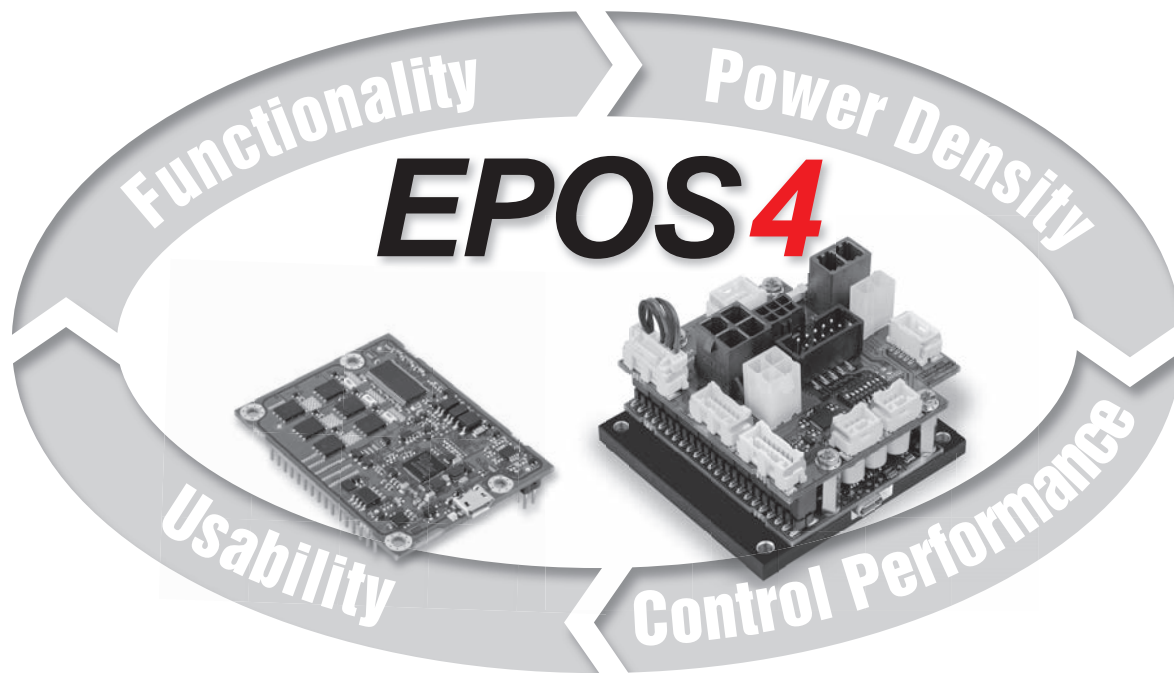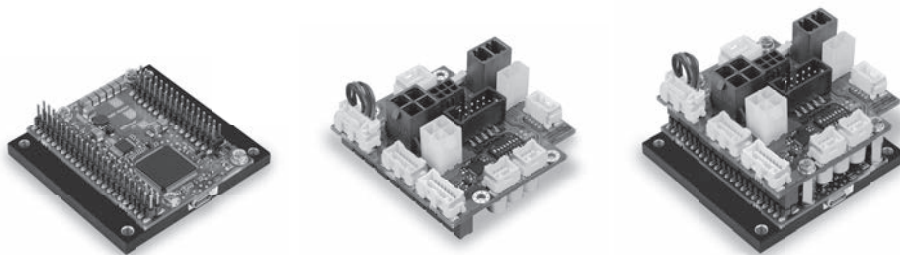# EPOS4 Positioning Controllers Overview

CANopen slave with EtherCAT option

EPOS4 is the next generation of our CANopen positioning controller. It combines maximum power density with improved control performance and better functionality. The modular concept also provides for a wide variety of expansion options with Ethernet-based interfaces like EtherCAT or absolute rotary encoders. All these innovations combined with the proven concepts of the EPOS product line are consistently based on the successful principle of the **E**asy to use **PO**sitioning **S**ystem.

As part of the new modular system, the EPOS4 controllers can be with ready-to-install connector boards into compact solutions that match a wide variety of requirements. Optional expansion modules make it possible to provide custom basic functionalities at low cost:

Module + Connector Board = Compact

EPOS4 is a modular digital positioning controller. It is suitable for permanent magnet-activated DC motors and brushless, electronically commutated EC motors with incremental or absolute encoders with an operational range of up to 750 W continuous power. The variety of operating modes provides high flexibility: The controllers are suitable for use in a wide range of drive systems in automation and mechatronics.

Cyclic Synchronous Position (CSP)
The master executes the path planning and sends the target position cyclically and synchronously to the EPOS4 via the network. The position control loop runs on the EPOS4. The EPOS4 sends the measured actual position, speed and current values to the master (in preparation).

Cyclic Synchronuous Velocity (CSV)
The master executes the path planning and sends the target speed cyclically and synchronously to the EPOS4 via the network. The speed control loop runs on the EPOS4. The EPOS4 sends the measured actual position, speed and current values to the master. The CSV mode is commonly used if a PI position control loop is closed via the master (in preparation).

Cyclic Synchronuous Torque (CST)
The master executes the path planning and sends the target torque cyclically and synchronously to the EPOS4 via the network. The torque (current) control loop runs on the EPOS4. The EPOS4 sends the measured actual position, speed and current values to the master. The CST mode is commonly used if a PID position control loop is closed via the master.

Point-to-point
The "Profile Position Mode" moves the position of the motor axis from point A to point B. Positioning is in relation to the axis Home position (absolute) or the actual axis position (relative).

Interpolated Position Mode (PVT)
Thanks to Interpolated Position Mode, the EPOS4 is able to synchronously run a path specified by interpolating points. With a suitable master, coordinated multi-axis movements as well as any profile in a 1-axis system can be carried out. (PVT = Position and Velocity versus Time, in preparation)

Position and velocity control with feed forward
The combination of feedback and feed forward control provides ideal motion behavior. Feed forward control reduces control error. EPOS4 supports feed forward acceleration and speed control.

Speed control
In the Profile Velocity Mode, the motor axis is moved with a defined set speed. The motor axis keeps the speed constant until a new speed set value is given.

Homing
The Homing Mode is used for referencing to a specific mechanical position. There is a wide variety of methods available.

Feedback options
Two different encoder signals can be evaluated simultaneously. In a suitable master unit, this enables dual loop control in order to compensate for mechanical backlash and elasticity. There is a wide range of suitable sensors (in preparation).

Protection
The positioning controller has protective circuits against overcurrent, excess temperature, under- and overvoltage, voltage transients, short-circuits in the motor cable, and against feedback signal loss. An adjustable current limitation protects the motor and load.

Safe Torque Off (STO)
With this safety feature in accordance with IEC61800-5-2 (certification pending), the drive can be brought to a safe state at any time from two independent digital inputs. The supply of torque-generating power is interrupted.

The state can be monitored via an additional digital output. The inputs and outputs are optically isolated.

Capture Inputs (Touch Probe)
The digital inputs can be configured so that the actual position value is stored whenever a positive or negative edge occurs at an input (in preparation).

Trigger Output (Position Compare)
The digital outputs can be configured to that a digital signal is sent at a selectable position value (in preparation).

Control of Holding Brakes
Control of holding brakes can be integrated in the device status management. The delay times can be individually configured for switching on and off (in preparation).

Supplementary information for technical data page 431–432.

Operating modes/Control
Cyclic Synchronous Position (CSP)[1]
Cyclic Synchronous Velocity (CSV)[1]
Cyclic Synchronous Torque (CST)
Profile Position, Profile Velocity and Homing Mode
Interpolated Position Mode (PVT)[1]
Speed and Acceleration Feed Forward
Sinusoidal or Block Commutation for EC motors
Alternative set value input via step/direction, master encoder or analog commands[1]
Dual-loop Position and Speed Control[1]

Communication/Configuration
Communication via CANopen and/or USB 2.0/3.0 and/or RS232
USB to CAN and RS232 to CAN gateway
Optional EtherCAT CoE[1]

Inputs/Outputs
STO (Safe Torque Off) inputs and outputs, optically isolated
Free digital inputs, configurable e.g. for limit/reference switches
Free digital outputs, configurable e.g. for brake
Free analog inputs, configurable e.g. for set value
Free analog ouputs, configurable e.g. for current monitor

Available software
EPOS Studio
Windows DLL / Linux Shared Object Library[1]
IEC 61131-3 libraries
Firmware

Available documentation
Feature Chart
Hardware Reference
Firmware Specification
Communication Guide
Application Notes

Accessories
A wide range of optional cables and connectors are available. See page 437.

[1] in preparation

EPOS4 performance characteristics
– Maximum power density
– Convincing control performance even with highly dynamic motors
– Comprehensive feedback options
– Diverse I/O connection options for peripherals
– Uncompromising protective features for controller and drive
– Configuration and communication via CANopen, RS232 and USB (EtherCAT option in preparation)
– Easy commissioning via EPOS studio GUI and intuitive tools
– Libraries and programming examples for efficient integration in a wide variety of systems
– All software components are freely available at any time
– Full documentation and outstanding support

The complete package for your motion control solution with added value.
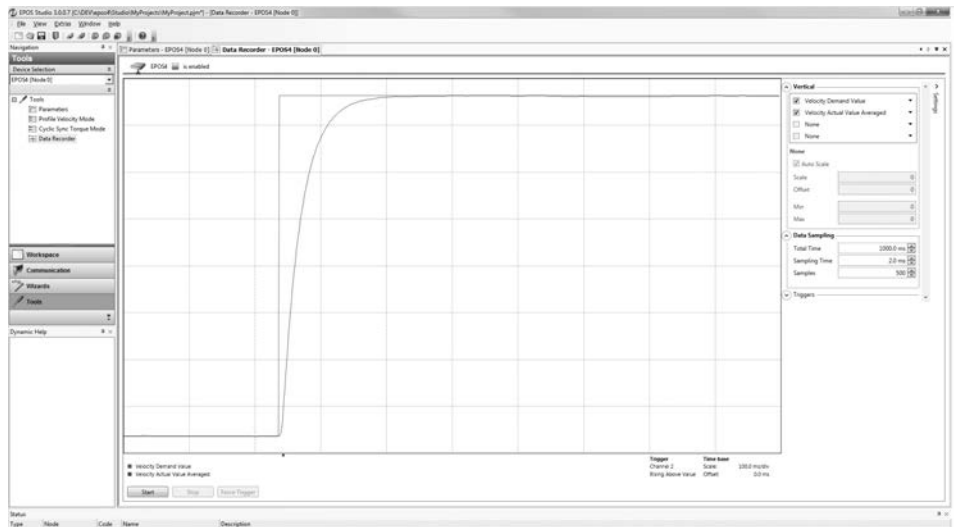
| Accessories EPOS4[2]	M 50/8	C 50/8 CAN	M 50/15	C 50/15 CAN
275829 Power Cable	—	✓	—	✓
520850 Power Cable High Current	—	✓	—	✓
275851 Motor Cable	—	✓	—	✓
520851 Motor Cable High Current	—	—	—	✓
275878 Hall Sensor Cable	—	✓	—	✓
275934 Encoder Cable	—	✓	—	✓
520852 Sensor Cable 5x2 core	—	✓	—	✓
520853 Signal Cable 8 core	—	✓	—	✓
520854 Signal Cable 7 core	—	✓	—	✓
520856 RS232-COM Cable	—	✓	—	✓
520857 CAN-COM Cable	—	✓	—	✓
520858 CAN-CAN Cable	—	✓	—	✓
403968 USB Type A - micro B Cable	✓	✓	✓	✓
422827 Ethernet Cable	—	—	—	—
520859 EPOS4 Connector Set	—	✓	—	✓
[2]not included in delivery				

EPOS4 Positioning Controllers Data

EtherCAT® (optional) **CANopen** **USB** **RS232** **GUI**

NEW

EtherCAT® (optional)
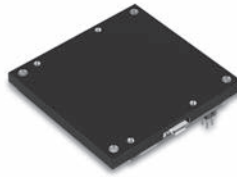
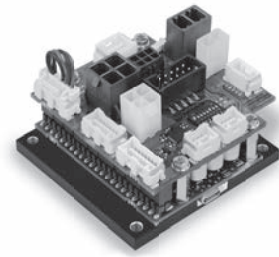**EPOS4 Module 50/15**
OEM position control module, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 750/1500 Watt.

NEW

EPOS4 Compact 50/15 CAN
Ready-to-install compact solution, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 750/1500 Watt.

Controller version		
	CANopen Slave with EtherCAT option	CANopen Slave
Electrical data		
Operating voltage V_{CC}	10 - 50 VDC	10 - 50 VDC
Logic supply voltage V_C (optional)	10 - 50 VDC	10 - 50 VDC
Max. output voltage	0.9 x V_{CC}	0.9 x V_{CC}
Max. output current I_{max} (<60 s)	30 A	30 A
Continuous output current I_{cont}	15 A	15 A
Switching frequency of power stage	50 kHz	50 kHz
Sampling rate of PI current controller	25 kHz (40 µs)	25 kHz (40 µs)
Sampling rate of PI speed controller	2.5 kHz (400 µs)	2.5 kHz (400 µs)
Sampling rate of PID position controller	2.5 kHz (400 µs)	2.5 kHz (400 µs)
Max. speed (1 pole pair)	50 000 rpm (sinusoidal), 100 000 rpm (block)	50 000 rpm (sinusoidal), 100 000 rpm (block)
Built-in motor choke per phase	–	2.2 µH / 15 A
Inputs		
Hall sensor signals	H1, H2, H3	H1, H2, H3
Encoder signals	A, A\, B, B\, I, I\ (max. 6.25 MHz)	A, A\, B, B\, I, I\ (max. 6.25 MHz)
Sensor signals	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\
Digital inputs	4 (logic level)	4 (level switchable: logic/PLC)
Analog inputs	2 (12-bit resolution, -10…+10 V)	2 (12-bit resolution, -10…+10 V)
CAN-ID (CAN node identification)	configurable with external wiring	configurable with DIP switch 1…5
Outputs		
Digital outputs	2	2
Analog outputs	2 (12-bit resolution, -4…+4 V)	2 (12-bit resolution, -4…+4 V)
Encoder voltage output	+5 VDC, max. 70 mA	+5 VDC, max. 70 mA
Hall sensor voltage output	+5 VDC, max. 30 mA	+5 VDC, max. 30 mA
Auxiliary voltage output	+5 VDC, max. 150 mA	+5 VDC, max. 150 mA
Interfaces		
RS232	RxD; TxD (max. 115 200 bit/s)	RxD; TxD (max. 115 200 bit/s)
CAN	high; low (max. 1 Mbit/s)	high; low (max. 1 Mbit/s)
USB 2.0/3.0	Data+; Data- (Full Speed)	Data+; Data- (Full Speed)
EtherCAT	optional (in preparation)	–
Indicator		
LED green = READY, red= ERROR	Green LED, red LED	Green LED, red LED
Environmental conditions		
Temperatrue – Operation	-30…+25 °C	-30…+25 °C
Temperature – Extended Range	+25...+77 °C	+25...+77 °C
Temperature – Storage	-40…+85 °C	-40…+85 °C
Humidity (condensation not permitted)	5…90%	5…90%
Mechanical data		
Weight	approx. 70 g	approx. 126 g
Dimensions (L x W x H)	59.5 x 62.0 x 16.4 mm	59.5 x 65.5 x 35.1 mm
Mounting	Pluggable (female headers 2.54 mm) or M3 screws	M3 screws
Part numbers		
	504383 EPOS4 Module 50/15	**520886** EPOS4 Compact 50/15 CAN
Accessories		
	235811 DSR 70/30 Shunt regulator	**235811** DSR 70/30 Shunt regulator
	Order accessories separately, see page 437	Order accessories separately, see page 437