What makes the perfect CNC system?

SINUMERIK, the powerful CNC platform for machine tools

Answers for industry.
The SINUMERIK CNC control systems

SINUMERIK MDynamics technology packages

SINUMERIK Operate – the new CNC user interface for efficient machine operation

Definitely more than just more safety

SINAMICS S120: The flexible modular drive system

Powerful motors for all applications

Solutions for the control cabinet

Even more information about SINUMERIK CNC

Service and Support for machine tools

SINUMERIK – technical data overview
With SINUMERIK, Siemens places a consistent system platform for machine tool automation for different industries and technologies at your disposal. SINUMERIK follows this concept: one CNC system, multiple possibilities – from CNC control systems to drives and motors, through to entire control cabinets. SINUMERIK is simple to operate and offers many innovative functions and technology cycles for even more cost-efficient manufacturing. And the programming method is always the right one for your requirements – be it for small or large batch production, for simple or complex workpieces. SINUMERIK is a productive CNC system for every technology application.
A class of their own – the SINUMERIK CNC control systems

SINUMERIK is a consistent system platform for machine tool automation that offers cost-efficient solutions for all technologies and all industries.

The SINUMERIK system platform

The SINUMERIK system platform offers several versions for different machine tool requirements: the SINUMERIK 802D sl for standard turning and milling machines, the compact SINUMERIK 828D and the innovative SINUMERIK 840D sl CNC system for complex solutions.

SINUMERIK is ...

... efficient in terms of programming, installation, commissioning and design

... innovative in terms of NC functionality, communication, operation and openness

... consistent in terms of programming, operation, machine interfaces and motors

Efficient means:

• Fast programming through easy-to-use Editor, ShopMill, ShopTurn and programGUIDE

• Cost-efficient wiring thanks to Ethernet, e.g. through reduction of the cable drag chain

• Compact, integrated drive control for up to six axes in the NCU, modularly extendable, reduced height (−80 mm), flat control cabinet with reduced depth (−35 mm), modular system with synergies for large performance types and one-axis expansions

• Compensation of inductive or capacitive reactive currents, kinetic energy feedback into the network
Compact class CNC
SINUMERIK 828D

- Compact, strong and simple CNC system
- Compact panel CNC in horizontal and vertical operator panel layout
- Available in two performance versions
- Up to 8 axes/spindles in one processing channel
- 3 axes and 3+2 axes

Premium class CNC
SINUMERIK 840D sl

- Open, flexible and strong CNC system
- Modular, scalable universal CNC control system
- Available in three performance versions
- Up to 31 axes/spindles in 10 processing channels
- From 3 to 5 axes simultaneously

Innovative means:
- Perfect surface quality thanks to intelligent Advanced Surface path control
- More powerful communication via Ethernet
- SINAMICS S120 with DRIVE-CLiQ communication
- Modularization of the machine tools and integration with DRIVE-CLiQ
- Automatic topology detection through electronic name plates
- Platform-independent user interface
- Robust with intelligent monitoring
- Innovative SINUMERIK Operate CNC user interface
- SINUMERIK MDynamics technology packages for milling applications (three-axis/five-axis)

Consistent means:
- Reusable CNC part programs, compatible NCC functionality, reusable open architecture applications for NCC/HMI
- Identical operating philosophy
- Identical PLC, PCU, OP, PROFIBUS periphery, identical performance type range as the current system, identical motor and drive package ranges
- Commissioning via CNC drive assistant

Simple operation
The control components enable consistent operation and innovative solutions such as easy, robust and ergonomic operation with the HT 2 or the HT 8 handheld devices including teaching. Flexible operating solutions such as parallel tool loading or multiple terminal operation can be easily implemented.

Extremely energy-efficient
With SINUMERIK and the SINAMICS S120 drive system, we offer solutions with a high degree of energy efficiency, targeted energy management and general energy recovery. Additional energy-efficiency highlights include:
- Automatic reactive power compensation
- Reusable packaging – suitable for your production logistics
- Efficient heat dissipation types for drives and motors, optimally adapted to the machine environment
- SINUMERIK Thin Client concept for energy and space savings
SINUMERIK 802D sl – the CNC system for standard machines

SINUMERIK 802D sl is a compact CNC system, which combines NC, PLC and HMI in the operator panel. Up to five axes make it the ideal control system for standard turning and milling machines.

Easy application

The SINUMERIK 802D sl is easy to operate and program. Thanks to the proven DIN programming with comprehensive programming aids (cycles, contour calculator), the setup is based upon ShopMill/ShopTurn, as well as the use of standard Compact Flash (CF) cards for the storage, transfer and processing of part programs.
**Always robust**

The robust CNC system platform offers a high degree of flexibility when it comes to the placement of the components inside the machine – not least because the individual components of the control system, drive and periphery can be placed up to 100 m apart from each other.

**For international use**

SINAMICS S120 can be used in a wide range of operating and ambient conditions, and thus also in the so-called emerging nations. The system offers short-circuit proof power modules, intelligent monitoring and a power failure strategy using energy management. All types of networks (TN, IT) are supported.

**Standards with a guaranteed future**

SINUMERIK 802D sl is based upon proven standards – for example SIMATIC®, Ethernet, PROFIBUS and USB technology, which means that you are well-equipped for the future.

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**SINUMERIK 802D sl:**

- Simple operation and programming by DIN programming, cycle and contour definitions and ShopMill/ShopTurn based setup
- Easy setup of tools and workpieces
- Robust, dynamic and precise drive control
- Environmentally friendly and energy-efficient
- With a guaranteed future
The SINUMERIK 828D is a panel-based CNC system, tailor-made for turning and milling machine applications. It combines CNC, PLC, operation and an axis control for six CNC measuring circuits in a very compact unit that fits into every operator panel housing. Despite these compact dimensions, the SINUMERIK 828D is an absolute powerhouse which leaves nothing to be desired when it comes to functionality: CNC functions such as kinematic transformations or powerful tool management are already integrated.

Performance and functionality for a large number of uses

The SINUMERIK 828D is perfectly suited for vertical and simple horizontal milling machines that are typically found in job shops. The new Advanced Surface path control makes it the ideal solution for tool- and mold-making.

With its performance, the SINUMERIK 828D can control turning machines with up to 8 axes/spindles in one processing channel. The system is available in two performance versions, and can be optimally adapted to the performance requirements of the machine. Separate system software features for turning and milling offer the maximum number of presets for the machine. This reduces commissioning time to a minimum.
Durable

The operator panel front of the SINUMERIK 828D is made of highly durable magnesium die cast, which is also suitable for use in rough conditions. The mechanical keys of the CNC keyboard are covered by an embossed plastic layer and are optimally protected against humidity.

Compact and user-friendly

Thanks to its small dimensions, the SINUMERIK 828D can be installed in very compact operator panel housings. It still offers a high degree of operator convenience with a 10.4” color display and a full QWERTY keyboard.

Scalable

The SINUMERIK 828D is available in either horizontal or vertical operator panel layout, each with two performance versions. It can be optimally adapted to the mounting situation as well as to the performance requirements.

Low-maintenance

Without the fan or hard disk and without typical wearing of parts, the SINUMERIK 828D is very low-maintenance and easily serviceable. In addition, it does not require a battery, and through the use of NVRAM memories, there is no need for buffering.

Communicative

The SINUMERIK 828D is equipped with all modern communication interfaces: Compact Flash (CF) card, USB and a service interface are all available on the operator panel front – directly behind a cover, which can still be closed with the CF card inserted.

SINUMERIK 828D:

- Minimal space requirements
- Complete package – with 10.4” TFT, full QWERTY keyboard, USB, Ethernet etc.
- Low-maintenance – no battery, fan or hard disk
- 80-bit NANO® technology
- Intelligent Advanced Surface path control
- Fully graphical CNC and DIN programming
- User-friendly commissioning and extendability
- Production-status monitoring via text message (SMS)
- Graphical user support via moving image sequences and context-dependent online help
With the SINUMERIK 840D sl, we offer a universal and flexible CNC system in the SINAMICS S120 design for up to 31 axes. Decentralized, scalable, open, interlinking and with a wide range of functions, it can be used in practically every technology – and it sets benchmarks in dynamics, precision and its ability for network integration.

Open and flexible user interface and CNC

An essential feature of the SINUMERIK 840D sl: the decentralized and simplified system structure, fully integrated into the SINAMICS S120 design and communication structure. Hardware and software can be scaled separately. In connection with hubs, the drive-internal communication via DRIVE-CLiQ allows a clear reduction of the machine wiring efforts. Another plus is the highly flexible operating concept with Thin Client units. This consistent modularity allows the implementation of innovative and perfectly tailored machines. The CNC is also available in a PC-based SINUMERIK 840Di sl version.
For individual requirements

The SINUMERIK 840D sl is available in three performance versions (numerical control units). The numerical control extensions NX10/15 are optionally available for applications with a larger number of axes. Due to the openness in the HMI and NCC, your special knowledge, as well as images and software, can be optimally integrated – and machines as well as user interfaces can be tailored to your needs. Both embedded systems and Windows systems can be programmed in the same way. SINUMERIK 840D sl uses Ethernet for standard communication. The powerful PLC/PLC communication via PROFINET CBA offers flexible integration possibilities, operator stations can be added dynamically.

A dynamic team

The SINUMERIK 840D sl, in combination with the SINAMICS S120 drive system based upon the highly dynamic position control DSC (Dynamic Servo Control) and the use of innovative linear motors, offers even more dynamic force. Adaptive current regulators ensure maximum utilization of the servomotors. Machine resonances are suppressed through software filters and the intermediate circuit voltage of the Active Line module prevents voltage dips.

Our technological highlights

• Optimum path control
• Excellent synchronization due to low level torque ripple
• High-resolution actual position value (single-digit nanometer range)
• Measurement and compensation of geometrical errors also for rotational axes
• Volumetric compensation system “VCS plus”
• Three-axis/five-axis SINUMERIK MDynamics milling packages
• SINUMERIK Operate – modern user interface

SINUMERIK 840D sl:

• Open and flexible CNC and user interface
• Robust, dynamic and precise drive control
• Simple operation and programming
• Integrated certified safety functions for operators and machines (SINUMERIK Safety Integrated)
• Environmentally-friendly and energy-efficient
• Powerful, innovative and future-proof
SINUMERIK MDynamics – made for perfect milling

SINUMERIK MDynamics provides technology packages consisting of CNC hardware, intelligent CNC functions and CAD/CAM solutions for three- and five-axis milling machines for compact and premium class SINUMERIK control systems.

SINUMERIK MDynamics – SINUMERIK 828D compact class CNC control system for 3-axis/3+2-axis processing

The SINUMERIK 828D offers a technology package for three-axis milling machines and is able to perform every turning and milling operation imaginable. Naturally also with swiveled levels and cylindrical workpieces. The control system can be extended by additional functions.

SINUMERIK MDynamics – SINUMERIK 840D sl premium class CNC control system for 3-axis/3+2-axis as well as 5-axis processing

You can choose between two SINUMERIK MDynamics technology packages for the SINUMERIK 840D sl – one for three axes, one for five axes. Depending on the requirements, the packages can be expanded by additional functions.

Intelligent Advanced Surface path control

The new Advanced Surface path control is an essential part of the SINUMERIK MDynamics milling packages. When using Advanced Surface, the optimized “look ahead” function contributes to perfect surface quality through reproducible results in neighboring milling paths, accuracy and increased speed. The new optimized compressor provides exact contour accuracy and the highest possible processing speeds. The intelligent jerk limitation protects the machine mechanisms. In spite of all the dynamic force available, it provides soft acceleration and deceleration of the axes and thus extends the service life of the machine. An essential improvement is the automatic harmonization of the speed profiles on neighboring milling paths through the CNC. It also works during forward/backward line-by-line milling of contours and free-form surfaces and directly provides an improved surface quality – in other words: perfect workpiece surfaces.
### Detailed functions

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### Optional functions

- Spline interpolation
- Transmit and lateral surface transformation
- Automatic measurement cycles
- 3D-simulation
- Simultaneous recording
- ShopMill/ShopTurn workstep programming
- Residual material detection
- Extended processing functions

### NX CAM – SINUMERIK Advantage Program

- SINUMERIK MDynamics
- HMI functions
SINUMERIK Operate – the new CNC user interface

The new SINUMERIK control systems are even more user-friendly, thanks to the new, clearly-structured and intuitive user and programming interface called SINUMERIK Operate. It provides access to all functions for efficient operation and programming – via a consistent and innovative user and programming interface.

A high degree of operator convenience

Apart from its intuitive operation, SINUMERIK Operate also offers many new and powerful functions. This allows the connection of workstep and high-level language programming under one system interface – and thus a very fast, rational and intuitive NC programming and operational planning.

Identical look and feel for turning and milling

Intelligent HMI functions offer highly efficient support for the operator during daily operation. For example, screenshots can be created very easily – using the CTRL+P key combination. The optimum presentation in modern Windows style is also user-friendly. The interface also sets new standards with regard to graphical support. Animated Elements are a helpful function: they display each processing step as a graphically-animated simulation.
Extended setup functions

Machine setup is clearly visualized with graphical support.

Using Animated Elements, the SINUMERIK CNC system can offer one-of-a-kind programming that is easy-to-use – even for technology cycles.

Extended setup functions

Easy machine or workpiece setup thanks to a high number of measuring functions. This includes self-explanatory icons in all softkeys, which can be pre-configured as favorites. In addition, intelligent functions are available in JOG – for tool and workpiece measurements. And, in this case, for switching and non-switching measuring styluses as well.

Swiveling during setup

Easy and quick handling allows for the production of complex workpieces in one setting. Different kinematics can be easily set up. Swiveling is possible either by individual axis or directly, including optional coordinate rotation.
Programming the way you want it

**ShopMill/ShopTurn workstep programming**

ShopMill and ShopTurn workstep programming is the tailor-made programming solution for the production of individual parts and small batch sizes. In addition to programGUIDE, ShopMill/ShopTurn also offer unique step sequence programming for extremely short programming times.
- Clear display of processing steps without G-code knowledge
- Simple interlinking of technology functions with geometric elements
- Dynamic display of the workpiece during programming

**Functions:**
- User-friendly feature with a graphical process step editor
- Perfect input assistance using Animated Elements
- Dynamic line graph for complete workpiece and cycle screens
- Large selection of standard drilling, milling and turning cycles
- Geometric calculator simplifies the inputting of workpieces
- Cycles for outline milling and turning with residual material detection
- High-performance 3-D CNC simulation

**SINUMERIK high-level language with programGUIDE**

The SINUMERIK high-level language with programGUIDE was developed for maximum flexibility and short development times – and it is perfect for medium to large batch sizes. programGUIDE ensures an extremely high degree of productivity and programming flexibility, combined with innovative technology and processing cycles.
- CNC language with high-level programming commands
- programGUIDE with graphical cycle support images including Tooltip (context-based short information)
- Online ISO Dialect Interpreter available

**Functions:**
- Fully flexible ASCII editor for CNC high-level language commands
- Perfect input assistance using Animated Elements
- Dynamic line graph for cycle screens
- Large selection of standard drilling, milling and turning cycles
- Geometric calculator simplifies the inputting of workpieces
- Cycles for outline milling and turning with residual material detection
- High-performance 3-D CNC simulation
Efficient operation thanks to Animated Elements and modern tool and program management

Parameters which are entered into a CNC system every day affect the movements of the machine. These can only be displayed to a limited extent with static auxiliary images. For this reason, SINUMERIK offers a completely new level of convenience in input assistance with Animated Elements. This fully redefines the concept of graphical programming and operation, thanks to its unique display using moving image sequences. Support also offers clear tool and program management.

Safe setup and programming

How can the workpiece’s zero point be determined using a circular spigot? In what order must the stylus be positioned and how does the CNC system withdraw the stylus? All of this is very easy with Animated Elements: A short moving-image sequence shows the progress of the stylus movement. You can also see the exemplary movement sequence, for example with helical immersion into a milling pocket. Or when differentiating between complete chip removal and chip breaking in deep-hole drilling. A static auxiliary image would only provide a number of arrows here, which would be difficult to interpret.

Tool and program management made easy

SINUMERIK offers a modern and clear system of tool and program management. The tools list has a configurable display and can be intuitively operated and displayed using context-dependent functions and self-explanatory icons – for efficient management of tool data. The innovative program management allows workpiece sub-folders to be created on local drives and directly accessed on external data media. The user benefits from a fast program check, convenient data transfer and simple program handling.
Technology cycles: Designed for every type of programming

Circular pockets, thread undercuts, deep-hole drilling and much more: SINUMERIK offers a unique spectrum of technology cycles for standard geometries, including engraving cycles. Allocation to processing positions is carried out simply, using a wide range of ready-to-use position patterns. This is also beneficial for the front and lateral surface of turned workpieces or in swiveled levels, as in the case of milled workpieces.

SINUMERIK also makes it easier to program counter-spindles: an ingenious ShopTurn cycle makes management of the counter-spindles possible without CNC voice commands. Programming of angular surfaces is also no problem. The integrated swiveling cycle allows the processing surface to be rotated as desired, without CAD or a calculator. With our innovative SINUMERIK system platform, long-lasting workpiece precision during processing is guaranteed by a comprehensive range of measuring cycles.
Innovative measuring cycles and workpiece simulation

With a comprehensive range of practical cycles, SINUMERIK offers graphical support in measuring workpieces/tools and with the process kinematics. In addition, our system platform’s five-axis workpiece simulation offers more security and control options when programming workpieces.

Innovative measuring cycles for workpiece and tool measurement in automatic operation

The SINUMERIK measuring cycles safeguard the quality of the parts being produced via automatic measurement on the machine.
- High-performance cycles for automatic tool and workpiece measurement
- Automatic measuring cycle in programGUIDE and ShopMill/ShopTurn
- Input screens with graphical support and automatic recording of measurement results

Innovative measuring cycles with kinematics measurement – CYCLE996 (for SINUMERIK 840D sl)

CYCLE996 (kinematics measurement) was developed for the measurement of multi-axis kinematics. It is easy to operate and does not require any expensive measuring equipment. The calibrating ball is scanned using a 3-D measuring stylus and the “Kinematics measurement” cycle in three ball positions. The cycle can be accessed directly from the NC program. In comparison to conventional measurement, CYCLE996 allows enormous time-savings whilst maintaining extremely precise measurement.

CNC simulation: workpiece simulation for multi-side processing

The 3-D simulation with three-level view and a volume model of the finished component, including simultaneous recording in automatic mode, also ensures increased security. Input of the unmachined parts is also possible. Simulation speed can be controlled via softkeys. SINUMERIK also offers optimum assistance and security in programming for five-axis workpieces – even during parallel processing with SINUMERIK 840D sl. The large number of different workpiece views in the simulation means that programming can be checked immediately. In addition, individual zooming is possible and cuts can be laid out – even with swiveled levels and in five-axis simultaneous processing with SINUMERIK 840D sl.
Multi-channel operation and complete processing with SINUMERIK

SINUMERIK supports multi-tasking machines when processing workpieces in one process step. New functions for complete processing are already being prepared.

A user-friendly solution for multi-channel machines

SINUMERIK’s numerous functions for easy operation include display via the dual editor, which shows a two-channel basic configuration. In milling processes, the second channel can be used to control and visualize handling modules or tool changes, for example – for even greater flexibility and cost-efficiency in production. With the programSYNC option, multi-channel processes can be synchronized quickly and easily. The simulation allows excellent visualization of multi-channel processing via SINUMERIK 840D sl. This allows multi-channel processes to be programmed with even greater efficiency:

• Create part program structures
• Fill individual process steps (blocks)
• Simulate part programs
• Apply part programs (by channel or by spindle)

Complete processing with SINUMERIK

SINUMERIK also supports complete processing within the framework of multi-channel machine processing. It provides all the functions needed for the processing of components in one processing center – even when switching between different technologies.
Definitely more than just more safety

When it comes to safety, SINUMERIK makes no compromises. SINUMERIK Safety Integrated is a comprehensive safety package for the protection of people and machines – extremely efficient and economical thanks to the complete integration of the safety functions into the control and drive technology. However, your data will be reliably protected, too.

Well thought-out safety concept

With SINUMERIK Safety Integrated, your machine can be operated safely – and in every operating condition – e.g. in setup and test mode when the protective door is open. The safety functions fulfill the requirements of Safety Integrity Level SIL 2 of IEC 61508 and of Performance Level PL d according to EN ISO 13849. The essential requirements of functional safety can thus be implemented – simply and economically.

- Functions for safe monitoring of speed and standstill
- Functions for safe delimitation of work space and protective space and for zone recognition
- Direct connection of all safety-relevant signals and their internal logical links

Reliable data protection

Your data is also permanently protected: the high-level, complete safety of NC hardware and software guarantees protection and long-term stability in your production. The “tougher” PC controller hardware (PCU) is based on a type-tested, standardized IT security configuration. Even in advance, intelligent components, particularly control systems, are subjected to simulated attacks and to a weak-point analysis in order to test the system design and find possible gaps in IT security. The result: Windows XP-based PCUs, configured as a type-tested, high-security workstation. Together with the newest virus scanners and an activated and optimally-configured firewall, SINUMERIK provides reliable protection.

Immune to attacks

SINUMERIK 840D sl’s “tougher” NC software is based on Embedded LINUX. The NCU’s operating system in SINUMERIK is immunized by the toughening process – for complete protection against malware which can endanger Windows systems. In addition, a firewall in the system kernel with optimized and pre-configured package filters allows the CNC to be used as a firewall to shield the entire communications network behind it.
SINAMICS S120 – the flexible, modular drive system for sophisticated tasks

The SINAMICS S120 drive system offers the perfect solution platform for high-performance applications in industrial machine and system engineering: a modular system that allows a very high degree of flexibility. Its multiple, coordinated components and functions allow tailor-made solutions to be implemented which are individually-designed for the respective area of application.

The modular SINAMICS system is the optimum basis for the implementation of individual solutions – efficient, innovative and consistent.
Efficient means:

- Integrated drive control for up to six axes in the NCU, modularly extendable up to the NCU’s maximum number of axes
- Compensation of inductive of capacitive reactive currents
- Compact with a flat control cabinet thanks to its low height
- Modular system with synergies for large performance types and axis extensions
- Kinetic energy feedback into the network
- Multi-axis concept allows energy compensation in the intermediate circuit

Innovative means:

- Flexible and modularly-configurable drive system
- Modularization of machine tools and integration with DRIVE-CLiQ
- Easy-to-configure and scale in performance, current and number of axes
- Robust thanks to intelligent monitoring
- Automatic topology detection via electronic type plates
- Line module with network feedback

Consistent means:

- Comprehensive range of performance types
- Comprehensive range of motors and network interface
- Commissioning via CNC drive assistant
SINAMICS S120 – dynamic and precise in all applications

Reliable
The numerous intelligent protection functions of SINAMICS S120 ensure optimum availability of the system. All performance models are proof against short circuits, ground faults and overvoltage. An intelligent combination of sensors and calculating algorithms monitors the temperature of the power units and thus prevents thermal overloads.

Compact and clear
Thanks to its compact design, SINAMICS S120 can even be mounted in the smallest control cabinets. All connections are easily accessible and thereby reducing installation effort. Data and power lines are strictly separated. Thanks to DRIVE-CLiQ, CNC, drive and motors communicate with one and the same data protocol. This means that you can connect all components with a single cable type.

Automatic configuration
With DRIVE-CLiQ, SINAMICS S120 is equipped with an optimum data highway. The components of the SINAMICS S120 drive control, which is integrated into the SINUMERIK, are automatically detected via the electronic type plates – for fast and safe commissioning. SINAMICS automatically detects the drive configuration when drive components are subsequently added – simple plug-and-play.

Top-level dynamics
With Dynamic Servo Control (DSC), SINAMICS S120 offers a unique position control system for top-level dynamics in spindles and feed motors. An adaptive current regulator helps to make optimum use of the motors’ performance. The productivity of your machine increases dramatically thanks to the acceleration values which this allows. The SINAMICS S120 Active Line modules keep the intermediate circuit voltage constant – even with fluctuating network voltages. Spindle start-up time can be considerably reduced and machine productivity increased even further.
Perfect surface quality

SINAMICS S120 contributes to perfect workpiece quality. With intelligent filter functions in the control system, integral resonances in the machine can be almost completely suppressed. This, together with the high-precision three-phase recording of actual current values, makes perfect workpiece surfaces possible. A high-resolution recording of actual position values in the nanometer range provides high-precision contour processing. This guarantees mirror-smooth workpiece surfaces.

Flexible network connection

SINAMICS S120 is designed for the connection to networks in the voltage range of 380V to 480V, and thus already covers 70% of voltage levels used globally as standard.

Energy efficiency

SINAMICS S120 saves energy thanks to its multi-axial concept and energy feedback with the SMART Line and Active Line modules. No unnecessary heat is produced in the control cabinet – even up to maximum infeed power. Through intelligent compensation of capacitive and inductive reactive currents, SINAMICS S120 also ensures that neither unnecessary energy losses in the network supply, nor current harmonics occur. This prevents not only negative influences on other power consumers, but it also reduces heat development in the control cabinet even further.

Optimal heat dissipation solutions for the power electronics

The power modules in booksize format are available with three types of heat dissipation:

- Internal air cooling: heat from power loss in the power unit is dissipated in the control cabinet.
- External air cooling: heat from power loss in the power unit is dissipated via a heat sink which runs through the mounting plate – in a separate heat dissipation chimney or outside the control cabinet.
- Cold plate cooling: power loss in the power unit is dissipated via a fluid heat sink.

Type range according to dimensions

Motor modules in booksize format

Internal/external and cold plate cooling, 3A to 200A

Motor modules in chassis format

Internal air cooling, 210A to 490A

Uniaxial drives in blocksize format

Internal air cooling, 1.3A to 178A

Motor modules in booksize format

Internal/external and cold plate cooling, 3A to 200A

Motor modules in chassis format

Internal air cooling, 210A to 490A

Uniaxial drives in blocksize format

Internal air cooling, 1.3A to 178A
Powerful motors for every application

Whether it be high standstill torques or nominal power, high maximum speeds or dynamics, air or water cooling: our comprehensive range of motors offers the right type for every drive application, in a wide performance range. This includes synchronous and asynchronous servomotors and highly innovative linear or rotatory direct drives.

1FK7 servomotors for standard applications

With their extended torque of up to 150 Nm and a high degree of protection, the universally applicable 1FK7 motors cover a wide range of applications. Their standstill torques range from 0.18 Nm to 48 Nm, and their nominal speeds between 2,000 and 6,000 rpm. Three motor versions are available, each with the best ratio of torque to rotor inertia.

• 1FK7 High Dynamic is capable of extremely fast acceleration thanks to its very low rotor inertia.
• 1FK7 Compact is suitable for a wide range of applications thanks to its balanced ratio of torque to intrinsic inertia.
• 1FK7 High Inertia provides robust control properties even with high and variable load inertia.

1FT7 servomotors for high-performance applications

With their excellent concentricity properties, the new 1FT7 synchronous servomotors are suitable for use in the demanding applications found in modern machine tool building. They cover nominal speeds of 1,500 to 6,000 rpm and standstill torques of 2 to 120 Nm. They are also very compact and are equipped with a newly-developed transmitter coupling which provides the transmitter with a high degree of protection against impact loads. The 1FT7 motors are equipped with a cross profile which allows easy installation, even from the rear side. At the same time, a rotatable plug with quick locking mechanism simplifies connection – for shorter installation and maintenance times.
Our torque motors are perfectly suited to rotational axes with very high torque, and can be integrated directly into the machine. They work with the highest degree of precision and dynamics, since elasticity and slackness in the powertrain are avoided and the overall mass and friction forces are minimized. They are also distinguished by their high availability, since they can function without transmission elements which are subject to wear. A further advantage: thanks to their compact design and low number of components, they only require minimal space. The 1FW6 torque motor is the first choice for use in rotary transfer machines, turntables, pivot and round axes, spindle machines, dynamic tool magazines and rotating spindles in milling machines. The torque motors provide torques of up to 8,570 Nm.
Main spindle motors for high-performance applications in machine tools

Whether belt drives, hollow shaft motors, built-in motors or integrated motor spindles, main spindles in turning, milling and grinding machines can be driven in multiple ways. The main spindle drive provides high cutting ability, production precision and availability and is thus a major factor in the machine’s productivity.

Dynamic power packs for main drives

1PH8 motor series

The 1PH8 series offers compact asynchronous motors with squirrel-cage rotors with IP55/IP65 degree of protection. They extend the performance range of the proven 1PH/1PM series and provide the correct version for every application. Available with air blast or water cooling, with solid or hollow shaft and with a very wide range of storage concepts and various transmitter types for speed control and high-precision positioning operation. Further features of this motor type: excellent performance and vibration quality, concentricity quality up to 10 µm, high dynamics (short start-up times), maximum speeds of up to 20,000 rpm. They really come into their own when extreme ambient conditions such as high temperatures, dust, dirt or aggressive atmospheric conditions make air cooling impossible – and in processes where the environment does not permit any negative thermal influences.
Built-in motors with asynchronous technology

**1PH2 motors for direct drives**

1PH2 built-in motors are fluid-cooled, three-phase asynchronous motors. They are used in cases where compact construction means that the motor has to be integrated directly into the machine. The workpiece is processed with the highest level of precision and without the influences of lateral forces from the drive thanks to the quiet, precise spindle movement, even at very low speeds. Their performance range covers 7.5 to 30.9 kW.

Built-in motors with synchronous technology

**Synchronous main spindle motors: highly dynamic and extremely compact**

1FE1 built-in motors are compact, water-cooled synchronous motors which are supplied as stator and rotor components. They provide maximum speeds of up to 40,000 rpm and performance of up to 104 kW (S1 operation) and are available in high-torque and high-speed versions. Permanently energized (PE) motor spindles increase the power density and cost-efficiency of CNC machines. They are used when extremely short start-up times are required, but at the same time, extremely high requirements are placed on processing quality, precision and sound.

Motor spindles with a high level of control dynamics

The advantages of motor spindles: rigid, compact design, extremely high power density and reduced overall mass and friction forces. They function without additional transmission elements such as belts and gears. This allows extremely short processing times and a high level of control dynamics. Thanks to the measurement value recording of spindle position and spindle speed, they provide a high level of precision in production. The following series are offered in our portfolio:

- Standardized motor spindles for milling machines – for use in vertical and horizontal machine concepts
- Motor spindles for milling, drilling, turning and grinding technologies
- Motor spindles which we specially develop according to individual customer specifications
Solutions for the control cabinet

Today, modern automation without flexible, decentralized solutions is unimaginable – solutions which are tailor-made for your requirements and lead to significant cost-savings. In addition to economical CNC and drive systems, Siemens offers a complete range of solutions for control cabinet construction – from consultation and development through to the construction of the equipment, delivery and commissioning support.

Experts in control cabinet construction

Control cabinets are produced to a high industrial standard in the WKC in Chemnitz. Work includes collision testing in 3-D design layout and automated pre-production and component testing. Our customers are supplied with complete modules, including switching components, cable harnesses, pneumatic and hydraulic components, and are taken care of by order processing centers and production teams with permanent customer allocation. Customer-specific logistics models, flexible production capacities and production areas, as well as change management in all process phases, ensure the highest degree of flexibility.

Learning through engineering

We provide our customers with advice in the standard layout and conception for drive technology, control system, operation and safety. We configure, carry out design-to-cost projects and change customer documents to UL or new technologies, as required. In addition, we also provide support in the selection and optimization of suitable control cabinet air-conditioning. Besides calculations and simulations, we also use measurement checks with load simulation in our own heat laboratory during this process.

Tip: control cabinet certification

As your partner, we also recommend having your control cabinet certified – in order to certify quality and to ensure the productivity of your machine or system. Further advantages: benefits for repair and service contracts, minimized downtime and reduced spare part requirements. We offer certifications both for individual control cabinets and series control cabinets, during control cabinet construction in the factory and on-site.
Solutions in the control cabinet

SIMATIC ET 200S provides a multi-functional and highly modular periphery system with IP20 degree of protection which can be precisely adapted to the automation task. Its robust design means that it can also be used under greater mechanical loads. It is connected to bus systems via various interface modules (IM). With an integrated CPU, these transfer the computing power of an S7-300 CPU directly into the peripheral device. They remove the burden from the central control system and allow rapid reactions to time-critical signals. Interface modules with an integrated CPU and connection to PROFINET are available. Decentralized automation solutions often include not only digital and analog signals, but they also require technological functions, motor starters, frequency converters or pneumatic connections. The ET 200S offers a comprehensive range of modules to fulfill these requirements.

Solutions without a control cabinet

SIMATIC ET 200pro, the particularly small, but highly robust and high-performance periphery system with IP65/66/67 degree of protection, does not require a control cabinet and can be mounted directly onto the machine. Its modular, time-saving design allows flexible implementation of customer-specific, decentralized automation solutions. ET 200pro can be connected to PROFIBUS and PROFINET.
As part of the SINUMERIK system platform, we provide more than first-class systems and solutions for a range of different requirements. We provide comprehensive and expert support with every task that arises from equipping machine tools.

Global technology expertise: Technology and Application Centers

Our Technology and Application Centers (TAC) are important information platforms and meeting points for machine tool manufacturers and end-users. Here we have the opportunity to demonstrate our systems, solutions and services through training courses and events for our customers and partners. For more information, visit www.siemens.com/cnc4you.

SinuTrain: Practical CNC training

SinuTrain offers a practical training system for the SINUMERIK CNC system. In addition to the classic range of courses and seminars, this also includes additional services such as online training modules, learning software and specialist literature. We provide everything you need for successful learning, practical and perfectly tailored to suit the varying training levels: from basic training and programming and operation, right through to professional training. For more information, visit www.siemens.com/sinutrain.

Documentation through the click of a mouse

Absolutely unique: with DOConWEB, you can research documentation online – with full text search, index search or via the tables of contents. Besides this, you can quickly and easily put together individual documentation that is needed. For more information, visit www.siemens.com/automation/doconweb.
Service and Support for machine tools

Whether you need a service technician, a consultation expert or a replacement part: Siemens provides the right support throughout the entire lifecycle of your machine or system. Our on-site services and the fast, cost-effective provision of spare parts and global repair are one of the main pillars of ensuring high availability of machines and systems. With our field service, we provide the full range of commissioning and maintenance services, from fault correction to replacement parts.

You can also use these in your production

- Spare part delivery
- Replacement and repair of components
- Checking/diagnosis of components
- Component upgrade service
- General overhauling of components

Ask your regional service representative about our services.

Service and Support – the benefits at a glance:

- Available 24-hours a day, 365-days a year
- Specialists are available locally around the world
- Spare parts, including low-cost replacement parts, are readily available

Technical Support:

Europe: Germany +49 180 5050 222
America: USA +1 800 879 8079,
Asia: China +86 1064 719 990

www.siemens.de/automation/service&support
www.siemens.com/automation/service&support
# Technical data overview

<table>
<thead>
<tr>
<th>Configuration</th>
<th>802D sl</th>
<th>828D</th>
<th>840D sl</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design</strong></td>
<td>Panel</td>
<td>Panel</td>
<td>Drive</td>
</tr>
<tr>
<td>Axes/spindles, up to</td>
<td>4+1</td>
<td>6(M), 8(T)</td>
<td>31</td>
</tr>
<tr>
<td>Channels, up to</td>
<td>1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Operating mode groups, up to</td>
<td>1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>CNC user memories, up to</td>
<td>3 Mbyte</td>
<td>5 Mbyte</td>
<td>15 Mbyte</td>
</tr>
<tr>
<td>User memory on hard disk of PCU 50.3</td>
<td>–</td>
<td>–</td>
<td>12 Gbyte</td>
</tr>
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<table>
<thead>
<tr>
<th>Control components</th>
<th>10”</th>
<th>10”</th>
<th>7.5”/10”/12”/15”</th>
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</thead>
<tbody>
<tr>
<td>Operator panel fronts, TFT display</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Operator panel fronts, TFT touch display</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Machine control panels/handheld operating devices/hand wheels</td>
<td>O / O / O</td>
<td>O / O / O</td>
<td>O / O / O</td>
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<table>
<thead>
<tr>
<th>Axis functions</th>
<th>●</th>
<th>●</th>
<th>●</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration with jerk limitation</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Running with fixed stop/with Force Control</td>
<td>● / –</td>
<td>● / O</td>
<td>● / O</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spindle functions</th>
<th>●</th>
<th>●</th>
<th>●</th>
</tr>
</thead>
<tbody>
<tr>
<td>Various thread-cutting functions</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Oriented spindle stop</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Flying synchronization of axes</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Interpolations</th>
<th>●</th>
<th>●</th>
<th>●</th>
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</thead>
<tbody>
<tr>
<td>80-bit NANO® technology (floating point accuracy)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Interpolating axes, up to</td>
<td>4</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>NURBS (non-uniform rational B-splines) universal interpolator</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>3-axis compressor/5-axis compressor</td>
<td>● / –</td>
<td>● / –</td>
<td>● / ●</td>
</tr>
<tr>
<td>Spline interpolation</td>
<td>●</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Advanced Surface</td>
<td>–</td>
<td>●</td>
<td>O</td>
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</table>

<table>
<thead>
<tr>
<th>Couplings</th>
<th>●</th>
<th>●</th>
<th>●</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupled motion of axes</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Angular axes</td>
<td>●*</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Synchronous spindles/multi-sided cutting (CP Basic/Static)</td>
<td>–</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Synchronized axis pair (Gantry axes)</td>
<td>–</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Guide value coupling/curve table interpolation (CP Basic/Comfort/Expert)</td>
<td>–</td>
<td>–</td>
<td>O</td>
</tr>
<tr>
<td>Electronic gears (with curve tables, with cascading) (CP Expert)</td>
<td>–</td>
<td>–</td>
<td>O</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transformations</th>
<th>●</th>
<th>O</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmit and lateral surface transformation (e.g. parallel groove wall)</td>
<td>●</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Transformations for machine-specific kinematics</td>
<td>–</td>
<td>–</td>
<td>O</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement functions/measurement cycles</th>
<th>●</th>
<th>●</th>
<th>●</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring in setup mode</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Measurement cycles/recording of measurement results</td>
<td>– / –</td>
<td>O / O</td>
<td>O / O</td>
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</table>

<table>
<thead>
<tr>
<th>Motion synchronizations</th>
<th>●</th>
<th>●</th>
<th>●</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asynchronous sub-programs</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Synchronous actions and fast output of auxiliary functions incl. 3 synchronous functions</td>
<td>–</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Positioning of axes and spindles via synchronous actions</td>
<td>–</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

- ● Standard (basic scope of supply)
- ○ CNC option – not available
- ●* not available in all versions
<table>
<thead>
<tr>
<th>Feature</th>
<th>802D sl</th>
<th>828D</th>
<th>840D sl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming language (DIN 66025 and high-level language extension)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Online ISO Dialect Interpreter</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Technological cycles for drilling/milling and turning</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Programming support for geometry and cycles (programGUIDE)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Programming support with &quot;Animated Elements&quot;</td>
<td>–</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ShopMill/ShopTurn Manual Machine/workstep programming</td>
<td>● / –</td>
<td>– / O</td>
<td>– / O</td>
</tr>
<tr>
<td>Simulation for turning and milling with surface display</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Simulation in 3-D display</td>
<td>–</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Simultaneous recording (real-time simulation of the current processing)</td>
<td>–</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Tools</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tool management/tool monitoring</td>
<td>– / ●</td>
<td>● / ●</td>
<td>● / ●</td>
</tr>
<tr>
<td>Tool management functions (TDI)</td>
<td>–</td>
<td>–</td>
<td>O</td>
</tr>
<tr>
<td>Communication/data management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data storage Compact Flash (CF) card/USB device</td>
<td>● / ●</td>
<td>● / ●</td>
<td>O / ●</td>
</tr>
<tr>
<td>Network drive management (Ethernet)</td>
<td>●*</td>
<td>O</td>
<td>●</td>
</tr>
<tr>
<td>Data storage PCU hard drive</td>
<td>–</td>
<td>–</td>
<td>O</td>
</tr>
<tr>
<td>Operation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extended operating functions for complex turning and milling work</td>
<td>–</td>
<td>O</td>
<td>●</td>
</tr>
<tr>
<td>Several operator panels on one CNC</td>
<td>–</td>
<td>–</td>
<td>●</td>
</tr>
<tr>
<td>Compensation</td>
<td></td>
<td></td>
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<tr>
<td>Temperature compensation</td>
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<tr>
<td>Sag compensation</td>
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<tr>
<td>Volumetric compensation system (VCS plus)</td>
<td>–</td>
<td>–</td>
<td>O</td>
</tr>
<tr>
<td>Vibration damper (VIBX vibration extinction)</td>
<td>–</td>
<td>–</td>
<td>O</td>
</tr>
<tr>
<td>Open architecture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy configuration of user images/Easy Screen</td>
<td>● / –</td>
<td>● / ●</td>
<td>● / ●</td>
</tr>
<tr>
<td>Integration of images, software and technological knowledge</td>
<td>–</td>
<td>–</td>
<td>O</td>
</tr>
<tr>
<td>PLC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated SIMATIC PLC</td>
<td>S7-200</td>
<td>S7-200</td>
<td>S7-300</td>
</tr>
<tr>
<td>Maximum PLC memory in KB/Instructions</td>
<td>– / 6,000</td>
<td>– / 24,000</td>
<td>1,536 / –</td>
</tr>
<tr>
<td>Typical processing time in ms/KA</td>
<td>0.1</td>
<td>0.02</td>
<td>0.01</td>
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<tr>
<td>Decentralized periphery via PROFINET DP/PROFINET</td>
<td>O / –</td>
<td>– / –</td>
<td>O / O</td>
</tr>
<tr>
<td>Safety functions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety Integrated (Safe Torque Off, Safe Brake Control, Safe Stop 1)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>SINUMERIK Safety Integrated</td>
<td>–</td>
<td>–</td>
<td>O</td>
</tr>
<tr>
<td>Commissioning functions</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Auto Servo Tuning (AST) automatic speed and position control optimization</td>
<td>–</td>
<td>●</td>
<td>●</td>
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<tr>
<td>Diagnostic functions</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Alarms and signals</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Remote diagnosis</td>
<td>O</td>
<td>O</td>
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</tr>
</tbody>
</table>
Further information

Everything you want to know about SINUMERIK CNC systems:
www.siemens.com/sinumerik

Everything having to do with job shop production:
www.siemens.com/cnc4you

Everything about the SINUMERIK Manufacturing Excellence service portfolio:
www.siemens.com/sinumerik/manufacturing-excellence

Information about CNC training:
www.siemens.com/sinumerik/training