

motion

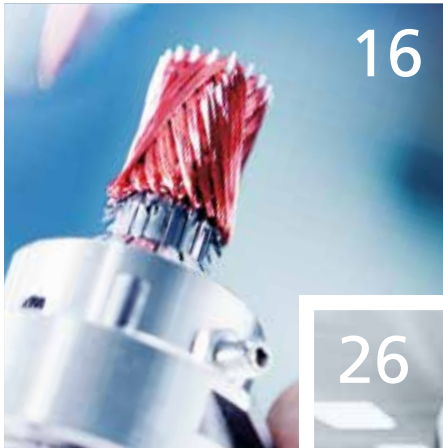
01.2026

THE MAGAZINE WITH DRIVE



ROBOTICS
HAS YOUR BACK

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Dear readers,

What is at the heart of motion? For our drives, the answer lies deeply embedded in our core technology: the winding. It defines how efficiently energy is transformed into power. In this edition, read about the spirit of continuous innovation that is driving the future of this technology.

Our company spirit is driven by those willing to look beyond the horizon. Managing Director Lutz Braun describes what it takes to maintain this spirit: experience, the courage to embrace change, and the will to actively shape the future. The embrace of innovative technology is decisive.

Just look up into the sky! There, airships from FloFleet are opening new perspectives – quietly, efficiently and precisely. They map out expansive areas and conserve resources. Back on the ground, the “VIRAS” autonomous shopping carts are guiding us; giving visually impaired people back a piece of independence.

Applications like this and the intelligent shower system from Aglaja are touching our lives each any every day. But other applications are pushing the limits where we as humans cannot go or for tasks that we cannot perform. Together with Ultra Motion, actuators are created that work as reliably in the deep sea as in outer space. Humanoid robots, on the other hand, don't need to shower – they need drive technology that makes movements natural and precise. This is where our new SXR and GXR motor families shine. Together with the GPT gearheads, we create compact, high-performance drive systems.

Whether it is a flexible surgical robotics platform or an exoskeleton supporting us in performing heavy physical tasks, our drive systems are enabling the next generation of man and machine synergies.

With our new DualGear drive system, which offer two output shafts for highly integrated synchronized motion, we show how new solutions can be created from a proven design – compact, efficient and ideal for modern intralogistics applications.

All of these examples show the various ways in which we enable innovation in motion. What unites them is the desire to push limits of creativity and technology.

I hope you enjoy reading this issue!

Regards

Karl Faulhaber
Managing Director

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Success requires talent and the courage to embrace change

Mr. Braun, FAULHABER has been in business for nearly 80 years. You have been part of this company for approximately a quarter of this time and have experienced both successful as well as challenging phases. What would you say: What makes a company successful in the long term?

For me, long-term success is based on several pillars. These include operative and technological excellence, a clear commitment to sustainability, and a resilient financial structure. These fundamentals then go hand in hand with three central factors: a clear company strategy, innovative products, and productive as well as motivated employees. The corporate strategy, the vision, and the mission are clearly formulated and we know in which markets and with which customers we want to be successful. We derive our economic goals from this. With innovative products, we secure our standing in the market and generate a true added value for our customers by enabling them to create their trendsetting products. Always decisive here are the people in the company: Motivated employees bundle competences, develop new ideas and make entrepreneurial progress possible in the first place.

When we talk about motivated and productive employees as an important basis for business success, what prerequisites and measures are we talking about for supporting long-serving employees and attracting new team members?

Employee retention and development begins for us already on the first day of work. New employees are supported at FAULHABER with an extensive onboarding process that helps them get started and provides orientation. We place value here on, for example, ensuring that each new employee is given an introduction into every department to learn more about the respective fields of activity and is provided with opportunity to communicate directly with the contact persons. This mentoring phase does not end after the first weeks, however: Periodic exchange and further development- and feedback meetings are a matter of course for us. With our group-wide management development program, we support both up-and-coming as well as experienced management staff in their specific tasks at FAULHABER and establish a consistent understanding of management in our international locations in the FAULHABER style.

Approximately 2000 employees, 15 locations, one motto: We are FAULHABER. Lutz Braun is a managing director at FAULHABER and is responsible for the areas of Human Resources and Legal Affairs. He has been with the company for 20 years and knows how important it is to look ahead, especially in turbulent times.

In the interview, he explains what business success is dependent on and how tradition and change can coexist. He takes a look at what has changed in recent years, at what has stayed the same, and at what is important for the future. What becomes clear: Technology is a central driver – but focus always remains on the people who make it possible.



At the same time, it is important for us in the HR department to be approachable and to be directly available. HR is a true “people business” for us. We therefore consciously rely on personal contact and have, for example, opted against an anonymous ticket system. Individual development opportunities, fair and competitive compensation, equal pay, well equipped workplaces as well as occupational safety and health protection are likewise standard for us. But above all, we think for the long term: “Coming and going” is not an option for us. It is instead important to sustainably bundle competencies with our employees, to help them develop further and to shape the future together.

What role do cooperation and mutual trust play for the success of a technologically demanding company such as FAULHABER?

FAULHABER is a company with a long family history, with local roots but is also established internationally. A down-to-earth mentality and accessibility have shaped our culture in this regard. Cooperation and mutual trust play a central role for us, especially as we work in a technologically demanding environment. The basis for this is certainly also the satisfaction of our colleagues. This ensures openness, security and a sense of togetherness that allows us to successfully develop technologically complex solutions and to exist on the market for the long term.



FAULHABER is a classic medium-sized enterprise. What are the greatest challenges and where do you see the greatest opportunities for remaining competitive for skilled personnel?

Today's labor market has, without a doubt, become more demanding, and specialist personnel as well as technologically ambitious talents are rare. Even if FAULHABER is able to build upon a very solid foundation and is well known locally, nationally we are still more of a classic "hidden champion." Here, it is our technology above all that serves as a point of attraction – it makes us interesting for specialists who are specifically looking for challenging tasks and understand our technology as an important component for helpful end applications. At the same time, we have clear advantages over many larger employers in the region. As a family-run company, we stand for reliability, short decision paths, transparency, and a company culture that is shaped by what is referred to as the "FAULHABER spirit." This combination convinces many applicants, particularly experienced specialists who are looking for a move into a more personal, adaptable environment.

Another important element is our youth development program. Every year we train apprentices in various trades and support students in a variety of career paths. This allows us to secure competencies for the long term and to develop skilled workers from within. For external skilled staff, on the other hand, we offer an attractive overall package comprising an exciting work environment, challenging tasks, a good standing on the market, and long-term perspective.

How would you describe the company culture at FAULHABER – and how has it changed in recent years?

Our company culture has grown over many years and is characterized above all by cooperation and a sense of responsibility. As an internationally operating company, we do, of course, feel geopolitical tensions directly. The associated decisions also affect the everyday working life of our employees and can be a source of uncertainty. This makes it all the more important that we don't stand still but instead that we jointly search for solutions, carry on, and stick together. Trust in each other, in our own strengths and in our technological competencies is, moreover, a central element of our success.

Our team philosophy is truly lived at FAULHABER. Overall, this creates a good balance and the necessary optimism for a successful future – especially in today's challenging times.

We have always placed great value on helpfulness and mutual support. Expertise is actively acquired and shared. This open exchange with one another has contributed greatly to our employees driving our growth over the years. We work along the entire value chain closely and in a process-oriented manner with one another and not next to one another. At the same time, we are very aware of the general changes that are occurring: The increasing digitization, the experiences from the Corona era, and the establishment of the home office have as much influence on our culture as do changed career aspirations and social developments overall. Topics such as compatibility of family, place of residence, and workplace cannot be disregarded and a certain sense of fast pace in daily life is perceptible. Our corporate culture is therefore continuing to develop further – without losing its roots. This offers guidance and allows us to structure changes together.

Between fresh graduates and "old hands": Is generational conflict an issue?

No, because cooperation between different generations is important to us. We benefit from everyone, as every professional and life experience has its merit. It's not just about age but also about the amount of time spent with the company. Experience and fresh perspectives compliment one another with us very well – without barriers or hierarchies between the generations. Our age structure is balanced, and even the digital transformation does not separate

any generations with us. We know that changes are part of everyday life and with them comes the willingness to actively embrace this transformation together. This is supported by clear structures within the departments and a good functioning collaboration across department boundaries.

And what, specifically, is important for the future?

The economical framework conditions, which are heavily influenced from the outside and are constantly changing, require more flexibility and personal as well as commercial resilience – both in the company itself as well as in the manner in which we act and react externally. To position ourselves more broadly and to be able to continue to offer our customers reliable and sophisticated solutions in a timely manner, processes are repeatedly examined and optimized. To this end, employees are authorized to act agilely and take responsibility.

We want to even more strongly encourage employees to make decisions on their own and use their own competencies as well as actively drive projects and processes. Trust, clear framework conditions and


the necessary freedom are decisive here. Our goal is to link FAULHABER's existing strengths with more agility – so that we continue to remain competitive even in a dynamic environment and shape the future together.

What motivates you personally in your role – and what makes work at FAULHABER so special for you?

On the one hand, it's the environment: the interaction and cooperation with committed, motivated, and competent employees and the special culture at FAULHABER. Even though I am not an engineer or technician myself, I am repeatedly fascinated by what is technologically possible at FAULHABER and by the passion and precision with which our products are created. On top of this comes the meaningfulness of our work. The drive systems that we develop and manufacture are often not directly visible in the application but are fundamental for the function. To know that our products make a true contribution – for example, in medical technology, where they support surgical procedures, or in space research such as in satellites – and have enormous potential for application inspires me. As a family-run company, FAULHABER offers true creative opportunities. Short communication paths, an open mindset for new ideas and developments as well as an established sense of togetherness within the management team are very motivating for me. The trust within management and the space to advance issues make the work something special. Last but not least, I am always learning something new here – such as in the context of internationalization. I find the expansion into other countries and the different local framework conditions extremely exciting and challenging. All of this motivates me daily to work together to further develop and actively help shape the success of FAULHABER. After all, we are all united by our shared understanding: We are FAULHABER.




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ROBOTICS HAS YOUR BACK

Lifting, carrying and bending down are all part of the daily work routine in logistics warehouses, when delivering parcels or at airports. These activities are physically demanding and over time can also result in physical strain. To provide this support, SUITX has developed a smart exoskeleton that significantly relieves the back during manual labor. Here, FAULHABER drive solutions ensure the natural range of movement.



Wearable, robotic support has long been more than a vision of the future – it can now be found in everyday working life. Especially in logistics and production environments where physical stress is part and parcel of day-to-day business, the demand for solutions that provide targeted support for humans without restricting them is growing. “The IX BACK VOLTON was developed in response to the desire to offer our customers more: a motorized solution that meets their needs beyond that which is possible with a purely passive exoskeleton,” explains Pascal Schwedhelm, Head of Global SUITX Operations and R&D. “We wanted to develop a more intelligent device – optimized for dynamic activities, with minimum resistance when bending down and distinct support when straightening up.”

The result is an exoskeleton that actively relieves the spine and integrates seamlessly with natural movements of the body. With its slimline, ergo-

nomie and optimally balanced design, the system fits discreetly against the body, providing all the support the wearer needs. With a total weight of just 5.7 kilograms including battery, the IX BACK VOLTON supports the wearer's back with up to 17 kilograms per lifting operation.

At its core is an adaptive intelligence, which adjusts the support dynamically and in real time. The exoskeleton always delivers exactly the right amount of force required for the situation in hand – not more and not less. This ensures that the wearer feels supported rather than impeded, even in the case of highly dynamic tasks. This not only reduces fatigue and the risk of injury, but at the same time also increases efficiency and endurance in the work process.



The IX BACK VOLTON adapts to the person and offers both freedom of movement as well as a high degree of wearing comfort.

Optimum support for every movement

Essentially, the IX BACK VOLTON supports the hips of the wearer with a specific torque. This torque makes it easier for the upper body to return to an upright position after a bending activity. The result: the back muscles are significantly relieved, the strain on the spine is reduced and therefore also the risk of overexertion and injuries in day-to-day work. As the exoskeleton is used directly on the human body, particularly high requirements apply. It must be comfortable, operate smoothly, function reliably and intuitively, and orient itself to the intended movement of the wearer at all times. At the same time, the system meets all relevant safety requirements.





In addition to reducing the risk of injury, the IX BACK VOLTON also makes a measurable contribution to increasing efficiency. A major factor is the frame construction on the wearer's back: It offers great freedom of movement and a high degree of wearing comfort. At the same time, this design allows parcels and loads to be carried close to the upper body – a key advantage when lifting, carrying and moving loads frequently. The exoskeleton is therefore ideal for fast-paced logistics environments with changing tasks, narrow time frames and a diverse workforce. The system adapts to the wearer – and not vice versa.



Precision and partnership are the key

Development of the IX BACK VOLTON is the result of interdisciplinary cooperation. The development team included experts from mechanical, electrical, software and biomechanical development. The clear objective: to create a motorized support that feels natural, is powerful and meets the demanding requirements of everyday industrial work. The engineering team from FAULHABER played a key role. A customer-specific motor solution was jointly developed which precisely combines those properties that are crucial for an exoskeleton: high performance, first-class manufacturing quality and the necessary scalability for subsequent serial deployment.

“We chose FAULHABER as a development partner because in our view there was no motor on the market that met our high demands,” explains Pascal Schwedhelm.

“With its expertise and well-known high quality standards, FAULHABER was our preferred partner right from the very beginning.” With a clear vision and profound understanding of the demands of the application, SUITX approached FAULHABER. In close cooperation, a drive solution was thus created that is not only technically impressive, but also integrates seamlessly with the overall system. The joint project demonstrates how cooperative development on an equal footing solves complex challenges – and how an idea can lead to a market-ready product.

A future with new possibilities

The continuous advances in drive and motor technology for exoskeletons open up new possibilities: Systems are becoming lighter, more reliable and of a greater quality than ever before. It is exactly this development that forms the basis for not only supporting the back, but in future also other specific body joints – and for utilizing exoskeletons in new industries and completely new markets. What today is primarily used in logistics and manufacturing environments or also in rehabilitation, will in the not-too-distant future establish itself further. Exoskeletons will increasingly support humans not only in physically demanding work or in convalescence, but also in daily life – wherever movement is to be made easier, safety is to be ensured and the quality of life is to be improved.

FAULHABER BXI

Motors such as the FAULHABER BXI series form the technical basis for applications where high force and dynamics with low weight and minimum installation space are required – for example in exoskeletons or the robotic joints of humanoid robots.



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“
DR. ROBOT
please come
to OR 3!
”

How modular
design brings
mobility into
surgical robotics

Italian company Valuebiotech has developed a surgical robot that is more compact, lighter and more adaptable than conventional systems. High-performance FAULHABER motors ensure precise, reliable movements within the system.

First-generation surgical robots are often large, heavy, and permanently installed in a fixed location. Their implementation typically requires specially adapted infrastructure and involves significant investment and installation costs. Valuebiotech fundamentally questioned this approach and developed a robotic platform intentionally designed for compactness, mobility, and flexibility. The result is a system that is smaller and lighter than conventional solutions and can be easily transported between different operating rooms.

The modular robotic platform can be seamlessly integrated into existing OR environments without requiring structural modifications or special infrastructure. For hospitals, this means lower investment costs and shorter setup times. At the same time, increased system availability enables more frequent and flexible use of robot-assisted procedures. Surgeons benefit from a user-friendly system that integrates intuitively into clinical workflows and efficiently supports surgical interventions. For patients, this translates into broader access to robot-assisted, minimally invasive surgery – a central element of Valuebiotech’s mission to make advanced surgical robotics more accessible to both healthcare professionals and patients.



The modular robotic platform is designed for compactness, mobility and flexibility and can be easily transported between different operating rooms.

M.I.L.A.N.O. – one platform for many surgical approaches

The robotic platform is named M.I.L.A.N.O., an acronym for “Minimally Invasive Light Automatic Natural Orifice.” The name reflects both its focus on minimally invasive procedures and the modularity of the system. A defining characteristic of the platform is its patented configurability, enabling a holistic concept: A single platform can thereby be flexibly adapted to different surgical requirements and procedures.

M.I.L.A.N.O. was developed based on the extensive clinical experience of its founder, Antonello Forgione. As a surgeon and pioneer in minimally invasive surgery, he brings more than 25 years of expertise in laparoscopic, endoscopic, and robot-assisted procedures. A key objective in the platform’s design was to overcome the practical limitations confronting surgeons in their daily work with existing robotic systems. The primary goals were to reduce system complexity and weight while expanding surgical application possibilities.



The compact and powerful brushless flat DC-Motors of the BXT family, including IEF3 encoder, are the ideal choice for integration in the limited installation space.

Bringing humans and machines closer together again

Alongside technological advances, the interaction between surgeon and machine has also evolved in recent years. Conventional robotic systems are often designed so that the surgeon operates from a console away from the operating table. However, a countertrend is gaining momentum. Under terms such as “hybrid laparoscopy” or “robotoscopic surgery,” this approach aims to keep the surgeon at the operating table while leveraging the strengths of robotics – such as stable and precise camera guidance.



The name of the robotic platform M.I.L.A.N.O. stands for “Minimally Invasive Light Automatic Natural Orifice”.



This concept allows clinical teams to select the optimal surgical technique based on the patient's needs rather than adapting to the technical limitations of a system. In this way, access to robot-assisted surgery can be extended to a broader patient population. The M.I.L.A.N.O. Robotic Platform fully supports this development and is designed to handle key tasks in minimally invasive procedures, including stable camera control and precise positioning of surgical instruments across various clinical configurations.

Precision drive technology as a key component

The used drive systems play a central role within the compact and modular architecture of M.I.L.A.N.O. FAULHABER flat motors from the BXT series, combined with the IEF3 incremental encoder and the motion controller of the MC3001B series, actuate all degrees of freedom of the robotic instruments and enable precise, smooth, and repeatable motion control. These characteristics are essential to ensuring the required accuracy and reliability in a surgical environment. The decision to use FAULHABER drive systems was based on their proven performance and robustness in demanding applications. In particular, the combination of high precision, compact design, and long-term reliability was decisive. On the one hand, the desired system compactness had to be achieved. On the other, all components needed to meet the stringent quality and lifecycle requirements applicable to medical devices. These include compliance with the EU Medical Device Regulation (MDR) as well as relevant standards such as ISO 13485 and ISO 14971, in addition to FDA-specific requirements.

From a clinical perspective, the platform had to ensure reliable and predictable performance while supporting the necessary verification and validation processes to demonstrate performance and patient safety. The close alignment between system architecture, drive technology, and regulatory requirements therefore forms a critical foundation for successful clinical use.

Looking ahead: the future of robot-assisted surgery

Robot-assisted surgery is increasingly evolving toward greater modularity, growing specialization, and closer integration between surgeons and technology. The rising acceptance of platforms that support multiple surgical approaches highlights the limitations of rigid systems. These developments reinforce Valuebiotech's roadmap, which consistently focuses on structural innovation, configurability, and genuine clinical adaptability – setting new standards for the next generation of surgical robotics.



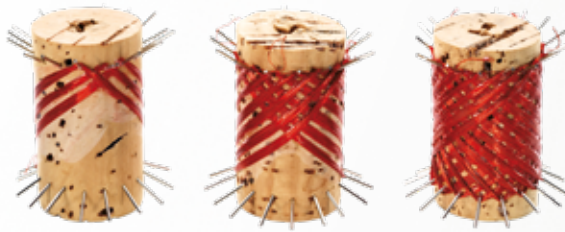
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WITH EXTERNAL ROTOR TECHNOLOGY



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To drive innovation,
you need to stay wired



The fields of application of the FAULHABER portfolio range from automated agri-robotics to reliable medical technology. Although the applications are diverse, at their heart they all have one crucial element in common: a highly developed winding which is a key factor for the performance of the motors.

The development of constantly new, optimized motor winding technologies is part of FAULHABER's DNA. Manifested in the company logo, the skew-wound wiring of the very first winding forms the heart of FAULHABER's identity.

Lookback: origins of the FAULHABER winding

In the 1950s, Dr. Fritz Faulhaber is working in his precision mechanics workshop on an innovative camera for Voigtländer. For the film transport, he first considers using an electric motor – and stumbles on a central problem. Conventional electric motors featured an iron core, resulting in inertia that caused uneven operation and unreliable starts at low voltage.

It is clear to him: The decisive disadvantage is in the design. So he pursues a new approach – an ironless, self-supporting bell-type armature winding that avoids these effects. In 1958 he succeeds and files a patent for his invention. When that is granted in 1965, the success of a technology begins that will revolutionize the market and continues to shape it today.

Well wound is half the battle

The self-supporting, diagonal rotor winding offers a reduced inertia, which enables fast response times and high dynamics. The absence of cogging torques and iron losses together with precise controllability increases the efficiency and the path to success takes its course.



*Precision in a tiny package:
FAULHABER micro-winding
with a diameter of 1.4 mm
under the electron microscope*

Further development of the winding technology continues unabated and opens up new possibilities, also in the miniaturization of drive systems. An impressive example of this is the tiniest winding used in an extremely delicate motor: With an outer diameter of just 1.9 mm, the winding for the motor measures just 1.4 mm. The diameter of the copper wires used also sets new standards: Today, extremely fine wires – thinner than a human hair – can be manufactured with extremely high precision, which, despite the minute dimensions, makes high-performance and reliable windings possible.

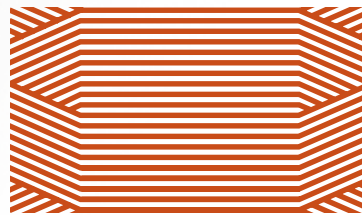
In the years that followed, linear, pin, segment and slotted copper windings expanded the technological portfolio. This variety is not an end in itself: The space available in the applications is shrinking and, at the same time, the need for greater performance, dynamics and efficiency is growing. Even greater focus is therefore placed on the winding technology – as a crucial lever for optimization and targeted new developments.

The best example: the brushless BXT flat motors with external rotor technology, whose high-performance inner workings are based on a precise electromagnetic design of the stator and rotor. With 14 powerful NdFeB single magnets on the rotor and 12 teeth on the stator, proven concepts meet an innovative winding technology. An extraordinarily high copper filling factor in the winding ensures maximum power density, while space requirements are reduced to a minimum thanks to optimum wiring.

With the BP4 brushless motors too, the winding is key to performance. The segment winding with overlapping, nested, individually wound segments means that an especially large amount of copper can be accommodated in the coil. The result is a high winding symmetry with minimum losses – and therefore a higher degree of efficiency. The central role that the winding plays with respect to stability and reliability is demonstrated by the example of BX4 motors: Here, the winding is overmolded also to guarantee maximum stability under demanding operating conditions. The know-how gathered over many decades has established itself on the market and form the basis for the drive technologies that FAULHABER uses to shape the trends of the future. Currently featured in the new series of SXR/GXR motors, which incorporate a new hexagonal winding.



The innovative winding technology of the iron-core BXT motors features a high copper filling factor with low space requirements.



The segment winding is used in the motors of the BP4 family.



Injection moulded skew-wound coils are installed in the BX4 motor series.



A hexagonal winding technology is used in the motors of the SXR/GXR family.





Armin Mannsdörfer

TEAM LEADER COIL WINDING

What role does the winding geometry play with regard to parameters such as torque, speed behavior and thermal management?

The self-supporting winding enables cogging-free and efficient operation. Although cooling of the winding is challenging due to the design, the reinforcement used means that the winding can cope well with the registered temperatures, even under heavy loads and at high speeds.

What challenges had to be tackled during development and industrialization of the hexagonal winding?

The wide variety of different winding designs, coupled with the relatively thick-walled winding, places high demands on the processing technology. For this purpose, new technologies were developed and implemented for which patents have been registered. What is new is the design of the winding with a high copper filling factor and a relatively high wall thickness. The processing technology also has to be designed in such a way that a wide variety of motor sizes and voltage types is possible. Although the technology that we have developed for this is more complex than the previously customary technologies, it allows the high-performance windings to be manufactured in a wide range of variants and also achieves a high level of precision with respect to the winding characteristics.



Dr. Roland Keller

TEAM LEADER ELECTRICAL DESIGN

What makes the new hexagonal winding of the SXR and GXR motors special from a technical viewpoint?

The straight interior increases the torque constant. If dimensioned correctly, this improves the characteristic curve gradient, which in turn means improved efficiency for the user. At the same time, improved efficiency results in an increase in the permissible continuous torque of a motor.

In what applications do customers benefit particularly strongly from this new winding technology?

As the SXR/GXR motors have a better characteristic curve gradient compared to other motors available on the market and, therefore, enable a higher torque, the use of SXR/GXR motors can save volume and/or mass in the application. Even if the possible continuous torque is not fully utilized, there are still benefits for the user. If two motors have the same friction, then the motor with the better characteristic curve gradient will deliver the better efficiency. A fact which is particularly valued by experts in the field.



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POWER DENSITY REDEFINED

Two technologies, one platform

SXR and GXR are based on a common platform and are structurally identical. The difference lies in the commutation: While the SXR family relies on precious metal commutation, the GXR family uses a robust copper-graphite-commutation. The SXR motors are available in diameters of 12 and 14 mm, each in two lengths, as well as 16 mm. The GXR series covers diameters 14 and 16 mm.

Maximum power in a very small space

Ensuring the high power density is an innovative hexagonal winding with optimized copper filling factor and proportion of straight lines as well as the use of new magnets. These create a stronger magnetic field and also improve the temperature stability. This is complemented by optimized rotor balancing, which guarantees especially smooth operation and contributes to a long service life.

The motors are available in various nominal voltages from 3 to 24 V and offer numerous bearing options. Furthermore, they can be flexibly adapted – from individual shaft modifications to solutions for vacuum or high-temperature applications.

Can be perfectly combined for maximum efficiency

In combination with the encoders of the IEP3 and IEX3 series as well as the planetary gearheads of the GPT family, diameter-compliant complete solutions without any additional interfaces are created. The result: high efficiency, maximum dynamics and compact drive systems from a single source.

Thanks to their versatility, the motor families are suitable for a wide range of applications – from optical high-end systems such as microscopes and telescopes to measuring technology, semiconductor manufacturing and automation and even medical applications such as surgical robots or infusion pumps.



www.faulhaber.com/sxr/en
www.faulhaber.com/gxr/en

The next generation of brushed DC-motors from FAULHABER redefines power density. With the new SXR and GXR motor families, compact drive solutions are created that consistently place focus on efficiency as a critical benchmark. The result: More power, more flexibility and maximum reliability – even when installation space is minimal.



NEWS

FROM ESPECIALLY QUIET TO **EXCEPTIONALLY ROBUST**

NEW



The GPT family of planetary gearheads from FAULHABER combines flexibility, high power density and an attractive price-performance ratio. Developed for the requirements of modern drive solutions, it can be combined with various motors from FAULHABER's standard range – from flat brushless BXT motors to DC microdrives.

Particularly in combination with the SXR and GXR motor families, optimally matched drive systems are created. Encoder, motor and gearhead can be integrated in a diameter-compliant manner and without additional connection elements to form compact, complete solutions.

Designed for high torques and dynamic load changes

The GPT gearheads are systematically designed for high torques and dynamic load changes. Up to six planets per stage enable an especially compact design while still delivering high power transfer. Made from hardened stainless steel and with continuously welded connections, they ensure a reliable load transmission, even under demanding conditions.

The gearheads are available in diameters from 14 to 42 mm and are significantly shorter than comparable models. They tolerate both constant load changes as well as changes that are abrupt. Depending on the variant, continuous torques of up to 18 Nm and speeds of up to 24,000 rpm are possible. Thanks to a large selection of reduction ratios from 3:1 to 1437:1, drive solutions can be precisely adapted to a wide variety of applications.

Optimized components, high-performance lubricants and various shaft bearings also contribute to performance and service life.

Low noise or high torque

For noise-sensitive applications, the 22 GPT LN and 32 GPT LN low-noise variants are available. An input gear stage made of plastic gears reduces the noise level by up to 10 dB compared to the standard version. At the same time, they remain high-performance and transfer peak torques of up to 4 or 12 Nm, respectively. They operate reliably in a temperature range from -30 to +110°C and convince not only with high efficiency but also with a very good price-performance ratio.

The HT models are designed for especially demanding environments. They offer a modified geometry for higher loads, improved dynamics and maximum performance. They are available with three or four gear stages, in numerous reduction ratios and cover a temperature range between -30 and +120°C. Sudden load changes or emergency stops do not impact the service life of the drives. With a low backlash of up to 0.6°, the HT models also enable accurate and repeatable positioning.



www.faulhaber.com/gpt/en

HOW TO CONVEY INNOVATION IN LOGISTICS – FAULHABER DUALGEAR

THE NEW FAULHABER
DRIVE SYSTEM
FOR SMART LOGISTICS



NEW

FAULHABER DUALGEAR

The new FAULHABER DualGear was specifically developed for the demands of modern conveying systems.

With its new DualGear, FAULHABER presents a high-performance drive system which combines tried-and-tested BX4 and GPT technology in a single, well thought-out unit. Developed for the demands of modern conveying systems, the DualGear provides high dynamics, robustness and precision in a compact, diameter-compliant design.



The DualGear drive system has been specifically designed for applications in conveyor belts as well as in compact wheel drives of autonomous logistics systems. Especially in intralogistics environments where space is limited, the system offers a high-performance and economical solution. A particular advantage is its versatility: Two synchronous movements can be realized with one drive. This reduces integration effort significantly, while at the same time optimizing installation space and system costs.

Powerful combination of BX4 and GPT technology

The new drive system combines two high-performance partners in a compact unit: the powerful and dynamic brushless 32 mm motor from the tried-and-tested BX4 family and two diameter-compliant mounted, robust metal planetary gearheads from the GPT series at both ends of the motor.

The BX4 base motor for the DualGear combination is available in two motor lengths with 42 mm and 68 mm. This allows the drive system to be flexibly adapted to different performance and installation space requirements. Hall sensors with sine/cosine output signals enable precise detection of the rotor position for exact commutation and positioning. In combination with an external motion controller, accurate positioning movement is possible, resulting in a drive system that combines torque and maximum accuracy with a compact design.

In this combination, the GPT planetary gearheads are available with up to three stages, which enables exact dimensioning with respect to speed and torque requirements. The components have only welded joints to ensure reliable and durable construction without the use of adhesives.

Upgrade for conveying and intralogistics systems

Modern conveying and logistics systems require dynamic, durable and integratable drive solutions. The DualGear meets these requirements thanks to its robust design, high control accuracy and long service life. The possibility of realizing two synchronous, powerful movements with just one drive and a central control, creates new approaches for efficient, simple system architectures in the next generation of conveying and intralogistics systems.



www.faulhaber.com/dualgear/en

Fine motor skills

They walk, grip, balance – and fascinate with their human-like appearance: Humanoid robots have impressive mobility and are even able to interpret facial expressions or understand language. What was still a futuristic vision just a few years ago is today taking concrete shape.

Humanoid robots form the interface between artificial intelligence and the real, physical world. They are able to process not only digital information but also transform this into concrete actions. If the sequences of movements function smoothly and safely, humanoid robots can perform a number of tasks that were previously reserved for humans – be it in hazardous environments, in direct contact with people or in repetitive processes. They assist in the household, support with rehabilitation, interact with older people or are used in retail business. Their strength is in their versatility and ability to adapt to human environments.

Prerequisite for reliable functionality of a humanoid robot is a complex interplay of precise mechanics and high-performance drive technology. It is decisive for how smoothly an arm is raised, how quickly a leg can respond or how gently a finger grips. With the drive technology, miniaturization, energy efficiency and precision are, in particular, the central requirements – they form the core of every movement.



The current record time for human "speedcubers" is approximately 3.13 seconds.

The current world record for robots is an incredible 0.305 seconds.

For comparison: It takes a person about 0.1 to 0.4 seconds to blink their eyes.

Humanoid robotics requires dexterity in motion

The hand is perhaps the most utilized human tool. Its dexterity, fine motor skills and sensory feedback make it the connection point between the body and the environment. Reproducing this fascinating functionality in an artificial hand is one of the greatest challenges in robotics, and at the same time one of the most promising ones. Whether in service- and assistance robotics, in industrial applications or modern prosthetics – robotic hands are expected to do what the human hand has perfected over thousands of years: coordinate complex movements, use different gripping techniques, react to external stimuli and precisely use force. It's not just about shape and mobility but also about miniature motors, intelligent control and the ability to adapt to changing environmental conditions.

The human hand comprises a highly complex and finely tuned interplay of 27 bones, over 30 joints and muscles as well as numerous tendons for maximum flexibility and control. For an artificial hand, this means that it must be designed to be robust and flexible, light and stable, as well as compact and efficient. It is a balancing act that places high demands on materials, design, and most importantly, drive technology! Electric motors ensure powerful movements, sensors provide the necessary feedback and intelligent control systems coordinate the processes in real time. In short, for a robotic hand to move as human-like as possible, it needs precision and finely tuned inner components. The aim is to create a symbiosis of technology and biology – be it to restore lost abilities or to expand human capabilities. The transition between humanoid robotics and modern prosthetics is fluid. Both disciplines use similar technical principles to enable movements that come as close as possible to the human model.



About Prof. Homayoon Kazerooni

Prof. Homayoon Kazerooni is professor for mechanical engineering at the University of California, Berkeley, and is among the leading international experts in the field of robotics, exoskeletons and human-machine systems. With more than 30 years of research experience, he is largely responsible for shaping the development of modern assistance and robotics systems that intelligently unite humans and machines. As the founder of SUITX (by Ottobock) and Ekso Bionics, Prof. Kazerooni has made a substantial contribution to transferring exoskeletons from research to practical use – with applications in medicine, industry and rehabilitation.



HUMANOID ROBOTICS AS A TOPIC AT THE FAULHABER CUSTOMER DAY

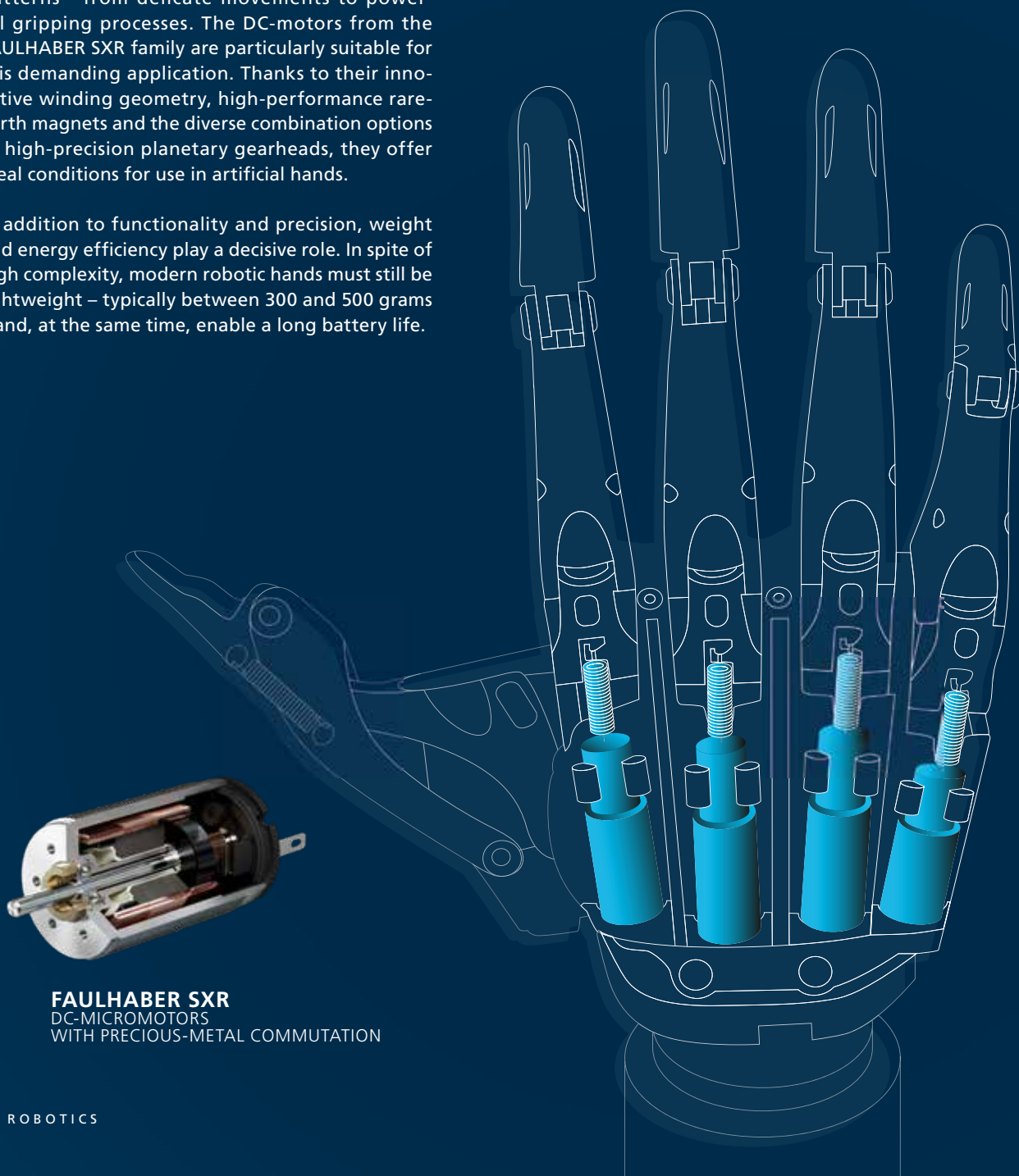
With his keynote address “Intelligent Manipulation – Fine Motor Skills for Humanoid Robots,” Professor Homayoon Kazerooni showed how close this future already is. The renowned researcher from the University of California, Berkeley, provided exciting insight into the current state of humanoid robotics at the FAULHABER customer day – and into a technology that has the potential to fundamentally change the working world. “Humanoids are here for real.” With this message, Prof. Kazerooni made clear that the potential of humanoid robots extends far beyond research laboratories: In production, assembly, maintenance, logistics and warehousing, they open entirely new possibilities for industrial automation. Using production employees as an example, Prof. Kazerooni illustrated the three central elements of human work: intelligence, vision, and manipulation. “Ordinary intelligence,” i.e., thought, is implemented in humanoid robots through artificial intelligence. Vision is performed by cameras and image processing systems, and manipulation, i.e., gripping and moving, is taken on by highly developed robot hands and grippers. It thereby becomes apparent relatively quickly that modern humanoid robots are already close to reaching the fundamental capabilities that characterize humans – cognitive intelligence, perception and fine motor skills.

Compact drive systems master every movement pattern

In order to be able to move the fingers of a robotic hand individually, each finger is driven by one or more actuators. More than 20 drives are often used per hand to enable the most complex motion sequences. It goes without saying that the drives, usually consisting of a motor, encoder, planetary gearhead, lead screw and controller, must be extremely compact. Only in this way can the fingers be individually arranged into different gripping patterns - from delicate movements to powerful gripping processes. The DC-motors from the FAULHABER SXR family are particularly suitable for this demanding application. Thanks to their innovative winding geometry, high-performance rare-earth magnets and the diverse combination options of high-precision planetary gearheads, they offer ideal conditions for use in artificial hands.

In addition to functionality and precision, weight and energy efficiency play a decisive role. In spite of high complexity, modern robotic hands must still be lightweight – typically between 300 and 500 grams – and, at the same time, enable a long battery life.

Also important are suitability for daily use and robustness. The essential requirements include waterproofness and easy-to-clean design as well as mechanical resilience. Only when technology, reliability and user comfort come together can a hand actually be considered to be "state of the art."



FAULHABER SXR
DC-MICROMOTORS
WITH PRECIOUS-METAL COMMUTATION

THE BXI MAKES HUMAN-LIKE MOVEMENTS POSSIBLE

Regardless of whether for a delicate finger motion or a forceful joint movement – compact and intelligently controlled drive systems are the central driver for the further development of humanoid robotics. The new FAULHABER BXI was also developed in this process. The internal rotor motor of the 9317 BXI G series combines exceptional power density with high robustness and defines new standards for integrated drive systems. As what has to-date been the most powerful integrated system in the FAULHABER portfolio, the BXI was specifically developed for the high requirements of modern and future robotic applications. Motor, integrated stepped planetary gearhead and high-resolution encoder form a compact, functional unit that enables maximum performance yet requires minimal installation space – a decisive prerequisite for powerful, reliable joint drives in the humanoid robots of the next generation.



Technical data

The BXI features a flat, space-saving aluminum housing, is resistant to corrosion and is cooling-optimized. Its high max. torque of up to 20 Nm enables effortless dynamic movements for fast reaction times and precise movement control. With a voltage range of up to 50 V, the available interfaces and a length of just 34 mm, the BXI can easily be integrated.

Interdisciplinarity as the key to progress

Today, true progress in the development of robotic hands takes place above all at the interfaces between various disciplines. Medicine, material science, computer engineering, sensor systems and drive technology must all work closely together in order to create technically mature solutions that are also suitable for daily use.

Medical know-how provides the understanding for anatomy, biomechanics and user needs. Material sciences enable lightweight, robust and aesthetic structures. Computer engineering and control technology ensure intelligent control, adaptive systems and efficient data processing. It is this tight integration that results in solutions that not only function but are also accepted.



www.faulhaber.com/en/markets/robotics/humanoid-robots

See the world with eagle eyes

Make aerial inspections more sustainable, safer and more efficient. With this vision, FloFleet aims to become a pioneer of a new generation of "service aircraft" – an innovative type of aircraft in which FAULHABER drives ensure the precise control of the propellers.



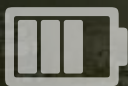
GRAVIMETER

Measurement of the gravitational field with high-precision gravimeters.



MAGNETOMETER

Measurement of the magnetic field without interference from on-board equipment.





Aerial inspection powered by FAULHABER drive solutions

Floating through the air like a fusion of zeppelin and drone, the airships from FloFleet embody a new approach to aerial mobility. The young Italian company is made up of a team of engineers specializing in airship design and autonomous flight.

Seeing the world from above offers countless advantages: large areas can be analyzed in the shortest possible time, and difficult-to-reach regions can be mapped with precision. This is where FloFleet's airships come into play. Available in different sizes and performance classes, they can be individually equipped with sensors and measurement systems to ensure optimal readiness for any application.

Their tasks range from geophysical surveys in the oil and gas sector – where highly precise gravimeters and magnetometers are used – to mapping subsurface structures in the search for rare earth elements. They also monitor high-voltage lines, oil and gas pipelines, as well as rail and road infrastructure to detect malfunctions, leaks, or unauthorized interference at an early stage. Beyond that, the airships support precision agriculture, broadcasting, and disaster relief – whether for soil analysis, live transmissions, or search-and-rescue missions.



ULTRA-HD CAMERA

Safe and sustainable monitoring and inspection flights



HYPERSPECTRAL CAMERAS

For capturing images in hundreds of different spectral bands.



A hybrid design combining aerostatics and aerodynamics

The design principle of FloFleet's airships combines the best of both worlds. Most of the lift is generated by the aerostatic force of the helium inside the hull, while the aerodynamic force created by the wing-like shape provides additional lift. This hybrid design enables exceptional stability and precision. It allows the airships to maintain a constant altitude and maneuver reliably even in windy conditions. At the same time, payload capacity can be flexibly adjusted by changing the angle of attack: a larger angle enables heavier loads, while a negative angle facilitates landing. The large surface area, ideal for mounting solar panels, further contributes to remarkable flight endurance. Andrea Cecchi, CEO of FloFleet, explains: "Because airships are sensitive to wind and have large dimensions, precision and controllability are crucial. From the very first prototypes, it was a challenge to find industrial solutions that combine precision, speed, and low weight – weight being especially important in aviation."

Due to its large dimensions and sensitivity to the wind, precise control of the airship is critical for safe and stable operation.

Stabilization and control through integrated drive technology

Stabilizing and orienting the propellers is particularly demanding. Eight thrusters must be controlled with exact precision at all times to maintain flight attitude or initiate course corrections. Requirements for reliability, energy efficiency, and weight are exceptionally high. The motors must operate under all conditions, every thruster angle must be adjusted precisely and with minimal energy consumption, and the system's weight must not reduce payload capacity. "The orientation of the thrusters is decisive, as it stabilizes the airship and determines its flight path. The motors must be reliable, lightweight, and energy-efficient," Cecchi emphasizes. When searching for a suitable solution, it was also important that the system support CAN communication and integrate all components compactly into a single unit.



Ultimately, FloFleet chose FAULHABER. "The integrated motion controller was one of the main reasons we selected FAULHABER motors," Cecchi continues. "It simplifies integration into the motor housing, protects both motor and driver, and the unified cabling increases overall system safety." With FAULHABER motors, FloFleet succeeded in cutting energy consumption of the thrust-direction motors in half, reducing weight by 40 percent, and shrinking the system size by 60 percent. At the same time, closed-loop control and onboard diagnostics shorten integration time and enable predictive maintenance. Native support for industrial bus systems such as CAN or CANopen, along with EMC compatibility, simplifies certification and wiring. Preconfigured motion profiles also enable fast and reproducible responses – an essential advantage during critical flight maneuvers.

With its combination of visionary design, sustainable technology, and precise drive engineering, FloFleet demonstrates what airships can be in the 21st century: efficient, versatile, and safe. And thanks to FAULHABER, every movement remains reliably under control.

Lightweight and reliable motors that function safely under all operating conditions are necessary for the alignment and stabilization of the propellers.



FAULHABER BX4 IMC RS/CO
BRUSHLESS DC-SERVOMOTORS
4-POLE TECHNOLOGY




FAULHABER GPT
PLANETARY GEARHEADS



www.faulhaber.com/en/motion/
www.flofleet.com

EXTREME ADAPTA

FAULHABER in action – from the deep sea to outer space



When it comes to developing reliable drive systems for the world's most demanding environments – and beyond – every detail matters. Ultra Motion, a U.S.-based specialist in electromechanical servo systems, designs and manufactures actuators that operate reliably from the deep sea to outer space. In close partnership with FAULHABER, they create solutions that combine maximum power density, precision, and robustness, making them indispensable for numerous high-end applications.

BILITY



Ultra Motion's fields of application are as diverse as they are challenging. Pressure-compensated, oil-filled linear and rotary actuators are deployed in maritime applications at depths of up to 6,000 meters. In aerospace, customized systems prove their capabilities under vacuum and radiation conditions, powering both manned and unmanned aircraft.

The robust drives also demonstrate their strengths in unmanned vehicles, industrial automation, as well as medical and research technology. What all of these applications have in common is the need for actuators that combine maximum reliability with outstanding power density.

FAULHABER technology at the core

FAULHABER motors of the BP4 family form the heart of Ultra Motion's L-Series Linear Servos and T-Series Rotary Servos. A particular highlight is the T3U-Series Submersible Rotary Servo. A specially engineered output shaft provides increased torque capacity here, while a vented, oil-filled configuration allows for pressure-compensated operation down to 6,000 meters. For the L-Series Linear Servos, FAULHABER implemented vacuum-optimized modifications to ensure reliable performance in space.

In both cases, the brushless DC motors with high power density, paired with precision planetary gearheads, deliver high torque in compact housings. The result is drives that excel in dynamics and reliability, even under extreme conditions. For example, the L-Series is equipped with the unique Phase Index contactless absolute position feedback, enabling precise control even in harsh environments.

These examples illustrate how FAULHABER products can be precisely tailored to special requirements, making a significant contribution to the performance of Ultra Motion actuators.

Integrating into these specialized actuator configurations requires a finely tuned balance between high torque, dynamic performance, and long-term reliability. Environmental conditions such as deep-sea pressure or the vacuum of space present enormous challenges that can only be overcome through customized mechanical and material engineering. Thanks to the close development cooperation between Ultra Motion and FAULHABER, it was possible to meet these challenges and deliver drives that operate flawlessly even in the toughest scenarios.





Whether in orbit or in highly dynamic industrial processes – modern servo actuators must be compact, robust and also cost efficient to meet future requirements.

Compact actuators with wide-ranging capabilities

The results speak for themselves: Ultra Motion actuators combine FAULHABER's precise drive systems with cutting-edge technology. They can be seamlessly integrated into autopilots and provide advanced motion-control functions with comprehensive telemetry, delivering information on motor current, absolute position, temperature, voltage, humidity, and system status. Additional features include a wide operating temperature range from -40 to $+100$ degrees Celsius, high shock and vibration resistance, and robust EMI/EMC performance. For deep-sea applications, pressure-compensated, oil-filled variants are available, while redundant architectures with multiple motors, controllers, and absolute position feedback systems ensure exceptional fault tolerance.

The market for unmanned systems is growing rapidly. As mission complexity increases, so too does the demand for compact, robust, and cost-efficient servo actuators. Whether in the deep sea, in orbit, or in highly dynamic industrial processes – Ultra Motion and FAULHABER are, through their close partnership, ideally positioned to continue delivering solutions that operate with precision and reliability, even under the most extreme conditions.



FAULHABER BP4
BRUSHLESS DC-SERVOMOTORS
4-POLE TECHNOLOGY

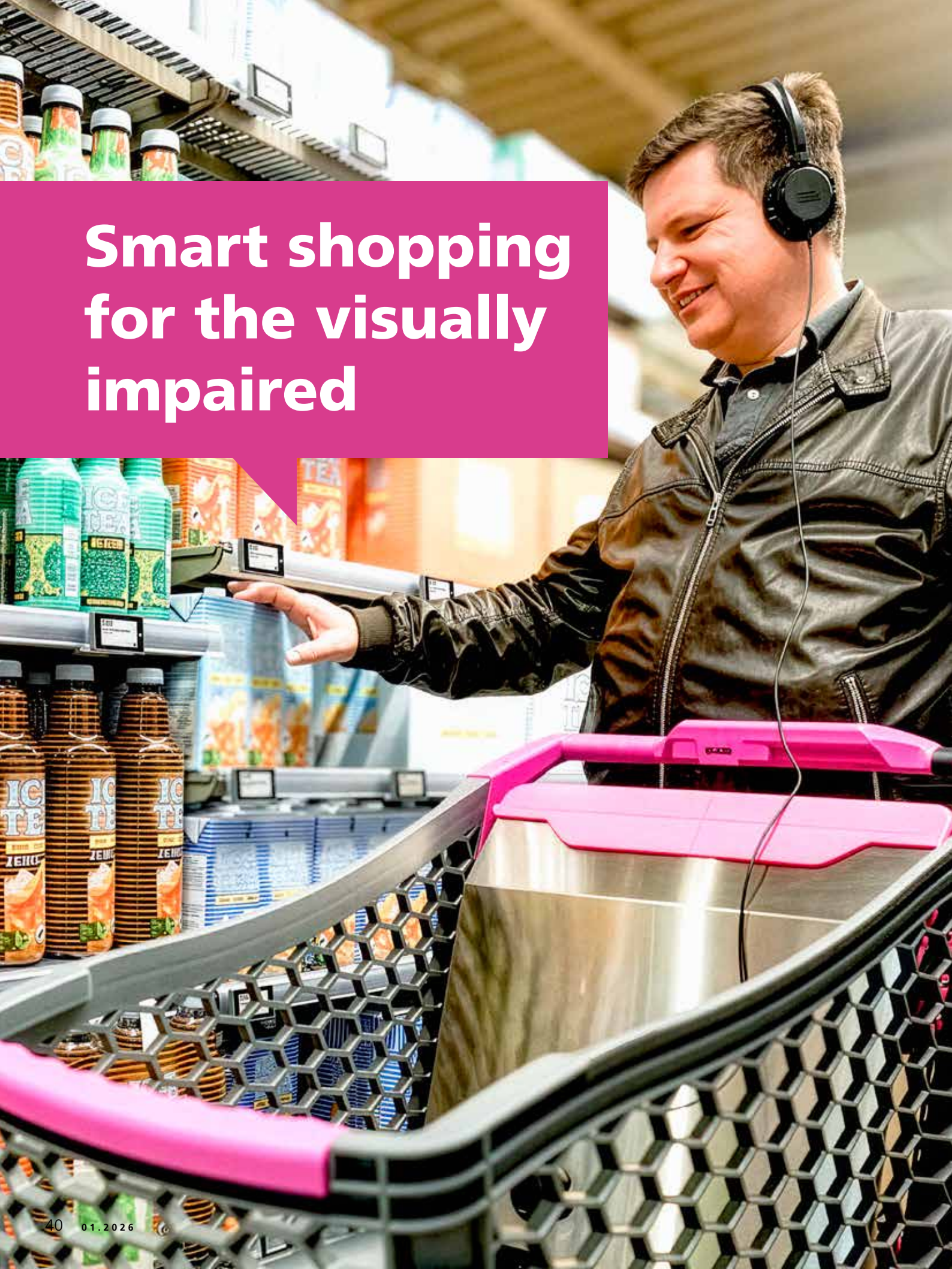


FAULHABER GPT
PLANETARY GEARHEADS



www.faulhaber.com/en/motion/
www.ultramotion.com

Smart shopping for the visually impaired



FAULHABER drives for barrier-free shopping

How can visually impaired and blind people shop independently in a supermarket? VIRAS supplies the answer – an autonomous shopping cart developed at the Eastern Switzerland University of Applied Sciences (OST) in Rapperswil. Thanks to intelligent sensors, motorization and precise control – supported by FAULHABER technology – the cart detects shelves, avoids obstacles and thereby enables a barrier-free shopping experience.

Chantal Keller is a development engineer in Prof. Dario Schafroth's team at the Institute for Lab Automation and Mechatronics at the Eastern Switzerland University of Applied Sciences (OST). As the leader of the VIRAS project, she emphasizes the great potential and social relevance of the smart shopping cart for equality and integration: "The project allows blind and visually impaired people to, for the first time, have a fully self-determined shopping experience and thereby closes a central gap in barrier-free provision. Focus is on a consistently user-centered development approach. With an acceptance rate of nearly 90% among those surveyed, VIRAS shows the high potential of assistive technologies that sustainably promote autonomy, quality of life and participation in society."

How the VIRAS smart shopping cart works

VIRAS stands for Visually Impaired Robot-Assisted Shopping. The smart shopping cart combines state-of-the-art sensors and intelligent software to make a safe and self-determined shopping experience possible for blind people. The entire process starts already with the shopping list. In the first step, this is transferred into the accompanying VIRAS app – either by entering it manually or by using a barcode scanner directly on packaging or household supplies. The autonomous navigation then starts: The shopping cart precisely localizes itself in the supermarket environment and plans efficient, collision-free routes to the desired products in real time.

This occurs with the help of a camera system for environmental perception as well as high-performance modules for data processing. The position of the cart can thereby be constantly adapted, allowing it to react to the current surroundings.

Once at the shelf, VIRAS activates product detection. Two laterally mounted, swiveling cameras detect the situation from different perspectives. An AI-assisted image analysis module identifies and finds the product being searched for using visual characteristics and audibly outputs its exact location. Parallel to this, a hand tracking module follows the movements of the user. Using acoustic information and haptic feedback, the hand is precisely guided to the desired item until the product has been correctly grasped. After placement in the cart, the system confirms the successful completion of the task with an audible signal. Voice control and intuitive feedback make the interaction easy and barrier-free. After all of the items from the shopping list have been gathered, the navigation system guides the user to the checkout. The result is a shopping process that combines technological precision with practical suitability for daily use.



VIRAS performs the route planning: from the first product on the shopping list to the checkout.

FAULHABER makes it possible: How VIRAS moves smoothly and jerk-free

One of the greatest technical challenges in the VIRAS project was in realizing precise localization and reliable 3D mapping in highly dynamic, often overcrowded supermarket environments – and to do it without external infrastructure. Another important feature for the shopping cart: That it can safely perform evasive maneuvers with respect to other people or movable objects in narrow, constantly changing aisles. To meet these requirements under real operating conditions, robust and high-performance hardware was essential. FAULHABER offered the necessary support here: The drive for the smart shopping cart was realized using the two brushless, flat DC-Micromotors from the BXT H family, including gearheads as well as the MC 5005 S Motion Controller. All operating and load scenarios – from the fully loaded cart to the requirements on energy efficiency and noise emissions – were taken into consideration for optimum motorization.

Special attention was given to the development of motors that produce high starting and static torque at low speeds. The shopping cart can thereby reliably be kept on the specified route even when fully loaded while still enabling gentle acceleration and braking operations. Also important was quiet operation of the drives: This ensures that users can clearly perceive their environment without additional noise.

The shopping cart in a practical test

Chantal Keller explains the process involved in the development and testing of VIRAS: “The target group is actively incorporated in all phases of the project, thereby ensuring that a needs-oriented solution is developed. Instead of passive tools, an intelligent, physically supportive system is used that doesn't act on behalf of people with disabilities but rather offers them targeted assistance to allow them to independently manage their daily lives.”

The field tests with the VIRAS smart shopping cart supplied valuable findings about its suitability for daily use. Especially positive was the fact that the cart could provide constant torque even at very low speeds. As a result, it was possible for the visually impaired test persons to safely follow the cart at all times. The drive motors immediately responded to input via the thumb-controlled accelerator and stopped precisely at the intended destination point in front of the shelf. The integrated 4-quadrant control, which enables a gentle transition between forwards and reverse travel, was also convincing. Potential collisions are thereby avoided.

The test persons also emphasized the low audible noise of the drive units. Thanks to the quiet motors, both audible messages from the system as well as environmental noises in the supermarket could be heard clearly. The test persons reported that they felt safe at all times and could give their full attention to the actual shopping process.

A watchful eye: The high-performance, low-noise drives ensure that the shopping cart is guided safely and gently, even when fully loaded.





When selecting the optimum motorization, everything from various load scenarios to noise emissions was taken into account.

Even more possibilities for the future

The experiences gained open diverse perspectives for the further development of VIRAS. Designed as a modular platform, the system can be flexibly transferred to other retail segments, such as furniture stores, DIY markets, clothing shops or pet supply stores. In addition, the planned self-checkout function offers an added value.

There are also exciting applications beyond classic retail stores: In museums or exhibits, VIRAS could be used as a mobile guide and, through multi-modal interaction, enrich the visitor experience of blind and visually impaired guests. At the same time, this concept opens new possibilities for additional target groups. Wheelchair users or older people with walking impediments could benefit from individually adapted hardware, such as variable handle heights, integrated seat and control elements as well as enhanced tactile feedback. Initial surveys are already underway at the OST Institute for Ageing Research. For people with cognitive limitations, VIRAS also offers clear route instructions and voice-activated reminders – such as for recurring shopping lists.

Last but not least, the employees of retail stores stand to benefit as well: The digital twin and a real-time inventory control can be used to integrate VIRAS in logistical processes. The cart could assist in stocking shelves by automatically detecting empty spaces and recording inventory data. This expands the uses of VIRAS from a pure shopping assistant to a comprehensive tool for customers and retailers alike.

Autonomous shopping as a key to more independence and inclusion

With VIRAS, the Eastern Switzerland University of Applied Sciences (OST) impressively demonstrates how innovation and drive technology can be more inclusively incorporated in daily life. The autonomous shopping cart opens the possibility of independent shopping for visually impaired and blind people – from the digital list to safe navigation and payment. Intelligent sensors, precise motor control and reliable drive systems from FAULHABER form the technological basis here. But VIRAS is more than a technical tool: The project pursues the goal of improving the quality of life, removing barriers and sustainably promoting the social participation of people with limitations. VIRAS thereby paves the path for a future in which independence and inclusion become a matter of course.



FAULHABER MC 5005 S RS
MOTION CONTROLLER



FAULHABER BXT
BRUSHLESS FLAT DC-MICROMOTORS
WITH EXTERNAL ROTOR TECHNOLOGY



www.faulhaber.com/en/motion/
www.ost.ch

Compact FAULHABER drive solutions for innovative shower system

Wellness at the touch of a button

Who wouldn't like a vigorous back massage every day? Ideally at home, quickly and without any extra work. After all, well-being begins with daily body care – especially when it is effortless and pleasant. This is precisely where aids for daily living can help: They bring comfort into the bathroom.

The family-run Swiss company Aglaja has the perfect solution. The innovative, specially-developed shower system with massage brushes utilizes a FAULHABER motor to ensure the desired rubdown. For individuals with limitations and special needs, it offers practical help with body care.

Bruno Oberli originally trained in the trade of butchery and later became a truck driver. After long days at the wheel, he increasingly suffered from back problems. "Every evening under the shower I imagined how nice a massage would feel," the founder and managing director of Aglaja recalls. "So, I started to think and sketch how I could accomplish that." Without the appropriate training but equipped with a deep technical understanding, he simply got to work. With help from friends and colleagues, he developed the first prototype.

The "back" as a common illness

According to the "Back Report" of Rheumaliga Schweiz (Swiss Rheumatism League) in 2017, 43 percent of the Swiss population complained of back pain in the four weeks preceding the survey. In Germany in 2021, nearly one third of people had visited a doctor due to back pain. Bruno Oberli thus had good reason to assume that he wasn't alone in wishing for a daily massage. Together with his wife Jeannine Wäckerlin, he laid the cornerstone for the company, which targeted this market, in 2007.



Switch on and enjoy the massage – the Aglaja shower system brings comfort into the bathroom.



"We had absolutely no experience. It was learning by doing," he explains. "A bit of luck was also involved, as we found good people right from the start who supported us with a great deal of commitment," she adds. A designer congenially realized the basic technical concept. There were likewise suitable suppliers of the individual parts for a high-end product in Switzerland. A nearby workshop that offers jobs to people with disabilities took on most of the production steps, from the manufacture of the prototypes to the assembly of today's series parts. From the initial collaboration, long-standing partnerships have been created. The products are ultimately completed in the company's own plant.

Brush with wave effect

A large part of the development efforts flowed into perfecting the brush, explains Bruno Oberli: "It has contact with the skin, therefore making it a decisive component. The brush should massage vigorously but not scratch or even scrape the epidermis. It should, however, remove the particles of dead skin. To do this, it needs the right bristles." Their ends are rounded off with a special machine. The number and arrangement of the bristles likewise plays an important role. On the roller brush of the shower systems from Aglaja, half of the surface is provided with bristles. Their V-shaped arrangement produces a wave movement on the skin, thereby amplifying the massage effect.

This can, of course, only occur if the brush rotates, ideally seventy or eighty times per minute. The founders of Aglaja determined the ideal number of rotations through trial and error. This number of rotations should always be available regardless of how hard the user pushes against the brush. The motor must, of course, be small enough to fit inside the brush but also deliver a very high power. Furthermore, its controller needs to be able to compensate for the varying load with minimal delay.

Strong drive that operates at a whisper

With that, a number of the strengths of the 2642...CXR brushed DC-motor from FAULHABER are already listed. It performs its work within the Aglaja brush with the support of a 22GPT planetary gearhead with a reduction of 72:1. In a diameter of just 26 millimeters, the combination offers enormous torque that ensures uniform rotation even under strong pressure.

This drive replaced a model that came from a different supplier about two years ago. While searching for an alternative, he found what he was looking for at FAULHABER – and was also surprised: “There is a world of difference between the two models with respect to noise development. While the shower is running, the FAULHABER motor can barely be heard. If the user does notice it, then only as a quiet sound with a pleasant frequency. It’s not only the volume that matters but also the type of sound.”

Efficient and resilient

Logically, the motor must also be able to tolerate moisture. Even though the exterior of the brush largely keeps out the shower water, condensation within the construction is unavoidable. Not only just plain water vapor is able to penetrate there. In addition to residues from shampoo and body wash, it is above all the cleaning agents and their vapors that cause the interior of the massage devices trouble. “A typical motor from the mass market wouldn’t last a month,” explains Bruno Oberli. “The FAULHABER motors, on the other hand, are characterized by their strong resistance to chemicals. Since we started using them, there has not been a single complaint.”

This means that the motor runs and runs..., and – thanks to its ironless technology – does so with maximum efficiency, i.e., it optimally utilizes the available power. When used daily by two people, the battery of the massage brush easily lasts three weeks. A charge lasts slightly less for the ‘Shower system supérieur’, which has a second motor for adjusting the height of the brush.

Skeptics convinced

Aglaja markets its products worldwide, whereby the home market in Switzerland not-so surprisingly plays a disproportionately large role. For most customers, the feel-good effect of the short daily massage stands in the foreground. For about one quarter of them, as estimated by the two owners, there are other reasons for using the rotating brush. It is used, for example, by competitive athletes for a revitalizing leg massage after training and competition. People with skin conditions use it to rubdown and moisturize skin areas on the back that would otherwise be difficult to reach. For people with upper limb deficiencies, the brush can replace a second hand during daily body care. Furthermore, it can also be used for lymph drainage and for fasciae massage.

Those who were initially skeptical are eventually convinced, explains Jeannine Wäckerlin: “We hear a typical story time and again from the couples among our customers. One of the two wants the shower system while the other puts little stock in it. A couple weeks after the purchase, the originally skeptical partner is thrilled by our product and can’t imagine living without it.” Wellness at the touch of a button convinces after all.



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Our Application notes and tutorials provide developers with in-depth information on the FAULHABER product portfolio. Resources are available for most motor series, various encoder types and interfaces, as well as Speed Controllers and Motion Controllers V2.5 and V3.0.



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