num*grind*

TOTAL SOLUTION
FOR GRINDING

num

CNC HighEnd Applications

NUM Solutions and Systems
Established Worldwide

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Outstanding solutions in machine automation have one thing in common: They are always the product of outstanding performance, exceptional technologies and a high degree of creativity!

num
CNC HighEnd Applications

NUM has earned its exceptional reputation in the machinery and tools industry exactly with that. We develop **customized automation solutions** that ensure a high degree of added value both to the machine manufacturer and the user. With our expertise that we have developed over decades, we put our motto "NUM automation solutions provide machine builders with a competitive advantage" into practice. NUM had already developed the first CNC controller in 1961, i.e. 10 years before CNC- or NC control systems found a wide acceptance among users. With the launch in 1964, **NUM was one of the first CNC providers in the world.** Since then, we have maintained our position as a technology leader in this segment and are eager to expand it further. Today's systems, with their flexibility and our expertise, enable us to automate a large variety of machinery. Our long, successful track record supports this finding in an impressive manner. We will continue to develop the **performance, functionalities and flexibility** of our systems in this direction and make the necessary investments in our products, our research & development, as well as in our staff

As an **international company** headquartered in Switzerland; we have sales, application development and service locations all over the world (see back cover) from which we operate worldwide. Our research and development departments are located in Switzerland, Italy and France. Our main production facility is located in Italy.

It is our clearly defined **vision** that we keep the **development and manufacture** of the core products in the CNC system, including the drives and motors, **under our control**. This enables us to adjust the performance, functionalities and flexibility of our systems to new market requirements very quickly and without delays.

The ready and flexible NUM automation systems combined with our locally available engineering expertise and the machine manufacturer, results in a uniquely flexible and powerful team.

Customized Projects

NUM tailors its support to your projects, ensuring it aligns perfectly with your business and infrastructure needs. Regardless of the specifics, our ultimate goal remains unchanged: collaboratively finding the most efficient solution for your project.

Project facilitation PRODESIGN

Efficient consulting for optimal application solutions
This model is ideal for companies with their own development teams and automation specialists. As an external partner, we provide our expertise and resources in field of CNC automation and take on an advisory role.

Project cooperation CODESIGN

Merging knowledge – potentiating results
Your development team will be combined with our team of specialists. Together we will realize the automation of your machine with clearly defined responsibilities. This form of cooperation has proven to be extremely efficient in many projects.

Total solutions ALLDESIGN

Delegating responsibility – controlling result
We assume the entire project management in the sense of a general contractor and are fully responsible for the successful implementation. Starting with the development of the requirements specification, over the development and commissioning, up to the support and service of the machine, and beyond

NUM Solutions and Systems
Intelligent and Creative

We have developed countless customer- and application-specific solutions for different industries as well as pioneering complete solutions for various industries, thus creating practical solutions for challenging applications and professional requirements.

All of our solutions are based on a wide range of perfectly matched proprietary products such as CNC, drive amplifiers and motors. The partnership with our customers in the evaluation, project and installation phase is further maintained by our training, support and other services even after commissioning. We attach importance to ensuring that our customers are served by our professionals with specific knowledge.

numroto

NUMROTO – successful trendsetter in high-precision tool grinding for many years

numspecial

NUMspecial – creative and practical solutions for your specific applications

numcut

NUMcut – a complete solution for advanced cutting machines

numgear

NUMgear – intelligent total solutions for new machines or as a retrofit in the field of gear machining

numtransfer

NUMtransfer – economical and flexible for all lot sizes for transfer, rotary transfer and multi-spindle machines

numhsc

NUMhsc – excellent quality at the highest speeds on machines with 5 or more axes

numgrind

NUMgrind – grinding and dressing cycles, with intuitive shop floor entry screens and 3D visual validation

nummill

NUMmill – flexible solution with a graphical interface for extensive milling cycles, including full 3D simulation

numwood

NUMwood – long tradition with powerful complete solutions in woodworking

numretrofit

NUMretrofit – rational extension of the service life of your machine by years

NUMgrind – Shop Floor Programming Solution for Cylindrical and Non-Circular Grinding

NUM has a great deal of experience in grinding applications and is one of the world's leading suppliers of CNC solutions for tool grinding. NUM also supports external and internal cylindrical grinding, including non-circular grinding, surface grinding as well as centerless cylindrical grinding, with CNC systems specially tailored to the respective application. Each application solution offers corresponding cycles and a matching and easy-to-use HMI.

NUMgrind for Cylindrical Grinding (Cylindrical Grinding Pack 1) is suitable for all aspects of the cylindrical grinding process. It offers a complete "off the shelf" solution, with embedded grinding and dressing cycles governed by a user-friendly menu-driven data entry system that includes 3D simulation and wizard-guided setup.

In short, NUMgrind not only saves OEMs years of development time, but also significantly reduces operators' training time.

NUMgrind HMI Cylindrical Grinding

The Flexium CAM-based programming process is extremely user-friendly. Entry screens provide the machine operator with a comprehensive graphical programming approach that depicts the grinding wheel, workpiece, and associated setup data in a clear and concise manner. Operators do not have to use ISO or G-code programming; they simply fill in the data fields presented by the program. After completion of the data entry session, the grinding program is automatically generated, stored, and is then ready for execution.
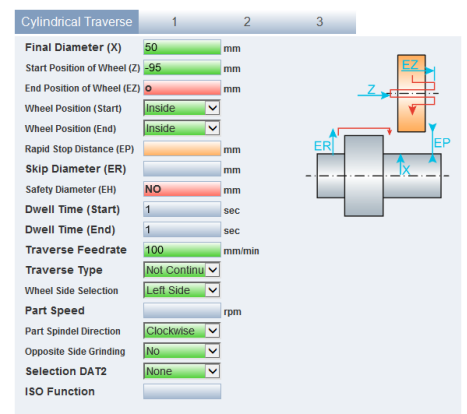
The architecture of the NUMgrind HMI is ergonomic and offers a comfortable programming experience with a very intuitive interface:

On the left-hand side is the "command tree" with all available functions (general definitions, tool selection, cycles, etc.). The user interface can work with mouse, keyboard and touch screen.

The middle frame shows the "Program sequence". The selected commands are inserted into it in the order that they should be performed. Whether a command is complete and plausible is indicated by a flag in green or red next to each command.

On the right-hand side we have the input page with graphic support. Orange fields are mandatory fields, blue fields are optional entries. If the fields are green or red, the entry is accepted or not accepted.

NUMgrind – Shop Floor Programming Solution for Cylindrical and Non-Circular Grinding

Cylindrical Grinding Cycles and Functions

NUMgrind for Cylindrical Grinding includes OD/ID grind cycles for 2-axis (X/Z) grinding machines and offers an inclined axis capability by tilting the grinding head or the table. The dressing station can be table-mounted or rear-positioned to accommodate all existing machines. The wheel dressing is carried out by means of one or more fixed pointed dressers or profile dressing roller.

A standard set of nine external grind functions (OD) gives the operator a library to quickly define and implement the external grind process. All geometry and process data is entered into a predefined set of parameter fields.

G Code	Cycle Description
G200	External plunge/multiplunge cycle
G202	External plunge cycle with inclined axis
G204	External oscillating plunge/multiplunge cycle
G206	External cylindrical traverse cycle
G208	External profile grinding cycle
G210	External conical traverse cycle
G212	External oscillating shoulder cycle
G214	External shoulder traverse cycle
G216	External shoulder cycle with fillet

A standard set of nine functions is available for internal grinding (ID).

G Code	Cycle Description
G201	Internal plunge/multiplunge cycle
G203	Internal plunge cycle with inclined axis
G205	Internal oscillating plunge/multiplunge cycle
G207	Internal cylindrical traverse cycle
G209	Internal profile grinding cycle
G211	Internal conical traverse cycle
G213	Internal oscillating shoulder cycle
G215	Internal shoulder traverse cycle
G217	Internal shoulder cycle with fillet

A number of additional grinding functions allow the operator to quickly define the entire grinding process. Among other things, functions such as the reduction of air grinding (gap elimination), measuring in process, wheel dressing, and more are also included.

In case your specific machine requires special grinding cycles, the system allows the creation of custom G- and M- functions, as well as the integration of special cycles in the real time kernel of the CNC.

Of course, the system also allows direct ISO code programming, which further increases flexibility.

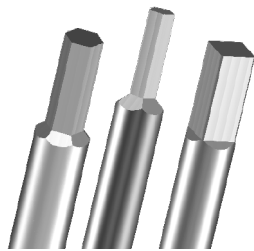NUMgrind of course also offers the possibility of entering grinding wheel data on special HMI pages.

Wheels
Wheels for profile dressing roller
Standard Wheels
Special Wheels
Angular Wheels

Example of a Work Piece

The following workpiece is to be produced. The diameters are to be ground.

Clippings of the associated NUMgrind program:

The simulation of the NUMgrind program shows:

Collision Detection Function to help identify issues with the cycle before running it on the machine.

The resulting piece looks like:

Example of a wheel
The data of a wheel consists of some general data such as the wheel file name etc., plus the geometrical data and parameters needed for dressing and shaping the wheel.

NUMgrind – Shop Floor Programming Solution for Cylindrical and Non-Circular Grinding

Non-Circular Grinding

A specialty in cylindrical grinding is non-circular grinding, such as the grinding of camshafts, punches, cams, eccentric shafts, polygons and more. Non-circular grinding is an extremely complex grinding application, as the non-circular contour leads to changing engagement and movement conditions on the workpiece to be ground. Special software is therefore required to make non-circular grinding a success.
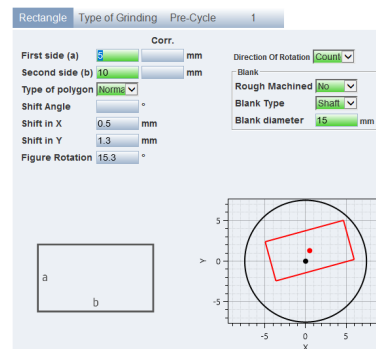
With NUMgrind, the closed shape of the workpiece is defined in the XY plane. However, grinding is done by interpolating or synchronizing the X axis with the C axis (workpiece spindle). The Flexium+ control transforms the contour from the XY plane into an XC plane and calculates the corresponding compensation and infeed movements, taking the grinding wheel diameter into account. Of course, the speed profile is also transformed, whereby the controller automatically adapts the speed and acceleration to the physical limits of the machine. NUMgrind offers all the non-circular grinding cycles ready to use.

Eccentric Circle	+⊙	Ellipse	⬭	Rectangle	▭
Reuleaux triangle	△	Super circle	▢	Stadium	⬭
Trapeze	⏢	Rhombus	◇	Wrench width	▢
Egg shape	◯	Polygon	⬡	Oval	◯
Circle segment	◗	External XPI	▱	Triangle	△
Eccentric Circle	+⊙	Pitch Circle	⊛		

OD NON-Circular Shapes / Last two ID Shapes

A large number of predefined shapes for OD as well as two for ID are available in the HMI, which makes programming much easier. In addition, for non-circular grinding, it is possible to load custom shapes into NUMgrind via an external XPI (part program) with the shape. The shape can be programmed in Cartesian coordinates (XY) as well as in polar coordinates (XC). This is very useful for editing cam profiles, which are often available in polar coordinates.

Clipping of the definition page for the rectangle

After filling out the dialog pages and determining the machining sequence, NUMgrind creates the necessary part program, which can then be run on the machine.

Summary

NUMgrind software has an exceptionally easy-to-understand graphical user interface that radically simplifies machine operation by employing interactive, dialog-supported operator guidance.

The operator determines the sequence of the grinding process via the HMI and enters the necessary data for the grinding operations, grinding wheels and dressing operations in the dialogue pages. The work piece program is then created fully automatically and stored in an executable form.
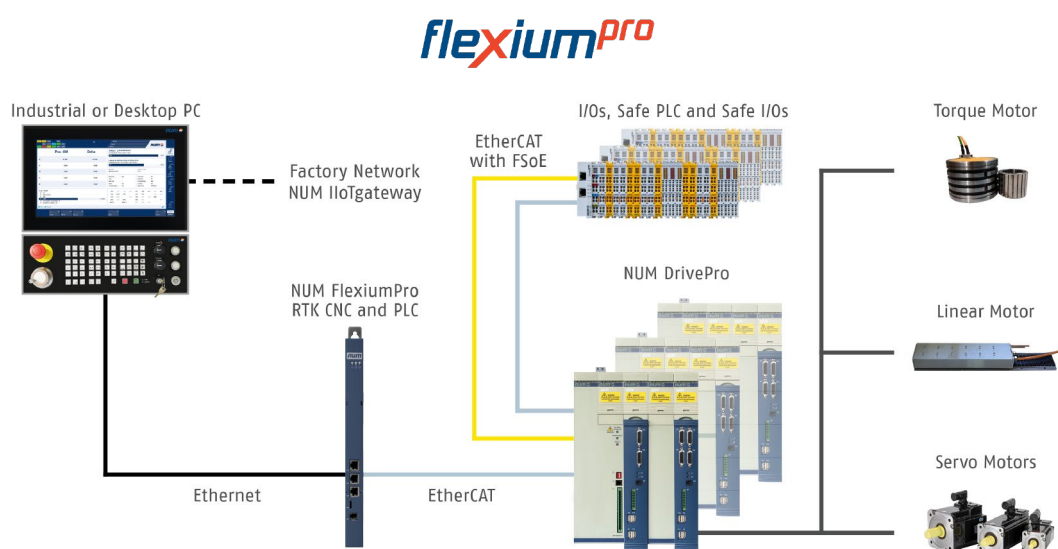
The NUMgrind package offers full grind cycles for OD/ID grinding and optional non-circular grinding. A wide range of shapes can be chosen. NUMgrind is supplied as a complete turnkey package, but can be extended with additional cycles and functions.
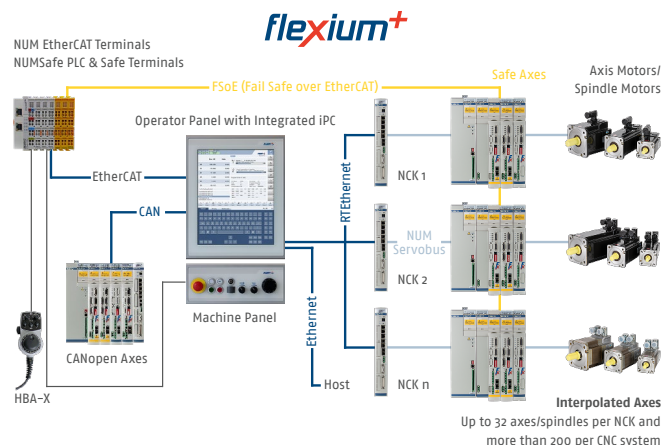
Flexium⁺ and FlexiumPro – Extreme Scalability

NUM control systems offer remarkable scalability, enabling a precise fit for each specific application. As a result, systems ranging from 1 to more than 200 CNC axes can be effortlessly implemented. In addition to the normal PLC, both the existing Flexium⁺ and new FlexiumPro systems have a safe PLC which communicates via FSoE (Fail Safe over EtherCAT) with the safe inputs and outputs as well as with the NUMDrive X or NUM DrivePro drive controllers. The systems cover all necessary safety functions in a simple way. The safety logic is programmed with the same software tool as the rest of the PLC. The same tool is also used for all system parameterization and machine commissioning.

The NUMDrive X and NUM DrivePro drive solutions are the result of more than 30 years of experience in the development of fully digital drive systems. The drive amplifiers are available in various versions with different performance data. The wide range of drive amplifiers is available in single-, dual- and quad-axis versions, with different computing power and supports rated currents from a few up to 200 amps. Another strength of the drive amplifiers is their compactness and high energy efficiency. Our experts will be happy to help you make a technically and financially optimal selection from the wide range of products, in coordination with your application.

NUM Motors
Perfect for all Applications

Excellent volume/performance ratio and great dynamics, so that our motors can satisfy almost all applications.
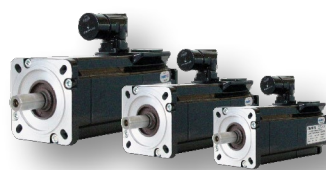
NUM has more than 50 years of experience developing servo and spindle motors. We pioneered the development and production of AC brushless servo motors, as well as synchronous spindle motors with flux weakening.

The comprehensive **servo-motor** series of NUM offer an excellent volume/output ratio, as well as first-class dynamic properties optimized for the machine tool industry. They, with perfect concentric run-out, give great performance even at very low speeds. The so-called "single cable" motors offer the advantage that the complete measuring system cable is eliminated. This simplifies the wiring of the machine significantly and thus saving time and money.

The **asynchronous motors** of the AMS series offer excellent quiet running at low speed, quick and accurate positioning and are ideally suited as a C-axis and for spindle indexing.

The TMX series **torque motors** have an extremely low cogging torque as well as a very high S1 torque density. They are ideal for applications that require very smooth and precise motion, especially at low speeds. Typical applications are direct drive rotary tables or workhead axes of machine tools.
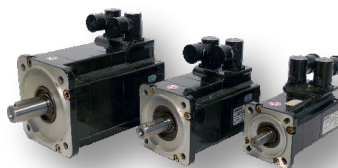
The NUM **LMX linear motors** are specially designed for machine tools. Among other features, they are characterized by a fully enclosed primary, a cooling circuit with large diameters to accommodate fluids with low specific heat capacity, a short pole pitch to increase the force density and reduce temperature, and many other interesting features.

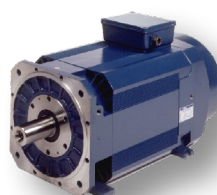Motors of the series
SPX "single cable"

Motors of the series
SHX "single cable"

Motors of the BPX series

Motors of the BHX series

Motors of the AMS series
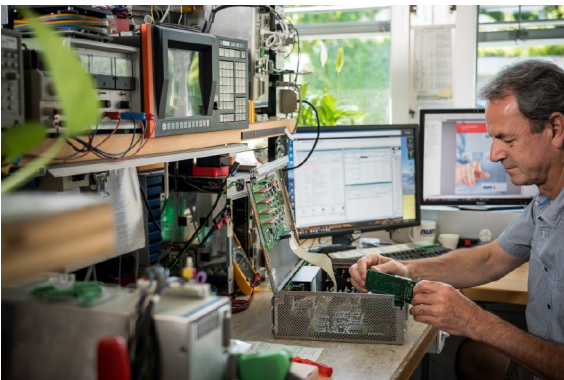
TMX torque motors

LMX linear motors

NUM Services
Worldwide at your Service

The decision for NUM is also the decision for a customer service that will support you long after the initial investment as on the first day – even after 20 years and on-site. Our specialists can ensure an extended life for your good (but old) machinery with NUM retrofits.

Worldwide support by experts

For professional analysis and trainings, a perfect infrastructure is available to our experts in all centers of excellence. So that we can assist you quickly and efficiently around the world, we also rely on the advantages of the most modern communication technologies, e.g. for remote maintenance. We can also offer on-site support and consultation services out of our regional branches

Comprehensive training offer

We orient our training to your indivual needs – whether its operator training, maintenance, repair and service training, HMI; CNC or PLC programming, or adjustment of servo drives etc.

NUM provides a training offer matched to the customer needs:

- CNC operation
- CNC programming
- PLC programming
- Commissioning and servicing
- Creation of a custom HMI
- Customized customer training

Technically always up to date

Our team of specialists will actively inform you on the latest

hardware– and software developments and provide you with useful technical information.

Repair– and spare parts service

If an error unexpectedly occurs in your CNC system in spite of proper maintenance, you can trust that this will be fixed by dedicated service employees of our global network.

Customer service

For you and your markets, we have a worldwide service organization. The International customer service provides telephone consultation and deployment on site, even for machine installations that are many years old. With a retrofit from NUM, the operating time of an excellent machine can be extended by many years.

Our customer service is available and responsive to help even with cutting edge products and custom developments. We carry local inventory and have your materials and components in stock ready to meet your requirements for quality and delivery times.

Complete CNC Solutions Worldwide

num ®
CNC HighEnd Applications

Finland
Sweden
Great Britain
Germany
Austria
France ★ Switzerland (Headquarters)
Spain
Italy
Turkey
USA
China
Taiwan
Mexico
India
Thailand
Brazil
South Africa
Australia

■ NTC (NUM Technology Center)
■ NUM Agent
■ NUM Contact

NUM systems and solutions are used worldwide.

Our global network of sales and service locations guarantees professional service from the beginning of a project to its execution and for the complete life cycle of the machine.

NUM has service centers around the world. Visit our website for the current list of locations.

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