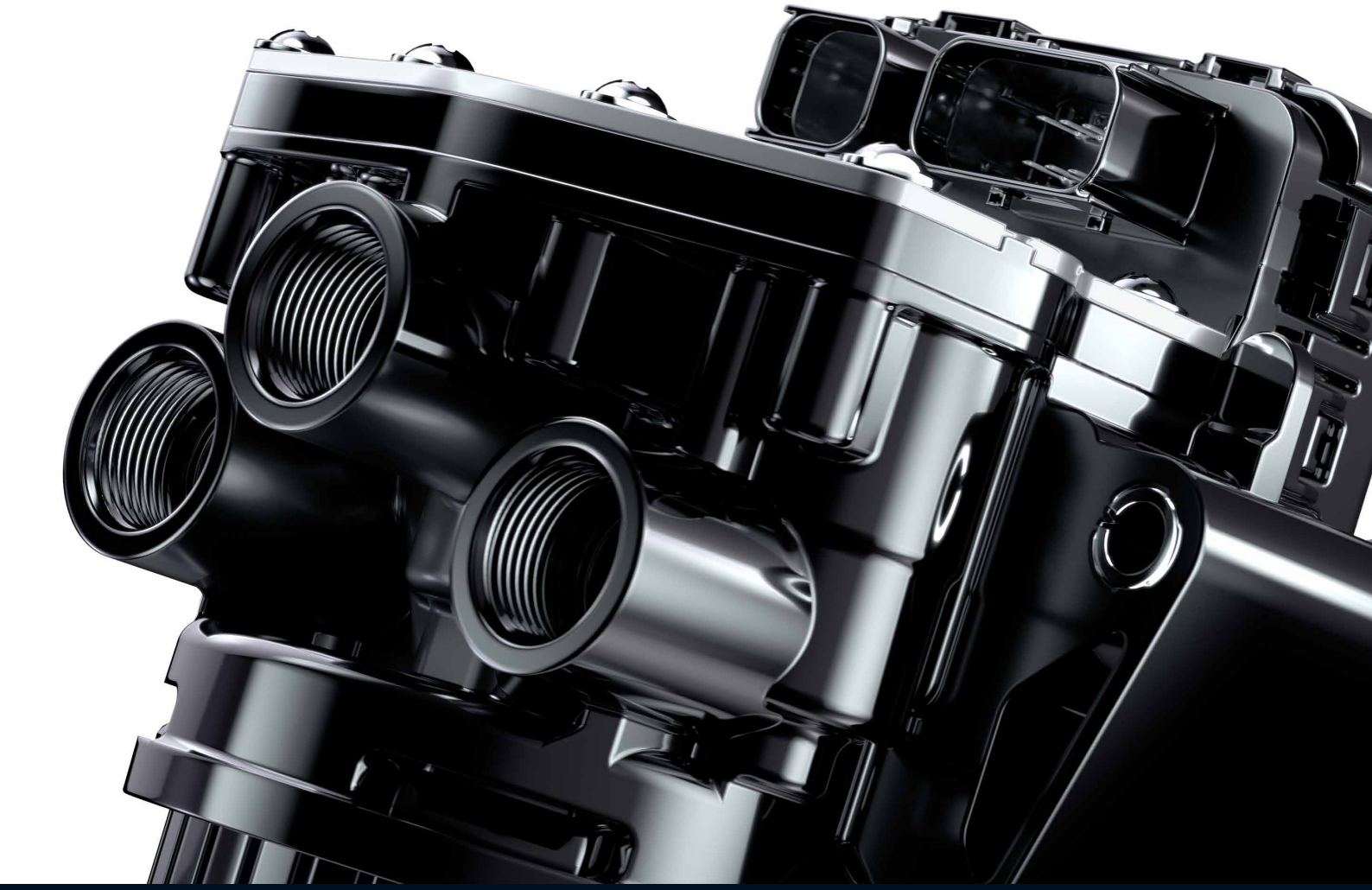


OptiRide™

Electronically Controlled Air Suspension (ECAS)

Latest innovation in modular and scalable air suspension solution for commercial vehicles

ZF's Latest Innovation in Air Suspension Control

The latest evolution of market-leading premium air suspension technology comes with simplified system layout and increased integration level. Its lean system architecture significantly reduces components, while minimizing wiring and piping. The modular and scalable design provides high flexibility for customization and can serve complex commercial vehicle applications with a broad spectrum of proven value-adding functionalities to effectively support a fleet's daily operations.

The ZF Difference

- Next evolution of ZF's market-leading premium air suspension technology comes with simplified system layout and higher integration level
- Modular and scalable design provides high flexibility for customization and serves even the most complex commercial vehicle applications
- Builds on 35+ years of engineering expertise in the development of electronically controlled air suspension systems with over 6 million OptiRide ECAS systems proven in the market globally

Unrivaled Expertise

#1
World market leader for electronically controlled air suspension (ECAS)

200,000+
ECAS systems sold in 2022 alone

35+
Years of experience

1986
First-to-market with ECAS for commercial vehicles

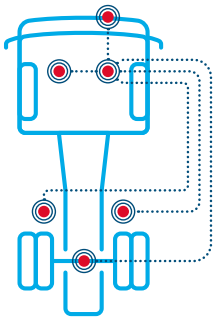
6,000,000+
ECAS systems sold worldwide

Value to Customers

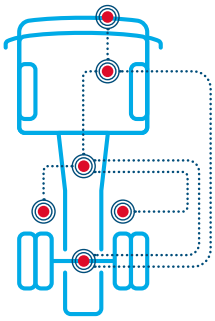
- Serves a wide range of commercial vehicle applications from standard 4x2 up to complex multi-axle applications
- Simplified system layout enables to reduce components by up to 60 %*
- Fosters lean vehicle system architecture with considerably reduced wiring and piping
- Allows for flexible software updates and functional extensions
- Provides state-of-the-art air suspension control with numerous value-adding, proven truck- and bus- specific functionalities
- Enables easy implementation of lift axle control with minimized wiring
- Enables easier assembly and installation into the vehicle including a simple and smooth end-of-line (EOL) procedure
- Complies with cyber security to fulfill regulatory requirements

*Calculation based on 6x2 truck application with steel suspended front axle, air suspended drive axle and air suspended lift axle.

ECAS with cab-mounted ECU



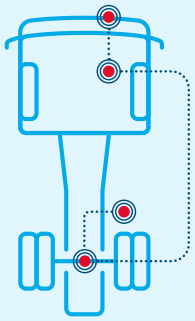
ECAS with frame-mounted ECU



New Generation

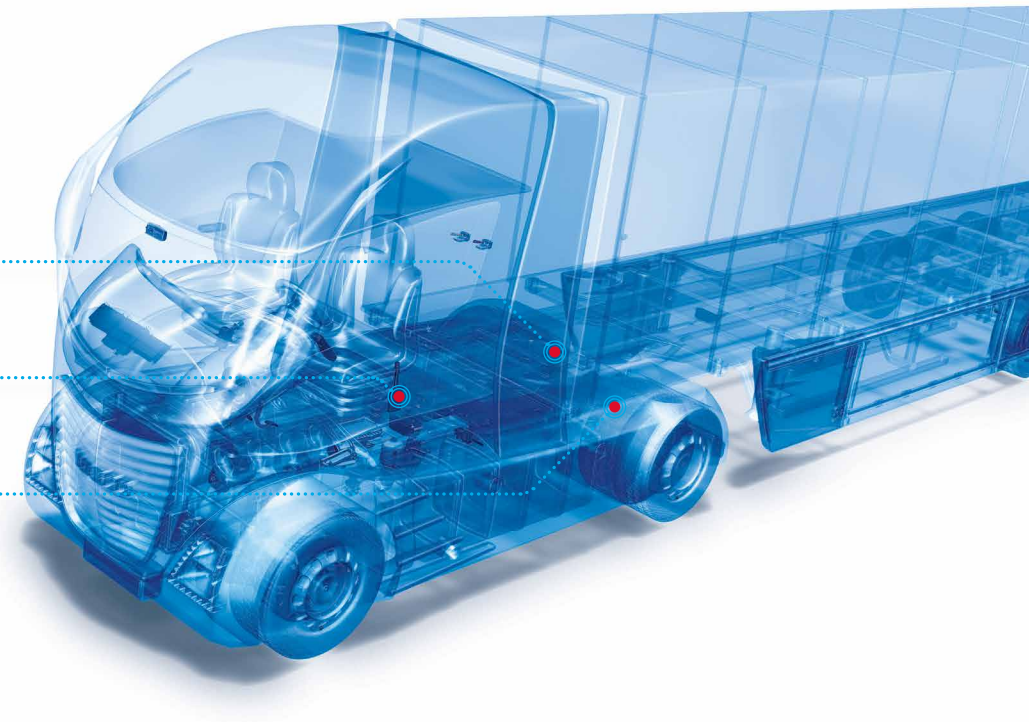
ECAS with Smart Pneumatic Actuator

New ECAS solution comes with simplified system layout and higher integration level contributing to reduced application efforts for different vehicle configurations



Technical Features

- Delivers highly scalable and modular innovative system solution
- Integrates electronic control unit, solenoid valves and pressure sensors into one smart pneumatic actuator
- Runs data processing on ECAS actuator, while integrating application software into domain controller
- Split system intelligence eliminates the need for a separate ECAS electronic control unit
- ECAS application software architecture is developed in full compliance with Autosar
- Operates through efficient and smart bi-directional communication via CAN-bus
- Offers direct connection of actuator and height sensor with up to two height sensors per actuator and axle
- Ensures functional safety according to highest automotive standards



- Comes as smart and scalable module integrating electronic control unit, solenoid valves and pressure sensors
- Analyzes system data and provides information regarding valve status, chassis height and bellow pressure
- Connects system and vehicle through smart CAN interface to enable bi-directional communication
- Controlled by ECAS application software hosted on vehicle's domain controller
- Adjusts bellow pressure to enable sophisticated chassis height control
- Offers actuator options spanning from one up to three channels to enable tailored side-specific chassis height and/or lift axle control
- Provides smart and efficient self-configuration process, while eliminating the need for separate sensor calibration

- High linearity leading to very high measurement precision
- Converts measurement results into electric signals to transmit to smart pneumatic actuator
- Supports flexible positioning inside the vehicle

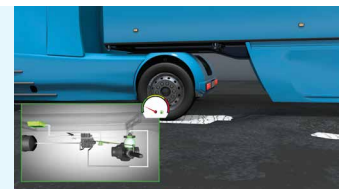
- Wired high-end RCU attached to cabin
- Dedicated for ECAS functionality on trucks
- Standardized interface with LIN protocol
- Protected against environmental influences through IP64 protection

Functional Advantages

OptiRide ECAS provides a broad spectrum of proven value-adding functionalities boosting efficiency, safety and comfort of daily vehicle operations.

Ride Quality

Minimizes chassis movements to enable excellent cargo treatment

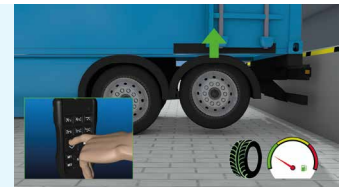


Traction Help

Mitigates imminent traction-loss through temporary axle load transfer to support start-upon low friction surfaces

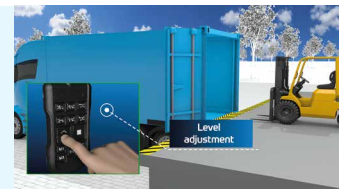
Lift Axle Control

Reduces rolling resistance through load-dependent lifting of a rear axle to help optimize fuel efficiency and tire life



Fast Loading and Unloading

Adapts chassis height at the loading dock to different ramp heights



Quick Drop & Hook

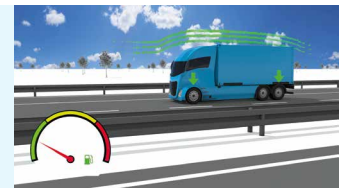
Provides rapid and seamless chassis raising and lowering to ease coupling and uncoupling process

Axle Load Monitoring

Continuously checks axle load and alerts the driver of overload

Speed-Dependent Driving Levels

Optimizes aerodynamic characteristics through automatic vehicle height adjustments to help improve fuel efficiency



Heeling

Enables raising of the tractor chassis above ride height for easy unloading of liquid goods

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About Us

ZF is a global technology company supplying systems for passenger cars, commercial vehicles and industrial technology, enabling the next generation of mobility. ZF allows vehicles to see, think and act. In the four technology domains of Vehicle Motion Control, Integrated Safety, Automated Driving, and Electric Mobility, ZF offers comprehensive product and software solutions for established vehicle manufacturers and newly emerging transport and mobility service providers. ZF electrifies a wide range of vehicle types. With its products, the company contributes to reducing emissions, protecting the climate and enhancing safe mobility. With some 165,000 employees worldwide, ZF reported sales of €43.8 billion in fiscal 2022. The company operates 168 production locations in 32 countries.

ZF's Commercial Vehicle Solutions (CVS) division is helping shape the future of commercial transportation ecosystems. Our mission is to be the preferred global technology partner to the commercial vehicle industry. Powerfully combining ZF's commercial vehicle systems expertise, extensive technology portfolio and global operations, the division serves the full commercial vehicle industry value chain. As the automotive industry progresses towards an increasingly autonomous, connected, and electrified (ACE) future, ZF's CVS division innovates, integrates and supplies components and advanced control systems that help make commercial vehicles and fleets operate more safely and sustainably.
CVS unites ZF's former Commercial Vehicle Technology and Commercial Vehicle Control Systems divisions, the latter being formed following ZF's acquisition of WABCO in Spring 2020.