ECS-FOC2410
Sensorless Field-Oriented Control for EC Motors
24 VDC / 10 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: Ø38 mm × 26 mm
- Supply voltage: 24 VDC (unregulated)
- Continuous winding current: 10 A
- Optional Hall sensor feedback (3 integrated Hall sensor inputs)
- Interfaces: RS-232, Serial Wire
- Inputs: 1 × 24 V direction input, 1 × analog input (0–10 V)
- Outputs: 1 × active-high fault output
- Windows configuration software with automatic motor-model parameter calculation

ECS-FOC2410 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.

Optional rotor position feedback is available via three integrated Hall sensor inputs. 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 discrete MOSFET technology and achieves an efficiency of up to 98.5%.

The maximum continuous winding current is 10 A. Current regulation is performed in software, while hardware protection shuts down the output stage at a phase current of 15 A.

The unit operates from a 24 VDC supply. A 24 V control input is provided for direction selection (CW/CCW), and speed is commanded through a 0–10 V analog input. An active-high 15 V fault output is also available.

RS-232 and Serial Wire 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 two circular printed circuit boards, each with a diameter of 38 mm, a center hole diameter of 14.3 mm, and a total assembly height of 26 mm.

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ECS-FOC2410– Technical Specifications



Operating Modes:	• Sensorless FOC with Field Weakening • Space Vector Modulation (SVM) • Speed Control • 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 via mathematical motor model • Sensorless rotor position detection at standstill • Optional Hall sensor or encoder interface
Supply Voltage	24 VDC, unregulated
Maximum Motor Current per Phase (Amplitude):	10 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) 10A 15A
Connections: Supply Voltage and Motor Phases:	 All connections via solder pads
Interfaces:	RS232B Serial Wire Interface
Outputs:	Fault output, 15 V, active high
Inputs: • 24 V Inputs: • Analog Input:	 1 × 24 V control input (Direction, CW/CCW) 1 × analog input, 0–10 V (speed setpoint)
Dimensions:	38 mm x 26 mm
Operating Temperature Range:	0 ... +60 °C
Storage Temperature Range:	-40 ... +85 °C