



# Light as air

Equipment manufacturers for the Aerospace & Aviation markets rely heavily on innovative new materials, processes, and parts to master the ever increasing challenges of better aircraft fuel efficiency and robustness, all the while reducing costs but making no compromises when it comes to aircraft safety compliance and performance. Once we leave our atmosphere and venture out into outer space, these challenges increase exponentially. From small drive systems for aircraft cabin equipment, to specialized micro motion components for optical systems operating in the vast expanse of space, FAULHABER understands the special challenges facing the industry when it comes to small motors and motion control. Micro DC motors and gear motors, whether they be brush DC, brushless DC, stepper motors, or linear motors must be designed to maximize torque and force while minimizing weight. The integration of intelligent features in the smallest space, such as encoders and sensors can vastly increase the functional density and value of a motion system while adding a minimum of additional size and weight. Whether it is cost reduction through increased fuel efficiency or better return on investment



through an increase in marketable payload, FAULHABER understands that every gram counts on lift-off. However, light weight, high power and integrated features are not the only benefits of FAULHABER Drive Systems. The motion system needs to survive in environments where extreme shock, vibration, and temperature changes are the norm and most importantly, given these harsh conditions to function reliably every time.

### **Further applications of Aerospace & Aviation with FAULHABER Drive Systems**

- Aircraft instrumentation
- ECS / Environmental control systems
- Drones and UAVs
- Flight recorders
- Cabin lavatory equipment
- Security / door locking systems





# Aircraft cabin equipment

For every aircraft cabin equipment components the most important requirement is reliability. Nothing must fail or break during a flight. And, of course, this also means that the maintenance intervals should be as long as possible. Weight is the second most important requirement. Every kilo increases fuel consumption, which is why airlines demand equipment that weighs as little as possible. Convenient seat adjustment all the way to the „lie-flat“ position is achieved by lightweight and high-performance FAULHABER Drive Systems.

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## MORE INFORMATION

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[www.faulhaber.com/cabin-equipment/en](http://www.faulhaber.com/cabin-equipment/en)

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### FAULHABER Drive Solution

#### Drive System

- Ø 26 mm & Ø 32 mm graphite brush motors with metal gearhead

#### Benefits

- High torque density with smooth adjustment speeds
- Low noise level
- Long lifetime

#### Options

- Special output shaft
- Integrated brake flange
- Special EMI-reducing cabling

#### Related applications

- Privacy dividing panels
- Fold-out tables and tablets





First proven successfully in private and business jets, motorized cabin equipment has been adapted for use in first and then later in business class. Tables and holders for tablet computers are raised and lowered at the push of a button, and window blind systems are automated. The individual FAULHABER drive components for these applications are optimally matched to one another, work perfectly together and thus achieve a very high level of efficiency. Premium economy class, which is now offered more and more frequently, is likely to be next to adopt a number of these comfort technology features.

## FAULHABER Drive Solution

### Drive System

- Ø 22 mm 4-pole brushless motor with metal gearhead and integrated encoder
- Ø 22 mm & Ø 13 mm precious metal brush motor with metal gearhead

### Benefits

- Compact size
- Low noise level & EMI emissions

### Options

- Special output shaft
- Special shielded cabling

### Related applications

- Lavatory toilet seats and lids
- Cabin fragrance dispensers



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#### MORE INFORMATION

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# Camera gimbal for drones

Photographic devices rely on additional stabilization especially in small drones or UAVs as they provide little automatic damping due to their low permanent weight. Here, a gimbal-mounted, gyro-stabilized mounting platform is a perfect solution. However, weight is an issue, simply because the mini aeroplane or reconnaissance drone still has to be able to take off. Lightweight and powerful FAULHABER stepper motors with adapted transmissions provide the perfect solution for easy, reliable gyro-stabilization.



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## MORE INFORMATION

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[www.faulhaber.com/hoodtech/en](http://www.faulhaber.com/hoodtech/en)

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## FAULHABER Drive Solution

### Drive System

- Ø 15 mm 2-phase stepper motor

### Benefits

- High torque density with smooth adjustment speeds
- Extremely precise positioning

### Options

- Special reduced backlash transmission

### Related applications

- Zoom and focus control
- Camera crane systems



# Amphibious aircraft

Be it on land, on water or in the air, the Flywhale moves safely and reliably in all three elements. And more than that: It is a special aeronautical pleasure with which to explore the world from above in this amphibious aircraft made from super-light fibre composite material. Innovative drive technology from FAULHABER is also put inside these fascinating seaplanes and play an important part in lowering and raising the nose landing gear to safely land the aircraft on solid ground.



## FAULHABER Drive Solution

### Drive System

- Ø 32 mm graphite brush motor with metal gearhead and integrated encoder

### Benefits

- High torque density with smooth adjustment speeds
- Reliability
- Long lifetime

### Options

- Special output shaft

### Related applications

- Pilot seat locking mechanisms
- Emergency door closing systems



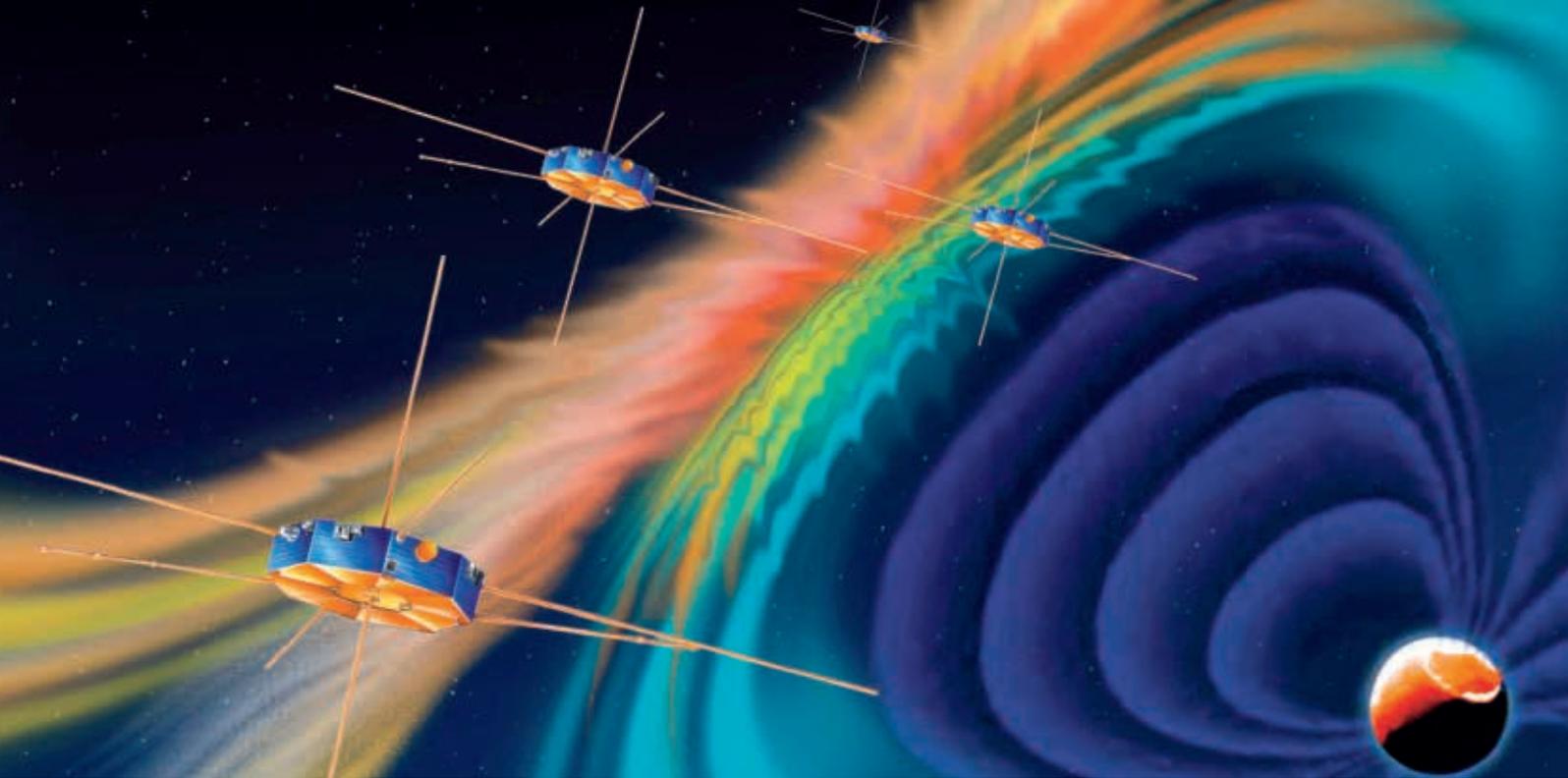
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#### MORE INFORMATION

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[www.faulhaber.com/flywhale/en](http://www.faulhaber.com/flywhale/en)

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# Sensing satellite

In order to research the influence of the Earth's magnetosphere on our modern world, NASA has sent four measurement probes into space for a multi-annual mission. Each of the satellites contains four stepper gearmotor units provided by FAULHABER which withstand the harsh space conditions. They are responsible for winding and unwinding the actual measurement cable.



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## MORE INFORMATION

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[www.faulhaber.com/mms/en](http://www.faulhaber.com/mms/en)

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### FAULHABER Drive Solution

#### Drive System

- Ø 22 mm 2-phase stepper motor with metal gearhead

#### Benefits

- Long lifetime under extremely harsh environments, including extremely low temperatures and high vacuum
- Resistance to cosmic rays

#### Options

- Special low-temperature & high vacuum execution

#### Related applications

- Antenna positioning systems
- Coronagraph orientation system



# Comet probe „Rosetta Mission“

At the end of May 2014, the Rosetta space probe swung into an orbit around the comet 67P/Churyumov Gerasimenko in order to, after more closely approaching it in August, map its surface and thus prepare for the landing of Philae. On 12th November 2014, this ballistic lander, weighing 100 kg, touched down on the comet and began experiments intended to provide information about its composition. This lander has 14 FAULHABER drive systems which defied the harsh conditions of the 10 year long journey through the vacuum and incredibly low temperatures of space, in order to deliver valuable information on the creation and history of our solar system.

## FAULHABER Drive Solution

### Drive System

- Ø 16 mm 2-pole brushless motor with metal gearhead
- Ø 10 mm precious metal brush motor with metal gearhead

### Benefits

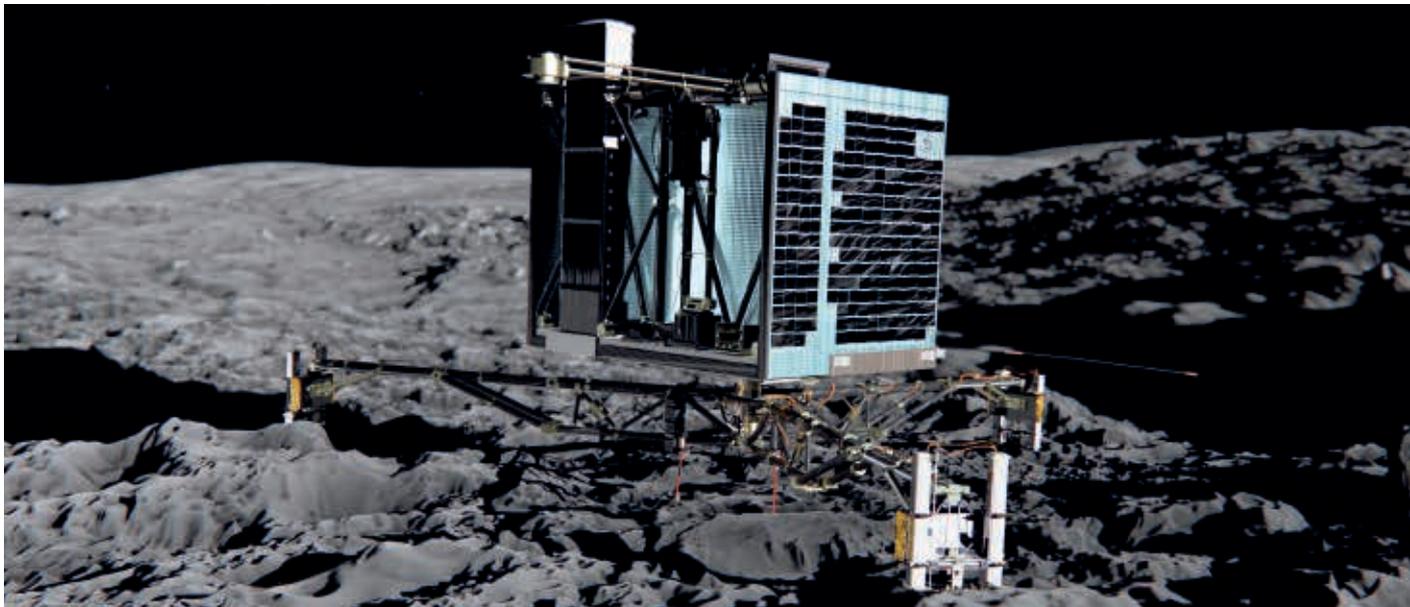
- Reliability
- Long lifetime under extremely harsh environments, including extremely low temperatures and high vacuum
- Resistance to cosmic rays

### Options

- Special low-temperature & high vacuum execution

### Related applications

- Solar panel orientation systems
- Landing harpoon retraction system



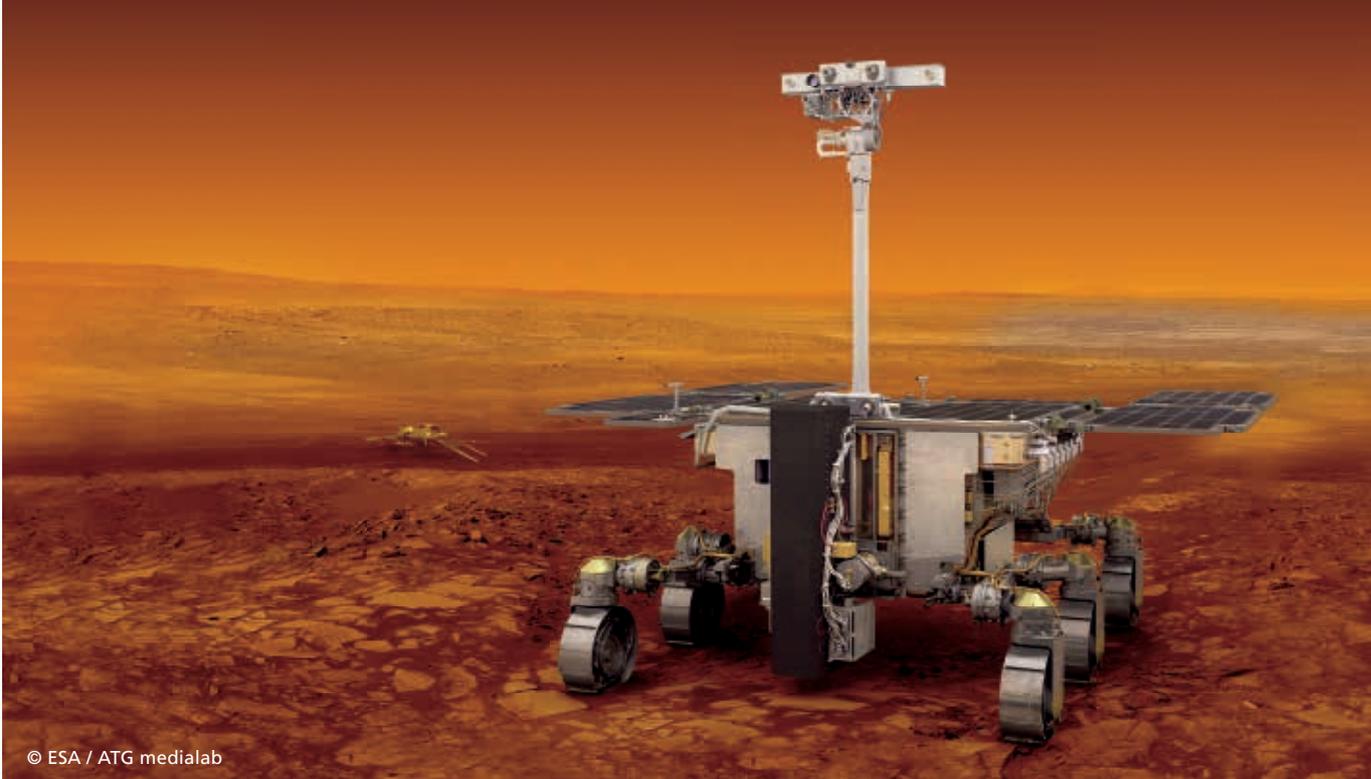
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### MORE INFORMATION

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[www.faulhaber.com/rosetta/en](http://www.faulhaber.com/rosetta/en)

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# Mars Rover

2020 is the year of the next Rover mission to Mars. The main payload of the Russian Proton rocket: the ExoMars Rover, developed by the European and Russian Space Agencies (ESA & Roskosmos). The plan is for the vehicle to be equipped with nine measuring instruments. Including one that will be mounted on a two-meter mast on the rover. „The Panoramic Camera“, which was developed by Mullard Space Science Laboratory (MSSL-UCL) in collaboration with OHB (Munich), DLR (Berlin) and TAS-CH (Zurich), will take stereo images of the planet. The so-called PanCam features two rotating filter wheels which are mounted in front of its wide-angle cameras (WAC; manufactured by Thales Alenia, Zurich) to enable it to take three-dimensional images of panoramic landscapes. A high resolution camera (HRC; manufactured by OHB/DLR) provides detailed images of landscapes, geological structures, and soil samples. Three stepper motors from FAULHABER drive the rotation shaft for the filter change system as well as the focus of the high-resolution camera.

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## MORE INFORMATION

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[www.faulhaber.com/exomars/en](http://www.faulhaber.com/exomars/en)

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## FAULHABER Drive Solution

### Drive System

- Ø 10 mm 2-phase stepper motor with metal gearhead

### Benefits

- Vacuum compatibility
- Long lifetime under extremely harsh environments, including extremely low temperatures and high vacuum
- Resistance to cosmic rays

### Options

- Special low-temperature & high vacuum execution

### Related applications

- Antenna positioning systems
- Robotic arm for drilling and collecting surface probes





© SpaceX

# Rocket fuel valves

Amid tightening budgets, space agencies are increasingly looking to the commercial space sector to provide the launch vehicles of the future. One way to control cost is by optimizing fuel burned during launch to minimize waste. A special fuel-trim valve, powered by robust, reliable brushless servo motors from FAULHABER, adjusts the optimal mixture of rocket fuel and liquid oxygen.

## FAULHABER Drive Solution

### Drive System

- Ø 35 mm 2-pole brushless motors with metal gearhead

### Benefits

- Robust construction
- Resistance under extremely harsh environments, including extremely high temperatures & vibration rates

### Options

- Special anti-vibration execution

### Related applications

- Racing motorbike throttle valve actuators



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## MORE INFORMATION

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[www.faulhaber.com/rocket-fuel-valves/en](http://www.faulhaber.com/rocket-fuel-valves/en)

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# Drive Systems for Aerospace & Aviation

FAULHABER offers the widest variety of micro motion technologies available on the market today and specializes in the application of these technologies in some of the world's most challenging areas of application including Aerospace & Aviation. From high precision micro stepper motors with integrated linear components to move lenses or to control fields of view, to lightweight, robust brush type DC or brushless DC motors for aircraft seat motion applications, FAULHABER has the right drive system to fit the most challenging specifications. Integrated encoders and sensor combinations complete the system and minimize space and weight. FAULHABER products offer inherent performance features important for success in aerospace and aviation applications.

## Benefits

- High torque / force to weight ratio
- Low EMI
- Wide temperature range
- The use of high performance materials and robust manufacturing processes
- Combinations with encoders, gearheads, brakes and drive electronics

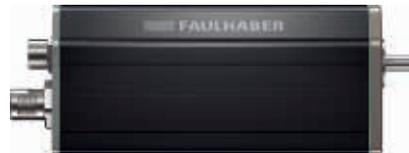


## FAULHABER Drive Systems at a glance



### DC-Motors

Outer diameter	6 ... 38 mm
No-load speed	up to 20 200 min <sup>-1</sup>
Cont. output torque	0.17 ... 224 mNm



### Motors with integrated electronics

Outer diameter	15 ... [ ] 40 x 54 mm
No-load speed	up to 16 300 min <sup>-1</sup>
Cont. output torque	1.8 ... 160 mNm



### Brushless DC-Motors

Outer diameter	3 ... 44 mm
No-load speed	up to 61 000 min <sup>-1</sup>
Cont. output torque	0.01 ... 217 mNm



### Stepper Motors

Outer diameter	6 ... 22 mm
Steps per revolution	up to 24*
Cont. output torque	0.17 ... 224 mNm

\* Full step per revolution



### Linear DC-Servomotors

Stroke length	15 ... 220 mm
Speed	1.8 ... 3.2 m/s
Continuous force	1.03 ... 9.2 N



### Precision Gearheads

Outer diameter	3.4 ... 44 mm
Reduction ratio	from 4:1 to 983 447 : 1
Cont. output torque	0,88 mNm ... 16 Nm



### Encoders

Principle	optical, magnetic
Channels	2 ... 3 / absolute
Lines per revolution	16 ... 10 000 / 4 096 absolute



### Drive Electronics

Power supply	4 ... 50 V
Cont. output current	up to 10 A
Interfaces	RS232, CANopen, EtherCAT

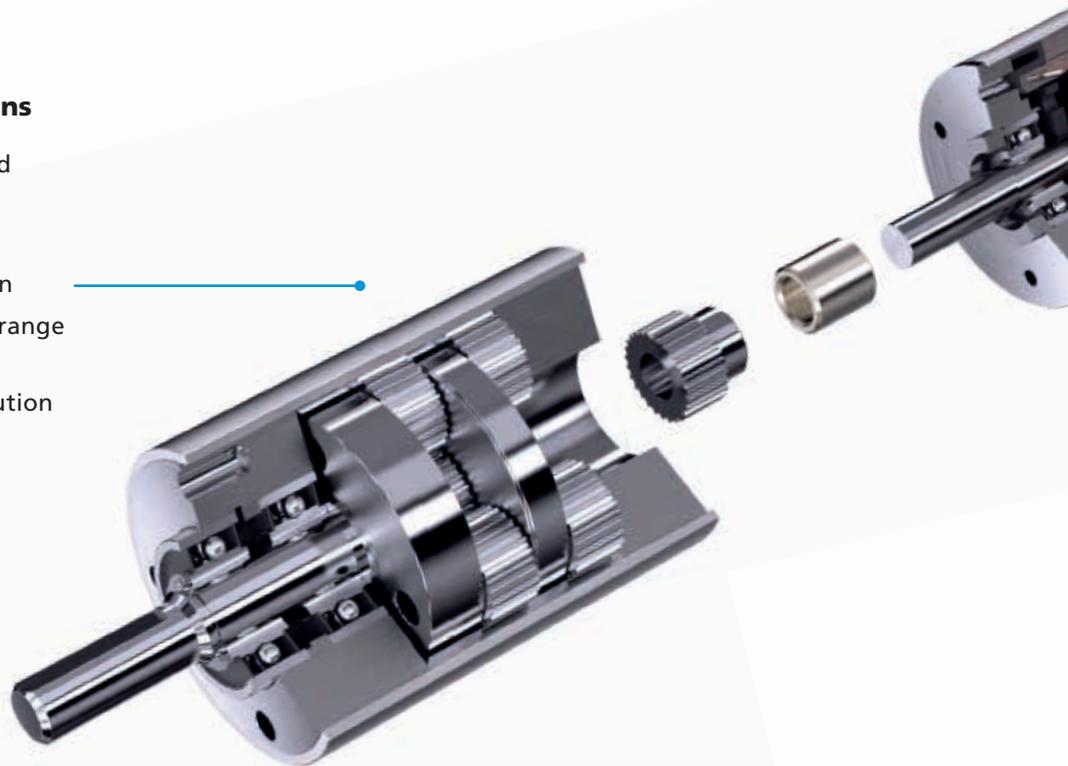
# From Standard to Custom Solution

The FAULHABER standard range can be combined in more than 25 million different ways to create the optimum drive system for a particular application. At the same time, this technological „construction kit“ is the basis for modifications which allow us to configure special versions to meet the specific needs of customers.

High-performance engineering and extensive application expertise also make us a valued partner for the development and production of customer-specific drive solutions. The solutions range from special components specifically or custom-designed for the application to system partnership with automated production for complex mechatronic assemblies.

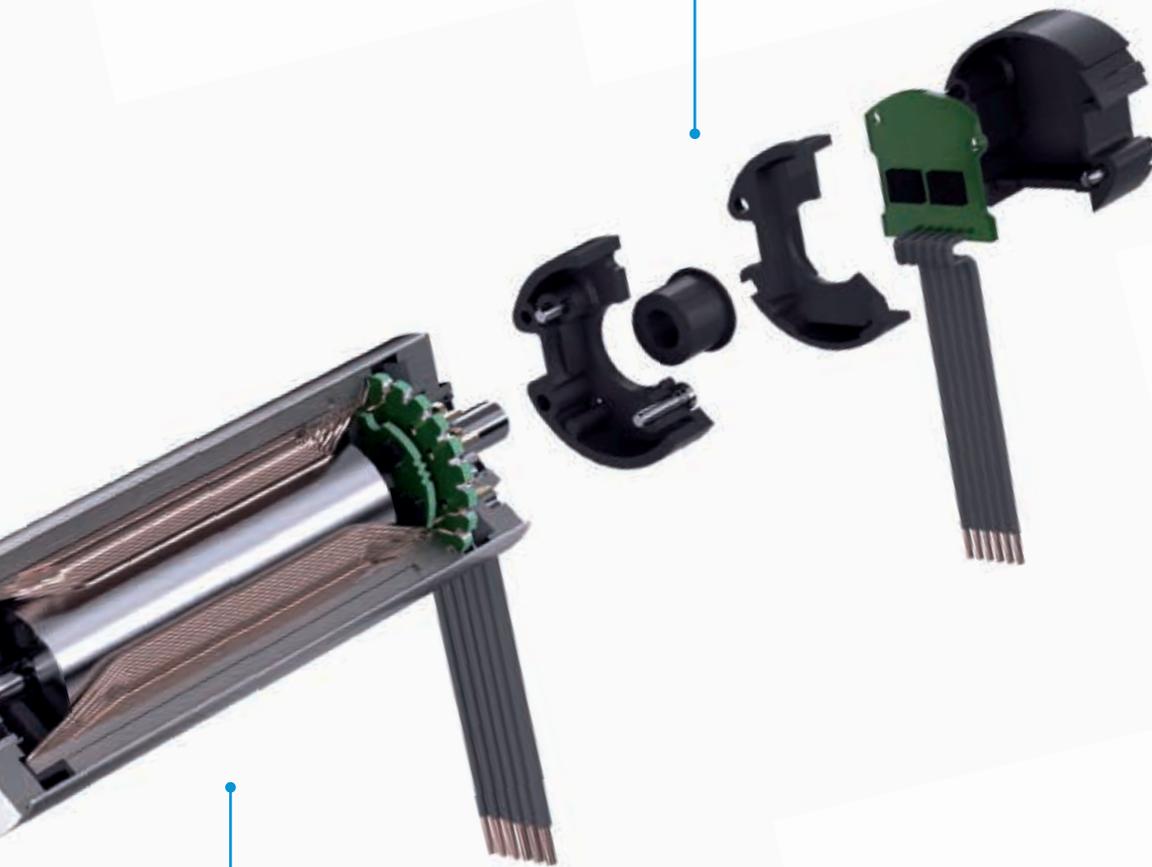
## Gearhead modifications

- Special output shaft and fixation flange
- Customized pinion
- High-vacuum lubrication
- Extended temperature range lubrication
- Reduced backlash execution



### Encoder modifications

- Encoder cable and connector
- Alignment between encoder and motor/gearbox flange
- Programmable resolution



### Motor modifications

- Special winding
- High-vacuum execution
- Extended temperature execution
- Fine-balanced rotor
- Special output shaft and fixation flange
- Customized pinion
- Special high-vibration resistance execution
- Special cable and connector

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**MORE INFORMATION**

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[www.faulhaber.com/products](http://www.faulhaber.com/products)

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## More information



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