Process monitoring functions such as tool position safety and press force monitoring

All these tasks can be programmed using the same engineering system and finally implemented with a machine-specific hardware platform.

Consequently,

- the number of interfaces is reduced,
- engineering and commissioning costs are optimized,
- and standardization is made easier.

Design

Automation solution

In the automation concept presented here, the SIMOTION D hardware platform with the SINAMICS S120 drive system was selected. Both the machine control and the technology functions are programmed on SIMOTION D and they control and monitor the machine through the distributed ET200 I/O. The output cam signals are output or sensor signals are acquired for process control over the drive-related, high-speed I/O Modules TM15 or TM17. The motors are controlled via the SINAMICS S120 Motor Modules.
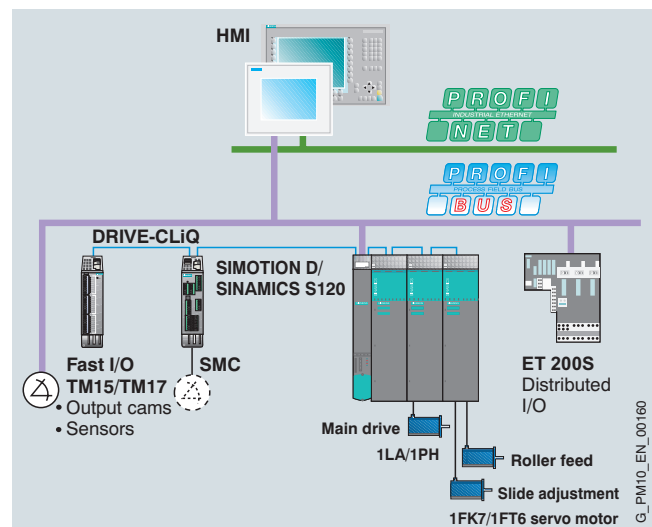
Automation based on the example of SIMOTION D

10

Pipe bending machine

Overview

Machine requirements

In pipe bending, round material (pipe, rod, wire, cable. etc.) is actively reformed using a bending head. The bending head guides the material around a bending roller or die. The end position of the bending head is the dimension for the bending angle. The bending radius is dependent on the die and can therefore not be altered during machining.

The bending programs are frequently created on the PC using special programs. The respective bending program comprising positions, angles, speed and pressure is selected via the operator panel and loaded into the controller. A bending machine typically has 3 to 5 positioning axes that are often implemented electrically, but the bending axes for large pipe diameters are frequently implemented hydraulically.

The pipe is inserted by hand as far as the stop in the clamping chuck of the rotary axis. On starting, the pipe is clamped hydraulically and the transport unit moves the pipe to the first bending point. The sliding rails or jaws are then hydraulically positioned. Clamping force and pressure are set in accordance with the material. The bending head is rotated by a defined angle and the first bend is formed. The bending axis of the pipe is automatically moved forwards in the Y direction (follow-up mode) or is positioned by means of a cam. The bending radius is defined permanently by the bending roller (tool). The sliding rail is then opened, the pipe is positioned at the next bending point and also rotated if necessary. Multi-dimensional shapes can be created in this manner. Different radii are achieved by means of different dies of various heights, so-called "multi-groove dies". For this purpose, the pipe is moved in the X direction away from the contour of the roller using the mandrel and transport unit, then aligned in the Z direction on the next roller and in the X direction on the roller again before it is moved to the next bending position. The sliding rails are then repositioned and the pipe is bent. This procedure is repeated until the bending program has been completed and the pipe is removed manually.

In order to ensure the shortest possible bending procedures and reproducible quality, it is important to be able to adapt the various parameters, such as acceleration, speed and pressure, to suit the respective product.

The following functions of the SIMOTION motion control system are provided to perform this task:

• Positioning of electrical and hydraulic axes
• Follow-up mode
• Cam disk
• Axis-dependent starting
• Output cam

Benefits

The automation concept with SIMOTION combines the following advantages for you:

• Reduced engineering overhead due to configuration, programming and commissioning with one system, the SCOUT engineering system
• Fewer interfaces, since different tasks are performed on the same hardware
• Simplified commissioning of drives by means of an electronic motor rating plate
• Optimized machine operation due to user-friendly, flexibly adjustable and reproducible process parameters on the operator panel, e. g. pressure, positions
• High availability of the machine through wide-ranging diagnostics functions in SIMOTION in the case of a plant failure
• TIA integration simplifies integration of HMI, I/O and drives

Design

Automation solution

As the system platform, SIMOTION P, the PC-based version with touch panel is a good choice. Without additional interfaces, the PC bending program, the Touch HMI functions and the control logic execute on Motion Control and a hardware platform.

SINAMICS S120 and 1FK7 motors are used for the electrical drives and provide highly dynamic and reproducible positioning. In the case of a hydraulic bending axis, the hydraulic servo valve can be activated via the TM31 Terminal Module with analog inputs and outputs. An isochronous PROFIBUS encoder is available for position detection.
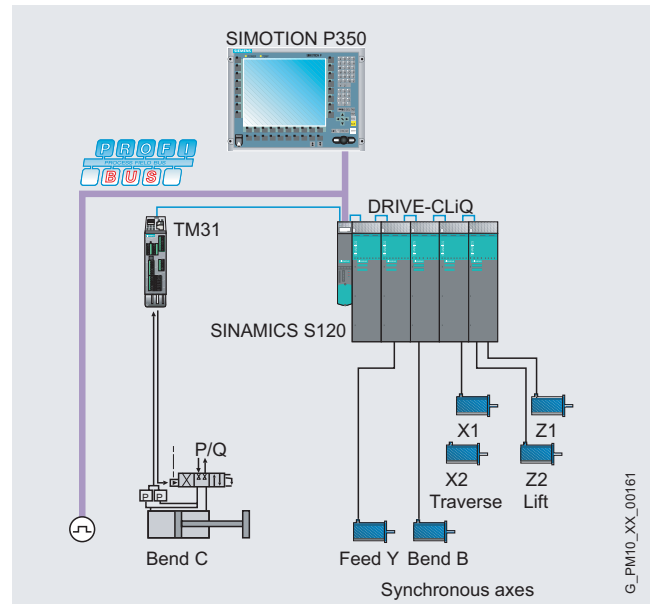
Automation based on the example of SIMOTION P and SINAMICS S120

Overview
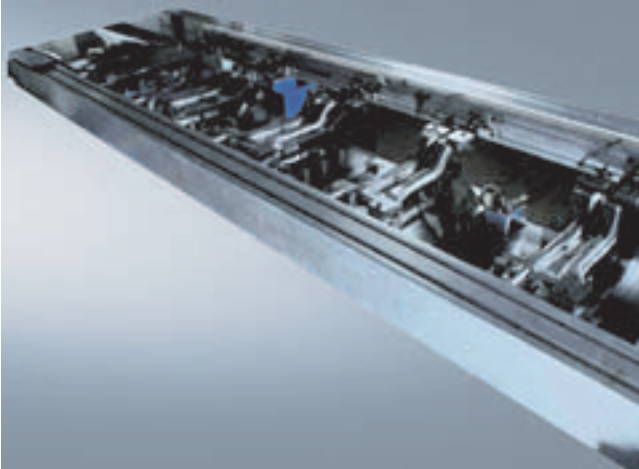
Machine requirements

Transfer systems are used to transport work pieces within a press with transfer press tools or large-component transfer presses. They are designed as a stand-alone machine or integrated as universal transfer in the press. Transfer systems are used in sheet-metal processing, punching and metalforming, as well as for cold, warm and hot massive forming in forges. The persistent trend toward greater automation in industrial production technology causes more and more machine manufacturers to replace conventional mechanically coupled transfer systems with freely parameterizable electronic transfer controls in which electrical positioning drives are increasingly implemented. In contrast to mechanical transfer systems, modern electronic transfer involves considerably less mechanical drive elements. These are replaced almost completely by electrical positioning drives that operate in synchronism with the main movement of the press. Transfer systems generally comprise gripper rails that are steered in three directions of motion that convey the work pieces in synchronism with the plant cycle. These rails are equipped with pneumatically operated active tongs or blades depending on the geometry of the sheet-metal, which hold the part during transport. The term electronic transfer refers to the situation in which mechanical drive solutions (cams mechanically linked to the plunger) are replaced with electrical drives. The axes are then traversed continuously by means of electrical positioning drives such that they follow a predefined traversing profile in accordance with the master setpoint of the plunger encoder. Transfers therefore offer a high flexibility with regard to the motional sequence to be implemented and therefore offer considerable advantages when changing tools.

Benefits

The automation solution with SIMOTION offers you the following advantages:

- Configuration with the standard components of SIMOTION, SINAMICS, SIMATIC HMI and I/O
- Graded performance of drive and operating components can be optimized to suit requirements
- Number of axes is scalable
- Reduction of production delays, such as during servicing and (repeated) commissioning after tool changeover
- Flexible parameterization of the motional sequence by the press operator
- High-dynamic and low-wear response due to motion in accordance with variable polynomials

Design

A variable number of drives are supported for transfer presses depending on the machine construction. For fast and flexible adaptation to current as well as future production requirements, the electronic transfer application SimoTrans is based on the universal Motion Control system SIMOTION and the SINAMICS drive platform. In accordance with the general SIMOTION concept, SimoTrans has access to high-dynamic Motion Control and PLC functionality in the same environment; time-critical communications interfaces are not used. The master value coupling to the presses allows all drives of a motion axis to be traversed synchronously and in accordance with the same laws of motion.

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Electronical transfer

■ **Design** (continued)
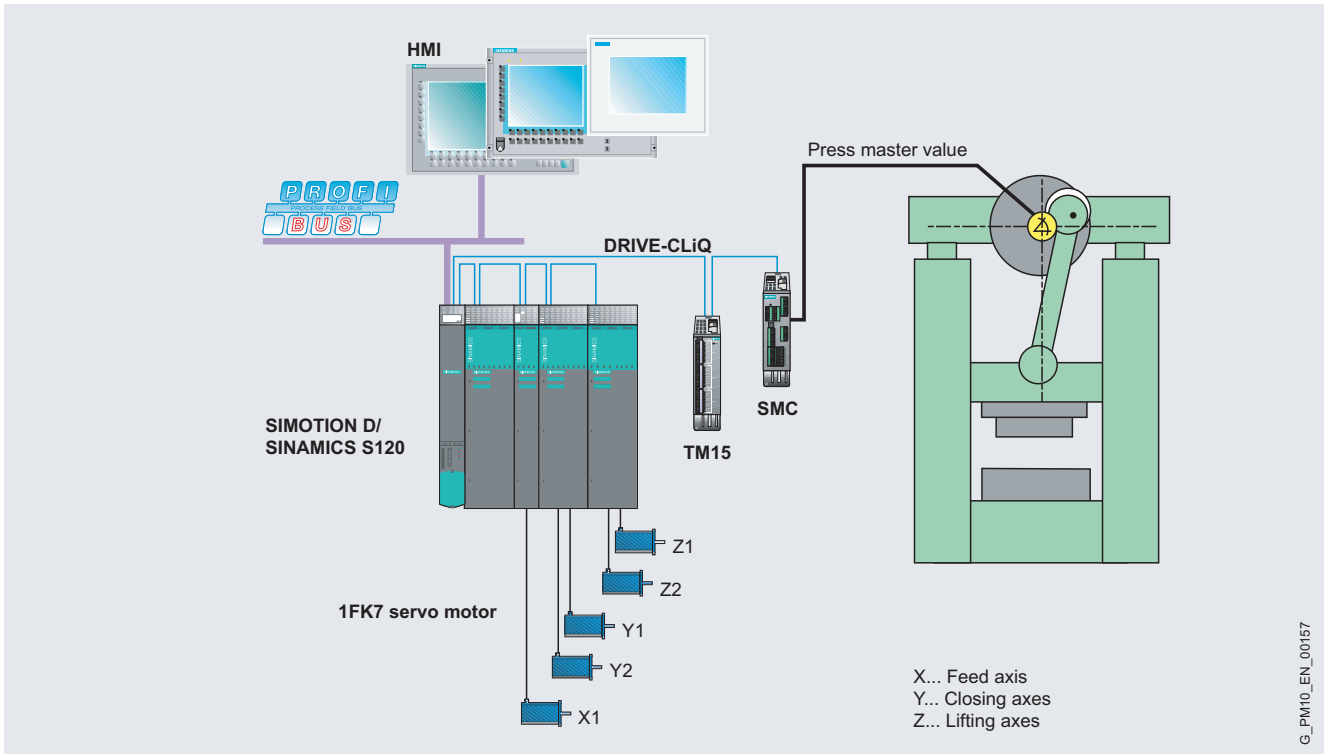
Automation solution example for SIMOTION D

Apart from a highly dynamic traversing response and the resulting maximization of productivity, further process-oriented functions are provided by SimoTrans:

- Coupling of the motion system to a higher-level master value
- Motion Control in accordance with standardized laws of motion (VDI 2143)
- Traversing in accordance with 5th-order polynomials resulting in favorable jerk and bump conditions
- Master value encoder changeover on the fly for adaptation to the mechanical conditions

- Modular, parameterizable program structure supports press variations
- Sequence parameterization using tables
- Operating modes: Service mode, setup, single stroke and automatic
- Openness for customization by the OEM
- Calculation of the maximum possible stroke number
- Encoder functionality can be monitored through redundant master value coupling
- Plausibility check of entered traversing data

■ Overview
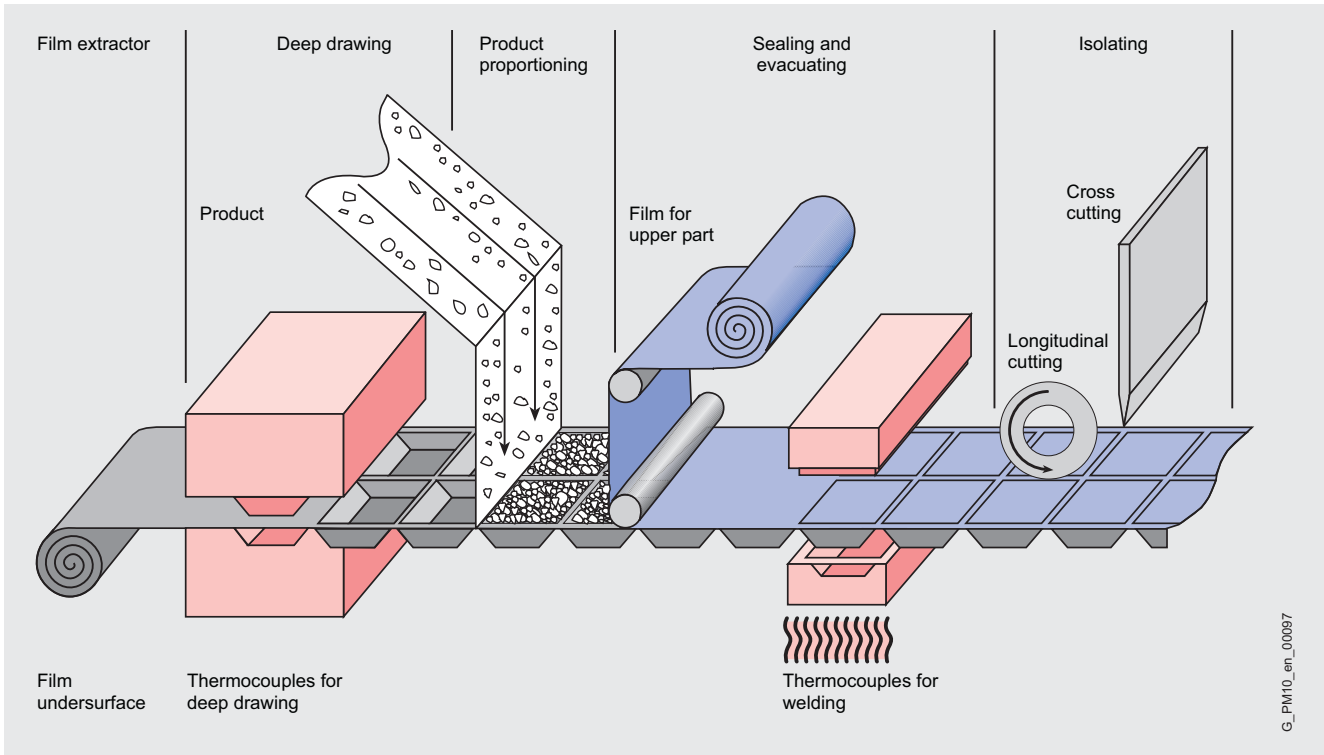
Principle of operation of the molding, filling, and sealing machine

Machine requirements

With molding, filling, and sealing machines, the film for the underparts is transported from station to station by a main drive.

The film is shaped into receptacles suitable for holding the product to be packaged. The tool inserted into the film is controlled at various velocity levels relating to the tool path and at the correct heating temperature.

Exact quantities of product must be poured into the receptacle at precise cycle times.

In order to preserve and seal the product after filling, the cover film must be pulled off by a second coil. The heated surface is then lowered from above, and the thermal effect seals the containers.

The sealed packages are then cut up into small units and carried off for further packaging.

The cross cutter movement is executed by means of a pneumatic mechanism. The objective is to control this process such that as many parts as possible pass through the machine per unit of time. Film-specific parameters must be taken into account during acceleration and deceleration.

Fast cycle times and format changes with the touch of a button are the main requirements.

The following Motion Control and technology functions are implemented in this machine:

- Position
- Cam
- Output cams
- Longitudinal cutter
- Temperature control

■ Benefits

The automation solution with SIMOTION described below offers you the following advantages:

- ONE system for logic, Motion Control and technology functions. This greatly simplifies engineering and minimizes level of effort required for the hardware
- SCOUT, an intuitive engineering system to create applications quickly and easily
- Extensive diagnostic options with SIMOTION, including trace functions, alarm-S concept, and teleservice, reduce commissioning times and increase machine availability and productivity
- Quiet machine operation due to cams and servo drives
- High level of productivity
- Convenient and flexible setting of machine parameters on the operator panel: examples include pressure buildup displacement and sealing time
- TIA integration makes it easy to integrate HMI, I/O, and drives

Molding, filling and sealing machine

Design

Automation solution

The drive-based version, SIMOTION D is selected. In this manner, control logic, Motion Control, drive functionality and HMI functions are combined in a single hardware and software system.

Technology functions such as temperature control and cam controller are available in the form of software.

Drive systems such as SINAMICS S120, SIMODRIVE 611 universal or SIMOVERT MASTERDRIVES MC with 1FK7 servo motors provide a precise, highly dynamic response.

The isochronous PROFIBUS DP is used for communication.

Automation solution example for SIMOTION D

Filament winder
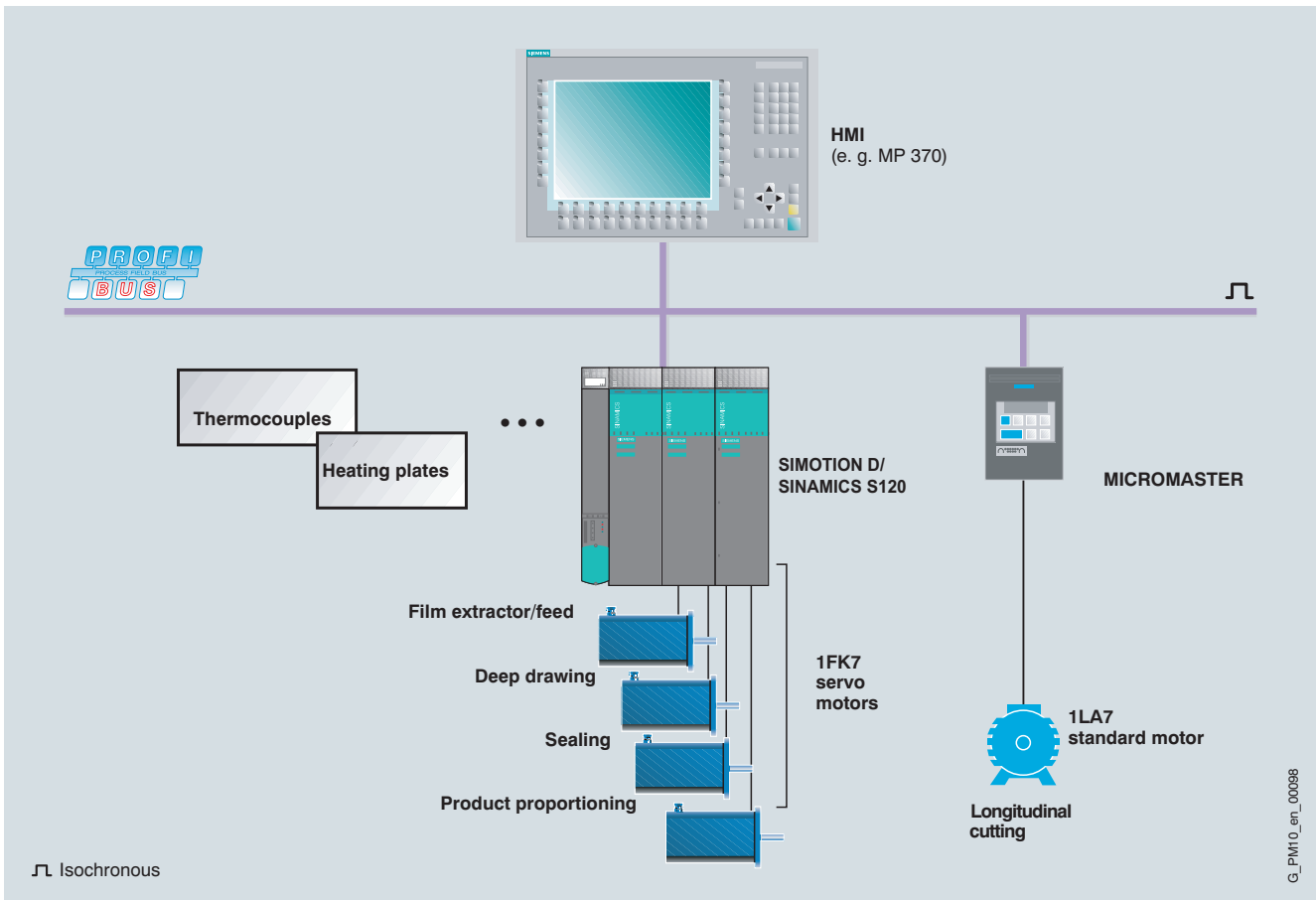
Overview

Machine requirement

In a synthetic fiber spinning plant, the winder performs the last step in the process.

In modern synthetic fiber spinning plants, spinning velocities of up to 8000 m (26247 ft)/min are attained. This means that the winder draws off and spools between 2 and 12 filament chains at this velocity. The finished spools are then changed on-the-fly to ensure a continuous spinning process.

One spool weighs up to 35 kg (77 lb) and can hold several million meters of filaments. Different requirements for spool design arise from different process-related values for the various types of thread and subsequent processing that is applied. The spool design determines how the thread is drawn off the spool and thus plays a critical role in determining possible follow-up processing methods.

Filament winders today are generally center winders (in the past, surface winders were used), that is, the mandrels are actuated directly.

The superimposed traversing motion is created by a servo motor. Use of single drives for winding spindles and traversing provides the highest degree of freedom for interaction of the units and thus for spool design. The surface velocity of the spools is measured by a roll frequency sensor and signaled to the diameter calculator. The increase in diameter of the spools is compensated for by the rotation of the rotary table. During on-

the-fly changeover, the spindle with the empty bobbins is accelerated to spinning velocity, the full spools pivot away from the roll frequency sensor, and the threads are cut and caught by the new bobbins. The changeover is complete when the new (empty) spools are in contact with the roll frequency sensor.

Essential requirements for the automation and drive system:
- During the production process, it is essential that faulty winders be replaced very quickly.
- Addressing of a new winder must occur automatically.

Benefits

The SIMOTION automation solution described below offers you the following advantages:
- One system for vector/servo drives, logic, and technology, instead of three
- High degree of user friendliness due to graphics-based programming
- Transparency due to comprehensive diagnostic tools and dialog-based user guidance in SIMOTION SCOUT
- Maximum degree of flexibility due to ability to select any winding mode
- High degree of flexibility and fast resetting times for product change
- Reproducibility of lots due to recipe memory
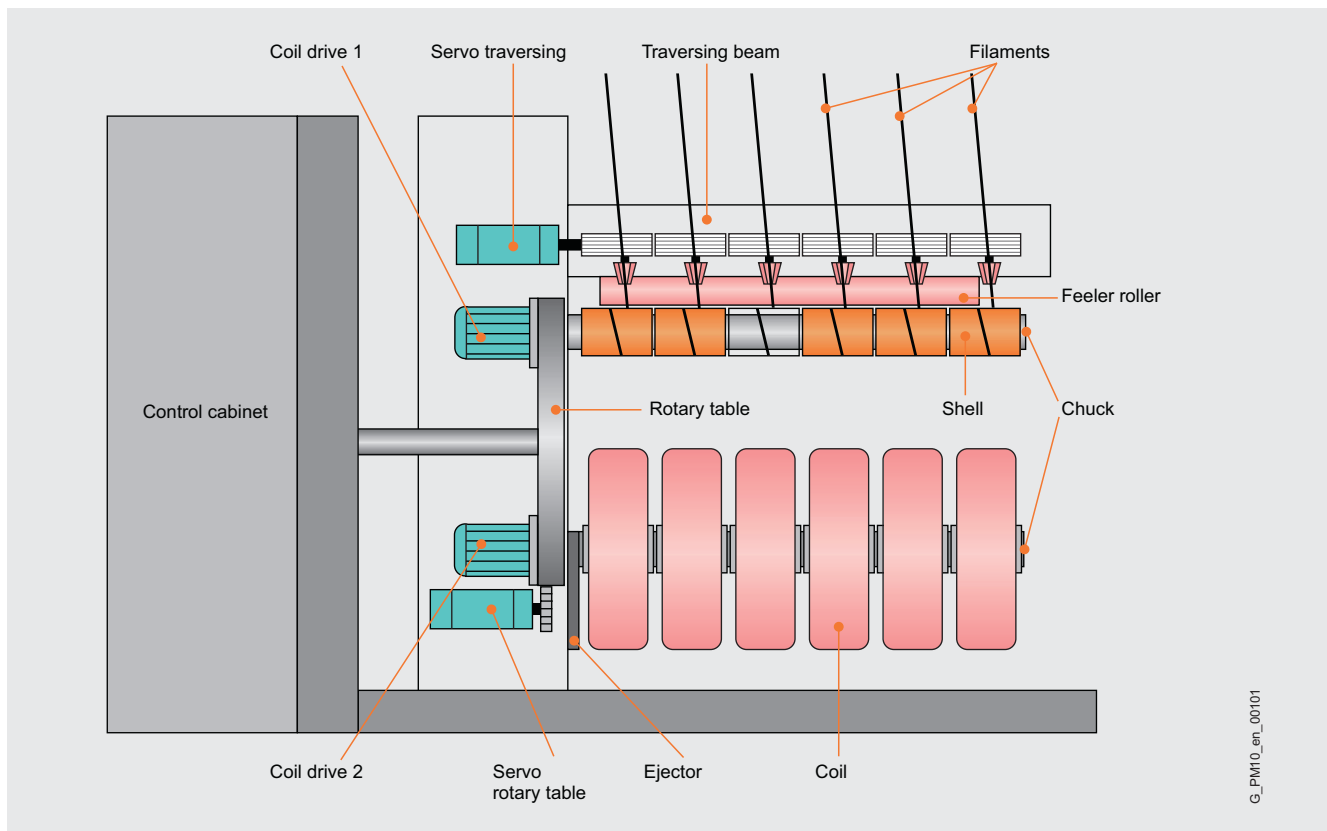
Principle of Operation of a Filament Winder

Filament winder

■ Design

Automation solution

The drive-based SIMOTION D Motion Control option with 4-axis closed-loop control is used. This combines functions for open-loop control, Motion Control, technology, and drives in one hardware and software solution.

Process-related functions such as calculations for traversing processes, wobbling and diameter of spools, and motion control functions such as positioning of rotary tables and sequence control (setpoint cascade, logic PLC) are covered by SIMOTION D. Central operator control of multiple winders can be implemented using the optional MP 270, for example. This enables all kinds of filament winders to be used.
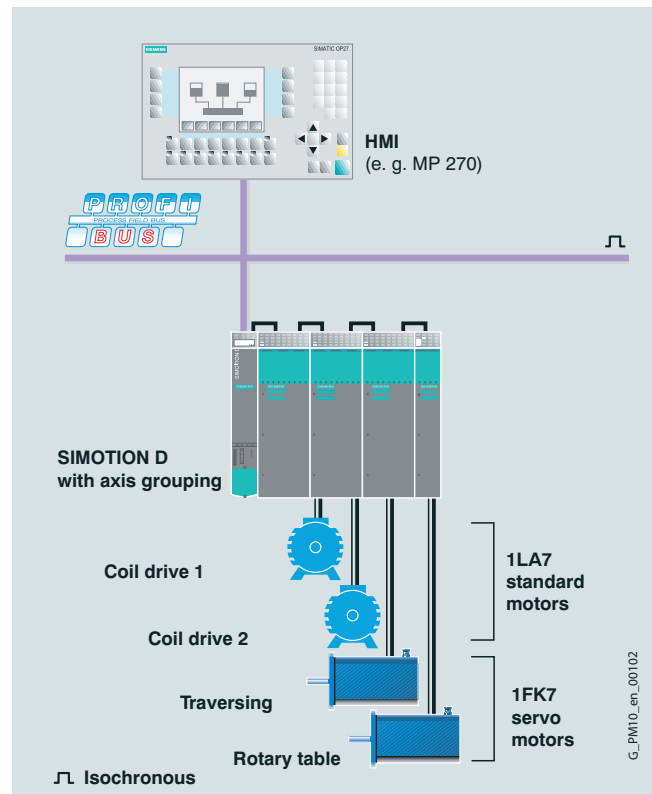
Example automation solution with SIMOTION D

Additional features of this automation solution:

- Any winding mode can be selected (random winding, ribbon-free random winding, precision winding, and stepped precision winding)
- Coupling of drives by means of the DRIVE-CLiQ system interface
- Scalable and open software menus for linking software parameters

Overview

Machine requirements

The fleece folding or cross folding machine is situated between the carding machine and needle loom in a fleecing installation. The fiber web from the carding machine seldom has the necessary mass per unit area for the application. For this reason, the cross folding machine forms as many fiber webs as necessary for the end application.

Task: Form a nonwoven fiber web with a constant infeed velocity using a batch process, thereby achieving a constant mass per unit area. The material is conveyed between the infeed conveyor and sandwich conveyor to the actual web formation position. Two traversing carriages lay the web in a zigzag pattern on a conveyor belt arranged at a 90° angle to the machine axis. The Motion Control of the undercarriage determines the width of the fabric produced, whereas the upper carriage functions as a material buffer to compensate for velocity differences between then infeed conveyor and the spreading carriage. The motion correlation of the two carriages is also influenced by process technology parameters, such as the required fiber web drafts at the edge, also referred to as profiling. The highly dynamic reversing motions of the carriage are implemented with servo motors without additional gearing. The required number of layers over the material cross section and thus the fleece strength (in g/m^2) is determined by the ratio of the infeed and exit velocity.

The machine has the following automation requirements:

- High dynamic response
  for reversing motion for exact web edges
- Flexible traversing profiles
  for different material requirements
- Draft-free layering
  of the fibrous web at high velocity

Benefits

The SIMOTION automation solution described below offers you the following advantages:

- Savings in memory space due to cam calculation in real time
- Faster and more convenient setup due to flexible parameter adjustment
- Scalable and open software menus for linking software parameters
- High degree of flexibility and fast resetting times for product change
- Reproducibility of lots due to recipe memory
- High degree of user friendliness due to graphics-based programming
- Transparency due to comprehensive diagnostic tools and dialog-based user guidance in SIMOTION SCOUT
- All machines involved in the process, such as carding machines and needle looms, can be easily automated using SIMOTION and networked together to form a line.
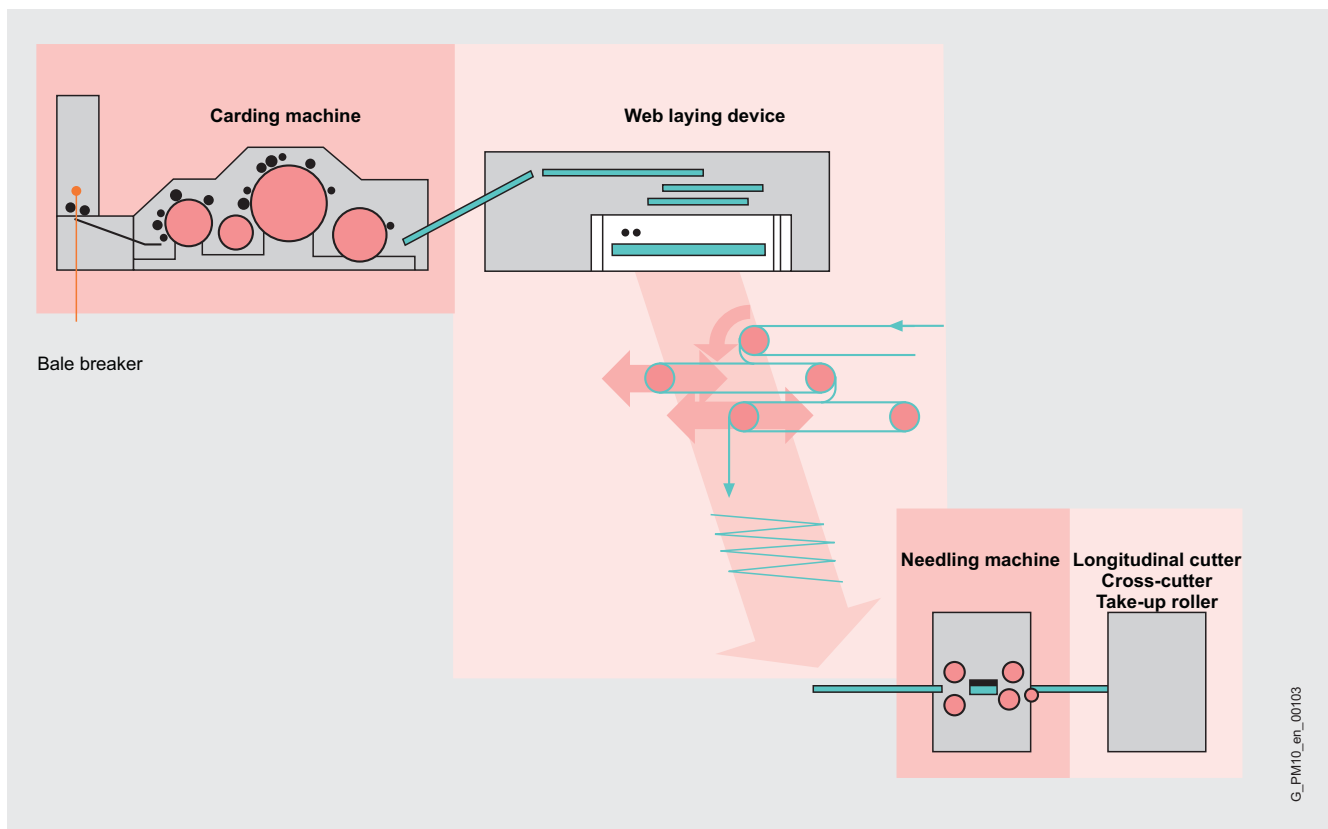
Principle of operation of the fleece folding machine

Fleece folding machine

Design

Automation solution

The SINAMICS S120 drive system is used in combination with the 1FK7 High Dynamic servo motors.

To ensure short cycle times, the SIMOTION P 350 Motion Control system is used.

SIMOTION P350
ProTool/Pro RT

ET 200S
1 station with
32 DI, 32 DO

SINAMICS S120

Upper carriage

Lower carriage

1FK7 servo motors

G_PM10_en_00111

⊓ Isochronous
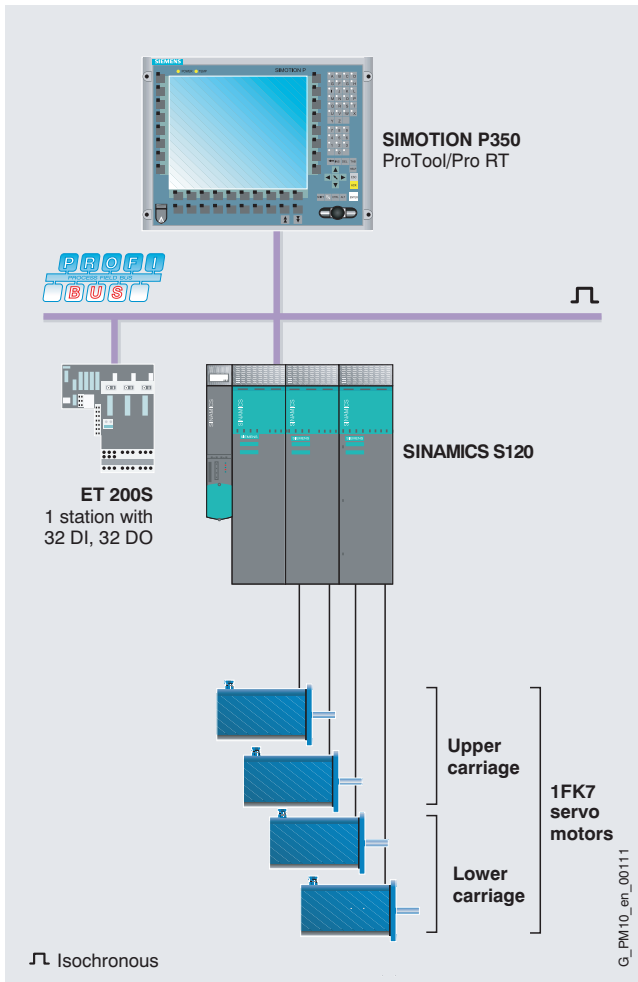
Automation solution with SIMOTION P and SINAMICS S120 in the example

Features of the automation solution:
- Calculation of the traversing curve profiles of the laying trolleys and adaptation of the curve profile in real time
- Transfer of data to the drives over the isochronous PROFIBUS

Overview

Machine requirements

Weaving is the most widely used method of fabric production for the decorative, apparel, and home furnishing textile sectors. Even technical textiles, including wire cloth, are also produced on modern weaving machines.

Irrespective of the weft insertion process, weaving machines depend on maximum clock-pulse rates and accelerations.

In addition, weaving machines are characterized by a large number of nonlinear motion sequences and time-critical starting times. This is the reason why essential components of weaving machines are mechanic. Up to now, mechatronic solutions could not offer an economic alternative with adequate performance for many parts of the weaving machine. Accordingly, the weaving reed will probably continue to be mechanically coupled to the main shaft.

Nevertheless, electronics still offer tremendous advantages for weaving machines in terms of flexible application and simple operator control.

Automation requirements are as follows:

- Constant velocity ratio of warp let-off and loom take-up subject to the main drive
- Constant thread tension during the process (uniform fabric quality)
- Weft insertion with clock pulse accuracy
- Fast position-oriented supply of weft threads corresponding to the color selection
- Increase in machine clock pulses (increased number of revolutions)
- Different weft insertion processes using a projectile, airjet, or rapier
- Short resetting times for a lot change
- Reproducibility of process data
- Pattern data management and preparation
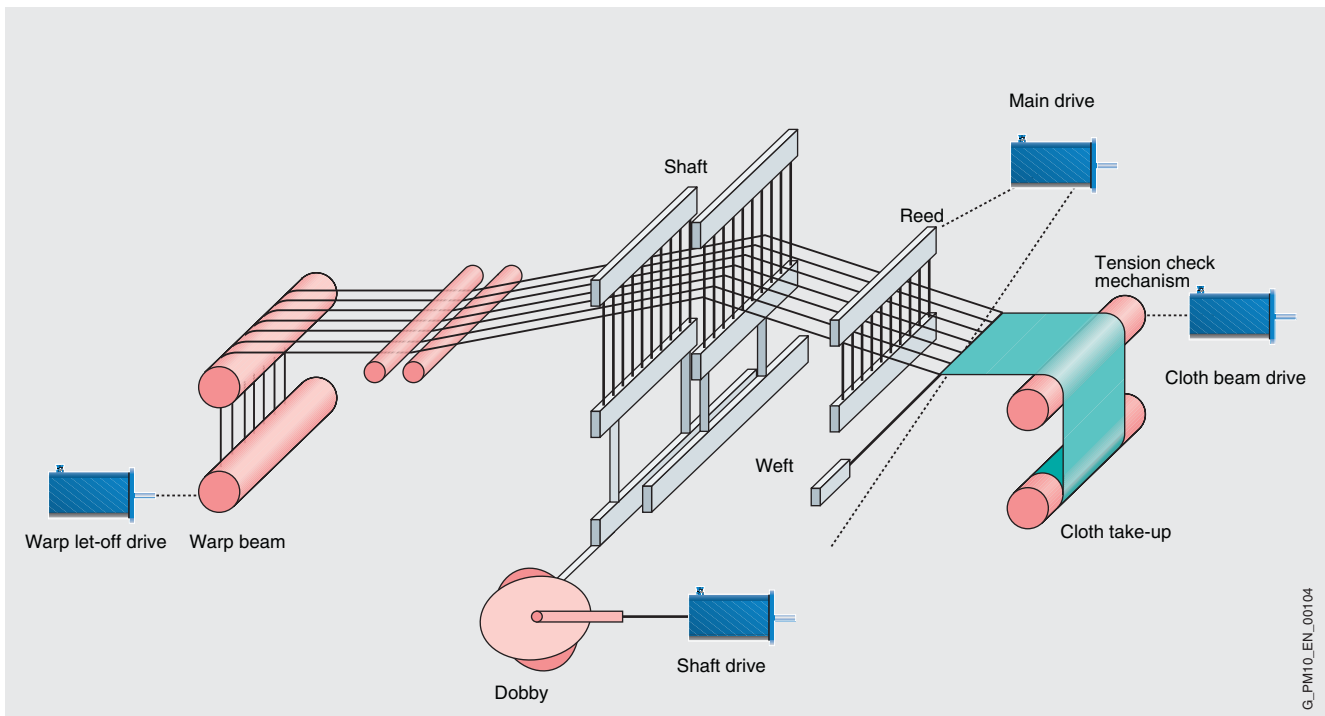
Principle of operation of weaving machines

Weaving machine

■ Benefits

The SIMOTION automation solution described below offers you the following advantages:

- To attain even faster resetting times, the mechanical cam can be replaced by a high resolution SIMOTION cam function for shaft motions.
- Variable user interfaces enable process parameters to be quickly adapted to the execution system.
  These data can be reproduced at any time and assigned according to process technology. A lot change no longer requires you to make manual adjustments.
- Tools for remote diagnostics, commissioning, and configuration integrated in the uniform, scalable SCOUT engineering system reduce service and configuration times.

■ Design

Automation solution

With the newest machine types, the flexible automation architecture is implemented in accordance with the technological requirements for the weaving machine.

The system performance for

- operation/visualization/diagnostics/pattern,
- process control,
- Motion Control and
- drive-related control

is matched in accordance with process engineering requirements.

The solution model is determined by preprocessing the process data and their implementation as a Motion Control process.

Machine control, implemented by SIMOTION D:

- Setpoint input
- Control of warp let-off and fabric take-off
- Weft entry control
- Machine monitoring

Operator control and monitoring (HMI)

Using a touch panel (e. g. TP 170B) or a multi panel (e. g. MP 270) based on the Runtime and configuration software ProTool/Pro:

- Process data management, e. g.:
  - Speed specification
  - Presetting of weft density
  - Presetting of technology values
- Recipe management
- Diagnostics/remote diagnostics

Drives

The integrated automation and drives structure is rounded off by the bus-coupled dynamic converter system SINAMICS S120 and the 1FT6/1FK7 motors.

Features of the automation solution:

- Constant thread tension control during the winding and unwinding process, correct provision of thread and accurate positioning when entering the weft are closely coupled to the process control and are processed synchronously with the machine cycle.
- A virtual master that obtains its actual values from an encoder mounted on the main shaft, outputs appropriate setpoint signals to the slaves of the drive and control system.
- Coupling through an OPC interface (Ethernet) ensures operating data management and coupling to a pattern system (CAD systems).
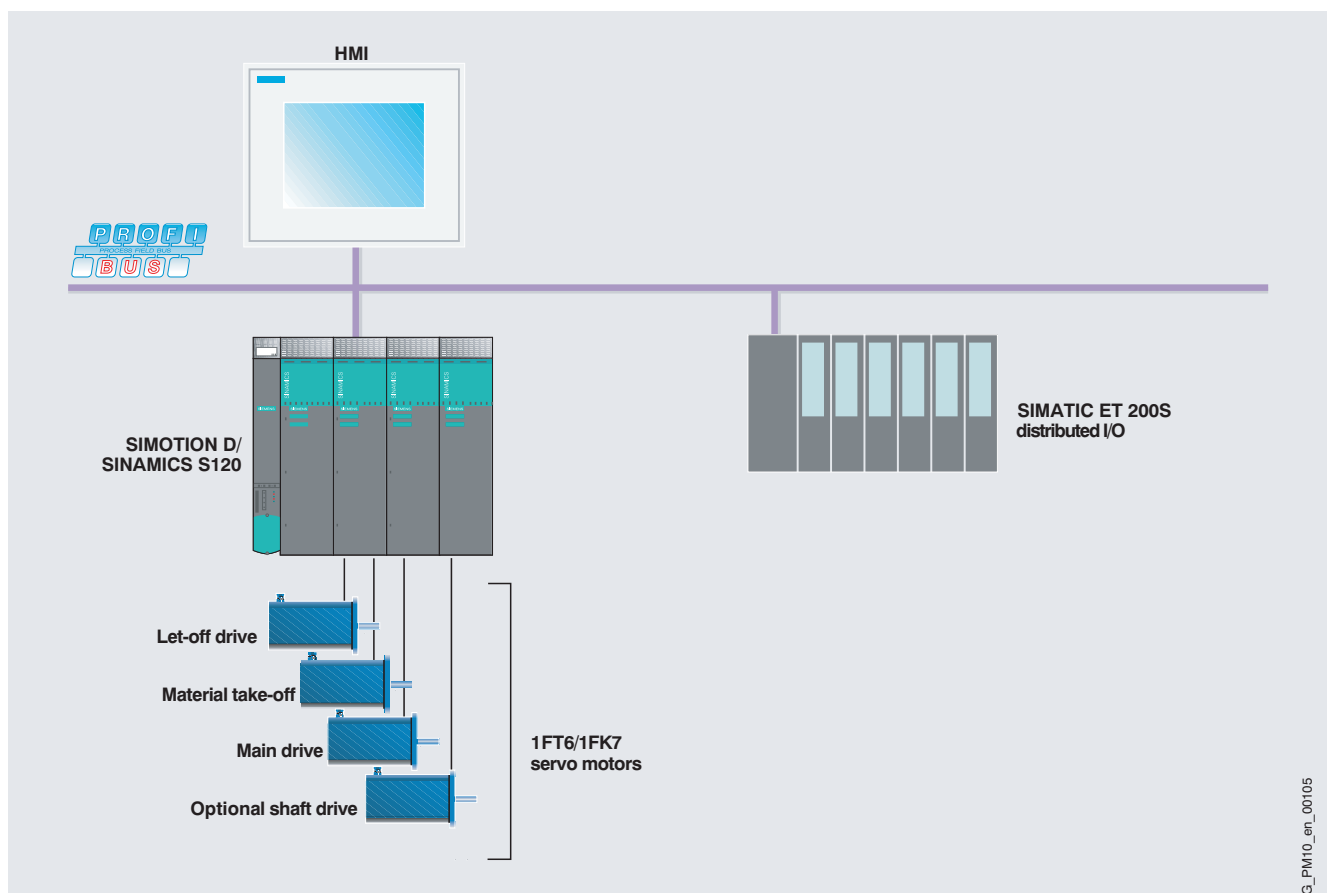
Automation solution example for SIMOTION D
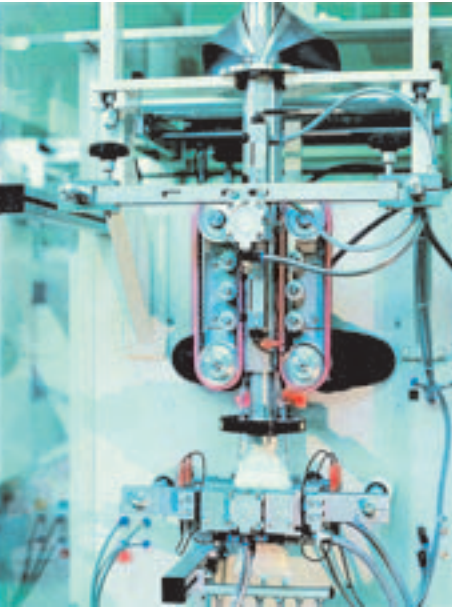
Ordering examples

Comfort package SIMOTION Easy Set – Baggers & Wrappers

■ Overview
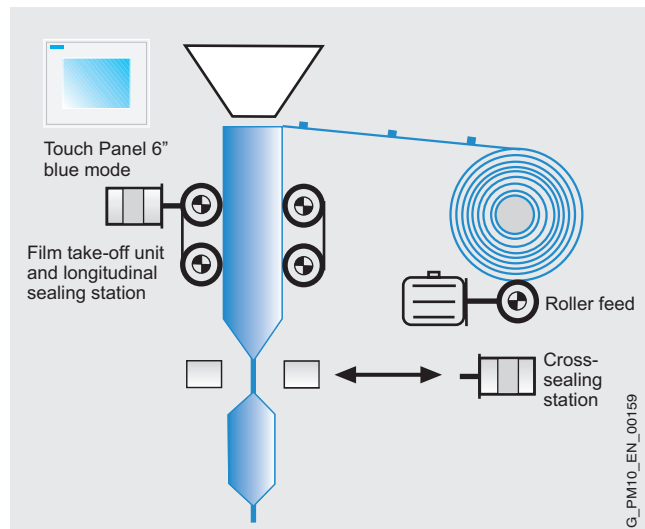
Vertical, intermittent tubular bag machine

The vertical, intermittent tubular bag machine in this example features a pre-extractor in addition to a film take-off unit and jaw drive.

5 A power sections are adequate for the drive tasks. Consequently, the comfort package **SIMOTION Easy Set – Baggers & Wrappers** can be used for automation of the machine.

The comfort package comprises the options:

- Touch panel TP 170B 6" blue mode
- Pre-extractor

■ Selection and ordering data

	Order No.
Comfort package SIMOTION Easy Set – Baggers & Wrappers For intermittent, vertical tubular bag machines	**6AU1650-0DA00-1EA1**
The package contains	
• D435 Controller Unit (6AU1435-0AA00-0AA1)	
• CF card, 64 MB for D435, with licenses for vertical intermittent tubular bag machines (for drives and temperature controllers) (6AU1400-2KA00-0GA0)	
• Filter package for SLM 5 kW (6.7 HP) (6SL3000-0GE15-0AA0)	
• Smart Line Module, 5 kW (6.7 HP), 400 V (6SL3130-6AE15-0AA0)	
• Double Motor Module, 5 A (6SL3120-2TE15-0AA0)	
• SITOP power supply, 24 V, 20 A (6EP1436-3BA00)	
• ET 200S Interface Module (6ES7151-1AA04-0AB0)	
• ET 200S Terminal Module (6ES7193-4CC20-0AA0)	
• ET 200S Power Module (6ES7138-4CA01-0AA0)	
• 5 x ET 200S universal Terminal Module (6ES7193-4CA40-0AA0)	
• 5 x 4 ET 200S digital inputs (6ES7131-4BD01-0AA0)	
• 5 x 4 ET 200S digital outputs (6ES7132-4BD01-0AA0)	
• 2 analog inputs PT 100 ET 200S (6ES7134-4JB50-0AB0)	
• Optional touch panel, TP 170B 6" blue mode (6AV6545-0BB15-2AX0)	
• Optional pre-extractor, MICROMASTER 420, 0.37 kW (0.5 HP), 230 V, with line filter (6SE6420-2AB13-7AA1)	
• PROFIBUS Communication Module for MICROMASTER 4 (6SE6400-1PB00-0AA0)	
In addition, the following components must be ordered	
Motor for film take-off unit	
• Servo motor 3 Nm (26.6 lb$_f$-in), 3000 rpm, resolver with DRIVE-CLiQ interface, LP90 alpha gearbox, i = 10	**1FK7042-5AF71-1SG0-ZV42**
• Power cable, 5 m (16 ft)	**6FX5002-5CS01-1AF0**
• DRIVE-CLiQ signal cable, 5 m (16 ft) (IP20/IP67)	**6FX5002-2DC10-1AF0**
Motor for cross sealer	
• Servo motor 6 Nm (53.1 lb$_f$-in), 3000 rpm, resolver with DRIVE-CLiQ interface, LP120 alpha gearbox, i = 10	**1FK7060-5AF71-1SG0-ZV42**
• Power cable, 5 m (16 ft)	**6FX5002-5CS01-1AF0**
• DRIVE-CLiQ signal cable, 5 m (16 ft) (IP20/IP67)	**6FX5002-2DC10-1AF0**
Software library Easy Set – Baggers & Wrappers (required once)	
• Software library Easy Set – Baggers & wrappers	**6AU1836-5AA10-0XA8**

◼ Overview

Touch Panel 10" color

Roller feed

Film take-off unit
and longitudinal
sealing station

Pocket-type
conveyor

Cross-sealing
station

G_PM10_EN_00158
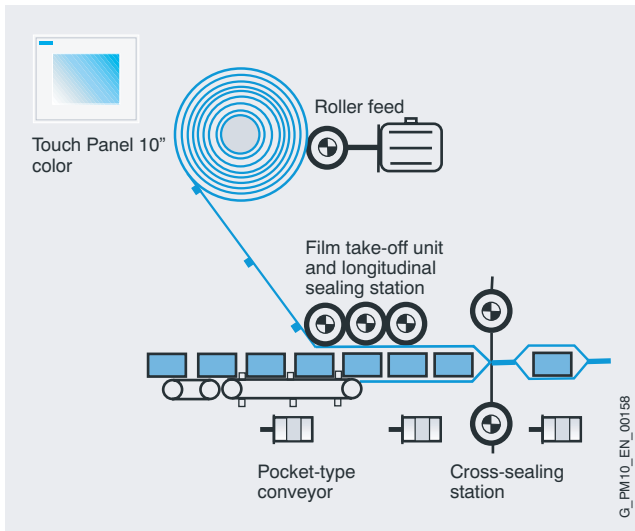
Horizontal tubular bag machines

The horizontal tubular bag machines in this example require higher-rated power sections than those included in the **SIMOTION Easy Set – Baggers & Wrappers** comfort packages. The **SIMOTION Easy Set – Baggers & Wrappers** basic package is used for automation. Power sections and licenses must be ordered separately (see additional components).

The motors are designed for mounting on servo gear units.

◼ Selection and ordering data | Order No.

	Order No.
Basic package SIMOTION Easy Set – Baggers & Wrappers With SIMOTION D435 and 10 kW (13 HP) Smart Line Module 10 kW (13 HP), for horizontal tubular bag machines	**6AU1650-0AA10-0AA0**

The package contains

- D435 Controller Unit (6AU1435-0AA00-0AA1)
- Filter package for SLM 10 kW (13 HP) (6SL3000-0GE21-0AA0)
- Smart Line Module, 10 kW (13 HP), 400 V (6SL3130-6AE21-0AA0)
- SITOP power supply, 24 V, 20 A (6EP1436-3BA00)
- ET 200S Interface Module (6ES7151-1AA04-0AB0)
- ET 200S Terminal Module (6ES7193-4CC20-0AA0)
- ET 200S Power Module (6ES7138-4CA01-0AA0)
- 10 x ET 200S universal Terminal Module (6ES7193-4CA40-0AA0)
- 5 x 4 ET 200S digital inputs (6ES7131-4BD01-0AA0)
- 5 x 4 ET 200S digital outputs (6ES7132-4BD01-0AA0)

◼ Selection and ordering data | Order No.

	Order No.
In addition, the following components must be ordered	
• Touch panel TP170 10" color	**6AV6545-0CC10-0AX0**
• ET 200S universal Terminal Module [1]	**6ES7193-4CA40-0AA0**
• 2 analog inputs PT 100 ET 200S (1 item)	**6ES7134-4JB50-0AB0**
• Double Motor Module 18 A (film take-off unit, cross sealer)	**6SL3120-2TE21-8AA0**
• Double Motor Module 5 A (finger chain conveyor, preliminary infeed)	**6SL3120-2TE15-0AA0**
• CF card 64 MB	**6AU1400-2KA00-0AA0**
• Runtime license TControl	**6AU1820-2AA20-0AB0**
• Runtime license Gear (finger chain conveyor, film take-off unit) (2 licenses)	**6AU1820-1AB20-0AB0**
• Runtime license Cam (cross sealer)	**6AU1820-1AC20-0AB0**
Motor for finger chain conveyor	
• Servo motor 6 Nm (53.1 lb$_f$-in), 3000 rpm, resolver with DRIVE-CLiQ interface	**1FK7060-5AF71-1SG0**
• Power cable, 10 m (32.8 ft)	**6FX5002-5CS01-1BA0**
• DRIVE-CLiQ signal cable, 10 m (32.8 ft) (IP20/IP67)	**6FX5002-2DC10-1BA0**
Motor for preliminary infeed	
• Servo motor 6 Nm (53.1 lb$_f$-in), 3000 rpm, resolver with DRIVE-CLiQ interface	**1FK7060-5AF71-1SG0**
• Power cable, 10 m (32.8 ft)	**6FX5002-5CS01-1BA0**
• DRIVE-CLiQ signal cable, 10 m (32.8 ft) (IP20/IP67)	**6FX5002-2DC10-1BA0**
Motor for film take-off and longitudinal sealer	
• Servo motor 11 Nm (97.4 lb$_f$-in), 3000 rpm, resolver with DRIVE-CLiQ interface	**1FK7063-5AF71-1SG0**
• Power cable, 10 m (32.8 ft)	**6FX5002-5CS01-1BA0**
• DRIVE-CLiQ signal cable, 10 m (32.8 ft) (IP20/IP67)	**6FX5002-2DC10-1BA0**
Motor for cross sealer	
• High Dynamic servo motor 12 Nm (106.2 lb$_f$-in), 3000 rpm, resolver with DRIVE-CLiQ interface, holding brake	**1FK7064-5AF71-1SH0**
• Power cable, 10 m (32.8 ft), with brake cores	**6FX5002-5DS01-1BA0**
• DRIVE-CLiQ signal cable, 10 m (32.8 ft) (IP20/IP67)	**6FX5002-2DC10-1BA0**
Software library Easy Set – Baggers & Wrappers (required once)	
• Software library Easy Set – Baggers & wrappers	**6AU1836-5AA10-0XA8**

1) The supply quantity is 5 items

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Ordering examples

Appendix

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Information on software licensing

Software types

Software requiring a license is categorized into types. The following software types have been defined:
- Engineering software
- Runtime software

Engineering software
This includes all software products for creating (engineering) user software, e.g. for configuring, programming, parameterizing, testing, commissioning or servicing.

Data generated with engineering software and executable programs can be duplicated for your own use or for use by third-parties free-of-charge.

Runtime software
This includes all software products required for plant/machine operation, e.g. operating system, basic system, system expansions, drivers, etc.

The duplication of the runtime software and executable programs created with the runtime software for your own use or for use by third-parties is subject to a charge.

You can find information about license fees according to use in the ordering data (e.g. in the catalog). Examples of categories of use include per CPU, per installation, per channel, per instance, per axis, per control loop, per variable, etc.

Information about extended rights of use for parameterization/configuration tools supplied as integral components of the scope of delivery can be found in the readme file supplied with the relevant product(s).

License types

Siemens Automation & Drives offers various types of software license:
- Floating license
- Single license
- Rental license
- Trial license

Floating license
The software may be installed for internal use on any number of devices by the licensee. Only the concurrent user is licensed. The concurrent user is the person using the program. Use begins when the software is started. A license is required for each concurrent user.

Single license
Unlike the floating license, a single license permits only one installation of the software.

The type of use licensed is specified in the ordering data and in the Certificate of License (CoL). Types of use include for example per device, per axis, per channel, etc.

One single license is required for each type of use defined.

Rental license
A rental license supports the "sporadic use" of engineering software. Once the license key has been installed, the software can be used for a specific number of hours (the operating hours do not have to be consecutive). One license is required for each installation of the software.

Trial license
A trial license supports "short-term use" of the software in a non-productive context, e.g. for testing and evaluation purposes. It can be transferred to another license.

License key

Siemens Automation & Drives supplies software products with and without license keys. The license key serves as an electronic license stamp and is also the "switch" for activating the software (floating license, rental license, etc.).

The complete installation of software products requiring license keys includes the program to be licensed (the software) and the license key (which represents the license).

Certificate of license

The Certificate of License (CoL) is the licensee's proof that the use of the software has been licensed by Siemens. A CoL is required for every type of use and must be kept in a safe place.

Downgrading

The licensee is permitted to use the software or an earlier version/release of the software, provided that the licensee owns such a version/release and its use is technically feasible.

Delivery versions

Software is constantly being updated.
The following delivery versions
- PowerPack
- Upgrade
- ServicePack

can be used to access updates.

PowerPack
PowerPacks can be used to upgrade to more powerful software.
The licensee receives a new license agreement and CoL (Certificate of License) with the PowerPack. This CoL, together with the CoL for the original product, proves that the new software is licensed. A separate PowerPack must be purchased for each original license of the software to be replaced.

Upgrade
An upgrade permits the use of a new version of the software on the condition that a license for a previous version of the product is already held.
The licensee receives a new license agreement and CoL with the upgrade. This CoL, together with the CoL for the previous product, proves that the new version is licensed. A separate upgrade must be purchased for each original license of the software to be upgraded.

ServicePack
Existing bug fixes are supplied with the ServicePack version.
ServicePacks are used to debug existing products. ServicePacks may be duplicated for use as prescribed according to the number of existing original licenses.

Note: Further detailed information on software licensing can be found under "Rights of use and copy".

Legal notes in the setup program for new software products

All software products are supplied with a common notice regarding license conditions.

The license conditions are included either with the documentation or with the software packaging. If the software is purchased over the Internet, the license agreement will appear on the screen before the order is processed and must be accepted by the user before the product can be downloaded.

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Software maintenance service
If you intend to maintain the most up-to-date version of your software, you can take out a software maintenance service contract. This service ensures that you will automatically be sent the most recent software updates, which will be released for delivery once the contract for the associated software product has been concluded.
This service can be used for single licenses and/or copy licenses and applies to all registered software products.

The software maintenance service is purchased individually for each software product to be maintained and is valid for one year. Before the year end, you will be notified of the service contract termination options in writing. If the service contract has not been terminated four weeks before the year end, the existing contract will be extended for one more year.

Ordering

An order number is required for the software maintenance service.

The software maintenance service can be ordered at the same time as the software products or at a later date. If it is ordered at a later date, you must be in possession of at least one single license.

Note

You are advised to take out the software maintenance service contract as early as possible. If a new version of a software product is released for delivery by Siemens, only customers registered in a corresponding supply list at that time will receive the product automatically.

Earlier software versions and the current software version are not covered by the software maintenance service contract. A precondition of every software maintenance contract is that the customer is in possession of the current version of the software product when the contract is taken out.

Delivery

When you order a software maintenance service contract, you will receive the contractual terms and conditions for this service. Payment is due at this point. At the same time, the software product to be maintained will be registered in a supply list.

If Siemens releases a new version of the software product for general supply (function or product version) during the period of validity of the contract, it will be automatically sent to customers figuring in the supply list.

You can find more information about license management on the Internet

at: http://www.siemens.com/automation/license

Additional information
Service & Support

A&D in the WWW

A detailed knowledge of the range of products and services available is essential when planning and configuring automation systems. It goes without saying that this information must always be fully up-to-date.

The Siemens Automation and Drives Group (A&D) has therefore built up a comprehensive range of information in the World Wide Web, which offers quick and easy access to all data required.

Under the address

http://www.siemens.com/automation

you will find everything you need to know about products, systems and services.

Product selection using the Interactive Catalog
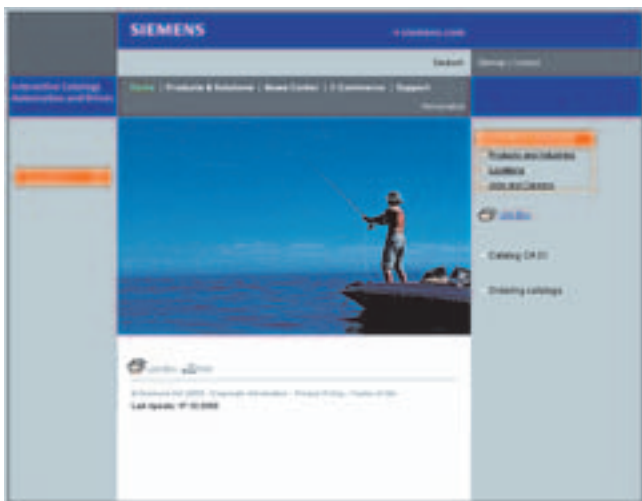
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The interactive catalog CA 01 covers more than 80,000 products and thus provides a full summary of the Siemens Automation and Drives product base.

Here you will find everything that you need to solve tasks in the fields of automation, switchgear, installation and drives.
All information is linked into a user interface which is easy to work with and intuitive.

After selecting the product of your choice you can order at the press of a button, by fax or by online link.

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The A&D Mall is the virtual department store of Siemens AG in the Internet. Here you have access to a huge range of products presented in electronic catalogs in an informative and attractive way.

Data transfer via EDIFACT allows the whole procedure from selection through ordering to tracking of the order to be carried out online via the Internet.

Numerous functions are available to support you.

For example, powerful search functions make it easy to find the required products, which can be immediately checked for availability. Customer-specific discounts and preparation of quotes can be carried out online as well as order tracking and tracing.

Please visit the A&D Mall on the Internet under:
http://www.siemens.com/automation/mall

At

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you can find details of Siemens contact partners worldwide responsible for particular technologies.

You can obtain in most cases a contact partner for

• Technical Support,
• Spare parts/repairs,
• Service,
• Training,
• Sales or
• Consultation/engineering.

You start by selecting a

• Country,
• Product or
• Sector.

By further specifying the remaining criteria you will find exactly the right contact partner with his/her respective expertise.

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Appendix
Directories

Order number index

Rotary inertia (to convert from A to B, multiply by entry in table)

A \ B	lb-in^2	lb-ft^2	lb-in-s^2	lb-ft-s^2 slug-ft^2	kg-cm^2	kg-cm-s^2	gm-cm^2	gm-cm-s^2	oz-in^2	oz-in-s^2
lb-in^2	1	6.94×10^{-3}	2.59×10^{-3}	2.15×10^{-4}	2.926	2.98×10^{-3}	2.92×10^3	2.984	16	4.14×10^{-2}
lb-ft^2	144	1	0.3729	3.10×10^{-2}	421.40	0.4297	4.21×10^5	429.71	2304	5.967
lb-in-s^2	386.08	2.681	1	8.33×10^{-2}	1.129×10^3	1.152	1.129×10^6	1.152×10^3	6.177×10^3	16
lb-ft-s^2 slug-ft^2	4.63×10^3	32.17	12	1	1.35×10^{-4}	13.825	1.355×10^7	1.38×10^4	7.41×10^{-4}	192
kg-cm^2	0.3417	2.37×10^{-3}	8.85×10^{-4}	7.37×10^{-5}	1	1.019×10^{-3}	1000	1.019	5.46	1.42×10^{-2}
kg-cm-s^2	335.1	2.327	0.8679	7.23×10^{-2}	980.66	1	9.8×10^5	1000	5.36×10^3	13.887
gm-cm^2	3.417×10^{-4}	2.37×10^{-6}	8.85×10^{-7}	7.37×10^{-8}	1×10^{-3}	1.01×10^{-6}	1	1.01×10^{-3}	5.46×10^{-3}	1.41×10^{-5}
gm-cm-s^2	0.335	2.32×10^{-3}	8.67×10^{-4}	7.23×10^{-5}	0.9806	1×10^{-3}	980.6	1	5.36	1.38×10^{-2}
oz-in^2	0.0625	4.34×10^{-4}	1.61×10^{-4}	1.34×10^{-5}	0.182	1.86×10^{-4}	182.9	0.186	1	2.59×10^{-3}
oz-in-s^2	24.13	0.1675	6.25×10^{-2}	5.20×10^{-3}	70.615	7.20×10^{-2}	7.09×10^4	72.0	386.08	1

Torque (to convert from A to B, multiply by entry in table)

A \ B	lb-in	lb-ft	oz-in	N-m	kg-cm	kg-m	gm-cm	dyne-cm
lb-in	1	8.333×10^{-2}	16	0.113	1.152	1.152×10^{-2}	1.152×10^3	1.129×10^6
lb-ft	12	1	192	1.355	13.825	0.138	1.382×10^4	1.355×10^7
oz-in	6.25×10^{-2}	5.208×10^{-3}	1	7.061×10^{-3}	7.200×10^{-2}	7.200×10^{-4}	72.007	7.061×10^7
N-m	8.850	0.737	141.612	1	10.197	0.102	1.019×10^4	1×10^7
kg-cm	0.8679	7.233×10^{-2}	13.877	9.806×10^{-2}	1	10^{-2}	1000	9.806×10^5
kg-m	86.796	7.233	1.388×10^3	9.806	100	1	1×10^5	9.806×10^7
gm-cm	8.679×10^{-4}	7.233×10^{-5}	1.388×10^{-2}	9.806×10^{-5}	1×10^{-3}	1×10^{-5}	1	980.665
dyne-cm	8.850×10^{-7}	7.375×10^{-8}	1.416×10^{-5}	10^{-7}	1.0197×10^{-6}	1.019×10^{-8}	1.019×10^{-3}	1

Length (to convert from A to B, multiply by entry in table)

A \ B	inches	feet	cm	yd	mm	m
inches	1	0.0833	2.54	0.028	25.4	0.0254
feet	12	1	30.48	0.333	304.8	0.3048
cm	0.3937	0.03281	1	1.09×10^{-2}	10	0.01
yd	36	3	91.44	1	914.4	0.914
mm	0.03937	0.00328	0.1	1.09×10^{-3}	1	0.001
m	39.37	3.281	100	1.09	1000	1

Force (to convert from A to B, multiply by entry in table)

A \ B	lb	oz	gm	dyne	N
lb	1	16	453.6	4.448×10^{-5}	4.4482
oz	0.0625	1	28.35	2.780×10^{-4}	0.27801
gm	2.205×10^{-3}	0.03527	1	1.02×10^{-3}	N.A.
dyne	2.248×10^{-6}	3.59×10^{-5}	890.7	1	0.00001
N	0.22481	3.5967	N.A.	100.000	1

Power (to convert from A to B, multiply by entry in table)

A \ B	HP	Watts
HP (English)	1	745.7
(lb-in)(deg./sec)	2.645×10^{-6}	1.972×10^{-3}
(lb-in)(rpm)	1.587×10^{-5}	1.183×10^{-2}
(lb-ft)(deg./sec)	3.173×10^{-5}	2.366×10^{-2}
(lb-ft)(rpm)	1.904×10^{-4}	0.1420
Watts	1.341×10^{-3}	1

Mass (to convert from A to B, multiply by entry in table)

A \ B	lb	oz	gm	slug
lb	1	16	453.6	0.0311
oz	6.25×10^{-2}	1	28.35	1.93×10^{-3}
gm	2.205×10^{-3}	3.527×10^{-3}	1	6.852×10^{-5}
slug	32.17	514.8	1.459×10^4	1

Rotation (to convert from A to B, multiply by entry in table)

A \ B	rpm	rad/sec.	degrees/sec.
rpm	1	0.105	6.0
rad/sec.	9.55	1	57.30
degrees/sec.	0.167	1.745×10^{-2}	1

Conversion tables

Temperature conversion

°F	°C	°C	°F
0	−17.8	−10	14
32	0	0	32
50	10	10	50
70	21.1	20	68
90	32.2	30	86
98.4	37	37	98.4
212	100	100	212
subtract 32 and multiply by $^5/_9$		multiply by $^9/_5$ and add 32	

Mechanism efficiencies

Acme-screw with brass nut	~0.35–0.65
Acme-screw with plastic nut	~0.50–0.85
Ball-screw	~0.85–0.95
Chain and Sprocket	~0.95–0.98
Preloaded Ball-screw	~0.75–0.85
Spur or Bevel-gears	~0.90
Timing Belts	~0.96–0.98
Worm Gears	~0.45–0.85
Helical Gear (1 reduction)	~0.92

Friction coefficients

Materials	μ
Steel on Steel (greased)	~0.15
Plastic on Steel	~0.15–0.25
Copper on Steel	~0.30
Brass on Steel	~0.35
Aluminium on Steel	~0.45
Steel on Steel	~0.58

Mechanism	μ
Ball Bushings	<0.001
Linear Bearings	<0.001
Dove-tail slides	~0.2++
Gibb Ways	~0.5++

Material densities

Material	lb-in^3	gm-cm^3
Aluminium	0.096	2.66
Brass	0.299	8.30
Bronze	0.295	8.17
Copper	0.322	8.91
Hard Wood	0.029	0.80
Soft Wood	0.018	0.48
Plastic	0.040	1.11
Glass	0.079–0.090	2.2–2.5
Titanium	0.163	4.51
Paper	0.025–0.043	0.7–1.2
Polyvinyl chloride	0.047–0.050	1.3–1.4
Rubber	0.033–0.036	0.92–0.99
Silicone rubber, without filler	0.043	1.2
Cast iron, grey	0.274	7.6
Steel	0.280	7.75

Wire gauges [1]

Cross-Section mm^2	Standard Wire Gauge (SWG)	American Wire Gauge (AWG)
0.2	25	24
0.3	23	22
0.5	21	20
0.75	20	19
1.0	19	18
1.5	17	16
2.5	15	13
4	13	11
6	12	9
10	9	7
16	7	6
25	5	3
35	3	2
50	0	1/0
70	000	2/0
95	00000	3/0
120	0000000	4/0
150	–	6/0
185	–	7/0

1) Table shows approximate SWG/AWG sizes nearest to standard metric sizes; the cross-sections do not match exactly.

Conditions of sale and delivery
Export regulations

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General

The prices are in € (Euro) ex works, exclusive packaging.

The sales tax (value added tax) is not included in the prices. It shall be debited separately at the respective rate according to the applicable legal regulations.

In addition to the prices of products which include silver, plump, aluminum and/or copper, surcharges may be calculated if the respective limits of the notes are exceeded. The respective note (e.g. source: German newspaper "Handesblatt" in category "deutsche Edelmetalle" and "Metallverarbeiter") for silver ("verarbeitetes Silber"), plump ("Blei in Kabeln"), aluminum ("Aluminium in Kabeln") and copper ("Elektrolytkupfer", "DEL-Notiz") respectively, of the day the order or rather the on call order is received, is decisive for the calculation of the surcharges.

Surcharges of copper shall be calculated for Drives at a note ("DEL-Notiz") above EUR 225,00 / 100 Kg and for chokes / transformers above EUR 150,00 / 100 kg.

Surcharges shall be charged based on the quantities of the materials which are contained in the relevant products.

Prices are subject to change without prior notice. We will debit the prices valid at the time of delivery.

The dimensions are in mm. Illustrations are not binding.

Insofar as there are no remarks on the corresponding pages, - especially with regard to data, dimensions and weights given - these are subject to change without prior notice.

Comprehensive Terms and Conditions of Sale and Delivery are available free of charge from your local Siemens business office under the following Order Nos.:
- 6ZB5310-0KR30-0BA0
  (for customers based in the Federal Republic of Germany)
- 6ZB5310-0KS53-0BA0
  (for customers based outside of the Federal Republic of Germany)

or download them from the Internet:
http://www.siemens.com/automation/mall
(Germany: A&D Mall Online-Help System)

Export regulations

The products listed in this catalog/price list may be subject to European/German and/or US export regulations.

Therefore, any export requiring a license is subject to approval by the competent authorities.

According to current provisions, the following export regulations must be observed with respect to the products featured in this catalog/price list:

AL	Number of the German Export List
	Products marked other than "N" require an export license. In the case of software products, the export designations of the relevant data medium must also be generally adhered to.
	Goods labeled with an "AL not equal to N" are subject to a European or German export authorization when being exported out of the EU.
ECCN	Export Control Classification Number
	Products marked other than "N" are subject to a reexport license to specific countries.
	In the case of software products, the export designations of the relevant data medium must also be generally adhered to.
	Goods labeled with an "ECCN not equal to N" are subject to a US re-export authorization.

Even without a label or with an "AL: N" or "ECCN: N", authorization may be required due to the final destination and purpose for which the goods are to be used.

The deciding factors are the AL or ECCN export authorization indicated on order confirmations, delivery notes and invoices.

Errors excepted and subject to change without prior notice.

A&D/VuL/En 17.03.05

Catalogs of the
Automation and Drives Group (A&D)

Further information can be obtained from our branch offices listed in the appendix or at www.siemens.com/automation/partner

Automation and Drives	*Catalog*
Interactive catalog on CD-ROM	
• The Offline Mall of Automation and Drives	CA 01

Automation Systems for Machine Tools	
SINUMERIK & SIMODRIVE	NC 60

Drive Systems	
Variable-Speed Drives	
SINAMICS G130 Drive Converter Chassis Units, SINAMICS G150 Drive Converter Cabinet Units	D 11
SINAMICS G110 Inverter Chassis Units	D 11.1
SINAMICS S120 Servo Control Drive System	D 21.2
SINAMICS S150 Drive Converter Cabinet Units	D 21.3
DC Motors	DA 12
SIMOREG DC MASTER 6RA70 Digital Chassis Converters	DA 21.1
SIMOREG K 6RA22 Analog Chassis Converters	DA 21.2
SIMOREG DC MASTER 6RM70 Digital Converter Cabinet Units	DA 22
SIMOVERT PM Modular Converter Systems	DA 45
SIEMOSYN Motors	DA 48
MICROMASTER 410/420/430/440 Inverters	DA 51.2
MICROMASTER 411/COMBIMASTER 411	DA 51.3
SIMOVERT MV Medium-Voltage Drives	DA 63
SIMOVERT MASTERDRIVES Vector Control	DA 65.10
SIMOVERT MASTERDRIVES Motion Control	DA 65.11
Synchronous and asynchronous servomotors for SIMOVERT MASTERDRIVES	DA 65.3
SIMODRIVE 611 universal and POSMO	DA 65.4
Low-Voltage Three-Phase-Motors	
Squirrel-Cage Motors, Totally Enclosed, Fan-Cooled	M 11
Automation Systems for Machine Tools SIMODRIVE	NC 60
• Main Spindle Motors	
• Feed Motors	
• Converter Systems SIMODRIVE 611/POSMO	
Drive and Control Components for Hoisting Equipment	HE 1

Electrical Installation Technology	
ALPHA Small Distribution Boards and Distribution Boards	ET A1
PDF: ALPHA 8HP Molded-Plastic Distribution System	*ET A3*
ALPHA FIX Terminal Blocks	ET A5
BETA Modular Installation Devices	ET B1
DELTA Switches and Outlets	ET D1
GAMMA Building Management Systems	ET G1

Factory Automation Sensors	FS 10

Human Machine Interface Systems SIMATIC HMI	ST 80

Industrial Communication for Automation and Drives	IK PI

Low-Voltage Controls and Distribution	*Catalog*
Low-Voltage Switchgear – Controlgear for Industry	LV 10
Power Distribution – Products and Systems for Low-Voltage Power Distribution	LV 30
SIDAC reactors and filters	LV 60
SIVACON 8PS Busbar trunking systems CD, BD01, BD2 up to 1250 A	LV 70
Low-Voltage Controlgear, Switchgear and Systems	LV 90

Motion Control System SIMOTION	PM 10

Process Instrumentation and Analytics	
Field Instruments for Process Automation Measuring Instruments for Pressure, Differential Pressure, Flow, Level and Temperature, Positioners and Liquid Meters	FI 01
PDF: Indicators for panel mounting	*MP 12*
SIREC Recorders and Accessories	MP 20
SIPART, Controllers and Software	MP 31
SIWAREX Weighing Systems	WT 01
Continuous Weighing and Process Protection	WT 02
Gas Analysis Equipment for the Process Industry	PA 10
PDF: Process Analytics, Components for the System Integration	*PA 11*
SIPAN Liquid Analysis	PA 20

SIMATIC Industrial Automation Systems	
SIMATIC PCS Process Control System	ST 45
Products for Totally Integrated Automation and Micro Automation	ST 70
SIMATIC PCS 7 Process Control System	ST PCS 7
PDF: Add-ons for the SIMATIC PCS 7 Process Control System	*ST PCS 7.A*
pc-based Automation	ST PC
SIMATIC Control Systems	ST DA

SIPOS Electric Actuators	
Electric Rotary, Linear and Part-turn Actuators	MP 35
Electric Rotary Actuators for Nuclear Plants	MP 35.1/.2

Systems Engineering	
Power supplies SITOP power	KT 10.1
System cabling SIMATIC TOP connect	KT 10.2

System Solutions	
Applications and Products for Industry are part of the interactive catalog CA 01	

TELEPERM M Process Control System	
PDF: AS 488/TM automation systems	*PLT 112*

PDF: These catalogs are only available as pdf files.

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.

Token fee € 5,–/$ 5,–

SIMOTION

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