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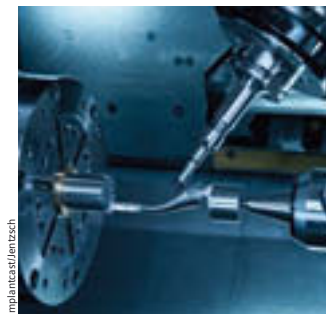
High-end CNC for medical implants and instruments

Highest Precision with Bones Made from Titanium

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For the manufacture of complex bone rasps, implantcast uses the Sinumerik 840D sl with the complete machining function

Implantcast/Jentzsch

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The Sinumerik 828D uses animated graphics to support users in manufacturing special parts

Koch

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Laser-supported tool measurement systems from Renishaw are particularly suited for use in turn-milling machines

Renishaw

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ISCAR manufactures metal-cutting tools for complex mill-turning work

Iscar

Dear Readers:

Increasing globalization and rapidly changing requirements are exposing the machine tool sector to harsh competition. Those who want to be successful in these fiercely competitive markets need to make the best possible use of their machine tools and keep downtime for tool changeover short. An important step in this direction is **"complete machining,"** because it makes it possible to carry out all the machining steps on one machine. The concept isn't new, but its adoption is becoming **a major trend**, because the control technology, the CAD/CAM systems, the tools, and also the various machine kinematics are becoming better and better at supporting this technology. In addition, it is not just pure turning, milling or grinding machines that are being brought to the market, but, increasingly, **combinations of various technologies**.

With special automation solutions for machine tools, we are accepting the challenge of making these highly effective technologies controllable for the machine operator. The Sinumerik 840D sl, with the **improved Sinumerik Operate user interface**, offers new functions that make the handling of mill-turn and turn-mill machines much easier. But complete machining is more than the combination of different technologies; it begins with the use of a simple vertical milling machine. For example, the use of a clamping cube allows the machine space to be better utilized and also makes it possible to virtually **machine** a workpiece completely **in one clamping**. This also opens up opportunities for effective machine utilization with the Sinumerik 828D.

At EMO, we will be demonstrating examples of what complete machining could look like in various sectors. On a variety of machine tools, you can observe the manufacture of typical workpieces from the automotive, aerospace, consumer goods and energy sectors. We will also provide a live demonstration of MDynamics on a five-axis milling machine. We look forward to seeing you at EMO!

Manfred Buchner
CNC Application Technician
Siemens AG

New functions for Sinumerik Operate and Sinumerik MDynamics

Optimal Usability and Surface Quality

It doesn't matter whether it is series production or small batches — through its adaptability, the open and flexible Sinumerik 840D sl high-end CNC has proven itself many times over in use on the shopfloor. The controller is optimally supplemented by the Sinumerik Operate user interface and the Sinumerik MDynamics technology package. The addition of new functions in time for EMO 2011 provides improved productivity, ease of use and quality.

The new functions of the Sinumerik 840D sl for multitechnology machining save time and money

> Complex workpieces demand efficient manufacturing methods and innovative CNC solutions. For this reason, the Sinumerik 840D sl was equipped with functionality for complete machining. In the future, this will allow multi-tasking using various technologies to be accomplished on a single machine and without time-intensive reclamping. In the Sinumerik Operate user interface, turning functionality for milling and milling functionality for turning have been integrated and supplemented by innovative measurement cycles in Animated Element design. The advantage for the user: the operation and "look and feel" are identical — even when switching between different technologies. In addition, the tool administration enables simple handling of all turning and milling tools, as well as multitools, in a uniform interface. Programming in programGuide has been expanded to include functions such as "Aligning and positioning of turning and milling tools" and "Turning and milling cycles including contour programming." The simulation of multitasking programs is also possible now, which makes the machining of workpieces even more efficient.

Fast, efficient and easy machine operation

Another important element in the new Sinumerik Operate interface is the modernization of the program administration to allow paperless production. That
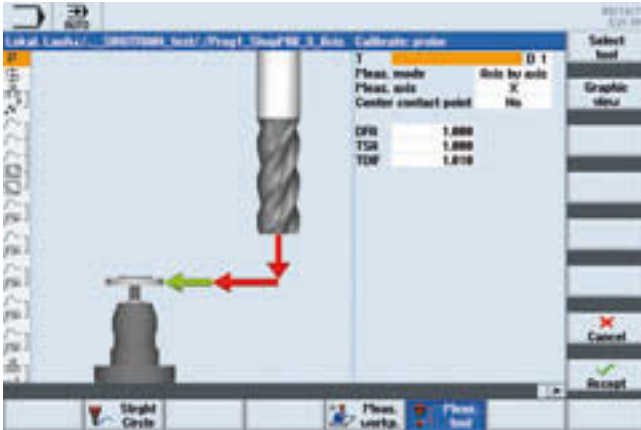
Sinumerik Operate offers process measurement cycles for automatic workpiece and tool measurement
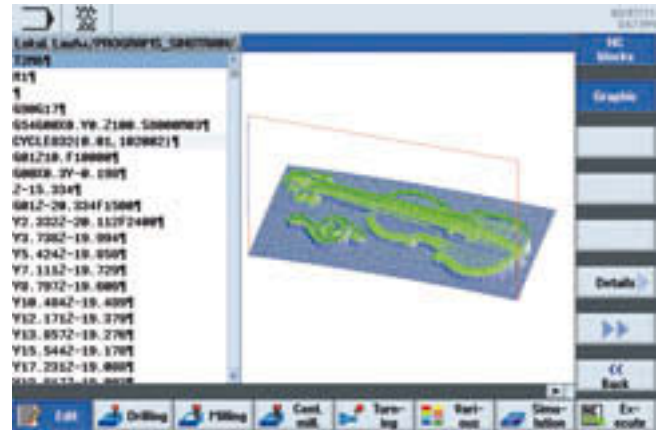
The "quick view" function in Sinumerik MDynamics allows manufacturing errors to be avoided

means that PDF files or even image files such as .jpg, .png, or .bmp can be displayed and saved to local drives, giving machine users an overview of which tool and which clamping means are currently in use. The user previously received a shadowing plan to avoid communication problems, but this process now functions completely without paper.

For automatic workpiece and tool measurement, the Sinumerik CNC process measurement cycles are now also available in Sinumerik Operate Style. This means that for cycles and new functionalities, the input screens with Animated Elements in programGuide and ShopMill/ShopTurn can be selected and

become visible at the end in the simulation. The measured values can be automatically updated both for the correction of the tool and for the zero point shift.

The new programming functionalities in ShopMill are also practical for the user. They include a pocket calculator function with fit specifications, a multiple clamping operation for workpieces, and new shortcuts, among other functions. If fits must be entered for the programming of workpieces, the user no longer needs a table book, but instead enters the fit into the fit calculator, and the fit average is automatically copied to the input value. With the new Ctrl-F search function, it is possible to easily

search for words or numbers in the machine area in cycle fields and in the program.

Perfect surface finishes

Sinumerik MDynamics offers optimizations in five-axis milling that enable even greater productivity with surface quality that is also higher. For example, the Advanced Surface intelligent path control was further developed in order to increase the quality and consistency of the speed profiles and achieve a reduction in machining time. Quality and productivity advantages with High-Speed Cutting (HSC) of free-form surfaces improves the look-ahead capability, with special emphasis being placed on the optimization and harmonization of the acceleration characteristics and return paths along neighboring track profiles.

With the "orientation path smoothing" (ORISON) function for five-axis machining, the fluctuations of the orientation can be smoothed over several sets. In spite of increased machining speed, the new look-ahead function allows even better surfaces to be achieved in one step. If users need a quick overview of a workpiece and the corresponding NC program, they can use the new "mold-making quick view" function. Even the largest NC programs and part programs are quickly converted into a 3-D preview of the workpiece. Various colors give the user a view of which travels he or she has chosen and indicate whether the user has chosen the correct shape, whether the program contains gross travel errors and what the basic machining strategy looks like. **<**

Technology in detail

The most important innovations at a glance

Sinumerik Operate

> Integrated turning functionality for milling, and milling functionality for turning, including simulation
> Uniform tool administration of turning and milling tools, as well as multi-tools
> New functionality for alignment and positioning of turning and milling tools, as well as turning and milling cycles
> New measurement cycles in Sinumerik Operate Style
> Pocket calculator with drilling fit
> PDF files and images (.jpg, .png, .bmp)

Sinumerik MDynamics

> Improved Advanced Surface intelligent path control
> "Orientation path smoothing" (ORISON) function
> Quick view of mold-making programs

Contact > manfred.buchner@siemens.com

Turn-milling and mill-turning with Sinumerik CNC

More Effective and Cost-Efficient Production

Complex milled workpieces often have a substantial proportion of turned elements. And conversely, many turned workpieces have a great number of milled elements. To optimize the production process, multi-tasking machines are used that bring together the two metal-cutting technologies of turning and milling in one machine tool. We spoke with CNC application technicians Bernd Barthelmann and Manfred Buchner from Siemens about what turn-milling and mill-turning have in common and how they are different.

> *Mr. Barthelmann, Mr. Buchner, what is the advantage of turn-milling and mill-turning machines?*
Bernd Barthelmann/Manfred Buchner: The biggest advantage of these machines is the more effective production process and the associated cost optimization. Another advantage is that the workpiece can be completely produced in a single clamping. This eliminates inaccuracies due to reclamping.

And how does that work with turn-milling machines?
Bernd Barthelmann: In their basic structure, turn-milling machines are turning machines; they have one turning spindle into which the workpiece is clamped. They can also incorporate static turning tools as well as rotating milling tools to completely machine the workpiece.

And with mill-turning machines?
Manfred Buchner: They are similar. Mill-turning machines are milling machines with one milling spindle that is clamped so that it can absorb lateral forces that arise during turning. These machines also have a turntable with torque drives that enable high speeds in order to achieve the cut speed required for turning. According to a common rule of thumb, a milled workpiece with a turning proportion of 20 percent is an optimal component for this technology.

Couldn't you get the same results with classic turning and milling machines?
Bernd Barthelmann: In principle, yes. Many classic turning machines with what are known as driven tools mounted on the revolver have long been able to carry out workpiece milling. But the cutting performance of these tools is limited, and not every milling task can be accomplished with them. Instead of a revolver, multi-tasking turning machines have a milling

spindle that is in no way inferior to the type installed in a normal milling machine. In addition, these milling spindles can be swiveled (B-axis). This means that five-axis simultaneous machining is also possible on these machining centers.

Manfred Buchner,
CNC application engineer

Manfred Buchner: On milling machines, the combination of both technologies is relatively new, because only a few machining centers can turn and the changeover of the technologies was often a problem for machine manufacturers and programmers. The cutting performance was also limited due to the lateral forces on the milling spindle, and the turntables did not reach the required speed. Not until torque motors were installed was it possible to develop turntables with the required dynamic. But the spindle manufacturers also made their contribution to being able to absorb the forces. Multi-tasking milling machines are equipped with a fourth and fifth axis, which makes turning possible in every position. Thanks to the five-axis kinematics, the turning tools can also be positioned in all positions. This provides an extremely high level of flexibility. These machines allow all turning contours to be realized — even extreme undercuts.

What technical challenges do the programmers and operators face with these machines?
Bernd Barthelmann/Manfred Buchner: Completely new machining methods and perspectives emerge for turn-milling due to the additional swiveling tool carrier axis (B-axis), and for mill-turning due to the swiveling tool or workpiece (five-axis kine-matics). These allow turning tools to be freely positioned in the space, and even tangential contour tracking is possible for turning. The Sinumerik 840D sl supports every cycle from the turning world, making programming on the machine clear and simple. Since the CNC also demonstrates its full performance with milling, such as the creation of inclined machining planes or even five-axis simultaneous machining, there are no limitations. The programmer can take advantage of proven functionality here, such as the Cycle800 swivel cycle, the Traori five-axis transformation, or machining cycles like trochoidal milling. In both technologies, the operator can use Sinumerik Operate, which offers the convenience of familiar programming along with animated elements and many turning and milling functions.

And what is your outlook for the future of this technology?
Bernd Barthelmann/Manfred Buchner: The expanded possibilities of these special machines will surely make a contribution to the boundaries of turning and milling growing even closer together.

Mr. Barthelmann, Mr. Buchner, thank you for this conversation.   <

"The biggest advantage of multi-tasking machines is the more effective production process and the associated cost optimization."

**Bernd Barthelmann,
CNC application engineer**

High-end CNC for medical implants and instruments

Highest Precision with Bones Made from Titanium

Strict legal requirements make for strict product specifications for implant manufacturers — from design and materials to manufacturing, the complete production chain must be documented and validated. The high-end CNC Sinumerik 840D sl supports prosthetic manufacturers in producing high-quality implants while facing ongoing pressure for cost-reduction.

> A long series of events is required for a new medical implant to be produced: it takes 12 to 18 months from the first drawing, the construction and the work planning to the finished, approved implant. "If we receive a suggestion for a new product from an orthopedist, we first design and develop a prototype," explains Hans-Joachim Mahr, production manager at the implantcast company in Buxtehude, Germany. A specially tailored set of instruments needed for implantation is required for each implant. This includes, for example, a surgical rasp that is used for the preparation of the bone. The CNC transfers the CAD/CAM data for these parts to the actual production.
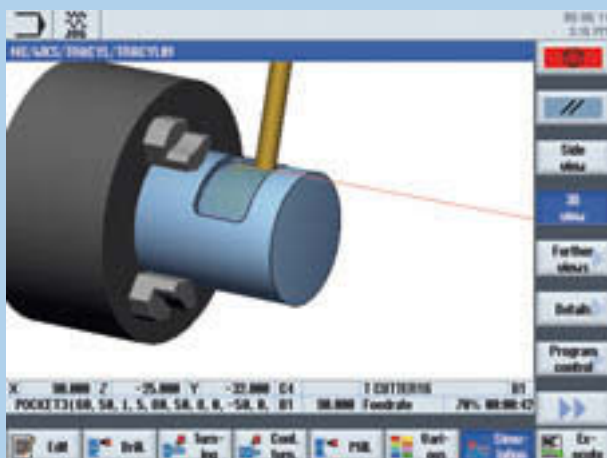
The right CNC for series production and for small lot sizes

Artificial bones made from titanium and the associated instruments are manufactured primarily using metal-cutting processes. For example, production runs on

Complex bone rasps represent a challenge for machining because of their form and difficult-to-cut material

Calling the surface transformation and definition of the pocket with the command POCKET

Technology in detail

TRACYL Surface Transformation

On a daily basis, programmers of turn-mill centers are given the task of producing milled elements such as pockets, surfaces, grooves, or similar features on a turned workpiece. Thanks to the excellent graphical support provided by the ShopTurn programming system and the easy handling of the milling cycles, even beginners succeed very quickly with the programming. But even with G-code, the creation of such elements is not rocket science, as the following example shows:

To make a pocket with the dimensions of 50 × 80 × 5 mm on a cylinder diameter of 100 mm, a turn-mill center with a swiveling milling head is used.

Following are the steps that are carried out:

1. The G54 zero point and the G19 surface milling level are switched on, and the axes are moved into a basic position.

```
G54 G19
```
```
G0 X800 Y0 Z800 B1=0
```

2. The tool is called up and engaged at 90° with the Cycle800.

```
T="FRAESER_16_RAD_C1"
```
```
CYCLE800(0,"WSP",300,57,,,,,90,,,,,-1,100,3)
```

3. The master spindle is changed over to the milling spindle, with the speed and turning direction provided and prepositioned.

```
SETMS(2)
```
```
G95 S4500 M3
```
```
G0 X120 Z-50
```

4. The surface transformation is called up with the command TRACYL, with the value in parentheses being the circumference diameter on which the surface is calculated. The standard pocket cycle POCKET then follows. It defines the pocket as if it were on a flat surface. Note that the radius programming of the X-axis is automatically activated during the cycle.

```
TRACYL(100)
```
```
POCKET3(60,50,1,5,80,50,8,0,-
```
```
-50,0,5,0,0,0.2,0.1,0,11,5,8,3,15,0,1,0,1,2,11100,13,101)
```

5. With TRAFOOF, the transformation is deselected, a changeover to the turning spindle as the master spindle occurs, and the axes are cleared.

```
TRAFOOF
```
```
SETMS(1)
```
```
G0 X300 Z300
```

DMG turn-mill centers equipped with a Sinumerik 840D sl at implantcast. Because their powerful functional offerings are suited just as well for complex individual parts as for series production, a single customer-specific implant is produced on the same machine that produces large numbers of standard products. For the standard implants produced in series, the fast data processing of the Sinumerik 840D sl is the first and foremost advantage. For especially complicated procedures, for example, those involving cancer patients, implantcast also offers manufacturing of patient-specific implants. In this case, implants and instruments are perfectly tailored to the patient's unique bone structure using computer tomography or magnetic resonance tomography. For this single-part production, implantcast uses the Sinumerik's extensive set-up functions, which enable fast retooling of the machine.

Many intelligent functions are available for it, including tool and workpiece measurement, among others. These measurement functions can be used both for setup as well as process measurement, that is, for quality assurance during machining. Simple swivel commands that simplify machine setup are also integrated into the user interface of Sinumerik Operate. Swivel functions are available both for swiveling about a machine axis and for swiveling about an axis of the workpiece coordinate system.

Validation ensures quality

Whether making a unique product to order or a series of standard products, the highest demands are made on each individual medical workpiece. No leeway in maintaining quality and precision can be allowed. The manufacturer is also responsible for validating the complete production process. The construction of the prototype, therefore, needs to be carried out under the same conditions as the series production that follows. And since Germany's Medical Product Act was amended in March 2010 to classify medical implants in the highest risk class (III), manufacturers need to go through a more extensive conformity process to receive the CE mark, the prerequisite for marketing and market introduction within the EU. A reliable technology that supports the manufacturers in the ful- >>

Implantcast/Jentzsch

The Sinumerik 840D sl makes the machining of complex parts much easier

>> fillment of these requirements is thus indispensable.

Efficient manufacturing at every lot size

NC programming, in which the functions for workpiece machining are defined and which includes all details regarding its form and technology, requires very little effort. This plays a crucial role primarily in the manufacturing of patient-specific products. "Thanks to the clear user interface of Sinumerik Operate, we can save a considerable amount of time," explains Axel Robiller, head of metal cutting at implantcast. "The reasons for this include the human-machine interface in Windows style, which is familiar from the PC." The Sinumerik 840D sl also offers a great variety of easy-to-use turning and milling cycles. All user functions and cycles are supported with animated auxiliary graphics (animated elements) so that the user intuitively understands how to use the function without having to consult the operating instructions. And where animated elements are not sufficient, such as when it is necessary to make the purpose of individual input values easier to understand during the parameterization of complex cycles, dynamic line graphics are

used. These take into account the current input values through proportional representation.

Most crucial for efficient series production are short machining times. The turn-mill center with the Sinumerik 840D sl allows five-axis simultaneous machining in the constellation for Y- and B-axes, thus reducing throughput time considerably: the implants and instruments are created in one operation with parallel machining on the main and counter spindles. For complete machining, the Sinumerik 840D sl offers turn-mill functions that can be used together. All milling functions are fully available, that is, from cycle technology to simultaneous clearance surface machining.

High quality for complex parts

Bone rasps are very complex workpieces, and they represent a challenge for machining because of their form alone: They are rasp bodies with a great variety of rasp teeth attached to their exterior surfaces. In addition, they are manufactured from a forged titanium alloy that is difficult to cut. The required surface quality at high machining speed is ensured by the Sinumerik MDynamics technology package, which, through the use of the

Advanced Surface motion guidance, shows milling results that completely meet the requirements for medical workpieces even with difficult materials. Each individual part also undergoes extensive quality control: Sensors check the precision of the contour and depth of roughness and scour the surface for the smallest instances of damage. Some parts are also x-rayed to check the material structure. It is not until these hurdles are overcome that the bone rasps are well packed in implantcast's in-house department for sterile packaging and sent on to goods issue.   <

You can experience the entire process chain for the manufacture of patient-specific bone rasps including turn-milling live at the Siemens booth at **EMO 2011** in Hall 25, Booth C18.

Bulgarian machine manufacturer relies on Sinumerik 828D

Perfect for the Mid-Range Market

At the Metalloobrabotka International Exhibition, which took place in Moscow in May 2011, Bulgarian machine manufacturer Rais LTD presented its M500 milling machine with Sinumerik 828D and had complete success with it. According to CEO Nishan Bazdigyan, the Sinumerik 828D was convincing because of its high quality, flexibility and productivity, as well as its clear operation in Windows style.

> Founded in Bulgaria in 1994 with five employees, Rais LTD initially concerned itself with retrofitting older machines from Bulgarian and Russian production. Because of high demand, the company decided to use its extensive expertise to develop and build its own machines. In 2000, Rais brought its first milling machine to the market, the M400. Now more than 60 employees manufacture six different milling machine and three turning machine series. Today, the Bulgarian manufacturer is a respected supplier particularly in the region of Eastern Europe, and interest is increasing in Central Europe through its sales partner Premium Maschinen Handel.

Successful partnership

In addition to high-quality mechanical engineering, a technically-superior and established controller and drive technology is especially important to break into new markets. For this reason, Rais CEO Nishan Bazdigyan decided to partner with Siemens and confirmed his complete satisfaction with this decision in May 2011 at the Metalloobrabotka International Exhibition. The mid-range milling machine type M500 with Sinumerik 828D that was exhibited there has, since then, been sold several times. In the future, all mid-range machine series from Rais will be equipped with the newest Sinumerik 828D controller generation.

The best in technology and service

The advantages of this CNC are numerous, as Nishan Bazdigyan emphasizes: "With this controller, all relevant turning and milling functions can be perfectly mapped. Many of them are even included in the basic version." Machine manufacturer Rais gives high marks particularly to the operability of the CNC. Equipped with Sinumerik Operate, the HMI has a modern Windows-style appearance and is the same as a normal computer in many ways. The various options for data transfer via network, USB drive or Compact Flash Card make work much easier.

But it is not just the technical features of the Sinumerik 828D that have contributed to CEO Nishan Bazdigyan's high level of satisfaction. He also highlights the good cooperation on a partnership basis: "Service and support from Siemens are extremely good. What I mean by that is the very professional advice and extremely fast response times for spare parts, among other services. I have not yet experienced such exemplary service and support with other control suppliers." <

"With the Sinumerik 828D, all relevant turning and milling functions can be perfectly mapped. Many of them are even included in the basic version."

Nishan Bazdigyan, CEO of Rais LTD

Siemens/Rais

Leadwell milling machine with Sinumerik 828D enables efficient production of special parts

Tailored and Flexible

Siemens and Leadwell have put together a total package that brings together the interplay of the milling machine and CNC in an optimal manner. This package is being offered in the German market by dealer Axon GmbH in Urbach. Siemens is the ideal partner and offers a modern user interface with the Sinumerik 828D. Special machine manufacturer FSP also profits from this with increased productivity and faster order handling.

> The delivery spectrum of FSP-Automations GmbH ranges from standardized tool technology to complex special machines. These include, for example, automatic assembly machines, assembly inspection systems, and handling and transfer systems for the automotive sector, for manufacturers of forestry technology, and for the pharmaceutical industry. The company has been active in these areas for 15 years and serves its customers from its company headquarters in Thuringia's St. Kilian, where all processes are carried out, from concept development and design to production and machine programming.

For capacity reasons, FSP began outsourcing the manufacturing of complex parts to contract manufacturers long ago. However, about two years ago, FSP CEO Klaus Polster brought the outsourced machining back in-house to expand production capacity. "In special machinery manufacturing, there are often part changes," explains Klaus Polster. "If you have the option to produce them in-house, you can react more flexibly and also gain a substantial cost and time advantage."

At the end of last year, FSP ordered a milling machine from the Taiwanese machine builder Leadwell from Axon GmbH, Leadwell's representative in Germany. "On the basis of its precision, it seemed to be especially well-suited for our work. In the end, the decisive factor was the machine's excellent value for the money," says Klaus Polster, looking back in satisfaction at his decision.

A great number of pre-settings

"Good experiences with Siemens controllers led us to order the milling machine with a Sinumerik 828D," reports the FSP CEO. During a two-day training course that took place in February 2011, Axon service technicians introduced the operators to the fine points of the new Leadwell Easymill V-30S and the Sinumerik 828D CNC.

The sophisticated concept of the Sinumerik Operate user interface minimized the amount of time it took to become familiar with the system. It is designed in a clear manner, can be operated intuitively and is equipped with functions that allow work-step programming and high-level language programming to be brought together under one user interface. ShopMill enables work-step programming for individual parts and small series. programGuide is conceived for programming according to DIN66025, which is suitable for large production batches with graphic cycle support. To support the operator, animated graphical elements are available

Animated graphics of the operating and programming software ShopMill support the user in setting up the milling machine quickly. Measuring probes determine the location of a workpiece in the machine and transfer the data to the controller. The Sinumerik 828D can then directly process the signals

FSP Automation

Milled parts that are produced, machined, and inspected on the Leadwell machines of FSP

in ShopMill, in programGuide, and for machine setup. ISO programming and high-level language elements are also available with the Sinumerik 828D.

### Create contours with just a few work steps

Klaus Polster sees another advantage in the option to use Sinumerik CAD readers to convert CAD data (DXF files) into NC programs (MPF, SPF) for drill patterns and contours so that they can be understood and edited by the geometry processor or cycle support. However, NC programs are created on a PC programming workstation that is not networked with the machine. The complete NC programs are thus transferred to the machine using a USB flash drive.

Klaus Polster is satisfied with the quality of the machine, which achieves the speed, flexibility and precision that he had hoped for. He is also planning to use another Leadwell milling machine equipped with a Sinumerik 828D. "The experienced employees are now handling the controller, which will allow us to go into production immediately after installation," says the FSP CEO in closing. A turning machine from Leadwell with Sinumerik 828D and ShopTurn is already in use in FSP's production.   **<**

Technology in detail

CAD Reader for Programming Convenience

Convenient support of the Sinumerik CAD reader allows contours to be generated or drill points to be filtered out in just a few work steps. Unnecessary components of the drawing such as dimensioning, hachures, labels and frames can be hidden and removed due to the layer technology. In addition, the CAD reader can convert CAD data (DXF files) into NC programs (MPF, SPF, ARC) for drill patterns and contours. The contours or drill patterns generated are implemented in such a way that they can be understood by the geometry processor or cycle support and edited on the controller. The CAD reader is available with SinuTrain or as a stand-alone application. To be able to read splines in Sinumerik CAD reader, they need to be converted into polylines. Instructions for doing this, along with a small program, are available online at www.siemens.com/cnc4you.

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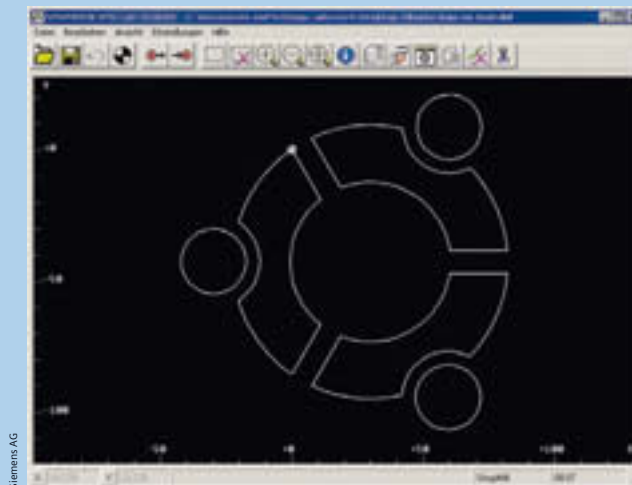
CAD reader converts DXF files into contours or drill patterns for Sinumerik CNCs

Optimum for Highly-Demanding Milling Tasks

For more than 40 years, Peter Schmitz GmbH, in Oberhausen, Germany, has been dealing with custom-made products and solutions for electrical and mechanical systems. In the search for a CNC milling machine for prototype development, the company found the ideal partner with Optimum and Sinumerik.

> Based upon many years of experience with heating and cooling systems in metallurgy, Peter Schmitz GmbH recognized at an early stage the necessity of reliable and energy-efficient cooling systems in telecommunication and network technology. To implement new water-cooled systems, the company ventured into in-house manufacturing. Following this development, the company purchased a CNC milling machine and began obtaining the required expertise.

In addition to the purely technical data of the CNC milling machine, the service offered by the manufacturer played an exceedingly important role because the company had no expertise on how to operate and program CNC milling machines; however, the training period needed to be kept as short as possible. The company ultimately found a machine manufacturer — Optimum, from Hallstadt, Germany — that fulfilled the technical requirements and provided the desired level of service with its

Optimum F210 TC-CNC milling machine equipped with the Sinumerik 828D and the Sinumerik Operate user interface. "We could extensively test the CNC milling machines on site several times, and all questions were thoroughly answered, such as ones relating to the necessary tools and operation, for example," says Technical Director Stefan Schmitz.

Energy efficiency with water cooling

Cooling elements made from non-ferrous metals, primarily copper and aluminum, are manufactured on the CNC milling machine. These are used for the water cooling of electrical systems in information technology, such as server and computer systems. While operating, the coolant circulates in the channels; and through direct contact of the cooling element with the semiconductor components, optimized heat dissipation occurs. Thanks to the high degree of efficiency, energy consumption is greatly reduced

in comparison with standard cooling systems that use fans or air-conditioning. In addition, the service life and fail-safe performance of the components were increased. All in all, water cooling greatly reduces costs in ongoing operation.

Simple to program and operate

Peter Schmitz GmbH had no experience in programming CNC milling machines, and additionally, the complex coolant paths and cooling elements made direct programming on the machine difficult; therefore, the company decided on a simple CAD/CAM system in the 2.5D range. "I first create the drawing on the CAD/CAM system and then define the machining steps on the machine," says Stefan Schmitz, explaining his typical work process.

"Through the integration of the Sinumerik 828D into the company network, I can transfer the NC program from the computer directly to the controller." When changes are made, the

Zero point setup with mechanical measuring probes and the "Measure edge" cycle of Sinumerik Operate

Face milling of a cooling pipe using the face milling cycle

Photos: Peter Schmitz GmbH

drawing is changed first, and then the NC program is recalculated. "It was especially important for me to be able to quickly make changes to prototypes in order to shorten the development phase for new products to the greatest extent possible. Particularly for cooling systems for computer technology, a two-week head start can be decisive for whether a product is a success," Stefan Schmitz adds.

The intuitive operation of the controller was a crucial selling point for Peter Schmitz GmbH. Setup is no problem for beginners, with the clear dialogs of the new Sinumerik Operate user interface, such as zero point determination, tool measurement and tool administration. Even mechanical dynamometers and measuring probes, which are used by Stefan Schmitz during setup, can be used on a partially automatic basis via the measurement cycles in a manner that is self-explanatory: "Measure corner" during zero point setup, for example.

Geared for the future

After a year of use, Stefan Schmitz gives a very positive impression when taking stock: "Right away, I managed very well with the machine and controller, and was able to quickly begin productive manufacturing." The potential for development in water cooling is not yet exhausted, and new ideas are waiting to

be tried out; so Peter Schmitz GmbH is thinking about upgrading the milling machine by adding two rotational axes. The Optimum company and Siemens are currently working together on commissioning the new kinematics, which are programmed with the new Cycle800 swivel cycle and allow the production of geometries with engaged axes as an option for the milling machine.   <

Technology in detail

Safety Integrated for Sinumerik 828D

With Safety Integrated, Sinumerik 828D offers the ideal platform for a safe machine concept. The safety functions are realized using the integrated drive functionality of Sinamics S120 and correspond to the machine directives 2006/42/EC. For the operator or owner of the machine, it brings the advantage of highly-effective personnel and machine protection through the secure monitoring of speed and stoppage, as well as workroom and protective space delimitation. A special highlight of Safety Integrated is setup with the safety door open, as the drives are always subject to active position and speed monitoring. The Optimum F210 TC-CNC is one of the few machines in the lower price segment that combines Safety Integrated with the Sinumerik 828D.

Faster data exchange saves time and money

Networking with Sinumerik 828D

Archive controller programs or exchange data between CNC machines
and the programming station — using the built-in Industrial Ethernet interface,
the Sinumerik 828D can be easily integrated into the company network.

> It is often the case on the shopfloor that customer parts need to be reproduced on short notice, and the last program version cannot be found. In this situation, it is first necessary to check the archive to find the correct version and then import it into the CNC using a physical data medium. This all leads to a loss of productive time that would not occur with a networked controller. The integrated Industrial Ethernet interface makes such processes easier, allowing the Sinumerik 828D to be integrated into any Windows or Linux network. This enables faster data exchange throughout the entire network. The network drives are displayed in the program manager of the CNC and can be accessed as usual. Using the example of a CNC milling machine that is assigned the user name "romi," we will show you how this works in a step-by-step manner.   <

1. Configure TCP/IP on the Sinumerik 828D

The X130 Industrial Ethernet connection for the network is located on the back of the Sinumerik 828D. The controller is connected to the network via the X130 port using a non-crossover Industrial Ethernet cable. The remaining configuration is carried out through the controller.

> In the "Diagnostics" operating area, use the menu-advancing key to select the soft keys "Bus TCP/IP" > "TCP/IP Diagnostics" > "TCP/IP Config." to set the communication parameters via the X130 port.
> Click the "Change" soft key to change the settings for NCU company network X130. Select "Manual — Off" as the address type so that the IP address of the CNC machine is not assigned using DHCP, but can instead be manually entered as a fixed address.

> Enter the IP address and the subnet mask. A configuration example is shown below in this screenshot:

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> After you have carried out the configuration, restart the controller so that the changes take effect.

2. Integrate the network drive in the program manager

After the configuration is complete, integrate the new network drive in the program manager.

> In the "Commissioning" operating area, select the soft keys "HMI" > "Log. Drive." In the displayed window, the USB drive of the front interface is configured under 1. You will use drive 2.
> Change the following settings:
> • Type: network type "NW Windows"
> • Path: for the path, enter the IP address of the server and the name of the share folder. You will later define the same name in the configuration under Windows, for example: "//192.168.1.44/ROMI"
> • Access level: Key switch 0
> • Soft key text and soft key icon: displayed text and icon in the program manager: NET; sk_local_drive.png
> User name and password: user name, which also needs to be entered under Windows: romi

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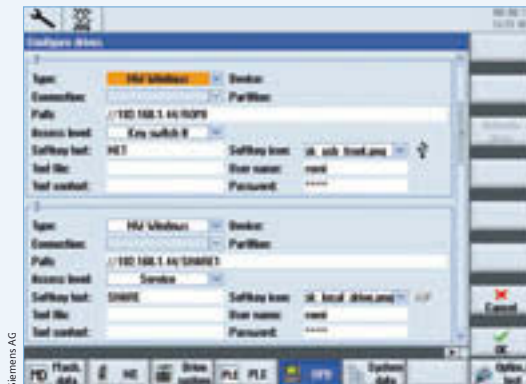
> Click the "Activate drive" soft key. This causes the drive to be displayed under the name "NET" in the program manager and allows it to be used.

3. Set up the network share under Windows

The simplest option for data exchange is network sharing of folders on the server. For example, a folder can be created on the Windows server in which all the necessary programs are stored and have access to the CNC machines. We can show you how simple this can be using the example of Windows XP:

> Use Windows Explorer to create a new folder on the local drive of the server, for example, "ROMI."
> Select "Properties" in the context menu and switch to the "Sharing" tab page in the displayed window. Click "Share this folder." The folder name is displayed under "Share name" (in the example: "ROMI").
> Click the "Permissions" button. All group and user names that are to receive access to the folder are displayed there. In our example, you set-up the user name "romi" for the CNC machine and allow only this user to have full control. You will define the user names during setup on the Sinumerik 828D.
> Click "Add," enter the name "romi," and confirm with "OK." The user name must exist in the network for it to be recognized.
> Select the newly created user "romi" and activate "Full control" and "Modify" so that data can also be written and modified from the CNC.
> Confirm with "OK." The user "romi," and thus the CNC milling machine, now has full control of this folder and can read, modify and write data.


Advantages of networked controllers at a glance

> Programs can be accessed from every CNC.
> Less time is wasted as there is no data to transport using physical media.
> The server always has the most current programs – programs from CAM systems, for example.

> The CNC is backed up on the server – archives, for example.
> Changed programs can be saved to the server and are accessible to all.
> Versioning and archiving of the programs takes place on the server.

Tactile measurement and laser tool measurement in one instrument

Optimal Combination for Turn-Milling Machines

The integration of turning and milling into one machine enables efficient and complete workpiece machining, but it also makes new demands on the CNC and the machine-integrated tool measurement systems. Crucial for reliability and precision is the use of the optimal process for the respective tool type.

Laser with integrated tactile tool tester
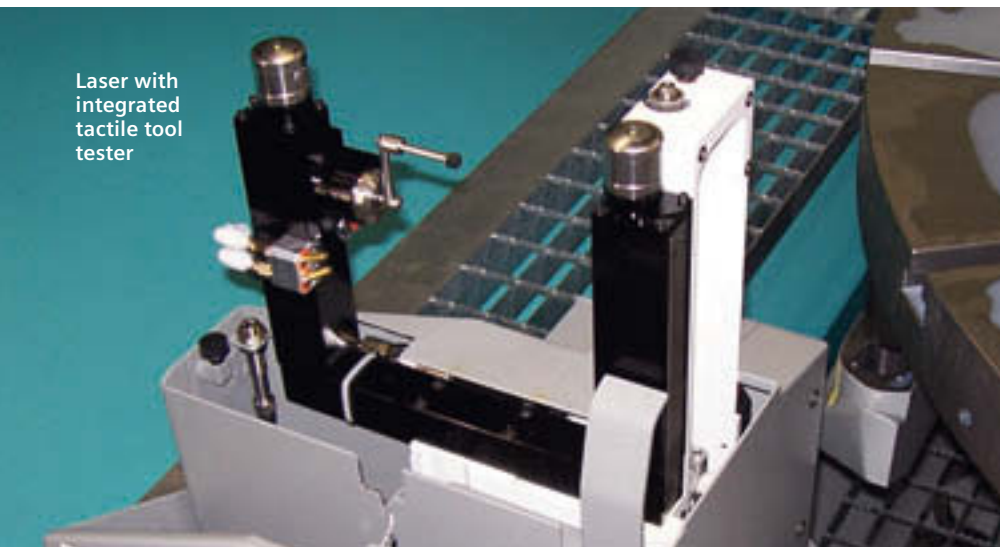
One-stop systems

With systems for machine accuracy inspection, workpiece and tool measurement and interactive programming from Renishaw, the user can increase process stability and reliability of complex workpieces without having to accept long positioning times. As a Sinumerik Solution Partner, the company offers tool measurement cycles for the controller as a certified additional function, thus ensuring optimal functionality and integration into the Sinumerik user interfaces.

> For the production of a workpiece, crucial specifications must be taken into account: deviations due to dynamic and thermal behavior, tool change precision, and for turning tools, the actual diameter of the rotary circle of the blades. Accurate specifications can be met through measurement of tool parameters in the machine. On milling machines, Renishaw's non-contact laser sensors have proven themselves for this purpose. For turning tools, tactile measuring probes are usually used because they offer higher process reliability with cooling lubricant and chip adhesion. For both milling and turning machines, the lasers and tool measuring probes must be adjusted to the operating conditions in the machine. Renishaw developed a laser with an integrated tactile tool measuring probe that combines both systems in the smallest possible space and simplifies installation through a common cable duct.

High measuring accuracy guaranteed

Through its small laser openings of 0.1 to 0.2 mm, the parallel beam of the Renishaw laser NC4 enables high sealing-air pressure with low consumption. With the patented geometry of the openings, the sealing air escapes obliquely from the round laser beam at high-speed so that the accuracy is not reduced through air turbulence in the beam; therefore, chip deposits on the openings are prevented from the very beginning. The system is also protected from coolant spray, because the pressure drop over the very small openings of the Renishaw laser is sufficient to directly activate the automatic lock. If the supply of sealing air fails, all openings are immediately hermetically sealed.

Another important condition for precise measurements is the cleaning of the tool. Non-contact measurement systems also detect a cooling lubricant film on the blades. This can cause errors in the range of a hundredth of a millimeter. With an optimized blow-off as with the Renishaw laser, even workpieces with internal coolant supply and dripping coolant can be reliably measured. <

Using the potential of mill-turn machines

The Synergy Between Machine and Tool

Manufacturing complex components in one clamping is the key to success in the booming industries of energy and aerospace. The combination of mill-turning and drilling processes without the need for reclamping eliminates unproductive downtime and excludes the possibility of tolerance errors resulting from workpiece clamping.

> To optimally use the advantages of a mill-turn machine, selecting the right metal-cutting strategy is crucial. Iscar Germany GmbH, a leading manufacturer of metal- cutting tools, has a solution for every application.

The new HELIDO milling cutter range lends itself to face or face-corner milling. "HELI" stands for a positively coiled cutting geometry, which Iscar presented for the first time in 1989; and "DO" stands for a two-sided design of reversible cutting plates, resulting in a stable, soft-cutting tool system at a favorable price per cut. During face milling, an optional 8 or 16 cuts per reversible cutting plate can be optimally used and adjusted to the machine's characteristics in regard to the metal removal rate and price per cut.

High-performance for difficult-to-cut workpieces

Through the use of high-pressure tools with a direct supply of coolant, milling/turning components for aerospace made from difficult-to-cut workpiece materials, such as Inconel for turbine components, can be produced in a much more efficient manner. The reduced temperature in the cutting zone makes increased cutting parameters possible. For piercing machining, the five-bladed Pentacut system is a good solution for production cost-savings. Through the unique plate seating, all five blades can be used with one cutting edge.

With the new modular drill line SUMOCHAM, workpiece material in the ISO ranges P, M, K and N can be machined, thanks to the symbiosis of a base body made from high-strength tool steel and a drill head made from carbide metal. The wide range of diameters between 7 mm and 33 mm is covered in 0.1 mm increments. The extremely stable construction enables high cutting parameters, which greatly increases productivity; and even with difficult-to-cut workpiece materials, this drill system ensures an unhindered flow of swarf.

The tool to select the right tool

The free Iscar Tool Advisor (ITA) found online at www.iscar.com helps with the selection of the right tools and machining parameters. The user is guided through the individual menu items and receives complete machining suggestions about tools, reversible cutting plates and cutting parameters, based on the task definition entered. This ensures that the Iscar high-performance tools deliver optimal performance with the correct cutting data. <

Iscar

High-performance tools from Iscar show what they can do, particularly in complex applications such as aerospace part manufacturing

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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
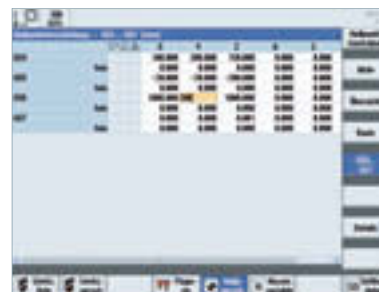
Tips and tricks:

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

[i]
HELP

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

INSERT

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

SHIFT + INSERT

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