“mo

COVER STORY:

FUTURE NOW!

SMART, CONNECTED AND EFFICIENT

MAGAZINE OF **MOTOR TECHNOLOGY**

INDUSTRIAL INTERNET OF THINGS

CONTENT

CONTENT

TRADE FAIRS

TRADE FAIR PARTICIPATION 2021

INTEC
Leipzig, Germany ..... 03/02 – 03/05/2021

SMART INDUSTRIES
Lyon, France ..... 03/16 – 03/19/2021

HMI
Hanover, Germany ..... 04/12 – 04/16/2021

SMART AUTOMATION
Linz, Austria ..... 05/18 – 05/20/2021

SPS SMART PRODUCTION SOLUTIONS
Parma, Italy ..... 05/25 – 05/28/2021

LOGIMAT
Stuttgart, Germany ..... 06/22 – 06/24/2021

MD&M WEST
Anaheim, USA ..... 08/10 – 08/12/2021

MOTEK
Stuttgart, Germany ..... 10/05 – 10/08/2021

COMPAMED
Dusseldorf, Germany ..... 11/15 – 11/18/2021

AGRITECHNICA
Hanover, Germany ..... 11/14 – 11/20/2021

SPS SMART PRODUCTION SOLUTIONS
Nuremberg, Germany ..... 11/23 – 11/25/2021

VIRTUAL BOOTH
https://www.dunkermotoren.com/en/company/trade-fairs/ ..... anytime


dunkermotoren
MAE
AMETEK
ADVANCED MOTION SOLUTIONS
» FUTURE NOW!
DC Voltage
EtherCAT
Distributed Clocks
CANopen
MindSphere | World
Exit

EDITORIAL

DEAR READERS,

After intensive years of dynamic growth, especially in 2017 and 2018, and a challenging year in 2019, the year 2020 requires a lot of patience and perseverance from us. Due to the global crisis caused by COVID-19, 2020 will not be an easy year for us either. Uncertainty about how things will continue, how long the crisis will go on or even the fear of falling ill itself determined the year 2020. In small steps we return to normal. But every crisis also brings its positive sides. We spent a lot of time with our family during the quarantine phase. Values such as solidarity, cohesion and community have regained a higher status.

A crisis decelerates. In times of crisis, we have increasingly focused on future-oriented technologies in order to be well prepared for the time after COVID-19.

In our fourth issue of "mo you can look forward to many different topics concerning "Future now! Smart, connected and efficient". Our team will take you on our journey towards IIoT and show you what role our drieves play in the digital age. Starting with intelligent features and decentralized solutions to communication between motor, edge and cloud - we are your partner in the field of smart drives.

After we introduced in our market segment Agriculture in issue 3 of our “mo, this issue deals with the segment Healthcare and Laboratory. The comic shows where our drive solutions come into action. Thanks to its dynamic and precision, our linear motors are the perfect solution for the diagnostic market.

The product highlights in this issue also include new hub and angle gearboxes. Combined with new electronics and encoders with safety functions, we can offer you an even wider range of complete drives for AGVs and AGCs.

2020 - also an anniversary year for us and thus a reason to celebrate. 70 years of Dunkermotoren give us reason to look back. Excerpts from our anniversary brochure give an insight into what has happened in 70 years of Dunkermotoren.

You can look forward to these and many other interesting topics relating to drive technology.

We hope you will enjoy reading it.

Yours Uwe Lorenz
Managing Director Dunkermotoren GmbH

NEWS

DUNKERMOTOREN BECOMES PART OF THE OPEN INDUSTRY 4.0 ALLIANCE

The digitalization of factories and plants as well as the Internet of Things promise ever new possibilities for the automation industry. In this development, a wide variety of technologies from the field level to the cloud and also across different stages of the value chain must be combined across manufacturers to create tangible added value for our customers. The sprior task within such an ecosystem is a consistent communication, and no time-consuming integration.

Dunkermotoren has accepted this challenge. At the same time, the world market leader for integrated servo motors is aware about the necessity of a strong cooperation - an ecosystem consisting of component manufacturers, software companies, machine builders and integrators - to be able to match the challenge. With the "Open Industry 4.0 Alliance" and "MindSphere World e.V." Dunkermotoren joined two partner ecosystems already in 2019. The objective of the "Open Industry 4.0 Alliance" is to build an interoperable and manufacturer-independent ecosystem that delivers functioning industry 4.0 solutions based on existing standards.

Through strong partners from the fields of automation technology, system integration, mechanical engineering and software, interoperable IoT solutions based on the IoT operating system MindSphere can be offered, which would not have been feasible by any company.

OPEN INDUSTRY 4.0 ALLIANCE

ABOUT THE OPEN INDUSTRY 4.0 ALLIANCE:

The Open Industry 4.0 Alliance acts as a partnership of leading industrial companies that pragmatically participate in the implementation of cross-vendor industry 4.0 solutions and services for manufacturing facilities and automated warehouses. The alliance was launched in April 2019. Since then, the alliance has grown to more than 40 members with different industrial core competencies and has made further technical advances over the last few months. The founding members include Beckhoff, Endress+Hauser, Hilscher, ifm, KUKA, MULTIVAC, SAP and Voith. The constantly expanding membership includes Balluff, SICK, Pepperl+Fuchs, Gebhardt and Software AG.

MindSphere | World

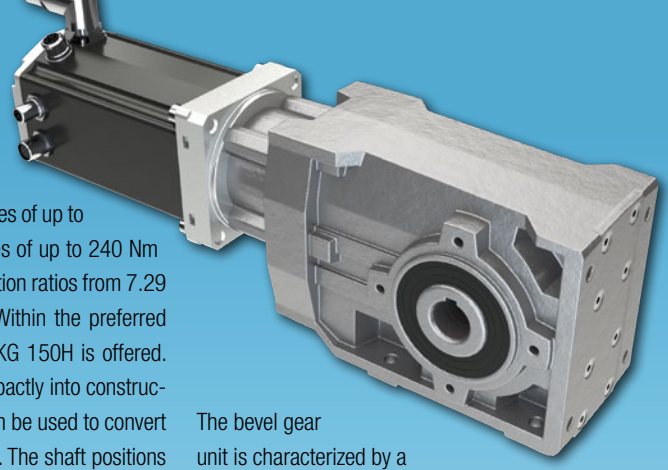
ABOUT MINDSPHERE WORLD:

In cooperation with 18 partner companies, Siemens AG founded the "MindSphere World e.V." association in January 2018 as a user organization for the cloud-based, open IoT MindSphere operating system. In the meantime, the association has grown to a total of 74 members. The objective is a worldwide expansion of the ecosystem around MindSphere. In addition, the associations task is to support the individual members in developing and optimizing IoT solutions on MindSphere and opening up new markets in the digital economy. This includes proposals on requirements for the MindSphere IoT operating system and recommendations on creating uniform rules for data usage. The association also promotes science, research and teaching around MindSphere.

NEWS

WITH THE KG 150, DUNKERMOTOREN OFFERS THE RIGHT-ANGLE GEARBOX TO BG 95

The 2-stage bevel gear unit KG 150 reliably transmits the torques of the brushless DC motors BG 95x40 and BG 95x80. Continuous torques of up to 120 Nm and acceleration torques of up to 240 Nm are available. The possible reduction ratios from 7.29 to 77.36 are finely graduated. Within the preferred series, the hollow shaft design KG 150H is offered. This can be integrated very compactly into constructions. As an option, a shaft kit can be used to convert to the solid shaft variant KG 150. The shaft positions outlet left (WL1) and outlet right (WL2) are possible.



The bevel gear unit is characterized by a slim design and a small axial offset.

MAIN CATALOGUE

ORDER OUR MAIN CATALOGUE EASILY AND CONVENIENTLY NOW.

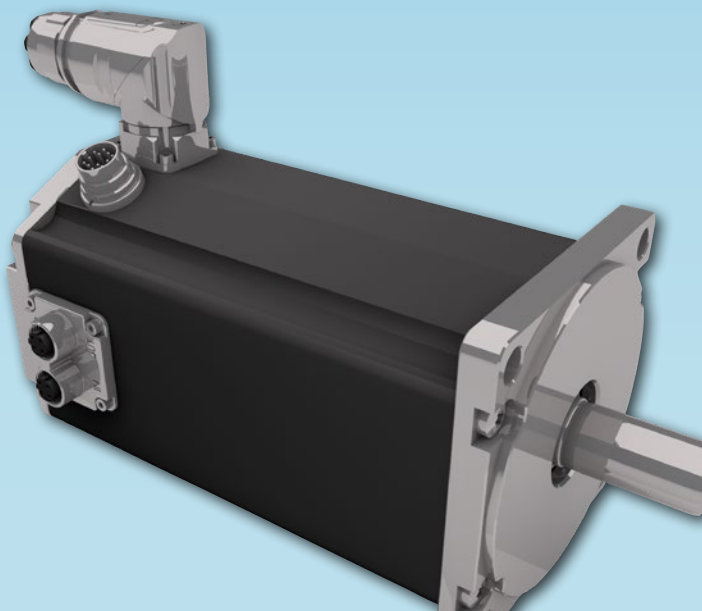
Either send a short mail with your contact details and the desired quantity to:
sales.dunkermotoren@ametek.com
or fill in the order form at:
https://www.dunkermotoren.com/en/contact/order-main-catalogue.html
and we will deliver our catalogue to your desired location free of charge.

NEWS

DUNKERMOTOREN PRESENTS IIOT DEMONSTRATOR

The Internet of Things offers ever new possibilities to monitor machines and equipment from any location. Especially in the current times with limited travel possibilities, this way of monitoring becomes more and more important. Possible anomalies can be diagnosed directly from your current location and the best possible support can be realized with a fraction of previous travel expenses. Dunkermotoren's IIoT team has taken the use case and built a demonstrator presenting how intelligent servo motors can be diagnosed quickly and easily via the cloud. For that purpose, a BG 95 dPro PN was connected to an EDGE gateway via PROFINET. Modular software applications developed by Dunkermotoren run on the gateway. One container records the general device information on the electronic type plate, while a second records live motor data such as current voltage, speed or temperature. In addition to the components for connection and information provision on the EDGE, the demonstrator also contains components for cloud connection. In the first step, cloud connectors to Microsoft Azure and Software AG's Cumulocity were implemented here. To complete the use case, dashboards for the motors were created on these two platforms, which provide an immediate overview of the motor's status. The type of motor, the current status and the current live data are displayed. Dunkermotoren takes a variable approach depending on the needs of its customers. In addition to the ready-to-use dashboards as used in the demonstrator, Dunkermotoren plans to provide evaluated information about the motor conditions within the individual customer application. As a result, customers do not need to build up know-how in the area of motor condition evaluation and analysis. Dunkermotoren sets the objective to provide its customers the best possible support for their IIoT implementations.

The modular concept on the EDGE makes it easy to put together the required components and adapt it individually to any application. The implementation corresponds to the guidelines of the "Open Industry 4.0 Alliance", which Dunkermotoren joined in 2019. The world market leader for integrated servo motors clearly follows the philosophy of an open and interoperable approach using existing standards.



NEWS

DUNKERMOTOREN AND MAE GROW TOGETHER

Since the beginning of 2020, Dunkermotoren and its Italian sister company MAE have been co-operating even more closely. Both companies are part of the American technology group AMETEK and have already cooperated in the past years, for example in trade show participations. For our customers, this cooperation results in a significant expansion of the existing product portfolio. Newly available products include stepper motors, universal motors and brushless blowers.

For further information, your usual contact person in our sales department will be pleased to assist you.

The catalog can also be downloaded at: https://www.ametekmae.com/downloads/catalogues

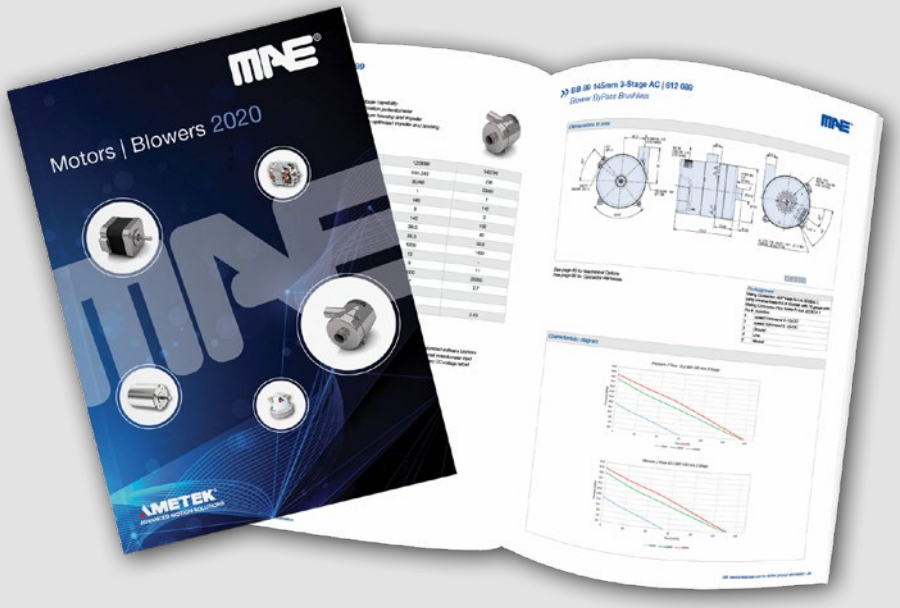
NEW IN THE PORTFOLIO:
Stepper Motors, Universal AC Motors, Universal Blowers, Brushless Blowers

EMPLOYEES:
MAE & Dunkermotoren occupy approximately 1.800 employees worldwide

JOINT SALES 2019:
300 Millionen €

PLANTS:
Serbia, China, Italy, Czech Republic, Brazil, Germany

MANAGING DIRECTOR OF BOTH COMPANIES:
Uwe Lorenz

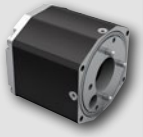


ENCODERS

Incremental Encoder
Up to 4096 ppr

Magnetic Pulse Generators
4 ppr

Absolute Encoder
Up to 4096 ppr



BRAKES

Power-off Brakes
0.2 - 7 Nm

Power-on Brakes
0.2 - 3 Nm

CONTROLLERS

Integrated Controller

External Controller

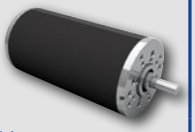
dGo/ dMove/ dPro

PROFINET EtherCAT CANopen

MOTORS

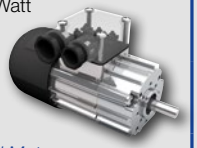
Brushless DC-Servomotors
6 - 3900 Watt

Permanent Magnet DC-Motors
3 - 370 Watt



Stepper Motors
8 - 14 Nm

AC-Motors
5 - 100 Watt



Universal Motors
150 - 1200 Watt

AC/DC Blowers
Thru-Flow, Bypass

Linear Motors
19 - 3690 N

GEARBOXES

Planetary Gearboxes
0.3 - 160 Nm

Worm Gearboxes
0.75 - 30 Nm

Spirotec Gearboxes
9 - 18 Nm

Bevel Gearboxes
1.6 - 120 Nm

Spindels and Cylinders
450 - 2500 N

NEWS

A DREAM START FOR PROJECTS IN MECHANICAL ENGINEERING

Which developer does not dream of quick test samples to gain first experiences with the drive unit? The newly developed starter set of our new Motor Control Platform fulfills exactly these wishes of the mechanical engineers. The customer can choose between different power packages from 20 W to 270 W.

The drive package includes a 4Q servo controller (BGE 5510 dPro) with a brushless DC motor of the BG series and an attached encoder system. A suitable single-stage or two-stage planetary gearbox can be configured, if desired. In addition, the set includes suitable connection cables and a programming adapter.

As soon as you have connected the motor with the control electronics configured at the factory, install the free commissioning tool Drive Assistant 5 and commission the unit without any major effort.

Use the unique opportunity to order up to three complete drive units at a special price. Our online configurator on our website will help you defining a suitable motor combination. If you are not sure about the selection, our sales department will be pleased to advise you.

FIRST EXTERNAL CONTROL ELECTRONICS ON A NEW PLATFORM

With the launch of the BGE 5510 dPro electronics, Dunkermotoren put forward with the roll-out of its new Motor Control Platform. In addition to the successful brushless motors with integrated electronics, these are also available as compact control cabinet versions. With this version, you can control brushed and brushless motors from the Dunkermotoren portfolio up to a continuous output power of ~250 W and a peak output power of 750 W. In addition to the drive, incremental encoders and a brake can also be connected. From 2021, the entire control electronics series is available optionally with SafeTorqueOff (STO).

In contrast to the previous external control electronics, the use of an encoder switches the motor from block to vector commutation, which further increases performance. Besides to the traditional CANopen bus interface, Industrial Ethernet-based interfaces such as PROFINET and EtherCAT are also available now. With the PROFIdrive profile (PROFINET) and Distributed Clocks (EtherCAT), the BGE 5510 dPro is real-time capable and can be used for many synchronous servo applications. The individual controller interfaces can be connected simply and cost-effectively via commercially available RJ45 network cables.

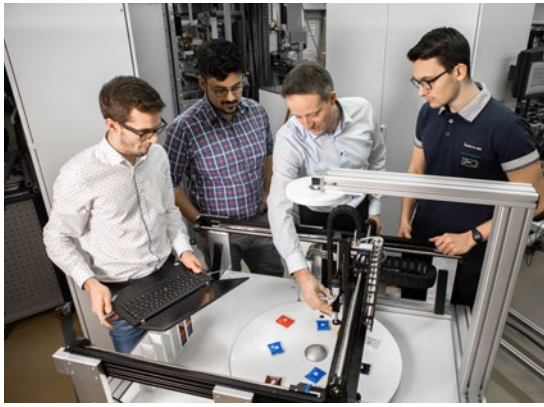
The appropriate commissioning software for our motors, our Drive Assistant 5, is available to the customer free of charge. A PLC-like sequence program in the C programming language, can also be installed onto the controller. This makes it possible to dispense with a higher-level controller.

NEWS

SQUARED, DYNAMIC AND DELICIOUS...

...is the motto for a new Dunkermotoren trade show model. In cooperation with the Karlsruhe Institute of Technology (KIT), more precisely with the industry 4.0 university group linkit, a highly dynamic, smart 4-axis handling system was built and put into operation. As suggested by the name of the university group, the students are specialized in software solutions for companies. With the assignment to linkit, the students were able to put their learned programming skills into practice on a small machine. The electrical and mechanical components were designed by Dunkermotoren's Industrial Engineering Team and assembled into a special machine. The development and training of machine learning algorithms, CAN bus communication between the motors and the controller, control engineering and path planning for the linear axis system, full-stack web development, UI and UX design, putting agile software development into practice as well as design and 3D printing were among the students' main tasks.

The realization of the model was excellently implemented by the students outside of their lecture times on weekends or during vacations. The result after more than one year is impressive and will certainly "sweeten" the stay at the Dunkermotoren booth for our trade show visitors. The trade show model is a pick & place handling system for the Ritter Sport Minis. Different types of chocolate are placed on a moving turntable, which is monitored constantly by a camera system. The trade show visitor can choose his desired variety on a tablet. After answering three questions about Dunkermotoren successfully, the gantry system consisting of carious ServoTube modules picks up the right "square" and delivers it to the transfer point.



High-speed linear technology for connoisseurs, made by Dunkermotoren.

NEWS

ADVANCED EFFICIENCY: ONLINE CONFIGURATOR WITH NEW 3D FUNCTIONALITY

With almost 27 million possible product combinations, our online configurator offers suitable motor solutions for any imaginable requirements. Simply enter your required parameters, e.g. torque, speed, voltage supply, communication interfaces or attachments, and our online configurator will provide you with suitable products and combinations in a power range from 1 - 4000 W.

For the selected product combinations, you will receive specifications and characteristic curves for the entire drive unit, not just for each individual component. Thus, a manual calculation of the performance data is no longer necessary.

3D-Modell-Designer Jessica Heizmann and Alexander Güntert

As of this year, a 3D view is available for the entire drive combination. The button "3D view" on the product detail page opens a separate CAD window. There, you can quickly and easily download the CAD data in 2D or 3D in all common formats. For all common CAD systems, you also have the possibility to insert the file directly into your own CAD system. In 2021, another functionality will be added to the online configurator.

As an extended function, you cannot only request a quote with one click, but also place an order directly via the online configurator.

Find your suitable drive solution today in our convenient online 3D configurator at https://www.dunkermotoren.com/en/configuration/

NEW EXPRESS PRODUCTION ENABLES EVEN SHORTER DELIVERY TIMES FOR SMALL REQUIREMENTS

Dunkermotoren offers a comprehensive modular system of modularly combinable drive solutions consisting of motors, gearboxes, brakes, encoders and controllers. A selection of approximately 1000 combinations can be generated using components of the stock program.

Soon, the assembly of the complete solutions will soon no longer take place in series production, but in unchanged quality in a new separate express production facility. As a result, Dunkermotoren can offer its customers delivery times of 3 days for solo motors and 10 days for complete drives from its stock program. The delivery time is valid for orders up to a maximum of 10 pieces and is without extra charge.

Customers can find an overview of the approx. 1000 possible solutions defined as stock program in the online configurator at https://www.dunkermotoren.com/en/configuration/

Independently of the new express production, Dunkermotoren continues to offer sampling for OEM projects from its own sample production. The production is usually within two weeks, this also applies to many customer-specific special designs.

NEWS

DUNKERMOTOREN'S WEBSITE SHINES IN NEW SPLENDOR

After a first complete overhaul in 2016, the Dunkermotoren website is shining in a completely new design now. The focus of the facelift was set o the adaption to current trends and designs. For example, the function of parallax when scrolling on the page was integrated. The new full-screen design allows an optimal presentation of the website in dependence of the screen size. This makes it even more convenient to configure motor solutions via our online configurator.

The integration of moving images offers a new experience of our applications to the website visitors. The biggest adaptation of the website probably is the career section, which has been completely redesigned in terms of content. In testimonials, employees report on their experiences working at Dunkermotoren. Overall, the layout is characterized by a new visual language compared to the previous version, which presents the company in a contemporary way.

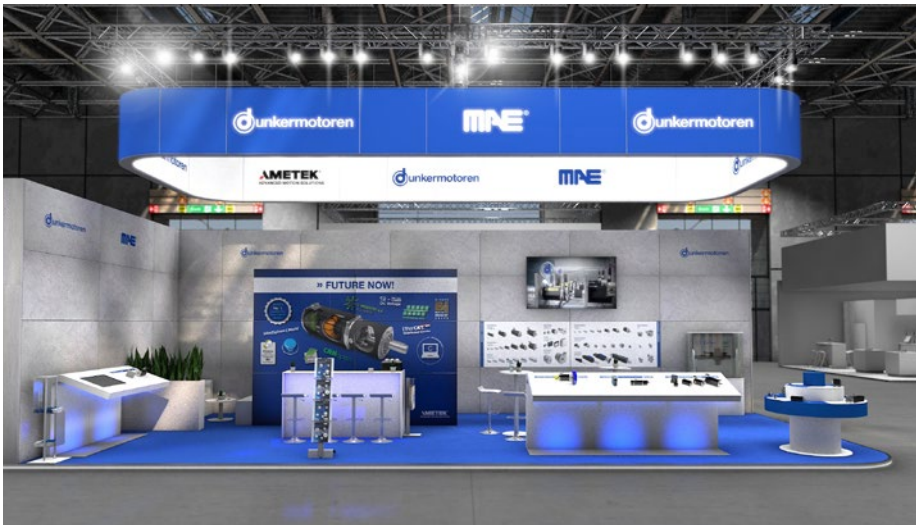
DUNKERMOTOREN PRESENTS VIRTUAL EXHIBITION BOOTH

Even though many trade fairs were cancelled this year, Dunkermotoren does not miss the opportunity to present its new products. As at the real exhibition booth, you can virtually experience the latest product highlights on the exhibits. Benjamin Hogg, Dunkermotoren's Head of Key Accounts, welcomes you as a virtual person and will be happy to guide you around the booth.

With the Open Industry 4.0 Demonstrator, Dunkermotoren will demonstrate the ease of integrating smart motors into your IIoT infrastructure. The NG 500 is the perfect wheel drive in combination with BLDC motors. By integrating the transmission into the wheel hub, it does not need any additional data storage. Depending on the desired performance and driving speed, the NG 500 can be built in different gear reductions and can be combined with the smart motors of the BG 75 and BG 95.

With the BGE 5510 dPro, the company presents its first external electronics based on the Motor Control Platform. The controller is suitable for motor solutions up to 250 W continuous output power from the Dunkermotoren portfolio. It is characterized by free programmability (C) and vector control. Since Q3/2020, the BGE 5510 dPro is also available with PROFINET or EtherCAT interface and supports SafeTorqueOff (STO).

It is no coincidence that the BG 95 dPro is the winner of the Best of Industry Award. In the certified PROFINET version, the smart motor even supports PROFIdrive application classes 1 and 4. The BG 95 dPro achieves the highest energy efficiency class IE 5.



FACTS & FIGURES

25
million sold GR motors

775
product combinations in stock program available within a few days

99
percentage of the Dunkermotoren portfolio can be manufactured on European production lines

1750
visitors on our virtual booth in the first 3 months

349
Euro special offer price for a development kit incl. programmable PROFINET or EtherCAT motion controller and servo motor

1999
Dunkermotoren's first smart motor came to life

70
years of Dunkermotoren

INTERVIEW

INTERVIEW MANAGING DIRECTOR DUNKERMOTOREN UWE LORENZ - THE YEAR 2020

Despite initial easing in public life and falling case numbers, the corona pandemic continues to dominate our private and business lives. How does your company experience this time?

In the first quarter of the year, incoming orders and sales were at their usual high level, then Corona led to a critical supply situation for many supplier components. With a certain time lag, there it came to a significant slump in demand in some target markets. As a consequence, short-time work was necessary, albeit on a small scale. We are currently registering a slight increase in demand and are confident that we will emerge from the crisis stronger than before.

Due to the current situation, the health care system has to meet enormous demands and therefore also technical needs. How does this affect your medical and laboratory technology division?

We supply motors for many devices in medical technology, including ventilators and sewing machines for the production of protective suits. At the beginning of the pandemic, there was an increase in the number of call-offs and enquiries in this business unit, but this returned to normal levels after just a few weeks.

In Dunkermotoren's corporate philosophy, customer orientation and innovative thinking and acting are at the top of the agenda. How do you bring these two aspects together in terms of product development?

In recent years, Dunkermotoren has brought a large number of new products and functionalities onto the market, which offer our customers an innovative and economical drive topology in their machines and systems, and thus real added value. The basis for a large part of the innovations is the "Motor Control Platform", which is currently being integrated into all servo motor series. This ranges from the simple and cost-effective "dMove" 4Q control electronics to the "dPro" motion controller with high-resolution encoder, vector control, Ethernet interfaces and safety functionality.

"A modern drive solution must have decentralized intelligence and sensor technology as well as a communication interface."

What does Artificial Intelligence and Swarm Intelligence, as the basis for Industry 4.0, mean for Dunkermotoren's motor solutions?

Swarm intelligence is strongly associated with IIoT (Industrial Internet of Things) and decentralized systems. We are very active here with our intelligent motors. The basis is that every motor or drive network itself carries the application in its stomach. Necessary real-time decisions for reacting to the environment are made by the drive itself and are coordinated with other drives. A separate PLC is no longer required in these applications.

Artificial intelligence is performed when drives transfer their status data, such as temperature or current curves, to the cloud and patterns are derived there. This makes it possible to recognize when defects or anomalies are imminent. This information can then be fed back to the drive itself or to management systems via bookable services in order to initiate the necessary reactions.

What requirements must a modern drive solution meet, in a nutshell?

It must have decentralized intelligence and sensor technology as well as a communication interface. This is the basis for many possibilities and

features, including those mentioned in the previous section. In addition, "classic" values such as energy efficiency, power density, performance and economy do not lose their importance.

Looking at the developments in the various user industries for drive technology products and systems, which industries do you think will be among the most important ones in the coming years?

At Dunkermotoren, our target markets include intralogistics, mechanical and plant engineering, medical technology, agricultural technology, railway technology and building automation. This is a strong selection of promising industries and a low dependence on individual applications.

What medium and long-term corporate development is Dunkermotoren focusing on?

Since 2019, a team at Dunkermotoren has been working exclusively on connecting Dunkermotoren's servo motors simply and securely to the Internet and, based on this, realizing added-value functionalities. To be able to fix this task in cooperation with strong partners, Dunkermotoren has also joined the "Open Industry 4.0 Alliance" and "MindSphere World" associations. In addition, the focus is on growing together with our sister company MAE from Italy. With a total of 1,800 employees, we will then be able to offer our customers stepper motors and blowers in the future.

Many thanks for the interview, Mr. Lorenz.

„WE TORQUE PROFINET"

How does the future of drive technology look like? Indeed, there are enough options and forecasts from industry experts. But on the following points, there are unanimous opinions:

1. The triumphal procession of Industrial Ethernet will continue unabated.
2. Automation will become more transparent because the components can provide much more and better data from the field level.

PROFINET communication is ideally equipped to fulfill the above-mentioned technology trends. PROFINET is fast, transparent and future-oriented. Consequently, it is hardly surprising that Dunkermotoren, as a motor technology manufacturer, is making use of this technology. More than two decades of experience with intelligent drives are thus combined with state-of-the-art communication.

Dunkermotoren will by no means be disloyal to itself in the process. On the contrary it is the implementation of PROFINET that demonstrates Dunkermotoren´s strength which is the integration of electronics in the motor housing. Even the complete PROFINET communication is highly integrated in the motor housing. This eliminates the need for costly gateways. Synchronous communication becomes possible. Even PROFIdrive with application classes 1 to 4 has been implemented and thus offers, for example, synchronous operation of several axes. Dunkermotoren is the first manufacturer to offer application class 4 completely integrated in the motor housing. PROFIdrive itself is a drive profile that significantly simplifies commissioning compared to earlier technologies. Tedious tuning of individual parameters and programming of sequences have passed. Drives are simply integrated into the configuration environment and are immediately ready for operation.

In PROFINET systems without PROFIdrive, Dunker's own Quickstart commands ensure fast commissioning. Several commands are combined into one, sequence programs are reduced to a clear minimum.

PROFINET is much more than just the changeover from simple fieldbus-based to Ethernet-based communication. PROFINET makes every component transparent. Because the transmission of huge amounts of status and status data does not affect the highly synchronous process data, all components in a PROFINET network can be analyzed and monitored at any time. The OPC UA capability of PROFINET can be defined as the entrance ticket to the IoT universe. The valuable data can be transported on safe paths to be analyzed elsewhere. At any time, the digital twin of a complete plant can be synchronized with the real plant.

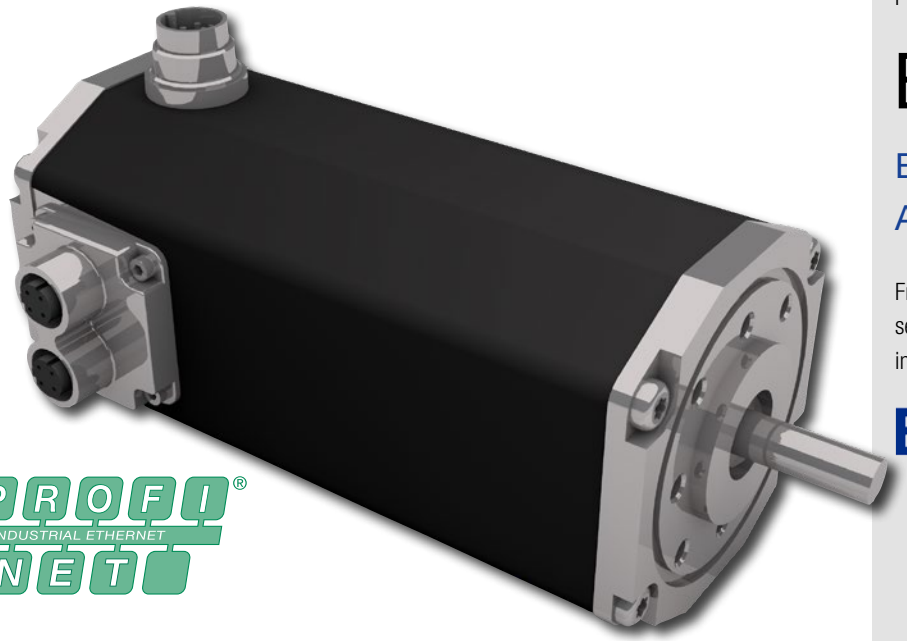
Smart motors of Dunkermotoren can easily be integrated into this world. For this purpose, it can be used the highly integrated and decentralized motor solution, for example with the BG 95 dPro PN or an external motor controller such as the BGE 5510 dPro PN control electronics. If special safety functionalities such as SLS or SSM are required, or if a

Siemens controller is suitable due to its topology, SIMATIC MICRO-DRIVE controllers can be used in combination with our specially adapted portfolio of Dunkermotoren motor solutions.

In addition to the communication interface, the motor includes the complete output stage, the encoder and the controller, including dynamic motor monitoring. Consequently, the mechanical components can also be mounted at the same time. In this way, customers receive complete drive units consisting of motor, gearbox, brake and linear cylinder from a single source. Connecting, integrating, projecting and then producing has never been so easy. For commissioning, the "Drive Assistant 5" commissioning tool is available, which establishes contact with the motor via the Ethernet connection. "Let's connect" - our special step-by-step commissioning description clarifies the final details. The strict PROFINET certification is a guarantee for smooth operation. With products conform to this certification, Dunkermotoren wants to ensure a fault-free operation of the drive over the entire lifetime, so that a fault analysis becomes not necessary at all.

One thing remains to be said: The combination of PROFINET and PROFIdrive, application class 4 completely integrated in drives will set standards. As so often before, Dunkermotoren technology will serve as an example for products from other manufacturers. BG 95 dPro and BG 66 dPro PROFINET are already available. The BG 75 dPro PN will follow in the beginning of 2021.

Author: Michael Burgert I
Product Manager BLDC Motors



PROFINET INDUSTRIAL ETHERNET

ETHERCAT WITH DISTRIBUTED CLOCKS

Since August 2020, the dPro series of Dunkermotoren is also available with EtherCAT interface. A special highlight is Distributed Clocks and the associated possibility of real-time synchronization.

Starter Sets are available immediately. Currently, they can be ordered for immediate sampling in combination with our motors of the series BG 66 dPro EC, BG 95 dPro EC, and the external control electronics BGE 5510 dPro EC. The BG 75 dPro EC will follow at the beginning of 2021.

Author: Matthias Utz I
Product Manager Linear Systems

EtherCAT®

ETHERNET/IP IN APPROACH

From Q2/2021 onwards, all smart motor series will also be available with EtherNet/IP interface.

EtherNet/IP

DATA EXCHANGE IN THE AGE OF THE "INDUSTRIAL INTERNET OF THINGS"

As a result of the Industrial Internet of Things (IIoT) being established as a key technology of the fourth industrial revolution, data generated by machines and components are getting an increasing attention from companies. Not without reason, data are being described as the new commodity, or gold, of the digital age. Data analysis enables the acquisition of information about associated products and processes which, in turn, forms the basis for an increased productivity or even brand-new business models. For example, by analyzing the operating data for motors, service-related business models such as predictive maintenance can be derived on the one hand which, on the other hand, minimizes production down times, thus increasing productivity. But how do these data find their way from the generating device to the place where they are analyzed? This whitepaper addresses this question and examines the most conventional communication standards in the context of the IIoT.

Nowadays, there is no doubt that classic fieldbus systems, such as DeviceNet or Profibus, will be replaced by industrial Ethernet buses, such as PROFINET, EtherCAT or Ethernet/IP, in the medium term. This is also borne out by the annual review of the market share of bus systems conducted by HMS, which shows the first indications of a decline in classic fieldbuses in 2019 (Figure 1). It is thus clear at any rate that in automation, just as in IT,

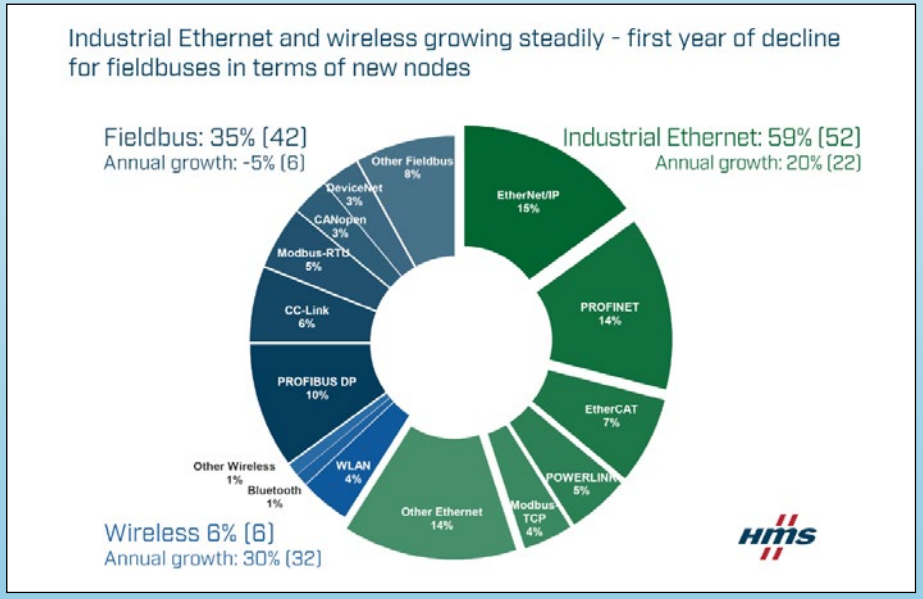


Figure 1: Market shares of industrial networks

Ethernet is also set to become the transmission medium in future as regards wired connections. Nevertheless, with industrial Ethernets, proprietary standards continue to dominate field and control levels. At present, this further complicates cross-manufacturer communication. However, even here, there appears to be light at the end of the tunnel as a result of the comprehensive support of OPC UA as a uniform standard, in the move towards shared and open horizontal and vertical communication.

This is crucial, as standardized and open communication between devices and systems is the greatest challenge, as well as the greatest enabler, for the Industrial Internet of Things. In fact, only a communication independent from manufacturer and level provides maschines and plant engineers with the opportunity to select and combine the best technologies for their specific application. This is the only economically viable way for data to be transmitted from all field devices to higher level analysis software, as they do not need to be gathered and interpreted from a wide range of proprietary systems.

In addition to these communication standards, which originate in automation, the policies originating from IT for data exchange via API (application program interface) or via protocols such as MQTT and AMQP are becoming increasingly important in automation, as the issue is increasingly one of transmitting data from automation devices to IT systems. The individual technologies, their advantages and disadvantages, are detailed and illustrated below:

FUTURE NOW!

INDUSTRIAL ETHERNET:

Industrial Ethernets are manufacturer-driven proprietary communication protocols, based on the Ethernet standard IEEE 802.3, extending this by including real-time capability and various additional control functionalities, such as “motion”. The three most widespread protocols in use are EtherNet/IP (Rockwell), PROFINET (Siemens) and EtherCAT (Beckhoff). The extent to which the individual industrial Ethernets rely on the conventional Ethernet varies from one system to another. The first two layers of the OSI model, standardized according to IEEE 802.3, these being the physical transfer layer and the MAC address, are used by nearly all protocols. However, based on this, the extent to which the conventional Ethernet's standard IP, TCP and UDP protocols are accessed depends heavily on the respective industrial Ethernet. EtherNet/IP is the closest to the conventional Ethernet, as, in this case, the standard IP, TCP and UDP protocols are also a fixed component of the protocol stack and only above the transport layer does the EtherNet/IP rely on specific CIP protocol.

Here, PROFINET is a separate protocol stack above the MAC address, but, when establishing a connection and with acyclical services, it still offers the option of falling back on UDP/IP. By contrast, EtherCAT sits above layer 2 and is a completely independent protocol, which only uses the Ethernet frame. This is one reason for the outstanding performance of EtherCAT regarding the latencies for which it was developed, but also because EtherCAT is the furthest away from the conventional Ethernet. Protocols are, in principle, open and can also be implemented by third-party suppliers in their devices. The protocols deploy their full performance, but usually only in the ecosystem of the manufacturer that developed the protocols. It thus becomes apparent that licenses are often required and particular hurdles exist specifically when integrating master capability. The “openness” thus serves more as a means of integrating the devices of third-party suppliers into an individual ecosystem and to tie users in to the individual ecosystem.

Based on the development cycle of around 15 years in automation, industrial Ethernets will continue to play a key role in the coming years, even if an overarching system, such as OPC UA, would be established. A HMS Study highlightens that industrial Ethernets have overtaken classic fieldbusses in 2018, approximately 15 years after their initial implementation, strengthen this assumption. Furthermore, classic fieldbuses only began to decline in 2019.

OPC UA:

OPC UA stands for Open Platform Communication Unified Architecture. Therefore, OPC UA should not be seen simply as an additional communication protocol, but rather as a communication framework that, besides data transmission, also details the significance of and access to data, as well as including security mechanisms. Security here is implemented by means of certificates and certificate and access rights management, which are included in OPC UA. Nevertheless, it must be noted that OPC UA is not secure per se, but rather it includes the necessary mechanisms and properties which can be used as the basis for implementing

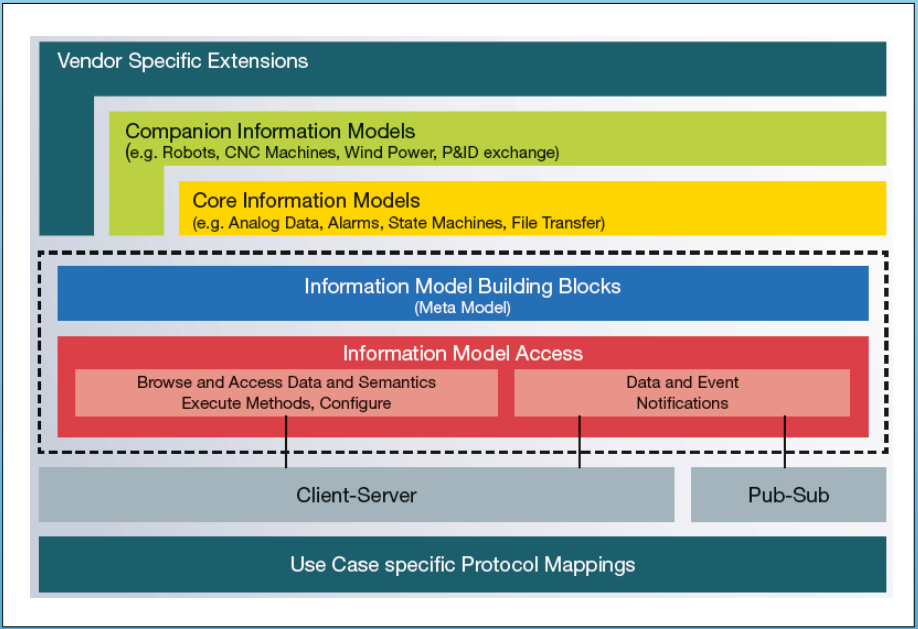


Figure 2: OPC UA setup

secure communication. OPC UA is based on the premise that devices are mapped in the form of information models. This means that devices are described in objects with their associated variables, methods, events and their connection to other objects. For example, in its simplest form, a motor can be an individual object with variables, events and methods. However, it can also comprise various objects, such as current controllers, position controllers and speed regulators.

Consequently, any complex components and machines can be mapped semantically and it is possible for an OPC UA application to be able to understand these semantic models, without knowing them in advance. To ensure this functions across manufacturers, OPC UA is based on a service-oriented architecture (SOA), which defines access to information models via standardized services. In the basic implementation, OPC UA includes the information models of Data Access (DA), Alarms & Conditions (AC), Historical Access (HA) and Programs, as well as Services Browse, Read/Write, Method Access and Subscribe to individual variables. Furthermore, OPC UA functionality can be extended via industry-specific information models, known as “companion specifications”. To also take account of the various distinguishing features of individual manufacturers in industries such as drive technology, there is also an option to map non-standardized functions via the manufacturer-specific extensions in OPC UA (Figure 2).

Fur actual communication, OPC UA provides two types. Server/Client and Publish/Subscribe. Both communication types can be used in parallel with an OPC UA application and any application can

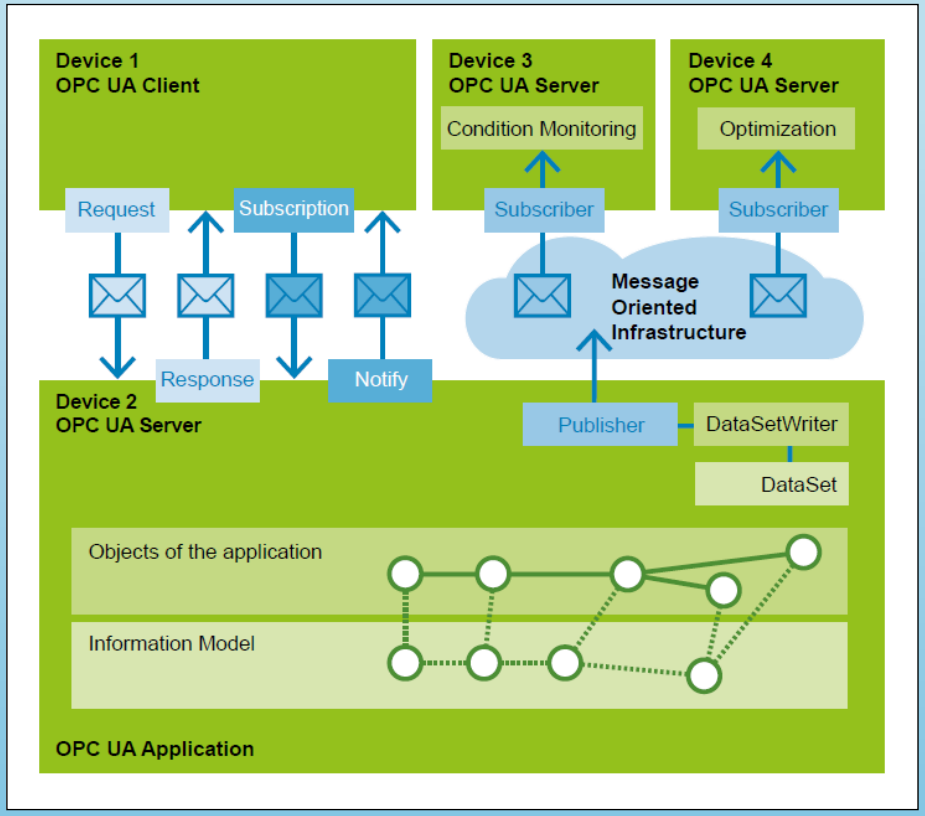


Figure 3: OPC UA communication

also assume any role (Figure 3). OPC UA thus covers the usual direct connections in automation via Server/Client and the usual indirect connections in Cloud connectivity via Publish/Subscribe. With Publish/Subscribe, OPC UA relies on the embedding of common standards, such as MQTT or AMQP. In the Publish/Subscribe context, a variant with UDP as the transmission protocol is also supported at field level. At the transport layer of communication, OPC UA continues to be based on Internet protocol (IP) and thus always requires an Ethernet-based network infrastructure. In its current form, OPC UA is therefore an ideal addition for industrial Ethernets to transfer data in parallel with control communication to higher-level systems for analysis and monitoring. Work is currently in progress on enhancing OPC UA with Time-Sensitive Networking (TSN), and thus enabling deterministic real-time communication.

This approach, as well as 5G, also forms the basis of the Field-Level-Communication (FLC) initiative of the OPC foundation, which is working on bringing OPC UA communication to field level. OPC UA

FUTURE NOW!

as an Ethernet-based and deterministic communication standard at field level thus has the potential to enable standardized, cross-manufacturer communication. Even for local system architectures with no distinct control level, this is a promising technological step, as field devices can communicate in the same way with each other and with control and management systems. As detailed, the features of OPC UA make it the ideal toolkit for cross-manufacturer and cross-level communication. Nevertheless, there are some limitations to bear in mind. The high degree of abstraction required by OPC UA to enable the generic approach, naturally makes entry difficult, as well as the analysis of the connection itself.

Furthermore, all the features included in OPC UA also result in a corresponding demand on the hardware used to run an OPC UA application. For this reason, reduced OPC UA profiles are also available, which do not support any security mechanisms or which only permit a connection at the lowest level, without method accesses and subscriptions.

MQTT:

Message Queuing Telemetry Transport is a lightweight protocol for data transmission. At best, data packages of just 2 bytes can be implemented, which is particularly advantageous for a large number of devices and messages. This benefit combined with the ease of implementation of MQTT has thus resulted in very heavy use of MQTT in the IoT environment in recent years. However, it must be noted that, in contrast to OPC UA, MQTT is purely a transmission protocol and does not provide any enhanced framework with functions such as semantic data description or security mechanisms. This means that security measures to safeguard the connection must be implemented separately and the type of data concerned as well as how the data should be understood must be declared on both sides of the communication. The structure of MQTT is an open Publish/Subscribe protocol for indirect 1 to n communication. This means that a publisher based on events sends messages on a specific topic to what is known as a broker. The broker forwards the corresponding message to all subscribers who have subscribed to the associated topic. With regard to a motor, this means for example that, under the topic “Diagnosis/Overcurrent”, the motor’s serial number and associated value is communicated to a broker when the preset limit value is exceeded. The broker then forwards the message to all subscribers, such as mobile terminals belonging to service engineers, control systems, or cloud applications.

When configuring the Publish/Subscribe communication, MQTT offers some more useful features. Retained Messages, for example, enable the last message sent on a topic to remain with a broker, so that it can be communicated to a new subscriber as soon as they subscribe. There is also a Last Will message a publisher can hold with the broker. This will be sent to all subscribers if a device is no longer connected and if any previous logout or unsubscribe action has failed. Even if the subscriber loses their connection, the Persistent Session feature provides the opportunity for the missed messages to be buffered (or “cached”) in the broker. They can then be communicated to the subscriber next time they log in. As a last resort, various Quality of Service settings offer three more options to ensure that sent messages reach one, more than one or at least one subscriber. Consequently, MQTT is a protocol that is easily controlled and ideally suited for implementation on devices with limited resources. It can also guarantee that data reach their destination in the event of any loss of connection. However, parties on both sides must be aware of the data communicated and there must be other means of ensuring data security, particularly for the broker.

AMQP:

Alongside MQTT, Advanced Message Queuing Protocol is the most widely used communication protocol in the IoT environment. Like MQTT, AMQP works with a broker and the Publish/Subscriber principle. With AQMP, each subscriber has a queue in which messages from the broker with subscribed topics are held. The messages remain in a queue until the subscriber confirms that they have received the message. The queues, thus, also act as a buffer for messages in case a subscriber is not always connected. If a message cannot be communicated to a recipient, the Publisher receives a corresponding message. However, in addition to Publish/Subscribe, AMQP offers the following types of transmission:

- Fanout, where the broker transmits a message to all connected queues.
- Direct, where a fixed connection between a subscriber and a queue can be established by means of an identifier.
- Headers, where messages in the broker are distributed via message headers instead of identifiers, which offers more rule-creation options compared with direct transmission.

With AMQP, messages can also be supplemented with metadata, which describe message data in form of attributes and which can be used by the recipient. The main way in which AMQP differs from MQTT is the extended range of functions offered by AMQP for message transmission. However, implementation of AMQP also requires more effort and more resource. The smallest possible packet size with AMQP is 60 bytes. Therefore, it is worth considering whether the extended functionality offered by AMQP is actually needed, or whether the simpler MQTT solution would suffice.

API/ REST API:

Application Program Interfaces originate from the concept of subdividing programs into function-based modules. The individual modules provide other modules with their public data via APIs and use APIs to retrieve the necessary data from other modules. APIs are structured with a number of variables which are described by the associated module and which can be read by other modules. Consequently, they decouple the module's "private" code from the outside world. This makes it possible to create modules that are easy to maintain and to identify incorrect code more quickly, as each module can be tested in its own right by means of the API description with the intended commands and by checking the anticipated results. APIs can thus generally be precisely customized to suit each individual application. However, they are manufacturer-, application- and module-specific, and are not standardized. APIs therefore need to be described in terms of how they are reached, which variables they include and whether the variables have write access or are read-only. Even when exchanging data with other manufacturers via APIs or with public APIs, the detailed description is important, so that "external" programmers know how can use the interface, as they have no knowledge of how the API's underlying application works.

REST stands for Representational State Transfer. REST is not a particular standard or protocol. It is an architectural approach for communication in distributed systems. As REST is not a specified standard, there are consequently no details on what compliant implementations should look like. However, there are six architectural principles (constraints) to be respected. In technological terms, REST also relies on what is already there.

Therefore, with data transmission, HTTP/S is often used as the protocol and XML (Extensible Markup Language) or JSON (Java Script Object Notation) are often used as the data format for information. As REST was developed in 2000, at a time when the Internet had its momentous breakthrough, it was actually the Internet that provided REST with a large part of the infrastructure required and most web services are based on REST. The six architectural principles defined by REST are as follows:

REST is built on a client-server model with strict separation of data storage and user interface. This means that user interfaces as clients can easily be adapted to different individual framework conditions, whilst data storage as a server is easily scalable by means of a standardized structure.

Messages must be stateless. Consequently, a client query to the server needs to be self-contained and include all information about the application status. The context of the message must therefore always be provided, as there are no existing sessions with REST and the server cannot otherwise interpret these. This principle also ensures easy scalability, as various messages from the client can be processed by different servers.

The client has the option to buffer (or "cache") the server's response for another identical query, if this is flagged accordingly. This helps to reduce network traffic and increase network efficiency. However, there is a risk of the client accessing obsolete data.

REST relies on a standard interface between all clients and servers with standard protocols, data formats and methods for access. The use of standard interfaces is usually accompanied by performance losses, as all data must be converted into a standard format. However, these losses are usually accepted willingly for the sake of simple architecture and usability. One example structure would be the use of HTTP/S the transmission and JSON as data format, as well as the following common methods:

» GET - requests data from the server
» POST - transmits data to the server
» PUT/ PATCH - amends existing data on the server
» DELETE - deletes existing data on the server

REST specifies an architecture in a layer system with a clear hierarchical structure and delimitation between the layers. This approach enables greater abstraction, thus giving the user access to various underlying architectures via a standard interface

FUTURE NOW!

layer, without the user being aware of this. It is therefore possible to encapsulate legacy systems as a layer, for example, and make them accessible via "new" interfaces. This results in increased security and usability. However, abstraction also means increased overheads and latency times as a result of communication via a number of layers. As the sole optional principle with REST, "code on demand" offers the opportunity to download or transmit executable code to the client via the API. This gives the option of modifying or enhancing a client's function independently of their own code.

CONCLUSION:

To summarize, we can say that even in the future there will not be one communication standard across all levels, although the variety will reduce significantly. It is most likely that OPC UA would have the potential to enable vertical and horizontal communication at and across all levels. However, for such a scenario, OPC UA also has certain requirements for hardware in the form of storage, processing power or even cryptological chips, most of which current embedded devices may not yet be able to satisfy. Also, as regards TSN, it is not yet possible to anticipate precisely when and in what form OPC UA can be implemented at field level as real-time bus. At present, and over the coming years, the heterogeneous industrial Ethernet fieldbuses will continue to dominate at field level, as here too, the investment cycle of approximately 15 years for machines and systems must be taken into account. A time range, in which existing systems will gradually be replaced by new ones.

Here, it is more likely that OPC UA will come into effect as a standard Ethernet interface for EDGE so that there is no need for each protocol to connect for each device. But also in the field of Cloud communication, Publish/Subscribe protocols such as MQTT or AMQP data exchange via REST APIs have, meanwhile, become established as a quasi standard for a number of applications, letting replacement in short-time become unlikely. Based on this situation and the given constraints, the communication architecture detailed below appears likely for the future:

Data from field devices are transmitted independently of the industrial Ethernet fieldbus via OPC UA or alternatively also directly via the respective industrial Ethernet" fieldbus to the EDGE. There, the incoming data are implemented via software adapters in the necessary Internet protocols, such as MQTT or AMQP, or directly transferred by means of a REST API. Which way will be used exactly depends heavily on other factors such as where data are transmitted to or which IIoT ecosystem is used to process the data. At Cloud level, data exchange via REST API currently looks most likely. When it comes to transmission, various technologies will also be used in future on various layers, albeit with greater standardization within the levels. In contrast, as regards data format, greater standardization will emerge across all levels. Here, the semantic data description in JSON specified by OPC UA currently has the potential to consistently become the quasi-standard.

Author: Markus Weishaar I
Product Manager IIoT

[1]https://www.hms-networks.com/de/news/pressemitteilungen-von-hms/2019/05/07/marktanteile-industrieller-netzwerke-2019-aus-sicht-von-hms

[2] OPC Unified Architecture, Interoperability for Industrie 4.0 and the Internet of Things; Version 10 INA; OPC Foundation, 2019; pg. 24

[3] Industrie 4.0 – Kommunikation mit OPC UA; VDMA; Fraunhofer IOSB-INA, 2017, pg. 13

FUTURE NOW!

SMART MOTORS ON THEIR WAY INTO THE INTERNET OF THINGS

Smart motors which include regulators, IOs, bus systems and control elements beside the motor, have been a parade discipline by Dunkermotoren for more than 20 years. They are the worldwide market leader when it comes to integrated BLDC motors. But lately the focus of motor manufacturers is shifting to the issue of “The Internet of Things”, asking the decisive question. Which meaning and requirements does the Internet of Things have for motors? Dunkermotoren asks this question actively and is working on answers to integrate smart motors into the “Internet of Things”. There is no mistaking, that intelligent motors of the industrial automation need to master Ethernet based field bus systems like PROFINET, EtherCAT und EtherNet/IP to control and communicate with other devices.

But the establishment of an additional parallel communication way, passing the controller and going straight from the field device into the internet, possible due IoT, is new. The base for this way of communication is depending on the application either OPC UA, MQTT or AMQP. Dunkermotoren is already working on the integration of these two standards into their smart motors, to be prepared for the basic requirements of the IoT.

Beside the type of communication, it is also important to regard the way the motor takes into the internet. For Dunkermotoren, IT safety and a simple network is the most important requirement, which can be solved by the use of IoT Gateways. IoT gateways develop fast lately. When choosing the right model, their hardware already offers a reasonable IT safety. Their structure which is similar to IPC and the support of various communication standards makes them a variable platform. But Dunkermotoren sees even more chances. As an alternative to IoT Gateways, provision is made for motor integrated IoT gateway interfaces but in particular software gateways. These software gateways can be installed as container or sever client application on existing gateways from mechanical engineers or plant operators.

With this innovation, Dunkermotoren is targeting the need of many mechanical engineers and operators who don’t want to use a separate gateway for every device manufacturer but using a single junction between device and internet instead. Dunkermotorens goal is it to offer the right gateway solution for every application.

Facing these conditions, Dunkermotoren could already implement a „Proof of Concept“, where a BLDC-Motor BG 45x15 CI in connection with an IoT gateway could get connected to the internet, controlled and selected. To consider all possibilities for existing technologies, BG 45x15 CI is using CANopen to communicate with the IoT gateway.

By using applications on the IoT gateway which can be handled with a web dashboard, the motor can get parameterized, several commandos can be sent and the condition of the motor can be tracked live. Furthermore, there is the opportunity to activate a real time measurement, which records the nominal current and the rotation speed using a time stamp. The recorded data is stored on the gateway and can get used for further analysis.

The IoT gateway is connected to the internet via WIFI and can get addressed device- independent via tablets, computers or smartphones. Due to this web surface, it is possible to communicate with the motor simultaneously. Complementary to these features, Dunkermotoren added a messaging function to the “Proof of Concept”. This messaging feature is sending an alert via internet, if the current consumption of the BG 66 dMove CO exceeds a certain threshold.

This alert is sent automatically to all devices which subscribed the status messages of the BG 66 dMove CO, for example to the smartphone of the responsible maintenance employee. By applying the “Proof of Concept”, Dunkermotoren proved that it is possible to find edge solutions in the sectors of “condition monitoring” “preventive maintenance“ or „remote support“ even with already available devices. The remaining question is what the concrete advances of smart motors and the Internet of Things is and where this way can lead to. Dunkermotoren wants to answer this question with the promising approach of a “device cloud”, a cloud in which all of the local motors can log in. The mechanical engineer or plant operator can regard and diagnose all of the active motors via this cloud. This opens up the opportunity for a free scalable and location-independent remote support

platform. Via device cloud it would also be possible to manage firmware and various software components centrally and transmit them to selected motors.Furthermore, the “device cloud” can be seen as base for further digitalisation processes like the “digital twin” of motors, which offers additional services such as the “predictive maintenance” for the customers of Dunkermotoren. The fundamental idea of this vision is the thought that every manufacturer focusses on their core competence in the future and offers not only data but already finished analyses to superior applications.

Let’s take a look on the following prime example: Dunkermotoren analysis the “digital twins” of its motors via artificial intelligence and provides current information to their customers. Due to this, the mechanical engineer can offer services like “dynamic service plans” or “just-in-time” spare parts to their customers. Focusing on preventing the unplanned failures of production plants. As it is visible in the explanation, Dunkermotoren sees a big potential in the connection of motors with the “Internet of Things”. As proved in the “Proof of Concepts” they are prepared for further steps in this field, which will, depending on the feedback of our clients, actively carry on. We are pleased to support our customers as a competent partner and to find solutions for IoT applications in combination with Dunkermotoren. We are convinced that IoT is a topic that can only be solved successfully as a team.

Autor: Markus Weishaar I
Product Manager IIoT

DUNKERMOTOREN ON THE WAY TO IIOT

For our customer magazine "mo, the three IIoT experts from Dunkermotoren answer the questions of the editorial staff. We are happy to introduce them to you: Markus Weishaar, Product Manager IoT, Vitas Kling and Lucas Mülhaupt, both software engineers at our headquarter in Bonndorf.

Where does Dunker stand in terms of IoT today?

M. Weishaar: Today, the logic integrated in our motors already provide all the relevant motor data via the existing field bus interfaces such as PROFINET, EtherCAT or CANopen. These can then be used and evaluated using our current tools such as Drive Assistant 5 or MotionCode. This is an ideal starting point for us, as we already have local condition monitoring which we now want to expand. To this end we are using our many years of experience with intelligent motors and customer applications to develop suitable IIoT solutions for our customers based on this. Our aim is to provide customers applications that enables them implementing their own digitization projects without having to worry about connecting and analyzing motors.

V. Kling: As already mentioned, Dunker has a great deal of know-how in the field of intelligent motor solutions. We can offer our customers almost any software solution as long as the motors communicate with each other or with a PLC. Here we are very well positioned with our new Motor Control Platform, through which the data provision, mentioned by Mr. Weishaar already works today. The first IIoT projects are just starting up.

What are the further developments?

M. Weishaar: We are currently working intensively on various software solutions for the Edge, which run on the current Edge Gateways. The software will take on the function of connecting the various motors to the cloud or providing data for customer applications. At the same time, we are beginning to build a device cloud that acts as a location-independent remote platform. Features such as a controlled remote firmware download or analytics functions such as the prediction of failure probabilities are planned.

What are the trends?

M. Weishaar: The current trend is clearly towards data provisioning in the cloud and building on the fact that every manufacturer analyzes its products with its expert knowledge and provides customers with ready-made information in the form of services. Thinking further into the future, models such as "motor as a service" are also conceivable, in which the function rather than the motor is sold. However, this presupposes that our customers first consider and implement similar business models.

V. Kling: Many mechanical engineers are currently trying to transfer information and data of their product into the cloud. A cloud platform, on the other hand, offers various interfaces to connect scalable software in order to provide the customer with data, analyses or other calculations based on the data available. Via a digital twin, which is a virtual image of a real device in the cloud, it will be possible to configure the device "on the fly", receive monitoring information and data sheets. Customers will be able to use the motor via the cloud as if it were directly connected to the motor on site.

What challenges can we expect?

L. Mülhaupt: Security is still a major issue, which we are also actively addressing. The data we obtain from the motor has a great value, which we have to secure throughout the entire path from the motor to the edge and on to the cloud. Here we are working closely with our partners in the alliances. By using open and established standards such as OPC UA and MQTT, we want to create robust, reliable and secure solutions.

V. Kling: Technologically, I don't see any obstacles. In order to achieve our goals, we need to digitalize our products and processes. We are working on that. We are trying to limit ourselves to what we can do and combine it with good solutions from other suppliers.

M. Weishaar: IIoT only develops its full potential if we think in terms of product ecosystems in which

all components from the motor or sensor to the ERP systems are compatible. The main thing here is that the individual pieces of the puzzle are interoperable and can be easily combined into a meaningful overall system. This is the only way for the end customer or plant operator to achieve the promised added value. For this reason, we are also a member of the Open Industry 4.0 Alliance and the MindSphere World in order to actively help shaping corresponding approaches.

Are other industries ahead of us?

V. Kling: Today, a Tesla owner receives a notification on the display when a software update is available, and can update it with a single click, without having to go to a workshop. Software such as traffic jam notifications with bypasses ensure stress-free driving pleasure. Cars can already stay in lane on the motorway. I think that the classic mechanical engineering companies and especially Germany have to catch up.

Will our product portfolio change?

V. Kling: I don't see Dunker IIoT developing new products. Rather the solution to the problems of our customers. Let's take a customer who uses our motors in his machines, which in turn are operated at a faraway location, as an example. If this customer wants a special firmware feature, he can book this quickly and easily via the cloud and transfer it to the motor without having to schedule a service employee for several days. With Dunker IIoT we want to help our customers to concentrate on their core business and use the full performance of our motor solutions.

L. Mülhaupt: Dunkermotoren has many years of experience in handling motors. Our aim is to digitalize this know-how so that we can pass it on to the customer as a service. Understanding, for example, how ambient temperature, certain load conditions or fluctuations in the power supply can affect the service life of a motor helps in many cases to be able to react in good time to impending failures.

M. Weishaar: Our main concern is also to develop complementary software solutions for our existing product portfolio that enable customers to operate our motors as efficiently as possible. As already mentioned at the beginning, we are already offering options for data provision and diagnosis, which we would now like to expand sensibly with new technologies.

What can a customer expect in the future?

V. Kling: My idea is that the customer can follow the entire production process online after placing an order. Transparency creates trust. As soon as a motor is delivered and connected to the network for the first time, it can automatically synchronize with the "Digital Twin". A software analyzes the capacity utilization of our motors and notifies the customer of a probable motor failure. The user has the possibility to order and exchange a new replacement motor without unplanned machine downtime.

M. Weishaar: That we support our customers in the best possible way to implement their own IIoT solutions and provide them with the necessary building blocks to embed our motors in it.

Thank you very much for this insight in the world of IIoT at Dunkermotoren.

The Dunker IIoT-Team from left:
Vitas Kling, Lucas Mülhaupt, Markus Weishaar


Module 1.2
C
BG dPro Master
BG dPro
BG dPro
BGE dPro
Module 1.1
C
BG dPro Master
BG dPro
BG dPro
BGE dPro
Module 2
C
BG dPro Master
BG dPro
BG dPro
BGE dPro
Mobile HMI
EDGE
Gateway
Module 3
C
BG dPro Master
BG dPro
BG dPro
BGE dPro
ERP / MES
Device Cloud

FUTURE NOW!

SMART, CONNECTED MOTORS ENABLE DECENTRALISED SOLUTIONS WITHOUT PLCS

Due to the influences of the "Internet of Things", more and more intelligence is being shifted from the control level to end devices. Process logic and analytics are moving further and further into higher levels up to the cloud. This insidious diffusion of the control level opens up completely new approaches for decentralized control concepts. As the global market leader for integrated BLDC motors, Dunkermotoren has been a pioneer in decentralized intelligent motors for 20 years. Dunkermotoren provides its customers with innovative solutions for implementing new decentralized control concepts without PLCs.

Decentralized architectures follow the approach that decisions are made directly where the resulting actions are executed. Only higher-level logic such as process data acquisition, workpiece tracking or visualization is taken over by higher-level systems. To be more precise, this means that all time-critical applications that must be executed in real time are executed directly on the field devices. All remaining applications that are not time-critical can also be taken over by management systems that are not real-time capable. The integrated smart motors of the BG series from Dunkermotoren have internalized this approach and provide the necessary tools for decentralized concepts due to their free programmability in C and networkability via common industrial communication systems. But what structural advantage does a decentralized architecture offer over a centralized architecture?

One of the two obvious advantages is the reduced wiring effort, as not all field devices have to be routed to a central control system. The second is the reduced space requirement, as no large central control cabinet is required. These two advantages, together with the savings for control elements that are no longer required, have a positive effect on cost and installation space optimization.

However, there are other significant advantages that are not obvious at first glance. On the one hand, modular modules for machines can be realized using a decentralized approach. Enclosed modules consisting of mechanics, electrics and software can be developed. The advantage of using software as an example is that parameters and settings do not have to be reassembled and reconfigured from complex master software code modules for each new project, but rather the ready-developed modules can simply be re-combined. The same applies to both, the mechanical and electrical components. Development times and possible sources of error within projects can thus be drastically reduced, as well as the costs for product maintenance of different versions. The combination of a modular system allows an enormous variety of versions to be offered to customers. However, internal complexity is drastically reduced by the maintenance of simple, standardized and comprehensive modules.

Within a modular system, a module always performs a precisely defined partial task, e.g. unwinding a foil. All necessary motors are contained in the module and react independently to linked sensor signals or actions of other motors, which also belong to the module. If several identical tasks have to be carried out in one system, a module can be used several times without additional effort. If it is a similar but slightly modified application, a new module can easily be derived from an existing module. Modules can therefore be kept simple, limiting complexity and interactions to a managable scope. This also shows another advantage of a decentralized concept: The simple and high scalability.

Up to this point, decentralized approaches were already feasible in the past. Many Dunkermotoren customers have already implemented these in their applications and successfully established them on the market. As mentioned at the begin-

ning, the influences of the "Internet of Things" are new. Their goal is to aggregate data into information in the field devices and transfer it directly to cloud systems for further processing. This means that even more intelligence is transferred to the field devices. Standards such as OPC UA, with or without TSN and MQTT, create a continuous communication line across all levels, directly from the field level to the management level. If one refers these developments back to the modular decentralized approach, this means that information that has to be exchanged within the modules or between modules and the HMI can be exchanged directly with TSN in real time via OPC UA. Information required for monitoring or process control is transferred directly to management systems or the cloud via MQTT or OPC UA. However, IT security also plays an important role when connecting to the "Internet of Things". One approach is to create a single controllable access point to the system. This approach can be implemented with the help of IoT gateways, which also master the OPC UA and MQTT communication standards and also provide IT security in terms of hardware. The IoT gateway has the function of a "single point of entry" between the individual modules and the "Internet of Things". This also does not contradict the decentralized approach, since an IoT gateway can also be accommodated decentralized due to its small design and only entails a fraction of the costs of a control system. Thus, the advantage of this development is obvious: A consistent communication architecture independent of rigid levels, combined with a much simpler implementation and maintenance. Information is transmitted directly from the point of origin to the point of use, without unnecessary detours. If this development is consistently pursued, the question inevitably arises: Will the PLC or the entire control level still be needed in the future? Dunkermotoren has recognized the potential of this development and is in procress of integrating of integrating OPC UA and MQTT into its smart motors in order to offer its advantages to their customers.

In summary, the advantages of a decentralized control concept lie in cost and space savings, reduced overall complexity, high scalability and the possibility of an integrated, future-oriented communication architecture. With a broad portfolio of smart BLDC motors from the BG series and experience in implementing decentralized concepts, Dunkermotoren is your perfect partner to support you in implementing a decentralized control concept with know-how and market-leading products.

Author: Markus Weishaar I
Product Manager IoT

"DUNKER ACADEMICS" KNOW MORE

The DunkerAcademy was established in close consultation with the management, personnel management and Dunker employees. It is an internal training program in which all employees can extend their existing skills and / or learn new ones. The DunkerAcademy is initially offered as an internal training catalogue, which covers training in all internal specialist areas. In addition, events on special topics such as health management are also offered. Currently, over 80 training courses are offered. E-learnings supplement the existing training courses.

Author: Anja Parsiegla I Human Resources

Our Dunker Vital Team from the left:
Elke Adelbrecht, Vjollca Sejdaj, Nils Pitsch

INSIGHTS

SUPPLIER QUALITY (SQ) – HOW WE ENSURE THE QUALITY OF OUR SUPPLIER PARTS

Quality is a matter of course at Dunkermotoren and is firmly anchored in our corporate principles and philosophy. Dunkermotoren understands quality as a holistic process that encompasses all operational activities.

In the area of procurement of vendor parts, the Supplier Quality Department is an important component in ensuring the high quality of purchased parts. In order to ensure that the constantly increasing demands on quality are met, we have set the course for the department's strategic orientation in the course of a project. The previous Supplier Quality Assurance became the two departments Supplier Quality and Supplier Development. Supplier Development focuses on the holistic development of suppliers including supplier audits. This ensures even closer cooperation with the suppliers.

In the new structure, the core processes of supplier quality are incoming goods inspection, series and complaint management for vendor parts, as well as their inspection planning and the measurement competence center. In addition to these tasks, we also support the other sites in Taicang, China and Subotica, Serbia. Although the organizational assignment is now in the central quality area, close cooperation with materials management is still a matter of course and is closely interlinked with other company departments such as engineering and production.

There was a major change in the complaints process for vendor parts. This process has been optimized in a way that the complete responsibility for processing lies with supplier quality and is documented and tracked throughout the ERP system. The desired result of the optimization is already noticeable through more efficient processing. During the incoming goods inspection, the objective of improving quality is pursued directly at the supplier. In this way, we follow the defined principle of "buy quality" instead of "check quality".

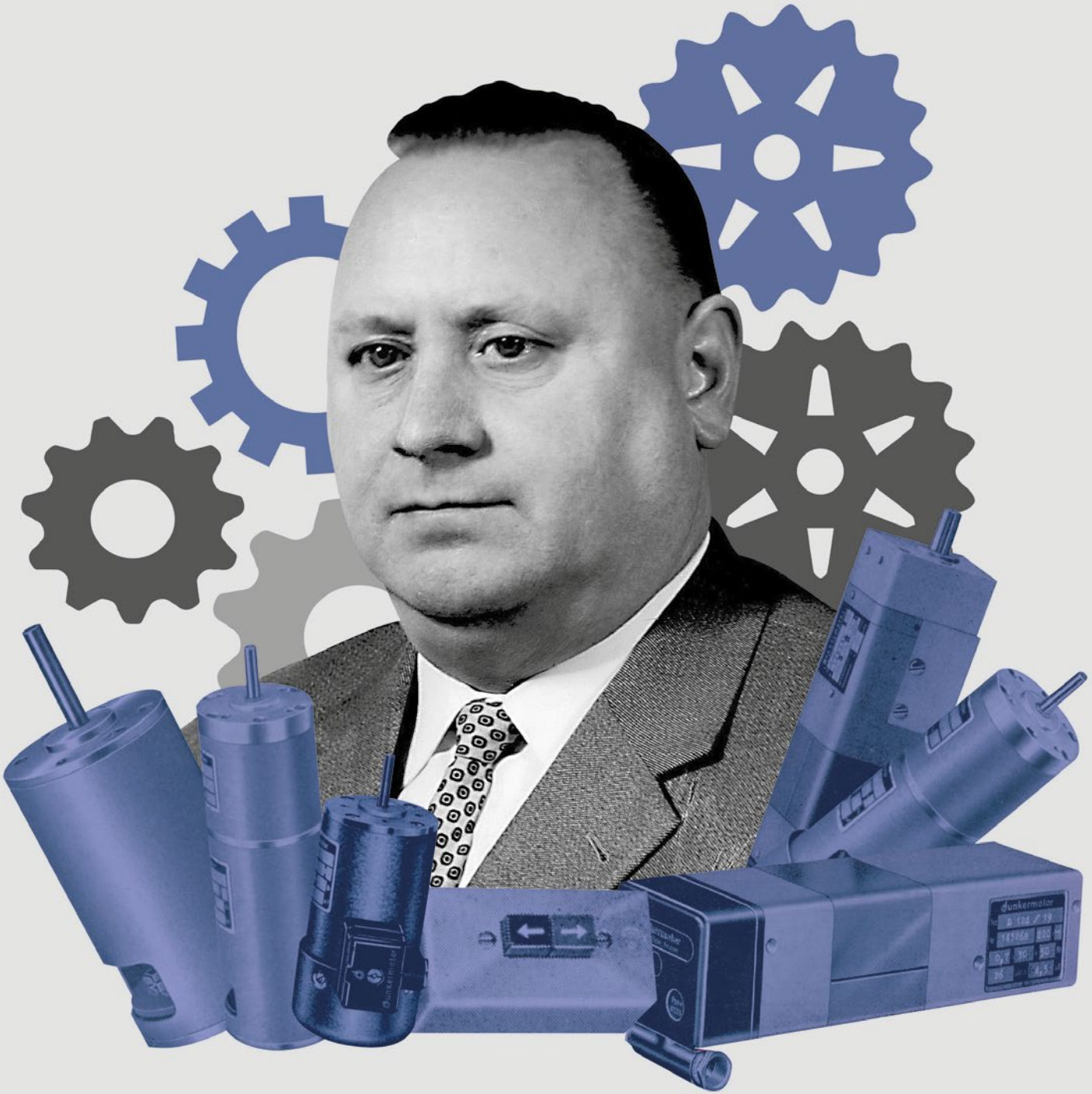
The inspection plans and the documentation of the inspections are currently being integrated into the ERP structure. This enables us to evaluate the measured values even better and use them for statistics. Tests can thus be made more dynamic and are only carried out when required. The focus will be on measurement competence in order to strengthen and expand it. In order to meet the requirements of the measuring competence center, permanent investments are made in the renewal of measuring equipment, in the improvement of measuring capabilities and in the competence of our employees.

In hardness testing, for example, the previous manual device was replaced by a fully automatic hardness testing device of the latest generation for micro and macro ranges. In the field of measuring magnets, we have switched to a new generation of a pole limit measuring machine. With our precise sensor magnets, the pole strength, pole width of magnetic slope are measured and evaluated.

With the above-mentioned structures and core processes in supplier quality and close cooperation with the other departments, we ensure that high-quality purchased parts are available to manufacture our products.

Author: Marc Tröndle I
Head of Supplier Quality

Fully automatic hardness testing device for micro and macro ranges


dunkermotor

INSIGHTS

DUNKERMOTOREN CELEBRATES ITS 70TH ANNIVERSARY

It is now 70 years since Christian Dunker founded his own workbench in Bad Godesberg in the adjoining room of his parents' carpentry. Those were the beginnings of Dunkermotoren - today, a company with over 1,300 employees, three locations and a turnover of € 239.2 million in 2019.

The anniversary year 2020 will probably go down in the history of the company as a year of mixed feelings. The challenges around the COVID-19 - the shutdown of the whole public life, lets look back. We want to do that independently of this year. Because despite all circumstances, we will celebrate the year 2020. 70 years of Dunkermotoren - many developments, new motor concepts, anecdotes from former times. A company that is still very much a family business today - our Dunker Family.

Four years after the foundation, Christian Dunker asks for a branch office in Bonndorf in the Black Forest, which is still the companys headquarters. Since the death of Christian Dunker, who died in a traffic accident in 1966, the company has repeatedly belonged to different groups. The time under the company SEL (Standard Electric Lorenz), later Alcatel, which lasted a total of 41 years, was a formative influence. Since 2012, Dunkermotoren has been part of the American technology group AMETEK.

Over the past 70 years, there have been some groundbreaking developments which enables the company to perform as it does today. For example, the development of the planetary gear series in 1977, the first 4-phase brushless DC motor in 1985 or the first brushless DC motors with integrated electronics in 1999. In 2005, Dunkermotoren introduced the first BLDC motor with integrated PLC functionality. The integrated CANopen interface paves the way for the approaches discussed today around the topic of Smart Factory. With the introduction of the Motor Control Platform in 2018, further important steps towards digitalization and modularity for integrated electronics are taken. A principle that Dunkermotoren has been successfully implementing for its drive combinations for many years. Thus, various drive combinations consisting of motor, gear, electronics, brake and encoder are available for a motor. In total, there are approximately 27 million configurations in 2020.

Fun Fact: In 70 years of company history, only three consumer products have been manufactured - a living room table adjuster, the ski edge sander and the electric granny. The idea for the development of the electric granny (1956/ 57) was born from the constant crying child of one of our employees - babysitters wanted. With the electric granny, a constant rocking back and forth of the stroller was achieved, which lulled the child into a peaceful sleep. Dunkermotoren was probably far ahead of its time with this product. While similar products are available on the market today, the electric granny was more of a slow seller in those days. The same was true of the development of the ski edge grinder, which came at a time (1979/80) when Dunkermotoren was in a very poor economic position. However, the promising product did not achieve the desired sales figures, even though there was a seemingly brilliant idea behind it. An adapter on the ski edge grinder for the 12-volt plug in the car should enable skiers to grind their ski edges individually and mobilely (without a workshop) shortly before departure. Unfortunately, the implementation of the product itself was probably less successful. In the seventieth year of our company's history, we also extend a warm welcome to our colleagues from our sister company MAE. Through the closer cooperation since the beginning of the year, we will continue growing together with MAE, will have a stronger market presence and will offer our customers an even more comprehensive modular portfolio. Our investments in the future, the support and trust of our parent company AMETEK, as well as the entire workforce of Dunkermotoren and MAE, are the best basis to continue to grow.

We look forward to another 70 years of Dunkermotoren with you at our side.

Author: Janina Dietsche I
Public Relations

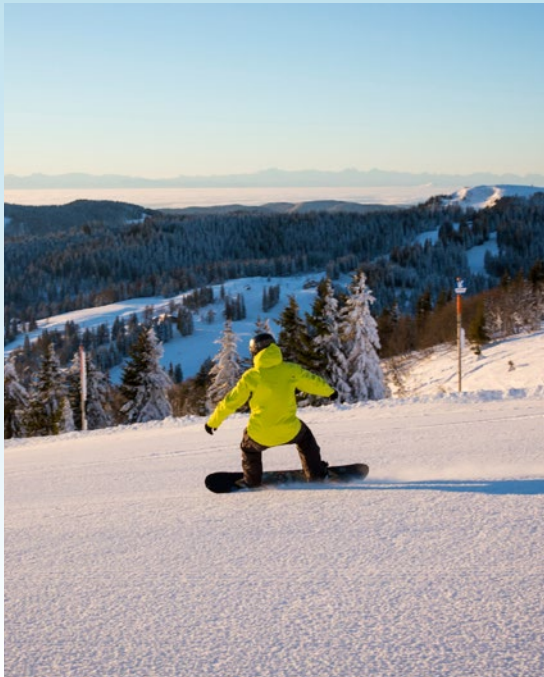
LOCATIONS

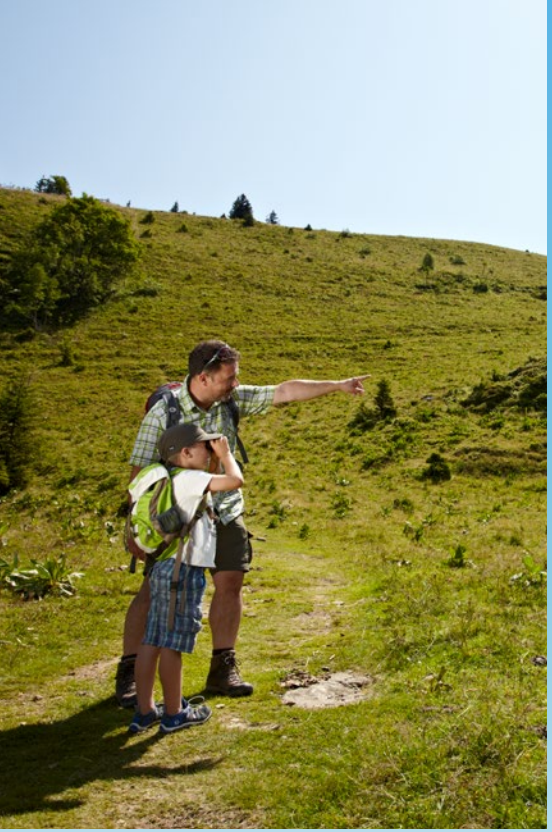
THE FELDBERG - PARADISE FOR HIKERS, MOUNTAIN BIKERS AND BLACK FOREST LOVERS

The climatic health resort Feldberg includes the highest peak of the Black Forest: the 1493 meter high Feldberg. In addition to the sporting activities, there are many sights and excursion destinations available through the year. Especially popular are the hiking and mountain bike trails as well as various winter sports. With only a 30-minute drive, this leisure paradise is located not far from Dunkermotoren's headquarters.

WINTER WORLD IN THE UPPER BLACK FOREST – THE FELDBERG SKI AREA

In winter, the Feldberg is considered the largest and oldest winter protection area in Baden-Württemberg. The Feldberg lift association is a merger of several ski areas in the region. Whether beginners, advanced or sporty skiers: With over 30 lifts, every age group and people from different sport levels will be satisfied. Since around 20 of the 63 kilometres are covered with artificial snow, winter fun is guaranteed even if the winter in the Black Forest has less snow than usual. The longest piste in the ski area is the Rothaus run. It starts at Seebuck and runs for about three kilometres. The FIS World Cup run is one of the most difficult runs. With the possibility of floodlighting, the lift association also offers working people the opportunity to do a few more runs in the evening. The Feldberg scores not only with ski slopes, but also with many other winter sports possibilities. Alpine skiing, cross-country skiing, tobogganing, snowboarding, ski-kiting and snowshoe hiking are possible in all degrees of difficulty. For ice sports fans the Feldberghalle in Altglashütten or the ice stadium in Titisee, which is about 15 kilometres away, offers possibilities for ice skating. Since winter sports are known to make you particularly hungry, you will find numerous huts, restaurants and farm taverns on the Feldberg for refreshment and a cosy get-together. With the après-ski locations with umbrella bars, sun terraces and music, hut fun is guaranteed for young and old even after the last descent.





FACTS ABOUT
THE FELDBERG

Height: 1493 m
Location: South-west Baden-Württemberg
Mountains: Black Forest
Average temperature: 3.9 °C
Special features: Highest mountain in Germany outside of the Alps

MOUNTAIN BIKING AND HIKING

However, the Feldberg region is not only known for winter sports. Also in summer there is no lack of leisure activities. Mountain bikers, as well as hikers like to meet at the Feldberg to pursue their favorite sport. Mountain bike tours are ideal for enjoying the beautiful landscape of the Black Forest. Altogether 144 varied mountain bike tours are available. There are also various hiking trails that offer what your heart desires: rustic forests, wide meadows, bubbling streams and small waterfalls. In addition, there is an impressive view over villages, forests and landscapes of the Black Forest from the Feldberg. From circular paths to hut hikes to routes specially designed for children, everything is represented on the Feldberg. Especially great is the stop at the Raimartihof, as it is only 500 meters away from the Feldsee. The Feldsee can only be reached via various hiking and mountain bike trails and is not accessible by car. Mountain biking as well as hiking offers different degrees of difficulty, which make it possible for everyone to have fun at the Feldberg.

Further sports and wellness offers around the Feldberg make the region an unforgettable experience for holidaymakers, sportsmen and families.

Author: Janina Dietsche I
Public Relations

PARTIAL DISCHARGE OF ELECTRIC DRIVE SYSTEMS

Due to increasing energy efficiency measures for equipment and control systems of electrical drives, switch-mode power supplies and frequency converters are increasingly used. Due to the converters there are higher voltage peaks which can lead to partial discharges and thus significantly shorten the service life of electrical machines. Partial discharge is not a continuous process. As the name implies, the electrical breakdown is not complete, but the discharge is only partial due to bridging the insulation. Only if a certain voltage is exceeded it comes to first discharges which stops again after a hysteresis at reduces voltage. The causes and the development of the partial discharge depend very much on the type of dielectric or insulating medium and the structural design of the insulation. Especially inhomogeneities in the insulation structure caused by foreign substances, impurities and gas cavities in the manufacturing process can favour partial discharges. Even in operating conditions, for example due to mechanical and temperature-dependent influences, deformations and vibrations, partial discharges can occur in the insulation due to the applied voltage.

The increasing demands on solid insulation systems of electronic and electrical components or equipment with compact design and with increasing switching frequencies of semiconductors require the use of insulation materials and composite materials that are free of partial discharges as well as resistant to partial discharges. This applies in particular to electrical components in variable-speed drives. The enamelled wire insulations of drives are stressed with twice the DC link voltage. One of the causes of the damaging voltage rise is the superposition of the reflecting voltage wave with the supply voltage due to the difference in impedance between cable and motor. The rectangular operating voltage with high switching frequencies produces high peak levels and steep rising edges, which together lead to the generation of partial discharges and accelerated aging of insulation systems. Partial discharge measurement technology and diagnostics are also playing an increasingly important role in monitoring product quality during production by means of type and routine testing and for estimating the service life of insulation systems. According to IEC 60270 and VDE 0434, respectively, partial discharge (PD) is defined as follows: "Locally confined electrical discharge which only partially bridges the insulation between conductors and which can but need not occur adjacent to a conductor" [1].

For quality control of the insulation system of electronic or electrical components and systems, short-term PD measurements can be used as non-destructive testing methods. Partial discharges can also occur in low-voltage applications, especially in electric motors. These are mainly internal partial discharges (gas discharges surrounded by a solid insulating material), which cause accelerated aging and, thus, weakening or failure of the insulation system due to the continuous decomposition of the insulation material.
The following three conditions must be met to generate partial discharges:

- A sufficiently high electric field strength to cause ionization
- A start electron must be present
- A feedback mechanism that maintains the avalanche effect

A partial discharge in a gaseous medium requires a lower voltage compared to a liquid or a solid foreign inclusion. Thus, these gas cavities are the most likely cause of insulation destruction. A tree-like structure is formed in the insulation material from an existing cavity, which continues to grow under the influence of the electric field and the discharges. These branches increase the conductivity and lead to a progressive destruction of the dielectric, as shown in the following figure.

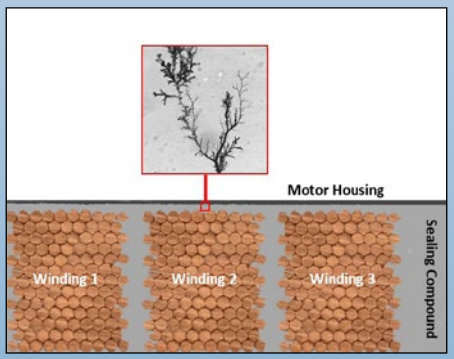


Figure 1: A partial discharge in a gaseous medium requires a lower voltage compared to a liquid or a solid foreign inclusion.

The occurring partial discharge is a physical quantity which can be measured with the help of different measuring methods. In the classic high-voltage test with alternating voltage, only typical breakdowns between the damaged conductor and the motor housing are considered. Faulty insulation is therefore not detected by the high-voltage and surge voltage test. The partial discharge measurement is able to detect insulation weaknesses. As already mentioned, partial discharge occurs in places where there are very high voltage differences.

However, the discharge of a cavity can also lead to several discharge structures (fingers). This depends on the geometry, field distribution, permittivity and other factors. The cavity discharges take place at the greatest voltage change. The consequence of this partial discharge is a slow but continuous destruction of the still functional insulation. This continuous enlargement of the weak spot inevitably leads to a complete breakdown of the electrical machine and thus to its destruction.

Partial discharges play an important role as a source of error in medium and high voltage systems and can affect almost any equipment or system in electrical power engineering. One of the most important elements in the design of electrical machines is the insulation of the windings to ensure fatigue resistance to partial discharges. Early detection in the development phase and the prevention of partial discharges is therefore essential and part of the quality of an electric drive to ensure a long service life.

Author: Dr. Bruno Basler I
Head of R&D Pre-Development

[1] IEC; DIN EN 60270 (VDE 0434):2016-11, Hochspannungs-Prüftechnik, Teilentladungsmessung, 2016.

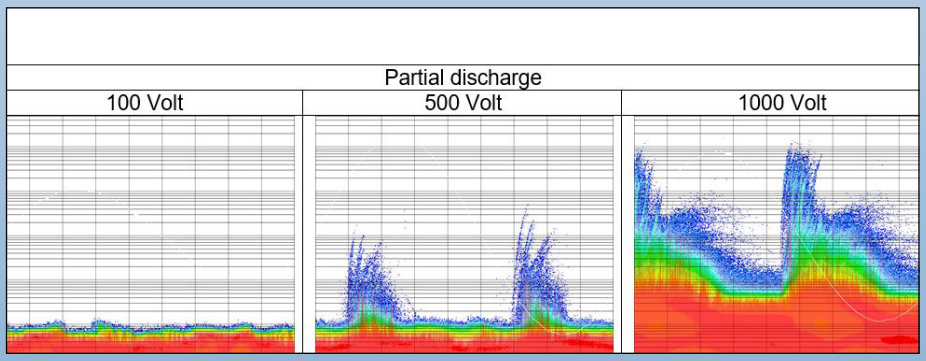


Figure 2: The discharge of a cavity can also lead to several discharge structures (fingers). This depends on the geometry, field distribution, permittivity and other factors.

DEVICE DATA - THE DNA OF THE ELECTRIC DRIVE

"Throttle up," "Brake up," "Turn left," "Wiper on," "Kill high beams," ... These are just a few of the basic functions of any motor vehicle. Some vehicles have special functions: "Panorama roof open" or "Seat heating level 3" or "Interior lighting: dark blue". All these functions are monitored and controlled in the vehicle by a software program in a control unit. Does this mean that a separate control software must be programmed for each individual vehicle? No. Very extensive software is installed, and the corresponding program parts are activated as soon as an additional device is installed in the vehicle. On the one hand, this significantly reduces the number of different software programs. On the other hand, it creates a very flexible system in which new extensions are simply added to the overall software and activated when required.

What has been established in the automotive industry also works for BG motors with integrated electronics since the introduction of the Motor Control Platform (MCP). For example, every dPro CO motor, regardless of size (BG 45, BG 66, BG 95, etc.,), whether with absolute encoder, with 24 V or 60 V winding or with additional SSI interface, has the same software program that controls the motor sequences.

This software program is called "Firmware". After the final test, it is installed on each motor. Thus, the motor already receives all possible functions. Now the individualization begins. Motors have different windings and thus different maximum motor currents, which may flow permanently or for a short time. Motors also have different encoders or brakes with different characteristics attached. These and many more individual data are uploaded to the motor. They are called device data, i.e. "device-specific data".

But what does the user gain from this? Users suddenly have not only the motor, but the complete drive in view. The device data not only contains motor-specific data, but also all information on attached encoders, gears, brakes, etc. In the previous motor generation, all parameters had to be set, such as the encoder resolution or the maximum current with which a certain motor may be operated and which is the transmission ratio of the attached gear unit. Previously, this information had to be read from the catalogue, data sheet or from the nameplate. A motor with MCP electronics has all this information stored and provides it at a glance. This means that a digital nameplate of the complete drive is available. This saves a lot

of time, especially during commissioning. Motor electronics, motor and attachments are already perfectly matched to each other ex-works.

Why should a user also have to deal with data such as maximum current, encoder resolution or gear ratio? A user would like to either execute a positioning task, call up a constant speed or a constant torque. He wants to see the electric drive as a whole and not just as individual parts that are screwed together. Device data is the putty that connects the individual parts to form a unit, making a complete drive from individual drive components.

But that's not all. For the engineers at Dunkermotoren, it was obvious to use the individual drive data even more to better control the accuracy of the motion sequences of drives: Every electronic component is subject to certain tolerances. An integrated current sensor measures an electrical current of 140 A perhaps as 139.8 A, whereas another sensor measures the same current as 141.1 A. During production of the motor electronics, this value can be determined very precisely and the measured value can be corrected by software. The correction factor is stored in the device data. This closes the circle to the motor vehicles. There, too, the motor parameters are fine-tuned after production to ensure that the vehicle works as effectively as possible.

With the device data, Dunkermotoren has paved the way away from rigid individual components to individual complete drives. For customers, the complete drive becomes on the one hand more transparent, and on the other hand even more individually adapted to its application. The device data is the DNA of the electric drive.

Author: Michael Burgert I
Product Manager BLDC Motors

SEGMENTS – HEALTHCARE

IMAGING ANALYSIS

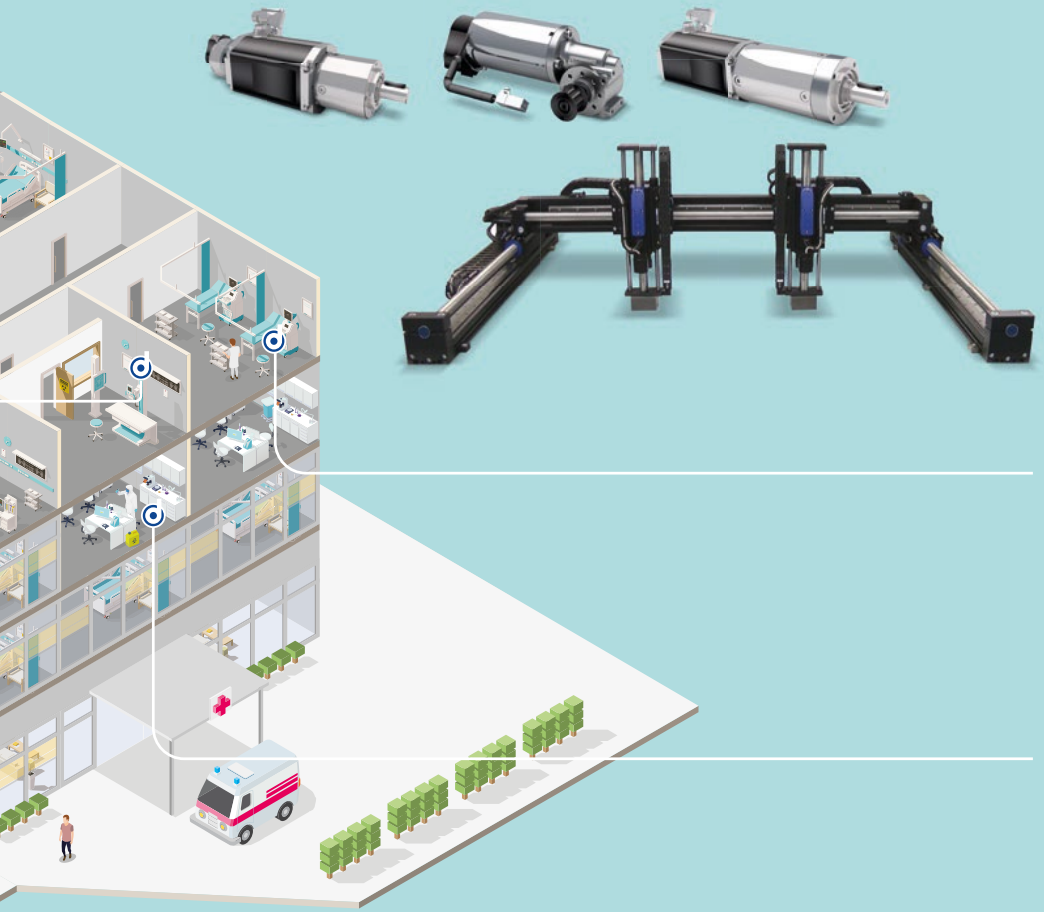
Imaging analysis refers to all applications that provide image data for diagnosis and targeted therapy. In addition to high and low adjustments, rotary movements and mobile applications must also be electrically driven. Dunkermotoren's motors offer customer-specific solutions for high torques in a small installation space, positioning accuracy and maximum flexibility.

PATIENT CARE

Patient handling systems mobilize patients safely and reliably. The electrically driven solutions relieve the hospital staff enormously. The requirements for reliability, self-locking and low-noise operation are reliably met by Dunkermotoren motor solutions.

OPERATING ROOM

A modern operating table must be very mobile in order to give the surgeon the best possible access to the patient. The motors for the various axes in the operating tables must therefore deliver high torques in the smallest possible installation space. In addition, the drives must work absolutely reliably in order to avoid failure during an operation or downtimes in the operating room. Smooth and low-noise operation are also common market requirements.



OUR VALUE PROPOSITION FOR YOU:

- High service life and cycle numbers
- Zero-error tolerance
- High resolution and good controllability
- Low-noise motors and gearboxes
- Optional integrated control electronics and bus interfaces

DIALYSIS CENTER

Pumps often assume an important function and are used in medical technology, for example in dialysis. The reliable and maintenance-free operation of the pumps is of great importance here. Due to the proximity to the patient, noise behavior is also extremely important.

LABORATORY & DIAGNOSTICS

In chemical analysis and the analysis of tissue and substances (e.g. blood), speed is required in addition to absolute precision. Dunkermotoren offers rotary motors (DC, BLDC) as well as linear motors with high dynamics and precision. This makes more efficient analysis possible.

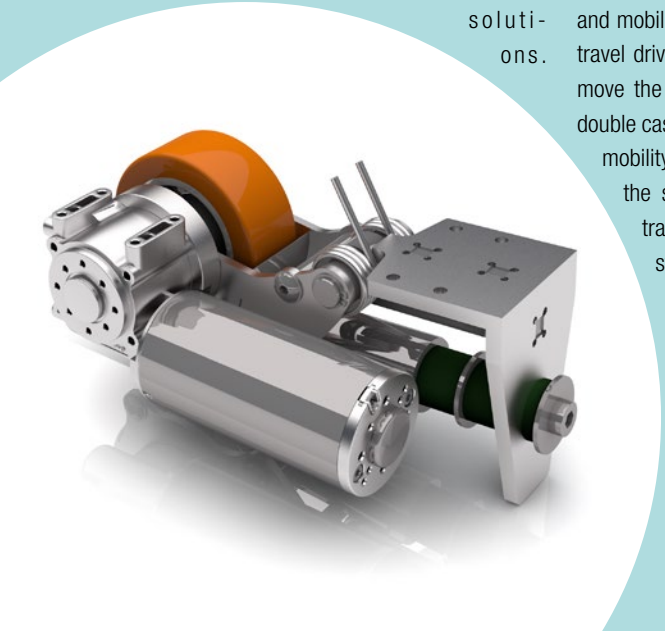
REHAB & THERAPY CENTER

Rehabilitation is a decisive milestone in the recovery of patients. Rehab is often supported by technical equipment. Some devices use an electric motor to support the movement sequences. The motors are exposed to radial and axial forces due to disturbed movement sequences of the patient. These must be absorbed by the drive. In order not to disturb the patient during training, low noise is an absolute must.

HEALTHCARE

AWARD-WINNING DESIGN MEETS HIGHEST FUNCTIONALITY

University Hospital Emergency Room 7:35 p.m.: Traffic accident with an injured person. After the drive with the ambulance, the patient is brought directly to the operating room. Blessing in disguise applies to the patient, who is admitted to hospital with only a few complicated bone fractures instead of life-threatening injuries. Due to his body mass index over 30, the patient is transferred to bariatric surgery. This is aimed at the treatment of overweight patients. In order to meet the increased requirements in this area, the operating rooms in bariatric surgery are specially equipped. Particular importance is placed to the robustness of the devices and the relief of personnel during manual activities. The company Getinge offers requirements-oriented solutions.



175 years of experience in the development of operating tables are reflected in their products. One of these newly developed products is the Maquet Meera operating table. It is a mobile operating table as a further development of the already established products Maquet Alphastar PRO and Maquet Betastar. During the development, Getinge incorporated the advantages of the predecessor models into the Maquet Meera product. Maquet Meera combines highest patient comfort, user friendliness and economy.

The mobile operating table doesn't only convinces by its stability and extreme mobility, but also by its design. The Maquet Meera is one of the winners of the famous iF label. It won the iF DESIGN AWARD 2016 in the category Medicine / Healthcare. For 60 years, the iF DESIGN AWARD has been considered one of the world's most influential industrial design awards. With a maximum patient weight of 250 kg and a total load capacity of 454 kg, the operating table offers full stability and mobility. Getinge is focusing on an integrated travel drive for the implementation of mobility. To move the table, it is raised electrically. The four double castors allow the operating table maximum mobility in every direction. In combination with the sensor drive, the table with integrated travel drive can be moved precisely and steplessly - forwards and backwards. In the narrow corridors and corridors of an operating wing, Maquet Meera offers users ergonomic and safe patient transport. Sensor drive creates safety in the operating room and relieves the hospital staff as the table does no longer need to be moved manually. By retracting the castors, the electrical detection sets the operating table foot completely on the ground.

The central component of the sensor drive is a motor solution from Dunkermotoren. As a manufacturer of electrical drive technology, Dunkermotoren distinguishes itself by its modular construction system. In a specification, the customer defines the requirements with regard to installation space, speed and torque for the application. With the modular system, Dunkermotoren has the option of implementing a customer-specific and economically attractive motor solution when selecting the right motor, gearbox, encoder and brake.

At Getinge and the mobile drive unit, Dunkermotoren is going one step further. Dunkermotoren becomes a system supplier who has optimized and further developed the complete drive unit in close cooperation with Getinge.

In addition to the drive combination including the brush type DC motor GR 63 and the worm gearbox SG 80, the supply scope of the complete system also includes the assembly of the roller, springs, cylinders and other mechanical components. Nevertheless, the design authority of the entire assembly is still at Getinge.

The challenge in this drive unit project was to meet the increased requirements of the medical market. Such a project can only be realized with a partnership-based and cross-company cooperation with regard to qualification and validation within the various areas of responsibility. The re-

HEALTHCARE

quirement for supplier optimization in the medical market can be implemented with the expansion to a system supplier. For Getinge, the motivation is reducing the supplier base and shortening the supply chain. This significantly reduces the involved effort in supplier management for the OEM. In order to evolve from a component supplier to a system supplier, some organizational, process and production-related adjustments are necessary. Dunkermotoren has gladly accepted and implemented this challenge.

The development of Dunkermotoren to a system supplier is a completely new practical experience and knowledge. To date, the motor manufacturer has only had an insight into the technical requirements of the application. By expanding the scope of supply, Dunkermotoren can now incorporate the design and selection of the drive into the overall system at an early stage. In addition, the interface between the drive and the application can be optimized. Another positive aspect is also direct communication between the individual departments and the customer and supplier. This allows a reduced time for the development of new products and a faster realization of product optimizations.

First positive experiences with the implementation of a project as a system supplier could be gained with the operating table Maquet Meera. Further projects are currently being implemented with well-known customers in the medical technology sector. Previously, the supplier's focus was more on the selection of the drive in relation to the application. This has now changed with the stronger integration into the customer's overall system. The additional information on the Maquet Meera product has led to a wider perspective and thus a better understanding of the needs of users and patients.

The accident patient from obesity surgery was optimally treated with the product Maquet Meera. The flexible travel drive was an important support. As a system supplier, Dunkermotoren was also able to make a small contribution to the patient's recovery.

In the field of medical technology, Dunkermotoren has established itself in numerous fields of applications. In addition to operating tables, MRT/CT applications, laboratory applications, pumps, X-ray applications and rehabilitation equipment are among the main applications.

Authors: Holger Tröndle, Axel Winterhalter I both Key Account Manager Healthcare & Laboratory, Janina Dietsche I Public Relations

HEALTHCARE

LINEAR MOTORS - THE PERFECT MOTOR SOLUTION FOR THE DIAGNOSTICS MARKET

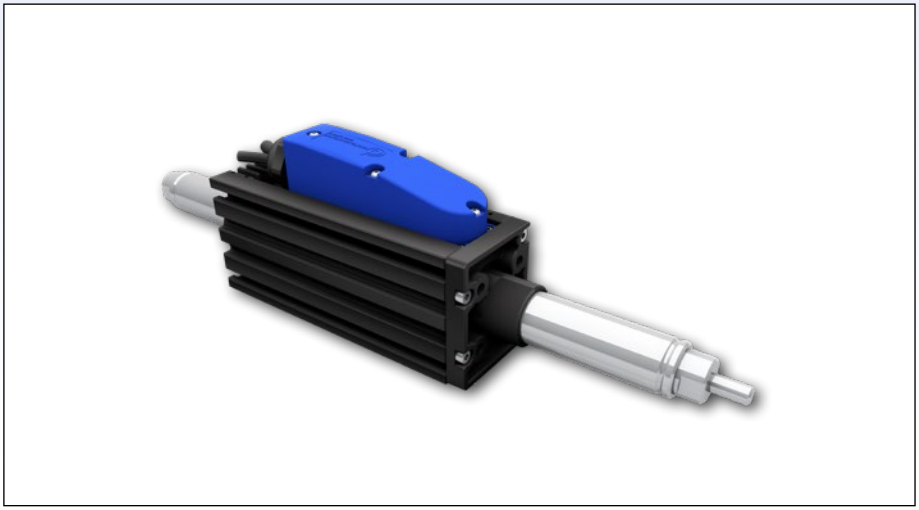
In the medical diagnostics market, electric motors are used in a variety of applications - from simple material handling to complex pick & place applications. The type of medium can vary, from liquids of varying viscosity to solids such as human or animal tissue. This also results in the enormous range of product variations of electric motors for controlling medical devices. Integrated in various applications, electric motors facilitate the daily work in the medical field.

Each individual application brings with it a multitude of requirements that must be taken into account in the specifications for the design of a diagnostic machine. For example, smooth running, good controllability, high accuracy and service life, freedom from wear and maintenance are indispensable criteria for manufacturers of diagnostic machines. Particularly in the medical/ diagnostics sector, it is of enormous importance to always be at the cutting edge of technology in order to present the most innovative solutions to doctors and patients. This causes designers to always be on the lookout for new solutions that will bring about an improvement in the above-mentioned criteria. With each subsequent generation of equipment, the reliability of the overall system is improved and the machine performance is increased. Especially the increasing number of tests, for example blood counts, inevitably leads to an automation of the test equipment. Large laboratories are already looking for compact, modular test cells that can be expanded with little effort even if demand continues to grow. Another important criterion is fast diagnosis and transmission of test results to the doctor and patient.

Dunkermotoren presents a unique solution for sample handling. With the electric linear motors (ServoTubes), Dunkermotoren offers the market a solution that is very flexible in its application. From single axes to multi-axis systems, highly dynamic and flexible linear modules are developed especially for the customer's machine. The linear motors of the ServoTube series impress with their high acceleration and speed, which clearly sets them apart from other linear module technologies, such as spindle or belt systems. These characteristics combined with a high-resolution linear encoder result in positioning accuracies of less than 0.01 mm. However, if the accuracy requirements are in the 0.1 mm range, this can be achieved with the standard integrated SIN/ COS encoder, without an additional linear encoder.

Each individual ServoTube design offers a high degree of precision and a long service life - depending on the application, mileages of more than 50,000 km can be achieved. With very little maintenance and extreme reliability, the ServoTubes convince all along the line.

The 3-phase motor with the integrated 1 Vss SIN/ COS feedback can be connected to numerous ser-



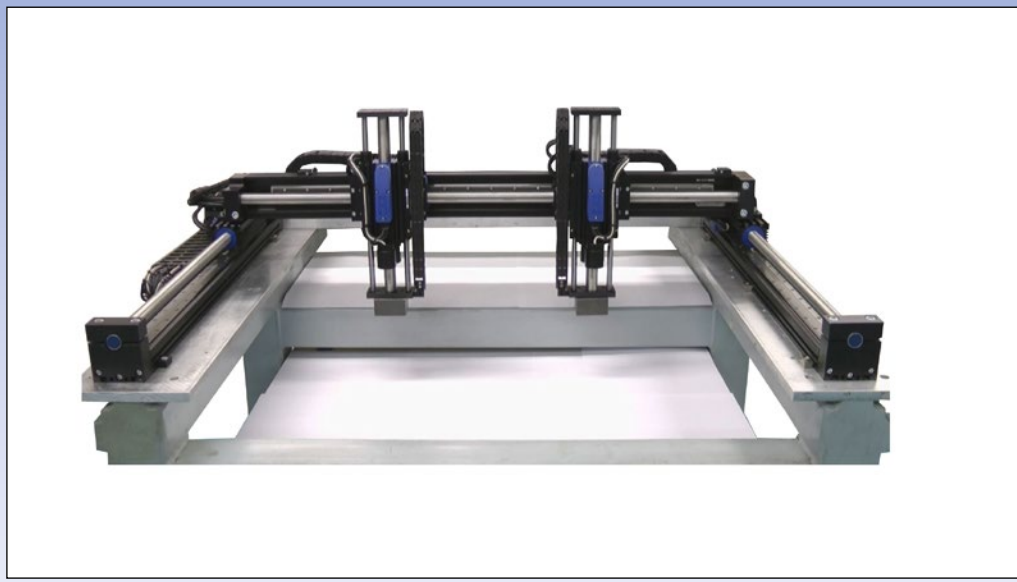
A linear motor of the ServoTube series is available in various configurations: as actuator, pick & place actuator or as a module.

vo controllers from various well-known manufacturers. The connection principle of the ServoTubes is comparable to that of a standard rotary servo motor with encoder system. Therefore, integration into the control concept of the machine manufacturer is also simple and less time-consuming. We have created a suitable how-to video for this purpose, which you can watch on our homepage or our Dunkermotoren social media channels.

Dunkermotoren offers a perfectly matched linear motor package for the ServoTubes 25 and 38 with the DME 230x4 servo controller series. The controller's hardware and settings are matched to the linear motors and make commissioning even easier. The customer's control takes place in two ways. Either via one of the widely used bus systems (PROFINET, EtherCAT or CANopen) or digital signals (24 V inputs or outputs). If the latter is the case, the customer has the option of storing a sequence program in the controller. With a maximum of 500 programming lines, complex motion profiles can be implemented without a higher-level bus system.

Even the use of a single linear motor for fast applications offers the customer enormous advantages - especially in comparison to the pneumatic solution, since the initial costs are amortized within a short time due to the increased machine performance and the lower operating costs.

However, if the rod-guided direct motors are used within a multi-axis system, two linear motors can also perform highly complex movements



X, YY, ZZ multi-axis system with two independently moving Y/Z axes.

independently of each other. A gantry is usually constructed as an XYY, or XYYZ variant. With Dunkermotoren's linear motor multi-axis systems, several motors can be moved independently from each other on one axis. With this type of multi-axis system, higher machine performance is achieved than with typical Pick & Place robots.

By using a programmed S-ramp it is possible for the ServoTube motors to evenly move even very sensitive products without causing the slightest damage to the samples or components. Not even if these movements are simultaneous and under highest dynamics. If the linear motors are used as a Z-axis, the question often arises how they react in a currentless state. In most cases, the magnetic rod is not held and falls down, so to speak. For these applications, ServoTubes from Dunkermotoren have integrated a holding brake for the 25 size. The wrap spring brake on the STA25 or XTR25 holds loads up to 20 kg. For larger loads, there is the option of using another linear product (CASM cylinder) from Dunkermotoren. The CASM series (electric lifting cylinders) is also suitable as a perfect 1:1 replacement for pneumatic cylinders in sizes 32 - 63.

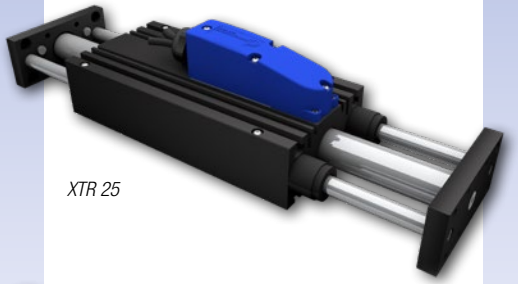
In conclusion, motors of the ServoTube series, regardless of their design, increase the machine performance of a diagnostic machine without sacrificing the flexibility and function of previously used technologies. In the future, fully automatic

HEALTHCARE

Pick & Place portals will increasingly find their way into large laboratories, if only because of the increased demand for examinations. The topic of security in companies worldwide is of great importance and should therefore not be neglected. Particularly in the case of hazardous media for laboratory personnel, consideration should be given to having the handling and analysis tasks carried out by a multi-axis system.

Author: Matthias Utz I
Product Manager Linear Systems

STA 11



XTR 25

XM 38

SA 38

PRODUCTS

DUNKERMOTOREN ADAPTS PRODUCT RANGE TO THE NEW REQUIREMENTS OF INTRALOGISTICS

In intralogistics, the importance of self-guided vehicles is increasing. Not only the traditional manufacturers, but also users or rather suppliers of operating equipment are designing new battery-powered solutions. The technical solutions are as diverse as the players in the market. To meet these requirements, Dunkermotoren relies on its existing portfolio of motors, encoders, controllers and gearboxes. But new system components have also been added.

Both in the AGVs (AutomatedGuidedVehicle) and especially in the AGCs (AutomatedGuidedCart), the vehicle width is kept as small as possible. The frame height is also limited. The shortest and slimmest possible drives are therefore required to drive the wheels.

NEW TRANSMISSION SERIES:

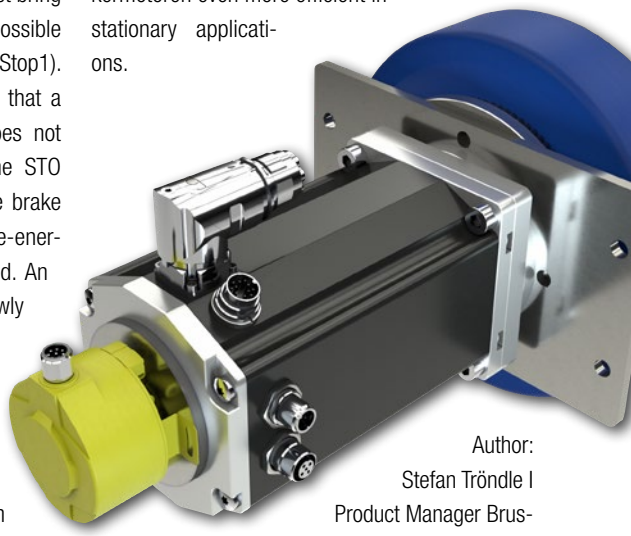
With the new NG (hub gearbox) series, the gearbox is putting into the wheel hub. Thus, the overall drive length is reduced by the length which is, otherwise, added by mounting a gearbox. The hub gears of Dunkermotoren take up the radial forces acting on the wheel directly on the gear housing. This means there are no lateral forces for the bearing. High loads can be absorbed cost-effectively and compactly. For the lighter AGCs, Dunkermotoren engineers consider the NG 250, which can carry 250 kg, to be ideal. In the area of AGVs, the NG 500 with 500 kg load capacity has proven to be the common size. Assuming four load-bearing wheels, the loaded vehicle can weigh up to 2,000 kg.

SMART AND SAFE:

Imagine a driverless vehicle driving at 6 km/h through the factory hall and an employee moving carelessly into the driveway? To ensure such an encounter to end painlessly, a special focus is set on safety. The AGV must therefore not only know its way and detect stationary obstacles, but also react correctly to moving people. For us as a manufacturer of drive technology, this is where the demand for STO (SafeTorqueOff) comes from. In such a case, the vehicle control system must bring the vehicle to a standstill in the shortest possible time. This is known as safe stop SS1 (SafeStop1). This would also be activated in the event that a component relevant to the movement does not function properly. The motor executes the STO triggered by the vehicle controls. The safe brake integrated in the drive (brake activated in de-energized state) engages and safety is ensured. An example of a product with STO is the newly developed smart controller BGE 5510 dPro. The encoders for speed feedback are very reliable but are not sufficient for the requirements of AGVs. The modular concept of Dunkermotoren makes it possible to mount a redundant encoder, e.g. from the RE 30 series, at the rear end of the motor in addition to the one integrated in the motor. Alternatively, so-called "safe encoders" can also be accessed. The safe control of the AGV / AGC can then reliably evaluate the encoder signals.

FACTORY OF THE FUTURE:

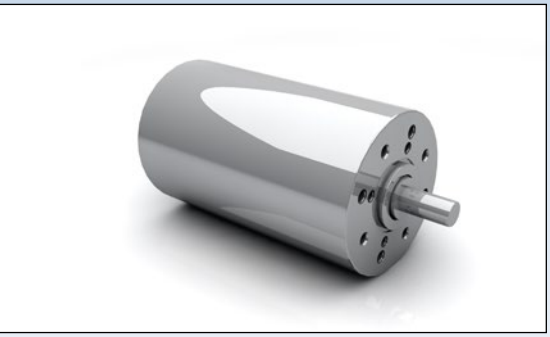
With a view to the giant factories currently under construction, which are also circulating under the name Giga-Factory, the demands on AGVs are likely to continue to rise, especially since ever greater distances have to be covered using batteries. With the highly efficient DC drive technology, coupled with the brilliant efficiency of the hub gears, Dunkermotoren is well prepared for this. Looking further into the future, factories based entirely on direct current are being built under the banner of "DC industries". This eliminates the need to convert AC to DC, making the DC technology of Dunkermotoren even more efficient in stationary applications.



Author:
Stefan Tröndle I
Product Manager Brushed DC-Motors and Gearboxes

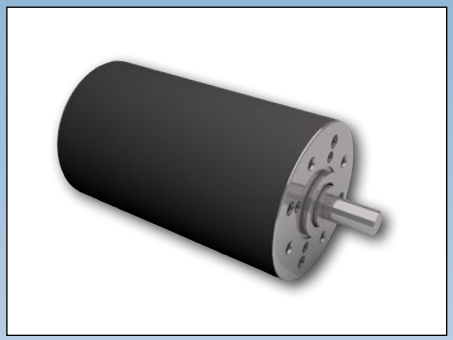
DUNKERMOTOREN FURTHER DEVELOPS THE PRODUCT LINE OF BRUSHED DC MOTORS

After the GR 80 series had already been optimized in 2019, the GR 42, GR 53 and GR 63 series now follow. In the future, they will offer up to 10% more continuous torque and a more corrosion-resistant surface. In Dunkermotoren's case, the designation GR stands for brushed DC motors with permanent magnetic excitation.



GR 80 in silver housing

In order to improve heat dissipation, a black-coated housing is used. The current housing is galvanized and the colour is silver. By using the black housing tube, an increase in performance



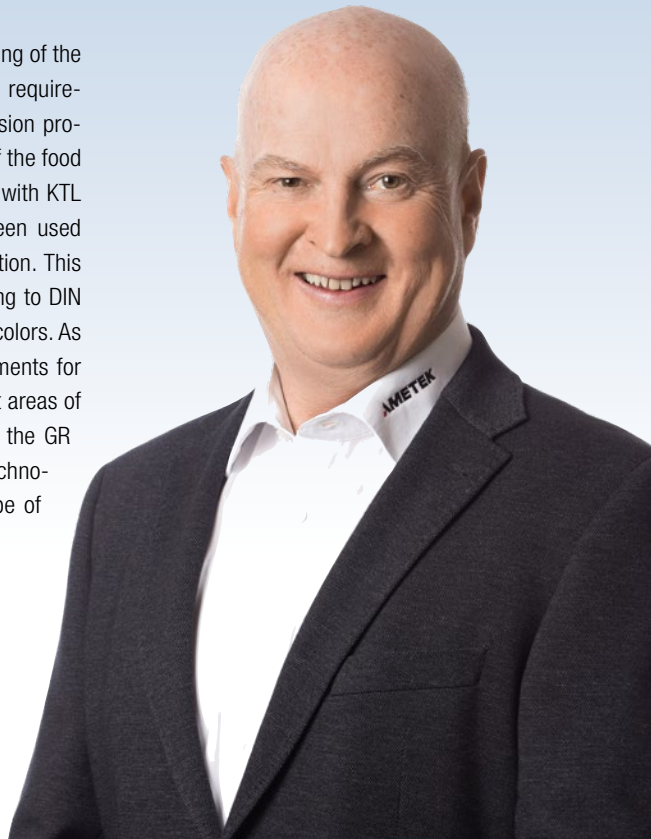
GR 80 in black housing

is achieved without changing the course of the motor characteristic curve. Only the nominal point is shifted. Thus, a higher torque is possible and the resulting output power increases.

With the previous galvanic surface coating of the GR 80, it was not possible to meet the requirements of the railway industry for corrosion protection and the hygiene requirements of the food industry. For some time now, housings with KTL coating (cathodic dip coating) have been used for such applications as a special solution. This has passed the salt spray test according to DIN EN ISO 9227 for 192 hours with flying colors. As a result of the conversion, the requirements for corrosion protection and in the different areas of hygiene will be covered by all sizes of the GR series in future. In order to make this technology available to all customers, the type of coating will be transferred to the generic products and successively presented accordingly in the sales documents.

As a result of this measure, the GR product line is perfectly equipped for the future and should continue to enjoy increasing popularity among our customers. All GR motors with nominal voltages ≤ 60 V are affected by the change. The change will be cost-neutral for Dunkermotoren customers.

Author: Stefan Tröndle I
Product Manager Brushed
DC-Motors and
Gearboxes



IMPRINT

ISSUE 2020:

PUBLISHER: ..... Dunkermotoren GmbH
Bonndorf im Schwarzwald, Germany
Phone: +49 (0) 7703 / 930-0
Fax: +49 (0) 7703 / 930-102
E-Mail: info@dunkermotoren.com
www.dunkermotoren.com

PROJECT MANAGEMENT AND EDITING: ..... Tobias Pfendler,
Head of Product Strategy & Marketing
Janina Dietsche,
Live Communication & PR
Dunkermotoren GmbH

DESIGN: ..... Ann-Kathrin Kopf,
Creative & Design Consultant
Dunkermotoren GmbH

FREQUENCY OF PUBLICATION: ..... Once per Year, German/ English

PICTURE CREDITS AND COPYRIGHT:

PAGE 1: ..... © stock.adobe.com, Author: WrightStudio
PAGE 36: ..... © Hochschwarzwald Tourismus GmbH
PAGE 37: ..... © Hochschwarzwald Tourismus GmbH

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