A Simplified Approach for Upgrading from Pneumatic Systems to Electric Actuators

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Summary

Learn how SMC EQ electric actuators make the switch from pneumatic actuators simple by employing familiar control principles with improved performance and energy efficiency.

Manufacturing facilities leverage motion control systems for positioning operations, handling materials, and managing process control functions across production lines. Industrial linear motion applications use two key technologies: compressed air-powered pneumatic systems and electric actuators. While pneumatic installations have generally provided motion control for basic positioning tasks, electric systems offer greater accuracy, energy performance, and enhanced control capabilities. SMC's EQ actuator series offers an integrated electric motion control solution that eliminates implementation complexity. These units combine actuators with built-in controllers, removing the need for external controllers or complex wiring typically required in electric systems. By designing the control interface to mimic a pneumatic solenoid valve's operation, the EQ series allows facilities to switch to electric motion without extensive programming changes or operator retraining.

Electric Actuators vs. Compressed Air Systems

Electric actuators provide rapid point-to-point motion similar to pneumatic devices, but utilize electric drive systems instead of compressed air. This technology is highly beneficial when compressed air infrastructure is unavailable or impractical, e.g., in cleanroom environments, remote installations, or facilities looking to reduce air compressor dependencies.

SMC EQ Series electric actuators offer improved control flexibility via programmable motion profiles, variable speed operation, and precise force control. They can achieve positioning repeatability of ±0.02mm with maximum speeds up to 1200mm/s depending on the model configuration.

Actuation Methods and Form Factors

Electric actuators are available in three principal form factors, each engineered for specific application needs. Rodless designs allow for compact installations with load guidance along the entire stroke length. This configuration optimizes space usage and provides lateral load capacity for material handling and conveyor positioning operations. On the other hand, rod type actuators feature a standard cylinder-style construction with common mounting options and thrust capabilities. The extending rod design makes them useful for general automation tasks requiring linear push-pull operations. Lastly, the guided-rod type features a rod design with integrated guide rods that prevent rotation and handle lateral loads. This configuration provides rod-type thrust with stability for applications involving side loads or moment forces.

Key Components and Control Methods

Electric actuators incorporate several key components within single assemblies. An integral step motor provides the primary drive force. The EQ series utilizes 24VDC step motors with power consumption ranging from 61W for size 16 up to 116W for size 40 configurations. An integrated controller manages motion profiles, positioning commands, and safety functions while interfacing with plant control systems. Standard industrial connectors handle all power and communication connections, simplifying installation procedures.

EQ electric actuators with integrated controllers utilize battery-less encoders for absolute position feedback without memory backup requirements. This allows the encoders to retain position information in the event of power interruptions, reducing maintenance requirements and improving long-term reliability. In the SMC EQ series, encoders provide 4096 pulses per rotation resolution, maintain position information during power interruptions and immediate position availability when power is restored without using a homing sequence. The operating temperature range is from 5° to 40°C with IP40 protection for industrial environments.
Electric actuators utilize various control methodologies to suit different automation systems. For example, PC-based software handles the initial parameter setup, allowing engineers to define the position targets, speed profiles, acceleration curves, and force parameters during commissioning. For runtime control, I/O signals from PLCs can replicate pneumatic solenoid valve operation. The EQ series offers 3 parallel inputs and 4 parallel outputs all operating at 24VDC ±10% with max. output current of 40mA per channel. This allows for straightforward retrofitting of existing pneumatic systems while preserving existing control logic and operator interfaces. Overall, this strategy prioritizes operational simplicity, only requiring maintenance personnel to have basic training in pneumatic solenoid valves.

Simplified Electric Motion Control Implementation With SMC's EQ Series

SMC EQY Rod with Integrated Controller

SMC's EQ series simplifies electric actuator deployment by leveraging pneumatic control principles that are already well-known within facilities. This methodology prevents long learning curves associated with electric motion systems. SMC has designed the EQ lineup to mirror existing pneumatic product offerings, creating one-to-one wiring replacements for existing compressed air solutions.
The EQ series is available in multiple form factors, size ranges, and payload capabilities to meet a broad range of application needs. Available configurations include compact units for space-constrained systems and higher-capacity models for industrial environments—stroke lengths and force ratings span typical automation needs.

SMC EQYG Guide Rod with Integrated Controller.

Built-In Control System Benefits

Embedding the controller directly within the actuator assembly provides clear benefits over distributed control architectures. This consolidated design minimizes external control cabinet spacing, reduces wiring requirements, and creates a more compact installation footprint.
The integrated design uses discrete I/O signals to replace pneumatic solenoid valve signals. Control signals that mirror pneumatic valve operation include inputs for extend, retract, and positioning commands that correspond to basic air valve control logic. Tight integration also improves system reliability with fewer interconnects and simplified troubleshooting. Having a single vendor responsible for the full motion package helps to streamline relationships and eliminate potential interface issues between components.

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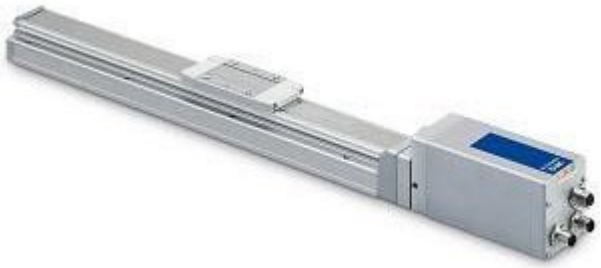
Setup and Programming

SMC's EQ Series uses a simplified configuration approach compared to typical electric axis systems. The e-Actuator Setup Tool provides PC-based configuration through standard USB connections with integrated drivers, supporting Windows 10/11 64-bit systems. This allows engineers to set motion parameters without programming knowledge. Setup tasks include the ability to define target positions, adjust movement speeds, configure acceleration profiles, and force limits. These functions correspond to pneumatic concepts. For example, position limits translate into cylinder stroke endpoints, while speed adjustments are similar to flow control valve operations. The EQ Series software guides users through the setup process with step-by-step instructions and error checking to avoid invalid configurations. It also includes preconfigured templates for common applications and real-time visualization with monitoring and diagnostic tools for ongoing system verification and optimization.



EQFS Slider with Integrated Controller.

Feedback and Monitoring

SMC's EQ architecture offers various feedback options to meet a broad range of monitoring requirements. As an example, standard digital outputs transmit status information to PLC input modules, which includes position arrival, movement completion, and faults. In addition, LED indicators provide visual status feedback, with PWR (green for power), ALM (red for alarm conditions), and OVL (orange for overload) indicators displaying actuator status, error conditions, and operating mode.

Conclusion

Industrial automation is moving toward electric solutions to provide greater precision, energy efficiency, and intelligence capabilities than pneumatic alternatives. Electric actuators offer a level of positioning accuracy that is usually difficult to achieve with compressed air systems. Moreover, electric actuators support more efficient energy consumption patterns to help improve operational economics and provide integrated feedback capabilities for advanced motion control and system monitoring.
Actuator selection involves evaluating application requirements across parameters such as force specifications, precision requirements, speed demands, environmental conditions, and budget constraints. The EQ Series from SMC provides comprehensive configuration options and maintains operational simplicity that minimizes complexity and training requirements.
For more information about the EQ Series or application-specific inquiries, visit SMC.

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