

Establishing competitive advantage through superior machine motion control design

How new machine motion configurations enable simpler builds, easier customization, and greater flexibility

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Life Is On

Schneider
Electric

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Understanding machine motion trends and challenges

The domain of machine motion is undergoing a period of profound change. OEMs are confronted with a disruptive marketplace and technological trends that accelerate and diversify end-user machine motion performance requirements.

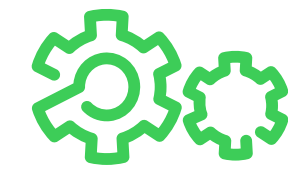
The machine motion branch of automation, encompassing the systems and sub-systems involved in the movement and control of machine parts, has evolved significantly in its degree of precision and high control. Access to more data and greater software integration has advanced a machine's ability to manage variables (such as positioning, acceleration, speed) and time during manufacturing operations.

As a result, demand for smart machines that enable motion has increased. Fueled by robust investment across industrial sectors in robots, semiconductors, and electronics, **IHS Markit predicts the world market size for motion control hardware will reach \$19 billion in 2022.**

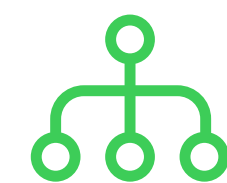
Global trends such as Industry 4.0 and the Industrial Internet of Things (IIoT) have considerably impacted how machine motion is enabled and managed and how automation components are designed and used. As machine devices become more intelligently designed and connected, the new influx of data has meant that customer expectations now go beyond delivering a simple machine component. Users also expect that new machines will come packaged with services that provide more detailed machine performance information. In this way, end users can leverage digitization benefits by better managing increases in production, reducing losses, and experiencing fewer downtime incidences.



A valuable approach for OEMs interested in developing new generation machine motion offerings is to identify the trends that are influencing the behaviors of industrial machine buyers, such as:

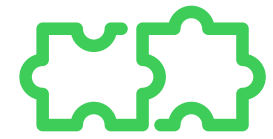


Smart manufacturing - Industry 4.0 and IIoT have filtered into most products within the industrial automation portfolio and will continue to spread as devices become more intelligently designed and connected. For example, lean manufacturing and production optimization software in intelligent factory environments can now aggregate data and information across plant operations and even upstream and downstream supply chains. These global visualization factors that are impacting plant performance enable operations to become more preventive and predictive and supports operational decision-making with live tracking of production line performance combined with digitized lean manufacturing best practices.



Networking interface and connectivity - Information sharing is one key enabler of IIoT. Despite the broad penetration of fieldbus, the fast transition from fieldbus to Ethernet for motion controls is a significant phenomenon in the market. Ethernet was developed for high-speed data transmission and is efficient, simple, and flexible. It's also, arguably, the most widely adopted networking protocol in the world. These factors, along with a low cost of implementation, make it an attractive networking technology for industrial environments. The increasing demand for high control speed and high precision also benefit the expansion of Ethernet protocol acceptance.

Significant progress is also being made to standardize interoperability of Ethernet protocols by expanding what is called the [OPC Unified Architecture \(OPC UA\)](#), machine-to-machine communication designed for industrial automation. Because of the strength of the OPC UA protocol to both access and interpret data, the goal is to spread its deployment rapidly. This way, the industry can use one language across all the areas of the automation pyramid (e.g., field level, control level, supervisory level, planning level, management level data). OPC UA can then provide the networking framework that supports Industry 4.0 / IIoT expansion.

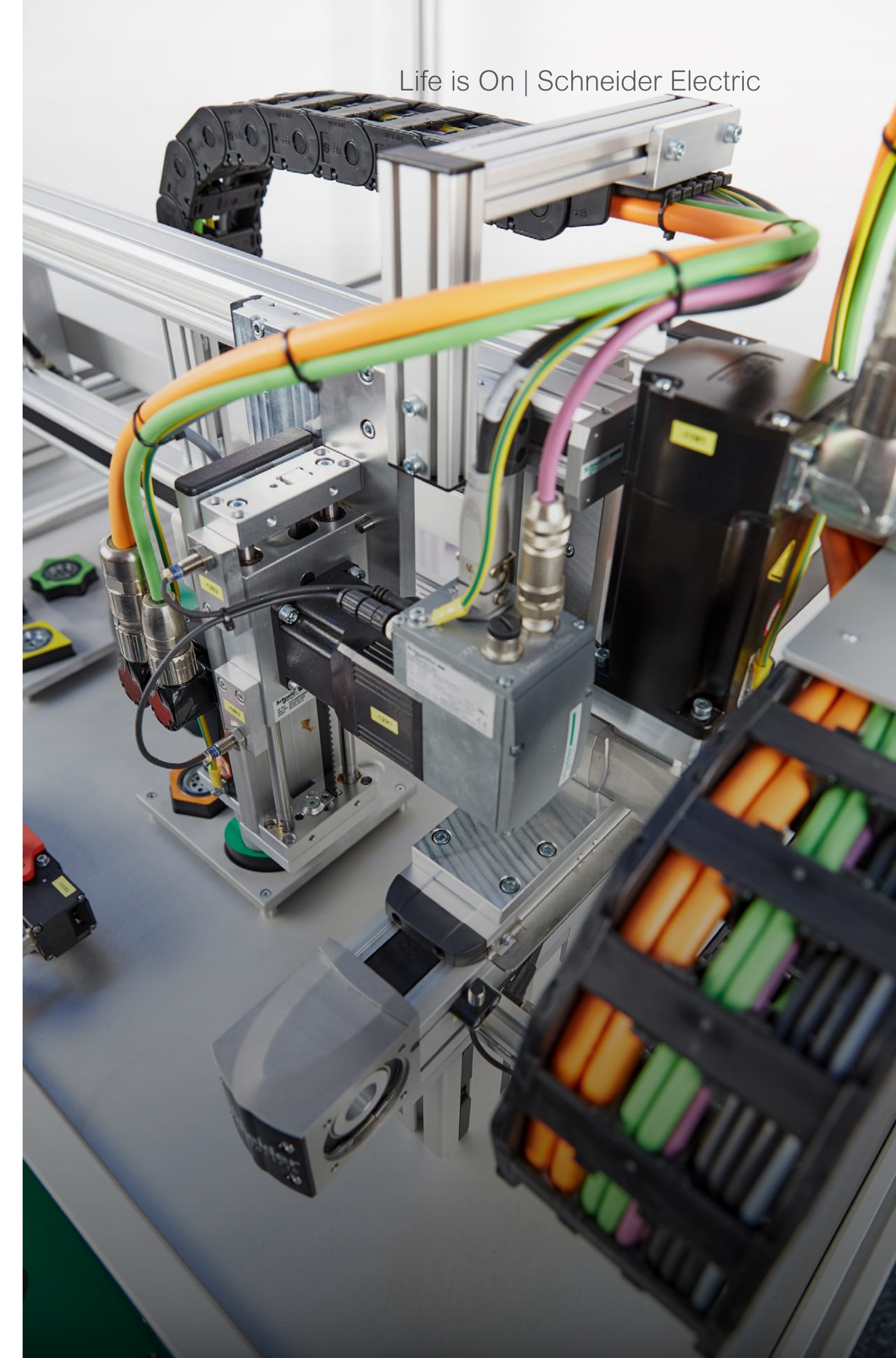


Modularity and decentralization - With the increasing need for production agility, machine designs are becoming more modular and decentralized due to rapidly accelerating marketplace changes. By providing end users with independent modules to easily integrate into existing assets, OEMs allow end users to run more flexible operations. Decentralized hardware helps to save space by removing equipment, as well as associated cabling, from central cabinets.



New developments in functional offerings - Many motion control equipment suppliers are improving their software development and product integration to expand their products from simple stand-alone components to broader offerings (e.g., complete packaging and conveying systems). This migration from simple one-function components to several functions working together requires more software integration. Software helps facilitate OEM project design phases and enables them to begin remote monitoring of component performance, thereby supporting the end user goal of lower downtime.

End users seek low lifecycle costs, higher reliability, and increased productivity. OEMs who are more selective in the components they choose to include in their smart machine configurations will likely build a competitive advantage. Critical evaluation criteria should consist of cost optimization, equipment reliability, components that contribute to differentiation through innovation, and software that enables “plug and play” simplicity.

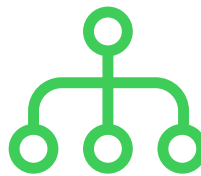


OEM technical design leader: Challenges and considerations

OEMs can more successfully navigate these new challenges by developing multiple long-term strategies.

With goals to improve machine performance and availability, and facilitate engineering, the risks of poor output quality, difficulties incorporating new motion technologies, and an overabundance of spare parts management tasks all present obstacles to business success. Companies like **Schneider Electric help to assure OEM business growth by providing machine components that save machine design time, quickly solve motion control functionality challenges, and offer optimum configurations to machine motion control scenarios and use cases.**

OEM technical design leaders who partner with Schneider Electric will benefit from:

 **Easier component connectivity** - The openness of Schneider Electric machine motion components makes controller integration much less labor-intensive. Our products interoperate with other machine brand components through Ethernet IP and Modbus protocols facilitating fieldbus communications and connecting easily to multiple brands of PLCs.

 **Simpler commissioning and autotuning** - Straightforward engineering, configuring, and commissioning helps OEM technical designers get their machines up and running faster, with less time-consuming, repetitive tasks resulting in lower-cost implementations.

How Schneider Electric can help

- Easily select and configure your machine motion function.
- Provide online tools to help you design faster, easier, and with fewer errors.

[Access to the Digital catalog](#)


[Motion Sizer Engineering tool for cam design and power unit dimensioning](#)


OEM marketing director: Challenges and considerations

OEM marketing directors can reassess their efforts to reflect changing end-user machine motion needs. When taking on the challenge of differentiating machines from competitors' offerings, an innovative, attractively priced, and reliable product road map from key technology suppliers is required.

A compelling value proposition must incorporate new generation technology benefits with proof points that ensure a customer experience that exceeds expectations. **The proposed functionality must also enhance productivity, reliability, efficiency, and responsiveness to support agile manufacturing needs.**

OEM sales and marketing leaders who look to Schneider Electric for support will benefit from:

 **Recognition of evolving trends** - Schneider Electric helps OEM marketing directors identify emerging technologies and motion control trends. New-generation machines can achieve the right balance between innovation and cost regardless of machine size and complexity.

 **Future-proofing** - Flexible and scalable combinations provide the needed level of power, performance, and functionality while minimizing up-front costs. Unlike oversizing to meet unpredictable capacity requirements, scalable hardware and software architectures allow end-users to pay as their machine motion requirements grow over time.

How Schneider Electric can help

Our extensive marketing support helps OEM marketing staff identify new machine control trends and emerging technologies addressing those trends. By proposing machine motion offerings that strike the right balance between cost and innovation, we help our partner OEMs to establish a competitive advantage.



Benefits of deploying modern machine motion control functions

Understanding machine motion trends and challenges

Benefits of deploying modern machine motion control

Small machines for point-to-point applications

Large machines for coordinated motion

Complex machines for synchronized motion

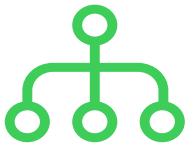
Final thoughts



Benefits of deploying modern Machine motion control functions

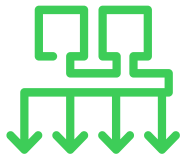
Schneider Electric offers OEMs a rich array of machine motion functions that support servo motors, servo drives, PLCs and robotics, and drive-based position control hardware (designed for automating single-axis to high-performance multi-axis machine applications). These functions enable support motion-centric machines for packaging, material handling, material working, electronics manufacturing, and other applications that require high-speed movements and precise positioning.

The Schneider Electric machine motion offerings are designed to address end user business challenges and to allow OEMs to respond to new market digitization trends. OEMs can benefit from deploying this new generation of machine motion functionality in five ways:

 **Connectivity openness** - As digitization accelerates its influence across more industrial machine motion aspects, smooth connectivity plays a greater role in driving operational efficiency. Thus, interoperability of best-of-breed products emerges as a critical element to deliver the efficiencies needed to establish marketplace advantage. New Schneider Electric tools and controllers work easily within mixed-vendor environments to enable the agility, innovation, and consistent quality needed to compete.

It is crucial to implement an open, standards-based architecture capable of operational step-change improvements and provide consumers a faster time-to-market delivery of highly customized products. Interoperable machine motion functions help optimize cost and performance through easy integration. This enables end users to implement new ways of driving manufacturing agility and productivity.





Flexibility and scalability - The Schneider Electric machine motion product families are built to conform to industry standards to address key growth constraints that many organizations currently face. From a *flexibility* perspective, for example, adherence to standards enables application-centric design by separating the application model from the system model. This allows devices to interoperate following standardized communications and data models across networks, with limited need for additional programming.

Scalability across our machine motion product sets helps both OEMs and end users to better accommodate growth and capture the opportunities that quickly present themselves in the marketplace. A wide variety of drive and motor combinations allows the OEM to configure functionality components with the right power and performance at the right price. Installing such flexible and scalable products helps OEMs address current end user needs without compromising future business opportunities.



Decentralized options - A wide-range of integrated technologies (including servo, stepper drives, brushless DC motors) can now operate as detached components. For example, a standard servo drive traditionally placed into a centralized cabinet can now work as a motor/drive combination that can be placed in a more remote location outside of its cabinet. This helps to address specific space-related constraints when smaller machine footprints are required.



Energy Efficiency - As a result of DC bus sharing capabilities, Schneider Electric servo motor and drive bundles are more energy efficient. The primary purpose of a common DC bus is to save energy, as the braking energy of one drive operating in generator mode can be re-used by another drive operating in motor mode (instead of dissipating waste heat into a braking resistor).



Easy commissioning and autotuning - The sequence of steps involved in engineering and setting up new production lines can take many months. Interdependencies across steps can introduce significant risks to a launch. Unidentified errors in engineering stages can have huge impacts on cost and time if discovered later, especially in manufacturing stages. Schneider Electric machine motion components are designed to support simplified engineering, installation, and commissioning processes. By reducing physical commissioning time at customer sites, OEMs help their customers to start productive work earlier, helping them to realize a much faster machine ROI.


In the same way that computers utilize a “plug and play” concept, industrial motion control now has similar capabilities with autotuning servodrives to identify the optimal controller parameters, and the motor determines the load type and mechanical coupling environment. Autotuning helps to better suppress oscillation and compensate for friction. Thus, machine motion components perform more efficiently over time with fewer instances of required maintenance.

Common machine scenarios for configuring the right machine motion functions

While recognizing trends and injecting innovation into machine motion configurations are significant first steps, it is essential to establish a method for properly sizing opportunities and for building machine motion function around core marketplace scenarios.


The following sections focus on three separate and distinct scenarios that cover most opportunities encountered in the marketplace today, including the main challenges and trends, and illustrate the price/performance product combinations:

1




FIRST SCENARIO
Small machines for point-to-point applications

2



SECOND SCENARIO
Large machines for coordinated motion

3



THIRD SCENARIO
Complex machines for synchronized motion

Small machines for point-to-point applications

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Small machines for point-to-point applications

1



Simple machines are often stand-alone, semi-automated catalog machines

Machine scenario

Challenges and trends

Recommended configurations

In this scenario, a simple motor and control mechanism is typically used to move one piece of a manufactured good from one point to another in the small machine motion environment.

The machine can be:

- Operated in a standalone mode or connect to an existing work process.
- Manufactured in high volumes and act as standard machines.
- Simple to integrate and operate.
- Flexible enough to connect to another machine.

Small machines for point-to-point applications

1



Simple machines are often stand-alone, semi-automated catalog machines

Machine scenario

Challenges and trends

Recommended configurations

End users who purchase these machines are faced with a number of challenges:

- They have little or no time to spend on training and are short on resources and skills.
- They are price-sensitive end point.
- They have minimal time to invest in commissioning or in addressing quality issues.

To overcome these challenges, the end users look for machine functions that:

- Can be provided on a cost-optimized basis.
- Are easy to learn, program and commission.
- Provide user-friendly interfaces, quick set-up, and energy efficiency.
- Can quickly integrate into larger systems.
- Are architected to enable IT/OT convergence.

Small machines for point-to-point applications

1



Simple machines are often stand-alone, semi-automated catalog machines

Machine scenario	Challenges and trends	Recommended configurations
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In this scenario where a repetitive gesture is crucial, this optimum configuration focuses on aesthetics and ergonomics without compromised performance. Enhancing the perceived quality of machines and allowing easy operation, makes the operator's work simpler and more efficient, without significant cost increases.

Schneider Electric recommends:

Optimum configuration

- Superior performance within a compact design
- Simplified engineering, installation, and commissioning to save time and money
- Open for the world of motion, alone or integrated
- Integrated safety (safe torque off)

[Discover](#)

Recommended enhancements

- Advanced connectivity
- Safety and security
- Higher integration
- More precise control

[Discover](#)

Small machines for point-to-point applications

Optimum configuration

1



Simple machines are often stand-alone, semi-automated catalog machines



[Lexium 32 servo drives and servo motors LXM32C & BSH/BMH motors](#)



[Lexium 32 Gearbox](#)



[Harmony STU Small Touchscreen HMI with Controller](#)

Small machines for point-to-point applications

Optimum configuration offers:

1. Superior performance within a compact design

- High power density design packs a maximum of power into a minimum volume.
- Saves on cabinet space and size, thereby reducing machine footprint and decreasing costs.
- Provides outstanding response with a speed bandwidth of 1,600 Hz.
- Modular, compact touchscreen interfaces that simplify operation.

2. Simplified engineering, installation, and commissioning to save time and money

- Powerful integration software simplifies the deployment process from planning to commissioning.
- Autotuning function eliminates the task of engineers having to perform manual tuning.
- Removable, color-coded connectors enable rapid installation and maintenance.

3. Open architecture for easy integration

- Supports a wide selection of interfaces for fast integration into architectures.
- A comprehensive list of choices for communication boards, encoder options, and accessories helps adapt the functionality to practically any environment.
- Easily integrates into and leverages the full power of current applications and existing assets such as legacy motors.

4. Integrated safety

- The "Safe Torque Off" feature requires less wiring and assures shorter downtime.
- Enhanced eSM safety module frees engineers of the time-consuming task of devising complex, proprietary safety concepts.

Small machines for point-to-point applications

Recommended enhancements

1



Simple machines are often stand-alone, semi-automated catalog machines



[Lexium 32 Servo Drives and Motors LXM32A or LXM32M](#)



[Lexium ILA, ILE, ILS Integrated Drives for Motion Control](#)
(Automated format adjustment)



[Modicon M241 Programmable Logic Controller](#)



[Safety Light Curtains](#)



[Modicon MCM Safety controllers](#) or [Harmony XPS Universal Safety Modules XPSU](#)

Small machines for point-to-point applications

Recommended enhancements configuration offers:

- 1. Advanced connectivity** - Applications requiring drives on a controller area network (CAN) should incorporate the Lexium 32A model drive, which provides CANopen/CANmotion machine bus connectivity. The Lexium 32M offers homing, manual mode, motion sequence, electronic gearbox, speed control, current control, and position control capabilities for additional operation modes in such high connectivity environments. Lexium 32M is compatible with CANopen/CANmotion, DeviceNet, EtherNet/IP, PROFIBUS DP V1, EtherCAT, PROFINET, and MODBUS TCP protocols.
- 2. Safety and security** - Preventa XUSL safety light curtains ensure automatic machine shutdown when a restricted area is breached. The single-beam versions provide finger (14mm) and hand (30mm) detection, while 2, 3, or 4-beam versions provide body detection. These devices, which are compliant with all current safety standards, can be used for any hazardous machine requiring zone protection for the security of operators and equipment.
- 3. Higher integration** - Lexium ILE, ILA, and ILS integrated drives provide a decentralized motion function that works with stepper, servo, or brushless DC motors. The integrated design offers a 50% reduction in required control cabinet space and a 40% decrease in wiring. In addition, using the Lexium Commissioning Tool, engineers experience a 25% reduction in installation time and easy commissioning.
- 4. More precise control** - Modicon M241 is a micro-controller designed to handle machine automation with a mixture of hardwired I/O and Ethernet-based automation bus/communications linked to devices such as drives, motion, remote I/O, and HMIs. Features 4-axis hardwired PTO.
- 5. Enhanced safety control** - Modicon XPSMCM or Preventa XPSU safety controllers are available to offer a scalable and modular expansion of safety automation if required.

Large machines for coordinated motion

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Large machines for coordinated motion

2



Advanced machines that can work in stand-alone or inline processes

Machine scenario

Challenges and trends

Recommended configurations

In the large machine motion environment, the system can coordinate two kinds of movements and integrate them into full lines of the production process.

This scenario is characterized by machines that:

- May challenge the end user operator with difficult access.
- Can be custom-designed.
- Either an operator has to move to various locations to operate the machine or multiple operators with varying skill levels may need to get involved.
- Are high performance, but they do not always require OEM involvement for issue diagnosis, maintenance, or upgrades.
- Need to be modular, flexible, energy-efficient, and fully automatic while coordinating motion.
- Require reduced commissioning and engineering time, along with ease of maintenance.

Large machines for coordinated motion

2



Advanced machines that can work in stand-alone or inline processes

Machine scenario

Challenges and trends

Recommended configurations

End users who purchase these large machines are looking for :

- Support in the areas of training and commissioning.
- OEMs for guidance on sizing, product selection, and pricing.
- Machine interoperability as a high priority with quality, maintainability, and safety as critical value-adds.
- Simplification that results in reduced engineering and design time and the possibility of monitoring machines remotely to perform predictive maintenance on behalf of the end user.

To address these challenges, OEMs are:

- Embracing marketplace trends such as digital twins, which enable rapid testing of machine concepts without first installing a physical machine.
- Emphasizing modularity and scalability in machine design to enable end user flexibility when modifying production line capacities.
- Building smarter machines that can capture data to run performance analytics and to predict when key components will wear out and need replacement. This enables more proactive maintenance and boosts end user machine uptime.
- Responding to end user total cost of ownership requirements by building smaller footprint machines that are more energy efficient.

Large machines for coordinated motion

2



Advanced machines that can work in stand-alone or inline processes

Machine scenario	Challenges and trends	Recommended configurations
------------------	-----------------------	----------------------------

In this scenario, fully automatic machines need coordinated motion flexibility, modularity, and energy efficiency. Lexium drives and Modicon PLCs provide the idea form, fit, function, and accessories to meet the application demands. Reduced commissioning and engineering are a priority along with ease of maintenance.

Schneider Electric recommends:

Optimum configuration

- Open for the world of motion, alone or integrated
- Connectivity and cybersecurity for real-time simple integration and to speed-up maintenance
- Robust, designed for long life, engineered to be placed directly within the manufacturing installations
- Safety designed to provide the most comprehensive protection for personnel and equipment

Discover

Recommended enhancements

- Integrated drives for motion control improving cost and energy efficiency
- Decentralized motion solution providing a compact design with everything integrated
- Cartesian axis robot

Discover

Large machines for coordinated motion

Optimum configuration

2



Advanced machines that can work in stand-alone or inline processes



[Lexium 32 Servo drives and servo motors & Lexium32M-BSH/BMH motors](#)



[Lexium 32 Gearbox](#)



[Lexium 32 Communication modules](#)



[Modicon M262 IIoT-ready logic and motion controller \(or equivalent\)](#)



[Harmony GTU Universal Touchscreen HMI](#)



[Modicon MCM Safety Controllers](#)



[Modicon TM3 Expansion I/O Modules](#)

Large machines for coordinated motion

Optimum configuration offers:

1. Open architecture for easy integration

- Supports a wide selection of interfaces for fast integration into industrial architectures.
- Communication boards, encoder options, and accessories all adapt quickly to the solution.
- Interoperates easily with existing legacy motors and other operational assets.

2. Simple and cybersecure connectivity

- Enables a high level of communication with dual serial, dual Ethernet, and integrated wireless LANs.
- Directly connects to the cloud without the need for building gateways.
- Transfers data to a cloud-based solution such as Schneider Electric's EcoStruxure™ Machine Advisor in a cybersecure manner.
- Manages logic applications, synchronized motion, embedded safety, and cloud connectivity in one controller.
- Up to 14 terminals can be added to the controllers without tools. When terminals are plugged in, their contacts are electrically linked to both the controller and the adjacent terminal.

3. Robust construction and easy maintenance for long and reliable life

- Sturdy aluminum housing and the ability to remain operational across a wide range of operating temperatures enables equipment to withstand harsh environments.
- Availability of multiple drives and motor combinations provides OEM designers with precisely the right power, performance, and functionality needed to build an optimized machine.
- Removable, color-coded connectors enable safe and rapid maintenance.

4. Advanced safety design

- A modular and configurable safety controller can monitor multiple safety functions on and around a machine protecting operators from accessing dangerous moving parts.
- Safety controller is designed to monitor emergency stops, guard monitoring, perimeter guarding, position monitoring, speed monitoring, and movement flexibility.
- Removable, color-coded connectors enable safe and rapid maintenance.

Large machines for coordinated motion

Recommended enhancements

2



Advanced machines that can work in stand-alone or inline processes



[Lexium 32i Integrated Servo Drive](#)



[Lexium ILA, ILE, ILS Integrated Drives for Motion Control](#)



[Lexium MAX Cartesian multi-axes systems](#)

Large machines for coordinated motion

Recommended enhancements configuration offers:

- 1. Advanced integration** - The Lexium 32i is a servo motor and servo drive integrated into one housing designed for applications requiring high precision and advanced motor control. An online configurator makes it easy to assemble the four desired core components with a click of a button. Configuration settings can be stored on the optional memory card. The Lexium 32i also reduces overall cabinet space by up to 60% (no need for motor cable and cabinet space for the drive). It can even be installed directly on a machine without a cabinet to reduce cost and increase energy efficiency (energy costs drop by up to 30% because cooling requirements are reduced).
- 2. More compact design** - The Lexium ILE, ILA, and ILS integrated drives provide a decentralized motion function that works with either stepper, servo, or brushless DC motors. The integrated design offers a 50% reduction in required control cabinet space and a 40% decrease in wiring. In addition, using the Lexium Commissioning Tool, engineers experience a 25% reduction in installation time and easy commissioning.
- 3. Lexium Max Cartesian axis robot** - These robotic components contain T-slots on three sides for simple integration into existing structures, grease nipples accessible on each side of the carriages to simplify routine maintenance and an intuitive system for simple motor assembly.



Complex machines for synchronized motion

Complex machines for synchronized motion

3



Complex machines are generally integrated into fully-automated production processes

Machine scenario

Challenges and trends

Recommended configurations

In this scenario, complex machines are part of an assembly line of several machines oftentimes procured from the same supplier.

- Internal machine components, and settings, are highly automated.
- The ability of these machines to interact digitally throughout their lifecycle is critical.
- Motion controllers, drives, software, and digital services can support a number of user profiles (e.g., operator, production line manager, and maintenance technician).
- The machine design is optimized to make the operator's tasks easier, enable improved diagnostics, allow close monitoring of production, and quickly respond to production changes.
- This machine category also requires connecting, collaborating, and sharing data with other end-user systems (like SAP) and machines.

In the complex machine motion environment, the system likely:

- Consists of a conveyor mechanism plus overhead robotics for high accuracy.
- Has repeatable picking, placing, and positioning across the conveyor (filling and capping machines in beverage manufacturing are good examples).
- Integrate into full lines.

Complex machines for synchronized motion

3



Complex machines are generally integrated into fully-automated production processes

Machine scenario

Challenges and trends

Recommended configurations

End users investing in complex machines are confronted with interoperability challenges and adherence to safety and quality standards.

- OEM support for end users must continue through integration and commissioning phases and machine design should enable a rapid learning curve.
- On the back end of the project cycle, end users require proactive maintenance via predictive maintenance techniques.

OEMs can address these challenges with digitization tools to expedite the machine development, delivery, implementation and support processes.

- Integrate cloud services and real-time analytics, smart maintenance concepts support efforts to increase machine uptime.
- High level of cybersecurity so that manufacturing process uptime threats when performing remote monitoring and maintenance.
- Digital twin simulation and visualization tools reduce machine development time with hardware components for a “pay as you grow” concept.
- Provide safe and secure connected machines capable of generating and receiving data to and from other machines in the process.

Complex machines for synchronized motion

3



Complex machines are generally integrated into fully-automated production processes

Machine scenario	Challenges and trends	Recommended configurations
<p>In this scenario, the motion controller, drives, software, and digital services will play a role for several profiles (e.g., operator, production line manager, and maintenance) from making machine operator's tasks easier to improve diagnostics and monitoring to closely monitor the production and respond to changing production. This requires a smooth collaboration with others End-users systems and with other machines.</p> <p>Schneider Electric recommends:</p> <p>Optimum configuration</p> <ul style="list-style-type: none"> • Flexible and scalable motion functions • Fast and simple remote maintenance due to connectivity • Safe and secure measures that ensure reliability for more peace of mind • Higher efficiency and lower cost operations <p>Discover</p>		<p>Recommended enhancements</p> <ul style="list-style-type: none"> • Faster time to market • Easier OT/IT integration • Remote management • Performance enhancement across the entire machine lifecycle <p>Discover</p>

Complex machines for synchronized motion

Optimum configuration

3



Complex machines are generally integrated into fully-automated production processes



[PacDrive 3 LMC Pro / LMC Eco](#) For automating machines/lines with 0 - 130 servo axes including robots



[Lexium 52 & Motors Stand alone](#) servo drives and servo motors for PacDrive 3 or [Lexium 62 & Motors Multi axis](#) servo system and servo motors for PacDrive 3 (Depending on application)



[Lexium 62 & Motors Multi axis](#) servo system and servo motors for PacDrive 3 SH/MH ILM/ILD



[Modicon XPS MF](#) Safety PLCs



[Harmony GTU High performance IoT-ready](#) modular HMI panels

Complex machines for synchronized motion

Optimum configuration offers:

1. High flexibility and scalability

- When packaged with PacDrive 3 LMC Pro2 controllers, the hardware platform can scale from four servo axes to 130 servo axes (at a 1 ms network update rate) and up to 255 virtual axes.
- Users can program up to 4,096 dynamic electronic cam disks operating in parallel. The program can switch between electronic cam disks during operation. All controllers feature an integrated PLC.
- Prefabricated hybrid cables and distribution boxes make cabling upgrades straightforward.
- True "plug and play" capabilities for high-density components that take up minimal space

2. Connectivity-enabled fast and simple remote maintenance

- Modern features such as electronic nameplates, color-coded plug-in connectors, and easy access to the front or top of servo drives make maintenance quick and less costly.
- Fast component replacement design improves reliability and eases the implementation of both mechanical and electronic maintenance tasks with fewer cables to contend with and with automated problem-detection and reconfiguration.

3. Enhanced peace of mind through safer and more reliable operations

- Integrated safety functions reduce design time and simplify compliance to safety standards
- Designs incorporate line chokes for improved protection from overvoltage and excessive harmonic distortion
- Safe Ethernet enables more precise diagnostics and improved communication performance with decentralized I/Os.
- Depending upon the specific application requirements, Safety PLCs make available up to 14 certified safety functions.

4. Higher efficiency and lower cost operations

- Integrated 3-phase power supply servo drives offer cost-effective configuration of functions with self-contained single axes.



Complex machines for synchronized motion

Recommended enhancements

3



Complex machines are generally integrated into fully-automated production processes



[EcoStruxure™ Machine SCADA Expert Lite SCADA for line management](#)



[Harmony Industrial PC Box PCs, Panel PCs, Rack PCs and Monitors](#)



[Lexium T, P Delta robots for pick & place solutions](#)



[EcoStruxure Machine Advisor](#)



[EcoStruxure Secure Connect](#)



[EcoStruxure Augmented Operator Advisors](#)

* Coming in 2021: Lexium MC12 multi carrier transport system + EcoStruxure Machine Expert Twin

Complex machines for synchronized motion

Recommended enhancements configuration offers:

- 1. Faster time to market** - With Delta robots, there is no need to develop customer-specific kinematics or to spend much time integrating third-party products. As a result, robot-enabled machine designs are quickly generated. Delta 2 and Delta 3 picker mechanisms (from the PacDrive portfolio) come with a software library for path generation, kinematic transformation, blending and interpolation, acceleration limiting, and belt tracking, to name a few of the central functions.
- 2. Easier OT/IT integration** - Harmony Industrial PCs (IPC) run on the Microsoft Windows operating system and seamlessly integrate into IT infrastructure. This enables large data storage management, multi-tasking capabilities, and connects to PC devices and databases. The units incorporate a slim, flexible, and durable design for individual users to configure their PC based on specific application needs. Redundant RAID hard disks and battery backup drive higher systems availability and a longer life span, and the ergonomic design provides space savings.
- 3. Remote management** - EcoStruxure Machine SCADA Expert allows OEMs to develop HMI, SCADA, OEE, and dashboard projects dedicated to line management and supervision applications. Users can view their process from any device with a flexible and easy-to-understand interface to rapidly troubleshoot alarms generated via email, handheld device, or web browser. The system easily integrates with ERP and other back-office systems through built-in connectivity.



Complex machines for synchronized motion



4. **Performance enhancement across the entire machine life cycle** - EcoStruxure Machine Advisor offers an online repository tracking service to provide machine builders with easy access to documentation (from bill of material to localization and maintenance logs, warranty information, and spare part availability) and stores the complete history of all their machines in the field. **Monitoring** is accomplished through the cloud to enable remote access to assess machines' health and performance data. Intuitive and user-friendly dashboards display KPIs and track notifications and alerts that require access to experts. Early warning signs of anomalies are also identified.

The actual **repair/fix** of the machine accelerates through mobile services that facilitate maintenance operations at end-user sites through augmented reality applications (using tools like Schneider Electric's EcoStruxure Augmented Operator Advisor). A combination of step-by-step procedures (made available as graphic images on handheld tablet devices) and the availability of remote experts leverage the augmented reality applications so that fixes are quick and easy. Together, such capabilities place machine builder OEMs in a solid position to add value to their end-user customers across the entire machine lifecycle.

In addition, manufacturing performance can be monitored using EcoStruxure Equipment Efficiency Advisor, a manufacturing intelligence software system that collects, measures, analyzes, and reports operational performance. This allows for the identification and delivery of OEE performance improvements in real-time.

Final thoughts

Understanding machine motion trends and challenges

Benefits of deploying modern machine motion control

Small machines for point-to-point applications

Large machines for coordinated motion

Complex machines for synchronized motion

Final thoughts



Final thoughts

In today's high-speed business environment, the time delays and complexities of traditional machine motion development and implementation are no longer a tenable business model. Time-to-market continues as a critical success factor that enables OEMs to compete. **New machine motion and automation control architectures from Schneider Electric leverage breakthroughs in digitalization technologies to completely revamp how OEMs interface with the information, documentation, and products they need to deliver.** As a result, concept-to-commissioning time for machine motion products will be reduced from months to weeks, with reconfiguration times dropping from weeks to days.

A move towards smart motion systems

With the increasing need for smart machines, the adoption of intelligent motion systems will likely grow in the coming years.

Fortunately, with [robotics](#) as integral parts of machines, improved machine connectivity, data analytics, and the growing importance of software at the shop floor, significant transformations are already happening to help meet evolving marketplace needs.

Disruptive technologies, such as [multi carrier transport solutions](#), combined with digital twin software adds innovation to this transformation. It enables OEMs to design, test, and optimize the system with certainty and without physical machinery.

Not only does this effectively minimize commissioning costs and improve design processes and quality, but it also provides an entirely new level of flexibility and efficiency to operations and maintenance. New products can be tested virtually, reducing the time-to-market exponentially.

Modularity and scalability of components also allow OEMs to build in flexibility in format when designing machines that address dynamic marketplace demands. The ability to quickly alter production rates and adjust product sets has become critical to global manufacturers.

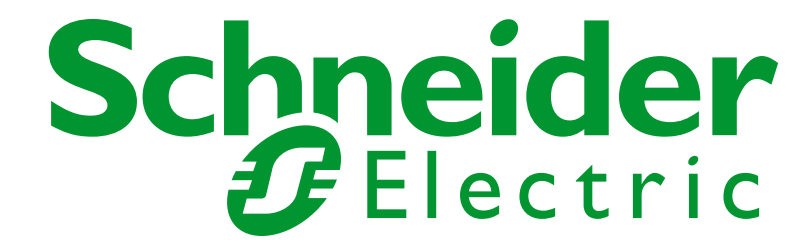
The Schneider Electric machine motion function offerings in this guide also mirror our sustainability-focused corporate culture with an emphasis on high energy efficiency, small footprint, and waste minimization. Machine builders can now stay one step ahead of their competitors by deploying smart machine motion functions that demonstrate advanced connectivity while helping end users to unlock the power of big data and advanced operational agility.

When machine motion projects involve digital solutions, potential cybersecurity issues must also be addressed. Digitization and cybersecurity are 100% linked and manufacturers, like Schneider Electric, can assist in these efforts by applying a Secure Development Lifecycle (SDL) approach to all core products (e.g., servo drives, robots, and PLCs). Within the context of SDL, secure architecture reviews are performed, threat modeling of the conceptual security design occurs, secure coding rules are followed, specialized tools are used to analyze code, and security testing of the product is performed.

With extensive machine motion expertise, Schneider Electric can help OEMs to better address global marketplace challenges and to significantly reduce time-to-market as they develop the next generation of smart machines. To learn more, visit our [OEM Partner Program platform](#) or [Schneider Electric Exchange](#) online portals and begin expanding your machine motion-related customer revenues.



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