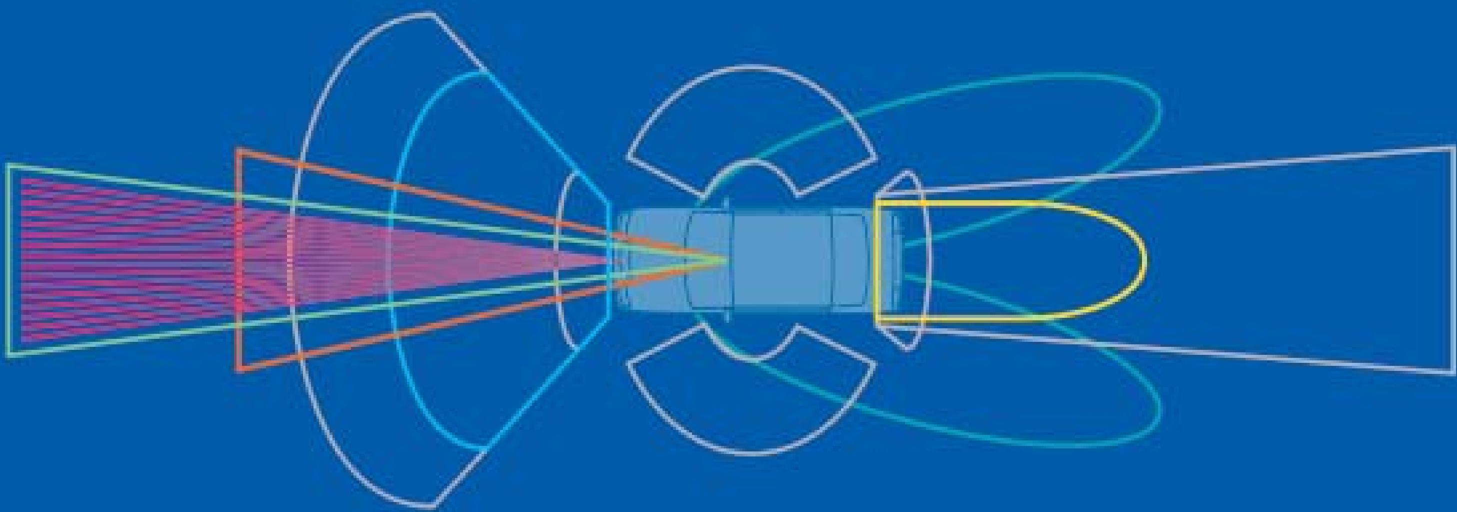
Technical Information

Electronics – Driver Assistance Systems



Ideas today for
the cars of tomorrow

LIDAR technology IDIS® ACC

ACC sensor

Adaptive Cruise Control (ACC)

The forerunner of adaptive cruise control is conventional cruise control, which automatically keeps the vehicle at the speed chosen by the driver or picks up this speed again after temporary deactivation. As traffic volume increases, however, driving at a constant speed over longer distances is less likely to be possible. Drivers are forced to frequently re-adjust the reference speed to adapt to changing traffic conditions, which has led to a relatively low acceptance of such systems in the European region.

The comfort system ACC makes relaxed driving possible, reducing the probability of accidents by warning drivers in good time. ACC recognizes vehicles driving in front, determines their speed, and automatically keeps the distance from the preceding vehicle by intervening through braking and accelerating. Drivers can choose the distance to the vehicles in front within the legal limits. If the deceleration provided by the ACC system is not sufficient, drivers are warned to apply the brakes manually as well.

Drivers remain in control of their vehicles at all times and can switch ACC on and off as required.

As well as regulating speed by influencing the engine performance, the ACC system can also activate the brake. For safety reasons, however, the braking capacity that can be used by the ACC system is limited to approx. ¼ of the maximum possible braking capacity.

As well as a significant gain in comfort, the ACC system also offers a gain in safety, since a sufficient safety distance is kept and drivers distracted by the traffic are made aware of the situation by the automatic triggering of the braking process.

The modern opto-electronic measuring technology used for this sensor is based on the principle of measuring the time of flight (LIDAR). With this method, the time the light requires for a certain distance is measured. For this purpose, a short light impulse is transmitted and the return signal recorded with the aid of high-speed evaluation electronics.

The performance of LIDAR technology is comparable with radar technology but is significantly less expensive. The sensor is insensitive to soiling and recognizes visibility limitations (e. g. through fog).

Further input parameters are the vehicle's own speed and the radius of the bend driven through, which can be determined using wheel sensor, steering angle, transverse acceleration or yaw rate. Along with the infrared distance sensor, the device also contains the actual speed regulator which takes over the automatic longitudinal regulation of the vehicle. Communication with the vehicle is via the CAN bus. The first series application of the Hella LIDAR-ACC system will be in 2006. Future generations of LIDAR technology will make functions such as pre-crash and collision mitigation possible.

Technical data	
Opening angle	12° x 3° (h x v) (alternatively 16° x 3°)
Mapping range	200 m
Regulation range	150 m
Resolution	0.1 m
Accuracy	1 %
Package space	105 x 105 x 76,5 mm (incl. lens cover)
Weight	410 g
Temperature	–40 °C to +85 °C
Interface	CAN

24 GHz technology

Lane change assistant

Lane change assistant

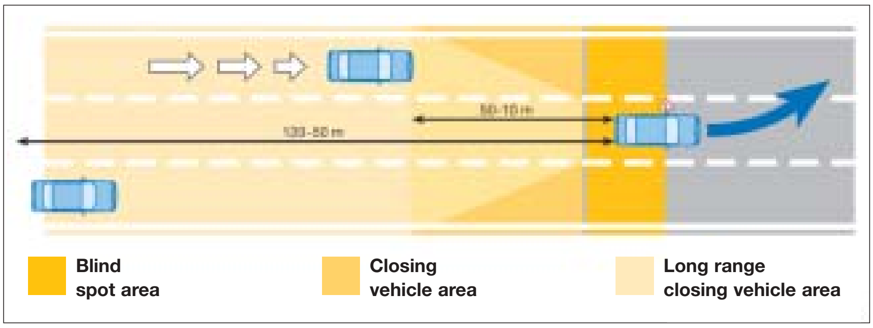
If drivers intend to change lanes, the lane change assistant system determines the distance and relative speed of other vehicles within the relevant range and generates an optical, acoustic or haptic warning if necessary. Objects in the blind spot and not visible in the rear view mirror are also recognized.

The lane change assistant recognizes other vehicles or objects behind or next to one's own vehicle on an adjacent lane with the aid of two 24 GHz radar sensors.

The sensor technology used means that the system is unaffected by darkness, soiling or other adverse weather conditions. The sensor can be mounted invisibly behind bumpers or design covers. The range of approx. 50 m guarantees the driver early detection of approaching vehicles.

At very high relative speeds, the mapping-range of 50 m is not sufficient to generate a timely warning. To cover these cases as well, the rear mapping range can be increased to approx. 120 m by a special third 24 GHz radar sensor in the rear of the vehicle.

The lane change assistant system can be directly connected to the high-speed CAN of the vehicle bus and does not require any further control units. The complete software and triggering of the HMI (Human-Machine Interface) is already integrated.



Sensor range

Technical data	
Frequency range	24,000 to 24,250 GHz (FMCW)
Monitoring range for the adjacent lane	Lane change assistant: up to 50 m, BSD: up to 6 m behind the vehicle
Accuracy of distance measurement	±2 %
Horizontal opening angle	±50° to ±70°
Vertical opening angle	13°
Horizontal angle precision	Better than 1°
Speed interval	0 to ±70 m/s
Speed precision	0.14 m/s
Measuring cycle	32 ms
Specified operating temperature	–40 °C to +70 °C
Dimensions (per sensor)	89 mm x 105 mm x 27 mm
Interfaces	High-Speed-CAN-interface (500 kB/s)
Approval capability	100 MHz bandwidth worldwide ISO conformity (Lane Change Decision Aid System)

The first series application of the lane change assistant system from Hella will be in 2006. The following further applications can be realized using 24 GHz radar technology.

- Parking assistance
- ACC Stop & Go
- ACC
- Pre-crash/collision mitigation

Camera technology

Rückfahrkamera

Rear view camera

The rear view camera allows drivers a complete view of the area directly behind the vehicle up to the bumper. An optional display of assistance lines provides drivers with additional information which makes parking maneuvers even easier. The rear view camera thus increases safety by extending the visible range to the rear, and comfort by providing support during parking.

A video image of the rear vehicle area is recorded by a camera installed in the rear of the vehicle.

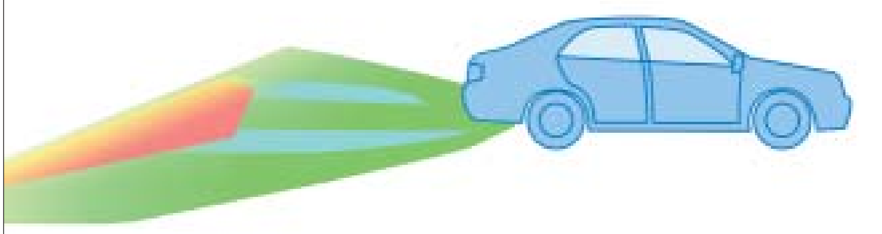
When the vehicle is put into reverse, the video signal is shown on the navigation-system display (or another display in the vehicle). The driver is now shown an image of the area behind the vehicle, an image which is to a large extent unaffected by external light influences, making maneuvering the vehicle significantly easier and more accurate.

Possible optional features include image correction and the fading in of assistance lines such as vehicle dimensions, distance lines etc.

The system works as a “standalone” solution, i. e. all the functions are already integrated in the camera.

Due to the small dimensions of the rear view camera, integration in the vehicle is extremely simple. The camera can be integrated almost invisibly in the tail gate or in the OEM vehicle emblem, for example, which is then swiveled out of the way when the system is activated thanks to an actuator system available from Hella.

The first series application of the Hella rear view camera system will be in 2006.



Visibility range of the camera
Rear view camera

Technical data	
Range	0.4 m to infinity
Visibility angle	120° to 130° horizontal, approx. 90° vertical (fish eye) Optionally available with image correction
Image sensor	CMOS color sensor
Resolution	640 x 480 pixels (VGA), used 510 x 496
Dynamic range	62 dB linear
Image repetition rate	30 fps
Output	Analog, NTSC
Operating temperature	–40 °C to +85 °C
Storage temperature	–40 °C to +105 °C

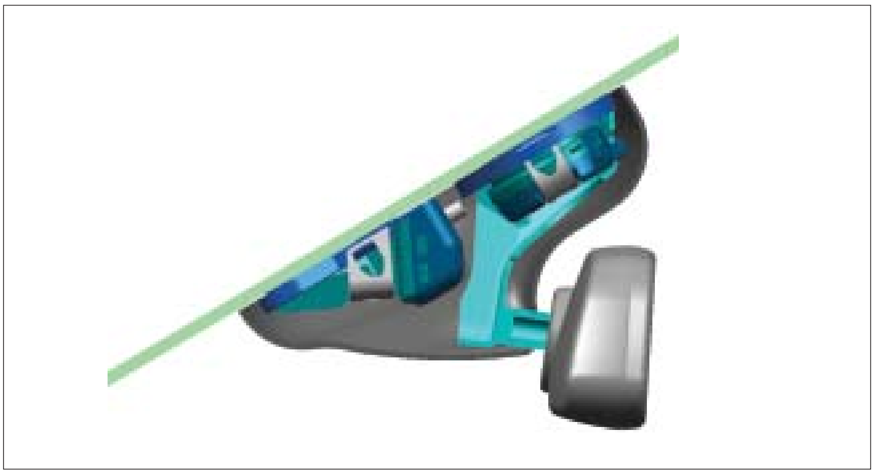
Lane Departure Warning

The lane departure warning system warns drivers early of imminent and unintentional lane departure, thus helping to avoid accidents. The main area of application for this system is highways and freeways.

A small CMOS camera installed on the windshield observes the road area in front of the vehicle. The recorded data are used by intelligent image processing software in a control unit to calculate the current vehicle position within the lane and the courses of the bends ahead. This allows drivers to be warned before they leave the lane unintentionally. The warning can be in the form of an acoustic, visual or even haptic signal. If drivers show they intend to change lanes, e. g. by activating the direction indicator, a warning is not issued.

Lane departure warning camera

How lane departure warning works



Lane departure warning camera and rain/light sensor integrated into the mirror base

Thanks to experience gained from the development of rain/light sensors and roof control modules, Hella can supply solutions optimized from a package space point of view. Thus, for example, the camera can be integrated in the mirror base together with Hella's rain/light sensor. The system will be ready for series production by 2007. Future lane departure warning generations will be able to be used in less structured environments. In addition, work continues on a possible fusion of lane departure warning and ACC systems. As well as improving both functions, the aim is to achieve object detection as well.

Technical data	
Range	≤50 m
Visibility angle horizontal	±29°
Visibility angle vertical	–14°/+29°
Image sensor	CMOS sensor
Resolution	640 x 480 pixels (VGA)
Dynamic range	62 dB linear 110 dB in the HDR (High Dynamic Range)
Image repetition rate	25 fps
Operating temperature	–40 °C to +85 °C
Storage temperature	–40 °C to +105 °C
Interfaces	CAN-interface, optional digital outputs for the triggering of actuators

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