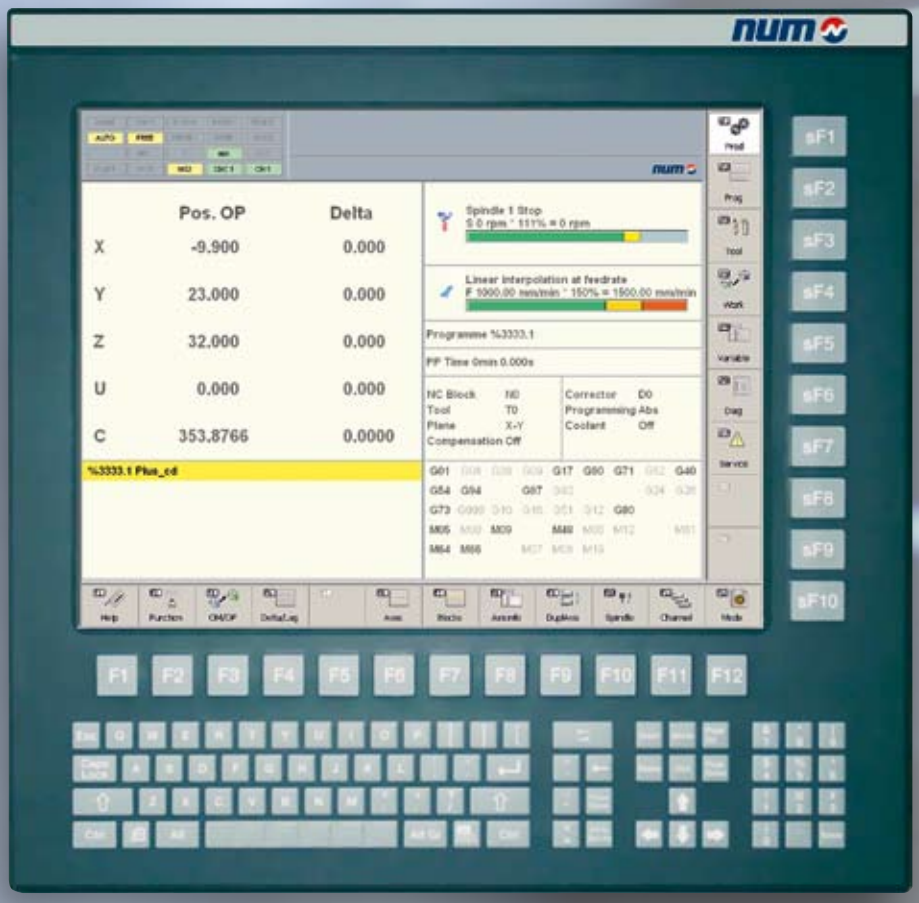
Axium Power CNC
2007



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num®
CNC HighEnd Applications

Catalog
Digital CNC System
Axium Power

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NUM, A World Player in Machine Automation

CNC Power Engineering

Always on the move

NUM supplies CNC complete solutions for the automation of production machines in special market segments and for customers with special requirements.

High flexibility of our systems in combination with our innovative engineering-team with extensive application know-how allow us to tailor the systems exactly to the needs of our partners – the machine manufacturers and the machine industry.

Founded in 1978 and with roots back into the late fifties today NUM is an independent European company with growing international activities.

Research and Development Guarantee the Future

NUM earmarks 12 percent of its sales figure for R&D. With its staff of engineers, NUM designs the automation solutions for tomorrow's machines.

World Service

The customers, both OEMs and end users, can benefit from all NUM's services: advice, assistance, applications, maintenance, training, etc.

Designing and Developing Applications

Unanimously appreciated for their expertise, their availability and their global approach, NUM's application engineers are able to propose optimal technical and economic solutions.

The range of services provided covers both consulting and preliminary design for automation of new machines and development of dedicated software and supply of turnkey systems including manufacture of custom automation cabinets complying with international standards.

Service and Maintenance

The international network of the Customer Service Department handles system integration and maintenance, the hotline, field service calls, equipment audits, anticipation of customer needs and extension of the service life of customer systems (retrofit) and hardware and software upgrades.

Aware of the most recent developments in products, the personnel has an inventory of hardware able to satisfy your needs in terms of quality and lead times.

Training

Many students receive training each year in our training centers located all over the world in Europe, North America and Asia.

Our engineers provide high level training in fully equipped premises and are able to meet all your special needs.

Introduction

Flexible, Open and High Performance

Axium Power systems are especially flexible, open and high performance. You can build a fully digital system tailored to your needs from the available subsystems. This allows you to have the same look and feel on very different types of machines.

A Compact Scalable CNC System

To create an optimal CNC, the OEM simply selects the platform best suited to his application and machine as well as options available in job-specific packs (turning, milling, woodworking, etc.) or individually.

Three basic systems are available:

- The First platform is definitely attractive from an economic standpoint. Capable of controlling up to 4 axes and 112 inputs/outputs, this platform benefits from the high performance DISC NT digital architecture and all the NUM integration and programming tools. Although the range of available options is more limited than on the Advanced platform, it meets most ordinary needs and ensures an excellent quality of machining.
- The Advanced platform is outstanding by its enormous flexibility. It supports a wide range of configurations and all the available options. The Advanced platform also has a DISC NT architecture and is capable of controlling up to 32 axes and 1024 inputs/outputs. It supports all Axium Power functions such as interpolation of up to 9 axes, B-spline and polynomial interpolation, 5-axis tool offsets, etc.
- The Ultimate platform represents the best achievement in term of CNC. Driven by a powerful processor, it supports the more demanding applications. The Ultimate platform is capable of controlling up to 32 axes in DISC NT architecture and 1024 inputs/outputs. Like the Advanced platform it supports all Axium Power functions.

These three platforms can be used in conjunction with all the servodrives of the Axium Power family.

Open, User-Friendly and Ergonomic, Guaranteed Efficiency

Customizing the Human/Machine Interface

Each OEM can use or adapt the NUMpass HMI or develop his own interface using widespread off-the-shelf tools: HTML editor, Visual Basic, etc.

Customizing the System to the Machine

Axium Power systems have high-level CNC functions such as dynamic operators in C and high performance servodrive algorithms such as the Tandem function, allowing them to adapt well to all machines and improve their productivity.

A Wide Range of Panels

The specific needs of each machine are met by the extended family of NUM panels with LCD screens: PC panel, compact panel and operator panel. The ergonomics and modular design of the Axium Power PC panel are another one of the family's open, flexible features.

Stable Safe Motors For a Variety of Applications

NUM offers a complete line of motors.

Brushless Axis Motors

Compact, with a high power-to-weight ratio and a high dynamic range, they cover continuous torques ranging from 1.1 Nm to 160 Nm:

- BPH servo motors: axes of machine tools, grinding machines, robotics and special automatic machines.
- BPG servo motors: as BPH but with increased inertia and rotor stiffness; for axes with high inertia at the motor shaft
- BPL servo motors: as BPH but for applications requiring very compact motors
- BHL servo motors: as BPH but specifically designed for large machines. A version with forced convection is available for optimizing size and performance

Spindle Motors

AMS asynchronous motors with ratings from 2.2 kW to 36 kW offer a very wide range of speeds at constant power making it possible to simplify or even do away with the gearbox. In addition, their high stability, even at low speeds, ensures excellent results for C axis and spindle indexing functions.

Motorspindle®

The active parts of the motor are integrated directly in the spindle, thereby ensuring better machine stiffness and more silent operation.

NUM supplies the active motor parts: hollow rotor, stator, cooling jacket and encoder. NUM also develops Motorspindle motors on request.

A Wide Choice of Drives

The family of NUM Drive servodrives includes two lines of servodrives .

NUM HP Drives and All-in-One drives

They are multisampled systems integrating advanced feedback algorithms. By their general characteristics, their sophisticated functions and their built-in filters, they are ideal for HSC and highend applications.

- MDLU3xxxN modular servodrive for axis and spindle motors Safety integrated function compliance with EN954-1 CAT-3 is disposable as option.
- MBLD2 All-in-one power supply and servodrive for axis and spindle motors.

NUMDrive C with high integration factor

The new generation of modular drives with one of the best power/volume ratio in the market is perfectly suited to save cabinet space. Mono-Axis and Bi-Axes Power Unit, BP (Basic Performances) and HP (High Performances) Control Unit allow you to choose the best combination for your application. The reduced depth and the scalable width support the engineering of the cabinet. Safety integrated functions compliance with EN954-1 CAT-3 is available as option.

- MDLU3xxxA Mono-Axis Power Unit
- MDLU3xxxB Bi-Axes Power Unit
- MDLU3000A Mono-Axis Control Unit
- MDLU3000B Bi-Axes Control Unit

This catalog presents the Axium Power family of CNCs, servodrives and motors, and help you choose the system best suited to your machines. The review of the product line opposite will give you a preview of the main characteristics and functions available.

The following chapters contain all the information you will need to prepare an order.

Chapters 2, 3 and 4 concern the CNCs:

- Chapter 2, Equivalence Tables, defines the links between the commercial references and the equipment and options. The comments accompanying the functions specify their limits depending on the CNC model
- Chapter 3, Technical Specifications, details the equipment configuration and the conditions of installation and use of the system components
- Chapter 4, Functional Specifications, describes the CNC architectures and operating modes. They are grouped by functional families (axes, PLC, part programming, integration and customizing software, communication).

Chapters 5, 6, and 7 are dedicated to the machine motors and drives:

- Chapter 5 presents the axis and spindle motors: applications, identification, characteristics and performance and overall dimensions
- Chapter 6 describes the axis and spindle servodrives: characteristics and functions, identification, implementation tools and overall dimensions
- Chapter 7 details the choice of sensors and motor/servodrive associations.

See Chapter 8 for contact information and regulations.

Review of the Axium Power Product Line

Description	Axium Power CNC		
Basic Platforms	**First**	**Advanced**	**Ultimate**
They control several servodrives via DISC NT digital bus distributed to CNC axes, PLC and digital spindles. TTL measurement inputs and axes and spindles using a ±10 V reference are available as options			
Axes			
Total number of axes (CNC and PLC), spindles, handwheels, etc. (digital and analog); * = The 5-axis option must include a spindle	1 → 5 *	1 → 32	1 → 32
Number of analog axes, spindles, measurements and handwheels	0 → 5	0 → 5	0 → 5
Number of axes (digital & analog)	1 → 4	1 → 32	1 → 32
Number of measured spindles (digital & analog)	0 → 1	0 → 4	0 → 4
Number of handwheels	0 → 3	0 → 3	0 → 3
Number of axis group	1	1 → 8	1 → 8
Number of interpoled axes per group	3 → 4	4 → 9	4 → 9
Number of unmeasured spindles	0 → 1	0 → 4	0 → 4
Inputs/Outputs			
Total number of logic inputs/outputs	0 → 112 I/O	0 → 1024 I/O	0 → 1024 I/O
Integrated logic inputs/outputs	0 → 64I/48O	0 → 64I/48O	0 → 64I/48O
Remote logic inputs/outputs	0 → 112 I/O	0 → 1024 I/O	0 → 1024 I/O
Integrated analog inputs/outputs	2 I/1O	2 I/1O	2 I/1O
Remote analog inputs	0	0 → 16	0 → 16
Remote analog outputs	0	0 → 8	0 → 8
Communication			
Serial lines	3	3	3
Ethernet TCP/IP	❍	❍	❍
Connections to Uni-Telway et Fipway networks	❍	❍	❍
DISC NT Digital Drives			
Axes			
NUM HP Drive	❍	❍	❍
NUMDrive C	❍	❍	❍
BPH, BPG, BPL, BHL Motors	❍	❍	❍
Spindles			
NUM HP Drive	❍	❍	❍
NUMDrive C	❍	❍	❍
MBLD All-in-one Drive	❍	❍	❍
AMS and Motorspindle Motors	❍	❍	❍

● basic
❍ optional

Format of the Commercial References

The commercial references of the Axium Power CNC systems include 10 alphanumeric characters:

ABCD	**123 456**
Nature of the item	Commercial reference number

The first group of 4 characters immediately identifies the nature of the item:

- **APP1**: Axium Power First Platform
- **APP2**: Axium Power Advanced Platform
- **APP3**: Axium Power Ultimate Platform
- **APSO**: Axium Power Software Option
  Software functions such as canned cycles or interpolations
- **APHO**: Axium Power Hardware Option
  Functions related to axes, spindles, etc.
- **APSW**: Axium Power Software
  Integration and operation software
- **APPC**: Axium Power PC Option
  PC panels, software packs for PC panel
- **APHE**: Axium Power External Hardware Option
  CNC panels, remote input/output modules, connectors, etc.
- **APHC**: Axium Power cables
  Miscellaneous cables
- **APDO**: Axium Power Documentation
  Technical documentation on CD-ROM

All the options can be ordered individually, provided they are available for the selected platform.

However, the job-specific APPA packs provide several functions under a single reference. These job-specific packs are function sets meeting clearly identified application needs: Turning, Milling, Grinding, Woodworking Applications, Stone-cutting Applications, etc.

For NUM Drive motors and servodrives, the references are constructed based on the required features and options.

Functions Available for Each Platform

The Equivalence Tables of Chapter 2 list the functions supplied with each platform as well as the available options:

● Function included in the basic platform,

❍ Optional function compatible with the platform selected,

– Function not available for the platform considered.

Selecting an Axium Power System

To select the system best suited to your machine, we recommended proceeding in the following order:

1. Determine the platform based on the number of axes and inputs/outputs required
   → (APP1, APP2 or APP3)
2. Select the Human/Machine Interface
   - PC panel
   - CNC panel: compact panel, operator panel or portable operator panel

   → (APHE, APPC, APHC)
3. Hardware and software functions included in the basic version or optional:
   - Control of the CNC and PLC axes and spindle
   - RAM space required for part and PLC programs

   → (APHO, APSO)
4. Select the job-specific pack or individual software options you need for your application
   → (APPA, APSO)
5. Software tools resident in the CNC or PLC designed to facilitate CNC integration and customization to the application
   → (APSW)
6. Technical documents required
   → (APDO)
7. Determine the drive systems best suited to your application (see Chapter 7)

Equivalence Tables

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Equivalence Tables

Selecting a Hardware Configuration
Platforms

The hardware configuration of an Axium Power CNC system is independent of its software configuration. It is therefore recommended to start by determining the platform best suited to the application to be performed.

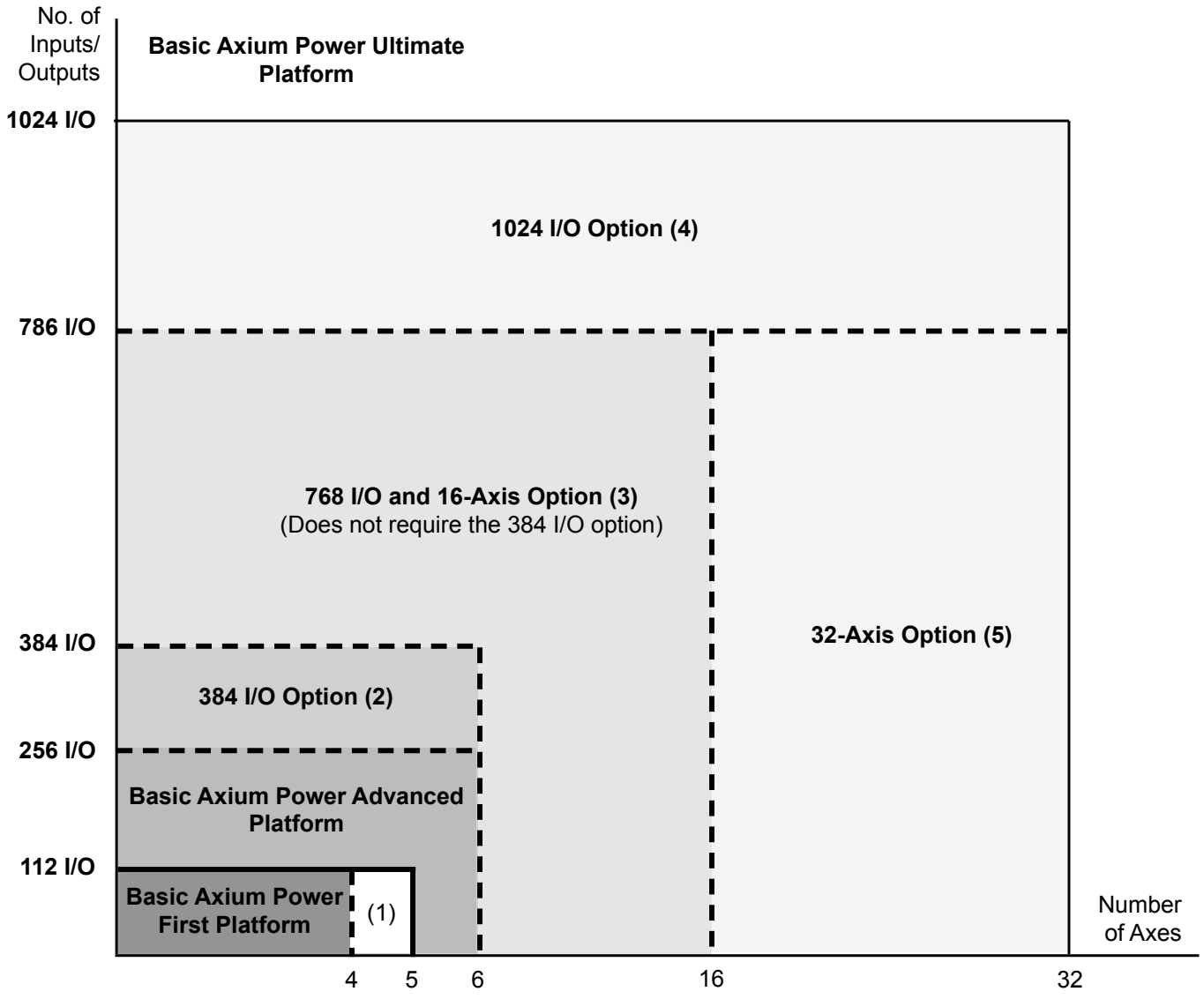
Three basic platforms are available:
- The Axium Power First platform is more specifically designed for machines with up to 5 axes (4 axes and one spindle) and 112 inputs/outputs.
- The Axium Power Advanced platform is designed for more complex applications and can control up to 32 axes and 1024 inputs/outputs.
- The Axium Power Ultimate platform is designed for top level applications and can control up to 32 axes and 1024 inputs/outputs.

The Axium Power includes a digital bus for controlling DISC NT digital servodrives, to be allocated to digital axes and spindles.
It can also control up to five ± 10 V analog axes (axes, spindles, measurement inputs and/or handwheels).

Min/Max Configurations	**Axium Power**		
	First	**Advanced**	**Ultimate**
Total : Axes + spindles + handwheels + measurements (digital and analog)			
Minimum	**1**	**1**	**1**
Maximum (* = must include one spindle)	**5 ***	**32**	**32**
Total : Axes + spindles + handwheels + measurements (analog)			
Minimum	**0**	**0**	**0**
Maximum	**5**	**5**	**5**
Axes (digital & analog)			
Minimum	**1**	**1**	**1**
Maximum	**4**	**32**	**32**
Measured spindles (digital & analog)			
Minimum	**0**	**0**	**0**
Maximum	**1**	**4**	**4**
Handwheels			
Minimum	**0**	**0**	**0**
Maximum	**3**	**3**	**3**
Interpoled axes per group			
Minimum	**3**	**4**	**4**
Maximum	**4**	**9**	**9**
Axes groups / Channels			
Minimum	**1**	**2**	**2**
Maximum	**1**	**8**	**8**
Inputs/Outputs			
Minimum	**0**	**0**	**0**
Maximum	**112 I/O**	**1024 I/O**	**1024 I/O**

Platform Selection Guide

The figure below allows you to see at a glance what platform and associated options provide the required resources.



(1) 5th axis option – APSO 000 478 – page 19

(2) 384 I/O option – APSO 000 670 – page 20

(3) 16-axis and 768 I/O option (APHO 000 611 or APHO 000 612) – pages 15, 19 and 20

(4) 1024 I/O option – APSO 000 670 associated with 16-axis and 768 I/O option (APHO 000 611 or APHO 000 612) – page 20

(5) 32-axis option – APSO 000 614 associated with 16-axis and 768 I/O option (APHO 000 611 or APHO 000 612)

RAM Memory

All the CNC operating programs are stored in the battery backed RAM.

The RAM is divided into four areas, shared between different applications:

- Area Qp: Part program and resident macros
- Area Qa: PLC program
- Area Qm: HMI resource program
- Area Qc: HMI program in C

For further details on the features of these memory areas, refer to the Chapter Functional Specifications, PLC Function (page 61), Part Program (page 69) and MMITool (page 74).

Basic Memory and Additional Memory

Depending on the needs of the application, it is possible to order a memory with a size above the basic size by indicating the number of additional modules required.

Description	Comm. ref.	Memory size Qp	Qa	Qm	Qc
Part Program Memory					
Basic		**128 KB**			
Additional 128 KB module	**APHO 000 343**	❍			
PLC Memory					
Basic			**64 KB**		
Additional 64 KB module	**APHO 000 347**		❍		
HMI Resource Memory					
Basic				**128 KB**	
Additional 32 KB module	**APHO 000 377**			❍	
Memory for HMI Program in C					
Basic					**64 KB**
Additional 32 KB module	**APHO 000 378**				❍

Memories Related to the Options

Additional memory is required for running certain software options. These options may also provide memory space for the user. This additional memory must be taken into account when calculating total memory needs.

Description	Commercial reference	Qp memory	
		Available for the user	Used by the application
PROCAM MILL	APSO 100 238	-	256 KB
PROCAM TURN	APSO 100 239	-	256 KB
PROCAM MULTITURN	APSO 100 133	-	512 KB
PROCAM MX (combined machines)	APSO 100 134	-	512 KB
Turning Pack	APPA 000 555	-	-
Basic Milling Pack M0	APPA 000 560	-	-
Milling Pack M1	APPA 000 561	128 KB	384 KB
Milling Pack M2	APPA 000 562	-	-
Milling Pack M3	APPA 000 563	128 KB	384 KB
HSC Milling Pack	APPA 000 564	-	-
Woodworking Pack W1 (5-axis milling)	APPA 000 576	1024 KB	-
Woodworking Pack W2 (longitudinal milling)	APPA 000 577	3096 KB	-
Stone/Marble/Glass Cutting Pack SMG	APPA 000 565	512 KB	-
Cylindrical Grinding Pack GC	APPA 000 588	-	-
Surface Grinding Pack GS	APPA 000 587	-	-
Tool Cutting and Grinding Pack	APPA 000 586	-	-
T Probing Cycles	APSO 100 590	-	32 KB
M Probing Cycles	APSO 100 591	-	96 KB

Maximum Total Memory Size

The total size of the memories (basic memory + memories related to the options + additional memory) must always remain below the maximum value indicated for each CNC.

Axium Power CNC	Part program Qp	PLC program Qa	HMI resource program Qm	HMI program in C Qc	Total memory
First	Qp	+ Qa	+ Qm	+ Qc	< 3500 KB
Advanced	Qp	+ Qa	+ Qm	+ Qc	< 3500 KB
Ultimate	Qp	+ Qa	+ Qm	+ Qc	< 3500 KB

Equivalence Tables

Basic Platforms

Refer to page 12 for the hardware configurations available for each system.

Description	Commercial reference	Axium Power First	Axium Power Advanced	Axium Power Ultimate	Comments
The Axium Power CNC is equipped with DISC NT high-speed digital bus.					
Aavailable platforms:					
Axium Power First Platform	**APP1 000 600**	❍	-	-	
Supports up to 4 axes and 112 inputs / outputs (for extensions see page 20)					
Axium Power Advanced Platform	**APP2 000 600**	-	❍	-	
Supports up to 6 axes and 256 inputs / outputs (for extensions see page 20)					For 384 I/O see page 20
Axium Power Ultimate Platform	**APP3 000 600**	-	-	❍	
Supports up to 32 axes and 1024 inputs / outputs					
Axium Power Ultimate Platform with coprocessor	**APP3 000 601**	-	-	❍	
Supports up to 32 axes and 1024 inputs / outputs					
16-axis and 768 inputs/outputs option					
This option increases total system power and extends the number of axes to 16 and I/O to 768					
Available with and without coprocessor:					
Without coprocessor	**APHO 000 611**	-	❍	-	For 1024 I/O see page 20
With coprocessor, required for applications using dynamic operators in C	**APHO 000 612**	-	❍	-	For 1024 I/O see page 20
32-axis option	**APHO 000 614**	-	❍	●	
APHO 000 614 associated with the 16-axis and 768 I/O option (APH0 000 611 or APHO 000 612) extends the number of axes to 32.					
Enhancement Option	**APHO 000 613**	-	❍	-	
Increases axes performances for configuration up to 16 axes					
Modules and cables for connecting the Axium Power CNC to NUM HP Drive servodrives					
Cables					
0.5 m	**APHC 081 500**	❍	❍	❍	
1 m	**APHC 081 501**	❍	❍	❍	
5 m	**APHC 081 502**	❍	❍	❍	
10 m	**APHC 081 503**	❍	❍	❍	
Analog axis interface module	**APHE 080 089**	❍	❍	❍	

● basic
❍ optional
- unavailable

Equivalence Tables

PC Panels
NUM iPC Compact, FS151 Family

The Axium Power CNC is available with two types of panels: PC panel or conventional CNC panels.

For a detailed description of the panels (specifications and dimensions), see Chapter 3, Technical Specifications.

Description	Commercial reference	Axium Power First	Axium Power Advanced	Axium Power Ultimate	Comments
NUM PC PANEL					
NUM iPC Compact: Compact industrial PC with touch screen *15'' LCD touch screen, Ethernet, 4xRS232, 3xUSB, 2xPCMCIA, 1xPCI* *NUM Compact iPC: delivered either with* *- Windows 2000 multilingual version or Windows XP pro SP2* *- NUMpass HMI Kit, PLCTool, SETTool (package 3 APSW 182 189) see p 28* *Requires "Communication Bits for NUM PC Panels" (APSW 182 112), see below*					
NUM iPC Compact – Windows 2000	**APPC 555 317**	❍	❍	❍	
NUM iPC Compact – Windows XP pro SP2	**APPC 555 318**	❍	❍	❍	
FS151 FAMILY					
FS151i *15.1'' LCD screen, 22 function keys, 3 x Ethernet, 2 x USB; NUMpass HMI, PLCTool, SETTool (similar to package 3, APSW 182 189), see page 28; KBD incl. Keyboard* *Requires "Communication Bits for NUM PC Panels" (APSW 182 112), see below*					
FS151i-P1 CF *800 MHz, CompactFlash™, Win XP Embedded*	**APPC 555 410**	❍	❍	❍	Available from 2007
FS151i-P2 HD *1.8 GHz, Harddisk 40 GB, Win XP Pro*	**APPC 555 413**	❍	❍	❍	Available from 2007
FS151i-KBD P1 CF *800 MHz, CompactFlash™, Win XP Embedded*	**APPC 555 510**	❍	❍	❍	Available from 2007
FS151i-KBD P2 HD *1.8 GHz, Harddisk 40 GB, Win XP Pro*	**APPC 555 513**	❍	❍	❍	Available from 2007
Hard disc with Windows XP Professional (upgrade for FS 151i with CompactFlash™)	**APPC 555 400**				Available from 2007
FS151 *For use with a standard or industrial PC, incl. 15'' display and function keys surrounding the display*					
FS151 *Screen with 22 function keys*	**APHE 000 783**	❍	❍	❍	without PC
FS151-KBD *Screen with 22 function keys and built-in 75-key Qwerty keyboard*	**APHE 000 784**	❍	❍	❍	without PC
PC/CNC Communication					
Communication Bits for NUM PC panels *PC panels are used with a network card:*	**APSO 182 112**	❍	❍	❍	
HSL High Speed Link Card	**APHO 000 932**	❍	❍	❍	

● basic
❍ optional
- unavailable

Equivalence Tables

PC Panels
CNC Panels, Cables for CNC Panels

For a detailed description of the panels (specifications and dimensions), see Chapter 3, Technical Specifications.

Description	Commercial reference	Axium Power First	Axium Power Advanced	Axium Power Ultimate	Comments
CNC PANELs					
Used for both: programming and production and require a graphic card.					
GSP graphic card	**APHO 000 715**	❍	❍	❍	
Compact CNC panel with LCD display					
CP10F: Panel with color LCD	**APHE 000 780**	❍	❍	❍	
Max. CNC cable length 10m					
Operator panels with LCD display					
CP20 F: Panel, 50-key keyboard, color LCD	**APHE 000 781**	❍	❍	❍	
CP30 F: Panel, Qwerty keyboard, color LCD	**APHE 000 782**	❍	❍	❍	
Panels in separate parts:					
FS20: LCD display unit	**APHE 000 484**	❍	❍	❍	
KBD30: Industrial Qwerty CNC keyboard	**APHE 000 485**	❍	❍	❍	
Supplied with 2 m connecting cable					
Multiplexing (multipanel or multi-CNC)					
Function available with CP20F and CP30F panels using a multiplexing module (see page 48) to set up:					
- A multipanel configuration (up to 3 additional panels), order one multiplexer module for each additional panel					
- A multi-CNC configuration (up to 4 CNCs connected to a single panel).					
Multiplexer module	**APHE 000 354**	❍	❍	❍	
Panel-CNC Connecting Cables					
For compact panels and operator panels.					
CNC cable without connectors					
5 m	**APHC 081 054**	❍	❍	❍	
10 m	**APHC 081 055**	❍	❍	❍	
15 m	**APHC 081 056**	❍	❍	❍	
20 m	**APHC 081 057**	❍	❍	❍	
30 m	**APHC 081 058**	❍	❍	❍	
40 m	**APHC 081 059**	❍	❍	❍	
CNC cable with connectors					
1.5 m	**APHC 081 157**	❍	❍	❍	
5 m	**APHC 081 154**	❍	❍	❍	
10 m	**APHC 081 155**	❍	❍	❍	

● basic
❍ optional
\- unavailable

Equivalence Tables

Portable Operator Panel, Machine Panels, Fiber-optic Cables, CNC User Languages

For a detailed description of the panels (specifications and dimensions), see Chapter 3, Technical Specifications.

Description	Commercial reference	Axium Power First	Axium Power Advanced	Axium Power Ultimate	Comments
Portable Operator Panel					
Used for programming, settings and production.					
POP: Portable operator panel with color LCD	**APHE 000 246**	❍	❍	❍	
Machine Panels					
Handwheel as option. Connected to the CNC by a fiber-optic cable.					
Maximum number of machine panels per CNC		4	4	4	
MP02 Machine Panel					
Customizable machine panel for FS20 LCD display unit	**APHE 000 486**	❍	❍	❍	
Electronic handwheel for MP02 panel	**APHE 081 021**	❍	❍	❍	
MP03 Machine Panels					
410 mm machine panel for NUM Compact iPC, FS151i, FS151iKBD, FS151, FS151KBD	**APHE 558 110**	❍	❍	❍	
... as above including handwheel	**APHE 558 120**	❍	❍	❍	
483 mm machine panel for CP30F, CP20F	**APHE 558 210**	❍	❍	❍	
... as above including handwheel	**APHE 558 220**	❍	❍	❍	
Fiber-Optic cables					
Used for connecting the machine panels and remote I/O modules to the CNC.					
Fiber-optic cable					
0.25 m	**APHC 081 039**	❍	❍	❍	
0.50 m	**APHC 081 089**	❍	❍	❍	
1 m	**APHC 081 045**	❍	❍	❍	
2 m	**APHC 081 090**	❍	❍	❍	
5 m	**APHC 081 046**	❍	❍	❍	
10 m	**APHC 081 047**	❍	❍	❍	
20 m	**APHC 081 049**	❍	❍	❍	
30 m	**APHC 081 052**	❍	❍	❍	
40 m	**APHC 081 053**	❍	❍	❍	
Fiber-optic link not used *Specify this reference if you are not using either a machine panel or remote I/O module*	**APHC 000 417**	❍	❍	❍	
CNC User Languages					
Resident languages: French, English, German, Spanish, Italian, Swedish. (NUMpass HMI – see page 28 – is available in English, French, German and Italian)		●	●	●	

● basic
❍ optional
\- unavailable

Equivalence Tables

Options for Axes, Spindles and Handwheels

The axis and spindle functions always include the control and measurement systems.

Description	Commercial reference	Axium Power First	Axium Power Advanced	Axium Power Ultimate	Comments
CNC Axes + PLC Axes + Spindles					
Basic		1 to 4	1 to 6	1 to 32	
Maximum number		5	32	32	
The 16-axis option (APHO 000 611 or APHO 000 612) is required for Axium Power Advanced with more than 6 axes (see page 15).					
5th axis	**APSO 000 478**	❍	-	-	
The fifth axis requires a digital spindle (APSO 000 452) or analog spindle (APHO 000 366).					
Spindles					
Basic		0	0	0	
Maximum number		1	4	4	
Axes with Digital reference					
Number of CNC axes + PLC axes + spindles					
Basic		1 to 4	1 to 6	1 to 32	
Maximum number		5	32	32	
Specify the number required, even for basic axes, not exceeding the limits specified on page 11.					
CNC axes	**APSO 000 450**	❍	❍	❍	
PLC axes	**APSO 000 451**	❍	❍	❍	
Spindles	**APSO 000 452**	❍	❍	❍	(1)
Axes with Analog reference					
Number of axes + spindles + measurement inputs + handwheels					
Basic		0	0	0	
Maximum number		5	5	5	
CNC axes with 5 V TTL incremental measurement	**APHO 000 373**	❍	❍	❍	
PLC axes with 5 V TTL incremental measurement	**APHO 000 534**	❍	❍	❍	
Measured analog spindle control					
1st spindle with 5 V TTL measurement input	**APHO 000 366**	❍	❍	❍	
2nd spindle with 5 V TTL measurement input	**APHO 000 367**	-	❍	❍	
3rd spindle with 5 V TTL measurement input	**APHO 000 368**	-	❍	❍	
4th spindle with 5 V TTL measurement input	**APHO 000 369**	-	❍	❍	
Additional measurement inputs					
5 V TTL measurement inputs for handwheel	**APHO 000 209**	❍	❍	❍	
Unmeasured spindle control					
By a PLC analog output (12-bit DAC)		●	●	●	
By a analog output of an axis card					
14-bit DAC analog output	**APHO 000 375**	❍	❍	❍	
Maximum number		1	1	1	

(1) See packs – pages 21 to 24.

● basic
❍ optional
- unavailable

Equivalence Tables

PLC Options

Description	Commercial reference	Axium Power First	Axium Power Advanced	Axium Power Ultimate	Comments
Max. permissible number of inputs/outputs					
Basic platforms		112 I/O	256 I/O	1024 I/O	
Extension to 384 inputs and outputs	**APSO 000 670**	-	384 I/O	-	
Extension to 768 inputs and outputs	**APHO 000 611**	-	768 I/O	-	
This extension is included in the 16-axis and 768 I/O option (APHO 000 611 or APHO 000 612) - see page 15	**or APHO 000 612**	-	768 I/O	-	
Extension to 1024 inputs and outputs	**APSO 000 670**	-	1024 I/O	-	
APSO 000 670 associated with 16-axis and 768 I/O option (APHO 000 611 or APHO 000 612) extends the number of inputs and outputs to 1024.					
Integrated inputs/outputs card					
Selection of one card per system.					
Card with 32 inputs/24 outputs 250 mA DIN	**APHO 000 631**	❍	❍	❍	
Card with 64 inputs/48 outputs 250 mA DIN	**APHO 000 636**	❍	❍	❍	
Connecting cable for 32 inputs 1 m	**APHC 080 090**	❍	❍	❍	
Connecting cable for 32 inputs 2 m	**APHC 080 091**	❍	❍	❍	
Connecting cable for 32 inputs 5 m	**APHC 080 094**	❍	❍	❍	
Connecting cable for 24 inputs 1 m	**APHC 080 092**	❍	❍	❍	
Connecting cable for 24 inputs 2 m	**APHC 080 093**	❍	❍	❍	
Connecting cable for 24 inputs 5 m	**APHC 080 095**	❍	❍	❍	
Wiring Modules					
32-input interface module	**APHE 080 080**	❍	❍	❍	
24-output relay module	**APHE 080 084**	❍	❍	❍	
Remote Input/Output Modules					
They are connected to the CNC by a fiber-optic cable (see page 18).					
Max. no. discrete + analog modules combined		8	32	32	
Maximum number of discrete modules		7	32	32	
Maximum number of analog modules		1	4	4	
Remote 16-input 24 VDC module	**APHE 080 097**	❍	❍	❍	
Remote 32-input 24 VDC module	**APHE 080 077**	❍	❍	❍	
32-output 24 VDC 0,5 A module	**APHE 080 078**	❍	❍	❍	
Remote 16-input/16-output 24 VDC 0,5 A module	**APHE 080 098**	❍	❍	❍	
Remote 8-input/8-output 2 A module	**APHE 080 099**	❍	❍	❍	
Remote 4-input/2-output analog module	**APHE 080 096**	❍	❍	❍	
Removable connectors					
Set of 3 plug-in connectors with screw terminals	**APHE 080 120**	❍	❍	❍	
Set of 3 plug-in conn. with spring-loaded terminals	**APHE 080 121**	❍	❍	❍	
Busbars					
Busbar with 1 row of screw terminals	**APHE 080 122**	❍	❍	❍	
Busbar with 2 rows of screw terminals	**APHE 080 124**	❍	❍	❍	
Busbar with 3 rows of screw terminals	**APHE 080 126**	❍	❍	❍	
Busbar with 1 row of spring-loaded terminals	**APHE 080 123**	❍	❍	❍	
Busbar with 2 rows of spring-loaded terminals	**APHE 080 125**	❍	❍	❍	
Busbar with 3 rows of spring-loaded terminals	**APHE 080 127**	❍	❍	❍	
PLC programming					
Programming in Ladder language		●	●	●	
Programming in C	**APSO 000 571**	❍	❍	❍	

● basic
❍ optional
- unavailable

Equivalence Tables

Software Packs
Milling Packs

NUM offers a wide range of milling functions. These functions can be ordered individually using their reference or in milling packs. Milling pack M0 includes all the basic milling functions. The other packs include additional functions selected according to the type of machine and the application.

Functions also used for milling but not included in a pack are identified by the letter M in the Comments column (see pages 26 and 27).

Description	Commercial reference	Axium Power			Functions included in the packs				
		First	Adv.	Ultim.	M0	M1	M2	M3	HSC
Basic Milling Pack M0	**APPA 000 560**	❍	❍	❍					
Milling Pack M1*	**APPA 000 561**	❍	❍	❍					
Milling Pack M2*	**APPA 000 562**	-	❍	❍					
Milling Pack M3*	**APPA 000 563**	-	❍	❍					
HSC Milling Pack*	**APPA 000 564**	-	❍	❍					
** Pack M0 required*									
5-axis interpolation	**APSO 000 335**	-	❍	❍			●	●	
Circular interpolation defined by three points	**APSO 000 497**	❍	❍	❍	●				
Milling cycles (G31, G81 à G89) and circular, rectangular et oblong pocket cycles (G45)	**APSO 000 695**	❍	❍	❍	●				
Scaling factor (G74)	**APSO 000 506**	❍	❍	❍	●				
Angular program offset (ED)	**APSO 000 507**	❍	❍	❍	●				
On-the-fly measurement acquisition (G10)	**APSO 000 520**	❍	❍	❍	●				
Transfer of active settings to the part program	**APSO 000 511**	❍	❍	❍	●				
Structured programming, program stack and symbolic variables	**APSO 000 535**	❍	❍	❍	●				
Extension to 255 tool offsets	**APSO 000 401**	❍	❍	❍	●				
Tool wear offset by the PLC	**APSO 000 410**	❍	❍	❍	●				
Measured digital spindle control	**APSO 000 452**	❍	❍	❍		1		1	
Irregular pocket cycles	**APSO 000 159**	❍	❍	❍		●		●	
Rigid Tapping	**APSO 000 332**	❍	❍	❍		●		●	
3D graphic display	**APSO 000 158**	❍	❍	❍		●		●	
PROCAM MILL	**APSO 100 238**	❍	❍	❍		●		●	
Includes: Angular program offset, Transfer of active settings to the program and 256 KB of Qp memory.									
3D tool radius offset	**APSO 000 400**	❍	❍	❍		●		●	
Inclined plane machining	**APSO 000 914**	❍	❍	❍		●	●	●	
RTCP function	**APSO 000 154**	-	❍	❍			●	●	
5-axis tool offset	**APSO 000 411**	-	❍	❍			●	●	●
Smooth polynomial interpolation	**APSO 000 499**	-	❍	❍					●
Spline interpolation	**APSO 000 518**	-	❍	❍					●
High speed cutting of precision contours (UGV1)	**APSO 000 155**	❍	❍	❍					●
Memory used by the application		-	-	-		256 KB		256 KB	
Part program memory (Qp)		-	-	-		128 KB		128 KB	

● basic
❍ optional
- unavailable

Equivalence Tables

Software Packs
Turning Pack, Tool Cutting and Grinding Pack, Gear Hobbing Pack

NUM offers a wide range of turning and tool cutting and grinding functions (preequipped for the NUMROTO function). These functions can be ordered individually using their reference or in packs.

Functions also used for turning and tool cutting/grinding but not included in a pack are identified by the letters T and TR in the Comments column (see pages 25 to 27).

Description	Commercial reference	Axium Power			Functions included in the packs			
		First	Adv.	Ultim.	T	TR	SEGB	FEGB
Turning Pack – T	**APPA 000 555**	❍	❍	❍				
Constant surface speed		-	-	-	●			
Measured digital spindle control	**APSO 000 452**	❍	❍	❍	●			
Tool wear offset by the PLC	**APSO 000 410**	❍	❍	❍	●			
Turning cycles (G63 to G66, G81 to G87, G89)	**APSO 000 696**	❍	❍	❍	●			
Axis/spindle servoing (thread cutting cycles)	**APSO 000 331**	❍	❍	❍	●			
Scaling factor (G74)	**APSO 000 506**	❍	❍	❍	●			
Angular program offset (ED)	**APSO 000 507**	❍	❍	❍	●			
Transfer of active settings to the part program	**APSO 000 511**	❍	❍	❍	●			
Structured programming	**APSO 000 535**	❍	❍	❍	●			
On-the-fly measurement acquisition (G10)	**APSO 000 520**	❍	❍	❍	●			
Circular interpolation defined by three points	**APSO 000 497**	❍	❍	❍	●			
Tool cutting and grinding Pack – TR (Preequipped for the NUMROTO software)	**APPA 000 586**	-	❍	❍				
5-axis interpolation	**APSO 000 335**	-	❍	❍		●		
Circular interpolation defined by three points	**APSO 000 497**	❍	❍	❍		●		
Programmable precision	**APSO 000 519**	❍	❍	❍		●		
Structured programming	**APSO 000 535**	❍	❍	❍		●		
Transfer of active settings to the part program	**APSO 000 511**	❍	❍	❍		●		
On-the-fly measurement acquisition (G10)	**APSO 000 520**	❍	❍	❍		●		
Gear Hobbing Pack 1 – SEGB	**APSO 000 596**	-	❍*	❍				
Gear Hobbing Pack 2 – FEGB	**APSO 000 597**	-	❍*	❍				
Both packs include "Axis/spindle servoing (thread cutting cycles)" APSO 000 331								
** = requires "16 Axis and 768 I/O Option" APHO 000 611 or 612*								
Tool wear offset by the PLC	**APSO 000 410**	❍	❍	❍			●	●
Scaling factor (G74)	**APSO 000 506**	❍	❍	❍			●	●
Angular program offset (ED)	**APSO 000 507**	❍	❍	❍			●	●
Structured programming	**APSO 000 535**	❍	❍	❍			●	●
Transfer of active settings to the part program	**APSO 000 511**	❍	❍	❍			●	●
On-the-fly measurement acquisition (G10)	**APSO 000 520**	❍	❍	❍			●	●
Emergency retract (G75)	**APSO 000 505**	❍	❍	❍			●	●
Dynamic operators	**APSO 000 250**	❍	❍	❍			●	●
Processor data interchange	**APSO 000 112**	❍	❍	❍			●	●

● basic
❍ optional
- unavailable

Equivalence Tables

Software Packs
Cylindrical Grinding and Surface Grinding Packs

NUM offers a wide range of grinding functions. These functions can be ordered individually using their reference or in cylindrical grinding and surface grinding packs.

Functions also used for cylindrical grinding or surface grinding but not included in a pack are identified by the letters GC and GS in the Comments column (see pages 25 to 27).

Description	Commercial reference	Axium Power			Functions included in the packs	
		First	Adv.	Ultim.	GC	GS
Cylindrical Grinding Pack – GC	**APPA 000 588**	❍	❍	❍		
Constant surface speed		-	-	-	●	
Turning cycles (G63 to G66, G81 to G87, G89)	**APSO 000 696**	❍	❍	❍	●	
Programmable precision	**APSO 000 519**	❍	❍	❍	●	
Scaling factor (G74)	**APSO 000 506**	❍	❍	❍	●	
Angular program offset (ED)	**APSO 000 507**	❍	❍	❍	●	
Transfer of active settings to the part program	**APSO 000 511**	❍	❍	❍	●	
Structured programming	**APSO 000 535**	❍	❍	❍	●	
Emergency retract (G75)	**APSO 000 505**	❍	❍	❍	●	
On-the-fly measurement acquisition (G10)	**APSO 000 520**	❍	❍	❍	●	
Axis/spindle servoing (thread cutting cycles)	**APSO 000 331**	❍	❍	❍	●	
Inclined or tilt axes	**APSO 000 315**	❍	❍	❍	●	
Circular interpolation defined by three points	**APSO 000 497**	❍	❍	❍	●	
Dynamic operators	**APSO 000 250**	❍	❍	❍	●	
Surface Grinding Pack – GS	**APPA 000 587**	❍	❍	❍		
Milling cycles (G31, G81 à G89) and circular, rectangular et oblong pocket cycles (G45)	**APSO 000 695**	❍	❍	❍		●
Programmable precision	**APSO 000 519**	❍	❍	❍		●
Scaling factor (G74)	**APSO 000 506**	❍	❍	❍		●
Angular program offset (ED)	**APSO 000 507**	❍	❍	❍		●
Transfer of active settings to the part program	**APSO 000 511**	❍	❍	❍		●
Structured programming	**APSO 000 535**	❍	❍	❍		●
Emergency retract (G75)	**APSO 000 505**	❍	❍	❍		●
On-the-fly measurement acquisition (G10)	**APSO 000 520**	❍	❍	❍		●
Circular interpolation defined by three points	**APSO 000 497**	❍	❍	❍		●
Dynamic operators	**APSO 000 250**	❍	❍	❍		●

● basic
❍ optional
\- unavailable

Equivalence Tables

Software Packs
Woodworking and Stone/Marble/Glass Cutting Packs

NUM offers a wide range of functions dedicated to woodworking and stone, marble and glass cutting. These functions can be ordered individually using their reference or in packs. Milling pack M0 includes all the basic functions for this type of job. The other packs include additional functions selected according to the type of machine and the application.

Functions also used for woodworking and stone/marble/glass cutting but not included in a pack are identified by the letter W in the Comments column (see pages 26 and 27).

Description	Commercial reference	Axium Power			Functions included in the packs				
		First	Adv.	Ultim.	M0	SMG	W1	W2	AM
Basic Pack – M0 (see page 21)	**APPA 000 560**	❍	❍	❍					
Stone/Marble/Glass Cutting Pack – SMG*	**APPA 000 565**	❍	❍	❍					
Woodworking Pack – W1* (5-axis milling)	**APPA 000 576**	-	❍	❍					
Woodworking Pack – W2* (longitudinal milling)	**APPA 000 577**	-	❍	❍					
Aluminium Machining Pack – AM*	**APPA 000 566**	-	❍	❍					
** Pack M0 required*									
5-axis interpolation	**APSO 000 335**	-	❍	❍			●	●	●
Circular interpolation defined by three points	**APSO 000 497**	❍	❍	❍	●				
Milling cycles (G31, G81 à G89) and circular, rectangular et oblong pocket cycles (G45)	**APSO 000 695**	❍	❍	❍	●				
Scaling factor (G74)	**APSO 000 506**	❍	❍	❍	●				
Angular program offset (ED)	**APSO 000 507**	❍	❍	❍	●				
On-the-fly measurement acquisition (G10)	**APSO 000 520**	❍	❍	❍	●				
Transfer of active settings to the part program	**APSO 000 511**	❍	❍	❍	●				
Structured programming , program stack and symbolic variables	**APSO 000 535**	❍	❍	❍	●				
Extension to 255 tool offsets	**APSO 000 401**	❍	❍	❍	●				
Tool wear offset by the PLC	**APSO 000 410**	❍	❍	❍	●				
Processor data interchange	**APSO 000 112**	❍	❍	❍		●			●
Dynamic operators	**APSO 000 250**	❍	❍	❍		●		●	
Dynamic operators in C	**APSO 000 249**	-	❍	❍				●	
Spline interpolation with 3D curve smoothing	**APSO 181 706**	❍	❍	❍		●			
3D tool radius offset	**APSO 000 400**	❍	❍	❍			●		
Inclined plane	**APSO 000 914**	❍	❍	❍		●			●
5-axis tool offset	**APSO 000 411**	-	❍	❍			●		
RTCP function	**APSO 000 154**	-	❍	❍			●		●
High speed cutting of precision contours (UGV1)	**APSO 000 155**	-	❍	❍			●	●	
Part program memory (Qp)		-	-	-		512KB	1024KB	3096KB	

● basic
❍ optional
- unavailable

Equivalence Tables

Software Options

Functions Related to Axes and Spindles

These functions are described in Chapter 4, Functional Specifications.

Description	Commercial reference	Axium Power First	Axium Power Advanced	Axium Power Ultimate	Comments
Functions related to axes					
Axis and interaxis calibration		●	●	●	
Progressive acceleration		●	●	●	
Anti-pitch correction		●	●	●	
Look-ahead function		●	●	●	
Multigroup-multichannel function					
Basic		1	2	2	
4 axis groups or channels	**APSO 000 392**	-	❍	❍	
6 axis groups or channels	**APSO 000 393**	-	❍	❍	
8 axis groups or channels	**APSO 000 394**	-	❍	❍	
Number of interpolated axes per group					
Basic		3	4	4	
4-axis Interpolation	**APSO 000 334**	❍	●	●	(1)
5-axis Interpolation	**APSO 000 335**	-	❍	❍	(1)
6-axis Interpolation	**APSO 000 336**	-	❍	❍	
7-axis Interpolation	**APSO 000 337**	-	❍	❍	
8-axis Interpolation	**APSO 000 338**	-	❍	❍	
9-axis Interpolation	**APSO 000 339**	-	❍	❍	
Linear and circular interpolation		●	●	●	
Circular interpolation defined by three points	**APSO 000 497**	❍	❍	❍	(1)
Spline interpolation (G06, G48, G49)	**APSO 000 518**	-	❍	❍	(1)
Smooth polynomial interpolation	**APSO 000 499**	-	❍	❍	(1)
Spline interpolation with 3D curve smoothing (G104)	**APSO 181 706**	❍	❍	❍	(1)
NURBS (B-Spline) interpolation	**APSO 000 426**	-	❍	❍	
Tandem function *Requires option APHO 000 611 or APHO 000612 – see page 15.*	**APSO 000 453**	-	❍	❍	
Inclined or tilt axes	**APSO 000 315**	❍	❍	❍	(1)
Duplicated and synchronized axes	**APSO 000 266**	❍	❍	❍	
Programmable precision	**APSO 000 519**	❍	❍	❍	(1)
High speed cutting of precision contours (UGV1)	**APSO 000 155**	❍	❍	❍	T, GC, (1)
Dynamic operators	**APSO 000 250**	❍	❍	❍	TR, (1)
Dynamic operators in C *Requires a coprocessor – APHO 000 612 option (see page 15)*	**APSO 000 249**	-	❍	❍	(1)
Functions Functions related to spindles					
Indexed spindle (M19)		●	●	●	
Spindle speed range search		●	●	●	
Axis/spindle servoing (thread cutting cycles)	**APSO 000 331**	❍	❍	❍	(1)
Rigid Tapping	**APSO 000 332**	❍	❍	❍	(1)
Spindle synchronization	**APSO 000 156**	-	❍	❍	

(1) See packs – pages 21 to 24
T - option useful for turning
GC - option useful for cylindrical grinding
GS - option useful for surface grinding
TR - option useful for tool cutting

● basic
❍ optional
- unavailable

Equivalence Tables

Software Options
Tool Management, Canned Cycles

These functions are described in Chapter 4, Functional Specifications.

Description	Commercial reference	Axium Power First	Axium Power Advanced	Axium Power Ultimate	Comments
Tool Management					
Tool axis selection		●	●	●	
Radius and legth correction		●	●	●	
Table of 32 offsets		●	●	●	
Extension to 255 offsets	**APSO 000 401**	❍	❍	❍	M
3D radius correction for milling	**APSO 000 400**	❍	❍	❍	(1)
Correction d'outil 5 axes en fraisage *Requires 5-axis interpolation*	**APSO 000 411**	-	❍	❍	(1)
Tool wear offset by the PLC	**APSO 000 410**	❍	❍	❍	(1)
Canned Cycles					
Milling cycles (G31, G81 à G89) and circular, rectangular et oblong pocket cycles (G45)	**APSO 000 695**	❍	❍	❍	(1)
Irregular pocket cycles *Requires a milling pack.*	**APSO 000 159**	❍	❍	❍	W, (1)
Turning cycles (G63 to G66, G81 to G87, G89)	**APSO 000 696**	❍	❍	❍	(1)
Combined machine function (turning + milling) *Includes : Turning cycle, Axis/spindle servoing (thread cutting cycles), Cartesian/ polar and cylindrical conversion, Double window graphics, Boring/radial axis function.* *Requires a milling pack.*	**APSO 000 581**	-	❍	❍	M, W
Functions requiring a job-specific pack : *(see comments)*					
Polygon cutting cycles *(consult NUM)*	**APSO 100 538**	❍	❍	❍	T
Cartesian/ polar and cylindrical conversion (G20, G21, G22)	**APSO 000 340**	❍	❍	❍	T, GC
T probing cycles *Includes : Transfer of active settings to the part program, On-the-fly measurement acquisition, Structured programming and 32 KB of Qp memory.*	**APSO 100 590**	❍	❍	❍	T
Radial axis boring/milling function (Z-axis interpolation)	**APSO 000 514**	❍	❍	❍	M, W
Inclined plane machining	**APSO 000 914**	❍	❍	❍	W, (1)
RTCP Function (G26)	**APSO 000 154**	-	❍	❍	(1)
M probing cycles *Includes : Transfer of active settings to the part program, On-the-fly measurement acquisition, Structured programming and 96 KB of Qp memory.*	**APSO 100 591**	❍	❍	❍	M, W
Automatic gear alignment	**APSO 000 595**	-	❍	❍	SEGB, FEGB

(1) See packs – pages 21 to 24
M - option useful for milling
T - option useful for turning
GC - option useful for cylindrical grinding
W - option useful for woodworking
SEGB, FEGB - option useful for gear hobbing

● basic
❍ optional
- unavailable

Software Options
Programming

These functions are described in Chapter 4, Functional Specifications.

Description	Commercial reference	Axium Power First	Axium Power Advanced	Axium Power Ultimate	Comments
Programming					
2D graphic dysplay		●	●	●	
Inch-metric conversion		●	●	●	
PGP and PROFIL		●	●	●	
Parametric programming		●	●	●	(1)
Hard copy of screen		●	●	●	
3D graphic dysplay	**APSO 000 158**	❍	❍	❍	GS, W, (1)
Scaling factor (G74)	**APSO 000 506**	❍	❍	❍	(1)
Angular program offset (ED)	**APSO 000 507**	❍	❍	❍	(1)
Transfer of active settings to the part program	**APSO 000 511**	❍	❍	❍	(1)
Structured programming, program stack and symbolic variables	**APSO 000 535**	❍	❍	❍	(1)
Building a profil table *Includes structured programming.*	**APSO 000 536**	❍	❍	❍	M, T, GC, W, (1)
Functions requiring a job-specific pack: *(see comments)*					
PROCAM TURN (Turning) *Includes : Angular program offset, Transfer of active settings to the program and 256 KB of Qp memory.*	**APSO 100 239**	❍	❍	❍	T
PROCAM MULTITURN (Turning / Multislide) *Includes : Angular program offset, Transfer of active settings to the program and 512 KB of Qp memory.*	**APSO 100 133**	-	❍	❍	T
PROCAM MILL (Milling) *Includes : Angular program offset, Transfer of active settings to the program and 256 KB of Qp memory.*	**APSO 100 238**	❍	❍	❍	W, (1)
PROCAM MX (combined machines – Milling/ Turning) *Includes : Angular program offset, Transfer of active settings to the program and 512 KB of Qp memory.*	**APSO 100 134**	-	❍	❍	M, W
PROCAM HG (Gear Hobbing)	**APSO 000 592**	-	❍	❍	HG, (1)
NUMAFORM, Mold and form machining cycles *Includes : Dynamic operators, 3D tool radius offset, Structured programming, Building a profile table.*	**APSO 000 917**	❍	❍	❍	M, W
Miscellaneous					
Auto n/m function	**APSO 000 082**	-	❍	❍	M, W
Emergency retract (G75)	**APSO 000 505**	❍	❍	❍	M, T, GS, W, (1)
On-the-fly measurement acquisition (G10)	**APSO 000 520**	❍	❍	❍	(1)
Backtrack along stored path	**APSO 000 523**	❍	❍	❍	M, T, GC, GS, W

(1) See packs – pages 21 to 24
M - option useful for milling
T - option useful for turning
TR - option useful for tool cutting
GC - option useful for cylindrical grinding
GS - option useful for surface grinding
W - option useful for woodworking
HG - option useful for gear hobbing

● basic
❍ optional
- unavailable

Communication
Integration and Customizing Software Tools

These functions are described in Chapter 4, Functional Specifications.

Description	Commercial reference	Axium Power First	Axium Power Advanced	Axium Power Ultimate	Comments
COMMUNICATION					
Serial lines (115 kbd)		3	3	3	
Link with PC panel					
Ethernet TCP/IP Connection	**APSO 000 933**	❍	❍	❍	
HSL high speed link	**APSO 000 932**	❍	❍	❍	
Includes the Uni-Telway connection					
Processor Data Interchange	**APSO 000 112**	❍	❍	❍	(1)
Connection to Networks					
Uni-Telway	**APSO 000 911**	❍	❍	❍	
Fipway	**APSO 000 924**	❍	❍	❍	
HMI and Tools					
32-bit Tools on Tool Workshop CD-ROM					
Includes software, option, documentation.					
MMI Interpreter	**APSW 000 946**	❍	❍	❍	
Standard MMI for PC	**APSW 182 110**	❍	❍	❍	
PCToolKit	**APSW 182 091**	❍	❍	❍	(1)
NUMBackUp	**APSW 182 093**	❍	❍	❍	(1)
PERSOTool	**APSW 182 094**	❍	❍	❍	
SETTool – Windows 2000/XP					
CD-ROM 1 licence	**APSW 182 092**	❍	❍	❍	
CD-ROM 5 licences	**APSW 182 192**	❍	❍	❍	
PLCTool – Windows 2000/XP					
CD-ROM 1 licence	**APSW 182 095**	❍	❍	❍	
CD-ROM 5 licences	**APSW 182 195**	❍	❍	❍	
CD-ROM 10 licences	**APSW 182 295**	❍	❍	❍	
MMITool – Windows 2000/XP					
CD-ROM 1 licence	**APSW 182 096**	❍	❍	❍	
Software Packages for customer PCs, on CD-ROM					
Package 1 – for panel PC (basic)					
Incl. NUMpass HMI, MMI Interpreter, PCTool Kit and NUMBackUp	**APSW 182 111**	❍	❍	❍	
Package 2 – for workstations	**APPC 182 188**	❍	❍	❍	
Incl. SETTool and PLCTool					
Package 3 – for panel PC (complete)	**APPC 182 189**	❍	❍	❍	
Incl. package 1 and package 2					
C Language Compiler (CD-ROM)	**APSW 182 026**	❍	❍	❍	

(1) See packs – pages 21 to 24

● basic
❍ optional
\- unavailable

Equivalence Tables

NUMpass HMI
Options

NUMpass HMI is a PC based HMI (Human Machine Interface) for the CNC range Axium Power and Num Power.

The basic NUMpass HMI software is a development of and the replacement for the Axium Power HMI and NUM HMI.

New features are offered and they are available individually or as packages providing several functions under a single reference.These functions are described in Chapter 4, Functional Specifications.

Description	Commercial reference	Functions included in the packages		Comments
		NUMtransferCNC®	NUMtransferCNC® (Multi-CNC)	
NUMpass HMI basic software licence *Note: This software is included in Package 1 (APSW 182 111), Package 3 (APPC 182 189) and Communication Bits with NUM PC Panels (APSO 182 112)*	**APSW 282 111**			(1)
NUMtransferCNC® **NUMtransferCNC® (Multi-CNC)**	**APSW 282 200** **APSW 282 201**			
Symbolic names	**APSW 282 112**	●	●	
Extended tool table	**APSW 282 113**	●	●	
Teach-in	**APSW 282 114**			
Extended PLC messages	**APSW 282 115**			
Multichannel functionality	**APSW 282 116**	●	●	(2)
Multi-CNC	**APSW 282 117**		●	
Integrated machine panel Typ F	**APSW 282 118**			
Integrated machine panel Typ P	**APSW 282 119**			
BackupAgent	**APSW 282 120**			
MDLU test point monitoring	**APSW 282 121**			
Extensions for NUMROTO*plus*	**APSW 282 122**			

(1) NUMpass HMI requires one of these packages
(2) This option is useful only with the multi channel option of the CNC enabled.

● basic
❍ optional
\- unavailable

Description	Commercial reference	Axium Power First	Axium Power Advanced	Axium Power Ultimate	Comments
Technical Documentation					
Each CNC includes a CD-ROM containing the basic documents in multiple languages.					
CD-ROM - Basic Documents	**APDO 000 815**	❍	❍	❍	
Includes all manuals in all available languages					
User Manuals					
M-W Programming	**938 819**	❍	❍	❍	**F E D I**
T-G Programming	**938 820**	❍	❍	❍	**F E D I**
Supplementary Programming	**938 872**	❍	❍	❍	**F E D I**
Addition to M-W Programming Manuals	**938 990**	❍	❍	❍	**F E**
Addition to T-G Programming Manuals	**938 989**	❍	❍	❍	**F E**
NUMpass HMI Operator Manual	**208 559**	❍	❍	❍	**F E**
NUM CNC M/W Operator Manual	**938 821**	❍	❍	❍	**F E**
NUM CNC T/G Operator Manual	**938 822**	❍	❍	❍	**F E**
PROFIL Function– Operation	**938 937**	❍	❍	❍	**F E D I**
OEM Documents					
Machine Parameters	**938 818**	❍	❍	❍	**F E D I**
Axium Power Installation/Commissioning	**208 558**	❍	❍	❍	**F E**
Addition to Installation Man. indexes M + N	**208 534**	❍	❍	❍	**F E**
Installation Manual – HSL Line	**938 996**	❍	❍	❍	**FE**
EMC Installation and Wiring Guide	**938 960**	❍	❍	❍	**F E I**
Remote Inputs/Outputs	**938 954**	❍	❍	❍	**F E D I**
Portable Operator Panel (POP)	**938 987**	❍	❍	❍	**F E**
Maintenance Documents					
CNC and NUM Drive Maintenance Manual	**938 979**	❍	❍	❍	**F E**
CNC Maintenance Manual	**208 531**	❍	❍	❍	**S**
CD-ROM – Special Manuals	**APDO 000 816**	❍	❍	❍	
Includes all manuals in all available languages					
User Manuals					
RTCP and 3/5 Auto Function	**950 003**	-	❍	❍	**F**
Polygon Cutting Function	**938 952**	❍	❍	❍	**F E**
PROCAM MILL – Technological Data	**938 958**	❍	❍	❍	**F E**
PROCAM MILL – Interactive Programming	**938 873**	❍	❍	❍	**F E D I S**
PROCAM TURN – Technological Data	**938 959**	❍	❍	❍	**F E**
PROCAM TURN – Interactive Programming	**938 874**	❍	❍	❍	**F E I**
PROCAM GRIND – Interactive Cylindrical Grinding Programming	**938 931**	❍	❍	❍	**F E I**
PROCAM GRIND – Interactive Surface Grinding Programming	**938 953**	❍	❍	❍	**F E**
Cylindrical Grinding – GC Programming	**938 930**	❍	❍	❍	**F E I**
Surface Grinding – GS Programming	**938 945**	❍	❍	❍	**F E**
Gear Hobbing and Grinding	**938 932**	❍	❍	❍	**F E D**
Inclined plane machining	**950 004**	❍	❍	❍	**F**
Dynamic operators	**938 871**	❍	❍	❍	**F E I**

F document available in French
E document available in English
D document available in German

I document available in Italian
S document available in Spanish

● basic
❍ optional
- unavailable

Description	Commercial reference	Axium Power First	Axium Power Advanced	Axium Power Ultimate	Comments
Technical Documentation / 2					
OEM Documents					
DISC NT - Integration	**938 907**	❍	❍	❍	**F E D I**
Cylindrical Grinding – Commissioning					
Duplicated and synchronized Axes	**938 875**	❍	❍	❍	**F E**
Milling Probing Cycles	**938 948**	❍	❍	❍	**F E D I**
T Probing Cycles	**938 947**	❍	❍	❍	**F E D I**
Fipway – Integration	**938 972**	❍	❍	❍	**F E**
RTCP Function – Integration Tool	**938 936**	-	❍	❍	**F E D I**
Inclined Plane and Axis Assignment – Integrator Tool	**938 935**	❍	❍	❍	**F E D I**
Synchronization of two spindles	**938 854**	❍	❍	❍	**F**
Rigid Tapping	**938 881**	❍	❍	❍	**F**
High Speed Cutting	**938 956**	❍	❍	❍	**F E D**
Uni-TE – Use of the Protocol	**938 914**	❍	❍	❍	**F E**
Uni-Telway – Integration	**938 880**	❍	❍	❍	**F E**
Random	**938 951**	❍	❍	❍	**F**
Development Support Documents					
PROCAM – Description Language	**938 904**	❍	❍	❍	**F E**
CD-ROM - PC Tools Documents	**APDO 000 817**	❍	❍	❍	
The NUM Tool Workshop CD-ROM includes all the manuals below in all available languages.					
This CD-ROM is supplied with the PC panel and when one of the NUM tools is ordered.					
PERSOTool	**208 521**	❍	❍	❍	F
SETTool	**208 517**	❍	❍	❍	F E D I
PLCTool	**208 519**	❍	❍	❍	F E D I
MMITool	**208 520**	❍	❍	❍	F E
32-bit NUM Tools - Installation	**208 537**	❍	❍	❍	F E

F document available in French
E document available in English
D document available in German
I document available in Italian
S document available in Spanish

● basic
❍ optional
- unavailable

Technical Specifications

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Axium Power First, Axium Power Advanced and Axium Power Ultimate

The Axium Power System comes with the high-speed DISC NT bus controlling NUM Drive servodrives. It is available in three versions:

- Axium Power First controls up to 5 axes (including one spindle) and 112 inputs/outputs.
- Axium Power Advanced, designed for more complex applications, controls up to 32 axes, 1024 inputs/outputs and 8 axis groups or channels. A coprocessor (16-axis and 768 I/O option APHO 000 612) is available for applications that require a high CPU power, such as dynamic operators in C.
- Axium Power Ultimate is the solution for the most demanding applications. It controls up to 32 axes, 1024 inputs/outputs and 8 axis groups or channels.

  For further details on the possible configurations, refer to the table and graph on pages 11 and 12.

Panels

Axium Power can be used in conjunction with

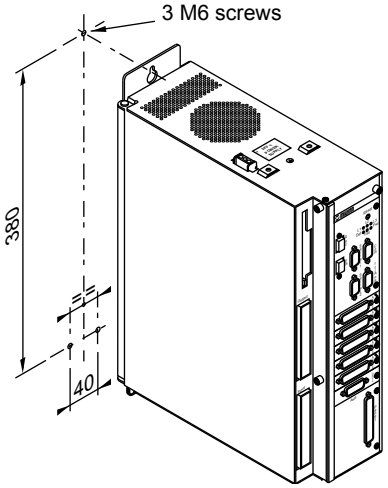
- A NUM iPC Compact panel, FS151i/FS151i-KBD or an external PC
- One or more NUM CNC panels, in which case a panel control card is required.

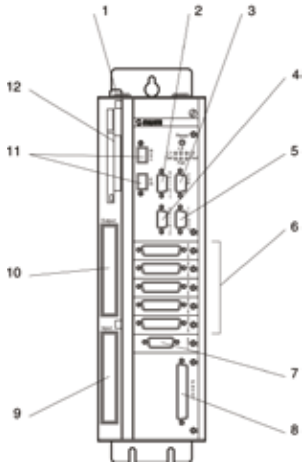
Applications

The Axium power system is designed to cover most machine tool and special machine applications (refer to Chapter 2 for the available software and job-specific packs).

Characteristics

• Power supply voltage	24 VDC +20% -15%
• Power consumption	70 W
• Protection class	IP20
• Relative humidity, noncondensing	5 to 85%
• Operating temperature range	5°C to 55°C
• Storage temperature range	-25°C to +70°C
• Overall dimensions (L x H x D)	110 x 404 x 285 mm
• Weight	6 kg





1 – Power supply connector
2 – Serial 1 serial port
3 – Com serial port
4 – Serial 2 serial port
5 – Interrupts, analog I/O
6 – Analog axes
7 – Connection to NUM Drive servodrives
8 – Video – operator panel connection
9 – Inputs
10 – Outputs
11 – Fiber-optic in/out
12 – PCMCIA port

Panels
General

General

Operator Panels and Machine Panels

NUM proposes a wide ranges of panels with the same look and feel to suit the needs of each machine as closely as possible:

PC Panels

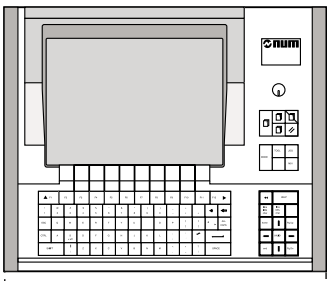
NUM iPC Compact

FS151 Family

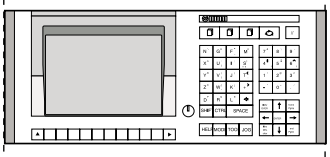
FS151, FS151i

FS151-KBD, F151i-KBD

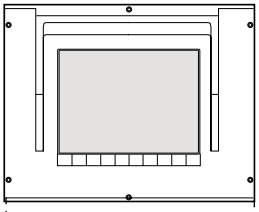
Operator Panels



CP30F Panel

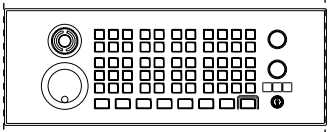


CP20F Panel



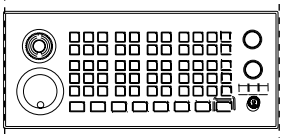
FS20 Display and KBD30 Keyboard

Machine Panels



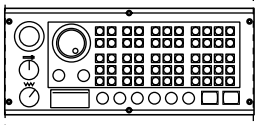
MP03 Panel

483 mm



MP03 Panel

410 mm



MP02 Panel

390 mm

Panels
Selection Guide

These tables give a rapid review of the main features of all the panels available from NUM.

Industrial PC panels	**NUM iPC Compact**
Panel type	PC
Display Unit	15" TFT LCD (1024 x 768)
Use	Combines the advantages of a conventional operator panel (part programming, settings, etc.) with those of a PC (compatibility with off-the-shelf tools and tools dedicated to an application, extended storage capacity and flexibility, etc.). In addition, they benefit from a user-friendly Human/Machine Interface. Developed in HTML, it can easily be modified to suit the special needs of certain markets. (Machine functions provided by an additional panel)
CNC/panel link	TCP/IP and HSL
Machine panel	MP03
CPU	Pentium 4 1.7 GHz, IDE 20 GB hard disk
Operating system	Windows XP Professional or Windows 2000
Keyboard	To be connected separately
Function keys	Touch screen
Communication	1 Ethernet port, 3 USB ports, 3 serial ports, 1 parallel port, 2 PS/2 ports
Extension slots	2 PCMCIA ports + 1 PCI
Power supply voltage	220 VAC
Power consumption	120 W
Protection class	IP 65
Overall dimensions (L x H x D*), mm	395 x 294 x 100
Weight	8 kg

*D: Depth behind panel

Technical Specifications

Panels
Selection Guide

These panels are described in greater detail on the following pages.

FS151 Family	FS151i P1 CF	FS151i-KBD P1 CF	FS151i P2 HD	FS151i-KBD P2 HD	FS151	FS151-KBD
Panel type	Active panel with integrated PC				Passive panel for an external PC	
Display unit	LCD 15"					
Use	These panels are especially developed for the use with NUMpass HMI					
CNC/panel link	TCP/IP and HSL					
Machine panel	MP03 (410mm)					
CPU	Celeron M 800 MHz CompactFlash™ 1 GB		Pentium M 1.8 GHz Hard Disc 40 GB		External PC required	
Operating system	Windows XP Embedded on CompactFlash™		Windows XP Professional on hard disc		-	-
Graphic card	Intel® 82852/82855 GM/GME Graphics Controller				Depends on PC used	
Qwerty-Keyboard	no	yes	no	yes	no	yes
Function keys	22 F-keys					
USB – interface for mouse and keyboard	yes					
Communication	3 Ethernet, 2 USB ports, 1 serial interface, 1 parallel interface, 2 PS/2 ports				Depends on PC used	
Power supply voltage	24 Vdc					
Power consumption	65 W		75 W		25 W	
Protection class	IP 65					
Overall dimensions (L x H x D*), mm	410 x 330 x 97.8	410 x 400 x 97.8	410 x 330 x 97.8	410 x 400 x 97.8	410 x 330 x 65	410 x 400 x 65
Weight	6.5 kg	7.1 kg	6.5 kg	7.1 kg	5.2 kg	5.8 kg

*D: Depth behind panel

Panels
Selection Guide

Conventional panels	CP30F	CP20F	FS20	CP10F	POP
Panel type	Operator			Compact	Portable
Display unit	12'' LCD	8''4 LCD	10''4 LCD	8''4 LCD	6''7 LCD
Use	For part programming next to the machine and for settings. The machine functions are provided by an additional panel.			Combines operator functions and machine functions	Allows you to move around the machine
Machine panel	MP03 (483 mm)		MP02 (390 mm)	Not required	Not required
Keyboard	Qwerty	50 keys	External Qwerty (KBD30)	External Qwerty (optional)	External Qwerty (optional)
Function keys	12		No	12 + 6 dedicated to the machine	18
Other	-			Spindle speed potentiometer Emergency stop button	
Power supply voltage	24 Vdc				
Power consumption	40 W	30 W	50 W	30 W	15 W
Overall dimensions (L x H x D*)	483 x 399 x 92 mm	483 x 220 x 107 mm	390 x 308 x 190 390 x 166 x 50 (KBD30 keyboard)	483 x 220 x 130 mm	310 x 240 x 87 mm
Weight	7.5 kg	5 kg	4,2 kg 1,7 kg (KBD30 keyboard)	5 kg	1.8 kg

*D: Depth behind panel

Panels

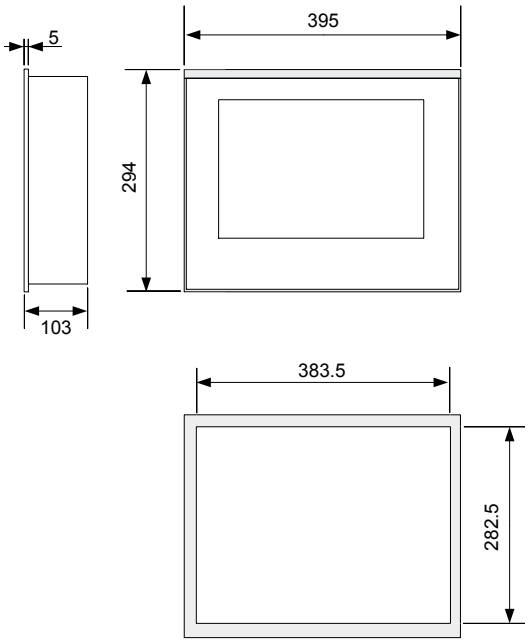
NUM iPC Compact Panel – with Touch Screen and integrated PC

NUM iPC Compact panel with touch screen and integrated PC

The performance-to-dimensions ratio of the NUM iPC Compact panel is remarkable. In addition, it has excellent communication possibilities and a touch screen that further improves the HMI's user-friendliness.

It's delivered with

- the NUMpass HMI (see page 74),
- Windows XP pro or Windows 2000,
- the software package for PC on CD-ROM, including SETTool, PCTool and PCToolkit (P/N 082 500, see page 79).



NUM iPC Compact: 220 V

- **with Windows XP pro (P/N APPC 555 318)**
- **with Windows 2000 (P/N APPC 555 317)**

Characteristics

- 15" touch screen
- Pentium 4-1.7 GHz
- IDE 20 GB hard disk
- 256 MB RAM
- 3½" floppy disk drive
- CD-ROM drive
- 1 Ethernet TCP/IP 10baseT/100baseTX port (RJ45 interface)
- 2x12 Mbit/s USB ports
- 3 COM serial ports (2 RS232 and/or 1 RS422/485)
- 1 parallel port
- Power supply voltage 220 VAC
- Power consumption 120 W
- Protection class IP65
- Operating temperature 0° to 50°
- Storage temperature -20° to +60° C
- Relative humidity without condensation 10 to 90%
- Overall dimensions (L x H x D) 395 x 294 x 100 mm
- Weight 8 kg

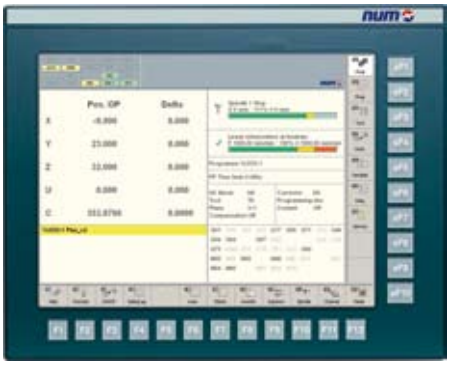
Panels
FS151i, FS151i-KBD – with integrated PC

NUM FS151i and FS151i-KBD panels with integrated PC

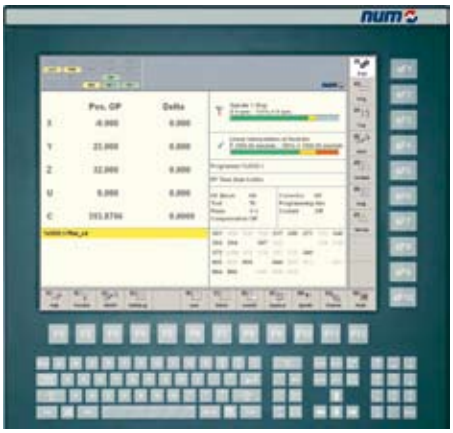
They making up a powerful and ergonomic control panel, particularly with the NUMpass HMI interface (see page 74).

The FS151i has 22 function keys around the screen. The FS151i-KBD has in addition a full Qwerty keyboard below keys F1 to F12.

The display quality of their 15.1" screen makes them very legible even in poorly lit environments. Compact, they are also very rugged and sealed (IP 65) for compatibility with the most severe industrial environments.



- **FS151i-P1 CF with 800MHz, CompactFlash™ and Win XP embedded: (P/N APPC 555 410)**
- **FS151i-P2 HD with 1.8GHz, Hard Disc and Win XP professional: (P/N APPC 555 413)**



- **FS151i-KBD P1 CF with 800MHz, CompactFlash™ and Win XP embedded: (P/N APPC 555 510)**
- **FS151i-KBD P2 HD with 1.8GHz, Hard Disc and Win XP professional: (P/N APPC 555 513)**

Characteristics

- Celeron Mobile 800 MHz or Pentium Mobile 1.8GHz
- CompactFlash™ 1GB (Win XP Embedded or hard disc 40 GB (Win XP Professional)
- Memory DDR RAM 512 MB (Celeron Mobile 800 MHz) or 1 GB (Pentium Mobile 1.8GHz)
- Intel® 82852/82855 GM/GME Graphics Controller
- 3 Port Ethernet TCP/IP 10baseT/100baseTX
- 2 USB V2 Ports
- 1 serial interface
- 1 parallel interface
- 1 interface for an exteral VGA-screen
- 15.1" display unit protected by a 2-mm mineral glass panel
- Colour: 16.19 million
- 22 function keys surrounding the screen
- Qwerty keyboard for the FS151i-KBD
- PS2 port for PC keyboard, which can be used alongside the function keys on the FS151i and the Qwerty keyboard on the FS151i-KBD
- May be associated with the MP03 machine panel
- EMC: CE conformity
- Power supply voltage 24 VDC
- Power consumption 65 W (Celeron Mobile 800 MHz) or 75 W (Pentium Mobile 1.8GHz)
- Protection class, front panel: IP65
- Protection class, sealing to cabinet: IP54
- Protection class, backside: IP20
- Operating temperature 0° to 45°
- Storage temperature -20° to +60° C
- Relative humidity without condensation 10 to 90%
- Overall dimensions (L x H x D)
  FS151i 410 x 330 x 96 mm
  FS151i-KBD 410 x 400 x 96 mm
- Weight
  FS151i 6.5 kg
  FS151i-KBD 7.1 kg

FS151i and FS151i-KBD:

Dimensions and cutout see page 43

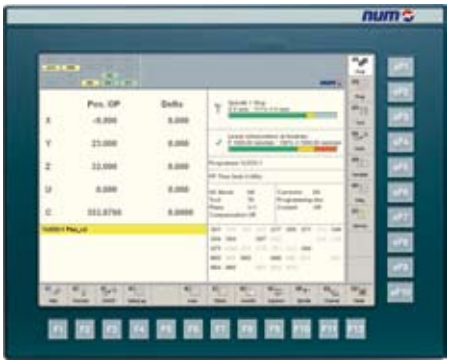
Panels
FS151, FS151-KBD

NUM FS151 and FS151-KBD panels

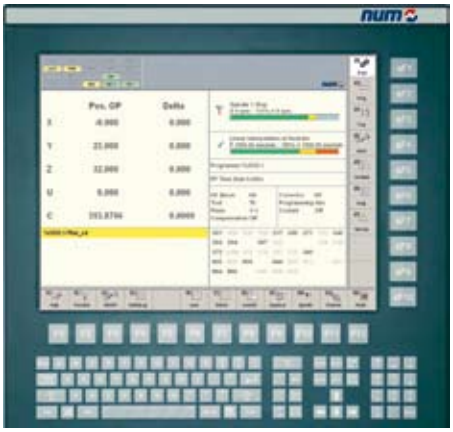
They are intended for use with a standard or industrial PC, making up a powerful and ergonomic control panel, particularly with the NUMpass HMI interface (see page 74).

The FS151 has 22 function keys around the screen. The FS151KBD has in addition a full Qwerty keyboard below keys F1 to F12.

The display quality of their 15“ screen makes them very legible even in poorly lit environments. Compact, they are also very rugged and sealed (IP 65) for compatibility with the most severe industrial environments.



• FS151: (P/N APPC 000 783)



• FS151-KBD: (P/N APPC 000784)

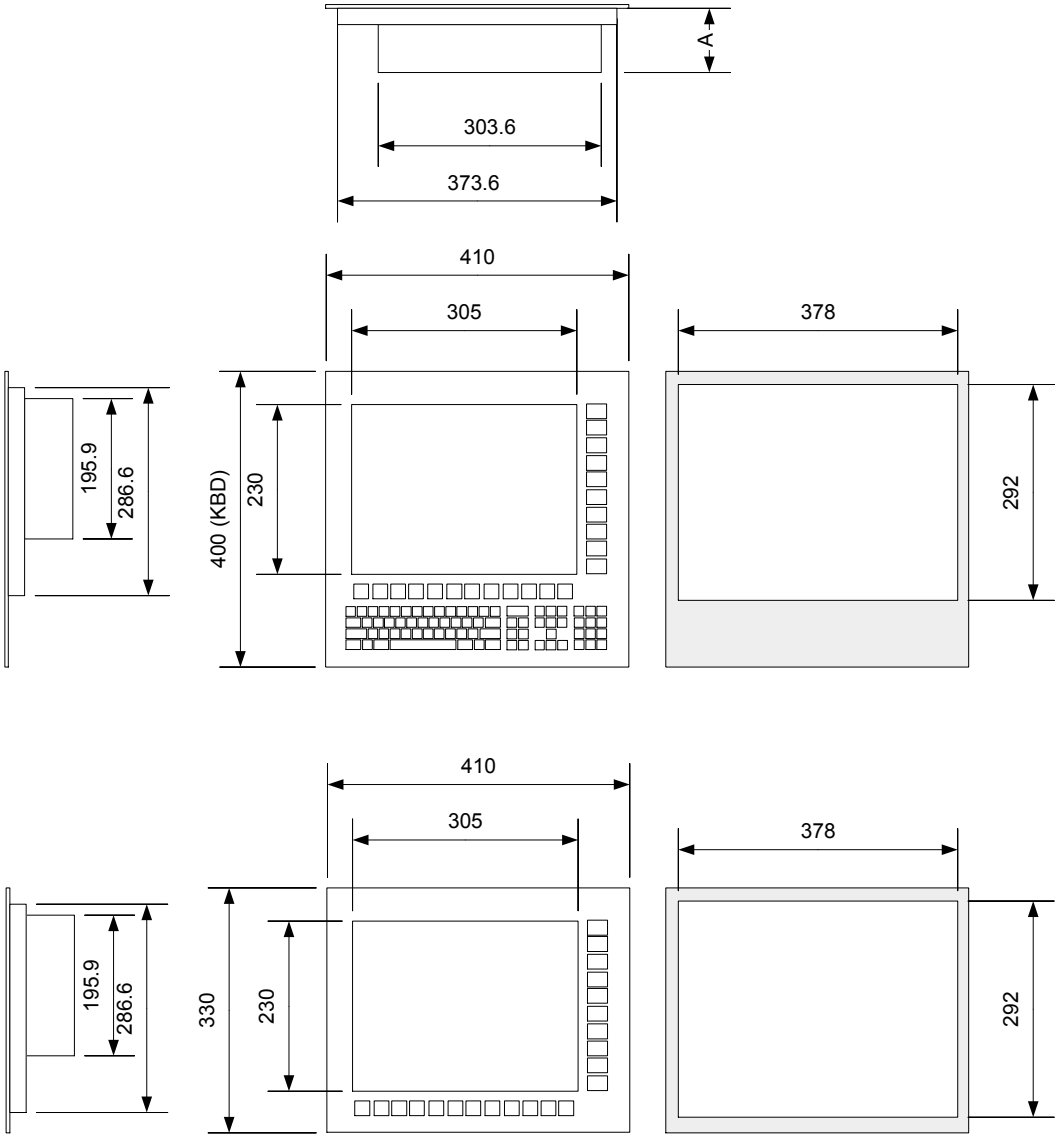
Characteristics

- 15.1” display unit protected by a 2-mm mineral glass panel
- 22 function keys surrounding the screen
- Qwerty keyboard for the FS151KBD
- PS2 port for PC keyboard, which can be used alongside the function keys on the FS151 and the Qwerty keyboard below keys F1 to F12 on the FS151KBD
- May be associated with the MP03 machine panel
- Power supply voltage 24 VDC
- Power consumption 20 W
- Protection class, front panel: IP65
- Protection class, sealing to cabinet: IP54
- Protection class, backside: IP20
- Operating temperature 0° to 50°
- Storage temperature -20° to +60° C
- Relative humidity without condensation 10 to 90%
- Overall dimensions (L x H x D)
  FS151 410 x 330 x 65 mm
  FS151-KBD 410 x 400 x 65 mm
- Weight
  FS151 5.2 kg
  FS151-KBD 5.8 kg
- Max distance from the PC 5 to 10 m
  up to 100 m with signal amplifier

FS151 and FS151-KBD:

Dimensions and cutout see page 43

Panels
FS151 Family Dimensions and Cutout



	FS151i / FS151i-KBD	FS151 / FS151-KBD
Measure "A"	96 mm	63 mm

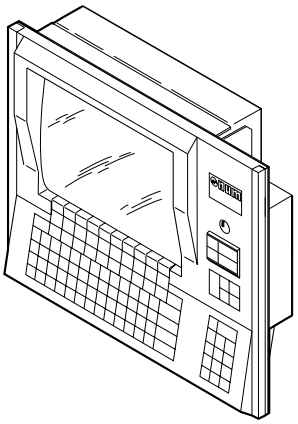
Panels

Operator Panels with LCD Display

CP30F Operator Panel

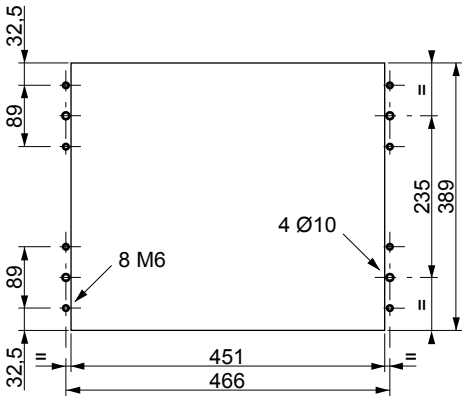
With its large LCD display unit and complete Qwerty keyboard, the CP30F panel (P/N APHE 000 782) is very agreeable to work with, especially for keyboard-intensive jobs.

- 12" TFT active matrix color LCD display unit
- Requires a panel controller card
- Can be used in conjunction with an MP03 machine panel (see page 47)
- Compatible with the multiplexer function (multi-CNC and multipanel, see page 48)



Characteristics

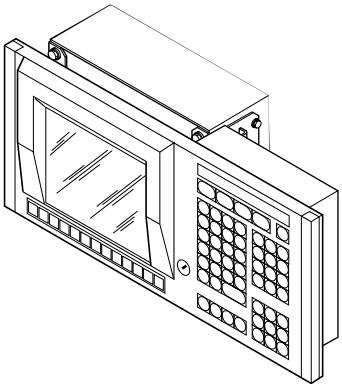
• Power supply voltage	24 VDC; +10%; -15%
• Power consumption	40 W
• Operating temperature range	5°C to 55°C
• Storage temperature range	-25°C to +70°C
• Relative humidity, noncondensing	5% to 85%
• Overall dimensions (L x H x D)	483 x 399 x 92 mm
• Weight	7,5 kg
• Max. distance from CNC	40 m



CP20F Operator Panel

The CP20F operator panel (P/N APHE 000 781) is smaller and has a keyboard with 50 keys.

- 8.4" TFT active matrix color LCD display unit
- Requires a panel controller card
- Can be used in conjunction with an MP03 machine panel (see page 47)
- Compatible with the multiplexer function (multi-CNC and multipanel, see page 48)



Characteristics

• Power supply voltage	24 VDC; +10%; -15%
• Power consumption	30 W
• Operating temperature range	5° to 55°
• Storage temperature range	-25° to +70° C
• Relative humidity, noncondensing	5 to 85%
• Overall dimensions (L x H x D)	483 x 220 x 107 mm
• Weight	5 kg
• Max. distance from CNC	40 m

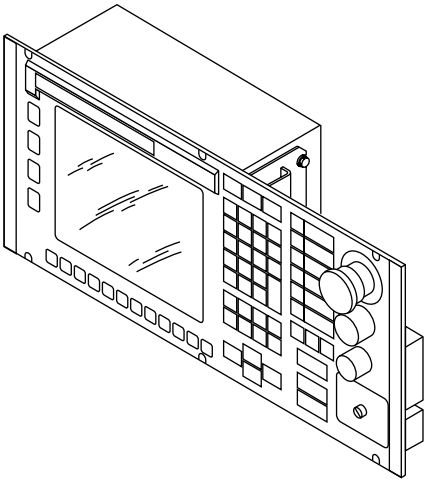
Technical Specifications

Panels
Compact Panel with LCD Display
Portable Operator Panel

CP10F Compact Panel

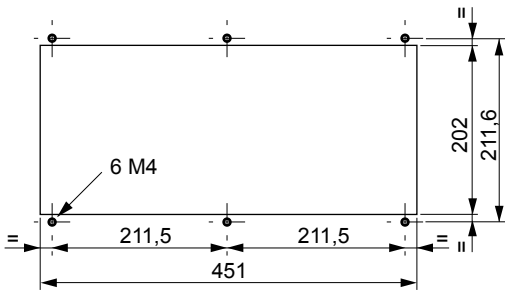
The CP10F compact panel (P/N APHE 000 780) combines operator functions and machine functions

- 8.4" TFT active matrix color LCD display unit
- Requires a panel controller card
- A keyboard (P/N APHE 000 248) facilitates ISO program entry and editing.



Characteristics

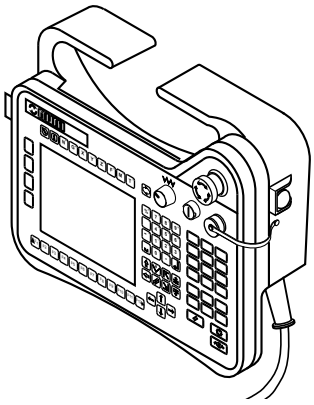
• Power supply voltage	24 VDC; +10%; -15%
• Power consumption	30 W
• Protection class	IP 65
• Operating temperature range	5° to 55°
• Storage temperature range	-25° to +70° C
• Relative humidity, noncondensing	5 to 85%
• Overall dimensions (L x H x P)	483 x 220 x 130 mm
• Weight	5 kg
• Max. distance from CNC	10 m



Portable Operator Panel

The Portable Operator Panel POP (P/N APHE 000 246) combines the functions of a CNC panel and a machine panel, while allowing the operator to move around the working area.

- It is used for programming (teach-in, PROCAM or ISO), settings and production.
- Requires a panel controller card



Characteristics

- 6" TFT active matrix LCD display unit
- Two 3-position dead-man buttons
- Dual contact emergency stop button
- Lighted ON button
- Feed rate override potentiometer
- 18 programmable keys
- Part program editor
- Connector for PC keyboard

• Protection class	IP 54
• Power supply voltage	24 VDC; +20%; -15%
• Power consumption	15 W
• Overall dimensions (L x H x D)	310 x 240 x 87 mm
• Weight (excluding cable)	1,8 kg
• POP/cabinet cable supplied	10 m
• Cabinet/CNC cable supplied	5 m

Panels
Operator Panel with separate Keyboard

FS20 Operator Panel

This panel is provided in two separate parts for improved ergonomics:

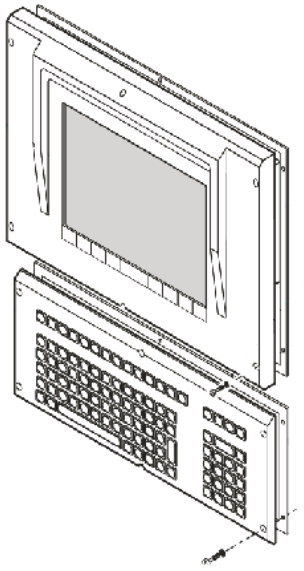
- The FS20 highly legible 10.4" active matrix TFT display unit (P/N APHE 000 484)
- The KBD30 QWERTY CNC keyboard with additional keys for the CNC functions (P/N APHE 000 485)
- Requires a panel controller card
- Can be used in conjunction with the MP02 panel with the same design
- Compatibility with the multiplexing function (multi-CNC or multipanel): Consult us.

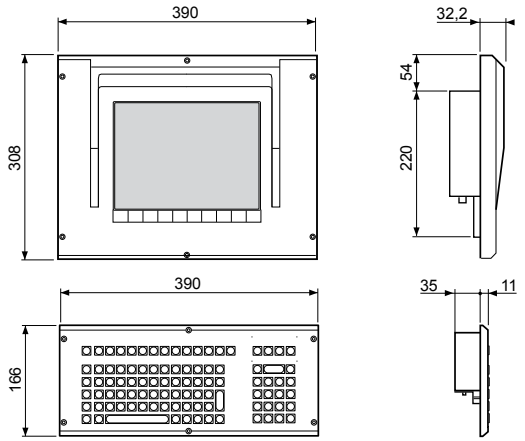
Characteristics

• Power supply voltage	24 VDC; +20%; -15%
• Power consumption	50 W
• Protection class	IP54
• Operating temperature range	0°C to +55°C
• Storage temperature range	-20°C to +60°C
• Relative humidity, non condensing	10% to 90%
• Overall dimensions (WxHxD) in mm	
Display unit	390 x 308 x 87
Keyboard	390 x 166 x 50
• Weight	
Display unit	4.2 kg
Keyboard	1.7 kg

FS 20

KBD 30





Panels
Machine Panels

MP02 Machine Panel

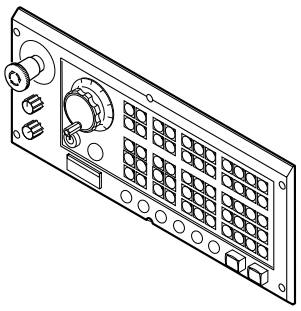
The MP02 (P/N APHE 0004 86) machine panel is used for control of manual movements, production initiation and manual intervention during production.
It has the same design as the FS20 operator panel. It includes:

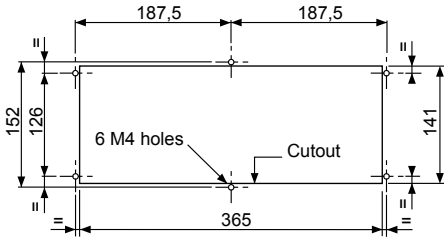
- 55 reassignable momentary action keys with built-in LEDs
- 2 potentiometers for feed rate and spindle speed override
- Optional handwheel (P/N APHE 081 021)
- Emergency stop pushbutton
- One two-way key switch, with the possibility of adding a second one
- 2 Illuminated Feed Stop and Cycle pushbuttons
- 6 locations for additional pushbuttons.

It is connected to the CNC by a fiber-optic link.

Characteristics

• Nominal power supply voltage	24 VDC; +20%; -15%
• Minimum/maximum tolerance	19 V to 30 V
• Power consumption	15 W
Outputs in use	40 W maximum
Outputs not in use	5 W maximum
• Maximum current rating	500 mA
• Maximum distance from CNC rack	40 m
• Overall dimensions (WxHxD)	390 x 166 x 60 mm
• Weight	
without handwheel	1.5 kg
handwheel	0.25 kg





MP03 Machine Panel

This panel is used for control of manual movements, production initiation and intervention during machining. It is available in two sizes:

- MP03 panel - 410 mm, same width as the NUM iPC Compact and the FS151 family (P/N APHE 558 120 - APHE 558 220)
- MP03 panel - 483 mm, designed for use with CP30F and CP20F operator panels (P/N APHE 558 120 - APHE 558 220)

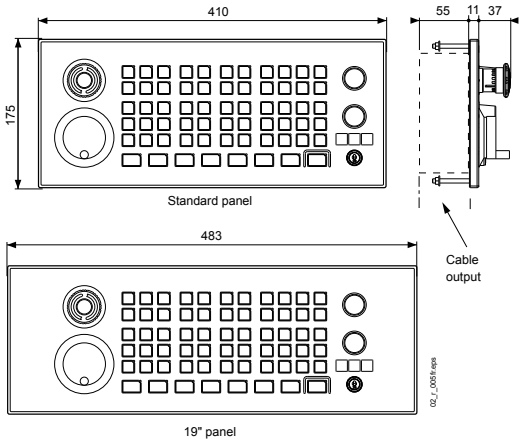
It includes:

- 55 configurable keys with LEDs
- 2 potentiometers for spindle speed and feed rate override
- 1 handwheel
- 1 emergency stop button
- 1 three-position key switch
- 3 controls: Cycle start, Cycle stop and Reset
- 5 keys for additional functions with LEDs

The MP03 panel is connected to the CNC by a fiber-optic line.

Characteristics

• Nominal voltage (external power supply)	24 VDC; +20%; -15%
• Minimum/maximum tolerance	19 V to 30 V
• Power consumption	15 W
Outputs in use	40 W max
Outputs not in use	5 W max
• Maximum current rating	500 mA
• Weight	
480 mm version	2.9 kg
410 mm version	2.5 kg
• Max. distance from CNC	40 m



Multiplexer Module for Operator Panels and Associated Configurations

Multiplexer Module

The multiplexer module (P/N APHE 000 354) is used to:

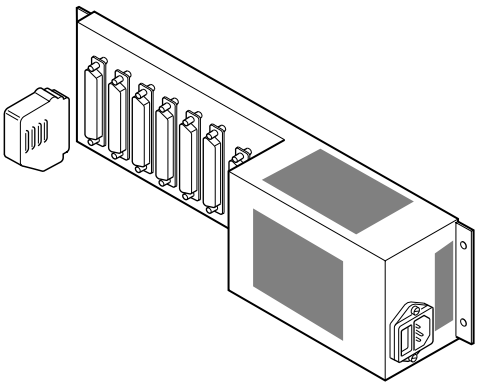
- Connect several panels to a single machine (multipanel configuration)
- Control several machines from a single panel (multi-CNC configuration).

These configurations, especially interesting for production shops, are available only for the CP20F and CP30 operator panels.

For FS20 panel, consult us.

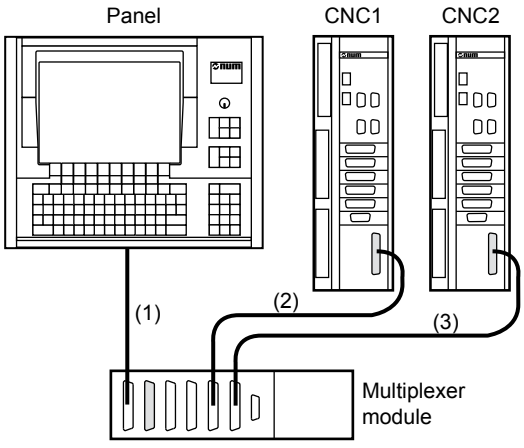
Characteristics

• Power supply voltage	220 VAC
• Power consumption	25 W
• Overall dimensions (WxHxD)	360 x 102 x 69 mm
• Weight	1.560 kg



Multi-CNC Configuration

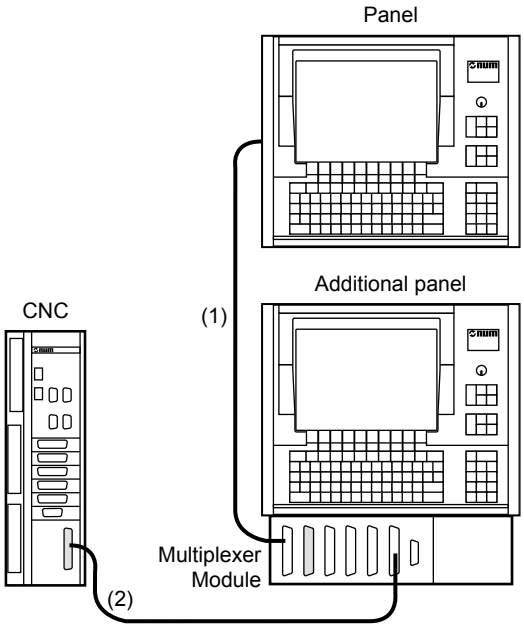
Two to four CNCs connected to a panel.



(1) 0.5 m cable supplied with the multiplexer module.
(2)(3) For panel-CNC connecting cables, see page 17.

Multipanel Configuration

Two to three panels connected to a single CNC.



A multiplexer module must be provided for each additional panel. The module can be mounted at the rear of the additional panel or externally (see page 17).

(1) (2) For panel-CNC connecting cables, see page 17.

Maximum cable length (1) + (2): 40 m.

Remote Input/Output Modules

Interface Modules

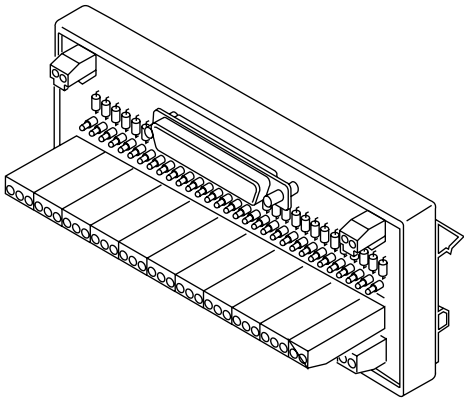
These modules facilitate wiring of the intput/output cards and machine components.

Cables are provided for connection to the different types of input/output cards.

32-Input Interface Module

(P/N APHE 080 080)

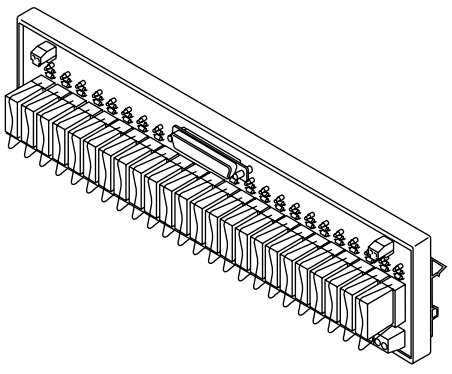
- Power consumption (all inputs switched) 24 W
- Overall dimensions (WxHxD) 183 x 86 x 60 mm
- Weight 0.3 kg



24 Output Relay Modules

(P/N APHE 080 084)

- Power consumption (all outputs switched) 19.2 W
- Overall dimensions (WxHxD) 376 x 98 x 69 mm
- Weight 1.05 kg

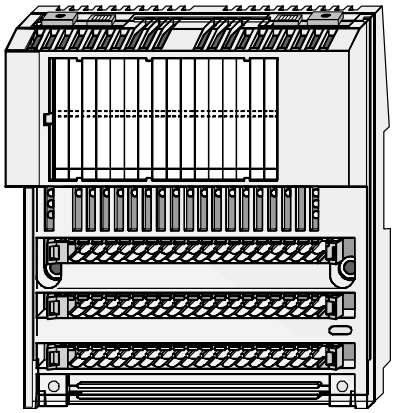


Remote Input/Output Modules

These modules supplement the line of input/output modules of the NUM Power CNCs. Four types are available:

- 16-input 24 VDC module
- 32-input 24 VDC module
- 32-output 24 VDC 0.5 A module
- 16-input 24 VDC/16-output 24 VDC 0.5 A module
- 8-input/8-output 2 A relay module
- 4 analog input/2 analog output module

(see page 20)

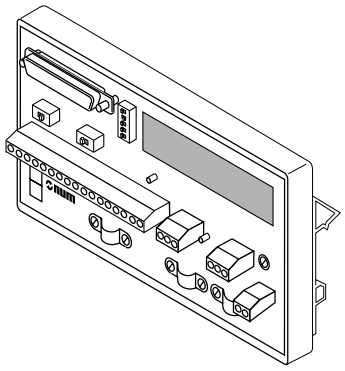


- Overall dimensions (WxHxD) 125 x 142 x 60 mm
- Wiring is facilitated by removable connectors and busbars.
- Connection to the basic rack is by fiber-optic cable.

Analog Axis Interface Module

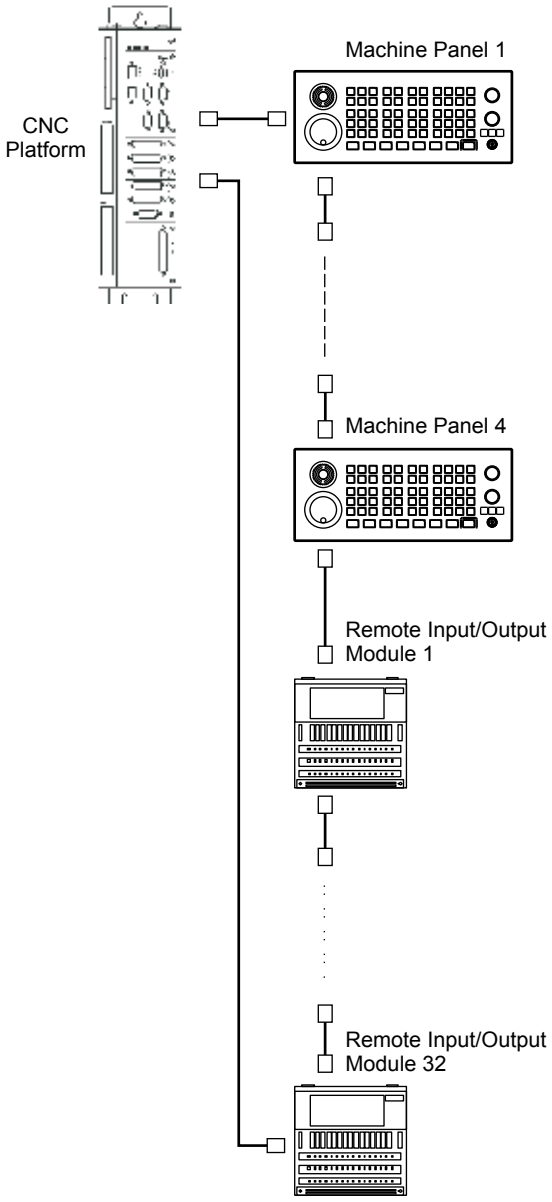
This interface module (P/N APHE 080 089) is used in conjunction with analog axis cards to facilitate wiring. It splits the cable arriving on the axis connector into three separate cables.

- Reference to the servodrive
- Measurement from the sensor. Possible signal from a home switch.



- Overall dimensions (WxHxD) 160 x 86 x 53 mm

Wiring Diagram of the Units Interconnected by a Fiber-Optic Link



The number of fiber-optic cables required is equal to the number of units + 1.

The maximum length of a fiber-optic cable interconnecting two units is 40 meters.

Functional Specifications

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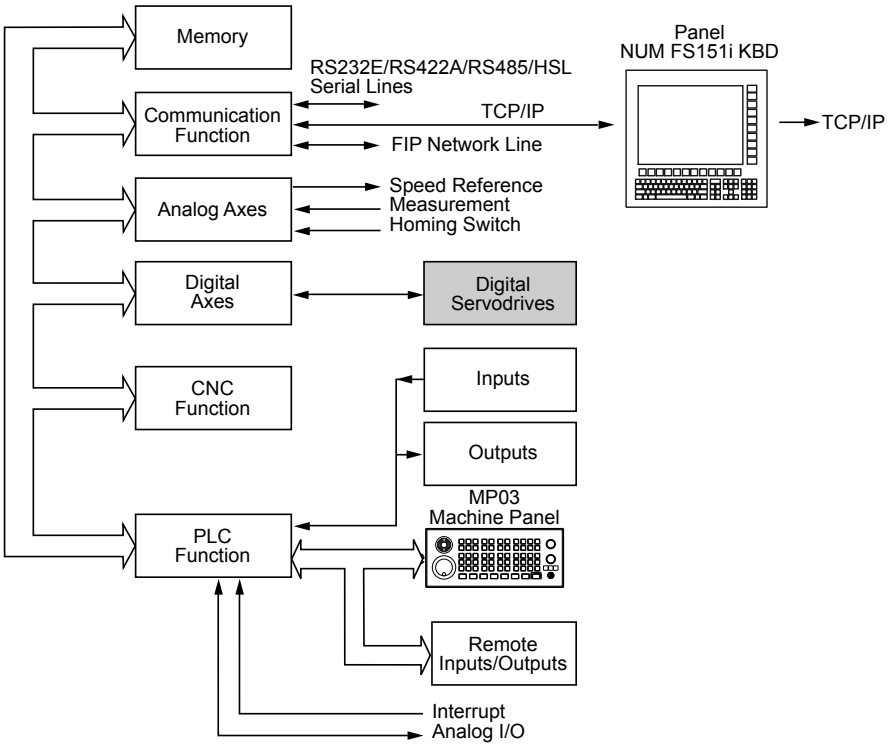
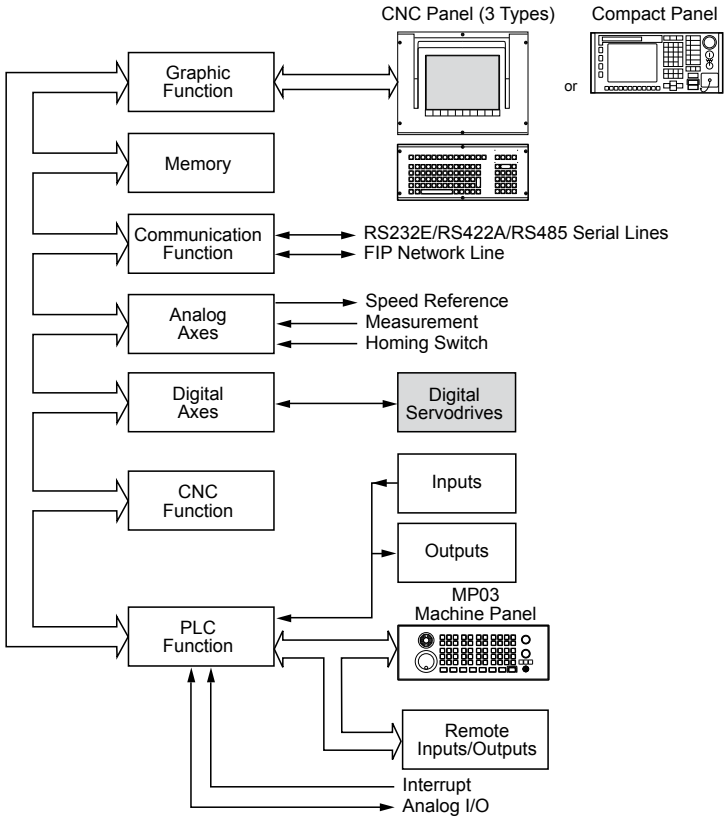
System Architecture
Functional Block Diagram

Functional Block Diagram

Axium Power with a NUM FS151i/FS151i-KBD or NUM iPC Compact Panel



Axium Power with CNC or Compact Panel



Axium Power, A High Performance Digital System

The Axium Power System, which comes with DISC NT digital servocontrols and high tech CNC functions, offers exceptional performance capabilities to improve machine productivity.

Closed-Loop Servosystem

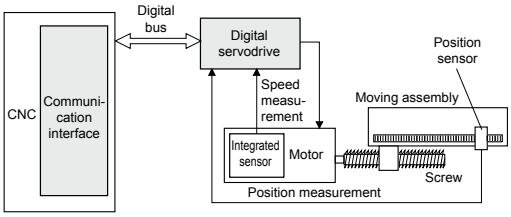
The main function of a CNC is to continuously control the speed of movement and position of the moving machine parts.

Each axis of movement is therefore controlled by a closed-loop servosystem or feedback system. The principle of such a system is to continually measure the real position of the moving assembly and compare it with the setting (or setpoint) output by the CNC to reach the new programmed position.

As soon as the difference between the two measurements is equal to zero, the moving assembly stops.

DISC NT Digital Servocontrols

DISC NT servocontrols are based on a high-speed digital bus which manages transfers between the CNC and the axis and spindle servodrives.



This distributed architecture ensures very fast positioning and excellent servosystem stiffness, thereby optimizing contour following and surface finish.

In addition, such an architecture saves enormous time on wiring and installation.

High-Level Functions

Progressive Acceleration

This function provides separate control of accelerations at the work rate and the traverse rate. It uses the gradual acceleration with controlled jerk rate derivative which is easier on the mechanical assembly of high speed machines.

It is essential on high speed machining centers.

Look-Ahead Function

This function makes a predictive analysis of the tool path and modulates the feed rate according to the difficulties arising in the path. This control ensures the required precision.

Anti-Pitch Correction

Speed compensation when movement is reversed on an axis prevents spikes at quadrant changes.

Tandem Function

This function includes three algorithms that are very useful for interdependent motors: backlash compensation and torque duplication and synchronization.

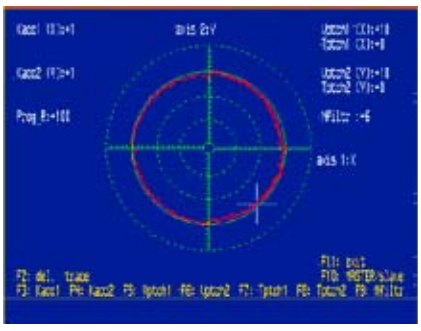
Ball-Bar Function

The ball-bar function is a predefined macro integrated in the CNC. It checks the behavior of the axes and sets the parameters related to the servodrives.

For circles drawn by G02/G03 or by small segments (Tabcyls), this function generates a diagram of the radial error on the main axes or other axis pairs, which facilitates adjustment of the following parameters:

- Acceleration anticipation coefficient
- CNC reference filter time constant
- Pitch compensation.

Ball-bar trace



Axes
CNC, PLC, Linear, Rotary Axes, Positioning, and Interpolated Axes

CNC Axes

P/N **APSO 000 450**: Digital DISC NT axes

P/N **APSO 000 373**: Additional 5 V TTL analog measurement axes

P/N **APSO 000 478**: 5th axis for Axium Power First

These axes are directly controlled by the CNC software using a program loaded into the user RAM space, or in drip feed mode for large programs (developed by CAD/CAM).

Movements are generated in an X, Y, Z cartesian coordinate system which may be supplemented by additional U, V, W axes. These axes may be independent or grouped in carrier/carried axis pairs.

Three rotary axes modulo 360 degrees, A, B and C, are associated with the main linear axes.

PLC Axes

P/N **APSO 000 451**: Digital DISC NT axes

P/N **APSO 000 534**: 5 V TTL analog measurement axes

These axes are designed to control auxiliary machine axes (tool changer, palletizers, manipulator arms, etc.).

The hardware part, interconnections, CNC/PLC exchange area and use are common with the CNC axes.
These axes may be placed in one or more independent groups. The ISO application programs (9998._) must be stored in the protected memory area.

The programming syntax is the same as for the CNC axes (positioning, interpolation, etc.).
The Cycle Start and Cycle Stop functions and the modes (single step or continuous) are processed separately for each axis group by the PLC.

Linear and Rotary Axes

Closed-loop axis servocontrol ensures:

- Positioning or movement along a path of the axes, at a programmed feed rate, with override from 0 to 120%
- Control of acceleration and deceleration, with the possibility of using the gradual acceleration function for smoother mechanical operation on high-speed machines
- Anti-backlash control when reversing movement
- Control of incremental encoder signals:
  - Absolute/incremental measurement by SSI link
  - Semi-absolute measurement which requires homing after applying power.

Linear axes are programmable by micrometer for a maximum travel of 100 meters, whilst rotary axes are by 0.0001 degree over 360 degrees (modulo 360).

Positioning Axes and Interpolated Axes

Positioning

During positioning, the programmed point is reached at the traverse rate without considering the path. Only the accuracy of the end point is considered.

Interpolation

During interpolation, the programmed point is reached by a linear or a clockwise or counterclockwise circular path at the programmed feed rate.

The accuracy of the contour between the start and end points is ensured.

Interpolation on 3 to 9 axes

Axium Power First:
• P/N **APSO 000 334**: 4-axis interpolation

Axium Power Advanced:
• P/N **APSO 000 335**: 5-axis interpolation
• P/N **APSO 000 336**: 6-axis interpolation
• P/N **APSO 000 337**: 7-axis interpolation
• P/N **APSO 000 338**: 8-axis interpolation
• P/N **APSO 000 339**: 9-axis interpolation

During interpolation, the programmed axes start, move and stop together.

Being able to interpolate just the number of axes necessary is another example of Axium Power's configuration flexibility.

Axes
Interpolation: Linear, Circular, Smooth Polynominal, Spline, NURBS

Linear and Circular Interpolation, Circular Interpolation Defined by Three Points

Linear Interpolation at the Traverse Rate (G00)

The programmed point is reached by a linear path at the fastest rate possible.

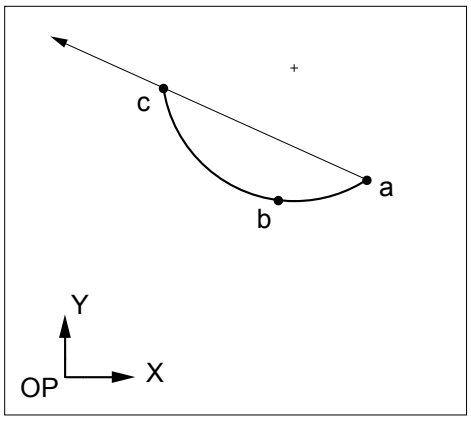
Linear and Circular Interpolation at Feed Rate (G01, G02, G03)

The programmed point is reached by a linear or circular path at the programmed feed rate (clockwise or counter-clockwise path defined by the center or radius).
The path is the result of all the axis movements programmed in the block.

Circular Interpolation Defined by Three Points (G23)

P/N **APSO 000 497**: Circular interpolation defined by three points

Circular interpolation can be executed by programming:
- the start point (defined in the block preceding function G23)
- the end point and the intermediate point (defined in the block including function G23).



Smooth Polynomial Interpolation

P/N **APSO 000 499**

Smooth polynomial interpolation allows creation of tool center paths defined by polynomials of degree 5 or less.

These paths are perfectly smooth continuous curves without segments. All the calculated points are located strictly on the curve.

This type of interpolation cannot be used on modulo axes. It is incompatible with tool offsets and backtrack along the path.

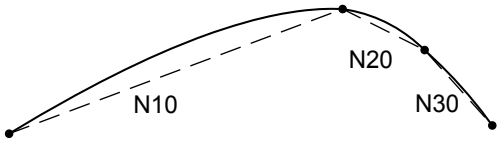
Spline Interpolation (G06, G48, G49)

P/N **APSO 000 518**

Spline interpolation is a mathematical method for smoothing curves. Spline curves are apparently continuous curves obtained by linking a series of points.

With spline interpolation, the tangent is continuous and the acceleration is constant in each of the points specified on the programmed paths.

Machining of a spline curve is programmed by defining:
- the points on the curve
- the sequence of execution of the curve.



Spline Interpolation with 3D Curve Smoothing (G104)

P/N **APSO 081 706**

Based on polynomial interpolation, this function allows the programmer to define curves of any shape in three dimensions, merely by defining the intermediate points.

NURBS Interpolation

P/N **APSO 000 426**

Geometric continuity of contours is a necessity for HSC.

NURBS (Non Uniform Rational B-Spline) curves, widely used in CAD and now on CNCs, are curves with poles that describe a contour in rational parametric form to be able to cut complex shapes with minimum contour error.

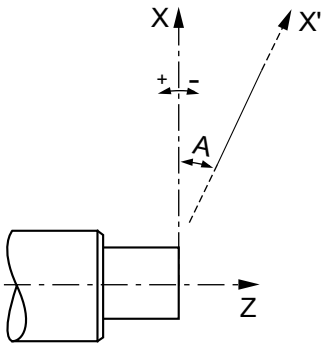
Axes
Inclined, Tilt, Duplicated, and Synchronized Axes
Multigroup/-channel Functions, Calibration, Compensations

Inclined or Tilt Axes

P/N **APSO 000 315**

On a lathe or a grinding machine, the X and Z axes can be orthogonal or inclined. The axis inclination or tilt is the angle A between the X axis and the normal to the Z axis. Coordinate conversion takes place downstream of the interpolator.

In an axis multigroup system, different axis inclinations can be specified for each group.



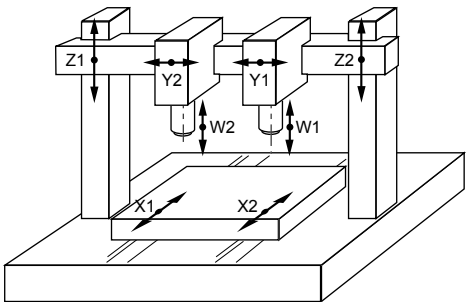
X : main axis in cartesian coordinate system
X' : inclined physical axis
Z : main axis
A : angle of inclination

Duplicated and Synchronized Axis

P/N **APSO 000 266**

This function couples one or more slave axes with a master axis, either by setting machine parameters (fixed coupling) or by programming external parameters.

It also ensures synchronization of the master axis with the slave axis (it does not include axis control).



The figure above shows a mechanical gantry axis pair (Z1 and Z2) and a programmable gantry axis pair (X1 and X2).

Multigroup/Multichannel Function

In the basic version, the Axium Power First CNC controls a single axis group/channel, and the Axium Power Advanced controls two axis groups/channels.

Axium Power Advanced:
- P/N **APSO 000 392**: 4 axis groups/channels
- P/N **APSO 000 393**: 6 axis groups/channels
- P/N **APSO 000 394**: 8 axis groups/channels

All the CNC axes and spindles of a machine can be declared in several groups or channels by setting parameters during installation.

The machining program consists of independent programs (one per group) denoted by a common radical followed by the group number.

A spindle declared in a group can be controlled by that group or be released and controlled independently.

The multichannel function can be likened to several separate CNCs.

In the multichannel function, the CYCLE START, CYCLE STOP and RESET commands as well as the operating modes are independent for each channel.

Axis Calibration and Interaxis Calibration

Axis Calibration Function

This function corrects the axis position according to the defects of the screw, rack or scale.

Interaxis Calibration Function

This function corrects the position reference of an axis via the position of another axis. The data are entered in a table.

A typical use of this function is to compensate for the weight of the “ram head” on a milling machine.

Compensations

Backlash Compensation

Positioning errors due to mechanical backlash on the linear and rotary axes are corrected automatically.

Temperature Compensation

It is possible to correct the axes using the dynamic operators (P/N **APSO 000 250**) or axis calibration.

Axes
Measurement Types for Analog Axes, Programmable Precision, Inch/Meter Units

Measurement Types for Analog Axes

The inputs of the CNC can be connected to two types of incremental sensor.

Incremental Sensors with Homing

Each axis has a measurement input to which are connected the four channels of an incremental sensor. Differential square encoder signals A, /A, B, /B, zero pulse, /zero pulse with an amplitude of 5 V are applied to these inputs.

Signals A and B and their complements are offset by 90 degrees. The rising and falling edges of each channel are taken into account, which increases the encoder accuracy by a factor of four. The measurement inputs also take the origin switch wiring into account. This measurement by incremental counter requires homing after the machine has been turned off.

Absolute Sensors with SSI Serial Interface

Measurement of an encoded position in a DATA, /DATA, BCD or binary frame is made via an RS422 serial synchronous interface (SSI). The format is from 12 to 31 bits, depending on the resolution of the SSI encoder used. Transfers between sensor and axis card are synchronized by a clock (CLK, /CLK signals generated by the axis card).

This type of measurement saves time and simplifies machine restart procedures. The use of absolute measurement does not entail any extra cost for CNC integration. After power is turned off, restart with ready retraction of the tool is immediate, even in a reference system transformed by the RTCP or inclined plane functions.

Programmable Precision Measurement Resolution

P/N **APSO 000 519**

The resolution or precision is the value assigned to the measurement unit (increment) generated by the system according to the mechanical assembly of the machine.

The default internal system resolution, common to all the linear axes, is set to 1 micrometer.

The internal system resolution for rotary axes is 0.0001 degree.

These values can be adjusted according to the required accuracy and speeds.

Inch/Metric Units (G70, G71)

Function G70 is used for programming in inches and G71 in metric units.

The default measurement unit is selected when integrating the system by setting a machine parameter.

Spindle
Automatic Spindle Speed Range Search, Indexing, Synchronization Rigid Tapping, Constant Surface Speed, Thread Cutting

Automatic Spindle Speed Range Search

The system determines which one of up to six possible spindle speed ranges corresponds to the programmed spindle speed S. The CNC sends function M40 to M45 to the PLC (via the exchange area), depending on the speed range search criteria set at initialization.

Indexing (M19)

Indexing accurately stops the spindle at a point programmed to 0.001 degree with respect to a fixed point (spindle measurement sensor zero).

The minimum required sensor accuracy is 1024 points per revolution.

Spindle Synchronization

P/N **APSO 000 156**

This function controls speed synchronization of two measured spindles.

It is used in particular for machining operations such as parting off.

Rigid Tapping (G84)

P/N **APSO 000 332**

The feed rate on the spindle axis is servoed to spindle rotation. At the end of tapping, reversal is gradual and smooth.

This function, based on cancellation of the following error, avoids use of a tool holder with axial float.

Constant Surface Speed

This basic function of turning products varies the speed of rotation of the spindle according to the position of the tool center with respect to the diameter of the part.

Thread Cutting (G33, G38, G31)

Constant Pitch Thread Cutting Cycle (G33, G38)

P/N **APSO 000 331** (see also the axis/spindle servoing function on page 60)

This basic function on lathes cuts cylindrical, tapered or scroll threads by servoing the spindle rotation (workpiece) to the longitudinal axis (toolhead).

The threads can be single or multiple pitch, executed by straight or angular penetration. The successive passes are carried out with reducing depths.

Thread Chasing Cycle (G31)

P/N **APSO 000 69**5 (see also the milling cycles on page 65)

Designed for milling machines, this cycle slaves the feed rate of the tool (spindle support axis) to spindle rotation. The workpiece is fixed and the tool is fixed in the spindle.

C Axis and Coordinate System Conversions

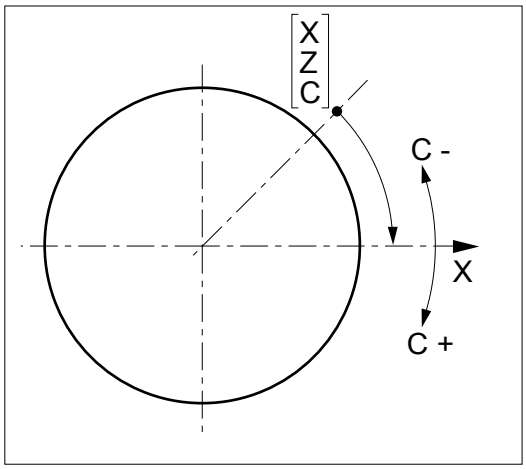
P/N **APSO 000 340**

In this turning configuration, the spindle is used as an interpolated axis with one of the CNC axes (X or Z). A resolution of at least 90,000 points per revolution is required for the measurement sensor. The spindle motor sensor used for the speed loop must be a high resolution sensor.

G20: Programming in X, Z and C polar coordinates

This function is used to program the X and Z linear axes and control a rotary C axis modulo 360 degrees.

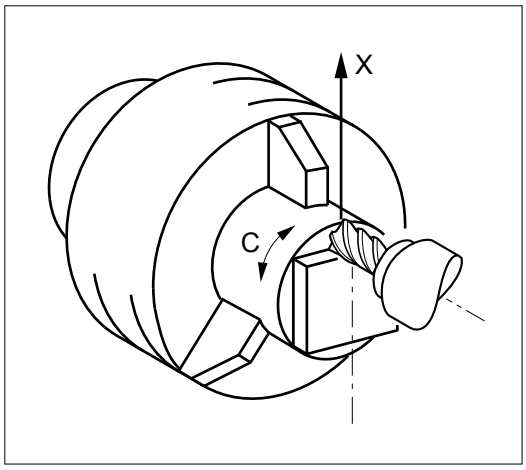
Use of G20 and polar coordinates



G21: Programming in X, Y and Z cartesian coordinates

The system performs cartesian/polar coordinate conversion (conversion of X-Y to X-C). The X and C axes are interpolated for milling in the plane perpendicular to the spindle axis. The tool is driven by an auxiliary spindle.

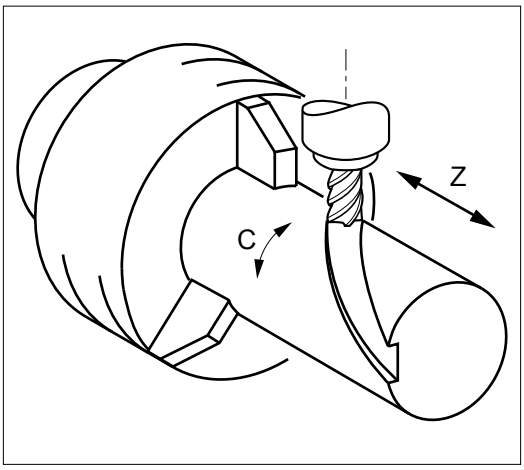
Use of G21



G22: Programming in X, Y and Z cylindrical coordinates

The system performs cylindrical/polar coordinate conversion (conversion of X-Y to Z-C). The C axis is interpolated for milling on the evolute of the cylinder with radius X. The tool is driven by an auxiliary spindle.

Use of G22



Axis/Spindle Servoing

P/N **APSO 000 331**

This function slaves the tool feed rate to spindle rotation. It is used in particular for thread chasing (see page 59).

This part number also includes constant pitch thread cutting cycles (see page 59).

PLC
Memory, CNC/PLC Exchange Area, Programming in C and Ladder Language

PLC Memory

P/N **APSO 000 347**

The machine PLC program in Ladder language and/or C is stored in this part of the global RAM.

This memory is supplied in 64 KB units.

CNC/PLC Exchange Area

Data transfers between the CNC function and the PLC function are via a data space usually known as the exchange area.

Data Transferred from CNC to PLC

- Keyboard characters, current modes, JOG increments, display page numbers, CNC error number, panel active or CNC active, external parameters
- CNC and machine status
- Active program number
- Axes (initialized, moving, clamped)
- Spindles (status, S5 speed)

Processing is by axis group (from 1 to 8 maximum, depending on the system) for:

- Group states, G functions, current modes
- Encoded M functions without report, on the fly
- Encoded M functions with report
- The 34 decoded M functions
- Tool number T5.

Data Transferred from PLC to CNC

- Pulse and latched commands for panel simulation
- Control of axis jogs, mode control, error messages
- Selection of axis groups, program numbers
- Processing of spindles, potentiometers, commands, setpoints
- Inhibiting of certain modes, jog commands, feed rates
- Torque enable for digital axes
- External parameters.

Processing is by axis group (from 1 to 8 maximum, depending on the system) for:

- Machine functions
- The axis feed rate override potentiometer for all the axis groups.

Programming in C

P/N **APSO 000 571**

This software function is used to load and run from the PLC an application program developed on an external PC using the C compiler.

Programming in Ladder Language

Ladder language, also called relay language, is a graphic language that is very similar to a relay diagram. It includes powerful functions able to solve the most complex automatic control problems.

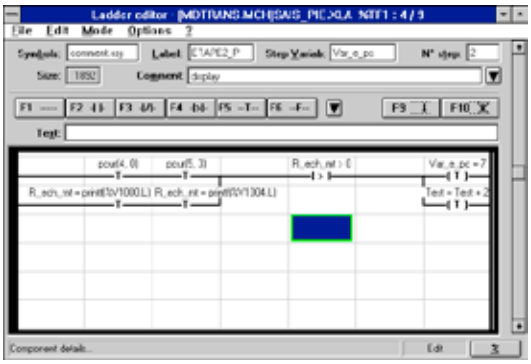
The graphic Ladder display gives good visibility into the program and facilitates debugging and error correction using the dynamic display functions.

This language includes all the automatic control functions of the machine:

- Description of a man/machine interface on the machine panel
- Management of a serial interface communication protocol
- Management of auxiliary machine axes called PLC axes
- Management of digital and analog inputs and outputs.

The PLCTool software running on a PC is used for programming the NUM CNC's PLC in Ladder language and debugging the programs.

Example of page programmed in Ladder language



PLC
Analog and digital Inputs/Outputs, High-Speed Digital Input

Analog Inputs/Outputs

Analog inputs and outputs are provided in the NUM CNC (see page 20).

Analog Inputs (ADCs)

Analog-to-digital converters (ADCs) convert 0-10 V PLC input voltages to digital values on 12 bits for processing by the PLC program.

Analog Outputs (DACs)

Digital-to-analog converters (DACs) convert digital values on 12 bits loaded by the PLC program to 0-10 V analog outputs for control or processing by external components.

Optional extension modules are also available:

P/N **APHE 080 096**: 4 I / 2 O

Digital Inputs/Outputs

Inputs

The machine status sensors are connected to these binary inputs, i.e. with two logic states. The inputs are read cyclically by the PLC and processed by the PLC program. The minimum time required for scanning these inputs is 20 ms.

Example: proximity detectors, pushbuttons, etc.

Outputs

The machine actuators are controlled by these binary outputs, i.e. with two logic states. These outputs are set by the PLC according to the programmed instructions.

The minimum time required for setting these outputs is 20 ms.

Example: control of contactor, indicator light, etc.

These digital inputs/outputs can be:

- Integrated
  P/N **APHO 000 631**: 32 I / 24 O - 250 mA DIN
  P/N **APHO 000 636**: 64 I / 48 O - 250 mA DIN
- Remote
  P/N **APHE 080 097**: 16 I - 24 VDC
  P/N **APHE 080 077**: 32 I - 24 VDC
  P/N **APHE 080 078**: 32 O - 24 VDC 0.5 A
  P/N **APHE 080 098**: 16 I / 16 O - 24 VDC 0.5 A
  P/N **APHE 080 099**: 8 I / 8 O - 2 A relayed

High-Speed Digital Inputs

Available in the basic version of the CNC, these binary inputs with two logic states activate hardware or event processing tasks by rising or falling edges.

The maximum setting time is 1 ms.
These tasks interrupt PLC or part program execution to perform priority processing.

Example: processing of discrete probe signals.

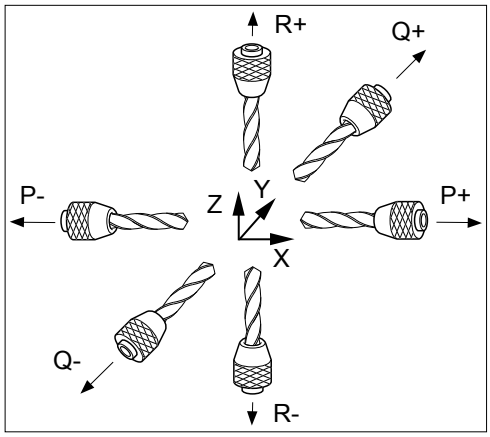
Tool Management
Tool Axis Selection, Tool Offsets, Turning Tool Offsets

Tool Axis Selection (G16)

Milling Tool Axis Orientation
Function G16 with one of the mandatory arguments (P, Q, R) followed by a plus or minus sign defines the tool axis orientation.

The tool axis can be oriented in six different positions on machines with interchangeable toolhead or with bevel gear.

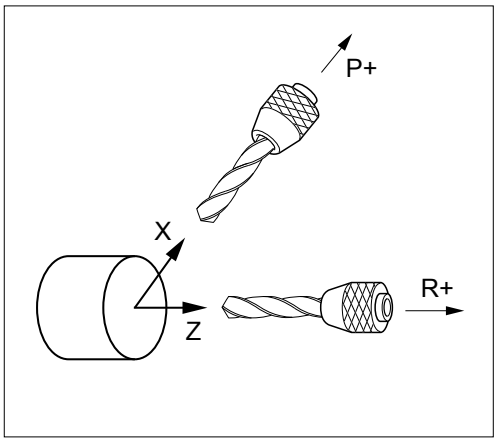
Milling tool axis orientation



Turning Tool Axis Orientation

Function G16 with one of the mandatory arguments (P or R) followed by a plus or minus sign defines the tool axis orientation.

Turning tool axis orientation



Tool Offsets

P/N **APSO 000 401**: Extension to 255 offsets

The basic system includes 32 tool offsets.

The D address followed by a number selects the tool offset.

The tool dimensions are stored in tables and validated according to the programmed axes.

Turning Tool Offsets

Tool Length Offset

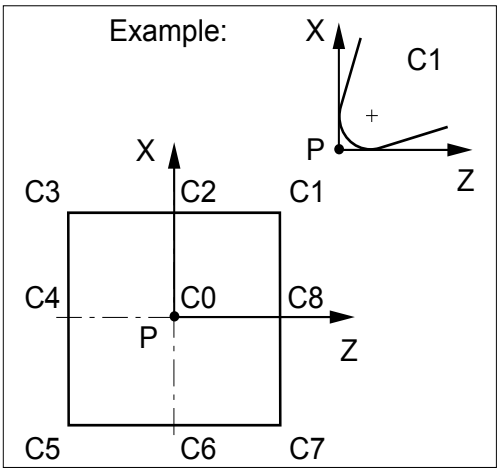
The tool length offset is assigned to the tool axis orientation defined by G16.

The programmed tool paths are corrected by a value equal to the tool length X and width Z declared in the D offset selected.

Tool Radius Offset

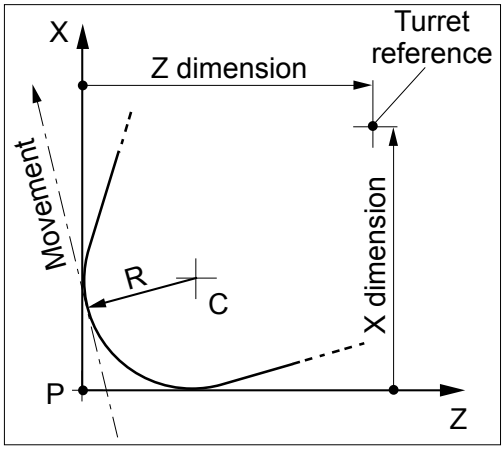
The programmed tool paths are corrected by a value equal to the tool insert radius based on the tool nose orientation defined by codes C0 to C8 declared in the D offset selected.

Tool nose orientation



Code C0 to C8 allows the system to identify the location of the center (C) of the cutting edge of the tool from the theoretical cutting point (P).

Radius of the tool cutting edge



Offset G41 offsets the contour to the left with respect to the direction of movement.

Offset G42 offsets the contour to the right with respect to the direction of movement.

Tool Management
Milling Tool Offsets, 3D Tool Offsets, Dynamic Tool Offsets by the PLC

Milling Tool Offsets

Tool Length Offset

The tool length offset is assigned to the tool axis orientation defined by G16. The programmed tool paths are corrected by a value equal to the tool length L declared in the D offset selected.

Tool Radius Offset

The programmed tool paths are corrected by a value equal to the tool radius declared in the D offset selected.

Offset G41 offsets the contour to the left with respect to the direction of movement.

Offset G42 offsets the contour to the right with respect to the direction of movement.

3D Tool Offsets

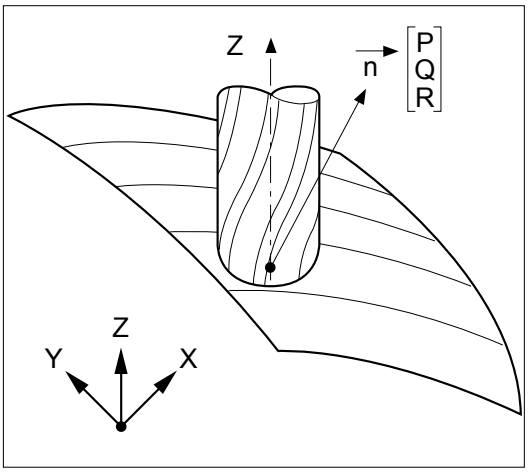
Three- or five-axis 3D tool offsets are used for machining 3D linear paths taking into account the dimensions of the toroidal, spherical (G29) or cylindrical (G43) tool used.

3-Axis Tool Offset (G29)

P/N **APSO 000 400**

With 3-axis offset, the tool axis is parallel to one of the axes of the basic three-axis reference system defined by the tool axis orientation function (G16). Each programmed point is associated with a vector normal to the surface to be machined, defined by its P, Q and R components.

3-axis tool offset



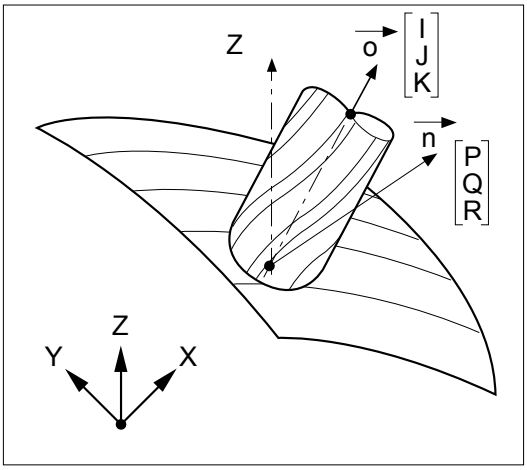
5-Axis Tool Offset

P/N **APSO 000 411**

With 5-axis tool offset, the tool axis can be inclined on machines equipped with a double twist toolhead.

Each programmed point is associated with a vector normal to the surface to be machined, defined by components P, Q and R, plus a tool orientation vector defined by components I, J and K, where applicable, which define the angles of the twist head.

5 axis tool offset



Dynamic Tool Offsets by the PLC

P/N **APSO 000 410**

The operator can enter dynamic offsets at any time (even during machining), whenever he observes a difference between the nominal and real dimensions.

The PLC can manage dynamic tool offsets associated with external measurement systems to allow the system to automatically apply wear compensation.

These offsets can be positive or negative. They are designed to compensate for slight variations in the tool or workpiece dimensions (wear, expansion).

Machining Cycles
Milling and Pocket, Irregular Pocket, Probing, Inclined Plane Machining

Milling and Pocket Cycles

P/N **APSO 000 695**

Milling Cycles (G31, G81 to G89)

The milling cycles can be called from the main machining program:
- Drilling (center drilling, counterboring, peck drilling, drilling with chip breaking), tapping
- Various types of boring
- Other cycles: thread chasing, etc.

These cycle are provided by ISO subroutines (macros) that can be edited. The standard set can be customized for the type of machine and job for which they are used.

It is also possible to create special cycles. These cycles can then be called from the main program by G functions (see Customized Cycles page 67).

Rectangular and Oblong Pocket Cycles (G45)

These cycles facilitate execution of circular, oblong, rectangular and square pocket cycles. The main and secondary axes are programmable in absolute dimensions. They define the pocket center in the plane or the pocket depth, depending on the tool axis.

Irregular Pocket Cycles (G46)

P/N **APSO 000 159**

These cycles are used to machine one or more pockets or recesses with a variety of shapes, with or without islands and walls.

Function G46 is used to program the specific NUx blocks defining the contour and scanning geometries as well as the three machining commands: drilling, roughing and finishing.

These cycles cannot be customized.

Probing Cycles for Milling Machines

P/N **APSO 000 591**

These cycles are designed for use in setting and measurement applications generated manually or automatically. They include the following functions:
- Probe calibration
- Tool presetting (L, R)
- Determination and restoring of DAT2 on the X, Y and Z axes (workpiece location) and DAT2 on the A, B and C rotary axes (workpiece alignment on a table)
- Determination and restoring of DAT3 (off-centering of a workpiece on a table).

These cycles can be edited.

Inclined Plane Machining (G24)

P/N **APSO 000 914**

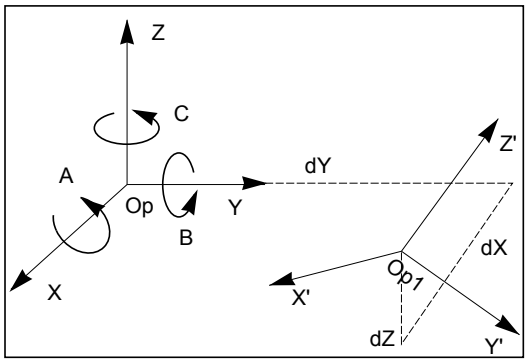
The inclined plane machining function manages many different machine head structures and simplifies programming of the machining operations.

Rotation and translation are combined to define a three-axis reference system with any orientation, used by the CNC to control the machine.

All the functions are preserved: L and R tool offsets, canned cycles as well as control of speed and feed, acceleration and travel.

The inclined reference system is defined as follows:
- UVW / XYZ translations
- ABC rotations around each of the XYZ axes.

The main head structures are supported with their offsets:
- B A cartesian head: B axis carried by A axis
- A B cartesian head: A axis carried by B axis
- A C cartesian head: A axis carried by C axis
- B C cartesian head: B axis carried by C axis
- Head with A axis carried by B and inclined by n degrees around X
- Head with A axis carried by C and inclined by n degrees around X
- Head with B axis carried by C and inclined by n degrees around Y
- Head with B axis carried by A and inclined by n degrees around X.



Specify rotation A B C
Specify translation on dX dY dZ
OP1 new workpiece origin

Machining Cycles
RTCP, n/m auto, HS Precision Contours, Radial Axis Boring/Milling

RTCP Function (G26)

P/N **APSO 000 154**

This RTCP function (Rotation around Tool Center Point) can be used with all known five-axis machine structures.

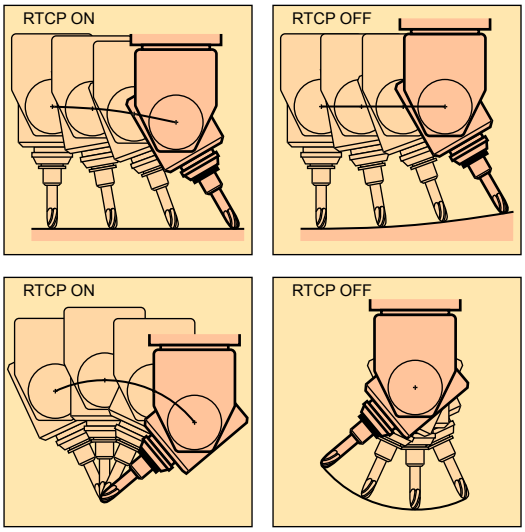
It provides automatic compensation on the main machine axis for the offsets caused by movement of the rotary axes of a five-axis machine. This compensation preserves the position of the center of a ball end tool during the interpolation.

The RTCP function is installed using a PC installation program running under Windows and supplied with the option.
The installation program generates a macroprogram which contains the description of the rotary axis movements.

Since this function does not handle tool orientation, it may be necessary to supplement it with the N/M auto function.

An inclined plane function identical to option **APSO 000 914** is integrated with this option.

RTCP ON and RTCP OFF.



n/m auto Function

P/N **APSO 000 082**

When enabled by the PLC, this function allows the operator to manually control up to five axes while the other axes remain under control of the part program.

The axes which can be controlled manually are selected and deselected by external parameters in the part program. Any commands in the program for movement on these axes are then ignored.

High Speed Machining of Precision Contours (UGV1)

P/N **APSO 000 155**

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

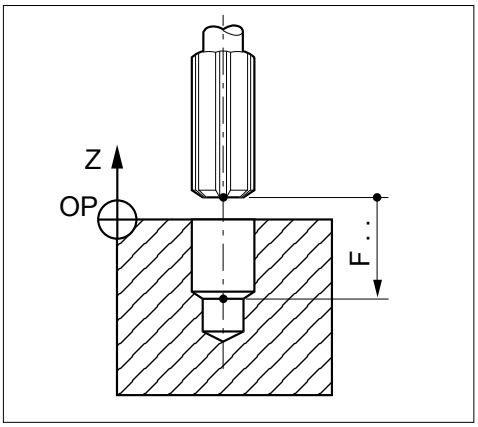
- Total speed anticipation
- Acceleration anticipation
- Anti-pitch correction: when machining circles, the friction torque appears as dynamic backlash when reversing direction; the adjustable correction compensates for this friction torque
- Gradual acceleration with controlled jerk rate derivative
- Accurate feed control based on upcoming changes in the machining path.

This control requires evaluating the curve radius over a sufficiently long section of future path (horizon). It also requires detecting and evaluating the sharpness of corners which may exist on this segment of path. For form machining, up to 60 blocks can be controlled in complicated sections of paths.

Radial Axis Boring/Milling Function

P/N **APSO 000 514**

This function allows interpolation of a radial axis (Z or U) as required for a boring application.



Functional Specifications

Machining Cycles
Functions: Combined Machine, Polygon Cutting
Cycles: Turning, Customized, Probing for Lathe

Combined Machine Function

P/N **APSO 000 581**

This option includes the basic milling functions plus several functions for controlling a combined machine (milling + turning):
- Axis/spindle servocontrol
- Support of a radial axis (boring)
- Cartesian/polar coordinate conversion
- Turning cycles
- Double-windowing graphics.

Turning Cycles

P/N **APSO 000 696**

Turning Cycles (G63 to G66, G81 to G87, G89)

These cycles can be called from the main machining program:
- Groove roughing, face-turn roughing, plunging
- Drilling (center drilling, counterboring, peck drilling, drilling with chip breaking), tapping
- Boring cycles.

These cycles can be edited and special cycles can be created. They are called by G functions (see Customized Cycles).

Creation of Customized Cycles

It is possible to create additional cycles that are specific to an application or a machine. These cycles are then called by new G or M functions. For G functions, it is possible to create programs %10100 to %10255 and call them by functions G100 to G255 respectively. For unassigned M functions, a machine parameter, “subroutine call by M function” is used to call a program number defined at installation when the M function is detected in the part program.

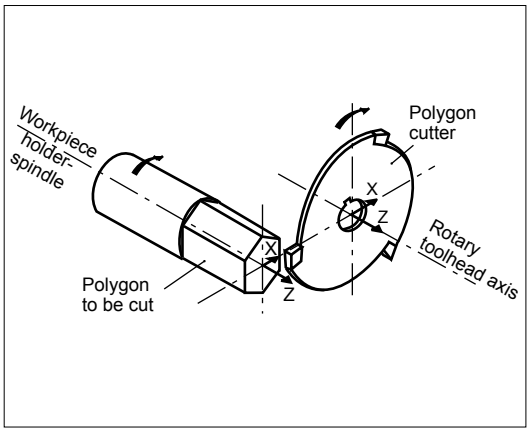
Polygon Cutting Function

P/N **APSO 100 538**

This turning function is used for cutting flats or polygonal shapes on the surfaces of parts of revolution.

The cutting technique is based on synchronization of a rotary axis with a spindle rotating in the same direction with a programmed speed ratio.

Relative tool/workpiece position for polygon cutting



Probing Cycles for Lathe

P/N **APSO 100 590**

These cycles are designed for use in adjustment and measurement applications generated manually or automatically. They include the following functions:
- Probe calibration
- Tool presetting
- Workpiece measurement and offset adjustment
- Determination and restoring of DAT2 on the linear X and Z axes.

These cycles can be edited.

Program Interrupts
On-the-Fly Measurement Acquisition, Backtrack, Emergency Retraction

On-the-Fly Measurement Acquisition (G10)

P/N **APSO 000 520**

The application of a signal to a high speed logic input of the PLC causes the target end point dimensions to be replaced by the current point dimensions and stores all axis positions on interrupt into external parameters.

Backtrack along Path

P/N **APSO 000 523**

This function, available only for group 1, is used to backtrack the axis, then return it to the point where the program was interrupted.

On a feed stop command, the operator enables the latched (modal) backtrack-along-path command. The axis is moved back along the path at the feed rate programmed in the stored blocks (up to 100). This function is operative in automatic, single step and dryrun modes.

When the operator enables the return command to resume the program to the point where feed was stopped, the initial mode is restored on resuming the block interrupted by the feed stop.

Tool offsets and wear offsets less than 0.1 mm can be applied during backtrack and return.

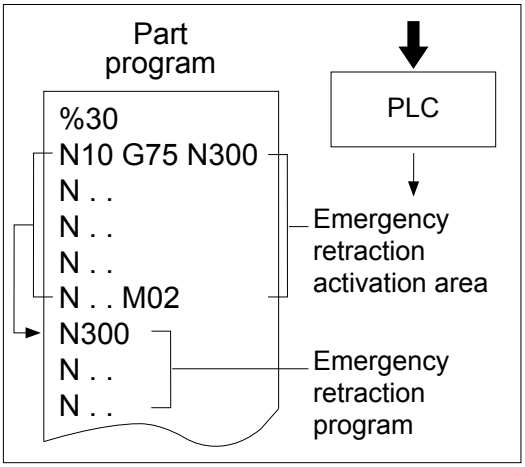
The program can be resumed ahead of the backtrack point. The automatic axis recall function can be used in intervention mode. In this case, the points on the manual backtrack path are stored (maximum 10 points) and restored in the same order in the axis recall phase at traverse rate, up to a programmable distance from the restart point.

Emergency Retraction (G75)

P/N **APSO 000 505**

A signal sent to the PLC interrupts the current block and causes a jump to the specified program sequence.

Exampel:



Part Programming
Part Program and Macro RAM, Resident Macros, Manual Input, Teach-in

Part Program and Macro RAM

P/N **APSO 000 341**: 128 KB part program RAM module

This part of the global RAM can be divided into four functional areas:
- Area 0: Modifiable user area
- Area 1: Protected customer area
- Area 2: Protected OEM area
- Area 3: Area reserved for NUM.

Access to the protected areas requires entry of a password to prohibit unauthorized accesses. This safeguards proprietary information and guarantees the functional integrity of the machine.

Resident Macros

Resident macros are part programs developed by NUM, the OEM or the machine manufacturer and loaded into the protected RAM areas.

These programs are written in standard ISO language and structured programming to facilitate understanding and modification (examples: customized canned cycles).

Editing the Resident Macros

Utility 3 (resident in the CNC) is used to transfer the programs from the protected areas to the user area (area 0) where they can be modified. The same utility is used to transfer them back to their original area.

Entering Programs from the Panel

Manual Data Input (MDI)

Edit mode is used to create, edit or delete programs.

A program can be entered one block at a time in MDI mode, with execution of each block.

Programs can be edited in background mode.

Programming by Teach-in

This function allows all or part of a program to be written by teach-in of specific positions. The coordinates of the current position are inserted automatically by the character “!”.

This mode allows:
- Access to the axis jogs and movement of the current position
- Entry of the current position coordinates in the program being edited.

Loading Programs

The tool dimensions and part programs can be loaded from peripherals (CD-Rom, PC, diskette) or from a host computer.

Program Execution in Drip Feed Mode

When a program is too long to be loaded into the CNC RAM or if it is not desired to store it (e.g. a program developed by a CAD system or subject to further modification), it can be run by direct download from a peripheral or a computer.

Certain restrictions concerning branches, subroutines and emergency retraction blocks apply to programs executed in so-called drip feed mode.

Editing a Stored Program

In edit mode, new programs can be written and existing programs can be edited, deleted and renamed.

The changes made are saved as they are entered.

These operations on part programs can be carried out during machining, i.e. in background mode, during machining in automatic, single step, dryrun and manual modes.

Part Programming
Datum Shifts, Dynamic Software Switches, ISO/EIA Language

Selecting the Dimensioning System: Datum Shifts

Regardless of the programming mode selected, the system always processes the dimensions with respect to a zero point or origin.

Measurement Origin (OM)

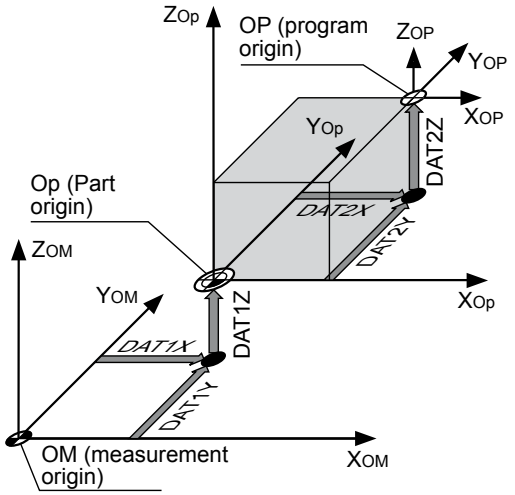
The measurement origin is a suitable point defined on each axis which sets the absolute measurement origin or zero point. The coordinates of this point can be entered or modified in special machine parameters.

Part Origin (Op)

The part or workpiece origin is independent of the measurement system. It is defined with respect to a suitable setting point on the workpiece. The part origin is specified with respect to the measurement origin by datum shift DAT1.

Program Origin (OP)

The program origin defines the origin of the program coordinate system. It is independent of the measurement system and is specified with respect to the part origin by datum shift DAT2.



Dynamic Software Switches

The machine travels entered when setting up the machine may be dynamically limited by software. This function is useful for modifying the travel according to the workpiece to be machined or its environment (collision avoidance). External parameters are placed at the beginning of the part program for this purpose.

These parameters are applied starting from their location in the program and remain valid until the CNC is reset or until the end of the program.

Main Functions

Programming of Movements

- Programming in absolute or incremental dimensions
- Machine or program dimensions
- Floating zero
- Inch/metric units
- Movement by positioning (G00) or interpolation: linear (G01), circular (G02) (G03), helical, spline or polynomial
- Positioning at a distance R from a programmed point
- Programming of lines and circles in cartesian or polar coordinates
- Connection of lines and/or circles by fillets or chamfers
- Block sequencing on paths or possibility of stopping to cancel the following error (G09) in order to pass through specified points.

Feed Functions

- Feed rate F.. from 0.000001 mm/min to 200 m/min
- Special feed rate for fillets and chamfers in PGP programming
- Programmable intervention by M12
- Tangential feed G92 R
- Acceleration override by EG.

Canned Cycles

Modifiable canned cycles are available. They can be edited as needed. Customized cycles can be written for special machining jobs or machines (see Cycles).

ISO/EIA Language

Data input and output transfers are made using ISO or EIA code with automatic recognition of the code used by the system. The data are stored in static RAM providing backup for two years.

General format:

%.....	
N.....	Sequence number
G...	Preparatory functions
XYZ+7.1 or 6.2 or 5.3 or 4.4 or 3.5	Axis movements
UVW+7.1 or 6.2 or 5.3 or 4.4 or 3.5	Auxiliary axis movements
ABC+3.3 or 3.4	Rotary axis movements
IJK+5.3	Circle center coordinates
EA3.3	Taper angle
EB5.3	Fillet or chamfer
EC3.3	Indexed spindle axis
ED3.3	Programmed angular offset
R5.3	Circle radius
F....	Feed rate
M...	Miscellaneous functions
S.....	Spindle speed
T.....	Tool number
D...	Tool offset
L...	Program variable
E.....	External parameter
H....	Subroutine number
/	Block skip.

Part Programming
Subroutines, Parametric/Structured Programming, Contour Table
Transfer of Active Settings, Scaling Factor, Programmed Angular Offset

Subroutines (G77)

Subroutines are special programs called by the main program. They are created by the OEM, by NUM (case of macros) or by the user to simplify and optimize the main program.

Example: Pattern repetition in several locations.

Subroutines are called by addresses H.. and/or N.. N.. associated with the function.

G77	Unconditional branch to a subroutine or sequence of blocks with return (maximum 8 subroutine nesting levels)
H	Number of a subroutine external to the main program
N..N..	Number of the first and last block called
P..	Number of a contour created by the PROFIL function (see Part Programming, PROFIL)
S..	Number of repetitions of a subroutine or block sequence (maximum 99).

Subroutines can also be called by the PLC or by an M function.

Parametric Programming

Parametric programming simplifies the writing of programs and the creation of identical families.

Variables L and external parameters E can be assigned to all the program addresses. Operations available on parameters:

- Addition, subtraction, multiplication, division, square root, truncation, sine, cosine, arc tangent
- Conditional and unconditional branches (>, <, =), logic AND and OR.

Structured Programming

P/N **APSO 000 535**

Structured programming based on symbolic variables makes programs easier to read and understand.

Symbolic variables (1 to 8 characters) can be assigned to all ISO functions and used in parametric expressions.

Variables L are saved and symbolic variables are allocated in a stack located in the bottom of the memory.

Construction of a Contour Table (Build Function)

P/N **APSO 000 536**

This high-level programming function is used to create a table and to store the data concerning a contour while the corresponding blocks are read (axis dimensions, F, T, S functions).

The data in the table are accessed and used by structured programming.

Transfer of Active Settings (G76)

P/N **APSO 000 511**

This function is used to update the contents of a file included in a subroutine or a block sequence of the main program.

The file of variables L and parameters E is updated with the corresponding new current settings.

Syntax:

G76	Transfer of the current settings of variables L and parameters E to the program specified
H	Specifies the program to which the settings are to be transferred
N..N..	Specifies the block sequence to which the settings are to be transferred
H%..	(example and format of the file to which the settings are transferred)

N.. Lxx=..... E8....=
|
|
N.. E5....=

Scaling Factor (G74)

P/N **APSO 000 506**

The scaling factor can be entered from the keyboard or via an E parameter to modify the dimensions of the part to be machined.

It is expressed in thousandths of the programmed dimensions. The variations are between 0.001 and 9.999.

Programmed Angular Offset (ED..)

P/N **APSO 000 507**

Function ED is assigned a value which defines an angular rotation with respect to the program origin.

The angular offset affects the axes programmed in the blocks following the function.

Example of application: machining features around a pitch circle diameter.

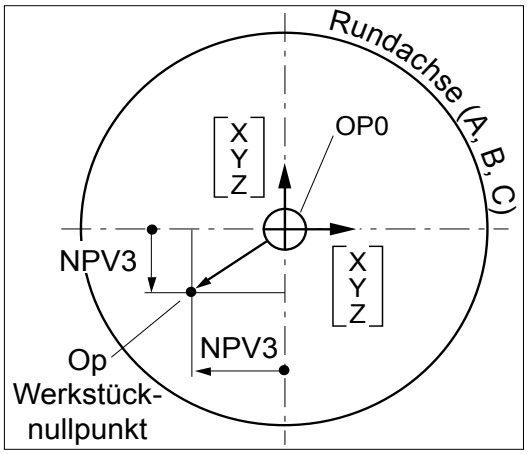
Part Programming
Index Table Eccentricity Function, Profile Geometry Programming PROFIL, 2D and 3D Graphic Display

Index Table Eccentricity Function

This function applies to the A, B or C rotary axes.
The offsets can be applied by entering values:
- On the CNC after switching to SHIFT mode
- By external parameter E
- By processor interchange.

For positioning, the index table eccentricity function takes into account a theoretic rotational shift of the part with respect to the table axis of rotation, regardless of its angular position.

Index table eccentricity functon.



Profile Geometry Programming PGP®

This special ISO programming language allows the rapid development of parts with a complex geometry consisting of a sequence of linear and circular geometric elements.

Main Functions:
- Insertion of fillets and chamfers
- Multiple line definitions
- Multiple circle definitions
- Possibility of implicitly declaring from one to three consecutive elements and having the system compute the intersection or tangent points.

PROFIL

PROFIL is a graphic module installed in the CNC. It is designed for creating 2D geometric contours without using ISO programming.

PROFIL facilitates development of all or part of the workpiece contours consisting of a sequence of geometric elements (irregular contours) or predefined forms (rectangles, circles or polygons).

The geometric elements are selected and called one at a time using the panel function keys.

PROFIL guides the operator continuously by instantaneous graphic display of the contour being created. The graphic display shows the operator what he needs to know to make the connections and makes suggestions when several solutions are possible.

All the geometric entities generated can be modified later by geometric transformations such as mirroring, scaling, rotation, translation, stock on finished contour. An internal system translator generates the ISO program corresponding to the contour drawn by the operator. The resulting subroutine can be called for execution by the main program.

2D Graphic Display

This function provides 2D display of the finished contour and machining passes on the CNC screen. For turning, this function includes dynamic simulation of material removal.

3D Graphic Display

P/N **APSO 000 158**

For milling, selection of the 3D Display function key associated with the blank definitions and tool data allows a part program to be viewed from different angles:
- Isometric projection, rotation by ±90 degrees around the selected axis
- 3D zoom, display on the same page of the front view, left-hand view and bottom view, in cross-section and perpendicular to the axis selected.

This function is available for ISO programming and PROCAM.

Part Programming
PROCAM, NUMAFROM, Messages

PROCAM Interactive Language

Part programs are written interactively using figures and canned cycles.

Four dedicated modules are available:

- PROCAM MILL (milling)
  P/N **APSO 000 238**
- PROCAM MX (mixed turning+milling machine)
  P/N **APSO 000 134**
- PROCAM TURN (turning)
  P/N **APSO 000 239**
- PROCAM MULTITURN (multislide turning)
  P/N **APSO 000 133**

The programmer writes the program by filling in the compulsory and optional data fields displayed on the PROCAM pages.
The user-friendly page sequencing is based on the machining job to guide the user through creation of work sequences and help him with the machining strategy.

The system automatically applies the technological data, i.e. it manages the cutting conditions according to the data contained in the material and tool files used for machining. This feature gives greater security for writing programs.

NUMAFORM

P/N **APSO 000 917**

NUMAFORM ®, integrated with the CNC is designed for machining a great variety of concave and convex 3D shapes such as surfaces of revolution around an axis, forms made of an assembly of elementary surfaces or irregular surfaces defined by sections set against two guide lines.

The user program calls each of the three dedicated macros according to the machining to be done after entering the settings when prompted by the program.

The 3D graphic display option allows the programmer to check the results.

Hard Copy of Screen

This function copies the image displayed on the CNC to a printer or a bitmap file.

Diagnostics: Machine Messages

The PLC program can display messages on the CNC panel. These messages must be stored in a special subroutine during installation.

The PLC program calls the line containing the message to be displayed by writing its number into a location in the special exchange area.

Diagnostics: CNC Messages

The CNC automatically manages two types of error messages:

Part Programming Messages

- Parametric programming errors
- Profile geometry programming (PGP) errors
- Structured programming errors
- Cycle programming errors.

Machine Error Messages

- Request for movements beyond the machine travels
- Faults on the axes (addressing, following error, synchronization, etc.).

The CNC reads and sends the messages written in the part program preceded by the symbol “$”:
- $0, message sent to the display
- $1, message sent to the PLC
- $2 $3 $4, message sent to a remote server
- $5 and $6, message sent to an external peripheral without imposed protocol
- $9, simple message sent to the PC or message sent with wait for a reply.

Human/Machine Interface
NUMpass HMI

NUMpass HMI for PC

The NUM iPC Compact and the FS151 family panels include a brand new human machine interface, NUMpass HMI, developed in HTML. Each OEM can use the HMI as is or develop his own HMI using standard tools: HTML, Java, Visual Basic, Delphi, Visual C or C++ editors.

The NUMpass HMI is available in several languages: French, English, German, Italian and Chinese (other languages: contact us).

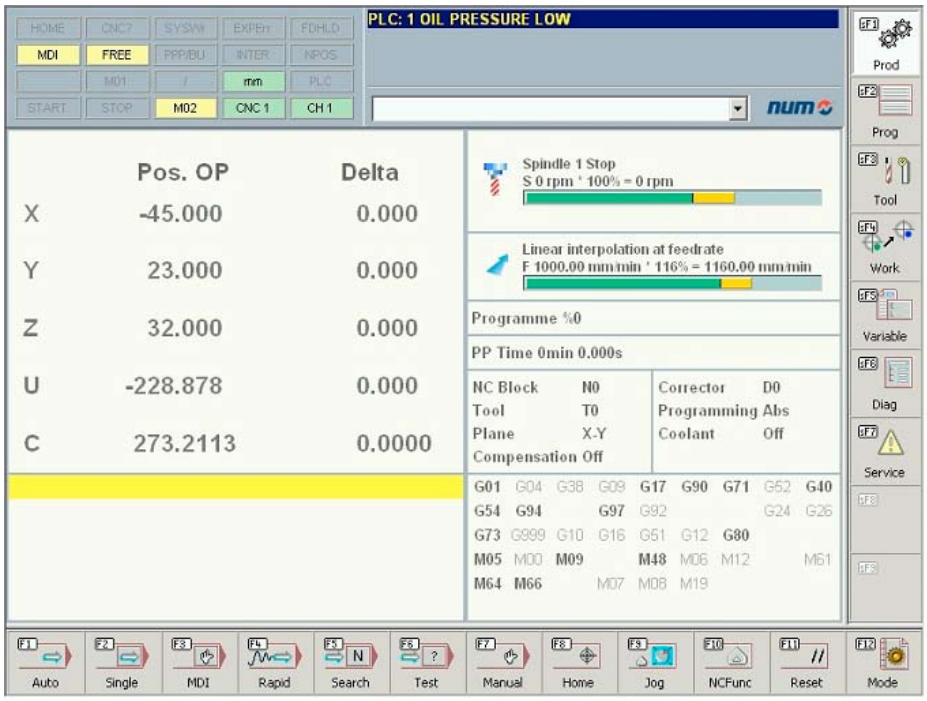
NUMpass HMI basic software

P/N **APSW 282 111**

Based on the Axium Power HMI and the NUM HMI, the NUMpass HMI basic software has been further developed and enhanced by a number of interesting features:

- The production context (sF1) was extended by two new pages. The axes positions and the CNC blocks are now displayed in full-screen format.
- Faster monitoring of the CNC blocks in the production context (sF1).
- The monitoring of the spindle load in the production context (sF1) in place of the spindle override is possible. The value is transferred by a PLC variable.
- The colour of the feed and spindle override in the production context (sF1) can be chosen. The settings are made in the service context (sF7).
- The programming context (sF2) offers the possibility to sort files by name, size, comment, etc.
- In the programming context (sF2), the selection of the files has been extended by the functions ‚mark all' and ‚mark reverse'.
- The list of displayed files in the programming context (sF2) can be restricted. The limits can be set in two different ways. The first method is to restrict the file extensions, the second to set a maximum part programme number. The settings are made in the service context (sF7).
- The CNC editor in the programming context (sF2) has been enhanced by the functions Search and Replace as well as highlighting of the actual line.
- In the variable context (sF5), the values of variables can be modified (as far as allowed).
- Backup and restore on external media of the alarm log files and exceptions in the diagnostic context (sF6) and of the debug variables list in the variable context (sF5).
- In the 700 and 1000 CNC range, it is possible to save and restore several part programmes in a single file. This is made available again by using files with the extension *.xpc' .
- Faster transfer of files between hard disk and CNC memory.
- In order to improve the PC performance when using external programmes, the NUMpass HMI window can be minimized or set in the background to reduce data transmission between PC and CNC.
- Automatic update of the file list of the available drives.
- For memory sticks etc. the window “Safely remove hardware” of the Windows OS can be called directly from NUMpass HMI.

This software is the basis for all offered additional features! It must be available to ensure their functions.



Symbolic names

P/N APSW 282 112

This function allows assigning names to the axes channels. These are displayed instead of the usual address numbers, for example on the axes position page and in the status window.

The axes channels can be grouped and assigned to a machine.

Part programmes can be assigned to the axes channels in the programming context (sF2).

Symbolic names can also be assigned to axes and are displayed in the production context (sF1).

Multichannel functionality

P/N APSW 282 116

This function is an extension of the channel selection. It allows selecting the channels on every relevant page of the HMI.

The display of messages and their recording in the history file are adapted for multichannel operation.

Multi CNC

P/N APSW 282 117

If a machine needs more than 32 axes and/or more than 8 axes channels, this function makes it possible to control several CNC kernels with one PC. There is no need for the machine operator to distinguish between the various CNC kernels. He works as usual with the multichannel functionality of the HMI.

This function extends the display of messages and their recording in the history file for multi CNC operation.

Specific PC software is supplied for data exchange between the PLCs of the CNCs. It reads a defined data area (up to 120 bytes) in the exchange zone of the PLC and sends the values to the other PLCs.

This option can of course also be used for applications having one control PC for several machines.

Extended tool table

P/N APSW 282 113

This feature is an enhancement of the tool table in the tool context (sF3).

It allows to give a name and a comment to any tool and to assign it to an axes channel.

This information is saved together with the tool data in one single file.

Teach-in

P/N APSW 282 114

The option adds a teach-in function to the editor in the programming context (sF2). The actual axes positions can be transferred easily into an open part programme.

The following settings are possible:

- Selection of the axes.
- Extension of the axes positions with CNC functions (G, M, F etc.).
- Insert a block or overwrite an existing block.
- Overwrite only the axes positions of an existing block.

Extended PLC messages

P/N APSW 282 115

This feature enables the simultaneous display of up to 120 PLC messages (instead of 2) out of a number of 1 to 9999 (instead of 1 to 255).

Up to 8 reaction classes can be assigned to the messages. This allows differentiating the reactions according to the importance of the PLC messages (e.g. emergency, warning).

The PLC messages are displayed in the message field of every context as usual. If more than 3 messages are active, the display will scroll automatically to show the next messages.

In the diagnostic context (sF6), the pending PLC messages (max. 120) will be sorted by their reaction class.

The display colour of the PLC messages can be set according to the reaction class. The settings are made in the service context (sF7).

The recording of PLC messages in the history file can be defined for each reaction class.

A programme library (requires the option **APSO 000 571** on the CNC) is supplied as a support for PLC programming.

MDLU test point monitoring

P/N APSW 282 121

Drives of the HP range (MDLU, MBLD) are fitted with test points that can be read on the drive bus. Test values may contain various information such as speed, temperature, load, etc. With the help of the monitoring function in the diagnostic context (sF6), the values can be tested.

The diagnostic context (sF6, F7) contains a configuration window as well as a display window. All available test values can be assigned to a test point.

Limits:

- up to 4 test points per drive
- up to 8 test points per CNC

Integrated machine panel type F

P/N APSW 282 118

The NUMpass HMI basic software offers the possibility to select the CNC modes with the help of function keys. This option allows in addition to control machine functions with a new set of function keys (e.g. spindle on/off, coolant on/off). The status of the machine functions is displayed in the status window.

Up to 10 machine functions can be controlled.

Soft key information are transferred to the PLC which controls the functions and returns the signals needed to set the status window.

Integrated machine panel type P

P/N APSW 282 119

This option allows the displaying of additional data of a machine panel. The displaying of the data takes place in the Menu production. If necessary it is possible to display the data on several screens.

In some cases the additional machine panel can be saved by displaying the data and control orders by NUMpass HMI.

Any functions can be displayed and controlled.

The key information will be transmitted to the PLC via the CNC.The PLC controls the functions and transmits the information to the status display.

Extensions for NUMROTO*plus*

P/N APSW 282 122

These extensions adapt the HMI for tool grinding machines using NUMROTOplus.

The CAD/CAM NUMROTOplus can be called by pressing Shift + F8 (sF8).

The tool table of the NUMpass HMI basic software in the tool context (sF3) is designed to accept milling, turning and boring tools. This additional feature offers an adapted tool management for tool grinding machines.

Various modifications for tool grinding applications are also activated in the other contexts.

BackupAgent

P/N APSW 282 120

This feature integrates a CNC data backup function in the HMI.

Automatic data backup can be performed periodically; a partial manual backup is possible as well.

Data can be saved to the hard disk of the PC, to a memory stick or net server.

Data restore can also be performed partially.

System requirements for NUMpass HMI

The NUMpass HMI software can be downloaded from the Internet. The required licences are also available on Internet. The Internet address, the user name and the password will be supplied on hardware delivery.

NUMpass HMI requires at least the following:

PC with

- Pentium-Prozessor P3 with min. 800MHz. For several additionals a higher tact rate is necessary.
- min. 128MB RAM
- min. 80 MB free space on the hard disc
- CD-drive or internet-connection

Operating system:

- Microsoft Windows 2000 or Windows XP
- Microsoft Internet Explorer 6.0 or higher
- Driver of NUM Tool Workshop Version F or higher

Fully Open Products for the OEM

NUM CNCs are fully open to the integrator, allowing optimal expression of his know-how and adaptation to a wide variety of machines.

In addition, since the systems are modular, it is easy to add hardware and software options.

The following features characterize this openness:

For the Man/Machine Interface

- Developed in HTML, NUMpass HMI is easy to customize using off-the-shelf tools;
- Organized in contexts, this interface is intuitive and suitable for users on different levels;
- It supports all the NUM integration tools.

For Cycles and Interpolations

- The dynamic operators provide a tool for developing real-time CNC applications for the axes, inputs/outputs, etc.;
- The macros, especially for the cycles called by G functions in the part program, allow the user to edit the basic cycles or create new ones;
- Structured programming makes the cycles easier to read and edit.

For System Integration

- The PERSOTool software facilitates reconfiguration of the system options by transmission of an option key via high speed communication links;
- PLCTool for Ladder language, and the C language with its compiler can be used to write PLC programs on a PC;
- SETTool is used on a PC for setting the servosystems.

PC Functions

NUMpass HMI equipped with a NUM iPC Compact or the FS151i/FS151i-KBD is:

- open, as it supports numerous applications developed in this environment, specific to the user (application-specific programs, CAD/CAM, etc.) and to the OEM (human-machine interface, remote maintenance, remote diagnosis, monitoring, etc.);
- flexible to use, with extended communication capabilities and memory space ;
- user-friendly, wiith keyboard, function keys, fast cursor control keys and a mouse.

PROCAM Interpreter

This integrated software tool is used to construct an interactive part programming method dedicated to a machine or a machining job by creating:

- Menus and figures
- Screen pages containing fields to be filled in, page sequences.

Software Package for Customer PCs

P/N **APSW 182 111**

This software package on CD-ROM includes:

- The NUMpass HMI,
- The MMI interpreter (required for installation of MMITool (see page 80),
- PCToolKit (see page 79),
- NUMBackUp (see page 79).

This option has to be ordered if a PC **not** supplied by NUM is used.

Resident CNC Utilities

The utilities are resident tools in the CNC performing the following functions:

- **Utility 2:** Axis calibration (see axis functions)
- **Utility 3:** Resident macros (see part programming, RAM)
- **Utility 5:** Machine parameters

  The machine parameters are used to adapt the CNC to the machine:

  - Axis declaration
  - Measurement settings
  - Servosystem settings
  - Axis travel
  - Spindle settings
  - Communications (PLCTool line and Uni-Telway)
  - Miscellaneous parameters (auxiliary functions, subroutine branches by M functions, etc.).
- **Utility 12:** Option setup.
- **Utility 20:** Interaxis calibration (see page 57).

Dynamic Operators

P/N **APSO 000 250**

This powerful language opens the real-time kernel of the CNC.

It uses simple operations to perform real-time computations which can act directly on the axis position references and discrete or analog inputs and outputs.

This tool, which also supports exchanges with the PLC program, offers the possibility of immediate correction according to the environment.

The dynamic operators operate with high priority at the real-time clock frequency of the CNC and do not penalize the functions managed by the CNC software. They are very useful in application programs, especially for operations on the servosystems and other high speed tasks.

Dynamic Operators in C

P/N **APSO 000 249**

The C language is used to program applications using dynamic operators.

This function requires a system equipped with a coprocessor (see Chapter 2).

C Language Compiler

P/N **APSW 082 026**

This software on diskette, to be installed on a PC or compatible in the PLCTool environment, is used to write applications in C (PLC, man/machine interface and real-time functions using the dynamic operators).

System Integration and Customization Tools under Windows

A set of integration tools for use on the NUM iPC Compact panel, the FS151i/FS151i-KBD or a external PC are available from NUM.

These 32-bit programs, running under Windows 95/98 and 2000, are supplied on CD-ROM.

NUMBackUp

P/N **APSW 182 093**: 32-bit NUMBackUp

NUMBackUp runs on a PC. It is used to back up and transfer all CNC files: CNC and PLC programs, machine parameters, tool files, etc.

It is supplied with the control panel FS151i/FS151i-KBD or the NUM iPC Compact.

PERSOTool

P/N **APSW 182 094**: 32-bit PERSOTool

This software, to be installed on a PC or compatible, is used to enter and transfer the CNC system customization parameters.

PCToolKit

P/N **APSW 182 091**: 32-bit PCToolKit

PCToolKit facilitates development of applications running under Windows.

- Transfer of all system files (part programs, utilities, PLC program)
- Tools, positions, speeds and feeds, CNC variables
- PLC variables and CNC/PLC exchange area.

The mechanisms governing these transfers are transparent to the user.

It is supplied with the control panel FS151i/FS151i-KBD or the NUM iPC Compact.

NUMpass SDK

The Software Development Kit is a specific interface for the development of customized operator software. For an optimal use of the interface, trainings are offered (see corresponding training plan):

SDK for NUMpass HMI

- How to extend the HMI using HTML and JavaScript.

SDK for communication with the CNC

- How to develop an own HMI or a Supervisor software using OOP.

The licence key for the installation of the SDK will be handed out on the occasion of the training courses.

SETTool

P/N **APSW 182 092**: 1 license for 32-bit SETTool

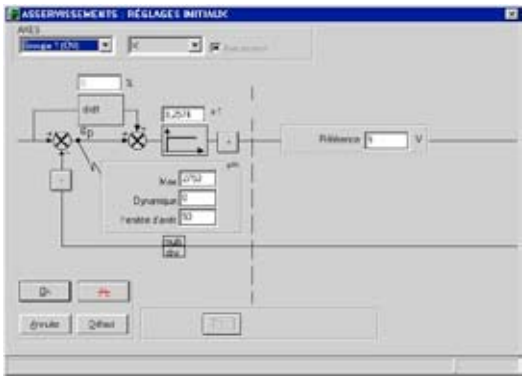
P/N **APSW 182 192**: 5 licenses for 32-bit SETTool

This complete integration tool is designed in particular for NUM HP Drive servodrives.

With advanced optimization functions, it experimentally determines (response to a level) the characteristic axis parameters. It includes a voltage level generator and an oscilloscope.

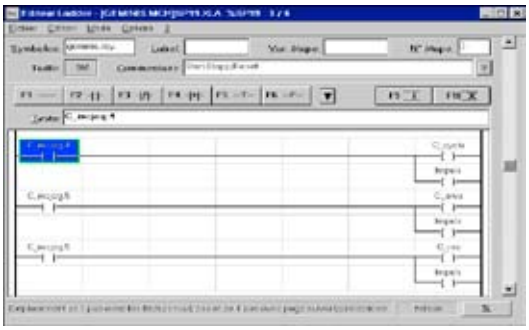
The OEM is guided in his work by an incremental approach.

It is supplied with the control panel FS151i/FS151i-KBD or the NUM iPC Compact.



System Integration and Customization Tools under Windows

PLCTool: Ladder Language



P/N **APSW 182 095**: 1 license for 32-bit PLCTool

P/N **APSW 182 195**: 5 licenses for 32-bit PLCTool

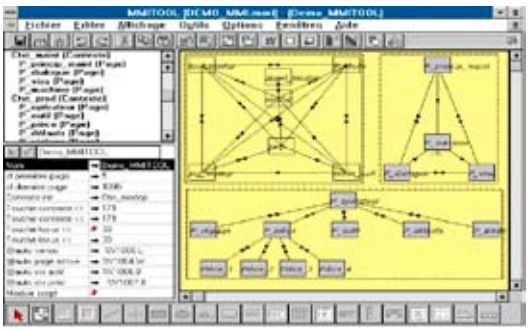
P/N **APSW 182 295**: 10 licenses for 32-bit PLCTool

PLCTool is a software tool designed for developing, debugging and maintaining the CNC PLC application.

It is used for:

- Managing the machine software by creating a library of modules
- Writing programs in Ladder language associated with high-level mathematical formulas
- Managing symbolic variables on 12 characters
- Creating a complete cross-referenced documentation folder
- Accessing a library of special functions
- Animating diagrams and variables on line.

MMITool



P/N **APSW 182 096**: 32-bit MMITool on CD Rom

P/N **APSW 000 946**: MMI Interpreter

MMITool is designed for developing dedicated human/machine interfaces for all types of machines and applications.

The human/machine interface is subdivided into contexts to adapt the interface to each category of user: programmer, setter, operator and maintenance staff.

The compiled files are loaded into a reserved area of the CNC RAM. The MMI interpreter runs this interface on the CNC.

MMI Memory

P/N **APHO 000 377**: MMI resource memory

P/N **APHO 000 378**: MMI C language memory

The man/machine interface files (customized pages) developed with MMITool are stored in these memories.

The MMI memory includes two parts:

- An MMI resource part containing the files describing the page contents
- An MMI C language part containing the dynamic page animation files writtenin C.

Serial Lines

The basic version of the Axium Power CNC is equipped with three serial lines.

All the serial line parameters can be set via menus on the CNC or PLC (lines 0 to 2). The lines can be assigned to links for program load/unload or programmed by the PLC to operate with special protocols:

- Peripheral
- Uni-Telway.

They can also be assigned to the link by the PLCTool PLC programming tool.

The types of available links include:

- RS232 link with handshake signals
- Link configurable by software and wiring: simplified RS232, RS422 or RS485.

PC Panel/CNC Link

Option P/N **APSO 000 933**: Ethernet TCP/IP link

Option P/N **APHO 000 932**: HSL high speed line

Communication between the NUM iPC Compact and FS151i/FS151i-KBD panels and the CNC is via an Ethernet TCP/IP network or an HSL high speed line.

Processor Interchange

Option P/N **APSO 000 112**

This option gives access to a set of requests used for data transfers between the PLC and CNC functions. It allows transmission of data (bits and words) inaccessible via the standard exchange area. These data concern the axes, spindles, tools, parameters, part programs, messages, etc.

The transfers are made by requests (read/write). Generally, the PLC is the client and the CNC is the server. The part program can also initiate a transfer to the PLC.

These transfers form the basis for integration of a machine into a flexible automation system.

Connection to a Uni-Telway Network

Option P/N **APSO 000 911**

Uni-Telway is a communication standard between automatic control components: CNCs, PLCs, dialog terminals, etc.

The Uni-Telway bus and its Uni-TE protocol support read/write data transfers and coordination of activities between intelligent equipment.

The connection uses one of the standard CNC serial lines or a dedicated module

The master or slave protocol is selected by a machine parameter.

Connection to a Fipway Network

Option P/N **APSO 000 924**

Fipway is a cell network (PLC/CNC/control station).

Characteristics:

- Data rate 1 Mbit/s
- Up to 32 stations on the same segment
- Network length: 1000 m without repeaters
- Distributed 128-word data base, automatically refreshed (common words)
- Uni-TE messaging system with client* and server functions (access to CNC and PLC objects)
- Pre-emptive calls (16-byte telegram).

** The client function requires the processor interchange option P/N APSO 000 112*

5 NUM Motors

NUM Motors BPH, BPG, BPL, BHL, AMS, Spindle Motors, AMR

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NUM Motors

NUM Motors BPH, BPG, BPL, BHL, AMS, Spindle Motors, AMR

NUM Motors
Introduction
Applications

Introduction

NUM proposes a comprehensive range of motors with a high power-to-weight ratio and dynamic range. This variety allows NUM to provide a solution tailored to each application.

Used in conjunction with NUM Drive, NUM motors are totally stable and smooth, even at very low speed.

NUM motors integrate robust optical encoders with different resolution/accuracy level to better fit the machine requirements

Applications

- BPH servo motors: axes of machine tools, grinding machines, robotics and special automatic machines.
- BPG servo motors: as BPH but with increased inertia and rotor stiffness; for axes with high inertia at the motor shaft.
- BPL servo motors: as BPH but for applications requiring very compact motors.
- BHL servo motors: as BPH but specifically designed for large machines. A version with forced convection is available for optimizing size and performance.
- AMS spindle motors: typically machine tools spindles.
- Special and built-in motors: NUM has also developed various customized motors:
  - Liquid cooled spindle motors
  - Liquid cooled servo motors
  - Built-in motors (Motorspindle®) both synchronous and asynchronous

For details about these motor type or custom motors please contact our sale offices.

NUM Motors BPH, BPG, BPL, BHL, AMS, Spindle Motors, AMR

NUM Motors BPH, BPG, BPL, BHL
General Characteristics

NUM Motors BPH, BPG, BPL, BHL

BPH, BPG, BPL and BHL brushless axis motors are designed with samarium cobalt magnets ensuring a high power-to-weight ratio, a high dynamic speed range, and a compact size.

General Characteristics

General Motor Features	**As per EN60034-1**
Environment Storage Conditions: Temperature Range Relative Humidity	 – 20 to + 80 °C max. 80% without condensation
Environment Working Conditions: Temperature Range Altitude	 0 to 40 °C without derating, max. 55 °C with derating 0 to 1000 m without derating, max. 3000 m with derating
Continuous Stall Torque Range	From 1.1 Nm up to 160 Nm
Protection Class as per EN60529	BPH, BPG, BPL: IP65 and optionally IP 67 BHL: Housing IP65, shaft and fan IP54
Connection	By rotary connector (excluding BHL)
Holding Permanent Magnet Brake	24 Vdc available as option (excluding BPG and BPL)
Motor Transducer	High resolution single turn and multi turn optical encoder Medium resolution single turn and multi turn optical encoder
Mounting Restriction	No mounting restrictions, IMB5 - IMV1 - IMV3 as per DIN42950
Fan Input Voltage	400 Vac ± 5% 3 phases, 50/60 Hz (for BHL260 only)

NUM Motors BPH, BPG, BPL, BHL
Technical Characteristics

For peak torque figures please refer to chapter 7 where the drive-motor associations are described.

	Stall Cont. torque	Rated speed	Rotor Inertia		Motor weight		Brake		Stall cont. current
			without brake	with brake	without brake	with brake	Torque	Current	
	[Nm]	[rpm]	[g.m2]	[g.m2]	[kg]	[kg]	[Nm]	[A]	[Arms]
BPH0751N5...	1.3	3 000	0.08	0.12	3.5	3.85	2.5	0.5	2.2
BPH0751V5...		6 000							3
BPH0752N5...	2.3	3 000	0.12	0.16	4.3	4.65			2.7
BPH0752V5...		6 000							3.5
BPH0754N5...	4	3 000	0.21	0.25	6	6.35	5		3.5
BPH0952N5...	4.3	3 000	0.3	0.41	6.7	7.5		0.7	3.5
BPH0952V5...		6 000							5.9
BPH0953N5...	6	3 000	0.41	0.52	8	8.8			5.2
BPH0953V5...		6 000							10.3
BPH0955N5...	9.2	3 000	0.64	0.75	10.5	11.3	11		5.8
BPH1152N5...	7.4	3 000	0.7	1.07	9.6	10.9	12	0.8	5.5
BPH1152V5...		6 000							10.5
BPH1153K5...	10.5	2 000	0.97	1.34	11.7	13			5.3
BPH1153N5...		3 000							9.2
BPH1153V5...		6 000							12.6
BPH1154K5...	13.3	2 000	1.25	1.62	13.8	15.1			6.2
BPH1154N5...		3 000							10.1
BPH1154V5...		6 000							17.6
BPH1156N5...	18.7	3 000	1.8	2.17	17.9	19.2	22		12
BPH1422K5...	12	2 000	1.59	2.54	17.2	19.4	20	1	6
BPH1422N5...		3 000							10.4
BPH1422R5...		4 250							11.5
BPH1423K5...	17	2 000	2.19	3.14	20.1	22.3			9.5
BPH1423N5...		3 000							11.7
BPH1423R5...		4 250							16.9
BPH1424K5...	22	2 000	2.79	3.74	23	25.2			10.4
BPH1424N5...		3 000							15.6
BPH1424R5...		4 250							20.8
BPH1427N5...	35	3 000	4.29	5.24	31.7	33.9	40		24.2
BPH1902K5...	25	2 000	5.14	8.25	32.1	36.2		1.5	16.6
BPH1902N5...		3 000							19.9
BPH1902R5...		4 250							29.2
BPH1903K5...	36	2 000	7.1	10.2	37.3	41.4			19.7
BPH1903N5...		3 000							27.8
BPH1904K5...	46	2 000	9.04	12.1	42.4	46.5			20.6
BPH1904N5...		3 000							30.3
BPH1905H5...	56	1 500	11	14.1	47.6	51.7	80		20
BPH1905L5...		2 500							31.4
BPH1907K5...	75	2 000	14.9	18	58	62.1			27.9
BPH1907N5...		3 000							52.3
BPH190AK5...	100	2 000	20.75	23.8	73.9	78			44

NUM Motors BPH, BPG, BPL, BHL
Technical Characteristics

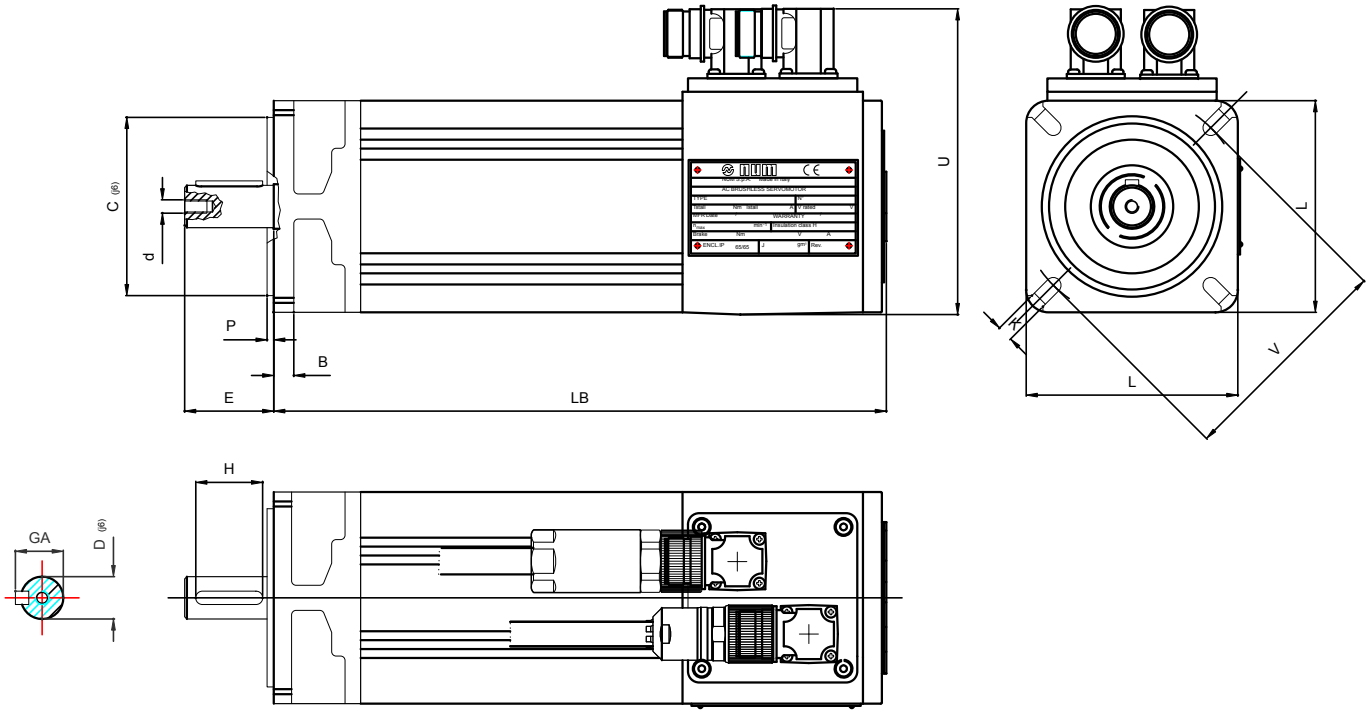
	Stall Cont. torque	Rated speed	Rotor Inertia		Motor weight		Brake		Stall cont. current
			without brake	with brake	without brake	with brake	Torque	Current	
	[Nm]	[rpm]	[g.m2]	[g.m2]	[kg]	[kg]	[Nm]	[A]	[Arms]
BPG0751N5...	1.3	3 000	0.25		4				2.2
BPG0752N5...	2.3	3 000	0.3		4.8				2.7
BPG0952N5...	4.3	3 000	0.86		7.6				3.5
BPG0953N5...	6	3 000	0.97		8.9				5.2
BPG1152N5...	7.4	3 000	2.45		11.2				5.5
BPG1153K5...	10.5	2 000	2.73		13.3				5.3
BPG1153N5...		3 000							9.2
BPG1153V5...		6 000							12.6
BPG1422N5...	12	3 000	6.7		20.4				10.4
BPG1423N5...	17	3 000	7.3		23.3				11.7
BPG1424K5...	22	2 000	7.9		26.2				10.4
BPG1424R5...		4 250							20.8
BPG1427N5...	35	3 000	9.7		34.9				24.2
BPG1902K5...	25	2 000	20.9		38.1				16.6
BPG1902N5...		3 000							19.9
BPG1903K5...	36	2 000	22.9		43.3				19.7
BPG1903N5...		3 000							27.8
BPG1904N5...	46	3 000	24.8		48.4				30.3
BPG1905L5...	56	2 500	26.8		53.6				31.4

	Stall Cont. torque	Rated speed	Rotor Inertia		Motor weight		Brake		Stall cont. current
			without brake	with brake	without brake	with brake	Torque	Current	
	[Nm]	[rpm]	[g.m2]	[g.m2]	[kg]	[kg]	[Nm]	[A]	[Arms]
BHL2601N5...	85	3 000	45	48.1	95	99	80	1.5	52
BHL2601N1...	120				100	104			75
BHL2602K5...	120	2 000	66.2	69.3	126	130			52
BHL2602K1...	160				131	135			69.3

BHLs with forced convection (V) require an **auto-transformer for 480Vac network (code: AMOTRF001)**

	Stall Cont. torque	Rated speed	Rotor Inertia		Motor weight		Brake		Stall cont. current
			without brake	with brake	without brake	with brake	Torque	Current	
	[Nm]	[rpm]	[g.m2]	[g.m2]	[kg]	[kg]	[Nm]	[A]	[Arms]
BPL0751V5...	1.1	6 000	0.1		3.2				2.6
BPL0753N5...	2.8	3 000	0.15		4.6				4
BPL0951V5...	2	6000	0.24		4.6				3.4
BPL0953N5...	5.4	3000	0.41		6				4.7

NUM Motors BPH, BPG, BPL, BHL
Outline Drawings BPH, BPG and BPL Motors

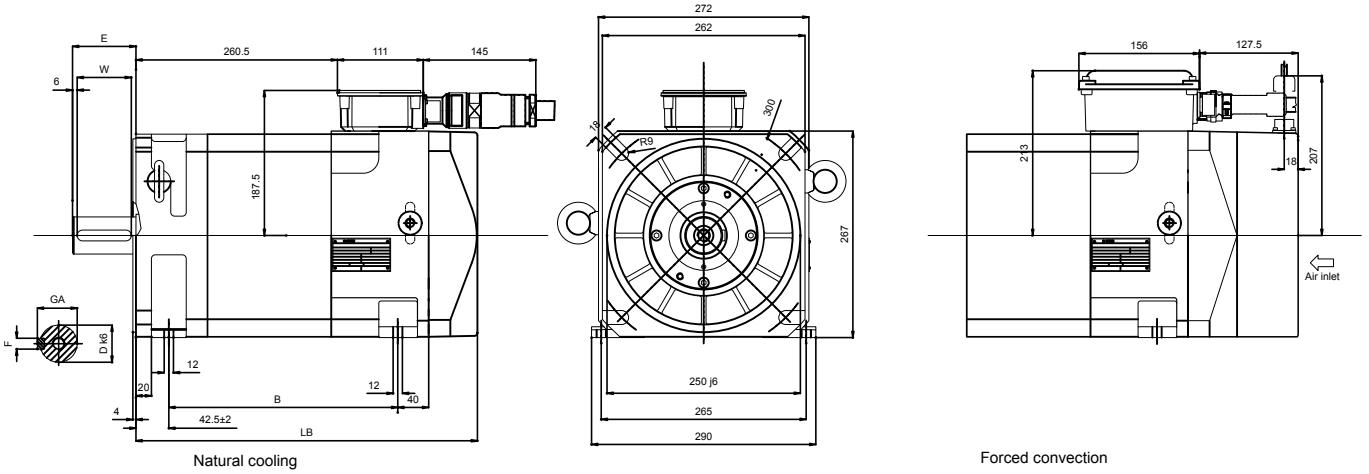


BPH / BPG		L	LB***	C	P	B	V	K	U	BPH shaft D	E	H	F	GA	d	BPG shaft D	E	H	F	GA	d
75	1	75	221	60	2.5	8	75	6	117	11	23	15	4	12.5	M4x10	14	30	20	5	16	M5x12
	2		250							14	30	20	5	16	M5x12						
	4		308																		
95	2	95	275	80	3	9	100	7	137	19	40	30	6	21.5	M6x16	19	40	30	6	21.5	M6x16
	3		304																		
	5		362																		
115	2	115	290	95	3	10	115	9	166	19	40	30	6	21.5	M6x16	24	50	40	8	27	M8x19
	3		319																		
	4		348							24	50	40	8	27	M8x19						
	6		406																		
142	2	142	316	130	3	14	165	11	193	24	50	40	8	27	M8x19	32	58	46	10	35	M12x28
	3		345																		
	4		374																		
	7		461							32	58	45	10	35	M12x28						
190	2	190	355	180	3	17	215	14	242* or 253**	32	58	45	10	35	M12x28	38	80	70	10	41	M12x28
	3		384																		
	4		413																		
	5		442																		
	7		500							38	80	70	10	41	M12x28						
	A		605																		

* 190 2K. 2N. 3K. 4K. 5H
** 190 2R. 3N. 4N. 5L. 7K. AK
*** BPH length doesn't change with or without brake

BPL		L	LB	C	P	B	V	K	U	D	E	H	F	GA	d
75	1	75	169	60	2.5	8	75	6	123	11	23	15	4	12.5	M4x10
	3		227							14	30	20	5	16	M5x12
95	1	95	184	80	3	9	100	7	142	19	40	30	6	21.5	M6x16
	3		242												

NUM Motors BPH, BPG, BPL, BHL
Outline Drawings BHL Motors



Natural cooling

Forced convection

	LB	B	D	E	W	F	GA	d
BHL2601x5xx2...	440	296 ± 2	48	82 ± 1	70	14	51.5	M16x36
BHL2601x1xxV...	510	366 ± 2	48	82 ± 1	70	14	51.5	M16x36
BHL2602x5xx2...	521	296 ± 2	48	82 ± 1	70	14	51.5	M16x36
BHL2602x1xxV...	591	366 ± 2	48	82 ± 1	70	14	51.5	M16x36

NUM Motors BPH, BPG, BPL, BHL, AMS, Spindle Motors, AMR

NUM Motors BPH, BPG, BPL, BHL
Ordering Codes

BPH Motors

	BPH	075	1	N	5	Q	A	2	L	0	1
Series											
Size											
Length											
Winding type											
Fixed value					5						
Sensor type											
- High resolution multi-turn encoder						P					
- High resolution single-turn encoder						Q					
- Medium resolution multi-turn encoder						J					
- Medium resolution single-turn encoder						K					
Brake											
- Without brake							A				
- With brake							F				
Fixed value								2			
Shaft extention											
- Smooth									L		
- Keyed									C		
Fixed value										0	
Degree of protection (shaft extention/frame)											
- IP 65/65 (connectors and terminal box standard version)											1
- IP 67/67 option (connector version only)											2

BPG Motors

	BPG	075	1	N	5	Q	A	2	L	0	1
Series											
Size											
Length											
Winding type											
Fixed value					5						
Sensor type											
- High resolution multi-turn encoder						P					
- High resolution single-turn encoder						Q					
- Medium resolution multi-turn encoder						J					
- Medium resolution single-turn encoder						K					
Brake											
- Brake not available							A				
Fixed value								2			
Shaft extention											
- Smooth									L		
- Keyed									C		
Fixed value										0	
Degree of protection (shaft extention/frame)											
- IP 65/65 (connectors and terminal box standard version)											1
- IP 67/67 option (connector version only)											2

NUM Motors BPH, BPG, BPL, BHL
Ordering Codes

BPL Motors

	BPL	075	1	N	5	Q	A	2	L	0	1
Series											
Size											
Length											
Winding type											
Fixed value					5						
Sensor type											
- High resolution multi-turn encoder						P					
- High resolution single-turn encoder						Q					
Brake											
- Brake not available							A				
Fixed value								2			
Shaft extention											
- Smooth									L		
- Keyed									C		
Fixed value										0	
Degree of protection (shaft extention/frame)											
- IP 65/65 (connectors and terminal box standard version)											1
- IP 67/67 option (connector version only)											2

BHL Motors

	BHL	260	1	N	1	Q	A	2	L	0	5
Series											
Size											
Length											
Winding type											
Power connection											
- With terminal box mandatory for forced convection version					1						
- With power connector mandatory for natural convection version					5						
Sensor type											
- High resolution multi-turn encoder						P					
- High resolution single-turn encoder						Q					
Brake											
- Without brake							A				
- With brake							F				
Cooling											
- Natural convection								2			
- With fan (ventilated)								V			
Shaft extention											
- Smooth									L		
- Keyed									C		
Fixed value										0	
Degree of protection (shaft extention/frame/fan if present)											
- IP 54/65/54											5

NUM Motors BPH, BPG, BPL, BHL, AMS, Spindle Motors, AMR

NUM Motors BPH, BPG, BPL, BHL
Accessories

BPH connectors, cables and cable assemblies

	Connectors		Cables		Cable assemblies	
	Power	Sensor	Power	Sensor	Power	Sensor
BPH0751N5...	AMOCON004D	AMOCON002D	AGOCAV004	AGOCAV007	AGOFRU018M	AGOFRU029M
BPH0751V5...						
BPH0752N5...						
BPH0752V5...						
BPH0754N5...						
BPH0952N5...						
BPH0952V5...						
BPH0953N5...						
BPH0953V5...						
BPH0955N5...						
BPH1152N5...						
BPH1152V5...						
BPH1153K5...						
BPH1153N5...						
BPH1153V5...						
BPH1154K5...						
BPH1154N5...						
BPH1154V5...			AGOCAV005		AGOFRU019M	
BPH1156N5...			AGOCAV004		AGOFRU018M	
BPH1422K5...						
BPH1422N5...						
BPH1422R5...						
BPH1423K5...						
BPH1423N5...						
BPH1423R5...			AGOCAV005		AGOFRU019M	
BPH1424K5...			AGOCAV004		AGOFRU018M	
BPH1424N5...			AGOCAV005		AGOFRU019M	
BPH1424R5...						
BPH1427N5...						
BPH1902K5...						
BPH1902N5...						
BPH1902R5...	AMOCON005D		AGOCAV006		AGOFRU020M	
BPH1903K5...	AMOCON004D		AGOCAV005		AGOFRU019M	
BPH1903N5...	AMOCON005D		AGOCAV006		AGOFRU020M	
BPH1904K5...	AMOCON004D		AGOCAV005		AGOFRU019M	
BPH1904N5...	AMOCON005D		AGOCAV006		AGOFRU020M	
BPH1905H5...	AMOCON004D		AGOCAV005		AGOFRU019M	
BPH1905L5...	AMOCON005D		AGOCAV006		AGOFRU020M	
BPH1907K5...						
BPH1907N5...						
BPH190AK5...						

5

NUM Motors BPH, BPG, BPL, BHL
Accessories

BPG connectors, cables and cable assemblies

<table>
<tr><th rowspan="2"></th><th colspan="2">Connectors</th><th colspan="2">Cables</th><th colspan="2">Cable assemblies</th></tr>
<tr><th>Power</th><th>Sensor</th><th>Power</th><th>Sensor</th><th>Power</th><th>Sensor</th></tr>
<tr><td>BPG0751N5...</td><td rowspan="13">AMOCON004D</td><td rowspan="18">AMOCON002D</td><td rowspan="9">AGOCAV004</td><td rowspan="18">AGOCAV007</td><td rowspan="9">AGOFRU018M</td><td rowspan="18">AGOFRU029M</td></tr>
<tr><td>BPG0752N5...</td></tr>
<tr><td>BPG0952N5...</td></tr>
<tr><td>BPG0953N5...</td></tr>
<tr><td>BPG1152N5...</td></tr>
<tr><td>BPG1153K5...</td></tr>
<tr><td>BPG1153N5...</td></tr>
<tr><td>BPG1153V5...</td></tr>
<tr><td>BPG1422N5...</td></tr>
<tr><td>BPG1423N5...</td><td rowspan="9">AGOCAV005</td><td rowspan="9">AGOFRU019M</td></tr>
<tr><td>BPG1424K5...</td></tr>
<tr><td>BPG1424R5...</td></tr>
<tr><td>BPG1427N5...</td></tr>
<tr><td>BPG1902K5...</td></tr>
<tr><td>BPG1902N5...</td></tr>
<tr><td>BPG1903K5...</td></tr>
<tr><td>BPG1903N5...</td><td rowspan="3">AMOCON005D</td><td rowspan="3">AGOCAV006</td><td rowspan="3">AGOFRU020M</td></tr>
<tr><td>BPG1904N5...</td></tr>
<tr><td>BPG1905L5...</td></tr>
</table>

BPL connectors, cables and cable assemblies

<table>
<tr><th rowspan="2"></th><th colspan="2">Connectors</th><th colspan="2">Cables</th><th colspan="2">Cable assemblies</th></tr>
<tr><th>Power</th><th>Sensor</th><th>Power</th><th>Sensor</th><th>Power</th><th>Sensor</th></tr>
<tr><td>BPL0751V5...</td><td rowspan="4">AMOCON004D</td><td rowspan="4">AMOCON002D</td><td rowspan="4">AGOCAV004</td><td rowspan="4">AGOCAV007</td><td rowspan="4">AGOFRU018M</td><td rowspan="4">AGOFRU029M</td></tr>
<tr><td>BPL0753N5...</td></tr>
<tr><td>BPL0951V5...</td></tr>
<tr><td>BPL0953N5...</td></tr>
</table>

BHL connectors, cables and cable assemblies

<table>
<tr><th rowspan="2"></th><th colspan="3">Connectors</th><th colspan="3">Cables</th></tr>
<tr><th>Power</th><th>Sensor</th><th>Fan</th><th>Power</th><th>Sensor</th><th>Fan</th></tr>
<tr><td>BHL2601N5...</td><td>AMOCON005D</td><td rowspan="4">AMOCON002D</td><td rowspan="4">CONN113D00</td><td>AGOCAV006</td><td rowspan="4">AGOCAV007</td><td rowspan="4">AGOCAV001</td></tr>
<tr><td>BHL2601N1...</td><td>None</td><td>RPC445S</td></tr>
<tr><td>BHL2602K5...</td><td>AMOCON005D</td><td>AGOCAV006</td></tr>
<tr><td>BHL2602K1...</td><td>None</td><td>RPC445S</td></tr>
</table>

<table>
<tr><th rowspan="2"></th><th colspan="3">Cable assemblies</th></tr>
<tr><th>Power</th><th>Sensor</th><th>Fan</th></tr>
<tr><td>BHL2601N5...</td><td>AGOFRU020M</td><td rowspan="4">AGOFRU029M</td><td rowspan="4">AGOFRU012Mxxx V</td></tr>
<tr><td>BHL2601N1...</td><td>None</td></tr>
<tr><td>BHL2602K5...</td><td>AGOFRU020M</td></tr>
<tr><td>BHL2602K1...</td><td>None</td></tr>
</table>

NUM Motors BPH, BPG, BPL, BHL
Accessory Descriptions

AMOCON004D	6 poles power connector *
AMOCON005D	6 poles power connector *
AMOCON002D	17 poles encoder connector *

AGOCAV004	High-End power cable with brake wires (4 x 1.5mm^2 + (2 x 1mm^2)) *
AGOCAV005	High-End power cable with brake wires (4 x 4mm^2 + (2 x 1mm^2)) *
AGOCAV006	High-End power cable with brake wires (4 x 10mm^2 + (2 x 1mm^2)) *
AGOCAV004L	Standard power cable without brake wires (4 x 1.5mm^2). The motor association is equivalent to AGOCAV004.
AGOCAV005L	Standard power cable without brake wires (4 x 4mm^2). The motor association is equivalent to AGOCAV005.
AGOCAV007	High-End Sensor cable (3x(2x0.14)+4x0.14+2x0.5) *
Cable ordering example: High-End Sensor cable 10 m long: AGOCAV007 (10 m)	

AGOFRU018Mxxx	High-End power cable assembly with brake wires (4 x 1.5mm^2 + (2 x 1mm^2)) *
AGOFRU019Mxxx	High-End power cable assembly with brake wires (4 x 4mm^2 + (2 x 1mm^2)) *
AGOFRU020Mxxx	High-End power cable assembly with brake wires (4 x 10mm^2 + (2 x 1mm^2)) *
AGOFRU018LMxxx	Standard power cable assembly without brake wires (4 x 1.5mm^2). The motor association is equivalent to AGOFRU018Mxxx.
AGOFRU019LMxxx	Standard power cable assembly without brake wires (4 x 4mm^2). The motor association is equivalent to AGOFRU019Mxxx.
AGOFRU029Mxxx	High-End Sensor cable assembly (3x(2x0.14)+4x0.14+2x0.5) *
Cable assembly ordering example: High-End Sensor cable assembly 15 m long: AGOFRU029M015 Available cable lengths for cable assemblies: 5, 10, 15, 25, 35, 50, and 75 meters	

AMOTRF001	Auto-transformer for fan needed in case of 480 Vac mains

* = See association tables on pages 93 and 94

NUM Motors AMS
General Characteristics

NUM Motors AMS

The AMS asynchronous motors are designed to control machine tool spindles as well as C axis application thanks to high-resolution encoder.

They are compact (with built-in axial fan) and exhibit low rotor inertia.

AMS associated to a NUM Drive with flux vector control ensure very smooth rotation, even at low speeds.

For applications requiring very high radial loads, AMS motors (size 132 and 160) can fulfill this need by a specific version available as option.

General Characteristics

General Motor Features	**As per EN60034-1**
Environment Storage Conditions: Temperature Range Relative Humidity	 – 20 to + 80 °C max. 80% without condensation
Environment Working Conditions: Temperature Range Altitude	 0 to 40 °C without derating, max. 55 °C with derating 0 to 1000 m without derating, max. 3000 m with derating
Power Range	From 3.7 up to 36 kW rated continous power
Protection Cass as per EN60529	IP65 for the housing IP54 for the fan IP54 for the shaft, optionally IP65
Connection	By terminal board for the power By connector for the encoder
Motor Transducer	High resolution single turn and multi turn optical encoder Medium resolution single turn and multi turn optical encoder
Mounting Restriction	No mounting restrictions, IMB5 - IMV1 - IMV3 as per DIN42950
Vibration Class as per EN60034-14	R class, optionally S class
Fan Input Voltage	400 Vac ± 5% 3 phases, 50/60 Hz

NUM Motors AMS
Technical Characteristics

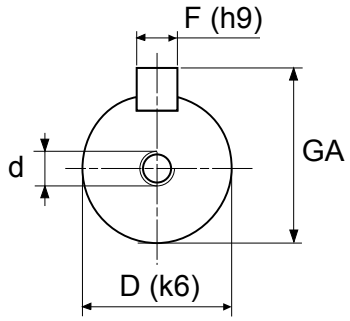
For power curves refer to the chapter 7 where the drive-motor association are described.

	Connection Type	Rated Continous Power	Rated Speed	Max Speed	Rated Torque	Rated Continous Current	Rotor Intertia	Fan (3 Phases)	
								Voltage	Current
		[kW]	[rpm]	[rpm]	[Nm]	[Ams]	[g.m2]	[V]	[Arms]
AMS100SB1...	Y	3.7	1500	6500	24	21	9	400	0.11
AMS100MB1...	Y	5.5			35	26	14		
AMS100GB1...	Y	9			57	39	23		
AMS100SD1...	Y	3.7	1500	12000	24	21	9		
AMS100MD1...	Y	5.5			35	26	14		
AMS100GD1...	Y	9			57	39	23		
AMS132SA1...	Y	5	750	7000	64	26	55		0.2
AMS132SC1...	Y	10	1500		64	39			
AMS132SE1...	Δ	15	1750		82	52			
AMS132MA1...	Y	7.5	750		95	39	75		
AMS132MC1...	Y	15	1500		95	52			
AMS132ME1...	Δ	19.5	1850		100	72			
AMS132LA1...	Y	11	750		140	52	113		
AMS132LE1...	Y	22	1250		168	72			
AMS132SF1...	Y	5	750	10000	64	26	55		
AMS132SG1...	Y	10	1500		64	39			
AMS132SH1...	Δ	15	1750		82	52			
AMS132MF1...	Y	7.5	750		95	39	75		
AMS132MG1...	Y	15	1500		95	52			
AMS132MH1...	Δ	19.5	1850		100	72			
AMS132LF1...	Y	11	750	9000	140	52	113		
AMS132LI1...	Y	12.5	680		175	39			
AMS132LH1...	Y	22	1250		168	72			
AMS160MA1...	Y	18	650	8500	264	52	250		0.3
	Δ		1300		132				
AMS160MB1...	Y	26	1200		208	72			
	Δ		2400		104				
AMS160MC1...	Δ	36	1700		202	100			
AMS160LA1...	Y	18	500	6500	344	52	370		
	Δ		1000		172				
AMS160LB1...	Y	26	950		260	72			
	Δ		1900		130				
AMS160LC1...	Δ	36	1050		328	100			

AMS require an **auto-transformer for 480Vac mains (code: AMOTRF001)**

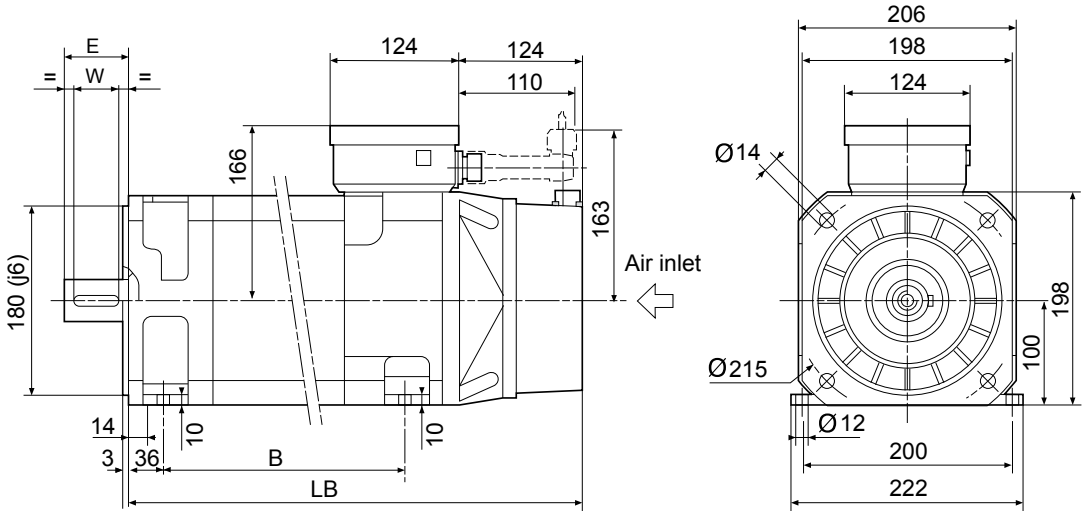
NUM Motors AMS
Outline Drawings AMS Motors

AMS Motor Shaft End

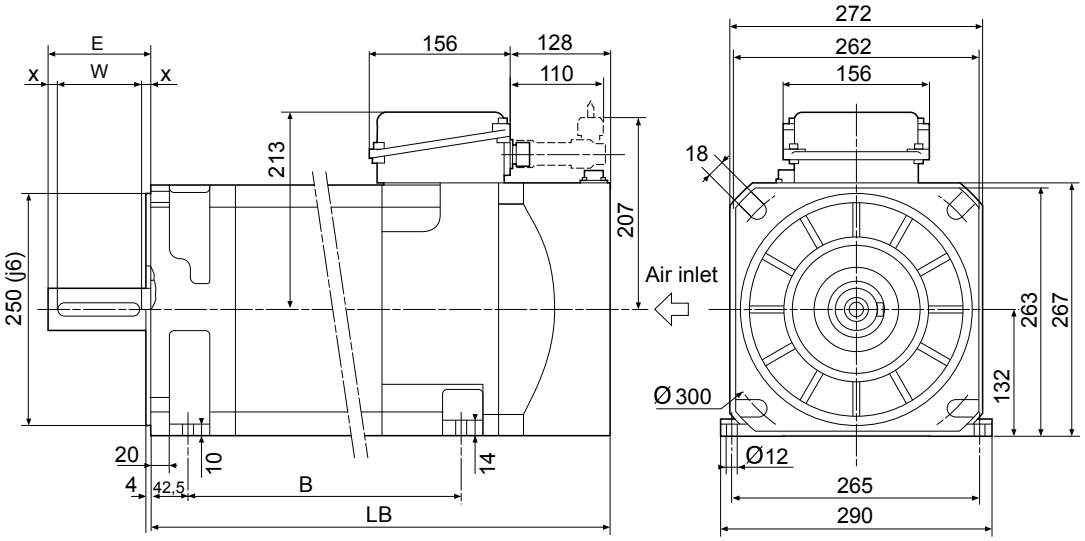


	LB	B	Shaft					
			D	E	W	F	GA	d
100 S	388	179 ± 1.5	32	60	50	10	35	M12x30
100 M	442	233 ± 1.5						
100 G	535	326 ± 1.5	38	80	70		41	
132 S	521	296 ± 2	42	110	90	12	45	M16x36
132 M	591	366 ± 2						
132 L	721	496 ± 2	48	110	90	14	51.5	
160 M	682	385 ± 2	55	110	90	16	59	M20x42
160 L	827	530 ± 2						

AMS 100 Motor

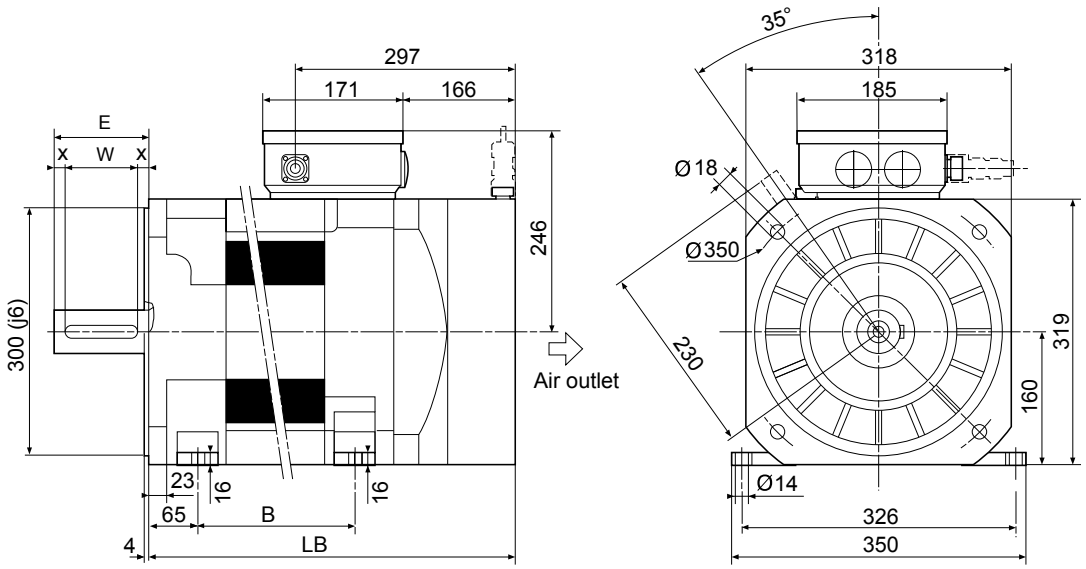


AMS 132 Motor



NUM Motors AMS
Outline Drawings AMS Motors

AMS 160 Motor



5

NUM Motors AMS
Ordering Codes

AMS Motors

	AMS	100	S	B	1	Q	22	L	R	0
Series										
Size (100, 132, 160)										
Length										
Winding type										
Fixed value					1					
Sensor type										
- High resolution multi-turn encoder						P				
- High resolution single-turn encoder						Q				
Fixed value							22			
Shaft extention										
- Smooth								L		
- Keyed								C		
Vibration class										
- Class R									R	
- Class S									S	
Degree of protection (shaft extention/frame/fan) and radial load										
- IP 54/65/54 with standard admitted radial load										0
- IP 65/65/54 with standard admitted radial load										1
- IP 54/65/54 with high admitted radial load (just for size 132 and 160)										2
- IP 65/65/54 with high admitted radial load (just for size 132 and 160)										3

NUM Motors AMS
Accessories

AMS connectors, cables and cable assemblies

	Connector		Cables			Cable Assembly
	Sensor	Fan	Power	Sensor	Fan	Fan
AMS100SB1...	CONN125D00	CONN113D00	RPC455S	AGOCAV007	AGOCAV001	AGOFRU012Mxxx V
AMS100MB1...						
AMS100GB1...						
AMS100SD1...						
AMS100MD1...						
AMS100GD1...						
AMS132SA1...			RPC445S			
AMS132SC1...						
AMS132SE1...						
AMS132MA1...						
AMS132MC1...						
AMS132ME1...						
AMS132LA1...						
AMS132LE1...						
AMS132SF1...						
AMS132SG1...						
AMS132SH1...						
AMS132MF1...						
AMS132MG1...						
AMS132MH1...						
AMS132LF1...						
AMS132LI1...						
AMS132LH1...						
AMS160MA1...						
AMS160MB1...						
AMS160MC1...						
AMS160LA1...						
AMS160LB1...						
AMS160LC1...						

CONN125D00	Encoder connector *
CONN113D00	Fan connector *

RPC455S	High-End power cable (4 x 6mm^2 + (2 x 1mm^2)) *
RPC445S	High-End power cable (4 x AWG04 + (2 x 1mm^2)) *
AGOCAV007	High-End Sensor cable (3x(2x0.14)+4x0.14+2x0.5) *
AGOCAV001	Standard fan cable, 4 x 1mm^2
Cable ordering example: High-End Sensor cable 10 m long: AGOCAV007 (10 m)	

AGOFRU012MxxxV	Standard fan cable assembly , 4 x 1mm^2
Cable assembly ordering example: Standard fan cable assembly 10 m long: AGOFRU012M010V Available cable lengths for cable assemblies: 5, 10, 15, 25, 35, 50, and 75 meters	

AMOTRF001	Auto-transformer for fan needed in case of 480 Vac mains

* = See association table on page 101

General Information

As well as the standard product described above NUM produces special and built-in (Motorspindle®) motors design in order to fit the customer needs.

Please contact our sale offices for information about special and built-in motors.

Motorspindle®: stator elements, synchronous and asynchronous technology, for integration in electro spindles.

AMR hybrid cooling motor: liquid plus air cooling from shaft

6 NUM Servodrives

NUM Servodrives: MBLD ‘All-in-one’, HP Drive, NUMDrive C

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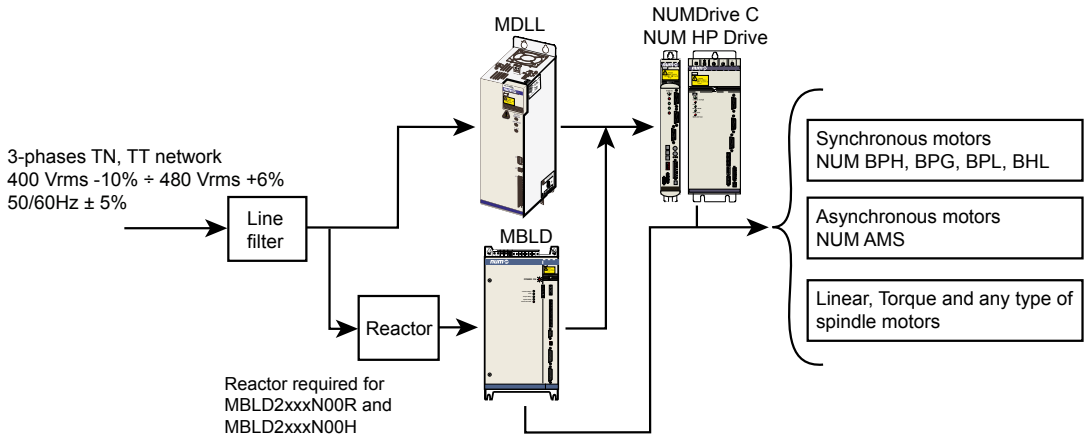
Introduction

NUM’s servodrive system with digital interface are composed by the following product families:

- Power supply module for modular drive system such as NUM HP drives and NUMDrive C
- All in one drive: drive module with built-in power supply; the integrated power supply can supply other NUM HP drives and/or NUMDrive C devices too.
- NUM HP Drive: High Performance modular drive for any type of machine tool application.
- NUMDrive C: Compact and scalable modular drive family; NUMDrive C is the newest NUM drive and is available in different versions to better fit any type of machine tool application with different performance/price ratios.

All the product families described above can interoperate as simply described in the following chart.



Common characteristics

All the NUM servo drives have got the following characteristics:

Protection degree	IP 20 to EN60529
Environment storage conditions:	
Temperature range	– 40 to + 80 °C
Relative humidity	max. 75% without condensation
Environment working conditions:	
Temperature range	0 to 40 °C without derating, max 60 °C with derating
Relative humidity	max. 75% without condensation
Vibration to EN60068-2-6	max. deflection 75 mm, frequency 10 to 58 Hz
Altitude	0 to 1000 m without derating, max 3000 m with derating

NUM Servodrives: MBLD ‘All-in-one’, HP Drive, NUMDrive C

Power Supplies
Introduction
Technical Characteristics

Introduction

MDLL power supplies are design for being used in conjunction with NUM modular drive ranges: NUM HP Drive and NUMDrive C; MDLL, as well as supplying the main voltage via DC bus, it supplies the control voltage too (auxiliary voltage).

MDLL are available in two different ratings: 15 kW and 30 kW continuous power with dissipation of the braking energy by external resistor.

MDLQ is a auxiliary power supply it’s used whenever the available auxiliary power built-in the MDLL device is not enough (high NUMber of drives). Refer to the installation manual for more information.

For using MDLL3 with NUM HP Drive a mechanical adapter is needed (see paragraph: accessories).

Technical Characteristics

MDLL3 Power Supplies		**MDLL3015N00AN0I**	**MDLL3030N00AN0I**
Rated Power (S1)	kW	15	30
S3 power (4s ON - 6s OFF)	kW	40	45
Overload Power	kW	50	50
Input Voltage	V	400VACrms -10% to 480VACrms+6% 50/60Hz ± 5% 3 phases	
Dissipation of Braking Energy		on braking resistor	
Overall Dimensions	mm	100 x 355 x 206	
Weight	Kg	5.5	
Filter		AGOFIL022	AGOFIL023
External Braking Resistor *		AGORES008	AGORES009
Mechanical Adapter **		AEOADA008	

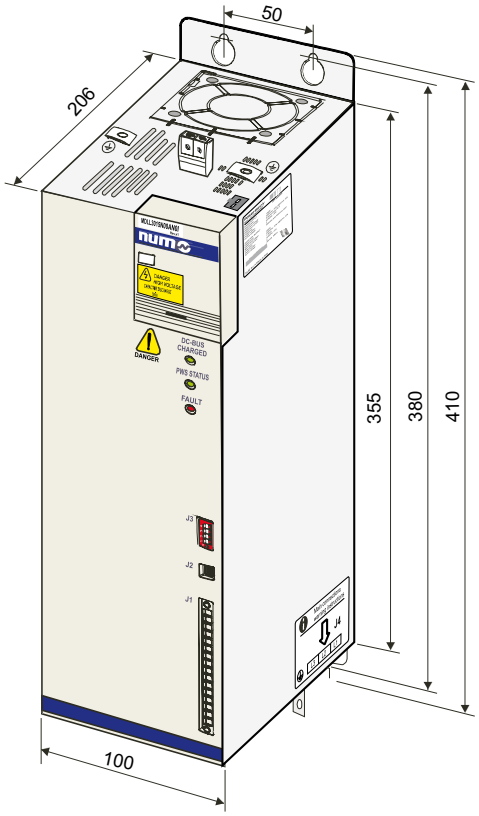
MDLQ3 Power Supply		**MDLQ3001N00**
Auxiliary Rated Power	W	250
Input Voltage	V	400VACrms -10% to 480VACrms+6% 50/60Hz ± 5% 3 phases
Overall Dimensions	mm	50 x 355 x 206
Weigth	Kg	2.8
Filter		AGOFIL001S
Mechanical Adapter ***		AEOADA007

* = At least one external braking resistor is mandatory.
** = Required in a system with NUM HP Drives.
*** = Required in a system with NUM HP Drives or MBLD All-in-one Drives.

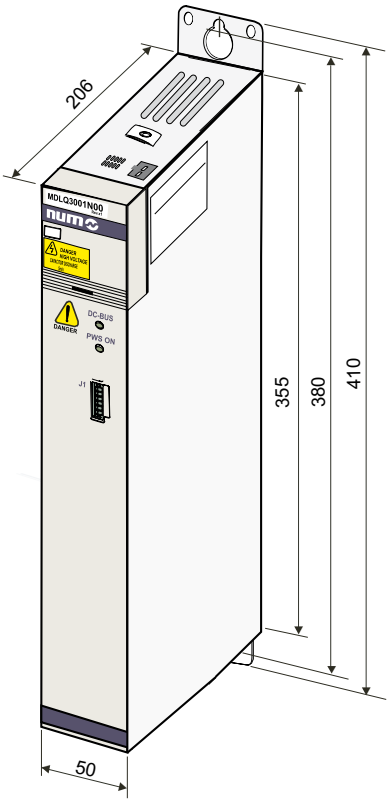
Power Supplies
Outline Drawings

Outline Drawings

MDLL3015N00AN0I
MDLL3030N00AN0I



MDLQ3001N00



Note:

For installation remember taking the cable and connector dimensions in account, adding approximately 75 mm to the depth (206+75mm = 281).

Power Supplies

	MDLL	3	015	N	00	A	N	0	I
Series									
Evolution index									
Rated power									
- Size 2: Pn 15kW			015						
- Size 2: Pn 30kW			030						
Mains supply									
- From 400Vac -10% to 480Vac +6% 50/60Hz +/-5%, 3 phases				N					
Options									
- None					00				
Type									
- Passive power supply, without internal brake resistance						A			
Version									
- Standard NUM							N		
Standard NUM								0	
Heat-sink position									
- Internal heat-sink									I

Note: An external resistor must be always taken in account

Accessories

AGOFIL022	Line filter *
AGOFIL023	Line filter *
AGOFIL001S	Line filter **
AEOADA008	Mechanical adapter for 100mm module
AGORES008	External braking resistor 480 W S1 17 ohm *
AGORES009	External braking resistor 480 W S1 8.5 ohm *

* = See MDLL technical characteristics tables on page 108 for association.
** = See MDLQ technical characteristics tables on page 108 for association.

NUM Servodrives: MBLD ‘All-in-one’, HP Drive, NUMDrive C

NUM Servodrives MBLD ‘All-in-one’
Introduction
Interoperability and Functions

Introduction

All-in-One Drive is a High Performance and universal drive system that can be easily adapted to any type of application and motor. The integrated power supply, as well as supplying the needed power for the built-in drive, can also distribute power, via DC bus, to a modular system such as NUM HP Drive and NUMDrive C.

The integrated power supply is available is 3 versions:

- with dissipation of braking energy by internal and/or external resistor
- with dissipation of braking energy by re-injection in the mains
- with a constant DC bus voltage regulated at 700 V= and dissipation of braking energy by re-injection in the mains

The interface between an All-in-One Drive and the CNC is done by a high speed digital bus where both cyclical and service information are shared.

All-in-One Drives are available in 5 different ratings: from 26 Arms up to 100 Arms rated current and they are mainly used for spindle motor control.

Interoperability and Functions

Interface	High speed digital bus DISC NT
Control Performance	High performance control loops
Compatible Motors *	Closed loop: synchronous rotary, linear and torque motors and asynchronous motors
Compatible Motor Sensors	Hiperface encoder Resolver Hall sensors
Compatible Direct Measure Sensors	TTL encoder / linear scale EnDat 2.1 encoder / linear scale 1 Vpp encoder / linear scale (also with coded references)
Special Functions	Spindle operation for synchronous and asynchronous motors Synchronous motor phasing without movement ** Spindle-Axis commutation Star/Delta commutation on the fly Rotary axis with mechanical ratio not 2^x Anti backlash Torque duplication Coherence control between motor and direct measure sensor Various active dumping functions (for resonance suppression) Various freely settable filters

* = Having a compatible position sensor
** = Required for incremental encoders

NUM Servodrives: MBLD ‘All-in-one’, HP Drive, NUMDrive C

NUM Servodrives MBLD ‘All-in-one’ Technical Characteristics

Technical Characteristics

MBLD with dissipation of braking energy by internal and/or external resistor.

MBLDxxxxN00A		**2050**	**2075**	**2100**	**2150**
Power Supply Rated Power (S1)	kW	30		37	45
Power Supply Overload Power	kW	39		50	64
Input Voltage	Vrms	400VACrms -10% to 480VACrms+6% 50/60Hz ± 5% 3 phases			
Drive Rated Current (S1)	Arms	26	40	52	72
Drive Max Current (S3-S6)	Arms	35	53	71	106
Overall Dimensions	mm	250 x 480 x 285		400 x 600 x 285	
Weight	kg	27		57	
Filter		AGOFIL004A	AGOFIL006A	AGOFIL007A	AGOFIL010A
External Braking Resistor		AGORES001 or KFIG2			
Direct Measure Sensor Connector		AECON001			

MBLD with dissipation of braking energy by re-injection in the mains.

MBLDxxxxN00R		**2050**	**2075**	**2100**	**2150**	**2200**
Power Supply Rated Power (S1)	kW	30		37	45	62
Power Supply Overload Power	kW	39		50	64	80
Input Voltage	Vrms	400VACrms -10% to 480VACrms+6% 50/60Hz ± 5% 3 phases				
Drive Rated Current (S1)	Arms	26	40	52	72	100
Drive Max Current (S3-S6)	Arms	35	53	71	106	141
Overall Dimensions	mm	250 x 480 x 285		400 x 600 x 285		400 x 776 x 285
Weight	kg	27		57		63
Filter		AGOFIL004A	AGOFIL006A	AGOFIL007A	AGOFIL010A	AGOFIL009A
Inductance		AGOIND006		AGOIND007		AGOIND008
Direct Measure Sensor Connector		AECON001				

MBLD with constant DC bus voltage regulated at 700 Vdc and dissipation of braking energy by re-injection in the mains.

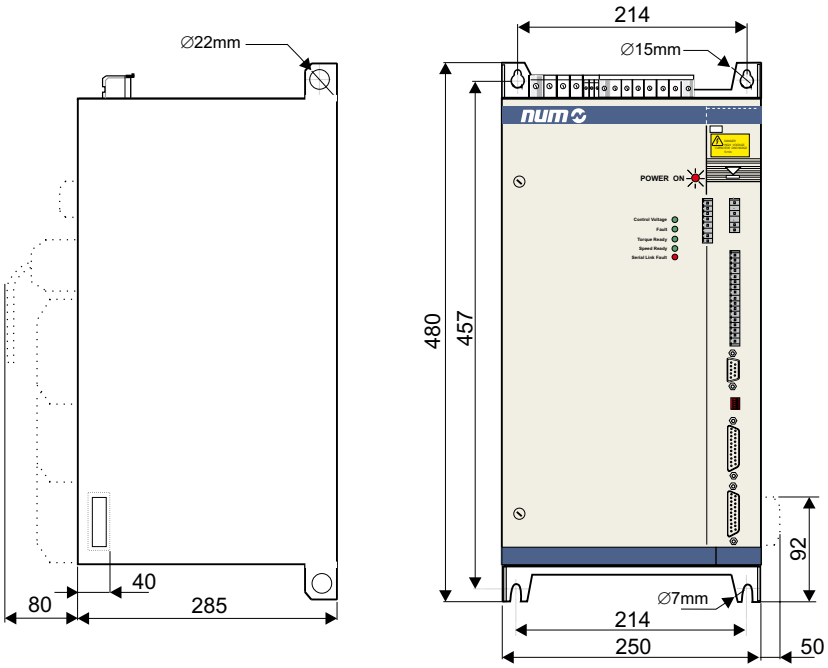
MBLDxxxxN00H		**2050**	**2075**	**2100**	**2150**	**2200**
Power Supply Rated Power (S1)	kW	20		25	30	42
Power Supply Overload Power	kW	33		44	66	88
Input Voltage	Vrms	400VACrms -10% to 480VACrms+6% 50/60Hz ± 5% 3 phases				
Drive Rated Current (S1)	Arms	26	40	52	72	100
Drive Max Current (S3-S6)	Arms	35	53	71	106	141
Overall Dimensions	mm	250 x 480 x 285		400 x 600 x 285		400 x 776 x 285
Weight	kg	27		57		63
Filter		AGOFIL004A	AGOFIL006A	AGOFIL011S	AGOFIL012S	
Inductance		AGOIND001		AGOIND002		AGOIND003
Direct Measure Sensor Connector		AECON001				

NUM Servodrives MBLD ‘All-in-one’
Outline Drawings

Outline Drawings

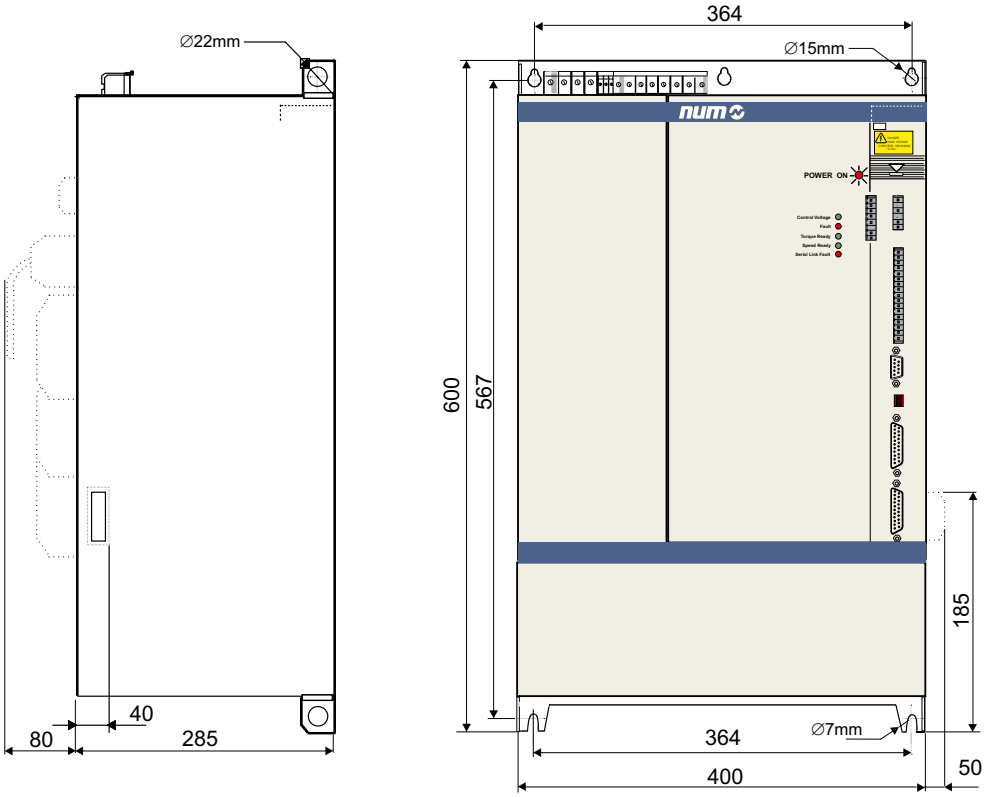
MBLD2050N00_

MBLD2075N00_



MBLD2100N00_

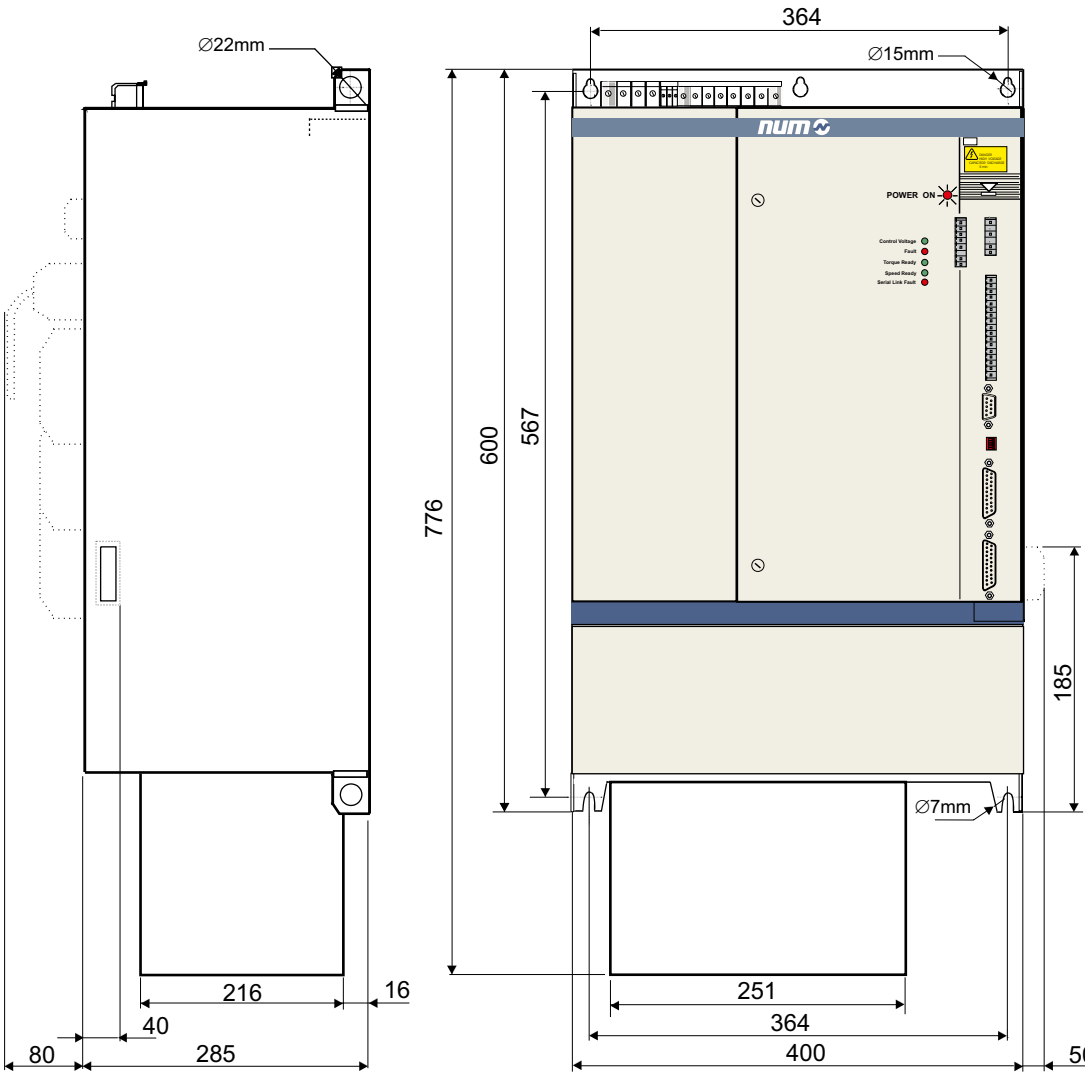
MBLD2150N00_



NUM Servodrives MBLD ‘All-in-one’
Outline Drawings

Outline Drawings

MBLD2200N00_



NUM Servodrives MBLD ‘All-in-one’
Ordering Codes
Accessories

NUM Servodrives MBLD ‘All-in-one’

	MBLD	2	050	N	00	A
Series						
Evolution index						
Rated power						
- Size 1: In 26Arms, Ipeak 35Arms			050			
- Size 1: In 40Arms, Ipeak 53Arms			075			
- Size 2: In 52Arms, Ipeak 71Arms			100			
- Size 2: In 72Arms, Ipeak 106Arms			150			
- Size 3: In 100Arms, Ipeak 141Arms			200			
Mains supply						
- From 400Vac -10% to 480Vac +6% 50/60Hz +/-5% 3 phases				N		
Options						
- None					00	
Version						
- Passive power supply with internal (or external) braking resistance						A
- Regenerative power supply with internal (or external) resistance for emergency braking						R
- Regulated 700Vdc Bus, regenerative power supply with internal (or external) resistance for emergency braking						H

Note: MBLD2200N00A is not available

Accessories

AGOFIL004A	Line filter *
AGOFIL006A	Line filter *
AGOFIL007A	Line filter *
AGOFIL009A	Line filter *
AGOFIL010A	Line filter *
AGOFIL011S	Line filter *
AGOFIL012S	Line filter *
AGORES001	External braking resistor 1.3 kW S1, 13.5 ohm *
KFIG2	External braking resistor 2.6 kW S1 13.5 ohm *
AGOIND006	Line inductance 60 A, 0.5 mH *
AGOIND007	Line inductance 100 A, 0.3 mH *
AGOIND008	Line inductance 230 A, 0.15 mH *
AGOIND001	Line inductance 36 kW, 0.7 mH *
AGOIND002	Line inductance 55 kW, 0.4 mH *
AGOIND003	Line inductance 80 kW, 0.6 mH *
AEOCON001	Direct measure sensor connector. This drive side sensor connector is needed only if the machine is equipped with a direct measuring device. An equivalent connector is present in the product box for the motor encoder.

* = See MBLD technical characteristics tables on page 112 for association.

NUM HP Drive
Introduction
Interoperability and Functions

Introduction

NUM HP drive is a High Performance and universal drive system that can be easily adapted to any type of application and motor. Being a modular system, several modules connected together share the same power supply, has got great benefits in term of power consumption and wiring complexity.

The interface between a NUM HP Drive and the NUM Axium Power CNC is done by a high speed digital bus where both cyclical and service information are shared.

NUM HP Drives are available in 5 different ratings: from 14 Arms up to 60 Arms rated current.

The High Performance are reached thanks to a very wide current, speed and position loop bandwidths, special functions dedicated to different application, a large NUMber of interoperable sensors/motors and a wide system configurability.

NUM HP Drives are available, as option (SAM-NUM Safety module), with certified (compliant with EN954-1 Category 3) safety functions, particularly:

- Safely reduced speed
- Safe brake ramps
- Safe emergency stop CAT0,1,2 (EN60204-1).

Interoperability and Functions

Interface	High speed digital bus DISC-NT
Control Performance	High performance control loops
Compatible Motors	Closed loop: synchronous rotary, linear and torque motors * and asynchronous motors Open loop: asynchronous motors
Compatible Motor Sensors	Hiperface encoder TTL encoder EnDat 2.2 encoder 1 Vpp toothed wheel/encoder Sensor less
Compatible Direct Measure Sensors	Hiperface encoder / linear scale TTL encoder / linear scale EnDat 2.2 encoder / linear scale SSI encoder / linear scale Hall sensors 1 Vpp encoder / linear scale (also with coded references)
Special Functions	Spindle operation for synchronous and asynchronous motors Synchronous motor phasing without movement ** Spindle-Axis commutation Star/Delta commutation on the fly Rotary axis with mechanical ratio not 2^x Anti backlash Torque duplication Coherence control between motor and direct measure sensor Various active dumping functions (for resonance suppression) Various freely settable filters
Certified Safety Functions compliant with EN954-1 CAT-3	Safely reduced speed Safe brake ramps Safe emergency stop CAT0,1,2 (EN60204-1)

* = Having a compatible position sensor
** = Required for incremental encoders

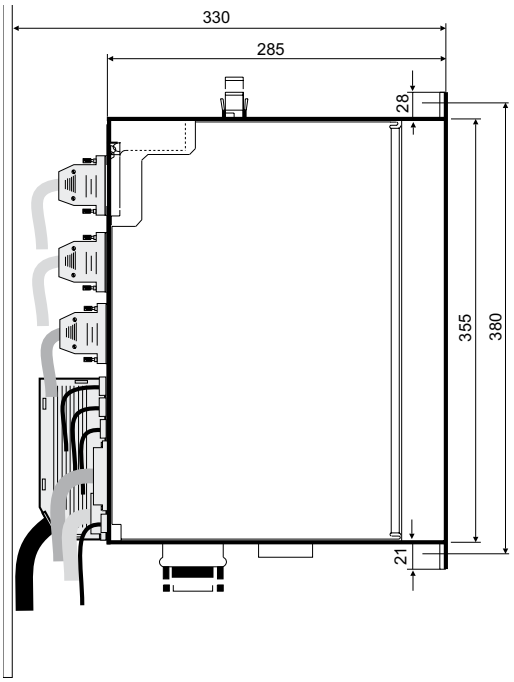
NUM HP Drive
Technical Characteristics
Outline Drawings

Technical Characteristics

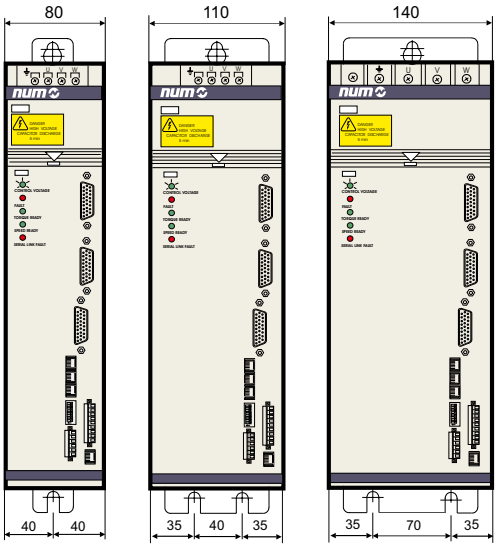
MDLU3xxxN		034	050	075	100	150
Rated Current (S1)	Arms	14	20	35	45	60
Maximum Current	Arms	24	35	53	71	106
Overall Dimensions	mm	80 x 355 x 285		110 x 355 x 285	140 x 355 x 285	
Weight	kg	6.9		9.2	11	
Direct Measure Sensor Connector		AEOCON012				

For smaller versions please get in contact with NUM or use NUMDrive C.

Outline Drawings



MDLU3034N MDLU3100N
MDLU3050N MDLU3075N MDLU3150N



NUM HP Drives

	MDLU	3	034	N	0	1	A	N
Series								
Evolution index								
Rated power								
- Size 2: In 14Arms, Ipeak 24Arms			034					
- Size 2: In 20Arms, Ipeak 35Arms			050					
- Size 3: In 35Arms, Ipeak 53Arms			075					
- Size 4: In 45Arms, Ipeak 71Arms			100					
- Size 4: In 60Arms, Ipeak 106Arms			150					
DC Bus voltage								
- Standard: Up to 700Vdc				N				
Communication								
- Standard: DISC-NT digital bus					0			
Sensor board								
- Standard						1		
Safety								
- Standard: Stop function Category 0 (1)							A	
- Option: SAM-Num Safely module (compliance with EN954-1 Category 3)							S	
Package definition								N

Note:

(1) Not certified

Accessories

AEOCON012	Direct measure sensor connector. This drive side sensor connector is needed only if the machine is equipped with a direct measuring device. An equivalent connector is present in the product box for the motor encoder.

NUMDrive C
Introduction

Introduction

Compact and scalable modular drive family, NUMDrive C is the newest NUM drive and is available in different versions to better fit any type of machine tool application with different performance/price ratios.

The interface between a NUMDrive C and the NUM Axium Power CNC is done by a high speed digital bus where both cyclical and service information are shared.

A NUMDrive C module is made up of 2 units: a power unit and a scalable control unit, both the units are available as mono or bi-axes drive.

The available control units targets different applications:

- HP, High Performance, control units target high complexity, dynamic, precision machine tools. HP units are available both for mono and bi-axes modules. The High Performance are reached thanks to a very wide current, speed and position loop bandwidths, special functions dedicated to different application, a large NUMber of interoperable encoders/motors and a wide system configurability.
- BP, Basic Performance control units target medium complexity, dynamic, precision machines; they have been designed for cost effective solutions.

NUMDrive C power units are available in 8 different ratings:

- Mono-Axis units from: 8.9 Arms up to 35 Arms rated current
- Bi-Axes units from: 5.6 up to 20 Arms

Important engineering efforts have brought to an extremely compact design that position NUMDrive C as one of the smallest drive on the market.

NUMDrive C mono-axis drives are available, as option (SAM-NUM Safety module), with certified (compliant with EN954-1 Category 3) safety functions, particularly:

- Safely reduced speed
- Safe brake ramps
- Safe emergency stop CAT0,1, 2 (EN60204-1).

NUMDrive C
Interoperability and Functions

Interoperability and Functions

		Bi-Axes BP	Mono-Axis HP	Bi-Axes HP
Interface	High speed digital bus DISC-NT	●	●	●
Control Performance	High performance control loops	-	●	●
Compatible Motors	Closed loop: synchronous rotary motors *	●	●	●
	Closed loop: synchronous torque and linear motors	-	●	●
	Closed loop: asynchronous motors	-	●	●
	Open loop: asynchronous motors	-	●	-
Compatible Motor Sensors	Hiperface encoder	●	●	●
	TTL encoder	●	●	●
	EnDat 2.2 encoder	●	●	●
	1 Vpp toothed wheel/encoder	●	●	●
	Sensor less	-	●	●
Compatible Direct Measure Sensors	Hiperface encoder / linear scale	-	●	●
	TTL encoder / linear scale	-	●	●
	EnDat 2.2 encoder / linear scale	-	●	●
	SSI encoder / linear scale	-	●	●
	Hall sensors	-	●	●
	1 Vpp encoder / linear scale (also with coded references)	-	●	●
Special Functions	Spindle operation for synchronous and asynchronous motors	-	●	●
	Synchronous motor phasing without movement **	●	●	●
	Spindle-Axis commutation	-	●	●
	Star/Delta commutation on the fly (for asynchronous motor)	-	●	●
	Rotary axis with mechanical ratio not 2^x	-	●	●
	Anti backlash	-	●	●
	Torque duplication	-	●	●
	Coherence control between motor and direct measure sensor	-	●	●
	Various active dumping functions (for resonance suppression)	-	●	●
	Various freely settable filters	●	●	●
Certified Safety Functions compliant with EN954-1 CAT-3	Safely reduced speed	-	❍	-
	Safe brake ramps		❍	
	Safe emergency stop CAT0,1,2 (EN60204-1)		❍	

* = Having a compatible position sensor
** = Required with incremental encoders

● basic
❍ optional
- unavailable

NUM Servodrives: MBLD ‘All-in-one’, HP Drive, NUMDrive C

NUMDrive C
Technical Characteristics

Technical Characteristics

Certain versions scheduled for early 2007.

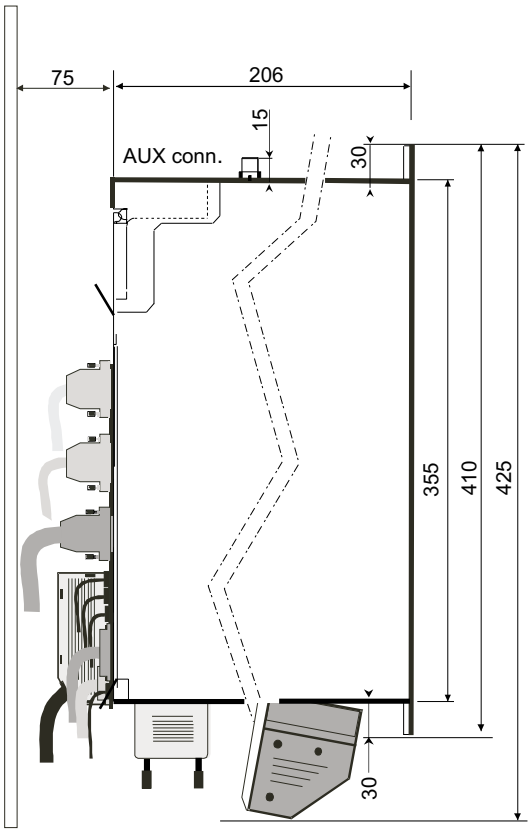
Mono-Axis		**MDLU3014A...**		**MDLU3021A...**		**MDLU3034A...**		**MDLU3050A...**		**MDLU3075A...**	
Switching Frequency	kHz	5	10	5	10	5	10	5	10	5	10
Rated Current (S1)	Arms	8.9	6	13	8	13	8	28	17	35	21
Maximum Current	Arms	10		15		24		35		53	
Overall Dimensions	mm	50 x 355 x 206						100 x 355 x 206			
Weight *	kg	3						5.5			
Drive Side Motor Connector		AEOCON009						AEOCON013			
Drive Side Sensor Connector		AEOCON012									
Mechanical Adapter **		AEOADA007						AEOADA008			

Bi-Axes		**MDLU3014B...**		**MDLU3021B...**		**MDLU3050B...**	
Switching Frequency	kHz	5	10	5	10	5	10
Rated Current (S1)	Arms	6.3 + 6.3	4.2 + 4.2	6.3 + 6.3	4.2 + 4.2	20 + 20	12 + 12
Maximum Current	Arms	10 + 10		15 + 15		35 + 35	
Overall Dimensions	mm	50 x 355 x 206		50 x 355 x 206		100 x 355 x 206	
Weight *	kg	3		3		5.5	
Drive Side Motor Connector		AEOCON009				AEOCON013	
Drive Side Sensor Connector		AEOCON012					
Mechanical Adapter **		AEOADA007				AEOADA008	

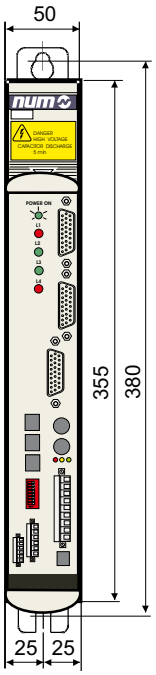
* = Power Unit + Control Unit
** = Required in a system with NUM HP Drives or MBLD All-in-one Drives.

NUMDrive C
Outline Drawings

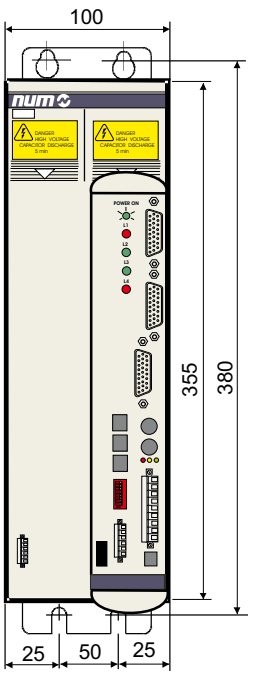
Outline Drawings



MDLU3014_000N0I
MDLU3021_000N0I
MDLU3034A000N0I



MDLU3050_000N0I
MDLU3075A000N0I



NUMDrive C
Ordering Codes

Ordering Codes

Control Units

	MDLU	3	000	A	0	B	A	N	0	0
Series										
Evolution index										
Control Unit										
Axis number										
- Mono-Axis				A						
- Bi-Axes				B						
Communication										
- Standard: DISC-NT digital bus					0					
Version										
- Basic Perfomance (1)						B				
- High Performance						C				
Safety										
- Standard: Stop function Category 0 (2)							A			
- Option: SAM-Num Safety module (compliance with EN954-1 Category 3) (3)							B			
Standard NUM								N		
Fixed value									0	
Fixed value										0

Note:

(1) Not available with Mono-Axis version

(2) Not certified

(3) Not available with Bi-Axes version

Power Units

	MDLU	3	014	A	000	N	0	I
Series								
Evolution index								
Rated Power								
Mono-Axis								
- Size 1: In 8.9Arms, Ipeak 10Arms			014					
- Size 1: In 13Arms, Ipeak 15Arms			021					
- Size 1: In 13Arms, Ipeak 24Arms			034					
- Size 2: In 28Arms, Ipeak 35Arms			050					
- Size 2: In 35Arms, Ipeak 53Arms			075					
Bi-Axes								
- Size 1: In 6.3+6.3Arms, Ipeak 10+10Arms			014					
- Size 1: In 6.3+6.3Arms, Ipeak 15+15Arms			021					
- Size 2: In 20+20Arms, Ipeak 35+35Arms			050					
Axis number								
- Mono-Axis				A				
- Bi-Axes				B				
Power unit					000			
Standard NUM						N		
Fixed value							0	
Heat-sink position								
- Internal heat-sink								I

Accessories

AEOCON009	Drive side motor and brake connector *
AEOCON013	Drive side motor and brake connector *
AEOCON012	Drive side sensor connector. This connector is used for the motor encoder and the direct measure sensor.

AEOADA007	Mechanical adapter for 50mm module.
AEOADA008	Mechanical adapter for 100mm module.

* = See NUMDrive C technical characteristics tables on page 121 for association.

7 Motor/Drive Associations

Servo and Spindle Motors

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Servo and Spindle Motors

Servo Motors
Association of BPH Motors with NUM HP Drive

Association of BPH Motors with NUM HP Drive

			MDLU3xxxx	034N	050N	075N	100N	150N
	Rated speed	Stall Cont. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BPH0751N5...	3 000	1.3					
BPH0751V5...	6 000						
BPH0752N5...	3 000	2.3					
BPH0752V5...	6 000						
BPH0754N5...	3 000	4					
BPH0952N5...	3 000	4.3					
BPH0952V5...	6 000						
BPH0953N5...	3 000	6					
BPH0953V5...	6 000		14				
BPH0955N5...	3 000	9.2					
BPH1152N5...	3 000	7.4					
BPH1152V5...	6 000		14				
BPH1153K5...	2 000	10.5					
BPH1153N5...	3 000		22				
BPH1153V5...	6 000		18				
BPH1154K5...	2 000	13.3					
BPH1154N5...	3 000		27				
BPH1154V5...	6 000			23			
BPH1156N5...	3 000	18.7	33				
BPH1422K5...	2 000	12					
BPH1422N5...	3 000		20				
BPH1422R5...	4 250		19				
BPH1423K5...	2 000	17	33				
BPH1423N5...	3 000		28				
BPH1423R5...	4 250			28			
BPH1424K5...	2 000	22	41				
BPH1424N5...	3 000			41			
BPH1424R5...	4 250				45		
BPH1427N5...	3 000	35			71		
BPH1902K5...	2 000	25		40			
BPH1902N5...	3 000			35			
BPH1902R5...	4 250				36		
BPH1903K5...	2 000	36		52			
BPH1903N5...	3 000				54		
BPH1904K5...	2 000	46			90		
BPH1904N5...	3 000				69		
BPH1905H5...	1 500	56		82			
BPH1905L5...	2 500				79		
BPH1907K5...	2 000	75			120		
BPH1907N5...	3000						125
BPH190AK5...	2 000	100				145	

Servo and Spindle Motors

Servo Motors
Association of BPH Motors with NUMDrive C (Switching Frequency 10 kHz)

Association of BPH Motors with NUMDrive C (Switching Frequency 10 kHz)

		MDLU3xxxx	014A 014B	021B	021A	034A	050A 050B	075A
	Rated speed	Stall Cont. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BPH0751N5...	3 000	1.3	5.2					
BPH0751V5...	6 000		3.9					
BPH0752N5...	3 000	2.3	7.5					
BPH0752V5...	6 000		5.9					
BPH0754N5...	3 000	4	11					
BPH0952N5...	3 000	4.3						
BPH0952V5...	6 000				10			
BPH0953N5...	3 000	6			16			
BPH0953V5...	6 000						14	
BPH0955N5...	3 000	9.2			22			
BPH1152N5...	3 000	7.4			16			
BPH1152V5...	6 000						14	
BPH1153K5...	2 000	10.5			24			
BPH1153N5...	3 000						22	
BPH1153V5...	6 000						18	
BPH1154K5...	2 000	13.3			27			
BPH1154N5...	3 000						27	
BPH1154V5...	6 000							23
BPH1156N5...	3 000	18.7					33	
BPH1422K5...	2 000	12			22			
BPH1422N5...	3 000						20	
BPH1422R5...	4 250						19	
BPH1423K5...	2 000	17					33	
BPH1423N5...	3 000						28	
BPH1423R5...	4 250							28
BPH1424K5...	2 000	22					41	
BPH1424N5...	3 000							41
BPH1424R5...	4 250							
BPH1427N5...	3 000	35						
BPH1902K5...	2 000	25						40
BPH1902N5...	3 000							35
BPH1902R5...	4 250							
BPH1903K5...	2 000	36						52
BPH1903N5...	3 000							
BPH1904K5...	2 000	46						
BPH1904N5...	3 000							
BPH1905H5...	1 500	56						82
BPH1905L5...	2 500							
BPH1907K5...	2 000	75						
BPH1907N5...	3000							
BPH190AK5...	2 000	100						

Servo Motors
Association of BPH Motors with NUMDrive C (Switching Frequency 5 kHz)

Association of BPH Motors with NUMDrive C (Switching Frequency 5 kHz)

		MDLU3xxxx	014A 014B	021A 021B	034A	050A 050B	075A
	Rated speed	Stall Cont. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BPH0751N5...	3 000	1.3	5.2				
BPH0751V5...	6 000		3.9				
BPH0752N5...	3 000	2.3	7.5				
BPH0752V5...	6 000		5.9				
BPH0754N5...	3 000	4	11				
BPH0952N5...	3 000	4.3	11				
BPH0952V5...	6 000		7.2	10			
BPH0953N5...	3 000	6	11.2	16			
BPH0953V5...	6 000				14		
BPH0955N5...	3 000	9.2	15.7	22			
BPH1152N5...	3 000	7.4	11.9	16			
BPH1152V5...	6 000				14		
BPH1153K5...	2 000	10.5	17.2	24			
BPH1153N5...	3 000				22		
BPH1153V5...	6 000				18		
BPH1154K5...	2 000	13.3	19.8	27			
BPH1154N5...	3 000				27		
BPH1154V5...	6 000					23	
BPH1156N5...	3 000	18.7			33		
BPH1422K5...	2 000	12	19.2	22			
BPH1422N5...	3 000				20		
BPH1422R5...	4 250				19		
BPH1423K5...	2 000	17			33		
BPH1423N5...	3 000				28		
BPH1423R5...	4 250					28	
BPH1424K5...	2 000	22			41		
BPH1424N5...	3 000					41	
BPH1424R5...	4 250						45
BPH1427N5...	3 000	35					71
BPH1902K5...	2 000	25				40	
BPH1902N5...	3 000					35	
BPH1902R5...	4 250						36
BPH1903K5...	2 000	36				52	
BPH1903N5...	3 000						54
BPH1904K5...	2 000	46					90
BPH1904N5...	3 000						69
BPH1905H5...	1 500	56				82	
BPH1905L5...	2 500						79
BPH1907K5...	2 000	75					120
BPH1907N5...	3000						
BPH190AK5...	2 000	100					

Servo Motors
Association of BPH Motors with NUM HP Drive
Association of BPG Motors with NUMDrive C (Switching Frequency 10kHz)

Association of BPH Motors with NUM HP Drive

			MDLU3xxxx	034N	050N	075N	100N	150N
	Rated speed	Stall Cont. torque		Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]		[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BPG0751N5...	3 000	1.3						
BPG0752N5...	3 000	2.3						
BPG0952N5...	3 000	4.3						
BPG0953N5...	3 000	6						
BPG1152N5...	3 000	7.4						
BPG1153K5...	2 000	10.5						
BPG1153N5...	3 000			22				
BPG1153V5...	6 000			18				
BPG1422N5...	3 000			20				
BPG1423N5...	3 000			28				
BPG1424K5...	2 000	22		41				
BPG1424R5...	4 250					45		
BPG1427N5...	3 000	35				71		
BPG1902K5...	2 000	25			40			
BPG1902N5...	3 000				35			
BPG1903K5...	2 000	36			52			
BPG1903N5...	3 000					54		
BPG1904N5...	3 000	46				69		
BPG1905L5...	2 500	56				79		

Association of BPG Motors with NUMDrive C (Switching Frequency 10kHz)

			MDLU3xxxx	014A 014B	021B	021A	034A	050A 050B	075A
	Rated speed	Stall Cont. torque		Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]		[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BPG0751N5...	3 000	1.3		5.2					
BPG0752N5...	3 000	2.3		7.5					
BPG0952N5...	3 000	4.3							
BPG0953N5...	3 000	6				16			
BPG1152N5...	3 000	7.4				16			
BPG1153K5...	2 000	10.5				24			
BPG1153N5...	3 000							22	
BPG1153V5...	6 000							18	
BPG1422N5...	3 000							20	
BPG1423N5...	3 000							28	
BPG1424K5...	2 000	22						41	
BPG1424R5...	4 250								
BPG1427N5...	3 000	35							
BPG1902K5...	2 000	25							40
BPG1902N5...	3 000								35
BPG1903K5...	2 000	36							52
BPG1903N5...	3 000								
BPG1904N5...	3 000	46							
BPG1905L5...	2 500	56							

Servo and Spindle Motors

Servo Motors
Association of BPG Motors with NUMDrive C (Switching Frequency 5 kHz)

Association of BPG Motors with NUMDrive C (Switching Frequency 5 kHz)

		MDLU3xxxx	014A 014B	021A 021B	034A	050A 050B	075A
	Rated speed	Stall Cont. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BPG0751N5...	3 000	1.3	5.2				
BPG0752N5...	3 000	2.3	7.5				
BPG0952N5...	3 000	4.3	11				
BPG0953N5...	3 000	6	11.2	16			
BPG1152N5...	3 000	7.4	11.9	16			
BPG1153K5...	2 000	10.5	17.2	24			
BPG1153N5...	3 000				22		
BPG1153V5...	6 000				18		
BPG1422N5...	3 000				20		
BPG1423N5...	3 000				28		
BPG1424K5...	2 000	22			41		
BPG1424R5...	4 250						45
BPG1427N5...	3 000	35					71
BPG1902K5...	2 000	25				40	
BPG1902N5...	3 000					35	
BPG1903K5...	2 000	36				52	
BPG1903N5...	3 000						54
BPG1904N5...	3 000	46					69
BPG1905L5...	2 500	56					79

Servo and Spindle Motors

Servo Motors
Association of BHL Motors with NUM HP Drive, MBLD ‘All-in-one’, NUMDrive C

Association of BHL Motors with NUM HP Drive

			MDLU3xxxx	034N	050N	075N	100N	150N
	Rated speed	Stall Cont. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BHL2601N5...	3 000	85					165
BHL2601N1...		98					
BHL2602K5...	2 000	120					230
BHL2602K1...		139					

Association of BHL Motors with MBLD ‘All-in-one’

			MBLD2xxxx	050N	075N	100N	150N	200N
	Rated speed	Stall Cont. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BHL2601N5...	3 000	85				165	
BHL2601N1...		115					
BHL2602K5...	2 000	120				230	
BHL2602K1...		160					

Association of BHL Motors with NUMDrive C

No association is foreseen.

Servo and Spindle Motors

Servo Motors
Association of BPL Motors with NUM HP Drive
Association of BPL Motors with NUMDrive C (Switching Frequency 5 & 10 kHz)

Association of BPL Motors with NUM HP Drive

No association is foreseen.

Association of BPL Motors with NUMDrive C (Switching Frequency 10 kHz)

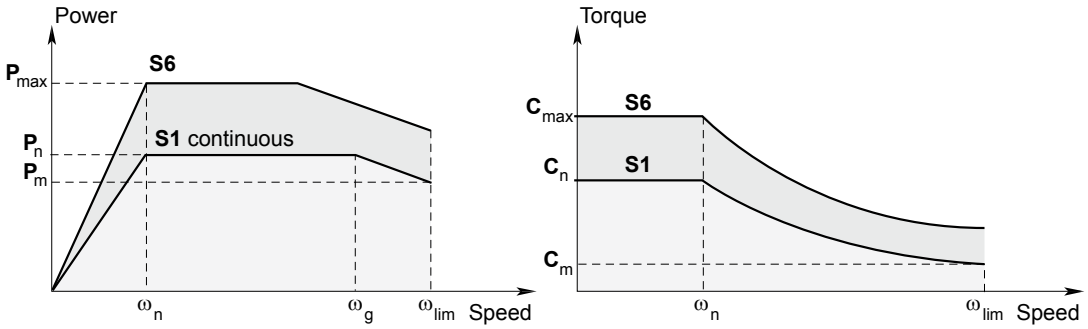
	MDLU3xxxx		014A 014B	021B	021A	034A	050A 050B	075A
	Rated speed	Stall Cont. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BPL0751V5...	6 000	1.1	3.9					
BPL0753N5...	3 000	2.8	7					
BPL0951V5...	6000	2	4.9					
BPL0953N5...	3000	5.4			16			

Association of BPL Motors with NUMDrive C (Switching Frequency 5 kHz)

	MDLU3xxxx		014A 014B	021A 021B	034A	050A 050B	075A
	Rated speed	Stall Cont. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BPL0751V5...	6 000	1.1	3.9				
BPL0753N5...	3 000	2.8	7				
BPL0951V5...	6000	2	4.9				
BPL0953N5...	3000	5.4	11.2	16			

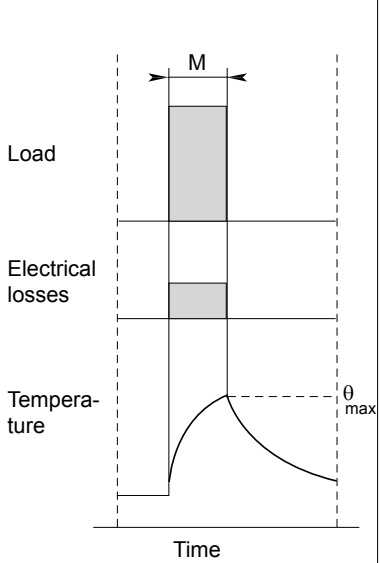
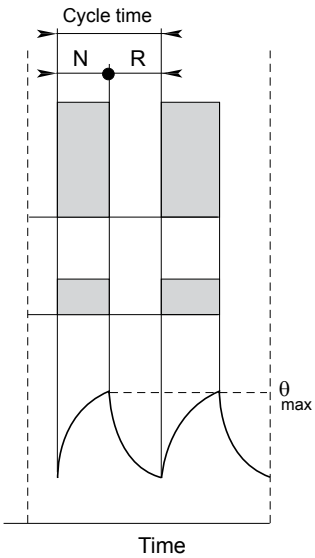
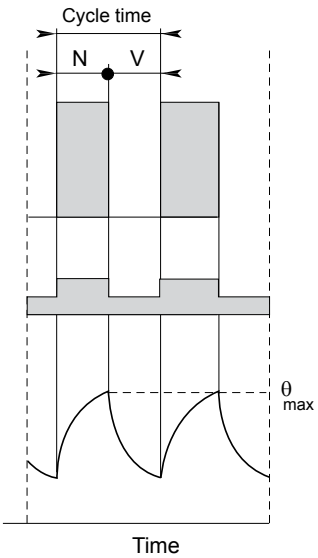
General Description

AMS Motor Power vs Speed and Torque vs Speed Characteristics



P_n = Continuous power (kW)
P_{max} = Overload power (kW)
P_m = Power at maximum speed (kW)
ω_n = Basic speed (rpm)
C_n = Constant torque between $\omega = 0$ and ω_n (Nm)
C_{max} = Overload torque between $\omega = 0$ and ω_n (Nm)
ω_g = Maximum speed for operation at constant power in range **S1** (rpm)
ω_{lim} = Maximum speed (rpm)
C_m = Torque at maximum speed (Nm)
I_{cont} = Continuous current rating of the motor/servodrive association (Arms)
I_{ms} = Motor overload current of the motor/servodrive association (Arms)

Services

S2	S3	S6
		
–	$f_m = \frac{N}{N+R} \times 100$ (%)	$f_m = \frac{N}{N+V} \times 100$ (%)

N = Operation at power P_{max}
R = Idle
V = Off-load operation
f_m = Duty cycle

Association of AMS Spindle Motors with MBLD ‘All-in-one’

AMS …		Con-nec-tion	MBLD2xxx	Continuous operation S1							Overload S6			
				Pn (kW)	ωn (rpm)	ωg (rpm)	ωlim (rpm)	Pm (kW)	Cn (Nm)	Icont (Ams)	Pmax (kW)	Cmax (Nm)	Ims (Ams)	10 mn (%)
100	SB	Y	50	3.7	1 500	6 500	6 500	3.7	24	21	6	40	35	30
	MB	Y	50	5.5				5.5	35	26	7.5	47	35	
	GB	Y	75	9				9	57	39	12.5	80	53	
	SD	Y	50	3.7	1 500	6 500	12 000	1.8	24	21	6	40	35	30
	MD	Y	50	5.5				5.5	35	26	7.5	47	35	
	GD	Y	75	9	1 500	8 200		6.2	57	39	12.5	80	53	
132	SA	Y	50	5	750	6 000	7 000	2.8	64	26	7.5	95	35	37
	SC	Y	75	10	1 500	6 000		8	64	39	14	89	53	37
	SE	Δ	100	15	1 750	4 000		10	82	52	23	110	71	30
	MA	Y	75	7.5	750	6 000		5.7	95	39	10	127	53	37
	MC	Y	100	15	1 500	6 000		12.5	95	52	21	134	71	37
	ME	Δ	150	19.5	2 000	6 500		19	100	72	35	134	106	30
	LA	Y	100	11	750	6 000		9	140	52	15	191	71	37
	LE	Y	150	22	1 250	4 200		15	168	72	36	229	106	30
	SF	Y	50	5	750	6 000	10 000	2	64	26	7.5	95	35	37
	SG	Y	75	10	1 500	6 000		6	64	39	14	89	53	37
	SH	Δ	100	15	1 750	4 000		7.5	82	52	23	110	71	30
	MF	Y	75	7.5	750	6 000		4	95	39	10	127	53	37
	MG	Y	100	15	1 500	6 000		9	95	52	21	134	71	37
	MH	Δ	150	19.5	2 000	6 500		13.5	100	72	35	134	106	30
	LF	Y	100	11	750	6 000	9 000	7	140	52	15	191	71	37
	LI	Y	75	12.5	680	2 300		3	175	39	16.8	236	53	30
	LH	Y	150	22	1 250	4 200		12	168	72	36	229	106	30
160	MA	Y	100	18	650	1 300	8 500	2.7	264	52	24.2	355	71	35
		Δ			1 300	2 600		5.4	132			178		
	MB	Y	150	26	1 200	2 400		7.3	208	72	36.4	290	106	
		Δ			2 400	5 500		14.5	104			145		
	MC	Δ	200	36	1 700	2 800		11.8	202	100	47	265	141	
	LA	Y	100	18	500	1 000	6 500	2.8	344	52	24.2	463	71	
		Δ			1 000	2 500		5.6	172			231		
	LB	Y	150	26	950	1 900		7.6	260	72	36.4	364	106	
		Δ			1 900	4 000		15.2	130			182		
	LC	Δ	200	36	1 050	2 100		11.6	328	100	48	437	141	

Spindle Motors
Association of AMS Spindle Motors with NUM HP Drive
Association of AMS Spindle Motors with NUMDrive C (Switching Frequency 5 kHz)

Association of AMS Spindle Motors with NUM HP Drive

AMS …		Con-nec-tion	MDLU3xxxx	Continuous operation S1							Overload S6			
				Pn (kW)	ωn (rpm)	ωγ (rpm)	ωlim (rpm)	Pm (kW)	Cn (Nm)	Icont (Ams)	Pmax (kW)	Cmax (Nm)	Ims (Ams)	10 mn (%)
100	SB	Y	050N	3.7	1 500	6 500	6 500	3.7	24	20	6	40	35	22
	MB	Y	075N	5.5				5.5	35	26	10	80	53	13
	GB	Y	100N	9				9	57	39	17	120	71	16
	SD	Y	050N	3.7	1 500	6 500	12 000	1.8	24	20	6	40	35	22
	MD	Y	075N	5.5				2.8	35	26	10	80	53	13
	GD	Y	100N	9	1 500	8 200		6.2	57	39	17	120	71	16
132	SA	Y	075N	5	750	6 000	7 000	2.8	64	26	10	150	53	16
	SC	Y	100N	10	1 500	6 000		8	64	39	19	122	71	20
	SE	Δ	150N	15	1 750	4 000		10	82	52	29	160	106	13
	MA	Y	100N	7.5	750	6 000		5.7	95	39	15	190	71	20
	MC	Y	150N	15	1 500	6 000		12.5	95	52	30	190	106	16
	LA	Y	150N	11	750	6 000		9	140	52	23	292	106	16
	SF	Y	075N	5	750	6 000	10 000	2	64	26	10	150	53	16
	SG	Y	100N	10	1 500	6 000		6	64	39	19	122	71	20
	SH	Δ	150N	15	1 750	4 000		7.5	82	52	29	160	106	13
	MF	Y	100N	7.5	750	6 000		4	95	39	15	190	71	20
	MG	Y	150N	15	1 500	6 000		9	95	52	30	190	106	16
	LF	Y	150N	11	750	6 000	9 000	7	140	52	23	292	106	16
	LI	Y	100N	12.5	680	2 300		3	175	39	19	270	71	16
160	MA	Y	150N	18	650	1 300	8 500	2.7	264	52	29	570	106	15
		Δ			1 300	2 600		5.4	132			255		
	LA	Y	150N	18	500	1 000	6 500	2.8	344	52	27	740	106	15
		Δ			1 00	2 500		5.6	172			400		

Association of AMS Spindle Motors with NUMDrive C (Switching Frequency 5 kHz)

AMS …		Con-nec-tion	MDLU3xxxx	Continuous operation S1							Overload S6			
				Pn (kW)	ωn (rpm)	ωg (rpm)	ωlim (rpm)	Pm (kW)	Cn (Nm)	Icont (Ams)	Pmax (kW)	Cmax (Nm)	Ims (Ams)	10 mn (%)
100	SB	Y	050A or 050B	3.7	1 500	6 500	6 500	3.7	24	20	6	40	35	22
	MB	Y	075A	5.5				5.5	35	26	10	80	53	13
	SD	Y	050A or 050B	3.7	1 500	6 500	12 000	1.8	24	20	6	40	35	22
	MD	Y	075A	5.5				2.8	35	26	10	80	53	13
132	SA	Y	075A	5	750	6 000	7 000	2.8	64	26	10	150	53	16
	SF	Y	075A	5	750	6 000	10 000	2	64	26	10	150	53	16

8 General Information

NUM Worldwide, Regulations

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NUM Worldwide

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Regulations

Compliance with EU Directives Relative to Electromagnetic Compatibility (EMC) (89/336, 92/31 and 93/68) and Low Voltage (73/23 and 95/68)

The list of standards with which NUM CNCs and servodrives comply is given in the conformity statements which can be supplied on request.

The products described herein must be used in compliance with the recommendations given in our Installation and Wiring Guide (on CD-ROM with basic documentation or 938 960).

The products of this catalog are designed for integration in a machine complying with Machine Directive 89/392/EEC.

Export Terms for CNC products

1. – Because of their technical characteristics or in some case their utilization, certain of NUM's products may be required to comply with the requirements of French or European regulations and/or US regulations concerning control of the final destination.

Relevant information is given on our purchase order acknowledgments, invoices and delivery notes.

These provisions apply to NUM's products so identified on our purchase order acknowledgments, invoices and delivery notes.

2. – Accordingly, the purchaser undertakes to fully comply in all respects with the regulations of his country and, as the case may be, with European and / or US regulations relating to the control of final destination of dual use products.

The purchaser undertakes to introduce and to follow within its own business control procedures in order to ensure that, in respect of the resale of Dual Use Products, such national legal obligations will be implemented.

3. – In any case, the purchase orders received by NUM shall be accepted subject to NUM's obtaining any required authorizations.

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CNC HighEnd Applications