Motion Development Kit

Automation1 MDK

Complex motion. Simple control.

Built for power and ease of use, the Automation1 Motion Development Kit (MDK) is the most user-friendly interface available for industry-leading precision motion control. Drastically reduce your system setup and deployment time—in some cases from days to minutes.

Tools like the Machine Setup wizard, MachineApps HMI builder, modern AeroScript™ programming language and a digital oscilloscope enable you to set up, program and optimize servo and stepper motors, precision stages, galvo scanning systems and more in one development environment.

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
- **MACHINEAPPS HMI BUILDER** quickly generates user interfaces
- **ALLOWS FOR COLLABORATION** with team members

AUTOMATION1 MDK FEATURES

STUDIO APPLICATION		
Workspace	**Module**	**Functionality**
Application Wide (All Workspaces)	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: • Controller - manage controller connection and update device software. • Notifications - see messages, warning, and errors. • Quick Navigation - quickly locate and get to different parts of the application. • Quick Compare - compare MCD configuration files or axes/tasks within a single MCD file. • Checklist - complete the configuration of each axis defined in Machine Setup. • Help - see contextualized help.
	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
Configure	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: * Direct Drive Linear Stage * Screw Drive Linear Stage * Direct Drive Rotary Stage * Gear Drive Rotary Stage * Rotary Motor (No Stage) * Gantry * Galvo Laser Scan Head * Galvo Lens
	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.
	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 indentified as such here.
	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.
	Motor Hall & Signal Status	An interactive tool for ensuring the controller is correctly reporting the status of different key inputs that characterize the interaction between the servo motor drive and the motor.
	Absolute Encoder Alignment	An interactive tool for automatically determining the Commutation Offset for axes that use absolute encoder feedback for commutation.

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AUTOMATION1 MDK FEATURES

STUDIO APPLICATION		
Workspace	**Module**	**Functionality**
Configure	Command Shaping Calculator	An interactive calculator for quickly calculating the required Command Shaping coefficients.
	EasyTune	A one-button tool that automatically tunes and optimizes an axis. Optionally, select the performance target you want for your axis tuning as “Conservative,” “Normal,” or “Aggressive.” Custom EasyTune® recipes are available upon request to tune complex multi-axis systems.
	Classical Tuning	A multi-functional tuning module contains “Closed Loop Tuning,” “Manual Servo Tuning,” and “Open Loop Tuning” sections. The “Closed Loop Tuning” section enables exciting the axis using a predefined input, measuring the resulting data and calculating 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. The “Open Loop Tuning” section moves the selected axis by injecting open-loop current into the axis when it is not under closed-loop control. This tool automatically measures the motion that occurred and calculates a set of servo gains based on the information that you specified..
	Frequency Response	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. Twelve (12) different response types are available. It is possible to overlap multiple frequecy response plots for visual analysis. 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. Loop shaping tools include: * Warnings for data that indicate unstable behavior. * Autofitting of digital filters. * Auto application of Enhanced Tracking Control (ETC) gains. * Graphically shifting the predicted open-loop magnitude and phase. * Graphical LowPass, Notch, LeadLag, and Resonant filters. * Direct editing of the digital filters graphical interface. 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.
Develop	Programming	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. Features include: * AeroScript syntax highlighting * Intelligent autocomplete * Task assignments * Code snippets * Real-time build error checking * Build, load, and run programs on controller tasks. * Debugging tools such as Run, Stop, Step Over, Step Into, Step Out and breakpoints. * View Task Status and Errors * View Message Log
	Variables & I/O	Shows the current value of all global variables and drive I/O on the controller and 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. Add, edit and manage Industrial Ethernet connections and configurations including adding Industrial Ethernet I/O points to “Favorites.”
	Task Status	Indicates the status of each controller task and the current program line and motion line of a running or paused program

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AUTOMATION1 MDK FEATURES

STUDIO APPLICATION		
Workspace	**Module**	**Functionality**
	Task Status	Indicates the status of each controller task and the current program line and motion line of a running or paused program
	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 Use Program Automation to: * Automatically run AeroScript programs. * Automatically load compiled AeroScript programs on the controller. * Automatically load compiled AeroScript libraries on the controller. * Automatically import compiled AeroScript libraries when compiling AeroScript programs. * Automatically include AeroScript files when compiling AeroScript programs.
	Data Visualizer	Collects and displays user configurable 1D, 2D, and 3D data from axis, task, and system signals. Includes zoom, dual cursor, and panning control. Supports 1D, 2D, 3D, surface and Fourier transform plots.
	Signal Collection Configuration	Configures which signals, to what resolution and how many collected points are desired for display in the data visualizer
Visualize	Data Visualizer	See above
	Signal Collection Configuration	See above

AUTOMATION1 MDK FEATURES

STATUS UTILITY APPLICATION	
Axis Information	Displays the following: • Axis status information, such as homing and enabled controller features • Axis I/O information, including hardware limits, Hall effect sensors and encoder feedback signals • Diagnostic and status information for each connected Aerotech drive • Detailed information and status concerning each connected Aerotech drive • Current axis fault status
Additional Information	Displays the following: • Status information about each task • Controller information, including performance and internal counters • Data collection status
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

License (Required)

-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.*

MachineApps (Required)

-MA0	No MachineApps workspace
-MA1	MachineApps Workspace HMI development tool

LabVIEW (Required)

-LV0	No LabVIEW VIs
-LV1	LabVIEW VIs for Automation1-iSMC controller

Software Subscription (Required)

-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 (Required)

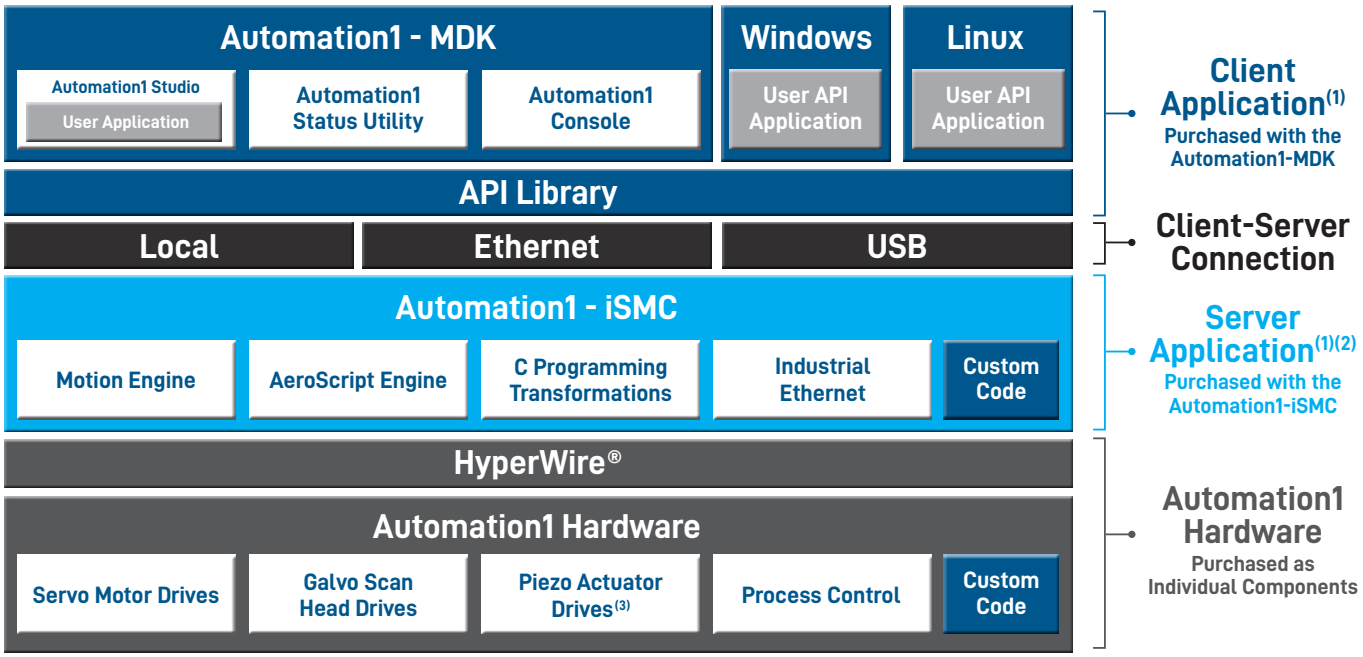
-M1	Installation file downloaded from aerotech.com*
-M2	Installation file provided on USB and downloadable from aerotech.com
-M3	Installation file provided on CD and downloadable from aerotech.com

**Installation files are available for download while the software substription is active.*

Version (Required)

-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
Python 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® 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)