EPOS4 Positioning Controllers Overview
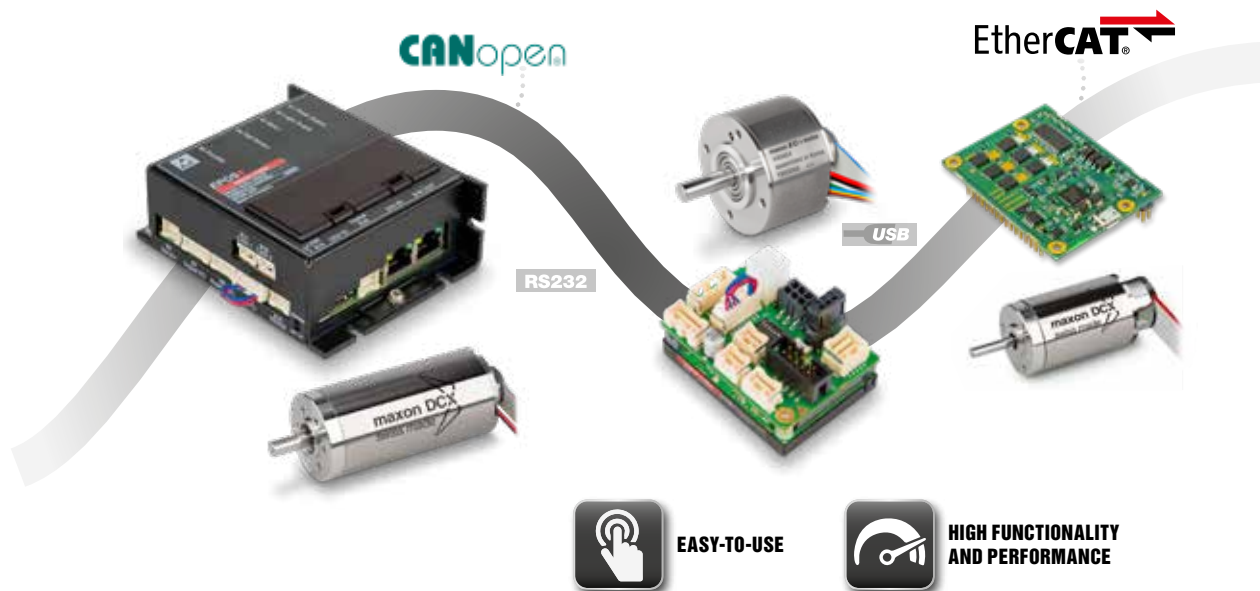
CANopen

EtherCAT

USB

RS232

EASY-TO-USE

HIGH FUNCTIONALITY AND PERFORMANCE

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 1050 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 Synchronuous 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.

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.

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

Operating modes/Control

Cyclic Synchronous Position (CSP)

Cyclic Synchronous Velocity (CSV)

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

Optional EtherCAT (CoE)

USB to CAN and RS232 to CAN gateway

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 (32-/64-bit) with programming examples

Linux shared object library (X86 32-/64-bit, ARMv7/v8 32-bit for Raspberry Pi and BeagleBone) with programming examples

IEC 61131-3 libraries

Firmware

Available documentation

Feature Chart

Hardware Reference

Firmware Specification

Communication Guide

Application Notes

[1] in preparation

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 permitted sensors: Digital incremental encoders, analog incremental encoders (sin/cos), and SSI absolute encoders.

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 based on 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.

Supplementary information for technical data page 454–455.

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 (CiA 301, 402, 305), RS232, USB, or EtherCAT. IEC 61158 type 12 EtherCAT slave: CoE (CAN application layer over EtherCAT) compliant with IEC 61800-7 profile type 1 (CiA 402). Easy integration into existing EtherCAT systems. Can be connected to a network of other EtherCAT units.
– 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.
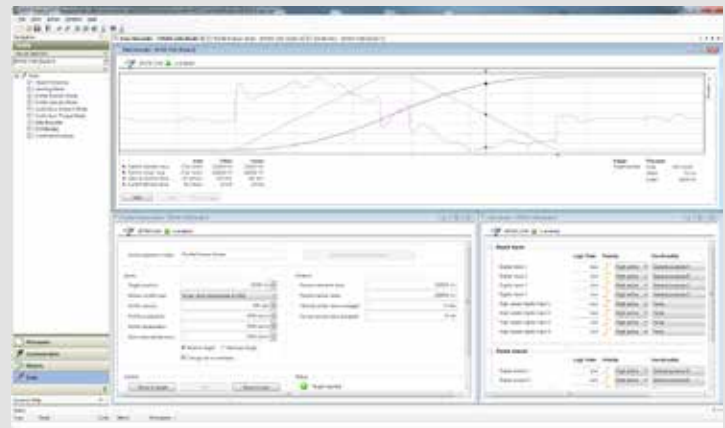
The complete package for your motion control solution with added value.

Accessories EPOS4 (not included in delivery)

	Module 24/1.5	Compact 24/1.5 CAN	50/5	Module 50/5	Compact 50/5 CAN	Module 50/8	Compact 50/8 CAN	Compact 50/8 EtherCAT	Module 50/15	Compact 50/15 CAN	Compact 50/15 EtherCAT	70/15
520858 CAN-CAN Cable	—	✓	✓	—	✓	—	✓	—	—	✓	—	✓
520857 CAN-COM Cable	—	✓	✓	—	✓	—	✓	—	—	✓	—	✓
275934 Encoder Cable	—	✓	✓	—	✓	—	✓	✓	—	✓	✓	✓
275878 Hall Sensor Cable	—	—	✓	—	✓	—	✓	✓	—	✓	✓	✓
520854 Signal Cable 7core	—	✓	✓	—	✓	—	✓	✓	—	✓	✓	✓
520853 Signal Cable 8core	—	✓	✓	—	✓	—	✓	✓	—	✓	✓	✓
275851 Motor Cable	—	—	✓	—	✓	—	✓	✓	—	✓	✓	✓
520851 Motor Cable High Current	—	—	—	—	—	—	—	—	—	✓	✓	✓
275829 Power Cable	—	—	✓	—	—	—	✓(a)	✓(a)	—	✓(a)	✓(a)	✓(a)
520850 Power Cable High Current	—	—	—	—	—	—	✓(b)	✓(b)	—	✓(b)	✓(b)	✓(b)
520856 RS232-COM Cable	—	✓	✓	—	✓	—	✓	—	—	✓	—	✓
520852 Sensor Cable 5x2core	—	✓	✓	—	✓	—	✓	✓	—	✓	✓	✓
520860 STO Idle Connector X9	—	✓(i)	✓(i)	—	✓(i)	—	✓(i)	✓(i)	—	✓(i)	✓(i)	✓(i)
403968 USB Type A - micro B Cable	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
422827 Ethernet Cable	—	—	✓	—	—	—	—	✓	—	—	✓	✓
536997 EPOS4 CB 24/1.5 CAN	✓	—	—	—	—	—	—	—	—	—	—	—
534133 EPOS4 CB 50/5 CAN	—	—	—	✓	—	—	—	—	—	—	—	—
520884 EPOS4 CB Power CAN	—	—	—	—	—	✓	—	—	✓	—	—	—
604594 EPOS4 CB Power EtherCAT	—	—	—	—	—	✓	—	—	✓	—	—	—
581245 EPOS4 EtherCAT Card	✓(c)	—	✓	✓(c)	—	✓(c)	—	—	✓(c)	—	—	✓
520859 EPOS4 Connector Set	—	✓	✓	—	✓	—	✓	✓	—	✓	✓	✓

(a) optional for separate logic supply   (b) mandatory for supply of power stage   (c) with matching motherboard   (i) included

EPOS4 Positioning Controllers Data
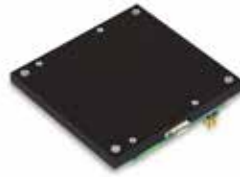
(optional) EtherCAT® | CANopen | USB | RS232 | GUI

NEW

EPOS4 Compact 50/8 EtherCAT
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 400/1500 Watt.

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.

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		
EtherCAT Slave	CANopen Slave with EtherCAT option	CANopen Slave
Electrical data		
10 - 50 VDC	10 - 50 VDC	10 - 50 VDC
10 - 50 VDC	10 - 50 VDC	10 - 50 VDC
$0.9 \times V_{CC}$	$0.9 \times V_{CC}$	$0.9 \times V_{CC}$
30 A (<5 s)	30 A (<60 s)	30 A (<60 s)
8 A	15 A	15 A
50 kHz	50 kHz	50 kHz
25 kHz (40 µs)	25 kHz (40 µs)	25 kHz (40 µs)
2.5 kHz (400 µs)	2.5 kHz (400 µs)	2.5 kHz (400 µs)
2.5 kHz (400 µs)	2.5 kHz (400 µs)	2.5 kHz (400 µs)
50 000 rpm (sinusoidal), 100 000 rpm (block)	50 000 rpm (sinusoidal), 100 000 rpm (block)	50 000 rpm (sinusoidal), 100 000 rpm (block)
2.2 µH / 15 A	–	2.2 µH / 15 A
Inputs		
H1, H2, H3	H1, H2, H3	H1, H2, H3
A, A\, B, B\, I, I\ (max. 6.25 MHz)	A, A\, B, B\, I, I\ (max. 6.25 MHz)	A, A\, B, B\, I, I\ (max. 6.25 MHz)
A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\	A, A\, B, B\, I, I\, Clock, Clock\, Data, Data\
4 (level switchable: logic/PLC)	4 (logic level)	4 (level switchable: logic/PLC)
4, differential	4, differential	4, differential
2 (12-bit resolution, -10…+10 V)	2 (12-bit resolution, -10…+10 V)	2 (12-bit resolution, -10…+10 V)
configurable with DIP switch 1…5	configurable with external wiring	configurable with DIP switch 1…5
Outputs		
2	2	2
1, differential	1, differential	1, differential
2 (12-bit resolution, -4…+4 V, max. 1 mA)	2 (12-bit resolution, -4…+4 V, max. 1 mA)	2 (12-bit resolution, -4…+4 V, max. 1 mA)
+5 VDC, max. 70 mA	+5 VDC, max. 70 mA	+5 VDC, max. 70 mA
+5 VDC, max. 30 mA	+5 VDC, max. 30 mA	+5 VDC, max. 30 mA
+5 VDC, max. 150 mA	+5 VDC, max. 150 mA	+5 VDC, max. 150 mA
Interfaces		
–	RxD; TxD (max. 115 200 bit/s)	RxD; TxD (max. 115 200 bit/s)
–	high; low (max. 1 Mbit/s)	high; low (max. 1 Mbit/s)
Data+; Data- (Full Speed)	Data+; Data- (Full Speed)	Data+; Data- (Full Speed)
100 Mbit/s (Full Duplex)	Optional EtherCAT Card Available	–
Indicator		
Green LED, red LED	Green LED, red LED	Green LED, red LED
Environmental conditions		
-30…+45 °C	-30…+25 °C	-30…+25 °C
+45…+77 °C; Derating: -0.250 A/°C	+25…+77 °C; Derating: -0.288 A/°C	+25…+77 °C; Derating: -0.288 A/°C
-40…+85 °C	-40…+85 °C	-40…+85 °C
5…90%	5…90%	5…90%
Mechanical data		
approx. 100 g	approx. 70 g	approx. 126 g
59.5 x 79.5 x 35.0 mm	59.5 x 62.0 x 16.4 mm	59.5 x 65.5 x 35.1 mm
M2.5 screws	Socket header 2.54 mm or M3 screws	M3 screws
Part numbers		
605298 EPOS4 Compact 50/8 EtherCAT	**504383** EPOS4 Module 50/15	**520886** EPOS4 Compact 50/15 CAN
Accessories		
235811 DSR 70/30 Shunt regulator	**235811** DSR 70/30 Shunt regulator	**235811** DSR 70/30 Shunt regulator
Order accessories separately, see page 470	Order accessories separately, see page 470	Order accessories separately, see page 470