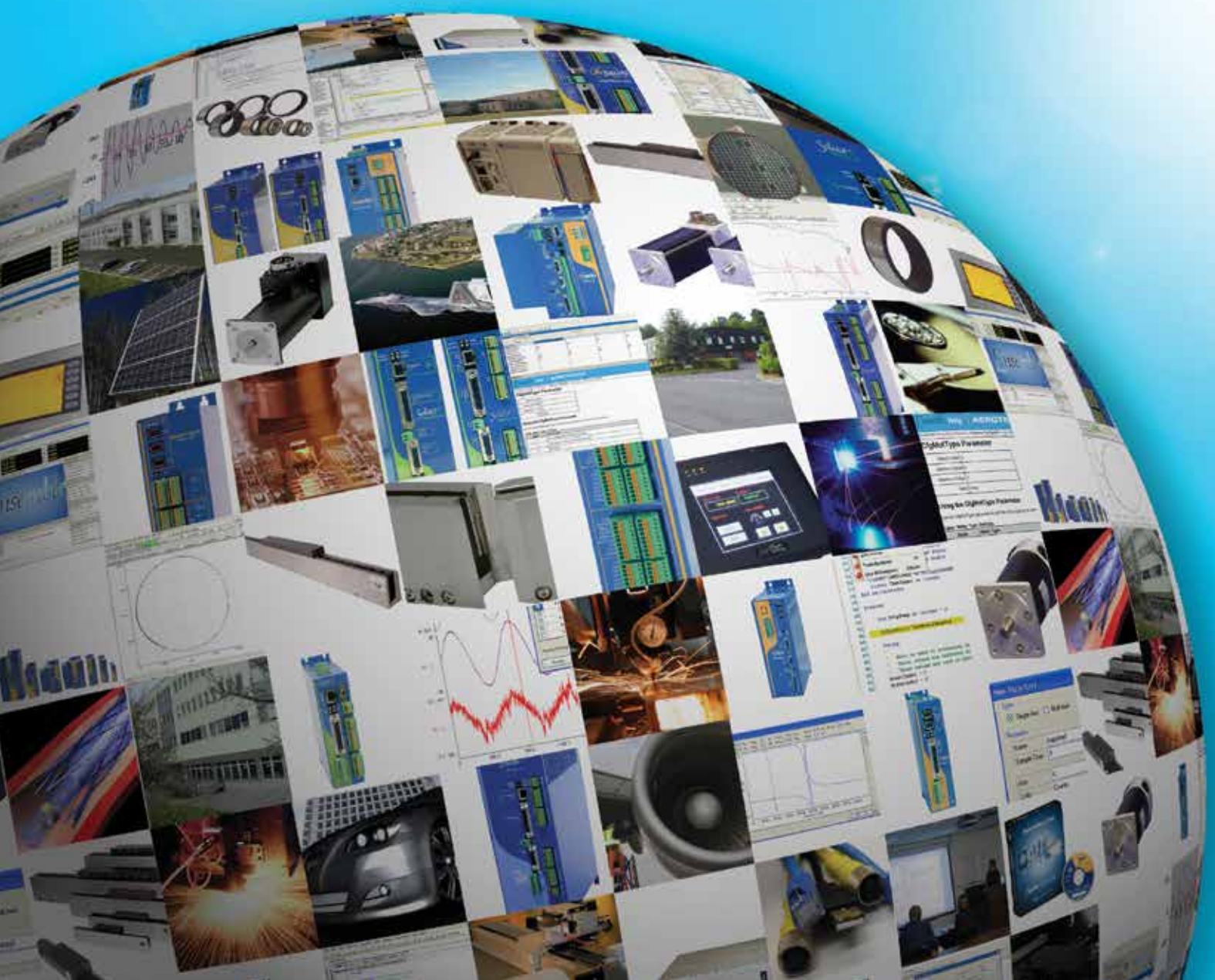

Integrated Motion and
Machine Control Solutions
AEROTECH®
AEROTECH.com
A3200
3200

Aerotech's Advanced Automation Technologies: 46 years in the making... and going strong...



- Controls
- Software
- Amplifiers
- Motors
- PLC
- Fieldbus
- I/O
- Vision
- Peripherals
- Robotics
- Data Acquisition

Contents

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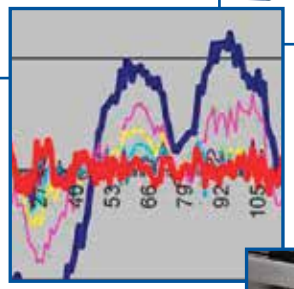
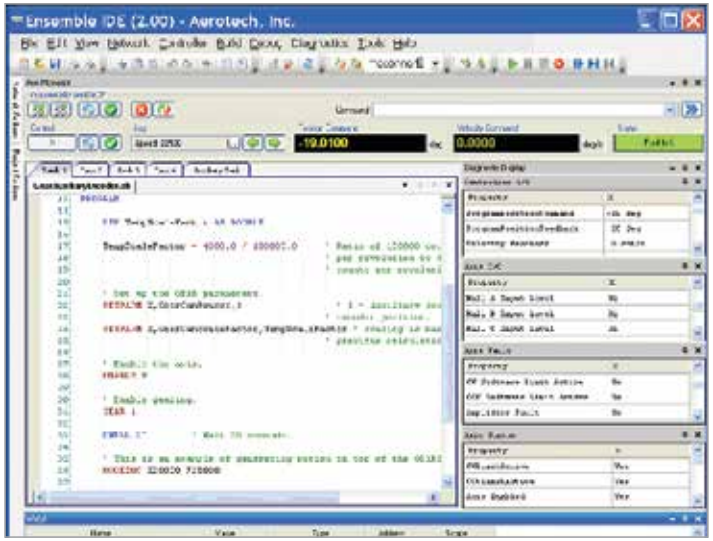


Common Software Platform:
Tools, Powerful Programming Environment, Calculators, Diagnostics

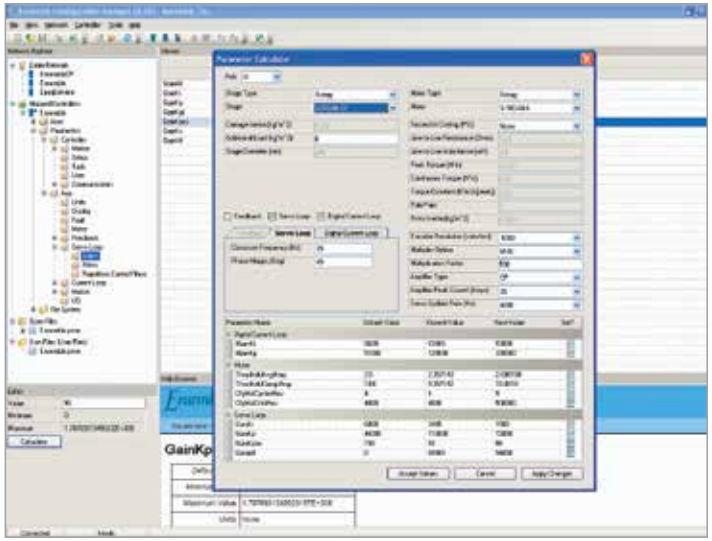
Aerotech Integrated Motion and Machine Control

- High performance
- Easy to use
- Flexible
- Scalable
- Networked
- Lowest cost of ownership
- Advanced control technology
- Controls servo, piezo, voice coil, and stepper motor

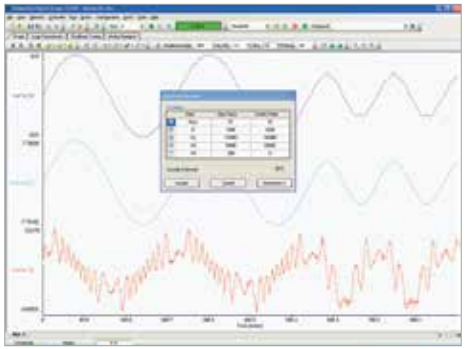
Diagnostics



PID Calculator

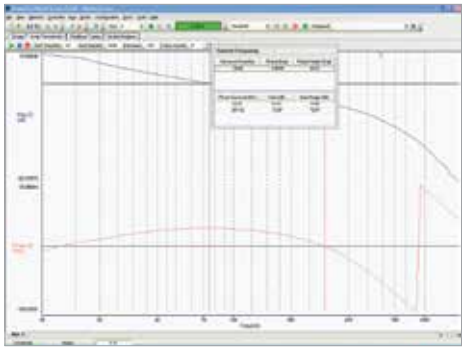


Autotune



PLC

Loop Transmission



Develop your own applications with .NET, C#, VB.NET, C, LabVIEW,® Tango, AeroBasic™ or PLC languages

Award-Winning Controllers

Automation 3200

- PC-based
- 1 to 32 axes of coordinated motion
- Up to 32 tasks
- RS-274 (G-code)
- Advanced features for demanding applications
- PWM or linear drives (up to 150 A)
- Scanner control for marking
- Tightly integrated laser functionality
- Retro-fit package for old controls
- Integrated PLC and Motion - MotionPAC

Ensemble™

- Stand-alone
- 1 to 10 axis controller
- Up to 4 tasks
- Versatile, cost-effective, coordinated motion
- PWM or linear drives (10-150 A peak)
- Drives brushless, linear, rotary, DC brush or stepper motors
- Desktop, rack mount or panel mount

Soloist™

- Stand-alone
- Network up to 1024 single axes
- Up to 4 tasks
- Elegant, economical, versatile controller
- PWM or linear drives (10-150 A peak)
- Drives brushless, linear, rotary, DC brush or stepper motors

Piezo Controls

- Network up to 32
- Coordinated motion with servo and stepper motor stages
- Available in desktop or rackmount configuration
- Powered by Automation 3200 motion controller

Configure Your Automation Solution with Aerotech

Linear and Rotary Servomotors/Accessories

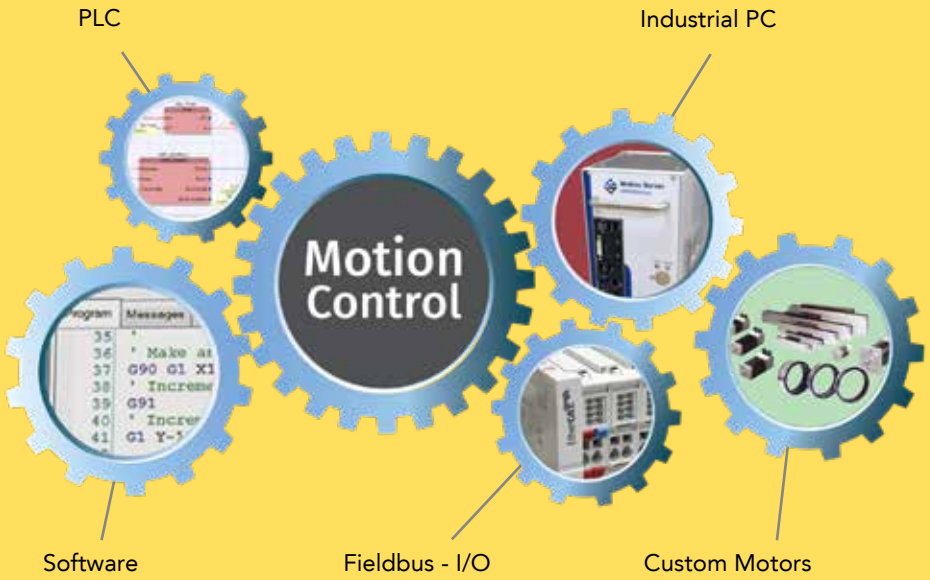
Fieldbus and Network Connectivity

- EtherNet/IP™
- PROFINET
- Modbus®/TCP
- RS-232
- EtherCAT™
- Ethernet TCP/IP
- USB
- GPIB

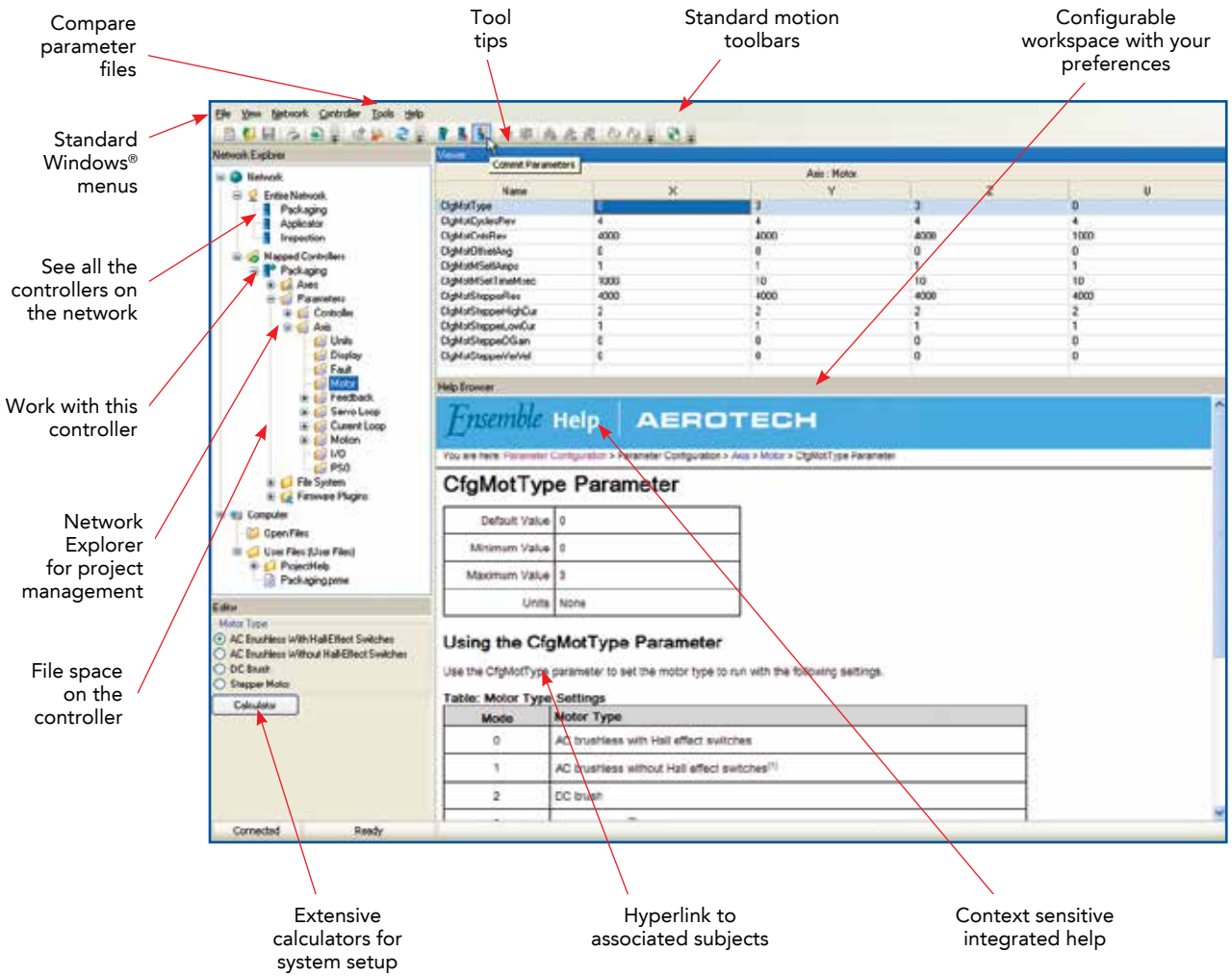
EPICS

ODVA™

Custom Controls, Drives and Motors



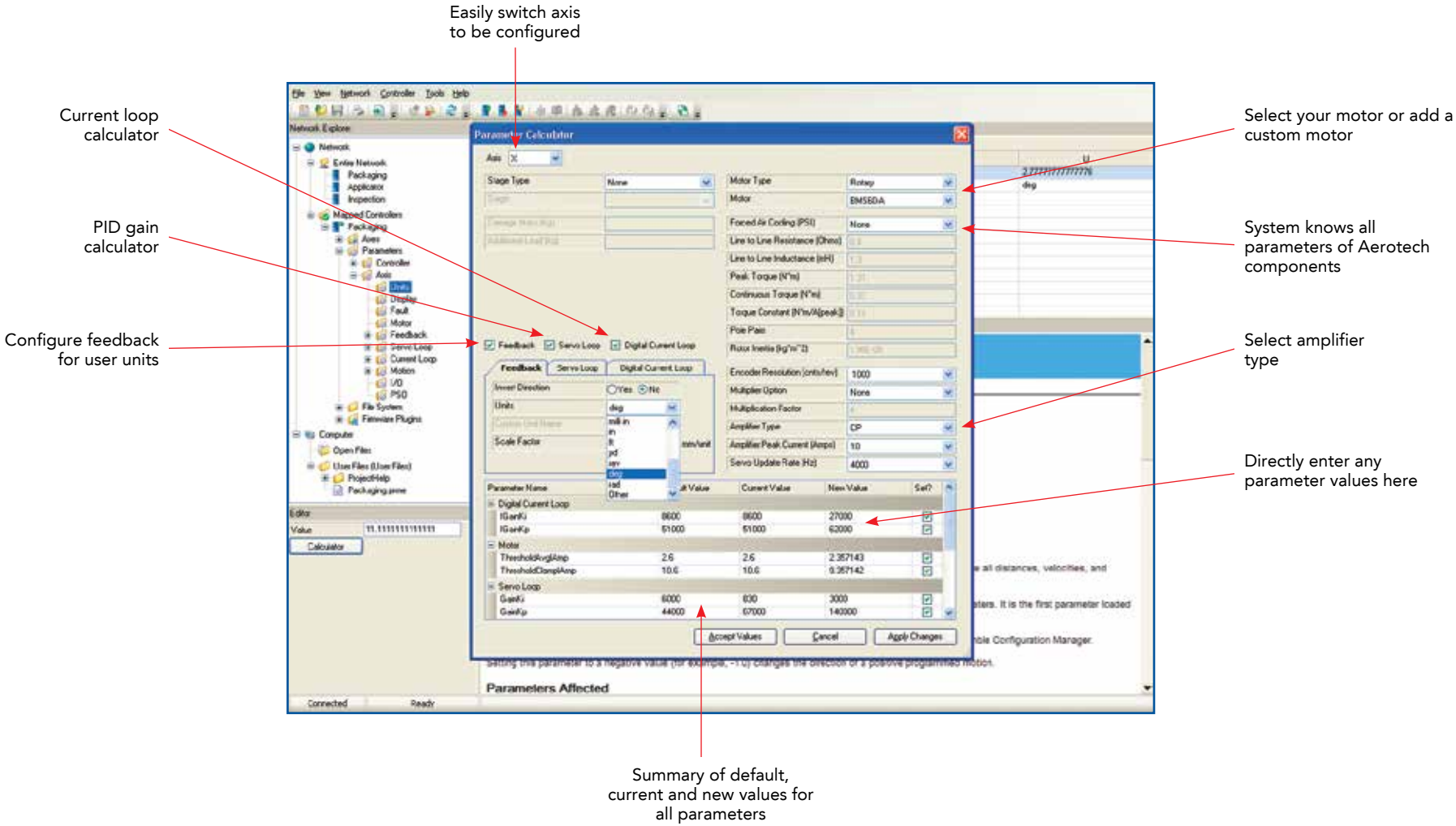
Integrated Configuration Manager for Easy Setup



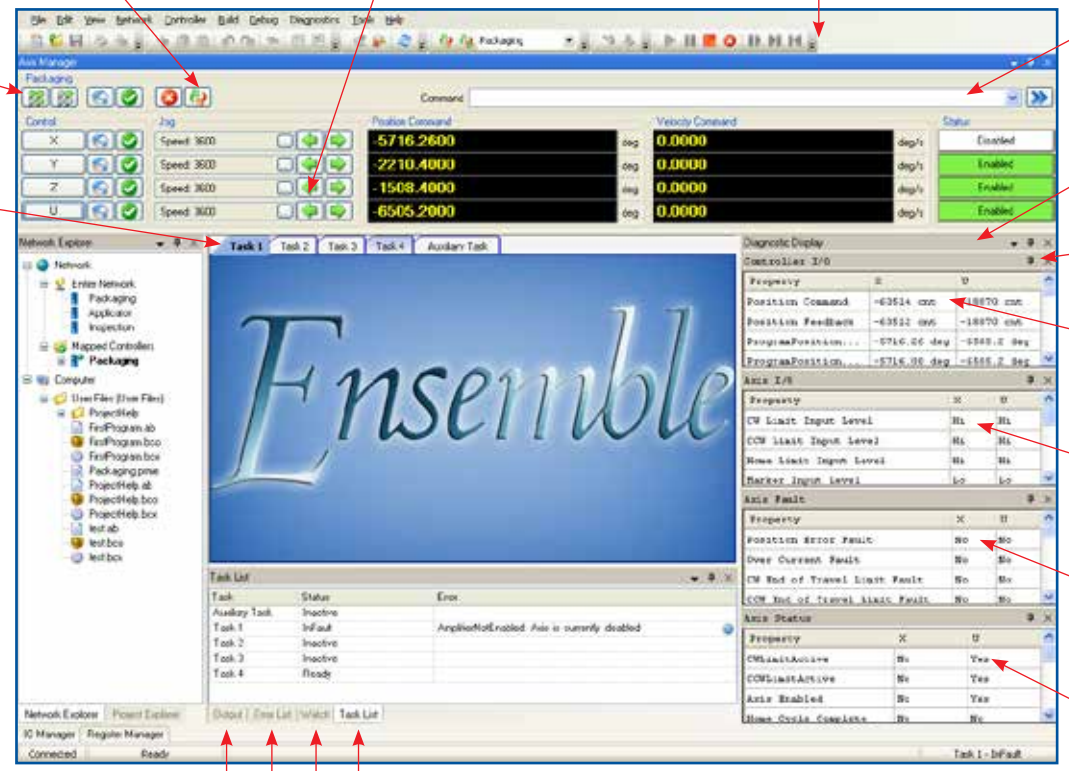
Motion Composer: Use the same Aerotech software with the A3200, Ensemble, or Soloist

- Configuration Manager to organize your applications
- Calculators for quick and easy setup
- Extensive diagnostics for commissioning
- Integrated Development Environment for fast development
- Data Acquisition and Analysis Tools for increasing performance
- Fully compliant .NET 2.0 shortens the development cycle

Calculators for Quick and Easy Setup



Extensive Diagnostics for all System Signals and Variables Shorten Debug and Startup Time

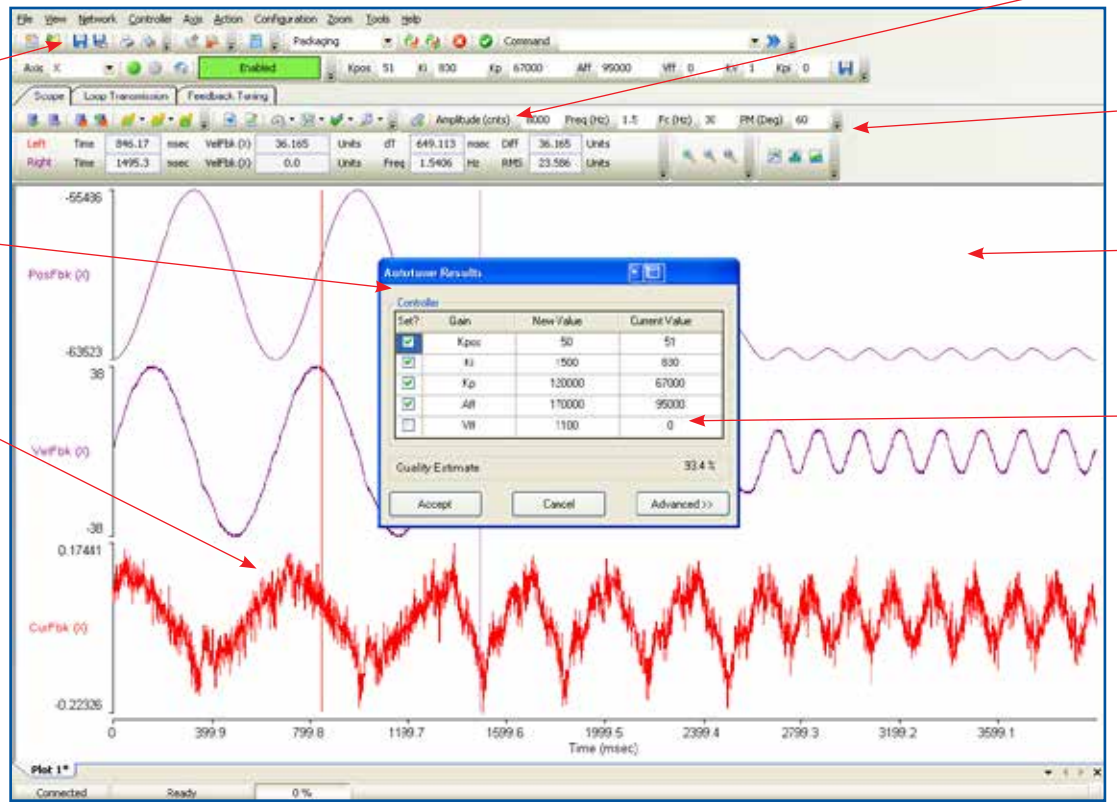


Advanced Diagnostic and Tuning Capabilities Minimize Startup Time and Allow Easy Optimization of Motion

Save plots for future reference

Current and recommended gains pop up after each run

Use sinusoidal sweep or white noise method



Input amplitude and frequency range for test

Select desired system bandwidth and phase margin

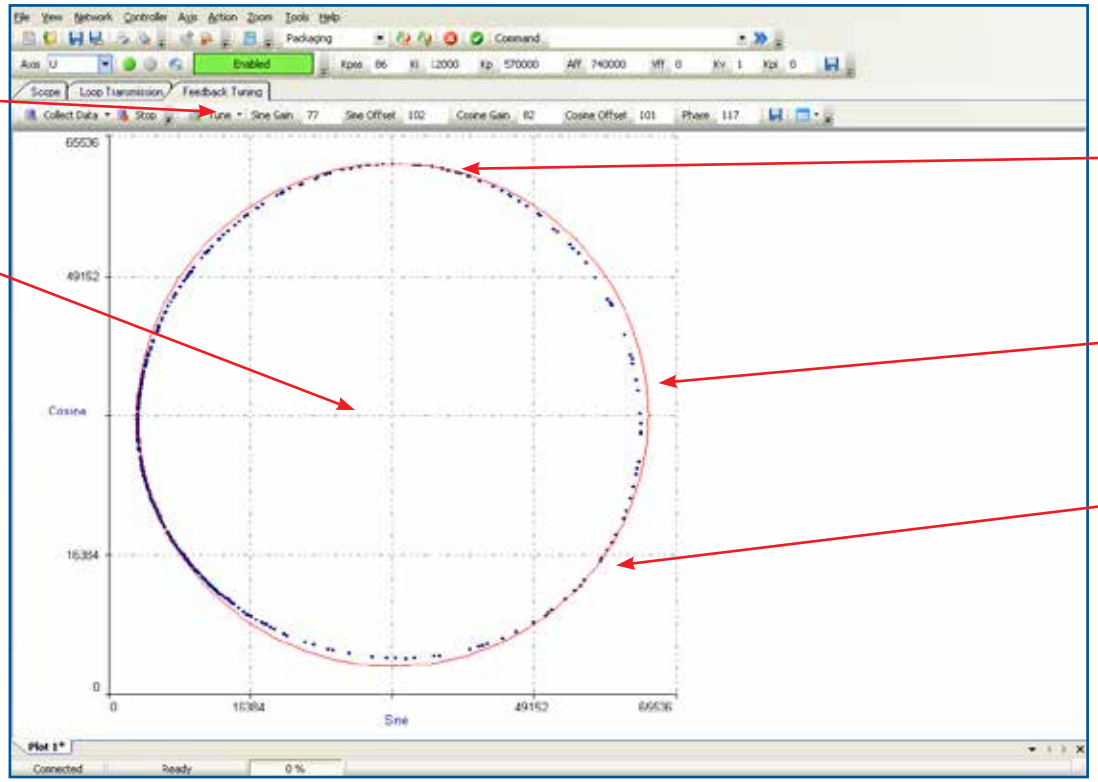
Scope, tuning and data collection fully integrated with controller

Automatic calculation of PID-FF gains

Use Encoder Tuning Tool to Increase System Accuracy

One click tuning

Fully integrated with controller



Optimally calculates gain and phase of amplified sine encoder channels in seconds

Actual encoder performance

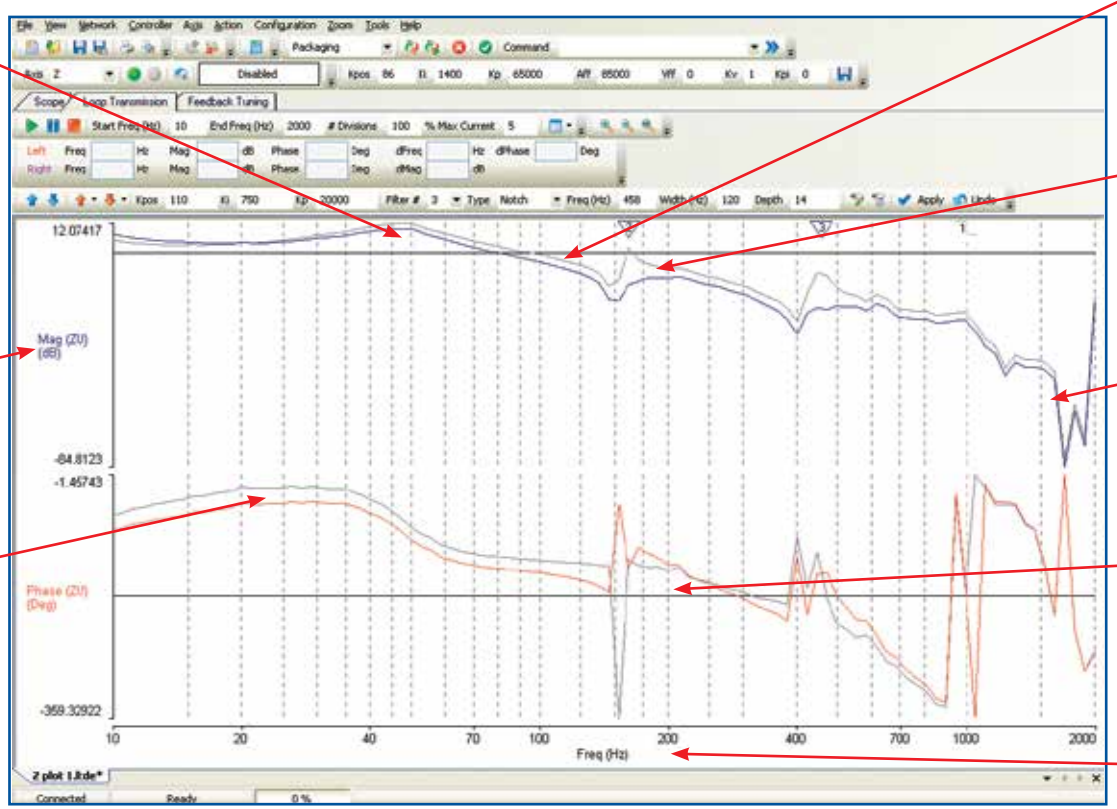
Graphical display of the Lissajous plot to optimize the encoder signal

Loop Transmission is a Tuning and Diagnostic Utility that Greatly Enhances System Performance

Graphical loop shaping — add filters or change gain by dragging the gain curve, and the filter coefficients and PID gains are calculated automatically

Open or closed loop response

Analyze position loop, velocity loop or current loop



Automatic calculation of gain margin

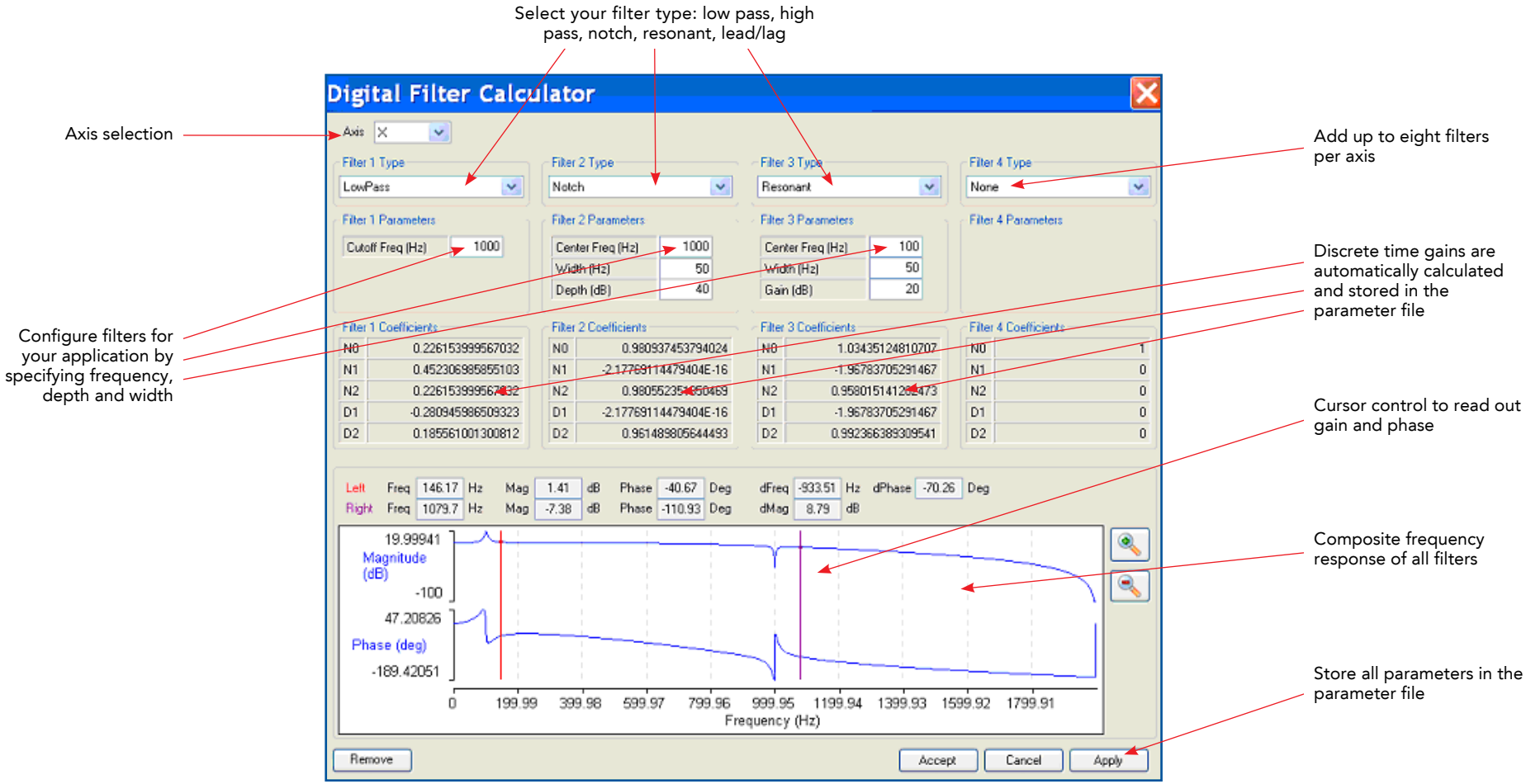
Identify resonances and use filters

Calculator and loop shaping to increase performance

Automatic calculation of phase margin

System frequency response or Bode plot

Fully Integrated Digital Filter Calculator Makes Performance Enhancements Easy



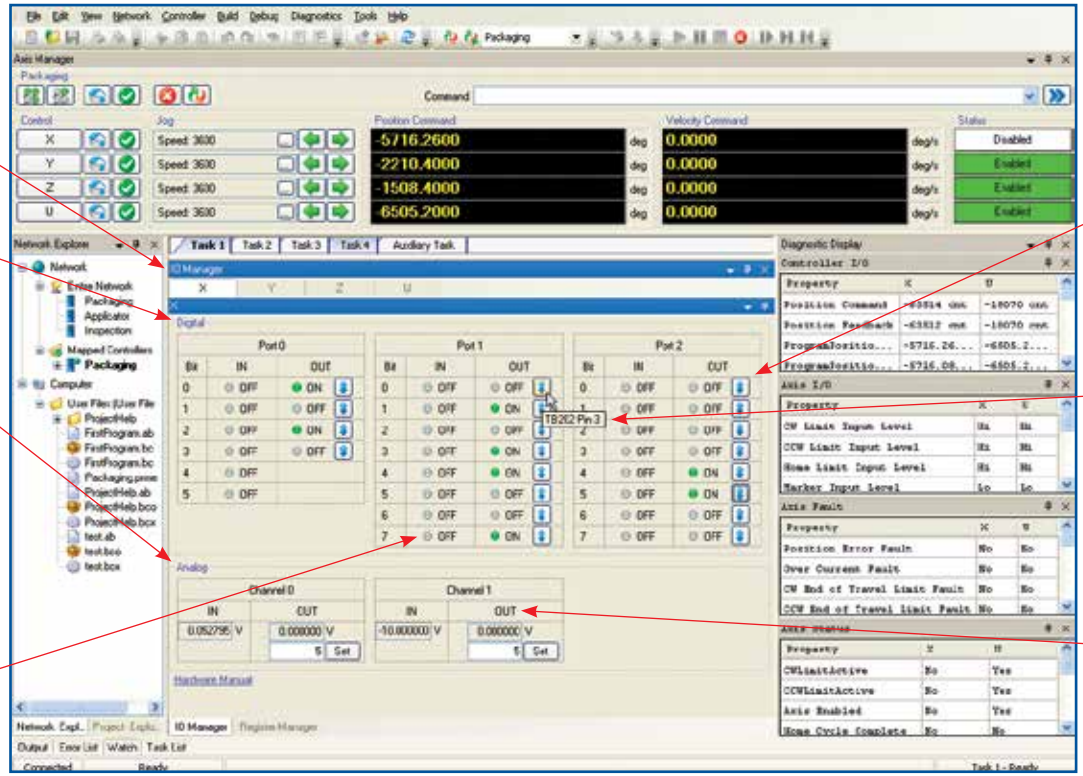
Integrated I/O Panel for Debug, Commissioning or Operations

View I/O axis information and program at the same time

Monitor digital I/O control

Monitor analog I/O

Set digital I/O during test and commissioning



Use the I/O panel during programming to test as you go

Tool tip provides physical connector and pin on the drive to easily associate electrical wiring with software variables

Set analog I/O during commissioning for easy testing

Integrated Development Environment Shortens Development Time

Hide the axis manager while programming to see more code

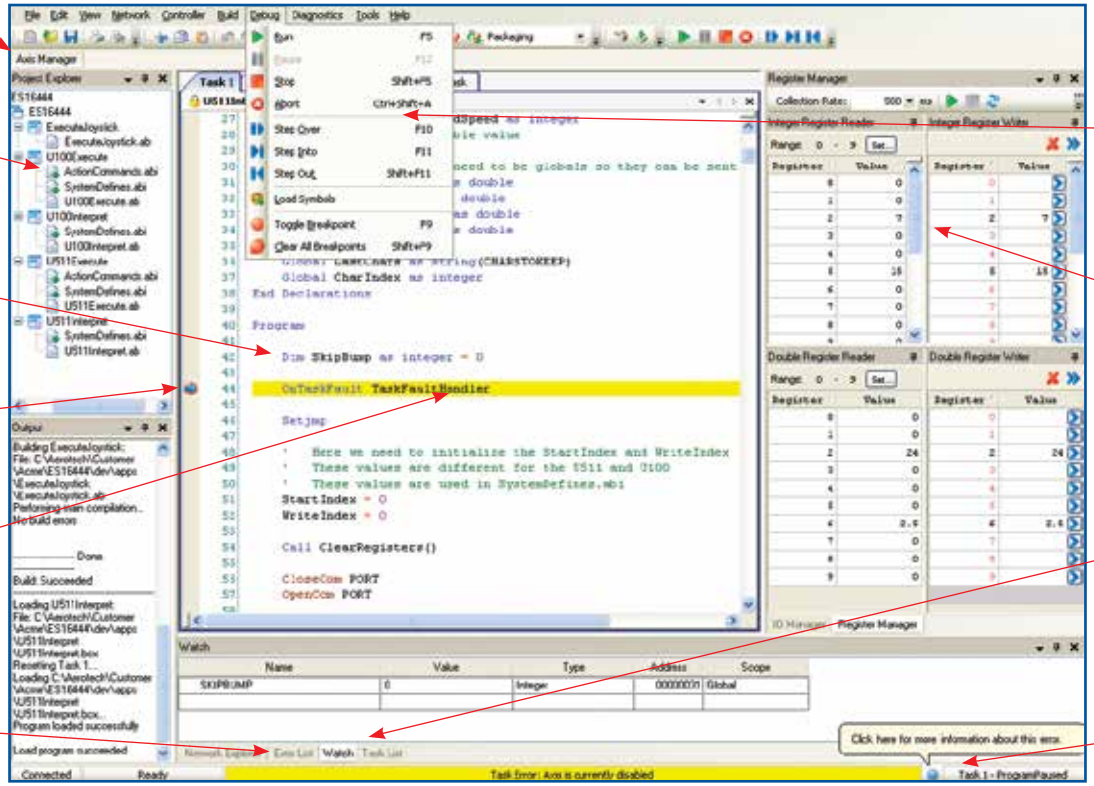
Visual Studio®-like project management for advanced programming

Powerful IntelliSense® capability

Insert breakpoints to debug program

Low learning curve with strict implementation of .NET naming conventions

Detailed error explanation in error list



Minimize development time with debug features, break point, step in and step over

Full diagnostic instrumentation while debugging

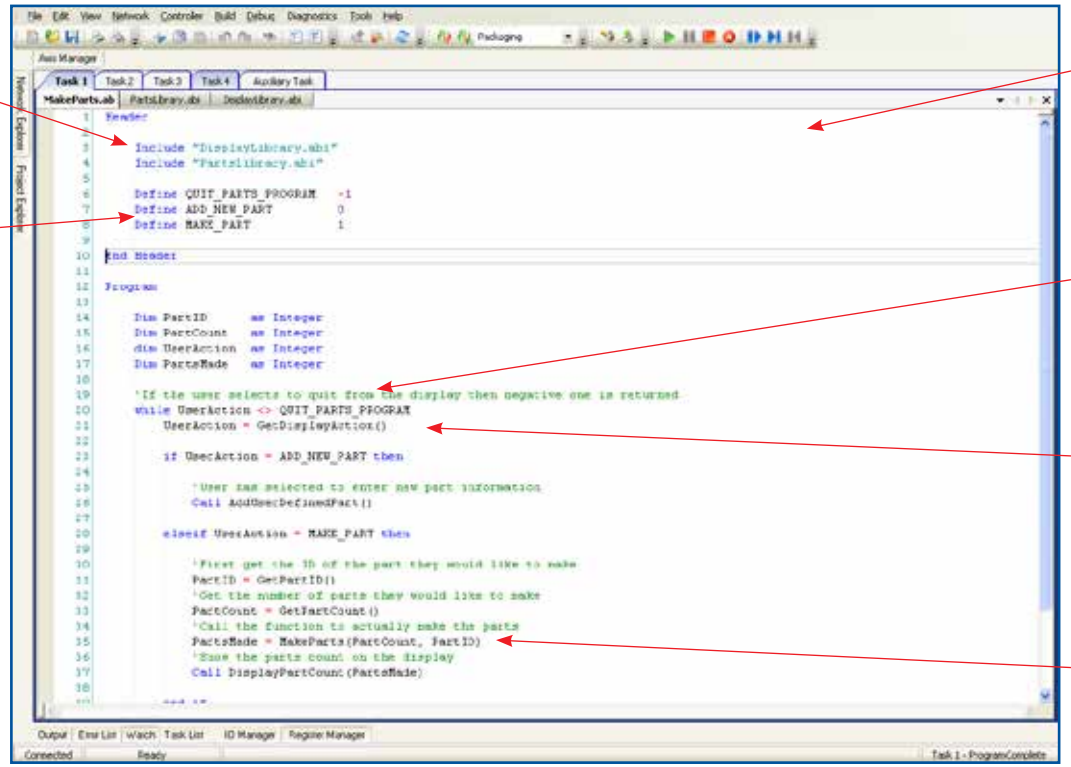
Watch window shows variable values for easy debugging

Link to help file for description of error

Create Reusable Modules with AeroBasic™

Create reusable code with libraries and `#include` files

Write easy-to-read and maintainable code by using `#define` (rather than numeric constants)



Real-time code environment

Advanced programming techniques result in code that is easy to read, simple to maintain and reusable for other projects

Protect intellectual property by using a library; permit or deny end users access to source code

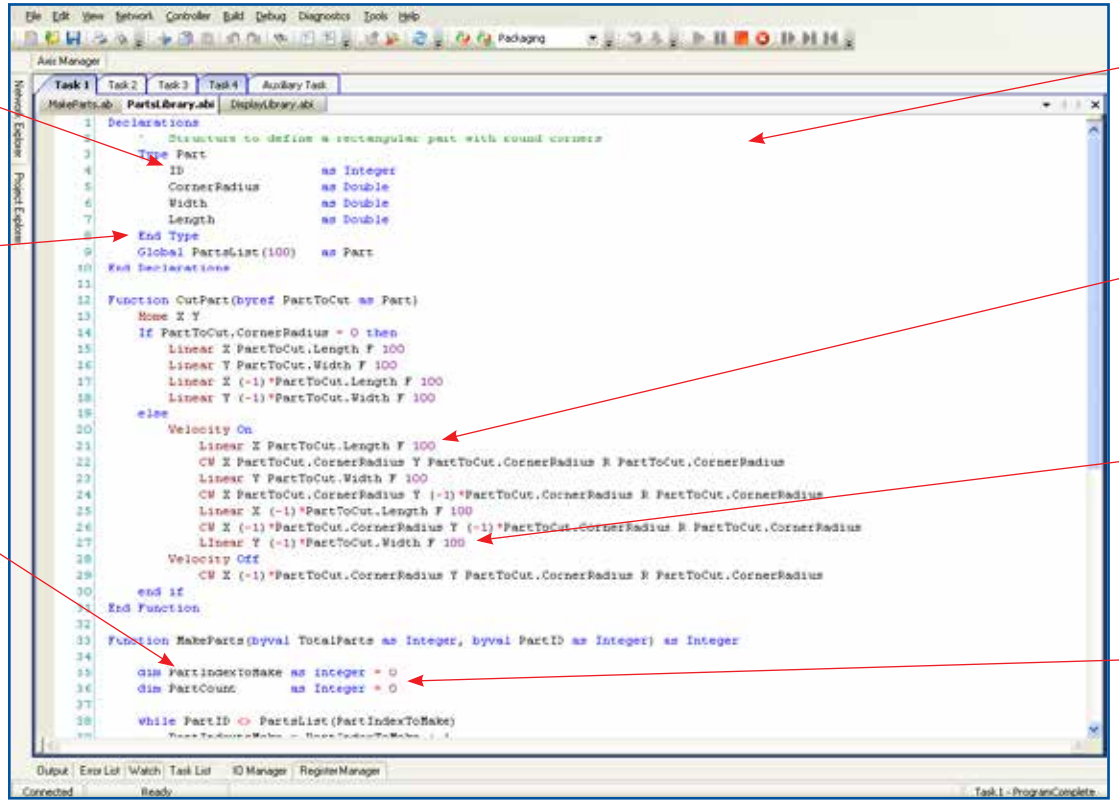
Built-in software security key for OEMs

Create Easy to Maintain Code with AeroBasic™

User defined variable types allow an object-oriented approach to system design

Use structures to define your own data types

Advanced variable types such as arrays and strings allow for more advanced program design



Memory management is done by the operating system

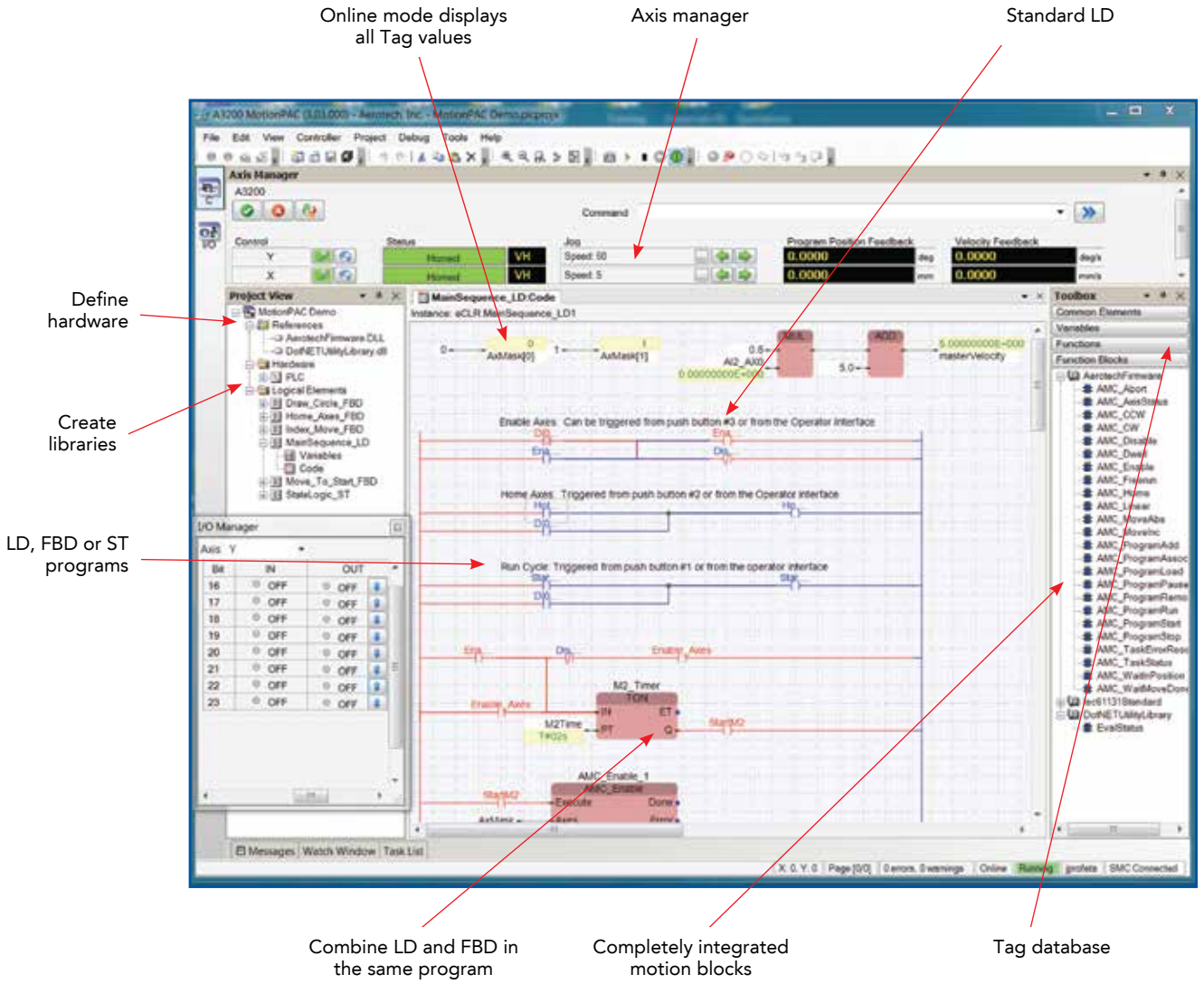
Keeping all motion code in one function creates modularity, which brings products to market faster and reduces maintenance cost

Variable initialization reduces code size and increases readability for multiple developers

Standard program flow:
while/wend
for/next
repeat
if/then/else

Program in IEC 61131-3: LD, FBD, ST

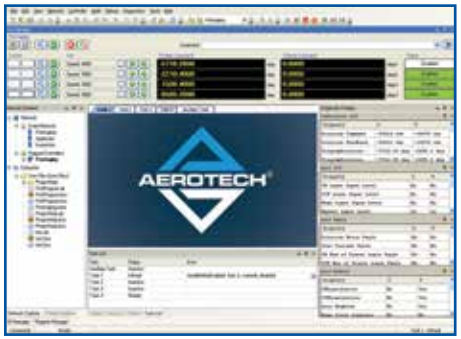
- 30% to 50% reduction in development time
- High-performance motion fully integrated with standard PLC environment
- Easy-to-use diagnostics and tools
- Standards & Flexibility: IEC 61131-3, .NET, PLCopen, PC-based



Integrated Automation: MotionPAC – PLC and Motion

HMI

- Program selection and run
- Jog panel
- Machine control
- Customizable buttons
- Axis manager



Motion Composer

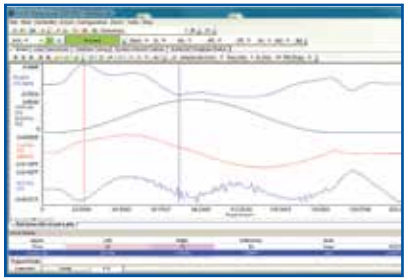
- Axis manager
- Low-level motion diagnostics
- Motion programming
- Advanced control algorithms

Beckhoff Wago

- Data acquisition synchronized with motion & PLC
- High-speed registration
- Position Synchronized Output
- Machine interlocks
- Fieldbus I/O

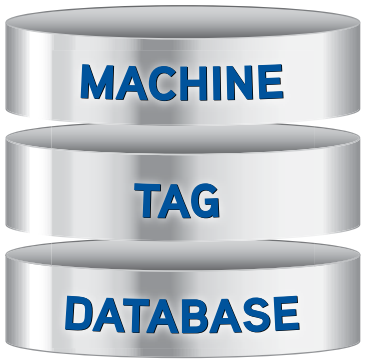
MotionPAC

- IEC 61131-3
- PLCopen
- Aerotech motion blocks
- Axis manager
- Extensive development & debug environment
- Simulate program



Scope

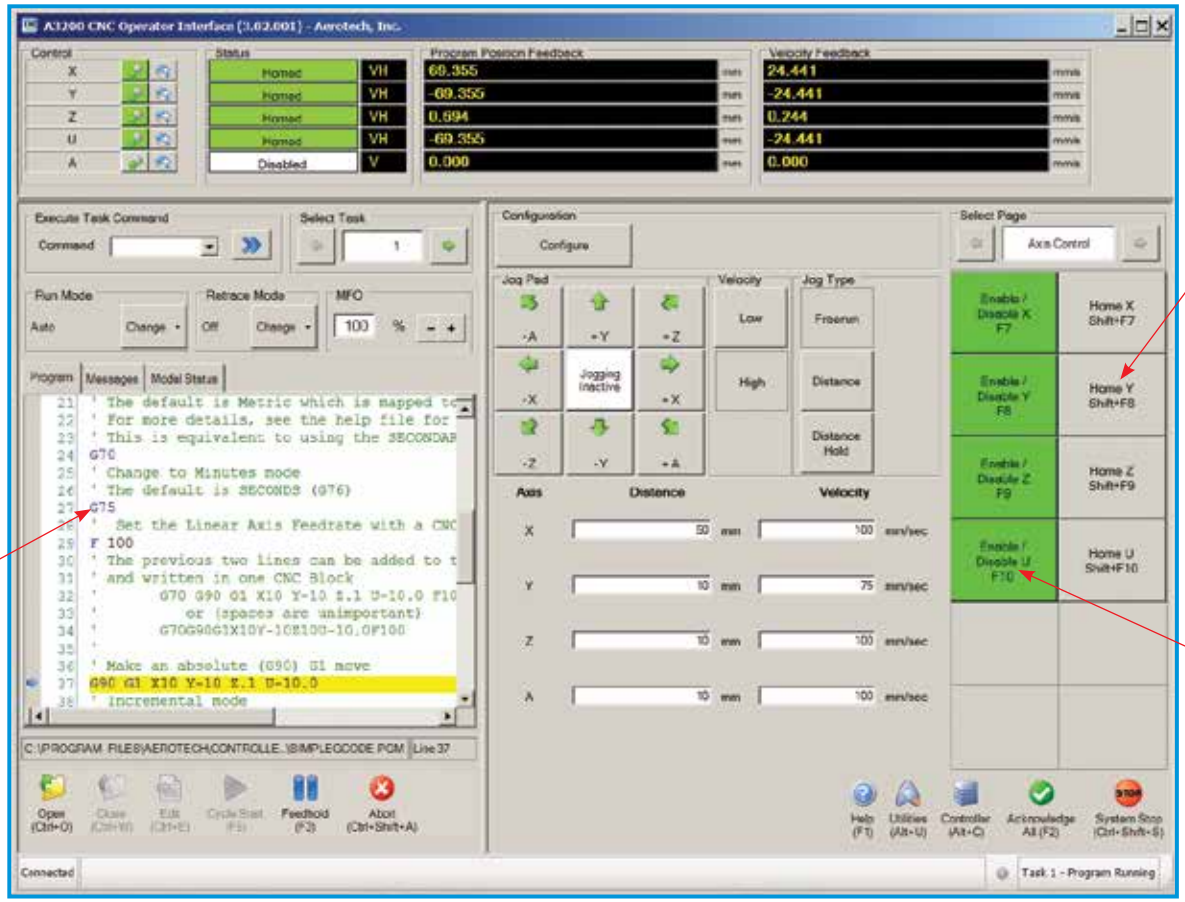
- Signal capture & analysis
- Autotuning
- Loop transmission
- Encoder tuning
- Advanced controls



Central Machine Tag Database

- Tags available in all applications by name
- Define both local or global machine Tags
- Define Tags in I/O definition, ST, LD, FBD or motion program

Use Tags in Operator Interface by Name



View CNC code running at same time as PLC code

Use shared Tags defined in MotionPAC by name in a button action

Use shared Tags by name in program called by a button click

Standard PLC Functions: IEC 61131-3

Ladder Diagram

- VALUE
- TRUE
- FALSE
- COMMENT
- CONNECTOR
- JUMP
- LABEL
- RETURN
- CONTACT (NO, NC)
- COIL
- LEFT POWERRAIL
- RIGHT POWERRAIL

Function Blocks

- CTD
- CTU
- CTUD
- F_TRIG
- R_TRIG
- RS
- SR
- TOF
- TOF_R
- TON
- TON_R
- TP
- TP_R

Motion Blocks (Partial List)

- MoveAbsolute
- MoveRelative
- MoveSuperimposed
- MoveVelocity
- Home
- Stop
- PositionProfile
- MoveContinuous
- Halt
- CamIn/CamOut
- CamTableSelect
- GearInPos
- GearIn/GearOut
- Phasing

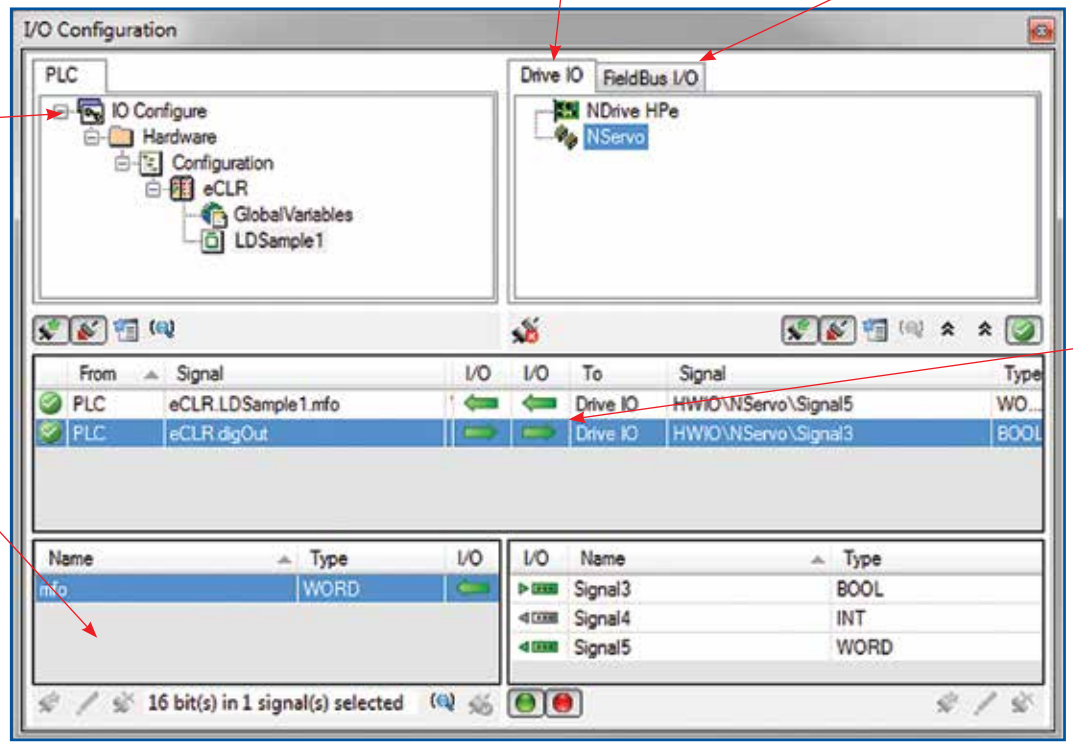
Administrative Motion Blocks (Partial List)

- ReadStatus
- ReadAxisError
- ReadParameter
- WriteParameter
- ReadActualPosition
- AbortTrigger
- ReadDigitalInput
- ReadDigitalOutput
- WriteDigitalOutput
- SetPosition

Functions (Partial List)

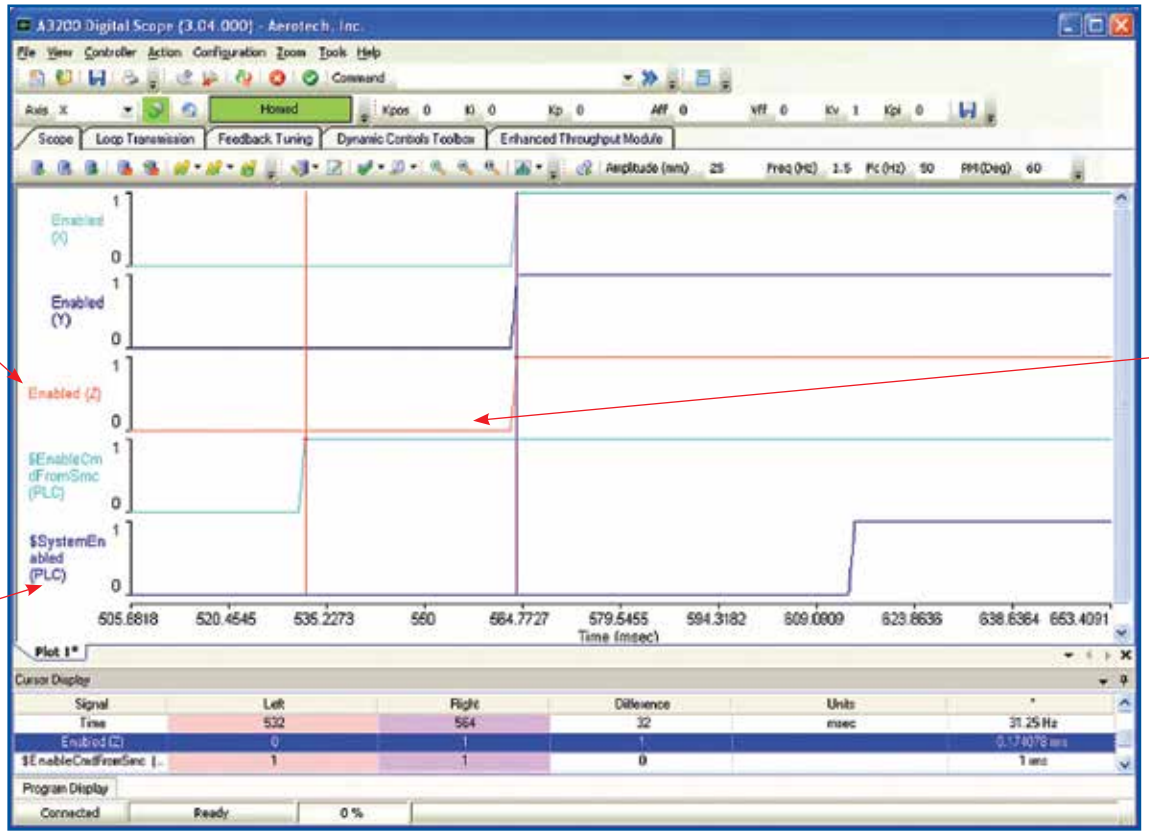
- ABS
- ACOS
- B_BCD_TO_DINT
- B_BCD_TO_INT
- DELETE
- DINT_TO_BOOL
- EXP
- EXPT
- FIND
- GE
- GE_STRING
- INT_TO_BOOL
- INT _TO_BYTE
- INT _TO_DINT
- INT _TO_DWORD
- LE
- LE_STRING
- LEFT
- LEN
- MULTIME
- NE
- OR
- REAL_TO_BOOL
- SEL_TO_BOOL
- SEL _TO_BYTE
- TRUNC _SINT
- UDINT_TO_BOOL

Integrated Development Environment Shortens Development Time



Memory management automatically done by the MotionPAC

Use Scope to Plot Any Motion, PLC, I/O, Variable or Tag



Motion variables

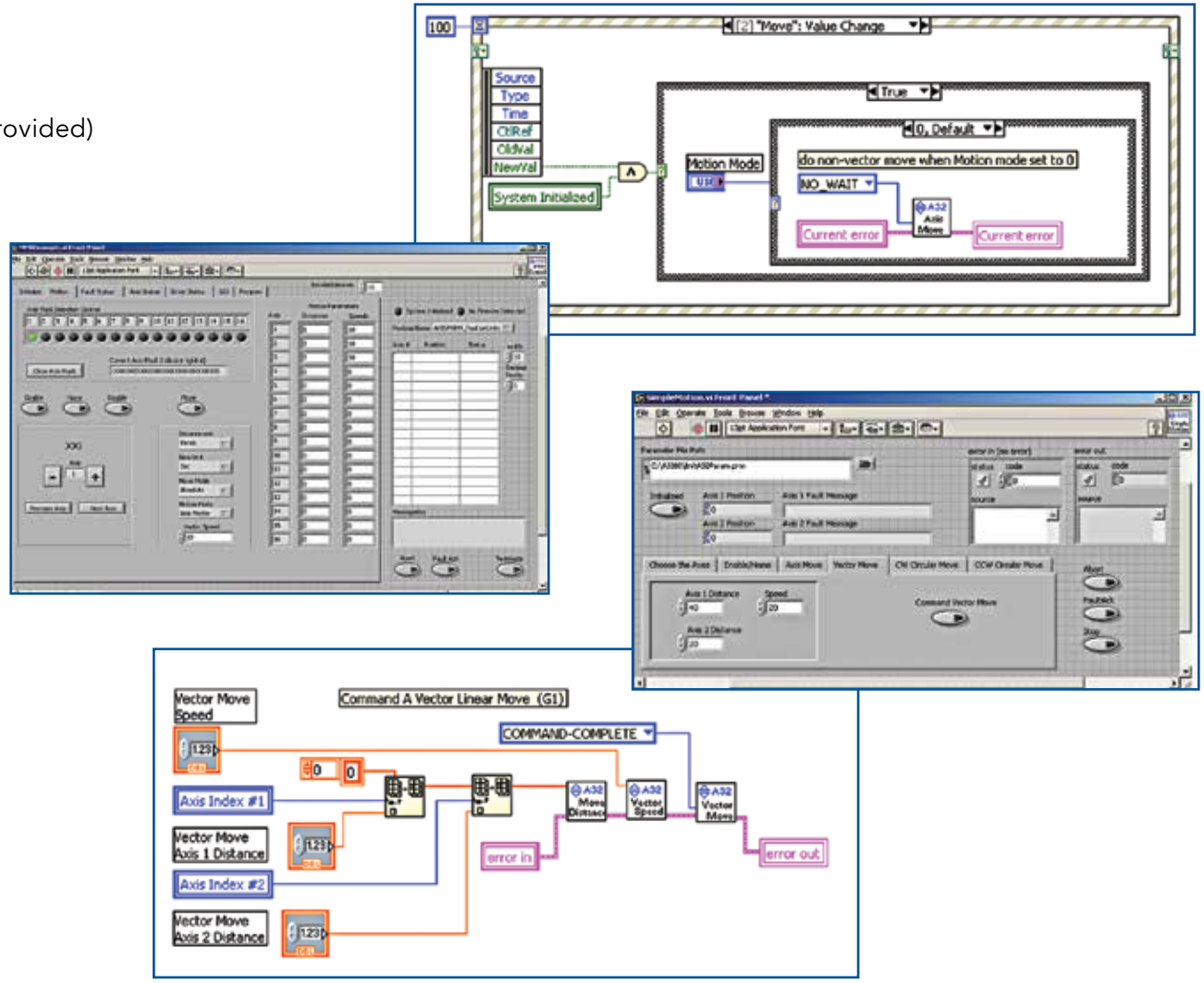
PLC Tags

All information in Global Tag database available for real time plotting and analysis with all motion variables

Use the Aerotech standard GUI...
...or build a custom interface for your application

- **Easy to use**
- **Faster development**
- **Lower maintenance cost**

- C#
- VB.NET®
- Managed C++
- LabVIEW® (VIs provided)
- C Library
- EPICS



.NET Library

- **High-end motion with a custom GUI**
- **Use the best language for the application**
- **Fully functional libraries for each language**

All Aerotech applications are written using the .NET library. Aerotech provides customers with the same tools used at Aerotech.

TAKE ADVANTAGE OF:

.NET Framework 2.0

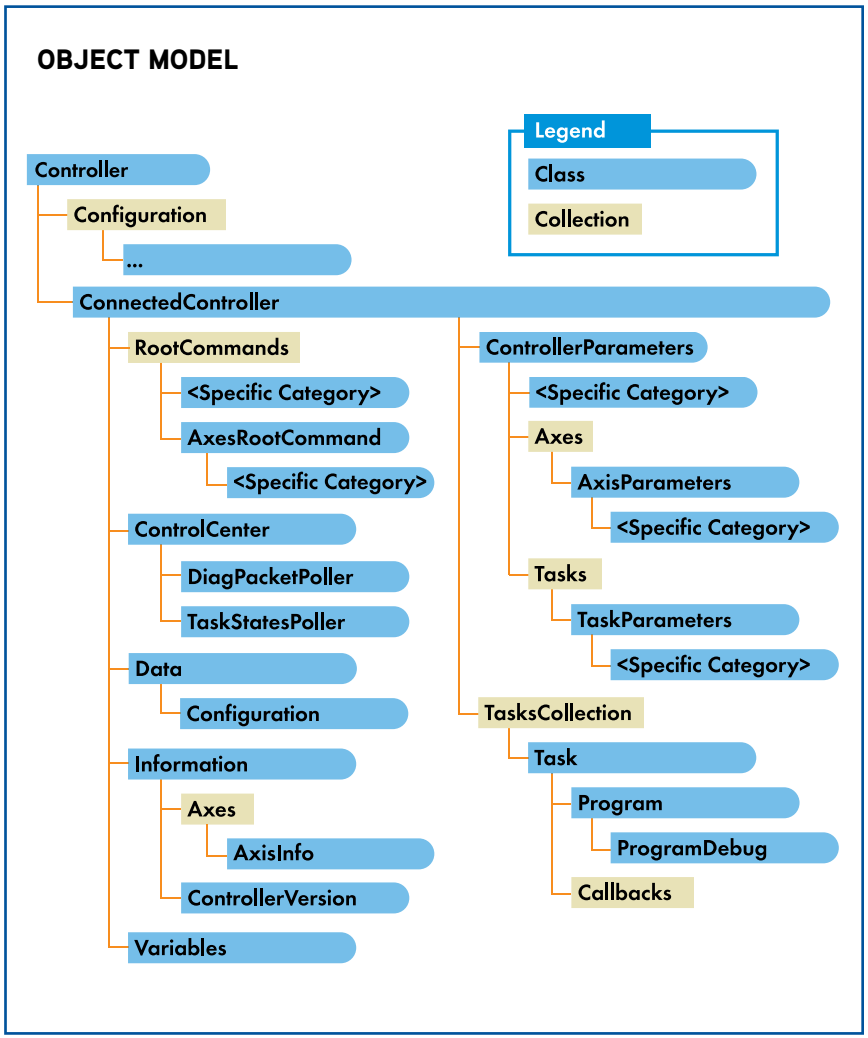
- Generics
- Enumerations
- Indexers
- Events
- Exceptions

Object Model

- Well-organized structure with two main classes: network and controllers
- Common features are higher in the hierarchy
- Minimal code required to accomplish the task at hand

Libraries Include:

- Initialization functions
- Global data functions
- Motion functions
- Error handling
- Status and position functions
- Analog and digital I/O functions
- Parameter functions
- Run CNC program functions
- Utility functions
- Get and set variable functions

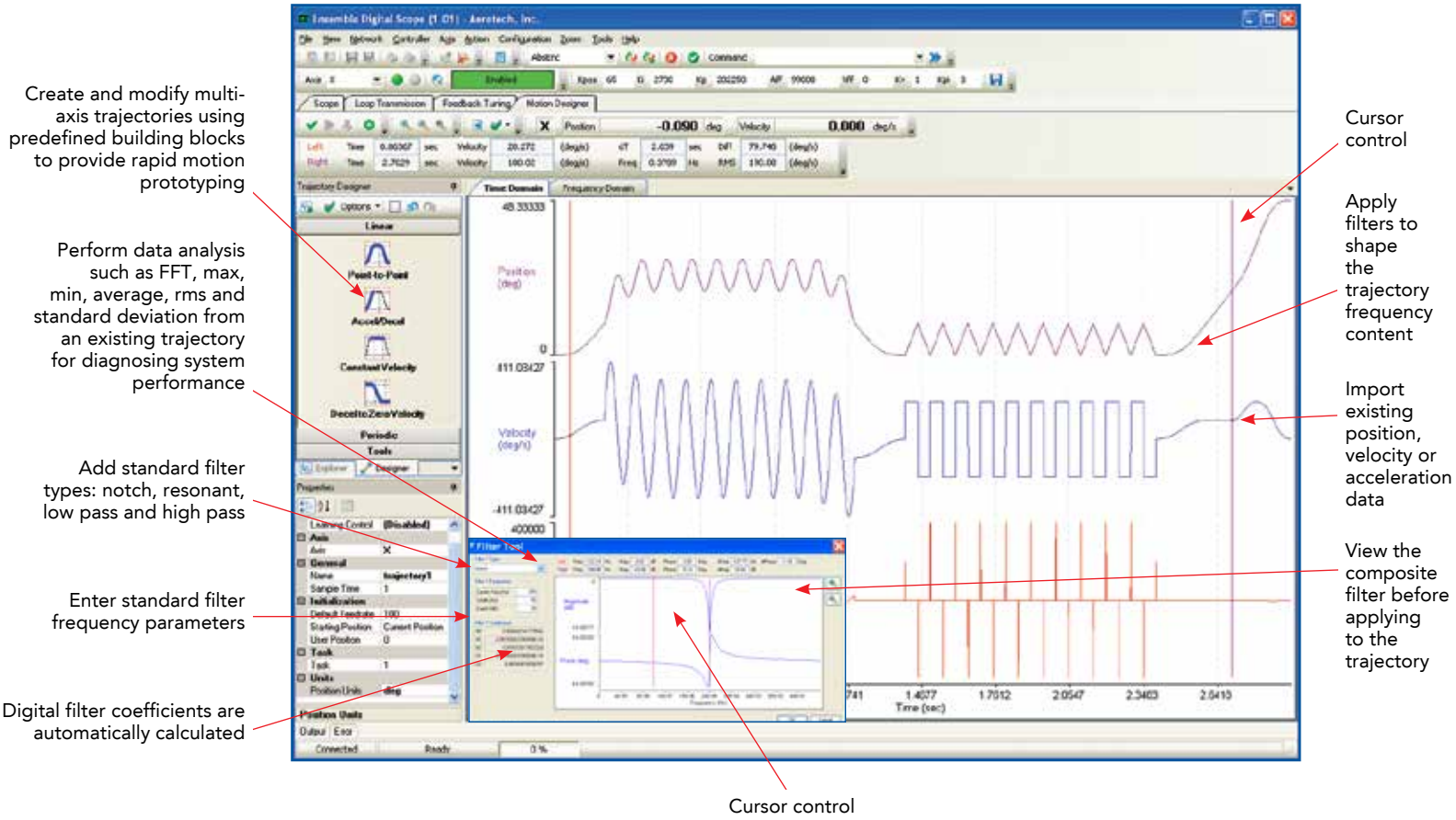


Motion Designer: Graphical Trajectory Generation and Data Analysis

- **Minimize programming time**
- **Import actual data**
- **Import from Excel or MATLAB®**

Applications

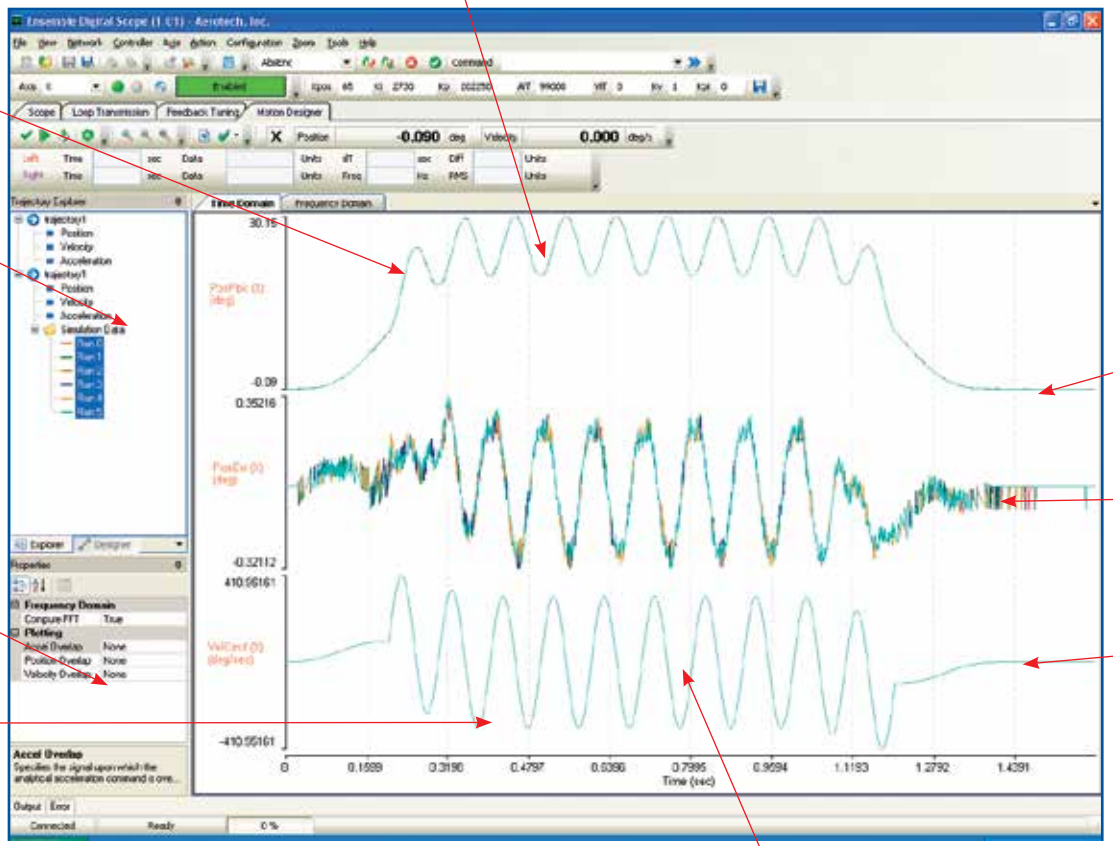
- Dynamic environment simulation
- Sensor or component testing
- Gyros or accelerometers; tracking or beam-steering gimbals
- Crash sensors and roll-over sensors



Create periodic motion

Automatic AeroBasic™ program generation for all controllers

Project tree for simple organization



Point-to-point moves

Overlay multiple trials for easy comparison

Trajectory properties (e.g., user units)

Automatically calculates missing state information (e.g., acceleration, velocity or position)

Easily modify an existing trajectory

Rapid motion programming

- **Operate 1,2,3 axis motion simulators**
- **Frequency response mode allows input sine sweep and UUT performance tests on customer device**
- **Harmonic Cancellation optimizes motion position errors generated by sinusoidal motion**

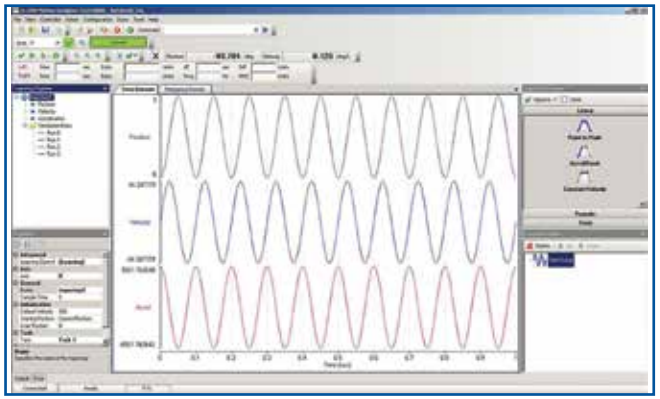
Aerotech Motion Simulator – The Integrated, Easy to Use, Graphical Trajectory Generation, Data Analysis and Enhanced Machine Performance Toolkit

Aerotech's Motion Simulator software is an easy-to-use Windows®-based program for creating simple and advanced motion stimuli for testing and calibrating inertial sensors and systems. The Aerotech Motion Simulator software includes all controls for manually or automatically running 1-3 axis motion simulations. The GUI provides a user interface and programming environment that requires no third-party development software.

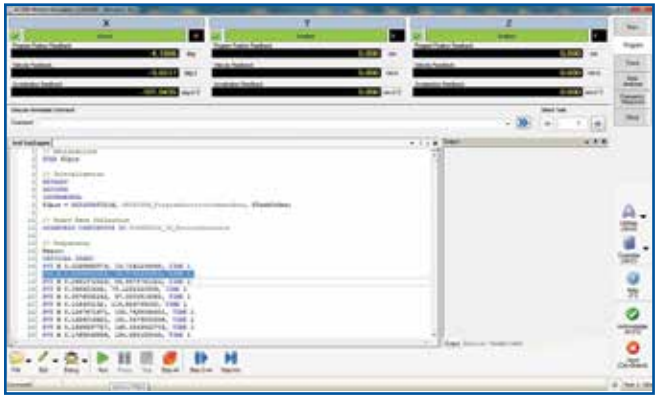
Key Features:

- User-friendly Windows®-based graphical user interface
- Trajectory tracking from Ethernet, analog or Windows® program inputs
- Iterative Learning minimizes position error
- Overlap multiple runs of a trajectory to easily see how program changes modify the motion
- Perform data analysis such as FFT, max, min, average, rms and standard deviation from an existing trajectory for diagnosing system performance
- Data input file formats include Excel, CSV or MATLAB®; Motion Simulator can calculate the missing state variables

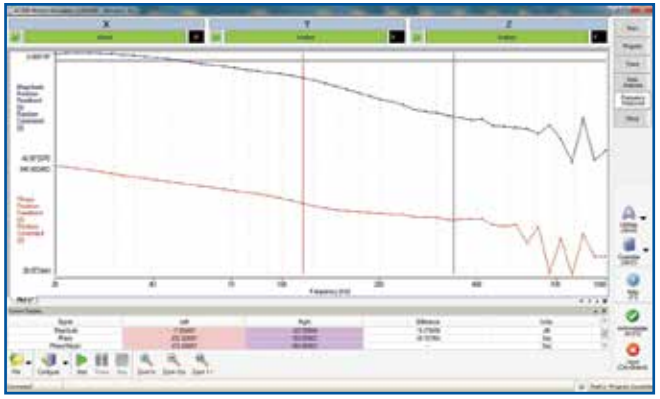
Main Screen



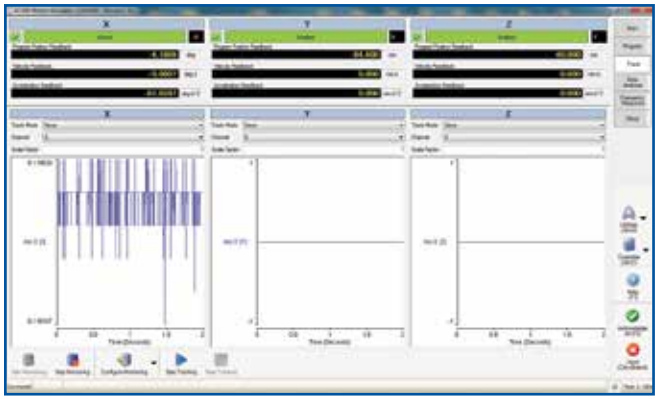
Motion Designer



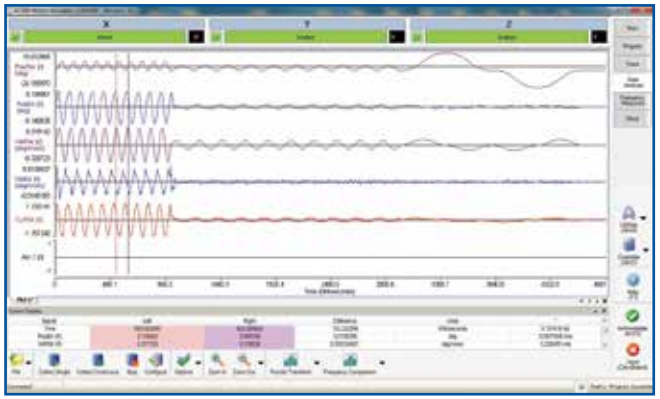
Program



Frequency Response



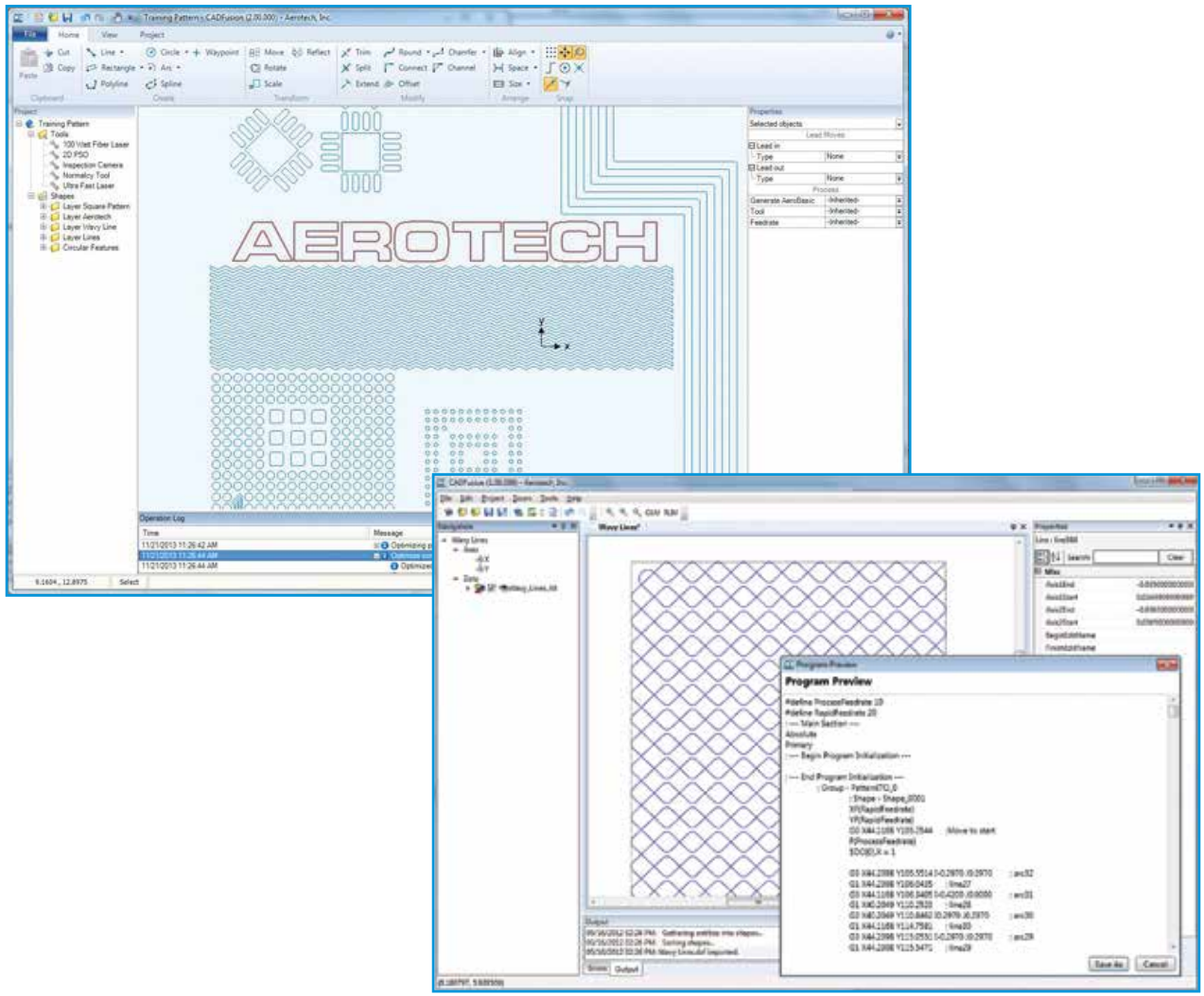
Track screen allows external signal selection for tracking



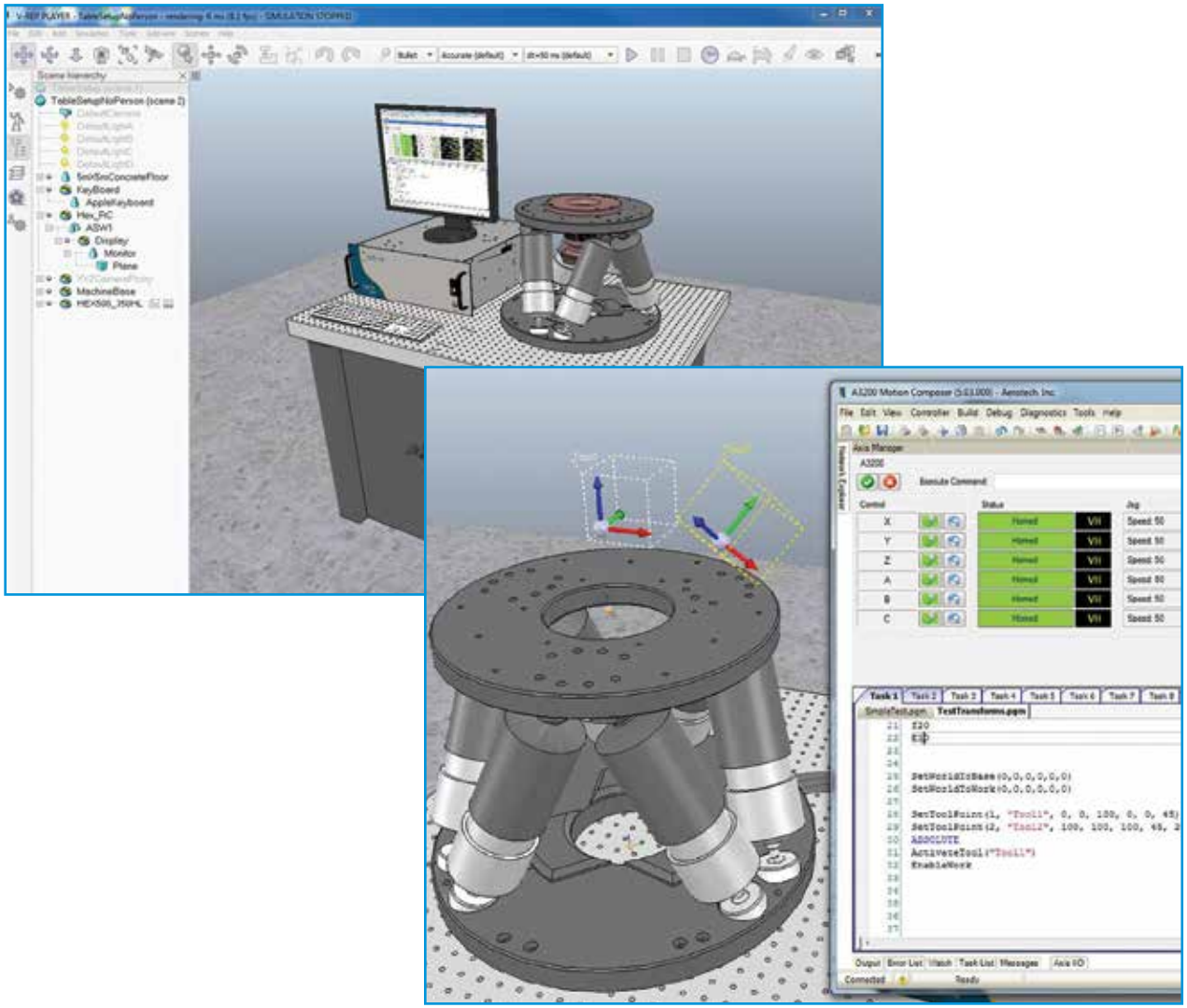
Data Analysis

Generate Motion Programs Directly From Your CAD Drawing

- Easily imports vector-based drawing files and produces G-code motion programs
- Interactive canvas allows easy editing and creation of new shapes and text
- Automatic and manual shape re-ordering options allow for optimal tool and processing paths
- Export to RS-274D G-code format
- Allows user-defined initialization, process shutdown, and shuttering commands (tool on/off)
- Offers seamless use of Aerotech's powerful controller features such as PSO (Position Synchronized Output)



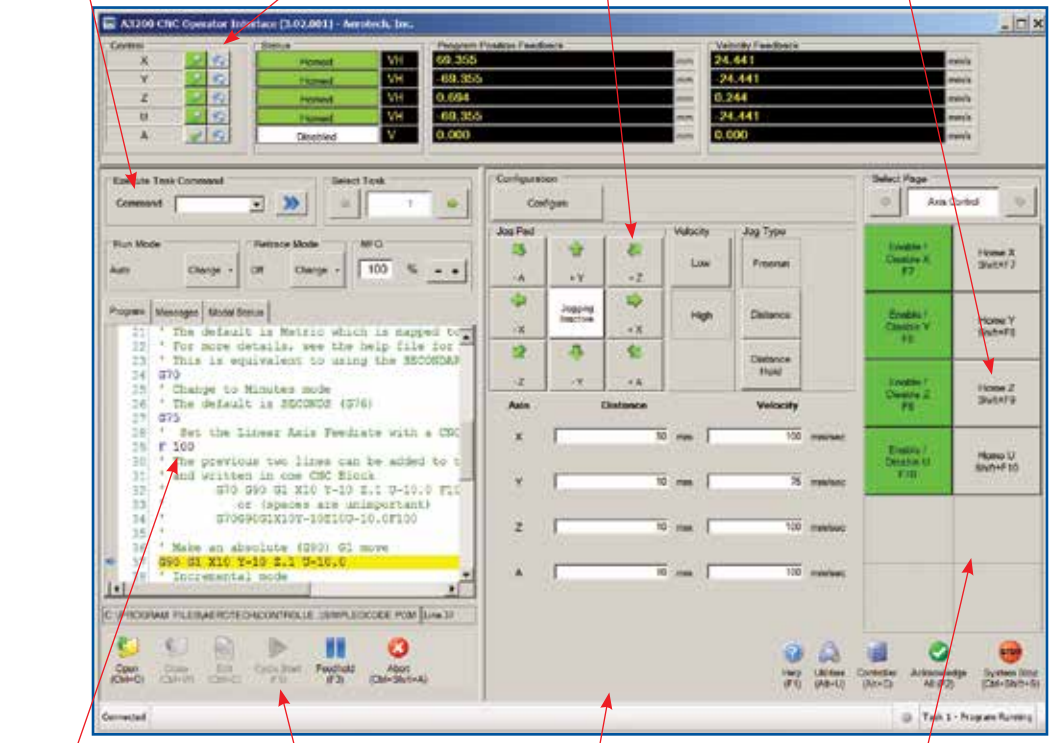
Open Simulation Environment



- Support for Coppelia Robotics virtual robot experimentation platform (V-REP)
- Full system modeling capability
- Visualization and selection of coordinate systems for multi-DOF systems like hexapods
- Pre-configured models connect directly to Aerotech's A3200 motion controller
- Import custom objects as 3D mesh files
- Supports collision detection between all elements in the environment
- Control grippers and vacuum pickup devices with Aerotech I/O

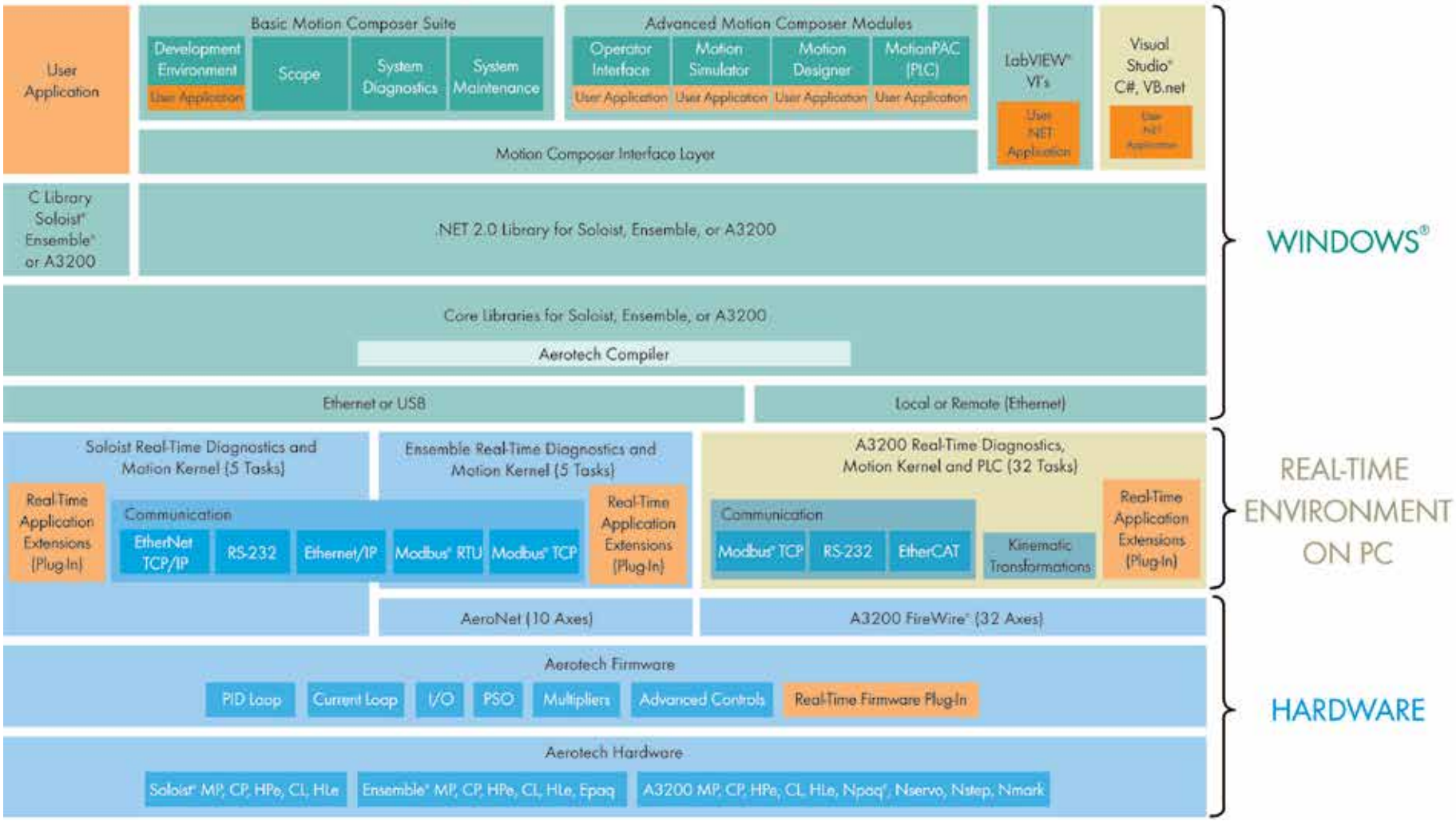
- Use the Aerotech Operator Interface (OI) for fast deployment
- Customize the OI to suit the application
- User customizable buttons that can execute standard G-code and AeroBasic™

Configurable Operator Interface



Advanced Software Architecture

Layered for flexibility • Customizable at many layers • Most cost-effective solution

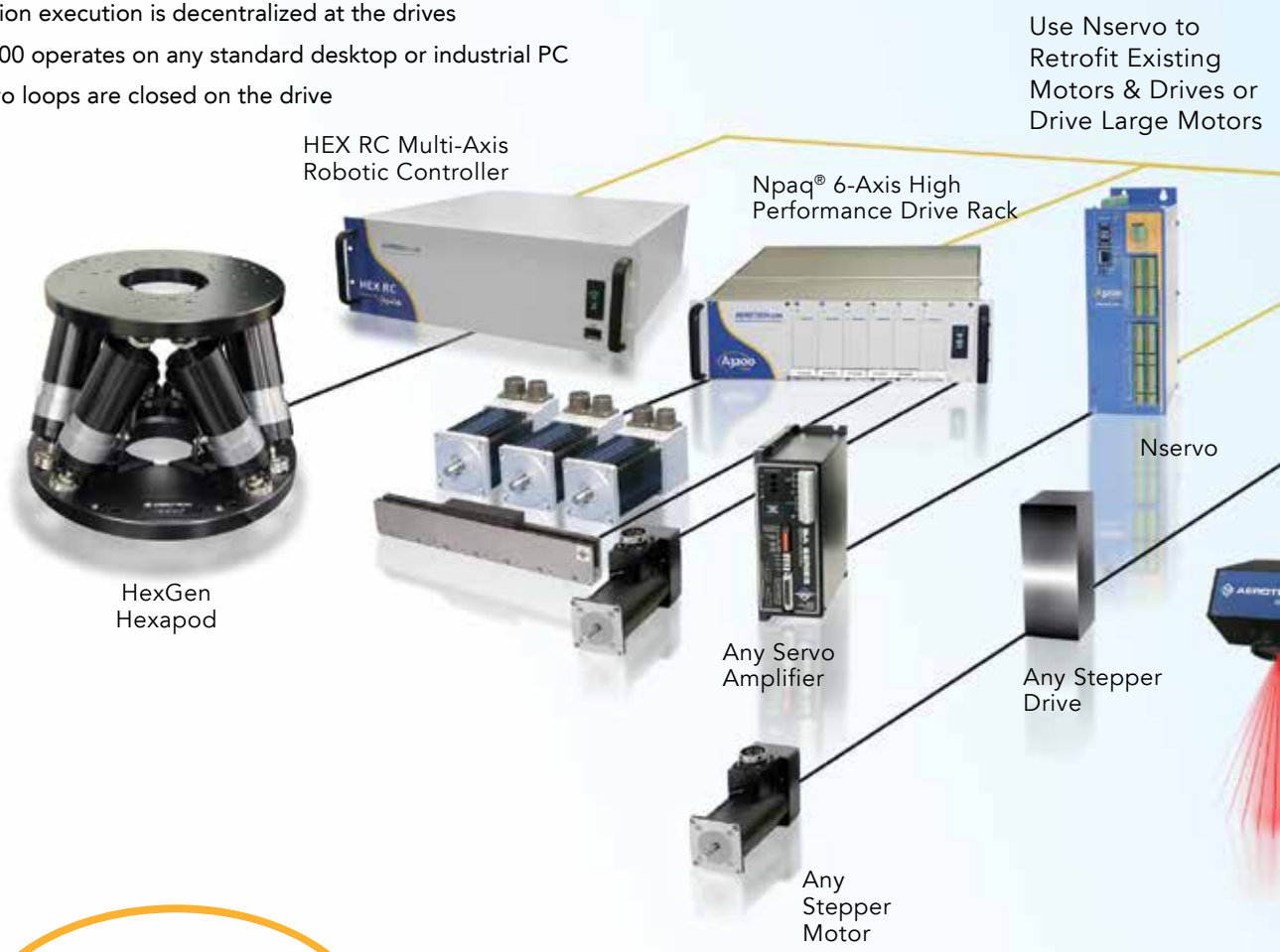


Digital Automation Platform

- Higher throughput due to high performance control, network and high-power drives
- Higher accuracy and repeatability due to all digital drives 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 life-cycle cost due to less components and reduced engineering
- Higher reliability due to fewer components
- Simplified integration

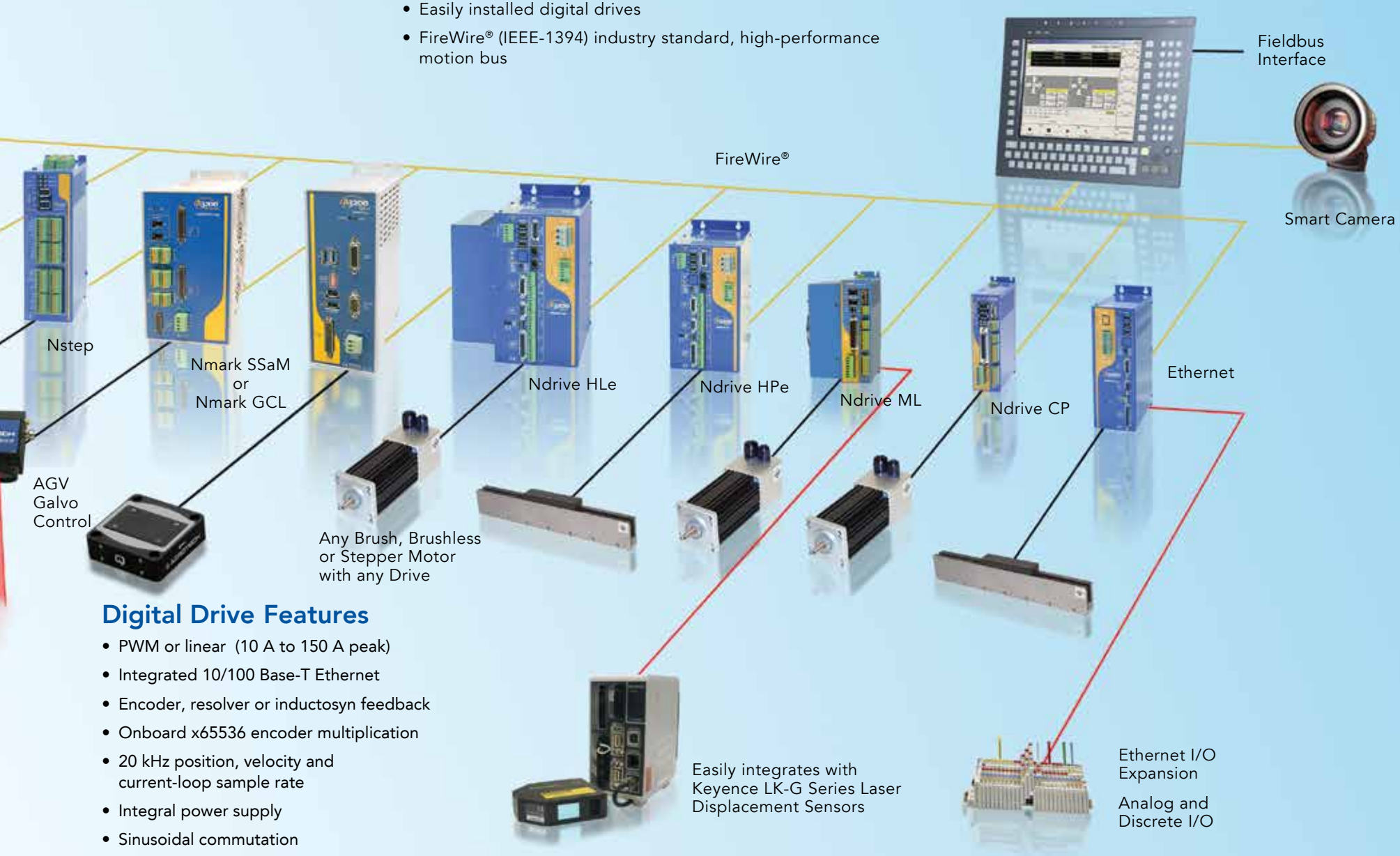
Distributed Motion Control

- Motion trajectory 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



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

- Easily installed digital drives
- FireWire® (IEEE-1394) industry standard, high-performance motion bus



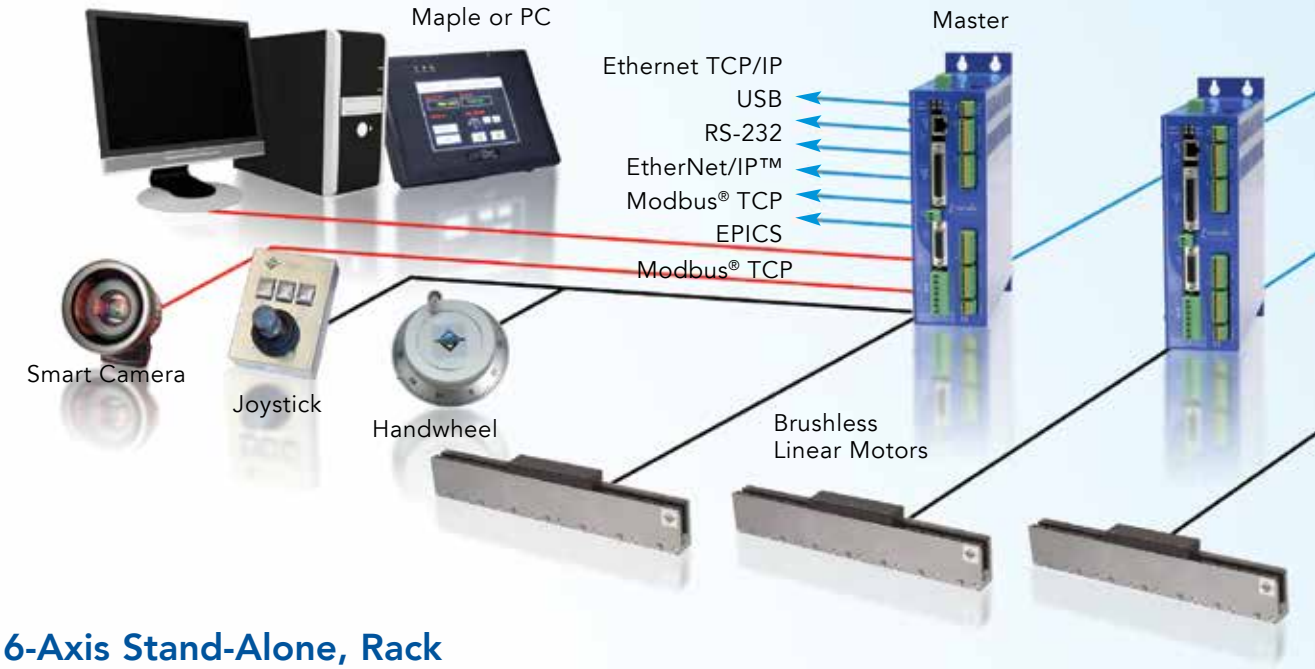
Digital Drive Features

- PWM or linear (10 A to 150 A peak)
- Integrated 10/100 Base-T Ethernet
- Encoder, resolver or inductosyn feedback
- Onboard x65536 encoder multiplication
- 20 kHz position, velocity and current-loop sample rate
- Integral power supply
- Sinusoidal commutation
- Local I/O ports

Ensemble®

Stand-Alone Multi-Axis Automation Controller

- Easy to use
- Powerful architecture
- Distributed control
- Network ready

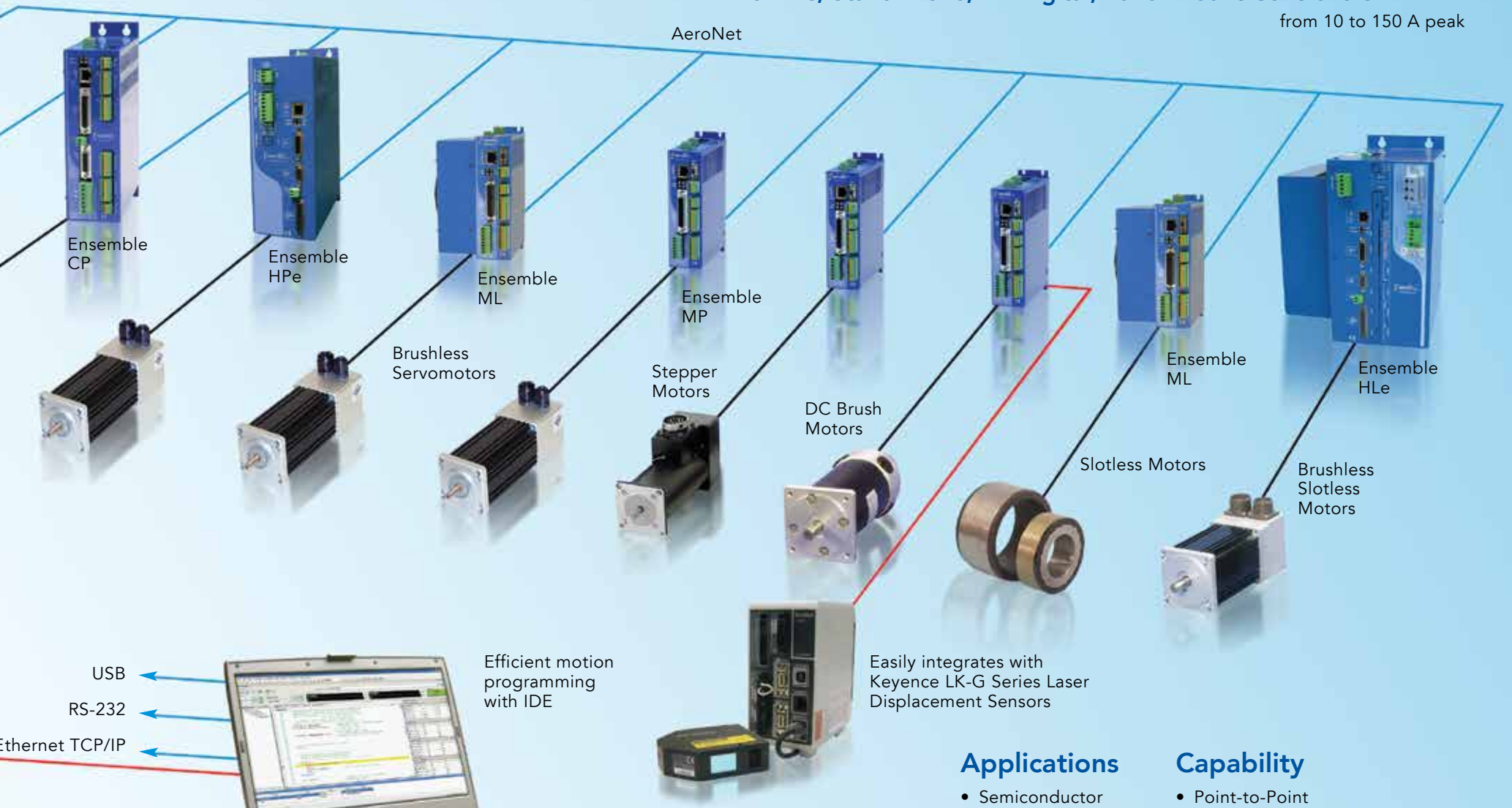


6-Axis Stand-Alone, Rack Mount or Desktop Plus Three Axes

Software, Controls, Drives and I/O... All in One Package

10-Axis, Stand-Alone, All Digital, Panel-Mount Controllers

from 10 to 150 A peak



Applications

- Semiconductor
- Medical
- Test and Inspection
- Packaging

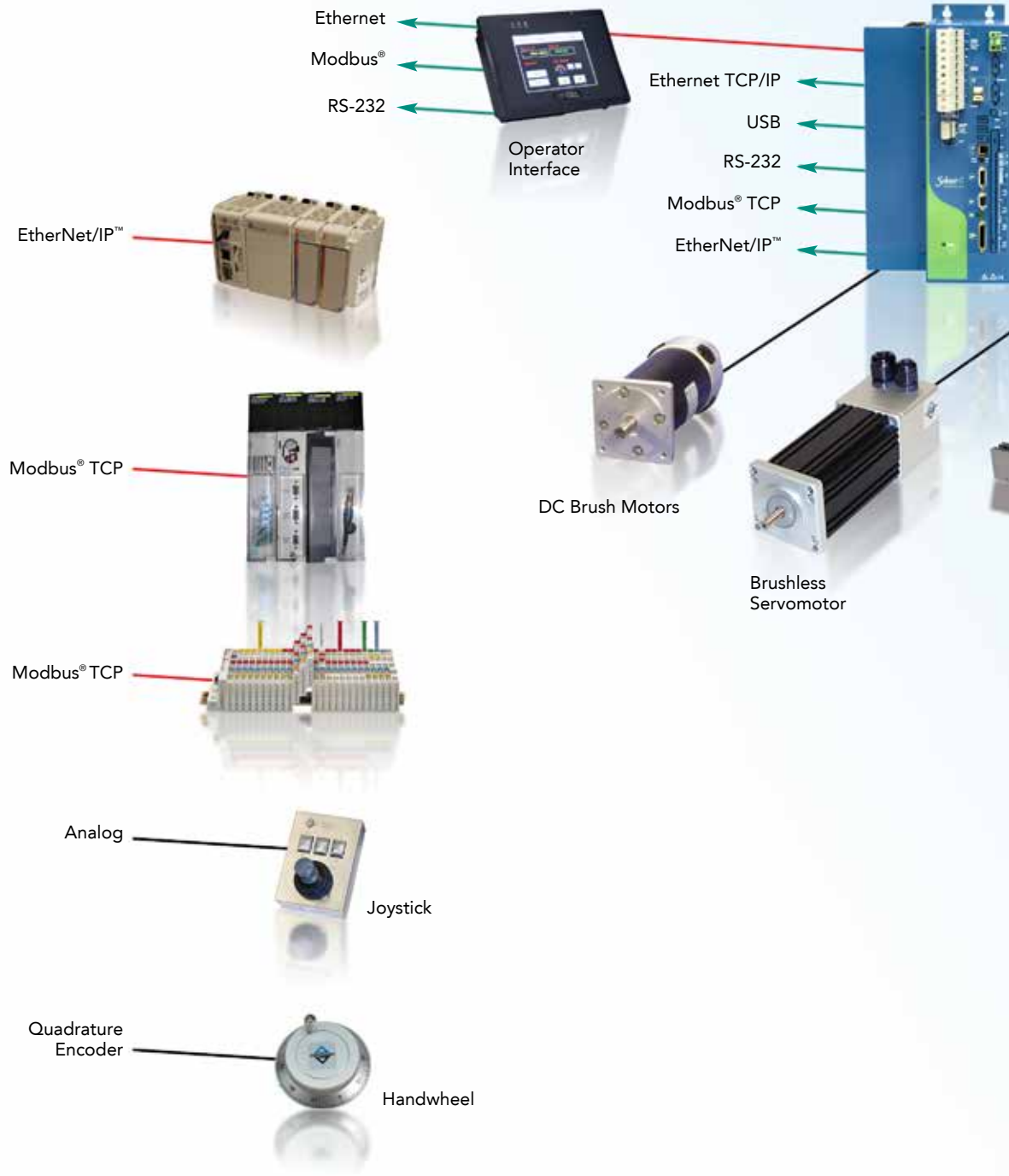
Capability

- Point-to-Point
- Linear and Circular Interpolation
- Electronic Gearing
- Velocity Profiling
- Gantry

Soloist®

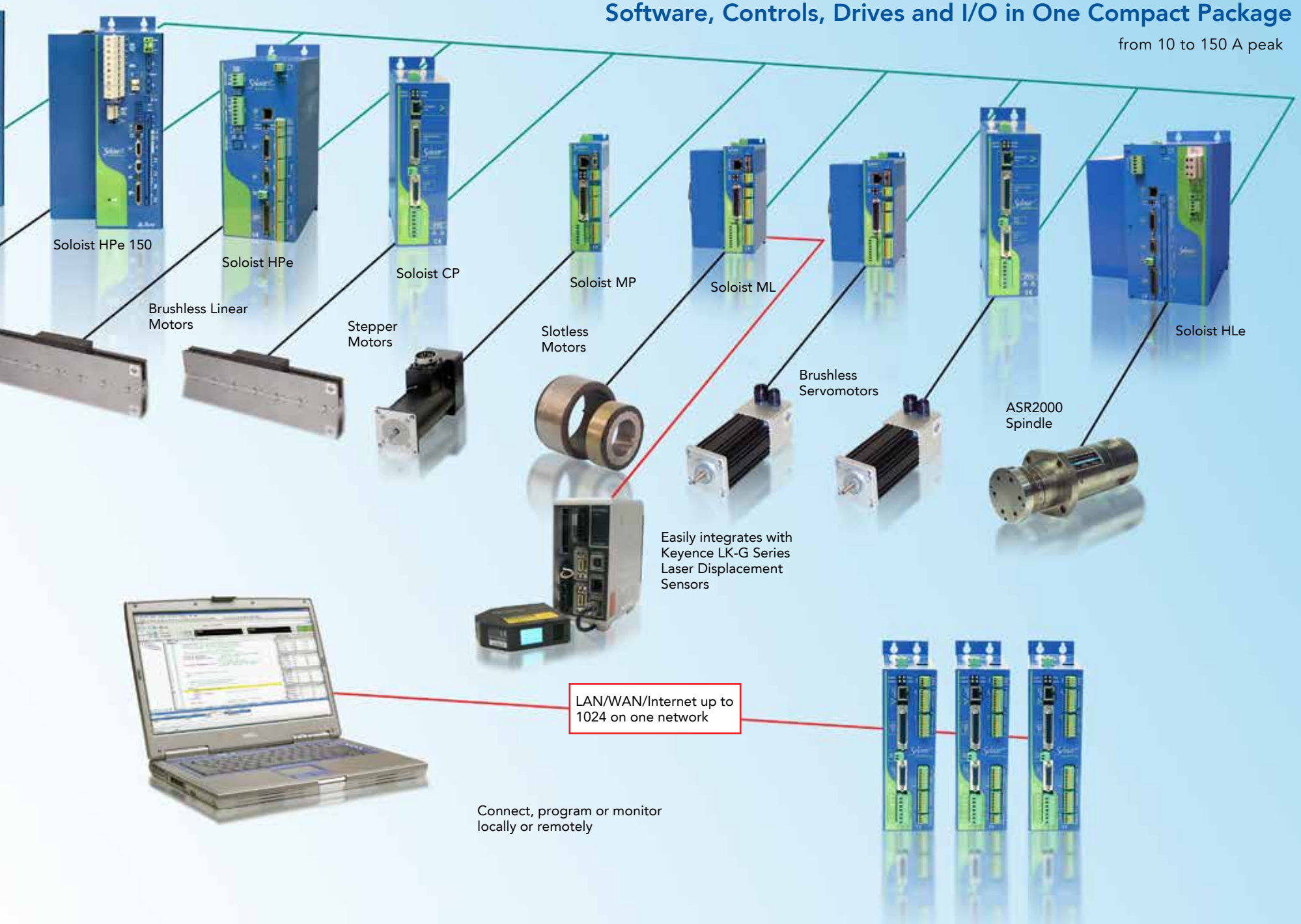
Stand-Alone Single-Axis Automation Controller

- Easy to use
- Scalable
- Ethernet/USB connectivity



Software, Controls, Drives and I/O in One Compact Package

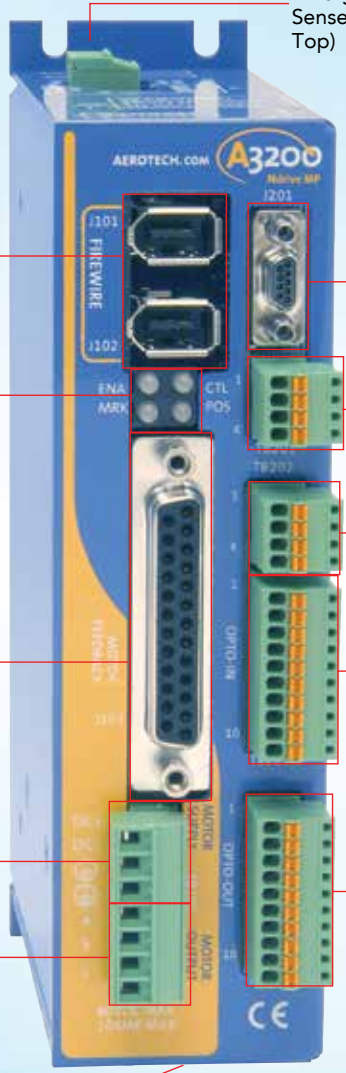
from 10 to 150 A peak



MP for OEMs lowers costs • CP solutions for less integration work • HPe for the highest performance solution

Ndrive® MP
Ensemble® MP
Soloist® MP

Width: 41.1 mm
Height: 141.2 mm



Emergency Stop Sense Input (TB101, Top)

FireWire® (IEEE-1394) (J101, J102)

Second Encoder Interface (J201)

LED Status Indicators

Brake Relay (TB201)

One 12-Bit Analog Input and One16-Bit Analog Output (TB202)

Motor Feedback Connector (J103)

Eight Opto-Isolated Inputs, Common Sink or Common Source (User Defined) (TB203)

10-80 VDC Bus Voltage Input

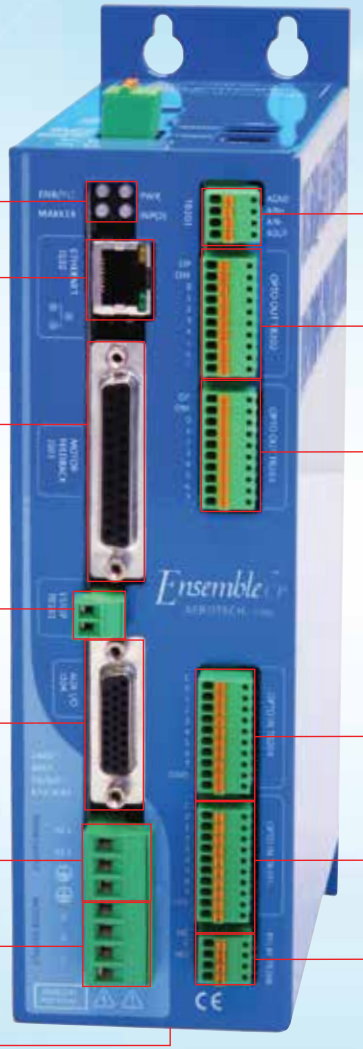
Eight Opto-Isolated Outputs, Common Sink or Common Source (User Defined) (TB204)

Motor Output 10-80 VDC, 10 Apk

24-80 VDC, 2 A Max Logic Power Input (TB103, Bottom)

Ndrive® CP
Ensemble® CP
Soloist® CP

Width: 63.5 mm
Height: 198.2 mm



LED Status Indicators

Two 16-Bit Analog Inputs, One Analog Output (TB201)

Ethernet TCP/IP (J101, J102)

Eight Opto-Isolated Outputs, Common Sink or Common Source (User Defined) (TB202)

Motor Feedback Connector (J103)

Eight Opto-Isolated Outputs, Common Sink or Common Source (User Defined) (TB203)

Emergency Stop Sense Input (TB101)

Eight Opto-Isolated Inputs, Common Sink or Common Source (User Defined) (TB204)

Auxiliary I/O (J104)

7-240 VAC Single-Phase Input

Eight Opto-Isolated Inputs, Common Sink or Common Source (User Defined) (TB205)

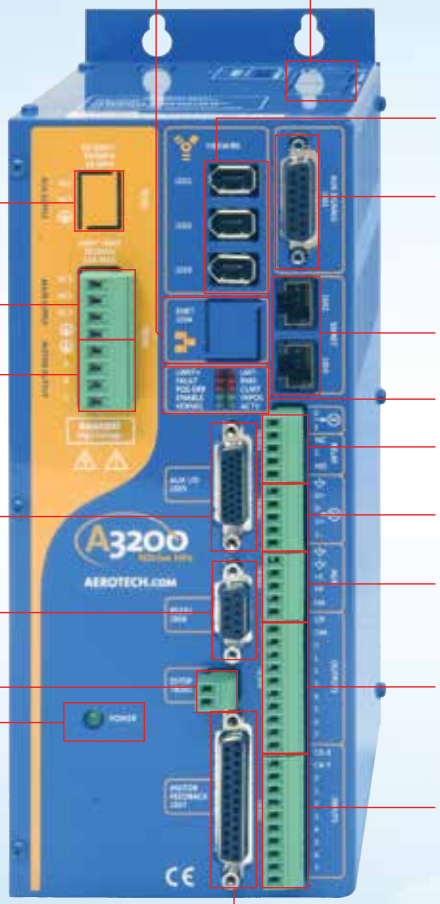
Motor Output 10-320 VDC, 10-30 Apk

Brake Relay (TB206)

Control Supply (Bottom)

Ndrive® HPe
Ensemble® HPe
Soloist® HPe

Width: 99.1 mm
Height: 232.5 mm



Ethernet (J204)
Resolver Interface (Opt) (J401, J402)
FireWire® (IEEE-1394) (J201, J202, J203)
Control Supply
PSO/Absolute Encoder Interface (J301)
1-3 Phase 7-240 VAC 50/60 Hz
Two Channels SSINet for Buffered RS-422 (Multiplied) Encoder IN/OUT (J302, J303)
3 Phase 10-320 VDC Motor Output 10-30 Apk
LED Status Indicators
Two 18-Bit Analog Outputs and Brake Relay (TB301)
Auxiliary I/O (J205)
Two 16-Bit Analog Inputs (TB302)
User Power (TB303)
RS-232 (J206)
Emergency Stop Sense Input (TB201)
Eight Opto-Isolated Outputs, Common Sink or Common Source (User-Defined) (TB304)
Power LED
Model shown is 10 to 30 amps peak with I/O expansion
Eight Opto-Isolated Inputs, Common Sink or Common Source (User-Defined) (TB305)
Motor Feedback Connector (J207)

Ndrive® HPe
Ensemble® HPe
Soloist® HPe

Width: 212.6 mm
Height: 234.8 mm

Communication Channel (Device #) Settings
Resolver Interface (Opt) (J401, J402)
Ethernet (J204)
IEEE-1397 FireWire® (J201, J202, J203)
LED Status Indicators
PSO/Absolute Encoder Interface (J301)
1-3 Phase 7-240 VAC 50/60 Hz
Two Channels SSINet for Buffered RS-422 (Multiplied) Encoder IN/OUT (J302, J303)
3 Phase 10-320 VDC Motor Output 50-100 Apk
Two 18-Bit Analog Outputs and Brake Relay (TB301)
Two 16-Bit Analog Inputs (TB302)
User Power (TB303)
Control Supply
Eight Opto-Isolated Outputs, Common Sink or Common Source (User-Defined) (TB304)
External Shunt
Eight Opto-Isolated Inputs, Common Sink or Common Source (User-Defined) (TB305)
Power LED
Model shown is 50 to 100 amps peak with I/O expansion
Auxiliary I/O (J205)
Motor Feedback Connector (J207)
RS-232 (J206)
Emergency Stop Sense Input (TB201)

Linear Drive Advantages

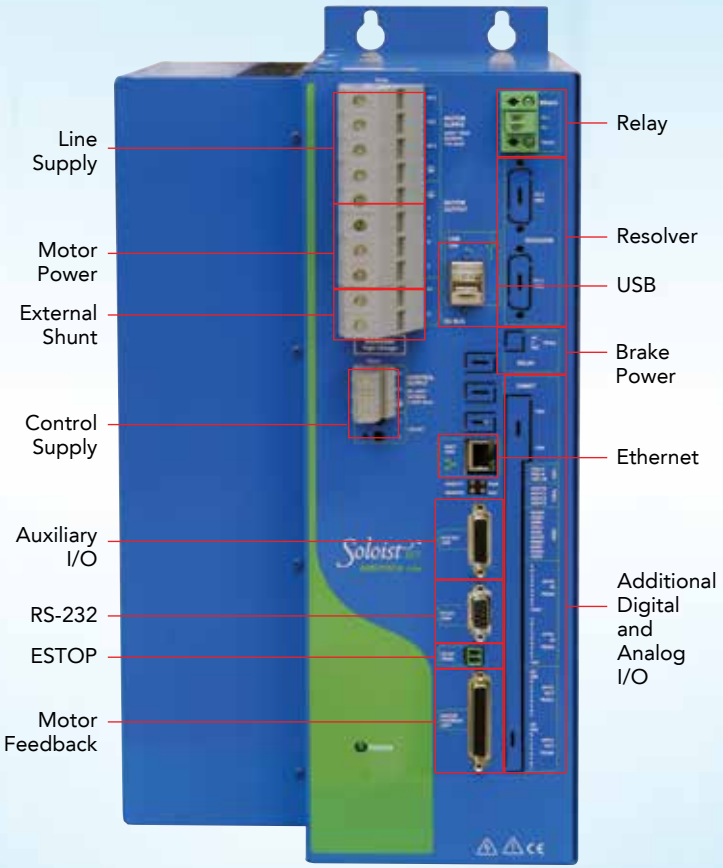
- Ultra-smooth motion during reversals
- Superior in-position stability
- Integrated with controls
- No switching noise
- No dead band
- Low EMI

Applications

- Nondestructive testing
- Stencil cutting
- Any small move, or sinusoidal movements
- Very slow velocity applications
- Stent manufacturing
- Target tracking
- Piezo stages

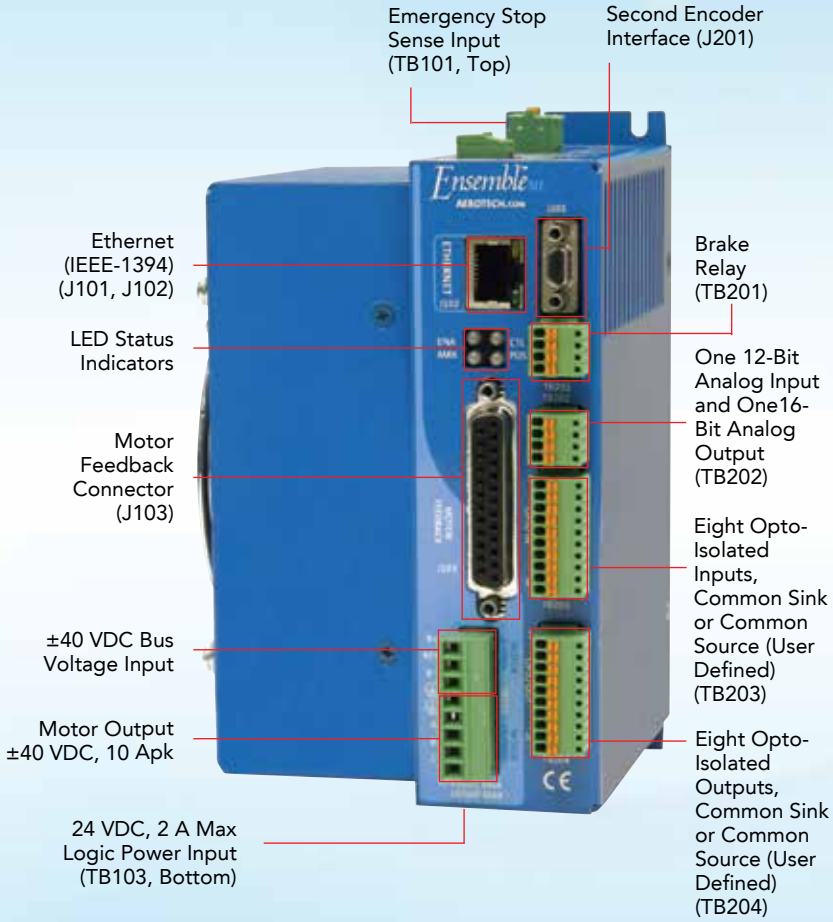
Ndrive® HPe150
Ensemble® HPe150
Soloist® HPe150

Width: 229.7 mm
Height: 406.1 mm



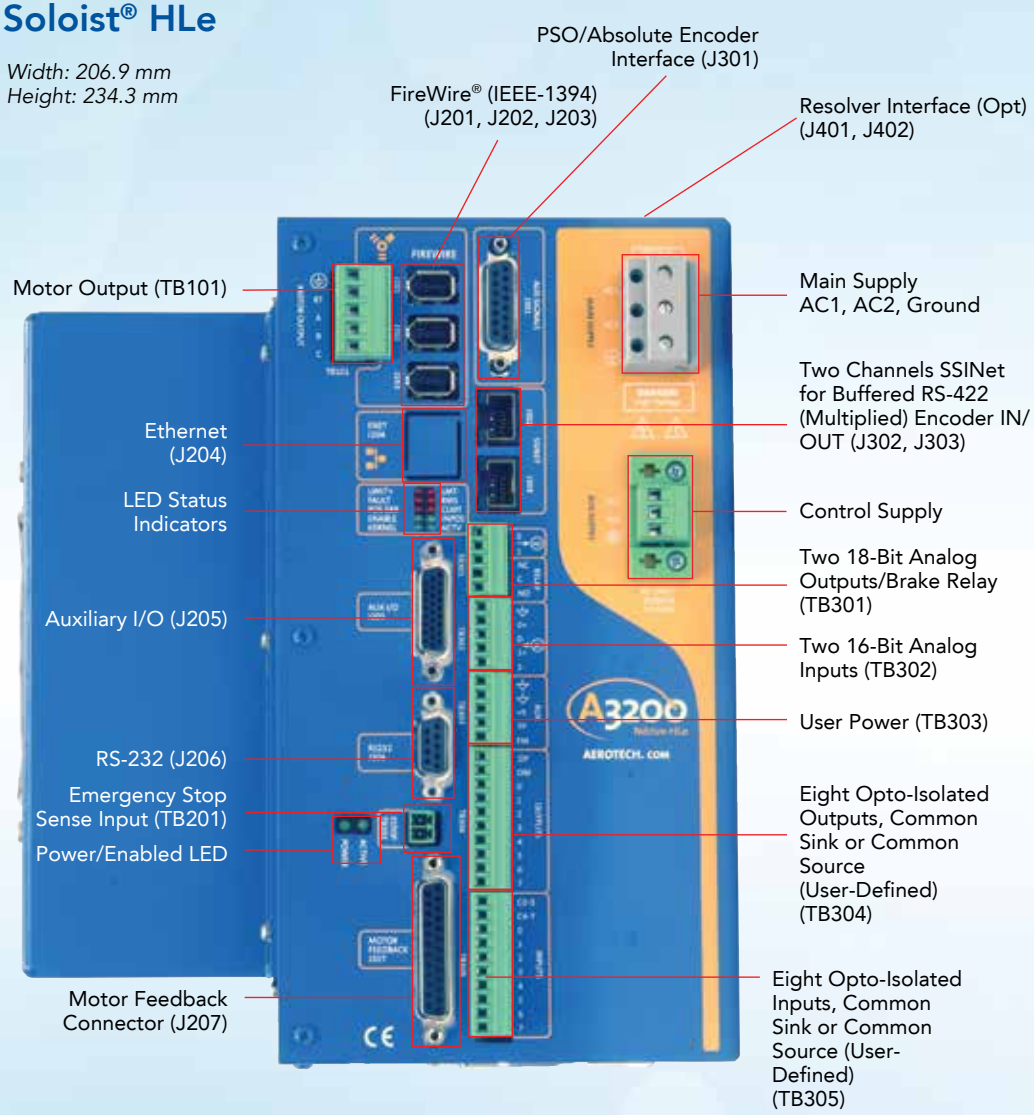
Ndrive® ML
Ensemble® ML
Soloist® ML

Width: 41.1 mm
Height: 141.2 mm



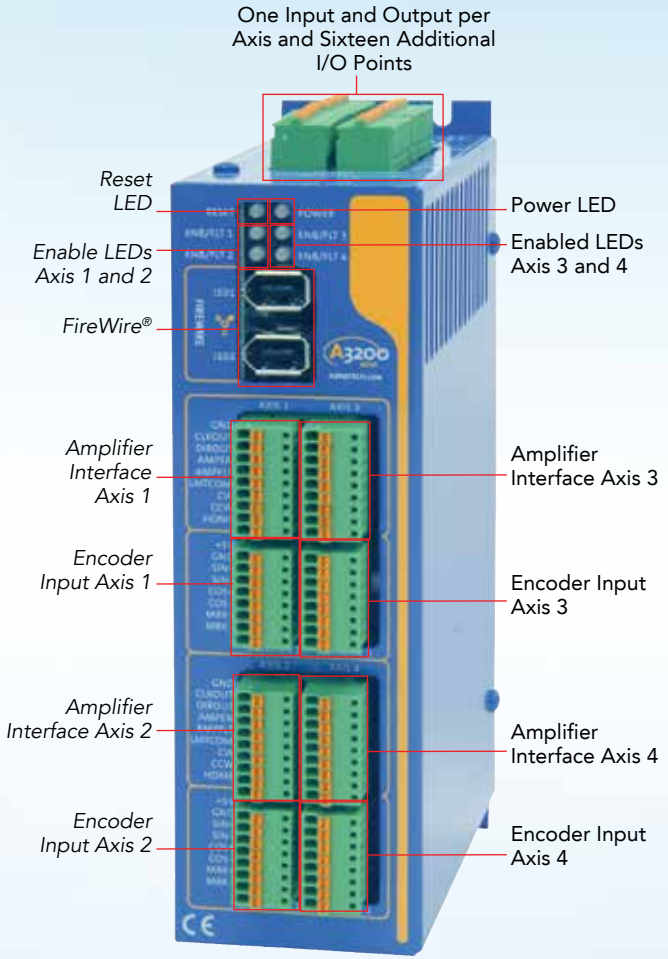
Ndrive® HLe
Ensemble® HLe
Soloist® HLe

Width: 206.9 mm
Height: 234.3 mm



Nstep

Width: 49.2 mm
Height: 161.8 mm

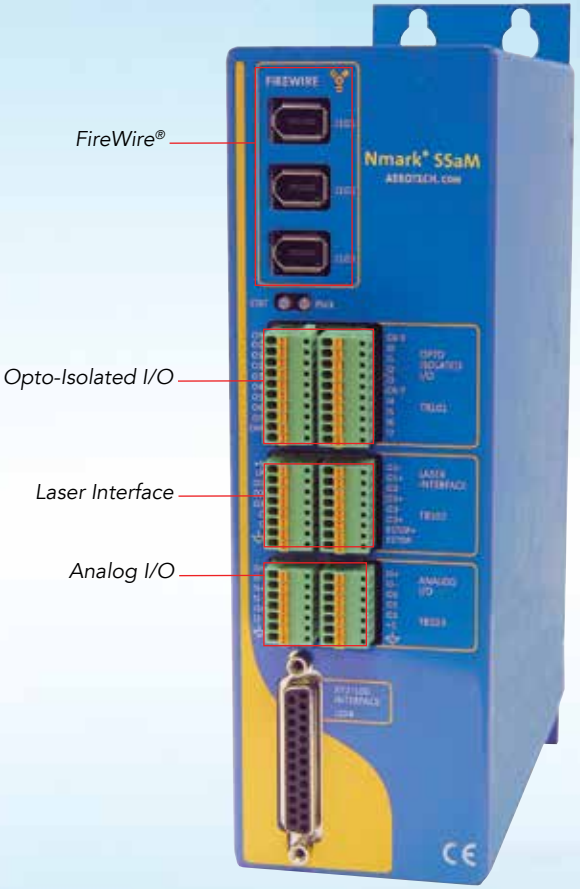


Nmark® GCL

Width: 121.5 mm
Height: 219 mm

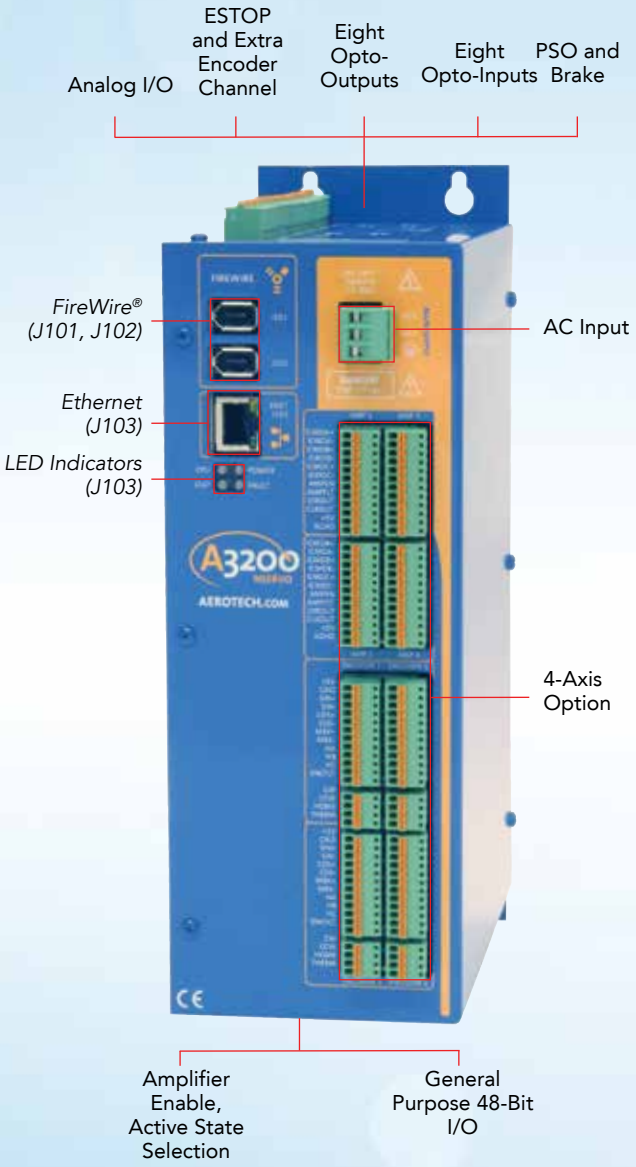
Nmark® SSaM

Width: 63.7 mm
Height: 199.0 mm



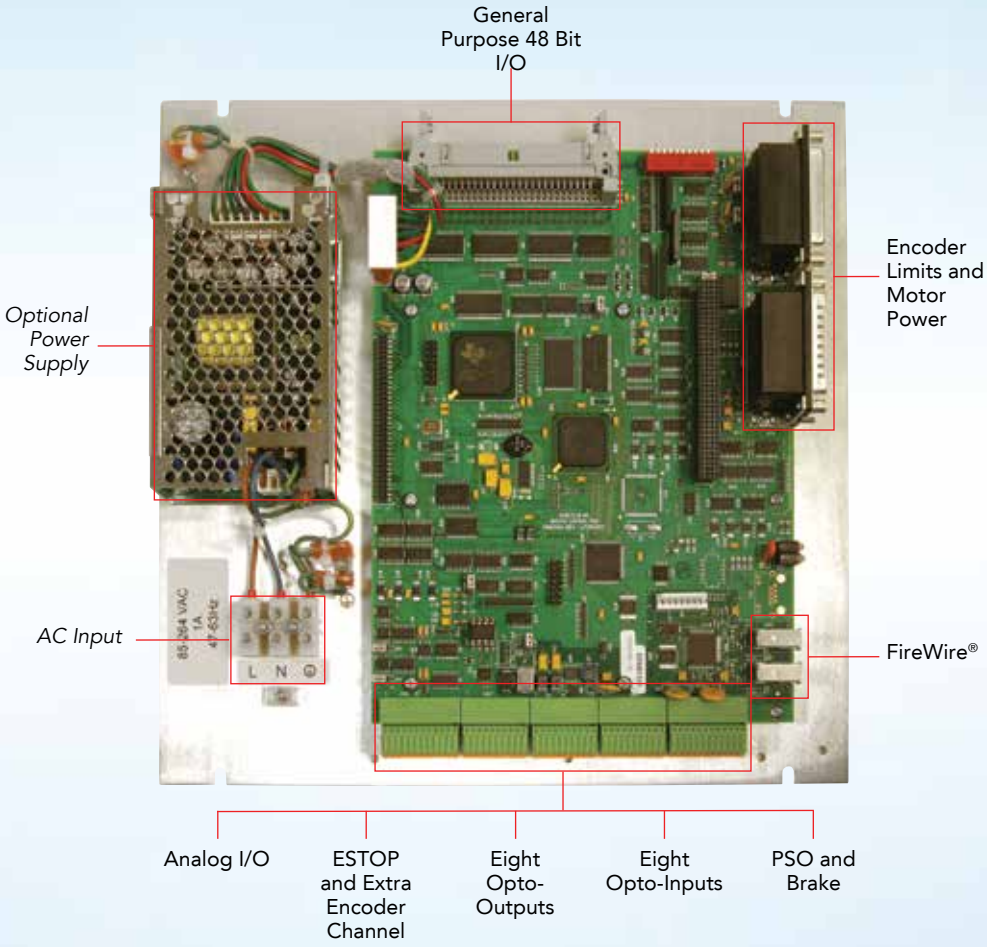
Nservo

Width: 87.6 mm
Height: 230.4 mm



Nservo – OEM

4 Axis or Less
Width: 284.5 mm
Height: 276.9 mm

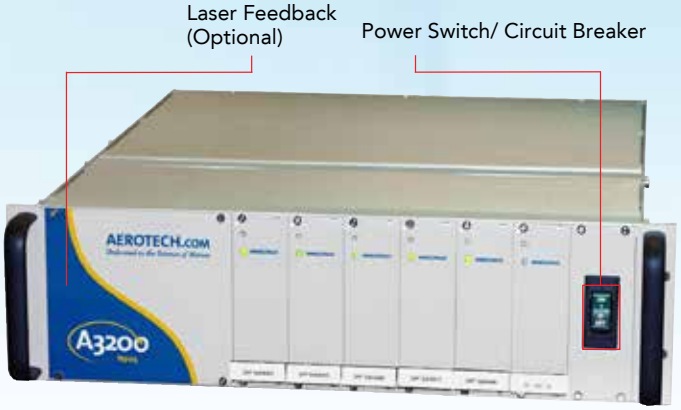


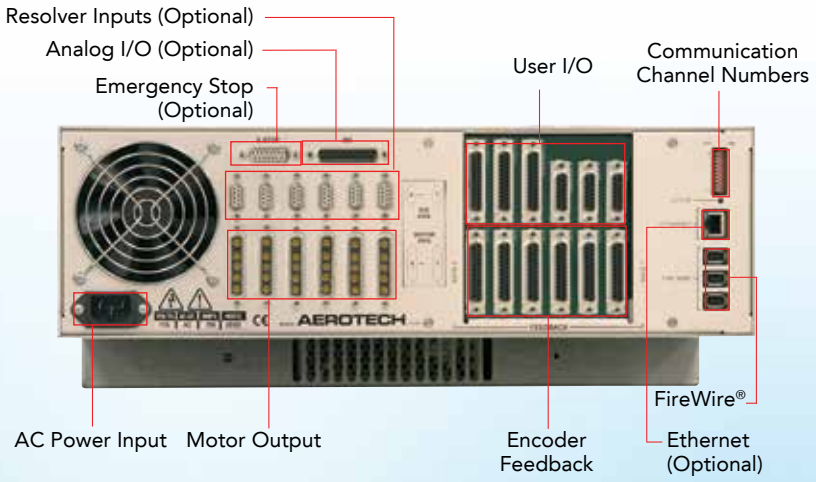
Npaq® and Epaq Rack Mount or Desktop Solutions in One Box Minimize Wiring

Console

Npaq®

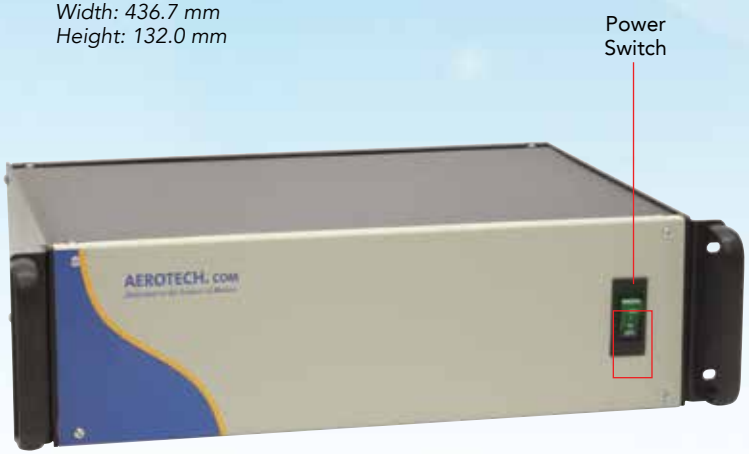
6 Axis or Less
Width: 436.7 mm
Height: 132.0 mm

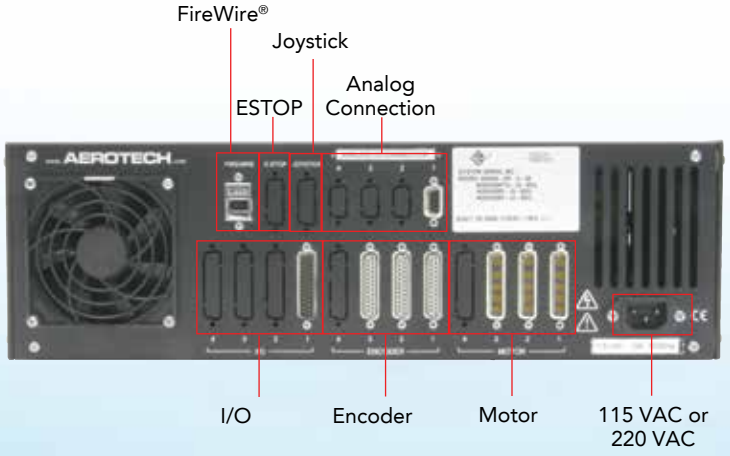




Npaq® MR/Epaq MR

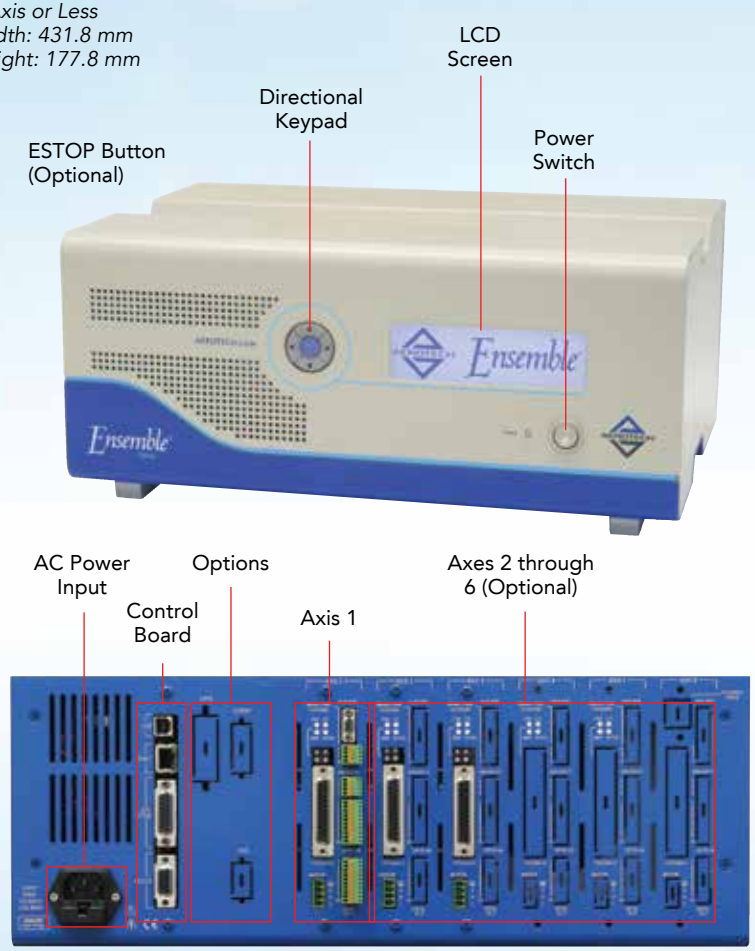
8 Axis or Less
Width: 436.7 mm
Height: 132.0 mm





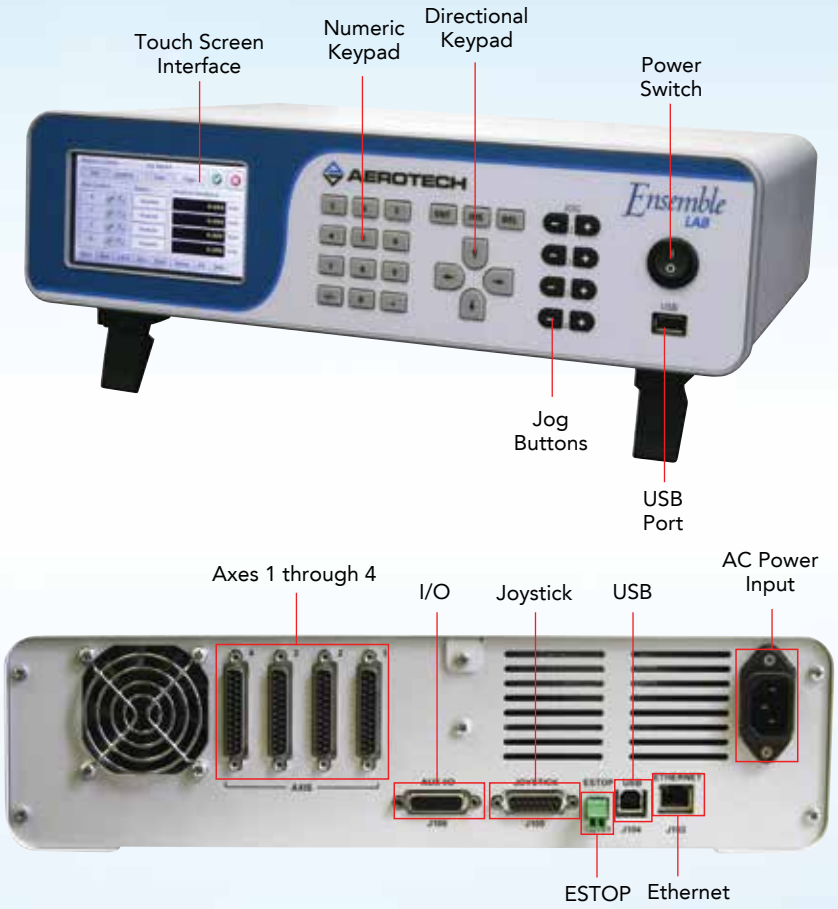
Ensemble® Epaq

5 Axis or Less
Width: 431.8 mm
Height: 177.8 mm



Ensemble® LAB

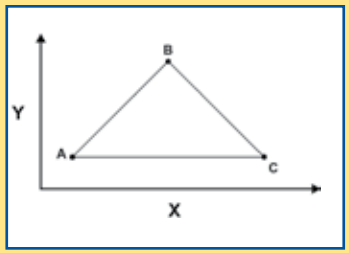
4 Axis or Less
Width: 370.2 mm
Height: 98.4 mm



Standard Control Capabilities

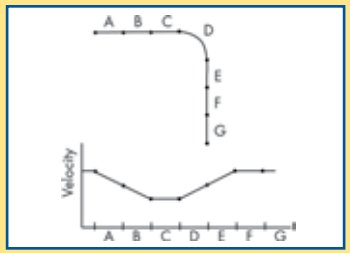
Aerotech controllers offer the broadest array of programming interfaces and core motion capabilities of any automation system available today. Aerotech controllers have the programming flexibility and capability to meet the requirements of the most demanding motion applications of OEMs and end-users alike.

Point-to-Point Motion



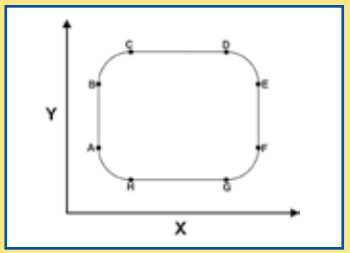
Basic independent axis positioning with programmable accel/decel and feedrate.

Acceleration Limiting



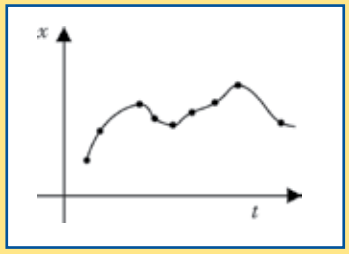
Anticipate sharp corners and small radius arcs and automatically decelerate as needed.

Coordinated Motion



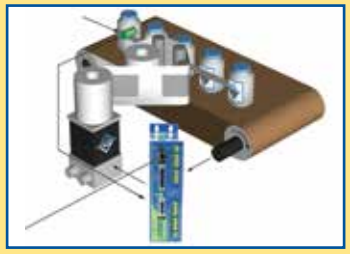
Linear and circular motions are supported in all languages.

Arbitrary Path Generation (PVT)



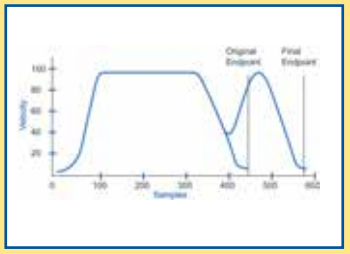
Specify discrete position, velocity and time and the controller will interpolate to create a smooth, contiguous path.

Electronic Gearing



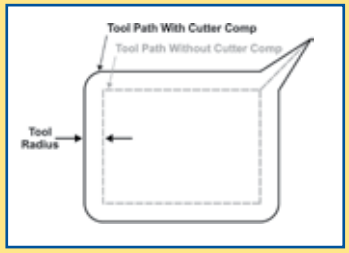
Electronically control one axis as a simple ratio or as a complex function of another axis; fire I/O in real time during a move.

On the Fly End-Point Modification



Modify the endpoint during execution of the motion profile.

Cutter Compensation

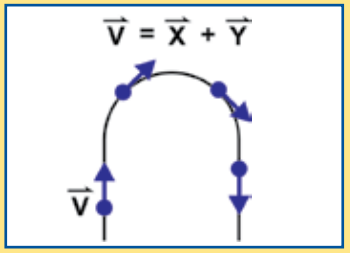


Also known as tool radius compensation, this feature automatically adjusts the path to allow for the radius of a cutting tool.

Parts Rotation

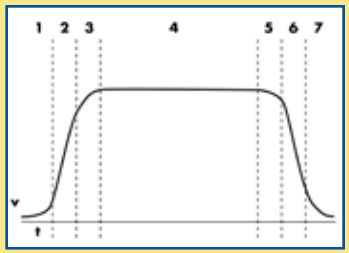
Use when a two-dimensional part must be repeated in different orientations without translating the part program many times over.

Velocity Profiling



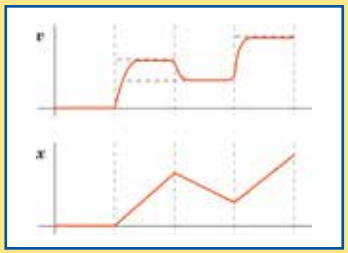
Maintains a constant vector velocity along the programmed path.

Seven Segment Acceleration



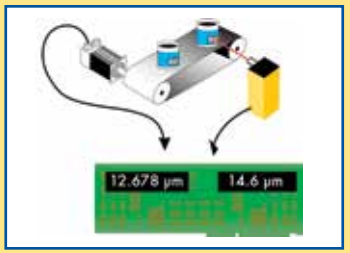
Specify the acceleration profile in seven segments, providing precise control over system motion.

Velocity Blending



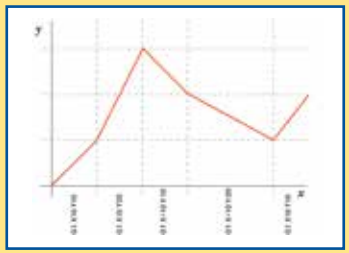
The velocity changes to the next velocity command, acceleration limited, without stopping.

Fast Position Capture



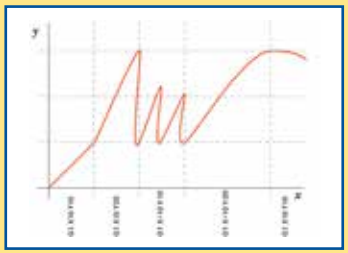
Store positions based on the transition of a digital input, allowing close correlation of axis positions to external events.

Retrace



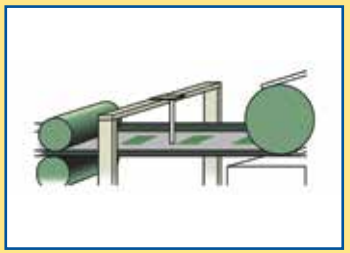
Retrace a path block by block.

Intra-Block Retrace



Retrace a path inside a block.

High-Speed Registration

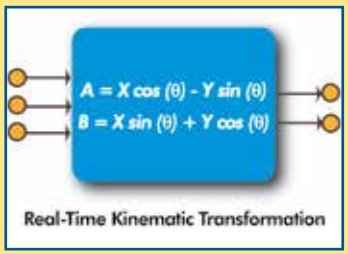


High-speed registration to trigger motion is useful in packaging and labeling.

Gantry Mode

Complex gantry control is reduced to a few simple commands to handle dual motor and/or dual feedback configurations.

Kinematics



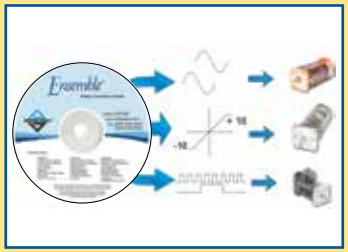
Execute complex inverse kinematic equations within the flow of the trajectory generation.

Analog Power Control

Adjust the setting of an analog output in relationship to the vector speed of two axes to permit the automatic regulation of laser power or material dispensing processes.

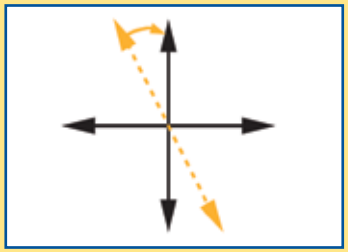
Standard Control Capabilities

Motor Control



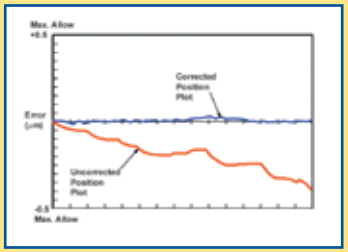
All controllers operate brush, brushless or stepper motors in any combination.

Orthogonality Correction



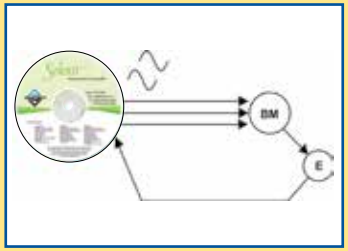
Improve X-Y planar accuracy by simply entering the known orthogonality error and the controller will compensate.

Axis Calibration



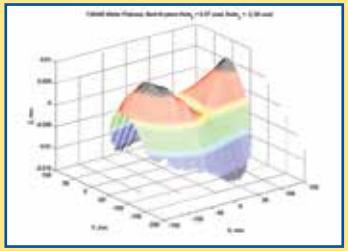
Compensate for repeatable mechanical errors in a positioning system.

Sinusoidal Commutation



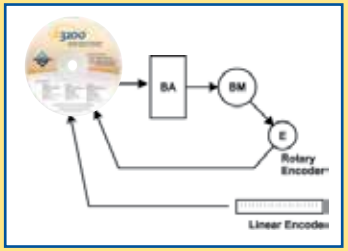
Brushless motors produce smoothest motion when sinusoidally commutated, eliminating the need for multiple transducers and reducing cabling.

3D Error Correction



Measure XYZ errors and the controller can correct the commanded position to accurately move to all locations in the 3D space.

Dual-Loop Control

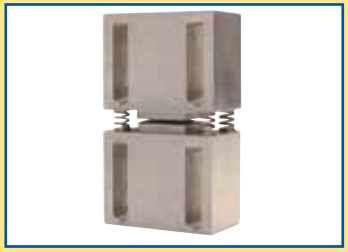


Dual-loop control is used to eliminate the effects of backlash and other sources of error.

Quadrature Encoder

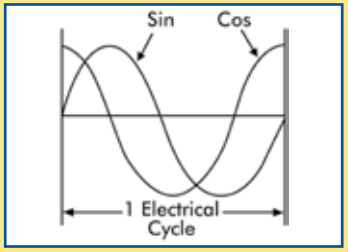
Use a standard A,B quadrature encoder, incremental or absolute.

Analog Feedback



For high resolution, short travel applications, linear drives accept analog inputs from analog sensors.

Resolver/Inductosyn

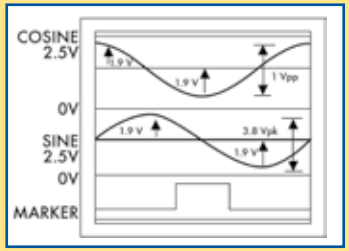


Programmable carrier frequencies make resolvers/ inductosyns easy to integrate.

Laser Interferometer

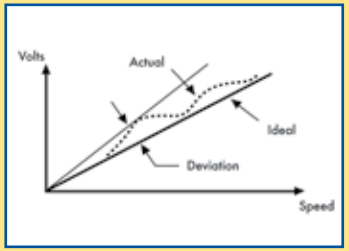
Systems requiring ultra-high resolution and feedback stability use interferometer feedback.

Encoder



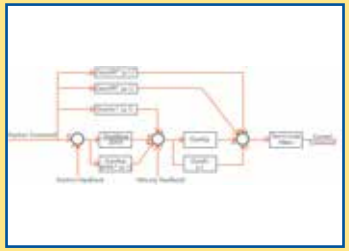
Systems requiring high resolution use a 1 Vpp encoder with Aerotech multiplier, up to 65,536 and 2 MHz input frequency.

Tachometer



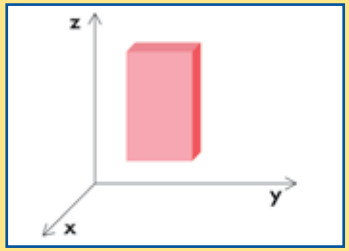
For dual feedback systems use tach for velocity control and encoder for position control.

PIDFF



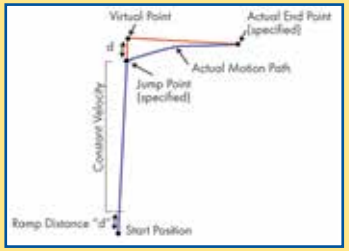
PID digital control loop with feedforward for velocity, acceleration and friction.

Safe Zones



Safe zones can be set up on multi-axis systems to protect against crashes.

Slice Move



Increase scanning throughput by blending step and scan into a contoured move.

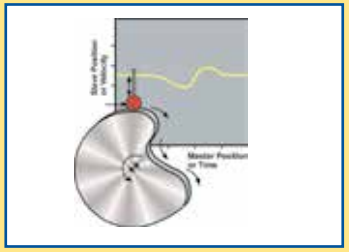
Limits

Set up hard limits and soft limits for maximum safety and flexibility.

Spindle Control

Spindle commands use standard m-codes.

CAM Profiling



Electronically command one axis position as a function of another axis with a CAM table and fire I/O during the move.

Harmonic Cancellation

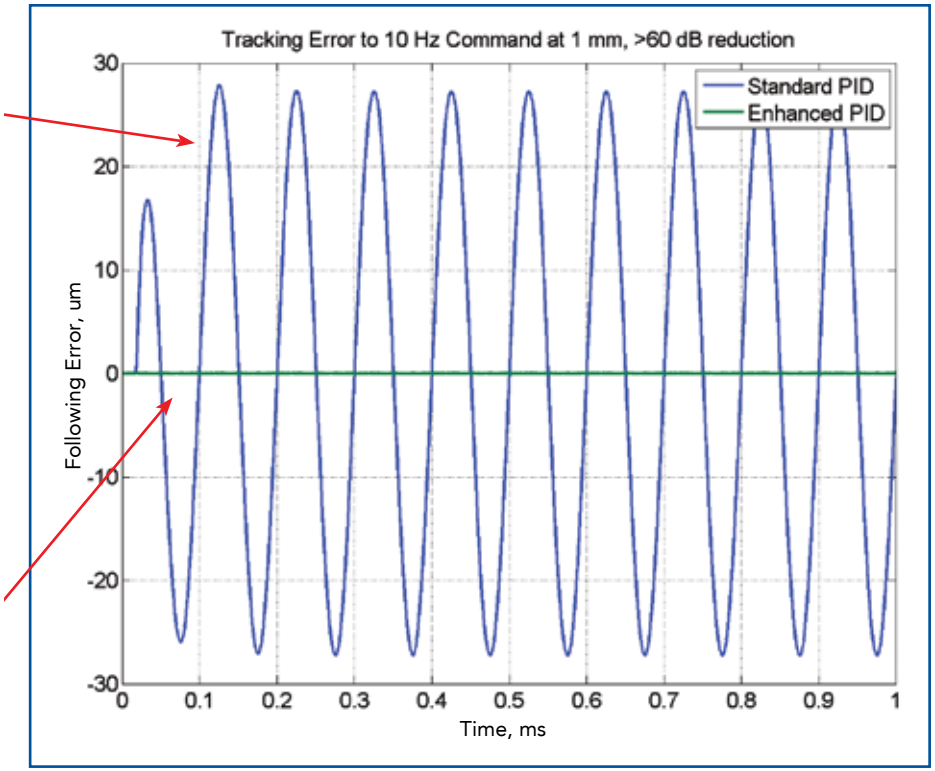
- Reduce position error on periodic trajectories
- Reject periodic disturbances
- Built-in setup wizards
- Adapts to magnitude and frequency of error source

Reduce Position Error

Continuously adapts and tracks sinusoids

Position error without harmonic cancellation

Position error with harmonic cancellation

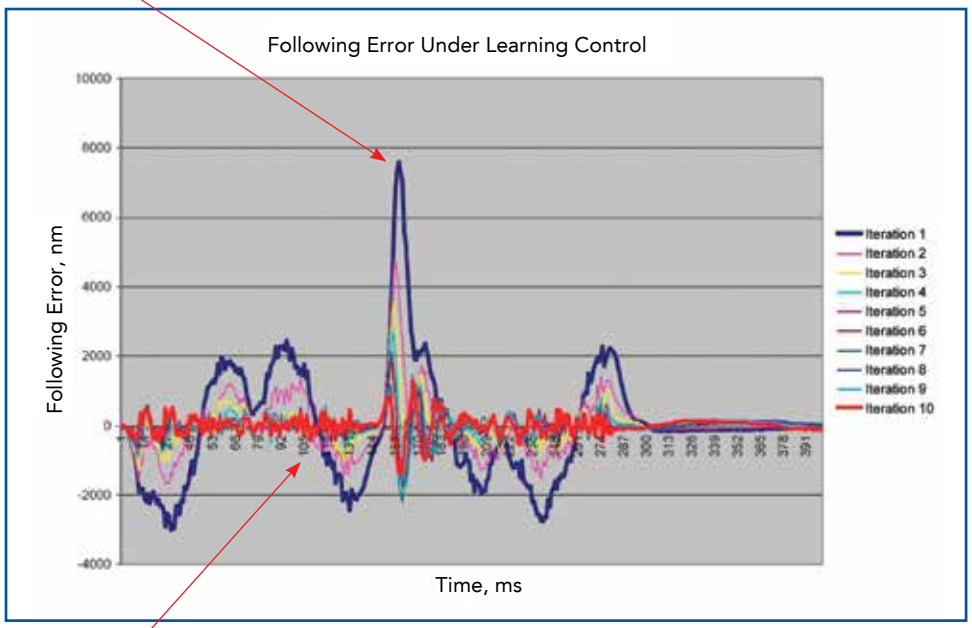


10 Hz Command; ± 1 mm

Applications

- Machining
- Spindle Control
- Cogging Reduction
- EDM/ECM
- MEMS Sensor Testing
- Rθ Wafer Inspection

1st Iteration



Final Iteration

Iterative Learning Control

- Repeating move sequences can be learned and optimized
- Reduce following error
- Increase dynamic accuracy
- Increase production rates

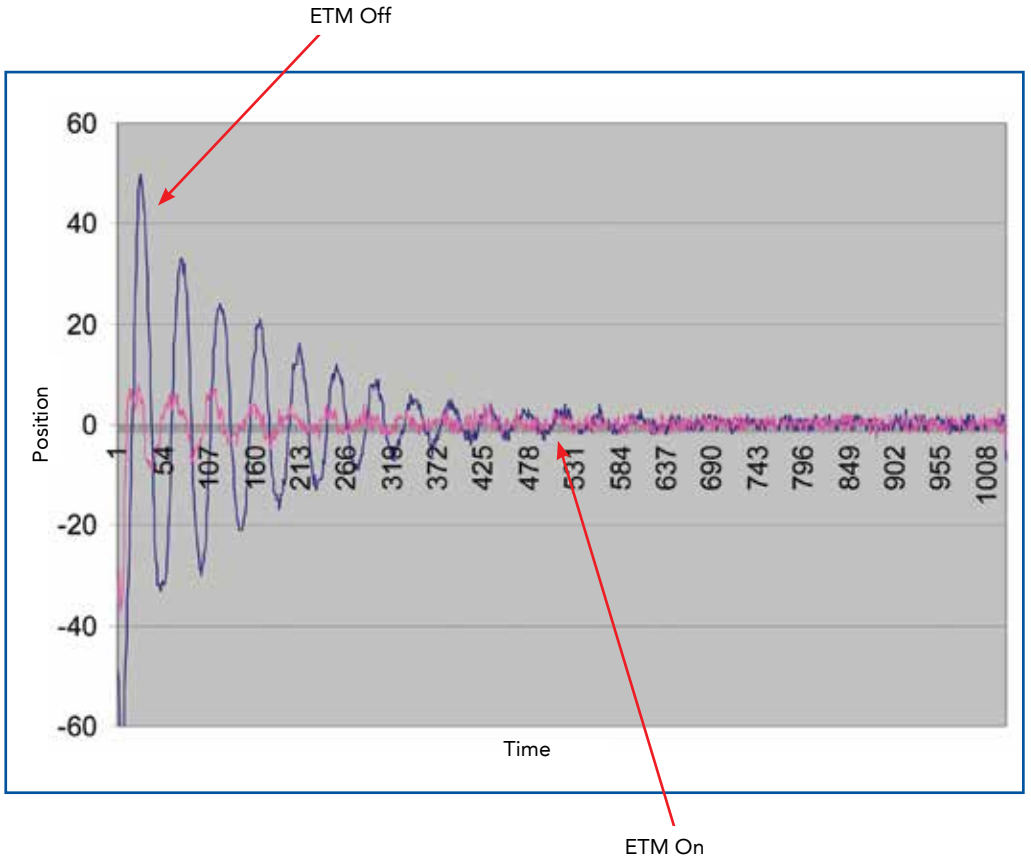
Applications

- Stencil Cutting
- Stent Cutting
- Sensor Testing
- Micromachining

Enhanced Throughput Module (ETM)

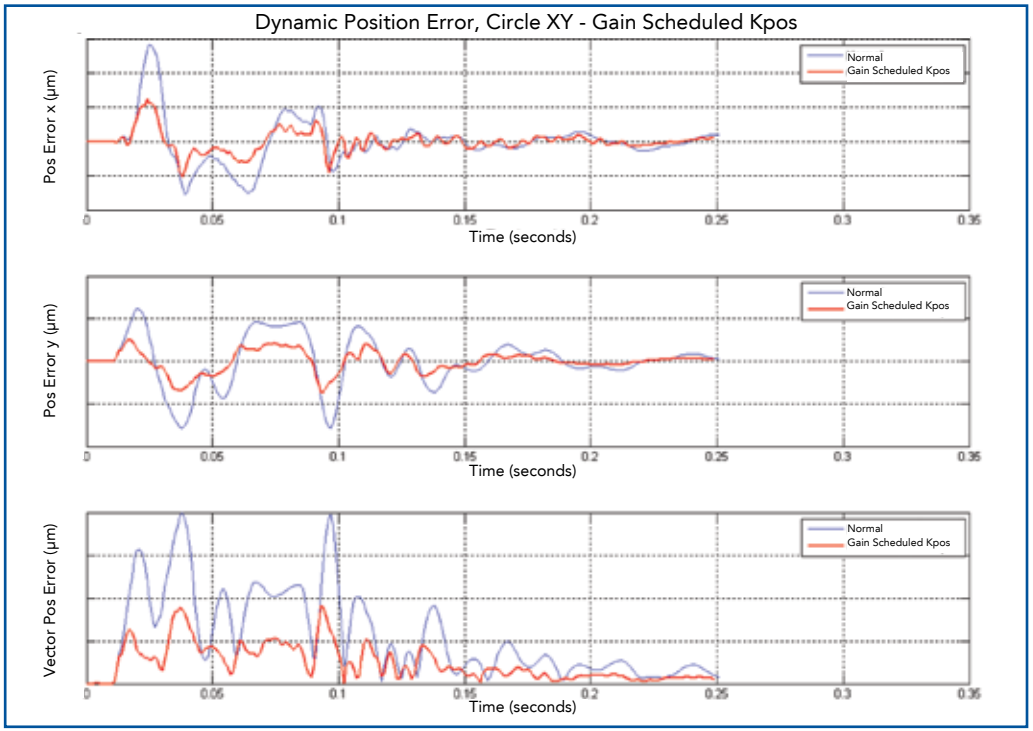
- Multi-axis feedforward capability
- Faster settling time
- Increase rate stability

Improved Settling Time



Applications

- Pick and Place Machines
- Semiconductor Inspection
- Genome Sequencing



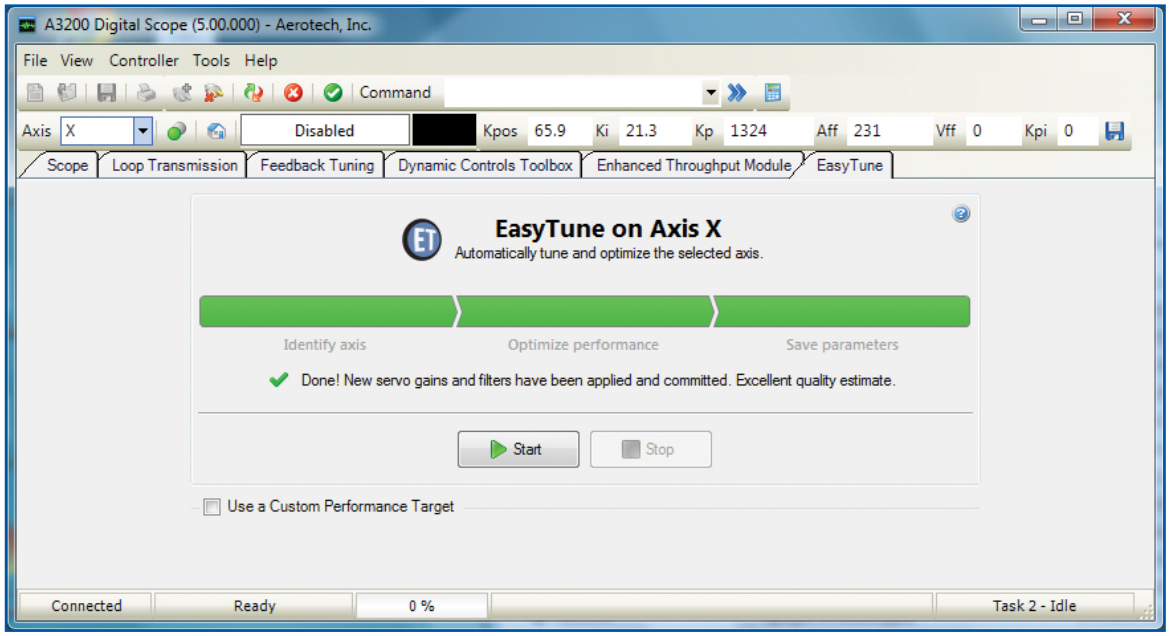
System automatically adjusts gain based on error motion during settling

Directional Gain Scheduling

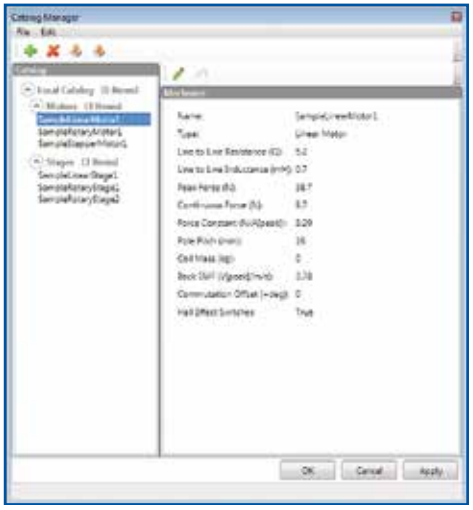
- Decrease settle time
- Increase in-position stability

EasyTune®/EasySetup

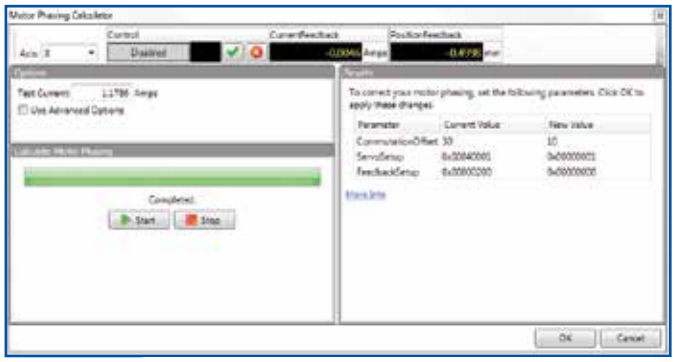
- Automatically tune servo and piezo axes
- Hands-off! EasyTune requires no user input or controls knowledge
- Set a custom performance target – improves throughput and system stability



EasyTune®

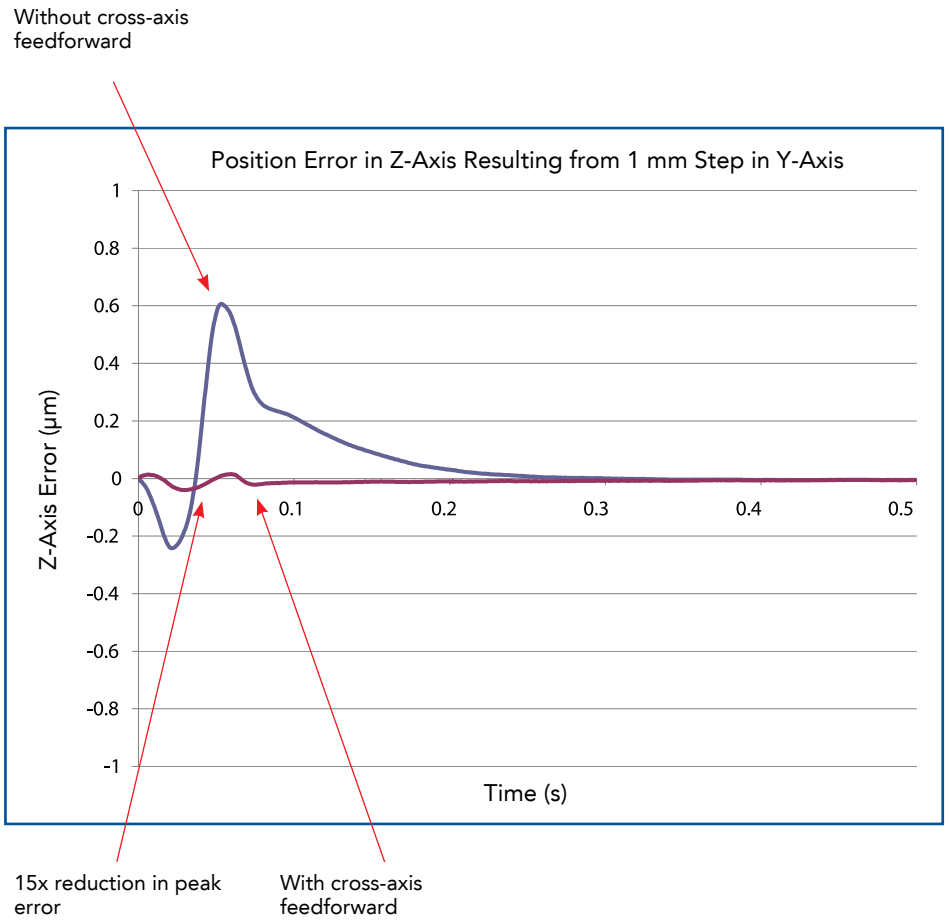


Catalog Manager



Motor Phasing Calculator

Reduce cross-axis position error during acceleration



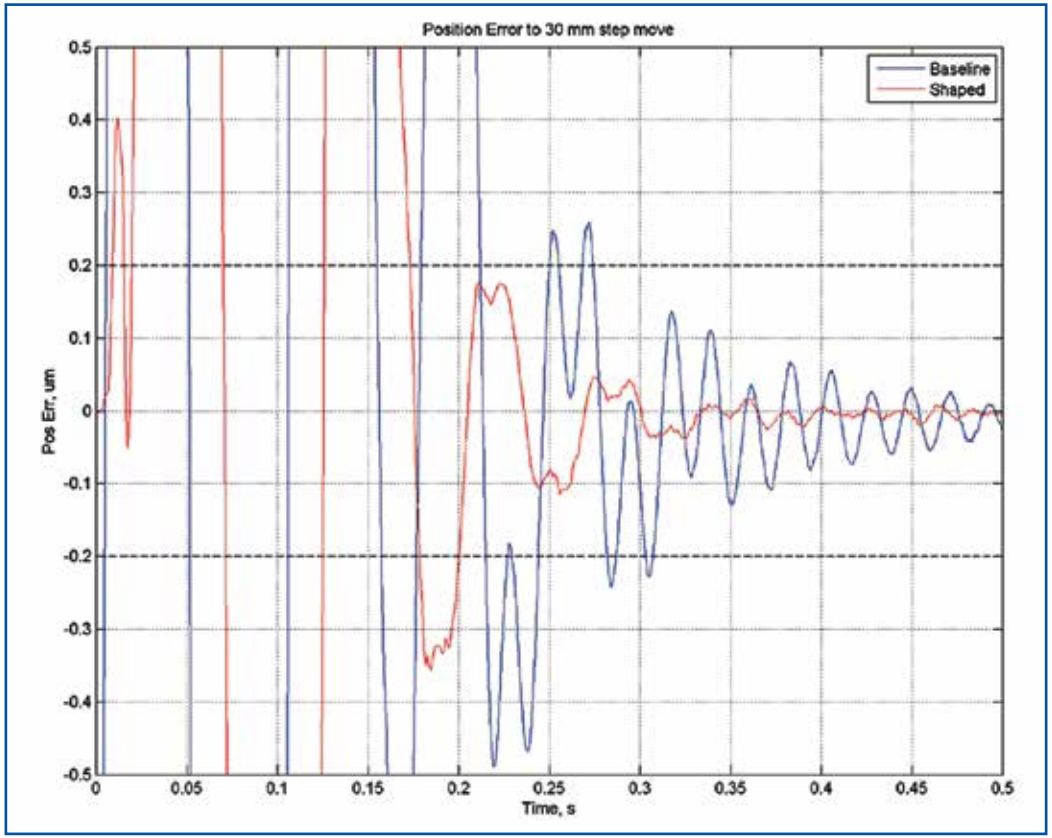
Cross-Axis Feedforward

- **Reduce position error on an axis due to acceleration of another axis**

Command Shaping

- Increase throughput
- Faster settle time at the work point
- No additional sensors required
- Reduced vibration in point-to-point moves
- Easy tuning

Reduce Vibration at the Work Point



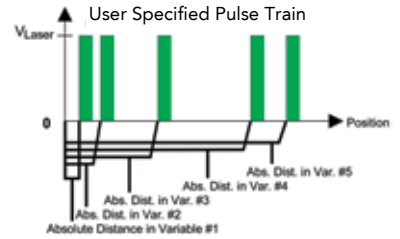
Position error at work point to 30 mm step move

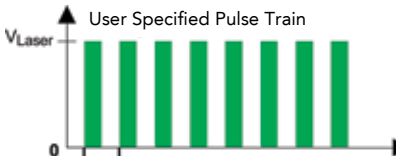
Applications

- Pick and Place Machines
- Semiconductor Inspection
- Genome Sequencing

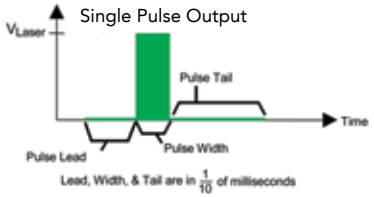
High Accuracy Firing Based on Actual Calibrated Encoder Counts

Array-Based Firing

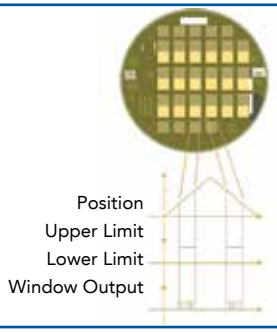




- PSO fire points are defined in an array based on calibrated position
- Pulse train specified with absolute or incremental positions
- Variable pulse width
- Specify pulse lead, pulse and pulse tail for precise energy delivery

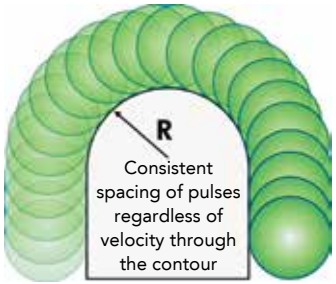


Windowing



- Output pulses are constrained inside a user-defined window with the first pulse relative to the edge of the window
- Excellent when the processing of a part requires the axes to move beyond the part for settling or direction reversal in applications such as flat-panel manufacturing or fuel-injector drilling

Fixed Distance Firing



- Single- or multiple-pulse output as a function of up to 3 axes' position feedback
- Minimizes heat-affected zone in welding, cutting and drilling
- Outstanding for stent manufacturing, hermetic welding and drilling holes in turbine blades

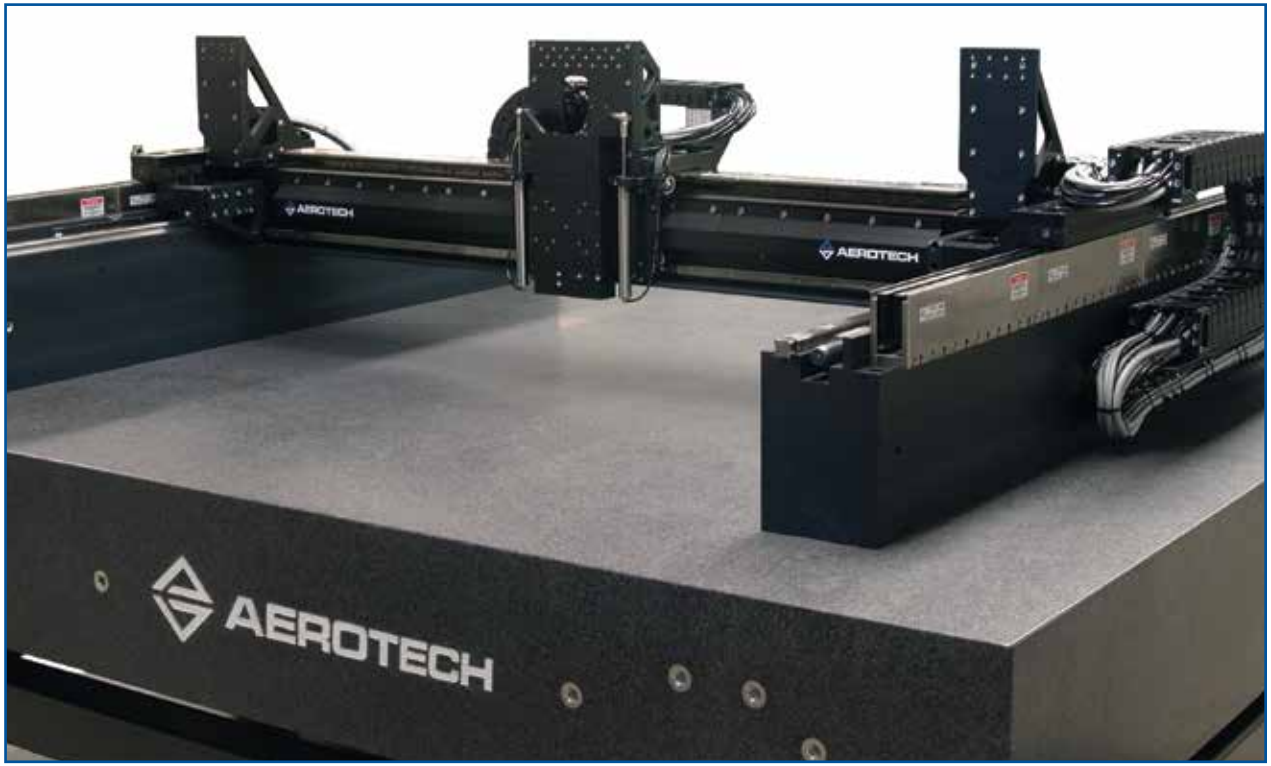
Position Synchronized Output (PSO)

- **Increase throughput**
- **Higher accuracy**
- **1-, 2- or 3-axis PSO**
- **Configurable command pulse train**

- **Use to trigger**
  - **Laser firing**
  - **Camera capture**
  - **Data acquisition**
  - **Nondestructive test triggering**

Gantry Control

- Both spars are programmed and commanded as a single axis
- Easy homing
- Marker offset for high accuracy
- Orthogonality correction



Gantry Modes

- Current Synchronization
- Position Synchronization

Gantry Configuration

- 2 Motors, 2 Encoders
- 2 Motors, 1 Encoder
- 1 Motor, 1 Encoder

Open architecture, PC-based robot controller for three-axis (X/Y/Z) Delta robots. Includes a pre-configured installation of Aerotech's A3200 automation platform with robot specific programming extensions, NEMA 32 frame size motors, drives, and cables. Key system features include:

Delta Robot Control

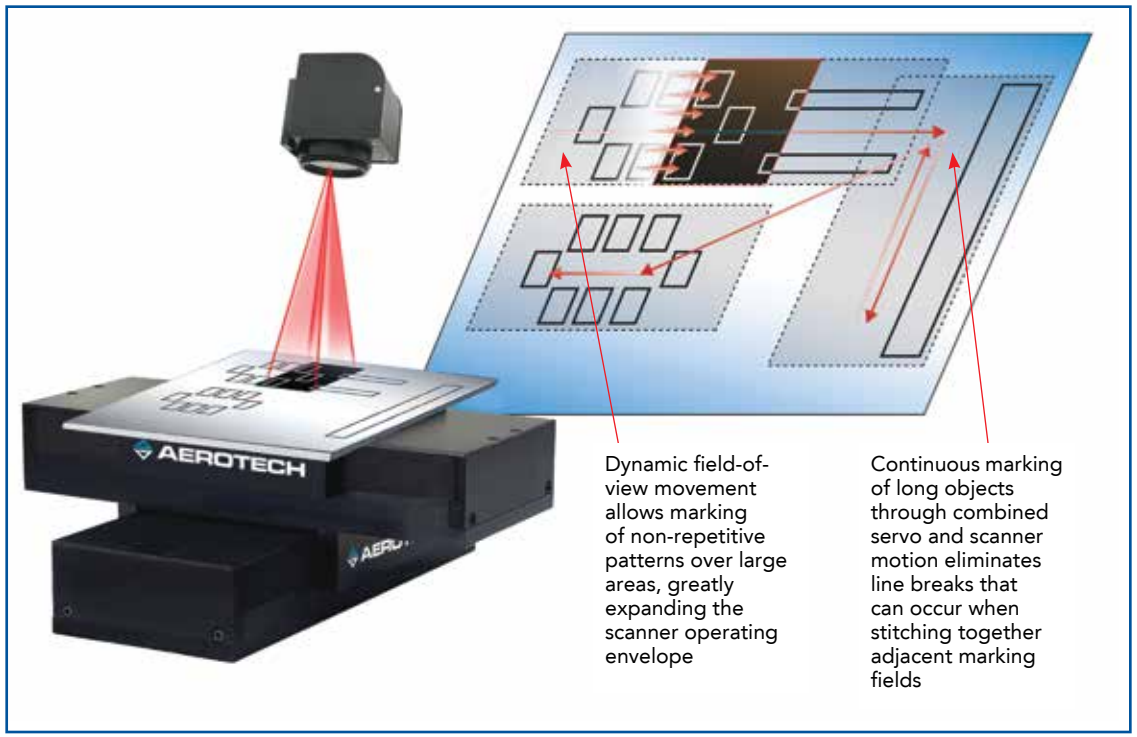
- Industrial panel-mount PC with solid-state disk drive
- Teach mode with user defined number of points
- Synchronization with moving material
- Target position command queue of user defined depth
- Real-time simultaneous display of tool and work-point coordinates
- G code and AeroBasic™ motion command syntax
- Control up to 20 additional axes
- Optional IEC 61131-3 PLC interface with support for PLCopen and .NET
- Servomotor with absolute feedback device and brake
- Ndrive CP10 drives
- 5 meter long motor power and feedback cables

Directly Synchronize Scanhead and Servo Motion for Ultimate Flexibility in Marking Applications

Laser Marking–Nmark® CLS

(Closed-Loop Scanner)

- Expand scanner field-of-view without sacrificing effective pixel resolution
- Mark long vectors with one continuous pass
- Draw large-scale graphics without stitching multiple exposures
- Mark on a tube or other irregularly shaped object without manually repositioning
- Single programming environment for both scanner and servo axes minimizes application complexity
- Eliminate angular errors
- Scanner programmed with standard RS-274 G code
- Laser firing based on real-time scanner position



Nmark AGV-HP

- Highest accuracy scanner available attains single-digit, micron-level accuracy over the field of view
- Optical feedback technology significantly improves thermal stability
- Industry-best resolution of >24 bits when used with Aerotech's Nmark GCL controller
- Wide range of apertures and focal lengths

Nmark AGV-HPO

- Highest accuracy scanner available attains single-digit, micron-level accuracy over the field of view
- Optical feedback technology significantly improves thermal stability
- Industry-best resolution of >24 bits when used with Aerotech's Nmark GCL controller
- Wide range of apertures and focal lengths, and many choices of mirror surface treatments for a variety of laser wavelengths

Nmark GCL

- Closed-loop, two-axis servo drive for Aerotech's AGV series scanners
- Infinite Field of View (IFOV) seamlessly combines AGV and servo motion to expand the scanner work area
- Full servo state control with "zero-tracking error" eliminates speed-related part distortion such as necking on circles and rounding of corners
- Position-based laser firing (PSO) with windowing maintains consistent spot spacing over a wide range of operating speeds

High-Performance Galvanometer Scanners

Vector Applications

- Cutting
- Welding
- Sealing
- Ablation
- Marking

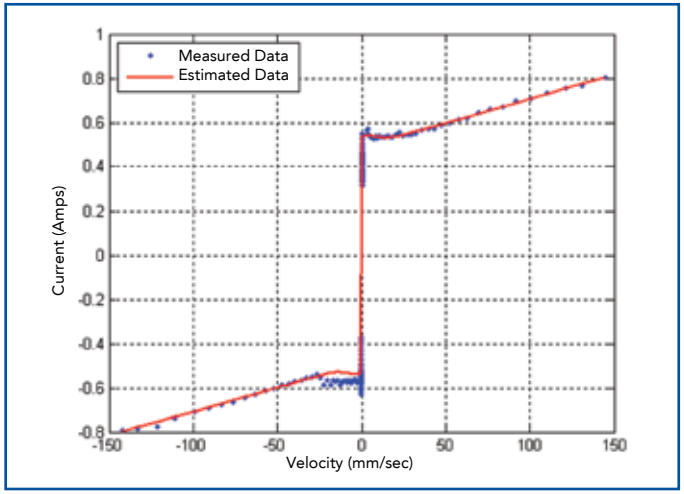
Graphic Applications

- Bar Code
- Serialization
- Engraving
- Character Scribing

Friction Compensation

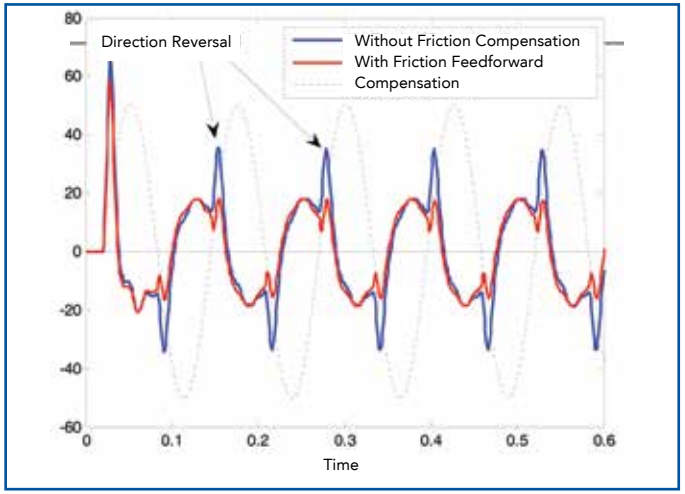
- Reduced settle time
- Reduced error at direction reversals

Advanced Friction Model



High speed, high accelerations and minimal position error achieved with feedforward additive force

Friction Compensation Results

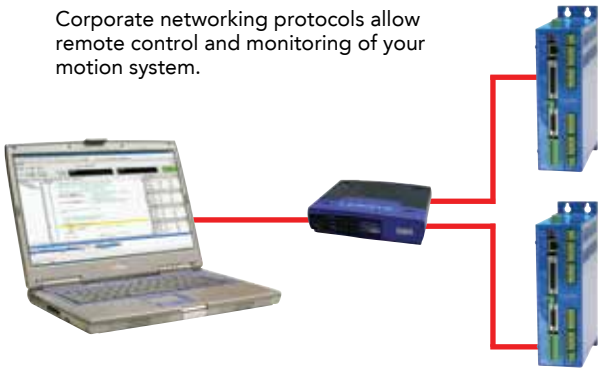


Aerotech controllers support a multitude of industry-standard communication protocols to facilitate easy component networking, device connectivity and superior motion system performance.

Networking Type	Plant				Fieldbus					PC Connectivity			Drive I/O	
Protocol	Ethernet TCP/IP	USB	RS-232	RS-485	EtherCAT	EtherNet/ IP™	PROFIBUS	Modbus® TCP	Web Interface	FireWire®	Ethernet	USB	Analog	Digital
A3200	✓		✓		✓		✓	✓	✓	✓			✓	✓
Ensemble	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
Soloist	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
Summary	Aerotech controllers connect seamlessly to your existing corporate network or PC via these standard protocols.				Aerotech controllers support a variety of fieldbus communication protocols to fit your application.					Aerotech controllers use state-of-the-art communication standards for motion network communication to ensure a robust, high-performance system.			Aerotech drives include a standard complement of on-board analog and digital I/O, with an option for an expanded I/O board.	

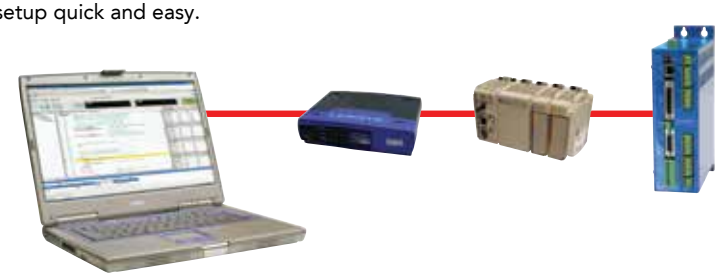
Fieldbus I/O with Hilscher NetX technology

Corporate networking protocols allow remote control and monitoring of your motion system.



Fieldbus communication protocols provide extensive options for communicating with PLCs and other components in your system.

Aerotech's motion networking architectures are truly plug-and-play, making setup quick and easy.



Aerotech's HEX RC

Aerotech's HEX RC is a high-performance, 6-axis motion controller ideal for controlling robotic systems like hexapods. The HEX RC is 4U high, rack-mountable, and compatible with the Automation 3200 (A3200) motion platform. A high-performance processor provides the intense computing power needed to run up to 32 axes, perform complex, synchronized motion trajectories, manipulate I/O, and collect data at high speeds.

- **4U high, rack-mount, six-axis controller for brush, brushless, and stepper motors**
- **Ideal for controlling six-axis robotic systems like hexapods**
- **Real-time A3200 distributed control architecture allows synchronized motion on up to 32 axes**
- **FireWire® or ASCII command interface via TCP/IP**
- **Optional integrated encoder multipliers for high resolution positioning and reduced integration complexity**
- **Optional six-axis jog pendant**
- **Program in native RS-274 G-code, AeroBasic™ command set, C, C++/CLI, .NET, MATLAB®, LabVIEW®, or IEC 61131-3 (LD, FBD, ST) for the ultimate in programming flexibility**

Ensemble QL/QLe™

The Ensemble QL/QLe™ panel-mount nanopositioning piezo drive family is designed for seamless use with the Ensemble family of drives and controllers. The QL/QLe connects to any Ensemble controller network enabling coordinated motion between piezo stages and servo axes at much higher rates than other controller or drive products. This power, versatility, and affordability make the Ensemble QL/QLe drives ideal for applications ranging from the most demanding fundamental scientific research to advanced OEM machine systems.

Ensemble QDe™

The Ensemble QDe™ is a high-performance desktop nanopositioning piezo drive designed for seamless use with the Ensemble family of drives and controllers. The QDe connects to any Ensemble controller network enabling coordinated motion between piezo stages and servo axes at much higher rates than other controller or drive products. This power and versatility make the Ensemble QDe ideal for single or multi-axis applications ranging from fundamental scientific research to advanced OEM machine systems.

Ensemble QLAB™

The Ensemble QLAB™ is a high-performance nanopositioning piezo stage controller for 1 to 4 axes of motion. The flexible controller platform allows user-configurable open-loop and closed-loop operation on a per axis basis. Simple software commands allow the user to switch between open-loop and closed-loop if an axis is configured for closed-loop mode.

Controller Comparison Chart

Unsure about which controller is right for your application?

Consult the chart to see which controller fits your needs.

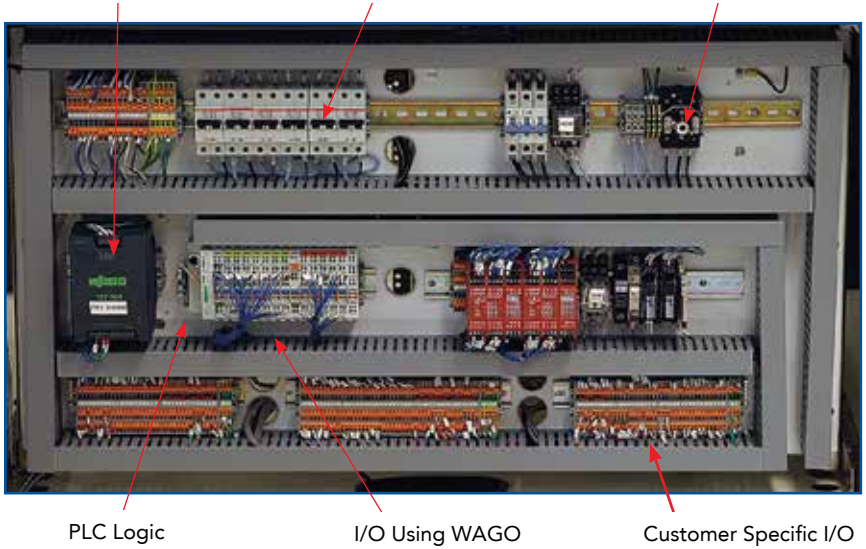
Basic Functions	A3200	Ensemble	Soloist
Multi-Axis	Up to 32 axes coordinated	Up to 10 axes coordinated	Single axis
Architecture	PC-based software controller	Stand-alone	Stand-alone
Number of Tasks	32	4	4
CNC Functionality/RS-274	✓		
Coordinated Motion	✓	✓	
Point-to-Point Motion	✓	✓	✓
Cutter Compensation	✓		
Multi-Block Look-Ahead	✓		
Acceleration Limiting/Look-Ahead	✓		
Gantry Mode	✓	✓	
Velocity Blending	✓	✓	✓
Electronic Gearing	✓	✓	✓
Electronic Cam Profiling	✓	✓	✓
Arbitrary Path Generation	✓	✓	✓
Jog and Offset, Jog and Return	✓		
Velocity Profiling	✓	✓	✓
Retrace (Block by Block)	✓		
Axis Calibration	✓	✓	✓
3D Error Mapping	✓		
Sinusoidal Commutation	✓	✓	✓
Analog Power Control	✓	✓	✓
Servo, Stepper or DC Motor Controller	✓	✓	✓
Expanded IO Available	✓	✓	✓
Encoder Tuning	✓	✓	✓
Dual Loop Control	✓	✓	✓
PLC (IEC 61131-3)	✓		

Advanced Functions	A3200	Ensemble	Soloist
IDE	✓	✓	✓
.NET, AeroBasic™	✓	✓	✓
Fast Position Capture	✓	✓	✓
High-Speed Registration	✓	✓	✓
On the Fly End-Point Modification	✓	✓	✓
Orthogonality Correction	✓	✓	✓
Parts Rotation	✓		
Intra-Block Retrace	✓		
Iterative Learning Control	✓	✓	✓
PSO	Yes, up to 3 axes	Yes, up to 3 axes	Yes
Harmonic Cancellation	✓	✓	✓
Direction Gain Scheduling	✓	✓	✓
Inertial Damping	✓	✓	✓
Friction Compensation	✓		
Linear Drive Amplifiers	✓	✓	✓
Machine Retrofit Hardware Available	✓		
Galvo Integration	✓		
Seven Segment Acceleration Profile	✓	✓	✓
Slice Move	✓		
Corner Rounding	✓		
Coordinate Transformations	✓	With Plug-In	
Kinematics	✓	With Plug-In	
Loop Transmission	✓	✓	✓
Advanced Diagnostics and Tuning	✓	✓	✓
Auto Focus	✓	✓	✓
MATLAB®	✓		
Force Control	✓	✓	✓
Soft Landing	✓	✓	✓
Piezo Nanopositioners	✓	✓	
HexGen Hexapod	✓		
RCP-DELTA Delta Robot	✓		

Use the Best Controller for Your Application

Aerotech Electrical Value

- Wired and tested consoles
- Wired panels and 19-inch racks
- Integrated subsystem with PC, controls, drives, cables, power supply or transformer, line filtering, PLC motion, I/O and customer I/O
- CE/UL standards
- Comply with NFPA79 wiring standard



Nsys Complete Consoles

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

Aerotech Machine Safety Standards

Safety Level	Fault Detection	Loss of Safety Function Probability	Single Fault Covered	Double Fault Covered	Input ESTOP Signal	Supply Power to Drive
Category B	None	Very High	No	No	No specific design	No specific design
Category 1	None	Very High	No	No	Simple mushroom switch	One relay
Category 2	Low	High	No	No	Simple mushroom switch	One positive guided relay with auxiliary contact for checking
Category 3	Medium	Medium	Yes	No	Dual circuit mushroom with fault detection	Two positive guided relays with cross checking
Category 4	High	Low	Yes	Yes	Dual circuit mushroom with independent fault detection	Two positive guided relays with cross checking

Hardware Options

	MP	CP	HPe	HLe	ML	Integrated Drive Racks		Nservo	Nstep	Nmark™	Console	QL/QLe
A3200 Drives						 Npaq®, Npaq MR, or HEX RC drive chassis						
Ensemble Controls						 Ensemble Epaq, Epaq MR, LAB, QLAB, or QDe drive chassis and motion controller		N/A	N/A	N/A	N/A	
Soloist Controls						N/A		N/A	N/A	N/A	N/A	N/A
Axes	1	1	1	1	1	1 to 8	1 to 8	2 or 4	2 or 4	3	1 to 12	
Output Type	PWM	PWM	PWM	Linear	Linear	PWM and Linear	PWM and Linear	Three-Phase ±10 V	Clock and Direction	Clock and Direction	N/A	
Peak Output Current	10 A	10-30 A	10-150 A	10-20 A	10 A	Npaq: 10-30 A Npaq MR: 10 A Hex RC: 10 A	Epaq/Epaq MR: 10 A Epaq: 10 A Ensemble LAB: 5 A Ensemble QLAB: 300 mA Ensemble QDe: 250 mA	N/A	N/A	N/A	N/A	
DC Bus Voltage	10-80 VDC (Output)	10-320 VDC	10-320 VDC	±40-80 VDC	±40 VDC	Npaq: 10-320 VDC Npaq MR: 10-80 VDC Hex RC: 80 VDC	Epaq: 24-90 VDC; ±10-40 VDC Epaq MR: 10-80 VDC Ensemble LAB: ±24 VDC Ensemble QLAB: -30 to +150 V Ensemble QDe: -30 to +150 V	N/A	N/A	N/A	N/A	
Standard I/O	1-AI	6-DI/4-DO 1-AI/1-AO	6-DI/4-DO 1-AI/1-AO	6-DI/4-DO 1-AI/1-AO	6-DI/4-DO 1-AI/1-AO	Multiple Configurations Available	1-AI per axis	11-DI/8-DO 4-AI/2-AO	16 Assignable IO	N/A	N/A	
Optional I/O	8-DI/8-DO 1-AI/1-AO	16-DI/16-DO 1-AI/1-AO	16-DI/16-DO 4-AI/4-AO	16-DI/16-DO 4-AI/4-AO	16-DI/16-DO 1-AI/1-AO	Multiple Configurations Available	Multiple Configurations Available	Via Optional Ethernet Port	N/A	N/A	N/A	
I/O Spec	12-bit differential AI 16-bit single-ended AO	16-bit differential AI 16-bit single-ended AO				Npaq or HEX RC: Four 16-bit differential AI Two 16-bit single-ended AO Npaq MR: Same as ML or MP per axis	Epaq or Epaq MR: Same as ML or MP per axis Ensemble QLAB: 4 AI, 4 AO Ensemble QDe: 1 16-bit, 1 18-bit	Two 16-bit differential AI Two 16-bit single-ended AO	N/A	N/A	N/A	
Incremental Encoder	✓	✓	✓	✓	✓	✓	✓	✓			✓	
Absolute Encoder		✓	✓	✓			✓	✓			✓	
Resolver/ Inductosyn			✓	✓		✓		✓			✓	
Capacitive Probes					✓	✓						
Laser Interferometer						✓						

All units capable of sinusoidal commutation, dual-loop control and drive brushless, brush, or stepper motor

The BA series amplifiers are Aerotech's stand-alone PWM drive for three-phase AC brushless and single-phase DC brush motors.

BL series amplifiers are highly reliable linear brushless servo amplifiers.

BA PWM Amplifiers

- Wide output power range from 10 A peak to 100 A peak at 320 VDC
- No transformer required; direct connection to AC line
- Capable of running brushless or single-phase DC brush motors
- Velocity, torque and dual-phase mode input command
- Accepts both encoder or tachometer feedback for velocity control
- Can be externally commutated
- UL, CE and CSA approval

BL Linear Amplifier

- Non-switching, high-performance linear operation for ultra-smooth control of brushless motors
- Totally modular design accepts 110 VAC or 220 VAC input power
- Ideal for air-bearing systems and noise-sensitive applications

- Ironless/cogless design for superior motion
- Iron-core motors for high force output
- Frameless torque motors for custom machines
- Ultra-precision positioning
- Low heat generation
- Vacuum compatible options
- NEMA 17, 23, 34, 42 and IEC 142

Rotary Motors

Torque	
Type:	**Brushless**
Continuous Torque:	0.16 - 31.6 N·m
Peak Torque:	**0.48 - 94.9 N·m**
Rated Speed:	2400 - 4000 rpm

Torque	
Type:	**Brushless, Slotless**
Continuous Torque:	0.27 - 2.86 N·m
Peak Torque:	**1.07 - 11.43 N·m**
Rated Speed:	2000 - 4000 rpm

Torque	
Type:	DC Brush
Continuous Torque:	0.25 - 1.48 N·m
Peak Torque:	**1.84 - 7.1 N·m**
Rated Speed:	3000 - 6000 rpm

Torque	
Type:	**Stepper**
Continuous Torque:	0.78 - 11.5 N·m
Peak Torque:	---
Rated Speed:	---

Full line of DC brush, brushless, servo and stepper motors to fit almost any situation.

Brushless motors feature neodymium iron boron magnets for maximum torque and acceleration in a small package.

Frameless Rotary Motors

Torque	
Type:	**Frameless**
Continuous Torque:	0.20 - 29.09 N·m
Peak Torque:	**0.82 - 116.37 N·m**
Rated Speed:	200 - 8000 rpm

Five frameless designs for easy integration into OEM machines.

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

Brushless Linear Servomotors — Flat and U-Channel

Force	
Type:	**Flat**
Continuous Force:	19 - 697 N
Peak Force:	**75 - 1507 N**

Force	
Type:	**U Channel**
Continuous Force:	14 - 1063 N
Peak Force:	**56 - 4252 N**

Aerotech's proprietary coil winding technology produces the highest force to volume ratios available.

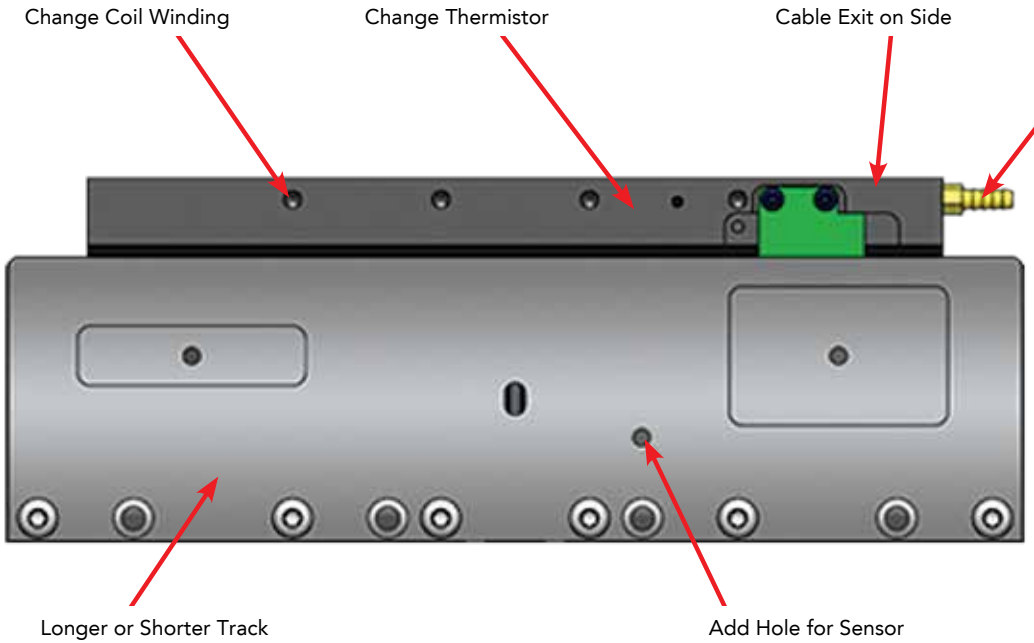
Direct drive, noncontacting forcer coil eliminates backlash, windup and wear for a maintenance-free system.

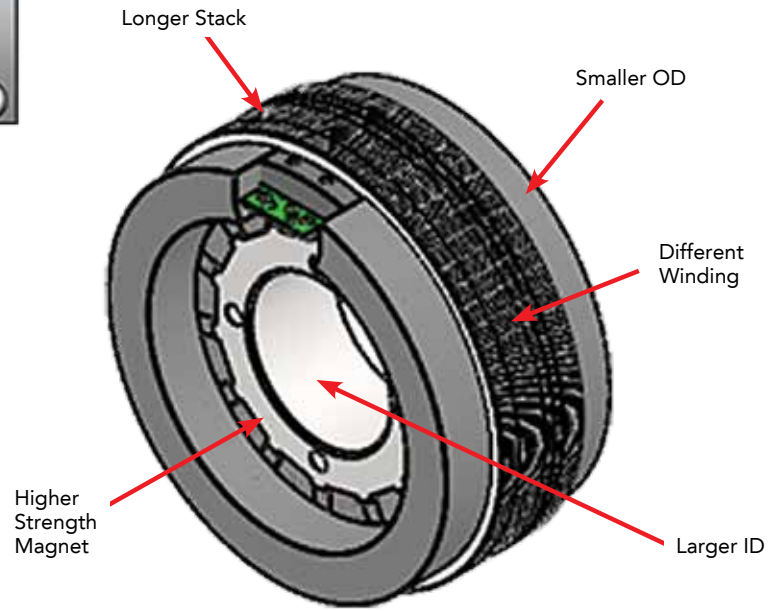
Linear servomotors are ideal for:

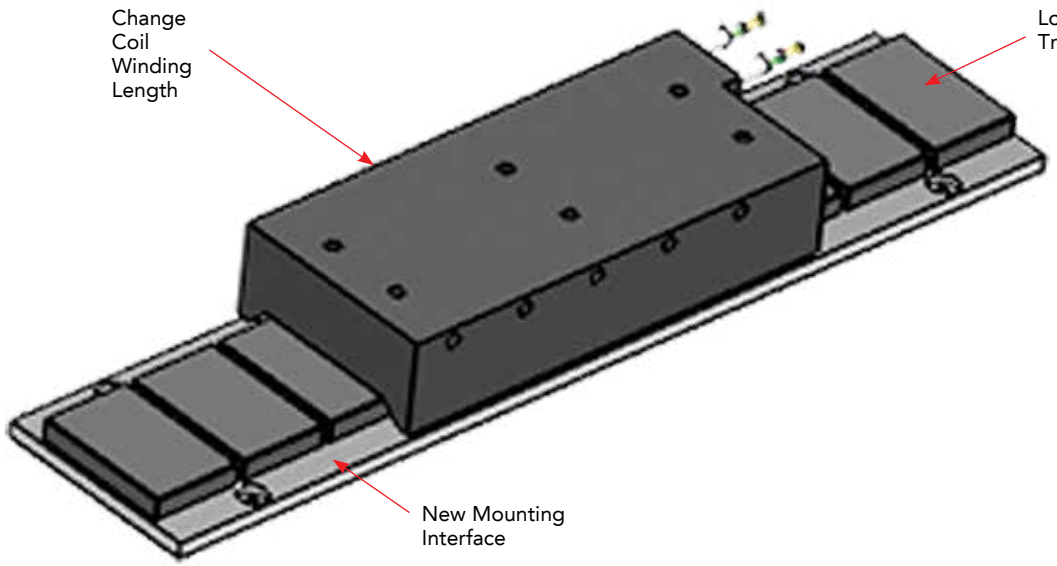
- Robotics
- Packaging
- Actuators
- Tables/Stages
- Assembly
- Fiber Optics/Photonics Alignment and Positioning
- Machine Tools
- Semiconductor Equipment
- Electronic Manufacturing

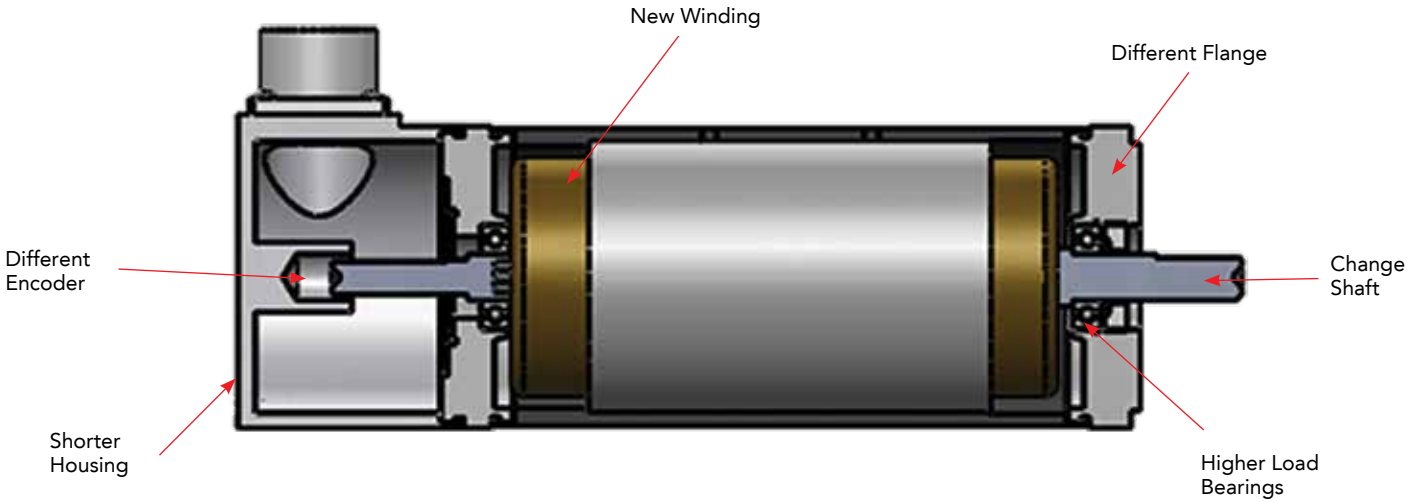
Advanced magnetic field synthesis and analysis yields highest motor output power per unit volume.

We customize for you






Change
Coil
Winding
Length
Longer or Shorter
Track
New Mounting
Interface


New Winding
Different Flange
Different
Encoder
Change
Shaft
Shorter
Housing
Higher Load
Bearings

We customize for you...

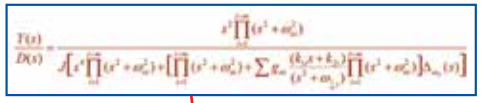
Hardware • Software • Firmware • Packaging • Motors • HMI • Electronics • I/O

Connectivity

- Ethernet
- Fieldbus
- Wireless
- USB

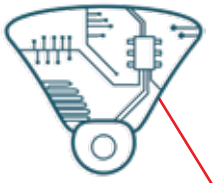
Custom Control Algorithms

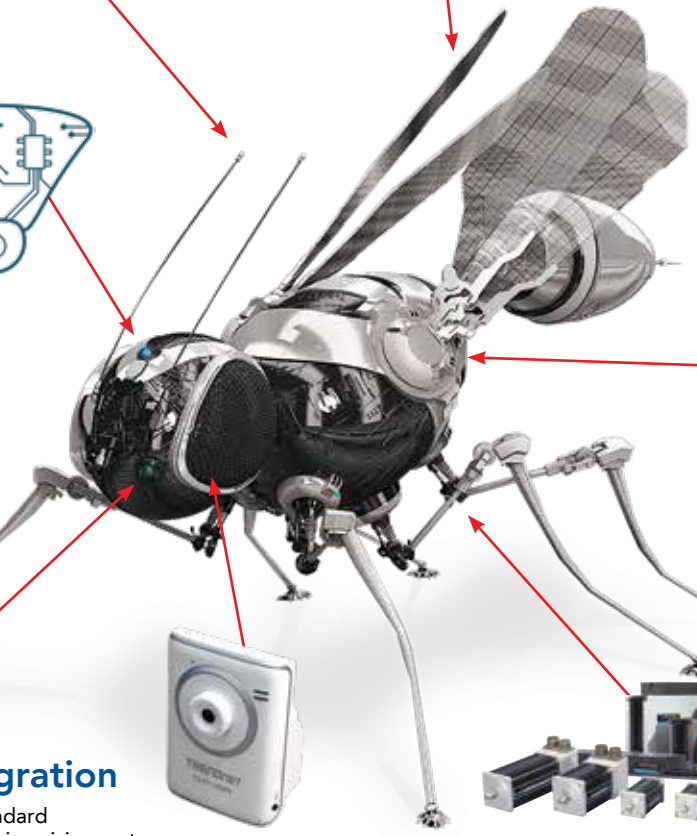
- Create algorithms at the application, motion engine, firmware, or hardware layer
- Flexible control architecture
- Custom kinematics



Custom Automation

- Coordinate motion, PLC, robotics, vision, and communications with one automation control
- Galvo control
- Piezo control
- Integration with process control
- HMI integration





Custom Drives

- Plug-in architecture speeds development of custom algorithms – for example, 2D bar code, interfaces to non-standard sensors, and signal outputs synchronized to servo sample time
- Packaging can be customized for specific form factor and space constraints
- Custom algorithms can be developed at the firmware layer

Custom Software

- Custom operator interfaces
- Custom applications
- Custom software libraries
- Program in nearly any language

Vision Integration

- Interface with standard cameras and machine vision systems
- Registration marks or fiducials can be located and used as a home or reference position
- Vision can be coordinated with servo motion for vision guided robotics

Custom Motor Design

- Custom motors optimized for your specific application at a minimal price
- Customized motor mechanical characteristics including torque/force, length, width, height
- Customized motor electrical characteristics including bus voltage, resistance, inductance, pole pitch, and current
- Custom motors for low-volume projects
- Completely new motor design

We implement with you...

Tuning • Parameters • Optimize Performance • HMI • Write Software

We will work with you onsite or at our facility to meet your machine specifications.

Aerotech personnel will:

- Perform parameter setup and system tuning
- Setup of the Advanced Controls Toolbox to achieve the highest performance possible
- Write motion programs in AeroBasic™
- Write software (.NET, C) by applying our libraries
- Write PLC programs using Ladder, Function Block, or Structured Text
- Product customization
- Product application
- Write/configure HMIs
- Integration with process controller

Benefits include:

- Maximize machine performance
- Minimize machine development time
- Minimize cost

Available Accessories:

Maple Operator Interface

Joystick

Handwheel/ Pendant

Transformers

Power Supplies

Cables

Automation

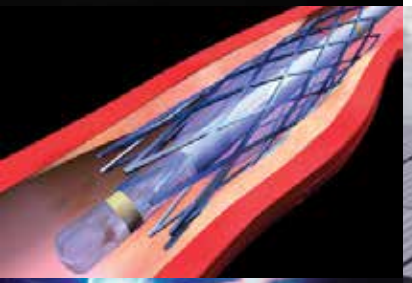
Server

MXH Multiplier Boxes

Line Filters

Panel PC

Markets and Industries



- Laser Processing
- Semiconductor Processing
- Military and Aerospace
- Electronics Manufacturing
- Medical Device Manufacturing
- Test and Inspection
- Machine Tools
- Automotive
- Packaging
- University Research
- Industrial R&D
- Photovoltaic Manufacturing

Aerotech controls and components have become the preferred solution for a variety of applications in a host of industries around the world.

Aerotech Customer Applications

- **Labeling**
- **Web Applications**
- **Case Erectors**

A3200

- Stencil Cutting
- Wire Bonding
- Die Bonding
- Optics Polishing
- Stent Manufacturing
- e-Beam Welding
- EDM
- Drilling and Milling
- Grinding and Polishing
- Waterjet Cutting
- Fuel Injector Drilling
- Fuel Cell Manufacturing
- Crystallography
- Target Tracking
- Beam Steering
- Pipe Thread Measurement

A3200 or Ensemble

- Dispensing (Printed Electronics, Material Dispensing)
- PCB Assembly (Pick and Place of SMT, Through-Hole)
- VIA Drilling
- Wafer Scribing and Singulation (Dicing)
- Die Bonding
- Resistor Trimming
- AOI/X-Ray Inspection
- Chip Testing
- Chip Packaging
- Crystallography
- Flat Panel
- Semiconductor Testing
- Semiconductor Manufacturing
- Photovoltaic Cell Manufacturing
- DNA Analysis
- Image Duplication
- Holographic Writing
- Sensor Testing
- Sensor Manufacturing

Ensemble

- Packaging Machines (Multi-Axis Applications)
- Web Applications
- Printing Applications
- Rollover Unit Testing
- IMU Testing
- ECM
- Marking
- Vertical Form, Fill, and Seal

Soloist

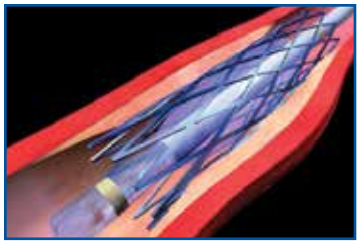
- EDM & ECM
- Packaging Machines (Case Erectors, Labeling Machines, Augers)
- Printing
- Gyro Testing
- Accelerometer Testing
- Optical Polishing (Spindle Axis)
- Beam Steering

Stent and Medical Device Manufacturing

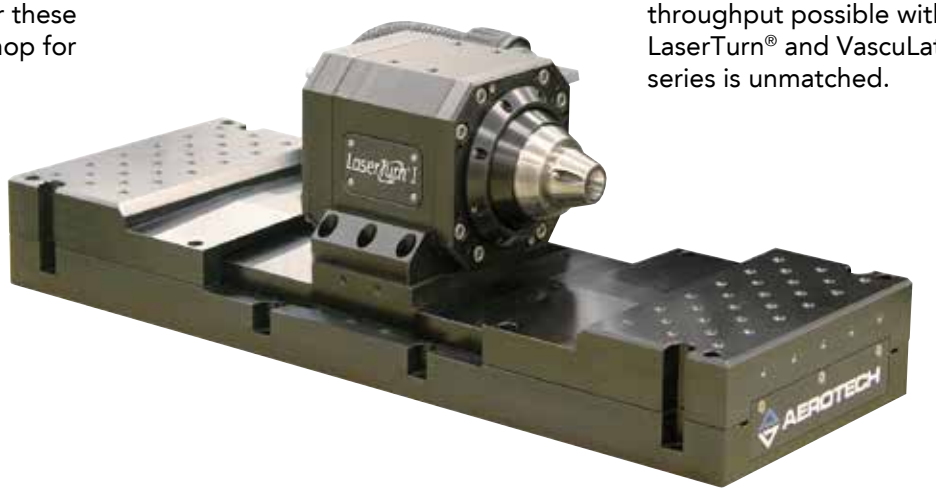
Aerotech's experience in market-specific solutions provides an edge in processes involving photonics, semiconductor processing, medical device manufacturing and laser processing. With a number of specially developed motion platforms for these industries, Aerotech provides a one-stop-shop for your motion requirements.

Controllers to Use:

- A3200



Aerotech's highly successful VascuLathe® and LaserTurn® platforms deliver maximum productivity in a compact, easy to maintain package with the lowest cost of ownership in the industry. With the A3200's PSO functionality, the throughput possible with the LaserTurn® and VascuLathe® series is unmatched.



Solar Panel Scribing

Extensive application experience and a broad array of motion products make Aerotech the perfect partner for your photovoltaic (solar cell) manufacturing or testing platform. Our worldwide operation has engineered and manufactured a multitude of motion platforms for solar cell manufacturing and inspection. These platforms range from small format systems for R&D to full-size production panel processing systems.

Controllers to Use:

- A3200
- Ensemble

- **Laser Cutting**
- **Welding**
- **Wafer Dicing**
- **Solar Panel Scribing**
- **Fuel Injector Drilling**
- **Turbine Blade Inspection**

- Fuel Cell Manufacturing
- 3D Laser Processing
- MRI Machines
- Lab Automation
- Target Tracking
- Optical Testing

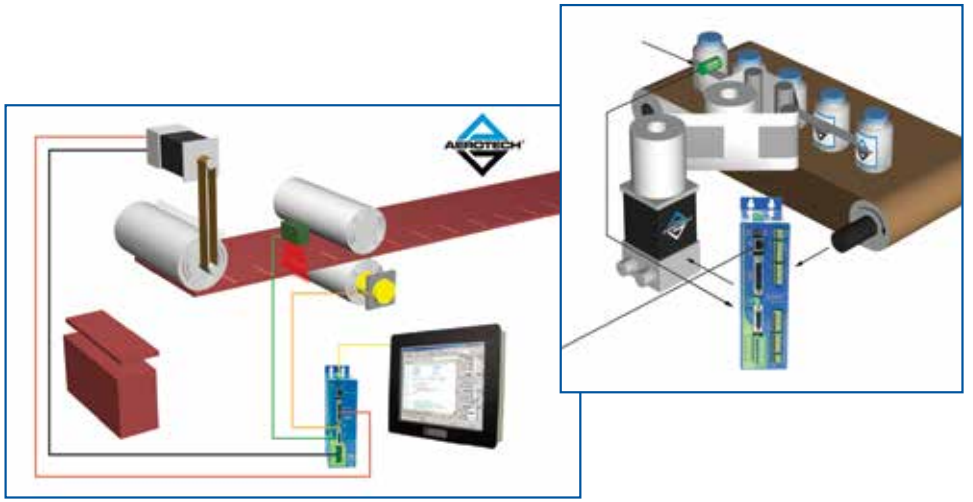
Packaging

Line following applications including:

- Labeling, cut-to-length, fly cutting, lane diversion, rotary knife and many others.

Basic features for line following:

- Auxiliary encoder input for measuring line speed
- High-speed registration for measuring line position
- The relationship between line speed/ position can be an arbitrary function or simply 1-to-1

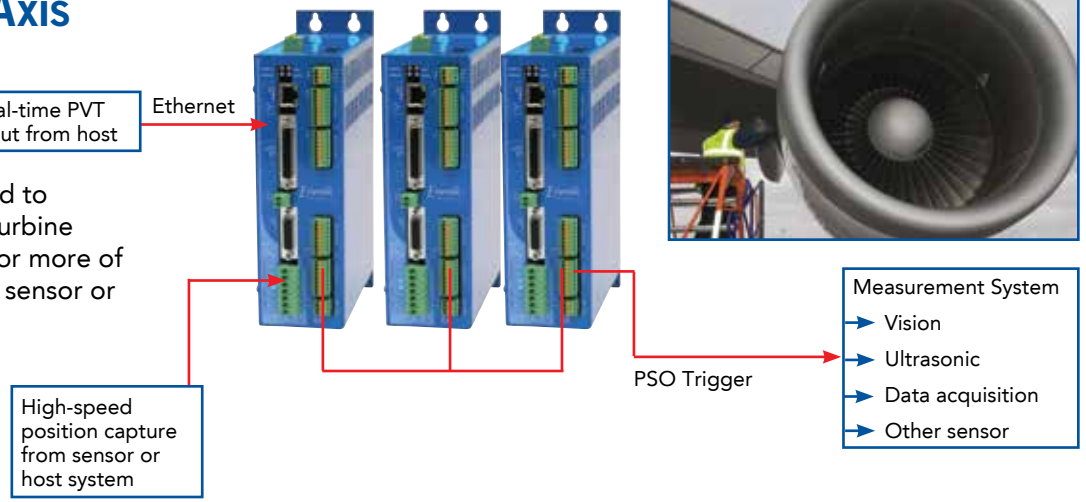


Controllers to Use:

- Soloist
- Ensemble
- A3200

High Accuracy, Multi-Axis Inspection Systems

The A3200 controller is uniquely suited to complex inspection applications like turbine blade inspection that requires 5 axes or more of coordinated motion integrated with a sensor or camera.



Controllers to Use:

- A3200 with linear drives

Optical Mounts and Gimbals

- Directing optics, lasers or antennas
- LOS target tracking
- Precision pointing

Controllers to Use:

- A3200
- Ensemble

Fuel Cell Manufacturing Operations

- Laser machining the membranes (also referred to as MEAs)
- Welding the plates/membranes together
- Stacking the membranes into a cell
- Inspection of the MEAs, plates and cells

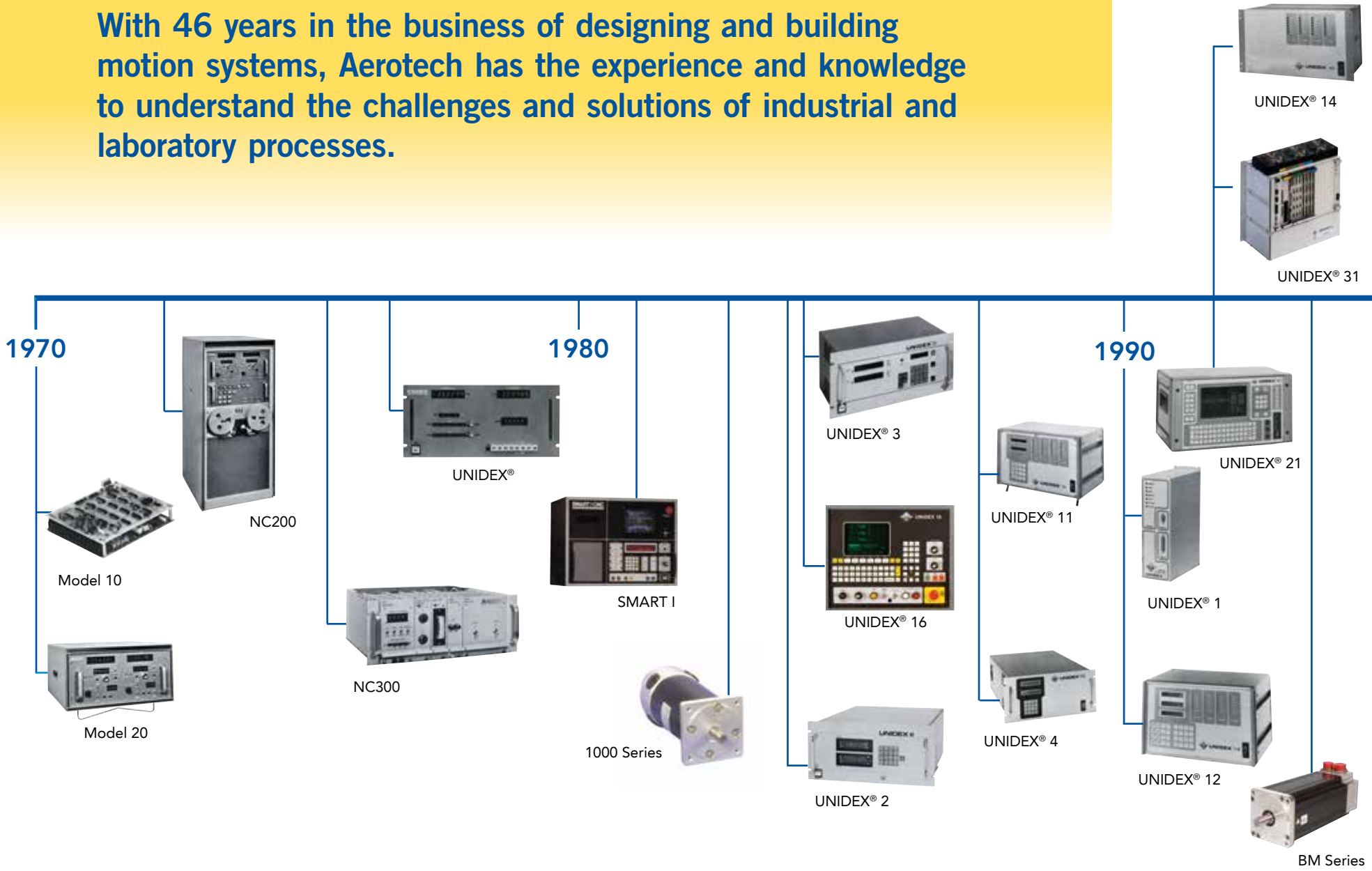
Controllers to Use:

- A3200

- **Gyro Testing**
- **Reticle Inspection**
- **Lithography**
- **Wafer Defect Detection**
- **Thin Film Measurement**
- **Pick and Place**

Controls Timeline

With 46 years in the business of designing and building motion systems, Aerotech has the experience and knowledge to understand the challenges and solutions of industrial and laboratory processes.



PC-Based

UNIDEX® 500

BLM Series

UNIDEX® 600

Integrated Automation
PLC + Motion = MotionPAC

Delta
Robot
Control

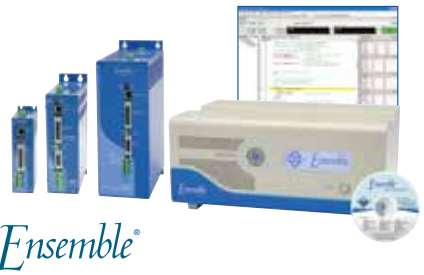
2000

2010

2016

UNIDEX® 400

UNIDEX® 511



Piezo Controls

Hexapod
Control

UNIDEX® 100

BAI

BMS Series

S Series

Stand-Alone

Aerotech has manufactured advanced motion controllers since 1970. From the industry workhorse PCI cards to state-of-the-art software-based control coupled with intelligent networked drives, the science of motion control has been our business for decades.

Worldwide Training and Support

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

Training Program:

- Standard and customized courses
- Hands-on training with Aerotech controllers
- Interactive training with experienced instructors
- Comfortable, spacious facilities
- Online training modules
- Online FAQs
- At customer site or at Aerotech

Installation and Startup (Commissioning)

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

Join.Me.

Aerotech can remotely support your startup, commissioning and debugging of systems over the internet.

Aerotech is an ISO 9001 Registered Company

Aerotech U.S.A.

Aerotech Germany

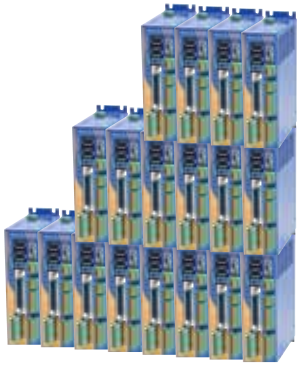
Aerotech United Kingdom

Aerotech Japan

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 to continually improve our products and processes.

High-Volume Manufacturing



Over 100,000 axes installed worldwide

Worldwide Service and Support

Worldwide startup service and on-site training

Fully equipped on-site training facilities

Technically Superior Components

Highest performance brushless linear and rotary motors

ADRT rotary stages

ALS1000 linear motor stage

A3200

Soloist®

Ensemble®

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

High Performance Sub-Assemblies

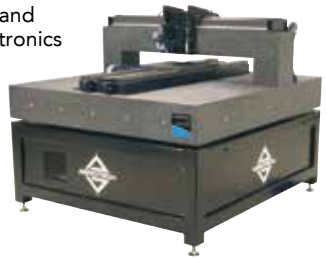
XYAB subsystem for high dynamic accuracy positioning in laser drilling and micromachining applications

HexGen high-load, ultra-precision hexapod provides unmatched performance

Highest throughput linear motor Cartesian gantry systems

Best-in-Class Subsystems

Highly integrated motion subsystems with machine frame, display and packaged electronics



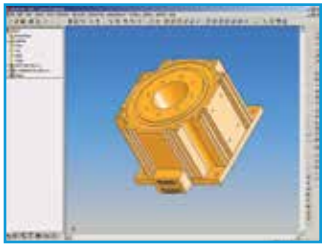
Custom-engineered, vacuum and cleanroom compatible systems

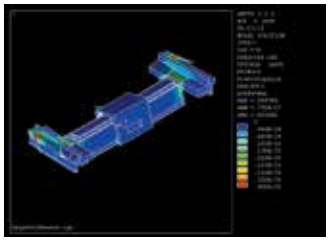
RCP-DELTA robot capable of 15g's of acceleration and up to 200 pick and place operations per minute

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

Aerotech Worldwide

Corporate Headquarters • Pittsburgh, PA • USA

Aerotech UK

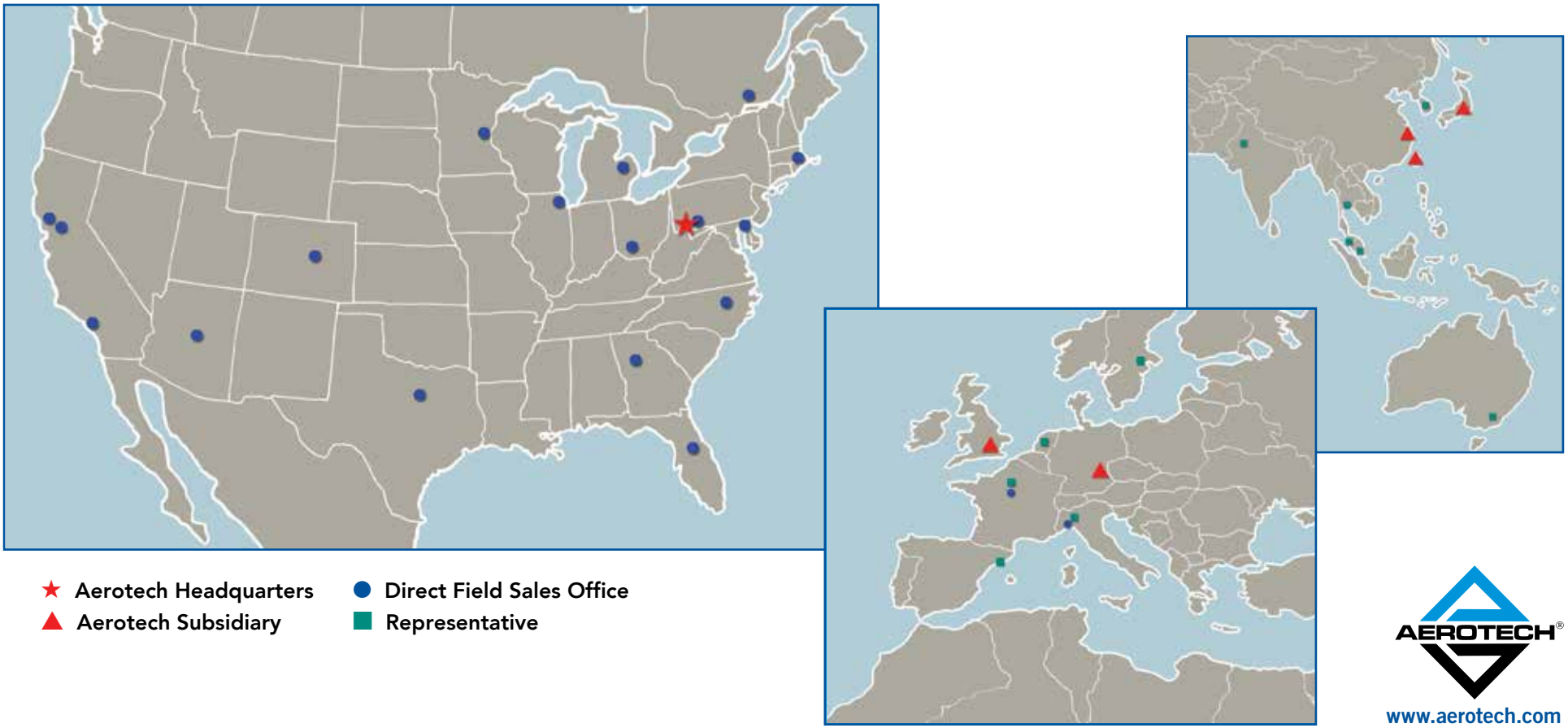
Aerotech Germany

Aerotech Japan

Aerotech China

Aerotech Taiwan

Aerotech Thailand



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

AEROTECH®

www.aerotech.com