

AEROTECH AUTOMATION

Intelligent Software-Based Motion Controller **Automation1 iSMC**

Get Moving Faster

The Automation1 Software-Based Machine Controller (iSMC) tightly integrates precision motion with process control. Whether you're programming a simple move, building a complete machine or doing something in between, the Automation1 iSMC delivers high-quality automation and improved throughput.

Because the iSMC integrates with our user-friendly Automation1 Motion Development Kit, you'll quickly configure and develop your application.

Capable of running a PC-based or drive-based hardware platform, the iSMC allows you flexibility in deploying a wide variety of motion control solutions.

Automation1

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

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



KEY FEATURES:

- ◆ Deploy powerful machine & motion control to either a **PC-BASED OR DRIVE-BASED** hardware platform with the same Automation1 Motion Development Kit (MDK)
- ◆ Connects to servo motor drives, galvo scan head controllers & more over our **HYPERWIRE® FIBER-OPTIC MOTION BUS**
- ◆ Programmable via modern **AEROSCRIPT PROGRAMMING LANGUAGE** or several controller APIs
- ◆ Enjoy **COMPLEX MOTION CONTROL MADE EASY** with a wide array of standard features & development tools

AUTOMATION1 iSMC SPECIFICATIONS

SPECIFICATION	AUTOMATION1 PC-BASED CONTROLLER	AUTOMATION1 DRIVE-BASED CONTROLLER
Programmable Coordinated Motion Trajectories	32 Axes	12 Axes
Programming Tasks	See Controller Plus option specs below.	See Controller Plus option specs below.
Communication/ Configuration Connection	Local PC Ethernet	Ethernet USB
Controller File System	Yes, memory depends upon PC.	Yes, 5 GB
Position Modes	Absolute, incremental, dynamic trajectory correction	
RS-274 G-Code Support	Automation1 includes RS-274 standard G-code motion, including linear, circular, helical and spherical interpolation; cutter radius compensation; normalcy; parts rotation; mirroring; path retrace; polar transformations and cylindrical transformations; and scaling.	
Coordinated Motion Types	<p>Coordinated Synchronous Motion Coordinated motion refers to moves that follow a well-defined path in space. Coordinated moves start and stop axes at the same time. They can execute in velocity profiling mode.</p> <ul style="list-style-type: none"> • Linear motion • Clockwise and counterclockwise 	
Independent Motion Types	<p>Non-Coordinated Synchronous Motion Non-coordinated motion refers to moves in which axes start at the same time but do not necessarily end at the same time. Each axis moves at its own velocity specified in the command or by axis parameters. Program execution does not continue to the next line until all axes in the move command have completed motion.</p> <p>Homing Multiple procedures are available to establish the home position of an axis:</p> <ul style="list-style-type: none"> • Home past limit switch to home marker • Home to limit switch and reverse to home marker • Home to home marker • Home to limit switch • Home at current position and set to zero • Home at current position and set to nonzero • Home at current position and set to absolute position <p>MoveRapid Command Generates single or multi-axis point-to-point motion</p> <p>Asynchronous Motion Asynchronous motion commands cause program execution to continue on to the next program block immediately after the move starts. The controller does not wait for the move to end before continuing to the next command.</p> <ul style="list-style-type: none"> • Home an axis without waiting for completion • Free run an axis at the specified velocity • Move to an absolute position • Move incrementally • Move an axis out of a limit condition • Move an axis into a limit condition 	

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AUTOMATION1 iSMC SPECIFICATIONS

SPECIFICATION	AUTOMATION1 PC-BASED CONTROLLER	AUTOMATION1 DRIVE-BASED CONTROLLER
Point-by-Point Motion Types	<p>Time-point (PT) and Vectoral Time-Point Motion (PVT)</p> <p>MovePT and MovePVT commands do not behave like the other synchronous or asynchronous motion commands. After these command are processed, the program immediately executes the next line in the program, much like an asynchronous motion command. However, unlike an asynchronous motion command, these motion commands are buffered and executed one after another. If a stream of MovePT or MovePVT commands is executed sequentially, it is possible to fill this buffer. If the buffer is full, subsequent MovePT or MovePVT commands wait on the line until buffer space becomes available. MovePT and MovePVT commands normally blocks the task.</p>	
Acceleration Profiles	<p>Acceleration Types</p> <ul style="list-style-type: none"> • Linear-constant acceleration applied, resulting in linear velocity profile • Sine (sinusoidal half-sine)-parabolic acceleration applied, resulting in a sine wave velocity profile • S-curve-trapezoidal acceleration applied, resulting in an “s-curve” velocity profile <p>Acceleration Modes</p> <ul style="list-style-type: none"> • Time based - axis acceleration takes place over a specified time • Rate based - axis acceleration takes place at a specified rate 	
Velocity Profiling	<p>Blend multiple, coordinated motion commands into one continuous motion path. In velocity profiling mode, the controller does not decelerate to zero between consecutive, coordinated moves. Velocity can be changed during the move sequence. The axes will increase or decrease in speed in a coordinated way to maintain the programming path.</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;"> <p>Without velocity profiling</p> </div> <div style="text-align: center;"> <p>With velocity profiling</p> </div> </div>	
Lookahead Mode	<p>Lookahead Synchronization</p> <p>For some advanced motion features, the controller must execute the program before it causes the motion so that it can precalculate the moves and speeds. This operation is called lookahead. These advanced motion features make lookahead active:</p> <ul style="list-style-type: none"> • Velocity Blending • Cutter Radius Compensation • Corner Rounding <p>Function Synchronization During Lookahead</p> <p>Some AeroScript functions are always synchronized to motion. These functions are synchronized when lookahead is active or not active. Many other functions that are not natively synchronized with motion can be made to be synchronized with motion, even when lookahead mode is enabled.</p>	
Advanced Features	<ul style="list-style-type: none"> • Camming Motion • Corner rounding • Tool normalcy control • Cutter compensation • Programmable fixture offsets • Part profile rotation • Part profile scaling • Polar & cylindrical transformations 	<ul style="list-style-type: none"> • Orthogonality correction • Electronic gearing • EasyTune® & classical tuning • Backlash compensation • Spindle motion • High-speed registration • Multi-dimensional error mapping

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AUTOMATION1 iSMC SPECIFICATIONS

SPECIFICATION	AUTOMATION1 PC-BASED CONTROLLER	AUTOMATION1 DRIVE-BASED CONTROLLER
Access Control	Control who can connect to the Automation1 controller or deploy specific MachineApps. Access Control uses Windows groups and users, including the active directory, to quickly deploy added security to your system.	Control who can connect to the Automation1 controller or deploy specific MachineApps. Access Control uses admin defined access groups with an encrypted local directory to securely deploy and manage the security settings on your system.
Secure Communication	Connect to your controller over your local area network with confidence. Automation1-MDK and Automation1-iSMC. Studio, MachineApps and Status Utility now use TLS to securely connect to controllers. Controllers have a unique digital certificate that you can manage by using the Automation1 Console.	Connect to your drive-based controller over your local area network with confidence. Automation1 drive-based controllers use unique digital certificates with TLS to connect to your controller while protecting your IP.
Controller Files	The Automation1 Controller has a local file system. Part programs, program automation files, calibration files and more are stored locally on the controller and managed via the Studio application. In addition, you can access the Windows file system.	
Safe Zones	<p>The Safe Zone feature is a protective mechanism that safely decelerates axes before they move through user-defined boundaries. You can specify these boundaries on two or more axes to make a "safe zone", which can be visualized as an n-dimensional space.</p> <ul style="list-style-type: none"> • Typical dimensions: 1, 2 or 3 • Maximum dimension: 32 • Maximum number of safe zones: 32 • Boundary action: When motion approaches the boundary of an area that is not permitted, the motion decelerates smoothly and stops one count before it reaches the boundary. 	
Controller Programming	<ul style="list-style-type: none"> • AeroScript • RS-274 G-code 	
APIs	<ul style="list-style-type: none"> • .NET (cross-platform Linux support) • C (cross-platform Linux support) • Python (cross-platform Linux support) • LabVIEW • EPICS (cross-platform Linux support) see EPICS & TANGO Drivers – Aerotech US • TANGO; see EPICS & TANGO Drivers – Aerotech US 	
Motion Bus	HyperWire	
Ethernet Communication⁽¹⁾	Socket (standard, TCP client and TCP server)	
Supported HyperWire Drives	<p>Servo Motor Drives</p> Automation1-XC6e Automation1-XC4e Automation1-XC2e Automation1-XC4 Automation1-XC2 Automation1-XA4 Automation1-XR3 Automation1-XL5e Automation1-XL2e Automation1-SI4 Automation1-XI4 Automation1-HXA4 <p>Laser Scan Head Drives</p> Automation1-GL4 Automation1-XL4s Automation1-GI4	<p>Servo Motor Drives</p> Automation1-XC6e Automation1-XC4e Automation1-XC2e Automation1-XC4 Automation1-XC2 Automation1-XA4 Automation1-XR3 Automation1-XL5e Automation1-XL2e Automation1-SI4 Automation1-XI4 Automation1-HXA4
Supported Trajectory Rates	100 kHz, laser scan head drives 20 kHz, servo motor drives	20 kHz, servo motor drives

1. Socket interface can be used concurrently with industrial ethernet.

CONTROLLER PLUS

SPECIFICATION	AUTOMATION1 PC-BASED CONTROLLER	AUTOMATION1 DRIVE-BASED CONTROLLER
-CP0	4 User Tasks (with -CP0 option) 1 Reserved task 1 Modbus Server Connection 1 Modbus Follower Connection	4 User Tasks (with -CP0 option) 1 Reserved task 1 Modbus Server Connection* 1 Modbus Follower Connection*
-CP1	31 User Tasks (with -CP1 option) 1 Reserved task 1 Modbus Server Connection 16 Modbus Follower Connections	9 User Tasks (with -CP1 option) 1 Reserved task 1 Modbus Server Connection* 16 Modbus Follower Connections*

*Drive-based controllers must be configured with industrial ethernet ports to use Modbus.

AEROSCRIPT PLUS OPTION (-AP1)

SPECIFICATION	DESCRIPTION
AeroScript Plus	Add the ability for the controller to load and execute 'AeroScript Plus' files. AeroScript Plus files are compiled AeroScript program files, created by Aerotech, which contain advanced functionality for targeted application spaces. These files are purchased using the separate AeroScriptPlus configurator. Please contact your sales representative for more information.
AeroScriptPlus Files	<ul style="list-style-type: none"> • Optical Alignment Routines • Five (5) Axis Tool Center Point Programming • Drill Optimizer - Laser Drilling Optimization

DYNAMIC CONTROLS TOOLBOX OPTION (-DCT1)

SPECIFICATION	DESCRIPTION
Cross-Axis Feedforward	A controller-level algorithm that minimizes off axis position errors.
Command Shaping	An advanced feature that removes move-induced vibrations that occur in lightly-damped mechanical structures.
Harmonic Cancellation	A set of controller-level algorithms that are designed to improve performance by reducing the tracking error to sinusoidal reference commands, motor force ripple or other position-dependent disturbances, and cross-axis disturbances such as that created in a linear axis by an unbalanced rotational axis.
Gain Shaping (pending)	*Pending DCT features. Not yet available.

INDUSTRIAL ETHERNET OPTIONS

SPECIFICATION	AUTOMATION1 PC-BASED CONTROLLER	AUTOMATION1 DRIVE-BASED CONTROLLER
-IE1	Modbus TCP Server/Client Support on the Automation1-iSMC.* The number of available Modbus client connections depends on the Controller Plus ordering option.	
-IE2	n/a	EtherCAT SubDevice support on the Automation1-iSMC*
-IE3	EtherNet/IP Adapter support on the Automation1-iSMC*	

*Drive-based controllers must be configured with industrial ethernet ports to use Modbus, EtherCAT or EtherNet/IP.

AUTOMATION1 iSMC ORDERING OPTIONS

License

- L1 Automation1 iSMC installation on a single PC
- L2 Adds a paid option to an existing license* **
- L3 Extends the subscription period for an existing license*
- L4 Increases the number of seats for 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.

Hardware Platform

- iPC Controller to be installed on a Windows PC
- iXC6e Controller to be installed on an Automation1-iXC6e
- iXC4e Controller to be installed on an Automation1-iXC4e
- iXC4 Controller to be installed on an Automation1-iXC4
- iXC2e Controller to be installed on an Automation1-iXC2e
- iXC2 Controller to be installed on an Automation1-iXC2
- iXA4 Controller to be installed on an Automation1-iXA4
- iXL5e Controller to be installed on an Automation1-iXL5e
- iXR3 Controller to be installed on an Automation1-iXR3
- iXI4 Controller to be installed on an Automation1-iXI4
- iHXA4 Controller to be installed on an Automation1-iHXA4

Controller Plus

- CP0 Base controller (four user tasks, one reserved task)
- CP1 Controller plus option (31 user tasks, one reserved task)*

*9 user tasks, one reserved task on drive-based controllers

HyperWire® Axes

- H00* No HyperWire axes connectivity (virtual mode)
- H01** Connect to one HyperWire axis (single axis smart drive)
- H02 Connect up to 2 HyperWire axes (-iXA4 hardware platform only)
- H04 Connect up to 4 HyperWire axes (-iXA4 hardware platform only)
- H06 Connect up to six HyperWire axes (default)
- H12** Connect up to 12 HyperWire axes
- H16* Connect up to 16 HyperWire axes
- H32* Connect up to 32 HyperWire axes

*Only available with the -iPC hardware platform.

**Only available for the non iPC (drive-based controller) hardware platforms.

Contoured Motion

- CM1 Up to four axes of contoured motion
- CM2 Five or more axes of contoured motion (export controlled)

Hexapod Support

- HX0 Does not include hexapod support
- HX1 Contoured motion for hexapods

ordering options continued on next page

AUTOMATION1 ISMC ORDERING OPTIONS

5-Axis Contouring Support

- FA0 Does not include 5-axis scan head support
- FA1 Contoured motion for 5-axis scan heads

AeroScript Plus

- AP0 No AeroScript Plus Files Allowed
- AP1 AeroScript Plus Library Files Enabled

PICAlign™ Support

- PIC0 No PICAlign Algorithm Support
- PIC1 PICAlign Algorithm Support Included

Dynamic Controls Toolbox

- DCT0 No Dynamic Controls Toolbox
- DCT1 Dynamic Controls Toolbox Included

MachineApps

- MA0 No MachineApps Connectivity
- MA1 Connect to controller using MachineApps

Industrial Ethernet

- IE1 Enables the Automation1-iSMC to operate as a Modbus TCP Server or Client (default)^{1,2}
- IE2 Enables the Automation1-iSMC to operate as an EtherCAT SubDevice²
- IE3 Enables the Automation1-iSMC to operate as an EtherNet/IP Adapter²

1. The number of available Modbus client connections depends on the Controller Plus ordering option (-CP0 supports 1 client, -CP1 supports 16 clients).

2. Drive based controllers must be configured with industrial ethernet ports to use Modbus, EtherCAT or EtherNet/IP.

Controller Subscription

- S1 One-year subscription to software version upgrades
- S3 Three-year subscription to software version upgrades
- S5 Five-year subscription to software version upgrades
- S0 One-month subscription to software version upgrades

HyperWire Card

- HW0 No HyperWire card
- HW1 HyperWire card included

Installation Media

- 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 subscription is active.

Version

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

HYPERWIRE COMMUNICATION NETWORK ORDERING OPTIONS

Automation1 Communication Accessories (Automation1-ComAcc)

HyperWire® PCIe HyperWire interface card, PCIe bus

Aerotech Communication Cables

HyperWire AO10-5 HyperWire cable, AOC, 10G, 5DM
HyperWire AO10-10 HyperWire cable, AOC, 10G, 10DM
HyperWire AO10-30 HyperWire cable, AOC, 10G, 30DM
HyperWire AO10-50 HyperWire cable, AOC, 10G, 50DM
HyperWire AO10-200 HyperWire cable, AOC, 10G, 200DM

AEROSCRIPPLUS ORDERING OPTIONS

Filetype

Compiled AeroScript Library File

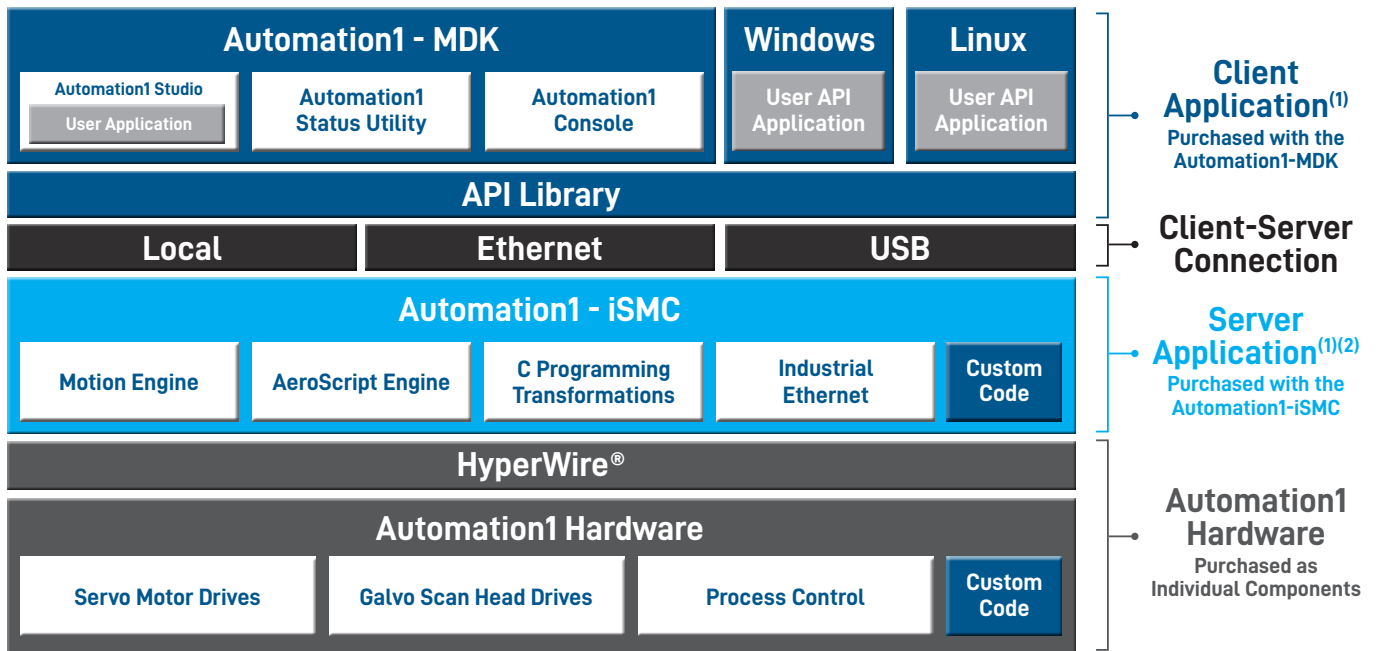
Files*

- F1 Optical Alignment Algorithms, Compiled AeroScript Library File
- F2 Tool Center Point Programming, Compiled AeroScript Library File
- F3 Drill Optimizer, Windows Application, API & Compiled AeroScript Library

**Note: to load and run AeroScriptPlus files on your controller, your Automation1-SMC motion controller must be configured with the -API option.*



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.

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
Process control features on each drive
Custom controller and drive firmware code is available (consult factory)