

# MOTION DEVELOPMENT KIT (MDK)



DEVELOP

CONTROL

DRIVE

CONNECT

## Better Machines. Built Faster.

Built to be more powerful and simpler to use than its predecessor, the Automation1 Motion Development Kit (MDK) is the most user-friendly interface available for precision motion control. The Automation1 MDK makes it easier than ever to set up a motion control system and implement industry-leading machine control.

## One Development Environment

The Automation1 MDK is your one development environment for precision motion control. Tools like the Machine Setup quick configuration wizard, the modern AeroScript programming language and the Data Visualiser digital oscilloscope come together to set up, program and optimize servo and stepper motors, precision mechatronic devices and galvo scanning systems.

- *Introduces the most user-friendly interface available for precision motion control*
- *Connects and deploys programs to the Automation1 Intelligent Software-based Machine and Motion Controller (iSMC)*
- *Drastically reduces system setup/deployment times*
- *Compiles large programs 50 times faster and develops more advanced programs with new programming language features*
- *Deploys custom user interfaces for Linux computers*
- *Simulates your process before going live*
- *Allows for collaboration with team members*



## INCLUDES

- Studio Application
- Status Utility Application
- Console Application
- Help Files

## STUDIO APPLICATION

The Automation1 studio application is a powerful central command center for configuring, developing and optimizing your motion control system. It includes several application-wide features for interfacing with a controller and connected devices, three dedicated workspaces and many more tools designed to help users succeed.

### *Be More Efficient with New Configure Workspace*

Drastically reduce your system setup/ deployment time — in some cases from days to minutes — thanks to a user-friendly, intuitive interface and machine setup wizard. Quickly enable, home and jog axes with the axis dashboard. Finalize your setup with automatic feedback tuning and EasyTune®, single-button tools that maximize the performance of your motion system.

With Automation1, you can even begin developing your process before hardware arrives. The powerful “virtual axes” feature allows you to prove out your process before you are ready to connect to, or even purchase, real hardware.

### *A Develop Workspace You'll Want to Use*

Developing your process is simple and enjoyable with the Automation1 studio. Use the most powerful, modern integrated development environment (IDE) and programming language in the motion control industry, including features that make your life easier:

- intelligent autocomplete
- line highlighting
- live build checking
- context sensitive help
- new AeroScript programming language

### *Powerful Tools for Complex Tasks*

The visualize workspace contains a powerful digital oscilloscope. Perform complex machine optimizations by looking at multiple signals side-by-side or zeroing in on specific characteristics of your data. Powerful verification, commissioning and optimization tools include debugging tools and variable and I/O watch windows. The data visualizer includes 1D and 2D graphs and can compute Fourier transforms of any signal, allowing you to identify any troublesome frequency content.

## STATUS UTILITY & CONSOLE APPLICATIONS

Further optimize your experience with the Automation1 status utility and console applications. The status utility displays the status of hundreds of data points for each axis of motion, while the console enables a simple, command line interface to the controller.

## SUPPORT AT EVERY STAGE

During your development process and throughout your machine's lifecycle, Aerotech has a team ready to support your needs. Our field sales and application teams become an extension of your design team, even as you are still considering solution options for your system.

When engineering your solution, Aerotech continues to serve as a resource to your team. Leverage our expertise as a design partner or bring us on for a simple consultation. Customers use our system engineering expertise to expand upon their own capabilities.

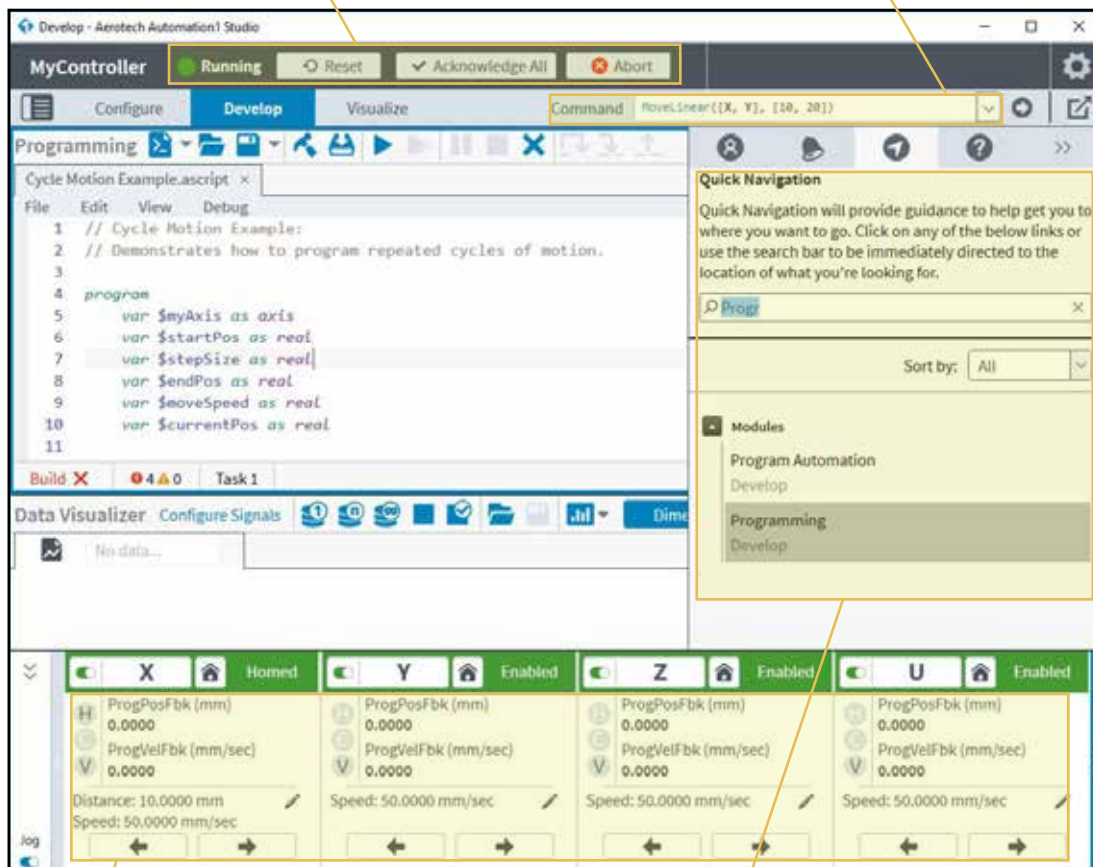
As you build, commission, operate and service your system, Aerotech's global technical support team guides your efforts. We have technology experts ready to optimize your process and develop code for your machine.

## Controller Status

The controller status bar allows you to quickly answer the questions, “Am I connected, to what am I connected, and what is the status of that connection?” It also enables you to reset the controller, acknowledge faults and abort programs that are running on the controller.

## Immediate Commands

The immediate commands interface allows you to send single line commands to be executed on the controller. This functionality is perfect for simple commands, such as asynchronous motion commands, switching programming modes, setting variables and setting I/O.

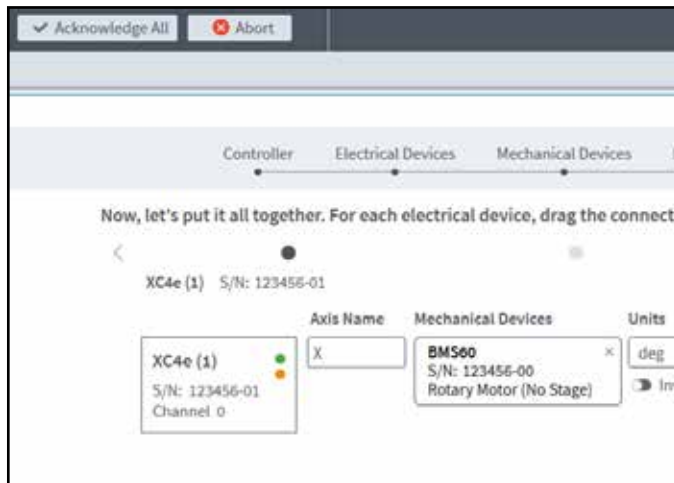


## Axis Dashboard

Quickly enable, home and jog axes from the new axis dashboard. Built with flexibility in mind, the axis dashboard includes a minimized view, a maximized view and a maximized view with jog controls. View up to three data items, selectable per axis, including position, velocity and acceleration command and feedback signals.

## Sidebar

The sidebar is a powerful application feature that makes it easy for you to manage user access and get notified of events that happen on the controller or a connected device. From here, you can quickly jump to specific areas of the application and directly access insightful help documentation.

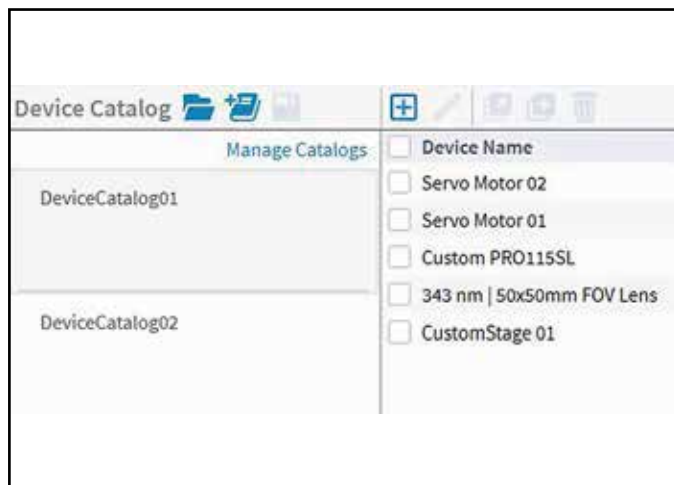
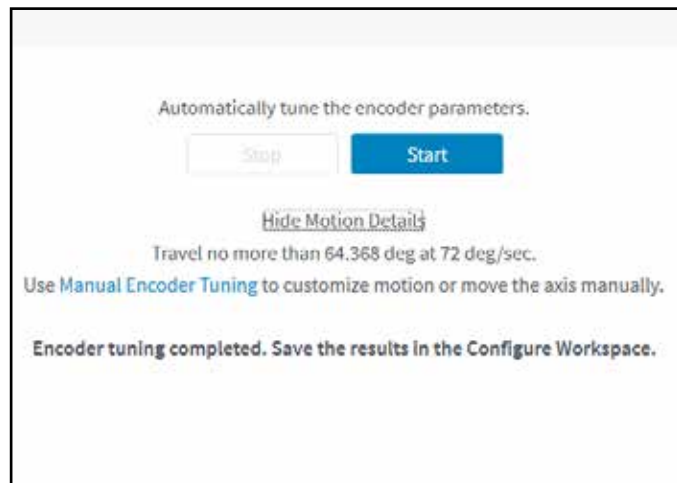


## Machine Setup

Quickly add drive electronics and precision motion control mechanics to your motion control system via the machine setup wizard. When connected via the HyperWire™ bus — Aerotech's newest and fastest fiber-optic communication bus — motor drives are automatically identified and added. Drive firmware is loaded with the click of a button. Then, simply drag and drop your precision mechanical device to the corresponding drive electronics to create an axis that is ready to move.

## EasyTune®

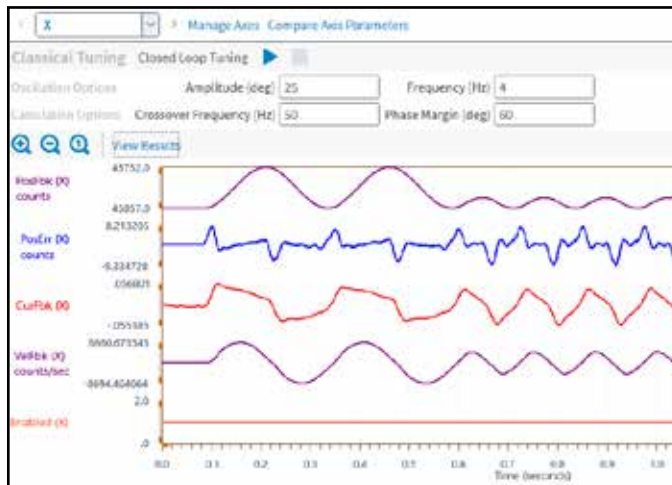
EasyTune® is the most advanced autotuning tool available. Entirely data-driven, the algorithm mimics the process followed by an experienced controls engineer. EasyTune® runs a system identification operation, develops a baseline stabilizing controller, and enables progressively more sophisticated compensation via loop-shaping procedures. This means your system has the highest practical bandwidth in just minutes — and you didn't need to provide any input.



## Device Catalog

Device catalog files contain detailed device descriptions that enable Machine Setup to quickly configure third-party devices. The Studio application's Device Catalog wizard creates and manages these files. Each file contains one or many device profiles of third-party stages, motors and galvo lenses.



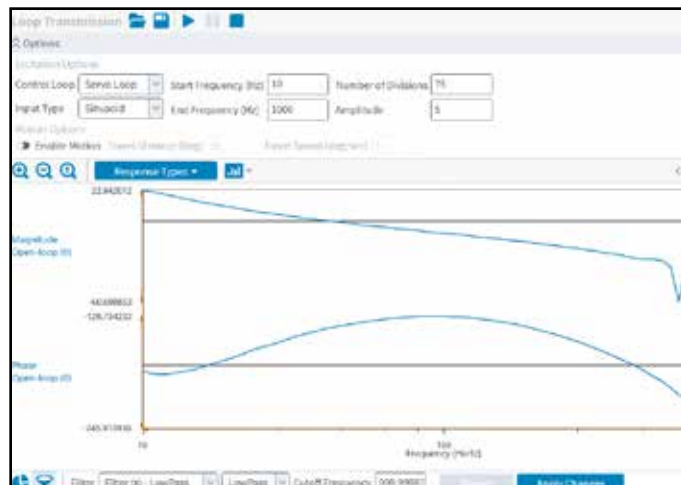


## Classical Tuning

The classical tuning technique involves exciting the axis using a predefined input, measuring the resulting data and calculating a set of servo gains that match a given criteria. The goal of the autotune algorithm is to translate a set of tuning specifications, described by the open-loop crossover frequency and phase margin, into a set of servo gains.

## Frequency Response Tool

The frequency response tool supports several different response types and digital filter types, and it can autofit digital filters. Advanced tools like three different excitation methods, pole-zero plots, quick loop shaping tools and more make it simple to evaluate and optimize complicated systems.



Automation1 Status Utility (0.4.0) - Aerotech, Inc.

Export Settings

Rolling rate: Fast

Diagnosics

Data highlighted in blue has not been updated.

Item	X	Y
Position Feedback	0000000000278	0000000000200
Position Calibration All	0000000000000	0000000000000
Position Master/Slave	0000000000000	0000000000000
Auxiliary Position Feedback	0000000000278	0000000000200
Analog Input 0	0.0000	0.0000
Analog Input 1	0.0000	0.0000
Analog Input 2	0.0000	0.0000
Analog Input 3	0.0000	0.0000
Digital Input 15:0	0000 0000 0000 0000	0000 0000 0000 0000
Digital Input 31:16	0000 0000 0000 0000	0000 0000 0000 0000
Digital Output 15:0	0000 0000 0000 0000	0000 0000 0000 0000
Digital Output 31:16	0000 0000 0000 0000	0000 0000 0000 0000

## Status Utility

This customizable display shows detailed information about each connected Aerotech drive and programming task, including the status of up to 32 axes, all controller tasks and several critical controller status details. Use it to quickly view the status of axis and task faults and controller information – including performance and internal counters – as well as axis homing, enabled controller features, axis I/O, hardware limits, Hall effect sensors and encoder feedback signals. All data can be easily exported to an HTML file.

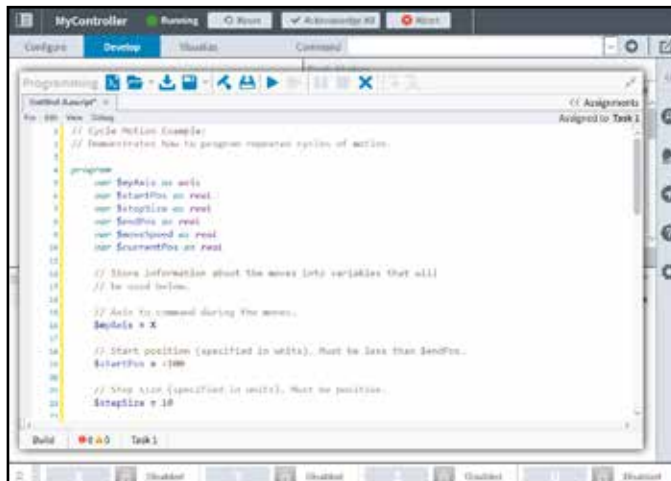
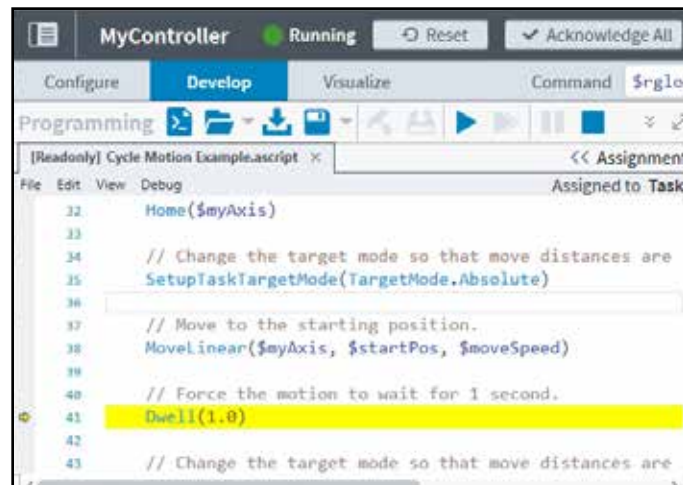


## Powerful Programming

With a modern text editor that delivers meaningful syntax highlighting, intelligent autocomplete and real-time build checking, it's easy for developers to access the right syntax and trust their programming is being developed correctly. Additional features include a single-line command prompt for quickly executing commands and calling known library functions, a variable and I/O watch window and a data visualization tool that's great for prototyping, commissioning and optimizing your application.

## Debug Control

Insert breakpoints, run and pause your program, step into or step over subroutines and toggle breakpoints easily. Debug control conveniently lives next to file controls, and this simplified approach means you can start developing programs very quickly.



## AeroScript Programming Language

AeroScript takes motion control programming to a powerful new level. G-code commands are included by default, allowing trajectories generated by the wide array of computer-aided manufacturing (CAM) post processors to be easily executed on the Automation1 controller. No delineation is required between AeroScript and G-code, so AeroScript's advanced features can be easily integrated with G-code. Users can access many language features and integrate this control with motion.

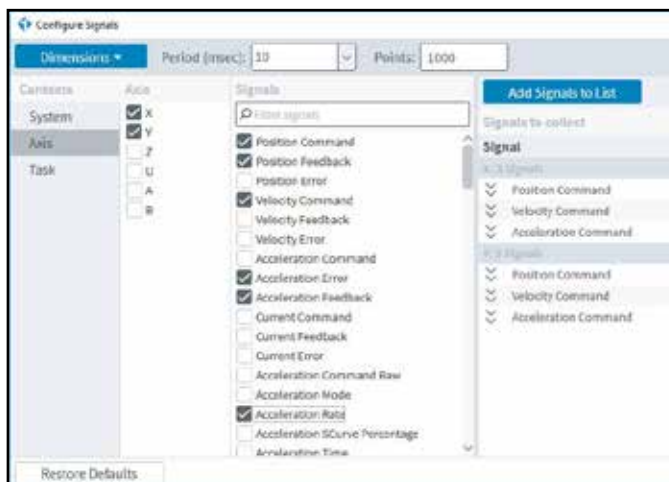
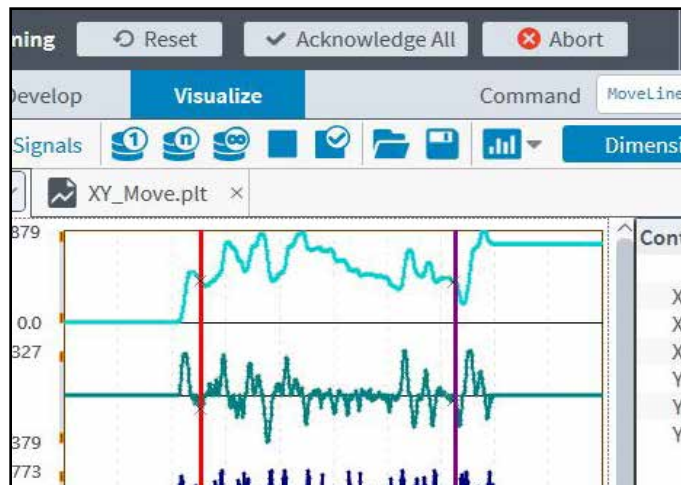


## Visualize Your Data

The Automation1 studio application contains powerful data collection and visualization tools. The data visualizer tool enables process optimization by integrating with your AeroScript programs and programming environment.

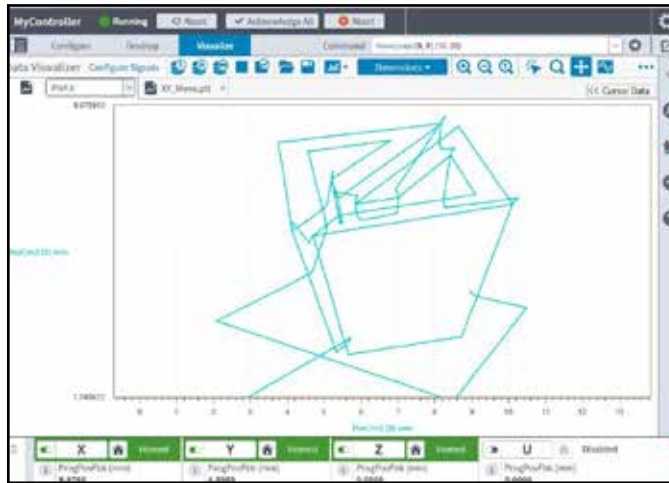
## Control Your Data Collection

Collect single sets, multiple sets or an infinite stream of data that can be viewed directly in the Automation1 Studio application. Save your files and share them with colleagues enabling better collaboration within your team. Enable data collection to be triggered directly by AeroScript programs or manually managed with the data visualizer controls.



## Configure Your Collection

Data collection is quickly configured using the configure signals wizard. Choose from hundreds of available signals. Set up both one and two-dimensional data collection.

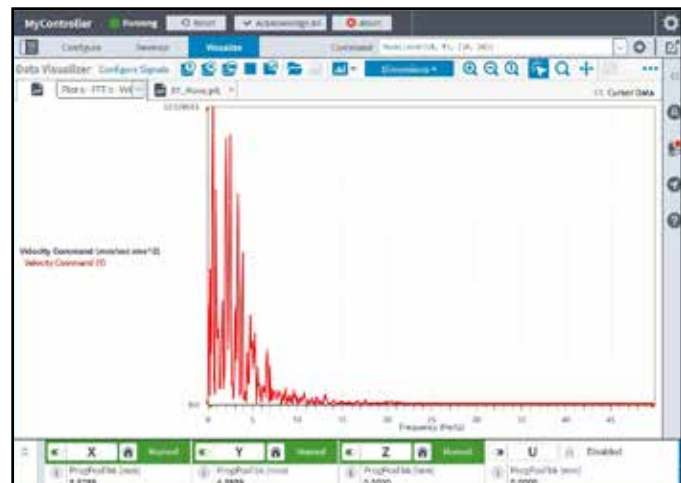


## 2D Plots

View your contoured motion paths by plotting data in two dimensions. The 2D plotting capability enables key features like plotting 2D position commands versus 2D position feedback. This enables quick and easy inspection into actual system performance.

## Frequency Domain Plots

Perform multiple types of Fourier transformations in order to evaluate the frequency content of your data. Looking at frequency content is often helpful for identifying machine oscillations and, in turn, optimizing system performance.



## Built on .NET Core

A powerful .NET API, built on .NET Core, makes Aerotech's controllers flexible enough to handle everything from simple motion to multiple-axes motion coordination and synchronization in your machine.



## STUDIO APPLICATION

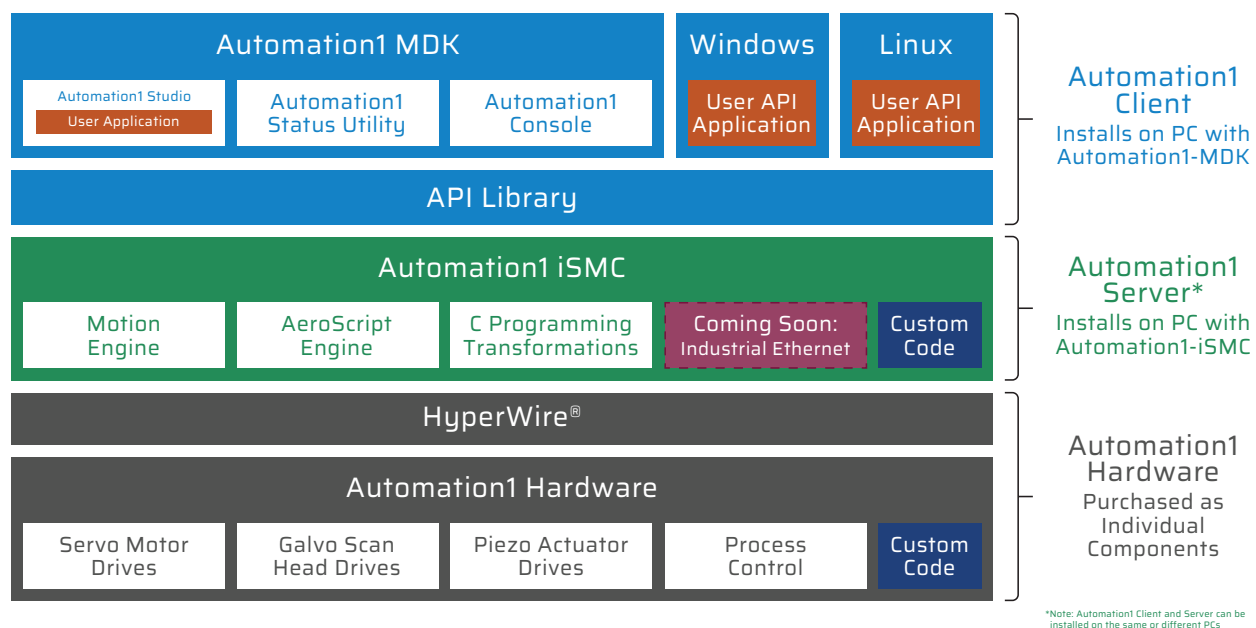
<b>Application</b>	Controller Status Bar	Contains the name of the controller which the Automation1 studio application is connected to and the status of the controller Enables the user to reset the controller, acknowledge faults and abort programs that are running on the controller
	Immediate Command Prompt	Single line command interface that allows users to send single line commands to be executed on the controller
	Multi-Window Display	Push button that opens another instance of the Automation1 studio application such that multiple monitors can be used
	Sidebar	Information finding and management tool that includes user settings, notifications, quick navigation and help
	Axis Dashboard	Axis command center with controls to enable, home and jog individual axes; each axis contains up to three user-selectable data items to display
<b>Configure Workspace</b>	Machine Setup	Motion control system setup wizard that enables setting up all or portions of controller, communication card, servo motor drives and mechanical devices such as precision stages and motors
	Device Catalog	Add and manage third party mechanical devices. Added devices are then made available for quick and simple configuration using Machine Setup. Device include: <ul style="list-style-type: none"> <li>• Direct drive rotary and linear stages</li> <li>• Gear-driven rotary and linear stages</li> <li>• Servo and stepper motors</li> <li>• Galvo lenses</li> </ul>
	Access Control	Control who can connect to the Automation1-iSMC controller. Access Control utilizes Windows groups and users, including the active directory, to quickly deploy added security to your system.
	Controller Files Management	Manage files and folders on the Automation1 controller file system. Transfer files and folders between the Controller and the Windows file systems.
	Manage Axes	Manages each axis name, level or precision and whether or not it is displayed in the application's axis dashboard Lists status items such as a listing of virtual axes and axes which have been set up via machine setup
	Compare Axes Parameters	Allows the parameter sets of two different axes to be compared and for differences to be highlighted
	EasyTune®	One-button tool that automatically tunes and optimizes an axis
	Classical Tuning	One-button tool with target settings that calculates and sets the servo gains on an axis
	Frequency Response	Analyzes the characteristics of the servo loop and the associated mechanical system Measures the response of the servo loop Signals are displayed for magnitude and phase analysis. Includes powerful 'loop shaping' tools that work with the existing data and show a prediction of an updated frequency response (should new servo gains and parameters be applied) Loop shaping tools include: <ul style="list-style-type: none"> <li>• Warnings for data that indicate unstable behavior</li> <li>• Single-button optimization of servo loop gains and digital filters</li> <li>• Single-button assignment of all digital filters</li> <li>• Graphically shifts the predicted open-loop magnitude and phase</li> <li>• Graphical additions of low-pass, notch, lead lag and resonant filters</li> <li>• Direct editing of the digital filters graphical interface</li> <li>• The ability to overlap multiple loop transmission plots</li> </ul>
	Automatic Feedback Tuning	Tunes the feedback device signals to achieve optimum performance; can only be used with sine-wave encoders and resolvers Can also be applied in situations that use dual-loop sine-wave (position and velocity loop) tuning.
	Controller File System Manager	Manages all files located on the connected controller's file system Files can be exported and imported to and from the client PC's native file system
	Manage Tasks	Add, delete and name the tasks that run on the controller
	Compare Task Parameters	Allows the parameter sets of two different tasks to be compared and for differences to be highlighted

STUDIO APPLICATION		
Develop Workspace	Programming Module	Text editor used for developing real-time application code for machine and motion control  Offers full suite of tools to run and debug programs while axes are in both virtual and connected (live) modes  Can be run in virtual mode when axes are setup as virtual or null
	Task Status	Indicates the status of each controller task and the current program line and motion line of a running or paused program
	Variables & I/O	Shows the current value of all global variables and drive I/O on the controller and also on the drive electronics connected to the controller  Allows for adding any global variable or drive I/O item to a list of "favorites," which can help in debugging and optimizing programs
	Program Automation	Automatically runs programs or includes them within other programs; these programs are automatically loaded or run on a specific task when starting or resetting the Automation1 controller
	Data Visualizer	Collects and displays 1D or 2D data; configure signals tool is used to choose which axis, system and task data items are desired to collect and visualize  Includes zoom, dual cursor and panning control  Supports 1D or 2D displays of data and Fourier transforms
	Configure Signals	Configures which signals, to what resolution and how many collected points are desired for display in the data visualizer
Visualize Workspace	Data Visualizer	See above
	Configure Signals	See above
STATUS UTILITY APPLICATION		
Axis Information	Displays the following: <ul style="list-style-type: none"><li>• Axis status information, such as homing and enabled controller features</li><li>• Axis I/O information, including hardware limits, Hall effect sensors and encoder feedback signals</li><li>• Diagnostic and status information for each connected Aerotech drive</li><li>• Detailed information and status concerning each connected Aerotech drive</li><li>• Current axis fault status</li></ul>	
Additional Information	Displays the following: <ul style="list-style-type: none"><li>• Status information about each task</li><li>• Controller information, including performance and internal counters</li><li>• Data collection status</li></ul>	
Customizable Interface	Choose which axes to display and which tasks to display Keep status viewable by choosing the "keep window on top" option	
Export Customized Data	Choose which data you want to export: axes, tasks and/or other Export data directly to an html file	
CONSOLE APPLICATION		
Overview	Advanced command line utility used to automate simple controller operations  Shell out to the console from the command line to perform controller commands  Manually launch the console to issue commands  Supports the ability to run script files so that multiple commands can be issued automatically	

## PC Requirements and Configuration

Please refer to [our website](#) for all information concerning:

- Approved PCs
- Support costs for other PCs
- Recommended PC specifications
- General recommendations



### The Automation1 MDK installed on a client PC

The Automation1 studio application  
 The Automation1 status utility application  
 The Automation1 console application  
 The Automation1 .NET API DLLs and help (.NET API is built on .NET Core)  
 The Automation1 general help files

### The Automation1 iSMC installed on a server PC (client and server PC can be a single PC)

The Automation1 iSMC motion engine  
 The Automation1 iSMC AeroScript engine  
 The Automation1 iSMC C transformation interface (consult factory)  
 Industrial Ethernet support (coming soon)

### The HyperWire® fiber-optic communication bus and Automation1 hardware devices, including

Servo motor drives  
 Galvo scan head drives (coming soon)  
 Piezo nanopositioner drives (coming soon)  
 Process control features on each drive  
 Custom controller and drive firmware code is available (consult factory)

## Automation1 Motion Control Development Kit (MDK) License (Required)

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-L1	Automation1 MDK installation on a single PC
-L2	Adds a paid option to an existing license* **
-L3	Extends the subscription period of an existing license*
-L4	Increases the number of seats of an existing license*
-L5	Provides hard copy media for an existing license*

\*Requires the current License ID.

\*\*Price is based on the new options added. If a subscription extension is required, an -L3 must be processed first.

## Software Subscription

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-S1	1 year subscription to software version upgrades
-S3	3 year subscription to software version upgrades
-S5	5 year subscription to software version upgrades
-S0	1 month subscription to software version upgrades

## Installation Media

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-M1	Installation file downloaded from aerotech.com
-M2	Installation file provided on USB and downloadable from aerotech.com
-M3	Installation file provided on CD and downloadable from aerotech.com

## Version

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-Default	Current version of software
-Legacy	Legacy version of software