Highly Integrated FOC Control for Energy-Efficient Closed-Loop Stepper Motors

Hardware-Based Motion Engine, Integrated Position Sensing and Flexible Power Stages for Compact, High-Performance Drive Solutions.



With the FU7371, Fortior introduces a highly integrated motor controller specifically developed for demanding closed-loop drives. MEV Elektronik Service GmbH presents the device as a powerful platform for field-oriented control (FOC) of two-phase stepper motors. The combination of dedicated control hardware, an integrated RISC-V processor and extensive peripheral functions enables compact drive solutions with high dynamic performance and load-dependent torque control.

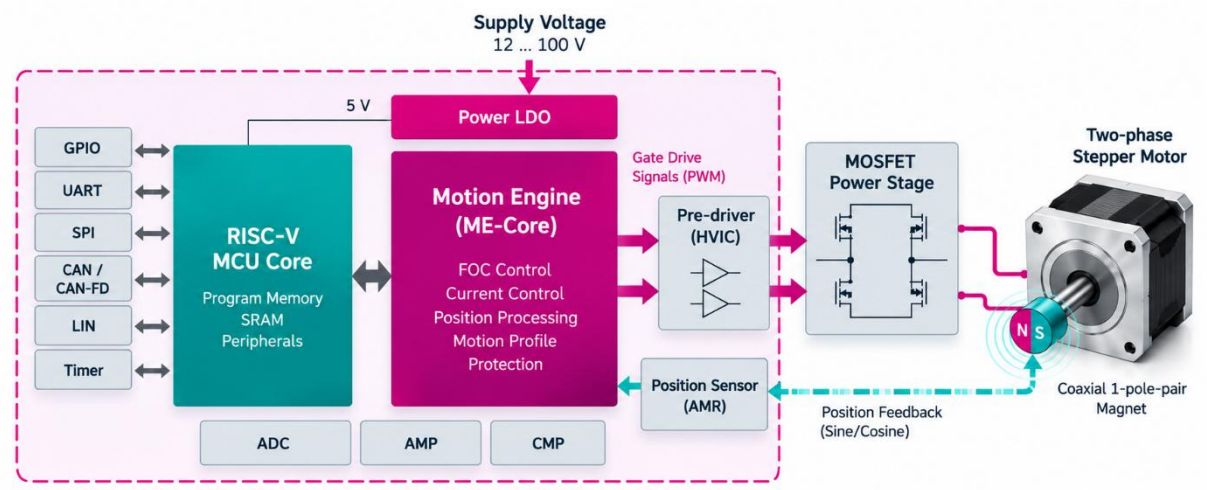
Field-Oriented Control Directly in Hardware

In conventional stepper motor drives, phase currents are often specified independently of the actual motor load. This results in unnecessary power consumption and heat generation, particularly during partial-load operation. Field-oriented control, by contrast, takes the actual rotor position into account and continuously adjusts the torque-producing current to the operating conditions.

At the heart of the FU7371 is the Motion Engine (ME-Core). It performs the time-critical calculations and control tasks required for FOC directly in dedicated hardware. This enables fast, deterministic control without burdening the integrated RISC-V processor with the computationally intensive tasks of current regulation.

The processor therefore remains available for higher-level control tasks, communication functions and application-specific software. This division of responsibilities simplifies the development of high-performance closed-loop drives while reducing the need for additional functional components.

FU7371 Block Diagram



Flexible Position Feedback for Different Requirements

Accurate rotor position sensing is essential for field-oriented control. For this purpose, the FU7371 features integrated AMR position sensing, enabling compact magnetic feedback systems. In addition, two integrated quadrature encoder interfaces (QEP) allow external incremental position sensors to be connected. Absolute position information can also be incorporated via suitable digital interfaces. This allows position feedback to be tailored to the requirements of the application, ranging from space-saving magnetic sensing directly at the motor to external high-resolution encoder systems.

High Integration Reduces Hardware Complexity

In addition to the Motion Engine and RISC-V processor, the FU7371 integrates numerous functions that often require separate components in conventional drive solutions.

These include ADCs and comparators for current sensing and monitoring, a CORDIC accelerator for mathematical calculations, as well as PWM units and gate drivers for controlling external MOSFET power stages.

The power stage itself remains external and can therefore be tailored to the specific motor and required power rating. The integrated gate drivers enable drive solutions for typical supply voltages ranging from 12 to 100 V.

Communication with higher-level controllers and other system components is supported through interfaces including CAN/CAN-FD, UART, SPI, I²C and LIN.

From a Conventional Stepper Motor to a Controlled Servo Drive

By combining position feedback with field-oriented current control, a two-phase stepper motor can be operated with torque-oriented control. Unlike purely position-dependent microstepping, the motor current is regulated according to the torque actually required.

This creates opportunities to reduce energy consumption and motor heating, particularly under varying load conditions and during extended periods of partial-load operation. At the same time, the available torque reserve can be utilized more effectively, and the dynamic behavior of the drive can be improved.

The FU7371 is therefore suitable for compact positioning drives, industrial automation, handling systems, laboratory and analytical equipment, and other applications requiring stepper motors with high precision and efficient control.

Development and Integration

The FU7371 provides developers with a highly integrated platform that combines essential closed-loop drive functions in a single controller. Its combination of hardware-based FOC, flexible position feedback and scalable power electronics enables the development of compact drive systems across different power classes.

MEV Elektronik supports customers in selecting suitable motors, position sensors and power semiconductors, as well as in assembling coordinated motion control solutions.

SPS 2026

MEV will present Fortior's new FOC-ICs at SPS 2026 in Nuremberg from November 24 to 26. Hall 4, Booth 174. You are welcome to schedule an appointment and request your free ticket in advance!



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