

Intelligent compact drives

maxon compact drive

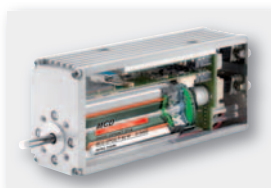
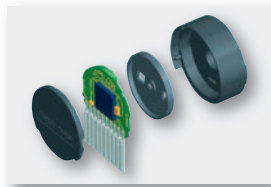


EDITION 09/2006

maxon motor
driven by precision

maxon compact drive

Compact Drives with integrated positioning controller



Motor

maxon's brushless EC-max motors with coreless winding are characterised in particular by favourable torque behaviour, high performance, an extremely wide speed range and unsurpassed service life.

Encoder

Actual value detection based on the magneto-resistant (MR) principle, 3 channels and 1000 counts per turn.

The advantages of the MR encoder are its small dimensions and robustness against ageing and contamination.

Controller

EPOS is a freely programmable, digital positioning controller with power stage available as a master or slave version. A number of operating modes allow it to be used flexibly in various drive and automation systems.

Compact Drive

The maxon compact drive combines these positive features in one device. Small and compact with extremely high power density. An innovative drive for solving problems quickly.



Everything in one casing – small and compact

maxon's compact drives feature controllers, sensors and motors in a modern aluminium casing. The use of existing maxon products with an adapted design results in robust, space-saving drive solutions with high power density. The decentralised concept of these intelligent drives minimises the use of centralised controllers.

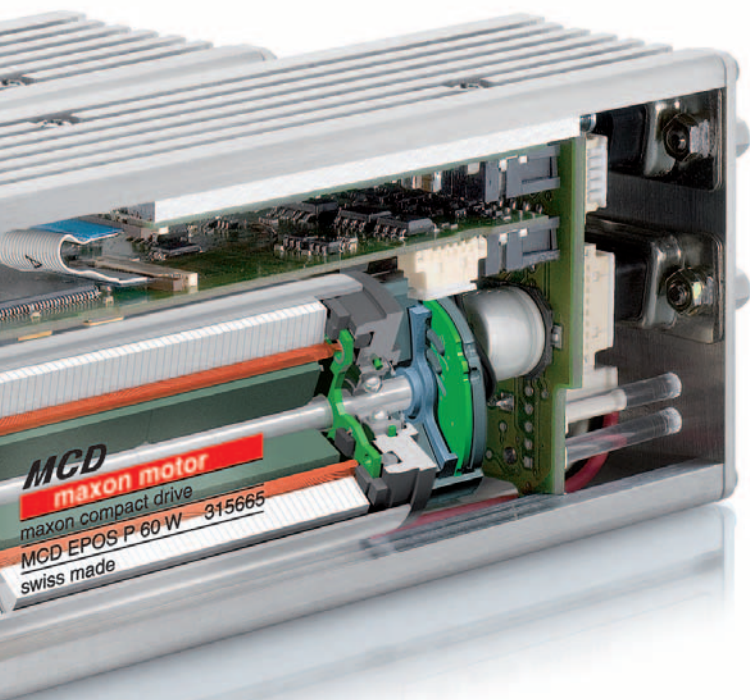
MCD EPOS – Maintenance-free positioning drive with tried and trusted components

Reliable standard products are used in the maxon compact drives. The combination of the brushless maxon EC motor, digital MR encoder and the fully digital EPOS positioning controller results in a highly dynamic, maintenance-free positioning drive with excellent functionality and high efficiency. The programmable version MCD EPOS P is equipped with a processor and memory for standalone operation. Up to 127 further CANopen devices can be controlled by the device.

Planetary gearheads can be selected from the maxon gear programme as an option for greater torque.

A complete system – easy start-up procedure

The compact drive's controller-motor combination is optimally tuned and ready for use. Wiring is kept to a minimum through direct connection to the CANopen bus or an SPS controller. Wiring errors are largely avoided and installation time is significantly reduced. The drive is controlled, parameterised and diagnosed via the CAN bus or the serial interface (RS232).



CANopen

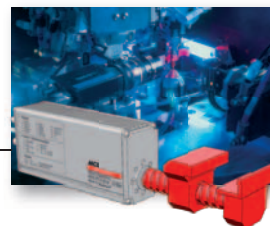
Driving

A reliable drive solution is the key to production machinery with many years of maintenance-free operation in a variety of applications.



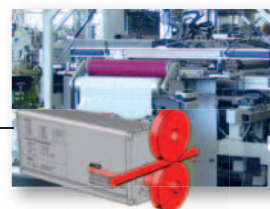
Setting-up

The rapid set-up of processing machinery which offers both precision and long-term accuracy is the key to efficient production.



Guiding

Products that are dynamically guided throughout the entire process ensure consistent product quality.



Intelligence at the right place

maxon's compact drives are fitted with several opto-coupled inputs and outputs. Sensor signals and events can be evaluated directly in the drive. Cable lengths are shorter, thus reducing susceptibility to interference.

CANopen, IEC 61131-3 and Motion Control Library – key to standardized operation

The MCD can be connected according to the CANopen standard, allowing communication with other CANopen devices. Drive programming complies with the IEC 61131-3 standard using the powerful "EPOS Studio" tool. The integration of the Motion Control Library under the widely used PLCopen standard reduces programme complexity and development costs.

Everything integrated – also a question of price

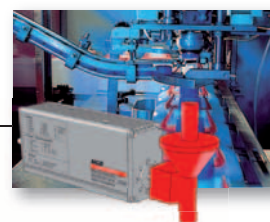
Substantial cost-savings have been made thanks to the careful selection and optimisation of components. The resulting drive is available at an unsurpassed price which is well below the cost of the individual parts. Simplified mounting results in further cost-savings.

Drives with a broad application spectrum

The requirements of compact design and enhanced functionality have been completely realised with maxon's compact drives. Their supreme flexibility ensures use in a wide range of industrial applications.

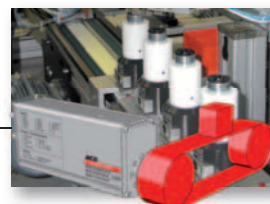
Dispensing

The precise set-up of dispensing systems provides maximum flexibility through the accurate dosing of individual component quantities.



Positioning

Several synchronised axes transport the product to the correct location with both high accuracy and sustained reproducibility.



maxon motor
driven by precision

Compact drive MCD EPOS – Slave Version



Standardised, extendable

- CANopen standard CiA DS-301 and DS-402. Can be easily integrated into existing CANopen systems. Interactive with other CANopen modules
- Alternatively controllable through serial interface (RS232)

Flexible, modular

- Configurable inputs and outputs for limit-switches, reference switches and for other sensors and displays near the drive

Easy start-up procedure

- Graphic user interface (GUI) with many functions and wizards for start-up procedure, auto-tuning, I/O configuration and tests

Easy programming

- Numerous prepared IEC 61131-3 libraries for CANmaster units of various PLC manufacturers and Windows-DLLs for PC-Master

State-of-the-art technology

- Digital position, speed and current/torque control. Optimal commutation for highest synchronism

The intelligent compact drive MCD EPOS combines a brushless maxon EC motor and a digital positioning control unit EPOS with field-bus connections CAN and RS232. A number of operating modes provides flexible application in a wide range of drive systems in automation technology and mechatronics.

Point to point

The “CANopen Profile Position Mode” helps position the motor axis from point A to point B. Positioning is in relation to the axis zero point (absolute) or current axis position (relative).

Feed forward

The combination of controlling feedback control and controlling feed forward measures provides ideal control. Anticipatory control reduces control error. MCD EPOS supports acceleration and speed anticipatory control.

Speed control

In “CANopen Profile Velocity Mode”, the motor axis is moved with a set speed. The motor axis retains speed until a new speed is set.

Torque control

Under “current mode”, a constant torque can be controlled on the motor shaft. The sinusoidal commutation used produces minimum torque ripple.

Reference route

The “CANopen homing mode” is for referencing to a special mechanical position. There are more than 30 methods available for finding the reference position.

Electronic gearhead

In “Master Encoder Mode”, the motor follows a reference input produced by an external encoder. A gearhead factor can also be defined using software parameters. Two motors can be very easily synchronised using this method.

Step/Direction

In “Step/Direction Mode” the motor axis is moved gradually with a digital signal. This mode can replace stepping motors. It can also allow the use of MCD EPOS to PLC controls without CAN interface for example.

Capture inputs (position marker)

MCD EPOS digital inputs can be configured so that the current position value can be saved when a positive and/or negative flank of an input appears.

Online commanded multi-axis system



Compact drive MCD EPOS P – Master Version

The intelligent compact drive MCD EPOS P combines a brushless maxon EC motor and a freely programmable digital positioning control unit EPOS with field-bus connections CAN and RS232. The standalone version of MCD EPOS can autonomously control single and multiple axis systems, dispensing with the need for a superior intelligent control unit. All axes can be coordinated at the same time via the CAN Bus.

Performance features (provisional)

- 32 bit host processor, 60 MHz
- 512 KB memory
- Type 2.5 ms / 5000 lines IL
- 512 Byte non-volatile memory
- Digital motion control signal processor

Standalone - multi-axis system



Software features

- Windows-based development environment
- IEC 61131-3 program languages (ST, IL, FBD, LD, SFC)
- IEC 61131-3 standard libraries
- Motion control function blocks according to PLCopen standard
- CANopen function block library
- User libraries
- Network variables and data exchange
- Online debugger with break points and watch variables
- Axis configuration and parameterization
- Online help

Technology

The programming of applications complies with IEC 61131-3 standard. A stable flash memory is used for saving. The three-stage code optimization produces IEC 61131-3 programs adjusted for the application's needs; optimized by memory, performance or a combination of both.

EPOS Studio – programming according to IEC 61131-3

Editors (ST, IL, FBD, LD, SFC) of the powerful “EPOS Studio” tool are available for programming according to IEC 61131-3. The integrated project browser shows all network resources. Complex programs with a large number of decentralized controls can be optimally managed with it. Drive systems are configured and networked quickly using intelligent step-by-step wizards.

Motion Control Library

The complexity and development costs of drive systems are substantially reduced. The Motion Firmware Library was implemented according to the widely-used PLCopen Motion Control Standard. Standardized function blocks make implementation easy.

- Drive control
- Referencing
- Speed control
- Positioning absolute and relative
- Error management
- Parameter handling

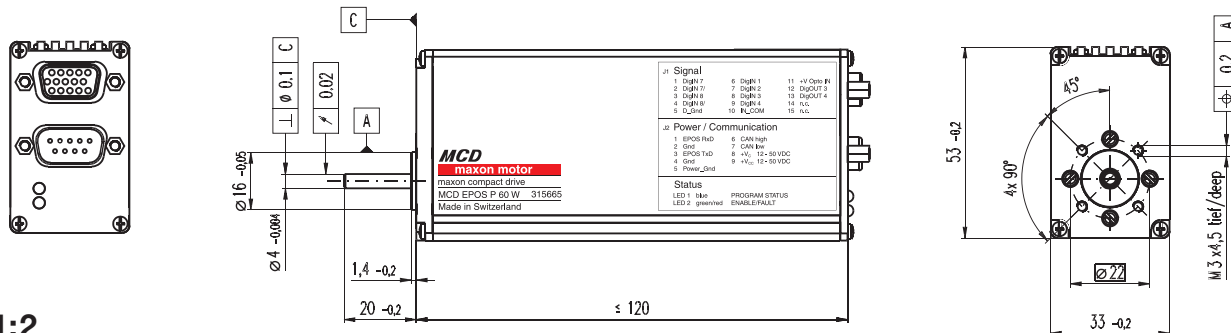
FBD Editor

ST Editor

SFC Editor

MCD EPOS and EPOS P 60 W Compact drive

DIGITAL CANopen
RS232 GUI



M 1:2

Motor Data

Nominal torque (max. continuous torque)	54 mNm
	($T_U=25^\circ\text{C}$, 5000 rpm)
Max. torque	218 mNm
Max. perm. speed (restricted by Encoder)	12000 rpm
Max. efficiency	70 %
Torque constant	24.3 mNm / A
Speed constant	393 rpm / V
Speed / torque gradient	20.6 rpm / mNm
Rotor moment of inertia	22.9 gcm ²
Axial play at axial load	< 6 N 0 mm
(preloaded ball bearings)	> 6 N 0.15 mm
Radial play	preloaded
Max. axial load (dynamic)	5.5 N
Max. force for press fits (static)	100 N
Max. radial loading, 5 mm from flange	25 N

Pin layout

Connector J1: Signal

D Sub connector High Density 15 poles (female)

1 DigIN 7	6 DigIN 1	11 +V Opto IN
2 DigIN 7/	7 DigIN 2	12 DigOUT 3
3 DigIN 8	8 DigIN 3	13 DigOUT 4
4 DigIN 8/	9 DigIN 4	14 not connected
5 D_Gnd	10 IN_COM	15 not connected

Connector J2: Power/Communication

D Sub connector 9 poles (male)

1 EPOS RxD	4 Gnd	7 CAN low
2 Gnd	5 Power_Gnd	8 +V _C 12-50 VDC
3 EPOS TxD	6 CAN high	9 +V _{CC} 12-50 VDC

Ambient temperature / Humidity range

Protection class	IP42 (optional IP54)
Operating	-20 ... +85°C
	power derating 1.4%/K from $T_U = 25^\circ\text{C}$
Storage	-40 ... +85°C
Non condensating	20 ... 80 %
Max. case temperature	< 100°C

Mechanical data

Weight	approx. 495 g
Dimensions (L x W x H)	120x33x53 mm
Mounting plate	for M3x4.5 screws

Order numbers

326343
315665

MCD EPOS 60 W
MCD EPOS P 60 W

Electrical data

Power supply voltage +V _{CC} (Ripple < 10%)	+12...+50 VDC
Logic supply voltage +V _C (Ripple < 10%)	(optional) +12...+50 VDC
Max. output voltage	0.9 · V _{CC}
Max. output current I _{max}	9 A
Continuous output current I _{cont}	2.6 A ($T_U=25^\circ\text{C}$, 5000 rpm)
Switching frequency	50 kHz

Controller

Sample rate PI - current controller	10 kHz
Sample rate PI - speed controller	1 kHz
Sample rate PID positioning controller	1 kHz
Position resolution	0.09°
Position accuracy	± 1°
Position reproducibility	± 0.09°
Encoder	1000 pulses/3 canal

Inputs

4 digital inputs (opto-coupled)	+9...+24 VDC
2 digital inputs (differential)	EIA-standard RS-422

Outputs

2 digital outputs (opto-coupled)	max. +24 VDC (I _L < 350 mA)
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Interfaces

RS-232 (EIA-Standard RS-232)	max. 115 200 bit/s
CAN (high-speed; ISO 11898 compatible)	max. 1 MBit/s
CAN ID	LSS CiA DSP-305

Protective functions

Current Limit (adjustable),
Under-/over-voltage limitation,
Temperature monitoring

LED indicator

Bi-colour LED	green = Enable, red = Fault Blink pattern = Operating status
Blue LED (only master version)	program status

maxon modular system

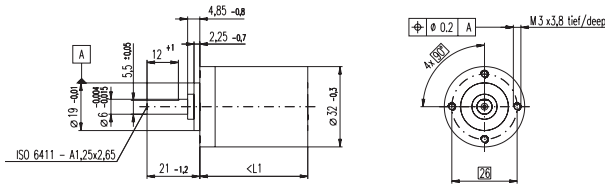
Planetary Gearhead	
Ø32 mm	
1.0 - 6.0 Nm	
Planetary Gearhead	
Ø42 mm	
3.0 - 15.0 Nm	

Options

- Encoder MR with 500 counts per turn
(account of the positioning precision 15000 rpm)
- Protection to IP54 (assembled and sealed connection cable)

Planetary Gearhead GP 32 C

Ø32 mm, 1.0 - 6.0 Nm



M 1:3

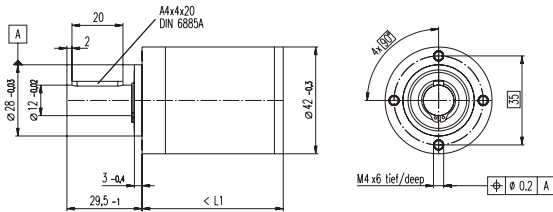
Technical Data

Reduction	3.7 : 1 – 6285 : 1				
Bearing at output	Ball bearing				
Max. permissible axial load	120 N				
Max. permissible force for press fits	120 N				
Sense of rotation, drive to output	=				
Recommended input speed	< 8000 rpm				
Recommended temperature range	-20 ... +100°C				
No. of stages	1	2	3	4	5
Max. radial load, 12 mm from flange	N	140	140	140	140
Max. continuous torque	Nm	1.0	3.0	6.0	6.0
Intermittently perm. torque at gear output	Nm	1.25	3.75	7.5	7.5
Max. efficiency	%	80	75	70	60
Weight	g	118	162	194	226
Average backlash no load	°	1.4	1.6	2.0	2.0
Gearhead length L1	mm	26.4	36.3	43.0	49.7

Combination	Overall length [mm]	= Motor + gearhead length + assembly parts			
MCD EPOS 60 W		146.5	156.4	163.1	169.8
MCD EPOS P 60 W		146.5	156.4	163.1	169.8

Planetary Gearhead GP 42 C

Ø42 mm, 3.0 - 15.0 Nm



M 1:3

Technical Data

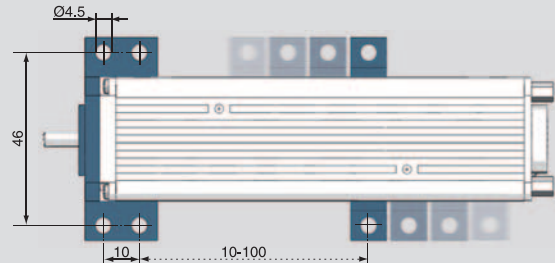
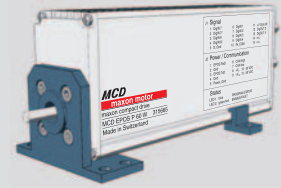
Reduction	3.5 : 1 – 936 : 1			
Bearing at output	Ball bearing			
Max. permissible axial load	150 N			
Max. permissible force for press fits	300 N			
Sense of rotation, drive to output	=			
Recommended input speed	< 8000 rpm			
Recommended temperature range	-20 ... +100°C			
No. of stages	1	2	3	4
Max. radial load, 12 mm from flange	N	120	150	150
Max. continuous torque	Nm	3.0	7.5	15.0
Intermittently perm. torque at gear output	Nm	4.5	11.3	22.5
Max. efficiency	%	90	81	72
Weight	g	260	360	460
Average backlash no load	°	0.6	0.8	1.0
Gearhead length L1	mm	40.9	55.4	69.9

Combination	Overall length [mm]	= Motor + gearhead length + assembly parts		
MCD EPOS 60 W		161.0	175.5	190.0
MCD EPOS P 60 W		161.0	175.5	190.0

Accessories MCD EPOS 60 W

Mounting Kit

Brackets for mounting the optional the MCD EPOS 60 W. The brackets provided can be placed in any position along the length of the MCD. Mounting screws are not included.



Order Number
326930

MCD EPOS 60 W Mounting-Kit

Cable

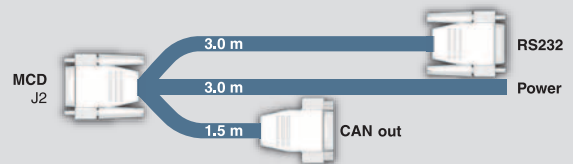
Signal cable



Order Number
326923

MCD EPOS Signal Cable

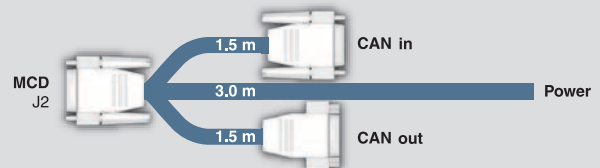
Power / RS232-CAN cable



Order Number
325939

MCD EPOS Power / RS232-CAN Cable

Power / CAN-CAN cable



Order Number
325235

MCD EPOS Power / CAN-CAN Cable

CAN Termination plug

Is required as line termination for the CAN-Network.



Order Number
326925

MCD EPOS CAN Termination Plug

maxon motor at a glance.



DC motors with moving coil rotor and strong permanent magnets: Ø6 - 75 mm, 0.3 - 250 watts.

DC motors with moving coil rotor and AlNiCo magnets, Ø12 - 32 mm, 0.5 - 20 watts.

DC motors with moving coil rotor and Neodymium magnets: Ø13 - 29 mm, 0.75 - 22 watts.

Brushless servomotors, autoclavable versions available: Ø6 - 60 mm, 1.2 - 400 watts.

Brushless servomotors with modular design: Ø16 - 40 mm, 5 - 120 watts.

4-pole brushless servomotors with maximum performance: Ø22 und 30 mm, 120 und 200 watts.



Brushless DC external rotor motors in flat design: Ø6 - 90 mm, 0.03 - 90 watts.

DC and EC drives with diameters smaller than < 10 mm: Ø6 - 8 mm, 0.03 - 1.2 watts.

Standard spur and planetary gearheads as well as customer specific gearheads

Encoders, DC tachos, resolvers.

Control electronics for DC and EC motors, servoamplifiers and positioning control units.

High-tech ceramic components (MIM/CIM technology), mainly customer specific solutions.

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