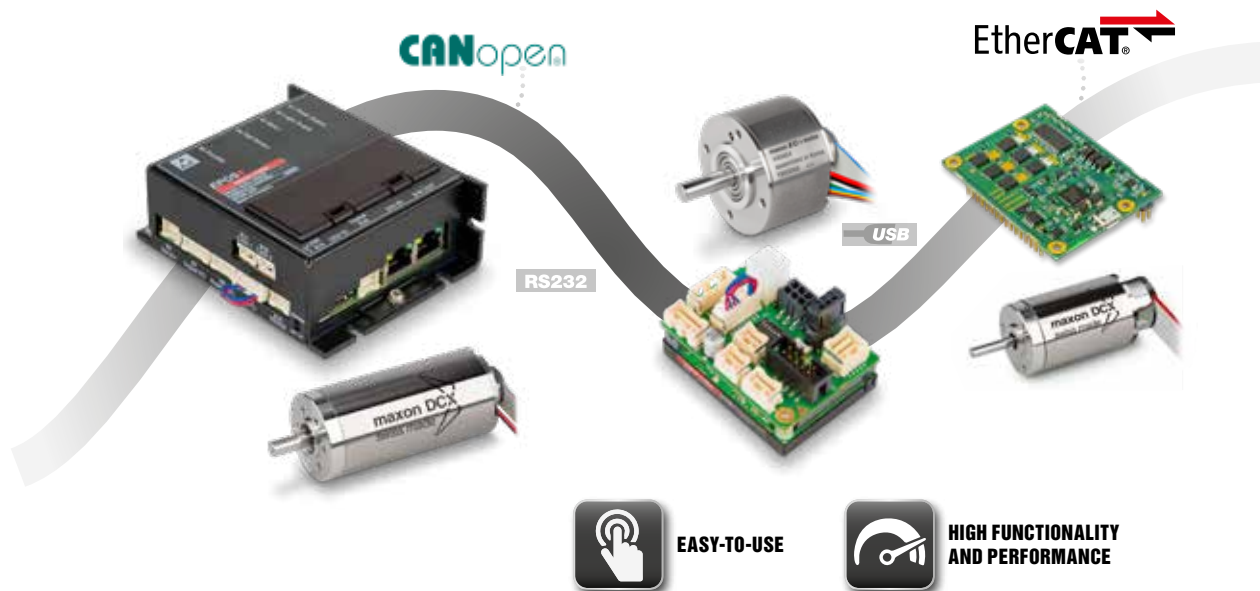


EPOS4 Positioning Controllers Overview



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 **PO**sitioning 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)¹
- Speed and Acceleration Feed Forward
- Sinusoidal or Block Commutation for EC motors
- Alternative set value input via step/direction, master encoder or analog commands¹
- Dual-loop Position and Speed Control¹

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

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 so that a digital signal is sent at a selectable position value (in preparation).

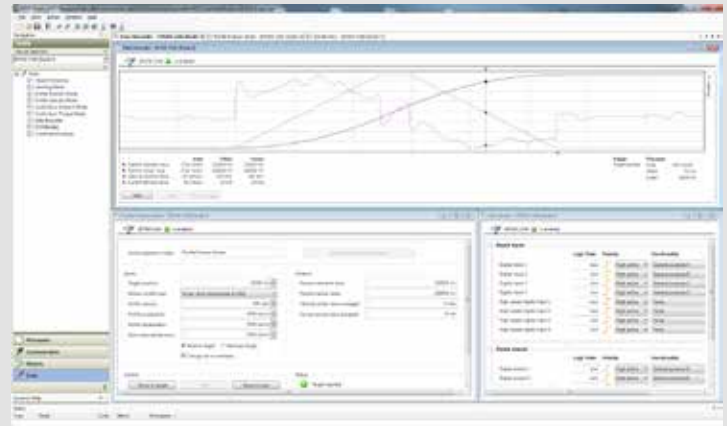
Control of Holding Brakes

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

(optional) EtherCAT

CANopen

USB

RS232

GUI



NEW

EPOS4 Compact 50/15 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 750/1500 Watt.



NEW

EPOS4 70/15
Positioning controller in a robust housing, designed for use with brushed DC motors with encoders or brushless EC motors with Hall sensors and encoders up to 1050/2100 Watt.

Controller version	EtherCAT Slave	CANopen Slave with EtherCAT option
Electrical data		
Operating voltage V_{CC}	10 - 50 VDC	10 - 70 VDC
Logic supply voltage V_C (optional)	10 - 50 VDC	10 - 70 VDC
Max. output voltage	$0.9 \times V_{CC}$	$0.9 \times V_{CC}$
Max. output current I_{max}	30 A (<60 s)	30 A (<60 s)
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 μ s)	25 kHz (40 μ s)
Sampling rate of PI speed controller	2.5 kHz (400 μ s)	2.5 kHz (400 μ s)
Sampling rate of PID position controller	2.5 kHz (400 μ s)	2.5 kHz (400 μ s)
Max. speed (1 pole pair)	50000 rpm (sinusoidal), 100000 rpm (block)	50000 rpm (sinusoidal), 100000 rpm (block)
Built-in motor choke per phase	2.2 μ H / 15 A	15 μ H / 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 (level switchable: logic/PLC)	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 DIP switch 1...5	configurable with DIP switch 1...5
Outputs		
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
Interfaces		
RS232	-	RxD; TxD (max. 115200 bit/s)
CAN	-	high; low (max. 1 Mbit/s)
USB 2.0/3.0	Data+; Data- (Full Speed)	Data+; Data- (Full Speed)
EtherCAT	100 Mbit/s (Full Duplex)	Optional EtherCAT Card Available
Indicator		
LED green = READY, red= ERROR	Green LED, red LED	Green LED, red LED
Environmental conditions		
Temperature - Operation	-30...+25 °C	-30...+50 °C
Temperature - Extended Range	+25...+77 °C; Derating: -0.288 A/°C	+50...+85 °C; Derating: -0.429 A/°C
Temperature - Storage	-40...+85 °C	-40...+85 °C
Humidity (condensation not permitted)	5...90%	5...90%
Mechanical data		
Weight	approx. 140 g	approx. 372 g
Dimensions (L x W x H)	59.5 x 79.5 x 37.1 mm	125.0 x 94.5 x 38.7 mm
Mounting	M3 screws	Flange for M4-screws
Part numbers	605299 EPOS4 Compact 50/15 EtherCAT	594385 EPOS4 70/15
Accessories	235811 DSR 70/30 Shunt regulator	235811 DSR 70/30 Shunt regulator
	Order accessories separately, see page 470	Order accessories separately, see page 470