SINUMERIK 840Di sl & SINAMICS
Exploit the freedom of the PC world

The SINUMERIK 840Di sl is a completely PC-integrated numerical controller that works in conjunction with the SINAMICS S120 drive system. The control which is open with regard to both hardware and software is particularly suited to customers who are looking for distributed automation solutions in the field of PLC I/O and drives and/or require a completely PC-integrated control.

The technological areas of application for the SINUMERIK 840Di sl range from machine tools and special machines through handling devices to retrofits.

The SINUMERIK 840DiE sl is available as an export version for use in countries where approval is required.

Brochure · September 2005

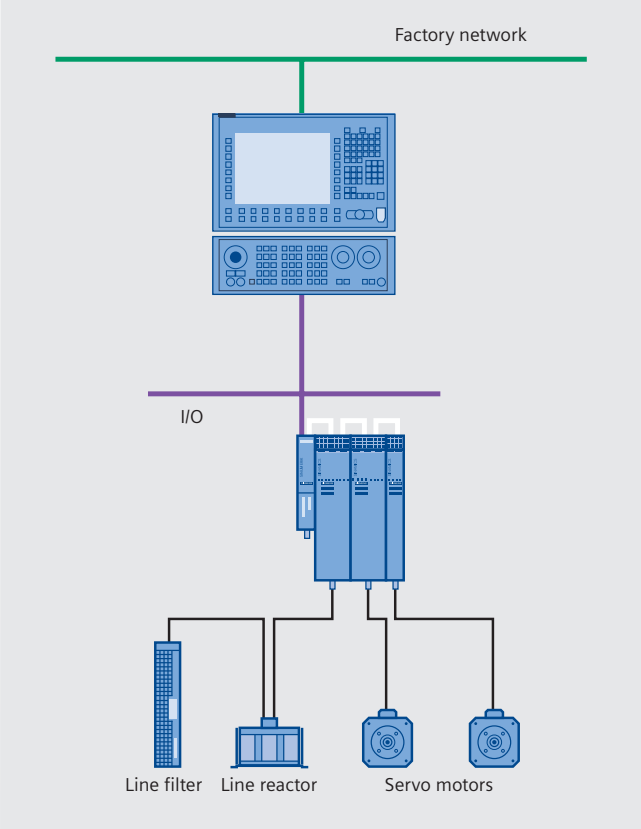
sinumerik 840Di sl

SIEMENS

SINUMERIK 840Di sl
The fully PC-integrated alternative

Structure

The SINUMERIK 840Di sl consists of the PCU 50.3 industrial PC, the MCI2 board and the system software for 6 or 20 axes. The PROFIBUS DP interface on the MCI2 board enables the connection of the SINAMICS S120 drive system and the SIMATIC DP ET 200 I/O. The PROFIBUS DP with Motion Control functionality (clock synchronized, equidistant) is operated at a transfer rate of 12 Mbit/s.



Topology of the SINUMERIK 840Di sl

Functions

Performance and flexibility

The scalability of the hardware and software creates excellent conditions for you to use the SINUMERIK 840Di sl in many areas. The possibilities range from simple positioning tasks up to complex multi-axis systems. We offer you two different 840Di sl types for your machining tasks.

System-wide openness

Thanks to openness in HMI and PLC you can apply your special know-how such that you achieve exactly the desired individual control solution.

Well-proven operator software and programming software

The following are available for the optimum operation and programming of your machine tools:

- Startup for entry to the 840Di sl
- HMI Advanced, cross-technology, multichannel user interface software
- ShopMill or ShopTurn for genuine workshop CNC

Startup

Startup is a Windows program for simple entry to the SINUMERIK 840Di sl. It permits simple operating processes as well as the creation and selection of user programs.

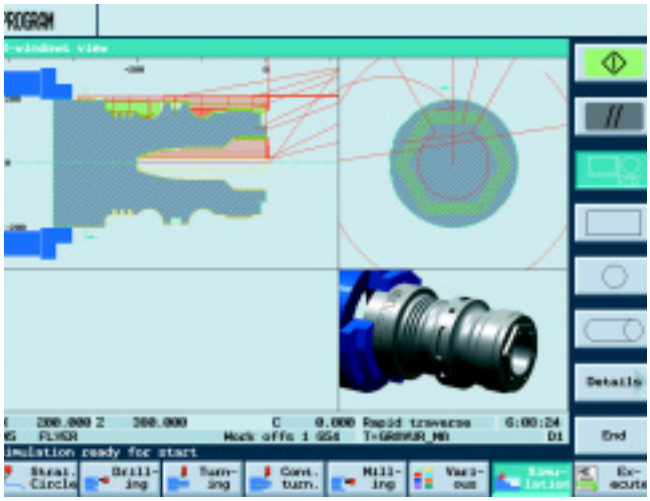
SINUMERIK 840Di sl
Innovation potential for greater efficiency during operation

Functions (continued)

HMI Advanced

The cross-technology, multichannel operator interface software offers user-friendly and complete operation of the machine tool using window technology. The generation of parts programs is assisted by a text editor which provides easy-to-use, screen form-based support. The powerful contour calculator enables programming and graphic display of complex workpiece contours. Parts programs can be quickly checked using the integrated simulation.

Workshop production – ShopMill/ShopTurn



ShopMill and ShopTurn are operating and programming software packages that simplify machine operation and the programming of workpieces. ShopMill for milling technology, applicable to vertical and universal milling machines and ShopTurn for the turning technology.

Further applications

Only those who know the practical requirements can develop tailor-made products and systems for different tasks. For this reason, we offer you innovative and industry-specific solutions for machine tools, special machines, handling devices right through to retrofitting.

Electronic rating plate in all components

All SINAMICS S120 components with a DRIVE-CLiQ interface have an electronic rating plate.

This rating plate contains all relevant component data. On commissioning or replacement, this data is automatically sent to the higher-level control or harmonized with it. This unique identification of the components used in the machine simplifies servicing enormously.

ePS Network Services – Innovation potential for service and maintenance

ePS Network Services supports company-wide service and support processes. To prevent faults and downtimes wherever possible, the ePS Network Services available to the factory maintenance department and the machine constructor permit cyclic evaluation of the machine status and of individual machine components. Test procedures – such as circularity or synchronization tests – based on standards are available for this purpose.

Using the trend analysis, the test results can be assessed throughout the entire life cycle of a machine. This ongoing evaluation means that maintenance measures can be scheduled on a predictive and selective basis and that inspection and maintenance procedures can be optimized.

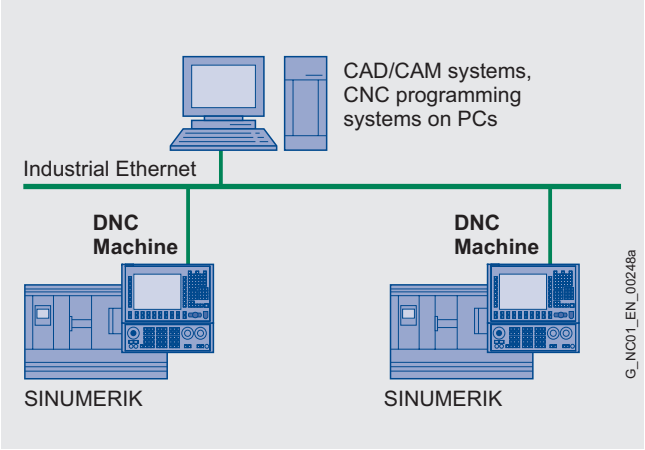
Motion Control Information System MCIS – The key to higher productivity

The Motion Control Information System (MCIS) offers powerful software modules for the optimum integration of the machines in your data processing environment.

They help you to improve the productivity and reliability of your processing machines.

For production, this means:

- Smooth coordination of planning, scheduling and execution
- Shorter setup times and enhanced efficiency
- Reduced machine downtimes
- Simplified fault analysis



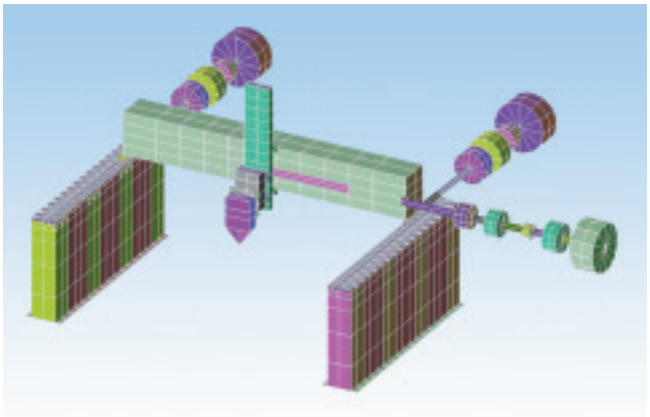
SINUMERIK 840Di sl
Virtual prototyping for a shorter time to market

Virtual prototyping –
Bundled competence for a faster and more efficient way to the perfect machine and the optimized workpiece

Mechatronic Support

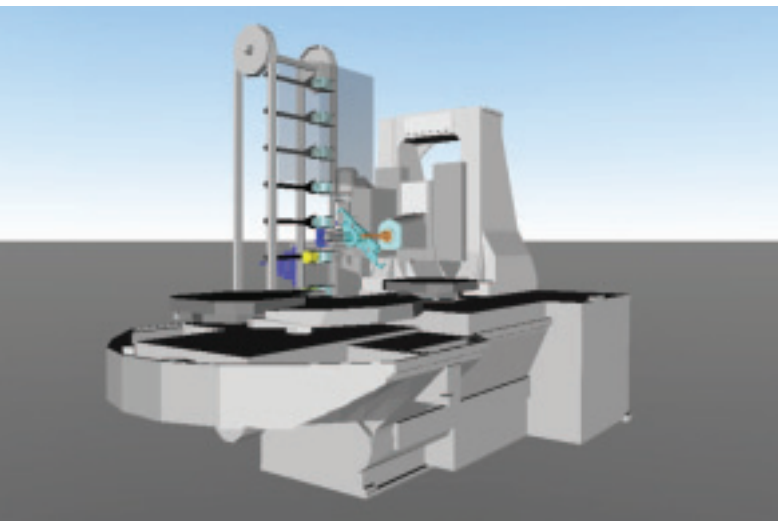
With our mechatronic approach, the development of efficient machines can be speeded up considerably.

This in turn leads to a shorter time-to-market and thus greater competitiveness for the machine constructor and the end user.



Virtual Production

With Virtual Production, the simulated machining and optimization replaces the repeated test machining of the workpiece on the real machine.
This provides the opportunity for optimizing the production even at the preliminary stage.



Machine Simulator

With SINUMERIK Machine Simulator you can tap into the potential that is offered by modern computer simulations. You can exploit the optimization potential on the model of your machine even at the early stage of development.

This results in considerable savings of time and money during machine optimization and commissioning.

PC-Tool SIZER –
Intelligent configuration

The PC-Tool SIZER offers you convenient configuration of the SINAMICS series of drives and of the CNC.

SIZER helps in the technical layout of the necessary hardware and software components for drive and control tasks.

SINUMERIK 840Di sl
Convincing performance data

CNC functionality included in the basic scope of supply	●
Options or accessories	○

PLC	
PC-based CNC path control for machine tools, special machines, manipulators, retrofitting The controller consists of a PCU 50.3 industrial PC and the MCI2 board. The distributed I/O and drives are connected by means of PROFIBUS DP.	
Optimum, digital complete solution with SINAMICS S120	●
Up to 10 operating mode groups, 10 channels and 20 axes/spindles	○
Channel structure: Simultaneous, asynchronous processing of parts programs	○
Axis functions	
Extensive axis functions, such as acceleration with jerk limitation, follow-up mode, separate path feed for roundings and chamfers, travel to fixed stop, trailing axes (TRAIL)	●
Feed and rapid traverse: 10^{-3} mm/min to 999 m/min	●
Rotary axis, turning endlessly	●
Velocity, max. 300 m/s	●
Programmable acceleration	●
Trailing axes (TRAIL)	●
Travel to fixed stop with Force Control	○
Pair of synchronized axes (gantry axes)	○
Tangential control	○
Position switching signals/cam controller	○
Spindle functions	
Extensive spindle functions, such as different thread cutting functions, automatic gear stage selection, oriented spindle stop, on-the-fly axis synchronization	●
Synchronous spindle/multi-edge turning	○
Interpolations	
Linear interpolating axes	●
Circle via center point and end point	●
Circle via interpolation point	●
Helical interpolation	●
Universal interpolator NURBS (non-uniform rational B-splines)	●
Continuous-path mode with programmable rounding clearance	●
Multi-axis interpolation (> 4 axes)	○
Spline interpolation (A, B and C splines/compressor) for 3/5-axis machining	○
Polynomial interpolation	○
Master-value coupling and curve table interpolation	○
Involute interpolation	○
Electronic gear unit	○
Axial coupling in the machine coordinate system (MCS coupling)	○
Continue machining at the contour (retrace support)	○
Transformations	
Cartesian point-to-point (PTP) traveling	●
Concatenated transformations	●
Generic transformation	●
Numerous additional transformations such as TRANSMIT, inclined axis, transformation package handling, transformation shearing kinematics two axes ...	○

Measurement functions/measurement cycles	
Measurement level 1: Two measurement inputs (switching) with/without deletion of distance-to-go	●
Measurement level 2: Logging of measurement results, measurement functions from synchronized actions, cyclic measurement	○
Measurement cycles for drilling/milling and turning: Calibrate workpiece probe, workpiece measurement, tool measurement	○
Technologies	
Punching/nibbling functions	○
Oscillation functions (block-related, modal and asynchronous)	○
More than one feed in block (e.g. for calipers)	○
Handwheel override	○
Contour handwheel	●
Electronic transfer	○
Processing package for five axes: Contains the multi-axis interpolation option	○
Machining package milling: Contains options: Machining package five axes, multi-axis interpolation, spline interpolation (A, B and C splines/compressor) for five-axis machining and 3D tool radius compensation	○
Motion-synchronous actions	
High-speed CNC inputs/outputs	●
Synchronized actions (max. 16) and high-speed auxiliary function output incl. three synchronous functions	●
Synchronized actions, stage 2	○
Positioning axes and spindles via synchronized actions (command axes)	●
Analog value control in interpolation cycle	●
Path velocity-dependent analog output (laser power control)	○
Laser switching signal, high-speed	○
Clearance control: 1D in interpolation cycle via synchronized action	●
Clearance control 1D/3D in position control cycle (including in the interpolation cycle), free direction	○
Evaluation of internal drive variables (prerequisite for Adaptive Control)	○
Continuous dressing (parallel dressing, online modification of the tool offset)	●
Asynchronous subroutine ASUP	●
Interrupt routines with high-speed retraction from the contour	○
Multiple mode actions (ASUPs and synchronized actions in all operating modes)	○
Open Architecture	
Expand user interface	●
SINUMERIK HMI programming package (OEM contract required)	○
SINUMERIK HMI programming package WinCC flexible (OEM contract required)	○

SINUMERIK 840Di sl
Convincing performance data

CNC functionality included in the basic scope of supply	●
Options or accessories	○

Programming	
CNC programming language	
Easy to use programming language (DIN 66025 and high-level language extension) such as configurable user variables, macro technology, program jumps and branches, program coordination with WAIT, START, INIT, control structures IF-ELSE-ENDIF, WHILE, FOR, REPEAT, LOOP, STRING functions	●
Programming in parallel with machining	●
Dimensions can be specified as metric, in inch or mixed	●
Work offsets, programmable (frames)	●
Reference point approach by program	●
Look Ahead	●
Inclined-surface machining with frames	●
Program preprocessing	○
Dynamic preprocessing memory (FIFO)	●
Online ISO dialect interpreter	●
Program/workpiece management	●
NC user memory (RAM) 1 to 5 MB for parts programs, tool compensation, offsets	●
Programming support system	
User-friendly program editor	●
Machining step programming	○
Multi-channel sequence programming	○
Programming support for geometry inputs and cycles	●
Process-oriented cycles for drilling/milling and turning	●
Programming and operating support for turning and milling machines with ShopTurn HMI and ShopMill HMI	●
CAD reader for PC, convert DXF files to contours and drilling templates	○
SinuTrain for PC, training software	○
Simulation	
Simulation for turning and milling	●
Mode groups	
AUTOMATIC	●
JOG (setup)	●
TEACH IN (program creation interactively with the machine)	●
MDA (process manual input block)	●
The operating modes are supplemented by machine functions:	
Repos (repositioning on the contour) • PRESET for setting a new coordinate reference point • Simultaneous traversing of axes with one or two handwheels • Overriding of machine functions in the setup and AUTOMATIC mode • Program selection via directory	●
Tools	
Tool types for turning, drilling/milling, grinding and groove sawing	●
Configurable number of intermediate blocks for tool radius compensation	●
Tool radius compensations with approach and retract strategies	●
Tool length offset	●
3D tool radius compensation	○
Look-ahead detection of contour violations	●
Tool offset for grinding operations	●

Tools (continued)	
Tool orientation interpolation	●
Online tool length compensation	●
Tool management with extensive functionality such as empty location search and place positioning, tool loading/unloading, tool life and workpiece count ...	○
TDI: Tool management functions	○
Connection of tool identification system MOBY E	○
Communication/data management	
Data storage to memory medium on USB (e.g. disk drive, memory stick)	●
Data backup on hard disk	●
Data backup to network via Ethernet	○
Direct Numeric Control (DNC): CNC program transmission via network, CNC program comparison, CNC program archiving	○
RPC SINUMERIK: Data exchange between CNC and host computer (computer link)	○
A&D Data Management (ADDM): Data storage system	○
Production data evaluation	
MDA Machine Data Acquisition (machine and operating data acquisition)	○
PMT IFC (parts tracking)	○
PDA IFC (production data management)	○
Operation	
Clear operation by means of operating areas each with eight horizontal/vertical softkeys	●
Control unit management: Same picture on all OPs with TCU, interlocking of simultaneous operation, activation/deactivation of MCP	●
Operator panel lock	●
User oriented, hierarchical access protection	●
OA-open user interface, configurable under Windows	○
Screen texts in several languages (English, German, Spanish, French, Italian, Chinese (simplified))	●
Other languages on request	○
Program window for block display	●
Position actual values in two to five times character size	●
Screensaver	●
Plain text display of operating states	●
Quick view for mold-making programs	●
Startup for entry to the 840Di sl	●
ShopTurn HMI, user-friendly operating and programming interface for turning and milling	●
ShopMill HMI, user-friendly operating and programming interface for milling and drilling	●
Measurement cycles, measurement in JOG	○
HMI Advanced, cross-technology multichannel operator interface software for machine tools	○

SINUMERIK 840Di sl
Convincing performance data

Operator components	
Operator panel fronts (width 310 mm) • OP 08T (7.5" display, membrane keys) and integrated TCU • OP 010S (10.4" display, mechanical keys)	○
Machine control panel (width 310 mm) • MCP 310C (membrane keys)	○
CNC full keyboard (width 310 mm) • KB 310C (mechanical keys)	○
Operator panel front (width 365 mm) • OP 012T (12.1" display, membrane keys) and with TCU	○
Operator panel fronts (width 19") • OP 010 (10.4" display, membrane keys) • OP 010C (10.4" display, mechanical keys) • OP 012 (12.1" display, membrane keys) • OP 015 (15" display, membrane keys) • OP 015A/015AT (15" display, membrane keys/with TCU) • TP 015A/015AT (15" display, touch, membrane keys/with TCU)	○
CNC full keyboard KB 483C (width 19", mechanical keys)	○
Standard PC keyboard KBPC USB US	○
Machine control panel (width 19") • MCP 483C, MCPC IE (mechanical keys, open user keys, ...) • MCP 483 (membrane keys, open user keys ...)	○
Pushbutton panel (width 19") • MPP 483, MPP 483H with handheld device connection, MPP 483A for assembly applications	○
Handheld unit	○
Handheld Terminal HT 8	○
SINUMERIK PCU 50.3 Industrial PC with 1.5 GHz/512 MB or 2.0 GHz/1024 MB • 40 GB hard disk: 12 GB for applications, 15 GB for local backups and software • Operating system Windows XP ProEmbSys SP2 • Ports: 2xEthernet, 4xUSB, 1xPROFIBUS • Expansion slots: 1xPCI, 1xCF card	○
Memory/memory devices • 3.5" disk drive, USB • CompactFlash card 512 MB • USB FlashDrive 512 MB	○
Monitoring functions	
Working area limitation	●
Software and hardware limit switch monitoring	●
Position monitoring	●
Downtimes monitoring	●
Clamping monitoring	●
2D/3D protection zones	●
Contour monitoring	●
Axis limitation from the PLC	●
Spindle speed limitation	●
Contour monitoring with tunnel function	○
Path length evaluation	○
Safety routines continuously active for overtemperature, battery, voltage, memory, fan monitor	●

Compensation	
Feedforward control, speed-dependent	●
Temperature compensation	●
Interpolation lead screw and measurement system error compensation	●
Backlash compensation	●
Quadrant error compensation per operation	●
Graphic control of the quadrant error compensation by means of circularity test	●
Sag compensation, multi-dimensional	○
Space error compensation (SEC) for kinematic transformations	○
Precontrol, acceleration-dependent	○
PLC	
Integrated SIMATIC S7-compatible CPU 317-2DP	●
STEP 7 programming language	●
Up to 32768 bit memories, 512 timers, 512 counters, 2048 FB/FC and 2047 DB	●
Distributed I/Os via PROFIBUS DP: Up to 128 distributed DP slaves	●
Program and data memory up to 768 KB, expandable	○
Input/output I/O expandable up to 4096 digital inputs/outputs	○
Programming in S7 HiGraph	○
Equipment for PLC programming and program test with PG/PC	○
Safety functions	
"Safe standstill" and "Safe brake control" integrated in drive	●
Drive	
SINAMICS S120 is a compact modular converter system with a revolutionary system architecture. The function units are systematically separated into intelligence and performance. The standardized, drive-internal digital interface DRIVE-CLiQ provides seamless communication between the system components, including the motors and encoders.	
Scalable in performance, functionality and mechanical design	●
Rated outputs to beyond 200 kW	○
Rated currents of the Motor Modules from 3 A to 200 A	○
Supply voltage levels from 380 V to 480 V 3 AC	●
System uniformity with "Totally Integrated Automation" at Siemens	●

SINUMERIK 840Di sl
Convincing performance data

CNC functionality included in the basic scope of supply	●
Options or accessories	○

Motors	
Feed motors coordinated for high-precision, dynamic applications • Synchronous motors, permanently-excited 1 FT6, 1FK, Static torque of between 0.4 and 300 Nm, Rated speeds 1500 rpm to 6000 rpm • Linear motors 1 FN With rated feedrate forces from 200 to 20700 N, Speeds of 58 to 736 m/min • Torque motors 1FW. With static torques from 96 to 2450 Nm, Speeds 40 to 495 rpm	○
Main Spindle Motors • Compact, ready-to-install synchronous built-in motors 1FE With rated torques of 5 to 820 Nm and speeds up to 40000 rpm • Depending on the design, air or water-cooled asynchronous motors in the power range from 5 kW to 100 kW are available as - 1PH complete motors - 1PM with drilled shaft for material feeding, clamping and cooling - a series of water-cooled built-in motors	○
Commissioning	
STARTER-commissioning software	○
Commissioning software on PC/PG	○
SinuCom NC: Parameterizing machine data on interactive basis, managing series commissioning files, integrated help, dynamic recording of variables and signals – optimizing, creating an image for the CF card, reading, deleting, inserting and modifying series commissioning files	●

Diagnostic functions	
Alarms and messages	●
Trip recorder can be activated for diagnostic purposes	●
PLC status	●
SIMATIC STEP 7 for SINUMERIK hardware (for service functions)	○
Remote Control System (RCS)	○
Service and maintenance	
ePS Network Services: Remote operation and observation of machine control, analyzing and processing machine faults, status-oriented maintenance	○
TPM Total Productive Maintenance (servicing and maintenance support)	○

Glossary of abbreviations

HMI – Human Machine Interface
MPI – Multi Point Interface
CNC – Computerized Numerical Control
PLC – Programmable Logic Control
OA – Open Architecture
MCP – Machine Control Panel
MPP – Pushbutton Panel
KB – Keyboard

Information on this product can be found on the Internet at:

http://www.siemens.com/sinumerik

You can find the address of your local contact at:
http://www.siemens.com/automation/partners

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