FAULHABER

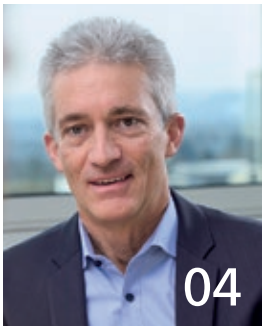
motion

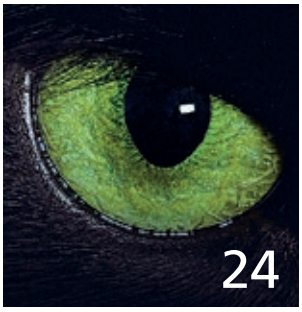
01.2025

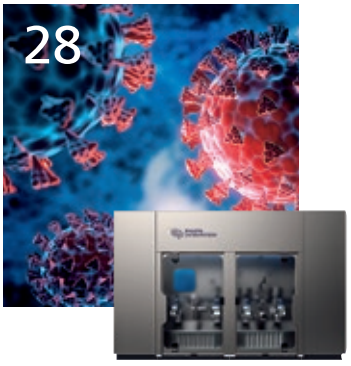
THE MAGAZINE WITH DRIVE

Time machine

Futuristic design meets
Swiss precision







Dear readers,

Innovation means also taking risks – this conviction not only shapes FAULHABER's work, but also characterizes this edition of FAULHABER motion. In an informative interview, Dr. Udo Haberland talks about the challenge of taking a holistic approach towards innovation: Not only new products, but also processes, methods and the mindset of our employees determine whether we can exist at the limits of what is technically feasible. For us, taking risks means having the courage to explore new avenues – whether it be through the use of artificial intelligence in development, the strategic reorientation of our production processes or the consolidation of our global presence.

This edition shows just how multifaceted and challenging innovation is. Whether in medical technology where robot-assisted filling systems with FAULHABER drives help provide medicines even more safely and efficiently, or in automation technology where our motors enable high-precision 3D printing in the nano-range – progress always requires the courage to question the status quo and to risk new solutions.

In mobility too, conventional boundaries are being crossed: The Bugatti "Tourbillon" features a mechanical dashboard display which visualizes highly precise vehicle data using stepper motors from FAULHABER – a unique interplay of traditional watchmaking and state-of-the-art technology.

Innovation does not follow fixed rules, but instead demands adaptation and vision. By automating processes and continuously developing our technologies, we not only set new standards in drive technology, but also lay the foundations for sustainable success – for us and our customers.

Happy reading!

Regards

Karl Faulhaber
Managing Director

Issue 01.2025

Publisher / Editor:
DR. FRITZ FAULHABER
GMBH & CO. KG
Schönaich · Germany
Phone: +49 (0)70 31/638-0
Fax: +49 (0)70 31/638-100
E-Mail: info@faulhaber.de
www.faulhaber.com

Layout:
Werbeagentur Regelmann
Pforzheim · Germany
www.regelmann.de

Publication frequency & subscription:
FAULHABER motion is published annually and is delivered to customers, interested parties and employees of FAULHABER free of charge.

FAULHABER motion is also available in digital format:
www.faulhaber.com/en/motion

INTERVIEW SERIES

Passion in motion – What drives us

#04

Dr. Udo Haberland
MANAGING DIRECTOR

Innovation means also taking risks

On the importance of optimized processes, the freedom to come up with ideas and the courage to try something new: as Managing Director, Dr. Udo Haberland is responsible for the areas of Development, Research, Quality, Logistics and Production. In this interview, he explains why innovation is about more than just new products, how FAULHABER overcomes the challenges facing the industry and why changes are often the starting point for sustainable success.

Mr. Haberland, you are responsible for the areas of Development, Research, Quality, Logistics and Production at FAULHABER. What fascinates you most about this role?

All these areas are linked in different ways. The exciting thing, and also the important thing, is undoubtedly looking at the interrelated processes and the continuous nature of it all – from a product idea to the final series, we go through many different phases. The level of quality is, for example, an important aspect. Ensuring that the smooth process meets a high standard right from the beginning means that there will be no problems, or only very few, during production. The complexity and size of our product range are constantly increasing. This also means that we are constantly questioning our approach and have to make our processes even more efficient. It's a balancing act – we want to reduce the complexity of the processes without endangering the core of our business model or the quality of our products. A key factor in this is how we automate our core processes. Work processes should be made leaner, while the speed and precision should be increased. When we automate steps in production or logistics, we create capacity for strategic tasks and can respond more quickly to changes in the market. In addition, data quality plays a crucial role. We can only work efficiently and sustainably if the data on which our decisions are based is reliable. Therefore, we invest not only in technology but also in strengthening our planning capacities, thus ensuring that we can always work with a clear overview and well-founded analyses.

Innovation is one of the key factors in FAULHABER's success. How do you define innovation in your area...

To us, innovation is crucial, but it isn't limited to the development of new products. To remain technology leaders, we have to think about innovation holistically – this means that we are also continuously developing our processes. After all, we are working in an environment in which we are often at the limits of what is technically feasible.

I like to define innovation using the five-pillar model: products, processes, people, methods and tools, as well as the environment.

When it comes to innovation, our first thought is often of products. To a certain extent, it is assumed that new products must offer innovative solutions – but it doesn't end there. Our processes must also be continuously adjusted and improved in order for them to stay efficient and flexible. Another key factor is the people aspect. A future-oriented company needs an innovative mindset. This means that our employees want and are allowed to learn and try things out, have the freedom to come up with creative ideas and also sometimes make mistakes along the way. Mistakes are part of the learning process and are not at all negative – they provide valuable information and drive us forward. Using the right methods and tools is also crucial. Old tools must be scrutinized and replaced with new technologies if necessary. Especially in product development, modern measuring methods, simulations and continuous training are fundamental in order to stay up to date.

... and which trends are driving the development of new products?

I like to call them the three Ds – digitalization, decarbonization and deglobalization. In digitalization, we see a huge opportunity to optimize both the predictability of our processes and the networking – here, the keywords are IoT and interface integration. This enables us to make decisions more quickly and more accurately. Just as importantly, we are driven by the topics of decarbonization and deglobalization.

The reduction of CO_2 emissions – those produced by us and by the supply chain – and the implementation of a circular economy and recycling are crucial to a sustainable future. At the same time, we are seeing a shift in global supply chains. For example, the dependence on rare-earth elements and the question of whether we still want to be reliant on deliveries from overseas in the future or whether we want to orientate ourselves even more within Europe. So, for us, innovation is a holistic process that is supported not only by products but also by continuous improvement in all areas.

Are there any current research projects or technological developments that you are particularly excited about?

We are working intensively on a variety of different research projects and technological developments that have huge potential for the future. I am particularly excited about our pilot project with Fraunhofer, which also involves artificial intelligence. Everyone is talking about AI and we want to understand at an early stage what opportunities it offers for future technologies and processes.

In parallel, we are carrying out an internal survey and review on the use of AI in order to analyze the current situation and derive new initiatives. We see this as an important foundation for investing in the most promising topics in a targeted manner and further increasing our innovative strength. Above all, because these developments are full of potential.

The development of new products requires a deep understanding of customer requirements and technological trends. What factors are currently playing the most important role in the development of new drive systems?

This is a process in which many factors play a role. It is particularly important to develop an understanding of systems. This is because, ultimately, it is not just about developing a powerful product but also about offering a functional, application-oriented solution. Two things are crucial here: technological expertise and a clear focus on the customer's requirements. It's a big advantage if we start working closely with the customer early in the development process. A direct dialog and the opportunity to discuss technical details on an equal footing are two of the key elements for successful, tailored solutions.

In your opinion, what are the current challenges facing the industry and what opportunities do they offer FAULHABER?

The current situation is like skiing through fog. You are moving, but visibility is limited. At best, you can only guess what's up ahead. It is therefore important to remain focused and flexible and to be able to respond quickly to whatever you encounter. The situation in the market is similar. From an economic perspective, we know that uncertain times lead to a lack of investments and we can see how geopolitical changes are impacting us. It is therefore all the more important that we at FAULHABER are both resilient and resistant and maintain the ability to respond quickly.

Efficient production and planning processes are crucial to performance as a supplier. What strategies is FAULHABER implementing in the area of Operations?

A key component here is the collaboration of all those involved from the areas of Sales, Inventory, Operations and Planning. The entire end-to-end chain is optimized so that all relevant issues can be identified and handled promptly. For this purpose, we differentiate between types of business. A customer who orders catalog products has different expectations than a customer with a framework agreement. For example, keywords such as availability, short lead times and on-time delivery play a big role in this context.

Another focus is to increase digitalization and automation in order processing. Orders for catalog products must be automated as much as possible and processing them must not require additional work. This enables our employees to concentrate more heavily on special requests and customer-specific solutions. At the same time, it is important to us that the role employees play in the overall process becomes more visible. Everyone in the company contributes to ensuring that our customers are supplied reliably and on time. Increasing awareness of this throughout order processing is an important step.

What motivates you personally in your work at FAULHABER and what is your vision for the company's future?

It's always fun to work with a highly competent team, experience the enthusiasm for our technology and tackle new challenges with a wealth of ideas. And I think this motivation and this passion are also reflected in our products and solutions.

My vision for FAULHABER is clear: we want to be number 1 in the field of precision drive systems. If we can't find a technically sound solution for an application, then nor can anyone else putting in a reasonable amount of work. We don't claim to be miles in front – but always at least one step ahead. FAULHABER should set the benchmark for the industry. Our aim is for customers to think of us first when they have challenging drive tasks, for them to come to us straightaway with their request and for them to trust that we will develop the best solution. We don't just want to be a provider – we want to be the best point of contact for the optimal technical solution. To achieve this, we must combine two things: a broad product range and customer-specific solutions with lean processes.

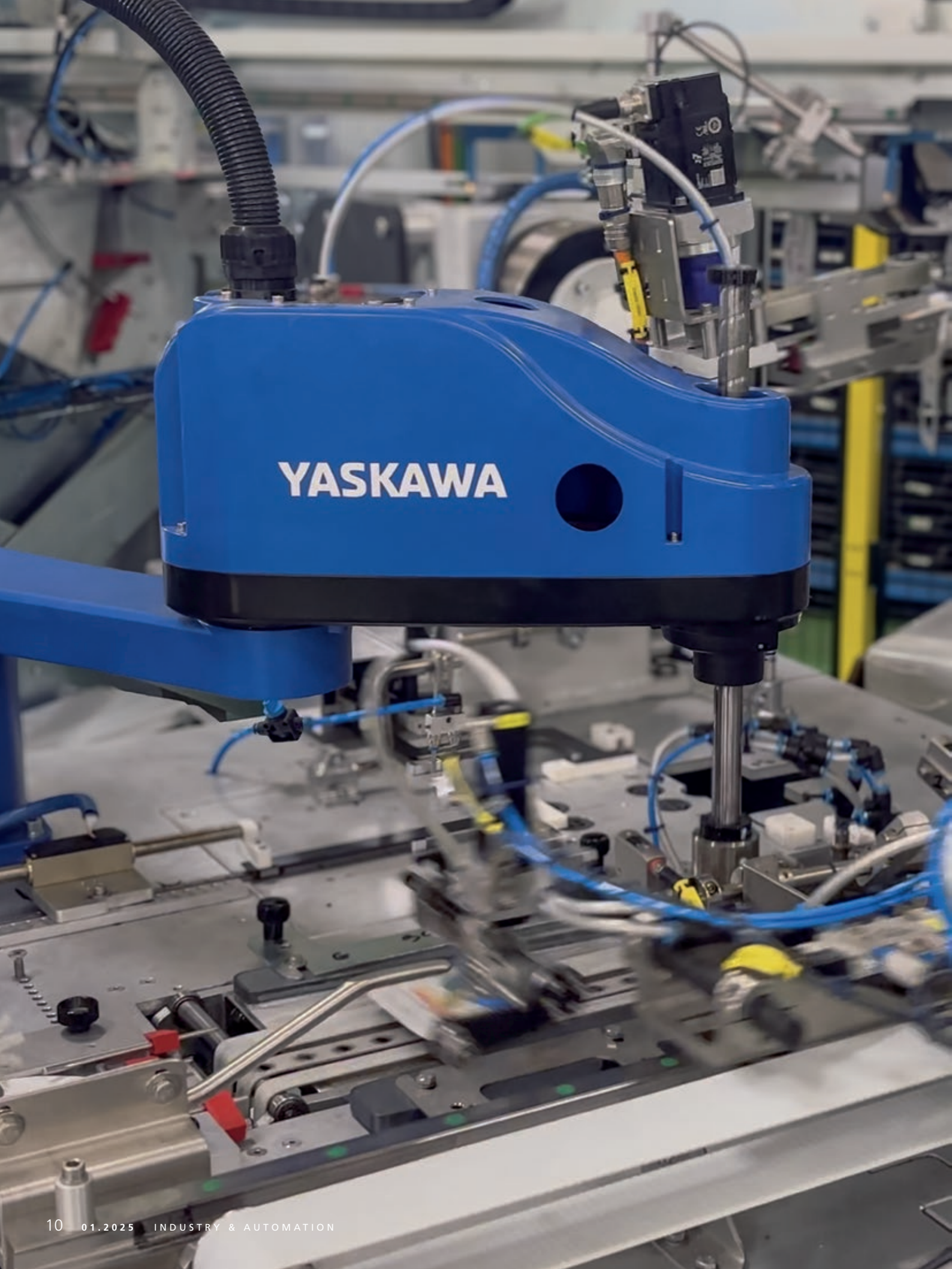
Has there been a particular moment or development in your career that has permanently shaped your view of technology and innovation?

Yes, I've had this experience. It was a situation that was equal parts risk and opportunity – and showed that changes can often be the starting point for something new and successful. I experienced an important customer order being canceled – a situation that initially seemed like a setback. But it was precisely this that led to us rethinking, looking for new approaches and developing solutions. We seized the opportunity and got started on a new technology. Being willing to take risks is essential. Sometimes, you simply have to have the courage to try something new – even if there is no guarantee that it will work straightaway. In a regulated process, it is rare for you to voluntarily break free and experiment with something new. But it is precisely these moments when you are challenged and forced to change that often drive innovation. I therefore think it's crucial to always stay open to change, take risks and actively seize opportunities.

www.faulhaber.com/en/motion/

THIS IS HOW TO BAG A VICTORY!

Whether professional or amateur, whenever athletes push their limits to achieve their goals, diet and nutrient supply play a vital role. This is where sports gels come into play: As compact, easily digestible sources of energy, they provide athletes with the necessary power during the stress of intensive training and competition. The gel pouches are filled using advanced systems from Scaldopack and linear motors from FAULHABER.


YASKAWA

High performance through cutting-edge technology

There are many different sizes, varieties and flavors of these sports gels, often with varying compositions to meet specific needs. The production process requires meticulous care, from the recipe to packaging. Before the sports gel finds its way into an athlete's bag, it must be properly filled into its packaging. Scaldopack, a company based in Belgium, develops and manufactures machines that automatically fill and seal these gels into pouches. The machines are customized to meet specific requirements, including the selection of pouches, spouts and closures. The demands are high: low total operating costs must be maintained, fast production changeovers must be possible, minimal maintenance is required, and energy efficiency, waste reduction and 24/7 availability must be implemented to optimum effect.

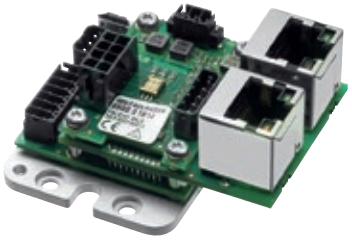
Customization of the machines allows the filling and sealing of different pouch designs with a wide variety of spouts and closures

Linear drives for maximum efficiency

For the smooth and efficient operation of these machines, Scaldopack relies on FAULHABER's BLDC motors – direct linear drives with built-in Hall sensors. These provide positioning accuracy of up to 1/10 mm with an acceleration of up to 4G. The compact unit, with dimensions of 22 x 22 x 74 mm, achieves a peak force of 27 N and offers exceptional long-term reliability: it can operate continuously for nearly three years without maintenance – an enormous advantage compared to conventional pneumatic components.

In addition to reliability, the ease of integration and operation of the machines are decisive factors. The FAULHABER MC 3603 ET Motion Controller significantly simplifies both integration and the necessary testing. The EtherCAT-CiA402 functionality, with integrated reference cycle, positioning and touch probe functions, allows for the seamless implementation of this dynamic controller. For perfectly matched drive systems and machines that deliver peak performance.

FAULHABER LM 2070
LINEAR DC-SERVOMOTORS



FAULHABER MC 3603 S/ET
MOTION CONTROLLER

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3D print of a castle on the tip of a pencil. The columns of the left castle tower are just 950 nanometers thick.

Although the ancient Greek “nano” means “dwarf”, in the nano sector the dwarf would be a giant. In the technical realm, “nano” means ten to the power of negative nine, or one billionth. In addition, parts even smaller than this are possible – for example, the intricate shapes that come out of the NanoOne 3D printer from UpNano. To produce these, light particles are fired at the starting material. This is a process that plays out over a range of thousandths of a millimeter. So that the substrate can be precisely aligned here, three compact, high-performance motors from FAULHABER ensure the correct position.

Miniaturization taken to the extreme

The structures that UpNano produces in the 3D printer are so small that they are recognizable neither with the naked eye nor with a strong optical microscope. Only under a scanning electron microscope do the smallest printed structures become visible. They are a sort of "tiny sphere" or dust particle with a total diameter of just a fraction of a millimeter. The bars that make up the construct are 100 times thinner than a human hair. These structures are used, for example, in medical experiments as, among other things, a framework for living cells, or as microfilters, microneedles or microlenses.

A castle on the tip of a pencil

UpNano is a spin-off of the Vienna University of Technology. Before the founders switched to free economy more than five years ago, they conducted research at the university in the field of 3D printing with high resolution. To demonstrate what is possible, they printed the model of a castle – complete with multiple levels, oriels, ledges, archways, two spires and elegant columns – on the tip of a pencil.

The columns were just 950 nanometers thick. The printer, which UpNano has since developed to market readiness and sells worldwide, goes even a step further: structures smaller than 200 nanometers can be realized horizontally and smaller than 550 nanometers vertically.

The production of such miniaturized objects is possible thanks to so-called 2-photon lithography, which is based on a quantum effect between two light particles. They thereby trigger the solidification of the material, resulting in the formation of stable chains in the plastic molecules. "To get the decisive photon pairs across the finish line, we need to fire a massive number of light particles," explains Peter Gruber, co-founder and CTO of UpNano. "This is because we need an enormous photon density with respect to both time and space to bring about the controlled polymerization."

With the help of two-photon lithography, the UpNano 3D printer prints extremely small structures in the nanometer range.

An accurate laser makes it possible

The laser that supplies the photons operates with extremely short, high-intensity pulses. Moreover, the method allows for high accuracy, as Peter Gruber explains: "With other light-based 3D-printing methods, polymerization is triggered along the entire beam path. As a result, production can only be performed in layers. With 2-photon lithography, we can focus them on a tiny point. This point can be moved freely through the material by our printer's high-performance optics. This allows us to produce nearly any geometric structure."

In addition to channels and other elements for microfluidics, such structures can also be used to create lenses that are printed on the end of individual glass fibers. Printing can even take place in existing microfluidic chips to add additional structures there. A special additional module also enables printing with biomaterial, which contains living cells. Polymerization of the three-dimensional structures transpires only at the intended locations; the cells in the spaces in between remain intact. The constructs can be formed like a cell cluster in human tissue. In such an arrangement, they are used today for pharmaceutical tests without animal experiments.

Micro-endoscopes and artificial insemination

The customers of UpNano are generally reticent to answer the question of exactly what they are producing with the devices. Many use them under strict secrecy. "We are aware of only a few concrete applications, such as in in-vitro fertilization, where work is performed with individual egg cells, or for lenses in micro-endoscopes," reports Peter Gruber. "Our customers are mainly in medical technology, the pharmaceutical industry and in telecommunication. There are also more and more industries that are discovering the possibilities of miniaturized 3D printing for their own uses."

The size scale of the objects that can be produced with a NanoOne printer spans from less than 150 nanometers to more than 40 millimeters. Four lenses with different resolution ensure maximum flexibility. The throughput of more than 450 cubic millimeters per hour is the basis for high productivity. Precision of the printing process is ensured not only by the high quality laser optics but also by the precise alignment of the substrate. This is secured on a moveable support.

FAULHABER drives in the NanoOne devices

The name "Automatic Tilt Correction Insert" describes the function of this support: It corrects the tipping that is nearly impossible to avoid when inserting the print substrate in the printer. The alignment of the substrate can be changed on three axes (x, y and z) and thereby optimally positioned. "We achieve a flatness in the sub-micrometer range," emphasizes Peter Gruber. "This ensures that the precision of the laser optics actually finds its way into the print material. Furthermore, the relevant components are decoupled from the surrounding technology and the housing. As a result, the printer can simply stand on any stable table."

The mechanical force for the precise positioning of the support is supplied by three precious metal commutated DC-gearmotors with integrated Encoder of the 1512 ... SR IE2-8 series from FAULHABER. The uniquely flat winding technology with three flat, self-supporting copper windings enables an extremely compact design with a diameter of 15 millimeters and a length of just 14.3 millimeters. Thanks to the high-performance rare earth magnets, the motor delivers an especially high drive torque.

In addition to the gearhead, an optical encoder is also integrated in the drive. "We selected the gearmotors as the optimum solution for our needs," recalls Peter Gruber. "The suggestion to select the version with encoder came from FAULHABER. Alignment thereby functions even more precisely and more smoothly. In relation to its small dimensions, the drive delivers enormous power. With its high precision, it contributes to the quality of the printing process of our NanoOne devices at a key point."

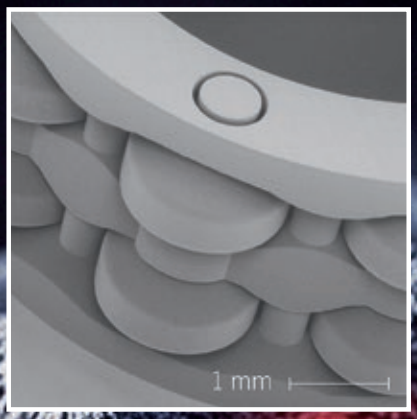
FAULHABER SR-FLAT
DC-GEARMOTORS

www.faulhaber.com/en/motion/

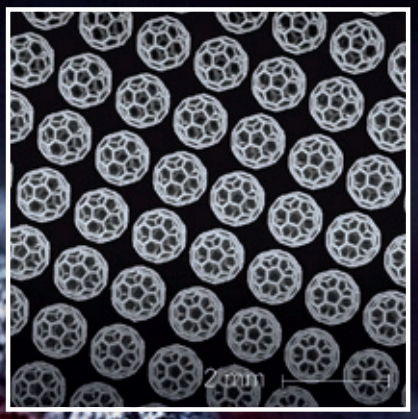
With two-photon lithography, an extremely short, intense laser pulse triggers the polymerization at a single, tiny point.

(stylized example illustration)

3D-printed nano roller bearings



3D-printed cell scaffolds



The NanoOne platform from UpNano enables the printing of sub-micrometer- to centimeter-sized structural details with a height of up to 40 millimeters

Time machine

Futuristic design meets traditional Swiss precision. In the new hyper sports car "Tourbillon" from cult brand Bugatti, time seems to flow backwards, at least as the driver's eyes follow the speedometer needle towards 446 km/h. He's not looking at fully digital cockpit, after all, but rather an open Swiss clockwork. The high level of watchmaking is provided by prestigious Swiss manufacturer Concepto; the translation of the electric signals from the on-board computer to the hands is performed by stepper motors from FAULHABER.

Describing the Bugatti Tourbillon without falling into clichés like "breathtaking design" and "uncompromising technology" is a challenge. Superlatives seem to wear out quickly due to their abundance: a top speed of 446 kilometers per hour, acceleration from 0 to 200 in under 5 seconds, and a starting price of 3.8 million euros are just a few highlights of this car.

The drivetrain for the new model, set to launch in 2026, has been completely redeveloped. It is based on a complex system of electric motors, a V16 naturally aspirated engine, and the latest generation eight-speed dual-clutch transmission. "It was important to us that this car retains the pure and unadulterated analog feeling of a combustion engine while also combining it with the agility and capabilities of electric motors," the manufacturer adds.

Pinnacle of Watchmaking

The French word "Tourbillon" means "whirlwind," which perfectly suits this unique vehicle. The name also references an invention by Abraham Louis Breguet, a titan in the world of watchmaking. He honed his craft in 18th-century Switzerland before moving to France – much like Ettore Bugatti, the Italian who founded his legendary sports car factory in Molsheim, Alsace, in 1909. Today, Bugatti vehicles are still manufactured there under the same prestigious name.

The Tourbillon is a highly complex and delicate mechanism that compensates for the effects of gravity on the accuracy of pocket watches and wristwatches. Today, these masterpieces of precision engineering are mainly crafted in La Chaux-de-Fonds, including at Concepto. Valérien Jaquet, who founded the company in 2006, is an admirer of Breguet and a remarkable watchmaker himself. In less than two decades, he has turned Concepto into one of the most important suppliers of watch movements to the major brands. Among its achievements, Concepto has developed the world's thinnest mechanical watch, which is just 1.70 millimeters thick. In addition to the Tourbillon, the company offers movements with all conceivable complications.

When Bugatti decided to create a mechanical display for its latest vehicle, Concepto was the natural choice as a technical partner. The car also has a fold-out digital display in the center console with all the functions expected in a modern vehicle, but the speedometer in the driver's direct line of sight had to be something truly exceptional.

Dimensional Leap and New Electronic Territory

"Bugatti wanted a display that not only resembled a high-end Swiss wristwatch on the outside but one that also utilized the same type of mechanics on the inside," says Guillaume Tripet, who leads the Bugatti project at Concepto. "From this idea, the concept of a large circular display in the center with two smaller satellite displays to the left and right was born. It's reminiscent of a classic wristwatch with multiple complications – except here, instead of a stopwatch or moon phase, the central vehicle data is displayed, along with the exquisite mechanics behind the hands."

The complex movement consists of 600 parts, all of which needed to be developed from scratch. While Concepto also produces desk clocks and has larger movements in its portfolio, the display in the Bugatti requires components up to 80 percent larger than these. The company's machines first had to be adapted for this without compromising the usual precision of their production.

Another challenge was integrating the mechanics with the car's onboard computer and the electric motors. The vehicle's drivetrain, fuel, and battery data are collected by electronic sensors and sent to the central computer. For this information to appear on a mechanical display, a "translator" is needed. This task is performed by eight FAULHABER stepper motors, which are also manufactured in La Chaux-de-Fonds. These motors move the hands by converting the electronic signals directly into precisely counted motor steps.

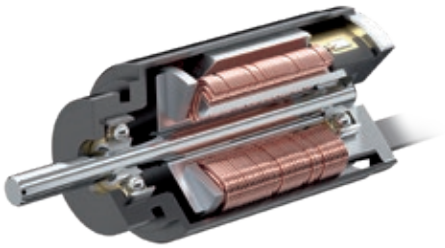
Highly Heat Resistant and Fast-Reacting

The pinpoint conversion of control signals into highly precise movements is a strength of all FAULHABER stepper motors. For this project, additional requirements and high hurdles in motor selection had to be met. The electromechanical display sits almost freely suspended on the steering column and has only a shallow depth. This limited space – alongside the intricate mechanics – had to accommodate eight stepper motors. The AM0820 and AM1020 models, with diameters of 8 and 10 millimeters, respectively, were selected.

Each motor moves one hand, meaning four motors are housed in the left satellite with its three display elements. These four are the only ones connected to the hands solely via a worm gear, while the other motors have a more complex transmission that is visible through sapphire glass. This component was custom developed by FAULHABER for this application, as was the motor control, which translates the measurement signals into hand movements or holds a stable position if the value remains unchanged.

"The display must always be easy to read, which is why numerous LEDs are integrated in the cluster," explains Guillaume Tripet. "It's also exposed to direct sunlight in its prominent position, making the inside extremely warm, especially as the limited space only allows for a single ventilation opening. On the other hand, the motors must also operate immediately after starting on a freezing winter day. They must start up without delay and manage very high loads relative to their small size, over long periods and without loss of performance."

The FAULHABER motors used in the Bugatti Tourbillon operate in a temperature range from minus 30 to plus 120 degrees Celsius. In terms of precision and reaction time, they meet all the requirements set by the Concepto engineers. Comparable products would only achieve the required performance with larger volumes. In pre-production, the drives have already proven that they perform flawlessly in the cluster and also pass test series such as the vibration test. Guillaume Tripet: "We are now perfecting the system so that the latest hyper sports car can be delivered with this exceptional display in time for the launch."



FAULHABER AM
TWO-PHASE STEPPER MOTORS
WITH INDIVIDUAL MAGNETS

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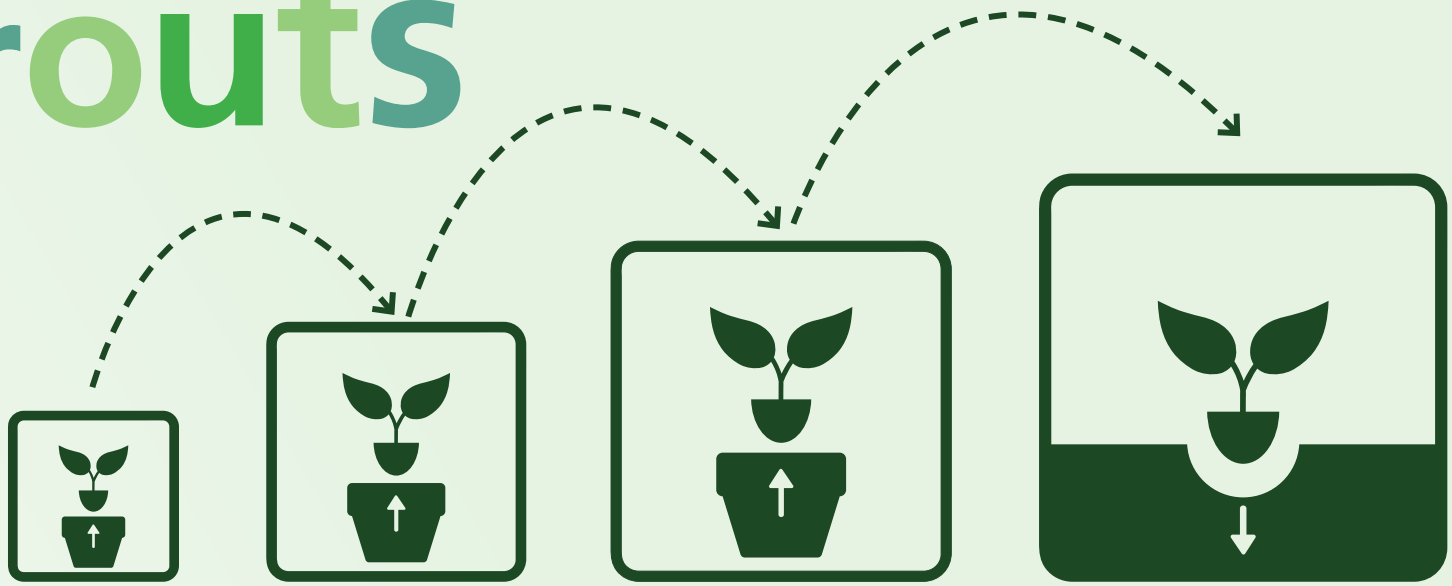
Smart mover **for little sp**

The global need for feed and food is constantly increasing and, it follows, so too are the requirements on the efficiency for the cultivation of fields and the operation of greenhouses. This is where the automation solutions from Italian company Da Ros Srl come into play. The company is a specialist in the production of agrotechnical applications. In this case, an automatic transplanter simplifies the transplanting of young seedlings – driven by powerful FAULHABER drive systems.

Transplanter TP-24 gripping seedlings

routs



With more automation and robotics in agriculture, the way food is grown is changing significantly. This brings numerous benefits, including improved efficiency and productivity, as well as more sustainable and environmentally friendly farming practices. Additionally, automation reduces physical strain and enhances safety for workers by handling heavy, repetitive, and physically demanding tasks. Not least, the use of robots and machines helps address labor shortages. Continuous technological innovation is crucial not only for staying competitive in the market but also for meeting the increasing demands of Industry 4.0.

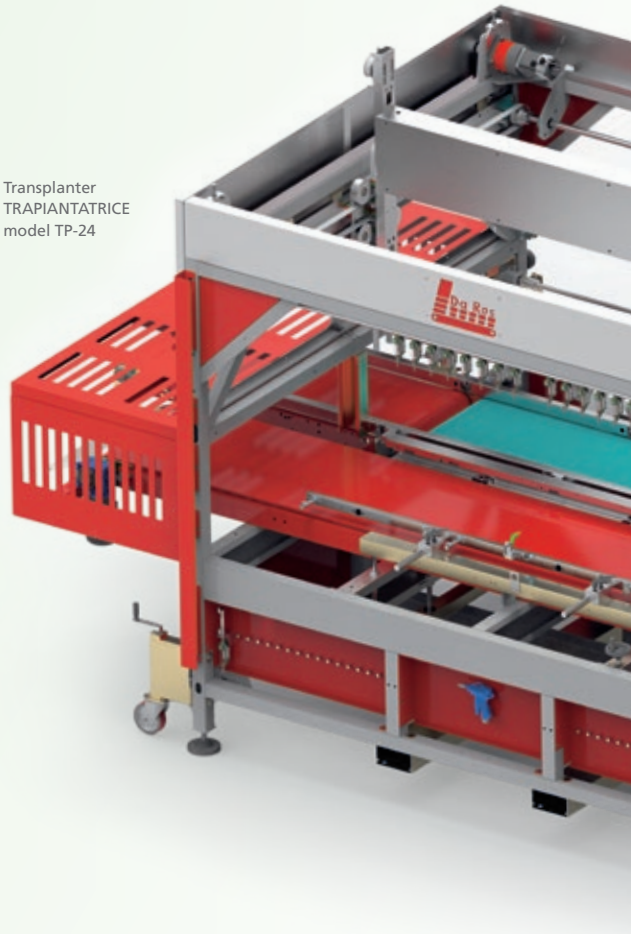
Smart Farming with the Transplanter

Thanks to advanced devices and machines, areas or individual plants can be precisely managed according to specific conditions. Smart farming allows sections or entire areas to be cultivated in a computer-assisted and automated manner. Networked processes ensure ease of use and efficient workflows.

One of the machines offered by Da Ros is the new transplanter, the "TRAPIANTATRICE Model TP-24." Suitable for all types of horticultural, floral, and forestry plants, it assists with transplanting. Equipped with grippers, it can autonomously move seedlings from small containers to larger ones without damaging them. This process helps thin out plant populations, giving seedlings better growth opportunities and enabling easier maintenance over a larger area. However, even modern machines and systems face challenges that must be overcome to maximize productivity in precision agriculture. They need to be quickly and easily set up and must operate accurately and reliably, especially for repetitive tasks.

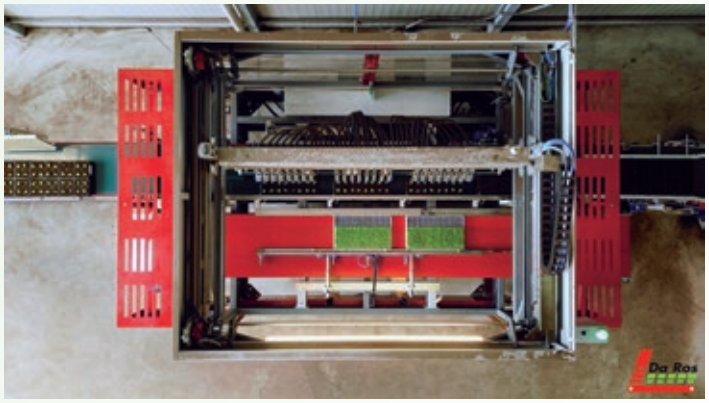
The Italian company Da Ros Srl is dedicated to the design, construction, and commissioning of highly functional agricultural machines. Founded in 1986, the company addresses the requirements, workflows, and unique challenges faced by the agricultural sector. With innovative technologies and modern products, Da Ros offers solutions for automation and optimization aimed at sustainable and efficient farming. Whether sowing, transplanting, potting, or watering, their high-performance machines provide not only standard solutions but also alternative and customized options for diverse agricultural needs.

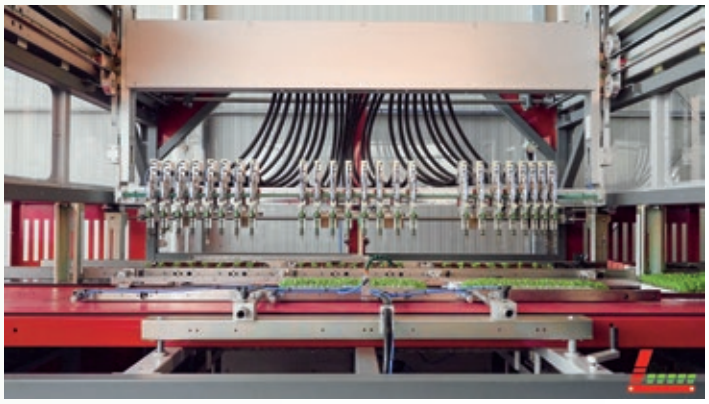
“We were looking for a small brushless motor. At FAULHABER, we found expertise and a great willingness to help, especially in the early stages of the project when we were unsure about the application specifications. From the beginning of the project to its commissioning, we were supported by a qualified and competent team that advised us on selecting the best products for our technical requirements."



Transplanter
TRAPIANTATRICE
model TP-24

Transplanter TP-24, top view

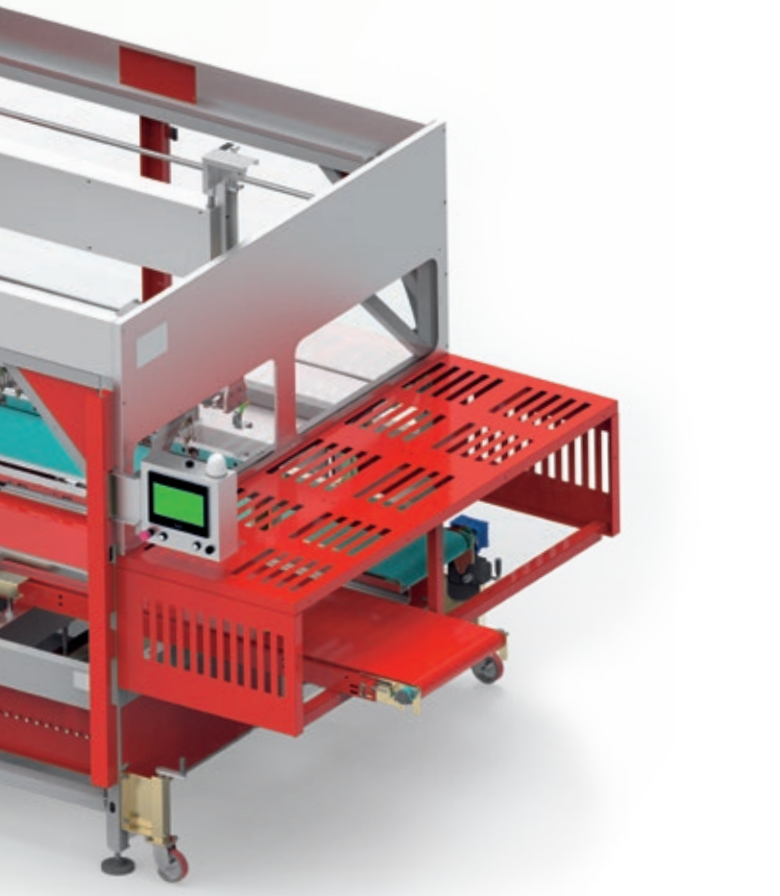




Transplanter TP-24

When FAULHABER Assists in Planting

FAULHABER drive systems are used for optimal gripper handling in the TP-24 transplanter. Thanks to their compact size and high dynamics, the minimum distance between individual grippers is just 22 mm, allowing up to 24 grippers to fit in the machine. A brushless motor from the 2250...BX4 series with integrated feedback and a planetary gearhead from the 22GPT series ensures reliable gripper operation. The gearbox is characterized by a high continuous torque and a high speed. Thanks to these speeds, the machine can work extremely productively. Control is managed via a FAULHABER Motion Controller MC 5004 P, which communicates via EtherCAT. The machine is also designed with a modular concept, enabling easy adaptation to different customer production requirements.



TP-24 shown watering seedlings

FAULHABER BX4
BRUSHLESS DC-SERVOMOTORS
4-POLE TECHNOLOGY

FAULHABER GPT
PLANETARY GEARHEADS

FAULHABER MC 5004 P
MOTION CONTROLLER

www.faulhaber.com/en/motion/

Beastly good **night**

Cats can easily spot their prey in the dark. This is thanks to the tapetum lucidum, a reflective layer in their eyes. Humans, on the other hand, need technical assistance to amplify residual light to likewise see well at night. Various technologies are available for this purpose. All of them require optical elements that are familiar to us from the field of photography: lenses, apertures, filters and shutters. To move these components, the smallest of motors are needed. After all, there is not much space in night-vision devices. At the same time, they must perform their work absolutely reliably, quickly and precisely.

It is under requirements such as these where the drives from FAULHABER reach their full potential.

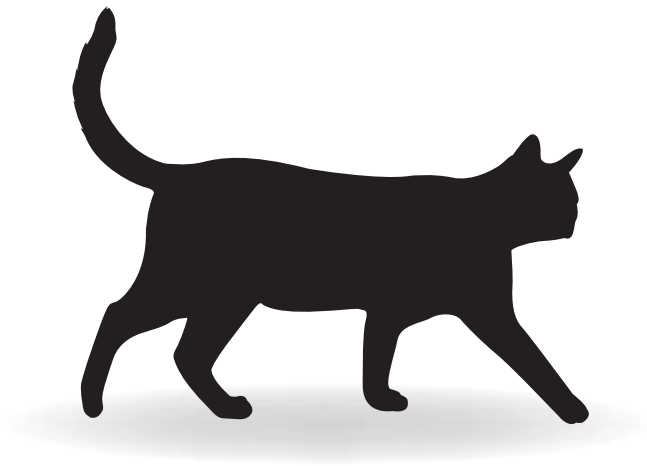
vision

The tapetum lucidum is located in the eye behind the retina. It is a reflective layer of tissue that reflects the incident light. This effect can be observed when the headlights of a car shine into the pupils of a cat: The eyes then light up like small lamps. In the animal itself, the reflection causes the light to pass through the retina twice and to be perceived more intensely.

Electron bombardment or thermal image

For humans to see well in the dark, they need technical assistance. This can be achieved, for example, through a technical residual light amplifier. This collects residual light, directs it into an electron tube and produces an increased light density on a fluorescent screen through accelerated electrons. Produced as a result are the characteristic green pictures in nocturnal images familiar from night-time scenes in action and documentary films.

As its name indicates, the residual light amplifier requires a minimum level of incident light. The flickering of the stars, for example, can suffice here. In a pitch-black night under cloudy skies or during fire fighting operations in an unlit, closed room, this technology is of no use, however. In such situations, heat-dependent infrared radiation comes into play. Thermal imaging cameras typically use medium- and long-wave infrared light for the imaging of objects. These are, in principle, constructed in the same way as a typical digital camera for visible light, only that their light-sensitive sensors are designed for the infrared part of the spectrum. In their images, the "light intensity" corresponds to the temperature profile: The warmer the object, the more strongly and more clearly it can be seen. Such images can, therefore, also be used to identify the sources of heat loss in buildings.



Various technologies for infrared imaging

In addition to the process that is similar to typical photography, there are other physical methods for evaluating infrared radiation. “Thermal” or IR imaging is used to identify the temperature difference between the background and foreground of an object and, of course, between areas with different temperatures. The microbolometer, for example, is a thermal sensor that can detect a very broad spectrum – from millimeter waves to UV and infrared to X-rays. In thermal imaging, it is used mainly for the detection of medium- and long-wave infrared radiation with wavelengths greater than three micrometers.

The quantum-well infrared photodetector, also known as QWIP, consists of thin layers of semiconductors that are arranged alternately. These layers limit the quantum mechanical states that a particle can take on. It responds if infrared waves are incident on the detector, thereby allowing meaningful images to be generated. These images are especially detailed and offer a high resolution that is comparable to colors. The technology is used in various areas, such as in atmospheric and space research.

Another application is active illumination, in which a thermal imaging camera is combined with an infrared light source. Similar to a conventional headlight, this serves as a light source to illuminate the scene, which can then be viewed with a corresponding night-vision device. This process is suitable, e.g., for observing dark rooms.

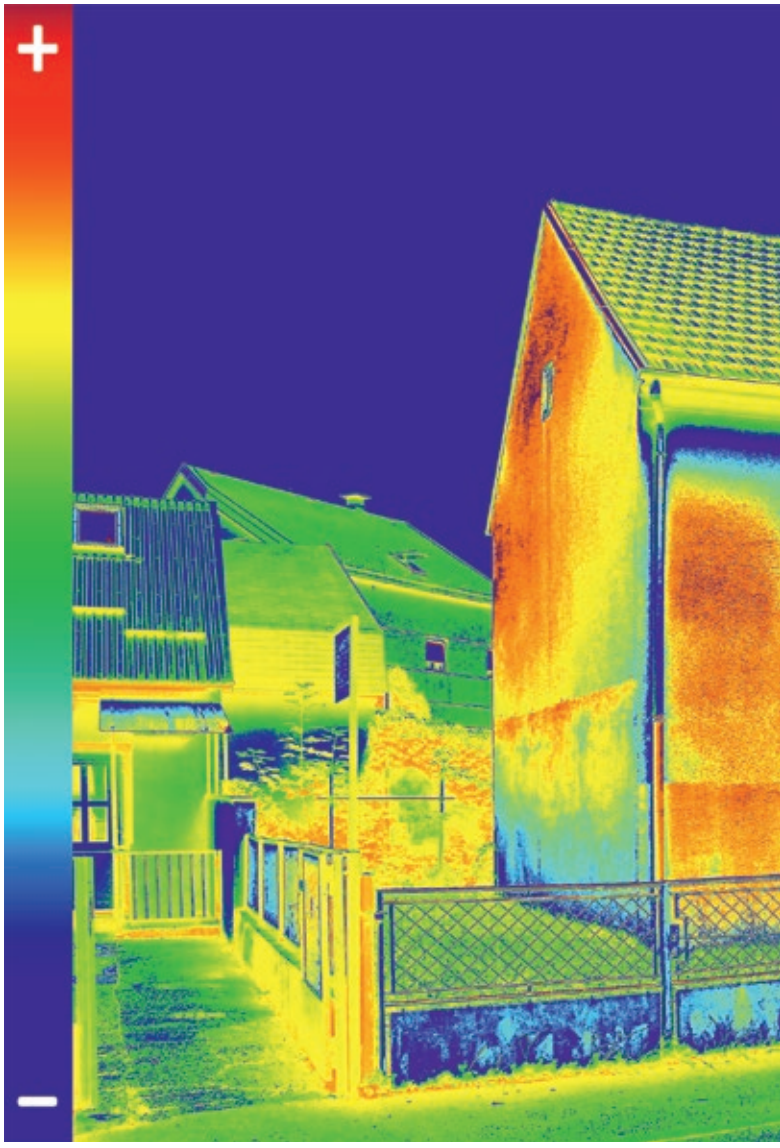
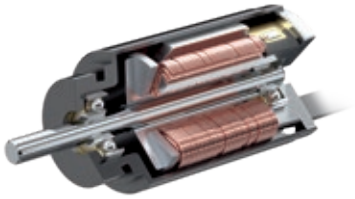


Image optimization by combining technologies

Different technical approaches are often combined with one another to achieve optimum results. By combining residual light amplification, thermal imaging technology and active illumination, more image information is generated, the resolution increased and the depth of focus of the images improved. Possible sources of interference that could negatively affect one of the methods are compensated for by other methods.

For focus and zoom in conventional as well as in night-vision devices, DC-micromotors of the 1516...SR and 1524...SR series with precious metal commutation are often used. The DC-micromotors of the SR series with diameters of 10 and 13 mm are also very popular. They fit into small lenses thanks to their minimal volume – without loss and with high performance values. The stepper motors of type AM1020 in combination with a lead screw are especially well suited for the positioning of filters and apertures. Thanks to the wide variety and numerous combination possibilities of the FAULHABER drive components, the optimum solution can be found for nearly every optical application.

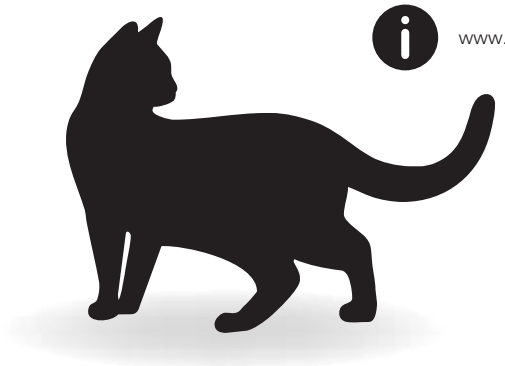
FAULHABER SR
DC-MICROMOTORS WITH
PRECIOUS-METAL COMMUTATION



FAULHABER AM
TWO-PHASE STEPPER MOTORS
WITH INDIVIDUAL MAGNETS

www.faulhaber.com/en/motion/

Nevertheless, it is necessary in any case to capture, bundle and direct light waves in order to create the images. This process is fundamentally similar to conventional photography in the range of light that is visible to the human eye. For this reason, familiar optical elements such as lenses for focusing and zooming, apertures for adjusting the amount of light, filters for making adjustments and shutters for controlling the exposure are used here as well.



When time isn't just money, but rather **life**

In day-to-day production in medical technology and the pharmaceutical industry, focus is increasingly on questions regarding improved efficiency and sustainability. In crisis situations, as the recent example of the COVID-19 pandemic showed, the topic of sustainability as it relates to the rapid development and provision of medications quickly becomes a matter that is vital for survival. With fully automated systems like the “Azzurra,” which is 100% robot-controlled, the Italian company Pharma Integration provides decisive answers. FAULHABER drives play a critical role here in the fill-finish process.

Anyone who has ever been to a pharmacy knows how large the selection of medicines is these days. There are pills for headaches, capsules for nausea, drops for the eyes or syrups that help with coughs. The demand for the different forms of medication is as varied as the illnesses they treat. To ensure that these medications can be taken safely, they must be produced, filled and packaged in sterile environments – a demanding process that must run smoothly and efficiently.

This is especially true for injectable medications, such as vital preparations, where any delay or error could have serious consequences. Strict controls, specialized equipment and careful packaging processes must ensure the integrity and safety of these sensitive drugs. In addition to supplying drugs already available on the market, the production of samples and small batches for research is another central element in the pharmaceutical value chain.

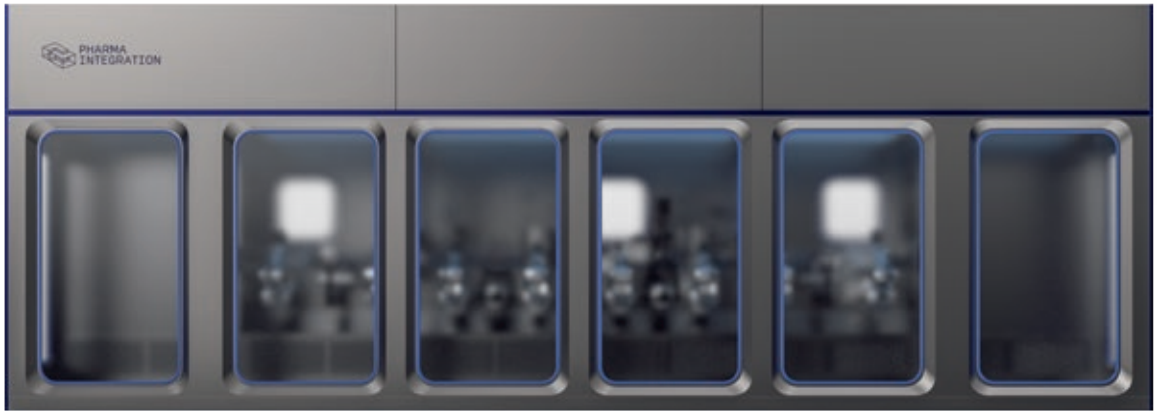
Azzurra Micro

Azzurra Small

Fully automated thanks to Azzurra

How can an innovation that advances the pharmaceutical industry look in practice? How can medications be delivered even more efficiently? The answer from Pharma Integration is "Azzurra." These machines were designed to revolutionize the pharmaceutical fill-finish process for next-generation biotechnological injectable drugs. They operate fully automated and 100% robot-controlled, integrating the latest

Azzurra FAB



Industry 4.0 technologies. This ensures maximum safety by eliminating the need for human intervention. Risks of contamination and human error are reduced, and the increasing demand for biotechnological injectable drugs is efficiently met. The goal of Azzurra is to offer a compact, flexible, and scalable solution that meets the diverse requirements of pharmaceutical production – from small-scale research and development to large-scale industrial production.

The Azzurra systems come in three different models: Azzurra Micro is a compact monoblock solution under an isolator with two robot modules. It is ideal for small-batch production, especially for research and development, clinical trials, personalized medicine, and cell and gene therapies. Azzurra Small is a monoblock solution under an isolator with four robot modules, developed for commercial production. It offers the same level of automation and flexibility as Azzurra Micro but with increased capacity. Additionally, there is Azzurra FAB, a monoblock solution that functions as a miniaturized cleanroom structure with four robot modules. It was designed for longer production campaigns and is suitable for large-scale industrial production. Thanks to their flexibility and variability, the machines are suitable for both niche products and mass production, adapting to the diverse needs of the pharmaceutical industry.

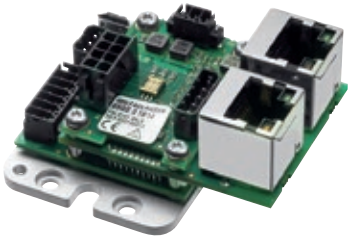
FAULHABER in action for filling and sealing

By integrating advanced robotics, as opposed to traditional mechanical systems, Azzurra offers unprecedented precision and gentle handling of the containers used for medication delivery. FAULHABER drives are used in various applications within the Azzurra machine, playing a crucial role in several process steps.

Motors, such as the brushless motors of the BX4 family, enable the movement and operation of various key components involved in the different phases of the fill-finish process. One key application concerns the sealing process: the integrated FAULHABER motors ensure that containers are correctly and consistently sealed. Another important task is the environmental monitoring system. FAULHABER drives are employed to move plates for environmental monitoring, which is critical for maintaining sterile conditions in pharmaceutical manufacturing. Additionally, the motors are responsible for handling tubs and nests – the special containers in which vials, syringes, or cartridges are brought into the machine.

Through the operation of these various mechanical groups, the FAULHABER motors make a significant contribution to the overall functionality of the Azzurra system. Their compact size and precise control capabilities, such as with the MC3603 motion controller, enable efficient control of multiple critical processes within the machine's limited space, making the system highly efficient and reliable overall.

FAULHABER BX4
BRUSHLESS DC-SERVOMOTORS
4-POLE TECHNOLOGY



FAULHABER MC 3603 S
MOTION CONTROLLER

www.faulhaber.com/en/motion/

SO POWERFUL YET SO SMALL

FAULHABER launches new motors, gearheads and encoders with 16 mm diameter.

New highlights for complete solutions in drive technology: With a new size of SXR motor, the launch of the GXR family, the high-precision encoder and the gearhead optimally suited to these motors, FAULHABER presents products that are perfectly matched to each other, come from a single source and are all diameter-compliant with Ø 16 mm. This combination enables optimal efficiency, maximum dynamics and absolute precision – ideal for high-tech industries and challenging applications in industrial automation, robotics and medical technology.

1627 GXR series NEW

The new brushed motor with copper-graphite commutation impresses with its high performance as well as a wide selection of equipment options to meet the requirements of modern drive solutions. It offers flexible voltage variants from 4.5 V to 24 V and various bearing configurations.

www.faulhaber.com/GXR/en

The 1627 SXR continues the series NEW

The already available 1218 and 1228 SXR motors with precious metal commutation are now joined by a new variant in the 1627 SXR size. Flexible voltage variants from 4.5 V to 24 V as well as various bearing configurations are possible. They have an outstanding power-to-volume ratio and are ideal for applications in the high-tech sector.

www.faulhaber.com/SXR/en

GXR and SXR – Two families with shared DNA

The motors of both families allow extensive customization – from modifications on the front and rear shafts to options for use in vacuum or high-temperature environments. Optimized rotor balancing ensures smooth operation and contributes to the motor's durability. The hexagonal winding technology – which has a high copper filling factor and an optimized straight section – and the high-quality magnets ensure temperature stability and improve overall performance. All components of the SXR and GXR series are RoHS compliant and the electrical connections offer a variety of configuration options.

16 GPT – Compact load transmission NEW

Following the introduction of the small metal planetary gearhead 14 GPT, it is now the turn of its slightly bigger brother, the 16 GPT. The particularly compact gearheads of the GPT series leverage the proven design principle of the larger GPT gearheads, which can reliably transmit extreme forces. This not only results in higher torque, but also enables a particularly short overall length – perfect for applications where constrained installation space is a key consideration. Additionally, the optimized design allows for a higher speed of up to 24,000 rpm, enabling efficient use of the motor's full speed range.

The increased number of gear ratios contributes to an optimized thermal behavior and extends the operating range of the gearhead. Thanks to increased radial and axial load capacity, even heavier loads can be handled effortlessly.

Reliability and efficiency for a wide range of applications

To meet the highest standards of reliability and durability, the new sizes of GPT gearheads are made entirely of hardened stainless steel. The welded joints between the components guarantee a robust and long-lasting construction without the use of adhesives. This stable design ensures reliable power transmission, even under extreme loads.
All gearheads operate with a high level of efficiency and work perfectly together with the motors of the FAULHABER GXR and SXR series.

www.faulhaber.com/GPT/en

IEX3 encoder with 16 mm diameter NEW

With the very latest chip technology, the new IEX3 and IEX3 L magnetic encoders offer a high resolution and measuring accuracy that typically reaches 0.3°. Equipped with a wide voltage range – both 3.3 V for battery-powered applications and 5 V are possible – and a temperature range of -40 to +100 degrees Celsius, the encoder is both flexible and robust. The IEX3 (L) is available with or without a line driver and is extremely compact as well as maintenance-friendly – ideal for use in combination with the new FAULHABER SXR and GXR motors.

www.faulhaber.com/IEX3/en

ONE CONTROLLER FOR FOUR DIFFERENT MOTOR TECHNOLOGIES

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With the new MC 3602 B and MC 3606 B motion controllers, selecting and commissioning drive systems is now even easier.

Used in combination with the compact MC 3602/06 B, DC-motors, brushless DC-motors and linear motors can be operated with the usual position encoders as a servo drive in accordance with CiA 402. Also new is the support of stepper motors with encoder as servo or without encoder in open-loop operation. The products "speak" EtherCAT, CANopen, RS232 as well as USB.

The new MC 3602 B variant with up to 2 A continuous output current for small motors and the MC 3606 B variant with up to 6 A continuous output current for medium-sized motors simplifies the work of engineers. For applications where more than one motor technology is used, only one controller and one GUI are now required. The free FAULHABER software "Motion Manager 7" is available for installation and commissioning. It gets the drive up and running in just a few steps. All key operating modes of the CiA 402 servo drive are available. Integration takes place via CANopen or RS232. Commissioning is predominantly performed using the USB interface. An additional optional EtherCAT module allows cycle times below 1 ms. It is also possible to operate the motion controller in standalone mode without central control.

In combination with FAULHABER motors, the MC 3602 B and MC 3606 B provide a sophisticated drive system with extensive protective functions. The products were designed for operating motors with ironless winding and offer high dynamics. Similarly, standard motors – such as NEMA stepper motors – can also be operated with the MC 3602/06 B without problem. They therefore form a solid basis for a multitude of applications.

www.faulhaber.com/MC3602/en

POSITIONING AT POLE POSITION

—

FAULHABER is expanding its product range with the ultra-precise incremental encoder IERF3 L. Thanks to the optical measuring principle and state-of-the-art chip technology, the device offers the highest resolution, excellent repeatability, and outstanding signal quality. In typical applications, the positioning accuracy is 0.1° and the repeatability 0.007°. This makes the encoder the perfect solution for high-precision positioning applications in confined spaces.

The IERF3 L is available in three sizes and is optimally matched to the brushless flat DC-Micromotors of the BXT family. The device is available in diameters of 22 mm, 32 mm, and 42 mm and can also be combined with a brake if required. The encoder is equipped with a Line Driver as standard, which ensures complementary output signals and reliable data transmission (especially with long connection cables).

Thanks to its very high positioning accuracy and repeatability, the encoder is perfectly suited for demanding positioning applications, such as in metrology or in optical systems including lasers, microscopes, and telescopes. The IERF3 L can also be used in automation technology, e.g., in semiconductor production or in robotics. As an optical encoder, it is also resistant to magnetic interference fields.

www.faulhaber.com/IERF3/en

INTUITIVE CONFIGURATION **AND VERSATILE RANGE OF FUNCTIONS**

—

Upgrade now!

Motion Manager 7

The FAULHABER Motion Manager is a powerful software tool for commissioning, configuring and optimizing the FAULHABER motion and speed controllers. With its intuitive graphical user interface, it enables uniform and user-friendly handling – regardless of which interface or device family is used. The latest version 7 offers an extensively reworked structure for simplified system configuration.

In addition to an interactive setup wizard, a range of powerful tools for controlling and monitoring drive behavior is also available to the user. An integrated development environment allows sequence programs to be created and managed. Furthermore, a maintenance area offers enhanced diagnostic functions and the possibility of directly installing firmware updates.

With optimized operability and powerful tools, FAULHABER Motion Manager 7 raises the performance of your drive solution to the next level.

www.faulhaber.com/moman7/en

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Further information:

faulhaber.com
faulhaber.com/facebook
faulhaber.com/youtube
faulhaber.com/linkedin
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FAULHABER motion is also available in digital format: