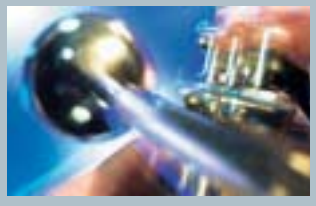
The right drive for every application

sinamics

System overview • May 2006



SIEMENS

Trends in drive technology

Drive technology today is characterized by two key trends:

- The number of variants in mechanical and plant engineering is increasing all the time with the result that drive solutions must be highly **flexible** and **scalable**.
- Customers in all industry sectors generally demand **customized** and **user-friendly** solutions.

For drive technology, this means:

- Only implementing the components and functions that are required for the task in hand.
  The drive variants are designed for different applications, which enables you to implement cost-optimized drive solutions regardless of whether you use single-axis or multi-axis applications or whether you require simple speed control or highly-dynamic servo control.
- Minimizing engineering costs for configuration and commissioning activities.
  Standardized tools for selection, configuration, and commissioning activities ensure quick, easy, and cost-effective engineering.
- Adopting an innovative approach on both a small and large scale. Distributed, intelligent drive technology permits a new approach to machine and plant engineering.

With the new SINAMICS drive family, Siemens AG offers you a basis that allows you to fulfil your requirements as effectively as possible.

SINAMICS sets new standards not only in

- mechanical and plant engineering but also in
- the process industry
- and building engineering.

The SINAMICS drive family

Tailored to suit different application areas, the SINAMICS range encompasses the following products:

Low-voltage drives (power supply < 1000 V)

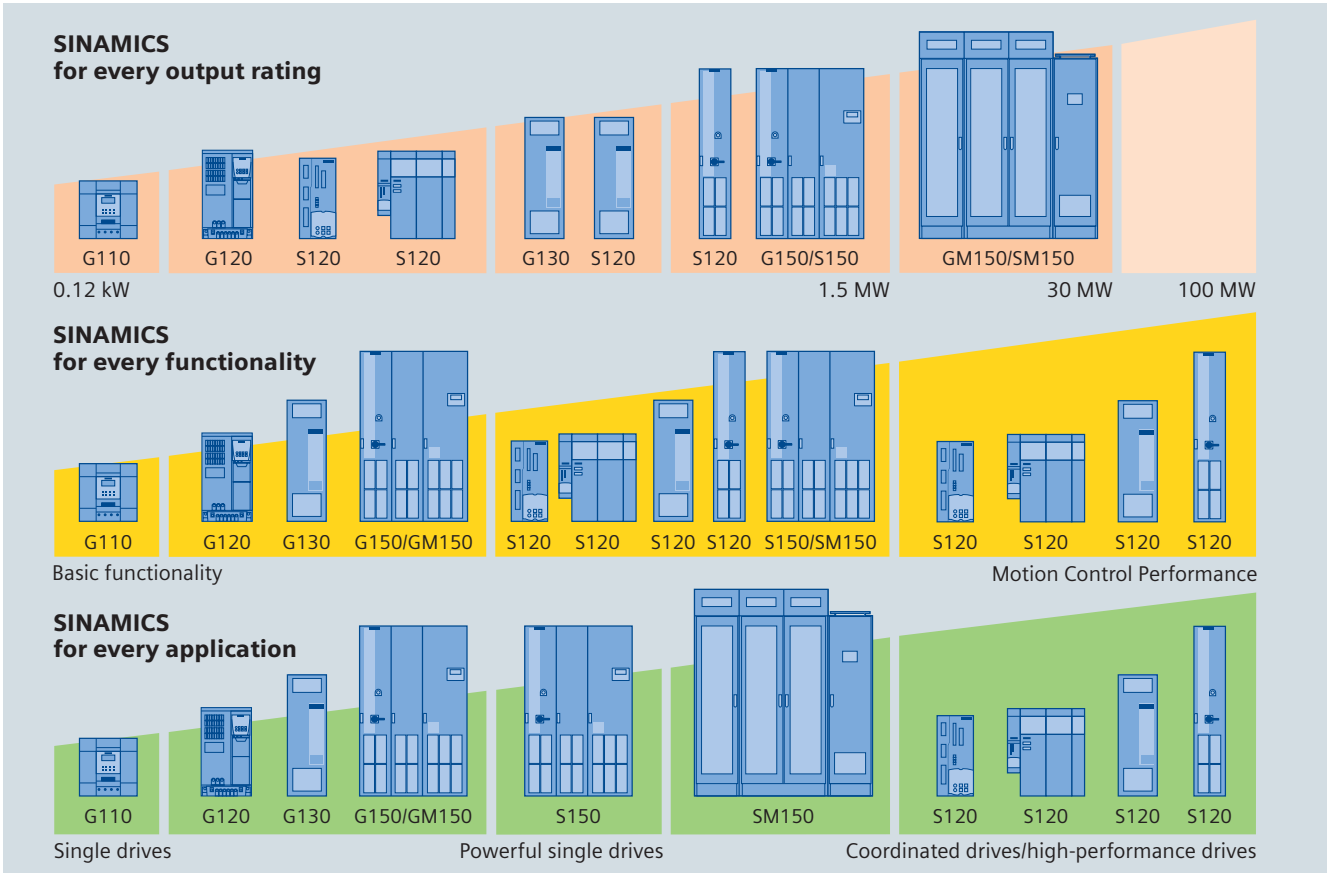
- ***SINAMICS G110*** – the versatile single drive for the lower power range
- ***SINAMICS G120*** – the modular single drive for small and medium output ranges
- ***SINAMICS G130/SINAMICS G150*** – the universal drive solution for single drives with high output ratings
- ***SINAMICS S120*** – the flexible, modular drive system for demanding drive tasks
- ***SINAMICS S150*** – the advanced drive solution for single drives with high output ratings

Medium-voltage drives (power supply > 1000 V)

- ***SINAMICS GM150*** – the universal drive solution for single drives in the medium-voltage range
- ***SINAMICS SM150*** – the advanced drive solution for single and multi-motor drives in the medium-voltage range

The SINAMICS range is characterized by the following system features:

- Integrated platform-based functionality
- Standardized engineering
- High degree of flexibility and combination capability
- Broad performance spectrum
- Designed for global use
- SINAMICS Safety Integrated
- Greater efficiency and effectiveness
- Versatile interfacing options with higher-level controllers
- Totally Integrated Automation



The SINAMICS system

Integrated platform-based functionality

The individual SINAMICS versions are based on a joint platform concept: In SINAMICS, the same software and hardware components are used for the same functions in a wide range of areas. Functions such as drive control, operator control, diagnostics, or communication with higher-level controllers are implemented across the board and make it easier to use the drive technology. The SINAMICS range creates various synergies in the individual drive variants that can be leveraged to reduce the time and effort involved in training as well as simplify support, servicing, and spare parts management.

Standardized engineering

The SINAMICS product range is characterized by a high level of standardization and its ease of engineering. The SIZER configuration tool helps users select and dimension their drive components, while the STARTER tool supports commissioning and diagnostic activities.

This generates synergies and makes the process of configuring, parameterizing, and servicing the various products much more efficient.

High degree of flexibility and combination capability

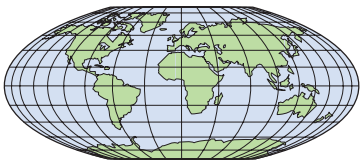
Covering a broad range of applications and demonstrating a high degree of standardization with respect to functions and engineering, the SINAMICS product range is a universal platform for drive-specific tasks. Depending on the task in hand, components from different products in the range can be combined as required to create a complete drive solution.

Broad performance spectrum

The SINAMICS product range covers a broad power spectrum. A highly comprehensive component range allows you to create a drive solution that is always tailored to your requirements.

Designed for global use

With its different voltages, the SINAMICS product range is suitable for different network types all over the world.



It also fulfils international standards and regulations, which means that the devices do not be recertified when they are exported.

A global network of regional Siemens offices and service partners is available to look after all your support needs.

Uniformity with SINAMICS

SINAMICS Safety Integrated

For the first time ever, drive-autonomous safety functions are available in the SINAMICS product range. Alongside "Safe Standstill" (SH) in the case of most of the drive versions, a "Safe Brake Control" (SBC) and further safety functions are also integrated in the power unit.

The integration of safety technology supports practical safety concepts that also simplify the installation technology.
All the safety functions are certified to international standards (IEC 61508, EN 954-1).

Greater efficiency and effectiveness

SINAMICS-based drive solutions provide a foundation for greater efficiency and competitive strength in mechanical and plant engineering as well as for end users:

- A wide range of drive variants ensure customized solutions optimized for the task in hand.
- Shorter project runtimes/order processing thanks to a high level of user friendliness and systematic configuration and commissioning
- Maintenance-friendly, highly-available machines and plants thanks to standardized, high-performance diagnostic mechanisms as well as reduced spare parts inventories thanks to an optimized component range.

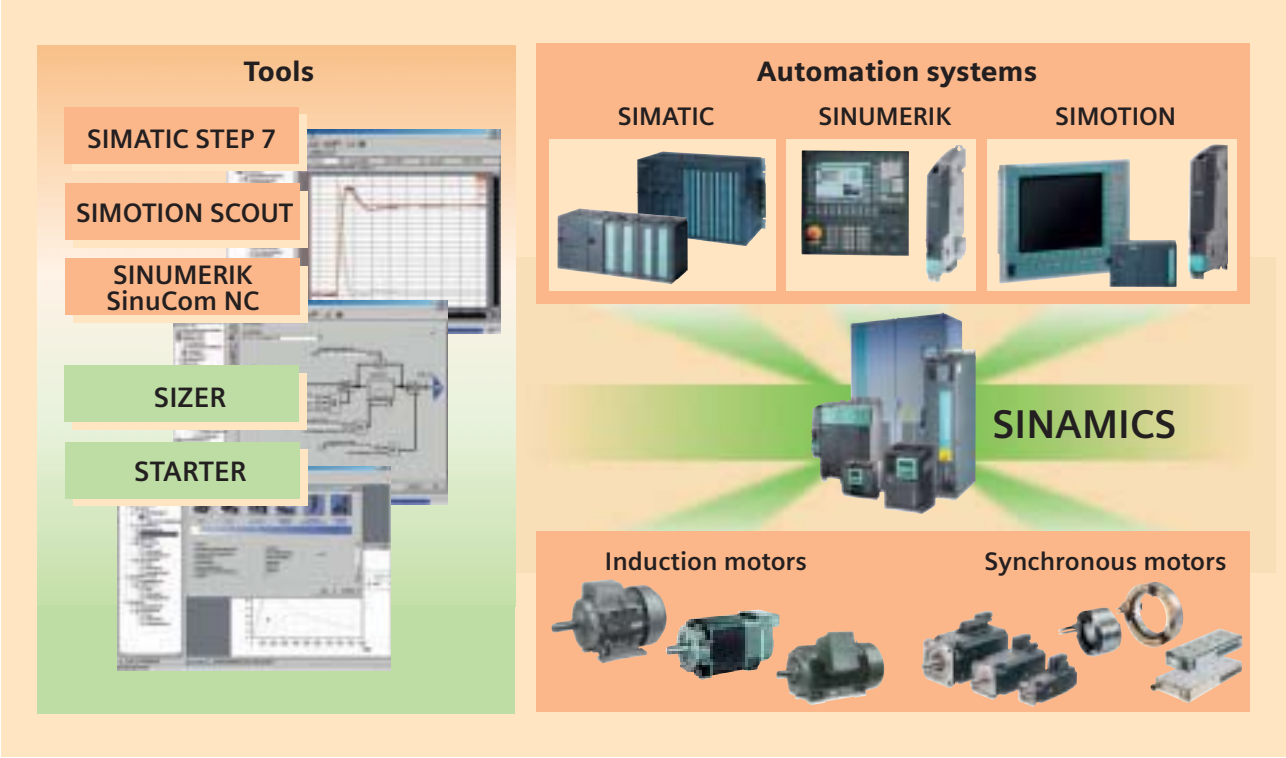
Versatile interfacing options with higher-level controllers

SINAMICS offers a range of options for interfacing with higher-level controllers, including:

- Connection via digital or analog interface
- Connection to SIMATIC, SINUMERIK and SIMOTION via PROFIBUS DP or PROFINET

Totally Integrated Automation

SINAMICS is 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, SINUMERIK and SIMOTION.



SINAMICS is part of the "Totally Integrated Automation" concept

Standardized engineering

SIZER configuration software

A particular feature of SINAMICS is that the user is supported by powerful and uniform tools during all phases of the project.

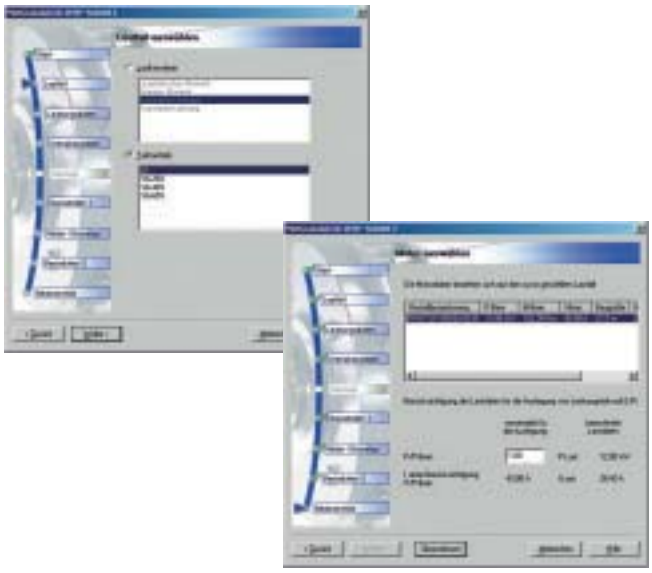
This begins with the dimensioning of the drive components. The SIZER configuration software allows you to configure a complete drive system and handle everything from single drives to complex multi-axis drives. The Workflow Wizard guides you step by step through the individual configuration phases.

SIZER allows you to:

- Calculate loads
- Design and dimension the motor and power components
- Configure further system components

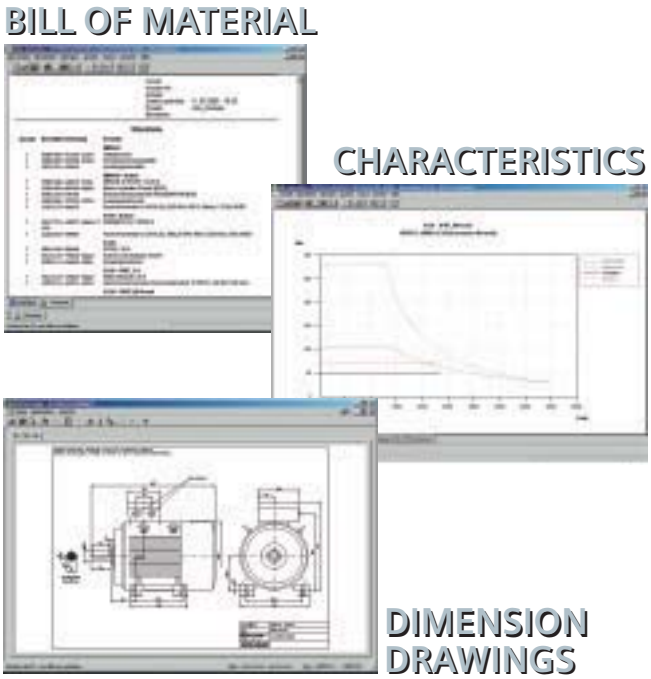
SIZER provides:

- Configuration results (characteristics, technical specifications, location diagram and dimension drawings)
- A bill of material with the associated order data.



Dimensioning suitable components in program-guided steps (using the Motor Wizard as an example):

An integrated IT interface with, for example, SAP systems, can be used to order components electronically.



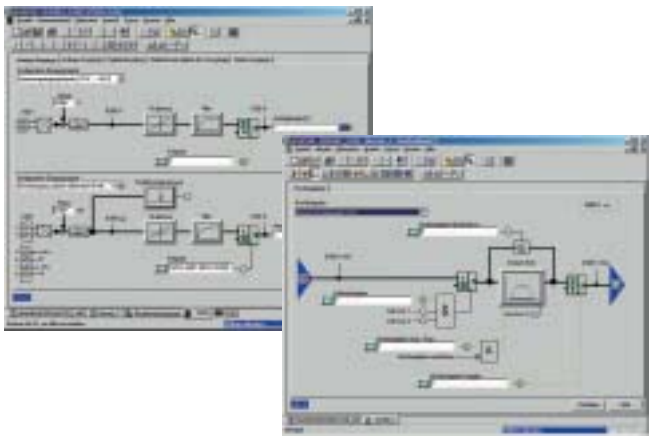
The results of the configuration process include bills of material, characteristics and dimension drawings.

A "guided tour" makes it easier for first-time users to find their way around the SIZER configuration software. The online help provides extensive physical and technical background knowledge during the configuration phase, which helps prevent users from entering incorrect combinations and ordering the wrong components.

STARTER commissioning software

The STARTER tool can be used to commission all SINAMICS drives. It features user-friendly menus and graphics that help you configure and commission the drive components.

A function for importing data from the electronic rating plates on the drive components is available, which not only makes parameterization much easier but also saves time and reduces the risk of incorrect data being entered.



Graphical screens for configuring and commissioning the drive

Integrated test functions can be used to monitor the functions and optimize the parameters. The time characteristics for speed as well as the setpoint and actual value curves can be logged.

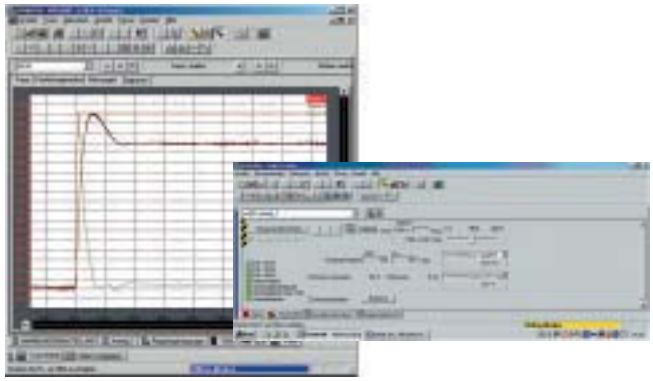
Clearly-structured graphics enable users to carry out diagnostic activities and find their way around the system quickly and easily.

SIZER and STARTER can run as separate Windows applications. They are connected to the drives via the serial interface or PROFIBUS DP.

In conjunction with the SIMOTION motion control system, STARTER can also be integrated into the SCOUT engineering system. The same applies to operating drives in conjunction with the SIMATIC industry automation system. Embedding STARTER in the STEP 7 engineering software means that the drive technology can be fully integrated in the PLC environment.

Implementing SINAMICS in conjunction with SIMOTION, SIMATIC and SINUMERIK results in fully-integrated, one-stop automation solutions that can be configured, parameterized, and commissioned using central engineering software. Diagnostics and troubleshooting activities can be carried out quickly and easily on-site or via teleservice.

The STARTER and SIZER tools are available in German and English; STARTER is also available in French and Italian.



A log function records setpoint and actual value characteristics.

SINAMICS G110
The versatile single drive for the lower power range

Overview

SINAMICS G110 is a frequency inverter designed for a wide range of industrial drive applications with variable speeds. The highly compact SINAMICS G110 uses voltage/frequency control (*V*/*f*) and is the ideal frequency inverter solution in the lower output and performance range in the SINAMICS product family.

The inverter is available in three frame sizes and covers a power range from 0.12 kW (0.16 HP) to 3.0 kW (4 HP) for connection to single-phase networks (200 V to 240 V).

Applications

The SINAMICS G110 is ideal

- for use as a drive in industrial and commercial applications
- in different industries
  (e.g. food and drink, textiles, packaging)
- in conveyor system applications
- for applications with pumps and fans
- for factory gate/garage door operating mechanisms and barriers
- as a drive for scrolling advertising billboards

Benefits

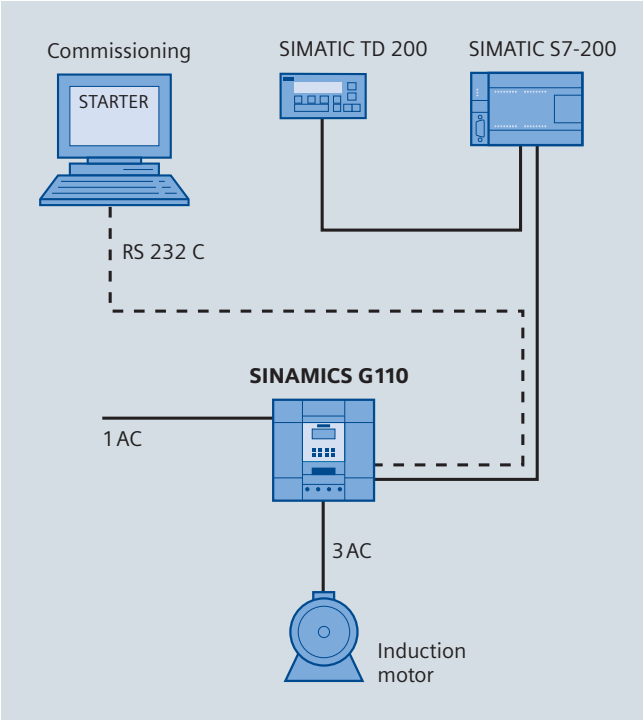
- Can be implemented as required thanks to comprehensive parameterization functions and various interfaces (analog and USS versions)
- Simple installation, parameterization, and commissioning
- Powerful diagnostic facilities with optional operator panel
- Fast standard commissioning by copying parameters via the optional operator panel
- Low-noise motor operation thanks to high pulse frequency
- Low mechanical wear through
  – skipped frequency band if resonance occurs
  – programmable ramp-up/ramp-down times
  – ramp smoothing
  – connection of inverter to rotating motor (flying restart)
- Increase in plant availability as a result of automatic restart following a power failure or operation fault
- Fast current limitation for fault-free operation in the event of sudden load surges
- Versions with integrated EMC filters for industrial and public networks
- DIP switches for quick adjustment to 50 Hz or 60 Hz applications
- DIP switches for simple bus termination for the USS version (RS 485)

Structure

SINAMICS G110 devices are compact units that are ready to connect. One version with a rib-free heat sink is ideal for installation in flat control cabinets. All units feature state-of-the-art IGBT technology in the power unit and digital microprocessor technology. SINAMICS G110 devices can be installed and connected quickly and easily.

SINAMICS G110 is available with an analog input or with a RS 485 communication interface (USS). The digital inputs can be programmed as required, which means that they can be adapted to suit a wide range of applications.

SINAMICS G110 can be parameterized on a PC with STARTER or by means of an optional operator panel. To commission more than one converter with the same parameters, you can store the settings you entered in the operator panel and simply transfer them to the other inverter(s).



SINAMICS G110 configuration example (USS version together with SIMATIC S7-200, connection between PC and inverter with optional PC connection kit)

Technical specifications	
Electrical data	
Line voltages; power ranges	200 ... 240 V 1 AC, ± 10%; 0.12 ... 3.0 kW (0.16 ... 4 HP)
Network types	IT, TN, TT
Line frequency	50 Hz/60 Hz
Output frequency	0 ... 650 Hz
Control methods	*V/f* control, linear (*M*~*n*) *V/f* control, quadratic (*M*~*n*²) *V/f* control, programmable
Fixed frequencies	3, programmable
Skipped frequency bands	1, programmable
Digital inputs	3 programmable 24 V DC digital inputs
Analog variant: Analog input	1 analog input for setpoint of 0 ... 10 V, scalable or can be used as a fourth digital input
Digital output	1 digital output 24 V DC
Communication interface	USS variant: RS 485 serial interface for use with USS protocol
Functions	
Software functions	Automatic restart following interruptions in operation due to power failure, smooth connection of converter to rotating motor, programmable ramp-up/ramp-down times, ramp smoothing
Protective functions	Undervoltage, overvoltage, ground fault, short-circuit, stall protection, thermal motor protection I^2t, converter overtemperature, motor overtemperature
Connectable motors	Induction motors
Mechanical data	
Degree of protection	IP20
Cooling method	≤ 0.75 kW (1 HP): Convection cooling, variant with flat heat sink, > 0.75 kW (1 HP): Internal air cooling (integral fan)
Standards	
Compliance with standards	CE, UL, cUL, c-tick

SINAMICS G120
The modular single drive for small and medium output ranges

Overview

The new SINAMICS G120 frequency inverter has a modular structure (Power Module with Control Unit and BOP) and features numerous innovative functions (e.g. Safety Integrated) as well as communication capability and energy recovery capability. With different unit versions (frame sizes A to F) in a power range of 0.37 kW (0.5 HP) to 90 kW (120 HP), it is suitable for a wide variety of drive solutions.

Applications

SINAMICS G120 is ideal ...

- as a universal drive in all industrial and commercial applications
- in the automotive, textiles, printing, and chemical industries
- for end-to-end applications (e.g. in conveyor systems)

Benefits

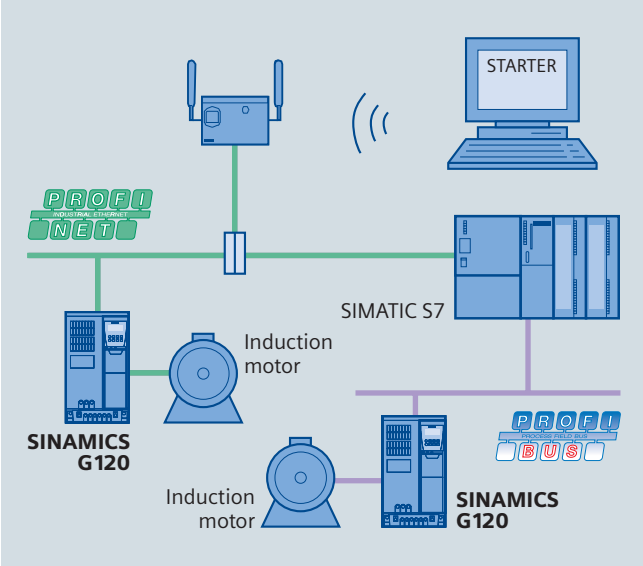
- Flexibility thanks to its modular structure. For a drive concept designed for the future – technical innovations can be integrated in one single system, thereby cutting cost and complexity. Modules that can be selected and scaled according to customer requirements – only the functions the customer actually requires are implemented. The modules can be easily replaced, which makes the system extremely service-friendly.
- The safety functions make it easier for drives to be installed in safety-oriented, integrated automation and drive environments.
- Communications capable via PROFIBUS, PROFINET: reduction in the number of interfaces, system-wide engineering, etc.
- Regenerative feedback capability thanks to an innovative Power Module (no braking resistor, braking chopper, or line reactor, and minimal heat generation).
- Innovative cooling concept and paint-finish on the electronic modules increase robustness (longer service life).
- Engineering and commissioning with standard tools SIZER and STARTER ensure that drives can be configured and commissioned quickly and easily.
- Simple device replacement and parameter cloning with optional, pre-installed MMC card
- Low-noise motor operation thanks to high pulse frequency
- Compact, small design
- Worldwide certification: in UL and CE, Safety Integrated (IEC 61508/SIL2)

SINAMICS G120 – Modular and flexible structure

Structure

The SINAMICS G120 frequency inverter is a modular inverter system for standard drives. Each SINAMICS G120 comprises two operative units – the Power Module and Control Unit (CU). The BOP (basic operator panel) or the STARTER commissioning software (via the interface) can be used to parameterize, operate, and monitor the system.

Different Control Units and Power Modules can be combined to create application and cost-optimized drive solutions. Power Modules PM240 (with integrated braking chopper, prepared for resistance brake) and Power Modules PM250 (with regenerative feedback capability) are suitable for safety-oriented applications. In conjunction with a Safety Control Unit (identified by type suffix "-F"), the drive is known as a Safety Integrated Drive.
This features a fail-safe closed-loop control function for induction motors in different control modes (*V/f*, FCC, vector control with and without encoder).



Configuration example: SINAMICS G120, PROFIBUS, and PROFINET variants, together with SIMATIC S7 and SCALANCE wireless communication. Control and parameterization with the STARTER software.

Technical specifications

Electrical data	
Line voltages; power ranges	380 ... 480 V 3 AC, ± 10%; 0.37 ... 90 kW (0.5 ... 120 HP)
Network types	IT, TN, TT
Line frequency	50 Hz/60 Hz
Output frequency	0 ... 650 Hz
Control methods	*V/f* control, linear (*M*~*n*) *V/f* control, quadratic (*M*~*n*²) *V/f* control, programmable Vector control without encoder Vector control with encoder (closed control loop) Torque control
Fixed frequencies	16, programmable
Digital inputs	Up to 9 digital inputs, depending on the Control Unit, 24 V DC
Analog variant: Analog input	2 analog inputs, scalable from 0 ... 10 V
Digital outputs	3 digital outputs
Communication interfaces	RS 485/USS (CU240S/CU240E); PROFIBUS (CU240S DP); PROFIsafe (CU240S DP-F); PROFINET (CU240S PN)
Functions	
Software functions	Torque control, flying restart, slip compensation, automatic restart following interruptions in operation due to power failure, free functional blocks for logical and arithmetic operations, signal interconnection with BICO technology, kinetic buffering, positioning deceleration ramp, simple process control with internal high-quality PID controller, programmable ramp-up times 0 ... 650 s, ramp smoothing, compound braking for controlled rapid deceleration, 3 switchable motor data sets
Protective functions	Undervoltage, overvoltage, ground fault, stall protection, thermal motor protection *I²t*, inverter overtemperature, motor overtemperature
Safety Integrated function	Yes
Connectable motors	Induction motors
Mechanical data	
Degree of protection	IP20
Cooling method	Innovative cooling concept; the power electronics are cooled by means of heat sinks with an external fan; open-loop and closed-loop control electronics are cooled by convection
Standards	
Compliance with standards	CE, UL, cUL, C-tick, Safety Integrated IEC 61508/SIL2

SINAMICS G130 and SINAMICS G150
The universal drive solution for single drives with high output ratings

Overview

SINAMICS G130 chassis units and SINAMICS G150 cabinet units are designed for variable-speed drives in mechanical and plant engineering applications.

They have been specially tuned to the requirements of single drives with quadratic and constant load characteristics, without regenerative feedback.

The SINAMICS G130 and SINAMICS G150 are cost-effective drive solutions that can be customized with a range of additional components and options in line with specific customer requirements.

Applications

Variable-speed drives are ideal for all applications that involve moving, conveying, pumping, or compressing solids, liquids, or gases.

Key applications include:

- Pumps and fans
- Compressors
- Extruders and mixers
- Mills

Benefits

- The drives are exceptionally quiet and compact thanks to state-of-the-art IGBT power semiconductors and an innovative cooling concept.
- Can be easily integrated in automation solutions thanks to the PROFIBUS interface, which is supplied as standard, PROFINET or a range of analog and digital interfaces.
- Plant availability is increased because individual modules and power components can be replaced quickly and easily.
- The drives can be commissioned and parameterized quickly and easily by means of interactive menus on the user-friendly AOP30 operator panel, which features a graphical LCD and plain-text display.

SINAMICS G130

The SINAMICS G130 provides machine and plant construction engineers with a modular drive system that can be tailored to specific applications.

SINAMICS G130 comprises two modular, stand-alone components:

- Power Module
- Control Unit

They can be located separately from one another or combined in a single unit. The Power Module contains a slot for the Control Unit.

The user-friendly AOP30 operator panel can be used for commissioning and on-site operation.

Predefined interfaces – either via the terminal block or PROFIBUS – make it much easier to commission and control the drive. The Control Unit interfaces can be enhanced with add-on modules.

SINAMICS G130 chassis units are available for power ranges from 315 kW (400 HP) to 800 kW (1000 HP).

SINAMICS G150

The SINAMICS G150 is a ready-to-connect AC/AC drive in the standard control cabinet.

With their standardized design and dimensions, the cabinets can be seamlessly integrated in any system. They are maintenance friendly and compact and can be installed and commissioned quickly and easily.

Thanks to an extensive range of options, the cabinets can be adapted in line with specific requirements. They are available in widths from 400 mm, which then increase in intervals of 200 mm, and with various degrees of protection up to IP54 with two design variants.

Version A

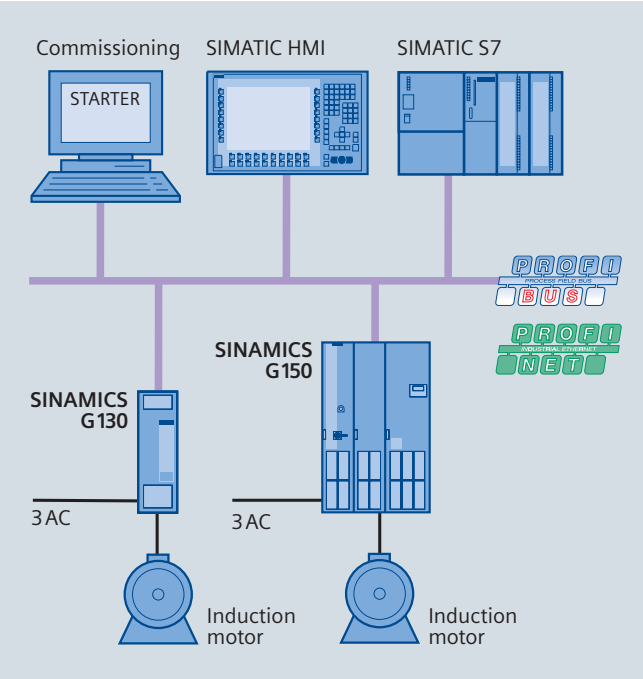
This version offers sufficient space for installing all available options. Depending on the variants, the line and motor connection can be located on the top or the bottom, offering you considerable flexibility regarding the location of the cabinet in the plant.

Version C

Version C is a highly compact version designed for applications in which the power supply components are located in a central low-voltage distribution unit and, therefore, do not need to be installed in the cabinet unit.

The user-friendly AOP30 operator panel is fitted as standard in the cabinet door for both versions.

The cabinet units are available for output ranges of between 75 kW (100 HP) and 1500 kW (2000 HP).



SINAMICS G130 and SINAMICS G150 configuration example with SIMATIC S7

Technical specifications

Electrical data	SINAMICS G130	SINAMICS G150
Line voltages; power ranges		
• 380 ... 480 V 3 AC, ± 10% (–15% < 1 min)	315 ... 560 kW (400 ... 750 HP)	110 ... 900 kW (150 ... 1200 HP)
• 500 ... 600 V 3 AC, ± 10% (–15% < 1 min)	315 ... 560 kW (400 ... 750 HP)	110 ... 1000 kW (150 ... 1300 HP)
• 660 ... 690 V 3 AC, ± 10% (–15% < 1 min)	315 ... 800 kW (400 ... 1000 HP)	75 ... 1500 kW (100 ... 2000 HP)
Network types	TN/TT, or IT systems	TN/TT, or IT systems
Line frequency	47 ... 63 Hz	47 ... 63 Hz
Output frequency	0 ... 300 Hz	0 ... 300 Hz
Control method	Vector control with or without speed encoder and *V/f* control	
Fixed speeds	15 fixed and 1 basic speed, programmable	
Skipped frequency bands	4, programmable	4, programmable
Customer's terminal block	Digital inputs/outputs, analog inputs/outputs, Inputs for motor temperature evaluation, variable number	
Communication interface	PROFIBUS DP as standard optional: PROFINET, CANopen	PROFIBUS DP as standard optional: PROFINET, CANopen
Braking operation	With the system component Braking Module	optional: Braking Module
Functions		
Software functions	Automatic restart following interruptions in operation due to power failure, smooth connection of converter to rotating motor, kinetic buffering, automatic motor identification for control optimization, programmable ramp-up/ramp-down times, ramp smoothing	
Protective functions	Thermal monitoring of motor and power units, overvoltage, undervoltage, ground fault, short-circuit, stall protection	
Connectable motors	Induction motors and synchronous motors	
Mechanical data		
Degree of protection	IP00/IP20	IP20, optional: IP21/IP23/IP54
Cooling method	Integrated fans (forced air ventilation)	
Sound pressure level	≤ 72 dB (A) at 50 Hz line frequency	
Cabinet system	–	Rittal TS 8
Standards		
Compliance with standards	CE, cUL	CE

SINAMICS S120
The flexible, modular drive system for demanding drive tasks

Booksize units for power ratings from 1.6 kW (2 HP) to 107 kW (145 HP) (front left)
Chassis units for power ratings from 75 kW (100 HP) to 1200 kW (1600 HP) (rear)
Blocksize units for power ratings from 0.12 kW (0.16 HP) to 90 kW (120 HP) (front right)

Overview

SINAMICS S120 is a modular drive system with servo and vector control that is ideal for sophisticated drive tasks in mechanical and plant engineering.

Versions are available for both single-axis and multi-axis applications. Covering power ranges of between 0.12 kW (0.16 HP) and 4500 kW (6000 HP) and featuring a variety of control modules classified according to function, the SINAMICS S120 modular system can be quickly and easily designed to meet the exact requirements of almost any high-performance drive configuration.

Even in their basic versions, the SINAMICS S120 Control Units feature extensive drive intelligence: servo and vector control, V/f control, positioning and safety functions, as well as numerous other useful functions required for ensuring reliable operation. The closed-loop control methods offered support synchronous and induction motors.

Integrated PROFIBUS DP interfaces ensure that SINAMICS S120 can be easily integrated in complete automation solutions. PROFINET, among others, is another additional field bus interface that is supported. In conjunction with the SIMATIC industry automation system, SINAMICS S120 can be used as a basis for creating conventional end-to-end automation and drive solutions.

Together with SIMOTION D or SINUMERIK 840D solution line control units, SINAMICS S120 can also be used as a basis for implementing complete drive-integrated motion control and machine tool solutions.

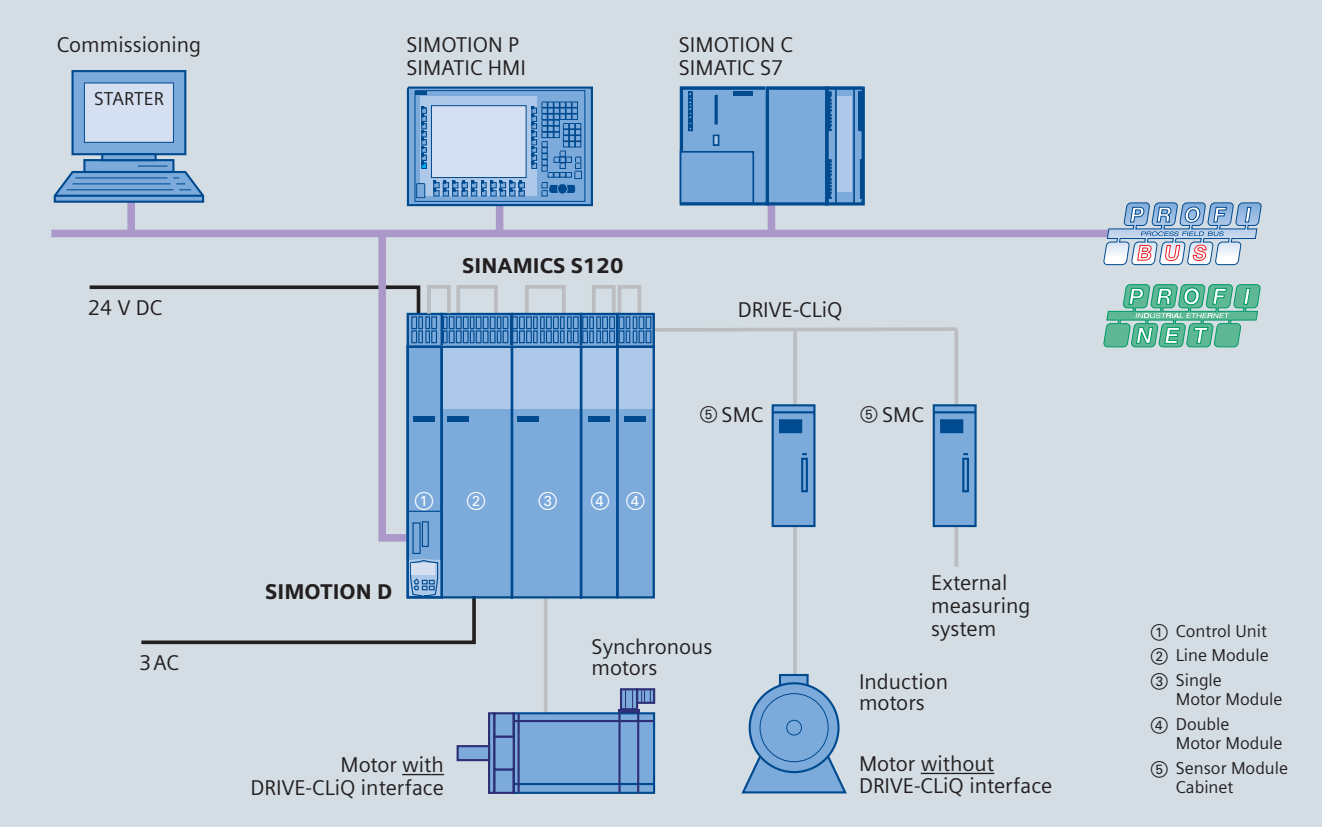
SINAMICS S120 is also available as cabinet modules specially designed for use in plant engineering applications that can be combined to create a row of drive cabinets with a total power of up to 4500 kW (6000 HP). Standardized interfaces enable the modules to be easily linked to a ready-to-connect drive solution for multi-motor applications.

Applications

The properties of the SINAMICS S120 means that it is ideal for use as a drive system in production machines and machine tools as well as in plant engineering applications, such as:

- Packaging machines
- Machines for producing food and beverages
- Plastics processing machines
- Textile machines
- Presses and punches
- Printing and paper machines
- Machines used in the timber, glass, and ceramics industry
- Assembly and testing equipment
- Handling devices and hoisting gear
- Turning, milling and grinding machines
- Rolling mill drives
- Vehicle and gear test bays

Cabinet Modules – the modular system for outputs of up to 4500 kW (6000 HP)



Configuration example: SINAMICS S120 booksize system with SIMOTION D

Benefits

SINAMICS S120 offers the following benefits:

- Universal application in high-performance single and multi-axis applications
- Can be combined as required to create customized solutions
- Broad power range
- Wide range of functions
- SINAMICS Safety Integrated functions
- Can support different cooling methods
- Can support different supply concepts
- Easy integration in higher-level automation and IT structure
- User friendliness
- Easy installation
- Practical connection system

Structure

SINAMICS S120 devices are available as single drives or as multi-axis drive systems.

SINAMICS S120 AC drives for high-performance single drives

SINAMICS S120 AC drives were developed especially for single drives. They have a modular structure and comprise the following components:

- **Power Module** in which the power supply and power unit are integrated. Power Modules are available for outputs of 0.12 kW (0.16 HP) to 250 kW (340 HP). Connected to the Power Module is the:
- **Control Unit**, which contains all the intelligent control functions as well as the drive interfaces for communication purposes and for connecting additional components.

SINAMICS S120
The flexible, modular drive system for demanding drive tasks

SINAMICS S120				
Modular drive system for demanding single/multi-axis applications				
Blocksize	**Chassis**	**Booksize**	**Chassis**	**Cabinet Modules**
				
AC/AC units for single-axis applications		**DC/AC units for multi-axis applications**		
IP20	IP20	IP20	IP00/IP20	IP20 (IP21/IP23/IP54)
0.12 ... 90 kW (0.16 ... 120 HP)	110 ... 250 kW (150 ... 340 HP)	1.6 ... 107 kW (2 ... 145 HP)	75 ... 1200 kW (100 ... 1600 HP)	75 ... 4500 kW (100 ... 6000 HP)

SINAMICS S120 DC/AC units for multi-axis applications

Optimized for use in multi-axis applications, SINAMICS S120 multi-axis units feature a central power supply and DC link.

They also have a modular structure and comprise the following components:

- **Control Unit**
  The Control Unit contains the control intelligence for all the drive axes integrated in the multi-axis line-up. It also contains drive-related I/Os and interfaces for communicating with higher-level controllers. Control Units are available with different ranges of functions and with different performance levels.
- **Line Module**
  The Line Module contains the central power supply for the DC link. Different Line Modules are available for different applications, including an unregulated infeed unit for motor mode and a regulated feed/feedback unit that provides a constant DC link voltage even if line voltage fluctuations occur and supplies excess energy back to the network. Line Modules are available for outputs of 5 kW (6.7 HP) to 6000 kW (8000 HP).
- **Motor Modules**
  One or more Motor Modules can be supplied with power for the motors via the DC link. Synchronous and induction motors can be operated. Motor Modules are available for rated outputs from 1.6 kW (2 HP) to 1200 kW (1600 HP).

Electronic options, Sensor and Terminal Modules

A wide range of additional modules and components are available for connecting different position measuring and encoder systems and for extending the drive system to include drive-related I/Os.

- **Terminal Modules, Terminal Boards**: for extending the drive system to include drive-related I/Os.
- **Sensor Modules**: for connecting position encoders to the drive system.
- **Communication Boards**: provide Control Units with an additional communication interface.

DRIVE-CLiQ system interface

All SINAMICS S120 components are connected easily via the high-performance DRIVE-CLiQ system interface.

- Line and Motor Modules are connected to the Control Unit via DRIVE-CLiQ.
- Terminal and Sensor Modules are connected to the drive system.
- Motors with a DRIVE-CLiQ interface can be connected directly to the drive system.

SINAMICS S120 with its different types and their combination.

SINAMICS S120 is available in different types. SINAMICS S120 AC drives are available for power ratings from 0.12 kW to 90 kW (0.16 HP to 120 HP) in the compact blocksize format and for power ratings from 110 kW to 250 kW (150 HP to 340 HP) in the chassis format. SINAMICS S120 multi-axis drives are available for power ratings from 1.6 kW to 107 kW (2 HP to 145 HP) in the booksize format, for power ratings from 75 kW to 1200 kW (100 HP to 1600 HP) in the chassis format, and up to 4500 kW (6000 HP) in the Cabinet Modules. All SINAMICS S120 types support internal air cooling. The multi-axis devices in chassis format are also available in versions that support liquid cooling (e.g. for applications in dusty, corrosive, or salty environments or if insufficient space is available). Booksize units are also available with external air cooling and in the Cold Plate version. All SINAMICS S120 types can be combined with each other as required. Even SINAMICS S120 AC drives can be combined to handle multi-axis applications via the DRIVE-CLiQ interface.

Auto-configuration with electronic type plate

All SINAMICS S120 components feature a digital type plate that stores all the relevant data about that particular component. For motors, this data includes the parameters of the electric equivalent circuit diagram and characteristic values of 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 digital rating plate stores logistical data (manufacturer ID, order number, and globally unique identification number). 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 simplifies servicing.

Technical specifications

Electrical data	
Line voltages	200 ... 240 V 1 AC, ± 10% 380 ... 480 V 3 AC, ± 10% 660 ... 690 V 3 AC, ± 10%
Power range	0.12 ... 1200 kW (0.16 ... 1600 HP) (4500 kW (6000 HP) Cabinet Module)
Supported network types	IT, TN, TT
Line frequency	50 Hz/60 Hz
Control methods	*V/f* closed-loop Vector control Servo control Dynamic servo control (DSC)
Digital inputs/ outputs	Yes, scalable number
Analog inputs/ outputs	Yes, scalable number
Communication interfaces	Digital inputs/outputs, 24 V DC Analog inputs/outputs PROFIBUS DP, PROFINET CANopen
Functions	
Technological functions	Several command/drive data set freely interconnectable through BICO technology, flying measurement, flying restart, kinetic buffering, Motion Control in conjunction with SIMOTION D, numeric control in conjunction with SINUMERIK 840 solution line, technology controller (PID), integrated positioning functions
Safety functions (Safety Integrated)	Safe Stop Safe Brake Control [1] Safe Standstill cat. 1 Other safety functions [2]

Functions (continued)	
Limitations	Torque limiting/current limiting Power limiting Speed limiting
Protective functions (excerpt)	Thermal monitoring of motor and motor modules Overcurrent, overvoltage and undervoltage Blocking protection Overspeed, standstill, short-circuit, ground fault
Setpoint processing	Direction of rotation reversal 4 skip bandwidths Basic ramp-function generator without rounding-off, with a special fast stopping ramp Expanded ramp-function generator with rounding-off and setting functions Speed setpoint filter
Connectable motors	Induction motors Synchronous motors Torque motors Linear motors
Supported encoders	Resolvers Absolute encoders Incremental encoder sin/cos 1 V_{pp} Incremental encoder TTL signal, RS 422 HTL incremental encoder
Mechanical data	
Degree of protection	IP00/IP20, optional up to IP54
Cooling methods	Internal or external air cooling, liquid cooling, Cold Plate cooling
Standards	
Compliance with standards	CE, UL, cUL, Safety Integrated IEC 61508/SIL2

1) In the case of Booksize and Blocksize formats. 2) Available soon.

SINAMICS S150
The advanced drive solution for single drives with high output ratings

Overview

SINAMICS G150 cabinet units are designed for use in variable-speed drives in mechanical and plant engineering applications.

They are ideal for variable-speed drives with stringent requirements regarding dynamic response and speed accuracy, frequent braking cycles with high levels of braking energy, and four-quadrant operation.

SINAMICS S150 offers high-performance speed control with excellent accuracy and a high dynamic response.

The cabinet units are available for power ranges from 75 kW to 1200 kW (100 HP to 1600 HP).

Applications

SINAMICS S150 can be used in any application with the most stringent requirements for processes with dynamic and reproducible procedures, such as:

- Test bay drives
- Centrifuges
- Elevators and cranes
- Cross cutters and shears
- Conveyor belts
- Presses
- Cable winches

Benefits

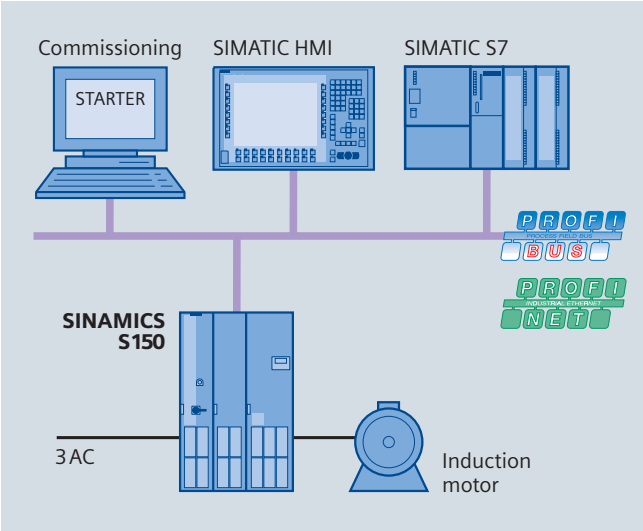
- Standard regenerative feedback, allowing unrestricted four-quadrant operation.
- Significant energy saving, particularly with frequent braking cycles.
- Highly accurate and dynamic line infeed thanks to IGBTs; robust when line fluctuations occur.
- Injection of virtually sinusoidal line currents thanks to fast current control.
- An innovative Clean Power Filter minimizes low-frequency line reactions. The values are well below the strict THD limits in accordance with IEEE 519. This also helps prevent losses in the low-voltage distribution unit and/or line transformer, and in the power supply cable caused by harmonic currents.
- Reactive power compensation is possible (inductive or capacitive)
- Can be easily integrated in automation solutions thanks to the PROFIBUS interface, which is supplied as standard, as well as a range of analog and digital interfaces.
- Plant availability is increased because individual modules and power components can be replaced quickly and easily.
- Easy commissioning and parameterization using interactive menus on the user-friendly AOP30 Operator Panel with graphical LCD and plain-text display.

Structure

SINAMICS S150 systems are ready-to-connect converters in the standard control cabinet. An extensive range of options means that they can be designed to meet specific requirements.

Depending on the variants, the line and motor connection can be located on the top or the bottom, offering you considerable flexibility regarding the location of the cabinet in the plant.

They are available in widths from 1400 mm, which then increase in increments of 200 mm. The standard cabinet degree of protection is IP20. This can be increased to IP54 (optional). The user-friendly AOP30 Operator Panel is fitted as standard in the cabinet door.



Configuration example: SINAMICS S150 with SIMATIC S7

Technical specifications

Electrical data	SINAMICS S150
Line voltages; power ranges	
• 380 ... 480 V 3 AC, ± 10 % (–15 % < 1 min)	110 ... 800 kW (150 ... 1000 HP)
• 660 ... 690 V 3 AC, ± 10 % (–15 % < 1 min)	75 ... 1200 kW (100 ... 1600 HP)
Network types	TN/TT, or IT systems
Line frequency	47 ... 63 Hz
Output frequency	0 ... 300 Hz
Control method	Vector control with and without sensor or *V/f* control
Fixed speeds	15 fixed and 1 basic speed (programmable)
Skipped frequency bands	4, programmable
Customer's terminal block	Digital inputs/outputs, analog inputs/outputs, inputs for motor temperature evaluation, variable number
Communication interface	PROFIBUS DP as standard/optional: PROFINET, CANopen
Braking operation	Four-quadrant operation as standard
Functions	
Software functions	Smooth connection of converter to rotating motor, kinetic buffering, automatic motor identification for control optimization, programmable ramp-up/ramp-down times, ramp smoothing
Protective functions	Undervoltage, overvoltage, ground fault, short-circuit, stall protection, thermal motor protection, thermal converter protection
Connectable motors	Induction motors and synchronous motors
Mechanical data	
Degree of protection	IP20, optional: IP21/IP23/IP54
Cooling method	Integrated fans (forced air ventilation)
Sound pressure level	≤ 78 dB (A) at 50 Hz line frequency
Cabinet system	Rittal TS 8
Standards	
Compliance with standards	CE

SINAMICS GM150 and SINAMICS SM150
The SINAMICS solutions for the medium-voltage range

SINAMICS GM150

Designed for medium-voltage drives without regenerative feedback, such as large pumps, fans, extruders, mixers, and mills, thereby extending the application and functional range of SINAMICS G150 into the medium-voltage sector.

Reliable power components, protective measures against environmental influences, robust Control Units, and redundant fans and pumps in the cooling system ensure smooth operation even under the most extreme conditions.

As with the low-voltage devices, configuration, commissioning, and operation are straightforward and standardized. Operator control is again menu driven via the user-friendly AOP30 Operator Panel, which features a plain-text display. The compact structure, the availability of all voltage classes, the choice between air or water cooling, ready-to-go connection options on the top or bottom of the devices, and seamless integration in higher-level automation systems mean that it could not be any easier to integrate the systems. Thanks to the intelligent SINAMICS G150 maintenance functions, the components automatically indicate when they need to be maintained. For instance, a differential pressure procedure determines the degree of contamination of the dust filters. Another example is the ion exchangers in water-cooled SINAMICS GM150.

The analog conductivity measurement continuously monitors operation of the ion exchanger and outputs an early-warning message when the exchange capacity decreases. This ensures that components are exchanged or other maintenance work is carried in good time (e.g. during a routine inspection).

For servicing, all the key components can be accessed from the front. They are arranged in such a way that they can be exchanged quickly and easily and without the use of special tools.

Up to 8.5 MW (11,500 HP), SINAMICS GM150 devices are equipped with the second generation of reliable HV IGBT power semiconductors, which are also now available for 6.5 kV. For even higher outputs, the tried-and-tested IGCT technology is used for two-figure megawatt ranges.

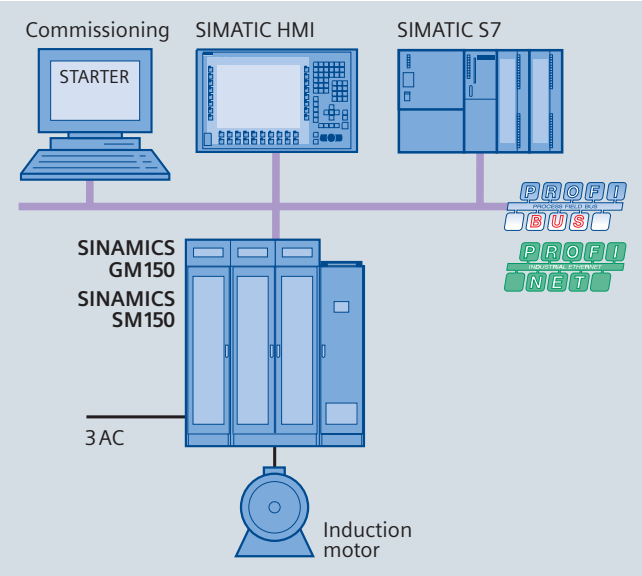
SINAMICS SM150

A medium-voltage converter for complex drive applications with regenerative feedback for both single and multi-motor drives. This means that the functions and applications of SINAMICS S150 and SINAMICS S120 Cabinet Modules now encompass the highest outputs. Typical applications include rolling mills and mine cages in the mining industry.

Its properties mean that the SINAMICS SM150 is ideal for regenerative, highly-dynamic applications. Transvector control with optimized pulse patterns ensures maximum dynamic response, minimum torque ripple, high overload capability, robustness during critical situations, and low noise. A technical highlight of the SINAMICS SM150 is the enhanced transvector control with ROTOS (Reduced Optimized Task Oriented Switching). This highly-dynamic control procedure with optimized pulse patterns ensures sinusoidal currents and maximum voltage utilization but at a low switching frequency. This results in greater efficiency and minimizes wear and tear to the motor.

SINAMICS SM150 can handle four-quadrant operation without any restrictions. With its Active Infeed technology, the device is ideal for power exchange in regenerative and motor applications. In multi-motor drives, this occurs via a joint DC bus.

The Active Infeed can also provide capacitive reactive power to compensate other converters. The output factor cosφ is variable. The Active Infeed also minimizes harmonics, which makes SINAMICS SM150 particularly network friendly.



Configuration example: SINAMICS GM150 and SINAMICS SM150 with SIMATIC S7

Technical specifications

Electrical data	SINAMICS GM150	SINAMICS SM150
Line voltages; power ranges 2.3 ... 36 kV 3 AC, ±10% (−15% < 1 min) motor voltage GM150: 2.3 ... 7.2 kV motor voltage SM150: 3.3 kV	800 ... 25000 kW (1000 ... 33,500 HP) (with induction machine)	5000 ... 28000 kW (6700 ... 37,500 HP) (with synchronous machine)
Network types	IT systems	IT systems
Line frequency	47 ... 63 Hz	47 ... 63 Hz
Output frequency	0 ... 250 Hz	0 ... 250 Hz
Control method	Vector control with or without speed encoder or *V/f* control	
Fixed speeds	15 fixed and 1 basic speed, programmable	
Skipped frequency bands	4, programmable	4, programmable
Customer's terminal block	Digital inputs/outputs, analog inputs/outputs, Inputs for motor temperature evaluation, variable number	
Communication interface	PROFIBUS DP as standard optional: PROFINET	PROFIBUS DP as standard optional: PROFINET
Braking operation	Braking Module optional	Four-quadrant operation as standard
Functions		
Software functions	Automatic restart following interruptions in operation due to power failure, smooth connection of converter to rotating motor, kinetic buffering, automatic programmable ramp-up/ramp-down times, ramp smoothing	
Protective functions	Undervoltage, overvoltage, ground fault, short-circuit, stall protection, thermal motor protection, thermal converter protection	
Connectable motors	Induction motors and synchronous motors	
Mechanical data		
Degree of protection	Air cooled IP22, optional IP42 Liquid cooled IP43, optional IP54	IP43, optional IP54
Cooling method	Fitted fan or liquid cooling	Liquid cooling
Sound pressure level	≤ 80 dB (A)	≤ 80 dB (A)
Standards		
Compliance with standards	IEC, EN, UL, cUL	IEC, EN

The members of the SINAMICS family

Low voltage			
SINAMICS G110	*SINAMICS G120*	*SINAMICS G130/G150*	*SINAMICS S120*
			
The versatile single drive for the lower power range	**The modular single drive for small to medium output ranges**	**The universal drive solution for single drives with high output ratings**	**The flexible, modular drive system for demanding drive tasks**
Main applications			
• Plants and machines for industrial and commercial applications	• Machines and plants for industrial and commercial applications (mechanical engineering, automotive, textiles, chemicals, printing, steel)	• Plants and machines in the process and production industry, water/waste water, power stations, oil and gas, petrochemicals, chemical raw materials, paper, cement, stone, steel	• Plants and machines for industrial applications (packaging, plastics, textiles, printing, wood, glass, ceramics, presses, paper, lifting equipment, semiconductors, automated assembly and testing equipment, handling, machine tools)
Application examples			
• Pumps and fans • Auxiliary drives • Conveyor systems • Billboards • Door/gate operating mechanisms • Centrifuges	• Pumps and fans • Compressors • Conveyor systems	• Pumps and fans • Compressors • Extruders and mixers • Mills	• Motion control applications (positioning, synchronous operation) • Numeric control, interpolating motion control • Converting • Technological applications
Benefits			
• Compact • Flexible adaptation to different applications • Simple, fast commissioning • Ready for operation • Clear terminal layout • Optimum interaction with SIMATIC and LOGO!	• Modular • Flexible expansion capability • Quick and easy commissioning • Regenerative feedback • Innovative cooling concept • Optimum interaction with SIMOTION and SIMATIC • SINAMICS Safety Integrated	• Space-saving • Low-noise • Simple, fast commissioning • G130: Modular components • G150: Ready-to-connect cabinet unit • Optimum interaction with SIMATIC	• For universal use • Flexible and modular • Scalable in terms of power, function, number of axes, performance • Quick and easy commissioning, auto-configuration • Innovative, future-oriented system architecture • Graded infeed/regenerative feedback concepts • Wide range of motors • Optimum interaction with SIMOTION, SIMATIC and SINUMERIK • SINAMICS Safety Integrated

	G110	*G120*	*G130*	*G150*
Degree of protection				
	IP20	IP20	IP00/IP20	IP20 optional: IP21/IP23/IP54
Line voltages				
200 ... 240 V 1 AC	0.12 ... 3 kW (0.16 ... 4 HP)	–	–	–
380 ... 480 V 3 AC	–	0.37 ... 90 kW (0.5 ... 120 HP)	315 ... 560 kW (400 ... 750 HP)	110 ... 900 kW (150 ... 1200 HP)
500 ... 600 V 3 AC	–	–	315 ... 560 kW (400 ... 750 HP)	110 ... 1000 kW (150 ... 1300 HP)
660 ... 690 V 3 AC	–	–	315 ... 800 kW (400 ... 1000 HP)	75 ... 1500 kW (100 ... 2000 HP)
Control method				
V/f control	Yes	Yes	Yes	Yes
FCC	–	Yes	–	–
Vector control without encoder	–	Yes	Yes	Yes
Vector control with encoder	–	Yes	Yes	Yes
Servo control	–	–	–	–
Dynamic servo control	–	–	–	–
Motors				
Induction motors	Yes	Yes	Yes	Yes
Synchronous motors	–	–	Yes	Yes
Torque motors	–	–	Yes	Yes
Linear motors	–	–	–	–
Functions				
Speed control	Yes	Yes	Yes	Yes
Torque control	–	Yes	Yes	Yes
Positioning	–	–	–	–
Synchronous operation	–	–	–	–
Axis synchronization	–	–	–	–
Safety Integrated	–	Yes	Yes	Yes
Communication interfaces				
Digital/analog	Yes	Yes	Yes	Yes
Serial	Yes	Yes	Yes	Yes
PROFIBUS DP	–	Yes	Yes	Yes
PROFINET	–	Yes	Yes	Yes
CANopen	–	–	Yes	Yes
Commissioning, parameterization, diagnostics				
Via Operator Panel	Yes	Yes	Yes	Yes
With PG/PC (STARTER)	Yes	Yes	Yes	Yes
MMC card/CF card	–	Yes	Yes	Yes
Further information				
Catalog	D 11.1	D 11.1 News	D 11	D 11
Internet	www.siemens.com/ sinamics-g110	www.siemens.com/ sinamics-g120	www.siemens.com/ sinamics-g130	www.siemens.com/ sinamics-g150

1) Motor voltages 2.3 ... 7.2 kV for induction machines.
2) Motor voltage 3.3 kV for synchronous machines.
3) In conjunction with SIMOTION D.
4) Available soon.

	S120	S150	GM150	SM150
Degree of protection				
	IP00/IP20 Cabinet Modules optional: IP21/IP23/IP54	IP20 optional: IP21/IP23/IP54	Air cooling: IP22 optional: IP42 Liquid cooling: IP43 optional: IP54	IP43 optional: IP54
Line voltages				
200 ... 240 V 1 AC	0.12 ... 0.75 kW (0.16 ... 1 HP)	–	–	–
380 ... 480 V 3 AC	0.37 ... 800 kW (3000 kW) (0.5 ... 1000 HP (4000 HP))	110 ... 800 kW (150 ... 1000 HP)	–	–
660 ... 690 V 3 AC	75 ... 1200 kW (4500 kW) (100 ... 1600 HP (6000 HP))	75 ... 1200 kW (100 ... 1600 HP)	–	–
2.3 ... 36 kV 3 AC	–	–	0.8 ... 25 MW[1)] (1000 ... 33,500 HP)	5 ... 28 MW[2)] (6700 ... 37,500 HP)
Control method				
V/f control	Yes	Yes	Yes	Yes
Vector control without encoder	Yes	Yes	Yes	Yes
Vector control with encoder	Yes	Yes	Yes	Yes
Servo control	Yes	–	–	–
Dynamic servo control	Yes	–	–	–
Motors				
Induction motors	Yes	Yes	Yes	Yes
Synchronous motors	Yes	Yes	Yes	Yes
Torque motors	Yes	Yes	–	–
Linear motors	Yes	–	–	–
Functions				
Speed control	Yes	Yes	Yes	Yes
Torque control	Yes	Yes	Yes	Yes
Positioning	Yes	–	–	–
Synchronous operation	Yes[3)]	–	–	–
Axis synchronization	Yes[3)]	–	–	–
Safety Integrated	Yes	Yes	–	–
Communication interfaces				
Digital/analog	Yes	Yes	Yes	Yes
Serial	Yes	Yes	Yes	Yes
PROFIBUS DP	Yes	Yes	Yes	Yes
PROFINET	Yes	Yes	Yes	Yes
CANopen	Yes	Yes	–	–
Commissioning, parameterization, diagnostics				
Via Operator Panel	Yes[4)]	Yes	–	–
With PG/PC (STARTER)	Yes	Yes	Yes	Yes
MMC card/CF card	Yes	Yes	Yes	Yes
Further information				
Catalog	D 21.1[4)]	D 21.3	D 12	D 12
Internet	www.siemens.com/sinamics-s120 www.siemens.com/sinamics-S120-cabinet-modules www.siemens.com/simotion www.siemens.com/sinumerik	www.siemens.com/sinamics-s150	www.siemens.com/sinamics-gm150	www.siemens.com/sinamics-sm150[4)]

	Medium voltage	
SINAMICS S150	*SINAMICS GM150*	*SINAMICS SM150*
		
The advanced drive solution for single drives with high output ratings	**The drive solution for variable-speed drives**	**The drive solution for demanding variable-speed single and multi-motor drives**
Main applications		
• Plants and machines in the process and production industry, food, beverages and tobacco, automotive and steel industry, mining/open-cast mining, shipbuilding, lifting equipment, conveyors	• Machines and plants in the process industry	• Machines and plants, e.g. in steel manufacture and mining
Application examples		
• Test bay drives • Centrifuges • Elevators and cranes • Cross cutters and shears • Conveyor belts • Presses • Cable winches	• Pumps and fans • Compressors • Extruders and mixers • Mills • Marine propulsion engines	• Rolling mills • Mine cages • Test bay drives • Conveyor belts
Benefits		
• Four-quadrant operation as standard • High level of control accuracy and dynamic response • Virtually no system perturbation, well below THD values in accordance with IEEE 519 • Tolerant to line voltage fluctuations • Option of reactive power compensation • Quick and easy commissioning • Ready-to-connect cabinet unit • Optimum interaction with SIMATIC	• Space-saving design • Quick and easy commissioning • Ready-to-connect cabinet unit • Optimum interaction with SIMATIC	• Four-quadrant operation as standard • High efficiency and motor-friendly operation • High level of control accuracy and dynamic response • Virtually no system perturbation • Option of reactive power compensation • Quick and easy commissioning • Ready-to-connect cabinet unit • Optimum interaction with SIMATIC

For further information on SINAMICS, visit:

www.siemens.com/sinamics

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