ECS-FOC560/9
Sensorless Field-Oriented Control for EC Motors
325 VDC / 1 A Phase Current

• Sensorless Field-Oriented Control (FOC) for speed and torque control
• Software-based FOC algorithm using a 32-bit microcontroller
• Sinusoidal commutation with sinusoidal motor currents
• Excellent speed stability and smooth, low-noise operation
• For brushless three-phase EC motors in delta or star configuration, with SPM or IPM rotors
• PID speed and torque control with underlying current loop
• Sensorless rotor position detection, including at standstill
• Space Vector Modulation (SVM)
• Field-weakening operation
• Dimensions: Ø130 mm × 43 mm
• Supply voltage: 560 VDC (unregulated)
• Continuous winding current: 9 A
• Integrated braking chopper
• Optional Hall sensor feedback (3 Hall sensor inputs)
• Interfaces: RS-485, CAN (galvanically isolated)
• Windows configuration software with automatic motor-model parameter calculation

ECS-FOC560/9 is a sensorless field-oriented control (FOC) drive for permanent-magnet synchronous machines (EC motors).

The control architecture combines a speed controller with an underlying current control loop, ensuring excellent speed stability together with smooth, low-noise, vibration-free motor operation.

Rotor position is determined from a mathematical motor model, which is also used to generate the appropriate phase signals for the power stage. Sensorless position detection at standstill is achieved by measuring the motor's inductance distribution.

The control concept inherently produces sinusoidal motor currents (sinusoidal commutation), requiring only the three phase currents as feedback signals.

A powerful and cost-effective 32-bit microcontroller executes the complete FOC algorithm in software. This minimizes hardware complexity while providing maximum flexibility for adaptation to different applications.

Space Vector Modulation (SVM) is implemented for optimal power stage control. In addition, field-weakening operation extends the maximum speed range of the EC motor.

The power stage is based on an integrated IGBT module and achieves an efficiency of up to 98.5%.

The maximum continuous winding current is 9 A. Current regulation is performed in software, while hardware protection shuts down the output stage at a phase current of 9.4 A.

The motor supply voltage is 560 VDC. A galvanically isolated 24 VDC supply is used for the control electronics.

An integrated braking chopper is provided for connection of an external braking resistor.

Optional rotor position feedback can be implemented using three Hall sensors. All control inputs are designed for 3.3 V signal levels.

RS-485 and galvanically isolated CAN interfaces ensure straightforward integration into higher-level control systems. All parameters and settings can be configured using the Windows-based commissioning software.

The controller is implemented on a circular printed circuit board with a diameter of 130 mm and a height of 43 mm.

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ECS-FOC560/9– Technical Specifications



Operating Modes:	• Sensorless FOC with Field Weakening • Space Vector Modulation (SVM) • Closed-Loop Speed Control • Closed-Loop Torque Control • Sinusoidal Commutation
Motor Type:	EC-motors
Rotor Types:	• Surface-mounted permanent magnet (SPM) rotors • Interior permanent magnet (IPM) rotors
Rotor Position Detection:	• Sensorless operation based on a mathematical motor model • Sensorless rotor position detection at standstill • Optional Hall sensor or encoder feedback
Power Supply (Power Stage): Power Supply (Logic):	560 VDC, unregulated 24 VDC, galvanically isolated
Maximum Motor Current per Phase (Amplitude):	9 A
Power Stage: • Switching Frequency: • Maximum Continuous Phase Current: • Maximum Current (ITrip = Shutdown Current):	 PWM switching frequency: 10 kHz to 17.5 kHz, adjustable (default setting: 14.4 kHz) 9 A 9,4 A
Connections: • Supply Voltage and Motor Phases: • Braking Chopper:	 6.3 mm quick-connect tab terminals 6.3 mm quick-connect tab terminals
Interfaces:	RS485 CAN, Galvanically Isolated
Inputs: • Hall Sensors (Optional):	 3.3 V, Hall Sensor 1 ... 3
Outputs: • Braking Chopper:	 IGBT output for external braking resistor
Dimensions:	130 mm x 43 mm
Operating Temperature Range:	0 ... +60 °C
Storage Temperature Range:	-40 ... +85 °C