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InSight

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SINUMERIK
CNC systems



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Drive Technologies Division

CEO Ralf-Michael Franke

Responsibility in accordance with the German

press law: Benjamin Schröder

Responsible for technical content:

Bernd Heuchemer

Editorial chair:

Hans Pischulti

Publishing house: Publicis Publishing,

P.O. Box 32 40, 91050 Erlangen

Phone: 091 31/91 92-5 01; Fax: -5 97

magazines-industry@publicis.de

Editor-in-chief: Gabriele Stadlbauer

Copy editor: Susanne Wanke

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Sinumerik on the road to Industrie 4.0

Intelligent solutions for machine tools

Siemens offers manufacturers simple and scalable solutions that require almost no additional hardware and enables IT networking up to the highest level of the company.

The demands on the metalworking industry are increasing constantly. As a result, the manufacturing industry has started to link the real and the digital world. This is why the vision of Industrie 4.0 comprises industrial business and manufacturing processes completely. However, this requires innovative software systems and powerful hardware that integrate the product development and production process, thus mapping them in a valid manner, ensuring that production plants become even more efficient and productive.

IT integration with the appropriate hardware and software

Siemens is perfectly prepared for this process with its Sinumerik product portfolio. It ranges from the modular Sinumerik 840D sl premium control for

high-end machines, to the compact Sinumerik 828D and 828D Basic for standard machines, to the Sinumerik 808D for basic/standard machine tools, and offers the right control for every machine. Thanks to the openness and standardized interfaces of the Sinumerik CNCs, every pre-requisite for the integration into the company's IT environment are met.

But not only hardware requirements have to be fulfilled to successfully complete IT integration. To enable the consistent use of data from company level to the control system, Siemens has developed Sinumerik Integrate, the software suite for production. It enables the simple management of tools and part programs, the transparent capture of machine status and production data, as well as the maintenance of machines installed all over the world by remote access. New functions have been added in

the new version. They can either be used individually or combined in a package.

Simple machine operation

In addition, future production models also demand efficient machine concepts while, at the same time, providing easier operation. With the intuitive operation and programming in Sinumerik Operate, shopfloor managers, especially in small companies, are given optimal support in using Sinumerik.

The operating structure in Sinumerik Operate is identical for every machine and technology, so that operators are quickly able to adapt to every Sinumerik CNC. In the newest version, the user interface has again been extended by several additional functions (see p. 8 for more details).

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Sinumerik Integrate Manage MyMaintenance

Effective maintenance management

The Manage MyMaintenance (MMM) software module for preventative service and maintenance automatically informs users as soon as a machine requires scheduled maintenance. A clear list of tasks, ordered by due date, displays the time and work to be done.

For higher efficiency, self-explanatory color codes indicate which measure is overdue or coming up. Users can also define – depending on storage space – a number of maintenance measures at their discretion and define an execution interval for every single one. No extra programming is required for software installation and this software can be directly activated via the user interface Sinumerik Operate. MMM is perfect for small- and medium-sized companies, which can now implement an effective maintenance management system without any additional investments.

Tasks	Status	Due	PDF	Remaining (h)	Interval (h)	Pres. limit (h)
Check Lube Oil Level	OK	07/24/14, 9:51 AM		-315	168	1
Schmieröl nachfüllen	OK	07/29/14, 2:45 PM		-199	168	24
clean filter	OK	08/01/14, 2:57 PM		-117	240	24
Check Slide Bars	OK	08/01/14, 9:58 AM		237	720	0
Filter reinigen	OK	08/01/14, 3:31 PM		291	672	72
clean filter	OK	08/01/14, 3:32 PM		291	672	72
clean filter	OK	08/01/14, 2:45 PM		314	672	72
Check Roll bar X, Y, Z	OK	10/17/14, 11:45 PM		1739	2222	11
Check Roll Bar Nuts	OK	10/29/14, 12:48 PM		2817	2500	0
Schmieröl nachfüllen	OK	10/30/14, 1:57 PM		2843	2400	240
Check Backlash X axis	OK	11/05/14, 8:46 AM		2181	2664	0
Check Filter Chiller	OK	07/17/15, 9:50 AM		8277	8760	168

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New features

- Local installation on the user interface Sinumerik Operate
- Clear list of upcoming maintenance work
- PDF documents can be filed for each maintenance measure
- Bundling of information from different sources on maintenance intervals and linked activities thanks to XML structure

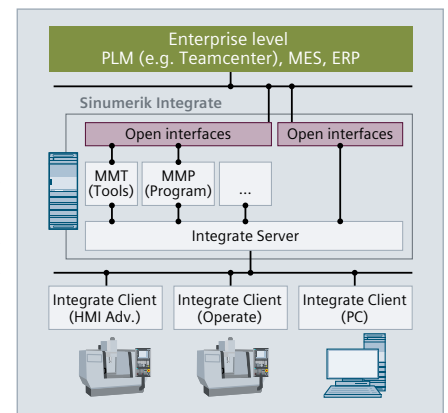
Sinumerik Integrate Access MyData

Data access on demand

Access MyData (AMD) offers an open interface function that provides smooth access to data on Sinumerik 840D sl-controlled machines. AMD Basic, which is free of charge, enables the direct writing and reading of NC and PLC data, which allows for the transfer of information to control center software and computers of all kinds, as well as for dynamic machine integration with any product lifecycle management, ERP or MES system. This kind of data transfer does require special knowledge, however. To reach a lower fault tolerance, a number of AMD interfaces, which are available at a cost, use pre-processed data and thus facilitate the implementation of well-defined services. Security during data transfer is provided by direct communication of the machine tools with the updatable

Integrate Server, which not only protects the machine from risks and threats, but also prevents the data exchange from disrupting machine operation.

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New features

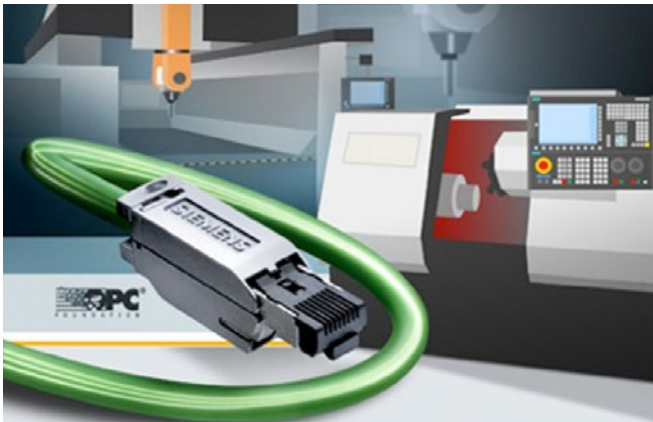
- Direct reading and writing of NC and PLC data with AMD Basic (free of charge)
- Access to pre-processed data offering well-defined functions (subject to cost)
- Expansions: interfaces to Manage MyTool, Manage MyPrograms
- Direct communication of machine tools with the Integrate Server

Sinumerik Integrate Access MyMachine /OPC UA

Determining machine and process data

The option Access MyMachine (AMM) /OPC UA makes it possible to easily identify current machine and process data from one plant. With this feature, users can capture operating data or get diagnostic information. This option allows the Sinumerik 828D/828D Basic and Sinumerik 840D sl CNCs to be integrated into the company network – without the use of an additional PC. The system can be accessed via the integrated OPC UA interface. The communication protocol enables the reading and writing of system variables, making it unnecessary to use an additional external PC to transport or read out machine data.

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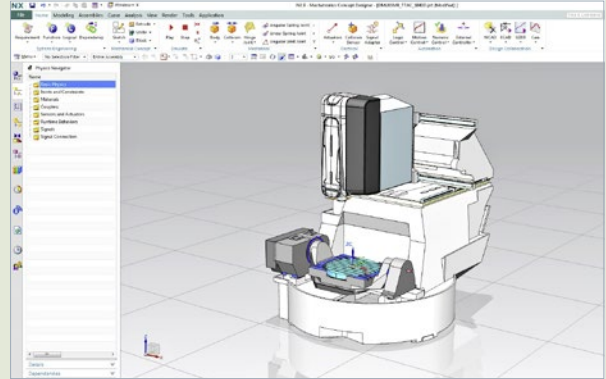


New features

- Application in Sinumerik 828D, 828D Basic, 840D sl
- Integration into company networks possible without PC
- No additional external PC required for data transfer

Virtual commissioning

Hardware-in-the-loop shortens real commissioning



Virtual commissioning makes it possible to test and validate the interplay of a planned machine tool with the automation under real conditions. This is achieved with a Hardware-in-the-Loop (HiL) solution – the connection of virtual machine model and real automation. This solution for virtual commissioning is based upon hardware in the Sinumerik 840D sl CNC context, which is connected to the Simba box hardware using the Simit simulation software, in combination with the Mechatronics Concept Designer (MCD) from Siemens PLM software. The communication between Simit and Sinumerik 840D sl takes place via Profinet/Profibus. The Simit simulation framework simulates automation behavior for the controller and the fieldbus stations. In Sinumerik 840D sl, axis values can be transmitted via PLC with the Sinumerik Integrate Run MyCC / ADAS compile cycle, for example. Thanks to this HiL-solution time savings of up to 70% can be realized during the actual commissioning.

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siemens.com/plm/mcd
siemens.com/simit

New features

- Consistent Siemens solution for the virtual commissioning of machine tools
- Creating a PC model for the simulation of a machine and its connected CNC
- Testing machine designs under real conditions, as well as running through the interaction of CNC and future machine in detail

Sinumerik 828D PPUxx.3**More efficient and robust**

With the new version of Sinumerik Operate V4.5 SP3, Sinumerik 828D's compact controls have been equipped with even more efficient hardware. The scalable PPUs of Sinumerik 828D Basic (PPU240.3 / PPU241.3) and Sinumerik 828D (PPU260.3 / PPU261.3 or PPU280.3 / PPU281.3) have significantly enhanced the operating speed in Sinumerik Operate, with the screens refreshing almost twice as fast as before when changing the operating areas. That speeds up work during commissioning, programming and operation. Additionally, the new hardware makes it possible to also operate both turning and milling technologies on the

Sinumerik 828D Basic on the same PPU240.3 or PPU241.3 hardware. This leads to considerable cost benefits, especially in terms of spare part logistics and warehousing. Last but not least, the hardware is even more robust for use in rough industrial environments and is better protected against faulty wiring during control cabinet installation.

PPUxx.3 has the same size and connections and is thus fully compatible with PPUxx.2, so users can switch to the new hardware at any time without any problems. To use the new hardware, Sinumerik 828D V4.5 SP3 software is required.

siemens.com/sinumerik-828d

New features

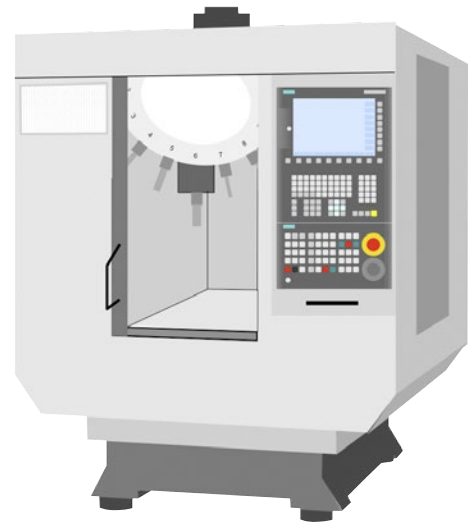
- Only one hardware for turning and milling with Sinumerik 828D Basic
- Sinumerik Operate – up to twice as fast as before
- Enhanced robustness
- 100% compatible with PPUxx.2
- Useable from Sinumerik 828D SW V4.5 SP3

Tapping center package**The right solution for tapping**

Tapping centers are especially designed for drilling and thread machining and are often used for manufacturing hard drives and mobile phone enclosures. They are machined with small tools and high speed. The new and well-coordinated Sinumerik 828D system components considerably improve the productivity of the machine. The package consists of the new PPUxx.3, the new version of Sinamics S120 Combi and the new Simotics M-1PH8 Premium Performance. Thanks to the perfect interplay of highly efficient hardware, the higher overload-capable converter

and the powerful main motor, spindles can be run up from 0 to 24,000 rpm, in less than one second. This saves a lot of time during the many tool changes per component that occur with these applications.

The new converter in the Sinamics S120 Combi series is optimized with triple overload capacity for use in the tapping centers. The different hardware versions of PPU260.3 or PPU280.3 also make it possible to adapt the package to different requirements regarding the machine's dynamics. The current trend for components in mobile phones goes toward free-form surfaces with high surface quality, which must be machined with small tools in High-Speed Cutting (HSC) and short processing times. This is where the Simotics M-1PH8 Premium Performance scores with its high achievable speeds.

**New features**

- High efficiency thanks to the combination of Sinumerik 828D PPU280.3/PPU260.3 with new Sinamics S120 Combi and Simotics M-1PH8 Premium Performance
- Spindle ramp time less than 1 second from 0 to 24,000 rpm for very fast tool changes
- Function and performance scalable thanks to different PPUxx.3 versions
- High speed for HSC with small tools

siemens.com/sinumerik-828d

smart operation: Operator Panel OP 015 black / OP 019 black**Robust screens for industrial use**

The new Sinumerik OP 015 black and OP 019 black operator panels, with their robust and durable capacitive touchscreens, are perfect for use in harsh industrial environments. Using glass with an IP65 high degree of protection rating, the panels have been equipped with non-contact sensors and can even be operated when the machine operator wears gloves.

Blackline panels also feature durable LED background lighting, providing 40% energy savings compared to conventional neon lamps. The wide 15.6" (OP 015 black) or 18.5" (OP 019 black) screens with a resolution of 1366 x 768 pixels provide brilliant images. The panels are installed with clamps and held in place by a self-supporting unit.

New features

- Robust and durable with capacitive touch
- Heel-of-hand recognition and recognition of liquids and contaminants
- Connection via Industrial Ethernet
- Operation with gloves possible

siemens.com/sinumerik

Efficiency in production**All information on the machine**

The new program management function in the operating area program manager offers users convenient data transfer and easy program handling. The parts program with a maximum of 24 plain text characters and a preview window enable easy reading, and direct access to all connected drives is possible thanks to plug-and-play. Program management makes organization easier, as well: Sub-directories for workpieces can be created in local drives (on the company network) and on the NC, and both image files (JPEG, PNG, BMP) and PDF, HTML and HTM files can be displayed directly on the control, which is the pre-requisite for paperless production.

siemens.com/sinumerik-operate

New features

- Direct access to connected network drives
- Parts program in plain text
- Sub-directory for workpieces – local and on the NC
- Display of image, PDF, HTML, and HTM files on local drives in the program manager

smart operation: ncTOUCH**Transparency for shopfloor managers**

For Sinumerik 840D sl with software versions higher than 4.5 SP3, it is now possible to get an overview of the current machine or processing status at any time – without any additional IT software and without actually going to the machine. With ncTOUCH, information about the machine's status, tool supply and machined material can be displayed on any mobile device. Users no longer need to install local software via universal browser apps. Instead, they have access to a selection of plug-and-play screens that provide quick and easy access to data. For this, ncTOUCH supports all file formats such as pdf, dxf and doc. This function is perfect for small manufacturers.

siemens.com/sinumerik

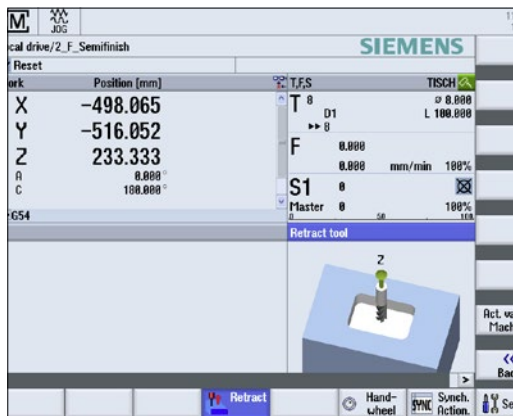
New features

- Information about the machine or machining status via mobile device
- Connection with Sinumerik 840D sl through the plug-and-play interface and local WLAN

Retract function with Sinumerik Operate

Tool retraction

The retract function in the new version of Sinumerik Operate supports manual retraction of the tool from the workpiece after an interruption due to a power failure or NC reset. This supports tool retraction in the tool direction in JOG mode and provides the op-



tion to resume machining at the point of interruption. The specifics of the interruption during an active Cycle800 swivel cycle, during five-axis TRAORI transformation, or during tapping (G33, G331/ G332) are taken into account. If a tapping process is stopped, the spindle interpolates in JOG with the z-axis when retracted from the thread.

siemens.com/sinumerik-operate

New features

- Retraction of the tool in JOG
- Consideration of specifics in Cycle800, TRAORI and tapping
- Interpolation of the spindle in JOG with the z-axis when tapping

Sinutrain for Sinumerik Operate

Learning and programming offline



With Sinutrain, Siemens offers users a perfect tool for the simple learning and professional training of CNC functions. The program works exactly like a real Sinumerik CNC. In the new software V4.5 ED.2, the collision avoidance function is now available in Sinutrain. This means

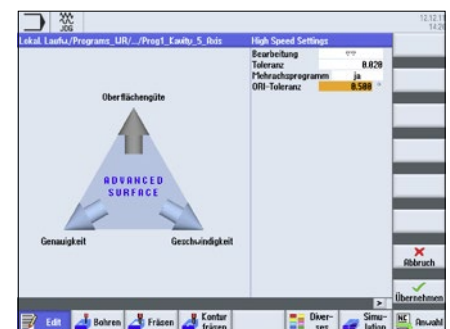
that example machines with already-commissioned models are made available for training purposes – and that real machines using collision avoidance can be mapped in Sinutrain. Integrating collision models with NX Sinumerik Collision Avoidance or NX MTB is also possible. Additionally, the new

High-speed setting cycle with Sinumerik Operate

Speaking plain text

High-Speed Setting Cycle (HSC) 832 in the operating area of programming is a simplified Sinumerik machining cycle for all mold and die applications transporting machining tolerance. The functionality of the new version has been extended. Machining types such as finishing, pre-finishing or roughing can now be displayed in plain-text, and orientation tolerances can be entered as well. HSC Cycle832 also impresses with its intuitive operation. Users need to enter just a few parameters for perfect machining.

siemens.com/sinumerik-operate



New features

- Convenient input of few parameters to optimize machining
- Output of machining type as plain text
- Input of orientation tolerance

New features

- Based on CNC software V4.5
- Collision avoidance function is now available
- Installation of Manage MyTools and Manage MyPrograms possible

software version also enables the installation and commissioning of functions from Sinumerik Integrate, such as tool and program administration (Manage MyPrograms [MMP] and Manage MyTools [MMT]) at a later point in time.

siemens.com/sinutrain

Sinumerik Integrate Run MyRobot

Easy robotic operation on the machine tool

Sinumerik Integrate Run MyRobot enables users to control, program and diagnose KUKA robots from a CNC machine tool. The robot is linked to the Sinumerik 840D sl via mxAutomation function blocks. This connection facilitates IT integration of the automated cell into the production process by further means of Sinumerik Integrate. In addition to data and program safety, this also applies to the capture of operating data and remote maintenance.



siemens.com/handling

New features

- Standardized integration of the automated cell into the production process
- Easy to operate with CNC expertise

Sinamics S120 Combi

Perfect combination for milling

A new version of the Sinamics S120 Combi drive has been developed in combination with the new Simotics M-1PH8 premium performance motor with a rotational speed of 24,000 min⁻¹ for use primarily in tapping centers. Like all Sinamics S120 Combi versions, the new drive also features faster current regulation for the spindle motor module with a constant current control clock cycle of 125 μs. The pulse frequency for the spindle motor module has been enhanced to 8 kHz, and overload capacity has also been increased. The new Sinamics S120 Combi comes with a drip catcher as standard.



New features

- Support of external measuring systems (certified Drive-Clig encoder)
- Random allocation of brakes: the brake is also allocatable to the spindle motor module (e.g., for applications with external spindle converters and a z-axis on the spindle motor module)
- Supports Simotics T-1FW6 motors
- New Sinamics S120 Combi version with higher overload capacity up to factor 3

siemens.com/sinamics-s120

Simotics M-1FE2 High Torque

Even larger and more productive

The Simotics M-1FE High Torque (HT) built-in motor series for large milling and turning centers has been extended with version M-1FE2, size 180. The larger inner diameter makes production even more efficient, as larger bars can pass and shaft stiffness is higher. Moreover, higher torques, up to 1,600 Nm, enable higher machining torque and eliminate the need for a gear in the machine, which also has a positive effect on productivity. Simotics M-1FE2 motors are equipped with permanent magnets, providing the highest torque density and enabling compact construction of the machine. As users can choose the version with or without a cooling jacket, the motor can be flexibly adjusted to the motor spindle.

siemens.com/simotics

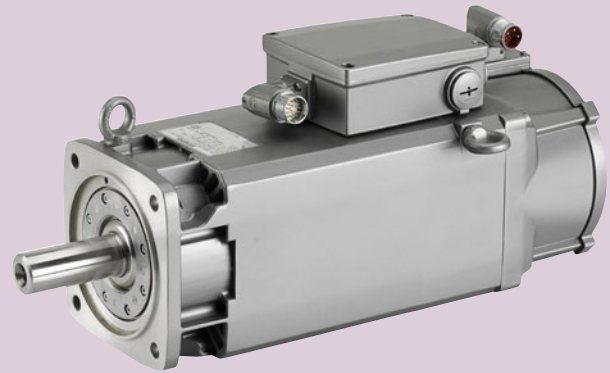


New features

- High torque density thanks to permanent magnets
- Large inside diameters
- Increased torques
- Available with or without cooling jacket

Simotics M-1PH8 Premium Performance

Speed demon



The new Simotics M-1PH8 Premium Performance main motors stand out thanks to an even higher maximum rotational speed of 24,000 min⁻¹. This enables better surface quality during finishing and higher productivity with a quicker feed. The motor has a very short run-up time due to its low moment of inertia and the high overload capacity, which guarantees high dynamics and short tool change times. The motor is optimized for use with the new Sinamics S120 Combi drive. Thus, it has the customized dimension for all tasks. The 24,000 min⁻¹ Simotics M-1PH8 motors are used primarily in tapping centers.

siemens.com/simotics

New features

- Maximum rotational speed of 24,000 min⁻¹
- Short run-up time
- Optimized for the new versions of Sinamics S120 Combi drive
- Versions in shaft height 80 with forced ventilation or water cooling and optionally with hollow shaft for inner cooling of tools

Weiss 6,000 Nm motor unit

XXL motor unit

The new 6,000 Nm motor unit from Weiss Spindeltechnologie GmbH stands out in particular due to its high precision and extremely high torque generated without any intermediate transmis-

sion gearing. With about 80 kW of power, it is capable of producing 6,300 Nm of torque with a rotational speed of 120 min^{-1} during continuous operation. During intermittent duty, it has a maximum torque of 8,350 Nm. These figures are especially important for manufacturing plants working in the aerospace, power generation and mining industries. The structure of the units is very similar to that of traditional motor spindles with powerful asynchronous

motors. However, the tool is not connected to the motor unit with a conventional clamping system, but via a connector on the spindle nose. With a total length of 2.2 m in relation to the available torque, this motor unit is very compact, which has a positive impact on machine design and precision.

siemens.com/spindles



New features

- High torque of 6,300 Nm to 8,350 Nm
- Extremely high precision (true running accuracy of $5 \mu\text{m}$) at high torque
- Can be used with large machine tools for heavy-duty cutting

SMI 24 Weiss spindle sensor module

Plug-and-play commissioning

The SMI 24 spindle sensor module from Weiss Spindeltechnologie GmbH makes it significantly easier to commission spindles in machine tools when combined with a Sinumerik CNC and Sinamics drives from SW 4.5 onward. The electronic nameplate independently feeds every parameter into the control system. In addition, signals from the rotary encoder and the motor temperature measuring unit are digitized and transmitted to the Sinamics drive. The new Weiss spindles with the SMI 24 sensor mod-

ule also offer great advantages if the machine tool has a Sinumerik 840D sl with the integrated ISM spindle motor option activated. The signals from the spindle are then evaluated statistically and archived in chronological order. Possible causes of failure can then be identified quickly and easily.

siemens.com/spindles



New features

- Easy commissioning due to independent transmission of parameters to the control system
- Statistical evaluation of spindle data such as temperature curves, run time, rotational speed, torque profiles, etc.
- Time-related changes while clamping the tool are shown in order to enable the planning of servicing tasks in good time

Sinumerik application examples

Visit our Siemens Industry Online Support Portal and find helpful application examples for Sinumerik under "Applications and tools."

This collection of completed, tested and documented application examples can be used free of charge.

The latest application examples:

- Sinumerik 840D/840D sl: Technology database for Sinumerik Operate
- Sinumerik 840D sl: Safe coupling of two Sinumerik 840D sl controls

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