maxon motor Australia Pty Ltd
Unit 1, 12-14 Beaumont Rd.
Mount Kuring-Gai NSW 2080

Tel. +61 2 9457 7477
sales.au@maxongroup.com
www.maxongroup.net.au

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Press Release

Brushed vs Brushless DC motors: what to look for when buying a DC motor.

What type of DC motor is best for your application? We look at the differences between selecting a brushed or brushless DC motor.

Whether you choose brushed (DC) or brushless motor (BLDC motor) will depend on the technical considerations of your application. BLDC motors are also known as EC motors (Electronically Commutated) characterised by their higher speeds reaching up to 100,000rpm. Multi-pole brushless motors often have higher torques, but you will need to take into consideration speed reduction.

Start by looking at the following:

- The required speed: brushless motors are advantageous for applications requiring high speeds.
- Ambient conditions: applications in harsh environments will usually require adjustments, brushless DC motors are usually easier to modify.
- Cabling and operating expenses - brushed DC motors are generally a simpler design.

Other factors such as environmental conditions, lifespan and economic circumstances will need to be taken into account.

Off-the-shelf design vs. customised drives

If you would like modifications to your DC motor, maxon offer an online selection tool. Choose adjustments to the motor as well as the entire DC combination consisting of gear, motor, encoder and brake. There is also the possibility to narrow your selection by filtering the range of DC motors to the smallest diameter or the lowest total price, for example. All selections can be saved and pricing is adjustable according to your currency of choice. There is also the option of placing the order through the online maxon E-Shop.

How will the DC motor be controlled?

There are three options for motor control – by speed, torque or position control. Care must be taken in selecting the interface of the controller operation – will it be via digital I/O, analog I/O or via corresponding bus interfaces such as RS232, CAN, USB or EtherCAT? maxon offer an extensive control portfolio within this program.

Situation analysis for DC drive selection
The requirements for small and DC servo motors are continuously increasing. The requests are for more flexibility, dynamics and precision as well as compactness, robustness and intelligence.

Before the actual selection process starts, a situation analysis with the drive situation is necessary. Considerations as to which type of DC motor is required depend on the mechanical design, such as motor speed, torque and inertia. The motor must have the right combination of speed and torque to meet the operating point defined by the application requirements.

The first step is to decide what needs to be regulated - ie current, speed or position. The control loop must be defined, and which control variable needs to be recorded. This leads to candidates for possible controllers and sensors. During the performance check, it must be determined whether enough electrical power is available to drive the load in all operating conditions and to compensate for the expected losses in the DC motor combination. Consider the economic constraints - how can the DC motor be configured cost-effectively and still meet the requirements in terms of technology and service-life.

The following points should help to clarify and set the framework for the further selection process:

1. What torque (Nm) at the operating point is required?
2. Which output speed (rpm) is required at the operating point?
3. What operating voltage and operating current are available?
4. What is the specific application?

There are options here for having high-temperature motors with special gearboxes with sensors etc. that can be designed by a maxon expert.

Selection of gearboxes

Gearbox options include helical, planetary or worm gearboxes. There is a large variety of possible gear types. Each design should be selected according to the application and the requirements.

Helical gearboxes have a relatively simple structure and low prices. Worm gearboxes have a high reduction ratio per stage and are self-locking. Furthermore, a worm stage brings an orthogonal orientation of the output to the drive axis. Planetary gears, on the other hand, are characterised by their very high-power density. maxon combines these with DC motors to enable the transmission of maximum torque and power through minimal installation space for the combination. Furthermore, planetary gearboxes offer a high degree of efficiency. Typically, 10% friction loss per stage can be expected.

If you choose the maxon UP Ultra Performance series, this can be halved to around 5%. Which gear type, size, version, storage, number of stages or reduction ultimately is required, depends on various criteria and specifications.

The main considerations are:
- medium and maximum speeds
- medium and maximum torque transmission
- radial and axial loads to be transmitted
- operating mode: continuous operation or cyclical operation with break times
- self-locking gearbox vs. reversibility and maximum efficiency
- life-span
- limitations on torsional play and positioning accuracy

- requirements for noise and vibration
- space restrictions within the application
- ability to withstand external influences such as temperature, dirt, moisture or vacuum environments.

For more information or assistance with your DC motor selection please contact maxon motor Australia tel. +61 2 9457 7477.

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The press release is available on the internet at: www.maxongroup.net.au

Left: maxon DCX brushed motors range from 6mm to 35mm diameter. Select your own brush type, bearing type and many other motor features.

Right: maxon ECX motor optimised for high speeds (up to 120,000 rpm) and withstands up to 2000 autoclave cycles.

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Twitter @maxongroupAus

The Swiss specialist for quality drives

maxon is a developer and manufacturer of brushed and brushless DC motors. as well as gearheads, encoders, controllers, and entire mechatronic systems. maxon drives are used wherever the requirements are particularly high: in NASA's Mars rovers, in surgical power tools, in humanoid robots and in precision industrial applications, for example. To maintain its leadership in this demanding market, the company invests a considerable share of its annual revenue in research and development. Worldwide, maxon has more than 3000 employees at nine production sites and is represented by sales companies in more than 30 countries.