

flexium⁺

CNC SYSTEM



www.num.com

num [®]
CNC HighEnd Applications

NUM Solutions and Systems

Established Worldwide

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

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It's these core attributes that have earned NUM its exceptional reputation within the machine tool industry. We develop customized automation solutions that ensure a high degree of added value to both the machine manufacturer and the user. In 1961, ten years prior to NC control finding wide acceptance among users, NUM developed the first CNC controller. With a commercial 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 extend on this success. Leveraging decades of expertise, we put our motto "NUM automation solutions provide machine builders with a competitive advantage" into practice. Today's system flexibility, combined with our expertise, enable us to automate a widely varied range of machines, whether it's a classical machine tool application or any other multi-axis automation motion. Our long, successful track record, over vast application references, impressively supports this claim. We will continue to develop the readiness and flexibility of our systems in this direction and make the necessary investments in R&D as well as in our staff.

As an international company headquartered in Switzerland, we have worldwide sales, application development and service locations (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 strategy that the development and production of all core products in the CNC system, including the drives and motors, remain under our control. This approach enables us to quickly expand and improve any aspect of our system, keeping it flexible to adapt to all new challenges in the market.

The resultant synergy of the machine manufacturer and NUM's locally available engineering expertise, combined with the extremely versatile NUM automation system, is sure to produce optimum machine solutions.

Customized Projects

NUM supports you with your projects in a way that is ideal for both your business and infrastructure. However, the goal of our cooperation always remains the same: to work with you to find the most efficient solution.



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 entire know-how in the 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 co-operation has proven to be extremely efficient in many projects.

Total solutions ALLDESIGN

Delegating responsibility – controlling result

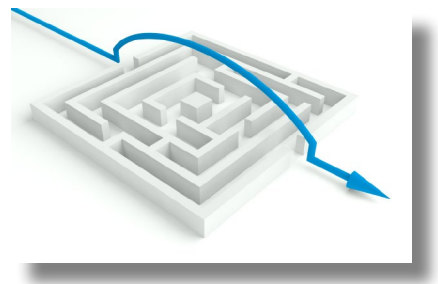
We assume the entire project management in the sense of a general contractor and are fully responsible for the successful implementation. Starting with the development of the requirements specification, over the development and commissioning, up to support and service.

NUM Solutions and Systems

Intelligent and Creative

We have developed countless customer- and application-specific solutions for many different industries and by doing so, mapped out practical solutions for professional requirements. As a result, our engineers created groundbreaking total solutions for demanding applications.

All 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 – Flexible, scalable and adaptable for all types of transfer machines, including linear, 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

Flexium+ CNC System

A Compact Scalable CNC System

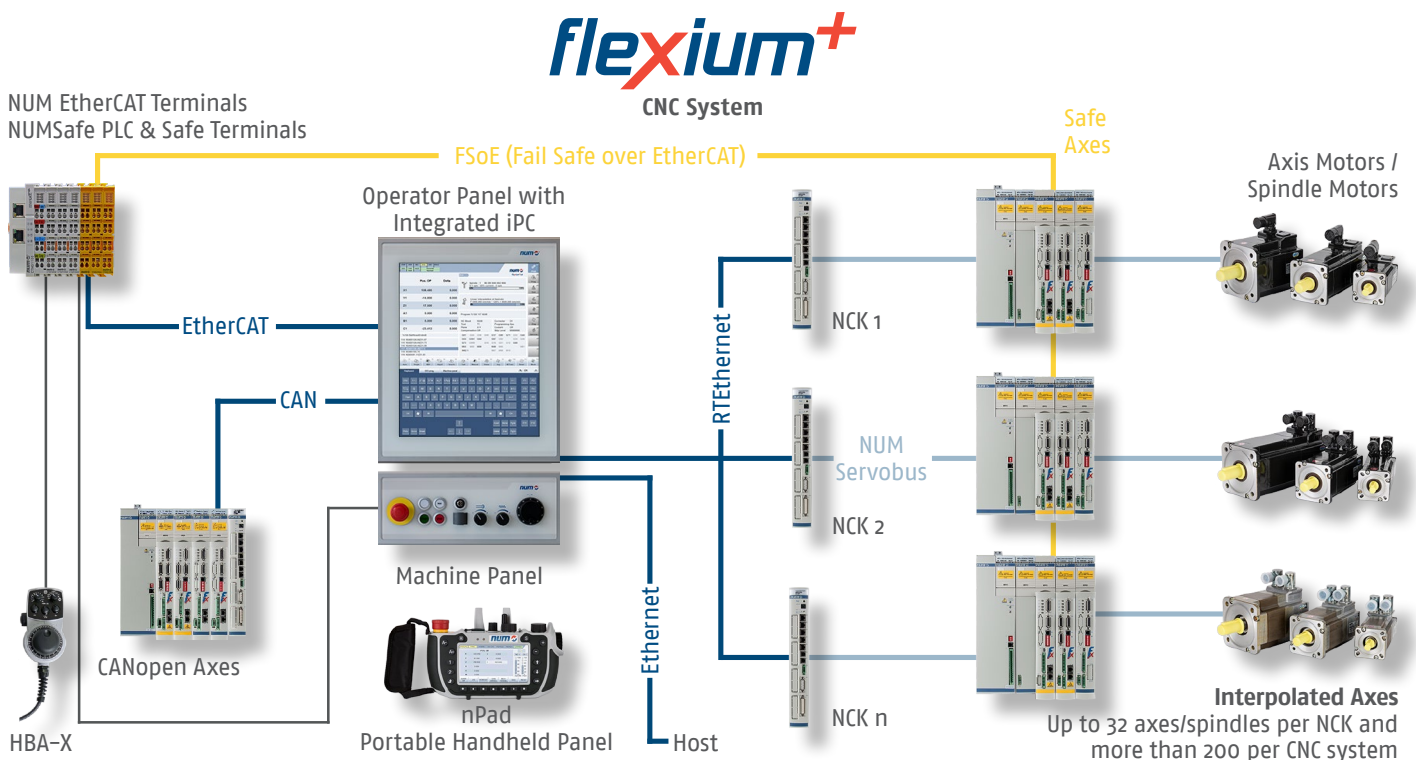
Flexium+ CNC is an essential element for NUM's solutions and systems. The Flexium+ system is easily scalable and can be fully implemented to the needs of each customer.

Platform

Flexium+ is built on the Flexium platform, with a field install base of more than 10'000 units. We took the best components, kept the elements behind the success of our previous CNCs, such as scalability, flexibility, unique CNC functions, standardized interfaces and PLC programming, then renovated and improved the complete system. Flexium+ has new and enhanced features, new panels, a new HMI, an enhanced servo bus, enhanced drives and simplified connectivity – all within a completely new safety-related architecture. There are three configuration levels – Flexium+ 6, Flexium+ 8 and Flexium+ 68 – to provide optimum cost/performance ratios.

Architecture

Its compact dimensions are the result of a design aimed at limiting energy requirements of the Flexium+ system. Using the newest generation processors to power intelligent and evolutionary hardware ensure return on investment and long system life; both coinciding with NUM's philosophy. Increased CNC functionality offers improved flexibility, scalability and accuracy. In particular, we have extended the concept of axis or spindle to allow control of up to 32 spindles per NCK unit (NCK for NC Kernel) and make spindle/axis commutation even easier. We have also improved internal computing resolution, increased "servobus" speed, and much more. The freedom to link several NCKs together in a global configuration has of course been maintained, enabling, for example, control of large transfer systems with more than 200 interpolating axes.



Flexium+ CNC System

Universally Applicable

Freely scalable systems ranging from 1 to over 200 CNC axes and spindles.

The system controls the NUMDrive X digital drives via up to three RJ45 ports, allowing for distributed drive sets on the machine. In addition to the digital interface, two interfaces are provided for analog control. If more analog axes are needed, they can be integrated into the system via additional hardware. The PLC complies with the IEC 61131-1 standard and communicates via efficient standardized interfaces. The single development environment provides different access levels for machine integration, setup and maintenance. Additional analog axes can also be integrated into the overall system via additional hardware.

The human-machine interface is provided via PC panels, including a revolutionary 19" unit and companion machine panel, all running modern fully redesigned HMI software. There is a choice of machine panels and portable units, and the renowned Flexium 3D simulation package rounds out the portfolio.

Basic characteristics

	Flexium+ 6	Flexium+ 8	Flexium+ 68
Axes + Spindles per NCK	4 + 1	5	32
Spindles per NCK	1	1	32
Axes + Spindles per system	N/A*	N/A*	> 200
Interpolated Axes per NCK	4	4	32
Interpolated Axes per system	N/A*	N/A*	> 200
Channels per NCK	1	2	8
Channels per system	N/A*	N/A*	> 50
CANopen axes/spindles per system	> 100	> 100	> 100
CANopen interfaces	1	1	2
EtherCAT interface	1	1	1
Smart Factory communication	Yes	Yes	Yes
Servobus digital ports per NCK (DISC NT)	3	3	3
Measurement Inputs per NCK	2	2	2
Handwheels per NCK	2	2	4
CNC Program Memory per NCK	40 MB	40 MB	40 MB
PLC Program Memory	1'024 MB	1'024 MB	1'024 MB

*N/A = not available because of only 1 NCK possible

Special features of Flexium⁺ include its NUMSafe security architecture and the ability to influence the real-time behavior of the system with applications.

A safe PLC (see page 16 for further details) is a safe PLC tightly integrated in the overall system architecture. It communicates with safe inputs and outputs, as well as with NUMDrive X units where the motion monitoring functions are executed. A single programming environment is provided for both "safety related" and "non safety related" logic.

NUMDrive X, featuring the new SAMX functional safety board, is a key component of this solution. It maintains all of the superb and well known characteristics of NUMDrive C – such as performance, scalability, modularity and reliability – and advances them even further.

Among other new features, we have doubled the drive's computing power, increased its resolution and bandwidth, and expanded its I/O capabilities. Unified firmware for both mono- and bi-axis drives simplifies version management.

Last but not least, thanks to an innovative communication protocol that accommodates encoder power and data on just two wires, we have managed to completely eliminate dedicated encoder cables. Motors and drives can now be linked with a single cable, simplifying installation and saving considerable time and money.

Influence on real-time behavior

Flexium⁺ allows users to alter the real-time behavior of the system to their required needs by using application macros. This option exists at both the CNC level, using dynamic operators, and the drive level, using DEMX (Drive Embedded Macros). An important advantage is that the firmware of the system is not changed – this, in turn, greatly simplifies the servicing of such systems.

For example, at the CNC level the programmer has a direct ability to influence the interpolator outputs in real-time. In this way, the driving behavior of the machine can be directly influenced by user-specific software, this effect is similar to that of tool correction. Among other things, special outputs on the CNC can also be addressed immediately as a function of a real-time signal. Real-time at the CNC levels interpolation clocking of the CNC. If we then go one level down to the DEMX functions, this allows real-time position control clocking of the drives. The DEMX functions allow users to create their own macros in real-time to interact with all physical and virtual drive resources and to even change the control algorithms. Additionally, filters, monitoring functions, test points and much more can be created according to defined rules.

Flexium+

Flexibility and Productivity

With Flexium+, safety is further supported through simplified programming, wiring, setup, plus the addition of new functions. Let's take a more detailed look at the different components of the Flexium+ system:

Flexium+ NCK: The CNC unit

Flexium+ NCK is the heart of the system. In a compact design compatible in size with the NUMDrive X components, it packs a powerful engine, up to 40 MB of user memory, connectivity for up to 32 axes or spindles, and the PLC link – all delivered via standard RJ45 ports. Additional Ethernet and clock synchronization ports for multi NCK operation, two analog axis ports and two probing inputs, as well as 16/16 digital I/O ports for direct part program access, four analog inputs and two analog outputs complete the line up. Efficient hardware is only one side of the solution; the reengineered Flexium+ firmware also provides new and innovative features.

Flexibility

This recognized attribute of NUM products has now been pushed even further. With Flexium+ the consideration of axes or spindles have been totally revised, so it might be necessary to find a new name. Any of the 32 connected devices can alternatively be an axis or a spindle. This makes spindle/C axis commutation even easier, but more importantly it opens the door to new possibilities – sophisticated transfer machines being one amongst many.

As a direct consequence, a single Flexium+ CNC is able to control up to 32 spindles. Among the four spindles of each channel, one will be the master on which all advanced functions (CSS, Threading, etc.) will be performed, the other three being declared as auxiliaries. They are controllable in speed, direction and indexing. Of course at a given time, any spindle can be master or auxiliary. And exchanging spindles or axes between channels is just an M code away.

Flexium+ provides up to eight channels, each able to handle up to nine axes, a main spindle and three auxiliary spindles. Each channel runs its own part program at its own speed, but can be synchronized whenever necessary. Thanks to the ad-

vanced programming function, this structure offers numerous possibilities, including the ability to pass one or more axes from one channel to another on the fly. The transfer of axes to another channel also works with multi-NCK systems. Axes can thus be transferred from one NCK to another – this feature is particularly important for transfer machines. Moreover, the different channels can function totally independently.

Programming/Operation

The controller provides more extensive programming functions and options. The user can program the control both in ISO, with high-level language extension, and in completely menu-driven form, i.e. without programming knowledge. In order to make the machine as user-friendly as possible for the user, both the ISO language and the menu-driven programming can be extended and adapted to the respective application. The unique flexibility of the system is also reflected in this area.

Flexium 3D helps secure safe machine operation by creating a 3D view of the final part while checking for interferences, collisions and other incidents. Further details are given later in this brochure.

Speed and accuracy

There is no longer any need to compromise between extended travel and high resolution, or between high traverse rates and highest possible accuracy. New algorithms have been implemented to extend performance in all areas. Detailed technical information is contained in the catalog.

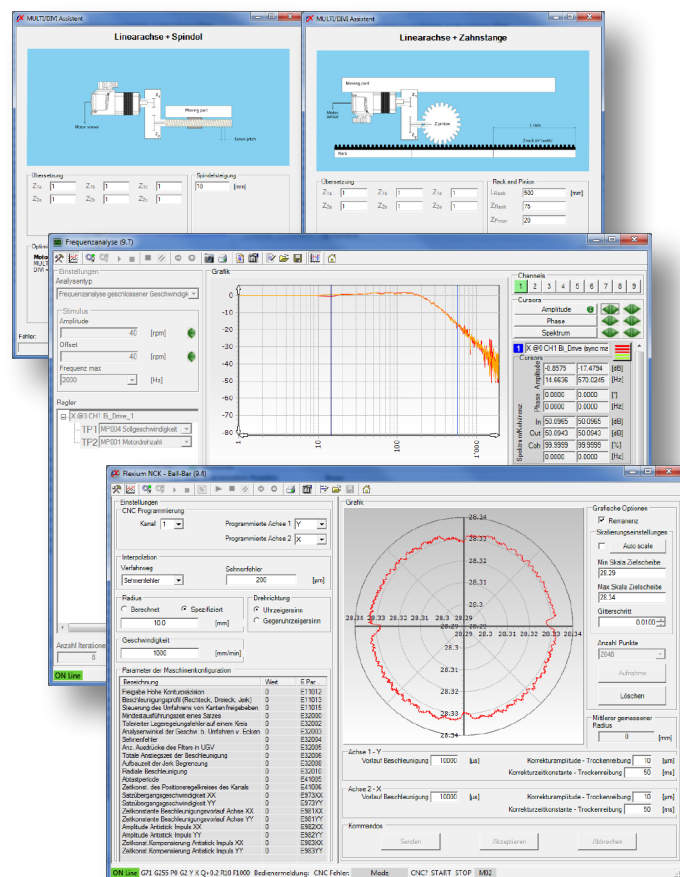
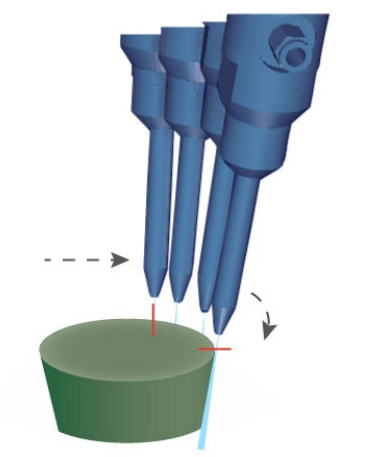
Axes control

Enhanced acceleration algorithms with increased resolution allow the "jerk" value to be fine tuned for optimal block transitions, while limiting mechanical stress.

The Flexium+ software development package Flexium Tools, has a powerful toolset, which includes dedicated tools for optimizing and checking servo response. Operating closely with the digital drives, they provide monitoring of the drives' internal values, oscilloscopes to check responses, a Ballbar function, and Contour accuracy checking to verify machine reaction at specific stages of operation.

Machining packages

The system offers a number of software and function packages tailored to specific machining processes such as turning, milling, grinding, cutting, gear machining, etc. Many of these packages provide special functions. For example, the cutting package (water jet, plasma, laser, etc.) includes functions such as automatic compensation of the conical shape of the cutting jet, as well as "Fly Cutting" or "Frog Jump".



And much more

Other components of Flexium+ are described later in this brochure. However, there is insufficient space to list all the benefits this unique system could bring you. Please don't hesitate to contact us – we will be happy to demonstrate our product in more detail so that you can understand why NUM is your ideal partner for high-end CNC applications.

A unique development environment

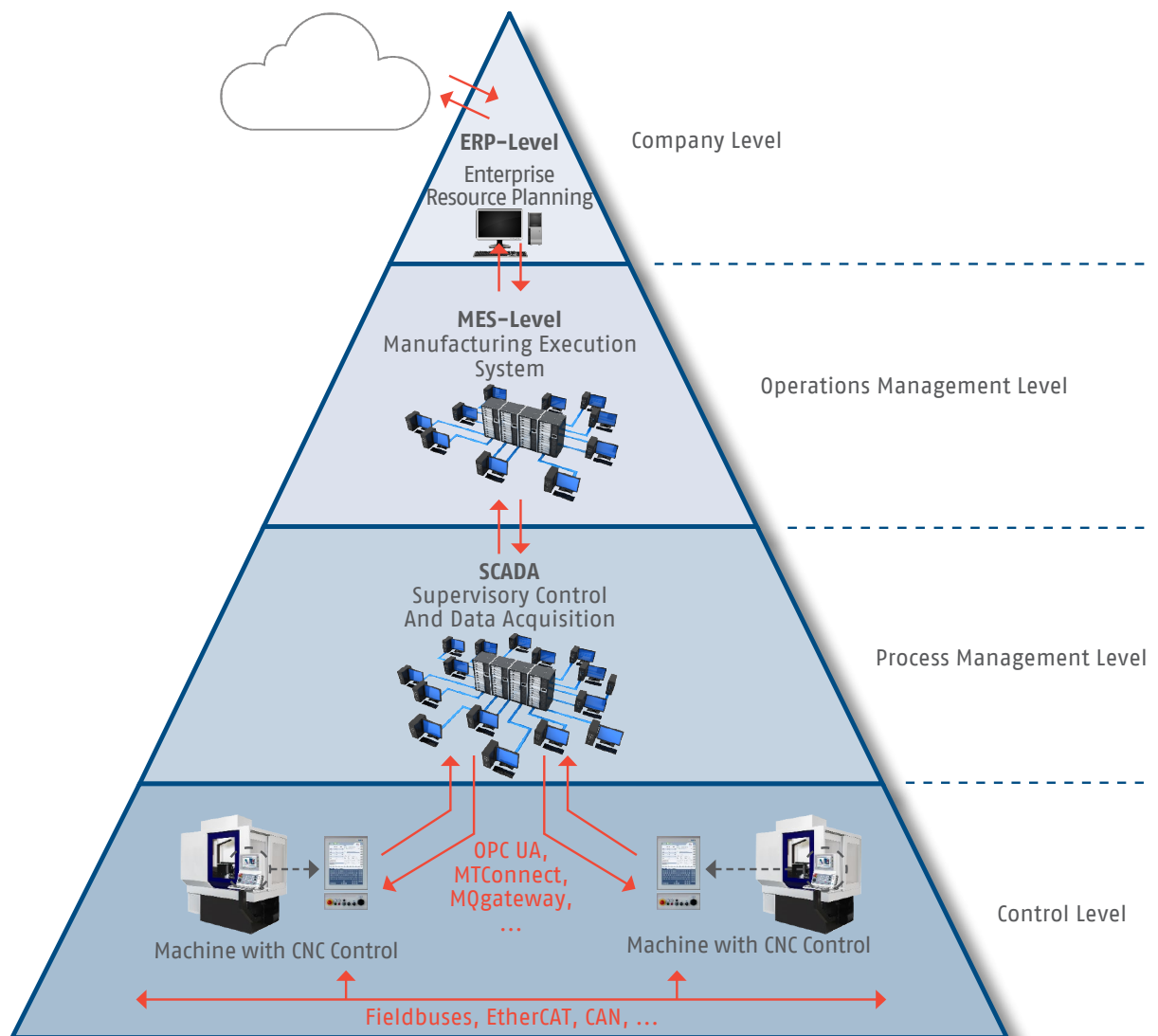
The complete Flexium+ system is configured via Flexium Tools. All CNC, servodrive, I/O, PLC (IEC 61131) and relevant safety logic setup and programming tasks are performed using a centralized toolset.

Flexium+ Smart Factory Boundless Communication

The Flexium+ CNC control system is PC-based and is compatible with a wide range of communication options; thus making it a viable option for implementation in a Smart Factory.

The precise beginning and end of this digital transformation cannot easily be determined. The changes are coming successively, have already begun and/or are based on already implemented solutions. Over time, the entire production logic will change: in the future, intelligent machines, storage systems, operating resources, etc., will be organized inde-

pendently in real-time-capable systems along the entire value-added chain. The ultimate goal is the Smart Factory. This is characterized by flexibility, resource efficiency and ergonomic design. Control system technology plays a major role in the success of Industry 4.0. It will ultimately control the machines that produce the real products. Anticipated benefits include

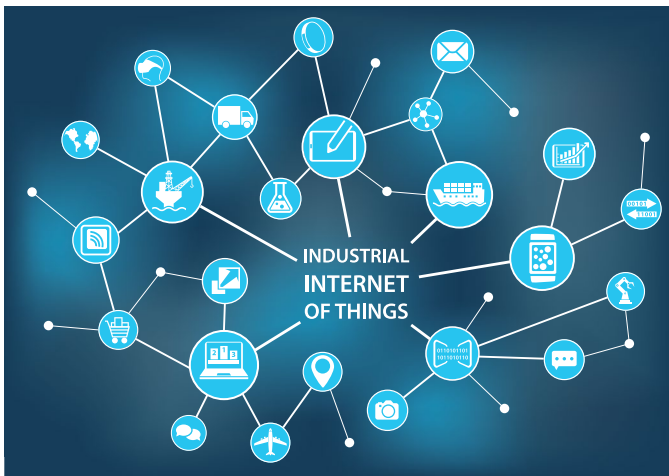


improved effectiveness, innovation leaps, increased information transparency and competitive advantages.

NUM's CNC controllers have always distinguished themselves through their openness and their versatile communication possibilities. These points have been continuously enhanced from one generation of controllers to the next. The Flexium+ CNC control system is PC-based and includes a wide range of communication options, thus satisfying the basic prerequisite for a possible Smart Factory. Fieldbuses such as EtherCAT or CAN are mostly used for horizontal integration. Vertical communication to SCADA, MES and ERP systems can be carried out via OPC, MTConnect, MQgateway (MQTT Interface) and other freely definable communication interfaces – which can be implemented efficiently and comprehensively using NUM's FXserver.

MTConnect is a protocol for data exchange between production facilities and software applications for monitoring and data analysis. MTConnect only allows data to be read from the CNC control, not written to the CNC control.

MQgateway is based on the MQTT protocol. MQTT is an open message protocol. It is designed for connections with remote locations. An interesting aspect of an MQTT server ("broker") is that it caches the data of its communication partners and can thus be used as a status database. It collects data from various devices and creates a complete situation picture. The data can be subscribed to at the MQTT broker and evaluated after receipt. On the other hand, control variables from one or more communication partners can also be transmitted to the MQTT broker and distributed to the individual devices. This makes MQTT very suitable for automation solutions.



OPC UA is a platform-independent standard based on TCP and differs considerably from its predecessors. In particular with its ability to transport not only machine data (control variables, measured values, parameters, etc.), but also with its ability to write machine and human-readable descriptions.

Fully Integrated 3D Simulation

Collision Detection Avoids Machine Damage

Flexium 3D is fast, three-dimensional graphical simulation software that can be used for applications such as milling, drilling, turning, waterjet and plasma cutting, and more.

The 3D software simulates the exact code that the controller is listing and not an intermediate code – which is the case with many other simulations. Thus the simulation corresponds exactly to the expected workpiece.

Office version

Flexium 3D can be used as a standalone program in production planning, without a CNC, to verify and optimize manually written or CAM generated part programs with direct source reference.

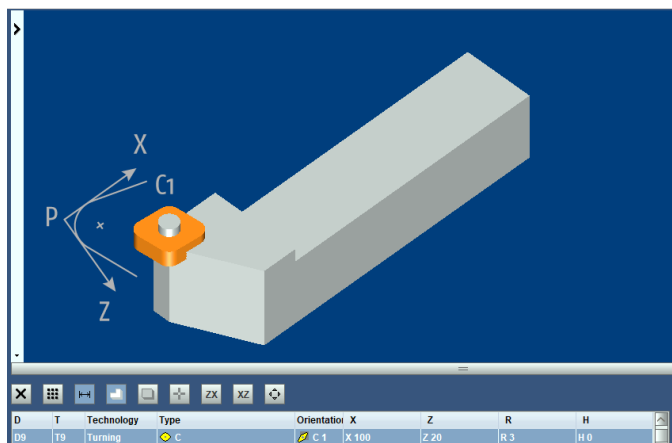
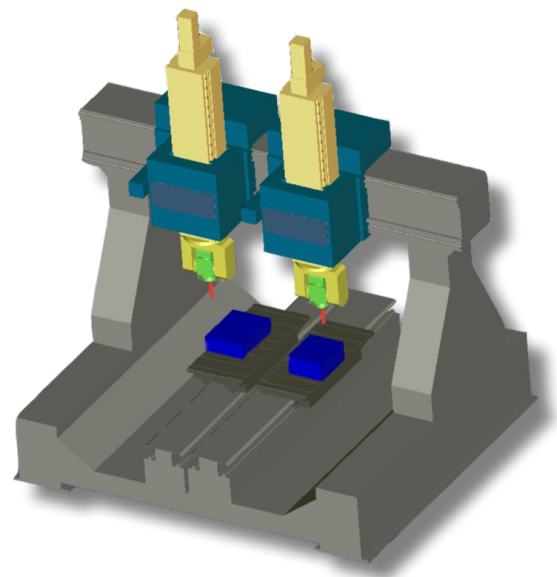
Machine version

Here, Flexium 3D forms an additional part of the Flexium HMI and is connected to the CNC. Flexium 3D can be used as pre-simulation program A (even during part processing program B) or to provide simultaneous online simulation during part processing.

During part program simulation you can visualize the path of the TCP (tool center point), simulate material removal from the work piece, and check for collisions between machine components, part and tool.

Milling/Drilling

Flexium 3D simulates part programs for standard turning, and milling in 3, 4 and 5 axis machines. On top of this, it offers full support for systems incorporating inclined plane, RTCP or combined mill turn machines.

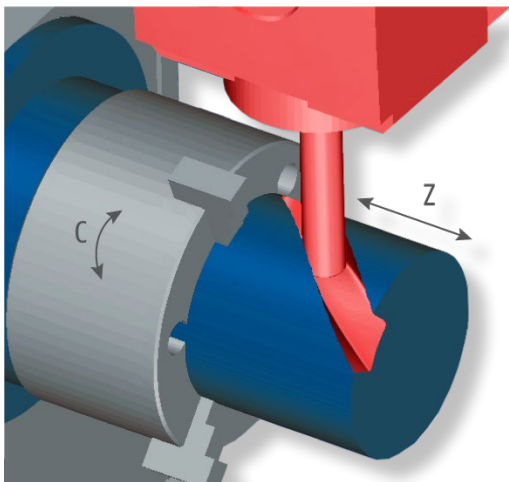


Turning

3-5 axes simulation of part programs. Includes simulation of grooving, thread cutting and tapping movements and cycles.

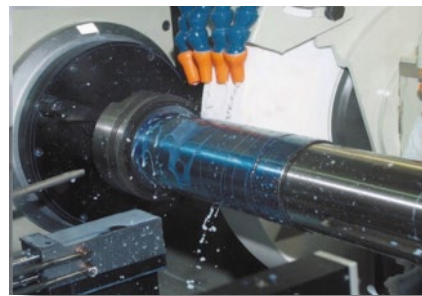
Cutting

2D/3D visualization of cutting contour. Configurable moving zoom window of TCP environment to illustrate local contour when comparing huge work pieces.



Grinding

Complete off-the-shelf solution with integrated grinding and dressing cycles controlled by user-friendly menu-driven data entry and wizard-driven setup.



Flexium 3D simulation main features

- Workpiece and Machine views
- Tool Editor
- Blank Editor
- Machine Editor
- Tool center point path (TCP) visualization/display
- Material removal
- Collision detection

Touch-sensitive Operating Panel

19-inch Touch Panel

With the 19-inch capacitive multi-touch screen system, NUM has set a new standard for operating panels in the machine tool industry. A compact and scalable PC panel accommodates multi-processor technology under Windows 10 OS.

With this multi-touch control panel you can operate the system in the same manner as you would your Smartphone. It has an IP65 degree of protection at the front, and IP20 at the rear. High-quality 4 mm hardened glass protects the front, without introducing any disturbing reflections. A narrow brushed aluminum frame with rounded edges provides complete side protection for the glass and multi-touch sensor. All necessary printing on the protective glass complies with NUM corporate design and color standards, and is executed with durable ceramic inks, using screen printing technology. The 19" touch panel presents a modern face to the world. NUM has completely revised its Flexium HMI panel software, in line with its design guidelines, to accommodate dual touch gestures such as "Drag & Drop", "Wipe", "Zoom" and "Rotate". Of course, touch gestures are only interpreted at the panel software level, so the system is still capable of handling faster or more direct forms of input. All HMI context levels have been adjusted to the new design for improved usability and operator convenience. The context levels of the HMI complete the design and contribute to an improvement of usability and overall comfort for the user.



MP05 Glass Operating Panel

To accompany the new touch panel, NUM has launched the MP05 machine operation panel. This uses the same 4 mm hardened safety glass as the and has the same IP65 protection level at the front. The glass is scratch resistant and screen printed on the reverse – again, using durable ceramic inks and to NUM's corporate design and color standards. Four-sided glass protection is afforded by the brushed aluminum frame with rounded edges. A solid aluminum back plate ensures correct stiffness.



Virtual keyboard/Virtual machine panel

As an option, a complete virtual machine operating panel with softkeys is available. Implemented with the same NUM design guidelines as the keyboard, this virtual machine panel eliminates need for an MP04 machine panel, reducing cost considerably. In addition to the virtual machine control panel, the system has virtual QWERTY and ISO keyboards – this provides the user with the right keyboard in every situation. However, machine builders will discover that the new panel is an easy mechanical fit in cabinets. Users will re-experience the power of NUM products.

Further control panel solutions

In addition to the 19" control panel, 12" and 15" control panel solutions are also available.

Flexium Tools – A Single Programming Environment for Everything

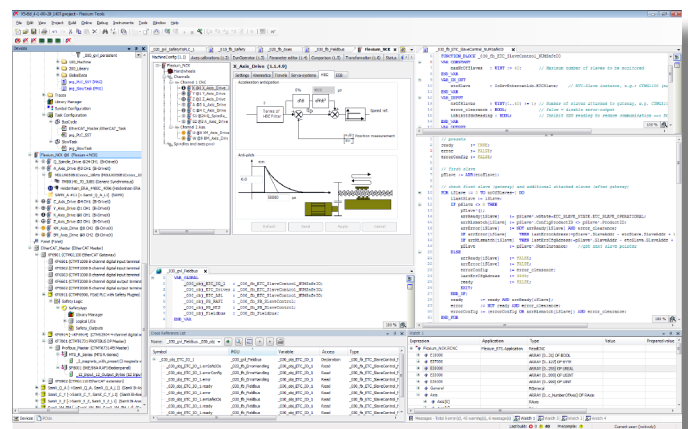
As a machine manufacturer, you can configure and program the entire Flexium⁺ system using a single software tool (Flexium Tools). All CNC, servodrives, I/O and PLC (IEC 61131) setup and programming tasks are performed using a centralized toolset.

The programming of the PLC offers libraries for system functions, customer functions, and your own programming functions. The program is easy to structure using program blocks, functions and function blocks. The programming is supported from the instruction list up to the project-oriented programming.

The programming of the safety-related logic is also done with Flexium Tools. The safety application is easily constructed using function blocks such as E-Stop, Operation Mode, AND, OR, etc. Programming the safe PLC is then simply a matter of linking inputs and outputs to these blocks, which can be chained in order to create complex functions.

The safety application is then downloaded to the safe PLC via EtherCAT.

A very large selection of instruments are available to facilitate commissioning, including: Frequency analyzer, circularity test, contour accuracy and much more.



NUMSafe

The Safety Architecture

Flexium⁺ integrates comprehensive solutions for the functional safety management of each machine type.

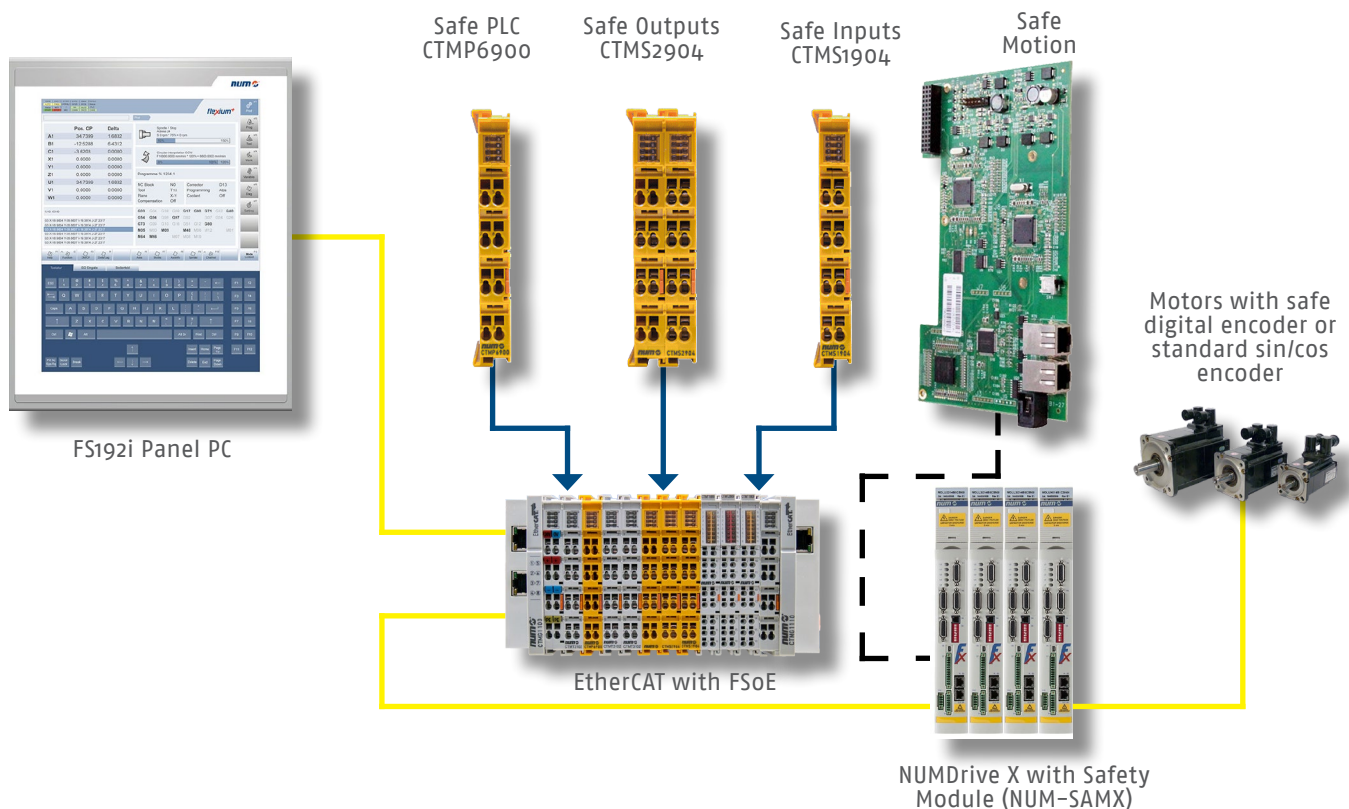
NUMSafe provides hardware and software solutions for implementing standard automation and safety technology in the Flexium⁺ system. Offering a wide range of benefits in terms of scalability, flexibility and reduced wiring needs, NUMSafe also provides a common programming environment for all system devices.

Architectures with mixed standard and safety related signals and components are possible; the NUMSafe PLC (CTMP6900), the NUMSafe Input (CTMS1904) and the NUMSafe Output (CTMS2904) can be positioned inside a standard terminal line up, that by means of a NUM EtherCAT gateway communicate

with the automation PLC, other EtherCAT gateways, servodrives and safety related components. The safety related motion functions are realized inside NUMDrive X by means of the NUM-SAMX board.

All safety related information is transmitted over the standard EtherCAT connection, with data reliability ensured by use of a Fail Safe over EtherCAT protocol (FSoE); wiring is reduced to a minimum, while flexibility and scalability are maximized.

NUMSafe is compliant with EN 13849-1 and EN61800-5-2 up to PL e and SIL 3 respectively.



Safe motion functions

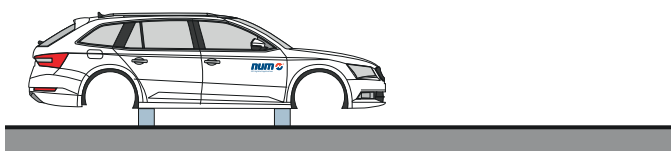
The safe PLC contains the programmed logic of the safety application, while the safe motion monitoring functions are handled by the NUM-SAMX board built into NUMDrive X servodrives.

The available monitoring functions, according to EN 61800-5-2, are: Safe Torque Off (STO), Safe Operating Stop (SOS), Safe Stop 1 (SS1), Safe Stop 2 (SS2), Safely-Limited Speed (SLS), Safely-Lim-

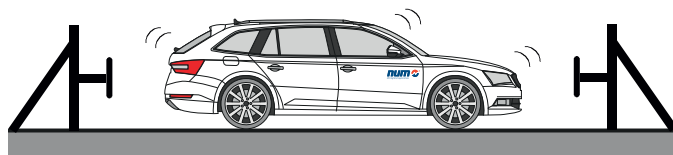
ited Position (SLP in preparation), Safe Direction Monitoring (SDM), and Safe CAMs (SCA).

The safe motion functions can either be realized using synchronous motors, to which standard sin/cos encoders are connected, or, in the case of SHX/SPX (single cable motors), with safety encoders.

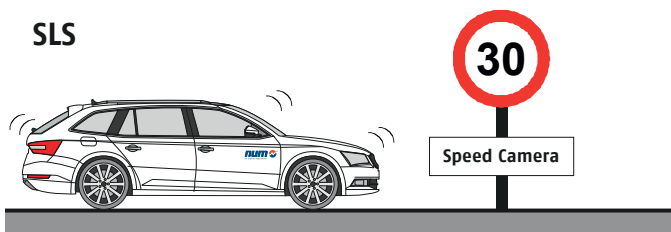
STO



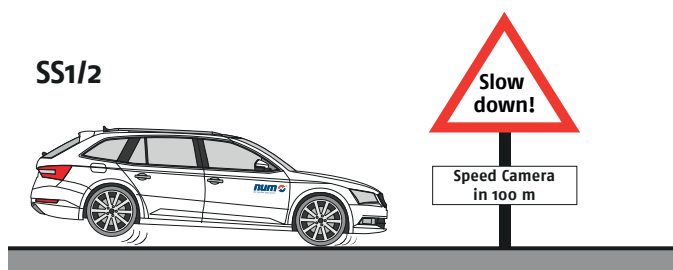
SLP



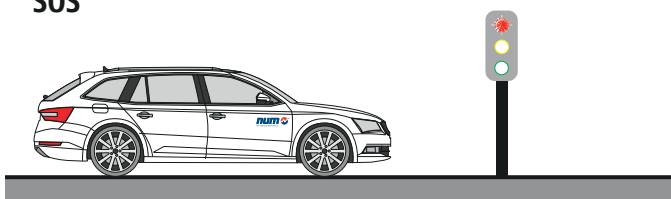
SLS



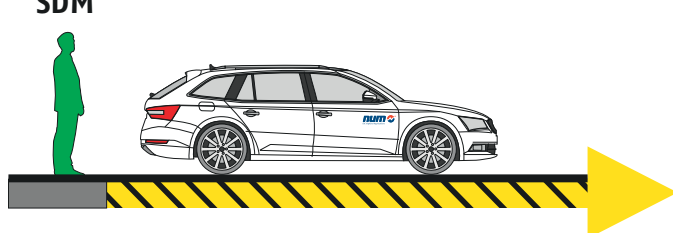
SS1/2



SOS



SDM



NUMDrive X

Compact and Scalable

NUM's drive – NUMDrive X – is the result of more than 20 years' experience in developing full-digital drive systems. This compact and modular drive is fully scalable – different performance versions are available to suit any type of machine tool application.

A high degree of integration and efficiency has allowed us to achieve an extremely compact design that makes NUMDrive X one of the smallest high-end drives on the market. Its small installation depth and scalable width (a multiple of 50 mm) simplify cabinet layout.

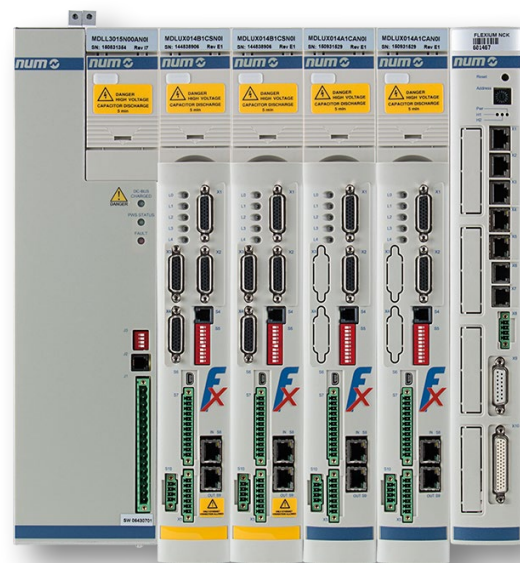
A wide range of power modules, available in Mono-Axis and Bi-Axes versions and with continuous current ratings from a few amperes up to 200 Arms, enables each application to be technically optimized at the lowest cost.

NUMDrive X offers the choice of three performance levels: enhanced-performance drives (EP drives), high-performance drives (HP drives) and standard-performance (SP drives). The EP and HP versions are designed for sophisticated and complex applications in precision machine tools. Featuring high internal resolution, a short sampling time and specially developed algorithms, they offer outstanding regulation performance and very wide current, speed and position loop bandwidths, as well as a number of built-in application-specific functions.

With the EP drive, velocity control loop bandwidths of >700 Hz can be achieved. By means of DEMX programming, customer-specific real-time adaptations of the drive amplifier can be implemented directly into the drive. This flexibility allows the drive controllers to be perfectly optimized for any application (e.g. special filters, speed observer, and more).

The different versions are intended for systems and precision machine tools of medium complexity, and are especially suitable for cost-sensitive applications. NUMDrive X provides safe functions by means of two options: a basic board for implementing the Safe Torque Off function (NUM-STO), and a powerful board (NUM-SAMX) which provides a huge number of safe motion monitoring functions.

NUMDrive X is a modular drive system optimized for multi-axis applications. Use of a common power supply unit means that only one mains connection, one line filter and one braking resistor are required per system, reducing cabling and overall costs.

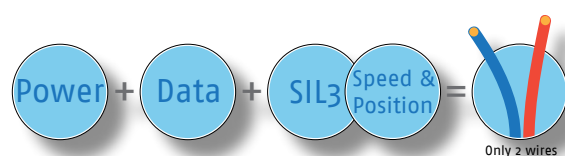


The system's modularity also facilitates energy exchange between different axes via the DC bus, offers the possibility of using stored energy for retraction purposes, and – in the case of regenerative power supplies – allows energy to be re-injected into the mains to reduce machine operating costs.

Significantly reduced wiring effort

Every machine builder has experienced the complexity of encoder wiring and knows that it takes time and effort to install and debug satisfactorily. NUMDrive X introduces a revolutionary innovation to overcome these issues. The drive handles a full digital encoder interface which uses a two-wire communication protocol. The two wires are integrated in the power cable, so there is only one cable connecting the drive to the motor. Furthermore, the two-wire connection handles the encoder supply voltage, as well as high resolution position, redundant position (for safe applications), motor thermal sensor and diagnostic data. Encoder wiring now becomes a very simple task. Elimination of the encoder cable means that there is no longer any need

to crimp and solder a large number of wires – the power cable merely contains two additional shielded wires, which are connected by screw terminals on the drive side. Aside from reduced installation time and cost, other advantages include reduced cabling costs, smaller cable carriers, lower moving masses, better reliability and electromagnetic immunity, and higher resolution control.



NUMDrive X Mono-Axis	Rated Current (S1) Arms	Maximum Current Arms	Overall Dimensions (W x H x D) mm
MDLUX007A...	4.4	5	50 x 355 x 206
MDLUX014A...	8.9	10	50 x 355 x 206
MDLUX021A...	13	15	50 x 355 x 206
MDLUX034A...	13	24	50 x 355 x 206
MDLUX050A...	28	35	100 x 355 x 206
MDLUX075A...	34	53	100 x 355 x 206
MDLUX100A...	45	71	150 x 355 x 206
MDLUX150A...	60	106	150 x 355 x 206
MDLUX200A...	100	141	200 x 355 x 206
MDLUX400A...	200	282	300 x 355 x 206
NUMDrive X Bi-Axes	Rated Current (S1) Arms	Maximum Current Arms	Overall Dimensions (W x H x D) mm
MDLUX014B...	6.3 + 6.3	10 + 10	50 x 355 x 206
MDLUX021B...	6.3 + 6.3	15 + 15	50 x 355 x 206
MDLUX050B...	20 + 20	35 + 35	100 x 355 x 206
MDLUX075B...	29 + 29	53 + 53	150 x 355 x 206
Power Supply	Rated Power (S1) kW	Peak Power kW	Overall Dimensions (W x H x D) mm
MDLL3005M00A...	5	6	100 x 355 x 206
MDLL3015N00A...	15	50	100 x 355 x 206
MDLL3030N00A...	30	50	100 x 355 x 206
MDLL3025N00R...	25	50	200 x 355 x 206
MDLL3050N00A...	50	97	200 x 355 x 206
MDLL3050N00R...	50	97	200 x 355 x 206
MDLL3025N00H...	25	50	200 x 355 x 206
MDLL3050N00H...	50	97	200 x 355 x 206
MDLL3120N00H...	120	190	300 x 355 x 206

A... = Passive power supply

R... = Regenerative power supply

H... = Regulated DC Bus power supply

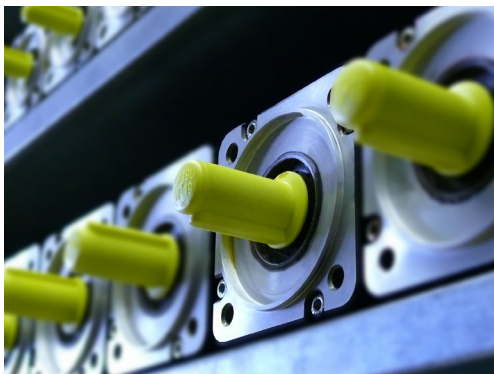
NUM Motors

Perfect for All Applications

NUM produces a comprehensive series of motors, all of which offer excellent performance/volume ratios and superb dynamic abilities. When combined with NUMDrive X servodrives, these motors provide excellent stability even at very low rotational speeds, and can be easily integrated into machines.

Brushless axis motors

NUM axis motors offer an excellent volume/performance ratio and provide very smooth running even at low speeds. The motors of the BHX/BPX series complete the range, and in addition to an advantageous price/performance ratio are characterised by a mass moment of inertia that is optimized for the machine industry. All NUM axis motors feature very compact designs; their overall length has been reduced to an absolute minimum, and most are available with or without a brake. The flange dimensions are oriented to those usual in the market, opening up possible new fields of application. The spectrum of all motor types extends from 0.5 Nm to 160 Nm constant torque.



Spindle motors

The asynchronous motors of the AMS series offer excellent smoothness of running at low rotational speeds, quick and accurate positioning, and are extremely well suited as a C axis and to spindle indexing. The spectrum ranges from 2.2 kW to 55 kW.

Motorspindle®

The active parts of the motor are integrated directly in the spindle, which ensures increased rigidity of the machine and greater quietness of running. On request NUM is pleased to develop special motor spindles.

bhx
bpX

Torque motors

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 TMX motors are complemented by an extensive range of torque motors from our partner company Schaeffler Industrial Drives (IDAM), who's customers include many well-known European machine builders.



NUM TMX series



SCHAEFFLER

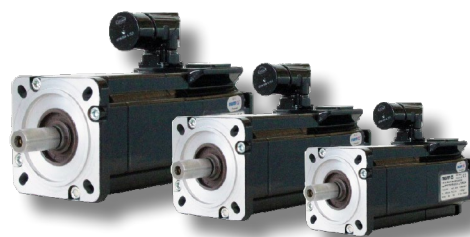
Schaeffler series

In addition to the standard products described below, NUM builds customized motors to suit customers' specific requirements. Please contact NUM for information about special and built-in motors.

Brushless axis motors

Motors

To perfectly match the new NUMDrive X, two new motor families have been marketed: SHX and SPX. Their characteristics are respectively similar to the well known BHX and BPX servo motors but the connection is realized with a "single cable solution" as more detailed explained in the previous pages.



Motor range	Main characteristics	Typical applications	Continuous torque	Frame sizes	Available options
BHX/SHX	Very compact, smooth operations, high inertia, IP64	Feeding axes for cost-effective machine tools	From 1.2 Nm up to 20 Nm	75 mm, 95 mm, 126 mm and 155 mm	Holding brake, keyed shaft, medium and high resolution single and multi turn encoder
BPX/SPX	Extremely compact, high peak torque, smooth operations, high inertia, IP67	Feeding axes for high-end machine tools, grinding machines, robotics and special machines	From 0.5 Nm up to 23 Nm	55 mm, 75 mm, 95 mm, 126 mm and 155 mm	Holding brake, keyed shaft, medium and high resolution single and multi turn encoder
BPH	Compact, smooth operations, medium inertia, up to IP67	Feeding axes for high-end machine tools, grinding machines, robotics and special machines	From 1.3 Nm up to 100 Nm	75 mm, 95 mm, 115 mm, 142 mm and 190 mm	Holding brake, keyed shaft, medium and high resolution single and multi turn encoder
BPG	Compact, smooth operations, very high inertia, up to IP67	Feeding axes for high end machine tools, grinding machines, robotics and special machines	From 1.3 Nm up to 56 Nm	75 mm, 95 mm, 115 mm, 142 mm and 190 mm	Keyed shaft, medium and high resolution single and multi turn encoder
BHL	Very compact, high inertia, IP65	Feeding axes for large machine tools	From 85 Nm up to 160 Nm	260 mm	Holding brake, keyed shaft, medium and high resolution single and multi turn encoder

Maintenance of Value Decades of Support from NUM

When you choose NUM you are also choosing customer service that will continue to serve you long after your initial investment, we still provide service on some systems that are 20 years old. Our specialists can help you extend the life of your quality older machines with NUM Retrofits.

Effective and timely customer service ensures that waiting time is kept to an absolute minimum. NUM's logistics structure is optimized to reduce response times and accelerate project completion. As part of our service to customers, we offer new solutions for old systems. Our specialists use their knowledge and skills to restore even the oldest systems as quickly as possible – new or old, we are on the case.

New life with Retrofit

When machines start to age, even the best are likely to suffer repeated electronics failure, or insufficient flexibility and power. As a consequence, they are often left unused, even though mechanically they may well be superior to newer models.

performing a combination of these complete with a mechanical overhaul. The “new” machine will have significantly improved power, productivity, and reliability. A Retrofit is executed quickly and has a short payback period, making it an economically sound proposition. NUM Customer Service will then continue to service the machine for decades to come.



With a Retrofit from NUM, the machine's operational life can be extended significantly. Depending on the machine and the customer's performance and productivity requirements, it can be improved in three stages by replacing its control, additionally replacing its servodrives and spindle motors, or

NUM Services

Professional Global Support

NUM is committed to transferring its knowledge to its customers on a regular basis. CNC knowledge and special production expertise, as well as drive and application techniques, are all subjects of training programs taught by our specialists.

Global support from professionals

A perfect infrastructure is available to our experts in all competence centers for conducting professional analyses and training seminars. In order to efficiently support you around the globe, we employ the latest communication equipment, offering secure remote assistance via Internet. We can, of course, also advise you directly on your company premises.

Comprehensive training programs

Our training programs are adapted to the needs of our customers. They can include operator, maintenance, repair and service training and even PLC programming or modification of servomotors and drives.

NUM offers a range of custom training programs, tailored to the needs of the customer:

- CNC operation
- CNC programming
- PLC programming
- Commissioning and maintenance
- Creation of custom interfaces
- Made-to-measure customer training

Always technically up-to-date

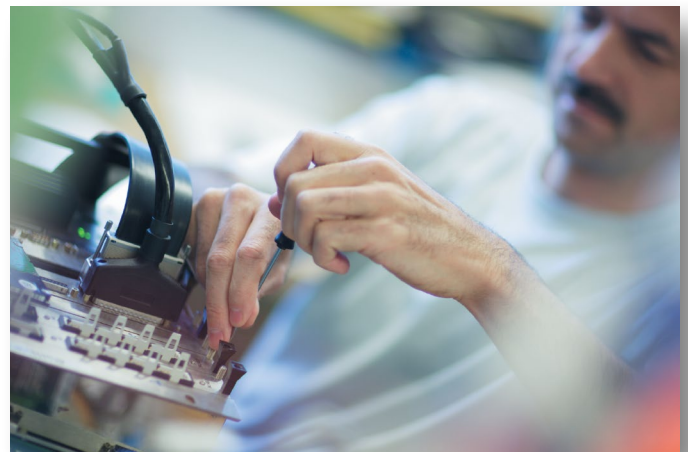
Our team of specialists actively informs you about the latest hardware and software developments, and provides useful engineering information.

Repair and spare parts service

In the rare event that a failure occurs in your CNC system despite proper maintenance, you can count on it being corrected by personnel from our global network of committed service professionals.

Customer service

Our worldwide service organisation is available for you and your markets. Our international customer service department ensures smooth commissioning and system integration, as well as providing telephone support, on-site service (also for older systems), product development, and software updates.



The department keeps up with latest product developments and maintains a large stock of material and components so that it can always meet your requirements and delivery expectations.

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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