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## Motion Development Kit

# Automation1 MDK

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### Complex motion. Simple control.

Built to be more powerful and simpler to use than its predecessor, our Automation1 Motion Development Kit (MDK) is the most user-friendly interface available for precision motion control. It's also your one development environment for precision motion control. Tools like the Machine Setup quick configuration wizard, 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.

### Automation1

The MDK is a part of the user-friendly Automation1 motion control platform, which also includes the following:

- ◆ **Controls**
- ◆ **Motor Drives**
- ◆ **Fiber-Optic HyperWire® Communication Bus**



### KEY FEATURES:

- ◆ Introduces the most **USER-FRIENDLY INTERFACE** available for precision motion control
- ◆ **CONNECTS & DEPLOYS PROGRAMS** to the Automation1 Intelligent Software-based Machine & Motion Controller (iSMC)
- ◆ **REDUCES SYSTEM SETUP/DEPLOYMENT** times—often from days to minutes
- ◆ Compiles large programs 50 times faster & 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

## AUTOMATION1 MDK FEATURES

STUDIO APPLICATION		
Workspace	Module	Functionality
<b>Application Wide (All Workspaces)</b>	Controller Status Bar	Contains the name and status of the controller connected to the Automation1 Studio application. Enables the user to reset the controller, acknowledge faults and abort programs that are running on the controller.
	Settings	Manage application settings and preferences.
	Immediate Command Prompt	Single line command interface that allows users to send single line commands to be executed on a specified controller task.
	Multi-Window Display	Opens another instance of the Automation1 studio application such that multiple monitors can be used.
	Sidebar	Application-wide information and help tool which includes the following sections: <ul style="list-style-type: none"> <li>• Controller - manage controller connection and update device software.</li> <li>• Notifications - see messages, warning, and errors.</li> <li>• Quick Navigation - quickly locate and get to different parts of the application.</li> <li>• Checklist - complete the configuration of each axis defined in Machine Setup.</li> <li>• Help - see contextualized help.</li> </ul>
	Axis Dashboard	Axis command center with controls to enable, home and jog individual axes; each axis contains up to two user-selectable data items to display
<b>Configure</b>	Machine Setup	This software wizard helps to configure the controller, configure electrical and mechanical devices, define axes, and change units of measurements so that your parameters are set up correctly.
	Device Catalog	Create a catalog of mechanical devices and galvo lenses (this is for 3rd party devices as standard Aerotech devices already exist in the application).  Catalogs can contain one or more devices and devices in open catalogs are available for use in Machine Setup. You can also add new catalog devices directly from Machine Setup. You can define the types of mechanical devices that follow in a catalog: <ul style="list-style-type: none"> <li>* Direct Drive Linear Stage</li> <li>* Screw Drive Linear Stage</li> <li>* Direct Drive Rotary Stage</li> <li>* Gear Drive Rotary Stage</li> <li>* Rotary Motor</li> <li>* Galvo Laser Scan Head</li> </ul>
	Manage Axes	A tool that manages each axis's name, its level of precision and whether or not is displayed in the application's Axis Dashboard. Status items such as a listing of virtual axes and axes which have been set up via Machine Setup are listed here.
	Compare Axis Parameters	A tool that allows compares 2 sets of axes parameters and displays all parameters whereas the parameters have different values. These differences can be highlighted.
	Manage Tasks	A tool that manages the number of available tasks and each task's name. If Program Automation is configured on a task or tasks, they will be identified as such here.
	Compare Task Parameters	A tool that allows compares 2 sets of task parameters and displays all parameters whereas the parameters have different values. These differences can be highlighted.
	Automatic Encoder Tuning Helper Module	A one-button tool for adjusting the gains, offsets, and phase of an amplified sine-wave encoder.
	Manual Encoder Tuning Helper Module	An interactive tool for adjusting the gains, offsets, and phase of an amplified sine-wave encoder.
	Gantry Alignment Helper Module	Performs an alignment in order to configure a valid yaw axis (Theta) home offset. (Required to be used prior to using a gantry.)
	Homing Helper Module	An interactive tool for setting up a homing routine for an axis.
	Motor Phasing Helper Module	A one-button tool for automatically detecting and compensating for motor wiring problems.
	EasyTune	A one-button tool that automatically tunes and optimizes an axis.
	Classical Tuning	A multi-functional tuning module that contains both 'Closed Loop Tuning' and 'Manual Servo Tuning' sections. The 'Closed Loop Tuning' section enables exciting the axis using a predefined input, measure the resulting data, and calculate a set of servo gains that match a given criteria. The 'Manual Servo Tuning' section enables manually adjusting the servo loop gains based on data collected during repeated motion and viewing the effects of these adjustments on subsequent motion.

*chart continued on next page*

## AUTOMATION1 MDK FEATURES

STUDIO APPLICATION		
Workspace	Module	Functionality
Configure	Frequency Response	<p>Analyze the characteristics of the servo loop and the associated electro-mechanical system by injecting a digitally-generated disturbance into the Proportional-Integral-Derivative (PID) servo loop and measuring the corresponding response.</p> <p>Twelve (12) different response types are available. It is possible to overlap multiple frequency response plots for visual analysis.</p> <p>A Loop Shaping Toolbar enables shaping of the open-loop frequency response by changing the controller gains and servo loop filters in the loop shaping toolbar. The same predictive loop shaping visual feedback is available for the application of servo loop filters and for Aerotech Enhanced Tracking Control feature.</p> <p>Loop shaping tools include:</p> <ul style="list-style-type: none"> <li>* Warnings for data that indicate unstable behavior.</li> <li>* Autofitting of digital filters.</li> <li>* Auto application of Enhanced Tracking Control (ETC) gains.</li> <li>* Graphically shifting the predicted open-loop magnitude and phase.</li> <li>* Graphical LowPass, Notch, LeadLag, and Resonant filters.</li> <li>* Direct editing of the digital filters graphical interface.</li> </ul> <p>Stability Metrics are available in order to see how stable the controller is. These metrics include Phase Margin, Magnitude Crossover Frequency, Gain Margin, and the Sensitivity Peak. Frequency response plot can be saved in their native format or as a CSV (comma separated value) file.</p>
	Programming	<p>A 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. Create, save, open, edit, compile, run, and debug AeroScript program files on the controller file system. Create and compile AeroScript library files.</p> <p>Features include:</p> <ul style="list-style-type: none"> <li>* AeroScript syntax highlighting</li> <li>* Intelligent autocomplete</li> <li>* Task assignments</li> <li>* Code snippets</li> <li>* Real-time build error checking</li> <li>* Build, load, and run programs on controller tasks.</li> <li>* Debugging tools such as Run, Stop, Step Over, Step Into, Step Out and breakpoints.</li> </ul>
	Variables & I/O	<p>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.</p> <p>Allows for adding any global variable or drive I/O item to a list of "favorites," which can help in debugging and optimizing programs</p>
	Task Status	<p>Indicates the status of each controller task and the current program line and motion line of a running or paused program</p>
	Program Automation	<p>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</p> <p>Use Program Automation to:</p> <ul style="list-style-type: none"> <li>* Automatically run AeroScript programs.</li> <li>* Automatically load compiled AeroScript programs on the controller.</li> <li>* Automatically load compiled AeroScript libraries on the controller.</li> <li>* Automatically import compiled AeroScript libraries when compiling AeroScript programs.</li> <li>* Automatically include AeroScript files when compiling AeroScript programs.</li> </ul>
	Data Visualizer	<p>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</p> <p>Includes zoom, dual cursor and panning control</p> <p>Supports 1D, 2D, combined 1D/2D and Fourier transforms data displays.</p>
	Signal Collection Configuration	<p>Configures which signals, to what resolution and how many collected points are desired for display in the data visualizer</p>
Visualize	Data Visualizer	See above
	Signal Collection Configuration	See above

## AUTOMATION1 MDK FEATURES

STATUS UTILITY APPLICATION	
<b>Axis Information</b>	<p>Displays the following:</p> <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>
<b>Additional Information</b>	<p>Displays the following:</p> <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>
<b>Customizable Interface</b>	<p>Choose which axes to display and which tasks to display</p> <p>Keep status viewable by choosing the “keep window on top” option</p>
<b>Export Customized Data</b>	<p>Choose which data you want to export: axes, tasks and/or other</p> <p>Export data directly to an html file</p>
CONSOLE APPLICATION	
<b>Overview</b>	<p>Advanced command line utility used to automate simple controller operations</p> <p>Shell out to the console from the command line to perform controller commands</p> <p>Manually launch the console to issue commands</p> <p>Supports the ability to run script files so that multiple commands can be issued automatically</p>



## AUTOMATION1 MDK ORDERING OPTIONS

### 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

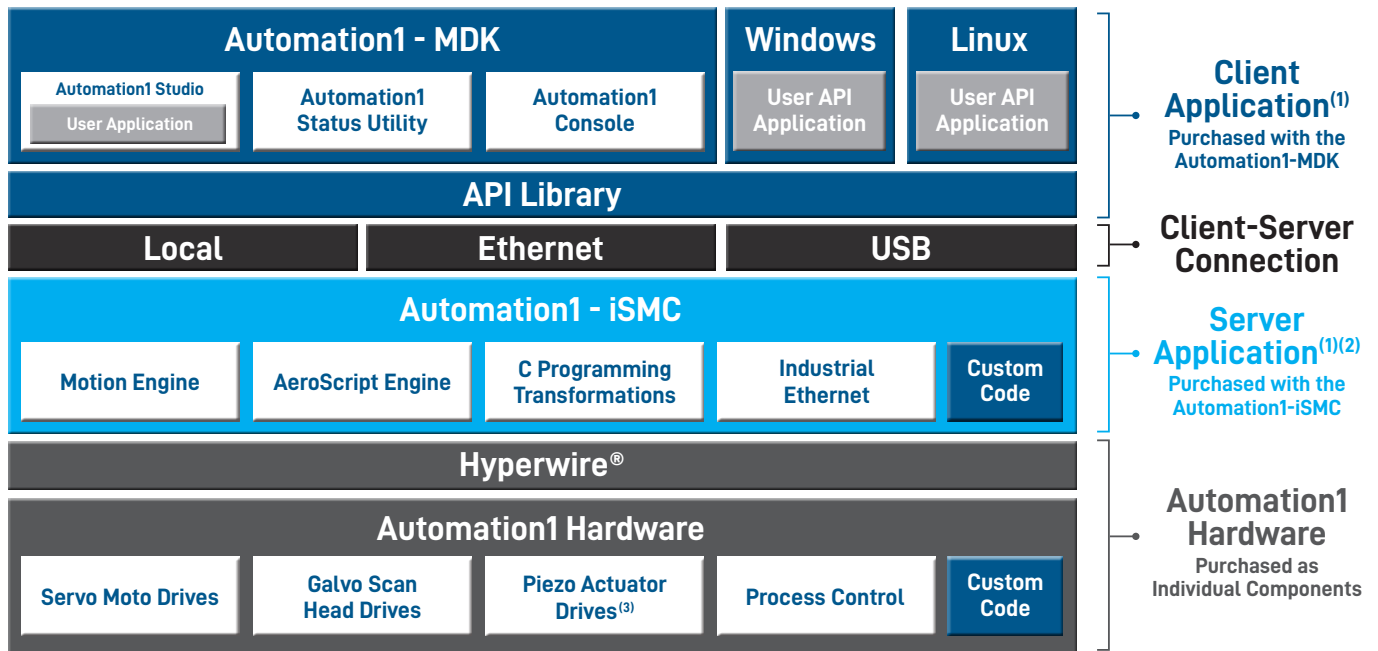
### Version

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



## AUTOMATION1 PLATFORM ARCHITECTURE



1. Automation1 client and server applications can be installed on the same or on different PCs.
2. The Automation1 server application (i.e. the controller) can be installed on a PC-based or a drive-based hardware platform.
3. In development. Not yet available.

### The Automation1 MDK includes:

Studio application  
 Status Utility application  
 Console application  
 .NET API DLLs (built on .NET Core)  
 C API DLLs  
 Help Files

### The Automation1 iSMC includes:

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

### The HyperWire<sup>®</sup> fiber-optic communication bus and Automation1 hardware devices, including:

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