

Num Power 1000 CNC NUM Drive



Catalog

Num Power 1020/1040/1060/1080 CNCs

Num Drive Drives and Motors

Executive Summary

Introduction	1
Presentation of Num How to Use This Catalog Review of the Num Power Product Line How to Select a CNC How to Select Drives	
Num Power CNCs	2
Equivalence Tables <i>Commercial References and Functions Available per Product</i>	
Num Power CNCs	3
Technical Specifications <i>Dimensions and Installation Conditions</i>	
Num Power CNCs	4
Functional Specifications <i>Description of the functions and how to use them</i>	
Motor/Servodrive Selection Guide	5
Review of Servodrive/Motor System Features Table of Main Functions	
Num Drive Motors	6
BPH, BPG, BML, BPL and BHL Axis Motors AMS, IM and AMR Spindle Motors Motorspindle	
Num Drive Servodrives	7
MDLA Modular Servodrives MDLS Compact Spindle Servodrives	
Num Drive Accessories	8
Connectors and Cables for Motors	
Motor/Servodrive Associations	9
Motor Sensors Motor/Servodrive Associations	
General Information	10
Index Num in the World Regulations	

Num, A World Player

In Machine Automation

A complete line of CNCs and drives, competent application and technical support engineers at your side, a worldwide base through membership of Schneider Electric make Num your ideal partner.

Num SA was created in 1978. Today it is part of the Industrial Process Control and Automation Business Segment of Schneider Electric, world leader for electric power distribution and process control.

Research and Development Guarantee the Future

Num earmarks a large share of its sales figure for R&D to be able to design 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 to problems, 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.

A Numerical Control for Each Machine

With the new line of Num Power compact CNCs including enhanced performance capabilities, Num proposes a wide array of solutions for equipping new machines or reengineering existing ones.

Num Power 1020 and Num Power 1040 CNCs

They offer the best price/performance ratio for all machines and handling systems with 1 to 6 axes.

Num Power Tplus and Num Power Mplus Intuitive CNCs

Based on a Num Power 1040 platform, these intuitive CNCs combine the flexibility of conventional turning and milling using handwheels with the precision and productivity of CNCs.

Num Power 1060 and 1080 CNCs

Benefiting from an even more powerful new technology, these CNCs are specially designed for controlling machines with a complex structure including up to 32 axes.

All the CNCs in the Num Power 1000 family benefit from the same software, so that the part programs, canned cycles and PCL programs are fully compatible.

All Solutions to Customize Your Applications

A new esthetic and user-friendly HMI

Available as an option with the PC panels, the new "Num HMI" interface has undeniable esthetic qualities. Complete, user-friendly and intuitive, it was developed in HTML which makes it easy to adapt if necessary.

Programming and graphic simulation, even CAM...

The Visual Tool functions accessed via the appropriate keys in the "Num HMI" provide a particularly user-friendly and tutorial 2D editor, a 3D simulation of the machining program, and even a veritable CAM (open to CAD/ DFX and IGES file compatibility).

A Wide Choice of Panels

The extensive range of panels available from Num, including compact panel, passive panel and PC panel associated with machine panel, is designed to cater ideally to the specific features of each machine.

An Array of Tried and Tested Tools

The Num CNC integration and customization tools, among the most powerful on the market, adapt the CNCs rapidly to all applications:

- Ball-bar, PLCTool, SETTool for system integration and setup
- Real-time and C language dynamic operators for performing complex applications
- MMITool, PCToolKit and PC function to tailor the man/machine interface and CNC to the application
- Communication tools for connection of the CNCs to the main shop networks.

Drives with a High Dynamic Range

Num proposes a complete line of motors.

Brushless Axis Motors

Compact motors with a high power-to-weight ratio and a high dynamic speed range, covering torques from 0.4 to 160 Nm:

- BPH motors for all applications
- BPG motors for high inertia machines
- BPL/BML motors for minimum size and harsh environments
- BHL axis motors for machines requiring high speed and high torque.

Spindle Motors

The AMS, IM and AMR asynchronous motors rated from 2.2 kW to 55 kW offer very smooth rotation at low speed, rapid, accurate positioning and 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.

High Stiffness, Accurate Servosystems

The motors are driven by digital servodrives using a ± 10 V analog reference generated by the CNC.

- MDLA modular servodrives
- MDLS compact spindle servodrives.

Associations

- Num AR Drive digital drives (Num Analog Reference Drive) can also be used with analog servodrives.
- Compact spindle servodrives can provide the power supply for modular servodrives.

How to Use This Catalog

This catalog is designed to present the line of Num CNCs and Num Drive drives and help you select the automation systems best suited to your machines. The review of the Num product line on the opposite page gives an overview of the features and main functions available on each CNC.

The following chapters give you all the information you need to prepare your order.

Chapters 2, 3 and 4 concern CNCs:

- Chapter 2, Equivalence Tables, defines the links between the commercial references and products. Comments associated with the functions show the limits according to the CNC models.
- Chapter 3, Technical Specifications, details the hardware configuration as well as the conditions of installation and use of the components comprising the products.
- Chapter 4, Functional Specifications, describes the architectures and operating modes of the CNCs. They are grouped by functional families (axes, PLC, part programming, integration and customization software, communication) to facilitate information lookup.

Chapters 5, 6, 7, 8 and 9 concern machine drives:

- Chapter 5 is a selection guide to determine the motor/servodrive combination best suited on the basis of the main characteristics.
- Chapter 6 describes the axis and spindle motors of the Num Drive line: applications, identification, specifications and performance, overall dimensions, associated connectors and cables.
- Chapter 7 describes the line of axis and spindle servodrives: specifications and functions, identification, implementation tools and overall dimensions.
- Chapter 8 groups all accessories common to several motors (connectors and associated cables, inductances, filters, etc.).
- Chapter 9 describes the line of sensors and contains the motor/servodrive association tables.

An index is provided in Chapter 10 to facilitate lookup of pages describing the products and functions of interest to you.

Review of Num Product Line

CNCs Motors and Servodrives

1

Description	Num Power Compact CNCs			
	1020	1040 *	1060	1080 *
Axes (1)				
• Total axes + spindles + handwheels + measurements	2 → 5	1 → 6	2 → 12	2 → 32
• Axis groups	1	1 → 4	1 → 3	1 → 8
• Axis	2 → 4	1 → 6	2 → 8	2 → 32
• Spindles	0 → 1	0 → 2	0 → 3	0 → 4
• Handwheels	0 → 1	0 → 3	0 → 3	0 → 4
PLC				
• Logical inputs/outputs	→ 112 I/O	→ 256 I/O	→ 336 I/O	→ 1024 I/O
• Logical inputs/outputs (W)	→ 112 I/O	→ 384 I/O	→ 512 I/O	→ 1024 I/O
• Analog inputs/outputs	2 I/1 O	2 I/1 O	2 I/1 O	2 I/1 O
Man/Machine Interface				
• PC panel (iPC)	○	○	○	○
• Compact panels (MP10, CP10F)	○	○	○	○
• TFT operator panel (CP20F, CP30F, FS20+KBD30)	-	○	○	○
• Portable operator panel	○	○	○	○
• Machine panel (MP01, MP02)	-	○	○	○
• Mplus/Tplus panels	-	○	-	-
Communication				
• Serial lines	2 → 3	2 → 3	3	3
• Uni-Telway and Fipway networks	○	○	○	○
Analog Servosystems				
<i>Axes</i>				
• MDLA modular servodrive	○	○	○	○
• BPH, BPG, BPL, BML, BHL motors	○	○	○	○
<i>Spindles</i>				
• MDLS compact servodrive	○	○	○	○
• AMS, IM, AMR, Motorspindle motors	○	○	○	○

* The Num Power 1040 and 1080 CNCs are available with two different platforms: Optima and Ultra. The Ultra platform enhances overall system performance.

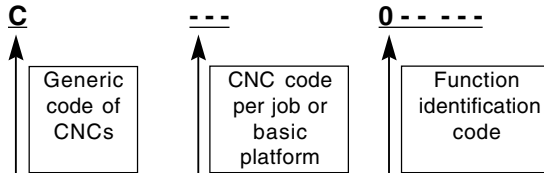
(1) for detailed distribution, see page 2/3.

- basic
- optional
- unavailable

How to Select a CNC

Format of Commercial References

As a general rule, the commercial references of the CNCs include ten characters:



Examples

C	079	000 053
Num Power 1040	GP CNC	CP30F panel
C	086	000 250
Num Power 1060M	CNC	Dynamic operators

The tools and components common to all CNCs are identified by a unique code (999) associated with the function code



Example

C	999	080 080
32-input interface module	example :	
C	999	182 091
PCTool kit.		

Functions Available per Product

In Chapter 2, Equivalence Tables, the CNCs are listed vertically. The functions, listed horizontally are identified by the following codes:

- Function included in the basic CNC/model platform
- Optional function
- Function not available for this product.

Selecting a CNC

To select the CNC best suited to your machine, we recommend proceeding in the following order:

- 1 - Determine the basic CNC platform, to be selected from the compact line (Num Power 1020, 1040, 1050, 1060 and 1080) according to:
 - The number of axes and inputs/outputs required
 - The servodrives: digital or analog
 - Possibly, the PC function.
- 2 - Choose the man/machine interface:
 - CNC panels: compact panel, operator panel or portable operator panel
 - PC panel.
- 3 - Choose the required 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
 - Software functions.
- 4 - Choose the software tools, resident in the CNC or on a PC, designed to facilitate integration of the CNC and its customization for the application.

How to Select Drives

Selecting Motors

Axis Motors

1 - Select axis motors based on the required characteristics.

Mechanical requirements	Motors	Torque (Nm)	Speed (rpm)
No special requirements	BPH	0.4 - 100	2,000 - 8,000
High inertia machine	BPG	2.5 - 36	2,000 - 3,000
Minimum size	BPL/BML	1.1 - 2.8	3,000 - 6,000
Machines requiring high speed and high torque	BHL	85 - 160	2000 - 3000

2 - In each case, check that the nominal torque and maximum speed requirements are satisfied.

3 - Determine the options: brake, shaft, etc.

Spindle Motors

1 - Check the tables giving the power versus speed.

2 - Determine the options: brake, shaft, etc.

Selecting Servodrives

MDLA Modular axis servodrives

Can be powered from the MDLS spindle servodrive
Can be used in conjunction with MDLU or MBLD digital servodrive.

MDLS For AMS and AMR spindle motors

Compact servodrives with optional regenerative braking by line reinjection
Can provide the power supply for modular servodrives
Can be used in conjunction with MDLU digital servodrives.

1 - Refer to the table on Chapter 9 for the possible associations between CNCs, servodrives, motors and motor sensors.

2 - Specify the servodrive types (see Chapter 7).

3 - Select the ratings corresponding to the motors from the motor/servodrive association tables (see Chapter 9) and take into account the available overtorque.

4 - Determine any servodrive options required.

Supplements

1 - Go through the checklist for each type of servodrive to be sure of not omitting anything (see Chapter 7):

- Power supply, braking resistor for modular servodrives
- Line power filters, chokes.

2 - Select the motor connectors and cables (see Chapter 8).

Num Power CNC

Equivalence Tables

Table of Contents

	Page
<hr/>	
Products and Jobs	
Basic CNC Platform and Jobs	2/2
Basic CNC Configuration and Maximum Limits - Axes, Spindles, Handwheels	2/3
Basic CNC Configuration and Maximum Limits - Total RAM Space	2/4
<hr/>	
Basic CNC Platforms	
Num Power 1020, 1040, 1060 and 1080 Compact CNCs	2/6
Num Power <i>Mplus</i> and Num Power <i>Tplus</i> Intuitive CNCs	2/7
<hr/>	
Panels	
PC Panel	2/8
CNC Panels: Compact Panels, Operator Panels, Portable Operator Panel	2/9
Cables for CNC Panels	2/9
CNC User Languages	2/10
Portable Operator Panel	2/10
Machine Panels	2/10
Fiber-Optic Cables for Machine Panel and I/O Modules	2/10
<hr/>	
Axis, Spindle and Handwheel Functions	
CNC Axes, PLC Axes, Measurement Inputs and Spindle Control	2/11
Accessories	2/11
Software Functions Related to Axes and Spindles	2/12
<hr/>	
Tool Management	
Tool Offsets	2/12
<hr/>	
PLC Functions	
Integrated Input/Output Cards and Connecting Cables	2/13
Wiring Modules	2/13
Remote Input/Output Modules, Connectors and Busbars	2/13
PLC Programming	2/13
<hr/>	
Machining Functions Per Type of Job	
Turning	2/14
Milling	2/16
General Purpose range	2/19
Cylindrical Grinding	2/20
Surface Grinding	2/21
Woodworking, Glassworking and Marble Cutting	2/22
Num Power <i>Mplus</i> /Num Power <i>Tplus</i> Intuitive CNCs	2/24
<hr/>	
Communication	
Serial Lines and Connection to Shop Networks	2/26
Diskette Drive	2/26
<hr/>	
Integration and Customization Software	
Resident Software and Software on PC	2/26
<hr/>	
Technical Manuals	
Documentation CD	2/28

Num Power CNC

Equivalence Tables

Basic CNC Platform and Jobs

Num Power 1020, 1040, 1060 and 1080 CNCs are organized around machine types which determine a set of basic functions for each system.

- In the CNC name, the type is represented by letters.
Example: Num Power 1040GP, Num Power 1080M, Num Power *Tplus*.
- In the commercial reference of the systems C---, the last three digits identify the type associated with the CNC.
Example: C079 (Num Power 1040GP), C082 (Num Power 1080M), C059 (Num Power *Tplus*).

Description		Commercial reference			
Type		Num Power compact CNCs			
		1020	1040	1060	1080
T	Turning	C017	C077	C610	C810
<i>Tplus</i>	Intuitive Turning	-	C059	-	-
M	Milling	C015	C075	C086	C082
<i>Mplus</i>	Intuitive Milling	-	C058	-	-
GP	General purpose range	-	C079	-	-
GC	Cylindrical grinding	C018	C078	C650	C850
GS	Surface grinding	C019	C074	C660	C860
W	Woodworking, glassworking and marble cutting	C016	C076	C088	C084

Num Power CNC

Equivalence Tables

Basic Configuration and Maximum Limits Axes, Spindles, Handwheels and Measurements

Num Power 1020, 1040, 1060 and 1080 Compact CNCs

		CNC axes	Analog measured spindles	PLC axes	Handwheel inputs	Total axes + spindles + handwheel + measurements	Axis groups / Channels
		Basic/maximum	Basic/maximum	Basic/maximum	Basic/maximum	Maximum	Basic/maximum
Num Power 1020	T	2/3	1	0	0/1	4	1
	M	3/4	0/1	0	0/1	5	1
	GC	2/4	0/1	0	0/2	4	1
	GS	3/4	0/1	0	0/1	4	1
	W	3/4	0/1	0	0/1	4	1
Num Power 1040	T	2/4	1/2	0/3	0/3	6	1/2
	Tplus	2/3	1/2 (1)	0/1	2	6	1
	M	3/5	0/2	0/3	0/3	6	1/2
	Mplus	3/4 (2)	0/1 (2)	0/2 (2)	1/3 (2)	6	1
	GP	1/6	0	0/5	0	6	1/4
	GC	2/4	0/2	0/4	0/3	6	1/2
	GS	3/5	0/2	0/3	0/3	6	1/2
	W	3/6	0/2	0/3	0/3	6	1/2
Num Power 1060 (3)	T	2/7	1/3	0/6	0/3	12	1/3
	M	3/8	0/3	0/5	0/3	12	1/3
	GC	3/8	0/3	0/6	0/3	12	1/3
	GS	3/8	0/3	0/6	0/3	12	1/3
	W	3/8	0/3	0/5	0/3	12	1/3
Num Power 1080	T	2/32	1/4	0/28	0/4 (4)	32	1/8
	M	3/32	0/4	0/28	0/4 (4)	32	1/8
	GC	3/32	0/4	0/28	0/4 (4)	32	1/8
	GS	3/32	0/4	0/28	0/4 (4)	32	1/8
	W	3/32	0/4	0/28	0/4 (4)	32	1/8

(1) With Full ISO option (option 000 593)

(2) The standard version can include either 3 handwheel measurement inputs or one switchable handwheel input (for details see page 2/24).

(3) Total number of axes + spindles: 8

(4) The fourth handwheel is available only for the maximum configuration provided all the slots are used.

Num Power CNC

Equivalence Tables

Basic Configuration and Maximum Limits RAM

The RAM with backup contains all the CNC operating programs which are saved when the system is turned off.

It is divided into four areas, shared between the applications:

- Area Qa PLC program
- Area Qp Part program and resident macros
- Area Qm MMI resource program
- Area Qc MMI program in C.

For further details on the features of these memory areas, refer to the chapter Functional Specifications, PLC functions (page 4/10), part program (page 4/19) and MMITool (page 4/28).

Basic Memory

The size of the memory delivered varies according to the CNC.

System	Memory size in KB			
	Qa	Qp	Qm	Qc
Num Power 1020, 1040, 1060, 1080 CNCs				
T	64	32	128	64
Tplus	64	128	32	31 x 32 KB
M	64	32	128	64
Mplus	64	128	32	31 x 32 KB
GP	64	32	128	64
GC	64	64	128	64
GS	64	64	128	64
W	64	128	128	64

Additional Memory

The memory can be extended by modules of 64 KB (Qa) or 32 KB (Qp, Qm, Qc).

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

Description	Comm. ref.	Num Power compact CNCs			
		1020	1040	1060	1080
Additional memory modules					
32 KB for part program (Qp)	000 341	○	○	○	○
64 KB for PLC program (Qa)	000 347	○	○	○	○
32 KB for MMI resource program (Qm)	000 377	○	○	○	○
32 KB for MMI program in C (Qc)	000 378	○	○	○	○

- basic
- optional
- unavailable

Num Power CNC

Equivalence Tables

Basic Configuration and Maximum Limits RAM

Memories Related to the Options

Certain software options occupy or include additional memory space required for their installation and operation which must be taken into account when calculating the total memory requirements.

Description	Comm. Ref.	Memory occupied in KB			
		Qa	Qp	Qm	Qc
PROCAM MILL/TURN	000 113		256		
PROCAM HG	000 592		128		
PROCAM MULTITURN	000 133		512		
PROCAM MX	000 134		512		
Milling package 1	000 382		384		
Milling package 2	000 383		0		
Milling package 3	000 384		384		
Woodworking package 1	000 380	64			
Woodworking package 2	000 381	64	256		
T probing cycles	000 590		32		
M probing cycles	000 591		96		
Gear-cutting cycles HG 1	000 596		32		
Gear-cutting cycles HG 2	000 597		32		

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.

System	Qa	Qp	Qm	Qc	Total
Num Power 1020	Qa	+ Qp	+ Qm	+ Qc	< 3500 KB
Num Power 1040	Qa	+ Qp	+ Qm	+ Qc	< 3500 KB
Num Power 1060	Qa	+ Qp	+ Qm	+ Qc	< 3500 KB
Num Power 1080	Qa	+ Qp	+ Qm	+ Qc	< 3500 KB
Num Power <i>Mplus</i> , Num Power <i>Tplus</i>	Qa	+ Qp	+ Qm	+ Qc	< 3500 KB

Num Power CNC

Equivalence Tables

Basic CNC Platforms

Num Power 1020/1040/1060/1080 Compact CNCs

Refer to page 2/3 for the basic functions available for each system.

Description	Comm. Ref.	Num Power Compact CNCs					
		1020	1040 Optima	1040 Ultra	1060	1080 Optima	1080 Ultra
<p><i>Ultra platforms enhance overall system performance.</i></p> <p><i>The system selected depends on the type of panel used:</i></p> <ul style="list-style-type: none"> - <i>Conventional CNC panels require a panel control card</i> - <i>The PC panel does not require a panel control card.</i> <p><i>The coprocessor is necessary for the Dynamic Operators in C option (000 249).</i></p>							
Num Power 1020 and Num Power 1040 Optima							
With panel control card	000 720	○	○	-	-	-	-
Without panel control card	000 620	○	○	-	-	-	-
Num Power 1040 Ultra, Num Power 1060 and Num Power 1080 Optima							
With panel control card							
with coprocessor	000 741	-	-	○	○	○	-
without coprocessor	000 740	-	-	○	○	○	-
Without panel control card							
with coprocessor	000 641	-	-	○	○	○	-
without coprocessor	000 640	-	-	○	○	○	-
Num Power 1080 Ultra							
With panel control card							
with coprocessor	000 761	-	-	-	-	-	○
without coprocessor	000 760	-	-	-	-	-	○
Without panel control card							
with coprocessor	000 661	-	-	-	-	-	○
without coprocessor	000 660	-	-	-	-	-	○
Axis Extension Units (Modax) on Num Power 1060 and 1080 CNCs							
<i>If there are more than 6 axes, the CPU is used in conjunction with extension units which can be fitted with an input/output card in addition to the axis cards</i>							
Number of Modax units							
CNC with 1 to 6 controllers		-	-	-	0	0	0
CNC with 1 to 12 controllers (max. 8 axes)		-	-	-	1	1	1
CNC with 1 to 16 controllers		-	-	-	-	1	1
CNC with 1 to 27 controllers		-	-	-	-	2	2
CNC with 1 to 32 controllers		-	-	-	-	3	3

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Basic CNC Platforms

Num Power 1020/1040/1060/1080 Compact CNCs

Num Power *Mplus*, Num Power *Tplus* Intuitive CNCs

For the available functions, see pages 2/3 and 2/4 for the basic functions and pages 2/24 and 2/25 for the dedicated functions.

Description	Comm.	Num Power Compact CNCs			
	Ref.	1020	1040	1060	1080
Num <i>Mplus</i> and Num <i>Tplus</i> Intuitive CNCs					
Platforms with panel control card <i>Includes dedicated keyboard and application software (see page 4/20)</i>	000 720	-	○	-	-
Keyboard					
For Num Power <i>Tplus</i> CNC	000 244	-	○	-	-
For Num Power <i>Mplus</i> CNC	000 245	-	○	-	-
Display units					
MS20: 9" monochrome CRT	000 184	-	○	-	-
CS20: 10" color CRT	000 185	-	○	-	-
CS30: 14" color CRT	000 186	-	○	-	-
<i>For Full ISO mode (option 000 593), replace the display unit with an CP30 CRT operator panel or LCD FS20 display unit associated with KBD30 keyboard.</i>					

2

- basic
- optional
- unavailable

Num Power CNC

Equivalence Tables

PC Panels

The Num Power 1020, 1040, 1060 and 1080 CNCs are 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	Comm.	Num Power Compact CNCs			
	Ref.	1020	1040	1060	1080
PC PANELS					
Modular iPCs: Modular industrial PCs					
<i>This modular panel includes a CPU on which is mounted a front panel with LCD display unit and Qwerty keyboard.</i>					
<i>The CPU is available in three versions of increasing power</i>					
"Small" iPC (without extension slot) – Celeron / 24 V	555 110	○	○	○	○
"Small" iPC (without extension slot) – Celeron / 220 V	555 111				
"Medium" iPC (with 3 extension slots) – Celeron / 24 V	555 210	○	○	○	○
"Medium" iPC (with 3 extension slots) – Celeron / 220 V	555 211				
"Medium" iPC (with 3 extension slots) – Pentium III / 24 V	555 220	○	○	○	○
"Medium" iPC (with 3 extension slots) – Pentium III / 220 V	555 221				
<i>The front panel can be equipped with either a 12" or a 15" display unit.</i>					
iPC 12KBD 12" – 410 mm	556 110	○	○	○	○
iPC 15KBD 15" – 480 mm	556 210	○	○	○	○
Compact iPCs: Compact industrial PCs with touch screen					
<i>This panel includes a 15" keyboard, an Ethernet port, 4 RS 232 ports, 3 USB ports, 2 PCMCIA ports and one PCI port</i>					
Compact Pentium 4 iPC – 1.7 GHz	555 317	○	○	○	○
<i>The modular and compact iPCs are delivered with</i>					
- Windows 2000 installed in multilingual version factory set to English					
- the Num HMI Man Machine Interface					
- the SETTool, PLCTool, PERSOTool, PC Standard MMI and NUM BackUp tools					
Industrial screens for PC panels					
<i>Designed for use with a standard or industrial PC, they include a 15" display unit and function keys surrounding the display unit.</i>					
FS151 : Screen with 22 function keys	000 783	○	○	○	○
FS151KBD : Screen with 22 function keys and built-in 75-key Qwerty keyboard	000 784	○	○	○	○
PC/CNC Communication					
<i>The PC panels are used with a network card:</i>					
Ethernet TCP/IP network card	000 933	○	○	○	○
HSL high speed link card	000 932	○	○	○	○

- basic
- optional
- unavailable

Num Power CNC

Equivalence Tables

CNC panels
Cables for CNC panels

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

Description	Comm. Ref.	Num Power Compact CNCs				
		1020	1040	1060	1080	
CNC PANELS						
<i>The Num HMI interface is not compatible with these panels.</i>						
Compact CNC panel with LCD display						
CP10F: Panel with 8.4" color LCD <i>Supports a CNC cable with a max. length of 10 m</i>	000 780	○	○	○	○	
Qwerty PC keyboard for compact CNC panel (optional)	000 248	○	○	○	○	
Operator panels with LCD display						
CP20 F : Panel with 50-key keyboard and 8.4" color LCD	000 781	○	○	○	○	
CP30 F : Panel with Qwerty keyboard and 12" color LCD	000 782	○	○	○	○	
Panel in separate parts:						
FS20 : 10.4" LCD display unit	000 484	○	○	○	○	
KBD30 : Industrial Qwerty CNC keyboard <i>Supplied with 2 m connecting cable</i>	000 485	○	○	○	○	
MP02 : Customizable machine panel	000 486	-	○	○	○	
Electronic handwheel for MP02 panel	081 021	-	○	○	○	
Panel-CNC Connecting Cables						
<i>For compact panels and operator panels.</i>						
CNC cable w/o connectors	5 m	081 054	○	○	○	○
	10 m	081 055	○	○	○	○
	15 m	081 056	-	○	○	○
	20 m	081 057	-	○	○	○
	30 m	081 058	-	○	○	○
	40 m	081 059	-	○	○	○
CNC cable with connectors	1,5 m	081 157	○	○	○	○
	5 m	081 154	○	○	○	○
	10 m	081 155	○	○	○	○

- basic
- optional
- unavailable

Num Power CNC

Equivalence Tables

Portable Operator Panel
Machine Panels
Fiber-optic cables
Systems User Languages

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

Description	Comm. Ref.	Num Power Compact CNCs			
		1020	1040	1060	1080
PORTABLE OPERATOR PANEL					
<i>Used for programming, settings and production.</i>					
POP : Portable operator panel with 6.7" color LCD	000 246	○	○	○	○
Qwerty PC keyboard for POP (optional)	000 248	○	○	○	○
MACHINE PANELS					
MP03 Machine Panels					
<i>These machine panels are both equipped with a handwheel. They are connected to the CNC by a fiber-optic cable.</i>					
Maximum number of machine panels per CNC		-	2	2	2
410 mm machine panel	558 120	-	○	○	○
483 mm machine panel	558 220	-	○	○	○
Fiber-Optic Cables					
<i>Used for connecting the machine panels and remote I/O modules to the CNC.</i>					
Fiber-optic cable					
0.25 m	081 039	-	○	○	○
0.50 m	081 089	-	○	○	○
1 m	081 045	-	○	○	○
2 m	081 090	-	○	○	○
5 m	081 046	-	○	○	○
10 m	081 047	-	○	○	○
20 m	081 049	-	○	○	○
30 m	081 058	-	○	○	○
40 m	081 053	-	○	○	○
Fiber-optic link not used	000 417	-	○	○	○
<i>Specify this reference if you are not using either a machine panel or a remote I/O module.</i>					
CNC User Languages					
Resident languages: French, English, German, Italian, Spanish, Swedish.		●	●	●	●

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Axis, Spindle and Handwheel Functions

The total number of axes, spindles, handwheels and measurements must not exceed the maximum limits specified for each system on page 2/3.

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

See page 2/24 for the functions available on the Num Power *Mplus* and Num Power *Tplus* intuitive CNCs.

Description	Comm. Ref.	Num Power Compact CNCs				
		1020	1040	1060	1080	
Num Power 1020/1040/1060/1080 CNCs						
CNC axes above basic number						
Analog/incremental 5 V TTL measurement	000 373	○	○	○	○	(11)
PLC axes						
Analog/incremental 5 V TTL measurement	000 534	-	○	○	○	(11)
Additional measurement inputs						
5 V TTL measurement input for handwheel <i>Mplus handwheel (000 309 or 000 409)</i> <i>Mandatorily choose one and only one</i>	000 209	○	○	○	○	(2) (4) (5)
Measurement inputs for <i>Mplus</i> handwheel (3)	000 309		○			
Switchable measurement input for <i>Mplus</i> handwheel	000 409		○			
Additional measurement input for Num Power 1040 GP	000 237	-	○	-	-	
Unmeasured spindle control						
Using an analog PLC output (DAC 12-bit)		●	●	●	●	
From an axis card analog output						
14-bit DAC analog output	000 375	○	○	○	○	(11)
Maximum number		1	1	1	1	
Measured analog spindle control						
Spindle 1 with 5 V TTL measurement input <i>Supplied with the T and Tplus</i>	000 366	○	○	○	○	(2) (11)
Spindle 2 with 5 V TTL measurement input	000 367	-	○	○	○	(2) (5) (7)
Spindle 3 with 5 V TTL measurement input	000 368	-	-	○	○	
Spindle 4 with 5 V TTL measurement input	000 369	-	-	-	○	
Accessories						
Axis interface modules	080 089	○	○	○	○	
Electronic handwheel compatible with MP02 panel	081 021	○	○	○	○	(2)

(2) except Num Power 1040 GP
(4) except Num Power *Tplus*
(5) except Num Power *Mplus*

(7) possible for Num Power *Tplus* with Full ISO option (000 593)
(11) possible for Num Power *Mplus* with switchable handwheel option (000 409)

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Axis, Spindle and Handwheel Functions Tool Management

Description	Comm. Ref.	Num Power Compact CNCs				
		1020	1040	1060	1080	
Software functions related to the axes						
Number of simultaneously interpolated axes		●	●	●	●	
Less than or equal to 4		●	●	●	●	
Between 5 and 9	000 531	-	○*	○	○	
<i>* Only on 1040W</i>						
Multigroup-multichannel function	000 371	-	○	○	○	(1) (2)
Maximum number		1	2	3	8	
4 group-channel function for Num 1040 GP	000 279	-	○	-	-	
Settable precision	000 519	○	○	○	○	
<i>Basic on GC, GS</i>						
Inch/metric conversion		●	●	●	●	
Axis calibration	000 260	●	●	○	○	
Synchronized and duplicated axes	000 266	○	○	○	○	(1)
Inclined axes	000 315	○	○	○	○	
Acceleration law		●	●	●	●	
Look-ahead function		●	●	●	●	
Anti-pitch correction		●	●	●	●	
2D linear and circular interpolation		●	●	●	●	
Helical interpolation		●	●	●	●	(2)
Spline interpolation	000 518	○	○	○	○	
Smooth polynomial and spline interpolation	000 499	○	○	○	○	
NURBS (B-Spline) interpolation on M and W	000 426	-	○	○	○	(1)
3D curve smoothing for M, W and GP	081 706	○	○	○	○	
Dynamic operator (see page 2/26)						
Software functions related to measured spindles						
Spindle indexing		●	●	●	●	
Spindle speed range search		●	●	●	●	
Constant surface speed for lathes		●	●	●	●	
Thread cutting for lathes		●	●	●	●	
Axis/spindle servoing (Thread chasing for mills)	000 331	○	○	○	○	
<i>Basic on GC and T</i>						
Spindle synchronization	000 156	-	○	○	○	(2)
Rigid tapping for T, M, W, Mplus and Tplus	000 332	○	○	○	○	(3)
Tool management functions						
Tool axis selection		●	●	●	●	
Table of 32 offsets		●	●	●	●	
Extension to 255 offsets	000 401	○	○	○	○	
Radius and length correction		●	●	●	●	
3D radius correction for milling (M, W, GP)	000 400	○	○	○	○	(12)
5-axis milling tool offset (M and W)	000 411	-	○*	○	○	
<i>Requires interpolation on 5-9 axes (000 531)</i>						
<i>* available only for Num Power 1040 W</i>						
Dynamic correction by the PLC processor	000 410	●	●	○	○	

(1) except Num Power Mplus and Tplus
(2) except Num Power 1040 GP

(3) optional for Num Power Mplus and Tplus with Full ISO option (000 593)
(12) possible for Num Power Mplus with Full ISO option (000 593)

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

PLC Functions

Description	Comm. Ref.	Num Power Compact CNCs			
		1020	1040	1060	1080
12-bit ADC analog inputs		2	2	2	2
12-bit DAC analog outputs		1	1	1	1
24 V hardware interrupt		2	2	2	2
Integrated input/output cards					
<ul style="list-style-type: none"> - Selection of one card per system - On Num Power 1060 and 1080 CNCs one card per extension unit can be added 					
Card with 32 inputs/24 outputs, 250 mA, DIN	000 631	○	○	○	○
Card with 64 inputs/48 outputs, 250 mA, DIN	000 636	○	○	○	○
Connecting cable for 32 inputs	1 m	○	○	○	○
	2 m	○	○	○	○
	5 m	○	○	○	○
Connecting cable for 24 outputs	1 m	○	○	○	○
	2 m	○	○	○	○
	5 m	○	○	○	○
Wiring modules					
32-input interface module	080 080	○	○	○	○
24-output relay module	080 084	○	○	○	○
Remote input/output modules					
<i>Up to 32 modules connected to the CNC by a fiber-optic cable (see page 2/10)</i>					
Maximum number of inputs/outputs		112	256*	336*	1024
* 384 I/O for 1040W, 512 I/O for 1060W					
Remote 16-input 24 VDC module	080 097	-	○	○	○
Remote 32-input 24 VDC module	080 077	-	○	○	○
Remote 32-output 24 VDC 0.5 A module	080 078	-	○	○	○
Remote 16-input/16-output 24 VDC, 0.5 A module	080 098	-	○	○	○
Remote 8-input/8 relayed output 2 A module	080 099	-	○	○	○
Remote 4 analog input/2 analog output module <i>(maximum 4 modules)</i>	080 096	-	○	○	○
Removable connectors					
Set of 3 plug-in connectors with screw terminals	080 120	-	○	○	○
Set of 3 plug-in connectors with spring-loaded terminals	080 121	-	○	○	○
Busbars					
Busbar with 1 row of screw terminals	080 122	-	○	○	○
Busbar with 2 rows of screw terminals	080 124	-	○	○	○
Busbar with 3 rows of screw terminals	080 126	-	○	○	○
Busbar with 1 row of spring-loaded terminals	080 123	-	○	○	○
Busbar with 2 rows of spring-loaded terminals	080 125	-	○	○	○
Busbar with 3 rows of spring-loaded terminals	080 127	-	○	○	○
PLC programming					
Programming in Ladder language		●	●	●	●
Programming in C	000 571	○	○	○	○

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Turning functions available on
Num Power 1020T, 1040T, 1060T, 1080T CNCs

See pages 2/24 and 2/25 for the functions available on the Num Power *Tplus* intuitive CNCs.

Description	Comm. Ref.	Num Power Compact CNCs				
		1020	1040	1060	1080	
Canned cycles						
Polygon cutting cycles (CD) <i>* Consult us</i>	000 538	○	○	○	○	
T probing cycles (CD) <i>includes the following functions: Transfer of active parameter settings to the part program (000 511), On-the-fly measurement acquisition (000 520), Structured programming (000 535), T Probing Cycles manual and 1 x 32 KB module.</i>	000 590	○	○	○	○	(10)
High speed machining of precision contours (UGV1)	000 155	○	○	○	○	
Programming						
With conventional CNC panels and modular small iPCs						
2D graphic display		●	●	●	●	
Parametric programming		●	●	●	●	
PGP and PROFIL		●	●	●	●	
With PC panels (modular Medium and Compact iPCs)						
Visual Tool <i>Includes a 2D editor and a 3D simulation</i>	200 073	○	○	○	○	
Visual Tool Advanced <i>Gives access to CAM functions. This option requires availability of the Visual Tool option</i>	200 074	○	○	○	○	
With all panels						
Cartesian/polar coordinate conversion (G21, G22)	000 340	○	○	○	○	
Scaling factor (G74)	000 506	●	●	○	○	
Programmed angular offset (ED..)	000 507	●	●	●	●	
Transfer of active settings to the program (G76)	000 511	●	●	○	○	
Structured programming, program stack and symbolic variables	000 535	●	●	○	○	
Construction of contour table <i>Includes structured programming (000 535)</i>	000 536	○	○	○	○	

(10) consult us

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Turning functions available on
Num Power 1020T, 1040T, 1060T, 1080T CNCs

Description	Comm. Ref.	Num Power Compact CNCs			
		1020	1040	1060	1080
<p>PROCAM TURN</p> <p><i>includes the following functions: Programmable angular offset (000 507), Transfer of active parameter settings to the part program (000 511), the PROCAM TURN diskette, the manuals: PROCAM TURN Interactive Programming and PROCAM TURN Technological Data and 8 x 32 KB modules (256 KB RAM).</i></p>	000 113	○	○	○	○
<p>PROCAM MULTITURN</p> <p><i>includes the following functions: Programmable angular offset (000 507), Transfer of active parameter settings to the part program (000 511), the PROCAM MULTITURN diskette, the manual PROCAM TURN Interactive Programming and 16 x 32 KB RAM modules (Qp).</i></p>	000 133	-	○	○	○
<p>Procedures</p> <p>Emergency retraction (G75)</p> <p>On-the-fly measurement acquisition (G10)</p> <p>Backtrack along stored path <i>supplied with basic Num Power Tplus</i></p>	000 505 000 520 000 523	○ ● ○	○ ● ○	○ ○ ○	○ ○ ○

2

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Milling functions available on
Num Power 1020M, 1040M, 1060M, 1080M CNCs

See pages 2/24 and 2/25 for the functions available on the Num *Mplus* intuitive CNCs.

Description	Comm.	Num Power Compact CNCs			
	Ref.	1020	1040	1060	1080
Canned cycles					
Boring function/radial axis (M and W)	000 514	○	○	○	○
Irregular pocket cycles	000 159	○	○	○	○
High speed machining of precision contours (UGV1)	000 155	○	○	○	○
RTCP function (G26 +/-)	000 154	-	○	○	○
Inclined plane function (G24 +/-)	000 914	○	○	○	○
Mixed (milling + turning) machine function <i>includes the turning cycles and functions: Axis/spindle servocontrol (000 331), Cartesian/polar and cylindrical conversion (000 340), Double window graphics Boring function (radial axis) (000 514), T Programming and T Operator manuals.</i>	000 581	-	○	○	○
M probing cycles <i>includes the following diskettes and functions: Transfer of active parameter settings to the part program (000 511), On-the-fly measurement acquisition (000 520), Structured programming (000 535), M Probing Cycle manual and 3 x 32 KB RAM modules (Qp).</i>	000 591	○	○	○	○
Milling packages					
Milling package 1 <i>includes the following functions PROCAM MILL (000 113) and 8 x 32 KB RAM modules for installation (256 KB), 128 KB additional RAM for the part program (Qp), 3D graphic display (000 158), Irregular pocket cycles (000 159), Rigid tapping (000 332), Measured spindle 1 control (000 366), 3D tool offset (000 400), Extension to 255 tool offsets (000 401), Scaling factor (000 506), Programmable angular offset (000 507), Transfer of active parameter settings to the part program (000 511), Inclined plane machining (000 914), the PROCAM MILL diskettes the manuals: PROCAM MILL Interactive Programming, PROCAM MILL Technological Data and Inclined Plane and Axis Assignment Integration Tool.</i>	000 382	○	○	○	○
Milling package 2 <i>includes the following functions: RTCP (000 154), 5-axis tool offset (000 411), Inclined plane machining (000 914), the PROCAM diskette, and the manual RTCP Function Integration Tool.</i>	000 383	-	-	○	○
Milling package 3 <i>includes packages 1 and 2.</i>	000 384	-	-	○	○

(10) consult us

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Milling functions available on
Num Power 1020M, 1040M, 1060M, 1080M CNCs

Description	Comm.	Num Power Compact CNCs			
	Ref.	1020	1040	1060	1080
Gear-cutting packages HG					
Gear-cutting package HG 1 Designed for machines with 3 axes + toolhead spindle Includes the following functions: G181: Z axis and toolhead spindle synchronization G180: Synchronization cancellation Dynamic operators (000 250) Structured programming (000 535) Transfer of active parameter settings to the part program (000 511) Emergency retraction (000 505) On-the-fly measurement acquisition (000 520) Processor interchange protocol (000 112) Tool wear offset by PLC (000 410) Scaling factor (000 506) 8x32KB RAM modules	000 596	○	○	○	○
Gear-cutting package HG 2 Designed for machines with 5 axes + toolhead spindle Includes the following functions: G181: Z axis and toolhead spindle synchronization G185: Y axis and toolhead spindle synchronization G180: Synchronization cancellation Dynamic operators (000 250) Structured programming (000 535) Transfer of active parameter settings to the part program (000 511) Emergency retraction (000 505) On-the-fly measurement acquisition (000 520) Processor interchange protocol (000 112) Tool wear offset by PLC (000 410) Scaling factor (000 506) 8x32KB RAM modules	000 597	-	-	○	○
Canned gear-cutting cycle Automatic alignment Allows the teeth of different gears to be aligned on the same shaft, or can even grind a disassembled part This cycle requires availability of one of the two above HG gear-cutting packages	000 595	-	-	○	○

- basic
- optional
- unavailable

Num Power CNC

Equivalence Tables

Milling functions available on
Num Power 1020M, 1040M, 1060M, 1080M CNCs

Description	Comm. Ref.	Num Power Compact CNCs			
		1020	1040	1060	1080
Programming					
With conventional CNC panels and modular small iPCs					
2D graphic display		●	●	●	●
3D graphic display	000 158	○	○	○	○
Parametric programming		●	●	●	●
PGP and PROFIL		●	●	●	●
With PC panels (modular Medium and Compact iPCs)					
Visual Tool <i>Includes a 2D editor and a 3D simulation</i>	200 073	○	○	○	○
Visual Tool Advanced <i>Gives access to CAM functions. This option requires availability of the Visual Tool option.</i>	200 074	○	○	○	○
With all panels					
Scaling factor (G74)	000 506	●	●	○	○
Programmed angular offset (ED..)	000 507	●	●	●	●
Transfer of active settings to the program (G76)	000 511	●	●	○	○
Structured programming, program stack and symbolic variables	000 535	●	●	○	○
Construction of contour table <i>Includes structured programming (000 535)</i>	000 536	○	○	○	○
PROCAM MILL <i>includes the following functions: Programmed angular offset (000 507), Transfer of active parameter settings to the part program (000 511), the PROCAM MILL diskette, the manuals PROCAM MILL Technological Data and PROCAM MILL Interactive Programming and 8 x 32 KB modules (256 KB RAM)</i>	000 113	○	○	○	○
PROCAM MX (machine mixte) <i>includes the following functions: Programmed angular offset (000 507), Transfer of active parameter settings to the part program (000 511), the PROCAM MILL and PROCAM TURN diskettes, the manuals PROCAM MILL and PROCAM TURN Interactive Programming and 16 x 32 KB modules (512 KB RAM).</i>	000 134	-	○	○	○
PROCAM HG (gear cutting)	000 592	○	○	○	○
NUMAFORM, mold and form machining cycles <i>includes the following functions: Dynamic operators (000 250), 3D tool offset (000 400) Structured programming (000 535), Construction of contour table (000 536), the manuals: Dynamic Operators, M-W Programming and M-W Operator.</i>	000 917	○	○	○	○
Procedures					
N/M auto function	000 082	-	○	○	○
Emergency retraction (G75)	000 505	○	○	○	○
On-the-fly measurement acquisition (G10)	000 520	●	●	○	○
Backtrack along stored path	000 523	○	○	○	○

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Functions Available for the Num Power 1040GP General Purpose Range

Description	Comm. Ref.	Num Power Compact CNCs			
		1020	1040	1060	1080
Cycles					
Canned cycles		-	●	-	-
Inclined plane function	000 914	-	○	-	-
High speed machining of precision contours (UGV1)	000 155	-	○	-	-
Programming					
With conventional CNC panels and modular small iPCs					
Circular interpolation	000 497	-	○	-	-
2D graphic display		-	●	-	-
Parametric programming		-	●	-	-
PGP and PROFIL		-	●	-	-
With PC panels (modular Medium and Compact iPCs)					
Visual Tool	200 073	-	○	-	-
<i>Includes a 2D editor and a 3D simulation</i>					
Visual Tool Advanced	200 074	-	○	-	-
<i>Gives access to CAM functions. This option requires availability of the Visual Tool option.</i>					
With all panels					
Scaling factor	000 506	-	●	-	-
Programmed angular offset	000 507	-	●	-	-
Transfer of active parameter settings to the program	000 511	-	●	-	-
Tructured programming, programm stock and symbolic variables	000 535	-	●	-	-
Construction of contour table	000 536	-	○	-	-
<i>Includes structured programming (000 535)</i>					
Probing cycle diskette	000 591	-	○	-	-
<i>Includes the Probing Cycles manual and 3 x 32 KB modules (96 KB RAM).</i>					
Procedures					
Emergency retraction	000 505	-	○	-	-
On-the-fly measurement acquisition	000 520	-	●	-	-
Backtrack along stored path	000 523	-	○	-	-

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Cylindrical Grinding Functions Available for
Num Power 1020GC, 1040GC, 1060GC, 1080GC CNCs

Description	Comm. Ref.	Num Power Compact CNCs			
		1020	1040	1060	1080
Canned cycles					
Turning cycles		●	●	●	●
High speed machining of precision contours (UGV1)	000 155	○	○	○	○
Programming					
With conventional CNC panels and modular small iPCs					
2D graphic display		●	●	●	●
Parametric programming		●	●	●	●
PGP and PROFIL		●	●	●	●
With PC panels (modular Medium and Compact iPCs)					
Visual Tool <i>Includes a 2D editor and a 3D simulation</i>	200 073	○	○	○	○
Visual Tool Advanced <i>Gives access to CAM functions. This option requires availability of the Visual Tool option.</i>	200 074	○	○	○	○
With all panels					
Cartesian/polar conversion (G21, G20)	000 340	○	○	○	○
Scaling factor (G74)	000 506	●	●	○	○
Programmed angular offset (ED..)	000 507	●	●	○	○
Transfer of active settings to the program (G76)	000 511	●	●	●	●
Settable precision	000 519	●	●	●	●
Structured programming, program stack and symbolic variables	000 535	●	●	●	●
Construction of contour table <i>Includes structured programming (000 535)</i>	000 536	○	○	○	○
Procedures					
Axis/spindle servoing	000 331	●	●	●	●
Circular interpolation	000 497	●	●	●	●
Dynamic operators	000 250	●	●	●	●
Emergency retraction (G75)	000 505	●	●	●	●
On-the-fly measurement acquisition (G10)	000 520	●	●	○	○
Backtrack along stored path	000 523	○	○	○	○

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Surface Grinding Functions Available for
Num Power 1020GS, 1040GS, 1060GS, 1080GS CNCs

Description	Comm. Ref.	Num Power Compact CNCs			
		1020	1040	1060	1080
Canned cycles					
Milling cycles		●	●	●	●
High speed machining of precision contours (UGV1)	000 155	○	○	○	○
Programming					
With conventional CNC panels and modular small iPCs					
2D graphic display		●	●	●	●
3D graphic display	000 158	○	○	○	○
Parametric programming		●	●	●	●
PGP and PROFIL		●	●	●	●
With PC panels (modular Medium and Compact iPCs)					
Visual Tool <i>Includes a 2D editor and a 3D simulation</i>	200 073	○	○	○	○
Visual Tool Advanced <i>Gives access to CAM functions. This option requires availability of the Visual Tool option.</i>	200 074	○	○	○	○
With all panels					
Scaling factor (G74)	000 506	●	●	○	○
Programmed angular offset (ED..)	000 507	●	●	○	○
Transfer of active settings to the program (G76)	000 511	●	●	●	●
Settable precision	000 519	●	●	●	●
Structure programming, program stack and symbolic variables	000 535	●	●	●	●
Construction of contour table <i>Includes structured programming (000 535)</i>	000 536	○	○	○	○
Procedures					
Circular interpolation	000 497	●	●	●	●
Dynamic operators	000 250	●	●	●	●
Emergency retraction (G75)	000 505	●	●	●	●
On-the-fly measurement acquisition (G10)	000 520	●	●	○	○
Backtrack along stored path	000 523	○	○	○	○

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Woodworking Functions Available for
Num Power 1020W, 1040W, 1060W, 1080W CNCs

Description	Comm. Ref.	Num Power Compact CNCs				
		1020	1040	1060	1080	
Canned cycles						
Milling cycles		●	●	●	●	
Boring function/radial axis (M and W)	000 514	○	○	○	○	
Circular, rectangular and oblong pocket cycles		●	●	●	●	
Irregular pocket cycles	000 159	○	○	○	○	
High speed machining of precision contours (UGV1)	000 155	○	○	○	○	
RTCP function	000 154	-	○	○	○	
Inclined plane function	000 914	○	○	○	○	
Mixed (milling + turning) machine function <i>includes the turning cycles and functions: Axis/spindle servocontrol (000 331), Cartesian/polar and cylindrical conversion (000 340), Double window graphics, Boring function (radial axis) (000 514), T Programming and T Operator manuals.</i>	000 581	-	○	○	○	
Probing cycles (on diskette) <i>includes the M Probing Cycles manual and 3 x 32 KB modules (96 KB RAM)</i>	000 591	○	○	-	○	(10)
Programming						
With conventional CNC panels and modular small iPCs						
2D graphic display		●	●	●	●	
3D graphic display	000 158	○	○	○	○	
Parametric programming		●	●	●	●	
PGP and PROFIL		●	●	●	●	
With PC panels (modular Medium and Compact iPCs)						
Visual Tool <i>Includes a 2D editor and a 3D simulation</i>	200 073	○	○	○	○	
Visual Tool Advanced <i>Gives access to CAM functions. This option requires availability of the Visual Tool option.</i>	200 074	○	○	○	○	
With all panels						
Scaling factor	000 506	●	●	○	○	
Programmed angular offset	000 507	●	●	●	●	
Transfer of active settings to the program	000 511	●	●	○	○	
Structured programming, program stack and symbolic variables	000 535	●	●	○	○	
Construction of contour table <i>Includes structured programming (000 535)</i>	000 536	○	○	○	○	
PROCAM MILL <i>includes the following functions: Programmable angular offset (000 507), Transfer of active parameter settings to the part program (000 511), the PROCAM MILL diskette the manuals PROCAM MILL Technological Data and PROCAM MILL Interactive Programming and 8 x 32 KB modules (256 Ko de RAM)</i>	000 113	○	○	○	○	

(10) consult us

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Woodworking Functions Available for
Num Power 1020W, 1040W, 1060W, 1080W CNCs

Description	Comm. Ref.	Num Power Compact CNCs			
		1020	1040	1060	1080
<p>PROCAM MX (combined machine)</p> <p><i>Includes the following functions: Programmed angular offset (000 507), Transfer of active parameter settings to the part program (000 511), the PROCAM MILL and PROCAM TURN diskettes the manuals PROCAM MILL and PROCAM TURN Interactive Programming and 16 x 32 KB modules (512 KB RAM).</i></p>	000 134	-	○	○	○
<p>NUMAFORM</p> <p>Mold and form machining cycle</p> <p><i>Includes the following functions: Dynamic operators (000 250), 3D tool offset (000 400) Structured programming (000 535), Construction of contour table (000 536), the manuals: Dynamic Operators, M-W Programming and M-W Operator.</i></p>	000 917	○	○	○	○
<p>Procedures</p> <p>N/M auto function</p> <p>Emergency retraction (G75)</p> <p>On-the-fly measurement acquisition (G10)</p> <p>Backtrack along stored path</p>	<p>000 082</p> <p>000 505</p> <p>000 520</p> <p>000 523</p>	<p>-</p> <p>○</p> <p>●</p> <p>○</p>	<p>○</p> <p>○</p> <p>●</p> <p>○</p>	<p>○</p> <p>○</p> <p>○</p> <p>○</p>	<p>○</p> <p>○</p> <p>○</p> <p>○</p>
<p>Packages</p> <p>Woodworking package 1 for customizing the man/machine interface</p> <p><i>includes the following functions: Processor interchange protocol (000 112), Transfer of active parameter settings to the part program (000 511), PLC programming in C (000 571), 1 x 64 KB module of additional PLC RAM.</i></p>	000 380	○	○	○	○
<p>Woodworking package 2</p> <p><i>includes package 1 and the PROCAM MILL function (000 113).</i></p>	000 381	○	○	○	○

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Functions Available for Num Power *Mplus* (Milling) and Num Power *Tplus* (Turning) Intuitive CNCs

The Num Power *Mplus* and Num Power *Tplus* intuitive CNCs with dedicated panel and man/machine interface combine the flexibility of machining with handwheels with the precision and productivity of a CNC.

The Light ISO editor is used to create machining programs intuitively by means of preformatted blocks accessible by icons representing the different machining operations.

When used with **the Full ISO editor** and with an operator panel, the Num Power *Mplus* and Num Power *Tplus* CNCs become full CNCs.

For more details on the functions mentioned, refer to the milling and turning function equivalence tables and the functional specifications (Chapter 4).

Description	Comm. Ref.	Num Power <i>Mplus</i>		Num Power <i>Tplus</i>	
		Basic	with FULL ISO option	Basic	with FULL ISO option
Axes, spindles, handwheels for Num Power <i>Mplus</i>					
3 CNC axes in the basic version		●	●	-	-
Handwheels: only one of the two following functions:					
• 3 measurement inputs for 3 handwheels <i>Incompatible with measured spindle (000 366)</i>	000 309	●	●	-	-
• 1 switchable measurement input <i>Required for the following functions:</i>	000 409	●	●	-	-
1 additional CNC axis	000 373	○	○	-	-
1 measured spindle	000 366	○	○	-	-
1 unmeasured spindle	000 375	○	○	-	-
1 to 2 PLC axes	000 534	○	○	-	-
Maximum 6 measurement inputs					
Axes, spindles, handwheels for Num Power <i>Tplus</i>					
2 CNC axes in the basic version		-	-	●	●
1 additional CNC axis	000 373	-	-	○	○
2 measurement inputs for handwheels		-	-	●	●
1st measured spindle		-	-	●	●
2nd measured spindle	000 367	-	-	-	○
1 unmeasured spindle	000 375	-	-	-	○
1 PLC axis	000 534	-	-	○	○
Maximum 6 measurement inputs					
Basic functions					
Milling functions		●	●	-	-
Turning, constant surface speed, thread cutting functions		-	-	●	●
Num <i>Mplus</i> application program		●	●	-	-
Num <i>Tplus</i> application program		-	-	●	●
PROCAM interpreter		●	●	●	●
MMI interpreter		●	●	●	●
Hard copy of screen		●	●	●	●
2D linear and circular interpolation		●	●	●	●
Helical interpolation		●	●	-	-
Axis calibration		●	●	●	●
Axis/spindle servocontrol		-	○	●	●
Settable precision	000 519	○	○	-	-
Dynamic operators and interaxis calibration		●	●	●	●
PGP and PROFIL		●	●	●	●
Scaling factor (G74)		●	●	●	●
Programmed angular offset (ED..)		●	●	●	●
Parametric programming		●	●	●	●
Transfer of active settings to the program (G76)		●	●	●	●
Structured programming, program stack and symbolic variables		●	●	●	●

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Functions Available for Num Power *Mplus* (Milling) and Num Power *Tplus* (Turning) Intuitive CNCs

Description	Comm. Ref.	Num Power <i>Mplus</i>		Num Power <i>Tplus</i>	
		Basic	with FULL ISO option	Basic	with FULL ISO option
Construction of contour table		●	●	-	○
Emergency retraction	000 505	○	○	○	○
On-the-fly measurement acquisition		●	●	●	●
Backtrack along stored path		●	●	●	●
Tool wear offset by PLC		●	●	●	●
Light ISO editor and graphic simulation	000 412	○	○	○	○
<i>Includes graphic simulation, ISO part program up/download functions and conversion of Num Power Mplus and Num Power Tplus programs into ISO.</i>					
Full ISO editor	000 593	-	●	-	●
<i>Requires replacement of the display unit by an CP20F or CP30F operator panel. Gives access to the following functions.</i>					
Axes					
Inclined axes	000 315	-	○	-	-
Inclined plane function (G24 +/-)	000 914	-	○	-	-
High speed machining of precision contours (UGV1)	000 155	○	○	-	○
Spindles					
Rigid tapping	000 332	-	○	-	○
Axis/spindle servocontrol - thread chasing	000 331	-	○	●	●
3D tool offset	000 156	-	○	-	○
Tools					
Extension to 255 tool offsets (32 in the basic version)	000 401	-	○	-	○
3D tool offset	000 400	-	○	-	-
Programming					
3D graphic display	000 158	-	○	-	-
PROCAM MILL	000 113	-	○	-	-
PROCAM TURN 000 113	-	-	-	○	-
Boring/radial axis	000 514	-	○	-	-
Irregular pocket cycles	000 159	-	○	-	-
NUMAFORM mold and form machining cycles	000 917	-	○	-	-
Cartesian/polar coordinate conversion (G21, G22)	000 340	-	-	-	○
Spline interpolation	000 518	-	○	-	○
Smoothed polynomial and spline interpolation	000 499	-	○	-	○
3D curve smoothing	081 706	-	○	-	-
Dynamic operators in C and interaxis calibration	000 249	-	-	-	-
Construction of contour table	000 536	●	●	-	○
Mixed machine function (milling + turning)	000 581	-	○	-	-
Milling software package 1	000 382	-	○	-	-
M probing cycles 000 591	-	○	-	-	-
T probing cycles 000 590	-	-	-	○	-
Communication					
Third serial line	000 252	○	○	○	○
Processor interchange	000 112	-	○	-	○
Uni-Telway	000 911	-	○	-	○
Fipway	000 924	-	○	-	○

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Communication Integration and Customization Software

These functions are described in Chapter 4, *Functional Specifications*.

Description	Comm. Ref.	Num Power Compact CNCs				
		1020	1040	1060	1080	
COMMUNICATION						
Serial lines			3	3	3	3
Processor data interchange	000 112	○	○	○	○	
Connection to networks						
Uni-Telway	000 911	○	○	○	○	
Fipway	000 924	○	○	○	○	
Accessories						
Floppy disk drive for CNC serial line	081 002	○	○	○	○	(1)
RESIDENT SOFTWARE						
PROCAM interpreter			●	●	●	●
MMI interpreter						
<i>With panel control card (000720, 000741, 000740, 000761, 000760)</i>			●	●	●	●
<i>Without panel control card (000620, 000641, 000640, 000661, 000660)</i>	000 946	○	○	○	○	
Dynamic operators						
Dynamic operators <i>Supplied with GC, GS, Mplus and Tplus.</i>	000 250	○	○	○	○	
Dynamic operators in C <i>Supplied with GC and GS, 1060 and 1080</i> <i>On 1040, 1050, 1060 and 1080, requires a system with coprocessor.</i>	000 249		-	○	○	○

(1) except *Mplus* and *Num Tplus*

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Integration and Customization Software

These functions are described in Chapter 4, *Functional Specifications*.

Description	Comm. Ref.	Num Power Compact CNCs			
		1020	1040	1060	1080
Num Tool WorkShop for PC on CD-ROM <i>Includes the software (Windows 95/98/2000/Me), token and software option, where applicable, plus the documentation.</i>					
Num HMI Kit package for PC <i>Includes Num HMI, PERSOTool, PC Standard MMI and Num BackUp</i>	182 111	○	○	○	○
Visual Tool <i>Includes a 2D editor and a 3D simulation</i>	200 073	○	○	○	○
Visual Tool Advanced <i>Gives access to CAM functions. This option requires availability of the Visual Tool option.</i>	200 074	○	○	○	○
PC Standard MMI	182 110	○	○	○	○
PC Panel MMI	182 109	○	○	○	○
PCToolKit	182 091	○	○	○	○
NUMBackUp	182 093	○	○	○	○
PERSOTool	182 094	○	○	○	○
SETTool					
CD - 1 license	182 092	○	○	○	○
CD - 5 licenses	182 192	○	○	○	○
PLCTool					
CD - 1 license	182 095	○	○	○	○
CD - 5 licenses	182 195	○	○	○	○
CD - 10 licenses	182 295	○	○	○	○
MMITool					
CD - 1 license	182 096	○	○	○	○
Package					
Single workstation software package 1 <i>Includes SETTool, PLCTool and MMITool</i>	182 186	○	○	○	○
Single workstation software package 2 <i>Includes SETTool and PLCTool</i>	182 188	○	○	○	○
C Language Compiler	082 026	○	○	○	○
Patch for Windows 95/98 16-bit software <i>For upgrading the software from 16 bits to 32 bits</i>	082 550	○	○	○	○
Data transfer program NUMTrans	NUMTRANS	○	○	○	○

- basic
- optional
- unavailable

Num Power CNC

Equivalence Tables

Technical Manuals

Description	Comm.	Num Power CNCs			
	Ref.	1020	1040	1060	1080
TECHNICAL MANUALS					
<i>Each CNC is supplied with a CD-ROM containing the basic documents in multiple languages.</i>					
CD-ROM - Basic documents	000 815	●	●	●	●
<i>Includes the following manuals in French, English, German and Italian:</i>					
User manuals					
M-W Programming		●	●	●	●
T-G Programming		●	●	●	●
Supplementary Programming		●	●	●	●
Addition to M-W Programming Manuals		●	●	●	●
Addition to T-G Programming Manuals		●	●	●	●
Addition to <i>Tplus</i> and <i>Mplus</i> Manuals		-	●	-	-
PROFIL Function - operation		●	●	●	●
M-W Operator		●	●	●	●
T-G Operator		●	●	●	●
Visual Tool Operator					
Num <i>Mplus</i> Operator		-	●	-	-
Num <i>Tplus</i> Operator		-	●	-	-
EMC Installation and Wiring Guide		●	●	●	●
Portable Operator Panel (POP)		●	●	●	●
Integration and commissioning manuals					
Machine Parameters		●	●	●	●
Num Power 1020/1040/1060/1080 - Installation and Commissioning		●	●	●	●
Num <i>Tplus</i> /Num <i>Mplus</i> - Installation		-	●	-	-
PC panel - Installation/Commissioning		●	●	●	●
TCP/IP link - Installation/Commissioning		-	●	●	●
Remote Inputs/Outputs		-	●	●	●
Addition to Installation Manuals, Index M and N		●	●	●	●
CNC and Num Drive Maintenance Manual		-	-	-	-
CNC Maintenance Manual		●	●	●	●
<i>In Spanish only</i>					

● basic
○ optional
- unavailable

Num Power CNC

Equivalence Tables

Technical Manuals

Description	Comm.	Num Power Compact CNCs			
	Ref.	1020	1040	1060	1080
CD-ROM - Special Manuals <i>Includes the following manuals in French, English, German and Italian:</i>	000 816	○	○	○	○
User manuals					
RTCP and 3/5 Auto Function		○	○	○	○
Contouring		○	○	○	○
PROCAM MILL – Technological Data		○	○	○	○
PROCAM MILL – Interactive Programming		○	○	○	○
PROCAM TURN – Technological Data		○	○	○	○
PROCAM TURN – Interactive Programming		○	○	○	○
Inclined Plane Machining		○	○	○	○
Integration and Commissioning manuals					
Duplicated and Synchronized Axes		○	○	○	○
M Probing Cycles		○	○	○	○
T Probing Cycles		○	○	○	○
Fipway – Integration		○	○	○	○
RTCP Function - Integration Tool		○	○	○	○
Dynamic Operators		○	○	○	○
Inclined Plane and Axis Assignment - Integration Tool		○	○	○	○
PROCAM – Description Language		○	○	○	○
Synchronization of Two Spindles		○	○	○	○
Rigid Tapping		○	○	○	○
High Speed Cutting		○	○	○	○
Uni-TE - Use of the Protocol		○	○	○	○
Uni-Telway – Integration		○	○	○	○
<i>Certain manuals are available in other languages in addition to French, English, German and Italian. Ask your Num agency about the availability of the technical manuals in the different languages.</i>					

- basic
- optional
- unavailable

Num Power CNC

Technical Specifications

Table of contents

CNC Platforms	Page
Num Power 1020 and Num Power 1040 Compact CNCs	3/2
Num Power 1060 and Num Power 1080 Compact CNCs	3/4

Panels	
Selection Guide	3/5
PC Panels	3/7
Screen for PC Panel	3/9
Operator Panel	3/10
Compact Operator Panel	3/11
Portable Operator Panel	3/11
Operator Panel with Separate Keyboard	3/12
Machine Panels	3/13
Num Power <i>Mplus</i> and <i>Tplus</i> Panels	3/14

Remote Modules	
Interface Modules	3/15
Remote Input/Output Modules	3/15
Axis Interface Module	3/15

CNC Fiber-Optic Link	
Wiring Diagram of Units Interconnected by a Fiber-Optic Link	3/16

Num Power CNC

Technical Specifications

Num Power 1020 and Num Power 1040 Platforms

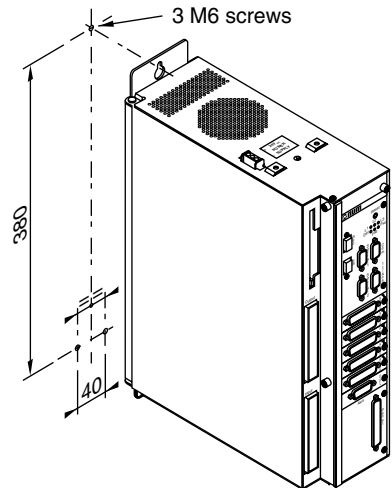
Num Power 1020

The central processing unit includes the CNC, PLC and communication functions.

- 2 to 4 axes depending on the type (see page 2/3).
- Up to 112 inputs and outputs
- 2 12-bit ADC inputs
- 1 12-bit DAC output
- 2 24 V hardware interrupts
- Available in two versions:
 - With panel control card for communication with the compact panel or portable operator panel;
 - Without panel control card for use with an iPC panel or an external PC.

Functions Available

- Milling M
- Turning T
- Cylindrical grinding GC
- Surface grinding GS
- Woodworking W



Num Power 1040

The central processing unit includes the CNC, PLC and communication functions.

- 1 to 6 axes depending on the type (see page 2/3).
- Up to 256 inputs and outputs (except W - 384 I/O)
- 2 12-bit ADC inputs
- 1 12-bit DAC output
- 2 24 V hardware interrupts
- Available in two versions:
 - With panel control card for communication with Num CNC panels;
 - Without panel control card for use with an iPC panel or an external PC.

Two platforms are available for the Num Power 1040: Optima and Ultra. The Ultra platform enhances overall system performance.

Functions Available

- Milling M and *Mplus*
- Turning T and *Tplus*
- Cylindrical grinding GC
- Surface grinding GS
- Woodworking W
- General purpose GP

Common Features

- Power supply voltage 24 VDC
+20%; -15%
- Power consumption 40 W
- Protection class IP20
- Relative humidity, noncondensing 5 to 95%
- Storage temperature range -25° to +70° C
- Operating temperature range 5° to 55°
- Overall dimensions in mm (W x H x D) 110 x 404 x 285
- Weight 6 kg

Num Power CNC

Technical Specifications

Num Power 1060 and Num Power 1080 Platform

Num Power 1060 and 1080

The compact CPU includes the CNC, PLC and communication functions.

Four versions are available:

- Version with panel control card for use with the compact panel or portable operator panel;
- Version without panel control card for use with all Num panels.

Each of the two versions is available with and without coprocessor (see page 2/6). The coprocessor is necessary for the dynamic operators in C option (000 249).

Num Power 1060

- Up to 8 axes and 12 measurements (for details, see page 2/3)
- Up to 336 inputs and outputs (except W - 512 I/O)
- 2 12-bit ADC inputs
- 1 12-bit DAC output
- 2 24 V hardware interrupts.

Num Power 1080

- Up to 32 axes (for details, see page 2/3)
- Up to 1024 inputs and outputs
- 2 12-bit ADC inputs
- 1 12-bit DAC output
- 2 24 V hardware interrupts.

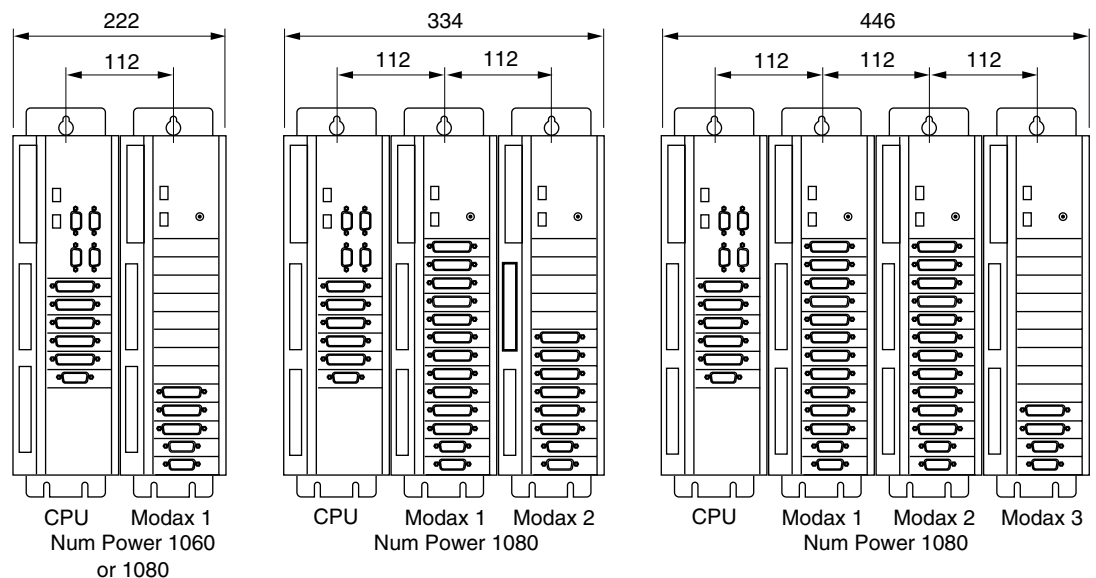
Two platforms are available for the Num Power 1080: Optima and Ultra. The Ultra platform enhances overall system performance.

Axis Extension Units (Modax)

If there are more than 6 axes, the CPU is used in conjunction with extension units which can be fitted with input/output cards in addition to the axis cards.

- | | |
|---|---------|
| • 1060/1080 with 2 to 6 controllers | 0 Modax |
| • 1060 with 2 to 12 controllers (max. 8 axes) | 1 Modax |
| • 1080 with 2 to 16 controllers | 1 Modax |
| • 1080 with 2 to 27 controllers | 2 Modax |
| • 1080 with 2 to 32 controllers | 3 Modax |

Configuration with Axis Extension Units (Modax)

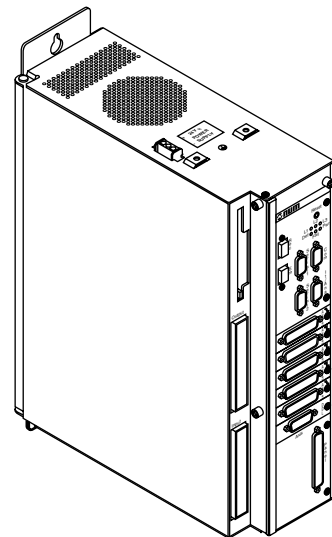


Functions Available on Num Power 1060 and 1080 CNCs

- | | |
|------------------------|----|
| • Milling | M |
| • Turning | T |
| • Cylindrical grinding | GC |
| • Surface grinding | GS |
| • Woodworking | W |

Characteristics

- | | |
|------------------------------------|-----------------|
| • Power supply voltage | 24 VDC |
| | +20%; -15% |
| • Maximum CPU power | 70 W |
| • Maximum power of a Modax | 45 W |
| • Protection class | IP20 |
| • Relative humidity, noncondensing | 5 to 95% |
| • Storage temperature range | -25° to +70° C |
| • Operating temperature range | 5° to 55° |
| • Overall dimensions (WxHxD) in mm | 110 x 404 x 285 |
| • Weight | 6 kg |



Num Power CNC

Technical Specifications

Panels Selection Guide

Table of Panels

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

Industrial PC panels	Modular iPC		Compact iPC
	Small iPC	Medium iPC	with touch screen
Panel type	PC		
Display unit	12" LCD (800 x 600) or 15" LCD (1024 x 768)		15" LCD (1024 x 768)
Use	Combine 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.).		
CNC/panel link	TCP/IP and HSL	TCP/IP and HSL	TCP/IP and HSL
Machine panel	MP03		MP03
CPU	Intel Celeron 556 MHz IDE 20 GB hard disk	Intel Celeron 566 MHz or Pentium III 850 MHz IDE 20 GB hard disk	Pentium 4 1.7 GHz, IDE 20 GB hard disk
Operating system	Windows 2000		Windows 2000
QWERTY keyboard	Yes		To be connected separately
Function keys	20 programmable keys		Touch screen
Mouse	Yes		-
Other	Numerical keypad, 14 cursor control keys		-
Communication	Ethernet TCP/IP, 2 USB ports, 2 serial ports, 1 parallel port, 1 PS/2 port, 1 infrared link		Ethernet TCP/IP, 3 USB ports, 3 serial ports, 1 parallel port, 2 PS/2 ports
CD-ROM drive	Optional	Removable	Fixed
Floppy disk drive	Fixed	Removable	Fixed
Extension slots	No	3 (ISA, PCI, ISA/PCI)	2 PCMCIA ports + 1 PCI
Power supply voltage	24 VDC or 220 VAC		220 VAC
Power consumption	120 W	160 W	120 W
Protection class	IP 65		IP 65
Overall dimensions (L x H x D*)	410 x 330 x 138.9	483 x 370 x 229.2	395 x 294 x 100
Weight	7.2 kg 12" front panel: 6.5 kg 15" front panel - 7.2 kg	10.6 kg 12" front panel: 6.5 kg 15" front panel - 7.2 kg	8 kg

*D: Depth behind panel

Num Power CNC

Technical Specifications

Panels Selection Guide

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

PC panels (cont'd)	FS151KBD	FS151
Panel type	Industrial screen for PC Panel	
Display unit	LCD 15"	
Use	Designed to equip an office or industrial PC with a screen including function keys	
Machine Panel	MP03	
Keyboard	Qwerty	No
Function keys	22 function keys surrounding the screen	
Ports	1 PS2 port for a second Qwerty keyboard	1 PS2 port for a Qwerty keyboard
Power supply voltage	24 VDC	
Power consumption	20 W	
Protection class	IP 65	
Overall dimensions (L x H x D)	410 x 400 x 65 mm	410 x 330 x 65 mm
Weight	5.8 kg	5.2 kg

Conventional panels CP30F	CP30F	CP20F	FS20	CP10F / MP10	POP
Panel type	Operator			Compact	Portable
Display unit	12" LCD	8.4" LCD	10.4" LCD	8.4" LCD (CP10F) 9" CRT monochrome (MP10)	6.7" LCD
Use	For more or less intensive part programming and settings next to the machine. The machine functions are provided by an additional panel. Select a model based on the display unit, keyboard and mechanical characteristics.			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	12	No	12 + 6 dedicated to the machine	18
Other	-	-	-	Spindle speed potentiometer Emergency stop button	
Power supply voltage	24 VDC	24 VDC	24 V DC	24 VDC (CP10F) 230 V AC (MP10)	24 V DC
Power consumption	50 W	40 W	50 W	40 W (CP10F) 30 W (MP10)	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 (CP10F) 305 mm (MP10)	310 x 240 x 87 mm
Weight	7.5 kg	5 kg	4,2 kg 1.7 kg (KBD keyboard)	5 kg (CP10F) 11 kg (MP10)	1.8 kg

*D: Depth behind panel

Num Power CNC

Technical Specifications

Num Power 1060 and 1080 Panels

Num iPC Panel

Num iPC panels combine the advantages of a conventional operator panel and a PC. They are delivered with:

- The Num HMI man-machine interface (see page 4/18).
- Windows 2000 installed in multilingual version, factory set to English.
- The software package for PC on CD-ROM, including SETTool, PLCTool and PCToolKit (P/N 082 500 - page 4/18).

These modular Num iPC panels include a PC CPU on which is mounted a front panel with LCD display and Qwerty keyboard. Both front panels can be mounted on any of the three CPUs.

To facilitate machine control during production, the Num iPC panel can be associated with an MP03 machine panel of the same width (410 mm or 480 mm).

Num iPC Front Panels



The front panels are available in two sizes:

- **Num iPC 12KBD (P/N APPC 556 110)**
Front panel with 12" color SVGA LCD (800x600 pixels), with a width of 410 mm
- **Num iPC 15KBD (P/N APPC 556 210)**
Front panel with 15" color XGA LCD (1024x768 pixels), with a width of 480 mm

Characteristics

- IP65 metallic front panel for harsh environments
- Backlit TFT active matrix color LCD display units, 262,114 colors
- Standard IBM alphanumeric keyboard with 70 keys
- 2 vertical rows of 10 programmable function keys
- Integrated pointing device (mouse)
- 1 PS/2 port for keyboard or pointing device protected by a cap
- 1 IrDA compatible infrared link for downloads

Num iPC CPU



Small CPU

Medium CPU

The Num iPC industrial PC is available in two models:

- **Num iPC Small**
 - 24 V (P/N **APPC 555 110**)
 - 220 V (P/N **APPC 555 111**)

The Num iPC Small is a one-piece unit including the CPU with Intel Celeron 566 MHz processor and power supply. It has no extension slots.

- **Num iPC Medium**

The Num iPC medium has three extension slots (1 ISA bus, 1 PCI bus, 1 ISA/PCI bus). It is available with two different processors

- Celeron 566 MHz / 24 VDC (P/N **APPC 555 210**)
- Celeron 566 MHz / 220 VAC (P/N **APPC 555 211**)
- Pentium III 850 MHz / 24 VDC (P/N **APPC 555 220**)
- Pentium III 850 MHz / 220 VAC (P/N **APPC 555 221**)

Characteristics

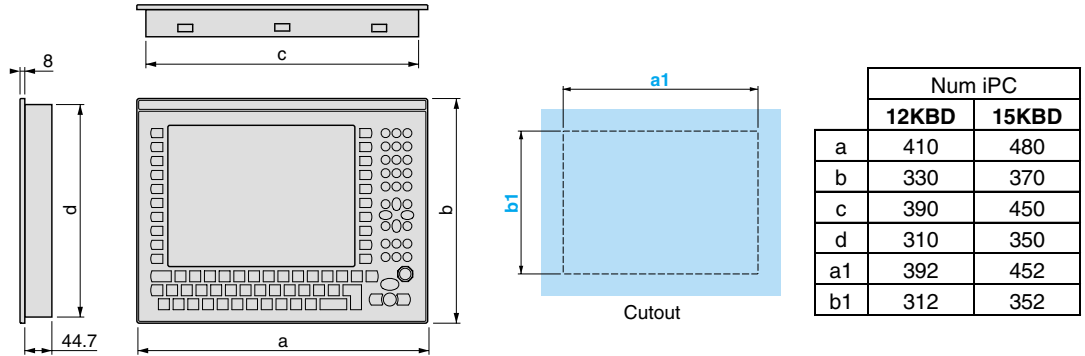
- IDE 20 GB (minimum) hard disk
- 128 MB SDRAM
- 3½ floppy disk drive (fixed on Num iPC Small, removable on Num iPC Medium)
- 24x CD-ROM drive (supplied with Num iPC Medium, optional on Num iPC Small)
- Video card: 64-bit PCI controller, 2 MB RAM
- 1 Ethernet TCP/IP 10baseT/100baseTX port
- 2x12 Mbit/s USB ports
- 2 COM serial ports (2 RS232 and/or 1 RS422/485)
- 1 parallel port
- 1 video connector for external VGA display unit
- Power supply voltage 24 VDC or 220 VAC
- Power consumption
 - Num iPC Small 120 W
 - Num iPC Medium 160 W
- Protection class IP65
- Operating temperature range 0°C to 50°C
- Storage temperature range -25°C to +60°C
- Relative humidity, noncondensing 10% to 90%

Num Power CNC

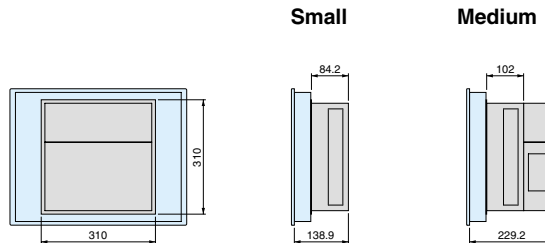
Technical Specifications

Panels Num iPC Panel

Num iPC 12KBD and 15KBD Front Panels



Num iPC CPU



Compact iPC panel with touch screen

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

It is delivered with:

- the Num HMI (see page 4/18),
- Windows 2000 installed in multilingual version, factory set to English,
- the software package for PC on CD-ROM, including SETTool, PLCTool and PCToolKit (P/N 082 500 - page 4/18).

- **Compact iPC: 220 V (P/N APPC 555 317)**



Characteristics

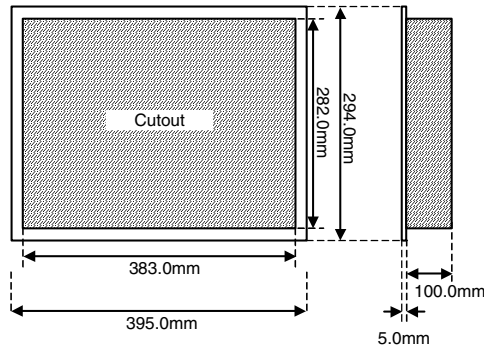
- 15" touch screen
- IP65 front panel for harsh environments
- Pentium 4-1.7 GHz
- IDE 20 GB hard disk
- 256 MB RAM
- 3½ floppy disk drive
- CD-ROM drive
- 1 Ethernet TCP/IP 10baseT/100baseTX port (RJ45 interface)
- 2x12 Mbit/s USB ports
- 3 COM serial ports (2 RS232 and/or 1 RS422/485)
- 1 parallel 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 10 to 90% without condensation
- Overall dimensions (L x H x D) 395 x 294 x 100 mm
- Weight 8 kg

Num Power CNC

Technical Specifications

Panels PC Panels

Compact IPC - Dimensions and cutout



PC Panel Screens

FS151



FS151KBD



They are intended for use with a standard or industrial PC, making up a powerful and ergonomic control panel, particularly with the new Num HMI interface (see page 4/18).

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)**
- **FS151KBD: (P/N APPC 000784)**

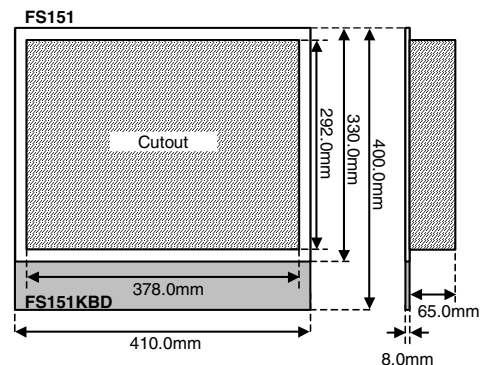
Characteristics

- 15" 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 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)

FS151	410 x 330 x 65 mm
FS151KBD	410 x 400 x 65 mm
- Weight

FS151	5.2 kg
FS151KBD	5.8 kg
- Max distance from the PC 5 to 10 m
up to 100 m with signal amplifier

FS151 and FS151KBD - Dimensions and cutout



Num Power CNC

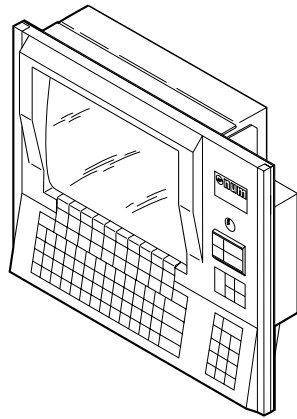
Technical Specifications

Panels Operator Panels

CP30F Operator Panel

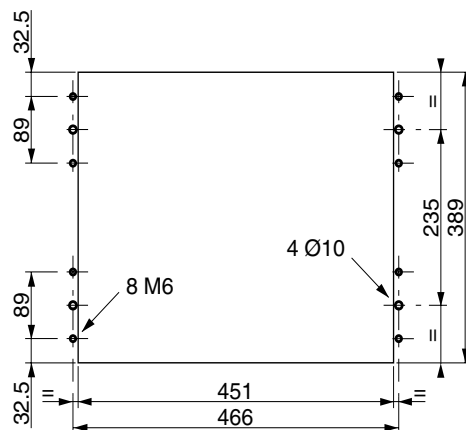
With its large LCD display unit and complete Qwerty keyboard, the CP30F panel (P/N **C999 000 782**) is very agreeable to work with, especially for keyboard-intensive jobs.

- 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 3/13)



Characteristics

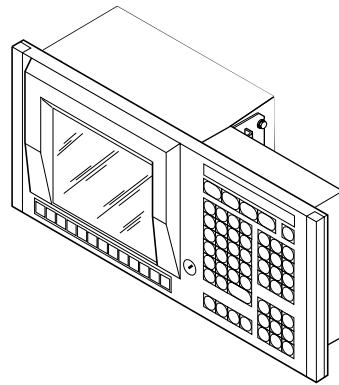
- Power supply voltage 24 VDC; +10%; -15%
- Power consumption 40 W
- Operating temperature range 5°C to 55°C
- Storage temperature range -25°C to +70°C
- Relative humidity, noncondensing 5% to 85%
- Overall dimensions (L x H x D) 483 x 399 x 92 mm
- Weight 7,5 kg
- Max. distance from CNC 40 m



CP20F Operator Panel

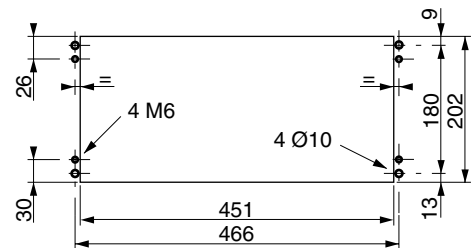
The CP20F operator panel (P/N **C999 000 781**) is smaller and has a keyboard with 50 keys.

- 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 3/13)



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



Num Power CNC

Technical Specifications

Panels

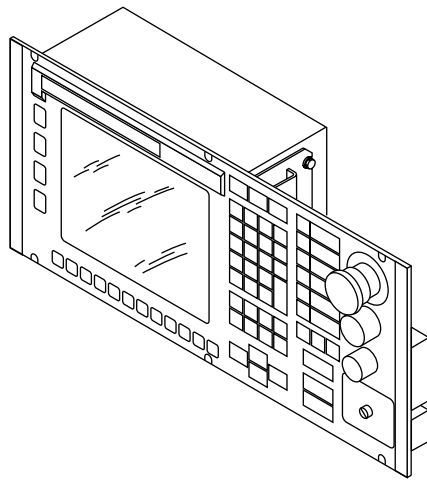
Compact Panel

Portable Operator Panel

CP10F Compact Panel

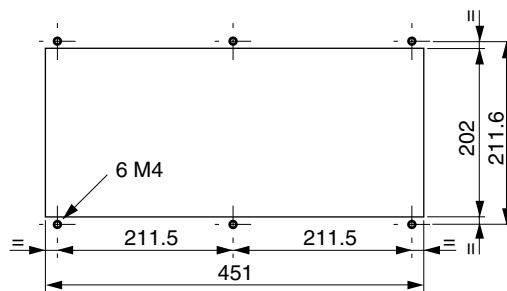
The CP10F compact panel (P/N **C999 000 780**) combines operator functions and machine functions

- 8.4" TFT active matrix color LCD display unit
- Requires a panel controller card
- A keyboard (P/N **C999 000 248**) facilitates ISO program entry and editing.



Characteristics

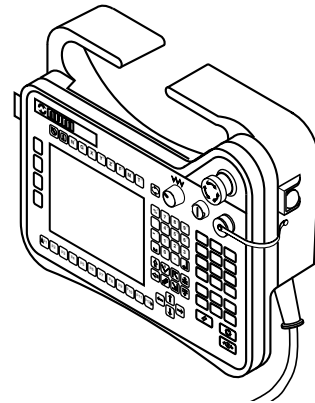
- | | |
|------------------------------------|--------------------|
| • Power supply voltage | 24 VDC; +10%; -15% |
| • Power consumption | 30 W |
| • Protection class | IP 65 |
| • Operating temperature range | 5° to 55° |
| • Storage temperature range | -25° to +70° C |
| • Relative humidity, noncondensing | 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 **C... 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

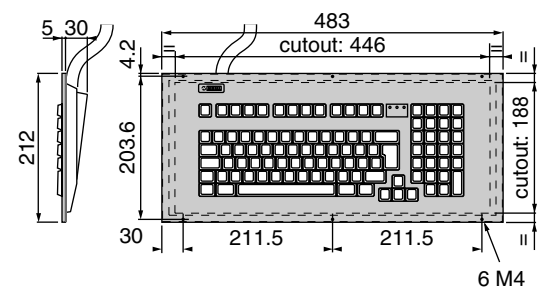


Characteristics

- | | |
|---|--------------------|
| • 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 |

PC QWERTY keyboard

- Standard PC keyboard with IP54 protection (front), IP20 (rear)
- Designed for use with CP10F, CP10 and MP10 compact panels and POP portable operator panel.
- Overall dimensions:



Num Power CNC

Technical Specifications

Panels

Operator Panel with Separate Keyboard

FS20 Operator Panel

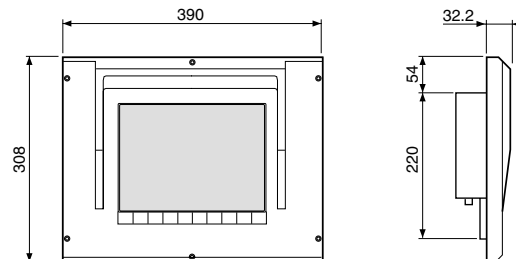
This panel is provided in two separate parts for improved ergonomics:

- The FS20 highly legible 10.4" active matrix TFT display unit (P/N C... **000 484**)
- The KBD30 QWERTY CNC keyboard with additional keys for the CNC functions (P/N C... **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.

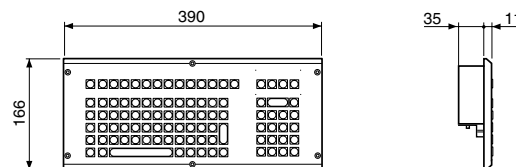
Characteristics

- 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



MP02 Machine Panel

The MP02 (P/N C... **0004 86**) machine panel is used for control of manual movements, production initiation and manual intervention during production.

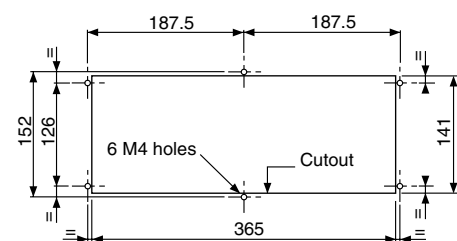
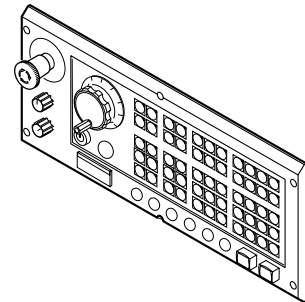
It has the same design as the FS20 operator panel. It includes:

- 55 reassignable momentary action keys with built-in LEDs
 - 2 potentiometers for feed rate and spindle speed override
 - Optional handwheel (P/N C... **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

MP 02



Num Power CNC

Technical Specifications

Pupitres Pupitre machine

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 12 KBD (P/N **C999 558 120**)
- MP03 panel - 483 mm, designed for use with Num iPC 15 KBD panels and CP30F and CP20F operator panels (P/N **C999 558 220**)

It includes:

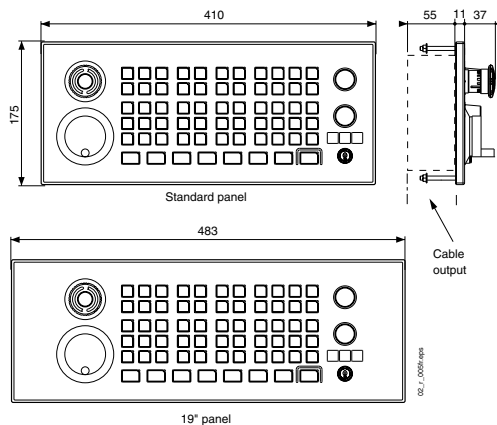
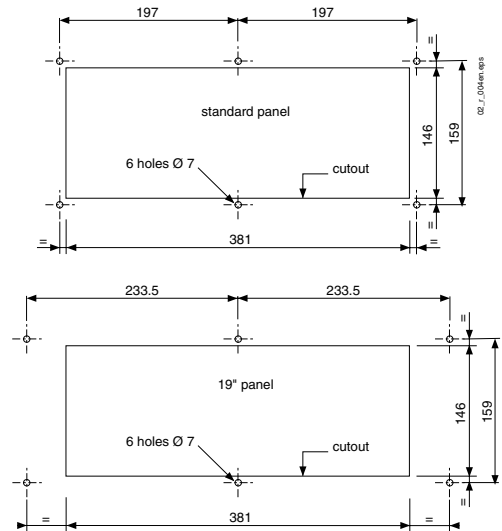
- 55 configurable keys with LEDs
- 2 potentiometers for spindle speed and feed rate override
- 1 handwheel
- 1 emergency stop button
- 1 three-position key switch
- 3 controls: Cycle start, Cycle stop and Reset
- 5 keys for additional functions with LEDs

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

Characteristics

- Nominal voltage (external power supply) 24 VDC; +20%; -15%
- Min/max values 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

Cutout



Num Power CNC

Technical Specifications

Panels

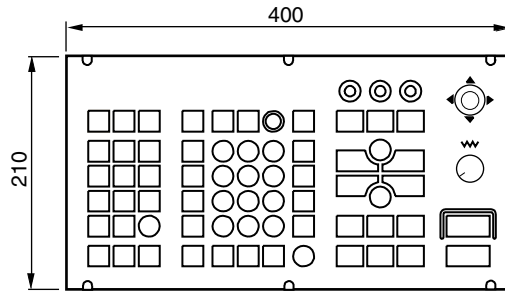
Num Power *Mplus* and *Tplus* Panels

Num Power *Mplus* and *Tplus* are intuitive milling and turning CNCs which combine the flexibility and user-friendliness of a conventional machine with the accuracy and productivity of a CNC machine.

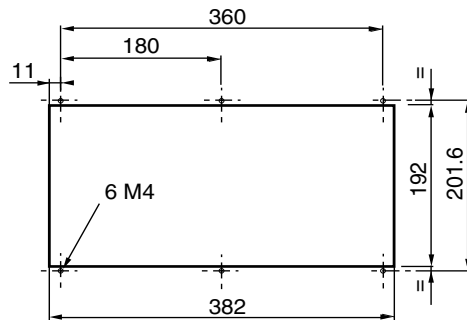
Based on a Num Power 1040 platform, they include a special panel and software including:

- A special separate keyboard dedicated to teach-in including machining mode selection keys, data entry keys and machine control keys
- A separate screen, either 9" monochrome (MS20), 10" color (CS20) or 14" color (CS30)

Num Power *Mplus* and *Tplus* keyboards

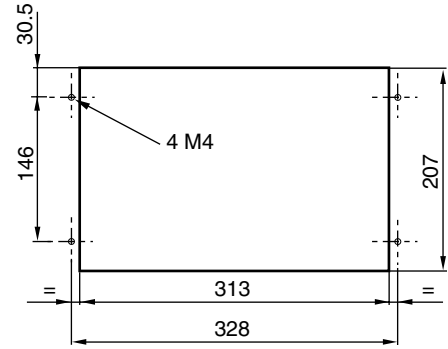


- Overall dimensions (WxHxD) 400 x 210 x 130 mm

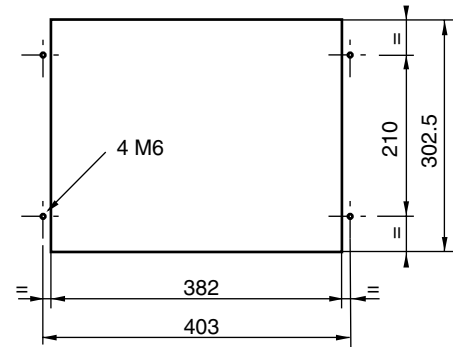


Num Power *Mplus* and *Tplus* Screens

Cutout for installation of the 9" monochrome (MS20) and 10" color (CS20) CRTs



Cutout for installation of the 14" color (CS30) CRT.



Num Power CNC

Technical Specifications

Remote Input/Output Modules

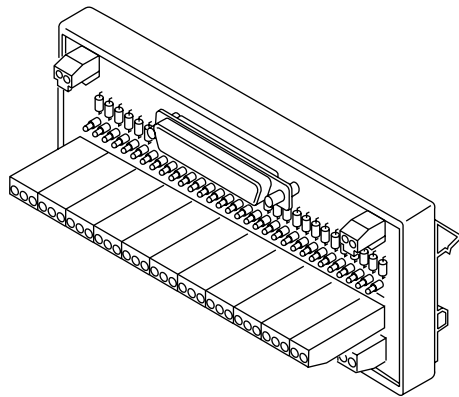
Interface Modules

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

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

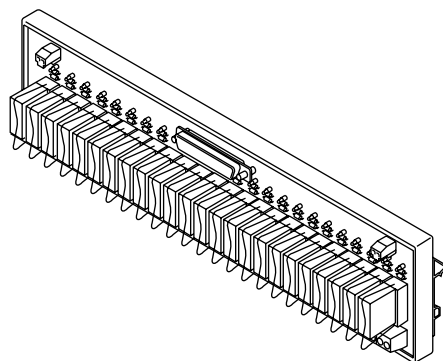
32-Input Interface Module

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



24 Output Relay Modules

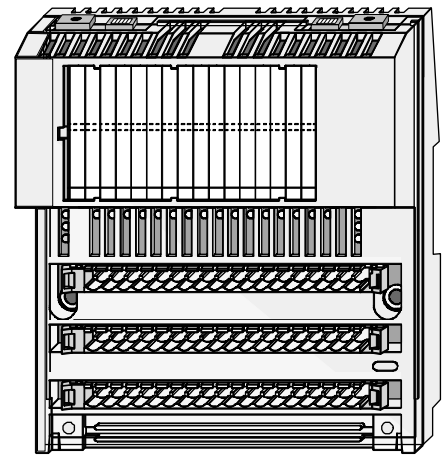
- Power consumption (all outputs switched) 19.2 W
- Overall dimensions (WxHxD) 376 x 98 x 69 mm
- Weight 1.05 kg



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.

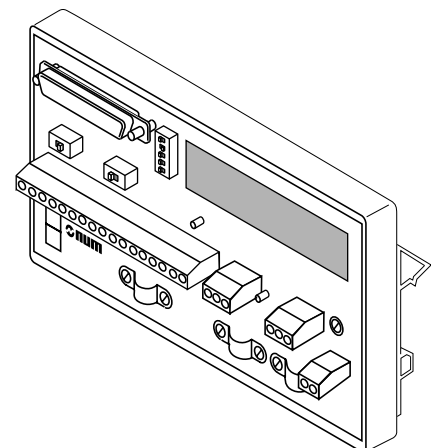


- Overall dimensions (WxHxD) 125 x 142 x 60 mm
- Wiring is facilitated by removable connectors and busbars.
- Connection to the basic rack is by fiber-optic cable.

Axis Interface Module

This interface module 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.

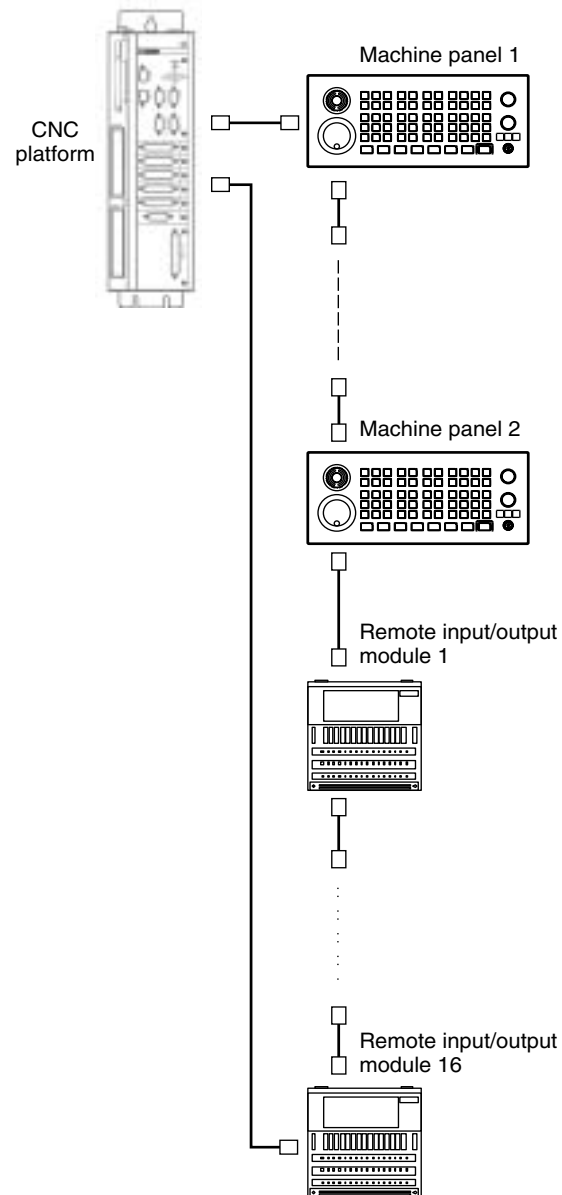


- Overall dimensions (WxHxD) 160 x 86 x 53 mm

Num Power CNC

Technical Specifications

Multiplexer Module and Associated Configurations



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.

Num Power CNC

Functional Specifications

Table of Contents

CNC Architecture	Page
Functional Diagram of a CNC	4/3
<hr/>	
Servosystems	
Analog Servosystems	4/4
Acceleration and Deceleration Control	4/4
Look-Ahead Function	4/4
<hr/>	
Axis Functions	
CNC, PLC, Linear and Rotary, Positioning and Interpolated Axes	4/4
Interpolation on 5 to 9 Axes, Helical Interpolation	4/5
Smooth Polynomial and Spline Interpolation, Spline Interpolation with 3D Curve Smoothing	4/5
NURBS interpolation	4/5
Axis Calibration and Interaxis Calibration	4/5
Duplicated and Synchronized Axis Function	4/5
Synchronized Axis Monitoring Unit	4/5
Multigroup/Multichannel Function	4/6
Inclined Axes	4/6
Measurement	4/6
Backlash Compensation on Reversal, Temperature Compensation	4/6
Adjustable Minimum Programmable Units	4/6
Inch/Metric Units	4/6
Ball-Bar Function	4/7
<hr/>	
Spindle Functions	
Spindle Operation	4/7
Speed Control	4/8
Control and Measurement	4/8
Automatic Spindle Speed Range Search	4/8
Constant Surface Speed	4/8
Thread Cutting	4/8
Spindle Indexing	4/8
C Axis and Coordinate System Conversions	4/8
Spindle Synchronization	4/9
Rigid Tapping	4/9
<hr/>	
PLC Functions	
CNC/PLC Exchange Area	4/10
PLC Memory	4/10
Programming in C, in Ladder Language	4/10
Inputs/Outputs	4/11
<hr/>	
Tool Management	
Tool Axis Selection	4/12
Tool Offsets, Dynamic Tool Compensation	4/12
Turning Tool Offsets	4/12
Milling Tool Offsets	4/13
3D Tool Offsets	4/13
<hr/>	
Machining Cycles	
Milling and Pocket Cycles, Probing Cycles for Milling Machine	4/14
Inclined Plane Machining	4/15
RTCP Function	4/15
N/M Auto Function	4/15
High Speed Machining Function	4/16
Mixed Machine Function	4/16
Turning Cycles, Probing Cycles for Lathe	4/16
Polygon Cutting Cycles	4/16
Customized Cycles	4/16

NumPowerCNC

Functional Specifications

Table of Contents

Program Interrupts and Branches

On-the-Fly Measurement Acquisition	4/17
Backtrack along Path	4/17
Emergency Retraction	4/17

Man/Machine Interface

Num HMI for PC Panel	4/18
Num HMI Kit Package for PC	4/18

Part Programming

Visual Tool - Programming, Simulation and CAM	4/19
Part Program Memory and Resident Macros	4/20
Entering Programs from the Panel	4/20
Loading Programs	4/20
Editing a Stored Program	4/20
Selecting the Dimensioning System: Datum Shifts	4/21
Dynamic Software Switches	4/21
Main Functions	4/21
Format - ISO/EIA Language	4/21
Subroutines	4/22
Parametric, Structured Programming	4/22
Construction of a Contour Table, Transfer of Active Settings	4/22
Scaling Factor, Angular Offset	4/22
Index Table Eccentricity Function	4/23
Profile Geometry Programming	4/23
PROFIL	4/23
2D and 3D Graphic Display	4/23
Hard Copy of Screen	4/23
Machine Messages	4/24
CNC Messages	4/24
PROCAM Interactive Language	4/24
NUMAFORM	4/24
Num Power <i>Mplus</i> , Num Power <i>Tplus</i> Interface	4/25

System Integration and Customization

Fully Open Products for the OEM	4/26
PC Functions	4/26
PROCAM Interpreter	4/26
Resident CNC Utilities	4/26
Dynamic Operators	4/27
C Compiler	4/27
Tools under Windows	4/27
Data Backup	4/27
SETTool	4/27
PLCTool	4/28
NUMBackUp	4/28
PersoTool	4/28
PCToolkit	4/28
MMITool	4/28

Communication

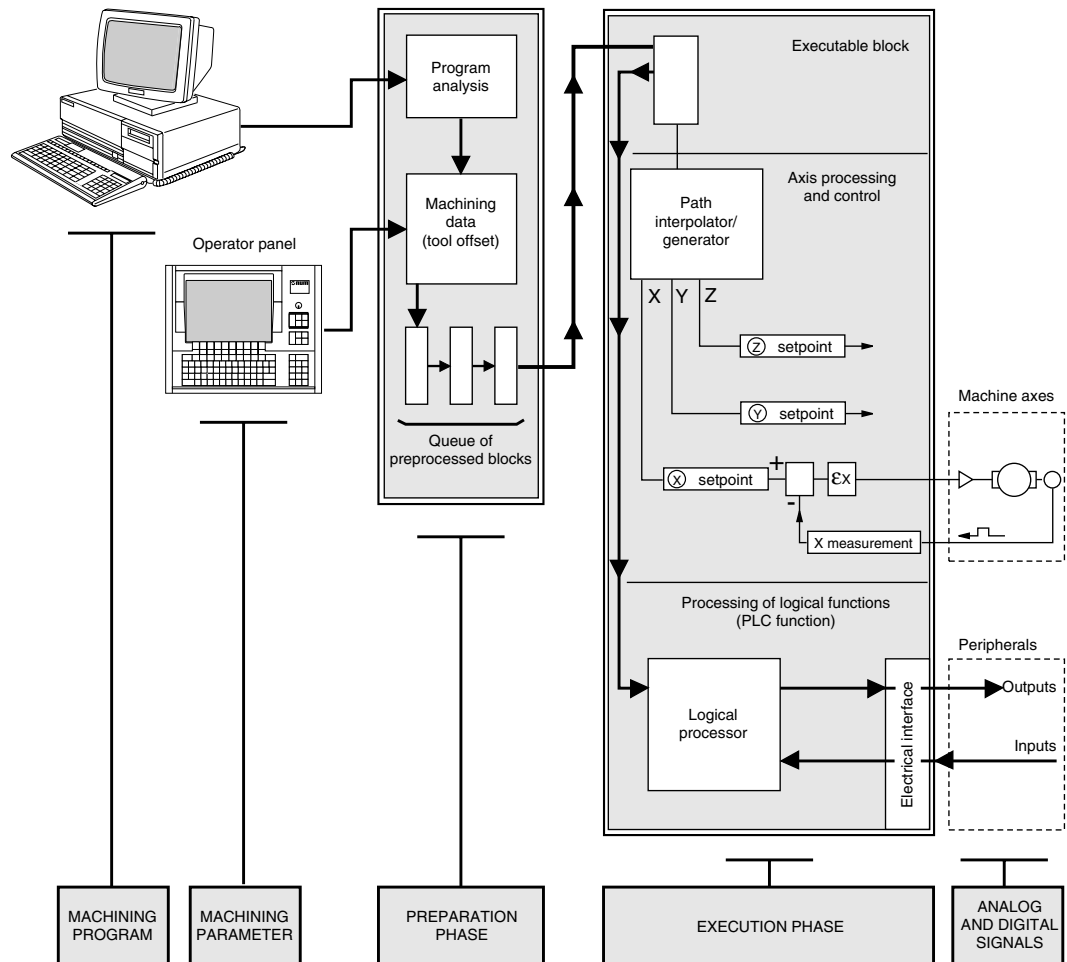
PC Panel/CNC Link	4/29
Serial Lines	4/29
Processor Interchange	4/29
Connection to a Uni-Telway Network	4/29
Connection to a Fipway Network	4/29

NumPowerCNC

Functional Specifications

Architecture of a Numerical Control

Functional Diagram of a CNC



Inputs

The CPU of the CNC contains:

- The part machining program
- The machining parameters, i.e.:
 - The tool offsets
 - The tables of parameter settings of the machining program
- The electrical spindle and axis speed and position measurement signals from the sensors installed on the machine
- Logical status signals from the peripheral devices.

Preparing the Data

Once the data have been entered, the CNC:

- Analyzes the machining program
- Reads the machining parameters to adjust the data analyzed
- Queues the preprocessed data blocks to ensure continuity of machining movements.

Processing the Data

The data contained in the active data storage stage is used for processing and monitoring the axes and spindles and controlling the machine auxiliary components.

The axis processing and monitoring functions are handled by interpolators, whose function is to ensure distribution of the increments on all the axes to follow the path.

The increments generated by the interpolators (CNC position) are compared with the measurement increments returned by the sensors (real position). The difference, called following error, is integrated in the axis drive motor control signal.

The auxiliary component control functions mainly include:

- Coolant control
- Definition of the spindle direction of rotation, stop and speed range
- Control of the tool carousels, palletizers, axis jogs, etc.

These functions, specific to each machine, are performed by the system PLC using sequential logic.

Analog and Digital Signals

Data processing results in signals of the following types:

- Control signals for the analog and/or digital axes
- Logical and/or analog signals for the peripheral devices.

The system can also accept logical and analog signals from external peripherals.

Num Power CNC

Functional Specifications

Servosystems Axis Functions

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.

Moving the table or tool from one point to another requires knowing:

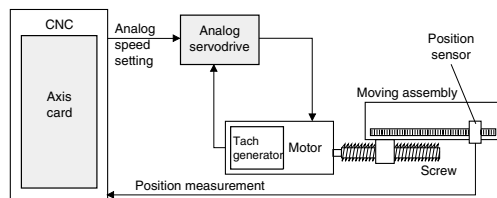
- The axis (X, Y, Z, etc.) on which the movement is to be made
- The coordinates of the end point
- The direction of movement (positive or negative)
- The speed of movement on the axis.

Analog Servosystems

The speed loop is wired to the servodrive input and processed by the servodrive.

The feedback loop is processed partly by the CNC, which receives the measurement, and partly by the servodrive, which converts the analog voltage output by the CNC to a current which drives the motor.

Analog servosystem (Fig. 1)



Acceleration and Deceleration Control

This function provides separate control of accelerations at the work rate and the traverse rate. It uses a 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.

CNC Axes

P/N C...000 373: Additional 5 V TTL analog measurement ports with respect to the standard version

These ports 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 C...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 which cannot be directly modified. 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.

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

For rotary axes, the internal system resolution is 0.0001 degree.

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

Linear axes are programmable by micrometer for a maximum travel of 100 meters.

Rotary axes are programmable over 360 degrees (modulo 360).

Positioning Axes and Interpolated Axes

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

During interpolation, the programmed point is reached by a linear or a clockwise or counterclockwise circular path at the programmed feed rate. In this case, the accuracy of the contour between the start and end points is ensured.

Interpolation on 5 to 9 axes

P/N C...000 531

During interpolation, the programmed axes start, move and stop together. In the basic version, four axes are interpolated simultaneously. This option extends interpolation from 5 to 9 axes.

Linear, Circular Interpolation

Linear Interpolation (G01)

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

The path is the result of all the axis movements programmed in the block.

Circular Interpolation (G02), (G03)

The programmed point is reached by a circular path.

G02: Clockwise circular interpolation.

G03: Counterclockwise circular interpolation.

Helical Interpolation

When circular and linear machining are combined, helical interpolation moves the tool axis along a helix with a constant pitch.

Helical interpolation can be carried out in the three planes and applies to the primary and secondary axes.

Smooth Polynomial Interpolation

P/N C...000 499

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

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 C...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.

Spline Interpolation with 3D Curve Smoothing (G104)

P/N C999 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 C...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.

Axis Calibration and Interaxis Calibration

P/N C...000 260

Axis Calibration Function

This function corrects the axis position according to the defects of the screw, rack or scale (entry of 2500 points for all axes).

Interaxis Calibration Function

This function corrects the position reference of an axis using 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 the milling machine.

Duplicated and Synchronized Axis Function

P/N C...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).

Num Power CNC

Functional Specifications

Axis Functions

Multigroup/Multichannel Function

P/N C...000 371

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.

The spindles declared in groups can be controlled by these programs or be released and controlled independently.

The multichannel function can be assimilated 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.

Inclined or Tilt Axes

P/N C...000 315

This software function changes the interpolator output coordinates.

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 between the X axis and the normal to the Z axis. The angle is positive or negative and is expressed in 0.001 degree.

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

Measurement Types

The inputs of the axis cards can be connected to two types of incremental sensors.

Semi-absolute/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/Incremental 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.

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 C...000 250) or axis calibration (P/N C...000 260).

Measurement Resolution

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, and for rotary axes is 0.0001 degree.

Adjustable Minimum Programmable Units

P/N C...000 519

The default internal system resolution can be adjusted according to the required accuracy and speeds of the application.

Inch/Metric Units (G70, G71)

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

Num Power CNC

Functional Specifications

Axis Functions Spindle Functions

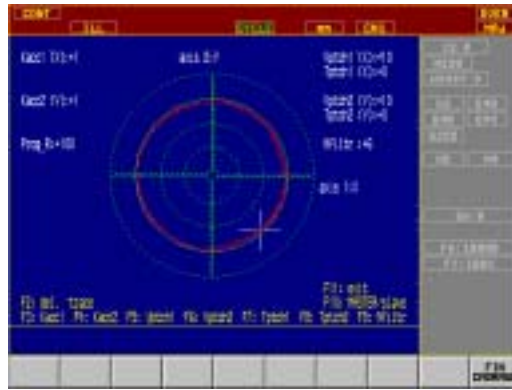
Ball-Bar Function

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:

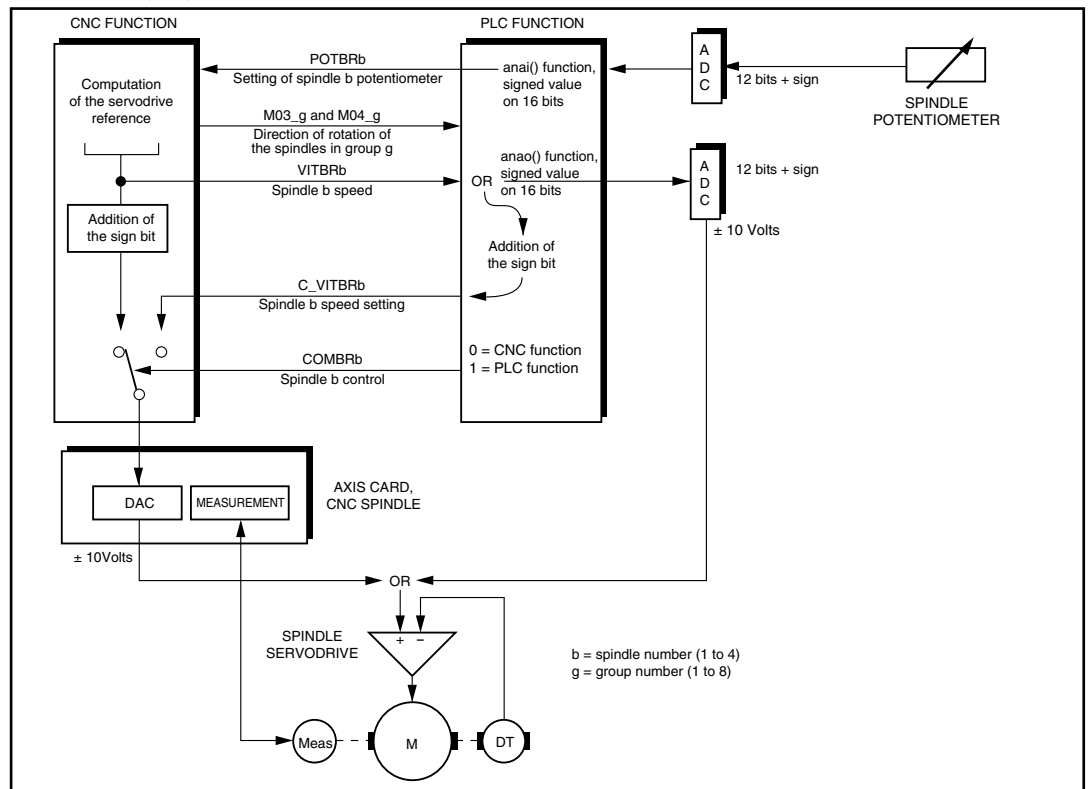
- Acceleration anticipation coefficient
- CNC reference filter time constant
- Anti-pitch compensation.

Ball-bar trace



Spindle Operation

Spindle operating diagram



Num Power CNC

Functional Specifications

Spindle Functions

Speed Control

The spindle speed programmed in the part program with the syntax S... is calculated by the CNC based on the setting of the override potentiometer (50 to 100%) and the spindle speed range. This processing allows the spindle speed setting to be output in three forms:

- Directly as a position on the axis card DAC
- On the axis card DAC after modification (setpoint and COMBRb) by the PLC program
- On the PLC card DAC (in the absence of an axis/spindle card).

Control and Measurement

P/N C...000 366; C...000 367; C...000 368; C...000 369; C...000 452

Spindle measurement is necessary for the following functions:

- Spindle indexing (M19)
- Thread cutting and tapping cycles
- Spindle synchronization
- C axis spindle function.

Automatic Spindle Speed Range Search

The system determines which one of the 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 set at initialization.

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

Constant Pitch Thread Cutting Cycle (G33, G38)

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 by degressive depths.

Thread Chasing Cycle (G31)

P/N C...000 331

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.

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.

C Axis and Coordinate System Conversions

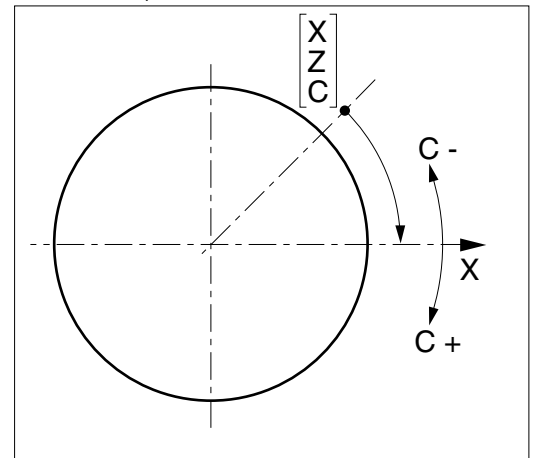
P/N C...000 340

In this turning configuration, the spindle is used as interpolated axis with one of the CNC axes (X or Z). A precision 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.

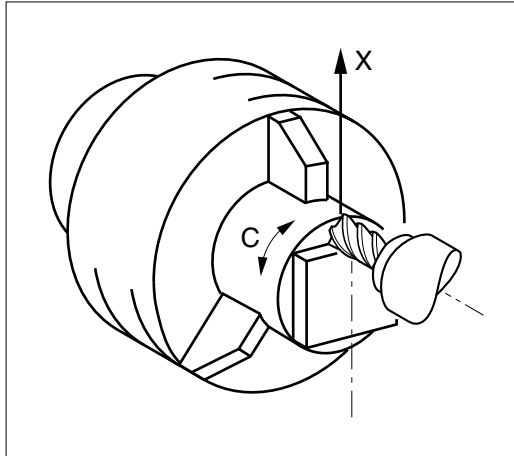
Use of G20 and polar coordinates



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

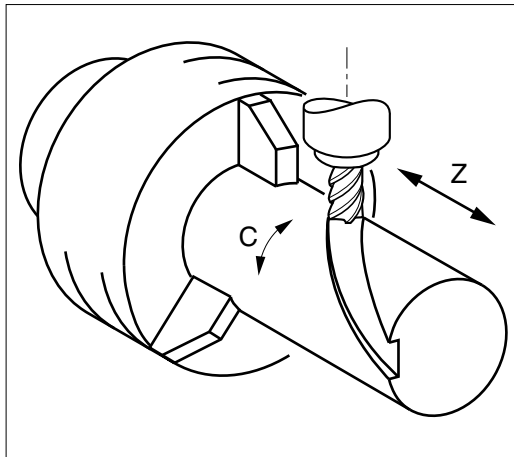


G22: Programming in X, Y and Z cylindrical coordinates

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



Spindle Synchronization

P/N C...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 C...000 332

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

The difference from tapping using a tool with axial clearance is that there is no following error.

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

Num Power CNC

Functional Specifications

PLC Functions

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.

PLC Memory

P/N C...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.

Programming in C

P/N C...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.

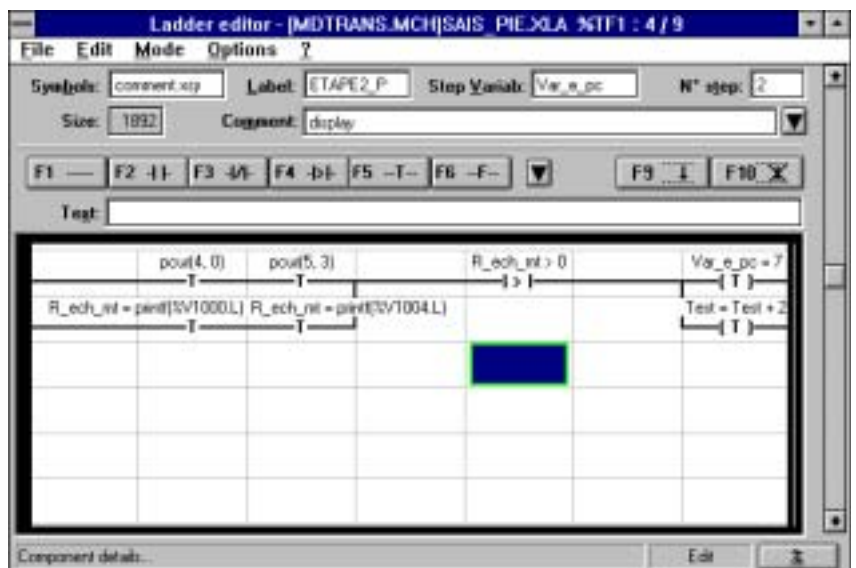
The graphic Ladder display gives good visibility into the program and facilitates debugging and error correction using the dynamic display functions.

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 Power CNC's PLC in Ladder language and debugging the programs.

Example of page programmed in Ladder language



Analog Inputs/Outputs

Analog inputs and outputs are provided in the Num CNC CPUs (see Chapter 2). Optional extension modules are available.

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.

Digital Inputs/Outputs

These modules are optional (see Chapter 2).

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.

High-Speed Digital Inputs

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.

Num Power CNC

Functional Specifications

Tool Management

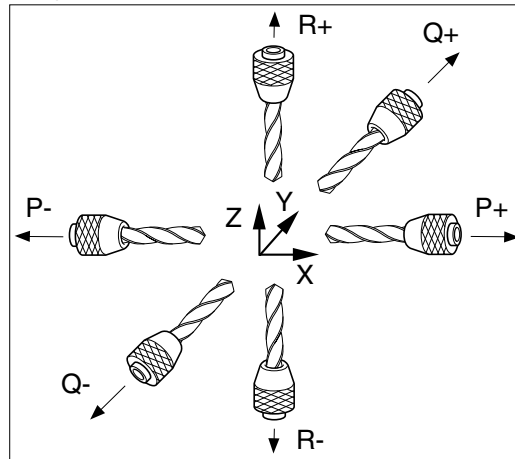
Tool Axis Selection (G16)

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.

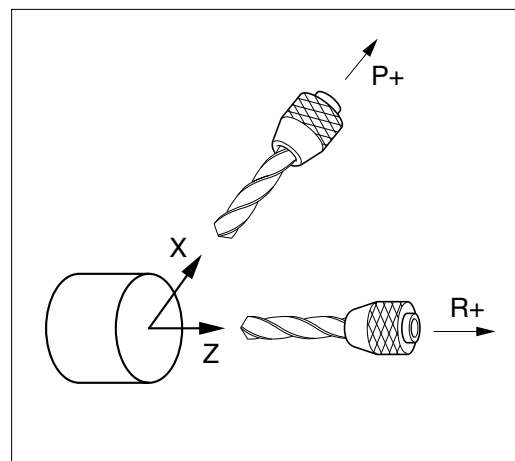
Milling tool axis orientation



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



Dynamic Tool Offsets by the PLC

P/N C...000 410 (by the PLC)

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).

Turning Tool Offsets

Tool Length Offset

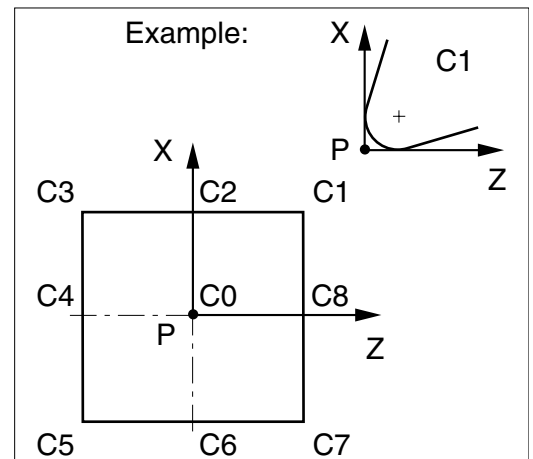
The tool length offset is assigned to the tool axis orientation defined by G16.

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



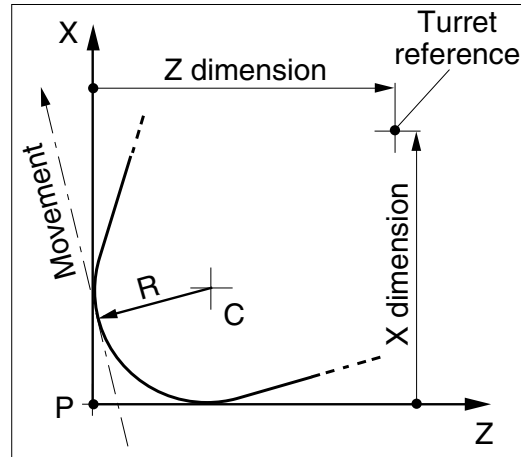
Tool Offsets

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

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

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.

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.

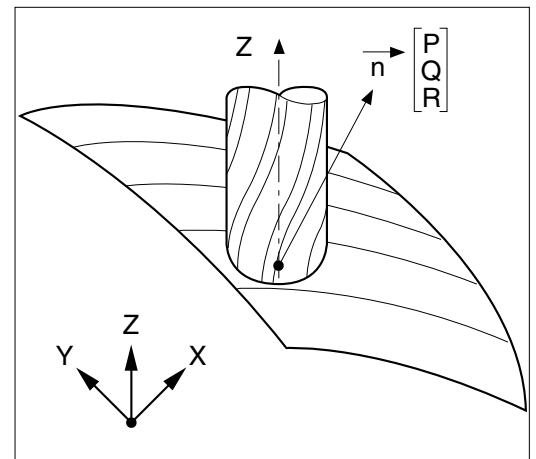
3-Axis Tool Offset (G29)

P/N C...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

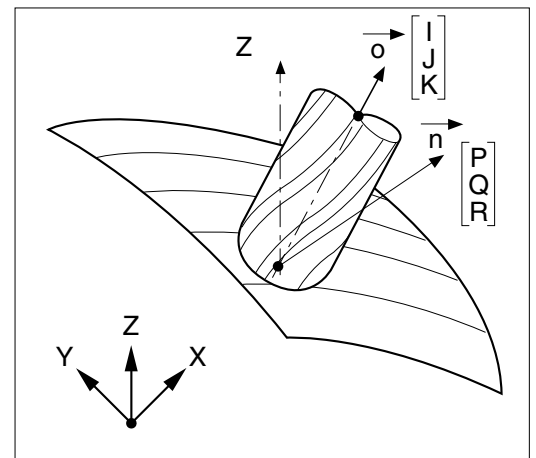


5-Axis Tool Offset

P/N C...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, a tool orientation vector defined by components I, J and K, plus, where applicable, the angles of the twist head.

5 axis tool offset



Num Power CNC

Functional Specifications

Machining Cycles

Milling Cycles

The milling cycles include all the basic canned cycles (G81 to G89) which can be called from the main machining program.

These cycles include the following functions:

- Drilling (center drilling, counterboring, peck drilling, drilling with chip breaking), tapping
- Various types of boring
- Other cycles: thread chasing, etc.

These functions 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).

Rectangular and Oblong Pocket Cycles (G45)

Cycles for Milling Machines

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.

Function G45 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.

Irregular Pocket Cycles (G46)

P/N C...000 159

Cycles for Milling Machines

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 edited.

Probing Cycles for Milling Machines

P/N C...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 balancing) 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.

Gear-Cutting Cycles (HG)

Two HG gear-cutting packages supplement the milling functions for cutting by grinding wheel or hob.

P/N C..000 596: package No. 1 intended for 3-axis machines + toolhead spindle. Includes functions G181 (synchronization between Z-axis and toolhead spindle) and G180 (cancellation of synchronization).

P/N C..000 597: package No. 2 intended for 5-axis machines + toolhead spindle. Includes functions G181, G180 and G185 (synchronization between Y-axis and toolhead spindle).

Associated with these 2 packages, the “automatic alignment” function (**P/N C..000 595**) gives the possibility of reworking the machined part. This function can also prove very useful for solving tooth alignment problems when two gears are cut on the same shaft.

A graphic, interactive HMI is available to create machining programs.

P/N C..000 592: PROCAMHG - interactive programming for gear cutting (only in English).

Num Power CNC

Functional Specifications

Machining Cycles

Inclined Plane Machining (G24)

P/N C...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.

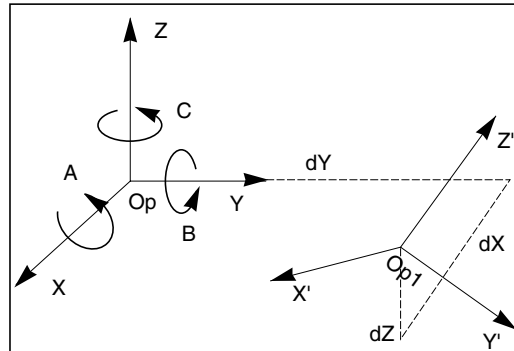
All the functions are preserved: L and R tool offsets, canned cycles as well as control of speed and feed, acceleration and travel.

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 X Y Z
Op1 new workpiece origin

RTCP Function (G26)

P/N C...000 154

Rotation around Tool Center Point

This function 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.

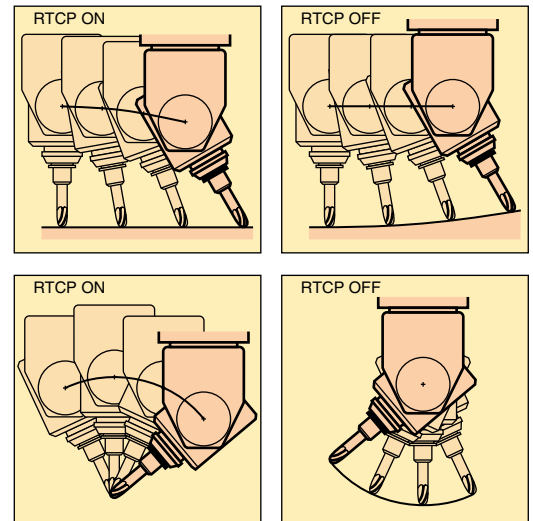
The RTCP function is installed using a PC installation program running under Windows and supplied with the option.

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 C0 ... 914 is integrated with this option.

RTCP ON and RTCP OFF.



N/M Auto Function

P/N C...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.

Num Power CNC

Functional Specifications

Machining Cycles

High Speed Machining of Precision Contours (UGV1)

P/N C...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
- Automatic offset correction on analog servodrives
- 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 the difficulties 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.

Mixed Machine Function

P/N C...000 581

The following turning functions are added to the milling software to control a mixed milling+turning machine:

- Axis/spindle servocontrol
- Support of a radial axis (boring)
- Cartesian/polar coordinate conversion
- Turning cycles
- Double-windowing graphics.

Turning Cycles

The turning cycles include all the basic canned turning cycles (G33, G38, G63-G68, G81-G85, G87 and G89) which can be called from the main machining program.

These cycles include the following functions:

- Sequenced tapered constant lead face-turn thread cutting
- Groove roughing, face-turn roughing, plunging
- Drilling (center drilling, counterboring, peck drilling, drilling with chip breaking), tapping
- Boring with or without dwell.

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

Probing Cycles for Lathe

P/N C...000 590

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.

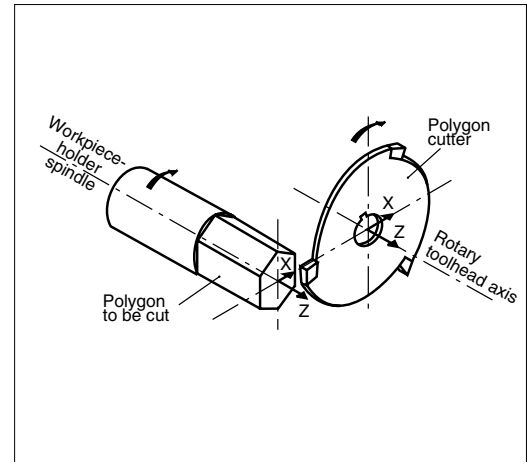
Polygon Cutting Function

P/N C...000 538

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



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 G or M functions not used in system programming.

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.

On-the-Fly Measurement Acquisition (G10)

P/N C...000 520

Application of a signal to a high speed logic input of the PLC causes the programmed 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 C...000 523

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

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 before the point where feed was stopped, the initial mode is restored when 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.

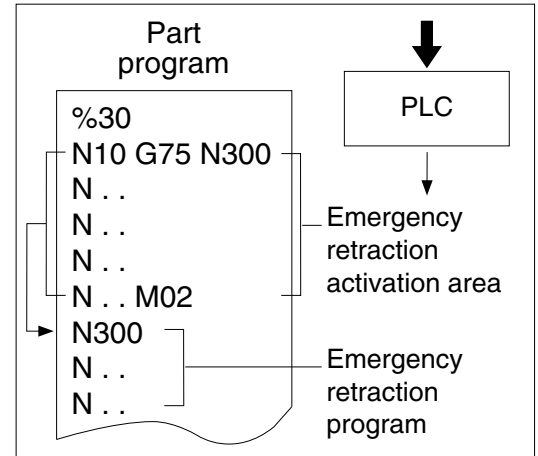
The automatic axis recall function can be used in intervention mode. In this case, the points on the manual backtrack path are stored (maximum 10 points) and restored in the same order in the axis recall phase at traverse rate, up to a programmable distance from the restart point.

Emergency Retraction (G75)

P/N C...000 505

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

Example:



Num Power CNC

Functional Specifications

Man/Machine Interface

Num HMI for PC Panel

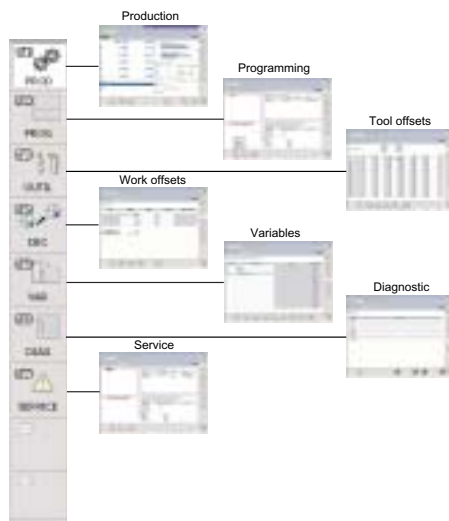
The iPC panels can benefit from a brand new human/machine interface, Num HMI, developed in HTML. It can be used as is or modified using standard tools: HTML, Java, Visual Basic, Visual C, or C++ editors.

The interface includes seven contexts tailored to the needs of each type of work on the machine:

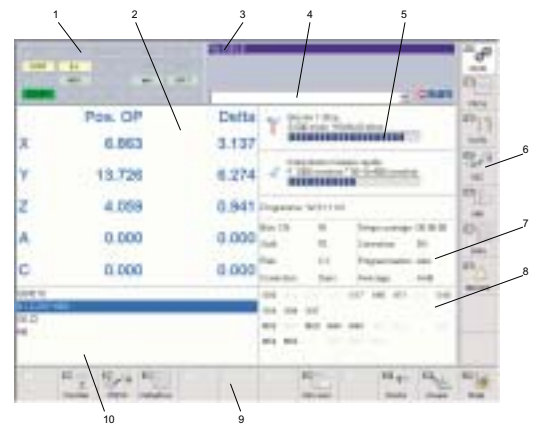
- **Production** context for using the machine
- **Programming** context for writing part programs
- **Tool Offsets** and **Machine Offsets** contexts for adapting the CNC to the application
- **Variables** context for control and debugging
- **Diagnosis** and **Service** contexts for maintenance and integration technicians.

An easily recognized icon is associated with each of these contexts. The seven icons are grouped in a context bar which is always displayed and accessible along the right-hand side of the screen.

The screens for each page are divided into several other readily identifiable sections.



- 1 - CNC status
- 2 - Axis positions
- 3 - CNC, PLC, system and error messages
- 4 - Command line used in MDI (Manual Data Input), SEARCH and HOMING (main window) modes
- 5 - Axis and spindle data
- 6 - Context bar
- 7 - General information
- 8 - Active functions
- 9 - Toolbar specific to the context or CNC function
- 10 - Block being executed



Num HMI Kit for PC Panel

P/N APSW 182 111

This software package on CD-ROM includes:

- The new Num HMI interface
- PERSOTool (see page 4/28)
- PC Standard MMI
- NumBackUp (see page 4/28).

Num HMI Kit must be ordered specially.

Num HMI is not available with the conventional CNC panels.

Num Power CNC

Functional Specifications

Part Programming

Visual Tool: Programming and Simulation

Only available with PC, medium modular iPC and Compact iPC panels fitted with the Num HMI interface, Visual Tool (P/N C.200 073) is compatible with the turning (2 axes), milling (3 axes), woodworking, cylindrical and surface grinding cycles. Accessible directly from the CNC HMI, this option comprises a particularly user-friendly and tutorial 2D editor, and a 3D simulation of the part program.

The 2D editor supplies the user with all design tools (ruler, compass, protractor, calculator, layers, etc.) to rapidly create a profile: with a wide range of functions, it is easy to draw circles, segments, fillets, etc. and correct the drawing.

The 3D simulator gives a particularly realistic view of the machine: rack, workpiece-holder, turret, tool shape, etc. The display/hide each element, zoom, wire frame or pass/tool display, rotation, etc. functions, make movements and potential collisions easy to visualize.

With the Backplot module, VisualTool can also simulate part programs written in Num ISO.

Visual Tool Advanced: a veritable CAM

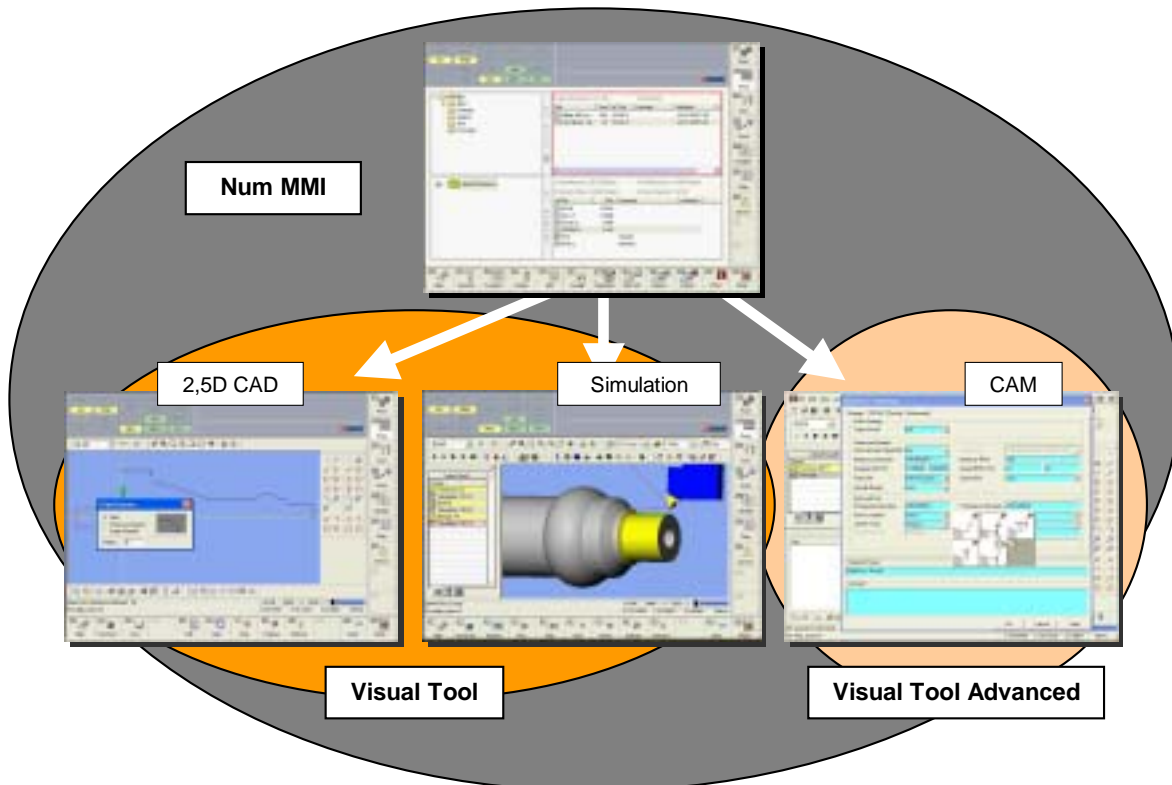
Visual Tool Advanced (P/N C.200 074) opens the Num Power CNCs to the turning (2 axes) and milling (3 axes) CAM functions. This integration makes it possible to use the menu and pictogram to:

- choose machining cycles (face milling, contouring, pocket, drilling, etc.),
- define machining strategies (cutting speed, pass and finishing depth, etc.),
- select approach and retraction strategies (helical plunge on Z for glass, etc.).

Thanks to the associated post-processor, these CAM functions can generate and manage the full functionality of Num cycles.

In addition, Visual Tool Advanced accepts the import of CAD-generated DXF and IGES files. Thus the (upstream/downstream and downstream/upstream) continuity of the digital chain for part creation is guaranteed; this ensures greater data transmission security and very high programming speeds.

The Visual Tool Advanced option requires availability of the Visual Tool option.



NumPowerCNC

Functional Specifications

Part Programming

Part Program and Macro RAM

P/N **C...000 341**

32 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 in 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)

The editing mode is used to display, edit or delete programs.

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

The programs can be edited in background mode.

Programming by Teach-in

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.

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 "I".

Loading Programs

The tool dimensions and part programs can be loaded from peripherals (magnetic tape, 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 read from a peripheral or a computer.

Certain restrictions concerning branches, subroutines and emergency retraction blocks apply to programs executed in 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 modesl.

Num Power CNC

Functional Specifications

Part Programming

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)

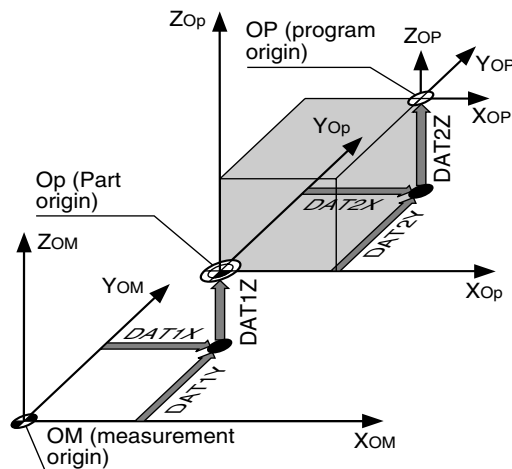
The measurement origin is a suitable point defined on each axis which sets the absolute measurement origin or zero point. The coordinates of this point can be entered or modified in special machine parameters.

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

Canned turning, milling, grinding and gear cutting 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.

Num Power CNC

Functional Specifications

Part Programming

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 C...000 535

Structured programming and symbolic variables make 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 C...000 536

This high-level programming function is used to create tables for storing 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 C...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 C...000 506

The scaling factor is entered from the keyboard 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 C...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: drilling of holes spaced on a circle defined by its radius.

Index Table Eccentricity Function

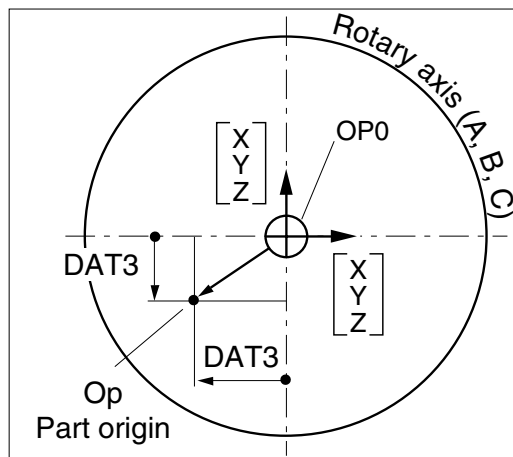
This function applies to the A, B or C rotary axes.

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 function



Profile Geometry Programming PGP®

This special ISO programming language allows 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 insertion or contact 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 C...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, crosswise and perpendicular to the axis selected.

This function is available for ISO programming and PROCAM.

Hard Copy of Screen

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

Num Power CNC

Functional Specifications

Part Programming

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 in the data placed 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 module of a PCNC system or message sent with wait for a reply.

PROCAM Interactive Language

Part programs are written interactively using figures and canned cycles. Four dedicated modules are available:

- PROCAM MILL (single-slide milling)
P/N **C...000 113** and P/N **C...000 238**
- PROCAM MX (mixed turning+milling machine)
P/N **C...000 134**
- PROCAM TURN (turning)
P/N **C...000 113** and P/N **C...000 239**
- PROCAM MULTITURN (multislide milling)
P/N **C...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 C...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 distributed on 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.

Num Power CNC

Functional Specifications

Num Power *Mplus*/Num *Tplus* Interface

Num Power *Mplus*/Num *Tplus* Interface

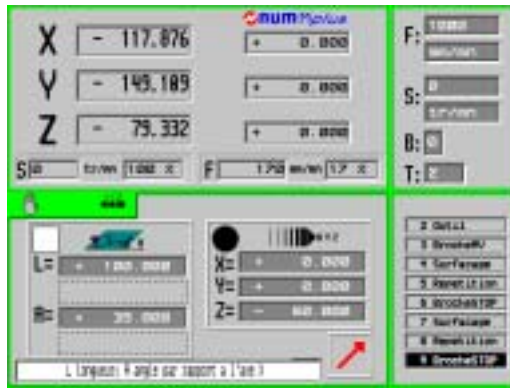
Milling and Turning by Teach-in

Num Power *Mplus* and Num Power *Tplus* are readily accessible to both skilled operators and beginners to allow them to familiarize themselves gradually with machining modes and machine control.

Manual Mode

Machining is carried out with the handwheels in exactly the same way as on a conventional milling machine or lathe:

- For milling: turn/face operations are performed using the three handwheels.
Linear and circular interpolation in the plane are carried out with a single handwheel.
- For turning: the handwheels are used for turning, facing and taper turning with the use of programmable limit switches where necessary.



Enhanced Manual Mode

Several machining operations with tool retraction are available to the operator:

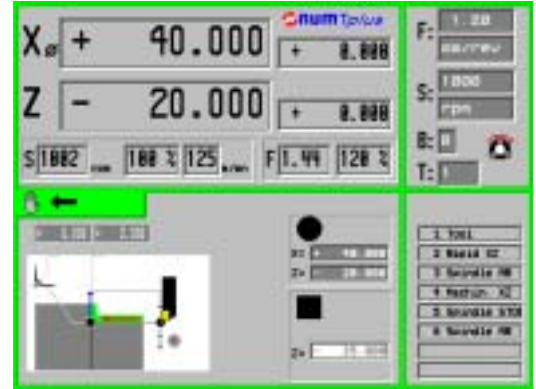
- For milling: uni- and bidirectional face milling, linear and single-axis contouring, linear and circular end milling, tapping and boring, pocket and island machining.
- For turning: facing, turning, taper turning, blending, grooving, threading and contouring.

Automatic Cycle Mode

In automatic cycle mode, the following machining operations are carried out by automatic roughing and finishing cycles:

- For milling: uni- and bidirectional face milling, linear and single-axis contouring, linear and circular end milling, pocket and island machining, drilling, tapping and boring, single point profiling. Patterns (linear, rectangular and circular) are available for all these cycles.
- For turning: facing, turning, taper turning, blending, grooving, threading and contouring.

Automatic copy mode



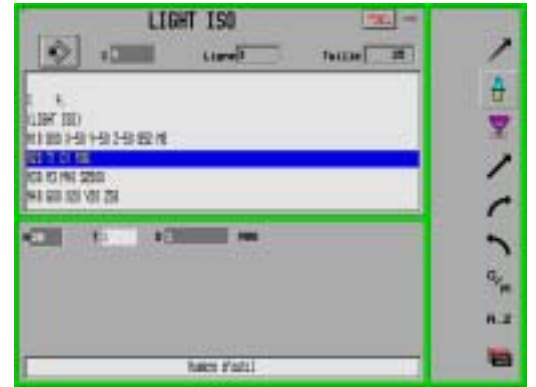
The automatic machining function is used to produce batches of parts identical to the reference part, ensuring a high degree of precision and quality.

Light ISO Editor

P/N C...000 412

Machining programs are created by selecting machining operations displayed by icons. Automatic generation of preformatted ISO blocks avoids syntax errors and saves considerable time.

This option also allows graphic simulation of the tool path, part program load and unload, and execution of ISO part programs written for other CNCs of the Num Power 1000 family.



Full ISO Editor

P/N C...000 593 (includes option P/N C...000 412)

Used in conjunction with a CP30F operator panel or an FS20 operator panel + KBD30 keyboard replacing the screen, the Num Power *Mplus* and Num Power *Tplus* CNCs give access to all ISO functions for creation, editing and graphic simulation of part programs.

Num Power CNC

Functional Specifications

System Integration and Customization

Fully Open Products for the OEM

The CNCs of the Num Power 1000 line 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:

The New Num HMI Human/Machine Interface

- Developed in HTML, Num 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 macro programs, especially the cycles called by G functions in the user part program, can be used to edit the basic cycles or create new ones
- Structured programming makes the cycles easier to read and edit.

For System Integration

- Utility 12 or the PERSOTool software facilitate reconfiguration of the system options by transmission of an option key via high speed communication links;
- PLCTool for Ladder language, the C language and its compiler are used to write the PLC programs on a PC;
- SETTool is used on a PC for setting the servosystems.

PC Functions

Equipped with a PC panel, Num Power 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 extensive communication capabilities and memory space
- user-friendly, with 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.

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 (see page 4/20).
- **Utility 20:** Interaxis calibration (see page 4/5).

Num Power CNC

Functional Specifications

System Integration and Customization

Dynamic Operators

P/N **C...000 250**

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

It uses simple operations to perform real-time computations used 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 at 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 **C...000 249**

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

C Language Compiler

P/N **C 999 082 026**

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).

Tools under Windows

A set of integration tools for use on the Num iPC panel or a external PC are available from Num.

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

CNC Data Backup

NUMTrans (**P/N NUMTRANS**) is a utility designed for the maintenance and backup of numerical control data. It can be used to download, edit and easily transfer data to another numerical control via an RS 232 link. Thanks to a data converter, this utility runs with several generations of Num multilingual numerical controls and NUMTrans is compatible with the Windows 98/NT4/ME/2000 and XP operating systems.

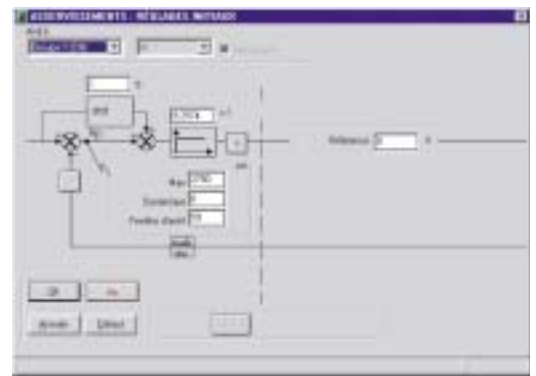
SETTool

P/N **C999 182 092**: 1 license for 32-bit SETTool
P/N **C999 182 192**: 5 licenses for 32-bit SETTool

This software, to be installed on a PC or compatible, is used for setting up analog and digital servosystems.

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 a step by step approach.



Num Power CNC

Functional Specifications

System Integration and Customization

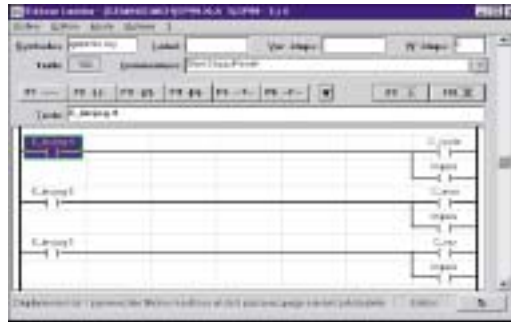
PLCTool: Ladder Language

P/N **C999 182 095**: 1 license for 32-bit PLCTool
P/N **C999 182 195**: 5 licenses for 32-bit PLCTool
P/N **C999 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



NumBackUp

P/N **C999 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.

PERSOTool

P/N **C999 182 094**: 32-bit PERSOTool

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

PCToolKit

P/N **C999 182 091**: 32-bit PCToolKit

PCToolKit facilitates development of applications running under Windows on the PC panel.

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

MMITool

P/N **C999 182 096**: 32-bit MMITool

P/N **C...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

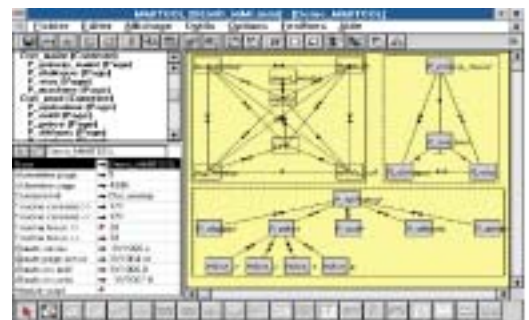
P/N **C...000 377**: MMI resource memory

P/N **C...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 written in C.



Num Power CNC

Functional Specifications

Communication

PC Panel/CNC Link

P/N **C.000 933** : Ethernet TCP/IP link

P/N **C.000 932** : HSL high speed link

Communication between the Num iPC panel and the CNC is via an Ethernet TCP/IP link or an HSL high speed line.

Serial Lines

The basic version of the Num 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.

Processor Interchange

P/N **C...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 of integration of a machine in a flexible automation system.

Connection to a Uni-Telway Network

P/N **C...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

P/N **C...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 **C...000 112**.

Motor and Servodrive Selection Guide

Table of Contents

Selection Guide	Page
General Servodrive Data	5/2
Axis Motors	5/2
Spindle Motors	5/2
Other Motors	5/2
Sensor Management	5/3
Control Functions	5/3
Anti-resonance Functions	5/3

Motor and Servodrive Selection Guide

Selection Guide - Motors and Servodrives

Num proposes a very wide range of motors for its various families of servodrives:

- Num AR Drive for Num Power CNC systems.
- Num HP Drive and Num GP Drive for Axium Power systems.

Some functions of these motors are not available with Num AR Drive servodrives. This chapter lists the characteristics and compatibilities of Num Drive motors with Num AR Drive servodrives.

	Num AR Drive	
	MDLA Servodrives	MDLS Servodrives
GENERAL SERVODRIVE DATA		
Technology	Modular	Compact
Power supply module	MDLL, MDLP or MDLS	integrated
Three-phase power supply voltage	MDLL - 400 V ± 10% - 50/60 Hz MDLP - 460 V ± 10% - 50/60 Hz MDLS - 400 V ± 10% - 50/60 Hz	400 - 460 V ± 10% - 50/60 Hz
Bus Voltage (V)	560 V	560 – 640 V
Switching frequency(kHz)	4.2 kHz	4.8 kHz
Digital control		Yes
Digital speed reference on DISC NT bus		No
Regenerative braking possible	No	Yes (option)
Emergency braking on sensor signal fault		Yes
Emergency braking on certain servodrive faults		Yes
Control of synchronous and asynchronous motors	synchronous	asynchronous
Input/output voltage		24 VDC
Protection class		IP 20
Certification		CE
AXIS MOTORS		
Types	Yes BPH, BPG, BPL, BML, BHL	No
Nominal torque (Nm)	0.4 to 139	
Maximum speed (rpm)	1500 to 8000	
Shaft/frame protection class (as per IEC 529)	BPH 055: IP 54/54 (opt. 64/54) BPH - BPG 075 to 190: IP 65/65 (opt. 67/67) BML: IP 54/65 BPL: IP 65/65 (opt. 67/67) BHL not ventilated: IP 54/65 BHL ventilated: IP 54/54	
SPINDLE MOTORS		
Types	No	Yes AMS, AMR, MSA, IM18M
Rated power S1 (kW)		3.7 to 36 (1)
Maximum speed (rpm)		6000 à 12000
Shaft/frame protection class (as per IEC 529)		AMR: IP 54/65 IM 18M: IP 54/54 (opt. 65/54)
OTHER MOTORS		
Rotary motors with any number of pole pairs		No
Direct drive motors		No
Electrospindle		No
Linear motors		No
Sensor setting with respect to the power		
With movement		No
Without movement for synchronous motors		No
Temperature probes managed		PTC and NTC

(1): For 55 kW, consult us

Motor and Servodrive Selection Guide

Selection Guide - Motors and Servodrives

	Num AR Drive	
	MDLA Servodrives	MDLS Servodrives
SENSORS MANAGEMENT		
For rotary motors		
Resolvers	Yes (1 or 3 pole pairs)	
Num and Léonord+Bauer cog wheels	No	Yes
Incremental sensors (sin and/or TTL)		
With zero mark	No	
With encoded reference	No	
Sincos® sensors (0.5 to 5Vpp), 1 Vpp, 2 Vpp, 4 Vpp	No	
Incremental sensors (absolute on one revolution)	No	
Absolute sensors on several revolutions	No	
For linear motors		
Incremental sensors (sin and/or TTL)		
With zero mark	No	
With encoded reference	No	
Absolute linear encoders	No	
Additional sensors	No	
Miscellaneous		
Compensation of sinusoidal sensor signals	Yes	
Encoder simulation	Yes (Resolver)	Yes (cog wheels)
Hall effect sensor management	No	
CONTROL FUNCTIONS		
Current loop cycle times (µs)	238	212
Tandem functions		
Backlash compensation	Yes	No
Torque synchronization	No	
Torque reference duplication	No	
Parameter sets (on-the-fly switching)	Yes - 2 sets	
Dual measurement	No	
ANTI-RESONANCE FUNCTIONS		
Notch filter (band rejection)		
On the current loop	Yes	No
On the speed loop	No	
Active damping	No	

Num Drive Motors

Table of Contents

BPH, BPG, BPL, BML and BHL Axis Motors	Page
General	6/2
Applications	6/2
General Characteristics	6/2
Parking Brake	6/3
Notes on Motors	6/3
Motor Identification	6/5
Detailed Technical Specifications	6/8
Overall Dimensions	6/8
Prewired for Encoder (Motors BPH/BPG 075 to 190)	6/12
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AMS and IM Spindle Motors	
General - Applications	6/14
Power vs Speed Characteristics	6/14
General Characteristics	6/14
Notes on Motors	6/14
Noise Level	6/15
Motor Identification	6/15
Detailed Technical Specifications	6/16
Axial and Radial Load Curves	6/17
Overall Dimensions	6/18
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AMR250 Spindle Motor	
General Characteristics, Identification	6/20
Overall Dimensions	6/21
<hr/>	
Motorspindle® Motors (MSA, MSS)	
General - Applications	6/22
General Characteristics	6/22
Motor Identification	6/23
Sensors	6/23
Overall Dimensions	6/24

Warning

Num Drive axis and spindle motors may cause temperature rises of more than 100 °C.
Take all necessary precautions to preclude hazardous contacts.

Num Drive Motors

BPH, BPG, BPL, BML and BHL Axis Motors

General

Num Drive brushless axis motors are designed with samarium cobalt magnets ensuring a high power-to-weight ratio, a high dynamic speed range, very low rotor inertia and a compact size.

The servodrives provide a sinusoidal waveform ensuring very smooth rotation, even at low speeds. A temperature probe is integrated in the motors for thermal protection.

This chapter lists all functions of Num Drive motors. To see those available with Num AR Drive servodrives, see chapter 5.

Applications

BPH motors: Machine tools, grinding machines (in IP67 version), robotics and special automatic machines.

BPG motors: With high inertia and high stiffness, they are especially well suited to the following applications:

- High inertia machine tool axis
- Motor mounted directly on the screw end
- Machine moving assembly lacking stiffness.

BPL, BML motors: Applications requiring an especially compact motor.

BHL motors: Applications requiring high speed and high torque. This motor is specially designed for large machines. A ventilated version optimizing size and performance is available

General Characteristics

BPH/BPG motors replace BMH/BMG motors.

They are physically identical as regards the shaft ends, centering diameters and flange squares.

The overall dimensions of the motor body may be slightly different (from + 1 mm to 4 mm).

BPH/BPG motors have two advantages:

- The power and sensor connectors can be positioned at 90-degree intervals by the customer
- Standard motor protection class (frame/shaft): IP65/65
- IP67/67 protection class possible.

Note:

BPH/BPG motor connectors are different from BMH/BMG motor connectors. Therefore, if replacing BMH/BMG motors by BPH/BPG motors, use the adapters described in Chapter 8, Accessories.

Characteristics

- General characteristics as per IEC 34-1
- Frame protection class: IP 65 as per IEC 529 (except ventilated BHL)
- Sensor connection by connector
- Thermal protection by PTC sensor integrated in the winding
- Winding insulation class: H (180°C) as per VDE 0530, except BPH 055 motor
- Out-of-round, concentricity, perpendicularity between flange and shaft as per DIN 42955 R
- End plate as per IEC 72-2
- Shaft end and key as per IEC 72-1
- Permissible installation positions: IMB5, IMV1, IMV3 as per DIN 42950
- Operating ambient temperature range: 0°C to 40°C.
- Rotor balancing: class S as per ISO 2373.
- Standard paint: RAL 9005 (black), 2-component epoxy resin paint (special paint, see further).

The special features of the BPH, BPG, BML and BHL motors are described on the next page.

Num Drive Motors


BPH, BPG, BPL, BML and BHL Axis Motors

Parking Brake

The optional built-in brake for BPH and BHL motors is a magnetic brake applied in the absence of power. It is a parking brake, not a dynamic brake. However, it is capable of 1800 to 2000 braking cycles in case of emergency.

- 24 VDC power supply, +5%, -10%.

Note: *The servodrives are capable of braking the motor in case of a line power failure.*

 *If a brake is provided on the motor, no axial loading must be applied to the shaft.*

Special Features of Motors

BPH 055 Motor

- Winding insulation class F (155°C) as per VDE 0530
- Sensor: only a resolver with one pole pair (U sensor) can be used
- Power and control line connection by two special IP65 connectors which can be positioned at 90-degree intervals
- Requires an **MDLQ1CR04** resolver interface for the associated servodrive (MDLA or MNDA)
- Shaft end protection class: IP54 standard, IP64 with seal **BMHQ101**
- Not available in BPG version
- Optional parking brake.

BPH/BPG 075 to 190 Motors

- Sensor: resolver with 3 pole pairs ("R") in the standard configuration; available options: resolver with 1 pole pair ("U"), DISC NT multi-turn encoder ("P"), DISC NT single-turn encoder ("Q").
- Shaft end protection class: IP65 standard
- IP67/67 option

This option provides a protection class of IP67 on both the frame and shaft end, providing the shaft seal is in contact with lubricating oil.


Example: Motor installation on a reduction gear. The shaft seal is then lubricated by contact with the reduction gear oil.

The seal life under these operating conditions is 5,000 hours.

The IP67/67 option is available only for type 5 power connection, not terminal box.

All IP67 motors are provided with a pressurization inlet (for injection of compressed air). Consult us.

- Sensor connection on connector
- Power connection in a terminal box or on connector
- Cable outputs can be positioned at 90-degree intervals by the customer. Delivery state: connector output towards the motor shaft.
- Cutting oil withstand capability (IP67/67 motors only)
The IP67/67 protection and frame paintwork are designed to withstand certain cutting oils: Shellcut HB (undiluted), Quaker 2793 (diluted by 10%), Ionorex 500 plus (undiluted).
Contact us to test for the withstand capability to another type of cutting oil (IP67/67 withstand and paintwork withstand) and possibly design a special version of the motor (x in the 14th reference character).
- Optional parking brake: for BPH motors only.
- An encoder adapter part and a coupling seal are available for BPH/BPG motors prewired for T encoder (see pages 6/12-6/13).

 *The connectors of BPH 075 to 190 motors are not interchangeable with those of BMH.*

Num Drive Motors

BPH, BPG, BPL, BML and BHL Axis Motors

BPG Motors

Certain BPH motors are available in BPG version:

- High rotor stiffness
- High rotor inertia
- No parking brake.



- The connectors of BPG motors are not interchangeable with those of BMG.
- The drive shafts of the BPH and BPG motors are different.

BPL motors

- Compact size
- No parking brake
- Sensor: resolver with 3 pole pairs ("R") in the standard configuration; available options: resolver with 1 pole pair ("U"), DISC NT multi-turn encoder ("P"), DISC NT single-turn encoder ("Q").
- Protection class: IP65 standard; IP67 optional.
- Power and sensor connections on connectors.
- Cable outputs can be positioned at 90-degree intervals by the customer. (Delivery state: connector output towards the motor shaft.)

BML Motors

- Compact size
- No parking brake
- Sensor: only a resolver with three pole pairs (R sensor) and an optional pole pair (U sensor)
- Shaft protection class: IP54 (frame IP65).
- Power and sensor connections on radial lead connectors (IP65).

BHL Motors

- Compact size and high torque
- Suitable for large machines (applications requiring high nominal torque and maximum torque).
- Can be used in conjunction with MDLA and MDLU axis servodrives and MBLD spindle servodrives.
- Protection class

BHL motor	Frame	Shaft
Not ventilated	IP65	IP54
Ventilated	IP54	IP54

- Sensor: resolver with 3 poles pairs ("R") or DISC NT encoder ("P") or DISC NT single-turn encoder ("Q").
- Optional brake and shaft key
- Power connection:
 - On terminal box (ventilated motor only)
 - On connector (unventilated motor only)



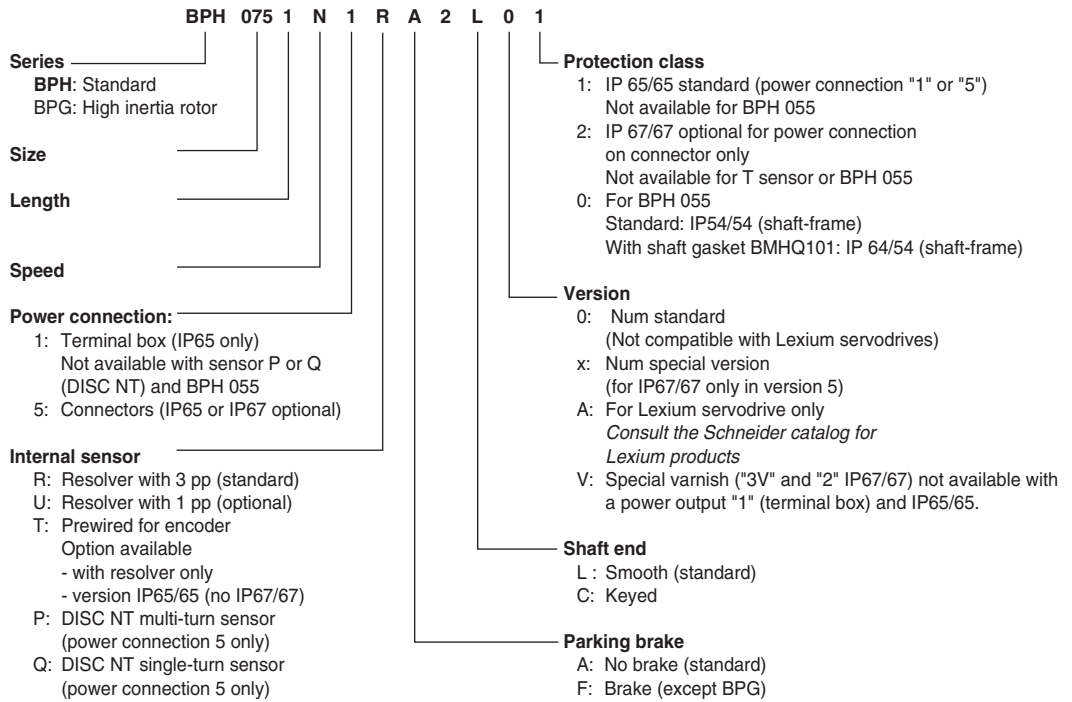
*If the servomotor is supplied by a 460 V system, use autotransformer P/N **AMOTRF001** for the motor fan (two BHL fans can be supplied by the same autotransformer).
Fan: 400 VAC ± 5%: current 0,2 A (see chapter 8, Accessories).*

Num Drive Motors

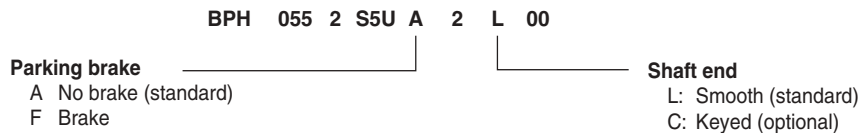
BPH, BPG, BPL, BML and BHL Axis Motors

BPH and BPG motor Identification

BPH and BPG 075 to 190 motors



BPH 055 Motor

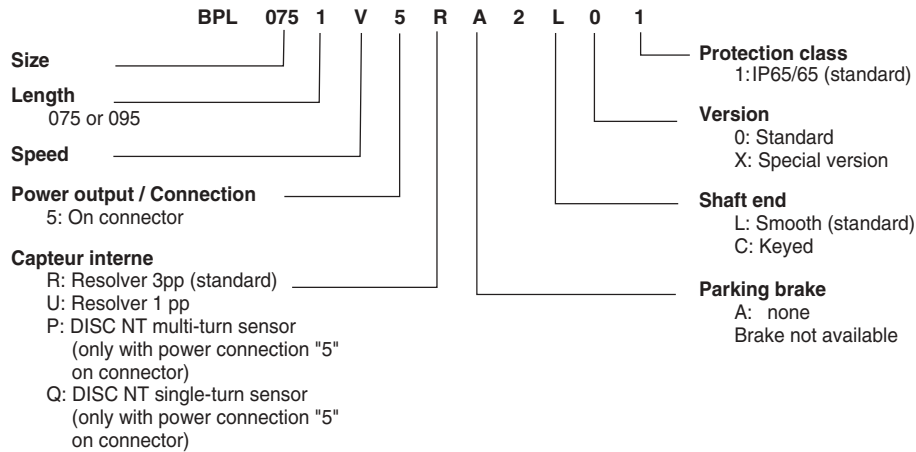


Num Drive Motors

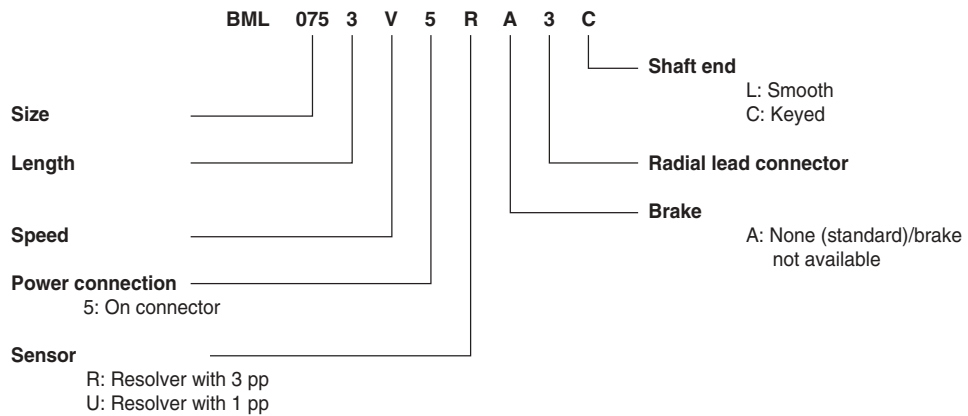
BPH, BPG, BPL, BML and BHL Axis Motors

BPL, BML and BHL motor Identification

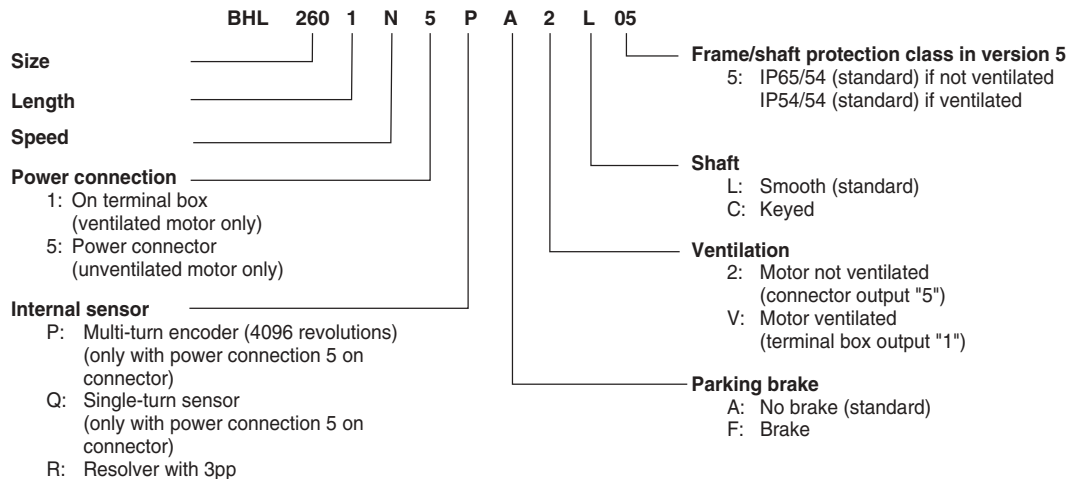
BPL Motor



BML Motor



BHL Motor



Num Drive Motors

BPH, BPG, BPL, BML and BHL Axis Motors

Detailed Technical Specifications

No.	BPH-BPG motor	Nominal torque when stopped (100K) Cn (1) (NM)	Nominal speed ωn (rpm)	BPH						BPG		Thermal time constant T th (min)	Permanent rms current when Stopped In (A ms)
				Rotor inertia without brake (g.m ²)	Rotor inertia with brake (g.m ²)	Motor weight		Brake		Rotor inertia without brake (g.m ²)	Rotor inertia with brake (kg)		
						without brake (kg)	with brake (kg)	Torque (Nm)	Current (A)				
1	055 2S	0.4	8 000	0.024	0.025	1.4	1.65	1	0.33			20	1.07
2	075 1N	1.3	3 000	0.08	0.12	3.5	3.85	2.5	0.5	0.254	4	23	2.2
3		1V	6 000										
4	2N	2.3	3 000	0.12	0.16	4.3	4.65			0.304	4.8		2.7
5	2V		6 000									3.5	
6	4N	4	3 000	0.21	0.25	6	6.35	5				26	3.5
7	095 2N	4.3	3 000	0.3	0.41	6.7	7.5		0.7	0.86	7.6	29	3.5
8		2V	6 000										
9	3N	6	3 000	0.41	0.52	8	8.8			0.97	8.9		5.2
10	3V		6 000									10.3	
11	5N	9.2	3 000	0.64	0.75	10.5	11.3	11				33	5.8
12	115 2N	7.4	3 000	0.7	1.07	9.6	10.9	12	0.8	2.45	11.2	29	5.5
13		2V	6 000										
14	3K	10.5	2 000	0.97	1.34	11.7	13						33
15	3N		3 000							2.73	13.3		9.2
16	3V		6 000										12.6
17	4K	13.3	2 000	1.25	1.62	13.8	15.1					36	6.2
18	4N		3 000										10.1
19	4V		6 000										17.6
20	6N	18.7	3 000	1.8	2.17	17.9	19.2	22				41	12
21	142 2K	12	2 000	1.59	2.54	17.2	19.4	20	1	6.7	20.4	30	6
22		2N	3 000										
23	2R		4 250										11.5
24	3K	17	2 000	2.19	3.14	20.1	22.3					34	9.5
25	3N		3 000							7.3	23.3		11.7
26	3R		4 250										16.9
27	4K	22	2 000	2.79	3.74	23	25.2			7.9	26.2	37	10.4
28	4N		3 000										16.6
29	4R		4 250										20.8
30	7N	35	3 000	4.29	5.24	31.7	33.9	40		9.7	34.9	42	24.2
31	190 2K	25	2 000	5.14	8.25	32.1	36.2		1.5	20.9	38.1	38	16.6
32		2N	3 000										
33	2R		4 250										29.2
34	3K	36	2 000	7.1	10.2	37.3	41.4					43	19.7
35	3N		3 000							22.9	43.3		27.8
36	4K	46	2 000	9.04	12.1	42.4	46.5					48	20.6
37	4N		3 000							24.8			30.3
38	5H	56	1 500	11	14.1	47.6	51.7	80				52	20
39	5L		2 500							26.8			31.4
40	7K	75	2 000	14.9	18	58	62.1					59	27.9
41	AK	100	2 000	20.75	23.8	73.9	78					74	44

* Motor not ventilated ** Motor ventilated Motor not available

(1) The torque and current are specified for a frame temperature rise of 100 K.
 Multiply these values by 0.77 if the motor temperature rise is limited to 60 K.
 Torque: tolerance: theoretical: ± 10%, typical: ± 5%
 If the motor is installed on a thermally insulating support, decrease the specified torques by another 10%.
 Nominal torque when stopped: Maximum available torque on the drive shaft at zero speed.
 Rated rms current: Necessary rms current per phase to have the nominal torque when stopped.

Num Drive Motors

BPH, BPG, BPL, BML and BHL Axis Motors

Overall Dimensions

No.	BHL Motor	Nominal torque when stopped (100K) Cn (1) (NM)	Nominal speed ωn (tr/min)	BPH						Thermal time constant Tth (mn)	Permanant rms current when Stopped In (A eff)
				Rotor inertia without brake (g.m ²)	Rotor inertia with brake (g.m ²)	Motor weight		Brake			
						without brake (kg)	with brake (kg)	Torque (Nm)	Current (A)		
1	260 1N*	85	3 000	45	48.1	95	99	80	1.5	63	52
2	1N**	120				100	104			45	73
3	2K*	120	2 000	66.2	69.3	126	130	80	1.5	70	52
4	2K**	160				131	135			50	69.3
No. BPL Motor											
1	075 1V	1.1	6 000	0.10		3.2				20	2.6
2	095 1V	2	6 000	0.24		4.6				24	3.4
No. BML Motor											
1	075 1V	1.1	6 000	0.08		3.2				20	2.8
2	3N	2.8	3 000	0.15		4.6				25	4
3	3V		6 000								5.8

(1) The torque and current are specified for a frame temperature rise of 100 K.

Multiply these values by 0.77 if the motor temperature rise is limited to 60 K.

Torque: tolerance: theoretical: ± 10%, typical: ± 5%

If the motor is installed on a thermally insulating support, decrease the specified torques by another 10%.

Nominal torque when stopped: Maximum available torque on the drive shaft at zero speed.

Rated rms current: Necessary rms current per phase to have the nominal torque when stopped.

BPH and BPG 075 to 190 motors

See drawing, next page.

BPH BPG motor	Terminal box 1								Con-nect 5	BPH shaft							BPG shaft								
	L	LB	C	P	B	V	K	R		S	T	U	D	E	H	F	GA	J	d	D	E	H	F	GA	J
075 1	75	221	60	2.5	8	75	6	82	55	116	117	11	23	15	4	12.5	5	M4x10	14	30	20	5	16	5	M5x12
2		250										14	30	20	5	16		M5x12.5							
4		308																							
095 2	95	275	80	3	9	100	7	82	51	134	137	19	40	30	6	21.5		M6x10	19	40	30	6	21.5	5	M6x16
3		304																M6x16							
5		362																							
115 2	115	290	95	3	10	115	9	111	53	157	166	19	40	30	6	21.5		M6x16	24	50	40	8	27	5	M8x19
3		319																							
4		348										24	50	40	8	27		M8x19							
6		406																							
142 2	142	316	130	3	14	165	11	111	60	194	193	24	50	40	8	27		M8x19	32	58	45	10	35	5	M12x28
3		345																							
4		374																							
7		461										32	58	45	10	35		M12x28							
190 2	190	355	180	3	17	215	14	111	60	244	242	32	58	45	10	35	6.5	M12x28	38	80	70	10	41	6.5	M12x28
3		384									(1)														
4		413									or														
5		442									253														
7		500									(2)	38	80	70	10	41									
A		605																							

(1) 190 2K, 2N, 3K, 4K, 5H

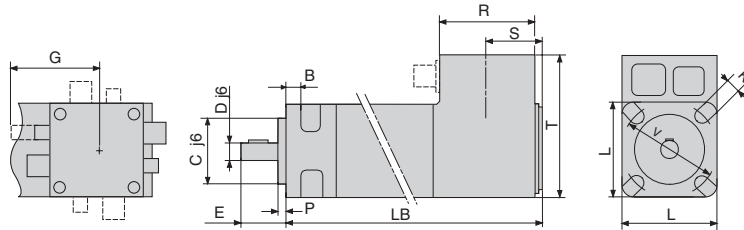
(2) 190 2R, 3N, 4N, 5L, 7K, AK

Num Drive Motors

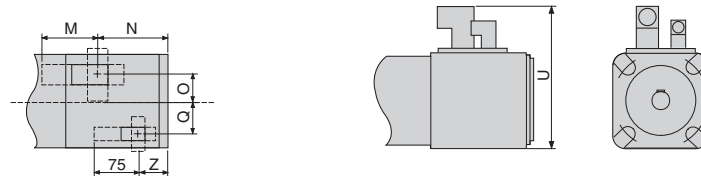
BPH, BPG, BPL, BML and BHL Axis Motors

Overall Dimensions

Power connection on terminal box "1"



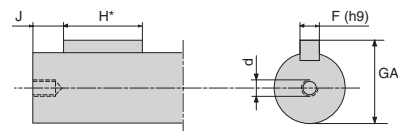
Power connection on connector "5"



Overall dimensions of connector plugs mounted on motors

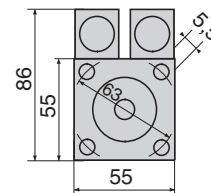
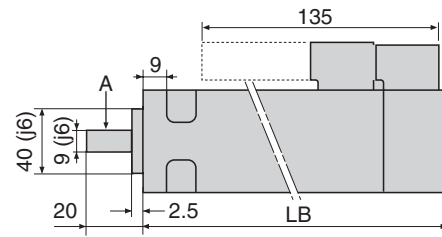
BPH/BPG	G	M	N	O	Q	Z	
075	110	94	71	16	16	39	
095	110	94	67			35	
115	123	102	68			36	
142	123	102	77	20	20	44	
BPH 190	2K	123	102			80	41
			102			80	41
			160	81	38		
			102	80	41		
			160	81	38		
BPG 190	2K	123	102	80	20	20	41
			160	81	21	22	38
			160	81	21	22	38

BPH and BPG 075 to 190 motors shaft end

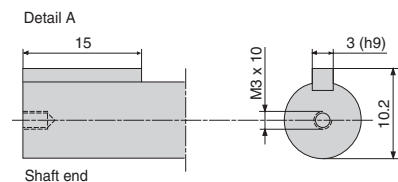


* Shaft key: dimensions and tolerances as per IEC 72-1.

BPH 055 Motor



BPH 055 2 Motor	LB
With brake	140
Without brake	176

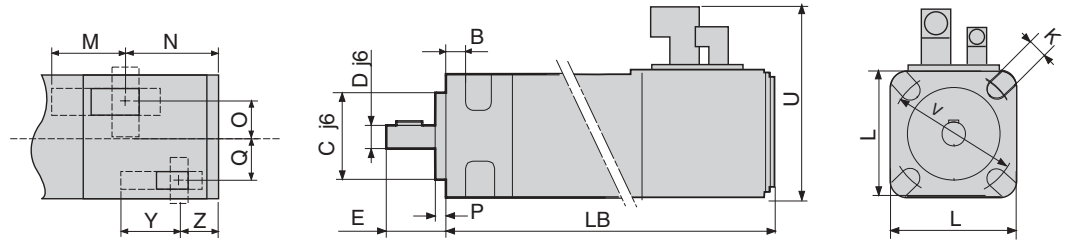


Num Drive Motors

BPH, BPG, BPL, BML and BHL Axis Motors

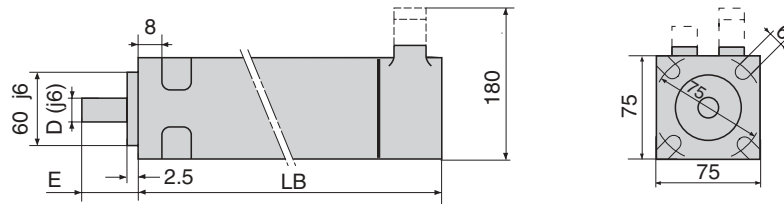
Overall Dimensions

BPL motor

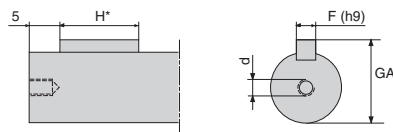


BPL	L	LB	C	P	B	V	K	U	D	E	H	F	GA	J	d	M	N	O	Q	Y	Z
075	75	169	60	2.5	8	75	6	123	11	23	15	4	12.5	5	M4x10	102	46	16	16	79	33
095	95	184.5	80	3	9	100	7	142	19	40	30	6	21.5	5	M6x16	102	44	18	18	79	34

BML Motors



Detail A



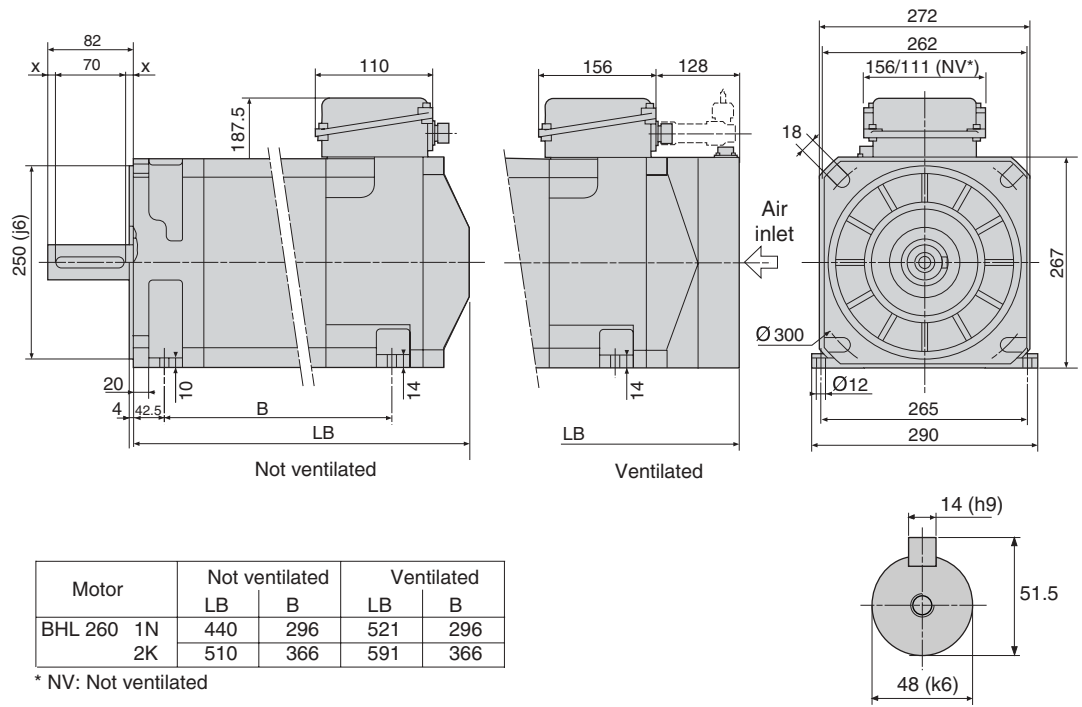
Motors	LB	Shaft					
		D	E	H	F	GA	d
BML 0751	156	11	23	15	4	12.5	M4x10
BML 0753	214	14	30	20	5	16	M5x12.5

Num Drive Motors

BPH, BPG, BPL, BML and BHL Axis Motors

Overall Dimensions

BHL Motors



Num Drive Motors

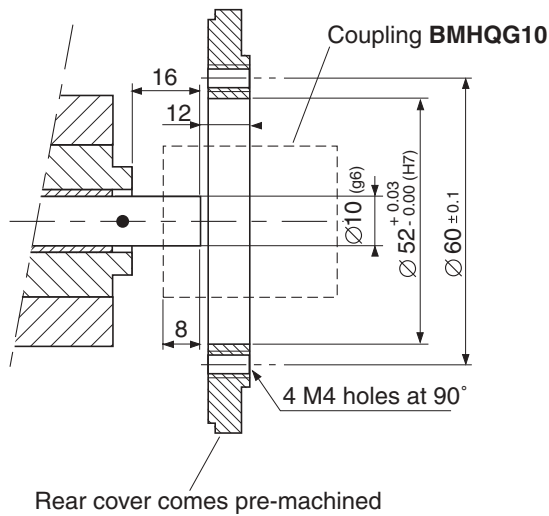
BPH, BPG 075 to 190 Axis Motors
Prewired for Encoder

For Rear Mounted Encoders

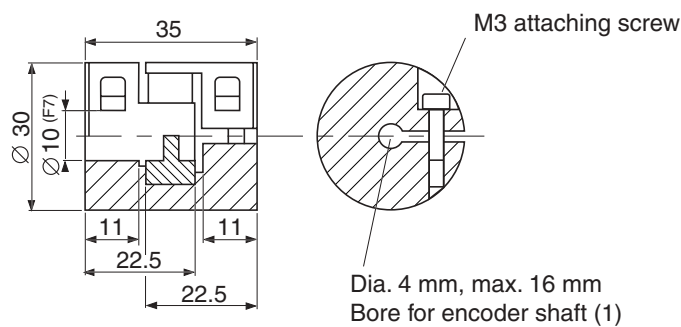
If it is desired to equip the motor with a sensor mounted at the rear, order the motor prepared for encoder "T". The "T" prepared for encoder design facilitates connection of an encoder:

- the rear cover of the motor is milled and bored,
- it includes four attaching holes,
- the bore is blanked by a screwed metal plate.

The encoder coupling can also be supplied (P/N **BMHQG10**).



Coupling **BMHQG10**



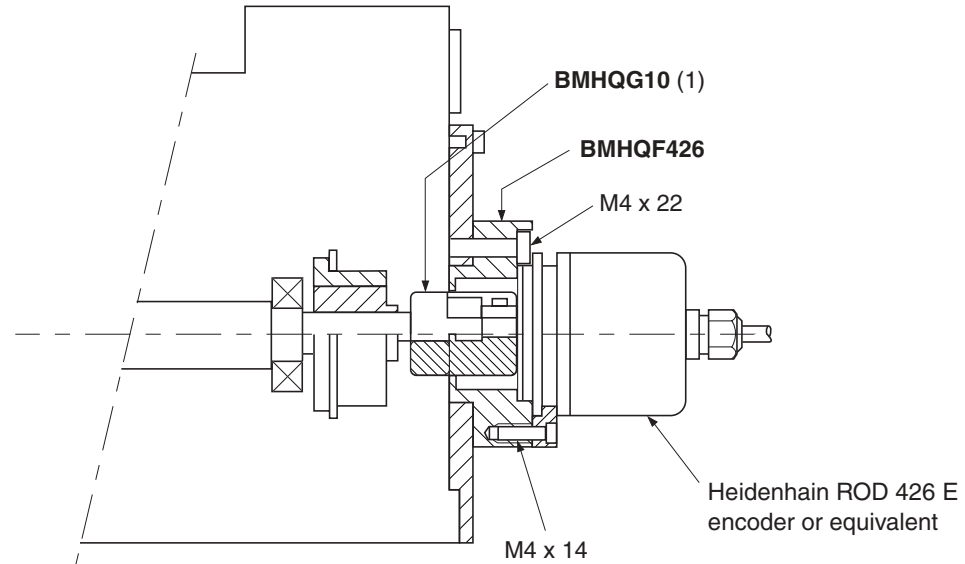
(1) The 4 mm dia precut hole must be modified by the customer to suit to the encoder shaft.

Num Drive Motors

BPH, BPG 075 to 190 Axis Motors
Prewired for Encoder

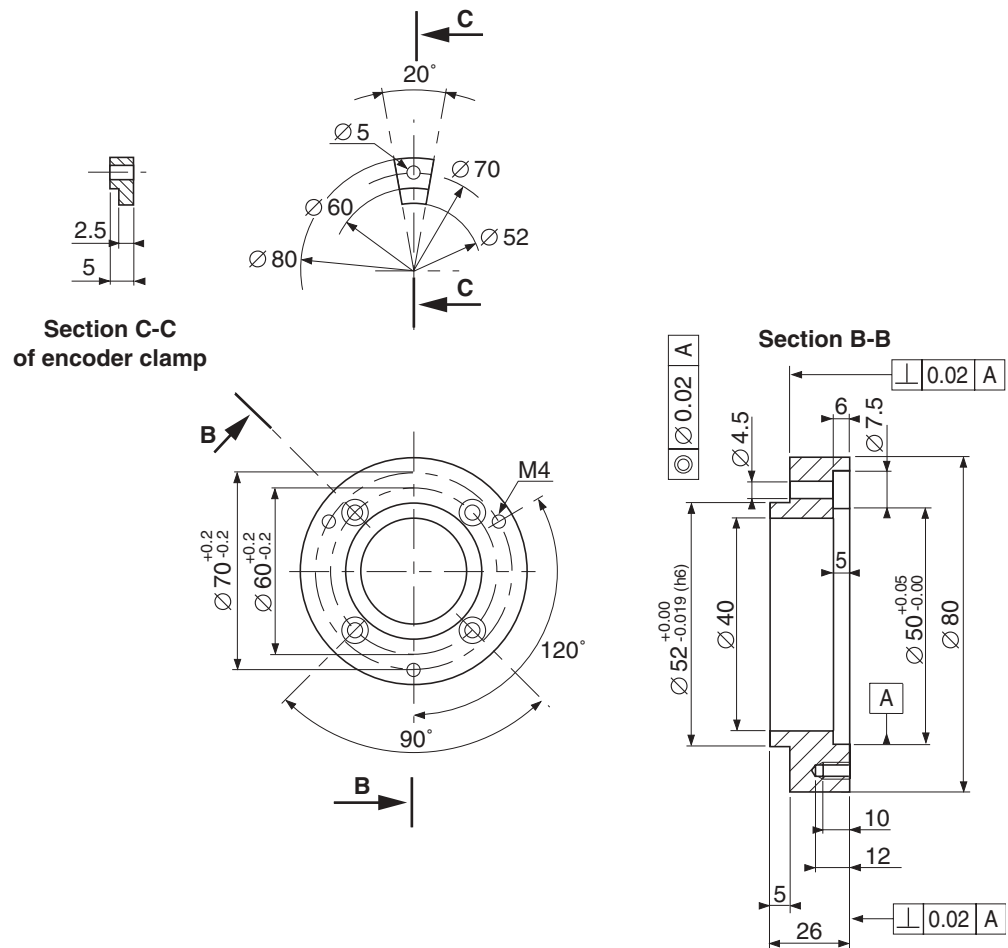
Coupling for ROD 426 Encoder or Equivalent

(1) The hole in the coupling (P/N **BMHQG10**) must be recut by the customer to suit the encoder shaft.



Coupling Part for ROD 426 Encoder or Equivalent

Adaptor plate P/N **BMHQF426** is common to all BPH/BPG 075 to 190 motors.



Num Drive Motors

AMS and IM Spindle Motors

Characteristics

General - Applications

The AMS and IM asynchronous motors are designed to control machine tool spindles.

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

C axis operation available as an option is provided by a high resolution encoder.

The power ratings range from 2.2 to 55 kW. The wide range of speeds at constant power simplify the gearbox or do away with it entirely.

The associated servodrives with flux vector control ensure very smooth rotation, even at low speeds.

Power vs Speed Characteristics

Refer to the motor/servodrive association tables in Chapter 9.

AMS and IM18M General Characteristics

- General characteristics as per IEC 34-1
 - Frame protection class: IP 65 as per IEC 529 (except for the fan: IP54)
 - Shaft end protection class: IP 54 standard, IP 65 optional as per IEC 529
 - Sensor connection by connector
 - Thermal protection by thermostat
 - Winding insulation class: H (180°C) as per VDE 0530
 - Out-of-round, concentricity, perpendicularity between flange and shaft as per DIN 42955 R
 - Attachment by flange with smooth holes as per IEC 72-2 or tabs
 - Shaft end and shaft key as per IEC 72-1
 - Permissible installation positions: IMB3, IMB5, IMV1, IMV3 as per DIN 42950
 - Balancing as per ISO 2373: class R standard, class S optional
 - Operating ambient temperature range: 0°C to 40°C
 - Change of electrical coupling on certain motors to increase the range of speeds at constant power even further.
 - Phenol epoxy resin base paint; color: RAL 5009 blue.
-

Notes on Motors

AMS Motors

- Certain AMS 160 motors are provided with change of electrical coupling
- The power supply for the built-in fan is via a separate connector
- The power connections are on terminal boxes which can be positioned every 90 degrees.
- If the servomotor is supplied by a 460 V system, use autotransformer P/N **AMOTRF001** (Chapter 8 - Accessories) for the motor fan (two AMS fans can be supplied by the same autotransformer).

IM Motors

- Certain IM 18M motors are provided with change of electrical coupling
 - The power connections are on three connectors.
-

Noise Level

AMS 100: 70 dB [A] +/- 3 dB (A)

AMS 132: 72 dB [A] +/- 3 dB (A)

AMS 160: 78 dB [A] +/- 3 dB (A)

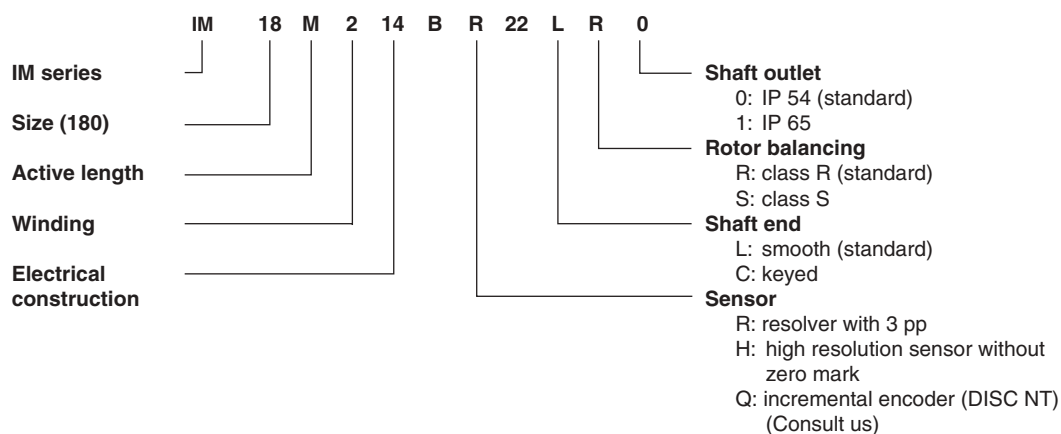
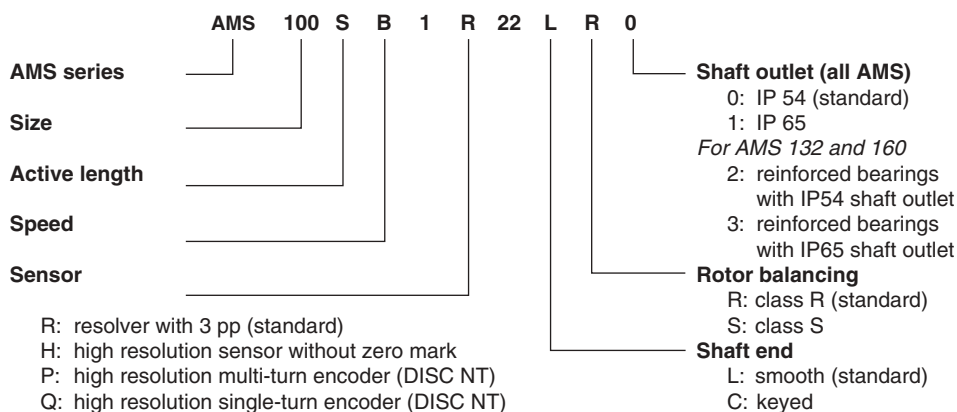
IM 18M: 75 dB [A] +/- 3 dB (A)

Num Drive Motors

AMS and IM Spindle Motors

Overall Dimensions

Motor Identification



Detailed Technical Specifications

Motor	Power S1 (kW)	Weight (kg)	Rotor inertia (kg.m ²)	Thermal time constant (min)	Three-phase fan	
					(V)	(A)
AMS 100 S	3.7	37	0.009	32	400*	0.11
AMS 100 M	5.5	49	0.014	35		
AMS 100 G	9	71	0.023	38		
AMS 132 S	15	105	0.055	45		0.2
AMS 132 M	19.5	131	0.075	50		
AMS 132 L	22	183	0.113	55		
AMS 160 M	36	215	0.25	57	0.3	
AMS 160 L	36	290	0.37	61		
IM 18M	55	415	0.57	63	220**	0.78

* For a 460 V three-phase system, provide an autotransformer (P/N **AMOTRF001** – Overall dimensions: see Chapter 8).

** Single phase fan.

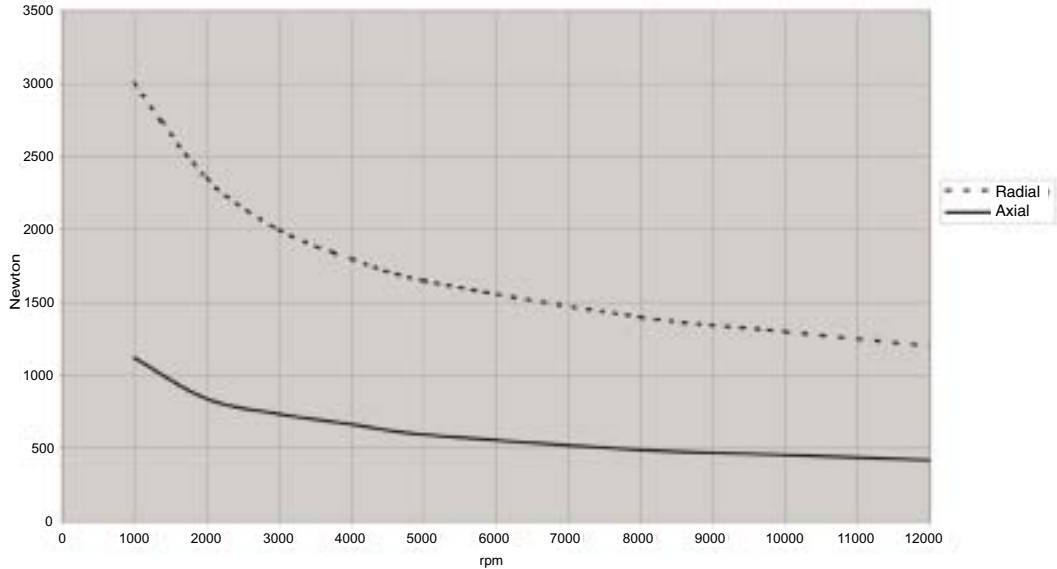
Num Drive Motors

AMS and IM Spindle Motors

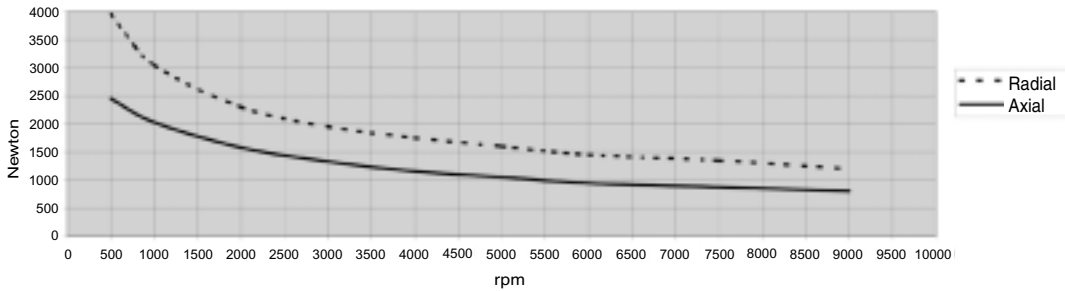
AMS Axial and Radial Load Curves

Maximum permissible loads for an operating life of 20,000 hours.

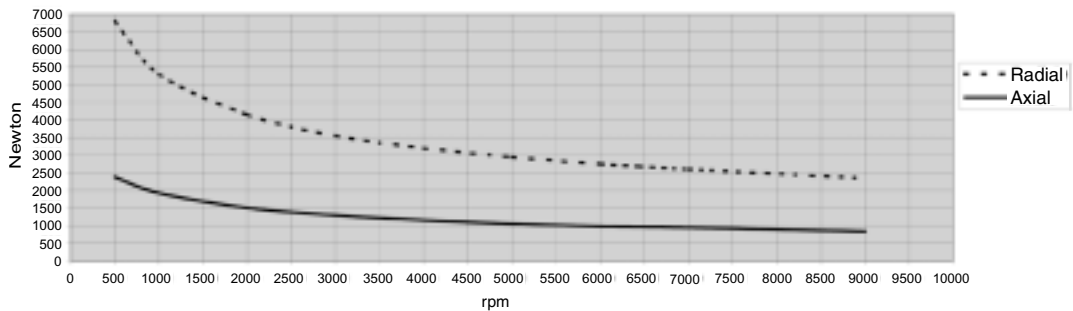
AMS 100



AMS 132 standard



AMS 132 with high-strength bearings

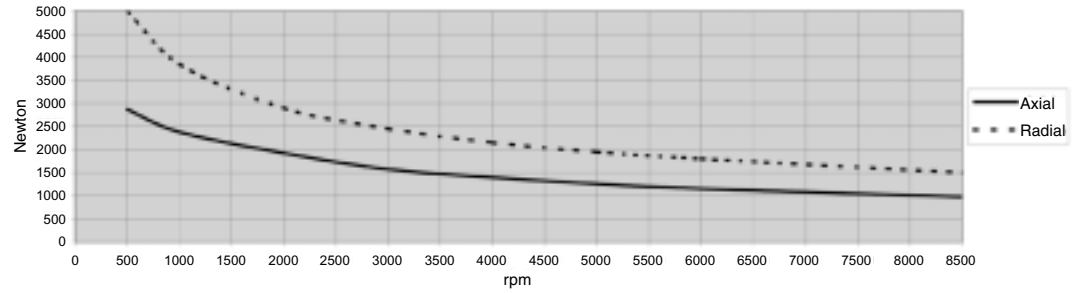


Num Drive Motors

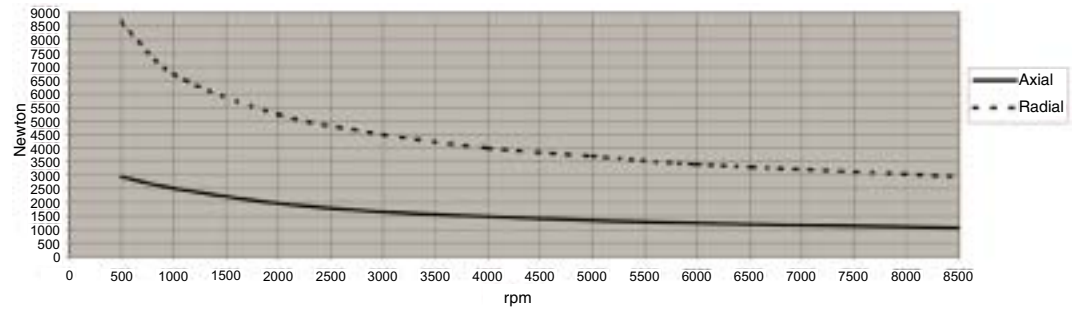
AMS and IM Spindle Motors

Maximum permissible loads for an operating life of 20,000 hours.

AMS 160 standard

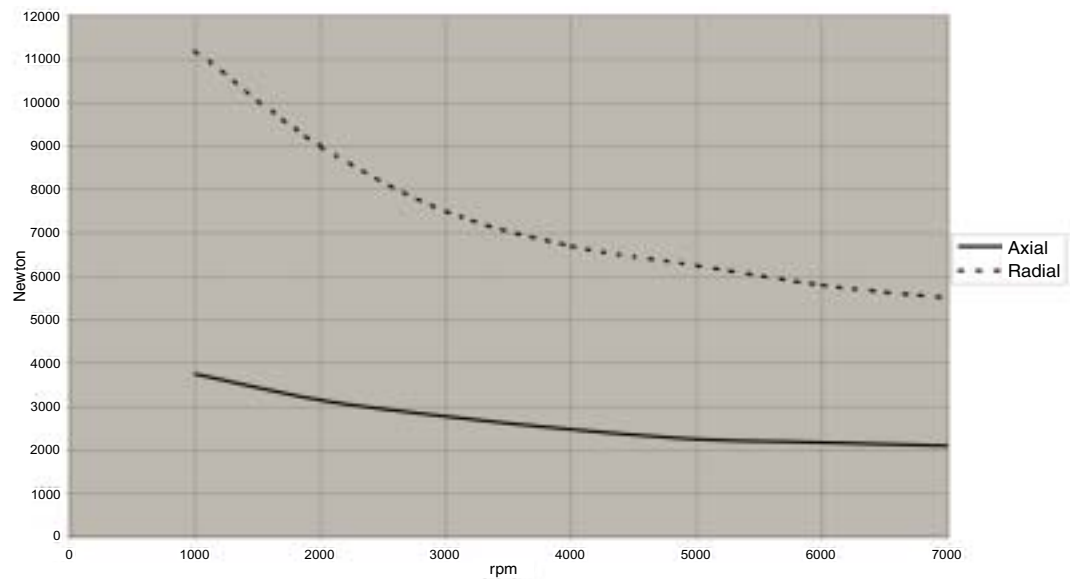


AMS 160 with high-strength bearings



IM 18 Axial and Radial Load Curves

Maximum permissible loads for an operating life of 20,000 hours.



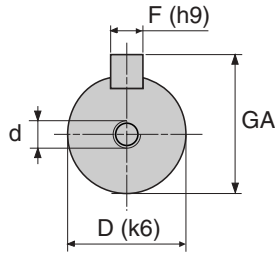
Num Drive Motors

AMS and IM Spindle Motors

Overall Dimensions

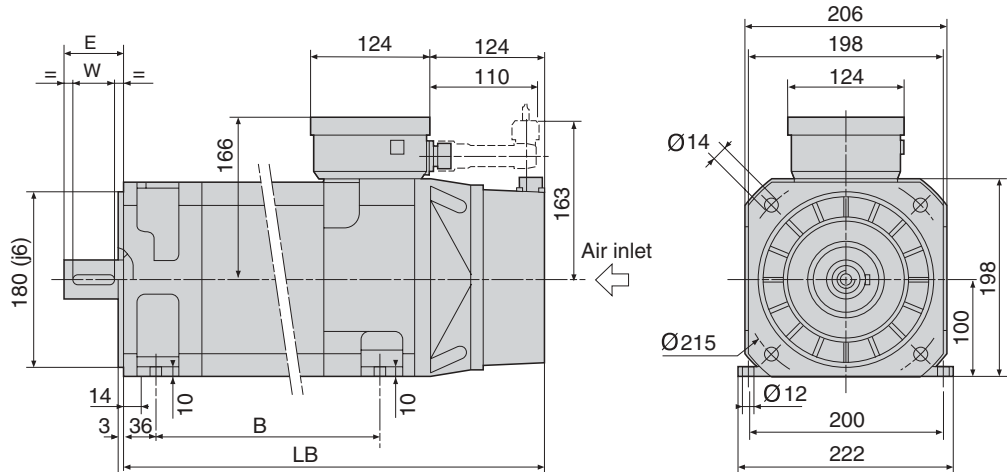
AMS Motors

AMS Motor Shaft End

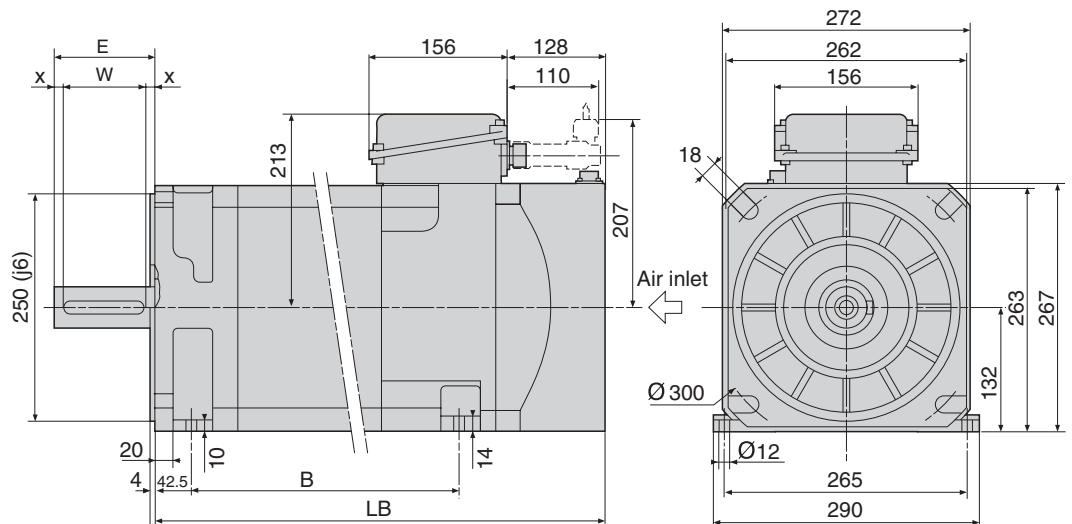


AMS Motor		LB	B	Shaft					
				D	E	W	F	GA	d
100	S	388	179	32	60	50	10	35	M12x30
	M	442	233	38	80	70	10		
	G	535	326					41	
132	S	521	296	42	110	90	12	45	M16x36
	M	591	366	48	110	90	14	51.5	
	L	721	496						
160	M	682	385	55	110	90	16	59	M20x42
	L	827	530						

AMS 100 Motor



AMS 132 Motor

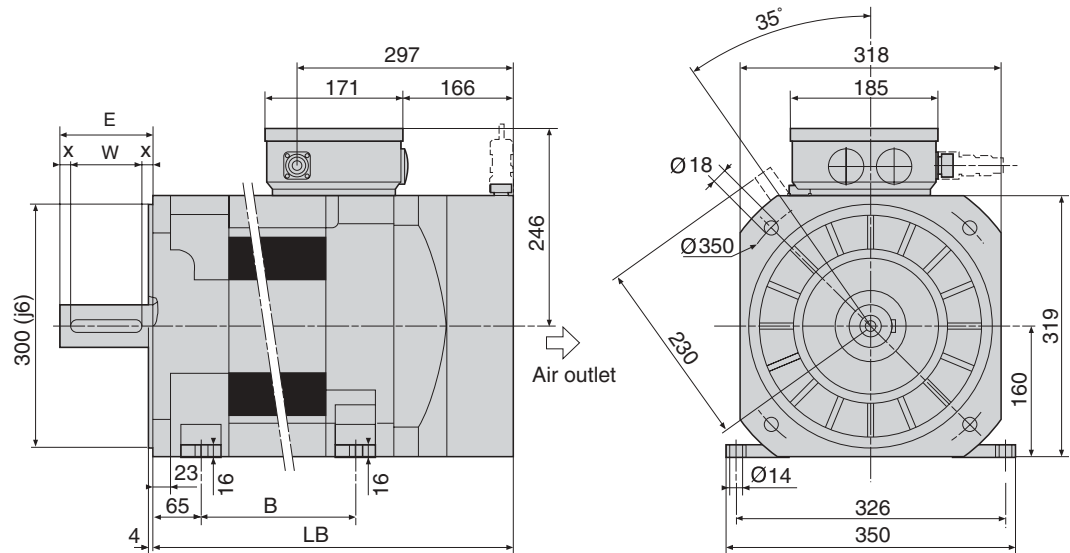


Num Drive Motors

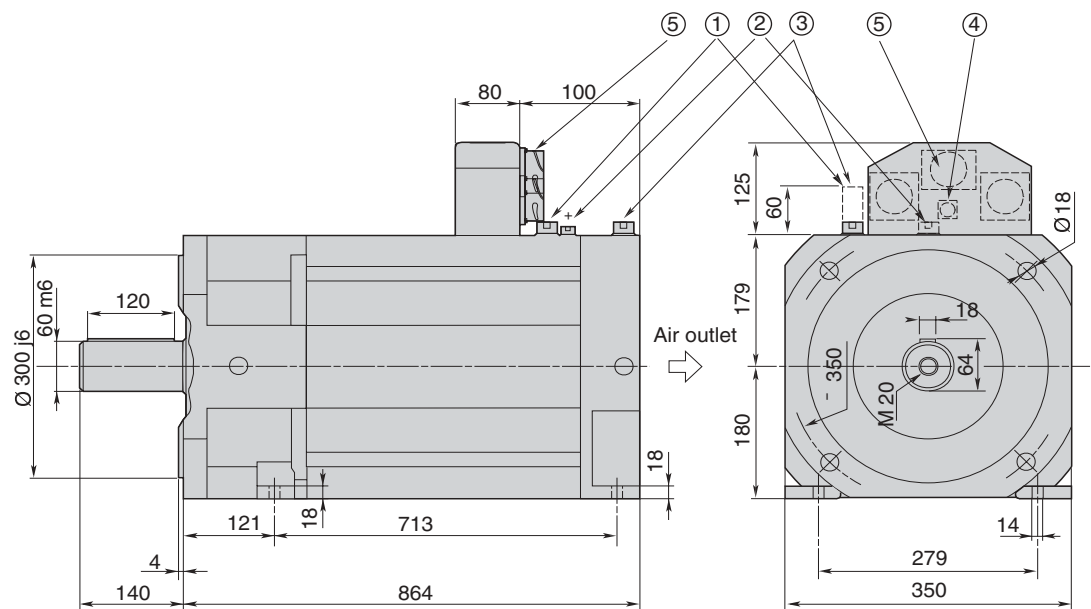
AMS and IM Spindle Motors

Overall Dimensions

AMS 160 Motor



IM 18M Motor



- ① : Sensor connector
- ② : Grounding terminal
- ③ : Fan connector
- ④ : Temperature probe connector
- ⑤ : Power connector (no. 3)

Num Drive Motors

AMR 250 Spindle Motor

General

The AMR 250 spindle motor has combined liquid/air cooling.

Its advantages make it particularly well suited to machine tool spindles:

- Minimum temperature rise of the motor and associated mechanical assembly
- Compact design
- Long life due to low temperature rise.

Power vs Speed Characteristics

Refer to the motor/servodrive association tables in Chapter 9.

General Characteristics

General electrical characteristics	: IEC 34-1
Winding insulation	: Class H (180°C)
Motor protection class	: IP 65
Shaft protection class	: IP 54 (IEC 529)
Rotor balancing	: S1 as per ISO 2373
Operating temperature range	: 5°C to 40°C
Shaft end	: Smooth or keyed
Connections	: 1 connector for the encoder and 3 power connectors
Weight	: 310 kg
Rotor inertia	: 0.22 kg.m ²
Sensor	: High resolution to operate with C axis (V and C type sensors, see page 5/20)
Power rating	: 30 kW from 843 to 6,300 rpm; ω_{max} 10,000 rpm
Star connection	: Constant power from 843 to 2,300 rpm
Delta connection	: Constant power from 1,900 to 6,300 rpm

Type of cooling fluid	Flow rate	Maximum fluid inlet and outlet temperature difference	Pressure
Water	6 (l/min)	15 °C	0.5 bar (1)
Air	33 (l/s)	50 °C	5 bars (2)

(1) Water inlet temperature: 20°C

(2) Inlet air dried and filtered to 30 micrometers.

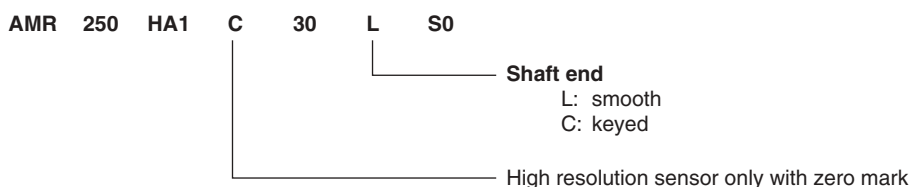
The coupling can be switched on the fly at speeds below 2100 rpm.

If the servodrive is a UAC servodrive, it must mandatorily be fitted with a relay card (G14 or G15).

Note

- Belt transmission is not possible as it would exert an excessive load on the bearings at high speed
- The motor is mounted by the front end plate, but can also be mounted by the rear end plate.

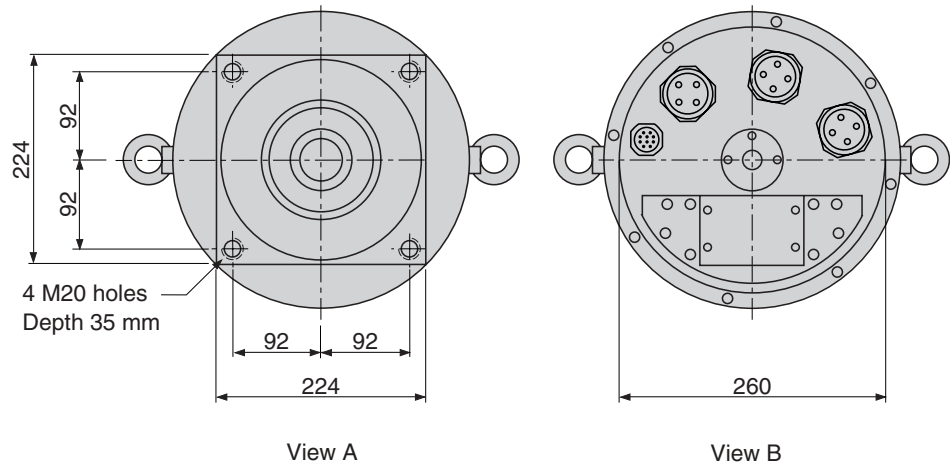
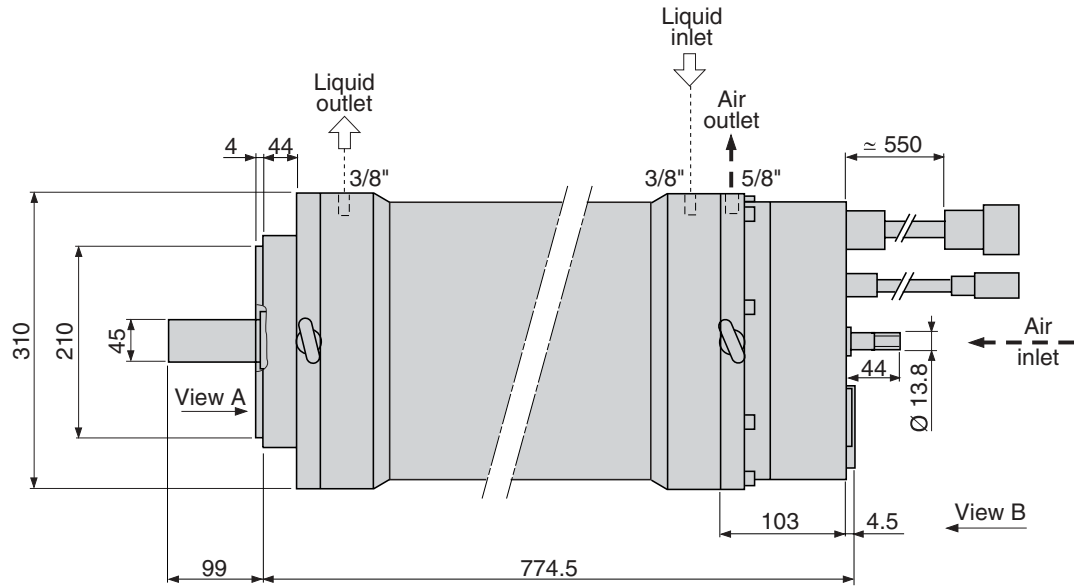
Motor Identification



Num Drive Motors

AMR 250 Spindle Motor

Overall Dimensions



Num Drive Motors

Motorspindle Motors (MSA, MSS)

Characteristics

General - Application

Motorspindle® motors optimize spindle integration, with compelling advantages:

- Very compact size
- Moving assembly simplified to the utmost
- Temperature rise minimized by liquid cooling.

The result is increased stiffness, more silent operation and higher reliability.

Motorspindle® motors are available in two technologies:

- Asynchronous (MSA)
- Synchronous (MSS), with compact magnets and especially low temperature rise.

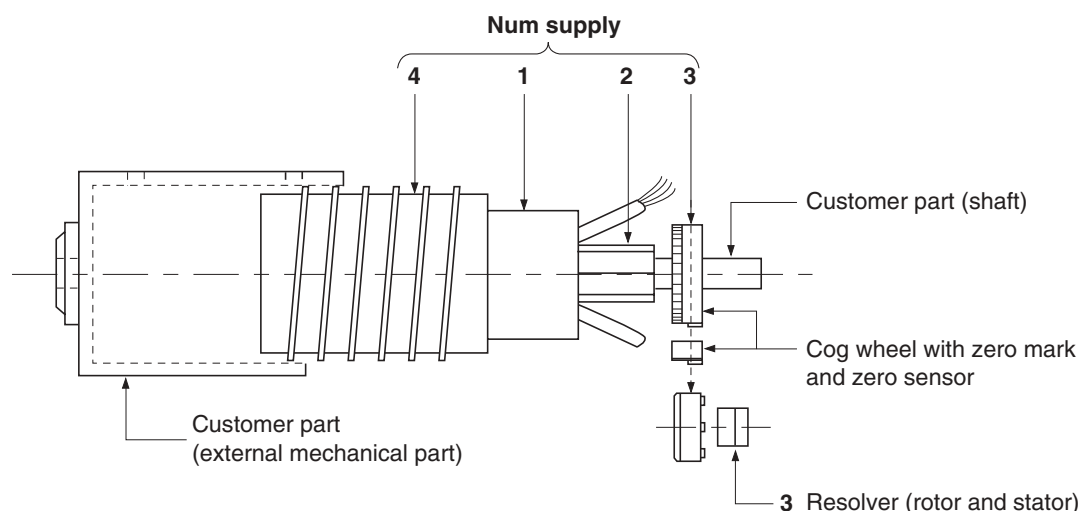
C axis operation is possible on MSA motors equipped with high resolution speed sensors.

Num's supply is limited to the active parts of the motor:

- Stator (1)
- Hollow rotor (2)
- Speed sensor (3)
- If required, an external iron cooling jacket (4) (UNI 7729, Fe51C).

Assembly of these components is up to the spindle manufacturer.

In some cases, it may be necessary to send the spindle assembled by the customer to Num Italy to determine its exact electrical characteristics and the parameters of the associated servodrive.



General Characteristics

- General characteristics as per IEC 34-1
- Protection by thermal probe (threshold 180°C)
- Winding insulation class: H (180°C) as per VDE 0530
- Rotor balancing to be performed by the customer after installing rotor on shaft. The rotor alone can also be balanced as per ISO 1940, Class G = 2.5 (option E).

Note: The distance between the stator windings and frame must not be less than 5 mm.

Refer to the association table in Chapter 7 for the power and coupling characteristics.

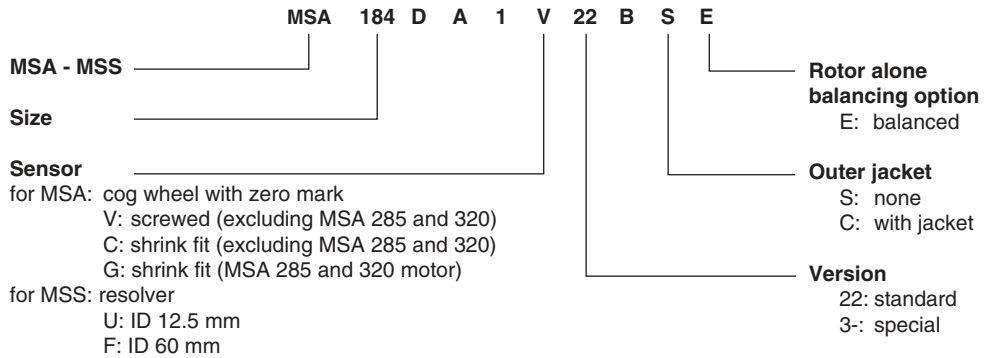
For the MSS135DB1 motor, a three-phase inductance **AGOREA001** must be connected in series with the stator.

		Unit	MSS							
			135D	184D	184H	220D	240D	240H	285D	320D
Rotor inertia		m ² .kg	0.0023	0.013	0.022	0.052	0.067	0.087	0.173	0.41
Weight	Rotor + stator	kg	12	23.5	38	46.5	57	75.5	103	198
	Cooling jacket	kg	5.5	10.5	13	12	13.5	15	25.5	39

Num Drive Motors

Motorspindle Motors (MSA-MSS)

Motor Identification



Sensors

MSA Motors

The high resolution motor sensors allow C axis operation with an excellent quality of rotation.

Cog wheels (V, C, G) are screwed or shrink fit on the rotor.

The associated compact servodrive (MBLD or MDLS) provides RS422 encoder simulation. The resolution depends on the speed of rotation:

- V, C sensors for all MSA motors except MSA 285 and 320
 - Minimum: 512 pulses per motor revolution (definition usable up to maximum speed)
 - Maximum: 65,536 pulses per motor revolution (definition usable up to 54 rpm maximum)
- G sensors for MSA 285 and 320 motors
 - Minimum: 1024 pulses per motor revolution (definition usable up to maximum speed)
 - Maximum: 131,072 pulses per motor revolution (definition usable up to 54 rpm maximum).

MSS Motors

- U, F sensors

These sensors are resolvers with one pole pair. They have an inner diameter of 12.5 mm or 60 mm.

The encoder simulation provides 1024 pulses per motor revolution up to maximum speed and a maximum of 16,384 pulses per motor revolution up to 960 rpm maximum.

Pseudo-C axis operation is possible, but the performance is not as good as with a cog wheel.

Spindle Indexing, C Axis and Encoder Simulation Options

Refer to the table below.

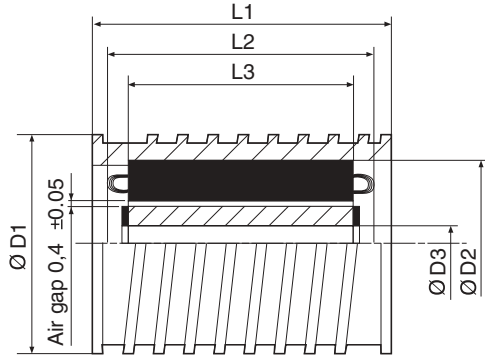
MSA and MSS motor sensors have a zero mark. It is therefore unnecessary to use an additional zero mark.

Servodrive	MSA motor (with V, C or G high resolution sensor)		MSS motor (U, F resolver with 1pp)	
	Option	Optional card to be provided	Option	Optional card to be provided
UAC	Indexing	with 2UACAXIS411	Indexing	with 2UACPOS1
	C axis	with 2UACHR411	Encoder simulation	with 2UACENC387
MDLS	Indexing	basic		
	C axis	with option 02		

Num Drive Motors

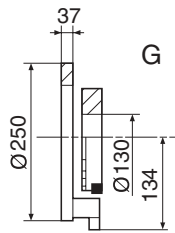
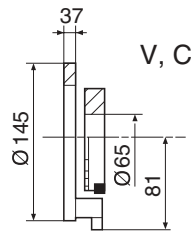
Motorspindle Motors (MSA, MSS)

Overall Dimensions

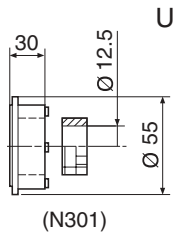


Motors	L1	L2	L3	D1	D2	D3	
MSA	184 DA1 HA1 HB1	245	239	127	205	184	59
		338	332	220			
		220 DA1 DB1	285	275			
	240 DA1 HA1 HB1 HC1	285	275	160	260	240	76
		340	330	215			
		285 DA1	365	355			
320 DA1	510	500	340	345	320	113	
MSS	135 DA1 DB1	204	194	116	155	135	45

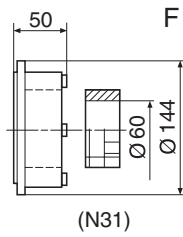
MSA Sensors



MSS Sensors



(N301)



(N31)

Num Drive Servodrives

Table of Contents

	Page
MDLA Modular Servodrives	
Introduction	7/3
Servodrive and Power Supply Identification	7/3
Servodrive Modules	7/3
Power Supplies	7/4
Braking Resistor	7/5
Limitation on the Number of Axes	7/6
Basic Functions and Options	7/6
Accessories (EMC Filters and Metal Connector Shells)	7/7
Commissioning Tools	7/7
Installation and Commissioning Manuals	7/8
General Review	7/8
Overall Dimensions, Servodrives and Braking Resistor	7/9
<hr/>	
MDLS Compact Spindle Servodrives	
Introduction	7/10
Servodrive Identification	7/10
Technical Specifications	7/10
Dimensioning Guide	7/11
Braking Resistor	7/11
Basic Functions	7/12
Regenerative Braking	7/13
Accessories (EMC Filters and Metal Connector Shells)	7/13
Choke Coils, Transformers and Filters*	7/13
Commissioning Tools	7/14
Installation and Commissioning Manuals	7/14
General Review	7/14
Overall Dimensions	7/15

Note

* For transformers and filters, see also chapter 8.

Notice

Num servodrives are designed to operate on **TN** and **TT** type distribution systems.

A transformer can be used provided the transformer secondary is wye-connected with the center point grounded.

IT Type Distribution System

Num servodrives cannot operate on an IT system. If the customer has this type of system, it is necessary to provide a transformer with the above characteristics.

Caution: The efficiency of the EMC filters is not guaranteed with this type of distribution system.

Num Drive Servodrives

MDLA Modular Servodrives

Introduction

MDLA servodrives use modular technology. Several modules share the same power supply. They are connected directly to the 400-460 V three-phase network.

These modules can also receive their power supply from MDLS compact spindle servodrives.

MDLA servodrives are designed to control axes with a ± 10 V analog speed signal.

Servodrive and Power Supply Identification

Servodrive	For	Servodrive module	Power supply
MDLA with analog reference	Axis motors	<p>MDLA 2 021 Q 00 N</p> <p>Index 2 _____</p> <p>Rating _____</p> <p>00 Standard 02 Backlash compensation Voltage 400 V 460 V*</p>	<p>MDLL 2 015 N 00 (1)</p> <p>Index 2 _____</p> <p>Rating _____</p> <p>Voltage Q : 400 V to 460 V</p>

* With a 460 V power supply voltage, use power supply P/N **MDLP1015N00X**.

MDLA servodrives do not operate on a regulated 700 VDC bus.

Power supplies **MDLL2 xxx N00** are used in conjunction with an external braking resistor **MDLLQ xxx**.

For an external resistor whose power rating is above the values indicated in the section Braking Resistor, page 7/5, refer to the servodrive commissioning manual.

Auxiliary power supply P/N **MDLQ2001Q00** can be used to increase the maximum permissible number of axes. See the section Limitation on the Number of Axes, page 7/6.

Servodrive Modules

Rating of MDLA servodrives	Unit	T1			T2		T3	T4	
		007	014	021	034	050	075	100	150 (1)
Rated rms current	A	2	4	7	14	20	35	45	60
Peak current	A	7	14	21	34	50	75	100	150
Heat dissipation at rated power	W	20	35	50	150	170	200	400	500
Weight	kg	4.6	4.6	4.6	6.9	6.9	9.2	10.5	11
Width	mm	50			80		110	140	

(1) Consult us

Protection class	IP 20
Operating temperature range	0°C to 40°C; above this, decrease the current by 1.7% per degree C up to a maximum of 60°C
Storage temperature range	-25°C to +70°C
Maximum operating altitude	1000 m; above this, decrease the current by 1.7% per 100 m
Relative humidity	Maximum 75% noncondensing

Num Drive Servodrives

MDLA Modular Servodrives

Power Supplies



With a 460 V power supply voltage, use power supply P/N **MDLP1015N00X**.

Power supply modules	Unit	MDLL2.N00		
		T2		T4
		008	015	030
Rated power	kW	8	12	30
Overload power (4 s on - 6 s off)	kW	12.7	17.9	50
Maximum continuous braking power permissible for the power supply*	kW	8.2	14	33
Peak braking power of the power supply* (40% duty cycle); see below for dimensioning of the power of the associated resistor.	kW	12.7	18	51
Rating of the axis control power supply	W	180	180	180
Maximum dissipation	W	70	165	280
Protective fuse to be provided by the customer upstream of the power supply	-	25 A; 400 V		63 A; 400 V
Rating of transformer, if any	kVA	12	19	48
Weight	kg	8.1	8.5	10.5
Width	mm	80		140
MDLL2...N00 power supplies directly on three-phase network	400 V to 460 V \pm 10%; 50-60 Hz			
Isolated power supply for the reference	\pm 10 V; 50 mA			
Isolated power supply for servodrive logical signals	+ 24 V; 500 mA			
Protection class	IP 20			
Operating and storage temperature range	Same as servodrives			
Maximum operating altitude	Same as servodrives			

* Always use at least one external braking resistor.

The power supplies are supplied with cap P/N **AEOCON007** (located at the bottom)

Power Supply Dimensioning Guide

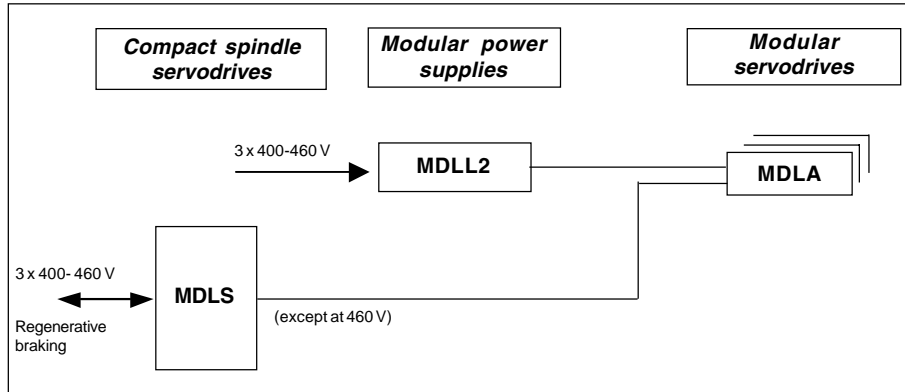
To select the right power supply according to the number of associated modules, take the following factors into account:

- The limits of the rated power and maximum instantaneous power during the cycle
- The maximum power level of the control supplies provided by the power supply module.

Num Drive Servodrives

MDLA Modular Servodrives

Table Summarizing Possible Power Supply Types for Modular Servodrives



Braking Resistor (Overall Dimensions: see page 7/9)

The braking resistor is connected externally on the power supply unit (terminals PA-PB).

Modular power supply MDLL2...Q00	008 - 015	030
Part number of normally associated resistor	MDLLQ115	MDLLQ130
Resistor rating and power	27 Ω - 480 W	6.8 Ω - 480 W

However, if braking requirements exceed the heat dissipation characteristic of this resistor, the associations shown below can be used.

Modular power supply MDLL2...Q00	Resistor(s)	Connection	Ω	Continuous power (W)	Peak power for 100 ms (kW)
008 015	4x MDLLQ115		27	1920	15
030	4x MDLLQ130		6.8	1920	59

Caution: If resistors other than those suggested are used, comply with the specified resistance and never exceed the continuous braking power of the power supply.

Num Drive Servodrives

MDLA Modular Servodrives

Limitation on the Number of Axes

The power rating of the control supplies provided by an MDLL power supply is 180 W. It is 140 W for an MDLS compact servodrive. It must be checked that the total power consumption of the servodrives used is below whichever of these values is relevant

Axis module rating	Unit	007	014	021	034	050	075	100	150
Power consumption of MDLA axis modules	W	23	23	23	24	25	26	27	28

For MDLA servodrives, if the total power consumption of the control exceeds the maximum limit, an auxiliary power supply can be used to provide an additional 200 W.

Part number: **MDLQ2001N00** (size 1 module).

Add 4 W for an axis with additional sensor.

Example: The power consumption of a system including four MDLA 14 A modules and three MDLA 50 A modules + 16 W consumed by auxiliary sensors is equal to: $4 \times 23 + 3 \times 25 + 16 = 183$ W.

Since $W > 180$, an auxiliary power supply is required.

Basic Functions and Options

Basic Functions

- 2 speed reference inputs (which can become torque inputs)
- 1 logical input for switching between two sets of speed loop parameters
- Programmable ramp (10 ms to 32 s)
- Torque current limiting
- Thermal protection of the servodrive by current limiting
- Analog test points for display of internal digital parameters (speed, current, etc.)
- Programmable output relay to be assigned to the parameters displayable on the test points
- Encoder simulation from the resolver (24 to 3072 points per motor revolution).

Provide a resolver interface when using MDLA modules with a BPH 055 motor.

Part number: **MDLQ1CR04**.

Options

02: Backlash compensation for high performance when two pinions drive the same rack to increase torque.

Caution, both servodrives must include option 02.

Example of part number: **MDLA2021Q 02 N**.

Note: For torque master/slave operation, use standard servodrives as per the Num manual.

Use: To control two motors rigidly coupled to the same drive assembly and supplying the same torque (the motors, servodrives and reduction gears may be different).

Num Drive Servodrives

MDLA Modular Servodrives

Accessories (See also chapter 8)

EMC Filters

Compliance with EMC regulations leads to recommending the use of a filter on the power supply input.

Power supply rating MDLL2...N00	008 - 015	030
Filter part number	AGOFIL003A	AGOFIL006A

Note: The servodrive has a single-phase input to supply the control circuitry separately from the power circuitry. If the auxiliary input is connected upstream of the EMC filter on the power circuitry, provide a single-phase EMC filter P/N **AGOFIL001S** per each MDLL2... power supply unit.

Metal Connector Shells

For compliance with EMC standards, it is recommended to replace the plastic connector shells provided on certain drives with metal shells. This applies to the following products in particular:

Drive	Connector	Part No. of metal shell
MDLA	P5 (15 contacts, male) J3 (25 contacts, male)	AEOCOP002 AEOCOP003

Commissioning Tools

- Commissioning and setup from a PC
The DPM integration software is very user-friendly for commissioning and setting up these modules (includes an electronic oscilloscope).
Each servodrive has an RS232 serial interface.
Software part number: **PACNUMDPM**, including a 3 1/2" diskette and a 5 m cable (**5PROPC**) for the link to the PC or **AGOCDT001** (SETTool CD and **5PROPC** cable) for the Windows 2000 and XP versions.
The DPM software manual is to be ordered separately.
Reference: **738 x 011** x: manual language (F: French, I: Italian, E: English, D: German).
- Setup from a removable keyboard
Removable keyboard **MDLT100** is used to set the parameters of the MDLA servodrive. It is compact and plugs directly into a connector on the servodrive front panel. It also allows transfer of the set of parameters from one servodrive to another.

Num Drive Servodrives

MDLA Modular Servodrives

Installation and Commissioning Manuals

To be ordered separately.

Servodrive	Manual reference	Available languages
MDLA modules	738 x 008 (1)	F, I, E, D

(1) (x) manual language (F: French; I: Italian; E: English; D: German).

General Review

Before making a final decision, review the following points:

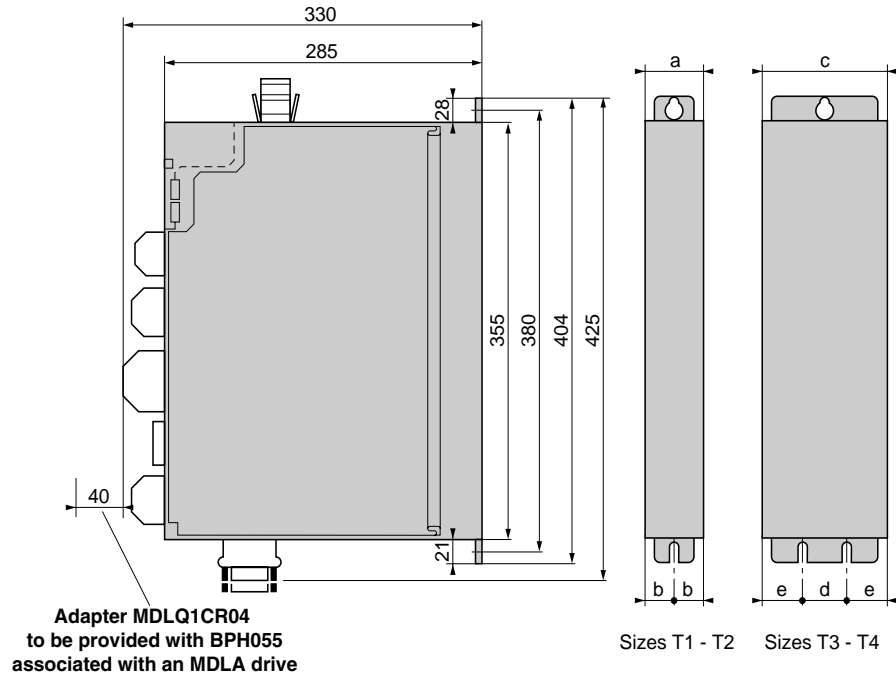
- Make sure each module is correctly associated with the motor selected (see Chapter 7, Association Tables)
- Check that the power supply rating corresponds to the power requirements
- Check that the braking resistor rating is correct
- Optional EMC filters
- Commissioning tools and manuals.

Num Drive Servodrives

MDLA Modular Servodrives

Overall Dimensions

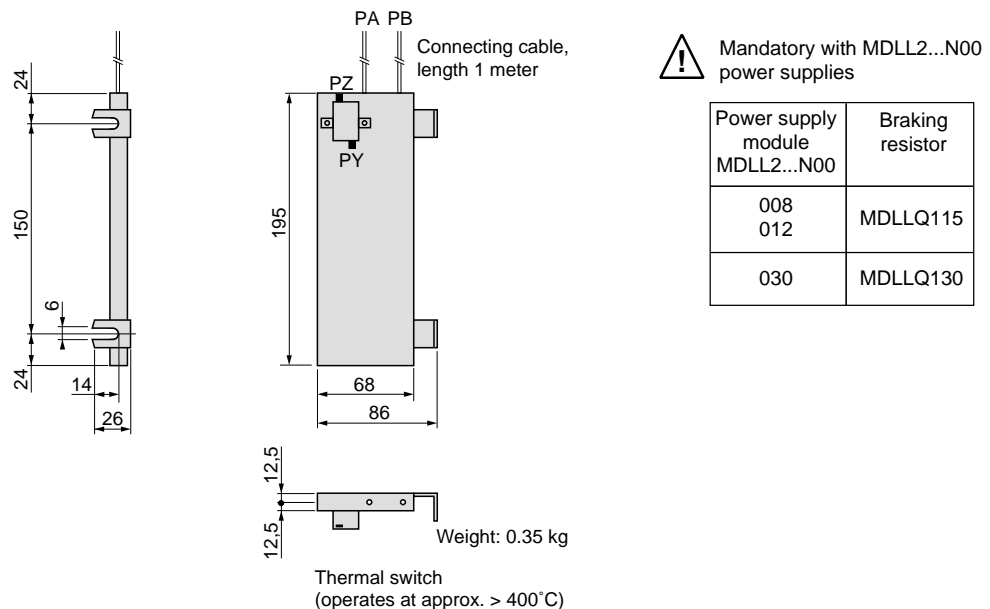
MDLA Servodrives



Servodrive modules MDLxx ... N00N	Size	a	b	c	d	e
007 014 021	T1	50	25			
034 050	T2	80	40			
075	T3			110	40	35
100 150	T4			140	70	35

Power supply modules MDLL2 ... N00	Size	a	b	c	d	e
008 015	T2	80	40			
030				140	70	35

Braking Resistor - MDLLQ115 and MDLLQ130 (see also page 7/5)



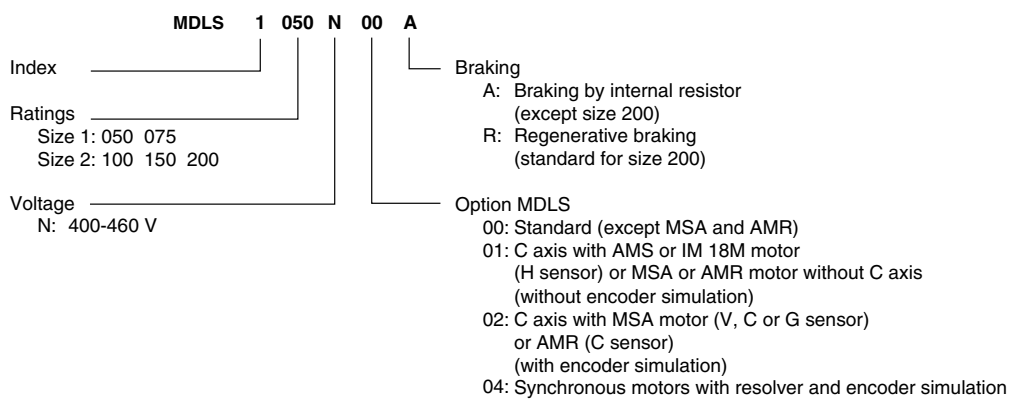
Num Drive Servodrives

MDLS Compact Spindle Servodrives

Introduction

The MDLS compact servodrives are designed to control AMS and IM spindle motors and MSA and MSS Motorspindles. These servodrives include built-in power supply and braking resistor and are connected directly to the 400-460 V network. The DC bus voltage is 560 VDC for a 400 VAC three-phase network. Regenerative braking with reinjection into the line is available as an option. On the 400 V network, they can also provide the power supply for MDLA modular servodrives.

Servodrive Identification



Technical Specifications

Ratings	Unit	Size 1		Size 2		
		050	075	100	150	200
Total active rated power	kW	30		37	45	62
Total active overload power (1)	kW	39		50	64	80
Power dissipated in the cabinet	kW	0.98		1.4	1.8	2.1
Rated rms current	Arms	26	40	52	72	100
Max. operating rms current for S3-S6 (1)	Arms	35	53	71	106	141
Peak current in S6 service (1)	A	50	75	100	150	200
Braking power with internal resistor						
- continuous	kW	1.3		2.5	3.5	–
- peak	kW	30		50	65	–
Continuous braking power						
- with braking resistor (2)	kW	20		25	30	–
- regenerative	kW	20		25	30	42
Peak braking power						
- with braking resistor (2) (3)	kW	30		50	65	–
- regenerative (3)	kW	25		32	38	53
Internal brush type protective fuse	–	80 A - 660 V		160 A - 660 V		
Rated power available (4)	kW	20		30	30	
Optoisolated logic input signals (IEC 65A)	V	Lev. 1: 1 to 30 VDC, max. 120 mA				
Optoisolated logic output signals (IEC 65A)	V	Lev. 1: 24 V, max. 120 mA				
Protective fuse to be provided by the customer upstream of the servodrive	–	80 A; 600 V		125 A 600 V	160 A 600 V	200 A 600 V
Rating of transformer, if any	kVA	42		52	63	87
Weight	kg	27		57	57	63

- (1) 4 minutes on, 6 minutes off
 (2) with suitable external resistor
 (3) S6: 3 minutes on, 7 minutes off

- (4) Maximum available power for the spindle: power complies with the following values:
 050 ≤ 11 kW; 075 ≤ 16 kW; 100 ≤ 23 kW;
 150 ≤ 31 kW; 200 ≤ 42 kW.
 The total power used by the spindle motors and MDLA modules must be less than the total active rated power.

Num Drive Servodrives

MDLS Compact Spindle Servodrives

Three-phase power supply voltage	400-460 V; $\pm 10\%$; 50-60 Hz
Auxiliary single-phase power supply	400-460 V; $\pm 10\%$; 50-60 Hz
Power of auxiliary voltage outputs available for MDLA servodrives	140 W, 50 VAC, 35 kHz
Power bus voltage	560 V for an input of 400 V 640 VDC for an input of 460 VAC
Available power supplies	$\pm 10\text{ V}$; 50 mA
Power supply for logical inputs/outputs	24 V; 700 mA

Protection class	IP 20
Operating temperature range	0°C to 40°C; above, decrease the current by 1.7% per degree C up to a maximum of 60°C
Storage temperature range	- 40 to + 70 °C
Maximum operating altitude	1000 m; above, decrease the current by 1.7% per 100 m
Relative humidity	Maximum 75% noncondensing

Dimensioning Guide



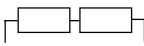
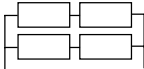
If the MDLS compact servodrives are to provide the power supply for MDLA modular servodrives, the three following conditions must be satisfied:

- 1 - The spindle motor rated power must not exceed the value specified in item (4a) under the table on page 7/10.
- 2 - The sum of powers S of the axis motors (MDLA) must not exceed the power specified in the line "Rated power available" (table on page 7/10).
- 3 - The total power calculated for the two above items must not exceed the power specified in the line "Total active rated power" (table on page 7/10).
- 4 - The total auxiliary power consumed by the modular servodrives must not exceed 140 W (refer to page 7/6 for the consumption of these servodrives).

Braking Resistor (Overall Dimensions page 7/16)

The compact servodrives always include an internal braking resistor (except for servodrive rating 200).

However, if braking requirements exceed the heat dissipation characteristic of this resistor, an external resistor mounted outside the cabinet to improve heat evacuation can be used in its place.

Possible choice	Wiring	Ω	Continuous power (kW)	Peak power (kW)
1 x AGORES001		13.5	2	16
1 x KFIG2		13.5	2,1	32
2 x KFIG2		27	4,2	16
4 x KFIG2		13.5	8,4	32

Caution: If resistors other than those specified in the table above are used, comply with a minimum resistance of 13.5 Ω for servodrive ratings 050 and 075, 9 Ω for servodrive rating 100, and 6.75 Ω for servodrive rating 150 in order not to exceed the continuous and peak braking power of the servodrive.

Never exceed the maximum continuous braking power with braking resistor mentioned in the table on the previous page.

For other configurations, consult us.

Num Drive Servodrives

MDLS Compact Spindle Servodrives

Basic Functions and Options

Basic Functions

- Torque current limiting
- Gear change request
- Electrical coupling change command
- Two sets of parameters for the speed loop, switchable on the fly
- Oscillations on speed reference for gear ratio change.
- Possibility of controlling the motor at very low speed, even motors equipped with a resolver (pseudo-C axis).

Information sent to the PLC

- Spindle speed reached/current reached
- Spindle rotating
- Gear change enable

Other functions

- Remote reset possible after certain faults
- Two analog test points for monitoring internal digital variables
- Line contactor command
- Ramps with double slope
- Choice of stopping in case of line power failure: by inertia or by braking
- Torque synchronization between two motors (to obtain a higher resistant torque)
- Spindle indexing

This function is used to position the spindle to one of eight positions pre-programmed over 360 degrees.

The mechanical ratio between motor and spindle can vary from 1:1 to 1:12.

Indexing is configurable. Positioning is accurate within ± 0.2 degrees. A «spindle indexed» logic signal is output by the servodrive when indexing is complete.

A spindle zero position logic sensor (P/N **BSPICAA0804**) mounted directly on the spindle must be provided in the two following cases:

- The motor sensor is a resolver R with three pole pairs or a high resolution sensor H
- The mechanical ratio between motor and spindle is not an integer.

The indexing accuracy achieved in this case is slightly lower.

- Power limiting on the motor shaft

Options

Option 01: Required for C axis operation with AMS or IM 18M motors with a type H high resolution sensor

A zero position sensor P/N **BSPICAA0804** must then be ordered separately. This option can also be used to control motors MSA (with V, C or G sensor) or AMR (C sensor) if the C axis is not required.

Example of part number: MDLS2050**N01A**

Option 02: Required for C axis operation with MSA motor equipped with a type V, C or G sensor or AMR motor with a type C sensor. In both the above cases, a zero position sensor P/N **BSPICAA0804** is unnecessary.

Example of part number: MDLS2050**N02A**

Option 04: Required for the operation of a synchronous motor with resolver and encoder simulation.

Example of part number: MDLS2050**N04A**

NUM DRIVE Servodrives

MBLD and MDLS Compact Spindle Servodrives

Regenerative Braking

Regenerative braking is required for short motor cycles with frequent braking, especially if a high inertia is applied to the motor.

Check the servodrive specifications for the maximum available braking power.

With regenerative braking, it is necessary to use:

- A choke coil upstream of the servodrive (see summary tables below)
- A single-phase isolation transformer for the CL1-CL2 auxiliary power supply to prevent damage to the servodrive.

This transformer must have the following characteristics:

- Primary/secondary: 400 or 460 V – 50/60 Hz, depending on the line voltage
- Transformer ratio: 1
- Isolation class: H
- Isolation voltage: 2500 V
- P: 600 VA.

It is recommended to use an EMC filter upstream of the servodrive. If no EMC filter is used, it is mandatory to use filter P/N **HPPM166**.

Electromagnetic Compatibility (see also the “Accessories” chapter)

EMC Filters

Compliance with EMC regulations leads to recommending the use of a filter upstream of the servodrive (see summary tables below).

Metal Connector Shells

For compliance with EMC standards, it is recommended to replace the plastic connector shells provided on certain drives with metal shells. This applies to the following products in particular:

Drive	Connector	Part No. of metal shell
MDLS	M1 (9 contacts) M3, M6 (15 contacts) M2 (25 contacts)	AEOCOP001 AEOCOP002 AEOCOP003

Table of Choke Coils, Transformers and Filters

The table below specifies the accessories to be used according as the equipment is certified CE or not.

CE Equipment

	Size	Rating	Choke coils (1)	Transformers	Power line filters (CEM)	Control line filters (CEM)
MDLS...N00A	1	050	-	-	AGOFIL004A	AGOFIL001S (2)
		075			AGOFIL006A	
	2	100			AGOFIL007A	
		150			AGOFIL010A	
		200			AGOFIL009A	
MDLS...N00R	1	050	AGOREA001	Single-phase isolation transformer (on inputs CL1 – CL2) – No part number	AGOFIL004A	
		075			AGOFIL006A	
	2	100	AGOREA002		AGOFIL007A	
		150			AGOFIL010A	
		200	AGOREA003		AGOFIL009A	

(1) Necessary upstream of the servodrive in all cases, both CE and non-CE equipment

(2) Necessary if single-phase input CL1-CL2 is upstream of the EMC filter

Num Drive Servodrives

MDLS Compact Spindle Servodrives

Non-CE Equipment

	Size	Rating	Choke coils (1)	Transformers	Power line filters (CEM)	Control line filters (CEM)
MDLS...N00A	1	050	-	-	-	AGOFIL001S (2)(3)
		075				
	2	100				
		150				
MDLS...N00R	1	050	AGOREA001	Single-phase isolation transformer (on inputs CL1 –CL2) –No part number	HPPM166	
		075				
	2	100	AGOREA002			
		150				
	200	AGOREA003				

(1) Necessary upstream of the servodrive in all cases, both CE and non-CE equipment

(2) Necessary if single-phase input CL1-CL2 is upstream of the EMC filter

(3) Recommended

Commissioning Tools

The MDLS servodrive is commissioned and set up (parameter load/unload, customization, fault display after a trip, etc.) using the CPM software on a PC, via the RS232 serial link.

The CPM software and its commissioning manual in French, Italian, English and German, reference **738IEF016**, are supplied with the servodrive.

A cable **5PROPC** (length 5 m) can be ordered for the serial link with the PC.

Installation and Commissioning Manuals

To be ordered separately.

Servodrive	Manual reference	Available languages
MDLS (analog reference) servodrive	738 x 013	F, I, E, D

(x) manual language F: French ; I: Italian ; E: English ; D: German.

General Review

Before making a final decision, review the following points:

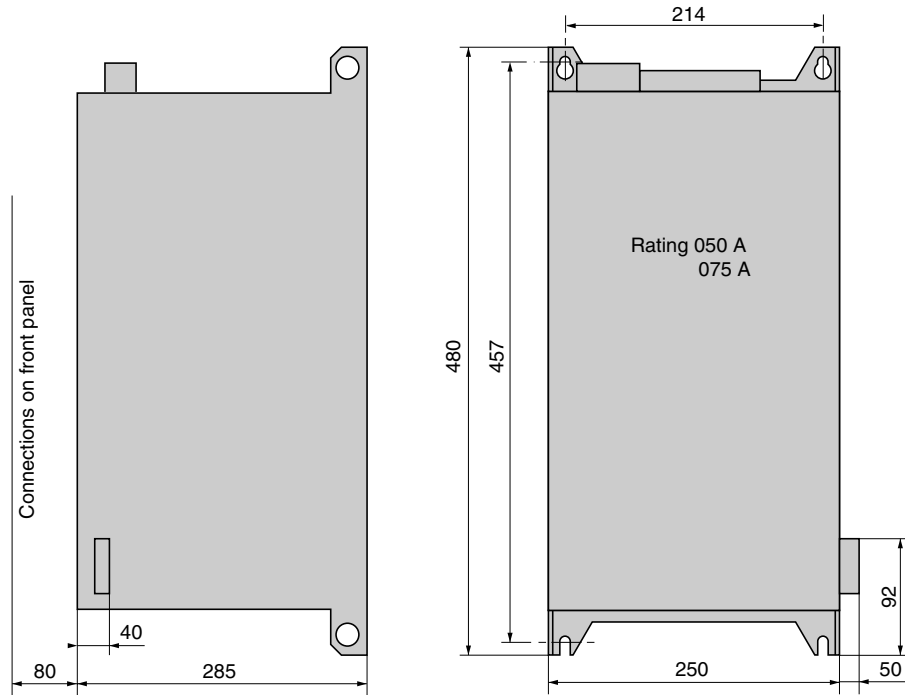
- Make sure each servodrive is correctly associated with the motor selected (see Chapter 7, Association Tables)
- Check that the servodrive rating is sufficient for power supply of the spindle and MDLU or MDLA servodrive modules selected
- Check that the braking resistor rating is correctly dimensioned
- Check that the choke coil is specified for regenerative braking
- Check that the maximum number of axes is not exceeded (power supply for MDLA axes)
- Optional EMC filters
- Commissioning tools and manuals.

Num Drive Servodrives

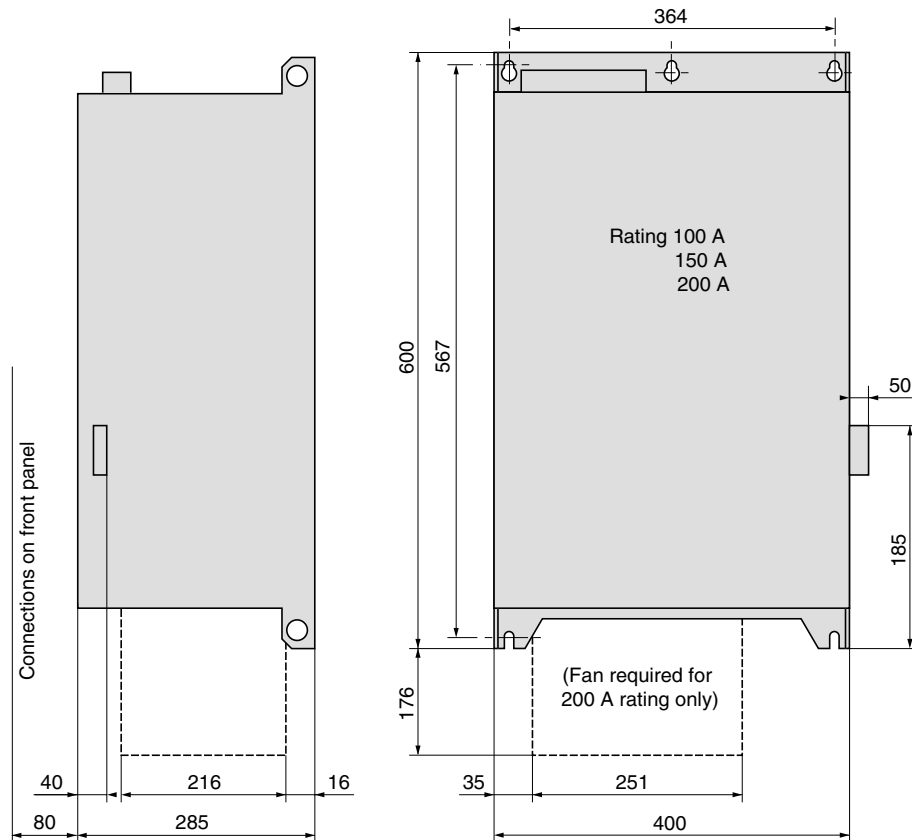
MDLS Compact Spindle Servodrives

Overall Dimensions

MDLS Size 1 (050, 075 A)



MDLS Size 2 (100 - 150 - 200 A)

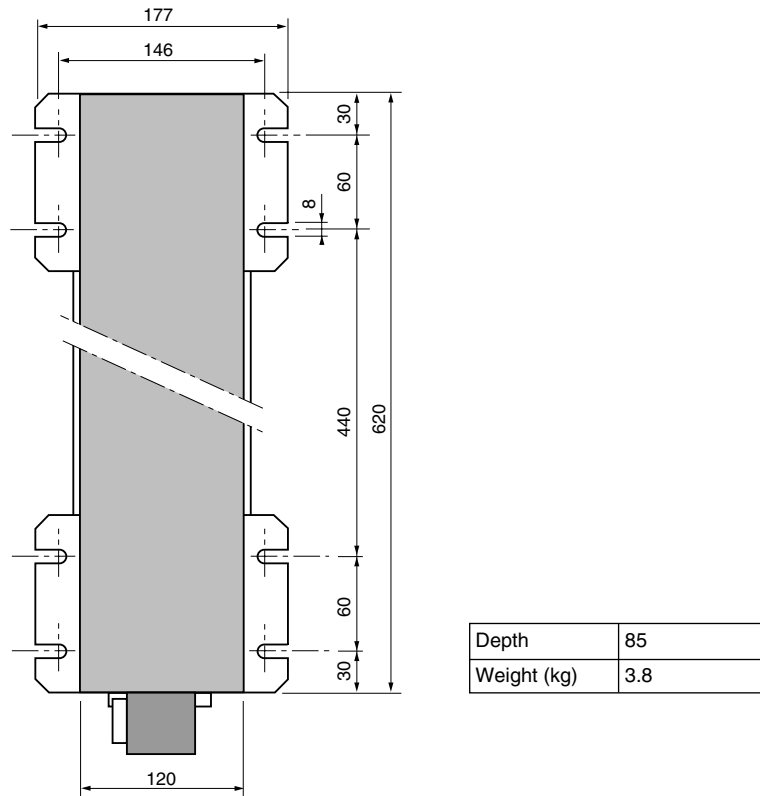


Num Drive Servodrives

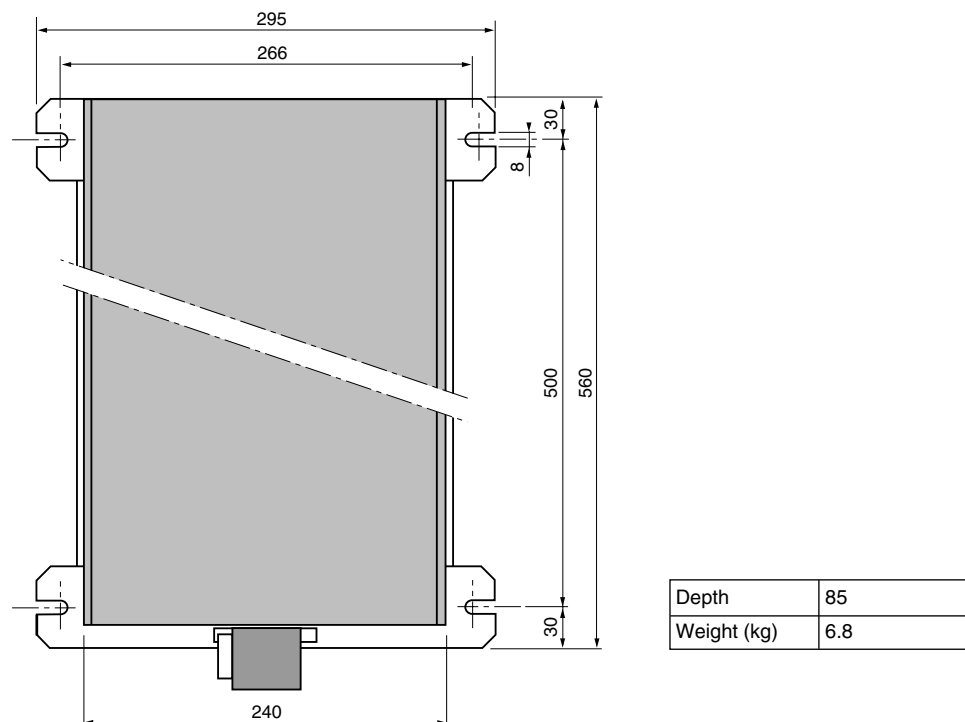
MDLS Compact Spindle Servodrives

Overall Dimensions

Braking resistor AGORES001 (1.3 kW - 13.5 Ω) (see also page 7/11)



Braking resistor KFIG2 (2.3 kW - 13.5 Ω) (see also page 7/11)



Num Drive Accessories

Table of Contents

	Page
Motor Connectors	
Connectors for BPH, BPG, BHL and BML Axis Motors	8/2
Crimping of Connectors for BPH/BPG 075 to 190 and BHL Axis Motors	8/3
Connectors for Spindle Motors	8/4
<hr/>	
Motor Cables	
General –Cables for BPH/BPG, BHL and BML Motors	8/5
Cables for BPH/BPG, BHL and BML Axis Motors	8/6
Adapter Cables for BPH / BPG Motors	8/7
Cables for SER Axis Motors	8/7
Cables for AMS-IM Spindle Motors	8/8
Motor Cable Sizes and Configuration	8/10
<hr/>	
EMC Filters	
AGOFIL Filters - Electrical Characteristics	8/9
Overall Dimensions of HPPM166 Filter	8/9
Overall Dimensions	8/10
<hr/>	
Choke Coils	
Overall dimensions of AGOREA Choke Coils	8/11
<hr/>	
Autotransformer	
Overall Dimensions of the Autotransformer	8/12

Note

For braking resistors, see Chapter 7: pages 7/5, 7/9, 7/11 and 7/16.

Num Drive Accessories

Connectors for Motors

Connectors must be ordered separately from motors unless the cables are specified assembled with motor connectors (cable assemblies).

Connectors for BPH, BPG, BPL, BML and BHL Axis Motors

Axis motors	Sensor and thermal probe connectors	
	Motor with 3 pp or 1 pp resolver (sensor R, U, T)	Motor with sensor for DISC NT (sensor P, Q)
BPH/BPG 075 to 190, BHL, BPL	AMOC0N003D (dia. 5.5 to 12)	AMOC0N002D (dia. 5.5 to 12)
BPH 055	CONN116D00	
BML 075	AMOC0N001D	

Axis motors	Power connections with EU shielded cables		
	Version "1" Connection to terminal box (1)	Version "5" Connection to connector (2)	Fan connector
BPH/BPG, BPL 075/ 095	BMHQPRE1	AMOC0N004D (dia. 7.5 to 18.5)	
BPH/BPG 115 All except 4 V 4 V	BMHQPRE2		
	BPH/BPG 142 2K, 2N, 2R, 3K, 3N, 4K 3R, 4N, 4R, 7N		
BPH/BPG 190 2K, 2N, 3K, 4K, 5H 2R, 3N, 4N, 5L, 7K, AK		BMHQPRE2	
	BPH 055	BMHQPRE3	
BML 075			
BHL 260 1N not ventilated 1N ventilated 2K not ventilated 2K ventilated		CONN118D00	
		AMOC0N005D (3) (dia. 9 to 24)	
			CONN113D00
		AMOC0N005D (3) (dia. 9 to 24)	
			CONN113D00

Motor unavailable

(1) Cable gland IP67 conforming to EU recommendations.

(2) The sealed cable gland is supplied with the power connector.

(3) The sealed cable clamp is supplied with the motor.

All the connector for the BPH/BPG motors have IP67 protection.

The numbers in parentheses are the minimum and maximum cable diameters acceptable by the connectors.

Example for AMOC0N003D: minimum cable diameter 5.5 mm, maximum cable diameter 12 mm.

Num Drive Accessories

Connectors for Motors

Crimping of BPH/BPG 075 to 190 and BHL Axis Motors

BPH/BPG 075 to 190 and BHL motors have crimped connectors. The following items are used for crimping:

- crimping pliers,
- wire positioners,
- any additional electric contacts (the motor connectors are supplied with their electric contacts).

Motors BPH/BPG 075/190, BPL and BHL	Connector	Crimping pliers	Positioners	Contacts	
All motors	Sensor (1)		AMOPOS001	AMOCTC001F	
BPH/BPG/BPL 075/095	Power (Phases and brake)	AMOPNZ001		AMOCTC002F	
BPH/BPG 115 all except 4 V 4 V		AMOPNZ002			
BPH/BPG 142 2K, 2N, 2R, 3K, 3N, 4K 3R, 4N, 4R, 7N		AMOPNZ001	AMOPOS002		
BPH/BPG 190 2K, 2N, 3K, 4K, 5H 2R, 3N, 4N, 5L, 7K, AK		AMOPNZ002	AMOPOS003 (2) AMOPOS004 (2)		AMOCTC003F (3) AMOCTC004F (3)
<i>Brake and phase connections differentiated</i>					
BHL 260 1N and 2K not ventilated (4) <i>Brake and phase connections differentiated</i>			AMOPOS003 (2) AMOPOS004 (2)		AMOCTC003F (3) AMOCTC004F (3)

(1) For motors equipped with sensors R, U, T, P and Q.

(2) 003 for brake connections; 004 for phase and ground connections.

(3) 003F for brake connections; 004F for phase and ground connections.

(4) The cable clamp is supplied with the motor. Ventilating motors require only a terminal box, but no power connectors.

Num Drive Accessories

Connectors for Motors

Connectors for Spindle Motors AMS, IM, AMR

AMS Motors

AMS motors are available only with power connection to terminal box.

Motors	Sensor and thermal probe connectors		Fan connector	Sealed cable gland conforming to EU recommendations for shielded power cable
	R	P, Q		
AMS 100	CONN108D00	CONN125D00	CONN113D00	BMHQPRE2 (1 per motor)
AMS 132				BMHQPRE3 (1 per motor)
AMS 160				BMHQPRE3 (2 per motor)

IM Motors

IM motors are available only with outputs via connectors.

Motor	Sensor connector H, R, (Q)	Fan connector	Thermal probe connector	Power connector	
				For EU shielded cable	For unshielded cable
IM 18M	CONN109G00	CONN114D00	CONN112D00	CONN122D00 (3 per motor)	CONN106D00 (3 per motor)

AMR Motors

AMR motors are available only with outputs via connectors.

Motor	Sensor and thermal probe connectors	Power connector
AMR 250	CONN109G00	CONN122D00 (3 per motor)

The sensors in parentheses are not presently available. Consult us.

Num Drive Accessories

Motor Cables

General - Motor Cables BPH/BPG, BHL, BML

Num only guarantees the operation of its equipment when used with the recommended cables.

Cables are supplied with or without the motor connector. For cables without, the connector must be ordered separately. Sensor and power cables are shielded.

Shielded Power Cables

Shielded power cables are available for all the motors. Their use is strongly recommended to guarantee compliance with EMC regulations.

For motors with a terminal box, it is necessary to order a **BMHQPREx** cable clamp to ensure the seal on the terminal box and compliance with EU recommendations (see pages 8/2).

General characteristics	Shielded power cables	
	High end P/N AGOCAV004, 005, 006	Low end P/N AGOCAV004L, AGOCAV005L
Conformity	UL and cUL, FT-1, CE, DESINA	
Operating temperature range	0 to 80 °C	0 to 60 °C
Chemical resistance (to cutting oils)	VDE 0472 - section 803 B - UL1581	VDE 0472 - section 803 B
Color	Orange - RAL2003	
Mechanical resistance	Tensile strength: Dynamic: 20 N/mm ² – Static: 50 N/mm ² Max. acceleration: 4 m/s ² Curve radius: 12 x cable external diameter Bending strength: 10 million cycles under the above conditions and at a speed of 120 m/min	Max. acceleration: 2 m/s ² Curve radius: 15 x cable external diameter Bending strength: 2 million cycles under the above conditions and at a speed of 30 m/min
Linear capacitance	< 150 pF/m	
Shielding	copper-plated encased tinplate (thickness > 85%)	copper-plated encased tinplate (thickness > 80%)
Service voltage	1000 V	

Other power, sensor and fan cables

General characteristics	Other power, sensor and fan cables P/N RSCAWG22x8, RPC001S, RPC445S, RPC455S, AGOCAV002, AGOCAV003
Conformity	UL and cUL, FT-1, CE, DESINA
Operating temperature range	0 to 80 °C
Chemical resistance (to cutting oils)	VDE 0472 - section 803B - UL1581
Color	Green - RAL6018
Mechanical resistance	Tensile strength: Dynamic: 20 N/mm ² – Static: 50 N/mm ² Max. acceleration: 4 m/s ² Curve radius: 12 x cable external diameter Bending strength: 10 million cycles under the above conditions and at a speed of 120 m/min
Linear capacitance	< 120 pF/m
Shielding	copper-plated encased tinplate (thickness > 85%)
Service voltage	300 V

Cable Part Numbers Depending on Length

See page 8/8 for the lengths available for each cable.

For all cables, the part number format is as follows:

- Cable alone (without motor connector): Specify the length in meters after the part number

Example for a 15-meter cable:

RSCAWG22X8 (15 m) RPC001S (15 m) AGOCAV001 (15 m)

- Cable assembly (cable equipped with motor connector): Specify the length in meters near the end of the part number (2 or 3 digits)

Example for a 15-meter cable:

AGOFRU022M015 AGOFRU008M015S AGOFRU005M015P

Num Drive Accessories

Motor Cables

Cables for Axis Motors

Motor	Sensor cables (shielded)			
	For resolver Sensor R, U, T		For DISC NT Sensor P or Q	
	Cables alone	Cable assemblies	Cables alone	Cable assemblies
BPH/BPG/BPL 075 to 190	RSCAWG22X8	AGOFRU022M...	RPC001S (1)	AGOFRU021M...
BHL		AGOFRU022M...	RPC001S (1)	AGOFRU021M...
BPH 055		AGOFRU008M...S		
BML 075		AGOFRU007M...S		

(1) or RPC002S, see page 7/10.

Motor unavailable

Cable assemblies for all BPH/BPG 075 to 190 motors are fitted with IP67 connectors (for resolver, DISC NT sensor and power line).

Cables for Additional Axis Sensor

Motor	Motor sensor	Cable
BPH/BPG 075 to 190	DISC NT sensor: P or Q	RPC002S (1)

(1) See page 7/10.

Power Cables for Axis Motors

Power Cables for BPH/BPG 075 to 190 Motors (phases UVW + brake)

BPH/BPG, BPL, BHL motors	Power cables		Fan cables	
	Cables alone	Cable assemblies	Cables alone	Cable assemblies
BPH/BPG/BPL 075/095	AGOCAV004	AGOFRU018M ...		
BPH/BPG 115 all except 4V 4V	AGOCAV004L	AGOFRU018LM ...		
	AGOCAV005 AGOCAV005L	AGOFRU019M ... AGOFRU019LM ...		
BPH/BPG 142 2K, 2N, 2R, 3K, 3N, 4K 3R, 4N, 4R, 7N	AGOCAV004 AGOCAV004L	AGOFRU018M ... AGOFRU018LM ...		
	AGOCAV005 AGOCAV005L	AGOFRU019M ... AGOFRU019LM ...		
BPH/BPG 190 2K, 2N, 3K, 4K, 5H 2R, 3N, 4N, 5L, 7K, AK	AGOCAV005L AGOCAV006	AGOFRU019LM ... AGOFRU020M ...		
	AGOCAV006 RPC445S	AGOFRU020M ...	AGOCAV001	AGOFRU012M010V
BHL 260 1N not ventilated 1N ventilated	AGOCAV006 RPC445S	AGOFRU020M ...	AGOCAV001	AGOFRU012M010V
	AGOCAV006 RPC445S	AGOFRU020M ...	AGOCAV001	AGOFRU012M010V

Motor unavailable

Cable assemblies for all BPH/BPG motors are fitted with IP67 connectors (for resolver, sensor, DISC NT and power line).

Power Cables for BPH 055 (phases UVW + brake) and BML 075 Motors (phases UVW)

Motors	Shielded power cables	
	Cables alone	Cable assemblies
BPH 055	AGOCAV004	AGOFRU001M...P/AGOFRU001LM...
BML 075	AGOCAV004L	AGOFRU002M...P

The "L" versions are intended for environments and operating conditions which are not very severe.

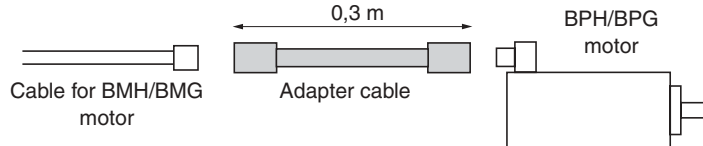
Num Drive Accessories

Motor Cables

Adapter Cables for BPH/BPG 075 to 190 Motors

The connectors (both sensor and power) of BPH/BPG 075 to 190 motors are different from those of the corresponding BMH/BMG motors. Adapter cables are available for use when replacing a BMH/BMG motor by a BPH/BPG motor.

These cables are 0.3 meters long. One end is fitted with a BMH/BMG type connector and the other with a BPH/BPG type connector.



Adapters for sensor cables	
All BPH/BPG 075 to 190 motors (1)	
DISC NT (sensor P, Q)	AMOADA001
Resolver (sensor R, T)	AMOADA002

Adapters for power cables		
Motors (2)		
BPH/BPG	075/095	AMOADA003
	115/142	AMOADA004
	190 2K, 2N, 3K, 4K, 5H	AMOADA005
	190 2R, 3N, 4N, 5L, 7K, AK	AMOADA006

If the motor comes with:

- terminal box (1), there is no power adapter, only a sensor adapter.
- power connectors (5), there are two adapters (sensor and power).

Cables for AMS-IM Spindle Motors

Motor	Sensor cables (shielded)	
	For resolver R	
	Cables alone	Cable assemblies
AMS	RSCAWG22X8	AGOFRU009M...S
IM 18M		AGOFRU006M...S

Motor		MDLS Servodrive	Power cable			
			Shielded		Unshielded	
			cable alone	cable assemblies	cable alone	cable assemblies
AMS	100 S/G/M	All sizes	RPC455S	Terminal box (no cables assemblies)		
	132 S/M/L	50-75-100	AGOCAV006			
	M/L	150	RPC445S			
	160 *	100	AGOCAV006			
		150-200	RPC445S			
IM	18M **	MDLS	RPC445S	AGOFRU005M...P	RPC435	5FM40M...

See page 8/8 for the minimum and maximum cable lengths

Unavailable

* Order two power cables for each AMS 160 motor, (two cables in parallel).

** Order three power cables for each IM 18M motor, (three power connectors).

Fan Cable for AMS Spindle Motor

The unshielded cable can be supplied alone or equipped with fan connector.

Motor	Cables alone	Cable assemblies
AMS	AGOCAV001	AGOFRU012M 010 V (1)

(1) For a length other than 10 m, consult us.

See page 8/8 for the minimum and maximum cable lengths.

Num Drive Accessories

Motor Cables

Cable for AMR Spindle Motor

Motor	Sensor cable	Power cable
AMR 250	RPC 001S	RPC 435S (3 per motor)

See page 8/8 for the minimum and maximum cable lengths.

Motor Cable Dimensions and Configuration

Cable part number	Cable alone or assemblies *	Diameter (mm)	Length (m)	Number and size of conductors		
AGOCAV001	Cable alone	8,2	Minimum length: 1 m Maximum length: 75 m	(3 + T) x 1 mm ²		
AGOCAV004		12,5		(3 + T) x 1,5 mm ² + 2 x 1 mm ²		
AGOCAV004L		9,1		4 x 1,5 mm ²		
AGOCAV005		15,5		(3 + T) x 4 mm ² + 2 x 1 mm ²		
AGOCAV005L		13,1		4 x 4 mm ²		
AGOCAV006		22,1		(3 + T) x 10 mm ² + 2 x 1 mm ²		
AGOFRU001M ... P	Cable assemblies *	11,2	005, 008, 010, 012, 015, 020, 025, 030, 040, 050, 075	Same as RPC305S		
AGOFRU001LM...		9,1		4 x 1,5 mm ²		
AGOFRU002M ... P		11,2		Same as RPC 305S		
AGOFRU005M ... P		24,8		Same as RPC435S		
AGOFRU006M ... S		11,5		005, 008, 010, 012, 015, 020, 025, 030, 040	Same as RSCAWG22X8	
AGOFRU007M ... S						
AGOFRU008M ... S						
AGOFRU009M ... S						
AGOFRU010M ... S	11,8	Same as RPC001S				
AGOFRU012M010V	8,2	010	Same as AGOCAV001			
AGOFRU018M ...	Cable assemblies *	13	005, 010, 015, 025, 035, 050, 075	Same as AGOCAV004		
AGOFRU018LM...		9,1		4 x 1,5 mm ²		
AGOFRU019M ...		16,2		Same as AGOCAV005		
AGOFRU019LM...		13,1		4 x 4 mm ²		
AGOFRU020M ...		23		Same as AGOCAV006		
AGOFRU021M ...		11,8		Same as RPC001S		
AGOFRU022M ...		12		Same as RSCAWG22X8		
AMOADA001		With connectors at both ends *		12	0,3	Same as RPC001S
AMOADA002	12		Same as RSCAWG22X8			
AMOADA003	11		Same as RPC305S			
AMOADA004	14,4		Same as AGOCAV005 (ex : RPC 315S)			
AMOADA005	21,8		Same as AGOCAV006 (ex : RPC 325S)			
AMOADA006						
RPC001S	Cable alone	12	Minimum length: 1 m Maximum length: 75 m	Twisted pairs + general shielding (2 p. 0,5 mm ² + 4 p. 0,25 mm ²)		
RPC002S		12		Twisted pairs + general shielding (2 p. 0,5 mm ² + 5 p. 0,25 mm ²)		
RPC305S		11		(3 + T) x 1,5 mm ² + 2 x 1 mm ²		
RPC435		25		(3 + T) x 21,5 mm ²		
RPC435S		25		(3 + T) x 21,5 mm ² + 2 x 1 mm ²		
RPC445S		25				
RPC455S		16,2		(3 + T) x 6 mm ² + 2 x 1 mm ²		
RSCAWG22X8		11,5		4 twisted pairs 0,3 mm ²		
5FM40M ...		Cable assemblies *		25	005, 010, 015, 020, 025	(3 + T) x 21 mm ²

* Cable assemblies: equipped with motor connector.

Num Drive Accessories

Motor Cables

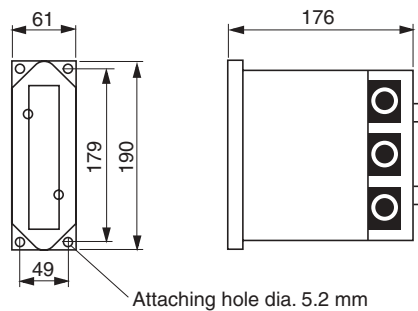
Electrical Characteristics (see also pages 7/13, 7/14)

Rms. current ratings of EMC Filters

Part number	Characteristics
AGOFIL001S	2 x 3 A - 400V - 50/60Hz
AGOFIL002A	3 x 16 A - 250/480V - 50/60Hz
AGOFIL003A	3 x 30 A - 250/460V - 50/60Hz
AGOFIL004A	3 x 50 A - 250/480V - 50/60Hz
AGOFIL005F	3 x 50 A - 250/460V - 50/60Hz
AGOFIL006A	3 x 70 A - 250/480V - 50/60Hz
AGOFIL007A	3 x 100 A - 250/480V - 50/60Hz
AGOFIL008F	3 x 100 A - 250/460V - 50/60Hz
AGOFIL009A	3 x 200 A - 250/480V - 50/60Hz
AGOFIL010A	3 x 150 A - 250/480V - 50/60Hz
AGOFIL011S	3 x 100 A - 480 V - 50/60 Hz
AGOFIL012S	3 x 180 A - 480 V - 50/60 Hz

The same filter can be common to several servodrives provided its current rating is sufficient.

HPPM 166 Filter

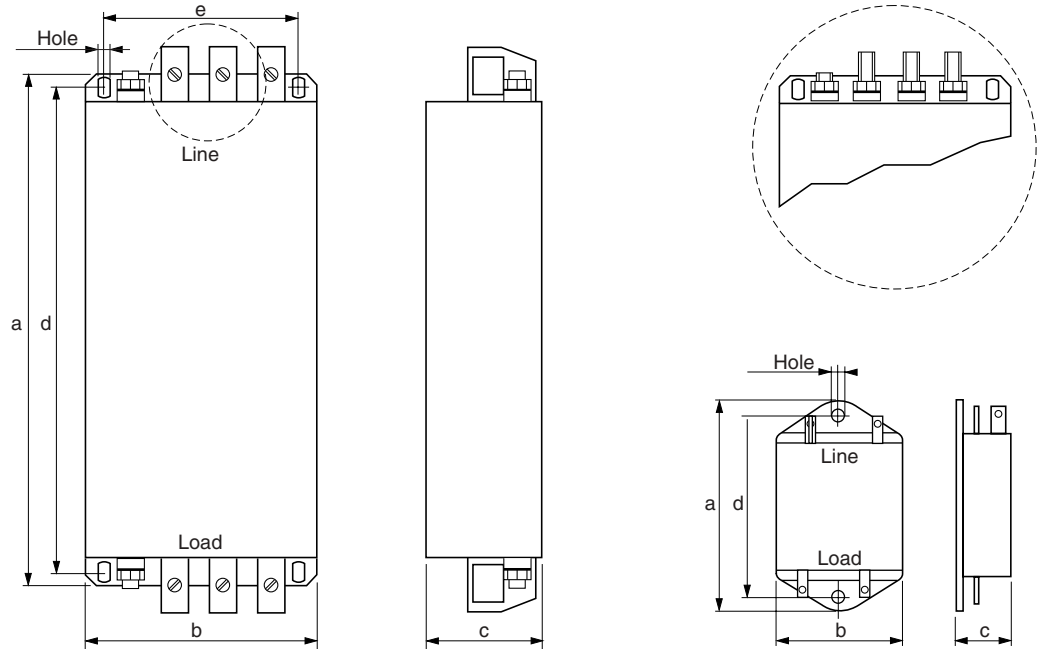


Weight: 1.2 kg
Attachment: screws (M8) and nuts
(recommended conductor dia.: 2.5 mm²)

Num Drive Accessories

EMC Filters

Dimensions



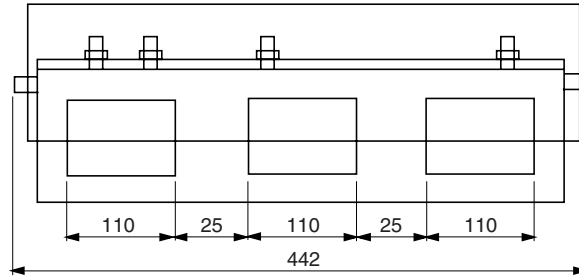
AGOFIL001S Filter

Filter part number	Dimensions (mm)					Hole Ø mm	Weight kg	Connection type			
	a	b	c	d	e			Terminal	Screw	Faston	Clamp
AGOFIL001S	85	54	41	75	–	5.3				x	
AGOFIL002A	230	96	38	213	80	4.5	1.4	x			
AGOFIL003A	360	210	39	340	180	7	3	x			
AGOFIL004A	360	210	50	340	180	7	3.2	x			
AGOFIL005F	245	100	90	220	70	4.5	4.1		M5		
AGOFIL006A	400	170	65	375	130	6.5	7.1	x			
AGOFIL007A	400	170	65	375	130	6.5	8.8	x			
AGOFIL008F	356	185	90	320	155	4.5	9.2		M6		
AGOFIL009A	550	220	153	500	180	6.5	13.1	x			
AGOFIL010A	400	170	90	375	130	6.5	9.1	x			
AGOFIL011S	379	90	220	364	65	6.5	6				x
AGOFIL012S	438	110	240	413	80	6.5	11				x

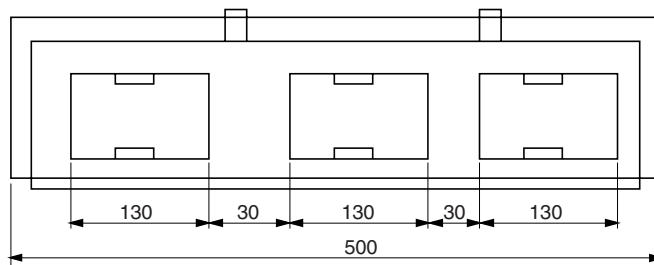
Num Drive Accessories

EMC Filters

AGOREA... Choke Coils (see also page 7/13)



	Weight (kg)
AGOREA001	14



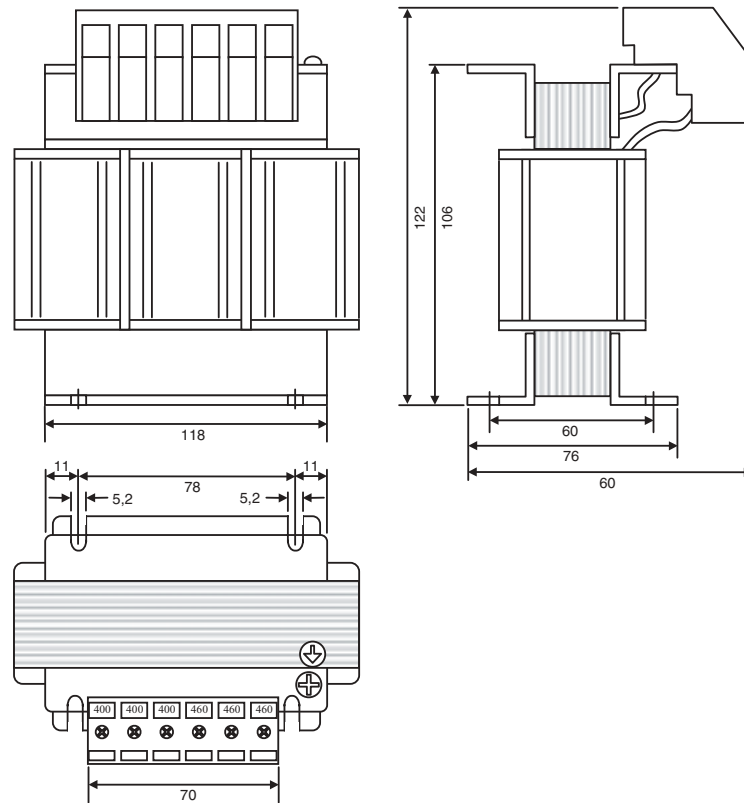
	L	Weight (kg)
AGOREA002	219	24
AGOREA003	254	36

Num Drive Accessories

Autotransformer

Autotransformer (see Sect. AMS and BHL)

Autotransformer (P/N **AMOTRF001** - 480/400 V - 60 Hz - 250 VA) available for AMS or BHL motor fans when a 460 VAC power supply voltage is used.



Motor/Servodrive Associations

Table of Contents

Selecting Sensors for Motors	Page
Sensors for Axis Motors	9/2
Sensors for Spindle Motors	9/2
<hr/>	
Axis Motor/Servodrive Associations	
Associations of BPH and BPG Axis Motors with MDLA Servodrives	9/3
Associations of BPL Axis Motors with MDLA Servodrives	9/4
<hr/>	
Spindle Motor/Servodrive Associations	
Characteristics	9/5
Associations of AMS Spindle Motors with MDLS Servodrives	9/6
Associations of IM 18M and AMR Spindle Motors with MDLS Servodrives	9/7
Association of IM 18M 214 Motor with UAC Servodrive	9/7
Associations of MSA Motorspindles with MDLS Servodrives	9/8

Motor/Servodrive Associations

Selecting Sensors for Motors

The sensor selected for a motor must correspond to the table below. The selection depends on the motor/servodrive association and the functionality required.

Sensors for Axis Motors

Axis motor	Num Power 1020/1040/1060/1080 CNC
	MDLA modular
BPH 055	U(1)
BPH/BPG 075 to 190 and BPL	R, U
BML 075	R
BHL 260	R

(1) When the BPH 055 motor is used with an MDLA servodrive, resolver adapter module P/N **MDLQ1CR04** is required.

Sensors for Spindle Motors

Spindle motor	Num Power 1020/1040/1060/1080 CNC
	MDLS
AMS	R, H
IM 18M	R (servodrive option 00)
	H (servodrive option 01)
AMR	C (servodrive option 01 or 02)
MSA (except 285 and 320)	V, C (servodrive option 01 or 02)
MSA 285 and 320	G (servodrive option 02)
MSS	

Combination unavailable.

The sensors in parentheses are not presently available. Consult us.

Example: An AMS 100 motor can be associated with an MDLS servodrive if it is equipped with an R or H sensor.

Sensor Definition

- R** Resolver with three pole pairs for all routine operations.
- T** Resolver with three pole pairs and prewired for encoder (available for BPG/BPH motors).
In addition, the rear end plate of the motor is bored to accommodate an adaptor plate P/N **BMHQF426** for mounting an ROD426 encoder or equivalent.
When delivered, the hole in the motor end plate is capped by a screwed metal plate.
A coupling P/N **BMHGG10** between the motor and encoder can be supplied.
- U, F** Resolvers with one pole pair; one zero pulse per mechanical revolution (inner and outer diameters different).
- P** High resolution (4096 revolutions) multiturn sensor used for DISC NT applications (parallel link). Includes a zero position and does not require a **BSPICAA0804** sensor.
- Q** High resolution singleturn sensor used for DISC NT applications. Includes a zero position and does not require a **BSPICAA0804** sensor.
- H** High resolution sensor used for C axis type applications (without zero marker).
- V, C, G** High resolution sensors used for C axis type applications (with zero marker).

Motor/Servodrive Associations

Associations of BPH and BPG Axis Motors with MDLA Servodrives

Motors		Permanent torque when stopped Cn (1) (Nm)	Nominal speed ω_n (tr/min)	MDLA servo-drive	Maximum torque (Nm)	BPH		BPG rotor inertia In (g.m ²)	Permanent current when stopped i_{dim} (A eff)	P = Cn x ω_n /1000 (kW) (2)	
						Un-braked rotor inertia (g.m ²)	Braked rotor inertia (g.m ²)				
No.	BPH-BPG ...										
1	055 2S	0.4	8 000	007	1.4	0.024	0.025		1.07	0.33	
2	075 1N	1.3	3 000	014	5.2	0.08	0.12	0.254	2.2	0.41	
3		1V	6 000	014	3.9				3	0.82	
4		2N	2.3	3 000	014	7.5	0.12	0.16	0.304	2.7	0.72
5		2V	6 000	014	5.9					3.5	1.45
6		4N	4	3 000	014	11	0.21	0.25		3.5	1.26
7	095 2N	4.3	3 000	014	11	0.3	0.41	0.86	3.5	1.35	
8		2V	6 000	021	10				5.9	2.70	
9		3N	6	3 000	021	16	0.41	0.52	0.97	5.2	1.88
10		3V	6 000	034	14					10.3	3.77
11		5N	9.2	3 000	021	22	0.64	0.75		5.8	2.89
12	115 2N	7.4	3 000	021	16	0.7	1.07	2.45	5.5	2.32	
13		2V	6 000	034	14				10.5	4.65	
14		3K	10.5	2 000	021	24	0.97	1.34		5.3	2.20
15		3N	3 000	034	22				2.73	9.2	3.30
16		3V	6 000	034	18					12.6	6.59
17		4K	13.3	2 000	021	27	1.25	1.62		6.2	2.78
18	4N	3 000	034	27					10.1	4.18	
19	4V	6 000	050	23					17.6	8.35	
20	6N	18.7	3 000	034	33	1.8	2.17		12	5.87	
21	142 2K	12	2 000	021	22	1.59	2.54		6	2.51	
22		2N	3 000	034	20				6.7	10.4	3.77
23		2R	4 250	034	19					11.5	5.34
24		3K	17	2 000	034	33	2.19	3.14		9.5	3.56
25		3N	3 000	034	28				7.3	11.7	5.34
26		3R	4 250	050	28					16.9	7.56
27		4K	22	2 000	034	41	2.79	3.74	7.9	10.4	4.61
28		4N	3 000	050	41					15.6	6.91
29		4R	4 250	075	45					20.8	9.79
30		7K	35	2 000	075	71	4.29	5.24	9.7	24.2	11.0
31		7N	3 000	075	71					24.2	11.0
32	190 2K	25	2 000	050	40	5.14	8.25	20.9	16.6	5.23	
33		2N	3 000	050	35				19.9	7.85	
34		2R	4 250	075	36				29.2	11.1	
35		3K	36	2 000	050	52	7.1	10.2	22.9	19.7	7.54
36		3N	3 000	075	54					27.8	11.3
37		4K	46	2 000	075	90	9.04	12.1		20.6	9.63
38		4N	3 000	075	69				24.8	30.3	14.5
39		5H	56	1 500	050	82	11	14.1		20	8.79
40		5L	2 500	075	79					31.4	14.7
41		5L	2 000	100	95				26.8	31.4	14.7
42	7K	75	2 000	075	120	14.9	18		27.9	15.7	
43	AK	100	2 000	100	145	20.75	23.8		44	21	
				150 (3)							

Motor unavailable

1) The torque and current are specified for a frame temperature rise of 100 K. Multiply these values by 0.77 if the motor temperature rise is limited to 60 K.

Torque tolerance: theoretical: $\pm 10\%$, typical: $\pm 5\%$

If the motor is installed on a thermally insulating support, decrease the specified torques by another 10%.

(2) Digital value used for a simplified sizing of the spindle servodrive (see page 7/11).

(3) Under evaluation.

Motor/Servodrive Associations

Associations of BHL Axis Motors with MDLA Servodrives

No.	Motor BPL	Permanent torque when stopped (100 K) Cn (1) (Nm)	Nominal Speed n (rpm)	MDLA Servo-drive	Maximum Torque (Nm)	Rotor inertia		Permanent torque when stopped In (Arms)	P = Cn x n / 1000 (kW) (2)
						Un-braked (g.m ²)	Braked (g.m ²)		
1	075 1V	1.1	6 000	014	3.6	0.108		2.6	0.69
2	095 1V	2.0	6 000	014	4.9	0.24		4.9	1.25

No.	BML ...								
3	075 1V	1.2	6 000	014	3.6	0.08		2.8	0.69
4	3N	2.8	3 000	014	7	0.15		4	0.87
5	3v		6 000	021	7.2			5.8	1.75

A BHL motor can be controlled by an MDLA axis servodrive.

No.	Motors BHL 260		Permanent torque when stopped Cn (1) (Nm)	Nominal Speed (ωn) (rpm)	MDLA servodrives	Maximum Torque (Nm)	Rotor inertia		Permanent torque when stopped In (Arms)	P = Cn x ωn / 1000 (kW) (2)
							Un-braked (g.m ²)	Braked (g.m ²)		
1	1N	Not ventilated	85	3000	MDLA 150	165	45	48.1	52	26.7
2	1N	Ventilated	98						60	30.8
3	2K	Not ventilated	120	2000		230	66.2	69.3	52	25.1
4	2K	Ventilated	139						60	29.1

(1) The torque and current are specified for a frame temperature rise of 100 K. Multiply these values by 0.77 if the motor temperature rise is limited to 60 K.

Torque tolerance: theoretical: ± 10%, typical: ± 5%

If the motor is installed on a thermally insulating support, decrease the specified torques by another 10%.

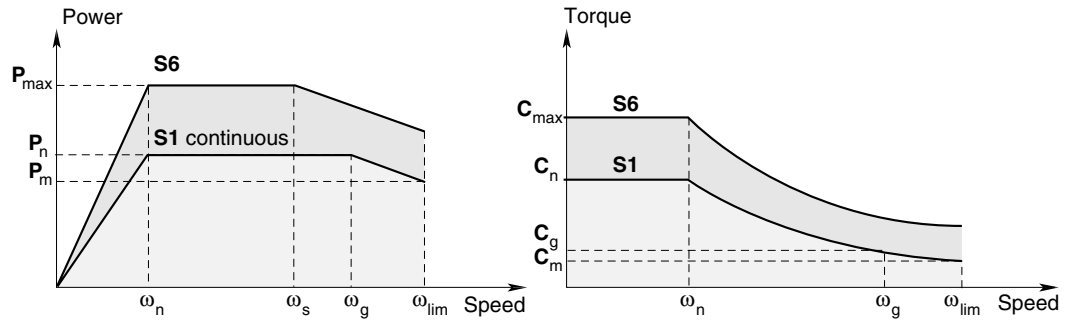
(2) Digital value used for a simplified sizing of the spindle servodrive (see page 7/11).

Motor/Servodrive Associations

AMS Spindle Motors

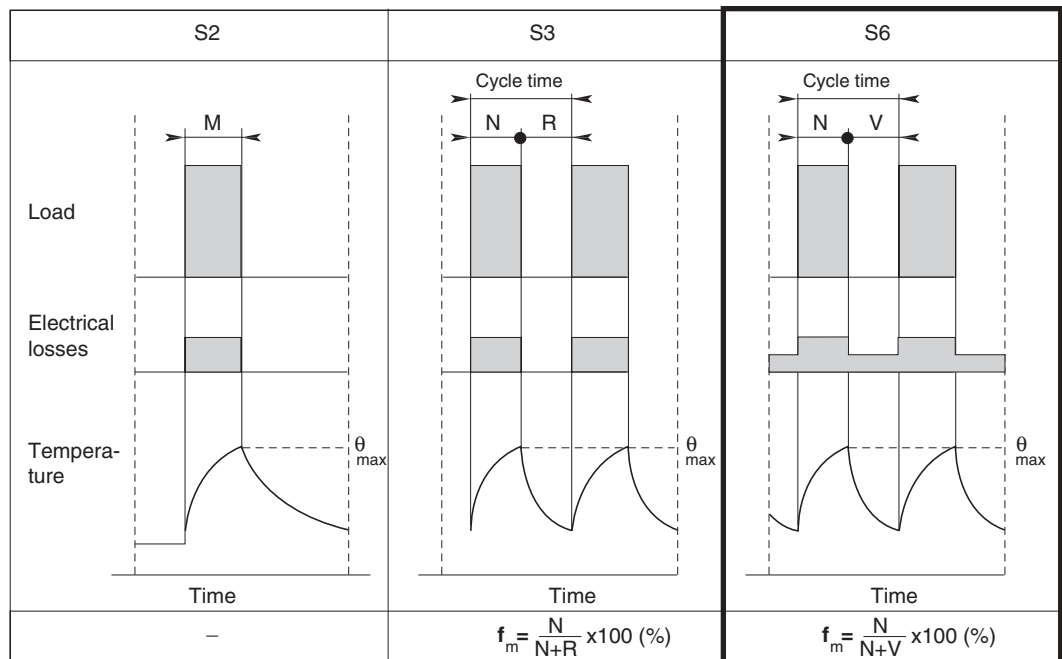
Characteristics

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_s = Maximum speed for operation at constant power in range S6 (rpm)
- ω_g = Maximum speed for operation at constant power in range S1 (rpm)
- C_g = Torque corresponding to speed ω_g (Nm)
- 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



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

Motor/Servodrive Associations

Associations of AMS Spindle Motors with MDLS Compact Servodrives

Motors		Cou- pling	MBLD MDLS Servo- drive	Continuous operation							Overload			
				S1							S6			
No.	AMS ...			Pn (kW)	ω_n (rpm)	ω_g (rpm)	ω_{lim} (rpm)	Pm (kW)	Cn (Nm)	Icont (Arms)	Pmax (kW)	Cmax (Nm)	Ims (Arms)	10 min (%)
1	100 SB	Y	050	3.7	1 500	6 500	6 500	3.7	24	21	6	40	35	30
2	MB	Y	050	5.5				5.5	35	26	7.5	47	35	
3	GB	Y	075	9				9	57	39	12.5	80	53	
4	SD	Y	050	3.7	1 500	6 500	12 000	1.8	24	21	6	40	35	30
5	MD	Y	050	5.5				2.8	35	26	7.5	47	35	
6	GD	Y	075	9	1 500	8 200		6.2	57	39	12.5	80	53	
7	132 SA	Y	050	5	750	6 000	7 000	2.8	64	26	7.5	95	35	37
8	SC	Y	075	10	1 500	6 000		8	64	39	14	89	53	37
9	SE	Δ	100	15	1 750	4 000		10	82	52	23	110	71	30
10	MA	Y	075	7.5	750	6 000		5.7	95	39	10	127	53	37
11	MC	Y	100	15	1 500	6 000		12.5	95	52	21	134	71	37
12	ME	Δ	150	19.5	1 850	5 500		19	100	72	35	149	106	30
13	LA	Y	100	11	750	6 000		9	140	52	15	191	71	37
14	LE	Y	150	22	1 250	4 200		15	168	72	36	229	106	30
15	SF	Y	050	5	750	6 000	10 000	2	64	26	7.5	95	35	37
16	SG	Y	075	10	1 500	6 000		6	64	39	14	89	53	37
17	SH	Δ	100	15	1 750	4 000		7.5	82	52	23	110	71	30
18	MF	Y	075	7.5	750	6 000		4	95	39	10	127	53	37
19	MG	Y	100	15	1 500	6 000		9	95	52	21	134	71	37
20	MH	Δ	150	19.5	1 850	5 500		13.5	100	72	35	149	106	30
21	LF	Y	100	11	750	6 000	9 000	7	140	52	15	191	71	37
22	LI	Y	075	12.5	680	2 300		3	175	39	16.8	236	53	30
23	LH	Y	150	22	1 250	4 200		12	168	72	36	229	106	30
24	160 MA	Y	100	18	650	1 300	8 500	2.7	264	52	24.2	355	71	35
25		Δ			1 300	2 600		5.4	132			178		
26	MB	Y	150	26	1 200	2 400		7.3	208	72	36.4	290	106	
27		Δ			2 400	4 800		14.5	104			145		
28	MC	Δ	200	36	1 700	2 800		11.8	202	100	47	300	141	
29	LA	Y	100	18	500	1 000	6 500	2.8	344	52	24.2	463	71	
30		Δ			1 000	2 000		5.6	172			231		
31	LB	Y	150	26	950	1 900		7.6	260	72	36.4	364	106	
32		Δ			1 900	3 800		15.2	130			182		
33	LC	Δ	200	36	1 050	2 100		11.6	328	100	48	437	141	

The torque and current are specified for a maximum ambient temperature of 40°C and a maximum frame temperature rise of 100 K.

Motors with electrical coupling change can be switched on the fly.

Torque tolerance: theoretical $\pm 10\%$, typical $\pm 5\%$.

Motor/Servodrive Associations

Associations of IM 18M and AMR Spindle Motors
with MDLS Compact Servodrives
Association of IM 18M 214 Motor with UAC Servodrive

Associations of IM 18M and AMR Spindle Motors with MDLS Servodrives

Motors		Cou-pling	MDLS Servo-drive	Continuous operation							Overload			
				S1							S6			
No.				P _n (kW)	ω _n (rpm)	ω _g (rpm)	ω _{lim} (rpm)	P _m (kW)	C _n (Nm)	I _{cont} (Arms)	P _{max} (kW)	C _{max} (Nm)	I _{ms} (Arms)	10 min (%)
34	IM 18M 214	Y	150	26	500	1 000	7 000	3.7	500	72	36.4	700	106	35
35		Δ			1 000	2 000		7.4	250			350		
36		Δ	200	36	950	1 900		9.8	362	100	50.4	506	141	
37		Δ Δ			1 900	3 800		19.6	181			253		
38	AMR 250 HA	Y	200	30	843	2 300	10 000	6.7	340	100	37	440	141	50
39	(1)	Δ		(1)	1 900	6 300			18	151			186	

(1) The above performance characteristics are obtained using a change of electrical coupling and dual cooling (air and water) as indicated below.

Type of cooling fluid	Flow rate	Maximum fluid inlet and outlet temperature difference	Pressure
Water	6 (l/min)	15 °C	0.5 bar (1)
Air	33 (l/s)	50 °C	5 bars (2)

(1) Water inlet temperature: 20°C.

(2) Inlet air dried and filtered to 30 micrometers.

The coupling can be switched on the fly.

If the servodrive is a UAC servodrive, it must mandatorily be fitted with a card (G14 or G15).

The above current and torque are specified for a maximum ambient temperature of 40°C and a maximum frame temperature rise of 100 K.

Torque tolerance: theoretical ± 10%, typical ± 5%.

Association of IM 18M 214 Motor with UAC Servodrive

Former motor name: IM 180 2Y 4814

With YY coupling, this motor must be supplied by a UAC300 servodrive.

Motor		Cou-pling	UAC Servo-drive	Continuous operation							Overload			
				S1							S6			
No.				P _n (kW)	ω _n (rpm)	ω _g (rpm)	ω _{lim} (rpm)	P _m (kW)	C _n (Nm)	I _{cont} (Arms)	P _{max} (kW)	C _{max} (Nm)	I _{ms} (Arms)	10 min (%)
40	IM 18M 214	YY	300	55	1 050	2 100	7 000	16.5	500	141	76	690	212	35

The torque and current are specified for a maximum ambient temperature of 40°C and a maximum frame temperature rise of 100 K.

Torque tolerance: theoretical ± 10%, typical ± 5%.

Motor/Servodrive Associations

Associations of MSA Motorspindles with MDLS Compact Servodrives

Motors		Cou- pling	MDLS Servo- drive	Continuous operation							Overload			
				S1							S6			
No.	MSA ...			Pn (kW)	ω_n (rpm)	ω_g (rpm)	ω_{lim} (rpm)	Pm (kW)	Cn (Nm)	Icont (Arms)	Pmax (kW)	Cmax (Nm)	Ims (Arms)	10 min. (%)
1	184 DA (1)	Y	050	6.5	2 000	4 000	10 000	2.6	31	26	8.7	42	35	25
2		Δ			4 000	8 000			5.2	15.5			21	
3	HB (1)	Y	100	15	2 000	4 000	12 000	5	72	52	20	95	71	25
4		Δ			4 000	8 400			10	36			48	
5	220 DA	Y	050	7.5	1 000	2 000	10 000	1.6	72	26	10	96	35	25
6		Δ			2 000	4 400			3.3	36			48	
7	DB	Y	100	14	1 400	2 600	10 000	3.5	96	46	18	123	62	25
8		Δ			2 600	6 000			7	51			66	
9	240 DA	Y	100	13.5	1 200	2 200	10 000	3	107	46	17.5	139	62	25
10		Δ			2 200	6 000			7	59			76	
11	HA	Y	100	13.5	850	1 500	10 000	2	152	46	18	240	71	19
12		Δ			1 500	4 000			4.5	86			145	
13	HB	Y	150	20	1 300	2 000	10 000	4	147	65	27	198	95	25
14		Δ			2 000	5 200			10	96			129	
15	HC	Y	200	30	2 000	3 800	10 000	11	144	100	41	196	141	25
16		Δ			3 800	10 000			30	72			103	
17	285 DA	Y	150	20	765	1 500	6 000	5	250	72	27	337	106	25
18		Δ			1 500	5 000			17	127			172	
19	320 DA	Y	150	20	425	1 050	6 000	4	450	72	27	610	106	25
20		Δ			1 050	4 500			13	182			246	
21		Y	200	20	425	800	6 000	4	450	75	27	760	120	20
22		Δ			800	4 500			13	238			322	

(1) MSA 184 DA and HB Motorspindles: The specified characteristics are obtained with dual cooling (liquid-cooled stator and air-cooled rotor).

The torque and current are specified for a maximum ambient temperature of 40°C and a maximum frame temperature rise of 100 K.

Motors with electrical coupling change can be switched on the fly.

The above performance characteristics are obtained when complying with the cooling recommendations given by Num (see Motorspindle catalog 738E012).

Torque tolerance: theoretical $\pm 10\%$, typical $\pm 5\%$.

General Information

Table of Contents

Index	10/2
Num in the World	10/4
Regulations	10/6

General Information

Index

A

Acceleration law 2/12, 4/4
Analog servodrives 1/3, 1/5, 4/4
Anti-pitch correction 2/12
ASM/IM/AMR motors 1/3, 1/5, 1/7, 6/1, 9/1
Axes
 axis calibration 2/12, 4/5
 axis interface module 2/11, 3/12
 axis motors 1/3, 1/5, 5/1, 7/1
 axis servodrives 1/3, 1/6, 1/7, 6/1, 7/1
 CNC axes, PLC axes 1/5, 2/11, 4/4
 duplicated and synchronized axes 2/12, 4/5
 functions related to the axes 2/12, 4/5-4/7
 inclined axes 2/12, 4/6
 measurement inputs 1/5, 2/3, 2/11
 multigroup-multichannel function 1/5, 2/3, 2/12, 4/6
 positioning axes and interpolated axes 2/12, 4/5
Axis Extension Units (Modax) 2/6, 3/4
Axis groups 1/5, 2/3, 2/12, 4/16

B

Backlash/temperature compensation 4/6
Backtrack along path 4/17
Ball-bar 4/7
BHL, BML, BPG, BPL motors 1/3, 1/5, 5/1, 7/1
Boring (function) 2/2, 2/16, 2/22

C

C language 2/13, 2/27, 4/10, 4/27
Cables
 CNC/panels, connecting cables 2/9
 fiber-optic for machine panel *Mplus* and *Tplus*
 panel, remote I/O modules 2/10, 2/14
 for motors 8/5-8/8
Channels 1/5, 2/3, 2/12, 4/6
Choke coils 7/13
Communication 1/5, 2/26, 4/29
Connectors for motors 8/2-8/4
Cycles
 customized 4/16
 gear-cutting 2/5, 2/17, 4/14
 milling 4/14
 turning 4/16

D

Dynamic operators 4/27

E

EMC filters 6/22
Emergency retraction 4/17

F

Fipway 1/5, 2/26, 4/29

G

Graphics (2D and 3D) 4/19, 4/23
Grinding 2/20-2/21

H

Handwheels 1/5, 2/3, 2/10-2/11
High speed machining 4/16
Human/Machine interface 4/18

I

Inclined plane 4/15
Inputs/outputs 1/5, 2/13, 3/15, 4/11
Interpolation
 5 to 9 axes 2/12, 4/5
 linear, circular, helical 2/12, 4/5
 smooth polynomial, spline, NURBS 2/12, 4/5
Intuitive CNCs (see Num Power *Mplus*, Num Power *Tplus*)

K

KBD30 keyboard (see FS20 operator panel)

L

Look-ahead 2/12, 4/4

M

Machine messages, CNC messages 4/24
MDLA 1/3, 1/5, 1/7, 6/1, 7/1
MDLS 1/3, 1/5, 1/7, 6/1, 7/1
Measurement 4/7, 4/17
Milling 2/5, 2/16
Mixed machine (milling+turning) 2/12, 4/16
MMITool 2/26-2/27, 4/28
Motor/Servodrive Associations 1/7, 9/1

N

N/M auto function 4/15
NumBackUp 2/27, 4/28
Num Power *Mplus*, Num Power *Tplus*
 basic platform, panel and keyboard 2/7, 2/10, 3/10
 functions, procedures 2/24-2/25, 4/25
 reference and limits 1/3, 1/5, 2/2-2/3
Num Power 1020 and Num Power 1040
 CNC platforms 2/6, 2/11, 3/2
 limits and references 1/3, 1/5, 2/2-2/3
Num Power 1060 and 1080
 limits and references 1/3, 1/5, 2/2-2/3
 basic CNC platforms 2/6, 2/11, 3/4

General Information

Index

O

On-the-fly measurement acquisition 4/17

P

Panels

compact CNC panel 2/9, 3/10-3/11
LCD operator panel 2/9, 3/12
machine panel MP02 2/9, 3/12
Num Power *Mplus*, Num Power *Tplus* panels 3/14
portable operator panel (POP) 2/10, 3/11

Parameters 4/22

PC 1/3, 1/5, 2/9, 2/27, 2/28, 3/7, 3/9

PCToolKit 2/27, 4/28

PERSOTool 2/27, 4/28

PLC

CNC/PLC transfers 4/10

inputs/outputs 1/5, 2/13, 3/15, 4/11

memory 2/4-2/5, 4/10

PLC axes 2/11, 4/4

programming 2/14, 4/10

PLCTool 2/27, 4/28

PROCAM 2/5, 2/15, 2/18, 2/26, 4/24, 4/26

Processor data interchange 2/26, 4/29

PROFIL 4/23

Program interrupts 4/17

Programming

parametric, structured 4/22

part 4/19

the PLC 2/13, 4/10

Q

QWERTY PC keyboard 3/7

R

RAM memory

part program 2/4-2/5, 4/20

MMI 2/4-2/5

PLC program 2/4-2/5, 4/10

Regulations 10/6

Resident macros 4/20

Resident utilities 4/26

RTCP 4/15

S

Scaling factor 4/22

Sensors for motors 9/2

Selection guide

Motors and Servodrives 5/2

Panels 3/5

Serial lines 1/5, 2/26, 4/29

Servodrives

Motor-servodrive associations 9/1

Settable precision 2/12, 4/6

SETTool 2/27, 4/28

Spindles

C axis 4/7-4/8

spindle control, functions 1/5, 2/3, 2/11-2/12,
4/8-4/9

spindle motors 1/3, 1/5, 5/1, 7/1

spindle servodrives 1/3, 1/6, 1/7, 6/1, 7/1

Subroutines 4/22

System integration 1/3, 2/26-2/27, 4/26

System user languages 2/9

T

Technical documentation 2/28-2/30

Transformer 7/13

Turning 2/2-2/3, 2/14

U

Uni-Telway 1/5, 2/26, 4/29

V

Visual Tool 4/19

W

Woodworking 2/5, 2/22

General Information

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NUM Worldwide

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General Information

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NUM Worldwide

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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.

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