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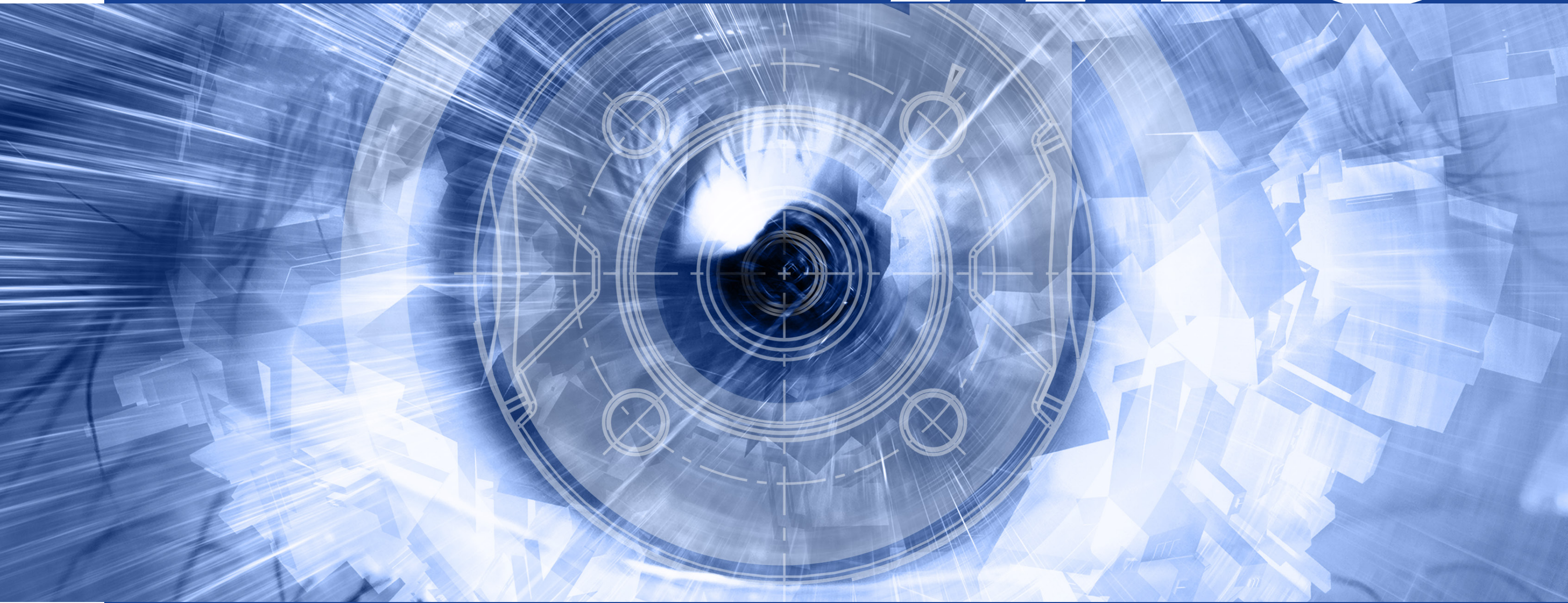

MAGAZINE OF **MOTOR TECHNOLOGY**

VISION IN MIND

dunkermotoren

Content

Trade fair participation

2017/18

Agritechnica – Hanover/ Germany	Nov 12 - 18, 2017
Compamed – Dusseldorf/ Germany	Nov 13 - 16, 2017
SPS IPC Drives – Nuremberg/ Germany	Nov 28 - 30, 2017
MD&M, – Anaheim, CA/ USA	Feb 06 - 08, 2018
FMB – Süd – Augsburg/ Germany	Feb 07 - 08, 2018
light + building – Frankfort (on the Main)/ Germany	Mar 18 - 23, 2018
Smart Industries – Paris/ France	Mar 27 - 30, 2018
HMI – Hanover/ Germany	Apr 23 - 27, 2018
Innorobo – Paris/ France	May 15 - 17, 2018
SPS IPC Drives – Parma/ Italy	May 22 - 24, 2018
Automatica – Munich/ Germany	June 19 - 22, 2018
Electronica – Munich/ Gerrmany	Nov 13 - 16, 2018
SPS IPC Drives – Nuremberg/ Germany	Nov 27 - 29, 2018


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MART FACTORY
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LINEAR SYSTEMS
»INNOVATIONS
»SMART FACTORY
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AMETEK
INTEGRATED POWER STAGE and CONTROLLER
COMPLETE PORTFOLIO of ROTARY and LINEAR DRIVES

Editorial

Dear Readers,

Uwe Lorenz
Managing Director Dunkermotoren GmbH

In the factory of tomorrow, the boundaries between the technologies and systems of industrial production blur and beyond this, from the field to the enterprise level and out to the end user. This development is based on the Internet of things that also includes our intelligent motors with the appropriate Ethernet interfaces. The increased networking, the use of cloud-based platforms and the decentralisation of computer performance create completely new possibilities for the analysis and utilisation of the data, provided by the motor, and also for the use of the motor itself for autonomously executed tasks.

Dunkermotoren is optimally positioned for this change. For more than 10 years, we have been a pioneer in intelligent motors with field bus interfaces and have therefore long been implementing the approaches discussed in the context of industry 4.0 with our customers. Many customers already assign defined local driving profiles to our motors, which respond to local inputs and only communicate with higher-level systems for feedback, condition monitoring or fault control.

Dunkermotoren will continue to offer innovative solutions in the future. The basis for this is the new Motor Control Platform, which, with the new BG 95 dPro, is entering the portfolio of Dunkermotoren for the first time. In the months to come, further sizes will be equipped with the new controller generation, which will offer our customers a whole new range of possibilities for motor performance, real-time communication and functional safety.

Look forward to this and many more exciting topics in this issue.

Uwe Lorenz
Managing Director Dunkermotoren GmbH

News

Order our main catalogue now quickly and conveniently.

Either send a short e-mail with your contact details and the desired quantity to: **Sales.Dunkermotoren@ametek.com** or fill out the order form at **http://www.dunkermotoren.com/en/service-support/order-main-catalogue/** and convince yourself of our diversity.

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News

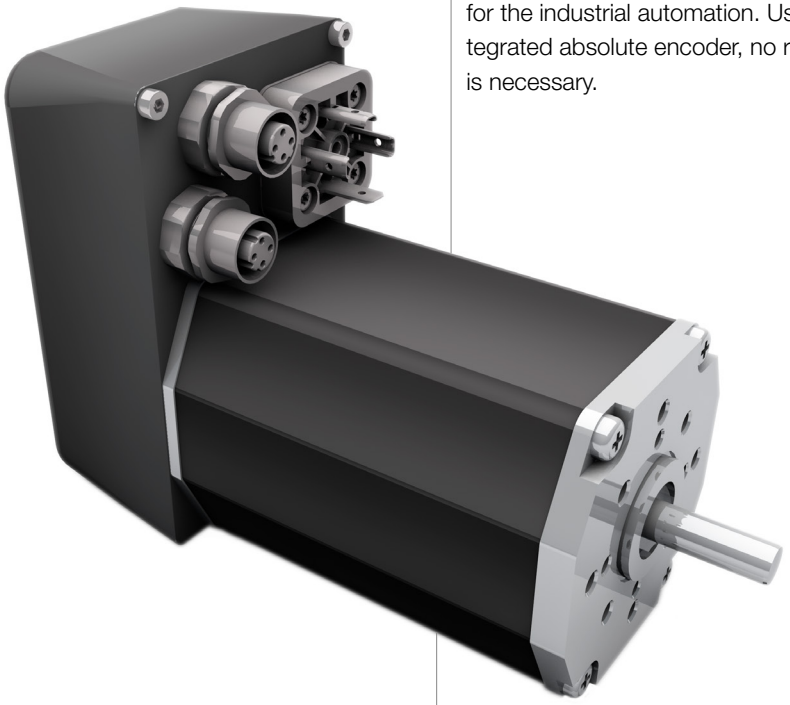
Dunkermotoren's BLDC motor BG 65 is now available with Profinet interface

Dunkermotoren's brushless DC motor BG 65 is now available with its integrated Profinet interface which is compatible with Siemens S7 series controllers. With function blocks the motor is simple to integrate with PLC controllers.

With a continuous output power of 60 – 190 W and a peak of 341 W, the BG 65 PN with its compact design is perfectly suited for the industrial automation. Using the integrated absolute encoder, no referencing is necessary.

According to Dunkermotoren, the BG 65 can be used for positioning tasks in linear axes or mechanical actuator applications.

Using their integrated modular system, Dunkermotoren is able to provide their customers the perfect drive solution with suitable gearboxes – planetary and right angle, with a continuous torque up to 160 Nm.



BG 65x50 PN

BGA 22 – IRONLESS BLDC MOTOR
now available with gearboxes and integrated controller

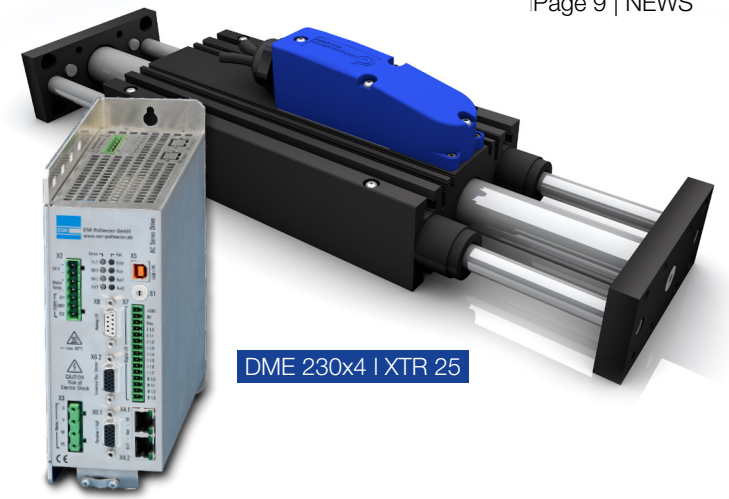
The BGA 22x22 ***dCore*** from Dunkermotoren is now available with a suitable gearbox, encoder and controller. The innovative, ironless, axial magnetic flow design of the BGA 22 provides definite advantages such as zero-cogging torque, low vibration, and very low audible noise.

In addition to this new motor, there is also available a four-quadrant controller, BGE 6005 with CANopen interface, which can supply currents up to 5 A. Additionally, the RE22 encoder is offered with 256 ppr or 360 ppr, matches the BGA 22's diameter, and can be mounted to the motor.

The available PLG 22 and PLG 24 planetary gearboxes can provide a nominal torque of up to 1.5 Nm.

For simple applications, Dunkermotoren can offer the BGA 22 ***dGo*** version with integrated commutation electronics and functions such as change of direction, start/stop, speed set input and speed output signal.

BGA 22X22 ***dCore*** with gearbox


DME 230x4 I XTR 25

ST SERIES LINEAR MOTOR
now available with PROFINET-DRIVE

The ST Series linear motor from Dunkermotoren is now available with Profinet drive, DME 230x4. In combination with this Profinet drive, the ST linear motors allow for easy integration into Siemens controller environments. The linear system with DME 230x4 provides high dynamic motion and good controllability for quick and precise positioning.

The ST Series ServoTube is commonly found in industrial machinery, laboratory equipment and test systems. Since there are no meshing mechanical parts such as gears or screws, the ServoTube linear motor assures extremely quiet operation. Applications with lifetimes, requiring more than 50.000 km (31,000 miles) are not uncommon for the ST Series motor. Speeds up to 10 m/s, accelerations up to 600 m/s², peak forces up to 1860 N and protection classes up to IP67 are achievable with the ST Series linear motor. The ServoTube provides outstanding performance and life advantages versus pneumatic systems.

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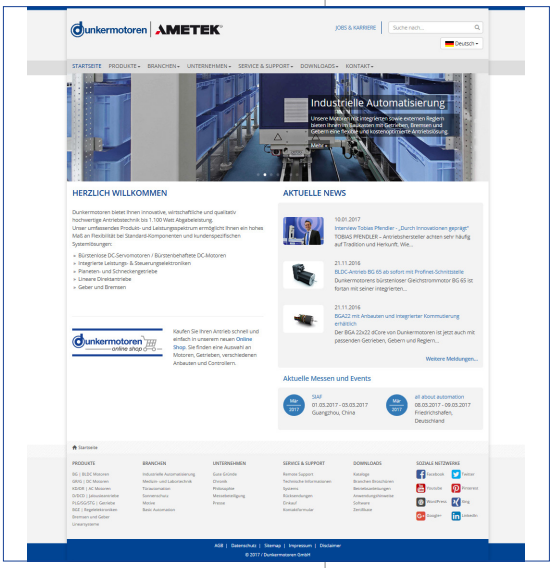
website with new design



Product groups Dunkermotoren GmbH

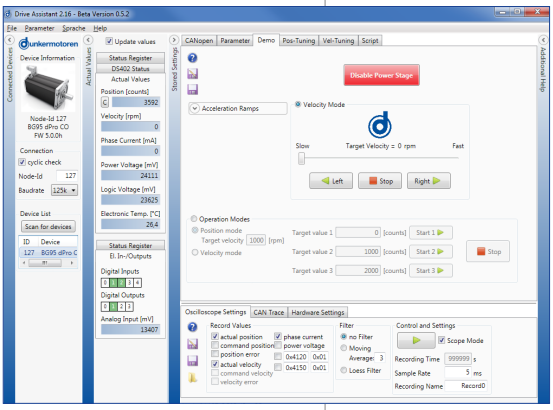
The Dunkermotoren website has a new design with a fresh new look which goes well with the corporate philosophy.

The new navigational structure makes it easier for the user to quickly discover their desired content in an uncomplicated way. The flexible design of the website also displays pages better on mobile devices. The integration of interactive elements like the new company history provides the visitor with a unique experience.

The ability to filter the new product overview stands out as the most important feature of the new Dunkermotoren website. This simplifies the user's search for the optimal drive solution. By indicating the motor or gearbox requirements, all options are shown with the help of the filtering function.

Curious? Then visit our website at

www.dunkermotoren.com



Drive Assistant 5 Dunkermotoren GmbH

Drive Assistant 5

The "Drive Assistant 5" service and commissioning program is a comprehensive software with a completely new intuitive interface for commissioning Dunkermotoren's motors. Via the CAN interface, the software connects to the motors and can access the parameters of the drive.

In addition to the modern, intuitive and flexible interface of the program, other technical highlights include the software oscilloscope function, the simple CAN trace function as well as the script functionality, according to project manager Florian Keller.

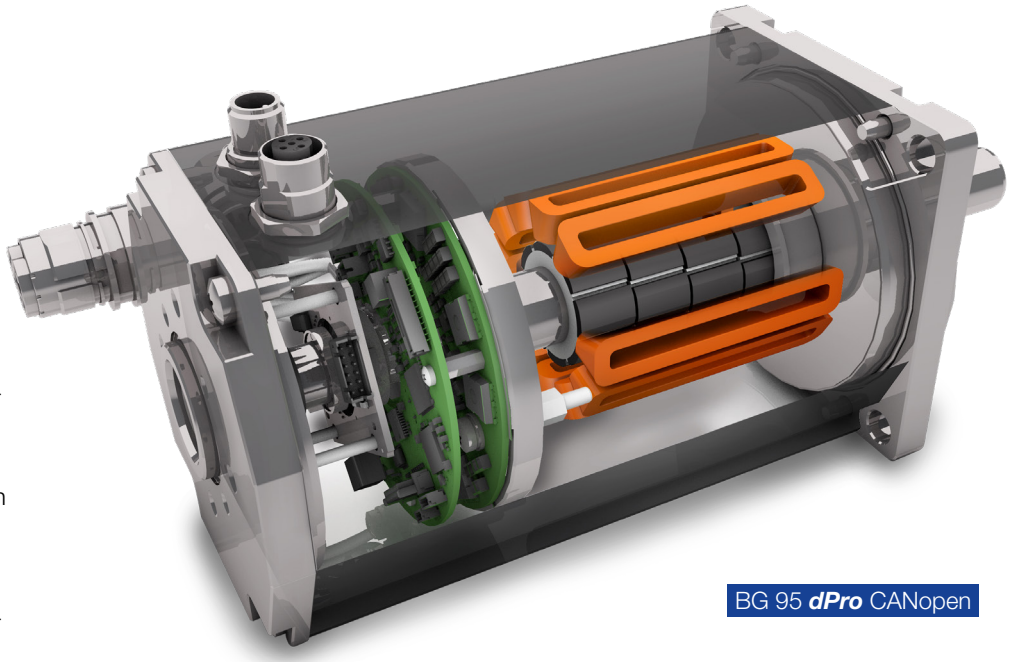
POWER AND FUNCTION
combined

With the BG 95 ***dPro*** CANopen, Dunkermotoren successfully launched a compact brushless DC motor with an output power of over 1 kW. The drive with its integrated control and power electronics can provide 1.100 W of continuous mechanical output power and has an integrated CANopen interface for an easy integration into a CANopen network. With voltage ranges of 24 V to 60 VDC the drive is able to excel in a wide range of applications.

The BG 95 ***dPro*** CANopen can be used above its rated power of 1.100 W. Sophisticated algorithms calculate the heating of the windings and power electronics. This enables the drive to be overloaded without any damage.

The integrated CANopen interface of the BG 95 ***dPro*** CANopen is compatible with DS402 (cf. IEC 61800-7) and accepts user-friendly quick start instructions. With its robust design and wide range of input voltages the BG 95 ***dPro*** CANopen is suitable for use with a battery and as a replacement for hydraulic applications.

The compact and environmentally sealed design of the BG 95 ***dPro*** CANopen is commonly used in autonomous shuttles, industrial automation, solar, door, medical and many specialty applications. The



BG 95 ***dPro*** CANopen

BG 95 can be sealed to a rating of IP67.

To simplify the installation, the BG 95 ***dPro*** CANopen is equipped with standard flange and standard shaft according to DIN EN 50347 and a robust plug. CAN IN and CAN OUT connectors are separate, which makes an additional, external T-connector redundant.

The new BG 95 ***dPro*** CANopen is available in two sizes – BG 95x40 and BG 95x80. It extends the modular system of Dunkermotoren with the increased output power. It can be combined with a planetary or right angle gearbox, as well as encoders and brakes, all designed and produced by Dunkermotoren.

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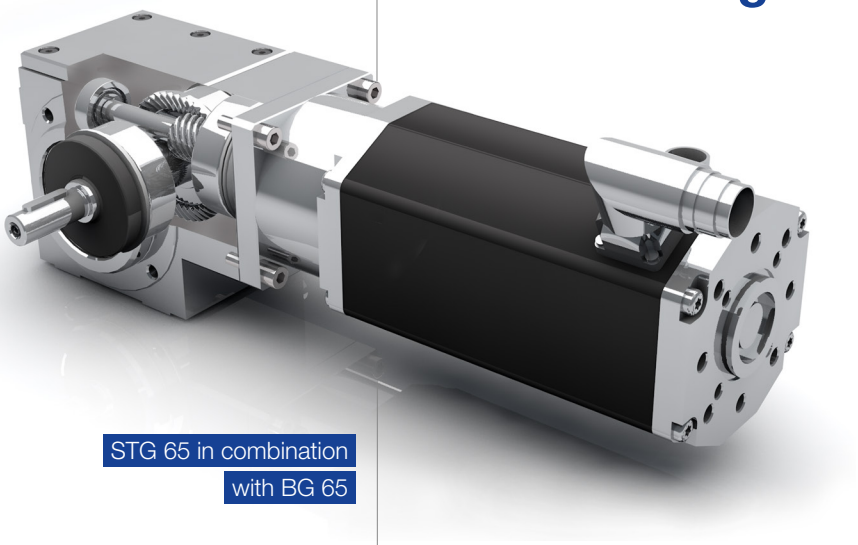
SPIROTEC DESIGNED
angular gearbox



STG 65 in combination with BG 65

In addition to its planetary and worm gearboxes, Dunkermotoren developed the SpiroTec gearbox and incorporated it into the product portfolio.

The centerpiece of the series STG is the helix tooth wheel set. This allows for the reliable transfer of high torque with minimal axial offset and compact installation footprint. Because the internal gears are machined from tempered steel, the gearbox has an long life expectancy. The lubricant remains free from contamination by way of sealing rings on the drive side and at the output shaft. This provides for an extremely long lifetime and is ideally suited for the use with brushless DC motors.

The housing is developed in single piece design which results in extremely high precision of the tooth alignment and improved stiffness of the drive system.

The STG 65 is available with reduction ratios of 5, 10, and 25:1 along with various output shaft options for applications such as industrial automation, material handling, motive and agriculture.

NEW SERVO GEARBOX SERIES
at Dunkermotoren

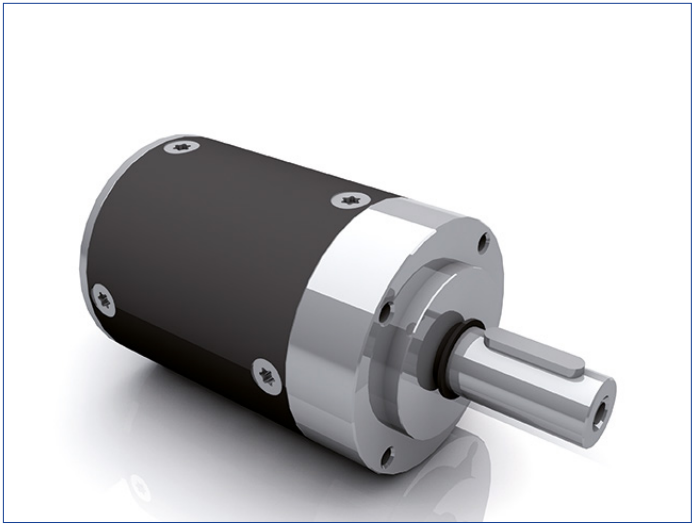
More dynamic servomotors of the BG ... dPro series increase the demands on performance, size and precision for gearbox technology.

Dunkermotoren‘s three new gearbox series PLG 63 HP, PLG 75 HP and PLG 95 HP meet these demands.

These new series gearboxes have torque ratings of up to 160 Nm, acceleration torques of up to 320 Nm and emergency stop torques of up to 480 Nm.

In addition, the company introduces three new low-backlash planetary gearboxes onto the market, the PLG 40 LB, PLG 60 LB, and PLG 80 LB series. The minimum backlash, depending on the size and reduction, is 7 arc-minutes with acceleration torques up to 184 Nm.

The gearboxes are used in applications where a small footprint is required. Thanks to grease lubrication and needle-bearing planetary wheels, the gearboxes have a particulary long lifetime.



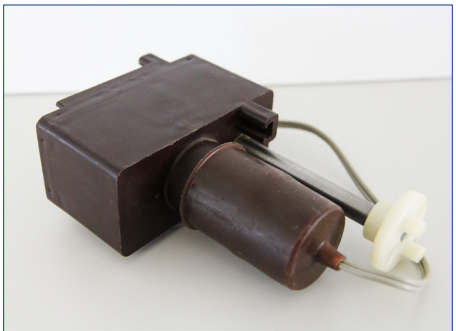
High Power Gearbox | PLG 75 HP

Facts & figures | »

» For the windings of our motor series (GR, BG, KD/DR), a total of 311 tonnes of wire was used worldwide in 2016
» In 2016, Dunkermotoren sold 3.851.119 motors of all series.
» More than 1.094.000 product variants are currently configurable within the modular system of Dunkermotoren.
» The average revenue growth for the past 20 years is 6% per year.
» The largest customer of Dunkermotoren has a turnover share of <6 % of the total turnover.
» 26% of the power consumption of Dunkermotoren is attributable to compressed air generation.
» **The only consumer products of Dunkermotoren were a ski edge grinder*, a living room table adjustment** and an electric baby swing***.**
» In 2016, 6.778.300 ball bearings were installed in the production areas of Dunkermotoren.
» In 2016, the company generated sales of 183 million Euros, which corresponds to a sales increase of 5 million Euros compared to the previous year.

Ski edge grinder

Living room table adjustment



Ski edge grinders: 1979-80

The ski edge grinder was developed at a time when Dunkermotoren was doing poorly. It was designed to keep the employees of Dunkermotoren busy. Although there was a seemingly brilliant idea behind it, the promising product did not achieve the desired sales figures. An adapter on the ski edge grinder for the 12 volt plug in the car was designed to allow skiers to grind their skis individually and mobile (without a workshop). A G42 motor was installed at that time.

Living room table adjustment: 1967

For the table adjustment of the TV set, a GS 30 motor with gearbox was installed at that time.

****Electric baby swing: 1956/57***

The idea for the development of the electric baby swing came about, when the child of an employee did not want to stop crying and a babysitter was wanted. With the electric baby swing, a constant swinging of the baby carriage was achieved thus rocking the child to sleep. Dunkermotoren was probably far ahead of its time with this product. While today similar products are available on the market, the electric baby swing was more or less dead stock.

GO-LIVE FOR THE ONLINE SHOP
of Dunkermotoren

From the beginning of 2016, Dunkermotoren has been providing its customers the possibility to order Dunkermotoren products online. With the Dunkershop it is now easier for both businesses and private customers to order products from Dunkermotoren.

The products offered in the Dunkershop include brushless and brushed DC motors, AC motors, venetian blind motors as well as linear systems. Utilising Dunkermotoren's long-standing, modular construction system, there are also many accessories such as encoders and brakes as well as gearboxes and controllers available in the online shop. The lead times for these stock products are typically just a few business days.

With the launch of the Dunkershop, Dunkermotoren has created an additional distribution channel, giving its customers the choice of ordering directly online or traditionally through the local sales offices. Payment of Dunker products can be made via PayPal or payment on invoice.

Today, the online shop is active for customers in the countries Germany, Italy, United Kingdom and Austria. Additional countries are being planned as well.

Facts & Figures Onlineshop:

» Dunker online Bestseller: GR 63x55 – 100 Watt
» Mostly searched article: GR 63x55 – 100 Watt
» Available in Germany, Austria, Italy and UK

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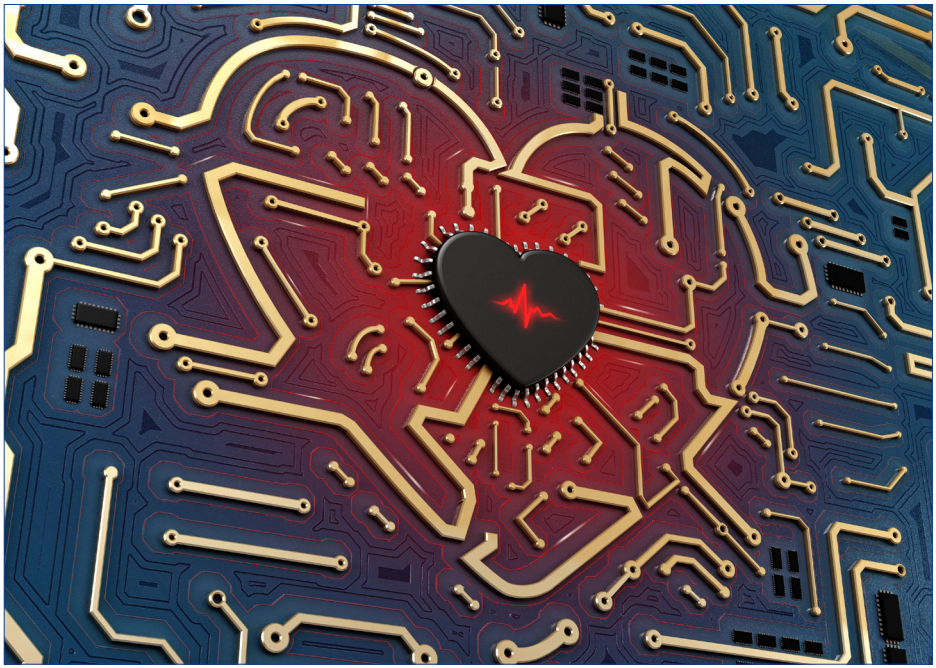
Smart factory

Motor Control Platform:
THE CORE TECHNOLOGY



1| Mr. Burgert, how much energy has Dunkermotoren invested in the development project „Motor Control Platform“ (MCP)?

Dunkermotoren has so far been investing 30 man-years in the new Motor Control platform. In order to be fundamentally prepared for the future, investment in future technologies is needed, including the Motor Control software, which prepares us for ever more demanding tasks and helps us to meet the demand for flexible products. 30 man-years sounds a lot, but is, on the one hand, more than adequate in view of the importance for our future development. On the other hand, the effort would have been many times higher if we had started without the many years of experience in the field of „motors with integrated electronics“.

2| How does the new MCP differ from the previous intelligent solution?

The main difference is in the software architecture. It was designed in such a way that, on the one hand, it can represent the existing and proven functions as efficiently as possible, and on the other hand, it was designed to be highly flexible for future features. To date, different firmware has been programmed for each of the various intelligent motors and has been further developed around a core. For simple extensions, this system is good and sufficient. However, as soon as fundamental extensions have to be carried out, the system is limited and the costs for adjustments are quickly high. Moreover, these extensions must be reprogrammed for each motor series. The new MCP has a modular software concept. It consists of individual software modules, which are linked via defined interfaces. If new features are programmed, they are programmed as modules and simply linked to the other modules. Each module can also be used individually for each drive. Thus, the greatest possible flexibility is provided. During the MCP development, of course, the latest generation of processors was used, which significantly increases system performance. To incorporate the latest findings in software architecture, we have cooperated with universities. In principle, the MCP is comparable to the modular design of motor vehicles. A basic module can be used to develop a wide range of dif-

ferent modules. Using a vehicle base, a VW Golf, but also a Skoda Octavia or a Caddy van can emerge. This is how the MCP can be imagined. A basic module is expanded as desired, thus offering maximum flexibility and future security.

3| Mr. Griesser, what do you think, which future features are still conceivable?

In principle, the motors can process more information and communicate better. For example, not only motor data, but also the data of the overall drive system, i.e., the data of the gearbox, the brakes and the sensors, is processed. In the first step, an operating hours counter is implemented. A complete condition monitoring system is conceivable, in which the motor electronics system precisely detects and assigns load fluctuations, whether these move within certain limits or whether a sign of wear of components is recognisable. As a further step, it is conceivable to record the load profile in the motor in order to determine how strongly and with which load profile the drives are actually operated in the application. This allows conclusions to be drawn as to whether motors are permanently overloaded, for example, are never fully utilised or are very seldom heavily overloaded. In this way we can design drives for customers much better, can choose a smaller motor, or strengthen potential weaknesses. By means of the more effective and faster data processing, features such as cam disk function and synchronous operation of axes will be possible. The communication module allows for more effective communication and, with appropriate hardware, the connection to all common communication interfaces. This prepares us for future communication channels that will be discussed in connection with the fourth industrial revolution. The MCP is also prepared for functional safety. As soon as we see a bigger demand, we are ready to equip MCP motors with functional safety. Particularly considering the requirements of customers with battery applications, we have placed great emphasis on energy saving options. We use components with low energy consumption and control algorithms, which significantly increase the motor efficiency. It is also conceivable to deactivate parts of the motor electronics, if they are not required. Thus, we can also look forward to future normative requirements for energy-efficient motors. The MCP software architecture is basically independent of the processor used. If new processors are launched that are even more powerful, the software does not have to be completely rewritten, but can be transferred to new process types. Not just new features matter when customer requirements are concerned. It is also important how fast these features can be implemented. In this respect, the MCP demonstrates its full strength because its modular design provides for the integration of new modules without rebuilding the entire software.

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4| Mr. Burgert, what happens to the products that are not based on the MCP?

Since we attach great importance to functional compatibility, the transition to the new MCP will most likely not lead to major problems. Until the complete conversion, these products will still be available. Of course, we take care of customers who carry out complex and long-term qualification measures for their applications.

5| Mr. Griesser, in how far are the products fit for industry 4.0?

Industry 4.0 essentially describes the digital networking of all components involved in the value-added process - from the material through the manufacturing facility to the product and the means of transport. The electrical drives are certainly also part of these components. The intelligent drives of Dunkermotoren are basically prepared by the MCP for the changes caused by digital networking. The great advantage of the Motor Control Platform is its flexibility due to the modular design of the software and hardware. This structure allows easy implementation of new fields of technology within short development times.

6| Are you fit for networking? What else do your motors need to learn? What about the sensor technology?

The ability to actively participate in a network is part of the Motor Control Platform. The most widely used Industrial Ethernet interfaces are already supported when using Profinet and EtherCAT. The basis for the implementation of further communication interfaces already exists. All common sensors can be connected to the intelligent drives of Dunkermotoren. These include, for example, temperature sensors, light barriers and position sensors. Numerous sensors are also integrated in the motor. Motor speed, voltages, currents and various temperatures must be read, processed and forwarded by the processor. Sensors, both integrated in the motor and as network components, will become more and more important. They are an important part of the fourth industrial revolution.

7| Mr. Burgert, how does Dunkermotoren with the MCP stand out from their competitors?

Dunkermotoren is clearly a pioneer in the integration of electronics into the motor. With the MCP, we are continuing this strategy and, in addition to the motor with electronics, we convert the overall drive into a single unit. The customer should not have to deal with which currents are overloading the motor, the encoder resolution to be adjusted, or the parameters required to optimise the gearbox. All this is possible only because we develop all the key components ourselves. These are motors, electronics, gearboxes and the software. The engineers in these four disciplines work closely together and can exchange information at any time due to the spacial proximity – all work in the same part of the building. In software development, for example, a programmer has only to take a few steps to find out how different motor algorithms affect the service life of gearboxes. Compared to competitors, we

are also extremely flexible in that we can select, modify and coordinate the individual drive components as required. Moreover, we have more than 20 years of experience with integrated electronics not only knowing exactly which components we can combine ideally, but also have a wealth of experience with a wide range of customer solutions. With the MCP, we have created a cross-disciplinary modular kit that gives us a great advantage.

8| What else affects the automation technology in the next 10 years?

Here I see flexibility in the first place. Our customers need to keep their equipment and machines as flexible as possible in order to meet fast-moving trends on the market. This requires, on the one hand, flexible development components, such as we have implemented with the MCP, but also the products themselves have to become more flexible. The demand for ever more universal drives, which are assigned specific functions only after installation in the machine, is increasing. The industry 4.0 term „Mass Customisation“ will characterise the automation technology. According to the trend towards universal drives, the drives will also need more and more intelligence. The drives will be assigned increasingly complex tasks, which they carry out autonomously. At the same time, the degree of networking continues to grow. Individual components of devices and machines can thus communicate their status to other components, which makes the overall state and processes very transparent. Intelligent components can use the data of other components in networked systems in order to work more effectively, but also execute commands from other components or give commands themselves. Systems thus change from a strongly hierarchical structure to organic structures. It becomes self-evident that devices that are at the very bottom of the field in the classic automation pyramid (sensors, signalling devices, drives, etc.), communicate data with devices of all other levels, for example, control level and command level, thus breaking through those levels. This is why it is of fundamental importance that our drives can communicate in all current bus systems and are also intelligent enough to handle autonomous tasks. In addition to these developments close to the drive technology, we must carefully monitor developments in the consumer goods sector or in other industrial sectors. Some of those developments have made it into drive technology, for example WLAN, Ethernet, near-field communication and cloud solutions. As soon as a trend is apparent, we have to recognise it and assess whether it will be implemented in automation and, in this case, whether we must adapt our products. Some trends that will shape the automation technology in 10 years are not even born today.

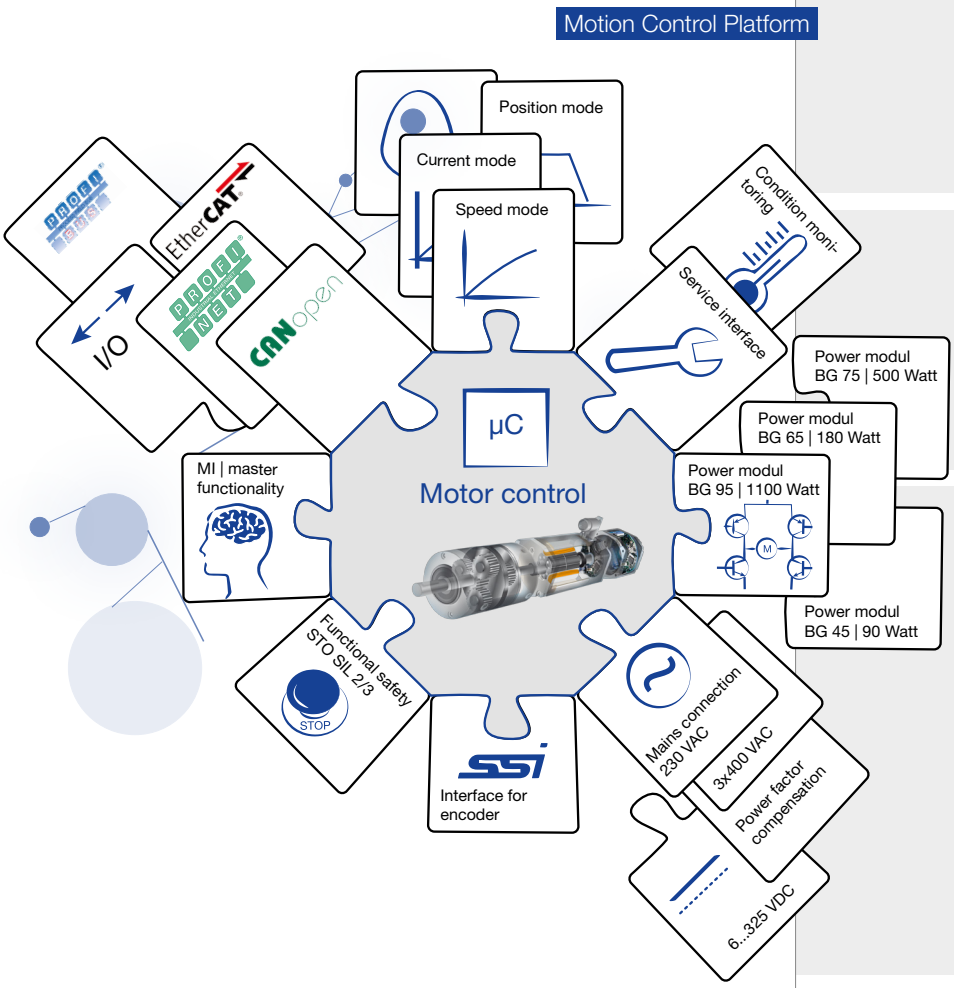
Michael Burgert
Product Manager
Dunkermotoren GmbH

dunkermotoren

The new

MOTOR CONTROL PLATFORM

Franz Kafka once said: „Paths are made by walking". Dunkermotoren also breaks new ground with regard to the control of its brushless servo drives. For the development of the new Motor Control Platform, Dunkermotoren have significantly expanded their software development. An investment that is worthwhile. With the new Motor Control Platform, a modular structure was created that provides the basis for integrated motor controllers for all motor series. The new BG 95 is the first motor based on the Motor Control Platform. Following on with the BG 65 this year and the other motor series later. A distinction is made between the cost-efficient ***dMove*** and the flexible and full-featured ***dPro*** variant. The latter offers the customer, among other things, parametrisable ballast thresholds, robust isolation of the bus connection, optional variants with Safe Torque Off, and all commercially available Industrial Ethernet interfaces



dCore

Brushless DC motors, series BG, with integrated Hall sensors for rotor position detection
» Can be combined with high-resolution encoders, brakes and gearboxes in the modular system
» Compact design

dGo

Brushless DC motors, series BG, with integrated commutation
» Very simple commissioning without parameterisation
» Can be combined with encoders, brakes and gearboxes in the modular system
» Motor speed depends on load and voltage
» Depending on the motor type, the rotational direction can be selected
» Compact design
» In the long term, it will replace the existing KI electronics

dMove

Brushless DC motors, BG series, with integrated control electronics
» Rotational speed, positioning and current control
» Can be combined with encoders, brakes and gearboxes in the modular system
» Control via digital and analogue inputs, parameterisation via Drive Assistant software
» Optional with CANopen and Modbus RS485 interface
» In the long term, it will replace the existing versions SI as well as CI (without high resolution encoders)

dPro

Brushless DC motors, BG series, with integrated control electronics
» Rotational speed, positioning and current control
» integrated high-resolution encoder
» Can be combined with encoders, brakes and gearboxes in the modular system
» Complex driving profiles possible
» Control via bus or I/Os or stand-alone operation
» High IP protection against water ingress or contamination
» Inherent protection against overload
» Modular design with FS, SSI…options
» I/O parameterizable or programmable
» Available with CANopen-, Modbus-, Profibus-, EtherCAT- and Profinet-interfaces
» In the long term, it will replace the existing versions PI as well as CI (without high resolution encoder), MI, PB and EC

Swarm intelligence in the WORLD OF DRIVING SYSTEMS

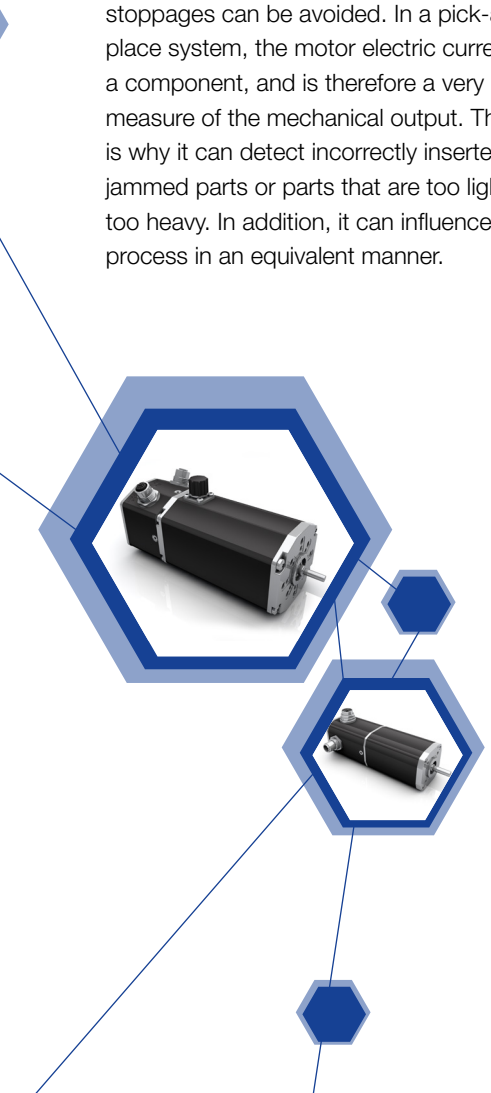
The beehive is a symbol often used as a paradigm for swarm intelligence: maximum productivity, perfect organisation, pinpoint-accurate communication and everyone performing tasks in an independent and autonomous way. Each task is therefore indispensable for the entire organisation. Sounds familiar? Quite possible, because these elements are also essential components for an ideal "industry 4.0" world.

Therein, components communicate with each other, they arrange themselves and provide for maximum flexibility which is accompanied by highest productivity in manufacturing and logistics. As in the beehive, the components monitor themselves as well as their environment. In addition, they compensate for external influences.

But what about the hard-working bees and therefore the components in a modern production line? Are they now ready for autonomous working? As an example, we take a quietly humming electric drive unit with integrated electronics, corresponding to the state of the art, and examine it per the following criteria: "Recognises and compensates environmental impacts," "works autonomously", "communicates" and "monitors itself".

Criteria „recognises and compensates environmental impacts ": Environmental impacts are detected by sensors which then pass these impacts to the motor electronics in the form of electrical signals. Nowadays, it is a breeze for drive units with integrated electronics to read digital or analogue signals and to incorporate them into the process. Position sensors record the actual position and regulate the position if necessary. Inclination sensors detect deflections through wind and thermal expansion effects in solar applications and regulate the position. With the aid of compression sensors, drive electronic systems regulate a constant hydraulic pressure. This environmental information is supplied from the outside to the drive unit. At the same time, there are many more sensors or sources of information which can be found in a modern drive unit: The electric current sensors in the motor measure the electric current of the motor, which is a measure for the mechanical output. If this output is increasing over time, although the load to be moved remains equal, then this could be an indicator for wear and tear of the driven mechanical components. By reading and

interpreting the motor electric current, worn mechanical components can be replaced before the actual failure and production stoppages can be avoided. In a pick-and-place system, the motor electric current is a component, and is therefore a very good measure of the mechanical output. This is why it can detect incorrectly inserted or jammed parts or parts that are too light or too heavy. In addition, it can influence the process in an equivalent manner.

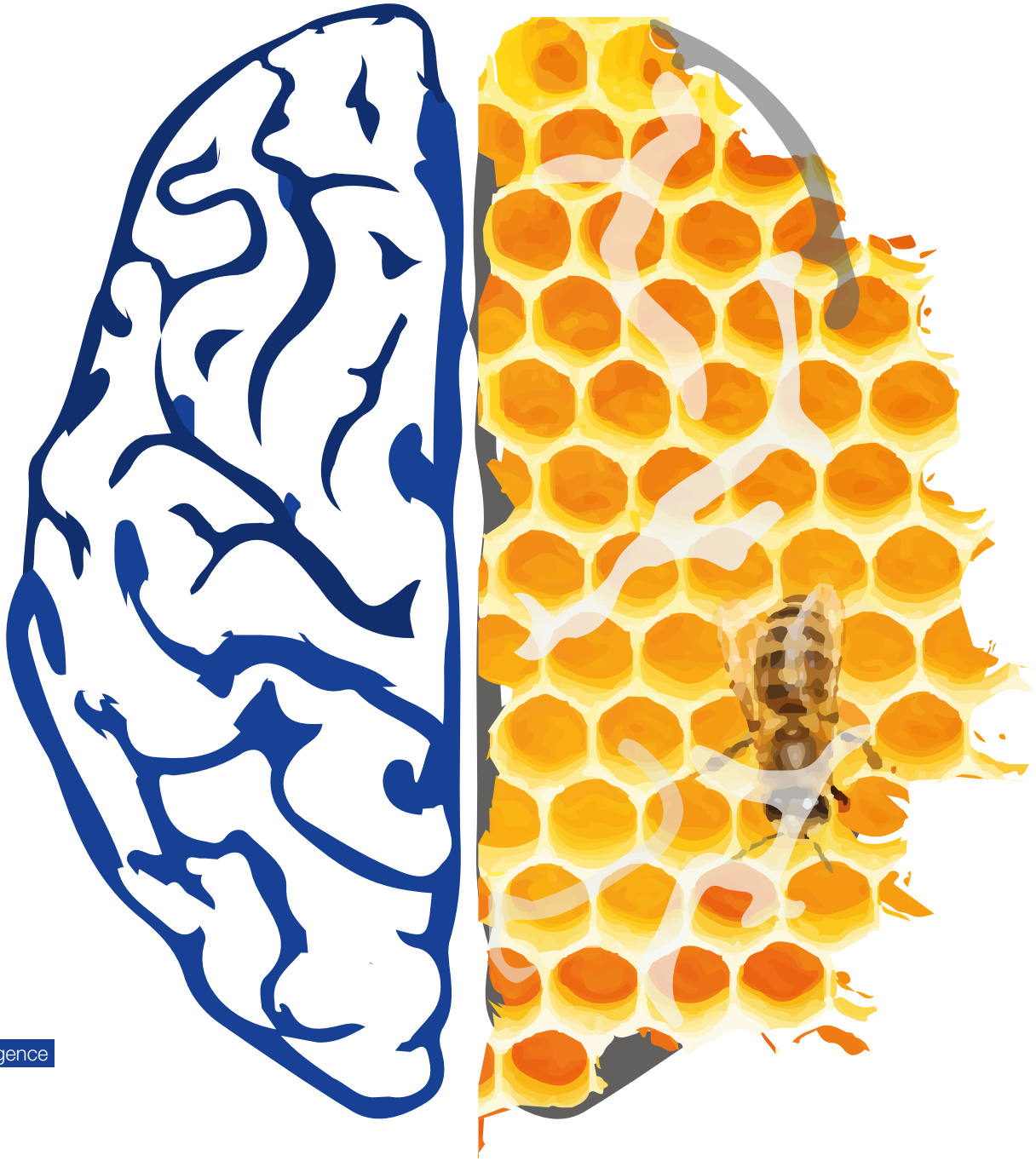


Related to the criteria “recognises and compensates environmental influences”, it is the electric drive unit with integrated electronics which scores well. But what about autonomous work?

Criteria “works autonomously”: Nowadays, motors with an integrated drive unit are already able to control small installations autonomously. In a packaging machine, for instance, a drive unit gives a command to another drive unit. This command could include that the second drive unit should tighten the packing tape with a certain force after the first drive unit detected that the tape has reached the station “tape taut”. The detection is managed in the way that the drive unit detects the position with the aid of the rise of the motor electric current. So, the individual components pass commands to each other depending on which process state was recognised previously. Today this works smoothly in practice. For tasks that are more complex, central controls are still used in general. As processors for integrated drives are becoming more efficient at the same price, more complex tasks can be performed autonomously and it is more and more possible to entirely omit central controls.

Integrated motor units already work autonomously although there is still a huge potential for more complex autonomous tasks. As described, the higher processor performance is a factor. Multiplied by new software algorithms, this factor first harnesses the higher processor performance. According to software, an enormous potential can be exploited in the future. To stay in the jargon of a bee.

Especially the ones who still remember the films from school-days in which bees communicated information for the food source through dancing, know how essential the criterion “communication” is. Without communication drive units on their own are limited to defined tasks. It is the communication with each other what makes movements coordinated, processes flexible and what allows an integrated drive unit to supply information on its environment. In the simplest case, the environment is a central control. In the future, every node of a network needs the information about the state of the drive unit. For instance, the Maintenance Department can obtain the calculated state of the drive unit related to the expected life expectancy, the ERP can determine actual material consumption of



Swarm intelligence

Industry 4.0

the motor data or the Quality Department can derive scrap rates. Totally essential is that the drive unit speaks the language of the other nodes. Currently, this is complicated by an almost Babylonian language confusion in digital communication. At this stage, a variety of different field bus languages are supplemented by an increasing number of Industrial Ethernet versions. Due to integrated “translators”, integrated drive units can already communicate in all common digital languages. However, these translators are inefficient and incur additional costs. A universal digital language, understandable for all network nodes, could therefore save costs and could make networked systems even more efficient.

So, the criterion „communicates“ for integrated drive units can be classified as fulfilled, but there is also potential for improvement as each drive unit must literally „carry“ a dictionary and is constantly looking at it to communicate.

The last criteria which is considered is “monitors itself”. Electronics integrated in the drive unit is exactly tuned to this drive unit. Even after the drive unit has been installed, variations of the drive parameters caused by component and manufacturing tolerances are detected and compensated by the software. Dynamic drive units calculate the expected warming of the motor and build up magnetic fields in advance. The expected warming can be calculated by motor electric current and the angular speed. The magnetic fields are necessary for a specific torque which will be available a few microseconds later. Even slightest deviations from the desired behaviour of the drive unit can be detected and compensated, if possible, by this continuous and high-frequency control of all motor parameters. Speed or position deviations, temperature, voltage fluctuations or overload are recognised immediately by the integrated drive unit. It compensates it within defined limits and generates an error message in the case that compensation is not possible.

During self-monitoring, the integrated drive unit can demonstrate its full strength. Due to the extensive measurement algorithms, the drive unit monitors itself continuously and thus prevents premature failure. The drive unit is able to monitor its environment by reporting unexpectedly high electric currents that indicate there is a wearing component. In addition, the drive unit can read local sensors via its digital and analogue interfaces and pass the data to other nodes on the network.

According to the considered criteria, clear parallels result from a network of integrated drive units and a swarm of bees and therefore, swarm intelligence. Higher processor power will intensify autonomous working in the future significantly and regarding communication, there are promising approaches for a uniform standard. Both improvement potentials make automation systems for manufacturing and logistics more efficient in the future. As in a swarm of bees, whatever more complex tasks can be mastered without the administration of all the information by a central node. Swarm intelligence does therefore not only inspire the honey production but also industrial production!

Locations

THE WUTACH GORGE – a paradise for nature lovers and hiking enthusiasts

The town of Bonndorf, headquarters of Dunkermotoren GmbH, is located in the south of the Black Forest at an altitude of approx. 800 m. With its eight neighborhoods, Bonndorf has about 6.900 inhabitants.

Due to its geological location, the city is one of the popular holiday destinations of the Southern Black Forest. Not far from the Swiss border, the surrounding area offers many possibilities for leisure time. From winter sports on the Feldberg mountain over cycling tours on the 240 km long Black Forest cycle path up to stand-up-paddling on lake Schluchsee, the region offers something for everyone. In each “mo” edition, we will give you a small insight into the region, one site of Dunkermotoren. In our first edition we take you on a discovery tour through the Wutachschlucht gorge. The Wutachschlucht gorge embracing Bonndorf, which is part of the South Black Forest natural park, offers a true experience for nature lovers and hiking enthusiasts. With a depth of 60 to 170 meters, numerous waterfalls, unique valleys and wild rivers and the existing plant and species diversity, the Wutachschlucht gorge is also called the Grand Canyon of Germany. Visitors can only walk through the extraordinary nature reserve, not drive through it. The Wutach river has its source at the east side of the Feldberg mountain and flows into the High Rhine river at Waldshut. During its course, the Wutach river has different names. From the Feldsee lake it runs through the Bärental valley to the heights of the Titisee lake as „Seebach“ rivulet. The „Seebach” rivulet leaves the Titisee lake as „Gutach“ river and is called „Wutach“ river to the east of the town of Neustadt. The names „Wutach“ and „Gutach“ derive from the names „angry Ach“ and „good Ach“. For amateur botanists, the Wutachschlucht gorge is a true paradise. In Southern Germany there are about 2800 species of ferns and flowering plants, about 1000 of which are found in this nature reserve alone. Hart‘s-tongue ferns, childing pinks, honesties (silver ragworts) - to name only a few rarities. With more than 500 species of butterflies, the only occasional mountain Apollo butterfly, about a hundred species of birds, and in its entirety over 10.000 species of vertebrates, articulate animals and molluscs, the Wutachschlucht gorge offers a unique fauna, which also astonishes experienced hikers and nature connoisseurs.

» MAIN HIKING TRAIL **of the Wutachschlucht gorge:**
» Schattenmühle Ⓗ - Bad Boll – Schurhammerhütte – Wutachmühle Ⓗ
Trail: 14 km, approx. 5 hours walking time

» **Circular route – panorama Trail:**
» Schattenmühle Ⓗ - Lotenbachklamm – Tiefental – Boll – Bad Boll – Schattenmühle.
Also suggested trail from/to Boll Ⓗ
Trail: 8 km, approx. 3 hours walking time

» **Starting at Löffingen:**
» **Railway station Löffingen Ⓗ - Unadingen Ⓗ :**
Gauchachschlucht gorge – Burgmühle – Neuenburg – Bachheim Ⓗ
Trail: 7 km, approx. 2,5 hours walking time
» **Route expandable to Reiselfingen Ⓗ**
Trail: 11,5 km, approx. 4 hours walking time
» **Route expandable to Schattenmühle Ⓗ**
Trail: 16,5 km, approx. 6 hours walking time

dunkermotoren

Engineering »

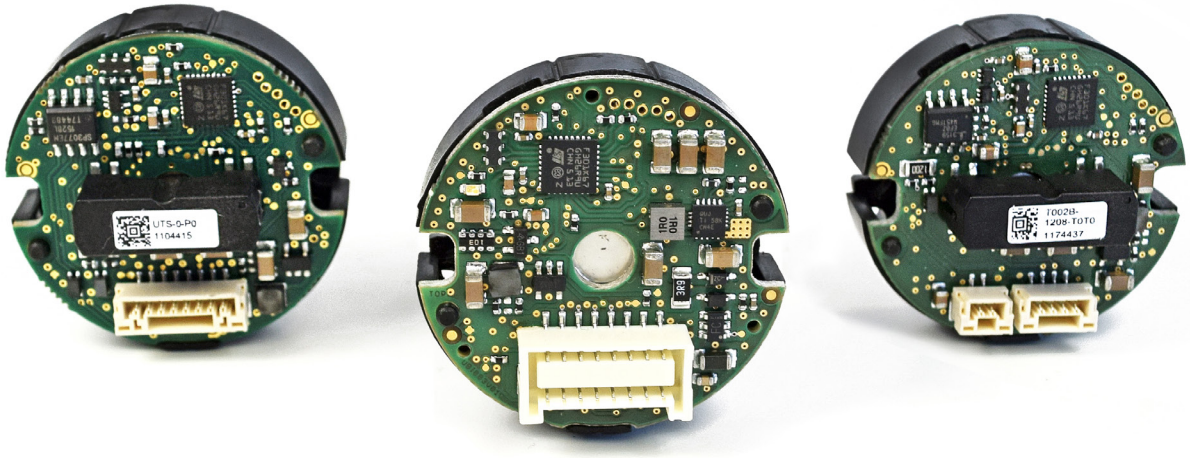
Electromagnetic ROTARY ENCODER **with** NEW TECHNOLOGY

Dr. Bruno Basler | Predevelopment Engineer
Dunkermotoren GmbH

For accurate positioning, it is essential to store the absolute path information during one or more motor revolutions. Integrated electronics versions with optional absolute encoder are offered for the basic motors of the BG family. For this purpose, the rotary encoder supplies signals via a communication interface, which allows absolute positioning without the teaching-in or over-travel of a reference point at any time. Due to the absence of a homing run, it is necessary to assign an absolute position value to each angular position over several revolutions.

The optional AE 38 is an electromagnetic multiturn encoder. The exact position information is retrieved via an internally galvanically isolated transmission interface. The absolute position value is available to the control pcb of the drive immediately after the drive is switched on. The control pcb accepts the master functionality and communicates with the absolute encoder via the Synchronous Serial Interface (SSI). The single-turn resolution of the encoder is 16 bits, the multi-turn resolution is 20 bits with a resolution and accuracy of 16 bits with respect to one mechanical revolution. Due to the additionally protective housing in the mounting part, the rotary encoder is insensitive to external interference fields, in particular caused by magnetic fields of the permanent magnets of the rotor or magnetic brakes. The advantage of the electromagnetic encoder lies in the detection of the position without mechanical connection of the encoder to the shaft of the drive.

Thus, the non-contact position detection does not require any further bearing and no mounted reduction gear for position detection. In addition, manufacturing tolerances can be better compensated by eliminating the mechanical connection between the drive and the encoder. Another crucial advantage is the omission of the battery for storing the position. The Wiegand principle is used to notice the change in position during a rotation in the de-energised



Electromagnetic rotary encoders gather the position without mechanical connection of the encoder to the drive shaft.

state or during a voltage drop. The centrepiece of this technology is a high-quality wire (Wiegand wire) consisting of a hard magnetic shell and a soft magnetic core. The Wiegand effect is due to the sudden reversal of magnetism in the wire. A prerequisite is a rotating magnetic field generated by the rotational movement of the drive shaft. Because of the magnetic field of a diametrically polarised permanent magnet, the soft magnetic core of the copper wire is directed by the magnetic field. The rotational movement of the magnet causes a change in the field intensity up to the polarity reversal of the wire shell. When the field strength is sufficiently large, the magnetic moments of the Weiss regions flip over one after the other and produce a sudden change in the polarisation. Irrespective of the rotational speed of the outer rotating field or of the drive rotational speed, the change in the state by the Barkhausen effect is always equally fast. Thus, a sufficiently large magnetic field can be generated even at a very low rotational speed. If the Wiegand wire is in the middle of a coil, a positive or a negative voltage pulse is induced by this change in state per mechanical revolution. This short voltage pulse is sufficient for the power supply of the electronic counting system. By means of an amplifier circuit and a buffer capacitor, an electronics evaluates the direction of rotation and saves permanently the number of revolutions. This process takes a maximum of 100 µs. Thus, the Wiegand sensor serves not only as a pulse sensor, but also as a source of energy for storing the position in the de-energised state.

Sources:

https://www.posital.com/media/posital_media/documents/Spannungsautarke_Drehgeber.pdf

http://www.k-magazin.de/index.cfm?pid=1651&pk=166775&p=1#.V-p5sY9OJaQ

APPLES AND PEARS:

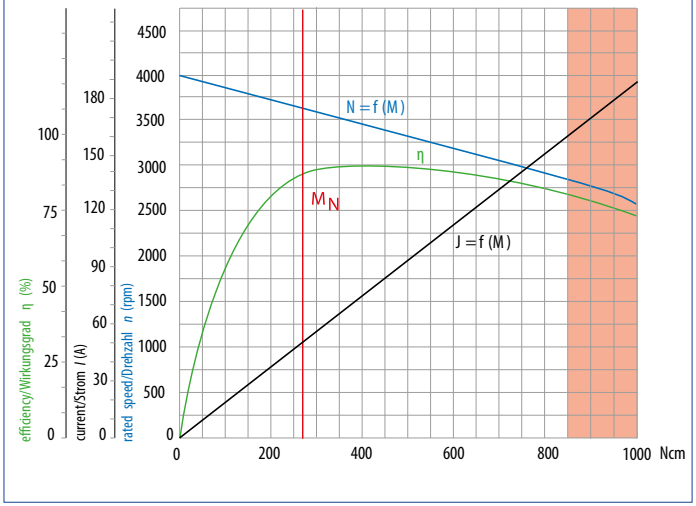
The performance comparison for motors

When specifying a drive the nominal output is normally considered as the best point for any application. At first glace this may give a good indication but is often misleading on closer inspection.
There are several reasons for this:

(1) When comparing different motor concepts, the high overload capacity of DC motors should be considered. In many applications with cyclic operating modes, the continuous output power is not relevant, but the short-term maximum output is. Both, the brushed and the brushless DC motors of Dunkermotoren are able to withstand multiple time the nominal torque. This is a property that does not exist in many other motor designs. The illustrated characteristic curve of the BG 95 ***dPro*** (24 V) with integrated power and control electronics serves as an example. In the continuous operating point, the motor reaches a torque of 2.65 Nm at a speed of 3.711 rpm, corresponding to a power of 1.030 W. In cyclic operation, on the other hand, up to 8 Nm at 3.000 rpm is possible, this corresponds to an output power of 2.515 W.

(2) In the case of DC motors, the winding design, i.e. the number of windings and the wire diameter, is decisive for the motor speed at a given voltage. Thus, it is possible to design the motors for a high speed, with only slightly lower permanent torque. This results in an optimized power density, i.e., a very high output power can be generated from the given installation space. However, high speeds have the disadvantage that these are not suitable for many industrial applications. High gear reduction ratios are necessary, which in turn are noise-intensive and result in a high wear on the part of the mechanical components. Therefore, the motors of Dunkermotoren are always designed for an industrial nominal speed in the range of 3.000 to 4.000 rpm.

If an application allows and requires it, the rotational speed can be easily increased by selecting another winding, for example the use of a GR motor of nominal 12 V at a supply voltage of 24 V. This doubles the idle speed and the entire motor characteristic is shifted accordingly in parallel. This results in a significantly increased continuous output power of the motor.

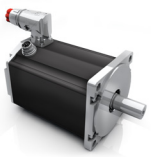


Load characteristic BG 95x80 ***dPro*** | 24 V

(3) The measurement methods for the specification of motors are not uniform and may differ widely from one supplier to another. This makes the comparison of values difficult even for comparable motor concepts and speeds. For example, motors are always measured in thermally insulated state according to EN60034 at Dunkermotoren, whereas in the case of competitors, 105x105 mm heat sink plates are mounted on the motor. This results in a better cooling of the motor, which means that significantly higher continuous output rates can be specified. Many manufacturers do not give any information on their method of measurement.

For a better comparison, motors from competitors were measured at Dunkermotoren and the values were compared with the respective catalogue specifications.

All comparative products show that the measurement methodology of Dunkermotoren is significantly more conservative. The deviations from the catalogue specifications to the measured powers were 35% to 50%. A result of this magnitude that even the engineers of Dunkermotoren did not expect.

PRODUCT		Specific continous output power	Measured continuous output power (thermally insulated)
Dunkermotoren BG 65X25 PI		123 W (0,405 Nm @ 2.900 rpm, 24 V)	123 W (0,405 Nm @ 2.900 rpm, 24 V)
Competitive product		178 W (0,425 Nm @ 4.000 rpm, 24 V)	113 W (0,22 Nm @ 4.900 rpm, 24 V)
Dunkermotoren BG 95x40 *dCore*		700 W (1,69 Nm @ 3.945 rpm, 48 V)	700 W (1,69 Nm @ 3.945 rpm, 48 V)
Competitive product		1160 W (3 Nm @ 3.716 rpm, 35.5 V)	580 W (1,49 Nm @ 3.716 rpm, 35.5 V)

Energy

ENERGY MANAGEMENT **of the future**

With the entry into force of the Energy Services Act on April 15, 2015, German companies are also obliged to improve their energy balance by following the directives of Article 8 of the Energy Efficiency Directive of the EU.

In Germany, all large companies (non-SMEs) are obligated to carry out an energy audit at least according to DIN-EN 16247-1 by December 5, 2015. Alternatively, an energy management system can be introduced by December 31, 2016.

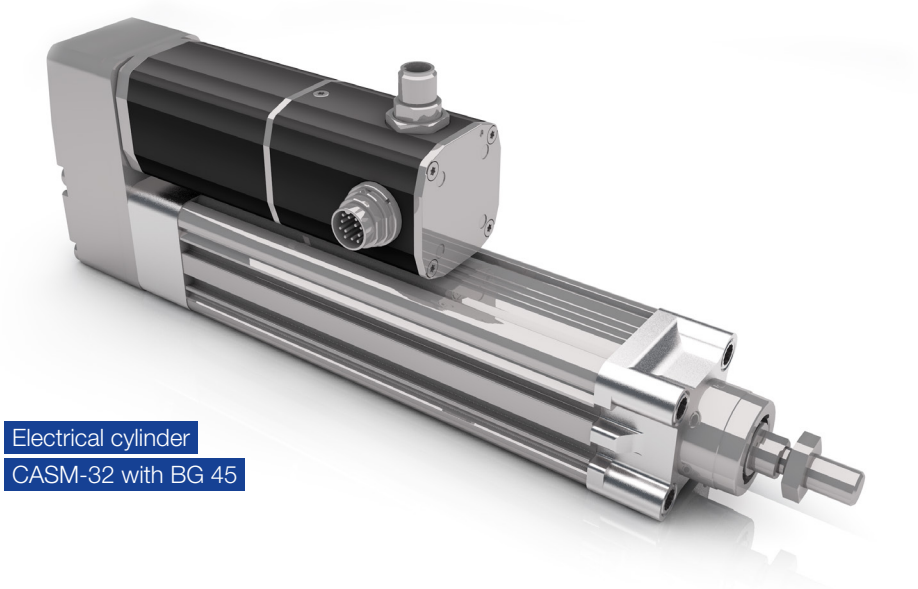
Dunkermotoren is one of the approximately 50.000 companies in Germany, which are affected. Due to the already existing integrated management system (DIN EN ISO 9001 - quality management and 14001 - environmental management), it was immediately clear to the management and responsible persons of Dunkermotoren that this should be extended by the requirements of DIN EN ISO 50001- energy management. The founding of a project team „Environment, Energy and Sustainability“, responsible for the implementation at Dunkermotoren, was necessary. In regular project meetings every 14 days, energy consumption is analysed, energy saving projects are pursued, and awareness for these issues are created in the company. With the common intention of improving the quality, the environmental performance and the efficiency of the energy used, the project team of Dunkermotoren has set strategic and operational goals. The intention is to use the energy that is consumed efficiently and, for example, to reduce losses. In order to set the target specifications, but also to set them in a realistic way, a data analysis and an energy flow measurement were carried out in advance for the largest consumers. This produced some amazing insights. The proportion of compressed air in the entire power consumption is 26%! The proportion of electrical power required for IT and lighting is also remarkable. At 16%, savings potential is also evident. In order to exploit this potential, the lighting in the multi-shift operation areas was changed from T8 to T5 lighting. A changeover of the lighting to LED operation was also tested in the production areas of Dunkermotoren, but the structural conditions as well as the elevated temperature have to be considered. The use of LED technology would not be energy-efficient there because of its low degree of efficiency. In the newly built R&D offices, as well as the new parking lot, an LED lighting system was already installed during the construction phase. In the R&D offices, Dunkermotoren already saves energy compared to the previous lighting. According to the above findings, Dunkermotoren is pursuing the strategic goal of reducing the share of

energy for compressed air and lighting from currently 42% to 35% until 2020. Further actions that are already planned i.e. include the integration of energy efficiency classes that became known for electric household appliances. They should allow the selection of electrical appliances or lighting to take account of their energy certificate, which is thus taken into account when purchasing. Furthermore, the employees of Dunkermotoren are to be informed about the energy certificates of the individual devices, whereby an increase in consciousness on the topic of energy efficiency is to be achieved. For large installations, for example, production facilities and compressors etc., electricity meters have already been installed to analyse the power consumption of the plants. Further cost savings in the area of the production plants result from the reduction of compressed air from 8 to 6 bar. The target is a reduction to 4 bar for special machines, which also allow this in certain parts of the production areas. On weekends, the existing compressed air network is already reduced to 4 bar. The start-up behaviour at the compressed air station was investigated in order to smooth the power peaks at the energy suppliers. When starting at the same time, all compressed air stations require 500 kW of electricity. This peak was smoothed by a start-up of the stations in 30 second intervals, resulting in an elimination of the current peak. However, the successive replacement of the pneumatic cylinders by electric drive axies will provide considerable savings. By implementing these projects, the system was successfully certified by DQS in May 2016. In order to permanently monitor the success of energy management, internal energy audits are regularly carried out. With the certification according to DIN EN ISO 50001, it is necessary to establish key figures for the success review. The type of the key figure is not specified by the standard. Thus, the company is free to determine the ratio of the successes of the energy management system. Dunkermotoren has decided to use the ratio of kilowatt hours required per one thousand Euro turnover.

FORMULA:
Performance measurement
of the energy management system

$$\frac{\textbf{(1 kWh)}}{\textbf{(1k € Turnover)}}$$

This decision was made on the basis of the dependence of energy consumption on turnover.



Electrical cylinder
CASM-32 with BG 45

dunkermotoren

Increased production requires more energy consumption in the company.

Reasons for this are:

» 3-shift operation and/or additional working days on Saturdays:
- Longer machine running times
- Energy consumption by lightning, heating, cooling etc.

» Less machine downtimes
» Production expansion
» Introduction of new products
» Additional production machines

In order to ensure that future energy consumption and CO_2 emissions are also taken into account when purchasing new machines, a technical and commercial assessment of the savings potential is made as a basis for decision making. If the energy certificate of the new plant offered does not comply with the established guidelines, it is imperative that a second or even third offer is required for the acquisition.

In addition, a further major step has been completed, working towards achieving the targets for Dunkermotoren from the point of view of safety, efficiency and environmental protection by replacing the transformer stations in 2017. In collaboration with many other large companies, the company can make a significant contribution to environmental protection. Every employee at Dunkermotoren helps with his commitment and the conscious handling of resources, to improve the company's energy balance and thus also to contribute to environmental protection. So, „even small stones can make big circles," as a song by Udo Jürgens tells us.

» Advantages of using MAINTENANCE-FREE, ELECTROMECHANICAL LINEAR SYSTEMS

Today we are seeing a major shift from pneumatic linear actuators to electromechanical systems. This is because of high maintenance requirements of pneumatic and hydraulic systems which results in long machine downtimes and lost productivity.

Most certainly the initial cost of ownership for pneumatic linear components are lower than electrical alternatives, however in most cases the user bears the higher operating and maintenance costs. The quick and easy retooling of production plants is becoming more and more important. By pressing a button, production plants are retooled for new end-products and new products are produced within a short period. With the use of intelligent drive technology in combination with linear componentes, this retooling becomes significantly easier. Commissioning of electromechanical systems is done in a much shorter time. Moreover, it is possible to read helpful measured data from the electrical linear units within milliseconds. This increases the process reliability of the plant, and ultimately the quality of the final product.

We have recognized this market trend, and have had an increasing number of inquiries to expand our product portfolio to meet the increasing demand of electromechanical linear systems. With the affiliation to Ametek Inc., Dunkermotoren has been able to procure efficient and maintenance-free lead screws and customise them to fit our rotary drives.

Dunkermotoren currently offers three different linear series. Depending on the application requirements, one of the following linear system could be selected.

» Direct drive linear motors – series ST
» Spindle motors – series LSM & LSG
» Electric actuators – series CASM

Linear systems are operated between 10 to 50 VDC and could be effortlessly integrated into conventional manufacturing plants. The products are optionally available with integrated controllers. Flexibility of the linear systems from brushed DC motors with lead screw to direct drive linear motors in combination with servo controllers, Dunkermotoren could offer the perfect drive solution for every linear movement.

The Servotube series ST is mainly used in industrial machinery, laboratory and life sciences equipment. Compared to classical linear systems such as lead screws, rack and pinion or belts, the ST series is considerably quieter due to its free moving contactless rod. Servotubes are rated to perform 50.000 km of travel which is very unique in its kind. Thereby, the Servotubes are far superior in performance and accuracy compared to the classical pneumatic cylinders. Furthermore, in rough environmental conditions for fast and precise positioning, the linear motor is an ideal choice. With Speeds up to 10 m/s, accelerations up to 600 m/s², peak forces up to 1860 N and protection classes up to IP 67, Servotubes cover a wide range of requirements in linear applications.

Matthias Utz | Product Manager
Dunkermotoren GmbH

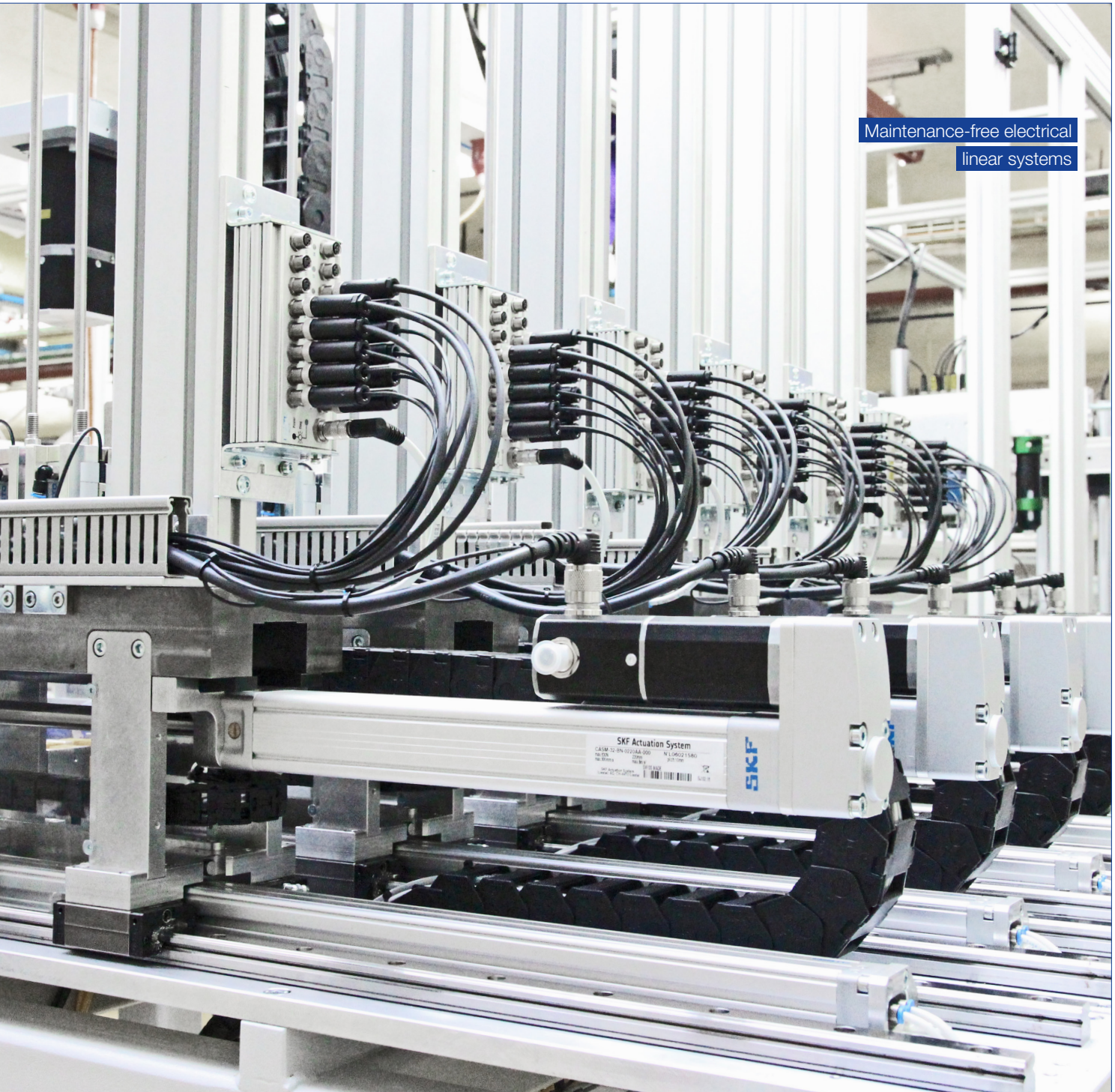
Servotubes could be supplied in three different variations:

» Actutators - moving rod with high performance polymer bearings. Suitable for pneumatic cylinders

» Components - motor housing without internal mounting and single magnet bar. With using the components, the customer constructs a linear module, where the motor housing is moving.

» Modules – Rodless linear actuator with up to 2 m of stroke. With cable, drag chain, end switch and bellows. This alows an easy and quick integration into the machinery

“Servotube motors convince with maximum dynamic and precision with high maintenance-free running performance“ Sridhar Balasubramanian, development linear motors



Maintenance-free electrical
linear systems

To complete the ST portfolio, Dunkermotoren offers these units with servo controller and various bus interfaces.

For format adjustments and lifting applications up to 680 N of thrust, the series LSM or LSG can be utilised. The spindle motors could speed up to 300 mm/s. This series is ideal for fast linear movements. A gearbox could be used in addition to the motor to increase the thrust. The coated stainless steel spindles with lead nuts is offered to be used in rough environmental conditions, e.g. using chemical detergents. Low backlash spindle-nut is offered for application with precise positioning requirements. LSM and LSG have a standard strokes up to 150 mm, however special length and nut versions can be produced on request. In combination with the intelligent brushless DC servo motors and integrated bus interface, spindles could be used in various bus networks.

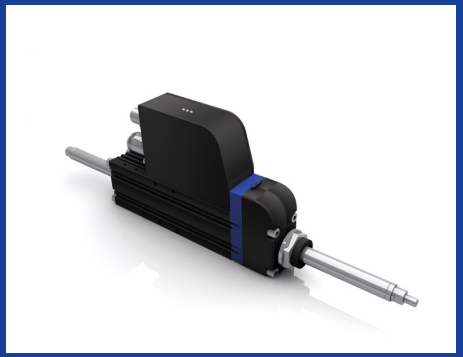
Compared to the LSM and LSG series, the CASM series is designed for forces >1kN and continuous operation. The electric cylinders are available in the frame sizes 32, 40 and 63 in combination with a DC servo motor. Motors could be mounted in-line or parallel to the actuator. The dimensions of the flange and the bar of the cylinders comply with ISO 15552. Many mounting accessories e. g. rod ends or similar accessories are available. Due to high efficiency of the motor and actuator, an electric cylinder of the frame size 40 can substitute a bigger pneumatic cylinder of the frame size 63.

Using the standard commissioning software allows parameters such as position, speed and acceleration to be defined for the actuator within minutes. The control of the individual positions is done with digital signals, e. g. 24 V output of a PLC. Installation of these actuators is done by connecting one or maximum two cables which is significantly easier than a pneumatic cylinder. For commissioning of pneumatic cylinder valves, end switches, chokings, air pipes etc. are needed.

With the introduction of the certified energy management systems in accordance with DIN EN ISO 50001, the awareness on inefficient systems in companies is informed. Reports suggest that there's an over 20% leakage in pneumatic systems which directly effects energy consumption. Considering the net energy cost the total cost of ownership of pneumatic systems is much higher than electromechanical alternatives.

It is a fact that the acquisition costs of a maintenance-free, electromechanical linear system are higher than pneumatic-driven linear system. But finally, the additional costs of the acquisition are compensated with lower operating costs within a short period. With its contribution to the environment and climate protection the electromechanical linear system convinces with another advantages.

Dunkermotoren GmbH with its headquarter in Bonndorf in the Black Forest, develops and produces high-quality linear and rotary drive solutions. With production and logistic sites in Germany, Serbia, China and the USA, Dunkermotoren's global footprint is able to offer you a worldwide operating partner for electric motion control solutions.



SCA 11 with integrated programmable servo controller

Products

Painted motor unit achieves
INCREASED CORROSION PROTECTION

Dunkermotoren motors are often used in harsh ambient temperatures with corresponding requirements for corrosion protection. These requirements can be met by special painting. Initial positive experiences have been achieved for a customer from the food industry. It is a BG 45x30 SI and a worm gear drive SG 62. This combination has successfully passed the salt spray test according to DIN EN ISO 9227. By using the two-component polyurethane (2C-PUR) varnish, the corrosion protection class C5i can be achieved, which belongs to the toughest of the atmospheric environmental conditions. In addition, it has a resistance to acid, lye and other cleaning agents. The varnish is available in various shades and different layer thickness.

Painted motor unit for increased corrosion protection

Seconds out for:

BRUSHED GR **V.S.** BRUSHLESS BG

ROUND 1: Brushless DC motors will replace brushed DC motors in the future.

Pro DC (GR series)

It is gratifying that Dunkermotoren is part of the growing market for BLDC and the sales share of the BLDC increases compared to the DC. When I started as a young developer at Dunkermotoren in 1992, the tenor was „BLDC is the future“. Since then, the DC sector has enjoyed an average annual growth of 5%. The actual trend is not that BLDC is replacing DC, but to develop products that are enduring, i.e., to conserve resources and ensure that the machine or device is fully operational over the planned lifetime. Qualitatively inferior DC motors have no future in the market addressed by Dunker, but our GR series, however, does have it. What falls victim to the BLDC world, the GR gains by growing markets and by changing customers. To put forward another current buzzword: „Frugal Engineering“ will boost growth for the GR world. Systems prevail in distant locations, when they are simple and reliable.

We can also observe how, in some sectors, after a „brushless hype“, there is once again a focus on the essentials, relying on proven cost-effective systems, based on DC motors. The prognosis „BLDC replaces DC“ I see in any case not confirmed. The market for brushed DC motors will also continue to grow.

Pro BLDC (BG series)

I agree with that. Since there are electric motors, the production of magnetic rotating fields, which make a motor run at all, is the central challenge in motor technology. For brushed motors, it is generated by means of mechanical sliding contacts and in the brushless motor by means of semiconductor switching transistors. At times when semiconductors were still very expensive, BLDC motors were used only for special applications or for extremely high demands on the service life. Compared to the mature mechanical sliding contacts, the semiconductor switches were still in their infancy.

The subsequent rapid development of semiconductor technology, both in terms of performance and price, stimulated the development of brushless motors and their development has not yet come to an end. In the meantime, there are complete semiconductor devices which fully automatically not only make the brushless motor rotate, but also keep its speed constant and continuously monitor the motor for overload. Since there will be more efficient and cheaper semiconductors, it is only a matter of time until the costs between brushless and brushed DC motors approach the same values so that there will be no longer any basis to use mechanically commutated DC motors.

ROUND 2: The service life is the central argument for BLDC motors.

Pro DC (GR series)

Whoever can calculate quickly, comes to the fact that the brushless DC motors of Dunkermotoren last longer than an automobile life without any maintenance. Therefore, if you differentiate between „industrial“ GR motors and low-cost products, you will see that the lifetime of a GR motor is sufficient for most applications.

Pro BLDC (BG series)

The service life is not the central argument for BLDC motors. The main arguments are the much better controllability, no brush sparking and therefore easier interference suppression, the high power density, better heat dissipation, the extremely high dynamics and easy to implement protective functions.

ROUND 3: The uncomplicated commissioning clearly stands out for brushed DC motors.

Pro DC (GR series)

It depends. In the simplest case, you only connect the two leads with the voltage supply and the motor starts. For applications with high control requirements, DC motors can also be used in combination with complex controllers, which means that commissioning is no less complex than with the BLDC motors.

Pro BLDC (BG series)

Today‘s brushless DC motors usually have an integrated electronics that makes commissioning as easy as using brushed motors – „plug and play“. With this commissioning, motor protection functions, speed control and parametrisability are also available without further external controls.

ROUND 4: Brushed motors are more sustainable.

Pro DC (GR series)

Even the fact that a GR motor is more economical to manufacture with reference to the torque suggests a better sustainability. Low-cost components made from standard materials, coupled with highly energy-efficient, automated production lines make it unbeatable. In the case of GR engines, the controversial rare earth metals are also dispensed with.

Pro BLDC (BG series)

Despite the perfected brush technology, GR motors have to be replaced after a certain lifetime. This is often done in a preventative way to avoid failures. Therefore, I regard the maintenance-free BG motors as significantly more sustainable. In terms of sustainability and if a long service life is not required, BG motors still gain acceptance through their high efficiency and lower material consumption due to the high power density.

INTERVIEW

with our product manager, Stefan Tröndle

The BGA 22x22 *dCore* ironless DC motor of Dunkermotoren is now available with suitable gearboxes, encoders and controllers. In this regard, „mo“ spoke with the responsible product manager Stefan Tröndle.

Stefan Tröndle
Product Manager | Dunkermotoren GmbH

Mr. Tröndle: What are the main advantages of the new integrated *dGo* electronics?

The new integrated ***dGo*** electronics reduces the wiring effort and thus increases the process reliability of the drive unit. Furthermore, the actual control of the machine or the device is thereby kept small and the installation of additional electronics is eliminated. The additional overall length can usually be accommodated in the application since the outer diameter of the motor is usually decisive.

What makes the series different from the conceptual design of products of the same size from other manufacturers?

Already in its basic design, the BGA 22 provides torques that are achieved by other suppliers only with improved variants at appropriate prices. Sensationally low are the running noises of the motor in a wide speed range. We are the only manufacturer to offer the ***dGo*** electronics in a bipolar 2-wire version that allows a similar operation to that of a brushed motor.

dunkermotoren

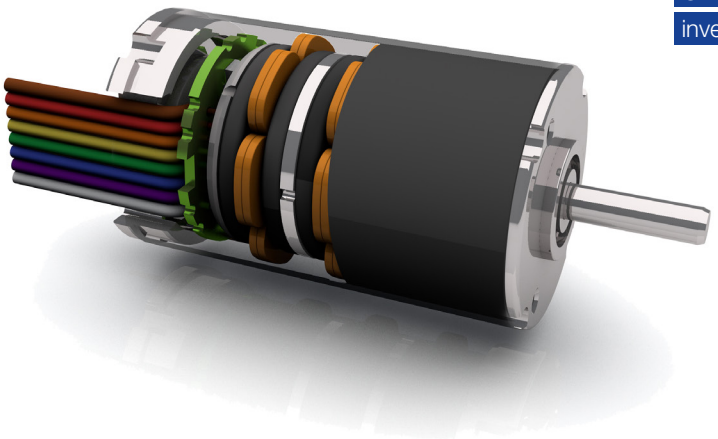
Do you see specific applications for medical device manufacturers?

The BGA 22 is not yet autoclavable, so the applications are outside the range in which the motor comes into direct contact with human body parts. The BGA 22 is used in adjustments, hand tools, for screwing, vitalisation in the rehab sector, pumps, diaphragms and imaging. In the field of laboratory technology, there are possible applications in dispensers, gantries, centrifuges and generally automation as well as robotics. Experience shows that the number of applications is diverse based on the creativity of our customers.

For the technicians among our readers: With which key data and performance data is the drive unit available?

The range of the operating voltage ranges from 6 to 24 V with nominal speeds of 3.000 - 16.000 rpm and a permanent torque of the motor of up to 2.2 Ncm. When the heat dissipation is adequate, the torque can also be much higher, up to the starting torque of 17 Ncm. In combination with the offered planetary gears, torque and speed can be optimally adapted to the application.

Oliver Niendorf-Kramer
inventor BGA motor



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Christiane Willems
Creative & Design Consultant |
Dunkermotoren GmbH
Cristina Hirschbeck
Trainee | Dunkermotoren GmbH

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Dunkermotoren GmbH
Allmendstraße 11 | 79848 Bonndorf/ Schwarzwald, Germany
t: +49 (0) 7703 930 - 0 | info@dunkermotoren.de | www.dunkermotoren.com