Press release
Bosch compact

Did you know...
Facts and figures about electronics and software in vehicles

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The market for vehicle software and electronics is growing rapidly.

- The overall market for vehicle software and electrical and electronic components will grow by around seven percent annually from 2020 to 2030. That equates to growth from 238 billion US-dollars in 2020 to 469 US-dollars billion in 2030.[1]
- Bosch estimates that the market for software-intensive electronic systems will grow by as much as 15 percent a year between now and 2030.

Software and electronics are future fields of automotive development.

- Around 90 percent of automotive innovations already come from software and electronics.[2]
- In 2019, around 140 billion euros were spent on research and development in the automotive industry as a whole. Around one-third of this related to electrics, electronics, and associated software. This proportion is expected to increase to around 40 percent by 2030. Annual software development expenditure alone is expected to rise to around 39 billion euros.[3]
- The per-vehicle cost of electronic components is set to rise from some 3,000 US-dollars today to roughly 7,000 US-dollars in 2025. This forecast compares a premium vehicle with a combustion engine in 2020 with a partially automated, electrified car in 2025. As a proportion of total component cost, therefore, the share of electronic components will rise from roughly 16 percent today to 35 percent in 2025.[4]

Software in the car is booming.

- Where a car included roughly 10 million lines of software code in 2010, the software of today's non-automated vehicles already runs to 100 million lines of code. By way of comparison, the Hubble space telescope has roughly 2 million lines of software code, and the latest PC operating systems have between 20 and 50 million.[5, 6]

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- Tomorrow's automated vehicles will require between 300 and 500 million lines of code.[6]
- One million lines of code is equivalent to 18,000 A4 pages.[5]

The complexity of vehicle electronics is increasing.

- Between 2006 and 2016, the average number of ECUs per vehicle across all vehicle segments rose from 28 to 38.[7]
- Up to 110 control units were installed in luxury vehicles in 2018; even in compact cars there were around 20.[7]
- The wiring harness of current mid-range vehicles is approx. eight kilometers long. At around 50 to 100 kilograms, control units and wiring make a significant contribution to total vehicle weight.
- Around ten different bus systems and transmission standards are used in a modern vehicle, including CAN, CAN-FD, MOST, LIN, Flexray, and Ethernet.

Bosch is also a software company.

- Bosch's mobility operations currently employ some 14,000 software engineers, and annual expenditure on software expertise comes to 3 billion euros. In 2019, Bosch already employed 30,000 software engineers throughout the company.
- Bosch was quick to recognize the significance of vehicle software, and has been developing it in-house for nearly four decades.
- The debut of the ABS antilock braking system in the Mercedes-Benz S-Class in the late 1970s was also the first application of digital circuitry in a car – a breakthrough in getting electronics on the road.
- Automotive electronics only became suitable for everyday use with the advent of semiconductors. Bosch has been developing them in-house for almost 50 years. This makes Bosch the automotive supplier with the longest tradition of in-house semiconductor development and production.
- Whether in airbags, belt tensioners, cruise control systems, rain sensors, or powertrains, there is scarcely a domain in modern automotive technology that does not rely on microchips. Globally, the average value of microelectronics per car grew from 138 US-dollars in 1998 to over 559 US-dollars in 2018. In 2023, this value is expected to increase to 685 US-dollars per vehicle.[8]
- In 1984, Bosch began developing the CAN controller area network as an automotive communication system. After initial use in industry, the Bosch CAN went into production in 1991.

Notes

[1] McKinsey, Automotive Software and Electronics 2030, p. 12

[2] Invensity GmbH, Automobilindustrie: 90 Prozent der Innovationen finden bei Elektronik und Software statt

[3] Berylls Strategy Advisors, via www.automobil-industrie.vogel.de

[4] Roland Berger, Computer on Wheels/Disruption in Automotive Electronics and Semiconductors, p. 7ff.

[5] Jeff Desjardins, How Many Millions of Lines of Code Does It Take?

[6] Roland Berger, Global Automotive Supplier Study 2018, p. 49

[7] Roland Berger, Consolidation in Vehicle Electronic Architectures, p. 6

[8] ZVEI, Mikroelektronik– Trendanalyse bis 2023, p. 50

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Mobility Solutions is the largest Bosch Group business sector. It generated sales of 46.8 billion euros in 2019, and thus contributed 60 percent of total sales from operations. This makes the Bosch Group one of the leading automotive suppliers. The Mobility Solutions business sector pursues a vision of mobility that is safe, sustainable, and exciting, and combines the group's expertise in the domains of personalization, automation, electrification, and connectivity. For its customers, the outcome is integrated mobility solutions. The business sector's main areas of activity are injection technology and powertrain peripherals for internal-combustion engines, diverse solutions for powertrain electrification, vehicle safety systems, driver-assistance and automated functions, technology for user-friendly infotainment as well as vehicle-to-vehicle and vehicle-to-infrastructure communication, repair-shop concepts, and 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 400,000 associates worldwide (as of December 31, 2019). The company generated sales of 77.7 billion euros in 2019. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT provider, Bosch offers innovative solutions for smart homes, Industry 4.0, and connected mobility. Bosch is pursuing a vision of mobility that is sustainable, safe, and exciting. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. The Bosch Group's strategic objective is to facilitate connected living with products and solutions that either contain artificial intelligence (AI) or have been developed or manufactured with its help. Bosch improves quality of life worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is "Invented for life." The Bosch Group comprises Robert Bosch GmbH and its roughly 440 subsidiary and regional companies in 60 countries. Including sales and service partners, Bosch's global manufacturing, engineering, and sales network covers nearly every country in the world. The basis for the company's future growth is its innovative strength. Bosch employs some 72,600 associates in research and development at 126 locations across the globe, as well as roughly 30,000 software engineers.

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