**[ 01 ] Efficient Bosch solutions for the commercial vehicles of today and tomorrow**

**[ 02 ] IAA Transportation 2024: Bosch grows with software and technology for trucks and vans**

Robert Bosch GmbH
Postfach 10 60 50
70049 Stuttgart

Media und Public Relations
Leitung: Melita Delic
Presse-Forum:
www.bosch-presse.de

# Press release
*Bosch Compact*

## Efficient Bosch solutions for the commercial vehicles of today and tomorrow
Bosch innovations at IAA Transportation 2024

August 8, 2024
PI 11874 BBM san/af

- Bosch supplies customized powertrain systems for sustainable freight transport.
- Individual and complete steering systems ensure safety and convenience on short and long journeys.
- Digital services improve the driving experience and protect the driver.

Stuttgart and Hannover, Germany – Freight transport is a mainstay of the global economy, and one in which commercial vehicles play a crucial role. These are undergoing a paradigm shift similar to the one in passenger cars, namely, the transformation from hardware- to software-defined vehicles. Bosch is responding to this change with hardware and software products, customized solutions, and smart services. The technology company supports truck manufacturers, freight forwarders, and logistics companies on their way into the future. Bosch will be showcasing its innovations for tomorrow's freight transport at IAA Transportation 2024 in hall 19/20, booth A51/B52.

**Efficient powertrains, reliability on the road**

Electric powertrain: Bosch manufactures economical and efficient electrification solutions for both light and heavy commercial vehicles. The Bosch **e-axle** is easy to integrate into commercial vehicles of up to 7.5 metric tons. One benefit of this is that fleet operators will still be able to serve delivery routes in restricted areas such as urban low-emission zones in the future. Bosch's **electric motor** and **inverter** already feature in a heavy-duty, purely battery-electric commercial vehicle. Here, an 800-volt operating voltage and the silicon carbide chips used enable longer ranges and shorter charging cycles for efficient goods transport, even over long distances.

Robert Bosch GmbH
Postfach 10 60 50
70049 Stuttgart,
Germany

E-mail anna.schmatz@de.bosch.com
Phone +49 711 811-12715

Corporate Department
Communications & Governmental Affairs
Executive Vice President: Prof. Christof Ehrhart
www.bosch-press.com

Fuel cell: Commercial vehicles can also be operated in a climate-neutral way with a **fuel-cell system**. This technology is particularly suitable for longer journeys and maximum payloads, making it a sensible addition to battery-electric trucks. Bosch already has a 200-kilowatt fuel-cell system in large-scale production. The company is now working on the Fuel Cell Power Module Compact 300, which will be even more compact and, with an increased output of 300 kilowatts, also more efficient. In addition to this type of complete solution, Bosch also offers individual system components and submodules as well as components for hydrogen storage systems, enabling it to provide every customer with the right solution.

Hydrogen engine: Another option for the climate-friendly transportation of goods by road is the **hydrogen engine**, which will initially be used in heavy trucks. At the beginning of 2024, the EU also recognized this powertrain solution as climate neutral. Derived from established diesel and natural-gas engines, this concept lets engine manufacturers use more than 90 percent of existing development and production technologies. Bosch is developing the key components of the injection system for the hydrogen engine, including a new injector for direct injection that requires no additional lubrication and is scheduled for launch in 2026. The first hydrogen engines equipped with Bosch intake manifold injection are set for launch in 2025.

$H_2$ tank system: The main challenges in the design of **$H_2$ tank systems** lie in storing the hydrogen safely under high pressure and controlling the supply of the highly flammable gas. ITK Engineering GmbH supports and advises vehicle manufacturers throughout the entire development process, from the design to the implementation of a safe, certified $H_2$ tank system. When designing systems, ITK Engineering also relies on digital twins for physical simulation so it can achieve maximum safety and efficiency.

Connectivity solutions: Fleet operators and vehicle manufacturers can also further improve the efficiency of their vehicles with Bosch digital services. The technical basis for this is the **Automotive Connectivity Hub** – a solution that can be retrofitted to any vehicle regardless of manufacturer, providing access to the vehicle's operating and diagnostic data and thus enabling a wide range of data-based services. With the efficiency services, such as the **Retrofit Efficiency module**, the speed can be easily adjusted as needed in line with empirical values stored in a central database, thus reducing consumption by up to 4 percent. **Vehicle Health**, in turn, records both standardized and manufacturer-specific error codes as well as notifications in the vehicle and evaluates them in the cloud. Any impending problems are recognized at an early stage and presented in an understandable way, and immediate responses such

as prioritized servicing are suggested. This significantly reduces the number of unexpected breakdowns, which makes it much easier for operators to plan. For electric vehicles, **Battery in the Cloud** for example offers an improvement in the performance and service life of high-voltage batteries. With the help of continuously recorded data on battery status and usage, it can analyze high-voltage batteries, predict their aging and defects, and optimize their rapid-charging behavior for greater durability, which improves the reliability and economy of electric vehicles. The **Digital Fuel Twin** is ideal for fleet operators who want to use alternative fuels such as HVO for their existing fleet. This function can verify the use of these fuels and thus the reduction in $CO_2$ achieved – in a fully automated way that is certified for auditing. To monitor the condition of the vehicle or fleet in real time, **RideCare Insight** uses an intelligent sensor box to detect potential bodywork damage, in-vehicle smoking, and risky driving maneuvers in light commercial vehicles.

**On course for the future with steering systems**

Fully electric power steering: The **ServoE** steering system augments Bosch's product portfolio to include a fully electric steering system for heavy trucks. This electromechanical steering system enables simple and oil-free assembly, while the power-on-demand function guarantees eco-friendly driving. Steering function and feel can be tailored to customer requirements.

Servotwin: The **Servotwin** electrohydraulic steering system for heavy commercial vehicles combines a hydraulic **Servocom** steering system with scalable electrical servo units and intelligent software architecture. This supports SAE Level 2 steering assistance and driver assistance functions as well as automated driving functions up to and including SAE Level 4.

Rear-axle steering system: The **electrohydraulic steering system for rear axles** is a stand-alone power-on-demand system. It enables the steering of three or more leading or trailing heavy-truck axles. Steering the additional axles, if required, reduces the turning radius and tire wear. Thanks to its compact design, this Bosch technology can be adapted to all powertrain types. The intelligent software architecture supports safe and eco-friendly driving and protects the steering system against external attacks.

Steering shaft: The modular and weight-optimized **steering shaft** is the connection between the steering mechanism and steering column and is used in medium- and heavy-duty commercial vehicles and buses. In vehicles fitted with a Bosch steering shaft, relative movements between the driver's cab and chassis that occur during driving have no effect on the steering behavior. Its design features impressively compact construction and low friction.

EPSapa highload: The high-load version of the long-established **electric power steering with parallel-axle servo unit** (EPSapa) has no difficulty driving on asphalt, gravel, or rough terrain. This new variant not only expands the Bosch electric power steering portfolio, but also fills a niche: thanks to increased steering-rack force and exceptional robustness, this steering system is – unlike previous variants – ideally suited for heavy SUVs, vans, and off-road pickup trucks. This makes EPSapa highload ideal for the North American market.

**Smart road safety: the vehicle as a mobility platform**

E/E architectures: With customized **consulting and engineering services**, Bosch Engineering supports manufacturers in the transition from hardware- to software-defined vehicles. The focus here is on defining a new electrical and electronic architecture to reduce the complexity of the process and cut integration costs.

Cloud-based diagnostic solution: Automakers and their suppliers have a common task: providing authorized workshops with **service solutions** so that they can carry out repairs and maintenance to ensure vehicle availability and customer satisfaction. This is particularly important for new technologies such as fuel cells, for which practical experience can be gathered only gradually. ETAS has a solution that takes diagnostic and repair capability into account during development, meaning it is available before the start of production. It enables manufacturers to significantly reduce the time to market for diagnostic and repair concepts while ensuring that the solution is always up to date with a cloud-enabled platform. This concept can also be applied to all the other complex components in modern vehicles. The mobile version enables diagnostics directly on the vehicle, whether in the workshop or on the road.

Connected map services: With the help of swarm data from connected vehicles and infrastructure data, Bosch **map services** provide accurate and up-to-date information about the driving environment. Here, the function benefits from the sum of information from all connected vehicles, from which attributes such as optimum driving speeds, exact lane geometries, localization landmarks, and current road conditions can be derived. Based on this real-time information, driving behavior can be planned predictively and safely and adjusted if necessary. In this way, connected map services not only improve existing driver assistance functions and increase their availability, but also create new possibilities for developing and improving vehicles and mobility services, thereby making the mobility of the future safer and more convenient.

Software platform for logistics specialists: Bosch's digital **service platform for logistics** (L.OS) addresses many of the challenges facing the transportation and logistics industry. At the heart of the software ecosystem for freight forwarders and carriers is a marketplace that offers centralized access to various providers' digital solutions for all aspects of the logistics business. But the platform is much more than just a marketplace. It enables the seamless integration of previously separate services and data. For example, software providers such as Webfleet, Europe's biggest fleet management system, are working with Bosch L.OS to offer fleet managers value-added services within their fleet management solution. This enables their users to activate new and value-creating functions without having to carry out their own costly and time-consuming IT projects. Bosch is working on this with Amazon Web Services. The first use case involved integrating **Bosch Secure Truck Parking**, the leading European booking platform for secure truck parking, into the **Webfleet fleet management** system via Bosch L.OS. This allows Webfleet customers to easily find and book truck parking spaces for their fleets without having to leave the application. It also helps companies to increase safety for drivers, vehicles, and goods and to better plan the estimated time of arrival. Cutting the time spent looking for a parking space also reduces fuel costs and $CO_2$ emissions and helps ensure driving hours are not exceeded.

Secure connectivity and communication: A prerequisite for numerous smart services that make driving safer and more efficient is for vehicles to be able to exchange data with objects in their immediate vicinity and with the traffic infrastructure. The basis for this is the Bosch **Connectivity Control Unit for commercial vehicles** (CCU). It uses wireless interfaces to connect the driver's vehicle with the cloud, the infrastructure, and other vehicles. The **Central Gateway** links the vehicle domains, serves as a router for in-vehicle communications, and communicates with the outside world via the CCU. It acts as a secure data distributor for communication within commercial-vehicle systems and is also the gateway for all data entering the vehicle. The Central Gateway supports various bus systems such as Ethernet and CAN.

Powernet Guardian: The Bosch **Powernet Guardian** is a holistic concept for the vehicle electrical system. It ensures that safety-relevant functions in commercial vehicles are supplied with power at all times. If a fault occurs, the Powernet Guardian takes over the function of an electronic circuit breaker, disconnecting the safety-relevant vehicle electrical system from the other consumers. This protects them from under- or overvoltage and, by extension, can prevent malfunctions or reduced functionality. By digitalizing the power supply, the Powernet Guardian enables intelligent power distribution functions that also

make it possible to switch loads according to demand and vehicle electrical system capacity.

Convenient vehicle access: **Fleet Management Xtended Access** is a digital vehicle access system that allows the driver to access the vehicle via a digital key on a smartphone and – depending on the variant – also to start the engine. Manufacturers can integrate the system components directly into their commercial vehicles according to their needs. They have the option of retrofitting their vehicle fleet with the Fleet Management Xtended Access Kit. This flexible combination of ultra-wideband, Bluetooth Low Energy, and near-field communication technologies enables manufacturers to provide secure and user-friendly access to vehicles and permits the scalable introduction of a digital vehicle access system that can replace their existing systems.

Truck cockpit technologies: Bosch's cockpit technology solutions include a **platform for integrating** instrumentation and **infotainment applications** and a **digital mirror replacement system** developed with Mekra Lang to replace conventional mirrors. The **Driver Monitoring System for commercial vehicles** detects driver fatigue and distraction at an early stage and warns the driver. In addition to these safety-related functions, the Bosch platform supports various convenience functions.

Infotainment in coaches: The Bosch **Coach Infotainment series** makes next-generation infotainment available for professional use in coaches. Perfectly coordinated components provide a new experience for drivers and in the passenger compartment. Enjoy movies, surf the internet, watch TV, listen to music, and hear announcements clearly – all this is possible with Bosch infotainment systems for coaches. Ethernet AVB technology provides optimum synchronization between image and audio signals, ensuring smooth playback of HD media content with very low latency.

**Keeping an eye on the environment**

Smart eyes: The **third generation of the multifunction camera** is tailored to the requirements of heavy trucks. With its unique multipath approach, the camera combines conventional image processing algorithms with AI-driven methods, giving it a key role in high-performance driver assistance systems. It reliably detects and processes objects and structures and uses an innovative, high-performance **system on a chip** for image processing. The camera is designed for safety-relevant driver assistance systems and convenience functions such as the lane-keeping support system, and it also supports object-based functions such as automatic emergency braking. Moreover, it permits implementation of other functions such as traffic sign recognition. This means

the system supports the legal requirements of the EU General Safety Regulation on intelligent speed assistance for detecting speed limits and warning of exceeding them.

Precise object detection: The **fifth-generation front and side radar** ensures greater safety in the heavy truck segment, thanks to reliable and precise object detection in the area to the front and side of the vehicle. Thanks to the sensors' large detection range and high angular resolution, as well as their wide aperture, they can detect complex driving situations very quickly, accurately, and safely. They employ novel **chirp-sequence modulation** to improve surround sensing by producing more detailed reflections. As a result, both the front and side radar solutions are extremely precise when detecting and distinguishing between objects and people as well as their position, relative speed, and direction of movement – even when visibility is poor. This means that Bosch radar sensors in heavy trucks can ensure greater safety for the driver and other road users by supporting functions such as automatic emergency braking and by helping to meet legal requirements.

**Press photos and infocharts in Bosch Media Service at www.bosch-press.com.**

**Contact person for press inquiries:**
Anna Schmatz
Phone: +49 711 811-12715
E-mail: anna.schmatz@de.bosch.com

*Mobility is the largest Bosch Group business sector. In 2023, its sales came to 56.2 billion euros, or just under 60 percent of total Group sales. This makes the Bosch Group one of the leading mobility suppliers. Bosch Mobility pursues a vision of mobility that is safe, sustainable, and exciting. For its customers, the outcome is integrated mobility solutions. The business sector's main areas of activity are electrification, software and services, semiconductors and sensors, vehicle computers, advanced driver assistance systems, systems for vehicle dynamics control, repair-shop concepts, as well as technology and services for the automotive aftermarket. Bosch is synonymous with important automotive innovations, such as electronic engine management, the ESP anti-skid system, and common-rail diesel technology.*

*The Bosch Group is a leading global supplier of technology and services. It employs roughly 429,000 associates worldwide (as of December 31, 2023). The company generated sales of 91.6 billion euros in 2023. Its operations are divided into four business sectors: Mobility, Industrial Technology, Consumer Goods, and Energy and Building Technology. With its business activities, the company aims to use technology to help shape universal trends such as automation, electrification, digitalization, connectivity, and an orientation to sustainability. In this context, Bosch's broad diversification across regions and industries strengthens its innovativeness and robustness. Bosch uses its proven expertise in sensor technology, software, and services to offer customers cross-domain solutions from a single source. It also applies its expertise in connectivity and artificial intelligence in order to develop and manufacture user-friendly, sustainable products. With technology that is "Invented for life," Bosch wants to help improve quality of life and conserve natural resources. The Bosch Group*

*comprises Robert Bosch GmbH and its roughly 470 subsidiary and regional companies in over 60 countries. Including sales and service partners, Bosch's global manufacturing, engineering, and sales network covers nearly every country in the world. Bosch's innovative strength is key to the company's further development. At 136 locations across the globe, Bosch employs some 90,000 associates in research and development, of which nearly 48,000 are software engineers.*

*Additional information is available online at www.bosch-press.com, www.bosch-mobility.com, www.bosch.com.*

# Press release

## IAA Transportation 2024: Bosch grows with software and technology for trucks and vans

Reorganization of the commercial-vehicle business to start in 2025

September 16, 2024
PI 11875 BBM ak/af

- Markus Heyn: “The transition to alternative powertrain systems in commercial vehicles can succeed only with technology neutrality.”
- Development of business: The Mobility business sector records slight sales growth in 2024 despite the very challenging market environment.
- Powertrain diversity: Bosch forecasts that in 2035, a good one in three new trucks will have a battery on board, and one in ten will feature a fuel cell.
- E/E architecture: The growing number of connected software and services for fleet management requires commercial vehicles to be updatable.

Stuttgart and Hannover, Germany – Freight transport is an important pillar of the economy. For their green transformation to succeed, commercial vehicles that transport goods must be equipped with alternative powertrains. As a result, the industry is on the move – and Bosch is leading the way. The technology company is expanding its product and solution portfolio and is once again focusing on diversity. “Commercial vehicles’ transition to alternative powertrains will succeed only if we remain technology neutral and continue to develop all forms of powertrains and make them more efficient,” said Markus Heyn, member of the Bosch board of management and chairman of the Mobility business sector, at this year’s IAA Transportation trade fair in Hannover. “In the coming years, we expect the continuing growth in global freight transport and the simultaneous switch to alternative powertrains for commercial vehicles to drive another surge in growth for our business. For us, our business with big vehicles is anything but a small matter – in Mobility, we generate one-quarter of our sales with trucks and vans,” Heyn said.

Global vehicle production is expected to stagnate in 2024 compared to the previous year. Assuming a good final quarter, the company anticipates slight sales growth at Bosch Mobility in 2024 despite the very challenging market

Robert Bosch GmbH
Postfach 10 60 50
70049 Stuttgart,
Germany

E-mail Athanassios.Kaliudis@bosch.com
Phone +49 711 811 7497

Corporate Department
Communications & Governmental Affairs
Executive Vice President: Prof. Christof Ehrhart
www.bosch-press.com

environment. Bosch Mobility aims to achieve global sales of more than 80 billion euros by 2029.

**New setup for commercial-vehicle business**

Bosch wants to seize the huge opportunities now arising from the growth in global freight transport and the switch to alternative powertrain systems. To that end, the company will be reorganizing its commercial-vehicle business within the Mobility business sector. Starting January 2025, under the leadership of Jan-Oliver Röhrl, executive vice president for commercial vehicles and off-road, the company will pool important competencies in a new business unit, bringing together system development and product and portfolio management for trucks and off-highway applications. “We’re convinced that this new setup will offer benefits to our customers – and that we will collaborate with even greater success as a result. Together, we want to get commercial vehicles on the road even more efficiently and safely,” said Röhrl at IAA Transportation 2024.

To achieve this, Bosch is focusing on powertrain diversity and technology neutrality. According to internal forecasts, the company assumes that, globally, around 20 percent of all newly registered commercial vehicles heavier than six metric tons will have a battery-electric powertrain in 2030, while fuel cells will have a share of around 3 percent. By 2035, a good one in three trucks will have a battery on board, and one in ten will feature a fuel cell. At this point, the hydrogen engine will also be on the road, albeit in smaller numbers. One thing is clear: freight transport can go electric only if the proper infrastructure is in place. “We need a consistent and faster expansion of electric charging stations and hydrogen filling stations in Germany and Europe,” Heyn said.

As Bosch sees it, the various powertrain technologies aren’t in competition with each other – on the contrary: the variety allows manufacturers to decide on the optimum solution for each application. That means Bosch is not only further developing powertrain technologies for batteries, fuel cells, and hydrogen engines, but is also making modern combustion engines even more efficient. And especially in view of how big the existing vehicle fleet is, synthetic fuels can also play a major part in mitigating climate change.

**Assistance systems for commercial vehicles are in the fast lane**

At IAA Transportation, Bosch presents its ideas, innovations, and solutions for modern freight transport. But even far away from Hannover, Bosch technology is already changing the way we transport goods from A to B. In China, for example, a Bosch e-axle for heavy commercial vehicles weighing between 18 and 49 tons has gone into volume production – with a fully integrated electric motor, transmission, clutch actuator, inverter, and differential. The solution is suitable

for both battery-electric vehicles and vehicles powered by fuel-cell electric modules. In India, the first test vehicles with hydrogen engines are on the road. For these, Bosch supplies injection systems, sensors, tank valves, and control units, including software – all crucial components for hydrogen propulsion. And in the U.S., Bosch and the company FirstElement Fuel are working intensively on something called a cryogenic pump, which will go into operation for the first time in California in 2025. The new pump will make it much easier and, above all, faster to refuel commercial vehicles – with enough hydrogen for 1,000 kilometers of driving in just ten minutes!

The assistance systems business also remains an important part of Bosch's commercial-vehicle strategy. According to an internal Bosch study, around one in eight accidents caused by a heavy truck can be avoided with the help of the lane-keeping support system – it not only saves lives, but also avoids property damage costs for transport companies. Another key Bosch assistant system is the electronic horizon, which enables fuel-efficient and emission-saving driving for heavy trucks. It collects data on, for example, topography, curve radii, or traffic signs, and intelligently adapts the vehicle's speed to its surroundings, including by using the truck's kinetic energy. The system works both on freeways and in urban traffic. For commercial vehicles with combustion engines, it can reduce fuel consumption by up to 5 percent and thus cut $CO_2$ emissions. Electrically powered commercial vehicles have better energy efficiency, which gives them a longer range. More than one million vehicles are already equipped with the Bosch electronic horizon system.

**Trucks and vans have to be updatable, too**

With the move in the automotive industry toward software-defined mobility, commercial vehicles are also facing a paradigm shift. The growing number of connected services and solutions for fleet management alone makes it crucial for trucks and vans to be updatable, similar to the passenger car sector. Here, the golden rule is to have fewer vehicle computers and hence less complexity in the vehicle's electrical/electronic architecture. Intelligence is currently distributed across several different computers, but in the future it will be grouped into just a few vehicle computers. Bosch supports manufacturers in the transition from hardware- to software-defined mobility, the commercial-vehicle business included, while offering a wide range of suitable software solutions and services.

Bosch's digital service platform for logistics, called L.OS, pinpoints and addresses the specific challenges facing the transportation and logistics industry. The company collaborates in this area with Amazon Web Services, among others. At the heart of the software ecosystem for freight forwarders and carriers is a marketplace that offers centralized access to various providers' digital

solutions for all aspects of the logistics business – all in one seamless experience: driver, transport, and fleet management; route planning and parking; financial services and supply chain transparency.

Bosch connectivity solutions also help mobility and logistics service providers to use their vehicles as efficiently as possible and minimize downtimes. The technical basis for this is a Bosch control unit that can be retrofitted to any vehicle regardless of manufacturer, allowing the fleet operator to access its operating and diagnostic data, and thus enabling a wide range of data-based services. The Retrofit Efficiency module (remodul) function, for example, recognizes the route a truck is taking and slightly adjusts its speed in line with empirical values stored in a central database. This can reduce fuel consumption by up to 4 percent – an attractive cost advantage for fleet operators. Vehicle Health, in turn, records both standardized and manufacturer-specific error codes in the vehicle and evaluates them in the cloud. As a result, impending problems can be identified at an early stage and presented in an understandable way so that, for example, early servicing can be suggested. This significantly reduces the number of unexpected breakdowns, thus making it much easier for operators to plan.

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**Contact person for press inquiries:**
Athanassios Kaliudis
Phone: +49 711 811 7497
Mobile: +49 152 08651292
E-mail: Athanassios.Kaliudis@de.bosch.com

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