

# motion world

The Magazine for CNC Automation

The background image shows a close-up of a person's hands holding a tablet computer. The person is interacting with a Siemens CNC machine control panel. The panel features a large red emergency stop button, a grid of function keys, and a numeric keypad. The tablet screen displays a blue interface with various data points and graphs. The overall scene is set in an industrial environment, likely a manufacturing plant.

IT platform increases  
productivity

New solutions for integrated production

## IT platform increases productivity

With Sinumerik Integrate for production, Siemens offers a software platform for integrated manufacturing that increases efficiency in both small and large companies significantly  
Cover picture: Siemens AG



## Editorial

- 03 The perfect solution for small and large companies**

## Cover

- 04 IT platform increases productivity**  
Sinumerik Integrate for production

## Retrofit

- 08 Retrofit with a vision**  
Silhouette uses Sinumerik-controlled robots for the manufacture of its sunglasses

## Automotive

- 12 Dynamic machining for complex parts**  
GKM equips new machine tool with powerful Sinumerik 840D sl

## Medical

- 14 Implants in series**  
Automated serial production of titanium implants at Stryker Leibinger

## Mold-and-die production

- 16 Success as standard**  
Huron uses Sinumerik Operate for simple programming and operation of its machine tools

## Power generation

- 20 Gigantic dimensions**  
Dörries Scharmann developed a series of large-scale machines for the production of turbine housings

## Aerospace

- 22 Ready for takeoff**  
Zimmermann Inc. equips its new machines with Sinumerik 840 D sl to machine large parts
- 24 Controlling success**  
Smiths machine produces complex parts for the defense and aerospace industries

## Milling

- 27 Perfect combination**  
Mazak machines now available with Sinumerik CNC for demanding five-axis machining tasks
- 30 Machining takes center stage**  
Martin Guitar relies on Siemens-controlled Fryer machines for right-angle compensation in the milling of guitar parts
- 32 Robot control included**  
DMG MORI SEIKI implements the innovative Run MyRobot automation solution on its new NTX 1000 machining center

## News

- 34 Sinumerik training in Japan**  
Weiss Spindeltechnologie GmbH

## Dialogue

- 35 Apps / Magazines**

# The perfect solution for small and large companies



Machine tools are an essential component in industrial manufacturing. Many small and medium-sized companies are successful in this market thanks to highly specialized and flexible manufacturing processes they are able to deliver even small lots of high-quality products. These companies need automation solutions that are perfectly tailored to their requirements, in terms of both optimum size and ease of use.

Our shopfloor operation exhibits at this year's AMB trade show in Stuttgart demonstrate how small and medium-sized businesses can benefit from Sinumerik CNC systems in operating their machine tools. One key component is our well-established and proven Sinumerik Operate interface; and with Sinutrain we offer a simple and user-friendly offline programming station. A completely new product is ncTOUCH, which allows users to access the current machine status from any smartphone or mobile device, no matter where they are. Visit us in Hall 4, Booth C12, for a hands-on demonstration of this feature on a mill-turning center with Sinumerik 840D sl. Together with KUKA we have developed the Run MyRobot solution that enables the level of automation to be increased in the direct vicinity of machine tools. Now operators can integrate robots for loading and unloading in manufacturing processes and can program and operate these robots with their existing CNC expertise.

In larger companies, networking and digitalization of systems is gaining in importance. By networking machine tools and integrating them with higher-level IT systems – which is another focus of our exhibits – we, together with our customers, are moving toward Industrie 4.0. In addition to our Sinumerik Integrate modules for communication of machines with control and monitoring systems, we offer powerful applications for easy and user-friendly management of tools and parts programs, for enabling high visibility of machine states and production data and for remote servicing of machines installed all over the world. Our AMB exhibits also showcase completely new modules, for example, for scheduling maintenance.

Visit our AMB booth to learn more about our latest solutions for CNC machine tools or read about the numerous insightful application examples in this issue of *motion world* and the supplement *Sinumerik InSight*.

Yours,

A handwritten signature in black ink that reads "Michael Brückner". The script is fluid and cursive.

**Michael Brückner**  
Vice President Machine Tools  
Sinumerik High-end

**Sinumerik Integrate for production**

# IT platform increases productivity

Today, practical solutions for CNC-controlled machine tools exist that actually merit the term Industrie 4.0. These tools can be found in many different production areas.







Industry software integrated directly into the control system is the key to networking machines and systems — and therefore the key to greater productivity.

The IT networking of machines and systems offers marked increases in the productivity of CNC machine operation. The pre-requisite is access to all relevant machine data. This includes a smooth connection of the individual machines to a higher-level machine control system. With the new Sinumerik Integrate for production (SIP) software suite, Siemens offers the key to practice-oriented machine integration.

### Practical benefits

Be it tool or program management, condition monitoring, maintenance planning or production data collection — this software suite makes every function available on a single platform. The package only needs to be installed on a Windows server, and Sinumerik-controlled machines can simply be integrated into an existing or new IT network via the Sinumerik Operate or HMI Advanced user interfaces — all of this using a minimum of hardware. A simple installation and licensing procedure activates the individual applications. The system itself is not complicated and can easily be expanded with additional applications later on. Integrated directly into the control system, the software suite can read all data

from the production hardware, the CNC and the PLC, and make that data available for further operational use. Benefits for the user include — applications have access to hard data, available in real-time and on-demand.

### Simple tool management

Whereas a conventional tool management program accesses a manually maintained database, the SIP application Manage MyTools (MMT), for example, retrieves its information directly from the machine. On MMT data levels, all attributes are recorded as master data in the tool library — from the length, radius and weight to assembly and measurement instructions including tolerances, as well as graphics, and so on. The lifecycle of the clearly-labeled tools can be monitored continuously. This makes it possible to immediately reuse partly worn tools, even if they have been discharged for reasons of space. As the information on the remaining operating life is retained by the actual measuring instrument, there is no need to measure it again. Even as a stand-alone version, MMT facilitates tool management by generating a list of differences on the individual machines.



## Secure remote access and maintenance

The Access MyMachine (AMM) and Analyze MyCondition (AMC) applications ensure remote access, diagnostics and maintenance. As these applications

from program management and maintenance planning to production data collection and the creation of key performance indicators.

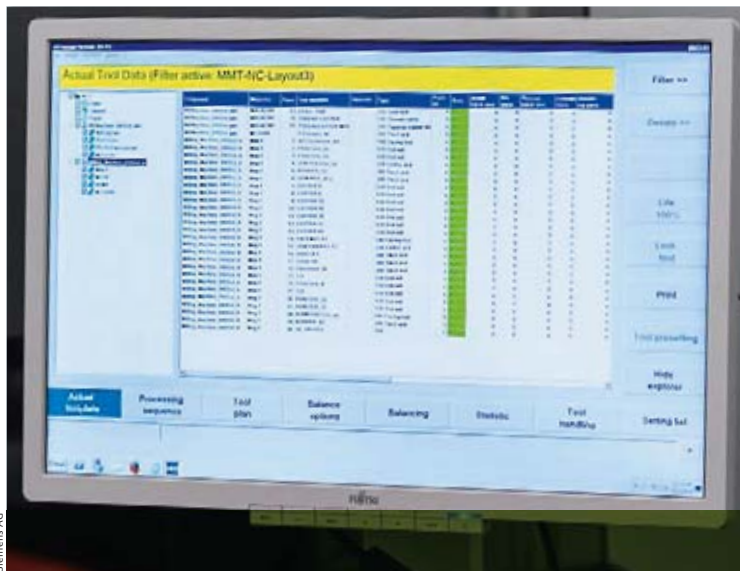
## Secure machine operation guaranteed

Security concerns often prevent decision makers from promoting IT integration, especially if a solution exceeds the boundaries of a plant. SIP protects the user from cyber threats any system is exposed to when machines are connected to internal and external networks. This is because, on the one hand, communication with the Integrate server comes directly from the machine tools, and on the other hand, updates and security patches can be installed promptly on the server without interfering with the machine's operation.

However, a complete system is only as secure as its weakest link. Looking at the service life of CNC-controlled machine tools, which is approximately 15 years, but sometimes reaches 40 years, Siemens made sure to design SIP in such a way that new machines and existing ones with weaker hardware can both be integrated. This backward compatibility is achieved by means of an updatable Integrate server, where all the individual applications are set up and which connects the machine tools as intelligent clients.

## Quick and flexible production

When used consistently, the applications in SIP make extensive information about production processes and machine statuses available to all those involved in production, as well as to production management or machine service. This solution is especially suitable when it comes to responding quickly and flexibly to customer requirements — and efficiently producing many product versions in small batch sizes — irrespective of the size of the manufacturing company or the number of machines to be connected. Already today, 15 Siemens plants and factories worldwide demonstrate the successful performance of this software suite. Here, various applications in operation contribute to increasing productivity on a daily basis.



## At a glance

- Tool management program Manage MyTools (MMT)
- Remote maintenance program Access MyMachine (AMM)
- Condition monitoring Analyze MyCondition (AMC)
- Program management Manage MyProgram (MMP)
- Maintenance planning Manage MyMaintenance (MMM)

do not require an IP address accessible via the Internet, and machine-side communication is limited to outbound connections to the Integrate server, remote access is both straightforward and secure. Service personnel have access to pre-defined machine information from the manufacturer and can carry out preventive maintenance measures besides eliminating specific disruptions. In addition to MMT for tool management and AMM for remote access, the software suite has many more applications available —

## INFO AND CONTACT

[siemens.com/sinumerik](http://siemens.com/sinumerik)  
[andreas.polz@siemens.com](mailto:andreas.polz@siemens.com)

“With Sinumerik Integrate for production, small enterprises can really benefit from easy IT integration solutions, too.”

Andreas Polz, Product Manager Sinumerik Integrate for production



Siemens AG

## Interview with Andreas Polz

# Practical solutions

**Mr. Polz, in the context of IT integration, there is often talk of intelligent handling of information. What does that mean in practice?**

**Andreas Polz:** Here's an example from private everyday life: Many practical benefits have resulted from connecting people and things via smart devices. Admittedly, not everyone uses these services excessively yet. But it is already possible to automatically operate the blinds in a house using a control device. In the meantime, if such a device is provided with information on when exactly the sun rises and sets at that location — via a weather app for example — it even works specifically at a particular time each day. This is what we mean by intelligent, because this system always does its job correctly, independently of the time zone.

**Can these applications from the private sector be transferred to industry?**

**Andreas Polz:** Although the principle is the same, unfortunately it is not quite so easy. We have completely different requirements and conditions in the industrial environment. Take hardware alone: while a three-year-old smartphone is completely outdated, a machine tool of this age is still considered to be new. What's more, in contrast to smartphones, machines cannot automatically update every minute — and even end up interrupting production to do so.

On the other hand, solutions are required to be able to install scheduled updates as needed. At the same time, it must be ensured that this does not cause any damage that might lead to machine failure, in extreme cases. This is the reason we installed the updatable Integrate server as an intermediary in our Sinumerik Integrate for production solution, which undertakes these tasks and guarantees machine operation.

**Can smaller companies also benefit from these solutions?**

**Andreas Polz:** Yes, although smaller users in particular often have this perception of very complicated, unaffordable applications that can only be manufactured for the most modern systems and require a great deal of expenditure.

But on the contrary, the benefits of Sinumerik Integrate for production are very high, even for small companies. Specifically, they can use the new application Manage MyMaintenance to easily get an overview and gain control over all maintenance work on the existing CNC machine tools. That's an advantage even for just three machines. Not to mention the fact that this function is also intended and available for non-networked stand-alone machines.

**Mr. Polz, thank you very much for talking to us.**



Silhouette International Schmied AG, Austria

# Retrofit with a vision

In the manufacture of high-quality sunglasses by Silhouette, a modernized multi-spindle manufacturing plant accurately cuts the polycarbonate glasses, while an articulated-arm robot precisely feeds the blanks — both with Sinumerik CNC.



From sporty to elegant, Silhouette manufactures high-quality sunglasses with a high technical standard

Siemens AG

Under the Silhouette brand name, the world's lightest sunglasses are manufactured in Austria and then exported to approximately 100 countries worldwide. The glasses are produced with a significant amount of handcraftsmanship, a distinct design language, the best materials and the latest technologies. In both the elegant Silhouette sunglasses and the sporty sunglasses from the Adidas eyewear brand, a special glass design ensures a clear perspective without creating fatigue. Herbert Flattinger, head of special-purpose machine development at Silhouette International, explains: "Especially for glasses inclined toward the eye, as is often the case with sporty glasses, the eye needs to compensate the small amount of light refraction arising. This results in long-term strain and sometimes causes headaches. We have succeeded in balancing this effect already in the glass manufacture."

The foundation is built during injection molding of the polycarbonate glasses, but the subsequent production processes need to follow through. This means that the outer cutting of the individual sun-protection lenses must take place in an exact position and within several steps. In the Silhouette production line, this task is performed by multi-spindle milling machines from Anger. Until a few years ago, the individual lenses were inserted into the machine by hand. The integration of a gantry robot meant that the operation could be automated — though not fully at first.

## Extensive retrofit

Thanks to an extensive retrofit of the entire machine, robot and CNC system, manual intervention is no longer necessary. Originally, the decisive factor for





Thanks to Run MyRobot software interface, Silhouette production workers have no fear of using the robot. They can control it using the Sinumerik 840D sl operator panel, just like any other axis of the machine tool

the complete modernization in 2013 was the age-related wear, along with the associated rising maintenance costs. From today's perspective, however, the redesign has also delivered benefits for the productivity, reliability and user-friendliness of the plant. "We expect the complete investment to have paid off within only 18 months," the project team at Silhouette International reports.

Because, according to Silhouette, there are no fully automated manufacturing plants on the market that are suitable for continuous production throughout the complete production process, it was already clear in 2011 that the existing equipment needed to be given a general overhaul. Accordingly, the company needed to supplement the expertise of its production personnel with a knowledge of drive, control and robot technology from external partners. After extensive studies and comparison tests, the company determined that Siemens and KUKA best fulfilled the technical requirements. Following the project launch, the entire system was completely disassembled within four months, mechanically optimized, equipped with a new drive and control system and supplemented with a KUKA KR 5 arc articulated-arm robot.

### Consistency from programming to machine and robot

A special feature of the new plant is that both the multi-channel milling machine and the six-axis robot are controlled centrally via the high-end Sinumerik 840D sl CNC. Engineers from both Siemens and KUKA worked closely together to develop a consistent, standard solution — an important aspect for Silhouette, because although the machining technicians knew exactly how to operate machine tools, they were not familiar with handling a multi-axis articulated-arm

robot. Controlling the robot with the CNC, and thereby reducing the technicians' fear of using the robot, was made possible with the Run MyRobot (RMR) software interface. As confirmed by Silhouette's production workers: "Being able to control the mechanical KUKA arm with our normal operator panel makes us very happy with the entire plant. To be honest, we actually enjoy being in charge of such complex movements every now and then." These complex movements are transferred to the robot control system in real-time via the mxAutomation command interface and are then performed by the robot with typical KUKA precision. In the process, the safety functions in the SafeOperation robot option ensure that the robot does not leave the designated operating range.

The NC technicians use the operating terminal primarily when setting up the machine and when teaching or retracting the robot. They are as enthusiastic about the touchpanel as they are about the intuitive Sinumerik Operate user interface. Above all, they like the brilliant resolution and the quick-response touchpanels on the industrial display as well as the PC-typical design of Sinumerik Operate. They already know several of the keyboard shortcuts from their PCs, such as Ctrl+A for "select all," which is one reason the employees find working with Sinumerik easy, even though some of them have worked with a different CNC for several years.

The milling machine and robot programs are generally written using Silhouette's own CAD/CAM workstations, which are equipped with NX CAM. Here too, consistency is a priority. "Once our lenses are developed, the data is made available to every department involved in the process. Even the robot and machine operators can access NC programs as well as tool data," explains the head of special-purpose machine



Thanks to its high level of flexibility and reliability and the extreme degree of freedom, the KUKA KR 5 articulated-arm robot facilitates a fully automated, unmanned nightshift

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development. After graphical simulation on the CAD/CAM workstation and any possible optimization, the NX program can be transmitted directly into the NC code using a post-processor optimized for Sinumerik and then transferred to the 840D sl. The production technician can then set up the system without further delay, equip it and start the production process.

### Smooth production process

The fully modernized production plant has been in operation and running smoothly in three shifts since mid-2013. In order for the night shift to function unmanned, the late-shift worker fills the workpiece storage with the appropriate blanks and loads the relevant NC program before the end of work. After this, even various product changeovers are possible. The six-axis articulated-arm robot takes the corresponding raw lenses out of the stacking magazine with its vacuum grippers and inserts them into a centering station, where it is positioned precisely and transferred to the milling machine. The machine then mills and drills the contours of the polycarbonate lenses in several steps. Here, thanks to the stable design and the high-quality Sinumerik 840D sl CNC, the multi-spindle center is able to observe tolerances of  $\pm 0.015$  mm and to reach surface qualities with an average roughness of  $R_a = 0.1 \mu\text{m}$ .

The Sinumerik MDynamics technology package, along with the corresponding Advanced Surface

intelligent path control, plays an important role for the high-quality machining taking place here, as highlighted by Siemens sales consultant Thomas Waltschek: "In this latest software version, our developers have optimized the look-ahead function once again and integrated a high-performance data compressor. Now, our control system achieves a perfect ratio of cutting efficiency to surface quality and precision." At the end of the machining process, the vacuum grippers are used once more to store the completed sunglasses in transport boxes.

### Correct lenses in less time

"With our completely overhauled plant, we can constantly manufacture optically correct lenses without any human intervention — and around 20% faster than before. For us as a premium eyewear manufacturer, these arguments are compelling," summarizes Flattinger. Currently, a second production line is going through the same retrofit with the same partners. "And our third production line, out of a total of eight, is already being planned," reveals the head of special purpose machine development. ■

### INFO AND CONTACT

[siemens.com/sinumerik](http://siemens.com/sinumerik)  
[michael.strahlberger@siemens.com](mailto:michael.strahlberger@siemens.com)



# CNC and Robotics.

# All operated by SINUMERIK.



## SIEMENS

Strategic partner for robot-based industrial automation and machining robots.

**Use a six-axis robot for machining and handling tasks directly at the CNC machine.** The central user interface of the KUKA robot on the SINUMERIK-CNC opens up the possibility of seamlessly integrating robots into machine concepts and production processes using the KUKA KR C4 without the need for lengthy training. For unprecedented flexibility and increased productivity, e.g. in fully automated 24/365 operation.

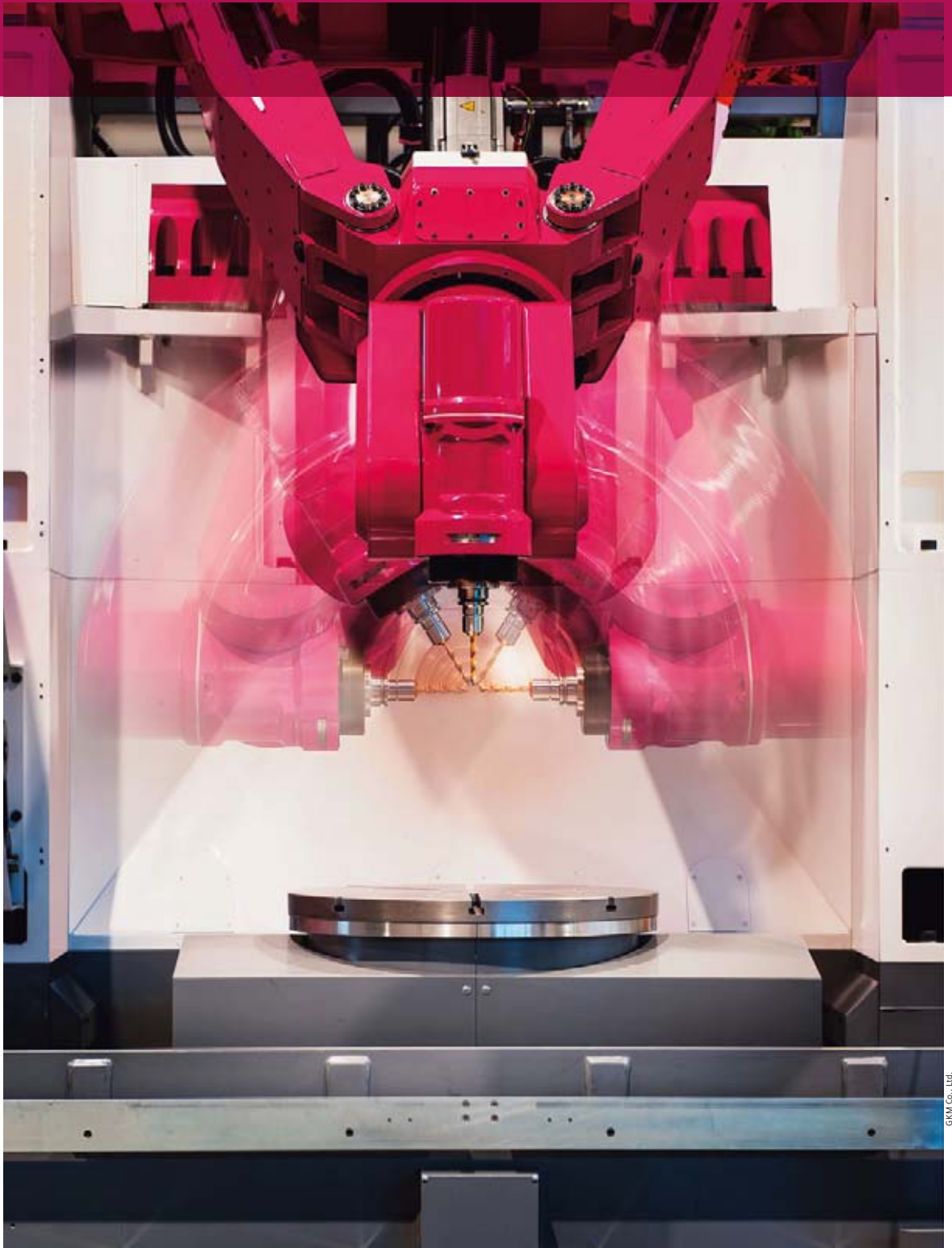
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# KUKA

GKM Corp., Japan

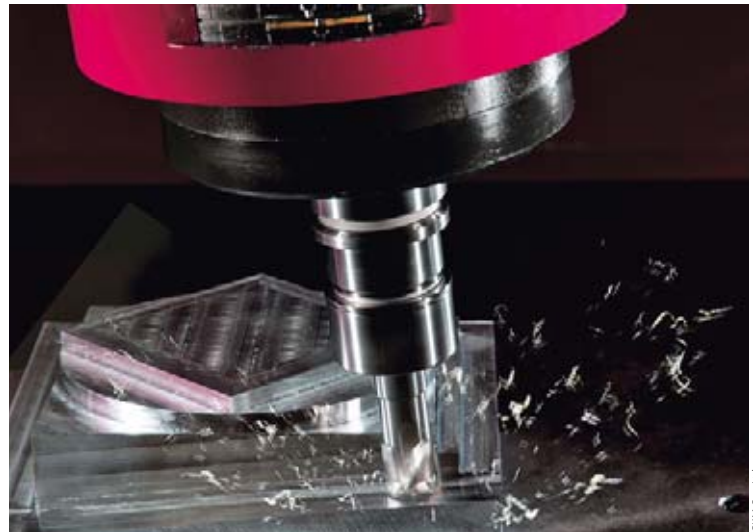
# Dynamic machining for complex parts



High-rigidity  
roller screws  
and temperature  
compensation  
in each axis  
result in high  
accuracies in  
roundness



Specialized in five-axis machine tools for the aerospace and automotive industries, GKM develops parallel kinematic machining technology in its new XT500S1 and XT700S1 machine tools. The highly dynamic and accurate modules require extensive programming within the controller — a natural fit for the powerful Sinumerik 840D sl premium CNC.



The spindles are designed for high-speed and high torque, capable of cutting materials such as aluminum, carbon fiber, steel and titanium

Japan-based GKM Corporation was founded in 2012 as a joint venture between two Japanese companies, Giken and BBS Kinmei, and the Korean automation specialist MRT. Based upon the revolutionary Exechon parallel kinematic technology, GKM manufactures state-of-the-art machine tools for five-axis machining in a competitive price range. The XT500S1 and XT700S1 machines have three linear axes and two rotary axes. They allow for automatic tool change on the spindle head of the five-axis module and are capable of cutting flat and angled surfaces, as well as drill holes. By mobilizing the module itself, they are also capable of cutting larger components. GKM relies on the high-end Sinumerik 840D sl control to secure a competitive edge for this leading technology. The CNC controller includes a function called "Transformation TRIPOD HYBRID Kinematic" function, which allows operators to use a standard program for five-axis machine tools worldwide. By automatically converting the position data of the tool center point and its orientation into the movement of the individual axes, the Sinumerik CNC turns the operation of this modern machine tool into child's play.

### Programming within the controller is key

The parallel kinematic machine (PKM), originally designed and developed by Karl Eric Neumann from Exechon, provides the flexibility and high dynamics of a robot with the rigidity and accuracy of a machine tool. Eliminating the large structures required by machine tools to achieve tight tolerances over large work envelopes and providing rigid machining capabilities that are not achievable with standard robots, the PKM is becoming the preferred flexible manufacturing solution for applications in which the machining of large, complex parts with compound angle surfaces requires unique machine agility, high speed

and dynamics. In the automotive industry, for example, complete car frames, engine cradles, engine blocks, cylinder heads and structural components all take advantage of the PKM. In the aerospace industry, PKM is often used in wing and fuselage structures and assemblies, while the heavy equipment industry uses it for the manufacture of structural components. The flexibility of the PKM allows many different components to be manufactured on a single machine.

### Siemens as a technology leader in PKM

The Exechon PKM technology requires extensive programs within the controller in order for the machine to be both programmed and operated like a typical Cartesian-coordinate machine tool. Early on, Siemens recognized the strategic importance of PKMs and dedicated a large team of developers to the design and development of a sub-program that would not only operate the complex machine, but allow it to be completely manipulated using the same language and commands that are used in standard five-axis machine tools. The M-codes and G-codes are the same; so, even though the machine is actually moving all five axes when the operator directs the tool center point to move in one direction, the sub-program converts the command to the movements of all the axes required to complete the task. This has resulted in Siemens leading the field since the early development of parallel kinematics. Its powerful Sinumerik 840D sl controllers are implemented in manufacturing-industry machine shops all over the world. ■

#### INFO AND CONTACT

[siemens.com/sinumerik](http://siemens.com/sinumerik)  
[sinumerik.jp@siemens.com](mailto:sinumerik.jp@siemens.com)



Siemens AG

Stryker Leibinger GmbH & Co. KG, Germany

# Implants in series

The mechanical equipment of the medical device manufacturer Stryker Leibinger fulfills every requirement for automated and fully documented serial production of titanium implants.



With a workforce of 120, Stryker Leibinger GmbH & Co. KG, based in Mühlheim-Stetten near Tuttlingen, Germany, manufactures medical instruments and implant systems for the head, hands and feet. The manufacture of such medical devices requires reliable mechanical equipment, especially when it comes to serial production and three-shift operation. To meet this requirement, the company has introduced a standardized machine and control combination. "For the manufacture of implants, we use Chiron machine tools equipped with Sinumerik CNCs," explains Stefan Waizenegger, head of CNC in the production of bone plates. "We regard these machines as both high-class and technically mature. In addition, the openness and adaptability of machine and control in this combination allow high-level automation and therefore permit unattended production."

The manufacturer of medical devices required the machining centers to be individually configured and to match the company's range of products, as well as the existing infrastructure. Stryker Leibinger selected a total of five Chiron FZ 12K S high-speed multi-functional machining centers with Flexcell Uno, all of which are equipped with Sinumerik 840D sl, a robot and a loading magazine. At the Mühlheim-Stetten site, two of the five-axis machines, operating as a complete machining system, perform serial production of osteosynthesis implants for the surgical repair of bone fractures. Because the products and manufacturing processes were already established when the company acquired these machining centers, the applications were optimized in terms of configuration and automation.

Fotolia

There are many different versions and implants for wrist plates for the radius



**“The openness and adaptability of the machines and control system in this combination permit high-level automation and therefore permit unattended production.”**

**Stefan Waizenegger, Head of CNC,  
Stryker Leibinger GmbH & Co. KG**

### Unattended production of parts

The loading magazine on the Chiron machining centers is equipped with a radio-frequency identification (RFID) system from Siemens. The RFID chips are programmed by a handheld terminal and contain a production code to which all the relevant information for the machine — robot program, routes and control program — is assigned. The blanks are cut to the required length from a titanium profile before machining, then stamped and bent, and then milled during production in a single operation on the five-axis machine. The integrated robot removes the blanks from the pallet and then stores the finished parts there once again after machining. If a pallet has been processed, it is then switched; the machine reads the chip on the new pallet, and the production of the next parts proceeds uninterrupted.

Once they are completely set up, the machines are capable of producing various products unattended, around the clock and using various orders in a single process. In this way, several hundred parts per machine are manufactured in 24 hours. “This broad range

has come about because the running times of the individual implants are very different,” explains Waizenegger. In lower leg implants for the fibula (calf bone), there are fairly large differences in length, for example. In wrist plates for the radius, there are different widths as well as different lengths. The distal radius fracture — that is, a fractured radius near the wrist — is the most common bone fracture in all humans. This is why shorter-radius plates in particular are requested and produced in Mühlheim-Stetten almost daily.

### Important for medical devices — traceability

The entire production process at Stryker Leibinger runs strictly in accordance with the standards specified by the US Food and Drug Administration and the European guidelines for the manufacture of medical devices. There is full documentation for every single implant system produced, from the titanium profile used for the blanks, to the individual production steps, and the packaging, labeling, and sterilization, along with all the continually interposed cleaning operations, measurements

and quality assurance measures and checks. Documentation is currently provided on paper. However, preliminary work is already under way to transition to paperless documentation in the near future.

The issue of documentation will require increased attention, as laws on the introduction of an electronic identification system known as the unique device identifier (UDI) are in progress, both in the United States and the EU. With its high level of automation in production, Stryker Leibinger is still an exception in the medical device industry. As soon as paperless production begins here, the company will unequivocally take on a pioneering role. Waizenegger is already looking forward to the simplification of the work when the stacks of accompanying paper disappear thanks to the introduction of electronic signatures. ■

### INFO AND CONTACT

[siemens.com/sinumerik](http://siemens.com/sinumerik)  
[alessandro.schillaci@siemens.com](mailto:alessandro.schillaci@siemens.com)





Huron equips its machine tools with Sinumerik CNCs and the Sinumerik Operate HMI system as standard

**W**ith the release of its new hardware and software generation, Sinumerik is considered to be the benchmark and is often listed as preferred standard equipment among well-known machine manufacturers. The traditional machine tool builder Huron Graffenstaden is particularly strict in this respect. Since 1854, the company has been pursuing a strategy that merges proven and innovative systems into high-performance and practical solutions. The company also benefits from the immense amount of expertise in machine and production technology that has guided it, even through difficult times — and it always lead the way to success. Today, Huron Graffenstaden is one of the preferred suppliers to the French and international aerospace industry and in mold-and-die production all over the world.

#### **Innovation based upon proven technology**

"In the manufacture and development of its machines, Huron has always placed great emphasis on proven technology with high efficiency," explains Michael Kimenau, technical director at Huron

Graffenstaden. For this reason, the company uses Sinumerik NCUs with the Sinumerik Operate system software in all machine tools as standard, unless a customer explicitly requires otherwise. The company favors the fast Sinumerik 840D sl NCUs with multi-core technology. Their high computing power improves performance due to faster block change times and very fast operator control, for example. "In our experience, the operation characteristics of these NCUs are extremely stable thanks to the new system," adds Kimenau. "With the current version of the software and the new, high-performance NCUs, this state-of-the-art control system supports us in the best possible way across all our applications. This is also reflected in the feedback we receive from our customers."

#### **Improved surface quality, higher performance**

Productivity and surface quality are particularly important for customers in the aerospace industry and in mold-and-die production. "Here, we really are spoiled by the Advanced Surface intelligent path





Wolfgang Marschner

Huron Graffenstaden, France

# Success as standard

Today, leading manufacturers equip their machine tools with high-performance system software and fast NCUs as standard practice. These are crucial for the productivity of intelligent machine designs.

control," stresses Pascal Jung, who is responsible for applications engineering and sales at Huron. "The MDynamics technology package, based upon Advanced Surface and the Sinumerik Operate user interface, definitively offers everything needed for three- and five-axis machining these days. It makes machining significantly faster, provides excellent surface quality and is therefore used in all our milling and mill-turning machines with Sinumerik CNCs." The same goes for 3+2- and three-axis machines, which Huron prefers equipped with Sinumerik 828D CNCs. "Here, we release exactly those options the customer requires for his application," explains Jung. "But again, the system provides us with a full menu of options that might also be useful."

## Simple operation and programming

The high level of satisfaction among Huron customers is largely a result of the excellent user-friendliness of the Sinumerik Operate user and programming interface. This begins with the simple selection, as well as the quick start and termination of NC programs; »

the quick and clear accessibility of all functional areas; and the simple change among G-code, cycle and work-step programming at any time — all of which are especially valued by users working with a Sinumerik-controlled machine for the first time. But even users who already have experience with Sinumerik also benefit from these advantages. As of the software version 2.7/4.4, Sinumerik Operate offers a complete five-axis simulation, new types of pre-defined blanks and additional measuring cycles, as well as an abundance of further detail improvements, which all offer additional value. Furthermore, several previously difficult work steps have been

much easier, for example, because they do not need to calculate the feed rates and spindle speeds themselves. ShopMill determines these based upon the data of the selected tool. Because ShopMill also reverses the machining direction when mirroring the contours, no accidental counter-rotation will result after mirroring.

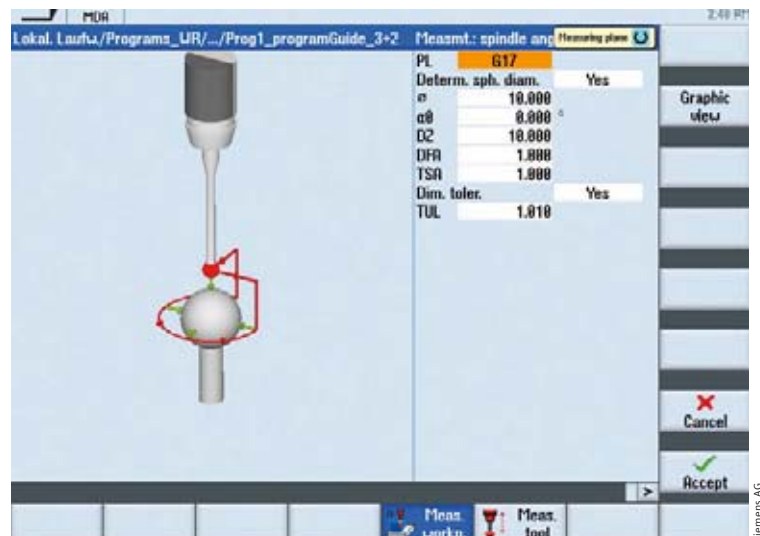
### A new degree of freedom thanks to independent kinematics

Whether conventional or CAD/CAM-aided parts programs are being created, with Sinumerik Operate,

## Measuring cycles in Sinumerik Operate

For measuring tasks in automatic mode, powerful measuring cycles for measuring the workpiece and the tool are available in Sinumerik Operate, both under ShopMill and programGuide. Input masks with dynamic help graphics make it possible to easily enter the measurement parameters.

Workpiece measurement — calibration, measuring corners, measuring edges, measuring drill holes, measuring cones, measuring 3-D. Tool measurement — calibration, measuring length and radius, measuring with a rotating or stationary spindle, tool compensation in geometry or wear.



considerably simplified thanks to new cycles, such as high-speed settings, plunging and trochoidal milling.

"Anyone who has worked with the new version of Operate will not want to go back," says Jung. Sinumerik Operate's ShopMill programming, which is fully integrated into the HMI system, plays a substantial role here. "While our users of CAD/CAM systems primarily benefit from the TRAORI TCP and Cycle800 functions, significantly more than 90% of end users who create their parts programs conventionally now use ShopMill," reports Sebastian Schmidt, who, as an applications engineer, is also responsible for user training and the Huron technology hotline. "That even goes for our smaller machines such as the NX range or our partner Jyoti's machines, which we equip with Sinumerik 828D CNCs as standard," stresses Schmidt. "Such machines are frequently used by less technically experienced users. For them, programming using ShopMill is

operation and programming are actually independent of the machine kinematics. "This is not only convenient for the user but also important to us," explains Kimenau. "For certain applications, for example, we prefer swivel tables with unconventional setting angles. They extend the machining range on the workpiece without reclamping, but they place high requirements on the operation and programming when it comes to conventional CNC technology. With Sinumerik Operate, the user simply guides the tool — whether in jog or automatic mode — in a Cartesian coordinate system adjusted to the surface of the workpiece. The axis movements required for this are automatically calculated by the CNC when Cycle800 is activated or using the TRAORI function." This dramatically improves the acceptance of unconventional yet highly productive kinematics — and therefore also improves access to the market for machine tool manufacturers.



Users benefit from the simple ShopMill programming in Sinumerik Operate — especially with smaller machines that are equipped with Sinumerik 828D

## Reduced training requirements

When it comes to user training, Schmidt confirms, “The new generation of software has yet again become a great deal more user-friendly. The fact that the simulation now also fully covers five-axis machining, for example, makes it a lot easier to track and verify the parts programs, and it also shortens familiarization with complex production technologies. And the newly-expanded and innovative measuring cycles are really simple to use — thanks to animated elements, which help users intuitively understand the mode of operation and immediately recognize the significance of the individual parameters. This has led to users being able not only to measure tools and workpieces, but also to regularly survey their machines themselves. Therefore, they have more control over their production processes.” As operation and programming with the new version of the Sinumerik system software has become easier despite more extensive functions, Huron has been able to shorten training for the machine to a maximum of four days. “Even if the machine operators have never worked with a Sinumerik CNC before, they can use the complete operating and programming functions afterward, and those who have already worked with Sinumerik 840D usually pick it up right away,” reports Schmidt.

## First-class surfaces and flexible deployment of personnel

Ever since Huron Graffenstaden made Sinumerik CNCs with the Sinumerik Operate HMI system its standard control option, users have been able to achieve maximum productivity with less effort using their new Huron machines. As operation and programming can now be performed technologically and kinematically independently for all three-, 3+2- or five-axis turning and milling machines using the same HMI system, it is possible to deploy personnel far more flexibly than before without any additional training requirements. Kimenau sums it up: “Such a powerful standard in CNC hardware and software, which is also suitable for a broad field of applications and many different types of machines, strengthens our position as a machine tool manufacturer and aids users in production. This added value makes us much more competitive in the market.” ■

### INFO AND CONTACT

[siemens.com/sinumerik](http://siemens.com/sinumerik)  
[wolfgang.reichart@siemens.com](mailto:wolfgang.reichart@siemens.com)



**E**fficient production of very large workpieces such as power plant turbine housings, for example, is only possible if all the work steps can be performed in a single clamping — from the heavy-duty machining of blanks that weigh hundreds of tons to the precise finishing of joints and surfaces. This requires large five-axis machine tools capable of turn-milling as well as mill-turning operations. To meet the increasing demands of the power industry in terms of efficiency and precision, Dörries Scharmann Technologie GmbH, a member of the Starrag Group, developed a new large-scale machine series for the global market.

### Flexible large-scale machines for a wide range of applications

The new five-axis machines offer portal passage heights of up to 10 m and, when required, can be equipped with a wide range of milling heads, a variety of different tool magazines and additional rotary tables. In order to improve dynamics and precision, the tool's vertical motions are executed by a vertically mobile crossbar (w-axis) and a RAM that functions as the z-axis. However, the real engineering challenge lies in ensuring the narrow production tolerances required when building turbines with repeat accuracy across the entire workspace. For maximum precision, dynamics and durability, all the axes in the new series of machines are mounted hydrostatically, and even the RAM is braced hydrostatically on all sides. In combination with the compensation functions of the CNC, rack and pinion drives, which are braced free from play in the servomotor, ensure the necessary precision when the gantry is being moved.

### Seamless automation minimizes project risks

The first machine in the new series, a Droop+Rein G-L, was delivered to a customer in St. Petersburg at the beginning of the year. This gantry machine has a range of 21 m on the x-axis and 9 m on the y-axis and a portal passage width of 8.5 m, and, like all the machines in the series, is a completely new develop-

**Dörries Scharmann Technologie GmbH, Germany**

# Gigantic dimensions

**Using integrated CNC and drive technology, Dörries Scharmann developed a series of large-scale machines for the production of turbine housings and brought them to market in a short period of time.**



ment. To minimize possible project risks Dörries Scharmann and Droop+Rein decided to use the seamless control and drive technology from Siemens. As a result, inconveniences and uncertainties that normally arise when integrating components from different manufacturers could be avoided. In addition, the consistent and uniform development

environment for the electrical equipment allowed for many simplifications that all parties involved could take advantage of early-on during project planning. Further time-saving simplifications are derived from synergies between system-integrated safety technology, which can draw on drive-based safety functions, and the power supply.



## Intelligent power supply, high energy efficiency

The mixed operation of booksize modules and high-performance chassis modules of Sinamics S120 drive components, which is now possible, proved especially advantageous. With the Active Line Module (ALM), they can now support larger drive capacities, and the newly-integrated reactive power compensation in the ALM accounts for lower energy costs for the machine operators. Combining the drive components with new drive motors

power loss, thereby reducing waste heat from the control cabinet by more than 90% in comparison to classic bi-metal technology and coil control. This also means that the machine's connected load can be limited to 230 kVA.

Thanks to the Siemens intelligent drive interface Drive-Cliq, which — among other things — supports electronic type plates, less time is needed for cabling and commissioning. "Via Drive-Cliq, distributed drive controllers can be connected directly to the CNC moving on the gantry. This was not possible until now, and it made modu-

## Short development period despite the complexity

All-in-all, the development period for the new series, lasting until the delivery of the first 21-m gantry portal machine, was only 22 months — a relatively short time for a project of this magnitude and complexity. Wallenstein concludes: "The new series of machines paves the way to an attractive growth market. Using state-of-the-art control and drive technology for a system as integrated and consistently as possible has given support to our development strategies



Left: With a total workspace of 21 m x 10 m x 8 m, the Droop+Rein five-axis portal milling machine offers the same precision as small machines and provides very high spindle power

Right: Sinamics S120 drives with the Active Line Module allow a reduced connected load

results in a high degree of efficiency ranging between 88% and 94%. The use of a synchronized spindle in the Droop+Rein machine also provides for energy savings, reduced heat loss and cooling capacity because its permanent magnets do not require an exciting current. In addition, coil control and electronic triggers reduce internal

larizing such a large machine significantly easier. Rotary tables and horizontal fulcrum shafts, including the CNC-controlled steady rest and tailstock, can be easily incorporated into the automation system as needed," explains Dietmar Wallenstein, head of the e-construction and commissioning divisions for Droop+Rein products.

and made it possible for us to enter the power plant component market early-on." ■

## INFO AND CONTACT

[siemens.com/sinumerik](http://siemens.com/sinumerik)  
[t.steiner@siemens.com](mailto:t.steiner@siemens.com)



Zimmermann Inc., United States

# Ready for takeoff

Zimmermann modifies its FZ100 portal milling machine with twin gantries, rotary six-axis milling heads and Sinumerik 840D sl CNCs to machine parts up to 985 inches (25 m) in length.

**T**riumph Structures — Wichita, a Triumph Group company, brought a unique challenge to the engineers at Zimmermann Inc. in Novi, Michigan, and the solution has yielded various benefits to this major supplier of aerospace components. The company specializes in complex, high-speed, monolithic precision machining and sub-assembly of aluminum and titanium structural airframe components, often with wall thicknesses down to 0.02 inches. Currently, 21 individual five-axis machining centers are housed at the facility, providing the ability to machine parts with a maximum length of 985 inches (25 m).

More than 20 other three-axis and four-axis machines complete the machining capability for aluminum structures. The results are build-to-print precision machining of aluminum and hard metal parts of all sizes, especially aircraft wing spars, skins, bulkheads and landing-gear components.

## Twin strategy for machine redesign

While the machining capabilities at Triumph Structures — Wichita were clearly substantial, a particular machine that could be used to serve multiple purposes was still found to be missing. First of all, the company needed to be able to machine very long parts with volumetric compensation to manage material expansion and the tool tip position over a very long cutting cycle, often multiple days. But then a single machine might also be capable of running multiple smaller parts or operating in twin fashion, occasionally using the entire machine bed with both heads working the same part in tandem. Triumph Structures — Wichita presented its multiple requirements to Zimmermann, its long-time partner and portal machine supplier. The German machine tool maker with a local subsidiary in Novi, Michigan, customized its popular FZ100 portal milling machine

A unique head design from Zimmermann is based upon three rotary axes

with twin gantries, each equipped with a three-axis rotary head and an independent Sinumerik 840D sl CNC. This provided simultaneous six-axis cutting in a very compact design, with no pole position, less overall axis rotation, a constant feed-rate capability and improved surface quality.

### Two machines as one

In designing the final work envelope and machine structure, Zimmermann engineers determined that the best solution was a removable center wall built into the mid-point of the machine bed, which would allow completely independent operation of the

removal rates were extremely high. This meant the machines must be very robust, with high-precision control of the cutting cycles, which often run for multiple days.

When asked about the choice of CNC for the machine, Zimmermann Inc. president Matthias Tockook explains: "With all the challenges we had on this machine, including the axes of motion, the integration of the twin gantry movements, the substantial safety factors involved and the need for independent and codependent gantry operations, we quickly determined that only twin Sinumerik 840D sl CNCs could handle the job."



entire machine, so it could literally run as two machine tools in one. When removed, the machine bed could accept table lengths up to 1,181 inches (30 m) and process them using the twin heads working in tandem and monitored for total collision avoidance by the two CNCs onboard. Owing to the unique volumetric compensation feature of the Sinumerik CNC, in which the execution of the machining is based upon the actual tool tip position, the point of intersection for the twin heads was found to be an easily addressed and resolved issue. Surface integrity on the workpiece would be preserved, while machine and operator safety would remain paramount.

### Sinumerik for high-precision control

"We had grown steadily since our incorporation of five-axis work in the 1990s and were ready to jump to a new level of competence for our customers, who represent the top players in both commercial and military aircraft," says Harry Thurmond, president of Triumph Structures — Wichita. The part length capability was 22 feet, and the company aimed to expand it into the 40- to 80-foot range. As with all aerospace structure machining, material

### Improved cycle times

The new machine was built over a period of 18 months. Parts were sent to Zimmermann to be fully tested prior to being assembled on-site. The local Zimmermann representative, Aaron Daugherty of Professional Sales Services in Wichita, Kansas, explains, "In operation, the Zimmermann head design provided significant advantages in speed on the typical peaks and pockets found in aerospace structure machining, working in tandem with the look-ahead feature on the CNC. It slows down and speeds up in anticipation of the next required surface contour. Over long-run times, this can translate into an improvement of 35% or better, because there is no deburring or polishing required." Thanks to this improvement in cycle times, combined with the flexibility of the machine to work a single structure or individual workpieces simultaneously, Triumph Structures — Wichita has been very satisfied with the results to date. ■

#### INFO AND CONTACT

[usa.siemens.com/cnc](http://usa.siemens.com/cnc)  
[john.meyer@siemens.com](mailto:john.meyer@siemens.com)





Smiths Machine LLC, United States

# Controlling success

Smiths Machine tackled the recession and managed to steadily expand its business into new markets. The company relies on DMG MORI and Siemens for high quality and precision in the machining of parts for the defense and aerospace industries.

Securing a competitive edge and exploiting new business potential seems to be in the DNA of Smiths Machine. The second-generation family-owned business found a way to grow its workforce by 70 people during the past five years, a time when many machine shops were struggling just to hang on. From automotive parts production, the company was moving its business in an entirely different direction, to defense and aerospace part manufacturing. "This kind of manufacturing requires a different business approach altogether, because it is specialized work that requires special approvals, locked-down processes and complicated procedures," says Tim Smith, CEO of Smiths Machine. "The complexity is challenging. And it all starts with a different way of thinking — more of an engineering approach than a production approach." The defense and aerospace machining market is characterized by small lot counts, complex parts and a very low tolerance for errors. Scrap rates thought to be nominal in the past would now be out of the question. "The emphasis is not on throughput, but on the high quality, highly precise manufacturing of very complex parts,"

Smiths Machine produces complex parts for the defense and aerospace market in partnership with DMG MORI and Siemens

The graphical interface of Sinumerik Operate provides the company with a quick change between milling and turning



explains Smith. "The more complex the part, the more competitive we are." Based upon these three inseparable machining requirements — quality, precision and complexity — Smiths Machine set out to achieve success in the machine tool market, not as a production machine shop, but as a company focused on complex part manufacturing. To protect and grow its competitive advantage, the company's leadership knew that Smiths Machine's internal processes and technology needed to align with the unique requirements of the defense and aerospace industries. Major investments in large, complex five-axis machines would need to be enhanced by equally complex control capabilities.

### A backbone for change

Traditionally a milling and turning company, Smiths Machine first teamed up with DMG MORI and Siemens in the year 2000 to establish a consistent machine tool platform. This brought about a synergistic approach to complex milling and turning — an advantage that took on greater significance when the company decided to focus on the defense and aerospace markets later in the decade. The DMG MORI/Siemens platform has enabled Smiths Machine to establish and maintain a high level of operational proficiency. "The technology and the people using it are the backbone of our organization," Smith asserts. "Even with 25 machines, we can share knowledge between the milling and the turning machines." The common control is Sinumerik 840D sl. The company bases its technology purchases on long-term business goals and the flexibility the technology can provide. According to Smith, the control's similarity

across milling and turning operations is one of the Sinumerik platform's key assets. "All controls are customized to a certain extent," Smith acknowledges. "But only the Sinumerik 840D sl is consistent. And this level of consistency extends to a graphical interface that really complements how we teach and learn." Teaching and learning are important values within an organization that uses a broad range of visual techniques to foster education, efficient information sharing and quality control. "We are a very visual company," Smith says. "Our parts inventory uses color-coded tags, for example, and the same is true across our production." Smiths Machine uses yellows and blues and reds for consistent instruction — and Sinumerik 840D sl does the same, visually guiding the operator for such things as axis direction, approach point, final depth and other variables within a cycle. This approach remains consistent from control to control, for both milling and turning. Smith says visually guided information flow is characteristic of today's complex range of next-generation electronic communications. Whether for a smartphone or a CNC, graphically guided interfaces enable rapid learning and proficiency, a fact that is leveraged by the 840D control interface design.

### New angles on programming

Gerhard Hetzler, engineering manager at Smiths Machine, has experienced first-hand how the company's consistent control platform has brought continuity to such manufacturing functions as post, machine simulation, NC code and control functionality. While the Sinumerik 840D sl control has evolved in significant ways over the years, Hetzler says these



changes have served only to accelerate the performance of the programmers and operators, rather than impede them with new and different procedures. The control platform has also given Smiths Machine the freedom to create custom cycles that can be copied and shared from control to control, and thus from machine to machine. "To catch occasional entry errors on the tool management side, we created a cycle that checks the length of the tool within a specific tolerance. So, in a matter of milliseconds, the control compares that value to the

## "The level of consistency of the Sinumerik 840D sl extends to a graphical interface that complements how we teach and learn."

Tim Smith, CEO of Smiths Machine



entry in tool management, and if a tolerance of 2 mm is exceeded, the control immediately stops the machine," Hetzler says.

According to Hetzler, the DMG MORI / Siemens relationship is also responsible for the ongoing simplification of complex cutting operations, especially in the area of angular milling heads. "Siemens has come a very long way to improve the cycles and support related to milling heads," Hetzler says. "Aerospace requires a lot more angular milling. Even a five-axis approach can't do it. You need an angular milling head. I would put this on the top of my list of the advantages DMG MORI and Siemens have developed. And this relates to another important development — Siemens NX."

### NX as in next

Siemens NX software integrates CAD, CAE and CAM for faster part manufacturing, encompassing all areas of tooling, machining, and quality inspection. NX has become integral to Smiths Machine's CNC platform because it supports part planning through manufacturing, while preventing errors and related costs. "Siemens NX allows us to develop our own postprocessors in house," Hetzler explains. "We set up our angular milling heads in NX and post the G-code before we even send it out to the machine."

The company had found out about the qualities of NX earlier, when Smiths Machine needed to write code to produce an especially challenging aerospace landing gear. It took six weeks to manually program the code. The same task could be realized in nine days using NX. Hetzler gives an example: "We can do 3+2-axis work in NX with a cycle called Cycle800. So when NX outputs the NC code, the machine already understands it. We are talking about how to manage the change of plane, a challenge that has been around for a long time. Now Cycle800 in NX does it all for you." Hetzler says Cycle800 makes programming the change of plane easier, faster and more accurate than traditionally calculated methods. "We would normally round off after the third or fourth decimal," he recalls. "Now the control calculates to nine decimals. When you start talking microns, especially in the aerospace industry, it makes a huge difference." This feature has been fully implemented by DMG MORI, ensuring that Siemens NX and Cycle800 work 100% of the time.

### Anything is possible

Smiths Machine's growth continues to be supported by the DMG MORI / Siemens CNC technology platform and the company's corresponding strategic relationship. This support includes Siemens service contracts, expedited motor repairs, direct parts availability and online NX tech support. When Smith and Hetzler talk about how far the company has come during the past five years, they quickly add that there is much more to look forward to. Looking back does help the company's many new employees understand Smiths Machine's heritage and core values, but there's too much shared excitement about looking ahead to ponder past success. As to how the company will go about achieving what is yet possible, Smith and Hetzler say they have another five-year plan on-hand that will continue to bring together the right people and the right technology. ■

#### INFO AND CONTACT

[usa.siemens.com/cnc](http://usa.siemens.com/cnc)  
[john.meyer@siemens.com](mailto:john.meyer@siemens.com)  
 Watch the video: <http://ow.ly/APYP6>



Robert Kindel Maschinenbau GbR, Germany

# Perfect combination

Machines with the Mazak logo are among the best the market has to offer. The fact that they are now also available with Sinumerik controls is a dream come true for the job shop Robert Kindel Maschinenbau. »

Increasingly complex customer parts can no longer be manufactured economically with three- or four-axis machining



**W**hen Robert Kindel took over the company from his father in 1993, it was one of the many small metal job shops in the Dortmund area that made their living with contract manufacturing on conventional milling and turning machines. Even then, Kindel stayed clear of line production — the company's focus is and has always been the manufacture of prototypes and small series. Until today, the owner refuses larger series, meaning everything with a larger count than 1,000. "They would tie up our machines for too long, and as a result, we would lose our flexibility. In addition, this bears the risk of a single customer getting too dominant and creating dependencies," Kindel explains his position.

### Manufacturing complex parts

Robert Kindel Maschinenbau follows the motto that anything technically possible can be achieved and will be taken on. Naturally, this results in specific pre-requisites on the part of the machine. Kindel explains: "The parts being commissioned by customers are becoming ever-more complex, meaning that many parts can no longer be manufactured economically with three- or four-axis machining. This is why we invested in a five-axis milling machine years ago." This was quite a remarkable decision for the six-man company to make at such an early time.

### Ideal machine with Sinumerik

In principle, Kindel was perfectly satisfied with the purchased machine. But he had seen a machining center nearby that corresponded even better to his vision of an ideal machine. It had just one small "flaw" — it was equipped with a different CNC. Kindel explains: "As one of the very first



The VARIAXIS offers not only outstanding machining results, but also excellent accessibility

Yamazaki Mazak Deutschland GmbH

ShopMill users in Germany, we only use machines with Sinumerik CNCs. We are absolutely convinced of their efficiency, and a consistent control system is an absolute must for a company of our size. It is the only way for us to ensure that the employees can change from one machine to another as required."

The machining center in question — a VARIAXIS 730-5X II from Mazak — was previously only available with Mazak's Mazatrol matrix CNC. The machine tool manufacturer has meanwhile responded to market demand and expanded its range of controls. As Johannes Burkart, marketing manager at Yamazaki Mazak Deutschland GmbH explains: "Due to the large number of requests, the management decided to offer a few selected machine series with the option of a Sinumerik CNC. This is a real growth market for us, as it is not always only the design deciding in favor of a machine, but frequently also the HMI, and as in this case, especially the CNC." For Kindel, this decision was a stroke of luck, as he had taken a particular liking to the VARIAXIS: "Alongside the compact size

of the center, it was primarily the excellent accessibility of the VARIAXIS that immediately caught my eye."

### Powerful design — proven in practice

Joachim Schojohann, area sales manager for the machine tool supplier Oltrogge, reports: "In the VARIAXIS i-600, we were able to provide Kindel with a machine that ideally met all the company's requirements and represented a quantum leap compared to the existing five-axis machine, primarily in terms of productivity." Kindel agrees: "Thanks to great accessibility, short workpiece change times are possible.

Above all, however, due to the high efficiency of the milling spindle at 37 kW and a maximum torque of 152 Nm with a maximum speed of 18,000 revolutions, in combination with the machine stiffness, we are able to achieve completely different chip removal rates. At the same time, significantly shorter chip-to-chip times are possible." Schojohann adds, "The VARIAXIS is characterized by very high dynamics in all axes,



Yamazaki Mazak Deutschland GmbH

For the production of complex special parts, Robert Kindel Maschinenbau GbR uses a combination of Sinumerik B40D sl and the intuitive ShopMill milling program

i-600 easily gets the right balance, enabling high material removal rates for roughing with high-speed capability for finish machining. And thanks to the NC rotary table integrated into the fully support trunnion table, the part can be machined completely in a single set-up, despite the complex contouring required after the machining of the surface.

### A win-win situation

For Robert Kindel, embracing flexible and demanding five-axis machining with the VARIAXIS i-600 is a real competitive advantage. And for Mazak, as a pioneer of the "done-in-one" concept, the integration of the five-axis Sinumerik 840D sl simultaneous control provides a realistic opportunity to gain a larger share of the market, especially in Europe. In this sense, it's a win-win situation. ■

resulting from the direct connection of the AC servomotors to the ball screws and from the use of roller gear cam technology in the A- and C-axes." The moving column of the machine is constructed in such a way that vibrations are effectively prevented during operation. In addition, the trunnion table is fully supported and therefore creates the stiffness required to guarantee high-precision machining.

These specifications are also reflected in manufacturing reality — as demonstrated by the production of a crank that is installed for power transmission in presses, where it is exposed to very heavy loads and therefore needs to be machined from solid metal. Its internal contours are roughly prepared in the first step using plunge holes and are then finished with relatively long tools (up to 6xD). The VARIAXIS

### INFO AND CONTACT

[siemens.com/sinumerik](http://siemens.com/sinumerik)  
[armin.blaschke@siemens.com](mailto:armin.blaschke@siemens.com)



**"The consistent Sinumerik control system ensures that employees can change from one machine to another as required."**

Robert Kindel, Managing Partner, Robert Kindel Maschinenbau GbR





Fryer Machine Systems, United States

# Machining takes center stage

Fryer Machine Systems supplies an American guitar builder with milling machines for the production of high-quality guitars. Right-angle head compensation is essential to the accurate, repeatable milling of guitar necks — an easy task for the Sinumerik 840D sl CNC on board Fryer machines.

The challenge of repeatable product performance is not new to C.F. Martin & Company. Six generations ago, company founder C. F. Martin Sr. was confronted with managing a guitar-making enterprise that was producing totally handcrafted guitars, one by one, with little means for standardization. Since those days, guitar legends such as Gene Autry, Eric Clapton, John Mayer and new comers Ed Sheeran and Hunter Hayes have relied on the consistently distinctive tone, treble and bass specific to Martin acoustic guitars. When Martin learned that its previous machine tool builder had exited the market, the company turned to Fryer Machine Systems for new machines to cover a production increase and seized the opportunity to upgrade the control technology with Sinumerik CNCs.

## Hands-on support in customizing the CNC

"We use right-angle head aggregates in our CNCs," explains Mark Bickert, engineering project manager at Martin. "We needed to find a machine builder that could give us right-angle head aggregate capability in conjunction with right-angle head compensation and a high-rpm spindle." Fryer Machine Systems has earned a reputation for building reliable production machines that come with unexpectedly advanced features and functionality. The company happens to be the largest purchaser of Siemens controls in the United States, and the customizable aspects of a Fryer machine can often be attributed to the versatility of the Siemens controls on board. This time, however, Martin needed to be certain that the new Fryer machines would perform as expected.



C.F. Martin & Company



C.F. Martin & Company



C.F. Martin & Company

Above: Larry Fryer (left) and Mark Bickert from Martin Guitar are satisfied with Siemens CNC technology, service and part quality

Left: Right-angle head compensation is essential to the accurate milling of guitar neck components. The function requires the sophisticated Sinumerik 840D sl CNC and ShopMill software from Siemens

"Anyone can sell you a machine with a controller on it and say, 'Here you go,'" Bickert says. "But that's not what happened this time. We were buying a machine through a Fryer dealership, and the machine had a Siemens control. Siemens invested their time in us during our transition and set-up. They really excelled."

Bickert says a potential constraint to the transition was that all-new milling programs might need to be written for the Fryer machines, including the right-angle head cutter compensation programs, which were essential. "Siemens not only gave us the right-angle head cutter compensation we wanted and the ability to do it properly, they also helped write the programs," Bickert says. "They took the programs that we already had for cutting parts on our existing machines and reconfigured them to work in the Fryer machine with the Siemens controller."

### Guitar body castings now also machined in-house

Having made a smooth transition to the company's new Fryer-built machines last year, Martin has not skipped a beat in its ability to perform right-angle compensation milling. Martin now has eight Fryer/Siemens machines, utilizing one for the guitar maker's tooling and machinery operations and seven for various other guitar production operations. It is here, behind the scenes, that the company's machinists reside and modern CNC technology and Old World craftsmanship come together to create the fixtures, tools and wherewithal that contribute to the mastery of Martin guitar making. It is also here that Martin found a way to bring previously outsourced

operations in-house, a step that has improved repeatable production quality while reducing production costs. "The machining of our castings had been another hurdle for us," says Terry Kline, Martin's manager of tooling and machinery. Until the company invested in the Fryer machines with the Siemens controls, Martin had outsourced the machining of its guitar body castings, with inconsistent results. "Now we're holding close tolerances on our guitar body castings," Kline says. "The quality of the castings is consistently accurate."

### CNC technology meets craftsmanship

On a daily basis at Martin, Kline sees what is possible when CNC technology and craftsmanship work together. "Without CNC technology, we'd be still carving out all our necks by hand, and that's just not efficient enough to compete in today's world," he says. The intersection of technology and craftsmanship has come naturally for this 180-year-old guitar company, without one side compromising the other. "I think every manufacturing company needs to embrace technology," says Kline. "Technology and craftsmanship go hand-in-hand. People are amazed by how much handwork still goes into our guitars. We'll build a neck and a body and then assemble the two elements together, which makes that guitar come to life." ■

#### INFO AND CONTACT

[usa.siemens.com/cnc](http://usa.siemens.com/cnc)  
[john.meyer@siemens.com](mailto:john.meyer@siemens.com)  
 Watch the video: <http://ow.ly/ApYN8>

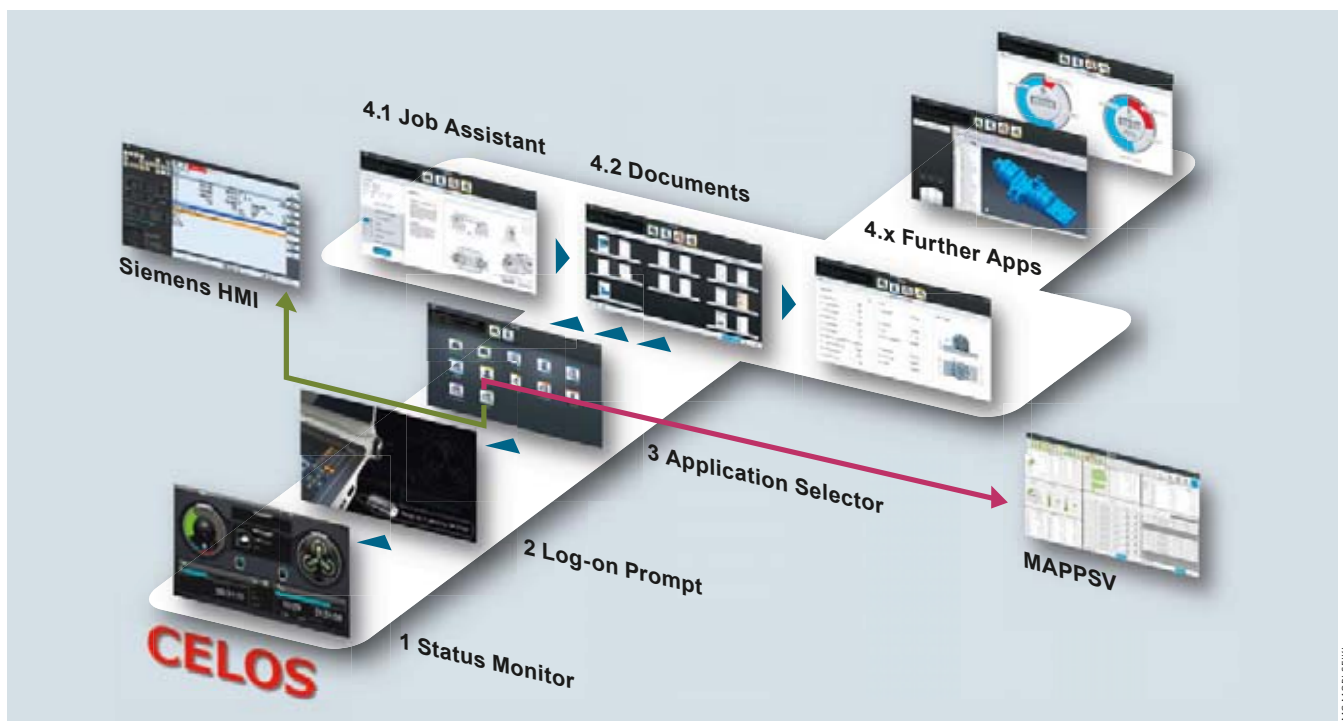


The new NTX 1000 mill-turning center by DMG MORI SEIKI features an innovative and space-saving design

DMG MORI SEIKI

DMG MORI SEIKI Co. Ltd., Japan

# Robot control included



DMG MORI SEIKI



## Sinumerik Integrate Run MyRobot

The Run MyRobot technology package facilitates high-speed workpiece and tool handling. The operator panel of Sinumerik 840D sl CNC can be used for operation, manual movement, teach-in and diagnostics, thereby increasing the efficiency and flexibility of the machine tool. As a result, the robot can be flexibly added to handle part loading and unloading. Like every other unit at the machine, it can be operated and monitored from the straightforward user interface. This dramatically simplifies production automation.

**For its new state-of-the-art NTX 1000 machining center, DMG MORI SEIKI relies on the high-end Sinumerik 840D sl CNC for utmost precision and efficiency. The Siemens control facilitates five-axis machining and implements the innovative Run MyRobot automation solution that allows handling tasks to be executed on machine tools equipped with robots.**

**T**he demand for machine tools capable of efficiently and precisely machining complex workpieces is steadily growing — for example, for the machining of small precision parts for medical equipment, watches, measuring instruments and impellers. As a result, the leading machine tool manufacturer DMG MORI SEIKI Co. Ltd., based in Japan, and its German partner DMG MORI SEIKI AG have developed the second-generation model of the company's compact integrated mill-turning center: the new NTX 1000. The machine tool features an innovative and space-saving design; the CELOS operating system with touchpanel operation; the premium Sinumerik 840D sl CNC; and a state-of-the-art automation solution for greater productivity, accuracy and energy efficiency. With extensive modifications based upon user feedback on its predecessor, the new NTX 1000 not only achieves increased reliability, but enhances the previous model's overall performance.

### Fully equipped for multi-axis machining

The new NTX 1000 offers the largest work envelope in its class by extending axis travel from 380 mm to 455 mm for the x-axis and from 460 mm to 800 mm for the z-axis, while achieving the smallest footprint in its class, of 9.9 m<sup>2</sup>. Thanks to the new design that optimized the distance from the turret to the machine cover, interference

between the turret and the workpiece, tool, or fixture can be avoided. Additionally, the machine minimizes thermal displacement by circulating coolant through the ball screws and ball nuts, ensuring high-accuracy machining of small precision parts. By incorporating a wide range of equipment and functions necessary for multi-axis machining, the integrated mill-turning center is capable of handling a complex workpiece requiring many different types of machining in one set-up. To implement all this functionality, DMG MORI SEIKI opted for Sinumerik 840D sl, the premium CNC for multi-tasking machines.

The combination of the DDM-driven b-axis and the direct-drive turning and milling spindles, coupled with the sophisticated simultaneous five-axis machining function offered by the Sinumerik CNC, enables accurately machined surfaces even on complex-shaped workpieces. For shorter cycle times and more flexible production processes, the new NTX 1000 combines advanced DIN programming for job-time optimization with simple ShopTurn programming. The innovative Run MyRobot automation solution incorporated into Sinumerik 840D sl allows the new NTX 1000 to be equipped with a workpiece-handling robot inside the machine. Run MyRobot provides operators with the robot operation status and enables robot control directly via the machine's operator panel as if it were part of the machine tool.

### Increased productivity and energy efficiency

For consistent management of order, process, and machine data, DMG MORI SEIKI has complemented the Sinumerik CNC with its CELOS operating system and touchpanel user interface. CELOS creates a paperless manufacturing environment by connecting the shopfloor with administration. CELOS is compatible with production planning and scheduling (PPS) and enterprise resource planning (ERP) software and can also be linked to CAD/CAM systems.

Energy efficiency was high on the priority list when developing the new machine tool. DMG MORI SEIKI succeeded

in shortening cycle times along with incorporating many energy-saving features on the new NTX 1000. These include a power-saving mode during automatic operation, using an inverter to adjust coolant supply according to the machining load, and shutting off the power of systems in standby mode. The machine also uses low power consumption components such as LED lighting, relays and magnet switches. Reducing cycle time also played a vital role in achieving energy savings. The new NTX 1000 has made standard M codes available as quick M codes and employs new functions for shorter canned cycles and faster automatic tool change (ATC) operation. The actual energy savings resulting from all these functions are monitored in real time and displayed in the CELOS operating system. Thanks to the open system architecture of Sinumerik 840D sl, machine shops using the NTX 1000 can adapt the control precisely to their technological requirements and secure the increase in productivity and energy efficiency that determine a company's competitive edge today. ■

### INFO AND CONTACT

[siemens.com/sinumerik](http://siemens.com/sinumerik)  
[sinumerik.jp@siemens.com](mailto:sinumerik.jp@siemens.com)

## Training for machine tool builders worldwide

### Sinumerik training goes to Japan

Given the success of Sinumerik CNCs all over the world, training has evolved into an important aspect of the Siemens local support and services portfolio. A fully equipped training facility for Sinumerik, along with training courses for the Japanese market, can be found at the Siemens Japan headquarters in Tokyo. It is equipped with an operator panel, a Sinumerik CNC unit, Sinamics drive systems, Simotics motors and Simatic programmable logic controller (PLC) I/O, as well as PCs to support engineering tools. As for the training materials, Siemens has customized the content to Japanese market requirements including translation into the Japanese language. The courses are set up according to various technology levels with appropriately organized content, and new courses, such as Components and Configuration or Setup/Maintenance, have been added to supplement the existing program. The newly devel-

Hands-on Sinumerik training at the fully equipped facility in Tokyo



Siemens AG

oped Sinumerik Introduction course, for example, offers customers the opportunity to familiarize themselves with the Sinumerik CNC product portfolio, learn its unique features, and receive an overview of how to operate the Siemens control, whereas the hands-on training course featuring the operator interface Sinumerik Operate

concentrates on creating and executing a number of basic programs. Whatever the requirements, Sinumerik training offers a broad range of individual courses for every degree of expertise and every level of technology. ■

[siemens.co.jp/sinumerik](http://siemens.co.jp/sinumerik)

## Weiss Spindeltechnologie opens new service centers

### High quality standards are guaranteed



All SWSS centers have the necessary machines, assembly stations and special tools required for spindle repairs at their disposal

Weiss Spindeltechnologie GmbH has further expanded its service presence in Europe. Since May 2014, two new Siemens Weiss Spindle Service centers (SWSS) have opened in Spain and Turkey, enhancing the company's worldwide network of service branches. Weiss was able to engage the experienced CastelOmega company in Madrid and Barcelona, and the Si-Mut Teknik company in Bursa, Turkey. Both enterprises have been cooperating with Siemens in the field of servomotors for more than ten years and both service centers have the necessary machines, assembly stations and special tools required for spindle repairs. In addition, the technicians at the new branches have undergone several training classes at the assembly and service works in Maroldsweisach. This ensures the typical high German quality standard at the new SWSS centers. ■

[weissgmbh.de](http://weissgmbh.de)  
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## Easy CNC app for iOS — now also for Android

**Y**ou asked and we listened. The popular Easy CNC app is now available for Android devices. Easy CNC contains all of the current training manuals for Sinumerik CNC and will ensure you always have the latest updates. With no more heavy manuals to carry, you have access to over 4,000 pages of vital CNC instruction and content. In addition, a handy G-code compatibility tool lets you quickly find compatible codes for Siemens and ISO G-codes. The glossary feature is your reference guide to CNC terminology, and web-links to service, support and CNC social media feeds open the door to our online user community. Don't wait — download the Easy CNC app for iPhone, iPad and Android devices for free.



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### Online

The CNC Community Sinumerik CNC4you [usa.siemens.com/cnc4you](http://usa.siemens.com/cnc4you) offers information on current trends, topics, and tips for every of CNC production. The most important Sinumerik CNC4you updates are available at a glance. Users can also learn more about the flexible and innovative CNC solutions with Sinumerik.

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**Drive Technologies Division**  
CEO Ralf-Michael Franke

**Editorial Responsibility in Accordance  
with the German Press Law:**  
Benjamin Schröder

**Responsible for Technical Content:**  
Bernd Heuchemer

**Editorial Committee:**  
Hans Pischul

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The Siemens logo is displayed in a teal, sans-serif font within a white rectangular box. The background of the entire advertisement is a blurred industrial scene featuring a large, dark metal component with two circular openings in the foreground, and a CNC machine with two people in the background.

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