

SIEMENS



SINUMERIK 840D sl

Open, flexible, powerful — the premium CNC platform for machine tools

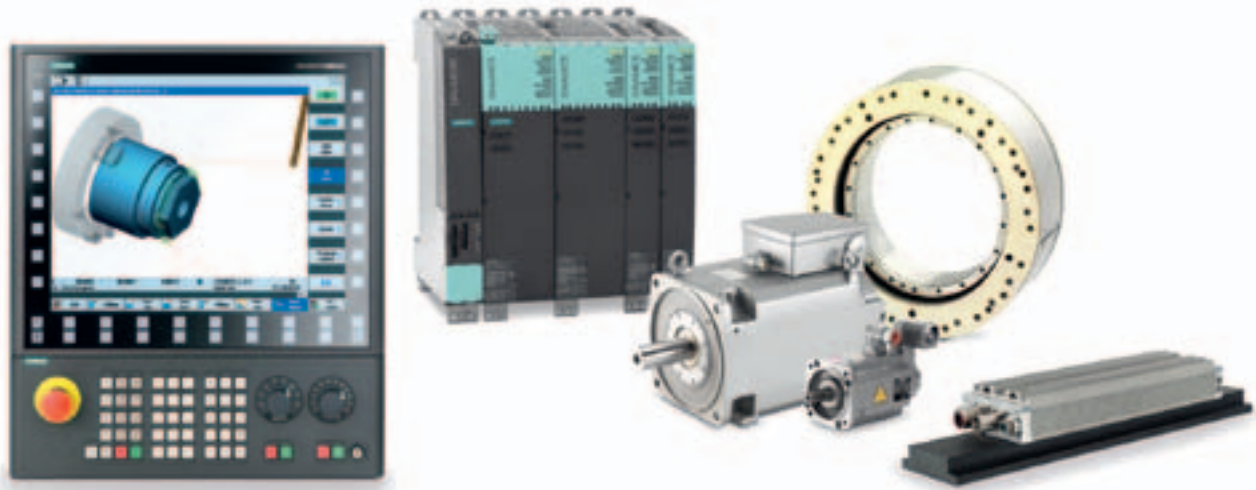
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SINUMERIK 840D sl — open, flexible, powerful



SINUMERIK® 840D sl provides an open, flexible and powerful CNC system with the SINAMICS S120 design for up to 93 axes. With characteristics that describe it as decentralized, scalable, open, inter-connectable and with a wide range of functionality, the SINUMERIK 840D sl is suitable for use in almost every machining technology and it sets the standard in dynamics, precision and network integration. The SINUMERIK 840D sl offers you uniformity in its programming, operation and machining cycles. With its efficiency in programming, installation and commissioning, this CNC system platform is characterized by its optimum design, innovative NC functionality, communication and openness. The SINUMERIK 840D sl, available in several performance variants, can be perfectly customized to the practically every machine and machining technology in the manufacturing industry.

SINUMERIK 840D sl — powerful system with impressive innovation

The SINUMERIK 840D sl CNC is the ideal control for every machining technology — no matter if it's milling, turning, grinding or even used on multi-tasking machines.



Milling



Turning

Simply innovative

Once again, the SINUMERIK 840D sl proves its innovative power with new, high-performance milling and turning functions, the shortest-possible machining times coupled with excellent surface finish and an ideal integration of the turn-milling and mill-turning applications. It is the premium CNC system for multitasking machines. Several performance variants provide even more flexibility and openness so that you can configure your machine as needed. The modern SINUMERIK Operate graphical user interface permits simple and efficient operation on multi-channel machines and programSYNC allows multi-channel machining operations to be synchronized easily and efficiently. Through the use of simulation, the SINUMERIK 840D sl makes visualization of multichannel machining easy. For example, handling modules or tool changes can be controlled, programmed and visualized in another channel. This provides even more flexibility and economics throughout the manufacturing process.

Versatile

The SINUMERIK 840D sl system platform provides comprehensive machine tool capabilities and innovative functionality for every machining technology. The CNC can be deployed around the world in a variety of machining applications, such as milling, turning, drilling, grinding, laser-cutting, nibbling, stamping, as well as in multi-tasking machines, namely, mill-turning and turn-milling. The SINUMERIK 840D sl is the ideal CNC for tool- and mold-making, high-speed-cutting applications, wood and glass processing, composite machining, medical part and power generation manufacturing, and not to mention the handling in transfer lines, rotary indexing machines and shop-floor manufacturing.



Grinding



Multi-tasking



Laser machining



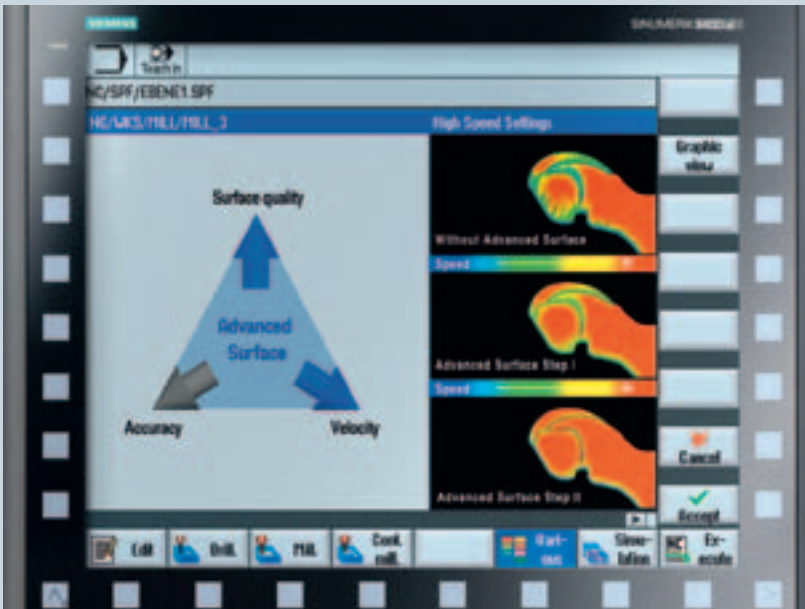
SINUMERIK 840D sl BASIC
The entry in the modular and flexible premium class for machines with a maximum of 6 axes.

SINUMERIK 840D sl

- Type 1A**
The proven, modular and scalable system platform for as many as 31 NC axes.
- Type 1B**
The new performance class of the SINUMERIK 840D sl with increased performance for as many as 93 NC axes.



SINUMERIK MDynamics — milling expertise in a technology package

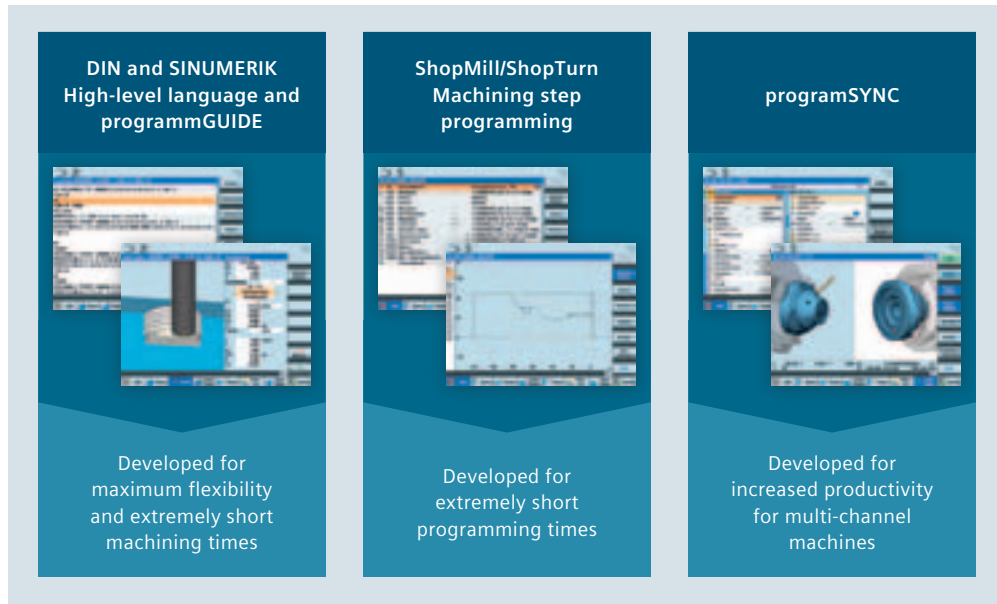


SINUMERIK MDynamics provides technology packages that consists of CNC hardware, intelligent CNC functions and CAD/CAM solutions for three and five-axis milling machines.

Surface finishes that are perfect immediately
Irrespective of whether precise machining, perfect surface finishes or high process reliability — milling during high-speed cutting places high demands on the entire process chain. To achieve this, we have bundled our complete milling expertise in the SINUMERIK MDynamics technology packages for three- and five-axis milling, including the innovative Advanced Surface motion control for perfect workpiece surface finishes. This ensures the best technological expertise in every manufacturing industry that demands high precision, quality and speed. And this all coupled with ease-of-operation and a complete CAD/CAM/CNC process chain — SINUMERIK is the right choice.

SINUMERIK MDynamics — function scope		
SINUMERIK 840D sl		
3-axis / 3+2-axis machining		5-axis machining
The functions contained in the package	<ul style="list-style-type: none"> Advanced Surface Save user data on Compact Flash (CF) card Spline interpolation Transmit and peripheral surface transformation Automatic measuring cycles Simultaneous recording of 3D simulation ShopMill/ShopTurn Machining step programming Residual material detection 	<ul style="list-style-type: none"> Advanced Surface Save user data on Compact Flash (CF) card Spline interpolation Transmit and peripheral surface transformation Automatic measuring cycles Simultaneous recording of 3D simulation ShopMill/ShopTurn Machining step programming Residual material detection 5 axes machining package 3D tool radius correction Kinematic measuring
	<ul style="list-style-type: none"> Kinematic measuring Volumetric compensation system (VCS) 	<ul style="list-style-type: none"> Volumetric compensation system (VCS)

SINUMERIK Operate — the innovative graphical user interface for efficient machine operation



The SINUMERIK Operate graphical user interface clearly and intuitively combines every function needed for the operation and programming of a CNC machine. It provides a consistent look-and-feel and offers you the same usability for every technology — even when a switch is made between different technologies, such as multi-tasking machines.

Programming has never been so easy

The SINUMERIK Operate graphical user interface has many new powerful functions. This permits the combination of machining step and high-level language programming under a single system user interface — it allows for very fast, rational and intuitive NC programming and job preparation.

Flexible and fast

G-code programming with cycle support is combined in programGUIDE. This ensures maximum flexibility and short machining times and is ideally suited for mid- to large batch sizes. SINUMERIK CNC also supports ISO code programming. The ShopMill and ShopTurn machining step programming is the tailored programming solution for the manufacture of single part and small batch sizes. This makes it perfect for the shopfloor manufacturing.

Support for every manufacturing technology

Complex workpieces demand economical manufacturing methods and innovative CNC solutions. The SINUMERIK 840D sl CNC supports multi-tasking machines for workpiece manufacturing in a single clamping for which it provides innovative functionality — or even during the change between different technologies, such as mill-turning and turn-milling. The innovative SINUMERIK Operate graphical user interface provides an integrated turning functionality for milling applications and an integrated milling functionality for turning applications, augmented with innovative measuring cycles in the Animated Element design. The usability and the interface's look-and-feel are always identical.

SINUMERIK OP 019 — the new operator panel for high-end CNC applications

User-friendly, powerful, robust, modular and an attractive design — these are the advantages of the new SINUMERIK OP 019 operator panel. As a tribute to its functional designs, it was awarded the iF product design award 2011.



product
design
award

2011



Its excellent design ensures ease-of-use

A new, modern SINUMERIK operator panel with high-quality design and new command technology sets standards in modern machine operation. The robust SINUMERIK OP 019 with the new SINUMERIK PCU 50.5 was awarded the iF product design award 2011. Thanks to the capacitive sensory system, fast key operation is possible on the large 19-inch glass front with IP66 degree of protection — even if the user wears gloves.

The proven SINUMERIK frame geometry is augmented with large-format LEDs that make each key action immediately apparent. An integrated key lock protects against inadvertent, faulty operation. The new SINUMERIK OP 019, based upon the SINUMERIK Operate graphical user interface, can display the machine's main screen with three or four channels and up to 13 axes.



A system that leaves no request unanswered

You can configure the SINUMERIK 840D sl to meet your requirements. The systematic modular CNC concept allows you to implement innovative and individually tailored machines. Hardware and software can be scaled independently. Flexible construction is possible for every machine and manufacturing environment — also under harsh operational conditions.

Decentralized and flexible design

A significant characteristic of the SINUMERIK 840D sl is its decentralized and simplified system construction – fully integrated in the design and communications structure of our SINAMICS S120 drive system. The SINUMERIK 840D sl unites CNC, HMI, PLC, closed-loop control and communications tasks on a SINUMERIK Numerical Control Unit (NCU). When increased performance is required in the operating area (HMI), you can use the SINUMERIK PCU 50.5 industrial PC. NCU Link allows an expansion to a maximum of 93 NC axes.

The robust CNC system platform provides a high degree of freedom for the placement of the components in the machine, not least thanks to the decentralized components for operation, drive and peripherals. The components can be positioned as far as 100 m apart. This allows as many as four decentralized OPs to be deployed concurrently on a NCU/PCU. An intelligent displacement mechanism allows even more than four operator panels to be attached. Even the high-performance multiprocessor NCU modules can be installed separately as far as 100 m from the SINAMICS S120.



The SINUMERIK 840D sl family — performance variants to satisfy every requirements

SINUMERIK 840D sl provides just the right equipment package for your machine and your manufacturing environment. The combination of the Operator Panel, PCU, a high-performance NCU customized to your requirements, our SINAMICS S120 drive and innovative motors gives you many possibilities.

SINUMERIK 840D
BASIC
NCU 710.3 PN
The entry-level package for as many as 6 axes

SINUMERIK 840D sl — BASIC

With the SINUMERIK 840D sl BASIC based on the SINAMICS S120 Combi, the SINUMERIK 840D sl allows entry into the modular and flexible premium class for machines with as many as six axes. This is a cost-optimum solution for machines that require comprehensive functionality and the high performance of the SINUMERIK 840D sl.

SINUMERIK 840D sl		
Type 1A		
NCU 730.2 / PN	NCU 720.2	NCU 710.2
The modular and scalable high-end system for as many as 31 axes		

SINUMERIK 840D sl —Type 1A


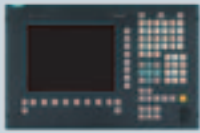
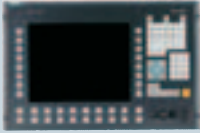
















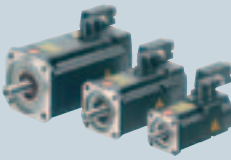
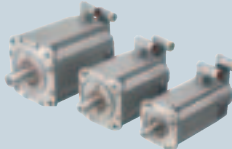
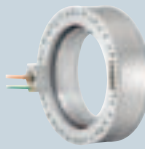




The proven, modular and scalable SINUMERIK 840D sl system platform for sophisticated machines, together with the SINAMICS S120 drive, provides the familiar capabilities and performance for as many as 31 axes.

SINUMERIK 840D sl		
Type 1B		
NCU 730.3 PN	NCU 720.3 PN	NCU 710.3 PN
Maximum performance with multi-core technology for as many as 93 axes		

SINUMERIK 840D sl —Type 1B

The new performance class of the SINUMERIK 840D sl with increased performance provided by multicore technology and a powerful PLC based upon the innovative SINAMICS S120 drive platform achieves further increased accuracy as well as maximum control dynamics for the best surface quality results in the machining.

NCU Link allows expansion to a maximum of 93 NC axes. In addition, the CU 320-2 can be used to implement further special axes on the SINUMERIK. The optimized HMI and graphical performance increases the operational efficiency and workpiece simulation speed for the machine operator.

SINUMERIK 840D sl system overview				
HMI	 OP 08T  OP 010C  OP 012  OP 015A / OP 015AT / TP 015A / TP 015AT  OP 019  MCP MPP  HW  HT 2  HT 8			
PCU	Increased power for HMI performance  PCU 50.5-C  PCU 50.5-P			
NCU	840D sl BASIC NCU 710.3PN up to 6 axes 	840D sl Type 1A NCU 710.2 NCU 720.2 NCU 730.2 	840D sl Type 1B NCU 710.3PN NCU 720.3PN NCU 730.3PN 	
Drive system	SINAMICS S120  COMBI  Compact SINAMICS S120  Blocksize  Booksize  Chassis			
Motors	 1FK7  1FT7  1FW6  1FN3  1PH8  1FE1  2SP1			

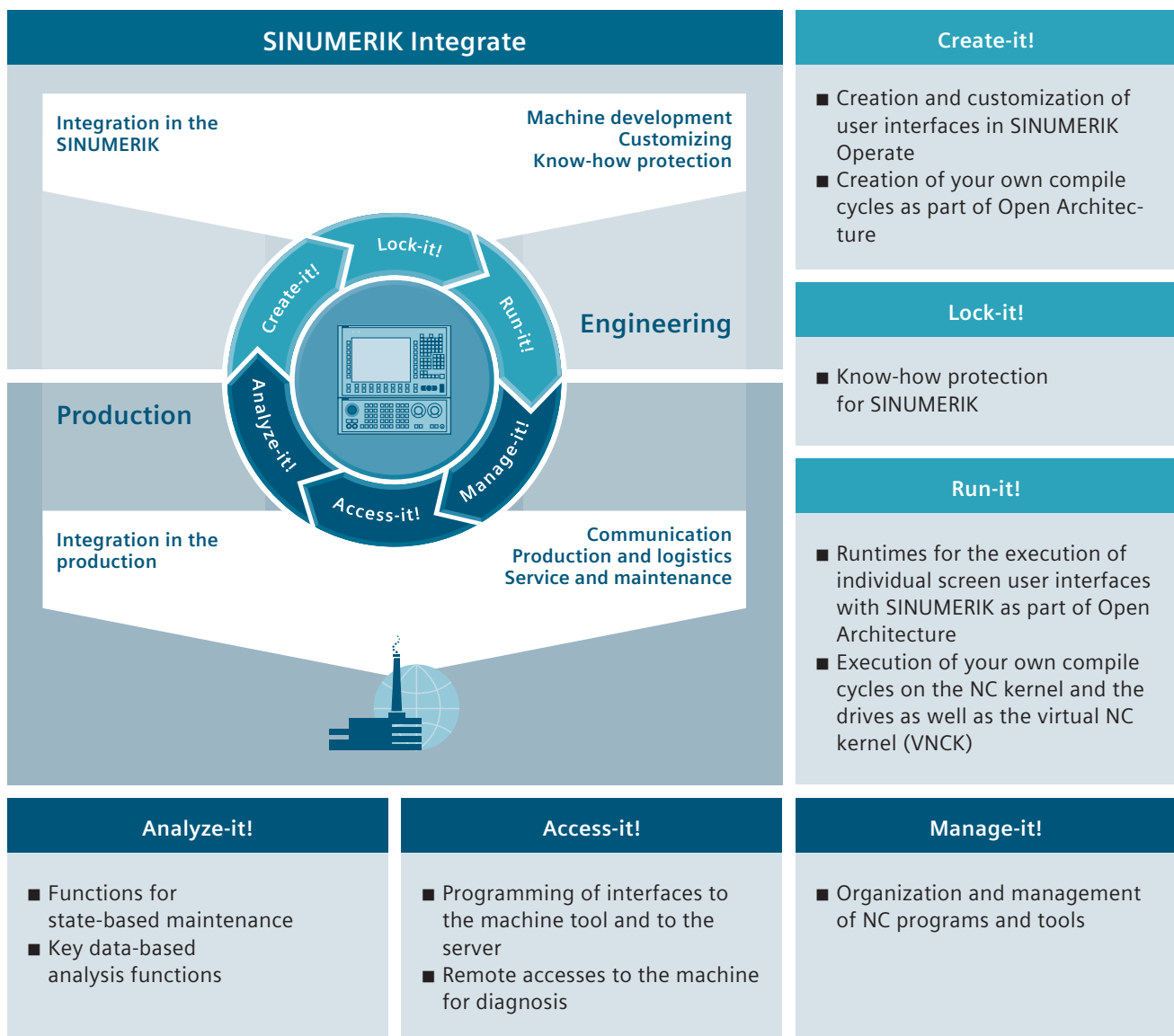
Matched modular system

The modular system for the SINUMERIK 840D sl CNC offers high flexibility and openness for every machine application.

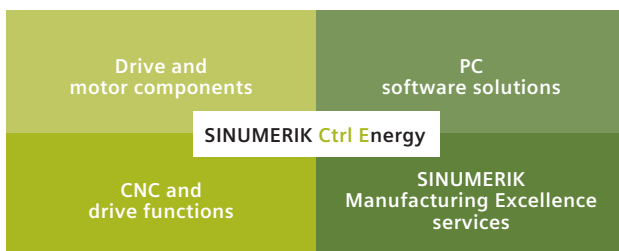
In full conformance to the mix-and-match slogan, the components can be perfectly matched to each other — exactly tailored to the requirements of the machine tool builder and for the subsequent end-user site.

SINUMERIK Integrate – integration of the CNC controller in company processes

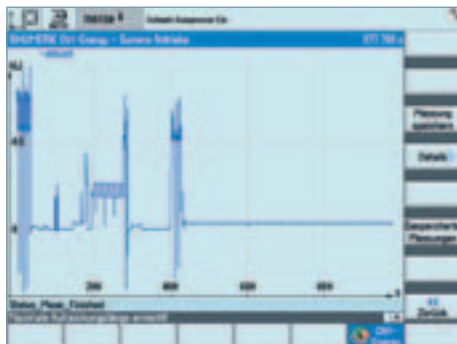
From the development and procurement through to the manufacturing and marketing — the integration of machine and manufacturing data into a company's manufacturing process is becoming ever more important. The integration of the machine tool into the company workflow is a significant requirement for lean and efficient manufacturing. SINUMERIK® Integrate offers a comprehensive product for the integration of machine tools into the communication, engineering and production processes of your company.



SINUMERIK Ctrl-Energy — energy savings at the touch of a button



As a technology leader in CNC and engineering, we offer not only technologically-advanced functions, but also powerful functions to increase the energy efficiency of the machine. In addition to the functions that can be called from the graphical user interface, SINUMERIK Ctrl-Energy provides you with a comprehensive portfolio of energy-efficient systems, solutions and services.



With a wide range of drive and motor components, CNC and drive functions, PC software solutions as well as our SINUMERIK Manufacturing Excellence portfolio of services, SINUMERIK Ctrl-Energy sets standards for machine tool energy efficiency.

Ctrl-E Energy Analysis

With the Energy Analysis function, the CNC acquires not only the energy consumption of the drive system, but also that of the entire machine. The machine user can analyze the energy consumption of each workpiece and, when necessary, optimize the machining strategy. With the Ctrl+E key shortcut, the machine operator can visualize the energy consumption at the touch of a button.

Ctrl-E Profile

Ctrl-E Efficient standby gives machine tool builders a configuration platform to control the energy-saving modes of the machine. This allows specific energy consumers to be shutdown during machine standstill times. With the Ctrl+E shortcut, the operator can quickly and easily influence the energy-saving modes.

SINAMICS S120 — the flexible, modular drive system for sophisticated tasks

The state-of-the-art design of drive components, spindle and feed motors, and switchgear cabinets is the basis for advanced and energy-efficient machine tool concepts. The SINAMICS S120 drive platform provides the perfect solution for high-performance applications in industrial machining.



Highly productive and modular

SINAMICS S120 drive solutions for the coordinated motion control of your machine — high-performance multi-axis configurations with modular multi-axis or independent single-axis modules. The modular system covers the 0.12 to 300 kW performance range. Together with SINUMERIK CNC, the SINAMICS S120 drive platform creates the perfect basis for modular plant and machine concepts in the power range of up to 300 kW. Uniform and integrated engineering tools ensure significantly-reduced engineering costs.

DRIVE-CLiQ — the digital interface between every drive component

Every component of the SINAMICS S120, including motors and encoders, as well as those from SINUMERIK, can be connected to each other using the common DRIVE-CLiQ interface. They all possess an electronic nameplate that contains relevant technical information. Because DRIVE-CLiQ acquires this data automatically from the SINUMERIK CNC, such data does not need to be entered during the commissioning or after replacement. This greatly reduces your machine's time for commissioning.

Decentralized and flexible design

Integrated communication using DRIVE-CLiQ permits flexible and decentralized machine concepts. The individual components can be installed up to 100 m from each other. For user solutions that have a larger number of moving axes in the machine kinematics, the basic system units can be augmented with the SINUMERIK NX10/NX15 expansion components to increase the computing performance in the drive.

The new SINAMICS S120 Combi — a unique drive class

The SINAMICS S120 Combi drive offers the usual SINAMICS functionality in an integrated drive concept, tailored for compact turning and milling machines. With its many technical highlights, the SINAMICS S120 Combi sets new standards in this drive class.

Powerful motors to get your machine moving

Our comprehensive motor spectrum offers the appropriate type for every drive task in a large performance range — and always ensures the correct movement.

The appropriate motor for each feed and auxiliary drive

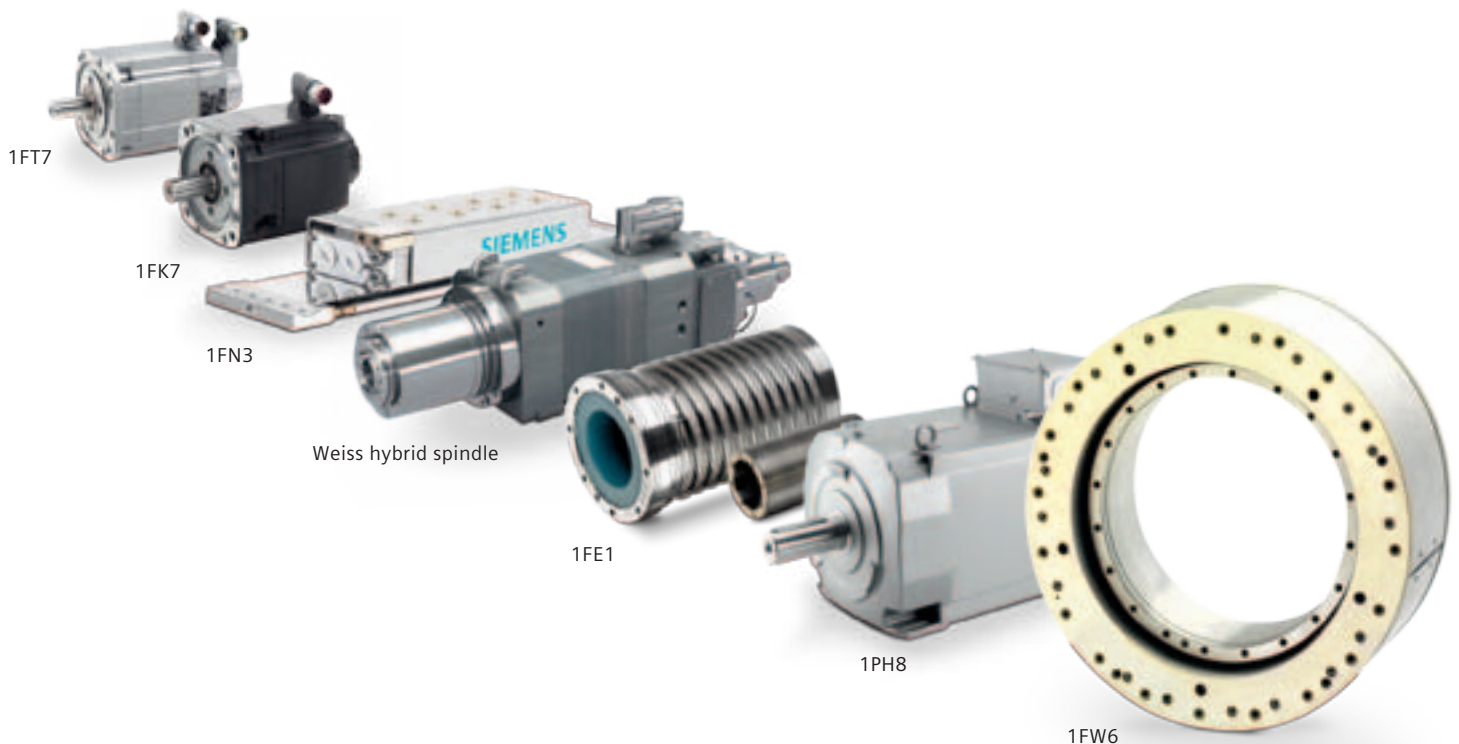
Irrespective of whether high standstill torques, high accuracy or rated powers, high maximum speeds or dynamics, air- or water-cooling, linear or rotary movements — our comprehensive motor spectrum offer you the appropriate type you require for every drive task. This includes synchronous and asynchronous servomotors, as well as highly-innovative linear and rotary direct drives.

- 1FK7 servomotors for standard applications
- 1FT7 servomotors for high-performance applications
- 1FN3 and 1FN6 linear motors
- 1FW6 torque motors

Spindle motors for high-performance deployment in machine tools

Irrespective of whether belt driven, hollow-shaft, built-in or even an integrated motor spindle — the spindles and tools for milling, turning and grinding machines can be driven in many ways. The spindle drive ensures high cutting performance, manufacturing precision and availability — all which lead to increased machine productivity. Motor spindles are clearly gaining popularity in this area. Their advantages lie in very high maximum speeds coupled with minimum vibration susceptibility. The result — high productivity and surface finish quality.

- 1PH8 main spindle motor
- 1FE1 built-in motors
- Motor spindles for milling, turning, grinding and special applications



More safety — guaranteed

When safety for personnel and machine is involved, SINUMERIK doesn't make any compromises. SINUMERIK Safety Integrated is a comprehensive safety package to protect personnel and machines — extremely efficient and economical, thanks to the complete integration of safety functions in the control and drive.

Simply safe





Thanks to SINUMERIK Safety Integrated, your machine can be operated safely and practicably for all required operating conditions. For example, in the setup and test operation when the protective door is open. Also with regard to the communication with other safety-relevant components, SINUMERIK Safety Integrated is extremely flexible. Flexible, because:




- Controllers can communicate safely via PROFIBUS or PROFINET. For example, a SINUMERIK 840D sl with a SIMATIC F-CPU.
- The DPI/AS-i F-Link permits safe network transition between AS-i Bus and PROFIBUS using ASisafe on PROFIsafe.




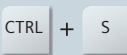
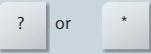

The safety functions satisfy the requirements of category 3 as well as PL d in accordance with DIN EN ISO 13849-1 and the Safety Integrity Level SIL 2 in accordance with DIN EN 61508. This allows the main requirements from the EU machine regulation to be implemented easily and economically.


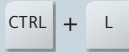
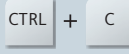
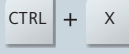
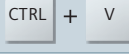
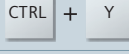
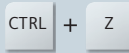
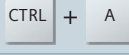
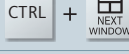
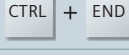
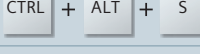
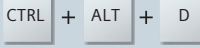



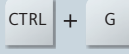
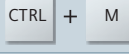
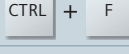
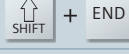
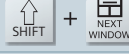


Functions, softkeys and shortcuts

Insert key	
	Edit mode for input fields or selection mode for comboboxes and toggle fields. These can be exited by making a new insert without change.
	Undo function provided no input or accept of the data in the fields has been made.
Toggle key	
	The Toggle key (Select) also allows toggle fields to be switched directly without opening them. Shift-Toggle switches them back.
Cursor keys	
	Open/close directory, open/close program, open/close cycle

Various	
	Comment-out cycles and direct edit of programGuide cycles
	Calculator function
	Help function

Simulation/simultaneous recording	
	Move: shift cursor up/down and rotate in the 3D picture
	Move segment
	Override +/- (simulation)
	Single block on/off (simulation)
	Wildcards can be used in the search masks, where "?" represents any character, "*" represents any number of any character
	Input of Asian characters

Control key	
	Create screenshot
	Toggle between languages
	Copy
	Cut
	Insert
	Repeat the input (editor functionality)
	Undo – max. five lines in the editor (editor functionality)
	Select all (editor functionality)
	Go to program start
	Go to program end
	Save NCK/PLC/drive/HMI complete archive
	Save the log files on USB or CF card

Various	
	SINUMERIK Ctrl-Energy Ctrl-E Analysis, Ctrl-E Profile
	Grid model in simulation
	Maximum simulation speed
	Search in all masks
	Select up to the end of the block
	Select up to the beginning of the line
	Jump to the beginning of the line
	Jump to the end of the line

Performance data

Optimum, digital complete solution with SINAMICS S120
Up to <ul style="list-style-type: none"> • 10 operating mode groups • 10 channels and • 31 axes/spindles
Channel structure: <ul style="list-style-type: none"> • Simultaneous, asynchronous processing of part programs
Axis functions
<ul style="list-style-type: none"> • Acceleration with jerk limitation • Tracking mode • Separate path feed for fillets and chamfers • Travel to limit stop • Coupled axes (TRAIL)
Spindle functions
<ul style="list-style-type: none"> • Various thread cutting functions • Automatic gear ratio selection • Oriented spindle stop • On-the-fly synchronization of the axis
Interpolation
<ul style="list-style-type: none"> • Linear-interpolating axes • Circle via center point and end point or via intermediate point • Helical interpolation • NURBS (non-uniform rational B-splines) universal interpolator • Continuous-path mode with programmable rounding clearance • Spline, polynomial and involute interpolation
Transformations
<ul style="list-style-type: none"> • Cartesian point-to-point (PTP) travel • Chained transformations • Generic transformation
Measuring functions/cycles
Measuring level 1: <ul style="list-style-type: none"> • Two probes (switching) with/without delete distance-to-go Measuring level 2: <ul style="list-style-type: none"> • Logging of measurement results • Measuring functions from synchronous actions • Cyclical measurement
Technologies
<ul style="list-style-type: none"> • Stamping and nibbling functions • Oscillation functions • Multiple feeds in the block (e.g. for calipers) • Handwheel superimposition • Electronic transfer • SINUMERIK MDynamics three axes • SINUMERIK MDynamics five axes

Motion synchronous actions
<ul style="list-style-type: none"> • Fast CNC input/outputs • Synchronous actions and fast help function output, including three synchronous functions • Positioning of axes and spindles using synchronous actions • Clearance control • Continuous dressing (parallel dressing, online changes of the tool correction) • Asynchronous subroutines • Actions between operating modes
Open Architecture
<ul style="list-style-type: none"> • Integrate configured pictures • Program pictures, operating areas and command interfaces • Integrate OEM-specific solutions in the NC kernel
Programming
CNC programming language: <ul style="list-style-type: none"> • Powerful programming language (DIN 66025 and high-level language extension), e.g. <ul style="list-style-type: none"> – configurable user variables – macro technique • Program jumps and branches • Program coordination with WAIT, START, INIT • Control structures IF-ELSE-ENDIF, WHILE, FOR, REPEAT, LOOP • STRING functions • Program creation parallel to the machining • Zero offsets • Look ahead • Program/workpiece management
Programmer support: <ul style="list-style-type: none"> • Powerful program editor • Programmer support for geometric inputs and cycles with programGUIDE • Technological cycles for drilling/milling and turning • Programmer and operator support for turning and milling machines with ShopTurn/ShopMill machining step programming
Simulation/visualization
<ul style="list-style-type: none"> • Up to 10 channels can be simulated sequentially • Quick View for mold making fast view (3D preview for NC programs) • Simultaneous recording, simulation for turning and milling and for multitechnology machines
Operating modes
<ul style="list-style-type: none"> • AUTOMATIC, JOG, TEACH IN, MDA; are supported with Repos (reapproach to the contour)

Tools <ul style="list-style-type: none"> Tool types: <ul style="list-style-type: none"> Turning Drilling/milling Grinding Groove cutting Tool radius corrections Tool change via T-number or plain text Tool management TDI tool management functions 	PLC <ul style="list-style-type: none"> Integrated SIMATIC S7-compatible CPU 317-2DP/319-3PN/DP STEP 7 programming language Decentralized peripherals using PROFIBUS DP / PROFINET
Communication / data management <ul style="list-style-type: none"> Data storage/backup <ul style="list-style-type: none"> Floppy disk, USB stick, CF card, hard disk, network DNC machine CNC program transfer 	Safety functions <p>SINUMERIK Safety Integrated for personnel and machine protection:</p> <ul style="list-style-type: none"> Safe monitoring of speed and standstill Safe working area and protection zone limitation as well as range recognition Safe inputs/outputs and safe logical link Safe brake control with cyclical braking test Safe communication Integrated acceptance test
Operation <ul style="list-style-type: none"> Clear operation Operator control unit management User-oriented (hierarchical) access protection User-oriented access rights for softkeys Screen text in multiple languages Plain text display of operating states 	Drive <ul style="list-style-type: none"> SINAMICS S120 Booksize form SINAMICS S120 Chassis form SINAMICS S120 Blocksize form
Operator components <ul style="list-style-type: none"> Operator panel fronts with display diagonal from 7.5" to 19", foil keys, capacitive keys or mechanical keys Machine control panels CNC complete keyboards PC standard keyboard Handheld terminals Handwheels 	Motors <p>Synchronous motors (matched for high-precision dynamic applications):</p> <ul style="list-style-type: none"> 1FT7, 1FK7 motors 1PH8 motors with solid shaft / external ventilation or water cooling 1FE1 built-in motors, 1FW6 built-in torque motors 2SP1 motor spindles 1FN3/1FN6 linear motors <p>Asynchronous motors:</p> <ul style="list-style-type: none"> 1PH4 motors with solid shaft / water cooling 1PH7 motors with solid shaft / external ventilation 1PH8 motors with solid or hollow shaft / external ventilation or water cooling 1PM4 motors with hollow shaft / oil or water cooling 1PM6 motors with hollow shaft / external ventilation
Monitoring functions <ul style="list-style-type: none"> Work field limitation End position switch monitoring Position monitoring 2D/3D protection zones Spindle speed limitation Safety routines (continuously active for over-temperature, battery, voltage, memory, fan monitoring) Integrated tool monitoring and diagnostics with solution partner Monitoring for maximum tool speed/acceleration 	Commissioning <ul style="list-style-type: none"> Commissioning software Commissioning trace Software for series manufacturing and software upgrade
Compensation <ul style="list-style-type: none"> Backlash compensation Leadscrew error compensation Precontrol speed-dependent Precontrol acceleration-dependent Temperature compensation Quadrant error compensation Bidirectional spindle error compensation Droop compensation, multidimensional Compensation in space VCS / for kinematic transformations Vibration absorber Compensation of magnetic detent torques 	Diagnostic functions and maintenance <ul style="list-style-type: none"> Alarms and messages Trip recorder can be activated for diagnostic purposes PLC status Remote diagnosis SINUMERIK Integrate ASP (ePS Network Services) Access MyMachine/Diagnosis (ePS Diagnostic Services) for diagnostic functions in case of machine failure, workflow services, remote operation and remote monitoring of machine controllers Analyse MyCondition (ePS Condition Monitoring) for state-oriented maintenance

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