flexium*pro*
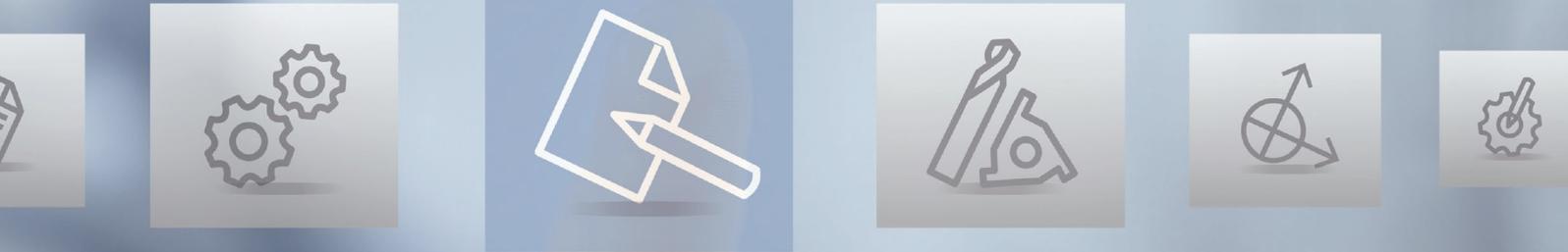
CNC SYSTEM

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!

num
CNC HighEnd Applications

And 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 the most varied machinery. Our long, successful track record supports this finding in an impressive manner. 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 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, CNC, drives and motors, **under our control**. This enables us to adjust the flexibility, performance and functionalities of the systems to new market requirements even in the short-term.

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

Customized Projects

NUM supports you with your projects in a way that is ideal for both your business and infrastructure. 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 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 support and service.

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 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 phases 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

FlexiumPro CNC System
A Compact Scalable CNC System

FlexiumPro CNC system significantly advances on the calculation power, speed, connectivity and reliability of the company's previous-generation Flexium+ CNC system — itself widely regarded as one of the leading control solutions for high-end machine tool applications.
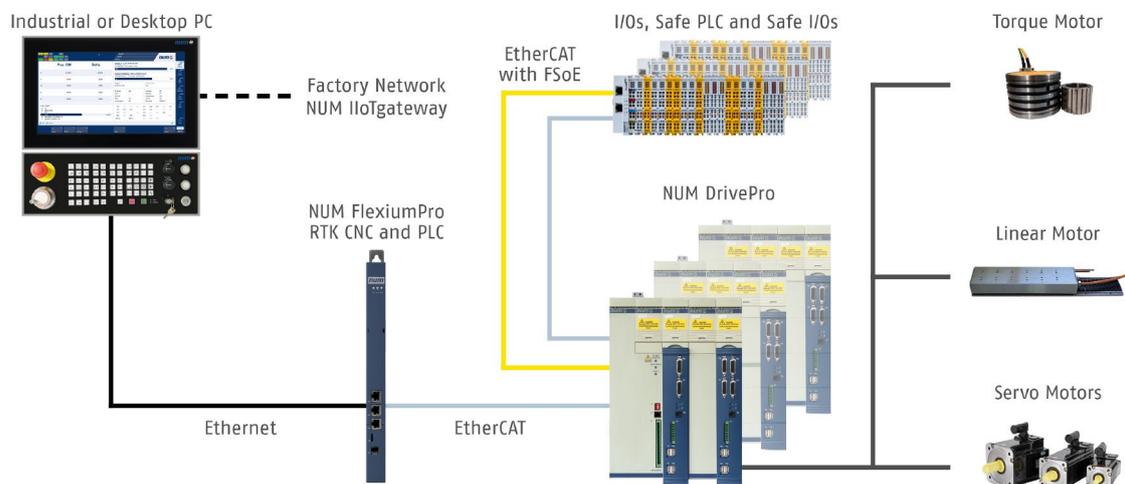
Architecture, functionalities and performance

FlexiumPro's Real-Time Kernel (RTK) hosts an embedded CODESYS V3 PLC and a CNC unit. Based on a multi-core ARM processor, the RTK is implemented using advanced system-on-chip (SoC) technology. The tightly integrated nature of this technology helps to significantly reduce component count, resulting in improved system reliability, availability and compactness; the single-board, fan-less design is only 25 mm wide. The speed advantages of NUM's FlexiumPro CNC system are considerable. Its hard real-time operating system reduces latency and obviates the time overheads of complex 'soft' operating systems; every aspect of the hardware and firmware is optimized to maximize machine productivity and availability. Compared to its Flexium+ predecessor, the new system is more than 10 times faster.

The PLC application, part programs, machine configuration, calibration data, etc., are all safely saved on a removable microSD card — and to secure shutdown processes, the FlexiumPro RTK incorporates super-capacitors, which keeps the system alive for the time needed to save all data in the case of hard power off.

FlexiumPro retains and extends all behavioral and functional aspects of NUM's Flexium+ system. These include control of up to 32 axes and/or spindles, up to 32 machining channels, and subnanometer interpolation capabilities. The system supports RTCP (Rotation Tool Center Point) and HSC (High Speed Cutting) functions, as well as a number of technology-specific functions and machining cycles.

NUM's FlexiumPro dual-layer HMI architecture significantly simplifies this aspect of machine tool design. The functionality of the underlying user interface modules (UIMs) can easily be defined, modified and saved by OEMs, facilitating the creation of highly ergonomic application-specific HMIs. This new approach to user/machine interaction utilizes the latest software technologies — WPF for the UIMs and C# for the software development kit (SDK) — to maximize performance in terms of speed and resource management.

Industrial or Desktop PC

Factory Network
NUM IIoTgateway

NUM FlexiumPro
RTK CNC and PLC

Ethernet

EtherCAT

EtherCAT
with FSoE

I/Os, Safe PLC and Safe I/Os

NUM DrivePro

Torque Motor

Linear Motor

Servo Motors

FlexiumPro CNC System
Universally Applicable

Freely scalable system

The FlexiumPro system is easily scalable and can be fully adapt-
ed to the needs of customers. Available in three configurations:
FlexiumPro 6, FlexiumPro 8 and FlexiumPro 68, each equipped
with specific functions and function packages, it can be tai-
lored to the particular application.

To create an optimal CNC, just pick the platform best suited to
the application and the machine, and include the appropriate
options, either individually or as technology packages (turning,
milling, woodworking, etc.).

FlexiumPro 6
- CNC with choice of kinematic structure: milling or turning
- CNC for up to 4 axes and 1 spindle
- One CNC machining channel
- Interpolates up to 4 axes simultaneously

FlexiumPro 8
- CNC for up to 5 axes or 4 axes and 1 spindle
- One machining channel is standard, a second is optionally
  available
- Interpolates up to 4 axes simultaneously
- Various options and technology packages available

FlexiumPro 68
- CNC for 5 axes + spindles in standard version, up to 32 axes/
  spindles as an option
- One machining channel is standard. Up to 32 channels as
  option
- Interpolates 4 axes per channel as standard, up to 9 inter-
  polated axes per channel as an option
- Various technology packages and interpolation functions
  are available

Basic characteristics

	FlexiumPro 6	FlexiumPro 8	FlexiumPro 68
Axes + Spindles	4 + 1	5	32
Spindles	1	1	32
Interpolated Axes	4	4	32
Machining Channels	1	2	32
CANopen interfaces	1	1	1
EtherCAT interface	2	2	2
Smart Factory communication	Yes	Yes	Yes
Measurement Inputs	4	4	4
Handwheels	2	2	4
CNC Program Memory	>40 MB	>40 MB	>40 MB
PLC Program Memory	1'024 MB	1'024 MB	1'024 MB

Special features of FlexiumPro are, among others, the safety architecture and the ability to influence the real-time behavior of the system with applications.

Safety

A key distinguishing feature of FlexiumPro is its safety architecture, NUMSafe.

A SIL 3 safe PLC is intimately integrated with the standard PLC and, using FSoE (Fail Safe over EtherCAT) protocol, it communicates with safe inputs and safe outputs and with new NUM DrivePro servodrives, where the safe motion functions are implemented and executed.

When equipped with the NUM-SAMX option, NUM DrivePro implements all required safety motion functions: Safe Torque Off (STO), Safe Stop (SS1/2), Safe Operating Stop (SOS), Safe Limited Speed (SLS), Safe Limited Position (SLP), Safe Direction Monitoring (SDM), Safe Cams (SCA) and Safe Brake Control (SBC).

The safety related devices are configured and programmed by means of NUM's Flexium Tools software. This provides a unique development environment where safety related logic, non safety related logic, CNC and drives are configured and programmed.

Influence on real-time behavior

FlexiumPro allows users to alter the real-time behavior of the system by using application macros. This option exists both at the CNC level, using dynamic operators, and at 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, in real-time, the interpolator outputs. In this way, the machine behaviours can be directly influenced by user-specific software. Among other things, special outputs on the CNC can also be addressed immediately as a function of a real-time signal. If we then go one level down to the DEMX functions, it allows users to create their own macros to interact in real-time with all physical and virtual drive resources and to even change the control algorithms. Additional filters, monitoring functions, test points and much more can be created according to defined rules.

FlexiumPro
Highly Productive Flexibility

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

FlexiumPro RTK: The CNC and PLC unit
FlexiumPro RTK is the core of the system. Both main processes, PLC and CNC, are embedded and running together on a single board based on a multi-core ARM processor. The extremely high integration level, achieved by using System on Chip technology, results in a huge reduction of components which improves system reliability and availability. PLC peripherals are connected either by using EtherCAT or CANopen field bus. To avoid performance compromises two EtherCAT ports are available, one for I/Os and safety (with FSoE) and one for drives. The user can access more than 100 MB of memory, and each RTK can handle up to 32 channels and up to 32 axes or spindles.

FlexiumPro RTK is very compact and can be mounted side-by-side to NUM DrivePro.

PLC application, part programs, machine configuration, calibrations, etc., are all safely saved on a removable microSD card – and to secure shutdown processes, the NUM FlexiumPro RTK (Real Time Kernel) integrates super-capacitors, which keep the system alive for the time needed to save all data in the case of hard power off.

Flexibility
This inherent attribute of NUM products has now been pushed even further. Any of the 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 FlexiumPro 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 terms of 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 command away.

FlexiumPro provides up to 32 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 advanced programming function, this structure offers numerous possibilities, including the ability to pass one or more axes from one channel to another on the fly.

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, 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 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 manuals and 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 powerful Flexium Tools software development package 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
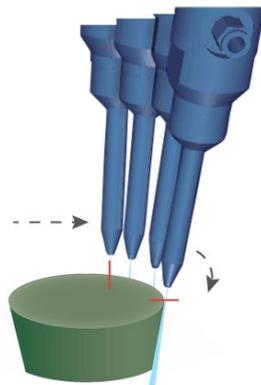
such as automatic compensation of the conical shape of the cutting jet, as well as "Fly Cutting" or "Frog Jump".

Another example is the grinding package for cylindrical grinding. This supports not only cylindrical grinding but also non-circular grinding. An up-to-date list of available technology packages can be found on our website or in our catalog.

And much more

Other components of FlexiumPro 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 and our services in more detail so that you can understand why NUM is your ideal partner for CNC applications.
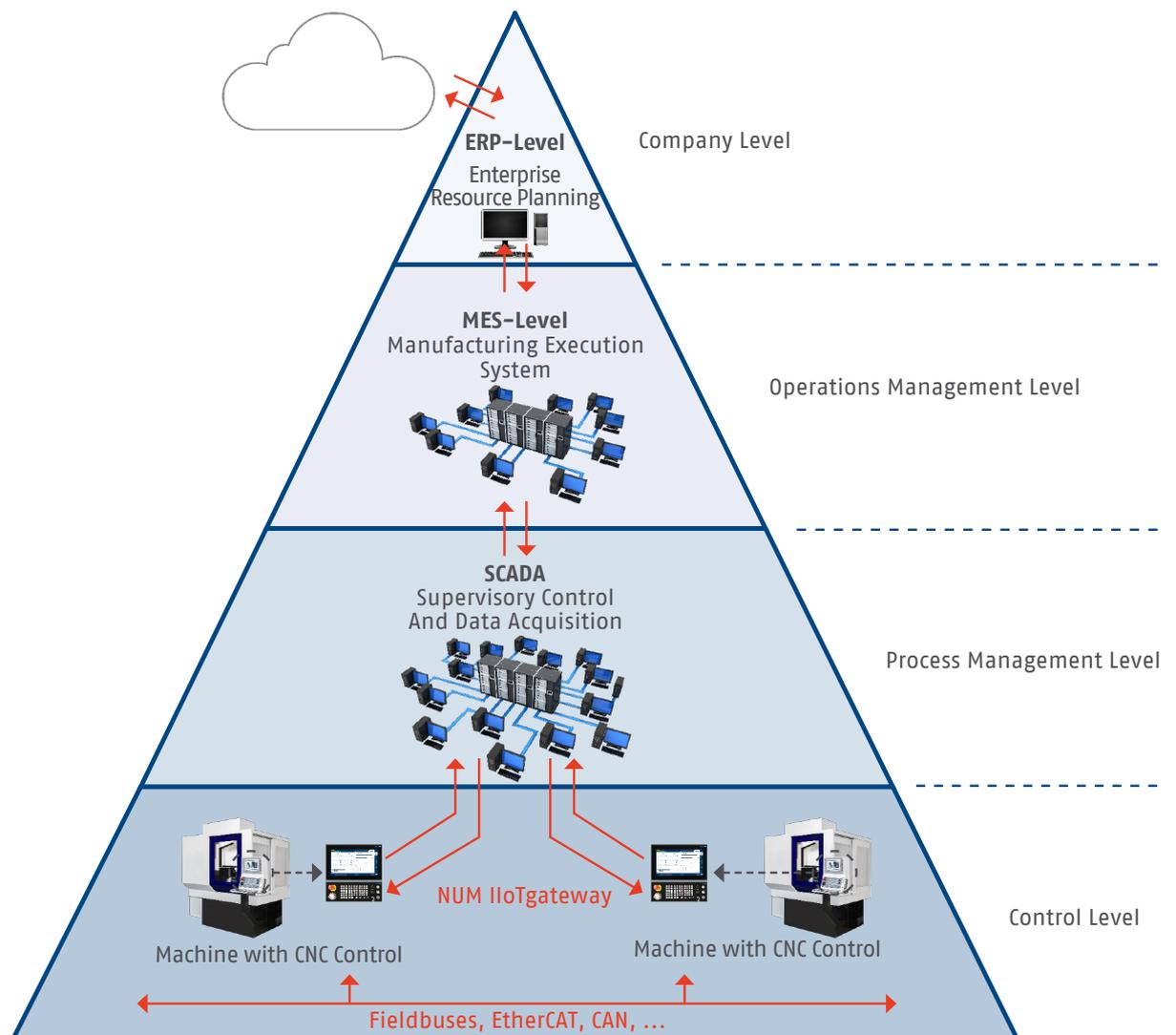
A unique development environment

The complete FlexiumPro 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.

FlexiumPro Smart Factory
Boundless Communication

The FlexiumPro CNC control system is compatible with a wide range of communication options, making it an obvious candidate for Smart Factory projects.

The precise beginning 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 independently in real-time-capable systems along the entire value-added chain. The ultimate goal is the Smart Factory.

ERP-Level
Enterprise
Resource Planning

Company Level

MES-Level
Manufacturing Execution
System

Operations Management Level

SCADA
Supervisory Control
And Data Acquisition

Process Management Level

NUM IIoTgateway

Machine with CNC Control   Machine with CNC Control

Control Level

Fieldbuses, EtherCAT, CAN, ...

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 FlexiumPro 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 NUM IIoT Gateway, which supports OPC UA, MTConnect and MQgateway. Of course, other freely definable communication interfaces are also available – which can be implemented efficiently and comprehensively using NUM's FlexiumPro power SDK.

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

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.

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. Not only machining process simulation, Flexium 3D allows to create a machine's digital twin that can be used for application development, debugging, work-cycle simulation etc.

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, analyze the movements of auxiliary axes and peripheral, simulate virtual probing, 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.
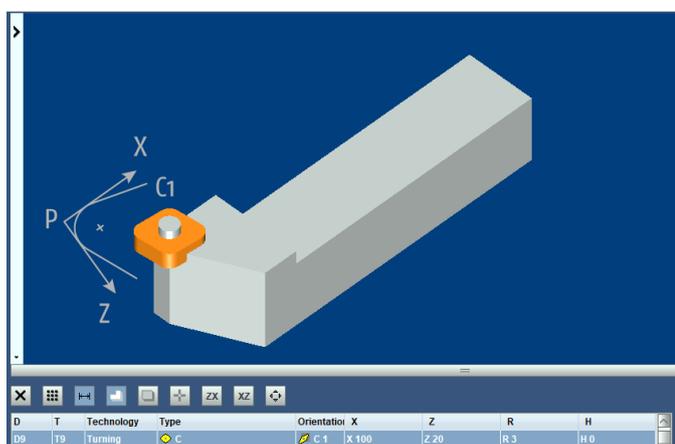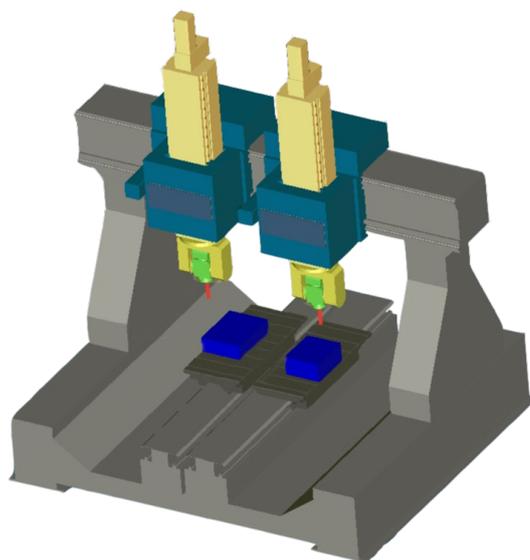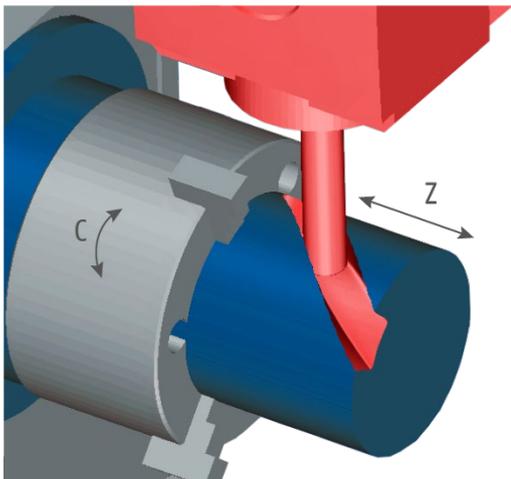
Turning

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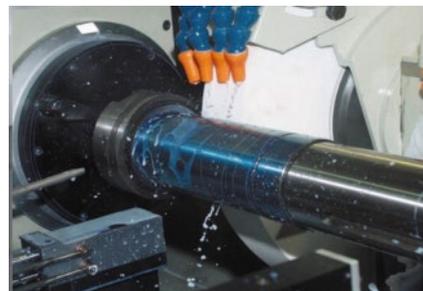
Cutting

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
18,5" and 24" Touch Panel

To host the NUM FlexiumPro HMI (Human Machine Interface) NUM launches wide screen operator panels and a dedicated machine panel.

FS184i and FS244i operator panels

The operator panels, called FS184i and FS244i, have a tablet-like design, integrate the latest multi-touch technology and are powered by an industrial PC equipped with an Intel i5 quad-core processor running the Windows 10 IoT Enterprise LTSB operating system. FS184i and FS244i operator panels provide a durable, modern front end for machine control. The antiglare glass used to protect the display makes the operator panels suitable for difficult lighting conditions and contributes to the panels' IP65 ingress protection.

MP07 machine panel

To accompany the new touch panels, NUM has launched the MP07 machine operation panel. A solid aluminum back plate ensures correct stiffness. All in all, the MP07 together with a multi-touch panel is a unit that helps OEMs to differentiate themselves from their competitors.
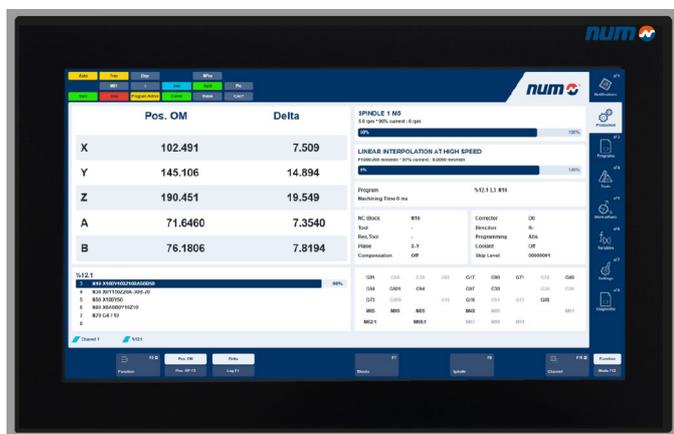

Virtual keyboard/Virtual machine panel

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 the need for a 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.

Further control panel solutions

In addition to the 18.5" panel, panel solutions in 12", 15", 19" and 24" versions are also available.

Flexium Tools – A Single Programming Environment for Everything

As a machine manufacturer, you can configure and program the entire FlexiumPro 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.
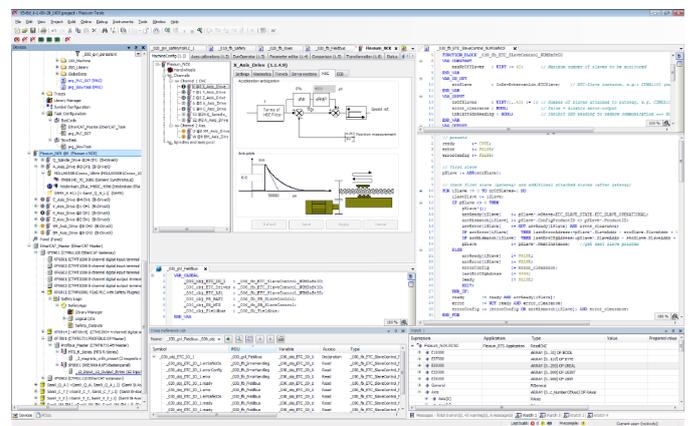
NUMSafe
The Safety Architecture

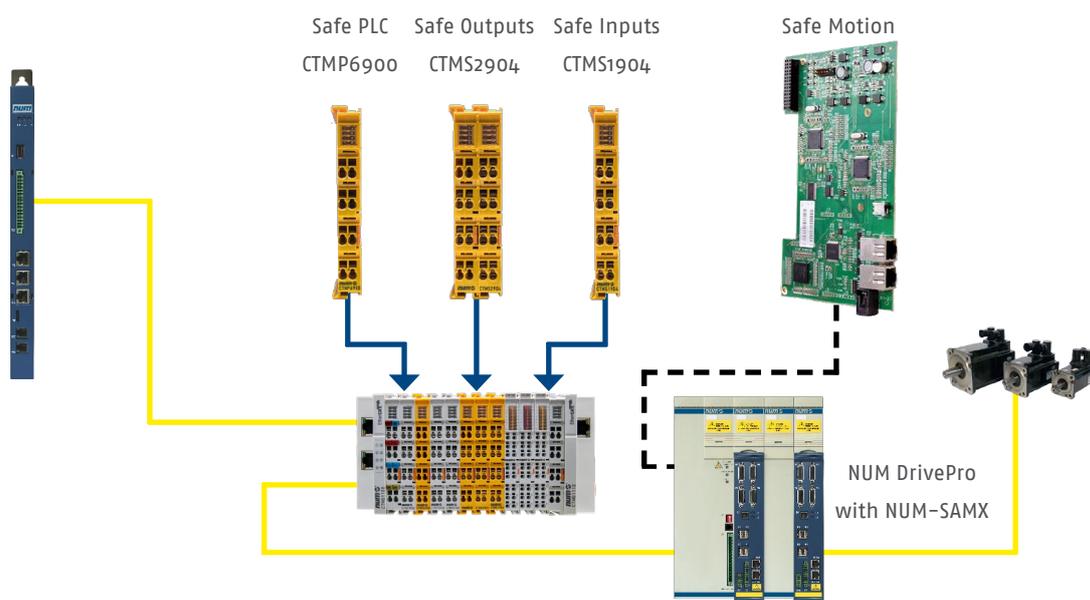**FlexiumPro integrates comprehensive solutions for the functional safety management of each machine type.**

NUMSafe provides hardware and software solutions for implementing standard automation and safety technology in the FlexiumPro 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; NUMSafe PLC, NUMSafe Input and NUMSafe Output can be positioned inside a standard terminal line up, by means of a NUM EtherCAT gateway, communicates with the automation PLC, other EtherCAT gateways,

servodrives and safety related components. The safety related motion functions are realized inside NUM DrivePro 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 PLC | Safe Outputs | Safe Inputs | | Safe Motion |
| CTMP6900 | CTMS2904 | CTMS1904 | | |

NUM DrivePro
with NUM–SAMX

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 NUM DrivePro 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-Limited Position (SLP), Safe Direction Monitoring (SDM), Safe CAMs (SCA) and Safe Brake Control (SBC).
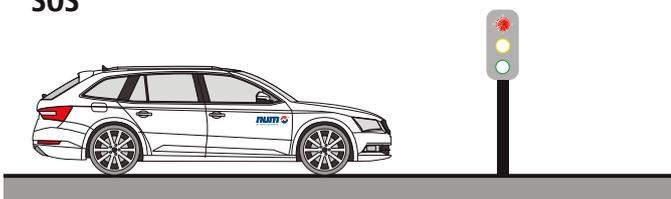
STO

SLP

SLS

30

Speed Camera

SS1/2

Slow down!

Speed Camera in 100 m
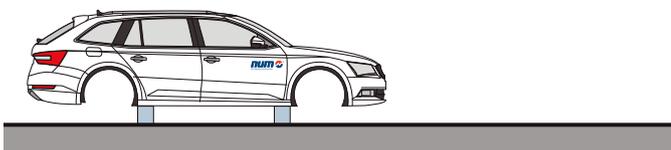
SOS

SDM

NUM DrivePro
Compact and Scalable

NUM's new DrivePro servodrive is the result of more than 30 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.

Like NUM FlexiumPro, the NUM DrivePro control unit has a very high integration level, thanks to its use of System on Chip technology incorporating a multi-core ARM processor. To avoid latency and overheads, there is no operating system between the CPUs and the software – it is a bare metal programming. As a result, the NUM DrivePro control unit can pilot up to 4 axes simultaneously, with a position loop sampling time of 50 μs.

Flexibility is a characteristic of all NUM products. NUM DrivePro can control any type of electric motor (spindle, servo, linear, torque, synchronous, asynchronous...). It's just a question of parameterization, and each axis can close the PID control loops with up to 3 external sensors, typically: motor's encoder, machine's encoder (for example linear scales) and NUM accelerometer.

Just like its predecessor, when equipped with the NUM-SAMX option, NUM DrivePro implements all the needed safety motion functions: Safe Torque Off (STO), Safe Stop (SS1/2), Safe Operating Stop (SOS), Safe Limited Speed (SLS), Safe Limited Position (SLP), Safe Direction Monitoring (SDM) and Safe Cams (SCA). The safety functions are activated through the system's Safe PLC by means of FSoE (Fail Safe over EtherCAT) – so there's no need for any local wiring.

A new safety feature introduced with NUM DrivePro is the Safe Brake Control function (for the moment available only for the smaller drive sizes). It is fully automated, when drive power is cut-off the brake is safely engaged.

There are various reasons why different servodrive setups may be required. For example, machine where axes/spindle can be changed/configured based on the type of machining or processes where the blank weight needs dedicated tuning. To meet these requirements NUM DrivePro supports up to 99 different saved parameter sets.
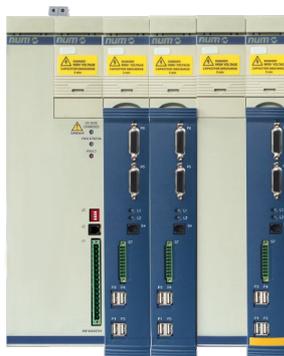
NUM DrivePro is a modular drive system optimized for multi-axis applications. A typical NUM DrivePro architecture consists of a common power supply that distributes power to a drive line-up via a DC bus; this reduces overall system energy consumption by utilizing an ENERGY BALANCE function.

Various control unit options and power unit versions/ratings are available for driving one (mono-axis), two (bi-axis) or four (quad-axis) motors each. The quad-axis power unit is a new product; it has been developed to further reduce the drive line-up dimensions, to minimize cabling and to offer a more cost effective solution for multi-axis machines.

Highlights:

- Multi-core ARM architecture with bare metal programming and floating point calculation
- High level of integration thanks to System on Chip technology
- EtherCAT as servo and safety bus (with Fail Safe over EtherCAT)
- Optimized for single cable motors
- Up to 3 sensors per axis (2 encoders + accelerometer)
- One control unit able to pilot up to 4 axes with position loop sampling time at 50 μs
- New industrial USB connectors for single cable motor's encoder (NUM SHX/SPX)
- Removable control unit for easier and cost effective after sales management
- Quad-axis drive module to increase compactness and minimize cabling
- Up to 99 complete parameter sets to easily manage different machine configurations and/or optimization

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. NUM DrivePro implements 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 a USB plug 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.

NUM DrivePro Mono-Axis	Rated Current (S1) Arms	Maximum Current Arms	Overall Dimensions (W x H x D) mm
MDLUF007A…	4.4	5	50 X 355 X 206
MDLUF014A…	8.9	10	50 X 355 X 206
MDLUF021A…	13	15	50 X 355 X 206
MDLUF034A…	13	24	50 X 355 X 206
MDLUF050A…	28	35	100 X 355 X 206
MDLUF075A…	34	53	100 X 355 X 206
MDLUF100A…	45	71	150 X 355 X 206
MDLUF150A…	60	106	150 X 355 X 206
MDLUF200A…	100	141	200 X 355 X 206
MDLUF400A…	200	282	300 X 355 X 206
NUM DrivePro Bi-Axes	**Rated Current (S1) Arms**	**Maximum Current Arms**	**Overall Dimensions (W x H x D) mm**
MDLUF014B…	6.3 + 6.3	10 + 10	50 X 355 X 206
MDLUF021B…	6.3 + 6.3	15 + 15	50 X 355 X 206
MDLUF050B…	20 + 20	35 + 35	100 X 355 X 206
MDLUF075B…	29 + 29	53 + 53	150 X 355 X 206
Quad-Axes	**Rated Current (S1) Arms**	**Maximum Current Arms**	**Overall Dimensions (W x H x D) mm**
MDLUF014D…	6.3 + 6.3 + 6.3 + 6.3	10 + 10 + 10 + 10	100 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
Models for Every Application

NUM produces a comprehensive series of motors, all of which offer excellent performance/volume ratios and superb dynamic abilities. When combined with NUM DrivePro 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 SHX/SPX 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.

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

Linear motors

There are many linear motors on the market but they are mainly designed for general automation (fast movements from A to B). The NUM LMX linear motors are specifically designed for machine tools. Their features include a fully enclosed primary, a large diameter cooling circuit to accommodate fluids with low specific heat capacity, a short pole pitch to increase force density and reduce temperature and many other interesting features.

NUM linear motor

Motor Range	Main Characteristics	Typical Applications	Cont. Torque / Power Range	Available Sizes	Available Options
SHX	Single cable servomotor with very compact design, medium inertia, IP64	Designed for feeding axes of cost sensitive machine tools	From 1.2 Nm up to 20 Nm	Frame sizes 75 mm 95 mm 126 mm 155 mm	Holding brake Keyed shaft Medium and high resolution single/multi turn encoder High inertia version
SPX	Single cable servomotor with extremely compact design, high peak torques, smooth operation, medium inertia, IP67	Designed for feeding axes of high-end machine tools, grinding machines, robotics and special machines	From 0.5 Nm up to 23 Nm	Frame sizes 75 mm 95 mm 126 mm 155 mm	Holding brake Keyed shaft Medium and high resolution single/multi turn encoder High inertia version
BHX	Very compact design, medium inertia, IP64 servomotor	Designed for feeding axes of cost sensitive machine tools	From 1.2 Nm up to 20 Nm	Frame sizes 75 mm 95 mm 126 mm 155 mm	Holding brake Keyed shaft Medium and high resolution single/multi turn encoder High inertia version
BPX	Extremely compact design, high peak torques, smooth operation, medium inertia, IP67 servomotor	Designed for feeding axes of high-end machine tools, grinding machines, robotics and special machines	From 0.5 Nm up to 23 Nm	Frame sizes 55 mm 75 mm 95 mm 126 mm 155 mm	Holding brake Keyed shaft Medium and high resolution single/multi turn encoder High inertia version
BPH	Compact design, smooth operations, medium inertia, up to IP67 servomotor	Designed for feeding axes of high-end machine tools, grinding machines, robotics and special machines	From 1.3 Nm up to 100 Nm	Frame sizes 75 mm 95 mm 115 mm 142 mm 190 mm	Holding brake Keyed shaft Medium and high resolution single/multi turn encoder IP67 degree of protection
BPG	Compact design, smooth operation, very high inertia, up to IP67 servomotor	Designed for feeding axes of high end machine tools, grinding machines, robotics and special machines	From 1.3 Nm up to 56 Nm	Frame sizes 75 mm 95 mm 115 mm 142 mm 190 mm	Keyed shaft Medium and high resolution single/multi turn encoder IP67 degree of protection
BHL	Very compact design, high inertia, IP64 servomotor	Designed for feeding axes of large machine tools	From 85 Nm up to 160 Nm	Frame sizes 260 mm	Holding brake Keyed shaft Medium and high resolution single/multi turn encoder
TMX	Torque motor	Designed for direct drives	From 33 Nm up to 325 Nm	Stator diameter 140 mm 210 mm 291 mm	None
AMS/IM	Compact fan cooled spindle motor	Designed for main spindles	From 2.2 kW up to 55 kW	Shaft height 100 mm 132 mm 160 mm 180 mm	Keyed shaft High resolution single/multi turn encoder Low vibration level High radial loads

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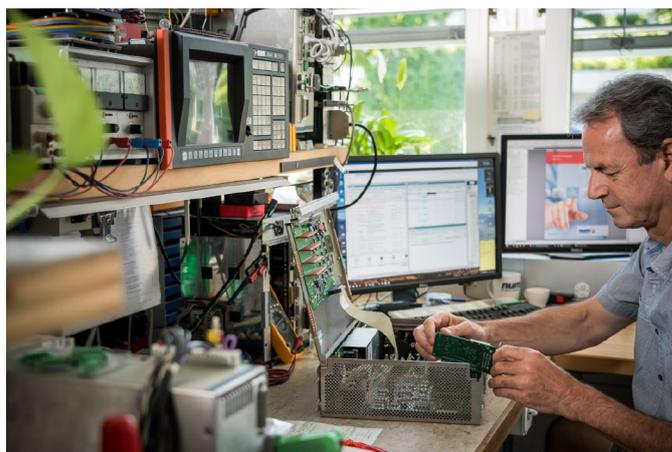
The department keeps up with latest product developments and maintains a large stock of material and components so that it can always meet your requirements and delivery expectations.

Complete CNC Solutions Worldwide

num
CNC HighEnd Applications

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

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

NUM systems and solutions are used worldwide.

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

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

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