

INNOVATIVE TECHNOLOGY
MAXIMUM RELIABILITY
MAXIMUM CAPACITY

CNC SYSTEM PA 8000 EL



MILLING

LASER CUTTING

WATERJET CUTTING

PLASMA CUTTING

OXY-FUEL CUTTING

TURNING

GRINDING

WELDING

PUNCHING

NIBBLING

ERODING

With pc-based CNC controls from POWER AUTOMATION you are ahead of time!

Power Automation is a medium-sized high tech company based in Pleidelsheim north of Stuttgart. In the center of one of the most important industrial areas of Europe, we develop innovative CNC systems for machine tools since over 30 years. Power Automation was one of the first companies which developed pc-based CNC controls for industrial use. Therefore we have many years of experience in the development and production of pc-based control systems. During that time we created efficient, reliable and flexible solutions in cooperation with our customers.

Power Automation is the only CNC manufacturer, that can regulate all working processes with a PC-based CNC control. From simple 3-axis application to high-complex 5-axis simultaneously process, we offer you entire automation solutions from one source. Beside CNC systems and accessories we offer also a wide range of services. We create with you completely custom-made solutions according to your requirements – from the development to start-up. **Benefit already today from next generation's CNC technology.**

Die PA 8000 EL is the most compact system of the PA 8000 series. The PA 8000 EL is available in 3 models:

PA 8000 EL PRO (Professional)

- Up to 16 axes
- Up to 7.200 NC-blocks/sec
- PA SDI
- Integrated I/Os

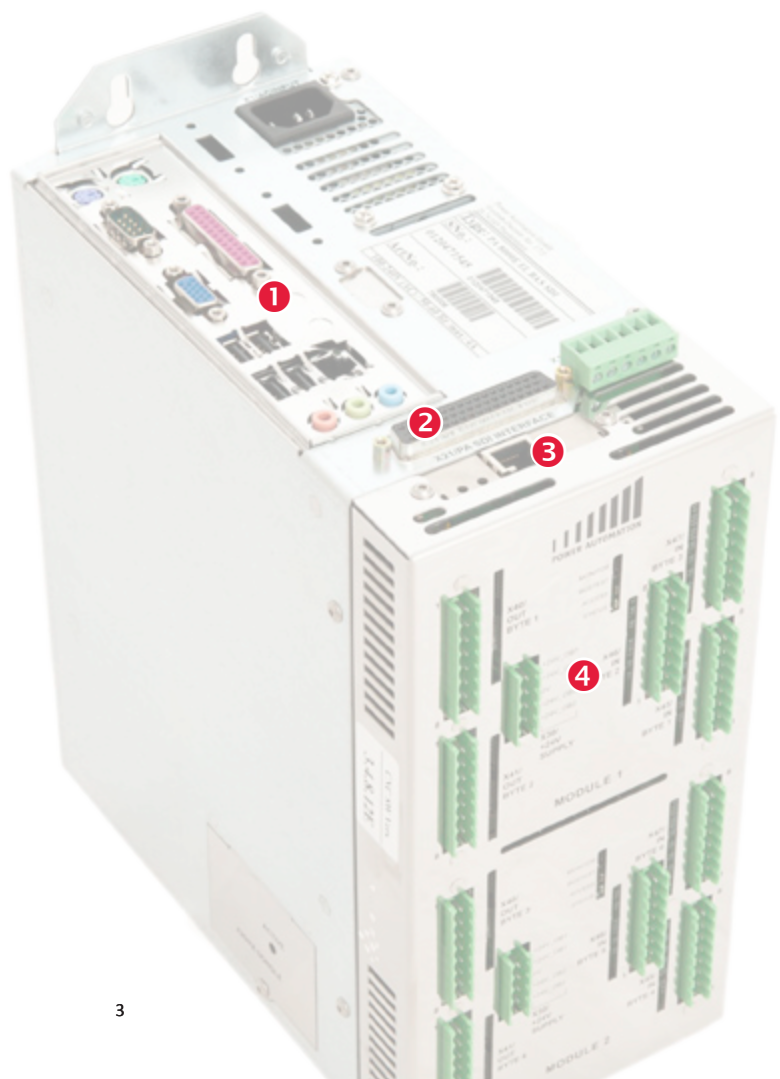
PA 8000 EL STD (Standard)

- Up to 16 axes
- Up to 7.200 NC-blocks/sec
- PA SDI und/oder Analog
- Integrated I/Os

PA 8000 EL BAS (Basic)

- Up to 16 axes
- Up to 7.200 NC-blocks/sec
- PA SDI
- Integrated I/Os

- ❶ PC interfaces for Mouse, Keyboard, USB, Network and VGA
- ❷ PA Superbus Interface for I/O extensions with PAMIO modules
- ❸ PA SDI interface for PA SDI Drive communication
- ❹ Integrated I/O (24V)



TECHNICAL DATA

	PA 8000 EL PRO SDI	PA 8000 EL STD SDI	PA 8000 EL BAS SDI	PA 8000 EL BAS SDI 24
SYSTEM INFORMATION				
Included number of controlled axes	4	4	4	4
Max. number of controlled axes	16	16	16	16
Included number of simultaneously interpolated axes	4	4	3	3
Max. number of simultaneously interpolated axes	16	16	3	3
Included number of spindles	1	1	1	1
Max. number of spindles	6	6	1	1
Included number of independent CNC channels	1	1	1	1
Max. number of independent CNC channels	8	2	-	-
Included number of adaptive Look-Ahead blocks	50	50	50	50
Max. number of adaptive Look-Ahead blocks	50	50	50	50
Included number of NC-blocks/sec.	900	450	225	225
Max. number of NC-blocks/sec.	7200	900	450	450
Included position cycle [ms]	2	2	2	2
Min. position cycle [ms]	1	2	2	2
Included number of cycle parameters	200	200	200	200
Max. number of cycle parameters	25000	25000	200	200
PLC-SYSTEM				
Integrated Soft-PLC CoDeSys IEC 6-11313	•	•	•	•
Basic PLC memory [KByte]	128	128	128	128
Max. PLC memory [KByte]	1024	1024	128	128
PLC language Ladder Diagram (LD)	•	•	•	•
PLC language Structured Text (ST)	•	•	•	•
PLC language Instruction list (IL)	◦	◦	◦	◦
PLC language Function blocks (FB)	◦	◦	◦	◦
PLC language Sequential flow chart (SFC)	◦	◦	◦	◦
PA-Superbus	•	•	•	•
Integrated digital inputs	48	48	48	24
Integrated digital outputs	32	32	32	16
Integrated Encoder inputs	-	-	-	-
Integrated analog outputs (+/-10V)	-	-	-	-
Max. number of digital inputs with PAMIO (24V)	744	744	744	744
Max. number of digital outputs with PAMIO (24V)	496	496	496	496
Max. number of analog inputs with PAMIO (+/-10V)	116	116	116	120
Max. number of analog outputs with PAMIO (+/-10V)	116	116	116	120

•STANDARD ◦OPTION -NOT AVAILABLE

TECHNICAL DATA

	PA 8000 EL PRO SDI	PA 8000 EL STD SDI	PA 8000 EL BAS SDI	PA 8000 EL BAS SDI 24
AVAILABLE DRIVE INTERFACES				
PA SDI-Drive Interface	•	•	•	•
SYSTEM CHARACTERISTICS				
CPU	Intel® Core™ 2 Duo min. E7400 2.8GHz	Intel® Celeron™ Dual Core min. E1500 2.2GHz	Intel® Atom™ min. 1.6GHz	Intel® Atom™ min. 1.6GHz
Operating system	Windows XP Standard Embedded Englisch	Windows XP Standard Embedded Englisch	Windows XP Standard Embedded Englisch	Windows XP Standard Embedded Englisch
RAM (GByte)	1	1	1	1
Disk space [GByte]	≥150	≥150	≥150	≥150
Number of USB ports	6	6	4	4
Number of Ethernet ports	1	1	-	-
FELDBUS EXTENSIONS				
PA-Superbus for PAMIO	•	•	•	•

•STANDARD ◦OPTION -NOT AVAILABLE

SOFTWARE SPECIFICATIONS

PA 8000 EL PRO SDI

PA 8000 EL STD SDI

PA 8000 EL BAS SDI & BAS SDI 24

HMI FUNCTIONS			
PA HMI	•	•	•
PA Logic Analyzer	•	•	•
PA Path Graphic	•	•	•
Teach-In function in manual mode	•	•	•
Teach-In function in automatic mode	◦	◦	-
CNC program editor	•	•	•
Inch/metric display	•	•	•
Languages: German, English, French, Chinese, Russian*	•	•	•

BASIC FUNCTIONS			
50 NC-blocks NC block buffer	•	•	•
128 KB CMOS NC memory	•	•	•
Handwheel function	•	•	•
Helix programming for 1 axis	•	•	•
Automatic drift compensation (analog only)	•	•	•
Infinite rotary axis	•	•	•
Feedrate interpolation	•	•	•
Diameter programming	•	•	•
Corner smoothing	•	•	•

AXIS FUNCTIONS			
Parallel axes function	◦	◦	-
Gantry axes function	◦	◦	◦
Oscillation axes function	◦	-	-
Spindle/Rotary axis switch	◦	◦	-
Spindle operation of SDI rotary axis	◦	◦	-
Angled wheel	◦	-	-
Distance coded measuring systems	◦	-	-
Tangential tracking	◦	◦	-
Logic for positioning axis	◦	◦	◦
Dynamic axis allocation	◦	◦	-

TRANSFORMATIONS			
5-axis transformation incl. Helix interpolation	◦	-	-
4-axis transformation incl. Helix interpolation	◦	-	-
3-axis transformation incl. Helix interpolation	◦	-	-
Polar coordinate transformation	◦	-	-
Barrel cam transformation	◦	◦	-

•STANDARD ◦OPTION -NOT AVAILABLE

SOFTWARE SPECIFICATIONS

	PA 8000 EL PRO SDI	PA 8000 EL STD SDI	PA 8000 EL BAS SDI & BAS SDI 24
INTERPOLATIONS			
Linear interpolation	•	•	•
Circular interpolation	•	•	•
Helix axis	○	○	-
Spline interpolation	○	○	-
Feedrate interpolation	•	•	•
Electronic gears	○	-	-
COMPILE CYCLES			
Compile cycles interface for interpreter	○	○	○
Compile cycles interface for position loop + interpolator + interpreter	○	○	○
FUNCTIONS FOR 3-, 4- AND 5-AXIS TRANSFORMATION			
Adaptive Look Ahead for 3-, 4- and 5-axis transformation	○	-	-
Real-time cutter radius compensation for 3-, 4 and 5-axis transformation	○	-	-
AXIS REGULATION			
Feedrate override via external analog signal	○	○	-
Sequencing override via digital signal	○	○	-
Curvature function	○	○	-
Command filter	○	○	○
ART – ADVANCED REGULATION TECHNOLOGY			
Adaptive ART up to 4 axes simultaneous incl. command filter	○	○	○
Adaptive ART for more than 4 axis simultan. incl. command filter	○	○	-
DISTANCE REGULATION			
Distance regulation incl. adaptive ART and command filter	○	○	-
Distance regulation incl. adaptive ART and command filter for 3-, 4-, and 5-axis transformation	○	-	-
SPINDLE			
Spindle control	•	•	•
Spindle control with feedback	•	•	•
Automatic gear step selection	○	○	-
GAUGING FUNCTIONS			
Probe logic	○	○	○

•STANDARD ○OPTION -NOT AVAILABLE

SOFTWARE SPECIFICATIONS

PA 8000 EL
PRO SDI

PA 8000 EL
STD SDI

PA 8000 EL
BAS SDI &
BAS SDI 24

NC-PROGRAMMIERUNG			
NC-Programming according to DIN/ISO 66025	•	•	•
Thread cutting / Rigid tapping	◦	-	-
Constant cutting speed	◦	-	-
Feed in mm / revolution, inch / revolution	◦	-	-
Polar coordinate programming	◦	-	-
Programmable acceleration	◦	-	-
Inch/metric programming	•	•	•
Mirroring	•	•	•
Turning	•	•	•
Scaling	•	•	•
Absolute/incremental	•	•	•

CUTTER COMPENSATION LOOK AHEAD			
Cutter compensation Look Ahead up to 25 blocks	◦	◦	-
Cutter compensation Look Ahead up to 100 blocks	◦	-	-

CYCLES			
Turning cycles	◦	◦	◦
Drilling cycles	◦	◦	◦
Cylindrical grinding cycles	◦	◦	-

SPECIAL FUNCTIONS			
Power control via analog output (laser power control)	◦	◦	-
Exact position related output signals	◦	-	-
Handwheel in automatic mode	◦	◦	-
Tool management	◦	◦	-

CNC INTERRUPT PROGRAMS			
1 CNC interrupt program	◦	◦	-
8 CNC interrupt programs	◦	◦	-
32 CNC interrupt programs	◦	◦	-

•STANDARD ◦OPTION -NOT AVAILABLE

SOFTWARE SPECIFICATIONS

	PA 8000 EL PRO SDI	PA 8000 EL STD SDI	PA 8000 EL BAS SDI & BAS SDI 24
MOVING BACKWARD ON THE CONTOUR			
Moving backward on the contour up to 50 blocks	○	○	○
Moving backward on the contour up to 200 blocks	○	○	-
Moving backward on the contour up to 1000 blocks	○	-	-
Moving backward on the contour up to 4000 blocks	○	-	-
COMPENSATIONS			
Machine axes error compensation up to 1000 points	●	●	●
Machine axes error compensation up to 4000 points	○	○	-
Machine axes error compensation up to 16000 points	○	-	-
Stiction compensation	○	○	○
AXIS CONTROL			
Safe zone programming	●	●	●
End position control	●	●	●
Position control	●	●	●
Standstill control	●	●	●
Measurement system control	●	●	●
DATABASE INTERFACES			
Database SQLite interface to HMI/PLC	○	○	-
Database Postgre SQL interface to HMI/PLC	○	○	-

● STANDARD ○ OPTION - NOT AVAILABLE

USER INTERFACE PA HMI

Every PA CNC is equipped with the standard **PA HMI**. The PA HMI is an open, browser-based human machine interface and allows you to add your own design and own functions. In order to that you can separate from other machine tool builders and offer your customers exactly the interface they need for operating your machines the best way. Other software applications can also be added to the PA CNCs by using the proven TCP/IP interface.



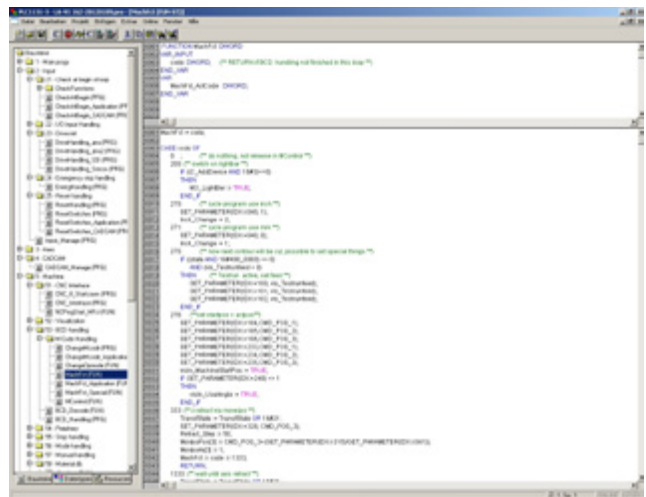
PA COMPILE CYCLES & PA SOFT PLC

The **PA Compile-Cycles** are made to let you integrate your specific know-how - which is more and more important to protect yourself against others and also to separate from others. Also you are more flexible to improve your machine-tool by adding your own functions like e.g. special transformations or compensations. With PA Compile-Cycles you do not have to wait for the integration of new CNC functionality, you choose the right point of time by yourself. On the today's fast changing markets and the special requirements of today's customers you can gain significant competitive advantages over competitors.

PA Compile-Cycles are written in the common C language so there is no special software development tool needed.

With PA Compile-Cycles you can add your own realtime functionality to the interpreter, interpolator and to the position loop of the PA CNC kernel. The integration is easy and safe, as you are not programming directly in the PA CNC kernel.

The integrated **PA Soft-PLC IEC 61131-3** guarantees short cycle times. Secondary activities, such as loading and unloading or tool change are running in the shortest possible time running. This makes the machine overall much more productive.



POSSIBLE PROGRAMMING LANGUAGES:

- Structured Text (ST)
- Ladder Diagram (LD)
- Sequential Function Chart (SFC)
- Function Block Diagram (FBD)
- Instruction List (IL)

SOFTWARE FUNCTIONS

BASIC FUNCTIONS

HAND WHEEL FUNCTION | Up to three hand wheels can be connected to the PA CNC controls. Each hand wheel can be assigned to a certain axis. The assignment is specified in the machine parameters.

HELIX FUNCTION | Only the 2 axis (e.g. X and Y) participating in a circular interpolation can be programmed, otherwise an error message will appear. The Helix function allows an additional axis being added to the 2 circular axis. They will be linear to the length of the circular bottom interpolated. If e.g. Z axis is used together with Y and X then the tool tip will describe a Helix or thread motion. Optional there can be multiple Helix axis.

AUTOMATIC DRIFT COMPENSATION (ONLY ANALOG) | Analog Interfaces can develop some drift caused by voltage differences and temperature dependencies of the analog electronic circuits. The CNC control compensates for these effects during standstill of the axis automatically.

INFINITE ROTARY AXIS | The function infinite rotary axis enables the endless moving of axes in one direction. By this the positions of axes are reduced automatically, without any influence for the moving of axes. In particular, this reduction has no effects on the moving of other axes (linear axes). Altogether, there are three different variants of the infinite rotary axis:

1. Normal round axis with which maximum $\pm 360^\circ$ is programmed
2. Shortest way axis which drives always on the shortest way to the programmed position (e.g. tool magazine axis).
3. Modulo rotary axis for which rounds and an angle can be programmed.

FEEDRATE INTERPOLATION | In addition to the path, the beginning and ending feed rate of the NC Block will be interpolated linear to the path length.

DIAMETER PROGRAMMING | This programming used mainly with turning machines. Instead of the regular turning programming (where the X coordinate defines the radius) the diameter can be used to define the work piece.

CORNER SMOOTHING | This function allows to round the corners automatically with a programmable radius.

AXIS FUNCTIONS

PARALLEL AXES FUNCTION | In certain applications there are parallel moved axes. If mechanically coupled axes refer to Gantry Axes. Parallel axes, which are mechanically not coupled but shall be moved synchronously, can be programmed (also temporarily) to move parallel (synchronous) with the leading master axis. The axes can also be programmed for independent motion.

GANTRY AXES FUNCTION | The Gantry axes function is required for physically coupled axes with two independent motors. The Gantry function of the CNC replaces a complex mechanical coupling of the axes and ensures the synchronous movement of the axes pair.

OSCILLATION AXES FUNCTION | This function allows two different modes of oscillation for an axis:

1. Linear oscillation where the reversal points and the velocity were defined.
2. Sinusoidal oscillation where the reversal points and frequency were used. The dwell times and the number of oscillations can be programmed as required. The frequency, number of oscillations and dwell times can be different for each axis.

SPINDLE / ROTARY AXIS SWITCH | The function spindle / rotary axis switch enables a programmable switch-over between spindle and rotational axis mode by using the same motor within the NC program. Any existing rotational axis in a CNC can be defined via machine parameters as a switch-over axis.

SPINDLE OPERATION FOR SDI ROTARY AXIS | Currently there is no Spindle Drive with SDI Interface available. For special applications a regular Servo Motor can be used as a Spindle as long as RPM and power requirements are sufficient. The standard spindle functions (M3, M4, M5, M19) can be used.

ANGLED WHEEL | Some machines can have linear axes which are not orthogonal to each other. These so called angled wheel axes can be used according to special technological needs. Usually angled wheel axes machines are difficult to be programmed by using standard NC-coding. The Angled-Wheel function allows to program such machines in the same manner as usual machines with orthogonal Cartesian axes. Up to three angled wheels are possible.

SOFTWARE FUNCTIONS

DISTANCE CODED MEASURING SYSTEMS | Some machines can have linear axes which are not orthogonal to each other. These so called angled wheel axes can be used according to special technological needs. Usually angled wheel axes machines are difficult to be programmed by using standard NC-coding. The Angled-Wheel function allows to program such machines in the same manner as usual machines with orthogonal Cartesian axes. Up to three angled wheels are possible.

TANGENTIAL TRACKING | This function enables a rotational axis to be oriented automatically during a path axes movement in such a way, that the rotational axis position matches the actual path tangent. Tangential axis could be activated and deactivated in NC-Program. Tangential axis could be used for automatically orientation of non-symmetrical tools (cutting and welding tools. Different settings of tangential axis are possible. Some constant angular offset to the path tangent could be programmed or set in machine parameter. Rapid orientation in defined angular range, orientation with maximal axis velocity and acceleration, orientation with programmed velocity.

LOGIC FOR POSITIONING AXES | "Logic for positioning axes" allows moving of additional axes independently from the path axes and the CNC program. Such axes could be used for tool magazines, part positioning or orientation and for other jobs, which don't need synchronous movement of several axes. The movement of position axes is done by PLC-functions. Positioning axes are defined in machine parameters and could not be moved by NC-program.

DYNAMIC AXIS ALLOCATION | This function allows to hand over an axis from one channel to another in a multi channel systems during run time. The axis changing channels has to be at stand still.

TRANSFORMATIONS

5-AXIS TRANSFORMATION | The software package "5-axis-transformation" is used for machines which have two round axes in addition to the usual three linear axes X, Y and Z. These round axes make it possible to orient a rotation-symmetrical tool (milling cutter, laser beam) at any point relative to the work piece. Active transformation allows programming in cartesian work piece coordinates without regard to the round axes. The work piece coordinate system may be shifted and rotated to the machine coordinate system.

The orientation of the tool can be made by the programming of the round axes or the tool direction vector. In addition to the 5 axes mentioned the machine can have further axes (e.g. loading axes or axes of tool changes) which are not involved in the transformation. The machine kinematics must correspond to the following requirements: The three linear axes X, Y and Z, must form a clockwise cartesian coordinate system. Each of the round axes rotates around one linear axis. That means the turning vector will be parallel to according linear axis. Both round axis must be oriented perpendicular to each other.

The round axes can be used either to turn the tool or to turn the work piece. The situation where one of the round axes moves the tool and the other one moves the work piece is permitted. There is a special type of "5-axes-transformation" for nutator machines, where one of the turning axes turns not parallel to the linear axes. The 5-axis transformation allows changes of tool programmes in the CNC control without changing the NC-program.

4- AND 3-AXIS TRANSFORMATION | The software package described above is also available for machines with 3 linear axes and 1 round axis (4-axes transformation) and 2 linear axes and 1 round axis (3-axes transformation).

INTERPOLATIONS

LINEAR INTERPOLATION | The linear interpolation is the common kind of movement for CNC machines. The tool will be moved with the programmed feedrate from the starting point to the programmed end point. This straight line can be in a plane or anywhere in space.

CIRCULAR INTERPOLATION | The movement from starting point to end point is done HAP. Programming of circular interpolation is only possible in XY, XZ or YZ. HAP are possible using the option 5x transformation. Programming can be done using end point and centre point or endpoint and radius. Tangential circular interpolation is possible where the previous nc block transitions into a circle.

SPLINE INTERPOLATION | Spline interpolation means the adding of mathematical curves and functions of higher order (polynomial) where the transitions are tangential. With this kind of programming, very complex curves can be described with less NC blocks than with the regular linear programming.

SOFTWARE FUNCTIONS

FEEDRATE INTERPOLATION | In addition to the path, the beginning and ending feed rate of the NC Block will be interpolated linear to the path length.

ELECTRONIC GEARS | This is a special feature for gear hobbing machines or machines with similar kinematics. The Movement of the rotary table 'C' with the part is depending on the position of a rotary axis carrying the tool 'B' (and can optionally depend on one or two more axis for the tool e.g. Y and Z). The 'C' axis with the part automatically follows the 'B' axis and the two linear axis 'X' and 'Y'.

FUNCTIONS FOR 4- AND 5-AXIS TRANSFORMATIONS

ADAPTIVE LOOK AHEAD | Adaptive Look Ahead can read multiple NC Blocks in advance to check the feedrate and avoid then unnecessary stops and reduction of feedrates. This function assures fast execution and is useful for programs with a limited amount of short NC Blocks.

REAL-TIME CUTTER RADIUS FOR 5-AXIS TRANSFORMATION | The Standard Cutter Radius Compensation can only be used in defined planes which is an exception in 5 axis cutting. Real time cutter radius compensation can be used with any orientation in space and works always perpendicular to the programmed tool path and tool direction (left or right). Real time cutter radius compensation can only be used together with linear moves (G1/G0) which is the case in standard 3D aerial programs.

AXIS REGULATION

FEEDRATE OVERRIDE VIA EXTERNAL ANALOG SIGNAL | This function allows to influence the feedrate using an external analog signal (0V-10V) similar to a feedrate potentiometer.

SEQUENCING OVERRIDE VIA DIGITAL SIGNALS | This function is often used with Grinding machines. It is especially helpful when a change of blocks is needed, caused by an outside signal (24V Input). Up to 16 Inputs can be defined which can be programmed to finish the current NC block and cause a change to the next block.

CURVATURE FUNCTION | Curvature function is an extension to standard look ahead and is especially useful for die cutting programs (3D). These CAD/CAM generated NC-Programs usually

include many short NC-Blocks. The Curvature function optimizes the feed profile of multiple NC blocks and makes sure a good surface finish will be reached with very short cycle times.

COMMAND FILTER | The function command filter results in a smooth movement of axes with continuous (like s-curve) acceleration. As well the feature reduces machine vibrations significantly and may be used to suppress natural oscillations of single axis. According the different applications of the feature it may be set up either by s-curve parameters or cut-off frequency of low-pass filter. The properties could be set in machine parameters permanently and could be set or changed by NC-program as well.

ART – ADVANCED REGULATION TECHNOLOGY

ADAPTIVE ART | The function Adaptive ART allows the reduction of the following error (lag) which in return causes an increase in accuracy. Even with higher feedrates a better accuracy of the contour can be reached. This function includes an advanced regulation for feed and acceleration. The factors of the advanced regulation need to be detected using a automated learning process.

DISTANCE REGULATION

DISTANCE REGULATION | The function distance regulation allows functionality such as heights regulation above the work piece. Distance regulation needs an external analog signal from a distance or heights sensor. In its easiest form the distance regulation can influence the position of an axis for heights control. Together with 5x transformation the regulation can work in tool direction with multiple axis. The distance tool- head or tool-tool will be regulated proportionally to the analog voltage. The Characteristics can be adjusted with parameters.

SPINDLE

SPINDLE CONTROL | Control for a spindle drive with analog output (+/- 10V). The spindle will be run in Velocity mode.

SOFTWARE FUNCTIONS

SPINDLE CONTROL WITH FEEDBACK | In addition to the analog spindle output an encoder input can be read. This function is needed for spindle positioning (M19) as well as Threading and Rigid Tapping.

AUTOMATIC GEAR STEP SELECTION | This function is for spindles with gear ranges, this function automatically switches gears depending on programmed spindle velocity.

GAUGING FUNCTIONS

PROBE LOGIC | Using the Probe logic it is possible to measure for example the Tool length. Through an external measuring input the current NC block will be interrupted. The current position and the remaining distance (distance-to-go) can then be used in a cycle program to calculate the tool length. The Probe has to be connected to special probing inputs on the control or servo drive.

NC PROGRAMMIERUNG

THREAD CUTTING | There are two main functions: Threading with constant pitch and threading with dynamic pitch for cylinders and taper threads. For all threading types there is the function 'zero lag threading' available. This reduces the control depended lag of the axes and therefore the error in the thread.

RIGID TAPPING | The control can perform tapping with or without floating tap holder.

CONSTANT CUTTING SPEED | The function constant cutting speed is used with lathes. This function makes it possible, instead of adapting to a firm number of revolutions, the spindle number of revolutions automatically to the diameter of the workpiece.

FEED IN MM/REVOLUTION | The function feed in mm/revolution is used with lathes. Instead of in mm/minute, this function makes a programming of the feed motion in „mm/spindle rotation“ possible.

POLAR COORDINATE PROGRAMMING | The control includes the possibility to program polar coordinates which means the programming is done by using angle and radius instead of the regular programming with cartesian coordinates. The plane for polar coordinate programming can also be selected.

PROGRAMMABLE ACCELERATION | The function programmable acceleration enables the reduction of the axis acceleration with respect to the preset maximum value. The term acceleration can be either an increase in velocity as well as a decrease. A reduction of the preset maximum acceleration is necessary e.g. if the load on certain components (e.g. laser optics) has to be limited.

INCH/METRIC PROGRAMMING | It is possible to switch the input and display between metric and inch. This mode can be pre-configured.

MIRRORING | It is possible to mirror parts of an NC program or contour in a plane with this programming feature

ROTATING | It is possible to rotate parts of an NC program or contour in a plane with this programming feature.

SCALING | Through programming it is possible to increase or decrease the size of parts in an NC program by a defined factor.

ABSOLUTE/INCREMENTAL | It is possible to switch in the NC program between absolute and incremental programming.

CUTTER COMPENSATION LOOK AHEAD

CUTTER COMPENSATION LOOK AHEAD | Cutter Compensation Look Ahead is an extension of the standard Cutter Compensation. Multiple Blocks (standard values: 10, 25, 100) can be looked at in advance to detect and avoid collisions. Different adjustments are possible for reaction to the detection of a collision: e.g. generate a message but keep executing, take a shortcut to avoid contour damage. Cutter Compensation Look Ahead can also execute NC programs with Dummy Blocks (blocks without movement information) which normally only works in special cases.

SPECIAL FUNCTIONS

POWER CONTROL VIA ANALOG OUTPUT | In laser cutting or laser welding the laser power needs to be controlled depending on the feed rate. This feature allows to control up to 3 outputs. The voltage of each output can be programmed as a function of feed, time or distance.

SOFTWARE FUNCTIONS

EXACT POSITION RELATED OUTPUT SIGNALS | This function can set an output on exact programmed positions in the NC program without a stop of program execution. Up to 8 Output signals are possible. The accuracy of the positions depends on the scan time of the performance level. The usage of special outputs modules can improve the positioning accuracy since the Output frequency is in the microsecond range.

HANDWHEEL IN AUTOMATIC MODE | This function allows the movement of one or more axis during automatic mode. The movement of the selected axis is added to the programmed path. The axis can be selected.

CNC INTERRUPT PROGRAMS

CNC INTERRUPT PROGRAMS | CNC interrupt programs can be used to interrupt the run of an automatic program to execute the request of the PLC or an external signal in a sub program (e.g. dressing of a grinding wheel). Up to 32 different sub programs are possible with this option.

MOVING BACKWARD ON THE CONTOUR

MOVING BACKWARD ON THE CONTOUR | This function allows the exact movement backwards on the previously executed path. The maximum number of NC Blocks depends on the selected Option level.

COMPENSATIONS

MACHINE AXES ERROR COMPENSATION | The machine axes error compensation offers the possibility to compensate mechanical inaccuracies of the axis e.g linear ball screw problems. This increases the accuracy of the machine dramatically. First the error values have to be measured precisely. Then a table with these values has to be generated for each axis. The maximum number of points can be selected as an option. Between points the control automatically interpolates.

STICTION COMPENSATION | With this feature the stiction effects of the axis can be reduced. For example for errors when during execution of a circle an axis has static friction on the reversal point. This compensation is not easy to adjust. This has to be done on each machine and each axis individually and repeatedly.

AXIS CONTROL

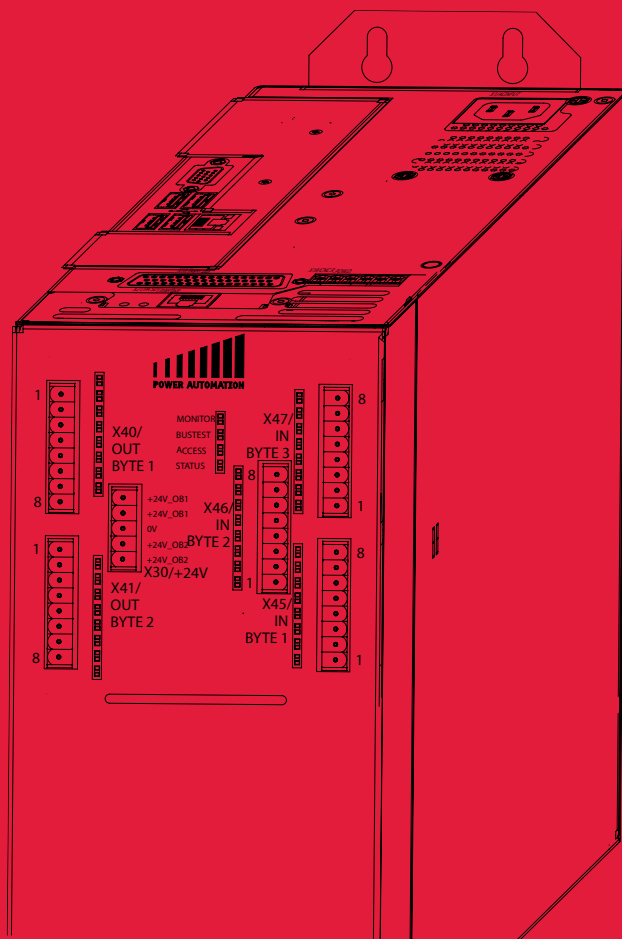
SAFE ZONE PROGRAMMING | This function allows a limited working area inside the Software limits defined by instructions in the NC Program. When by active safe zone programming the axis limits will be reached or exceeded, the move will not executed an error will be displayed.

END POSITION CONTROL | For every axis the control has a software defined limit in each direction. If the limit position is reached, the movement in this direction will be stopped and a message be displayed. It is possible to switch between two sets of End positions. These positions have to be defined during setup in machine parameters.

POSITION CONTROL / LAG CONTROL | During movement the Lag of each axis will be checked. If the maximum value will be reached, the movement will be stopped and an error message will be displayed. The maximum Lag error can be adjusted with machine parameters.

STANDSTILL CONTROL | At standstill the maximum lag error of all axes will be checked. In an error situation the process will be stopped and an error message displayed. The standstill control can be adjusted by machine parameters.

MEASURING SYSTEM CONTROL | When the CNC receives the a measuring system information, the CNC will check for Wire breaks, Interruptions and Errors of the Measuring System Signals. In case of a detected problem the process is stopped and Emergency Stop is activated.



STRONG ARGUMENTS for PC based CNC controls from POWER AUTOMATION

FASTEST BLOCK THROUGHPUT | The PA CNC systems are equipped with high speed processors to accomplish an extremely fast “Block Throughput”. Even highly accurate contours with very small NC blocks can be processed without any loss of speed. Therefore the machine always reaches the highest productivity.

OPEN NC KERNEL | All Power Automation CNC systems have an open NC Kernel. This makes possible to realize your own technology-specific requirements. You can reach this by the use of the so-called PA Compile Cycles, which you can program in C or C++. You can not only create own CNC functions such as your own transformations or compensations, but also protect your own know-how. For the creation of the Compile Cycles you do not need an OEM contract and no special development environment as with other CNC manufacturers. Just one week of training for the CNC system and a small fee for the appropriate run time license and you are ready to go. This way we offer to everyone to profit from this technology.

HIGHEST ACCURACY OF THE CONTOUR | PA’s CNCs calculate complex paths dynamically in advance and adapt the axis-speed in time. The axes are regulated by highly sophisticated algorithms to obtain an optimal movement and acceleration guidance. Using different filters, like e.g. the PA Path Filters the axes are accelerated in a way that no machine-specific oscillations are triggered. Therefore high accuracies and a perfect surface quality can be achieved.

NETWORKED CNCs | All CNC systems include a fast Ethernet interface of the latest generation. Thus the CNCs can be integrated without any problems into networks and be connected in such a way with PCs, servers and Cad/Cam Work stations. The fast data communication guarantees minimum transmission times even by very large NC-programs.

OPEN INTERFACES | Some CNC models can be extended with additional PCI cards and offer the possibility to add Fieldbus interfaces like Profibus, DeviceNet and many others.

RELIABILITY AND QUALITY | Different machine concepts require a high measure of flexibility and quality. By the long-time experience of our employees and the know-how of our experts you always receive the ideal hard- and software solution for your machines. From the first to the last screw - each of our CNC systems is manufactured by only one person at the time. Therefore each employee feels responsible for the result and success. From the development to the distribution - we take care of absolute quality.

LESS TRAINING DUE TO EASY OPERATION | CNC controls from PA are easy to operate. Each PA CNC System is equipped with the PA HMI (Human Machine Interface). With this open, browser based PA HMI all important control functions are clearly represented to the operator, so it will work within shortest training time efficiently and safely with the CNC system.



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