



numcut

**TOTAL SOLUTION FOR
WATER JET CUTTING
PLASMA CUTTING
LASER CUTTING**

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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Worldwide at your Service



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

NUMcut – Perfection in Cut Quality and Speed

NUMcut running on NUM's latest Flexium+ control system, is a modular, open, and flexible cutting system. NUMcut supports many specific features of water jet, plasma, or laser cutting.

NUMcut Total Solutions

This innovative solution contains a large range of operations and parameters for water jet, plasma, or laser machining. When used with NUM drive amplifiers and motors, NUMcut can produce some stunning results.

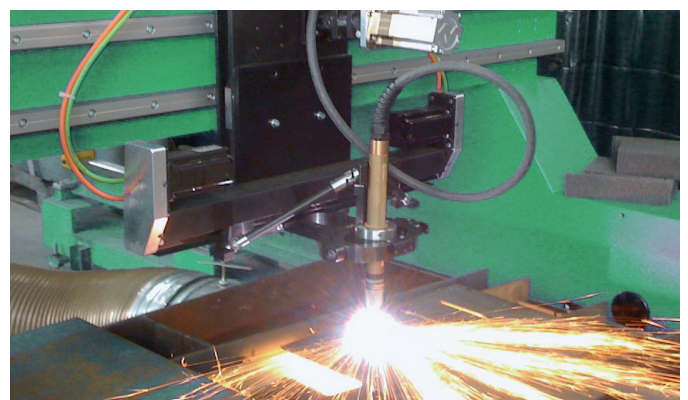
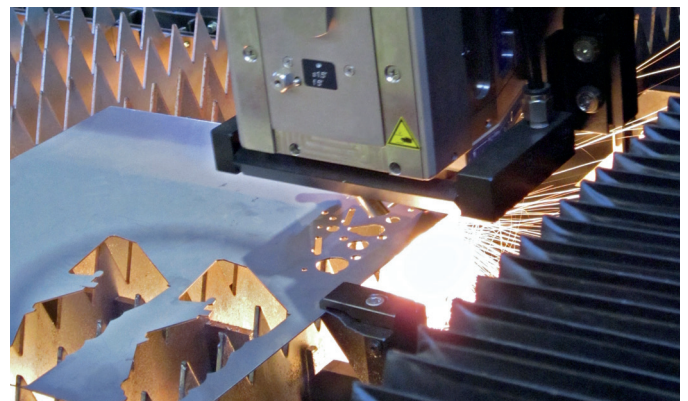
Functions like automatic distance control for cutting heads, coordinate transformations of non-cartesian cutting heads, and cutting head error correction contribute to achieve a perfect cut quality at high machining speeds even in 3D applications. Stored technology tables guarantee constant cutting quality and help to increase the productivity and to optimize the process security. It is also possible to create CNC programs in the teach-in process which is very common; especially in prototype construction.

The openness and flexibility of the system allows 3D machines to realize special head-corrections. Thus, the accuracy of 3D machines can increase extremely.

Continual development of the system, committed long term customer support, and high reliability of the hardware ensures very high value retention for every NUM system. Training specifically tailored to the application requirement, expert customer service and remote diagnostics complete the qualities of NUMcut.

NUMcut Cutting Head

The exemplary NUMcut cutting head for plasma torches converts the movement of two linear actuators into a horizontal 360° rotary movement. The angle of inclination can be up to 47°. This type of cutting head offers an easy way to upgrade a 2D machine to a true 3D solution. These actuators allow unlimited rotational movement without cables or hoses getting twisted or damaged.



NUMcut – Sets the Standard in Water Jet, Plasma and Laser Cutting

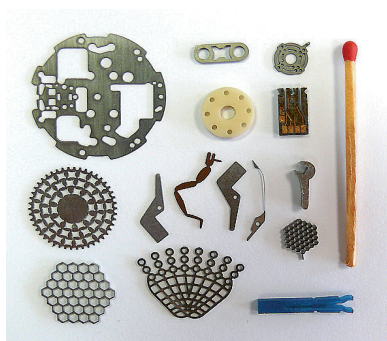
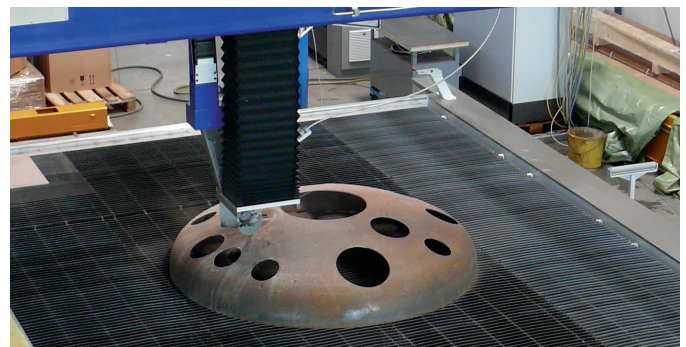
NUMcut was developed to satisfy the exceptional demands in water jet, laser and plasma cutting. For many years successful companies with extraordinary requirements in this area have been relying on solutions from NUM.

A variety of materials can be advantageously machined with the water jet. Machines with 5 or more axes can use special functions to maintain cut quality and accuracy for 3D machining.

A variety of criteria can be used to determine the quality of a plasma cutting process; including burr-free cuts, absence of wave formations, and smooth surfaces on the finished part. NUMcut has many special functions to achieve this, such as cutting rectangular edges with an inclined head.

Many parameters are monitored in real time for perfect laser cutting. NUMcut contains many functions, such as controller the laser power for the cutting speed and easily storing and recalling the cut parameters per material. Other functions such as "Frog Jump" or height control are specified for laser processing.

NUMcut also contains special functions, which are necessary for the 3D machining and the cutting of hollow profiles. The option of re-entry into the CNC program using Flexium 3D offers an indispensable comfort. For this, the path of the CNC program is displayed on the screen of the controller. The re-entry point is defined using the mouse. The CNC program then starts from this point.



Intelligent Algorithms for Highest Efficiency

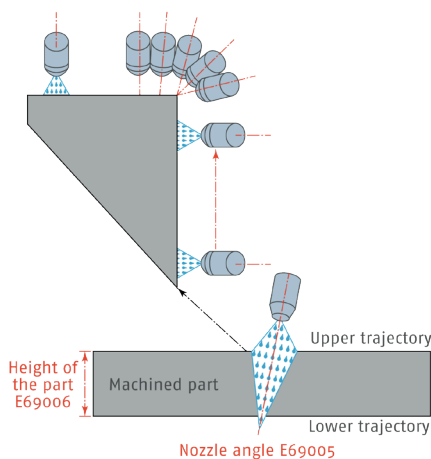
With respect to the technology and therefore also the requirements, there are different requirements in water jet, plasma and laser cutting, but there are also similarities. For all technologies, NUM offers solutions that are oriented to the respective requirements and the practice. A few, selected functions are presented in more detail in the following.

Re-entry after aborting the cutting procedure

A simple re-entry after aborting the cutting procedure (break; interruption; disruption) on the contour is made possible by Flexium 3D. The machine operator has the option to re-enter at the corresponding point in case of a break in the cutting procedure. Apart from the speed and ease of use, the workpiece can thus be „rescued“ in a simple manner.

Correction of the Jet Form (Nozzle Inclination)

For various reasons, the cutting head might have to stand diagonally opposite the workpiece, for example, in order to correct the jet conicity. When moving the axes, this inclination should be taken into consideration. NUMcut has a function that recalculates the angles and repositions the nozzle continuously and in real time.



Height Control

For all cutting technologies, the constant distance between the cutting head and the workpiece surface is a prerequisite for a good cut. For uneven workpieces, this distance must be tracked. NUMcut provides a height control in the CNC, which meets various requirements. It includes continuous tracking of the distance, as

it is required in laser and plasma applications, as well as optionally sequential tracking for water jet cutting machines. The height control can analyze a variety of measurement systems.

Fly Cut

The Flexium+ control provides the ability to execute path-synchronous I/O commands without stopping machine movement. For example, the switching action (e.g. laser on/off) can be controlled down to microsecond accuracy, taking into account system-related delay times and ensuring that the laser is toggled at exactly the right position. This allows the cutting head to move at high speed over the entire sheet, line by line. To execute the cuts, the control system disables and enables the laser on the fly with pinpoint accuracy. This significantly reduces the production time, especially for the production of perforated grids.

Head Transformations / Correction

For 3D machining, two rotary axes are added to the 3 linear axes (X, Y, Z). For various reasons, however, these are often not implemented in cutting processes using two classic rotary axes. A good example of this is our plasma cutting head (NUMcut head). It consists of two linear axes. Rotating movements are performed using parallel kinematics. This allows normal part program commands to rotary axes, and the CNC converts the programmed traversing movements into the movements of linear axes. Due to the openness of the system, any transformations can be realized. Correction functions are especially important in 3D-cutting, which are able to compensate for mechanical errors. For this, NUMcut offers various solutions that are adjusted to the respective application case; this way, the accuracy can be massively increased.

Intelligent Algorithms for Highest Efficiency

Laser Power Control

NUMcut contains a function, which converts control commands from the parts program into control signals for the laser power via an EtherCAT Terminal. This is useful both during insertion and during cutting. During insertion, it is about the quickness, thus the nozzles and the lens are protected. During cutting, the laser power must be adjusted to the machine dynamics depending on the material thickness and contour.

Technology Tables

All relevant setting values (parameters) such as the material thickness, material quality, cutting speed, laser power, cutting gas type and pressure are stored in the technology table, which constitutes the centerpiece of the cutting parameters. Depending on the requirement, these are activated via the parts program and used in the NUMcut functions.

“Frog Jump”

Using the function „Frog Jump“, the laser head will move as quickly as possible between the contour end and the new contour start. For this, an upward evasive movement is included in the function. This ensures that there is no collision of the laser head with cut out parts. These might have been placed in an incline on the support plate and obstruct the travel movement. This function is retrieved in the parts program.

Adjustment of the Feed Rate

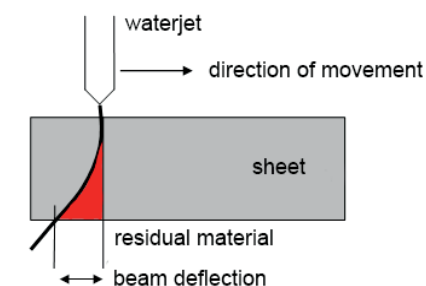
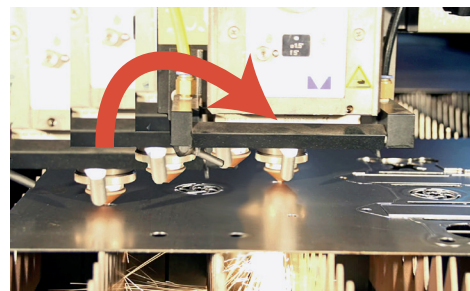
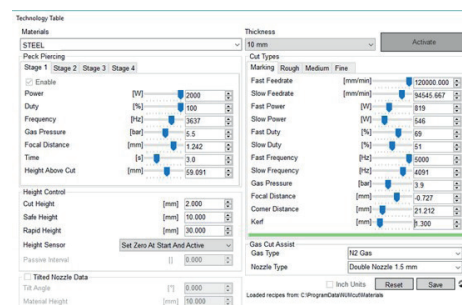
With water jet cutting, the cut lags on the bottom side compared to the inlet side for technological reasons. Now if the feed rate of the cutting head is not decelerated gently or accelerated thereafter in front of a corner, the material is not cut through over the entire cross-section. The cut part thus remains connected to the residual material. Various NUMcut functions make it possible to adjust the cutting speed so that this effect does not occur.

Other Functions / Specialties

Of course, there are other functions necessary for the various machining methods.

However, a particular advantage of NUMcut is also the open Flexium+ system itself. Special functions customized to specific application cases can be implemented efficiently. This applies to all areas of the system from the real-time kernel to the HMI (Human Machine Interface). These extensions can be programmed by NUM or by the machine manufacturer himself and

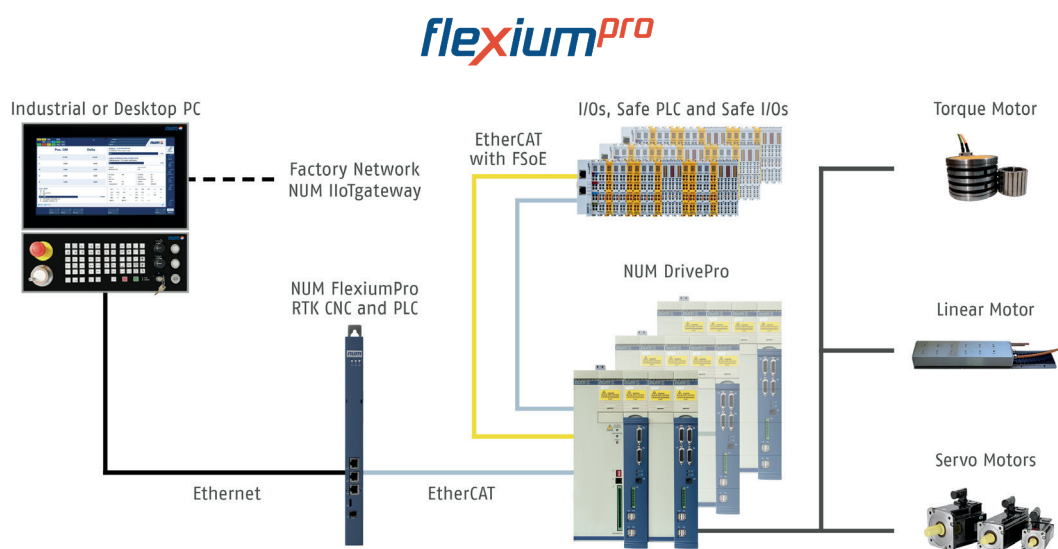
can be integrated into the overall system through a special encryption method as copy-proof.



CNC-Systems

Flexibility, Productivity and Safety

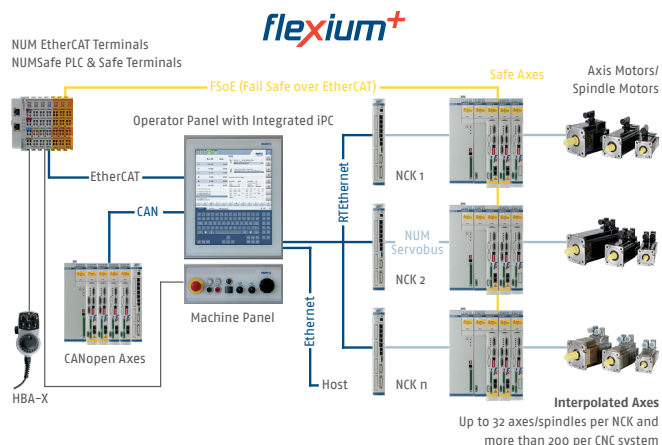
Flexium+ and FlexiumPro – Extreme Scalability



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.

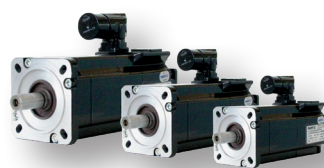
NUM has more than 50 years of experience developing servo and spindle motors. We pioneered the development and production of AC brushless servo motors, as well as synchronous spindle motors with flux weakening.

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.

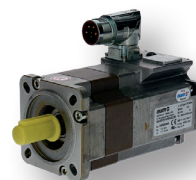
The **asynchronous motors** of the AMS series offer excellent quiet running at low speed, quick and accurate positioning and are ideally suited as a C-axis and for spindle indexing.

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.

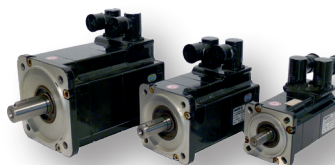
The NUM **LMX linear motors** are specially designed for machine tools. Among other features, they are characterized by a fully enclosed primary, a cooling circuit with large diameters to accommodate fluids with low specific heat capacity, a short pole pitch to increase the force density and reduce temperature,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



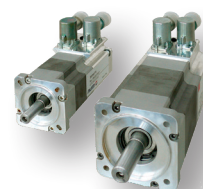
Motors of the series SPX "single cable"



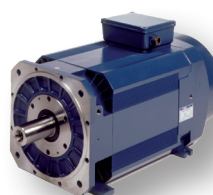
Motors of the series SHX "single cable"



Motors of the BPX series



Motors of the BHX series



Motors of the AMS series



TMX torque motors



LMX linear motors

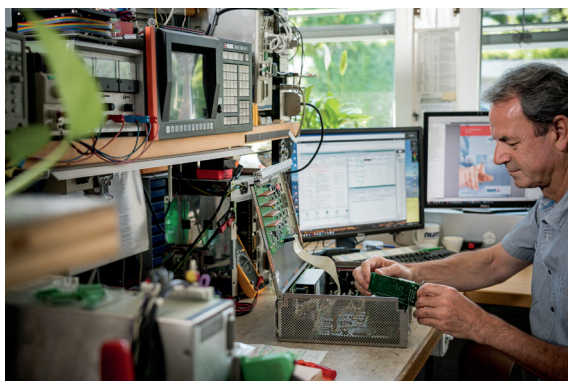
NUM Services

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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