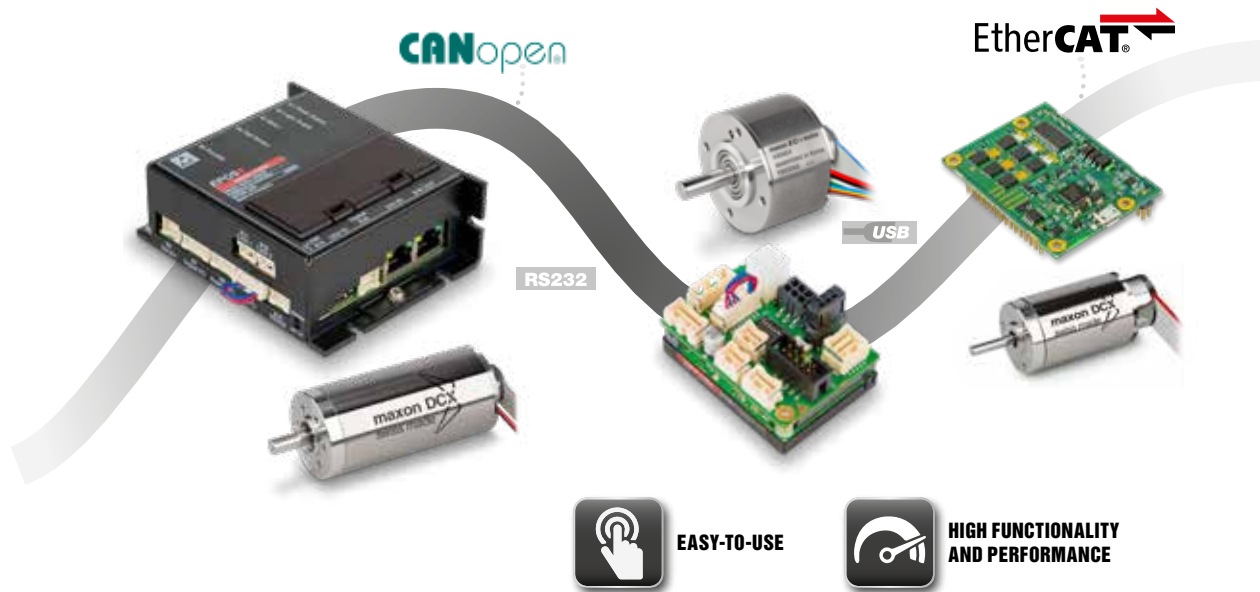


# EPOS4 Positioning Controllers Overview



## 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 Easy to use POsitioning System.

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 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.

### Cyclic Synchronous 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 Synchronous 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)<sup>1</sup>
- Speed and Acceleration Feed Forward
- Sinusoidal or Block Commutation for EC motors
- Alternative set value input via step/direction, master encoder or analog commands<sup>1</sup>
- Dual-loop Position and Speed Control<sup>1</sup>

## 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 outputs, 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

<sup>1</sup> 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 so that a digital signal is sent at a selectable position value (in preparation).

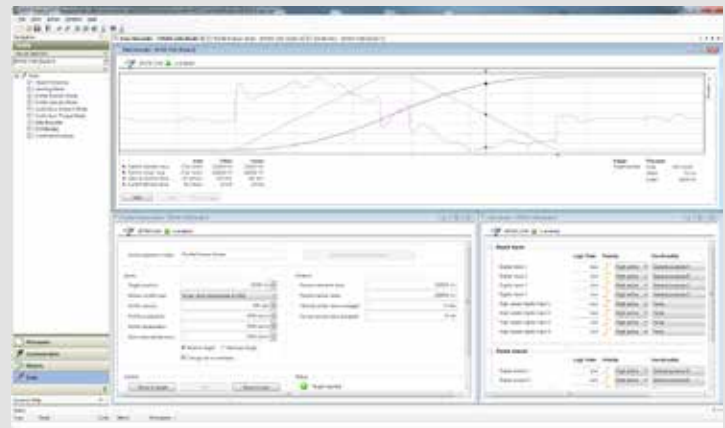
**Control of Holding Brakes**

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)**

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

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

# EPOS4 Positioning Controllers Data



### EPOS4 Module 24/1.5

OEM position control module, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 36/108 Watt.

### EPOS4 Compact 24/1.5 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 36/108 Watt.

Controller version	CANopen Slave with EtherCAT option	CANopen Slave
<b>Electrical data</b>		
Operating voltage $V_{CC}$	10 - 24 VDC	10 - 24 VDC
Logic supply voltage $V_C$ (optional)	10 - 24 VDC	10 - 24 VDC
Max. output voltage	$0.9 \times V_{CC}$	$0.9 \times V_{CC}$
Max. output current $I_{max}$	4.5 A (<30 s)	4.5 A (<30 s)
Continuous output current $I_{cont}$	1.5 A	1.5 A
Switching frequency of power stage	100 kHz	100 kHz
Sampling rate of PI current controller	25 kHz (40 $\mu$ s)	25 kHz (40 $\mu$ s)
Sampling rate of PI speed controller	2.5 kHz (400 $\mu$ s)	2.5 kHz (400 $\mu$ s)
Sampling rate of PID position controller	2.5 kHz (400 $\mu$ s)	2.5 kHz (400 $\mu$ s)
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	-	94 $\mu$ H / 1.5 A
<b>Inputs</b>		
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)
Digital inputs "High-speed"	4, differential	4, differential
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
<b>Outputs</b>		
Digital outputs	2	2
Digital outputs "High-speed"	1, differential	1, differential
Analog outputs	2 (12-bit resolution, -4...+4 V, max. 1 mA)	2 (12-bit resolution, -4...+4 V, max. 1 mA)
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
<b>Interfaces</b>		
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 EtherCAT Card Available	-
<b>Indicator</b>		
LED green = READY, red= ERROR	Green LED, red LED	Green LED, red LED
<b>Environmental conditions</b>		
Temperature - Operation	-30...+60 °C	-30...+45 °C
Temperature - Extended Range	+60...+73 °C; Derating: -0.115 A/°C	+45...+70 °C; Derating: -0.060 A/°C
Temperature - Storage	-40...+85 °C	-40...+85 °C
Humidity (condensation not permitted)	5...90%	5...90%
<b>Mechanical data</b>		
Weight	approx. 17 g	approx. 58 g
Dimensions (L x W x H)	53.8 x 38.8 x 11.1 mm	55.0 x 40.0 x 28.3 mm
Mounting	Socket header 1.27 mm or M2.5 screws	M2.5 screws
<b>Part numbers</b>		
	<b>536630</b> EPOS4 Module 24/1.5	<b>546714</b> EPOS4 Compact 24/1.5 CAN
<b>Accessories</b>		
	<b>309687</b> DSR 50/5 Shunt regulator	<b>309687</b> DSR 50/5 Shunt regulator
	Order accessories separately, see page 470	Order accessories separately, see page 470