

NEWSLETTER

English version | 06/2023

**BATTERY
SWAPPING
SOLUTION**
by GETEC



START OF A NEW ERA

In recent years, GETEC Getriebe Technik GmbH has made massive efforts to develop new product solutions. The demands from politics for the abolition of the combustion engine require smart ideas so that we can continue to move around as we are used to. In other words, we must concentrate on getting around and not have to deal with the planning of longer forced breaks due to necessary charging cycles.

**AMONG OTHER THINGS,
THERE IS THE VEHICLE CONTROL
UNIT (VCU) NEWLY DEVELOPED BY GETEC,
AS WELL AS A RANGE EXTENDER.**

The proprietary VCU allows free programming by our development engineers. It also opens the door to the further development of smart functions. The range extender is playing an increasingly important role in the electrification of powertrains. Wherever it is not technically or economically feasible to install larger batteries, the range extender is a very good alternative.

Furthermore, we are looking at the topic of „changing instead of charging“ and are now proud to offer a solution in this segment as well. The idea is so simple and everybody knows it: If the battery of the remote controlled car or the cordless screwdriver is empty, it is exchanged and it goes on. The empty battery is then charged at rest. We now offer this solution especially for small logistics fleets. One battery changing station can serve up to 100 light duty trucks in the 4.5t segment.

The advantages are obvious:

- ▶ Batteries can be dimensioned smaller – **Reduces costs**
- ▶ Vehicle downtime is minimized – **Availability is increased**
- ▶ Batteries can be charged more gentle – **Increased Lifetime**

In order to better support our customers on their way to eMobility, we are constantly expanding our test capacities.

I hope you enjoy reading this newsletter and I am looking forward to welcoming you to our company!

Joachim Trumpff
General Manager

GETEC'S BATTERY SWAPPING SOLUTION

Autor: Mr. Sven Steinwascher
CTO



Driving range is crucial for any electric vehicle. For passenger vehicles the driving range is linked mainly to the usage comfort, e.g. less time for a trip due to less charging stops.

For commercial vehicles the range is especially a cost factor:

- any stop for charging reduces the daily usage time of the vehicle,
- the application of super chargers requires high investments into infrastructure and vehicle

Within this boundary GETEC Getriebe Technik GmbH has developed two technical solutions:

- range extender electric vehicle (REEV) and
- battery swapping electric vehicle

The first solution is the range extension by applying an internal combustion engine paired with a generator to recharge the battery. This solution can be easily refitted to battery electric vehicle applications – the overall system control can be handled by GETEC's VCU solution. This solution was introduced in GETEC's 2022 newsletter already.

The second solution is the decoupling of the charging functionality from the vehicle. This is realized by exchanging the empty battery for a full one (battery swapping) and charging in a dedicated charging station. The full development of customized vehicles, batteries and swapping stations from hardware, electronic and control side can be conducted or be supported by our highly experienced engineers.

GETEC focusses especially on the cost efficiency, user friendliness and safety. In detail the development involves the following features:

- vehicle-based battery holding / locking structure
- battery structure which supports the swapping feature
- rail guided vehicle (RGV) which releases / fixes the battery / moves it between station & vehicle
- stacker which handles the battery in the charging station
- battery charging devices

Overall, the technical solutions for the systems need to fulfill the technical requirements for installation space, swapping time, durability, NVH, energy consumption and cost. The following chapters will introduce the features in detail.

VEHICLE-BASED BATTERY HOLDING / LOCKING STRUCTURE

Generally, the battery fixing of a battery swapping application must be designed to support the easy and reliable positioning of the battery, the reliable and durable fixing especially in bad road conditions or in case of high loads during crash and self-locking as well as easy release.

Most battery swapping solutions in the market introduced a battery swapping from the bottom of the vehicle – the reason for this is that carmakers must apply the battery swapping to series vehicles in which normally the battery is fixed from below.

Some light and medium duty vehicle solutions introduced the battery swapping from both sides of the vehicle which requires less changes on existing vehicle structure but has significant disadvantages for the battery swapping station design: either the station needs to access the vehicle from both sides which requires two RGVs, two stackers and two charging racks or the vehicle has to be turned by 180 deg within the process.

Heavy duty vehicle solutions typically swap the battery from the top via a kind of lifting system. This solution is highly valid for vehicles in which the engine package of conventional vehicles or the driver rest area is converted to the package for the swapping battery.

AFTER SEVERAL CONCEPTIONS AND CONSIDERING FULL SCOPE SUPPLY (VEHICLE AND STATION) GETEC ENGINEERS DECIDED FOR THE INTRODUCTION OF A ONE-SIDED BATTERY SWAPPING.

The benefit of this one-sided swapping solution for the station design is that only one RGV is required. The battery will be guided in the vehicle by a rail system like a draw in a cupboard. GETEC applied a special fast locking connector for the high and low voltage connection of battery and vehicle system.

For the secure locking GETEC introduced a patented battery self-locking mechanism which has no vehicle-based actuation system. The unlocking of this solution is handled by the RGV.

BATTERY STRUCTURE

The battery design must support the battery swapping requirement. **GETEC specifically focused on the development and verification of the following features:**

- ▶ Self-carrying battery structure,
- ▶ Rollers supporting the battery movement in vehicle / in the station and
- ▶ fast locking connector for the high and low voltage connection.

The first battery application has a capacity of 80 kWh to support a driving range of around 300 km with one charge. Lithium battery modules have been carried over from reference applications to reduce development time and costs. The battery management system (BMS) has been customized to support the battery swapping.

RAIL GUIDED VEHICLE (RGV)

The RGV is the most complex system of the battery swapping station and has the following functions:

- ▶ positioning of the RGV vs. the vehicle in 3 main directions (x, y and z) as well as rotatory adjustment which is required to cope with the different loading conditions of the vehicle
- ▶ release the self-locking mechanism in the vehicle
- ▶ transfer the empty battery from vehicle to RGV
- ▶ transport the empty battery to the station
- ▶ support the transfer of the empty battery to the stacker
- ▶ support the transfer of the full battery to the stacker
- ▶ transport the full battery to the vehicle
- ▶ transfer the full battery from RGV to vehicle

Those functionalities have been realized by multiple actuators which are part of the RGV. The RGV itself has been designed to optimize the required space, low power / energy consumption for the actuation and moving, highest reliability and durability.



Wheel Adjustment in Swapping Station

STACKER

The stacker handles the battery in the charging station and has the following functions:

- ▶ transfer the empty battery from RGV to stacker,
- ▶ transport the empty battery to the designated charging slot,
- ▶ transfer the empty battery from stacker to the designated charging slot,
- ▶ transfer the full battery from charging slot to the stacker,
- ▶ transport the full battery to the RGV and
- ▶ transfer the full battery from stacker to RGV.

For maintenance or in case of critical issue of the battery the stacker additionally handles the transport of the concerned battery to a designed fire protected location.

BATTERY CHARGING DEVICES

For the battery charging GETEC has chosen for the first version of the station 15 charging slots. Each of the slots is linked to a 60 kW fast charger. With this configuration the station can supply every 4 minutes a fully charged battery, which is fitting to the swapping overall process timing incl. entry and exit of the vehicle. In case a battery needs to be charged urgently, two charging lines can be used in parallel to charge the battery with 120 kW.

GETEC also developed the related station master control which decides to optimal charging strategy for the batteries to supply sufficient state-of-charge to the next to be swapped battery. The master control also included functionalities for the swapping process itself, fire protection, billing and the important communication between vehicle and station.

GETEC HAS SUCCESSFULLY COMPLETED THE FULL DEVELOPMENT OF CUSTOMIZED VEHICLES, BATTERIES AND BATTERY SWAPPING STATIONS FROM HARDWARE, ELECTRONIC AND CONTROL SIDE AND CAN OFFER RELATED ENGINEERING SOLUTIONS OR SUPPORT TO OUR CUSTOMERS.

1. HOT POST

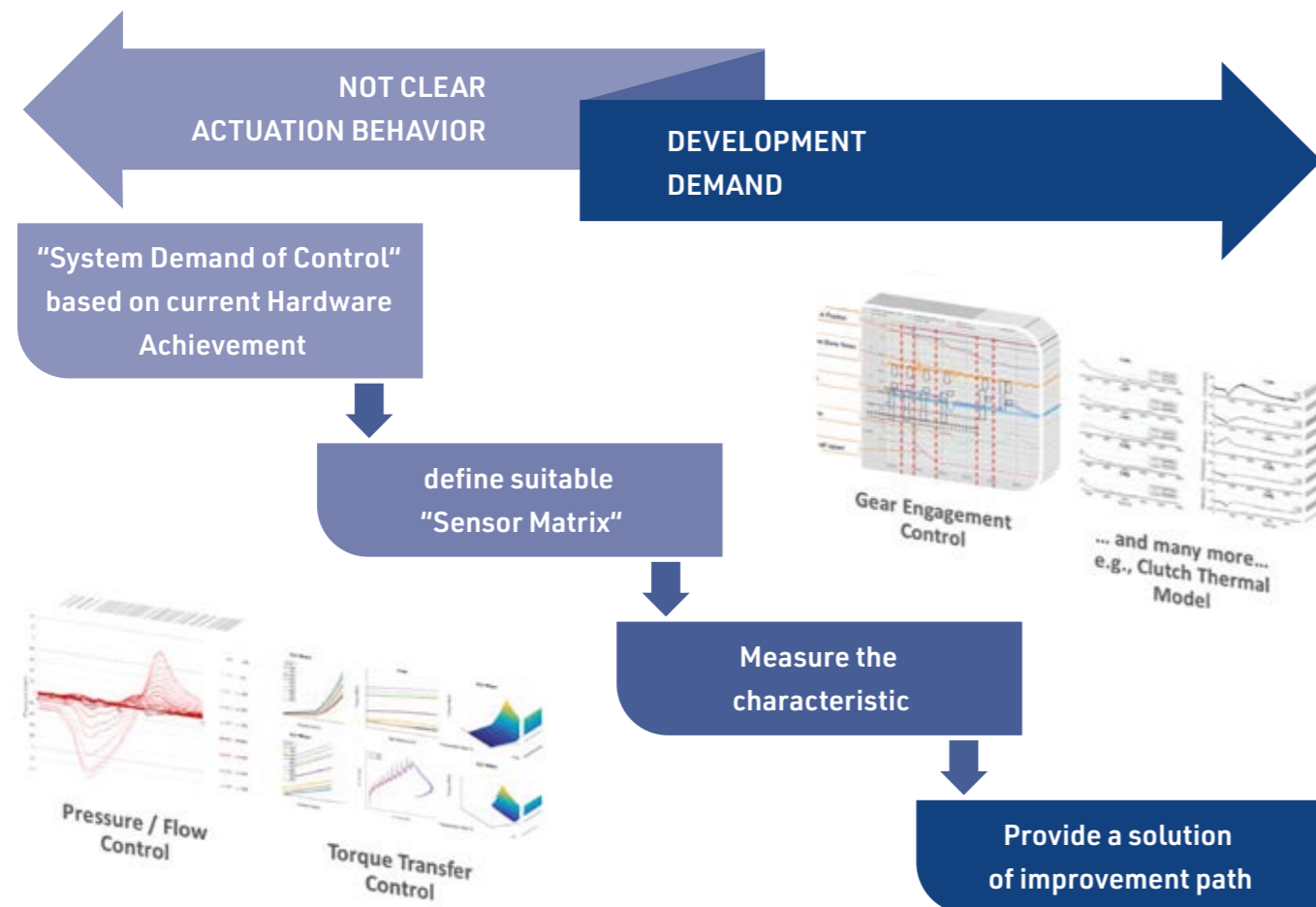
GETEC'S CONTROL OBJECT TESTING

The powertrain system attributes drivability, reliability, controllability and NVH are crucial for the market success. GETEC Getriebe Technik GmbH, as engineering and testing solution provider, focusses especially on the interaction between controls (control software, E/E) and mechanical hardware.

GETEC has successfully implemented the control object testing for multiple customers, products and attributes. Based on the control demand a sensor matrix is defined to visualize the control and system's reaction. This sensor matrix typically contains standard sensors like temperature, pressures, travel

etc. or more sophisticated telemetry systems to measure torque, temperatures, forces and travels. The visualization allows the detailed investigation of the characteristic incl. delays, overshoots, inaccuracies, hysteresis and so on. The aim is to develop a control or hardware solution to improve the concerned attributes.

Please contact us if you are facing NVH issues like gear engagement clonk, clutch judder, pressure vibrations or controllability issue like the clutch is not following the control demand and many more.



2. HOT POST

HOW GETEC GETRIEBE TECHNIK GMBH IS REVOLUTIONIZING HIGH-SPEED TESTING ON THE TESTBENCH!

GETEC is constantly pushing the boundaries of engineering innovation, and our latest breakthrough in high-speed testing for the automotive industry. Our cutting-edge testbench technology enables us to simulate extreme conditions and push drivetrain components to their limits, ensuring superior performance and durability in real-world applications.

With the state-of-the-art testbench capabilities, we can replicate speeds of up to 20,000 RPM, allowing us to accurately assess the performance of transmissions, gearboxes, and other critical drivetrain components at unprecedented speeds. Our advanced testing methodologies provide invaluable insights

into component behavior, including wear and tear, temperature, and vibration analysis, helping us and our customer optimize designs and improve product reliability.

Our high-speed testing capabilities are crucial for developing next-generation drivetrain solutions for electric vehicles, where durability and performance are important. With our expertise in transmission and gear technology, we are driving innovation in the field of e-mobility, enabling our customers to deliver cutting-edge electric vehicles that meet the demands of today's dynamic automotive industry.



3. HOT POST

GETEC GETRIEBE TECHNIK GMBH'S EXPERIENCE WAS APPLIED TO THE RACING CAR i30N FROM MERTENS MOTORSPORT.

Mertens Motorsport is a professional racing team from Germany, their race cars use various high-tech components, such as calibrated transmissions, to improve performance and stability. GETEC supported the team with their calibration experience of transmissions that not only improve gearbox performance but also have better self-learning capabilities during the endurance race. This allows the transmission to precisely and quickly execute the driver's commands during the race, resulting in a seamless integration of man and machine.

The transmission was for revision at GETEC during winter. The General Manager of GETEC, Mr. Joachim Trumpff, also participated in the driving tests and retrained the transmission together with Daniel Mertens, making the gearbox more

adaptive to the driving habits of the racers. After an extensive test-drive, Joachim Trumpff could approve the transmission for the first race. We look forward to seeing Mertens Motorsport and their i30N achieve even more impressive results in future races.

Mertens Motorsport is a professional racing team from Germany, founded in 2020 and headquartered in Müllenbach at the Nürburgring. The team participates in various races, such as the VLN endurance race NLS, RCN, and 24-hour Nürburgring race, and is known for its high-speed driving and quick tire changes. The team has won numerous honors and achievements through its outstanding driving and efficient team collaboration.



4. HOT POST

ED1 LAUNCH – INCREDIBLE DAY FOR GETEC GETRIEBE TECHNIK GMBH!

Started less than one year ago as a set of concepts our global team developed in total 4 commercial vehicle variants:

- ▶ 1.5t last mile light duty battery electric commercial vehicle
- ▶ 3.5t range extender delivery vehicle
- ▶ 4.5t battery swapping commercial vehicle
- ▶ 4.5t range extender commercial vehicle plus battery swapping station



HOT POST IN EU

1 Key forecasts in automotive industry

- The automotive industry will remain vulnerable to global headwinds in 2023 including the energy crisis, slower global demand and continued supply-chain problems.
- Global new-vehicles sales will remain flat in 2023: new-car sales will rise by 0.9% and new commercial vehicle (CV) sales will fall by 1.3%.
- Sales of electric vehicles (EVs) will be the only bright spot, growing by 25%, but governments will restructure their incentive schemes.
- Governments' focus will turn to charging networks, which are inadequate to meet the expanding EV fleet.
- Autonomous vehicles will take a leap forward, as UN regulators lift their speed limit.

Source: EIU Whitepaper

2 Mercedes taps F1 team to keep up with Tesla in race for efficient EVs

Mercedes' F1 team is working on new projects developing parts for mass-market EVs, that include batteries, inverters and new generations of motors. F1 technology has always eventually bled over into mass-market vehicles. But Mercedes' F1 collaboration to build more efficient EVs faster is unprecedented because it embeds that racing mindset and technological expertise directly in product development.

- Last year, Mercedes unveiled its EQXX concept car, a super-efficient EV capable of a range of more than 1,200 km (745 miles), which was jointly developed with the automaker's F1 team in England. Tesla did not respond to a request for comment.
- Mercedes EV breaks 1,000 km range barrier to outdo Tesla

Source: autonews.com

3 Tesla recalls 363,000 cars over self-driving software

Tesla is updating its self-driving software after US safety officials raised concerns that it could allow drivers to exceed speed limits or travel through intersections unsafely.

- NHTSA said the system allowed behavior that could „infringe“ on local laws or customs such as driving through a yellow light, travelling straight through an intersection from a turn-only lane or not coming to full stop at a stop sign.
- “FSD Beta software that allows a vehicle to exceed speed limits or travel through intersections in an unlawful or unpredictable manner increases the risk of a crash,” it said.
- Tesla said it disagreed with the agency's conclusions but decided to issue a recall „out of an abundance of caution“, according to the filing.

Source: bbc.com

4 ZF and Wolfspeed build new chip research center

The U.S. chip manufacturer Wolfspeed and the automotive supplier ZF want to establish a joint European high-tech research center in the Nuremberg area. Semiconductors made of silicon carbide are to be developed and improved there for the automotive industry, other vehicle manufacturers, and green power plants. The project is supported by both the federal government and the Bavarian state government.

- One focus of development work is to be semiconductors for electromobility.

Source: autohaus.de

5 Smarter regulation for a globally competitive European auto industry

It's now been more than two months since the EU launched its Green Deal Industrial Plan (GDIP), and a month since the long-awaited Critical Raw Materials Act, and the Net-Zero Industry Act. These initiatives seek to rise up to the growing ambitions of our US and Chinese counterparts, who are pursuing aggressive, and in some instances, protectionist policies that seek to attract investment from the best and brightest industries, including the automotive sector.

- Back in Europe, there is yet again good news for the EV market. Recent ACEA data confirmed that market share rose to 13.9% for battery electric cars and 24.3% for hybrid models.
- While China is currently ahead of Europe and the US in the electrification of the car market, the European market will rebound in 2025 and take the lead again on the other world regions by 2030.
- Access to raw materials risks stalling the EV revolution. a meagre 1% of the critical raw materials needed for batteries are produced in the EU. That's why it is of utmost importance that all critical raw materials essential for the electric and fuel cell revolutions are designated in the EU's list of strategic raw materials.
- The message to policy makers is clear: realising net-zero emissions in the transport sector cannot be achieved simply by piling on regulations. Instead, we urgently need an ambitious and coherent policy framework for investment.

Source: acea.auto

6 World Hydrogen Summit, Rotterdam Netherlands, in a country at the forefront of hydrogen mobility

HYVIA, a pioneer in hydrogen mobility, is naturally partnering with Renault Group Nederland, always at the forefront of zero-emission mobility, in a country where some 30 cities are moving to low-emission zones by 2024 and which strongly encourages H2 mobility. This commitment is strategic and heralds the start of our wider commercial deployment.

Source: automotiveworld.com

7 New EV entrants disrupt Europe's automotive market

Asian EV players are entering Europe at high speed, with widely different strategies—and consumers are interested. In the last two years, more than ten new entrants have started sales in Europe.

- And while current sales figures remain low (largely between 100 and 2,000 cars per brand per year), the ambitions of these players are high.
- For example, BYD announced a deal with a market-leading rental company to provide them with 100,000 cars through 2028 in Europe, and Xpeng reportedly aims to sell 100,000 vehicles in Europe in 2023.
- Customer research shows, for example, that almost two-thirds of European customers are interested in buying an entirely new brand when moving to an EV, including so-called “disruptor” brands.

Source: KYODO

HOT POST IN ASIA



1 **Is China's EV market still competitive without incentives? China's electric vehicle sales projections for 2023 are expected to be almost 30% lower than last year.**

Between 2021 and 2022, electric vehicles (EVs) grew from representing 6% of China's total passenger vehicle market to 26%, according to financial services corporation ING Group. In 2022, approximately one in four cars sold was an electric model, and the country accounted for over 50% of global EV sales. However, in its Q1 2023 analysis, ING concluded that sales are beginning to stagnate. This coincides with Reuters' findings that China's overall passenger vehicle market slumped 20% in January and February.

Source: [automotiveworld.com](https://www.automotiveworld.com)

3 **January to March 2023, 2023 Chinese cumulative sales of passenger vehicles reached 4.26 million units, down 13.4% year-on-year.**

By the end of March, domestic sales of new energy passenger vehicles reached 1.13 million units, up 22.4% year-on-year.

Source: [CPCA](https://www.cPCA.com)

2 **In the first quarter of this year, Chinese auto exports amounted to 994,000 units, up 70.6% year-on-year;**

among them, new energy vehicles became an important force for export growth, contributing 78,000 units of auto exports in March, up 390% year-on-year, and 248,000 units of auto exports in the first quarter, up 110% year-on-year. In March this year, the export of new energy passenger cars, pure electric vehicles accounted for 94.3%, A0 + A00-class pure electric exports accounted for 55% of new energy, is the main force of exports.

Source: [lautodaily](https://www.lautodaily.com)

4 **Nissan announced the new „all-in-one (X-in-1)“ EDS technology.**

Under this new technology, Nissan's EV and e-POWER model systems will be shared and modularly applied. Nissan says that by 2026, R&D and manufacturing costs will be reduced by 30% compared to 2019. The „X-in-1“ technology allows for „3-in-1“, „5-in-1“ and other more integration methods, enables core components for pure electric models and e-POWER technology to share the same production line.

Source: [CLS.CN](https://www.CLS.CN)

5 **On April 10, BYD released the world's first new energy exclusive intelligent body control system - Yunnian.**

Yunnian controls the vertical direction systematically from the whole vehicle to realize the ascending safety. Yunnian can effectively suppress the change of body posture, greatly reduce the risk of vehicle rollover, and reduce the displacement of the driver and passenger sitting position. Yunnian intelligent body control system is self-researched by BYD, realizing system-level deep integration, which also marks BYD as the first Chinese car company to independently master the intelligent body control system.

Source: [CLS.CN](https://www.CLS.CN)

6 **Honda announced corporate plans for new models, with Toyota launching two new electric models in China in 2024;**

An all-electric SUV to be produced in the U.S. in 2025, using batteries produced locally in the U.S.; and in Asia and other emerging markets, Toyota plans to start local production of electric pickup trucks and small electric vehicles from the end of 2023. A total of 10 all-electric vehicles will be launched by 2026, when sales of all-electric vehicles rise to 1.5 million units per year.

Source: [D1ev](https://www.D1ev.com)

7 **New vehicle sales (including minivans) in Japan for FY2022 were 4.38 million units, up 4.0% from the previous year.**

The impact of the prolonged global semiconductor shortage and difficulties in parts procurement due to the New Crown epidemic eased. Sales of automobiles other than minivans (registered vehicles) rose 1.2% to 2.69 million units. Sales of minivans rose 8.9% to 1.69 million units.

Source: [KYODO](https://www.KYODO.com)

8 **Singapore plans to phase out internal combustion engine vehicles by 2030,**

with electric vehicles accounting for nearly 12 percent of total vehicle sales in Singapore last year, up from nearly 4 percent in 2021.

Source: [Gasgoo](https://www.Gasgoo.com)

9 **The Korean Ministry of Environment and the 2050 Carbon Neutral Green Development Committee released the government program „The First National Carbon Neutral Green Development Basic Plan“ (2023-2042) on March 21.**

According to the program, the government aims to reduce carbon emissions by 40% by 2030 compared to 2018. The Korean government will invest budgets from this year to 2027 for research and development of core technologies for carbon neutral industries, zero-carbon energy and green transformation and upgrading, and subsidies for electric and hydrogen vehicles.

Source: [Caijing.com.cn](https://www.Caijing.com.cn)

COMING EVENTS

GETEC E-MOBILITY EXPERTISE SEMINAR

GETEC, Aldenhoven, Germany



Date: 29. 06. 2023

Time: 09:30-16:00

FREE ATTEND

NOTE: Limited Attendee (1st order, 1st get)

Find more informations online:
www.getec-gmbh.com

AACHEN COLLOQUIUM GERMANY 2023

Eurogress Aachen, Germany



S-BEV -Launch of a modular Battery Swapping Station Solution with tailored Logistic Vehicle Platform

Date: 09-11.10.2023

Time: released soon

Speaker: Mr. Sven Steinwascher

www.aachener-kolloquium.de



Headquarters

Aldenhoven, Germany

R&D and Testing Center

Wujiang, China

Sales Office

Seoul, South Korea

Sales Office

Nagoya, Japan



HEADQUARTERS



GETEC Getriebe Technik GmbH

Galileo-Allee 2

52457 Aldenhoven

GERMANY

☎ 0049 2464 90266 00

📠 0049 2464 90266 29

@ info@getec-gmbh.com



📘 GETECGetriebeTechnik



🌐 getec-getriebe-technik-gmbh