



numgear

**TOTAL SOLUTION FOR
GEAR MACHINING**

www.num.com

NUM [®]
CNC HighEnd Applications

NUM Solutions and Systems

Established Worldwide

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!

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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

NUMgear – Perfection in Gear Machining

NUMgear on NUM's current control system Flexium⁺ is one of the leading industrial solutions for the production of gears in the world. NUMgear is fully integrated in the controller. With NUMgear, gears can be produced – after a few hours of training – by just entering the tool, workpiece and process data with first-class precision of up to DIN 1 for continuous generating grinding and up to DIN 3 for gear hobbing.

Gears move the world

Long ago, the number of vehicles surpassed the one billion mark. More than 80 million new vehicles are produced worldwide every year.

In most of these vehicles, at least one gear train is installed in the drive train to transfer power from the engine to the road by changing gear combinations. Electric vehicles also require gears for optimal battery performance and balanced driving characteristics. The high noise requirements for these gears demand the highest precision in manufacturing.

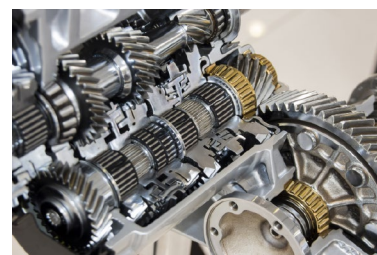
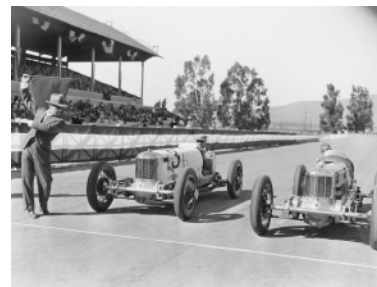
Gear drives aren't only used here; they're also found in oil pumps, wind turbines, machinery, mining, marine propulsion, and aircraft. Thus, the requirement for gears that meet ever-increasing standards continues to grow.

In gear manufacturing, the continuous processes, such as hobbing, gear grinding, gear peeling, and gear shaping, are typically the most productive. Gear hobbing has been a method for producing gears for over 100 years. Machines and technology have continuously evolved since then.

Outdated machines that may seem obsolete can be modernized using NUM's Flexium⁺ and the NUM gear software package. Old gear hobbing machines, gear grinding machines, and gear shaping machines don't end up in scrapyards and can stay in production due to NUM's up-to-date systems.

Especially today, the emphasis on sustainability and resource conservation is rising. So it makes sense to give time-tested machines, which might have reached the end of their initial life cycle, a second or third lease on life and reintegrate them

into the modern manufacturing process. This approach is not just economical but also ecologically sound.



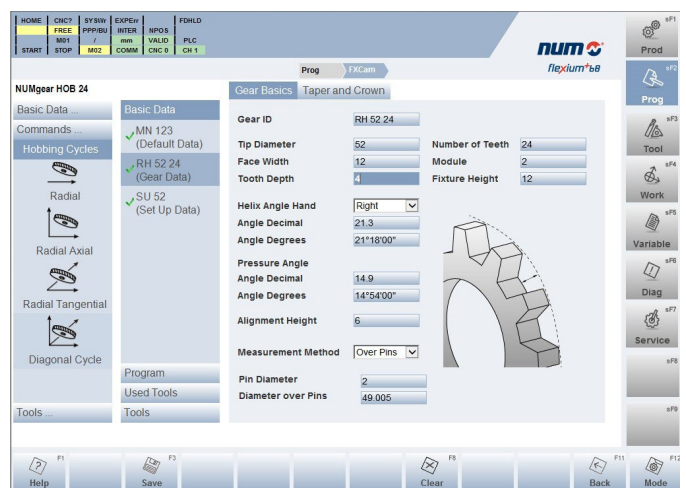
NUMgear Moves Machines

On new machines, the old mechanical drives and couplings have long been replaced by modern CNC controls. This allows for the production of gears that satisfy the requirements of today's gearbox manufacturer.

As a leading manufacturer of modern, high-performance CNC controllers, NUM offers complete technology software for gear production.

- NUMgear is fully integrated into the contemporary Flexium+ control system, providing an interactive user interface for entering machine, workpiece, and tool data, as well as defining machining processes
- Input fields are illustrated with visual references
- Several processing steps can be easily combined
- Once the data are entered, machining starts at the simple press of a button
- A central overview presents the relevant production data during automated machining
- The integrated tool management feature allows users to store both the machining and wear condition of various tools
- For automatic loading, a fast measuring system ensures that tool and workpiece are mounted in the correct position
- DIN 1 for generating grinding
- DIN 3 for hobbing
- Combinations of different flank modifications – and profile modifications in case of grinding – are already a reality today

- Beveled flanks and crowns – spherical, eccentric, or limited to certain flank areas – can be combined simply by entering the corresponding values in the NUMgear workpiece data



NUMgear is Complete, Flexible and Precise

Gears that are manufactured on a machine with a NUM control system meet the highest standards.

NUMgear is Complete

The required CNC cycles are included within NUMgear.

NUMgear program packages contain – interlocked with the user interface – all the functions required to start production in a short time. The main program is generated, combined with the data entered by the operator, loaded into the NC and activated.

Gear Hobbing:

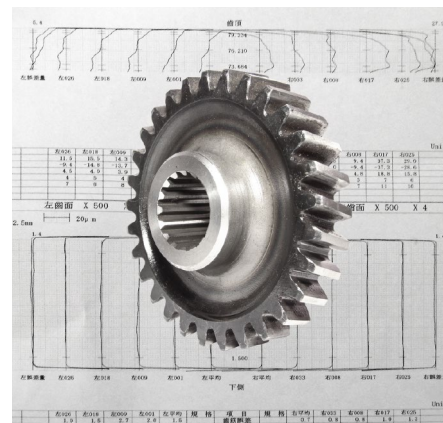
- Axial, radial, tangential and diagonal hobbing for spur and helical cylindrical gears, for splines, worm gears and worm shafts
- A combination of up to five gears can be machined in one operation on one axis
- For each gear on the axis, a hob can be assigned on the tool spindle
- Automatic centering ensures correct orientation of the gear teeth of multiple workpieces and trouble-free restarting after an interruption
- Shifting along the hob and even skipping certain areas in case they are damaged

Gear Grinding:

- Grinding of straight and helical cylindrical gears
- Automatic centering for positioning of grinding worm and gear
- Semi-automatic centering to ensure uniformly ground flanks
- Shifting along the worm
- Dressing of single or multi-start grinding worms

Gear Shaping:

- Shaping of internal and external gears



NUMgear is Complete, Flexible and Precise

NUMgear is Flexible

NUMgear can be used as a complete package on new machines or on upgraded older machines.

Since NUMgear is fully modular, a different user interface, proprietary technology- and calculation modules or other advanced functionalities can be integrated – as required. A particular strength of the experts at NUM is to work closely with customers and to enhance the strengths of both partners into an outstanding product. We feel to be, in the best sense of the word, responsible for the success of the joint work. Projects and data can be stored centrally or locally. The HMI application of NUMgear can run on both the individual machine, or on a Windows computer within the corporate network. This means that corrections can be carried out on multiple gear machines from a mobile device or from an office PC. NUMgear is, of course, "Industry 4.0 ready".

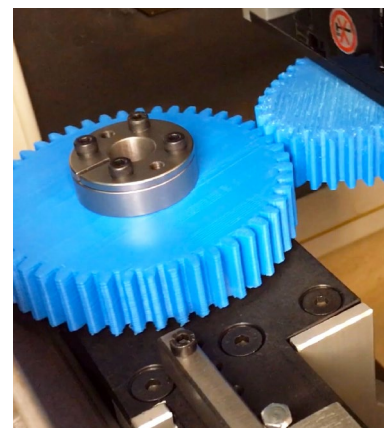


NUMgear with precise MLEGB

NUM provides a very flexible and powerful electronic gear train with the current control system generation Flexium⁺, with the accuracies up to the sub-nano range. Higher speeds increase the productivity and new technologies improve the precision.

NUM's Electronic Gear Box (MLEGB) is integrated directly into the CNC kernel and can be used for gear production as well as for other technologies. There are two basic types, static and dynamic gear mechanism. With this MLEGB, tool speeds of up to 25,000 revolutions per minute are possible.

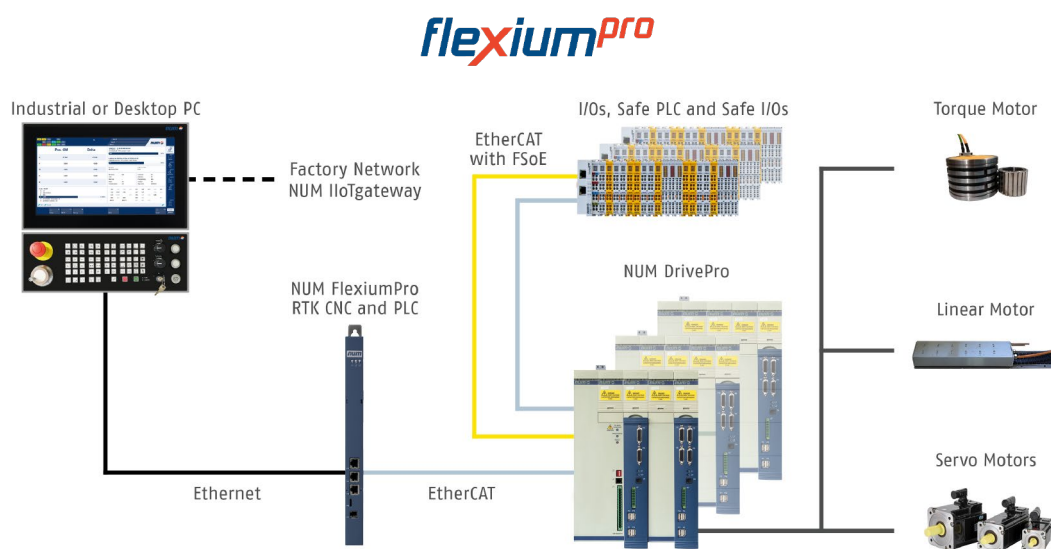
Static gear mechanisms use the factor specified in its definition factor for the axis coupling. Each axis of a machine can be the leading or controlled axis. Gear mechanisms can be combined and connected in series. Several axes can control an additional axis – this can also be virtual – and become the leading axis of another gear mechanism. In this case, linear and rotary axes can be combined with each other. In addition, it is possible to superimpose further movements to controlled axes. Dynamic gear mechanisms use curve tables instead of the fixed coupling factor. The interpolation between two table points is done linearly or as spline. Thus, the movement of the tool for non-circular gears, for special flank shapes can be controlled more flexibly. Static and dynamic gear mechanisms can also be combined. A calibration or parameter set changeovers are not needed; the MLEGB takes care of it.



CNC-Systems

Flexibility, Productivity and Safety

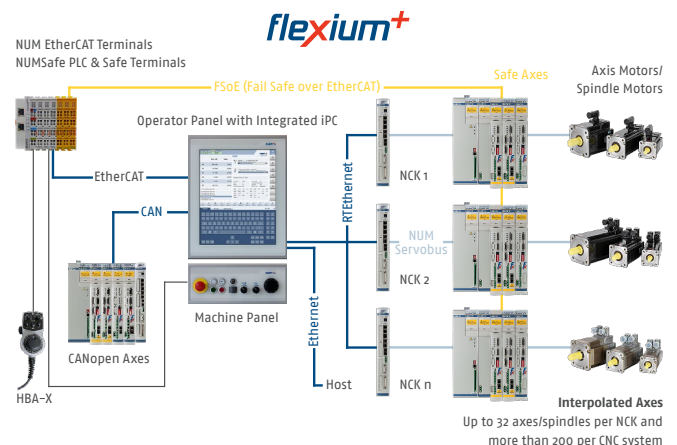
Flexium+ and FlexiumPro – Extreme Scalability



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.

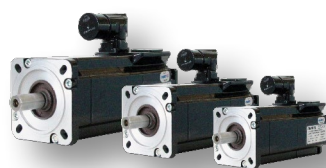
NUM has more than 50 years of experience developing servo and spindle motors. We pioneered the development and production of AC brushless servo motors, as well as synchronous spindle motors with flux weakening.

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.

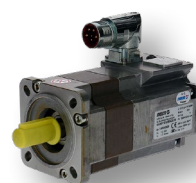
The **asynchronous motors** of the AMS series offer excellent quiet running at low speed, quick and accurate positioning and are ideally suited as a C-axis and for spindle indexing.

The TMX series **torque motors** have an extremely low cogging torque as well as a very high S_1 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.

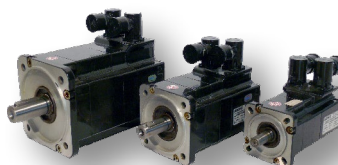
The NUM **LMX linear motors** are specially designed for machine tools. Among other features, they are characterized by a fully enclosed primary, a cooling circuit with large diameters to accommodate fluids with low specific heat capacity, a short pole pitch to increase the force density and reduce temperature, and many other interesting features.



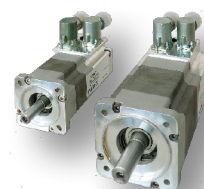
Motors of the series
SPX "single cable"



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

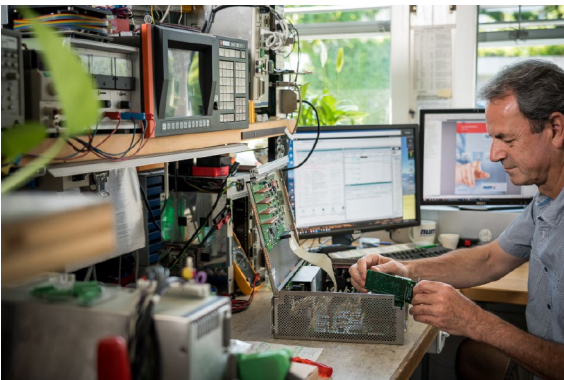
NUM Services

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 individual 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 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.

www.num.com



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