

Automation 3200

Software-Based 32-Axis Motion, Vision, PLC, Robotics, and I/O Platform

Complete motion capabilities include: point-to-point; linear, circular, helical, and spherical interpolation; velocity profiling; electronic gearing; on-the-fly trajectory modification; high speed I/O; camming

1 to 32 axes of scalable, synchronized motion

Utilizes the power of the PC to eliminate the motion control card

Uses commercially available IEEE-1394's (FireWire™) determinism for communications between drives and controller

Programmable in native RS-274 G-code, AeroBASIC™ command set, C, C++, .NET, VisualBASIC®, or LabVIEW® for flexibility

20 kHz servo update rate for 1 to 32 axes provides consistent performance regardless of axis count

Digital current loops for improved control and stability

Integrated high-speed Position Synchronized Output (PSO) for laser firing or position latching

Optional PLC with industry standard IEC-61131 programming interface

Integrated I/O

Kinematics task for robot control

Fiber optic interface expandable up to 1000 meters



High Performance, 32-Axis Motion, Vision, PLC, Robotics, and I/O Platform

Aerotech's ground-breaking, motion, vision, PLC, robotics, and I/O platform, the Automation 3200, is used in many applications in semi, data storage, medical laser processing, automotive, and machine tool industries. The system features a high-performance, software-only controller (Motion Composer) that offers 32 axes of synchronized motion control. It is the successor to Aerotech's performance-leading and widely utilized UNIDEX 500 and 600 PC-based motion controllers. Motion Composer retains the best features of these previous controllers and combines them with an advanced, high-performance distributed control architecture to produce a truly state-of-the-art motion, vision, PLC, robotics, and I/O platform.

The Digital Automation Platform: Automation 3200

The Automation 3200 digital automation platform represents a revolutionary advancement over traditional PC-bus-based motion controllers. The A3200 is software-based (no PC slots required) and marries a robust, high performance motion engine with vision, PLC, robotics, and I/O in one unified programming environment. The A3200 utilizes the industry standard super high performance FireWire® (IEEE-1394) network to provide from 1 to 32 axes of synchronized control with no degradation in performance as the axis count increases.

Automation 3200 DESCRIPTION

The integration of multiple common automation tools into a single platform provides users the ability to integrate, develop, and maintain the system faster, with lower cost than ever before. For instance, coupling a vision module with the motion system that coordinates a cutting process (laser, drill, mill, etc.) provides the ability to identify the workpiece and its position, and to adjust the position and signal to the cutter all within one system. This integration dramatically reduces wiring and the necessary components, which not only lowers integration and setup cost but also increases reliability.

Industry-Leading 32 Axes of Synchronized Control

The Automation 3200 is capable of 32 axes of synchronized motion through one interface. Aerotech has designed the current platform to be expandable to 62 axes of synchronized control.

No Degradation of Performance as Axis Count Increases

The Automation 3200 addresses a major shortcoming of today's multi-axis controllers: as axes are added, performance markedly degrades as either the servo update time or program execution time increases. The Automation 3200 utilizes a distributed control architecture that enables it to maintain performance independent of the number of axes being controlled. It accomplishes this by avoiding the processing bottleneck caused by today's common single processor control architecture. Position, velocity, and current loop closure are handled by Aerotech's Intelligent Network Drive (Ndrive). Trajectory generation is done on the PC using a real-time operating system that runs with higher priority than Windows®. The PC executes programs and sends the position commands to the Ndrive via the IEEE-1394 (FireWire®) high-speed serial bus.

Greatly Simplified System Wiring

All of the external signals including encoder and I/O are fed directly into the drive, allowing one cable to be used between the PC and the drive. Drives are networked together with a single cable.

The Advantages of FireWire™ (IEEE-1394)

In designing the Automation 3200, Aerotech decided that its next generation controller had to overcome the shortcomings of the traditional ± 10 V network interface. While still viable for many applications, ± 10 V has shortcomings, particularly when complex motion control is involved such as is common in many Aerotech applications. For example, noise coupling onto the analog signals can cause instability in the servo loop that prevents high system bandwidth. Also, with the ± 10 V command, the controller doesn't have knowledge of how well the current loops are tracking. With these and other shortcomings, it was decided that the next generation controller had to utilize a high-speed serial interface.

Digital networks, such as Ethernet and RS-232, are widely used in many different industries. Other newer networks such as FireWire® (IEEE-1394) and USB are becoming increasingly popular. For example, nearly all new computers now have these interfaces as standard.

With a variety of digital networks available, Aerotech developed a list of criteria that the Automation 3200 network interface had to possess. The following list details the key criteria we used to ultimately select FireWire® (IEEE-1394), and why those criteria were considered important.

- **Deterministic**

Complex motion such as contouring requires that all axes receive their data at exactly the same interval of time each time.

- **Capable of greater than 100 Mbps**

A faster network reduces the latency between transmitting and receiving data. Also, this allows the user to view real-time data on the PC.

- **Standard on PCs**

As the Automation 3200 does not require a motion card, having the network standard on PCs eliminates the cost of additional hardware.

- **Supported by Windows® operating systems**

Windows® support ensures that the software will work on the PC with the network.

- **Have continued R&D effort by the chip manufacturers**

A strong R&D effort by manufacturers allows the performance to increase and cost of the chips to decrease.

- **Tree topology**

Unlike a ring topology, a tree topology does not require a link back to the originating PC, which reduces the cabling effort.

- **Peer-to-peer transmissions**

Peer-to-peer transmissions allow the transfer of data between two drives without going through the root node. This allows quick transmission of encoder or I/O or any other type of information between drives.

The following table shows a comparison between the different networks. Based on this information, the IEEE-1394 network was chosen by Aerotech.

Automation 3200 SPECIFICATIONS

Criteria	FireWire® (IEEE-1394)	SynqNet™	Ethernet	USB	SERCOS	CAN
Deterministic	Yes	Yes	No	No	Yes	No
Data Rate	3.2 Gbps	200 Mbps	1 Gbps	480 Mbps	16 Mbps	1 Mbps
Standard on PCs	Yes	No	Yes	Yes	No	No
Windows Support	Yes	No	Yes	Yes	No	No
Self ID	Yes	Yes	Yes	Yes	No	No
Topology	Tree	Ring	Tree	Tree	Ring	Tree
Peer-to-Peer	Yes	NA	Yes	No	No	Yes

SynqNet™ is a registered trademark of Motion Engineering.
FireWire® is a registered trademark of Apple Computer.

Motion Composer Specifications		
Axes	32 Axes	
Driver Type Compatibility	Brushless (linear or rotary) servo with on-board commutation DC brush servo Stepper	
Position Feedback	5 V TTL quadrature encoders; max 40 MHz input 1 Vp-p sine wave encoders; max 250 kHz input; requires MXH, MXR, MXU multiplier Resolver, Inductosyn® Absolute encoder	
Position Modes	Absolute, incremental, dynamic trajectory correction	
Motion Types	Independent Motions	Point-to-point incremental; target position or velocity; velocity profiles; time based; free run
	Coordinated Motions	RS-274 standard G-code motion including linear, circular, helical and spherical interpolation, cutter compensation, normalcy, parts rotation, mirroring, path retrace, polar transformations and cylindrical transformations, scaling
	Electronic Gearing	Electronic master/slave gearing, cam profiling with cubic splining
	Advanced Features	High-speed registration, multi-dimensional error mapping and orthogonality correction, autotuning, backlash compensation, gantry algorithms
Range Limits	Position	±2 ⁵² cnt
	Velocity	8 x 10 ⁹ cnt/second
Acceleration Profiles	Linear and modified sine	
Programmable Multitasking	4 tasks standard; 32 tasks available with Professional Edition	
Programming	Native G-code programming with AeroBASIC™ extensions, .NET, C#, C, LabVIEW®	
Advanced Functionality	Three-dimensional Position Synchronized Output, PLC, kinematics, Dynamic Controls Toolbox, Enhanced Throughput Module (ETM), Galvo API, Motion Designer	
Minimum PC Requirements	The Automation 3200 platform works with most modern Windows/Intel-based desktop PCs. Please refer to the Aerotech website for complete specifications.	

A3200 ORDERING INFORMATION

Ordering Example

A3200-MC	-MACHINE	-4 AXES	-DYNAMIC CONTROLS TOOLBOX	-MOTION DESIGNER	-MAINTENANCE-1-0
Software	License	Number of Axes	Controller Options	Motion Composer (MC) Options	Maintenance
A3200-MC	-MACHINE -DEVELOPER -REMOTE	-2 AXES -4 AXES -6 AXES -8 AXES -10 AXES -12 AXES -14 AXES -16 AXES -32 AXES	-FIVE AXIS CONTOURING -GALVO VTC AND GRC -DYNAMIC CONTROLS TOOLBOX -ENHANCED THROUGHPUT MODULE	-MOTION DESIGNER -CNC OPERATOR INTERFACE -LabVIEW	-MAINTENANCE-y-mm

Automation 3200 Software

A3200-MC Full installation of Automation 3200 Controller and selected software components on a new system. Full part number includes options listed below. Pricing is summation of selected products. Maintenance (software update) included in price for one year from date of purchase. A3200 is intended for deployment on desktop or industrial PCs with a minimum Intel Pentium 4 processor (AMD and Celeron not recommended), Intel 9XX-series chipset (numbered 915 or higher), 512 MB RAM, Windows® XP or Windows® Vista Business (without SP1 installed). A full list of PC requirements and recommendations is available at www.aerotech.com.

MOTION COMPOSER STANDARD: Includes the Integrated Development Environment, Parameter Editor, Tuning Scope, System Diagnostics, and System Maintenance. Includes the following software options:

License

-MACHINE	Provides the ability to write, compile, execute, debug programs in AeroBASIC or G-code; full access to .NET 2.0 and C Library; access full diagnostics, fault, and status information; access and set I/O, registers, and variables; collect, analyze, and save data; view files from machine for analysis and record keeping; connect PC to machine directly with FireWire® card; connect PC to machine remotely through Ethernet TCP/IP; upgrades can be installed (firmware or controller) using Loader; 2 axes of software motion engine; simulate trajectory on PC; installs RTX on the PC; includes A3200-MC Standard
-DEVELOPER	Provides the ability to write, compile, execute, debug programs in AeroBASIC or G-code; full access to .NET 2.0 and C Library; access full diagnostics, fault, status information, and RTX properties; access and set I/O, registers, and variables; collect, analyze, and save data; view files from machine for analysis and record keeping; connect PC to machine remotely through Ethernet TCP/IP; simulate trajectory on PC; installs RTX on the PC; CANNOT upgrade firmware or controller software (No loader, Nreg or NENetCfg); CANNOT directly connect to drives with FireWire® and run; includes A3200-MC Standard except loader, nreg, and NENetCfg; Note: Axes and Control Options are not valid for Developer License
-REMOTE	Provides the ability to write, compile, execute, debug programs in AeroBASIC or G-code; access full diagnostics, fault, and status information; access and set I/O, registers, and variables; collect, analyze, and save data; view files from machine for analysis and record keeping; connect remotely through Ethernet TCP/IP to Machine License (if no connection, no features can be accessed); CANNOT upgrade firmware or controller software; CANNOT directly connect with FireWire® to machine to run; CANNOT simulate trajectory; DOES NOT install RTX on the PC; includes A3200-MC Standard except loader, nreg, NENetCfg, and RTX; Note: Axes and Control Options are not valid for Remote License

Axes

-2 AXES	Software only motion, robotics, and I/O controller; provides 2 axes coordinated motion and 4.5M FireWire® cable
-4 AXES	Software only motion, robotics, and I/O controller; provides 4 axes coordinated motion and 4.5M FireWire® cable
-6 AXES	Software only motion, robotics, and I/O controller; provides 6 axes coordinated motion and 4.5M FireWire® cable
-8 AXES	Software only motion, robotics, and I/O controller; provides 8 axes coordinated motion and 4.5M FireWire® cable
-10 AXES	Software only motion, robotics, and I/O controller; provides 10 axes coordinated motion and 4.5M FireWire® cable
-12 AXES	Software only motion, robotics, and I/O controller; provides 12 axes coordinated motion and 4.5M FireWire® cable
-14 AXES	Software only motion, robotics, and I/O controller; provides 14 axes coordinated motion and 4.5M FireWire® cable
-16 AXES	Software only motion, robotics, and I/O controller; provides 16 axes coordinated motion and 4.5M FireWire® cable
-32 AXES	Software only motion, robotics, and I/O controller; provides 32 axes coordinated motion and 4.5M FireWire® cable

Note: Old part number – NMotion SMC-nn

A3200 ORDERING INFORMATION

Controller Options

-FIVE AXIS CONTOURING Note: Old part number – CNC-5	More than 4 axes of coordinated motion with a single motion command
-GALVO-VCT AND GRC Note: Old part number - Nmark-VCT or Nmark-GRC	Galvo programming interface for vector-type marking applications; requires ScanLabs RTC-4 Galvo control card
-DYNAMIC CONTROLS TOOLBOX	Includes Harmonic Cancellation and Gain Scaling
-ENHANCED THROUGHPUT MODULE	Includes setup and monitoring screens of the ETM module; included in the price of the hardware modules sold separately

Motion Composer (MC) Options

-MOTION DESIGNER Note: Old part number – A3200-MD	The Motion Designer is an add-on software component to the Digital Scope that provides the ability to create, import, run, and evaluate motion profiles (trajectories)
-CNC OPERATOR INTERFACE Note: Old Part Number – Nview MMI	Man-machine interface CNC software for Windows XP/Vista; includes user manuals, technical manuals, and cable drawings for all related equipment
-LABVIEW	Includes LABVIEW 8.2 VI samples

Maintenance

- MAINTENANCE	First year of maintenance is included with the initial purchase; additional years can be purchased
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