Schütte

335*linear*: the next evolutionary step of the tried-and-tested series

THE LATEST ONE IS EVEN MORE PRECISE AND ECONOMIC

The 335*linear* allows you to ideally cover the diversity of the processes and clamping technology for your workpieces:

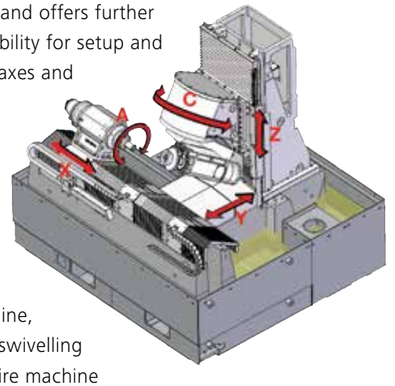
- Production and resharpening of material removal tools
- Grinding, mill cutting, polishing and finishing of implants
- Process-reliable grinding from hob cutters to microtools

Compact, versatile basic machine

The 335*linear* grinding machines impress with their small footprint and large machining area.

The high-precision 5-axis CNC grinding machine 335*linear* is extremely flexible and universal. This flexibility allows you to meet all requirements for the production and resharpening of tools of all kinds. An equipment variant for medical technology also makes the pre-machining and finish-machining of medical parts such as knee implants possible.

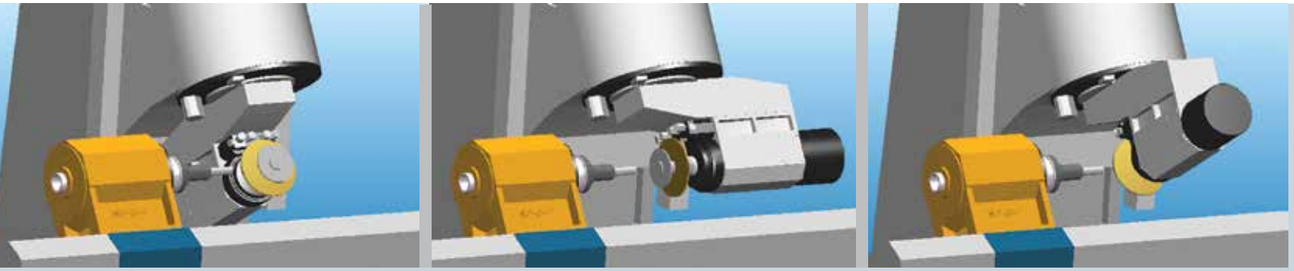
An important feature of the 335*linear* series is an immensely stable and, at the same time, compact design. The 30°-inclined grinding spindle allows the use of an extremely rigid axis structure and offers further advantages: a large machining area with a small installation space, excellent accessibility for setup and a very clear view of the grinding area. The 335*linear* series is equipped with 5 CNC axes and state-of-the-art digital control engineering. Schütte guarantees simple operation and programming of the machines thanks to the in-house developed software SIGS*pro*.



For high-precision grinding operations, the thermal stability of the machine is of vital importance. The stable basic structure of the machine contributes to this. The machine base forms a unit with the cooling lubricant tank, which holds more than 400 litres of temperature-controlled cooling lubricant. The heat sources in the machine, such as the powerful drive motors for the grinding spindle, workpiece rotation and swivelling axis, are also cooled to provide a constant and uniform temperature level in the entire machine structure.

- Compact design – small footprint and large machining area
- Open machining area – clear view of the material removal process
- Optimised hood – excellent accessibility and simple setup
- Rigid axis structure and optimised power input – inclined swivelling axis
- Minimal compensating motion – optimised spindle swivel point
- Thermal stability – cooled drives and temperature-controlled machine base
- Simple handling – user-friendly Schütte software SIGS*pro*

USER-FRIENDLY, STABLE AND SPACE-OPTIMISED THE SCHÜTTE 335*LINEAR* WITH THE SPECIAL AXIS ARRANGEMENT



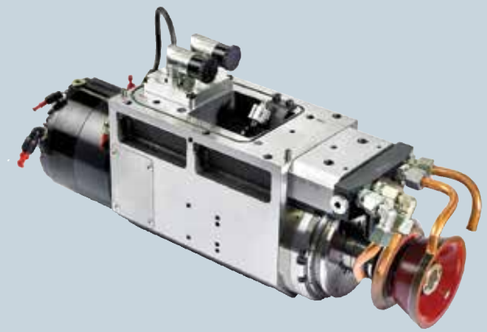
The generously dimensioned swivel area of the grinding head allows all necessary positioning of the grinding wheel in relation to the workpiece. Rotational speed 15,000 rpm, or 24,000 rpm as an option.

Powerful grinding spindle

With continuously increasing complexity and accuracy requirements in the area of grinding technology, the 335*linear* from Schütte perfectly meets the demands of a future-oriented market. Core components include the powerful, high-precision drives, which are exactly tuned to one another thanks to the software and control engineering.

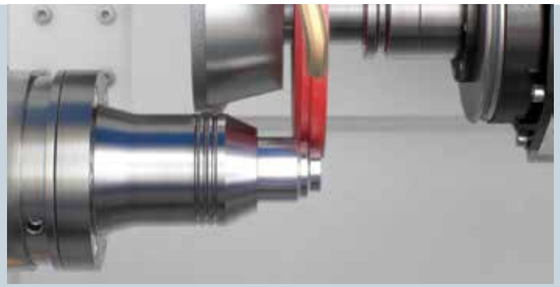
All rotation drives are designed as digital direct drives and have high-resolution direct measuring systems. The compact powerful grinding spindle with a maximum torque of 15 Nm and a speed of 15,000 rpm enables material removal volumes and is even suitable for machining operations such as high-performance creep feed grinding. With an optionally available grinding spindle, speeds of up to 24,000 rpm are also possible, which allow the effective use of grinding points.

The HSK holder for the grinding wheels guarantees high accuracy of repeatability and offers fast manual or automatic changing of the grinding wheel sets. Special features at Schütte: the cooling lubricant nozzles are changed together with the grinding wheel set. This ensures that the optimum cooling lubricant supply is available for every grinding process even during an automatic change.



- Process-flexibility through automatic grinding wheel change
- Optimised cooling and lubrication through joint change of grinding wheel set and cooling lubricant nozzles
- High change accuracy thanks to HSK holder
- Speed up to 24,000 rpm

COMPACT AND POWERFUL

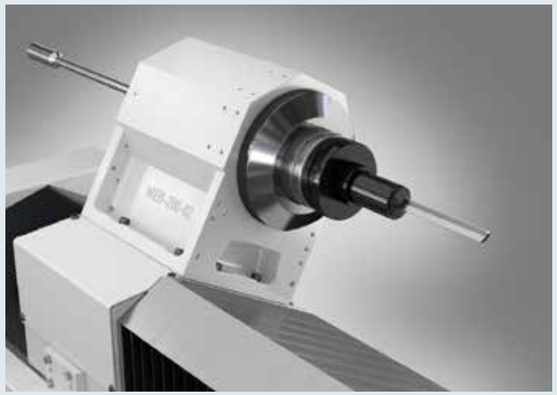


External cylindrical grinding

Internal cylindrical grinding

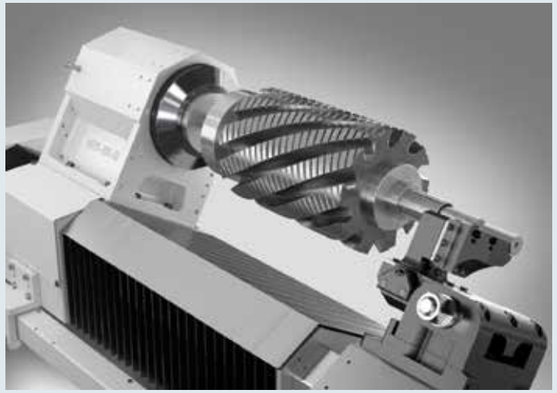
Universal workpiece axis

Microtools



Extremely long tools, clamped in a hollow spindle

Tools with a large diameter

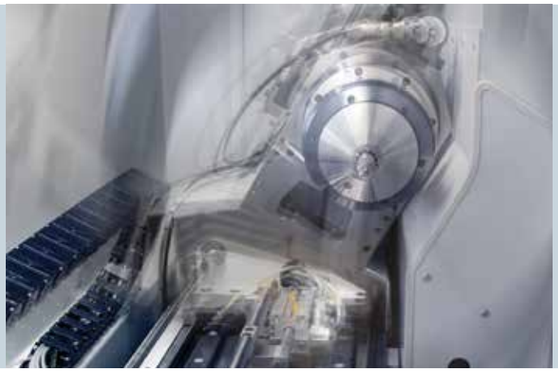


Tools with a high mass

The main area of application for the 335*linear* is the manufacturing and preparation of cutting tools for the metal and wood processing industries. With regard to the length and diameter of the workpieces, it covers a wide range of applications: everything is possible from the smallest of tools up to hobs.

A wide range of options are available for the different applications for automatic or manual clamping, guidance, support or the workpieces. Work is possible with collet clamping, automatic multi-range chucks or high-precision hydraulic expansion chucks depending on the required concentricity accuracy and the given tolerances of the workpiece shank. Intermediate sleeves can also be changed automatically. For workpieces with a large length-diameter ratio, a tailstock and/or different support variations can be used that are either fixed under the grinding point or that move parallel with the workpiece.

With its high torque and its excellent concentricity and indexing precision, the universal rotation axis for the workpieces permits efficient and very accurate process management, even in complex operations such as the grinding of tool contours and angles. At the same time, it can run at extremely high speeds up to a maximum of 2,500 rpm. Cylindrical grinding operations such as cylindrical contour surface grinding or axial contour grinding can thus be carried out. The rigidity and dynamics are ideally tuned to one another, which allows a workpiece diameter range from 0.01 mm up to 200 mm (up to 280 mm as an option) to be covered.

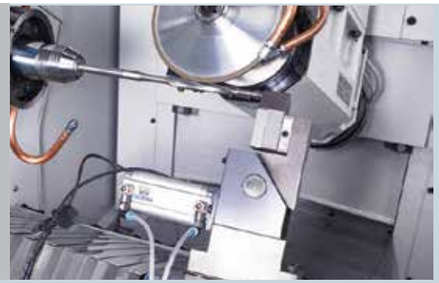


- High torques, high indexing precision
- Suitable for cylindrical grinding and contour grinding
- Speed up to 2,500 rpm

VERSATILE AND WILLING TO WORK

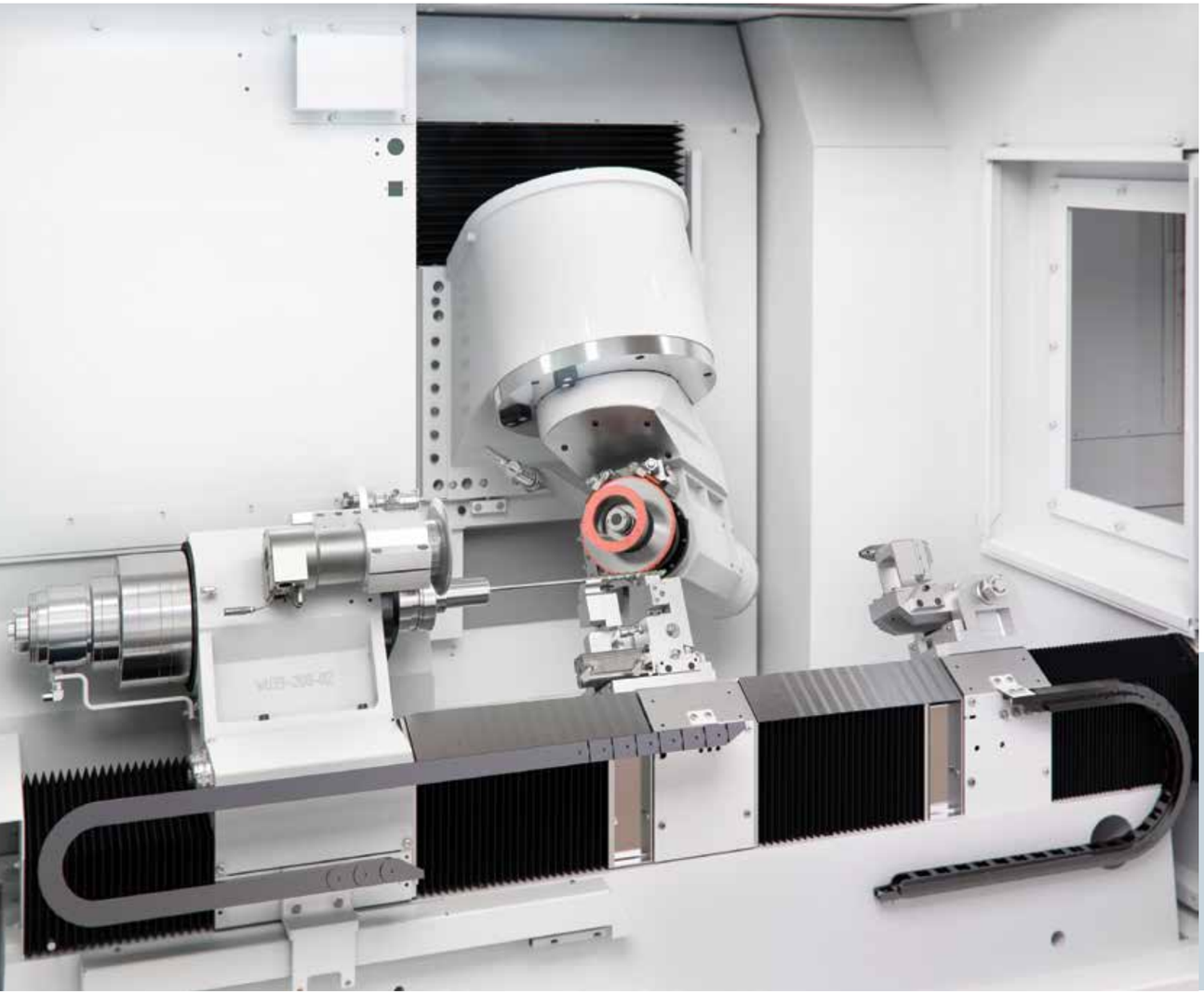
Foldable support

Fixed tailstock



Foldable tailstock

Two slides for pure flexibility



The solutions for clamping, supporting and precise guiding of the 335*linear* are as versatile and sophisticated as your workpieces.

For perfect clamping of all workpiece versions, the 335*linear* can be equipped as an option with one or two auxiliary slides. The auxiliary slide X1 can be used equally as a support slide or a tailstock slide. The support function is made possible by coupling the slide at any position you desire on the workpiece slide or on the machine base. The support can thus be used in a fixed position in relation to the workpiece (e.g. for end-face machining) or in relation to the grinding wheel (e.g. for grinding flutes). The tailstock function is implemented by a pneumatic auxiliary stroke.

The following clamping aids can thus be used on auxiliary slide X1:
Foldable or fixed support, foldable or fixed tailstock, workpiece guidance system, any combination of two of the above-mentioned variants, two foldable or fixed supports.

The auxiliary slide X2 can be configured as a tailstock slide or a pallet slide. In the tailstock slide version, a pneumatic stroke implements the clamping function; in the pallet slide version, the mounted workpiece pallet is moved from an NC axis during the loading cycle.

The attachments mounted on the auxiliary slides X1 and X2 can be combined with one another as desired. For each machining operation, operators can define which attachments are to be used in which positions.

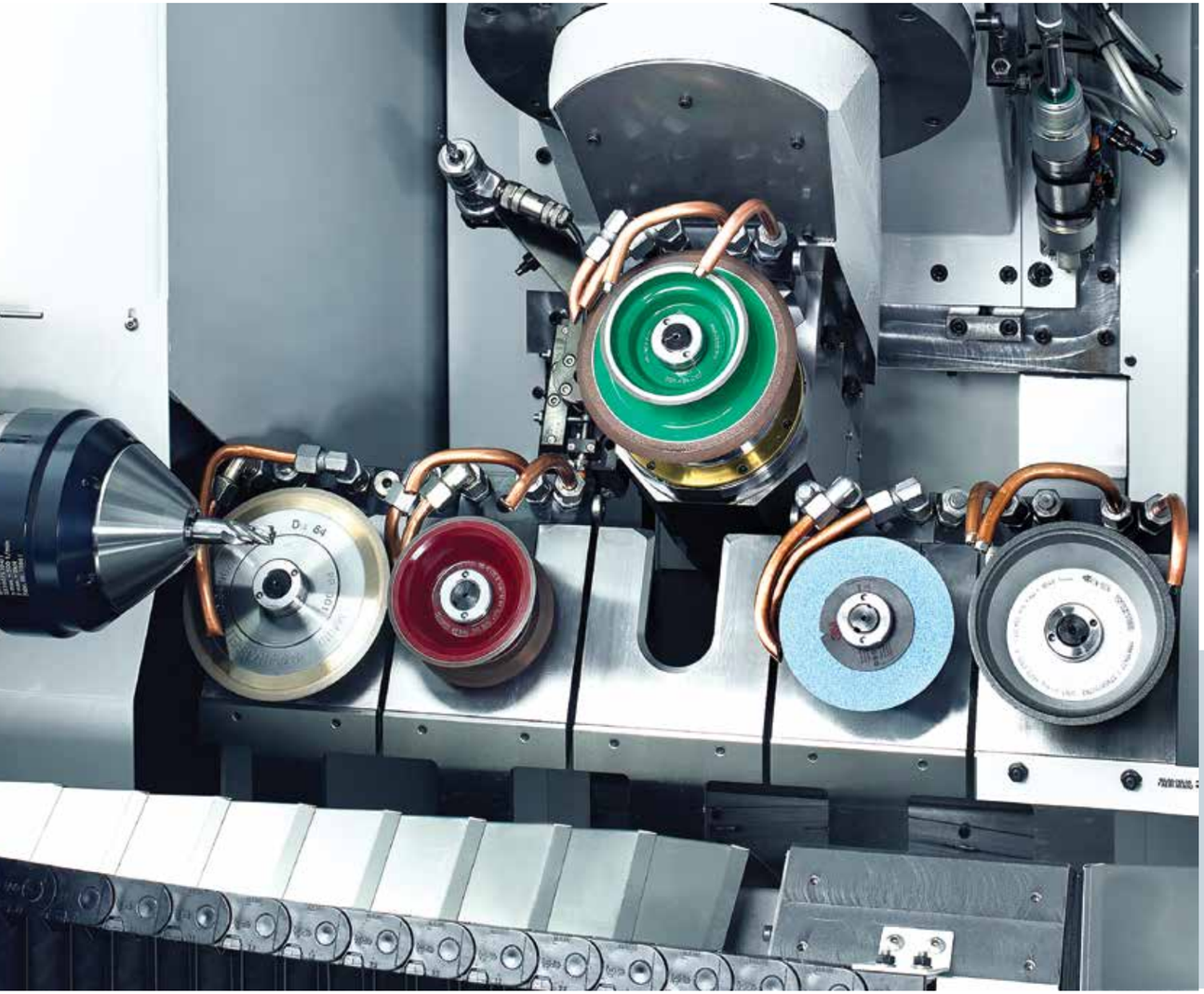
- Two auxiliary slides in the X-workpiece axis
- Support function fixed in relation to wheel or workpiece
- Pneumatic auxiliary stroke for tailstock function
- Modular structure for flexible setup of the clamping aids
- Workpiece guidance system, supports, tailstocks and pallet
- Support and tailstock can be combined on a single slide

Application example of flute grinding:
Support fixed in relation to grinding wheel

BUILDING ON TWO AUXILIARY SLIDES

Expansion stages of the grinding wheel magazine:
left: 12 positions (option)
right: 24 positions (option)
bottom: 5 positions (standard)

Scalable grinding wheel changers



Productivity benefits are not only achieved through efficient grinding processes but also through a high degree of automation. This makes flexible concepts necessary, e.g. an automatic grinding wheel change for unmanned production. Schütte provides innovative and made-to-measure solutions for this purpose.

The automatic grinding wheel change is carried out with machine axes that are used to exactly approach the transfer position. A HSK interface in the spindle guarantees positioning of the grinding wheel to µ-accuracy.

The coolant distributors are changed together with the grinding wheels. Every process thus has the optimum coolant supply even after the automatic change. An extensive range of grinding wheels is provided from the magazines. Abrasive wheel holders are available for a very large range of bores. Different expansion stages provide almost unlimited flexibility: selection of between 5, 12 or 24 grinding wheel positions is possible.

The basic configuration of the 335*linear* already contains a 5-fold grinding wheel magazine integrated in the installation space. As an option, a magazine with 12 or 24 positions can be used, with which the next wheel set is provided parallel to the process in the fast-acting 2-fold changer.

- 5-fold grinding wheel magazine included in basic equipment
- Optional 12 or 24-fold grinding wheel magazine
- Grinding wheel change with associated cooling lubricant distributors

WHEEL SETS AVAILABLE ON CALL

Pallet magazine

Chain magazine

Loading with a robot cell

Made-to-measure automation

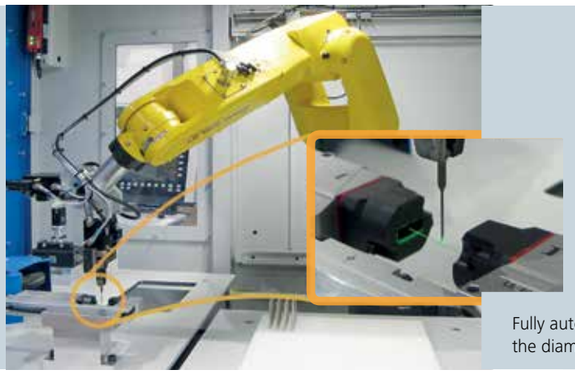
Loading with robot in conjunction with external pallet magazine

The automation solutions of the 335*linear* allow you to produce workpiece geometries efficiently and flexibly from a batch size of one up to highly optimised bulk production. For this purpose, the 335*linear* is automated as an individual cell and can thus operate profitably in unmanned shifts or can be interlinked in production systems.

Depending on the workpiece and batch size, different handling systems are available with the 335linear. This means that everything is possible from manual loading via a pick-up system with pallet or chain magazine to the completely flexible robot cell.

With the pallet loader, workpiece loading and unloading is by means of a pneumatically actuated swivel arm. If this is equipped with a double gripper, both procedures can be carried out directly one after the other. The swivel arm is a pick-up solution integrated in the installation space that can be combined with pallets of different capacities (max. 400 pallet positions). The chain magazine (max. 100 workpieces) is operated via a gripper/swivelling device that is mounted on one of the X-slides.

As an alternative to the pick-up system, the chuck of the workpiece rotation axis can also be filled directly by a robot. The robot cell offers considerably higher capacities (max. 3000) and possibilities for additional activities such as reversing, measuring, ejecting and others. Depending on the flexibility requirements, the software supports a diameter-dependent bundling of the workpiece supply and purely order-based processing. Mixed-mode operation is also possible. Our gripper solutions change every workpiece shape safely and precisely.



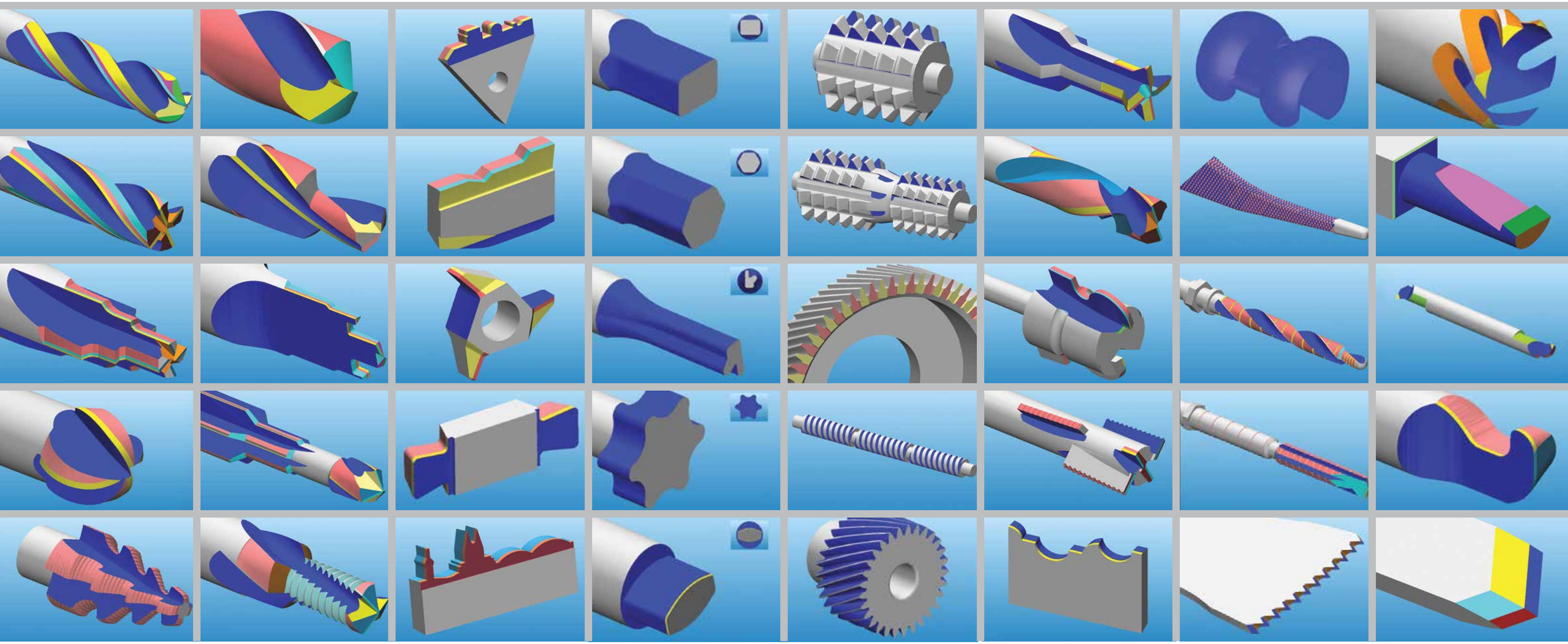
Fully automatic measurement and correction of the diameter during tool production

- Scalable automation: Pick-up with pallet or chain magazine, robot
- Precise, safe gripping technology
- Fast change cycles
- Capacity of diameter flexibility optimised to one shank

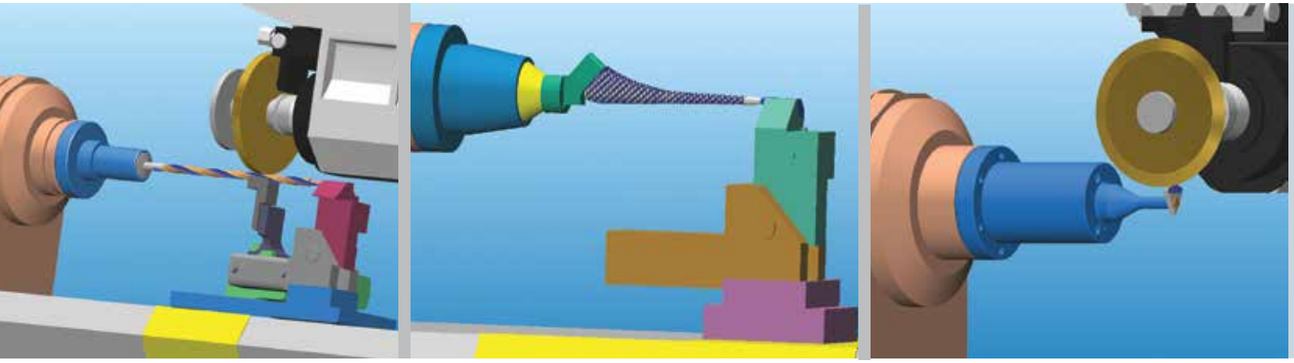
MAKE MONEY WHILE YOU SLEEP

Unlimited possibilities

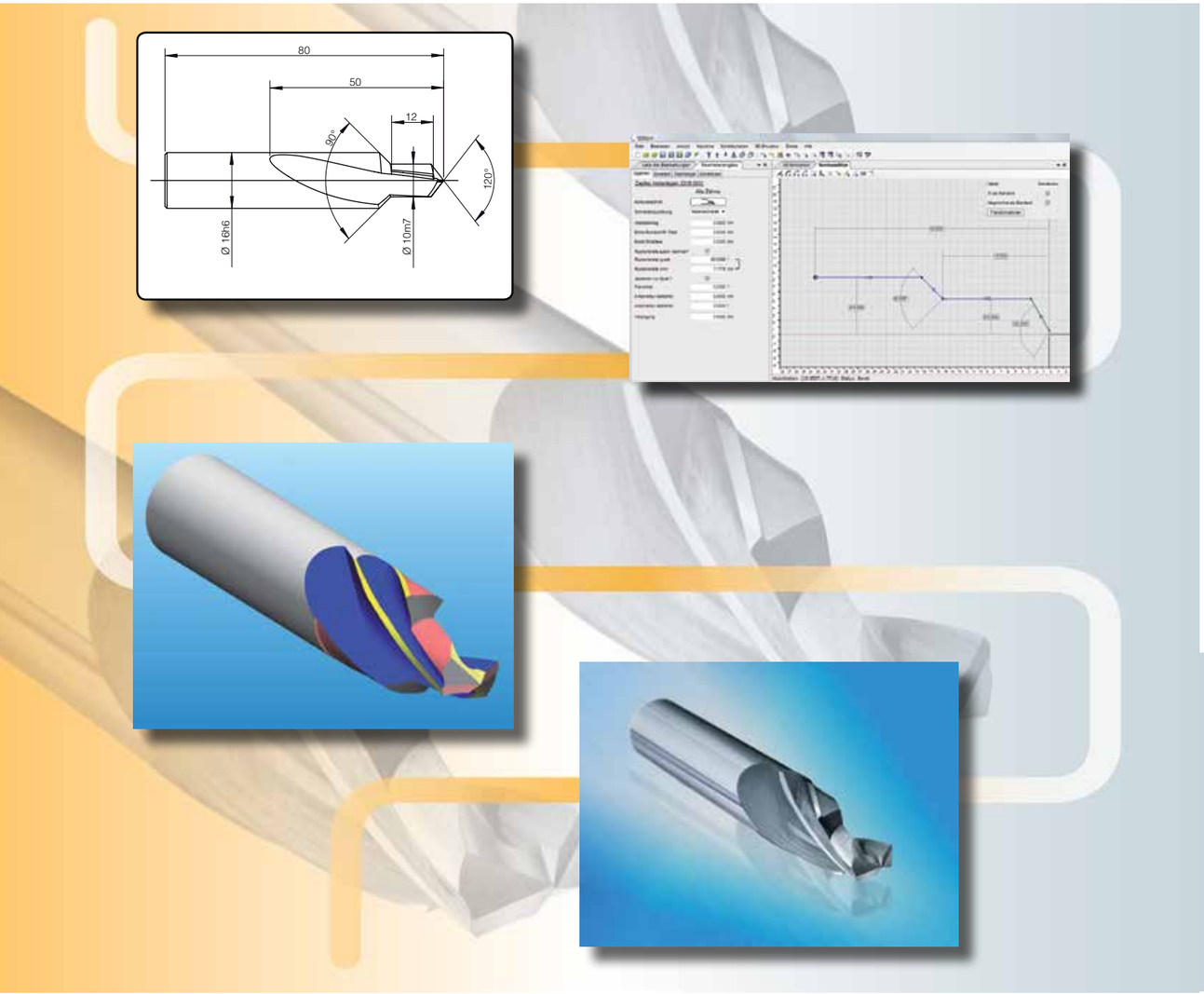
Milling cutters | Drilling tools | Profile plates | Profile punches | Toothed tools | Woodworking tools | Medicinal requirements | Special applications



THE 335*LINEAR* AND SIGS*PRO* – A STRONG TEAM



SIGS*pro* – impressively simple



Simple operation and programming are possible even for complex kinematic sequences. Schütte demonstrates this with its convenient, in-house-developed operation and processing interface SIGS*pro* **(S**chütte **I**ntegrated **G**rinding **S**oftware**).**

When the software handles as many work steps as possible and makes input automatically, users quickly achieve their objective. Wizards are integrated in the software for this purpose. On the basis of a few queries, they create the required grinding operation, assign suitable grinding wheels and preassign all geometry and technology parameters in a practical manner.

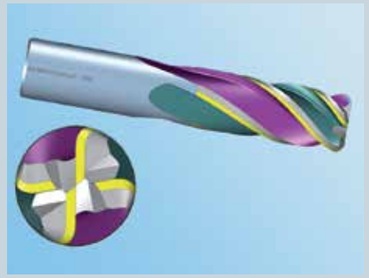
To guarantee the highest level of flexibility, SIGS*pro* allows you to freely combine the grinding operations and to use them as often as you wish in a production sequence. There are no limitations due to preset tool types. Furthermore, during the entire process SIGS*pro* is able to generate separate NC subprograms for the individual teeth of the workpiece. This allows grinding operations to be activated or deactivated without any problems on a tooth-to-tooth basis or to be assigned tooth-specific parameters. Furthermore, many parameters along the cutting edge can be varied.

A closed surface model of the workpiece is generated in the 3D simulation. The viewing angle can be changed and you can zoom into the smallest details without any problems and with no loss of quality. A series of innovative functions are introduced for further convenience: For example, the rotational solid of a step drill can be calculated, drawn and compared with the target contour.

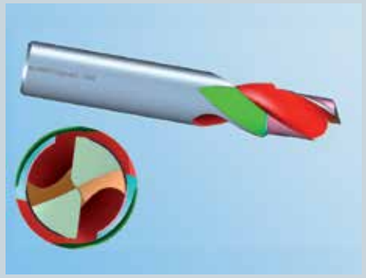
Before production at the machine starts, the entire sequence can be checked for the possibility of collisions. In particular, moving machine parts, such as the support or tool guidance system, can be included in the analysis.

- Comprehensive, convenient and user-friendly control system interface
- Simple to learn with intuitive, Windows-oriented menu navigation
- Integrated 3D simulation
- Efficient measuring and analysis functions
- Machining area simulation based on realistic 3D models
- Automatic collision monitoring

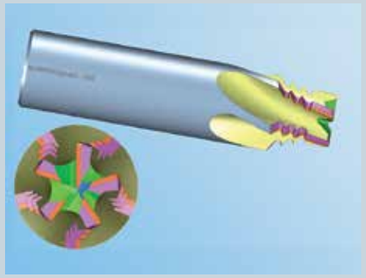
GRINDING HAS NEVER BEEN EASIER



Application example: End mill with multispiral

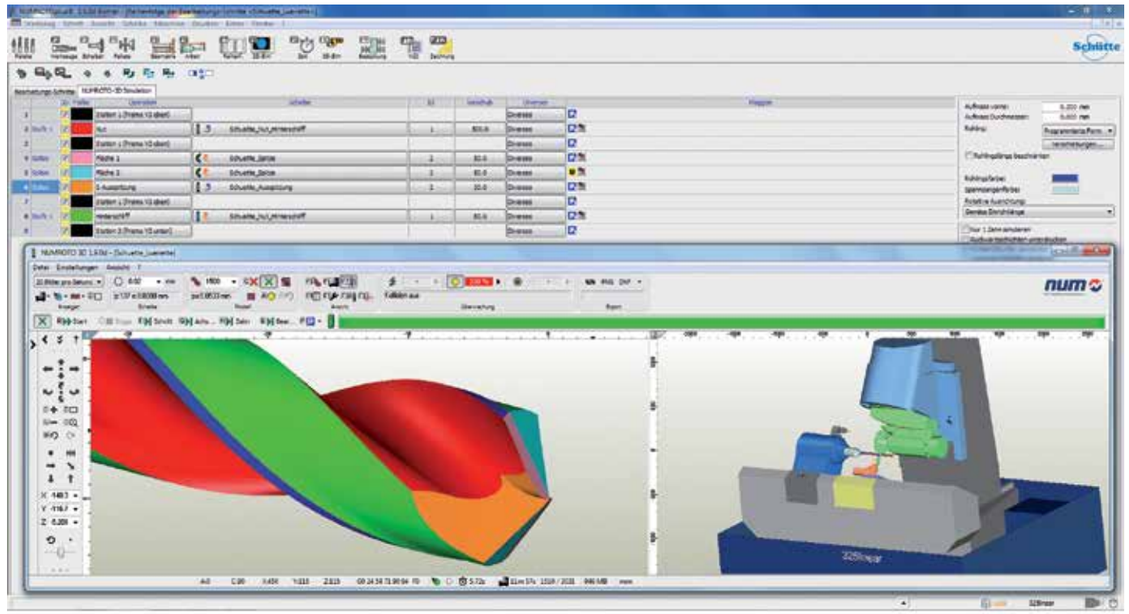


Application example: Step drills



Application example: Form cutter

NUMROTO – proven standard



In the 3D simulation, the 335*linear* including all collision-relevant additional options can be displayed.

NUMROTO is a complete solution for tool grinding that has been used on machines from different manufacturers for more than 25 years. By popular demand of the users, the 335*linear* is available with SIGS*pro* (Schütte Integrated Grinding Software) or NUMROTO.

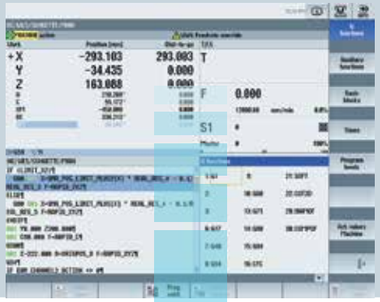
The core of NUMROTO is the programming system NUMROTOplus. With NUMROTOplus, a huge variety of workpieces can be produced and sharpened. Each detail of the individual workpieces can be changed and thus adapted to individual needs. NUMROTOplus is constantly expanding with new workpiece geometries and features, making it a future-oriented investment.

In addition to the NUMROTOplus software, the NUMROTO complete solution also includes all the elements required to implement this intelligence on the tool. The 2D workpiece simulation enables a quick assessment of the programmed workpiece. In addition, the sequence of the grinding process can be observed in the 3D simulation. All relevant machine components can be displayed; Optionally, a collision check is possible. Extensive and precise probing cycles for workpiece and grinding wheel are offered. The Job Control option controls fully automatic operation with all available automation systems. The programmed workpieces can be documented using the additional NUMROTO Draw function in the form of a workshop-specific drawing.

- Extensive, constantly expanding NUMROTOplus programming system
- Integrated 2D workpiece simulation
- Integrated 3D simulation for workpiece and machine room incl. collision control
- Probing and measuring functions for workpieces and grinding wheels
- Fully automatic operation via Job Control
- Documentation via drawing (NUMROTO Draw) suitable for the workshop

NUMROTO OR SIGS*PRO* – YOU ARE SPOILED FOR CHOICE

SIEMENS SINUMERIK Operate HMI



NUM HMI

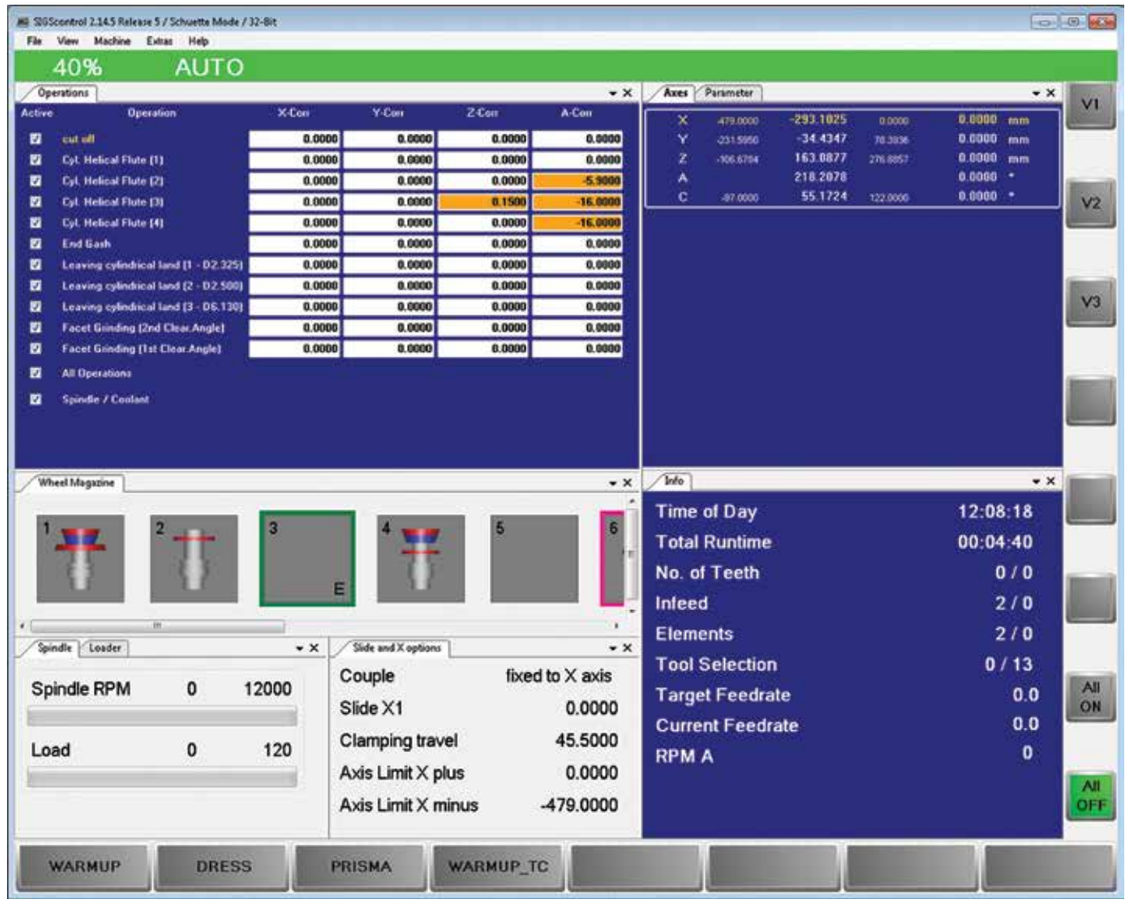
Powerful CNC control

The HMI of the individual CNC systems offers extensive functions for the operation and diagnosis of the 335*linear*.

SIEMENS Ingenuity for life

num CNC HighEnd Applications

Schütte SIGS Control



By choosing one of the two programming systems, CNC control is also defined. SIGS*pro* was designed for the SIEMENS SINUMERIK 840D control family; NUMROTO requires the use of a NUM Flexium + controller from NUM.

The scalable modern controllers SIEMENS SINUMERIK 840D sl and NUM Flexium + control all CNC axes and the grinding spindles of the Schütte machine 335*linear*. With the installed drives and motors as well as the comprehensive safety concepts SIEMENS Safety Integrated and NUMSafe for hardware and software, the Schütte 335*linear* meets all the important standards for safety-related motion functions. The entire system elements from control to grinding software, drives, motors and safety are perfectly coordinated with one another and thus promise maximum success in the practical implementation of the applications programmed with SIGS*pro* or NUMROTO.

The modern standard Schütte HMI SIGSControl combines both CNC systems. It offers extensive functions for the operation of the 335*linear* independently of the control system. For efficient work on the machine, simple operation is of central importance. SIGSControl can therefore be adapted to the different operating requirements. Touch and gesture operation are moving into production.

- Complete, digital system (CNC, drives, motors)
- Open system adaptable to machine equipment and customer needs
- Control-internal position calculation in the subnano range for high accuracy and outstanding surfaces
- Integrated, comprehensive safety management (according to EN ISO 13849-1 and EN 61800-5-2)
- Highly productive automation solution for CNC production
- Perfect integration into the IT landscape of modern factories
- Enormous time and cost savings with online support through remote maintenance
- Worldwide service and customer support

READY FOR INDUSTRY 4.0

Dressing attachment that saddles the workpiece axis (A-axis)

Swivelling probe for position determination and measurement of the workpieces

Additional probe for measuring the grinding wheels in the machine

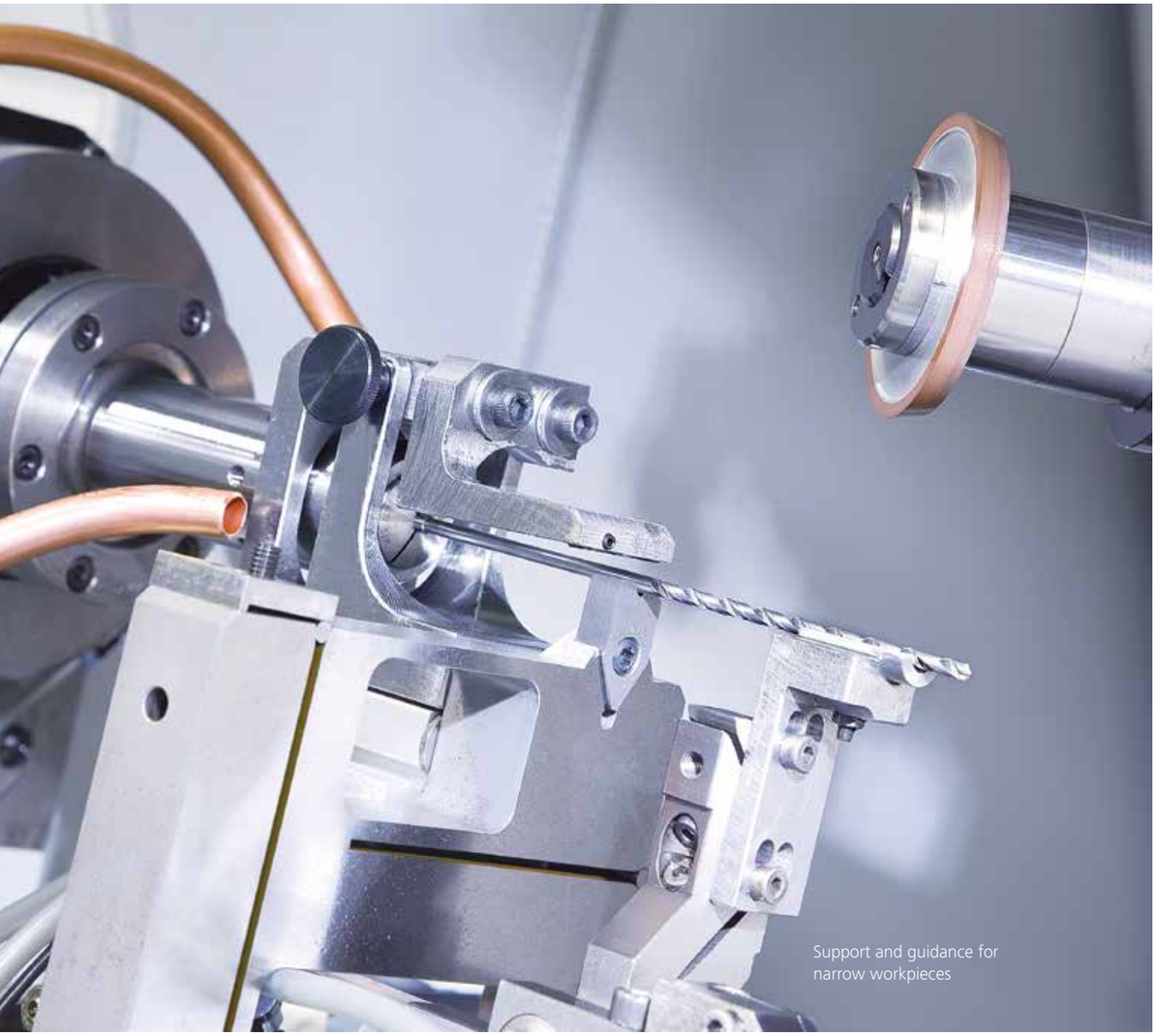
Option for increasing precision

When high precision is demanded, the 335*linear* can be equipped with additional options which can also be used in fully automatic mode to achieve top accuracy.

After the workpiece has been clamped, the permanently present workpiece probe determines the exact position and orientation of the workpiece. Thanks to a special probe tip, the position of cooling ducts can also be determined. As an option, a second measuring probe can be fitted on the workpiece axis with which, e.g. the diameter and the unclamped length of the grinding wheels in the machine can be measured fully automatically. This probe can also be used for thermal compensation. For this purpose, a reference ball installed at the spindle housing is probed at adjustable intervals. The determined probing results are forwarded to the control system as axis corrections.

The grinding wheels can be dressed in the machine at intervals of your choice. Stationary and rotating dressing tools can be used for this purpose. The rotating tools used may be diamond forming rollers and dressing rolls with conventional abrasives. The dressing roll can be installed either on the rotation axis or with its own spindle drive on the housing of the rotation axis. In addition, a first-cut and balancing sensor system can be implemented.

The machine measurement can be carried out fully automatically as an option. This guarantees high accuracy of repeatability of the results.



Support and guidance for narrow workpieces

- Automatic recording of the workpiece position with the 3D measuring probe
- Special probing tip for cooling ducts
- Dressing the grinding wheels in the machine
- Measuring the grinding wheels in the machine
- Automatic machine measurement

High accuracy of repeatability of the machine measurement through fully automatic cycle

PRECISION MEANS LEAVING NOTHING TO CHANCE

Innovative medicinal applications

The medicinal products constitute an important element of medical technology. Due to a constantly increasing life expectancy and the demand for a high quality of life in old age, medical technology is enjoying an increasing economic interest. Because of strict contour accuracy and surface quality requirements, grinding operations on many technical medical products are necessary.

Schütte provides ready-made solutions for the production of a large number of medicinal products:

- Surgical instruments (e.g. knives, saws, bone drills, reamers and rasps)
- Cannulae
- Implants (e.g. hip, knee or shoulder implants)

The production process for these products, some of which are extremely complex, often involves several machining operations. The 335*linear* makes it possible to implement cost-effective complete production on a single machine tool. Integration and shortening of the complete process chain in production results in considerable potential for savings and optimisation. The omission of reclamping operations also improves accuracy. An example of this is the complete machining of the femur components of
a knee joint implant on the tool grinding machine 335*linear* in a single clamping system. This involves pre- and finish-grinding, which can be followed by cutting with end mills and spherical cutters and multi-stage abrasive belt grinding and polishing.

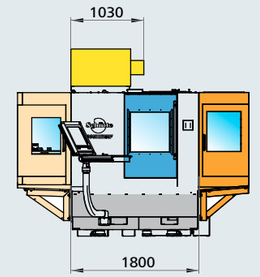
The use of grinding wheels that can be dressed and balanced means that high surface quality is already reached after grinding. Subsequent fine machining achieves high-gloss surfaces with Ra values of below 0.05 µm – starting with a cast blank.

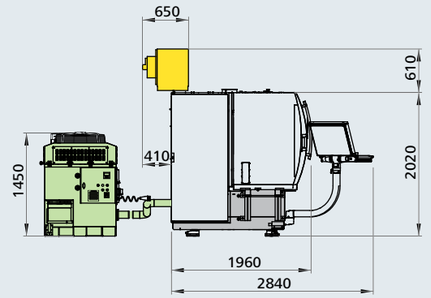
- Solutions for a large number of instruments and implants
- Productivity benefits through complete production
- Precision thanks to omission of reclamping operations
- Grinding wheels that can be dressed and balanced for high surface quality
- Fully automatic order handling with 49- or 100-fold chain loader and 12- or 24-fold grinding wheel magazine

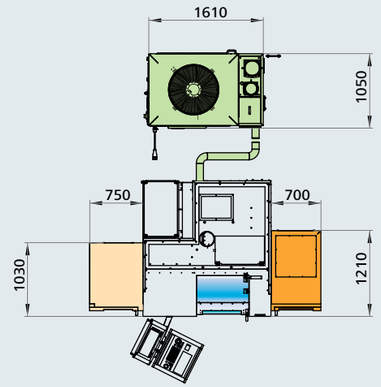
OPEN DOORS TO NEW MARKETS

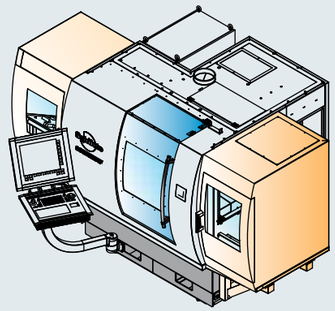
Technical data

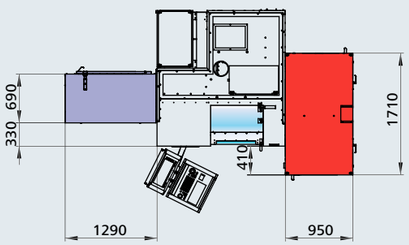
Machine		335*linear*
Linear axes		
Stroke (MKS):		
X-axis (longitudinal movements)	mm	480
Y-axis (transverse movement)	mm	300
Z-axis (vertical movement)	mm	330
Resolution:		
X-, Y- and Z-axis	µm	< 0.1
max. feed speed		
Y- and Z-axis	m/mm	24
X-axis	m/min	48
Rotation axis for workpiece (A-axis)		
Resolution	degrees	< 0.0001
max. speed range as rotation axis	rpm	200
max. speed range as universal rotation axis (optional)	rpm	2500
Support taper		SK 50
max. torque	Nm	88
Swivelling axis for grinding head (C-axis)		
Swivelling range	degrees	225
Resolution	degrees	< 0.0001
max. swivelling speed	degrees/s	360
Grinding spindle (motor spindle)		
max. speed	rpm	15,000
max. torque	Nm	15
Support taper		HSK-E 50
Grinding spindle option (among others, grinding points)		
max. speed	rpm	24,000
max. drive output	kW	8
Support taper		HSK-E 50
Control system		
CNC	SIEMENS	SINUMERIK 840D sl
Drive technology	SIMODRIVE	SINAMICS S 120
alternatively:		
CNC	NUM	FlexiumPlus68
Drive technology	NUM	DriveX











Installation variant with 100-fold chain magazine, 12-fold grinding wheel changer and oil cooler with filter

- Basic grinding machine 335*linear*
- 100-fold chain magazine
- 12-fold grinding wheel changer
- Extraction system
- Oil cooler with filter

Installation variant with robot cell and 24-fold grinding wheel changer

- Robot cell
- 24-fold grinding wheel changer

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