

# motion

01.2017

THE MAGAZINE WITH DRIVE



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The FAULHABER GROUP mourns the loss of its chairman/CEO and partner

## Dr. Fritz Faulhaber

Dr. Faulhaber died on 6th February 2017 at the age of 68 following a severe illness. With him the FAULHABER GROUP has lost a great and visionary entrepreneurial personality, who combined and considerably and positively shaped all companies, which emerged from Dr. Fritz Faulhaber senior's legacy.

Born in 1948 in Schönaich, Dr. Fritz Faulhaber moved to the United States with his mother at the age of 10. There he graduated university and did his doctorate in "Mechanical Engineering Design". In 1981 he became president of MICROMO Electronics, Inc. (Clearwater, Florida). Dr. Faulhaber was intensively involved in the FAULHABER GROUP: since 1985 as partner and since 1992 as chairman of the board for Dr. Fritz Faulhaber GmbH & Co. KG in Schönaich as well as chairman of the supervisory board for all subsidiaries.

His passion has always been technology and engineering. He drove a Tesla, operated drones and experimented with 3D printers. Dr. Fritz Faulhaber did not just have one but two workshops in his house in Florida, in which he assembled and tested out everything feasible. At the age of 65 he obtained his helicopter licence. He liked to cook, loved Mozart and Monty Python.

Several years ago, in his hometown in Florida, he and his wife founded a charitable organisation to promote scientific education in schools – the Suncoast Science Center, into which he put his heart and soul. The "FAB LAB" was created, a laboratory equipped with numerous devices and machines, in which interested young talented engineers can put into practice and produce their ideas and dreams.

Those, who met him, will remember him in particular for his openness and huge interest in new concepts as well as his fine sense of humour.



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FAULHABER motion is now available as an app.



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## FAULHABER – A POWERFUL PARTNER

Within the "Electric Drives" product group, Heidelberger Druckmaschinen AG (HDM), with headquarters in Wiesloch-Walldorf, has honoured Dr. Fritz Faulhaber GmbH & Co. KG as a "Preferred Supplier". "To keep pace with technical progress, partners and suppliers play a decisive role for us", said Markus Vetter, director of Electronics Procurement at HDM.

The evaluation is based on various performance indicators, including the zero-error rate in product and process quality, continuous improvement, a cooperative partnership and reliability with regard to logistics. "FAULHABER convinced us in all of these points",

explained Helmut Braun, director of Quality Assurance in Electronics Procurement at HDM.

During the award ceremony, Dr. Thomas Bertolini, managing director of FAULHABER, expressed thanks for the confidence that the award embodies and emphasised: "It is the close co-operation that allows us to find the best solution together with the customer."

**FURTHER INFORMATION**

FAULHABER  
[www.faulhaber.com/news](http://www.faulhaber.com/news)

## THE CHALLENGE OF MANAGING COMPLEXITY

Coordinating global production and development networks successfully is a complex task. In order to cope with this, international companies are putting their faith in global complexity management.

This topic was the main focus of attention at the "Complexity Management" consortium's benchmarking.

Of the more than 130 companies that took part, FAULHABER was selected and awarded as one of the five most successful best practice companies. The "ERWIN complexity management" training series, the reduction of throughput time in production and the reduction in the number of variants using modular systems, were all arguments in FAULHABER's favour.

The award ceremony took place on the premises of the Claas company in Harsewinkel on 20th February 2017.

The "Global Complexity Management" consortium's benchmarking was carried out in collaboration with



the Complexity Management Academy in Aachen with the Institut für Technologiemanagement (ITEM - Institute for Technology Management) of the University of St. Gallen and the Innovation Management department of the Werkzeugmaschinenlabor (WZL, Machine Tool Laboratory) at RWTH Aachen.

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## NEW FAULHABER SUBSIDIARIES IN AUSTRIA AND MALAYSIA



Subsidiary in Austria

On May 2, FAULHABER Austria GmbH in Vienna opens for business. The newly founded company will take over sales and service of FAULHABER Drive Systems products in Austria from ELRA-Antriebstechnik Vertriebs Ges.m.b.H., which served as the distributor there up to now. "Austria is an important market

new subsidiary, customers will be able to profit even more than before from the know-how and services offered by FAULHABER. "Direct contact can offer great advantages, particularly when selecting the optimum motor for a specific use and the customer-specific development of miniature drives."



Subsidiary in Malaysia

for us, one in which we would like to strengthen our presence", explains Marcus Rimmel, general sales manager at FAULHABER Drive Systems and managing director of FAULHABER Austria. "In the areas of medical technology and automation technology, among others, there are many very interesting companies located here who are either already our customers or who we would like to win over as customers." In addition to the Austrian market, the Slovenian market will also be serviced from Vienna. With the

FAULHABER has also had its own subsidiary in Malaysia since January 2017. The products and services of FAULHABER Drive Systems are sold there by FAULHABER Malaysia Sdn Bhd. The newly founded sales company has its headquarters in Penang. FAULHABER was previously represented in Malaysia by Aims Motion Technology Sdn Bhd.

"The new subsidiary brings us even closer to our customers. We are looking forward to exchanging ideas with them and having comprehensive discussions about the joint development of customer-specific products. Our presence on-site will be a milestone in the further development of the Malaysian market.", emphasises Marcus Rimmel.

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### FURTHER INFORMATION

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INTERVIEW

# CLOSER to the **CUSTOMER**

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**MARCUS REMMEL**

General sales manager

Which direction is FAULHABER going to take in the future? How will the customers benefit from this? Which industries will be increasing their demand for micro drives and complete solutions? General sales manager Marcus Remmel talks about markets and sales strategies, the company's own locations, the tremendous innovative strength of the company - and his own, exciting way to FAULHABER.

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**What does FAULHABER represent in your opinion?**

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FAULHABER is one of the technology leaders in its industry - but the main focus is still on the people: that is the nice thing about working for a family-run company. Above all, the company thinks in the long term, regardless of whether it is about customer or staff loyalty or our on-site commitment in the markets.

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**What brought you to FAULHABER, and what did you find appealing about the job?**

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I studied mechatronics; the combination of electrical and mechanical systems and software as an overall system has always interested me. I started out as a developer, and found my way to Sales via project management. I wanted to develop products which would benefit customers. Perhaps because I spent two years developing something unmarketable during my first project as a young developer. This ended up being shelved – which motivated me to ask the question of how to develop products which would be successful on the market. I therefore accompanied Sales to the customers, became more involved in product management, and ultimately introduced customer requirements into products. I then went in the direction of project management where I carried out many sales training courses and at some stage, joined the Sales division.

The way to FAULHABER was almost logical, since my two previous employers used FAULHABER technology. The main thing that attracted me to the job was the intention to unify Sales, which was still scattered around in several locations at the time, and bring it into overall alignment for the markets.

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**In which products can FAULHABER be found?**

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That is the beauty of FAULHABER: you are not limited to one particular industry, but new ways of using FAULHABER products are always arising; thousands of applications, new customers and new products every day. From autonomously operating underwater robots in the deep sea, for example, to satellites in space. One highlight for certain was the Rosetta mission 2 years ago, when Philae landed on the Churyumov comet with 14 FAULHABER motors.

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**How has the market developed for FAULHABER?**

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In a way that is extremely varied, mainly because of the trend towards automation across all industries such as medical engineering and laboratory automation. Time and time again, extremely dynamic developments take place in individual industries and markets, which consolidate after several years before starting off again elsewhere. This does not exactly make it easy to predict developments, but since FAULHABER is highly innovative and continuously bringing new products onto the market, we are generally very well prepared.



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**What industries are particularly driven by innovation?**

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At the moment, a lot of work is being put into laboratory automation in order to bring analysis closer to the patients. The systems that are required for this are in hospitals and doctor's practices, and require a completely new type of product concept.

In medical engineering, the trend is more towards the direction of operation robots – systems which will penetrate the body by remote control and with which there will ultimately no longer be a direct link between the surgeon and the scalpel or endoscope. Additional electrifica-

# WE ARE CONTINUOUSLY MAKING PRODUCTION MORE EFFICIENT



tion is also taking place in the aviation industry: functions which are still mainly mechanical are now being equipped with drives for additional comfort – be it the shutters in business class to seat adjustments in premium economy. And finally the before-mentioned automation technology, which is going in the direction of interconnected, but autonomously operating robots and systems to a certain extent.

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## Does FAULHABER want further global expansion?

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We have had an efficient distribution network for many years, but we are also aware that we must be represented in certain markets in order to tackle more complex projects and developments with customers. We are intensifying our efforts in this area or have already been active – for example two years ago in the Benelux countries, last year in Poland, and at the beginning of this year in Malaysia. And now in Austria as the next step.

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## How important is innovation leadership to FAULHABER?

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As we have said, FAULHABER is one of the technology leaders in the area of micro technology, and it is essential for FAULHABER to maintain this leadership. In an increasing number of cases we no longer sell individual components such as motors or drives but are going in the direction of

complete solutions, which are then sold together with encoders and controllers. Particularly in the controller area, we took yet another major step last year with the introduction of our new Motion Controller generation. This makes it much easier to incorporate our drive technologies in superordinated process control systems or PLC systems.

Our innovative strength is also in demand in manufacturing technology; there is considerable pressure to reduce costs in this area – and we are continuously making production more efficient.

Even in the sales area we are continuously thinking ahead in order to become more innovative and more efficient.

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## Where does FAULHABER get its ideas for new, innovative products?

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Having ideas for new innovative products is more or less the brand DNA of FAULHABER. On one hand, there is the classic route via development and







advanced development at FAULHABER, which deals with new technologies and provides input for new products. Usually, these are technologies which are introduced in Sales or via product management, and which we then discuss with customers or sales partners. On the other hand, FAULHABER is orienting itself more strongly to markets and the customer groups which are active there. In order to do this, we started identifying and talking to important players years ago – asking for specific requirements and the desired customer benefits. The results were made available to product management and development so that we receive products which are optimally oriented to customer requirements.

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**Are we talking about products in the standard product range, or customer-specific developments?**

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Both. Of course, the goal is for the standard products at FAULHABER to be as close as possible to the final application, so that only minor modifications are needed to make the required adjustments. There is also the area of purely customer-specific development, of course. These are projects on which we specifically tackle developments for individual customers or collaborate with them and design these customer projects in a truly customised way.

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**What can we expect from FAULHABER in the near future?**

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FAULHABER will continue to comply with customer requirements as far as product development is concerned, of course, and make drives smaller, more efficient and quieter than they are now. New drives and systems will be added, and we will continue to develop the Motion Control product range. On the whole, we are going to become even more customer-orientated, and will design products in collaboration with customers more frequently – but whatever happens it will remain exciting.

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**FURTHER INFORMATION**

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Kinetic sculpture in the showroom

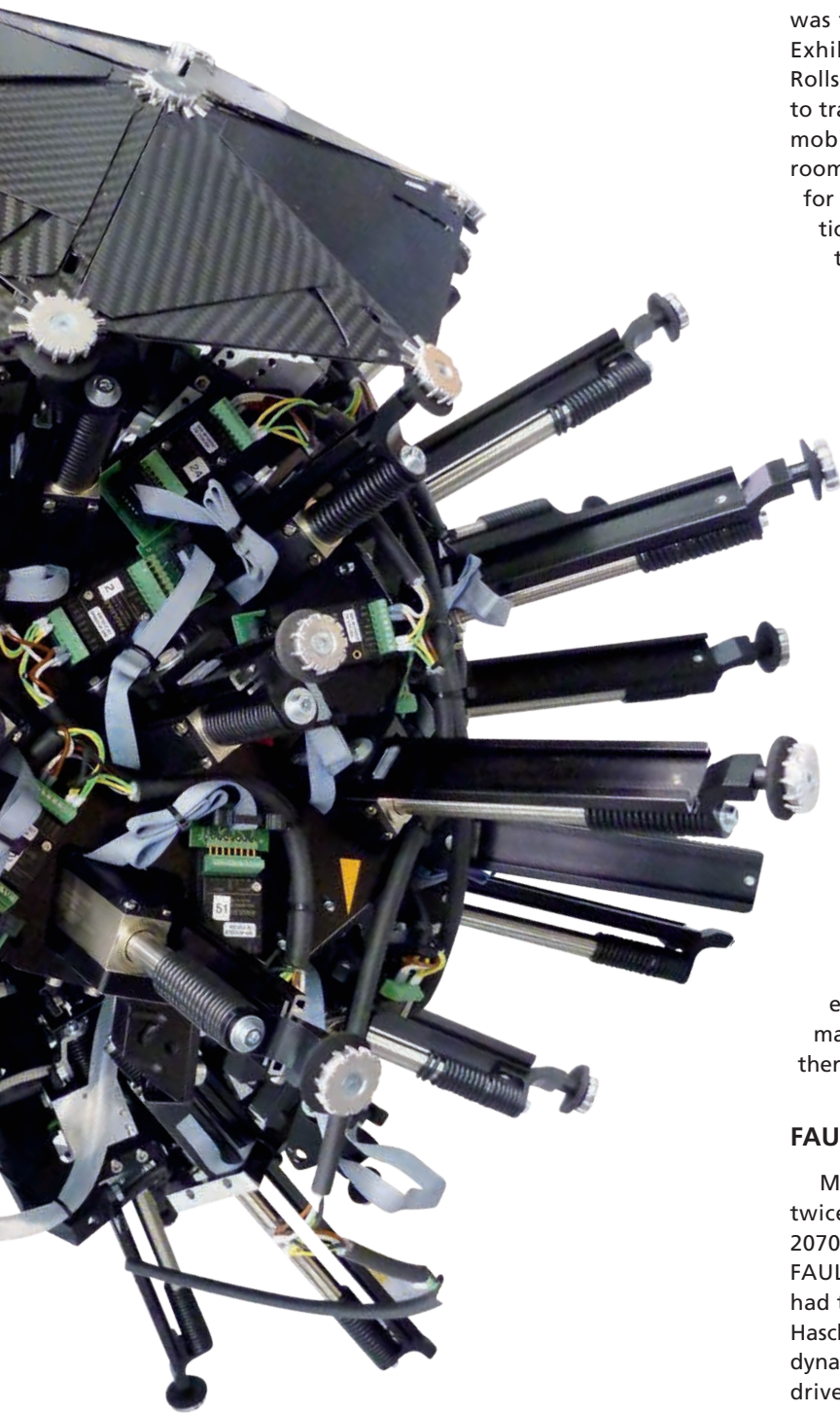
# Living GEOMETRY ILLUSTRATES DRIVING PLEASURE of the **FUTURE**

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In celebration of their 100th anniversary, the BMW Group commissioned the development of the "Iconic Impulses" exhibition, which looks ahead to the future: What will mobility look like in the next 100 years? What will move people? The technical implementation of the international exhibition was undertaken by MKT AG from Olching near Munich, who relied on drives from FAULHABER.



The approach taken by MTK AG is to explain the complexity of the modern world in a simple manner and yet still create a unique experience for the visitor. "Our strength is to concisely summarise technically complex and complicated facts and literally make them tangible", explains chairman Alex Haschkamp. For their customers, MKT AG realises unique exhibits, multimedia presentations, interactive installations or descriptive models, whereby the viewer is generally invited to interact.



## Visionary ideas

For the anniversary of the BMW Group, the task was to think ahead about mobility in the future. Exhibits for the four core brands – BMW, MINI, Rolls-Royce and BMW Motorcycle – were designed to transport the visionary ideas developers have for mobility in the future. Embedded in a concentric room concept, a kinetic-digital exhibit was created for each of the brands that activates the imagination of the viewer. Here, narration, sound, sculpture and viewer merge into a vision for mobility of the future. For the MINI, for example, a digital light sculpture was developed that aligns its individual interplay of colour with the heartbeat of the visitor, thereby reflecting its uniqueness.

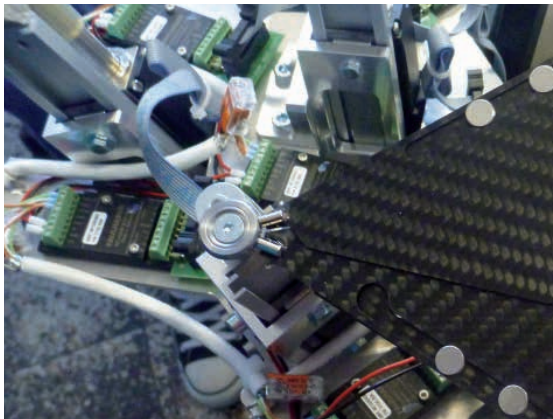
## The fascination of driving

In the brand space of BMW, a kinetic sculpture explains to the user from the future of mobility. Hundreds of extremely thin carbon scales, arranged in a spherical shape, fascinate as a shape-shifter. They move elegantly and fluidly and represent the agility that will embody the vehicles of the future – according to the vision of the BMW developers. Already today, the BMW brand stands for pure driving pleasure. The fascination of driving will continue to intensify in the future, of that the BMW developers are certain. New technologies will allow the driver to constantly and intuitively exchange information with his vehicle. This will expand the driver's spectrum of perception and make him an "Ultimate Driver" – the best driver there ever was.

## FAULHABER inside

MKT AG implemented the kinetic sculpture twice: one exhibit with 92, the other with 42 LM 2070 ("Quickshaft") linear motors – motors of the FAULHABER brand. "The complex control system had to function silently and agilely," explains Axel Haschkamp from MKT AG. "We imagined beautiful, dynamic movements. For this reason, we decided on drives from FAULHABER: they do that effortlessly and reliably." The control system was realised with CANopen Motion Controllers from FAULHABER.





CANopen Motion Controller from FAULHABER

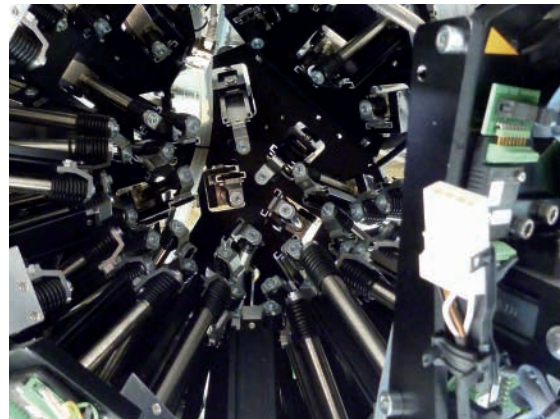


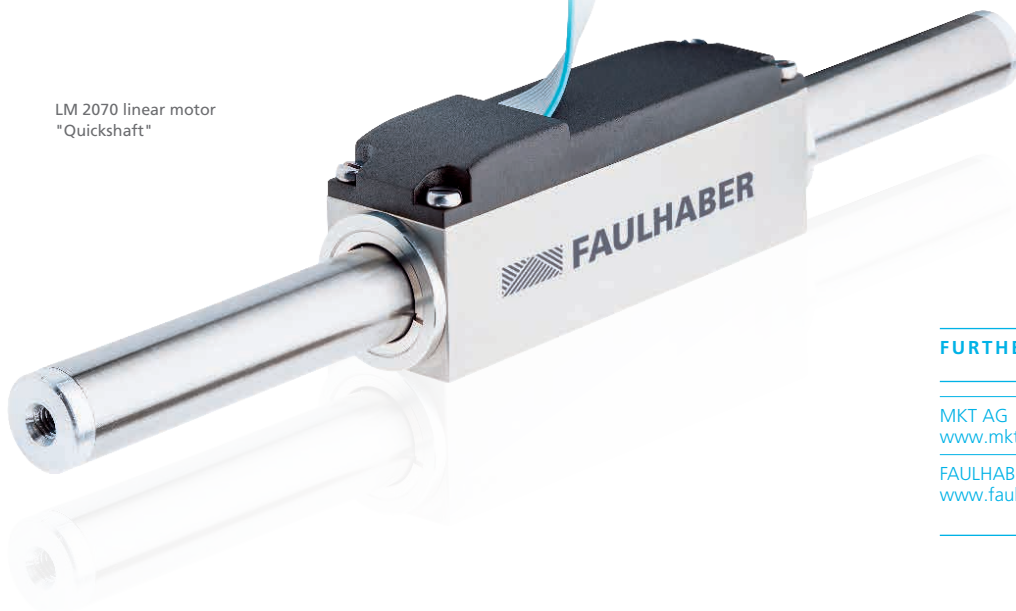
Exhibit with 92 linear motors of the LM 2070 Series

"In collaboration with the motion control experts from the FAULHABER company, the cycle times of the complete system could be optimised and fascinating, flowing movements achieved," says Andreas Eiler, who was responsible at FAULHABER for this project. For the shape-shifter with 42 motors, the strokes had a radius of 300 to 400 millimetres; for the model with 92 motors, the radius ranged from 350 to 430 millimetres.

### In use internationally

During BMW's anniversary year, the "Iconic Impulses" exhibit thrilled visitors in Munich, Beijing, London and Los Angeles. The exhibit can still be viewed in 2017 in the Double Cone of BMW Welt in Munich.

LM 2070 linear motor  
"Quickshaft"



### FURTHER INFORMATION

MKT AG  
[www.mkt-ag.de](http://www.mkt-ag.de)

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To the car driver waiting for the green light, the busy intersection in the heart of the city looks no different from any other morning. They don't realize that they are in the middle of a building site – or on top of one to be more precise. Just a few meters below them, a dazzling beam of light cuts through the darkness and startles the underground "inhabitants". A camera lens is transmitting images of wet, cracked walls to the surface where the operator intensively watches his monitor while he controls the robot. Not a scene from a science-fiction or horror film, but modern everyday life in sewer renovation. Motors from FAULHABER are used for camera control, tool functions and the wheel drive.



The days when conventional construction teams went to work on the sewer system, digging up roads and crippling the traffic for weeks are a thing of the past. It is much more pleasant if the inspection and renovation of the pipes take place below ground. Today, sewer robots can perform many tasks from the inside. They play an increasingly important role in the maintenance of urban infrastructure. There are more than 500,000 millions of kilometres of sewers to be maintained – ideally without disturbing the life that transpires just a few metres above them.

### Robots replace excavators

It was previously necessary to expose underground pipelines over long stretches just to localise damage. Today, sewer robots perform the assessment with no construction work at all. "There are different kinds of sewer robots", explains Regina Kilb, who analysed this growing market segment at FAULHABER. "The devices for pipes with small diameters, usually shorter house connections, are attached to a cable harness. They are moved by rolling this harness in or out. They are equipped only with a swivelling camera for damage analysis. For large pipe diameters, on the other hand, machines mounted on carriages and equipped with multifunctional working heads can be used. Such robots have long been available for horizontal and, more recently, vertical pipes."

The most commonly used type of robot is designed for straight, horizontal travel in sewers with only a slight gradient. These self-propelled robots consist of a chassis – usually a flat cart with at least two axes – and a working head with integrated camera. Another version is able to navigate bends in the pipe. Lastly, there are robots that can even move in vertical pipes because their wheels or crawler tracks press against the pipe wall from the inside. A moveable suspension on the frame centres the device in the middle of the



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**REGINA KILB**

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Sales Engineer  
International

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pipe; the spring system compensates for irregularities as well as small cross section changes and ensures the necessary traction.

These and other sewer robots are used not only in sewer systems, but also in industrial pipeline systems, such as in the chemical, petrochemical or oil and gas industries. "The requirements on the motors in the chassis are very high", emphasises Regina Kilb. "They must pull the weight of the cables that supply them with power and transmit the camera images. For this purpose, they require motors that deliver very high power with minimal dimensions."

## Working in the pipe

Sewer robots can be equipped with very versatile working heads for automated repairs. They are able to eliminate obstacles, incrustations and deposits or protruding sleeve misalignments through e.g. milling and grinding. They fill small holes in the pipe wall with a sealing compound carried on-board or bring a sealing plug into the pipe. On robots for larger pipes, the working head is located at the end of a moveable arm.

In such a sewer robot, up to four different drive tasks are handled: for the wheels or the crawler tracks, for the movement of the camera, for the drive of the tools and for the moveable arm that moves them into position. With some models, a fifth drive is used to adjust the camera zoom.

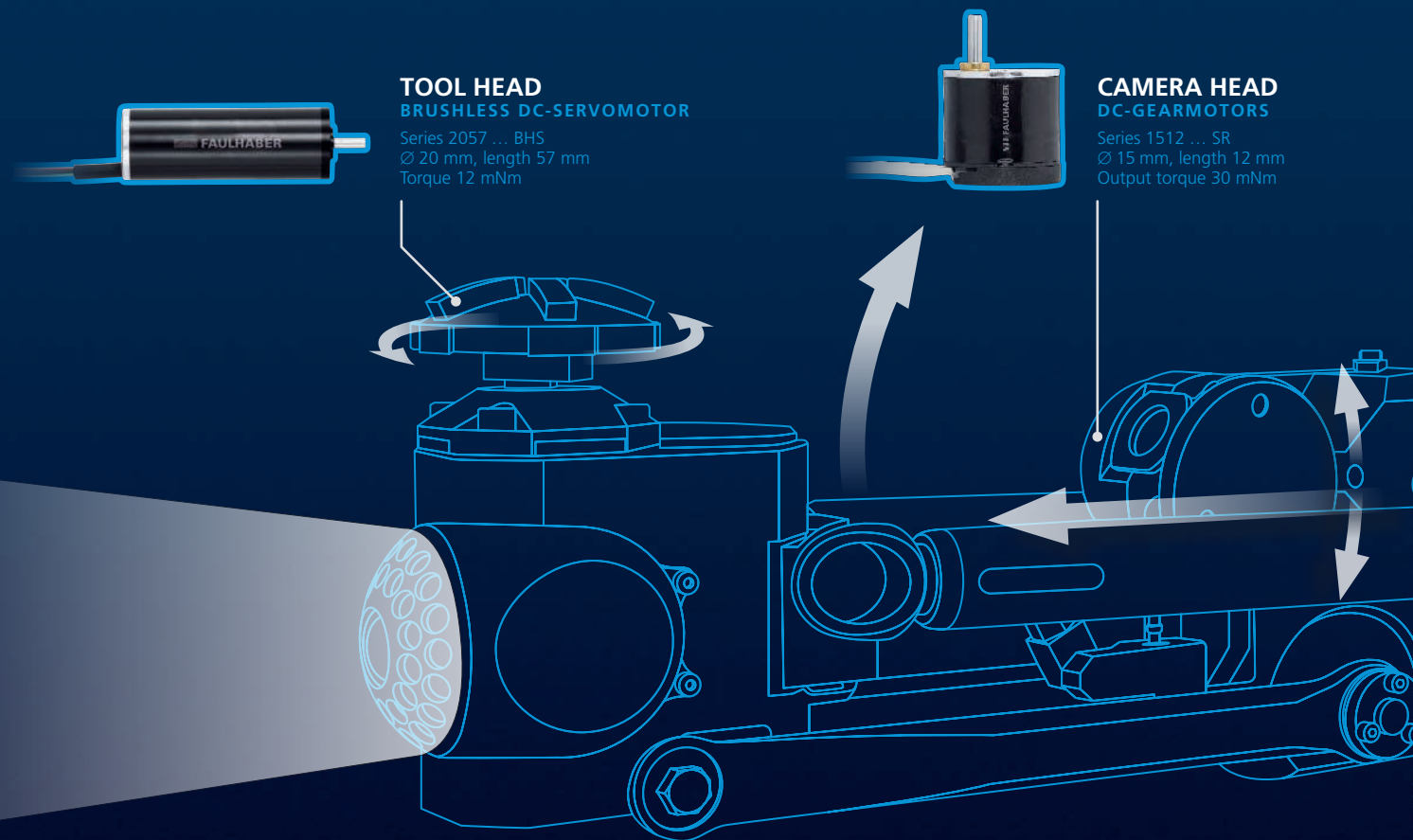
The camera itself must be swivelled and rotated so that it can always supply the desired viewing angle. The camera bracket does not require much space, which is why particularly small, yet very precise, motors are needed here. Possible options include the flat and, measuring just 12 mm, extremely short gear motors of the 1512 ... SR series or even larger models of the 2619 ... SR series. FAULHABER's wide range of products also includes Stepper Motors or

brushless drives with diameters from 3 mm as well as the corresponding gearheads. "With respect to their size, these drives achieve the highest efficiency and energy density that is available", stresses Regina Kilb.

## Heavy cable-drag

The design of the wheel drive varies: the entire carriage, each axis or each individual wheel can be moved by a separate motor. Not only must the motor or motors move the chassis and attachments to the point of use, they must also pull along heavy pneumatic or hydraulic lines in addition to the electric cable.

With a range of up to 2.000 metres, the result is a cable drag of considerable weight. "Thus, the drive must produce a very high torque", says the process engineer. "At the same time, movement is time and again impeded by an obstacle. Overload at full speed occurs regularly. This is something that only very robust motors and gearheads can withstand. For this type of use, we recommend the graphite-commutated 3257 ... CR series with the 32/3R gearheads or the brushless power pack of the 2264 ... BP4 series.



### TOOL HEAD BRUSHLESS DC-SERVOMOTOR

Series 2057 ... BHS  
Ø 20 mm, length 57 mm  
Torque 12 mNm

### CAMERA HEAD DC-GEARMOTORS

Series 1512 ... SR  
Ø 15 mm, length 12 mm  
Output torque 30 mNm



The motor can be equipped with radial pins to secure the suspension and to absorb the forces that arise during overload."

The motor for the robot arm requires less force than the radial drive and has more space than the camera version. The requirements on this power train are not as high as on the others in the sewer robot. "For this task, we have a very wide range of standard motors available", says Regina Kilb. "Among them is the optimum solution for every variant."

## Pipe in pipe

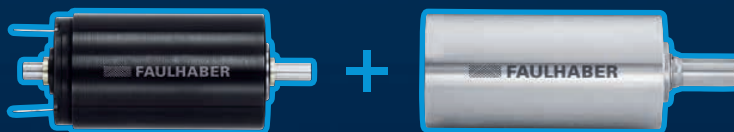
Today, damaged sewage pipes are often not replaced, but rather lined on the inside with plastic. For this purpose, a plastic tube is pressed into the pipe with air or water pressure. To harden the soft plastic, it is subsequently irradiated with UV light. There are, in turn, specialised robots equipped with high-power lamps that move through the pipes for this purpose. After they perform their work, the multi-purpose robots with working head must move in to cut out the lateral branches of the pipe. This is because the hose initially sealed all inlets and outlets

of the pipe. During such applications, one opening after the next is milled into the hard plastic, often over the course of hours. The service life and reliability of the motors are of decisive importance here to allow work to be performed uninterrupted.

## Compact power pack

The drives for the tools, on the other hand, must by definition consistently deliver maximum performance – with small dimensions, since space is always limited in the function head. At the same time, motors that offer a particularly large amount of force and can operate trouble-free for a long time are needed for powerful gripping or for hours of milling.

"Motor type 2057 ... BHS, for example, is developed for such milling heads and achieves speeds in excess of 30,000 rpm", says Regina Kilb.



### WHEEL DRIVE

#### DC-MICROMOTOR

Series 3257 ... CR  
 Ø 32 mm, length 57 mm  
 Output torque 73 mNm

#### PRECISION GEARHEADS

Series 32/3R  
 Ø 32 mm  
 Torque 8 Nm



### ROBOT ARM

#### DC-MICROMOTORS

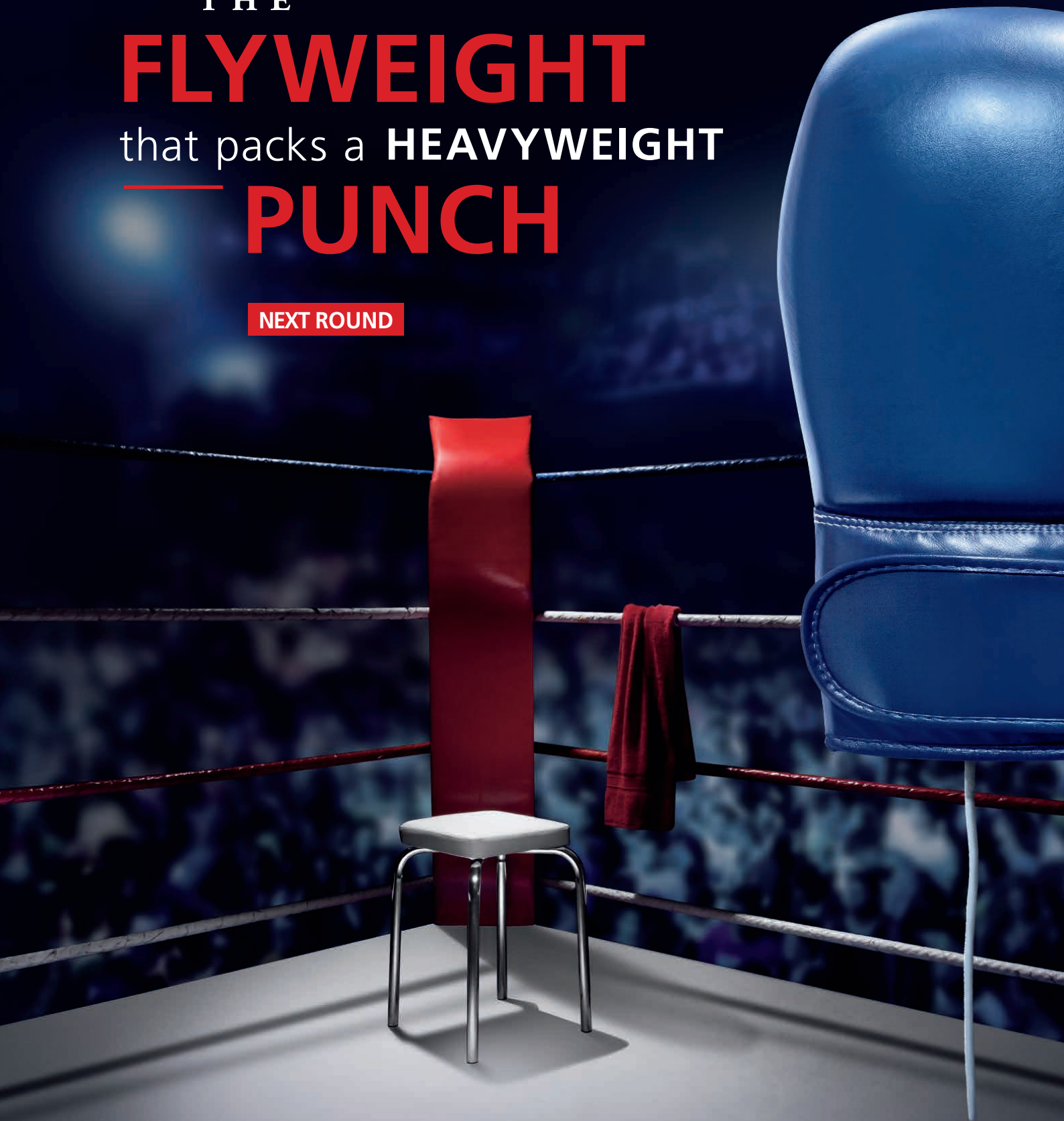
Series 2224 ... SR  
 Ø 22 mm, length 24 mm  
 Torque 6.8 mNm

## FURTHER INFORMATION

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THE  
**FLYWEIGHT**  
that packs a **HEAVYWEIGHT**  
**PUNCH**

NEXT ROUND





## NEWS

The 2264 ... BP4 Brushless DC-Servomotor opens a new performance class. In addition to an outstanding ratio of torque to size and weight, it offers integrated sensors and a wide speed range.



The new drive achieves a torque of 59 mNm with a weight of just 140 g and a diameter of 22 mm. Furthermore, the 2264 ... BP4 reaches up to 34,000 revolutions per minute. "Its possible scope of application is thus even broader than that of its big brother, the 3274 ... BP4", explains product manager Anne Schilling. She refers to the larger motor of the same design type, which is among the most powerful in its class two years running.





## New winding technology

The reason for the outstanding performance and at the same time the heart of both motors is the innovative segment winding of the coil. "Since the history of modern micromotors began with the FAULHABER winding in 1947, winding technology has been one of our core competencies. With the new segment winding, which we developed for our brushless DC-motors of the BP4 family, we continue this tradition and open a new performance class," emphasizes Anne Schilling. "We developed not only the winding, but the corresponding production technology ourselves and master this technology like nearly no other company." Thanks to the overlapping, nested, individually wound segments, an especially large amount of copper can be accommodated in the coil. Desirable side effect: high winding symmetry with minimal losses and a correspondingly high efficiency.

But above all, with the patent-pending winding the performance of the motor increases with the copper content. With the compact coil, a resilient shaft with 4 mm diameter and suitable bearing can also be installed. "As a result, the small motor can also readily serve as a direct drive, e.g., in handpieces of motorised tools." Furthermore, the four-pole motor has a low inertia and is therefore very well suited for dynamic start/stop operation.

## Sensors already integrated

In addition to the enormous torque, the new motor is also characterised by its compact and economical sensors. Optionally analog Hall sensors very precisely determine the position of the shaft. The sensors are integrat-

ed in the motor, i.e., they do not require additional installation space. In most cases, they can replace an encoder, thereby making very compact and light solutions possible. If even more precision is required, e.g., with optical systems, in measurement systems or in semiconductor production, compatible optical and magnetic encoders are available. They can very easily be attached to the rear multifunction flange of the motor.

The 2264 ... BP4, like its big brother, is overload-resistant. It operates without wear-prone mechanical commutation and, as a result, has a service life many times longer than standard DC-micromotors. Also unusual is the very large temperature range in which the motor can be used: it spans from -40 to +125°C.

## Numerous applications

"With these features, the 2264 ... BP4 is an ideal drive solution for nearly all applications of this size class – whenever space is tight or weight plays a decisive role yet a high torque is required", says Anne Schilling. She considers the two most important areas of application to be in handpieces of electrical tools and in industrial automation.

"With electric loppers, electric screwdrivers or motorised instruments for surgery, users often work with their devices for many hours. Thus, every gram that needs to be held and moved counts. At the same time, the tools should be fast, robust and effective. They need to operate at maximum performance so that every work step can be completed on the first pass."





## Use directly in automation environment

It is hard to believe how much intelligent and high-performance drive technology we have conjured up in the compact FAULHABER Motion Control Systems of the MCS 3274 ... BP4 series.

They combine powerful brushless DC-servomotors of the 3274 ... BP4 series with tailor-made control electronics in the smallest of spaces - a highly dynamic drive system for complex positioning tasks directly in the automation environment.

They are connected via M12 round connectors as per industry standard. Their rugged design in accordance with IP 54 meets even the most demanding industrial requirements. Supported communication interfaces are – depending on the device – as standard RS232 or CANopen. EtherCAT is also an available interface option with which multiple axes can easily be controlled synchronously via the usual cyclic modes CSP, CSV and CST, together with, e.g., a higher-order PLC. Commissioning is, as usual, quick and simple using Motion Manager 6.0 in combination with a programming adapter.



Supported interfaces:

EtherCAT  CANopen RS232 / 

### FURTHER INFORMATION

FAULHABER  
[www.faulhaber.com/bp4/en](http://www.faulhaber.com/bp4/en)

## EXPAND YOUR POSSIBILITIES

### **NEW** Series 26/1R and 32/3R Planetary Gearheads

FAULHABER expands its metal Planetary Gearheads R series with the new 26/1R and 32/3R gearheads. These new products with 26 mm and 32 mm diameter represent the evolution of previous 26/1 and 32/3 gearheads maintaining the same geometry to guarantee mechanical compatibility with their predecessors. The output power available for impulsive cycle operation has been more than doubled compared to the previous generation.

The 26/1R and 32/R models significantly improve the performance by achieving continuous input speed respectively up to 9.000 rpm and 8.000 rpm, resulting in an impressive 100% increase. In intermittent operation conditions, the input speed can reach up to 10.000 rpm and 9.000 rpm to exploit the best DC or Brushless motor capability. Maximum output torque has also been enhanced to exhibit up to 4 Nm and up to 8 Nm in continuous operation.

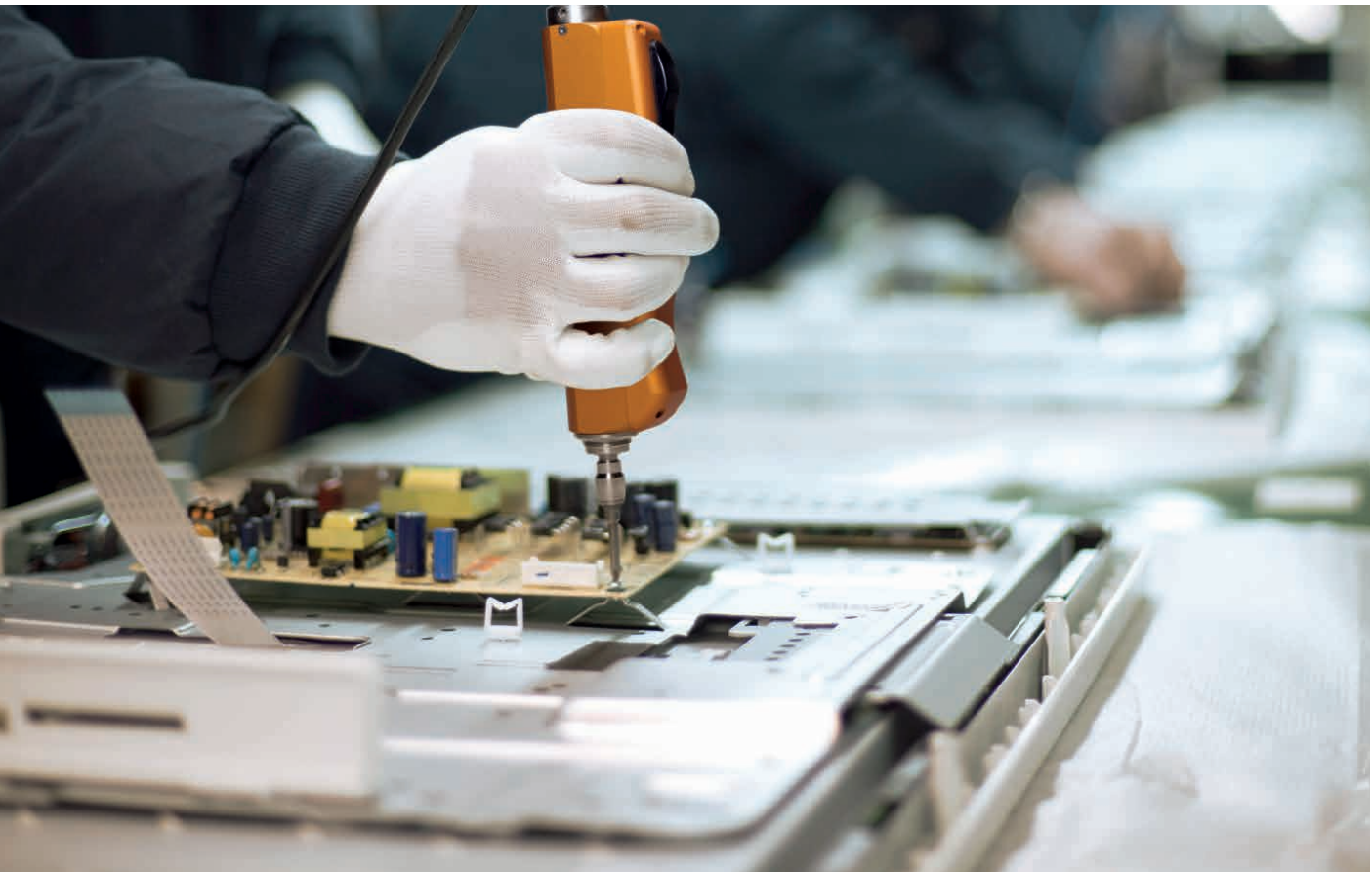
The gearheads are available in versions with one to five stages, and the span of the 13 possible reduction gear ratios ranges from 3.7:1 to 1526:1. The output shaft has no axial play thanks to the pretensioned ball bearing. They are able to operate in the typical temperature range conditions of -10°C to +125°C and options are also available for lower temperatures of -45°C to +100°C.



SENSOR SCREWDRIVER

WITH A

DELICATE TOUCH



Every handyman intuitively knows how to tighten a screw: according to feel. In the hobby room, this is generally sufficient for achieving the correct amount of tightening torque. In industrial production, on the other hand, the demand for secure screw fixing is much greater because the intention is to ensure that the end product remains functional until the end of its service life.



Mounting of extremely small screws, e.g. in mobile phones



The micro sensor screwdriver systems from n-gineric can be used both manually and in automation systems. They are predestined for process-safe mounting of extremely small screws (from thread size of M 0.6) such as those found in mobile phones, smart watches or "classic" wristwatches.

Threaded connections up to a thread size of M5 are covered by several screw spindle sizes.

In order to ensure that the screwdriving process is reliable, the screw spindles are equipped with an integrated rotating torque/rotational angle sensor, with which the torque acting upon the threaded connection and the rotational angle is measured with the extremely high precision directly above the blade holder.

The torque measuring principle is based on deformation measurement using strain gauges. A rotation-symmetrical sensor body (in the form of a measurement shaft) made from an alloy attached between the blade chuck and the FAULHABER drive deforms proportionally to the applied torque, resulting in a resistance change within the strain gauges. The result is a measurement signal which follows the torque, which is electronically prepared on the rotating measurement shaft and digitised with an extremely high resolution (24 bits).



Micro sensor screwdriving system

The power supply to the rotor electronics is provided contactlessly (inductive) via a coil system, and independently of this 2,000 torque measurements per second in the form of a serial bit code are transmitted opto-electronically from the rotor to the stator electronics, where they are decoded again, i.e. depicted 1:1 without losses.

"To my knowledge, we are the only company to install the rotating torque sensors into a screw spindle for small torques with comparable precision", says Stefan Flaig, General manager of n-gineric.

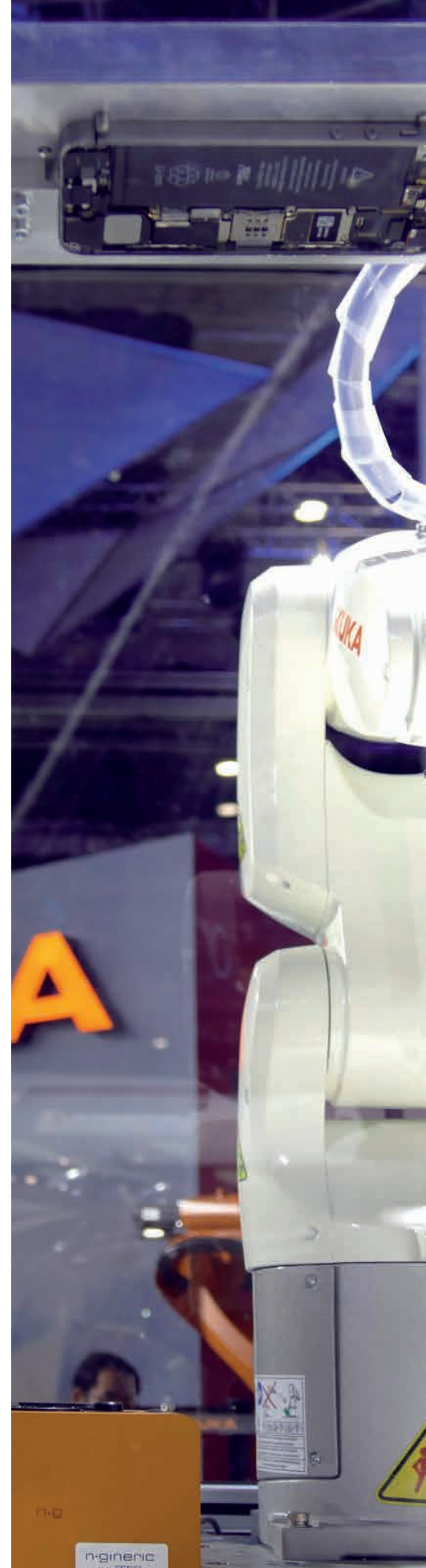
"Of course, the motor and the gearhead play an extremely important part in these systems", emphasises Stefan Flaig. "We need high power with extremely small dimensions and a considerable amount of dynamics, because fast control of the torque and speed is needed for every screwdriving process within a sequence of screwdriving stages."

## OF COURSE, THE MOTOR AND THE GEARHEAD PLAY AN EXTREMELY IMPORTANT PART

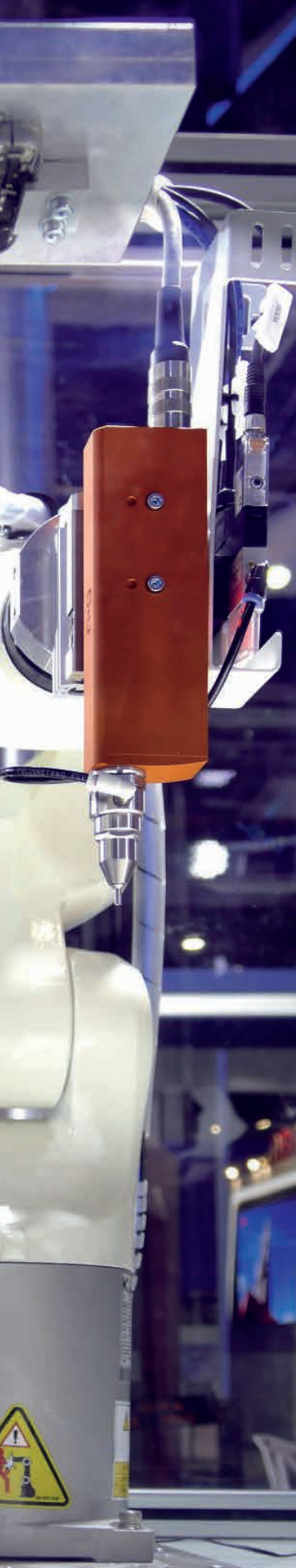
The FAULHABER drive unit with brushless motor and planetary gearhead provides the ideal performance for this.

"We achieve very short cycle times due to the high acceleration capacity of the drives, i.e. excellent productivity. The brushless FAULHABER drive is also characterised by having an extremely long service life, therefore qualifying the screwdriving system for mass production under 24/7 conditions."

Particularly for safety-relevant threaded connections in the automotive area (risk class A threaded connections, VDI directive 2862), screwdrivers must be equipped with sensor systems for measuring at least one control variable, explains Stefan Flaig.







"We measure the torque and the rotation angle directly, and also have redundancy as a third variable by simultaneously recording the motor current. This is used for permanent self-monitoring of system integrity.

## WE MEASURE TORQUE AND ROTATION ANGLE DIRECTLY

In full-automatic screw fixing, a sensor screwdriver such as this is the best choice because it safeguards the core process of the automation system.

Screwdriving processes which are difficult to control with little "leeway" between a loose screw (without clamping force) and the destruction of the screw connection (due to over-rotation) can be kept in check by means of multi-stage precision screwdriving. Defective workpieces cause screwdriving errors which can be reliably detected by multiple overlaid parameter windows within the screwdriving stage sequence (zero error production).

A considerable amount of value was placed on making the systems intuitive and simple to operate using Windows software. This is used to program the screwdriving parameters, provides process transparency by means of a differentiated display of the screwdriving curves in real time, and provides the best possible options for process data documentation.

Combining a screwdriving automation system with an intelligent, stationary torque sensor with a screw falling simulator makes automated cyclic checking of the screwdriving system's machine capability possible, e.g. every day before the start of a shift.

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### FURTHER INFORMATION

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n-gineric gmbh  
[www.n-gineric.com](http://www.n-gineric.com)

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FAULHABER  
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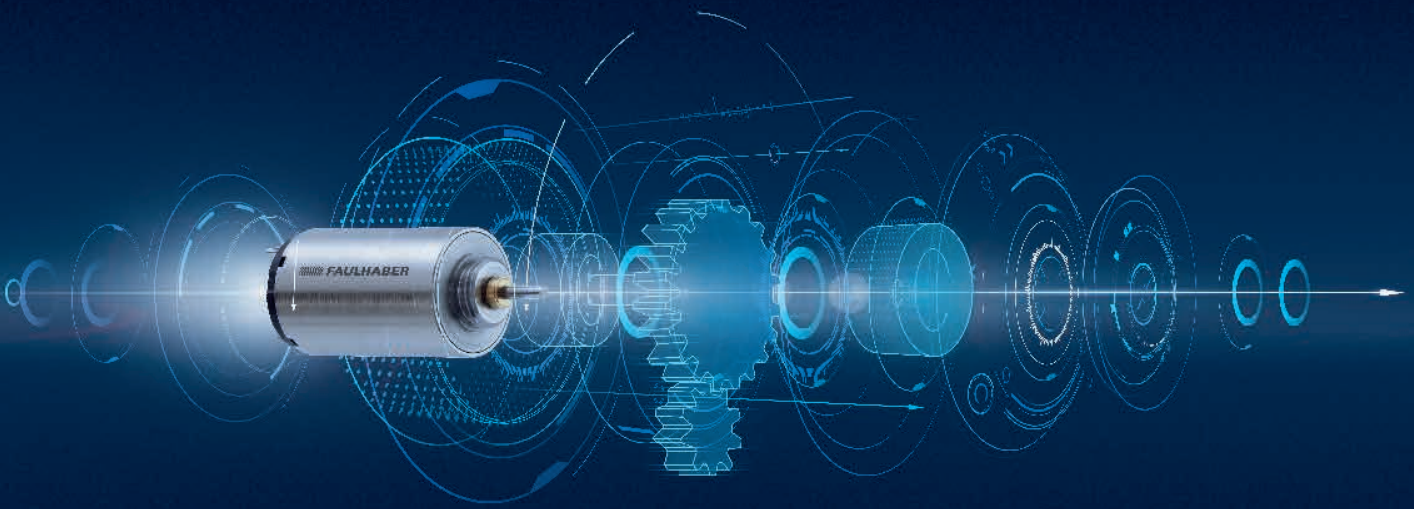
CALCULATE

# DRIVE SYSTEMS

QUICKLY AND EASILY

ONLINE

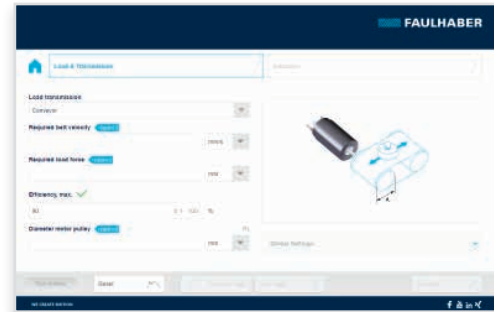
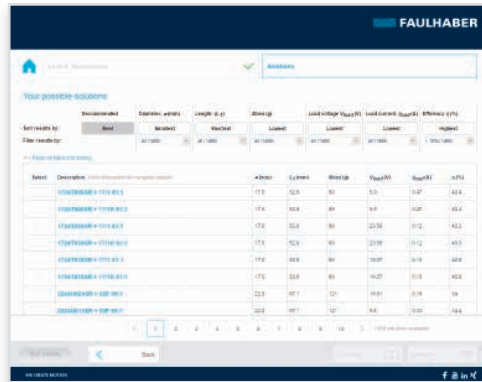
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## **FAULHABER DRIVE SELECTION TOOL**

You can precisely determine the FAULHABER Drive System required for your projects with the particularly user-friendly FAULHABER Drive Selection Tool - and then make a specific inquiry. The ideal solution for developers and application engineers - especially when they are in a hurry.

Intelligent filtering and sorting options quickly lead to appropriate solutions.



Selection of different drive types and well-arranged input screen.



Only little information, such as speed and torque, is sufficient in order to quickly determine the appropriate solution. An easy-to-read list with the most important parameters shows the choices calculated. This can then be reduced further using an intelligent filter until the most suitable drive solutions are found. For this, there is a comparison function for up to three variants, whereby the comprehensive product data is immediately presented in a table.

If a certain motor series or special series of a motor/gearhead combination are already relevant, this can be selected in advance and the solution calculated accordingly in connection with the required performance. It is also worth pointing out that the FAULHABER Drive Selection Tool also takes the changes to the electrical characteristics caused by the heating of the motor into consideration with the thermal ("warm") calculation.

Once you have found the systems that meet your requirements, you can inquire about them directly at FAULHABER using the specially set up function - making it possible for a sales engineer to contact you immediately.

The FAULHABER Drive Selection Tool is being developed gradually - with additional drive types, products and functions. In the future, you will therefore be in a position to determine suitable drive systems for your planned applications at early stages of development.



Detailed information about the chosen solution with the calculated values and clear diagram.

## STRAIGHT TO THE TOOL

FAULHABER  
fdst.faulhaber.com



PREVIEW

# ULTRA-STRONG AND ULTRA-LIGHT



Unlimited freedom with a hint of adventure - among connoisseurs seaplane flying is considered to be one of the most fascinating types of motorised air travel. Flywhale AIRCRAFT GmbH, a fledgling company based in north Germany, has set itself the task of now opening up this special aviation enjoyment to the many ultra-light aircraft enthusiasts. This has resulted in an ultra-strong amphibian aircraft made from super-light fibre composite material with high aerodynamic quality and an outstanding fun factor. You can look forward to finding out more about the part played by FAULHABER drive technology in the success of this pioneering feat in the next issue of motion.



Ident-no. 000.9122.17

#### Further information:



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