



Automated Driving

Intelligent Systems for Commercial Vehicles



What Does ADAS Stand For?

Advanced Driver Assistance Systems support drivers in certain situations to increase convenience, safety and cost-efficiency. This reduces both operating costs and emissions and additionally lowers the risk of accidents.



Sensors are the "eyes" of the vehicle. They capture the environment and send their data to the central control unit for processing. Multiple sensors such as cameras, Radar and Lidar sensors are used in order to meet different requirements for resolution and contour accuracy, range and scope of operation. Detecting objects with several different sensors increases the performance, availability and safety of the functions.



The central control unit is the "brain" that controls automated driving. It collects and analyzes the data that has been captured by the sensors and determines the instructions/functions that are required for accelerating, braking and steering the vehicle and assisting the driver. Among other functions, these include adaptive cruise control, collision avoidance systems, automatic light control as well as more complex functions such as turn assist.



The central control unit analyzes the sensor data and then uses functions that control the vehicle's actuators for longitudinal and lateral guidance. These include steering and safety functions, damping, and braking and transmission control.

Automated Driving

Due to legal regulations and economic conditions, bus and truck fleet operators face great challenges. These demand new and innovative solutions.

Advanced Driver Assistance Systems offer the opportunity to reduce fuel consumption and emissions, and in addition react quickly in safety-relevant situations. This reduces stress for the drivers and lowers the risk of accidents.

One application example is platooning, in which trucks are linked together electronically to form a convoy. Driving in the slipstream saves fuel, lowers pollutant emissions and, on future levels of automated driving, can reduce drivers' hours.

Intelligent Systems ... Everything Under Control ...

ZF is one of the few manufacturers in the world that can draw on an extensive product range in the commercial vehicle sector. Now, the next generation of our intelligent sensors, central control units and actuators forms the basis for automated driving.

see.

Camera

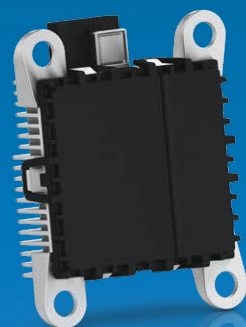
- Predictive safety camera with two-lens optics for optimal visual range
- Object detection and classification, light control, road-sign recognition
- Various versions available

Radar

- Latest generation of 77 GHz radar systems for various detection areas
- Detection of vehicles, pedestrians and obstacles



S-Cam4T

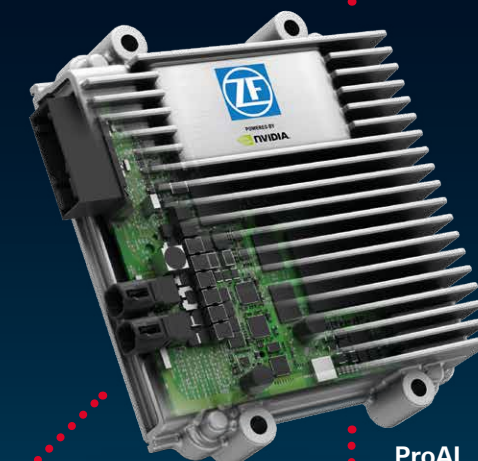


AC1000T

think.

ProAI

- Central control unit for software and algorithm integration
- Integrated high-performance computer with NVIDIA GPU
- Developed for AI applications
- Numerous interfaces for sensors and external communication
- Designed for commercial vehicle applications

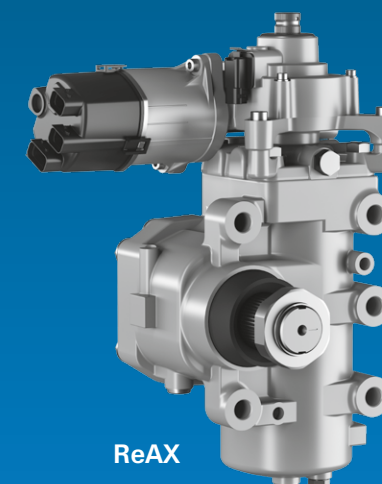


ProAI

act.

ReAX steering system

- Precise and easy to use
- Integrated electronic control for semi-autonomous steering
- Crosslinking of ZF ADAS systems provides functions in commercial vehicles such as Lane Keeping Assist, Emergency Steering Assist and automated parking
- The uniform topology of the ZF systems enables implementation of these functions with maximum performance



ReAX

Products in Detail

In cooperation with our technology partners, ZF develops products for all applications connected to driver assistance and automated driving. Four examples illustrate the scope of functions.

The new 77 GHz **midrange radar AC1000T** was designed specifically for use in commercial vehicles, and excels due to its long range and variable aperture angle of up to $\pm 35^\circ$ at close range. The radar can detect objects at a distance of up to 200 meters.

Digital beam forming ensures that the field of view is adapted to the current vehicle speed. This in turn enables functions such as collision avoidance and fully automatic emergency braking (AEB), adaptive cruise control (ACC) and pedestrian detection.

The 77 GHz **short range radar Gen5.1 SRR**, which was developed in cooperation with Hella, can be used for various applications in the front, side or rear areas of commercial vehicles.



Due to the large aperture angle of up to 160° , this radar is especially suitable for close range use and is able to detect objects as well as other road users. Additional features, such as recognizing free spaces, guardrails and construction sites, complete the scope of functions. These radars are also used in subsystems such as the ZF turn assist.

The **scalable two-lens safety camera S-Cam4T** is a high-power predictive camera with progressive object recognition technology by Mobileye® (EyeQ4® image processor). Thanks to its two-lens technology, the camera is able to recognize and classify various objects, including pedestrians, vehicles, road signs or traffic signal systems both at long-distance range (52° field of view) and close range (150° field of view). The S-Cam4T also controls the functions that operate Automatic Emergency Braking and Lane Keeping Assist.



The powerful **Safety Domain ECU ProAI 2.0** is a flexible hub that integrates a range of control functions for chassis, suspension and extended advanced driver assistance systems into one unit. It can collect data from various kinds of sensors and process extremely high data rates. The electronic architecture has the flexibility to cope with different combinations of active safety and chassis systems in vehicles. The ZF ProAI is adapted specifically to the environmental conditions and service life of commercial vehicle applications and also allows third-party software modules to be integrated.

ZF Strategy & Technology

ZF designs components such as camera and radar sensors to support the development of intelligent transmissions, electric steering and damper systems; all of which are required for the commercial vehicle ADAS and automated driving market.

Our extensive experience in the commercial vehicle sector and the development of ADAS technology for passenger car assist systems serves as the foundation for this. The expertise of our technology partners in the fields of sensor technologies and data processors plays an important role here as well.

In future, the way components are interconnected and communicate with each other will be even better. Today, ADAS subsystems such as adaptive cruise control and PreVision already enable functions such as predictive gear shifting, automatic braking or accelerating.

Other examples of subsystems are the longitudinal and

lateral controls that assist the driver in keeping in the lane. In our test vehicles, we have developed more complex systems that combine several features of these subsystems. Here, automatic Traffic Jam Assistance systems or the Highway Pilot, a function for semi-automated driving on certain highway sections, prove that as a principle they also function in commercial vehicles.

Further ZF convenience systems such as the new active cabin suspension optimize roll and pitch behavior as well as the upward and downward movement of the driver's cabin. In future, this will enable drivers to use the cabin as an "office on wheels" during highly automated driving operation.



ZF Friedrichshafen AG
Commercial Vehicle Technology Division
88038 Friedrichshafen
Germany

Phone +49 7541 77-0
zf.com