Automation 3200

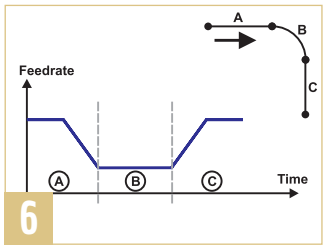
A3200 The Intelligent 32-Axis Motion, Vision, PLC, Robotics, & I/O Platform

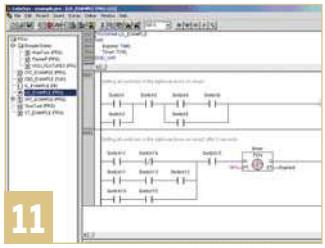
AEROTECH®

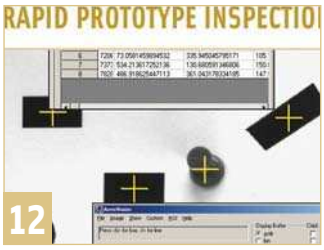
Dedicated to the Science of Motion

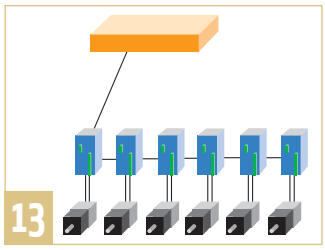
www.aerotech.com

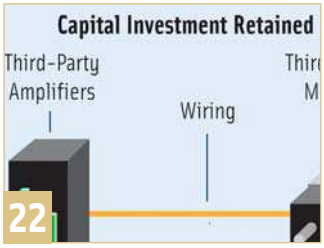
Contents

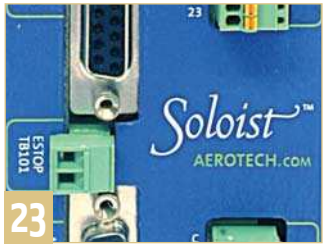












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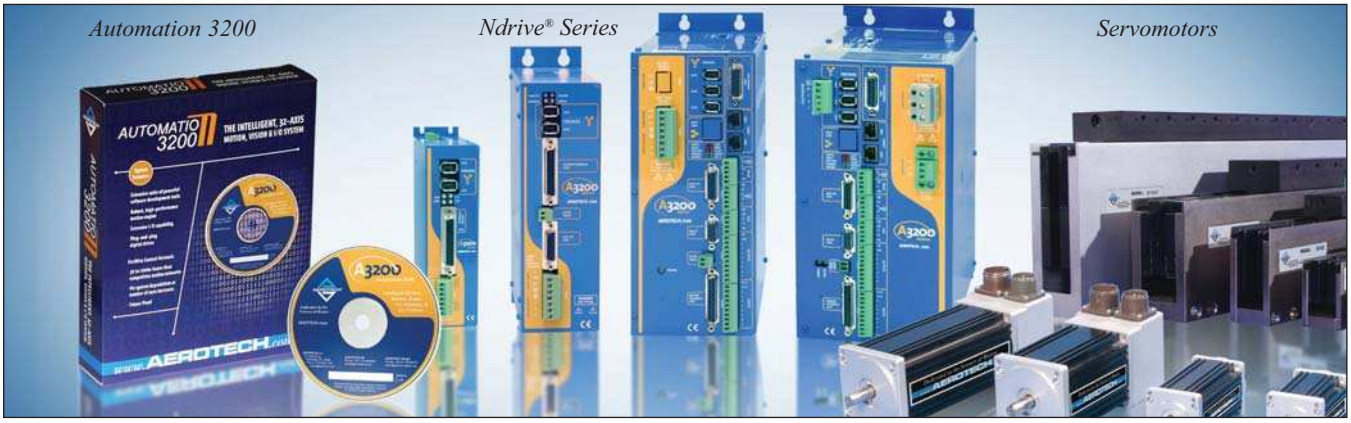
Automation 3200

Overview



This brochure presents Aerotech's ground-breaking, next generation motion, vision, PLC, robotics, and I/O platform, the Automation 3200. It is used in many applications in semiconductor, data storage, medical laser processing, automotive, and machine tool industries. The system features the world's first high-performance, software-only controller (Nmotion® SMC) 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. The Nmotion® SMC 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 A3200 is software-based (no PC slots required) and combines a robust, high performance motion engine with vision, PLC, robotics, and I/O in one unified programming environment. It utilizes the industry standard FireWire® (IEEE-1394) network to provide from 1 to 32 axes of synchronized control with no degradation in performance as the axis count increases.

The integration of multiple common automation tools into a single platform provides users with the ability to integrate, develop, and maintain the system faster and with lower cost. For instance, coupling the 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.

32 AXES OF SYNCHRONIZED CONTROL

The Automation 3200 is capable of 32 axes of synchronized motion through one interface, and the current platform is designed to expand to 62 axes of synchronized control. Applications developed on the Automation 3200 platform will be portable to future releases so users can look forward to future advancements without having to worry about abandoning legacy programs.

NO DEGRADATION OF PERFORMANCE AS AXIS COUNT 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 FireWire® (IEEE-1394).

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.

COMPLETE SYSTEM SOLUTIONS OR RETROFIT YOUR EXISTING SYSTEM

Aerotech offers the A3200 with both the Ndrive® series drives and our linear and rotary motors to provide a complete system solution. You can also retrofit existing motion systems with the A3200 and a combination of Aerotech drives and motors, or retain your third-party drives and/or motors. The flexibility of the A3200 means you get the system you want, at a price you can afford.

This brochure describes the features and benefits of Aerotech's Automation 3200 platform, as well as the associated Ndrive® series and Aerotech's complete line of linear and rotary servomotors.

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Digital Automation Platform

The Intelligent 32-Axis Motion, Vision, PLC, Robotics, & I/O Platform

POWERFUL SOFTWARE

Extensive suite of development tools:

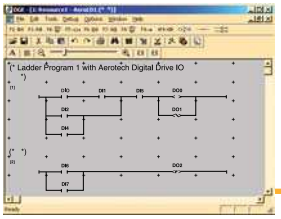
- **Nmotion® SMC – Software Motion Controller**
- **Nview® HMI – Human-Machine Interface**
- **Ncontrol® SDK – Software Development Kit**
- **Nlab SDK – LabVIEW® Software Development Kit**
- **Nlogic PLC – Programmable Logic Controller**
- **Nvision® VCM – Vision Control Module**

Modular software architecture permits mixing and matching of applications to suit the automation process requirements.

Programmers can create their own applications with modern tools such as Active X-based components and .NET class libraries.

A3200 ADVANTAGES

- Higher throughput due to high performance control, network, and high-power drives
- Higher quality output (accuracy and precision) due to fully digital drive and advanced servo algorithms
- Faster startup and changeover results from fully integrated motion platform, easy to use setup tools, and extensive diagnostics
- Lower startup and lifecycle cost due to lower component count and reduced engineering time
- Higher reliability due to fewer components
- Simplified integration as all major automation components are bundled into one platform
- User interface flexibility due to local or remote processing
- "Future Proof" architecture built on commercially available PCs running Windows® 2000/XP operating systems



PLC

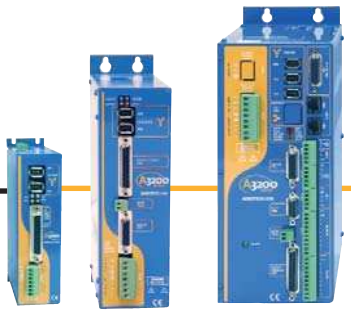
FireWire® (IEEE-1394) INDUSTRY STANDARD, SUPER-HIGH-PERFORMANCE COMMUNICATION NETWORK

EXTENSIVE I/O CAPABILITY

All Automation 3200 drives and drive racks are available with an integrated 10/100 Base-T Ethernet interface. This permits Automation 3200 systems to interact with third-party I/O boards and PLCs!

EASILY INSTALLED DIGITAL DRIVES FROM 8A-100A

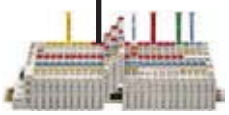
From highly compact, cost-optimized designs to self-contained, plug and play models, Aerotech has the drive for any application!

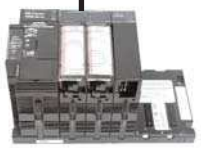


DIGITAL DRIVE FEATURES

- PWM or linear
- Integrated 10/100 Base-T Ethernet
- Onboard x65536 encoder multiplication
- 20 kHz position, velocity, and current loop sample rate
- Integral power supply
- Sinusoidal commutation
- Local I/O ports

Analog and Discrete I/O





Ethernet I/O Expansion

PLC

Distributed Motion Control

Motion control is performed at the drive level.

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Distributed Control from Aerotech

ROBUST, HIGH-PERFORMANCE MOTION ENGINE CAPABILITIES

- Point-to-point motion
- Interpolated motion
- Velocity profiling
- Look-ahead
- Electronically geared motion
- Cutter compensation
- CNC functionality
- Electronic CAM profiling
- Position synchronized output
- Fast position capture
- High-speed registration
- Gantry mode
- Motor control
- Dual loop control
- Axis calibration
- Orthogonality correction
- 3D error mapping
- Helical interpolation
- Autotuning
- Coordinate transformations
- Normalcy, parts rotation, mirroring, and retrace
- Cubic spline fitting
- Kinematics

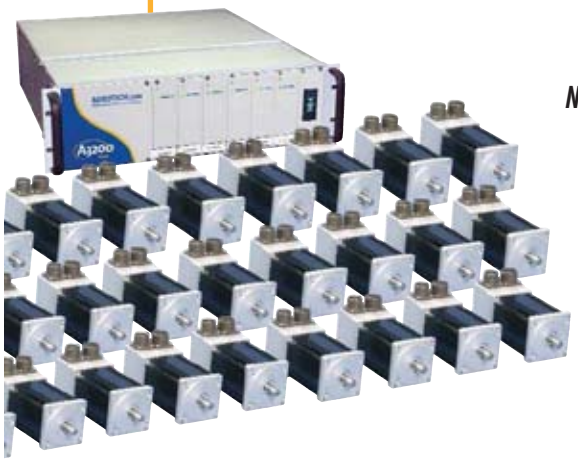
FIREWIRE® (IEEE-1394) ADVANTAGES

- Deterministic architecture maintains consistent performance updates across all 32 axes
- 30 to 1000 times faster than competitive motion networks
- 3.2 Gbps over fiber
- No system degradation as number of axes increases
- Versatile high-speed, low-cost communication system
- "Future Proof"
- Commercially available
- Nonproprietary architecture
- OHCI compliant
- International standard
- FireWire® (IEEE-1394) standard on PCs

Motion Controller

Motion generation and synchronization are centralized at the PC. Motion execution is decentralized at the drives. A3200 operates on any standard desktop or industrial PC. Servo loops are closed on the drive.

Npaq®
6-Axis Drive Rack



RETROFIT TO EXISTING MOTORS & DRIVES

Use as an integrated system or interface to existing motors and drives in a cost-effective retrofit.

Nservo

Any Servo Amplifier

Any Brush or Brushless Servomotor

Nstep

Any Stepper Drive

Any Stepper Motor

Robotics

Vision

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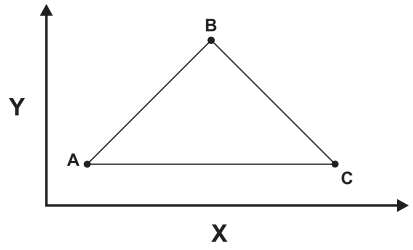
Nmotion® SMC
Software Motion Controller

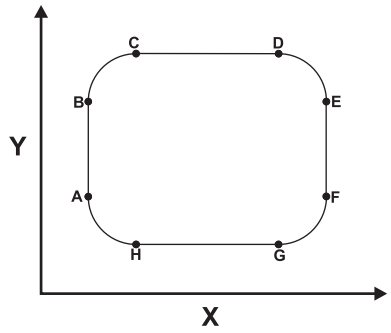
The Nmotion® SMC offers the broadest array of programming interfaces and core motion capabilities of any automation system available today. All motion commands can be accessed in C, C++, or Visual Basic® for custom OEM applications, or in AeroBASIC, a rapid prototyping development language based on a RS-274 G-code-style programming interface. The Nmotion® SMC has the programming flexibility and capability to meet the requirements of the most demanding motion applications of OEMs and end-users alike.

POINT-TO-POINT MOTION



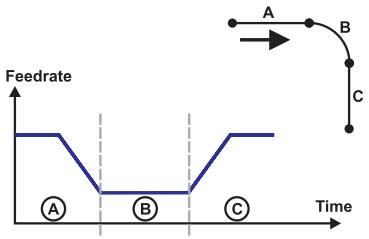
Basic motions such as independent axis positioning and jogging are simple to implement. Users can program in either absolute or incremental mode, or jog at constant speed with programmable accel, decel, and feedrate. Accel and decel can be linear or sinusoidal.

INTERPOLATED MOTION



Linear and circular interpolated motions are supported. Users can program in AeroBASIC English-style commands, G-code, or C/C++/VB. The Nmotion® SMC can also run CAD generated programs.

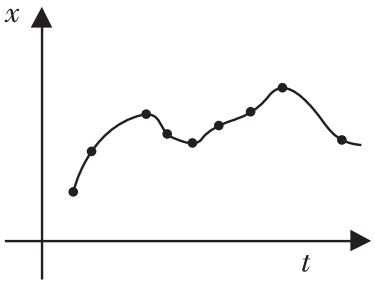
ACCELERATION LIMITING



Anticipating sharp corners and small radius arcs is a special feature of velocity profiling. The Nmotion® SMC continuously monitors multiple blocks and will automatically decelerate as needed. The number of blocks it can look ahead is limited only by available processor time.

ARBITRARY PATH GENERATION

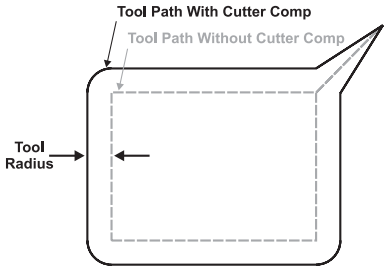
The Nmotion® SMC supports arbitrary path generation where the user specifies the position, velocity, and time. The controller can then perform a linear or spline interpolation between the points to provide an ultra-smooth contiguous path. Multiple axes' motion can be coordinated to create an arbitrary path in multidimensional space.



ELECTRONICALLY GEARED MOTIONS

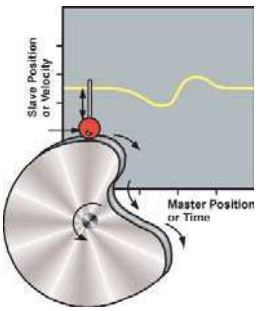
Mechanical line shaft motion can be replaced with electronic gearing. Gear ratios are programmable and can be electronically engaged and disengaged for flexible, software-based machine control.

CUTTER COMPENSATION



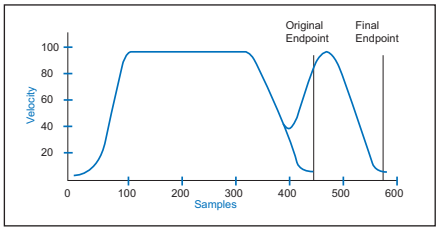
Also known as "tool radius compensation," this feature automatically adjusts the path to allow for the radius of a cutting tool.

ELECTRONIC CAM PROFILING



CAM profiling is a special version of electronic gearing where complex slave motion is generated as a function of another axis, a master encoder, or a virtual axis. CAM motion is defined in CAM tables. Cubic spline interpolation ensures smooth profiles. The Nmotion® SMC's large memory allows it to store many large tables.

ON THE FLY END-POINT MODIFICATION



The Nmotion® SMC trajectory generation software supports the modification of targets on the fly. These modifications can be given at any time during the motion profile and as often as required by the application.

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Nmotion® SMC
Software Motion Controller

A3200

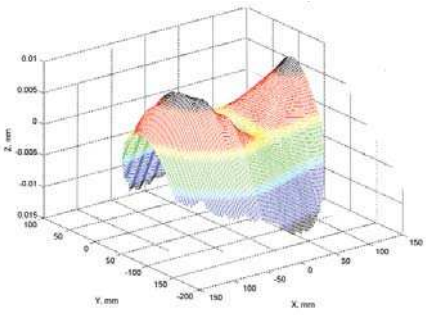
POSITION SYNCHRONIZED OUTPUT

This function is used to precisely set digital outputs as a function of motor positions in one, two, or three dimensions. Rather than operate as a background task in the Nmotion® SMC, this function is off-loaded to separate hardware on the Ndrive® for fastest execution and maximized accuracy.

FAST POSITION CAPTURE

The Automation 3200 system has the capability to store motor positions based on the transition of a digital input. This high-speed position capture capability, with a latency on the order of 50 nanoseconds, is useful for applications where the axis positions must be closely correlated to an external event such as a touch probe in a coordinate measuring machine or a transducer reading on an ultrasonic inspection system.

3D ERROR CORRECTION

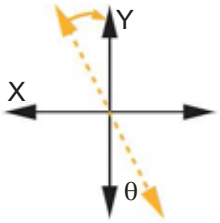


Aerotech's advanced 3-D error correction enables users to measure XYZ errors and enter them into a multi-dimensional lookup table. The Nmotion® SMC transparently corrects the commanded position to eliminate these mapped errors and moves accurately to all locations in the 3-D plane. It dramatically improves part quality and overall system accuracy while eliminating the effect of mechanical deflections.

ANALOG POWER CONTROL

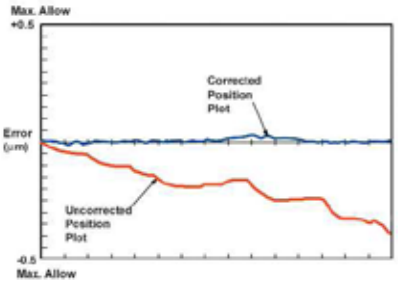
The Nmotion® SMC can adjust the setting of an analog output in relationship to the vector speed of two axes. This function permits the automatic regulation of laser power or material dispensing processes as the axes change velocity. Combining analog power control with look-ahead acceleration limiting reduces program complexity and increases machine throughput by specifying a peak machine speed and analog power setting and having the control automatically adjust these values as a function of the programmed tool.

ORTHOGONALITY CORRECTION



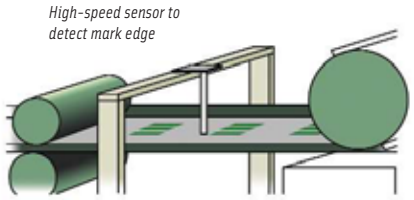
Angular misalignment of motion axes can be corrected by simply entering the value of the orthogonality error into a parameter. The Nmotion® SMC will combine this information along with any corrections required under axis calibration to significantly improve X-Y planar accuracy.

AXIS CALIBRATION



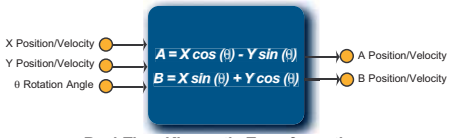
Axis calibration is a way to compensate for repeatable mechanical errors in a positioning system. A lookup table onboard the Nmotion® SMC is used to make corrections based on measured data. Backlash correction values can also be entered to minimize reversal errors.

HIGH-SPEED REGISTRATION



For packaging and label printing applications, Nmotion® SMC supports high-speed registration operations where an axis can move a predefined distance based on the transition of a digital input. The registration move can be superimposed over motion in progress to support rotary-knife-style applications. The registration "distance" can also be monitored and modified to adjust for variations in material length.

KINEMATICS



Real-Time Kinematic Transformation

The Nmotion® SMC can execute complex inverse kinematics equations within the flow of the trajectory generation. Application programs can be created in X/Y/Z part space and seamlessly transformed into joint coordinates. For maximum flexibility, transformations are written in the C programming language and are executed within the real-time operating system. This architecture permits the integration of specialized application specific transformations to meet the requirements of almost any robotic-type actuator.

GANTRY MODE

The Nmotion® SMC has built-in gantry control algorithms. Complex gantry control is reduced to a few simple commands. Single feedback-dual motor or dual feedback-dual motor configurations are easily controlled.

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AEROTECH®

Nview® HMI

Human-Machine Interface

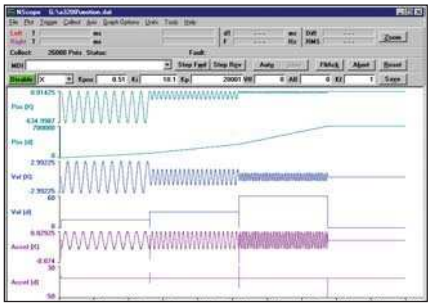
MANUAL MODE SCREEN

The Nview® HMI software offers a robust joystick (jog) and MDI command line interface. The joystick mode offers two configurable virtual joysticks for distance and free-run jogging. The MDI command line allows the manual entry and execution of immediate commands.

CUSTOMIZABLE INTERFACE

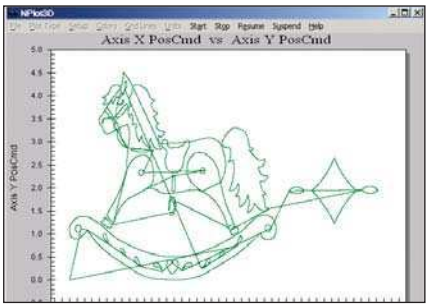
The HMI buttons on the *run* and *manual* screens can be customized by the user to perform a variety of functions including: program execution, setting output, and launching external programs. CNC programs can be automatically run at startup, and axes can be renamed.

SYSTEM ANALYSIS AND AXIS TUNING



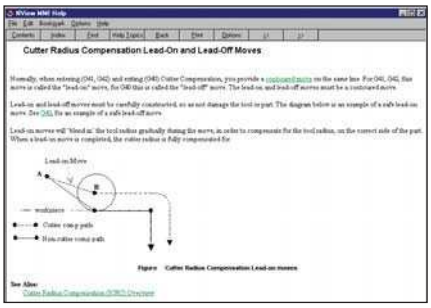
Years of experience and research have led to the development of a complete analysis tool, including an Autotune routine. Using this tool, system characteristics such as torque, error, and velocity can be determined quickly.

PLOTTING UTILITIES



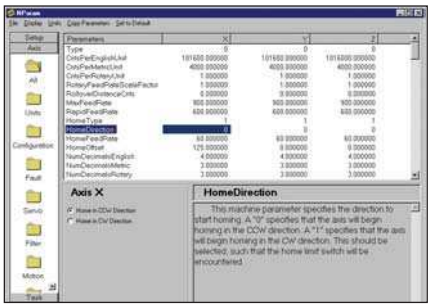
Displaying the real-time tool path in 2- or 3- dimensional space allows for the visual verification of axis position.

ON-LINE HELP



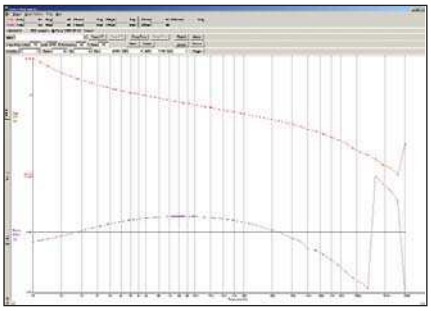
Not only a quick reference guide, the on-line help also serves as a comprehensive on-line manual. With over 1,500 searchable topics, the help file can be the only manual that you ever need.

PARAMETER EDITOR



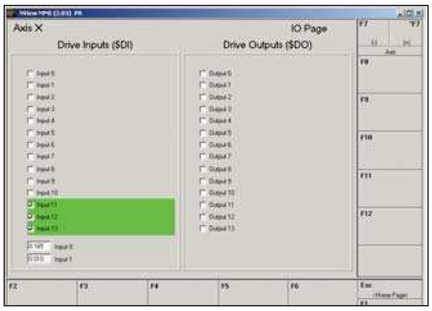
Logically divided into categories of axis, task, and machine automation, the editor gives real-time access to parameters and parameter descriptions.

LOOP TRANSMISSION



Loop Transmission is a tuning and diagnostic utility that greatly enhances system performance. Plots of frequency response in both phase and magnitude provide a quick assessment of system gain and phase margin. Multiple system resonances can be easily identified and compensated for with the A3200's four second-order cascade-able filters.

INPUT/OUTPUT



The I/O display screen enables the quick viewing and manipulation of virtual, drive, and Ethernet based I/O. The state of digital outputs can be changed through a single mouse click. Edit boxes are provided for reading and writing register-based data.

DIAGNOSTICS

Organized by tabs, the diagnostics utility allows the status of the machine and system to be determined with the click of a mouse.

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Ncontrol® SDK

Software Development Kit

The Ncontrol® SDK is a collection of Active-X programming objects, C++ class libraries and .NET class libraries that greatly reduce the programming effort required to build custom Automation 3200 applications. The Active-X components permit "drag and drop" programming in visual programming environments while the class libraries provide an object-level programming interface for C++ or .NET programmers. The SDK simplifies I/O handling, event management, fault handling, data collection, and program management through an intuitive, high-level programming interface. Shown below is a partial list of the functions supported by the programming objects available in the SDK.

Program management and display

Data collection

Event manager for fault handling

Monitor I/O, axes' positions, program variables

Axis configuration

Parameter display and editing

Motion and task status display

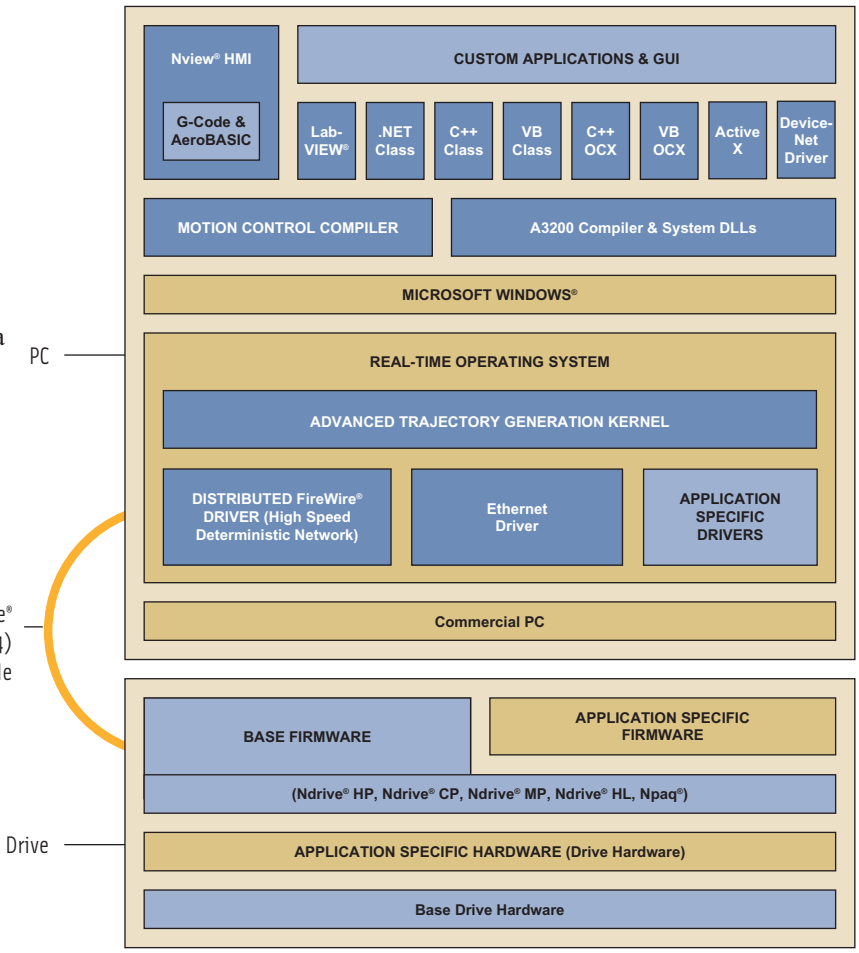
Remote HMI capability

Robust base platform

Layered for flexibility, with custom features at each level

Extensive diagnostics for easy maintenance

Integrated tools for rapid deployment



Advanced Software Architecture

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Nlab SDK

Virtual Instruments for the LabVIEW® Environment

The Automation 3200 32-axis motion controller includes integrated LabVIEW® VIs and LabVIEW® example code for powerful motion capabilities in the Windows® LabVIEW® environment. The LabVIEW® multi-axis HMI front panel easily integrates into your application. Our user-friendly VI library includes tools and examples for initializing the A3200, executing simple or complex move functions, status checking, error checking, and fault handling. Now LabVIEW® programmers have a toolbox of advanced motion VIs for rapid prototype work with no need to know C, Visual Basic®, or other software packages.

The Nlab SDK provides a set of LabVIEW® VIs that can be used to control and communicate with the A3200 motion controller. These VIs can be used as building blocks or as stand-alone VIs to perform various tasks such as initialization, motion, and status/position updates.

The VIs are organized into the following categories, with a dedicated .llb file for each category:

Initialization Functions

Global Data Functions

Motion Functions

Error Handling Functions

Status and Position Functions

Analog and Digital I/O Functions

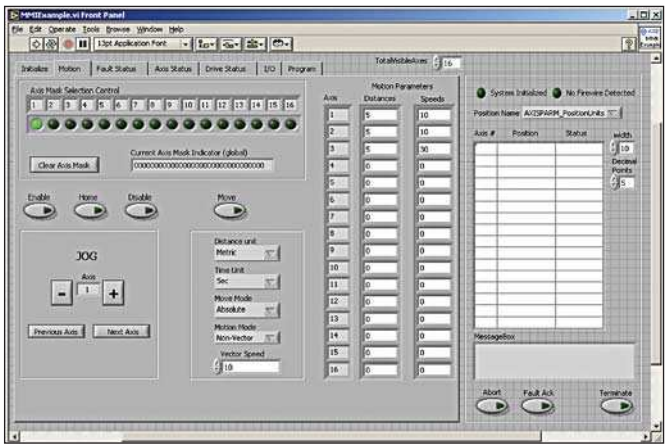
Parameter Functions

Run CNC Program Functions

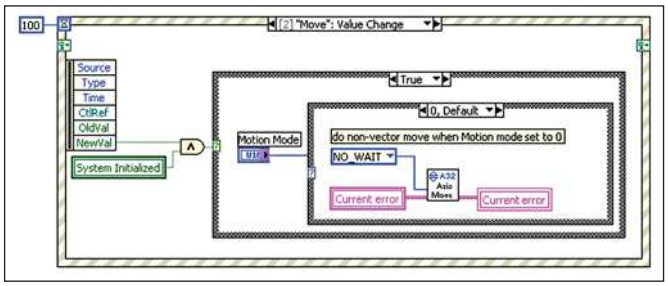
Utility Functions

Get and Set Variable Functions

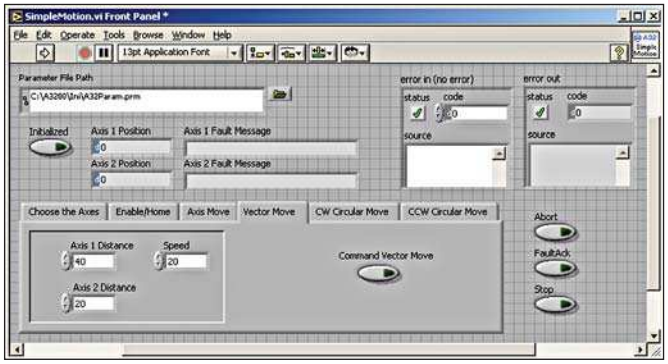
Aerotech's VIs conform to National Instruments LabVIEW® programming standards. LabVIEW® library files (.llb) are used to create a higher level 'directory' structure. Each library file contains VIs that are grouped according to functionality. For example, the motion.llb library file contains VIs that perform axis and/or vector moves, while the initialization.llb library file contains VIs that initialize the A3200. Each VI is simple and intuitive to use.



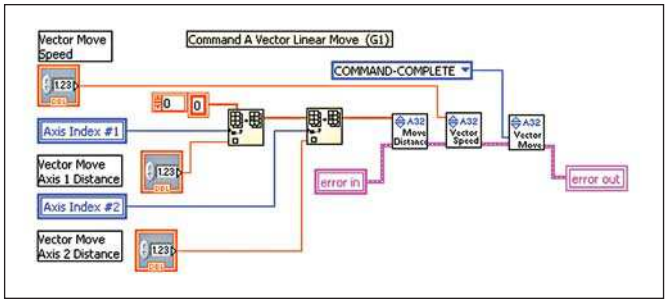
LabVIEW® multi-axis HMI front panel



HMI diagram



LabVIEW® simple 2-axis VI



Vector linear move diagram

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Windows® is a registered trademark of Microsoft.
Visual Basic® is a registered trademark of Microsoft.

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Nlogic PLC

Programmable Logic Controller

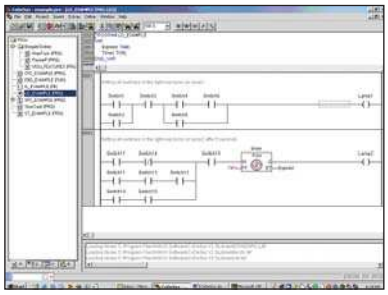
Integrated PLC and motion

Industry standard IEC61131 language support

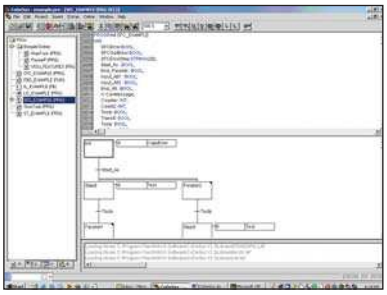
Machine and process sequence control through supervisory PLC program

INTEGRATED PLC AND MOTION

Vendors of motion automation solutions often overlook I/O programming interfaces. With Aerotech's Automation 3200 system, support for sophisticated PLC programming capabilities is available with the Nlogic PLC programming environment. Programming interfaces for all IEC languages are supported.



Ladder Diagram (LD)



Continuous Function Chart (CFC)

ETHERNET I/O

The I/O capacity of the Automation 3200 system Ndrive® and Npaq® components can be expanded easily through onboard 10/100 Base-T Ethernet ports. Each drive can be directly connected to an Ethernet I/O expansion module with a crossover cable. This eliminates the need for hubs or switches and provides a dedicated high-speed, collision-free communication channel. Ethernet I/O units that communicate with the ModBus/TCP protocol are supported, including devices from WAGO, Opto22, Sixnet, and Schneider.

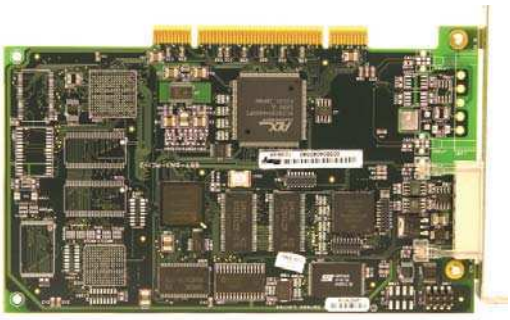
Virtual I/O Map
128 Floating Point Outputs
128 Floating Point Inputs
128 Register Outputs
128 Register Inputs
4096 Binary Outputs
4096 Binary Inputs

DeviceNet™ Compatible

Fieldbus Interface

Many of today's automation projects not only include traditional I/O (digital and analog), but also include devices such as photosensors, relays, valves, monitors, and many others. The task of integrating these items can be challenging. However, many manufacturers have adopted the DeviceNet™ architecture to reduce this integration time and improve system reliability.

Aerotech has extended the functionality of the Automation 3200 by integrating support for DeviceNet™ modules. This capability gives the manufacturer the ability to seamlessly integrate a powerful motion controller along with the flexibility of DeviceNet™ products.



DeviceNet™ circuit board

Nvision® VCM

Vision Control Module

Aerotech's vision and motion toolkit is designed for rapid prototyping with end users, system integrators, and OEMs in mind. Experienced vision and motion engineers, as well as first-time users, can begin rapid prototyping immediately with Nvision®.

Our complete product offering will address the unique requirements associated with integrating vision into automation production processes.

Program in VB/C/C++ or use AeroBASIC to rapidly debug, prototype, and deploy vision-assisted applications.

Nvision® can be easily applied to any combined vision and motion application such as pick-and-place, part identification, measurements, etc. Nvision® builds on the Matrox Imaging Library (MIL®).

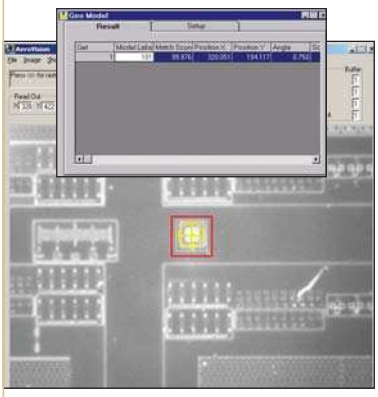
Standard and non-standard cameras can be interfaced with various hardware options.

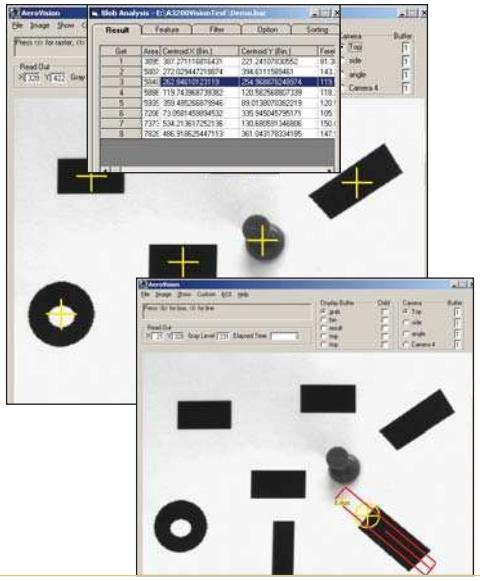
Standard vision tools such as blob analysis, centroid calculations, edge detection, and geometrical feature analysis are integrated with the A3200.

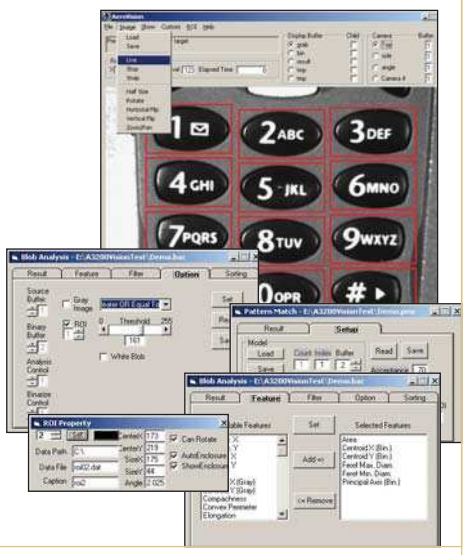
RAPID PROTOTYPE INSPECTION

Using Nvision® you can quickly set up, test, and save inspection objects with no programming necessary.

Our user friendly pull down and pop-up vision controls let customers test inspection objects for robust performance.

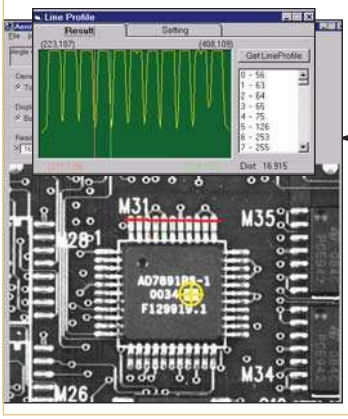






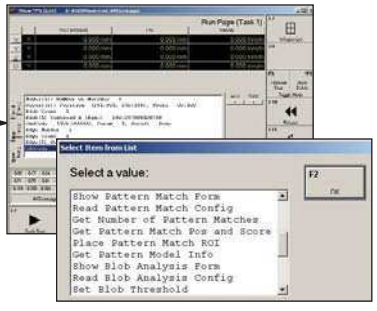
USER ADVANTAGES

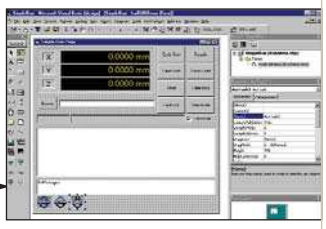
Users can easily call inspection objects from Nview® HMI, Ncontrol® SDK example, VB, or C++. Users can also make custom multiple-inspection objects.



Nview® HMI

Load inspections
Set ROIs
Run inspections
Return results





VB Ncontrol® SDK

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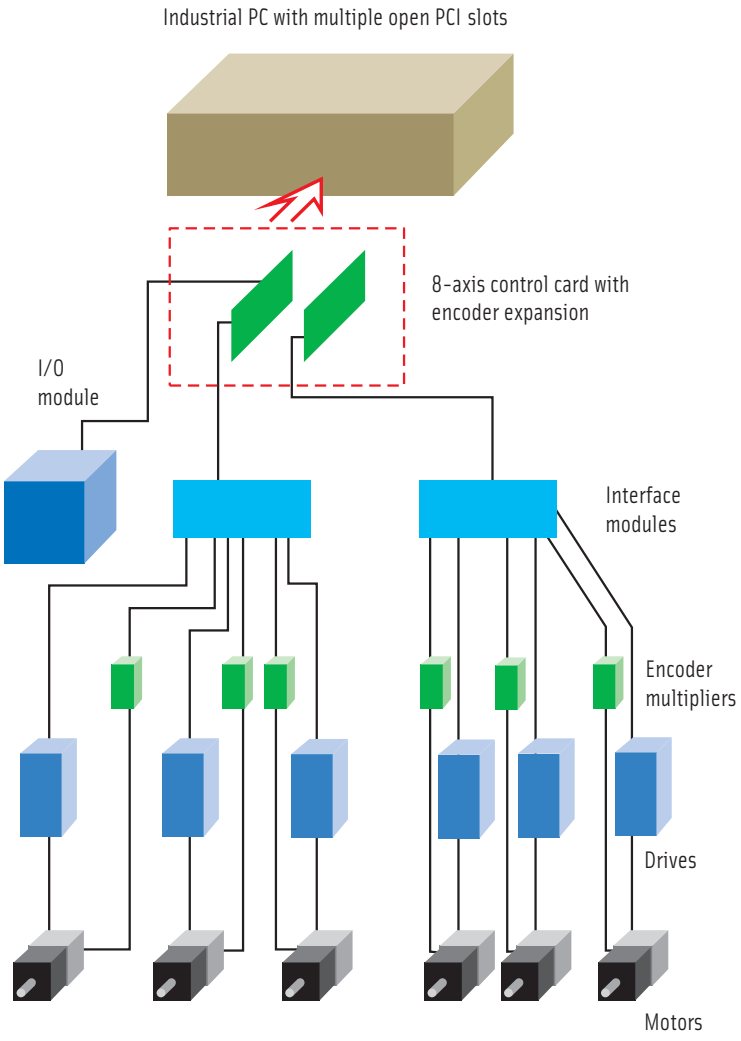
Digital Automation Platform

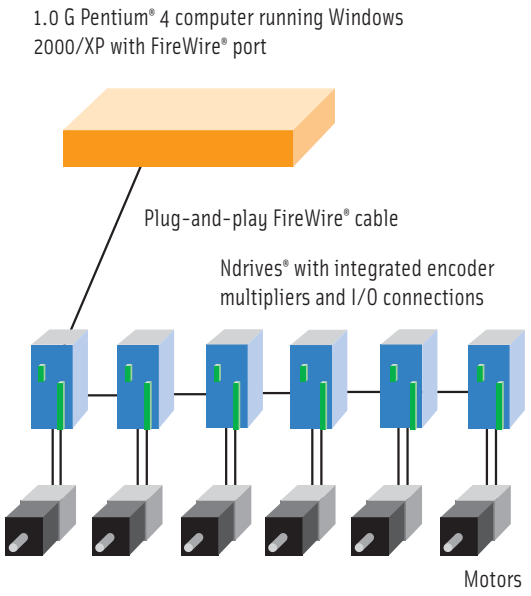
Simplified Integration...Reduced Cost

Compared with traditional PCI card solutions (see below left) that contain many "breakout" modules and excessive wiring, the distributed architecture of the Automation 3200 reduces integration time by replacing unnecessary cabling and electronics with a simple plug-and-play FireWire® cable. In addition, many commonly used devices such as encoder multiplication and I/O can be integrated into the Ndrive®, further reducing the amount of cabling and panel space required. The elimination of the components and cables means faster integration, lower support costs, and fewer spare parts to manage. It's been designed to make your integration smoother and improve the bottom line.

TRADITIONAL 6-AXIS SOLUTION



AUTOMATION 3200 SOLUTION



BENEFITS OF THE A3200 SOLUTION

Significant integration and support savings

38% less wiring

65% fewer components

Plug-and-play drive interface cabling (FireWire®)

Simplified troubleshooting

Increased design flexibility

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Aerotech offers a large variety of servo and stepper drives...

Ndrive® MP

Ndrive® CP

Ndrive® HP

Ndrive® HL

"Micro-sized" drive saves space and reduces costs	Compact drive minimizes integration time	High performance drive for demanding applications	High powered linear drive for ultimate performance
Digital servo/stepper amplifier	Digital servo/stepper amplifier with integral power supply	Digital servo/stepper amplifier with integral power supply	Digital servo amplifier with integral linear power stage for low noise, zero cross-over distortion and high loop gain
Output power up to 10 A peak at 80 VDC	10-30 amps peak; 20-320 VDC	10-100 amps peak; 20-320 VDC	400 W continuous, 800 W peak power output
Digital current, velocity, and position loops for improved motion stability	Digital current, velocity, and position loops for improved motion stability	Digital current, velocity, and position loops for improved motion stability	Digital current, velocity, and position loops for improved motion stability
Optional software multiplier	Optional software multiplier	Optional integrated hardware encoder multiplier for higher throughput and reduced wiring	Optional integrated hardware encoder multiplier for higher throughput and reduced wiring
Dedicated E-Stop input	Dedicated E-Stop input	Dedicated E-Stop input	Dedicated E-Stop input
Single-axis position synchronized output (laser firing) capability	Single-axis position synchronized output (laser firing) capability	Supports up to three axes of position synchronized output	Supports up to three axes of position synchronized output
Optional brake	Optional brake	Optional brake	Optional brake
Drive brushless/DC brush-type servomotors as well as stepping motors	Drive brushless/DC brush-type servomotors as well as stepping motors	Drive brushless/DC brush-type servomotors as well as stepping motors	Drive brushless/DC brush-type servomotors as well as stepping motors
Ultra compact (41 mm x 141 mm x 107 mm)	16 in/16 out expansion board with analog in/out, auxiliary encoder input, and brake relay	8 in/8 out I/O expansion board; Ethernet for additional I/O	8 in/8 out I/O expansion board; Ethernet for additional I/O
Dedicated end of travel limit inputs	Dedicated end of travel limit inputs	Resolver option	Resolver option
CE compliant	CE compliant	Dedicated end of travel limit inputs	CE compliant
		CE compliant	

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...as well as drive racks, consoles, and servo and stepper retrofit options.

Npaq®

Nsys

Nservo

Nstep

Highly integrated six-axis drive chassis

3U x 19" rack mount

5 A to 30 A peak output

Integral power supplies

Digital current, velocity, and position loops for improved motion stability

8 in/8 out opto-isolated plus high-speed differential I/O

Optional Ethernet for I/O expansion

Supports up to six amplifiers (PWM or linear) for controlling brushless, brush, or stepping motors

Up to six axes of integrated encoder multiplier

Optional integrated E-Stop relays

CE compliant

Integrated consoles

Multiple solutions available for different system configurations

Integrated computer, controller, I/O, and customer supplied product

Optional user buttons for E-Stop, power, and cycle start/stop

CE compliant

Multi-axis servo interface for retrofits or 3rd-party drives

Use to retrofit your existing system with new controls; extend the life of your capital investment

Supports two (standard) or four closed-loop servo axes

Each axis has three-phase ±10 volt outputs to drive any amplifier

FireWire® enabled servo controller for simplified wiring

Software configurable for brush, brushless, and stepper motor operation provides flexibility

Optional Ethernet port to connect additional I/O

Connector options include terminal block, D connector, and legacy OP500 connector

Optional position synchronized output

CE compliant

Multi-axis stepper interface for retrofits or 3rd-party drives

Support up to four axes of loop stepper with encoder verification

One clock output (up to 25 MHz) and direction output per axis

One non-isolated digital input (5-24 VDC)

5-24 VDC opto-isolated CW/CCW/HOME and Drive Enable inputs

Supply voltage of 24 to 80 VDC

Screw terminal connectors for I/O

Easily connects to 3rd-party power modules

CE compliant

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Ndrive® MP

"Micro-Sized" Drive Saves Space and Reduces Costs

Output power up to 10 A peak at 80 VDC

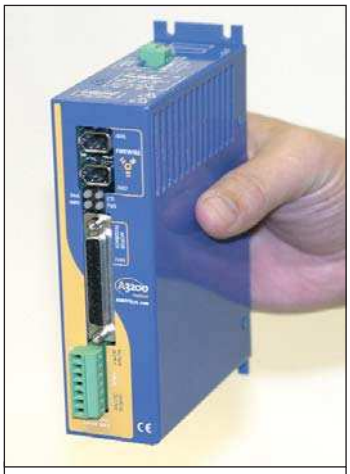
PWM power stage

Integrated E-Stop input

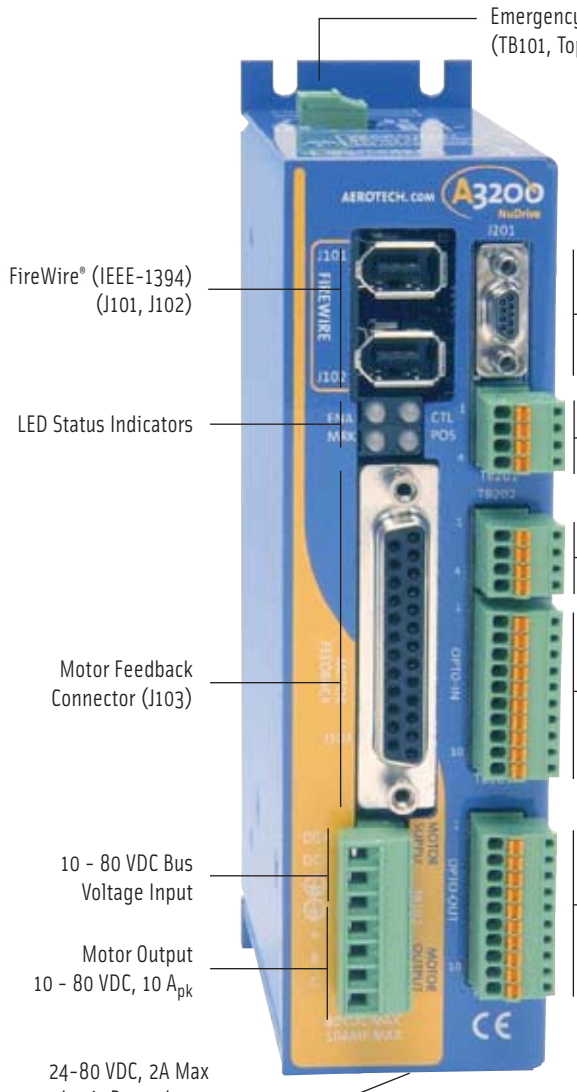
Digital current, velocity, and position loops for improved motion stability

Ultra compact, flexible design provides the ability to drive brushless and DC brush-type servomotors as well as stepping motors

Ndrive® MP is the compact, high performance discrete drive option for the Automation 3200 motion system. Capable of driving brushless, DC brush-type, and stepper motors, Ndrive® MP amplifiers perform both current loop and servo-loop closure and are built on high performance DSPs that allow complex calculations in real time. This processing capability allows Ndrive® MPs to sample the digital current loop and servo loop at a rate of 20 kHz. Ndrive® MPs also handle both digital and analog I/O, and encoder multiplication. Standard options include software-based encoder multiplication, brake relay, additional I/O, and separate logic supply inputs for "keep-alive" operation during an E-Stop condition.



Ndrive® MP is 70.5% smaller than the Ndrive® CP.



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Ndrive® CP

Compact Drive Minimizes Integration Time

Output power range from 10 A peak to 30 A peak at 320 VDC

No transformer required; direct connection to AC line

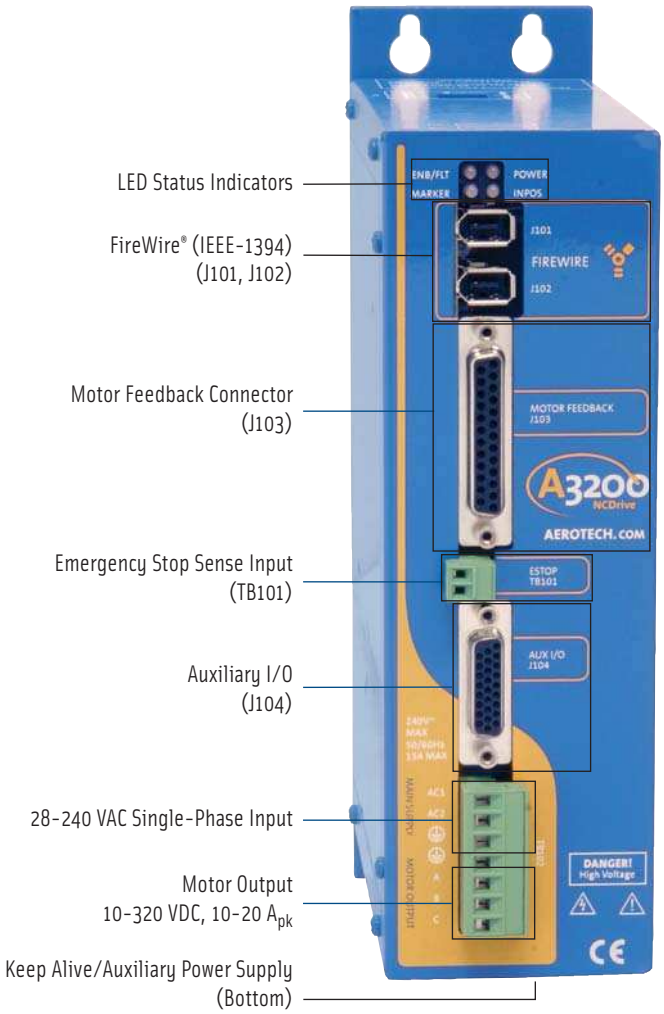
PWM and linear power stages available

Digital current, velocity, and position loops for improved motion stability and reliability

Flexible design provides the ability to drive brushless and DC-brush-type servomotors as well as stepping motors

UL, CE, and CSA approval

The Ndrive® CP is a high performance amplifier for cost-sensitive applications that maintains the same level of sophisticated control architecture found in the rest of the Ndrive® series. Any combination of Ndrive® amplifiers can be used on the FireWire® network to allow the user to customize the system as needed.



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Ndrive® HP

High-Performance Drive for Demanding Applications

Wide output power range from 10 A peak to 100 A peak at 320 VDC

No transformer required; direct connection to AC line

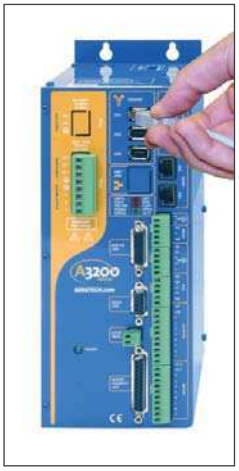
PWM and linear power stages available

Digital current, velocity, and position loops for improved motion stability and reliability

Optional integrated encoder multiplier for higher throughput and reduced wiring

Flexible design provides the ability to drive brushless and DC-brush-type servomotors as well as stepping motors

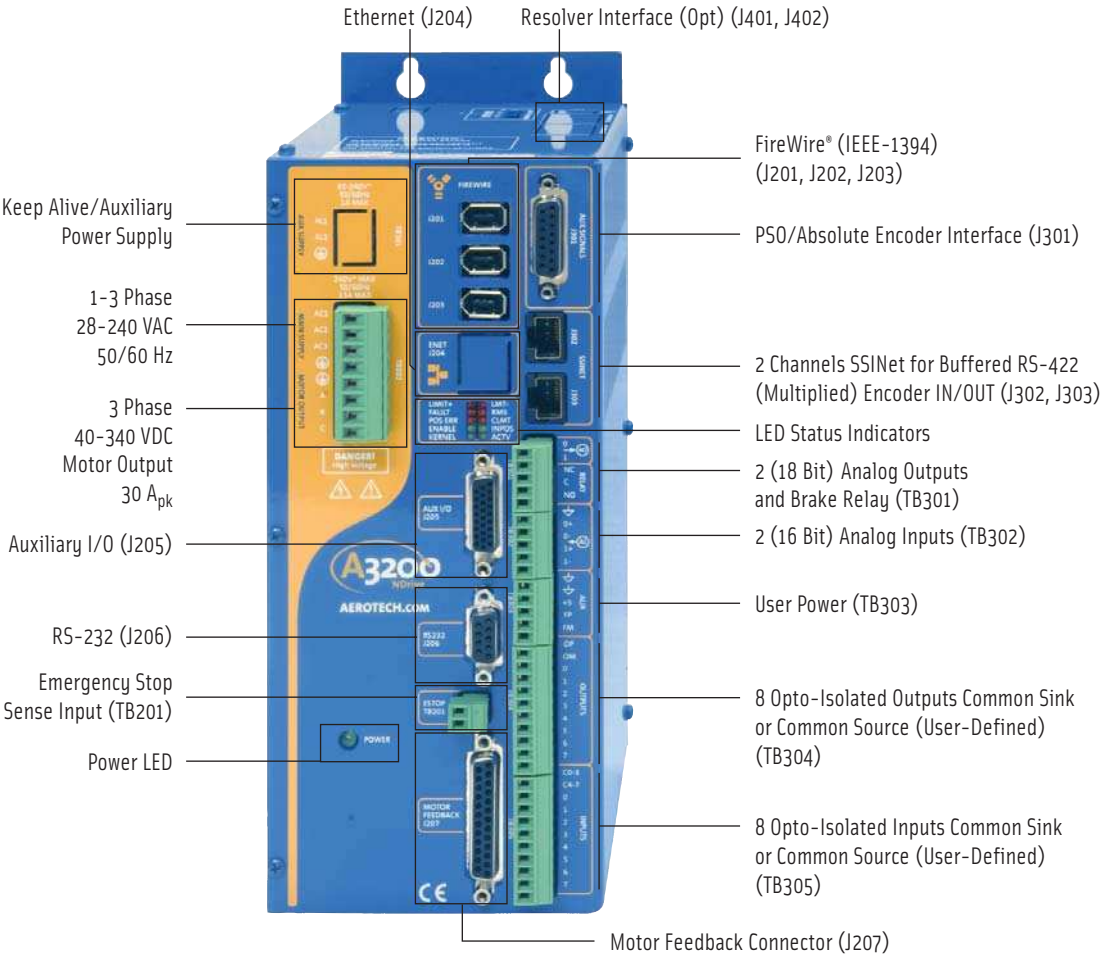
UL, CE, and CSA approval



Drawing upon 30 years of advanced drive development, Aerotech has introduced a line of intelligent digital drives for the Automation 3200 network. Connected via the FireWire® (IEEE-1394) communication bus, these drives provide deterministic behavior, auto-identification, and easy software setup from the Nmotion® software controller. Featuring an 80 MHz DSP, the drives have fully digital current and servo loops providing a selectable 1-20 kHz loop sample rate, a 32 MHz encoder data rate, and an Ethernet port for access to third-party networked I/O solutions. Our intelligent digital drives also feature onboard brake relays and options such as programmable resolution multiplication (x65536) and two-axis position synchronized outputs. In addition to these features, the use of the commercially standard FireWire® communication link allows easy integration into the Automation 3200 network.

Ndrive® HP up to 30 amps

Ndrive® HP 50 - 100 amps with I/O expansion



Model shown above is a 30 amp Ndrive® HP with I/O expansion.

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Ndrive® HL

High-Powered Linear Drive for Ultimate Performance

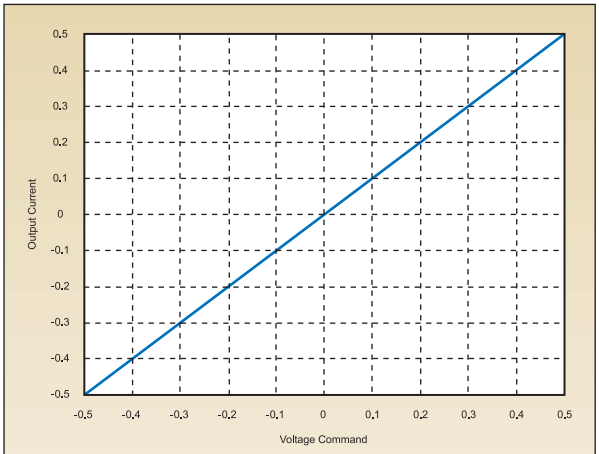
±40 V and ±80 V output voltage

Peak output current up to 20 amps

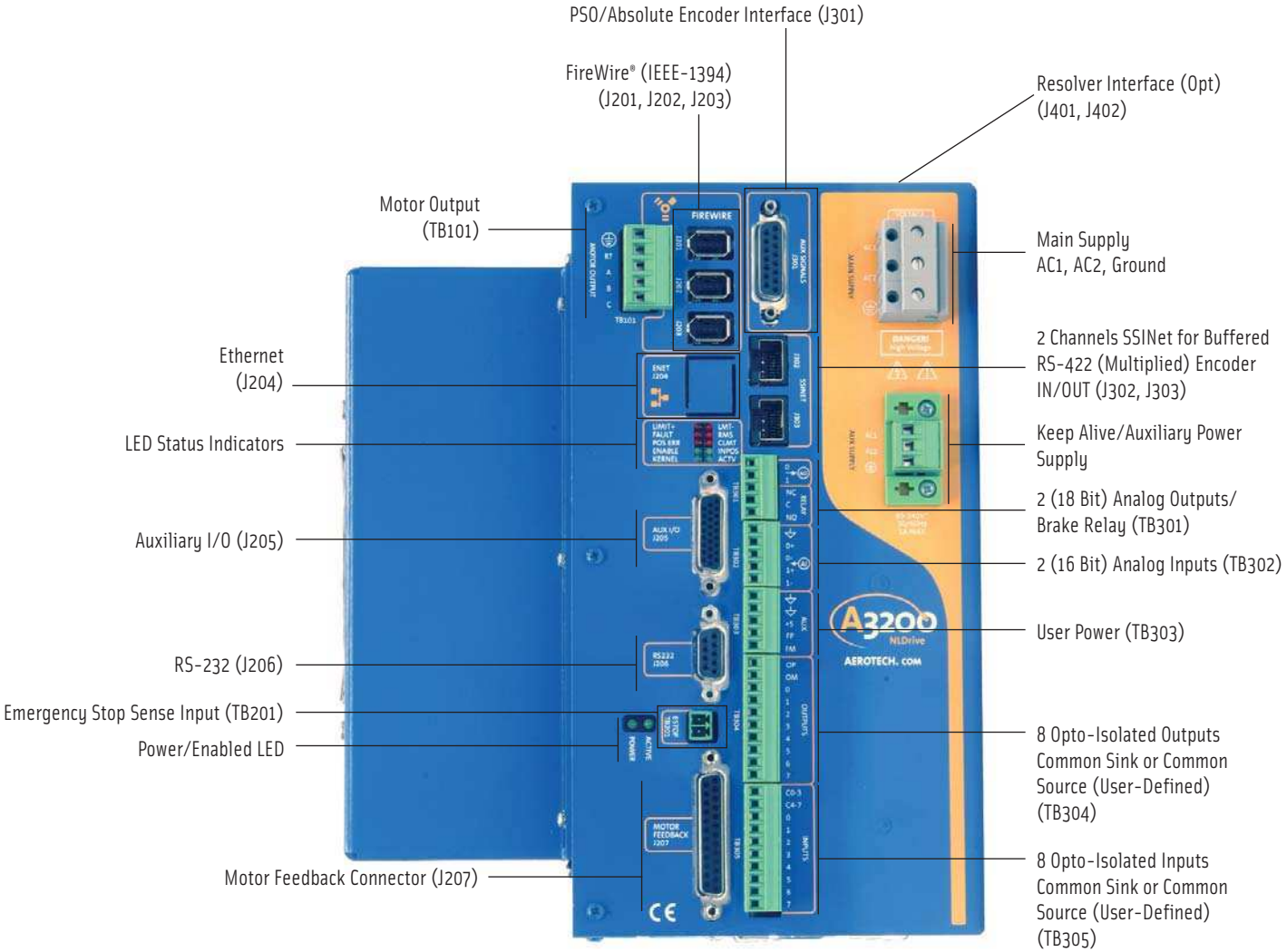
Continuous output current up to 10 amps

Software selectable power amplifier bandwidth

The Ndrive® HL is a linear servo amplifier for motion control applications that require high accuracy drives with no PWM switching noise and zero dead band. It was designed to complement Aerotech's Automation 3200 32-axis motion, vision, PLC, robotics and I/O platform, and is available in three different current and voltage configurations. Because the Ndrive® HL has no PWM switching noise, it does not induce electrical noise into sensitive electrical measurement devices. The Ndrive® HL has no dead band, and provides smooth current through motion direction reversals.



For quiet operation, the Ndrive® HL series linear amplifiers offer excellent linearity with zero crossover distortion.



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Npaq® and Nsys Consoles

Highly Integrated Six-Axis Drive Chassis

Compatible with all linear and rotary feedback devices: resolver, encoder (incremental, absolute), Inductosyn®, laser interferometer

20 kHz sample rate for parameter and servo loops

High bandwidth server to minimize position and rate errors

6 axes of amplifiers

Recognizing that not everyone wants to panel-mount their amplifiers, Aerotech also supplies the Npaq® 3U, a 3U high, 19" rack-mount chassis capable of powering six axes of motion while providing unparalleled ease of integration. Foregoing the complicated wiring and assembly schemes offered by other vendors, Aerotech has designed the Npaq® 3U to accept simple plug-in digital amplifiers as well as one-step connections to the Automation 3200 network (via FireWire®) and third-party Ethernet I/O networks. Already containing 16 opto-isolated digital I/O, four 16-bit analog inputs, and four 16-bit analog outputs, the addition of an Ethernet port allows the user to control machines with the networked I/O of choice. Combine that with the ability to accept linear and PWM drives of varying power, support onboard encoder multiplication across all axes, and connect to additional Ndrives® and Npaqs®, and you have a powerful solution for all of your automation needs.

NSYS COMPLETE CONSOLES

Complete consoles are available that integrate all the electronics for your system, including the controller, drives and/or drive racks, I/O, and monitor.

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Nservo *Interface to Any Servo Drive and Preserve Your Capital Investment*

Nservo

Retrofit your existing system with new controls – extend the life of your capital investment

Supports 2 or 4 closed-loop servo axes

FireWire® enabled servo controller provides true plug-and-play wiring

Optional Ethernet port to connect additional I/O

Encoder or resolver feedback accepted

Connector options include terminal block, D connector, and legacy OP500 connector support block for Aerotech retrofits – reduces wiring and changeover time

Position Synchronized Output (PSO) synchronizes laser firing or other external event triggering for 3-dimensional machine motions

Nservo upgrades any existing system with analog servo amplifiers to Aerotech's Automation 3200 32-axis motion, vision, PLC, robotics, and I/O platform. Nservo is a digital 2- or 4-axis, 20 kHz sample time servo (position and velocity) controller. Nservo complements the Automation 3200 system's networked digital drives (Ndrive® series and Npaq®), allowing industry standard analog amplifiers to interface to Aerotech's digital drive network. As with the Ndrive® series, a single plug-and-play cable communicates with the motion generator on the PC. A FireWire® communication bus provides deterministic behavior, auto-identification, and easy software setup from the Nmotion® SMC software controller. Other features include limits, E-Stop, brake, auxiliary feedback input, high-speed latching input, and Ethernet.

Nservo allows upgrade of any existing system using analog servo amplifiers to the Automation 3200.

Nstep *Interface to Any Stepper Drive and Preserve Your Capital Investment*

Nstep

Support up to four axes of open loop stepper

One clock output (up to 25 MHz) and direction output per axis

One non-isolated digital input (5-24 VDC)

5-24 VDC opto-isolated CW/CCW/HOME and Drive Enable inputs

Supply voltage of 24 to 80 VDC

Screw terminal connectors for I/O

Easily connected to 3rd-party power modules

Nstep is a one- to four-axis stepper controller that interfaces with any standard stepper drive via clock and direction inputs. Nstep can be used in multi-axis systems where axes require stepper motor controllers that are either sequenced or coordinated with the servo axis of the system. Or it can be used as the main controller for a completely stepper-based system. This provides the user the ability to control all axes on the system (servo, stepper, or brush motor) with one motion controller — the Automation 3200. Additionally, tighter integration of all diverse axes results in less integration work thereby shortening the development and deployment cycle.

Nstep allows the A3200 to control any stepper drive.

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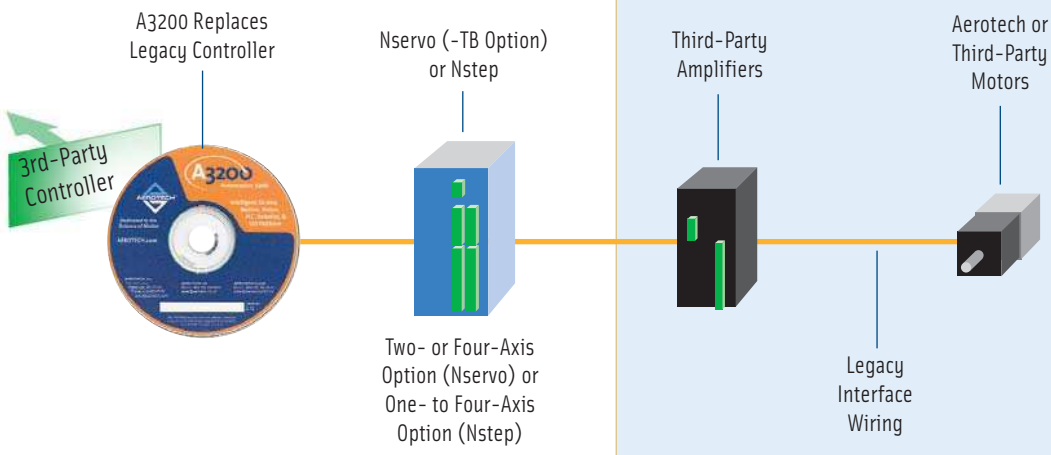
Nservo and Nstep *Interface to Any Servo or Stepper Drive and Preserve Your Capital Investment*

Nservo or Nstep

A3200 Upgrades Performance from Legacy Controller

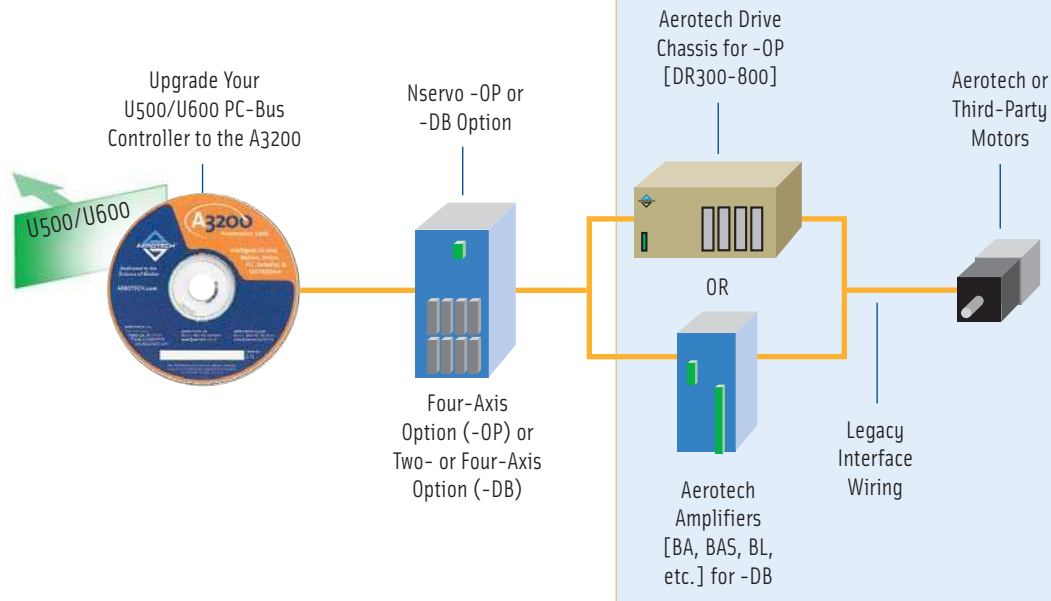
Existing 3rd-Party Amps/Motors Retained



Nservo *(-OP or -DB Option)*

U500/U600 Upgraded to A3200

Aerotech Drive Chassis/Amplifiers and Motors Retained



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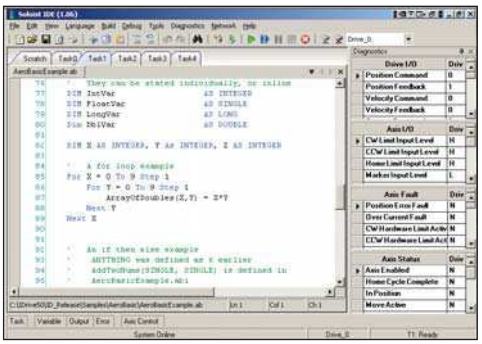
Soloist™ *Stand-Alone, Single-Axis Drive and Control Features Ethernet & USB Connectivity*

Soloist™ CP and Soloist™ MP

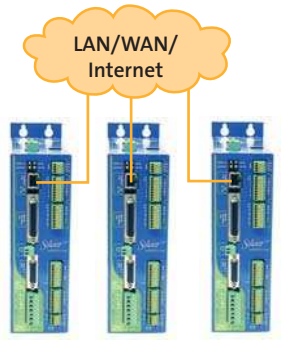
Aerotech's Soloist™ single-axis digital servo controller combines advanced software architecture (.NET) with a power supply, an amplifier, and a position controller in a single package. The flexibility and scalability of the Soloist™ make it the ideal controller for both small and large applications on the production floor and in laboratory applications.

Advanced software architecture reduces development times and eases maintenance



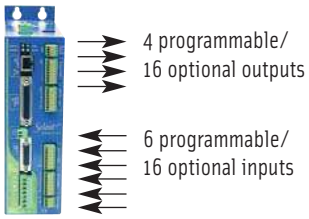
- Development environment for .NET (C#) or Windows® (C++)
- Virtual instruments for the LabVIEW® environment
- Positioning modes include indexing, homing, velocity profiling, freerun, and CAM tables
- Autotuning makes servo tuning fast and simple
- File storage folder for parameters, programs, maintenance data, etc.
- Multitasking operating system
- Advanced data logging capabilities

Industry standard interfaces (Ethernet/USB/RS-232) make connectivity quick and cost-effective



- Multi-axis configuration through Ethernet up to 1024 axes
- MODBUS over Ethernet master/slave capabilities
- Status, development, and commands can be performed via Ethernet or locally through USB
- General purpose RS-232 serial port

Scalable design suitable for large axis count web applications or stand-alone operation



- Digital drive in models up to 30 A_{pk}
- Six programmable inputs (two high speed); four programmable outputs
- E-Stop input
- Dual encoder inputs for master/slave applications or dual-loop control
- Optional AUX power, encoder multiplier, single-axis PSO, integral or external shunt
- Expansion board with 16 digital inputs, 16 digital outputs, 1 analog input, 1 analog output, and brake relay

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Direct-Drive Linear and Rotary Solutions

Linear Motors

Advanced design yields 49% greater continuous output force than competitive models

Zero-cogging design allows super-smooth velocity and position control

Special magnet options available for increased force output

Modular tracks use a symmetrical mounting pattern to mount end-to-end for unlimited travel

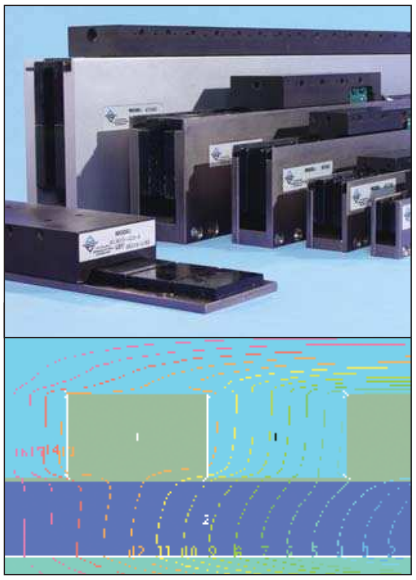
Optional cooling for higher rms force

Multiple forcer models provide a wide output selection

Drawing less current than competitive models (for a given output), ACCUDEX® linear motors run significantly cooler – a critical benefit for high-precision applications

Vacuum versions available

Up to 4740 N of peak force and 1200 N of continuous force



Advanced magnetic field synthesis and analysis yields highest motor output power per unit volume

Frameless Rotary Motors

S-Series

Five frame sizes

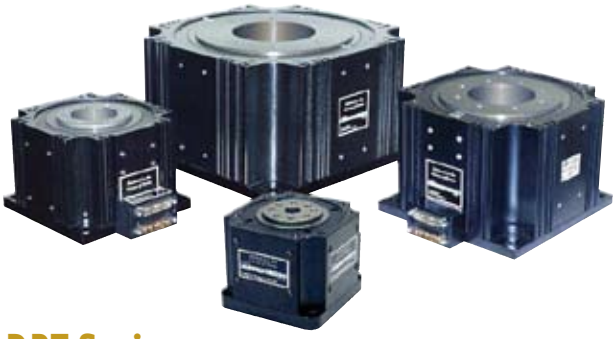
Frameless design for easy integration into OEM machines

Slotless stator and high-pole-count rotor provide zero cogging for exceptional velocity control

Large torque range

Up to 146 Nm of peak torque and 36.5 Nm continuous torque

ADRT Rotary Stages



ADRT Series

Four frame sizes

High torque output, low system inertia, high system acceleration

Outstanding velocity stability, wobble, and runout

Large aperture, optional slip ring, rotary joint, brake assembly, tabletop, collets, vacuum, and 3-jaw chucks

Applications range from indexing to high-speed laser machining to precision wafer inspection

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Servomotors

BM Series

Standard sizes (NEMA) for easy integration and retrofitting

Wide range of continuous output torques cover most applications (0.5 - 31.5 Nm)

Advanced 8-pole design matched with skewed stator minimizes torque ripple and cogging for smoother velocity control

Rugged construction ideal for 24/7 production applications

Excellent power density rating results in maximum torque in a compact package

Optional IP65 through IP67 construction allows use in harsh environments

Vacuum, food-ready, and explosion-proof construction are standard configurations

BMS Series

The ultimate replacement for brush-type motors

Standard NEMA sizes for easy integration and retrofitting

Advanced slotless design yields superior velocity control

Brushless technology provides maintenance-free use and delivers higher acceleration than their brush counterparts

Ultra-high resolution (8 M cts/rev) available when combined with Aerotech MXH encoder multiplier

Vacuum versions available

Custom BM

Extremely rugged design for demanding environments such as automotive and machine tool industries

IP67 (Immersible) and IP68 (Submersible) sealing available

12.2 - 440 lb-in (1.4 - 50 Nm) continuous torque range

Custom BMS

Designed exclusively for the food and baking industries. Capable of withstanding repeated high pressure washdowns. Smooth housing and special connectors minimize potential entrapment areas.

"Finless" extruded aluminum housing

FDA-approved epoxy coating

Stainless-steel shaft available

Optional terminal box

12.2 - 440 lb-in (1.4 - 50 Nm) continuous torque range

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Cartesian Robots

AGS10000 and 20000 Series

Velocities to 5 m/s

Accelerations to 5 g

Customizable Z and theta axes

Noncontact linear encoders

Rugged design for 24/7/365 use

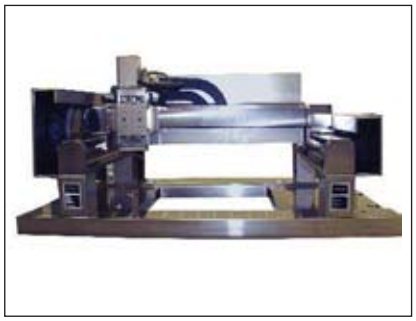
Lower cost of ownership due to noncontacting, non-wearing linear motor and encoder

Optional machine base and risers

Optimized cable management system

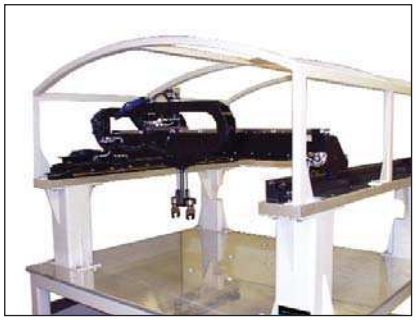
Optional coatings for enhanced ESD protection

Available with high-performance motion controllers and amplifiers for a complete, turnkey solution



Travel up to 1 m x 1 m

Travel up to 1 m x 1 m



Travel up to 1.3 m x 1.5 m

Travel up to 1 m x 1 m

Actuators

LMA Series

Travel lengths to 1 m

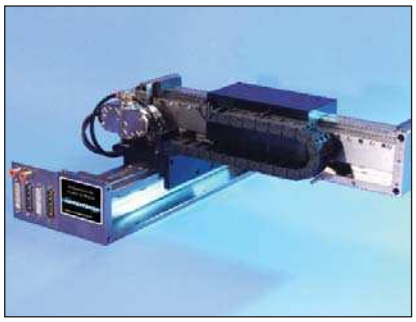
Variety of motor sizes available

Compact, space-saving design

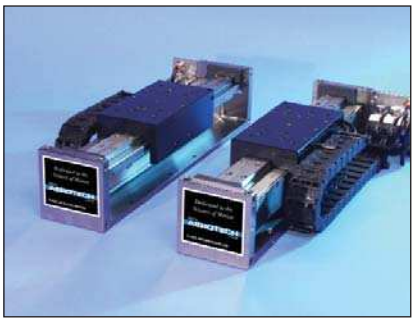
Integral E-chain for easy integration

Intelligent design protects motor and encoder from contamination or damage

Continuous force outputs from 73 N to 276 N are available



T configuration



Two single-axis actuators

Vertical or Z-axis operation

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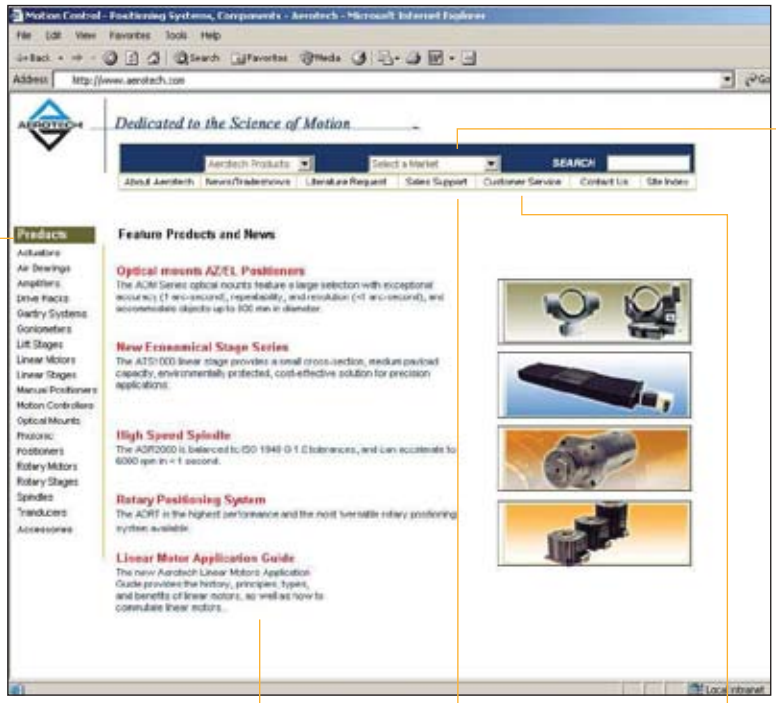
Aerotech Online

Aerotech's website at www.aerotech.com is your comprehensive resource for all Aerotech information worldwide. Our product information is very thorough and better than having a catalog! Each product section comes with all the information available in print and includes downloadable 2D and 3D models. Register for our e-newsletter *In Motion* to receive bi-monthly news on all of the current activities at Aerotech.



PRODUCT NAVIGATION

Easy to use product navigation intuitively and quickly guides you through our broad product range.

SELECT YOUR MARKET

Our new "select a market" feature details market-specific automation solutions from Aerotech.

CURRENT PRODUCT AND COMPANY NEWS

The most current product and company news is featured prominently on our home page.

WORLDWIDE SALES OFFICE LOCATOR

Use our worldwide sales office locator to quickly find an Aerotech office near you.

CUSTOMER SERVICE

Our customer service center provides contact information for Aerotech customer service worldwide. Also included are details on our training programs, software and product manual downloads, and a FAQ section.

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Worldwide Training and Support

Aerotech offers comprehensive worldwide training and customer service either at customer facilities or at one of our Aerotech training centers.

OUR TRAINING PROGRAM FEATURES:

Standard and customized courses

Hands-on training with Aerotech positioning systems

Interactive training with experienced instructors

Comfortable, spacious facilities

Aerotech Ltd

Aerotech North America

Aerotech GmbH

INSTALLATION AND STARTUP (COMMISSIONING)

Aerotech offers startup and commissioning services to minimize startup times, reduce cost and accelerate time-to-production. By combining our product knowledge with your process and application expertise, new systems and applications can be completed faster at a reduced overall cost.

ENGINEERING SUPPORT

Aerotech provides complete engineering support for our products, including onsite support and maintenance, and remote support via phone, fax, website, and/or WebEx® software. As a manufacturer staffed by engineers, we understand the unacceptability of downtime.

TRAINING

Aerotech training classes are designed to help our customers realize the full potential of our products. By demonstrating all of a product's features and how to use them, customers have been able to reduce startup time and quickly optimize their applications. Aerotech's classes have been developed, and continually upgraded, using feedback from our customers.

Aerotech has over 30 years of expertise in designing motion control and positioning systems and components with an unsurpassed track record of reliability. When you make the choice to purchase from Aerotech, we urge you to learn how to get the most from your new Aerotech products. Aerotech provides both onsite (your facility) and/or in-house (our facility) training for our customers' convenience.

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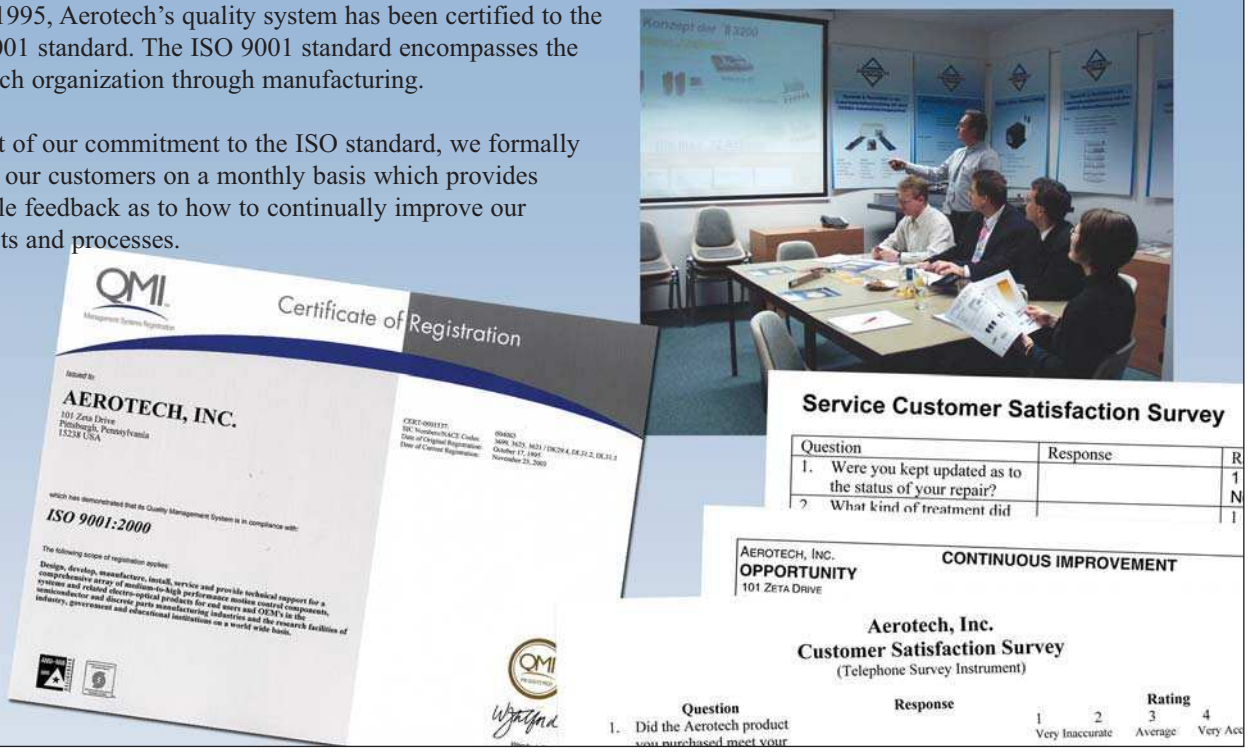
Aerotech: An ISO 9001 Registered Company

Since 1995, Aerotech's quality system has been certified to the ISO 9001 standard. The ISO 9001 standard encompasses the Aerotech organization through manufacturing.

As part of our commitment to the ISO standard, we formally survey our customers on a monthly basis which provides valuable feedback as to how to continually improve our products and processes.



Award Winning Aerotech

Aerotech's strong commitment to research and development has resulted in many patents and a number of awards for our innovative products. We look forward to advancing the capabilities of our customers for many years to come.

Machine Design
Slides/Ways

Lightwave OFC 2001 Attendees' Choice Award
FiberAlign® 130

Lightwave NFOEC 2002 Attendees' Choice Award
FiberMax®

PD & D Top 50 Product 2002
Automation 3200

Aandrijftechniek 2002 "Most Innovative Product"
FiberMax®

Design News Best Product of the Year finalist:
2002 Automation 3200
2004 VasculatheTM
2004 ADRS

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Aerotech at a Glance

Corporate Headquarte
Pittsburgh, PA USA

Technically Superior Components Create...

Highest performance brushless linear and rotary motors

ADRT rotary stage system

ALS1000 series linear motor stages

Award-winning Automation 3200 1-32 axis motion, vision, PLC, robotics, and I/O platform

Ndrive® HP

Npaq®

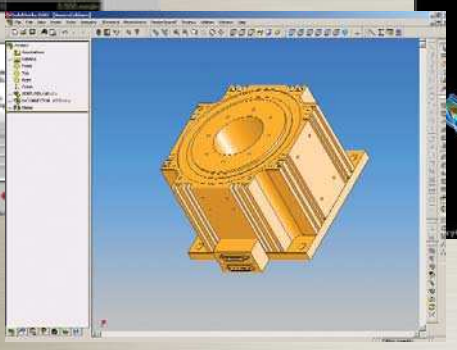
High Performan

Award-winning FiberMax® 6-axis nanopositioner

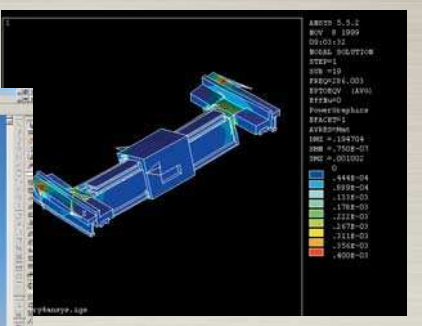
Highest throughput linear Cartesian gantry systems

Comprehensive Technical Support Services

Custom software application support



3D models to facilitate faster and more accurate system layout



Advanced analytical techniques for optimization of system geometry

| High Volume M

Aerotech Germany

Aerotech UK

Sub-Assemblies... and Best-in-Class Sub-Systems.

High-speed cylindrical laser cutting systems

Production-proven, large format air-bearing systems for flat panel and semiconductor applications

Highly integrated motion sub-systems with machine frame, display, and packaged electronics

Custom-engineered vacuum and clean-room compatible systems

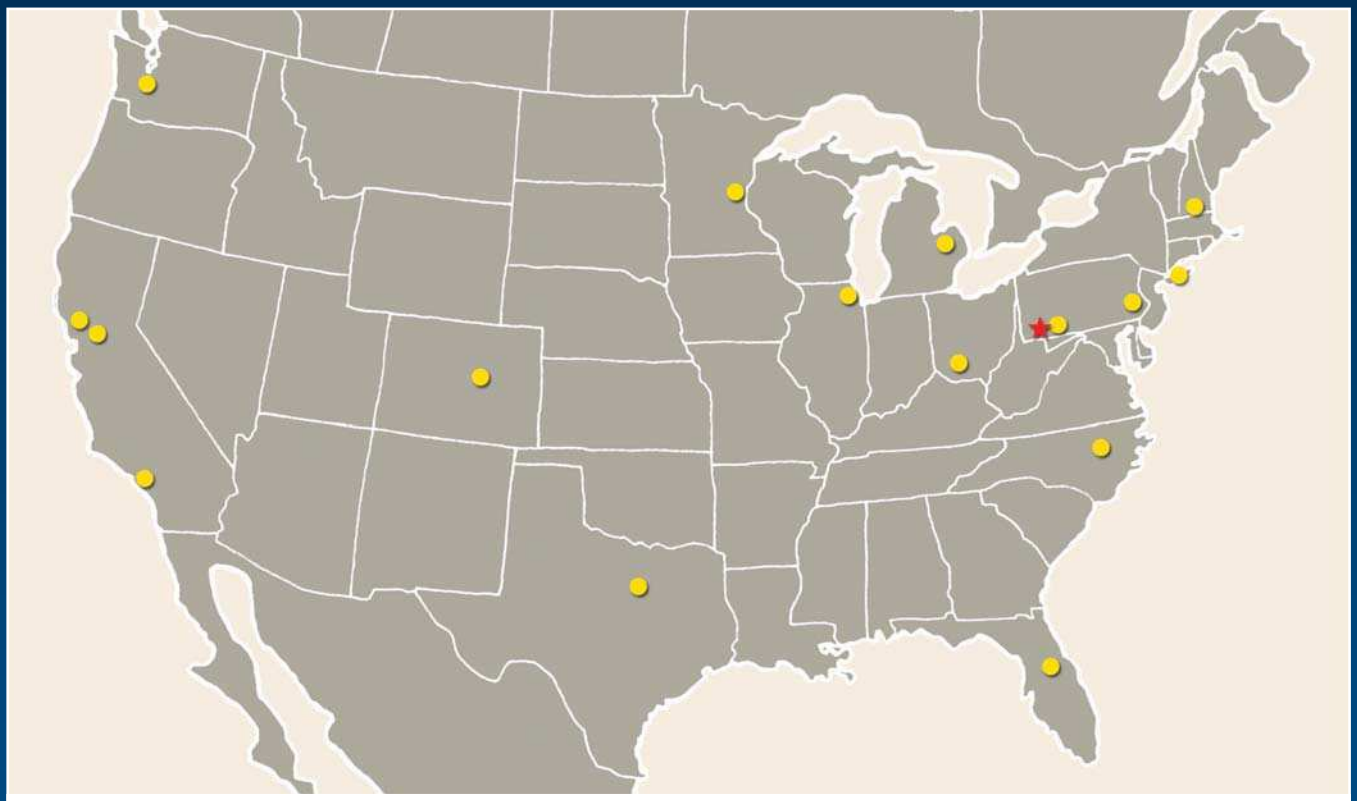
ufacturing | Worldwide Service and Support

Over 100,000 axes installed worldwide

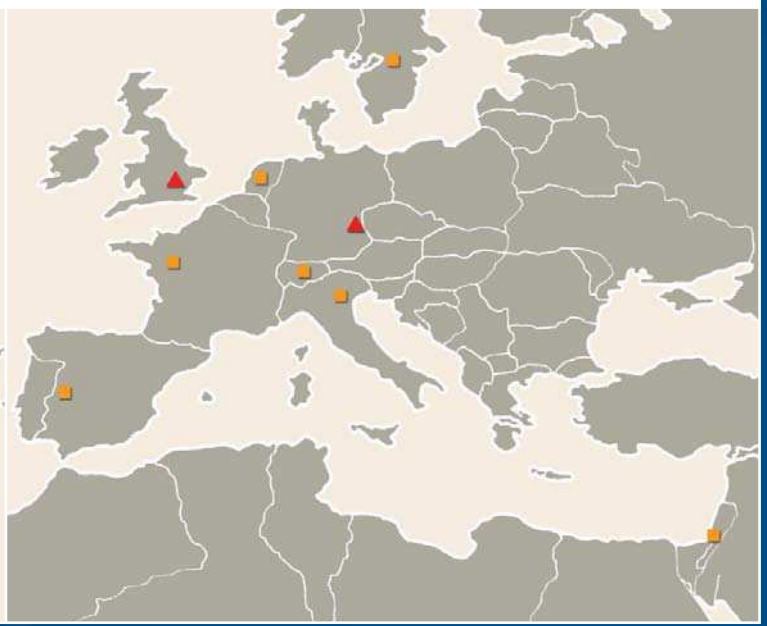
Worldwide startup service and onsite training

Fully equipped on-site training facilities

Aerotech's Worldwide Sales and Service Locations



★ - Aerotech Headquarters ● - Direct Field Sales Office ▲ - Aerotech Subsidiary ■ - Representative



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Dedicated to the Science of Motion

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