

CNC4you

The Shopfloor Magazine

Volume 6, March 2012

SIEMENS

Sinumerik 840D sl successful in a racing sidecar

Full Throttle for High-Tech Wheel Hubs

In this issue:



Mobile Energy
Storage



Fit for Practice



High-Precision
One-Off
Production

www.siemens.com/cnc4you



Siemens AG

7

HMS produces sought-after spare parts for the Trabant using the Sinumerik 840D sl



Siemens AG

12

Sinutrain facilitates user-friendly operation of Sinumerik and CNC programming on a PC



Siemens AG

18

Precision parts are manufactured on the Leadwell turning center with Sinumerik 828D



Walter Bantz GmbH

22

The Chick vise towers reduce setup times and are also easy to program

3 EDITORIAL

MOBILITY

4 Full Throttle for High-Tech Wheel Hubs

Sinumerik 840D sl successful in a racing sidecar

7 Tuning for "Trabis"

Manufacturing special components using a CNC-controlled five-axis milling center

10 Mobile Energy Storage

eBuggy project introduces students and trainees to the shopfloor

TRAINING

12 Sound and Practical

New version of the Sinutrain training software

14 Fit for Practice

Training institute chooses Sinutrain for basic and advanced vocational training

ON THE SHOPFLOOR

16 High-Precision One-Off Production

Easier programming with Sinumerik Operate

18 Self-Explanatory and Intuitive Operation

Precision parts manufacturer chooses a compact CNC with an innovative operator interface

TIPS AND TRICKS

20 Effective Use of Tools

Multiple clamping with ShopMill

22 More Productivity for Small Series

Multiple clamping with Chick clamping systems

23 NEWS

EDITORIAL INFORMATION CNC4you 1_2012

Publisher
Siemens Aktiengesellschaft,
Gleitwitzer Str. 555,
90475 Nuremberg,
Germany

Division Drive Technologies
CEO Ralf-Michael Franke

**Editorial responsibility in
accordance with the
German press law**
Arno Hoier

**Responsible for
technical content**
Bernd Heuchemer

Editorial committee
Elke Pilhöfer

Publishing House
Publicis Publishing,
P.O. Box 32 40,
91050 Erlangen, Germany
Tel.: (0 91 31) 91 92-5 01
Fax: (0 91 31) 91 92-5 94
publishing-magazines@publicis.de
Editor:
Gabi Stadlbauer

Layout:
Nadine Söllner, Kerstin Rosenow
Editor-in-chief, final editing:
Sabine Zingelmann
DTP: Mario Willms
Job number: 002800 37706
Cover photo: J. Glaser
Printing: Wünsch Offset-Druck
GmbH, Neumarkt/Opf., Germany
Circulation: 7,000
© 2012 by Siemens
Aktiengesellschaft
Munich and Berlin.
All rights reserved.

This issue was printed on paper
made from environmentally
friendly, chlorine-free bleached
pulp.

**The following products are
registered trademarks of
Siemens AG:**
ShopMill, ShopTurn, SINAMICS,
SINUMERIK, SINUMERIK 802,
SINUMERIK 810, SINUMERIK 828,
SINUMERIK 840, SINUTRAIN

If trademarks, trade names,
technical solutions, etc., are not
referred to specifically, it does not
mean that they are not protected.

The information in this publication
only includes general descriptions
and/or performance characteristics,
which do not always apply in the
form described in a specific appli-
cation, or which may change as
products are developed. The
required performance characteris-
tics are only binding if they are
expressly agreed at the point of
conclusion of the contract.

Order No.:
E20001-A1540-P610-X-7600

Dear Readers:



Once again at this year's METAV, we will introduce you to the newest products, solutions, and trends from the world of metalworking with Sinumerik CNC. This time, we will focus on **machine tool users** from different industries or from the supply chain. This includes a large number of **shopfloor environments** that have concentrated on special solutions and small batch sizes, such as the spare parts for unusual racing sidecars described in our cover story or precision parts for new cars. Be it wheel hubs, gearwheels, or countless special molds, the parts manufactured in **one-off and small-series production** require maximum flexibility when it comes to machining. This is where many manufacturers and users rely upon the Sinumerik CNC, which not only guarantees maximum **precision when milling and turning**, but can also be programmed quickly via the **ShopMill and ShopTurn** graphical user interface. Whether high-speed cutting of complex parts in the automotive, medical part manufacturing, or power generation industries, or flexible production in the consumer goods industry, with **Sinumerik 828D and 840D sl**, the **Sinumerik Operate** user interface, and the **Sinumerik MDynamics** technology package, we have the right solution available for virtually every sector of the end-user market. As demands increase, especially in the five-axis machining of highly complex components, only the **best-trained staff** will be able to guarantee perfect results from the machine. Our Sinutrain training software, based upon Sinumerik Operate, provides a quick and simple method for trainees to learn how to use a real Sinumerik CNC right on your PC. Read more about our comprehensive **Sinumerik CNC solutions** in this issue and see their performance for yourself at the Siemens booth (C44) in Hall 13 at METAV.

A handwritten signature in black ink, reading 'R. Schütze'.

Robert Schütze
CNC Applications Engineer
Siemens AG

Sinumerik 840D sl successful in a racing sidecar

Full Throttle for High-Tech Wheel Hubs

When Otto Haller goes out onto the racetrack with the racing sidecar he built himself, he and his passenger must be able to rely totally on the engineering of this racing bike. This is why he builds his bikes himself. Manufacturing expert Helmut Kottmaier supplies him with key components such as wheel hubs and gearwheels of the highest quality, which are programmed directly on Sinumerik-controlled five-axis milling and turning machines.



> Haller has gasoline in his blood – what other explanation could there be as to why a 70-year-old man not only designs and builds racing sidecars, but is still competing in class K2 sidecar races and regularly takes his place on the winner's podium? At the Classic Sidecar Cup 2011 in Schleiz, Germany, Haller celebrated a triple success: he took second place as a driver and first and third places as a designer and builder. His sidecars are far from the most powerful on the starting grid, though. His specially tuned BMW Boxer engines achieve approximately 80 hp. Haller says, "Other K2 combinations reach in excess of 100 hp. Of course, we could do that, too, but then the wear is much higher and that means completely overhauling the engine after only a few races. An expensive hobby." He is a great fan of durability in both the engine and all the other wear parts of his bikes.

Many details contribute to Haller's sidecars usually being among the winners despite their lower power. These include the rigid chassis design, connection of the steering, integration of the engine, Cardan shaft, and bearing seats in addition to the wheel hubs and various gear parts. Haller has all of the many components produced in the highest quality and tunes them perfectly to each other. As a result, his sidecars more than make up for time lost on the straights by being faster in the bends.

This young-at-heart racing driver is hugely enthusiastic about the production quality of his wheel hubs, gearwheels, and Cardan shafts, which are manufactured by a Bavarian machining expert: "The wheel hubs have to be turned accurately to within a hundredth of a millimeter; otherwise, the tight-fitting seal can't do its job. The oil runs out and the wheel bearing is useless. That hasn't happened anymore since Helmut Kottmaier has been making these key parts, and now my racing sidecars run even more smoothly and reliably."

Manufacturing quality equals reliability

As a master cutting machine operator, Kottmaier knows exactly what's needed when it comes to Haller's high-quality parts. For many years he has been providing all types of CNC turning and milling services for a large number of demand-



Production specialist Helmut Kottmaier, sidecar builder Otto Haller, and Siemens sales adviser Alois Penzkofer (from left to right) are pleased with the parts produced using Sinumerik:

“There is no longer any need to refinish individual parts such as wheel bearings, gearwheels, and Cardan shafts, thanks to the high surface quality.”

ing sectors at his contract manufacturing company in Bergkirchen-Lauterbach, Germany. What's more, Kottmaier is himself an avid sidecar driver. He says, "My sidecar is a little older and not designed to be as sporty as Haller's BMW. I do know, however, exactly what's needed where these vehicles are concerned, and I have just the technology required to manufacture extremely sophisticated new parts and spare parts using my Sinumerik-controlled lathes and five-axis milling machines."

So, for example, he uses a state-of-the-art TC 800-77 MC CNC lathe by Spinner with driven machine tools, controlled by the high-end Sinumerik 840D sl CNC, to produce the Cardan shafts from hardened and tempered spring steel and the wheel bearings from an Al-Mg alloy.

The rigid Meehanite cast-iron bed with large hardened and ground slide-ways ensures excellent damping and rigidity characteristics, which enable a high chip removal rate and also maximum precision. According to manufac-

turing expert Kottmaier, the Sinumerik CNC, which is extremely efficient and delivers optimal production quality, is equally important. This means that the Spinner lathes easily achieve the runout required for the wheel bearings, which must be accurate to hundredths of a millimeter, and deliver the surface qualities that are crucial for the Cardan shafts. Haller explains, "Cardan shafts of sidecars are exposed to maximum torsional loads during K2 races. Hairline cracks form over time and lead to fractures in the Cardan shaft if it is not manufactured with the highest surface quality. This hardly ever happens in my vehicles."

Special requests are fulfilled at short notice

Haller gets the same level of quality and reliability in his gearwheels, which differ from one racetrack to another. The racing biker says, "If we're racing on a track with a lot of long straights, it makes sense to fit the upper gears with a high transmission ratio because that >>

For more information >

www.siemens.com/cnc4you

Contact >

karsten.schwarz@siemens.com

The skilled workers appreciate the easy menu navigation of the ShopMill programming interface when programming the special gearwheels

>> means we'll achieve a higher end speed." Kottmaier explains, "We manufacture the gearwheel for the last gear with one tooth less, and that's how Otto Haller gets his high transmission ratio."

To be able to manufacture such special requests quickly and flexibly, the production expert from Bergkirchen relies on the DMU 70 eVo linear milling center controlled by a Sinumerik 840D sl, which can negotiate all the necessary contours with five NC axes freely positioned in the room. In the process, the NC swivel rotary table rotates the workpiece at its center of gravity and enables relief cuts of up to 12°. The dynamic range of the linear drive in the x-axis also allows the DMU 70 eVo linear enormous accelerations of up to 10 m/s² and rapid traverse rates of 80 m/min. As Kottmaier confirms, repeat accuracies of 8 µm are also achieved in the process. He also considers it a huge advantage that he can produce the gearwheels in one clamping fixture and no longer needs to refinish them, thanks to the high surface quality.

Even faster in the curves with Sinumerik

Just like they do for the wheel bearings and Cardan shafts, Kottmaier's employees also program the gearwheels on the machine, and for this they use the ShopMill graphical programming interface. Menu navigation is easy and intuitive,

making it quick to learn how to use it and resulting in the creation of perfect programs in no time. "Even my experienced G-code programmers are up to 70 percent faster using ShopMill. Of course, we can input a more exact program sequence in DIN, which gains us a few seconds or minutes of production time. That only really pays off with series parts. ShopMill and ShopTurn are clearly the better solution for individual parts such as the gearwheels, wheel bearings, and Cardan shafts that Haller needs."

Cycle supported for the perfect result

Along with the user-friendly operation, Kottmaier also appreciates the performance of the Sinumerik 840D sl, which he is convinced is just as important for fast and accurate machining of the workpieces as the machine's design and the drives used. The master cutting machine operator says, "The 840D sl sets the cycle, particularly in complex five-axis machining." Fast block processing, short cycle times, and adjustable and programmable zero offsets are crucial reasons for this. In addition, the setup of workpieces can be performed effortlessly in setting up and automatic mode using standard measuring and swivel cycles (Cycle800), which is very important when producing complicated and expensive five-axis parts. The supplementary high-speed cutting (HSC) function, high-speed setting Cycle832, and five-axis transformation using Tool Center Point programming with TRAORI provide invaluable support in this case. Cycle832 ensures rapid adaptation to the machining strategy. The TRAORI command ensures for its part that the right traversing movements are generated correctly even for kinematically independent programs with vectors. <

Technology in detail

The contour processor can do more!

Contours can be created easily with the helpful support of the Sinumerik contour processor. The Sinumerik contour processor, however, can do much more than merely support users when simply creating contours:

- > By using the "All Parameters" softkey with the finishing cycle selected, it is possible to display additional element-related parameters for the known parameters.
- > It is then possible to program an element-related feedrate ("FB") and a dedicated feedrate for the transition element ("FRC"). Chamfer, radius, and undercut are available as transition elements. There is also an element-related machining allowance ("CA"), for example, for a grinding allowance. Adjacent transition elements also change in line with this machining allowance.
- > In addition to this, there is a free input field via which additional commands such as a G9 (block-by-block exact stop), a cutting edge change (e.g., D2), or an M date (e.g., "Water off") can be given to the element at the same time.

For examples of these element-related parameters, visit our website www.siemens.com/cnc4you and click on "CNC topics."

For more information > www.siemens.com/cnc4youContact > karsten.schwarz@siemens.com

Manufacturing special components using
a CNC-controlled five-axis milling machine

Tuning for “Trabis”



The Trabant cult car has many fans who urgently need spare parts for their mode of transport

All photos: Siemens AG

Mario Helzig, who specializes in individual parts and small-batch production, utilizes the possibilities afforded by a Sinumerik-controlled five-axis machining center and mills a wide variety of spare and tuning parts for the Trabant, the cult car affectionately referred to as the “Trabi” by its fans.



Helzig is a skilled industrial mechanic by trade and, while working as an instructor from 2002 to 2007, he gained extensive experience with a wide variety of machine tools and different types of controls. During this period he operated conventional turning and milling machines as well as complex CNC-controlled machining centers. He also worked with a five-axis milling machine controlled by the Sinumerik 840D sl CNC with the ShopMill graphical user interface. Helzig says, “This operator control unit impressed me from the outset. Menu navigation is easy and intuitive, so error-free programs can be written incredibly quickly.”

>>

>> Based on this experience, he chose a machining center with five axes and a Sinumerik CNC operated by ShopMill as his start-up equipment when he established his own company under the name HMS in 2007. His decision was ultimately to go for a DMU 70 with a Sinumerik 840D sl. Although this was a huge investment for the young entrepreneur, according to Helzig the price/performance ratio was spot on. A CNC turning machine completed this job shop.

Trabi parts are scarce

Orders quickly started to roll in from a wide variety of industries. A friend who competed in rallies with a specially tuned Trabant asked him to manufacture several wear parts for it. Helzig remembers: "I was already manufacturing various racing parts for my Opel. So of course I was happy to do this and I produced some for stock at the same time." However, before this stock was even close to being used up, his friend ended his Trabi rallying career. What initially appeared to be a problem ultimately proved to be a stroke of luck, however. The boss of HMS put the excess Trabi parts on eBay and was thrilled that they sold like hotcakes. Helzig did some more research and discovered that there was a huge demand for spare and tuning parts for the Trabant. As far as he is aware, there are approximately 35,000 registered cars of this type, for which there are hardly any spare parts.



HMS manufactures more than 50 different spare and tuning parts for the Trabant, such as shock absorber mounts and seal ring molds

However, another number he researched sounds even more interesting: it is estimated that there are around 150,000 to 200,000 Trabis in existence that are off the road mainly due to the lack of spare parts. The A-arms for the rear wheel suspension are particularly scarce. In addition, axle parts and sports chassis, molds for plastic parts, engine and carburetor parts, racing rims, and other accessories such as roof racks are in demand, but difficult to find on the market. As a result, Helzig, with his three employees, now mills and turns more than 50 different spare and tuning parts for the Trabi in three-shift operation. This already accounts for around a quarter of his total sales. The independent businessman is sure that this is a growing trend.

Complex CNC milling machine, easy-to-operate

The essential basis of his success, along with the sales ideas that HMS implements jointly with a trade partner, is the high quality and reliability with which his small business produces the parts required. According to Helzig, the DMU 70 by DMG/Mori Seiki, which is designed for four- as well as 3+2-axis machining, plays a major part in this. He can use it to execute even complex jobs (with free-form surfaces) with maximum precision, enabling him to tap into attractive markets. Equipped with an NC swivel rotary table, the DMU 70 rotates the workpiece at its center of gravity and enables relief cuts of up to 20°. The high dynamics of the digital drives in all axes permit rapid traverse rates of up to 24 m/min and accelerations of 5 m/s². The powerful 35 kW motor spindle also enables speeds up to 18,000 rpm. Even before Helzig had decided on the make of his five-axis machining center, he was certain that the control unit should come from Siemens. Ultimately, it was the Sinumerik 840D sl CNC, together with the ShopMill graphical user interface, that won the entrepreneur over so completely. "Although my employees and I have G-code experience, we are twice as fast, on average, when programming with ShopMill. Of course, we



The owner of HMS, Mario Helzig (left), and Siemens sales adviser Enrico Ehrhardt share enthusiasm for the Sinumerik-controlled DMU 70, with which the Trabi parts are manufactured

can input a more flexible program sequence in the traditional DIN language (G-code), which gains us a few seconds or minutes of production time. However, this is of no interest for small and medium batches such as those we offer.”

Sinumerik 840D sl makes work much easier

Initial training on Siemens' graphical user interface is easy. This is a huge point in ShopMill's favor, since Helzig is planning to develop his company. He says, "Anyone who has trained as a skilled tradesman and has a basic knowledge of programming can handle it perfectly after no more than two weeks of introductory training. If something is still a little unclear, then pressing the Help key on the operator panel to activate a help menu leads straight to the problem's solution." Switching to a text-based DIN interface is just as straightforward. This is useful, for example, if specific contours can be written faster with a DIN data set. It is also clear that the Sinumerik 840D sl is especially suitable for five-axis machining, scoring not only with fast block processing, short cycle times, and adjustable and programmable zero offsets, but also with the effortless setup of workpieces in the setup and automatic mode using standard measuring and swivel cycles. Further important functions for five-axis-machining are the high-speed setting Cycle832 and the five-axis transformation using Tool Center Point programming with TRAORI. Cycle832 helps to rapidly adapt the machining strategy to the workpiece, with TRAORI ensuring that the right traversing movements are generated correctly even for kinematically independent programs with vectors. The actual workpiece length is also taken into account in the process.

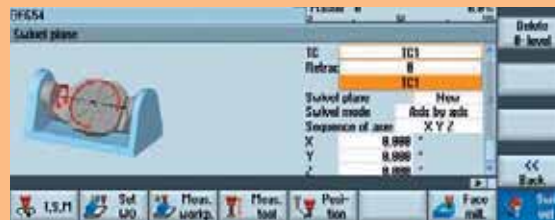
Helzig, who is highly satisfied with both machine and control unit, not to mention the development of his business, has already made firm plans to expand his company. The DMF 260 simultaneous five-axis machining center by DMG/Mori Seiki is already on order. Once again the control unit is a Sinumerik 840D sl, this time with the latest operating and programming structure Sinumerik Operate, which stands out due, among other things, to PC-typical functions and enables even more intuitive operation. <

Technology in detail

Swiveling made easy – swiveling in setting up mode

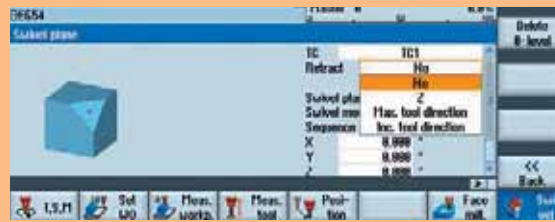
The extremely intuitive navigation through the animated swivel cycle not only shows the user a huge number of possibilities, but also displays the best solution for each application in a very simple way.

TC: Tool Carrier – swivel data record



The machine kinematics set up by the machine's manufacturer are selected or reset by entering "TC1" or "0."

Retract



A wide variety of input possibilities exist, depending on the machine configurations available: with table kinematics, retracting in the z-direction or additional positioning on the x- and y-axes, and with head kinematics, various retraction movements in the tool direction. All of these possibilities guarantee maximum flexibility and safety.

Swivel plane



Alternatively, it is possible to define "new" swivel planes here, or they may also be "added" to simply continue calculating from an existing swivel plane.

Swivel mode



Swiveling "axis-by-axis" refers to the workpiece's coordinate system. This means that the swivel axes are programmed completely independently of the machine axes actually present. Everything else is calculated automatically by the control unit. In direct swiveling, the desired positions of the existing swivel axes are entered and calculated.

eBuggy project introduces students and trainees to the shopfloor

Mobile Energy Storage

CNC technology from the technical training course was used in a forward-looking Smart Grid project at Siemens Engineering Academy Berlin. The students used innovative Sinumerik technology to produce an eBuggy, which was presented at the EMO trade fair in Hannover, Germany.



The students produced an eBuggy for the Smart Grid Showroom of Siemens Engineering Academy Berlin

> Siemens Engineering Academy Berlin, a department of Siemens Professional Education (SPE), is an officially recognized technical college that leads high school graduates and vocational high school graduates, in a dual study course lasting four years, to the vocational qualification of “State Certified Industrial Technologist” and subsequently to a bachelor of engineering in electronic systems. A Smart Grid Showroom is currently under construction at the academy. The idea behind it is to give visitors and customers an impression of what the power grid of the future will look like. The aim from the outset was to generate enthusiasm for this topic among the trainees of the entire SPE. Primarily, however, it was to train students and

trainees on innovative technology and prepare them for starting their careers with Siemens.

Interdisciplinary collaboration

The task of students at Siemens Engineering Academy Berlin was to convert a vehicle with a combustion engine to an electric drive. The reason for this assignment was that, as mobile energy storage devices, electric vehicles will play an increasingly important part in stabilizing the power grid in the future. Among other things, the students had to produce special engine mounting blocks to enable them to fit the electric motor in the car. Chris Hommel, one of those taking the electronic systems dual course, explains that this was a project that could not be completed within Siemens Engineering

Special engine mounts had to be manufactured to convert the combustion engine to an electric drive





All photos: Siemens Engineering Academy Berlin

“Producing the eBuggy was a lot of fun. Of course, it was also a very valuable experience for me and an opportunity to work with other students and trainees, with a mutual exchange of what we have learned at the academy. The week in Hannover at the EMO 2011 trade fair was a wonderful experience because, as a member of our team, I had the chance to present the eBuggy project. I got to know many interesting people and learned about their everyday professional lives, which enabled me to gain an idea of what I might expect after I finish my studies.”

**Chris Hommel, Electronic Systems Student,
Siemens Engineering Academy Berlin**

Academy Berlin. “As training for industrial mechanics is also provided in the same building here on the SPE site, we immediately asked our colleagues if it would be possible for them to produce these parts for us.” He continues, “The trainees showed a keen interest in supporting our project and helping us by producing the missing parts.” Following this, the students and trainees of SPE carried out calculations together, produced CAD drawings, and met up regularly with the budding industrial mechanics regarding the feasibility of their ideas under real conditions.

Exploiting the strengths of Sinumerik CNC

The trainees used a five-axis milling machine by DMG/Mori Seiki with a

Sinumerik 840D equipped with Sinumerik Operate to mill the engine mounting blocks. The Sinumerik Operate graphical user interface made programming and operation easier. The extensive cycle processing functions of ShopMill were utilized to the full for machining the complex parts. Machining the angled surfaces on the workpiece, which had holes, was particularly challenging. They were produced using Cycle800, which can be used to parameterize pivoting of the planes with appropriate orientation in just one input screen. Subsequent machining was performed as usual, for example, with the face milling cycle. High Speed Setting Cycle832 was also used when machining the workpieces to achieve excellent surface quality at high feedrates.

Much-admired vehicle

The resulting eBuggy could be admired at EMO 2011 in Hannover at the stand of the VDW-Nachwuchsstiftung (German Machine Tool Builders' Association – Young Talent Foundation). The red vehicle aroused the curiosity of many visitors to the fair who were interested to learn about it in greater detail. They were particularly impressed with the fact that students and trainees were already completing such complex projects during their training at Siemens and were able to apply what they had learned under realistic conditions. Anyone interested who missed the exhibition in Hannover can take a look at the eBuggy when visiting METAV 2012 in Düsseldorf in February. <

New version of the Sinutrain training software

Sound and Practical

Siemens will present the new version of the Sinutrain training software at METAV. Based upon Sinumerik Operate, it offers a comprehensive range of solutions for efficient CNC training. The new release now also runs on the Windows 7 operating system in the 32-bit and 64-bit versions.



> With Sinutrain for Sinumerik Operate, it is quite easy to take the machine tool into the classroom. The latest version 4.4 for Windows 7 now offers students full programming functionality. Whether the initial programming used was DIN 66025, the G-code programming was carried out with programGuide, or the graphic programming was completed with ShopMill or ShopTurn, users will always find the best possible support with Sinutrain for Sinumerik Operate. They learn, for example, how to use ShopMill and ShopTurn programming to combine various machining steps so as to substantially reduce programming time.

Integration of multiple functions

The many functions offered by Sinutrain, such as the cycles with animated elements, are an important aid for training course participants. They can see immediately from these moving-image sequences how the machining takes place. The huge variety of machine kinematics offered is also very helpful. It enables effortless programming from basic machines up to complex machine kinematics (five-axis simultaneous machining). More importantly, Sinutrain highlights all of the necessary machining parameters for trainees – from tool and magazine data to state-of-the-art frame concepts for zero offsets. Course participants learn how to transfer data from the machine to the PC and gain an

Sinutrain facilitates user-friendly operation of Sinumerik and CNC programming on a PC

insight into advanced tool management. The perfect simulation under Sinumerik Operate also displays the swiveled planes with the machining, so the operator can already see on the PC how his or her workpiece will look later on the machine.

Effective support

If users have any questions about these functions, they can use the online help. Pressing the “Help” key gives them access to all the documentation for the system. All questions are answered. This applies both to beginners in programming and to those with more sophisticated requirements. Furthermore, those seeking advice can access the support for Sinutrain on the CNC4You website (www.siemens.com/cnc4you) at any time.

Popular training solution with intelligent licensing

The new release is available in various operator languages, and in addition to running on WinXP, SP3 32-bit now also runs on the Win7 32/64-bit operating system. Continuous updates ensure that the training software is a future-proof investment. Many training centers value it as a solution for basic and advanced training due to its high level of functionality. The proof: over 25,000 Sinutrain licenses are now in use. Intelligent software license management ensures that all users find the version most appropriate to their needs, from universities and workplaces to professional training centers. For example, the downloaded Sinutrain system, that is, the machines and programs that were created with the test key, remains unchanged when a full license is purchased. Siemens offers an upgrade during a retrofit to training centers that

Highlights of Sinutrain for Sinumerik Operate at a glance

- > Compatible with Sinumerik 828D Basic, 828D, and 840D sl
- > Capable of running on WinXP SP3 32 bit and Win7 32/64 bit
- > Sinutrain Basic for turning and milling machines with Sinumerik 828D Basic
- > Control-identical training software for the PC
- > DIN-compliant and ShopMill/ShopTurn programming
- > Training workstations can be linked up to create a network
- > Link to CAD systems for fast program creation
- > Import of machine tool geometries
- > Realistic keyboard in original layout

want to continue using the machine tools that have been used for training. Even older Sinutrain versions or Siemens applications can now be installed simultaneously on one training computer, for example. This means that the customer always has all of the Sinutrain versions available on one computer. The test version of Sinutrain Operate 4.4 and supplementary language packs can be downloaded at www.siemens.com/cnc4you under CNC topics/ Sinutrain Downloads. Here, you can also find out where the Sinutrain student version can be obtained. <



Alongside their lessons in the classroom, the students receive intensive training on real machines so that they can operate machines and control units safely on their own, and as soon as possible (photos above and right)

Training institute chooses Sinutrain for basic and advanced vocational training

Fit for Practice

The Ansbach Mechanical Engineering Institute has installed a PC-based training system that realistically simulates the operation of real CNCs. Both teachers and students have been working intensively on the 64 training stations and have found it a very positive experience.

> Several years ago, the school administration of Ansbach Mechanical Engineering Institute decided to purchase a training system to make the CNC training and the creation of CNC programs as effective and realistic as possible. “The decision process, in which six lecturers were involved, took a long time. All aspects were considered and examined in detail to see which system best matched our requirements,” explains technical instructor Oliver Herrlen. “It was important for us that the controls of the new training system be in line with the systems that are used in practice,” adds Alois Hufnagel, also a technical instructor at the institute. The teaching staff also wanted a solution that the students would enjoy using and that would make them keen to learn. “Otherwise they can quickly lose interest in their lessons,” says Herrlen, speaking from experience.

At the end of the selection process, the teaching staff chose the Sinutrain training system and Sinumerik controls



A typical training situation: the task is projected onto the board and each student works on it on his or her own PC

for CNC machines. Today there are 64 Sinutrain licenses in use. The control-identical CNC training software runs on Windows PCs without any additional hardware and is based upon the programming and operator interface of Sinumerik controls.

Realistic training

The practice-oriented training software gives the students the best possible preparation for real CNC programming and operation. They can test all the operating modes of the Sinumerik Operate operator interface, which includes in its range of functions work-step programming with ShopMill and ShopTurn and high-level language programming. The trainees are familiarized with the CNC programming methods and system environments, which they can later try out on the machines. The same applies for milling and turning applications. At the start of the second year, the vocational students are taught the basic principles of computer-aided manufacturing. They learn to use ShopTurn and ShopMill and program their first work-

pieces. The third year of the course is used to deepen their knowledge. The students are now programming more complex workpieces and are introduced to programming according to DIN 66025. The training enables them to understand “the whole edifice of computer-aided manufacturing,” says Herbert Bartelmeß, deputy principal of the institute. “Because the Sinutrain system is so easy to learn and because of the compatibility of ShopTurn and ShopMill, we save teaching time, and this makes room for practical exercises and trying things out,” adds Hufnagel.

Successful training system

According to the teachers, the system is largely self-explanatory, which means that, within a short period of time, students can work independently and safely in their everyday learning environment. The fact that the Mechanical Engineering Institute is on the right path with its training strategy is evidenced by the positive feedback from firms that frequently choose their well-trained graduates. <

Ansbach Mechanical Engineering Institute

Ansbach Mechanical Engineering Institute is a training institute steeped in over 100 years of tradition. Around 300 students are taught here every year in three courses.

While the vocational training school is responsible for the theoretical and practical training of industrial and precision mechanics, the Mechanical Engineering Institute is in charge of their advanced professional training to become “State Certified Technicians.” And the specialist academy for medical technology provides “State Certified Medical Technicians” for employers from the metal, electrical, and IT sectors. Students from the vocational training school and the technical school are also trained in CNC technology. Over the two years of training, approximately 100 hours are devoted to imparting theoretical and practical knowledge. Where appropriate, CNC machines are also used in individual projects. “Our aim is to give our students intensive training so that they can then create CNC programs and operate CNC machines in the real world without any problems,” says Herbert Bartelmeß, deputy principal of the Mechanical Engineering Institute.

Easier programming with Sinumerik Operate

High-Precision, One-Off Production

Florian Mayer's company specializes in the fast and flexible production of high-quality, one-off workpieces. Doing this successfully requires both reliable staff and modern machinery. The company's most recent acquisitions include two modern machining centers, controlled using a powerful CNC with a graphical user interface. These can be used to program even complex workpieces in no time at all.



The Sinumerik-controlled Saeilo machining centers allow Mayer Maschinenbau to reliably achieve form, positional, and runout tolerances of 5 µm, along with high-quality surface finishes

All photos: Siemens AG

> Prien am Chiemsee (Germany) is better known as a holiday destination than as a site for high-quality metal processing. Florian Mayer, owner of the 10-employee Mayer Maschinenbau GmbH metal processing company, is himself a trained mechanical engineer and qualified mechanical technician and knows exactly what it takes to be a successful

player in this market. His company produces high-precision, one-off parts and small-series batches without limiting itself to any single industry sector. Its customer base includes well-known companies from the medical, packaging, and automotive industries. The company is able to machine structural steel, stainless steel, and titanium just as economically as plastics – a fact that Mayer attri-

butes primarily to the 10 machining centers he currently has in operation.

Robust machining centers with innovative details

The mechanical engineer is particularly impressed with his brand-new Sinumerik-controlled three-axis Saeilo Contur MMV-600 and MMV-1100 machining centers: “When combined with different

tools, our 4- and 8-ton MMV machines are on average, more than twice as fast as our previous machines. And because the Saeilo machining centers offer excellent value for money, the investment will pay for itself over a relatively short period of time.”

Among other features, it is the innovative details that make working with these machines such a pleasure. For example, the integrated infrared measuring probe, which can be used to accurately set any workpiece in a very short time. Mayer sees the large drum revolver, which can accommodate up to 30 tools, as another major benefit, while the five-bearing

precision spindle helps extend tool life and achieve high levels of precision and surface finish even under maximum load. The MMV-600 and MMV-1100 reliably achieve the form, positional, and runout tolerances of 5 µm and smooth surface finishes in the range of $Ra \leq 1.6$ µm that are often demanded of Mayer Maschinenbau.

A high-performance compact CNC with a modern user interface

According to Mayer, the Sinumerik 828D compact CNC is a major contributor to these high levels of accuracy and precision: “We’ve been working with Siemens

controllers for the past 15 years now and value their fast processing rates and short cycle times. The new, modern Sinumerik Operate interface makes using the system even easier than before.” With its Sinumerik Operate software, Siemens has developed a brand-new operating and programming structure that includes PC-style functions such as copy and paste. Sinumerik Operate offers three different methods for programming and setting the workpieces: the ShopMill graphical user interface, programGUIDE for G-code with cycle support, and traditional DIN/ISO programming.

Faster programming with cycle support

Most of the orders received by Mayer Maschinenbau come in the form of DXF files, which are primarily converted into CNC programs using the graphically animated ShopMill work-step programming system via CAD reader on the machine itself. Specialist operator Peter Weber tells us why: “Because we specialize in one-off pieces and small-series production, I need to generate safe and functional programs very quickly. ShopMill is the perfect tool for doing that.” Another advantage is the clear and self-explanatory design of the dialog programming functionality for the Sinumerik controller, which allows even new employees with no programming experience to get to know the system in no time at all.

If an operator wants to use programGUIDE, he or she can switch into that system at the push of a button. This mode requires G-code knowledge, which is not a problem for specialist operator Stefan Perl. However, he still makes use of the supporting cycles and animated images used to simplify the programming task, especially the standard measurement and swiveling cycles (Cycle800), which can be used to quickly and easily clamp workpieces in both setup and automatic operation.

According to Mayer, the Sinumerik 828D’s “engraving cycle” is another feature that has proved very useful on the shopfloor, because it lets the operator program an engraving cycle in seconds simply by typing in a few letters or numbers. This can be used to engrave identifying marks or the name of the customer onto workpieces, if desired. <



“The Sinumerik 828D offers fast processing and short cycle times, while the modern Sinumerik Operate graphical user interface makes programming considerably easier.”

Florian Mayer, Managing Director, Mayer Maschinenbau GmbH

Precision parts manufacturer chooses a compact CNC with an innovative operator interface

Self-Explanatory and Intuitive Operation

For manufacturers of small and individual parts, it is important to be able to generate CNC programs quickly and, if possible, make the parts in one chucking. To achieve this, a precision parts manufacturer uses a turning center with Sinumerik 828D compact CNC and the Sinumerik Operate graphical user interface.

> OSP Präzisionsteile GmbH in Neckarwestheim, Germany, has specialized as a subcontractor in the automotive, aerospace industry, and medical part production industries. Production manager Torsten Möller sums up this medium-sized company's recipe for success as follows: "The basis is formed by both qualified personnel and our modern set of machine tools with around 25 CNC turning and milling centers. This makes us extremely flexible and able to fulfill our customers' wishes to the greatest possible extent." Small series production of a few hundred parts and the manufacture of individual parts are among OSP's specialties. This means that the machines must be reset several times a day. Therefore, it is vital that executable programs be generated quickly. Since turned parts are primarily programmed on the shopfloor, Möller places particular value on the controls' ease of operation.

Minimal training requirement

The horizontal Leadwell T-7M turning center, supplied by the machine distributor Axon in February 2011, together with the new Sinumerik 828D compact CNC, fulfills this requirement perfectly. This is confirmed not only by the production manager, but also by skilled operator Christoph Schneider, who operates the machine on a daily basis. Until recently he had only programmed in accordance with DIN, but he has been totally won over by the graphical operator interface: "I only needed one day of training to be able to use the CNC without any problems. That's pretty great." Schneider can choose between three different methods when creating his programs and can change over at any time at the touch of a button: from ShopTurn and its graphically-supported shopfloor-oriented workstep programming, to programGUIDE for G-code programming with cycle support, to Sinumerik high-level language and ISO code programming. With

The Leadwell turning center allows precision turning as well as drilling and milling

ShopTurn, the OSP personnel are able to use the comprehensive mapping of the workpiece to create safe and functional programs in a short time.

Cycles simplify programming

The CNC specialist is also happy to use cycles from programGUIDE, for example, the effective stock removal cycle. Schneider also uses the cutoff cycle. This enables him to create the program steps for this very complex machining process in seconds. Supporting moving-image sequences and a final 3-D simulation of the entire program also ensure maximum process safety. In addition to turning, the Leadwell machine is also used for drilling and milling work so that OSP can produce many complete workpieces. Here again, a Siemens control system with Sinumerik Operate proves to be of great help. After all, in addition to traditional turning tasks, it provides optimal support for the programming of drilling and milling work. For example, CNC expert Schneider has access to a wide range of milling and drilling cycles at any time via soft key. The Sinumerik 828D-controlled turning center can store 128 tools with a maximum of 256 cuts. Data sets can be called up and reused to create new programs. That saves a lot of time, as Möller knows from experience: "On machines with a different control system we are always having to delete tools and install new ones because there is insufficient storage capacity." <



Manufactured with Sinumerik CNC: precision parts such as the point fitting with swivel joint

Technology in detail

Programming counter-spindles in G-code

Standard lathes have a spindle into which the workpiece is chucked and then machined with turning or milling tools. To allow the workpiece to be completely machined (including the "back" side) it must be rechucked by hand – a process in which errors can often be made at the expense of the precision of the workpiece. By using machines with counter-spindles, this process is automated, allowing a much higher level of precision to be achieved. These counter-spindles pick off the workpiece from the main spindle with positional accuracy so that it can be completely machined on one machine. The operator can simply program takeover of the workpiece with ShopTurn in one cycle. If ShopTurn is not available, synchronization must be programmed via G-code. The following example describes this sequence:

Synchronous takeover at 1000 rpm

```
COUPDEF(S3,S1,1,1,"NOC","DV")   S3 is counter-spindle
COUPON(S3,S1)                   S1 is main spindle
G95 S1000 M4
```

Handover

```
M?                               Open M-function to counter-spindle chuck
                                  with spindle rotating
G0 Z2=300                         Preliminary position of counter-spindle
                                  absolute dimension
G94 G1 Z2=280 F1000              Pick-off position absolute dimension approach
                                  at 1000 mm/min
G4 F0.5                           Dwell time
M?                               Close M-function to counter-spindle chuck
                                  with spindle rotating
G4 F0.5                           Dwell time
M?                               Close M-function to main spindle chuck
                                  with spindle rotating
G4 F0.5                           Dwell time
G0 Z2=600                         Pull-back position counter-spindle absolute
                                  dimension
```

Pull-back position counter-spindle absolute dimension

```
COUPOF(S3,S1)
COUPDEL(S3,S1)
M1=5
M3=5
MIRROR Z0                         Mirror the machining, programming
                                  in Z minus direction
SETMS(3)                          Select master spindle for counter-spindle
```

Note:

With the mirror command, the control system automatically resets the path correction commands (G41/G42 and/or G42/G41) in keeping with the change in machining direction – that is, G42 external machining is also programmed on the counter-spindle.

Machining on the counter-spindle

```
G55                               Zero point of counter-spindle
MIRROR                            Deselect mirroring
M30
```

Multiple clamping with ShopMill

Effective Use of Tools

> The machining space of a machine tool can be utilized even more effectively by using several clamping fixtures. In some cases, however, the advantage that users gain by using several vises may be lost again due to the number of tool changes. In addition, it also requires increased effort to program this clamping arrangement.

Siemens, in collaboration with Walter Bautz GmbH, has developed a function called multiple clamping, which optimizes the tool change in such a way that,

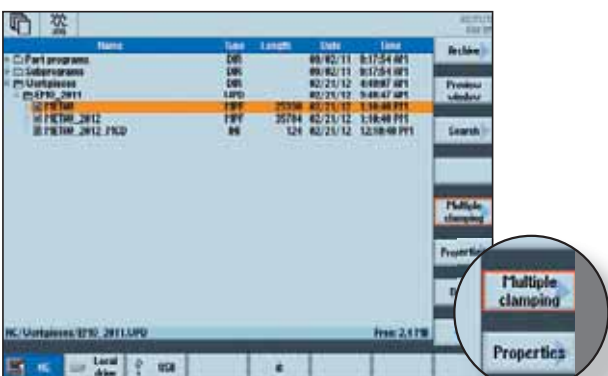
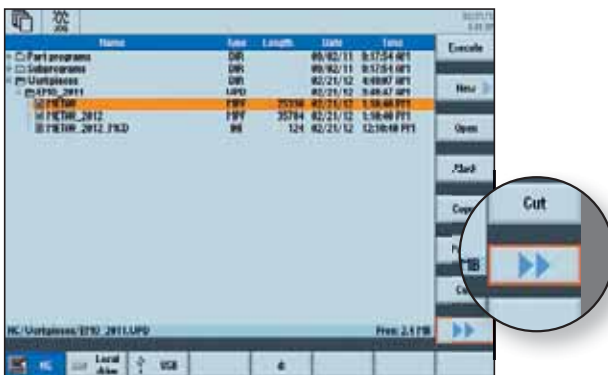
to begin with, all the operations on all the clamping fixtures are processed using the tool currently inserted before the next tool is inserted into the spindle. As a result, even clamping cubes or reversible clampings can easily be programmed on the Sinumerik using menu-prompted input – regardless of whether the workpieces are identical or different. The number of workpieces is limited only by the 99 zero offsets. In real shopfloor situations, however, this rarely, if ever, represents a limitation. Here is an example of how the programming works:

Requirements for multiple clamping with ShopMill

- > Only work-step programs
- > No marks/repeats
- > No inch-to-metric changeover
- > No coordinate transformations
- > Unique names for contours
- > Maximum 50 contours per clamping fixture
- > No setting of the “starting point” parameter to “manual” in the machining cycle
- > No specifying of any differing safe distances via “Settings”

1. Launch in program manager

You can access the multiple clamping cycle via the program manager. From there, click on **More** in the vertical softkey bar. You will find the **Multiple clamping** cycle in the newly-displayed vertical softkey bar.



2. Configure clampings and zero offsets

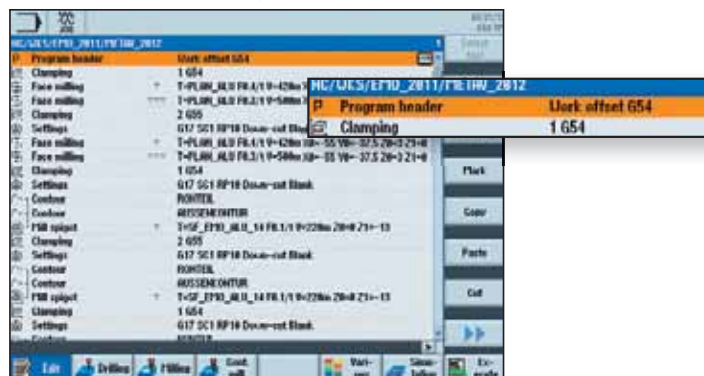
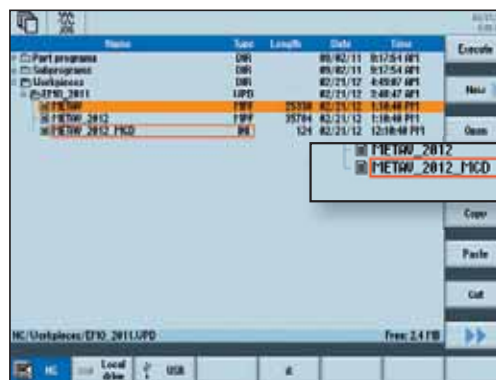
Select the number of clampings in the cycle and the first zero offset and then enter a name for the configuration file (*.INI). In the case of several zero offsets, ShopMill automatically extrapolates the zero offsets and assigns them to the clampings. There are eight clampings in our example, starting with the first zero offset. In general, the following applies: G54–G57 are assigned the first through fourth clampings, and G505–G599 are assigned the fifth through 99th clampings. You can use four zero offsets (G54–G57) for standard configurations of the machine. Please contact the machine’s manufacturer if there are not enough zero offsets set up for your application. Once you have specified the clampings, ShopMill generates a configuration file for the multiple clamping, as in the example METAV_2012.INI.



| No. | UID | Name |
|-----|------|-----------------------|
| 1 | G54 | METAV_2012_PART_1.MPF |
| 2 | G55 | METAV_2012_PART_2.MPF |
| 3 | G56 | METAV_2012_PART_3.MPF |
| 4 | G57 | METAV_2012_PART_4.MPF |
| 5 | G505 | METAV_2012_PART_5.MPF |
| 6 | G506 | METAV_2012_PART_6.MPF |
| 7 | G507 | METAV_2012_PART_7.MPF |
| 8 | G508 | METAV_2012_PART_8.MPF |

3. Automatic program creation

ShopMill completes the METAV_2012_MCD.INI file and creates the METAV_2012.MPF program. The INI file is the configuration file and the MPF file is the program for the multiple clamping. ShopMill optimizes all of the machining steps for the multiple clamping in the newly-created program – that is, technically feasible machining operations using the same tool are grouped together into a program block and zero offsets are generated automatically.



4. Set-up cycle cust_clamp.spf for reversible clampings

When using reversible clampings, you must also adapt the cycle to allow for rotation of the reversible clamping. You will find the cycle (cust_clamp.spf) in the System Data in the Manufacturer Cycles folder. Copy the cycle into the User Cycles or Manufacturer Cycles directory. The cycle takes care of positioning rotary axis A of the reversible clamping. The cycle needs to be set up only once for the reversible clamping. The following example shows a cycle adaptation for a four-sided reversible clamping. In each case, the position of rotary axis A is assigned in degrees to the actual clampings (_ACT) 1 to 4. The rotary axis is rotated by a further 90 degrees between the clamping in each case.

Example:

```
%_N_CLAMP_SPF
$PATH=/_N_CUS_DIR
PROC CLAMP(INT _NPV,INT _PREV,INT _ACT,INT _NEXT)SBLOF DISPLOF
V06.02.01 31.05.2001 Pe
```

Example of clamping bridge for machine manufacturer

PARAMETERS:

_NPV : Number of 1st zero offset:

0 = G500

1 = G54

...

_PREV : Number of previous clamping (-1 = none)

_ACT : Number of current clamping (1, ...)

_NEXT : Number of following clamping (-1 = none)

DEF INT _NV Auxiliary variable

Adaptation for a reversible clamping with 4 sides offset by 90 degrees

```
IF ACT==1
GO A=DC(0)
ENDIF
IF ACT==2
GO A=DC(90)
ENDIF
IF ACT==3
GO A=DC(180)
ENDIF
IF ACT==4
GO A=DC(270)
ENDIF
```

Multiple clamping with Chick clamping systems

More Productivity for Small Series

“If only we had the right batch sizes ...,” could well be running through the minds of many users when looking at tombstone fixtures, multiple clamping systems, and pallet changers. The right combination of machine, multiface clamping system, and macro programming has a significant effect on reducing nonproductive time, particularly with small- and medium-sized series.

Chick vise towers enable short traverse paths and fast machining and tool change times. They also take up very little work space



Walter Bautz GmbH

> Customer proximity and flexibility are the key advantages of small machining companies because they can quickly and easily squeeze in orders. These key advantages, however, can quickly become their major stumbling block. Large batch sizes are split into small orders and spread over the fiscal year since neither party is prepared to finance the order volume in advance and bear a potential credit risk. This often disrupts the workflow, increases the proportion of nonproductive time, and decreases machine running time. A dedicated clamping fixture, which is almost always expensive, is also a necessity for many of the parts requested. On top of this, it is usually not even certain at the inquiry stage what the actual volume of the order will be. In many cases this ignorance results in a poor compromise. If the fixture is designed to be as simple as possible, the company is generally forced to acknowledge down the

line that the natural increase in order volume would actually have allowed for a more sophisticated and more cost-efficient solution. But if the order inquiry is for a large quantity and the correspondingly high-quality, easily automated fixture is produced, the desired order volume might fail to materialize. Then the company is stuck with its high costs for workpiece-specific clamping tools. Added to this, the fixtures are also put into separate storage for an indefinite period of time, in the hope of additional orders.

Multiple Machine Pallets in One System

In this situation, flexible Chick vise towers provide the ideal solution, as they combine multiple machine pallets into one system while offering several programming levels. Chick offers a broad portfolio of clamping systems for horizontal and vertical machining centers that produce a maximum num-

ber of workpieces with a minimum of clamping effort. The key is that, despite their complexity, the vise towers are simple to program with Sinumerik's multiple clamping functionality (see article on pp. 20–21).

This efficient manufacturing approach has already been proven in practice. If an operator previously needed to load three machine pallets in order to produce one finished part using four mainly dedicated clamping fixtures, the machining time per workpiece is reduced by 30 percent when the fixtures are milled on the Chick vise tower. Tooling time is reduced by over 80 percent.

Chick clamping systems are also perfect for using the full work-space capacity of a vertical milling machine. The adaptation of a compact Chick vise tower at the CNC axis using a universal interface enables three-way machining with just one clamping fixture. This reduces machining as well as tooling times and shortens traverse paths. <

G-Code Compatibility App for Sinumerik CNCs

The new G-Code Compatibility app will help you find compatible NC codes for the Siemens high-level language and ISO G-code quickly and easily. It also provides examples, making the Sinumerik CNC even easier to use. A glossary containing cycles and functions is always available for you as a reference. The app for iPhone and iPad is available in English free of charge.

www.siemens.com/CNC4you-app



G-Code Compatibility app

Scan the QR code with your iPhone or iPad and simply download the app directly.



Always up-to-date with the CNC4you app



With the CNC4you app, designed for both iPhone and iPad as well as the Android operating system, users always have direct access to the most important news and information from their CNC community. You will hear immediately if a new individual workpiece is released, when a new test version of SinuTrain is available, or if events are taking place in your area. There is also detailed information about the extensive range of basic and advanced training courses offered for ShopMill and ShopTurn.

The informative CNC4you magazine can be opened, read, and downloaded directly to smartphone or tablet as a PDF.

Download the app free of charge at:

www.siemens.com/CNC4you-app

SIEMENS



siemens.com/cnc4you

The only address for cool CNC workpieces and useful tips

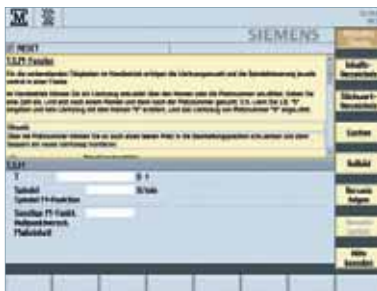
The SINUMERIK® Operate user interface makes programming quite simple, every step of the way.

Many new and useful functions:

SINUMERIK Operate provides you with a wide range of functions and makes machine operation even more efficient. As a result, programming and operator control are clear and easy-to-understand thanks to the tool list and animated help elements. Simple tips and tricks make SINUMERIK Operate easy-to-use.

SINUMERIK Operate – programming and operator control made simple

Tips and tricks:



The language-independent help key, tooltips, as well as improved search functionality with CTRL+F, are available in all screen forms.



The undo function using the “Insert” key – as long as an Input key has not been pressed or data already transferred into the fields.



Recompiling, commenting out or processing cycles with just one or two keys.



Download useful tips and tricks free-of-cost:

There are many additional functions and softkeys for fast programming and operator control. All this and more can be found online – visit www.siemens.com/cnc4you.

answers for industry