

**num**wood

**TOTAL SOLUTION  
IN WOODWORKING**

[www.num.com](http://www.num.com)

**num** <sup>®</sup>  
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

# NUMwood – Powerful Complete Solution in wood processing

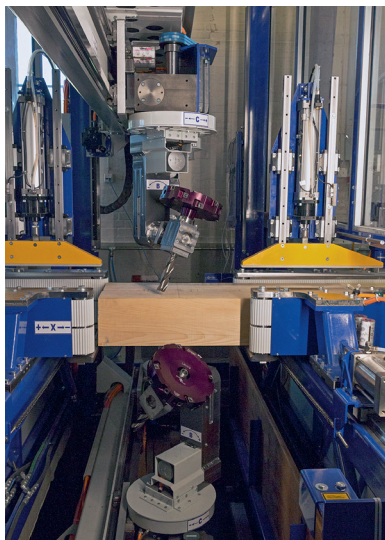
## NUMwood – Your solution for the automation of woodworking machines

The woodworking industry has experienced rapid advancements in recent years, with increasing demands for precision, efficiency, and networked solutions. As technology evolves and the need for precise wood workpieces grows, the automation of woodworking machines has become essential. NUM, a pioneer in CNC technology for woodworking machines, has developed a cutting-edge solution to take the automation of these machine types to a new level. NUMwood is the comprehensive answer to the modern woodworking industry's evolving needs.

### The versatility of NUMwood

NUMwood is not limited to a specific type of machine. On the contrary, it is an extremely versatile solution that supports different types of woodworking machines. This includes joinery centers, machining centers, routers, lathes, gantry machines, throughfeed machines to name a few. No matter what range of woodworking you cover, NUMwood has the solutions to optimize your processes.

Woodworking is often about fast and efficient machine control. For this range, NUM offers CNC controls that meet even the most demanding requirements.



*View into the heart of the CNC-controlled 28-axis woodworking center*

### Intelligent algorithms for the highest quality

#### RTCP

The RTCP (Rotation Tool Center Point) function, originally introduced to the market by NUM, stands as a crucial component in CNC machining. RTCP ensures the continuous positioning of the tool tip within the workpiece. The post-processor calculates the position of the rotating axes, while the CNC executes real-time geometric transformations to maintain optimal cutting conditions. This results in reduced machining time, enhanced surface quality, and reduced strain on the tool. Direct support is provided for over 20 different kinematics, with the capability for our team to create additional ones. Multiple kinematics can be employed in the same machine, especially when different milling heads are in use.

#### Inclined plane

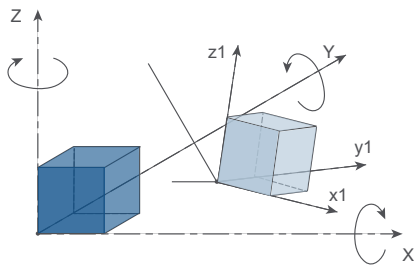
The inclined plane function significantly simplifies and shortens the programming of complex forms. In addition to the six standard levels in the XYZ coordinate system, an inclined plane can be generated at any rotation angle. This allows the programming of the workpiece contour in a manner similar to a normal level, eliminating the need for complex spatial thought processes by the programmer. If the program is interrupted during production, the "Inclined plane" function remains active, enabling the user to manually maneuver the tool out of a drill hole, for instance, in case of a break. It is also possible to use the RTCP function within the "Inclined plane."

#### Workpiece positioning compensation

When positioning a workpiece on a machine, achieving perfect alignment can be challenging due to factors like weight, structure, prior machining operations, or other reasons. Shifting parallel to the main axes is manageable and requires a simple offset adjustment. However, addressing a tilt can be more complex as it involves compensating for the tool orientation. Traditionally, after identifying offsets and tilt angles, reprocessing the

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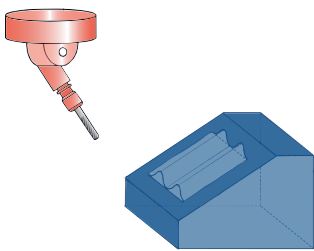
program is a common solution, but this takes time. NUM offers cycles and parameters specifically designed for easy workpiece alignment or compensation. The HMI includes a dedicated page to assist the end-user in verifying the settings. The advantage



lies in not altering the part program; instead, the CNC automatically compensates for misalignment by rotating the tool vector.

## Tool vector programming

A part program written using tool vector orientation can run on machines with different kinematics. In fact, a CNC system that is aware of the kinematics of a particular machine can calculate the angles of the machine's rotary axes and the associated linear transformations. The advantage is that a part program can be generated without needing to know the specific kinematics of the machine on which it will be executed.



## High Speed Cutting (HSC)

This function practically eliminates the following error, even at high machining speeds. This is achieved by the following mechanisms:

- Total speed anticipation
- Acceleration anticipation
- Anti-pitch correction: when machining circles, the friction torque appears as dynamic backlash when reversing direction; the adjustable correction compensates for this friction torque

- Gradual acceleration with controlled jerk-rate derivative
- Accurate feed control based on upcoming changes in the machining path

This control requires evaluating the curve radius over a sufficiently long section of future path (horizon). It also requires detecting and evaluating the sharpness of corners, which may exist on this segment of path. For form machining, up to 1000 blocks per channel can be pre-analyzed.

## High-level smoothing

CAD/CAM-generated part programs often include numerous small G01 segments, which, especially during rotary axis movements, can lead to uneven distribution and velocity discontinuity, negatively influencing surface quality. To address this, NUM employs algorithms that maintain a constant velocity at pivot points during rotary axis movement, effectively smoothing out discontinuities and enhancing the surface finish.

Another challenge lies in significant speed variations within programmed axes, resulting in vibrations and poor surface quality. NUM addresses this by incorporating smoothing filters that significantly reduce speed fluctuations. The G732 function further simplifies the optimization process, offering pre-settings for roughing and finishing with adjustable smoothing levels. These solutions collectively contribute to achieving a more consistent and improved surface finish in CNC machining.

## Compensation of the rotary head

The kinematic measuring cycle (G248) is employed to measure and subsequently compensate for the geometric deviations of a rotary head. This cycle is typically utilized during the machine commissioning phase or following a machine crash to ensure accurate and precise performance.

### Multi-channel system

Many machines require processes to be executed in parallel and independently. With the multi-channel function, the NUM control optimally supports this requirement. A Flexium+ NCK can easily execute up to 8 CNC programs in parallel. If more CNC programs are to be executed, an additional Flexium+ NCK can easily be added for this purpose. A FlexiumPro RTK has even more computing power and can run 32 CNC programs in parallel.

### Simple axis change between channels

Axes may change their assignment to a channel, e.g. if they are mounted on a rotary table. This axis transition is a standard function of the Flexium controllers that can be executed via a single command. The scenario of a Flexium+ system with more than 8 stations was also taken into account. A special control function enables the seamless transfer of axes to other NCKs in such cases.

### Early Block Change (G777 EBC)

Early Block Change EBC means a faster machining cycle, as the NCK can begin the execution of the next block before the previous has been finished. EBC also provides a very fast signal exchange between PLC and part program.

The block change may occur under several conditions:

1. Immediately, the two blocks are therefore executed simultaneously
2. After a certain distance has been traversed
3. When the residual distance (Delta or To Go distance) is lower than a value
4. When the PLC sets a certain signal
5. When the block is normally ended (standard way)

### Multi-level Electronic Gear Box (MLEGB)

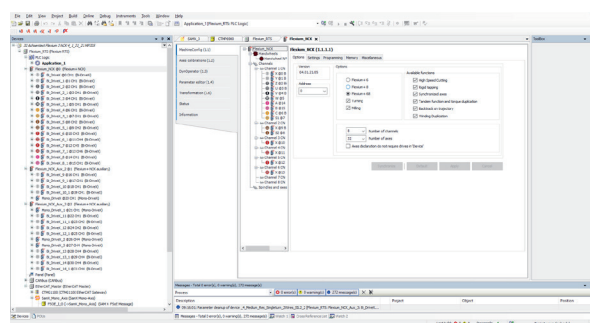
Flying saws? Synchronization of multi 5-axis processes? This and other axis synchronizations are possible with the MLEGB.

It enables you to synchronize up to five input axes or spindles, circular or linear, into a resulting axis movement. You can combine several layers and use virtual axes as results as well as inputs. Input can be fix values as well as curve tables.

## Helpful Tools and Functions

### One program for complete control system commissioning

The definition of the control system and its commissioning is carried out by means of the Flexium Tools software. The corresponding project contains all information on all devices involved, as well as the PLC programs and the definition of the safety functions.



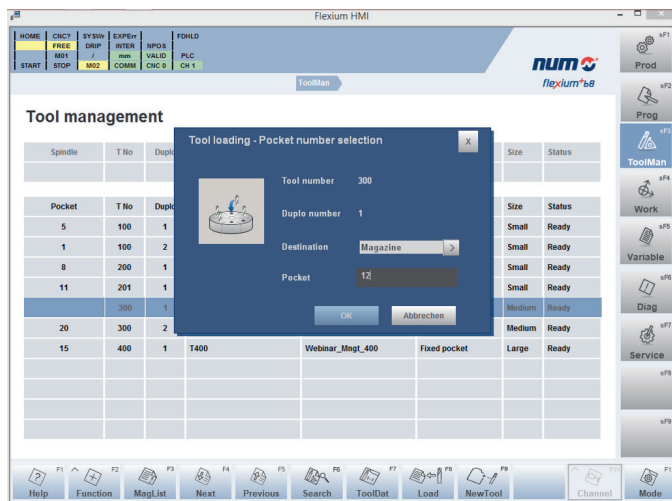
### Safety First with NUMSafe

In today's world, where machines are becoming increasingly complex, the safety of people is paramount. That's where NUMSafe comes in - this feature provides a comprehensive and easy-to-integrate solution for personnel protection on machining equipment. With the ability to incorporate personnel protection elements such as light curtains, safety mats, doors, emergency stop switches, etc., this system ensures that workers are protected in the workplace. Because NUMSafe is software-based, the solution is very flexible and also allows machines to be run safely at reduced speed if people need to be in dangerous ranges to set up the machines.

# NUMwood – Powerful Complete Solution in wood processing

## 3D simulation and 3D collision monitoring

In addition to providing a perfect simulation of the complete workpiece, the software offers versatile functionalities such as measuring geometric features, creating cross-sections of the workpiece, and analyzing the volume of material removal for each machining process. The 3D collision monitoring function is a valuable tool that examines the entire machining process for collisions either upon command, through fully automatic operation, or in parallel with CNC file transfer. Even with normal workpieces, the collision check only takes a few seconds.



In manual operating mode, online collision monitoring proves to be a crucial tool in preventing machine damage, especially when inclined plane or RTCP is active, where some axis movements might be unexpected. The "online collision monitoring" function continuously supervises the axes' movements in manual mode. In the event of a potential collision, it proactively stops the axes' movement, helping the end-user avoid costly mishaps.

## Integrated tool management

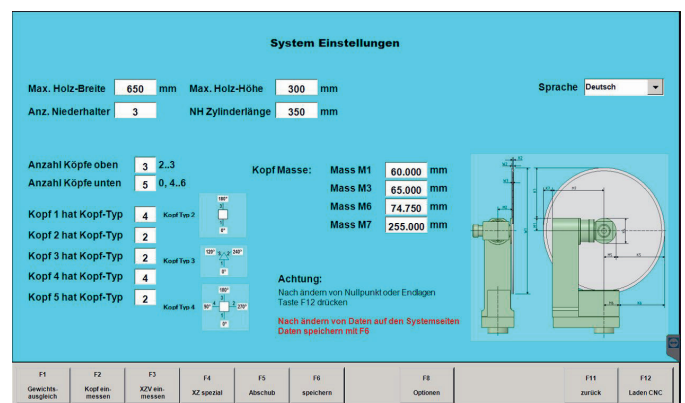
The tool management integrated in the control system also covers the requirements of transfer machine applications. The

tools can be assigned to an axis channel. The tools per channel are displayed on a special page.

## Customized HMI

NUM offers flexible HMI customization options to meet your unique requirements. You can easily personalize the standard HMI to your preferences, even without extensive technical knowledge. For more specialized HMI customization needs, you can supplement the standard interface with custom-designed pages incorporating specific buttons, controls, displays, or other elements. To streamline the creation of your custom HMIs, you can leverage our library of prebuilt components.

No matter the complexity of your HMI customization needs, NUM is your dedicated partner. We can also handle all aspects of HMI customization in-house, eliminating the need to engage third-party providers who may require a learning curve.



HMI of a woodworking machine





# NUM Motors

## Perfect for all Applications

**Excellent volume/performance ratio and great dynamics, so that our motors can satisfy almost all applications.**

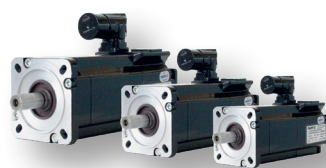
NUM has more than 50 years of experience developing servo and spindle motors. We pioneered the development and production of AC brushless servo motors, as well as synchronous spindle motors with flux weakening.

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.

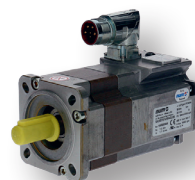
The **asynchronous motors** of the AMS series offer excellent quiet running at low speed, quick and accurate positioning and are ideally suited as a C-axis and for spindle indexing.

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.

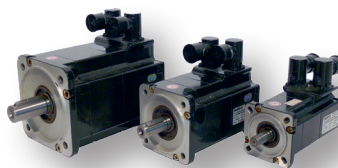
The NUM **LMX linear motors** are specially designed for machine tools. Among other features, they are characterized by a fully enclosed primary, a cooling circuit with large diameters to accommodate fluids with low specific heat capacity, a short pole pitch to increase the force density and reduce temperature,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



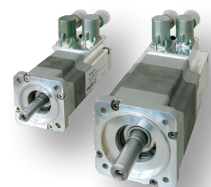
Motors of the series SPX "single cable"



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

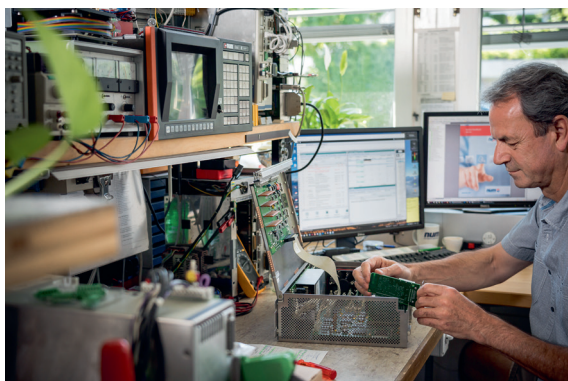
# NUM Services

## 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.

Follow us on our social media channels for the latest information on NUM CNC Applications.



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