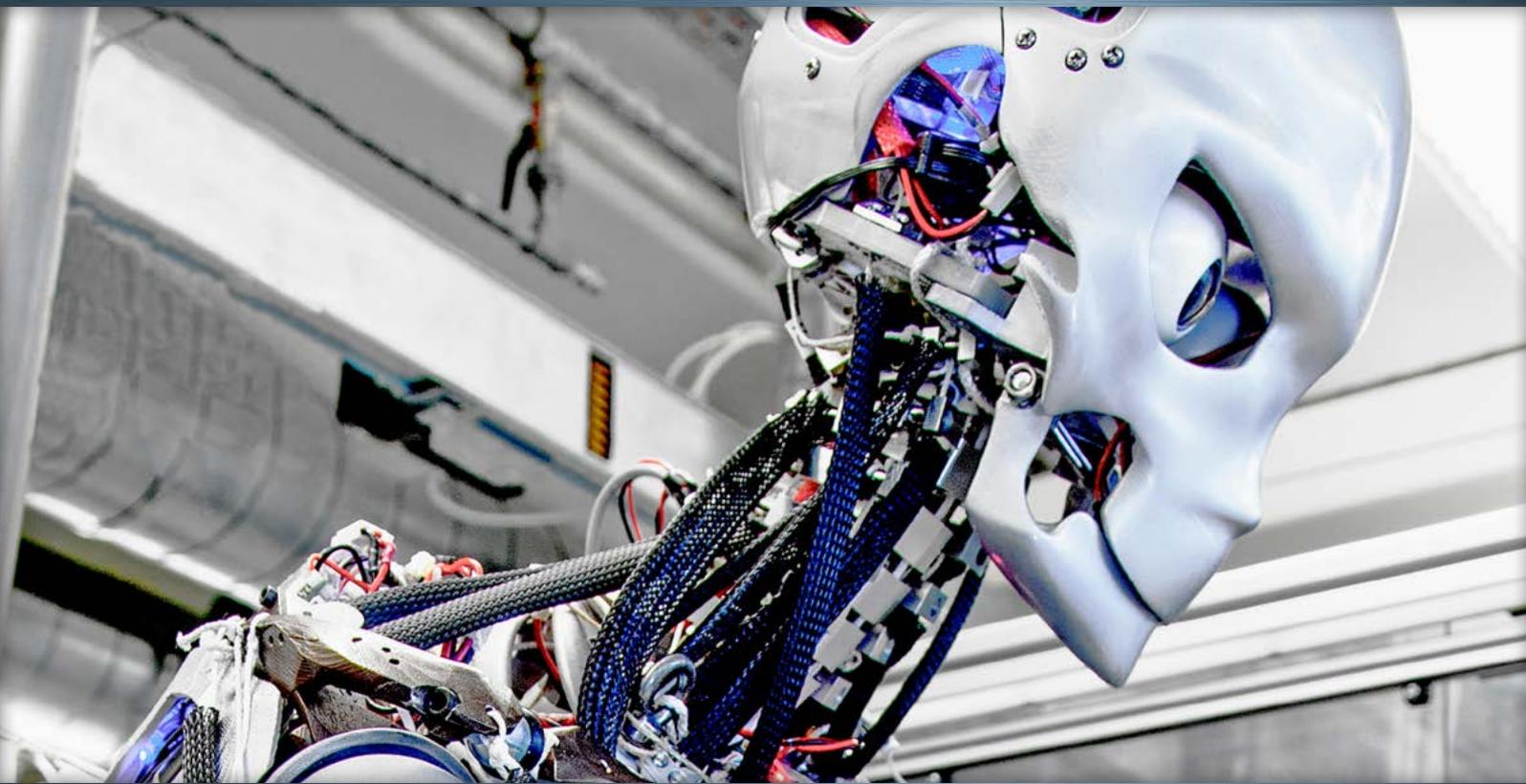


Drive systems for robotics.

High torque, compact and efficient.



www.maxonmotor.com

maxon motor

driven by precision

Founded in Switzerland. Available worldwide.

maxon – a strong global brand.

maxon motor, with headquarters in Sachseln/Central Switzerland, has production sites in Switzerland, Germany, Hungary and South Korea, as well as sales companies in more than 30 countries. Our machines and product lines are developed in-house to guarantee cost-effective manufacturing of our products and enabling us to create custom solutions to fit your specific application needs.

Driven by precision.

maxon motor is the worldwide leading provider of high-precision drives and systems up to 500 W. We develop and manufacture brushed and brushless DC motors with a unique ironless winding as well as motors with iron cores. The maxon modular system also includes planetary, spur and special gearheads, as well as encoders and control electronics.



What makes a robot unique?

Drive solutions from 0.0002 to 120 Nm.

The industrial environment is becoming faster, more precise – and safer. This places tough demands on machinery.

- Utmost precision at high speed: For example in PCB placement machines or in the semiconductor industry.
- Rapid but safe motion sequences: For example in robots designed to work with people.
- Advanced dynamics with low heat build-up: Particularly in precision machinery or multiple-axis systems.

Excellent control characteristics

Due to their ironless maxon windings and high-quality rare-earth magnets, our DC and BLDC motors have linear motor characteristics and an extremely high overload capacity. Other excellent characteristics of maxon motors include constant friction and low attenuation.

Highly dynamic with excellent torque density in a very compact package

The multi-pole, brushless EC-i and EC flat motor excel for their high torque and low inertia, and their resulting high dynamics.

High precision from a single source

A wide range of optical, magnetic, and inductive encoders offer resolutions of up to 6400 pulses per turn.

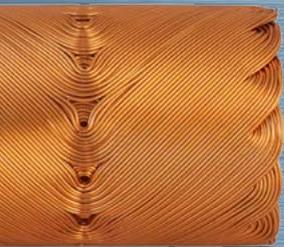
Drive control easily implemented on site

maxon position controllers can be designed as modules that are built directly into the joints of robots. The CANopen standard ensures easy integration.

Our products are as varied as your robot is unique. In addition to a wide range of standard products, we offer modifications on request, quick and convenient.

Strong together.

Contact us. Together we will develop a suitable solution.
contact.maxonmotor.com



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driven by precision

maxon technology.

Powerful performance comes in small packages. Efficiencies of over 90 %.



maxon DC motor

Ironless winding

Brushed DC motors with ironless rotor, in sizes of Ø6–65 mm, with up to 250 W power.

Main characteristics

- No magnetic cogging torque
- Withstands high overload for short periods
- Low electromagnetic interference

Product programs

DCX and **RE** motors provide excellent performance and robust design.

A-max and **RE-max** motors combine cost-effectiveness with excellent motor performance.

DCX and **DC-max** motors can be **configured online** and are ready for shipment within 11 working days.

maxon EC motor

Ironless winding

Brushless DC motors are electronically commutated. They are available in sizes of Ø4–60 mm, with up to 480 W power.

Main characteristics

- Excellent control properties
- High overload capacity
- Very long service life
- Speeds of up to 100 000 rpm
- Autoclavable up to 1000 x

Product programs

ECX and **EC** motors provide optimum performance with high speeds.

EC-4pole motors offer high torques combined with high power density.

EC-max motors offer an excellent price/performance ratio.

ECX motors can be **configured online** and are ready for shipment within 11 working days.

maxon EC motor

Iron core winding

Brushless DC external- and internal-rotor motors are electronically commutated. They are available in sizes of Ø9.2–90 mm and torques up to 500 mNm.

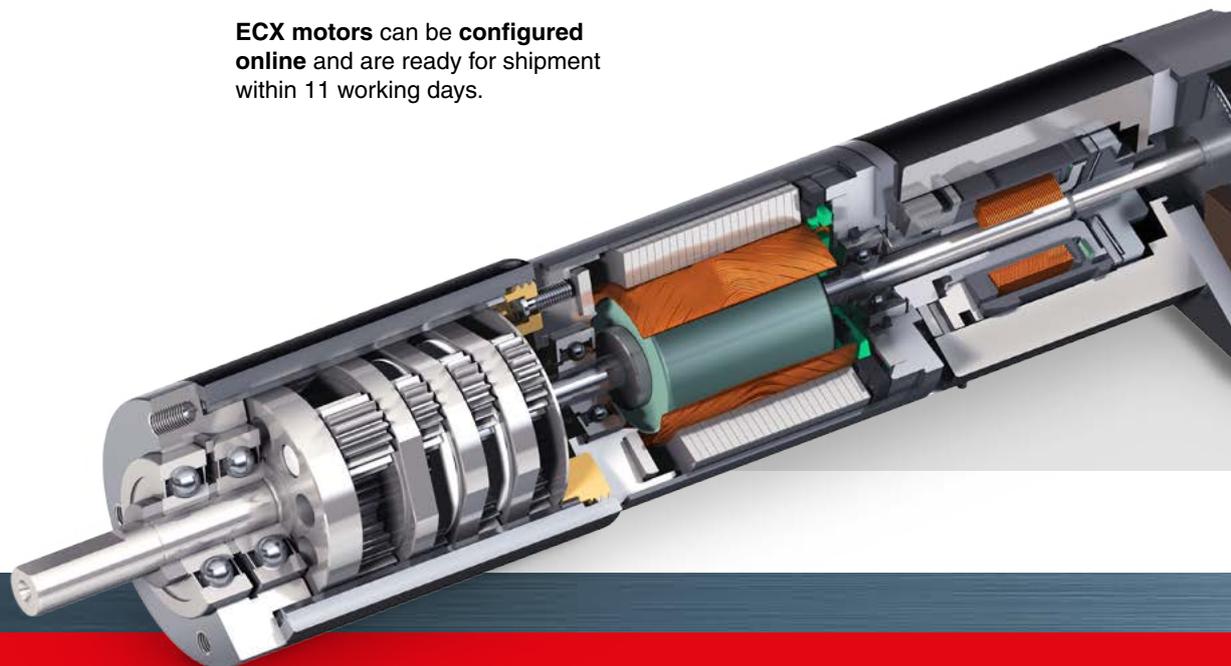
Main characteristics

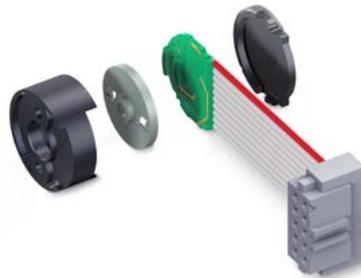
- Flat design
- High torques
- Very long service life
- Excellent price-performance ratios

Product programs

EC-flat motors provide very high torques and are available with integrated electronics.

EC-i motors are characterized by high torques and excellent dynamics.





maxon gear

Precision planetary and spur gearheads as well as customer-specific special gears. Compact spindle drives with steel or ceramic spindles.

Product programs

GP and GPX planetary gearhead

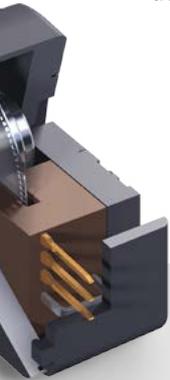
- For transmission of high torques
- High power
- High reduction ratio
- Autoclavable, with shaft seal
- Can be configured online (GPX only)

GS spur gearhead

- Economically priced
- For low torques
- High efficiency

GP S spindle drive

- Steel or ceramic spindle
- Metric spindle, ball screw and trapezoidal screw



maxon sensor

High-resolution encoders and digital encoders.

- Relative position signal, suitable for positioning tasks
- Direction detection
- Speed information from number of pulses per time unit

Product programs

Magnetic encoder

- Minimal space requirement
- Resistant against dirt
- Interpolated

Optical encoder

- High counts per turn
- Very high accuracy

Inductive encoder

- Robust against magnetic fields and dirt
- Integrated into EC flat motors

DC tachometer, resolver

maxon motor control

4-Q servo controllers and position controllers for controlling quick-response brushed and brushless DC motors up to 700 W. Available as OEM module for installation on a motherboard or ready for connection with housing.

Product programs

ESCON

Compact and powerful servo controller. Commanded by an analog set value.

EPOS2 / EPOS3

Position controllers with CANopen or EtherCAT.

MAXPOS

Highly dynamic positioning controller with EtherCAT.

maxon modular system

The motors, gearheads, encoders, brakes and controllers from maxon motor are perfectly matched to each other and can be combined to meet specific requirements.

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driven by precision



Max out your motor.

maxon EC motors designed for you as a frameless kit.

In order to achieve the optimum of high torque density and minimum installation volume, maxon offers the EC flat motors in a frameless kit version. Rotor and stator are delivered separate without bearings or motor shaft. This allows the motor to be integrated optimally in the structure of the robot.

High torque density

The EC flat motors are part of our BLDC series of motors with iron windings. Due to their large number of pole pairs, they have a very high torque.

Compact, with plenty of space inside

Due to their flat construction, EC flat motors can be integrated into robot joints in a way that is very economical in terms of space. With outer diameters of 32–90 mm, the brushless DC motors are extremely compact. Designed as external rotor motors, they offer plenty of space inside for cable glands.

Low operating voltage

maxon BLDC motors typically operate at voltages from 12 to 48 V, easily fulfilling applicable safety regulations. Take full advantage of the great selection of available windings for the standard versions.

Complete control

To easily control the motors, maxon offers frameless kits with and without Hall sensors. To monitor motor temperature, a heat-sensitive NTC resistor can also be installed on the circuit board.

Proven design

maxon EC flat motors are used daily in thousands of applications with excellent reliability. High production quantities and automated manufacturing lines guarantee consistently high quality. Get the best out of your robots. We look forward to working with you to find the perfect frameless kit for your application.



Frameless motors in robotics.

Applications in robotics often require high torque in order to not only move joints, but also do so with sufficient force. In some cases, minimizing the weight of each component is also crucial, for example when a robotic arm is mounted on a wheelchair. A frameless solution should be considered in such cases. This means that the stator and the rotor are delivered individually without housings, to be connected only when the limbs are assembled. This saves space and weight. If these are among the primary criteria, then maxon engineers will work with customers to find out whether a frameless solution is suitable.

The maxon solution

Brushless DC motors from the EC flat series.
EC 45 flat as a frameless kit.

- High level of integration in the structure of the machine
- High torques through multi-pole external rotor
- Plenty of space for cable glands
- High overload capacity
- Hall sensors
- Thermal sensors (NTC)



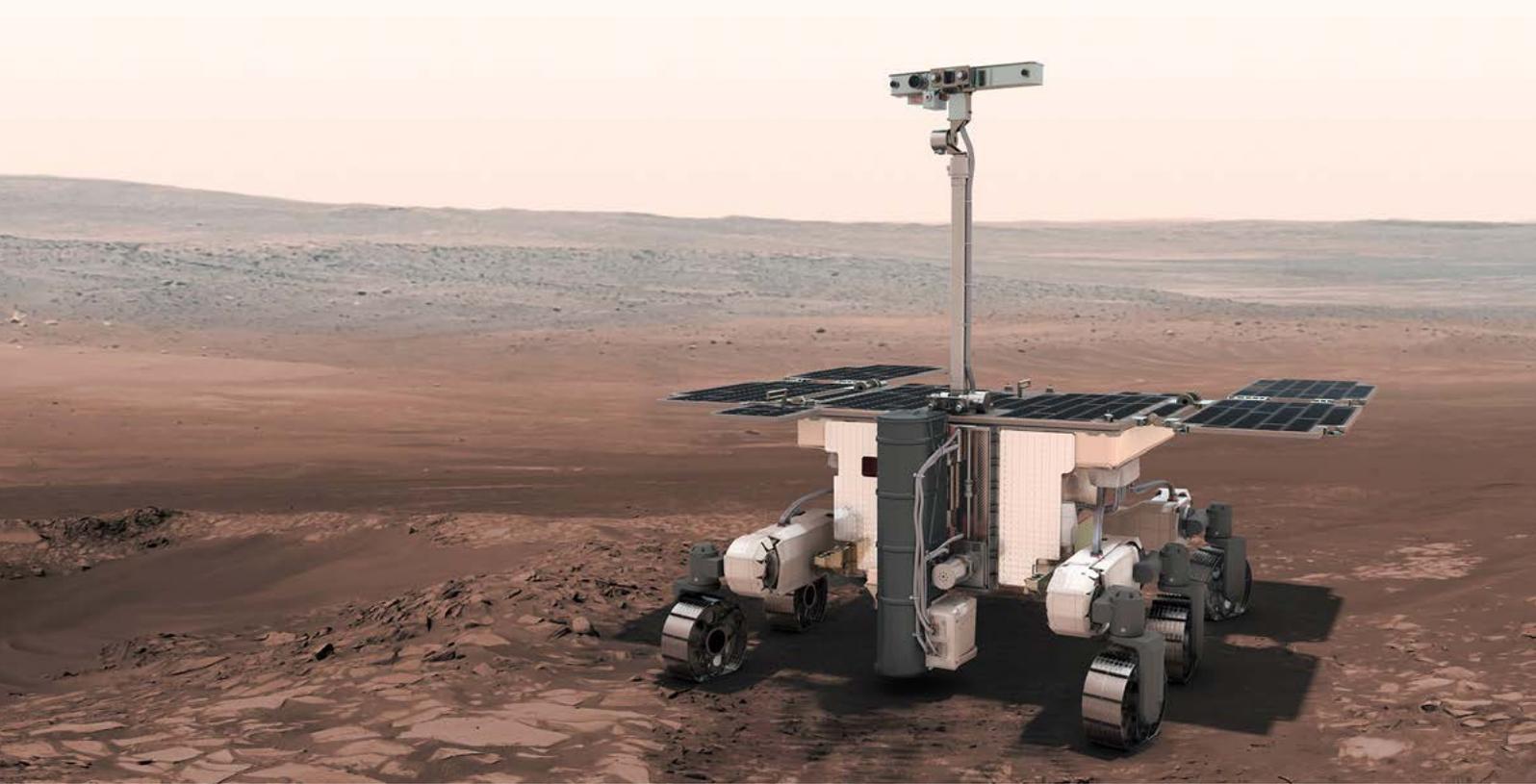
Other products to consider include:

BLDC motors: frameless kits EC 32 flat, EC 60 flat and EC 90 flat with or without Hall sensors
Controllers: EPOS2 24/2, EPOS2 24/5, EPOS2 Module 36/2

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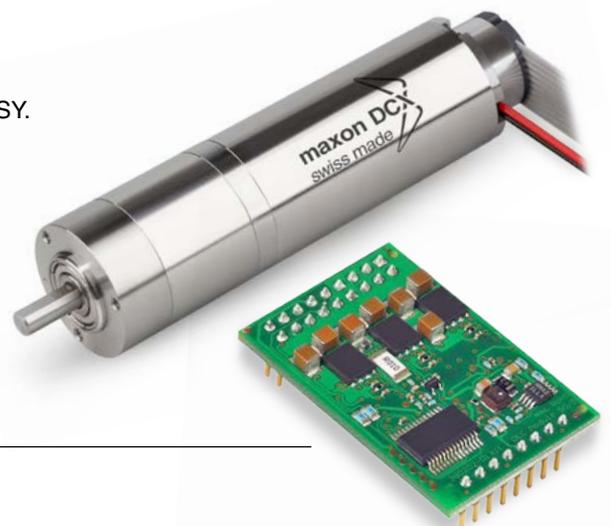
Unmanned vehicles.

Strange planets, narrow shafts, or dangerous locations: Wherever people can't go, unmanned robotic vehicles stand ready to do the work. They need to maneuver independently, overcome obstacles, and perform a variety of tasks. Reliable components are indispensable because intervention or repair are often impossible. Many engineers prefer maxon drives, because they are robust, lightweight, and durable. The energy efficiency of micromotors is also a decisive factor when running on batteries.

The maxon solution

Brushed DC motor, planetary gearheads, and X-series encoders.
DCX 22 with graphite brushes combined with a GPX 22 HP and ENX 16 EASY.
Configurable online. Ready in 11 days: xdrives.maxonmotor.com

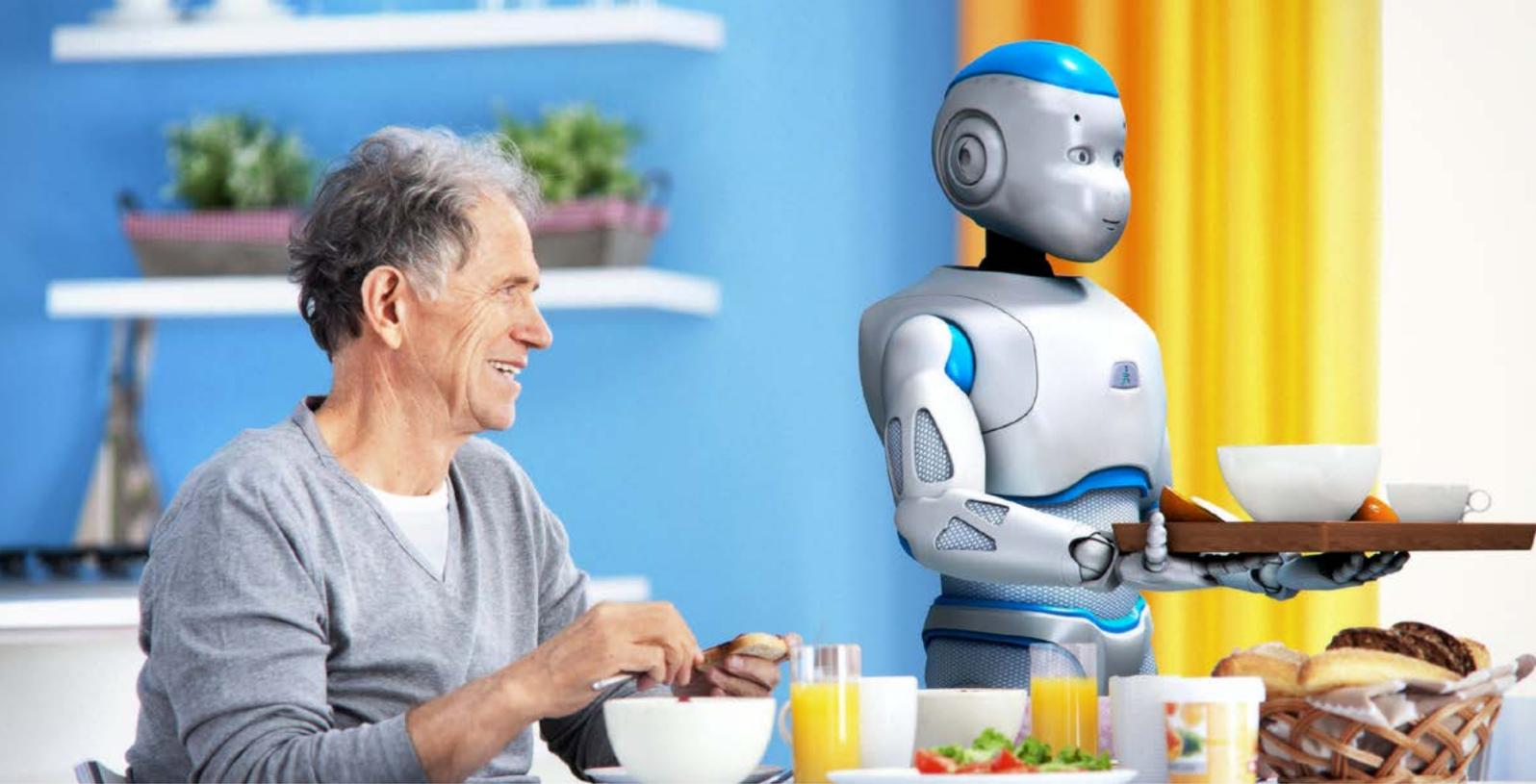
- High energy efficiency
- High power packed into extremely small spaces
- Precise speed or position control
- Very high output torques



Other products to consider include:

BLDC motors: EC-i 40, EC-i 40 High Torque with EASY encoder
BLDC flat motors: EC 45 flat, EC 60 flat and EC 90 flat with MILE encoder
Controllers: ESCON Module 50/5, DEC Module 50/5, EPOS2 Module 36/2

You can find additional application stories at www.maxonmotor.com



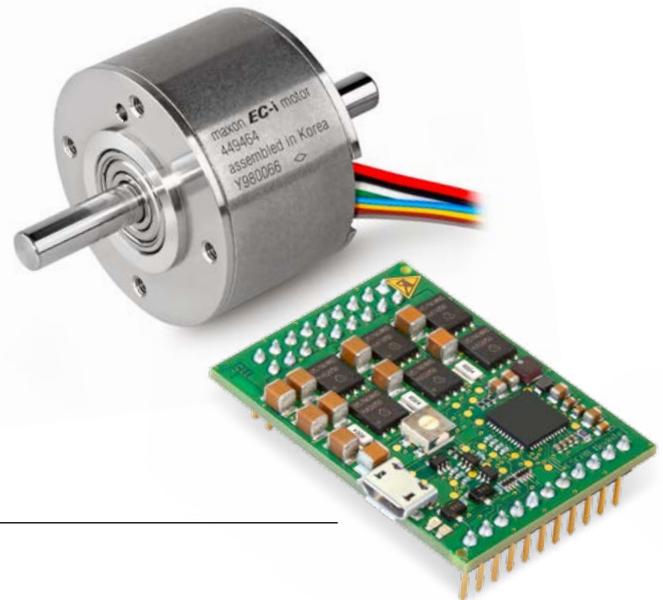
Humanoid robots.

Humanoid robots will soon be part of our daily lives, performing as service or caretaker machines, as teaching aids, or as rescuers in disaster areas. Such robots require lightweight, compact, and powerful components. Especially the legs need high-torque actors. With its brushless DC motors, maxon has just the right solution. Especially the multi-pole motors offer excellent torque-to-size ratios.

The maxon solution

Brushless DC motor EC-i 40 with ENC EASY.

- Compact design and high torque density
- Over 10,000 hours of service life
- High precision due to high-resolution encoders with up to 1024 pulses per turn
- Dust and oil resistant



Other products to consider include:

DC motors: DC-max or DCX

BLDC motors: EC-i, EC flat or EC-4pole

Planetary gearheads: GPX, GPX High Power, GP, GP High Power

Controllers: ESCON Module 50/5, EPOS2 24/2, EPOS2 50/5

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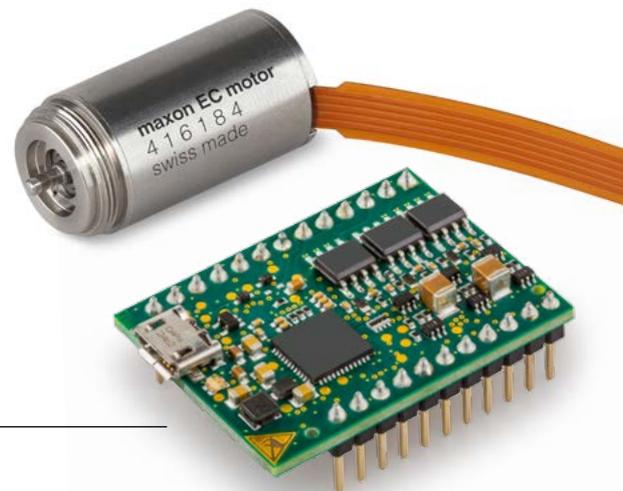
Industrial grippers.

Grip it firmly, don't drop it... and please, please don't crush it! Grippers for industrial apparatus, humanoid robots, or robotic arms have to meet high requirements. Proper gripping is a challenge, not least for the electric motors that have to execute the movement. Precise interaction between motors and encoders is crucial. Moreover, engineers demand drives with a high power density to generate maximum torque in very small installation spaces. With its motors, maxon is offering the right solutions. Their special winding makes maxon motors efficient and precise.

The maxon solution

Brushless DC motor EC 13 with Hall sensors.

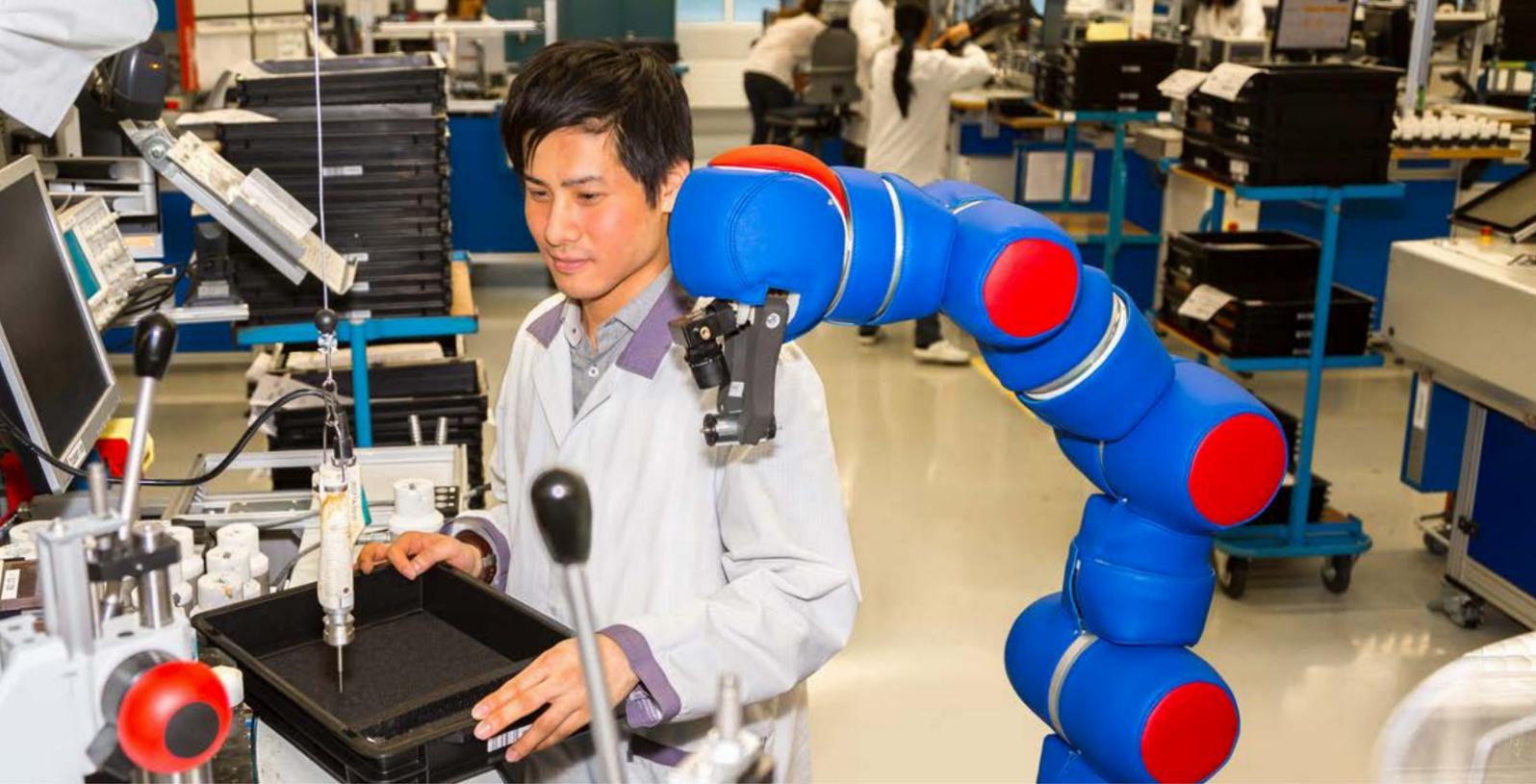
- High overload capacity
- Small diameter
- Highly dynamic
- Excellent control characteristics – linear curve



Other products to consider include:

BLDC motors: EC 9.2 flat, EC 20 flat
 Planetary gearheads: GP 10 A, GP 13 A
 Controllers: ESCON Module 24/2

You can find additional application stories at www.maxonmotor.com



Collaborative robots.

The times are gone when industrial robots needed to be locked away behind protective barriers. An increasing number of developers is introducing robots that work hand in hand with humans. These collaborative robots (cobots) perceive their environment and “sense”, by means of torque feedback, when they get too close to another robot or a human. High-torque motors are advantageous in such applications, to keep the gearhead units small. With their outstanding power-to-size ratio, maxon flat motors come into their own here.

The maxon solution

Brushless DC motor EC-flat 90 with integrated Mile encoder.

- Compact, flat design and high torque density
- Robust design
- High precision due to high-resolution encoders with up to 6400 pulses per turn
- Dust and oil resistant



Other products to consider include:

BLDC motors: EC-i, EC flat or EC-4pole

Planetary gearheads: GP, GP High Power

Controllers: EPOS2 24/5, EPOS2 Module 36/2, EPOS2 50/5

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Surgical robots.

What was unimaginable a few decades ago is now reality in operating rooms all over the world: Robots support surgeons during difficult prostate removal surgery or other operations on the torso. During the operation, the surgeons sit at a control console, from where they control the four-arm robot. Its instruments are laparoscopically inserted into the patient through small openings, where they can be maneuvered with more flexibility and precision than would be possible with any human hand. This prevents nerve damage or major bleeding during the operation. Additionally the small incisions make the healing process much faster. To accurately transmit the movements of the surgeon to the robot and have the robot execute them, several dozen maxon DC motors are needed. These have no cogging torque and are therefore ideal for use in surgical robots.

The maxon solution

Brushed DC motors of the DCX series. DCX 22 with graphite brushes, DCX 10 combined with a GPX 10 planetary gearhead and an ENX encoder. Configurable online. Ready in 11 days: xdrives.maxonmotor.com

- Ironless maxon winding provides smooth running
- Linear characteristic, excellent control properties
- High energy efficiency
- Minimal heat build-up
- Very quiet
- Backdrivable gearhead



Other products to consider include:

DC motors with precious metal brushes: RE 30, 15 W and RE 40, 25 W
 Controllers: EPOS2 Module 36/2

contact.maxonmotor.ch



Pipetting with a column of 16 DiTis using the MCA 384.
Photo courtesy of Tecan Group Ltd.

Laboratory robots.

Pipetting robots perform an increasing variety of tasks while taking up less and less space. They are used for active ingredient screening by large pharmaceuticals companies, as well as by small molecular biology labs that require flexible liquid handlers. These robots are able to handle hundreds of samples simultaneously and can be equipped with multiple pipetting heads. Their speed is ever increasing as they dispense smaller and smaller fluid quantities. However, all this only works with highly dynamic and precise drives. maxon DC motors are especially suitable for this type of positioning task. These motors have a very low moment of inertia, and their ironless windings provide stutter-free movements. Together with encoders and a matching controller, perfect drive combinations become possible.

The maxon solution

Brushed DC motor DCX 12 with encoder ENX 10 EASY and planetary gearhead GPX 12.
Configurable online. Ready in 11 days: xdrives.maxonmotor.com

- High overload capacity
- Small diameter
- Highly dynamic
- Excellent control characteristics – linear curve
- High precision with up to 1024 pulses per turn



Other products to consider include:

BLDC motors: EC or EC flat
Planetary gearheads: GPX, GPX High Power, GP, GP High Power
Controllers: EPOS2 24/2, EPOS2 24/5, EPOS2 Module 36/2

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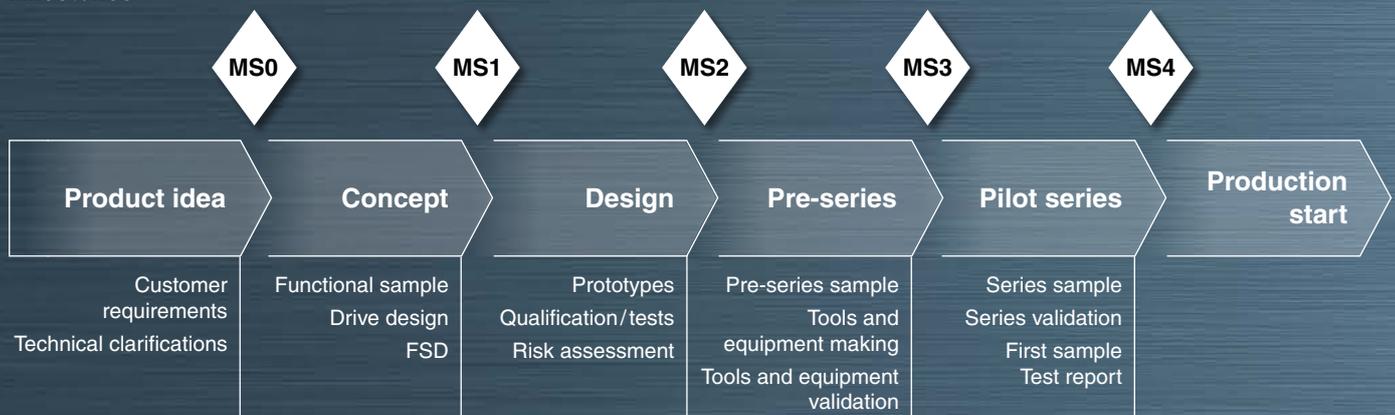
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There is always a solution.

From our mechatronics specialists.

- Systems from a single source, made possible by a broad spectrum of in-house competences: motors, gearheads, electronics, software, sensors, injection molding technology, housing design.
- We are familiar even with the motors' "hidden" parameters and can tailor our drives to perfectly suit your needs.
- We integrate electronics, sensors and fieldbuses into the motor – saving you space and money.
- You gain a competitive advantage with shorter cycle times, lower energy consumption, and greater repeat accuracy.
- The proven maxon project process divides a project in three distinct phases. The milestone concept makes development progress easy to follow.

Milestones





A global network.

Everywhere in the world, maxon motor's sales engineers collaborate with customers to develop tailor-made drive solutions.

● **maxon Manufacturing Companies**

Switzerland (headquarters), Germany, Hungary, South Korea.

● **maxon Sales Companies**

Australia, Belgium/Luxembourg, China, Denmark, Germany, Finland, France, Great Britain, India, Italy, Japan, South Korea, the Netherlands, Norway, Austria/Hungary/Slovenia/Romania, Sweden, Switzerland, Spain, Taiwan, Czech Republic/Slovakia/Poland, USA.

○ **maxon Sales Agents**

Brazil, Hong Kong, Israel, Canada, Malaysia, Russia, Singapore, South Africa, Thailand, Turkey.

For detailed contact information please visit contact.maxonmotor.com

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Precise drives since 1961.

maxon motor is the worldwide leading provider of high-precision drives and systems up to 500 W. We develop and manufacture brushed and brushless DC motors with a unique ironless core winding as well as motors with iron cores. maxon motor's modular system includes planetary, spur and special gearheads, as well as encoders and control electronics. High-tech CIM and MIM components are manufactured in a specialized facility. maxon motor stands for top quality, innovation, competitive pricing, and a worldwide distribution network. What matters most, however, is the high quality of the customer-specific solution that we create with you and for you.



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